

Broken River Rehabilitation project

Summary survey of Fish and Macroinvertebrates (June 2006 to May 2007)



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Management Authority

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Development of a Monitoring Program for the Broken River

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Introduction

The presence (or absence) of large woody debris (LWD) within lowland river channels is a major driver of both primary productivity and community structure of fish and invertebrates as well as other associated biota (Nicol et al 2002). In Australian lowland rivers the substratum generally consists of sand, silt or clay. In general these substrates are colonized by few invertebrates (Humphries et al. 1998). The principle substratum for biofilm development and macroinvertebrate colonization is large woody debris (Crook and Robertson 1999). Large woody debris supports a more diverse invertebrate community in comparison to other instream sediments (Humphries *et al.* 1998; Grouns *et al.* 1999) and increases instream habitat complexity (Pusey and Arthington 2003).

The presence of LWD influences fish habitat at a number of scales. The number of fish in a river is often related to the quality and heterogeneity of instream habitat (Koehn and O'Connor 1990). The presence and complexity of LWD assists in the creation of scour pools and slackwaters promoting habitat diversity for fish and refuge from flow and predators. Fish communities in streams with a poor diversity of habitat are usually dominated by fish species that are tolerant of a wide variety of habitats. These generalists are most often introduced species (Koehn and O'Connor 1990) which compete with native fish species for food resources.

Between 1960 and 1975 "River improvement" works were carried out in the Broken River in an effort to decrease the frequency of flooding. Works undertaken included the construction of levees and removal of LWD. In 2006 work was commenced to re-sag the Broken River. This report summarizes data from a fish and macroinvertebrate surveys undertaken prior to the commencement of this work and the monitoring following the introduction of the snags.

Methods

Site Selection

In December 2005 site assessments were undertaken along the Broken River to identify nine reaches approximately 500 m in length with either high (3 sites) or low (6 site) existing wood densities. To be included the study sites had to have a defined set of criteria (Table 1). Wood would then be added to 3 of the sites with low wood densities with the aim of eventually achieving a density of wood of 1m³ per 10 m² of reach. The remaining reaches would act as reference reaches. Sites were selected based on

- Site visit
- Survey by Earthtech
- Data from previous MDFRC & CRCFE projects
- Site accessibility

The nine sites selected are located within 3 reaches of the Broken River; Benalla to Casey's weir; Casey weir to Gowangardie weir; Gowangardie weir to Shepparton (Table 2)

Table 1. Proposed re-snagging treatments

Treatment	Condition
Reference 1	These sites will have a reasonable density of LWD, in good condition, which will be used to determine the natural density of LWD. This will establish the density of snags to be added to the treatment sites. No snags will be added to these sites. They should also have an intact riparian zone
Reference 2	These sites will have a low density of snags, possibly in poor condition. No snags will be added to these sites. They may have a degraded or rehabilitated riparian zone.
Re-snagged.	These sites will have a low density of snags, possibly in poor condition. Preferably they will also be, or have been, targeted for riparian zone rehabilitation.

Table 2. Selected sites within Broken River

Site	Wood density	Reach
Morago	high	Benalla – Casey weir
Scholes Rd	re-snag*	
Mokoan Park	low	
Quinn Rd	high	Casey weir – Gowangardie weir
Burnells Rd	re-snag*	
Goomalibee Bridge	low	
Cosgrove Rd	high	Gowangardie weir – Shepparton
Pine Lodge Rd	re-snag*	
Keats Rd	low	

- Wood added to achieve a density of 1m³ per 10 m²

Fish

Fish were surveyed on eight occasions between May 2006 and May 2007 using a Smith-Root 12-A backpack electrofisher employing the Sustainable River Audit technique (MDBC 2005) in combination with 10 small bait traps. For the electrofishing within each 500 meter reach 8, 150 second of accumulated power on time was undertaken. Collected fish were identified on site, measured and returned at point of capture.

