

Lower Balonne Ecological Condition Report - Survey of May 2002

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On behalf of *Smartrivers***

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1. Introduction

This report represents the fourth in a series recording the results of monitoring events sponsored by stakeholder organizations in the Lower Balonne. The Department of Natural Resources and Mines conducted similar sampling programs in April and November 2001 and they have made their data available for use in this report. A summary of ecological sampling in the region is presented in **Table 1**. Pre-June 2000 sampling for macroinvertebrates was by AusRivAS techniques only and David Moffatt of DNR Toowoomba had conducted fish sampling at two sites (one in NSW). As a result of NRM's sampling in April and November 2001, Sinclair Knight Merz (SKM) supplemented that program by inclusion of additional riverine sites, reference sites and floodplain sites in their sampling in November 2001. EM (Ecology Management) Pty Ltd (EM) took over management of the program from SKM in January 2002. Due to the lack of floodplain sites with water, only riverine sites were sampled on this occasion.

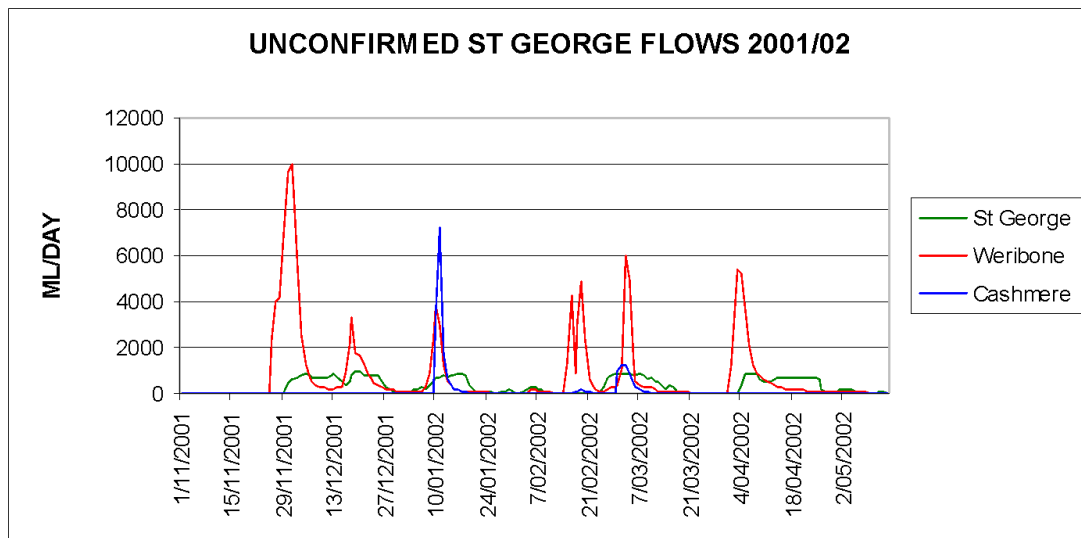
Table 1. History of ecological sampling in the Lower Balonne

Site Description	Location	Pre-2000	June 2000	April/May 2001	Nov 2001	May 2002
Moonie River on Fenton	28°55'51.3"S 148°44'35.9"E				SKM	EM
Moonie River at Nindigully	28°25'45.4"S 148°48'55.1"E	Aus	SKM		SKM	EM
Warrego River on Tinninburra	28° 44' 12.9"S 145°36'26.1"E				SKM	EM
Warrego River at Shannonvale	28°08'39.8"S 145°41'41.8"E	Aus	SKM		SKM	EM
Cashmere on Maranoa	27°15'44.4" 148°04'19.1"	Aus		NRM		
Balonne River at Weribone	27°19'07.1" 148°49'33.5"	Aus		NRM	NRM	
Balonne River at St George	28°03'52.7" 148°33'40.3"		SKM	NRM	NRM	EM
Balonne River at Kurray	28°11'35.3" 148°31'46.9"			NRM	NRM	
Balonne River at Mooramanna	28°17'20.2" 148°25'05.9"	Aus	SKM			EM
Balonne River at Whyenbah bridge	28°23'23.4" 148°19'00"	Aus	SKM	NRM	NRM	EM
Culgoa River at Whyenbah	28°25'52.9" 148°16'09.9"			NRM	NRM	EM
Culgoa River at Cubbie	28°36'41.1" 147°58'49.9"		SKM	NRM	NRM	EM
Culgoa River at Ingie Bridge	28°40'10.8" 147°48'18.4"			NRM (not fish)	NRM	
Culgoa River at Woolerbilla	28°47'11.9" 147°37'43.9"		SKM	NRM	NRM	EM
Culgoa River at Balandool	28°47'13.2"S 147°37'38.0"E			SKM	Dry	EM
Donegri Creek (Narran R.)	28°36'43.7"S 148°12'03.8"E		SKM		SKM	EM
Narran River on Clyde	28°46'20.2"S 148°04'52"E				SKM	EM
Narran river at the gauge	28°50'25.8" 148°03'10.3"	Aus	SKM	NRM	NRM	
Narran River on Booligar	28°56'24.4"S 148°04'49.5"E				SKM	EM
Balonne Minor near Miegunyah	28°27'58.3" 148°18'41.1"		SKM	NRM	NRM	EM

Balonne Minor at Trafalgar	28°38'43.8" 148°05'08.6"			NRM	NRM	EM
Bokhara River near Kirrima	28°43'34.3" 148°03'06"			NRM	Dry	EM
Bokhara River at Nee Nee	28°53'05.4"S 147°57'48.0"E		SKM			
Bokhara River at Koala	28°57'11" 147°46'17.3"	Aus	SKM	NRM	NRM	EM
Balandool River at bifurcation	28°45'32.6"S 147°58'40.4"E			SKM	Dry	EM
Balandool River at Euraba	28° 52' 58.9"S 147° 52' 34.7"E			SKM	Dry	EM
Balandool River at Currawilingah	28°56'17.4"S 147°45'08.1"E		SKM			
Brairie Ck at Briarie lagoon	28°48'24.4" 147°48'04.6"	Aus	SKM	NRM	Dry	Dry
Schutte Lagoon	27°43'45.9"S 148°42'58.1"E				SKM	
Savel Lagoon at Whyenbah	28°23'40"S 148°17'56.6E				SKM	
Belah Creek Lagoon	28°30'07.7"S 148°12'07.6"E				SKM	Dry
Police Lagoon Dirranbandi	28° 33' 28.4"S 148°15'04.2"E			SKM	Dry	Dry
Pilgra Lagoon 'upstream'	28°41'12.9"S 147°59'9.6"E			SKM	SKM	Dry
Pilgra Lagoon 'downstream'	28°46'31.8"S 147°52'39"E			SKM	SKM	Dry
Chinaman Creek Lagoon	28°37'28.7"S 148°01'49"S			SKM	SKM	
Walla Lagoon	28° 44' 13.7"S 147° 50' 39.4"E			SKM	Dry	Dry
Woolerbilla Lagoon	28° 46' 44.6"S 147° 39' 53.2"E			SKM	Dry	Dry
Clyde Lagoon	28°45'36.4"S 148°07'24.5"E				SKM	

At the time of sampling in May 2002, the area was drought affected with little local rain over the previous 12 months. The river did not flood over summer with only a series of compensation flows (base flow levels) released from Beardmore Dam (**Figure 1**). Very low flows were still passing the bifurcation weirs except the Culgoa River at Whyenbah, which was blocked by stop logs in order to direct flow down the other channels. All river channels had flowed for their full length, albeit at very low levels, as a result of the compensation flows. While overtopping weirs, these flows do not result in weir drown-out. The most significant flow in the system in recent times was a flow of 4720ML/d in February 2001. Flows only remained above compensation level for 3 days and this size of flow stays entirely within the channels. The Warrego River did not flow between 17 March 2001 and 12 January 2002 but it recommenced flowing with a flood which peaked at 54,217ML/d and quickly receded before ceasing to flow on 4 February. The Moonie River at Fenton showed very low flows immediately prior to sampling (9 April to 3 May), in December, November and July-August 2001 and a significant low level flow in February which peaked at 6320ML/d.

Figure 1. Flows in the Lower Balonne, November 2001 – May 2002



The primary aim of sampling at this time was to note the effect of these low flows on water quality, fish breeding and distribution and macroinvertebrate distribution as the sampling in November 2001 showed deteriorating water quality and faunal diversity as the system dried out.

2. Methods

Twenty riverine sites were sampled in May 2002. Sampling methods mirrored earlier events (Benson and Paton 2002) with respect to:

- Fish sampled by multiple gill and fyke nets, bait traps, seine and dip nets
- Water quality sampled by a multi-parameter data logging water quality meter (a Yeokal 610)
- Macroinvertebrates sampled from specialised habitats by qualitative dip netting.

Methods differed from earlier events in terms of the technique used for sampling macroinvertebrates from the edge habitat *per se*. An earlier experiment (SKM, Nov 2001) recommended replicated quantitative surber samples replace AusRivAS style dip netting. Five surber samples were therefore collected from the edge at each site. Specialised habitats such as macrophytes or tree roots were sampled with a dip net irrespective of the proportion of habitat they offered. Sample duration using this method was up to 30 seconds, depending on the area of habitat available. Identification and enumeration of macroinvertebrates was conducted by staff of the Queensland Museum.

No investigation of riparian zones was undertaken as these have been described previously. No analytical chemistry was undertaken as this data is only collected occasionally, the most recent occasion being November 2001.

3. Results

Results are initially presented by site. A regional appraisal is presented in the Discussion.

3.1 Balonne River at St George

This site is adjacent the gauging station below Jack Taylor weir. The banks have a fairly gradual slope and a good cover of grass and trees. The substrate is mainly deep silt with outcroppings of large areas of conglomerate rock. The river is approximately 60m wide and contained a significant number of large snags, particularly near the gauge. Water level was apparently undergoing a slow decline and was about 40cm below the main flow marker (probably the compensation flow level) on trees near the gauge. Flow was very close to zero. Significant amounts of recreational fishing apparently occur at the site.

3.1.1 Water quality

Spot water quality meter readings were collected near the centre of the river (**Table 3-1.1**). Other than the very high turbidity, the results show relatively low conductivity water with a high dissolved oxygen content, particularly given the time of day the recording was made. The turbidity result exceeded the Condamine Balonne Water Committee trigger for the Lower Balonne (375 NTU; CBWC 2002). No datalogging was conducted at this site.

Table 31.1 Spot water quality readings – St George

Sample Period	Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
May 2002	08:30	Surface	11.4	90	118	>500	6.8
		0.5	11.4	90	118	>500	7.0
		1.0	11.3	91	121	>500	7.1
		1.5	11.2	91	121	>500	7.3

The results are very similar to those obtained in June 2000.

3.1.2 Macrophytes

Ludwigia peploides was noted in a small area near the rocks.

3.1.3 Fish

The seine net was not used at this site because of the number of snags and rocks. **Table 3-1.2** shows the catch by netting technique. A large Murray Cod had recently been captured from within Jack Taylor storage a short distance upstream.

■ **Table 3-1.2 Results of fishing at St George in May 2002, by fishing method**

Species	Common name	Gill nets	Seine nets	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1	Not used				1

<i>Cyprinus carpio</i>	Carp				1		1
Total Numbers		1		0	1	0	2

This is a very poor catch and does not reflect historical sampling at the site. **Table 3-1.3** shows the results of all recent sampling. The seine net has not been used on any occasion so lack of use on this occasion does not explain the catch.

Table 3-1.3 Historical results of fishing at St George

Species	June 2000	April 2001	Nov 2001	May 2002	Total abundance
<i>Macquaria ambigua</i>	√	√	√	√	105
<i>Leioptherapon unicolour</i>	√				4
<i>Nematalosa erebi</i>	√	√	√		315
<i>Hypseliotris klunzingeri</i>		√	√		12
<i>Retropina semoni</i>	√		√		3
<i>Cyprinus carpio</i> *	√		√	√	14
<i>Carassius auratus</i> *			√		1
<i>Gambusia holbrooki</i> *	√				5

*= introduced species

A total of 5 native species and 3 introduced have been recorded at this site and in terms of abundance the fauna is dominated by native species. The reason for the poor catch in May 2002 is unknown.

3.1.4 Macroinvertebrates

Three habitats were sampled at St George. Surber samples were collected from both rock and silt / leaf litter substrates. Dip net samples were collected from amongst tree roots and from *Ludwigia* / submerged grass on a nearshore "island". A total of 22 taxa were identified, 16 from the edge habitat (**Table 3-1.4**). Bait traps also collected 16 *Macrobrachium*. The fauna was dominated by chironomids, copepods and caenids. Microhabitat preferences were exhibited by atyids, baetids and caenids.

