NJ Department of Environmental Protection

Water Monitoring and Standards

Reappraisal Report of Shellfish Classification for Growing Area DB3 The Delaware Bay Offshore (Cross Ledge, Deadmans & Brandywine Shoal)

December 2012

Reappraisal Report of Shellfish Classification for Growing Area DB3
The Delaware Bay Offshore (Cross Ledge, Deadmans & Brandywine Shoal)

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Cover Photo – The Delaware Bay Offshore Remote area.

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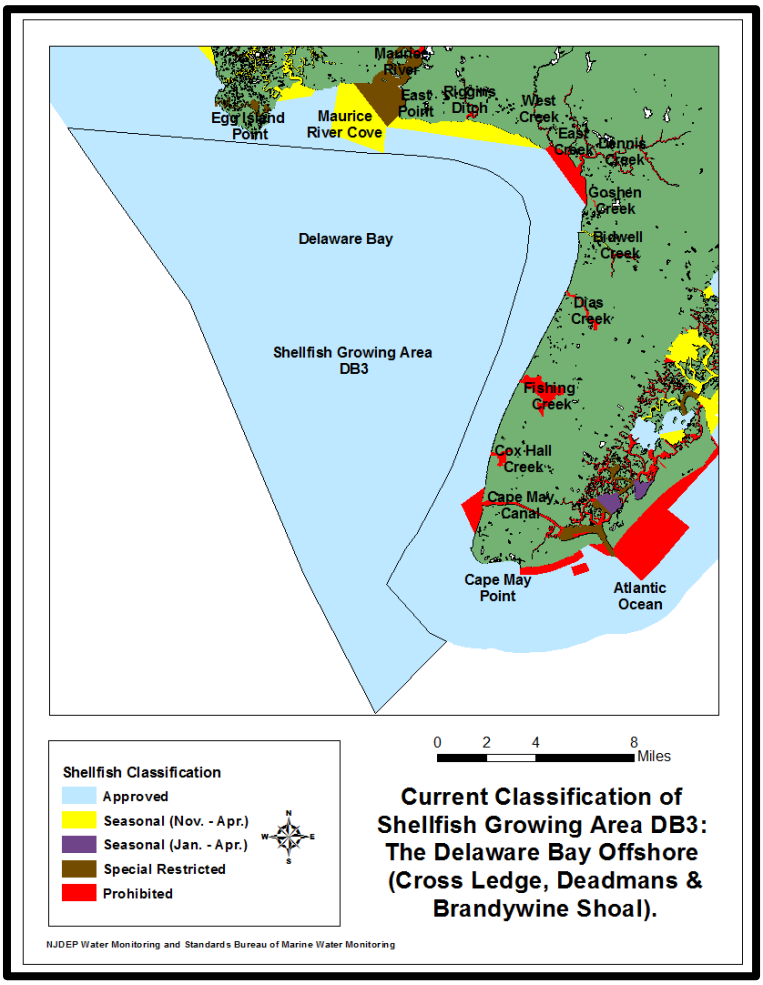
EXECUTIVE SUMMARY

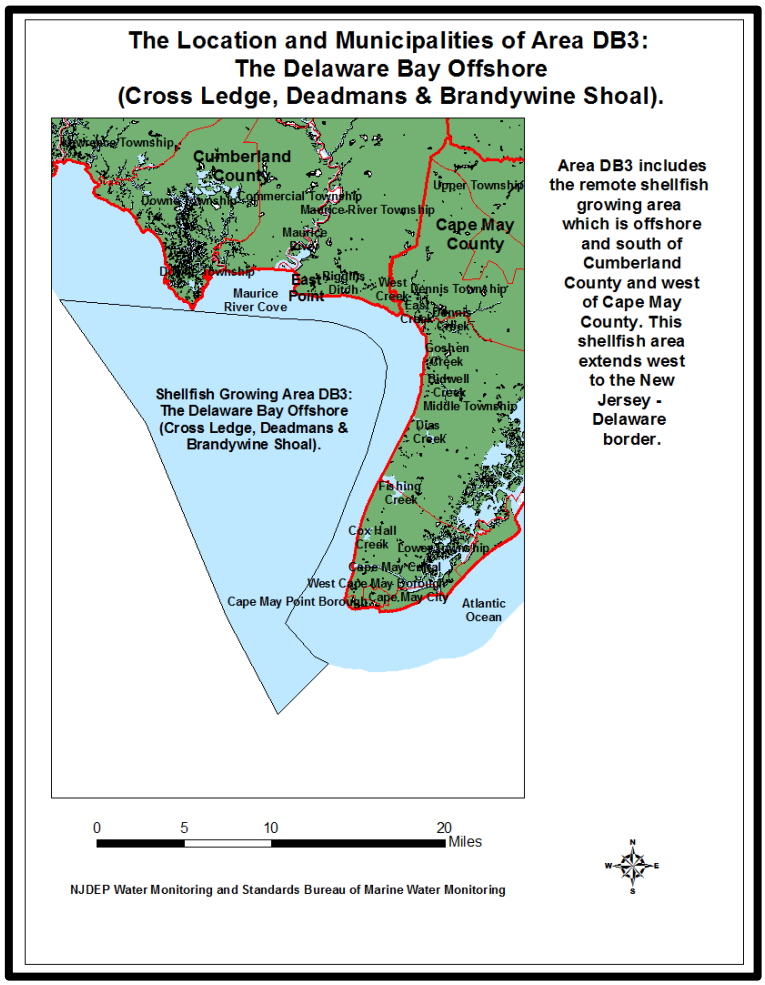
Shellfish Growing Area DB3, The Delaware Bay Offshore (Cross Ledge, Deadmans & Brandywine Shoal), is a remote shellfish growing area located west of Cape May County and south of the eastern part of Cumberland County in the southwestern part of New Jersey. The water quality data presented in this Reappraisal of Shellfish Growing Area DB3 were collected between May 2002 and April 2012. This shellfish growing area is a remote area with no human habitation and no actual or potential pollution sources, and, as such, is sampled using the Remote strategy. According to NSSP sampling criteria, only 2 water samples are needed for each sampling station per year. The approximate size of this shellfish growing area is 135,345 acres, and the shellfish classification for this growing area is *Approved* for shellfish harvesting (as seen in the figure to the right). All sampling stations were in compliance with the total coliform criteria for the existing classifications of this shellfish growing area, as specified by the National Shellfish Sanitation Program (NSSP). No classification changes are recommended for this shellfish growing area. There were no observed changes to pollution sources of this area as documented in the shoreline survey included in this report.



