

August 2008

Hydrilla eradication response

Frequently asked questions

About hydrilla

What is hydrilla?



Hydrilla - Lake Opouahi, Photo: Rohan Wells

Hydrilla (*Hydrilla verticillata*) is recognised as one of the world's worst submerged waterweeds. Hydrilla is native to Asia and northern Australia and is now found on every continent except Antarctica. Hydrilla has been used overseas as an 'oxygen weed' for use in pet fish tanks and ponds.

It out-competes other aquatic plants including natives and can remain dormant in sediments for up to ten years waiting for the right conditions to grow.

Weed beds of hydrilla are a nuisance to lake users such as bathers, anglers and boat users. Plant material washed ashore rots, reducing the aesthetic value of the lakes, and restricting access to water. It may also clog hydroelectric dams and block water intakes in water bodies where it is present.

Eradicating hydrilla from the Tutira lakes will protect other New Zealand fresh waterways from this highly invasive aquatic plant.

Propagation, spread and sale of hydrilla is prohibited under the Biosecurity Act 1993. If you suspect the presence of hydrilla you must report it to MAF Biosecurity New Zealand on 0800 80 99 66.

What does hydrilla look like?

Hydrilla has slender stems which can grow up to the surface, from crowns rooted in the substrate in water as deep as nine metres. Leaves are 6 to 20 millimetres long, 2 to 4 millimetres wide. The leaves are strap-shaped with pointed tips and saw-tooth edges, and they grow in whorls of 4 to 8 around the stem. Leaf colour can vary from green, translucent, yellowish, to brown. Hydrilla produces turions in the axils of leaves and tubers (like little potatoes). Both turions and tubers over-winter within the sediment. Only male plants are present in New Zealand.



Leaves and stem



Tubers (L) and turions (R)

Where does hydrilla grow?

Hydrilla grows in freshwater lakes and slow moving rivers between one and nine metres below the surface.

Where is hydrilla found in New Zealand?



Lake Tutira Photo: Ian R Gear

New Zealand populations of hydrilla are currently limited to four lakes in [Hawke's Bay](#)

- Tutira (174 ha);
- Waikopiro (11 ha) - immediately adjacent to Tutira;
- Opouahi (6 ha); and
- Eland (4 ha), on a privately owned hill country farm. The infestation found in Lake Eland has been eliminated by the use of grass carp.

It has not been found elsewhere in New Zealand.

An Order in Council was issued by the Governor General in 1973 preventing the use of motorised craft on Lakes Tutira, Waikopiro and Opouahi. This order determined that the lakes were Wildlife Refuges. This plus the relative isolation of lakes Tutira, Waikopiro and Opouahi and inaccessibility of Lake Eland, is the likely reason why hydrilla has not spread further.

How long has hydrilla been in New Zealand?

It is not known exactly when hydrilla first arrived in New Zealand. Hydrilla was first detected in lakes Tutira and Waikopiro in 1963 and Lake Opouahi in 1984. Hydrilla was most likely moved from these lakes to Lake Opouahi on eel nets. It was found in Lake Eland in 1986.

The Eradication Response

Why eradicate hydrilla?

Eradicating hydrilla from the Tutira lakes will protect other New Zealand waterways from this highly invasive aquatic plant.

Eradication is now feasible following the successful trial in Lake Eland, Hawke's Bay, to eradicate hydrilla using grass carp (also known as white amur) to eat the plants and the recent approval by the Environmental Risk Management Authority (ERMA) for the use in New Zealand of the herbicide endothall.

Hydrilla is a [national interest pest](#) and is one of eleven pests established in New Zealand the Ministry of Agriculture and Forestry Biosecurity New Zealand (MAFBNZ) has identified for eradication or national control.

What does the hydrilla eradication response involve?

A freshwater fish called grass carp (also known as white amur) will be introduced to the lake to eat the hydrilla. The herbicide endothall will be used in the early part of the response to control hydrilla at high risk sites and where hydrilla persists in sites inaccessible to the fish.

How long will it take to eradicate hydrilla?

MAFBNZ has planned a 20-year eradication response. The proposed eradication techniques are likely to take about three years (possibly up to 10 years) to effectively control all shoots of hydrilla in the lakes.

However, the reproductive bodies (tubers and turions) produced by hydrilla can live in lake-bed sediment for up to 10 years before they germinate and grow. Scientists advise that once the plants in the lake are eliminated, ten years must pass to make sure all the tubers in the lake-bed have gone. Only then we can be sure hydrilla has been eradicated.

When will eradication work at the Tutira lakes begin?

