TURTLES IN SCHOOLS

TERM 3 WORKBOOK

Photo credit: Bellingen Riverwatch

1 Million Turtles

COMMUNITY CONSERVATION PROGRAM

Photo credit: Dr James Van Dyke

TURTLES IN SCHOOLS

Produced by the
1 Million Turtles Community
Conservation Program
and funded by
The Foundation for National
Parks and Wildlife.

In the pages that follow, you will find a comprehensive set of lesson plans. Our initiative is not just about imparting knowledge but fostering a deep connection between students and their natural environment and instilling a sense of responsibility and awareness of freshwater turtles and their conservation.

As we embark on this educational venture, we extend our gratitude to educators, students, and all those who champion the cause of conservation. The Turtles in Schools Program is not just a curriculum; it is a movement to inspire the next generation of environmental custodians.

Thank you,

1 Million Turtles Community Conservation Program

LESSON

TERM THREE

WATER QUALITY PARAMETERS

- Learning Intentions
- Background
- Activities
- Curriculum Mapping

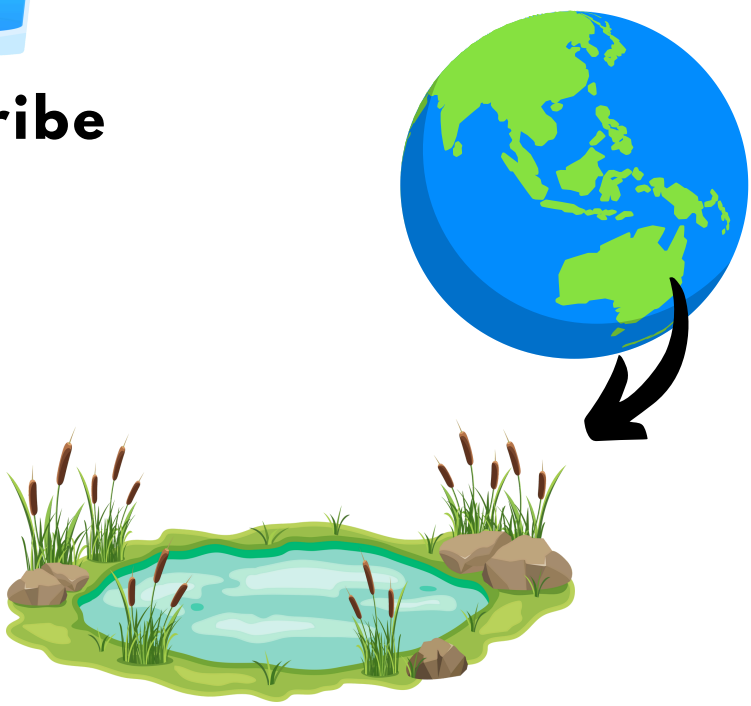
Photo credit: Marilyn Connell

Learning Intentions

(1) Describe water quality parameters and explain how they relate to wetland health.

(2) Use applications (such as Google Earth) to plan scientific investigations, through the identification of sites for wetland sampling.