GROWING AREA PROFILE

Location & Description

Shellfish Growing Area DB3: The Delaware Bay Offshore (Cross Ledge, Deadmans & Brandywine Shoal) is a remote shellfish growing area located in the southwestern part of New Jersey (see figure below). The eastern edge of this shellfish growing area is about 1.7 miles west of the shoreline bordering the coast of Lower Township and Middle Township in Cape May County and about 2.5 miles west of the shoreline bordering the coast of Dennis Township in Cape May County. The northwestern edge of this shellfish growing area is located at channel buoy Flashing Green 2.5 second "29" (Fl G 2.5 sec "29") in the Delaware Bay and the northern edge of this shellfish growing area is located at channel buoy Flashing 4 second 27 feet 7M (Fl 4 sec 27ft 7M) in the Delaware Bay, which is about 183 yards south of the tip of Egg Island Point in Downe Township, Cumberland County. The western edge of this shellfish growing area is located at the border between New Jersey and Delaware, which is a line extending southeast from a point about 7.5 miles west of Egg Island Point to a point about 7.3 miles west of Cape May Point (see figure to the right).



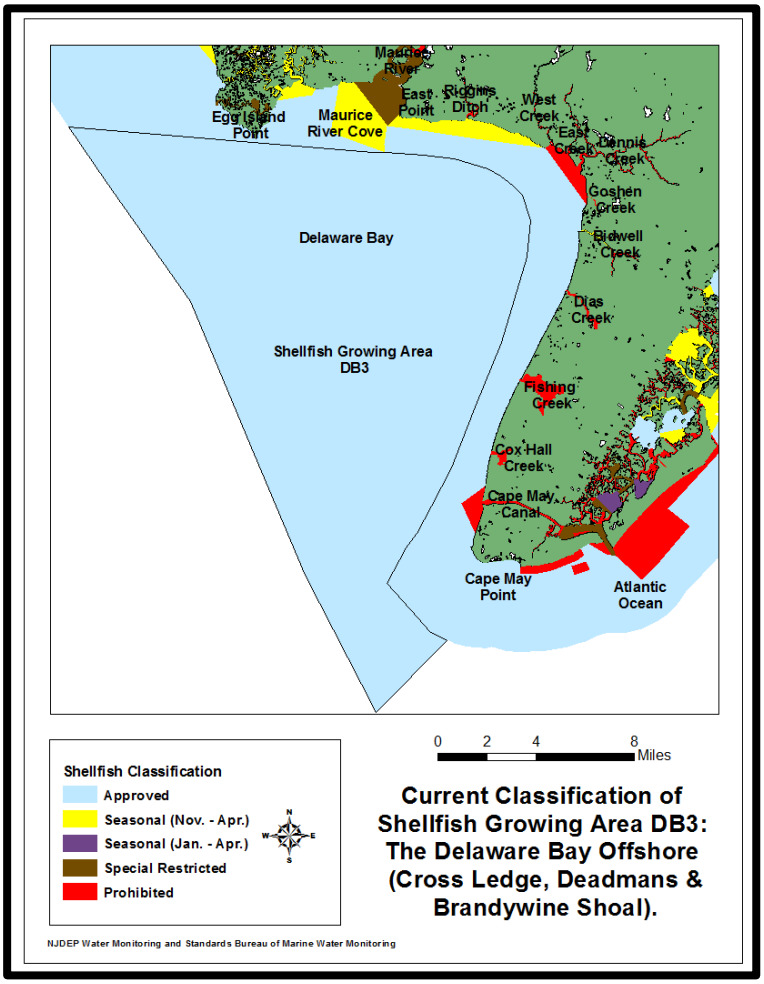
This remote shellfish growing area does not border any shorelines. The shellfish classification of this growing area is *Approved* and the approximate size of this shellfish growing area is 135,345 acres.

The municipalities onshore of this remote shellfish growing area include Cape May Point Borough, Lower Township, Middle Township, and Dennis Township to the east in Cape May County, and Maurice River Township, Commercial Township, Downe Township, and Lawrence Township to the north in Cumberland County. The locations of these municipalities are shown in the figure above.

In Cumberland County, the Delaware River drains into this shellfish growing area. This area can be found on Chart 18 of the "2012 State of New Jersey – Shellfish Growing Water Classification Charts" (NJDEP, 2012). The figure below shows the current classification of this shellfish growing area.

Growing Area Classification

The Delaware Bay Offshore area has historically been an area with a medium abundance of eastern oysters (*Crassostrea virginica*) (Morris, 1975, Gosner 1978). The shellfish classification for this growing area is *Approved* for shellfish harvesting (NJDEP, 2009). Since 1992, this shellfish growing area has been classified and sampled as a remote area. According to the NSSP *Guide for the Control of Molluscan Shellfish*, a growing area may be placed in the remote status if: 1) a sanitary survey determines that the area has no human habitation, and is not impacted by any actual or potential pollution sources, and 2) the area is in water that is classified as *Approved* (USPHS, 2003 Revision). Shellfish Growing Area DB3 meets both of these criteria.