Eradication work is scheduled to commence in Spring 2008. A public notice will be placed in the local newspaper 'Hawke's Bay Today' advising when endotoxin treatment will be occurring.

Notices will be placed at strategic positions around the lakes when activities such as surveys and endotoxin treatment are underway.

Which other agencies are involved with the programme?

MAFBNZ is working closely with Fish and Game Hawke's Bay, the Department of Conservation, the Ministry of Fisheries, representatives of local iwi, and the Hawkes Bay Regional Council on this response.

Who provides the scientific and technical advice?

A technical advisory group including water quality, aquatic plant, ecology and freshwater fishery scientists provides advice to MAFBNZ on the hydrilla eradication response.

MAFBNZ also contracts scientists to undertake studies on the lakes, to provide monitoring and prepare scientific reports.

Control Methods

Grass Carp

What are grass carp?

Ctenopharyngodon idella commonly called grass carp, is a freshwater fish, native to China. Grass carp are sometimes called white amur after the Amur River in China where they occur naturally.



Grass carp

Grass carp are typically dark olive, brownish-yellow on the sides with a white belly and large slightly outlined large thick scales (as big as a 50c coin) with a cylindrical shape (similar to kahawai or mullet) growing to between 30 to 90 cm long in New Zealand.

Adult fish are vegetarian – preferring the tips of growing plants rather than dead plant material.

Have grass carp been used to eradicate hydrilla elsewhere?

Grass carp have been used successfully to manage waterweeds in other lakes in New Zealand and the United States.

Grass carp is the only method of biological control known to be successful for hydrilla eradication or the large scale control of weed beds.

Do any other animals eat hydrilla?

Swans graze on weed beds – however they can only reach to a depth of 1 metre into the water, while hydrilla can grow down to 9 metres deep.

Have the environmental effects of grass carp been assessed?

MAFBNZ commissioned the National Institute of Water and Atmospheric Research (NIWA) to prepare an [Assessment of Environmental Effects](#) report for grass carp. The assessment found that the removal of the hydrilla will allow native aquatic plants to regenerate with minor effects on the water quality and fisheries of the lake.

Will grass carp stir the lake bed up?

Adult grass carp are vegetarians preferring to eat from the tip of the plant down. They do not search around in the lake bed sediments for their food. Because grass carp are browsers that cannot forage in very shallow water, a turf of low growing plants species forms a mat to depths of 1-2m. The turf mat protects the sediments in shallow waters around the waters edge. No decline in water quality is expected following the introduction of grass carp. Water quality will be monitored for the life of the response.

Do grass carp affect eels and other native fish?

A Department of Conservation research report *Hydrilla in New Zealand: A review of the problem and recommendations for further actions*. Nov 2001, found that grass carp do not prey on fish in their natural environment.

When will the grass carp be introduced to Lake ?

Grass carp are scheduled to be introduced into the Tutira lakes in Spring 2008.

Where do the grass carp to be released into the lakes come from?

Grass carp are raised on a fish farm near Warkworth.

Are grass carp able to breed in New Zealand lakes and rivers?

Grass carp are not able to breed naturally in New Zealand because physical triggers such as monsoon floods are required for spawning. Additionally grass carp eggs are buoyant and are carried downstream. If they settle, they die. Because hatching time is related directly to water temperature long rivers are needed in colder climates, otherwise the eggs are carried out to sea or settle and die. Rivers in New Zealand are not long enough to allow successful development of the eggs.

Artificial breeding techniques must be used in a laboratory to stimulate fish to reproduce.

Will grass carp be able to escape from the lakes?

Barriers to prevent the movement of grass carp from Lake Waikopiro and from Lake Tutira will be placed between the lakes and at the outlet of Lake Tutira. This will ensure that the fish remain in their allotted lakes to maintain the grazing pressure on the hydrilla.

A barrier to prevent grass carp movement will also be placed between Lake Opouahi and the pest proof barrier.

How long will the grass carp take to eliminate the weed beds?

Scientists estimate that the hydrilla weed beds should begin to reduce in size about eighteen months after grass carp are introduced into the lakes. The weed beds should disappear completely within three to four years following the release of the grass carp.

What happens to the grass carp once hydrilla is eradicated?

The decision regarding the fate of the grass carp will be made once the hydrilla has been eaten out. Options include either leaving the fish in the lakes to die of natural causes or removing them.

Can I put grass carp in my farm ponds to control aquatic weeds?

Grass carp cannot be purchased from the breeder for release into waterways without an assessment of environmental effects and the necessary approvals.




