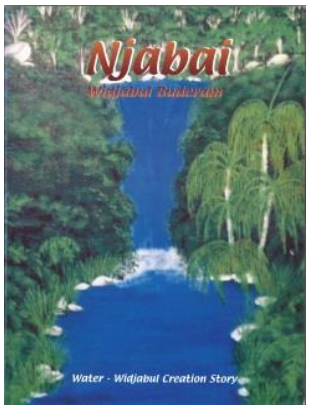


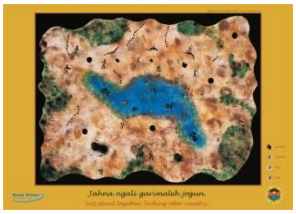
Station 2 – "Njabai" and indigenous fishing

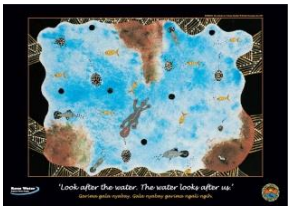
Students read Njabai: Widjabul Buderam (Water: A Widjabul Creation Story) before they visit the lab and discuss its main concepts about indigenous water use and conservation. *"Water is the most precious gift that we have had and still must be used sparingly to help everything that lives for future generations"*, Aunty June.

At the Lab students propose a hypothesis regarding the action of native plant material used in indigenous fishing. They prepare some leaves, seeds or bark and test it for its effect on water e.g. soapy lather, surface tension or dissolved oxygen. They conclude whether these are real effects or whether some other mechanism is responsible. This Station also demonstrates the application of scientific knowledge from indigenous people to the current day.

Key concepts

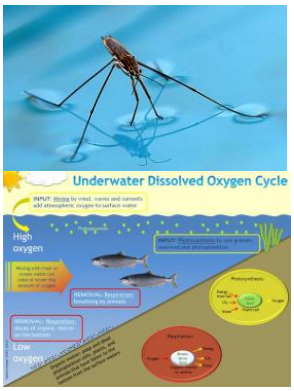
The catchment areas for Creek Dam, Emigrant Creek Dam and the Wilsons River Source all lie in Widjabul country of the Bundjalung Nation. Rous Water recognises that the people of the Widjabul country are the original custodians of the lands, waters, animals and plants of our water catchment areas. Njabai is the Widjabul word for 'water'. This traditional Dreamtime story was told to Widjabul Elder Auntie June Gordon when she was a little girl. The story focuses around Valley Falls (Minyon Falls) and the big pond at its base which is one of the headwaters of the Wilsons River. A tale of trickery and desire for control teaches us the need to share and protect the most precious gift of water for future generations.



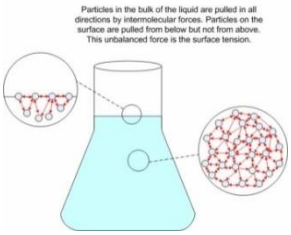


A variety of chemicals found in native plants will stun fish when it passes through the gills or in some cases ingested. The fish then floats to the surface for easy capture. The active ingredient is released by mashing the appropriate plant parts, which are then introduced to the water environment. Poisoning was generally done in stagnant pools or slow-flowing creeks that allow the pounded bark, leaf, seed, root or fruit, to concentrate its power without being washed away or diluted by a strong current. Sometimes creeks would be partly blocked to slow down the water flow. Gathering the fish was usually done by hand, but baskets, spears and nets were sometimes employed. The two main poisons identified in these plants are saponins and rotenones.

- Saponins – Plants that have an ability to make a soapy lather when crushed indicate they contain saponins. These are naturally occurring detergents and it was thought that their ability to reduce water surface tension was the way they affected fish. It is now believed that they destroy the cells in the gill membranes.
- Rotenones – These are especially toxic to fish and invertebrates. They interfere with the ability to use oxygen. Fish are highly susceptible because rotenone can efficiently and quickly enter the blood stream through the gills.
  http://www.primitiveways.com/fish_poison.html



Possible local plants are**:** Inkweed leaves (*Phytolacca octandra)*, Foambark leaves and bark (*Jagera pseudorhu), Black bean seeds (Castanospermum austral)* and Tie bush leaves and bark *(Wikstroemia indica)*



