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Updated Aquatic Sites of Significance

Document in support of the Nelson Plan Water Management Framework

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Table of Contents

Executive Summary

Nelson City Council has embarked upon a review of its Regional Policy Statement (RPS), Nelson Resource Management Plan (NRMP) and Regional Air Quality Plan. The resulting document will be called the Nelson Plan.

One of the issues to be addressed through the Nelson Plan is management of the region's waterways and water (quality and quantity) resource. This will be achieved through a water management framework, as directed by the National Policy Statement for Freshwater Management (NPS FM 2014). One of the key steps in this framework is the identification of freshwater values.

In 2015 The Catalyst Group was engaged to compile existing available information relating to the following potential values for possible inclusion within the Freshwater section of the Nelson Plan:

- Sites of Significance - Threatened fish (covering threatened native fish species)
- Sites of Significance - Inanga spawning (covering inanga spawning grounds)
- Sites of Significance - Trout habitat and spawning (covering brown trout habitat and spawning grounds)
- Sites of Significance - Threatened birds (covering threatened native bird species utilising waterways for critical parts of their lifecycle)

Based upon the information compiled the 2015 study recommended values for threatened fish, inanga spawning, and trout habitat and spawning be included in the Nelson Plan. This recommendation was supported with information in the 2015 report on where each value should apply in the region, along with information on how each value can be protected from various threats.

In 2017 The Catalyst Group was engaged to update the 2015 report to take into account additional freshwater fish data (collected through an enhanced Nelson City Council monitoring effort), and to address an error identified in the New Zealand Freshwater Fish Database that was detected after the original report was completed.

This report updates the original Aquatic Sites of Significance report (June 2015).

1 Introduction

Nelson City Council has embarked upon a review of its Regional Policy Statement (RPS), Nelson Resource Management Plan (NRMP) and Regional Air Quality Plan. The resulting document will be called the Nelson Plan - a combined RPS, coastal, regional and district plan.

One of the resource management issues to be addressed through the Nelson Plan is management of the region's waterways and water (quality and quantity) resource. This will be achieved through a water management framework, as directed by the National Policy Statement for Freshwater Management (NPS FM 2014). This framework requires regional councils to:

1 Identify freshwater management units

2 Identify the values for each freshwater management unit. The values must include the compulsory values and may include any other national value or local/regional value

3 Identify the attributes applicable to each value

4 Formulate objectives and limits to maintain or improve the identified values depending upon their current state relative to the assigned state

The Catalyst Group was engaged in 2015 to compile existing available information relating to the following potential freshwater values for possible inclusion within the Nelson Plan:

- Sites of Significance - Threatened fish (covering threatened native fish species)
- Sites of Significance - Inanga spawning (covering inanga spawning grounds)
- Sites of Significance - Trout habitat and spawning (covering brown trout habitat and spawning grounds)
- Sites of Significance - Threatened birds (covering threatened native bird species utilising waterways for critical parts of their lifecycle)

A separate chapter was provided for each of these values. Each chapter outlined the critical habitat requirements for each value and made specific recommendations to protect these values within the Nelson Plan. Policy outcomes from these recommendations were designed to ensure activities with the potential to negatively impact on habitat were managed in a way that provided for and maintained these values within the Nelson region.

Recommendations in the initial report were (and still are) to be read in conjunction with technical work to determine water quality and quantity limits for Ecosystem Health and other ecological and cultural values and proposed natural character provisions of the Nelson Plan. Environmental bottom lines, objectives and limits were to be set to support the ecological health of Nelson's waterways, in addition to recommendations on physical habitat requirements to ensure waterways are capable of supporting healthy aquatic life.

Attributes set through the National Policy Statement for Freshwater Management ("NPS-FM") for Ecosystem Health do not address physical disturbance of bed, banks and riparian zones, so these effects are best addressed as part of the suite of values identified above. As such, recommendations in the original report contained elements that were additional to provisions related to the Freshwater Ecosystem Health value.

In 2017, The Catalyst Group was engaged to update the initial aquatic sites of significance report to take into account:

- Additional data entered into the New Zealand Freshwater Fish database (NZFFDB), resulting from an enhanced Nelson City Council monitoring effort, and
- a data-entry issue involving the NZFFDB that came to light following completion of the first report. The issue relates to the entry of absence (not found) records into the database, when only presence (fish found) records should be entered. This issue opened-up the possibility of both the distribution and presence of a fish species being overstated.

This report is not a rewrite of the original report, but rather an update of the information presented and the recommendations made (where appropriate), in light of the above considerations.

2 Threatened Fish

New Zealand's native freshwater fish assemblage has several important characteristics:

- the total number of species is sparse in comparison to elsewhere in the world
- thirty-one of the species are found only in New Zealand, and
- more than half of the species are diadromous, spending parts of their lives in both freshwater and marine environments

Since colonisation all native freshwater fish species have experienced, and continue to experience, rapid declines in total population size and extent as rivers, wetlands and estuaries have been modified as a result of land clearance and development. Approximately half of New Zealand's native freshwater fish species are now threatened with extinction.

Nationally threatened species of native freshwater fish has been identified as an important freshwater value in the Nelson Plan water management framework. Maintenance of the physical habitat requirements to support this value is integral to ensuring the survival of threatened native fish species, and their protection as taonga. Protection of threatened native fish species are section 6(c) and (e) matters of national importance under the Resource management Act ("RMA" or "the Act").

2.1 Freshwater Fish Species

Twenty-three species of fish have been reported in the Nelson region (Table 1) in the New Zealand Freshwater Fish Database, and more recent data sources. Of these three (cockabully, grey mullet and yellow eye mullet) are marine wanderers, spending the vast majority of their lives in estuaries and the marine environment. A further four are exotic or pest species – brown trout, Gambusia, rainbow trout, and tench), leaving a total of 16 native freshwater fish species.

The distribution of native freshwater fish within the region is largely associated with their life history requirements since many of the native fish are diadromous i.e. they require access to and from the sea as part of their life cycle. Certain diadromous species (e.g. shortfin eel, common smelt, giant kokopu, banded kokopu, inanga, and giant bully) are generally found close to the coast and/or in the lower reaches of larger rivers. Other diadromous species (e.g. longfin eel, koaro, and to a lesser extent torrentfish, redfin bully, black flounder and lamprey), known as strong migrants, have been found in the headwaters of the Maitai, Roding, and Wakapuaka catchments.

Non-diadromous freshwater fish species (e.g. upland bully) are widely distributed through the region.

Table 1: The fish species recorded for the Nelson region, from the New Zealand Freshwater Fish Database and other more recent sources.

Common name	Scientific name
Yelloweye mullet	*Aldrichetta forsteri*
Shortfin eel	*Anguilla australis*
Longfin eel	*Anguilla dieffendachii*
Torrentfish	*Cheimarrichthys fosteri*
Giant kokopu	*Galaxias argenteus*
Koaro	*Galaxias brevipinnis*
Banded kokopu	*Galaxias fasciatus*
Inanga	*Galaxias maculatus*
Shortjaw kokopu	*Galaxias postvectis*
Gambusia	*Gambusia affinis*
Upland bully	*Gobiomorphus breviceps*
Common bully	*Gobiomorphus cotidianus*
Giant bully	*Gobiomorphus gobioides*
Bluegill bully	*Gobiomorphus hubbsi*
Redfin bully	*Gobiomorphus huttoni*
Lamprey	*Goetria australis*
Cockabully	*Grahamina nigripenne*
Grey mullet	*Mugil cephalus*
Rainbow trout	*Oncorhynchus mykiss*
Common smelt	*Retropinna retropinna*
Black flounder	*Rhombosolea retiaria*
Brown trout	*Salmo trutta*
Tench	*Tinca tinca*

2.2 Threatened Species Classification

The Department of Conservation has developed a Threat Classification System for all native and endemic species (both plants and animals) in New Zealand to determine the threat of extinction of each species. The freshwater fish species within Nelson identified as threatened under the latest classification (Goodman *et al*, 2014) are set out in Table 2. The classifications are nationally applicable as set out in Townsend *et al.* (2007).

