Report No:	REP11-08-07
File No:	W416
Date:	15 August 2011
Information Only – no decision required	

REPORT SUMMARY

Report to: Environment & Planning Committee

Meeting Date: 25 August, 2011

Report Author Trevor James, Resource Scientist

Subject: **The Health of Freshwater Fish Communities in Tasman District**

EXECUTIVE SUMMARY

This report summarises information gained from "State of the Environment" freshwater fish surveys carried out by Council and project partners from 2005-10. This information can be used to determine the appropriateness of particular activities in and around streams and identify streams of particularly high value that require greater protection from habitat disturbances. It will also assist making informed decisions in the Tasman Resource Management Plan (particularly Part IV) and with the processing of specific resource consent applications.

The overall aim of Council's Freshwater Fish monitoring programme is to compare the diversity and abundance of freshwater fish in streams of varying habitat condition. Habitat condition largely changes in response to riparian condition, land use and stream disturbance activity.

As part of this programme, a total of 247 sites were assessed on 89 individual streams from 2006-2010. Longfin eels/tuna were observed most frequently (75% of sites), followed by adult inanga (46%) and shortfin eel/tuna (45%). Longfin eel, is a species recognized as "at risk" and "in decline" nationally based on low levels of recruitment of elvers (young eels). In Tasman this is observed in trap and transfer operations. Inanga, common bully and shortfin eel have a greater tolerance to poor water quality and degraded habitat, and were found in lowland streams in farmland with silt-laden beds, intermediate in-stream cattle disturbance and streamside corridors dominated by pasture grasses. However, even these less- sensitive fish are found in much fewer numbers in streams or drainage ditches containing excessive aquatic plant growth or are dug out regularly.

Banded kokopu, koaro, shortjaw kokopu, giant kokopu, torrentfish, bluegill bully and redfin bully have been found in studies throughout New Zealand to be more sensitive to works in waterways. In these surveys in Tasman these species were also found to be absent or rare in sites where streamside vegetation has been removed, channels straightened or where there are high loads of fine sediment input by, for example, machinery or larger farm animals. These sensitive native fish species were observed in 21% of the sites surveyed, with 75% of these records being in the least disturbed

REPORT SUMMARY

streams. Giant kokopu, for example, are very rare in the region (there are only 44 known records of giant kokopu in the district since 1990). This rarity is due to the huge loss of their preferred habitat: lowland, deeper, slow-flowing streams associated with lowland wetlands (which are now also very rare within the region). Based on distribution patterns and abundance of native fish compared to trout, it would appear that trout and eels dominate larger waterways and other native fish appear to dominate smaller waterways that flow directly to the coast.

The general absence of sensitive native species from modified streams provide justification for implementing improved measures to better avoid, remedy or mitigate effects on habitats of native fish from activities, such as: drain clearance, stream straightening, cattle trampling, fine sediment discharges, riparian vegetation removal, urban stormwater discharges and other land uses impacting the beds and riparian zones of small order streams in the District. Avoiding, mitigating or remediating adverse effects on small lowland or spring-fed streams located within 10-15km of the coast are particularly important as these streams have both, the highest fish species abundance and diversity and the most vulnerable fish species.

Several survey results demonstrated the outstanding success of fish passage remediation projects and habitat restoration.

A full “State of the Environment” technical report is available that provides detailed information on particular catchments and results from studies of paired reference-impact sites, discussion about effects on particular fish species, discussion about effects of particular activities in streams, fish records overlaid on maps of predicted likelihood fish presence, migration calendars for particular species, maps of fish passage barriers and a list of sites with degraded habitat.

RECOMMENDATION/S

That the Committee adopt the draft resolution.

DRAFT RESOLUTION

THAT the Environment & Planning Committee receives this report entitled: The Health of Freshwater Fish Communities in Tasman District REP11-08-07.

Report No:	REP11-08-07
File No:	W416
Report Date:	15 August 2011
Information Only – no decision required	

Report to: Environment & Planning Committee
Meeting Date: 25 August 2011
Report Author Trevor James
Subject: **The Health of Freshwater Fish Communities in Tasman District**

1. Introduction

1.1 Tasman District Council has functions under the Resource Management Act to monitor and manage the life-supporting capacity and natural character of wetlands, lakes and rivers and their margins, as well as significant habitats for indigenous fauna and introduced sports fish such as trout and salmon. Along with water quality, fish and habitat are important indicators of the health of waterways.

1.2 The overall aim of Council's Freshwater Fish monitoring programme is to compare the diversity and abundance of freshwater fish in streams of varying habitat condition. Condition changes due to varying land use activity, differing states of riparian intactness and direct stream disturbance activities. This information can also be used to identify streams of particularly high value that may require greater protection from habitat disturbances. It will also be used in the Tasman Resource Management Plan Part IV and with the processing of specific resource consent applications. More specific objectives include:

- compare the diversity and abundance of freshwater fish in streams of varying habitat condition caused by various resource use activities, particularly works in the beds and banks of streams.
- assess the efficacy of stream rehabilitation projects, such as riparian plantings, and restoration at structures that present a barrier to fish migration
- provide baseline data from which to build a more complete picture of fish distribution and abundance patterns in the region.

1.3 This monitoring programme involved cooperation between TDC, Department of Conservation (DoC), and Fish and Game New Zealand Nelson Marlborough Region (F&G) for survey design and fieldwork. All three organisations have responsibility for the monitoring and management of fish populations under a range of legislation and have over-lapping objectives in this programme. Contract assistance was provided by Fish & Wildlife Services Ltd.

1.4 In Tasman there are 20 species of indigenous freshwater fish, fifteen of which migrate to and from the sea to complete their life cycle. Of these fish 11 species are classified as “in decline” by a recent independent review for Department of

Conservation. Three sport-fish are present in Tasman, the most abundant of which is brown trout.

1.5 Background

Trend analysis across New Zealand commissioned by Ministry for the Environment in 2009 has produced some concerning results for streams through pastoral and urban land. An index of biological integrity (IBI) was used for New Zealand fish communities, and accounts for the natural variation in fish communities caused by elevation and distance from the coast. IBI scores and number of species were significantly higher at sites in native vegetation than sites in pasture or urban catchments. Trends over the period from 1970 to 2007 show a significant reduction in IBI scores in pasture and urban sites, but a general increase at native forest sites (Figure 1)

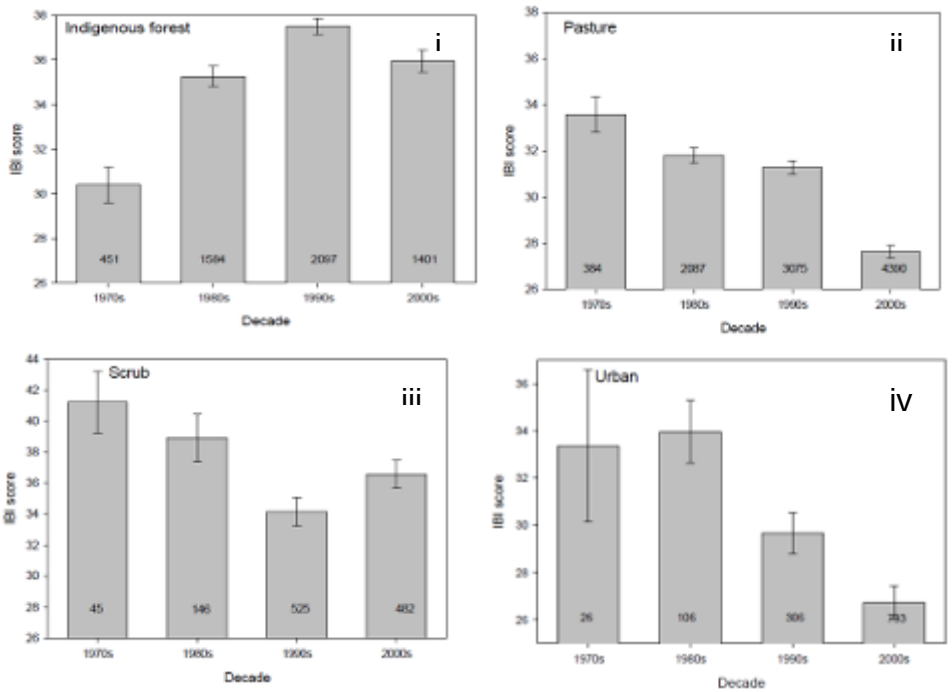


Figure 1: Average decadal Index of Biological Integrity scores for river environment classification (REC) land cover: (i) – Indigenous forest, (ii) – Pasture, (iii) – Scrub, (iv) – Urban. (Numbers per site inside bars) (Joy et al 2009).

A copy of a full report on this subject is available on request.

2. Methods of the "State of the Environment" Fish Monitoring Programme

2.1 The streams sampled were generally small streams with varying types and degrees of habitat modification. From 2006-2010 a total of 247 sites were assessed on 89 individual streams, with a focus on coastal streams in Golden and Tasman Bays, as well as some streams in the upper Buller and Motueka catchments. Streams selected were primarily sampled by backpack electric fishing or spotlighting but, in some circumstances, gee minnow traps and/or fyke nets were employed.

2.2 Data and information was also incorporated from the NZ Freshwater Fish Database (managed by NIWA) and Assessment of Environmental Effect documents submitted as part of resource consent applications.

2.3 For analysis of fish communities with respect to habitat disturbance each site was grouped into one of four classes ranging from most disturbed to undisturbed stream-scape.

3. Results and Discussion

3.1 Native fish were observed or captured in all but three of the 247 sample sites. The average number of fish per station was 3.0 with a range of zero to eight fish per station. Barriers to passage were responsible for two of the three "no" fish sites. The frequency of occurrence and abundance of various native fish species recorded in this monitoring programme is presented in Figure 2.

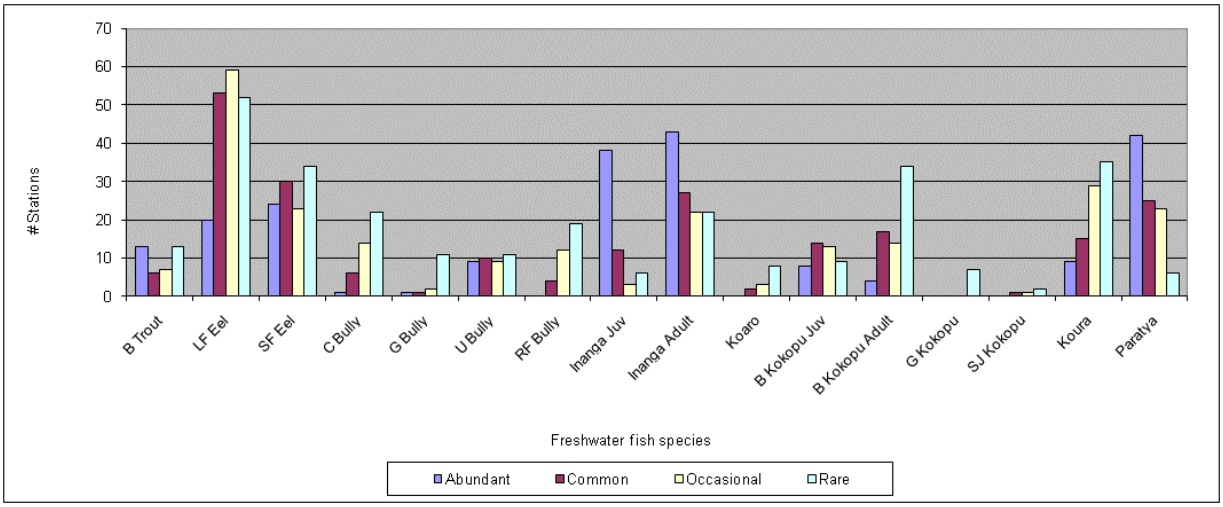


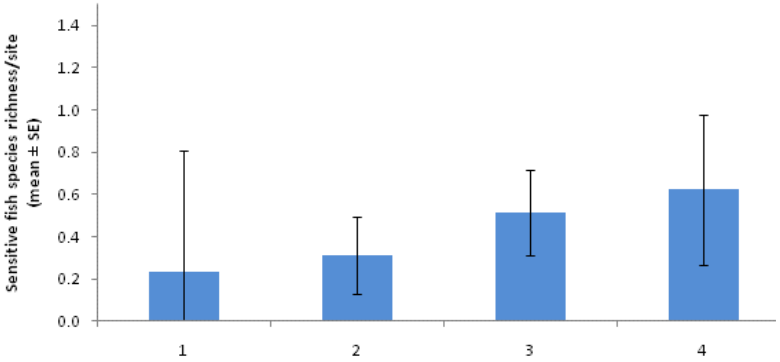
Figure 2: Occurrence of all freshwater fish species across all survey sites (note this includes the two invertebrates Koura and Paratya)

Brown trout populations are relatively healthy in the Motueka parts of the Buller catchment, the Aorere and Takaka catchments, where a good mix of spawning, rearing and adult habitat exist. Trout have returned to reasonable numbers in the Motueka River after a series of floods in the early-mid 1990s which are thought to have severely affected the population.

3.2 Comparison of the diversity and abundance of freshwater fish in streams of varying habitat condition

In this region, on average it was three times more likely to find sensitive fish species at sites in a virtually undisturbed stream compared to highly disturbed streams (Figure 3). However, this difference was not statistically significant because of the high variability between sites. There were also no significant differences among stream disturbance classes, when comparing species richness for all fish species recorded per site.

A



B

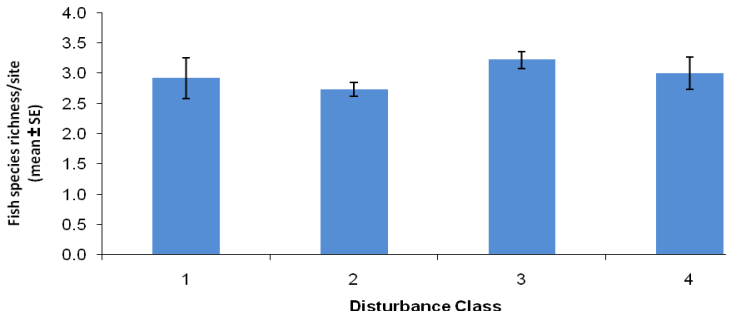


Figure 3: Mean sensitive fish species richness per site (A) and overall fish species richness per site (B) for the four site disturbance classes (class 1 represents the highest and class 4 the lowest disturbance).

3.3 Reference-impact site comparisons

About 15 reference-impact pairs of sites in this survey were investigated to compare fish communities between partially modified and extensively modified reaches on the same water body. The results of the majority of these were profound with much higher fish diversity and abundance in reference streams with good in-stream and riparian cover, natural meander and limited disturbance. Some selected examples are included in Table 1. These examples were selected because they were not complicated by water quality, fish passage or other issues and show a range of levels of disturbance. The only example where a sensitive species was found in a highly worked site was in

Maud Creek which is a mountain-fed river that gets a high level of disturbance anyway (frequent high flows that cause bed movement).

3.4 Effect of Specific Activities

The activities that were found to affect fish the most were:

- "Stream cleaning"
- Stream straightening
- Fine sediment discharges
- Stock trampling
- In-line ponds
- Removal of stream shading

While there is reasonable information on the effect of these activities in this region, a similar pattern of effect is found in many more studies around New Zealand.

3.4.1 Stream Cleaning

Along with the direct disturbance of habitat, fish are killed from entrainment in material extracted from the stream that is left on the bank or adjacent paddock. During cleaning the stream is often straightened or the channel cross-section shape made uniform. Regular digging out of silt and deposits in lowland streams and this has been found to have significant adverse effects for 3-10 years after the disturbance. Faster recoveries are known in higher-gradient mountain or hill-fed streams, but recoveries can be even slower in low gradient lowland, wetland and spring-fed streams. It is these latter streams that are much more likely to accumulate sediment as settling velocities are much greater and therefore cleaning out of silt and other deposited material from these streams is relatively common. The fish values of many of these streams can be high, particularly if giant kokopu are likely to inhabit the waterway. The concept of requiring consents only for high-value streams has been met with reasonable support across the resource user community, but unfortunately identifying and mapping these streams is difficult due to the accuracy of the current digital elevation model and information on loss and gain of stream water to groundwater used by the New Zealand River Environment Classification.

Figure 4: Stream Cleaning of a creek near Murchison

Eels can wriggle out of small piles of material but they usually travel downslope and if they are deposited on the back side of a levee they will usually perish. Eels can travel far by night or low light when the grassy paddocks are wet but not in dry conditions.

3.4.2 Stream Straightening

Stream meander is very important in providing diversity of habitat that leads to diversity of stream life. For example, deeper zones with good overhead cover are usually found on the outside of a bend with slower shallower areas on the inside of a bend. Even with good vegetation canopy over the stream a straightened stream appears to hold much fewer overall number of fish and fewer different species e.g. Little Kaituna Stream.

Table 1: Some examples of the differences between reference and impact site pairs.
Sensitive native fish highlighted in bold.

STREAM	REFERENCE REACH			IMPACT REACH		
	DESCRIPTION		FISH COMMUNITY	DESCRIPTION		FISH COMMUNITY
Plumbago Stream *(Figure 36)* *Hill-fed*	~200m reach almost adjacent to impact reach Almost full canopy of riparian tree cover. Natural meander		**banded kokopu (c), giant kokopu (r),** redfin bully (o), longfin eel (o), koura (o), shrimp (a)	~150m reach Straightened Full cattle access but little trampling evident No riparian trees or vegetation cover		longfin eel (o), shortfin eel (c), inanga (c), common bully (r), koura (o), shrimp (o)
Mackay Creek *(Figure 37)* *Lowland-fed*	A 100m reach, ~600m d-s from impact reach Partial to majority canopy of riparian native bush Natural meander		**redfin bully (o),** common bully (o), i (o), longfin eel (a), shortfin eel (a), ka (o), shrimp (c),	~150m Partial straightening Partial fencing, stock trampling		longfin eel (o), shortfin eel (a), inanga (o), upland bully (r)
Little Kaituna Stream *(Figure 41)* *Lowland-fed*	~100m reach immediately upstream of impact reach Original riparian podocarp forest and highly meandering		**banded kokopu (a), redfin bully** (o), inanga (c), longfin eel (c), shortfin eel (c)	180m Straightened Fenced & no stock access Overhanging grass & the odd shrub		banded kokopu (r), shortfin eel (r)

Horton/Tasman Valley Streams *(Figure) Lowland-fed*	~100m tributary of Tasman Valley No stock access High % tree canopy cover Natural meander		**banded kokopu (c), giant kokopu** (r), longfin eel (r), shortfin eel (o), shrimp (r)	~100m reach within 1km of reference site but about 3x the flow No fencing but not heavy trampling No riparian trees		inanga (a), common bully (r), longfin eel (r), shortfin eel (a), shrimp (c)
Seaton Valley Stream *(Figure 64) Lowland-fed*	1.2km reach immediately upstream of impact reach Regenerating scrub (mix of exotic and native; partial to full canopy) Natural meander		**banded kokopu (a), giant kokopu** (r), i (c), common bully (o), longfin eel (c), shortfin eel (o), koura (c)	~900m Straightened Free stock access & heavy trampling Sediment & aquatic plants dug out every 1-2 years		shortfin eel (c), longfin eel (r), inanga (o), koura (r)
Maud River *Mountain-fed*	~150m reach in pine forest with riparian beech forest Natural meander		brown trout (a), upland bully (r)	~200m Completely cross-bladed (bed turned over with a bulldozer) 2.5 years earlier		brown trout (a), upland bully (c), **dwarf galaxid** (r), longfin eel (r)

Stream straightening is not permitted under the new Part IV rules.

3.4.3 Fine Sediment Discharges

Of the 20 fish species recorded in Tasman, at least 13 are crevice dwellers for most of their lives in the freshwater. This means that when fine sediment builds up in the bed and fills the spaces between stones in the bed, these fish get displaced and may perish. Most fish, particularly trout, are visual feeders so need to see their prey so clear water is important too. In general, Tasman compares well to the rest of New Zealand for water clarity. However, there are a large number of smaller lowland streams flowing through intensively used land(mostly urban or intensive pastoral) which are degraded by fine sediment clogging the bed (see Table 9 in "River Water Quality in Tasman District, 2010). Significant one-off discharges of fine sediment have been recorded in the district in the last decade from earthworks associated with road building, subdivisions, re-contouring or disking (e.g., for farming or horticulture) and forest harvesting.

3.4.4 Removal of Shading

Shading streams is critical to maintain suitable water temperatures for fish. Most riparian forest was removed over the last 150 years progressively along with original pasture conversion. A threshold temperature of half way between the midpoint of the daily mean and the daily maxima of 20^{o}C was used in assessing effects on fish. Temperature studies carried out at 50 sites around the district from 2004-09 recorded 35 sites exceeding this threshold. Some of these sites exceeded the threshold for more than 50% of the record e.g. east Motupipi catchment, Sherry and Tadmor Rivers, Dove River and Moutere River. High stream temperature is a widespread issue in Moutere hill streams and for many farmland streams where more than a third of their catchment is in pasture and without riparian shade. For this reason, streamside planting to create shade is strongly recommended. Overhead tree cover also means more food for the fish from insects, leaf and woody matter falling into the stream.

3.4.5 Other effects

Discharges of toxic substances to streams has caused direct fish kills in Tasman. Reticulating streams in culverts for long distances was also found to reduce fish species richness and abundance. Ponds constructed within the waterway often results in significant increases in stream temperature.

4. The Effect of Fish Passage Barriers and Remediation Projects

4.1 For most sites the maxim "fish are good climbers and lousy jumpers" applies; so even if you have a vertical face (e.g. a dam wall) that the stream flows over, it is much better than an overhang.

4.2 From December 2004-December 2010, 1150 structures were surveyed by Council. Of these:

- 345 (~30%) are likely to be barriers to, or impede, fish migration
- 240 are perched culverts (70% of all likely barriers)
- 115 are serious barriers at all flows (~10% of likely barriers)
- 24 are tidal flap-gates (~7% of likely barriers)

These data exclude structures which have been remediated.

4.3 A disproportionately high number of fish passage barriers are present in streams of Separation Point geology (Land Disturbance Area 1 as defined in the Tasman Resource Management Plan). Fish passage barriers form readily at the downstream end of culverts in these streams after high rainfall events due to the granite being highly erodible.

4.4 At least 24 tidal flap-gates are known to exist in Tasman with varying affect on fish migration and water quality (examples shown in Figure 5). While the flaps on these structures open as the tide falls the velocity is often too great for fish to swim up against. Some may allow a few fish to enter just as this flow eases and before the incoming tide that pushes the gate closed again. Because of reduced flushing and flow of water on the landward side of the structure water becomes stagnant and with the general lack of shading in these situations water temperatures are often too high for many fish and the dissolved oxygen too low.

Figure 5: Left: Hamilton Drain near Riwaka (FP0412), right: North of Hamilton Drain near Riwaka (FP0850)

4.5 There are plans to install a fish-friendly device on a suitable standard flapgate (yet to be determined). These devices are fully adjustable and can allow a precise amount of tide water to pass and then close at set water levels. This means that issues such as salt-water intrusion into groundwater and surface water, or release of floodwaters do not become a problem. Since 2007 several of these fish-friendly devices have been installed by a number of regional councils to good effect.

4.6 All fish passage barriers discovered to date have been prioritised to guide a programme of remediation across the district. Between 2005-2010, 16 of the top fish passage barriers have been remediated, giving fish access to streams draining a total area of 4200ha. The bulk of that area has been from remediation of an old weir used for hydrology monitoring on Moutere River downstream of Old House Rd. High-quality aquatic habitat has also been opened up again at Wainui Bay in Golden Bay, plus Onekaka and the Aorere Valley.

Figure 6: Conveyor belt material bolted on to the outlet end of a culvert in the Aorere catchment to assist fish passage

Often the solution to overhanging culverts is simple and cheap such as using used conveyor belt material (see Figure 6).

4.7 When a consented structure (usually a dam) or water take restricts fish passage for a period of time, fish trapping and transfer has been required as a condition of consent (e.g. Kainui Dam and Waitui Stream Hydro-electric power scheme).

5. Stream Rehabilitation

5.1 Rehabilitating streams by re-establishing a natural meander pattern, channel cross-section profile and variety of water depth and widths, as well as riparian fencing and planting is well-known to improve the ecological condition of the stream provided that there is good water quality, stream sediment quality and no fish passage barriers. Such improvements can take a decade or more to realise, especially in streams over 2-3m wide. With any project it is important that the objectives are clear and that it is well planned. The riparian planting must be suitable for the particular site e.g. particular grasses or sedges should be planted in areas with potential for inanga spawning, rather than trees.

5.2 There is often a clear relationship between whitebait catch and the amount of spawning habitat available. Only seven sites in the District have been confirmed as inanga spawning sites (3 in Golden Bay and 4 in Tasman Bay).

One of the key strategies for improving the whitebait catch is to know the location of and protect inanga spawning sites. To date relatively little effort has been put into surveys to find these sites. Early in 2012, University of Canterbury will run a series of workshops (funded by Envirolink) on investigating and managing inanga spawning as a prelude to carrying out our own surveys, with the help of interested locals. It is also hoped that schools will become interested in this project as some useful resources are now available on this topic.

Spawning grounds do not always remain good for spawning because of being over-run by weeds (e.g. willow or blackberry) or by mowing or structures such as rock protection and tidal flap gates.

5.3 Restoration of giant kokopu habitat (in particular deeper, coastal, slow-flowing, wetland-fed streams) is the highest priority given that so much of this type of habitat has been lost (e.g. 90-95% of wetlands lost in Motueka District). Of the few such projects attempted in the region, most have been successful e.g. Puponga farm park.

5.4 Waterbodies with degraded habitat are listed in Table 10 of the full "State of the Environment" technical report on the "Health of Freshwater Fish Communities" (similar to the list in the 2010 River Water Quality report). This table recommends remedial actions for parts of streams and is intended to be linked to Part IV of TRMP.

5.5 Currently these recommendations do not have any priority in Council work programmes. At present the Stream Enhancement Programme is focused on sediment and erosion control by providing fencing materials to prevent stock trampling of stream banks or planting programmes to holt erosion. While this does provide a direct benefit to stream habitat and water quality, it is far from being the total solution for restoring degraded stream habitat in most streams and planting, restoration of fish passage barriers and re-meandering will be necessary to achieve a healthy freshwater ecosystem. Once plants are established there is usually a longer term benefit to landowners, because weed control in this riparian land do not need the same level of effort.

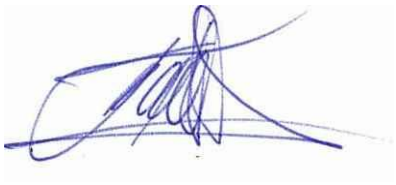
5.6 We will look to use the Stream Enhancement Programme to improve ecosystem health using the findings of both the water quality and stream habitat SOE reports. We will continue to work with the Engineering Department to take a lead in remediating Council-owned fish passage barriers each year and promoting an awareness of stream shading benefits. We continue to liaise with contractors and will explore opportunities to prepare guidance to land owners and developers.

6. RECOMMENDATIONS

That the Committee adopt the draft resolution.

7. DRAFT RESOLUTION

THAT the Environment & Planning Committee receives this report entitled: The Health of Freshwater Fish Communities in Tasman District REP11-08-07.



Trevor James
Resource Scientist