



NIWA
Taihoro Nukurangi

FRESHWATER INVASIVE SPECIES OF NEW ZEALAND 2020



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Introduction

Many of New Zealand's freshwater habitats have been invaded by organisms not native to this country. Impacts from these species can be significant, including destabilisation of aquatic environments, loss of indigenous plant biodiversity, implications for human health and cultural wellbeing, economic losses through lost hydropower generation, impeded drainage and irrigation and reduced opportunities for recreational activities like boating and fishing.

Freshwater pest management

Crossing the New Zealand border

Over 200 species of freshwater animals and plants have naturalised in New Zealand, the vast majority being deliberately introduced as ornamental garden pond or aquarium specimens, but also as part of acclimatisation efforts in the past to create sport fisheries. Other introduction pathways include contaminant organisms associated with those deliberate introductions but also importation for food, medicinal and fodder uses and rarely through accidental pathways such as contaminated recreational gear and machinery. Legislation from the 1970's restricted the deliberate importation of any further non-native species and, in the 1990's, the Biosecurity Act (1993) (<http://www.legislation.govt.nz/act/public/1993/0095/latest/DLM314623.html>) along with the Hazardous Substances and New Organisms Act (1996) (<http://www.legislation.govt.nz/act/public/1996/0030/latest/DLM381222.html>) clarified, consolidated responsibility and provided the legal framework for New Zealand management agencies to help keep harmful (invasive non-native) organisms out of New Zealand. To date, no new legal introductions of freshwater organisms have occurred since that time, but illegal and/or accidental introductions of potential pests still occur.

Internal dispersal

Once in New Zealand, introduction and establishment of naturalised populations in our water bodies has occurred through deliberate release of species or disposal of unwanted aquarium/pond contents. Many of our current pest species have limited capacity to disperse from catchment to catchment, without human mediated transfer, either deliberate or accidental via contaminated watercraft and trailers, fishing gear and other equipment used in water (e.g. drainage clearing machinery).

Risk assessment

Not all naturalised pest species have the same level of impacts on habitats where they have established. In order to quantify the risks posed by the range of freshwater plant and fish species to New Zealand waters, two risk assessment models have been developed by NIWA. The Aquatic Weed Risk Assessment Model (AWRAM) was designed to characterize functional traits relevant to alien aquatic plant invasion e.g., ability to displace other species, reproductive output and dispersal mechanisms, along with assessment of environmental and economic impact and ease of management (<https://niwa.co.nz/freshwater-and-estuaries/research-projects/aquatic-weed-risk-assessment-model-awram>). Species are assigned a score for each undesirable trait with a maximum theoretical score of 100. The Fish Risk Assessment Model (FRAM) was developed to assess risks posed by the introduction of non-native fish into New Zealand (<https://niwa.co.nz/freshwater/management-tools/fish-risk-assessment-model>). This scores the potential risk of establishment and likely impact of introduced freshwater fish species in New Zealand. These models provide useful decision support tools for management agencies working to prevent importation and prioritise management of species with limited current distribution within New Zealand. Additional to species-based risk assessment, research to predict the risk of invasive species spread to new unimpacted water bodies (pathway risk) is also undertaken to assist management to prevent future spread.

Legislation

A number of named freshwater pests have legal status under the Biosecurity Act. These include organisms named in the Biosecurity (Notifiable Organisms) Order 2016 (New Zealand Government 2016). It lists a number of organisms that must be reported by anyone either finding them or suspecting their presence in imported goods. These include six aquatic weeds and freshwater marron crayfish along with a range of disease causing organisms such as crayfish plague. The Biosecurity Act also defines a larger number of Unwanted Organisms as any organism that is capable of causing harm to natural or physical resources or human health. These include the pests named as Notifiable Organisms and another twenty aquatic plants, three fish and the alga didymo which have been found inside our border. These organisms can be searched for at <https://www.biosecurity.govt.nz/protection-and-response/finding-and-reporting-pests-and-diseases/registers-and-lists/>. Unwanted Organisms cannot be distributed or sold in New Zealand and the 25 plant species are included in the National Pest Plant Accord (<https://www.mpi.govt.nz/protection-and-response/long-term-pest-management/national-pest-plant-accord/>), an agreement between the New Zealand Plant Producers Incorporated, Regional Councils, Department of Conservation and the Ministry for Primary Industries Biosecurity New Zealand. The Accord collectively agree on which potential weeds are managed by banning deliberate distribution through the nursery/aquarium trade.

One of the fish designated as an Unwanted Organism (koi carp) along with another fish (rudd) are classed as a Noxious Fish under the Freshwater Fisheries Regulations 1983 (<http://www.legislation.govt.nz/regulation/public/1983/0277/latest/DLM93750.html>). This legislation prevents the possession, breeding and movement of those species.

Freshwater pest management

The risks posed by freshwater pest species and the ways they are spread are critical pieces of information to biosecurity managers in developing control strategies, along with knowledge of the distribution and access to effective control tools. Management of freshwater pests is undertaken by central and territorial (regions and some district/city councils) government agencies.

Guidance is provided by the National Policy Direction for Pest Management (2015) (<https://www.mpi.govt.nz/protection-and-response/biosecurity/national-policy-direction-for-pest-management/>), which outlines requirements for pest management plans run by central or regional government. This outlines six different management goals:

- **Exclusion** – preventing the establishment of a pest within the area managed
- **Eradication** – eliminating all individuals of a pest including their reproductive structures (potentially long-lived seed or spore banks for plants and some invertebrates) within the area managed
- **Progressive Containment** – containing or reducing the geographic distribution of the pest over time within the area managed
- **Sustained Control** – ongoing control of pests to reduce their impact within the area managed and prevent further spread
- **Site-led** – any of the above goals with the focus on protecting sites with high values

Pathway plan – to reduce the spread of pests (not considered in this guide – please see <https://www.mpi.govt.nz/travel-and-recreation/outdoor-activities/check-clean-dry/>).

Central government agencies include the Ministry for Primary Industries Biosecurity New Zealand (MPI), Department of Conservation (DOC) and Land Information New Zealand (LINZ). MPI is the lead agency for biosecurity, administering the Biosecurity Act and leading responses for newly detected pest species (e.g. gudgeon and fanwort) and National Interest Pest Responses for the five Notifiable Organism plants (the sixth Notifiable Organism, water lettuce, is considered eradicated from New Zealand) (<https://www.biosecurity.govt.nz/protection-and-response/long-term-pest-management/freshwater-pests/>). DOC primarily manage the containment and eradication of four freshwater pests (koi carp, gambusia, rudd, hornwort), with additional management of other invasive aquatic pest species (<https://www.doc.govt.nz/stopthespread>). LINZ is responsible for the management of submerged weeds in a number of North and South Island lakes (<https://www.linz.govt.nz/crown-property/using-crown-property/biosecurity/control-programmes>). Each regional council or unitary authority (district or city council with regional responsibilities; Gisborne, Marlborough, Nelson and Tasman) has developed a Regional Pest Management Plan (RPMP) and all include the management of freshwater pest species (see Table 1 for links to each RPMP).

Table 1: Regional Pest Management Plans

Abbreviation	Agency	Web-page
NTL	Northland Regional Council	https://www.nrc.govt.nz/resource-library-summary/plans-and-policies/pest-management/northland-regional-pest-and-marine-pathway-management-plan/
AUK	Auckland Council	https://www.aucklandcouncil.govt.nz/have-your-say/topics-you-can-have-your-say-on/regional-pest-management-plan/Documents/proposed-regional-pest-management-plan.pdf
WKO	Waikato Regional Council	https://www.waikatoregion.govt.nz/council/policy-and-plans/regional-pest-management-plan/rpmp/
BOP	Plenty Bay of Plenty Regional Council	https://cdn.boprc.govt.nz/media/781531/proposed-regional-pest-management-plan-for-the-bay-of-plenty-region-21-september-2018-pdf.pdf
GIS	Gisborne District Council	http://www.gdc.govt.nz/regional-pest-management-plan/
HKB	Hawke's Bay Regional Council	https://www.hbrc.govt.nz/environment/pest-control/biosecurity/pest-management-plan-review/
TKI	Taranaki Regional Council	https://www.trc.govt.nz/environment/core-documents/regional-pest-management-plan-and-trc-biosecurity-strategy/
MWT	Horizons Regional Council	http://www.horizons.govt.nz/HRC/media/Media/Pests/2017-2037-Regional-Pest-Management-Plan.pdf
WGN	Greater Wellington Regional Council	http://www.gw.govt.nz/greater-wellington-regional-pest-management-plan-2019-2039/
TAS	Tasman District Council	https://www.tasman.govt.nz/my-council/key-documents/more/environment-reserves-and-open-space/tasman-nelson-regional-pest-management-plan/
MBH	Marlborough District Council	https://www.marlborough.govt.nz/environment/biosecurity/regional-pest-management-plan-2018
NSN	Nelson City Council	http://www.nelson.govt.nz/council/news/public-notice/regional-pest-management-plan-2019-2029/
WTC	West Coast Regional Council	https://www.wcrc.govt.nz/publications/regional-plans/regional-pest-management-plan
CAN	Canterbury Regional Council	https://ecan.govt.nz/your-region/your-environment/our-natural-environment/pest-management/
OTA	Otago Regional Council	https://www.orc.govt.nz/media/7736/biosecurity-strategy-2019-final.pdf
STL	Southland Regional Council	https://www.es.govt.nz/about-us/plans-and-strategies/regional-plans/southland-regional-pest-management-plan

The guide

Freshwater Invasive Species of New Zealand is intended to provide a guide to the most serious pests that are subject to control programmes carried out by resource and natural heritage managers. All Unwanted Organisms currently or previously present in New Zealand are included in this guide.

This resource builds on previous guides produced in 2004 and 2013, with fact sheets provided on the following freshwater pests:

1. Vertebrates (9 fish species and 1 reptile species)
2. Invertebrates (11 species)
3. Plants (32 aquatic weeds species and 3 algal species)

Information provided for each species includes the scientific and common name, presence in New Zealand including the first record in the wild, suitable habitats, methods of spread, key identification features, reference photographs, similar species and key differences to distinguish the pest species, their biosecurity status under legislation and biosecurity risk (including their ranking according to AWRAM or FRAM). Distribution maps are provided based on records in NIWA databases and those of management agencies, the Australasian Virtual Herbarium (<http://avh.chah.org.au/>) and verified records on iNaturalist NZ (<https://inaturalist.nz/home>) and management approaches undertaken in each region.

This 2020 version differs from earlier guides, with the distribution maps not only showing individual records but also linking to the management approach by regional and territorial management agencies, and also the exclusion of plant species that are not managed under statutory management plans or those that are considered eradicated from New Zealand. New species included in this guide for the first time are the alga lake snow, red-eared slider turtle and three plants; Vietnamese parsley, lizard's tail and great reedmace.

What to do if you find a freshwater pest?

1. Use the Freshwater Invasive Species of New Zealand guide (and other suggested weblinks) to identify the potential pest, its known distribution and information on its management status.
2. Document your find by noting exact location, date and photograph of the pest.
3. Photographs can be sent to NIWA Email: enquiries@niwa.co.nz for identification.
4. If possible, collect a pest sample. Plants can be stored in the fridge wrapped in damp paper towels in a zip-lock plastic bag, invertebrates and small fish can be preserved in 70% alcohol, with larger fish stored in a freezer.
5. If the pest is managed for eradication or exclusion in your region by MPI or DOC report it to the pests-and-diseases hotline on 0800 80 99 66.
6. Similarly, for pest species not in the guide, report to the pests-and-diseases hotline on 0800 80 99 66.
7. If the pest is managed for eradication or exclusion in your region by a Regional Pest Management Plan (Table 1) contact your regional council biosecurity section.

Additional NIWA information

<https://niwa.co.nz/freshwater-and-estuaries/management-tools/identification-guides-and-fact-sheets/macrophyte-plant-id-guides>

https://niwa.co.nz/sites/niwa.co.nz/files/import/attachments/aquarium_high_risk.pdf

https://niwa.co.nz/sites/niwa.co.nz/files/import/attachments/aquarium_low_risk.pdf

<https://niwa.co.nz/freshwater-and-estuaries/nzffd/NIWA-fish-atlas/fish-finder>

<https://niwa.co.nz/freshwater-and-estuaries/nz-freshwater-fish-database/freshwater-fish-id-guideskeys/formal-identification-keys>

<https://niwa.co.nz/freshwater-and-estuaries/management-tools/identification-guides-and-fact-sheets/algae-id-guides>

<https://niwa.co.nz/freshwater-and-estuaries/management-tools/identification-guides-and-fact-sheets/macroinvertebrate-id-guides>

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A close-up photograph of a brown catfish, likely a common carp, in an aquarium. The fish is positioned horizontally, facing right. It has a dark brown body with a lighter, pinkish-brown underbelly. Its most prominent features are its long, dark, hair-like whiskers (barbels) extending from its mouth. The background is filled with green, feathery artificial aquarium plants. The lighting is bright, highlighting the texture of the fish's skin and the details of its whiskers.

FISH

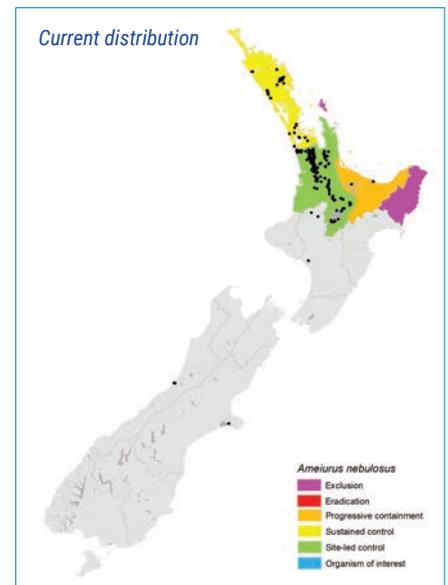
Contact: cindy.baker@niwa.co.nz

Ameiurus nebulosus

Le Sueur, 1819 (Ictaluridae)

Common name:	Brown bullhead catfish
Presence in NZ:	First introduced to Auckland in 1877 and stock from this source sent to Wellington and Hokitika in 1885. Now widespread throughout the middle of the North Island (most recently in Lakes Rotoiti and Rotorua in the Bay of Plenty) with a few scattered populations in the South Island.
Preferred/known habitats:	Catfish occur in lakes, ponds, rivers, streams and wetlands, preferring slow-flowing, shallow waters with silty or muddy bottoms.
Dispersal mechanisms:	Catfish have been spread accidentally to lakes and rivers throughout New Zealand via eel fishers' nets, boats, and boat trailers. Deliberate illegal introduction as a source of food is a likely, as yet unquantified, dispersal pathway. Natural colonisation of downstream habitats has occurred via floods.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Large (up to 40 cm long) elongate, grey to black coloured fish with eight long barbels around the mouth; relatively small eyes; smooth skin (no visible scales); leading edge of dorsal and pectoral fins with a sharp spine.
Similar species:	No similar species.
Biosecurity status:	No status under the Biosecurity Act. Regional Pest Management Plans in 5 North Island regions: AUK, BOP, GIS, NTL, WKO. Possession by non-commercial fishers is prohibited, without permission from MPI, and catch must be killed and disposed of. Sale is prohibited. Commercial fishing must adhere to a Code of Practice to prevent accidental spread by nets and boats.
Biosecurity risk:	Catfish have the potential to modify invertebrate communities, ecosystem processes, and nutrient status through benthic feeding and stirring up bottom sediments. Adult catfish have been implicated in the decline of kōura (freshwater crayfish <i>Paraneohaps planifrons</i>) in some water bodies and may compete with eels (<i>Anguilla</i> spp.). FRAM score: 41 (3rd = worst pest fish).

<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>

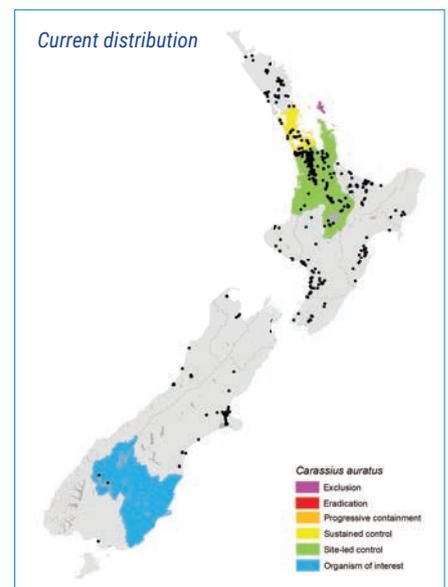


Carassius auratus

Linnaeus, 1758 (Cyprinidae)

Common name:	Goldfish
Presence in NZ:	The earliest documented record for goldfish is their introduction to Rotorua from Auckland in 1919, but they were probably imported to New Zealand and populations established in the wild from 1865 onwards. Goldfish populations are now present throughout both the North and South Island but are much more numerous in the North Island.
Preferred/known habitats:	Goldfish prefer the shallow areas of ponds, lakes, reservoirs and wetlands where macrophytes occur. They also occur in the slow-moving, weedy areas of rivers and streams.
Dispersal mechanisms:	Goldfish were widely distributed in the early 1900s by European settlers and are still sold and commonly kept as aquarium and ornamental pond subjects. Continued liberation of fish into water bodies is likely. Disperses downstream during floods.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Bronze coloured fish with deep body and large scales. Single dorsal fin originates directly above pelvic fin; no barbels around mouth. Last spine in dorsal fin is stout and serrated.
Similar species:	Koi carp (<i>Cyprinus carpio</i>), rudd (<i>Scardinius erythrophthalmus</i>), orfe (<i>Leuciscus idus</i>). Koi carp have barbels. Koi and goldfish may interbreed; first generation hybrids have drab coloration, one pair of barbels, but subsequent generations of hybrids may be highly variable. Goldfish can be distinguished from rudd and orfe because they lack the stout spines on the front edge of the dorsal fin.
Biosecurity status:	No status under the Biosecurity Act. Regional Pest Management Plans in 3 regions: NI - AUK, WKO; SI - OTA.
Biosecurity risk:	Goldfish may contribute to reduced water clarity in some shallow lakes. High density populations increased turbidity in Canadian ponds. FRAM score: 31 (8th = worst pest fish).

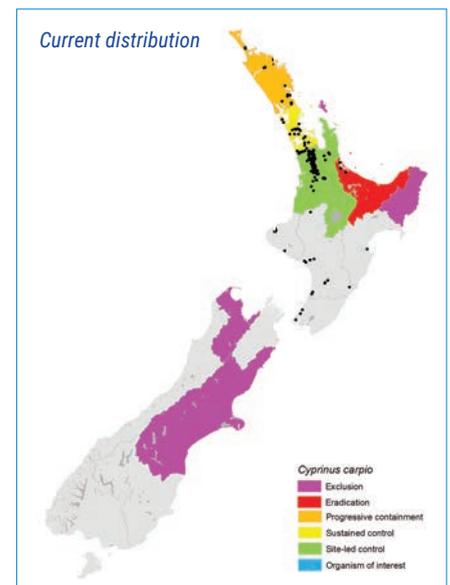
<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>



Cyprinus carpio

Linnaeus, 1758 (Cyprinidae)

Common name:	Koi carp
Presence in NZ:	Ornamental stocks of koi carp existed in aquaria and ponds until 1983 when the first wild population was reported in the Waikato River. Scattered populations now occur throughout the North Island. No longer recorded in the South Island after several populations in Tasman were eradicated.
Preferred/known habitats:	Koi carp prefer lakes, ponds and wetlands, slow flowing reaches of large rivers with associated backwaters.
Dispersal mechanisms:	Koi carp have been spread through illegal stocking into various lakes and ponds in the North Island from the 1980s onwards. Natural colonisation of downstream habitats has occurred via floods.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Elongate fish, up to 60 cm long, becoming deeper bodied with age, variously coloured; orange, black, red and/ or white blotches; two small barbels near each corner of mouth; origin of dorsal fin is in front of pelvic fin. Large scales.
Similar species:	Goldfish (<i>Carassius auratus</i>), rudd (<i>Scardinius erythrophthalmus</i>), orfe (<i>Leuciscus idus</i>). Hybridises with goldfish. Koi and goldfish may interbreed; first generation hybrids have drab coloration, one pair of barbels, but subsequent generations of hybrids may be highly variable.
Biosecurity status:	Unwanted Organism. Regional Pest Management Plans in 5 North Island regions: AUK, BOP, GIS, NTL, WKO, and 3 South Island regions: CAN, NSN, TAS. Listed as a noxious fish, but controlled commercial harvest allowed with permission from DOC.
Biosecurity risk:	Koi carp are thought to pose the greatest risk to shallow, warm, nutrient-rich waterbodies. At high densities koi carp degrade waterways by increasing the turbidity of water and disturbing the ecology of aquatic ecosystems. They are omnivorous preying on various aquatic fauna depending on fish size and compete with other benthivorous fish. Koi carp can reduce submerged aquatic vegetation contributing to submerged vegetation loss in shallow lakes and a switch to planktonic algal dominated systems. FRAM score: 46 (1st worst pest fish).

