## APPENDIX 1: List of Freshwater Fish and Shellfish in New Zealand

Conservation status taken from the Department of Conservation New Zealand Threat Classification System Lists 2005 (published January 2007).

| Family | Common name | Scientific name | Native / introduced/ native marine wanderer | Conservation status/ legislation |
|---|---|---|---|---|
| ANGUILLIDAE | Shortfin eel | *Anguilla australis* | Native | |
| | Longfin eel | *Anguilla dieffenbachii* | Native | Gradual decline |
| | Australian longfin eel | *Anguilla reinhardtii* | Native | |
| ARRIPIDAE | Kahawai | *Arripis trutta* | Marine wanderer | |
| CYPRINIDAE | Goldfish | *Carassius auratus* | Introduced | |
| | Grass carp | *Ctenopharyngodon idella* | Introduced | Restricted species (Conservation Act 1987) |
| | Koi carp | *Cyprinus carpio* | Introduced | Noxious fish (Freshwater Fisheries Regulations 1983)<br>Unwanted organism (Biosecurity Act 1993) |
| | Silver carp | *Hypophthalmichthys molitrix* | Introduced | Restricted species (Conservation Act 1987) |
| | Orfe | *Leuciscus idus* | Introduced | |
| | Rudd | *Scardinius erythrophthalmus* | Introduced | Sports fish |
| | Tench | *Tinca tinca* | Introduced | Sports fish in the Auckland region<br>Noxious fish elsewhere |
| ELEOTRIDAE | Tarndale bully | *Gobiomorphus alpinus* | Native | Range restricted IUCN vulnerable |
| | Cran's bully | *Gobiomorphus basalis* | Native | |
| | Upland bully | *Gobiomorphus breviceps* | Native | |
| | Common bully | *Gobiomorphus cotidianus* | Native | |
| | Giant bully | *Gobiomorphus gobioides* | Native | |
| | Bluegill bully | *Gobiomorphus hubbsi* | Native | |
| | Redfin bully | *Gobiomorphus huttoni* | Native | |
| GALAXIIDAE | Roundhead galaxias | *Galaxias anomalus* | Native | Gradual decline |
| | Giant kokopu | *Galaxias argenteus* | Native | Gradual decline IUCN vulnerable |
| | Koaro | *Galaxias brevipinnis* | Native | |
| | Lowland longjaw galaxias | *Galaxias cobitinis* | Native | Nationally critical |
| | Flathead galaxias | *Galaxias depressiceps* | Native | Gradual decline |
| | Dwarf galaxias | *Galaxias divergens* | Native | Gradual decline |
| | Eldons galaxias | *Galaxias eldoni* | Native | Nationally vulnerable |
| GALAXIIDAE | Banded kokopu | *Galaxias fasciatus* | Native | |
| | Gollum galaxias | *Galaxias gollumoides* | Native | Gradual decline |
| | Dwarf inanga | *Galaxias gracilis* | Native | Serious decline IUCN vulnerable |
| | Dune lakes galaxias | *Galaxias gracilis* | Native | Nationally vulnerable |

| Family | Common name | Scientific name | Native / Introduced | Conservation status |
|---|---|---|---|---|
| | Bignose galaxias | *Galaxias macronasus* | Native | Gradual decline |
| | Inanga | *Galaxias maculatus* | Native | |
| | Alpine galaxias | *Galaxias paucispondylus* | Native | |
| | Shortjaw kokopu | *Galaxias postvectis* | Native | Sparse<br>IUCN vulnerable |
| | Upland longjaw galaxias | *Galaxias prognathus* | Native | Gradual decline |
| | Dusky galaxias | *Galaxias pullus* | Native | Gradual decline |
| | Canterbury galaxias | *Galaxias vulgaris* | Native | |
| | Brown mudfish | *Neochanna apoda* | Native | Gradual decline |
| | Canterbury mudfish | *Neochanna burrowsius* | Native | Nationally endangered<br>IUCN vulnerable |
| | Black mudfish | *Neochanna diversus* | Native | Gradual decline |
| GALAXIIDAE | Northland/burgundy mudfish | *Neochanna heleios* | Native | Nationally endangered |
| | Chatham mudfish | *Neochanna rekohua* | Native | Range restricted<br>IUCN vulnerable |
| GEOTRIIDAE | Lamprey | *Geotria australis* | Native | Sparse |
| ICTALURIDAE | Brown bullhead catfish | *Ameiurus nebulosus* | Introduced | |
| LEPTOSCOPIDAE | Stargazer | *Leptoscopius macrophygus* | Marine wanderer | |
| MICRODESMIDAE | Dart goby | *Parioglossus marginalis* | Marine wanderer | |
| MUGILIDAE | Yelloweye mullet | *Aldrichetta forsteri* | Marine wanderer | |
| | Grey mullet | *Mugil cephalus* | Marine wanderer | |
| PERCIDAE | Perch | *Perca fluviatilis* | Introduced | Sports fish |
| PINGUIPEDIDAE | Torrentfish | *Cheimarrichthys fosteri* | Native | |
| PLEURONECTIDAE | Black flounder | *Rhombosolea retiaria* | Native | |
| | Yellowbelly flounder | *Rhombosolea leporina* | Marine wanderer | |
| POECILIIDAE | Gambusia/mosquito fish | *Gambusia affinis* | Introduced | Unwanted organism (Biosecurity Act 1993) |
| | Caudo | *Phallocerus caudimaculatus* | Introduced | |
| | Sailfin molly | *Poecilia latipinna* | Introduced | |
| | Guppy | *Poecilia reticulata* | Introduced | |
| | Swordtail | *Xiphophorus helleri* | Introduced | |
| RETROPINNIDAE | Common smelt | *Retropinna retropinna* | Native | |
| | Stokell's smelt | *Stokellia anisodon* | Native | Range restricted |
| SALMONIDAE | Rainbow trout | *Oncorhynchus mykiss* | Introduced | Sports fish (Conservation Act 1987) |
| | Sockeye salmon | *Oncorhynchus nerka* | Introduced | Sports fish |
| | Chinook salmon | *Oncorhynchus tshawytscha* | Introduced | Sports fish |
| | Atlantic salmon | *Salmo salar* | Introduced | Sports fish |
| | Brown trout | *Salmo trutta* | Introduced | Sports fish |
| | Brook char | *Salvelinus fontinalus* | Introduced | Sports fish |
| | Mackinaw | *Salvelinus namaycush* | Introduced | Sports fish |
| TRIPTERYGIIDAE | Cockabully/estuarine triplefin | *Grahamina nigripenne* | Marine wanderer | |

| Family | Common name | Scientific name | Native / Introduced | Conservation status |
|---|---|---|---|---|
| HYDRIIDAE | Kākahi (freshwater mussel) | *Hyridella menziesi* | Native | Gradual decline |
| | | *Hyridella auklandica* | Native | |
| | | *Cucumerunio websteri* | Native | Data deficient |
| PARASTACIDAE | Koura (freshwater crayfish) | *Paranephrops planifrons* | Native | Gradual decline |
| | | *Paranephrops zealandicus* | Native | Gradual decline |
| ATYIDAE | Freshwater shrimp | *Paratya curvirostris* | Native | |

**APPENDIX 2: Use of species in this fish plan.**

210 **Lamprey** *Geotria australis*. Lamprey or piharau is highly prized by Māori and is mentioned in a number of Treaty Settlements as a taonga species. Traditionally each whanau were allocated specific areas in which they would gather the piharau. These areas were jealously guarded in a similar way to whitebait stands. The piharau were cooked whole by grilling over embers, and the head was eaten first. When large numbers of piharau were caught they were shared around the wider whanau with the rest stored for later use.