Describe



Identify

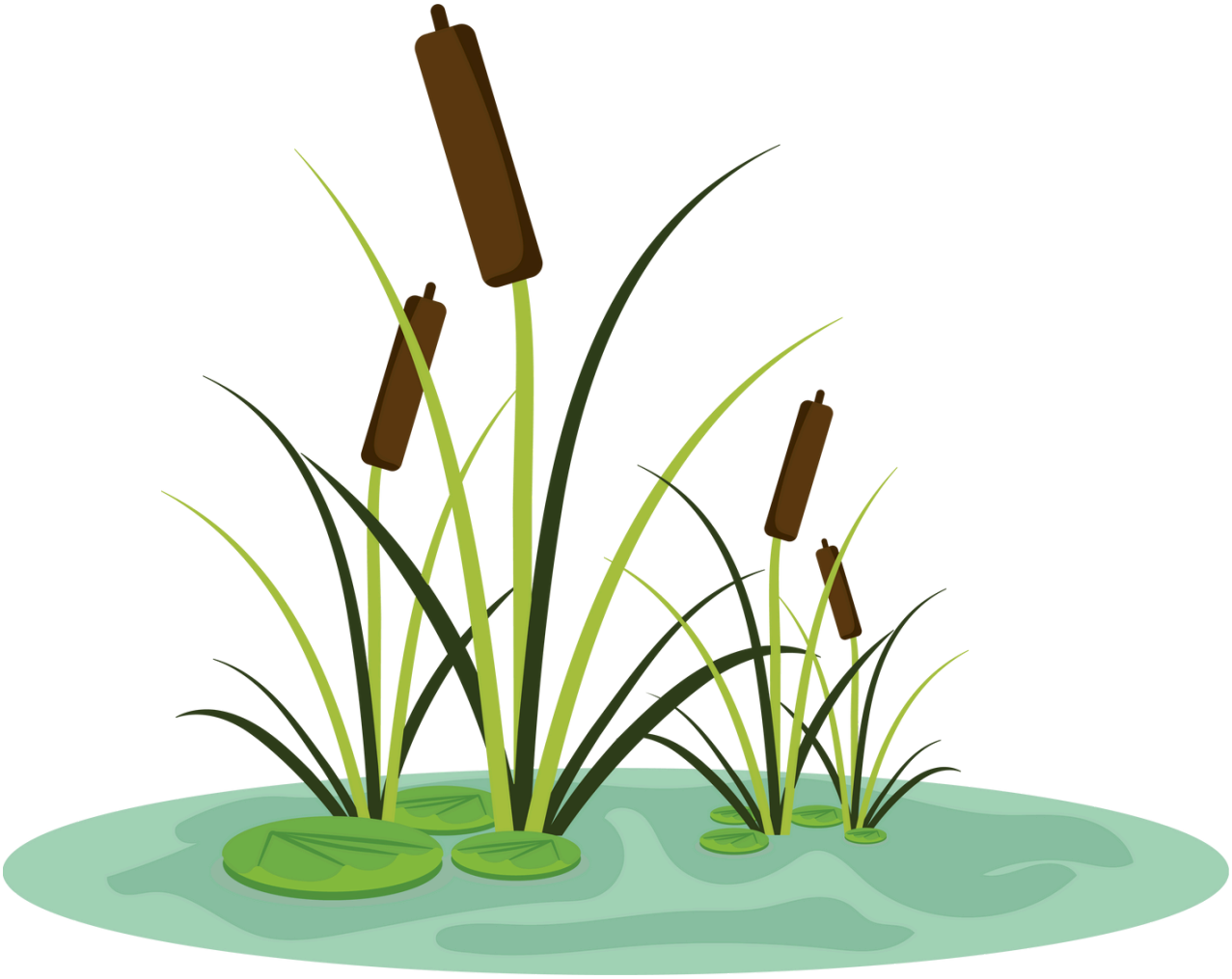
Background Information

Why do we test water quality?

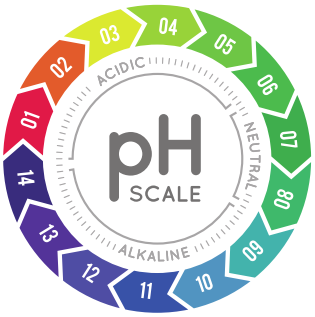
Water quality testing can tell us how healthy the water is in our local rivers, creeks and wetlands.

The health of the aquatic habitat can be influenced by:

- Land clearing, agriculture, roadworks and erosion;
- Farming practices where fertilisers and pesticides leach into the water;
- Pollution;
- Weeds and feral animals which cause bank instability;
- Urban development (such as the construction of roads and suburbs).



