



Fresh water aquatic plants



What are freshwater aquatic plants?

Aquatic plants refer to any organisms living in water that photosynthesise and complete part or all of their life cycle in or near the water. Aquatic plants may include single-celled organisms (e.g., phytoplankton) that can make water turn green in colour when they are abundant, or they can be long filaments that may grow on rocks and make them slippery or slimy when you pick them up. The aquatic plants we will be looking at in this Alpha are all quite large and can appear similar to plants that we see on land. These aquatic plants are often collectively referred to as 'macrophytes', which means 'large plants'.

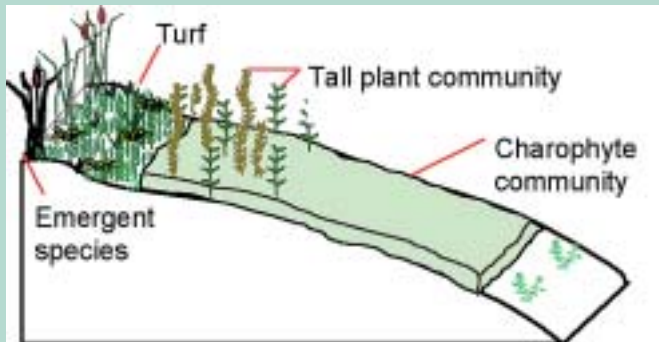
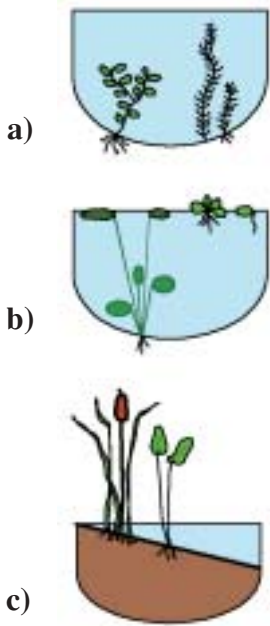
Freshwater aquatic plants can be seen growing in our lakes, rivers, streams and ponds and their form is varied. Even though aquatic plants are quite diverse, they can be grouped into three general categories:

a) Submerged aquatic plants grow below the water's surface. They may be rooted or non-rooted to the bottom sediments.

b) Floating aquatic plants. There are two types: those that float freely on the water surface and floating-leaved plants that have their leaves on the surface, but are attached to bottom-rooted plants by long stalks or petioles.

c) Emergent aquatic plants are rooted in the water-logged sediments while leaves and stems protrude up above the water's surface.

Note: This alpha focuses on submerged aquatic plants.



The above profile diagram illustrates the four main distinct aquatic plant community types present in an all-native New Zealand lake. A fifth community type (Bryophytes) may occur in some deep clear lakes.



Emergent species grow around edges of undisturbed lakes



A low growing **turf community** can look like underwater grass

Seeing below the surface

Native aquatic plants are those that have evolved and developed in New Zealand and are a natural part of our lakes and other water bodies.

Native aquatic plants play many important roles in maintaining healthy aquatic ecosystems. Before the arrival of humans, New Zealand lakes would have contained only native aquatic plants. Let's take a look at what aquatic plants look like and what you will see below the surface!

Put on your diving mask and fins and take a swim out from the side of an all-native, clear-water New Zealand lake – what will you see?

Emergent zone

Lets start at the lake edge – if a lake is sheltered and has not been disturbed, you are likely to find a band of emergent plant species growing around the lake margin. These species can include tall sedges, rushes and grasses.

Turf community

In the shallow zone of a lake, at about knee deep, you can often find a great diversity of low-growing plants that we refer to as the turf

Surviving under water

Submerged aquatic plants, like plants that grow on land, require light to photosynthesise and grow. Because of this, they are often restricted to living around the lake edges where the water is shallow enough to allow light to penetrate to the bottom. In lakes with clear water, light can penetrate to considerable depths and therefore aquatic plants can be found growing much deeper than in murky lakes. For example, in Lake Wakatipu, a clear water lake in the South Island, submerged plants (in this instance mosses and liverworts) can grow at a depth of 60 m.

Aquatic plants have made many adaptations to a life in water and some of these can be easily observed.