Across all native freshwater fish species recorded in Nelson 56% have an 'at risk' or 'threatened' status. Nationally, 78% of native freshwater fish have an assigned conservation threat status[1]. This is an increase from the last reported threat classification for native fish in 2009 where 67% were identified as threatened or at risk (Allibone *et al.* 2010) and the 2005 classification which described

[1] A number of rare non-migratory Galaxias taxa found only in parts of Canterbury or Otago are included in the calculation of this proportion, many of which have a nationally endangered or nationally critical conservation threat status.

53% as threatened or at risk (Hitchmough *et al.* 2007). Increases in the proportion of threatened and at risk species is a result of changes in taxonomic resolution for some species, changes in threat classification method between the 2007 and 2010 classifications, and the result of continued decline in native fish populations. The leading causes of national patterns of decline in native fish populations include impacts from introduced fish species, declining water quality, effects of water abstraction, loss of habitat via land-use change and land-use activities, and river modification (Allibone *et al.* 2010).

The two species identified as 'threatened' are estimated to have significant, nationally declining population trends, in combination with small total areas of occupancy or very low total numbers of mature fish. Both lamprey and shortjaw kōkopu have had their threat status elevated to nationally vulnerable since the last freshwater fish classification. Percentage population declines in Table 2 were estimated over 10 years or the time-span of three generations, whichever period was longer, depending on the species.

Of the species identified as 'at risk' all have substantial, nationally declining population trends.

The IUCN Red List is a second well recognised threat classification system. The IUCN Red List is a global approach to evaluating the status of plant and animal species for the purposes of identifying those species most in need of conservation attention if global extinction rates are to be reduced and to provide a global index of the state of biodiversity degeneration. The Nelson freshwater fish species with a threatened status under this classification system are shown in Table 2. The Nelson Plan should recognise any freshwater fish species appearing on this list as significant within a regional, national and international context.

Table 2: Threatened native freshwater fish in the Nelson region

Common Name	DOC Threat Status	Description[2]	IUCN Red List Threat Status
Lamprey	Threatened – Nationally Vulnerable	10-50% declining trend, worsening threat status since 2009, total area of occupancy ≤100 ha (1 km^2)	Data deficient
Longfin eel	At Risk – Declining	10-70% declining trend, threat status unchanged, conservation dependent	Not assessed
Torrentfish	At Risk – Declining	10-70% declining trend, threat status unchanged, >100,000 mature individuals	Vulnerable
Bluegill bully	At Risk – Declining	10-70% declining trend, threat status unchanged, >100,000 mature individuals	Vulnerable
Redfin bully	At Risk – Declining	10-70% declining trend, threat status unchanged, >100,000 mature individuals, partial decline	Near Threatened
Giant kokopu	At Risk – Declining	10-50% declining trend, threat status unchanged, 20,000-100,000 mature individuals, partial decline	Vulnerable
Koaro	At Risk – Declining	10-70% declining trend, threat status unchanged, >100,000 mature individuals, partial decline	
Inanga	At Risk – Declining	10-70% declining trend, threat status unchanged, >100,000 mature individuals, conservation dependent	
Shortjaw kokopu	Threatened – Nationally Vulnerable	10-50% declining trend, worsening threat status, 5,000 – 20,000 mature individuals	Endangered

[2] Definitions as per Townsend *et al.* (2008): ***Conservation dependent*** *means the taxon is likely to move to a higher threat category if current management ceases.* ***Partial decline*** *means taxa undergoing decline over the majority of their range, but with one or more secure populations.*

2.3 Threatened Freshwater Fish

The following section summarises the life cycles of the threatened freshwater fish species included within the Sites of Significance – Threatened fish value.

2.3.1 Lamprey

Lamprey (Figure 1) are migratory fish that are long-lived and very secretive. They have particular significance as a food source to Māori in many parts of the country. Lamprey can penetrate far inland and have a reasonable ability to negotiate barriers, leaving the water to move across land in a similar manner to eels.

Figure 1: Lamprey *(Mike Joy, Massey University)*

Adult lamprey spawn in forested headwater streams and larval ammocoetes spend 4-5 years before metamorphosis into macrophthalmia which then migrate to the sea where they live and mature for 3-4 years. During the ammocoete stage they are filter feeders, consuming aquatic microorganisms and inhabiting shallow muddy or sandy backwaters along river margins. They migrate to sea from late winter to early spring in the early hours of the night, during freshes.

Once matured at sea, macrophthalmia return to freshwater from late winter to early spring as adult lamprey. Inward migration is greatest at times of elevated flow and turbidity. Adults do not feed as they slowly migrate for up to 16 months into small upland streams to spawn. These migrations occur at night during dark phases of the moon. During the day adult lamprey hide beneath overhanging banks and in holes. Spawning occurs in shallow nests in streambed gravels. It is likely adults die after spawning.

2.3.2 Longfin eel

Longfin eels (Figure 2) can be found throughout New Zealand. They live mainly in rivers and inland lakes but can be found in almost all types of waters, usually well inland from the coast.

Figure 2: Longfin eel *(Mike Joy, Massey University)*

They are legendary climbers and have made their way well inland in most river systems, even those with natural barriers. Elvers (young eels) swimming up river will climb waterfalls and even dams by leaving the water and wriggling over damp surfaces.

Small longfin eels living amongst river gravels will feed on insect larvae, worms and snails. When bigger, they will feed on fish, fresh-water crayfish and small birds like ducklings. During the day, eels are secretive, hiding under logs and boulders or under riverbanks. Hunting generally occurs at night.

Longfin eels breed only once, at the end of their life. When ready to breed they migrate down river to the sea during autumn then swim 5000 kilometres up into the tropical Pacific to spawn, probably in deep ocean trenches near Tonga.

Upon reaching their destination, females lay millions of eggs that are fertilised by the male. Leptocephalus (transparent, flat, leaf-shaped larvae) return to New Zealand by drifting on ocean currents.

Before entering fresh water, the leptocephalus change into a more familiar eel shape, remaining transparent for up to a week after leaving the sea. These "glass" eels enter fresh water between July and November, often in very large numbers.

Eels take many years to mature - the average age of a migrating longfin eel is 23 years for a male and 34 for a female. Large adult females may be 80+ years old.

2.3.3 Torrentfish

Torrentfish (Figure 3) are diadromous migrants that move long distances up and down rivers throughout their lives. Due to their swift-water swimming ability they tend to inhabit the mid to upper reaches of fast-flowing rivers and streams and are able to negotiate their way upstream through large rapids. As their name suggests they are often found in rapids or 'torrents' and their distribution is closely associated with swift-flowing, open rivers with gravel or bouldery substrate.

