

Weed Management Guide

C a b o m b a – C a b o m b a c a r o l i n i a n a



Cabomba (*Cabomba caroliniana*)

The problem

Cabomba is a *Weed of National Significance*. It is regarded as one of the worst weeds in Australia because of its invasiveness, potential for spread, and economic and environmental impacts. It is choking waterways along Australia's east coast.

Cabomba grows quickly and produces a large amount of plant material. It can significantly reduce water storage capacity and taint drinking water supplies. Water treatment costs can be increased by up to \$50 a megalitre. Heavy infestations can also raise water levels to a point where overflows and heavy seepage losses occur.

It is extremely persistent and can take over a water body, excluding native plant species. It can also have an impact on native animals – in northern Queensland platypus and water rat numbers are lower in infested creeks.

Cabomba's dense mass of underwater stems and leaves provide a hazard for recreational water users. When this vegetation dies off, decomposition causes dramatic oxygen reductions and foul-smelling water.

The weed

The plant is fully submerged, except for occasional floating leaves and flowers above the water surface. The roots grow on the bottom of water bodies and the stems can reach the surface. Parts of the



In some countries cabomba is known as fanwort due to the shape of its leaves.
Photo: Abyss Diving

plant can survive free-floating for six to eight weeks.

Cabomba is sensitive to drying out and requires permanent shallow water, usually less than 3 m, but up to 10 m, deep. It is a perennial plant with branched stems that have white or reddish brown hairs growing on them. The underwater leaves are divided into fine branches, giving them a feathery fan-like appearance (in some countries, cabomba is known as fanwort). These leaves secrete a sticky mucous which covers the submerged parts of the plant. The floating leaves, on the other hand, are small, diamond-shaped and borne on the flowering branches. The flowers are solitary. They range in colour from white to pale yellow and may also include a pink to purplish tinge.

Key points

- Cabomba is an aquatic weed that grows quickly and produces vast amounts of submerged plant material.
- It is still sold as an aquarium plant in some states, which makes control even more difficult. Its spread has been assisted by the deliberate 'seeding' of waterways to ensure a wild supply for the aquarium trade.
- Weed control in aquatic environments is difficult and control options are limited by social and environmental pressures.
- Cabomba is sensitive to drying out and requires permanent shallow water. So, where possible, draining a water body can provide temporary control.



Natural Heritage Trust
Helping Communities Help Australia
An Australian Government Initiative

Growth calendar

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
New growth	■	■	■	■	■	■	■	■	■	■	■	■
Active growth	■	■	■	■	■	■	■	■	■	■	■	■
Flowering	■	■	■	■	■	■	■	■	■	■	■	■
Seed formation	No viable seed yet found in Australia											
Seed drop	No viable seed yet found in Australia											
Germination	No viable seed yet found in Australia											

- General growth pattern in temperate regions
- In tropical areas, growth and flowering are continuous

In northern Queensland cabomba grows and flowers continuously. However, in southern areas it flowers and has its maximum growth period in summer. It dies back in winter and lies on the bottom of the water body, where the stems break up and provide dispersal material. New growth starts from these dislodged stem pieces.

How it spreads

Cabomba reproduces and spreads by the movement of small plant pieces. It does not produce fertile seed or fruit in Australia. Plant fragments may survive in water for six to eight weeks, and a detached shoot with at least one pair of leaves can grow into a mature plant. Pieces as short as 10 mm may be viable.

A native of South America, cabomba has been dispersed throughout the world by the aquarium trade. It is still illegally sold as an aquarium plant in many states of Australia, supplied by both growers and wild harvest operations. The trade represents a \$300,000-a-year industry, while conservative 1999 estimates place the national cost of cabomba control at more than \$500,000.

Where it grows

Cabomba grows well on a silty bed but not so well on hard surfaces. It grows quickly – growth of 50 mm a day has been reported in Lake Macdonald in Queensland – allowing it to respond to wide fluctuations in water depth.

It grows well in high nutrient environments with low pH, but in more alkaline waters it tends to lose its leaves. High calcium levels also inhibit growth. Unlike other aquatic weeds, cabomba can grow well in turbid water. It prefers a warm, humid climate with a temperature range of 13–27°C but can survive when the surface of the water body is frozen.

Most infestations occur in the hinterlands of northern New South Wales and



Massive amounts of decomposing vegetation cause dramatic oxygen reductions when cabomba dies back at certain times of the year.

