Oyster Gardening for Pumicestone Passage

Bribie Island Community Oyster Gardening Initiative

By Dr Ben Diggles and Carlo Sain

Thanks for your interest in Australia's first community oyster gardening initiative here on Bribie Island. Bribie forms the eastern shoreline of Pumicestone Passage, a valuable estuary and internationally significant wetland which is coming under ever increasing pressure from accelerating development in its catchments. Indeed, research has shown that over the past 150 years of European settlement the passage has suffered an almost complete loss of its once prolific subtidal shellfish reefs.

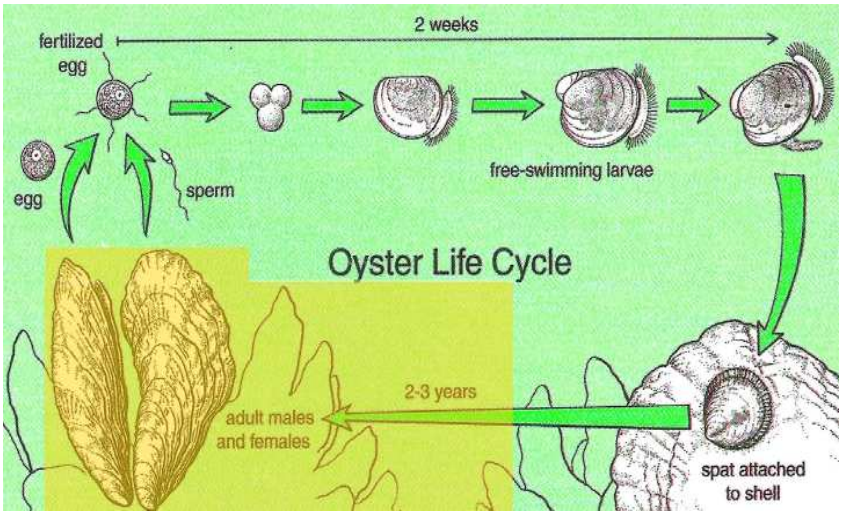
Subtidal reefs of shellfish (oysters, mussels etc.) are "the lungs" of healthy estuaries, providing various "ecosystem engineering" services including filtering to clean the water, nutrient uptake, shoreline stabilisation and food and shelter for fish and crabs. Worldwide around 85% of shellfish reefs have been lost, due to historic overfishing and habitat change bought about by coastal development. Due to their important ecological role in maintaining healthy estuaries, there is much interest in restoration of shellfish reefs overseas, and more recently in Australia (see www.shellfishrestoration.org.au). As part of this national initiative, Pumicestone Passage been identified as a priority area for restoration of subtidal shellfish reef habitat.

Oyster Bank, Moreton Bay, c. 1889

Why Pumicestone Passage ? Not only was it historically a prolific area for oyster reefs, there is also significant local community support for reef restoration from traditional owners, recreational fishing groups, Healthy Waterways and Catchments, the Moreton Bay Regional Council, Unity Water and many others (for more details, see www.restorepumicestonepassage.org). However, prior to scaling up restoration efforts, local sources of live shellfish must be re-established. To help do just that, thanks to funding from the Federal Government Landcare program and permissions from Fisheries Queensland, we have established Australia's first community based oyster gardening program in Bribie Island's residential canal systems. Our aim is to recruit local residents living on the water to help grow out shellfish obtained from local sources which will eventually be used for experimental trials restoring subtidal shellfish reefs. Our oyster gardening program brings together scientists, oyster farmers and the local community to help us begin the process of restoring the stressed and degraded ecosystem of Pumicestone Passage.

Getting Started- Registering as an Oyster Gardener

This leaflet has been designed to provide you with basic information on setting up and maintaining your oyster garden. The first step in the process is to register your details for the Queensland Fisheries Permit. The number of oyster gardeners is currently limited by law under the conditions of the Fisheries Permit and registered gardeners may only undertake oyster gardening activities at their place of residence. Each person who wishes to undertake oyster gardening will need to read and sign the registration form (Page 8) including providing your name, residential address where the oysters will be gardened, contact phone numbers and e-mail address.



