

Oyster Gardening

FOR RESTORATION & EDUCATION

BY WILLIAM GOLDSBOROUGH AND DONALD MERITT

The Chesapeake Bay Foundation's OYSTER GARDENING PROGRAM is a cooperative effort of the Oyster Alliance, which includes the Maryland Sea Grant Extension Program, the University of Maryland Center for Environmental Science and the Oyster Recovery Partnership. The Oyster Alliance offers participants an opportunity to grow oysters, a key species in Chesapeake Bay; to learn about the complex ecology of the Bay system; and to play a hands-on role in oyster restoration in Maryland.

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This publication outlines what you need to know to participate in the Oyster Gardening Program. It will provide you with basic information on setting up and maintaining your oysters under the best possible conditions for your location. The program brings together scientists and citizens to help enhance the Chesapeake Bay system's stressed oyster populations. As a participating oyster gardener, you will be asked to adhere to the guidelines outlined here. They will help ensure that your oyster garden is successful, thereby enabling you to make a meaningful contribution to the Bay-wide oyster restoration effort.

Getting Started

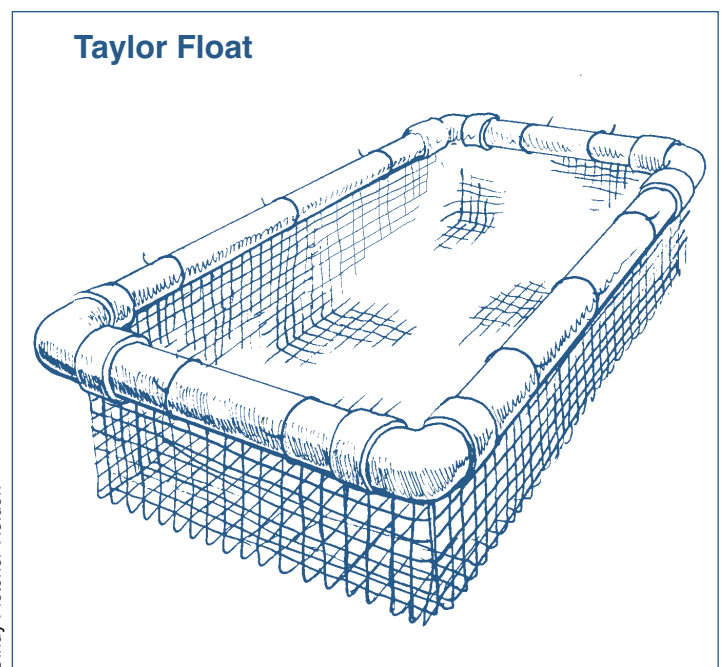
The Oyster Gardening Program allows you to grow oysters near the surface of the water. This affords them excellent exposure to oxygen and phytoplankton (their food source), and helps produce big, healthy mature oysters for Chesapeake Bay restoration. The structure of the garden also affords some protection from predators that can feed on young oysters. After several months in this environment, oysters should be ready for planting on sanctuary reefs.

In this program, you have your choice of two types of gardens in which to grow your oysters: either a Taylor float, or a set of four wire mesh cages. The best choice for you will depend on your location, dock facility and personal preference. Below is a description of each type of oyster garden and the circumstances under which it works best.

Taylor Float

A Taylor float is made from a rectangular frame of PVC pipe for floatation, with a wire mesh basket suspended from it. The float measures about 3 feet x 5 feet and is one foot deep. The float can be secured to your dock the same way you would tie up a small dinghy (see Deploying Oyster Seed). The advantage of this type of oyster garden is that the float is at the surface of the water, so your oysters are always

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at the top of the water column. This positioning allows them maximum exposure to oxygen and plankton. Another advantage of keeping your oysters very close to the surface is that you can readily observe some of the underwater activity of fish and other organisms that will be drawn to your garden. Still another advantage is that wave action at the surface may help keep the oysters clean.