Photo: Colin G. Wilson

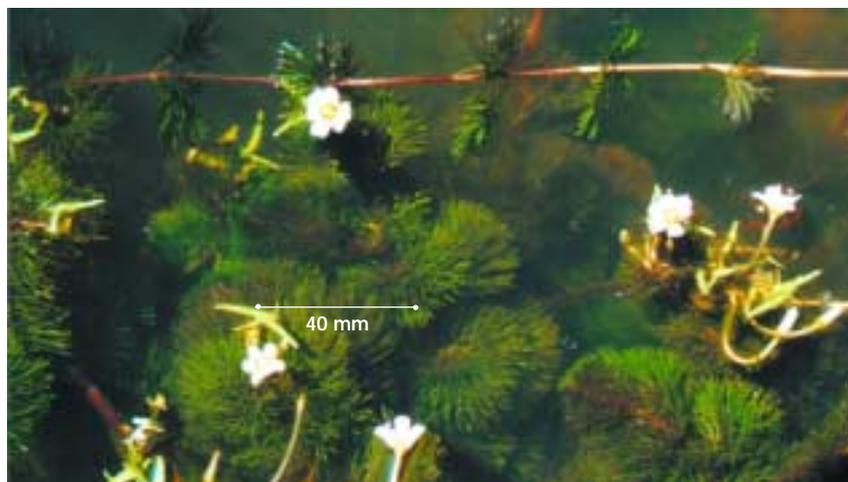
southern Queensland. However, infestations have been recorded as far apart as Darwin and central Victoria.

In Queensland it occurs in shallow, permanently flowing creeks and deep, slow-flowing pools of coastal river systems. The heaviest infestations occur in shallow dams on the Sunshine Coast but significant infestations also occur in Far North Queensland.

Cabomba is also growing in numerous creeks and river systems on the New South Wales North Coast and in lakes in central Victoria. At Lake Nagambie in Victoria, the infestation has spread quickly over the last few years and now covers 50–60 ha. It has also been the subject of an expensive eradication campaign at Marlow Lagoon at Palmerston in the Northern Territory.

Potential distribution

Cabomba infestations are isolated and currently only affect relatively few water bodies. However, based on climate and the availability of water, it could easily spread beyond its current distribution, especially across southern and eastern Australia. Waterways from Cape York to Hobart and from Sydney to Perth are at risk. Additionally, cabomba could potentially infest the Ord River irrigation system.



Cabomba is fully submerged except for occasional floating leaves and flowers above the water surface. Photo: Tom Anderson, Qld DNRM

Similar species to cabomba

Cabomba may be easily confused with other aquatic species. Another introduced species, the closely related pink cabomba (*Cabomba furcata*), is also sold as an aquarium plant. It is pink in colour with purple flowers and is not considered a weed in Australia. Other introduced aquarium species are considered weeds, such as the hornworts (*Ceratophyllum* spp.) and the watermilfoils (*Myriophyllum* spp.). These are generally similar looking to cabomba and identification is likely to be confirmed only by experts.



Underwater leaves secrete a sticky mucous which covers the submerged parts of the plant.
Photo: Tom Anderson, Qld DNRM

What to do about it

Preventing the further spread of cabomba

There is no clear picture about how far cabomba has spread in Australia. Detection is difficult and there is a low level of identification skills and awareness in the community.

The spread of cabomba in Australia has been aided by the deliberate 'seeding' of waterways to ensure a wild supply for the aquarium trade. This demand must be stopped and people educated to buy other species of aquarium plants.

Do not dump cabomba into drains or waterways

Some strategies to help prevent spread include the following:

- Dispose of cabomba from aquariums responsibly, eg by drying and burning the entire plant. The infestation at Marlow Lagoon near Darwin is thought to have started by someone emptying an aquarium (complete with coloured rocks) into the lagoon.
- Local agencies need to be able to close waterways to prevent spread.
- Develop protocols for ensuring washdown of boats, trailers and fishing equipment before they leave an infested site.

Mechanical control requires ongoing work

Physical cutting and removal is suited to accessible areas of closed water bodies with established heavy infestations. However, cabomba grows so quickly that treatment by this method is only likely to maintain a clear water surface for a few weeks.

Trials of mechanical removal in Lake Macdonald showed that two treatments over a month resulted in clearer water and some regrowth of other desirable aquatic species.

The cost of mechanically removing cabomba from dams is very high. At Marlow Lagoon more than \$400,000 was spent initially trying to control the weed without eradicating it.