NRM captured nine taxa in November 2001 from one habitat (edge) using a dip net. Chironominae dominated. NRM classified the site as in Band B (OE=0.45) on AusRivAS protocols. It had been classified as Band B (OE= 0.77) in April 2001 and SKM had detected 21 taxa in June 2000.

Table 3-1.4 Numbers of aquatic macroinvertebrates recorded from St George

Taxa	Edge surber (mean +/- sd)	Tree Root dip	Macrophyte dip
Ancylidae	0.4 +/- 0.9		
Arachnida		4	
Atyidae	1.0 +/- 2.2	32	4
Baetidae		15	4
Caenidae	19.0 +/- 17.1		
Ceratopogonidae	5.2 +/- 6.5		
Chironominae	26.0 +/- 14.7	100	6
Cirolanidae	0.2 +/- 0.4		
Coenagrionidae	0.2 +/- 0.4	2	
Copepoda	15.2 +/- 15.3	53	2
Corixidae		1	6
Gerridae		1	
Leptoceridae	0.4 +/- 0.9		1
Lumbriculidae	1.0 +/- 2.2		
Nematoda	1.0 +/- 2.2		
Oniscidae	0.2 +/- 0.4	5	1
Ostracoda	1.0 +/- 2.2		
Palaemonidae	2.8 +/- 1.8		
Porifera	3.0 +/- 6.7	1	
Sphaeriidae	1.0 +/- 2.2		
Staphylinidae		7	
Veliidae		4	1
Taxa per sample	6.4 +/- 2.5	12	8
Individuals per sample	77.6 +/- 53.2	225	25
Total taxa	(16)		22

3.2 Balonne River at Mooramanna

This site was on a straight stretch of river just upstream from an irrigation pump station. The channel was approximately 50m wide and of trapezoidal shape with parallel flood-runners. The banks were generally well grassed but on the outside of the meander bend downstream from the pumps they were bare and eroding. Cattle also accessed this area. The substrate varied from silt to coarse sand and a number of sand bars were exposed. Bank undercuts were limited but some tree roots were exposed. *Juncus* sp was present in low density near the low water line but there were no macrophytes. The area was obviously frequented by recreational fishers and campers.

3.2.1 Water quality

The site was very shallow, generally < 0.6m, so no spot recordings were taken. Datalogging showed parameters varied little overnight eg:

- Temperature: 11.2-12.4°C
- Dissolved oxygen: %sat, 86-94; mg/l, 9.2-10.2
- pH: 7.3-7.9
- Conductivity: 121-125 µS/cm
- Turbidity: >500NTU at all times.

As a result of the way in which the CBWC triggers were established, while Mooramanna is the regional reference site, some of these results fall outside the trigger levels, and not because the results are not what one would expect in the 20th-80th percentile range upon which the triggers are based, but simply because the triggers were not based on data collected at this time of year or over 24hrs.

In June 2000 the logged temperature was about 9-10⁰C, ph about 7, turbidity <300NTU, DO 85-90% saturation and conductivity 95µS/cm.

3.2.2 Macrophytes

No macrophytes were recorded though *Juncus* sp. was present on the edge.

3.2.3 Fish

Table 3-2.1 shows the fish catch by netting technique.

■ Table 32.1 Results of fishing at Mooramanna in May 2002, by fishing method

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		3	2			5
<i>Nematolosa erebi</i>	Bony Bream		111	3			114
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		342				342
<i>Retropinna semoni</i>	Smelt		3				3
<i>Carrasius auratus</i>	Goldfish*		1				1
<i>Gambusia holbrooki</i>	Mosquito fish*		19				19
Total Numbers		0	479	5	0	0	484

* noxious fish

Four native fish species and two introduced were captured, predominantly in the seine net. Many of the native fish were very small individuals, indicating recent breeding. Previous sampling at this site, including that by David Moffatt, has recorded between 3 and 7 native species per sampling event and a total of 11 species (9 natives). The number of fish captured on this occasion is much higher than that captured previously eg (native sp / total catch): June 2000 (3/14), April 2001 (4/65), November 2001 (not sampled).

Local fishermen noted that at least 3 Murray Cod of good size had been captured in the nearby Doondi waterhole in recent times.

3.2.4 Macroinvertebrates

Surber samples were collected from sand and silt substrates on different sides of the river. One dip net was collected from amongst the fibrous roots of Melaleucas. Nineteen taxa were recorded at the site with micro and macro crustaceans, chironomids and caenids the most common (Table 3-2.2). Bait traps collected 45 *Macrobrachium*. The seine haul captured one Yabby (*Cherax destructor*) and numerous *Macrobrachium* and Atyids. The site has been sampled seven times previously and has recorded between 12 and 22 taxa in edge and macrophyte habitats.

SKM (June 2000) noted that only between about 30 – 50% of the taxa captured at this site in one sampling event were captured in the next.

■ **Table 32.2 Numbers of aquatic macroinvertebrates recorded from Mooramanna**

Taxa	Edge surber (mean +/- sd)	Tree root dip	Macrophyte dip
Atyidae		15	3
Baetidae		5	5
Caenidae	6.0 +/- 6.5	45	20
Capitellidae	1.0 +/- 2.2		
Ceratopogonidae	7.4 +/- 12.8	5	5
Chironominae	11.0 +/- 8.9	85	35
Cirolanidae		13	11
Cladocera		20	
Copepoda	2.4 +/- 3.4	145	25
Corixidae	1.0 +/- 2.2	30	5
Ecnomidae			1*
Leptoceridae	1.0 +/- 2.2	5	3*
Libellulidae		1*	
Lumbriculidae	5.0 +/- 8.7		
Noteridae		5	
Oligochaeta	0.2 +/- 0.4		
Palaemonidae	0.4 +/- 0.9	46	20
Parastacidae			1
Porifera		20	5
Taxa per sample	4.0 +/- 1.2	14	13
Individuals per sample	35.4 +/- 33.2	439	135
Total taxa	(10)		19

3.3 Balonne River at Whyenbah

This site is within the pool formed by the bifurcation weirs and is just upstream of the bridge, within a popular camping and fishing area. The right bank has relatively gentle slope while the left is very steep for about 4 metres above the water line. The substrate is black soil or fine sand. The flat camping area is reasonably cleared with only a thin line of young melaleuca at the water's edge. The left bank is better treed. Cattle access both banks.

The pool was approximately 60m across and the sampling gear was spaced over about 150m. Patchy snags and exposed eucalypt roots were evident, some Melaleuca roots trailed in the water and vegetation overhang was significant on the left bank. A very small patch of *Ludwigia* was growing about 50m from the bridge. A green algal scum covered about 40% of the water surface and was moved about by the wind.

3.3.1 Water quality

Spot water quality readings were taken near the left bank and the results are presented in Table 3-3.1. No data logging was undertaken at this site. No stratification was evident and the water was well oxygenated and of low conductivity but very turbid.

Table 3.3.1 Spot water quality readings – Balonne River at Whyenbah

Sample Period	Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
May 2002	14:30	Surface	13.6	86	125	>500	7.1
		0.5	11.8	89	125	>500	7.1
		1.0	11.5	92	126	>500	7.1

Datalogging in June 2000 recorded 9.5-11°C, ph about 7.2, DO 90-100% sat, conductivity 277µS/cm and turbidity 110-160NTU.

3.3.2 Macrophytes

Ludwigia peploides was the only macrophyte noted and it covered only a few metres of the water surface. A green algal scum covered 40% of the water surface. *Juncus* occurred at the water line in patches.

3.3.3 Fish

All gill nets and one fyke net were removed from the water by a conscientious local and handed to Queensland Fisheries after the required permit labels were sighted. No data are available for these nets (**Table 3-3.2**).

■ **Table 33.2 Results of fishing the Balonne River at Whyenbah in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets (1)	Bait traps	Dip net (2)	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	Not used	3	1			4
<i>Nematolosa erebi</i>	Bony Bream		38	13			51
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		43				43
<i>Hypseleotris sp.4</i>	Carp gudgeon		1				1
<i>Melanotaenia fluviatilis</i>	Rainbow fish		5				5
<i>Retropinna semoni</i>	Smelt		65				65
<i>Gambusia holbrooki</i>	Mosquito fish*		8				8
Total Numbers		0	163	14	0	0	179

* noxious fish

The catch of 6 native species and one introduced is very good considering the number of nets not effectively available. Three previous sampling events have captured (native/introduced species); 5/2, 6/1 and 7/3 for a total of 9 native species and 3 introduced.

3.3.4 Macroinvertebrates

Surber samples were collected from a compact sandy/silt substrate and some samples included fibrous melaleuca roots. Melaleuca tree roots and the *Ludwigia* were sampled by dip net. Fourteen prawns and one yabby were captured in bait traps. One yabby was also captured in the fyke net. Hundreds of small prawns and possibly shrimps were captured in the seine net. Twenty seven taxa were identified with chironomids, micro- and macro-crustacea, surface beetles and baetids being common (**Table 3-3.3**). Abundance in the edge was low but much higher in the macrophytes.

SKM captured 14 taxa in June 2000 and sampling by NRM classified the edge as Band A (O/E 1.05) and the bed as Band B (O/E 0.44) in November 2001 and the edge as Band B (O/E 0.48) and the bed as Band A (O/E 0.88) in April.

■ **Table 33.3 Numbers of aquatic macroinvertebrates recorded from the Balonne River at Whyenbah**

Taxa	Edge surber (mean +/- sd)	Tree root dip	Macrophyte dip
Ancylidae	0.2 +/- 0.4		
Atyidae		36	10
Baetidae		7	40
Caenidae	5.8 +/- 8.3		
Capitellidae	1.0 +/- 2.2		
Ceratopogonidae	6.0 +/- 8.2	2	25
Chironominae	3.0 +/- 4.5	9	690
Cirolanidae	0.4 +/- 0.9		
Cladocera			10
Copepoda	2.4 +/- 4.3	2	400
Corixidae	2.4 +/- 2.5		15
Culicidae		5	
Dytiscidae			5
Ecnomidae			35
Gerridae		3	45
Hydrophilidae			5
Lepidoptera 1			10
Leptoceridae	2.0 +/- 2.7	6	10
Lumbriculidae	1.0 +/- 2.2		
Mesoveliidae		1	
Notonectidae		21	
Oniscidae		6	
Ostracoda		2	65
Palaemonidae	1.6 +/- 2.1		3
Parastacidae		4	
Porifera	1.0 +/- 2.2	1	160
Temnocephalidea	1.0 +/- 2.2		
Taxa per sample	4.8 +/- 1.3	14	16
Individuals per sample	27.8 +/- 20.8	105	1528
Total taxa	(13)		27

3.4 Culgoa River at Whyenbah

This site is about 1.5 km downstream from the gauging station and weir and just upstream of an old bridge which crosses the river. The bridge also serves as access to the Meigunyah site. An old fishing camp 100m upstream of the bridge marks the access to the site. Immediately below the weir the river is wide and sandy with several Melaleuca islands. It then enters a series of strong meander bends just upstream of the site and is very steep sided with occasional large sand point bars.

At the site the river is 10-15m wide at the base with abundant snags and minor overhangs with fibrous roots. A strong bath-tub ring of green alga was present, and significant detritus banks were present in backwaters and caught under the bridge. Most sampling was conducted within a 50m length of river at the site with gill nets placed further upstream. No foam, odour of surface scum was present.

3.4.1 Water quality

No spot water quality readings were collected as the water was very shallow and datalogging was undertaken. Parameters varied little overnight:

- Temperature: 11.2 – 8.3 °C
- Dissolved oxygen (% sat): 74 - 87
- pH: 7.5 – 8.1
- Conductivity: 121 – 130 µS/cm
- Turbidity: >500 NTU

3.4.2 Macrophytes

No macrophytes were observed.

3.4.3 Fish

Seven species of fish were captured at Culgoa River at Whyenbah, including Carp and Mosquito fish (**Table 3-4.1**). In April 2001 NRM captured 4 natives (*Hypseleotris spp*-18, *M. ambigua*-1, *N. erebi*-11, *T. tandanus*-1) plus carp (2). In November NRM captured 5 native species (*Hypseleotris spp*-29, *M. ambigua*-5, *N. erebi*-99, *L. unicolor*-1, *M. fluviatilis*-53) plus carp (4) and goldfish (1). Seven native species have now been captured at this site plus three introduced. The introduced species tend to be in very low numbers.

■ **Table 34.1 Results of fishing the Culgoa River at Whyenbah in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2					2
<i>Nematolosa erebi</i>	Bony Bream		20	1			21
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		52				52
<i>Retropinna semoni</i>	Smelt		31				31
<i>Melanotaenia fluviatilis</i>	Rainbowfish		17				17
<i>Cyprinus carpio</i>	Common Carp*	2	1	2			5
<i>Gambusia holbrooki</i>	Mosquito fish*		1				1
Total Numbers		4	122	3	0	0	129

* noxious fish

3.4.4 Macroinvertebrates

Surber samples were collected from mud (2 samples), gravel (2) and mixed substrate. Bait traps captured six yabbies and 36 prawns and prawns were abundant in the seine haul. Overall, 21 taxa were recorded at the site with chironomids, copepods, caenids and atyids most common (**Table 3-4.2**). Using AusRivAS protocols NRM classified the site as follows:

April 2001 edge, O/E=0.88 - Band A: bed, O/E=0.81 - Band B

November 2001 edge, O/E=0.75 – Band B; bed, O/E=0.33 – Band C.