211 The traditional fishery for lamprey still occurs in Taranaki, the Whanganui River near Pipiriki and in Southland. Methods vary from hand gathering and netting, to traditional methods such as "wakaparu" where a bed of fern and rock that is laid on the river bed providing cover for the migrating lamprey which are then gathered.

212 The Ngati Ruanui, Ngai Tahu and Ngati Mutunga Treaty settlements prohibit the commercial harvest of lamprey unless the Minister can demonstrate a commercial harvest is sustainable. Lamprey in FMAs 3, 5 and 7 are on Schedule 4C of the Act and are subject to a permit moratorium, reflecting the status of the species in the Ngai Tahu settlement legislation.

213 **Common smelt** *Retropinna retropinna* are widespread throughout New Zealand, including Stewart and Chatham Island. They live in flowing and still water, and there are both diadromous (sea-going) and non-diadromous (land-locked) populations, although many land-locked populations have established through human activity. Common smelt are particularly abundant in the Waikato River catchment.

214 Common smelt are not native to Lake Taupo but were released there in the 1930s to augment the food available for trout after they had reduced the stocks of koaro. Koaro had formerly been an important food resource for Māori in this area. Māori began harvesting smelt as it was introduced to Lake Taupo as trout forage. Common smelt (adults and juveniles) are part of the whitebait fishery and they are important in Waikato as ‘second class’ whitebait. Common smelt is still taken in customary fisheries from Lakes Rotorua, Rotoiti and Taupo.

215 **Stokell’s smelt** *Stokellia anisodon* closely resembles the common smelt. It is found only on the east coast of the South Island between the Waiau and Waitaki Rivers. Stokell’s smelt is a strictly coastal species and is never found very far inland. This species probably spends most of its life in the marine environment. Stokell’s smelt enter freshwater to spawn in late spring and summer, and can be extremely abundant at times, providing food for fish and birds that prey on the annual migrations. Stokell’s smelt is taken in much the same way as whitebait in mid-Canterbury rivers. Huge shoals of this species migrate from the sea into river estuaries from mid spring to December and can be dried in the sun or frozen for export to south-east Asia and the Pacific Islands.

216 **Galaxiids** (nine species). The adults of the nine galaxiid species included in this plan are important for customary fishing. There is an increasing, yet modest, interest in galaxiid species for the aquarium trade or in private aquaria collections. The juveniles of all species of the genus Galaxias are included as ‘whitebait’, which are managed by the whitebait regulations under the Conservation Act 1987. See **paragraph 26d** for the definition of whitebait. Adult galaxiids are managed under the Fisheries Act.

- **Inanga** *Galaxias maculatus* adults and juveniles are highly valued by Māori. In most river systems, the inanga makes up the majority of the whitebait catch. Inanga inhabit open rivers, streams, lakes, and swamps near the coast and can often be seen shoaling in open water. They are very poor climbers, however, and do not penetrate any distance inland unless the river gradient is very gradual.

- **Koaro** *Galaxias brevipinnis.* The juveniles were highly valued by Māori living near inland lakes, especially around Rotorua and Taupo. Although koaro are the second most abundant species of the whitebait catch, they also form land-locked populations in river systems associated with large lakes. For example, koaro populations occur in the catchments of Lake Tarawera, Taupo, Manapouri, Wanaka, and many other inland lakes. Koaro occur well inland, and thus have a more widespread distribution than the other whitebait species. Their distribution in New Zealand has probably been curtailed by widespread forest clearance.

- **Giant kokopu** *Galaxias argenteus* are primarily a coastal species and do not usually penetrate inland very far. They are found on the major offshore islands. They can establish land-locked populations as in Lake Brunner near Greymouth. Giant kokopu are the largest of the galaxiid species although they are a very small proportion of the whitebait catch.

- **Shortjaw kokopu** *Galaxias postvectis.* Although this species occurs well inland in many catchments, they appear to be restricted to streams with native forest vegetation. Little is known about its life history as it is one of the rarest of the galaxiids.

- **Banded kokopu** *Galaxias fasciatus* are a minor component of the whitebait fishery. They are common around Auckland and Wellington. In contrast, banded kokopu are rare along the east coast of New Zealand. This distribution is probably a result of intensive land development and the sensitivity of the juveniles to suspended sediments. Although the juveniles are good climbers, banded kokopu do not penetrate very far inland and are primarily a coastal species.

- **Dwarf galaxias** *Galaxias divergens* has the widest distribution of the non-diadromous members of the galaxiid family, although this pattern is extremely fragmented. Recent studies show there are some genetic differences between the populations, but probably not enough to warrant status as a separate species.

- **Canterbury mudfish** *Neochanna burrowsius.* Mudfish are regarded as a taonga species to Māori. The Canterbury mudfish is one of New Zealand's most threatened fishes due to very extensive loss of wetland habitats throughout the Canterbury plains. Recently, a release of Canterbury mudfish occurred in a protected wetland near Willowby, south of Ashburton, where it is hoped they will survive and reproduce. MFish recently granted a special permit to take Canterbury mudfish at a site near Woodend, North Canterbury, where the habitat is to be enhanced. It was necessary to temporarily remove the Canterbury mudfish to enable the enhancement work to take place. The Department of Conservation has a species recovery plan for this species. This fish species has customary value.

- **Black mudfish** *Neochanna diversus.* The black mudfish is widespread in the northern North Island although it has disappeared from many areas. In addition to

the threat to black mudfish from land drainage and development, these fish are also threatened by gambusia, an aggressive, carnivorous and prolific introduced fish that has a similar distribution pattern to black mudfish. Black mudfish has customary value.

- **Brown mudfish** *Neochanna apoda.* The brown mudfish occupies central New Zealand, from Taranaki, through Wellington and the Wairarapa, and on the northwest coast of the South Island. This fish was prized as food by Māori and is known as kauhau or waikaka.

- **Torrentfish** *Cheimarrichthys fosteri* is abundant and widespread and penetrates inland in river systems where the gradient is relatively low. Traditionally torrentfish was of interest to Māori who know it as papanoko. This fish has little commercial value, although it has customary value, and is taken for the aquarium trade.