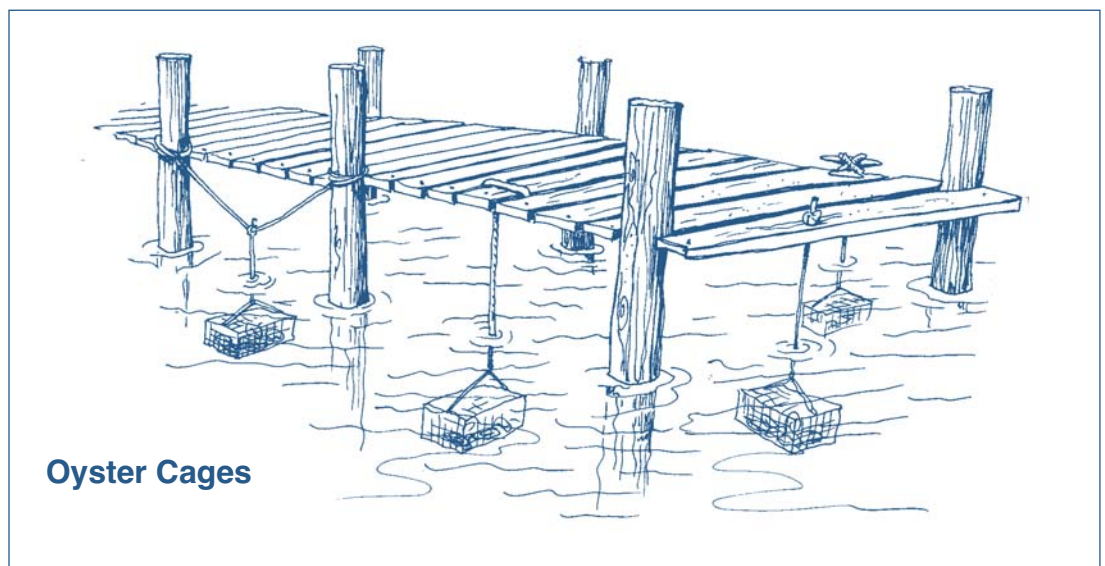
The major drawback to a Taylor float is its weight. While you will start out with some 70 pounds of oysters and shell, the weight of oysters can increase considerably in a good growing year. Because you will need to get the float and oysters out of the water periodically (see Care and Maintenance of Oysters), this can present a problem. Floats can be lifted onto the dock, or moved onto a beach, mud flat or marsh at high tide. Taylor floats work well if you have such an area nearby, or if you have a low or floating dock. They work best in low wave-energy areas. In high wave-energy areas, Taylor floats have the potential to bang against pilings and crack. Once cracked, the PVC flotation will take on water and sink.

Oyster Cages

Oyster cage gardens consist of four wire mesh boxes, each measuring 1.5 feet x 1 foot x 1 foot. These cages should hang from your dock so the oysters sit about one foot below the water surface at low tide (see Deploying Oyster Seed). The main advantage of this type of garden is that it divides the weight of your oysters into four smaller, easy-to-manage parcels. For this reason, oyster cages work well if your dock sits high above the water surface, or if you feel it may be difficult to lift a Taylor float out of the water.

Oyster cages are also durable in high wave-energy areas. There is no floatation to crack if the garden bumps up against pilings. Their location below the water surface also helps dampen the effect of surface wave energy on the cages. This type of garden is recommended for higher wave-energy areas.

