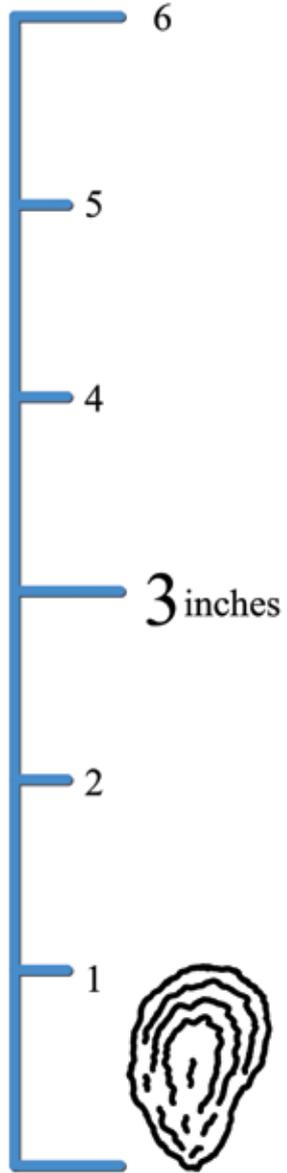


OYSTER STEWARDSHIP PROGRAM

Oystermen's Guide to Mississippi Gulf Coast Oyster Reefs





How long does it take for an oyster to grow to market size?

While it is possible for warm water oysters in the Gulf of Mexico to reach a length of four inches in less than nine months, those oysters tend to be very thin and unmarketable. It usually requires between 18 to 24 months for Gulf of Mexico oysters to reach a marketable three inch size. A Pacific oyster requires two years to reach the market size of two and a half to three inches. Kumamotos, cultivated in Japan and the West Coast, require five years. Olympia oysters are very tiny and require four years to reach just a single inch. Olympia oysters are native to the US West Coast but are cultivated mostly in Puget Sound and British Columbia. Belons, grown in the Brittany region of France, can take over five years to reach marketable size. Atlantic oysters grow more slowly and take on average, six to seven years for market size.

SPAT

SEED

SACK

The Oystermen's Guide to Mississippi Gulf Coast Oyster Reefs

A Publication of the
Mississippi Department of Marine Resources
Marine Fisheries – Shellfish Bureau



The Oystermen's Guide to Mississippi Gulf Coast Oyster Reefs

AUGUST 2013

A Publication of the

Mississippi Department of Marine Resources

Marine Fisheries – Shellfish Bureau

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Mississippi Department of Marine Resources

1141 Bayview Avenue
Biloxi, MS. 39530
(228) 374-5000 or (800) 374-3449

Marine Emergencies

MDMR Marine Patrol (800) 294-5551
Gulfport Coast Guard (228) 863-5818
Pascagoula Coast Guard (228) 769-5600

In the event of a boating accident, complete the [Boating Accident Report Form](#) found on the MDMR website and deliver to:
1141 Bayview Ave, Biloxi, MS. 39530

Oil Spill Response Environment/Community Hotline (866) 448-5816
Medical Support (Poison Control) (800) 222-1222
Volunteer Training (PEC Hotline) (866) 647-2338
Report Oiled Wildlife (866) 557-1401

Oyster Check Stations

Pass Christian Check Station (228) 867-8957
Bayou Caddy Check Station (228) 382-2327

Oyster Hotline

Because coastal conditions change rapidly, oyster reefs/areas may be closed abruptly. For the current season status, please call the Oyster Hotline 24-hours a day at:
(228) 374-5167 or (800) 385-5902

Shrimp Hotline

(866) WE-TRAWL or (866) 938-7295

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Biloxi Oyster Tongers harvesting oysters near Deer Island, 1935.

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STATE OF MISSISSIPPI
Phil Bryant
Governor

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
Jamie M. Miller, Executive Director

Dear oyster harvesters, dealers and processors,

Mississippi's oyster resources and processing industry are both important assets to the state. The Mississippi Department of Marine Resources appreciates your hard work in protecting these valuable resources by being good stewards.

We developed this book, "Oystermen's Guide to Mississippi Gulf Coast Oyster Reefs," to help those just starting out in the oyster business, as well as oystermen who have years of experience.

This guidebook is a first edition, and we encourage your input on its usefulness, as well as any suggestions for improvement. The section for notes can be used to record your "secret" fishing spot, but I also encourage you to write down any ideas you may think of while you are on the water to help us improve future editions of this guide. We hope you will use this guide in your work harvesting and processing oysters, as well as a training tool for new deckhands to be smarter, safer workers.

The state of Mississippi and the MDMR pledge to work with you to give you the information and tools you need to be successful oystermen. Together we will protect the natural resources that allow so many Mississippians the opportunity to live and work on the Mississippi Gulf Coast.

In Appreciation,

A handwritten signature in black ink that reads "Jamie M. Miller".

Jamie M. Miller, Executive Director
Mississippi Department of Marine Resources

Mississippi Department of Marine Resources

The Mississippi Gulf Coast is home to some of the nation's most productive shellfish and finfish waters and their supporting coastal wetlands. This region is rich in renewable natural resources upon which many generations have depended for their livelihoods. Our coastal resources have not only sustained a growing economy, but have contributed greatly to the culture and heritage that define The Mississippi Gulf Coast.

The Mississippi Department of Marine Resources (MDMR), created by the Legislature as a new state agency in 1994, manages our coastal resources through the authority of the Commission on Marine Resources (CMR). The MDMR is dedicated to enhancing, protecting and conserving the marine interests of Mississippi for present and future generations. MDMR manages all marine life, public trust wetlands, adjacent uplands and waterfront areas for the long-term recreational, educational, commercial and economic benefit of everyone.

The MDMR and the CMR play an important role in administering Mississippi Seafood Laws, the Mississippi Coastal Wetlands Protection Act, the Public Trust Tidelands Act, the Boat and Water Safety Act, the Derelict Vessel Act, the Non-Point Source Pollution Act, the Magnuson Stevens Act, the Wallop-Breaux Sport Fish Restoration Act, Marine Litter Act and other state and federal mandates.

Jamie M. Miller, Executive Director

Kelly Lucas, PhD, Chief Scientific Officer

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Commission on Marine Resources

Jimmy Taylor, Chairman, Charter Boat Operator, Harrison County

Steve Bosarge, Commercial Fisherman, Jackson County

Shelby Drummond, Recreational Sports Fisherman, Jackson County

Richard Gollott, Commercial Seafood Processor, Harrison County

Introduction to the American Oyster

The American oyster (*Crassostrea virginica*) is one of the more valuable resources of the Mississippi Gulf Coast. It provides a livelihood for a number of oystermen and satisfies many Gulf Coast appetites. The oyster is often grouped with shrimp and crabs under the term shellfish, but the oyster has no relation to either. It is a bivalve mollusk with two shell valves hinged together at one end and closed by a single, large muscle attached to the valves at the other end.

You can find oysters in shallow waters that rapidly change in temperature and salinity. The MDMR manages 17 natural oyster reefs. Approximately 97% of the commercially harvested oysters in Mississippi come from the reefs in the western Mississippi Sound, primarily from Pass Marianne, Telegraph and Pass Christian reefs. On page 15 of this book, you will find a map of the western Mississippi Sound showing the locations of these harvestable oyster reefs.

Before oystering, a recreational or commercial license must be purchased at the MDMR. Harvesting oysters is done primarily by tonging or dredging. An oysterman can use a set of tongs to scoop oysters off the bottom of the Mississippi Sound. Tongs resemble two rakes attached by two 15-foot long poles that work like scissors and can catch as many as 40 oysters. An oyster dredge can be used to pick up several hundred oysters. A dredge is a basket or bag attached to a toothed bar. It is towed by boat over the reef and oysters are scraped off the bottom by the teeth on the bar, caught in the basket, and then hauled aboard.

Oysters may be taken only from those waters approved safe for shellfish harvest by the CMR. Harvesting, shucking, processing and selling oysters must conform to all state and federal regulations. Following heavy rainfall, oyster reefs may be temporarily closed to harvesting when poor water quality exists. Important information about the opening and closing of oyster reefs is available by calling the 24-hour MDMR oyster hotline found at the front of this book.

Natural pearls can be found in a Mississippi oyster. The process begins when sand grains, shell fragments or other particles become embedded within the mantle tissue. Mantle cells stick to this particle and become trapped within the mantle tissue. These cells continue to build up around the particle and form a pearl. An American oyster lacks the ingredient in its secretion to form the mother-of-pearl coating that gives the luster of a true pearl. Therefore, the Mississippi oyster's pearl, although interesting, is not valuable and is often misshapen.

Oysters are good to eat all year long, but are in best condition and most tasty in the winter and early spring. No gutting or grilling is necessary to eat an oyster; the meat can be completely consumed. It is one of the few foods that can be eaten raw. This coast cuisine can be eaten on the half shell, fried, smoked, baked, and broiled and can be found in stews, soups, gumbos, dressings and seafood casseroles and on the menus of most local seafood restaurants.

Mississippi Oyster Reefs

Oysters may be taken only from those waters approved for shellfish harvest by the CMR. The harvesting, shucking, processing and sale of oysters must conform to all regulations specified by state statute and the regulations adopted by the CMR. Several natural reefs are located in approved waters. Approved waters along with all other defined areas are described in detail on the following pages. Some of these approved coastal reefs include:

- Pass Marianne Reef
- Telegraph Reef
- Buoy Reef
- Umbrella Reef
- Pelican Key Reef

The major natural oyster reefs known to be located entirely within conditionally approved waters (see following definition) include:

- St. Joe Reef (St. Joseph's Point Reef)
- Waveland Reef
- St. Stanislaus Reef
- Square Handkerchief Reef
- Henderson Point Reef
- Bay St. Louis Reef
- Kittiwake Reef (Long Beach Reef)
- White House Reef
- North and South Rigolets
- Middle Bay



The map on pages 14 and 15 of this book gives a closer look at the harvestable oyster reefs found in the western Mississippi Sound.

Following a heavy rainfall, an increase in river stage or a pollution event, conditionally approved reefs may be temporarily closed to oystering when poor water quality conditions exist. Such closures are released to local newspapers, television and radio media. Pertinent information about the opening and closing of reefs is available by calling the MDMR 24-hour toll-free oyster information hotline at (800) 385-5902. The hotline information may be updated daily during oyster season. Information on the current status of any shellfish growing waters in this state may be obtained from the MDMR.

METHODS OF TAKING OYSTERS

An oyster license is required for all methods of oyster harvest. During open season, oysters may be taken by hand, tong or dredge. Dredges for oystering may not exceed 140 pounds in weight nor may they have an excess of 16 teeth. Teeth on the dredge must be five inches or less in length. Restrictions on the maximum number of dredges carried or the maximum number of sacks that may be harvested daily are established seasonally by the CMR.

SPECIAL PROVISIONS

Both recreational and commercial oyster harvesters must purchase a license from the MDMR. Oysters taken from Mississippi waters must be tagged. These tags are issued by the MDMR at officially designated check stations. These stations will be identified in the opening order for each oyster season. Both commercial and recreational oyster harvesters must check in at the designated check station before going to reefs and must check out at the same station.

Tags are issued at the time of inspection. Each tag must be completed with the harvester's name, license number, harvest date, harvest area. If the oysters are to be sold, the tag must also include the shellstock dealer's name and identification number. Oysters taken for personal consumption must also be inspected and a tag will be issued for each sack. Such tags will identify that the contents are not to be sold. Tags must be affixed to the sacks with the fasteners provided by the MDMR. All harvesters are required to pay a shell retention fee to the MDMR on the day of harvest. Shell retention fees will be used to further oyster production within the state.

Each boat or vessel used to harvest or transport shellfish is required to have on board a functional, approved marine sanitation device (MSD), portable toilet or other approved sewage disposal receptacle to contain human sewage. In addition, harvest vessels must have an awning or similar covering above shellstock to provide protection from the sun during the summer months of May to September.

Any oysters taken from waters other than in Mississippi must be accompanied by a bill of landing indicating the point of origin. Oysters harvested outside of Mississippi waters and transported by water into the state must apply for a permit issued by the MDMR and comply with the provisions of the state. Oysters destined for interstate commerce must originate from a certified Mississippi dealer with a fixed cooler facility.

SEASONS

The opening and closing of oyster season is regulated by the CMR and notice thereof will be duly published in local newspapers and released to both the radio and television media. Oysters may be taken only during daylight hours.

LEGAL SIZE LIMITS

Oysters taken from Mississippi public waters must be at least 3 inches from hinge to bill. At times, however, the MDMR may adjust this limit upon public notice to that effect.

LEGAL CATCH LIMITS

Recreational catch limits, set by Statute §49-15-46 (4), and commercial catch limits, set by Statute §49-15-38, are set annually, and may be adjusted throughout the season.

Definitions of Oyster Reef Classification

An **APPROVED AREA** is the classification of a state shellfish growing area, which has been approved by the State Shellfish Control Authority (SSCA) for growing or harvesting shellfish for direct marketing. The classification of an approved area is determined through a sanitary survey conducted by the SSCA. An approved shellfish growing area may be temporarily closed when a public health emergency such as a hurricane or flooding is declared.

A **CONDITIONALLY APPROVED AREA** is the classification of a state shellfish growing area determined by the SSCA to meet approved area criteria for a predictable period. The period is conditional upon established performance standards specified in a management plan. A conditionally approved shellfish growing area is closed by the SSCA when it does not meet the approved growing area criteria.

RESTRICTED AREAS are state waters that have been classified by the SSCA as an area from which shellfish may be harvested only by permit from the SSCA and are subjected to suitable and effective treatment through relaying.

PROHIBITED AREA are growing waters where there is no current sanitary survey or where the sanitary survey or other monitoring program data indicate that fecal material, pathogenic microorganisms, deleterious substances, marine toxins or radionuclides may reach this area in excessive concentrations. The taking of shellfish for any human food purposes from such areas is prohibited.



UNCLASSIFIED AREAS are waters that are presently unclassified and from which the harvest of shellfish is prohibited pending classification based on a sanitary survey of the area.

The areas of the Mississippi Sound are defined in greater detail on pages 8 to 13 of this book according to their classification for harvesting oysters.

Definitions are from the National Shellfish Sanitation Program's "Guide for Control of Molluscan Shellfish," 2009 Revision.



John Mitchell, MDMR Scientist, measuring dredged oysters during a reef assessment



Oyster spawn or "Spat" settlement on an oyster shell

Mississippi Oyster Harvesting Locations

<http://www.dmr.ms.gov/dmr-information/regulations>

Mississippi oyster harvesting locations are identified by sections and harvesting conditions. Harvestable oyster reefs are divided into two sections: tonging grounds and dredging grounds. Tonging grounds are intended for taking oysters by tong harvesting methods only. Dredgers are prohibited from dredging on tonging grounds. However, dredging grounds may be harvested by both tonging and dredging. Harvestable oyster locations are further divided into the following five harvesting conditions: approved, conditionally approved, restricted, prohibited, and unclassified.

The following information describes oyster harvesting areas in greater detail. This information was taken directly from *Title 22 Part 1: Oyster Growing and Harvesting Regulations for the State of Mississippi*. These regulations are subject to change at any time. For more information and to find a copy of the most up-to-date regulations, please visit the MDMR website at www.dmr.ms.gov or request a printed copy by calling (228) 374-5000 or (800) 374-3449. Refer to the map on page 14 and 15 of this book for a look at the locations of the oyster reefs in the western Mississippi Sound.

I. Harvesting by Tonging only

Tonging Line

The tonging line for harvesting oysters runs across the entire Mississippi coastline. The tonging line begins at a point on the southern shore of the mouth of Bayou Caddy and proceeds to a point one nautical mile due east. From here, the one mile distance meanders north along the shoreline. The tonging line maintains one nautical mile off the CSX railroad bridge and proceeds easterly following the meandering shoreline one nautical mile from the shoreline. The tonging line continues through the following points:

- Longitude 89°15.139'W.
- Proceeding due south to a point at Latitude 30°17.138'N, Longitude 89°15.139'W.
- Proceeding due east to a point at Latitude 30°17.138'N, Longitude 89°14.340'W.
- Proceeding due north to a point at Longitude 89°14.340'W one nautical mile from the shoreline.
- The tonging line continues easterly, following the meandering of the shoreline one nautical mile from the shoreline to the intersection of the Alabama State line.

II. Harvesting by Tonging and/or Dredging

Approved Harvesting Waters

Approved waters are a classification of a state shellfish growing area which has been approved by the SSCA for growing or harvesting shellfish for direct marketing. The

classification of an approved area is determined through a sanitary survey conducted by the SSCA. An approved shellfish growing area may be temporarily closed when a public health emergency, hurricane or flooding is declared.

AREA II APPROVED

Area II Approved includes the public oyster reefs known as Telegraph Reef, Buoy Reef, and the Shell Keys referred to as Pelican Reef, Fletcher's Reef, Umbrella Reef, and the southern portion of Pass Marianne reef. Area II Approved boundaries are as follows:

- Area II approved boundary line begins at a point on the boundary line between Mississippi and Louisiana at Longitude 89°20.000'W, and runs easterly along the state line to a point due south of the westernmost tip of Cat Island.
- Due north to the westernmost tip of Cat Island.
- North to northwesterly along a line drawn between the westernmost tip of Cat Island and a point 700 feet seaward of the southernmost point on the mainland shoreline due south of Menge Avenue in Pass Christian, MS.
- Continuing along the line to a point of intersection with the Mississippi Intracoastal Waterway.
- Southwestly to Mississippi Sound Marianne Channel Lighted Buoy 3 (FI G 4s 4M "3").
- Westerly to Mississippi Sound Pass Marianne Buoy 2P.
- Westerly to Mississippi Sound Pass Marianne Light 4P (FI R 2.5s 17ft 3M "4P").
- Southwestly to Mississippi Sound Pass Marianne Buoy 6P.
- Westerly to the Mississippi Sound Pass Marianne Merrill Shell Bank Light (FI W 6s 30ft. 4M).
- Southwestly to Mississippi Sound Pass Marianne Buoy 12P.
- Southwestly to Mississippi Sound Pass Marianne Light 15P (FI G. 4s 17ft. 5M "15P").
- From Pass Marianne Light 15P running southwestly along a line drawn through Mississippi Sound Pass Marianne Light 4P and Pass Marianne Light 15P to a point of intersection with Longitude 89°20.000'W.
- Southerly along Longitude 89°20.000'W to a point on the boundary line between Mississippi and Louisiana, this point being the *point of beginning*.

AREA II Approved shall be further sub-divided as follows:

- **AREA II "H"** is made up of those waters of Area II Approved that are WEST of Longitude 89°15.000' W.
- **AREA II "I"** is made up of those waters of Area II Approved that are EAST of Longitude 89°15.000' W.

Conditionally Approved Harvesting Waters

Conditionally approved waters are the classification of a state shellfish growing area determined by the SSCA to meet approved area criteria for a predictable period. The period is conditional upon established performance standards specified in a management plan.

When a conditionally approved shellfish growing area does not meet the approved growing area criteria, it is temporarily closed by the SSCA.

The western Mississippi Sounds consists of five conditionally approved waters including:

- Area I “B”
- Area II “A”
- Area II “B”
- Area II “C” (Subdivided into Areas II “E”, II “F”, II “G”)
- Area II “D”.

The boundaries for these areas are explained below. Refer to the map on page 14 and 15 of this book for a look at the locations of these areas.

Area I “B” Conditionally Approved Waters

Area I “B” boundaries are as follows:

- The line begins on a point at Mississippi Intracoastal Waterway St. Joe Pass Light 3 and runs easterly along the Mississippi/Louisiana State line boundary, to Longitude 89°20.000’W.
- Continues northerly along Longitude 89°20.000’ W to a point of intersection with a line drawn due east from the most seaward point on the south shore of the mouth of Bayou Caddy.
- Westerly along said line of intersection to a point on the south shore of the mouth of Bayou Caddy.
- South to southwestwardly along and following the meanderings of the mainland shoreline around Point Clear and Point St. Joseph to the westernmost point of Heron Bay Point.
- South to Mississippi Intracoastal Waterway St. Joe Pass Light 3 which is the *point of beginning*.

AREA II “A” Conditionally Approved Waters

Area II “A” includes portions of the public oyster reefs known as Henderson Point and Pass Christian. Area II “A” boundaries are as follows:

- The line commences at a point on the CSX Railroad Bridge across St. Louis Bay at the center of the swing span.
- Runs easterly along the bridge to a point 700 feet seaward of the eastern end of the bridge.
- South-southeastwardly, parallel to and remaining 700 feet seaward of the mainland shoreline around Henderson Point following the meanderings of the mainland shoreline 700 feet, running easterly and remaining 700 feet seaward of the prohibited waters of Pass Christian Municipal Harbor to a point 700 feet seaward of the southernmost point on the mainland shoreline due south of Menge Avenue in Pass Christian.

- South-southeastwardly along a direct line drawn between the previously stated point to the westernmost tip of Cat Island, to a point one nautical mile from the mainland shoreline.
- Westerly, parallel to and following the meanderings of the mainland shoreline, maintaining a distance of one nautical mile, to a point one nautical mile south of the CSX Railroad Bridge across St. Louis Bay, on a line drawn between the Mississippi Square Handkerchief Shoal Light 2 (FL R 4s 17ft 4M “2”) and a point on the CSX Railroad Bridge across St. Louis Bay at the center of the swing span.
- Northeastwardly following said line to a point on the CSX Railroad Bridge across St. Louis Bay at the center of the swing span, said point being the *point of beginning*.

AREA II “B” Conditionally Approved Waters

Area II “B” includes the public oyster reefs known as St. Stanislaus and Waveland Reef. Area II “B” boundaries are as follows:

- The line begins at a point at the center of the swing span on the CSX Railroad Bridge across St. Louis Bay.
- Running southwestwardly along a direct line to Mississippi Sound Square Handkerchief Shoal Light 2 (FL R 4s 17ft 4M “2”), on the western edge of the Square Handkerchief Shoal.
- West from the Mississippi Sound Square Handkerchief Shoal Light 2 to Longitude 89°20.000’W.
- Southerly along 89°20.000’W, to a point of intersection with a line drawn due east from the most seaward point of the south shore mouth of Bayou Caddy.
- West along said line to a point at Longitude 89°24.000’W.
- North to a point 700 feet seaward from the mainland shoreline.
- North-northeastward parallel to and remaining 700 feet seaward from the mainland shoreline to a point 700 feet seaward and east of the west end of the CSX Railroad Bridge across the St. Louis Bay.
- Eastward along the CSX Railroad Bridge to a point at the center of the swing span, said point being the *point of beginning*.

AREA II “C” Conditionally Approved Waters

Area II “C” includes the northern portion of Pass Marianne reef and southern portion of the Pass Christian Reef. Area II “C” boundaries are as follows:

- The line begins at a point one nautical mile from the mainland shoreline on a direct line drawn between a point 700 feet seaward of the southernmost point on the mainland shoreline due south of Menge Avenue in Pass Christian, to the westernmost tip of Cat Island.
- Runs westerly, parallel to and following the meanderings of the mainland shoreline, maintaining a distance of one nautical mile, to a point one nautical mile south of the CSX Railroad Bridge across St. Louis Bay, on a line drawn between the Mississippi Square Handkerchief Shoal Light 2 (FL R 4s 17ft 4M “2”) and a point on the CSX Railroad Bridge

across St. Louis Bay at the center of the swing span.