- Submerged aquatic plants have flaccid stems (they will hang limply out of water). This is because the buoyancy they get from being surrounded in water gives them support without requiring strengthening tissue in their stems.
- Living in water also leads to a reduction in root mass and water conducting tissues. Submerged plants are able to absorb water, nutrients and dissolved gases directly from the surrounding water. Roots are used primarily for anchorage and a few species have no roots at all.
- Another adaptation to life in water is the presence of specialised leaf shapes. Leaves are often small and thin giving them the flexibility to resist potential damage from water movement.
- Some submerged aquatic plants also have the ability to reproduce vegetatively. This means they can grow directly from small broken fragments (as small as 1 cm). This enables them to spread without the need for flowers and seeds

community. This mixed community can tolerate short-term exposure out of the water that may result from changes in water level.

Tall plant community

Next you will need to start swimming. Reaching up towards the surface you will see our tall plant community. These tall native plants will often be growing among other plants (turf or charophyte communities) and include milfoil and potamogeton species.

Charophyte community

Swimming further down the depth profile you will find charophytes. Charophytes are in fact macro-algae that form dense meadows and are a very important plant community in lake ecosystems.

Bryophyte community

Finally, you will have to use a submarine or dive gear if you want to see these plants. Deepwater bryophytes (mosses and liverworts) are quite rare around the world. In New Zealand, they can only be found in a small number of clear-water lakes in the South Island.



Milfoils and Pondweeds forming a **tall plant community** in Lake Wanaka



Charophytes seen here bright green in colour growing with milfoil species



Bryophytes growing down to 60m deep in Lake Wakatipu



Benefits of aquatic plants

Aquatic plants are a natural and important part of most lake communities and provide many benefits to fish, wildlife, water quality and people.

Aquatic plants serve many important functions. They:

- **Provide food**

Aquatic plants are an essential part of a lake ecosystem. They use photosynthesis to convert the basic chemical nutrients available to them in the water and sediments into plant matter. This then becomes food for lake fish, insects, snails, water birds and other wildlife.

- **Provide shelter**

Aquatic plants provide a refuge for small animals. Many native New Zealand fish, including the common bully, use the plants in a lake to hide from other fish such as eels and trout that eat them. Koura, our native freshwater crayfish also use aquatic plants as a shelter.

- **Improve water clarity**

Aquatic plants can help maintain clear water in a lake. They do this by trapping fine sediments and algae suspended in the water. They also help to prevent the bottom sediments from being stirred up by wind, waves and boat activity.



Koura (native freshwater crayfish) sheltering in a native plant community. Photo John Clayton (NIWA)



Native New Zealand fish such as this common bully also use aquatic plants for shelter. Photo Stephen Moore (Landcare)

- **Improve water quality**

Submerged aquatic plants assist in the maintenance of good water quality. They provide an important buffer strip at the edge of a lake or river, absorbing many of the harmful nutrients and pollutants that may run into the water from the surrounding land. They also reduce nutrients directly within the water column and help lessen the chance of undesirable algal blooms developing.

- **Protect shorelines**

Beds of aquatic plants help prevent shoreline erosion by dampening the effects of wave action and currents. The presence of plants in a lake slows down water movement and helps to absorb wave energy whereas in a river they aid in slowing river flows. Emergent plants growing around lake margins also play a part in protecting lake shorelines by stabilising the lake bottom in those areas.

- **Improve aesthetics**

In many lakes, aquatic plants contribute to the visual appearance and are enjoyable in their own right. The water lily is a good example of an aquatic plant that is often introduced to a lake or pond for this reason, but it can become a weed.

- **Provide economic value**

New Zealand has a fast growing tourism industry that is centred on our lakes and rivers and the activities they support. An example is trout fishing. Trout depend on small fish and other animals (snails and invertebrates) for food. The presence of healthy diverse aquatic plant beds help improve the variety and amount of food available to trout.

Invasive weeds

Invasive submerged weeds originate from other countries and several have had spectacular success in invading New Zealand lakes. Invasive weeds can be defined as those plants that interfere with, or have the potential to interfere with the values or uses of a water body.

When invasive weeds replace our native plants, there are significant environmental consequences:

- Habitats for native fish and wildlife can be adversely modified or destroyed.
- Important native plant and animal species (biodiversity) are lost.
- Recreational activities such as swimming, boating and fishing can be restricted.
- The aesthetic (visual) appeal of a water body can be ruined.

Invasive weeds can also adversely affect economic value:

- restricting irrigation and drinking water intakes.
- clogging hydroelectric dams.
- blocking navigational pathways
- restricting water movement causing flooding.
- reducing tourism and property values.