Macroinvertebrates

Macroinvertebrates were sampled in June and November 2006 using snag-bags (Gowns et al. 1999). Three snags from each reach were sampled. Collected animals were identified to taxonomic resolution of Family and all numbers converted to number of animals per square meter of wood (m²).

Results and Summary

Wood Density

Wood was added to three treatment sites along the river in May 2006 to achieve a minimum density of 1m³ per 10m² along the 500 m length of the reach (Table 3)

Table 3.. Total density of wood added at each re-snagged site (area of reach calculated at 500 m x 30 m)

Site	Volume (m ³)	Density (m ³) per 10m ²
Scholes Road	541.59	0.361
Burnells	565.77	0.377
Pine Lodge	292.98	0.195

Fish

Seven native fish and three introduced fish species were collected from all sites prior to the re-snagging commencing with rainbow fish dominating the catch (Table 1). There were substantially more fish collected from the sites with high densities of wood, and only small differences in numbers collected from the sites with low wood densities (Figure 1). There was little difference in the number of fish species collected from all sites whether they had high or low densities of wood (Figure 1) with numbers ranging from 2 species at the Scholes Road site to 6 at the Mokoan Park site.

This pre survey of the 9 selected sites appears to confirm the initial site assessment process. A greater abundance of fish were collected from the sites that were assessed to have naturally occurring high densities of wood whereas substantially fewer fish were collected from the sites with low densities of wood. An average of four species was collected from all sites.

Table 4. List of species recorded from the Broken River during the pre-survey (* indicates introduced species)

Species	Number
Murray Cod	8
Trout Cod	1
Golden Perch	2
Silver Perch	2
Rainbow fish	198
Australian Smelt	12
Carp gudgeon	36
*European Carp	11
*Redfin	1
*Mosquito Fish	12

Over all sampling events (including the pre-works survey) a total of 1567 fish of 14 species (nine native and five introduced) were caught across all sites. Native fish species captured were dominated by Rainbow Fish and Carp Gudgeon, whereas

introduced species captured were dominated by European Carp and Mosquito Fish (Table 5).

There does appear to be differences in fish assemblages between reaches. The three reaches above Casey's weir are dominated by small native fish species (i.e. Carp Gudgeons and Rainbow Fish) and introduced European Carp whereas in the reaches below Casey's weir there appear to be more Murray Cod present (Table 6; Figure 2). There was little difference in the numbers of taxa recorded from each site (Figure 3).

Fish were surveyed in all re-snagged reaches between July 2006 and May 2007 (Table 7). Of particular interest was the increase in numbers at Burnells Road in April 2007. On this occasion 14 Murray Cod less than 100 mm in length were captured from within the re-snagged area suggesting that juveniles of this species may be utilizing these habitats. The other point of interest is in the reach at Goomalibee Bridge (a low wood density reach) which had the second highest numbers of Murray Cod recorded. At the bottom of this reach the river divides around a small island creating areas of higher flow. Approximately 10 Murray Cod less than 100 mm in length have been recorded in this section in April and June 2007. All though only circumstantial, this data appears to suggest that within the Broken River, small Murray Cod prefer areas with higher flows.

Table 5. List of species recorded in total from the Broken River survey (* indicates introduced species)

Species	Number
Murray Cod	109
Trout Cod	6
Golden Perch	31
Murray Hardyhead	1
Murray Jollytail	1
Silver Perch	3
Rainbow fish	473
Australian Smelt	159
Carp Gudgeon	472
*European Carp	134
*Goldfish	17
*Redfin	2
*Mosquito Fish	60
*Weatherloach	2
Total	1567

Macroinvertebrates

Oligochaeta abundance data have been omitted from these results as the numbers in counting and identification are subjective and may skew the data. However, they have been left in the richness data as being present.