217 **Common bully** *Gobiomorphus cotidianus* is widespread and common. Sea-going populations occur in river and streams near the coast, and land-locked populations have become established in lakes. Bullies are known to Māori as toitoi. This fish has little commercial value, although it has customary value, and is taken for the aquarium trade.

218 **Cran's bully** *Gobiomorphus basalis* is widespread throughout the North Island. It has no marine phase in its life cycle, and is most common at mid altitudes and some distance inland. This fish has little commercial value, although it has customary value, and is taken for the aquarium trade.

219 **Redfin bully** *Gobiomorphus huttoni* is widespread throughout New Zealand. The adult male has bright red fins. This fish has little commercial value, although it has customary value, and is taken for the aquarium trade.

220 **Black flounder** *Rhombosolea retiaria* is fished commercially where it is sufficiently abundant, in large, coastal and brackish lakes, such as Wairarapa, Onoke and Ellesmere. Commercial fishermen use gill nets to take black flounder. The biggest commercial fishery is in Lake Ellesmere but level of catch depends on the access by young flounders to the lake, as the outlet is closed to the sea for much of the year by a gravel bar. Black flounder is also fished by recreational fishers using gill nets and spears in estuaries at night.

221 **Yelloweye mullet** *Aldrichetta forsteri* can spend considerable time in freshwater. For example, they are found at all times of the year in Lake Ellesmere south of Christchurch, but their spawning takes place in the sea. They occur all around New Zealand but are more common in the north. Yelloweye mullet support small commercial fisheries in Lake Ellesmere and esturine areas such as the Manukau Harbour and the Waikato River. Recreational fishers also have an interest as they are easily caught off wharves and harbours.

222 **Kākahi** (freshwater mussel) *Hyridella menziesi, Hyridella aucklandica* and *Cucumerunio websteri.* These bivalve shellfish are found in freshwater lakes, streams, and rivers. Māori traditionally favoured kākahi as food. Contemporary Māori perceive a decline in the abundance of kākahi. Kākahi once formed extensive beds in lakes and rivers, and were harvested as a food by pre-European Māori. The decline in kākahi is unquantified, but seems likely in some waterways, and discussion has taken place about the cause and how it can be

mitigated. *Hyridella menziesi* is listed for FMAs 3, 5 and 7 on Schedule 4C of the Act and is subject to a permit moratorium.

223 **Koura** (freshwater crayfish) *Paranephrops planifrons* and *Paranephrops zealandicus* are an important food resource for Māori and a significant component of healthy natural freshwater ecosystems. Although MFish facilitates sustainable harvest of koura for research, education and enhancement under the Act, koura are still prohibited from commercial take under regulation 71 of the Freshwater Fisheries Regulations 1983. Koura is listed for FMAs 3, 5 and 7 on Schedule 4C of the Act and is subject to a permit moratorium. Koura have a daily bag limit of 50 under the Fisheries (Amateur Fishing) Regulations 1986.

224 **Freshwater shrimp** *Paratya curvirostris* is endemic and the only freshwater shrimp in New Zealand. It is a characteristic inhabitant of lowland streams and rarely found at altitudes above 40 m. This shrimp is taken for the aquarium trade.

225 **Brown bullhead catfish** (*Ameiurus nebulosus*) were introduced in to New Zealand in 1877 to the Auckland area, and since then their numbers and range have extended significantly throughout the North Island. They are now widespread in the Waikato River system including Lake Taupo, where they occur in large numbers. They also exist in one isolated population on the West Coast of the South Island. Catfish are considered undesirable in New Zealand because they stir up sediment and prey on small native fish and fish eggs. Commercial and non-commercial fishers take catfish either by targeting them, or as a bycatch while fishing for other fish, usually eels. In recent decades catfish have become a popular food fish available in a number of retail outlets, particularly around Auckland.

226 **Grass carp (or white amur)** *Ctenopharyngodon idella.* Grass carp were first brought to New Zealand in the 1960s, because of their potential to control the growth of aquatic plants. In 1984, some fish escaped from a field trial in the lower Waikato River but never established a wild population. Their main value in New Zealand has been to control problem weed species from water impoundments and drains, thus allowing native plant communities to re-establish. Grass carp have very specific breeding and rearing requirements and it is unlikely that self-sustaining populations could develop in New Zealand. Today, stocks of grass carp are maintained for breeding at a private hatchery north of Auckland. Grass carp are often confused with koi carp which can cause management problems – grass carp have no barbels and a shorter dorsal fin base than koi carp.

227 **Silver carp (or silver amur)** *Hypophthalmichthys molitrix.* There are no self-sustaining populations of silver carp in New Zealand. Silver carp were brought to New Zealand for their potential to control phytoplankton blooms which they have been used for in some small lakes. Like grass carp, silver carp have very specific breeding and rearing requirements and it is unlikely that self-sustaining populations could develop in New Zealand. A brood stock is maintained at a private hatchery north of Auckland.

228 **Koi carp (or European carp)** *Cyprinus carpio*. This species was introduced to New Zealand illegally for the ornamental trade. The first wild population in New Zealand was noticed in the Waikato in 1983. Koi eat a wide variety of organisms, including both plants and animals. One way they feed is by sucking up and expelling material from the bottom, filtering out edible material as they do so and increasing the turbidity of the water. They also eat and compete with native species. Koi carp are mainly taken as a bycatch of the eel fishery and are used for fish bait products. They are a noxious fish under the Freshwater Fisheries Regulations 1983 and an unwanted organism under the Biosecurity Act 1993, so it is illegal to

possess live koi. Commercial use of this species is restricted through a range of legislative provisions under the Conservation Act 1987 and the Biosecurity Act 1993.

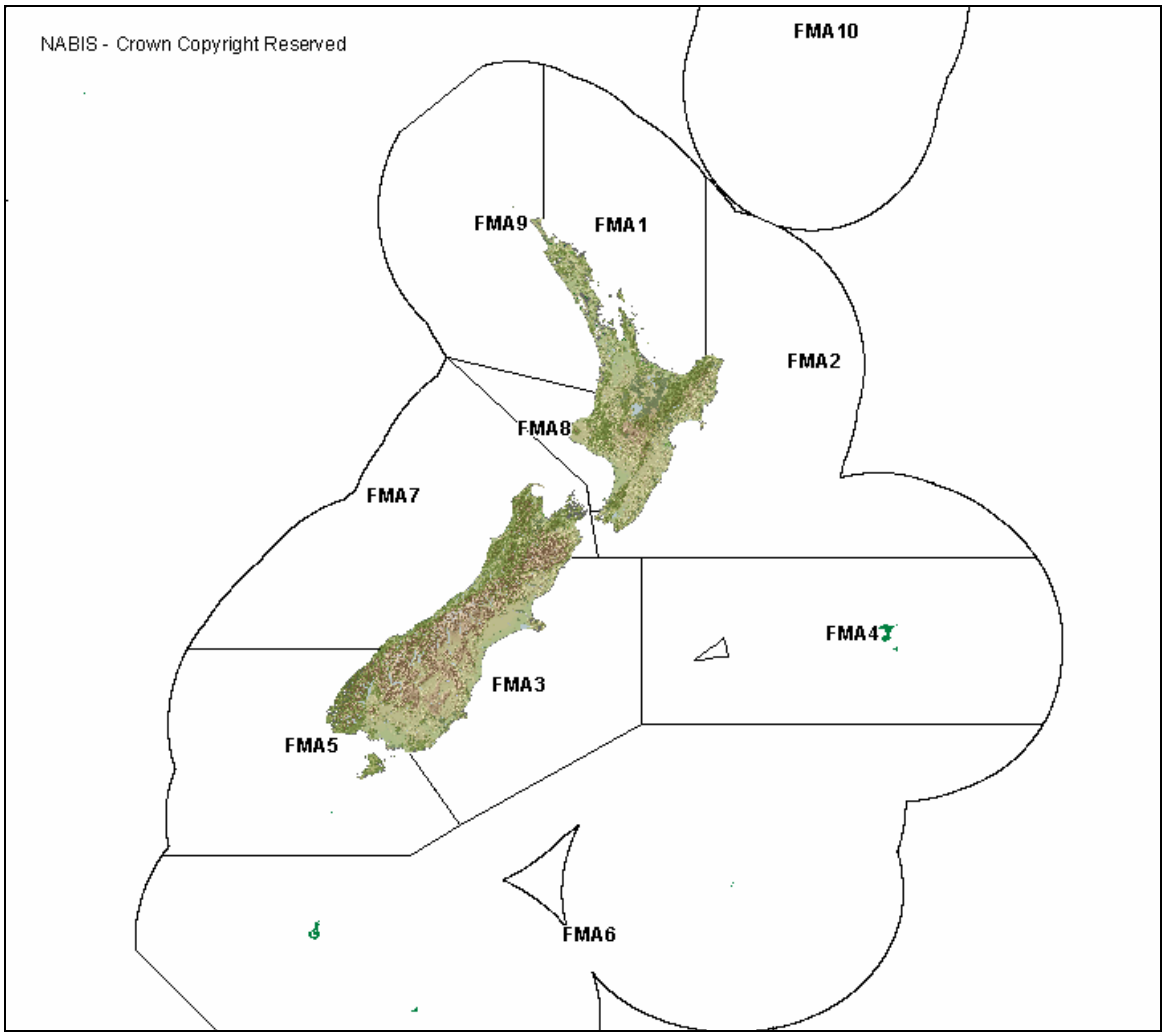
229 **Goldfish** *Carassius auratus* are found in New Zealand lakes and ponds. They were introduced for many years for aquarists and pond keepers until 1972 when the importation of cold-water fishes was restricted. The goldfish is likely to be confused with koi (European) carp. It differs as it lacks barbels around the mouth (there are two pairs in the koi carp). Although it has never been studied, the goldfish has probably done little harm in the New Zealand environment in contrast with the koi carp. In the past goldfish were an important food source for Māori. They are still exploited today in some places such as Te Arawa lakes. Feral goldfish are occasionally harvested for the ornamental trade.

230 **Sailfin molly** *Poecilia latipinna* occurs in a geothermal wetland near Tokaanu on Lake Taupo. It was introduced from America for the aquarium trade. The sailfin molly is popular with aquarists because of the exaggerated dorsal fin, and it is netted from these wetlands for the aquarium trade.

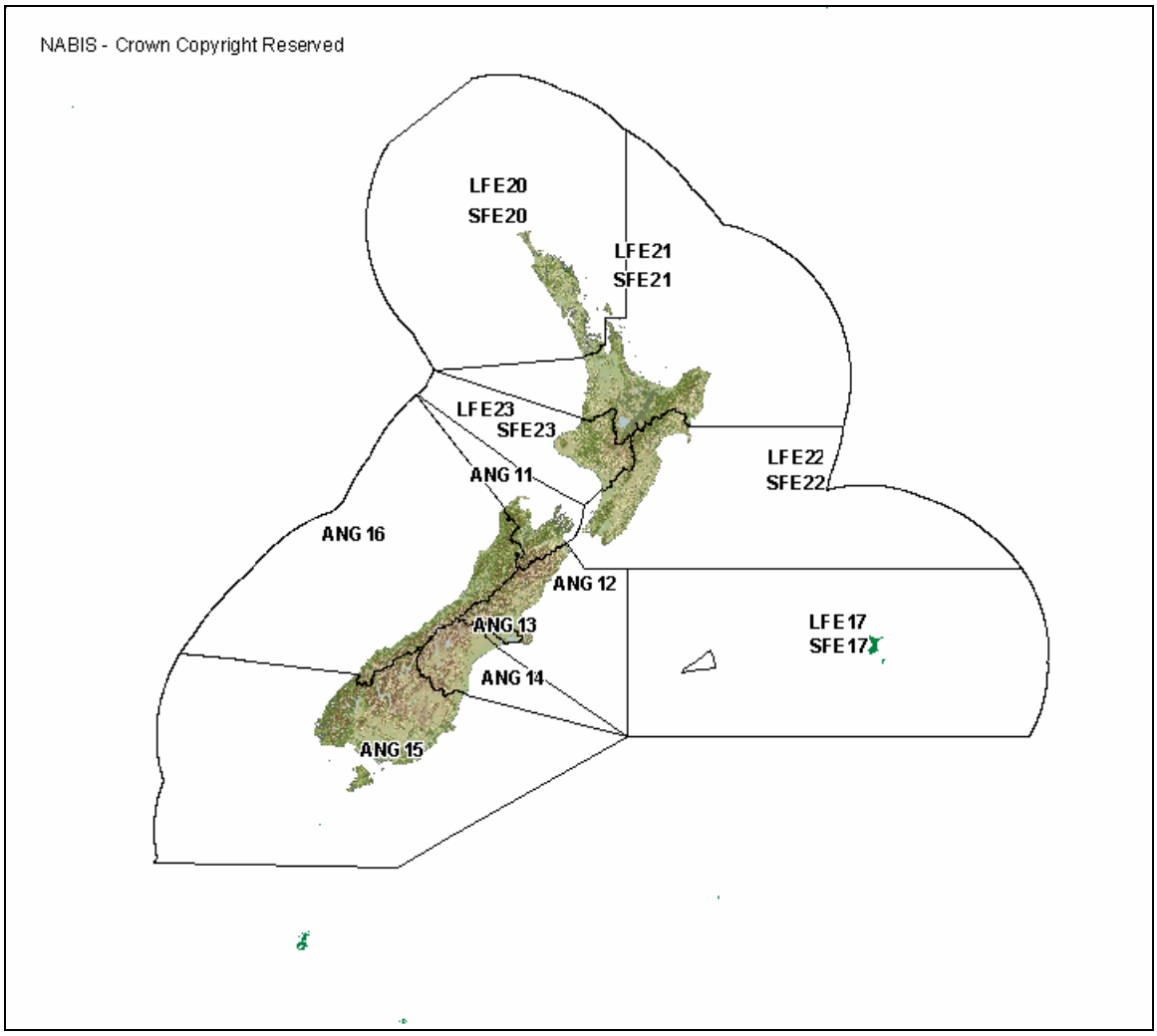
231 **Watercress** *Nasturtium microphyllum* and *Nasturtium officinale* occur in freshwater streams and drains in temperate areas worldwide. The two species are almost indistinguishable and were introduced into New Zealand by the French as a food plant. They are harvested recreationally and commercially and are an important food plant for Māori. Watercress can also be farmed.