Am I allowed to catch the grass carp?

No, if grass carp are accidentally hooked they should be released immediately. However, grass carp very seldom take a hook. While grass carp are grown for food in Asia and Eastern Europe, the presence of blue green algae in the Tutira lakes will taint grass carp flesh and will likely make the flesh unpleasant to eat.

Are grass carp related to gold fish and koi carp?

Grass carp (*Ctenopharyngodon idella*), gold fish (*Carassius auratus*) and koi carp (*Cyprinus carpio*) belong to the carp family Cyprinidae but behave very differently. The carp family is one of the largest of the freshwater fish families with about 1450 known species. There are no native carp species in New Zealand.

The following table compares the three species.

	Grass carp	Gold fish	Koi (Koi means carp in Japanese)
	<i>Ctenopharyngodon idella</i>	<i>Carassius auratus</i>	<i>Cyprinus carpio</i>
			
Names	Grass carp, White Amur.	Moriana (by Maori in Rotorua and Taupo).	European or Japanese carp.
Colour	Typically dark olive, brownish-yellow on the sides with a white belly and large slightly outlined scales.	Typically olive-bronze to deep gold in the wild.	Typically greenish-olive, dull browns, blacks or greys sometimes with irregular colour blotching of orange, red, yellow or white.
Feed	Vegetarian – preferring the tips of growing plants rather than dead plant material.	Omnivorous - feeding on plant material, decaying organic matter and occasionally small bottom-living animals.	Omnivorous bottom feeders that uproot vegetation and stir up the sediments creating turbidity.
Features	Typically 30 to 90 cm long in New Zealand. Cylindrical shape similar to kahawai or mullet. Large thick scales (as big as a 50c coin).	Adults are generally 10 to 25cm long. Flattened body shape similar to snapper.	Adults range from 25 to 70 cm long. Cylindrical shape but larger fish can develop big guts. Have two pairs of barbels (feelers) near the mouth for feeling around in the sediments.
Distribution	Controlled releases of leased fish into approved water bodies.	Found in many ponds and lakes following release by fanciers. Widely distributed in the lower Waikato, its tributaries and lakes.	Found in some upper North Island water bodies.
Status	Not widely available.	Can be purchased.	A pest fish species.
Variants	No selected forms.	Fanciers have selected a range of colour types and forms from the wild stocks.	Fanciers in Japan and elsewhere have selected a wide range of colour types and forms.
Breeding	Will not breed in NZ lakes and rivers	Will breed in NZ lakes and rivers	Will breed in NZ lakes and rivers

Endothall

What is endothall?

Endothall is an herbicide that has been approved by the Environmental Risk Management Authority (ERMA) for use in New Zealand fresh water environments. Endothall is a contact herbicide, acting on the foliage of the hydrilla. Endothall does not affect the tubers and turions, which must germinate and be in active growth to be affected.

Can eradication in the Tutira lakes be achieved by using endothall alone?

No. Grass carp, the removal of obstructions such as fallen tree branches and the use of endothall work together to eradicate hydrilla.

Will endothall stay in the lakes?

Endothall will not stay in the lakes. Endothall is rapidly broken down by micro-organisms found in the sediments and water. It is made up of only carbon, oxygen, hydrogen and potassium, breaking down to form water, carbon dioxide and potassium ions. Where Aquathol K (the product being used) is applied Endothall is usually not detectable four days after application.

Is endothall safe?

Endothall will be applied in amounts well within the manufacturer's safety recommendations for humans and animals. Small portions of the lakes will be treated and the endothall will be diluted and will rapidly breakdown to form water, carbon dioxide and potassium ions.

Where will endothall be used?

The areas to be treated with endothall are shown on the following maps. Only high-risk sites such as the areas close to boat ramps and the causeway, where hydrilla may be caught in boats and canoes or other sports equipment, will be treated.



The target areas for hydrilla control in Lake Tutira (aerial photograph from Survey Series Hawkes Bay 2000).



The target area for hydrilla control in Lake Waikapiro (map after Irwin 1978).



The target area for hydrilla control in Lake Opouahi (map after Department of Lands and Survey 1981).

How often will endothall be applied?

Endothall is scheduled to be applied to the nominated high-risk sites in Spring 2008 before grass carp are released into the lakes. One application is planned at that time and a second may be needed if the hydrilla is not reduced by 80 percent. Further applications will be made

- At high risk sites if re-growth occurs before the effects of the grass carp are observed
- Where hydrilla persists as the response progresses.

How will endothall be applied?

