

South Carolina Department of Health and Environmental Control

ENVIRONMENTAL AFFAIRS

SHELLFISH MANAGEMENT AREA 04

2023 ANNUAL UPDATE

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

September 2023



WEB ADDRESS
<http://www.scdhec.gov/FoodSafety/ShellfishMonitoring/>

SHELLFISH MANAGEMENT AREA 04 2023 ANNUAL UPDATE

[Data Through December 2022]



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A handwritten signature in black ink, appearing to read 'Mike Marshall'. The signature is fluid and cursive, with the first and last names being the most prominent. Below the signature is a solid horizontal line.

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2023 ANNUAL UPDATE
Shellfish Management Area 04
SCDHEC Environmental Affairs

Data Inclusive Dates:
01/01/20 thru 12/31/22

Classification Change:
 X Yes No

Shoreline Survey Completed: Yes

(I)increased/(D)ecreased/(N)one:

Prior Report & Date: 2022 Annual Update

D Approved
 N Conditionally Approved
 I Restricted
 N Prohibited

SUMMARY

Classification changes within Shellfish Management Area 04 (SFMA 04) will be implemented for the upcoming 2023-2024 shellfish harvesting season. Fecal coliform bacteriological data during this review period have indicated that two stations be downgraded from Approved to the Restricted classification. Station 04-24 (Oaks Creek at First Curve) and Station 04-30 (Oyster Cove, North Branch) now both meet the criteria for a Restricted classification. Therefore, a new Restricted boundary around Station 04-24 for 1,000' in all directions continuing from Allston Creek into Oaks Creek will be implemented. In Oyster Cove, Station 04-29 (Oyster Cove, South Branch) will now become a boundary station since Station 04-30 will be downgraded. All previous station classifications within SFMA 04 from the prior shellfish harvesting season will remain the same.

SFMA 04 is made up of two separate estuaries with the northern estuary being in Murrells Inlet and the southern portion in Pawleys Island/Litchfield. Both sections of this area are very popular among local residents and tourists visiting the area. The Murrells Inlet section is a very high traffic area which is consistently used for fishing, boating, kayaking, sight-seeing, and both commercial and recreational fishing. There are several shellfish commercial leases, state grounds, and recreational grounds located in the area, and all are suitable for shellfish harvesting.

The southern section of the area (Pawleys Island/Litchfield) is also very popular among both residents and tourist alike; however, commercial fishing options are not as abundant. Unfortunately, water quality data continue to indicate that fecal coliform levels are still above allowable shellfish harvesting limits throughout this section of the area. Therefore, the Pawleys Island/Litchfield section of Area 04 will continue to be classified as Restricted in its entirety for the upcoming shellfish harvesting season. These sections continue to have issues due to surrounding land being mostly developed with commercial buildings, residential housing, golf courses, and other land disturbance issues, in addition to narrow and shallow water depths within the surrounding growing waters. These characteristics contribute to make rainfall and related non-point source runoff major contributors that affect water quality.

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 National Shellfish Sanitation Program (NSSP) Guide for the Control of Molluscan Shellfish is used by the United States Food and Drug Administration (USFDA) 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 the 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 predictable, 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 deperated 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 deperation 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 deperation 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 deperation, or as source water for deperation, 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 the 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 deperation 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 deperation, 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 the 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

Shellfish Management Area 04 (SFMA 04) consists of 4,364 acres of habitat suitable for the production of molluscan shellfish. SFMA 04 is comprised of two separate estuaries, Murrells Inlet, and Pawleys Island/Litchfield, which includes Midway Inlet and Pawleys Inlet. A portion of U.S. Highway 17 traversing the Waccamaw Neck defines the area's western boundary; the northern boundary is defined by uplands of Horry County approximately one mile north of Garden City Beach. The eastern boundary is the Atlantic Ocean, and the southern boundary extends from the Atlantic Ocean to U.S. Highway 17, approximately one mile south of Pawleys Inlet in Georgetown County.

Murrells Inlet encompasses approximately 3,108 acres of habitat suitable for the production of shellfish. This includes numerous commercial shellfish Culture Permit Areas, three State Shellfish Grounds that are used both commercially and recreationally, and two Recreational Shellfish Grounds. The northern boundary of the Murrells Inlet estuary is Garden City, a densely developed, unincorporated portion of Horry County, and its southern border is defined by Huntington Beach State Park. The Atlantic Ocean is to the east, and lands of the Waccamaw Neck define the western boundary.

The Pawleys Island/Litchfield estuary comprises approximately 1,256 acres of Restricted shellfish habitat. Two State Shellfish Grounds within the Litchfield portion of the estuary are occasionally utilized for relay purposes. Pawleys Island has not been utilized as a source of shellfish for relay projects during this review period.

The shellfish harvesting season in South Carolina normally 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 SFMA 04 **prior** to this sanitary survey were as follows:

Prohibited:

Murrells Inlet:

1. Those waters within approximately 1,000 feet of Captain Dick's and Marshview Marinas;
2. Those waters within approximately 1,000 feet of the docking facilities at Bovines and Snug Harbor;
3. Those waters within approximately 1,000 feet of Marina Colony;
4. Those waters within approximately 1,000 feet of the Marlin Quay Marina.

Pawleys Island/Litchfield: None

Restricted:

Murrells Inlet:

1. The Garden City Canal north of Station 04-04A and the marina closure zone at Marlin Quay Marina.
2. All portions of Main Creek north from Station 04-03B including all feeder creeks and marsh adjacent to the mainland and north of Flagg Creek including portions of C371 to Station 04-04A.
3. All waters of Parsonage Creek extraneous of marina closure zones.
4. All small feeder creeks and marsh adjacent to the mainland and Allston Creek extending from the northern end of Allston Creek to a point 200 meters south of Hughes Landing.
5. Allston Creek in its entirety, from Parsonage Creek Canal to Oaks Creek (near Station 04-24). This will also include all tributary creek mouths and marshlands within approximately 75' of Allston Creek.
6. Portions of marshlands and flats adjacent to and northwest of Allston Creek (near Station 04-07).
7. Those waters west of an imaginary line beginning at Station 04-31 in Woodland Creek heading southwest and 100 meters from the mainland through Weston Flat to Station 04-06 in Allston Creek.
8. Those waters southwest of an imaginary line extending from Huntington Beach through Station 04-32 at Brigham Hole, following the boundary line of State Shellfish Ground S354 and continuing to the mainland at Shell (Carr) Landing at Station 04-08A.

Pawleys Island/Litchfield: All Waters.

Conditionally Approved:

Murrells Inlet: None

Pawleys Island/Litchfield: None

Approved:

Murrells Inlet:

1. All portions of creeks and flats seaward and south of Stations 04-03A, 04-03B

and 04-04B to include C370 and portions of C371 south of Flagg Creek, excluding the Marlin Quey Marina Closure zone.

2. From the entrance of Allston Creek at Oaks Creek seaward to the Murrells Inlet jetty and areas adjacent to Drunken Jack Island south including S354 and R355.
3. All portions of the central part of the Murrells Inlet estuary including Oyster Cove but excluding any portions of Parsonage Creek, Allston Creek and any portion of any marina closure zone.
4. The waters of Weston Flat that are east and seaward of an imaginary line 100 meters from the mainland from Station 04-31 in Woodland Creek to Station 04-06 in Allston Creek.
5. The Garden City Canal from Station 04-04A south to the Marlin Quey Marina Closure zone within C371.