■ **Table 34.2 Numbers of aquatic macroinvertebrates recorded from Culgoa River at Whyenbah**

Taxa	Edge surber (mean +/- sd)	Tree root dip
Ancylidae	0.2 +/- 0.4	
Arachnida		2
Atyidae	0.2 +/- 0.4	100
Baetidae		24
Caenidae	6.6 +/- 8.1	100
Capitellidae	2.0 +/- 4.5	
Ceratopogonidae	15.0 +/- 14.4	
Chironominae	12.0 +/- 16.7	100
Coenagrionidae		1
Copepoda	5.4 +/- 8.2	100
Corixidae	0.2 +/- 0.4	7
Gerridae		5
Leptoceridae		9
Libellulidae		1
Notonectidae		4
Oligochaeta	0.4 +/- 0.9	
Ostracoda	0.4 +/- 0.9	
Palaemonidae	0.2 +/- 0.4	
Psychomyidae		2
Sphaeriidae	0.2 +/- 0.4	
Veliidae		1
Taxa per sample	5.0 +/- 1.2	14
Individuals per sample	42.8 +/- 47.6	456
Total taxa	(12)	21

3.5 Culgoa River at Cubbie

This site has been regularly sampled by either SKM or NRM since June 2000. It is described in earlier reports. The western bank has only a very thin riparian zone and the outer side of the meander is eroding. The banks are steep with little or no vegetation. Snags are plentiful in the water but no specialised habitats exist other than a very small area of *Ludwidgia*. A slight fringe of filamentous green algae existed. This appears to be a permanent waterhole and is successfully fished for Yellowbelly by recreational anglers.

3.5.1 Water quality

Spot water quality readings were collected at 0850hrs and showed little variation to a depth of 1m. The results showed temperature 6.3°C, dissolved oxygen 71% sat, pH 8.6, conductivity 175µS/cm and turbidity >500NTU. Datalogging was undertaken between 1530hrs and 0815hrs with the probe set approximately 0.5m below the surface. Parameters varied little overnight:

- Temperature: 11.5 – 8.3 °C
- Dissolved oxygen (% sat): 71 - 88
- pH: 7.5 – 8.1

- Conductivity: 118 – 130 $\mu\text{S}/\text{cm}$
- Turbidity: >500 NTU

Results from datalogging in June 2000 showed turbidity about 250NTU, pH 6.8 and dissolved oxygen 60-70% saturation.

3.5.2 Macrophytes

A very small area of *Ludwigia* was present near the log jam. There were no fringing aquatic plants. Only a slight fringe of filamentous green algae was present. This fringe was more significant in June 2000.

3.5.3 Fish

Four native species and carp were caught at the site. Seining was not very effective because of snags. Previous sampling at this site has resulted in (native sp / total catch): June 2000 (6/49), April 2001 (4/67) and November 2001 (2/58) plus the capture of carp in reasonable numbers and goldfish on one occasion in low numbers. Seven native fish species have now been captured at the site.

■ **Table 35.1 Results of fishing the Culgoa River at Cubbie in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1		1			2
<i>Nematolosa erebi</i>	Bony Bream	1	4	3			8
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		5				5
<i>Retropinna semoni</i>	Smelt		4				4
<i>Cyprinus carpio</i>	Common Carp			1			1
Total Numbers		2	13	5	0	0	20

3.5.4 Macroinvertebrates

Surber samples were collected from a mud edge with little detritus and a limited bath-tub ring. Seventeen taxa were identified from the edge habitat and a further two from *Ludwigia* habitat. The most common elements were chironomids, microcrustacea, ceratopogonids and caenids. Bait traps collected 18 *Macrobrachium* and one *Cherax* and good numbers of *Macrobrachium* were captured in the seine net. In April, NRM classified the edge habitat as Band A (O/E=0.9). In November it was Band B (O/E=0.65). The bed habitat was classified as Band B (O/E=0.81) in April and as Band C (O/E=0.22) in November.

Table 35.2. Numbers of aquatic macroinvertebrates recorded from Culgoa River at Cubbie

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Ancylidae	0.4 +/- 0.5	1
Atyidae	0.6 +/- 0.9	4
Baetidae	1.2 +/- 2.2	3
Caenidae	12.4 +/- 11.7	
Ceratopogonidae	13.0 +/- 12.6	62
Chironominae	28.2 +/- 20.8	38
Cladocera	2.0 +/- 4.5	
Coenagrionidae		1
Copepoda	17.0 +/- 19.6	4
Corixidae	0.2 +/- 0.4	
Culicidae	0.2 +/- 0.4	5
Lumbriculidae	2.0 +/- 2.7	
Mesovelliidae		1
Nematoda	1.0 +/- 2.2	
Oligochaeta	0.6 +/- 0.9	1
Ostracoda	3.0 +/- 6.7	
Palaemonidae	0.6 +/- 0.5	
Porifera	1.0 +/- 2.2	1
Sphaeriidae	0.2 +/- 0.4	
Taxa per sample	7.4 +/- 2.1	11
Individuals per sample	83.6 +/- 39.3	121
Total taxa	(17)	19

3.6 Culgoa River at Woolerbilla

This site has been consistently sampled since June 2000, either by SKM or NRM. The site is fully described in earlier reports. Little habitat diversity exists at the site other than significant log jams. The substrate is silt with some sand. A green filamentous algal fringe was present at the time of sampling and a surface scum existed on the pool downstream.

3.6.1 Water quality

The datalogger was placed near a log jam at about 0.5m depth. The pH probe malfunctioned so no data are available. A slight diurnal pattern was present for temperature (range 2.5 to 8°C) and DO (range 38-51% saturation or 5-6mg/L). Conductivity was between 166 and 173µS/cm and turbidity was >500NTU. No water quality data was available from NRM for the sampling undertaken in November 2001. In June 2000, the temperature ranged between 5.7 and 7.2°C, pH was close to 7, turbidity ranged between 300 and 320NTU and conductivity was about 107µS/cm.

3.6.2 Macrophytes

No macrophytes or fringing rushes were noted.

3.6.3 Fish

Two species of native fish plus carp and mosquito fish were captured at this site. In all sampling events to date at this a total of four native species plus three introduced have been captured. Historical sampling shows (native sp / total catch): June 2000 (3/26), April 2001 (3/33) and November 2001 (3/24). The proportion of the catch represented by introduced species, dominated by carp, is usually high.

■ **Table 36.1 Results of fishing the Culgoa River at Woolerbilla in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Nematolosa erebi</i>	Bony Bream		3	1			4
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		6				6
<i>Cyprinus carpio</i>	Common Carp	1					1
<i>Gambusia holbrooki</i>	Mosquito fish		2				2
Total Numbers		1	11	1	0	0	13

3.6.4 Macroinvertebrates

No specialised habitats were available for sampling and this is usually the case at Woolerbilla. A strong ring of filamentous green algae was present. The fauna was relatively abundant and dominated by chironomids, microcrustacea and caenids. One prawn and two yabbies were captured in bait traps. NRM classified the edge habitat at this site as Band A in both April and November 2001 (O/E= 0.88 and 0.86). The bed was only sampled in November and was classified as Band C (O/E=0.22).

■ **Table 36.2 Numbers of aquatic macroinvertebrates recorded from the Culgoa River at Woolerbilla**

Taxa	Edge surber (mean +/- sd)
Ancylidae	5.0 +/- 11.2
Baetidae	4.0 +/- 6.5
Caenidae	106.0 +/- 182.3
Capitellidae	3.0 +/- 2.7
Ceratopogonidae	37.0 +/- 21.4
Chironominae	504.0 +/- 272.5
Cladocera	185.0 +/- 136.6
Copepoda	144.0 +/- 120.1
Corixidae	12.0 +/- 16.8
Ecnomidae	1.0 +/- 2.2
Hydridae	2.0 +/- 2.7
Leptoceridae	1.0 +/- 2.2
Libellulidae	1.0 +/- 2.2
Lumbriculidae	1.0 +/- 2.2
Ostracoda	81.0 +/- 50.7
Palaemonidae	0.4 +/- 0.5
Porifera	27.0 +/- 37.0
Taxa per sample	9.6 +/- 2.7
Individuals per sample	1114.4 +/- 764.4
Total taxa	17

3.7 Culgoa River at Balandool

This site has been sampled by SKM in April and November 2001 as part of Cubbie monitoring. It was dry in November so only sediment chemistry sampling was undertaken. Maximum depth in May was about 1.2m but most areas were less than 0.5m. Upstream of the site was dry when sampled. The site offers little habitat variation at low water levels though some tree roots reach the water at a pool downstream and some snags were present. The tree roots are caked with sediment which dries onto the roots as the water level recedes.

3.7.1 Water quality

Spot water quality readings were taken near the water surface at 1500hrs. The results show temperature; 8.8°C, dissolved oxygen; 7.8mg/L or 66% saturation, pH (malfunctioned), conductivity 165µS/cm and turbidity >500NTU. In April 2001 the results showed DO of 6.4mg/L or 70% saturation, conductivity of 107µS/cm, turbidity of 338NTU and pH of 6.9.

3.7.2 Macrophytes

No macrophytes or algal fringe was present.

3.7.3 Fish

Four native species and three introduced were captured at this site. Gill nets could not be used because of the low water level and small pool size. The site had been dry in

November so this catch represents individuals which had moved through the system and recolonised during the compensation flows. The site had been sampled in April 2001 by SKM and recorded six native species (the additional species to those recorded here being Smelt and Rainbow fish) plus three introduced.

■ **Table 37.1 Results of fishing the Culgoa River at Balandool in May 2002, by fishing method**

Species	Common name	Gill nets (not used)	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		1	1	1		3
<i>Nematolosa erebi</i>	Bony Bream		46	72			118
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		7				7
<i>Leiopotherapon unicolor</i>	Spangled perch		1	1			2
<i>Carrasius auratus</i>	Goldfish		2	1			3
<i>Gambusia holbrooki</i>	Mosquito fish		60		1		61
<i>Cyprinus carpio</i>	Common carp			2			2
Total Numbers		0	117	77	2	0	196

3.7.4 Macroinvertebrates

Surber samples were collected from compact mud with a small amount of leaf litter. There were no macrophytes or filamentous algae at this site but a small amount of *Melaleuca* tree root habitat was available. Twenty seven taxa were recorded with taxonomic density and overall abundance relatively high. The fauna was dominated by microcrustacea, chironomids, caenids and ceratopogonids. Some evidence of habitat preference was observed for example baetids, ecnomids, hydrids and libellulids strongly preferred the tree root habitat. One prawn and 17 yabbies were captured in bait traps. NRM has not sampled this site but ten taxa (mostly families) were recorded by SKM in April 2001. These were collected from three habitats (deep pool, edge and log). The fauna was of very low abundance and was dominated by prawns, chironomids and copepods. The site was dry in November 2001. The fauna captured here therefore also represents new colonists.

■ **Table 37.2 Numbers of aquatic macroinvertebrates recorded from the Culgoa River at Balandool.**

Taxa	Edge surber (mean +/- sd)	Tree root dip
Ancylidae	12.0 +/- 9.7	10
Baetidae		95
Caenidae	53.0 +/- 16.0	145
Capitellidae	3.0 +/- 2.7	
Ceratopogonidae	70.0 +/-30.8	5
Chironominae	530.0 +/- 189.2	860
Cladocera	52.0 +/- 35.5	615
Coenagrionidae		1*
Copepoda	67.0 +/- 24.9	1290
Corixidae	30.0 +/- 18.0	
Dytiscidae		1
Ecnomidae		10
Hydridae	1.0 +/- 2.2	45
Hydrophilidae	2.0 +/- 2.7	
Leptoceridae	5.0 +/- 8.7	
Libellulidae	2.0 +/- 4.5	90
Lumbriculidae	1.0 +/- 2.2	10
Nematoda	11.0 +/- 16.0	
Odontoceridae	5.0 +/- 6.1	
Osmylidae	1.0 +/- 2.2	
Ostracoda	165.0 +/- 55.7	135
Palaemonidae	0.2 +/- 0.4	7
Parastacidae		1
Pionidae		10
Planorbidae	1.0 +/- 2.2	
Porifera	12.0 +/- 16.8	68
Temnocephalidea		25
Taxa per sample	11.8 +/- 1.8	18
Individuals per sample	1023.2 +/- 257.8	3422
Total taxa	(20)	27

* denotes identified from subsample residue

3.8 Balonne Minor River at Meigunyah

This site was sampled by SKM in June 2000 and a nearby site, apparently less permanent, was sampled by NRM in April and November 2001. The site is below the first bifurcation weir and is apparently permanent or near so. The downstream end is marked by the mouth of Middle Creek. At this point the Balonne Minor constricts and flows through a well treed section with more sand and gravel than the pool upstream which is sampled for fish. The constricted section was a riffle/glide when sampled. The site includes plenty of snags in the pool, small debris dams in the riffle area and some trailing or exposed roots, also in the riffle area. A well established camp exists at the site.