Twenty nine macroinvertebrate families were identified from all reaches in June 2006 and thirty two families in November 2006. In all reaches on both sampling occasions abundances were dominated by the dipteran family Chironomidae. There are no apparent differences between reaches for either the number of families present within each reach (Figure 4) or the abundance of invertebrates within each reach (Figure 5).

These numbers however suggest that greater abundances of macroinvertebrates and consequently more food resources for fish will exist within reaches that have a greater density of wood.

References

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- Koehn, J.D. and O'Connor, W.G. (1990) *Biological information for management of native freshwater fish in Victoria*. Department of Conservation and Environment, Arthur Rylah Institute for Environmental Research; Melbourne.

Table 6. Total abundance of each fish species captured at each site.

Site	Silver Perch	Goldfish	Murray Hardyhead	Carp	Murray Jollytail	Mosquito Fish	Carp Gudgeon	Trout Cod	Murray Cod	Golden Perch	Rainbow Fish	Weatherloach	Redfin	Australian Smelt
Mokoan Park		2		25		10	135	1	5	3	77			52
Morago		2		35	1	23	97			9	104		2	30
Scholes Rd		8		26		20	222			1	194			41
Goomalibee		1		5		3	1		32	4	22			10
Quinns Rd		3	1	4		1	28	2	1	7	46			29
Burnells Rd				2			1	1	44	2	15			2
Keats Rd				8					17		8			4
Cosgrove Rd	3	2		15		1			16	5	39			4
Pine Lodge	1			20		4	6	2	8		7	2		3
Total	4	18	1	140	1	62	490	6	123	31	512	2	2	175

Table 7. Total abundance of fish captured within and outside of treatments during each survey.

Sample Month	Scholes Rd		Burnells Rd		Pine Lodge	
	caught in treatment	caught out of treatment	caught in treatment	caught out of treatment	caught in treatment	caught out of treatment
July	1	11	1	4	0	4
October	15	25	0	3	0	5
December	3	47	0	2	0	1
January	0	120	2	2	2	6
February	13	111	4	8	2	6
April	9	92	14	5	2	4
May 07	8	16	4	5	0	1

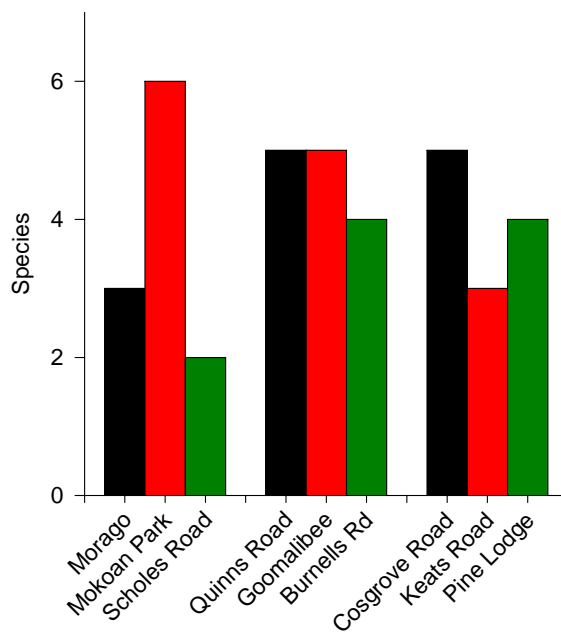
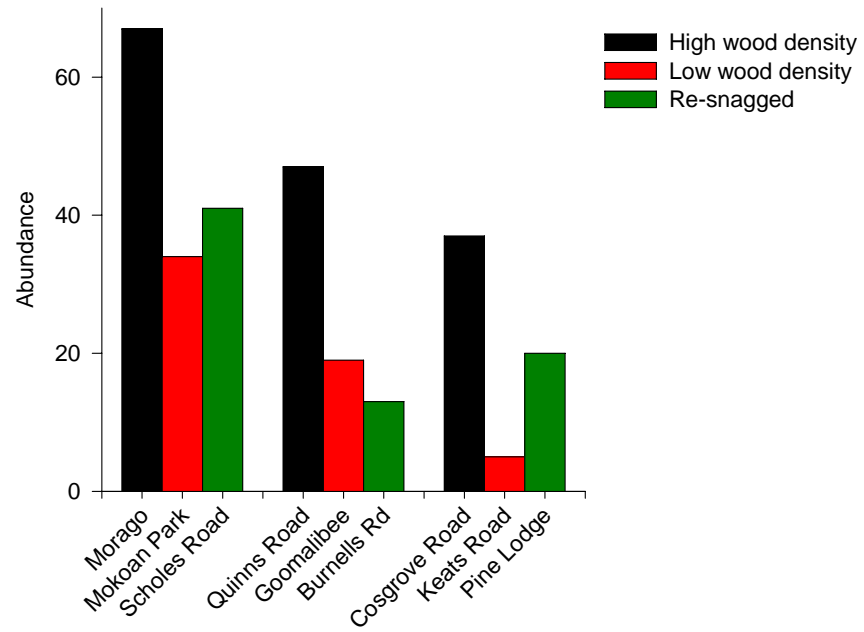