Water quality parameters



pH:

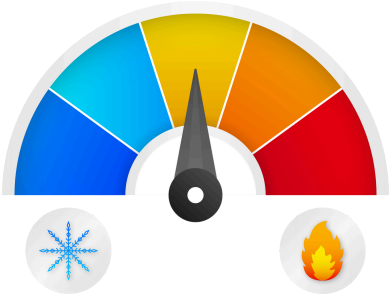
pH is a measure of how acidic or alkaline the water is. The pH scale ranges from 0 to 14, with 7 classed as neutral, less than 7 classed as acidic and values greater than 7 classed as alkaline.

- Different aquatic organisms have specific pH ranges within which they thrive. Extreme pH levels (too acidic or too alkaline) can stress or harm aquatic life, affecting their physiology and behaviour.
- Changes in pH can be indicative of human activities, such as industrial discharges, acid rain, or agricultural runoff. Monitoring pH levels over time can help detect long-term trends and assess the overall health of the wetland.

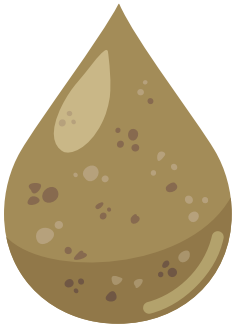
T*emperature:*

Temperature is how hot or cold the water is, and is measured in degrees Celsius. Measuring the temperature of a wetland is important because:

- Temperature directly affects the metabolic rates of aquatic organisms. Different species have optimal temperature ranges for growth and reproduction.
- Temperature affects the solubility of gases in water, including oxygen. As water temperature increases, its capacity to hold dissolved oxygen decreases. This is crucial for the survival of aquatic organisms, as they rely on dissolved oxygen for respiration.
- Temperature plays a role in determining the types of species that can thrive in a particular wetland. Some species are adapted to specific temperature ranges, and changes in temperature can influence the composition and diversity of the aquatic community.

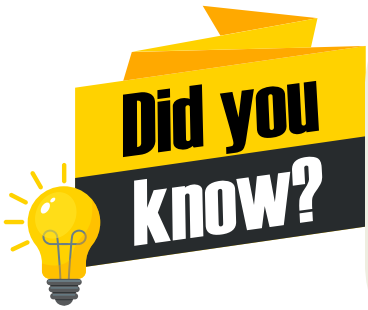


Turbidity:



Turbidity measures how murky or cloudy the water is, and is usually caused by suspended particles.

- High turbidity levels can reduce water clarity, potentially impacting light penetration and photosynthesis in aquatic plants.
- Turbidity may also reduce visibility, making it more challenging for predators to locate prey. Aquatic organisms adapted to clear water conditions may be negatively affected by increased turbidity.
- High turbidity levels can indicate increased erosion and runoff. Monitoring turbidity helps assess the impacts of land-use changes, construction activities, or other factors contributing to sedimentation.



Some Australian freshwater turtles breathe through their cloaca. They are often referred to as “bum breathers”. These species rely on clear, highly-oxygenated water. Increased sedimentation may cause the species to rely on aerial breathing and increase exposure to predation and shorter dive durations.

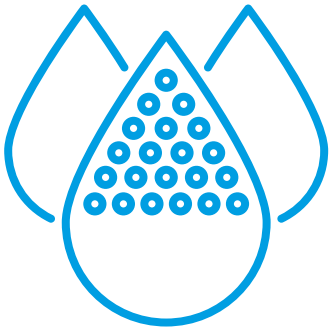
Dissolved Oxygen:

- Dissolved oxygen (DO) is a measure of how much oxygen is dissolved in water. It is crucial for the survival of organisms as they rely on oxygen for respiration.
- Low dissolved oxygen levels can be indicative of increased organic matter decomposition. Microorganisms breaking down organic material consume oxygen, potentially leading to hypoxic (low oxygen) or anoxic (no oxygen) conditions harmful to aquatic life.
- Anthropogenic pollutants, such as nutrient runoff or organic pollutants, can lead to oxygen depletion. Monitoring dissolved oxygen levels helps identify potential pollution sources and assess the overall health of the wetland ecosystem.

