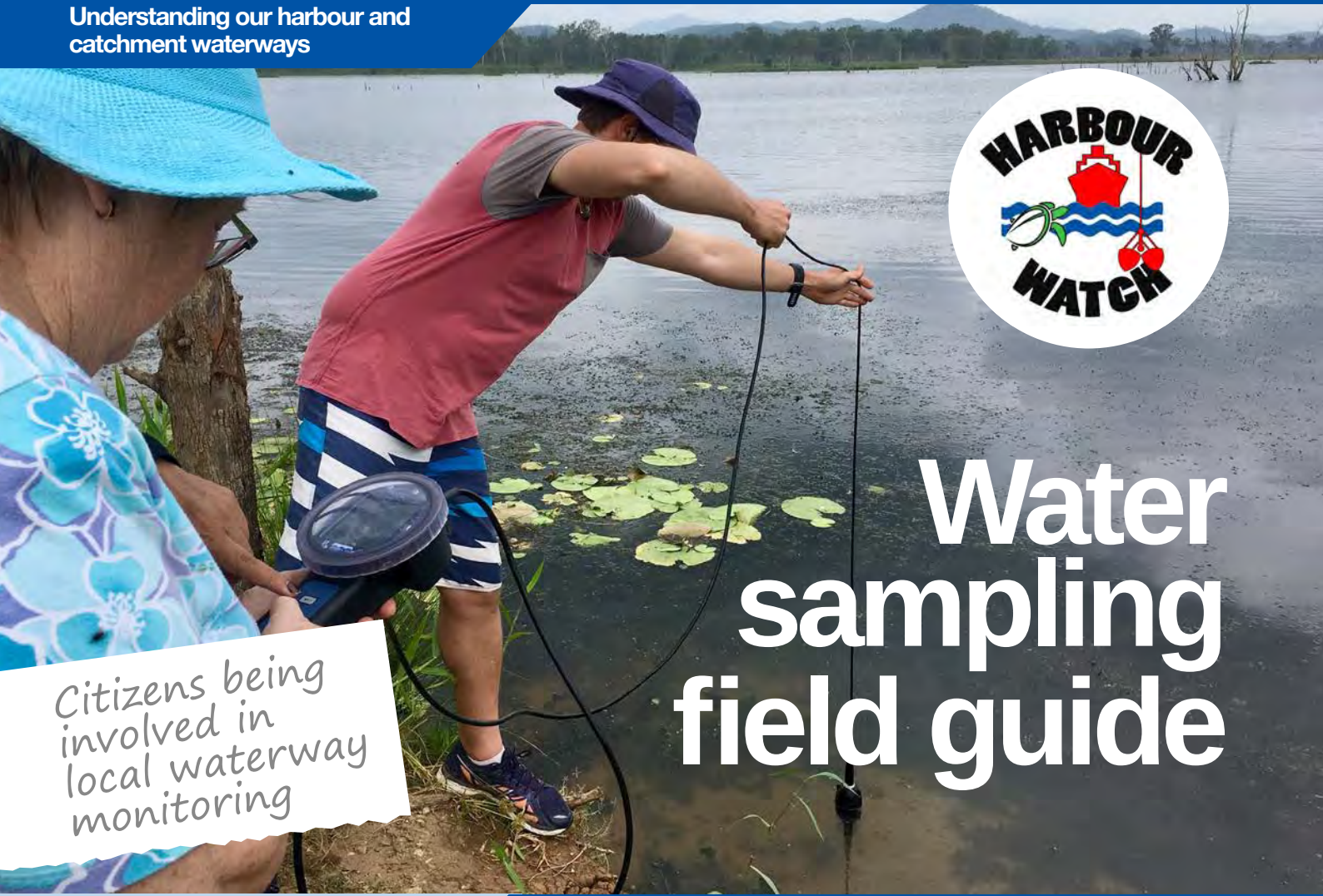
Understanding our harbour and catchment waterways



Water sampling field guide

Citizens being involved in local waterway monitoring

Why Sample?

Water is a precious resource and needs to be carefully managed. Changes in land use have affected the natural flow of waterways, with considerable quantities of sediment, salts nutrients and toxic chemicals entering and changing the physical, biological and chemical characteristics within them. The resulting decline in water quality can affect corals, seagrass, and other important aquatic habitats as well as the aquatic animals they support. Catchment run-off and associated water quality is identified as the second most significant pressure on the Great Barrier Reef and is expected to have significant compounding effects with climate change. Water Monitoring of our local waterways is important so we are aware of its health, and can communicate this to others if needed, so practical actions can be taken to maintain and improve the quality of our water.

Equipment Needed

- Multi-probe data logger
- Bucket
- Sorting trays
- Magnifying glass
- Scoop net with handle
- Spoon / pipettes
- Fish traps
- Guides (waterbugs, fish and weeds – see indicator pages for details)

MyWater Portal: Data Use Warning

The results displayed on the community monitoring website are based on data that has been collected by enthusiastic and dedicated members of the community. The MyWater portal and associated results are provided for educational and awareness raising purposes. No quality control measures have been applied to the data. As such the data is not fit for use beyond this stated purpose. There is no training requirement for community members or groups to enter data to the MyWater portal.

Waterway Sampling: Health and Safety Warning

Community members or groups using this manual and conducting associated waterway testing do so at their own risk. As such, community members and groups must ensure they have appropriate levels of insurance and conduct activities according to the risk and workplace health and safety procedures of their particular group.

If in doubt, don't test your local waterways!

What are the indicators?

Physical/Chemical Indicators

pH
pH is a measure of the acidity of the water

Salt
Salt or Electrical Conductivity (EC) is a measure of the amount of salt in the water

Turbidity
Turbidity or water clarity is a measure of the amount of dirt in the water

Dissolved Oxygen
Dissolved oxygen is oxygen gas molecules (O2) present in the water

Temperature
Temperature must always be measured when taking readings as it impacts all water quality parameters

Biological Indicators

Water bugs
Waterbugs (macroinvertebrates) are insects and crustaceans that live in the water

Fish
Diversity of native fish is a good indicator of stream health

Riparian vegetation
Healthy riparian vegetation is essential to streams and creeks

Weeds
Weeds are an indicator of biodiversity loss and changed environments

Step 1

Collect a Water Sample

Where to sample

Running water in the centre of the stream provides the most representative sample because water on the edges or water held in pools is likely to have more variation than the main body of water. It is important not to disturb the area that you are going to sample. This can be avoided by standing downstream of where you are going to sample and not kicking up sediment.

How to sample

Place the multi-probe approximately 30cm below the surface of the water or if using a bucket, collect a sample of water from the sampling area.

To take a reading using the multi-probe, follow instructions on pages 17-19.

Step 1: Ensure circulator is turned on

Step 2: Place multi-probe 30cm below surface

Step 3: Store data and record on written data sheet (minimum: date, time, location & stored data number)

Step 2

Test Sample for water quality indicators

Physical/Chemical Indicators

- pH
- Salt
- Turbidity
- Dissolved oxygen
- Temperature

Biological Indicators

- Water bugs
- Fish
- Riparian vegetation
- Weeds

Go to the website for more information and to enter your data

www.riverhealth.org.au/hosted/harbourwatch

Before you start - understanding your results

For each water quality indicator tested, a grade can be determined by using the guideline ruler on each page. Once the raw data for chemical /physical and ecological indicators have been entered into the MyWater community portal an overall grading of A-E (as shown below) will be awarded to the sample. An A grade means the result is equal or above the Water Quality Guidelines (WGC) and a grading of E means the result is equal or worse than Worst Case Scenario (WCS).

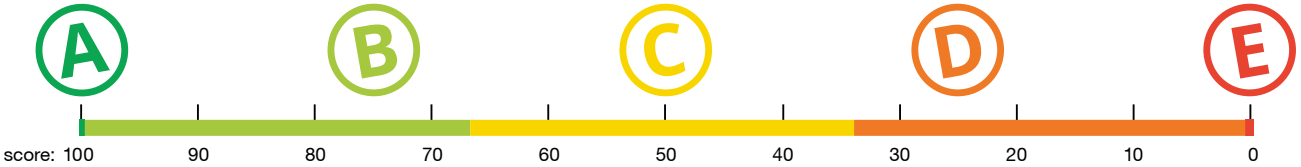
Excellent
All water quality and biological health indicators meet desired levels

Good
Most water quality and biological health indicators meet desired levels

Fair
There is a mix of good and poor levels of water quality and biological health indicators

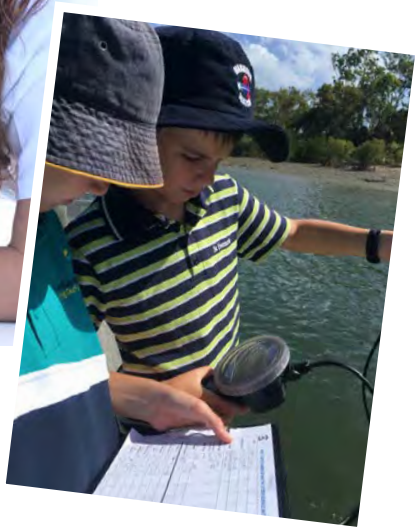
Poor
Some or few water quality and biological health indicators meet desired levels

Fail
Very few or no water quality and biological health indicators meet desired levels