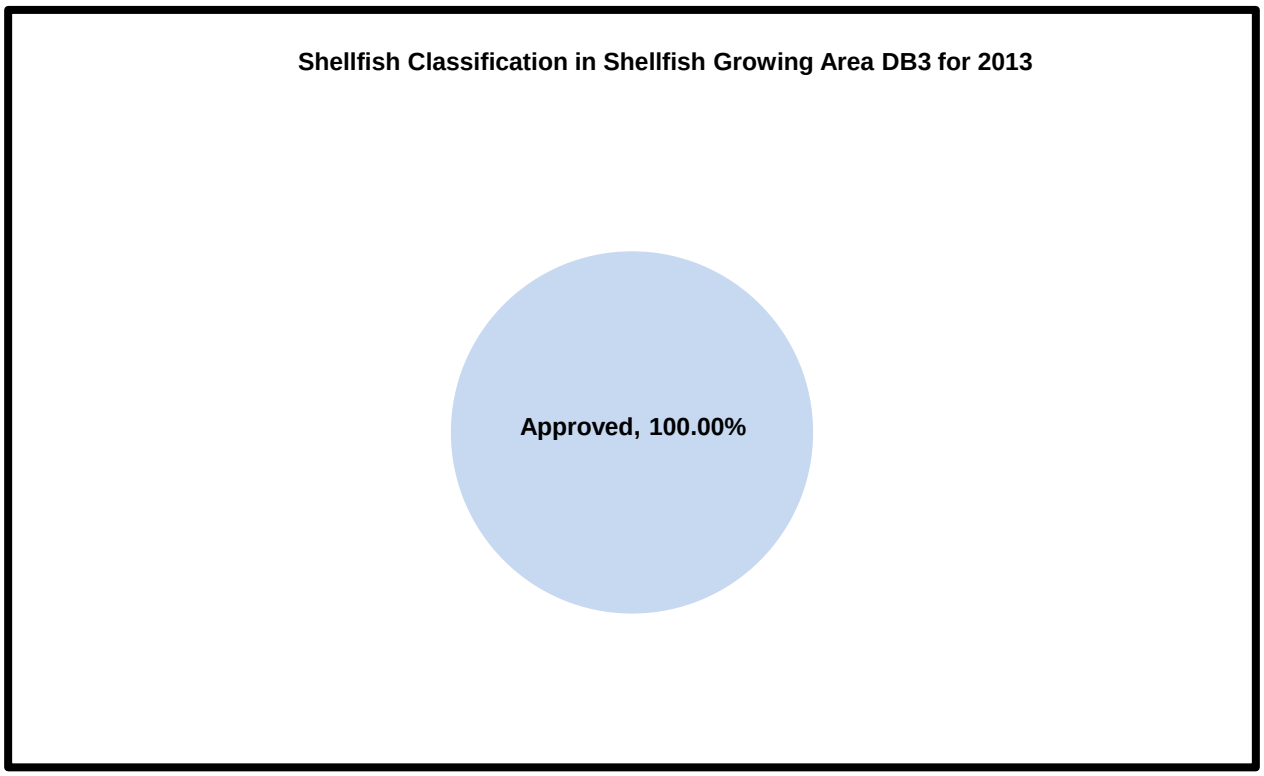


In the Reappraisal of the Delaware Bay Offshore for 2003, data were evaluated from October 1998 to September 2002 and all of the sampling stations met the *Approved* criteria for water quality. No changes were proposed for the shellfish classification or sampling strategy for this shellfish growing area (Wesighan, 2003).

In the Reappraisal of the Delaware Bay Offshore for 2007, data were evaluated from October 1999 to September 2006 and all of the sampling stations met the *Approved* criteria for water quality. No changes were proposed for the shellfish classification or sampling strategy for this shellfish growing area (Wesighan, 2008).

In the 2005 to 2012 Annual Reviews of Shellfish Growing Area DB3, no classification changes were proposed (NJDEP, 2005, NJDEP, 2006, NJDEP 2007, NJDEP, 2008). No sampling stations in this shellfish growing area exceeded the existing shellfish classification criteria, and the data supported the existing shellfish classifications for this area. The last Sanitary Survey for this area was written in 2004.

The figure on the preceding page illustrates the shellfish classification for this growing area. The shellfish classification of this area can be seen in the 2012 State of New Jersey Shellfish Growing Water Classification Charts booklet on chart number 18, or on WM&S/BMWM's website at http://www.state.nj.us/dep/bmw/.



Evaluation of Biological Resources

This growing area has a wide variety of biological resources. The eastern oyster (*Crassostrea virginica*) exists in medium abundance in the Delaware Bay, and has a long history of its commercial and economic importance in the Delaware Estuary (Morris, 1975, Gosner, 1978, Matassino, et al, 2002). The table below shows the total New Jersey eastern oyster landings data from 2002 to 2009 (NJDEP, 2009, NMFS, 2009). Shellfish landing statistics had not been verified and posted for 2009 or 2010 at the time this reappraisal report was written.

The table on the next page shows the total New Jersey shellfish landings data from 2002 to 2009 (NJDEP, 2009, NMFS, 2009). These shellfish species include blue crabs (*Callinectes sapidus*), blue crabs – peelers, hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), blue mussels (*Mytilus edulis*), bay scallops (*Aequipecten irradians*), oysters (*Crassostrea virginica*), ocean quahogs (*Arctica islandica*), surf clams (*Spisula solidissima*), and sea scallops (*Placopecten magellanicus*) (NJDEP, 2005, NJDEP, 2004, Morris, 1975, Gosner, 1978). However, this report primarily focuses on bivalve mollusks, such as clams, quahogs, oysters, and mussels, and does not include crustaceans, such as blue crabs.

New Jersey Eastern Oyster Landings - 2002 to 2009 (NMFS, 2009).

NEW JERSEY EASTERN OYSTER LANDINGS 2002 to 2009		
YEAR	POUNDS OF MEAT (millions)	$ VALUE (exvessel)
2002	379,284	$1,852,523
2003	713,928	$3,366,374
2004	323,049	$1,558,136
2005	161,526	$822,609
2006	343,191	$2,254,622
2007	444,227	$2,230,835
2008	550,086	$2,547,127
2009	*	*

***No data**

New Jersey Shellfish Landings - 2002 to 2009 (NMFS, 2009).