Salinity:

Salinity refers to the concentration of dissolved salts in water. Salinity can have significant implications for the health and functioning of aquatic ecosystems.

- Different species of aquatic organisms have varying tolerances to salinity levels. Some organisms, such as certain types of fish and invertebrates, are adapted to specific salinity ranges.
- Salinity influences the osmotic regulation of aquatic organisms. Changes in salinity can affect the balance of water and salts within the cells of organisms.
- Salinity can affect the types of plant species that can thrive in a wetland. Some plants are adapted to saline conditions, while others prefer freshwater. Changes in salinity can lead to shifts in vegetation composition and structure.
- Elevated salinity levels in wetlands can be indicative of human activities such as agriculture runoff, industrial discharges, or improper waste disposal. Monitoring salinity can help identify potential sources of pollution and guide conservation efforts.



Ammonia:

Ammonia is a nitrogen compound commonly found in aquatic ecosystems, originating from sources such as agricultural runoff, wastewater discharge, and decomposing organic matter.

- Elevated levels of ammonia can be toxic to aquatic organisms, particularly fish and invertebrates.
- Ammonia serves as a nutrient for algae and aquatic plants. Excessive ammonia can lead to algal blooms and eutrophication, causing oxygen depletion and harm to aquatic life.
- Monitoring ammonia levels in water bodies is important for assessing water quality and identifying sources of pollution, such as agricultural activities or wastewater treatment plants.

Nitrate:

Nitrate is a form of nitrogen found in water bodies, primarily from agricultural fertilisers, animal waste, and sewage discharges.

- High nitrate levels can promote excessive algal growth, leading to algal blooms and oxygen depletion in aquatic ecosystems.
- Monitoring nitrate concentrations is crucial for protecting water quality, safeguarding human health, and preventing eutrophication of water bodies.

Nitrite:

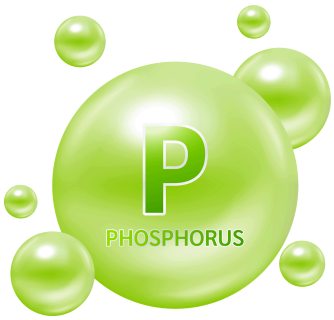
Nitrite is an intermediate compound in the nitrogen cycle and is often found in conjunction with nitrate in aquatic environments.

- Elevated nitrite levels can be toxic to aquatic organisms, particularly fish, by interfering with their ability to transport oxygen.
- Nitrite contamination is often associated with sources such as agricultural runoff, sewage discharge, and industrial effluents.
- Monitoring nitrite concentrations helps assess water quality and identify potential sources of pollution, allowing for timely intervention and mitigation measures.

Phosphorus:

Phosphorus is a nutrient essential for plant growth, but excessive phosphorus can lead to eutrophication and degraded water quality.

- Sources of phosphorus in water bodies include agricultural runoff, wastewater discharge, and soil erosion.
- Elevated phosphorus levels can promote algal blooms, which can deplete oxygen levels, produce toxins harmful to aquatic life, and degrade habitat quality.
- Monitoring phosphorus concentrations is vital for managing nutrient inputs, preventing eutrophication, and preserving the ecological health of aquatic ecosystems.



How to test water quality parameters

pH: Use pH strips or pH indicator to measure the acidity or alkalinity of the water. Follow the instructions provided with the testing kit to dip the strip or add the indicator solution into the water sample, then match the colour displayed to determine the pH.

Temperature: Temperature testing is done using a thermometer. Submerge the thermometer into the water sample and wait for the reading to stabilise.