Figure 1. Total number (top) and number of species (bottom) of fish caught in pre-survey sampling trip.

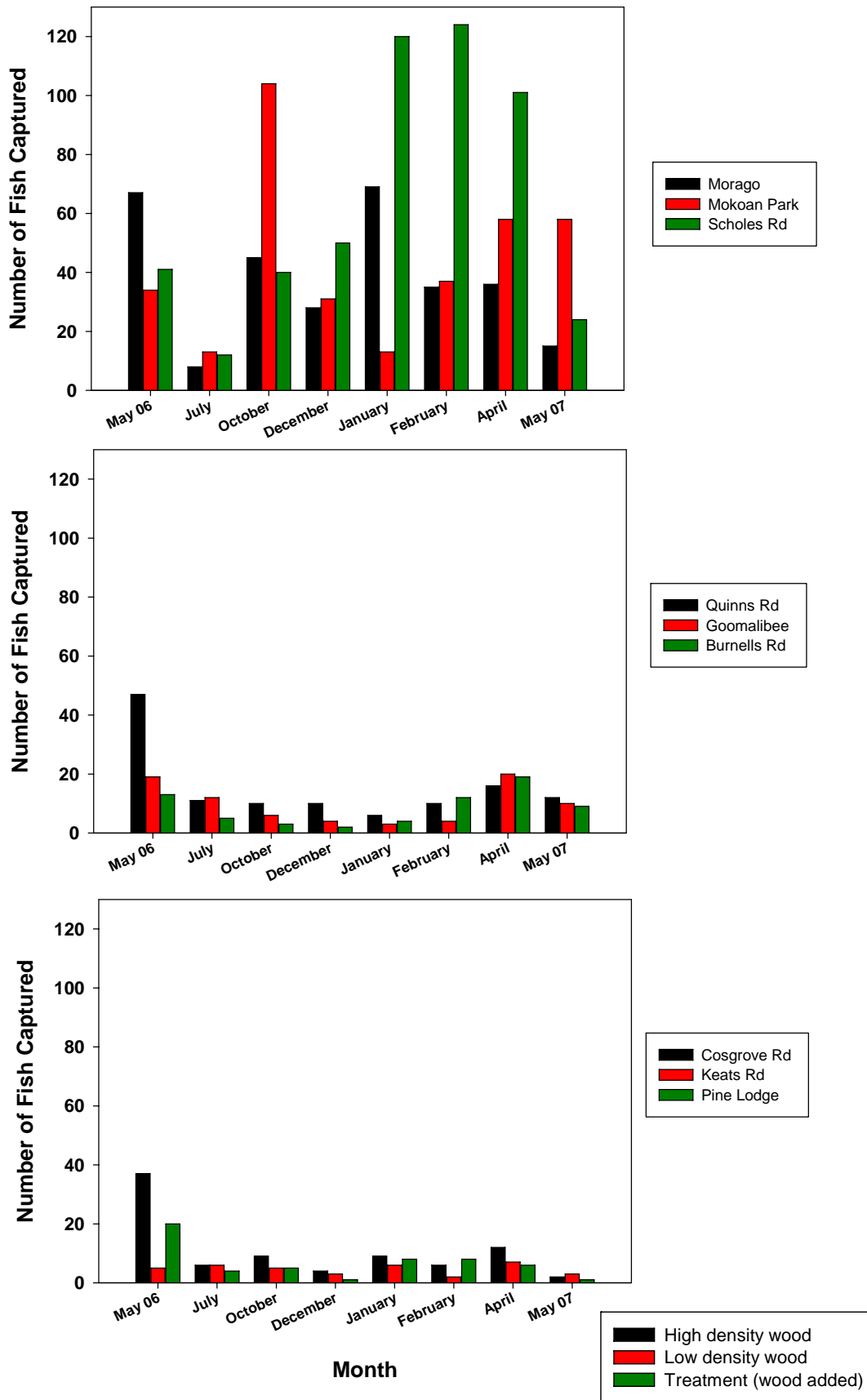


Figure 2: Total abundance of fish captured at each site during each survey.

