South Carolina Department of Health and Environmental Control

ENVIRONMENTAL AFFAIRS

SHELLFISH MANAGEMENT AREA 12A

2022 ANNUAL UPDATE

Shellfish Sanitation Section
Environmental Affairs
2600 Bull Street
Columbia, SC 29201

September 2022

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SHELLFISH MANAGEMENT AREA 12A
2022 ANNUAL UPDATE

[Data Through December 2021]

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Shellfish Management Area 12A

Data Inclusive Dates:
01/01/19 thru 12/31/21

Classification Change:
___ Yes _X_ No

Shoreline Survey Completed: Yes

Prior Report & Date: 2021 Annual Update

(I)ncreased/(D)ecreased/(N)one:
_N_ Approved
_N_ Conditionally Approved
_N_ Restricted
_N_ Prohibited

SUMMARY

There are no classification changes recommended for the 2022-2023 shellfish harvesting season in Shellfish Management Area 12A (SFMA 12A). The 2021 annual rainfall total was 55.31 inches. This data, along with the rainfall data available from the last two years, suggests that non-point source runoff from precipitation may have impacts on the water quality in this SFMA 12A.

During the past several years major storms have impacted the area. In September 2019, Hurricane Dorian produced 5.61 inches of rainfall during a two-day period. On April 24, 2020, a major rain event produced 4.03 inches of rain in a 24 hour period which closed SFMA 12A for the remainder of the open shellfish harvesting season. On July 8, 2021, Tropical Storm Elsa produced 4.59 inches of rain in a 24 hour period which closed summer harvesting in SFMA 12A until July 21, 2021.

INTRODUCTION

PURPOSE AND SCOPE

The authority to regulate the harvest, sanitation, processing, and handling of shellfish is granted to the South Carolina Department of Health and Environmental Control by Section 44-1-140 of the Code of Laws of South Carolina, 1976, as amended. The Department promulgated Regulation 61-47, which provides the rules used to implement this authority and outlines the requirements applied in regulating shellfish sanitation in the State. This regulation specifically addresses classification of shellfish harvesting areas and requires that all areas be examined by sanitary and bacteriological surveys and classified into an appropriate shellfish harvesting classification.

The United States Food and Drug Administration (USFDA) use The National Shellfish Sanitation Program's (NSSP) *Guide for the Control of Molluscan Shellfish* to evaluate state shellfish sanitation programs. The NSSP Model Ordinance requires that a sanitary survey be in place for each growing area prior to its use as a source of shellfish for human consumption and

prior to the area's classification as Approved, Conditionally Approved, Restricted, or Conditionally Restricted. Each sanitary survey shall be updated on an annual basis and accurately reflect changes which have occurred within the area. Requirement of the annual reevaluation include, at a minimum, field observations of pollution sources, an analysis of water quality data consisting of the past year's data in combination with appropriate previously collected data, review of reports and effluent samples from pollution sources, and review of performance standards for discharges impacting the growing area. A brief report documenting the findings shall also be provided.

The following criteria consistent with the NSSP Model Ordinance and S.C. Regulation 61-47 are used in establishing shellfish harvesting classifications:

Approved Area - Growing areas shall be classified approved when the sanitary survey concludes that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in concentrations that would render shellfish unsafe for human consumption. Approved classifications shall be determined upon a sanitary survey that includes water samples collected from stations in the designated area adjacent to actual or potential sources of pollution. For waters sampled under adverse pollution conditions, the median fecal coliform Most Probable Number (MPN) or the geometric mean MPN shall not exceed fourteen per one hundred milliliters, nor shall more than ten percent of the samples exceed a fecal coliform MPN of forty-three per one hundred milliliters (per five tube decimal dilution). For waters sampled under a systematic random sampling plan, the geometric mean fecal coliform MPN shall not exceed fourteen per one hundred milliliters, nor shall the estimated ninetieth percentile exceed an MPN of forty three per one hundred milliliters (per five tube decimal dilution). Computation of the estimated ninetieth percentile shall be determined using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Conditionally Approved Area - Growing areas may be classified conditionally approved when they are subject to temporary conditions of actual or potential pollution. When such events are unpredictable, as in non-point source pollution from rainfall runoff or discharge of a major river, a management plan describing conditions under which harvesting will be allowed shall be adopted by the Department prior to classifying an area as conditionally approved. Where appropriate, the management plan for each conditionally approved area shall include performance standards for sources of controllable pollution (e.g., wastewater treatment and collection systems), evaluation of each source of pollution, and means of rapidly closing and subsequently reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish shall not be directly marketed from a conditionally approved area until conditions for an approved classification have been met for a period of time likely to ensure the shellfish are safe for consumption. Shellstock from conditionally approved areas that have been subjected to temporary conditions of actual or potential pollution may be relayed to Approved areas for purification or depurated through controlled purification operations only by special permit issued by the Department.