**APPENDIX 3:**

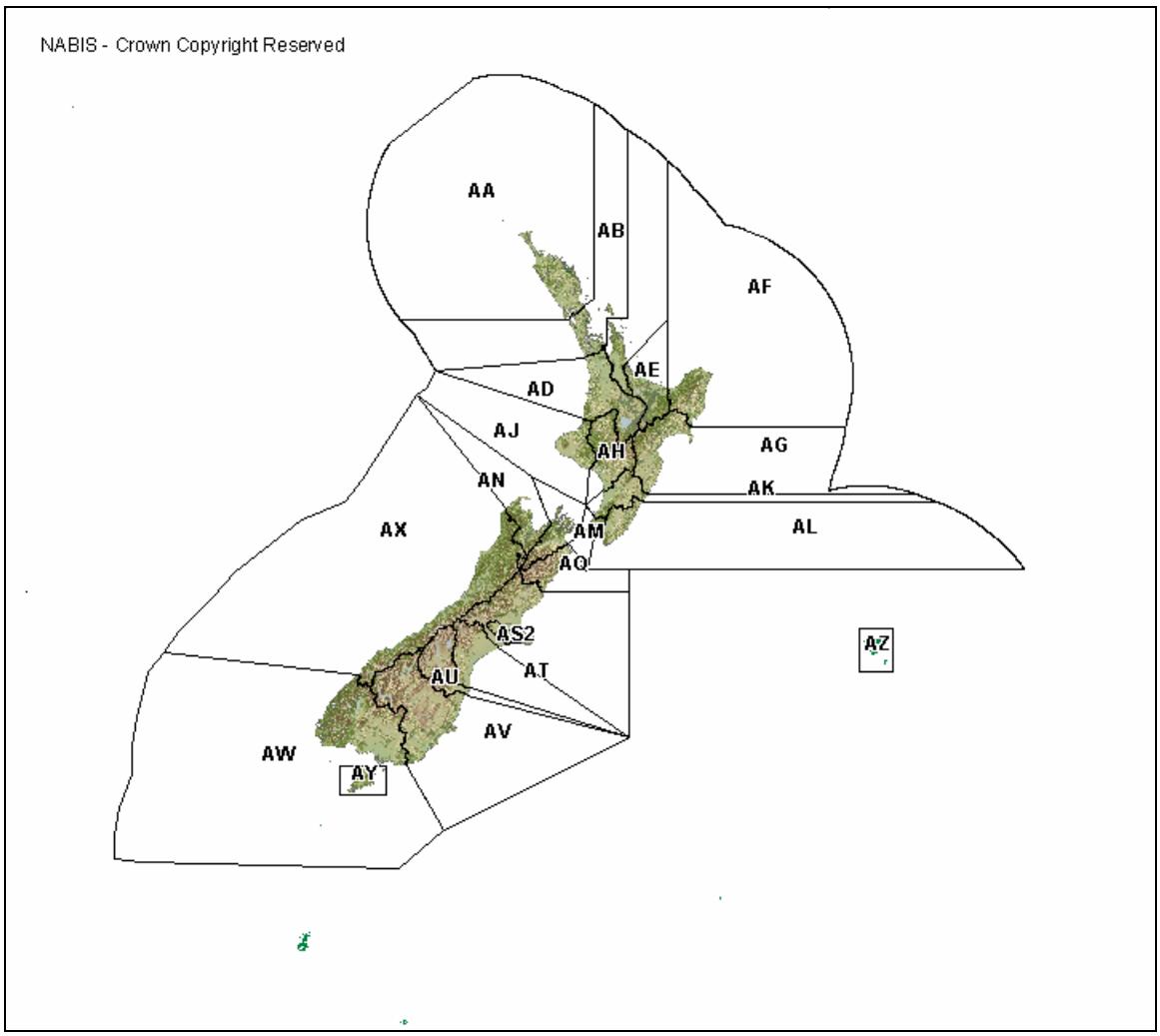
## Map 1: Generic Fishery Management Areas (FMAs)