Figure 3: Torrentfish *(Stella McQueen)*

Adult torrentfish spawning habitat is unknown but is likely to be in substrate gravels. Males generally occur in the lower reaches of rivers and females upstream, so a spawning migration is clearly required for at least one of the sexes. Spawning can occur several times in one season from late spring to early autumn, peaking in February. Larvae are washed downstream after hatching and return to estuaries to migrate instream in spring and autumn.

2.3.4 Bluegill bully

The bluegill bully (Figure 4) is the smallest of the New Zealand bullies and like most native fish is cryptic, possibly nocturnal and seldom seen. Typical habitats are swift-flowing rivers with gravel substrate, commonly occurring with torrentfish.

Figure 4: Bluegill bully (male) *(Stella McQueen)*

Bluegill bullies feed mainly on benthic invertebrates in rapids and riffles. Male and female adult fish appear to have somewhat separate populations, males most often inhabiting lower reaches of rivers and streams and females more commonly found in upper reaches. Spawning habitat is unknown but because of possible habitat separation between the sexes, fish of at least one sex may have to migrate for spawning. Fish passage throughout bluegill bully habitat may therefore be essential for successful reproduction.

Newly hatched larvae are most likely washed out to sea. Juvenile bluegill bullies are known to migrate into freshwaters during spring and autumn, suggesting a dual spawning season (McDowall, 1990).

2.3.5 Redfin bully

Redfin bullies (Figure 5) are a migratory fish generally found at lower elevations (<150m above sea level) but are occasionally found inland and have the capability to climb barriers. Redfin bullies occur mainly in runs and pools of small bouldery streams and their principal food is mayfly, caddis fly and chironomid larvae. Because of their dependence on this habitat type, they are more sensitive to the effects of siltation in streams than other native fish species. This is because of sedimentation impacts on the presence of large invertebrate food sources, and on spawning habitat and success.

Figure 5: Redfin bully (male) *(Stella McQueen)*

Spawning occurs between July and November on the underside of large rocks upstream of adult habitat; male fish defend nest sites. Hatching is stimulated by high flow events and juveniles are washed downstream to the sea returning to freshwater throughout the summer (from November).

2.3.6 Giant kokopu

Giant kokopu (Figure 6) are diadromous galaxiid fish that do not have good climbing ability or migratory drive and tend to inhabit lowland, slow-flowing streams, lakes and wetlands. They are the largest galaxiid fish but are seldom seen due to their nocturnal nature.

Figure 6: Giant kōkopu *(Stephen Moore, Landcare Research)*

Growth is slow and giant kokopu are long-lived, taking several years to reach maturity. Spawning is not well studied but it is thought to occur in the margins of adult habitat in late autumn to early winter. Juveniles are washed out to sea and return late in the whitebait run (early November) (McDowall, 2006).

2.3.7 Koaro

Koaro (Figure 7) probably have the best climbing ability of all the diadromous Galaxiid fish. They penetrate well inland and inhabit steep gully streams with heavily forested margins. Nationally, koaro are the second most common species in the whitebait catch, although this has not been verified for Nelson.

Figure 7: Kōaro *(Stella McQueen)*

The critical habitat requirements of koaro are cold, clear, high velocity, heavily vegetated, upland streams with good instream cover and bouldery substrate. Spawning occurs in autumn to early winter, in the marginal gravels of adult habitat during fresh events[3]. Juveniles are washed out to sea, returning in early whitebait runs in September and October. Instream migration occurs on the tail of freshes while the water is still turbid and flows are elevated.

2.3.8 Inanga

Inanga (Figure 8) are found in a wide variety of habitats, from tiny creeks, to coastal rivers, lowland streams, lakes and wetlands, generally at low elevation (<20m above sea level) and within 10km of the coast. Although predominantly diadromous, there are land-locked lake populations present in parts of New Zealand.

[3] Kōaro spawning was confirmed in 2017 in Brook Stream, beneath mid-stream boulders in riffle habitat. It is unknown if this spawning behaviour is typical or in response to habitat loss and competition.

Figure 8: Īnanga *(Stella McQueen)*

Mature adults migrate to estuaries in autumn to spawn in marginal estuarine vegetation during king tides. Eggs develop in humid air, hatching when inundated during the following king tide. Larvae migrate to sea for 21-23 weeks, returning in spring as part of the whitebait run. Inanga make up the greatest proportion of the whitebait catch.

Inanga are diverse bottom, mid-water and surface feeders and are short-lived, generally not surviving spawning. Inanga are the only native species known to form shoals as adult fish.

2.3.9 Shortjaw kokopu

Shortjaw kokopu (Figure 9) are diadromous galaxiid fish with good climbing capability and an ability to penetrate far inland, occupying habitat at the point where streams transition from lowland to upland gradients.

Figure 9: Shortjaw kōkopu *(Stella McQueen)*

Shortjaw kokopu are nocturnal and generally inhabit pools in small-medium streams with thick over-hanging native riparian vegetation and good instream cover. They feed on a mixture of benthic and terrestrial invertebrates, dominated by caddis (McDowall, 2006). Spawning occurs on riparian margins with good overhead cover, gravel, debris and leaf litter, alongside pools and backwaters in adult habitat, during bank-full freshes. Egg development occurs in damp spaces amongst the riparian litter and debris and may take 2-3 weeks (though eggs can remain viable in damp terrestrial environments for up to two months) (Charteris *et al.,* 2003). Larvae are washed out to sea, returning in whitebait runs in the spring.

Shortjaw kokopu have had their conservation threat status elevated in recent years due to significant population declines in many parts of the country.

2.4 Critical Habitat Requirements

The specific adult and spawning habitat requirements for those threatened freshwater fish species included within the Sites of Significance – Threatened fish value are set out in Tables 3 and 4.

Table 3: Adult habitat summary of freshwater fish species included in the Sites of Significance - Threatened fish value

Species	Habitat requirements	Catchment location	Adult Migration/Direction
Lamprey	Boulder aggregations and forested margins	Middle/upper	Yes (upstream from sea)
Longfin eel	Faster-flowing stony streams and rivers	Middle/upper	Yes (downstream to sea)
Torrentfish	Fast flowing water	Middle/upper	Yes (unknown)
Bluegill bully	Fast flowing water, riffles, and fast runs and associated substrate (gravel/cobble)	Middle/upper	Yes (unknown)
Redfin bully	Moderately to swift flowing water – low deposited sediment	Middle	Migratory (upstream within catchment)
Giant kokopu	Gently flowing weedy/boggy streams and swampy lagoons, wetland tributaries	Lower	Non-migratory
Koaro	Swift boulder-cobble streams	Upper	Non-migratory
Inanga	Gently flowing and still water	Lower	Yes (downstream to estuary)
Shortjaw kokopu	Small bouldery streams with dense podocarp forest margins	Upper	Migratory (within catchment)

Table 4: Spawning habitat summary of freshwater fish species included in the Sites of Significance - Threatened fish value

Species	Habitat requirements	Catchment location
Lamprey	Beneath large instream rocks	Upper
Longfin eel	Migrates to sea to spawn	-
Torrentfish	Not known, likely gravel substrate	Unknown (middle/upper)
Bluegill bully	Beneath instream rocks	Unknown (middle/upper)
Redfin bully	Beneath instream rocks	Middle
Giant kokopu	Stream/river margins during floods	Lower
Koaro	Marginal gravels and litter during elevated flows	Upper
Inanga	Intertidal vegetation	Lower
Shortjaw kokopu	Riparian margins and litter during floods	Upper

In summary, the maintenance and enhancement of threatened freshwater fish species requires:

- Habitat heterogeneity - variability in the physical structure of waterways e.g. pools, runs, riffles, backwaters, variation in the size of bed material,
- Instream refuge - due to the cryptic and nocturnal nature of many species instream cover is needed from undercut banks and woody debris. These types of instream cover also provide shading and refuge from elevated water temperatures.
- Connectivity - from source to sea to provide for migratory species and essential life cycle needs
- Riparian - a connection between waterways and their riparian margins (particularly forested margins) in terms of cover, input of woody debris, terrestrial invertebrate food sources, and flooding of margins for spawning purposes
- Stability - low anthropogenic physical disturbance of adult habitat and spawning grounds

2.5 Adult and Spawning Habitat Threats

Most of the waterways in the Nelson region have been extensively modified through their middle and lower reaches as a result of forestry, farming, and urban development. While the upper reaches of most catchments have retained much of their natural character, although both the upper Maitai and Roding are impacted by water supply structures. The middle and lower reaches of those waterways running through forestry and farmland (Wakapuaka and Whangamoa rivers) are generally the least modified. The greatest threats to threatened freshwater fish in these catchments are loss of riparian vegetation, stock trampling of spawning grounds, sedimentation from farming and forestry activities and occasional river works/gravel extraction.

In contrast, the middle/lower reaches of the Maitai River and Stoke streams have been extensively modified for flood and erosion control, and water storage purposes. These effects are most pronounced in The Brook (concrete lined for a considerable length) and the Stoke streams (straightened, rock lined, undergrounded).

Specific threats to the adult and spawning/juvenile habitats of threatened freshwater fish species in Nelson are summarised in Table 5.

Table 5: Threats to adult and spawning/juvenile habitats of threatened freshwater fish species in Nelson

Species	Adult habitat & migration threats	Spawning and juvenile threats	Lifecycle timing
Lamprey	• Loss of riparian and instream cover • Loss of habitat and flow variability • Disturbance of sandy shallow backwaters	• Loss of riparian cover • Instream barriers to downstream juvenile migration	• Adult migration - June – September (upstream) • Spawning – spring • Larvae migration – all year (in river) • Juvenile migration – autumn-spring (downstream)
Longfin eel	• Large hydroelectric and water supply dams	• Large Instream barriers	• Adult migration – autumn (to sea) • Spawning – offshore • Larvae migration – winter-spring (enter rivers) • Juvenile migration – summer-autumn (upstream)
Torrentfish	• Water quality degradation • Loss of habitat variability • Loss of high flow areas	• Bed disturbance • Sedimentation - suspended and on spawning substrate	• Adult migration – winter-spring (direction unknown) • Spawning – summer-autumn • Larvae migration – summer-autumn (downstream) • Juvenile migration – autumn-spring (upstream)
Bluegill bully	• Water quality degradation • Loss of high quality aquatic invertebrates • Loss of habitat variability	• Instream barriers • Instream disturbance or embedding of cobble spawning substrates	• Adult migration – July-December (direction unknown) • Spawning – spring-summer • Larvae migration – spring-summer (downstream) • Juvenile migration – summer (upstream)

Species	Adult habitat & migration threats	Spawning and juvenile threats	Lifecycle timing
Redfin bully	• Water quality degradation • Loss of high quality aquatic invertebrates • Loss of habitat variability	• Bed disturbance • Sedimentation - suspended and on spawning substrate	• Adult migration – spring (direction unknown) • Spawning – spring • Larvae migration – spring-summer (downstream) • Juvenile migration - summer (upstream)
Giant kokopu	• Instream barriers • Loss of forested riparian margin • Loss of slow flowing/pool habitat in lowland waterways • Disconnection/loss of forested wetland habitat • Loss of instream woody debris • Presence of brown trout	• Margin disturbance in adult habitat • Regulation/loss of overbank flows during autumn freshes	• Adult migration – autumn-winter (downstream) • Spawning – autumn-winter • Larvae migration – winter (downstream) • Juvenile migration - spring (upstream)
Koaro	• Forest clearance • Opening up of gullies • Disturbance of substrate • Loss of flow in upland streams	• Riparian and instream disturbance • Loss of cobble/boulder substrate on river margins • Instream barriers	• Adult migration – autumn-winter (in adult habitat) • Spawning – autumn-winter • Larvae migration – winter (downstream) • Juvenile migration - spring (upstream)
Inanga	• Loss of lowland lakes, wetlands and slow flowing streams through drainage and channelisation	• Instream barriers • Loss of estuarine and lower river riparian vegetation • Loss of overbank flows from autumnal freshes and high tides	• Adult migration – autumn (downstream) • Spawning – year round, peak in autumn/winter • Larvae migration – year round, peak in autumn/winter (to sea) • Juvenile migration – winter-spring (upstream)

Species	Adult habitat & migration threats	Spawning and juvenile threats	Lifecycle timing
Shortjaw kokopu	• Loss of podocarp/broadleaf riparian forest and over-hanging cover • Loss of instream woody debris • Loss of pool/backwater habitat • Loss of high quality aquatic invertebrates • Presence of brown trout	• Instream and riparian vegetation disturbance in adult habitat – particularly adjacent to backwaters and pools • Regulation/loss of overbank flows during autumn freshes	• Adult migration – autumn-winter (in adult habitat) • Spawning – autumn-winter • Larvae migration – winter (downstream) • Juvenile migration – spring (upstream)

2.6 Recommendations for the Nelson Plan

Based upon the known location of adult and spawning habitat[4], life cycle requirements, and threats the following Sites of Significance – Threatened fish are recommended for inclusion within the Nelson Plan (Table 6).

Table 6: Recommended Sites of Significance – Threatened fish for the Nelson region. The FMU (freshwater management unit) code refers to: (1) Roding catchment, (2) Stoke streams, (3) Maitai catchment, (4) Wakapuaka catchment, and (5) Whangamoa catchment.

FMU	Waterways	Reach
1	Roding River	Entire catchment upstream of regional boundary
2	Saxton Creek	Entire catchment from sea to source
2	Orchard Stream	Entire catchment from sea to source
2	Orphanage Stream	Entire catchment from sea to source
2	Poorman Valley Stream	Entire catchment from sea to source
2	Jenkins Creek	Entire catchment from sea to source
3	Maitai River	• mainstem from sea to Maitai dam • entire Maitai North Branch catchment • entire Maitai South Branch catchment • The Brook mainstem from Maitai confluence to source (excluding the concreted channel reach) • entire Sharland Stream catchment (including Packer catchment) • York Stream mainstem from Maitai confluence to source
3	Oldham Creek	Mainstem from sea to source
3	Todd Valley Stream	Mainstem from sea to source
3	Hillwood Stream 2	Mainstem upstream from State Highway 6
4	Wakapuaka River	• mainstem – sea to source • mainstem of Lud River from Wakapuaka confluence to source • entire Teal River catchment
5	Whangamoa River	• mainstem – sea to source • Collins River – from Whangamoa confluence to forestry weir • Graham Stream – entire catchment
5	Frenchmans Stream	Entire catchment from sea to source

[4] Based upon the last 15 years of records (2002-2017) in the NZFFDB, and known recent survey results not listed in the NZFFDB. Records earlier than 2002 were not considered for this analysis because habitat modification over the 15 years is likely to have altered fish populations, making records older than this less representative of present-day fish distribution.