Restricted Area - Growing areas shall be classified restricted when sanitary survey data

show a moderate degree of pollution or the presence of deleterious or poisonous substances to a degree that may cause the water quality to fluctuate unpredictably or at such a frequency that a conditionally approved classification is not feasible. Shellfish may be harvested from areas classified as restricted only for the purposes of relaying or depuration and only by special permit issued by the Department and under Department supervision. The suitability of restricted areas for harvesting of shellstock for relay or depuration purposes may be determined through the use of comparison studies of background tissue samples with post-process tissue samples, as well as other process verification techniques deemed appropriate by the Department. For restricted areas to be utilized as a source of shellstock for depuration, or as source water for depuration, the fecal coliform geometric mean MPN of restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Conditionally Restricted Area - Growing areas may be classified conditionally restricted when they are subject to temporary conditions of actual or potential pollution. When such events are predictable, as in the malfunction of wastewater treatment facilities, non-point source pollution from rainfall runoff, discharge of a major river or potential discharges from dock or harbor facilities that may affect water quality, a management plan describing conditions under which harvesting will be allowed shall be prepared by the Department prior to classifying an area as conditionally restricted. Where appropriate, the management plan for each conditionally restricted area shall include performance standards for sources of controllable pollution, e.g., wastewater treatment and collection systems and an evaluation of each source of pollution, and description of the means of rapidly closing and subsequent reopening areas to shellfish harvesting. Memorandums of agreements shall be a part of these management plans where appropriate. Shellfish may be harvested from areas classified as conditionally restricted only for the purposes of relaying or depuration and only by permit issued by the Department and under Department supervision. For conditionally restricted areas to be utilized as a source of shellstock for depuration, the fecal coliform geometric mean MPN of conditionally restricted waters sampled under adverse pollution conditions shall not exceed eighty-eight per one hundred milliliters nor shall more than ten percent of the samples exceed a MPN of two hundred and sixty per one hundred milliliters for a five tube decimal dilution test. For waters sampled under a systematic random sampling plan, the fecal coliform geometric mean MPN shall not exceed eighty-eight per one hundred milliliters nor shall the estimated ninetieth percentile exceed an MPN of two hundred and sixty per one hundred milliliters (five tube decimal dilution). Computation of the estimated ninetieth percentile shall be obtained using National Shellfish Sanitation Program Guide for the Control of Molluscan Shellfish methodology.

Prohibited Area - Growing areas shall be classified prohibited if there is no current sanitary

survey report or if the sanitary survey report or monitoring data show unsafe levels of fecal material, pathogenic microorganisms, or poisonous or deleterious substances in the growing area or otherwise indicate that such substances could potentially reach quantities that could render shellfish unfit or unsafe for human consumption.

BACKGROUND INFORMATION

This sanitary survey evaluates the current harvesting classification of shellfish growing waters designated as Shellfish Management Area 12A. SFMA 12A consists of approximately 8,292 acres of shellfish growing area habitat located in Charleston County, South Carolina. The area consists of Adams, Bohicket, Church, Fickling, New Cut, Pine, Privateer and Raven Point Creeks. SFMA 12A is bounded to the east by Johns Island and to the north by Bohicket Road and the Stono River. The western border is a line, passing through Wadmalaw Island, starting at Goshen Point and ending on the western side of Adams Creek. The southern boundary is the North Edisto River.

The shellfish industry in South Carolina is based primarily on the harvest of the eastern oyster (*Crassostrea virginica*) and hard clams, which include both the northern clam (*Mercenaria mercenaria*) and several small populations of the southern clam (*Mercenaria campechiensis*). The ribbed mussel (*Geukensia demissa*) is also harvested in South Carolina, primarily gathered on a small scale by the general public for recreational harvest. Areas in South Carolina designated for commercial harvest by the South Carolina Department of Natural Resources (SCDNR) include State shellfish grounds, Culture permits, Mariculture permits and Kings Grant areas. The South Carolina Department of Health and Environmental Control will disallow the harvesting of shellfish within SFMA 12A, for direct marketing purposes, from the Restricted waters listed below in the Recommendations.

There are three (3) State Shellfish Grounds (S) within SFMA 12A: S172, S182, and S187. There is one (1) Culture Permit (C) within the area which is C188. There is one (1) Mariculture Permit (M) within the area which is M706F and no Kings Grants (G) or Recreation Grounds (R) within SFMA 12A.

The shellfish harvesting season in South Carolina typically extends from October 1 through May 31. The South Carolina Department of Natural Resources (SCDNR) has the authority to alter the shellfish harvesting season for resource management purposes and grant permits for year-round mariculture operations. Additionally, the South Carolina Department of Health and Environmental Control has the authority to prohibit shellfish harvesting when necessary to ensure that shellfish harvested in South Carolina waters are safe for human consumption.

The harvesting classifications of Area 12A **prior** to this sanitary survey were as follows:

PROHIBITED

1. Those waters of Bohicket Creek, extending approximately 1,956 feet upstream and downstream from the Bohicket Marina in Bohicket Creek, as measured from the centermost dock;
2. Those waters within a radius of approximately 1,000 feet of both the Cherry Point Seafood and East Coast Seafood commercial docks in Bohicket Creek;
3. Those waters extending approximately 1,000 feet upstream and downstream from the Adams Creek commercial docks in Adams Creek.

RESTRICTED

1. Those waters of Church Creek and all adjacent marshland extending from Station 12A-41 downstream to Station 12A-31 in Bohicket Creek;
2. Those waters of New Cut Creek and the AIWW and adjacent marshlands from Station 12A-41 to the borders with Shellfish Management SFMA's 11 and 12B.
3. Those waters of Adams Creek and all adjacent marshland extending from Station 12A-11A (Adams Creek, northern boundary of Adams Creek Marina closure zone) down to Station 12A-09 (Adams Creek at Bohicket Creek) will be to Restricted.

CONDITIONALLY APPROVED

None

APPROVED

All other waters in SFMA 12A.