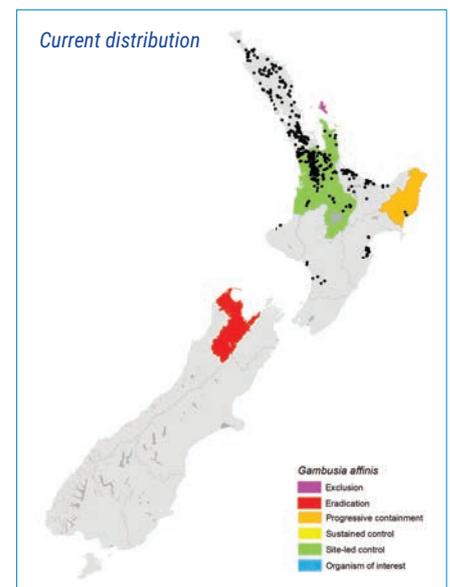


<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>

Gambusia affinis

(Baird & Girard, 1854) (Poeciliidae)

Common name:	Gambusia
Presence in NZ:	Introduced to Auckland in 1930. <i>Gambusia</i> is now widely distributed throughout the top-half of the North Island (north of Taupo), with fewer populations in Taranaki, Hawkes Bay, Manawatu and Wellington. Populations in Tasman in the South Island have mostly been eradicated.
Preferred/known habitats:	Occurs in the shallow margins of lakes, reservoirs, ponds, wetlands, rivers and streams, mainly in summer and autumn months. In rivers and streams, it is confined to still-water areas, and in lakes and ponds it occurs mainly in sheltered bays where macrophytes or emergent vegetation occurs.
Dispersal mechanisms:	<i>Gambusia</i> were introduced to New Zealand to control mosquito larvae in ponds and swamps. Downstream dispersal then occurred following floods. <i>Gambusia</i> can tolerate high salinity so readily colonise brackish estuaries and mangrove swamps at stream and river mouths. It can also colonise nearby catchments via marine currents and may also be spread accidentally (in fyke nets and boats) by fishermen.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	<i>Gambusia</i> are small fish (up to 7 mm (female) or 4 cm (male) long) with rounded caudal fin and a single, high dorsal fin; origin of dorsal fin behind the origin of the anal fin. Males have an enlarged, tube-like anal fin. Females may have a black blotch on their side.
Similar species:	Common bullies (<i>Gobiomorphus cotidianus</i>), guppy (<i>Poecilia reticulata</i>), sailfin molly (<i>Poecilia latipinna</i>) and caudo (<i>Phallocerus caudimaculatus</i>). Bullies are generally benthic, whereas <i>Gambusia</i> commonly aggregate at the water surface in shallow water. The other fish (all in the Poeciliidae family) are similar to <i>Gambusia</i> but restricted to thermally influenced waters.
Biosecurity status:	Unwanted organism, Regional Pest Management Plans in 4 regions: NI - GIS, WKO; SI - NSN, TAS. Possession of <i>Gambusia</i> requires permission by Fish & Game.
Biosecurity risk:	High numbers of <i>Gambusia</i> have been associated with negative effects on a range of fish, invertebrate and amphibian species worldwide, through direct predation or competition for food. <i>Gambusia</i> may impact galaxiid (<i>Galaxias</i> spp.) and other fish populations in shallow lakes and in other still-water habitats and may also affect mudfish (<i>Neochanna</i> spp.). FRAM score: 41 (3rd worst pest fish).

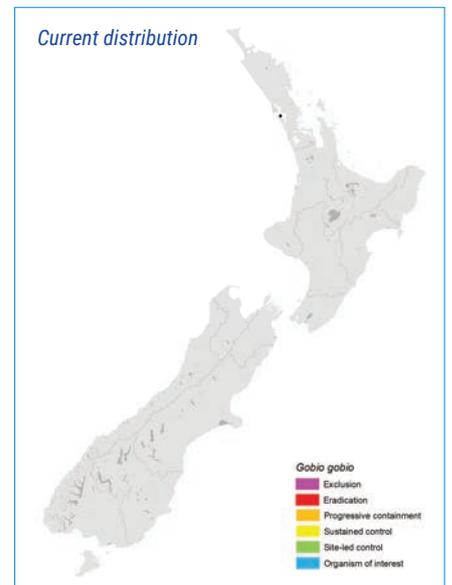


<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>

Gobio gobio

Linnaeus, 1758 (Cyprinidae)

Common name:	Gudgeon
Presence in NZ:	First reported in an Auckland pond in 2004. This population was eradicated but other unknown populations may be present.
Preferred/known habitats:	Lakes, reservoirs, ponds, wetlands and the still-water habitats of rivers and streams.
Dispersal mechanisms:	Illegally established in a pond near Auckland but later destroyed. Overseas is stocked as a coarse fishery bait species, with escape downstream or via bait cages and anglers hooks into rivers.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach by MPI.
ID features:	A small elongate fish with similar coloration to large common bullies, but has larger scales and a series of large, dark blotches along its side. Distinguished from other small fish in New Zealand by the presence of a barbel on the side of the mouth.
Similar species:	Juvenile catfish (<i>Ameiurus nebulosus</i>) and small koi carp (<i>Cyprinus carpio</i>) (both have barbels). Large bullies (<i>Gobiomorphus</i> spp.) (no barbels).
Biosecurity status:	Unwanted Organism, national eradication programme led by MPI.
Biosecurity risk:	The gudgeon is a highly adaptable species that can live in both still and fast-flowing waters. It is primarily a benthic carnivore feeding on aquatic life in silt and sand. It may therefore compete with native fish for food and affect water quality in lakes and ponds. FRAM score: 33 (7th worst pest fish).

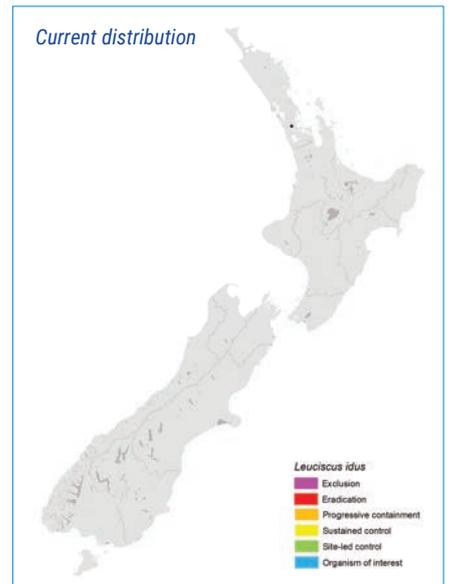
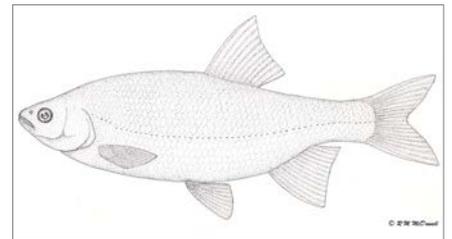


Leuciscus idus

Linnaeus, 1758 (Cyprinidae)

Common name:	Orfe
Presence in NZ:	An ornamental variety (golden orfe) was illegally released in 1985/86 in up to 13 sites (ponds and lakes) north of Auckland. Reported in 1988 from a pond in Riverhead, Auckland. There are no recent records of this species captured in New Zealand and its status in other waters is unknown.
Preferred/known habitats:	Orfe inhabit slow-flowing waters in rivers and lakes.
Dispersal mechanisms:	Illegally released into ponds and lakes north of Auckland to establish coarse fisheries and a future source of fish for fishery development via stocking.
NZ distribution:	New Zealand distribution showing records as dots.
ID features:	Very similar to rudd, but with smaller scales and lacking the small projection at the base of pelvic and pectoral fins. Typically grows to about 45 cm in length.
Similar species:	Rudd (<i>Scardinius erythrophthalmus</i>), goldfish (<i>Carassius auratus</i>). Orfe have smaller scales than these species.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	Like other cyprinids, orfe are prolific breeders and their natural controls (piscivores) do not occur in New Zealand. It is a carnivore feeding on aquatic insect larvae, gastropods, crustaceans and even small fish so can compete with native fish for food. As it tolerates brackish waters, it has the capacity to colonise the lower, tidally influenced regions of rivers where it could impact on inanga. FRAM score: 37 (5th worst pest fish).

<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>

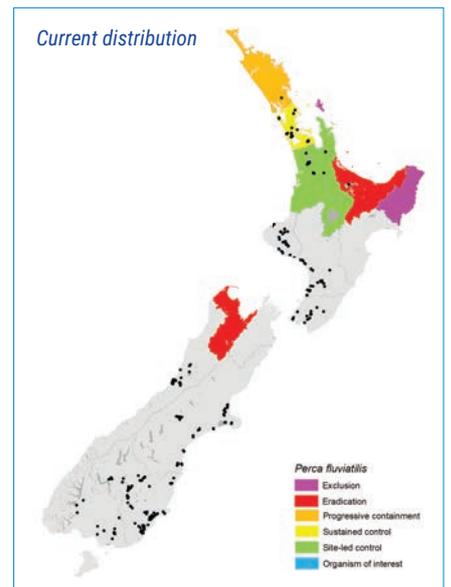
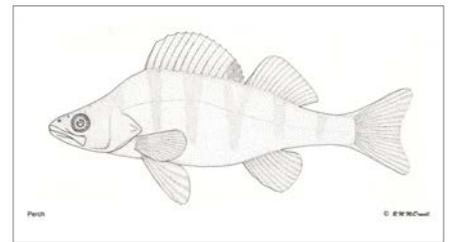


Perca fluviatilis

Linnaeus, 1758 (Percidae)

Common name:	Perch
Presence in NZ:	First populations were established in New Zealand between 1868 and 1877 in Canterbury, the West Coast, Wellington, Wanganui and Taranaki. They were subsequently spread to other parts of the country and are now present in lakes, ponds and reservoirs throughout most of the west coast of the North Island and the east coast of the South Island.
Preferred/known habitats:	Lakes, reservoirs, ponds and wetlands. Also occurs in rivers where water is slow-moving.
Dispersal mechanisms:	Stocking was carried out in the 1980s and early 1900s by early settlers to create sports fisheries. Since the 1970s, new populations have been established illegally in many lakes and ponds to create coarse fishing opportunities. Deliberate illegal introduction as a source of food is a likely, as yet unquantified, dispersal pathway.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	A deep-bodied fish with two dorsal fins, six or more dark, vertical stripes along the side of the body and orange-edged fins; sharp spines on the first dorsal ray and lower posterior edges of the operculum (gill cover).
Similar species:	Rudd (<i>Scardinius erythrophthalmus</i>), goldfish (<i>Carassius auratus</i>), orfe (<i>Leuciscus idus</i>). These species lack the characteristic black stripes or spine-tipped fins of perch.
Biosecurity status:	No status under the Biosecurity Act. Regional Pest Management Plans in 7 regions: NI - AUK, BOP, GIS, NTL, WKO; SI - NSN, TAS. A sports fish requiring a licence from Fish & Game Councils to catch them.
Biosecurity risk:	Perch reduce the abundance of common bullies (<i>Gobiomorphus cotidianus</i>) and planktivorous fish (i.e., smelt (<i>Retropinna retropinna</i>) and galaxiids (<i>Galaxias</i> spp.)) in lakes. Reduces kōura (freshwater crayfish <i>Paranephrops planifrons</i>) and is also associated with the development of cyanobacterial blooms in lakes through predation of zooplankton. FRAM score: 45 (2nd worst pest fish).

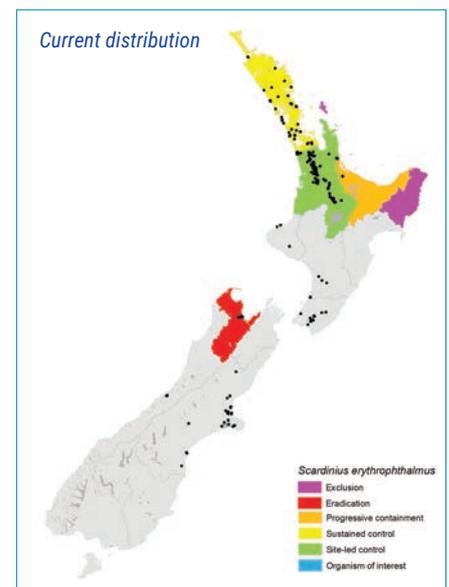
<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>



Scardinius erythrophthalmus

(Linnaeus, 1758) (Cyprinidae)

Common name:	Rudd
Presence in NZ:	Illegally imported to New Zealand in 1967. The progeny of these fish have been bred and illegally spread to the extent that wild populations are now present throughout the top half of the North Island (Northland to Waikato), down the western side of the North Island from Taranaki to Wellington, and are scattered down the east coast of the South Island from Nelson to South Canterbury, with a recent population discovered on the West Coast (Lake Ianthe).
Preferred/known habitats:	Rudd do best in lakes, reservoirs, ponds and wetlands, but also occur in the large, weedy pools of rivers and streams.
Dispersal mechanisms:	During the 1970s and 1980s, rudd were illegally stocked into numerous waters centred around Auckland, and into ponds near Christchurch. It has since been illegally stocked into waters further afield to create coarse fisheries. Deliberate illegal introduction as a source of food is a likely, as yet unquantified, dispersal pathway.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Rudd are a red to orange coloured fish (more silver when young), often with darker coloration on the dorsal side, lacking barbels around the mouth. Fins are conspicuously red coloured. The dorsal fin originates behind pelvic fin.
Similar species:	Goldfish (<i>Carassius auratus</i>), koi carp (<i>Cyprinus carpio</i>), orfe (<i>Leuciscus idus</i>). Koi carp have barbels. Rudd can be distinguished from goldfish because they lack the stout spines on the front edge of the dorsal fin and from orfe by the projections that occur at the bases of their pectoral and pelvic fins.
Biosecurity status:	No status under the Biosecurity Act. Regional Pest Management Plans in 7 regions: NI - AUK, BOP, GIS, NTL, WKO; SI - NSN, TAS. Sports fish in the Auckland-Waikato Fish and Game Council region, and a noxious species in other regions. Possession of rudd requires permission by DOC and Fish & Game.
Biosecurity risk:	A high density population of rudd was responsible for the collapse of a stocked trout fishery in Lake Parkinson. Juvenile rudd feed on zooplankton but become more herbivorous as they mature suppressing the regeneration of macrophytes in turbid lakes. Rudd may contribute to reduced water clarity in shallow lakes through impacts on food webs. FRAM score: 36 (6th worst pest fish).



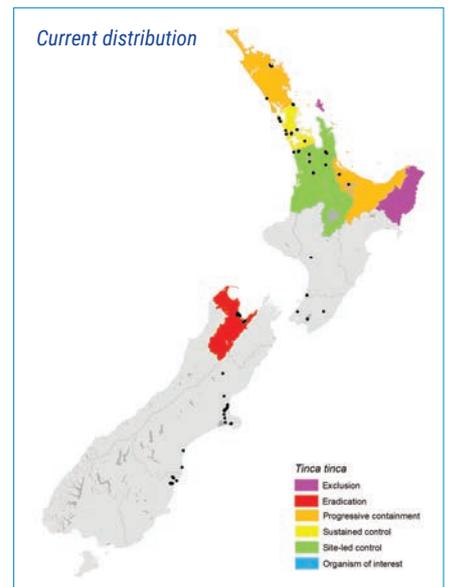
<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>

Tinca tinca

Linnaeus, 1758 (Cyprinidae)

- Common name:** **Tench**
- Presence in NZ:** First populations were established in New Zealand in 1867, probably in Auckland, and later (1950s) stocked in waters near Oamaru and Otaki. They have since been spread to Northland and Whanganui in the North Island, and to Nelson, Canterbury and Otago in the South Island.
- Preferred/known habitats:** Shallow lakes, reservoirs, ponds and wetlands. Tench are benthic fish and prefer shallow, still waters where macrophytes are present.
- Dispersal mechanisms:** Tench were spread by illicit stocking in the 1960s and 1970s to create coarse fisheries, especially in the Auckland region.
- NZ distribution:** New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
- ID features:** An olive-green fish with very small scales, one small barbel at each corner of mouth, thick, fleshy fins and eyes that are small and bright red.
- Similar species:** No similar species.
- Biosecurity status:** No status under the Biosecurity Act. Regional Pest Management Plans in 7 regions: NI - AUK, BOP, GIS, NTL, WKO; SI - NSN, TAS. A sports fish requiring a licence from Fish & Game Councils to catch them.
- Biosecurity risk:** Tench may contribute to reduced water clarity in shallow lakes by altering food webs and disturbing sediments. FRAM score: 31 (8th = worst pest fish).

<https://www.doc.govt.nz/Documents/conservation/threats-and-impacts/animal-pests/nz-invasive-fish-management-handbook.pdf>

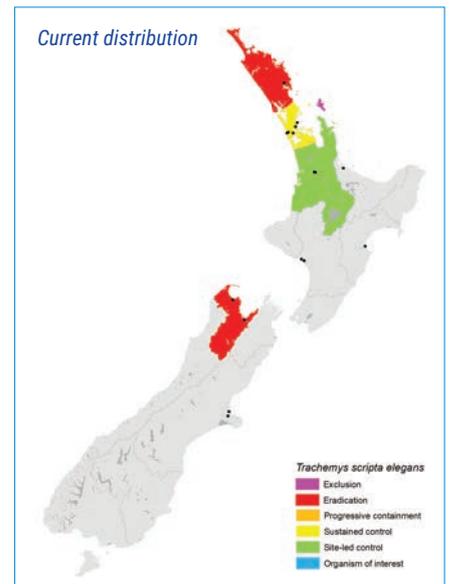


Trachemys scripta elegans

(Wied-Neuwied, 1839) (Emydidae)

Common name:	Red-eared slider turtle
Presence in NZ:	Introduced to New Zealand via the pet trade. Wild individuals have been observed since the 1980s.
Preferred/known habitats:	Lakes, reservoirs, ponds and the still-water habitats of rivers, streams and estuaries.
Dispersal mechanisms:	On-line sales of red-eared slider turtles are reported to be in the order of 750 per year. All current reports of wild turtles result from escapes from captivity or deliberate liberations. Although nesting has been reported and observed, to date only male hatchlings have been found.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	The red-eared slider turtle is a medium sized freshwater and estuarine turtle, with a shell up to 30 cm long, the shell and skin are olive to brown with yellow stripes or spots. Males are usually smaller than females and have a long, thick tail. This turtle has characteristic red patches on each side of the head.
Similar species:	The other turtles kept in captivity in New Zealand include snake-neck turtle (<i>Chelodina longicollis</i>) and Reeves turtle (<i>Chinemys reevesii</i>). Snake-necked turtle have an elongated neck and neither species has the red blotch on either side of their head.
Biosecurity status:	No status under the Biosecurity Act. Regional Pest Management Plans in 10 regions: NI - AUK, NTL, WKO; SI - NSN, TAS
Biosecurity risk:	Red-eared slider turtles are on aquatic plants and small aquatic vertebrates and invertebrates. Feeding habits and associated activities are likely to result in food-web and ecosystem process impacts, and reduced water quality in invaded habitats. Current New Zealand temperatures appear slightly too low for the production of female offspring, with only male progeny reported to date. predicted climate change will increase the likelihood of established populations of this pest.