The liquid form of endothall (Aquathol K) will be applied by a registered chemical applicator using a specially designed, air propelled boat to allow easy manoeuvrability and prevent water disturbance. Weighted nozzles suspended from a boom will be trailed in the water to apply the endothall directly above the weed beds.

How much endothall will be applied?

Endothall as Aquathol K will be applied at the recommended rate of 5ppm (parts per million which is equivalent to 5 mg a.i./L) at the following sites:

	Area to be treated (hectares)	Total area to be treated as % of lake area	Average weed bed depth (metres)	Endothall as Aquathol K (litres)
Tutira		4.0		
Boat ramp	0.05		4.0	19.6
Causeway	7.60		4.5	3351.0
Waikopiro		13.0		
Causeway	1.34		4.5	590.0
Opouahi		<2.0		
	0.12		2.5	29.5
Eland	No hydrilla plants have been found since 2003. Endothall will be used in Lake Eland should hydrilla be found to be present.			

Have the environmental effects of endothall been assessed?

MAFBNZ commissioned the National Institute of Water and Atmospheric Research (NIWA) to prepare an [Assessment of Environmental Effects](#) report for endothall. The assessment did not identify any significant adverse effects and supports the use of endothall to treat high-risk sites.

Will endothall affect trout?

Endothall will not affect trout at the rates being applied.

Are there any with-holding periods following endothall use?

The following with holding periods are required by the Environmental Risk Management Authority (ERMA):

- Swimming 1 day
 - Consumption of fish 3 days
 - Drinking/irrigation water 25 days
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Response Effects

Will the eel fishery be affected by the eradication response?

The Environmental Risk Management Authority (ERMA) has considered all of the data regarding fish toxicity and has taken that into account when granting the approval for the use of endothall.



Short fin eel Photo: Ian R Gear

Eels are common in the lowland waterways of New Zealand where grass carp have been used over the past two decades. No adverse effects or competition between the two species (one a vegetarian and the other a carnivore) have ever been found. Eels and grass carp naturally co-exist in the rivers of China and in New Zealand for the last 20 years in Western Springs where grass carp are huge in the presence of numerous eels.

In the Assessment of Environmental Effects reports NIWA discusses the likely impacts on eels in the lakes. It is concluded that there will be little effect.

Do grass carp affect other native fish?

Adult grass carp are vegetarian and do not prey on fish in their natural environment.

In New Zealand, grass carp interactions with trout, bullies, smelt, tench, rudd and galaxids were studied in Lake Parkinson and Waihi Reservoir. Eels, bullies, smelt and galaxids have survived in the presence of large (>250mm) starved grass carp. Bullies have been observed to spawn successfully in ponds containing high densities of feeding grass carp.

Will the trout fishery be affected as the hydrilla is removed?

When grass carp were first introduced to New Zealand trout and grass carp were grown together at high densities in ponds at Rotorua. No signs of competition were ever observed by the staff involved.

The assessment of the environmental effects of grass carp found that while there will most likely be a shift in the composition of the spectrum of food consumed by trout – probably more bullies and a shortening of the food chain – it is unlikely that there will be a reduction in the food available.

Observations of grass carp released into Lake Parkinson noted that while there was initially a decrease in trout numbers due to predation of newly stocked fish by shags, the trout that remained grew to a larger size, more quickly, than the population present when the weed beds existed. Condition of the trout also increased following the removal of the weed beds. The increase in size was attributed in part to a lower trout density but also indicated that in the absence of the exotic weed beds the food was available for trout. Common bullies were the main summer food source for trout in Lake Parkinson. Bully numbers expanded following the removal of the exotic weeds.

NIWA reported to the Department of Conservation in a 2004 report:

"In essence, the food web leading to trout was simplified and changed by weed removal. Aquatic insects such as caddis larvae and Odonata were reduced, but this change was compensated for by the increase in benthic foraging space, an increase in the availability of common bullies on the lake bed, and an increase in mid-water prey such as water boatmen and smelt.

NIWA continues:

"similar changes in the food web leading to trout would be expected following weed removal in Lake Waikopiro. Snails and aquatic insects associated with weed beds can be expected to decline, although more snails will be able to colonise the lake bottom where they feed on periphyton films. Common bullies and chironomid larvae can be expected to increase in abundance and water boatmen will increase in importance as a trout food as they will be more exposed to predation. Overall, the aquatic food production will not be reduced in this lake by weed removal, and only the prey species involved in transferring it to trout will change.

Are grass carp used elsewhere in New Zealand where trout are present?