Operators and their equipment require rigorous hygiene protocols to minimise spread. The removal of plant material needs to be carefully controlled. Cabomba easily fragments from disturbance, so control activities can actually contribute to spread of the weed if great care is not taken. Using a venturi dredge, which is like a giant vacuum cleaner, can help to overcome this problem. It minimises fragmentation and also extracts the root ball.

Hand pulling

Hand pulling by divers is more suited to isolated plants and small areas. A 100 m strip was hand pulled in Lake Macdonald but within two weeks it was difficult to find a trace of the cleared area.



Cabomba grows well in high nutrient environments: San Ramon, Paraguay.
Photo: Mic Julien

Weed control contacts

State / Territory	Department	Phone	Email	Website
ACT	Environment ACT	(02) 6207 9777	EnvironmentACT@act.gov.au	www.environment.act.gov.au
NSW	NSW Agriculture	1800 680 244	weeds@agric.nsw.gov.au	www.agric.nsw.gov.au
NT	Dept of Natural Resources, Environment and the Arts	(08) 8999 4567	weedinfo.nreta@nt.gov.au	www.nt.gov.au
Qld	Dept of Natural Resources and Mines	(07) 3896 3111	enquiries@nrm.qld.gov.au	www.nrm.qld.gov.au
SA	Dept of Water, Land and Biodiversity Conservation	(08) 8303 9500	apc@saugov.sa.gov.au	www.dwlbc.sa.gov.au
Tas	Dept of Primary Industries, Water and Environment	1300 368 550	Weeds.Enquiries@dpiwe.tas.gov.au	www.dpiwe.gov.au
Vic	Dept of Primary Industries/Dept of Sustainability and Environment	136 186	customer.service@dpi.vic.gov.au	www.dpi.vic.gov.au www.dse.vic.gov.au
WA	Dept of Agriculture	(08) 9368 3333	enquiries@agric.wa.gov.au	www.agric.wa.gov.au
Australia wide	Australian Pesticides and Veterinary Medicines Authority	(02) 6272 5852	contact@apvma.gov.au	www.apvma.gov.au

For up-to-date information on which herbicides are registered to control cabomba and the best application methods and dosages, contact your state or territory weed management agency or local council. This information varies from state to state and from time to time. Contact details are listed above, including contacts for the Australian Pesticides and Veterinary Medicines Authority, which hosts the PUBCRIS database. This database contains information on all herbicides that are registered for use on weeds in each Australian state and territory.

When using herbicides always read the label and follow instructions carefully. Particular care should be taken when using herbicides near waterways because rainfall running off the land into waterways can carry herbicides with it. Permits from state or territory Environment Protection Authorities may be required if herbicides are to be sprayed directly onto water.

Drying or shading cabomba are other control options

The deliberate lowering of the water level (known as drawdown) may be the best option for drinking water supplies. If the base of the water storage dries out completely there is little chance of cabomba surviving, but if it remains damp there is a more than 50% chance it will return.

Because cabomba requires direct sunlight, shading has been used to kill it in small areas. However, the cost is prohibitive for large-scale programs.

Once established, it is extremely difficult to control cabomba

Re-establishment of riverbank vegetation may offer some control if it provides a shading effect. Long-term benefits are expected from maintaining tree coverage along the edges of creeks and rivers to discourage cabomba establishing in the shallows.

Herbicides require special care

Chemical control is difficult because of the problems associated with applying

chemicals in water and the potential to affect non-target species. However, there are cases where herbicides have been used successfully. For example, at Marlow Lagoon in the Northern Territory, a \$4000 herbicide program successfully cleared the infestation after unsuccessful attempts at eradication by mechanical control.

Biological control has not yet been attempted

Biological control of cabomba has not been attempted. However, a new project being funded under the Natural Heritage Trust is looking for potential biological control agents in the native range of the weed.



Cabomba's dense mass of underwater stems and leaves provide a hazard for recreational water users. Photo: Abyss Diving

Cabomba threatens water supply in Lake Macdonald, southeastern Queensland

Lake Macdonald, near Noosa in southeastern Queensland, holds 8000 ML of drinking water for the region and provides a significant wildlife refuge.

The lake has been infested with cabomba for about ten years and now 75% of its surface area (about 180 ha) is covered by the weed. Control options are limited by the fact that herbicides cannot be used on the town water supply. Drawdown is not an option as the lake is part of the town's drinking water supply, is habitat for the endangered Mary River cod and provides local recreational opportunities such as boating and fishing.