<https://www.stuff.co.nz/environment/103847182/turtle-rescuer-calls-for-ban-on-breeding-of-redeared-slider-turtles-for-sale-in-nz>



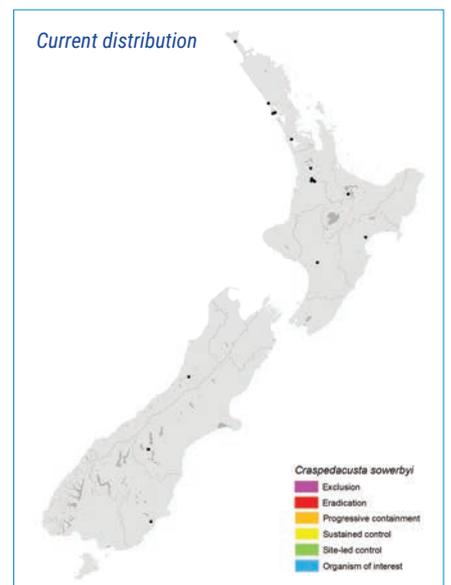
INVERTEBRATES

Contact: brian.smith@niwa.co.nz



Craspedacusta sowerbyi (Lankester, 1880) (Olindiidae)

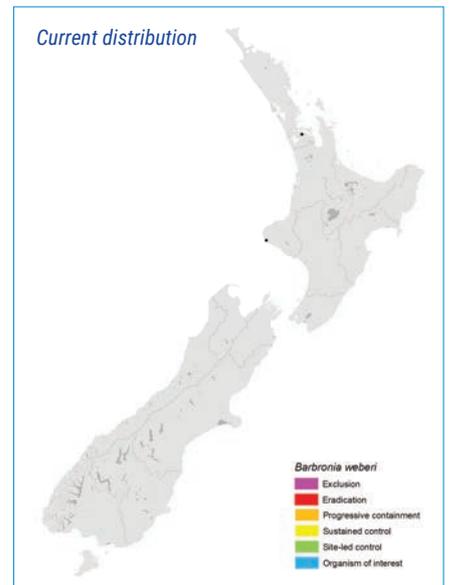
Common name:	Freshwater jellyfish
Presence in NZ:	Widely naturalised in both North and South Islands, distributed throughout the Waikato, first record 1950s.
Preferred/known habitats:	Lakes and hydroelectric impoundments.
Dispersal mechanisms:	Can reproduce only by 'budding' when water temperatures reach 25 °C; juveniles (polyps) attach to aquatic plants or other surfaces and can be dispersed to new water bodies by human movement of aquatic plants or contaminated gear; also spread by aquatic animals (e.g. birds' feet).
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Classic jellyfish shape – umbrella – type (5-25mm in diameter) with tentacles around the circumference.
Similar species:	There are no other freshwater jellyfish known in New Zealand.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	Unlikely to affect zooplankton populations but may compete with native zooplankton feeders such as pelagic fish.



Barbronia weberi

(Blanchard, 1897) (Salifidae)

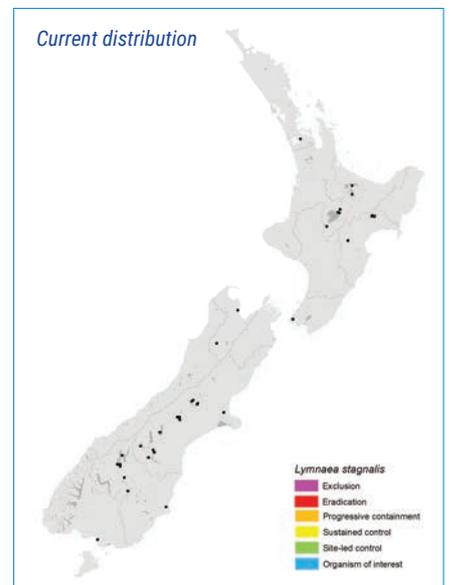
Common name:	Asian freshwater leech
Presence in NZ:	Unknown, first record 1976.
Preferred/known habitats:	Ponds and sluggish, weedy streams; also recorded from urban stormwater treatment ponds.
Dispersal mechanisms:	Close association with pond plants by both adult and cocoon (eggs); dispersal between waterbodies is enhanced by human mediated spread through disposal of contaminated pond plants and aquarium contents and also contaminated watercraft and trailers, nets, drainage machinery etc.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Long narrow body (worm-like) up to 50 mm; jaws lacking; 3-4 pairs of eyes; 2 copulatory pores on ventral surface; 5-6 testes on each side of body; fresh specimens dark red brown with green markings.
Similar species:	Similar general appearance to <i>Dina maoriana</i> (native); 2-4 pairs of eyes; 32 testes on each side; copulatory pores on ventral surface.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	Rapid developer; preys on aquatic worms and snails, and possibly other New Zealand aquatic invertebrates (consumes the entire invertebrate).



Lymnaea stagnalis

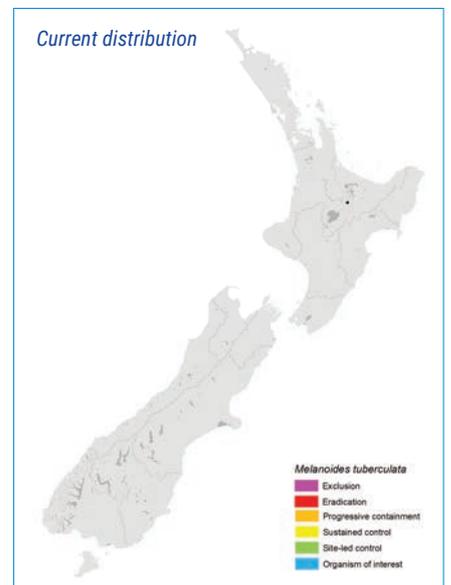
(Linnaeus, 1758) (Lymnaeidae)

Common name:	Great pond snail
NZ distribution:	Patchy distribution within New Zealand, can be locally abundant; still absent from some North Island lakes; readily obtainable through the aquarium trade.
Preferred/known habitats:	Ponds and lakes.
Dispersal mechanisms:	Dispersal of small snails and eggs between waterbodies is enhanced by human mediated spread through disposal of contaminated pond plants and aquarium contents (specimens readily available through the aquarium trade) and also contaminated watercraft and trailers, nets, drainage machinery etc.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Shell spire, long and acute; adult snail may attain a length up to 45-60 mm and width 20-30 mm; shell yellowish to brown with whitish markings; the shell is fragile and easily damaged.
Similar species:	Most similar to <i>Pseudosuccinea columella</i> , but <i>L. stagnalis</i> is much larger and lighter in colour; unlikely to be confused with other naturalised and native aquatic snails in New Zealand.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	<i>L. stagnalis</i> is predominately an omnivore and known to consume plants, detritus and carrion; it is also predatory on other snails, insects, and in the UK has been known to prey on small fish and newts; thought to be an intermediate host for swimmer's itch or duck itch (schistosome cercarial dermatitis).



Melanoides tuberculata (Müller, 1774) (Thiaridae)

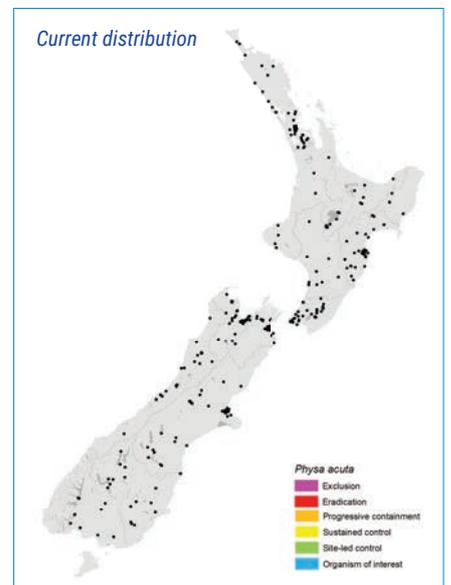
Common name:	Red-rimmed melania
Presence in NZ:	Locally naturalised in Golden Springs, near Reporoa, Waikato. First record 1920s.
Preferred/known habitats:	This tropical snail is restricted to heated water (e.g. geothermal) habitats (18-30 °C); also tolerant of poorly oxygenated waters.
Dispersal mechanisms:	Widespread throughout aquarium trade. Likely to be deliberately released, possibly for subsequent wild collection for aquaria. Natural dispersal is probably limited by intolerance of cold waters.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Shell an elongate conical shape with rust coloured spots, and whorls with prominent grooves; length typically up to 32 mm but can attain 80mm; usually <15 mm in pet shops. Operculum present.
Similar species:	Unlikely to be confused with other established snails in New Zealand.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	Overseas information indicates competitive abilities over native freshwater snails; herbivorous; unfertilised females able to reproduce. Known vectors for Chinese liver fluke (<i>Clonorchis sinensis</i>) and oriental lung fluke (<i>Opisthorchis felineus</i> and <i>O. viverrini</i>); risk of spreading probably limited by water temperature



Physa acuta

Draparnaud, 1805 (Physidae)

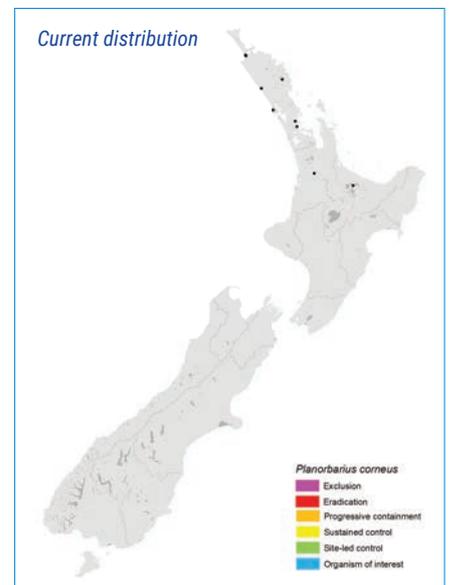
Common name:	Left-handed pond snail
Presence in NZ:	Widespread and common in New Zealand, though believed to be absent from some Northland lakes.
Preferred/known habitats:	Prefers lakes, ponds, and wetlands, and running waters; can be locally abundant.
Dispersal mechanisms:	Dispersal of small snails and eggs between waterbodies is enhanced by human mediated spread through disposal of contaminated pond plants and aquarium contents and also contaminated watercraft and trailers, nets, drainage machinery etc.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Thin shelled, smoothly coiled; white-lipped opening on left-hand side; digitate process present on inner mantle opening; the yellowish-grey shell may be transparent with mottled pigmentation; mature specimens up to 12 mm long, but usually about 7 – 8 mm.
Similar species:	Similar to <i>Glyptophysa variabilis</i> (native), which is larger (12-16 mm) reddish, and lacks digitate process.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	<i>P. acuta</i> appears to have displaced <i>G. variabilis</i> to some degree. Thought to be an intermediate host for swimmer's itch (schistosome cercarial dermatitis).



Planorbarius corneus

(Linnaeus, 1758) (Planorbidae)

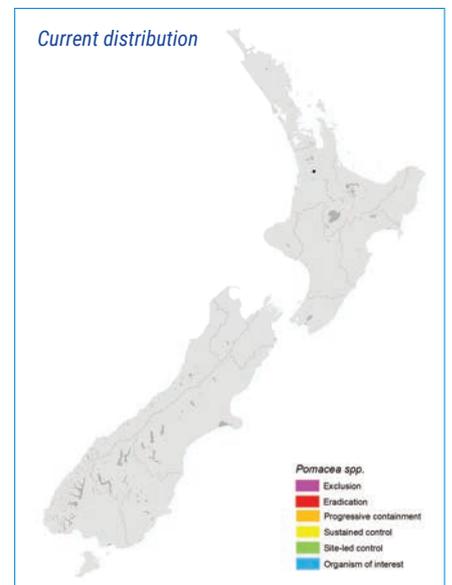
Common name:	Great ramshorn snail
Presence in NZ:	Widespread but locally naturalised, first record 1968.
Preferred/known habitats:	Ponds and lakes
Dispersal mechanisms:	Dispersal of small snails and eggs between waterbodies is enhanced by human mediated spread through disposal of contaminated pond plants and aquarium contents and also contaminated watercraft and trailers, nets, drainage machinery etc.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Shell reddish brown to olive brown; shell height up to 14 mm and width up to 30 mm.
Similar species:	Similar to native species <i>Gyraulus corinna</i> and <i>G. kahuica</i> , which are much smaller (5 mm diameter) and have a yellowish-brown shell.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	<i>P. corneus</i> may survive several weeks out of water during drought; may serve as second intermediate host of <i>Echinostoma echinatum</i> ; final hosts are mammals. Human infection is through consumption of the host (e.g., ramshorn snails consumed with water cress), and results in the clinical symptoms of echinostomiasis. Light infections can cause anaemia, headache, and gastric pain; heavy infections can cause abdominal pain, emaciation, weakness, anaemia, profuse water diarrhoea, haemorrhage and anorexia.



Pomacea spp.

(Lamarck, 1819) (Ampullariidae)

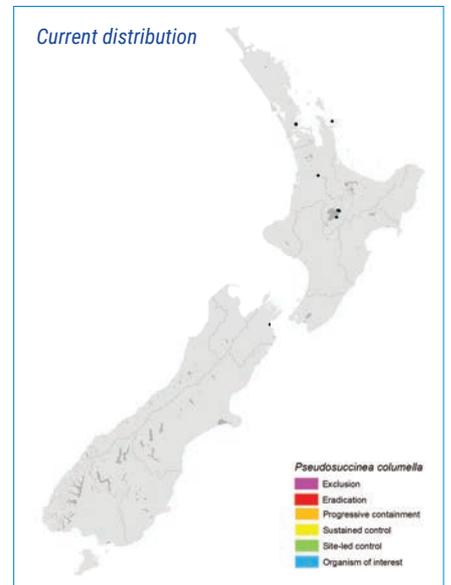
Common name:	Apple snail
Presence in NZ:	Present but not naturalised, single specimen recorded from Waikato River probably a recent release.
Preferred/known habitats:	Ponds, lakes and slow flowing waters. These snails would be restricted to heated water (e.g. geothermal) habitats.
Dispersal mechanisms:	Apple snails are available in the aquarium trade and deliberate release is the most likely mechanism for spread.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Large snails (up to 50mm diameter) with left-hand coiled shell with a large operculum; very long tentacles visible when mobile; shells colouration variable from entirely yellow or with bands of yellow-tan, brownish or black.
Similar species:	Unlike other pond snails recorded in New Zealand.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	Known vector for rat lungworm (<i>Angiostrongylus cantonensis</i>), which can cause the brain disease eosinophilic meningoencephalitis; will eat rooted aquatic vegetation, and a serious pest of rice and taro; will eat other snail eggs; observed eating <i>Lymnaea stagnalis</i> in laboratory.



Pseudosuccinea columella

(Say, 1817) (Lymnaeidae)

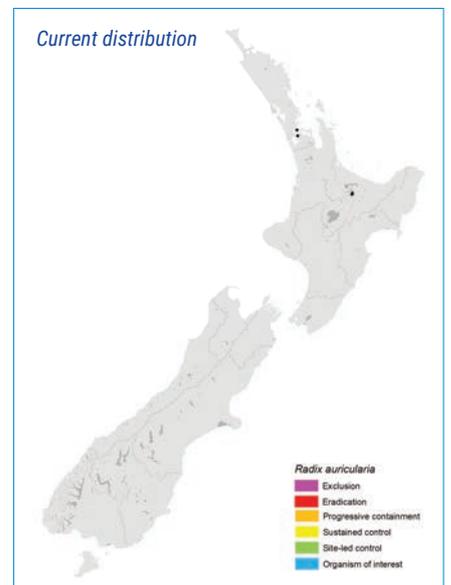
Common name:	American ribbed fluke snail
Presence in NZ:	Widely naturalised but may not be present south of Canterbury. First record from New Zealand in 1940.
Preferred/known habitats:	Ponds, lakes, ditches, seepages and sluggish stream; known also from the Waikato River; prefers open sunny water bodies up to 35 °C.
Dispersal mechanisms:	Dispersal of small snails and eggs between waterbodies is enhanced by human mediated spread through disposal of contaminated pond plants and aquarium contents and also contaminated watercraft and trailers, nets, drainage machinery etc. This snail is a prolific breeder, able to self-fertilise.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Shell opening on right-hand side with a narrow lip; shell also tends to be fragile with fine lines apparent; operculum absent; wide triangular tentacles present; up to 11 mm when fully grown.
Similar species:	Similar to the native <i>Austropeplea tomentosa</i> , which has a more globular shape and a thicker lipped opening.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	<i>P. columella</i> is a vector for liver fluke (<i>Fasciola hepatica</i>) which affects livestock and humans; in Australia, <i>P. columella</i> is thought to be a more important vector of <i>F. hepatica</i> than <i>A. tomentosa</i> .



Radix auricularia

(Linnaeus, 1758) (Lymnaeidae) (was known as *Lymnaea auricularia*)

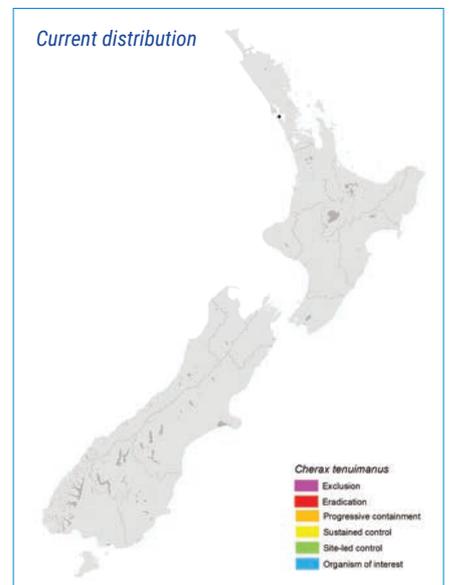
Common name:	Ear pond snail
Presence in NZ:	Widely naturalised, first record 1977.
Preferred/known habitats:	Ponds and lakes
Dispersal mechanisms:	Dispersal of small snails and eggs between waterbodies is enhanced by human mediated spread through disposal of contaminated pond plants and aquarium contents and also contaminated watercraft and trailers, nets, drainage machinery etc.
NZ distribution:	New Zealand distribution showing records as black dots.
ID features:	Easily identified from other lymnaeids by its relatively large size, short spire, and large lower coil; black blotches visible through the shell.
Similar species:	Unlike other pond snails recorded in New Zealand.
Biosecurity status:	No status under the Biosecurity Act. Not on any Regional Pest Management Plan.
Biosecurity risk:	Serves as an intermediate host to flukes such as echninostomes and trematodes parasitic in aquatic birds; studies have shown that <i>R. auricularia</i> is an unlikely host for the liver fluke (<i>Fasciola hepatica</i>).



Cherax tenuimanus

Smith 1912 (Parastacidae)

Common name:	Marron
Presence in NZ:	All known populations eradicated, introduced in 1986.
Preferred/known habitats:	Small, forested streams.
Dispersal mechanisms:	Introduced from Australia for aquaculture. Marron are able to survive for long periods out of water, and consequently able to cross land in search of water bodies; dispersal potential enhanced by illegal translocation and breeding.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach by MPI.
ID features:	One of the largest freshwater crayfish in the world; can grow up to 380 mm (total length) and weigh up to 2 kg; marron have jet black pinchers and a paler olive-green to brown or cobalt-blue body and may have areas of red colouration on the underside with some splashes of purple.
Similar species:	Small specimens may initially be confused with native koura but can be distinguished by coloration.
Biosecurity status:	Notifiable organism, national eradication programme led by MPI.
Biosecurity risk:	Marron are omnivorous and could threaten species such as koura (native freshwater crayfish) and whitebait. Like most crayfish, marron can carry two species of tiny animals attached to their shell and gills, a ciliate protozoan <i>Epistylis</i> and a small flatworm <i>Temnocephala</i> . The diseases microsporidiosis and <i>Thelohania</i> have been reported in marron; although absent from Australia and New Zealand, marron are very susceptible to the crayfish plague <i>Aphanomyces astaci</i> .

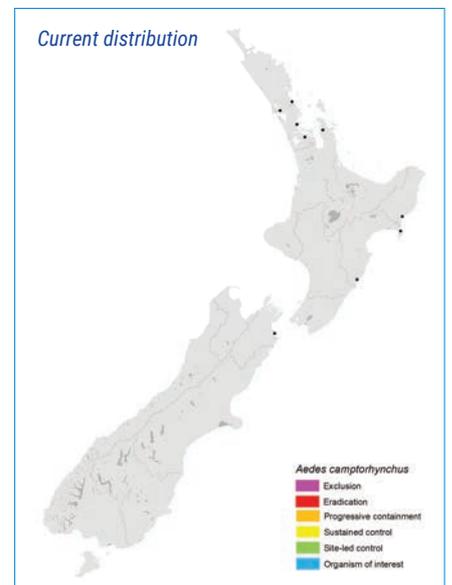


Aedes camptorhynchus

(Thomson, 1869) (Culicidae) (was known as *Ochlerotatus camptorhynchus*)

- Common name:** Southern salt marsh mosquito
- Presence in NZ:** First record in 1998 from coastal regions of the North Island including Napier, Mahia, Gisborne, Whitford, Kaipara Harbour, Whangaparaoa and Coromandel. It has also been recorded from the South Island from the Wairau/Grassmere regions, near Blenheim. Believed to have been eradicated in 2010.
- Preferred/known habitats:** Larvae have been found in brackish to saline water
- Dispersal mechanisms:** Introduced from Australia, possibly via containers or imported tyres. Under favourable conditions, the entire life cycle from egg to adult can take only 5 days; adults have a 8km flight range.
- NZ distribution:** New Zealand distribution showing records as black dots.
- ID features:** Requires specialist identification of either adult or larval form. Larvae identifiable using a compound microscope; anal gills small and round; pecten teeth in single row on siphon; comb scales cockscomb-like.
- Similar species:** Two native species may also occur with *A. camptorhynchus* (*A. antipodeus* and *Culex pervigilans*). *Aedes camptorhynchus* is most similar to the native species *A. subalbirostris*.
- Biosecurity status:** Notifiable organism. MPI declared that *Aedes camptorhynchus* had been eradicated in June 2010 following a 12 year control programme led by Ministry of Health and MPI.
- Biosecurity risk:** Risk of Ross River virus infection is believed to be low; infected possums or farm livestock may act as reservoirs for disease; secondary hazard in the form of 'nuisance biting behaviour'.

https://www.derraik.org/resources/Publications/024.Derraik%26Slaney_2007-EcoHealth.pdf



A full-page underwater photograph showing a diver in a dark wetsuit and a yellow scuba tank. The diver is positioned in the lower-left quadrant, holding a clipboard and pen, appearing to be conducting a survey. The surrounding environment is a dense, vibrant green field of tall, thin, branching aquatic plants. A stream of bubbles rises from the diver towards the top center of the frame, where the water is a lighter, clearer blue. The overall scene is dimly lit, typical of an underwater environment.