- West from said Mississippi Sound Square Handkerchief Shoal Light 2 to Longitude 89°20.000'W.
- Southerly along Longitude 89°20.000'W to a point of intersection with a line drawn through Mississippi Sound Pass Marianne Light 4P (FI R 2.5s 17ft 3M "4P") and Mississippi Sound Pass Marianne Light 15P (FI G. 4s 17ft. 5M "15P").
- North-northeasterly from said Pass Marianne Light 15P.
- Northeasterly to the Mississippi Sound Pass Marianne Buoy 12P.
- Northeasterly to the Mississippi Sound Pass Marianne Merrill Shell Bank Light (FI W 6s 30ft. 4M).
- Northerly to Mississippi Sound Pass Marianne Buoy 6P.
- Northeasterly to the Mississippi Sound Pass Marianne Light 4P (FI R 2.5s 17ft 3M "4P").
- Easterly to Mississippi Sound Pass Marianne Buoy 2P.
- Easterly to Mississippi Sound Marianne Channel Lighted Buoy 3 (FI G 4s 4M "3").
- Northeasterly from said Marianne Channel Lighted Buoy 3 to a point of intersection on the Mississippi Intracoastal Waterway with a line drawn north-northwesterly from the westernmost tip of Cat Island and a point 700 feet seaward of the southernmost point on the mainland shoreline due south of Menge Avenue in Pass Christian.
- North-northwesterly along said line to the *point of beginning*.

AREA II "C" shall be further sub-divided as follows:

- **AREA II "E"** is comprised of those waters of Area II "C" that are WEST of Longitude 89°16.000'W and north of Latitude 30°15.500'N.
- **AREA II "F"** is comprised of those waters of Area II "C" that are EAST of Longitude 89°16.000'W and north of Latitude 30°16.300'N.
- **AREA II "G"** is comprised of those waters of Area II "C" that are SOUTH of Area II "E" and Area II "F".

AREA II "D" Conditionally Approved Waters

Area II "D" boundaries are as follows:

- The line begins at a point 700 feet from the western shoreline of the St. Louis Bay on the CSX Railroad Bridge.
- Easterly along the CSX Railroad Bridge to a point 700 feet from the eastern shoreline of St. Louis Bay.
- Northerly 700 feet from the mainland shoreline following the meanderings of the mainland shoreline 700 feet from the mainland shoreline to a point 700 feet from the eastern shoreline of St. Louis Bay on the U.S. Highway 90 bridge.
- Westerly along the U.S. Highway 90 Bridge to a point 700 feet from the western shoreline of the St. Louis Bay on the U.S. Highway 90 Bridge.
- Southerly 700 feet from the mainland shoreline following the meanderings of the mainland shoreline 700 feet from the mainland shoreline, to the *point of beginning* on the CSX Railroad Bridge.

Restricted Waters

Restricted waters include state waters that have been classified by the SSCA as an area from which shellfish may be harvested only by special permit from the SSCA and are subjected to suitable and effective treatment through relaying.

Prohibited Waters

Prohibited waters are growing areas where there is no current sanitary survey or where the sanitary survey or other monitoring program data indicate that fecal material, pathogenic microorganisms, poisonous or deleterious substances, marine toxins or radionuclides may reach this area in excessive concentrations. The taking of shellfish for any human food purposes from such areas is strictly prohibited.

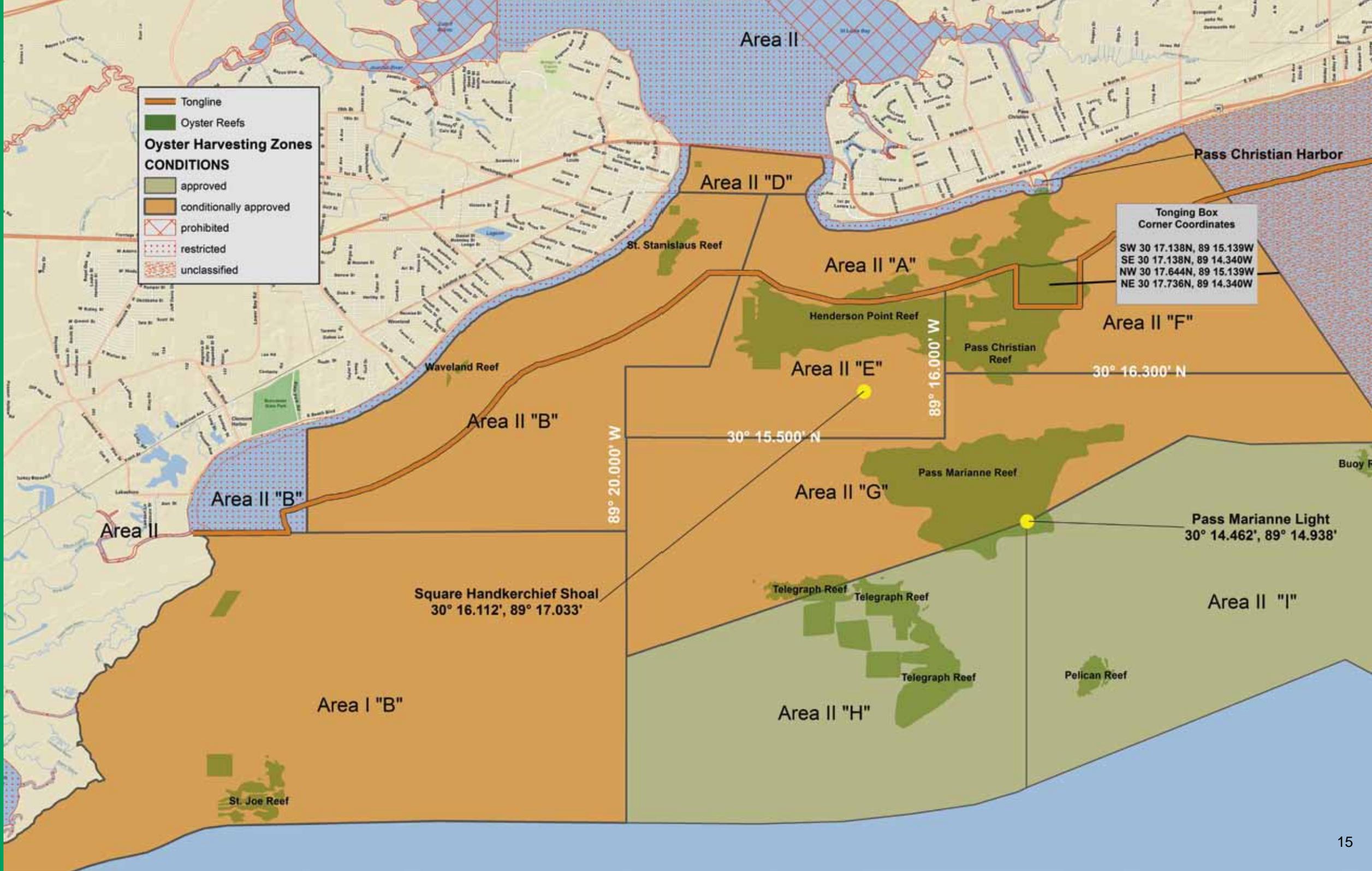
Unclassified Waters

Unclassified waters are presently unclassified as one of the previous four classifications and from which the harvest of shellfish is prohibited pending classification based on a sanitary survey of the area. Permission must be granted to harvest shellfish from unclassified waters in accordance with the respective classification by the CMR and MDMR.

This information was derived from Mississippi State Rules and Regulations [Title 22 Part 01: Oyster Growing and Harvesting](#). For a complete copy of Title 22, please visit the following link: <http://www.dmr.ms.gov/dmr-information/regulations>.



The American Oyster, Crassostrea virginica, harvested from the Pass Christian Oyster Reef



Shellfish Harvesting: The Safe Handling of Shellstock, Overboard Discharge and No-Discharge Zones

Excerpts taken from a publication of the Interstate Shellfish Sanitation Conference (ISSC) – in cooperation with the Gulf of Mexico Program

Shellfish Harvesting

Oysters, clams and mussels are seafood delicacies that are enjoyed by millions of consumers. Broiled, baked, steamed, fried, or raw on the half-shell, shellfish have been a seafood favorite around the world for thousands of years.

When oysters are feeding, molluscan shellfish (oysters, clams, and mussels) filter large quantities of water, entrapping plankton and other materials from the water as it passes over the gills. Mollusks have the ability to accumulate concentrations of bacteria and chemicals up to 1,000 times that of surrounding waters. The primary contaminant is usually human sewage. When consumed raw, the contaminants are consumed as well, and can result in illnesses ranging from mild discomfort to severe illness and even death.

Consumption of shellfish from polluted waters may result in illness outbreaks. Some of these outbreaks, however, occur from shellfish harvested in approved waters. In most of these cases overboard discharge of human feces or vomitus has been cited as the cause. When illnesses do occur, harvesting areas may be closed and the entire shellfish industry loses sales due to adverse publicity. The message is simple: always harvest shellfish from approved or open waters and do not discharge waste overboard.

In state waters, molluscan shellfish can only be harvested from approved or open waters. To ensure that only safe shellfish are consumed by the public, shellfish control agencies conduct sanitary surveys and classify all shellfish growing areas. These shellfish growing areas are then patrolled by state shellfish control authorities who provide law enforcement to prevent harvesting from closed areas.

Onboard the Vessel

Harvesters must be licensed from the state authority before they harvest any shellfish. Harvesters are legally liable for illnesses and deaths that might occur from their disregard for proper harvesting and handling practices. Boats used to harvest and transport shellstock must be properly constructed, operated and maintained to prevent contamination and decay of shellstock.

Decks, storage bins and bilge pumps must be kept clean, well drained and appropriately located to prevent polluted water from touching shellstock. Effective covers can shield shellstock from the hot sun and birds.

The most important concern is overboard discharge. It is critical that human sewage not be discharged overboard while boats are in growing areas or in no-discharge zones. Pathogens transmitted through overboard discharge may sicken many people. This often leads to losses in sales. Harvesters who ignore safe harvesting and handling practices are ultimately hurting themselves.

From 1977 to 2006, 1,274 illnesses within the United States were traced to overboard discharge of human sewage containing viruses which were consumed by the oyster and then eaten by unsuspecting patrons. To deal with the issue of overboard discharge, approved marine sanitation devices (MSDs) are required. Approved devices include MSDs, portable toilet or other sewage disposal containers. These containers must be secured to prevent

spillage, must be used ONLY for sewage, and must only be emptied into a sewage disposal system such as a toilet or a pump-out facility.



No-Discharge Zones

To further protect waters, including shellfish growing areas, states can have all or portions of their waters designated as no-discharge zones for vessel sewage. These designations can protect public health by providing pump-out facilities or dump stations.

Mississippi regulation Title 22 Part 01 states that “It shall be unlawful for any person, firm or corporation to discharge solid or human waste overboard any boat or vessel while said boat or vessel is in any public or private marine waters of the State of Mississippi.” Similar to Mississippi, Rhode Island and New Hampshire have all of their waters designated as no-discharge zones. Others states, including: California, Florida, Texas, Georgia, Maryland, Virginia, Massachusetts, New Jersey, New York and North and South Carolina have certain bays and estuaries protected.

Time and Temperature Controls

The second line of defense to ensure the safe handling of shellstock is the dealers and distributors. Pathogens such as *Vibrio parahaemolyticus*, and *Vibrio vulnificus* occur naturally in seawater, but can sicken consumers and, in some cases, result in death to high-risk individuals. These pathogens are affected by temperature. Pathogen levels can

double in shellfish in as fast as eight to nine minutes at 98.6°F (37°C). Moderate levels can increase to high in as short as two to three hours at 68° - 95°F (20° - 35°C). Temperature control is critical to product safety. Cooling after abuse will only slow reproduction. Refrigeration cannot be relied upon to kill the bacteria. States set time limits for harvesting to lessen the growth of *Vibrio* pathogens and keep the product as cool as possible.



Once the shellstock begins to warm, *Vibrio* rapidly reproduces and the possibility of causing illness in consumers increases. To maintain the quality of the product, shellstock should be washed with approved water and cooled as soon as possible. Minimize exposure of harvested shellstock to heat. Place shellstock in a refrigerated environment as soon as possible following harvest. Consult your state regulatory and licensing agency to determine proper time and temperature controls for your area.

Conclusion

Through observation and enforcement of safe harvesting and handling practices, harvesters can help to protect public health, the shellfish industry, and ultimately their own livelihood. Harvesters play the most critical role in ensuring that shellfish are safe to consume. Because of their unique nature in accumulating pathogens, shellfish must only be harvested from approved waters. Shellfish harvested from contaminated waters can lead to serious illness when consumed. Even shellfish harvested from safe waters can be quickly contaminated by the discharge of human waste from onboard boating vessels. Do not dump human waste overboard in harvesting waters or in areas designated as “no-discharge-zones.” Once harvested, handle and store shellfish according to storage time and temperature regulations determined by your state.

Excerpts of this article are taken from a publication of the Interstate Shellfish Sanitation Conference (ISSC) – in cooperation with the Gulf of Mexico Program. For a copy of this publication, please visit the ISSC website or call toll-free: Interstate Shellfish Sanitation Conference, (803)788-7559, www.issc.org.

SHELLFISH HARVESTING

The Safe Handling of Shellstock,
Overboard Discharge and
No-Discharge Zones



The Interstate Shellfish Sanitation Conference
In cooperation with
The Gulf of Mexico Program

MDMR State Rules and Regulations

Title 22 Part 01: Oyster Growing and Harvesting

The following are segments from MDMR Rules and Regulations [Title 22, Part 01: Oyster Growing and Harvesting](#). This section is NOT intended to be comprehensive. Portions of each chapter are described below in an effort to give a brief narrative. For a full version of Title 22, Part 01, contact the MDMR.

Chapter 01: Introduction

“This section establishes the minimum requirements necessary to regulate the intrastate and interstate commerce of molluscan shellfish and to establish a program to protect the public health of consumers by assuring the sale or distribution of shellfish from safe sources and assuring shellfish have not been adulterated during landing, unloading, transporting, processing, buying, selling, opening and other shellfish-related activities in the state.”

Chapter 02: Justification and Authority

“The Mississippi Commission on Marine Resources (CMR) has determined that it is in the best interest of the State of Mississippi and necessary for the protection, conservation, and propagation of all shellfish in the waters under the territorial jurisdiction of the State of Mississippi to regulate the harvesting, landing, unloading, transporting, processing, buying, selling, opening, relaying, and other shellfish related activities in the state, and the leasing of waters within the area under the territorial jurisdiction of the State of Mississippi.”

Chapter 03: Definitions

Terms defined in this chapter include: Adulterated, Approved Area, Conditionally Approved Area, Illegal Molluscan Shellfish, Landed, Misbranded, Prohibited Area, Restricted Area, Sanitary Survey, Shall, Shellfish, Shellstock, Should, Unclassified Area.

Chapter 04: Legally Harvested and Properly Tagged Shellfish

“It shall be unlawful for any person, firm, or corporation to harvest, possess, land, handle, unload, open, sell or offer for sale or transport any shellfish taken from the waters under the territorial jurisdiction of the State of Mississippi except those shellfish taken legally and properly tagged from an area declared open to shellfish harvesting by public order of the CMR or as hereby authorized by the MDMR, its Executive Director, Director of Marine Fisheries, Bureau Director, Program Coordinator or other MDMR designee in accordance with the procedures outlined in this Part and its document parts.”

Chapter 05: Possession of Illegal (Molluscan) Shellfish

“It shall be unlawful for any person, firm or corporation to sell or possess any illegal

(molluscan) shellfish as defined in Mississippi Code Annotated §49-15-3 and as provided for in §49-15-44.”

Chapter 06: Shellfish Harvesting Requirements/Specifications

“Except for oysters legally harvested on private lease sites, it shall be unlawful for any person, firm or corporation to take from the reefs of this state any oysters that measure less than three (3) inches from end to end.”

Chapter 07: Dredge Specifications

“It shall be unlawful for any person, firm or corporation to take or attempt to take any oysters from the waters under the territorial jurisdiction of the State of Mississippi by the use of a dredge having a weight in excess of one hundred forty (140) pounds and the tooth bar cannot have more than sixteen (16) teeth and the teeth on the tooth bar cannot exceed five (5) inches unless otherwise permitted by the CMR or as hereby authorized by the MDMR.”

Chapter 08: Shellfish Area Openings and Closings

“The CMR shall set the opening date of oyster season in an opening order at a regularly scheduled meeting.”

Chapter 09: Harvester License and Check Stations

“It shall be unlawful for any person, firm, or corporation to take or attempt to take any oysters from the waters under the territorial jurisdiction of the State of Mississippi without first having obtained a license as specified in Mississippi Code Annotated §49-15-29, as amended.”

Chapter 10: Resident, Recreational and Non-Resident Requirements

“No nonresident recreational harvest will be permitted in the State of Mississippi.”

Chapter 11: Closed Shell or Cultch Plant Areas

“It shall be unlawful for any person, firm, or corporation to place or cause to be placed any material or gear used in the catching or taking of saltwater fish, shrimp, crabs or shellfish, with the exception of crab traps or pots, or hook and line fishing or cast nets on any public reef area that has been planted with shells or other cultch material that has not been released or opened to harvest by the CMR or the MDMR.”

Chapter 12: Adulterated, Misbranded, or Unlabeled Shellfish and Products

“It shall be unlawful for any person within the State of Mississippi to produce, harvest, provide, purchase, sell, offer, possess, or expose for sale, or have in possession with intent to sell, any raw shellfish and shellfish products which are adulterated, misbranded, or unlabeled and no person shall hold or pack shellfish under conditions whereby the shellfish may become adulterated.”

Chapter 13: Transportation of Shellstock by Vessel

“Boats or vessels transporting shellstock legally harvested and legally transported from waters outside the State of Mississippi into Mississippi unrefrigerated shall:

- Before entering Mississippi territorial waters, apply to the MDMR for a transport permit.
- Comply with all permit conditions required by the Department.
- Properly tag shellstock as described in this Part.
- Mechanically refrigerate shellstock within four (4) hours after landing such that the product is maintained at 45°F (7.2°C) or less.
- The Executive Director is hereby authorized to establish earlier checkout times, additional tagging requirements and additional time to temperature requirements of shellstock as may be required or necessary.”

Chapter 14: Tonging Line

For a detailed description of the tonging line, see page 8 of this book.

Chapter 15: Marine Sanitation Devices

“It shall be unlawful for any person, firm or corporation to discharge solid or human waste overboard any boat or vessel while said boat or vessel is in any public or private marine waters of the State of Mississippi. Each boat or vessel used in the harvest or transport of shellfish is required to have onboard a functional approved marine sanitation device (MSD), portable toilet or other sewage disposal receptacle to contain human sewage.”

Chapter 16: Management Documents Associated with This Part

“The MDMR shall manage and maintain a management plan for shellfish growing waters and harvesters’ operations according to the relevant specifications stated in the current National Shellfish Sanitation Program (NSSP) of the Interstate Shellfish Sanitation Program (ISSP), according to CMR Titles and Parts and requirements that are not in conflict with these specifications and according to the applicable statutes of the State of Mississippi.”

Chapter 17: Management Plan for Shellfish Growing Waters

“All Areas classified as prohibited are closed to the harvesting of shellfish at all times. All Areas classified as restricted are closed to the direct harvesting of shellfish. All Areas classified as approved and conditionally approved may be open to the direct harvesting of shellfish from the time the CMR adopts as the opening date of oyster season provided the area is open pursuant to this Part and its subsequent revision and until that area is officially closed.

All unclassified areas are closed to the harvest of shellfish pending classification of the area as prohibited, restricted, conditionally approved, or approved based on a sanitary survey of the area and granting of permission to harvest shellfish in accordance with the respective

classification by the CMR or as authorized in this Part: by the MDMR, its Executive Director, Director of Marine Fisheries, Bureau Director or Biological Program Coordinator.”

Chapter 18: Classification and Description of Shellfish Growing Area Waters

This section gives a detailed explanation of the classification of shellfish growing waters including: prohibited areas, unclassified areas, restricted areas, conditionally approved areas and approved areas.

Chapter 19: On-Bottom Shellfish Leasing Regulations

This section describes regulations for leasing Mississippi Sound shellfish grounds.

Chapter 20: Regulations for Relaying Activities

This section describes all regulations imposed during relaying events.

Chapter 21: Penalties

“Any unlawful act under this Part committed by any person, firm, or corporation shall be deemed a violation of the provisions of this Part and shall constitute a misdemeanor and upon conviction shall be punished in accordance with Mississippi Code Annotated § 49-15-63, as amended, unless a penalty is specifically provided elsewhere in the Mississippi Code Annotated of 1972, as amended.

Any person, firm, or corporation convicted of taking shellfish from leased land or from closed waters as described in Chapter 17 of this Part shall, upon conviction thereof, be subject to all the penalties provided under Mississippi Code Annotated § 49-15-27, as amended. Violations of more than one chapter or subchapter of this Part or Part thereof shall be considered separate offenses and punished as such.

Any person in possession of shellfish in violation of any chapter of this Part shall be subject to confiscation and disposal of such shellfish by direction of any designated Marine Patrol Officer of the MDMR.”

Chapter 22: Chapters and Subchapters Declared Separable

“Each chapter and subchapter of this Part is hereby declared separable, and if any chapter or subchapter or Part thereof shall be held invalid or unconstitutional, the balance of said Title 22 Part 01 shall remain in full force and effect. Violations of more than one chapter or subchapter of this Part or Part thereof shall be considered separate offenses and punished as such.”

Chapter 23: Administrative Procedures Act

“Pursuant to the amendments to the Administrative Procedures Act, § 25-43-1.101, et seq., of the Mississippi Code Annotated of 1972, as amended, and the rules and regulations promulgated pursuant thereto by the Secretary of State; the former Ordinance 1.016 has been modified and the CMR and MDMR have adopted the terminology and numbering system developed by the Secretary of State. Therefore, references to “ordinance” or to “Part” appearing in these regulations or the underlying statutes are used interchangeably and refer to the same instrument.”

Time and Temperature Regulations on Harvesting Oysters

By Ruth Posadas

The Food and Drug Administration (FDA) concurred with the Interstate Shellfish Sanitation Conference (ISSC) Model Ordinance (MO) changes and supporting Guidance Documents for new time and temperature controls adopted by the ISSC Executive Board. In accordance with the Executive Board’s recommendation, these changes will become effective 30 days from ISSC receipt of FDA concurrence. The purpose of these changes is to help ensure that MO time/temperature controls support the National Shellfish Sanitation Program (NSSP) *Vibrio* Control Plan requirements and provide for their uniform application. The revised MO changes and Guidance Document will be submitted to the full delegation of the ISSC at its 2013 Biennial meeting for final deliberation and Conference adoption.