In 1901 it was recorded in the journal Science of Man that the Coombangaree people on the north coast caught fish in freshwater by poisoning it. There was a detailed description of this practice: "A weed called Bumbil Bumbil is collected and tied into small bundles. With a small bunch in each hand they dived under water and rubbed them together. This was quickly repeated. The poison from the weed so affected the fish by making their eyes smart so much that they could hardly see and they would shortly after float to the top of the water where the Aborigines would spear and catch them.***12*** Another way of stupefying fish was to beat together the leaves from a tree called 'Cutiga' until a lather was formed and then dive under water and rub it together as with the Bumbil Bumbil weed, whereupon the fish would gradually float to the surface.***12*** These poisoning methods had no effect on the edibility of the fish. ***12: JS Ryan, The land of Ulitarra: early records of the Aborigines of the Mid-North Coast of New South Wales, University of New England, Grafton, 1964, p.139.***

Although water molecules contain an oxygen atom, this is not what is needed by aquatic organisms living in natural waters. A small amount of oxygen, up to about ten molecules of oxygen per million of water, is actually dissolved in water. Oxygen enters a creek mainly from the atmosphere. This dissolved oxygen is "breathed" by fish and zooplankton and is needed by them to survive. http://water.usgs.gov

Dissolved oxygen in surface water is used by all forms of aquatic life therefore this is measured to assess the "health" of lakes and rivers. Oxygen enters a river from the atmosphere and from ground-water discharge. Cold water can hold more dissolved oxygen than warm water. Therefore dissolved-oxygen concentrations fluctuate with water temperature seasonally as well as daily. Rapidly moving water, such as in a creek tends to contain a lot of dissolved oxygen, whereas stagnant water contains less. Bacteria in water can consume oxygen as organic matter decays. As the amount of dissolved oxygen drops below normal levels, the water quality is harmed and creatures begin to die off. http://water.usgs.gov

The cohesive forces between liquid molecules are responsible for the phenomenon known as surface tension. The molecules at the surface of a glass of water do not have other water molecules on all sides of them and consequently they cohere more strongly to those, next to and below them. It is not really true that a "skin" forms on the water surface; the stronger cohesion between the water molecules as opposed to the attraction of the water molecules to the air makes it more difficult to move an object through the surface than to move it when it is completely submersed. http://water.usgs.gov

Detergents and soaps are used for cleaning because pure water can't remove oily, organic soiling. Soap cleans by acting as an emulsifier. Basically soap allows oil and water to mix so that oily grime can be removed during rinsing. Detergents are primarily surfactants, which could be produced easily from petrochemicals. Surfactants lower the surface tension of water, essentially making it 'wetter' so that it is less likely to stick to itself and more likely to interact with oil and grease. Modern detergents contain more than surfactants. Cleaning products may also contain fragrances and colours, enzymes to degrade protein-based stains, bleaches to de-colour stains and add power to cleaning agents and blue dyes to counter yellowing. http://chemistry.about.com

Detergents can have poisonous effects in all types of aquatic life if they are present in sufficient quantities and this includes the biodegradable detergents. All detergents destroy the external mucus layers that protect the fish from bacteria and parasites; plus they can cause severe damage to the gills. Most fish will die when detergent concentrations approach 15 parts per million. Detergent concentrations as low as 5 ppm will kill fish eggs. Detergents also add another problem for aquatic life by lowering the surface tension of the water. Organic chemicals such as pesticides and phenols are then much more easily absorbed by the fish. A detergent concentration of only 2 ppm can cause fish to absorb double the amount of chemicals they would normally absorb, although that concentration itself is not high enough to affect fish directly. Phosphates in detergents can lead to freshwater algal blooms that release toxins and deplete oxygen in waterways. When the algae decompose, they use up the oxygen available for aquatic life. http://www.lenntech.com

Images

http://science-at-home.org insect
http://chemwiki.ucdavis.edu beaker of water
http://www.globalspec.com DO
http://rouswater.nsw.gov.au Widjabul posters and book cover

Water literacy list

Cohesive force: The intermolecular forces (such as those from hydrogen bonding) which cause a tendency in liquids to resist separation. http://chemwiki.ucdavis.edu

Meniscus: The curvature of a liquid's surface within a container because of the surface tension. http://chemwiki.ucdavis.edu

Dissolved oxygen: Oxygen dissolved in water. Oxygen makes its way into water through a variety of processes, including aeration, as a by-product of photosynthesis and from surrounding air. http://www.globalspec.com

Surfactants: Compounds or substances that lower the surface tension of water, essentially making it 'wetter' so that it is less likely to stick to itself and more likely to interact with oil and grease.