While it has been accepted that the weed will never be eradicated, the local shire and community groups have adopted an integrated approach, focusing on actions to reduce impacts and prevent the spread. The control program includes: constructing sealed boat ramps to prevent snagging of cabomba on boat trailers; organising education campaigns to promote decontamination of vehicles and equipment; restoring and maintaining riverbank vegetation; and investing large amounts of time and money in mechanical removal and limiting the flow of nutrients into the system from catchment land uses.

The council purchased a mechanical weed harvester for \$260,000, which is capable of cutting and collecting weeds down to about 1 m below the surface.

It compacts the cabomba to prevent nutrients leaking back into the lake. The waste can then be disposed of safely. The first cut with the harvester grew back within three weeks, but after the second run the plant responded at a much slower

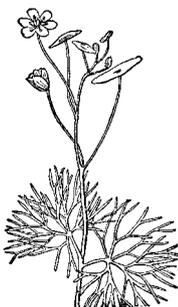
rate. The aim is that continual cutting will weaken the cabomba to such an extent that native water plants can compete for space. However, after several years this has not yet happened.



Lake Macdonald cabomba infestation.
Photo: Abyss Diving



Lake Macdonald after mechanical harvesting of cabomba.
Photo: Abyss Diving



The feathery underwater leaves, small white flowers and floating leaves of cabomba.

Photo: N. L. Britton and A. Brown @USDA-NRCS Plants

Legislation

Cabomba can be cultivated and traded in Victoria but is prohibited in all other states and territories. It has been traded from Queensland and New South Wales to the markets in Victoria and South Australia. The importation of all species of the genus *Cabomba* is prohibited under federal legislation. Check with your local council or state/ territory

government agency about its requirements for cabomba control.

Acknowledgments

Information and guide revision: Mic Julien (CSIRO/Weeds CRC), Richard Carter (NSW Agriculture/Weeds CRC), Bob Trounce (NSW Agriculture), Steve Wingrave (NT DIPE) and John Thorp (National Weeds Management Facilitator).

Maps: Australian Weeds Committee.

How to control cabomba

Quick reference guide



Trials of mechanical removal in Lake Macdonald showed that two treatments over a month resulted in clearer water and some regrowth of other aquatic species.
Photo: Abyss Diving

Education and identification

Detection of cabomba is difficult because so much of the plant is hidden under water. Community awareness

about the weed and identification skills need to be increased. People also need to be educated to buy other species of aquarium plants to stop the demand for cabomba and the deliberate seeding of waterways.

Prevent new outbreaks

There are few effective control options so it is very important to prevent the weed's spread by maintaining rigorous hygiene with boats and equipment, and disposing of plants by drying and burning.

Drinking water supplies

The deliberate lowering of the water level (known as drawdown) may be the best option for drinking water supplies.

If the base of the water storage dries out completely there is little chance of cabomba surviving but if it remains damp there is a more than 50% chance it will return.

Mechanical control

Ongoing mechanical control is expensive but may be the only option in accessible areas of closed water bodies with heavy infestations.

Chemical control

A herbicide is registered for cabomba control in non-drinking water in Queensland and the Northern Territory but there is community opposition to its use. There is no herbicide registered for cabomba control in drinking water.

Control options

Type of infestation	Hygiene	Physical	Mechanical	Habitat modification	Herbicides
Recreational water body / river	Develop protocols for ensuring washdown of boats, trailers and fishing equipment.	Not suitable.	Not suitable.	Revegetation may offer some control if it provides a shading effect.	Not suitable.
Closed water body with heavy infestation	Ensure operators maintain strict hygiene.	Not suitable.	Cut and remove plants, eg with a venturi dredge, to ensure fragments are not spread.	Not suitable.	Not suitable.
Isolated plants and small areas	Not suitable.	Hand pulling by divers.	Not suitable.	Not suitable.	May offer a suitable control.
Drinking water supplies	Not suitable.	Not suitable.	Not suitable.	Lower the water level to allow the base of the water storage to dry out and kill cabomba.	Not suitable.

Disclaimer

While every care is taken to ensure the accuracy of the information in this publication, the CRC for Australian Weed Management and the Commonwealth Department of the Environment and Heritage take no responsibility for its contents, nor for any loss, damage or consequence for any person or body relying on the information, or any error or omission in this publication.