Station Addition/Deactivation/Modification: None

POLLUTION SOURCE SURVEY

SURVEY PROCEDURES

Shoreline surveys of SFMA 12A are conducted by the South Carolina Department of Health and Environmental Controls, Environmental Affairs, Lowcountry – Charleston Shellfish Sanitation Program staff**,** by watercraft, vehicle, and on foot, during the survey period and are ongoing. Previous shoreline survey efforts conducted by the Office of Coastal Resource Management (OCRM) will continue to be documented.

OCRM developed GIS shapefiles that documented rural, non-MS4 (Municipal separate storm sewer system) areas in Charleston County serviced by septic tanks. A one-mile buffer was drawn around all impaired shellfish water bodies in the county. County parcel data was cross-referenced

with Department septic tank permit data in those areas to develop shapefiles of all parcels on septic tanks, to include the number of tanks on the property and the property owner's names(s) and address(s). A physical shoreline survey of these same areas was also conducted, including GPS coordinates of any observed animal farms, type and number of animals observed, and their distance from shellfish harvesting waters. Together, the septic data and animal farm data should provide focus for future shoreline survey efforts in locating and evaluating potential non-point source impacts near impaired shellfish harvesting waters.

POINT SOURCE POLLUTION

A. Municipal and Community Waste Treatment Facilities

There are no permitted wastewater treatment plants (WWTP) within SFMA 12A. However, the Town of Seabrook Island (ND0063347) on Seabrook Island has been issued a land application permit for treated effluent. Although technically within the boundary of SFMA 11, ND0063347 actually lies within the watershed boundary of Privateer Creek in SFMA 12A and is therefore referenced in this report. The table below summarizes all instances where WWTP facilities exceeded their allowed permit values for fecal coliform, the Discharge Monitoring Report (DMR) value of that violation, and flow value. For the 2019-2021 reporting years for this Annual Update, Seabrook Island WWTP had no instances of permit violation for fecal coliform parameters.

National Pollutant Discharge Elimination System (NPDES) Permitted Facilities			
Permit #	**Facility**	**Outfalls**	**Permitted Flow (Gallons Per Day)**
ND0063347	Town of Seabrook Island - WWTP	001-003 - Land App. to Golf Course	869,200 GPD

WWTP Discharge Monitoring Report Violations 2019-2021					
Facility	**Limit**	**Violation**	**Outfall**	**Report Date**	**Monthly Avg. Flow (Gallons Per Day)**
Seabrook Island - WWTP	14 FC/100 ml	None	N/A	N/A	N/A
	43 FC/100 ml	None	N/A	N/A	N/A

The town of Seabrook had no reported sanitary sewer overflow (SSO's) during this review period.

Sanitary Sewer Overflows – Seabrook – 2019-2021				
Date	**Location**	**Gallons Released**	**Waterbody Entered**	**Comments**
N/A	N/A	N/A	N/A	N/A

B. Industrial Waste (Discharges) - There are two permitted industrial wastewater discharges located within the boundaries of SFMA 12A. Charleston County/Collins Mine (SCG730514) and Bishop Construction/Ed's Mine (SCG730726). Both permits are for mineral mine dewatering, issued to address dewatering of excavated sand pits/granite mines. Their discharges are depicted on the attached Potential Pollution Source map

(Figure 1).

C. **Marinas** – In 2007, prompted by a SCDHEC Office of Coastal Resource Management (OCRM) marina definition change, SCDHEC Shellfish adopted the following marina definition. S.C. Regulation 61-47, Shellfish defines *Marina* as any of the following: 1) locked harbor facility; 2) any facility which provides fueling, pump-out, maintenance or repair services (regardless of length); or, 3) any facility which has permanent docking space of 250 linear feet or greater. 4) Any water area with a structure which is used for docking or otherwise mooring vessels and constructed to provide temporary or permanent docking space for more than ten boats. 5) A dry stack facility.

There are currently four (4) marinas in SFMA 12A. Bohicket Marina is a recreational marina located in Bohicket Creek on Seabrook Island. The marina offers 196 wet slips, another 85 dry-stack slips, fuel services and wastewater pump-out services, including a pump-out boat. Bohicket Marina allows a maximum of six live-aboard vessels at its marina. However, given its distance from the more heavily traveled AIWW corridor, there are typically only three to four live-aboards at any given time. A Prohibited closure zone extends the full breadth of Bohicket Creek, approximately 1,956 feet upstream and downstream, as measured from the centermost marina dock.

Two commercial fisheries marina facilities are also located within SFMA 12A. East Coast Seafood and Cherry Point Seafood are located on Bohicket Creek, approximately two and three miles, respectively, from the North Edisto River. East Coast Seafood has approximately 360 ft. of dockage and currently has two shrimp trawlers and one sailboat. They also occasionally accommodate out-of-state shrimp trawlers during shrimp season. East Coast Seafood does have a diesel fuel tank, but it is empty, as they are currently purchasing their fuel from Cherry Point Seafood. Cherry Point Seafood typically accommodates seven local shrimp trawlers, seven long-line fishing vessels (seasonal), and also occasional transient out-of-state shrimp trawlers during shrimp season. Cherry Point Seafood offers diesel fuel as well as sewage pump-put service.

Finally, Marine Propulsions is located on Adams Creek. Marine Propulsions is a recreational boat repair facility with 14 work-slips used for docking boats awaiting haul-out for land-based repair. Marine Propulsions has neither fuel nor sewage pump-out services. Administratively Prohibited closure zones encompass all facilities. Table #7 is included at the end of this report, providing additional detail on SFMA 12A boat docking facilities.

D. **Radionuclides** - Sources of radionuclides have not been identified within SFMA 12A, and radionuclide monitoring has not been conducted. No other sources of poisonous or deleterious substances have been identified within the area.