NZ's 4 worst submerged aliens



1. *Ceratophyllum demersum*



2. *Hydrilla verticillata*



3. *Egeria densa*



4. *Lagarosiphon major*

Alien's attack!

Invasive plant species can rapidly establish in a lake after which they can form solid bands and floating mats of dense weed around lake margins. Some of these invasive weeds can grow to over 8 m in height (that's taller than a house) and can grow down to a depth of 10 m. Although native charophyte communities may continue to grow below this depth in clear water, some invasive species (e.g., *Ceratophyllum* – see inset above) can still destroy such native vegetation below this depth by periodically collapsing and smothering deeper plants.



Invasive weed bed (*Lagarosiphon major*) dominating all other vegetation (Lake Taupo)
Photo: NIWA Hamilton

Invasive weed control

Because water is so important, scientists and managers are continually searching for effective ways to control invasive aquatic weeds. Weed control methods should not only control the weeds but they must have no effect on human health and should help protect our native plants and animals.

At present three common weed control methods are used in New Zealand.



A weed harvester mechanically removes weeds from the edges of Lake Wanaka. Photo: John Clayton, NIWA



Grass carp are the only biological control agent available in New Zealand for removing submerged invasive weeds. Photo: Rohan Wells, NIWA



NIWA diver monitoring aquatic plants in Lake Waikaremoana. Photo: John Clayton, NIWA

1. Mechanical control

Many different kinds of machines are being used to cut, chop, shred, suck, remove and transport invasive aquatic weeds away from a lake or water body. These methods tend to be costly but are capable of removing large amounts of weed that can then be disposed of away from the area. Hydroelectric stations have machines set up to remove weed from the entrance of their turbine intakes on a daily basis in peak weed season (late autumn).

2. Chemical control

Chemicals used to control aquatic invasive weeds are called herbicides. At present only one herbicide is approved for use on submerged weeds in New Zealand: Diquat. Diquat is a cost-effective way of controlling large areas of submerged weeds. Fortunately native charophytes (see inset on p. 3) are not affected by this chemical. Diquat is usually applied as a gel to minimise drift.

3. Biological control

A third less commonly used method is biological control. Grass carp are the only biological control agent presently available in New Zealand for removing submerged weeds and they are used only in a few water bodies. Grass carp are a species of fish that grow to a large size quite quickly by eating large quantities of submerged weeds. They are often called biological mowers because they tend to eat all submerged plants including native species, so they are only really suitable for special weed problem areas.

Monitoring aquatic plants

Monitoring plants allows us to better understand how lakes work, what condition they are in, and how best to preserve their quality.

Divers using SCUBA equipment can record information about aquatic plants under the water using waterproof paper attached to a clipboard.

Monitoring aquatic plants is important in making weed management decisions. It allows lake managers to detect invasive species at an early stage, allows them to monitor changes in a lake over time and provides them with a means to assess the effectiveness of weed control efforts and other management activities.