3.8.1 Water quality

Spot water quality readings were taken near the tarzan swing and the logger was also placed here.

Table 3.8.1 Spot water quality readings – Balonne Minor at Meigunyah

Sample Period	Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)	pH
May 2002	15:30	Surface	11.2	82	124	>500	7.4
		0.5	11.1	82	124	>500	7.4
		1.0	11.0	82	124	>500	7.4
		1.5	11.0	82	124	>500	7.3
		1.8	11.1	82	124	>500	7.3

The logger was placed at a depth of about 1m and recorded very little variation overnight and readings were very similar to the spot records. The minimum dissolved oxygen value was 77% and pH reached 7.9.

In June 2000 dissolved oxygen was about 80% saturation, conductivity 114µS/cm, turbidity about 275NTU and pH about 7.

3.8.2 Macrophytes

No macrophytes were present but the surface scum which was noted on the weir pool at Whyenbah arrived on the second day of sampling.

3.8.3 Fish

Five native species plus carp were captured at this site. Silver perch is a rare capture in the region. The size of fish captured in the seine net reflected recent breeding (eg Yellowbelly 28mm). Fishermen had camped at the site about one week earlier, mainly targeting Yellowbelly. Historical sampling at the site shows (native sp / total catch): June 2000 (5/333, including 114 *Gambusia*), April 2001 (3/133) and November 2001 (dry). NRM sample in a slightly different location on Meigunyah so the 2001 results are not strictly comparable. The site sampled by SKM and EM has apparently never dried out to the knowledge of the landowner.

■ **Table 38.2 Results of fishing the Balonne Minor River at Meigunyah in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2	3	1			6
<i>Nematolosa erebi</i>	Bony Bream		10	3			13
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		228				228
<i>Retropinna semoni</i>	Smelt		6				6
<i>Bidyanus bidyanus</i>	Silver perch	1					1
<i>Cyprinus carpio</i>	Common carp	2					2
Total Numbers		5	247	4	0	0	256

3.8.4 Macroinvertebrates

Surber samples were collected from mud (2), gravel in flowing water (2) and mud with fibrous roots (1). A dip net sample was collected from *Melaleuca* roots. Thirteen taxa were recorded from the edge samples and a further six from the tree roots. The most common elements were copepods, chironomids, ceratopogonids and

prawns/shrimps. Bait traps collected 126 prawns and they were also numerous if seine and fyke nets.

In June 2000, SKM recorded sixteen taxa in the edge habitat, with another five in the deep pool. The most common taxa were Copepoda and Mesoveliidae. In April 2001 NRM classified the edge as Band A (O/E=1.11) and the bed as Band B (O/E=0.65) on AusRivAS protocols. In November the edge was classified as Band B (O/E=0.50) and the bed as Band C (O/E=0.33).

■ **Table 38.3 Numbers of aquatic macroinvertebrates recorded from the Balonne Minor at Meigunyah**

Taxa	Edge surber (mean +/- sd)	Tree root dip
Atyidae		18
Baetidae		5
Caenidae	3.0 +/- 4.5	
Ceratopogonidae	13.0 +/- 6.7	
Chironominae	15.0 +/- 13.7	10
Cirolanidae	0.2 +/- 0.4	2*
Copepoda	6.0 +/- 6.5	480
Corixidae		1*
Culicidae	1.0 +/- 2.2	
Ecnomidae	1.0 +/- 2.2	
Gerridae	1.0 +/- 2.2	20
Leptoceridae		2*
Lumbriculidae	4.0 +/- 6.5	
Nematoda	1.0 +/- 2.2	
Oniscidae		5
Palaemonidae	2.0 +/- 1.4	23
Porifera	3.0 +/- 4.5	50
Tipulidae	3.0 +/- 6.7	
Veliidae		5
Taxa per sample	5.8 +/- 1.5	9
Individuals per sample	53.2 +/- 24.7	616
Total taxa	(13)	19

• = detected in sample residue

3.9 Balonne Minor at Trafalgar

This site is within the weir pool which includes Cubbie's licenced offtake on this river. NRM sampled the site in April and November 2001. The weir wall is 3.5m high. The site contains a good number of snags and partly submerged red gums and melaleucas but few fibrous roots and no macrophytes. No surface scum was present.

3.9.1 Water quality

The data logger was placed approximately 0.5m below the surface and recorded very little overnight variation in water quality parameters. Temperature remained around 4.2°C and conductivity between 128 and 132µS/cm. Dissolved oxygen was low, between 37 and 41% saturation or 4.8 to 5.8mg/L. Turbidity remained above

500NTU. pH recorded around 9 but we believe this is when the meter began drifting out of calibration.

Spot water quality readings were taken by NRM in April 2001 (Table 39.). Dissolved oxygen levels were much higher and turbidity was much lower than in May 2002.

■ **Table 39.1 Spot water quality readings – Balonne Minor Weir (Trafalgar Station)**

Sample Period	Sample Time	Depth (m)	Temp. (°C)	DO (mg/L)	DO (% sat.)	Conductivity (µS/cm)	Salinity (ppt)	Turbidity	pH
April 2001		-	24.9 [#]	7.6 [#]	92	160	-	190	8.4 [#]

[#]: Exceeds CBWC (2002) local water quality guideline level.

*: Exceeds ANZECC (2000) Guideline.

3.9.2 Macrophytes

No macrophytes were observed, nor was a filamentous algal fringe.

3.9.3 Fish

Three native species plus carp were captured at this site, all in low numbers. NRM sampled this site twice in 2001 and recorded five native species and 42 individuals in April and four native species and 81 individuals in November. In total, six native species have been recorded here plus three introduced, the latter generally in low numbers.

■ **Table 39.2 Results of fishing the Balonne Minor at Trafalgar in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2	1				3
<i>Nematolosa erebi</i>	Bony Bream	1	1	2			4
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		3				3
<i>Cyprinus carpio</i>	Common carp	2					2
Total Numbers		5	6	2	0	0	12

3.9.4 Macroinvertebrates

Five surbers were collected from black clay silt areas. One dip net was collected from *Melaleuca* roots. Fourteen taxa were recorded from the surbers and a further five from the tree root. Common taxa included chironomids, microcrustacea and ceratopogonids. Nine prawns and two yabbies were captured in bait traps. NRM sampled the site in April 2001 and classified the edge in Band A (O/E=0.89). In November they classified the edge as Band B (O/E=0.72) and the bed as Band C (O/E=0.33).

■ **Table 39.3 Numbers of aquatic macroinvertebrates recorded from the Balonne Minor at Trafalgar.**

Taxa	Edge surber (mean +/- sd)	Tree root dip
Atyidae		15
Baetidae	2.0 +/- 4.5	10
Caenidae	1.0 +/- 2.2	10
Capitellidae	1.0 +/- 2.2	20
Ceratopogonidae	19.0 +/- 8.9	
Chironominae	62.0 +/- 81.7	980
Cladocera	16.0 +/- 15.6	150
Copepoda	92.0 +/- 18.2	270
Corixidae	16.0 +/- 9.6	2*
Ecnomidae		10
Gerridae	4.0 +/- 4.2	
Isostictidae		5
Libellulidae		15
Lumbriculidae		5
Notonectidae	1.0 +/- 2.2	
Ostracoda	37.0 +/- 63.9	10
Palaemonidae	1.0 +/- 1.0	12
Porifera	5.0 +/- 3.5	15
Tabanidae	1.0 +/- 2.2	
Taxa per sample	8.4 +/- 0.9	14
Individuals per sample	258.0 +/- 170.4	1527
Total taxa	(14)	19

• = detected in sample residue

3.10 Donegri Ck (Narran River) at Dirranbandi

This site is described in SKM 2000. It is near to the town of Dirranbandi and is a popular recreational fishing area. The site is downstream of the second bifurcation weir and a very low flow was passing over the weir at the time of sampling. The river is a series of strong meander bends in this region and the riparian zone has been cleared in parts. The area shows some level of habitat diversity with significant snags, melaleuca islands, banks of various gradients, some *Ludwigia* and some riffle, though the latter would be short-lived. A green algal scum was present on the water surface, moreso in the weir pool upstream.

3.10.1 Water quality

Spot water quality readings were recorded in a deep section on the outside of a meander bend. There was very little variation with depth. pH readings were thought dubious so are not shown.

Table 3.10.1 Spot water quality readings – Donegri Creek

Sample Period	Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)
May 2002	16:30	Surface	9.1	90	128	>500
		0.5	8.8	89	126	>500
		1.0	8.8	90	126	>500
		1.5	8.8	90	126	>500
		2.0	8.8	90	126	>500
		2.5	8.8	91	126	>500
		3.0	8.7	89	126	>500
		3.5	8.7	89	126	>500
		4.2	8.6	90	126	>500

The datalogger was placed at a depth of about 0.7m suspended from a tree root. Unfortunately all logged data was lost. In June 2000 conductivity was about 110µS/cm, pH about 7.7 and turbidity around 380NTU.

3.10.2 Macrophytes

Ludwigia peploides occurred in sparse patches totally <5% surface coverage. Patchy sedges occurred occasionally near the water line. Green filamentous algae lined the edge and stems of macrophytes. An algal scum was evident on the water surface, moreso in the weir upstream.

3.10.3 Fish

Four native species plus carp were captured at this site. In June 2000, four native species plus goldfish and carp were captured. In November 2001 SKM also captured four native species plus goldfish and carp. In total, six native species and two introduced have been captured at this site. The site is heavily fished by locals targeting Yellowbelly.

■ **Table 310.2 Results of fishing at Donegri Creek in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1	1	2			4
<i>Nematolosa erebi</i>	Bony Bream		13	4			17
<i>Leiopotherapon unicolor</i>	Spangled perch		1				1
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan			2			2
<i>Cyprinus carpio</i>	Common carp		1				1
Total Numbers		1	16	8	0	0	25

3.10.4 Macroinvertebrates

Surbers were collected from edge mud substrate. The riffle was of compacted mud and exposed fibrous roots. The macrophyte was *Ludwigia*. Twenty five taxa were recorded from the four habitats with common taxa including chironomids, microcrustacea, ceratopogonids and caenids. Habitat preferences were observed such as simuliids in the riffle and baetids in the macrophytes and tree roots. Bait traps

captured 65 prawns and very high numbers were captured in seine hauls, particularly from the riffle area.

Twenty-two taxa were captured in June 2000. Fifteen taxa were recorded in November 2001 from three habitats (edge, log and macrophyte). The most abundant taxa were chironomids and corixids. Fourteen taxa recorded in June 2000 were not captured in November 2001 while seven new taxa were recorded.

■ **Table 310.3 Numbers of aquatic macroinvertebrates recorded from Donegri Creek (Narran River)**

Taxa	Edge surber (mean +/- sd)	Tree root dip	Riffle dip	Macrophyte dip
Ancylidae	1.2 +/- 1.6			10
Atyidae	2.0 +/- 1.6	4		12
Baetidae		5		45
Caenidae	12.2 +/- 10.5	105	5	
Ceratopogonidae	20.2 +/- 14.5	5		10
Chironominae	28.8 +/- 37.6	90	125	1150
Cladocera		15		490
Coenagrionidae		2*		15
Copepoda	8.2 +/- 15.1	80	10	20
Corixidae	0.8 +/- 1.3	5		
Culicidae				20
Ecnomidae				10
Gerridae		2*		20
Leptoceridae	0.2 +/- 0.4	25		
Lumbriculidae	2.0 +/- 4.5			5
Nematoda			5	
Oligochaeta	0.2 +/- 0.4			
Oniscidae		1*		
Ostracoda	1.2 +/- 2.2	20		5
Palaemonidae		22	15	3
Parastacidae			1	
Porifera		15	5	
Simuliidae			125	
Sphaeriidae	0.2 +/- 0.4			
Tipulidae	1.0 +/- 2.2			
Taxa per sample	6.4 +/- 2.3	12	8	14
Individuals per sample	78.2 +/- 75.3	391	291	1815
Total taxa	(13)			25

* = detected in sample residue

3.11 Narran River at Clyde

This site has only been sampled once previously, by SKM in November 2001. It is fully described in that report. The site shows little habitat diversity other than snags and terrestrial litter. There were no fibrous tree roots in the water, no macrophytes and no filamentous algae. A site just upstream appears more easily accessible, more permanent, easier to use the seine net in and perhaps to contain more habitats.

3.11.1 Water quality

Logged data was recorded from a depth of approximately 0.5m. There was little variation overnight with temperature between 3.7 and 6.2°C, conductivity between 142 and 147µS/cm, dissolved oxygen between 52.5 and 61.4% saturation and turbidity >500NTU.

Results from November 2001 show a temperature range overnight of from 15 to over 16°C, dissolved oxygen declining from over 60% to about 45%, ph steady at about 7.9 and turbidity fluctuating wildly at over 2000NTU. Spot measurements showed the water was strongly stratified at about 0.5m with warm water and high dissolved oxygen levels at the surface. Conductivity was between 270 and 284µS/cm.

3.11.2 Macrophytes

No macrophytes were recorded.

3.11.3 Fish

Three native species and two introduced were captured at this site. Sampling in November 2001 by SKM captured three native species and three introduced in a total catch of 19 individuals. In total, four native species (those below plus Western Carp Gudgeon) have been captured here plus three introduced. Introduced fish have so far contributed approximately 50% of the total catch.

■ **Table 311.1 Results of fishing the Narran River at Clyde in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly			2			2
<i>Nematolosa erebi</i>	Bony Bream		1	2			3
<i>Leiopotherapon unicolor</i>	Spangled perch		1				1
<i>Carrasius auratus</i>	Goldfish				1		1
<i>Cyprinus carpio</i>	Common carp	1		3			4
Total Numbers		1	2	7	1	0	11

3.11.4 Macroinvertebrates

No specialised habitats were available to sample at this site. The surbers were collected from compacted clay substrate. Fifteen taxa were recorded with chironomids, microcrustacea, ceratopogonids and caenids common. The taxonomic density and faunal abundance was relatively high. Bait traps captured 14 prawns. In November 2001 SKM recorded thirteen taxa from two habitats, edge and log.

Table 311.2 Numbers of aquatic macroinvertebrates recorded from the Narran River at Clyde

Taxa	Edge surber (mean +/- sd)
Ancylidae	1.0 +/- 2.2
Caenidae	51.0 +/- 25.1
Capitellidae	4.0 +/- 4.2
Ceratopogonidae	87.0 +/- 73.2
Chironominae	272.0 +/- 151.6
Cladocera	20.0 +/- 11.7
Copepoda	105.0 +/- 28.5
Corixidae	16.0 +/- 10.8
Culicidae	2.0 +/- 4.5
Ecnomidae	1.0 +/- 2.2
Nematoda	1.0 +/- 2.2
Ostracoda	19.0 +/- 16.4
Palaemonidae	0.4 +/- 0.5
Porifera	12.0 +/- 13.0
Sphaeriidae	1.0 +/- 2.2
Taxa per sample	9.6 +/- 2.1
Individuals per sample	592.4 +/- 129.0
Total taxa	15

3.12 Narran River at Booligar

This site had only previously been sampled in November 2001 by SKM and it is described in that report. At that time the site consisted of a small isolated pool whereas on this occasion the river was flowing, albeit only just, so all nearby habitat was connected. The environs of the site have been grazed over many years and the banks are very bare. There are a significant number of snags and major tree roots exposed in the water but little or no fibrous roots. No macrophytes or filamentous algal fringe was noted though green algae was present in the small riffle area.

3.12.1 Water quality

Spot water quality readings show mild stratification just below the surface. Stronger stratification was evident in November with supersaturated dissolved oxygen levels in the surface waters and conductivities up to 300µS/cm.

Table 3-12.1 Spot water quality readings – Narran River at Booligar

Sample Period	Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)
May 2002	15:30	Surface	7.0	65	140	>500
		0.5	4.7	64	144	>500
		1.0	4.5	61	144	>500
		1.5	4.4	58	144	>500
		2.0	4.4	47	134	>500

3.12.2 Macrophytes

No macrophytes were observed and filamentous algae was only present in the small area of riffle.

3.12.3 Fish

Five native species and three introduced were captured at this site, most in very low numbers. Three native species plus Carp and Goldfish were captured in November, with the introduced species contributing 75% of the catch (total of 48 individuals). Only one fyke net was used at this site.

■ **Table 312.2 Results of fishing the Narran River at Booligar in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets (1)	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	5	1				6
<i>Nematolosa erebi</i>	Bony Bream	16	10				26
<i>Retropinna semoni</i>	Smelt		2				3
<i>Tandanus tandanus</i>	Eeltail catfish			1			1
<i>Leiopotherapon unicolor</i>	Spangled perch		1				1
<i>Carrasius auratus</i>	Goldfish		1				1
<i>Cyprinus carpio</i>	Common carp	1					1
<i>Gambusia holbrooki</i>	Mosquito fish		2				2
Total Numbers		22	17	1	0	0	40

3.12.4 Macroinvertebrates

One surber was collected from the riffle area, which had a substrate of silt with some sand plus filamentous green algae. The other surbers were collected from the pool, which had a mud substrate. The dip net sample was collected from the riffle. Nineteen taxa were identified, most from the riffle. Common faunal elements included chironomids, microcrustacea, ceratopogonids and caenids. Bait traps collected 38 prawns. SKM reported 11 taxa in November 2001 when the water level was lower. NRM sampled near the gauging station upstream in November and recorded 18 taxa with similar relative abundance to that recorded in May 2002. In April the gauging station site classified as Band A (O/E=0.99) in the edge habitat and Band B (O/E=0.81) in the bed habitat while in November it was Band B (O/E=0.65) in the edge and Band C (O/E=0.34) in the bed.

Table 312.3 Numbers of aquatic macroinvertebrates recorded from Narran River at Booligar

Taxa	Edge surber (mean +/- sd)	Riffle dip
Ancylidae	3.0 +/- 4.5	
Atyidae		1*
Baetidae	1.0 +/- 2.2	5
Caenidae	36.0 +/- 19.8	75
Ceratopogonidae	91.0 +/- 62.1	130
Chironominae	384.0 +/- 255.8	195
Chrysomelidae		5
Cladocera	43.0 +/- 32.1	175
Copepoda	65.0 +/- 22.6	850
Corixidae		10
Culicidae		5
Dytiscidae		1*
Gerridae	1.0 +/- 2.2	
Osmylidae		5
Ostracoda	13.0 +/- 7.6	50
Palaemonidae	1.8 +/- 2.0	1*
Parastacidae		1*
Pionidae	1.0 +/- 2.2	
Porifera	1.0 +/- 2.2	50
Taxa per sample	7.8 +/- 1.8	16
Individuals per sample	640.8 +/- 332.6	1555
Total taxa	(12)	19

*denotes identified from subsample residue

3.13 Balandool River at Cubbie

SKM sampled this site in April and November 2001 though in the latter it was dry. In April it consisted of a series of shallow isolated pools. In May 2002 the river was just flowing so was connected between weirs but the maximum depth was about 0.6m. The bed is primarily deep soft silt and there is very little habitat diversity, though snags are not uncommon. No macrophytes were observed but a slight filamentous algal fringe was present. Sheep have heavily grazed the environs.

3.13.1 Water quality

Logged water quality was recorded from a depth of approximately 0.5m. The results show temperature decreased from 8.5 to 4.4°C overnight while other parameters were quite stable: conductivity 131-121µS/cm; dissolved oxygen 85-89% saturation and turbidity >500NTU. The results probably reflect the proximity to the weir and the current, though declining, discharge from it. Spot surface results for April 2001 showed dissolved oxygen at 68.6% saturation, conductivity of 123µS/cm, pH of 7.2 and turbidity of 511NTU.

3.13.2 Macrophytes

No macrophytes were recorded.

3.13.3 Fish

Four native species of fish plus Carp were captured in May. This site was fished in April 2001 by SKM and yielded four native species including Rainbow fish and Spangled Perch, plus Carp, in a total catch of 75 individuals. Bony Bream had dominated. The site was dry when visited in November. Six species of native fish plus Carp have now been captured at this site in two sampling events.

■ **Table 313.1 Results of fishing the Balandool River on Cubbie in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly		7	5	1		13
<i>Nematolosa erebi</i>	Bony Bream		81				81
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		1				1
<i>Retropinna semoni</i>	Smelt		2				2
<i>Cyprinus carpio</i>	Common carp		11	5	20		36
Total Numbers		0	102	10	21	0	133

* noxious fish

3.13.4 Macroinvertebrates

Surber samples were collected from mud substrate and a dip net sample was collected from a small area of tree root. Numerous roots were above the waterline. Only three taxa were recorded in the edge and abundances were very low. Eleven taxa were recorded from tree roots with chironomids, copepods and caenids most common but not abundant. Bait traps collected eight yabbies and 13 prawns. Fyke nets captured one yabbie and three prawns and a small number of prawns were also caught in the seine. The site was dry when visited in November 2001 and in April 2001 only five taxa were recorded plus prawns and yabbies.

Table 313.2 Numbers of aquatic macroinvertebrates recorded from the Balandool River on Cubbie (*denotes identified from subsample residue)

Taxa	Edge surber (mean +/- sd)	Tree root dip
Caenidae		20
Ceratopogonidae	2.2 +/- 2.7	5
Chironominae	7.6 +/- 4.6	70
Copepoda		155
Dytiscidae		1
Libellulidae		10
Oligochaeta	2.2 +/- 3.3	
Osmylidae		1*
Parastacidae		1
Porifera		20
Tabanidae		1*
Temnocephalidea		10
Taxa per sample	2.2 +/- 1.1	11
Individuals per sample	12.0 +/- 8.1	292
Total taxa	(3)	12

3.14 Balandool River at Euraba

In April 2001 this site was a series of shallow isolated pools and in November it was dry. The site environs have been heavily grazed by sheep and the riparian zone is poor. While a number of snags add habitat diversity, there were no macrophytes and no filamentous algae. Several areas of fibrous roots did not quite extend to the water. Depth of water did not exceed 1m.

3.14.1 Water quality

Logged water quality data were recorded from a depth of 0.5m. Temperature decreased from 8.7 to 2.1°C and dissolved oxygen from 74 to 57% saturation overnight. Other parameters remained stable: conductivity 132-143µS/cm, turbidity >500NTU. In April 2001 no diurnal pattern was evident with dissolved oxygen between 73 and 77% saturation, pH between 6.9 and 7.2, turbidity between 250 and 300NTU and conductivity about 141µS/cm.

3.14.2 Macrophytes

No macrophytes were noted and no filamentous algae was present.

3.14.3 Fish

Two native species of fish plus two introduced were captured in May. This site was fished in April 2001 by SKM and yielded four native species including Rainbow fish, Smelt and Yellowbelly, plus three introduced, in a total catch of 65 individuals. Bony Bream had dominated. The site was dry when visited in November. The site has thus yielded five native species and three introduced from two sampling events.

■ **Table 314.1 Results of fishing at the Balandool River at Euraba in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Nematolosa erebi</i>	Bony Bream		5	20			25
<i>Leiopotherapon unicolor</i>	Spangled perch			3			3
<i>Carrasius auratus</i>	Goldfish		6	5			11
<i>Cyprinus carpio</i>	Common carp		1				1
Total Numbers		0	12	28	0	0	40

3.14.4 Macroinvertebrates

Surber samples were collected from silt substrate with little litter or bath-tub ring. No other habitats were available to sample though some tree roots were exposed just above water level. A total of 13 taxa were collected and the more common elements were ceratopogonids, chironomids, worms and sponges. Bait traps captured 10 yabbies and seine netting captured a number of prawns. Ten taxa, all in low numbers, were captured in April 2001 along with over 400 prawns. The site was dry in November.

■ **Table 314.2 Numbers of aquatic macroinvertebrates recorded from the Balandool River at Euraba**

Taxa	Edge surber (mean +/- sd)
Ancylidae	4.0 +/- 2.2
Baetidae	1.0 +/- 2.2
Caenidae	3.0 +/- 4.5
Capitellidae	15.0 +/- 15.8
Ceratopogonidae	59.0 +/- 46.7
Chironominae	26.0 +/- 16.0
Cladocera	8.0 +/- 8.4
Corixidae	2.0 +/- 4.5
Odontoceridae	1.0 +/- 2.2
Osmylidae	1.0 +/- 2.2
Ostracoda	2.0 +/- 2.7
Pionidae	3.0 +/- 4.5
Porifera	13.0 +/- 18.9
Taxa per sample	7.8 +/- 1.3
Individuals per sample	149.0 +/- 57.5
Total taxa	13

3.15 Bokhara River at Kirrima

This site was sampled by NRM in April 2001 but was dry in November. This site is about 100m below the third bifurcation weir. The river cross section is trapezoidal in shape with bare banks except where tree roots are exposed. The area is black clay and the bottom is very soft silt. The riparian zone is thin and has been partly cleared. It is dominated by natives but has very few large trees. Lignum is common in the area between the Balandool and Bokhara rivers. Snags are plentiful in the river and some melaleucas have re-grown where they fell. These provide some fibrous root habitat but most are caked with sediment. No macrophytes were observed though sedges occurred occasionally. A minor filamentous algal fringe was present. The river is 5-8m wide and rarely reached 1m deep.

3.15.1 Water quality

Spot water quality measurements only were taken at this site (at 1500hrs). Readings at the surface and at 0.5m depth were almost identical and showed: temperature 9.5°C, dissolved oxygen 85% saturation, conductivity 129µS/cm and turbidity >500NTU. The meter pH reading of 9.1 was questionable given the meters reliability. In April 2001 NRM recorded spot surface water quality at 0800hrs of: conductivity 163µS/cm; dissolved oxygen of 60% saturation; pH of 8.6 and turbidity of 390NTU. At that time there was a green algal slick on the surface.

3.15.2 Macrophytes

No macrophytes were observed and only sparse sedges lined the waterline.

3.15.3 Fish

Seven native fish species plus two introduced were captured in May. Five of these were represented by only one or two individuals. NRM found the site dry in November and too shallow to sample in April.

■ **Table 315.1 Results of fishing the Bokhara River at Kirrima in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1	6	1			8
<i>Nematolosa erebi</i>	Bony Bream		10	2			12
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		2				2
<i>Retropinna semoni</i>	Smelt		5				5
<i>Leiopotherapon unicolor</i>	Spangled perch			1			1
<i>Neosilurus hyrtl</i>	Hyrtl's tandan			1			1
<i>Melanotaenia fluviatilis</i>	Rainbow fish		1				1
<i>Carrasius auratus</i>	Goldfish			1			1
<i>Gambusia holbrooki</i>	Mosquito fish		5				5
Total Numbers		1	29	6	0	0	36

3.15.4 Macroinvertebrates

Surber samples were collected from silt substrate with limited detritus. Melaleuca tree roots upstream of the causeway were sampled by dip net. A total of 11 taxa were captured with the most common being chironomids, ceratopogonids and copepods. Abundances were very low. Bait traps captured 40 prawns and three yabbies. Six yabbies were caught in fyke nets and large numbers of prawns were caught in the seine net. NRM sampled the site in April 2001 and classified both the edge and bed as Band B (O/E= 0.68 and 0.48 respectively). The site was dry in November 2001 so was not sampled.

■ **Table 315.2 Numbers of aquatic macroinvertebrates recorded from the Bokhara River at Kirrima**

Taxa	Edge surber (mean +/- sd)	Tree root dip
Atyidae	0.2 +/- 0.4	5
Baetidae		5
Caenidae		5
Ceratopogonidae	6.2 +/- 9.0	10
Chironominae	1.8 +/- 2.2	35
Copepoda		10
Gerridae	2.2 +/- 4.9	
Leptoceridae	0.2 +/- 0.4	
Oligochaeta	0.8 +/- 0.8	
Oniscidae	0.2 +/- 0.4	
Palaemonidae		5
Taxa per sample	2.8 +/- 1.8	7
Individuals per sample	11.6 +/- 14.3	75
Total taxa	(7)	11

3.16 Bokhara River at Koala

This site is described in SKM's report of the November 2001 sampling event. SKM had sampled this site for fish in June 2000 but sampled a site just downstream for macroinvertebrates because of apparently greater habitat diversity. All sampling was conducted at one site on this occasion. The site is basically a long and almost permanent pool and at the time of sampling was over 2m deep in places. The eastern bank has only a sparse riparian zone bordered by cleared grazing land. Unlike many other sites this pool has a broad profile, similar to Nindigully or Fenton. There is little root exposure or erosion. The substrate is deep silt. Snags were common but generally the bottom was quite clean, particularly when compared to sites like Woolerbilla.

3.16.1 Water quality

Spot water quality readings were taken at the surface and at 0.5m depth and there was little difference between the two except for temperature. Temperature at the surface was 8.4°C and at 0.5m was 6.6°C. Dissolved oxygen was around 66%, conductivity 139 – 142µS/cm and turbidity >500NTU. In April 2001 NRM reported spot readings taken at 0900hrs of: conductivity 198, dissolved oxygen 46% saturation, pH of 7.7 and turbidity of 482NTU.

3.16.2 Macrophytes

Ludwigia occurred in small patches totalling less than 1% of the surface area. A fringe of filamentous green alga was present.

3.16.3 Fish

Three native species plus Carp and Goldfish were captured at this site in May. The catch in April 2001 constituted three native species plus Carp in a total of 80 individuals. Bony Bream dominated (67 individuals). Five native species plus three introduced were recorded in November from a catch of 56 individuals. In total, six native species and three introduced have been recorded from three sampling events.

■ **Table 316.1 Results of fishing the Bokhara River at Koala in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	5	2	2			9
<i>Nematolosa erebi</i>	Bony Bream	1	19	2			22
<i>Leiopotherapon unicolor</i>	Spangled perch		1				1
<i>Carrasius auratus</i>	Goldfish		1				1
<i>Cyprinus carpio</i>	Common carp	1					1
Total Numbers		7	23	4	0	0	34

3.16.4 Macroinvertebrates

Surber samples were collected from soft mud with significant amounts of leaf material. A dip net sample was collected from a small area of *Ludwigia*. Nineteen taxa were recorded, several with relatively high abundances. While an algal bath-tub ring was evident, it was not strong. The more common taxa were chironomids,

microcrustacea, ceratopogonids and caenids. Baetids and sponges were common in the macrophytes. Bait traps captured 11 prawns.

Fourteen macroinvertebrate taxa were recorded from the NRM November 2001 survey. The most abundant taxa were Chironominae and Coenagrionidae. NRM classified the edge as Band B (OE=0.57) and the bed as Band C (O/E=0.34) on AusRivAS protocols. In April only the edge was sampled and was classified as Band A (O/E=1.0).

The June 2000 survey (SKM, 2000) showed 25 taxa in total however the site was slightly downstream and included a small weir pool. Eighteen taxa occurred in edge (backwater) habitat and 15 taxa in the deep pool habitat.

■ **Table 316.2 Numbers of aquatic macroinvertebrates recorded from Bokhara River at Koala**

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Ancylidae	9.0 +/- 8.9	
Atyidae		1
Baetidae		45
Caenidae	58.0 +/- 34.0	15
Capitellidae	5.0 +/- 11.2	
Ceratopogonidae	98.0 +/- 40.1	30
Chironominae	772.0 +/- 418.8	430
Cladocera	241.0 +/- 60.8	1600
Coenagrionidae		5
Copepoda	217.0 +/- 42.8	450
Corixidae	17.0 +/- 25.4	5
Culicidae		75
Ecnomidae	1.0 +/- 2.2	
Gerridae		5
Leptoceridae		5
Lumbriculidae	1.0 +/- 2.2	
Nematoda	2.0 +/- 2.7	
Ostracoda	173.0 +/- 73.3	35
Porifera	44.0 +/- 36.5	140
Taxa per sample	9.0 +/- 2.0	14
Individuals per sample	1638.0 +/- 418.5	2841
Total taxa	(13)	19

3.17 Warrego River at Shannonvale

This site has been sampled by SKM in June 2000 and November 2001 and is described in those earlier reports. The site consists of a long pool with a sandy substrate. A number of snags were present and at higher water levels the roots of melaleucas would be in the water.

3.17.1 Water quality

Spot water quality readings were taken in a deep hole and showed some variation with depth. Results are shown below. The pH recordings of just over 9 may not be valid and are not included.

Table 3-17.1 Spot water quality readings – Warrego River at Shannonvale

Sample Period	Sample Time	Depth (m)	Temp. (°C)	Dissolved Oxygen (%sat)	Conductivity (µS/cm)	Turbidity (NTU)
May 2002	0900hrs	Surface	6.9	62	95	350
		0.5	6.6	53	93	352
		1.0	6.5	51	93	352
		1.5	6.2	48	94	365

Overnight datalogging showed little pattern though temperature decreased from 9 to 6.6°C and dissolved oxygen from 65 to 48% saturation. Conductivity ranged between 87 and 96µS/cm, pH from 8.6 to 9.3 (questioned) and turbidity from 345 to 374NTU.

In November a strong diurnal pattern had been present, particularly for temperature and dissolved oxygen, which varied from 21 to 15°C and 68% to 35% saturation respectively. Turbidity fluctuated wildly at very high levels while pH remained fairly constant at 7.8.

3.17.2 Macrophytes

No macrophytes were recorded.

3.17.3 Fish

Eight species of native fish plus Carp were captured at Shannonvale. On each of two previous sampling occasions only three native species plus two introduced had been captured. The site total is now eight native species plus three introduced.

Table 317.2 Results of fishing the Warrego River at Shannonvale in May 2002, by fishing method

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	3		1			4
<i>Nematolosa erebi</i>	Bony Bream	1	38	8			47
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		49				49
<i>Hypseleotris sp4</i>	Gudgeon		16		1		17
<i>Leiopotherapon unicolor</i>	Spangled perch		1				1
<i>Retropinna semoni</i>	Smelt		147				147
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan			25			25
<i>Tandanus tandanus</i>	Eeltail catfish	1					1
<i>Cyprinus carpio</i>	Common carp	1					1
Total Numbers		6	251	34	1	0	292

3.17.4 Macroinvertebrates

Ten taxa were recorded from two habitats at Shannonvale. In addition, 128 *Macrobrachium* were captured in bait traps. Abundances were low. Twenty taxa were recorded in June 2000, mainly from macrophyte habitat, and 17 taxa were recorded in November 2001, eight of which were new to the site record. The occurrence of Cladocera at this site has been sporadic with none recorded in June 2000 or May 2002 but 243 recorded in November 2001. The dominance hierarchy is similar to that at Tinnenburra.

■ **Table 317.3 Numbers of aquatic macroinvertebrates recorded from Shannonvale**

Taxa	Edge surber (mean +/- sd)	Log dip
Aeschnidae	0.4 +/- 0.9	
Atyidae	2.4 +/- 3.4	4
Caenidae	9.0 +/- 13.7	1
Ceratopogonidae	23.0 +/- 28.5	
Chironominae	21.8 +/- 22.8	
Copepoda	3.2 +/- 3.7	50
Corixidae	1.6 +/- 2.5	
Leptoceridae	0.6 +/- 1.3	
Oligochaeta	0.4 +/- 0.5	
Ostracoda	0.4 +/- 0.5	1
Taxa per sample	5.6 +/- 2.1	4
Individuals per sample	62.8 +/- 67.7	56
Total taxa	(10)	10

3.18 Warrego River at Tinnenburra

This site was first sampled in November 2001 and is described in that report. At that time the site consisted of two very small pools. In May 2002, the pool sampled was at least 400m long and 20m wide. The substrate was a clay silt overlaying sand. Little detritus was present but isolated snags occurred in places. Water clarity was restricted to a few centimetres and some foaming was present upstream.

3.18.1 Water quality

Time series water quality data only is available for this site. There was little pattern overnight and parameters showed the following ranges: temperature; 6.1 – 4.6°C, dissolved oxygen; 29 – 37% saturation, conductivity; 103 – 110µS/cm, pH; 9 – 9.6 (suspect) and turbidity; 295 – 317NTU. In November 2001 surface waters were supersaturated with dissolved oxygen (113%), conductivity was 166µS/cm, turbidity 660NTU and pH 7.4.

3.18.2 Macrophytes

No macrophytes were observed.

3.18.3 Fish

Five native fish species plus Carp were captured at Tinnenburra. In November only seine netting was possible as the site consisted of just two very small pools. Only three species were recorded; Yellowbelly, Bony Bream and Goldfish.

■ **Table 318.1 Results of fishing the Warrego River at Tinnenburra in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	1		1			2
<i>Nematolosa erebi</i>	Bony Bream		35	3			38
<i>Hypseleotris klunzingeri</i>	Western carp gudgeon		6				6
<i>Retropinna semoni</i>	Smelt		6				6
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan			7			7
<i>Cyprinus carpio</i>	Common Carp	1					1
Total Numbers		2	47	11	0	0	60

* noxious fish

3.18.4 Macroinvertebrates

No specialised habitats were present at Tinnenburra so sampling was restricted to the edge habitat. Thirteen taxa were recorded and Chironomidae dominated the fauna. Faunal distribution was patchy and abundance was low. Some surface elements were captured but generally the fauna is representative of fine substrates with some algal presence. Thirty two *Macrobrachium* and three *Cherax* were captured in bait traps and numerous *Macrobrachium* were captured in the seine net.

■ **Table 318.2 Numbers of aquatic macroinvertebrates recorded from Tinnenburra**

Taxa	Edge surber (mean +/- SD)
Acarina	0.2 +/- 0.4
Arachnida	0.2 +/- 0.4
Caenidae	2.0 +/- 1.6
Ceratopogonidae	3.8 +/- 4.9
Chironominae	19.6 +/- 16.6
Copepoda	6.2 +/- 4.8
Corixidae	4.0 +/- 8.9
Leptoceridae	2.0 +/- 2.3
Oligochaeta	0.4 +/- 0.5
Ostracoda	1.4 +/- 1.1
Sphaeriidae	0.2 +/- 0.4
Stratiomyidae	0.2 +/- 0.4
Tabanidae	0.4 +/- 0.5
Taxa per sample	6.6 +/- 1.8
Individuals per sample	40.6 +/- 33.9
Total taxa	13

3.19 Moonie River at Nindigully

This site is described in the SKM June 2000 and November 2001 reports. In May 2002 few snags were present and the site constricted at the downstream end to a short clay-based riffle. The upper end of the constriction was covered with *Ludwigia* but

it had little presence elsewhere. The site appears to be rarely visited by grazing animals but some signs of recreational angling were evident. The fringe of filamentous algae was poorly developed. The pool was up to 40m wide and 1.5m deep. No algal scum was evident.

3.19.1 Water quality

The water quality meter was suspended from a snag at a depth of about 0.5m. Little overnight variation was recorded. Temperature ranged from 5.7 to 4.4°C; conductivity from 68 to 71µS/cm; dissolved oxygen from 34 to 47% saturation and turbidity was always >500NTU. Spot readings in November showed gradual changes with depth but no stratification. Conductivity was between 140 and 145µS/cm. Overnight, dissolved oxygen fluctuated between 50 and 65% saturation and pH was stable at about 7.2.

3.19.2 Macrophytes

Ludwigia was common at the constriction (not actually in the riffle) but sparse elsewhere. Occasional *Juncus* and Sword sedge lined the waterline.

3.19.3 Fish

Four native fish species plus Carp were recorded at Nindigully. The fish were much larger than captured in the Lower Balonne and the seine was relatively unsuccessful despite two good hauls being conducted. In June 2000 four native species plus one introduced were identified from a total of 19 fish. In November 2001 the catch was 24 fish and comprised of three native species. The site total is now five native species and three introduced. Other than good numbers of relatively large Bony Bream and Yellowbelly, the site regularly produces a poor fish fauna. Western Carp Gudgeon is yet to be captured here though it is often abundant at other sites.

■ **Table 319.1 Results of fishing the Moonie River at Nindigully in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (2)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	7	4				11
<i>Nematolosa erebi</i>	Bony Bream	34	1	1			36
<i>Neosilurus hyrtlii</i>	Hyrtl's tandan			1			1
<i>Retropinna semoni</i>	Smelt		1				1
<i>Cyprinus carpio</i>	Common carp	3					3
Total Numbers		44	6	2	0	0	52

* noxious fish

3.19.4 Macroinvertebrates

Surber samples were collected from a compact mud substrate with some detritus but little algae. The macrophyte sample was collected from a large area of *Ludwigia* while the riffle was a very shallow area on compact mud and contained significant green filamentous algae. The riffle habitat has not existed when the site has been sampled previously. Four *Macrobrachium* were captured in bait traps and none in either seine haul. The surber samples were completely sorted while the dip samples were sub-sampled to 1/5.

Three habitats were sampled at this site and 21 taxa in total were identified. Sixteen taxa were collected from the edge habitat, a further three added from the macrophyte habitat and two from the riffle. This compares with 16 taxa collected in June 2000 and 14 in November 2001. The fauna continues to be dominated by microcrustacea and chironomids and is relatively abundant. Some consistency in microhabitat distribution is now evident, for example, baetids tend to occur in the macrophyte habitat whereas caenids are more common in the edge. Similar strong preferences can be seen by Culicidae, Porifera and Simuliidae, amongst others. No culicids or simuliids, and only one ceratopogonid, had been captured here previously.

Table 319.2 Numbers of aquatic macroinvertebrates recorded from Nindigully

Taxa	Edge surber (mean+/-sd)	Macrophyte dip	Riffle dip
Ancylidae			10
Baetidae	7.0 +/- 13.0	145	20
Caenidae	20.0 +/- 12.7		5
Capitellidae	4.0 +/- 5.5		
Ceratopogonidae	58.0 +/- 23.1	5	10
Chironominae	132.0 +/- 77.3	185	920
Cladocera	74.0 +/- 61.8	1440	310
Copepoda	287.0 +/- 215	880	845
Corixidae	1.0 +/- 2.2	1*	20
Culicidae		205	1*
Hydrophilidae		5	
Isotomidae	1.0 +/- 2.2		
Nematoda	2.0 +/- 2.7		
Odontoceridae	1.0 +/- 2.2		
Osmylidae		5	
Ostracoda	14.0 +/- 12.9	10	50
Palaemonidae	0.6 +/- 0.5		
Planorbidae	1.0 +/- 2.2		
Porifera	11.0 +/- 9.6	280	
Simuliidae			90
Unionicolidae	4.0 +/- 4.2		
Taxa per sample	9.4 +/- 2.9	11	11
Individuals per sample	617.6 +/- 385.3	3160	2280
Total taxa	(16)		21

*=identified from sub-sample residue.

3.20 Moonie River at Fenton

This site has been sampled once previously in November 2001 and it is described by SKM in the applicable report. The site is a long pool generally 20m wide and up to 1.5m deep. It is lined with a thin riparian zone and the cross section is quite gradual above the water line. There is little erosion, the bottom is deep silt and snags/debris dams and leaf litter are common. No tree root habitat was found here.

3.20.1 Water quality

Spot measurements were taken to 1m depth and logged data was collected at approximately 0.5m depth in a total of less than 1m. Spot measurements taken at 1600hrs show a thin band of warm surface water (10.2°C) overlying cooler water (6-6.6°C at .5m and 1m depth). Dissolved oxygen dropped from 56 to 48% saturation from top to bottom while conductivity remained at 95-97µS/cm and turbidity above 500NTU. Overnight recordings showed little pattern but temperature dropped from 8.9 to 6°C while conductivity was stable at 90-94µS/cm. Dissolved oxygen was very low, between 30 and 23% saturation. Spot results for November 2001 are shown in **Table 3-20.1**.

■ **Table 320.1 Spot water quality readings - Moonie River at Fenton Station in November 2001**

Sample Period	Sampling Time	Depth (m)	Temp. (°C)	DO (mg/L)	DO (% sat.)	Conductivity (µS/cm)	Salinity (ppt)	Turbidity	pH
November 2001	16:20	Surface	23.0	4.6 [#]	53.1*	100	0.05	-	6.9 [#]
		0.5	19.0	3.6 [#]	40.7*	94	0.05	-	6.7**
		1	17.4	2.7 [#]	29.3*	89	0.05	-	6.4**
		1.5	17.3 [#]	2.3 [#]	24.2*	89	0.05	-	6.3**

[#]: Exceeds CBWC (2002) local water quality guideline level.

*: Exceeds ANZECC (2000) Guideline.

Logged data in November was recorded with the probe at about 0.3m depth, apparently in the upper, productive layer, because temperature and dissolved oxygen showed a very strong diurnal pattern. Dissolved oxygen dropped from around 80% saturation in the late afternoon to below 30% in the early morning. pH remained stable at just below 7.

3.20.2 Macrophytes

Ludwigia was present in one patch but covered <1% of the pool surface. A single line of *Juncus* sp and *Schoenoplectus* lined 80% of the waterhole. A fringe of filamentous algae was obvious.

3.20.3 Fish

Three native species plus Carp and Mosquito fish were captured at Fenton. Like Nindigully, the individuals were much larger than captured in the Lower Balonne and very few small specimens of any species were recorded. When sampled in November 2001 the same three native species were again captured, along with Goldfish, in a total catch of 34 individuals. The fish were again large and the seine produced very little. The site total from two sampling events is three native species and three introduced. Western Carp Gudgeon has not been captured here.

■ **Table 320.2 Results of fishing the Moonie River at Fenton in May 2002, by fishing method**

Species	Common name	Gill nets	Seine net (1)	Fyke nets	Bait traps	Dip net	Total Numbers caught
<i>Macquaria ambigua</i>	Yellowbelly	2	7				9
<i>Nematolosa erebi</i>	Bony Bream	23					23
<i>Tandanus tandanus</i>	Eeltail catfish	2					2

<i>Cyprinus carpio</i>	Common carp	1		1			2
<i>Gambusia holbrooki</i>	Mosquito fish		8				8
Total Numbers		28	15	1	0	0	44

3.20.4 Macroinvertebrates

Two habitats were sampled at Fenton with 14 taxa identified from the edge habitat and a further nine identified from the macrophyte habitat. Low numbers of *Macrobrachium* were captured in bait traps and seine hauls. The taxa count compares with 21 taxa collected from three habitats in November 2001. Thirteen taxa were common to the two sampling events. The most common taxa were chironomids, microcrustacea, ceratopogonids and caenid/baetid mayflies. The fauna was relatively abundant.

Table 3.20.3 Macroinvertebrates captured at Fenton

Taxa	Edge surber (mean +/- sd)	Macrophyte dip
Ancylidae	1.0 +/- 2.2	
Anisitsiellidae		5
Atyidae		2
Baetidae	1.0 +/- 2.2	70
Caenidae	21.0 +/- 30.1	
Capitellidae	6.0 +/- 8.9	
Carabidae		5
Ceratopogonidae	34.0 +/- 31.3	75
Chironominae	37.0 +/- 43.1	130
Cladocera	128.0 +/- 68.8	2880
Copepoda	400.0 +/- 121.6	3350
Corixidae	3.0 +/- 4.5	
Culicidae		50
Eylaidae		5
Hydrophilidae		1*
Lepidoptera 1		5
Libellulidae	1.0 +/- 2.2	5
Limnephilidae	1.0 +/- 2.2	
Mesoveliidae		5
Ostracoda	46.0 +/- 50.5	90
Palaemonidae	0.6 +/- 0.9	3
Planorbidae		1*
Porifera	22.0 +/- 36.8	100
Taxa per sample	7.8 +/- 2.4	18
Individuals per sample	701.6 +/- 281.9	6780
Total taxa	(14)	23

4. Discussion

4.1 Water quality

A common feature at many sites was a breakdown of the stratification which had developed in November. It was postulated then that the lack of flow and drying out of the waterholes had led to development of eutrophic conditions in some cases and at least to stratification and higher pH, turbidity and conductivity in many others. Sampling in May occurred when flow had generally ceased or was very low in most rivers. The flows achieved over summer were only at compensation level, that is, very low flows, and no flooding occurred. While these flows relieved the water quality stress noted in November to some extent, it is likely only a temporary reprieve if no further flows eventuate, as the waterholes will again commence the drying cycle.

Table 4-1.1 summarises the results from all sites sampled in May 2002. Shading highlights individual river systems. Ranges are given where logged data was available. The universally high turbidity may reflect disturbance of the soft substrate of the main channel by low level flows, flows too small to strip it to any great extent, and increased access to the waterbodies by grazing animals. At these low water levels animals actually walk through the waterbodies rather than just to the edge. Turbidity was lower in the Warrego but still high.

Both Moonie and Warrego sites showed lower conductivity but suffered from low dissolved oxygen content. There is a trend in the Lower Balonne for conductivity to increase slightly downstream. There is an increase at Woolerbilla which is sustained at Balandool. The increasing conductivity may reflect gradual concentration as the volume of water decreases downstream. At 173 μ S/cm the conductivity is not high and represents freshwater suitable to irrigate any crop.

Woolerbilla also showed low dissolved oxygen so the poor fish results at this site may be linked to that, and in turn to some local impact on water quality. The old farm dump on the riverbank may be deserving of further investigation. The site is not alone with respect to very low dissolved oxygen levels. The reference sites and a number of other test sites show results consistently below both ANZECC and local guideline levels.

Table 4-1.1 Summary Water Quality Data for May 2002

	Temperature (°C)	Dissolved O ₂ (% sat)	Conductivity (µS/cm)	pH	Turbidity (NTU)
Balonne at St George	11.4	90	118	6.8	>500
Balonne at Mooramanna	11.2 - 12.4	86 - 94	121 - 125	7.3 - 7.9	>500
Balonne at Whyenbah	13.6	86	125	7.1	>500
Culgoa at Whyenbah	8.3 - 11.2	74 - 87	121 - 130	7.5 - 8.1	>500
Culgoa at Cubbie	8.3 - 11.5	71 - 88	118 - 130	7.5 - 8.1	>500
Culgoa at Woolerbilla	2.5 - 8.0	38 - 51	166 - 173	?	>500
Culgoa at Balandool	8.8	66	165	?	>500
Balonne Minor at Meigunyah	11.2	82	124	7.4	>500
Balonne Minor at Trafalgar	4.2	37 - 41	128 - 132	9?	>500
Narran at Donegri	9.1	90	128	?	>500
Narran at Clyde	3.7 - 7.2	53 - 61	142 - 147	?	>500
Narran at Booligar	7.0	65	140	?	>500
Balandool on Cubbie	4.4 - 8.5	85 - 89	121 - 131	?	>500
Balandool at Euraba	2.1 - 8.7	57 - 74	132 - 143	?	>500
Bokhara at Kirrima	9.5	85	129	?	>500
Bokhara at Koala	8.4	66	139 - 142	?	>500
Warrego at Shannonvale	6.6 - 9.0	48 - 65	87 - 96	?	345 - 374
Warrego at Tinnenburra	4.6 - 6.1	29 - 37	103 - 110	?	295 - 317
Moonie at Nindigully	4.4 - 5.7	34 - 47	68 - 71	?	>500
Moonie at Fenton	6.0 - 8.9	23 - 30	90 - 94	?	>500

4.2 Macrophytes

No further macrophytes have been recorded by this survey and *Ludwigia* remains the most commonly encountered species. When present and sampled, these plants provide good habitat for fauna. Sedges are present at many sites but only as occasional specimens or a single row of plants at best. The fringe of filamentous green algae is a common site but not as pronounced as it had been in November, possibly because rising water levels had reduced the light reaching it or the flows had been sufficient to scour it.

4.3 Fish

In a total catch of 2057 individuals, ten native species of fish were identified from sites in the Lower Balonne and eight from reference sites. All species captured at reference sites were also captured at test sites but two native species, Silver Perch and Rainbow fish, and one introduced species, Goldfish, were not captured at reference sites. Goldfish has however been recorded previously at all reference sites.

Table 4-3.1 summaries the fish catch across all sites. Shading in the table marks each river and sites are placed from upstream to downstream within each river. Other than the very poor result from the site at St George, the number of native species recorded at test sites varied between two and seven and at reference sites between three and eight. The number of individuals captured varied from 11 to 484 at test sites and from 44 to 292 at reference sites. It should be remembered that the use of the seine varied among sites and this can significantly affect the total catch.

The most commonly encountered species at test sites were Bony Bream (all but one site), Yellowbelly (all but two sites) and Carp (all but three sites). The most abundant species at test sites were Western Carp Gudgeon (42.8%), Bony Bream (32.3%), Smelt (7.3%) and Mosquito fish (6.1%). Introduced species contributed 10.9% of the catch at test sites and 3.3% at reference sites. The least common species were Sliver Perch, Eeltail catfish, *Hypseleotris* sp4. and Hyrtl's tandan. The latter two were common at the Shannonvale reference site. While species such as Yellowbelly were relatively evenly distributed across sites, others such as Western Carp Gudgeon, Smelt, Mosquito fish and at times Bony Bream, were very patchily distributed.

One clear difference between reference and test sites was the size of many of the native species. Reference sites had noticeably larger specimens, of Bony Bream and Yellowbelly particularly, while test sites commonly showed recent breeding by a number of native species.

The results are obviously affected by the low water levels over most of the area. Some sites in the Lower Balonne were dry in November but have shown considerable recolonisation based on only compensation flow releases, which, while flowing over the weirs, do not drown them out or allow movement upstream past them. Recolonisation was therefore largely between weirs or at best downstream over weirs. The Culgoa River at Balandool for example showed 6 native species and 114 individuals in April 2001, was dry in November, and showed 4 native species and 196 individuals in May 2002. The Bokhara River at Kirrima was also dry in November but seven native species were recorded there the following May.

The number of taxa captured at a site can vary significantly between sampling events even when the site has not been dry. The reference site at Shannonvale is a good example where three native species were captured in November 2001 and eight were captured in May 2002, three of these being represented by single specimens. Some sites however have been more consistent. The Woolerbilla site has now been sampled on four occasions and the number of native species has been 3, 3, 3 and 2 while the number of individuals has been 26, 33, 24 and 13. Overall, just four native species have been captured here. The reason is unknown as the next upstream site (Cubbie) has captured a total of seven native species with the count from individual sampling

events varying between two and six. The site downstream (Balandool on Culgoa) has only been sampled twice for a total of six native species.

Table 4-3.1 Summary of fish catch by site; May 2002

Site	<i>Maquarria ambigua</i>	<i>Leiopotherapon unicolor</i>	<i>Bidyannus bidyanus</i>	<i>Nematolosae erebi</i>	<i>Hypseloeotris klunzingeri</i>	<i>Hypseloeotris sp.4</i>	<i>Melanotaenia fluviatilis</i>	<i>Retropinna semoni</i>	<i>Tandanus tandanus</i>	<i>Neosilurus hyrtlii</i>	<i>Cyprinuscarrpio*</i>	<i>Carrasius auratus*</i>	<i>Gambusia holbrooki*</i>	Total catch	Species	Natives
St George	1	0	0	0	0	0	0	0	0	0	1	0	0	2	2	1
Mooramanna	5	0	0	114	342	0	0	3	0	0	0	1	19	484	6	4
Whyenbah	4	0	0	51	43	1	5	65	0	0	0	0	8	177	7	6
Culgoa at Whyenbah	2	0	0	21	52	0	17	31	0	0	5	0	1	129	7	5
Culgoa at Cubbie	2	0	0	8	5	0	0	4	0	0	1	0	0	20	5	4
Culgoa at Woollerbilla	0	0	0	4	6	0	0	0	0	0	1	0	2	13	4	2
Culgoa at Balandool	3	2	0	118	7	0	0	0	0	0	2	3	61	196	7	4
Meigunyah	6	0	1	13	228	0	0	6	0	0	2	0	0	256	6	5
Trafalgar	3	0	0	5	3	0	0	0	0	0	2	0	0	13	4	3
Balandool on Cubbie	13	0	0	81	1	0	0	2	0	0	36	0	0	133	5	4
Balandool at Euraba	0	3	0	25	0	0	0	0	0	0	1	11	0	40	4	2
Bokhara at Kirrima	8	1	0	12	2	0	1	5	0	1	0	1	5	36	9	7
Bokhara at Koala	9	1	0	22	0	0	0	0	0	0	1	1	0	34	5	3
Donegri Ck	4	1	0	17	0	0	0	0	0	2	1	0	0	25	5	4
Narran at Clyde	2	1	0	3	0	0	0	0	0	0	4	1	0	11	5	3
Narran at Booligar	6	1	0	26	0	0	0	2	1	0	1	1	2	40	8	5
Shannonvale	4	1	0	47	49	17	0	147	1	25	1	0	0	292	9	8
Tinnenburra	2	0	0	38	6	0	0	6	0	7	1	0	0	60	6	5
Nindigully	11	0	0	36	0	0	0	1	0	1	3	0	0	52	5	4
Fenton	9	0	0	23	0	0	0	0	2	0	2	0	8	44	5	3
SUM	94	11	1	664	744	18	23	272	4	36	65*	19*	106*	2057	13	10

(* = introduced species)

4.4 Macroinvertebrates

Table 4-4.1 summarises the macroinvertebrate data for all sites. An unexpected, but clear and common observation is that both the number of taxa and the number of individuals per surber sample increased downstream within each test river. The result is weakest in the Narran and not evident in the Balonne. The total number of taxa at a site does not show this trend, probably because it is affected by the number of habitats at a site. The abundance trend relates largely to increases in the numbers of chironomids, microcrustaceans (particularly cladocerans) and ceratopogonids. With so much variation in the taxonomic complement among sites it is difficult to ascertain any particular groups which may be more common downstream and an explanation for the general observation is not clear.

Table 4-4.1 Summary of macroinvertebrate data May 2002

	Taxa summary					Individuals (surber)
	Surbers	Tree roots	Macrophyte	Riffle	Total	
Balonne at St George	6.4 +/- 2.5	12	8		22	77.6 +/- 53.2
Balonne at Mooramanna	4.0 +/- 1.2	14	13		19	35.4 +/- 33.2
Balonne at Whyenbah	4.8 +/- 1.3	14	16		27	27.8 +/- 20.8
Culgoa at Whyenbah	5.0 +/- 1.2	14			21	42.8 +/- 47.6
Culgoa at Cubbie	7.4 +/- 2.1		11		19	83.6 +/- 39.8
Culgoa at Woolerbilla	9.6 +/- 2.7				17	1114 +/- 764
Culgoa at Balandool	11.8 +/- 1.8	18			27	1023 +/- 258
Balonne Minor at Meigunyah	5.8 +/- 1.5	9			19	53.2 +/- 24.7
Balonne Minor at Trafalgar	8.4 +/- 0.9	14			19	258 +/- 170
Narran at Donegri	6.4 +/- 2.3	12	14	8	25	78.2 +/- 75.3
Narran at Clyde	9.6 +/- 2.1				15	592 +/- 129
Narran at Booligar	7.8 +/- 1.8			16	19	641 +/- 333
Balandool on Cubbie	2.2 +/- 1.1	11			12	12.0 +/- 8.1
Balandool on Euraba	7.8 +/- 1.3				13	149 +/- 56
Bokhara at Kirrima	2.8 +/- 1.8	7			11	11.6 +/- 14.3
Bokhara at Koala	9.0 +/- 2.0		14		19	1638 +/- 419
Warrego at Shannonvale	5.6 +/- 2.1	4 (log)			10	62.8 +/- 67.7
Warrego at Tinnenburra	6.6 +/- 1.8				13	40.6 +/- 33.9
Moonie at Nindigully	9.4 +/- 2.9		11	11	21	617 +/- 385
Moonie at Fenton	7.8 +/- 2.4		18		23	702 +/- 282

As the trend is not evident in the Balonne, it may be related to total floodplain diversity, that is, as the floodplain becomes larger towards the south, perhaps riverine diversity reflects floodplain diversity, particularly as the floodplain habitats dry up and the only available habitat is in the river. If this is correct then the taxa making the difference should be mobile floodplain species and while there is some evidence to support this, it is certainly not strong.

As with the fish results, the macroinvertebrate results show a range of recolonisation strengths. Some sites came back strongly after being dry, such as the Culgoa River at Balandool, while others did not show a good fauna, such as the Balandool River at

Cubbie. This may reflect permanence of nearby habitats and the possible avenues for recolonisation. It is suspected that long lengths of the Balandool in this area dry out, and do so for extended periods of time, whereas the Culgoa does not dry out over such long lengths or for such long periods. The nearest source of colonists to the Balandool River site in low flow conditions is the weir pool on the Balonne Minor at Trafalgar. The usual range of colonists exist in this pool but compensation flows are not at a level which will cause significant dislodgement or drift. Recolonisation will only be passive. Recolonisation by microcrustacea can occur much more rapidly from in situ sources.

AusRivAS scores reported by NRM for 2001 show poorer condition in the bed habitat than the edge and a general decrease in condition from April to November. The results may be real or they may reflect different levels of applicability of the model to different habitats, to different times of year or to drought conditions. If reference site data were collected from climatically similar periods and there was no anthropogenic influence affecting the results then no decrease in scores should be observed. If the results are real then they are quite possibly linked to sediment and turbidity effects, as the effect is mainly on the bed, but to a degree in the edge. Turbidity was markedly higher in November and this, coupled with the physical impact of animals accessing the waterholes, may be the reason for the edge result. Chemical analysis of the sediment in November did not detect any likely toxic effects so the answer may be linked to sedimentation rate. However, as the bed fauna has been depauperate on nearly all occasions sampled, the effect may be a natural one based on a simple and harsh sediment habitat and naturally low levels of dissolved oxygen. In such an environment the AusRivAS score would be expected to change markedly as just one or two taxa were either collected or not at test or reference sites.

4.5 General

In this drought period, stresses related to land use may be emphasised, partly because the soil is more exposed and land degradation is more visually obvious, but also because the river is barely connected longitudinally and no water harvesting is occurring so no consequential direct impact from that risk source can occur. The effects of the drought are probably exacerbated by the operation of instream storages as they remove much of what small flows may enter the system. The current situation also stresses the importance of maintaining quality habitat, as opposed to aiming to maintain the volume of habitat. It is clear that much of the faunal diversity is in small areas of specialised habitat, such as macrophytes, tree roots and the filamentous algal fringe. The area of such habitats may have been reduced through the impacts of catchment-wide land clearing, particularly within the riparian zone, through grazing and its accompanying erosion and sedimentation issues and at a local scale through direct access of grazing animals to the waterholes. If turbidity and sedimentation is greater than natural, as suggested by Thoms (2001), then the condition of these habitats will be deteriorating, as evidenced by the caking of fibrous tree roots with sediment. Management action directed at reducing turbidity and sedimentation, protecting the riparian zone and limiting access to cattle and sheep, would appear to offer significant potential to maintain quality habitat and thereby, faunal diversity. The debate over water resource use seems to be overly concerned with the volume of water, and thereby the volume of habitat, rather than the quality of habitat.

5. References

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