Pawleys Island/Litchfield: None

Station Addition/Reactivation/Deactivation/Modification:

Addition – Station 04-33 (Woodland Creek – 1000’ NE of Weston Flat)

POLLUTION SOURCE SURVEY

SURVEY PROCEDURES

The South Carolina Department of Health and Environmental Control (SCDHEC) Environmental Affairs, Pee Dee - Myrtle Beach, Shellfish Sanitation Staff, routinely conduct shoreline survey activities in SFMA 04. Extensive visual examination of lands adjacent to the waters of SFMA 04 was conducted to determine the location of significant concentrations of domestic animals and other actual and potential sources of pollution entering shellfish growing waters.

Reviews of SCDHEC Environmental Affairs, Pee Dee - Myrtle Beach files were conducted and ongoing for information on central collection disposal systems and lift stations. Reviews of both Grand Strand Water & Sewer Authority and Georgetown County Water & Sewer District lift station locations for SFMA 04 were completed and site visits have been conducted.

Additionally, a shoreline survey reconnaissance was conducted of sites with a high probability of structures being serviced by individual sewage treatment and disposal systems in past years.

POINT SOURCE POLLUTION

B. Municipal and Community Waste Treatment Facilities - Two wastewater treatment facilities provide service to lands adjacent to shellfish growing waters; however, none discharge within SFMA 04. Georgetown County Water & Sewer Authority provides wastewater disposal service to Litchfield Beach, Pawleys Island, and portions of Murrells Inlet. Treated wastewater is discharged to the Waccamaw River and does not affect SFMA 04 shellfish waters. Portions of the Pawleys Island Community, located on the mainland, are also serviced by Georgetown County Water & Sewer District. Grand Strand Water & Sewer provides service to the Horry County portions of Murrells Inlet and Garden City.

Both authorities have acknowledged their responsibility to promptly notify the Department in the event of spillage of untreated wastewater that could affect SFMA 04. Lift stations with the potential of adversely affecting shellfish growing waters are provided with emergency power, visual and audible alarms, and telemetry systems to alert repair crews and nearby residents when malfunctions occur. These lift stations have been inspected by SCDHEC staff and found to be well maintained by the local sewer authority. During the years of 2020-2022 there were no sanitary sewer overflows that entered SFMA 04 waters.

| Sanitary Sewer Overflows | | | | |
|--|-----------------|----------------|---------------------------|-----------------|
| Grand Strand Water & Sewer (2020-2022) | | | | |
| Date | Location | Gallons | Water Body Entered | Comments |
| N/A | N/A | N/A | N/A | N/A |
| Georgetown County Water & Sewer Authority (2020-2022) | | | | |
| Date | Location | Gallons | Water Body Entered | Comments |
| N/A | N/A | N/A | N/A | N/A |

C. Industrial Waste - Industrial wastewater discharges have not been permitted within SFMA 04.

D. Marinas – In 2007, prompted by the Department’s Office of Coastal Resource Management (OCRM) marina definition change, the Shellfish Sanitation Section incorporated the following 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); (3) any facility which has effective docking space of greater than 250 linear feet or provides moorage for more than 10 boats; (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, such as a mooring field; or (5) a dry stack facility.

Several marinas and multiple docking facilities are located within the Murrells Inlet estuary. Locations of these facilities are shown in Figure 1. Marinas are not located within the Pawleys Island/Litchfield system due to the estuary's shallow waters. Water depths limit the size of watercraft using the area to typically less than 16 feet in length. Murrells Inlet marinas are encompassed by approximately 1,000 foot Administratively Prohibited Closure Zones.

E. Radionuclides - Sources of radionuclides have not been identified within SFMA 04 and no other sources of poisonous or deleterious substances have been identified within the area.

NONPOINT SOURCE POLLUTION

A. Urban and Suburban Stormwater Runoff - Stormwater runoff from construction activities can have a significant impact on water quality. As stormwater flows over a construction site, it can pick up pollutants like sediment, debris, and chemicals and transport these to a nearby storm sewer system or directly to a river, lake, coastal waterways, or shellfish growing area. Stormwater runoff continues to impact the majority of SFMA 04 waters due to dense

development of the surrounding area. SCDHEC Bureau of Water in coordination with the Office of Ocean and Coastal Resource Management ensure that land disturbance activities are permitted accordingly and utilize stormwater best management practices to ensure potential pollutants are not introduced into the environment and nearby water bodies. There have been several stormwater projects that have been contemplated by Georgetown County Stormwater Division over the past several years.

There are a few large, undisturbed tracts of forested lands adjacent to SFMA 04 shellfish growing waters. Construction has generally been limited to single and multi-family housing and golf courses. An increase in human population density has resulted in the development of shopping centers, restaurants, and gasoline stations primarily adjacent to U.S. Highway 17.

In the early 1980's, the Department attempted to disinfect the initial flush of bacterial pollutants entering the Murrells Inlet estuary following rainfall events. This effort involved using both chlorine and ozone contact chambers in drainage ditches. Neither treatment system appeared to lower bacteria levels effectively in adjacent shellfish growing areas and as a result, treatment was discontinued.

The lands adjacent to shellfish growing waters in SFMA 04 consist of various soil types and conditions that have been defined by the United States Department of Agriculture, Soil Conservation Service (1982) utilizing general classifications and descriptions.

A demarcation in soil type and condition occurs between the Murrells Inlet and Pawleys Island/Litchfield system. Lands adjacent to Murrells Inlet and extending westward toward the Waccamaw River range from level to gently sloping and possess soils that are moderately to excessively draining. Soil types are generally Lakeland-Chipley-Centenary fine sands. Areas to the south of the demarcation line are primarily level and possess poorly to moderately well drained soils. Soil types are generally Leon-Lynn Haven sands in addition to Chipley fine sands.

- B. Agricultural Runoff** – Shellfish Management Area 04 does not have great potential for agricultural nonpoint source pollution. Brookgreen Gardens is a 9,127-acre nature park located approximately one-half mile southwest of Murrells Inlet. Brookgreen Gardens has gravitated from its former policy of benign forestry management. Brookgreen Gardens currently provides for timber harvest through selective or diseased management cutting.
- C. Individual Sewage Treatment and Disposal (ISTD) Systems** - Individual sewage treatment and disposal systems in SFMA 04 have been replaced gradually by municipal wastewater collection and treatment facilities. Central treatment systems have less potential to impact shellfish growing waters than ISTD systems, although central treatment system malfunctions can occasionally result in spills of untreated wastewater to the environment.

Grand Strand Water and Sewer Authority personnel reported two small areas bordering the Main Creek in the northern portion of Murrells Inlet in years past that are not currently served by central sewer.

Personnel with Department's Bureau of Environmental Health Services (BEHS) - On-Site Wastewater (OSWW) Section conducted surveys previously, beginning in southern Horry

County and progressing through portions of Georgetown County, of Murrells Inlet sites with a high probability of having operational septic systems. Initial screenings cross-referencing county tax maps with active water and sewer authority customer accounts. Sites not shown on authority maps as being provided with central sewer were visited for evaluation. Sites determined to have active septic systems were mapped with a Trimble GeoExplorer GPS unit. Out of a total of 4,014 sites, 1,869 were visited. Of the sites visited 119 proved to have active septic systems. Of these, 101 were in Horry County and the remaining 18 were in Georgetown County. Of the total number identified, 76 were concentrated within two mobile home parks near the northwestern portions of the estuary.