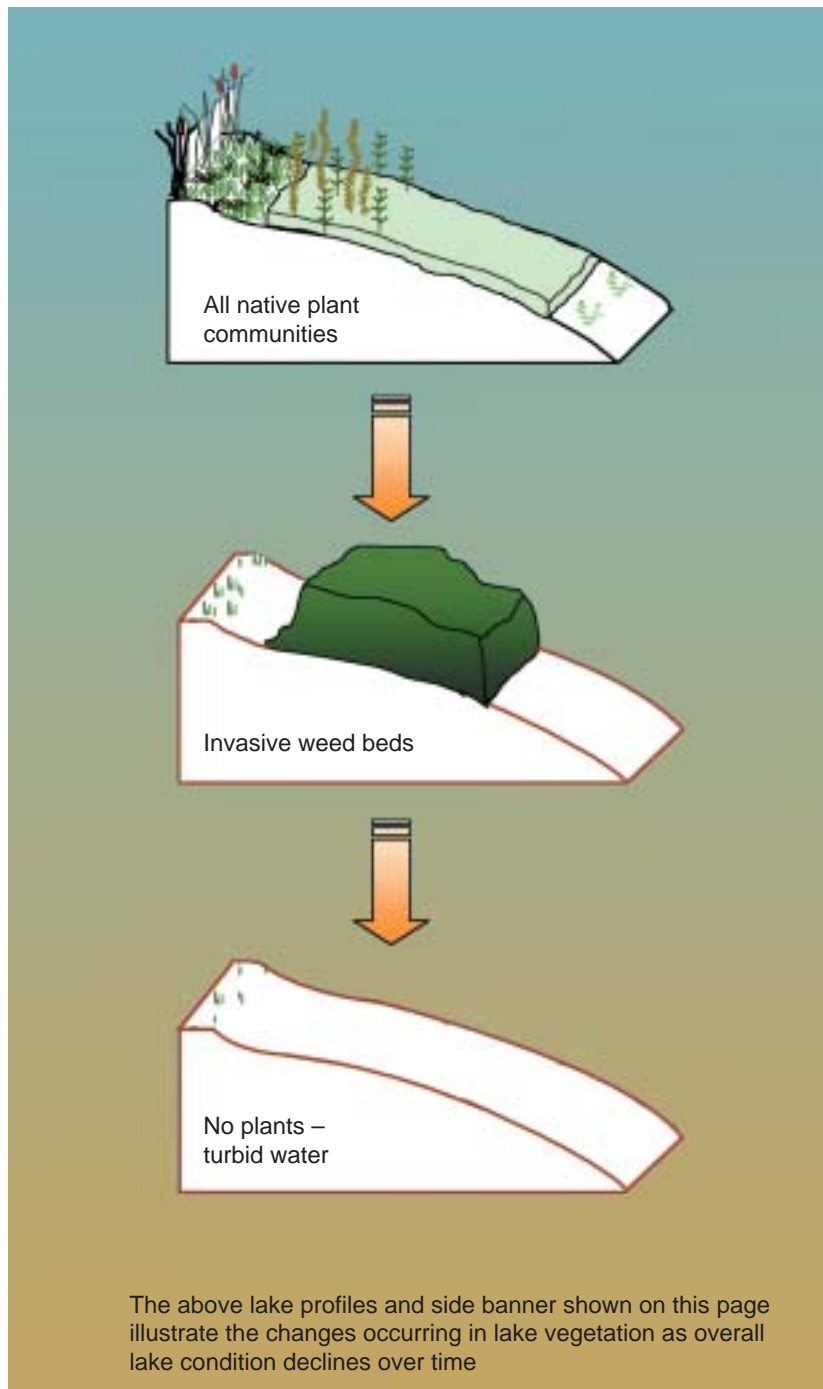
Aquatic plants can indicate lake condition

Did you know that some native aquatic plants are good indicators of lake condition?

Aquatic plants make good indicators because they:

- are big enough to see and can be easily monitored and identified
- can't swim away from disturbances and changes in water conditions like fish can
- grow in our lakes all year round so can integrate any changes occurring in a lake over time
- indicate the condition of lake edges where we all swim.

Using aquatic plants as indicators, lake managers are able to tell if a lake is in a good or poor condition.



What can you do to protect lakes around you?

You are the first line of defence against aquatic weed invasions. If new invasive plants are found early enough in a lake or river, managers have a much better chance of being able to remove them before they get out of control.

So what can you do?

- Don't be a spreader – check boats, trailers and fishing gear for plants and remove them when you leave the water. Always check and remove plants before entering a new lake.
- Be kind to your pets – don't release non-native plants and fish from fish bowls or ponds into natural water bodies. Always get fish and aquarium plants from an aquarium supplies shop so you know you are not buying pests.



Rare plants found in Lake Matheson
Photo: Tracey Edwards, NIWA



Lake Te Anau (South Island)

- Know your enemy – check out the websites listed below and learn to identify the plants you find in a lake or garden pond near you. If in doubt – collect samples and have them identified.
- Be observant – note any changes in the lakes, ponds, rivers and streams around you and report any new sightings to Department of Conservation or Regional Council Pest Plant officers as soon as possible.
- Communicate – talk to friends and family about protecting lakes from aquatic weeds.

Where can I find more information?

National Institute of Water and Atmospheric Research
Aquatic Plant Management in Hamilton
www.niwa.co.nz/rc/prog/aquaticplants

Landcare Research
www.landcareresearch.co.nz

Department of Conservation
www.doc.govt.nz/Conservation

WEEDBUSTERS
www.weedbusters.org.nz

Excellent resource and campaign in the United States of America
www.Protectyourwaters.net



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