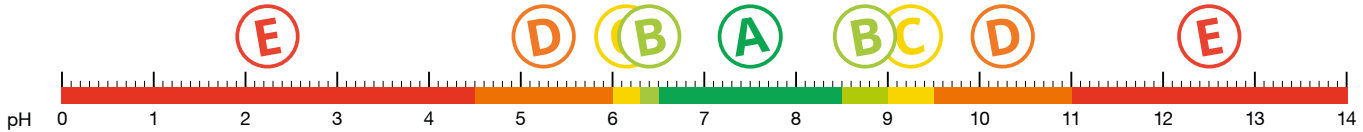


pH

The term pH is an abbreviation for potential hydrogen and is based on a logarithm scale ranging from 1 (highly acidic) through 7 (neutral) to 14 (highly alkaline). pH changes can have adverse effects on the health of fish and aquatic invertebrates. Low pH can lead to increases in the toxicity of ammonia and heavy metals within stream sediments and a reduction in the survival rates of aquatic organisms.



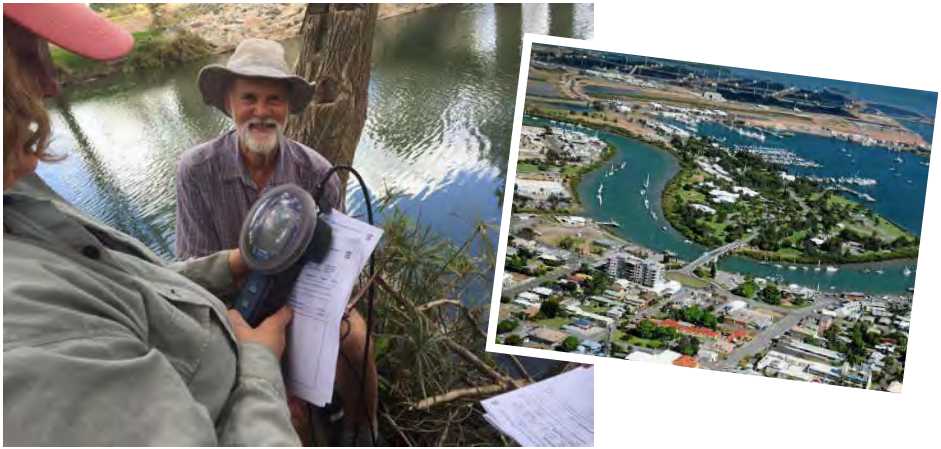
To protect the multi-probe sensors, always use the guard and keep the probe off the bottom



Guidelines for pH results for Freshwater & Saltwater in the Gladstone Region

Salt

Salinity is a measure of the content of salts in soil or water. Salinity is measured in µS/cm. Salinity can affect both the community structure and function of freshwater ecosystems. It also affects the health and survival of riparian vegetation, aquatic macroinvertebrates and fish. The salinity of water is measured by determining the electrical conductivity of salt in the water using a conductivity meter.

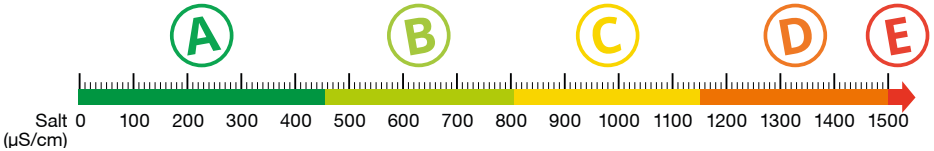


Saltwater Range

Fresh <800µS/cm

Estuarine 800-48000 µS/cm

Saltwater > 48000 µS/cm



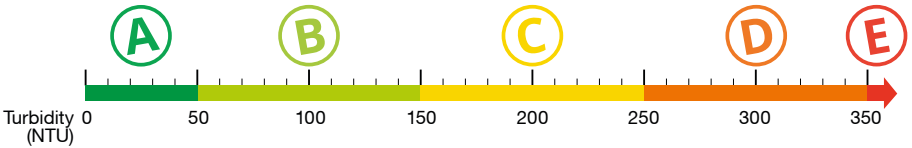
Guidelines for salt (EC) results for Freshwater in the Gladstone Region

Multi-probe SpC (EC) will record salinity in mS/cm. Multiply by 1000 to convert to µS/cm

Turbidity

Turbidity and water clarity are both measures of the amount of sediment suspended in the water. Excess amounts of suspended particles can reduce light penetration through the water column to the bottom smothering benthic organisms like mussels and snails, irritate fish gills and carry contaminants. Changes to the availability of light within the water column also influences the ability of aquatic plants to photosynthesise.

The turbidity sensor uses light to determine a turbidity reading. To ensure false readings are not recorded, do not disturb the sediment on the bottom and make sure there is nothing in the middle of the sensor when taking the reading; like sticks, leaves or mud.



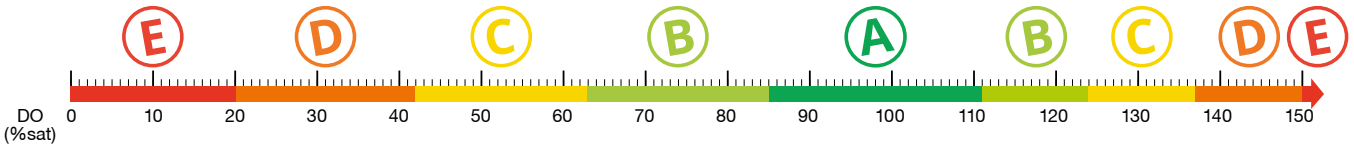
Guidelines for water clarity/turbidity results for Freshwater & Saltwater in the Gladstone Region

Dissolved Oxygen

Dissolved oxygen is the most important factor in sustaining life. Free oxygen molecules (O2) present in the water are used by all organisms, for cellular respiration. Oxygen enters streams from the surrounding air and as a product of photosynthesis from aquatic plants and organisms. Levels of dissolved oxygen naturally vary depending on factors including water temperature, salinity, time of day (diurnal changes), season, depth, altitude, and rate of flow/wave action. Dissolved oxygen reaches its peak during the day when photosynthesis is at its maximum.

Human factors that affect dissolved oxygen levels in waterways include addition of oxygen consuming organic wastes such as sewage, addition of nutrients, changing the flow of water, raising the water temperature, and additions of chemicals.

Dissolved oxygen is best monitored by recording the 'Dissolved Oxygen % Saturation' (DO %Sat.) levels which allows for direct comparison between waterways of differing temperatures and salinities.



Guidelines for Dissolved Oxygen (DO %sat) results for Freshwater and Saltwater in the Gladstone Region

Water bugs

Water bugs (macroinvertebrates) are animals without back-bones that live in the fresh water and are large enough to be seen with the naked eye (e.g. bugs, shrimp, and snails).

This is one of the most commonly used indicators of stream condition because they are common, widespread, and easily sampled. Different types of water bugs tolerate different stream conditions and levels of pollution, and are a very important part of the food chain.

There are two methods of sampling for water bugs; sweep sampling and kick sampling. Sweep sampling is best suited to the stream edge and habitats with vegetation overhanging from the stream bank, aquatic plants, undercut banks, root mats, leaf packs and woody debris. Kick sampling is designed for sampling stream bed habitats and can be used to sample a range of depths and flows. It is performed most effectively in riffles – fast flowing, rocky sections of the stream bed where the highest diversity of water bugs is generally found.

Approach the sampling area from downstream to prevent disturbing the area and select either sweep sampling or kick sampling.

Download app from app store: F Macroinvertebrates

NOTE: It is best to sample for water bugs after water quality testing so as not to stir up bottom sediments.

Sweep sampling

1. Sweep net among differing habitats using a short upward movement at right angles to the bank. Stir up the bottom while doing so.
2. Stop regularly to rinse mud and fine silt out of net.
3. Once finished scoop the net from the water in a forward motion and empty contents into sorting trays.
4. Sort the captured water bugs into groups of similar looking bugs using a pipette or spoon.
5. Identify bugs using magnifying glass and ID sheets on pages 11 and 12.
6. Return water bugs to the stream in a shady spot.
7. Record water bugs found on field sheet or website.

Kick sampling

1. Hold the net downstream with the net mouth facing the sampling area upstream.
2. Disturb the sampling area with your feet as you move slowly upstream. This will cause the water bugs to become suspended and pushed into the net by the flow of the water. If there is little or no flow use a short sweeping action.
3. Repeat this process over a distance of 10m.
4. Once finished scoop the net from the water in a forward motion and empty contents into sorting trays.
5. Sort the captured water bugs into groups of similar looking bugs using a pipette or spoon.
6. Identify bugs using magnifying glass and ID sheets on pages 11 and 12.
7. Return water bugs to the stream in a shady spot.
8. Record water bugs found on field sheet or website.

waterwatch NEW SOUTH WALES
Communities Caring for Catchments

WATER BUG DETECTIVE GUIDE

Macroinvertebrate sampling and waterway health

Sampling will reveal information about the abundance and diversity of macroinvertebrates and their tolerance to pollution. This will provide an indication of the health of the waterway.

ABUNDANCE = the total number of macroinvertebrates present

DIVERSITY = the number of different types of bugs present. Healthy streams usually have a greater diversity of bug types

POLLUTION TOLERANCE = the ability of macroinvertebrates to withstand pollution. This is reflected by its SIGNAL 2 score based on their sensitivity to pollution.

STREAM POLLUTION INDEX = calculation based on the abundance and diversity of bugs and their SIGNAL 2 score.

HEALTHY WATERWAYS = a high SIGNAL score and a large number of bug types

Very Sensitive Bugs - 10,9

Stonefly nymph 10
Order: Plecoptera
Description: Two thin tails and gills extending from their abdomens.
Habitat: Found among stones or plants, in fast-moving waters.
Maximum size: 7-12 mm

Mayfly nymph 9
Order: Ephemeroptera
Description: Three long thin tails and gills along the sides of their bodies.
Habitat: Found on or under rocks or among plants and leaf litter in standing water and fast flowing streams.
Maximum size: Up to 15 mm

Sensitive Bugs - 8,7,6

Alderfly larva 8
Order: Megaloptera
Description: Their bodies are fleshy with a a hard-shelled head.
Habitat: Found among rocks, in a variety of flow conditions.
Maximum size: Up to 20 mm

Caddisfly larva 8
Order: Trichoptera
Description: They are often enclosed within a case of twigs and plant material or silk.
Habitat: Found among sediment and rocks in streams, ponds and lakes.
Maximum size: Up to 20 mm

Riffle beetle and larva 7
Order: Coleoptera
Description: Beetle-like, tiny and usually black. Larvae have circular stripes or rings.
Habitat: Fast-moving water.
Maximum size: Up to 4 mm

Water mite 6
Order: Acarina
Description: Mites usually have simple rounded bodies with eight legs.
Habitat: Found among plants or stones on the stream bed in standing or slow moving waters.
Maximum size: Up to 5 mm

Tolerant Bugs - 5,4,3

Beetle larvae 5
Order: Coleoptera
Description: Larvae are usually elongated with well developed legs and a large head.
Habitat: A variety of habitats including still waters or quiet areas of flowing water.
Maximum size: Up to 35 mm

Dragonfly nymph 4
Order: Odonata
Description: Stout bodies, no external gills and extendable mouth parts.
Habitat: Found within the substrate of rivers and streams.
Maximum size: 12-50 mm

Water strider 4
Order: Hemiptera
Description: Flat spider appearance with long pairs of middle and hind legs.
Habitat: Found on the surface of slow moving rivers and streams.
Maximum size: 8-12 mm

Whirligig beetle and larva 4
Order: Coleoptera
Description: A streamlined oval beetle that swim in circles.
Habitat: Found on the surface around the edges of ponds an streams.
Maximum size: 5-25 mm

Freshwater yabby/crayfish 4
Order: Decapoda
Description: Fan tailed with well developed claws and prominent front end.
Habitat: Slow flowing and still waters and burrow into sediment.
Maximum size: Up to 400 mm

Damselfly nymph 3
Order: Odonata
Description: Nymphs have three gill structures extending from the tail.
Habitat: Found on plants among rocks and leaf litter or burrowing into the sediments.
Maximum size: 16-33 mm

Fly larva and pupa 3
Order: Diptera
Description: Larva usually have an elongated body with a small head. They do not have true legs.
Habitat: Found in shallow regions of ponds and stream amongst mud and detritus.
Maximum size: Up to 30 mm

Midge larva and pupa 3
Order: Diptera
Description: Often small and C shaped.
Habitat: Attached to debris by their tiny legs and can be found anywhere that water collects.
Maximum size: Up to 50 mm

Freshwater mussel 3
Class: Bivalvia
Description: Freshwater mussels have paired hard shells (valves) with a fleshy body between them.
Habitat: Found in or on sandy or muddy stream beds.
Maximum size: Up to 350 mm

Illustrations: Christine Buckley

NSW GOVERNMENT Environment, Climate Change & Water

A	Very sensitive bugs present with lots of diversity (3+ types)
B	Very sensitive bugs present
C	Only sensitive to tolerant bugs present
D	Only tolerant to very tolerant bugs present
E	Only very tolerant bugs present

Guidelines for water bug results for freshwaters

Tolerant Bugs - 5,4,3

Nematode 3
Order: Nematoda
Description: Thin elongated worms without segments and can look translucent.
Habitat: Burrow into the substrate.
Maximum size: Up to 12 mm

Freshwater sandhopper 3
Order: Amphipoda
Description: Slightly curled and flattened sideways and have hard segments each with a pair of legs for swimming or walking.
Habitat: The edges of slow moving water amongst plants and stones.
Maximum size: 6-20 mm

Freshwater shrimp 3
Order: Decapoda
Description: Covered by a shell. Fanned tail and stalked eyes.
Habitat: Shrimps and prawns are found amongst plants and rocks in permanent slow-moving waters.
Maximum size: Up to 35 mm

Water scorpion/Needle bug 3
Order: Hemiptera
Description: Large grasping forelegs and short breathing tube at the end of their abdomen.
Habitat: Found among plants or on the water surface of slow-moving waters.
Maximum size: Up to 50 mm

Needlebug
Water scorpion

Very Tolerant Bugs - 2,1

Diving beetle 2
Order: Coleoptera
Description: Sleek, shiny beetles with hard-shelled body and hairy paddle-shaped hind legs.
Habitat: A variety of habitats including still waters or quiet areas of flowing water.
Maximum size: Up to 40 mm

Adult
Larva

Flatworm 2
Class: Turbellaria
Description: Flat, thin, slow-moving worms with two simple eye spots.
Habitat: Found gliding over rocks and plants in a variety of flow conditions.
Maximum size: Up to 20 mm

Hydra 2
Class: Hydrozoa
Description: Hydras have a simple sack-like body with a mouth encircled by tentacles.
Habitat: Found attached to rocks, plants or twigs in fast flowing water.
Maximum size: Up to 30 mm

Water treader 2
Order: Hemiptera
Description: Long middle and back legs, and thick body
Habitat: Found on the water's surface of slow flowing pools near banks and plants.
Maximum size: Up to 5 mm

Freshwater worm 2
Class: Oligochaeta
Description: Segmented worms with rounded ends with no suckers or legs and usually coloured red or flesh coloured.
Habitat: Found in soft sediment rich in organic matter.
Maximum size: Up to 30 mm

Freshwater slater 2
Order: Isopoda
Description: Flattened from top to bottom with no body carapace or shield.
Habitat: Found in still to slow-moving waters.
Maximum size: Up to 20 mm

Waterboatman 2
Order: Hemiptera
Description: Boat-shaped with piercing mouth parts and boat shape appearance.
Habitat: Found among plants on the water surface or swimming freely in still to slow-moving waters.
Maximum size: Up to 10 mm

Backswimmer 2
Order: Hemiptera
Description: Curved back, large eyes, long hairy hind legs and swim on their backs.
Habitat: Found in standing water or slow flowing ponds.
Maximum size: Up to 11 mm

Bloodworm 1
Order: Diptera
Description: Worm-like and C shaped. Only the red ones are called Bloodworms.
Habitat: Found in soft sediment rich in organic matter.
Maximum size: Up to 20 mm

Leech 1
Class: Hirudinea
Description: Leeches are soft-bodied animals made up of 32 segments with a sucker on one or both ends.
Habitat: Found in standing or slow moving water.
Maximum size: 7-100 mm

Mosquito larva and pupa 1
Order: Diptera
Description: Thorax wider than the head and breathes through a long siphon at the end of the abdomen.
Habitat: Still water.
Maximum size: Up to 25 mm

Pupa
Larva

Freshwater snails 1
Class: Gastropoda
Description: Snails are soft-bodied animals enclosed in a hard, protective, coiled shell.
Habitat: Found on plants and rocks in slow flowing or standing water.
Maximum size: Up to 25 mm

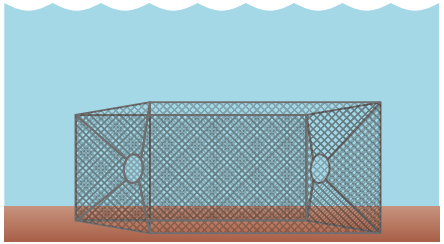
WATER BUG DETECTIVE GUIDE

waterwatch NEW SOUTH WALES Communities Caring for Catchments
NSW GOVERNMENT
Environment, Climate Change & Water

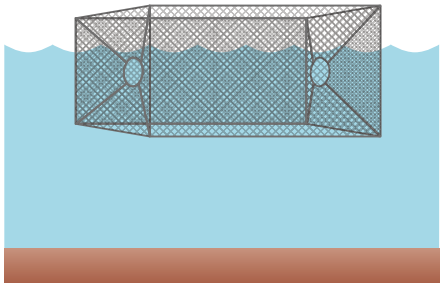
Fish

Fish are useful indicators of aquatic ecosystem health and are considered a more sensitive indicator of pollution than macroinvertebrates.

Bait trap placed on stream bed bottom



Bait trap entrance placed just below water line



Step 1

It is best to set the openings at the end of the net just below the waterline for two of the three nets.

Step 2

Bait and set the fish traps in three locations (with different habitats if possible)and leave undisturbed for at least 15 minutes. It is best to set the traps first and then complete the other sampling before returning to the traps after all other activities are completed.

Step 3

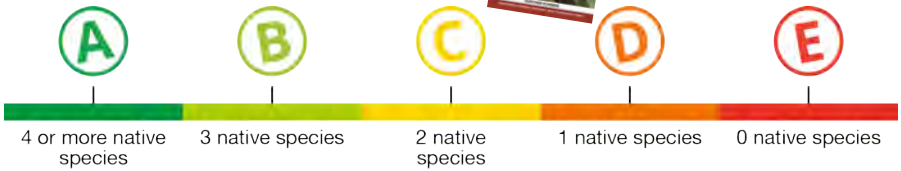
If the water is clear, sit and quietly observe water for five minutes to identify fish not trapped.

Step 4

Check the traps and place fish caught in sorting trays with some water while identifying them using the fish identification guide - A Wild Australia Guide: Freshwater Fishes.

Step 5

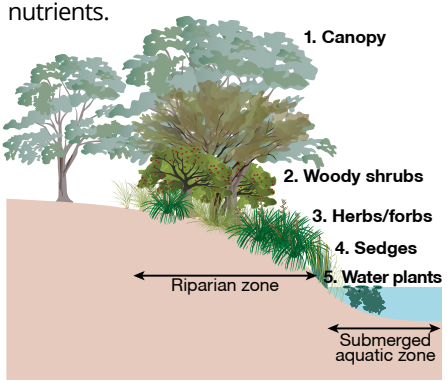
Release fish as soon as possible after identification and record fish found on record sheet or website.



Guidelines for fish results for Freshwater & Saltwater in the Gladstone Region

Riparian vegetation

Riparian vegetation is any flora, native or introduced, growing around water bodies that is directly associated with the moisture provided by the water body. It is recognised as one of the most important indicators for assessing the condition of streams, as it fulfils many important functions including; stabilising banks, providing shade and shelter, providing leaf litter and other organic debris to the stream and providing a buffer zone for intercepting sediments and nutrients.



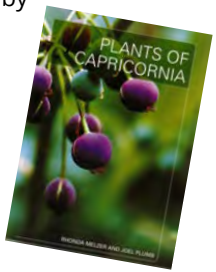
Step 1

Inspect the riparian zone (see diagram) for the presence of the five different types of vegetation strata including;

1. Canopy Trees
2. Woody Shrubs
3. Herbs/Forbs
4. Sedges and
5. Waterplants

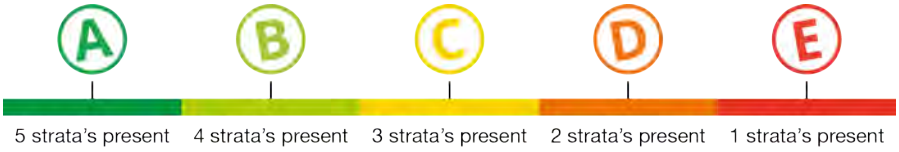
Step 2

If possible, identify plants within the strata types using an appropriate field guide such as Plants of Capricornia by Melzer and Plumb.



Step 3

Record plants found and the number of strata types present on the field sheet or website.



Guidelines for riparian vegetation results for freshwater in the Gladstone Region

Weeds

Weeds can be extremely invasive and contribute to biodiversity loss, alter ecological processes and damage riparian environments.

Step 1

Inspect the riparian zone and use an appropriate weed identification guide to classify weeds (Grow Me Instead and Priority Weeds of the Capricorn Region are useful guides for Central Queensland).

Step 2

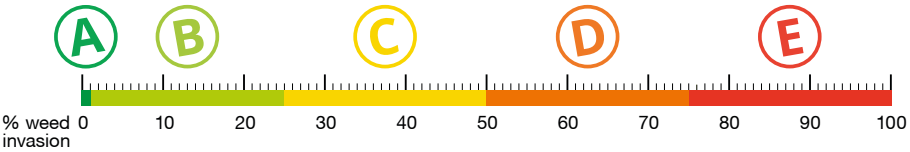
Determine the percentage of weed invasion.

Step 3

Remove weeds and dispose as rubbish (where possible).

Step 4

List weeds found and results on field sheet or website.