The highlighted area shows the oyster life stages which are gardened. From Goldsborough and Meritt (2001), Maryland Sea Grant.

If the number of applicants exceeds the number allowed under the Fisheries Permit, a selection process will be undertaken which takes into account the location where a gardener lives within the Bribie canal systems (selected for scientific purposes), and the date which their first expression of interest was received. Successful applicants will receive a copy of the Fisheries Permit as well as an oyster gardening kit, including oysters. Unsuccessful applicants will be placed on a waiting list and will be advised when additional gardening positions become available.

As a registered oyster gardener, you will be required to adhere to the guidelines outlined here and on your permit. These guidelines have been developed to help ensure that your oyster garden will be successful, thereby helping you contribute to the wider shellfish reef restoration effort. Failure to adhere to these guidelines will risk revocation of your position on the permit and exclusion from the program.

Oyster Gardening Bags

Each registered oyster gardener will be supplied with 1 or 2 oyster gardening bags. These consist of polypropylene mesh bags measuring 60 x 30 x 25 cm. Each bag will be supplied with approximately 200 juvenile oysters and a numbered, colour coded identification tag with permit details on one side (including a warning - NOT FOR HUMAN CONSUMPTION). You will have to fill in your name and address (using pencil) on the other side. Bags with **blue** tags will contain only Sydney rock oysters, while bags with **green** tags will contain a mixture of Sydney rock oysters, leaf oysters and hairy mussels. After filling out the tag, relock it, use 2 or more zipties to secure the top of the bag and hang it from your pontoon so the oysters sit around 1 meter below the water surface. You can set them deeper if you like, provided the bag remains at least 30 cm (12 inches) off the bottom at low tide. Locating bags below the water surface keeps the oysters out of sight (discouraging

Oyster gardening bag with waterproof label

theft) and provides the oysters with maximum food availability while reducing sunlight and dampening the effect of surface wave energy on the bags. Securing the bags on the south side of your pontoon will shade them even further, helping to reduce algal growth. Oysters grow best when they are located in areas with maximum water flow around them, so try to place your garden where tidal flow is good.

Oyster gardening kits include oyster bags, colour coded waterproof labels, measuring calipers, gloves and an assortment of zip ties for re-closing or repairing the oyster bags.

Tips for Placing and Securing your Oyster Bags

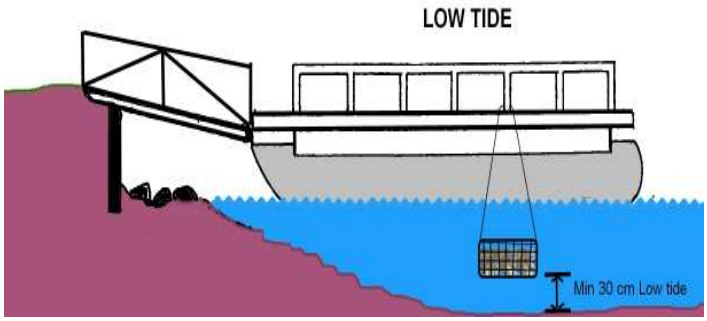
On some pontoons you may wish to use heavier line, double up the lines, or run lines through a section of old garden hose to prevent line chafing and breakage. Every pontoon site is different, because of tides, currents, salinity, water depth and so on. Experience will be your best guide for determining exactly how to set up a garden at your site. Some things worth keeping in mind include:

- Oyster bags are usually hung horizontally to give the oysters maximum room to grow
- Oysters that sit too close to bottom sediment may become stressed or infected by mudworms (spionid polychaetes)
- The objective is to keep cages in the upper/ middle water column where the supply of plankton and oxygen is plentiful without excessive exposure to mud.
- Oyster bags protect juvenile oysters from predators – ensure they are closed with 2 or more zipties before placing underwater!