D. Wildlife and Domestic Animals - SFMA 04 supports substantial populations of both wildlife and domestic animals. Brookgreen Gardens, the nature park situated approximately one-half mile southwest of Murrells Inlet, contains a variety of wild animals confined for exhibition. Huntington Beach State Park, located along the southern reaches of the estuary, is a popular bird watching area and has a public beach. Brookgreen Gardens and Huntington Beach support natural populations of rabbit, white-tailed deer, raccoon, opossum, alligators, rodents, songbirds, shorebirds, and migratory waterfowl typical of the coastal Carolinas. Murrells Inlet receives runoff from both of these areas. Other portions of SFMA 04 support similar natural wildlife populations.

Domestic animal populations in the area are generally limited to dogs and cats. However, there are several horse stables within approximately two miles of estuarine waters. During the warmer months, several goats are kept on a small island within the Snug Harbor Marina closure zone.

E. Boat Traffic - Murrells Inlet is a small estuary; however, it provides ocean access for many recreational and commercial vessels. Boat traffic is heaviest during summer months and on weekends during the spring and fall. Weekday boating activity during the spring and fall is moderate. Boat traffic during the winter months is dependent on weather conditions and fisheries product prices and may range from very light to moderate. Boat traffic in the shallow Pawleys Island/Litchfield system is generally light, consisting primarily of boats less than 16 feet in length.

F. Hydrologic and Habitat Modification - Hydrologic and habitat modification in estuarine areas requires both State and federal approval. A rubble jetty system was constructed at the mouth of Murrells Inlet. Maintenance dredging has been allowed in several Murrells Inlet locations (primarily marinas) and in the Oyster Cove section of Garden City Beach. The U.S. Army Corps of Engineers routinely dredges the entrance channel of Murrells Inlet and did so in October 2016. Sand from this dredging project was utilized for beach renourishment in southern portions of Garden City Beach. Sand considered non-compactable was used on the western side of Huntington Beach State Park. Georgetown County has dredged channels south of Captain Dicks Marina near sample stations 04-17A and 04-03A, as well as marina entrance channels north in the vicinity of Station 04-03B. In early fall of 2017, Marshview Marina (formally Inlet Marina & Voyager View Marina) began a maintenance dredging project in the marina basin and this project was completed in 2018. In 2019, Marina Colony which is located adjacent to Station 04-25 in Murrells Inlet was issued a dredging permit.

At the Huntington Beach State Park causeway a flood control structure at a brackish water

impoundment controls saltwater intrusion and regulates pond water levels within the southern reaches of the Murrells Inlet estuary.

NATURALLY OCCURRING PATHOGENS

- A. Marine Biotoxins** - 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 SFMA 04. There have 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 piscicida*, 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 Management Plan** – Because State water temperatures exceed 81 degrees Fahrenheit (F) during June through September; *Vibrio* 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 of oysters is currently typically closed from June 1 through September 30. Because R.61-47 does not specifically address control of wild-stock harvest from waters exceeding 81 degrees F, the Department will recommend to and request of SCDNR that the wild stock harvesting season not be opened until October 1. The Department is currently not opposed to the issuance of special wild-stock harvest permits to Certified Shippers during the closed season as long as special permit conditions are included. 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

The Murrells Inlet and Pawleys Island/Litchfield systems are classical well-mixed, meso-tidal, bar-built estuaries typical of the northern coastal region of South Carolina. In terms of freshwater input, the estuaries conform closely to the definition of a neutral embayment (Odum and Copeland, 1974). Murrells Inlet is approximately 5.5 nautical miles in length with an average width of less than 1 nautical mile. The maximum width is approximately 1.5 nautical miles. Main channel depths are approximately 4 meters. The Pawleys Island/Litchfield system is approximately 5.5 nautical miles in length with typical widths of less than one-half nautical mile. Depths rarely exceed 2.5 meters in this system.

The Murrells Inlet and Pawleys Island/Litchfield systems are similar in terms of estuarine geological development. Characteristics of both systems are ebb and flood tidal deltas, protective point bars (although not readily apparent in Murrells Inlet due to rubble jetty construction), expansive intertidal mud flats, and intertidal oyster reefs. Small meandering creeks as well as high marsh areas dominated by smooth cord grass (*Spartina alterniflora*) are also prevalent.

The most obvious difference between the two estuarine systems is at the inlet mouths. Murrells Inlet has a rubble jetty system (completed in 1980) extending approximately 1,000 meters seaward which serves to stabilize the inlet entrance channel (Van Dolah et al., 1983).

Considerable shoaling has occurred around both jetties. In contrast, two separate inlets, Midway Inlet to the north and Pawleys Inlet to the south, feed the Pawleys Island/Litchfield system. There is very little intermixing of waters from these two inlets, partially due to the two causeways extending from the mainland onto Pawleys Island. The southern causeway appears to impede flushing action in the south-central portion of the estuary. A tidal node has been observed in the vicinity of this causeway.

Water temperatures in shallow portions of the estuaries often differ from temperatures in adjacent coastal waters. Overnight changes in temperature of five degrees centigrade are not unusual.

The tides in SFMA 04 are semidiurnal, consisting of two low and two high tides occurring each lunar day. Mean tidal range in Murrells Inlet varies from 4.2 feet to 4.5 feet, dependent upon location. Spring tides range from 4.7 feet to 5.3 feet. Mean tidal range in the Pawleys Island/Litchfield system varies from 2.9 feet to 4.9 feet, and spring tides range from 3.2 feet to 5.7 feet (Tides and Currents for Windows, 1997). Wind direction and intensity, as well as atmospheric pressure, can alter predicted tidal ranges.

Precipitation in SFMA 04 is generally heaviest during late summer and early autumn. Tropical storms or hurricanes also produce large amounts of rainfall when they occur. During winter months, rainfall amounts usually decline and events are more uniform in occurrence. However, winter thunderstorms associated with rapidly moving low-pressure systems can generate heavy rains. Precipitation in the form of snow or ice rarely occurs. Spring weather patterns are often dynamic and occasionally produce hail and tornados.

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 2022, the annual rainfall total in SFMA 04 was 56.28 inches. The 10-year average for SFMA 04 is 53.25 inches per year. Major storm events such as hurricanes and flooding have impacted the area over the past few years. On September 30th, 2022, Hurricane Ian made landfall on the coast of South Carolina and produced 4.52 inches of rain during the storm. SFMA 04 was put under a precautionary closure until water quality sampling could be performed and the area did not reopen until October 13th, 2022. In September of 2019, Hurricane Dorian made landfall on the coast of South Carolina and produced 9.99 inches of rain during a two-day period. In September of 2018, Hurricane Florence made landfall just north of the South Carolina/North Carolina state line and produced 9.77 inches of rain during a four-day period. Hurricane Florence was a very slow-moving storm that produced extreme rainfall amounts in North Carolina which weeks later flowed south and flooded many areas within Georgetown County and SFMA 04.