NONPOINT SOURCE POLLUTION

A. **Urban and Suburban Stormwater Runoff** - Past shoreline surveys conducted in SFMA 12A revealed the concentration of homes to be uniform throughout the area. Single-

family homes continue to be built along both Bohicket and Church Creeks. Land clearing, associated with new construction, can accelerate shoreline erosion. Stormwater runoff impacts water quality by transporting fecal coliform bacteria from land to the shellfish growing area.

The North Edisto River and southern portions of Bohicket Creek could require maintenance dredging. However, the Army Corps of Engineers has not conducted any dredging projects recently in the area.

The uplands surrounding the shellfish growing waters of SFMA 12A consist of various soil textures defined by the United States Department of Agriculture (USDA), Soil Conservation Service (1971) utilizing general classifications and descriptions. Although lands within SFMA 12A consist of numerous soil types, the area is generally comprised of Kiawah-Seabrook-Dawhoo soils, and occur on low, broad ridges and long, narrow-to-broad depressions in areas roughly parallel with the coastline. The USDA (1971) further describes these soils as "moderately well drained to very poorly drained, nearly level to depressional, sandy soils."

B. **Agricultural Runoff** - There are no permitted agricultural facilities located in SFMA 12A. However, there are many agricultural crop farms within the area.

C. **Individual Sewage Treatment and Disposal Systems** - Nearly all homes adjacent to shellfish growing waters within SFMA 12A are served by individual septic systems. Each system requires inspection by South Carolina Department of Health and Environmental Control's, Environmental Affairs, Bureau of Environmental Health Services Lowcountry-Charleston, On-site Wastewater Section and approval before final installation.

D. **Wildlife and Domestic Animals** - SFMA 12A supports a large population of domestic animals attributable to the number of private residences along the shores. SFMA 12A also supports a moderate wildlife population: primarily various types of waterfowl and land mammals such as deer, raccoon, and rodents, as well as marine mammals. The area has an extensive network of small tidal creeks. This creek system provides a possible conduit for animal fecal coliform bacteria to be transported to the adjacent growing waters.

E. **Boat Traffic** - Through much of the year, recreational boat traffic is moderate from the Bohicket Marina to the North Edisto River; and the boat traffic is light from the marina northward. Commercial traffic in Bohicket Creek is light and consists primarily of shrimp boats that are headed off shore. Commercial fisheries boats, ranging in size from 16 to 50 feet, operate as long as the product demand exists. During the recreational shrimp-baiting season, typically extending from mid-September through mid-November, recreational traffic is moderate.

F. **Hydrographic and Habitat Modification** - Hydrographic and habitat modification in estuarine areas requires both State and Federal approval. The North Edisto and southern

portions of Bohicket creek may require maintenance dredging. The U.S. Army Corps of Engineers utilizes designated tracts of land adjacent as dredge spoil sites.

NATURALLY OCCURRING PATHOGENS

A. **Marine Biotoxins** - Bivalve shellfish contamination from marine biotoxins has not been shown to be a human health concern within SFMA 12A. During the winter and spring of 1988, South Carolina experienced an occurrence of "Red Tide", specifically *Ptychodiscus brevis* (*K. brevis*), which affected water quality in Area 01. There has been no documented reoccurrences of this organism at levels requiring emergency response in South Carolina waters subsequent to the 1988 event. Due to the vast media coverage of events related to *Pfiesteria pisicida*, the Department participates in a State Task Group on Toxic Algae and operates a toxic algae emergency response team. The Department also has a Marine Biotoxin Contingency Plan in place that must be evaluated and updated annually.

B. ***Vibrio parahaemolyticus*** – Because State water temperatures exceed 81 degrees Fahrenheit (F) during June through September, *Vibrio parahaemolyticus* (Vp) management controls must be implemented during these months. Management controls for permitted Aquaculture facilities are specifically addressed in R.61-47. The season for wild-stock harvest is currently closed from June 1 through September 30. The Department is currently opposed to issuance of special wild-stock harvest permits to Certified Shippers during the closed season. Special permit conditions for maricultured triploid oysters during the vibrio control months must include current R.61-47 and NSSP temperature control requirements to be included in the Certified Shipper's HACCP plan.

HYDROGRAPHIC AND METEOROLOGICAL CHARACTERISTICS

PHYSIOGRAPHY

Shellfish Management Area 12A consists of the waters of Adams, Bohicket, Church, Fickling, New Cut, Pine, Privateer and Raven Point Creeks. The entire area is tidally influenced by the Atlantic Ocean through the North Edisto Inlet. The creeks within the area typically range from 30 to 200 feet in width and average 2 to 25 feet in depth. The entire area is approximately 8.5 miles long (north to south) and 4 miles wide (west to east).

Tides in SFMA 12A are semidiurnal, consisting of two low and two high tides occurring each lunar day. Mean tidal ranges in Bohicket Creek at the Maybank Highway Bridge are 6.1 feet during normal tides and 8.5 feet during spring tides. Wind direction and intensity, as well as atmospheric pressure, typically cause variations in predicted tidal ranges.

In 2017, the collection of rainfall data has been improved for a more consistent, accurate, and reliable data set that can be accessed directly from a shellfish staff member's computer or phone. With assistance from the National Weather Service's, Southeastern River Forecast Center, the development of the South Carolina Shellfish Rainfall Program was introduced and utilized. This new technology provides shellfish program staff with real-time daily updates for

rainfall accumulation in each of the South Carolina shellfish growing management areas, as well as providing critical triggers that alert staff to when rainfall thresholds for closures are exceeded.

