DEPARTMENT *of*
PRIMARY INDUSTRIES,
WATER *and* ENVIRONMENT

Tasmania

Aquatic Ecology of Rivers In the Pipers Catchment

A Report Forming Part of the Requirements for State of Rivers Reporting

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Glossary

anadromous refers to fishes which migrate from saltwater to freshwater to spawn

diadromous refers to fishes that migrate freely between freshwater and saltwater in either direction.

macroinvertebrate animals without a backbone which can be seen with the naked eye. In rivers, common macroinvertebrates include insects crustaceans, worms and snails.

riparian of or on the river bank

1. Introduction

This section of the 'State of Rivers' report deals with aspects of the aquatic ecology of the Pipers River and associated tributaries. It provides a brief overview of the aquatic fauna found in the catchment and some detail of the habitat requirements and potential threats to particular species found in the Pipers River catchment. Another section deals specifically with endangered species found in the catchment and covers potential threats to the distribution of each species. However, the main focus of this report details work carried out in the Pipers catchment under the Monitoring Riverine Health Initiative (MRHI), a national program aimed at the development of models to assess riverine health using macroinvertebrates as a bio-indicator. These models are comprehensive in their development and allow a relatively rapid assessment of riverine health of specific sites along the river and its tributaries. Sites in the Pipers catchment were examined in respect to potential impacts of water quality and habitat degradation on aquatic macroinvertebrate communities. The final section briefly examines algal community composition at selected sites in the Pipers River and two tributaries. Algae were sampled concurrently with macroinvertebrates under the MRHI program in spring and autumn of 1997.

2. Aquatic Fauna

At least six different species of frogs are found in the Pipers catchment. The Northeast region has been identified as a significant region for frogs due to extensive coastal wetlands which form excellent frog habitat (Brown, 1996). It is especially significant to the species *Litoria raniformis*, which is classified as 'vulnerable' in the State. Preservation of wetlands is seen as vital to the long term preservation of frog species diversity in the Northeast.

There are 16 freshwater fish species found in northeast Tasmania, two of which are introduced species (Chilcott, 1995). Most of these species are diadromous and have a Tasmania wide distribution. Three of the native fish species are confined entirely to freshwater areas (Table 1), and all three have the most limited natural distributions of species occurring in the northeast (Fulton, 1990).

Of the species listed below, the dwarf galaxias, *Galaxiella pusilla* Mack (dwarf galaxiid), is the only species having a conservation status of 'rare' in Tasmania. This species is also considered 'vulnerable' on mainland Australia, with causes of decline being seen as drainage of wetlands, river channelisation, removal of riparian vegetation and interactions with introduced fish (Koehn, 1990a; Koehn, 1990b). Inland Fisheries Commission surveys have not sampled this species in the Pipers catchment but its presence cannot be discounted from this region. Management recommendations to protect the habitat of this species should be considered and these will also protect the habitats of other native freshwater fish populations in the catchment. The only other species currently requiring conservation attention is *Prototroctes maraena* Gunther (Australian grayling), which is considered 'vulnerable'. Two other species, *Galaxias cleaveri* Scott (Tasmanian mudfish) and *Lovettia sealli* Johnston (Tasmanian whitebait) although quite common (Fulton, 1990), are subject to various pressures that may limit their abundance and distribution on a local scale.

The usual habitat of *G.cleaveri* is swampy areas near the coast and the species is found mostly in still waters, heavily vegetated mud bottomed swamps and drains (McDowall & Fulton, 1996). Mudfish are regarded as widespread and common around Tasmania (Fulton, 1990), although its habitat is under continual threat from drainage of swamps and reclamation of estuarine marshes. The juvenile fish form part of the whitebait runs on their return from the sea in spring and they take up residence in the lower part of coastal streams (Fulton, 1990).

The true whitebait *L.sealli* exhibits an anadromous lifestyle migrating into freshwater to breed. Spawning occurs during spring and early summer when large schools of year old adults migrate into freshwater. Eggs are attached in clusters to submerged logs, stones or plants and hatching occurs in 2-3 weeks. The larvae are then washed down into the sea. In the past, this species was the basis of an important commercial fishery, however since the 1940's populations have declined to the point where the fishery was closed from 1973 to 1990. The fishery has since been opened on a restricted basis. There are no surveys that indicate that whitebait runs have occurred in the river, although it is likely given their historical range that *L.sealli* may still be present in the Pipers River catchment.

Table 1 :Freshwater Fish of northeast Tasmania

Life History: M = migrates to and from sea or estuary, NM = freshwater only
Habitat:R = rivers, L = lake, W = wetlands

Common Name	Scientific Name	Life History	Habitat
Native Fish			
Short-headed lamprey	*Mordacia mordax*	M	R
Pouched lamprey	*Geotria australis*	M	R
Short-finned eel	*Anguilla australis*	M	R/L/W
Long-finned eel	*Anguilla reinhardtii*	M	R/L/W
Jollytail	*Galaxias maculatus*	M	R/L
Spotted galaxias	*G. truttaceus*	M	R/L
Climbing galaxias	*G. brevipinnus*	M	R
Tasmanian mudfish	*G. cleaveri*	M	R/W
Tasmanian whitebait	*Lovettia sealii*	M	R
Australian grayling	*Prototroctes maraena*	M	R
Tasmanian smelt	*Retropinna tasmanica*	M	R
River blackfish	*Gadopsis marmoratus*	NM	R/L
Southern pygmy perch	*Nannoperca australis*	NM	R/W
Sandy flathead	*Pseudaphritis urvillii*	M	R
Introduced Fish			
Brown Trout	*Salmo trutta*	M	R/L
Rainbow trout	*Oncorhynchus mykiss*	M	R/L