Care and Maintenance of Oyster Gardens

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

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



Bags should be tied off so the oysters sit around 1 meter below the water and over 30 cm above the bottom at low tide.

You can best accomplish all of these objectives by giving your garden a regular shake to remove sediment whenever its convenient, and periodically pulling your garden up onto the pontoon, cleaning it with a stream of fresh or salt water (a spray of freshwater will not hurt your oysters), and then letting it dry out for 3 to 4 hours (dessication) in the shade. On cloudy and cool or rainy days in winter, you can leave them out for up to 12 hours, however this may kill associated fish like gobies and/or their eggs. Cleaning and drying out may be required once every 2-4 weeks, but experience will be your best guide in determining how often to clean your garden. If you notice a large buildup of algae, or if you see flatworms (see section on **Oyster "Associates"**) , 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.

Various types of algae are common in Moreton Bay today due to nutrient enriched runoff, septic leaks and disposal of sewage into local waterways. These algae do not harm oysters directly, but they are one of the most persistent fouling organisms which make handling your garden dirty and difficult. Algae also impedes the ability of oyster spat (juvenile oysters in the plankton) to settle and grow on your oyster shells, while buildup of algae can also restrict the flow of water (hence food and oxygen) around oysters.

The best way to control algae is to begin a regular cleaning schedule. Shading your garden by keeping it on the south side of the pontoon may also help reduce algal fouling. Heavy overgrowth by algae or other fouling organisms may require more direct action in the form of scrubbing your garden with a hard-bristle brush or water blaster (use a low setting). You don't 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 bag surface to allow for maximum water flow around your oysters.

Lyngbya is a toxic algae that occurs in Moreton Bay. To avoid contact with this and other nasties, always wear gloves when handling oysters and oyster cages.

Gardeners also need to be aware of another type of fouling organism called *Lyngbya*. This is a toxic cyanobacteria (blue green algae) that has become problematic in Moreton Bay since the 1990's due to environmental changes from catchment development. Direct exposure to *Lyngbya* toxins may cause skin irritation, so it's always important to wear the gloves provided in your oyster gardening kit whenever you handle your oyster bags or oysters (which have sharp edges and are homes to cranky crabs).

Oyster "Associates" - Organisms Associated with your Oysters

Oysters are the building blocks of the hard substrate benthic (bottom reef) food chain. Over time, you should begin to see many invertebrate organisms that are common to natural oyster reefs, such as crabs, shrimp, gastropods, mussels, tunicates, bryozans, and worms. While some associates are predators of oysters (like the flatworms pictured below), most are not a threat to oyster survival. Mussels are useful reef formers themselves while barnacles don't cause any problems unless they are extremely abundant because they feed on a different component of plankton.

Oyster associates include shrimps (above) and crabs (below)

Small fish (gobies, juvenile parrotfish and wrasses) may also make your oyster bag home and dead oyster shells are a favoured spawning substrate for some fish species which will deposit their eggs inside.

Flatworms (arrow and inset) are oyster predators which need to be removed.

If you find any fish in your oyster bags, try not to dry your bags out for too long as while most invertebrates such as crabs and shrimp can survive for many hours out of the water if kept moist, it doesn't take very long for small fish or fish eggs to dry out and die once they are removed from the water (this is why subtidal reefs are better for our local fisheries – they are much better nurseries for fish eggs!).

Small fish that call oysters home include blennies (top, inset) which lay eggs inside dead oysters (inset), and parrotfish (below).

Controlling Oyster Predators

The mesh structure of your oyster garden will help to exclude many organisms that would normally eat juvenile oysters, including natural predators like larger mud crabs, and certain fish species including snapper, bream, and oyster cracker dart. After all, protecting juvenile oysters is the whole idea of oyster gardening! However predatory flatworms can still enter the bags and can have a devastating impact on young oysters.