In September of 2019, Hurricane Dorian produced 5.61 inches of rainfall during a two-day period. On April 24, 2020, a major rain event produced 4.03 inches of rain in a 24 hour period which closed SFMA 12A for the remainder of the open shellfish harvesting season. On July 8, 2021, Tropical Storm Elsa produced 4.59 inches of rain in a 24 hour period which closed summer harvesting in SFMA 12A until July 21, 2021. Precipitation totals recorded for SFMA 12A in 2021 were 55.31 inches.

Prevailing winds along the central portion of the South Carolina coast are from the south and west during spring and summer and from the north during autumn and winter. Wind speeds are generally less than 15 miles per hour (mph); however, strong weather systems may generate winds in excess of 25 mph. Tropical storms and hurricanes occur occasionally. Freshwater rivers do not discharge directly into SFMA 12A. Freshwater influence is primarily due to rainfall.

WATER QUALITY STUDIES

DESCRIPTION OF THE PROGRAM

The Department currently utilizes a systematic random sampling (SRS) strategy within SFMA 12A in lieu of sampling under adverse pollution conditions. In order to comply with NSSP guidelines, a minimum of thirty samples are required to be collected and analyzed from each station during the review period. Sampling dates are computer generated prior to the beginning of each quarterly period thereby insuring random selection with respect to tidal stage and weather. Day of week selection criteria is limited to Mondays, Tuesdays and Wednesdays due to shipping requirements and laboratory manpower constraints. Sample schedules are rarely altered.

During July 1998, an updated shellfish water quality data scheduling and collection procedure was formalized. Samples utilized for classification purposes are limited to those samples collected in accordance with the SRS for a 36-month period beginning January 1 and ending December 31. This allows for a maximum of 36 samples per station, yet provides a six-sample "cushion" (above the NSSP required 30 minimum) for broken sample bottles, lab error, breakdowns, etc. This also allows each annual report's water quality data to meet the requirements for the NSSP Triennial Review sampling criteria.

Five hundred and four (504) SRS routine surface water quality samples (<1.0 ft. deep) were collected for bacteriological analyses and classification purposes from fourteen (14) active water quality sampling stations in SFMA 12A during the period 01/01/19 through 12/31/21. Multiple samples were taken for non-classification purposes, associated with reopening the area following precautionary closures. Samples were collected in 120 ml amber glass bottles, immediately placed on ice and transported to the South Carolina Department of Health and Environmental Control's, Environmental Affairs, Lowcountry – Charleston Laboratory in North Charleston, South Carolina. An additional 120 ml water sample was included with each shipment for the purpose of temperature control. At the laboratory, sample sets exceeding a 30-hour holding time

or containing a temperature control in excess of 10 degrees Centigrade were discarded (APHA, 1970).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using an automatic temperature compensated refractometer. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling.

MONITORING RESULTS

Stations exceeding a fecal coliform geometric mean MPN value of 14 were 12A-20, 12A-21, 12A-29, 12A-38, 12A-40, and 12A-46. No station exceeded a fecal coliform geometric mean MPN value of 88.

Stations exceeding a fecal coliform MPN estimated 90th percentile value of 43 were 12A-11A, 12A-13, 12A-13A, 12A-20, 12A-21, 12A-22, 12A-29, 12A-38, 12A-40, 12A-41, and 12A-46. No station exceeded an estimated 90th percentile fecal coliform MPN value of 260.

CONCLUSIONS & RECOMMENDATIONS

Based on review of fecal coliform bacteriological data and the pollution source survey, there will be no recommended changes for the upcoming 2022-2023 shellfish harvesting season.

SFMA 12A appears to be impacted primarily by non-point source pollution. Although in 2021, the total precipitation was lower than in 2020, rainfall still may have contributed to portions of the growing area maintaining a Restricted classification. Stormwater runoff appears to be the major source of fecal coliform bacteria throughout the area. Domestic and wild animal populations are likely contributors to excessive fecal coliform levels within the area. Moderate numbers of livestock have been observed along both Bohicket and Church Creeks.

Based upon the findings of this Annual Update, the following classification is recommended:

PROHIBITED

1. Those waters of Bohicket Creek, extending approximately 1,956 feet upstream and downstream from the Bohicket Marina in Bohicket Creek, as measured from the centermost dock;
2. Those waters within a radius of approximately 1,000 feet of both the Cherry Point Seafood and East Coast Seafood commercial docks in Bohicket Creek;
3. Those waters extending approximately 1,000 feet upstream and downstream from the Adams Creek commercial docks in Adams Creek.

RESTRICTED

1. Those waters of Church Creek and all adjacent marshland extending from Station 12A-41 downstream to Station 12A-31 in Bohicket Creek;

2. Those waters of New Cut Creek and the AIWW and adjacent marshlands from Station 12A-41 to the borders with Shellfish Management SFMA's 11 and 12B.
3. Those waters of Adams Creek and all adjacent marshland extending from Station 12A-11A (Adams Creek, northern boundary of Adams Creek Marina closure zone) down to Station 12A-09 (Adams Creek at Bohicket Creek.)

CONDITIONALLY APPROVED

None

APPROVED

All other waters in SFMA 12A.

Station Addition/Deactivation/Modification: None

Analysis of sampling data for SFMA 12A demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of Area 12A will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured by the National Weather Service, Southeastern River Forecast Center. This methodology is associated with the concept of the Probable Maximum Precipitation (PMP). The National Weather Service publishes PMP estimates for the coastal United States in a series of hydro-meteorological reports (HMRs) (*National Weather Service*). PMP estimates for South Carolina's growing areas are derived from HMRs 51, 52, and 53 (*National Research Council, 1985*).

