The Mississippi Oyster Gardening Program

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Thank you for joining the 2019 season of the Mississippi Oyster Gardening Program. Did you know that more than 80% of the world's oyster reefs have been lost (Kroeger, 2012)? Together we will work to help restore oyster reefs within Mississippi coastal areas. This program is not possible without you the Gardener. It is in fact your oyster gardening program. As such, we need you to be an ambassador for the program. Recruit new Gardeners, recommend improvements and let us know if something is not working.

What is Oyster Gardening?

At its heart, oyster gardening is a citizen driven project focused on education and restoration with respect to oysters and oyster reefs in coastal Mississippi. It is an opportunity for individuals to participate in a larger cooperative education and restoration program. Gardeners, ranging from K-12 aged children to retired adults, receive hatchery reared spat (juvenile oysters) set on whole shell and care for them during the summer and fall. These spat grow from thumbnail size (0.4 inches) to sub-adult (2.5 inches) during these few months. In November, the oysters are collected by the program and planted on designated reef sites where they will spawn (reproduce) the following spring. This spawning capacity provides millions of additional larvae to the ecosystem and is a tremendous ecological value.

What do Oyster Gardeners do?

Oyster Gardening is an easy, fun way to take an active role in restoration projects. The primary responsibility of a Gardener is to keep the oyster gardens clear of predators (see oyster predator section) and to make sure water can flow through the garden by limiting algae and mud accumulation. It takes about 45 minutes every 7-10 days during the 6 month season.

Can we eat the oysters we grow?

There is no allowable consumption of oysters grown in the Mississippi or Alabama oyster gardening programs. Oysters are well known for their edibility; however, the oysters grown in a gardening program are strictly for restoration. These oysters have important work to accomplish while in the gardens as well as on the reefs. As such, no consumption is permitted under any circumstances.

Why oysters? *Oysters as Food*

Oysters are a popular and familiar resource along our coasts. Simply put, we love to eat them. The first oysters are traced to the Triassic period, more than 200 million years ago (Oyster Company of Virginia, 2016). Globally there are more than 100 known oyster species, however the Eastern oyster (*Crassostrea virginica*) is the only commercially important oyster species in the Gulf of Mexico (Wallace, 2002).

Wild oyster reefs in Mississippi are periodically opened for harvest then closed again once a specific quota is reached. This assures the reefs have the opportunity to repopulate. Oyster Gardening oysters are planted onto restoration reefs, which are not opened to harvest. Farm raised oysters are a growing trend along the Northern Gulf of Mexico and are completely sustainable. Farms generally focus on a premium half-shell market, where as wild harvest oysters are typically shucked in large quantities and sold in pints and gallons. Alabama estimates fifteen individual farms growing oysters in an off-bottom setting using a variety of gear options. Revenues range

from $500,000 to $1,000,000 annually. Most of the farm production leaves the state for larger markets around the country. Mississippi has recently begun the process of developing premium oyster farming.

Why oysters? *Oysters in the Environment*

Globally, more than 80% of oyster reefs have reportedly been lost to several causes (Kroeger, 2012). There are several oyster restoration projects that are ongoing in the Gulf of Mexico region. Their individual objectives include education/gardening programs, shell planting, shoreline stabilization, and habitat restoration. The aggregations of these begin to reveal the variety of roles oysters and oyster reefs play in an estuarine environment. Collectively, these are referred to as ecosystem services; and we are only beginning to fully understand the value. In terms of dollars, Kroeger (2012) estimates an acre of reef is valued at $19,376.11. This includes habitat value, impact on recreational and commercial fishing, and water quality improvement (nitrogen sequestration, etc.). Ecosystem services provided by oysters are realized in both restoration and farm applications and are generally broken into three categories.