Mississippi uses a *Vibrio* Risk Management Plan that sets guidelines to monitor time and temperature matrices per month throughout the year. Two core components of the plan that are monitored are as follows:

1. The length of time allowable for oysters to be unrefrigerated.
2. The proper cooling rate of oysters at a certain temperature.



MDMR Seafood Officers, Jeff Davis and Jessica Rankin, conduct a time-temperature monitoring experiment using a sack of freshly harvested Mississippi oysters.

Vibrio is a naturally occurring bacterium in the Gulf of Mexico waters and is high in count during the hottest summer months. Most *Vibrio* bacteria grow in shellfish and the rate of growth is dependent upon the temperature. The established controls begin with harvesting of the oyster and continue through all levels of handling.

During May to September, the time-temperature matrix is reduced when compared to the winter months, October to April. The purpose of this regulation change is to assure that the risk is decreased and that if *Vibrio* is present in the oysters, these controls will decrease the contamination.

The Mississippi *Vibrio* Control Plan has three levels to be followed in accordance with the *2011 MO Guidance Documents Chapter II: Risk Assessment and Risk Management* and *Chapter VIII: Harvesters Time to Temperature Control*. For the purpose of time and temperature control, time begins once the first shellstock harvested is no longer submerged. The Authority shall ensure that harvesters document and provide trip records to the initial dealer demonstrating compliance with the time to temperature requirements. The adopted changes should help improve shellfish safety and support state and industry efforts to effectively manage the time and temperature requirements of *Vibrio* control plans.

Action Level	Average Monthly Max Air Temp	Max Hours from Exposure to Temp Control
Level 1	< 60°F (15°C)	24 hrs
Level 2	60° to 80°F (15° to 27°C)	18 hrs
Level 3	≥ 81°F (≥ 27°C)	12 hrs

NOTE: The Executive Director is authorized to establish new time and temperature controls as deemed necessary. These regulations are subject to change under the most current version of the ISSC’s NSSP MO. For more information, contact the MDMR Seafood Technology Bureau and speak with a Seafood Officer.

Mississippi Oyster Tags

By Rita Duvernay

Harvesters must place one of the three types of tags on each sack of oysters harvested at the time of landing. These tags may be purchased at any MDMR check station during operating hours.

The following is an explanation of each type of tag dispersed in Mississippi:

- **A COMMERCIAL TAG** is yellow in color and is two-sided. One side of the tag includes: the harvester's name, license number, date and harvest area. The reverse side displays the dealer's information including: company name, address, certification number, and original shell stock shipper certification number. If a sack has a yellow tag attached, this sack can be sold or carried home. This sack **MUST** be refrigerated within four hours. This time to refrigeration may be changed as deemed necessary by the CMR and MDMR.



- **A PERSONAL USE TAG** is green in color and is two-sided. One side of the tag includes: the harvester's name, license number, date and harvest area. The reverse side displays the following notice: "COMMERCIALY HARVESTED PERSONAL USE OYSTERS. SALE PROHIBITED BY LAW". This tag is used when a commercial harvester wants to take a sack home for personal consumption. If a sack has a green tag, it **CANNOT** be sold. A commercial harvester is allowed to have three green tag sacks in a seven day period, but cannot exceed his daily limit of harvestable sacks.



- **A RECREATIONAL USE TAG** is red in color and is two-sided. One side of the tag includes: the harvester's name, license number, date and harvest area. The reverse side of the tag displays the following notice: "RECREATIONALLY HARVESTED OYSTERS. SALE PROHIBITED BY LAW". This tag is distributed to Mississippi Recreational Oyster Harvesters only. If a sack has a red tag, it is for personal consumption and this sack **CANNOT** be sold. A recreational harvester is only allowed to harvest three sacks in a seven day period.



Notification Slip

Oystermen must complete a notification slip each morning before leaving the harbor to harvest oysters. This slip is placed in a drop box located in or near a state oyster check station before the oystermen leave the harbor for harvest. The intention of this notification slip is to allow check station staff to input license data into the trip ticket program before the harvester returns to the check station to purchase oyster tags. The notification slip includes the following information:

1. The vessel identification number which is either the state registration number or documentation number for the vessel. The state registration number will begin with letters representing the state of vessel registration including: MI for Mississippi, AL for Alabama, LA for Louisiana, etc.
2. The name of the vessel used for harvesting oysters.
3. The time the vessel left the dock to harvest oysters.
4. License type (either commercial or recreational).
5. License type (either dredging or tonging).
6. The number of either dredges or tongs used during harvest (usually one or two).
7. The area where the oysters were harvested, which will be: 2A, 1B, 2B, 2D, 2E, 2F, 2G, 2H or 2I. Refer to map on page 14 and 15 of this book to view the layout of areas in the western Mississippi Sound.
8. The name of the reef harvested (Pass Christian, Pass Marianne, Telegraph, etc). Again, refer to the map on page 14 and 15 of this book to view the reef names.
9. The vessel's oyster license number.
10. Type of license registered (either in state or out of state license).
11. The name of the person listed on the oyster license.
12. The code for license type. This code will be a number corresponding to the state of license holding and the type of harvesting including: recreational, commercial dredger or commercial tonger. This chart shows a few of the most common codes used for license type in MS.
13. Number of people on board the harvesting vessel, including the captain.

Code	License Type
5	MS Recreational license
6	MS Commercial tonger
7	MS Commercial dredge
8	Out of state tonger
9	Out of state dredge
14/39	Louisiana dredge
29	Louisiana tonger

Codes used in Mississippi for Each License Type

**MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
OYSTER NOTIFICATION SLIP**

Vessel ID Number: _____ 1 Vessel Name: _____ 2

Date: _____ Time Out: _____ 3 Comm 4 Rec 5 Dredge 5 Tong 5

of Gear: _____ 6 Reef Area: _____ 7 Reef Name: _____ 8

License Number: _____ 9 In State 10 Out of State 10

License Harvester Name: _____ 11 Lic Type: _____ 12

Captain's Name: _____ # Of Crew: _____ 13

Oystermen must complete this notification slip each morning before leaving the harbor to harvest oysters.



Oyster Reef Cultch Planting

The goal of the Mississippi oyster cultch planting program is to restore and enhance oyster reefs within the existing footprint of oyster harvest areas. Oyster cultch is a clean, hard material, typically oyster shell, limestone or crushed concrete, placed in suitable areas, upon which oyster larvae can attach and grow. Oyster cultch plant areas are routinely surveyed to identify potential enhancement and restoration opportunities.



Danny Ross, MDMR Marine Fisheries Technician, measures a barge of limestone for cultch planting.



Mississippi Cultch Plant History

YEAR	Reef Name	Cultch Material	Cubic Yards	Acreage
1997	Telegraph Reef	Oyster Shell/Concrete		300
	Kittiwake Tonging Reef (Long Beach)	Oyster Shell		8
	St. Stanislaus Reef	Oyster Shell		9
	Waveland Reef	Oyster Shell		12
1999	Telegraph Reef	Crushed Concrete		20
2000	Square Handkerchief Reef	Oyster Shell		50
	Point Clear Reef	Oyster Shell		50
	St. Joe Reef	Oyster Shell		65
2001	Pass Christian Reef	Oyster Shell		100
2002	Henderson Point Reef	Oyster Shell		80
	Telegraph Reef	Oyster Shell	3,950	80
2003	Kittiwake Tonging Reef (Long Beach)	Oyster Shell		14
	Telegraph Reef	Limestone		85
	Between the Bridges, Bay St. Louis	Oyster Shell		5
	St. Stanislaus Reef	Oyster Shell		14
	Square Handkerchief Reef	Oyster Shell		65
2004	Square Handkerchief Reef	Oyster Shell		60
	Telegraph Reef	Oyster Shell		90
2005	Telegraph Reef	Limestone		215
	Kittiwake Tonging Reef (Long Beach)	Oyster Shell		10
	Henderson Point Reef	Oyster Shell		75
2006	Henderson Point Reef	Oyster Shell	5,022	50
	Telegraph Reef	Limestone	9,352	125
2007	St. Louis Bay Reef	Oyster Shell	439	4
	Biloxi Bay Reef	Limestone	1,763	10
	Henderson Point Reef	Limestone		108

YEAR	Reef Name	Cultch Material	Cubic Yards	Acreage	
2007	Pass Marianne Reef	Limestone	37,000	375	
	Pass Christian Reef	Limestone	20,168	200	
2008	Pass Christian Reef	Oyster Shell	24,196	1,600	
	Pass Marianne Reef				
	Henderson Point Reef				
	Pass Christian Reef	Limestone	24,444		
	Pass Marianne Reef				
Henderson Point Reef					
2009	Pass Marianne Reef	Oyster Shell	6,042	292	
	Pass Christian Reef	Limestone	14,330		
	Pass Marianne Reef				
	St. Joe Reef	Oyster Shell	14,961		
	Pass Christian Reef				
	Pass Marianne Reef				
	Pass Christian Reef			Limestone	23,589
Pass Marianne Reef					
2011	Henderson Point Reef	Oyster Shell	17,606	175	
	Pass Marianne Reef	Oyster Shell	30,000		
	St. Joe Reef				
	Henderson Point Reef	Limestone	34,861	1,043	
	Telegraph Reef				
	Pass Marianne Reef				
Pass Christian Reef					
2012	Pass Christian Reef	Limestone	20,000		200
2013	Pass Christian Reef	Limestone	120,807		1,030
	St. Joe Reef				
	Pass Marianne Reef				
	Pass Christian Reef	Oyster Shell	20,000		
	Henderson Point Reef				
	St. Louis Bay Reef			Oyster Shell	1,068
Biloxi Bay Reef	2,467	25			

Oyster Reef Cultivation

Cultivation of oyster reefs is the process of using bagless dredges, or a similar apparatus to drag over the shells. The primary purpose of cultivation activity is to sufficiently clean fouling organisms and sediment from shells, exposing clean shell material, thereby making the reef more conducive to an oyster spat set. For this primary purpose, the timing of the cultivation activity is critical to a successful spat set. Too far in advance of a spat set, and the material may become re-fouled. Too late, and the spat set will be missed. Secondary beneficial purposes include breaking up clusters of oysters for a more even distribution of the reef, and to help reduce hooked mussel infestations.



A Bagless Dredge Used for Cultivation

Oyster Reef Relay

The primary purpose of the relay project is to move viable oysters from areas of higher abundance into areas with lower abundance, or into areas more favorable to their growth and survival. This project utilizes commercial fishermen to harvest the oysters from the original donor area, and having the contracted fishermen unload the oysters onto a contractor's barge for transport to and deployment on the receiving area. Biologists conduct biological sampling before relaying begins to measure and count the oysters in a specific area. A major consideration is whether the oysters are of sufficient size to survive any injury from dredging.



Oysters are taken from a productive reef and loaded onto a barge for relocation.

Culling Oyster Clusters

By Steve Breland

Culling oysters is the act of detaching undersized oysters or dead shell from a live oyster. The correct culling tool is necessary to properly and effectively cull oysters. A small hatchet or a piece of flat bar works best for culling. Clustered oysters can be separated one at a time. All small oysters or fouling should be removed as well as all dead shell and spat. Spat is a live oyster less than one inch in length. Mussels are more difficult for harvesters due to the extended time required to properly cull. A hatchet works best to remove more than one mussel at a time from the oyster. Removing all of the fouling on the oyster improves product quality and oyster production and saves time that could be used in re-culling.



Steve Breland, MDMR Marine Fisheries Technician, culling oyster clusters harvested from an oyster reef.



The American Oyster, *Crassostrea virginica*, harvested from the Pass Christian Oyster Reef

The MDMR Oyster Stewardship Program

By Dale Diaz

The MDMR Shellfish Bureau developed the Oyster Stewardship Program to better inform and promote the active involvement of oyster industry members including oyster tongers, dredgers, dealers, and processors. The goal is to encourage harvest practices and other techniques that can be used to assist resource managers in the judicious utilization of oyster resources of the state. Ideally, the Stewardship program will have the harvesters and industry representatives heavily involved throughout the development and implementation process by way of meetings, surveys and individual contacts. Innovative methods of improving the resource potential will be investigated and implemented where feasible.



Why is stewardship important?

Being a good steward of Mississippi's oyster reefs is doing your part to help conserve the resource for the future. By practicing best harvest methods, you are ensuring that there will be oysters for harvest the next season and for generations of fishermen to follow. By taking such actions as leaving small oysters on the reefs to grow for future harvest and keeping trash in a closed container on your boat, you are engaging in the wise stewardship of our oyster reefs.

Do your part...Harvest Smart!

The MDMR distributed a survey to licensed commercial oyster fishermen, asking them what harvest practices they use to conserve the resource for the future. The following is a list of the top 20 responses:

1. Cull properly and don't harvest small oysters (See page 38).
2. Pull as little chain as possible on the dredge.
3. Pull dredges slowly.
4. Don't use a basket dredge.
5. Never throw trash overboard.
6. Clean all shells from the deck before leaving the current reef.
7. Never dredge on the tonging grounds.
8. Never throw an oyster drill back into the water (See page 46).
9. Return shells to the reef from personal use oysters.
10. Roll dredges often and try to bring up something less than a full dredge.
11. Cull clusters of oysters to break them up and make singles.

12. Keep moving while oystering and harvest evenly, not just in one spot.
13. Obey weight and size limits of dredges.
14. Pull only one oyster dredge.
15. Keep rope and chain in good repair.
16. Only fill sacks to the legal measure.
17. Use your marine sanitation device. Use pump-out stations to dispose of sewage.
18. Voluntarily use a light oyster dredge
19. Make sure dredge teeth are at least three inches long.
20. Never harvest over the limit.

Marine Sanitation Disposal Give-Away – Spring of 2009

The MDMR Shellfish Bureau donated approximately 200 coupons for free marine sanitation devices (MSD) or portable flushing toilets to licensed Mississippi oyster harvesters during the spring of 2009. The intention of the giveaway was to encourage necessary equipment aboard vessels and promote sanitary conditions of the oyster reefs, in an effort to avoid possible Norovirus outbreaks. The fishermen were issued a coupon which they redeemed at a local vendor to receive their free MSD. The program ended December 4, 2009, and was part of the Oyster Stewardship Program. Funding was provided by NOAA Fisheries through the Emergency Disaster Recovery Program.

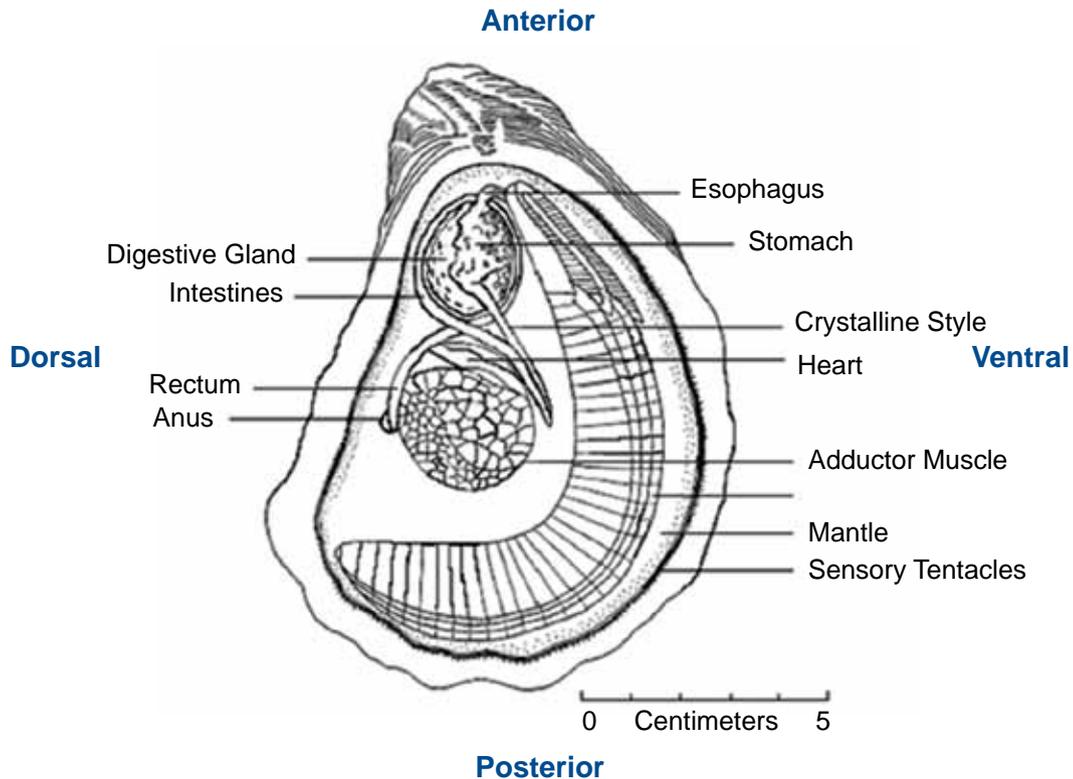
Newsletters

In July of 2009, the MDMR Shellfish Bureau developed the newsletter titled "Rebuilding Mississippi Oyster Reefs". There were 611 newsletters sent by mail to all licensed oyster harvesters, dealers and processors. This newsletter was the second in a series of newsletters developed by the Shellfish Bureau with the goal of informing the industry of important information that affects our oyster reefs. Articles included: the 2008-09 Recap of Oyster Season, Spring Shell Cultch Plant, and New Oyster Refrigeration Standards, among others.

In March of 2012, the Shellfish Bureau published another newsletter titled "Oyster News for the Mississippi Gulf Coast". There were 650 newsletters mailed to all licensed oyster harvesters, dealers and processors. Articles included: CMR Sets Limits for 2012-2013 Commercial Oyster License Sales, the New Oyster Check Station, Fall 2011 Oyster Cultch Planting, Fall Cultivation, St. Louis Bay Hydrographic Dye Study, Waveland Weather Station and a Proposal for Erosion Control on East Deer Island.

Funding for all newsletters was provided by NOAA Fisheries through the Emergency Disaster Recovery Program. To view a copy of these newsletters, visit the MDMR website at <http://www.dmr.ms.gov/news-a-events/newsletters>.

Anatomy of an Oyster



General anatomy of an oyster viewed from the right side with the right valve removed (from Galtsoff 1964).

How long can an oyster live?

An oyster can live 20-30 years, depending on the species. Some may live longer, based on the body of water and the algae it consumes.

How do oysters reproduce?

Under natural conditions, oysters spawn as water temperatures rise in the spring. The temperature at which spawning occurs varies from north to south. Southern oysters spawn at temperatures above 68°F (20°C) while northern oysters spawn at temperatures between 60° and 68°F (15.5° and 20°C). Spawning can occur throughout the warm months. Sperm and eggs are released at the same time and fertilization occurs in the water column.

Eggs are fertilized in the water, outside of the oyster's body, resulting in a low survival rate. When successful, a tiny larvae forms. Young oysters progress through several developmental stages. Fertilized eggs hatch into oyster larvae called trocophores. Only one percent of larvae reach the next stage of development. Those that survive become veligers and begin to swim and drift, feeding on tiny plants. Eventually, the veliger becomes a pedi-veliger, producing a foot-like formation and settling onto a hard, clean substrate. Once there, the juvenile oyster, called a 'spat', attaches itself to the substrate with a cement secretion from a gland in the foot. Here, it will spend the remainder of its life.

How does an oyster eat?

Oysters are filter feeders, meaning they pump water through their gills by opening and closing their shell. Each adult oyster filters and cleans approximately 50 gallons of water per day ingesting algae or phytoplankton in the process. Refer to pages 54 and 56 of this book for more information about phytoplankton. In addition to phytoplankton, the oysters consume anything that is in the water including zooplankton, larvae and detritus. The flavor of an oyster usually is influenced by the algae oysters filter, the depth in which it is growing, as well as the amount of salt in the water it filters.

Are oysters male or female?

Oysters are protandric, meaning they are all born male. A portion of the population converts to female after birth so the species can reproduce. But if an oyster colony (called a 'bed') ends up lacking males, some females will convert back to being male to balance out the sexes.

It is impossible to differentiate male oysters from female oysters by examining their shells. The gonads (organs responsible for producing both eggs and sperm) surround the digestive organs and are made up of sex cells, branching tubules and connective tissue.

Do all oysters develop pearls?

Pearls do occur in Mississippi oysters, but are extremely rare, and are usually poor quality. A pearl begins as a grain of sand that becomes trapped inside the oyster and is covered in calcium as a defense mechanism of the oyster. In order to protect itself from irritation, the oyster will quickly begin covering the uninvited visitor with layers of nacre — the mineral/organic matrix substance that fashions the mollusk's shells. Layer upon layer of nacre, also known as mother-of-pearl, coat the grain of sand until the iridescent gem is formed.

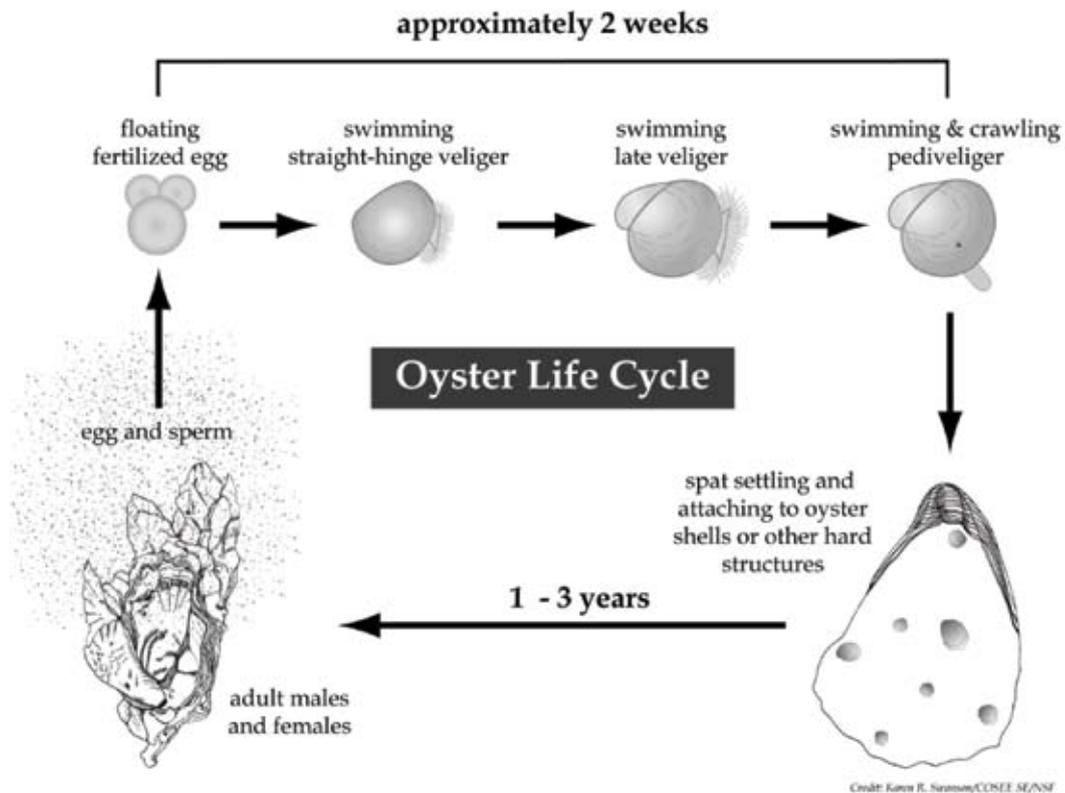
Cultured pearls are made in the same way. The only difference is that instead of accidental circumstances, a "pearl farmer" embeds a grain of sand into the mollusk. The pearl known to the jewelry industry is cultivated mostly in the South China Sea. The pearl oyster is called a Rock Oyster, *Crassostrea malagrina*, and is only farmed for pearl-culturing purposes. A quarter-inch pearl requires almost 10 years to grow in nature, but in a controlled environment, it can be accomplished in a third of the time.