Guidelines for weeds results in riparian zones in the Gladstone Region

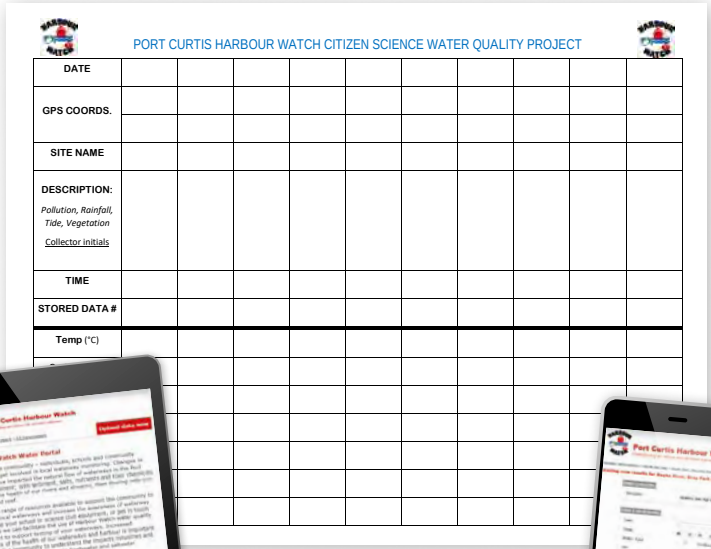
Record Sample Results

Record results on Harbour Watch MyWater Portal

Port Curtis Harbour Watch website has a community portal (MyWater) where raw water sample results are uploaded and interpreted with each of the site indicators being awarded an instantaneous grade from A-E.

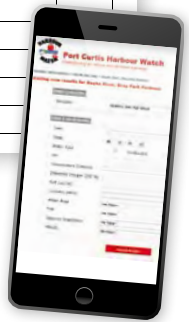
1. Navigate to the Harbour Watch MyWater portal riverhealth.org.au/hosted/harbourwatch and click on **Upload data now**
2. Select an existing site and click 'continue' if site already exists or create a new site by:
3. Clicking on the create a new site tab.
4. Enter details of site (longtitude and latitude can be selected by dragging red marker to site location on the map) and then click 'continue'
5. Select a recorder (if you are new then select Add new... then add your groups name and email contact).
6. Enter the date and time for your sample along with the results.
7. Make sure to select water type; Freshwater or saltwater
8. Submit the results and then add more records or explore your results.

If you have a tablet or smartphone with wireless in the field, you can enter this information directly into the MyWater portal at riverhealth.org.au/hosted/harbourwatch.



PORT CURTIS HARBOUR WATCH CITIZEN SCIENCE WATER QUALITY PROJECT

DATE										
GPS COORDS.										
SITE NAME										
DESCRIPTION: *Pollution, Rainfall, Tide, Vegetation* Collector initials										
TIME										
STORED DATA #										
Temp (°C)										



Reminder: Make sure to write your data on the data sheet and return to Harbour Watch

Hydrolab multi-probe

An easy step by step instruction guide on how to use the Hydrolab Quanta Multi-Probe Data Logger for Water Quality testing and Data Collection.

Calib Review Screen Store Setup

Multiprobe data

Temperature
pH
TDS
DO
Turbidity

Data logger buttons

Enter

Escape/ circulator

Arrow across

Arrow across

On/off

Hydrolab multi-probe

Step 1

Remove Multi-Probe Data Logger from waterproof case.

Step 2

Connect probe to Data Logger hand piece.

Step 3

Turn ON data logger by pressing the 

The display SCREEN will begin flashing.

Step 4

Remove the protective cap from the Multiprobe and place guard on.

Step 5

Place the multi-probe into the water sample site that you are testing.

Your sample should be 10-20cm below the surface of the water.

Be careful not to disturb the testing site and stir up sediment as this may affect your water sample result.

Step 6

Turn multi-probe circulator ON by pressing the  button on the keypad. Propeller will be displayed on screen.

Step 7

[SCREEN] will be flashing on display to indicate real time monitoring

1st screen on data logger will display:

- Temp; SpC; DO; pH (& depth)

2nd screen on data logger will display:

- (Battery); TDS; DO%; Turbidity

To toggle to second screen press

Step 8

To capture data

or to store

Hit to capture

The display will toggle between 2 screens & a number will appear at bottom of screen

Record number

NOTE: This will capture data but not store data

Step 9

To store data

Hit to store data for review

Once stored you will be returned to real time monitoring

Note: Enter must be pressed twice to store readings

Step 10

To review data

across to REVIEW

Hit enter

Scroll through using arrow keys to number of captured data

Record the results on your data sheet

Step 11

To stop reviewing data

Hit to return to real time monitoring

Step 12

Turn OFF data logger by pressing the

Replace the Multi-Probes protective cap, Probe sensors to be stored in clean tap water when not in use

This Citizen Science community monitoring initiative is provided by Port Curtis Harbour Watch and facilitated by Boyne Island Environmental Education Centre with the generous support of our valued partners

Major partners

Partners

This guide has referenced elements of the Queensland Government's Queensland Community Waterway Monitoring Manual, August 2007

Port Curtis Harbour Watch
C/O Boyne Island Environmental Education Centre
61 Malpas Street, Boyne Island, QLD 4680
Phone: 07 4851 0333 - Fax: 07 4851 0300
Email: harbourwatch@boyneisleec.eq.edu.au
Website: www.harbourwatch@eq.edu.au
Facebook: www.facebook.com/HarbourWatch
MyWater Portal: www.riverhealth.org.au/hosted/harbourwatch