The reaches listed in Table 6 encompass the survey point at which each particular threatened species was observed, and a buffer zone around each survey point. Given riverine fish (particularly diadromous species) can utilise large reaches of rivers and streams a 'habitat buffer zone' is recommended for each fish record to provide aquatic habitat for the identified species at that location. In the absence of ecologically relevant information on fish habitat utilisation at each site, an arbitrary buffer zone of 2km upstream/downstream of the survey point was adopted.

Due to the arbitrary nature of this designated 'buffer' reach, the following exceptions to the 2km upstream and downstream buffer apply:

- ephemeral waterways are excluded because there is insufficient information on the significance of these waterways to fish distribution within Nelson. Evidence from elsewhere in New Zealand indicates native fish populations expand and contract into these intermittently flowing waterways depending upon whether they are carrying flow or dry.
- where a buffer reaches a major confluence with another waterway, the buffer ends at the confluence
- where the reach intersects the DOC Conservation Estate or Nelson City Council reserve land in a catchment's headwaters, then the buffer extends to the river's source and all upstream tributaries
- where the buffer zones for several species are in close proximity, they are linked to form a larger, contiguous, more ecologically significant buffer, and
- where habitat for a diadromous species is in close proximity to the sea the buffer is extended to the sea in recognition of the value of marine access

Further, a 10 metre wide landward riparian zone applies from the bank edge of each buffer in recognition of the importance of riparian vegetation to the survival of threatened native fish species, particularly riparian spawners. There is a degree of cross-over between this riparian buffer, and the riparian habitat types that need to be picked-up through the terrestrial biodiversity provisions of the Nelson Plan.

Activities undertaken within and alongside the beds of waterways have the potential to adversely affect instream values. Permitted activity thresholds within the Nelson Plan need to acknowledge and provide for the maintenance of Ecosystem Health via the likes of water quality and quantity limits. As such, many potential adverse effects on threatened freshwater fish species can be managed through the Freshwater Ecosystem Health value.

However, the Freshwater Ecosystem Health value does not adequately address physical disturbance effects on the adult and spawning habitat of threatened freshwater fish species or their migration through the river system. These effects will need to be addressed at the regional level through a separate Sites of Significance – Threatened fish value. Recommendations to address these effects for inclusion within the Nelson Plan are:

- that the construction/installation of barriers to fish passage within and downstream of Sites of Significance – Threatened fish is a non-complying activity. Any potential barrier will need to demonstrate fish passability for all species of interest within that catchment area and be monitored to ensure it remains in a fish-passable state throughout its life.
- that activities with the potential to physically impact on Sites of Significance – Threatened fish (over and above permitted activity thresholds) are recommended for regulation as discretionary activities under the Nelson Plan. Addressing and providing for the critical habitat requirements of the threatened fish species at each site through a resource consent process allows for avoidance, remedying or mitigation of potential adverse effects. To assist with this, the freshwater fish species present in each Site of Significance – Threatened fish is presented in Table 7.
- that stock access to all Sites of Significance – Threatened fish and SOS-Inanga spawning (during critical time periods – refer next chapter) is a non-complying activity
- that current best practice with respect to provisions to exclude native freshwater fish from water intakes are adopted
- include a link to the Nelson Nature and Project Maitai/Mahitahi programmes and the inanga-related actions they contain

Table 7: Freshwater fish presence in each Site of Significance – Threatened fish for the Nelson region. The FMU (freshwater management unit) code refers to: (1) Roding catchment, (2) Stoke streams, (3) Maitai catchment, (4) Wakapuaka catchment, and (5) Whangamoa catchment. Threatened native fish species are highlighted in blue.

FMU	Waterways	Reaches	Shortfin eel	Longfin eel	Torrentfish	Giant kokopu	Koaro	Banded kokopu	Inanga	Shortjaw kokopu	Lamprey	Upland bully	Common bully	Giant bully	Bluegill bully	Redfin bully	Common smelt	Black flounder
1	Roding River			✓	✓		✓					✓						
2	Saxton Creek		✓	✓			✓	✓	✓				✓			✓		
	Orchard Stream		✓	✓			✓	✓	✓				✓	✓		✓		
	Orphanage Stream		✓	✓	✓	✓	✓	✓	✓				✓	✓		✓	✓	✓
	Lower Poorman Stream		✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Upper Poorman Stream			✓			✓	✓										
	Jenkins Creek		✓	✓			✓	✓	✓			✓	✓			✓		
	Maire Creek			✓			✓	✓										
3	Mahitahi/Maitai River	Lower mainstem	✓	✓	✓		✓	✓	✓		✓		✓	✓	✓	✓	✓	✓
		North branch	✓	✓			✓					✓						
		South branch		✓			✓		✓			✓	✓			✓		
		Upper Brook	✓	✓			✓	✓	✓			✓						
		Lower Brook	✓	✓	✓		✓	✓	✓			✓	✓			✓	✓	
		Packer	✓	✓			✓					✓	✓					
		Sharland	✓	✓								✓	✓			✓		
		York	✓	✓				✓								✓		
	Oldham Creek		✓	✓			✓	✓	✓			✓	✓			✓	✓	
	Todd Valley Stream		✓	✓			✓		✓				✓			✓		
	Hillwood Stream		✓	✓			✓	✓	✓				✓			✓		

FMU	Waterways	Reaches	Shortfin eel	Longfin eel	Torrentfish	Giant kokopu	Koaro	Banded kokopu	Inanga	Shortjaw kokopu	Lamprey	Upland bully	Common bully	Giant bully	Bluegill bully	Redfin bully	Common smelt	Black flounder
4	Wakapuaka River	Lower mainstem		✓	✓		✓		✓		✓	✓	✓	✓		✓		
		Upper mainstem		✓			✓		✓		✓	✓	✓	✓		✓		
		Lud		✓								✓	✓					
		Teal		✓			✓					✓						
5	Whangamoa River	Upper mainstem		✓			✓					✓				✓		
		Lower mainstem		✓			✓		✓			✓	✓		✓	✓		
		Collins		✓			✓		✓			✓	✓		✓	✓		
		Graham		✓			✓						✓					
		Dencker		✓					✓			✓	✓			✓		

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3 Inanga Spawning

Inanga spawning has been identified as an important freshwater value in the Nelson Plan freshwater management framework. Maintenance of the physical habitat requirements to support this value is integral to ensuring the survival of this species, and continuation of whitebaiting as a recreational/cultural activity within the region. Protection of inanga spawning habitat is a section 6(c and e) matter of national importance under the Act.

The focus of this chapter is inanga spawning. Protection of adult inanga habitat is considered a part of the Sites of Significance-Threatened fish value discussed above.

3.1 Inanga

Inanga (*Galaxias maculatus*) are found in a wide variety of habitats, from tiny creeks, to coastal rivers, lowland streams, lakes and wetlands, generally at low elevation (<20m above sea level) and within ~10km of the coast. Although predominantly diadromous (spend parts of their lifecycle in freshwater and the sea), there are land-locked populations present in lakes in some parts of the country.

Adult inanga have been found in three of the main river systems (Maitai, Wakapuaka, and Whangamoa) of the Nelson region, and many smaller waterways (e.g. several of the Stoke streams). Inanga spawning has been confirmed in the lower reaches of 9 waterways in the region, and is predicted (but not yet observed) in a further 7 waterways.