NEW JERSEY SHELLFISH LANDINGS 2002 to 2009		
YEAR	POUNDS OF MEAT (millions)	$ VALUE (exvessel)
2002	90,768,652	$88,136,826
2003	88,296,314	$94,873,590
2004	88,760,756	$139,182,589
2005	77,368,183	$131,261,937
2006	82,570,024	$107,701,202
2007	84,766,901	$120,767,607
2008	72,789,676	$138,430,240
2009	87,654,064	$125,735,266

The cities of Port Norris and Bivalve, along the Maurice River in Cumberland County, were once known as the hub of the Delaware Bay oyster industry, and Bivalve was once recognized to be the oyster capital of the world for its oyster production and processing industries. Their oyster industry processed and delivered thousands of pounds of oysters to markets all over the eastern coast of the United States (Flemlin and Tweed, 2000, Matassino, et al, 2002).

The population of oysters in the Delaware Bay had fluctuated widely. In the early 1900's, annual oyster landings were from one million to two million bushels. However, in the 1950's, the oyster population was reduced dramatically by the disease MSX, which is caused by the parasite *Haplosporidium nelsoni*. Only 49,000 bushels of oysters were harvested in the Delaware Bay in 1960. There was a gradual increase in the numbers of oysters harvested in the late 1960's and early 1970's. Then, in 1990, a new disease named Dermo was found to be spreading among the oyster population on the eastern side of the Delaware Bay and it caused heavy losses of both planted and seeded oysters. Dermo is caused by the parasite *Perkinsus marinus*. In 1988, juvenile oyster disease (JOD) also became a serious problem for oyster nurseries in the northeastern Atlantic region. The causative agent for JOD is unknown (Guo, Dr. Ximing, and Dr. John Kraeuter, 2000). While MSX, Dermo and JOD are diseases of oysters, they do not infect humans and therefore do not have any public health significance.

The Haskin Shellfish Research Laboratory of Rutgers University has attempted to develop disease resistant strains of oysters that show a resistance to MSX. Their long-term oyster-breeding program has genetically produced a disease resistant strain of oysters for MSX, and they have also genetically produced an oyster with some resistance to Dermo. These disease-resistant oysters are the main production line for the Atlantic Cape Fisheries oyster farm in Cape May (Guo and Kraeuter, 2000).

The Delaware Bay also contains the world's largest population of horseshoe crabs (*Linulus polyphemus*). In New Jersey for 2003, the landings for horseshoe crabs were 367,553 pounds harvested for an exvessel value of $193,605 (NJDEP, 2005). In New Jersey for 2005, the landings for horseshoe crabs were 330,714 pounds harvested for an exvessel value of $120,782 (NMFS, 2008). After 2005, there was a moratorium placed on the harvest of horseshoe crabs in the Delaware Bay, and horseshoe crab landings for 2006 were 9,141 pounds harvested for an exvessel value of $3,474 (NMFS, 2008). A total moratorium was placed on the harvest of horseshoe crabs for 2007 and the National Marine Fisheries Service had no values for horseshoe crab landings for that year. Since horseshoe crabs are used as bait for catching eels and conch, and their natural habitat is gradually being lost to development and shoreline retreat, the population of horseshoe crabs has been declining. Migrating shorebirds also feed on the eggs of nesting horseshoe crabs, which also contributes to their decline in population numbers (Matassino, et al., 2002).

For migrating shorebirds, the Delaware Bay is located along the Atlantic Flyway, which is an important migratory corridor for wildlife populations of shorebirds along the eastern half of the United States. The Delaware Bay area is considered to be one of the largest stopover locations along the Atlantic Flyway, with an estimated 425,000 to 1,000,000 migratory shorebirds converging and feeding in the Delaware Bay Estuary. Red Knot, Dunlin, Ruddy Turnstone, Sanderling, Semi-Palmated Sandpiper, and other species of shorebirds use the Delaware Bay Estuary as an important resting and feeding area, and they are known to consume large quantities of horseshoe crab eggs (certain species of shorebirds can and will eat thousands of horseshoe crab eggs in a single day) (Matassino, et al., 2002).

Blue crabs (*Callinectes sapidus*) are also found in the waters of the Delaware Bay and they are commercially and recreationally harvested from these waters. In New Jersey for 2003, the landings of blue crabs were 4,004,164 pounds harvested for an exvessel value of $4,730,470 (NJDEP, 2008). In New Jersey for 2007, the landings of blue crabs were 4,821,452 pounds harvested for an exvessel value of $6,004,341 (NJDEP, 2008). Striped bass (*Morone saxatilis*) and American shad (*Alosa sapidissima*) are also an important biological resource in the Delaware Bay and Delaware River (Matassino, et al., 2002). Both of these species of fish are commercially and recreationally harvested in the waters of this shellfish growing area, since this area is also utilized for fishing and boating. In 1991, the striped bass was classified as a gamefish in New Jersey, and this status prevents the commercial harvest or sale of this first coastal saltwater species designated as such in New Jersey (Bochenek, 2000).

The wetlands bordering this shellfish growing area also contain the Corsons Wildlife Management Area, the Heislerville Wildlife Management Area, the Turkey Point Fish & Wildlife Management Area, the Egg Island Berrytown Wildlife Management Area, the Fortescue Wildlife Management Area, the Nantuxent Wildlife Management Area, the New Sweden Wildlife Management Area, the Dix Fish & Wildlife Management Area, the Osborn Fish & Wildlife Management Area, and the Mad Horse Creek Wildlife Management Area.