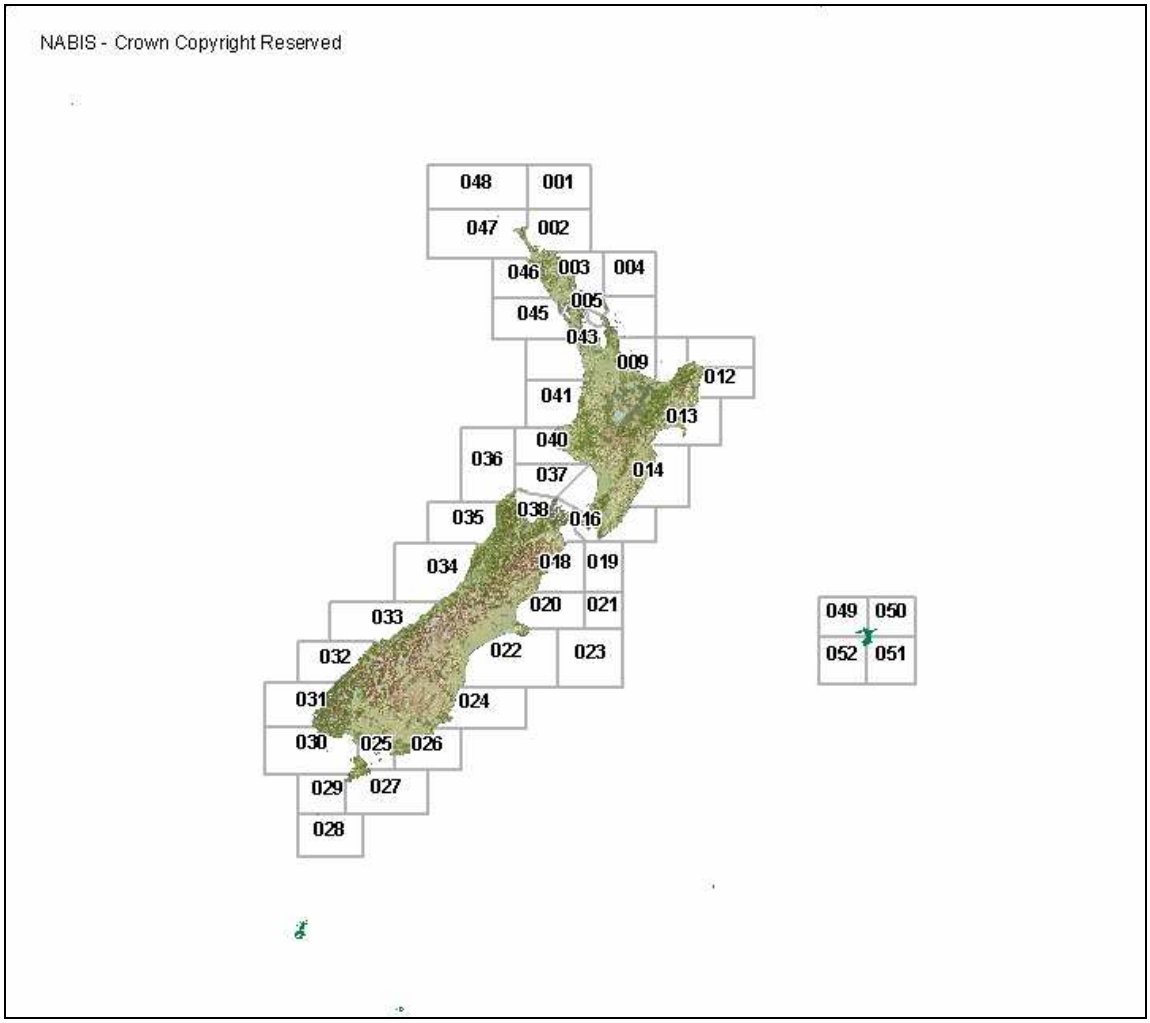
**Map 2: Quota management areas for shortfin and longfin eel stocks in New Zealand.**



**Map 3: Eel Statistical Areas for shortfin and longfin eel stocks in New Zealand.**



## Map 4: General Statistical Areas



**APPENDIX 4: Description of freshwater habitats in New Zealand**

- *Estuaries and tidal rivers.* Estuaries have salinity gradients from the sea upstream. They have wide diurnal fluctuations in water level and low flow velocities, which alternate in direction with tidal change. 17 of the 37 indigenous fish species plus two of the introduced species use estuaries as part of their migration pathways. The classic estuarine fishes in this plan are Stockell's smelt and black flounder. They penetrate upstream some distance and are most abundant in or just above the tidal zone.

- *Estuarine lakes.* New Zealand has a few large, brackish, estuarine lakes (Ellesmere, Forsyth, Wairapara, Onoke, Tomahawk, Waituna). They are shallow with extensive marginal wetlands. Fish include black flounder, common smelt, inanga, common bully, brown trout and eel. Perch and goldfish are salt sensitive and occupy areas of these lakes that are farthest from the sea. Sea openings of some of these waters may be transitory, and in some species sea-migratory stocks may become landlocked, either temporarily or permanently, e.g. common smelt and common bully in Lake Ellesmere.

- *Low-elevation rivers.* These rivers have sluggish, sandy habitats. In large rivers with low gradients such as the Waikato, Mokau, Manawatu and Clutha, extensive reaches are populated by common smelt, shortfin eels, black flounder and especially inanga which forms shoals along margins and in pools and backwaters. Perch, goldfish, koi and catfish occur in some of these habitats where they occupy weedy, slow-flowing marginal waters.

- *Lowland wetlands.* These are shallow and marshy, with mud substrates. Many are deeply brown stained by leachates from surrounding forest. Lowland podocarp forest with extensive pools of water lying amongst the trees and extensive areas of flax wetlands used to be two closely associated habitats which are now extensively modified and greatly reduced in area. The remaining fragments are important for inanga, eels and giant kokopu. Productivity of the West Coast whitebait fishery has probably long depended on the continuous availability of such habitats to inanga in particular. Mudfish may occur in areas that are wet for only part of the year with few other species. Mosquito fish occupy shallow margins.

- *Low elevation lakes.* These habitats are an extension of low elevation wetlands although they are deeper, have sandy substrates and are surrounded by marshy vegetation. The west coast of the North Island has many small, coastal, sand-dune lakes, while some rivers like the Waikato, have shallow lakes closely associated with them. Their connections to other water bodies may be intermittent and some lakes are temporarily or permanently isolated and land locked with few significant tributaries. They therefore have sparse faunas as only migratory species that can adapt to landlocked lifecycles can survive. These species include the common bully, kokopu, giant kokopu, inanga and dwarf inanga. Introduced fish such as tench, rudd, goldfish, koi, catfish and perch are common in weedy lakes where they have successful breeding.

- *Boulder/gravel rivers.* These rivers are steeper and swifter and alternating pools and riffles are typical. They are often clear flowing and large with sandy riverine channels and gravelly and bouldery habitats. Slower-flowing pools may have inanga and bullies. Torrentfish are found in the fastest waters. Pools and runs in boulder/gravel rivers are sparsely populated by native fishes, but are often have adult brown and rainbow trout, and in the South Island quinnat salmon juveniles.

- *Inland wetlands and springs.* These habitats are marshy and have tenuous connections with flowing watercourses. Mudfish tend to be the only species present possibly because they are intolerant of competition or predation and possibly because they can survive recurring periods of drought. Typical mudfish habitats are depleted by deforestation and few areas remain. They are now found in overgrown drains which provide good cover.

- *Small forest streams.* These streams are small, steep, cold, brown and acidic with alternating pools and riffles and cascades. Bush streams have native forest cover which provides unique habitat conditions that some species require. Some species also depend on terrestrial foods that originate in the forest cover. These fish include galaxiids, bullies and eels.

- *Small streams draining farmland.* Once forest has been replaced by farmland the fish fauna changes abruptly. These streams have unstable banks and beds, limited habitat diversity and are often polluted. Species that occur in these streams include eels, lamprey, bullies and occasionally torrentfish.

- *Inland alpine rivers and streams.* Upland rivers are mostly gravelly or boulder bedded, fast flowing, cool and turbid from snow thaw. Many of these rivers flow through mountain forest and open tussock grassland. More aggressive inland migrants reach these rivers including koaro, torrentfish and longfin eel.

- *Inland and mountain lakes and tarns.* New Zealand has numerous inland to alpine lakes, varying from large (Lake Taupo) to small. They are usually deep clear and cold. The faunas are of low diversity and usually only have two or three species of fish due to the limited accessibility of these areas. The fish are usually the koaro, the common bully and the longfin eel, and are abundant in these lakes.