Mature adults migrate to estuaries in autumn to spawn in marginal estuarine vegetation during king tides. Eggs develop in humid air, hatching when inundated during the following king tide. Larvae migrate to sea for 21-23 weeks, returning in spring as part of the whitebait run. Inanga make up the greatest proportion of the whitebait catch (approximately 95%).

3.2 Critical Habitat Requirements

Inanga spawn in estuaries on high tides (generally spring tides on the new or full moon) in autumn. Their spawning habitat does not coincide with the spawning habitat of other native fish species, which is why more specific protections are needed through the identification of a separate value.

Spawning occurs amongst riparian vegetation with the greatest spawning density near the upper limit of the high-tide, salt-water wedge. The same spawning sites are used year after year. Inanga generally do not survive spawning. Within the Nelson region estuarine vegetation is highly modified as a consequence of channelisation (in urban areas), stock grazing/farming and drainage activities (in rural areas), or is not accessible due to flood or tide gates.

The critical habitat requirements for the long-term sustainability of inanga spawning are:

- unimpeded access (without fish barriers, perched culverts or floodgates) between the coast and lowland waterways
- estuarine and lowland riparian vegetation
- stock exclusion from spawning areas to enhance riparian vegetation and reduce direct disturbance prior to spawning and throughout egg development
- inundation of spawning vegetation by autumnal freshes, and
- slow moving run, pool and back-water habitat within lower reaches of rivers and streams with overhanging or instream cover for adult fish and juvenile development

The critical threats to inanga habitat and spawning success are summarised in Table 8.

Table 8: Critical threats to inanga spawning habitat and success in the Nelson region

Value	Critical habitat threats	Specific spawning threats	Timing
Inanga spawning	• Physical disturbance of spawning habitat and sedimentation • Loss of overbank flows from autumnal freshes and high tides	• Loss of estuarine and lower river riparian vegetation • Disconnection of lower river channels from estuarine flood plains • Invasive aquatic weeds (potentially) • Rat and mouse predation of eggs (potentially)	• 1 March- 30 July on high tides during full and new moons

3.3 Recommendations for the Nelson Plan

Activities undertaken within and alongside the beds of waterways have the potential to adversely affect instream values. Permitted activity thresholds within the Nelson Plan will provide for the maintenance of Ecosystem Health via the likes of water quality and quantity limits. As such, many of the adverse effects of activities on inanga spawning values are managed through the Freshwater Ecosystem Health value.

However, the Ecosystem Health value does not address physical disturbance effects on inanga spawning habitat and success. These effects are best addressed through a separate inanga spawning value.

Recommendations for inclusion within the Nelson Plan are:

- that the construction/installation of barriers to fish passage between adult inanga habitat and inanga spawning habitat is a non-complying activity. Any potential barrier will need to demonstrate that inanga can pass it, and that it is monitored to ensure it remains in a fish passable state throughout its life.
- that activities with the potential to physically impact on Sites of Significance – Inanga spawning (over and above permitted activity thresholds associated with the Freshwater Ecosystem Health value) are recommended for regulation as discretionary activities under the Nelson Plan. Addressing and providing for the critical habitat requirements of inanga spawning at each site through a resource consent process allows for avoidance, remedying or mitigation of potential adverse effects
- that physical disturbance of inanga spawning sites is avoided from 1 January-30 July to provide sufficient time for habitat recovery following disturbance, and then to protect inanga spawning, egg development, and fry hatching
- only suitable grass species are to be used in plantings as part of remediating an inanga spawning site following physical disturbance
- that stock access to Sites of Significance – Inanga spawning is a non-complying activity during the period 1 January to 30 July.
- include a link to the Nelson Nature and Project Maitai/Mahitahi programmes and the inanga-related actions they contain

Waterways valued for inanga spawning have been identified within the region (Table 9).

Table 9: Waterways recommended for the inanga spawning value in the Nelson region. The FMU (freshwater management unit) code refers to: (2) Stoke streams, (3) Maitai catchment, (4) Wakapuaka catchment, and (5) Whangamoa catchment.

FMU	Waterways[5]	Reach	Accuracy
2	Saxton Creek	Downstream of Saxton Field	Confirmed
2	Orphanage Stream	Downstream of Elms Street bridge	Confirmed
2	Poorman Valley Stream	Downstream of Seaview Road	Confirmed
2	Arapiki Stream	Downstream of Pascoe Street	Predicted
2	Jenkins Creek	Downstream of Pascoe Street bridge	Confirmed
2	Maire Stream	Downstream of Awatea Place	Predicted
3	Maitai River	Between Collingwood Street and Ngaire Place	Confirmed
3	Oldham Creek 2	Between The Haven and Atawhai Crescent	Confirmed
3	Todds Valley Stream	Extending approximately 400m upstream of The Haven	Predicted, but currently prevented by tidal flood gate
3	Hillwood	Extending approximately 800m upstream of The Haven	
4	Delaware Bay – Maori Pa Stream	Extending approximately 300m upstream of estuary	Confirmed
4	Delaware Bay – two unnamed tributaries at eastern end of Bay	Extending approximately 300m upstream of estuary	Predicted
4	Wakapuaka River	Extending approximately 600m upstream of estuary	Confirmed
5	Whangamoa River	Extending approximately 800m upstream of estuary	Confirmed
5	Toi Toi Stream	Extending up to 500m upstream of estuary	Predicted
5	Frenchmans Stream	Extending up to 500m upstream of estuary	Predicted

Note: the upstream extent of inanga spawning is likely to change over time in response to tide heights, river flows and sea level change. An upstream buffer of 100m has been applied to the observed inanga spawning habitat to account for this variability. Likewise the downstream extent of the spawning habitat is subject to change in response to a variety of factors. To ensure this variability is captured the downstream limit is extended to the sea/estuary.

[5] Although not observed, inanga spawning could also be occurring on estuary margins where the vegetated edges are wide enough to intercept the salt-water wedge during spring tide events (most likely at the mean high water springs boundary).

Information sources:

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Olley R 2014 Investigating potential locations for inanga spawning within Todd Valley and Hillwood streams. Report prepared for Nelson City Council. Fish & Wildlife Services

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4 Trout Habitat and Spawning

Trout habitat and trout spawning have been identified as important freshwater values in the Nelson Plan freshwater management framework. Maintenance of the physical habitat requirements to support these values is integral to ensuring the continuation of trout fishing as a recreational activity within the region. Protection of trout habitat is another matter for particular regard under section 7(h) of the RMA.

4.1 Brown Trout

Brown trout (*Salmo trutta)* are the dominant trout species in the Nelson region, with only one record for rainbow trout (*Oncorhynchus mykiss)* from the Teal River in the Wakapuaka catchment. Brown trout were introduced to the region in the late 1860s.

Brown trout are present in low-moderate numbers as juveniles through to large adults in each of the large river systems – Whangamoa, Wakapuaka, Maitai (including the water supply dam), and Roding. Brown trout have also been recorded in Poorman Valley Stream.

The major rivers of Nelson offer a locally important angling experience (Annex A) which attracts a relatively low angler effort (Unwin 2009). Anecdotal observations indicate adult trout numbers have declined significantly in recent decades, reducing the value of the region's rivers from a trout fishery perspective.

4.2 Critical Habitat Requirements

4.2.1 Trout Habitat

Large adult trout generally inhabit pools and margins of deep water and often require cover (both instream and riparian shade) when resting. Adults feed primarily on aquatic invertebrate drift but are also surface feeders, taking large aquatic and terrestrial insects when available. Large trout are also known to consume larger prey in their diets, including small fish, mice and frogs.