Heavy flatworm infestations can cause high mortalities over a period of weeks, so it is important to monitor your oysters closely for flatworms. Fortunately, flatworms can be controlled via drying out, so a regular schedule of desiccation to control other fouling is also likely to control flatworm populations.

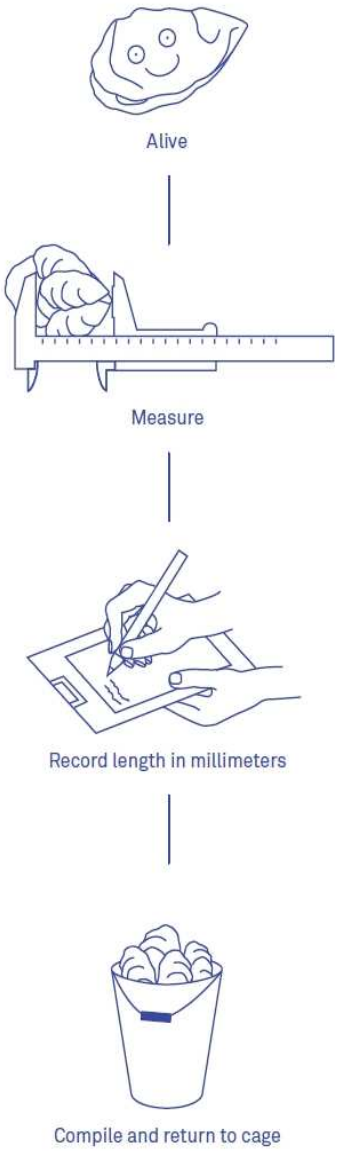
You will see many species of polychaete worms in your garden which are long, thin and often segmented. These are relatively harmless (though some may carry developmental stages of the QX parasite that can kill Sydney rock oysters). Flatworms are flattened and disk-shaped, often as large as a 50 cent piece, and usually grayish or pink/flesh colored. If you see many flatworms on your oysters, consider going to a more regular drying schedule preceded by hosing down with fresh water.

Collecting Data on Your Oysters

When cleaning your garden, do not discard any dead oysters. The percentage of dead oysters is an important data point we are collecting, so dead shells need to be counted when collecting data. Furthermore, dead oyster shells also provide habitat, both in your garden and when the oysters are ultimately placed out on a reef. In addition to growing oysters to a size where they can be used for reef restoration, you are asked to make another contribution by collecting data on your oysters, which you will need to do twice a year, in **November** and **April**.

At these times you should cut the zipties to open the bag, select 50 Sydney rock oysters at random and measure the live ones with the calipers provided. You should also count the number of live vs dead oysters *from the same fifty oysters*. Collate these data and submit them to info@restorepumicestonepassage.org and we will compare your data with information from other growers in order to gain information on the health of Bribies canal systems. Data sheets for recording survival, and growth can be downloaded from http://restorepumicestonepassage.org/wp-content/uploads/2016/05/Oystergardeningdatasheet.xls

Measuring live oysters



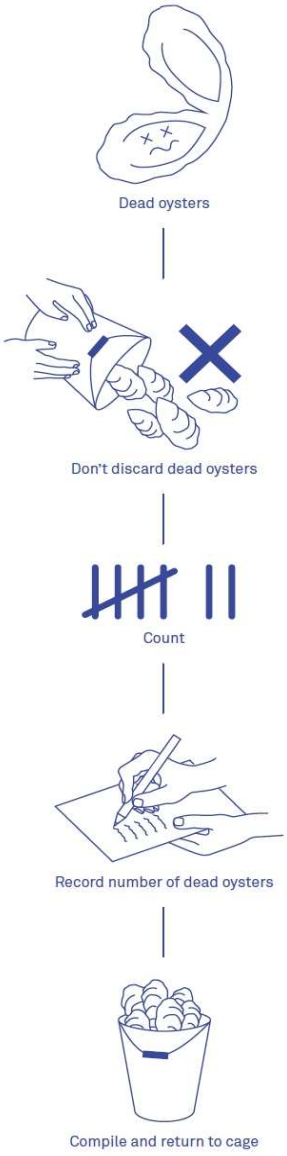
Here are some tips for measuring oysters, thanks to the Billion Oyster Project http://www.billionoysterproject.org/

Oyster Diseases

Oysters in Moreton Bay have been severely impacted by QX disease, caused by the protozoan *Marteilia sydneyi*. QX disease is facilitated by suppression of the oysters immune system from reduced water quality together with increased mud input into the bay which is likely to have increased exposure to QX infective stages that are found in mud dwelling polychaete worms. 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.