Excerpts taken from "An Oyster Manifesto" by Mark Mavranonis; "Guide to Oysters From European Flats to Pacifics" By Molly Watson; Fisheries and Oceans Canada, Underwater World, The American Oyster; Live Science, "How Do Oysters Make Pearls?" by Michelle Bryner, Life's Little Mysteries Contributor

Oyster Life Cycle

<http://score.dnr.sc.gov>

Adult oysters begin reproduction when water temperatures become greater than 68°F (~20°C). Oysters are broadcast spawners, meaning they release eggs and sperm into the water column. A fertilized egg develops into a planktonic (free-swimming) trochophore larva in about six hours. A fully shelled veliger larva is formed within twelve to twenty four hours. The larva remains planktonic for about three weeks. Towards the end of this period it develops a foot (hence, pediveliger) and settles to the bottom of the water column where it seeks a hard substrate. When a suitable surface (ideally adult oyster shell) is located, the larva cements itself and metamorphoses to the adult form. This newly attached oyster is known as a "spat."

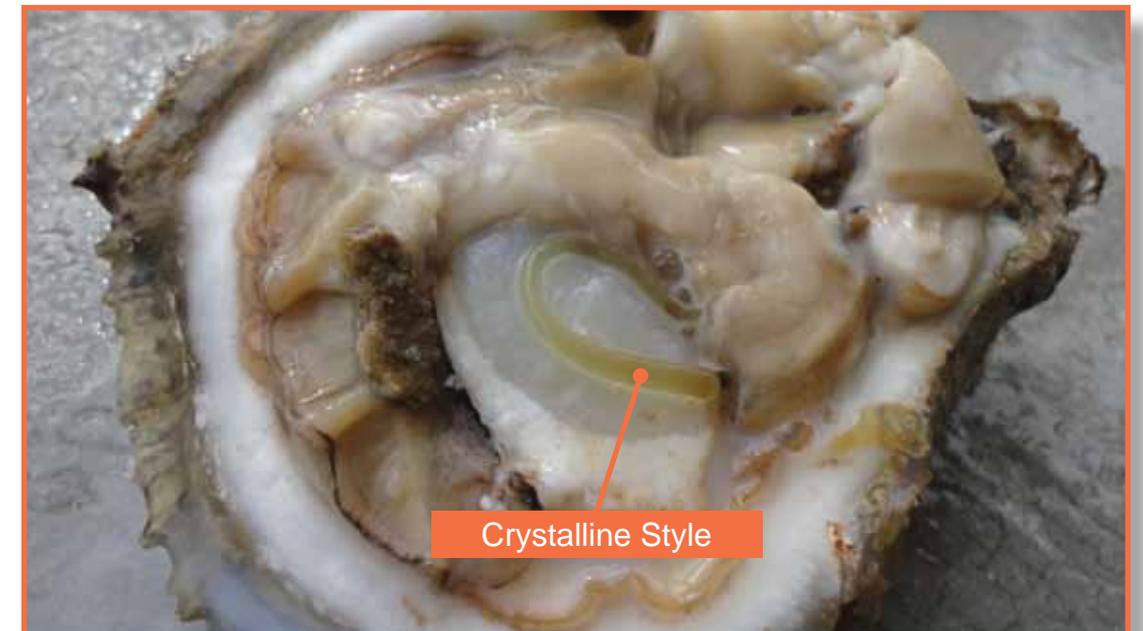


Information and illustration courtesy of South Carolina Department of Natural Resources. More information can be found at the following website: <http://score.dnr.sc.gov>.

Crystalline Style

By Bradley Randall

The crystalline style or style sac is a long gelatinous, jelly-like protein rod found in oysters and other gastropods. The main function of the crystalline style is the digestion of food particles. The top of the crystalline style has a bulging head protruding inside the stomach wall and resembles a translucent worm. Due to the remarkable resemblance of a worm, it is often mistaken as a parasite by people shucking fresh oysters. Its color ranges from a deep yellow to brown depending on the food being consumed. The crystalline style rod rotates clockwise against the gastric shield to grind algae or phytoplankton and releases enzymes to help aid and digest them as food. The presence of the crystalline style indicates that the oyster is healthy and feeding. When the oyster is taken out of the water, the crystalline style is reabsorbed and disappears in two to three hours.



The crystalline style functions to digest food particles. It is often mistaken for a parasite since it resembles a worm.

The Southern Oyster Drill

By Kristina Broussard

The Southern oyster drill, *Stramonita haemastoma*, can be found throughout the Gulf of Mexico. Oyster drills are one of the most devastating predators to oysters. The drill's rate of feeding usually increases during the warmer months. They do not like colder water and will stop feeding at about 54°F (12°C). Drills prefer salty water above 15 parts per thousand (ppt), but can tolerate fresher water as low as 8 ppt.



Adult Oyster Drill in It's Shell

DID YOU KNOW?
Hermit crabs often use discarded oyster drill shells as their homes. The hermit crab does not make its own shell.



Hermit Crabs in Drill Shells

The oyster drill uses a radula, or tongue-like projection with teeth, to open the oyster and then digest the meat. They can consume one large oyster every few days. Drills are devastating to oyster reefs because of their large population. They lay their eggs in creamy yellow casings. Once the eggs hatch or the casings have dried out, the casings turn purple. These egg casings can each contain up to 900 embryo. These animals can also overwhelm an oyster reef by eating young oysters called spat. One drill can consume over 100 spat per day.

Information derived from "Marine Maladies? Worms, Germs, and Other Symbionts From the Northern Gulf of Mexico" by Robin M. Overstreet



Oyster Drill Egg Casings attached to a hatchet



Oyster Drill Egg Casings



Oyster Drill Egg Casings

Hooked Mussels

By John Mitchell

The Hooked Mussel (*Ischadium recurvum*) is native to the northern Gulf of Mexico, and is found in coastal Mississippi waters as a member of oyster reef ecosystems. Hooked Mussels thrive in lower salinity estuarine habitat, where they grow on similar substrate to oysters. Hooked Mussels attach themselves to a suitable surface with byssal threads. Hooked Mussels can be a major problem to oyster reefs because live oysters are a preferred substrate. However, a Hooked Mussel is not a parasite. Instead, it is a symbiont. Symbionts are different organisms that live together. This relationship can be helpful, harmful, or have no effect on the organisms. As it turns out, hooked mussels do not directly harm the oysters they are living on. However, thick aggregations of mussels can have some negative results. Because hooked mussels are competitors of oysters, mussels and oysters compete for food and substrate. Also, clusters of hooked mussels can be a nuisance to oyster harvesters. Thick clusters of mussels can decrease harvesting efficiency, leading to increased harvest times and culling.



Predators of Hooked Mussels

Crabs are a natural predator of Hooked Mussels. Of all the crab species of the Mississippi Sound, the Blue Crab (*Callinectes sapidus*) has been shown to be the most prominent predator of Hooked Mussels. Studies have also shown that Blue Crabs can help control Hooked Mussel populations.

Another prominent predator of Hooked Mussels is the Black Drum (*Pogonias cromis*). Black Drum have strong jaws suitable for crushing shells of mussels, oysters, and crustaceans.

What can we do?

The MDMR uses bagless oyster dredges to cultivate oyster beds. By dragging the bagless dredges over the oyster reefs, mussel clusters are broken apart allowing crabs access to the mussels.



Hooked mussels attach themselves to a suitable surface with byssal threads.



Bagless Oyster Dredge Used for Oyster Cultivation

Oysters Parasitic Relationships

By Jill Zednick

Ever been bitten by a tick? How about attacked by mosquitoes while trying to flounder? You might not know it, but there is a parasitic relationship going on between you and all the creepy crawlers that like to suck your blood. A parasitic relationship occurs when two different organisms live in close contact with each other. One benefits from the contact while the other is harmed. In most cases, the organism being harmed is not killed. It is far more valuable to the parasite when it is alive. Parasites help only themselves.

There have been a variety of parasitic relationships identified which involve the American Oysters (*Crassostrea virginica*) along the northern Gulf Coast. This is especially true in the high salinity reefs, such as those off Pass Christian. One example of a parasitic marine organism that competes with the oyster for food is the Oyster Crab (*Zaops ostreus*). This small crab, less than one-millimeter wide, enters an oyster through its mantle, and then resides directly on the gill surface, irritating and eroding the oyster's gills. The oyster crab steals nutrients from an oyster by trapping food in its walking legs with mucus collected from the oyster's tissues. It will also use its pincers to pick food directly from the oyster's gills.

Another parasitic culprit to Mississippi's oysters is the Boring Clam (*Diplothyra smithii*). The clam burrows into the oyster's shell and excavates space inside the oyster to live. This parasitic relationship can be identified by its characteristic small hole in the oyster's shell. The clam's foot secretes a softening substance and the clam then uses the sharp serrated edge of its shell to scrape a tunnel into the oyster. Once inside the oyster, the clam extends a siphon through the tunnel gaining access to food and oxygen.

The Burrowing Sponge (*Cliona sp.*) is a third example of a parasitic relationship involving the American oyster in the northern gulf. The sponge weakens the shells of both living and dead oysters by forming extensive networks of burrows. The sponge also competes with oyster spat for space by preventing spat from settling and by deteriorating the oyster shell material.

When an oyster detects a burrow into the inner part of its shell, it will produce layers of hard proteinaceous materials to help reinforce its shell. Nevertheless, burrows ultimately weaken the shells of oysters increasing their vulnerability to predation and disease. Oysters involved in a burrowing parasitic relationship are usually less desirable to the seafood industry because their shells tend to crumble. Even though the organisms mentioned above do not directly prey on oysters, their parasitic behaviors can undermine the ability of juvenile or stressed oysters to resist disease, which may eventually cause death.

Overstreet, R.M. 1978. "Marine maladies? Worms, germs and other symbionts from the northern Gulf of Mexico." Miss.-Ala. Publ. Ocean Springs, Miss. MASGP- 78-021. 140pp.



Damage to an Oyster Shell Caused by the Burrowing Sponge, *Cliona spp.*



Damage to an Oyster Shell Caused by the Boring Clam, *Diplothyra smithii*

Help Stop Aquatic Hitchhikers

<http://www.dmr.ms.gov/environment/invasive-species>

Enjoying the great outdoors is important to many of us. Boating, fishing, hunting, and wildlife watching are traditions that we want to preserve for our children and their children. Today, these traditions are at risk. Aquatic invaders threaten our valuable waters and recreation. Non-native, or exotic, plants and animals do not naturally occur in our waters and are called invasive species because they cause ecological or economic harm. The good news is that the majority of waters are not yet infested with invasive species.

You can help protect our valuable waters. Aquatic hitchhikers can spread in many ways, such as on aquatic plants, on recreational equipment, and in water. Fortunately, there are a few simple actions you can take to prevent them from spreading. The main way invasive species get into lakes, rivers, and wetlands is by “hitching” rides with anglers, boaters, and other outdoor recreationists. If you leave a body of water without taking precautions, you may be transporting these harmful species from one lake, river, or wetland to another.

The following are a few precautions you can take to help stop aquatic hitchhikers.

INSPECT your boat, trailer, and equipment and **REMOVE** visible aquatic plants, animals, and mud before leaving the water access. It is important to carefully remove all plant fragments before you leave the access area to ensure you are not transporting an invasive plant species. This will also reduce the threat of moving mussels that hitchhike by attaching to aquatic plants.

DRAIN water from your boat, motor, bilge, live wells, and bait containers before leaving the water access. Many types of invasive species are very small and easily overlooked. A good example is mussel larvae which are invisible to the naked eye. Seeds or small fragments of invasive plants, eggs of fish and small aquatic animals, and fish diseases can be carried in water. Draining water before you leave the access area will effectively reduce the chance that any remaining plants and animals survive.

REPORT new sightings of invasive species. If you suspect a new infestation of an invasive plant or animal, save a specimen and report it to a local natural resource or Sea Grant office. Many agencies have “ID” cards, websites, and volunteer monitoring networks to help you identify and report invasive species.

DISPOSE of unwanted bait and other animals or aquatic plants in the trash. Releasing live animals and plants along the coastal shore, in a river, or a lake often causes invasive species to become established. Identifying fish when they are small is difficult and it is hard to be absolutely sure there are no invasive fish in your bait bucket. Even earthworms that you collect in northern states or buy for bait are not native and

should not be dumped on the ground. Likewise, other aquatic plants or animals that you collect, or buy in a pet store, should never be released into the wild.

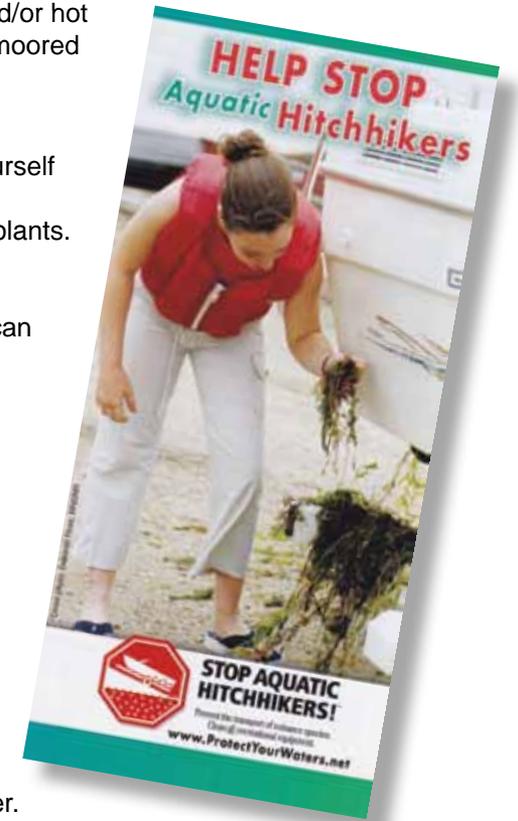
SPRAY, RINSE, and DRY boats and recreational equipment to remove or kill species that were not visible when leaving a water body.

- Spray or rinse your boat with high pressure, and/or hot tap water (above 104°F or 40°C), especially if moored for more than a day.
- Leave boat on land to dry for at least five days.

CONSULT your natural resource agency. Do-it-yourself control treatments could be illegal and can make matters worse by harming native fish, wildlife, and plants. It is best to contact your natural resource agency before you try to control an invasive species or add new plants along your shoreline. These agencies can provide recommendations about what permits are required.

ADDITIONAL STEPS are recommended for the following activities.

- **Shore and fly-fishing:** Remove aquatic plants, animals, and mud from waders and hip boots. Drain water from bait containers.
- **Personal watercraft:** Avoid running engine through aquatic plants. Run engine for 5-10 seconds on the trailer to blow out excess water and vegetation from the internal drive, and then turn off the engine. Remove aquatic plants and animals from water intake grate, steering nozzle, watercraft hull, and trailer.
- **Sailing:** Remove aquatic plants and animals from hull, centerboard or bilge board wells, rudderpost area, and trailer.
- **Scuba diving:** Remove aquatic plants, animals, and mud from equipment. Drain water from buoyancy compensator, regulator, tank boot, and other containers. Rinse suit and inside of buoyancy compensator with hot water.
- **Waterfowl hunting:** Remove aquatic plants, animals, and mud from boat, motor, trailer, waders or hip boots, decoy lines, and anchors (elliptical and bulb-shaped anchors can help reduce snagging aquatic plants).



For more information on Invasive species, please contact the MDMR Invasive Species Department by phone or email. Any sighting of invasive, non-native, species should be reported to: report.invasive@dmr.ms.gov. This information was derived from the brochure “Help Stop Aquatic Hitchhikers” which can be found on the MDMR website at: <http://www.dmr.ms.gov/environment/invasive-species>.

Harmful Algal Blooms

By Kristina Broussard

Marine Phytoplankton

The MDMR Shellfish Bureau conducts phytoplankton sampling twice per month to monitor local oyster reefs for harmful algal blooms. Biologists use a 20-micron mesh plankton net to conduct a three-minute plankton tow. Sampling occurs at two locations.

The first sample location is the northern most point of the Pass Christian oyster reef and the second sample is located at the southern most perimeter of Area II "I". When an influx of freshwater is released into the western Mississippi sound, a third sampling location is added. This additional site is located within the St. Joe oyster reef southwest of Bayou Caddy.

Environmental water quality data is recorded during each sample trip. This includes: air and water temperature, salinity, dissolved oxygen, pH, and turbidity. Sample analysis is conducted in house with a phase contrast microscope. Qualitative analysis is recorded. In the event of a bloom, quantitative analysis will be conducted to determine possible toxicity levels.

MDMR personnel conduct field observations for water discoloration during routine water sampling. If an area is suspected of a toxic bloom, samples are taken for phytoplankton identification. MDMR personnel investigate possible toxic blooms reported by credible sources primarily: adjacent state agencies, federal agencies, local health agencies, and academic institutions. In the event of a biotoxin producing bloom, not caused by the classic "red tide" organism, *Karenia brevis*, technical assistance from FDA and others will be sought in determining oyster reef closing criteria.



Discoloration of water due to a non-toxic phytoplankton bloom.



A Scientist collects a phytoplankton sample using a plankton net.



Aerial photos of a phytoplankton bloom, *Ceratium furca*. Photos taken by Darrin Stewart, MDMR Projects Officer.

What are Phytoplankton?

By Rebecca Lindsey and Michon Scott, NOAA

Derived from the Greek words *phyto* (plant) and *plankton* (made to wander or drift), phytoplankton are microscopic organisms that live in watery environments, both salty and fresh.

Some phytoplankton are bacteria, some are protists, and most are single-celled plants. Among the common kinds are [cyanobacteria](#), silica-encased [diatoms](#), [dinoflagellates](#), [green algae](#), and chalk-coated [coccolithophores](#).

Like land plants, phytoplankton have chlorophyll to capture sunlight. They use photosynthesis to convert to chemical energy. They consume carbon dioxide, and release oxygen. All phytoplankton photosynthesize, but some get additional energy by consuming other organisms.

Phytoplankton growth depends on the availability of carbon dioxide, sunlight, and nutrients. Phytoplankton, like land plants, require nutrients such as nitrate, phosphate, silicate, and calcium at various levels depending on the species. Some phytoplankton can fix nitrogen and can grow in areas where nitrate concentrations are low. They also require trace amounts of iron which limits phytoplankton growth in large areas of the ocean due to iron concentrations being very low. Other factors that influence phytoplankton growth rates include: water temperature, salinity, water depth, wind, and predators.

When conditions are right, phytoplankton populations can grow explosively, a phenomenon known as an algal bloom. Blooms in the ocean may cover hundreds of square kilometers and are easily visible in satellite images. A bloom may last several weeks, but the life span of any individual phytoplankton is rarely more than a few days.

The Food Web

Phytoplankton are the foundation of the aquatic food web. These primary producers feed everything from microscopic, animal-like zooplankton to multi-ton whales. Small fish and invertebrates also graze on the plant-like organisms and, in turn, those smaller animals are eaten by larger ones.

Phytoplankton can also be the harbingers of death or disease. Certain species of phytoplankton produce powerful biotoxins, making them responsible for “red tides,” or harmful algal blooms. These toxic blooms can kill marine life.

Phytoplankton cause mass mortality in other ways. In the aftermath of a massive bloom, dead phytoplankton sink to the ocean or lake floor. The bacteria that decompose the phytoplankton deplete the oxygen in the water, suffocating animal life; the result is a dead zone.



Microscopic view of marine phytoplankton collected from the Mississippi Sound. Photos taken by Kristina Broussard, MDMR Scientist.

Vibrio Bacteria

By Ruth Posadas

There are two main types of harmful bacteria associated with eating raw oysters: *Vibrio vulnificus* (Vv.) and *Vibrio parahaemolyticus* (Vp.). These bacteria are found naturally in waters of the Gulf of Mexico and are present in higher concentrations during the summer months. These two bacteria are part of the diets of oysters, clams and all Molluscan filter-feeders. Eating raw or undercooked oysters highly increases the risk of developing sickness from *Vibrio* bacteria. If a person is an at-risk consumer, meaning that they have a compromised immune system, he/she can become seriously ill from consuming *Vibrio* bacteria. A more serious consequence is death. Most healthy individuals are not at risk for Vv. infection.



Microscopic view of the bacterium *Vibrio vulnificus*

Vibrio vulnificus is a gram-negative bacterium and is considered the most dangerous of the *Vibrio* Genus. Present in brackish and salt water, this bacterium is not the result of pollution of marine waters. Vv. is found in higher concentrations from April through October when coastal waters are at their warmest.

When *Vibrio vulnificus* bacteria are digested, the primary illness is septicemia, i.e. an infected bloodstream. Vv. multiplies rapidly in the digestive tract. Fever and chills occur and usually are accompanied by nausea, vomiting and diarrhea. A sharp drop in blood pressure also occurs. Sometimes the patient goes into shock and then death occurs. In addition, high-risk individuals may become infected when cuts, burns or sores come in contact with seawater containing Vv. The majority of patients also develop painful skin lesions. The skin initially appears red, and then blisters form and quickly erode into necrotic ulcers.



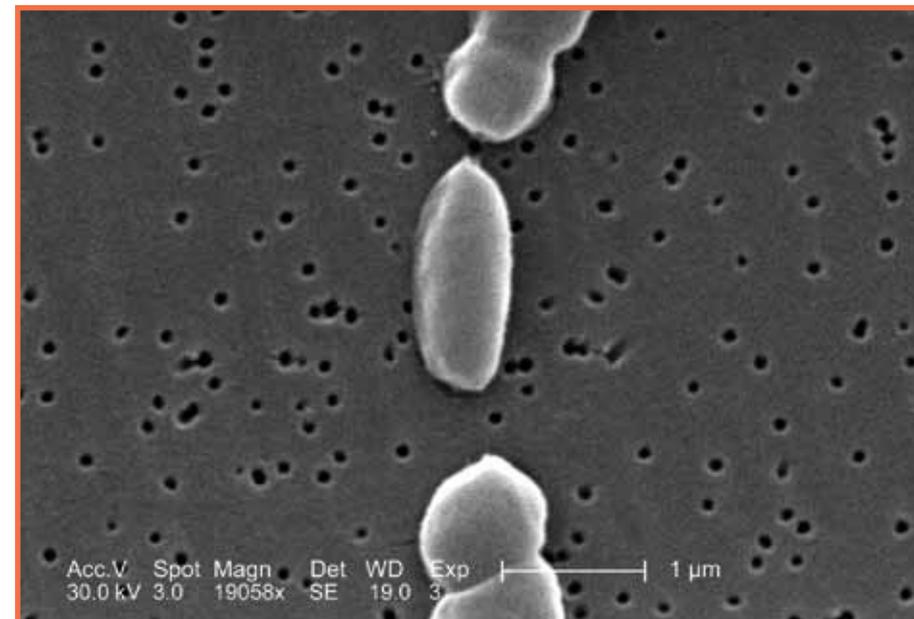
Vibrio parahaemolyticus is a bacterium in the same family as those that cause cholera. When consumed, it can cause gastrointestinal illness in humans and its symptoms include: diarrhea, abdominal cramping, nausea, vomiting, fever and chills. Usually these symptoms occur within 24-hours of ingestion and last three days. Severe disease is rare from Vp. and occurs more commonly in persons with weakened immune systems. Vp. can also cause an infection of the skin when an open wound is exposed to warm seawater.