One disadvantage of oyster cages is that they are tied off at a set height, and therefore do not rise and fall with the tide. **In the wintertime, it is absolutely essential that your cages remain under water!** This is because oysters exposed to freezing air temperatures may die. (Oysters are fine if they are in water, even if they freeze into a solid block of ice). We therefore recommend that you lower your cages



Oyster Cages



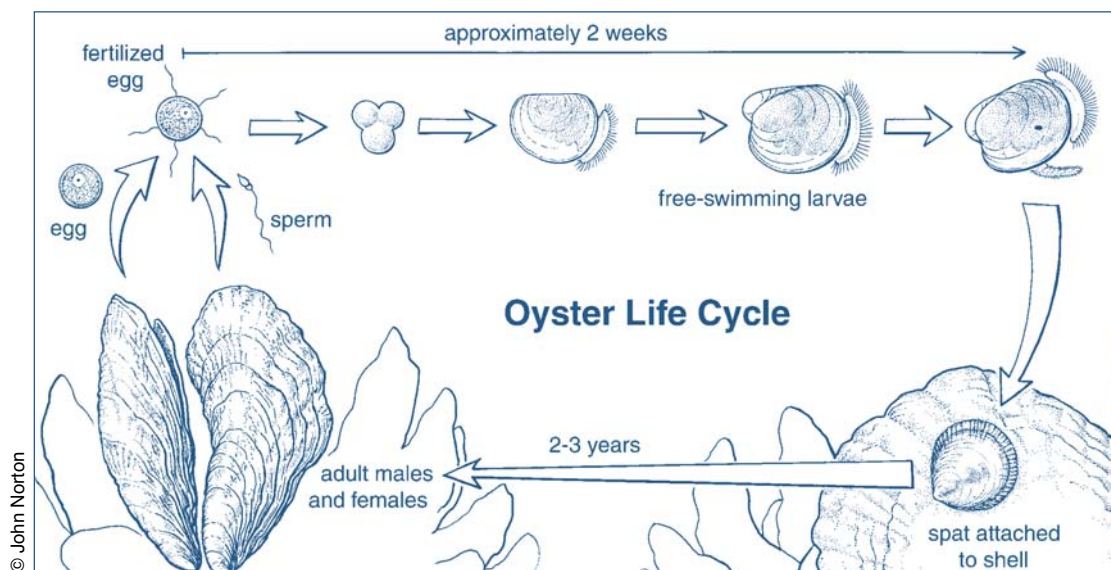
to just above the Bay bottom late in the fall, and leave them there until all risk of freezing air temperatures has passed. If winter storms and tides combine to create unusually low water depths in your creek, oysters will remain underwater. However, if you have a floating dock that goes up and down with the tide, you can tie your cages so the oysters always sit a few inches below the surface. (For more on this, see Deploying Oyster Seed).

Oyster Seed

As a participant in the program, you will start with young oysters, called “seed” or “spat,” that have been spawned and reared in a hatchery. After oysters are spawned they first go through a free-swimming larval phase and then reach a stage when they must attach to a hard substrate, usually another oyster or shell. In hatcheries, old, whole oyster shells are often used as the hard substrate (called “cultch”) on which the larvae are “set.” Several spat may set on each oyster shell. This arrangement, where larvae set onto oyster shell, is called “cultched” seed. Alternatively, “cultchless” seed can be produced by allowing larvae to set on tiny fragments of sand or shell. Cultched seed is used in the oyster gardening program because it more closely replicates oysters as they are found in nature.

In producing cultched seed (also called spat-on-shell) in the hatchery, old oyster shell is first dried out on land in order to remove organic material that could degrade water quality in the setting tanks. Shell is placed in plastic mesh bags and stacked in tanks. River water is then added and heated to temperatures that will enhance the setting of the free-swimming larval oysters. Millions of hatchery-produced larvae are then released into the tank. Once the larvae have attached themselves, metamorphosed and set, they are referred to as spat. The spat-on-shell are generally kept in the tanks for several days, then removed to a nursery area where tides and currents provide the water exchange necessary for growth and survival.

Although cultched oysters can exhibit rapid growth, sometimes reaching 25 mm (one inch) in two to three months after settlement, growth is extremely variable and depends on many interacting factors, especially salinity, temperature, food availability and water quality. Data that you collect about your oyster garden will provide valuable insight for oyster restoration projects.





Deploying Oyster Seed

You will start off with two mesh bags of spat-on-shell for your garden. Distribute seed as follows:

Taylor Float. Deploy your float. Cut open each mesh bag of spat. Spread the oysters out evenly in the bottom of the float. Discard the mesh bags.

Oyster Cages. Cut open each mesh bag of spat. Divide the spat evenly among all four cages. Deploy cages horizontally. Discard the mesh bags.

When Spat Are Small

Occasionally oyster gardeners will receive spat-on-shell that are less than 1/4 inch. These spat should remain in the mesh bags for one to two weeks after you receive them, which will help protect the young oysters from predation. If you receive spat less than 1/4 inch, please follow these instructions:

Taylor Float. Set both mesh bags in your Taylor float, and leave them there for one to two weeks. At that time, cut open the bags, spread the seed out in your float, and discard the bags.

Oyster Cages. Place one whole bag of spat in each of two cages (leave the other two cages ashore for the time being). Deploy the two cages that have spat in them, and leave them in the water for one to two weeks. At that time, cut open the mesh bags, divide the spat equally among all four cages, discard the bags, and deploy all four cages.

Do not leave the spat in the mesh bags too long, or they could begin to grow through the mesh making them difficult to remove. In addition, spat left in the bags too long may suffer high losses due to predation from flat worms (see Controlling Oyster Predators).

Placing and Securing Your Oyster Garden

The location of your oyster garden is important: since oysters grow best when they are located in areas with maximum water flow around them, place your garden where tidal flow is good. Securing the garden underneath your dock will shade it, and help reduce algal growth. Throughout the winter, keep an eye on your garden to make sure it is secure. Ice flows can cut the lines to oyster gardens, while increased wind and wave energy can cause the lines to chafe. You may want to use heavy line, double up the lines, or run lines through a section of old garden hose to prevent chafing and breakage.

Every dock site is different, because of tides, currents, salinity, water depth and dock facilities. Experience will be your best guide for determining exactly how to set up a garden at your site. A few suggestions follow.

Taylor Float

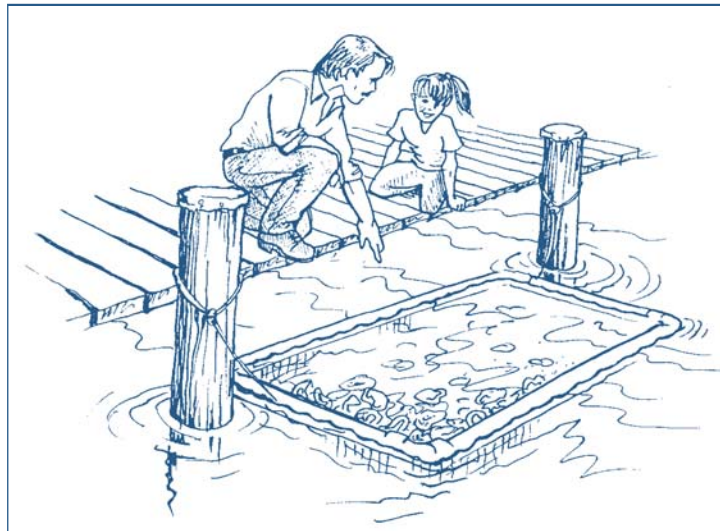
Tie the Taylor float to your dock the way you would tie up a small skiff or dinghy. That is, make sure there is enough slack in the lines so it can rise up and down with the tide, but not so much slack that the float bangs against pilings.

Banging can cause oysters to close up and stop feeding, and may damage your float. It is helpful to use two lines to tie the float between two pilings to prevent this from occurring.

Your float and oysters will not be hurt if the water freezes around them in the wintertime. **Oysters will die if they freeze *in air*, but not if they freeze *in water*.** For this reason it is essen-

tial that your float is not exposed to air by extremely low tides or storms.