Prevailing winds along the northern portion of the South Carolina coast are from the south during the spring and summer and from the north during autumn and winter. Wind speeds are typically less than 15 miles per hour (mph); however, strong weather systems can generate winds

in excess of 25 mph. Tropical storms and hurricanes are unusual but occasionally occur during summer and autumn. "Northeasters" frequently occur during late autumn and early winter months.

The lack of major freshwater input into this area results in a generally homogenous salinity distribution. Freshwater input is limited to precipitation and resulting runoff, so salinities are generally greater than 30 parts per thousand (ppt) through the estuaries. Surface water salinities of less than 20 ppt are sometimes encountered near drainage ditches.

WATER QUALITY STUDIES

DESCRIPTION OF PROGRAM

The Department utilizes a systematic random sampling (SRS) strategy within Area 04 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 data analysis 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 samples, lab error, breakdowns, etc. This also allows each annual report to meet the NSSP Triennial Review sampling criteria.

During the period 01/01/20 through 12/31/22, one-thousand one-hundred and forty-seven (1,147) surface water samples (<1.0 ft. deep) were collected at the thirty-four (34) currently active SFMA 04 monitoring stations for bacteriological analyses. All samples collected were utilized for classification purposes in accordance with the Department's systematic random sampling plan. 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 as a temperature control. Upon receipt at the laboratory, sample sets that exceeded a 30-hour holding time or contained a temperature control >10 degrees C. were discarded. Samples collected after September 1, 1986 have been analyzed using the five-tube/three dilution modified A-1 method described by Nuefeld (1985).

Surface water temperatures were measured utilizing hand-held, laboratory-quality calibrated centigrade thermometers. Salinity measurements were measured in the laboratory using automatic temperature compensated refractometers. Additional field data include ambient air temperature, wind direction, tidal stage and date and time of sampling. Tidal stages were determined using Nautical Software's Tides and Currents, Version 2.2 (1997).

MONITORING RESULTS

Murrells Inlet Stations 04-01, 04-08, 04-16 and 04-26 and Pawleys Island/Litchfield Stations 04-09, 04-10, 04-11, 04-12, 04-13, 04-14, 04-15, 04-19 and 04-21 exceed a fecal coliform geometric mean MPN value of 14.

Murrells Inlet Stations 04-01, 04-02, 04-06, 04-07, 04-08, 04-16, 04-17A, 04-18, 04-24, 04-26, 04-27, 04-28, 04-30 and 04-31 and Pawleys Island/Litchfield Stations 04-09, 04-10, 04-11, 04-12, 04-13, 04-14, 04-15, 04-19, and 04-21 exceed a fecal coliform estimated 90th percentile MPN value of 43.

Station 04-16 in Murrells Inlet and Pawleys Island/Litchfield Station 04-09 exceeded a fecal coliform geometric mean MPN value of 88.

Murrells Inlet Stations 04-01, 04-08 and 04-16, and Pawleys Island/Litchfield Stations 04-09, 04-12, 04-13, 04-14, 04-15, and 04-19 exceed a fecal coliform estimated 90th percentile MPN value of 260.

Fecal coliform data collected are summarized in Table #2. Also, included in this report is a long-range trend summary of each station with the estimated 90th percentile values in correlation to annual rainfall totals (Table #3).

CONCLUSIONS

Harvesting classification changes will be implemented within Shellfish Management Area 04 for the 2023-2024 shellfish harvesting season. Water quality within the area has shown two downgrades during this review period. Station 04-24 (Oaks Creek at First Curve) and Station 04-30 (Oyster Cove, North Branch) now both meet the criteria for a Restricted classification. Therefore, a new Restricted boundary around Station 04-24 for 1,000' in all directions continuing from Allston Creek into Oaks Creek will be implemented. In Oyster Cove, Station 04-29 (Oyster Cove, South Branch) will now become a boundary station since Station 04-30 will be downgraded. All other stations within the entire management area will retain their current classification. In 2021, Station 04-33 was added to the routine sampling strategy to better represent water quality within Woodland Creek.

All existing marinas should retain their administrative Prohibited Classification. Additionally, during the harvest season, all Approved portions of the estuary should continue to be placed under a precautionary closure upon issuance of an official National Weather Service Hurricane Warning or upon receipt of four or more inches of rainfall within twenty-four hours, as recorded by the South Carolina Shellfish Rainfall Program.

South Carolina Shellfish Regulation 61-47 sets no upper limit for Restricted waters. Due to excessive fecal coliform levels, areas in proximity to Stations 04-01, 04-08 and 04-16 (Murrells Inlet), and 04-09, 04-12, 04-13, 04-14, 04-15 and 04-19 (Pawleys Island, Litchfield) may not be utilized as a source of shellfish for relay or depuration purposes.

RECOMMENDATIONS

Upon reviewing the shoreline survey and bacteriological data of Shellfish Management Area 04,

the following classifications are recommended:

Prohibited:

Murrells Inlet:

1. Those waters within approximately 1,000 feet of Captain Dick's and Marshview Marinas;
2. Those waters within approximately 1,000 feet of the docking facilities at Bovines and Snug Harbor;
3. Those waters within approximately 1,000 feet of Marina Colony;
4. Those waters within approximately 1,000 feet of the Marlin Quay Marina.

Pawleys Island/Litchfield: None

Restricted:

Murrells Inlet:

1. The Garden City Canal north of Station 04-04A and the marina closure zone at Marlin Quay Marina.
2. All portions of Main Creek north from Station 04-03B including all feeder creeks and marsh adjacent to the mainland and north of Flagg Creek including portions of C371 to Station 04-04A.
3. All waters of Parsonage Creek extraneous of marina closure zones.
4. All small feeder creeks and marsh adjacent to the mainland and Allston Creek extending from the northern end of Allston Creek to a point 200 meters south of Hughes Landing and 1000' in all directions including Station 04-24 (Oaks Creek at First Curve) into Oaks Creek.
5. Allston Creek in its entirety, from Parsonage Creek Canal to Oaks Creek (near Station 04-24). This will also include all tributary creek mouths and marshlands within approximately 75' of Allston Creek.
6. Portions of marshlands and flats adjacent to and northwest of Allston Creek (near Station 04-07).
7. Those waters west of an imaginary line beginning at Station 04-31 in Woodland Creek heading southwest and 100 meters from the mainland through Weston Flat to Station 04-06 in Allston Creek.
8. Those waters southwest of an imaginary line extending from Huntington Beach through Station 04-32 at Brigham Hole, following the boundary line of State Shellfish Ground S354 and continuing to the mainland at Shell (Carr) Landing at Station 04-08A.
9. Oyster Cove from Station 04-29 (Oyster Cove, South Brach) north including Station 04-30 (Oyster Cove, North Branch).

Pawleys Island/Litchfield: All Waters.