Turbidity: You can use a Secchi disc to test turbidity. A Secchi disc is a circular disk with alternating black and white quadrants.To test turbidity with a Secchi disc, lower the disc into the water sample until it disappears from view. Note the depth at which the disc disappears from sight. Deeper disappearance indicates higher turbidity, while shallower disappearance indicates clearer water.

Dissolved Oxygen: Dissolved oxygen testing usually involves using a dissolved oxygen meter. Submerge the meter in the water and read the value displayed.

Salinity: You can use a hydrometer to test salinity. Follow the instructions to submerge the hydrometer into the water sample and record the reading displayed.

Ammonia, Nitrate, Nitrite and Phosphorus: Testing typically involves using a test kit. Follow the instructions provided with the kit to the add reagents to the water sample, which react with ammonia, nitrate, nitrite or phosphorus to produce a colour change. Compare the colour to a chart provided to determine the concentration of each.

Experimental Design

Experimental design refers to the process of planning and organising an experiment in order to gather data and draw conclusions to answer a research question.

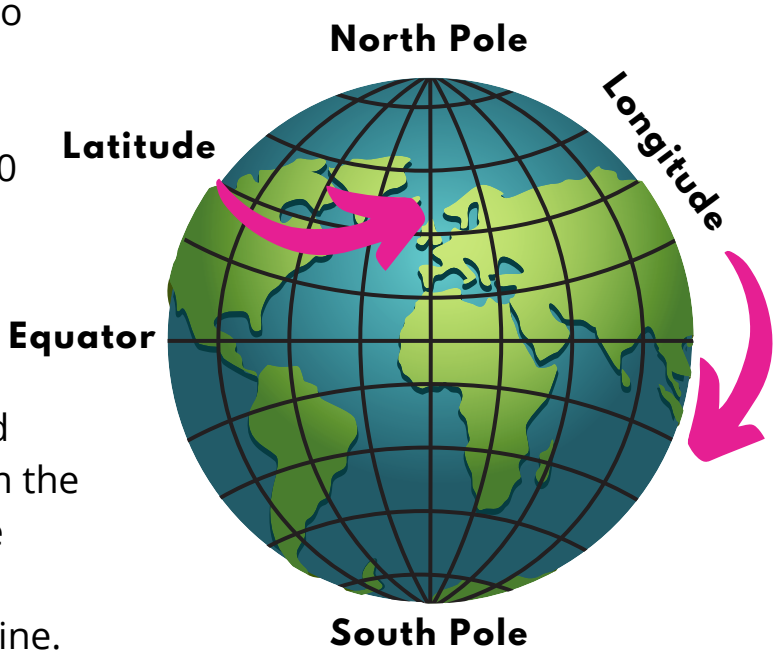
The experimental design usually has the following components:

1. **Research Question:** The research question is the central inquiry that the experiment seeks to address. It should be clear, specific, and relevant to the topic of study.
2. **Hypothesis:** A hypothesis is a testable statement that predicts the outcome of the experiment based on prior knowledge, observations, or theoretical principles. It typically consists of an "if-then" statement that proposes a cause-and-effect relationship between variables.
3. **Methods:** The methods section describes the procedures and techniques used to conduct the experiment and collect data. It includes detailed step-by-step instructions for implementing the experimental protocol, including experimental setup, sampling procedures, data collection, controls and variables, statistical analysis.
4. **Expected Outcomes:** The expected outcomes describe the anticipated results or findings of the experiment based on the hypothesis. Expected outcomes provide a basis for evaluating the success of the experiment and determining whether the results support or refute the hypothesis. They also help anticipate potential implications and applications of the research findings.

Understanding GPS and Latitude-Longitude

GPS (Global Positioning System) helps us find locations on Earth using latitude and longitude coordinates.

Latitude: These lines go sideways, like belts around Earth. The Equator is the main line, dividing Earth into the Northern and Southern Hemispheres. Latitude lines are measured in degrees, starting at 0 degrees at the Equator and increasing as you move north or south.