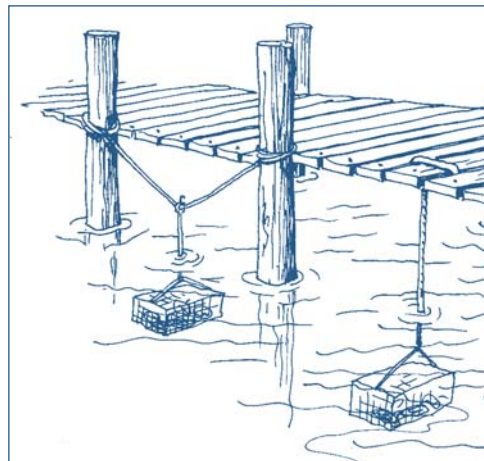
Consider moving your float to a deeper area on your dock for the winter or even to a neighbor's dock if necessary. If strong ice flows threaten your float, you can slice the cable ties and let the basket of oysters remain on the bottom until spring when it can be lifted and re-secured to the float frame.



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Oyster Cages

Oyster cages are usually hung horizontally to give the oysters plenty of room and to maximize their growth rates. They should be tied off so the oysters sit about one foot below the surface of the water at low tide. Remember that your cages are one foot deep, and the oysters sit at the bottom of them. The top of the cage may be exposed during low tides. The objective is to keep cages as high up in the water column as possible (where the supply of plankton and oxygen is plentiful), without risking exposure to freezing air temperatures.



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In wintertime, we strongly recommended that you lower your cages to just above the bay bottom to ensure that they are never exposed to freezing air temperatures during extreme low tides or storms. **Oysters exposed to freezing air temperatures will die, but they are fine *in water*, even if they are completely encased in ice.** For this reason it is essential that oysters remain underwater whenever there is a chance of freezing air temperatures. You may want to consider moving your cages to a deeper area of your dock or even to a neighbor's dock for the winter if there is any chance of the water depth at your dock falling below the one-foot level. During the warmer months, you can raise your cages up closer to the water surface. Oysters will benefit from drying out a bit when exposed to air during the occasional extremely-low tides once all risk of freezing has passed (see Care and Maintenance of Oyster Garden). Just make sure they are not exposed to hot, direct sunlight for longer than three or four hours.



Cages can be secured to the dock in any number of ways. Each cage can be suspended between two pilings or hung by tying a line around a plank on your dock. Some gardeners drill small holes through four dock planks and thread one cage line through each hole. Knots can be tied in the top ends of the lines so they can't fall back down through the holes. Your securing system will depend on your dock site. The important point here is to make sure the cages do not bang against pilings — banging can cause oysters to close up and stop feeding.

Organisms Associated with Oyster Habitats

Oysters are the building blocks of the hard substrate benthic (bottom) community. Over time, you should begin to see many organisms that are common to natural oyster bars, such as barnacles, mussels, bryozans, and worms. While some are predators of oyster spat, most of these organisms are not a threat to oyster survival. Mussels, for example, may compete with oysters for food while barnacles do not generally cause any serious problems unless the barnacles are extremely abundant. (This is because barnacles feed on a different component of plankton.) Other organisms such as filamentous algae and sea squirts can cause problems when they grow too heavily on oysters.

You will also find several kinds of fish and crabs that concentrate around oysters. Some are simply feeding on associated organisms, some are there for protection themselves, and some are there to lay eggs and use oyster shell as a nursery for producing their young. The diversity of plants and animals found on oyster bars illustrates the important habitat role oysters play in the Bay system.

Oyster Bar

- | | |
|-------------------|----------------|
| 1. Oyster spat | 6. Sea anemone |
| 2. Skilletfish | 7. Barnacles |
| 3. Hooked mussels | 8. Fan worms |
| 4. Whip mud worms | 9. Mud crab |
| 5. Sea squirts | |





Care and Maintenance of Oyster Gardens

To ensure the most efficient growth of oysters, you will need to do three things:

- Keep your garden clear of fouling organisms such as barnacles, mussels and algae;
- Remove heavy loads of sediment and oyster feces that collect in your garden;
- Do your best to exclude predators such as flat worms which can feed voraciously on young oysters.