Conditionally Approved:

Murrells Inlet: None

Pawleys Island/Litchfield: None

Approved:

Murrells Inlet:

1. All portions of creeks and flats seaward and south of Stations 04-03A, 04-03B and 04-04B to include C370 and portions of C371 south of Flagg Creek, excluding the Marlin Quey Marina Closure zone.
2. From the entrance of Allston Creek at Oaks Creek, not including 1,000' buffer zone including Station 04-24 seaward to the Murrells Inlet jetty and areas adjacent to Drunken Jack Island south including S354 and R355.
3. All portions of the central part of the Murrells Inlet estuary, however, excluding those portions of the northern section of Oyster Cove, Parsonage Creek, Allston Creek and any portion of any marina closure zone.
4. The waters of Weston Flat that are east and seaward of an imaginary line 100 meters from the mainland from Station 04-31 in Woodland Creek to Station 04-06 in Allston Creek.
5. The Garden City Canal from Station 04-04A south to the Marlin Quey Marina Closure zone within C371.

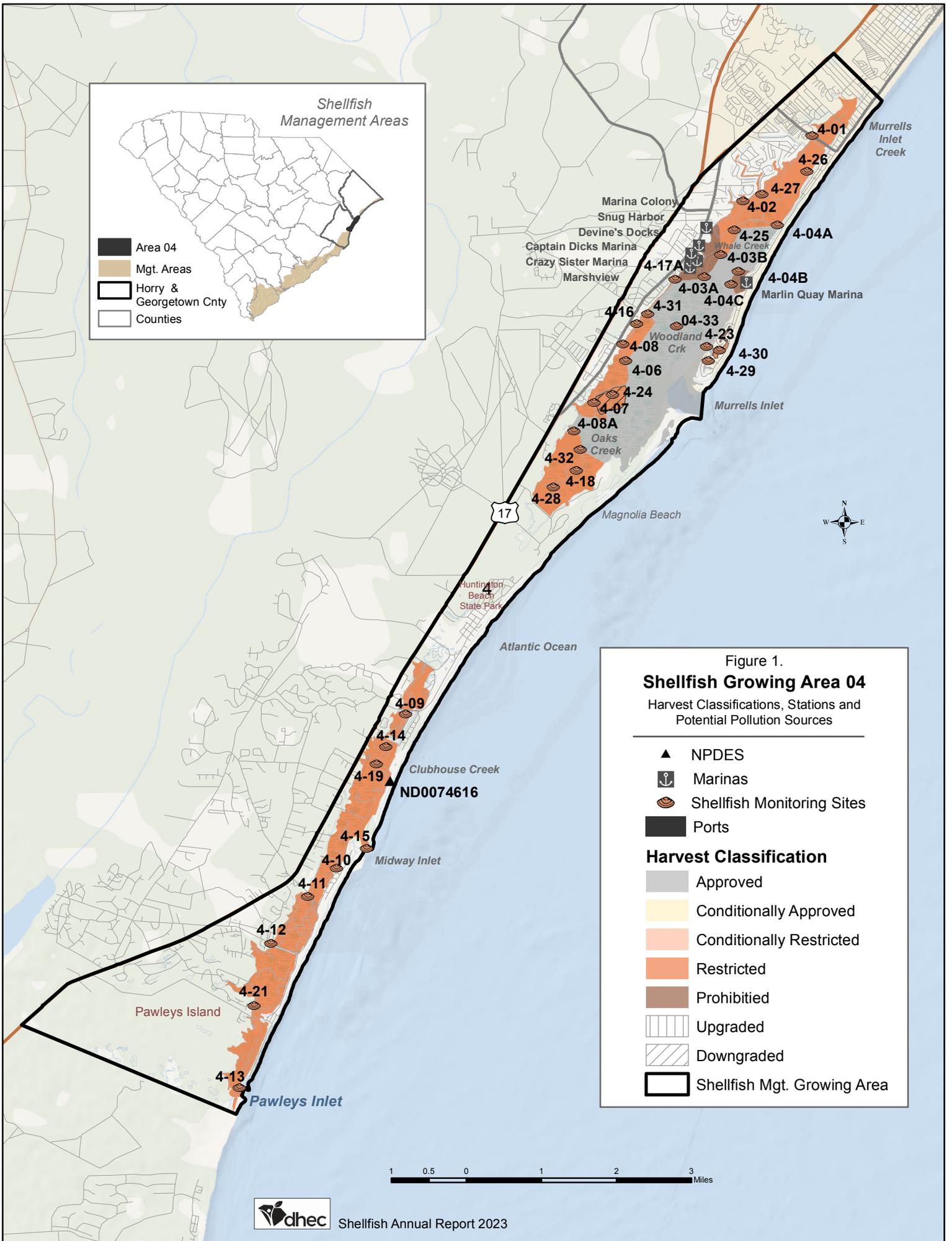
Pawleys Island/Litchfield: None

Station Addition/Reactivation/Deactivation/Modification: None

Analysis of sampling data for SFMA 08 demonstrates the probability of a significant impact from rainfall exceeding 4.00" in a 24-hour period. Therefore, a precautionary closure of SFMA 08 will be implemented following rainfall events of greater than 4.00" in a 24-hour period, as measured by the NWS, 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*).

REFERENCES

- Caulder, D.R., C.M. Bearden, and B.B. Booth, Jr. 1976. Environmental inventory of a small neutral embayment: Murrells Inlet, South Carolina. Technical Report #10. South Carolina Marine Resources Center. South Carolina Wildlife and Marine Resources Department, Charleston, S.C. 52 p.
- National Research Council, 1985, *Safety of Dams - Flood and Earthquake Criteria* National Academy Press, Washington DC.
- National Weather Service. The National Oceanic and Atmospheric Administration. *Precipitation Frequency Atlas of the Western US: NOAA Atlas II*. Superintendent of Documents, US Government Printing Office - Washington DC.
- NOAA, National Weather Service database.
- Nuefeld, N. 1985. "Procedures for the Bacteriological Examination of Seawater and Shellfish". In: A.E. Greenberg and D.A. Hunt (eds.) *Laboratory Procedures for the Examination of Seawater and Shellfish, Fifth Edition*. American Public Health Association, Washington, D.C. p. 37-63.
- Van Dolah, R.F., D.M. Knott, and D.R. Caulder. 1983. Ecological effects of rubble weir jetty construction at Murrells Inlet, South Carolina, Technical Report EL-84-4, Vol. 1, Colonization and Community Development on New Jetties. U.S. Army Corps of Engineers, Washington, D.C. 69p.



Shellfish Management Areas

- Area 04
- Mgt. Areas
- Horry & Georgetown Cnty
- Counties

Figure 1. Shellfish Growing Area 04
 Harvest Classifications, Stations and Potential Pollution Sources

- ▲ NPDES
- ⚓ Marinas
- 🐚 Shellfish Monitoring Sites
- ▬ Ports

Harvest Classification

- Approved
- Conditionally Approved
- Conditionally Restricted
- Restricted
- Prohibited
- Upgraded
- Downgraded
- Shellfish Mgt. Growing Area



TABLE # 1
Shellfish Management Area 04
WATER QUALITY SAMPLING STATIONS DESCRIPTION

| <u>Station</u> | <u>Description</u> |
|----------------|--|
| 04-01 | Main Creek at Atlantic Avenue Bridge |
| 04-02 | Main Creek at Mickey Spillane's Home |
| 04-03A..... | Southeast side of the Prohibited Zone near Captain Dick's Marina in Main Creek |
| 04-03B..... | Northwest side of the Prohibited Zone near Captain Dick's Marina in Main Creek |
| 04-04A..... | Garden City Canal due E of Entrance to Flagg Creek |
| 04-04B..... | Northern Boundary of the Marlin Quay Closure Zone in Main Creek |
| 04-04C..... | Western Boundary of the Marlin Quay Closure Zone in Main Creek |
| 04-06 | Allston Creek at Weston Flat |
| 04-07..... | Allston Creek - Hughes Landing |
| 04-08..... | Parsonage Creek at Nance's Dock |
| 04-08A..... | Oyster (Carr) Landing at Huntington Beach State Park |
| 04-09..... | Clubhouse Creek at Litchfield Boulevard Bridge |
| 04-10..... | Shell Avenue and Pawley's Island Creek |
| 04-11..... | North Causeway Bridge at Pawley's Island Creek |
| 04-12..... | South Causeway Bridge at Pawley's Island Creek |
| 04-13..... | Pawley's Inlet |
| 04-14..... | Dock at End of Sportsman Boulevard |
| 04-15..... | Midway Inlet |
| 04-16 | Parsonage Creek at Chicken Farm Ditch |
| 04-17A..... | Southwest Corner of the Marshview Marina Prohibited Zone in Parsonage Creek |
| 04-18..... | North Boundary of Clambank Flats POG |
| 04-19..... | Clubhouse Creek - First Bend South of Salt Marsh Cove |
| 04-21 | South Pawley's Island Boat Landing |
| 04-23 | Main Creek at Oyster Cove |
| 04-24..... | Oaks Creek at First Curve |
| 04-25..... | Main Creek at Flagg Creek |
| 04-26..... | Garden City Canal at the "Old Boat Wreck" |
| 04-27..... | Main Creek, Opposite Entrance to Mt. Gilead Canal |
| 04-28..... | Oak's Creek, Approx. 150 Meters from the Huntington Beach State Park Causeway |
| 04-29..... | Oyster Cove, South Branch |
| 04-30..... | Oyster Cove, North Branch |
| 04-31 | Woodland Creek - 100 Meters East of Mainland |
| 04-32 | Oak's Creek at Brigham Hole |
| 04-33 | Woodland Creek - 1000' Northeast of Weston Flat |

(Total Active - 34)

TABLE #2

**Shellfish Management Area 04
FECAL COLIFORM BACTERIOLOGICAL DATA
From Shellfish Water Quality Sampling Stations Between
January 01, 2020 to December 31, 2022**

| Station # | 1 | 2 | 03A | 03B | 04A | 04B | 04C | 6 | 7 | 8 | 08A | 9 |
|----------------|------|------|-----|-----|-----|-----|-----|------|-----|------|-----|------|
| SAMPLES | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 | 34 |
| GEOMEAN | 38.9 | 13.3 | 5.3 | 4.8 | 5.8 | 3.5 | 4.4 | 12.7 | 12 | 30.6 | 5.2 | 95.5 |
| 90TH %ILE | 346 | 110 | 32 | 27 | 33 | 15 | 21 | 106 | 153 | 319 | 23 | 704 |
| WATER QLTY | RND | R | A | A | A | A | A | R | R | RND | A | RND |
| CLASSIFICATION | RND | R | P | P | R | P | P | R | R | RND | R | RND |

| Station # | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17A | 18 | 19 | 21 |
|----------------|------|------|------|------|------|------|------|------|-----|------|------|
| SAMPLES | 34 | 33 | 33 | 34 | 34 | 34 | 34 | 33 | 34 | 34 | 32 |
| GEOMEAN | 25.3 | 19.8 | 65.4 | 23.6 | 80.9 | 25.1 | 99 | 14.6 | 9.6 | 52.9 | 18.4 |
| 90TH %ILE | 257 | 213 | 723 | 267 | 548 | 367 | 1904 | 187 | 73 | 394 | 185 |
| WATER QLTY | R | R | RND | RND | RND | RND | RND | R | R | RND | R |
| CLASSIFICATION | R | R | RND | RND | RND | RND | RND | P | R | RND | R |

| Station # | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 |
|----------------|----|-----|-----|------|-----|------|-----|-----|------|-----|------|
| SAMPLES | 34 | 34 | 34 | 34 | 34 | 34 | 33 | 34 | 34 | 34 | 19 |
| GEOMEAN | 3 | 5.9 | 6.7 | 22.7 | 9.1 | 11.9 | 5.1 | 8.2 | 10.8 | 5.3 | 11.4 |
| 90TH %ILE | 10 | 44 | 41 | 228 | 83 | 105 | 20 | 47 | 83 | 30 | 141 |
| WATER QLTY | A | R | A | R | R | R | A | R | R | A | N/A |
| CLASSIFICATION | A | R | R | R | R | R | R | R | R | R | N/A |

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

TABLE #3
Fecal Coliform Historical Trend Sheet

Area 04 Stations 90thile Values for Annual Updates Related to Rainfall

| Station # | 2022 | 2021 | 2020 | 2019 | 2018 | 2017 | 2016 | 2015 | 2014 | 2013 | 2012 |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|
| 04-01 | 346 | 360 | 531 | 573 | 495 | 439 | 650 | 716 | 744 | 858 | 1181 |
| 04-02 | 110 | 101 | 118 | 57 | 65 | 49 | 106 | 135 | 203 | 153 | 138 |
| 04-03A | 32 | 37 | 30 | 19 | 21 | 26 | 40 | 36 | 22 | 19 | 20 |
| 04-03B | 27 | 31 | 37 | 24 | 21 | 22 | 41 | 46 | 39 | 21 | 22 |
| 04-04A | 33 | 34 | 50 | 35 | 32 | 19 | 35 | 48 | 52 | 38 | 45 |
| 04-04B | 15 | 15 | 19 | 15 | 16 | 15 | 20 | 21 | 14 | 15 | 25 |
| 04-04C | 21 | 19 | 23 | 13 | 14 | 18 | 20 | 18 | 15 | 21 | 23 |
| 04-06 | 106 | 94 | 73 | 65 | 108 | 101 | 176 | 152 | 112 | 58 | 90 |
| 04-07 | 153 | 160 | 147 | 90 | 111 | 50 | 79 | 49 | 49 | 31 | 58 |
| 04-08 | 319 | 253 | 233 | 140 | 282 | 319 | 472 | 355 | 284 | 219 | 358 |
| 04-08A | 23 | 21 | 31 | 24 | 26 | 15 | 18 | 18 | 18 | 13 | 18 |
| 04-09 | 704 | 798 | 708 | 698 | 656 | 892 | 964 | 1231 | 974 | 1141 | 969 |
| 04-10 | 257 | 261 | 146 | 85 | 127 | 158 | 276 | 240 | 201 | 236 | 293 |
| 04-11 | 213 | 158 | 90 | 81 | 144 | 177 | 299 | 244 | 265 | 116 | 106 |
| 04-12 | 723 | 622 | 557 | 356 | 363 | 261 | 590 | 894 | 1008 | 674 | 514 |
| 04-13 | 267 | 338 | 295 | 191 | 142 | 156 | 364 | 325 | 323 | 143 | 278 |
| 04-14 | 548 | 373 | 344 | 288 | 376 | 368 | 508 | 509 | 492 | 329 | 397 |
| 04-15 | 367 | 277 | 277 | 182 | 233 | 243 | 473 | 365 | 307 | 96 | 194 |
| 04-16 | 1904 | 1430 | 1480 | 645 | 1034 | 602 | 1072 | 853 | 1084 | 438 | 548 |
| 04-17A | 187 | 200 | 147 | 97 | 100 | 66 | 79 | 49 | 47 | 50 | 70 |
| 04-18 | 73 | 66 | 40 | 22 | 24 | 26 | 53 | 53 | 42 | 23 | 36 |
| 04-19 | 394 | 296 | 270 | 261 | 424 | 350 | 529 | 451 | 617 | 313 | 408 |
| 04-21 | 185 | 133 | 124 | 90 | 134 | 154 | 392 | 362 | 367 | 262 | 250 |
| 04-23 | 10 | 11 | 13 | 14 | 11 | 9 | 8 | 10 | 10 | 10 | 13 |
| 04-24 | 44 | 43 | 26 | 12 | 12 | 9 | 15 | 12 | 15 | 10 | 15 |
| 04-25 | 41 | 45 | 51 | 30 | 33 | 36 | 55 | 57 | 43 | 36 | 39 |
| 04-26 | 228 | 224 | 250 | 131 | 128 | 90 | 127 | 117 | 105 | 88 | 132 |
| 04-27 | 83 | 88 | 77 | 50 | 49 | 70 | 147 | 161 | 128 | 101 | 124 |
| 04-28 | 105 | 99 | 82 | 44 | 49 | 35 | 54 | 57 | 50 | 37 | 104 |
| 04-29 | 20 | 15 | 16 | 13 | 16 | 14 | 17 | 19 | 12 | 20 | 17 |
| 04-30 | 47 | 33 | 25 | 11 | 14 | 16 | 34 | 35 | 28 | 29 | 34 |
| 04-31 | 83 | 75 | 63 | 39 | 54 | 58 | 79 | 57 | 34 | 50 | 80 |
| 04-32 | 30 | 33 | 25 | 17 | 17 | 11 | 20 | 21 | 18 | 9 | ND |
| 04-33 | 141 | ND |
| Annual Rainfall (inches) | 56.2 | 48.6 | 55.7 | 45.7 | 61.7 | 43.6 | 63.2 | 61.3 | 54.9 | 52.9 | 44.9 |

ND = No Data Red = Impaired Water Quality

TABLE #4

**WATER QUALITY
SAMPLING STATION DATA**

Shellfish Management Area 04

Detailed data for each shellfish monitoring station listed in this report's "Fecal Coliform Bacteriological Data Summary Table" and in other shellfish reports can be obtained by writing 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 04

Source:

2020 – 2022 Data

*NOAA National Weather Service - Southeastern River Forecast Center
Location: Murrells Inlet, South Carolina*

2020 Annual Rainfall Summary

Source: NOAA National Weather Service - Southeastern River Forecast Center

Location: Murrells Inlet, S.C.

| 2020 | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC |
|---|-------------|-------------|-------------|-------------|-------------|--------------|-------------|--------------|------------------------|-------------|--------------|-------------|
| 1 | | 0.60 | | 0.36 | 0.44 | 0.01 | 1.19 | | | | | 0.29 |
| 2 | | 0.01 | | | | | 0.23 | 0.16 | 0.01 | | 0.11 | |
| 3 | | | 0.57 | | | | | 0.14 | | | | |
| 4 | 0.03 | | | | | | | *4.24 | | 0.02 | | |
| 5 | 0.05 | | 0.41 | | 0.05 | 0.14 | | 0.85 | | | | 0.04 |
| 6 | | | 1.12 | | | | | 0.05 | 0.40 | | | |
| 7 | | 1.49 | | | 0.03 | | 0.21 | 0.48 | 0.01 | | | |
| 8 | | | | 0.04 | | | 2.84 | 0.37 | | | | |
| 9 | | | | 0.04 | | | 0.01 | | 1.98 | | | |
| 10 | | | | | | 0.14 | 0.14 | | 1.10 | | | |
| 11 | | | | | | 0.24 | 0.03 | | | 3.25 | 0.11 | |
| 12 | 0.05 | | 0.03 | | | 0.36 | 0.01 | | 0.31 | | 1.25 | |
| 13 | 0.04 | | | 0.06 | | 0.70 | 0.40 | | 0.09 | 0.01 | 2.17 | |
| 14 | 0.07 | 0.13 | | 0.86 | | 0.01 | 0.46 | 0.13 | | | | 0.01 |
| 15 | | | | 0.22 | | 0.93 | | | | | | |
| 16 | 0.02 | | | 0.32 | | 0.20 | 0.16 | 0.18 | | 0.14 | | 0.05 |
| 17 | 0.05 | 0.12 | | | | | | | 0.29 | 0.43 | | 0.09 |
| 18 | | | 0.10 | | | | | 0.02 | 0.97 | | | |
| 19 | | 0.58 | | | 0.02 | | | 0.44 | | | | |
| 20 | | 0.08 | | 0.41 | 0.08 | 0.13 | | 0.36 | | | | 0.01 |
| 21 | | 0.96 | | 0.02 | 0.14 | 0.69 | | 0.15 | | | | 0.45 |
| 22 | | | | | 0.82 | | 0.01 | 0.18 | | | | |
| 23 | | | 0.21 | 0.07 | 0.04 | 0.01 | | 0.02 | | | | |
| 24 | | 0.01 | 0.46 | 0.51 | | 0.08 | 0.02 | 0.59 | | | | |
| 25 | 0.14 | 0.65 | 0.05 | | | 0.53 | 0.68 | 1.80 | | 0.12 | | 0.63 |
| 26 | | 0.30 | | | | 0.09 | 0.10 | 0.01 | 0.65 | 0.03 | 0.04 | |
| 27 | 0.11 | 0.18 | | | 0.23 | | | | | | 0.04 | |
| 28 | 0.03 | | | | 1.85 | | | | 0.17 | | | |
| 29 | | | | | 0.07 | 0.34 | 0.17 | 0.06 | 0.87 | | | |
| 30 | 0.30 | | | 0.37 | 0.60 | 0.01 | 0.18 | | 0.81 | 0.02 | 0.22 | |
| 31 | | | | | 0.18 | | 0.09 | | | | | 0.01 |
| Total | 0.89 | 5.11 | 2.95 | 3.28 | 4.55 | 4.61 | 6.94 | 10.23 | 7.66 | 4.02 | 3.94 | 1.58 |
| *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 | | 55.76 | |

2021 Annual Rainfall Summary

Source: NOAA National Weather Service - Southeastern River Forecast Center

Location: Murrells Inlet, S.C.