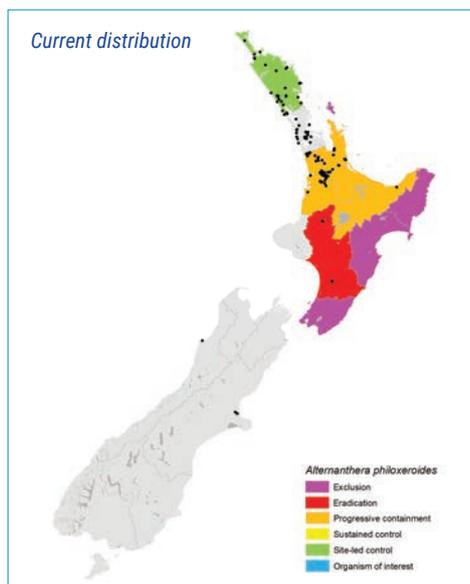
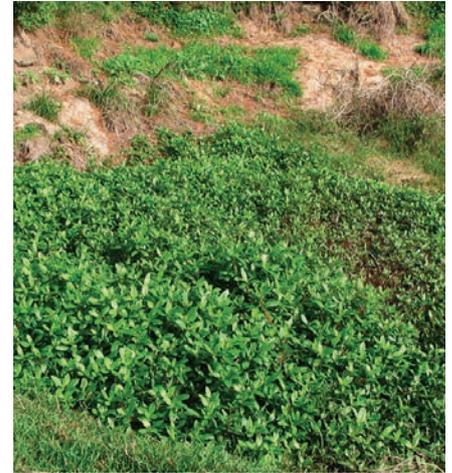
PLANTS

Contact: paul.champion@niwa.co.nz

Plant

Alternanthera philoxeroides (Mart.) Griseb. (Amaranthaceae)

Plant life-form:	Sprawling emergent
Common name:	Alligator weed
Presence in NZ:	Locally naturalised, often locally abundant, first record from Northern Wairoa River in 1906.
Preferred/known habitats:	Still and slow flowing water bodies, wetlands, also terrestrial habitats including pasture, cropping land, urban lawns etc.
Dispersal mechanisms:	Reproduction is vegetative by the extension of prostrate stems or stem fragmentation. The floating fringe of marginal mats is also readily fragmented and dispersed by water movement, especially during floods. Additional dispersed by contaminated machinery, lawn clippings and earth movement. Seed set is unknown in New Zealand.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Sprawling emergent perennial herb. Stems are thick, soft, and hollow, often with a reddish tinge, often rooting at each node. Leaves are bright green, waxy, and elliptical. They are between 5-10 cm long, up to 2 cm wide, and arranged in opposite pairs on the stem. The white flower at the end of a longish stalk superficially looks like a small clover flower, but is papery, not soft, to the touch.
Similar species:	Two native <i>Alternanthera</i> species, nahui (<i>A. nahui</i>) and lesser joyweed (<i>A. denticulata</i>), Senegal tea (<i>Gymnocoronis spilanthoides</i>), and primrose willow (<i>Ludwigia peploides</i>). The native <i>Alternanthera</i> species are smaller, with the flowers lacking stalks and located at the base of paired leaves. Senegal tea has serrated and wavy leaf margins. Primrose willow has alternate rather than opposite leaves.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 7 North Island regions: BOP, GIS, HKB, MWT, NTL, WKO, WGN (see map).
Biosecurity risk:	Currently our worst sprawling emergent weed, affecting arable and pastoral land in addition to aquatic habitats. A major weed in many temperate countries, being a Weed of National Significance (WoNS) in Australia. AWRAM score: 63 (7th worst aquatic weed).



Plant

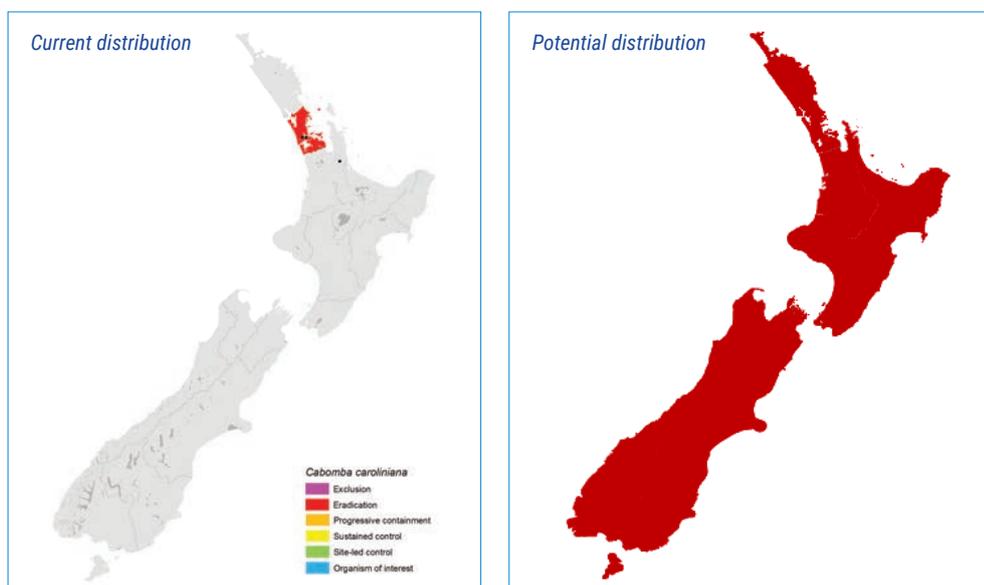
Cabomba caroliniana

A. Grey (Cabombaceae)

Plant life-form:	Submerged
Common name:	Cabomba
Presence in NZ:	Only known from one ~3 ha site in Henderson, Auckland. First record Western Springs, Auckland in 2009, but failed to persist.
Preferred/known habitats:	Still and slow flowing water bodies.
Dispersal mechanisms:	Reproduction is vegetative by stem fragmentation and potentially dispersed by deliberate introductions or contaminated watercraft and trailers, fishing nets or drainage machinery. Seed set is unknown in New Zealand.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach led by MPI Biosecurity New Zealand.
ID features:	<p>Cabomba is a perennial submerged species with grass green to olive green shoots. The leaves are of two types: submersed and floating. The submersed leaves are finely divided and arranged in opposite pairs on the stem, with a pale underside. They are fan-shaped, hence the name fanwort. The floating leaves, when present, are linear and inconspicuous, with an alternate arrangement. They are less than 15 mm long and narrow. The flowers are white and small (less than 15 mm in diameter), and float on the water surface.</p>
Similar species:	Hornwort (<i>Ceratophyllum demersum</i>) and <i>Myriophyllum</i> spp. Differs from hornwort and <i>Myriophyllum</i> spp. in that fanwort has leaves arranged in pairs, whereas the others have leaves arranged in whorls.
Biosecurity status:	Unwanted Organism, Incursion response occurring at the one known field site led by MPI Biosecurity New Zealand.
Biosecurity risk:	A major weed in Australia where it is a Weed of National Significance (WoNS). Considered a threat to New Zealand waterbodies based on the Henderson infestation. AWRAM score: 53 (20th worst aquatic weed).



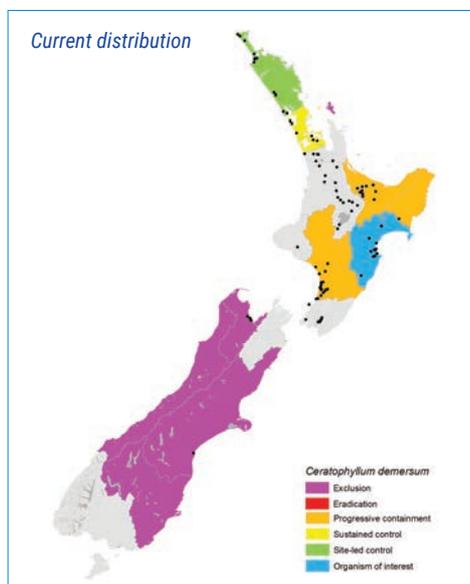
<https://www.mpi.govt.nz/dmsdocument/13987-cabomba-caroliniana-have-you-seen-this-aquatic-weed>



Plant

Ceratophyllum demersum L. (Ceratophyllaceae)

Plant life-form:	Submerged
Common name:	Hornwort
Presence in NZ:	Widely naturalised in North Island, all South Island sites have been targeted for eradication with no plants seen since 2008, first record from Napier 1961.
Preferred/known habitats:	Moderate flowing to still water bodies, growing to >10 m deep in some clear water lakes.
Dispersal mechanisms:	Reproduction is vegetative by stem fragments and dispersal between waterbodies is human mediated (e.g. via watercraft and trailers, fishing nets or drainage machinery contaminated with hornwort fragments). Seed set is unknown in New Zealand.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Hornwort is a perennial submerged species with stiff, dark green shoots. Leaves are whorled and 10-40mm long. The leaves fork once or more into linear segments which are toothed (the teeth look like tiny horns – hence the name hornwort, wort being old English for plant). Flowers are minute and located at the base of the leaves. Hornwort has no roots, instead its lower leaves anchor it to sediment. It can survive as a free floating mat.
Similar species:	<i>Cabomba</i> (<i>Cabomba caroliniana</i>), <i>Myriophyllum</i> spp. Leaves are arranged in pairs on fanwort, whereas hornwort and <i>Myriophyllum</i> spp. have leaves arranged in whorls. <i>Myriophyllum</i> leaves are pinnate or feathered while hornwort are forked.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 11 regions: NI - AUK, BOP, GIS, HKB, MWT, NTL; SI – CAN, NSN, OTA, TAS, WTC (see map).
Biosecurity risk:	Currently our worst submerged weed, affecting indigenous plant biodiversity, hydro-generation, irrigation, flood protection and recreation. AWRAM score: 67 (4th = worst aquatic weed).

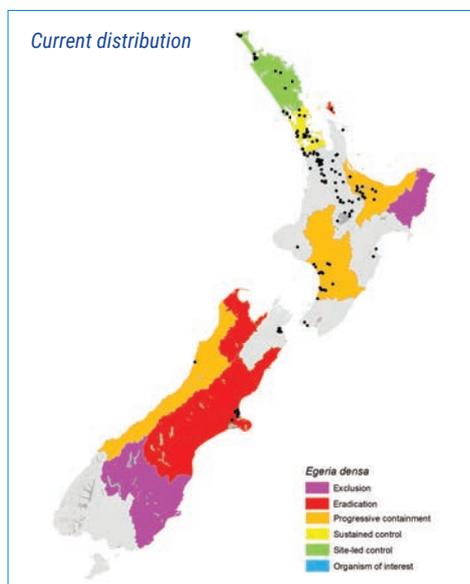


Plant

Egeria densa

Planch. (Hydrocharitaceae)

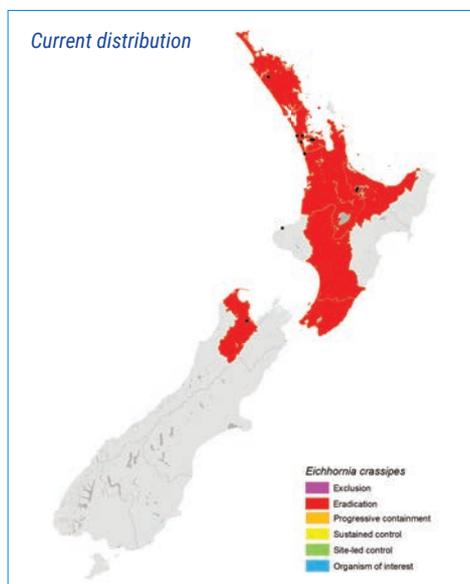
Plant life-form:	Submerged
Common name:	Egeria
Presence in NZ:	Widely naturalised in North Island and Marlborough. Few sites elsewhere in South Island, first record from the lower Waikato River in 1946.
Preferred/known habitats:	Moderate flowing to still water bodies, usually in moderately to highly enriched water bodies.
Dispersal mechanisms:	Reproduction is vegetative by stem fragments and dispersal between waterbodies is human mediated (e.g. via watercraft and trailers, fishing nets or drainage machinery contaminated with egeria fragments). Only male plants in New Zealand.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Egeria is a perennial submerged species with leafy, dark grey-green shoots. Leaves usually in whorls of 4-5 (sometimes 3-8). Leaves 10-30 mm long, narrowing to an acute tip. Egeria is the only oxygen weed with visible white flowers.
Similar species:	Elodea (<i>Elodea canadensis</i>) and lagarosiphon (<i>Lagarosiphon major</i>). Elodea almost always has leaves arranged in whorls of three. Lagarosiphon has leaves that curl downwards and are not arranged in whorls.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 10 regions: NI - AUK, BOP, GIS, MWT, NTL; SI - CAN, NSN, OTA, TAS, WTC (see map).
Biosecurity risk:	A major submerged weed with impacts on indigenous plant biodiversity, hydrogeneration, irrigation, flood protection and recreation. AWRAM score: 64 (6th worst aquatic weed).



Plant

Eichhornia crassipes (Mart.) Solms. (Pontaderiaceae)

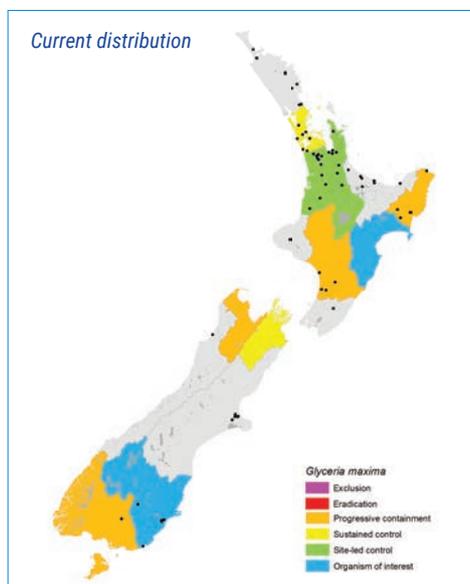
Plant life-form:	Free-floating
Common name:	Water hyacinth
Presence in NZ:	Locally naturalised, subject to a national eradication programme since 1950's, first record from Rotorua in 1950.
Preferred/known habitats:	Still and slow flowing water bodies in warm areas, usually in moderately to highly enriched water bodies.
Dispersal mechanisms:	Reproduction is primarily vegetative when older stolons between individual plants decay to release young plants. Also spreads by seed. To date, all dispersal between waterbodies is human mediated via deliberate introduction, with water movement important for spread within catchments.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded where it is managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
ID features:	Water hyacinth is a free-floating perennial herb. Plants are stoloniferous with daughter plants often attached. Leaves are bright green, often with a spongy inflated petiole. Roots are long and finely divided and are bright purple when young before becoming black. Flowers are large (7 cm in diameter) in a spike of up to 10 flowers. They are blue-purple with a central yellow eye surrounded by a dark blue ring on the uppermost petal.
Similar species:	No similar species.
Biosecurity status:	Notifiable Organism, National Pest Plant Accord, managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
Biosecurity risk:	Widely considered the world's worst weed, with a mostly tropical and subtropical distribution. Completely smothers water bodies impacting on biodiversity, with potential to adversely affect hydrogeneration, irrigation, flood protection and recreation. AWRAM score: 67 (4th = worst aquatic weed).



Plant

Glyceria maxima (Hart.) Holmb. (Poaceae)

Plant life-form:	Sprawling emergent
Common name:	Reed sweet grass
Presence in NZ:	Widely naturalised, often locally abundant in both main islands, first record from Palmerston North, Manawatu in 1931.
Preferred/known habitats:	Still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is vegetative by the extension of rhizomes and fragmentation. Also produces large amounts of seed. Dispersed within catchments is by water movement, especially during floods. Additionally, dispersed by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Very large bright green grass, with stout erect leaves (30-60 cm long and up to 20 mm wide), with creeping rhizomes that form large patches excluding all other plants. The tip of the leaf is boat-shaped. The panicles are generally taller than the foliage, branched, rather dense, and have numerous spikelets. The sheath has obviously cross veins. Reed sweetgrass can grow up to 2 m tall.
Similar species:	Sweet grasses <i>Glyceria declinata</i> and <i>G. fluitans</i> . Both of the other sweet grass species present in New Zealand are much smaller (up to 50 cm tall) and form low clumps as opposed to the often >1 m tall clumps formed by reed sweet grass.
Biosecurity status:	No status under the Biosecurity Act, Regional Pest Management Plans in 11 regions: NI - AUK, GIS, HKB, MWT, WKO; SI - CAN, MBH, NSN, OTA, STL, TAS (see map).
Biosecurity risk:	A major sprawling emergent weed, especially affecting drains and other flowing water bodies. AWRAM score: 51 (25th = worst aquatic weed).



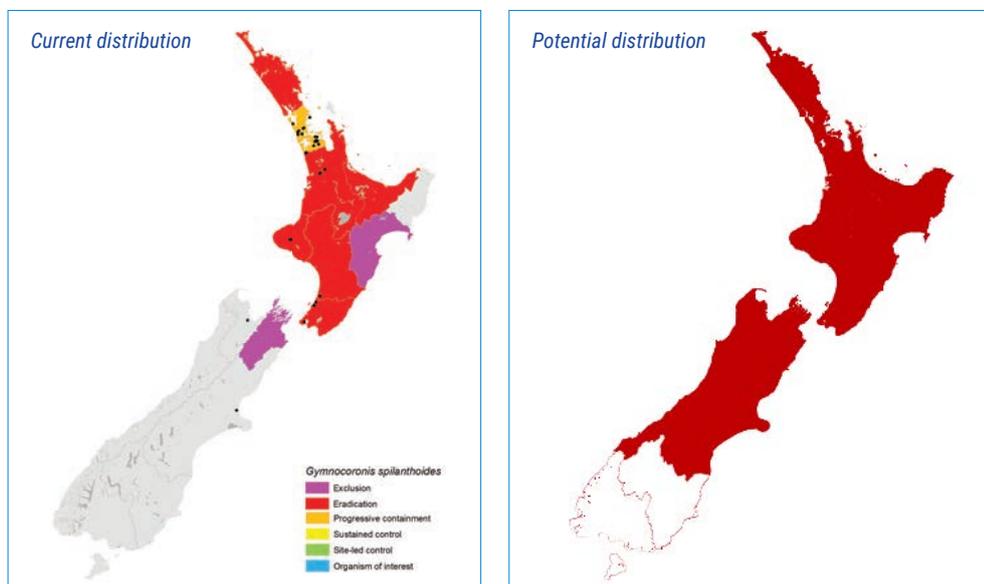
Plant

Gymnocoronis spilanthoides (D. Don) DC. (Asteraceae)

Plant life-form:	Sprawling emergent
Common name:	Senegal tea
Presence in NZ:	Locally naturalised, most sites targeted for eradication, first record from Papakura, Auckland in 1990.
Preferred/known habitats:	Still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is vegetative by the extension of prostrate stems and fragmentation. Also produces large amounts of seed. Dispersed within catchments is by water movement, especially during floods. Potentially dispersed by contaminated drainage machinery. To date, most dispersal between waterbodies is human mediated via deliberate introduction.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Senegal tea is a sprawling emergent perennial herb. Leaves are dark green, opposite, and ovate to lanceolate in shape. They vary in size from 5 to 20 cm long, 2.5 to 5 cm wide, and are on shortish stalks. Leaf margins are toothed and slightly wavy. Flowers are whitish, numerous, and grouped into terminal heads that are 1.5 to 2 cm in diameter. Stems are pale green and prostrate, often rooting at each node, becoming erect when flowering. Flowers are highly scented.
Similar species:	Similar to alligator weed (<i>Alternanthera philoxeroides</i>) when in its sprawling phase. Can be differentiated from alligator weed by its serrated leaf margins.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 11 regions: NI - AUK, BOP, HKB, MWT, NTL, TKI, WGN, WKO; SI - CAN, MBH, NSN (see map).
Biosecurity risk:	A potential sprawling emergent weed, with eradication programmes at almost all known sites. AWRAM score: 57 (12th = worst aquatic weed).