You can best accomplish all of these objectives by periodically pulling your garden up onto the dock or shore and letting it dry out. Shading your garden by tying it up under a dock can also help reduce fouling. If you have a Taylor float, you can also consider making a simple, lightweight cover to reduce direct sunlight. The following expands on steps you can take to optimize the growth and survival of your oysters.

Control of Fouling Organisms

The best way to control fouling organisms is to periodically pull your garden out of the water and let it dry out (a process called “desiccation”). Keep your cages or float out for only three or four hours if they are in direct sunlight. This is long enough to kill most unwanted organisms and will not harm your oysters. On cloudy and cool or rainy days, you can leave them out for up to 24 hours. Experience will be your best guide in determining how often to clean your garden. Each site is different, so each garden will require a different desiccation schedule. On average, oyster gardens usually need to be desiccated about once every two weeks during warm months. If you notice a buildup of algae, or if you see flatworms, you may need to clean the garden more frequently; if your garden appears clean and free of predators, you may not need to clean it as often. *Remember: freezing air temperatures can kill oysters.* Do not remove your garden from the water if the air temperature is at or below freezing. (Oyster gardens should not need to be cleaned in the winter months, except for occasional shaking or moving around of the oysters to dislodge any sediment).

To lighten the Taylor float enough so that you can pull it out of the water for cleaning or desiccation, it may be easiest to reach down and remove most of the oysters first. You can do this either from the dock, or by approaching the float in a dinghy, or even by wading out to the float. Place the oysters you remove in a bushel basket or bucket on the dock. Once you have removed most of the oysters,

A Word on Algae...

Filamentous algae are one of the most persistent fouling organisms. They do not harm oysters directly, but they can make handling your garden difficult and impede your ability to observe the growth of spat. They can also restrict the flow of water (hence food and oxygen) around oysters. The best way to control such algae is to make sure they do not get started. As soon as you detect algae in or on cages, begin a regular desiccation schedule. Tying your garden under a dock, or on the shady side, will help control algae growth.



the float should be light enough to pull up onto the dock. Also keep this strategy in mind when it comes time to return your oysters for planting. Oyster cages should be light enough to be pulled up onto the dock without removing oysters first.

Because of unusually rapid growth, or neglect, you may get to a point where you actually need to scrub your garden with a hard-bristle brush, paint scraper or garden hoe. A high-pressure hose may also be helpful for cleaning the cages or float (use a low setting). You do not have to scrub fouling organisms off the oysters themselves, unless growth is so heavy that it could impede the oysters from opening to feed. Just clean organisms from the garden structure to allow for maximum water flow around your oysters. Remember, it really pays to keep ahead of this unwanted growth — just ask anyone who has spent a Saturday scraping barnacles with a garden hoe!

Cleaning Your Garden

The structure of your oyster garden, and the oyster shells themselves, can trap sediment, which can result in decreased water flow and hence slower growth of oysters. In addition, the filtering activity of oysters will remove suspended algae and sediment from the water. The sediment particles are released as “pseudofeces,” and, along with waste products, are deposited into the garden. Because build-up of these particles can also restrict water flow to oysters and result in anoxic (lack of oxygen) conditions, keeping your garden clean is vital.

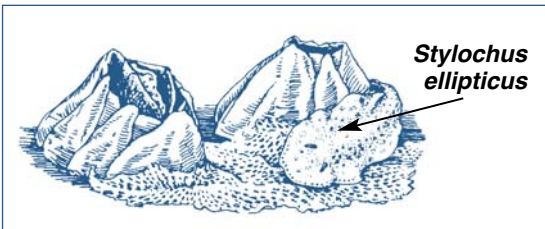
The best way to clean these particles from cages is to either rinse them with a garden hose (fresh water will not hurt oysters), or pull the line rapidly up and down to rinse them in bay water. Do this as often as possible — at least once every two weeks is best. In fact, it is a great idea to tug up and down on the lines to your garden every time you walk down your dock. Encourage friends and family members to pull them up, look at them, shake them, rinse them — the more the better!