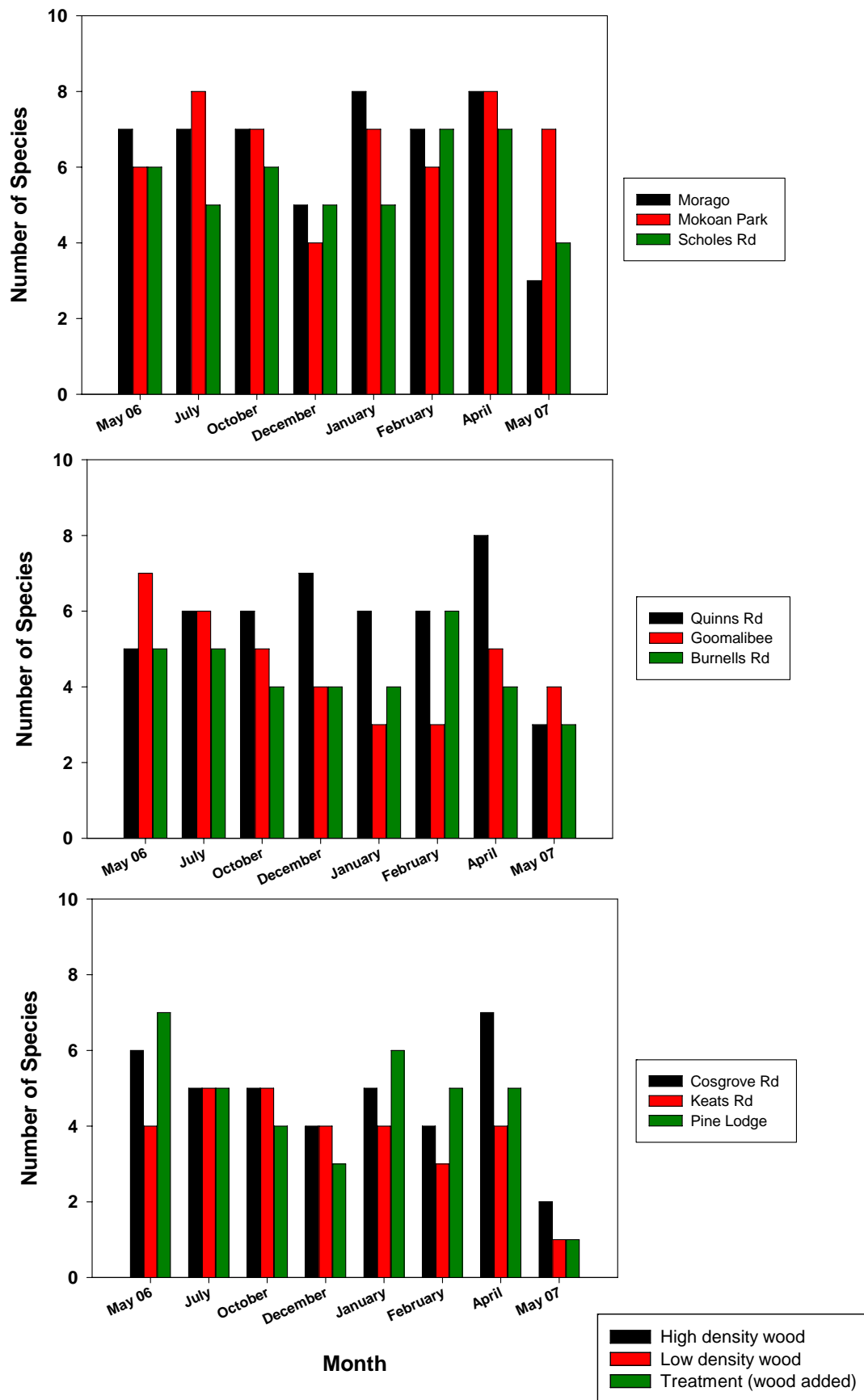


Figure 3: Species richness of fish for each site as recorded during each survey.

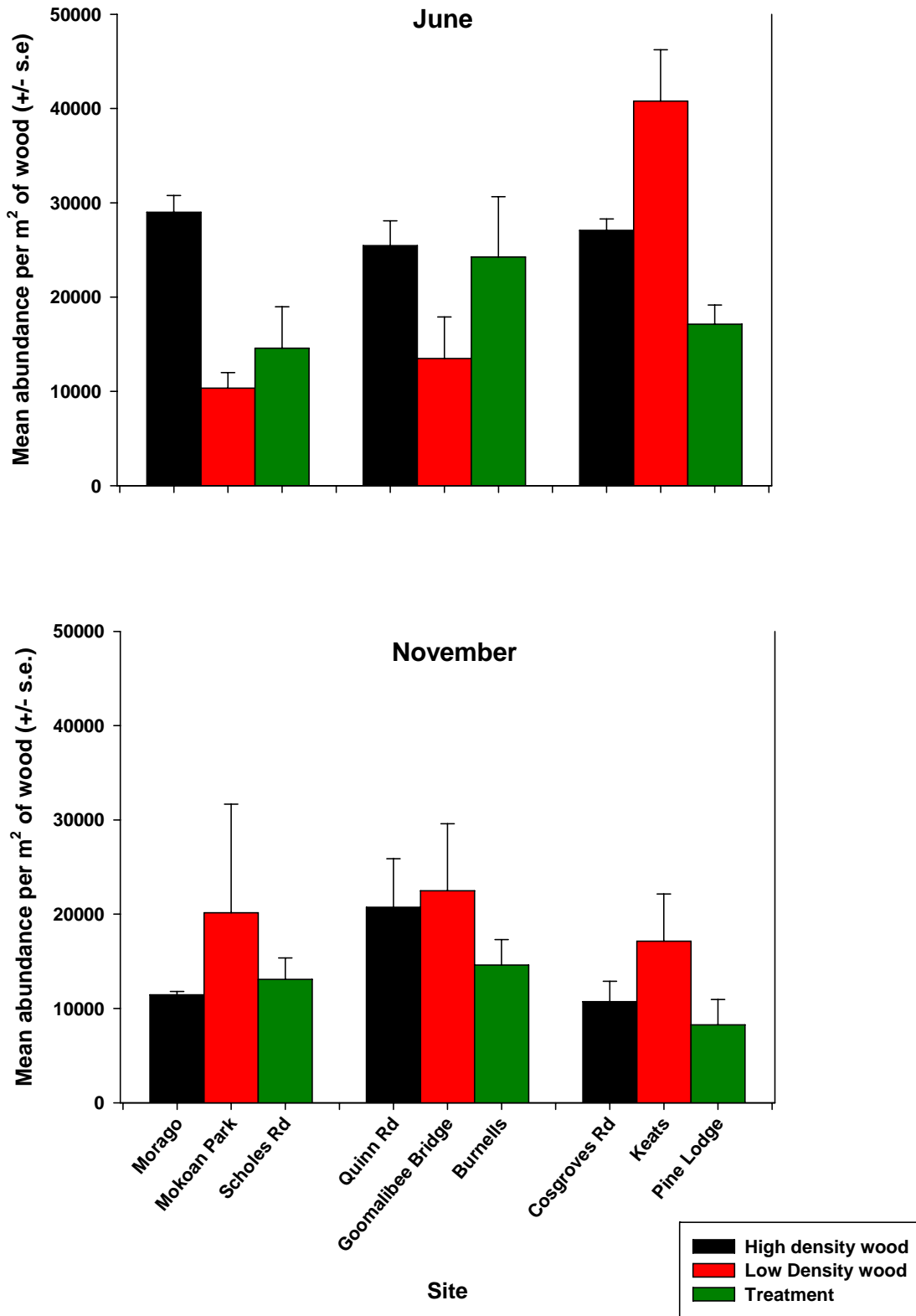


Figure 4: Mean abundance of Macroinvertebrates per m² of wood for each sampling occasion.

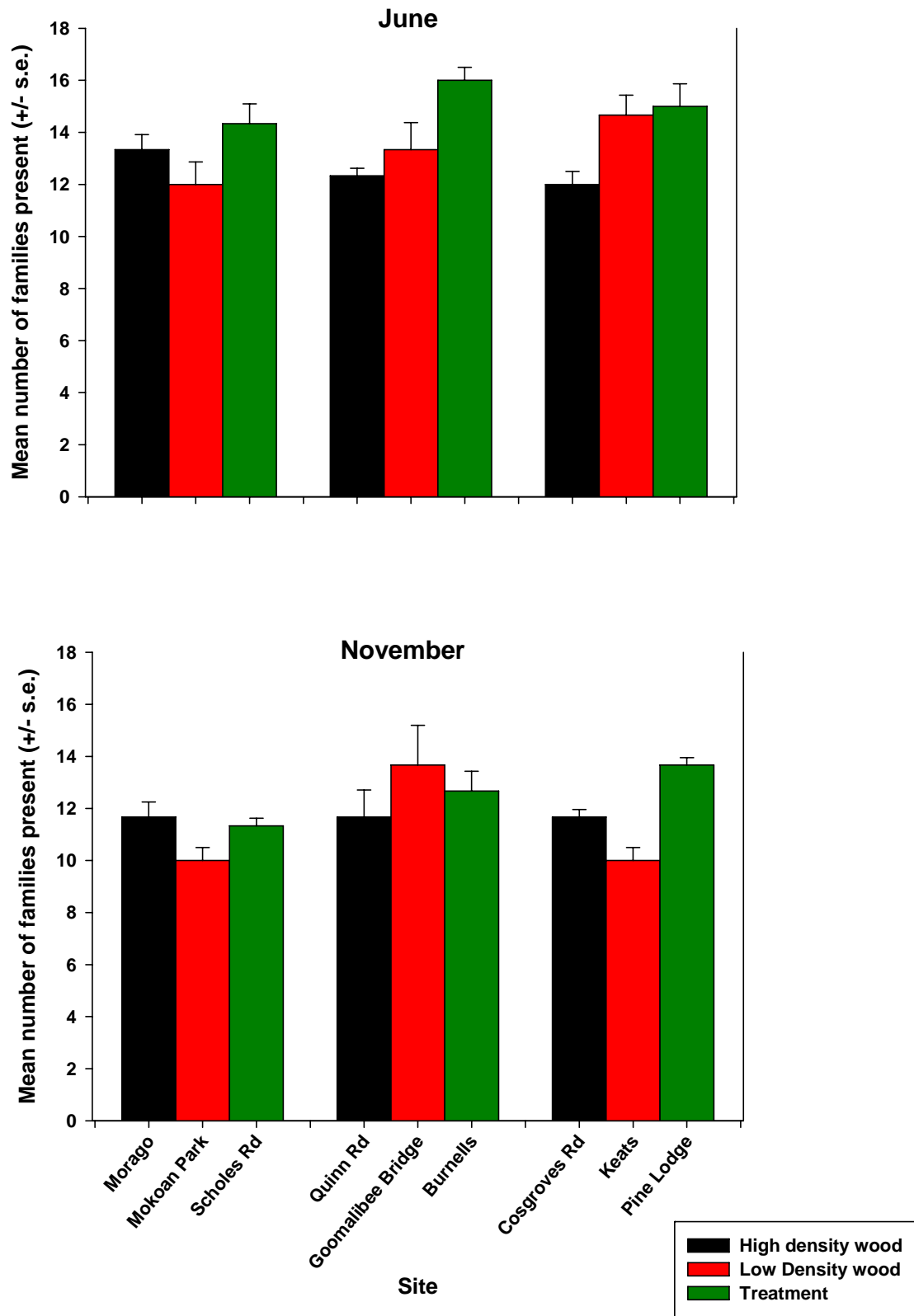


Figure 5: Mean number of families present at each site for each sampling occasion.

Budget July 2007 to June 2008

Fish

Sampling: Six bi-monthly sampling events will be undertaken through out the year. Samples will be collected around LWD and from slackwaters within each reach. Sampling will be undertaken using a backpack electrofisher around LWD and in slackwaters with techniques developed for the Sustainable Rivers Audit (SRA) (MDBC 2004). Native fish will be released at point of capture and introduced fish will be euthanased.

Data

Information gained will be abundance, richness and size classes of fish present. Size classes can be used to indicate changes in age structure of the populations.

Macroinvertebrates

Sampling: One sampling event will be undertaken in spring 2007. Sampling will be undertaken using snag-bags (Growth *et al.* 1999) from 3 LWD per reach (total number of samples = 27)

Data: Information gained will be on abundance and richness at the taxonomic resolution of Family.

Budget July 2007- June 2008

Costs

	Task	Trips	People	Days	Cost (exclusive GST)
Fish	Field work ¹	6	2	18	\$36,000
Macroinvertebrates	Field work ¹	1	2	3	\$ 6,000
	Sorting & Identification of samples		1	60	\$42,000
Total cost					\$84,000.00

¹. All costs are inclusive of labour, travel and operating expenses

Milestones

MILESTONE	OUTPUT	Date	Progress Payment
1	Bi-monthly fish monitoring and interim report (fish data)	31 July 2006	\$ 6000
2	Bi-monthly fish monitoring and interim report (fish data)	30 September	\$ 6000
3	Bi-monthly fish monitoring and interim report (fish data) Macroinvertebrate monitoring	30 November 2007	\$12000
4	Bi-monthly fish monitoring and interim report (fish data)	31 January 2008	\$ 6000
5	Bi-monthly fish monitoring and	31 March 2008	\$ 6000

	interim report (fish data)		
6	Bi-monthly fish monitoring and interim report (fish data) Completion of sorting and identification of macroinvertebrate samples and interim report	22 June 2006	\$43000
FINAL REPORT		29 June 2007	\$ 5000

Project Team

Dr Daryl Nielsen time allocation 20%

Technical Officer time allocation 50%

Commencement

The project will commence once verbal approval is received from GBCMA