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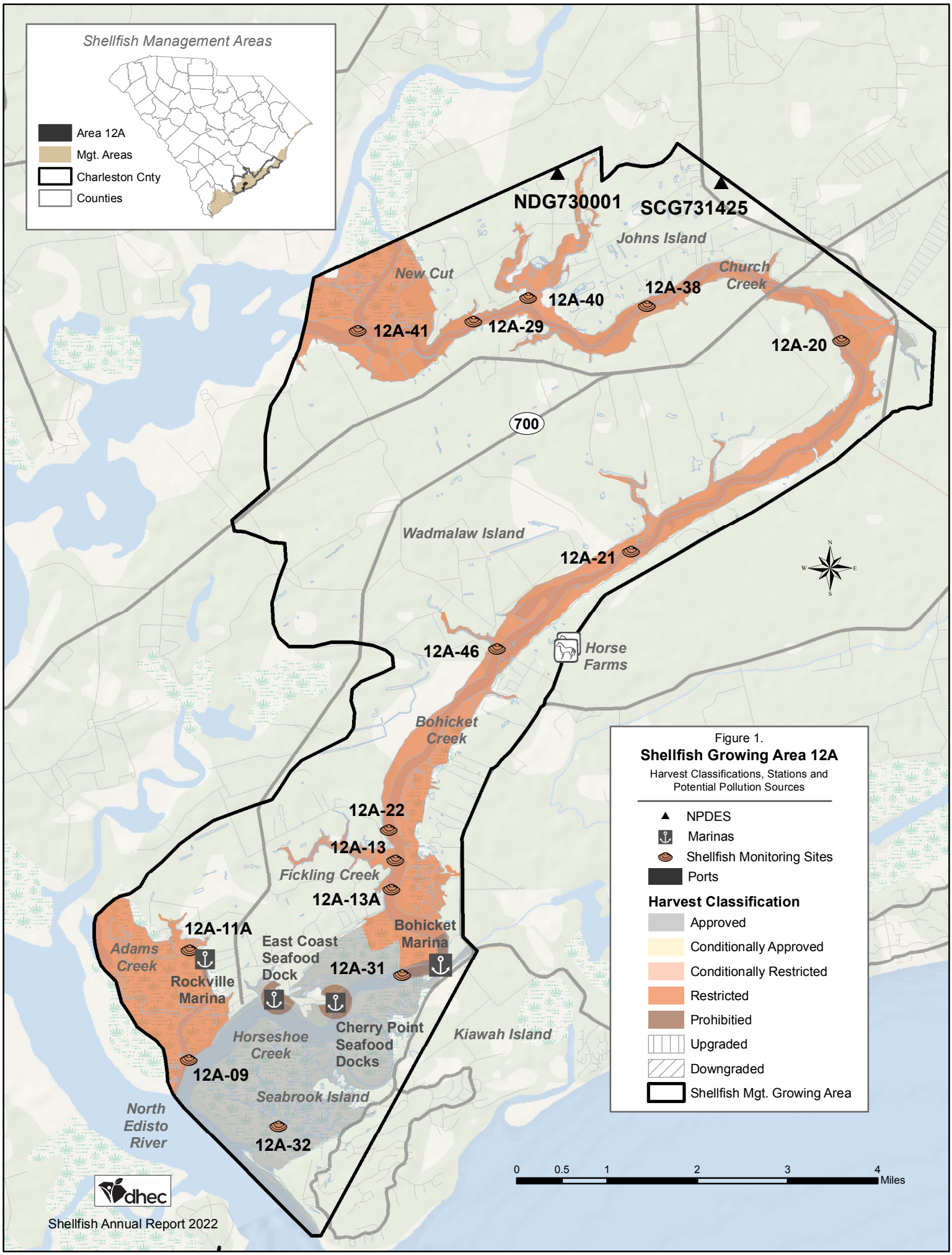

Figure 1.
Shellfish Growing Area 12A
Harvest Classifications, Stations and Potential Pollution Sources

NPDES
Marinas
Shellfish Monitoring Sites
Ports

Harvest Classification
Approved
Conditionally Approved
Conditionally Restricted
Restricted
Prohibitied
Upgraded
Downgraded
Shellfish Mgt. Growing Area

TABLE #1

Shellfish Management Area 12A

Water Quality Sampling Stations Description

Station	**Description**
12A-09	Adams Creek at Bohicket Creek
12A-11A	Adams Creek, northern boundary of Adams Creek Marina closure zone
12A-13	Bohicket Creek at Fickling Creek
12A-13A	Bohicket Creek at Bloody Point
12A-20	Bohicket Creek at Hoopstick Island
12A-21	Bohicket Creek at old dam (causeway with two live oaks)
12A-22	Bohicket Creek at Boy Scout Camp
12A-29	Church Creek at Ravens Point
12A-31	Bohicket Creek, southwest boundary of Bohicket Marina closure zone
12A-32	Privateer Creek at fork
12A-38	Church Creek at power line crossing
12A-40	Pine Creek at first fork
12A-41	Church Creek at New Cut
12A-46	Bohicket Creek between Stations 21 and 22 at small tributary on west bank

(**Total Active – 14**)

TABLE #2

Shellfish Management Area 12A
FECAL COLIFORM BACTERIOLOGICAL DATA SUMMARY
From Shellfish Water Quality Sampling Stations Between