If you're not careful, oysters can grow into the wire mesh of your cages. Unfortunately, removing ingrown oysters usually results in their destruction. To prevent this situation, move the oysters around in your garden often. Gently shaking or tumbling oyster cages works well. Taylor floats can be lifted at one end so the oysters all move to the low end; the oysters can then be rearranged to balance the float. If the float is too heavy to lift, try spreading them around in the float using a garden hoe or long-handled shovel.

When cleaning your garden, do not remove any dead oysters. They will need to be counted when collecting data; in addition, the shells will also provide habitat, both in your garden and when the oysters are ultimately planted on a reef.

Controlling Oyster Predators

The structure of your oyster garden will help to exclude many predatory organisms that would normally eat your oysters. Several species of crabs, fish and other animals may feed on oysters at different stages in their life cycle. The wire mesh of your garden will limit most of the major problems with predation with one exception, the oyster flatworm, *Stylochus ellipticus*. Flatworms can have a devastating impact on young oysters, spreading via a planktonic larval form, that can easily slip into any garden. They reproduce throughout the summer in Maryland, and one of their favorite foods is oyster spat. A heavy flatworm infestation could result in over 90 percent mortality of your spat in a couple of weeks. Therefore it is important



that you monitor your cages regularly for flatworm presence. Fortunately, flatworms can be controlled via desiccation, so a regular schedule of desiccation to control other fouling is also likely to control flatworm populations. You will see many species of worms in your garden which are harmless. Any organisms that look like normal worms (that is, long, thin, often segmented worms) will not harm your oysters.

Flatworms are disk-shaped, generally smaller and thinner than a quarter, and usually grayish or flesh colored. If you see many flatworms on your oysters, consider going to a more regular schedule of desiccation preceded by hosing down with fresh water.

Blue crabs should be removed from your garden whenever they are noticed. While blue crabs should not cause major mortalities in your garden, a confined blue crab will eat what is available to it, and in most cases this will be your oysters. Removing any blue crabs when you see them should alleviate the potential problem. You may see many small, brown mud crabs in your garden — these are not harmful to your oysters.

It is not likely that most other oyster predators will cause problems in your garden. One advantage to spat-on-shell is that they are generally more predator-resistant than cultchless oysters. The shell to which they are attached acts as protection for the spat until they reach a size where predation is more difficult.

Collecting Data on Your Oysters

In addition to the satisfaction of growing oyster seed for restoration efforts, you can make another contribution by collecting data on your oysters, which we ask you to do at least twice a year, in November and April. You should select 50 oysters at random and measure them with the metric ruler provided. Please take all measurements in millimeters. You should also do a simple count of the number of live versus dead oysters *from this set of fifty*.

Data from these measurements will be submitted to a central location where they will be incorporated into data from all other oyster gardening sites within the state. Data sheets should be sent to you via mail or e-mail. You can also print them from the oyster gardening web page, www.savethebay.org/oysters. On the same web page you'll find a link to the Maryland Sea Grant web site, where you can view compiled oyster gardening data on growth and survival rates in your river and Bay wide, www.mdsg.umd.edu/oysters/garden/index.html.

Oyster Diseases and Their Impact on Oysters

Oysters in the Chesapeake Bay and other waters in the mid-Atlantic have been severely impacted by parasitic disease, in particular Dermo (*Perkinsus marinus*) and MSX (*Haplosporidium nelsoni*). Even with good natural sets of oysters in the Bay, many oysters do not survive the three years it generally takes to reach harvest size.