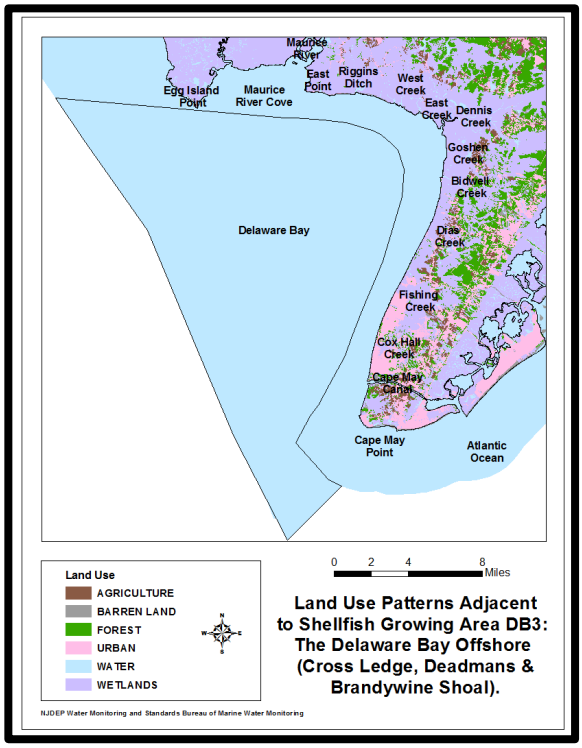
SHORELINE SURVEY: EVALUATION OF POTENTIAL POLLUTION SOURCES

Shoreline Survey

Shellfish Growing Area DB3 is a remote area, which is completely surrounded by water and borders Shellfish Growing Area DB2 (The Delaware Bay - Cape Shore) to the east and Shellfish Growing Area DB1 (The Delaware Bay from Maurice River Cove to Artificial Island) to the north. During the shoreline surveys conducted in and around the Delaware Bay, no evidence could be seen that direct and indirect discharges from potential sources of pollution draining into Shellfish Growing Areas DB1 and DB2 are having an impact on the water quality of Shellfish Growing Area DB3.

Land Use

The major land use patterns for the municipalities to the north and east of this remote offshore shellfish growing area are mainly wetland areas, agricultural areas, and forest areas, with some urban and rural areas interspersed between them (see the adjacent figure). The urban and rural areas are mainly located in clusters to the southeast, east, and north of this remote shellfish growing area, but this growing area does not border on any of these urban and rural areas. The urban areas are primarily connected to sewage treatment facilities; the rural areas, however, are connected to private septic systems and failing septic systems could be a potential indirect source of pollution to Shellfish Growing Areas DB1 and DB2. There is no current evidence that the direct and indirect discharges from these potential sources are affecting the water quality of this remote offshore shellfish growing area.

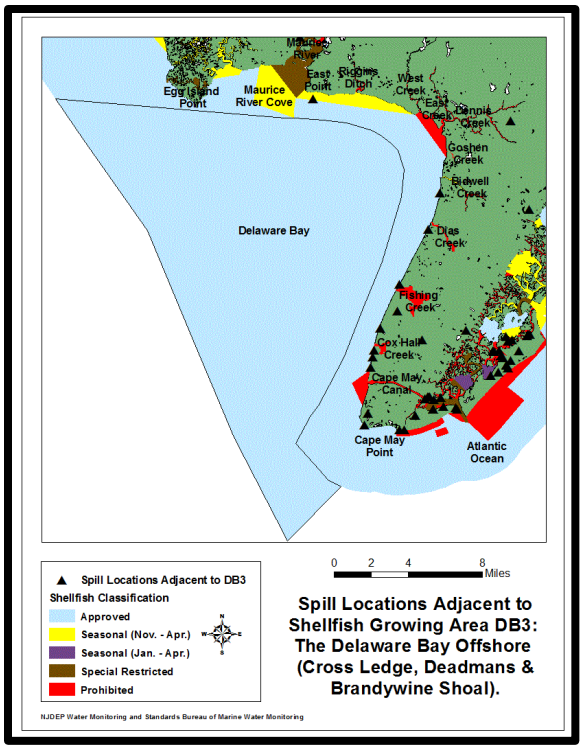


The wetlands onshore and surrounding this remote shellfish growing area also contain the Cape May National Wildlife Refuge to the east, the Dennis Creek Wildlife Management Area to the northeast, and Corsons Wildlife Management Area,

Heislerville Wildlife Management Area, Egg Island Berrytown Wildlife Management Area, and Fortescue Wildlife Management Area to the north. The figure above shows the land use patterns for the surrounding shoreline of this area. There are no storm water outfalls or marinas draining into this remote offshore shellfish growing area.

Spills, Unpermitted Discharges, and Closures

On June 16, 2007, a sewage spill was reported for the area of Main Avenue and Riverside Avenue near the Maurice River in Millville, Cumberland County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 30,000 gallons of sewage spilled into the Maurice River at this location when a malfunction at a pump station caused the sewage to overflow into the storm drain. The shellfish classification of the Maurice River in this area is *Prohibited* to shellfish harvesting. However, the edge of this shellfish growing area is located near the mouth of the Maurice River. This sewage spill was reported as terminated on this date and the cleanup of the area was completed at the time this report was received.



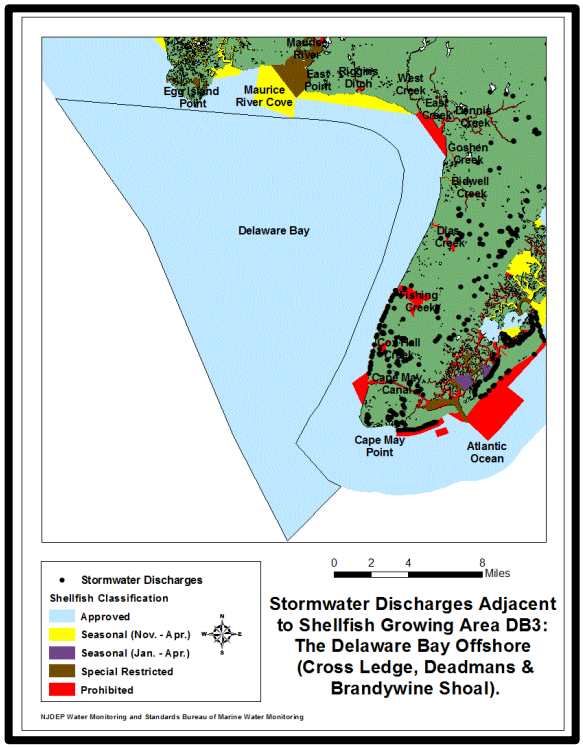
On July 6, 2007, an algae spill was reported for the area of the end of Hollywood Road, in Lower Township, Cape May County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, approximately 1,000 gallons of algae spilled into the Delaware Bay at this location when township personnel unclogged a pipe that was clogged by a recent storm and drained the wetlands south of Tolz Beach. This spill was reported as terminated on this date.