- *Impoundments* used for electricity generation have changed riverine habitats into lake habitats and have prevented the upstream and downstream migration of many migratory fishes. Those species living upstream of dams that are able to establish land-locked populations include koaro, common bully and brown trout. Species unable to establish land-locked populations gradually disappear eg. shortjaw kokopu.

- *Drains and culverts* used for directing surface water for drainage as well as directing rivers and streams have changed diverse natural riverine habitats into straightened, uniform habitats. Species diversity will be less in these habitats, although some species may use these areas for cover. Drains and culverts also prevent the upstream migration of many migratory fish.

- *Geothermal hot springs.* No native species are able to occupy these waters but several exotic species can, including sailfin mollies, goldfish and guppies. Fish are confined to restricted warm areas surrounded by cold water which they cannot survive in.

## APPENDIX 5: Estimated catch weights of freshwater species for the 2005-2006 fishing year.

The following data is the estimated catch reported on the catch effort landing return forms and eel catch effort landing return forms for the 2005-2006 fishing year. Much of the reported catch is from the upper North Island.

It is important to note that this data is largely incomplete due to non-reporting or mis-reporting of catch. The majority of freshwater species are taken as bycatch in the eel fishery with small amounts taken as bycatch by set netters who are targeting grey and yelloweye mullet and flounder. Bycatch is often discarded without reporting.

Key: see below

| Species caught | Catch Kg | Statistical area | Method | Target species |
|---|---|---|---|---|
| | | | | |
| **Galaxiid adult** | 4 | AD | FN | EEU |
| | | | | |
| **Black flounder** | 175 | 2 | SN | BFL |
| | 17528 | 22 | SN | BFL |
| | 12 | AK | FN | EEU |
| | 34 | AV | FN | EEU |
| | 7564 | 22 | SN | FLA |
| | 5061 | 25 | BT | FLA |
| | 2091 | 30 | BT | FLA |
| | 150 | 38 | BT | FLA |
| | 30657 | 39 | SN | FLA |
| | 50 | 13 | BT | GUR |
| | 12 | 6 | DS | JDO |
| | 31 | 39 | SN | KAH |
| | 230 | 22 | SN | SFL |
| | 125 | 22 | SN | YBF |
| | **Total 63720** | | | |
| | | | | |
| **YEM bycatch** | 47 | 2 | SN | GMU |
| | 269 | 3 | SN | FLA |
| | 2 | 5 | SN | FLA |
| | 59 | 7 | SN | FLA |
| | 15 | 12 | SN | FLA |
| | 179 | 16 | SN | FLA |
| | 10 | 17 | SN | FLA |
| | 5 | 18 | SN | FLA |
| | 615 | 22 | SN | FLA/SFL/YBF/BFL |
| | 2 | 27 | SN | FLA |
| | 1372 | 39 | SN | FLA |
| | 11 | 42 | SN | FLA/GMU |
| | 220 | 43 | SN | FLA/GMU/KAH/ SPO/TRE/YBF |
| | 70 | 622 | SN | FLA |
| | 33 | 009H | SN | FLA/GAR |
| | 14 | AN | FN | EEU |

| | | | | |
|---|---|---|---|---|
| | 8 | AR | FN | EEU |
| | 2 | AX | FN | EEU |
| | **Sub-total 2933** | | | |
| | | | | |
| **YEM target** | 1405 | 3 | SN | YEM |
| | 230 | 5 | SN | YEM |
| | 105 | 7 | DN | YEM |
| | 300 | 15 | SN | YEM |
| | 375 | 16 | SN | YEM |
| | 2264 | 22 | SN | YEM |
| | 2050 | 39 | SN | YEM |
| | 490 | 42 | DN | YEM |
| | 2421 | 43 | RN/SN | YEM |
| | 789 | 44 | SN | YEM |
| | 12 | 009H | SN | YEM |
| | **Sub-total 10441** | | | |
| **YEM total** | **Total 13374** | | | |
| | | | | |
| **Koura** | 2 | AX | FN | EEU |
| | 61 | AD | FN | EEU |
| | 4 | AB | FN | EEU |
| | 186 | AA | FN | EEU |
| | **Total 253** | | | |
| | | | | |
| **Catfish** | 3 | 42 | SN | GMU |
| | 8 | 43 | SN | GMU |
| | 570 | AA | FN | EEU |
| | 14 | AB | FN | EEU |
| | 70 | AC | FN | EEU |
| | 29651 | AD | FN | EEU |
| | **Total 30316** | | | |
| | | | | |
| **Koi** | 8 | 42 | RN | GMU |
| | 67 | 43 | SN | GMU |
| | 9747 | AD | FN | EEU |
| | 16 | AK | FN | EEU |
| | **Total 9838** | | | |
| | | | | |
| **Goldfish** | 89 | AA | FN | EEU |
| | 4 | AB | FN | EEU |
| | 16 | AC | FN | EEU |
| | 508 | AD | FN | EEU |
| | 6 | AF | FN | EEU |
| | **Total 623** | | | |

**Statistical areas**: AA=Northland, AB=Auckland, AC=Hauraki, AD=Waikato, AE=Bay of Plenty, AF=Poverty Bay, AG=Hawkes Bay, AH= Rangitikei-Wanganui, AJ-Taranaki, AK=Manawatu, AL=Wairapara, AM=Wellington, AN=Nelson, AP=Marlborough, AQ=South Marlborough, AR=North Canterbury, AS1=Lake Ellesmere, AS2=Lake Ellesmere Migration Area, AT=South Canterbury, AU=Waitaki, AV=Otago, AW=Southland, AX=Westland, AY=Stewart Island, AZ=Chatham Islands, for statistical areas 1 to 801 see Appendix 3 Map 4.

**Fishing method**: FN=fyke net, SN=set net, RN=ring net, DS=Danish seine, DN=drift net.

**Species code**: BFL=black flounder, EEU=freshwater eel, FLA=flatfish, GAR=garfish, GMU=grey mullet, GUR=gurnard, KAH=kahawai, JDO=John dory, SFL=sand flounder, SPO=rig, TRE=trevally, YBF=yellow-bellied flounder.