Small trout often inhabit runs and large riffles, feeding on benthic invertebrates; they also require abundant instream cover and cool water temperatures (below 20^{o}C, although optimum water temperature is 13^{o}C), particularly in summer when sunshine hours are longer, and avian and aquatic predators are more active.

In order to provide habitat for different trout age classes, aquatic macroinvertebrate production (which is greatest in riffles), and variations in velocity, flow and depth, instream habitat heterogeneity and morphological diversity of river channels needs to be maintained. Deposited sediment also negatively impacts on trout habitat, reducing the availability and accessibility of benthic macroinvertebrates, particularly for juvenile trout. All major waterways in the Nelson region have high natural morphological diversity and thus a high degree of instream habitat variation. Trout mainly inhabit gravel streams, rivers and lakes and are found less often in mudstone or siltstone catchments. They require cool waters (below 20^{o}C) and have high dissolved oxygen requirements,

especially as water temperatures increase. They also require low suspended sediment as turbidity significantly reduces visual feeding.

As water quality declines and dissolved nutrient concentrations increase, nuisance periphyton growths can proliferate (especially in summer) and cause shifts in the aquatic invertebrate communities from high energy, good quality insect larvae to lower energy small midge larvae and snails. These shifts in invertebrate community can cause reductions in the quality and quantity of trout available for anglers.

Excessive periphyton growth can also entrain sediment, further reducing the availability of benthic invertebrates for food and significantly reducing the spawning potential of gravel substrates.

Growths of benthic cyanobacteria (i.e. Phormidium sp.) are common in the Maitai catchment during extended summer low flow periods, and can affect the palatability of trout, causing the fish to taste 'muddy'. High amounts of cover by potentially toxic cyanobacteria also reduce the amenity and aesthetic aspects of the angling experience.

4.2.2 Trout Spawning

Trout spawn in gravel-bottomed, upland rivers and tributaries from late autumn to late winter. Given their small geographical spread, all waterways in the Nelson region are expected to experience trout spawning at more or less the same time. To date trout spawning has only been observed in the Maitai catchment, however, given the presence of young (<1 year old) trout in the other large catchments in the region, it is presumed that suitable spawning habitat and conditions exist to allow trout spawning to occur.

Spawning is stimulated by freshes and low water temperatures. Spawning trout excavate nests known as redds by digging depressions in river gravels; eggs are deposited into these depressions and then covered with gravel by further upstream excavation. Elevated river flows assist the fish in moving gravels for digging and covering phases as well as their migrations to and from spawning grounds.

Timing of egg development depends on water temperature (generally development is slower in colder waters) and eggs can take between one and several months to develop into fry. Trout eggs are particularly susceptible to high temperatures with mortality rates increasing significantly beyond 11^{o}C for brown trout. The maintenance of low winter and spring water temperatures through upstream riparian cover is important for juvenile trout recruitment. Fry remain within the redd gravels for several weeks where some feeding takes place, before emerging as alevins into the flowing water environment.

Development of eggs and fry within redds is the most critical aspect of successful spawning and juvenile recruitment of trout into adult populations. During this time redds must remain physically undisturbed with low suspended and deposited sediment loads to allow the flow of highly oxygenated, good quality water through the redd gravels to the developing juveniles.

Flood events during these egg and fry developmental phases can be disastrous to successful recruitment. Likewise mechanical disturbance within or upstream of spawning grounds can directly disturb redds, or adversely impact fry development through sediment release and lack of oxygen flow through redd gravels.

Critical trout habitat and spawning requirements and threats are summarised in Table 10.

Table 10: Critical habitat requirements and threats for trout habitat and spawning values in the Nelson region

Value	Critical habitat requirements	Specific threats to habitat	Specific threats to spawning	Timing
Trout fishery	• Pool/riffle/run habitat • Overhanging shade • High quality terrestrial and aquatic macroinvertebrate food sources • Instream cover • Low suspended sediment for sight feeding • High dissolved oxygen levels • Low-moderate water temperatures • Good water quality	• Loss of pool/run/riffle habitat • Loss of instream and riparian cover • Channelisation of rivers • Loss of high quality food sources • Water quality degradation • High water temperatures • Low dissolved oxygen levels • High suspended and deposited sediment levels due to flooding and instream/near stream works		• Effects of suspended sediment can be critical to adult persistence and juvenile survival during low flows
Trout spawning	• Accessible spawning habitat • Cool water • High dissolved oxygen levels • Stable cobble/gravel substrate • Low suspended and deposited sediment	• Sedimentation of spawning gravels • Barriers to upstream adult migration • Channelisation of rivers • Increased water velocities	• Physical disturbance of spawning habitat and release of sediment upstream or within spawning grounds • High water temperatures	• March-July for peak spawning • April-October for egg and fry development

4.3 Recommendations for the Nelson Plan

4.3.1 Trout Habitat

It is recommended that physical disturbance of trout habitat at a scale beyond the permitted activity thresholds attached to the Freshwater Ecosystem Health value is treated as a discretionary activity within the Nelson Plan. Addressing and providing for the critical habitat requirements of trout at each site through a resource consent process allows for avoidance, remedying or mitigation of potential adverse effects.

The trout habitat value is attributed to the waterways described in Table 11.

Table 11: Waterways recommended for the trout habitat value in the Nelson region. The FMU (freshwater management unit) code refers to: (1) Roding catchment, (3) Maitai catchment, (4) Wakapuaka catchment, and (5) Whangamoa catchment.

FMU	Waterway name	Classification	Reference
1	Roding River	Locally important	• mainstem upstream from Tasman District boundary
3	Maitai River	Locally important	• mainstem upstream from the Riverside Drive pedestrian walkway • mainstem of the Maitai River North Branch • mainstem of the Maitai River South Branch
4	Wakapuaka River	Locally important	• mainstem upstream from Maori Pa Road • mainstem of the Lud River • mainstem of the Teal River
5	Whangamoa River	Locally important	• mainstem upstream from Elizabeth Stream confluence • mainstem of the Collins River up to the forestry weir

4.3.2 Trout Spawning

The trout spawning value has been attributed to the waterways listed in Table 12. It is recommended that physical disturbance of trout spawning habitat at a scale beyond the permitted activity thresholds attached to the Freshwater Ecosystem Health value is treated as a discretionary activity within the Nelson Plan. Addressing and providing for the critical habitat requirements of trout spawning at each site through a resource consent process allows for avoidance, remedying or mitigation of potential adverse effects. Bed disturbance between 1 May and 30 September is to be avoided to provide for successful egg deposition, egg and fry development, and alevin emergence.

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Table 12: Waterways recommended for the trout spawning value in the Nelson region. The FMU (freshwater management unit) code refers to: (1) Roding catchment, (3) Maitai catchment, (4) Wakapuaka catchment, and (5) Whangamoa catchment.

FMU	Waterway name	Reference
1	Roding River	• mainstem upstream from Tasman District boundary
3	Maitai River	• mainstem upstream from Sharland Creek • mainstem of Sharland Creek • mainstem of Packer Creek • mainstem of The Brook, upstream to the old dam (excluding the concreted channel reach) • mainstem of the Maitai River North Branch • mainstem of the Maitai River South Branch
4	Wakapuaka River	• mainstem upstream from Maori Pa Road • mainstem of the Lud River • mainstem of the Teal River
5	Whangamoa River	• mainstem upstream from Elizabeth Stream confluence • mainstem of the Collins River up to the forestry weir

Note: with the exception of waterways in the Maitai catchment, the recommendation to apply this value to waterways is based on the presence of suitable trout spawning habitat, rather than observed spawning.