On August 6, 2007, a crude oil spill was reported for the area of Village Road, in Lower Township, Cape May County. According to the report sent to WM&S' Bureau of Marine Water Monitoring on this date, an unknown amount of crude oil spilled onto the beach of the Delaware Bay at this location from an unknown source and the spill was a block long. This crude oil spill was reported as terminated on this date and the cleanup of the area was completed at the time this report was received.

There were no records of spills or unpermitted discharges in the spills database from 2008 to 2012. There were also no emergency closures of shellfish waters in shellfish growing area DB2 due to spills or unpermitted discharges for the time period from May 2007 to April 2012.

Stormwater Discharges

Stormwater runoff is generated when precipitation from rain and snowmelt flows over land or impervious surfaces and does not percolate into the ground. As the runoff flows over the land or impervious surfaces (paved streets, parking lots, and building rooftops), it accumulates debris, chemicals, sediment or other pollutants that could adversely affect water quality if the discharge is untreated run-off. The typical pollutants that are associated with stormwater run-off are bacterial, heavy metals, pesticides, herbicides, chlorides, petroleum, and nutrients. (NJStormwater.Org) Most of the stormwater outfalls within this growing area are near residential and urbanized districts. About 70 outfalls in this area have the potential to impact water quality. The bulk of these outfalls are in Lower Township, Middle Township, and Dennis Township.



These outfalls usually discharge to nearby creeks and lagoon systems. For this reason, shellfish harvesting is condemned in all lagoon system.

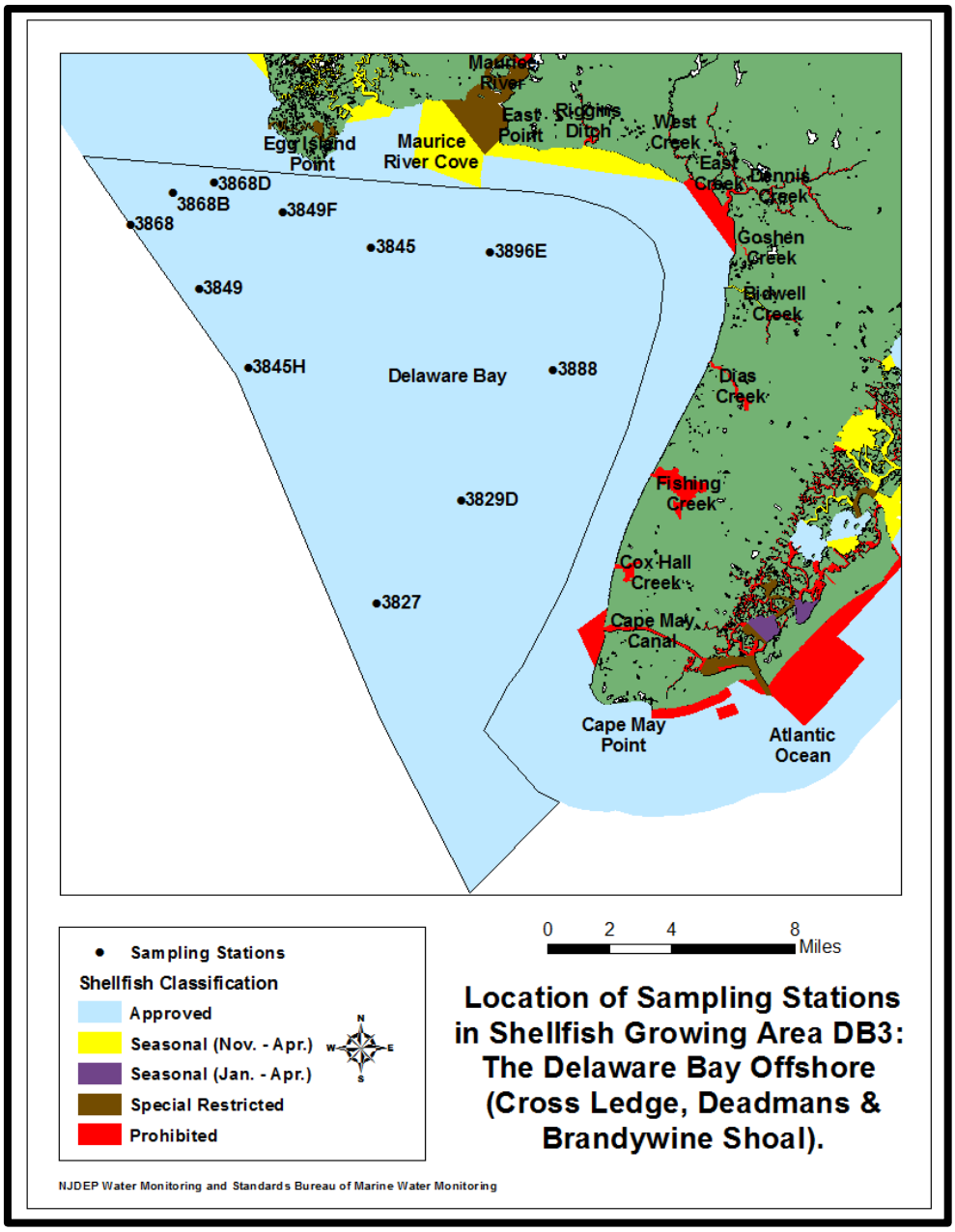
WATER QUALITIES STUDIES

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 *Shellfish Growing Area Report Guidance Document, 2007.* This shellfish growing area could possibly be impacted by the discharges from the sewage treatment facility in this area or combined sewer overflows; therefore, it was sampled under the Adverse Pollution Condition (APC) Strategy.