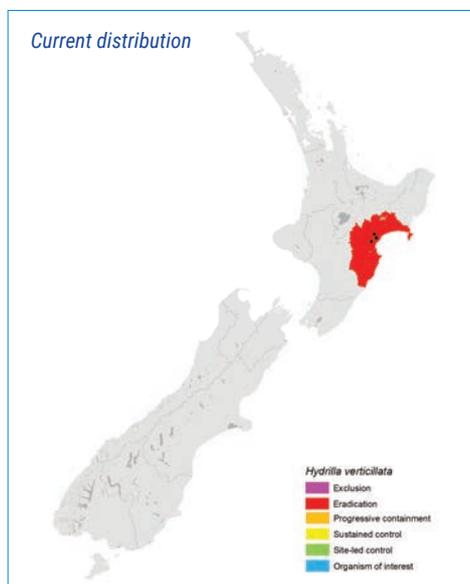
<https://gd.eppo.int/taxon/GYNSP/documents>



Plant

Hydrilla verticillata (L.f.) Royle (Hydrocharitaceae)

Plant life-form:	Submerged
Common name:	Hydrilla
Presence in NZ:	Locally naturalised in Hawkes Bay, first record from Lake Tutira in 1963.
Preferred/known habitats:	Only known from lake environments in New Zealand but grows in flowing waters in other countries.
Dispersal mechanisms:	Reproduction is vegetative by stem fragments and potential dispersal between waterbodies is human mediated (e.g. via watercraft and trailers, fishing nets or drainage machinery contaminated with hydrilla fragments). Only male plants in New Zealand.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded where it is managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
ID features:	Hydrilla is a perennial submerged species with leafy, dark green shoots. The leaves are 6-20 mm long and occur in whorls of 3-10, often varying greatly on the same shoot. They generally have sharp teeth along the leaf margin. Male flowers are tiny, produced on the stem above the leaf whorls.
Similar species:	<i>Egeria</i> (<i>Egeria densa</i>) and elodea (<i>Elodea canadensis</i>). Hydrilla is most easily distinguished from these two species by its toothed leaf margins.
Biosecurity status:	Notifiable Organism, National Pest Plant Accord, managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
Biosecurity risk:	New Zealand's worst potential submerged weed with impacts on indigenous plant biodiversity and potential impacts on hydrogeneration, irrigation, flood protection and recreation. AWRAM score: 74 (2nd worst aquatic weed).

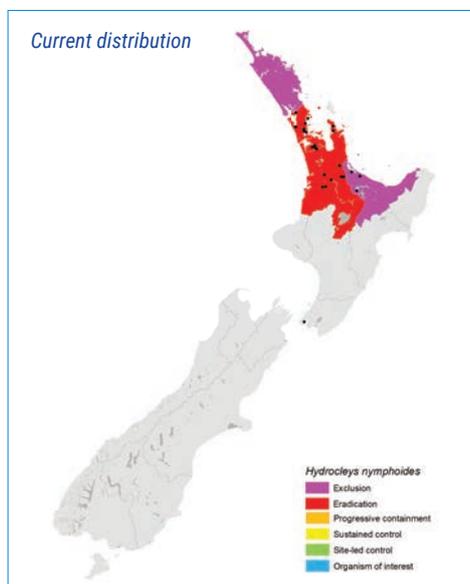
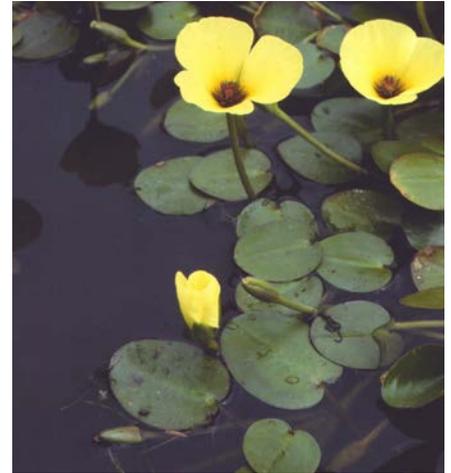


Plant

Hydrocleys nymphoides

(Humb. et Bonpl.) Bucheneau (Alismataceae)

Plant life-form:	Floating leaved
Common name:	Water poppy
Presence in NZ:	Locally naturalised, eradicated from most known sites, first record from Te Aroha, Waikato in 1914.
Preferred/known habitats:	Still and slow flowing water bodies.
Dispersal mechanisms:	Reproduction is vegetative by stolon fragments. To date, all dispersal between waterbodies is human mediated via deliberate introduction, with water movement important for spread within catchments.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Water poppy is a perennial water lily-like plant, with an elastic, creeping stem, floating at or near the water surface. Leaves and roots are attached at each node along the stem. The leaf is a bright glossy green, oval, 7 cm long, and with an inflated main vein on the underside. The leaf sinus is shallow. Flowers consist of 3 yellow petals with a purple centre (filaments) and are up to 8 cm across.
Similar species:	No other water lily-like plants have a three-petalled yellow flower or oval leaves with an inflated main vein.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 4 NI regions: AUK, BOP, NTL, WKO (see map).
Biosecurity risk:	A potential invasive water lily-like weed, with eradication programmes at all known sites. AWRAM score: 45 (37th = worst aquatic weed).



Plant

Iris pseudacorus L. (Iridaceae)

Plant life-form: Erect emergent

Common name: **Yellow flag iris**

Presence in NZ: Widely naturalised in both main islands, first record in 1878.

Preferred/known habitats: Still and slow flowing water bodies, wetlands including saline-influenced sites.

Dispersal mechanisms: Reproduction is both vegetative by the extension of rhizomes and fragmentation and the production of large amounts of floating seeds. Grown as a garden plant and likely still either deliberately planted or garden discards. Dispersed within catchments is by water movement, especially during floods. Additionally, dispersed by contaminated drainage machinery.

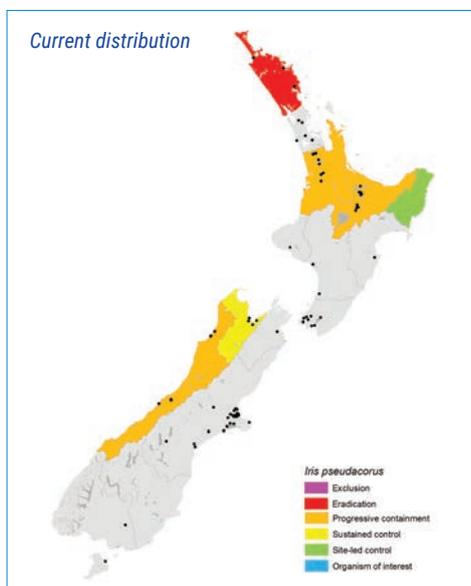
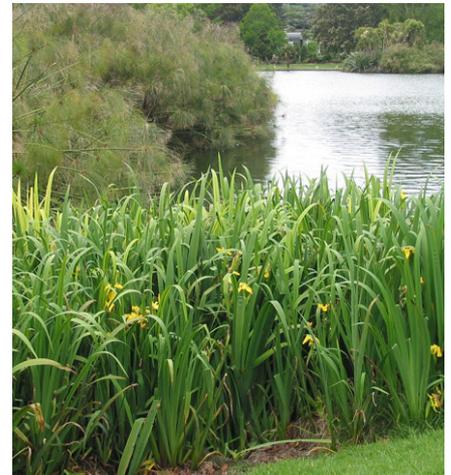
NZ distribution: New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.

ID features: Yellow flag iris is a tall marginal summer-green perennial. It forms dark green, leafy clumps. Leaves are sword-shaped, 2-3 cm wide that shred to fibres when old. The flower stalk is stout, flowers are yellow and up to 12 cm across. Seed are produced in drooping sausage-shaped green capsule 5 x 2 cm. Plants growing over water can form rafts of floating rhizomes, strong enough to support the weight of a human.

Similar species: Raupo (*Typha orientalis*) has a narrower leaf than yellow flag and has a characteristic twist in the top of the leaf blade. Manchurian wild rice (*Zizania latifolia*) is much taller and has sharp-edged leaves.

Biosecurity status: Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 7 regions: NI - BOP, GIS, NTL, WKO; SI - NSN, TAS, WTC (see map).

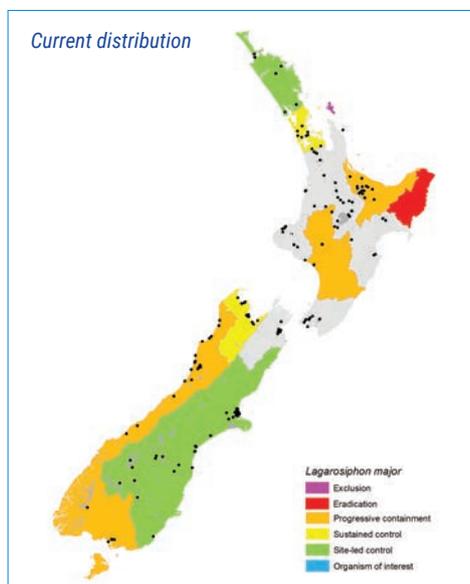
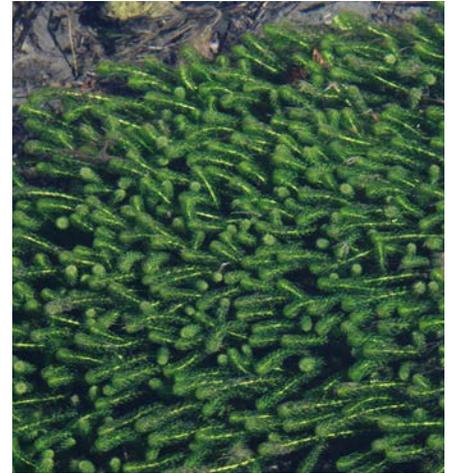
Biosecurity risk: A problem weed in still and flowing water bodies, also in flooded pasture because the species is potentially toxic to livestock. A weed of swamps, marshes and salt marsh vegetation. AWRAM score: 52 (22nd = worst aquatic weed).



Plant

Lagarosiphon major (Ridley) Moss (Hydrocharitaceae)

Plant life-form:	Submerged
Common name:	Lagarosiphon
Presence in NZ:	Widely naturalised in North Island and locally abundant in the South Island, first record from the Hutt Valley in 1950.
Preferred/known habitats:	Moderately fast flowing to still water bodies, including low nutrient waters.
Dispersal mechanisms:	Reproduction is vegetative by stem fragments and dispersal between waterbodies is human mediated (e.g. via watercraft and trailers, fishing nets or drainage machinery contaminated with lagarosiphon fragments). Only female plants in New Zealand.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Lagarosiphon is a perennial submerged species with brittle, leafy, dark green shoots. Leaves are alternate, arranged spirally around the stem and typically are curved downwards, 6-20 mm long. Lagarosiphon has tiny female flowers borne on long filamentous stalks.
Similar species:	<i>Elodea</i> (<i>Elodea canadensis</i>) and <i>egeria</i> (<i>Egeria densa</i>). Both of these species have leaves arranged in whorls on the stem, whereas lagarosiphon has leaves arranged alternately in a spiral pattern.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 11 regions: NI - AUK, BOP, GIS, MWT, NTL; SI - CAN, NSN, OTA, STL, TAS, WTC (see map).
Biosecurity risk:	A major submerged weed with impacts on indigenous plant biodiversity, hydrogeneration, irrigation, flood protection and recreation. AWRAM score: 60 (8th worst aquatic weed).

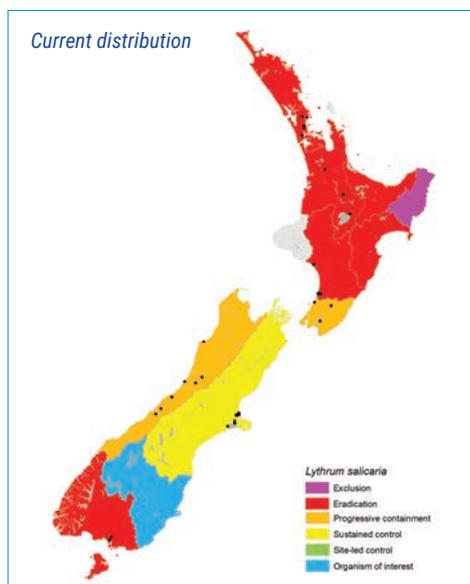


Plant

Lythrum salicaria

L. (Lythraceae)

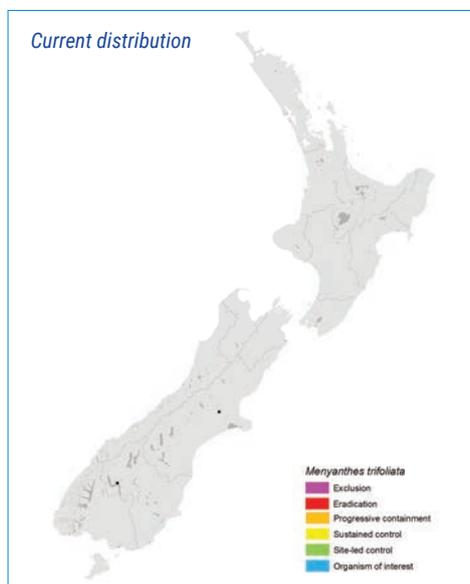
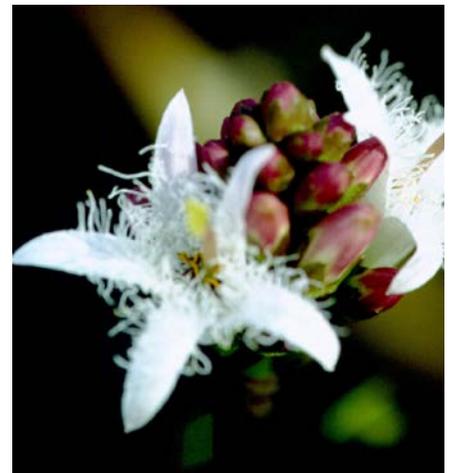
Plant life-form:	Erect emergent
Common name:	Purple loosestrife
Presence in NZ:	Locally naturalised, especially in Horowhenua and Canterbury, first record in 1958.
Preferred/known habitats:	Margins of still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is vegetative by the extension of rhizomes, but primarily by the production of large amounts of long-lived seed. Dispersed within catchments by water movement, especially during floods. To date, most dispersal between waterbodies is human mediated via deliberate introduction but potentially also by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Purple loosestrife is a tall emergent perennial summer-green herb, dying back to a root crown in winter. Normally 60-100 cm tall but can grow taller. Stems are angled (4-6 sided). The stalkless leaves can be opposite, or sometimes in whorls of 3 near the base. Showy purple flowers are produced in dense terminal spikes.
Similar species:	No similar species.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 16 regions, with the exception being TKI (see map).
Biosecurity risk:	A potential major weed in still water bodies and wetlands and managed for eradication in most regions. Regarded as North America's worst wetland weed species. AWRAM score: 57 (12th = worst aquatic weed).



Plant

Menyanthes trifoliata Tournef. (Menyanthaceae)

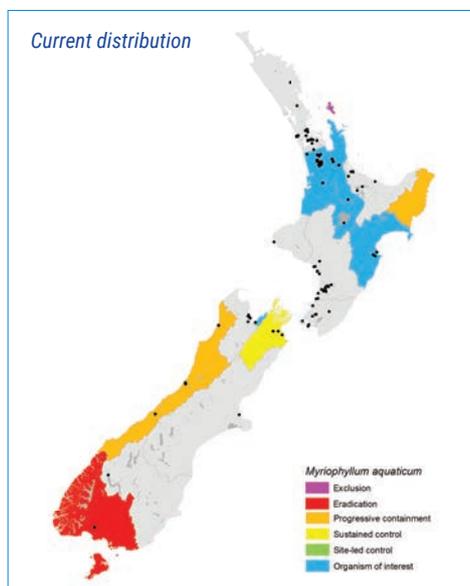
Plant life-form:	Sprawling emergent
Common name:	Bogbean
Presence in NZ:	Nationally eradicated, first record from Darfield, Canterbury in 1976.
Preferred/known habitats:	Only found in an ornamental pond and irrigation race in New Zealand, found in nutrient poor waters in native range.
Dispersal mechanisms:	Reproduces by seeds, creeping stem extension and fragmentation. New Zealand sites were either in cultivation or subsequent dispersal by water flow to irrigation channels.
NZ distribution:	New Zealand distribution showing records as dots, not included in any Regional Pest Management Plan.
ID features:	Bogbean is a sprawling emergent perennial herb with thick long-reaching rhizomes. Leaves are divided into three leaflets, like the leaves of broad bean. Leaflets are elliptical to obovate, 3-10 cm long, 1-5 cm wide, entire or sometimes coarsely toothed. Leaves are all basal, arranged alternately on the creeping stem. Flowers have five petals, pinkish-white in colour, with long white hairs on the top surface. Flowers are about 2.5 cm across.
Similar species:	No similar species.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord.
Biosecurity risk:	A potential sprawling emergent weed, eradicated at all known sites. AWRAM score: 45 (37th = worst aquatic weed).



Plant

Myriophyllum aquaticum (Vell. Conc.) Verdc. (Haloragaceae)

- Plant life-form:** Sprawling emergent
- Common name:** **Parrot's feather**
- Presence in NZ:** Widely naturalised, often locally abundant in the North Island but rare in the South Island, first record from Palmerston North in 1929.
- Preferred/known habitats:** Moderately flowing to still water bodies, including wetlands.
- Dispersal mechanisms:** Reproduction is vegetative by the extension of prostrate stems or stem fragmentation. It is dispersed by water movement, especially during floods, with additional dispersed by contaminated machinery and deliberate introduction/disposal of unwanted ornamental pond vegetation. Only female plants in in New Zealand.
- NZ distribution:** New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
- ID features:** Parrot's feather is a sprawling emergent perennial herb. Emergent leaves are a light bluish-green, up to 3.5 cm long, that are deeply divided (pinnate), giving them a feathery appearance. They are arranged in whorls of 4-6 on a rubbery stem up to 2m long, but with only up to the top 10 cm emerging above water. Flowers are white, tiny (up to 1.5mm across), with no petals, and attached at the leaf-stem junction.
- Similar species:** Other *Myriophyllum* spp. and hornwort (*Ceratophyllum demersum*). Of the *Myriophyllum* species in New Zealand, the rare *M. robustum* is the most similar to parrot's feather, the easiest way to tell the difference is by looking at the shape of each leaf; *M. robustum* is pointed at the end, whereas parrot's feather has a rounded leaf tip. Hornwort has forked leaves compared with the pinnate leaves of parrot's feather.
- Biosecurity status:** Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 7 North Island regions: BOP, GIS, HKB, MWT, NTL, WKO, WGN (see map).
- Biosecurity risk:** Currently a major sprawling emergent weed in the North Island, affecting drains and other aquatic habitats. AWRAM score: 56 (14th worst aquatic weed).