- Filtration
    - An adult oyster can pump up to 5 gallons of water each hour (Wallace, 2002).
    - Oysters feed on phytoplankton which range in size, generally to 0.00004 inches helping to clear water, increase sunlight and stimulate sea grass growth (National Oceanic and Atmospheric Administration, 2016)
    - Filtered particles not used as food are packaged as 'pseudofeces' and expelled from the shell where they sink and can be used by the benthic communities.
    - Water quality improvement (*nitrogen*): Oysters sequester nitrogen at a rate estimated to range between 47.8 and 709 pounds per acre per year. Nitrogen is a problem in coastal environments often originating as fertilizer from homes and agricultural sources within the watershed and can lead to 'dead zones.' (Kroeger, 2012)

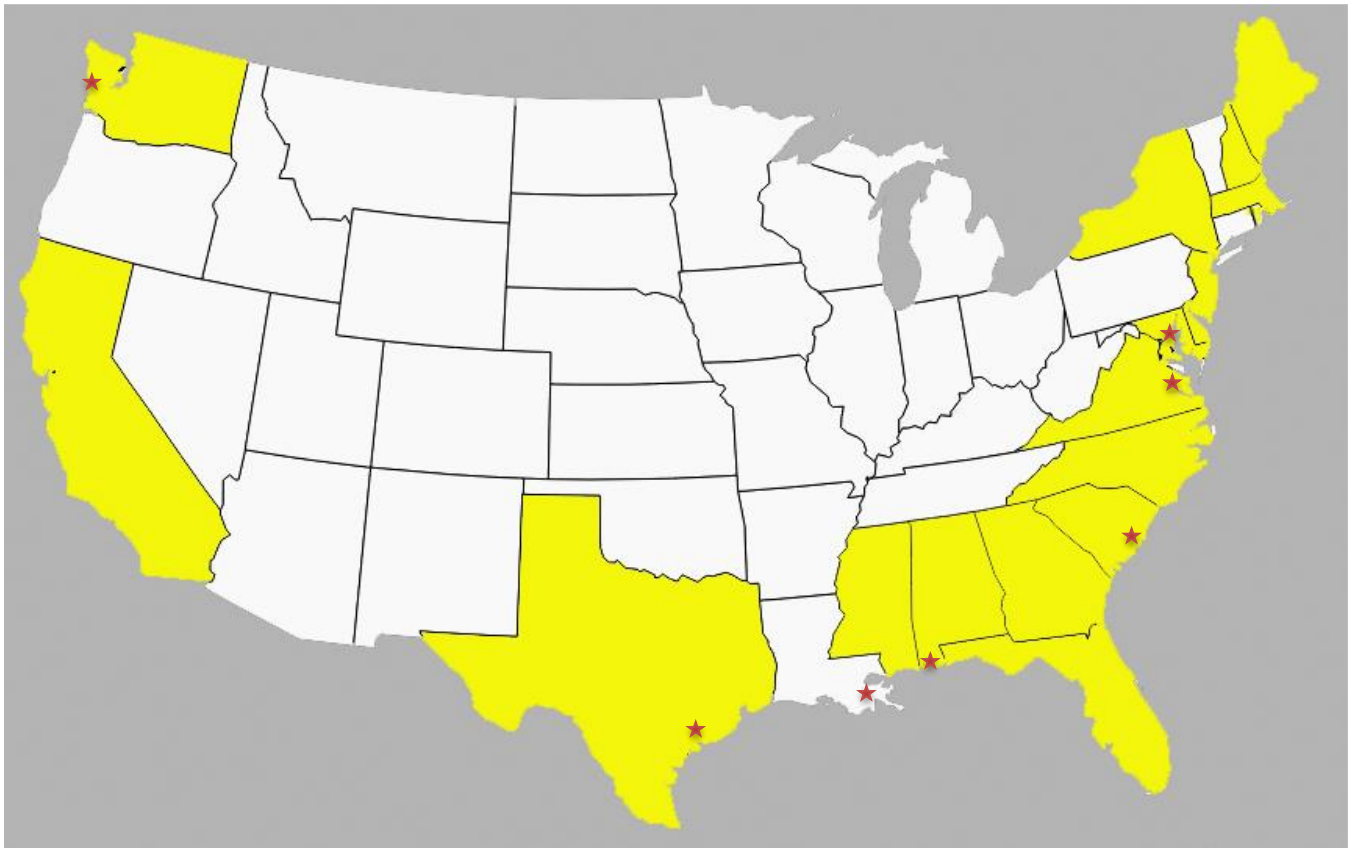
- Habitat
    - More than 300 species of invertebrates and vertebrates use oyster reefs at some point in their lifecycles (Wallace, 2002).
    - Reefs have been shown to increase abundance and production of fish that utilize reefs (Kroeger, 2012).