Microscopic view of the bacterium *Vibrio parahaemolyticus*

Which individuals are at higher risk for *Vibrio* infection?

High-risk individuals include those with liver disorders, including hepatitis, cirrhosis and liver cancer; hemochromatosis (excessive iron); diabetes mellitus; and those with immune-compromising conditions, such as HIV/AIDS, cancer, or undergoing treatments. People who take prescribed medication to decrease stomach acid levels or who have had gastric surgery are also at risk. Younger and older individuals, as well as pregnant women, are included among the immune-compromised.

If anyone exhibits these symptoms, seek medical attention immediately and inform the doctor that they have eaten raw or undercooked seafood. Most infections caused by Vv. and Vp. can be prevented by thoroughly cooking seafood, especially oysters. Wound infections can be prevented by avoiding exposure of open wounds to warm seawater. If consumers have a desire to consume raw or under-cooked oysters, they should consider post harvest processed (PHP) or treated oysters found in many coastal seafood markets. There are four types of commercially available PHP products: individually quick-frozen oysters (IQF), heat-cool pasteurized oysters (HCP), high hydrostatic pressurized oysters (HHP) and irradiated oysters.



Microscopic view of the bacterium *Vibrio parahaemolyticus*

Dermo

By Michael Brochard

Dermo is the common name for a parasitic disease that occurs in the American Oyster. It is caused by the protozoan *Perkinsus marinus* (syn. *Dermocystidium marinum*) and often leads to oyster mortality. It poses no known hazard to human health, but it does have the potential to devastate entire oyster reefs.

Without lab tests, it's difficult to tell if an oyster is infected. However, oyster tissue infected with Dermo often exhibits a yellowish appearance and a shrunken size.

After death, oysters will have a characteristic gaping shell. In the picture below, you will see an example of both a healthy oyster and an infected oyster.



Trophozoites of Perkinsus marinus, the microscopic protozoan responsible for Dermo infection in oysters.



Healthy oyster (left) vs. infected oyster (right.)



Dead oyster cluster, possibly from a Dermo infection, exhibiting gaping shells.

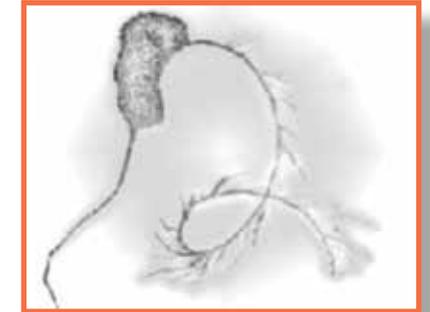
Most of the Dermo life cycle happens inside the oyster. The parasite divides, enlarges, and forms daughter cells. The infection is usually spread upon the death of an oyster or when the infection reaches high enough levels. Dermo cells occasionally form zoospores. This mobile version of the parasite has the ability to swim.

Dermo growth increases when both water salinity and water temperature are high. It is often present in low numbers throughout winter months, but increases rapidly when the temperature rises above 77°F (25°C). The growth of Dermo is suppressed in areas with salinities below eight to ten parts per thousand, and will proliferate if infected oysters from these areas are exposed to higher salinities.

What can we do?

There is little that we can do to prevent Dermo infection; however, oyster reef managers may recommend certain measures be taken to reduce the impact of the disease once infection has been identified. Transplanting infected oysters to lower salinity areas is one such management technique.

MDMR currently conducts quarterly assessments to check for the occurrence of Dermo.



Zoospore of Perkinsus marinus, with attached flagella giving it the ability to swim

Information taken from "Dermo Disease" by Inke Sunila, Connecticut Dept. of Agriculture; and "Marine Maladies? Worms, Germs, and Other Symbionts From the Northern Gulf of Mexico" by Robin M. Overstreet *Pictures courtesy: "Perkinsus spp. EURL for Molluscs Diseases", <http://www.eurl-mollusc.eu/Scientific-activities/Perkinsus-spp>

Norovirus

By Jessica Rankin

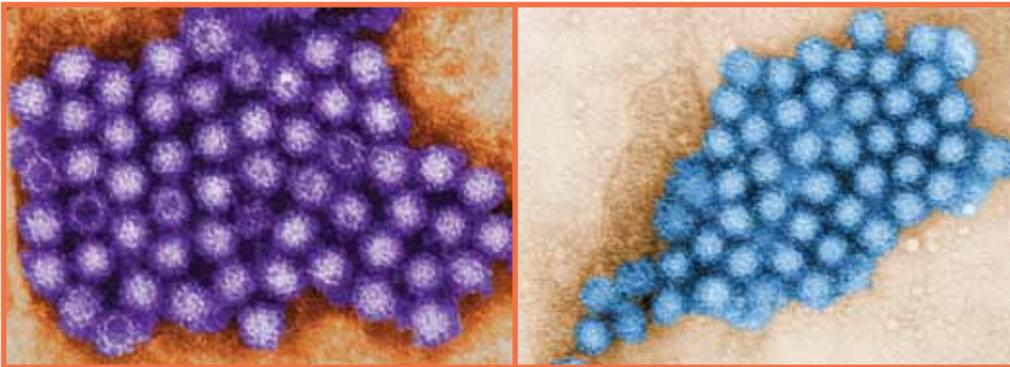
What is Norovirus?

Norovirus is a highly contagious virus that affects people of all ages. *Norovirus* is the most common cause of food borne disease outbreaks in the United States. Patrons can get *Norovirus* from an infected person, contaminated food or water, or by touching contaminated surfaces. The virus causes acute gastroenteritis, inflammation of the stomach and/or intestines. This leads to stomach pain, nausea, diarrhea and vomiting. Anyone can be infected with *Norovirus* and it is possible to have *Norovirus* illness many times. *Norovirus* illness may become serious, especially for young children and older adults.

Norovirus is the most common cause of acute gastroenteritis in the United States. Each year, it causes about 21 million illnesses and contributes to about 70,000 hospitalizations and 800 deaths, according to the Centers for Disease Control. The best way to help prevent *Norovirus* is to practice proper hand washing and general cleanliness.

How is Norovirus Spread?

- Person-to-Person – Direct contact with a sick person may lead to illness of *Norovirus*. (For example: when caring for someone with *Norovirus*, sharing foods, or sharing utensils).
- Food borne – ingesting contaminated foods (For example: an infected person gets stool or vomit on their hands and touches food being prepared for consumers).
- Waterborne – exposure to contaminated water.



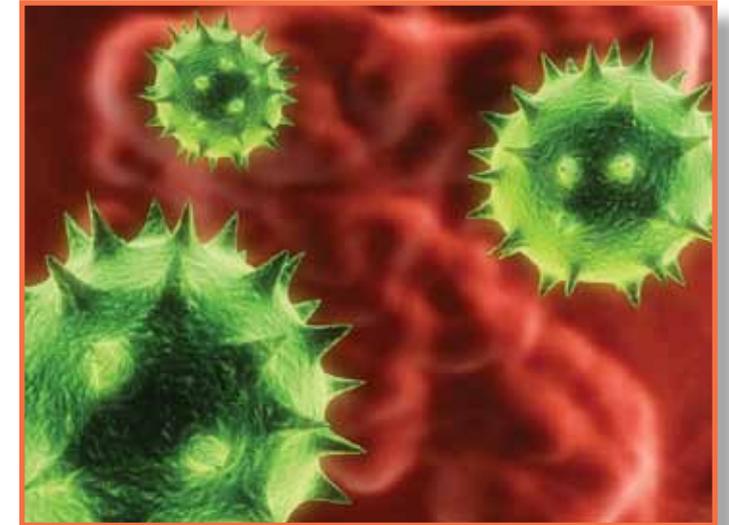
Microscopic view of the structure of norovirus. Photo courtesy of: CDC/Charles D. Humphrey

Symptoms Include

- Nausea
- Stomach Cramps
- Vomiting
- Diarrhea Without Blood
- Low-Grade Fever

Treatment

- The only treatment for *Norovirus* is to drink plenty of fluids to prevent dehydration.
- No vaccine exists for *Norovirus*.
- There is no specific drug to treat *Norovirus*.
- *Norovirus* cannot be treated with antibiotics due to its viral nature.



Microscopic view of *Norovirus*. Photo courtesy of: cruiselawnews.com

How can you avoid infection?

- Do not prepare/handle food while you are sick.
- Wash your hands thoroughly with soap and water.
- Clean and disinfect contaminated surfaces.
- Wash exposed laundry thoroughly.

How can you help protect our waters from contamination?

- Use a marine sanitation device.
- Use an approved pump-out station.
- Do NOT dispose of waste overboard.

Information derived from the Centers for Disease Control and Prevention. For more information on *Norovirus*, please visit their website at: <http://www.cdc.gov/norovirus>

Boating Safety in Mississippi Waters

By Lt. Patrick Levine, Boat and Water Safety Supervisor

The MDMR encourages everyone to keep safety in the forefront while boating on Mississippi's coastal waters. Don't let misfortune find you unprepared. Before venturing out, be sure to file a float plan with a responsible friend or relative. The float plan should include the place of departure, destination points and expected times of arrival, the time of expected return, and the names of all individuals on-board. Advise the friend or relative to contact proper authorities, i.e. MDMR's Marine Patrol Office or the United States Coast Guard (USCG), if you have not returned by an agreed upon time. It is of paramount importance that you do not deviate from the intended float plan. In the event of an emergency, valuable search and rescue time could be saved if a float plan has been properly filed and followed.



Before departure, a boat check should be performed to ensure the proper equipment is on board and functional. Remember, some equipment items, such as visual distress signals, first aid kits and fire extinguishers, have items with expiration dates where service or replacement is required.

Always be watchful for adverse weather conditions. A small National Oceanic and Atmospheric Administration (NOAA) weather radio is an excellent way to constantly receive updated weather broadcasts, and severe weather warnings. NOAA also provides National Weather Service, which may be accessed via the Internet at <http://www.nws.noaa.gov/>.

In addition, the USCG provides emergency alerts and marine warning broadcasts on Very High Frequency (VHF) channels 16 and 22 as conditions warrant. Remember to have adequate communications on board your boat at all times. A VHF radio is the preferred equipment for marine use. Cell phones, although popular for communicating on land, have a limited use on the water. A cell phone should not be depended upon as your only form of communication. Also, remember to have personal flotation devices (PFD) or lifejackets on the boat at all times.

Knowing the boat and water safety rules and regulations can save lives, and significantly reduces the possibility of accident or injury while on the water. For more information or to sign up for MDMR Boating Safety Classes, please call MDMR Bureau of Boat and Water Safety (228) 523-4134.

Why should I take a boating education course?

All persons born on or after June 30, 1980, must have passed a boating education course approved by the Mississippi Department of Wildlife, Fisheries and Parks (MDWFP) to legally operate a vessel. In addition, to operate a motorboat or a personal watercraft, a person under 12 years of age must also be accompanied onboard by someone who is at least 21 years old. The boating education certificate must be carried onboard the vessel whenever it is operated by someone required to have a certificate. Again, the MDMR Marine Patrol offers free approved boating education classes to the public along the Mississippi Gulf Coast.

How do I register my boat?

If your boat is motorized or is a sailboat, you must have a Mississippi Certificate Number and validation decals to legally operate your vessel on public waters in Mississippi. The validation decal must be affixed on both sides of the vessel, preceding the prefix letters of the registration number and within six inches of the registration number. If your vessel requires registration, it is illegal to operate or allow others to operate your vessel unless it is registered and numbered as described above.

If a registered vessel is sold or otherwise transferred to another person, the "buyer" must apply for the Certificate of Number to be transferred to his or her name within ten days of the date of purchase. Owners of new or used boats may obtain a registration form at any local county tax collector's office, most places where boats are sold or serviced, the MDMR office, the MDWFP district and Jackson offices, or online at www.mdwfp.com.



Personal Watercraft (PWC) and Towing Requirements

Each person riding on or towed behind a personal watercraft (PWC) must wear a Type I, II or III USCG approved PFD in Mississippi waters south of Interstate 10. The PWC must be equipped with a self-circling device or lanyard-type ignition safety switch with the lanyard attached to the operator's person, clothing or PFD. The PWC may not be operated at an excessive speed within 100 feet of another occupied vessel except in a crossing situation or overtaking in accordance with the navigation rules. The PWC may not jump, or attempt to jump, the wake of another vessel within 100 feet of that vessel and may not follow within 100 feet of a water skier. Every vessel towing a person(s) on water skis, a surfboard or a similar device must have a person older than ten years of age, in addition to the operator, observing the

towed person(s) at all times. If towing a person behind a PWC, the PWC must be rated for at least three people: the driver, the observer and the person being towed.

What equipment is legally required on my boat?

Personal Flotation Devices (PFDs)

All vessels must carry one wearable USCG-approved PFD for each person onboard. In addition to the above, vessels 16 feet in length or longer must have one Type IV, USCG-approved PFD onboard and readily accessible. Anyone who has not reached their 13th birthday must wear a Type I, II or III USCG-approved PFD whenever underway in a vessel under 26 feet in length. Each person riding on or being towed behind a personal watercraft must wear a Type I, II or III USCG-approved PFD.

In addition, all PFDs must be:

- In good and serviceable condition.
- Readily accessible, which means you are able to put the PFD on quickly in an emergency.
- The proper size for the intended wearer. Sizing for PFDs is based on body weight and chest size.

Navigation Lights

Boat lights help you and other boaters determine which vessel is the give-way vessel when encountering each other at night. These lights should be displayed from sunset to sunrise and during periods of restricted visibility such as fog.



Fire Extinguisher

Approved types of fire extinguishers are labeled "Marine Type USCG Approved," followed by the size and type symbols and the approved number. All vessels are required to have a Type B fire extinguisher onboard if one or more of the following conditions exist:

- Closed compartments under seats where portable fuel tanks are stored.
- Closed storage compartments in which flammable or combustible materials are stored.
- Closed living spaces.
- Permanently installed fuel tanks.



Sound Producing Devices

Any vessel less than 39.4 feet (12 meters) in length is required to make an efficient sound signal (horn, whistle or bell) to signal your position in periods of reduced visibility. Vessel operators are required to carry some type of horn or whistle capable of a four-second blast audible for one half mile for all boats. Athletic whistles are not acceptable on boats over 39.4 feet.

Visual Distress Signals

All boats less than 16 feet operating between sunset and sunrise must be equipped with visual distress signals, such as flares. Boats larger than 16 feet must be equipped with visual distress signals at all times.

All boats used on federally controlled waters must be equipped with USCG-approved (day and night) visual distress signals. All boats on federal waters are required to carry night signals when operating between sunset and sunrise. In addition, the following boats must also carry day signals:

- Recreational boats 16 feet or longer.
- Non-motorized, open sailboats 26 feet or longer.



Weather Emergencies on the Water

Weather can change very rapidly and create unexpected situations for boat operators. Even meteorologists have trouble predicting rapid weather changes. You should always monitor weather developments. Preferably, tune a Very High Frequency (VHF) radio to the frequencies listed below for NOAA weather reports.

What to do if caught in severe weather.

Prepare the boat to handle severe weather.

- Slow down, but keep enough power to maintain headway and steering.
- Close all hatches, windows, and doors to reduce the chance of swamping.
- Stow any unnecessary gear.
- Turn on your boat's navigation lights. If there is fog, sound your fog horn.
- Keep bilges free of water. Be prepared to remove water by bailing.
- If there is lightning, disconnect all electrical equipment. Stay as clear of metal objects as possible.



Prepare your passengers for severe weather.

- Have everyone put on a United States Coast Guard (USCG)-approved life jacket or personal flotation device (PFD). If passengers are already wearing their PFDs, make sure they are secured properly.
- Have your passengers sit on the vessel floor close to the centerline for their safety and to make the boat more stable.

Decide whether to go to shore or ride out the storm.

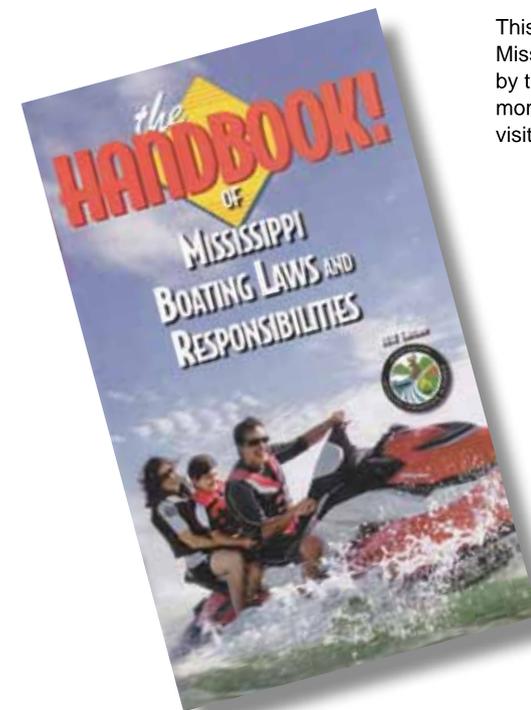
- If possible, head for the nearest shore that is safe to approach. If already caught in a storm, it may be best to ride it out in open water rather than try to approach the shore in heavy wind and waves.
- Head the bow into the waves at a 45 degree angle. PWCs should head directly into the waves.
- If the engine stops, drop a "sea anchor" on a line off the bow to keep the bow headed into the wind and reduce drifting while you ride out the storm. In an emergency, a bucket will work as a sea anchor.
- If the sea anchor is not sufficient, anchor using your conventional anchor to prevent your boat from drifting into dangerous areas.

VHF Frequencies Broadcasting NOAA Weather Reports

162.400 MHz	162.450 MHz	162.500 MHz	162.550 MHz
162.425 MHz	162.475 MHz	162.525 MHz	

The following are the most commonly used VHF channels on US waters.

- **Channel 6:** Internship safety communications.
- **Channel 9:** Communications between vessels (commercial and recreational), and ship to coast (calling channel in designated USCG).
- **Channel 13:** Navigational use by commercial, military, and recreational vessels at bridges, locks, and harbors.
- **Channel 16:** Distress and safety calls to USCG and others, and to initiate calls to other vessels; often called the "hailing" channel. Some regions use other channels as the hailing channel. When hailing, contact the other vessel, quickly agree to another channel, and then switch to that channel to continue the conversation.
- **Channel 22:** Communications between the USCG and the maritime public, both recreational and commercial. Severe weather warnings, hazards to navigation, and other safety warnings are broadcast on this channel.
- **Channels 24-28:** Public telephone calls (to marine operator).
- **Channels 68, 69, and 71:** Recreational vessel radio channels and ship to coast.
- **Channel 70:** Digital selective calling "alert channel".



This information was taken from "The Handbook of Mississippi Boating Laws and Responsibilities" developed by the Department of Wildlife, Fisheries & Parks. For more information and to request a copy of the handbook, visit their website at www.mdwfp.com or call (601) 432-2182.

Beaufort Wind Scale

The Beaufort scale is a measure that relates wind speed to observed conditions at sea or on land. Its full name is the Beaufort Wind Force Scale, although it is a measure of wind speed and not of “force” in the scientific sense of the word. The scale was developed in 1805 by Francis Beaufort (later Rear Admiral Sir Francis Beaufort), an Irish Royal Navy officer, while serving on HMS Woolwich. He developed the scale to help sailors estimate the winds via visual observations. The scale starts with 0 and goes to a force of 12.

In the United States, winds of force 6 or 7 result in the issuance of a small craft advisory, with force 8 or 9 winds bringing about a gale warning. Force 10 or 11 winds lead to a storm warning or a tropical storm warning and force 12 winds result in a hurricane force wind warning or a hurricane warning if related to a tropical cyclone. A set of red warning flags for day time and red warning lights for night time are displayed at shore establishments which coincide with the various levels of warning. Note that wave heights in the scale are for conditions in the open ocean, not along the shore.

Hurricane force winds are sometimes described as Beaufort scale 12 through 16, very roughly related to the respective category speeds of the Saffir–Simpson Hurricane Scale, by which actual hurricanes are measured, where Category 1 is equivalent to Beaufort 12. However, the extended Beaufort numbers above 13 do not match the Saffir–Simpson Scale.

Huler, Scott (2004). *Defining the Wind: The Beaufort Scale, and How a 19th-Century Admiral Turned Science into Poetry*. Crown. ISBN 1-4000-4884-2.

Force	Wind Speed (Knots)	Classification	Appearance of Wind Effects On the Water	Appearance of Wind Effects On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended

Force	Wind Speed (Knots)	Classification	Appearance of Wind Effects On the Water	Appearance of Wind Effects On Land
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft, whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-19 ft, white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (18-25 ft) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	High waves (23-32 ft), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (29-41 ft) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft) waves, foam patches cover sea, visibility more reduced	
12	64+	Hurricane	Air filled with foam, waves over 45 ft, sea completely white with driving spray, visibility greatly reduced	

This chart can be found at the following NOAA website: <http://www.spc.noaa.gov/faq/tornado/beaufort.html>

Saffir-Simpson Hurricane Wind Scale

The Saffir-Simpson Hurricane Wind Scale (SSHWS) is a 1 to 5 rating based on a hurricane's sustained wind speed. This scale estimates potential property damage. Hurricanes reaching Category 3 and higher are considered major hurricanes because of their potential for significant loss of life and damage. Category 1 and 2 storms are still dangerous, however, and require preventative measures. In the western North Pacific, the term "super typhoon" is used for tropical cyclones with sustained winds exceeding 150 mph.

The SSHWS underwent a minor modification in 2012 in order to resolve awkwardness associated with conversions among the various units used for wind speed in advisory products. The change broadens the Category 4 wind speed range by one mile per hour (mph) at each end of the range, yielding a new range of 130-156 mph. This change does not alter the category assignments of any storms in the historical record, nor will it change the category assignments for future storms.