Yes. Lake Parkinson in South Auckland is an example. Waikato Fish and Game Council has recently purchased grass carp for the third introduction of the grass carp into this lake, to enhance angler access to trout stocked in the lake. By removing weed beds, grass carp enhance trout fishing from lake edges.

Will the aquatic bird life be affected?

The native duck scaup (papango) (*Aythya novaeseelandiae*) will benefit from the removal of the hydrilla beds. Rarely found on coastal lakes or rivers scaup are diving ducks preferring large bodies of clean water. They can dive to a depth in excess of 3 metres searching for freshwater snails, invertebrates and aquatic plants. Hydrilla occupies the most productive parts of the lakes at depths of between 1 and 9 metres. Formerly quite widespread, scaup range and numbers have declined due to habitat modification, shooting and predation.

The introduced black swan (*Cygnus atratus*) feeds on the hydrilla weed beds grazing them to approximately 1 metre beneath the surface. Eradication of hydrilla will remove a significant food supply of swans and may cause them to relocate.

If native plants are eaten by grass carp will they come back when the fish are removed?

Regrowth of native plant species following aquatic weed eradication has been shown in the following places in New Zealand:

- Post grass carp Waihi Reservoir and Lake Parkinson
- Post chemical Lake Rotoroa (Hamilton Lake) and Lake Ahimanawa

In Lake Eland, native macrophytes regenerated readily from the seed banks in bottom sediment inside exclosures used to keep grass carp out. A similar response can be expected in the Tutira Lakes.

Other agencies

What is the Hawke's Bay Regional Council's role in the hydrilla eradication response?

The Hawke's Bay Regional Council (HBRC) is MAFBNZ's partner in this national interest pest response. HBRC is helping MAFBNZ in the response by facilitating interactions with stakeholders and undertaking water quality monitoring.

What is the Department of Conservation's role in the hydrilla eradication response?

The Department of Conservation (DoC) must approve the release of grass carp.

Have iwi been consulted?

Ngati Pahauwera and Ngati Tu have both been consulted. Both provided input into the preparation of the Assessment of Environmental Effects for endothall and for grass carp.

What is Hawke's Bay Fish and Game Council's role in the eradication response?

Fish and Game need to approve release of grass carp – Hawke's Bay Fish and Game Council has given approval, for MAFBNZ to release grass carp into the Tutira lakes.

Hawke's Bay Fish and Game Council is working closely with MAFBNZ to develop a Memorandum of Understanding and will monitor the fishery, providing assistance where it can.

OXYGEN WEED

What oxygen weed species occur in the Tutira lakes?

Two oxygen weed species *Elodea canadense* and hydrilla which are both exotic occur in lakes Tutira, Waikopiro and Opouahi. Grass carp will eat both species.





What is oxygen weed?


Oxygen weed is the term given to a number of submersed aquatic plants thought to be beneficial as they give off oxygen during the day. During the night however these plants remove oxygen, which is required by fish and invertebrates such as insect larvae, from the water. The five oxygen weed species present in New Zealand are vigorous and compete with and displace our native freshwater plants.

What introduced oxygen weeds are there in New Zealand?

In New Zealand five species of introduced aquatic plants are commonly referred to as oxygen weed. They are:

- *Elodea canadensis* Canadian pond weed
- *Hydrilla verticillata* Hydrilla
- *Lagarosiphon major* Lagarosiphon
- *Ceratophyllum demersum* Hornwort
- *Egeria densa* Egeria

<i>Elodea canadensis</i>	Canadian pond weed	
<i>Hydrilla verticillata</i>	Hydrilla	
<i>Lagarosiphon major</i>	Lagarosiphon	
<i>Ceratophyllum demersum</i>	Hornwort	

<i>Egeria densa</i>	Egeria	
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Are oxygen weeds good for ponds and lakes?

The group of plants commonly referred to as oxygen weed are not good for the health of ponds and lakes. The five species compete with native plants. In some instances they will often grow to the water surface and form dense mats that exclude sunlight from other plants. This can significantly reduce aquatic plant and animal biodiversity. Large populations of oxygen weed(s) may affect fish size and fish population levels. The dense mats also affect recreational activities. Apart from interfering with fishing, boat motors can become tangled with them and swimming areas choked. Oxygen weeds will often slow or clog rivers, irrigation ditches, flood control canals, and impede inflows to hydro-electric turbines. Dense stands can alter water quality by decreasing oxygen levels and increasing pH and water temperature destabilising the aquatic system.

Can I use hydrilla for my fish tank?

No you cannot. It is illegal to be in possession of, give away or sell, release or spread hydrilla, which is an unwanted organism.