## APPENDIX 6: Gazette Notice of Species that can be Farmed

**Freshwater Fish Farming Regulations 1983**

**Notice specifying Fish Species Which May be Farmed (2006)** (No. F369)

Pursuant to regulation 2 of the Freshwater Fish Farming Regulations 1983, I hereby specify the following species to be fish for the purposes of those Regulations:

(1.1) Abalone or paua, being:
- (i) Ordinary paua (*Haliotis iris*)
- (ii) Virgin paua (*Haliotis virginea*)
- (iii) Yellow-foot paua (*Haliotis australis*)

(1.2) Anemone, being
- (i) Common anemone (*Actinothoe albocinta*)
- (ii) Dahlia anemone (*Isocradactis magna*)

(1.3) Bass (*Polyprion moeone*)
(1.4) Blue cod (*Parapercis colias*)
(1.5) Brine shrimp (*Artemia salina*)
(1.6) Butterfish (*Odax pullus*)
(1.7) Carp, being
- (i) Grass carp (*Ctenopharyngodon idella*)
- (ii) Silver carp (*Hypophthalmichthys molitrix*)

(1.8) Cat's eye (*Turbo smaragdus*)
(1.9) Crab, being:
- (i) Cancer crab (*Cancer novaezelandiae*)
- (ii) Giant spider crab (*Jacuinotia edwardsii*)
- (iii) King crab (*Lithodes murrayi*)
- (iv) Paddle crab (*Ovalipes catharus*)
- (v) Red crab (*Chaeceon bicolour*)

(1.10) Coarse dosina (*Dosina zelandica*)
(1.11) Cockle (*Austrovenus stutchburyi*)
(1.12) Cooks turban (*Cookia sulcata*)
(1.13) Eel, being:
- (i) Longfin eel (*Anguilla dieffenbachii*)
- (ii) Shortfin eel (*Anguilla australis*)

(1.14) Flounder, being:
- (i) Black flounder (*Rhombosolea retiaria*)
- (ii) Brill (*Colistium guntheri*)
- (iii) Greenback flounder (*Rhombosolea tapirina*)
- (iv) Sand flounder (*Rhombosolea plebeia*)
- (v) Turbot (*Colistium nudipinnus*)
- (vi) Yellowbelly flounder (*Rhombosolea leporina*)

(1.15) Freshwater crayfish or koura, being:
- (i) *Paranephrops planifrons*
- (ii) *Paranephrops zealandicus*

(1.16) Grey mullet (*Mugil cephalus*)
(1.17) Hapuku (*Polyprion oxygeneios*)
(1.18) John dory (*Zeus faber*)
(1.19) Kahawai (*Arripis trutta*)
(1.20) King clam or geoduck (*Panopea zelandica*)
(1.21) Koheru (*Decapterus koheru*)
(1.22) Leatherjacket (*Parika scaber*)
(1.23) Lobster, being:
- (i) Packhorse or green lobster (*Jasus verreauxi*)
- (ii) Spiny or red rock lobster (*Jasus edwardsii*)

(1.24) Mussel, being:
- (i) Blue mussel (*Mytilus galloprovincialis*)
- (ii) Freshwater mussel (*Hyridella menziesii* and *Cucumerunio websteri*)
- (iii) Green lipped mussel (*Perna canaliculus*)

(iv) Horse mussel (*Atrina zelandica*)

(1.25) Octopus, being:
- (i) *Octopus huttoni*
- (ii) *Pinnoctopus cordiformis*

(1.26) Mysid shrimp, being:
- (i) *Mysidopsis* sp.
- (ii) *Tenagomysis nova-zealandiae*
- (iii) *Tenagomysis similes*

(1.27) Oyster, being:
- (i) Dredge oyster (*Tiostrea chilensis*)
- (ii) Pacific oyster (*Crassostrea gigas*)

(1.28) Parore (*Girella tricuspidata*)

(1.29) Perch (*Perca fluviatilis*)

(1.30) Pipi (*Paphies australis*)

(1.31) Red gurnard (*Chelidonichthys kumu*)

(1.32) Rock shrimp (*Palaemon affinis*)

(1.33) Salmon, being:
- (i) Atlantic salmon (*Salmo salar*)
- (ii) Chinook or quinnat salmon (*Oncorhynchus tshawytscha*)
- (iii) Sockeye salmon (*Oncorhynchus nerka*)

(1.34) Scallops (*Pecten novaezelandiae*)

(1.35) Scampi (*Metanephrops challengeri*)

(1.36) Sea cucumber (*Stichopus mollis*)

(1.37) Seahorse, being:
- (i) Seahorse (*Hippocampus abdominalis*)
- (ii) Spotted seahorse (*Hippocampus kuda*)

(1.38) Sea urchin (*Evechinus chloroticus*)

(1.39) Seaweed, being:
- (i) Agar weed (*Pterocladia lucida*)
- (ii) Gigartina (*Gigartina atropurpurea* and *Gigartina circumcincta*)
- (iii) Gracilaria (*Gracilaria chilensis*)
- (iv) Small agar weed (*Pterocladia capillacea*)

(1.40) Snapper (*Pagrus auratus*)

(1.41) Sponge, being:
- (i) Bath sponge (*Spongia manipulatus*)
- (ii) Finger sponge (*Callyspongia ramosa*)
- (iii) Grey sponge (*Ircinia* sp.)
- (iv) *Latrunculia* sp.
- (v) *Lissodendoryx* sp.
- (vi) *Mycale* sp.
- (vii) Pink conular sponge (*Chondropsis kirkii*)
- (viii) *Raspailia agminata*
- (ix) Red flabby sponge (*Crella encrustans*)

(1.42) Striped trumpeter (*Latris lineate*)

(1.43) Surf clam, being:
- (i) Deep water tuatua (*Paphies donacina*)
- (ii) Fine dosinia (*Dosinia subrosea*)
- (iii) Frilly venus shell (*Bassina yatei*)
- (iv) Large trough shell (*Mactra murchisoni*)
- (v) Ringed dosinia (*Dosinia anus*)
- (vi) Silky dosinia (*Dosinia lambata*)
- (vii) Small trough shell (*Mactra discors*)
- (viii) Triangle trough shell (*Spisula aequilateralis*)
- (ix) Tuatua (*Paphies subtriangulata*)

(1.44) Tarakihi (*Nemadactylus macropterus*)

(1.45) Toheroa (*Paphies ventricosa*)

(1.46) Trevally (*Pseudocaranx dentex*)

(1.47) Tropical freshwater prawn (*Macrobrachium rosenbergii*)

(1.48) Tuna, being:
- (i) Bigeye tuna (*Thunnus obesus*)

(ii) Southern bluefin tuna (*Thunnus maccoyii*)

(1.49) Venus clam (*Ruditapes largillierti*)

(1.50) Watercress, being:

(i) *Nasturtium microphyllium*

(ii) *Nasturtium officinale*

(1.51) Whitebait, being:

(i) Banded kokopu (*Galaxias fasciatus*)

(ii) Giant kokopu (*Galaxias argenteus*)

(iii) Inanga (*Galaxias maculatus*)

(iv) Koaro (*Galaxias brevipinnis*)

(v) Shortjaw kokopu (*Galaxias postvectis*)

(1.52) Yellowtail kingfish (*Seriola lalandi*)

The previous notice published in the *New Zealand Gazette* on 18 March 2004, No. 30, page 689, specifying Fish Species Which May Be Farmed, is hereby revoked.

Dated at Nelson this 6th day of July 2006
DANIEL LEES, Aquaculture Manager, Ministry of Fisheries.

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