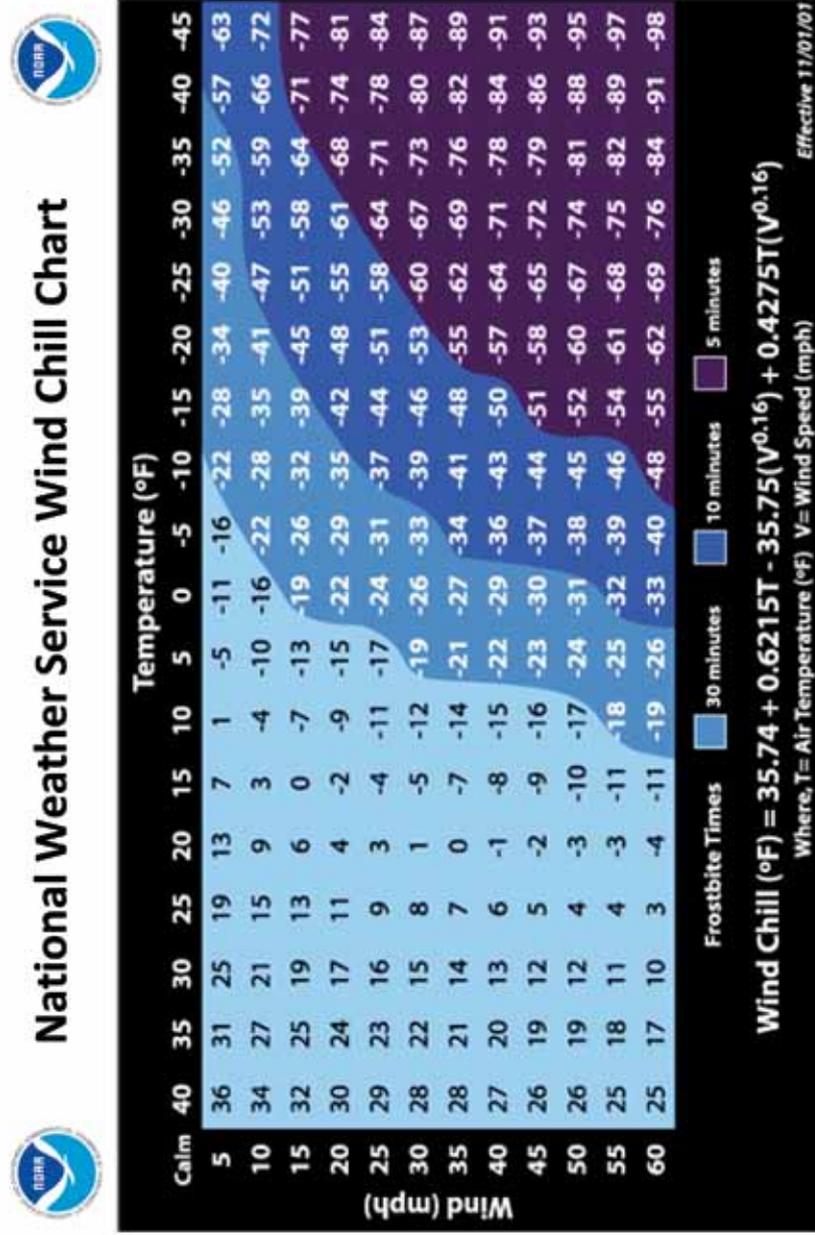
This information was derived from the NOAA Hurricane Center. For more information or to view a conceptual animation illustrating the wind damage associated with increasing hurricane intensity, visit their website at <http://www.nhc.noaa.gov/aboutsshws.php>.



Saffir-Simpson Hurricane Wind Scale – Hurricane Katrina

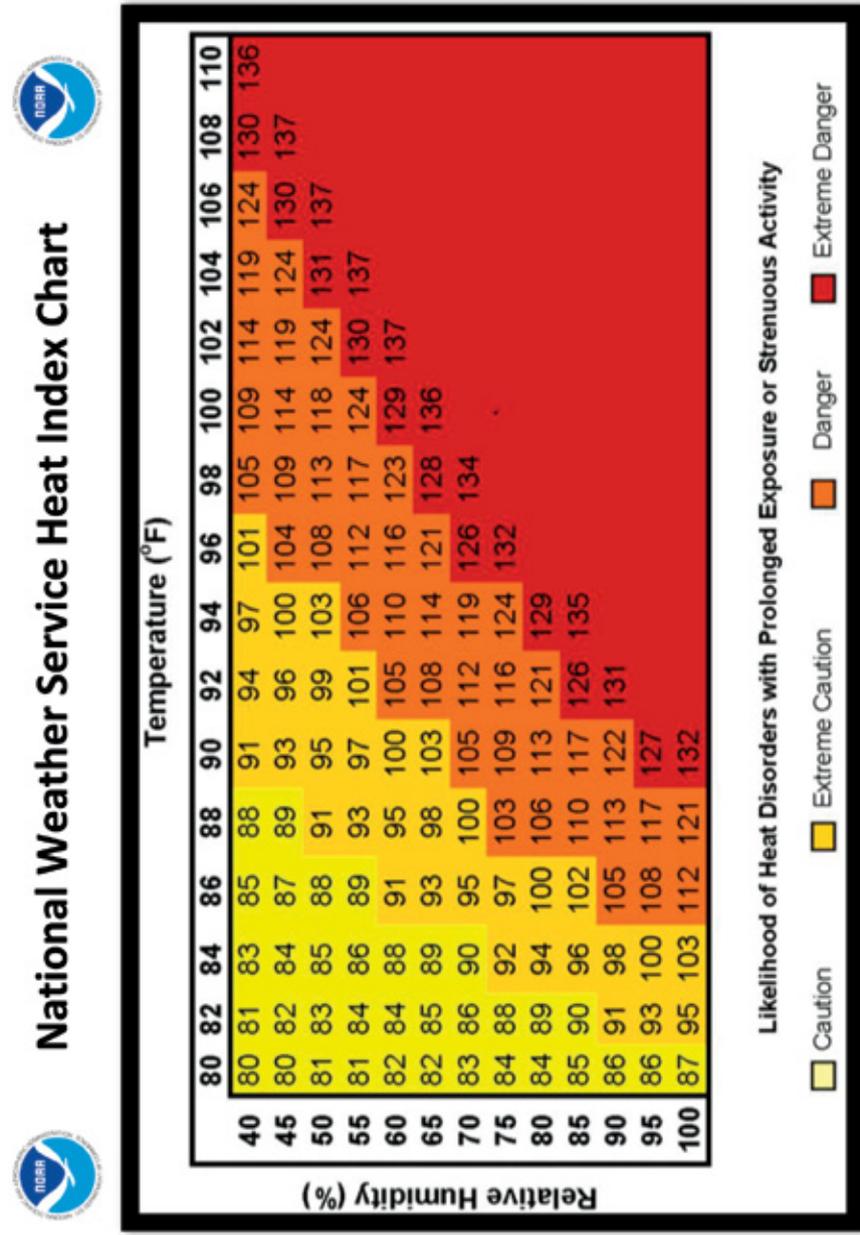
Category	Sustained Winds	Types of Damage Due to Hurricane Winds
1	74-95 mph 64-82 knots 119-153 km/h	Very dangerous winds will produce some damage: Well-constructed frame homes could have damage to roof, shingles, vinyl siding and gutters. Large branches of trees will snap and shallowly rooted trees may be toppled. Extensive damage to power lines and poles likely will result in power outages that could last a few to several days.
2	96-110 mph 83-95 knots 154-177 km/h	Extremely dangerous winds will cause extensive damage: Well-constructed frame homes could sustain major roof and siding damage. Many shallowly rooted trees will be snapped or uprooted and block numerous roads. Near-total power loss is expected with outages that could last from several days to weeks.
3 (major)	111-129 mph 96-112 knots 178-208 km/h	Devastating damage will occur: Well-built framed homes may incur major damage or removal of roof decking and gable ends. Many trees will be snapped or uprooted, blocking numerous roads. Electricity and water will be unavailable for several days to weeks after the storm passes.
4 (major)	130-156 mph 113-136 knots 209-251 km/h	Catastrophic damage will occur: Well-built framed homes can sustain severe damage with loss of most of the roof structure and/or some exterior walls. Most trees will be snapped or uprooted and power poles downed. Fallen trees and power poles will isolate residential areas. Power outages will last weeks to possibly months. Most of the area will be uninhabitable for weeks or months.
5 (major)	157 mph or higher 137 knots or higher 252 km/h or higher	Catastrophic damage will occur: A high percentage of framed homes will be destroyed, with total roof failure and wall collapse. Fallen trees and power poles will isolate residential areas. Power outages will last for weeks to possibly months. Most of the area will be uninhabitable for weeks or months.

Wind Chill Chart



This chart may be found at the following NOAA link: <http://www.nws.noaa.gov/om/windchill/>

Heat Index Chart



This chart may be found at the following NOAA link: <http://www.nws.noaa.gov/os/heat/index.shtml>



To download the latest updated version of this sheet: www.ncddc.noaa.gov/NEWS

STATE INFORMATION

- Mississippi Emergency Management Agency (www.msema.org).....1-866-519-MEMA(6362)
(24 hrs) 1-800-222-MEMA (6362)
- Mississippi Department of Transportation (www.GoMDOT.com)..... 601-359-7001
(activated only during a disaster) 1-866-521-MDOT(6368)
- Mississippi Department of Public Safety (www.dps.state.ms.us) 601-987-1212
(*hp from any cell)
- National Weather Service Forecast Office (New Orleans/Baton Rouge)
(www.weather.gov/neworleans) 504-522-7330
- National Weather Service Forecast Office (Mobile) (www.weather.gov/mob)
251-633-6443
- StormSmart Coasts<http://ms.stormsmart.org>
- Mississippi Tourism (www.visitmississippi.org)..... 1-866-SEE-MISS(733-6477)
- Mississippi Board of Animal Health (www.mbah.state.ms.us) 601-359-1170
- Governor’s Office (www.governorbryant.com) 1-877-405-0733 or 601-359-3150
- Mississippi Attorney General (www.ago.state.ms.us)..... 601-359-3680
- Mississippi Insurance Department (www.mid.state.ms.us) 1-800-562-2957
- Mississippi Department of Environmental Quality (www.deq.state.ms.us).....601-961-5171
- Mississippi Department of Marine Resources (www.dmr.state.ms.us)..... 1-800-374-3449
- US Coast Guard, 8th District (www.uscg.mil/D8) 504-589-6225
- Mississippi Power (www.mississippipower.com) 1-800-532-1502
- Coast Electric Power Association (www.coastepa.com)..... 1-800-624-3348
- Singing River Electric Association (www.singingriver.com) 228-497-1313
- Pearl River Valley Electric Power Association (www.prvepa.com) 1-877-302-4647

• FOR EMERGENCIES, CALL 911•
• FOR NON-EMERGENCY INFORMATION AND REFERRALS, CALL 211•



COUNTY INFORMATION

GEORGE

Emergency Management	601-947-7557
Sheriff.....	601-947-4811
Lucedale Police	601-947-3261
Lucedale Fire.....	601-947-3406

HANCOCK

Emergency Management	228-255-0942	
		www.hancockeoc.com
Sheriff.....	228-255-9191	
Bay St. Louis Police & Fire.....	228-255-9191	
Diamondhead Police & Fire.....	228-255-9191	
Waveland Police & Fire	228-255-9191	

HARRISON

Emergency Management	228-865-4002	
		http://co.harrison.ms.us/departments/ema
Sheriff.....	228-897-1364	
Biloxi Police & Fire.....	228-392-0641	
D'Iberville Police.....	228-865-7060	
D'Iberville Fire.....	228-392-3525	
Gulfport Police & Fire	228-868-5959	
Gulfport Action Line	311	
Long Beach Police & Fire.....	228-863-7292	
Pass Christian Police & Fire.....	228-452-3300	



JACKSON

Emergency Management	228-769-3111	
		www.co.jackson.ms.us/departments/public-safety/emergency-management.php
Sheriff.....	228-769-3063	
Gautier Police.....	228-497-2486	
Gautier Fire.....	228-497-1656	
Moss Point Police.....	228-475-1711	
Moss Point Fire.....	228-475-8848	
Ocean Springs Police.....	228-875-2211	
Ocean Springs Fire.....	228-875-4063	
Pascagoula Police.....	228-762-2211	
Pascagoula Fire.....	228-762-3066	

PEARL RIVER

Emergency Management.....	601-795-3058	
		www.pearlrivercounty.net/civdef
Sheriff.....	601-795-2241	
Picayune Police.....	601-798-7411	
Picayune Fire.....	601-798-6513	
Poplarville Police.....	601-795-2241	
Poplarville Fire.....	601-795-2200	

STONE

Emergency Management.....	601-928-3077	
		www.stonecountygov.com/emergency_management.htm
Sheriff.....	601-928-7251	
Wiggins Police.....	601-928-5444	
Wiggins Fire.....	601-928-2800	



NATIONAL INFORMATION

- American Red Cross 1-800-RED-CROSS (1-800-733-2767)
www.redcross.org
- Centers for Disease Control www.cdc.gov
- Environmental Protection Agency..... www.epa.gov
- Federal Emergency Management Agency (FEMA)..... 1-800-621-FEMA (3362)
www.fema.gov
- Agencia Federal para el Manejo de Emergencias (FEMA) www.fema.gov/esp
- National Oceanic and Atmospheric Administration (NOAA) www.noaa.gov
- National Weather Service..... www.nws.noaa.gov
- Gulf of Mexico Disaster Response Center <http://oceanservice.noaa.gov/hazards/drc>
- National Data Buoy Center..... www.ndbc.noaa.gov
- National Hurricane Center www.nhc.noaa.gov
- National Oceanographic Data Center..... www.nodc.noaa.gov
- National Coastal Data Development Center..... www.ncddc.noaa.gov
- NOAA Coastal Services Center..... www.csc.noaa.gov
- National Environmental Satellite, Data, and Information Service (NESDIS)
www.nhc.noaa.gov/satellite.shtml
- US Department of Homeland Security..... www.dhs.gov



NOAA Watch is a website offering information about ongoing environmental events. NOAA Watch explains the role of NOAA in prediction, monitoring, and recovery from environmental hazards. It provides public access to current information on a number of environmental threats ranging from oil spills, to hurricanes and tsunamis, to space weather.

The National Hurricane Center issues Public Advisories on their website for active tropical cyclones every six hours at 4 a.m., 10 a.m., 4 p.m., and 10 p.m. CDT. When coastal watches or warnings are in effect, Intermediate Public Advisories are issued at either two or three hour intervals between the regular Public Advisories. Special Public Advisories may be issued at any time to advise of an unexpected significant change in the cyclone or when watches or warnings are to be issued.



Mobile NHC and NWS Weather Data

- Graphical Tropical Weather Outlook RSS/XML feed..... <http://hurricanes.gov/gtwo.xml>
- Website for PDAs and Smartphones..... <http://hurricanes.gov/mobile>

RADIO STATIONS

Mississippi:

- MS Public Broadcasting 88.1- 91.3 FM
- WZKX 107.9 FM (Gulfport)
- WBUV 104.9 FM (Biloxi)
- WRJW 1320 AM (Picayune)
- WKNN 99.1 FM (Pascagoula)
- WXRR 104.5 (Hattiesburg)
- WJZD 94.5 FM (Gulfport)
- WQRZ 103.5 FM (Bay St. Louis)

- WDGL 98.1 FM (Baton Rouge)
- WJBO 1150 AM (Baton Rouge)
- KTDY 99.9 FM (Lafayette)

Alabama:

- WBLX 92.9 FM (Mobile)
- WCSN 105.7 FM (Orange Beach)
- WAAO 103.7 FM (Andalusia)
- WDJR 96.9 FM (Dothan)
- WMXC 99.9 FM (Mobile)
- WOOF 99.7 FM (Dothan)
- WKMX 106.7 FM (Enterprise)
- WNTM 710 AM (Mobile)

Louisiana:

- WWL 870 AM (New Orleans)
- WWL 870 AM (New Orleans)
- WLMG 101.9 FM (New Orleans)
- KHLA 99.5 FM (Lake Charles)

NOAA Weather Radio

NOAA Weather Radio (NWR) All Hazards is a nationwide network of radio stations broadcasting continuous weather information directly from a nearby National Weather Service office. NWR broadcasts National Weather Service warnings, watches, forecasts, and other hazard information 24 hours a day.

- | | | | |
|-------------|-------------|-------------|-------------|
| 162.400 MHz | 162.450 MHz | 162.500 MHz | 162.550 MHz |
| 162.425 MHz | 162.475 MHz | 162.525 MHz | |

(Not manufactured by NOAA, NWR receivers can be purchased at many retail outlets and on the Internet)



CONTRAFLOW PLANS

Interstates 59 and 55 Contraflow Plans

In an effort to assist the state of Louisiana, MDOT will implement contraflow (lane reversal doubling the number of lanes available for evacuation traffic out of the area) for both I-59 and I-55 when requested by Louisiana and approved by the Governor of Mississippi. Category III, IV or V hurricanes in the Gulf of Mexico are situations that might cause a mandatory evacuation of the greater New Orleans area. (Contraflow operations cannot be considered on Highway 49).

- The decision to contraflow is NOT automatic and will only be used when absolutely necessary. Citizens should not delay their evacuation plans in anticipation of contraflow.
- The I-59 contraflow operations would begin in Louisiana, extend into Mississippi, and end just south of Hattiesburg.
- The I-55 contraflow operations would begin in Louisiana, extend into Mississippi, and end just south of Brookhaven.
- All exits within the contraflowed sections of the interstate highways will remain open as traffic conditions allow. Law enforcement officers will be present to assist with traffic control.
- The shoulders of both Interstates 59 and 55 should be kept clear for emergency vehicles. Motorists needing to stop should use the next available exit.
- During contraflow operations Hancock County residents traveling West into Louisiana on I-10 will be routed North onto I-59 at the I-10/I-12 split.
- Tune in to Mississippi Public Broadcasting radio stations for emergency information and updated road conditions.

www.gomdot.com

MDOT on Twitter

- www.twitter.com/mdot_i55
- www.twitter.com/mdot_i59
- www.twitter.com/mdot_i10
- www.twitter.com/mdot_i20
- www.twitter.com/mdot_us49
- www.twitter.com/mdot_us98

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www.ncddc.noaa.gov/NEWIS

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Ropes, Knots and Splicing

By Scott Gordon

A knot is a way of joining or securing a line, such as a rope, by tying or interlacing. It may be a section of one or several pieces of line material like rope, string, webbing, twine, strap, cable or even chain; intertwined such that the line can connect to itself, another section of line or to another object.

Knot-tying is one of the earliest complex skills learned in life. Tying your shoes is so automatic; it is usually done without even thinking about it. Many different knots are used daily in different occupations. On board a vessel, knot-tying is a necessary everyday skill you should master. A properly tied knot may be the difference between life and death. A knot can help secure a vessel to the dock, in both calm and stormy conditions. This section will cover some common knots you may find useful as well as some of their various uses. Chances are, you probably already know and frequently use more than a few of these knots. This section may also be used to refresh your knot-tying skills, learn new knots, or be useful in teaching someone else about tying a particular knot or its usage.

CAUTION! - INCORRECT USE OF ROPES MAY RESULT IN SERIOUS INJURY, DEATH OR PROPERTY DAMAGE.

Turn or Single Turn – or single turn is a single pass behind or through an object.¹



Round Turn – the complete encirclement of an object; requires two passes.¹



Half Hitch – A simple overhand knot, where the working end of a line is brought over and under the standing part.²



Round Turn and Two Half Hitches – is a hitch used to secure the end of a rope to a fixed object. The name refers to the components used to form the knot: a round turn wraps the rope around the object, completely encircling it, and the two half hitches secure the end around the standing part. Variations of this hitch can be made with differing numbers of turns and half-hitches.³



Bowline – used for tying a loop in the end of a rope, as around one’s waist or to secure a ring or grommet. This knot is also used as an anchor knot. ¹ It is easy to tie and untie and will not jam. The bowline is one of the most useful knots on a boat. Make a quick loop to tie up to a piling. All boaters should know this knot. Many people remember how to tie a bowline by memorizing the saying:

“The rabbit comes out of the hole, around the tree then back down the hole.”

It is tied by making a loop (the hole) with the standing line (the tree), then bringing the free end (the rabbit) through the loop (the hole), around the back of the standing line (the tree), and back through the loop (the hole).

The knot should be tightened by holding the standing line while pulling firmly on the free end.



Rolling Hitch or Magnus Hitch – A knot used to attach a rope to a rod, pole, or other rope. ² It is tied by making a round turn around the object. Then crossing over the standing end and finishing with a half-hitch tied firmly around the object. It is simple to tie and more secure than a clove hitch.



Square Knot – for joining the ends of a piece of cordage wrapped around an object or objects. ¹



Clove Hitch – two successive half hitches around an object. ² It is often used to start and stop lashings.



Figure 8 Knot – a stopper knot. ¹ It may be used for stopping ropes from running out of retaining devices.



1. Tying a Figure 8 Knot



2. Figure 8 Knot Tightened

Sheet Bend – for joining the ends of two ropes, which need not be the same diameter. ¹



1. Tying a Sheet Bend Knot



2. Sheet Bend Knot Tightened

Cleat Hitch – a knot used to secure a rope to a cleat. ⁴ Additional turns or wraps may be added to provide more security if the line tends to slip, or in rough conditions.



1. Pass the running end under the cleat horn farthest from, but on the same side as the standing part.



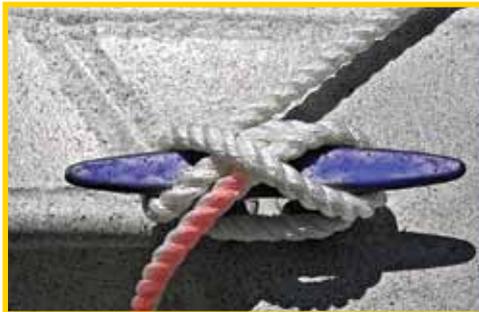
2. Pass the running end under the cleat horn nearest to and towards the standing part.



3. Wrap the running end over the top of the cleat, and under the opposite cleat horn.



4. Wrap the running end back over the cleat again, making an under hand loop over the cleat horn closest to the standing part.



5. Tighten by pulling firmly on the running end.

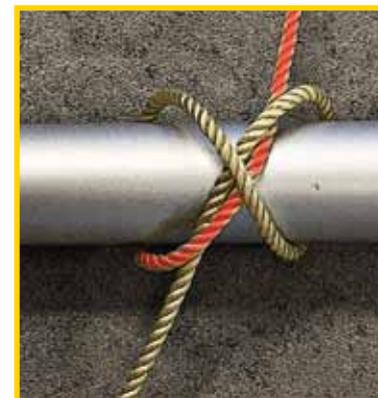
Constrictor Knot – one of the most effective binding knots. Simple and secure, it is a harsh knot that can be difficult or impossible to untie once tightened. ⁵ A constrictor knot can be used temporarily to hold the fibers of a cut line until a final whipping can be applied. ⁶ The constrictor knot may even be useful as an emergency hose clamp when sticks are tied to each end for extreme tightening with your hands and feet.



1. Make a turn around the object and cross over the standing part with the second turn.



2. Bring the running end over the standing part.

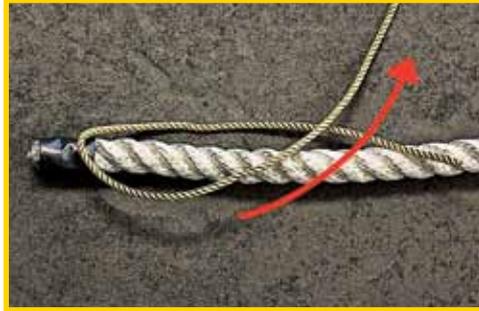


3. Tuck the running end under the "X" formed by the first crossover.

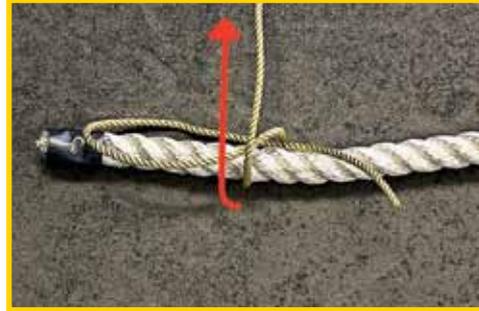


4. Pull firmly on both ends to tighten the knot.

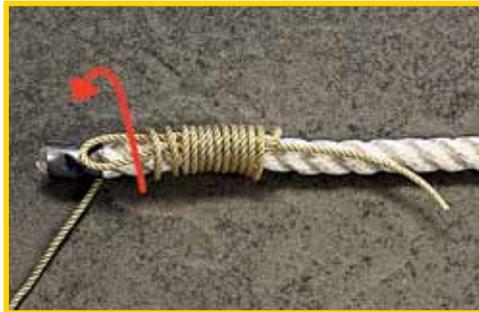
Whipping – a binding of marline twine or whipcord around the end of a rope to prevent its natural tendency to fray. The whipping can be made neat and permanent by tying it off or sewing the ends of the twine through the rope. ⁶



1. The rope should be whipped a short distance, about 1½ times the rope diameter, from its end. Lay the head of the twine along the rope. Make a bight along the rope.



2. Wrap the twine around the rope and bight of twine securely. You should wrap in the same direction as the twist of the rope.



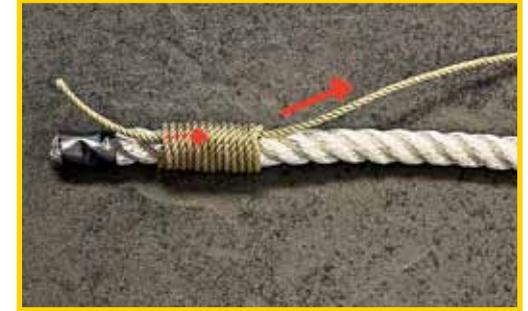
3. Continue wrapping tightly.



4. Slip the working end of the twine through the bight.



5. Carefully pull on the standing end of the twine so the bight and working end are pulled back to the whipping. Hold the working end so the wrapping does not untwist.



6. Continue pulling the standing end, until the bight and working end are about half way under the whipping. Don't pull all the way through!



7. Trim the twine ends and the rope to give the end a finished look. Leave at least half the ropes width from the whipping.

A constrictor knot can be used temporarily to hold the fibers of a cut line until a final whipping can be applied.

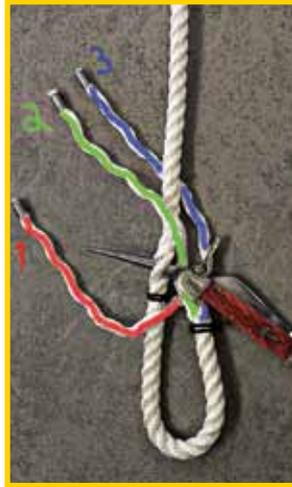
French whipping is a whipping knot that consists of a series of half hitches. It is used to stop unraveling of rope ends as well as to provide a grip over railings.

Take care of your boat lines so they will last longer and do a better job.

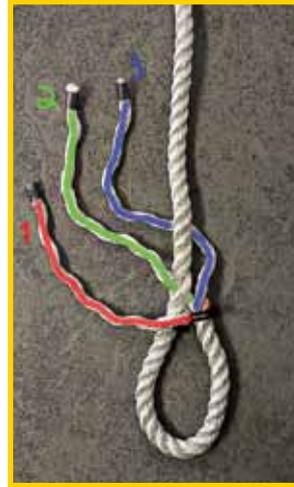
Splicing Rope – the forming of a semi-permanent joint between two ropes or two parts of the same rope by partly untwisting and then interweaving their strands. Splices can be used to form a stopper at the end of a line, to form a loop or an eye in a rope, or for joining two ropes together. Splices are preferred to knotted rope, since while a knot typically reduces the strength by 20-40%, some splices can retain up to 95% of the strength of the line. However, splicing usually results in a thickening of the line and, if subsequently removed, there will be a distortion of the rope.⁷



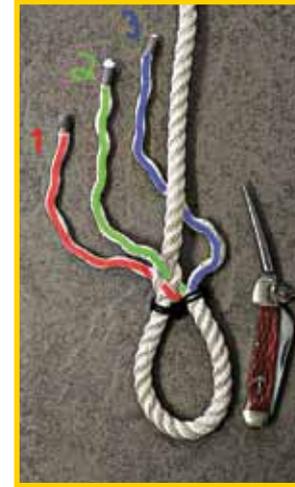
1. Open more than enough of the rope strands than is necessary for tucking. It may help to mark or secure the ends with tape or a constrictor knot. You may also mark the location you will begin splicing so the “eye” will be the desired size. Place ends so the two strands nearer the eye are across the lay of the rope and the third is behind.



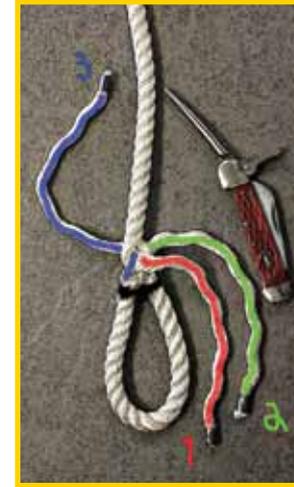
2. Using a marline spike or a fid, open a main strand enough for a loose strand to pass through.



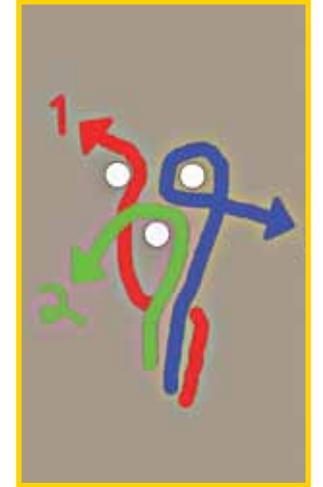
3. Tuck strand #2 through the opening you made with the marline spike.



4. Tuck strand #1 under the next main strand, going in where strand #2 comes out.



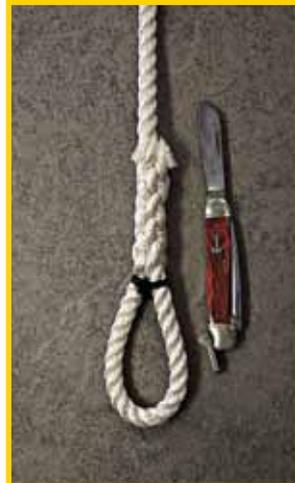
5. Turn splice over and tuck strand #3 under the only main strand without an end projecting from it, going the same way around the rope as the other two tucks.



6. There will now be one end projecting from each space in the rope. Pull the ends through to give an even tension and a close joint.



7. Continue by tucking strand #2 again, over and under one main strand, then similarly, in order #1, #3, etc., each over one and under one main strand, pulling to even tension, for a total of at least four tucks per strand for synthetic rope, and at least three for natural rope.



8. You may roll the splice under your foot to help "set" it. Finish by trimming the excess strands with a sharp knife.

A metal thimble is often spliced tightly into the eye, and may be used to help protect the rope from wear when it is fastened to a chain with a shackle.

Metal thimbles are available for various sized rope.

"Practice makes perfect."

Knot Glossary and Terms ¹

Bend – A knot uniting two lines.

Bight – Any curved section, slack part, or loop between the ends of a rope, string, or yarn.

Binding – A knot that restricts object(s) by making multiple winds.

Bitter End – The end of a rope that is tied off, hence the expression "hanging on to the bitter end". This is more of a rope maker's term rather than a knot term. In fact the bitter end is the end of the anchor "cable" that connects to the anchor bits in the cable locker under the forecastle or poop using the bitter pin. (British nautical usage.) Other uses may be borrowed from this derivation.

Coil – Knots used to tie up lines for storage.

Decorative Knot – A complex knot exhibiting repeating patterns often constructed around and enhancing an object.

Elbow – Two crossing points created by an extra twist in a loop.

Hitch – A knot tied to a post, cable, ring, or spar.

Lashing – A knot used to hold poles together.

Loop – A full circle formed by passing the working end over itself or a knot used to create a closed circle in a line.

Plait (or braid) – A number of lines interwoven in a simple regular pattern.

Seizing – A knot used to hold two lines or two parts of the same line together.

Sennit – A number of lines interwoven in a complex pattern.

Slip (or running) – A knot tied with a hitch around one of its parts. In contrast, a loop is closed with a bend. While a slip knot can be closed, a loop remains the same size.

Slipped – Some knots may be finished by passing a bight rather than the end, for ease of untying. The common shoelace knot is an example, being a reef (square) knot with both ends slipped.

Splice – A knot formed by interweaving strands of rope rather than whole lines. More time-consuming but usually stronger than simple knots.

Standing End – The longer end of the rope not involved in the knot, often shown as unfinished. It is often, but not always, the end of the rope under load after the knot is complete. For example, when a clove hitch ties a boat to a pier, the end going to the boat is the standing end.

Standing Part – Section of line between knot and the standing end.

Stopper – A knot tied to hold a line through a hole.

Turn – A single pass behind or through an object. A round turn is the complete encirclement of an object and requires two passes. Two round turns circles the object twice and requires three passes.

Whipping – A binding knot used to prevent another line from fraying.

Working end – The active end of a line used in making the knot. May also be called the 'running end', 'live end', or 'tag end'.

Working part – Section of line between knot and the working end.

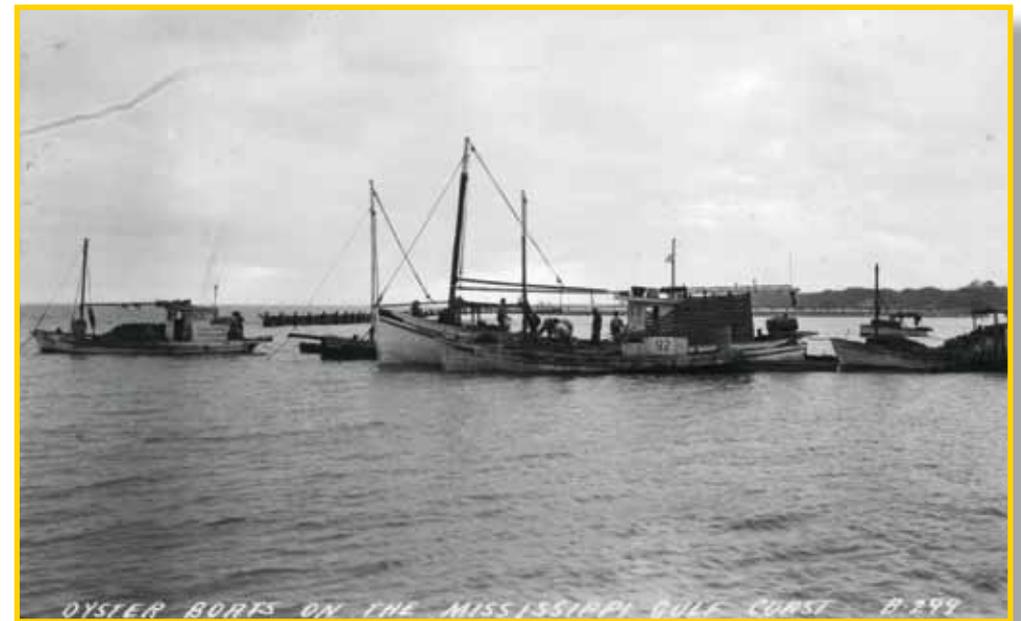
References

1. <http://en.wikipedia.org/wiki/Knot>
2. http://en.wikipedia.org/wiki/List_of_hitch_knots
3. http://en.wikipedia.org/wiki/Round_turn_and_two_half-hitches
4. http://en.wikipedia.org/wiki/Cleat_hitch
5. http://en.wikipedia.org/wiki/Constrictor_knot
6. http://en.wikipedia.org/wiki/Whipping_knot
7. http://en.wikipedia.org/wiki/Rope_splicing

International Guild of Knot Tyers - Knot Charts <http://www.igkt.net/publications/index.php>
 AF REGULATION 64-4, VOLUME I, 15 July 1985, Search and Rescue, SURVIVAL TRAINING
 U.S. Army Field Manual 3-05.70 Survival (FM 21-76) May 2002
http://wikimediafoundation.org/wiki/Terms_of_Use



Photo taken by John Mitchell, MDMR Scientist



How to Anchor

www.boatsafe.com

Steps to Smooth Anchoring

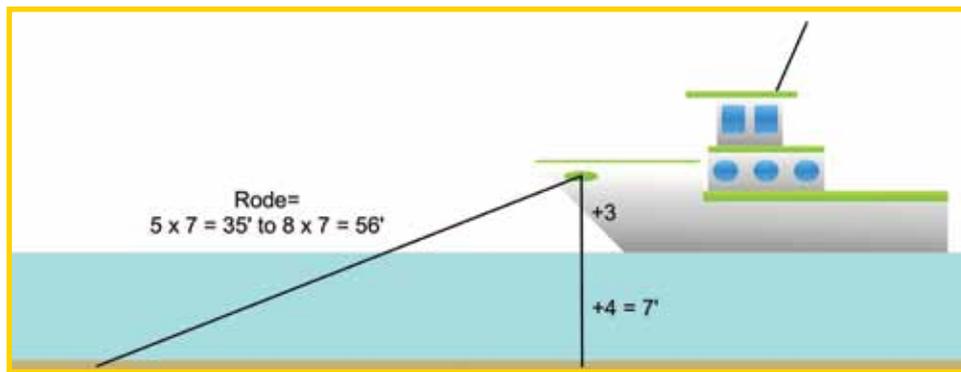
At some point in your boating career you will probably want to anchor. You may want to stop and fish, swim, have lunch or stay overnight. A second reason to drop anchor may be to control the boat if bad weather is blowing you ashore or if your engine has quit and the wind and current are pushing you into shallow water or other boats.

The first step in anchoring is to select the proper anchor. In spite of claims to the contrary, there is no single anchor design that is best in all conditions. On most pleasure boats, the three anchors you will find most are the *fluke* or *danforth* type, the *plow* and the *mushroom* anchor.

Mushroom anchors do not have the holding power of a fluke or plow anchor and should only be used on small, lighter weight boats. A local marine supply store can help you select the proper anchor for your boat and for the waters in which you will be boating.

Anchors also must have something to attach them to the boat. This is called the *anchor rode* and may consist of line, chain or a combination of both. The whole system of gear including anchor, rode, shackles etc. is called ground tackle.

The amount of rode that you have out (scope) when at anchor depends generally on water depth and weather conditions. The deeper the water and the more severe the weather, the more rode you will put out. For recreational boaters, at a minimum, you should have out five to eight times (5 to 1 scope for day anchoring and 6 to 8 to 1 for overnight) the depth of the water plus the distance from the water to where the anchor will attach to the bow. For example, if you measure water depth and it shows four feet and it is three feet from the top of the water to your bow cleat, you would multiply seven feet by six to eight to get the amount of rode to put out.



Steps to Anchoring a Boat

- Select an area that offers maximum shelter from wind, current, boat traffic etc.
- Pick a spot with swinging room in all directions. Should the wind change, your boat will swing bow to the wind or current, whichever is stronger.
- Determine depth and bottom conditions and calculate the amount of rode you will put out.
- If other boats are anchored in the area you select, ask the boat adjacent to the spot you select what scope they have out so that you can anchor in such a manner that you will not bump into the neighboring vessel.
- Anchor with the same method used by nearby boats. If they are anchored bow and stern, you should too. If they are anchored with a single anchor from the bow, do not anchor bow and stern. *Never anchor from the stern alone, this could cause the boat to swamp or capsize.*
- Rig the anchor and rode. Check shackles to make sure they are secured with wire tied to prevent the screw shaft from opening.
- Lay out the amount of rode you will need on deck in such a manner that it will follow the anchor into the water smoothly without tangling.
- Cleat off the anchor line at the point you want it to stop. (Don't forget or you'll be diving for your anchor.)
- Stop your boat and lower your anchor until it lies on the bottom. This should be done up-wind or up-current from the spot you have selected. Slowly start to motor back, letting out the anchor rode. Backing down slowly will assure that the chain will not foul the anchor and prevent it from digging into the bottom.
- When all the anchor line has been let out, back down on the anchor with engine in idle reverse to help set the anchor. *Be careful not to get the anchor line caught in your prop.*
- While reversing on a set anchor, keep a hand on the anchor line. A dragging anchor will telegraph itself as it bumps along the bottom. An anchor that is set will not shake the line.
- When the anchor is firmly set, look around for reference points in relation to the boat. You can sight over your compass to get the bearing of two different fixed points (house, rock, tower, etc.) Over the next hour or so, make sure those reference points are in the same place. If not you're probably dragging anchor.
- Begin anchor watch. Everyone should check occasionally to make sure you're not drifting.
- Retrieve the anchor by pulling or powering forward slowly until the anchor rode hangs vertically at the bow.
- *Cleat the line* as the boat moves slowly past the vertical. This will use the weight of the boat to free the anchor and protect you from being dragged over the bow.
- Once free, raise the anchor to the waterline.
- Clean if necessary and let the rode dry before stowing away.

This information was taken directly from the website www.boatsafe.com. Copyright 1996/2012 Nautical Know How, Inc. All rights reserved.



Danforth Anchor



Plow Anchor



Mushroom Anchor



An Old Schooner Named Mamie Foster, Used for Harvesting Oysters By Dredge

Pump-Out Stations: Keeping Our Waters Clean

<http://www.dmr.ms.gov/environment/sport-fish-restoration/123-clean-vessel-act>

The MDMR has been committed to cleaning up the quality of our water since 1992, when the Clean Vessel Act (CVA) program was first authorized. Since that time, discharging raw sewage into state waters has been prohibited. The program provides for a cost reimbursable grant with a 75% Federal and 25% marina match, and any marina in Mississippi is eligible to participate.

Since 1992, the Coast has grown significantly and more people continue being drawn to the Coast. With an increase in population, there is an increase in threats to the richness and beauty of the waters which provide these attractions in the first place. Even boating can contribute to the degradation or loss of our important coastal resources. Extensive studies show boat sewage dumped into our waters may affect aquatic plants, fish and other animals. The primary goal of Mississippi's CVA program is to reduce and eventually eliminate overboard sewage discharge from boats.

Congress passed the CVA in 1992 to reduce pollution from vessel discharges after finding an inadequate number of onshore sewage disposal facilities and determining this to substantially contribute to localized degradation of water quality. Under the CVA, \$40 million will be distributed to the states for funding of marine toilet pump-out facilities for sewage waste disposal. These funds come from boaters and anglers through taxes paid on fishing tackle and motorboat fuels under the Federal Aid in Sport Fish Restoration Program. Federal funds can constitute up to 75% of all approved projects with remaining funds provided by the states or marinas.

Raw sewage can spread disease; contaminate shellfish beds and lower oxygen levels in water, causing fish and other aquatic animals to die. Because of the CVA, boaters can expect to see more convenient and reasonably priced pump-out and dump stations and as a result, cleaner waters, with healthier fish and shellfish populations.

Why use a pump-out station?

Extensive studies prove that boat sewage dumped into our waters may affect aquatic plants, fish and other animals. By using a pump-out station to properly dispose of waste, you can help reduce overboard sewage discharge, resulting in cleaner waters and healthy fish and shellfish populations.

How can marinas help?

All designated Mississippi marinas must have fully functioning pump-out or dump stations for proper disposal of all vessel wastes, as required by the CMR in Title 22, Part 10. Owners of marinas, harbors and other boating facilities may apply through the MDMR for grants to install pump-out stations. For more information, call (228) 523-4150 or visit

our website at <http://www.dmr.ms.gov/environment/sport-fish-restoration/123-clean-vessel-act>. This website offers several links including an electronic grant application for installation of the pump-out stations.

The Clean Marina Initiative is a voluntary incentive-based program promoted by the MDMR that encourages marinas and recreational boaters to protect coastal water quality by engaging in environmentally sound operating and maintenance procedures. The program offers information, guidance and technical assistance to marina operators, local governments and recreational boaters on best management practices that can be used to prevent or reduce pollution. Marinas that participate in the Clean Marina Program are recognized for their environmental stewardship through a certified designation and the right to fly the Clean Marina flag.

Coastal Pump-Out Locations

Hancock County:

- Bay Marina, Bay St. Louis, (228) 466-4970
- Diamondhead Marina, Diamondhead, (228) 216-6247

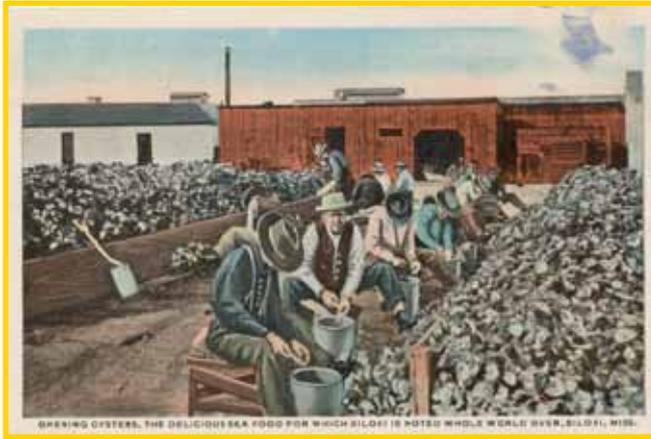
Harrison County:

- Biloxi Small Craft Harbor, Biloxi, (228) 436-4062 (Currently under construction – out of service until June, 2014)
- Gulfport Small Craft Harbor, Gulfport, Harbor Office (228) 867-8721, Daytime – 8am to 4pm (228) 236-8070, Night time – 4pm to 8am (228) 236-8071, (Seven pump-out stations located at the end of each pier)
- Keesler Marina, Biloxi, (228) 377-3160
- Long Beach Small Craft Harbor, Long Beach, (228) 863-4795
- Pass Christian Small Craft Harbor, Pass Christian, Harbor Office (228) 452-5128
- Point Cadet Marina, Biloxi, (228) 432-0454, (Currently under construction)
- Schooner Pier, Biloxi, (228) 435-6320

Jackson County:

- Ocean Springs Harbor, Ocean Springs, (228) 872-5754
- Mary Walker Marina, Gautier, (228) 497-3141
- Pascagoula Inner Harbor, Pascagoula, (228) 938-2356
- Singing River Yacht Club, Pascagoula, (228) 769-1876

Recipes to Enjoy with Mississippi Oysters



Batter Fried Oysters

2½ dozen medium-sized Mississippi oysters; freshly shucked
vegetable oil for deep frying
2 eggs
2 tablespoons water
horseradish sauce to taste

1½ cup flour
1½ teaspoon salt
½ teaspoon freshly ground black pepper
1/8 teaspoon cayenne pepper

Drain oysters. Preheat oil in deep fryer to 375°F. Combine eggs, water and horseradish sauce. Combine flour, salt, pepper and cayenne in a bowl and mix thoroughly. Dip oysters in egg mixture, then in seasoned flour to coat. Place side by side but not touching on a platter and allow the oysters to dry for a few minutes. When ready to fry the oysters, dip again in seasoned flour. Fry in batches of 6 to 8 until golden brown (about 3 minutes). Drain oysters by placing on a platter lined with paper towels. Can be set in a 200°F oven.