January 1, 2019 to December 31, 2021

Station #	9	11A	13	13A	20	21	22	29	31	32
SAMPLES	36	36	36	36	36	36	36	36	36	36
GEOMEAN	4.7	8.7	11.9	11.7	45.6	20.6	14.1	18.7	8.4	4.8
90TH %ILE	17	51	48	45	138	135	67	100	40	15
WATER QLTY	A	R	R	R	R	R	R	R	A	A
CLASSIFICATION	R	P	R	R	R	R	R	R	P	A

Station #	38	40	41	46
SAMPLES	36	36	36	36
GEOMEAN	53.3	31.3	12.5	19.3
90TH %ILE	216	173	58	91
WATER QLTY	R	R	R	R
CLASSIFICATION	R	R	R	R

A - Approved **CA** - Conditionally Approved **R** - Restricted
RND - Restricted/No Depuration **P** - Prohibited

Table #3 Fecal Coliform Historical Trend Sheet											
Area 12A Stations 90th%ile Values for Annual Updates Related to Rainfall											
Station #	**2021**	**2020**	**2019**	**2018**	**2017**	**2016**	**2015**	**2014**	**2013**	**2012**	**2011**
12A-09	17	15	11	15	12	8	6	6	7	5	8
12A-11A	51	56	33	34	28	20	16	14	15	15	23
12A-13	48	74	99	115	93	31	30	20	25	19	37
12A-13A	45	52	68	72	54	22	21	18	21	26	32
12A-20	138	219	287	266	183	109	120	102	74	32	64
12A-21	135	134	176	149	193	99	85	34	30	28	34
12A-22	67	72	130	126	134	39	39	23	22	21	34
12A-29	100	82	106	162	170	124	109	87	73	50	49
12A-31	40	31	29	34	35	15	18	14	16	9	21
12A-32	15	12	7	8	10	10	8	9	10	9	21
12A-38	216	182	216	196	225	175	243	204	154	88	120
12A-40	173	181	212	223	198	145	183	149	153	107	116
12A-41	58	52	76	84	96	53	48	33	27	18	22
12A-46	91	133	165	154	123	53	70	53	42	23	37
Annual Rainfall (in inches)	**55.31**	**63.17**	**49.62**	**57.61**	**55.85**	**62.08**	**67.67**	**53.05**	**26.0***	**7.00***	**32.25**
ND = No Data Red = Impaired Water Quality											

*** Toogoodoo Rain Gauge was not operable for several months of 2012 and 2013**

TABLE #4

WATER QUALITY SAMPLING STATIONS DATA

Shellfish Management Area 12A

Detailed data for each shellfish station listed in this report's "Fecal Coliform Bacteriological Data Summary Table", and in other shellfish reports, can be obtained through South Carolina's Department of Health and Environmental Control – Freedom of Information Office at the address below.

Freedom of Information
SC Dept. of Health & Environmental Control
2600 Bull Street
Columbia, SC 29201

Any explanation or clarity needed on the report's content can be obtained by contacting the preparer(s), and/or reviewer(s) listed on the cover page.

TABLE #5

RAINFALL DATA

Shellfish Management Area 12A

Source:

2019 – 2021 Data
National Weather Service - Southeastern River Forecast Center
Location: Wadmalaw Island, South Carolina

2019 Annual Rainfall Summary
Source: National Weather Service - Southeastern River Forecast Center
Location: Wadmalaw Island, South Carolina

2019	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1			0.07	0.01		0.06			0.51		0.20	
2			0.04	0.56					0.02			0.10
3				0.21			0.23	0.58	0.32			
4	0.06	0.08	0.43		0.06		0.07	0.05				
5	0.34		0.20	0.10	0.09	0.68	0.12	0.40	***4.83**	0.09	0.02	
6			0.04	0.48		0.21	0.33	0.07	***0.78**	0.02	0.10	
7				0.27		1.15				0.02		0.05
8				0.20		0.75	0.05	0.06		0.20	0.26	
9				0.07	0.03	0.64		0.02				
10				0.64	0.05	0.19	0.11	0.23				
11			0.06	0.06		0.14	1.47	0.07	0.21			0.01
12		0.21	0.03	0.05		1.35		0.44				
13		0.01			0.41	2.35		0.02			0.23	0.03
14	0.06				0.03		0.04	0.30		0.12		1.85
15								1.49	0.14		0.58	0.01
16		0.10	0.01				0.12	0.29	0.01	2.71	0.44	
17		0.06	0.01		0.07	0.01		0.19		0.01	1.21	
18	0.06					0.03	0.19	1.85				0.30
19				0.27		0.01	0.35	0.01		0.02		
20	0.70	0.02		0.30		0.12				1.46		
21		0.17				0.31						
22						0.14						0.01
23						0.49	0.08	0.02				2.00
24	0.56						1.11				0.12	2.22
25	0.06	0.06						0.06				
26			0.04									
27										0.10		
28						0.02				0.16		
29								0.20				
30	0.06					0.36	0.04			0.02		0.38
31							0.55	0.03				
Total	**1.90**	**0.71**	**0.93**	**3.22**	**0.74**	**9.01**	**4.86**	**6.38**	**6.82**	**4.93**	**3.16**	**6.96**

***Days highlighted indicate 4 or more inches of rain in a 24-hour period. Blank fields indicate no rainfall.**

*** Sample dates are indicated in blue.**	**ND = No Data**	**ANNUAL RAINFALL**	**49.62**

2020 Annual Rainfall Summary
Source: National Weather Service - Southeastern River Forecast Center
Location: Wadmalaw Island, South Carolina