These losses may adversely affect the local oyster aquaculture industry, but on natural reefs juvenile oysters still grow fast, filter water, provide shelter, food and the various other ecosystem services and environmental benefits we are looking for. So even if there are large losses in your garden, the survivors remain valuable for planting out as future brood stock. These survivors potentially have a natural tolerance for disease, which could be passed onto their progeny. **So please retain all your oysters, both live and dead**. You are not permitted to move oysters off your pontoon until we obtain permissions to use them to restore local reefs. DigsFish Services will work with QLD Fisheries and Marine Parks to ensure your oysters are placed on a reef so as not to spread disease.

Measuring dead oysters



Health and Safety while Oyster Gardening

To ensure you remain safe during your oyster gardening activities, and abide by the Fisheries Permit conditions, please ensure you do the following:

- NEVER EAT ANY of the oysters. Unlike oysters purchased from retail outlets, oysters supplied for oyster gardening have NOT been tested in a quality assurance program. They are not fit for human consumption and besides, the whole idea is to generate live oysters for reef restoration.
- ALWAYS WEAR GLOVES when handling oysters and oyster bags and look carefully before placing your hands inside oyster bags to ensure there are no nasties present including large crabs, *Lyngbya* algae, and other potential surprises (worst cases could include juvenile stonefish, or blue ringed octopus).

Oyster Gardening – Calendar

To summarise, in order to be a successful oyster gardener always remember to:

- Abide by the conditions on your Fisheries Permit
- Never eat any of your oysters and always wear gloves when handling oysters and bags
- Monitor and clean your gardens every 2-4 weeks
- Collect and submit data on oyster survival and growth every 6 months (November and April)
- Be ready to give your oysters back for reef restoration in 18-24 months
- Have fun !

The reefs in Pumicestone Passage have been literally turned upside down. Lets help get them back !

Further Information

If you are an oyster gardener with questions or queries regarding your oyster garden, feel free to contact us at info@restorepumicestonepassage.org and we will endeavor to help answer your questions. If your circumstances change and you no longer are able to be an oyster gardener, again contact us by email and we will repossess your oysters and reallocate them to others on the waiting list. If you are not an oyster gardener but are interested in becoming one, please fill out the form on page 8 of this leaflet and send it to info@restorepumicestonepassage.org with your name, email and address where the oysters would be gardened, and we will put you on our waiting and information list.

To learn more about activities related to our efforts to restore shellfish reefs in Pumicestone Passage, be sure to check out www.restorepumicestonepassage.org. If you want to keep up to date on shellfish reef restoration projects in other parts of Australia, including the activities of the Australian Shellfish Reef Restoration Network, keep an eye on www.shellfishrestoration.org.au.

Application to become an Accredited Oyster Gardener in the Bribie Island Community Oyster Gardening Initiative

Please fill out all relevant details and return by email to info@restorepumicestonepassage.org

1. Applicant's name: _____

2. Email address: _____

3. Telephone numbers: Home _____, Work _____, Mob _____

4. Physical address where oysters would be gardened (must also be main residential address):

Street address: _____

5. Any relevant experience:_____

_____

6. I understand the guidelines in this leaflet and wish to undertake oyster gardening and abide by the conditions of Fisheries Permit 186854. Signed _____

I am also interested in permitting shellfish filtration experiments on my pontoon (circle) YES / NO

7. Please indicate the approximate location of your gardening site on the map below: