

**A summary of the distribution and spawning of freshwater fish within the waterways administered by the Nelson City Council.**

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**Prepared for the Nelson City Council**



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## **1. Introduction**

This report examines the broad distributions and population patterns of freshwater fish species within the jurisdiction of the Nelson City Council (NCC). Where catchments overlap with other regional authorities, only those parts of the catchment that fall within the NCC boundary are examined. This is the case with the Roding River and Saxton Creek, both of which cross the NCC and Tasman District Council boundaries. Records of fish species (including freshwater crayfish, hereafter referred to as an 'honorary fish') have been taken predominantly from The National Institute of Water and Atmospheric Research (NIWA) fresh water fish database (FFDB). These records date from 1965 to the present. Additional data that was not present on the FFDB has been added based on records from Fish and Game Nelson Marlborough (F&GNM), NCC, Department of Conservation (DoC) Nelson Regional Office and Fish and Wildlife Services (F&WS). All records contained within this report represent data collected by a range of techniques including electric fishing, night spotlighting, bank observation, and fish salvage operations. No attempt has been made to differentiate between these differing techniques. Species notes have been presented for each major stream or catchment. These notes are derived following an analysis of the collated fish data, from the observations of the authors, and following discussions with local freshwater fish experts, notably Paul Fisher (NCC), Martin Rutledge (DoC), Neil Deans (F&GNM), Lawson Davey (F&GNM) and Rhys Barrier (F&GNM). The notes fit into three general categories; (i) Fish distribution and diversity including comments on population patterns, (ii) fish spawning areas and likely viability and (iii) problems that are likely to affect the ecology of the various rivers examined. Recommendations are then made to amend gaps in the understanding of fish communities and spawning patterns within the NCC boundaries, with specific attention to the identification of fish passage barriers.

## **2. Supplementary Information**

Where relevant, reports containing useful supplementary information are referenced within the notes presented. Not referenced, but highly relevant is Rutledge (2011) titled "Habitat enhancement opportunities for inanga in Jenkins, Orphanage, Poorman Valley and Saxton Waterways, Nelson City Council". This report outlines extensive and useful information as well as recommendations for improvements for the major streams flowing across the Stoke Fan, paying particular attention to inanga.

## **3. Overview of fish distribution and diversity**

Of the 65 different species of fish found within the fresh waters of New Zealand, 24 have been recorded within the NCC boundaries. They include; two species of eel, five species of bully, five species of galaxiid, two salmonids, seven species with strong links to the coastal environment, two pest fish, and the freshwater crayfish. A full list of these species and their common names can be seen in Table 1. The distribution of these species throughout the NCC region is not even and probably reflects various species habitat preferences and migratory ability, the ecological limitations of the various streams, both natural and anthropogenic, and barriers to fish movement. A review of species diversity for each stream or catchment can be seen in Table 2.

**Table 1.** Common and scientific names of the fish species recorded from the waterways within the jurisdiction of the NCC (1965 to 2014). Species codes used in Table 2 are also included.

<b>Common name</b>	<b>Scientific name</b>	<b>Species Code</b>
Longfin eel	<i>Anguilla dieffenbachii</i>	angdie
Shortfin eel	<i>Anguilla australis</i>	angaus
Common bully	<i>Gobiomorphus cotidianus</i>	gobcot
Redfin bully	<i>Gobiomorphus huttoni</i>	gobhut
Giant bully	<i>Gobiomorphus gobioides</i>	gobgob
Bluegill bully	<i>Gobiomorphus hubbsi</i>	gobhub
Upland bully	<i>Gobiomorphus breviceps</i>	gobbre
Inanga	<i>Galaxias maculatus</i>	galmac
Banded kokopu	<i>Galaxias fasciatus</i>	galfas
Giant kokopu	<i>Galaxias argenteus</i>	galarg
Shortjaw kokopu	<i>Galaxias postvectis</i>	galpos
koaro	<i>Galaxias brevipinnis</i>	galbre
Brown trout	<i>Salmo trutta</i>	saltru
Rainbow trout	<i>Oncorhynchus mykiss</i>	oncmyk
Torrentfish	<i>Cheimarrichthys fosteri</i>	chefos
Lamprey	<i>Goetria australis</i>	geoaus
Smelt	<i>Retropinna retropinna</i>	retret
Yelloweye mullet	<i>Aldrichetta forsteri</i>	aldfor
Grey mullet	<i>Mugil cephalus</i>	mugcep
Black flounder	<i>Rhombosolea retiaria</i>	rhoret
Cockabully	<i>Grahamina nigripenne</i>	graham
Tench	<i>Tinca tinca</i>	tintin
Gambusia	<i>Gambusia affinis</i>	gamaff
Freshwater crayfish	<i>Paranephrops planifrons</i>	parane

**Table 2.** The species of freshwater fish present within each of the streams and river catchments described in this report. Full names for the species codes used in this table can be found in Table 1.

	angdie	angaus	gobcot	gobhut	gobgob	gobhub	gobbre	galmac	galfas	galarg	galpos	galbre	saltru	omcmyk	chefos	geoaus	retret	aldfor	mugcep	rhoret	graham	tintin	gamaff	parane	
Roding	✓			✓			✓					✓	✓											✓	6
Saxton	✓	✓	✓	✓	✓			✓	✓			✓						✓	✓					✓	11
Orchard	✓	✓	✓	✓	✓			✓	✓			✓												✓	9
Orphanage	✓	✓	✓	✓	✓			✓	✓		✓	✓			✓		✓	✓	✓	✓		✓	✓	✓	17
Poorman Valley	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓							✓	16
Arapiki	✓	✓		✓				✓	✓																5
Jenkins	✓	✓	✓	✓			✓	✓	✓			✓	✓					✓						✓	11
Maire	✓								✓																2
York	✓	✓		✓					✓															✓	5
Saltwater	✓	✓			✓																				3
Little Go									✓															✓	2
Maitai	✓	✓	✓	✓	✓	✓		✓				✓	✓					✓	✓		✓	✓		✓	16
Brook	✓	✓	✓	✓			✓	✓	✓			✓	✓					✓						✓	11
Sharland	✓			✓			✓						✓							✓				✓	6
Maitai S.Branch	✓		✓	✓								✓	✓											✓	7
Maitai N.Branch	✓						✓					✓	✓												4
Oldham	✓	✓		✓				✓				✓	✓					✓						✓	8
Todd Valley	✓	✓	✓	✓				✓				✓						✓	✓			✓			11
Hillwood	✓	✓							✓									✓	✓					✓	6
Delaware Bay	✓	✓		✓				✓	✓															✓	6
Wakapuaka	✓	✓	✓	✓	✓		✓	✓				✓	✓		✓							✓		✓	12
Lud	✓		✓	✓	✓		✓						✓											✓	7
Teal	✓						✓					✓	✓	✓										✓	6
Whangamoa	✓	✓		✓			✓	✓	✓			✓	✓			✓								✓	9
North Nelson																									0

#### **4. Overview of fish spawning**

Outside of brown trout and inanga, no records exist for freshwater fish spawning within the NCC administered streams. A recent programme to map the sites where, and the extent to which, inanga spawn has provided almost all of the current data on inanga spawning within the NCC administered streams. Inanga are known to spawn at the base of submerged streamside vegetation within the tidal zone of streams on a king tide during March, April and May, near the maximum extent of the tidal wedge. The spatially restricted nature of inanga spawning makes identification of spawning sites and the assessment of spawning success a relatively easy task when compared to the examination of the spawning of New Zealand's other freshwater fish species. Some brown trout spawning surveys have occurred within the Maitai River catchment, but by enlarge, conclusions as to the likely spawning areas and spawning success of brown trout in both this and preceding reports has been based on the knowledge of the stream conditions required for successful brown trout spawning. This is also the case for all of the assumptions on the locations for, and viability of native fish spawning, outside of inanga, presented in this report. The difference however, is that the current knowledge of the spawning ecology of New Zealand's native freshwater fish fauna pales in comparison to the respective knowledge embracing brown trout. Where possible, this report has drawn on published reports and anecdotal evidence relating to native fish spawning to draw conclusions around the likely locations for, and the viability of, fish spawning. However, in some cases the rule of thumb 'if it's there, then it's probably spawning' has been used. In many ways this is a foolish approach to reporting fish spawning, however, it does offer a safe assessment option until such time as species and site specific spawning surveys can occur, or the knowledge around native fish spawning develops.

#### **5. A collection of notes on fish**

##### **5.1 Waimea River Streams**

###### **5.1.1 Roding River**

###### Species diversity

Longfin eel, upland bully, koaro, brown trout and crayfish are recorded from the NCC regions of the Roding River catchment. One Redfin bully is recorded from Hilton Creek, a tributary in the upper catchment. Recent surveys from 2014 suggest a robust population of koaro is present in the upper reaches.

###### Fish spawning

It is likely that upland bullies and koaro spawn throughout their respective ranges.

###### Problems

The Roding River water abstraction weir has historically been a barrier to the upstream migration of some species, however modifications were made in 2001 to create a permanently wetted area on the edge of the weir to allow easier fish passage.

###### Recommendations

- Fish surveys should aim to examine gaps in the record from the upper catchment and to assess the extent to which the water intake weir acts as a fish passage barrier.

## 5.2 Stoke Streams

### 5.2.1 Saxton Creek

#### Species diversity

Both longfin and shortfin eels are recorded from Saxton Creek, as well as three species of bully; common, redfin and giant. Smelt and yelloweye mullet have been recorded from the lower reaches. Smelt have not been recorded further upstream than the intake for the old Daelyn pond. Although adult koaro and adult banded kokopu are found in the upper reaches of the Saxton Creek catchment, only the juvenile whitebait of these species have been recorded in the reaches within the jurisdiction of the NCC. Inanga are common throughout, often reaching large sizes (120mm+), and crayfish have been recorded from a number of sites. There has never been any record of upland bullies within Saxton Creek. During spring, high numbers of whitebait are often present in large schools. At certain times of the year a large proportion of these fish are juvenile banded kokopu. No records exist from the South Branch Reservoir or upstream of it.

#### Fish spawning

Good numbers of large inanga are often present in Saxton Creek, but spawning is likely to be restricted by the available habitat. Very restricted spawning is recorded from a small area approximately 100m upstream of the Main Road Stoke culvert. Future stream work associated with the development of the Saxton Field Sport Complex should focus on restoring spawning habitat within the lower reaches of Saxton Creek. Ripe redfin bullies have been found in the section of stream opposite the old Daelyn pond suggesting spawning in this area is likely although may be restricted by a lack of cobble sized substrate.

#### Problems

The habitat within the marine influenced zone of Saxton Creek downstream of Main Road Stoke is severely degraded. The water quality throughout the NCC administered reach is of poor quality with high nutrient and sediment levels common. Opportunities for remediation and restoration of habitat and water quality are possible as part of the Saxton Field Sport Complex development, including the development of habitat suitable for banded kokopu, giant kokopu and giant bullies, the presence of these species should be monitored as development progresses.

#### Recommendations

- Fish surveys should aim to examine fish populations in the South Branch Reservoir and fish passage beyond it.
- Fish surveys should monitor fish populations in concert with the Saxton Field Sport Complex development.
- Inanga spawning should be monitored, and an assessment of possible opportunities for the rehabilitation of spawning habitat should occur.

### 5.2.2 Orchard Stream

#### Species diversity

Orchard Stream shows the high level of species diversity often found within small coastal streams despite its urban setting. Common, redfin and giant bully species have been recorded as have inanga, banded kokopu, koaro and crayfish. Koaro habitat is uncommon; only two individuals are recorded from an area with some riffle structure downstream from Main Road Stoke. There is good banded kokopu and inanga habitat near Wordsworth Place and good numbers of these species

within this area reflect this. Riparian cover throughout the mid reaches is good. With additional in stream structure such as anchored woody debris, and more riparian planting, the lower reaches downstream of Nayland Road could become suitable for giant kokopu and giant bullies. There are no records of upland bullies within Orchard Stream.

#### Fish spawning

No inanga spawning has been recorded for Orchard Stream, although limited spawning is likely to occur downstream of Nayland Road. Some spawning habitat rehabilitation may be necessary and could be incorporated with the general in stream and riparian restoration of this lower reach. It is likely that the bully species present and banded kokopu spawn within the mid reaches of Orchard Stream.

#### Problems

Much of the upper catchment of Orchard Stream is culverted reducing the available habitat.

#### Recommendations

- Fish surveys should aim to explore the fish populations downstream of Nayland Road with a view to habitat enhancement.
- Inanga spawning should be investigated, and an assessment of possible opportunities for the rehabilitation of spawning habitat should occur.

### **5.2.3 Orphanage Stream**

#### Species diversity

Orphanage Stream has a high species diversity. The mid and lower reaches are dominated by eels, with a higher proportion of shortfin eels than other Nelson streams. Habitat within the tidal zone is reduced by the presence of the Whakatu Drive culvert, although species diversity is good here including the only record of grey mullet within the NCC region. The reach between the tidal extent and Orphanage Pond appears to be starved of gravel, resulting in some deep channels and pools. With habitat enhancement, such as the placement of anchored woody debris habitat for giant kokopu and giant bullies could be created. Orphanage Pond provides good habitat for eel and inanga. Tench and gambusia have been found within and near to Orphanage Pond, and eradicated in the past. The mid reaches of Orphanage Stream above Suffolk Road are notable for records of torrentfish, koaro and banded kokopu. Sub adult koaro and banded kokopu presence within this reach may be seasonal, or at least quite variable. Torrentfish numbers throughout Orphanage Stream are low, and they are absent from the lower reaches. Inanga numbers are often high especially during the summer months with large schools often seen down stream of Orphanage Pond and up stream of Saxton Road. No smelt have been recorded up stream of Orphanage Pond. Giant, common and redfin bullies are common throughout the lower and mid reaches as are crayfish. The upper Reaches beyond Bridgwater Lane and including the un-named tributary at Montebello Avenue are likely to provide relatively intact and unmodified habitat for banded kokopu and koaro, and one large giant kokopu (250mm) is recorded from near Suffolk Road having most likely originated from either of these locations. The extent of the fish populations within the un-named tributary at Montebello Ave is unknown but the habitat within this stream appears excellent with good riparian vegetation, stream structure and in stream cover. The fish populations within Orphanage Stream beyond the old hospital grounds are unknown, but this area may be important for koaro, banded kokopu and redfin bullies. No upland bullies or brown trout are recorded from Orphanage Stream.

#### Fish spawning

Ripe redfin and common bullies are common throughout the lower and mid reaches during winter and spring and spawning is likely. Inanga have been recorded spawning upstream of Whakatu Drive, but spawning is probably hindered by the channelization of the tidal reach. The enhancement of spawning habitat through bank excavation and bench creation may be possible. The management of riparian vegetation within this reach such as maintaining no-mow/spray areas should see the development of spawning habitat. Ripe koaro are recorded from the lower reaches of the un-named tributary at Montebello Avenue. Spawning by koaro and banded kokopu is likely within this tributary, and good riparian cover makes egg viability probable. Spawning surveys for these species within this tributary would be of interest.

#### Problems

Possible fish passage barriers exist at the outlet of Orphanage Pond, at the culvert over Saxton Road, at in stream rock weirs above Suffolk Road during low flows, at the hydrological weir up stream of Suffolk Road, and at a farm crossing approximately 500m up the un-named tributary at Montebello Avenue. The outlet of Orphanage Pond may be a barrier to smelt as very few are recorded upstream. Monitoring of fish populations near the hydrological weir, and for the presence of inanga at upstream sites suggests that the hydrological weir is not a barrier to poor swimming species such as inanga. High summer water temperatures into the low twenties are common and stress associated with times of extended low flow, and times of peak flow from urban run-off is likely for more sensitive species. In stream work following flood damage in 2011 and 2012 is likely to have been detrimental at least in the short term. Pool habitat within the mid reaches is limited. Continued housing development in the upper reaches is likely to have negative effects on stream habitat and water quality and should be managed with care. Livestock have access to Orphanage Stream in the upper reaches causing erosion and sedimentation. The provision of generous riparian margins within developed areas will help, and all reaches of Orphanage Stream would benefit from continued riparian planting.

#### Recommendations

- Fish surveys should aim to examine fish populations within the unnamed tributary at Montebello Avenue, and within the reaches upstream of Bridgewater Lane.
- The known inanga spawning area above Whakatu Drive should be monitored and assessed for enhancement opportunities.
- Spawning surveys for banded kokopu and koaro could occur within the unnamed tributary at Montebello Avenue.
- Fish surveys should examine the effects of known fish passage barriers and the efficacy of any modifications.
- Fish surveys should examine any changes to fish populations following in stream excavation and monitor recovery patterns.

### **5.2.4 Poorman Valley Stream**

#### Species diversity

Poorman Valley Stream has high species diversity. Five species of bully and five species of galaxiid have been recorded from its waters. Longfin eels dominate the eel population, and are almost the only species of eel present upstream of Main Road Stoke. The tidal reach remains fairly intact as most of it is downstream of Whakatu Drive, and although un-surveyed, is likely to contain species that are common to the tidal zones of other Nelson streams such as yelloweye mullet and black flounder. The lower reaches from Whakatu Drive to Nayland Road contain five species of bully,

common, redbfin, giant, upland and small numbers of bluegill bullies. The population of redbfin bullies within this reach is robust, and some large individuals (100mm+) have been recorded. One giant kokopu is recorded from a pool under a large willow upstream of Nayland Road in an area of relative seclusion shaded by mature trees. Generally however, giant kokopu habitat is restricted due to lack of pool habitat. There is one record of a lamprey within Poorman Valley Stream captured near Nayland College, assumed to be heading upstream to spawn within the upper catchment. From Nayland Road upstream to The Ridgeway good populations of large redbfin bullies, reflect the larger substrate size present and slightly steeper gradient of the stream. Small sized trout are common throughout Poorman Valley Stream, some of which would tempt a light rod and a delicate fly. Inanga have been recorded as far upstream as Marsden Valley, but smelt have not been recorded beyond main Road Stoke. Crayfish are common throughout. Adult koaro can be found from Neal Avenue upstream within steeper riffle sections and rock weirs. Sub adult koaro and banded kokopu presence in lower Marsden Valley may be seasonal, or at least quite variable. Upstream of Sanctuary Drive high numbers of koaro and banded kokopu have been recorded, up to 0.3 to 0.4 fish per lineal meter of river, with some large koaro individuals exceeding 150mm recorded. Two shortjaw kokopu individuals were salvaged during stream work near Sanctuary Drive. Bullies become rare upstream of The Ridgeway. The fish populations upstream of the quarry within the bush catchment beyond Marsden Valley Road are unknown but are likely to contain high numbers of koaro, and possibly shortjaw kokopu as the steep gradient, pool, riffle, cascade structure seems conducive to their presence. Given their rarity, surveys for the presence of shortjaw kokopu in this area would be very interesting.

#### Fish spawning

Inanga spawning is recorded on the true right hand side of Poorman Valley Stream immediately downstream of Whakatu Drive. At present no vegetation exists on the true left due to repeated disturbance by machinery clearing gravel from the Whakatu Drive culvert, although historically it is almost certain that inanga would have spawned on the true left hand side of the stream as well. The modification of gravel removal methods to allow for the re-growth of suitable riparian spawning habitat would be highly beneficial and easily achieved. Vegetation management within this reach such as areas of no mowing/spraying would likely enhance the existing spawning habitat. Upland bullies and the diadromous bully species are likely to spawn throughout Poorman Valley Stream from the Ridgeway downstream. Upland bullies are likely to spawn upstream of The Ridgeway also. Brown trout are likely to spawn throughout Poorman Valley Stream as far upstream as the quarry. A spawning pair of brown trout has been recorded near Tussock Place. Koaro and banded kokopu may spawn throughout the catchment, but the viability of spawning may be limited by reduced riparian cover in many places. Koaro, banded kokopu and shortjaw kokopu spawning is likely to be most successful upstream of the quarry within the bush catchment. Monitoring the spawning of these species within this part of the catchment and throughout the upper reaches of Marsden valley would of interest.

#### Problems

The culvert at Main Road Stoke may be a barrier to the upstream migration of smelt. Riparian planting within Marsden Valley would be beneficial as housing development within this area is likely to negatively affect water quality.

#### Recommendations

- Fish surveys should aim to examine fish populations upstream of the quarry at the end of Marsden Valley Road.

- Fish surveys beyond Main Road Stoke should aim to determine to what extent the culver at Main Road Stoke creates a barrier to fish passage.
- Inanga spawning should be monitored downstream of Whakatu Drive, following the development of a plan to protect and enhance this spawning site from gravel removal practices.
- Spawning surveys for banded kokopu and koaro should occur within Marsden Valley, examining viability within and outside of the bush catchment.
- Brown trout spawning surveys should aim to examine important areas for brown trout spawning.

### **5.2.5 Arapiki Stream**

#### Species diversity

The lower reaches of Arapiki Stream are known to contain longfin eels, shortfin eels, inanga and redfin bullies. Good numbers of adult inanga have been observed upstream of Main Road Stoke. There are good numbers of adult banded kokopu near The Ridgway, however this habitat has been severely reduced by a recent subdivision which culverted much of it. A thorough summary of fish distribution can be found in Bloxham (2001a).

#### Fish spawning

It is possible that inanga may spawn within the tidal reaches of Arapiki Stream near Quarantine Road, but this has not been confirmed. Banded kokopu may spawn within what is left of the habitat near The Ridgway.

#### Problems

Arapiki Stream is culverted through much of its length, and numerous and varied fish passage barriers are present. A summary of these barriers can be found in Bloxham (2001a). Protection of the remaining banded kokopu habitat near The Ridgway should be a priority.

#### Recommendations

- Inanga spawning should be investigated near Quarantine Road, including an assessment of possible opportunities for the rehabilitation of spawning habitat.

## **5.3 Tahunanui Streams**

### **5.3.1 Jenkins Creek**

#### Species diversity

By comparison to Orphanage Stream and Poorman Valley Stream, species diversity within Jenkins Creek is relatively low. Of the bully species, only upland bullies and common bullies are recorded, with only upland bullies present in recent records. Both longfin eels and shortfin eels are recorded, and Jenkins Creek is notable for some very large longfin eels with individuals occasionally exceeding 1m in length. The tidal reach of Jenkins Creek is degraded, confined within steep stop banks, and with poor water quality. The lower reaches as far as Pascoe Street are dominated by small to medium sized shortfin eels. Some large schools of Inanga have been recorded near the tidal reaches of Jenkins Creek and smaller schools are recorded extending as far upstream as Annesbrook Drive. Whitebait have been recorded at the bottom end of Enner Glyn Valley. Surprisingly, no smelt have been recorded in the Jenkins Creek catchment, although yelloweye mullet are recorded within the tidal reaches. The mid reaches of Jenkins Creek from Pascoe Street to The Ridgway are relatively devoid of fish also, although in stream habitat appears more conducive to a wider range of fish

species. One small brown trout has been recorded from this reach. Adult banded kokopu and koaro individuals can be found upstream of The Ridgeway, but in low numbers. Little is known of the fish populations beyond the end of Enner Glyn Road. Crayfish are recorded throughout Jenkins Creek. A series of three small spring creeks drain land adjacent to the Nayland College playing fields, and run under Whakatu Drive joining Jenkins Creek within its tidal zone. These creeks are notable for their populations of banded kokopu and redfin bullies, the former, for the keen but careful observer, can be seen surface feeding during daylight hours under a veil of hawthorn and blackberry.

#### Fish spawning

Steep channel sides restrict Inanga spawning to a very small area of eroded bank not far up stream of Quarantine Road. Only a handful of eggs have been found. Upland bullies are likely to spawn throughout the catchment. It is possible that Inanga may spawn within tidal reaches of the spring creeks near Whakatu Drive but this area has never been surveyed, and banded kokopu spawning in these spring creeks as they flow through the paddocks opposite Nayland College playing fields is possible. Banded kokopu and koaro are likely to spawn upstream from the Ridgeway although viability may be compromised throughout much of Enner Glyn Valley due to a reduced riparian cover.

#### Problems

There are a series of small barriers to fish passage within Enner Glyn Valley that are unlikely to restrict the passage of climbing species. A barrier to fish passage upstream of Newman Drive is expected to be addressed sometime during 2014/2015. A belt and rope fish ramp over a ford exists at the top of Inner Glyn Valley which may need further work. Livestock grazing is a threat to the riparian zone and stream bed upstream of Newman Drive. Poor water quality and stress associated with summer low flows may be a restriction to some species within the lower reaches. There is evidence of point source pollution in the lower reaches downstream of Pascoe Street and gravel extraction following floods has historically not followed best practice guidelines.

#### Recommendations

- Fish surveys should aim to establish fish populations upstream of Newman Drive and consider any effect of downstream fish passage barriers.
- Inanga spawning should be investigated at Quarantine Road and within the tidal reaches of the spring creeks near Whakatu Drive, including an assessment of possible opportunities for the rehabilitation of spawning habitat.

### **5.3.2 Maire Stream**

#### Species diversity

Maire Stream is notable for its extremely high numbers of banded kokopu. Low numbers of longfin eels are also present. High numbers of exclusively banded kokopu whitebait have been recorded during the spring run. Some banded kokopu and higher numbers of longfin eels are recorded within the culverted lower reaches underneath of Parkers Road. Fungal infections are commonly seen infecting adult banded kokopu, and may be density related. The upper reaches of Maire Stream beyond Douglas Road are perennial and un-surveyed. Additional information on the Maire Stream catchment can be found in Tonkin & Taylor Ltd (2014).

#### Fish spawning

It seems probable that banded kokopu spawn throughout Maire Stream. Garden vegetation along the riparian margins may provide a useful surrogate for bush habitat, but spawning surveys and drift surveys of hatchlings would be of interest to examine viability.

### Problems

The lower reaches of Maire Stream are culverted. Barriers to fish passage exist underground near the Parkers Road / Annesbrook Drive intersection, and upstream of Annesbrook Drive, although neither barrier is likely to hinder climbing species such as banded kokopu. Natural bedrock waterfalls and shoots exist upstream of Annesbrook Drive. Maire Stream is subject to partial drying during summer low flows, however residual pools remain. Summer low flow and peak flood flows should be monitored in concert with subdivision development in the upper catchment. There was a sewer leak in the upper catchment May 2014.

### Recommendations

- Fish surveys should aim to explore the effects of summer low flow and peak flood flow following subdivision development in the upper catchment.
- Spawning and post-hatch drift surveys for banded kokopu would be of interest to examine viability within a non-bush catchment.

## **5.4 York Valley Streams**

### **5.4.1 York Stream**

#### Species Diversity

Species diversity within York Stream is depauperate at best. The lower and mid reaches contain mainly shortfin eels, with some longfin eels and a few crayfish. One redfin bully is recorded from a location near Victory School. One large and lonely banded kokopu (190mm) is recorded within Bishopdale Reserve and a sub adult (90mm) is recorded from just downstream of the retention dam. A population of banded kokopu can be found within a tributary flowing adjacent to Emano Street. Although culverted in its lower reaches, banded kokopu have been recorded throughout this tributary as far up stream as Pipers Park. Crayfish, congregating into strange groups, are recorded from within the retention pond alongside Market Road. The upper catchment of York Stream beyond the quarry is un-surveyed.

#### Fish Spawning

Some banded kokopu spawning may occur within the Emano Street tributary.

#### Problems

The low number of species recorded despite apparently suitable habitat within York Stream suggest that more sensitive species are probably restricted by extremely poor water quality. York Stream is also channelised with high sides throughout most of its mid reaches which may magnify flood effects. The lower reaches are culverted. Records of banded kokopu mortality near Pipers Park are likely to be flood related, and habitat enhancement could easily occur within this small corner of the catchment. Significant fish passage barriers occur downstream and upstream of Waimea Road and at the end of Westley Place. A summary of fish passage barriers can be found in Bloxham (2001b).

#### Recommendations

- Fish surveys should aim to examine fish populations in the upper catchment and assess any potential limitations by downstream passage barriers.

### **5.4.2 Saltwater Creek**

#### Species diversity

Saltwater Creek is effectively a storm water drain that runs under Vanguard Street and exists below Anzac Park where it is joined by York Stream. It remains an open, tidal waterway for approximately

600m before meeting the Maitai River upstream of SH6. Species diversity is very low within Saltwater Creek, but the tidal reaches are un-surveyed. Longfin eels, shortfin eels and one giant bully have been recorded from within the lower reaches of the Saltwater Creek Culvert.

#### Fish Spawning

It is unlikely that much fish spawning occurs within Saltwater Creek. The tidal extent is located well upstream of the culvert outlet.

#### Problems

All but the low tidal reaches of Saltwater Creek are culverted. Water quality is likely to be influenced by urban storm water discharge.

#### Recommendations

None

### **5.4.3 Little Go Stream**

#### Species diversity

Very little information exists. Little Go Stream exists as an open waterway from the Grampians to Franklyn Street and is known to contain banded kokopu and crayfish. It is culverted under Nelson College but opens briefly at 270 Rutherford Street where longfin eels have been recorded. Little Go Stream eventually drains into Saltwater Creek below Anzac Park.

#### Spawning

Banded kokopu may spawn in the upper catchment.

#### Problems

There are barriers to fish passage within the mid reaches and at Franklyn Street. Water quality in the mid-lower reaches likely to be affected by urban runoff.

#### Recommendations

- Fish surveys should aim to examine fish populations upstream from Nelson College, and assess possible habitat enhancement opportunities.
- Downstream fish passage barriers should be assessed and modified where necessary.

## **5.5 Maitai River Catchment**

### **5.5.1 Maitai River**

#### Species diversity

The Maitai River has high species diversity. Longfin eels are the dominant eel species present. High numbers of giant bullies, common bullies and redfin bullies are recorded mainly from the tidal and lower reaches although common and redfin bullies are recorded as far upstream as the Maitai River Dam. Some very large (150mm+) giant bullies are recorded from the lower reaches of the Maitai River near Riverside Pool. Yelloweye mullet, inanga and smelt are all recorded in the tidal and lower reaches often in high numbers. Riffles within the lower reaches are notable for records of torrent fish and bluegill bullies. Some large longfin eels (1m+) and Brown Trout (500mm+) have been recorded between the Collingwood Street Bridge and the Nile Street Bridge. Brown trout biomass has been recently recorded within the reach as 1.16g/m<sup>2</sup> (Fish & Game Nelson/Marlborough drift dive records 2002 to 2010). Records of inanga extend as far upstream as the Matai Campground while smelt have been recorded above the golf course. Adult koaro have been recorded as far downstream as the almond tree ford and can be found in low numbers right up to the Maitai Dam. Crayfish are recorded from locations throughout the Maitai River. Small to medium sized brown

trout are also recorded throughout, with recent surveys suggesting a biomass of 0.17g/m<sup>2</sup> near Pole Ford (Fish & Game Nelson/Marlborough drift dive records 2002 to 2010). Historic records suggest numbers of brown trout were higher in the past. A thorough summary of brown trout records, spawning patterns, flow requirements and threats, as well as information on the distribution native fish species within the Maitai River catchment can be found in Crowe et al, 2004.

#### Fish spawning

Inanga spawning is recorded upstream of the Collingwood Street Bridge on the true right hand side bank opposite 4 Shakespeare Walk. Most of the adjacent bank is rock armoured with little vegetation and unsuitable for inanga spawning. Bully species are likely to spawn throughout their respective ranges and torrent fish are likely to spawn within the Maitai River somewhere although little is known of their spawning behaviour, and it is speculated that it may involve a migration. Koaro may spawn within the river upstream of almond tree ford, although successful spawning may be limited to areas with good riparian cover. Brown trout spawning is recorded from the Sharlands Creek confluence upstream although spawning is likely to be limited and sporadic (Fish & Game Nelson/Marlborough spawning records 1995 to 1996). Recently emerged brown trout have been recorded near almond tree ford.

#### Problems

Fish barriers exist at the almond tree flat ford and at a ford within the grounds of the Maitai River Golf Course. Water quality may be detrimentally affected by the operation of the Maitai Dam; this is covered in more detail in recent Cawthron reports.

#### Recommendations

- Fish surveys should aim to examine fish populations upstream and downstream of the almond tree flat and Maitai Golf Course fords to grow a data base relating to the passage of fish presently and following remediation.
- An ongoing fish survey programme at representative locations throughout the Maitai River should be designed to assess native fish and brown trout population dynamics over time and as they may relate to any changes in the Maitai River following the development of the Maitai River rehabilitation programme. This could include electric fishing, spotlight surveys, and also the development of the current drift dive programme.
- Inanga spawning should be investigated near Shakespeare Walk, including an assessment of possible opportunities for the enhancement of spawning habitat.
- Brown trout spawning surveys should aim to examine important areas for brown trout spawning.

### **5.5.2 The Brook**

#### Species Diversity

Longfin eels are the dominant eel species recorded in The Brook, often in high numbers. Upland bullies are recorded from locations throughout The Brook, as far upstream as the old book dam, but seem to exist in low numbers upstream of the Brook Street Dairy. Common Bullies are rare, with records extending no further upstream than Tantragee Road. Inanga and smelt have both been recorded above the concrete section of the river channel, but no further upstream than Burn Place. One torrent fish is recorded just upstream of the confluence of The Brook with the Maitai River within a rock weir. Koaro are recorded in low numbers throughout the lower and mid reaches, however recent surveys suggest high numbers upstream of the Brook Valley Camp Ground, with densities up to 0.3 adult fish per lineal meter of river (NCC SOE records 2014). Juvenile banded

kokopu have been recorded within the Nile Street culvert, and near the Manuka Street ford. Six adult banded kokopu were salvaged from a pool above the old dam wall at the Brook Sanctuary car park following a large flood in 2011. Brown trout of small to medium size are recorded throughout The Brook as far upstream as the old brook dam, whereupon their upstream journey is abruptly terminated. Within the Brook Sanctuary longfin eels, shortfin eels, koaro and crayfish have been recorded. Further surveys within the sanctuary would be interesting to investigate the presence or absence of shortjaw kokopu and for brown trout as historical Acclimatisation Society records refer to releases in the top of the Brook Stream catchment.

#### Fish spawning

Upland bullies and koaro are likely spawn throughout their ranges, however, viable koaro spawning is likely to be restricted to the catchment within the Brook Sanctuary under an intact riparian canopy. Koaro spawning surveys within the Brook Sanctuary would be of interest to the many visitors. Brown trout have been recorded spawning throughout The Brook as far upstream as the old Brook Dam (Fish & Game Nelson/Marlborough spawning records 1996).

#### Problems

The concrete channel extending from The Brook Dairy to Sowman Street probably hinders fish passage for a number of species. Poor swimming species may struggle with flow rates, and all species are likely to be subject to high levels of stress and predation due to lack of cover. This concrete channel also transfers heat to the stream during the summer months. There is a general lack of riparian cover downstream of Motor Camp to the Maitai River confluence and urban runoff is likely to have degraded the water quality in the lower reaches.

#### Recommendations

- Fish surveys should aim to examine the fish populations within the Brook Sanctuary.
- Fish surveys upstream, downstream and within the concrete channel section should aim to identify the effects this channel has on fish passage and include an assessment of potential remedial measures.
- Spawning surveys for koaro within the Brook Sanctuary would be interesting.
- Brown trout spawning surveys should aim to examine important areas for brown trout spawning.

### **5.5.3 Sharland Creek**

#### Species diversity

Sharlands Creek is notable for records of torrentfish and redfin bullies. Longfin eels, upland bullies, koaro, brown trout and crayfish have also been recorded, but generally in low numbers. Numbers of koaro and brown trout appear to have been historically greater. Records from the upper reaches of the catchment above the confluence of Sharland Creek and Packers Creek are lacking, but would be of interest to assess the fish populations of a catchment predominantly planted in *Pinus radiata* and the potential effects of forest harvest.

#### Fish spawning

Sharland Creek and Packers Creek were historically acknowledged as important brown trout spawning streams. Sharland Creek was being used as early as 1881 to raise trout and perch for the Acclimatisation Society. However, the extent and success of recent brown trout spawning is largely unknown, but is assumed to be greatly reduced as a result of spawning habitat degradation following forest harvest. Brown trout spawning surveys in both creeks would be of interest, as would an assessment of the possibility for brown trout spawning habitat rehabilitation, or the construction

of artificial spawning channels. Koaro, upland bullies and redfin bullies are likely to spawn throughout the catchment. Spawning surveys for koaro especially, and comparison to spawning within native catchments, such as The Brook, would be of interest.

#### Problems

The impacts of plantation forests and associated harvest are likely to have degraded the Sharland Creek catchment. The impact of both short and long term forestry related effects need to be better understood. There is a barrier to fish passage at the first ford crossing of Packers Creek.

#### Recommendations

- Fish surveys should aim to develop the current understanding of fish populations within Sharland and Packers creeks. They should be designed so as to allow an assessment of the potential effects the ford at the bottom of Packers Creek may have to fish passage, and to allow an investigation into any effects forestry operations may be having on stream ecology. These surveys should be linked to other assessments of stream health such as water quality monitoring or macro invertebrate indices.
- Brown trout spawning surveys and/or juvenile abundance surveys should aim to examine the current extent brown trout spawning.
- Spawning surveys for koaro would be interesting to assess galaxiid spawning within exotic forest plantations.

### **5.5.4 Maitai River South Branch**

#### Species diversity

Longfin eels are the only species of eel recorded from the Maitai River South Branch. Both redfin bullies and common bullies are recorded relatively high up in the catchment. Very few koaro are recorded, and only one individual has ever been noted from the South Branch outside of its tributaries. There are no records of koaro from historical records prior to the construction of the Maitai Dam. Densities of koaro may however be higher in some of the tributaries of the Maitai River South Branch, for instance, there were four individuals recorded in a survey of the Wrey Stream in 2003, however, none have been recorded from surveys of either Sclanders or Beachamp streams. Further investigation of koaro distribution would be of interest, and may provide a useful comparison to the Maitai River North Branch. Brown trout are present in almost all surveys, with young of year and yearlings recorded throughout and into the major tributaries. The brown trout population above the water intake weir near the Maitai Dam may be self-sustaining.

#### Fish spawning

It is probable that upland bullies, koaro and brown trout spawn throughout their respective ranges.

#### Problems

The South Branch water intake weir may be a barrier to fish passage. Fish passage over this weir is investigated in detail in Stark and Hayes (1996)

#### Recommendations

- Fish surveys should aim to better understand the fish populations within the Maitai River South Branch and its tributaries.

### **5.5.5 Maitai River North Branch**

#### Species diversity

Surveys suggest that numbers of longfin eels appear unusually low in the Maitai River North Branch, especially by comparison to numbers in the Maitai River South Branch. The combined data is too

deficient however to draw robust conclusions, and more sampling is recommended. Koaro are present in low numbers, but, are more numerous than in the Maitai River South Branch. Small brown trout are recorded in good numbers, forming a self-sustaining population above the Maitai Dam. Crayfish are absent from all surveys. Overall, there is scant fish data from the Maitai River North Branch.

#### Fish Spawning

It is probable that upland bullies, koaro and brown trout spawn throughout their respective ranges.

#### Problems

The Maitai Dam spillway and possibly the dam itself create potential barriers to the passage of fish species into the Maitai River North Branch. Longfin eel numbers appear to be unusually low upstream of the Maitai Dam, but by comparison to the Maitai River South Branch, koaro numbers appear unaffected, however, more survey work is recommended.

#### Recommendations

- Fish surveys should aim to explore the fish populations above the Maitai Dam, and pay particular attention to any effects the dam may be having on fish passage.

## **5.6 Nelson Haven Streams**

### **5.6.1 Oldham Stream**

#### Species diversity

Large schools of inanga are recorded in the lower reaches of Oldham Stream and smelt are also present in lower numbers. There is a population of banded kokopu recorded from a small tributary in the north-eastern corner of the lagoon. Redfin bullies are the only species of bully recorded. Although only juvenile koaro are recorded below the culverted section at Winton Place, adult koaro have been found upstream of this point. One small, but presumably adventurous brown trout was recorded not far downstream of Winton Place. Crayfish have been recorded from the lower and mid reaches of Oldham Stream. Fish records above Naumai Place are unknown, and there are no records from two other branches of Oldham Stream either.

#### Fish spawning

No inanga spawning has been recorded in Oldham Stream, despite some suitable spawning habitat within Corder Park. Enhancement of spawning habitat within this area is possible and recommended. Redfin bullies are likely to spawn throughout their range and koaro may spawn upstream of Winton Place, however spawning viability may be reduced by vegetation clearance and subdivision development. Riparian restoration is recommended.

#### Problems

Subdivision development in the upper reaches is likely to degrade habitat and water quality. There is a barrier to fish passage as the Oldham Stream enters the culvert at the top of Naumai Street.

#### Recommendations

- Fish surveys should aim to explore the fish populations upstream of Naumai Place with a view to habitat enhancement within the adjacent subdivisions.
- Fish passage through the Winton Place and Naumai Street culverts should be assessed.
- Inanga spawning should be investigated within Corder Park, and an assessment of possible opportunities for the rehabilitation of spawning habitat should occur.

## 5.6.2 Todd Valley Stream

### Species diversity

Todd Valley Stream has a large tidal zone extending throughout the Wakapuaka Flats as far as SH60 and large schools of up to 500 inanga have been recorded within this area (Olley, 2014). Yelloweye mullet and smelt have also been recorded and large longfin eels have been observed feeding on inanga during high tides. Upstream of SH60 redfin bullies, common bullies and crayfish have been recorded. The reach of Todd Valley Stream from SH60 to Biggsburn Way runs predominantly through farm land, with some sections of intact weedy riparian vegetation. This reach is dominated by eels with some large (1m+) individuals present. Banded kokopu are present throughout this reach in low numbers. The reach above Biggsburn Way is subject to seasonal drying, but longfin and shortfin eels, inanga and juvenile koaro have been recorded. Banded kokopu are recorded throughout the lower and mid sections of Little Todd Valley Stream, however anecdotal evidence suggest numbers have declined following extensive flooding in 2011. The upper reaches of Little Todd Valley Stream are un-surveyed but may be home to koaro.

### Fish spawning

Inanga spawning is as yet un-recorded, but is likely to exist near the footbridge within the tidal reserve. The spawning habitat available may be influenced by the effects of flood scouring and tidal flow (Olley et al 2014). Banded kokopu are likely to spawn throughout their range. There are unconfirmed reports of a spawning pair of banded kokopu on a receding flood within Little Todd Valley just downstream of Todd Bush Road. Redfin and common bullies are likely to spawn throughout their respective ranges.

### Problems

The ecology of the tidal zone is probably influenced by the operation of tide gates on Boulder Bank Drive. There is a fish passage barrier downstream of Todd Bush Road on Little Todd Valley Stream. Riparian vegetation is lacking throughout the lower reaches.

### Recommendations

- Fish surveys should aim to explore the fish populations within Little Todd Valley Stream.
- Fish passage through the Todd Valley Road culvert should be assessed.
- Inanga spawning should be monitored within the Wakapuaka Flats with particular thought given to the operation of the tide gates under Boulder Bank Drive and to the possible opportunities for the enhancement of spawning habitat.

## 5.6.3 Hillwood Stream

### Species diversity

Overall, Hillwood Stream is poorly surveyed and the species and abundance of fish within it are largely unknown. Inanga and Yelloweye mullet are recorded in the tidal reaches. Crayfish, longfin and shortfin eels, and banded kokopu have been recorded within a small tributary at Kanuka Rise.

### Fish spawning

Inanga spawning is as yet un-recorded. Banded kokopu may spawn throughout their range.

### Problems

The ecology of the tidal zone is probably influenced by the operation of the tide gates on Boulder Bank Drive. The lower and mid reaches of Hillwood Stream are negatively affected by the adjacent farming operation, regular stream clearance and highway maintenance. Recent rainfall events have damaged adjacent pasture and ponding is a frequent occurrence. Long term drainage solutions are

required to avoid ongoing stream degradation. Hillwood Stream represents a good candidate for a lowland coastal stream restoration.

#### Recommendations

- Fish surveys should aim to explore the fish populations within the Hillwood Stream catchment with a view towards potential rehabilitation in the future.
- Inanga spawning should be investigated within the Wakapuaka Flats with particular thought given to the operation of the tide gates under Boulder Bank Drive and to the possible opportunities for the enhancement of spawning habitat.

## **5.7 Delaware Bay Catchment**

### **5.7.1 Delaware Bay Streams**

#### Species diversity

The small streams Crossing Cable Bay Road and entering into Delaware Estuary are generally steep, and often perennial. However, longfin eels, crayfish and banded kokopu have been recorded from them. A survey of the stream near Cable Bay Campground found longfin and shortfin eels, inanga and redfin bullies. Both adult and juvenile banded kokopu have been recorded within a small stream on Pepin Island at the top of a boulder beach just beyond the high tide mark. The low gradient coastal streams along Maori Par Road should be surveyed.