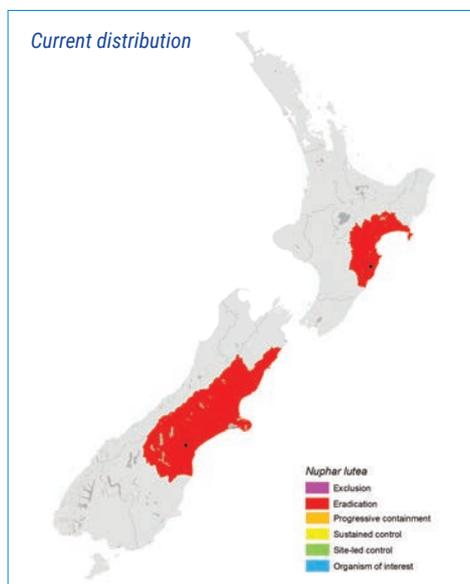
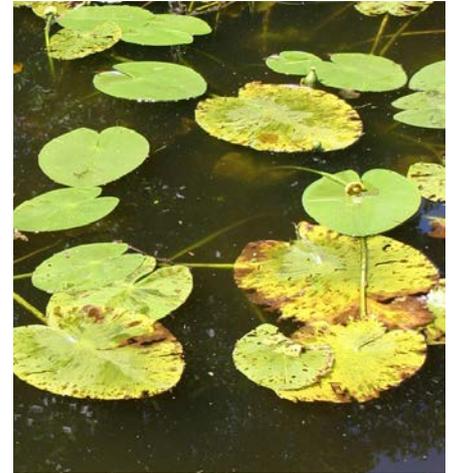


Plant

Nuphar lutea

(L.) Sibth. & Small (Nymphaeaceae)

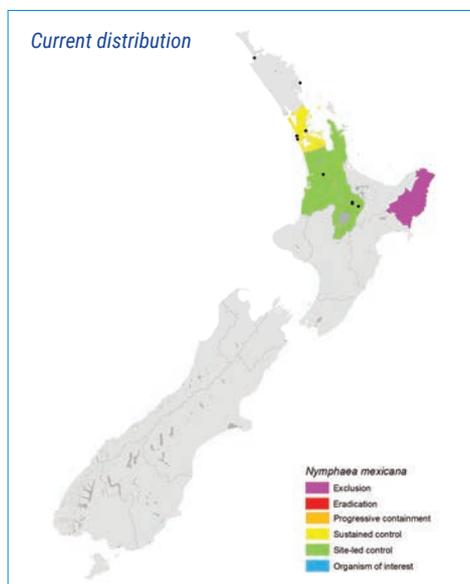
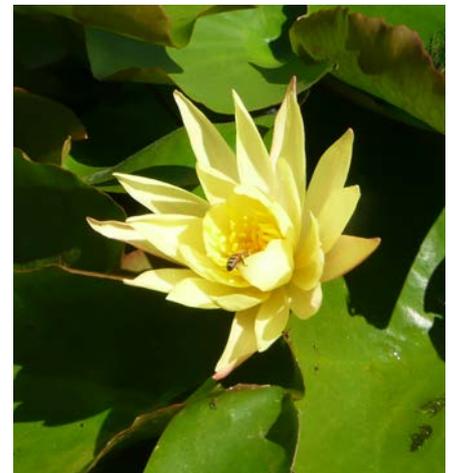
Plant life-form:	Floating leaved
Common name:	Yellow water lily
Presence in NZ:	Very local, first record from Patangata, Hawkes Bay in 1975.
Preferred/known habitats:	Still and slow flowing water bodies.
Dispersal mechanisms:	Reproduction is vegetative by rhizome fragments and long-lived seeds. To date, all dispersal between waterbodies is human mediated via deliberate introduction, with water movement important for spread within catchments.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Yellow water lily is a perennial water lily, with stout, spongy rhizomes up to 10 cm thick. Leaves and roots are attached along the stem. Floating or emergent leaves are bright green, oval with a deep notch (sinus) where the stalk attaches, 30 cm long. Submerged leaves are rounded, very thin and translucent. Flowers are held above the water surface and consist of 6 golden yellow petals (like a very large buttercup flower) up to 6 cm across, with a characteristic alcoholic scent.
Similar species:	No other water lily-like plants have similar large oval leaves and buttercup-like flowers.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 2 regions: HBR, CAN (see map).
Biosecurity risk:	A potential invasive water lily, with eradication programmes at all known sites. AWRAM score: 44 (43rd = worst aquatic weed).



Plant

Nymphaea mexicana Zucc. (Nymphaeaceae)

Plant life-form:	Floating leaved
Common name:	Mexican water lily
Presence in NZ:	Locally naturalised, first record from Lake Ohakuri, Waikato River in 1982.
Preferred/known habitats:	Still and slow flowing water bodies.
Dispersal mechanisms:	Reproduction is vegetative by rhizome and stolon fragments and long-lived seeds. To date, all dispersal between waterbodies is human mediated via deliberate introduction, with water movement important for spread within catchments.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Mexican water lily is a perennial water lily, with upright rhizomes and far spreading thick spongy stolons often with distinctive 'brood-bodies' which look like miniature hands of bananas. Leaves are almost round to elliptical in shape, with a deep sinus and conspicuous main vein obvious on the underside. Leaves are up to 20 cm across, green with pink on the lower surface, often with brown blotches on the upper surface and scalloped edges. The flower is yellow made up of many (> 10) and up to 15 cm across. New Zealand plants are likely to be of hybrid origin but have the characters of the parent species.
Similar species:	Common water lily (<i>Nymphaea alba</i>), marshwort (<i>Nymphoides montana</i>), and fringed water lily (<i>Nymphoides peltata</i>). Common water lily has a horizontal rhizome and lacks the spongy stolons distinguishing it from Mexican water lily, which has an erect rhizome. Marshwort and fringed water lily do not have the conspicuous main vein obvious on the underside of the leaf and have five petalled yellow flowers.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 3 North Island regions: AUK, GIS, WKO (see map).
Biosecurity risk:	An invasive water lily that can choke shallow still water bodies. AWRAM score: 47 (29th = worst aquatic weed).

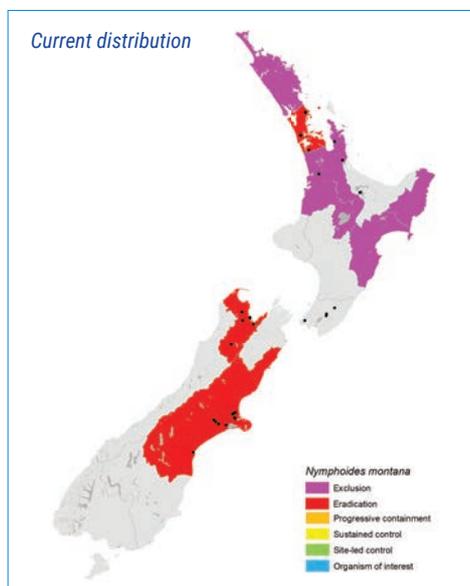
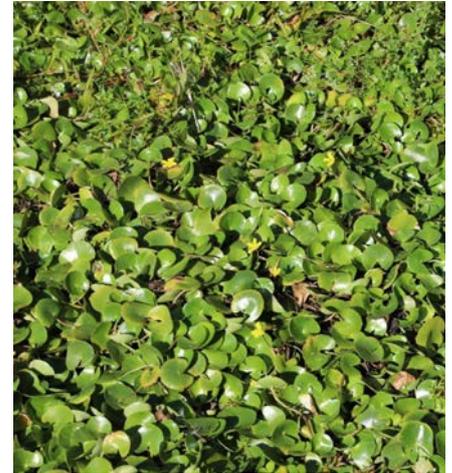


Plant

Nymphoides montana

Aston (Menyanthaceae) (previously known as *N. geminata* (R. Br.) Kuntze)

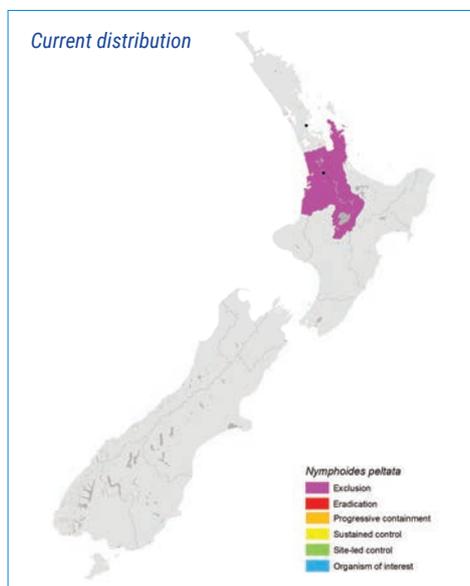
- Plant life-form:** Floating leaved
- Common name:** **Marshwort**
- Presence in NZ:** Locally naturalised, mostly eradicated, first record from Lake Okareka, Bay of Plenty in 1985.
- Preferred/known habitats:** Still and slow flowing water bodies.
- Dispersal mechanisms:** Reproduction is vegetative by stolon growth and fragmentation. To date, all dispersal between waterbodies is human mediated via deliberate introduction, with water movement important for spread within catchments.
- NZ distribution:** New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
- ID features:** Marshwort is a perennial waterlily-like plant with an elastic, creeping stem, floating at or near the water surface. Leaves and roots are attached at each node along the stem. Leaves are heart-shaped and up to 10 cm across. Bright green on upperside and often pinkish beneath. The main vein is indistinct on the underside of the leaf. Flowers are bright yellow, up to 4 cm across, with 5 petals that have fringed marginal wings.
- Similar species:** Fringed water lily (*Nymphoides peltata*) and water lily (*Nymphaea* spp.). Fringed water lily has leaves with scalloped margins, whereas marshwort has entire leaf margins. Unlike true water lilies (*Nymphaea*) marshwort does not have a conspicuous main vein on the underside of the leaf.
- Biosecurity status:** Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 8 regions: regions: NI - AUK, BOP, GIS, HKB, NTL, WKO; SI - CAN, NSN, TAS, (see map).
- Biosecurity risk:** An invasive water lily-like plant that can choke shallow still water bodies. AWRAM score: 46 (33rd = worst aquatic weed).



Plant

Nymphoides peltata (Gmel.) Kuntze (Menyanthaceae)

- Plant life-form:** Floating leaved
- Common name:** **Fringed water lily**
- Presence in NZ:** Nationally eradicated, first record from Whangaparaoa, Auckland in 1988.
- Preferred/known habitats:** Still and slow flowing water bodies.
- Dispersal mechanisms:** Reproduction is vegetative by stolon growth and fragmentation and by floating seeds which are fringed with many bristles. Huge potential for spread because seeds are adapted for water bird dispersal. All known sites were the result of deliberate plantings.
- NZ distribution:** New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
- ID features:** Fringed water lily is a summer-green perennial waterlily-like plant dying back to root crowns during winter. Plants are rhizomatous also with creeping stem, floating at or near the water surface. Leaves and roots are attached at each node along the stem. Leaves are heart-shaped, with scalloped edges and often with brown blotches and up to 10 cm across. Bright green on upperside and often pinkish beneath. The main vein is indistinct on the underside of the leaf. Flowers are golden yellow, up to 4.5 cm across, with 5 petals that have solid marginal wings.
- Similar species:** Marshwort (*Nymphoides montana*) and water lily (*Nymphaea* spp.). Marshwort has leaves with entire margins, whereas fringed water lily has scalloped margins. Unlike true water lilies (*Nymphaea*), fringed water lily does not have a conspicuous main vein on the underside of the leaf.
- Biosecurity status:** Notifiable Organism, National Pest Plant Accord, Regional Pest Management Plans in Waikato Region (see map).
- Biosecurity risk:** An invasive water lily-like plant that can choke shallow still water bodies. AWRAM score: 58 (9th = worst aquatic weed).



Plant

Oenanthe javanica

(Blume) DC. (Apiaceae)

Plant life-form: Sprawling emergent

Common name: **Vietnamese parsley**

Presence in NZ: Recently naturalised, few localities in both main islands, first record from Rotorua in 2009.

Preferred/known habitats: Moderately flowing water bodies and drains.

Dispersal mechanisms: Reproduction is vegetative by stem fragmentation and seed production. Dispersed within catchments by water movement, especially during floods. Additionally, dispersed by deliberate plantings as it is grown both ornamentally as a food and medicinal plant for some ethnicities.

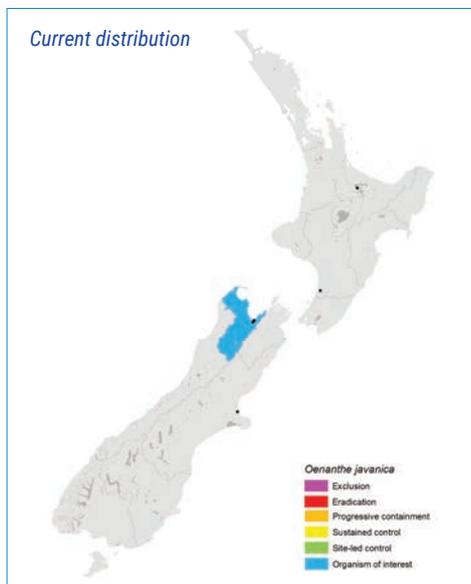
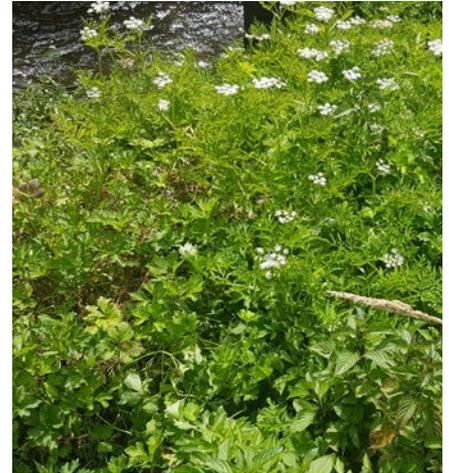
NZ distribution: New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.

ID features: Vietnamese parsley is a perennial sprawling emergent plant, with pale green and prostrate stems, often rooting at each node, becoming erect when flowering. Leaves are alternate and compound (double-pinnate) leaves up to 30 cm long. Leaflets are deeply toothed, arranged in groups of 3 or 5, or they occur individually. Flowers are compound umbels of tiny white five-petaled flowers, the inflorescence up to 5 cm across. produced opposite the middle and upper leaves. Two seeded fruits are produced. These are buoyant and are spread by water movement.

Similar species: Two *Oenanthe* species (*O. aquatica* and *O. sarmentosa*) and water celery (*Apium nodiflorum*) are also aquatic umbellifers. *O. aquatica* has three-times compound leaves and both this species and *O. sarmentosa* produce a highly poisonous sap causing contact blistering. Water celery has pinnate leaves and stalkless umbels, unlike Vietnamese parsley which has twice compound leaves and stalked inflorescences.

Biosecurity status: No status under the Biosecurity Act, organism of interest in Nelson City Council (see map).

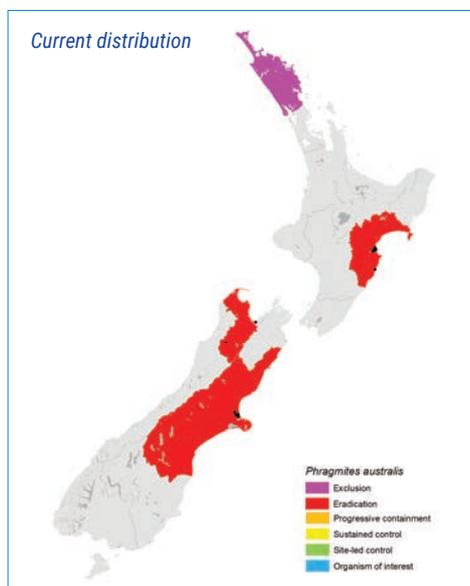
Biosecurity risk: A potential sprawling emergent weed, especially affecting drains and other flowing water bodies. AWRAM score: 47 (29th = worst aquatic weed).



Plant

Phragmites australis (Griseb.) Stapf (Poaceae)

- Plant life-form:** Erect emergent
- Common name:** **Phragmites**
- Presence in NZ:** Locally naturalised, in Napier and Canterbury, targeted for eradication, first record from Napier in 1960.
- Preferred/known habitats:** Margins of still and slow flowing water bodies, wetlands and reported from salt marshes overseas.
- Dispersal mechanisms:** Reproduction is vegetative by the extension of rhizomes and fragmentation. No seed is set in New Zealand. Dispersed within catchments by water movement, especially during floods. To date, most dispersal between waterbodies is human mediated via contaminated drainage machinery and possibly mowers. Also spread by deliberate introduction, with variegated plants found in several populations.
- NZ distribution:** New Zealand distribution showing records as dots and territorial regions and territorial regions are shaded where it is managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
- ID features:** Phragmites is a tall (3 m) emergent perennial summer-green, rhizomatous grass, dying back to a root crown in winter. Dense clumps of erect dead stalks often remain throughout the winter. Leaves are blue-green, stalkless, alternate up the stem and often align in one direction blown by the wind, up to 60 cm long and 3 cm wide. Flower head is purplish, silky, and almost up to 40 cm long.
- Similar species:** Tall reed (*Phragmites karka*), giant reed (*Arundo donax*) and bamboos. All these grasses are evergreen and do not die off in autumn. Otherwise tall reed is very similar to phragmites. Giant reed is taller with arching stems. Bamboos have stalked leaves rather than leaves that attach directly to the stalk in the case of phragmites.
- Biosecurity status:** Unwanted Organism, National Pest Plant Accord, managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
- Biosecurity risk:** New Zealand's worst potential aquatic weed species. AWRAM score: 75 (1st worst aquatic weed).

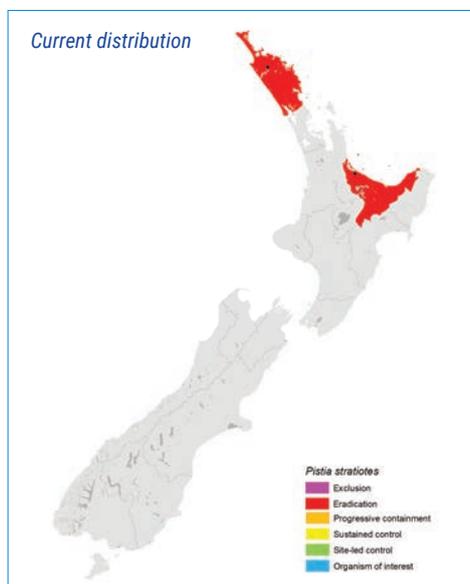


Plant

Pistia stratiotes

L. (Araceae)

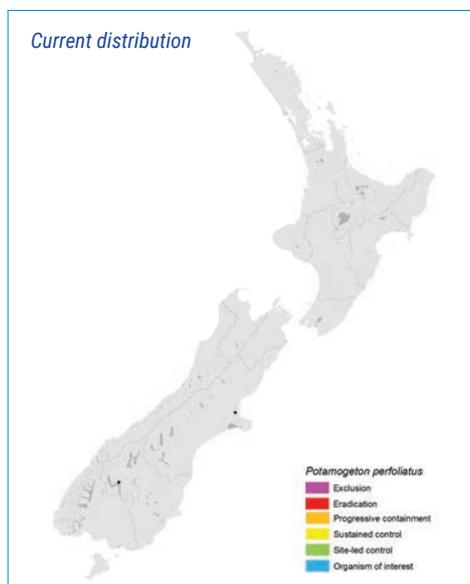
Plant life-form:	Free-floating
Common name:	Water lettuce
Presence in NZ:	Nationally eradicated, first record from Tauranga in 1975.
Preferred/known habitats:	Still and slow flowing, usually in moderately to highly enriched, water bodies, only found in ornamental ponds and a farm dam in New Zealand.
Dispersal mechanisms:	Reproduction is primarily vegetative when older stolons between individual plants decay to release young plants. Also spreads by seed. To date, all dispersal between waterbodies is human mediated via deliberate introduction, with water movement important for spread within catchments.
NZ distribution:	New Zealand distribution showing records as dots, not included in any Regional Pest Management Plan.
ID features:	Water lettuce is a free-floating perennial herb. Plants are stoloniferous with daughter plants often attached. Leaves are ridged or fluted, velvety hairy, pale yellow- to blue-green arranged in a rosette (like a lettuce). Roots are long and finely divided. Flowers are small, arranged on a spike surrounded by a ~1 cm long bract (like a miniature arum lily).
Similar species:	No similar species.
Biosecurity status:	Notifiable Organism, National Pest Plant Accord.
Biosecurity risk:	A potential free-floating weed, eradicated at all known sites. AWRAM score: 47 (29th = worst aquatic weed).



Plant

Potamogeton perfoliatus L. (Potamogetonaceae)

Plant life-form:	Submerged
Common name:	Clasped pondweed
Presence in NZ:	Nationally eradicated, first record from a pond near Lake Hayes, Otago in 1996.
Preferred/known habitats:	Moderate flowing to still water bodies, only found in ornamental ponds in New Zealand.
Dispersal mechanisms:	Reproduction is vegetative by stem fragments and possibly by seed. To date, all dispersal between waterbodies is human mediated via deliberate introduction. Potentially it could be spread by waterfowl dispersed seed.
NZ distribution:	New Zealand distribution showing records as dots, not included in any Regional Pest Management Plan.
ID features:	Clasped pondweed is a submerged perennial herb. Plants are rhizomatous with leaves arranged alternately along the length of each stem. Leaves are narrowly or broadly ovate, up to 7 cm long and 4 cm wide with undulating margins, distinct longitudinal veins, green to red/brown leaves, with the base of the leaves 'clasping' the stem. Flowers are small, arranged on a brown spike that emerges above the water's surface.
Similar species:	Other <i>Potamogeton</i> spp. <i>Potamogeton perfoliatus</i> can be distinguished from all other <i>Potamogeton</i> species by the way the leaf clasps the stem.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord.
Biosecurity risk:	A potential submerged weed, eradicated at all known sites. AWRAM score: 55 (15th worst aquatic weed).