Methods

Water sampling was performed in accordance with the Field Procedures Manual (NJDEP, 2005). From 2002 through 2012, approximately 187 water samples were collected for total coliform bacteria from 11 monitoring stations. The locations of these stations are shown in the map on the next page. These samples were analyzed by the standard three-tube MPN method and/or standard three-tube four-dilution method (APHA, 1970). Water quality sampling, shoreline and watershed surveys were conducted in accordance with the NSSP *Guide for the Control of Molluscan Shellfish*, Revision 2009. Data management and analysis was accomplished using database applications developed for the Bureau. Mapping of pollution data was performed with the Geographic Information System (GIS: ARC map).


Maurice River
East Point
Riggins Ditch
West Creek
East Creek
Dennis Creek
Goshen Creek
Eldwell Creek
Dias Creek
Fishing Creek
Cox Hall Creek
Cape May Canal
Egg Island Point
Maurice River Cove
3868D
3868B
3868
3849F
3845
3896E
3849
3845H
Delaware Bay
3888
3829D
3827
Cape May Point
Atlantic Ocean
Sampling Stations
Shellfish Classification
Approved
Seasonal (Nov. - Apr.)
Seasonal (Jan. - Apr.)
Special Restricted
Prohibited
N
W
E
S
0 2 4 8
Miles
Location of Sampling Stations in Shellfish Growing Area DB3: The Delaware Bay Offshore (Cross Ledge, Deadmans & Brandywine Shoal).
NJDEP Water Monitoring and Standards Bureau of Marine Water Monitoring

Bacteriological Quality

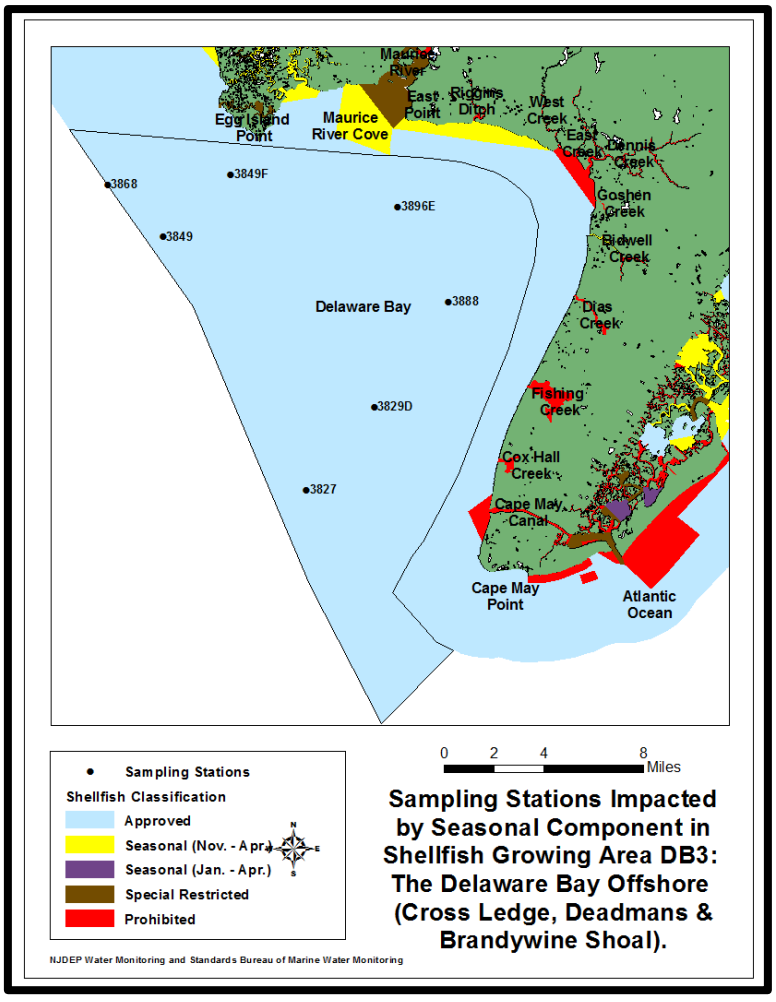
This report includes data analyzed from May 2002 to April 2012. This shellfish growing area is composed of one assignment area, Assignment 376 (The Delaware Bay Offshore – Cross Ledge, Deadmans, and Brandywine Shoal) and is sampled using the Remote sampling strategy year-round. The preceding figure shows all of the sampling stations for this area. The raw data listings for each sampling station, in accordance with the National Shellfish Sanitation Program (NSSP), are at the end of this report in the Appendix.

Compliance with NSSP Remote Criteria

All of the sampling stations in this shellfish growing area met the *Approved* shellfish classification criteria, year-round, in the summer, and in the winter. Therefore, all of the sampling stations in this area were in compliance with their existing shellfish classification criteria. There were no stations that exceeded the NSSP shellfish classification criteria for water quality in the *Approved* waters of this shellfish growing area.

Seasonal Effects

As the earth experiences variations in the tilt of its axis and its revolution around the sun, it goes through seasonal phases of summer, spring, autumn, and winter. These seasonal phases cause much variation in the atmosphere of the earth, resulting in changes in weather patterns. Temperature, precipitation, wind, and the general circulation of the atmosphere have seasonal variations that also 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.



To determine whether seasonal variation can influence bacteria counts, WM&S/BMWM uses a t-test to compare the total coliform MPN

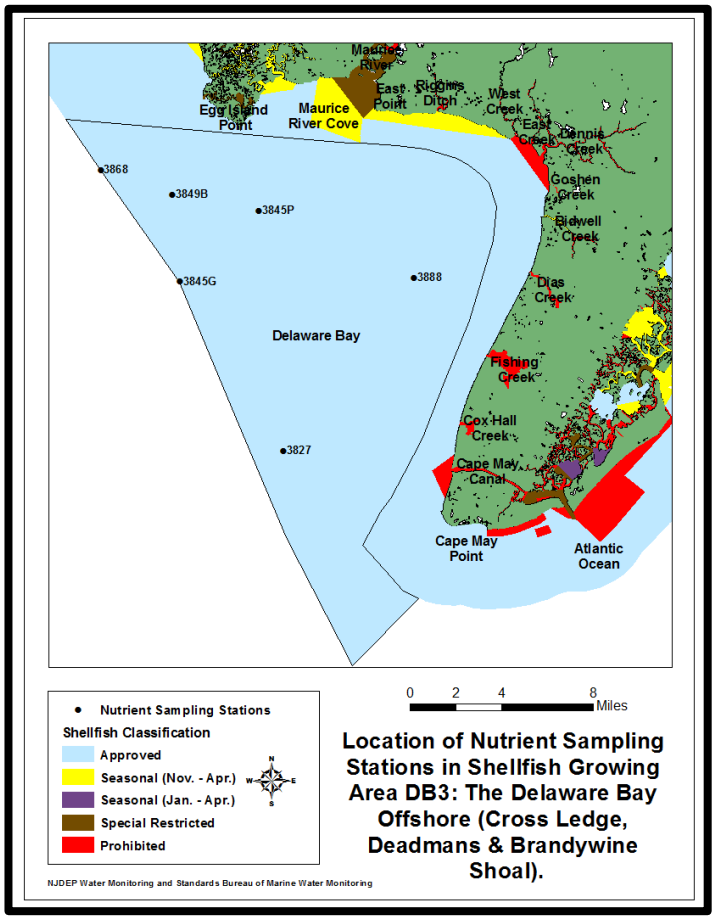
values from samples collected during the summer season versus samples collected during the winter months Based on the t-test results, seven (7) monitoring stations had a t-statistical probability of less than 0.05. All of these monitoring stations show a higher geometric mean during the winter than during the summer. This shellfish growing area was sampled with no seasonal preference.

RELATED STUDIES

Nutrients

In this growing area, six nutrient monitoring sites were sampled under the estuarine monitoring program. At these nutrient monitoring sites, various parameters were measured including water temperature, salinity levels, secchi depth, total suspended solids, dissolved oxygen levels, ammonia levels, nitrate and nitrite levels, orthophosphate levels, total nitrogen levels, and the inorganic nitrogen to phosphorus ratios. Between 2007 and 2012, 494 water samples were analyzed for these nutrient parameters in this growing area. For full nutrient assessment, see the Estuarine Monitoring Reports, available electronically at:

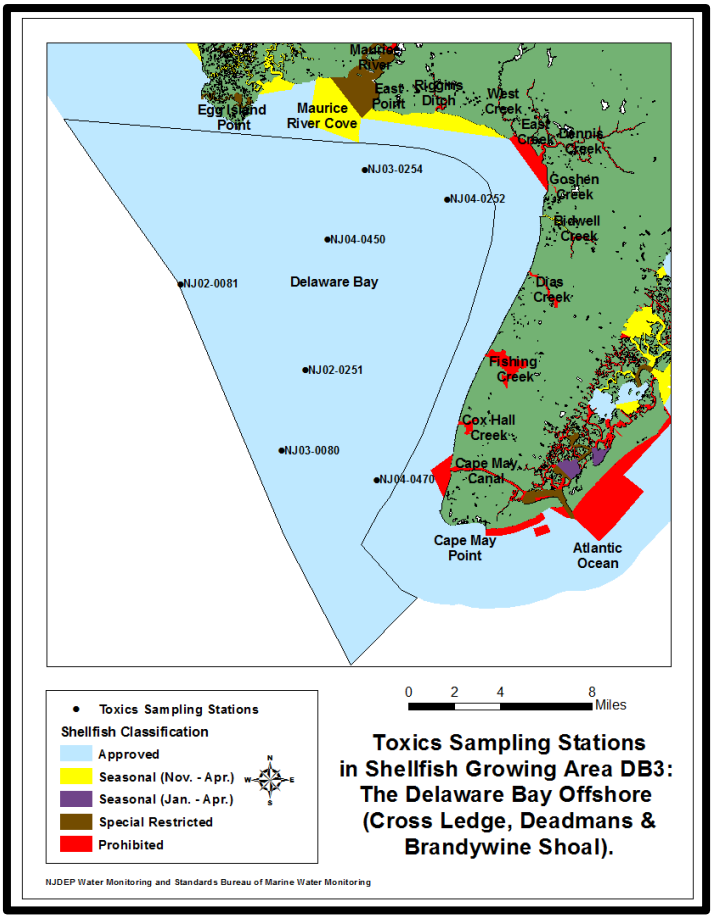
http://www.state.nj.us/dep/bmw/



Location of Nutrient Sampling Stations in Shellfish Growing Area DB3: The Delaware Bay Offshore (Cross Ledge, Deadmans & Brandywine Shoal).

Toxic Monitoring

The Department collects samples at regular intervals throughout the summer to determine the occurrence of marine algae that produce biotoxins (see figure for the location of the seven phytoplankton sampling stations in this shellfish growing area). Certain planktonic species have the potential to adversely affect the suitability of shellfish for human consumption. These planktonic species cause algal blooms that deplete the dissolved oxygen levels in the water. Algal blooms were reported each year for the period 2001 to 2005. The areas most severely impacted include the Raritan/ Sandy Hook Bay, the Barnegat Bay, and sporadic offshore areas (NJDEP, 2005). No algal blooms capable of producing biotoxins were identified for the Delaware Bay – Cape Shore area from 2007 to 2012 (NJDEP, 2012). The phytoplankton monitoring of sampling stations in New Jersey waters is available electronically at: www.nj.gov/dep/bmw/.



CONCLUSIONS

Based on the bacteriological data assessed, all of the sampling stations within this growing area meet their current shellfish classifications. The overall water quality for this growing area is good. No significant changes to landuse pattern, hydrography, or discharges that would change the shellfish waters classification in this area.

RECOMMENDATIONS

Continue sampling using the existing Adverse Pollution Condition (APC) Remote strategy for Assignments 376.

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