2020	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1		0.34		0.71	0.28	0.05	0.16					0.53
2							0.15	0.02			0.07	
3			0.38				0.20	0.26	0.01			
4	0.04		0.03					0.88		0.04		
5	0.09		1.33			0.27		0.01				0.06
6			1.70			0.02	0.31	0.06	0.28	0.01		
7		0.79				0.80	1.17	0.04	0.11	0.09	0.02	
8							2.41	0.02			0.01	0.20
9						0.15	0.03	0.62	0.52		0.11	
10				0.01		0.23	0.13		0.08		0.05	
11						0.12	0.66	0.01		1.26	0.84	
12	0.06		0.08			0.02	0.16	0.01	0.14		0.39	
13	0.30			0.07		0.45	0.04				1.14	
14	0.02	0.12		1.24				0.28				
15	0.02	0.01		0.29		1.67	0.04	0.19				
16			0.02	0.48				0.28		0.05	0.07	0.04
17	0.09	0.23	0.01						2.05			0.31
18					0.02				0.41			
19		0.70						0.31				
20		0.04		1.89	0.13	0.23		0.15				0.03
21		0.83		0.01	3.30	0.24		1.26				0.48
22								0.06		0.20	0.01	
23			0.04	0.04	0.52			1.13			0.09	
24			0.24	***4.03**		0.74		0.18		0.39		0.12
25	0.18	0.65	0.09			0.74	0.10	2.58	0.05	0.15		0.46
26		0.07	0.02		0.16		0.20	0.42	1.66		0.02	
27	0.14	0.18			2.46		0.01	0.17				
28					0.29	0.01			0.21			
29							0.28	0.03	1.02		0.22	
30	0.41			0.36	0.41	0.01	0.13		0.43	0.40	0.56	
31					0.79		0.12	0.02				
Total	**1.35**	**3.96**	**3.94**	**9.13**	**8.36**	**5.75**	**6.30**	**8.99**	**6.97**	**2.59**	**3.60**	**2.23**

***Days highlighted indicate 4 or more inches of rain in a 24-hour period. Blank fields indicate no rainfall.**

*** Sample dates are indicated in blue.**	**ND = No Data**	**ANNUAL RAINFALL**	**63.17**

2021 Annual Rainfall Summary
Source: National Weather Service - Southeastern River Forecast Center
Location: Wadmalaw Island, South Carolina

2021	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC
1	0.03	0.79		1.20				0.20	0.08			
2	0.03		0.06				0.01	0.35		0.03		
3	0.21		1.20				0.14	0.02		0.09		
4			0.13		0.35	0.18		1.04		0.19		
5					0.23	0.62		0.02		0.01		
6		0.08				0.03		0.45	0.01	2.11	0.37	
7		0.53	0.02			0.02	0.03	0.17	0.02	0.21	0.73	
8	0.63					0.01	*4.59	0.03	0.01	0.20	0.18	0.60
9	0.03	0.01						0.28	0.89	0.07		0.57
10		0.03		0.01		0.09	0.57	0.05	2.67	0.02		
11												
12	0.08				1.22	0.17					0.01	0.19
13		0.19			0.24	1.27	0.06	0.05				
14	0.06	0.63				0.38	0.20	0.02				
15	0.00	1.12					0.05	0.10				
16	0.37	0.35	0.08			0.67		0.42	0.02			
17				0.02		0.20		0.82	0.12			
18		0.06						1.11	0.03			
19		0.64	2.12				0.13	0.03	0.14			
20		0.48				0.17	0.15		0.36			0.11
21			0.17			2.23	1.27	0.01	2.15			0.18
22	0.20	0.02	0.14			0.01		0.96	0.70			0.28
23	0.17	0.01				0.59	0.44	0.08	0.02		0.03	
24							0.01	0.03				
25				1.80						0.60		
26										0.07	0.03	
27	0.66		0.48			0.07	0.10					
28	0.57					0.01	0.93					
29			0.04			0.47	0.65			0.49		
30					0.07							
31			0.01									0.39
Total	3.04	4.94	4.45	3.03	2.11	7.19	9.33	6.24	7.22	4.09	1.35	2.32

*Days highlighted indicate 4 or more inches of rain in a 24-hour period. Blank fields indicate no rainfall.

* Sample dates are indicated in blue.	ND = No Data	ANNUAL RAINFALL	55.31

TABLE #6

SHELLFISH MANAGEMENT AREA 12A
Pollution Event Closures
2019 – 2021

Event	Date(s)	Sample Date(s)	Opening Date	Comments
Hurricane Dorian	09/05/2019-09/06/2019	N/A	N/A	5.61 inches of rain produced during a 2-day period. Open Shellfish Harvesting Season was closed. No summer harvest in SFMA 12A during this time.
April Rainfall Event	04/24/2020	5/27/2020	N/A	4.03 inches of rain produced during a 24 hour period. Open Shellfish Harvesting Season closed. No summer harvest in SFMA 12A during this time.
Tropical Storm Elsa	7/8/2021	7/14/2021	7/21/2021	4.59 inches of rain in SFMA 12A produced during a 24 hour period closed summer harvesting for seven days.

TABLE #7
Shellfish Management Area 12A
MARINA INVENTORY

Marina	Total Slips	Pump-out Facility	Fuel Dock
Marine Propulsion Inc.	14	No	No
Bohicket Marina	196	Yes	Diesel-Gas
Cherry Point Seafood	20	Yes	Diesel
East Coast Seafood	4	No	Diesel