Longitude: These lines go up and down, like steps on a ladder, from the North Pole to the South Pole. The Prime Meridian, passing through Greenwich, England, is the main line. Longitude lines are also measured in degrees, starting at 0 degrees at the Prime Meridian and increasing east or west.

Using GPS, we can find our latitude and longitude coordinates anywhere on Earth. Latitude tells us how far north or south we are, and longitude tells us how far east or west. These coordinates help us know exactly where we are on a map or GPS device.

For example, let's say you're at the Sydney Opera House in Australia. The latitude might be around 33.8568° S (that means you're 33.8568 degrees south of the Equator), and the longitude might be around 151.2153° E (meaning you're 151.2153 degrees east of the Prime Meridian).

GPS and latitude-longitude coordinates help us navigate and find places accurately, whether it's exploring new places or finding our way home.

Classroom Activities

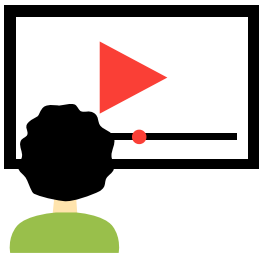
ACTIVITY 1

(1A) Watch the following video. The video gives an example of water quality testing by the Environmental Protection Authority in Victoria.

Link to video: https://www.youtube.com/watch?v=94YcjbYBchc [Copy and paste into browser]

(1B) Discuss what you learnt from the video as a class. Write your ideas on the whiteboard.

(1C) Complete the Video Reflection worksheet.



Video

Discuss

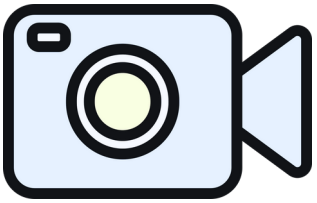
ACTIVITY 2

(2A) Complete the water quality parameter worksheet. This worksheet will test your knowledge on what each parameter is measuring.

Video Reflection

3

Three things I learnt while watching



2

Two questions I have from the video

1

One fact I found most interesting

Water Quality Parameters

Define the water quality parameters in the boxes below.

Temperature

pH

Dissolved oxygen

Turbidity

Salinity

Water Quality Parameters

Define the water quality parameters in the boxes below.

Ammonia

Nitrate

Nitrile

Phosphorus

Classroom Activities

ACTIVITY 3

(3A) In groups, collect information about local environmental organisations, catchment authorities and local council and how they are engaged in water quality testing at your local wetland. Use the internet, books, and articles in your research.

(3B) Collate the following information:

- Names and contact information of the group, council or catchment authority conducting water quality testing.
- The mission, objectives, and activities of each group related to water quality monitoring.
- Any recent water quality reports or findings published by these groups.

(3C) Compose a letter to one of the groups, council or catchment authority to ask them if your class can be involved in their next water quality testing day at your local wetland.
Demonstrate in your letter your current understanding of water quality parameters and explain why joining them in the field would be beneficial to you and your class.

A worksheet for your letter has been provided on the following page.

Classroom Activities

ACTIVITY 4

(4A) In Lesson 2, you will be visiting your local wetland and will be testing the water quality. Prior to the wetland visit, you will need to design your own water quality experiment.

(4B) In small groups, use Google Earth to view your local wetland. Brainstorm potential research questions related to water quality at the wetland. Think about factors that could affect water quality (i.e. human activities).

(4C) Select one of the research questions and develop a hypothesis and experimental design. Your experimental design should include:

- Identification of sampling sites within the wetland. You can use Google Earth for this. Write down the GPS coordinates of your site(s).
- Hypothesis.
- Identification of the water quality parameters to be measured (i.e. pH, turbidity, temperature) and how you intend to measure them.
- Prediction of the expected outcomes based on your hypothesis.

Water Quality Experiment

Research question:

Hypothesis:

GPS coordinates of site(s):

Water quality parameters to be measured:

Water Quality Experiment

Methods:

Expected outcomes: