NJ Department of Environmental Protection
Water Monitoring and Standards
Marine Water Monitoring

Reappraisal Report of Shellfish Growing Area NE4

Shark River

October 2013

Data from July 1, 2007 – December 31, 2011

State of New Jersey
Chris Christie, Governor
Kim Guadagno, Lt. Governor

NJ Department of Environmental Protection
Bob Martin, Commissioner

Reappraisal Report of Shellfish Growing Area NE4

Shark River

New Jersey Department of Environmental Protection (NJDEP)

Bureau of Marine Water Monitoring (BMWM)
Bruce Friedman, Chief

October 2013

Report prepared by:

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This report was written under the direction of NJDEP WM&S administration. Special acknowledgment is given to the Boat Captains, the laboratory staff, and the technical and support staff. The Appendix includes supporting data and shoreline survey report(s); it can be found in a separate PDF available at www.nj.gov/dep/bmw/reports. Additional information on the Bureau of Marine Water Monitoring and the National Shellfish Sanitation Program can be found in our guidance document, also available at www.nj.gov/dep/bmw/reports.

Cover Photo – Shark River Inlet (photo by Tracy Fay)

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Shellfish Growing Area NE4, the Shark River, is located in southern Monmouth County and connects to the Atlantic Ocean via the Shark River Inlet. The approximate size of this shellfish growing area is 800 acres. Water samples from the Shark River were collected, using the Systematic Random Sampling strategy, and analyzed from 27 sampling stations for total coliform. There are no direct discharges into the Shark River, although there are numerous stormwater outfalls and other indirect discharges. No significant changes to land use pattern, hydrography, or discharges were observed on shoreline survey that would change the shellfish waters classification in this area. The timeframe for this Reappraisal report was July 1, 2007 through December 31, 2011. The Shark River has been classified as *Special Restricted* since 1987. All sampling stations currently comply with their criteria for the *Special Restricted* classification. The results of this data evaluation prove to be consistent with the existing shellfish growing water classification. Currently, no classification changes are recommended for this area. It is recommended in this report to further investigate possible pollution sources surrounding station 1221B after observing high spikes in the data.

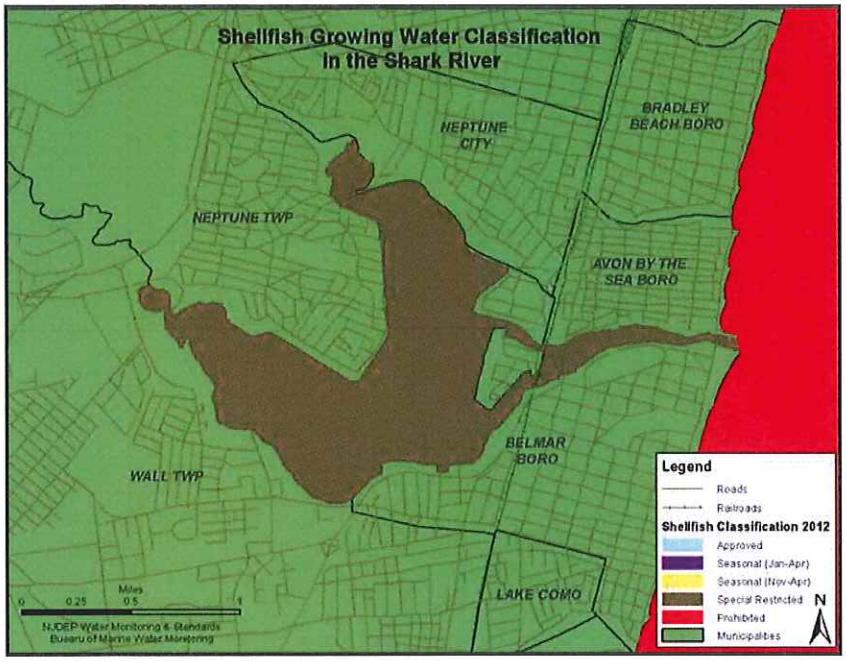
DESCRIPTION OF GROWING AREA

Location & Description

The Shark River is located in Monmouth County (see below figure). Tidal waters enter the Shark River via the Shark River Inlet. There are numerous freshwater influences Shark River including Shark River Stream, Jumping Brook, Musquash Brook, and Laurel Gully Brook, and Heroy's Stream. The Shark River is bordered the following municipalities: Avon-by-the-Sea, Neptune City, Neptune Township, Wall Township and Belmar Borough. In total, the Shark River is about 11 miles long and has approximately 800 acres of shellfish growing waters.