#### Fish spawning

Inanga spawning is known to occur within the tidal zone of an unnamed stream along Maori Par Road, and may also occur in other small streams flowing into Delaware Bay in this area. Banded kokopu and redfin bullies may spawn throughout their respective ranges.

#### Problems

The steepness of some streams combined with stock access has created some erosion and sedimentation problem.

#### Recommendations

- Fish surveys should aim to explore the fish populations within the low gradient coastal streams along Maori Par Road.

### **5.7.2 Wakapuaka River**

#### Species diversity

The Wakapuaka River contains a relatively high diversity of species in its mid and lower reaches as far upstream as the Lud River confluence. Four species of bully are present, common, redfin, giant and upland. Torrent fish have been recorded in the lower reaches only, and inanga have been recorded as far upstream as the Lud River confluence. The only banded kokopu recorded in the Wakapuaka River catchment was in a small tributary which joins the tidal zone of the Wakapuaka River near to Cable Bay Kayaks. Brown trout are recorded throughout, with some large (500mm+) individuals present. The lower and mid reaches were historically well regarded for brown trout fishing, however, the general consensus suggest that the fishery has declined over recent years. Longfin eels, redfin bullies, koaro, brown trout and crayfish have been recorded from Pritchards Stream. Only longfin eels, brown trout, koaro and crayfish have been recorded upstream of the Lud River confluence. Koaro are recorded as far upstream as Slaters Creek, but are likely to extend well into the upper tributaries. There are only two records of shortfin eels in the Wakapuaka catchment from the same small tributary which joins the tidal zone of the Wakapuaka River near to Cable Bay

Kayaks, as discussed earlier, and from the main stem of the Wakapuaka River near to the confluence of Pritchards Stream. No smelt have been recorded in the Wakapuaka River catchment.

#### Fish spawning

Inanga spawning is known to occur in the tidal reaches of the Wakapuaka River. Bully species and torrentfish are likely to spawn in the mid to lower reaches as far upstream as the Lud River confluence. Brown trout are likely to spawn throughout the mid reaches and into the headwaters, and koaro are likely to spawn upstream of the Teal River confluence.

#### Problems

Historically livestock have had access to the lower and mid reaches of the Wakapuaka River but this is gradually improving. Public access for trout fishing is restricted between Maori Par Road and Hira.

#### Recommendations

- Fish surveys should aim to better understand the fish populations within the lower reaches near Maori Par Road and within the upper catchment.
- Surveys of brown trout should aim to assess the current state of the fishery and identify key spawning areas.

### **5.7.3 Lud River**

#### Species diversity

Four species of bully are recorded from the Lud River. Redfin bullies and giant bullies have only been recorded from the lower reaches near to the confluence with the Wakapuaka River. Common bullies have been recorded as far upstream as the end of Lud Valley Road while upland bullies have been found throughout the Lud River including within the stream as it flows through the farmland beyond Lud Valley Road, often in high numbers. Crayfish and longfin eels are common throughout, but no shortfin eels have been recorded from any surveys. Small brown trout are relatively common within the lower reaches and have been recorded as far upstream as the end of Lud Valley Road.

#### Fish Spawning

Bullies and brown trout are likely to spawn throughout their respective ranges.

#### Problems

The Lud River experiences reduced water quality associated with farming and forestry practices. The continuation of riparian restoration is recommended.

#### Recommendations

- Fish surveys should aim to better understand the fish populations within the mid reaches of the Lud River.

### **5.7.4 Teal River**

#### Species diversity

The Teal River is notable for the only record of a rainbow trout in the NCC region. Small brown trout are recorded throughout, but not in high numbers. There are only two records of bullies within the Teal River. Only one upland bully and an unknown species of bully are recorded. Longfin eels are recorded throughout. Although koaro have only been recorded on two survey occasions, recent records suggest a robust population.

#### Fish Spawning

Koaro and brown trout are likely to spawn throughout their respective ranges.

#### Problems

Fairly pristine, with few problems.

## Recommendations

None

### **5.8 North Nelson Waterways**

#### **5.8.1 Whangamoia Catchment**

##### Species diversity

There are very few records from the Whangamoia River catchment. Only one record from the main stem of Whangamoia River, dated 1965, exists in which longfin eels, redfin bullies and brown trout were recorded approximately 1 Km upstream of the Collins River confluence. Three records exist for the Collins River, in which, longfin eel, Shortfin eel, redfin bully, brown trout, lamprey, banded kokopu and crayfish were observed. Only a single individual of both lamprey and banded kokopu are recorded. A survey in Frenchman's Stream found longfin eels, redfin and upland bullies, inanga and brown trout. The Whangamoia River is considered a trout fishery but little is known of its current state. Extensive survey work is required to understand the peculiarities of the Whangamoia River catchment.

##### Fish spawning

Inanga spawning has been recorded from a site at the extent of the high tide near a remnant stand of coastal alluvial forest. Brown trout are likely to spawn throughout, however any conclusions concerning native fish spawning is severely restricted due to the lack of records.

##### Problems

There is insufficient data to examine patterns in fish populations, however, the Whangamoia River and its tributaries are likely to be effected by forestry operations as much of the catchment is planted in *Pinus radiata*. Thorough fish surveys would be required to assess any impacts of reduced habitat quality. The Collins River weir is likely to be a barrier to upstream fish movement.

##### Recommendations

- Fish surveys should aim to explore the fish populations within the entire Whangamoia River catchment.
- Targeted surveys could examine the effects of plantation forestry.

#### **5.8.2 North Nelson Streams**

##### Species diversity

Nothing is recorded of the streams within the far northern realms of the NCC jurisdiction. Two catchments are worth considering for future survey work southwest of Cape Soucis. The streams flowing into Omokau Bay and Oananga Bays are worth examining. Their species composition may be more similar to the rich aquatic communities often found in the Marlborough Sounds, and they may be home to rare large bodied galaxiid species. Of further potential interest, examination of aerial photographs reveals that the Omokau Bay catchment has predominantly been planted in exotic forest, while the Oananga Bay catchment remains in intact or regenerating bush. An interesting paired comparison may then provide some clues as to the potential impacts of plantation forestry on stream systems.

##### Recommendations

- Fish surveys should aim to explore the fish populations within the Omokau Bay and Oananga bay catchments.

## 6. References

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