Oysters infected with the parasite that causes Dermo eventually become weakened and die — this may not occur until the second or third year of growth. When the oyster dies, its tissue rots and the infective stages of the parasite are released into the water. Nearby oysters can ingest these spores through their filtering activity and become infected; this usually happens during the late summer or early fall in our region. The mode of transmission for MSX is still not fully understood, though its virulence is controlled to some extent by lower salinity (usually below 15 parts per thousand).

While spat produced in hatcheries for the oyster gardening program will be initially free of disease, these oysters can eventually contract Dermo and, in high salinity regions, MSX. However, even if there are large losses in your garden, the survivors may be valuable for planting as future brood stock. These survivors potentially have a natural tolerance for disease, which could be passed on to their progeny. So



please return your oysters to the Chesapeake Bay Foundation for planting on sanctuary reefs, even if many of them are dead. CBF will make sure your oysters are placed on an appropriate reef so as not to spread disease.

Ongoing research efforts are attempting to breed oysters that are resistant to disease. As these superior strains become available, every effort will be made to distribute them to oyster gardeners in a way that will most benefit the overall restoration effort.

Your Oysters in Maryland's Restoration

Community-based oyster restoration programs are one important element in widespread efforts to restore populations devastated by overfishing, habitat destruction, land runoff, pollution, and oyster disease. While disease continues to pose major problems to oyster survival, scientific research on disease management and developing disease-resistant oyster stocks hold promise for future restoration programs.

The Chesapeake Bay was once home to the most bountiful oyster stocks in North America. While that bounty will not be restored quickly, the new restoration efforts on the part of citizens, private organizations and public agencies represent a commitment to a resource that was once thought to be unrecoverable.

As an oyster gardener, you will be doing your part for Maryland's oyster restoration effort. Each year, you will receive 2,000 to 4,000 hatchery-reared seed oysters. After a year's growth, the Chesapeake Bay Foundation will collect the oysters, and they will be planted on prepared sanctuary sites. Those oysters should eventually serve as broodstock for new generations of oysters. In this way, the oysters that you rear year after year will help contribute to sustainable oyster populations in the Chesapeake Bay ecosystem.

For Further Information

To learn more about the Oyster Alliance and oyster gardening for restoration and education, contact:

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Credits

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Oyster Gardening Calendar

Please understand that this schedule may vary due to natural conditions in the Bay

August/September/October

Keep your float or cages clean. This is a very heavy time for algae growth and oyster predators.

November

You should receive an Oyster Data Sheet via e-mail or post. Please fill it out and return it to Stephanie Reynolds at CBF (sreynolds@savethebay.cbf.org)

December/January /February/March

Oysters are dormant for the winter. They can freeze solidly in the water, and they will be fine; however, oysters exposed to freezing air temperatures may die. Make sure to lower cages to a few inches off the Bay bottom for the winter, to avoid all risk of exposure to freezing air temperatures. Check your garden often, as ice can cut the lines securing it.

April

Oysters begin to feed again when the water reaches about 36° F. Make sure you return to a regular desiccation schedule, but do not expose your oysters to freezing air temperatures. Please fill out another Oyster Data Sheet and return it to Stephanie Reynolds at CBF.

May

Late in the month, look for a schedule of Oyster Return Days on www.savethebay.org/oysters and in your mailbox.

June — Give Your Oysters to CBF!

Returning your oysters at this time of year saves you the labor of keeping them clean all summer.

July — Please Give Your Oysters to CBF!

If you have not returned your oysters, be sure to keep them clean. Look on www.savethebay.org/oysters or in your mailbox for a schedule of Spat Pick Up Days, when you can pick up spat and return your oysters.

August — CBF Must Have Your Oysters!

If you have not done so already, please return your oysters at any Spat Pick Up Day. **And Get New Spat!** Please e-mail or leave a phone message with Stephanie Reynolds several days in advance, indicating which Spat Pick Up Day you'll attend and how many oyster gardens you have. (A "garden" is one float or 4 cages.) That way we can be sure to have enough spat for everyone. Check www.savethebay.org/oysters and in your mailbox for the schedule of Spat Pick Up Days.



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