Information sources:

Olley R and Kroos T 2014 A summary of the distribution and spawning of freshwater fish within the waterways administered by the Nelson City Council. Fish & Wildlife Services.

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Annex A: Angler Experience

Angler experience is a composite value that combines the quality of the trout (related to the size and condition of the fish), the surroundings (related to the quality of the river and adjoining landscape), and experience (related to the amount of effort required to access the water, and the likelihood of encountering other anglers/water uses). Back-country rivers typically receive high scores, whereas lowland waterways and urban streams receive low scores.

For convenience, angler experience can be divided into four categories: (1) internationally significant, (2) regionally significant, (3) locally important, and (4) not a trout fishery. In terms of angler experience, internationally significant waterways are the most highly prized trout fisheries, are the equal of any trout fishery in the world, attract overseas anglers, and are used to promote New Zealand as a tourist destination. As the name suggests, regionally significant and locally important trout fisheries offer a lesser experience than internationally significant fisheries, but are still important for local anglers. Given the small size of the Nelson region, a regionally important fishery should be considered within the context of the Nelson/Tasman/Marlborough region, whereas a locally important fishery would have value at the Nelson region scale.

Those waterways considered to be 'not a trout fishery' have little or no significance to trout anglers, but will hold other aquatic values e.g. presence of native fish.

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5 Threatened Birds

Threatened species of native birds that have a strong association with waterways has been identified as a potential freshwater value in the Nelson Plan freshwater management framework.

There are a number of bird species present in the wider Nelson/Tasman region that are reliant upon waterways for critical parts of their lifecycle, such as nesting. These species are not to be confused with:

- the large number of shore birds that make use of the estuaries and inlets (particularly Waimea Inlet) for nesting and feeding purposes (it is intended the habitat supporting these species is addressed through the coastal section of the Nelson Plan)
- the various birds species that are present in and around waterways and wetlands, but are not reliant of rivers and streams and their immediate riparian margins for critical parts of their life cycle e.g. Australasian bitten, kingfisher, welcome swallow etc. (it is intended the habitat supporting these species is addressed through the terrestrial biodiversity section of the Nelson Plan)
- long-tailed bats[6]

Maintenance of the physical habitat requirements to support this value is integral to ensuring the survival of threatened native bird species, and their protection as taonga. Protection of threatened native bird species is a section 6(c and e) matter of national importance under the RMA.

5.1 Threatened Species Classification

The Department of Conservation has developed a Threat Classification System for all native and endemic species (both plants and animals) in New Zealand to determine the threat of extinction of each species. The bird species within Nelson identified as threatened under the latest classification (Robertson *et al*, 2012), and dependent upon waterways for critical parts of their lifecycle are set out in Table 13. The classifications are nationally applicable as set out in Townsend *et al.* (2007).

The IUCN Red List is a second well recognised threat classification system. The IUCN Red List is a global approach to evaluating the status of plant and animal species for the purposes of identifying those species most in need of conservation attention if global extinction rates are to be reduced and to provide a global index of the state of biodiversity degeneration. The bird species present in Nelson with a threatened status under this classification system are shown in Table 13. The Nelson Plan should recognise any bird species appearing on this list as significant within a regional and international context.

[6] Long-tailed bats (*Chalinolobus tuberculatus*) are not a bird, but one of two native mammals capable of flight. Long-tailed bats have a close association with rivers as demonstrated by the Pelorus River reserve population. However, it is the author's view that protection of long-tailed bat habitat is most appropriately dealt with through the Biodiversity section of the Nelson Plan, rather than the Freshwater section.

Table 13: Threatened native bird species with a reliance upon waterways for critical parts of their lifecycle

Common Name	DOC Threat Status	IUCN Red List Threat Status
Whio	Threatened – Nationally Vulnerable	Endangered
Black-billed gull	Nationally Critical	Endangered
Banded dotterel	Threatened – Nationally Vulnerable	

5.2 Critical Habitat Requirements and Threats

There are three bird species present within Nelson that are reliant upon waterways and their immediate riparian habitat for critical parts of their lifecycle, such as the provision of nesting sites:

- Whio (*Hymenolaimus malacorhynchos*) – reliant upon steep, rocky, fast flowing, high quality waterways for their entire life-cycle (feeding and breeding)
- Black-billed gull (*Larus bulleri*) – requires large sparsely vegetated river gravel beaches, not subject to tides, for breeding/nesting purposes. The breeding/nesting season extends from the start of August to the end of January.
- Banded dotterel (*Charadrius bicinctus*) - requires large sparsely vegetated river gravel beaches, not subject to tides, for breeding/nesting purposes. The breeding/nesting season extends from the start of July to the end of January.

There is no recent record of resident whio populations in the Nelson region, despite suitable habitat existing in the upper reaches of the major catchments (Roding, Maitai, Wakapuaka, and Whangamoa). The absence of a resident population is put down to mustelid predation (*pers comm.* Chris Golding, DOC). The upper reaches of the larger catchments are likely visited by fledged juveniles when they are ejected from their parent's home territory from nearby resident populations. Whio can travel large distances in their search for new habitat.

There is no record of black-billed gull or banded dotterel nesting on gravel beaches within the Nelson region (*pers comm.* David Melville, OSNZ). Nesting is unlikely given the relatively small size of the gravel beaches within the region, and high level of disturbance experienced on potentially suitable gravel beaches (i.e. along the Maitai River) as a result of bikers, and walkers and their dogs (*pers comm.* Chris Golding, DOC; Paul Fisher, NCC).

5.3 Recommendations for the Nelson Plan

Activities undertaken within and alongside the beds of waterways have the potential to adversely affect instream values. Permitted activity thresholds within the Nelson Plan acknowledge and provide for the maintenance of ecosystem health via the likes of water quality and quantity limits. As such, many of the adverse effects of activities on threatened bird values are managed through the Freshwater Ecosystem Health value.

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However, the Freshwater Ecosystem Health value does not address physical disturbance effects on threatened bird habitat or their breeding success. These effects would be best addressed through a separate threatened bird value.

Given (1) the absence of a resident whio population, and (2) absence of black-billed gull and banded dotterel nesting in the region, there is no justification for inclusion of a Sites of Significance – Threatened birds value within the Nelson Plan. Further, given that any potentially suitable whio habitat is located with remote areas of the region, wholly within public conservation land and/or Council reserve land, there is a very low probability of human-induced physical disturbance to this habitat.

Information sources:

Hugh Robertson, John Dowding, Graeme Elliott, Rod Hitchmough, Colin Miskelly, Colin O'Donnell, Ralph Powlesland, Paul Sagar, Paul Scofield, Graeme Taylor 2013. *New Zealand Threat Classification Series 4.* 22 p

IUCN Red list of threatened species website – http://www.iucnredlist.org

New Zealand Birds Online website - http://nzbirdsonline.org.nz

Townsend AJ, de Lange PJ, Duffy CAJ, Miskelly CM, Molloy J, Norton DA 2007: New Zealand Threat Classification System manual. Department of Conservation, Wellington. 35p

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