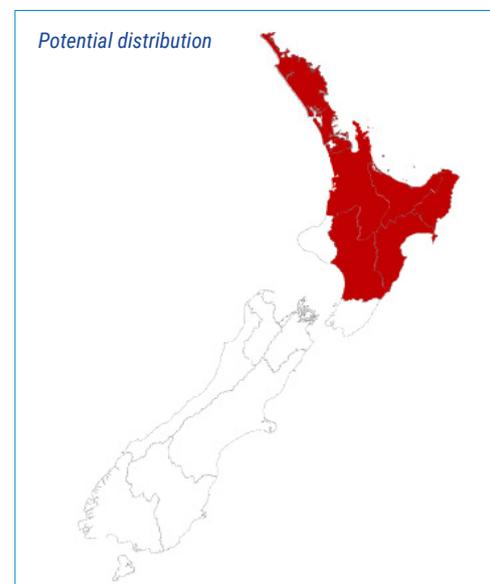
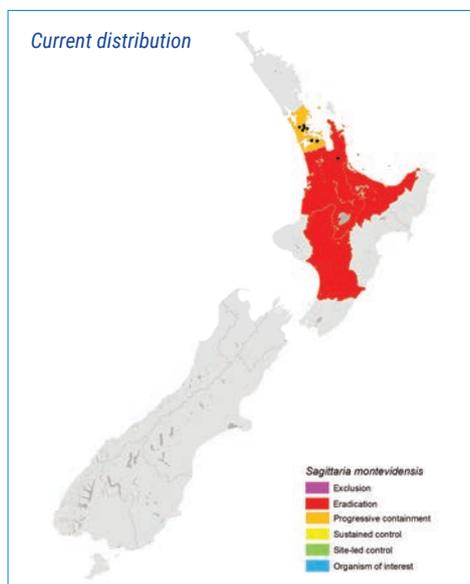


Plant

Sagittaria montevidensis

Cham. & Schlecht (Alismataceae)

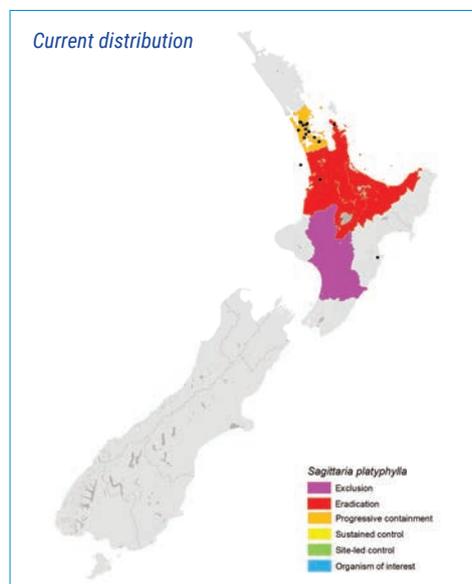
Plant life-form:	Erect emergent
Common name:	Arrowhead
Presence in NZ:	Locally naturalised, first record from Manukau, Auckland in 1996.
Preferred/known habitats:	Still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is primarily by the production of large amounts of seed. Dispersed within catchments by water movement. To date, dispersal between waterbodies is human mediated via deliberate introduction but potentially also by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Arrowhead is a tall (≤ 2 m) emergent perennial herb growing from a short, thick upright rhizome. Leaves have a distinctive arrow-shape with basal lobes up to 15 cm long. The rest of the leaf is up to 25 cm long and 20 cm wide. Flowers are white with a purple basal spot, about 2.5 cm in diameter, arranged in whorls on a stalk of similar height to the leaves, with male flowers in upper whorls and female flowers beneath. Masses of 3 mm long, brown seed are produced that float and are dispersed by water movement.
Similar species:	Other <i>Sagittaria</i> species. <i>S. sagittifolia</i> also has arrow-shaped leaves but petioles are triangular in cross-section and it produces creeping rhizomes and tubers. The two other <i>Sagittaria</i> species present in New Zealand (<i>S. subulata</i> and <i>S. platyphylla</i>) do not have arrow-shaped emergent leaves.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 4 North Island regions: AUK, BOP, MWT, WKO (see map).
Biosecurity risk:	A potential major weed in irrigation and drainage channels and natural wetlands and managed for eradication in most regions. AWRAM score: 46 (33rd = worst aquatic weed).



Plant

Sagittaria platyphylla (Engelm.) Smith (Alismataceae)

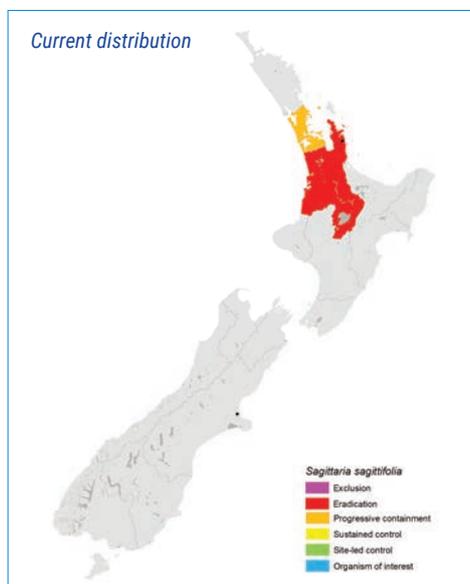
Plant life-form:	Erect emergent
Common name:	Sagittaria
Presence in NZ:	Locally naturalised, first record from Glenfield, Auckland in 1989.
Preferred/known habitats:	Still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is primarily by the production of large amounts of seed, but also by rhizome extension and the spread of tubers. Dispersed within catchments by water movement. To date, dispersal between waterbodies is human mediated via deliberate introduction but potentially also by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Sagittaria is a tall (≤ 1.5 m) emergent perennial herb growing from far-reaching stolons that produce tubers up to 4 cm x 1.5 cm in size. Emergent leaves are lance-shaped or ovate up to 60 cm long and 10 cm wide on a triangular leaf stalk. Submerged leaves are strap-like, up to 50 cm long and 3 cm wide. Flowers are white, about 2 cm in diameter, arranged in whorls on a stalk of similar height to the leaves, with male flowers in upper whorls and female flowers beneath. Masses of 2.5 mm long, brown seed are produced that float and are dispersed by water movement.
Similar species:	Water plantains <i>Alisma</i> spp. Water plantains have D-shaped rather than triangular petioles and much larger inflorescences with smaller flowers. Eelgrass (<i>Vallisneria australis</i>). The submerged leaves of sagittaria look similar to those of eel grass; however, eelgrass never has emergent leaves or conspicuous white flowers.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 5 regions: NI - AUK, BOP, MWT, WKO; SI - CAN (see map).
Biosecurity risk:	A potential major weed in irrigation and drainage channels and natural wetlands and managed for eradication in most regions. It is a Weed of National Significance (WoNS) in Australia. AWRAM score: 52 (22nd = worst aquatic weed).



Plant

Sagittaria sagittifolia L. (Alismataceae)

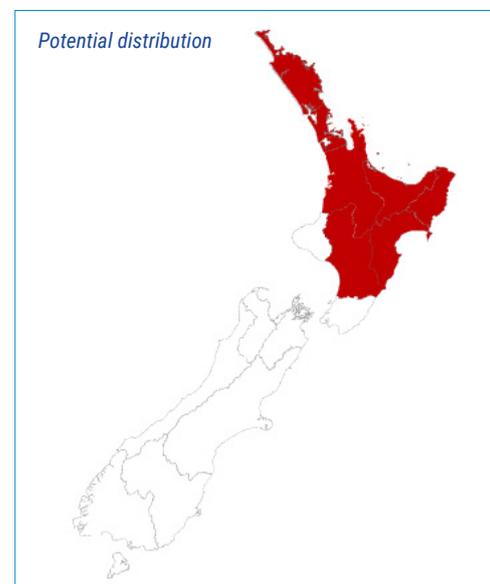
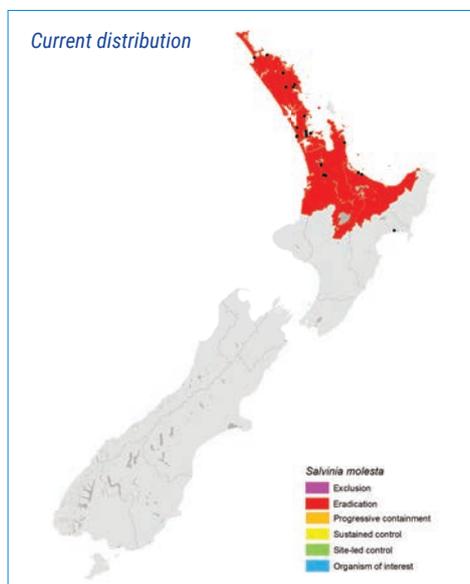
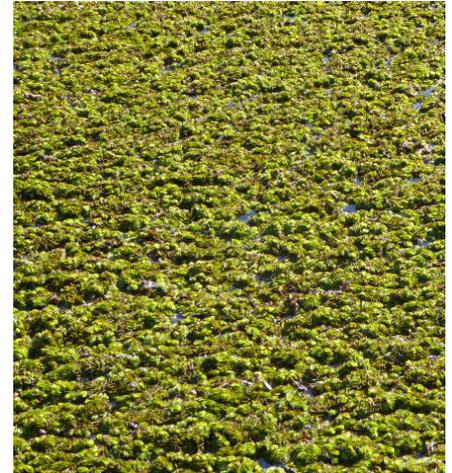
Plant life-form:	Erect emergent
Common name:	Arrowhead
Presence in NZ:	Only naturalised in one location, first record from Coromandel Peninsula in 2002.
Preferred/known habitats:	Still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is primarily by rhizome extension and the spread of corms. Dispersed within catchments by water movement. To date, dispersal between waterbodies is human mediated via deliberate introduction as the corms are eaten by some ethnicities, but potentially also by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Arrowhead is a tall (1 m) summer-green perennial dying back to underground parts over winter. Emergent leaves have a distinctive glossy arrow-shape with long basal lobes. Petioles are triangular in cross-section. Plants are rhizomatous with stolons and round tubers, up to 3 cm across, produced on these. No flowers have been seen on New Zealand material.
Similar species:	Other <i>Sagittaria</i> species. <i>S. montevidensis</i> also has arrow-shaped leaves but petioles are D-shaped in cross-section and it does not produce creeping rhizomes or tubers. The two other <i>Sagittaria</i> species present in New Zealand (<i>S. subulata</i> and <i>S. platyphylla</i>) do not have arrow-shaped emergent leaves.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 2 North Island regions: AUK, WKO (see map).
Biosecurity risk:	A potential major weed in irrigation and drainage channels and natural wetlands and managed for eradication in most regions. AWRAM score: 53 (20th = worst aquatic weed).



Plant

Salvinia molesta Mitch. (Salviniaceae)

Plant life-form:	Free-floating
Common name:	Salvinia
Presence in NZ:	Locally naturalised predominantly in the northern North Island, subject to a national eradication programme since 1983, first record from Western Springs, Auckland in 1963.
Preferred/known habitats:	Still and slow flowing water bodies in warm areas, usually in moderately to highly enriched water bodies.
Dispersal mechanisms:	Reproduction is vegetative, spreading rapidly by fragmentation and producing plantlets from the new tips of the horizontal stem, and can grow from a single node. The plant is apparently a sterile hybrid.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded where it is managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
ID features:	Salvinia is a perennial free-floating fern with a distinctive orange-green colour when mature. It has a horizontal stem with paired aerial (above the water) leaves. Adult leaves are folded, whereas young leaves are flat. Aerial leaves have hairs shaped like egg-beaters. Lower submerged leaves look more like roots and can be up to 30 cm long, often associated with chains of bead-like sporangia, but spores are not produced.
Similar species:	No similar species.
Biosecurity status:	Notifiable Organism, National Pest Plant Accord, managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
Biosecurity risk:	A major weed in warmer parts of the world. Completely smothers water bodies impacting on biodiversity, with potential to adversely affect hydrogeneration, irrigation, flood protection and recreation. AWRAM score: 57 (12th = worst aquatic weed).

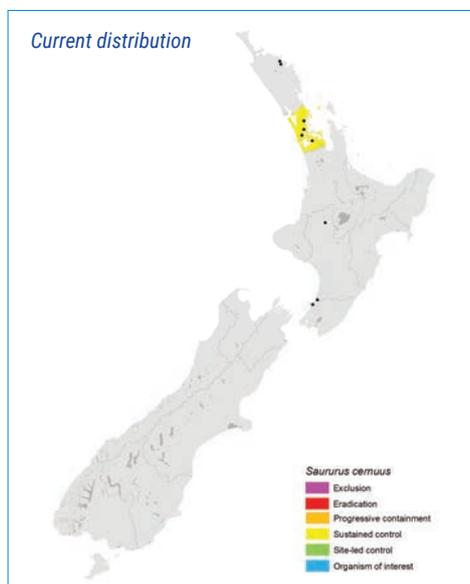


Plant

Saururus cernuus

L. (Saururaceae)

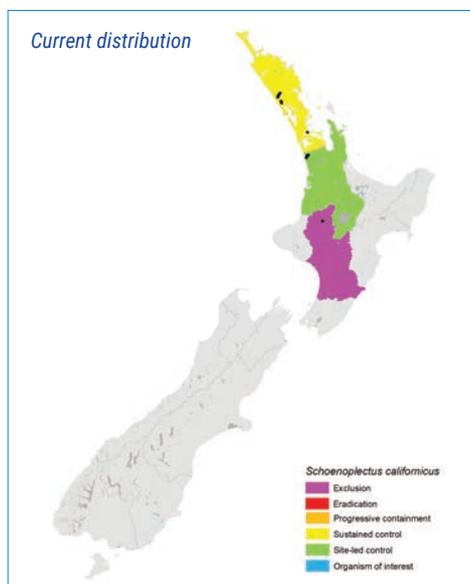
Plant life-form:	Erect emergent
Common name:	Lizard's tail
Presence in NZ:	Only known from garden escapes with small stands establishing away from planted areas, first record from Puhoi, Auckland in 2001.
Preferred/known habitats:	Margins of still and slow flowing water bodies, wetlands including shaded sites.
Dispersal mechanisms:	Reproduction is primarily by rhizome extension. No evidence of seed set in New Zealand. Dispersed within catchments by water movement. To date, dispersal between waterbodies is human mediated via deliberate plantings, but potentially also by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Lizard's tail is an erect emergent perennial (up to 0.6 m), dying back to underground parts over winter in the southern parts of its range but evergreen in the northern North Island. Plants are rhizomatous and form dense clumps. Leaves are heart-shaped up to 10 cm long, conspicuously veined and with an unpleasant peppery smell when crushed. Flowers are white, lacking petals borne on a long arched spike up to 30 cm long.
Similar species:	No similar species.
Biosecurity status:	No status under the Biosecurity Act, Regional Pest Management Plan in Auckland.
Biosecurity risk:	A potential minor weed in natural wetlands, currently limited by poor dispersal mechanisms. AWRAM score: 39 (50th worst aquatic weed).



Plant

Schoenoplectus californicus (C.A.Mey.) Palla (Cyperaceae)

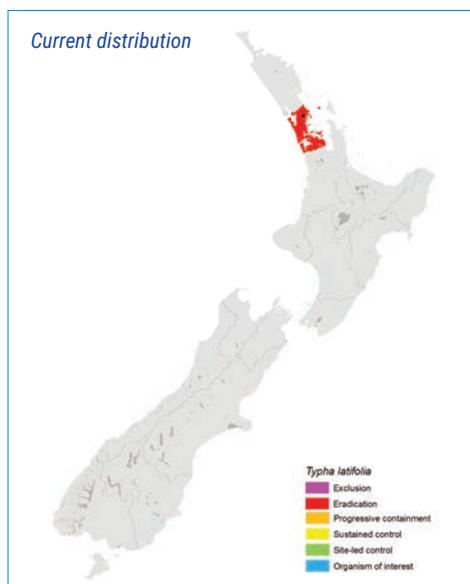
Plant life-form:	Erect emergent
Common name:	Californian bulrush
Presence in NZ:	Locally abundant, first record from the Northern Wairoa River, Dargaville in 1992, but likely to have been present for > 100 years.
Preferred/known habitats:	Estuarine habitats, previously planted in freshwater wetlands.
Dispersal mechanisms:	Reproduction is primarily by rhizome extension and the fragments. Dispersed within catchments by water movement, but potentially also by contaminated drainage machinery. Seed is viable, but seedlings have not been observed in the field. Plants were distributed in the past as a plant suitable for constructed wetlands to treat farm/domestic effluent.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Californian bulrush is tall rhizomatous sedge up to 4 m tall, with stems triangular near the base, round in upper parts, up to 3 cm across. Leaves are reduced to brown papery basal sheaths. Small brown flowers are produced in many branched drooping heads near the stem tip.
Similar species:	The native sedge <i>Schoenoplectus tabernaemontani</i> . Key differences are the round bluish-green stem, smaller size and clustered, not drooping flower heads of this species.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 4 North Island regions: AUK, MWT, NTL, WKO (see map).
Biosecurity risk:	A major weed in coastal waterways including drainage channels and natural wetlands. AWRAM score: 43 (46th = worst aquatic weed).



Plant

Typha latifolia L. (Typhaceae)

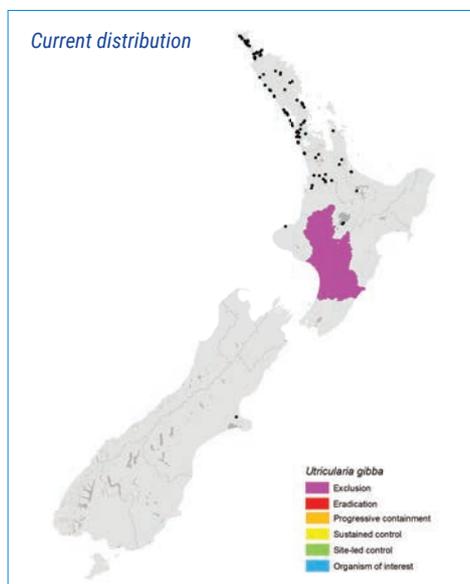
Plant life-form:	Erect emergent
Common name:	Great reedmace
Presence in NZ:	Only naturalised in one location, first record from near Warkworth, North Auckland in 2001.
Preferred/known habitats:	Margins of still and slow flowing water bodies, wetlands.
Dispersal mechanisms:	Reproduction is primarily by rhizome extension and the fragments. Dispersed within catchments by water movement, but potentially also by contaminated drainage machinery. Flower heads are produced, in New Zealand but viability is unknown. Seed are wind dispersed.
NZ distribution:	New Zealand distribution showing records as dots.
ID features:	Great reedmace is tall rhizomatous reed up to 3 m tall, with rounded stems. Leaves are pale-greyish-green, wide, flat, and stiff sheathing the stem, D shaped on cross section. All <i>Typha</i> species have a characteristic twist in the upper part of an otherwise flat leaf. Flowers are produced in early summer, in a characteristic dark brown to black erect sausage-shaped flower spike.
Similar species:	The native raupo <i>Typha orientalis</i> . Key differences are the wider, paler green leaves and almost black flower spikes of great reedmace, compared to the bright green and reddish brown flower spikes of raupo.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord.
Biosecurity risk:	A potential major weed in the margin of water bodies and natural wetlands. AWRAM score: 58 (9th = worst aquatic weed).



Plant

Utricularia gibba Lam. (Lentibulariaceae)

Plant life-form:	Submerged
Common name:	Humped bladderwort
Presence in NZ:	Abundant in northern North Island, spreading south, first record from Waitakere, Auckland in 1978.
Preferred/known habitats:	Still water bodies.
Dispersal mechanisms:	Reproduction is vegetative by stem fragments and seed. Waterfowl appear to be the main dispersal agent spreading seed to new water bodies, but human mediated dispersal via contaminated watercraft and trailers, nets, machinery are all probable.
NZ distribution:	New Zealand distribution showing records as dots, only included in one Regional Pest Management Plan, as an exclusion pest.
ID features:	Humped bladderwort is a submerged plant that is either unattached or anchored to other vegetation by clawed modified stems. Stems and leaves are filamentous forming dense tangled mats, superficially similar to filamentous algae. Leaves are simple or forked, up to 1 cm long. Bladderworts are carnivorous, capturing small aquatic animals in bladders that are up to 1.5 mm long and obliquely ovoid, situated on the leaves on short stalks. Flowers are commonly produced in one-three flowered spikes above the water surface or underwater. Emergent flowers are small and yellow, 6 mm across, fruit a small round green capsule.
Similar species:	<i>Utricularia australis</i> (rare native species mostly in northern North Island). Humped bladderwort has entire or nearly entire leaves, whereas <i>Utricularia australis</i> has leaves divided many times into filiform segments with larger bladders.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord. An exclusion pest in MWT.
Biosecurity risk:	A submerged weed, rapidly increasing its range into central North Island. AWRAM score: 54 (18th = worst aquatic weed).

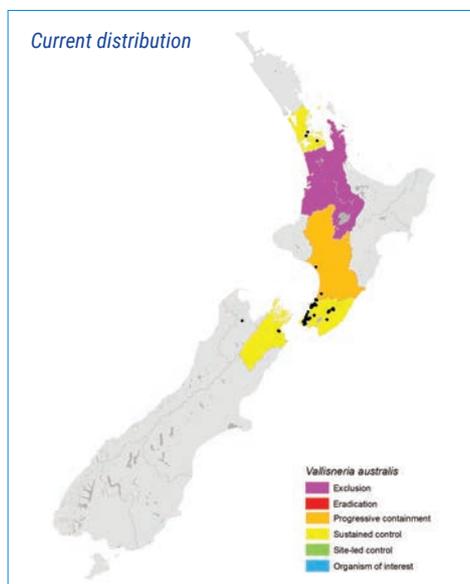


Plant

Vallisneria australis

S.W.L.Jacobs & Les (Hydrocharitaceae)

Plant life-form:	Submerged
Common name:	Eelgrass
Presence in NZ:	Locally abundant, first record from Lake Pupuke, Auckland in 1897.
Preferred/known habitats:	Moderately fast to still water bodies.
Dispersal mechanisms:	Reproduction is vegetative by stolon fragments. Dispersed within catchments by water movement. To date, dispersal between waterbodies is human mediated via deliberate plantings or disposal of pond/aquarium contents, but potentially also by contaminated drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots and territorial regions are shaded according to the management approach in the appropriate Regional Pest Management Plan.
ID features:	Eelgrass is a perennial submerged plant with long thick and strap-like leaves, up to 3 m long and between 0.5 and 5 cm wide arising from long creeping stems. Male plants are only known from Lake Pupuke, with female plants also confirmed there. Male flowers (a translucent sheath surrounding many tiny yellow flowers) being produced in the leaf bases. All other naturalised populations are female, the female flowers are green and cylindrical borne on long, often spiral, filamentous stalks arising in the leaf bases and extending to the water's surface. No seed production has been observed in New Zealand.
Similar species:	<i>Sagittaria subulata</i> , <i>S. platyphylla</i> and swamp lily (<i>Ottelia ovalifolia</i>). The submerged leaves of these species look similar to the submerged leaves of eel grass; however, eelgrass never has emergent leaves or conspicuous white flowers.
Biosecurity status:	Unwanted Organism, National Pest Plant Accord, Regional Pest Management Plans in 5 regions: NI - AUK, MWT, WGN, WKO; SI - MBH (see map).
Biosecurity risk:	A potentially major submerged weed, wetlands, limited by poor dispersal mechanisms. AWRAM score: 51 (25th = worst aquatic weed).

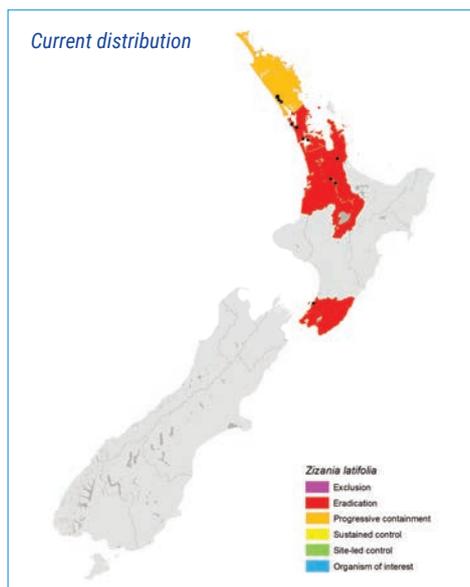


Plant

Zizania latifolia

(Griseb.) Stapf (Poaceae)

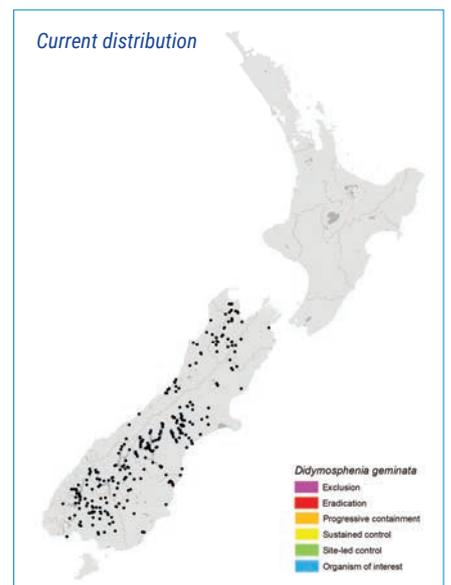
- Plant life-form:** Erect emergent
- Common name:** **Manchurian wild rice**
- Presence in NZ:** Locally naturalised, abundant on the Northern Wairoa River, Dargaville and first recorded there in 1900's.
- Preferred/known habitats:** Margins of still and slow flowing water bodies and wetlands.
- Dispersal mechanisms:** Reproduction is vegetative by the extension of rhizomes and fragmentation, although viable seed is set in New Zealand seedlings have not been observed in the wild. Dispersed within catchments by water movement, especially during floods. To date, most dispersal between waterbodies is human mediated via contaminated drainage machinery and deliberate introduction in the past.
- NZ distribution:** New Zealand distribution showing records as dots and territorial regions and territorial regions are shaded where it is managed for eradication or containment as a NIPR species by MPI Biosecurity New Zealand.
- ID features:** Manchurian wild rice is a tall (up to 4 m) emergent perennial, rhizomatous grass. Tall marginal perennial. Leaves are light (dull) green, coarse, more than 1 m long and up to 2 cm across, growing in basal fans (like a flax). Inflorescences are purplish or reddish brown. Lower part is spreading and male, the upper part is more closed and with female flowers.
- Similar species:** Raupo (*Typha orientalis*). Raupo is usually shorter (1-3 m) than Manchurian wild rice, with bluish-green leaves with a characteristic twist in the leaf blade and a cylindrical brown flower spike.
- Biosecurity status:** Unwanted Organism, National Pest Plant Accord, managed for eradication as a NIPR species by MPI Biosecurity New Zealand.
- Biosecurity risk:** A major erect emergent weed where it has established. AWRAM score: 68 (3rd worst aquatic weed).



Didymosphenia geminata

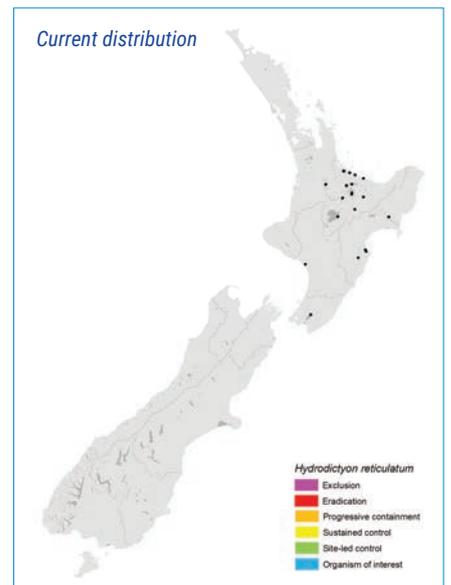
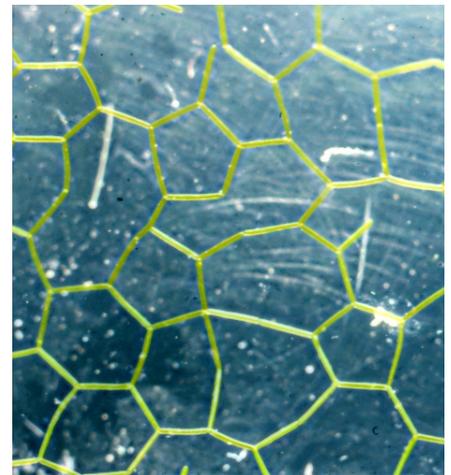
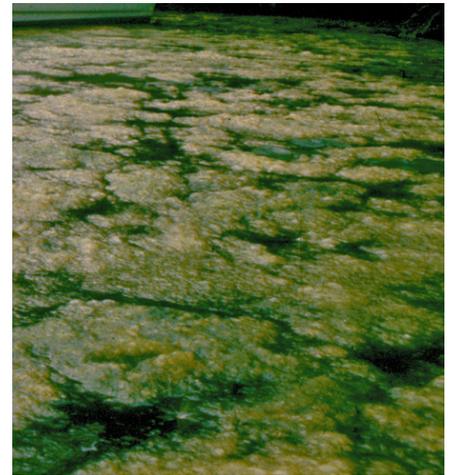
(Lyngbe) M.Schmidt (Bacillariophyceae)

Common name:	Didymo
Presence in NZ:	Widely naturalised in the South Island, but apparently absent from the North Island, first record from the Waiiau River, Southland in 2004.
Preferred/known habitats:	Fast flowing to still water bodies, especially nutrient poor waters.
Dispersal mechanisms:	Reproduction is vegetative by shedding of cells that are transported by water movement. Dispersal between catchments is primarily human mediated via recreational equipment such as angling gear, felt-soled waders, kayaks and 4WD vehicles. In cool, wet conditions, cells can remain viable for weeks.
NZ distribution:	New Zealand distribution showing records as dots.
ID features:	Didymo is a diatom (microscopic alga characterised by cells with silica cell walls). Individual cells are bottle-shaped (wedge-shaped in side view) and up to 140 µm long. Cells exude polysaccharide stalks which attach to stable substrates (usually rocks) producing the visible growths known as 'rock snot'. These colonies are brown to slightly pinkish-brown at the surface, with a white, cream or brown interior, depending on age. Range from round "pimples" a few mm in diameter to continuous mats up to 50 mm thick. Mats have a tough, woolly feel rather than the slimy texture of most algae.
Similar species:	The native stalk-forming diatom <i>Gomphoneis minuta</i> var. <i>cassieae</i> , can form thick mats that resemble didymo. However, <i>Gomphoneis</i> mats are slimier and more fragile than those of didymo.
Biosecurity status:	Unwanted Organism.
Biosecurity risk:	Didymo can form large blooms in low-nutrient waters that would not normally support high algal biomass. Anecdotal evidence suggests that didymo impacts upon environmental (water quality – ecosystem health, biodiversity; indigenous biodiversity – biodiversity/extant), economic (industry – maintenance and nuisance), and social (recreational – swimming; aesthetics - potential) values.



Hydrodictyon reticulatum (L.) Lagerh. (Chlorophyta)

Common name:	Water net
Presence in NZ:	Widely spread but uncommon in the North Island, but apparently absent from the South Island, first record from Welcome Bay, Tauranga in 1986.
Preferred/known habitats:	Slow flowing to still water bodies, in lakes, reservoirs, rivers, streams, ponds, wetlands, ornamental ponds and patches of damp ground.
Dispersal mechanisms:	Reproduction is via vegetative (asexual) development of daughter nets or sexual production of resistant spores, both of which are transported by water movement. Spores may also be dispersed by wind movement. Dispersal between catchments can be human mediated via recreational equipment such as angling gear, watercraft and trailers and drainage machinery.
NZ distribution:	New Zealand distribution showing records as dots.
ID features:	Water net is a green algae, that forms a net of cells arranged in hexagons, which is visible to the naked eye. Colonies tend to be cylindric and either float on top of submerged plants or form free-floating mats.
Similar species:	No other algae form the net structure.
Biosecurity status:	No status under the Biosecurity Act.
Biosecurity risk:	Extensive floating mats interfere with recreational activities, degrade the aesthetic values of water bodies and accumulate in decaying drifts on beaches. Smothered macrophyte beds become prone to collapse and subsequent decay. Surprisingly, many invertebrates and trout appear to benefit from the water net blooms, with the nets providing refugia for large populations of cladoceran crustacea and snails. Marked boom/bust behaviour of water net is common and the extensive growths seen in the Rotorua Lakes during the late 1980 and early 1990s have not been seen subsequently.



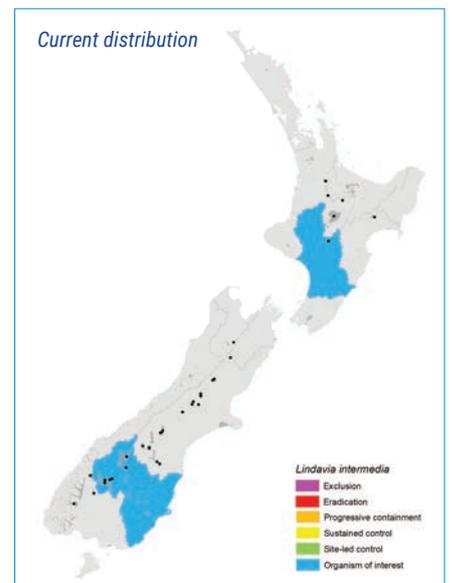
Lindavia intermedia

(Manguin ex Kociolek & Reviere) T.Nakov, W.X.Guillory, M.L.Julius, E.C.Theriot & A.J.Alverson ex W.C.Daniels, Novis & Edlund (Bacillariophyceae)

- Common name:** **Lake snow** (used for slimy proliferations sometimes produced by this species)
- Presence in NZ:** Widely naturalised in lakes in the central and southern South Island, but also found in Lakes Waikaremoana, Moawhango and the Waikato River lakes including Lake Taupo in the North Island. First record from Lake Wanaka in 2004.
- Preferred/known habitats:** Still water bodies.
- Dispersal mechanisms:** Reproduction is vegetative by cell division. Dispersal pathways are unknown but likely to be both natural and human assisted. Lake snow was not detected in Lake Wakatipu (<70 km from Wanaka) until 2016. However, this alga was detected in other South Island and North Island in the interim period but there have been no New Zealand records earlier than 2004.
- NZ distribution:** New Zealand distribution showing records as dots.
- ID features:** Lake snow is formed by a microscopic diatom (alga characterised by cells with silica cell walls). Individual cells are circular (a centric diatom) between 16 and 38 µm across. Cells can produce a nuisance slime known as lake snow or 'lake snot' but this has not been reported in all water bodies with this diatom. Slime production appears to be related to low nutrient conditions. Unless this slime is produced, the detection of this species requires microscopic analysis and/or DNA sequencing of lake water samples.
- Similar species:** There are a range of microscopic native centric diatoms, but only *Lindavia intermedia* produces the nuisance slime.
- Biosecurity status:** No status under the Biosecurity Act.
- Biosecurity risk:** Lake snow can clog fishing reels and block water intakes but is not toxic. The mucus-like strands hang and drift under the water, sticking to fishing gear, boat hulls, swimmers and water filters. A nuisance to lake recreational users and infrastructure such as municipal water supplies.



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GLOSSARY

Glossary

Plant terms

acute – sharply pointed.

alternate – arranged singly along the stem (opposite of opposite).

annual – plant living only one year or season.

axil – upper angle between dissimilar parts such as leaf and stem.

basal – attached near the base, as with leaves on a stem.

bladder – swollen body with hair triggers (carnivorous plants).

bract – a modified, usually much reduced, leaf (scale-like).

capsule – dry fruit containing many seeds.

cleft – deep incision.

cross-veins – veins that run perpendicular to the leaf across longitudinal veins.

elliptical – rounded at both ends, widest in the middle.

entire – not toothed or lobed, smooth.

filiform – thread-like.

filament – stalk of a stamen.

globose – nearly spherical.

inflorescence – collection of flowers and their supporting branchlets which arise from a common point.

lamina – an expanded flattened portion of an organ (usually the blade of a leaf).

lanceolate – lance-shaped.

lateral – from the side or extending horizontally from the main axis.

ligule – outgrowth at the inner junction of the leaf sheath and blade.

linear – narrow with parallel margins.

lobed – divided into (usually rounded) segments.

node – the region of a stem from which one or more leaves or branches arise.

oblique – having a slanting direction.

oblong – with parallel sides and rounded ends.

obovate – egg-shaped, attached at the narrow end.

obtuse – blunt.

opposite – arranged in pairs along the stem (opposite of alternative).

ovate – egg-shaped, attached at the broad end.

ovoid – of a solid body with ovate outline.

panicle – an indeterminate (continuing to grow at the apex) inflorescence which is branched several times. Especially common in grasses.

perennial – living for several or many years.

petiole – stalk of a leaf.

pinnate – compounds, with parts arranged on either side of an axis.

prostrate – (stem) lying parallel to the ground

rhizomatous – producing rhizomes.

rhizome – stem growing underground, usually horizontally.

rosette – one or more whorls of leaves, clustered tightly at the base of a plant.

scabrid – with minute harsh projections, rough to touch.

sessile – attached directly to the stem

sheath – enclosing tubular structure, usually around the base of a stem or leaf.

sinus – a recess or indentation between adjacent lobes or teeth (usually on the margin of a leaf).

spathulate – spoon-shaped.

spike – inflorescence with an unbranched axis and unstalked flowers.

spikelet – a small spike (usually used to describe grass flowers)

stipule – a leaflet-like appendage at the base of a leaf stalk.

stolon – stems growing horizontally at or above ground level and giving rise to upright stems at nodes (runners).

stoloniferous – producing stolons.

summer-green – perennial but shoots dying off to underground parts over winter.

terminal – borne at the end of a stem and limiting its growth.

tuber – swollen portion of a stem or root, usually underground.

turion – a winter bud that is produced by certain aquatic plants. Turions become detached and remain dormant on the pond or lake bottom during the winter before developing into new plants the following season.

undulate – wavy, in a plane at right angles to the surface (like corrugated iron).

ventral – the lower surface of the leaf.

whorl – three or more parts arranged on one level.

Glossary

Animal terms

adipose fin – a small fleshy lobe with no spines or rays on the back of fish between the dorsal fin and caudal fin.

anal fin – the unpaired or single fin on the ventral (underside) of a fish just behind its vent; the base of the anal fin is where it joins the body.

anal gill – the respiratory structure positioned at posterior of invertebrate.

barbel – soft, whisker-like appendage protruding from around the mouth of fish.

budding – offspring grows out of the body of the parent.

caudal fin – tail fin of fish.

comb scales – small comb-like scales present on lateral margins of last abdominal segment of mosquito larvae.

forked – refers to the posterior margin of the caudal fin: a forked fin is deeply indented.

gill opening – the exterior opening of the gills – located just behind the head. Gill openings may be covered by a bony plate (the operculum) or soft flaps of skin.

gonopodium – a specialised part of the anal fin in male gambusia and other poeciliids (live bearing fish) that is used to transfer sperm to female fish.

dorsal fin – an unpaired fin on the back of fish; there may be up to 3 dorsal fins and some may be joined.

echinostomes – intestinal flukes (flatworms) of the Family Echinostomatidae which consists of many species. They occur in man and other vertebrates. The intermediate hosts are frequently snails.

fin rays – soft rods that give support to fins. Rays are usually branched into two halves (side by side), are often segmented, and are usually flexible.

fin spine – a stiff, bony rod supporting a fin. Some spines are sharp. Not divided into two halves.

liver fluke – flatworm parasitic in liver and bile ducts of domestic animals and humans.

operculum – a hardened plate used to seal a snail shell.

pecten teeth – scale or comb-like teeth on respiratory siphon of mosquito larva.

pectoral fins – paired fins (one on either side of the body) located just behind or below the gill openings.

pelvic fins – paired fins (one on either side of the body) located on the ventral side of the fish between the head and the vent. Pelvic fins are not always present, e.g. mudfish.

rounded – refers to the posterior edge of the caudal fin; edge is shaped like a convex curve.

scales – this, overlapping plates of a hard substance that protect the skin of fish. The easiest way to tell if a fish has scales is to run your finger along the side of the fish from back to front. If the fish feels smooth and slippery, it has no scales or the scales are small and deeply embedded within the skin; if it feels rough and your finger catches, then it has external scales.

siphon – breathing tube of mosquito larva.

spire – the pointed end of a snail shell.

trematodes – flukes, parasitic flatworms.

vent – the posterior, external opening of the gut (akin to the anus).

ventral – the lower surface of the body.