| 2021 | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC |
|---|-------------|-------------|-------------|-------------|-------------|--------------|-------------|-------------|------------------------|-------------|--------------|-------------|
| 1 | 1.35 | 1.60 | | 0.14 | | | | 0.12 | | 0.12 | | |
| 2 | 0.33 | 0.06 | 0.02 | | | 0.01 | | 0.79 | 0.05 | | | |
| 3 | 0.11 | | 0.58 | | | | 1.09 | 0.14 | | | | |
| 4 | | | 0.34 | | 1.04 | 0.60 | | 1.55 | | | | |
| 5 | | | | | 0.06 | 1.47 | | 0.01 | | | | |
| 6 | 0.04 | 0.05 | | | | 0.08 | | 0.04 | | 0.43 | 0.14 | |
| 7 | | 0.43 | | | 0.12 | 0.71 | | 0.82 | 0.14 | 0.27 | 1.59 | |
| 8 | 0.85 | | | | | 0.05 | 3.28 | 0.21 | 0.16 | | | 0.01 |
| 9 | | | | | | | 0.16 | | 0.58 | 0.21 | | 0.94 |
| 10 | | 0.12 | | 0.01 | | 0.07 | | | 1.18 | 0.85 | | |
| 11 | | | | 0.62 | 0.01 | 0.46 | | | | | | 0.04 |
| 12 | 0.01 | | | | 0.05 | 0.33 | 0.16 | | | | 0.03 | 0.20 |
| 13 | | 0.31 | | | 0.09 | 1.36 | 0.08 | | | | | |
| 14 | 0.03 | 0.57 | | | | 0.07 | 0.10 | | | | | |
| 15 | | 1.19 | | | | | | | | | | |
| 16 | 0.13 | 0.39 | 0.01 | | | 0.30 | | 0.15 | 0.01 | | | |
| 17 | | | 0.47 | | | 0.01 | | 0.63 | | | | |
| 18 | | | | | | | | 0.38 | | | | |
| 19 | | 0.67 | 0.02 | | | | 0.10 | 0.35 | | | | |
| 20 | | 0.80 | | | | 0.38 | 1.34 | | | | | 0.03 |
| 21 | | | 0.09 | | | 1.79 | 0.10 | 1.47 | 0.56 | | | 0.04 |
| 22 | | 0.01 | | | | 0.07 | | 0.52 | 0.10 | | | 0.94 |
| 23 | | 0.01 | | | | 0.17 | 0.02 | 0.45 | 0.34 | | 0.01 | |
| 24 | | | | | | | | | | | | |
| 25 | | | | 0.15 | | | | | | 0.21 | | |
| 26 | | | | | | 0.01 | | | | 0.07 | 0.02 | |
| 27 | 0.10 | | | | | 1.14 | 1.22 | | | | 0.01 | |
| 28 | 0.31 | | 0.03 | | | | 0.74 | | | | | |
| 29 | | | 0.17 | | 0.01 | 0.13 | 0.15 | | | 0.10 | | |
| 30 | | | | | 0.05 | | | | | | | |
| 31 | | | 0.01 | | | | | | | | | 0.37 |
| Total | 3.26 | 6.21 | 1.74 | 0.92 | 1.43 | 9.21 | 8.54 | 7.63 | 3.12 | 2.26 | 1.80 | 2.57 |
| *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 | | 48.69 | |

2022 Annual Rainfall Summary

Source: NOAA National Weather Service - Southeastern River Forecast Center

Location: Murrells Inlet, S.C.

| 2022 | JAN | FEB | MAR | APR | MAY | JUNE | JULY | AUG | SEPT | OCT | NOV | DEC |
|---|-------------|-------------|-------------|-------------|-------------|--------------|--------------|-------------|------------------------|-------------|--------------|-------------|
| 1 | | | | 0.10 | | | 0.39 | 0.01 | | *4.52 | | 0.17 |
| 2 | | | | | | | 1.46 | 0.07 | | | | |
| 3 | 0.60 | | | | | | 0.21 | | | | | |
| 4 | | | | | | 1.35 | | | | | | 0.01 |
| 5 | | 0.46 | | | 0.22 | 0.85 | 2.98 | | | | | |
| 6 | | | | 0.58 | | | | 0.01 | 0.02 | | 0.17 | 0.05 |
| 7 | | 0.07 | | 1.08 | | | | | | | | |
| 8 | | 0.20 | | 0.09 | 0.01 | | | | 0.08 | | | |
| 9 | | | 0.80 | | | 0.32 | 0.08 | 0.10 | 0.51 | | | |
| 10 | 0.08 | | 0.23 | | | 0.04 | 0.01 | | 1.04 | | | 0.13 |
| 11 | | | | | | | 1.49 | | 2.80 | | 1.25 | |
| 12 | | | 0.07 | | | 0.02 | | 0.01 | 1.06 | | 0.10 | 0.03 |
| 13 | | | 0.15 | | 0.16 | 1.18 | 0.87 | 0.59 | | 1.52 | | |
| 14 | | 0.04 | | | 0.08 | | 0.13 | | | 0.10 | | |
| 15 | | | | | | 0.03 | 0.52 | | | | | 0.09 |
| 16 | 0.22 | | | | | | 0.68 | 1.74 | | | 0.36 | 0.05 |
| 17 | 1.09 | | 0.76 | 0.25 | 0.26 | 0.30 | 0.07 | 0.07 | | | | |
| 18 | | 0.02 | | 0.28 | | 1.23 | 0.05 | 0.02 | 0.01 | 0.12 | | |
| 19 | | 0.06 | 0.01 | 0.16 | | | 0.21 | 0.50 | | | | |
| 20 | | | | | | | 0.01 | 2.40 | | | | |
| 21 | 0.05 | | | | | | 0.15 | | | | | 0.47 |
| 22 | 0.34 | | | | | | | 0.19 | | | | 1.10 |
| 23 | | | | | 0.44 | | 0.91 | 0.12 | 0.01 | | 0.05 | 0.06 |
| 24 | | | 1.57 | | 0.02 | | 0.01 | 0.01 | | | | |
| 25 | | | 0.72 | | 0.01 | | | 0.51 | | | 0.09 | |
| 26 | | | | | | | 0.05 | 0.18 | | | 0.05 | |
| 27 | | | | 0.40 | | | 0.01 | 0.03 | | | 0.01 | |
| 28 | | 0.17 | | | 1.28 | 0.02 | | | | | 0.05 | |
| 29 | 0.01 | | | | | 0.23 | | 0.07 | | 0.09 | | |
| 30 | | | | | | 0.61 | 0.04 | 0.14 | 2.34 | | | |
| 31 | | | | | | | 1.16 | 0.06 | | 0.13 | | |
| Total | 2.39 | 1.02 | 4.31 | 2.94 | 2.48 | 6.18 | 11.49 | 6.83 | 7.87 | 6.48 | 2.13 | 2.16 |
| *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 | | 56.28 | |

TABLE #6
Shellfish Management Area 04
Precautionary & Pollution Event Closures
2020 – 2022

| Event | Date(s) | Sample Date(s) | Opening Date | Comments |
|---------------|------------|----------------|--------------|---|
| Hurricane Ian | 09/30/2022 | 10/10/2022 | 10/13/2022 | Hurricane produced 4.52 inches of rain. |

TABLE #7
Shellfish Management Area 04
MARINA INVENTORY

| Marina | Total Slips | Pump-out Facility | Fuel Dock |
|----------------|--------------------|--------------------------|------------------|
| Captain Dicks | 45 | Yes | Diesel-Gas |
| Crazy Sisters | 14 | Yes | Diesel-Gas |
| Marlin Quay | 63 | No | Diesel-Gas |
| Marshview | 36 | No | No |
| Snug Harbour | 10 | No | No |
| Marina Colony | 19 | No | No |
| Divine's Docks | 22 | No | No |