Taken from Chilcott and Humphries (1995)

There are two major genus' of freshwater crayfish found in the northeast region, *Astacopsis* (including the Giant Freshwater Crayfish, *Astacopsis gouldi*) and *Engaeus* (a smaller burrowing crayfish) which consist of about eight species in northeast Tasmania (Horwitz, 1996). *Astacopsis gouldi*, Clark is found in the Pipers catchment (Hamr, 1992), while four species of *Engaeus* are also known to occur (*Engaeus tayatea*, *Engaeus mairener*, *Engaeus orramakunna* and *Engaeus laevis* (Clark)). *Astacopsis gouldi* is presently registered as a 'vulnerable' species and is now protected under the Rare and Threatened Species Act and will be discussed in the next section.

3.Endangered Species

A species is regarded as endangered if it is in danger of extinction because long-term survival is unlikely while the factors causing them to be endangered continue operating. Approximately 4 endangered aquatic species are listed that have distributions in the Pipers catchment. The best known of these is *A.gouldi* (the Giant Freshwater Crayfish). *A.gouldi* is listed as "vulnerable" under the Tasmanian *Threatened Species Protection Act* 1995. At the beginning of 1998 *A.gouldi* was declared a "Protected fish" under the *Inland Fisheries Act* 1995 ending recreational fishing for the species.

Astacopsis gouldi has been the subject of numerous scientific studies (Hamr, 1990; Horwitz, 1994; Growns, 1995) and a draft recovery plan currently exists for the species (Bluhdorn, 1997). *A. gouldi* is a lowland wet forest/rainforest species. Distribution is limited between sea level and around 400m altitude, although most animals are found below 200m (Horwitz, 1994). *A.gouldi* requires streams with good water quality, a stable thermal regime of relatively low water temperature, and habitat cover in the form of woody debris, undercut banks and ample canopy cover (Growns, 1995; Bluhdorn, 1997). Large-scale habitat disturbance from agricultural and urban landuse, forestry activity and fishing pressure has reduced both the species abundance and viability of some populations. Localised extinction's or large depletion's of stocks are thought to have occurred in the Pipers River as well as many other northeastern rivers (Bryant, 1998a).

(Bryant, 1998b) listed key issues associated with the protection of the habitat of *A.gouldi* as follows:

- Protection of stream side vegetation.
- Appropriate willow removal and retention of stumps and rehabilitation of native riparian vegetation.
- Retention of Large woody debris.
- Management of stock access.
- Appropriate use of fertilisers and chemicals.

Galaxiella pusilla (Dwarf Galaxiid) is found in northeastern lowland rivers and inhabits still or slow flowing waters such as swamps and backwaters of creeks, frequently amongst marginal vegetation (Humphries, 1986; Jackson & Munks, 1998). There are no records of this species recorded for the Pipers River in Inland Fisheries Commission surveys (Stuart Chilcott - Inland Fisheries Commission, personal communication) although the species has been recorded in catchments to the east of the Pipers catchment and cannot be discounted from occurring in the river and associated tributaries. Spawning for *G.pusilla* occurs from August to October. Eggs are usually deposited on macrophytes or leaf litter. The species current status is rare due to a limited distribution at unprotected sites. Important management considerations include retention of riparian vegetation, maintenance of good water quality and flow regime and restriction of sediment input from roads and drainage of swamps.

Prototroctes maraena (Australian Grayling) lives in coastal streams and rivers around the Tasmanian coast and occurs most commonly in clear gravelly streams with a moderate flow. Its need to migrate to and from the sea makes it vulnerable to depletion in rivers that prevent fish passage as a result of barriers to upstream and downstream migration (McDowall, 1986). Spawning takes place in autumn and once larvae have hatched, they are swept downstream towards the sea. Larval life is marine and juveniles return to rivers from the sea during spring and the rest of their life is spent in rivers. This species was once known to have an extensive range across northern coastal streams. The current status of this species is vulnerable due to a decline in its population resulting in decreased numbers across much of its former range.

The Green and Gold frog (*Litoria raniformis*) occur in localised parts of Tasmania. The species is listed as vulnerable under Tasmania's *Threatened Species Protection Act 1995* and are found in lowland areas, predominantly in the Northeast coastal areas. It is estimated that their range has contracted by over 50% in the last 20 years. Green and gold frogs live in or near permanent or temporary waterbodies such as streams, swamps, vegetated pools and farm dams (Bryant & Jackson, 1999). The waterbodies are usually dominated by plants such as *Triglochin procera*, or species of juncus and sedge. They spend most of their time on the ground among vegetation or at the edge of the water body and are rarely seen in open water (Bryant & Jackson, 1999). They are dependent on permanent freshwater for breeding and ideally prefer sites, which are shallow with diverse vegetation. Key threats to their habitat include:

- Loss of wetland habitat by drainage and clearance for pasture.
- Weed invasion.
- Pollution, overgrazing and trampling of waterbodies by stock.
- Pollution by pesticides, fertilisers and effluent.
- Collection for use as fish bait.

Bryant (1999) lists the following key recommendations for habitat management to protect this species.

- Protection of wetlands by prevention of drainage or the drawing of water for other purposes.
- Consideration of long term protection for frog habitat via the establishment of a wildlife sanctuary or management agreement.
- Prevent clearing of native vegetation buffers.
- Re-establishment of native riparian vegetation.
- Appropriate willow removal (see Bryant & Jackson 1999).
- Prevention of removal of instream and riparian woody debris.
- Fencing and reduction of stock access and grazing in wetlands.
- Appropriate and ecologically sensitive use of chemicals and fertilisers (see Bryant & Jackson, 1999).
- Appropriate design of culverts, weirs and dams (see Bryant & Jackson, 1999).

The Mount Arthur burrowing crayfish (*Engaeus orramakunna*) is listed as vulnerable under the *Threatened Species Protection Act 1995*. The range of the Mt Arthur burrowing crayfish is centred around Mount Arthur in the northeast and enclosed roughly by Lilydale, Nabowla, the Sideling Range and Nunamara. The species occupies a wide range of wet vegetation types and situations, ranging from undisturbed rainforest, eucalypt forest, open pasture, roadside gutters and pine plantations (Bryant & Jackson, 1999). However the species is absent from areas where streams and water quality are degraded. *E. orramakunna* excavates its burrows in areas of high soil moisture and high clay content and can be some distance from stream edges. Type localities for this species are recorded for the Pipers catchment.

Bryant (1999) list key threats to *E. orramakunna* as primarily relating to water availability and quality and are as follows;

- Any changes in drainage or stream channel which affect the water table.
- Water pollution, especially chemical sprays or toxic leaching.
- Clearing of vegetation, exposing burrows, changing hydrology and causing drying out of sites.
- Soil compaction due to cattle grazing and trampling, which prevent burrow formation.

Key recommendations for habitat management for this species include;

- Maintenance of water availability (especially in seepages).
- Maintain or improve water quality (against pollutants, pesticides).
- Retain native vegetation throughout the habitat (particularly native riparian vegetation).
- Exclude stock and other heavy impacts from compacting soil and burrows.

In summary, many of these species are affected by habitat degradation. Management prescriptions in the form of retention and rehabilitation of native riparian vegetation and minimal disturbance to in-stream habitat particularly in the lower reaches of the Pipers River will increase the chances of recovery for many of these species.

3. Macroinvertebrates

The Monitoring Riverine Health Initiative (MRHI) was formed in 1993 by the Federal Government to provide a means of assessing the ecological condition of Australia's river systems. MRHI in Tasmania commenced in 1994 and the programs primary objectives were to develop predictive models to allow assessment of river health using macroinvertebrates as biological indicators. Over 120 sites in Northern Tasmania were sampled in order to build the bioassessment models. As part of this, seven sites (Figure 1) were sampled at various times from spring 1994 to spring 1997 in the Pipers catchment. One site (Pipers River at Underwood) was sampled consistently each spring and autumn from 1994 to 1997. Seven test sites were sampled in autumn and spring 1997. Two of these sites were originally designated as reference sites but were redefined as test sites as preliminary analysis detected impacts at both sampling locations as part of the model development process. Reference sites are defined as sites that are least disturbed and are suitable for use in the construction of predictive models. Test sites are those sites defined to be of importance in assessing the condition of a river known or thought to be experiencing an impact from water quality or habitat degradation. Because the selection of sites in the Pipers catchment was primarily aimed at the development and testing of the river health model, the overall coverage of the catchment is not extensive.

As a comprehensive description of sampling protocols is given in CEPA (1994) and extensive discussion of the development of river health models for northern Tasmania is already provided by Oldmeadow (1998), a detailed description of both of these procedures will not be given here. The biological monitoring package AUSRIVAS (Australian River Assessment System) was used to provide a broad scale picture of the health of previously sampled sites in the Pipers catchment at different times.

The model AUSRIVAS essentially compares the observed taxonomic composition of the macroinvertebrate community at a site with the expected composition if the site were unimpacted. Each site is classified into four categories based on the ratio of macroinvertebrates "Observed" (or sampled) to the macroinvertebrates "Expected". This ratio is known as the observed / expected score or "O/E". Table 2 presents the categories used and the O/E ratio ranges for each cut off.

Figure 1: Pipers River Catchment. MRHI Sites

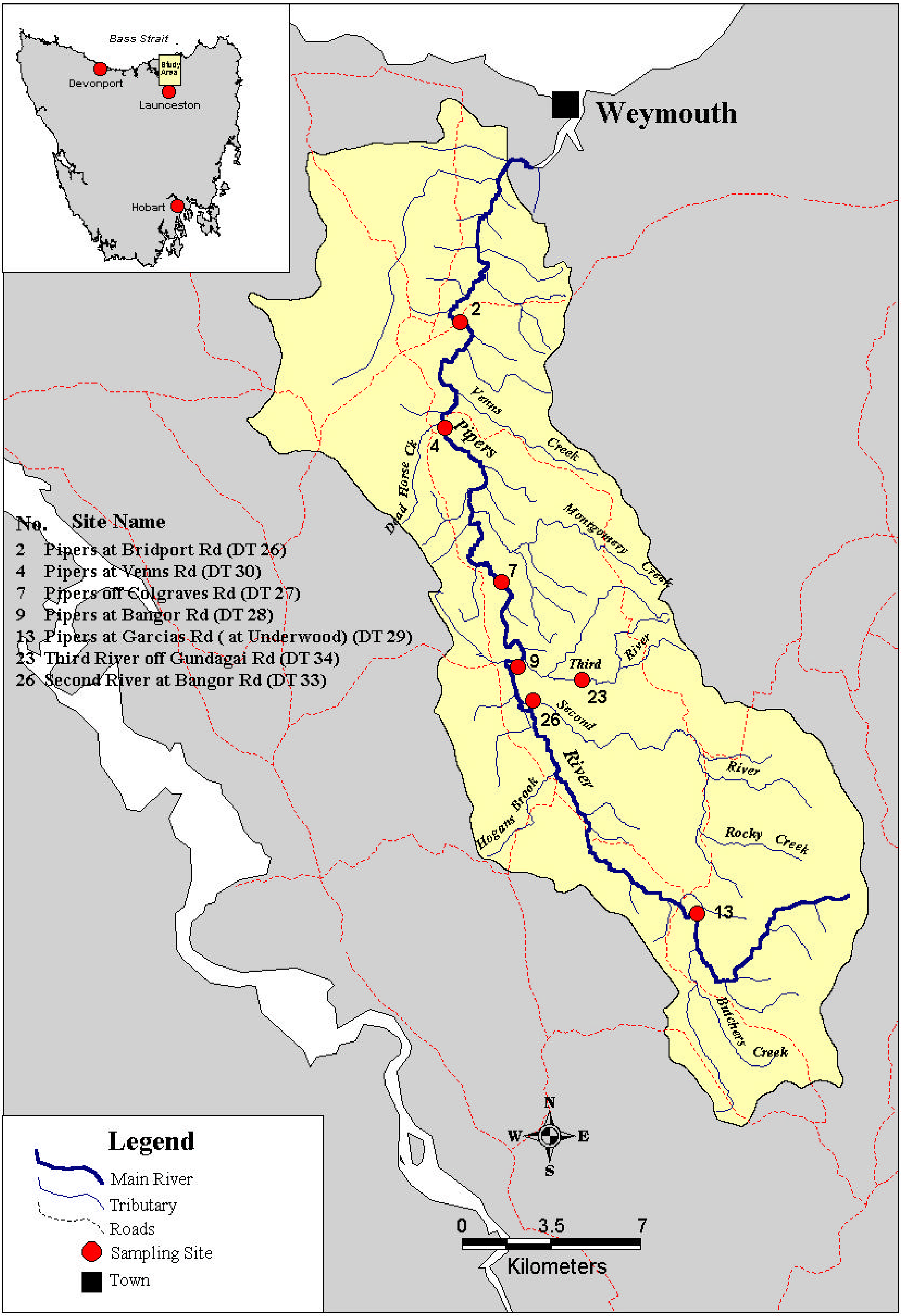


Table 2: River Health categories and Associated O/E scores

Site Status	O/E
Unimpaired	> 0.89
Slightly impaired	0.70-0.89
Impaired	0.41-0.69
Severely impaired	<0.41

The O/E ratio represents the percentage of taxa sampled at a site. From the above table, a site with less than 41 percent of the taxa expected to be present at the site is considered to be severely impaired. The advantages of these river health models are that not only the presence of an impact but also the magnitude can be determined for a specific site.

A biotic index (SIGNAL, Stream Invertebrate Grade Number Average Level, (Chessman, 1995) is incorporated into the model output in the form of a ratio of the observed SIGNAL score (or that sampled) to the expected signal score. The index is based on the sensitivity of macroinvertebrates to common types of pollutants. Each family of macroinvertebrates is assigned a grade according to their tolerance, where the "observed" SIGNAL score is the sum of the grades divided by the number of taxa collected and the "expected" score is the sum of the grades divided by the number of taxa expected. The biotic index is sensitive to water quality and combined with the O/E ratio provides an insight into the nature of the disturbance or impact.

All macroinvertebrates were identified to family level. A total of 53 families were identified from edgewater habitats and 43 families from riffle habitats. These taxa represented all the major taxonomic groups typical of freshwater streams. Insects were the most dominant, representing around 80% of the total number of taxa collected and accounting for 90% of the total number of individuals collected. The two most dominant families in edgewater habitats were Leptoceridae (Caddisflies) and Chironomidae (Midges). The two most dominant families in riffle habitats were Leptophlebiidae (Mayflies) and Hydrobiosidae(Caddisflies).

In Table 3, the category classifications for both riffle and edgewater habitats are presented for sites visited in the Pipers catchment since the programs inception in 1994. Figure 2a and 2b are plots of the O/E scores against the ratio of the SIGNAL scores (OESIGNAL) for edgewater and riffle habitats respectively of sites in the Pipers catchment. OESIGNAL emphasises the effects of water quality on the fauna whereas O/E reflects a wide variety of impacts including habitat degradation as well as reduced water quality.

Tributaries

Under the MRHI program, only two tributary sites were sampled in the autumn and spring sampling rounds of 1997. Only edgewater habitats were sampled at Third River at Gundagai Rd. as on both visits, riffle habitats were dry and could not be sampled. In autumn, although the edgewater habitat was sampled, a measure of the degree of impairment could not be obtained as the site was outside the experience of the model. This indicates that one of the habitat variables measured at this test site is outside the range of the specific habitat measures taken at reference sites used for model development. Examination of the raw data indicates that high conductivity (496 µs) at Third River was the likely cause of this. This site however, was also assessed as being extremely degraded and eroded in terms of physical habitat. The unimpaired rating of the edgewater habitat sampled in spring 1997 is therefore surprising, although this may be attributable to the higher seasonal flows of spring ameliorating water quality degradation.

Second River at Bangor Road was sampled in autumn and spring of 1997. Riffle habitats in both seasons were rated as slightly impaired and both fall relatively low on the OE axis. This indicates a potential impact other than water quality. In contrast, edgewater habitats sampled in the same seasons indicate that edgewaters are unimpaired in terms of river health. The slight impairment of the health of riffle habitats at this site in autumn and spring indicate that habitat degradation is impacting on riffle macroinvertebrate faunas but not those faunas in edgewater habitats. Initial habitat assessment indicates that this site is extremely degraded in terms of habitat with heavily eroded banks, sparse riparian vegetation and stock access.

Pipers River mainstream

Five sites were sampled on the Pipers mainstream. One of these is located in the upper catchment (Pipers River at Underwood) with the remainder of mainstream sites located in the middle to lower reaches of the Pipers River.

River health ratings for the Pipers River at Underwood have fluctuated markedly since sampling commenced in spring 1994. Riffle habitats have generally rated as unimpaired and on two sampling occasions, (spring 1994 and autumn 1997), macroinvertebrate communities have been found to be in excellent health (Banding X) or potentially bio-diverse. In spring 1995, macroinvertebrate communities were found to be slightly impaired. On this occasion, the site plotted low on the OE axis indicating a potential impact other than water quality. Review of habitat assessment sheets filled out at the time indicates that sampling took place in a period of moderate to high flow after a rain event. This suggests that sampling efficiency rather than impacts related to water quality or habitat degradation were responsible for the slight impairment rating at the time of sampling. Similarly, the moderate impairment rating of edgewater habitat at this time can also be attributable to decreased sampling efficiency given the reduced availability of edgewater habitats under high flows. Edgewater habitats however on two other occasions (autumn 1996 and autumn 1997) were rated as slightly impaired and the reasons for this are unclear given the minimal disturbance to the site in terms of habitat and water quality.

The lower catchment site at Bridport Road generally rated as unimpaired for both habitats in 1997 with the exception of the riffle habitat sampled in spring. This site plots relatively low on the OESIGNAL axis indicating that the impact is water quality related although there is no evidence from water quality parameters measured on site at the time to confirm this. From the habitat assessment at this site the surrounding riparian and instream habitat would appear to be in good condition and provide a diverse habitat for a range of aquatic macroinvertebrate species (extensive riparian vegetation, high large woody debris standing stocks and diverse overhanging vegetation). In addition, there was no evidence of stock access or eroded banks that may account for a degradation of water quality.

The middle catchment sites would appear to be most degraded. Both riffle and edgewater habitats at Pipers River at Venns Rd. and Pipers River at Colgraves Rd.) have consistently fluctuated between slight impairment to moderate impairment of river health. On many of these occasions impacts on macroinvertebrate communities are related to habitat degradation rather than water quality. On two occasions, edgewater habitats at both sites have been classified as impacted either by water quality, habitat degradation or both.

Site	Code	Spring 94		Autumn 95		Spring 95		Autumn 96		Autumn 97		Spring 97	
		Riffle	Edge	Riffle	Edge	Riffle	Edge	Riffle	Edge	Riffle	Edge	Riffle	Edge
Pipers/Bridport Rd.	DT26	-	-	-	-	-	-	-	-	A	A	B	A
Pipers/Colgraves Rd.	DT27	-	-	-	-	-	-	-	-	B	B	C	B
Pipers/Second River Rd.	DT28	-	-	-	-	-	-	-	-	A	A	B	B
Pipers/Underwood	DT29	X	A	A	A	B	C	A	B	X	B	A	A
Pipers/Venns Rd.	DT30	C	C	B	C	-	-	-	-	B	B	C	B
Second River/Bangor Rd.	DT33	-	-	-	-	-	-	-	-	B	A	B	A
Third River/Gundagai Rd.	DT34	-	-	-	-	-	-	-	-	-	*	-	A

Table 3: River health categories for riffle and edgewater habitats at sites visited under the Monitoring River Health Initiative 1994-1998. Ratings are as follows

Category: '-' - Not sampled
'*' - Outside the experience of the model
X - Above Reference banding (Potentially biodiverse)
A - Unimpaired
B - Slightly impaired
C - Impaired
D - Severely impaired

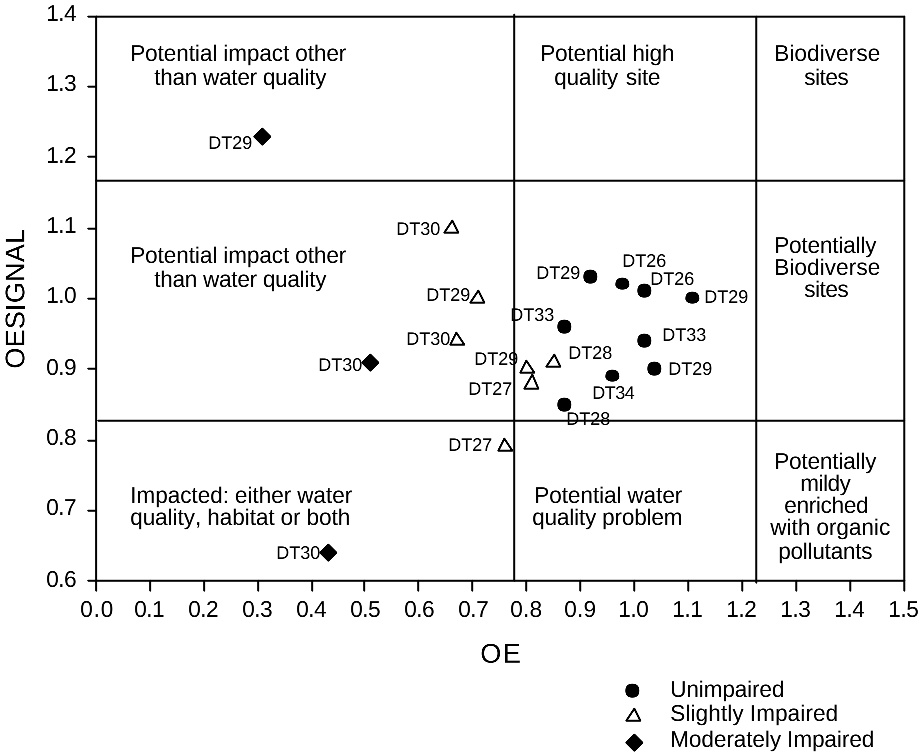


Figure 2a) Plot of O/E50 and OESIGNAL for edgewater habitats at each site in the Pipers catchment. Some data points represent several visits to a site between 1994-1997.

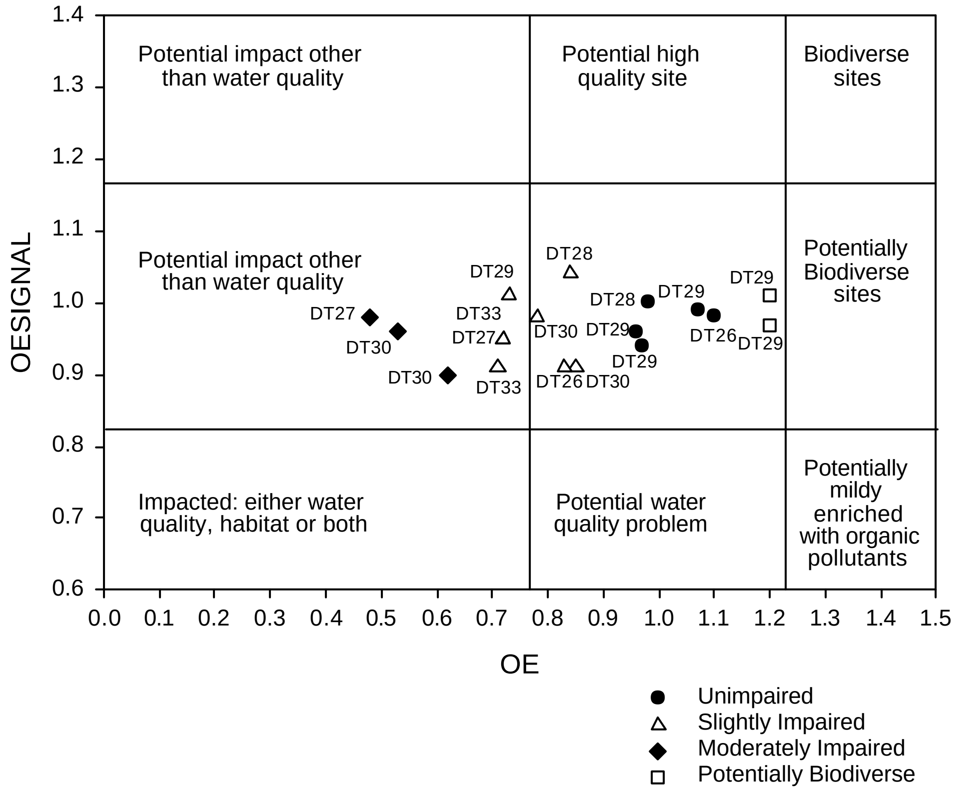


Figure 2b) Plot of O/E50 and OESIGNAL for riffle habitats at each site in the Pipers catchment. Some data points represent several visits to a site between 1994-1997.

Both riffle and edgwater habitats at Pipers River at Second River Road were found to be unimpaired in autumn 1997 in contrast to a slightly impaired rating for both habitats sampled in spring 1997. It is difficult to attribute this slight impairment to either a degradation of water quality or habitat given the location of the siteplots on Figure 2a and b and impacts on the macroinvertebrate community at this site could be related to either of these impacts. This site does not appear to be impacted to the same degree as sites lower down in the catchment and this may be due to its location above both confluences of Second River and Third River to the Pipers mainstream. Both of these tributaries are highly degraded in terms of erosion and sedimentation and have been shown in the present Water Quality study (see Water Quality section of this report) to have a degraded water quality. The riparian vegetation at Second River Rd. is dominated by exotic species such as *Salix fragilis* (Crack willow) and *Rubus fruticosus* (blackberry) and this may have been a contributing factor to the slight impairment rating for both habitats in spring 1997.

Summary

In general at the times sampled, the majority of Pipers River sites fluctuate markedly between poor river health and fair river health indicating that the impacts upon macroinvertebrate communities and river health are sporadic in nature. There appears to be no relationship with seasonal fluctuations or discrimination in terms of whether riffle or edgewater habitats are affected. The sites that are impaired to varying degrees indicate that impacts are mostly attributable to physical habitat degradation and not water quality. One site (Pipers River at Venns Road) has consistently rated as slightly impaired to impaired since sampling first commenced in 1994. Other sites on the Pipers mainstream and tributaries have fluctuated between unimpaired to mostly slightly impaired. No sites sampled in the catchment under the River Health Program have consistently been rated as unimpaired. There are no clear reasons for these fluctuations. The middle to lower reaches of the Pipers rivers are highly modified due to agricultural land use and show the most impact in terms of river health. The impacts in these middle reaches would appear to be related to habitat degradation. This may be exacerbated by periods of low flow and elevated nutrient inputs into reaches in the form of runoff from agricultural land practices upstream or stock access, particularly in autumn after low seasonal flows in summer.

5.Algae

Algae are simple plants that vary considerably in size, shape and colour, and are found in a range of habitats. They are a natural part of the surface water ecosystem and are encountered in every water body that is exposed to sunlight. While a few algae are found in soils and in surfaces exposed to air, the great majority are truly aquatic and grow submerged in ponds, lakes, water supply storages, streams, estuaries and oceans. In water storages the phytoplankton, or floating microscopic plants, are of major importance, and are the basic food source of small aquatic animals. There are four main types of freshwater algae: Green Algae (Chlorophyceae), of which the threadlike filamentous form is the most common, Blue-green Algae (Cyanophyceae), Diatoms (Bacillariophyceae) and Euglenoids (Euglenieae). Excessive growth of algae can cause numerous problems in waterways. Blooms can severely reduce the oxygen content of the water and cause the death of fish and other aquatic animals. Mats of filamentous algae can clog irrigation channels and pipes and severely reduce flow and certain blue-green algal blooms (in particular *Anacystis cyanea*) are toxic and have been known to kill livestock, including cattle, sheep, horses and domestic fowl.

The use of algae has many advantages over traditional indicators of water quality particularly in an urban setting (Round, 1991). Unlike macroinvertebrates, algae are a ubiquitous component of a water environment and are even found in concrete drains (common in urban environments). Algae have particular advantages as bio-indicators over other animals such as fish and macroinvertebrates in that they are often present before and after pollution incidents, reflect nutrient composition of the water more closely than animals and are often different to macroinvertebrates in their sensitivity to toxic materials (Whitton & Kelly, 1995).

In many Australian states, algae have been used on small spatial scales for bio-monitoring (Chessman, 1986; Sonnerman & Breen, 1997). There have been investigations into the feasibility of using algal taxa to assess river health and many researchers have suggested various protocols for bioassessment of rivers using algae as indicators (Hotzel & Croome, 1998). The development of river health models such as AUSRIVAS, the current platform for using macroinvertebrates to assess river health, has prompted various workers to develop similar models using algae as the indicator taxa. In this vein, DPIWE has been sampling algae at sites where macroinvertebrates have been sampled for the Monitoring Riverine Health Initiative (MRHI) and the First National Assessment of River Health (FNARH) since late 1996 with the long term plan to develop bioassessment models for algae similar to those currently being developed for macroinvertebrates. To date, over 247 genera have been identified from over 350 sites around Tasmania.

As part of this program algal samples were collected from 7 sites in the Pipers catchment in autumn 1997 and 6 sites in spring 1997. These sites were located on the Pipers mainstream and associated tributaries. Samples were taken from both riffle and edgewater habitats by scraping the top surface of a cobble. They were preserved in 5% Formalin and identified to genus level under a compound microscope in the laboratory.

66 genera of algae were identified from the Pipers catchment during the spring sampling round of 1997 and 78 genera of algae were identified from the autumn 1997 sampling round. These genera included Diatoms, Green algae, Blue-green algae and Euglenoids. These species are common throughout Tasmania and as such pose no public risk.

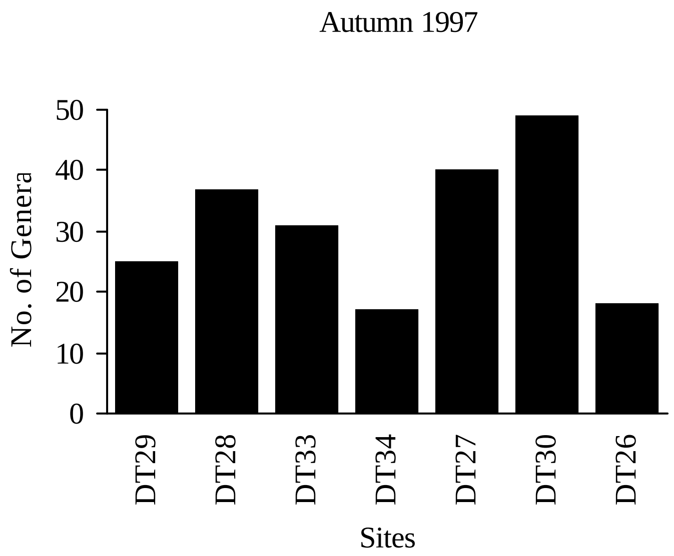
The number of genera of algae recorded per site ranged from 17 to 49 in autumn and 25 to 41 in spring (Figure 3). Previous surveys of other catchments in the northeast (DPIWE, unpublished data) have shown that the low numbers of algal genera occur in the upper reaches of catchments and that the number of genera increase with elevated nutrient loads resulting from changes in land use down the catchment (eutrophication). This pattern was not evident in this study as the lowest site on the Pipers catchment (Pipers at Bridport Rd.) had relatively low numbers of algal genera in both seasons. In autumn 1997, the highest number of algal genera was sampled at Pipers at Venns Road and Pipers at Colgraves Road in the middle catchment. The increased numbers of algal genera at these sites may be attributable to elevated nutrient concentration in the middle reaches of the catchment in this season. In addition both of these site had high levels of sedimentation in edgewater and riffle habitats. It is likely that nutrient release from sediments during periods of low flow have led to an increase in algal genera at these sites in autumn. High sedimentation and phosphorous levels have also been recorded for these sites in the recent survey of water quality (see Water Quality section in this report).

Lower numbers of algal genera were sampled at Pipers at Underwood and Pipers at Second River Road and this may indicate nutrient limitation of the comparatively undisturbed sites. The lowest number of algal genera was sampled at Third River at Gundagai Rd. and Pipers River at Bridport Road. The low number of algal genera sampled in Third River and Pipers

River at Bridport Rd. were surprising given that these sites would also be expected have high numbers of algal genera given high nutrient loads and degraded water quality in the middle to lower reaches of the catchment and it is likely that other environmental factors may be determining algal community composition at these sites. The site at Third River was sampled in the middle reaches of the tributary and it is possible that the contribution of nitrogen and phosphorous in high intensity agricultural areas via surface runoff is elevated further down the tributary. It is possible that the low numbers of algal genera sampled at Bridport Rd. in autumn may be related to low light penetration through the riparian canopy, which from review of habitat assessment sheets was quite dense at this site. Increased shading may eliminate some algal taxa from this site

In spring the number of algal genera was generally consistent at all sites. This is most likely due to similar habitat conditions and reduced nutrient loads at all sites under elevated seasonal spring flows. The low numbers of algal genera are still prevalent at the lowest site (Pipers at Bridport Road). The reasons for low numbers of algal genera sampled at this site in both seasons are unclear although it is possible that given the highly shaded environment provided by thick native vegetation at this site may eliminate some shade intolerant algal species. Other factors influencing the presence of algal taxa cannot be discounted and a more comprehensive study would need to be carried out to fully determine the processes determining algal community composition at all sites sampled.

To make further comments on the composition of algal communities and how these relate to specific water quality impacts or habitat degradation in the Pipers River catchment would be inappropriate as too few sites and environmental variables were sampled in 1997 for a rigorous analysis. However the brief survey carried out at this time indicates that algal communities in autumn and spring are different in terms of number of algal genera. The upstream site at Underwood in both seasons has generally low numbers of algal taxa indicative of nutrient limitation of forested upland rivers. The lowermost site at Bridport Rd. also had low numbers of algal genera, most likely due to heavy shading at this site eliminating some algal taxa.



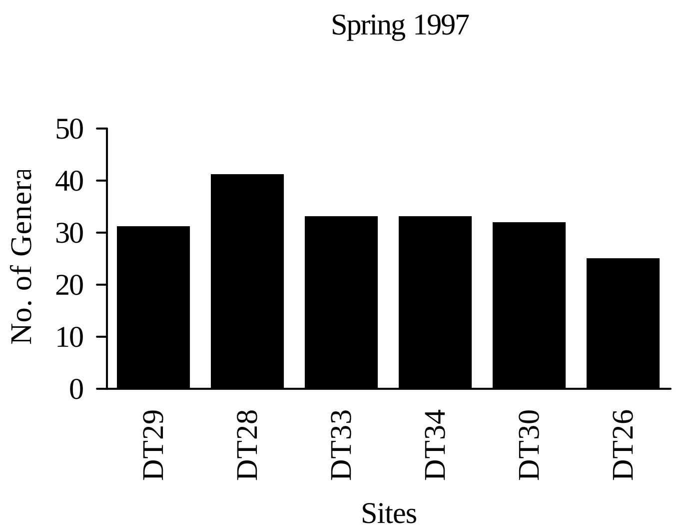


Figure 3: Number of algal genera sampled at each site in the Pipers catchment in autumn 1997 and spring 1997: Site codes for the following sites are as follows

DT26 - Pipers River at Bridport Road
DT27 - Pipers River at Colgraves Road
DT28 - Pipers River at Second River Road
DT29 - Pipers River at Underwood
DT30 - Pipers River at Venns Road
DT33 - Second River at Bangor Road
DT34 - Third River at Gundagai Road

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