Surface tension: The energy or work, required to increase the surface area of a liquid due to intermolecular forces. The molecules on the surface of the liquid, lack pulling forces in the upward direction therefore have a net downward pull. http://chemwiki.ucdavis.edu

Teacher reference

Water Walk info sheet 1 – link to pdf

Book: Njabai: Widjabul Buderam (Water: A Widjabul Creation Story) – in your School Library or ask Rous Water for a copy.

"The Water hole" found at http://www.rouswater.nsw.gov.au
A cartoon series and children's story explores how we might all take better care of the water and catchment ecology, through the eyes of the local native creatures. It has been developed by the creative partnership between Rous Water and Widjabul custodians e.g. "Flat out like a lizard drinking" – link to pdf

Link to our local water supply and sustainable water use

Learning about water is not just about 'facts and figures'. We need to learn new ways to act and care for our land and the water that springs from it. We need to learn to share water, not only with each other, but with all the other animals and plants in our environment. Aboriginal cultures, for thousands of years, have taught these messages through art, story, song, dance and the landscape itself. The catchment areas for Rocky Creek Dam, Emigrant Creek Dam and the Wilsons River Source all lie in Widjabul country. Rous Water recognises that the people of the Widjabul country are the original custodians of the lands, waters, animals and plants of our water catchment areas. Despite the significant changes of the past 200 years, the Widjabul people still maintain a responsibility and deeply felt association with the water and the land of this area. To find out more visit the Rous Water website 'Learning from Aboriginal Culture' section: http://www.rouswater.nsw.gov.au/cp_themes/default/page.asp?p=DOC-MKB-71-05-16

Kids section

Watch how to make a small boat move across the water. Questacon
http://www.youtube.com/watch?v=5u8ED8d6qb0

Science scenarios - Research and design an experiment that will show each statement to be correct:

- The surface of water is like a skin. Light things can lie on the top and don't fall through.
- Water can travel up a plant's stem.

Experiments

1. Surface tension creates the 'skin' on top of the water

What you need: 20 cent coin, cup of water and eye dropper.
What you do:

1. First make a prediction: how many drops of water do you think you can fit on the top surface of the coin?
2. Add one drop. After seeing how much room it takes, do you want to rethink your first prediction?
3. Now continue carefully adding drops until the water spills off the coin.
4. Try this three times, recording the number of drops each time, and then find the average number of drops that can fit.

PREDICT, OBSERVE & EXPLAIN.
Surface tension is the reason you can fit so much water on the coin. The water molecules attract each other, pulling together so the water doesn't spill. Try this experiment with different-sized coins.

2. Drive your boat with soap

What you need: Thick cardboard, scissors, large shallow bowl or dish full of water, dishwashing liquid and toothpick or eye dropper.

What you do:

1. Cut a cardboard boat shape with a triangular notch cut out of the back of the boat.
2. Gently place the boat on the water in the dish.
3. Place a drop of detergent into the notch at the back of the boat using the toothpick or eye dropper.

PREDICT, OBSERVE & EXPLAIN.

What's happening? It looks like the boat is being pushed along by the detergent, but in fact it is being pulled by the water in front of it. In many liquids the molecules of the liquid are attracted to each other. This attraction makes the surface of the liquid act like a stretched-out balloon skin. Any point on the surface of a liquid is under tension. In water, the tension is only very slight and it is fairly easy to break through the surface, but if you have ever done a 'belly-flop' into a swimming pool, you have felt the effect of surface tension. Normally, surface tension pulls the boat in every direction but when you add the detergent, the surface tension at the back is reduced. The tension at the front pulls the boat forward. The triangular notch helps the boat drag a little bit of the detergent with it, so it travels further. http://www.csiro.au