- Erosion
    - Oyster reefs are a breakwater, offering protection to the shoreline. Low energy zones shoreward of oyster reefs help facilitate sea grass development which further reduces erosion along the shore (Kroeger, 2012).

Other oyster restorative projects

The Chesapeake Bay region (Maryland and Virginia) is credited with the first oyster gardening program. Historically, the bay had enormous populations of oysters. It is estimated when settlers arrived from Europe in the 1600s; oysters were filtering the entire volume of the bay every week. The peak harvest of oysters from the Chesapeake was the late 19th century when an estimated 20 million bushels per year were taken (Oyster Company of Virginia, 2016).

This dramatic loss in wild oysters from historical highs is a leading motivation behind oyster gardening and other restoration programs. As awareness of the role of oysters in a healthy ecosystem grows, interest in being active in restoration intensifies as evidenced by the number of volunteer shellfish gardening programs in the US.



States which have or had active shellfish (oysters, clams, etc.) gardening programs for restoration.
★ *Indicates shell recycling programs in that state.*

Oyster restoration by gardening is well established and an effective method of demonstrating the role of oysters in an ecosystem. In many cases, these programs include a shell recycling component where individuals and restaurants can return shells used in culinary applications ***NOT OYSTER GARDENING OYSTERS***. These programs recognize the value of oyster shell as habitat for estuarine systems in addition to being the preferred settlement material for larval oysters. Used shell should be allowed to season (~6 months) prior to being returned to the water.

Citations

Kroeger, T. (2012), Dollars and Sense: Economic Benefits and Impacts from two Oyster Reef Restoration Projects in the Northern Gulf of Mexico. *The Nature Conservancy*.

National Oceanic and Atmospheric Administration (2016). *Oysters*. http://chesapeakebay.noaa.gov/fish-facts/oysters

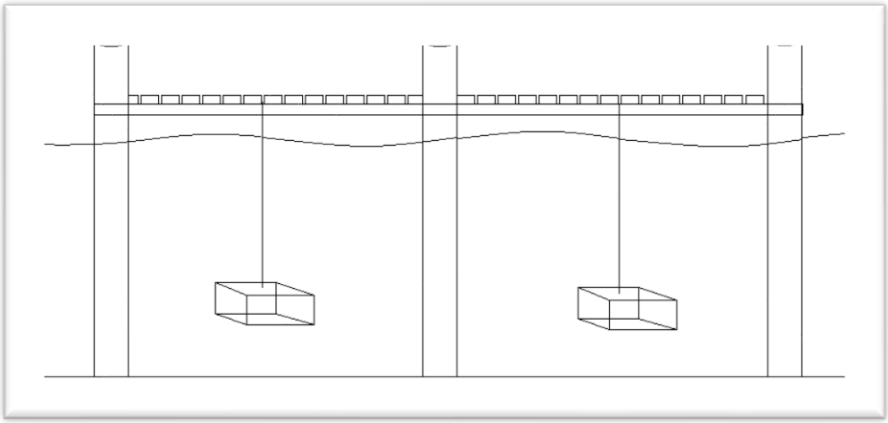
Oyster Company of Virginia (2016). *Our World is Your Virginia Oyster-Oyster History*. http://www.oysterva.com/oyster-history.html

Wallace, R. K. (2002). *Oysters in Alabama*. Alabama Cooperative Extension System (ANR -832); Mississippi- Alabama Sea Grant Publication (MASGP-02-2012).

Oyster Gardens:

How do I install the gardens?

The main theme behind installation of oyster gardens is preventing them from touching anything. Specifically, we do not want them sitting on the bottom, close enough to bang into or resting against a piling or another garden. By having the gardens 'in space' we can greatly reduce access by predators (see predator section).



Proper installation. Note the gardens are off of the bottom, between pilings and separated from one another.

Fouling Control

Keeping the gardens clean is directly related to how well the oysters do. If the mesh is clear, plenty of food and oxygen will reach the oysters allowing them to grow well during the gardening period. Conversely, if the mesh clogs with algae, mud or other debris, the oysters will stunt, and in severely clogged gardens the oysters will die. There are several techniques we recommend for keeping the gardens clean including desiccation, hose/brush/pressure washing and rotational gardening. In most cases, a combination of these techniques can be used every 7-10 days to limit the hassle of maintaining the gardens. These techniques generally take about 45 minutes to complete.

The newsletter will provide guidance and recommendations when more rigorous techniques (read pressure washer) can be used if desired. Early in the season, gentle rinsing should be sufficient along with rotational gardening. The objective is to clean the garden mesh rather than the oysters themselves. Small oysters are delicate and can be destroyed by overly aggressive cleaning.

Rotational Gardening

Each site will receive four oyster gardens and one bag of 100 spat set shells. At the end of the season, approximately 25 set shells will fill 50-100% of a single garden depending on growing conditions. Early in the season however, a Gardener can opt to place half of their set shells in each of two gardens. After 7-10 days, they can *rotate* the set shells to the two unused gardens and return them to the water. The two gardens rotated out of the water can then be left in direct sunlight to dry up any mud, algae and barnacle set that may have accumulated during the first rotation. Additionally, they can safely be subjected to more aggressive cleaning as needed. This process can be repeated until such time as the oysters require additional space. This technique can often be used for as much as the first half of a gardening season.

Predators

Next to excessive fouling, the biggest threat to oyster gardening oysters is predation. The two major predator types of the oysters in your gardens include crabs (blue and stone) and a predatory snail we call a drill. Most likely, the term drill is used to refer to several potential species including crown conch as well as the true oyster drill. Regardless of which species it is, you do not want them in or on your oyster gardens. Proper installation of oyster gardens (off bottom and between pilings) will limit access to drills which do not swim.

Both blue crabs and stone crabs can significantly reduce the number of oysters in a garden. They seek shelter in the garden when they are small. Once in, they feed and grow quickly to a point where they cannot get out. While cleaning your gardens directly or rotating your set shell to clean gardens, take a second to remove any blue crabs or stone crabs you find. Note, small mud crabs, though present, are not a problem in oyster gardens.

Other predators of oysters include fish (Black Drum), worms (Oyster Flatworm) and rays. These however are not likely to be significant predators of your oysters.

Predator Identification

Blue Crab

Can you find the juvenile blue crab in this photo? They can be hard to find, but it is important to remove crabs like this from your gardens.

Blue crabs will enter a garden when small and grow too large to escape. They range in size up to five inches if allowed to remain in a garden for a complete season. They also blend in well with the set shell, so take care when handling your oysters.

Stone Crab

Brownish in color, these crabs are most recognized by their large crushing claw. The clump oysters grown in the gardening program are more difficult for predators to access. If a crab more than two inches across the shell is found inside a garden it should be removed.

Stone crabs have one claw for holding and one for crushing.

Oyster Drill

Oyster drills are a significant predator and should be removed from a garden if found. There are several predators of oysters similar in shape to drills and will likely fall into that classification during our discussions. Regardless of the species, they can cause tremendous losses. The way to limit drills or other conchs is the proper installation of a garden. Drills cannot swim, but they do climb. Maintaining a garden off the bottom and between pilings can greatly reduce access.

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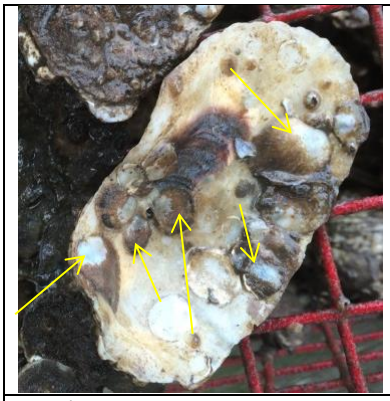
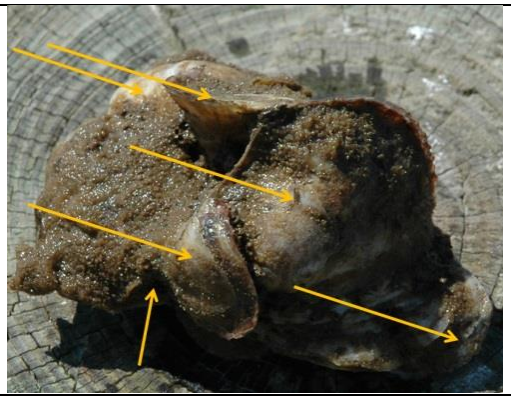
How do I know if my oysters are ok?

The good news is that your oysters are probably ok. Every season someone will pull their gardens out to dry in the shade and forget to put them back in the water for a couple of hours. So long as they were in the shade and not very young (>4 weeks) they are probably fine. The following photos are of oyster gardening oysters that are doing well at that time of the season. If you are ever concerned, just let us know and we will make arrangements to come check them out.

		
June/July: Oysters are still relatively flat to the parent shell. (8-10 mm)	August/September: Oysters on a parent shell. Some fouling is expected.	October/November Oysters have formed a nice clump similar to wild oyster reefs. (2-4 in)

Newsletter

The program newsletter is a monthly communication between the program and volunteers, interested parties and partners. It is a primary communication route for the program. Major announcements found in the newsletter include:

- oyster delivery
- oyster pickup
- recommendations for garden maintenance
- tour opportunities

In addition to program announcements, the newsletter will contain a growth graph during the season. This is the tracking system of oyster growth by geographic area. You will be able to determine how your oysters are performing compared to those in your area and program wide. If you would like to include your oyster measurements, please let us know.

We prefer electronic delivery of the newsletter and we request Gardeners let the program know if email addresses change.

Safety (what to do with storms, heat, etc.)

The first priority for all Gardeners involved with the program is safety. Children should be supervised at all times while working with the gardens. It is recommended that anyone who may handle the gardens or oysters wears gloves and closed toed shoes. Care should be taken when lifting gardens for cleaning, observations or other reasons. The gardens can be heavy, so seek assistance when necessary. Take precautions when handling gardens near the edges of your pier or other structure. Avoid working with your gardens during inclement weather. If you can hear thunder or see lightening, you should leave your gardening site immediately. Be aware of the risk of heat related illness, particularly in the summer months. Work in the shade, early morning or late evening- avoiding the hottest times of the day. In the event of hurricanes, or other strong storms, your first priority is the safety of yourself and your family. If it does not feel right, or you are unsure of anything STOP and contact us.

Volunteer log

At the conclusion of each season, a volunteer log will be sent to each gardening site. It is extremely important to complete and return this log to the program. This is one of our evaluation tools of the program and only the time on these logs may be counted. In addition to evaluation of the program, these data are used in grant writing for program funding. Throughout the season, we ask that you keep track of how often you are checking your gardens and how much time this is taking.

Evaluation criteria

The program is evaluated in a number of ways using a variety of metrics. Some of these evaluations are conducted by program personnel and include the number of gardening sites, number of gardeners, number of oysters planted, acres and dollar value of acres planted. Other metrics rely on gardeners for input including volunteer logs (we really do use them), as well as feedback from participants on the program itself. Some of the feedback may be solicited (survey, etc.), however in many cases the most valuable feedback received is unprompted. Emails and phone calls from participants communicating what works, or what does not work are invaluable. Some of the best changes (rotational gardening) were generated by active gardening sites.

Copy of MS permit

The Mississippi Oyster Gardening Program operates in partnership with the MS Department of Marine Resources. DMR issues an annual permit to MSOGP which allows the program and its volunteers to possess oysters which are undersized as well as housed (gardened) in waters that are classified as restricted or prohibited. The following permit is required to be in possession of each gardening site and produced on demand by an identified enforcement officer of the MS DMR. This permit only allows the holder to possess oysters for use within the MSOGP which are not to be consumed and must be returned to the program at the conclusion of each season. All returned oysters will be collected by the program and planted on restoration sites approved by MSDMR.