In May of 1998 that the Environmental Protection Agency approved the New Jersey Department of Environmental Protection's (NJDEP's) plan to make the Shark River a "no discharge zone". This means that no boats may dump treated or untreated sewage into the waters of the Shark River.

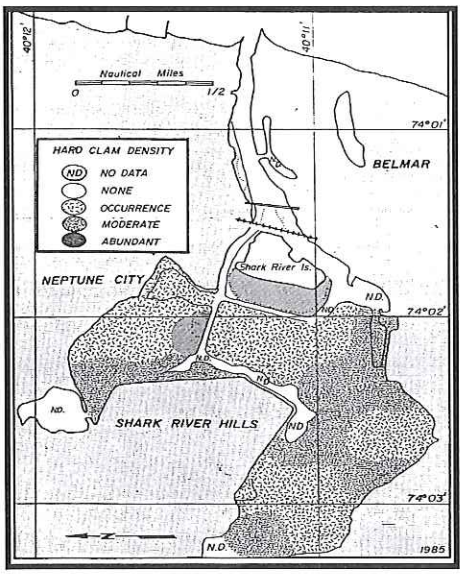
Growing Area Classification Summary



The Shark River has been classified as *Special Restricted* since 1987; previously it was classified as *Prohibited* based on administrative reasons. Since 1987, the water quality has supported the *Special Restricted* classification (see adjacent figure). Until 1998, this area was sampled under the Adverse Pollution Condition (APC) of rainfall; it is now sampled under the Systematic Random Sampling (SRS) strategy since there are no point sources contributing to bacterial contaminants in this area.

The *Special Restricted* classification means that it is prohibited to harvest shellfish from these waters for direct market; a special permit must be issued to be in compliance with the State of New Jersey's Relay or Depuration Programs. Recreational harvest of shellfish is not permitted from *Special Restricted* waters. This area is displayed on chart # 3A of the current State of New Jersey Shellfish Growing Water Classification Chart (NJDEP, 2011) or on the Bureau of Marine Water Monitoring's (BMWM) website at http://www.state.nj.us/dep/bmw/; the official and most current classification descriptions can be found at N.J.A.C. 7:12.

Evaluation of Biological Resources



Commercially important shellfish native to New Jersey include hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), blue mussels (*Mytilus edulis*), eastern oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), and sea scallops (*Placopecten magellanicus*).

The Shark River has few to moderate densities of hard clams (according to the last clam census in the 1980's done by NJDEP's Division of Fish & Wildlife, see adjacent figure).

Factors that contribute to having a viable resource include salinity, dissolved oxygen levels, bottom conditions, and predation.

SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Waterfowl are known to inhabit the Shark River, especially during winter months. At low tide many gulls, ducks, and geese occupy the sandbars and shoreline. Oftentimes, these waterfowl also nest within the wetlands. Bird waste can add to contamination of the waters, and contribute to high coliform values. The Shark River Inlet is often used as a diving region because of its interesting and diverse sea life. The area also entertains an influx of population in the summer months and is a well-known tourist spot on the New Jersey shore.

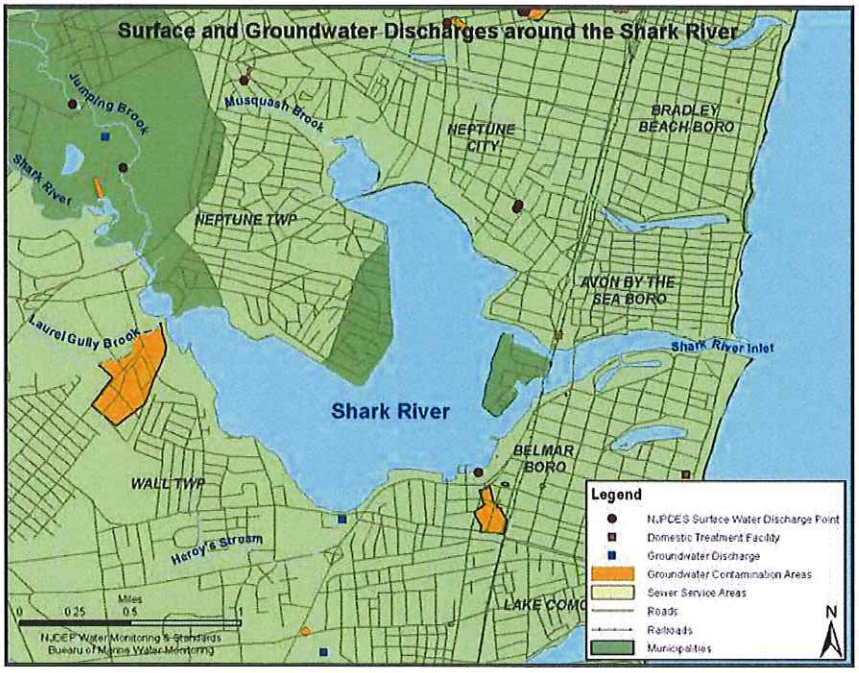
Vegetation is an essential part of the marine ecosystem, offering habitat and nursery grounds for numerous species. In the Shark River, the submerged aquatic vegetation (SAV) is prevalent in shallow areas. Some of the most common species of SAV in New Jersey include widgeon grass (*Ruppia maritima*), sago pondweed (*Potamogeton pectinatus*), horned pondweed (*Zannichellia palustris*) and eelgrass (*Zostera marina*).

Land Use

The current land use surrounding the Shark River is predominately urban and residential. Most residential development is single family homes, however, there are some higher density cluster development in the area. There are also areas of wetlands and scattered regions of forests, barren lands, and agricultural lands. Seven municipalities surround the Shark River; they are Wall Township, Neptune Township, Neptune City, Bradley Beach Borough, Avon-By-the-Sea, Belmar Borough, and Lake Como. Historically, most of this region has been urban land used for residential housing. Since this region is already highly developed there has not been much residential growth in recent years. The surrounding landscape had not changed significantly since the last shoreline survey.

Surface and Ground Water Discharges

A surface water discharge involves the release of treated effluent from various municipal and industrial facilities directly into a river, stream, or the ocean. There are two domestic treatment facilities in the general vicinity, although neither directly discharges into the Shark River. The Southern Monmouth Regional Sewerage Authority (SMRSA) and the Township of Neptune Sewerage Authority (TNSA). Both facilities discharge treated wastewater into the Atlantic Ocean (TNSA, 2008 & SMRSA, 2008). As a precautionary measure, the NSSP requires a *Prohibited* safety zone



of at least 1.5 miles around each of the ocean outfalls. Therefore, the waters of the Atlantic Ocean outside of the Shark Inlet are classified as *Prohibited*, see Shellfish Growing Area Atlantic Ocean, North-Central Region.

According to New Jersey Pollutant Discharge Elimination System (NJPDES), there are a few facilities with active Discharge to Groundwater (DGW) permits in this area. Besides groundwater dischargers, septic systems are occasionally used where public sewer lines are unavailable. When a septic system's leach field fails septic waste may pond on the grounds surface and can flow or be transported by stormwater to storm sewers, and ultimately discharge to surface water. Failing septic systems can be a significant localized source of bacteria. The location of groundwater discharges, groundwater contamination sites, surface water discharges, domestic treatment plants, and sewer areas are shown in the above map.

Marinas

Boating is a popular summertime activity within the Shark River. In this growing area there are a total of 15 marinas (see adjacent map). Most of these marinas are located near the inlet. Some of the marinas in this area run charter and party boat trips, although there are also many private boats within the marinas. The waters enclosed by the footprint of a marina are classified as *Prohibited*; depending on the size of the marina and the water quality, water immediately adjacent to each marina may be classified as *Prohibited*, *Special Restricted*, or *Seasonally Approved* (no harvest during summer months when the marina is active). Marina buffer zones were calculated using the Virginia Model or the marina buffer equation, depending on the location.

The size of each buffer zone is shown in the adjacent table. Additional information on the marina equations used for buffer generation can be found in the NJDEP *Shellfish Growing Area Report Guidance Document* (2007).

Map Key	Marina Name	Approximate # of Slips	Buffer Area (radius; feet)
1	AP's Inlet Marina	18	401
2	Avon Fishing Basin	15	302
3	Belmar Municipal Marina	250	1693
4	Bry's Marine	20	339
5	Main One Marina	50	896
6	Unknown Name - Condo	30	250
7	Unknown Name - Residential Home	8	358
8	Oliver Com Pier	8	402
9	Riverview Ave. Boatyard	10	204
10	Seaview Marina	100	1267
11	Shark River Hill Beach Yacht Club	74	1169
12	Shark River Hills Marina	180	2055
13	Shark River Yacht Club	166	976
14	Southport Condo Marina	12	310
15	Sunset On The Waterfront	45	508

Spills, Unpermitted Discharges, and Closures

Spills reported to the NJDEP hotline (1-877-WARN-DEP) are passed on to the BMWM when shellfish waters might be impacted. Since there is a direct relationship between the pollution of shellfish growing areas and the transmission of diseases to humans, BMWM must carefully assess each spill occurrence. If the spill is determined to be detrimental to the shellfish beds then a closure is made in the impacted area to protect public health. The closure is not lifted until the source of the problem is fixed/eliminated and all samples in that area fit within the appropriate classification criteria. There were no reported spills that required shellfish closure in the area of the Shark River that occurred during the July 1, 2007 to December 31, 2011 time period.

The process of dredging can impair water quality and contaminate shellfish beds that are living near dredging and disposal sites. BMWM is given the opportunity to review such projects through CAFRA submission and will deny a project if the proposed dredging or disposal site can potentially contaminate shellfish beds or impair water quality. BMWM's comments are taken into consideration by the NJDEP Division of Land Use Regulations (DLUR) when approving or denying a permit. Plans remain to dredge the Shark River, but delays continue due to the unavailability of an appropriate dewatering location(s) (APP, 2012).

Stormwater Discharges

Environmental pressures on shellfish beds in New Jersey can originate from pollutants that enter growing waters via stormwater discharges. Runoff is a term for the surface water that moves from land to the ocean. During this transition the water picks up both nutrients (helpful and harmful) and pollutants. While some of this runoff provides nutrients for plants and animals, it also carries pollutants that can potentially contaminate the waters. Some pollutants include animal waste, agricultural pesticides, and bacteria from faulty septic systems and failing municipal infrastructure. Storm drains along roads collect the runoff and transmit it to stormwater outfalls. The outfalls discharge the runoff into streams, bays, oceans, and other bodies of water. They are often found in urban areas, and are especially common within lagoon communities. The first flush after a rain event often carries the most pollutants. Stormwater outfalls are one of the most significant non-point sources of pollution in this shellfish growing area.

The Bureau of Marine Water Monitoring conducts stormwater projects to mitigate the effect of stormwater runoff. Water samples are taken during a storm event and the preceding days in order to determine the effect of runoff. Once a possible source of the problem is identified, the appropriate people (usually the municipality/county) are notified to remedy the situation. Currently, an investigation into the area of station 1221B has been recommended.

WATER QUALITY STUDIES

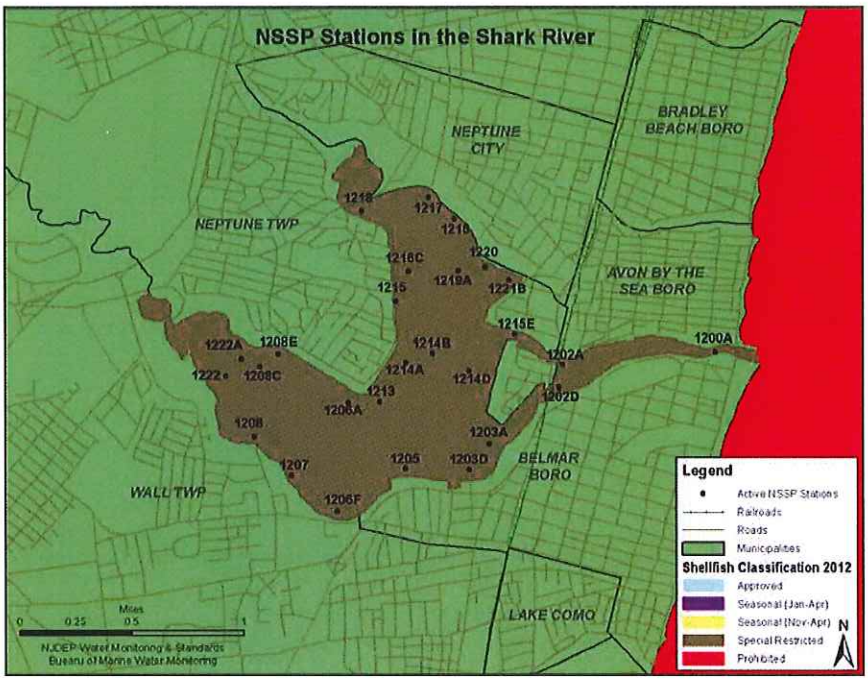
Sampling Strategy

The State Shellfish Control Authority has the option of choosing one of two water monitoring sampling strategies for each growing area. For additional information on the types of sampling strategies see the

NJDEP *Shellfish Growing Area Report Guidance Document* (2007). This shellfish growing area is not impacted by discharges from sewage treatment facilities or combined sewer overflows; therefore, it was sampled under the Systematic Random Sampling Strategy (SRS).

Each shellfish producing state is directed to adopt either the total coliform or fecal coliform criterion. While New Jersey bases its growing water classifications on the total coliform criterion, the laboratory does have the ability to make corresponding fecal coliform determinations. Each classification criterion is composed of a measure of the statistical 'central tendency' (geometric mean) and the relative variability of the data set. The criteria were developed by the NSSP to ensure that shellfish harvested from designated waters would safe for human consumption (NSSP, 2007). For the Systematic Random Sampling Strategy, variability is expressed as the estimated 90th percentile. The following table shows the statistical criteria for the SRS strategy.

CRITERIA FOR SYSTEMATIC RANDOM SAMPLING STRATEGY				
	Total Coliform Criteria		Fecal Coliform Criteria	
	Geometric mean (MPN/100 mL)	Max. 90th Percentile (MPN/100 mL)	Geometric mean (MPN/100 mL)	Max. 90th Percentile (MPN/100 mL)
Approved Classification	70	330	14	49
Special Restricted Classification	700	3300	88	300



The water quality of each growing area must be evaluated before an area can be classified as *Approved, Seasonal (Nov-Apr or Jan-Apr), Special Restricted,* or *Prohibited.* A *Seasonal* area must be sampled and meet the *Approved* criterion during the time of the year that it is open for harvest. The criteria for the bacterial acceptability of shellfish growing waters are provided in the NSSP *Guide for the Control of Molluscan Shellfish,* 2007 Revision.

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005). Water quality sampling, shoreline, and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish,* 2007 Revision. Data management and analysis were accomplished using database applications developed for the Bureau of Marine Water Monitoring. Mapping of data was performed with Geographic Information System software (GIS: ArcMap).

Bacteriological Quality

Approximately 860 water samples were collected from this shellfish growing area for total coliform testing between July 1, 2007 and December 31, 2011 and analyzed by the three-tube, three-dilution (at some stations four-dilutions are used) standard total coliform fermentation method according to APHA (1970, 1995). The above map shows the 27 Shellfish Growing Water Quality monitoring stations in the Shark River. All of these stations are located in *Special Restricted* waters and were sampled using the Systematic Random Sampling (SRS) strategy.

Compliance with NSSP Criteria

Each sampling station must comply with its respective criteria according to the NSSP *Guide for the Control of Molluscan Shellfish* (2007 Revision) for *Approved, Seasonal,* or *Special Restricted* waters, based on a minimum of 30 data sets.

In order for waters to be classified as *Approved,* the total coliform geometric mean must be below 70 MPN/100ml and the total coliform Est. 90^{th} Percentile must be below 330 MPN/100ml. For waters to be classified as *Special Restricted,* the Geometric Mean must be below 700 MPN/100ml and the Est. 90^{th} Percentile must be below 3300 MPN/100ml. All stations sampled complied with the NSSP total coliform criteria for *Special Restricted* waters and sampling data does not indicate an opportunity for a shellfish classification upgrade at this time.

Station 1221B shows unusually high spikes in coliform data. Nearby stations do not show the same trends, so this report recommends a special pollution source trackdown study for the area. If the high coliform spikes continue, this area of the Shark River will have to be downgrading, hopefully this study will find a repairable source of pollution in order to avoid a downgrade of shellfish waters.

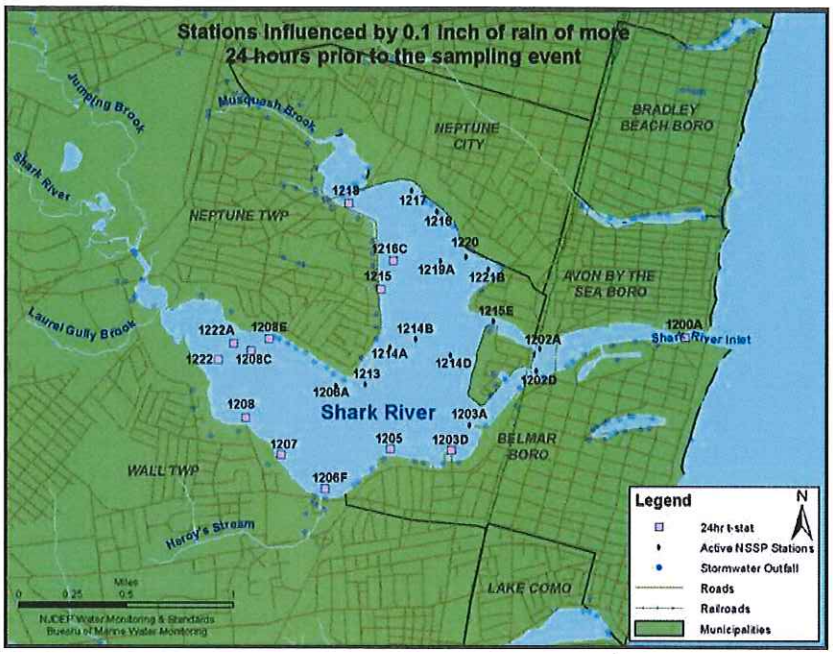
The year round data are divided between the summer and winter sampling seasons. The summer season runs from May through October, and the winter season runs from November through April. There are no seasonal waters in the Shark River, but since all stations were below year-round *Special Restricted* criteria, a potential upgrade was considered for portions of the Shark River to become *Seasonally Approved.* Many stations exceed the *Approved* criteria under the extended timeframe during the winter months, therefore no upgrade can be made at this time.

Rainfall Effects

Precipitation patterns in the coastal areas of New Jersey are typical of the Mid-Atlantic coastal region. Summer storms are localized and often associated with thunder and lightning activity. Winter storms are frequently associated with northeasters. Hurricanes can occur during the summer and early fall.

A *t*-test is used to compare log-transformed total coliform values for wet verses dry data. The *t*-statistical probability must be less than or equal to 0.05 for a station to be rainfall impacted. There is also a wet/dry cutoff for each growing area that dictates what data is considered 'wet' and what data is considered 'dry'. The scenario used for this growing area was based on a wet/dry cutoff of 0.1 inch.

Rainfall amounts are based on the closest established NOAA/NWS station; each assignment run is assigned to a weather station to accurately reflect the rainfall at the sampling stations; this shellfish growing area uses station RA005.

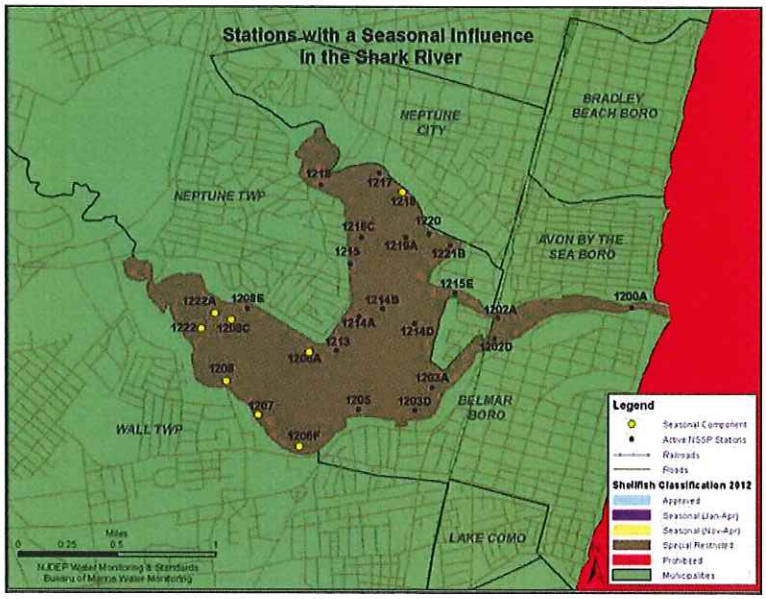


The effects of the 'first flush' should be captured by the '24 hours prior to sampling' *t*-statistics. *T*-statistics are also determined for the 'cumulative 48 hours prior to sampling' and the 'cumulative 72 hours prior to sampling'. These *t*-statistics help to determine if there is a delayed impact on the waterbody.

Rainfall analysis shows that the Shark River is influenced by rain, particularly within the first 24 hours prior to sampling, where 13 stations showed a *t*-stat below 0.05. Eight stations triggered within the 48 hours prior to sampling and within the 72 hours prior to the sampling event 5 stations in the Shark River showed a *t*-stat below 0.05. Stations with rain components showed a higher geometric mean during wet conditions as opposed to dry during all scenarios. Overall, there are both immediate and extended affects on the coliform levels in the river due to rainfall, although more of an immediate impact. Three stations showed an impact in all three scenarios. Rainfall appears to be a significant factor for the stations located in this growing area. This is expected since this area is urban with a high percentage of impervious surfaces.

Seasonal Effects

Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that affect the marine environment (Ingmanson and Wallace, 1989). Seasonal variation may also be the result of a variety of conditions, including specific agricultural land-use practices, biological activity, stream flow and/or sediment. Statistically significant seasonal impacts were observed at eight of the stations in the Shark River, mostly in the western portion of the river, near Wall



Township (see above figure). The *t*-statistical probability must be less than 0.05 for a seasonal difference at that station to be considered significant. Summer includes the months of May through October and winter includes November through April. Summertime pressures are usually more likely to impact these waters because of such things as heavy boat travel and higher summer temperatures. The water quality also has the potential to be affected by other non-point sources from increased summer population and/or increased use of recreational water activities. No changes in classification are needed as a result of these seasonal influences.

RELATED STUDIES

Water Monitoring and Standard's (WM&S) Bureau of Marine Water Monitoring (BMWM) also monitors New Jersey waters for levels of nutrients (estuarine monitoring), phytoplankton, and bathing beach standards.

Nutrients

Coastal water quality is monitored for ecological health parameter including dissolved oxygen and total nitrogen. Samples are collected on a quarterly basis at 5 stations, 1201A, 1203A, 1206C, 1215E, & 1217A, within the Shark River. The parameters are evaluated, analyzed, and presented in a separate report by the Bureau of Marine Water Monitoring, available on the web at: www.nj.gov/dep/bmw.

Phytoplankton

Phytoplankton are photosynthetic algae that play a critical role at the base of aquatic food webs. Phytoplankton studies are used to show what species are present and in what concentration.

The Bureau of Marine Water Monitoring and USEPA (United States Environmental Protection Agency) Region 2 conduct routine helicopter surveillance throughout the summer to determine the occurrence of species of marine phytoplankton that could produce biotoxins. BMWM, in accordance with the NSSP requirements, also analyzes the data. There is not a phytoplankton station in the vicinity of the Shark River, but for more information on the Phytoplankton reports visit the BMWM website, www.nj.gov/dep/bmw.

Bathing Beaches

WM&S cooperatively works with the New Jersey Department of Health and local health agencies to monitor the bathing beaches in New Jersey. Together, these agencies implemented the Cooperative Coastal Monitoring Program (CCMP). With this program, the coastal and estuarine waters that are open to the public for recreational bathing are surveyed and regularly monitored for the concentration of bacteria. The CCMP, in conjunction with US Army Corps of Engineers, also carries out the NY/NJ Harbor Estuary Program's Floatables Action Plan that utilizes aerial surveillance to detect floating solid

waste and debris. Flights are schedules for six days a week, weather permitting, during the summer months.

Typically, bathing beach samples are taken once a week for the entire summer. These samples are tested for Enterococci as a fecal coliform indicator. Ocean and bay recreational beaches are subject to opening and closing procedures of the State Sanitary Code. Local health agencies and law enforcement may close a bathing beach if the results exceed the State Sanitary Code of 104 Enterococci per 100 mL. Stations must be re-sampled when bacteria concentrations exceed the primary contact standard of 104 Enterococci per 100 mL of sample. Consecutive samples that exceed the standard require the closing of the beach until a sample is obtained that is within the standard. Environmental stations are not bathing beaches and do not require re-sampling. Beaches can also be closed at any time if health or enforcement agencies believe it is in the interest of public health.

There are four bathing beach station in the Shark River; CCMPMC0030, CCMPMC0031, CCMPMC0037, & CCMPMC0038. Three of these stations, CCMPMC0030, CCMPMC0037, & CCMPMC0038 are considered environmental stations because swimming is not allowed. BMWM utilizes these data as adjunct information; the closure of shellfish waters does not correspond with these results. Please see http://www.njbeaches.org/ for further information.

Toxic Monitoring

Toxic chemicals such as heavy metals, pesticides, polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs) are dangerous chemicals that can be found in the environment. These substances can be released into the environment by storm drains, runoff, sewage treatment facilities, and atmospheric deposition. Bottom dwelling organisms are most vulnerable to these chemicals and may pose a risk to human health if consumed.

USEPA National Coastal Assessment Program (NCA)

USEPA National Coastal Assessment EMAP and its partners began sampling in the coastal and estuarine water of the United States in 1990. Data collected include water column parameters, sediment chemistry & toxicity, benthic communities, and tissue contaminants. There has been no new NCA data gathered in the Shark River since the last reappraisal report. Please see http://www.epa.gov/emap/nca/index.html for further information and the most recent data.

National Oceanic and Atmospheric Administration (NOAA) Mussel Watch

The National Oceanic and Atmospheric Administration (NOAA) Mussel Watch Program monitors the levels of toxins and metals in shellfish. The blue mussel, *Mytilus edulis*, occurs worldwide and effectively takes up toxins and metals from seawater and sediments. The toxins and metals then become concentrated in the mussel's living tissues. Assays from the living tissues of this shellfish can be made easily and cheaply. The Mussel Watch Program monitors metals such as mercury, lead, zinc, nickel, cadmium, copper, chromium, aluminum, silicon, manganese, iron, arsenic, selenium, tin, antimony, thallium, and silver. The program also monitors toxins such as the synthetic organic compounds that are widely used in pesticides, solvents, flame-retardants, and other products. There is a mussel watch station outside of the Shark River Inlet. Please see http://ccma.nos.noaa.gov/about/coast/nsandt/musselwatch.aspx for further information and the most recent data.

CONCLUSIONS

The appendix lists the water quality data obtained from the sampling period of July 1, 2007 to December 31, 2011. Systematic Random Sampling strategy was used to collect the samples, laboratory tests were run for total coliform, and a thorough analysis of the data was assembled for this report. The bacteriological data for each station supports the respective criteria for the *Special Restricted* classification under the total coliform standard. Based on the data, this growing area is adequately classified.

There were 6 stations with a seasonal component. It was found that the Shark River shows the most impact 24 hours after 0.1 inches of rainfall. On analysis it was found that none of these impacted stations require a change in classification. Analysis of the Shark River shellfish growing area samples indicate that the geometric mean and 90^{th} percentile total coliform levels meet the standards of the National Shellfish Sanitation Program (NSSP). Sampling data does not indicate an opportunity for a shellfish classification upgrade at this time. The Shark River is acceptably classified, as supported by the total coliform levels sampled from July 1, 2007 to December 31, 2011.

RECOMMENDATIONS

There are no recommended changes in classification for the Shark River.

There are no recommended changes in monitoring schedule for the Shark River.

The recommendation for further analysis is to develop a special pollution source track-down study in the area of station 1221B. Any information gathered will be included in the next reappraisal report.

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APPENDICES (see separate Appendices document)

A. Statistical Summary

B. Seasonal Evaluation

C. Precipitation

- Rainfall Amount
- Weather Observations
- Wet/Dry Statistics

D. Data Listing: July 1, 2007 to December 31, 2011

E. Shoreline Survey Report