Smoked Oyster Casino

Smoke oysters on the half shell.
Top with garlic and butter. Serve with Orange Sauce.

Orange Sauce:

1 cup white sugar
½ cup butter
½ cup light corn syrup or Karo syrup
½ cup frozen orange juice concentrate, thawed

Combine all ingredients in a medium saucepan over medium heat. Bring to a boil, reduce heat and simmer 5 minutes. Pour over smoked oysters and brown in the oven.

Oyster Cornbread Dressing

- | | |
|-------------------------------|--------------------------------------|
| 2 packages dry cornbread mix | 3 tablespoons butter |
| 2 eggs | 1 quart Mississippi oysters, chopped |
| 2/3 cup milk | 1 lb. sausage, hot or mild |
| 1 sweet potato | 2 cans chicken broth |
| 1 stalk celery – chopped | 2 tablespoons Season All |
| 1/2 onion – chopped | 1 teaspoon garlic powder |
| 1 bunch green onion – chopped | 1/4 cup parsley, chopped |

Make the cornbread according to the package, using the chicken broth. Let cool, then crumble and set aside for later. Boil sweet potatoes until tender, then mash and set aside to cool. Cook sausage and drain. Chop the celery, onion, and green onions and then sauté with butter. Add cooked sausage to skillet with vegetables. Add oysters, cornbread and sweet potato. Mix together. Place in 9 x 13 greased baking dish. Bake at 350°F for 1 hour or bake with chicken or turkey until bird is fully cooked.

Smoked Oyster Pâté

- | | |
|--|-----------------------------------|
| 1 cup smoked Mississippi oysters (chopped) | 1 tsp prepared horseradish |
| 1 8oz package cream cheese | 1/4 tsp salt |
| 1 tbsp lemon juice | 1/2 cup chopped pecans |
| 2 tbsp grated onion | 3 tbsp cilantro (chopped) |
| | 2 slices of cooked bacon, crumble |

Combine the oysters, cream cheese, lemon juice, onion, and horseradish into a bowl and mix. Add the salt and 1 tbsp of cilantro. Chill for 2 - 3 hours. Then shape into a ball or a log and serve on a flat platter. Top with pecans, remaining cilantro, and crumbled bacon. Serve with crackers of your choice.



Oyster Cakes

- | | |
|--------------------------------------|---------------------------------|
| 1 dozen Mississippi oysters, chopped | 1/4 teaspoon dry mustard |
| 1 egg | 1 tablespoon mayonnaise |
| 1 teaspoon Worcestershire sauce | 1 teaspoon prepared mustard |
| 1 teaspoon lemon juice | 1/4 cup cracker or bread crumbs |
| 1 teaspoon Seafood seasoning | 2 tablespoon olive oil |
| 1 teaspoon parsley flakes | |

Place oysters into a large mixing bowl. In a separate mixing bowl, beat the egg then add Worcestershire sauce, lemon juice, seafood seasoning, dehydrated parsley flakes, dry mustard, mayonnaise and prepared mustard. To make a dressing add cracker crumbs to the mixture. Fold dressing into oysters. Shape into slightly flattened patties and chill. You can either sauté the cakes in 2 tablespoons of extra virgin olive oil on both sides until they are golden brown, or you can broil until golden brown on each side. Yield: the number of oyster cakes depend on their size.

Cooking with Oysters

Oysters are good to eat all year long, but are in best condition and most tasty in the fall, winter and early spring. Raw oysters are a healthy choice having a protein content of about 9% and a fat content of less than 2%. Oysters are also very high in iron. This coast cuisine can be eaten on the half-shell, fried, smoked, baked, roasted, broiled, sautéed, poached and steamed, and can be found in stews, soups, gumbos, dressings and seafood casseroles and on the menus of most local seafood restaurants.

Cooking Tips

In The Shell

Cook live oysters or clams in small pots so those in the middle are cooked thoroughly.

Boiling: Once the shells have opened, continue boiling live oysters or clams for another 3-5 minutes.

Steaming: In a pot that is already steaming, cook live oysters or clams for 4-9 minutes.

Shucked Oysters

Boil or simmer oysters for at least 3 minutes or until edges begin to curl.

Fry oysters at 375°F for at least 3 minutes.

Broil oysters at least 3 inches from the heat for 3 minutes.

Bake oysters on a baking sheet at 450°F for 10 minutes.

Nutritional Information	
Serving Size:	100g = 3.5 oz.raw
Calories:	68
Fat Calories:	23
Total Fat:	2.5g
Saturated Fat:	0.8g
Cholesterol:	53mg
Sodium:	211mg
Protein:	7.1g
Omega-3:	0.5g
Source: Seafood Handbook Poster 2003	

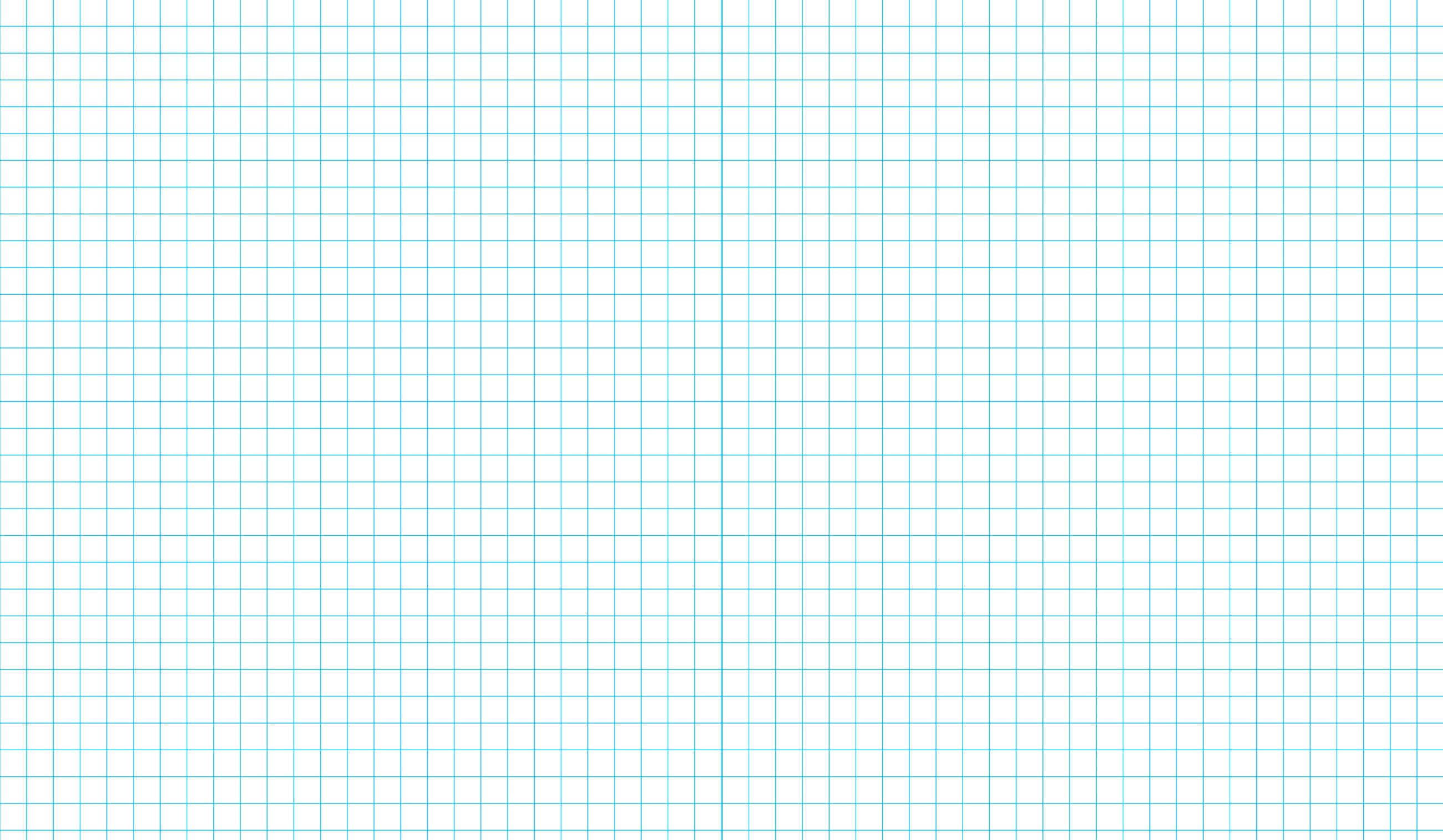


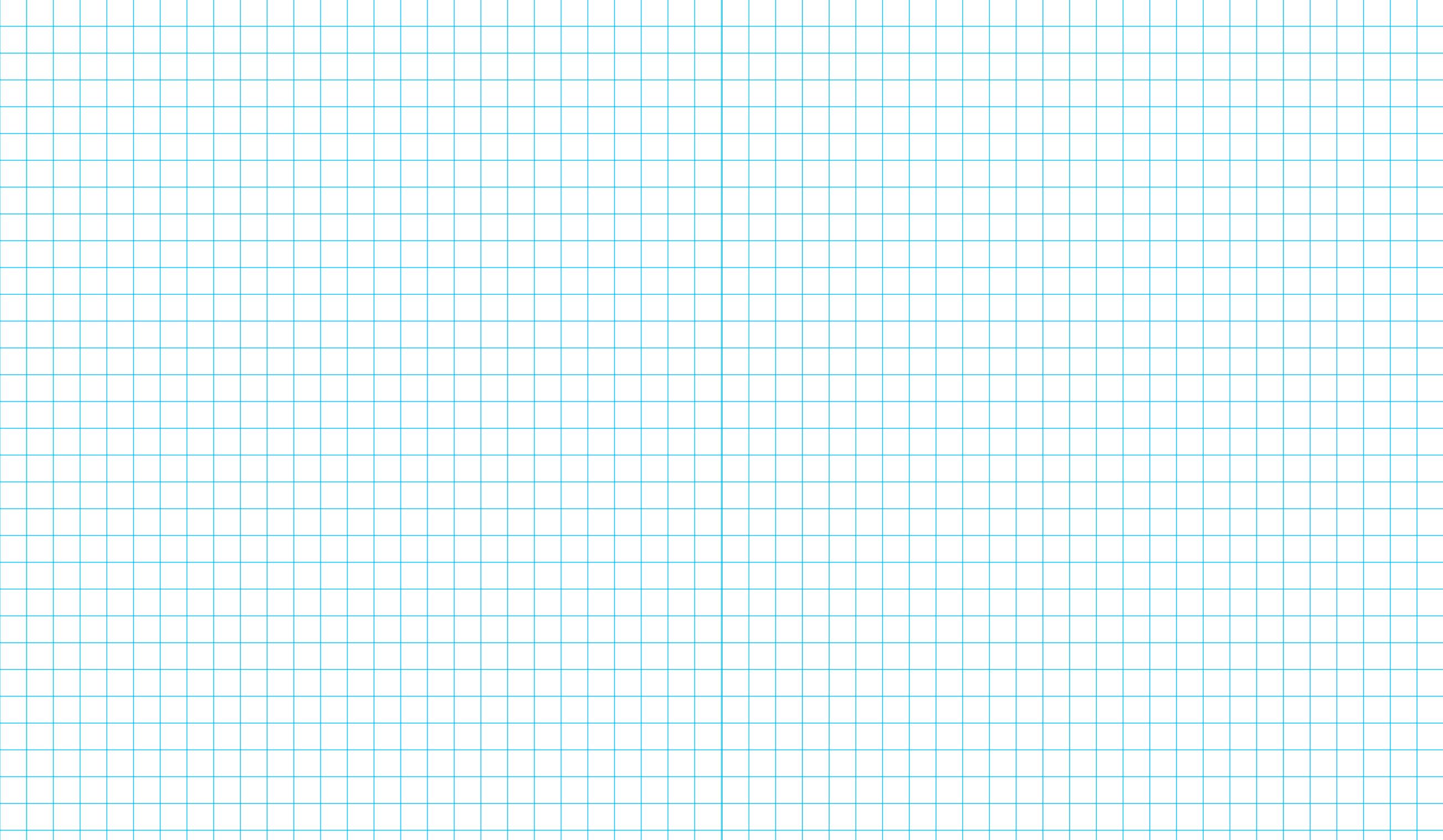
Cooking and Safety

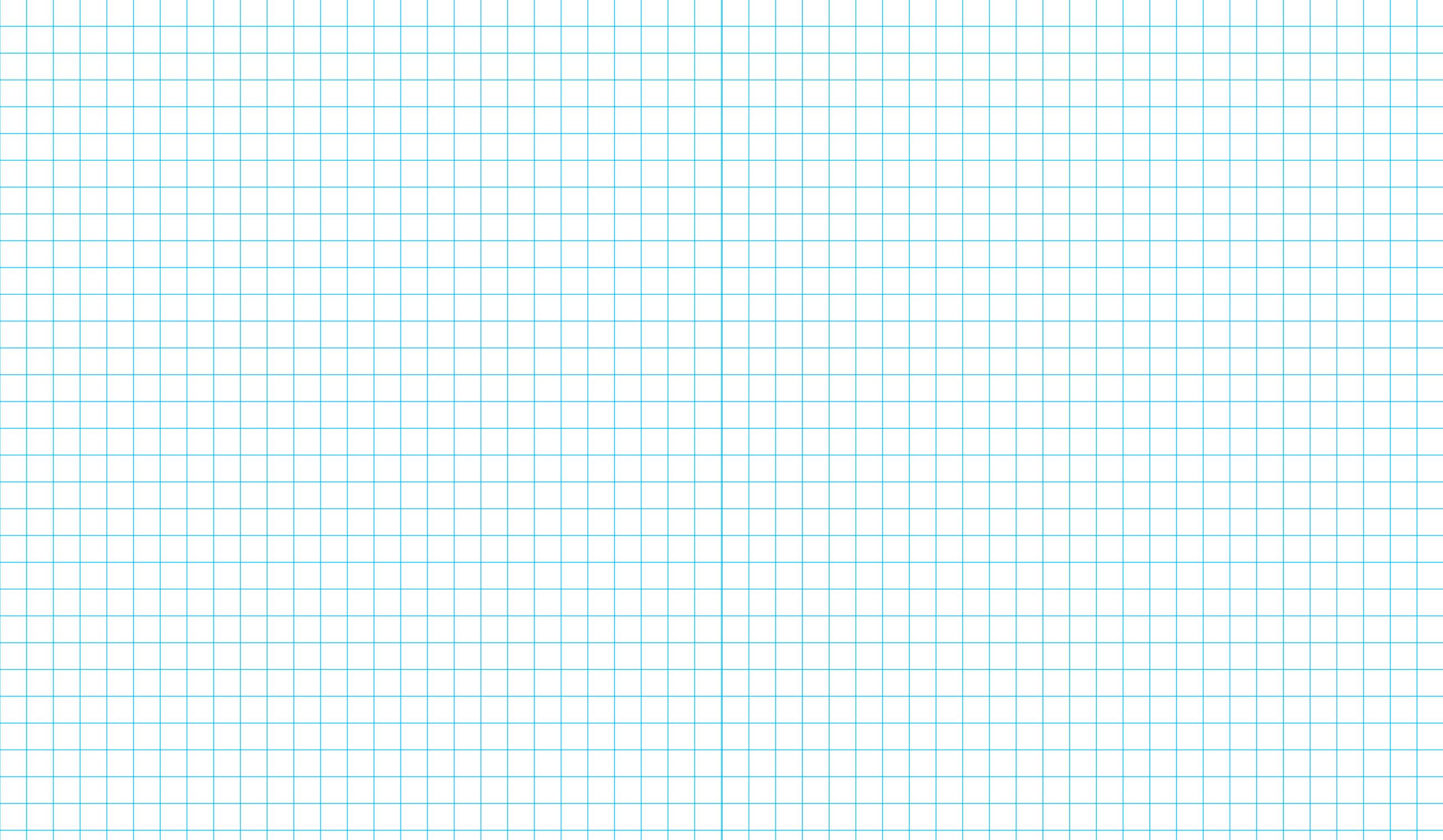
As is the case with consuming other raw animal protein products, there is a risk associated with consuming raw oysters, clams and mussels. If you suffer from chronic illness of the liver, stomach, or blood, or have immune disorders, do not eat these products raw. Once an oyster has been removed from its shell (shucked), the meat can be completely consumed. It is one of the few meats that can be eaten raw. Oysters harvested from approved waters, packed under sanitary conditions and properly refrigerated are usually safe for raw consumption by healthy individuals.

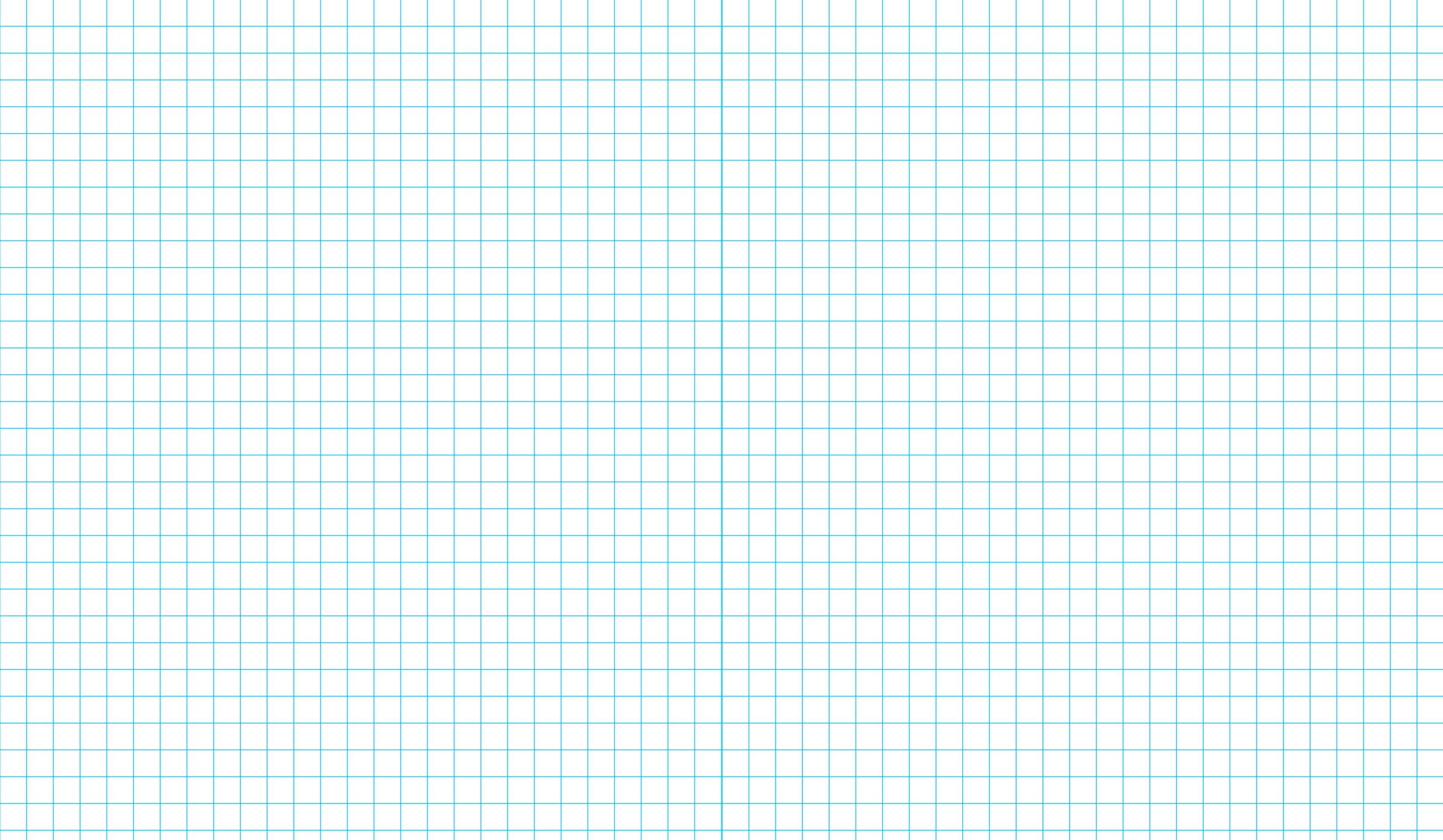
Cooking oysters to an internal temperature of 140°F or greater, for four to six minutes destroys the common microorganisms of public health concern. For more information about cooking and safety, please visit the Interstate Shellfish Sanitation Conference website at www.issc.org.

*Recipes and Photos by: Linda Andrews, Susan DeBlanc, Ron Jordan, Jeff Davis and Ruth Posadas.
Food Preparation by: Chappy's Restaurant and Dr. Linda Andrews.*











*A Young Boy Working in an Oyster Factory,
Biloxi MS, Circa 1911.*

“The Oyster”

There once was an oyster
Whose story I tell,
Who found that some sand
Had got into his shell.
It was only a grain,
But it gave him great pain.
For oysters have feelings
Although they're so plain.

Now, did he berate
The harsh working of fate
That had brought him
To such a deplorable state?
Did he curse at the government,
Cry for election,
And claim that the sea should
Have given him protection?

No – he said to himself
As he lay on a shell,
Since I cannot remove it,
I shall try to improve it.
Now the years have rolled around,
As the years always do,
And he came to his ultimate
Destiny – stew.

And the small grain of sand
That had bothered him so
Was a beautiful pearl
All richly aglow.
Now the tale has a moral;
For isn't it grand
What an oyster can do
With a morsel of sand?

What couldn't we do
If we'd only begin
With some of the things
That get under our skin.

Author: Unknown

<http://www.scrapbook.com/poems/doc/4617/109.html>



A publication of the
Mississippi Department of Marine Resources
Marine Fisheries – Shellfish Bureau
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The Mississippi Department of Marine Resources is dedicated to enhancing, protecting and conserving marine interests of the state by managing all marine life, public trust wetlands, adjacent uplands and waterfront areas to provide for the optimal commercial, recreational, educational and economic uses of these resources consistent with environmental concerns and social changes.

