Lake Mealup Invertebrate sampling November 2016. Summary presented to Lake Mealup Technical Advisory Group Meeting, March 2017

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Introduction

Macroinvertebrates have been monitored at Lake Mealup since the inception of the Lake Mealup Recovery Plan in 2009. The aim of this report is to determine the present diversity and sensitivity of macro-invertebrates in Lake Mealup central and Little Lake Mealup and to determine if the ecosystem has responded to the Lake Mealup Recovery Plan.

Methods

Melita Pennifold, Megan Sheenan (DPaW) and volunteers (Griselda, Heather and Jamie) sampled invertebrates in Lake Mealup and Little Lake Mealup on 30th November 2016.

On the mid-western shore of Lake Mealup we collected two 10 metre sweep net samples (using a 250 µm mesh net): one under the inundated *Melaleuca* and one in open water just beyond the trees near the bird hide. Depth (1.15m on gauge) was such that wading much beyond the trees was not possible. At Little Lake Mealup, one sample was taken under the inundated *Melaleuca* at the south-eastern end using the same methods. Note due to water depth being >0.8m, sampling in open water beyond the trees was not possible.

Each invertebrate sample was passed through a series of 3 sieves (10mm, 2mm and 0.25 mm mesh) and the contents of each sieve were examined by all 4 people at the same time. We aimed to pick at least 200 animals from each sample and to remove representatives of all species present, as per AusRivAS methods (Department of Water 2009). It should be noted that the open water sample from Lake Mealup contained few invertebrates and only 149 animals were picked. In general, all of the contents of the coarsest sieve was sorted and enough of the smaller sieves to be confident that we had seen all species present. Sampling occurred between 10am and 4pm.

Invertebrates were identified to family or order level by Melita Pennifold.

Data from previous macroinvertebrate surveys carried out at the lakes (listed below) were collated with the 2016 data and analysed. 'Abundance' scores are those used by ECU in 2012 (1=1-2 specimens, 2 = 3-10 specimens, 3 = 11-100 specimens and 4 = 101-1000

- 2009 - Liz Bonner, (PHCC),
- 2010, 2012 and 2014 – Simon Judd, Pierre Horwitz and students (ECU),
- 2011 - Heidi Bucktin (DPaW) and Thelma Crook (PHCC),
- 2013 - Adrian Pinder (DPaW)

Results

<u>Water quality</u>

At the time of sampling pH was neutral at both lakes (7.26 at Lake Mealup and 7.08 at Little Lake Mealup) and conductivity was relatively low (1739 µS/cm at Lake Mealup and 2081 µS/cm at Little Lake Mealup).

Conductivity and pH have changed in both lakes since 2009 (Figures 1 and 2). The pH level has increased at both lakes becoming more neutral since 2009, when both lakes were acidic (pH <4). However, low pH was recorded in 2014 by ECU, so fluctuations in acidity may still be occurring. Conductivity has also changed over time with Little Lake Mealup showing a decrease in conductivity and annual fluctuations occurring in both lakes.

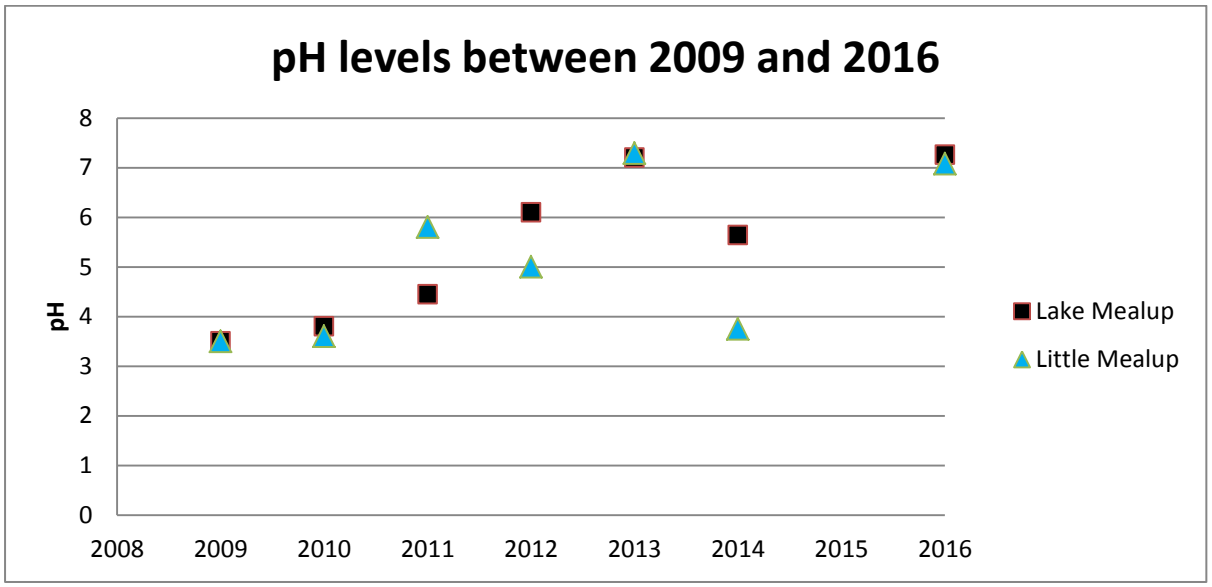

Figure 1. pH values for Lake Mealup and Little Lake Mealup at time of invertebrate sampling between 2009 and 2016

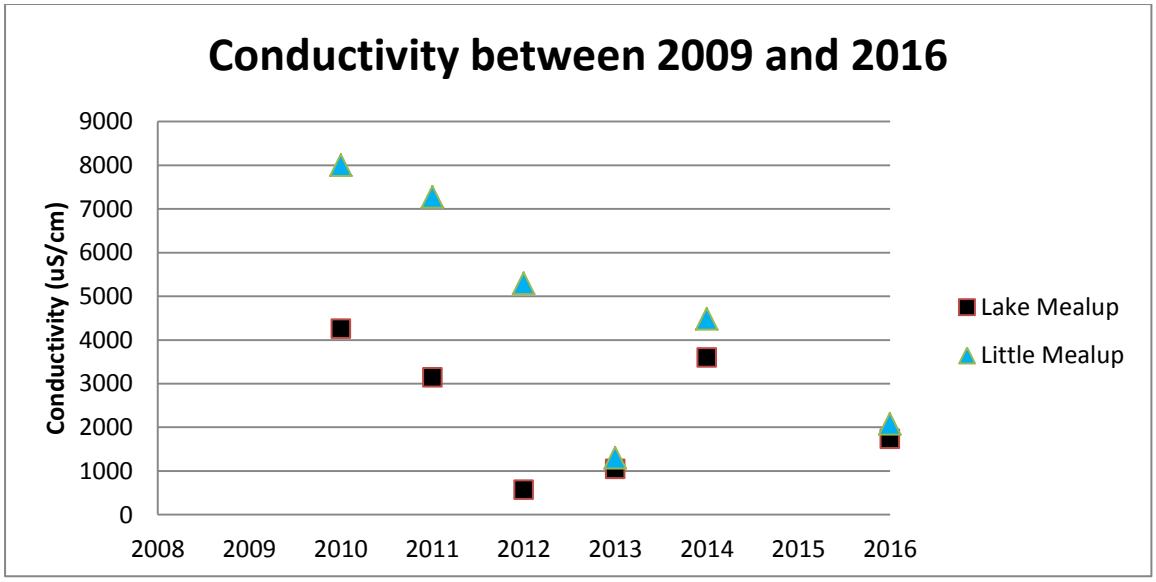

Figure 2 Conductivity at Lake Mealup and Little Lake Mealup between 2009 and 2016

Invertebrates

A total of 19 invertebrate family groups were collected in 2016 (Table 1). The most abundant taxa collected from Lake Mealup were chironomids (midges), notonectids (backswimmers) and copepods. Midges and copepods were also the most abundant taxa at Little Lake Mealup.

During the 8 years of monitoring (2009-2016), 32 family groups have been recorded from Lake Mealup and 24 from Little Lake Mealup. In 2016 five taxa were present at one lake only (Lake Mealup). These were a nematod, a Limnesiid water mite, amphipods, mosquito larvae (Culicidae) and caddisflies (Leptoceridae). Nematodes, mosquito larvae and caddisflies have been collected from Little Lake Mealup in previous years. Amphipods have been collected from drain sites in previous years but this is the first record from Lake Mealup and could be an indication of improved water quality and an increase in pH, as amphipods (Ceinidae) are acid-sensitive.

Table 1. Number of individuals removed from the invertebrate sweeps collected in November 2016. Water quality sensitivity of taxa are shown by Signal 2 score (Chessman, 2003) and SWAMP score (Chessman, Trayler & Davis, 2002).

					Lake Mealup (2016)		Little Lake Mealup (2016)
Class	**Order**	**Family**	**Signal 2 score**	**SWAMP-F score**	**1 (nearshore)**	**2 (open)**	**1 (nearshore)**
Oligochaeta			2	43	1	6	3
Nematoda			3	35	1		
Gastropoda	Pulmonata	Physidae	1	38	1		2
Arachnida	Acarinformes	Limnesiidae	*6	38	1		
Arachnida	Acarinformes	Pionidae	*6	14	8	8	9
Crustacea	Copepoda	Calanoida	-	51	7	31	50
Crustacea	Copepoda	Cyclopoida	-	29	7	17	15
Crustacea	Cladocera	Daphniidae	-	29	1	6	15
Crustacea	Amphipoda	Ceiniade	2	41	1	1	
Crustacea	Ostracoda	Cyprididae	-	34	19	11	7
Insecta	Coleoptera	Hydrophilidae	2	55	15	7	11
Insecta	Coleoptera	Dystiscidae	2	49	16		15
Insecta	Diptera	Culicidae	1	66	1	1	
Insecta	Diptera	Chironomidae	3	43	95	42	79
Insecta	Hemiptera	Corixidae	2	20	2	27	7
Insecta	Hemiptera	Notonectidae	1	39	23	5	26
Insecta	Odonata - Anisoptera	Corduliidae	3	61	14	4	20
Insecta	Odonata - Zygoptera	Lestidae	1	50		12	2
Insecta	Trichoptera	Leptoceridae	8	47	3	1	
		Family Richness			**18**	**15**	**14**
		SWAMPS-F score			**41**	**41**	**40**

* Score for Order level

One family (Limnesiidae, a water mite) had not been collected in previous years however only one individual was collected from Lake Mealup, so it is unsure whether this taxa is a new colonizer or just not collected in past sampling.

The sensitivity of each family group to water quality is shown in Table 1 and was determined using the Swan Wetlands Aquatic Macroinvertebrate Pollution Sensitivity (SWAMPS) index (Chessman, Trayler & Davis, 2002) and the sensitivity grade for Australian river macroinvertebrates (SIGNAL 2)(Chessman, 2003). SWAMPS was developed as a biotic index for wetlands near Perth to determine the extent to which macroinvertebrates communities have been disrupted by human intervention. The grades are from 100 (sensitive) to one (most tolerant). The SWAMPS-Family score for Lake Mealup and Little Mealup were both below 42 indicating that cultural eutrophication or other human impact is likely to be occurring. This score is lower than that determined for Lake McLarty in 2016 (SWMAPS_F of 47-48) indicating eutrophication was unlikely.

As a number of different collectors and methods for sorting samples have been used in the past, comparison of abundances and richness should be used with caution. Using a scaled abundance score of 1 to 5, as used by ECU, should eliminate some biases, however care must be taken when interpreting results.

Compared to previously collected invertebrate data, invertebrate richness in individual samples was high (Figure 3 and Figure 4) with 14-18 families per sample. Despite there being only one or two samples collected at each wetland in 2016, total richness (all samples within a lake combined) at Lake Mealup (19) was similar to 2013 and 2014 when 18-19 families were collected (Figure 5).

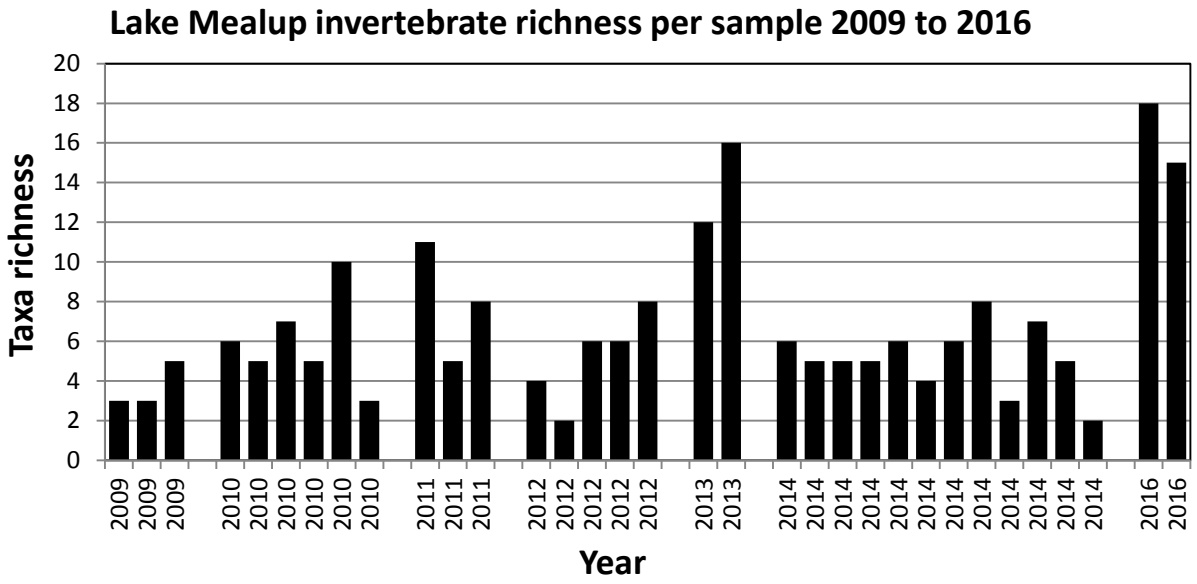

Figure 3. Invertebrate richness in samples collected from Lake Mealup between 2009 and 2016.

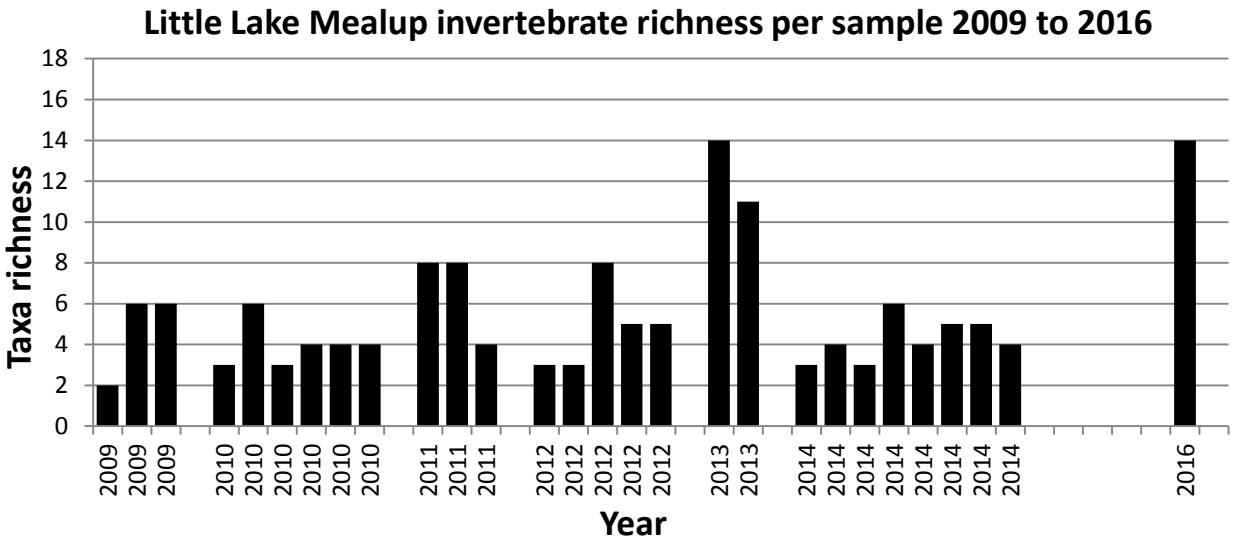

Figure 4. Invertebrate richness in samples collected from Little Lake Mealup between 2009 and 2016.

The higher total richness at Lake Mealup since 2013 is probably related to the more benign water chemistry than had been present in previous years with lower salinity and pH being about neutral. At Little Lake Mealup total richness was 14, which was similar to 2013 (15), but higher than 2014 (Figure 5).

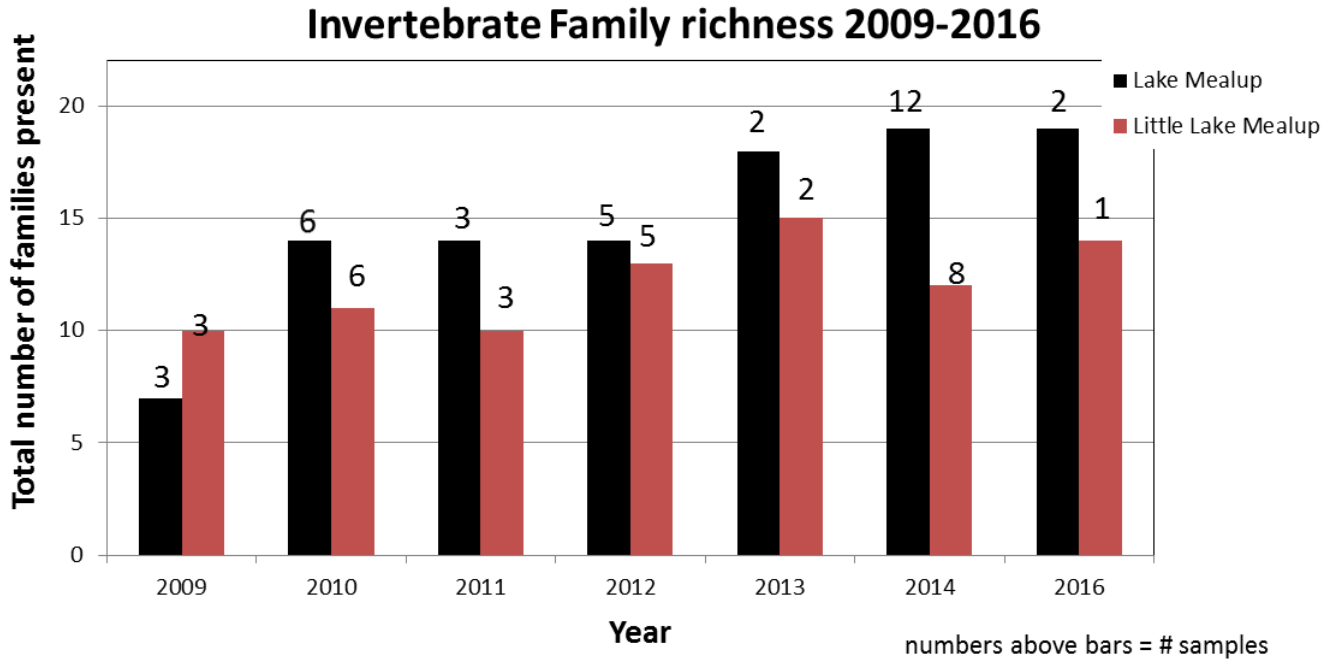

Figure 5. Total richness at Lake Mealup and Little Lake Mealup between 2009 and 2016.

To compare changes in richness with pH over time, the average richness per sample was used (Figure 6 and 7). Although at Lake Mealup the total richness (Figure 5) was similar between 2013 and 2016, it can be seen in Figure 6 that the average richness per sample was lower in 2014 when pH was low. This indicates that richness in some areas of the lake was reduced, as revealed by three samples having less than 4 families (Figure 3). Figure 7 shows that Little Lake Mealup also had low average richness per sample in 2014 when pH was below 4.

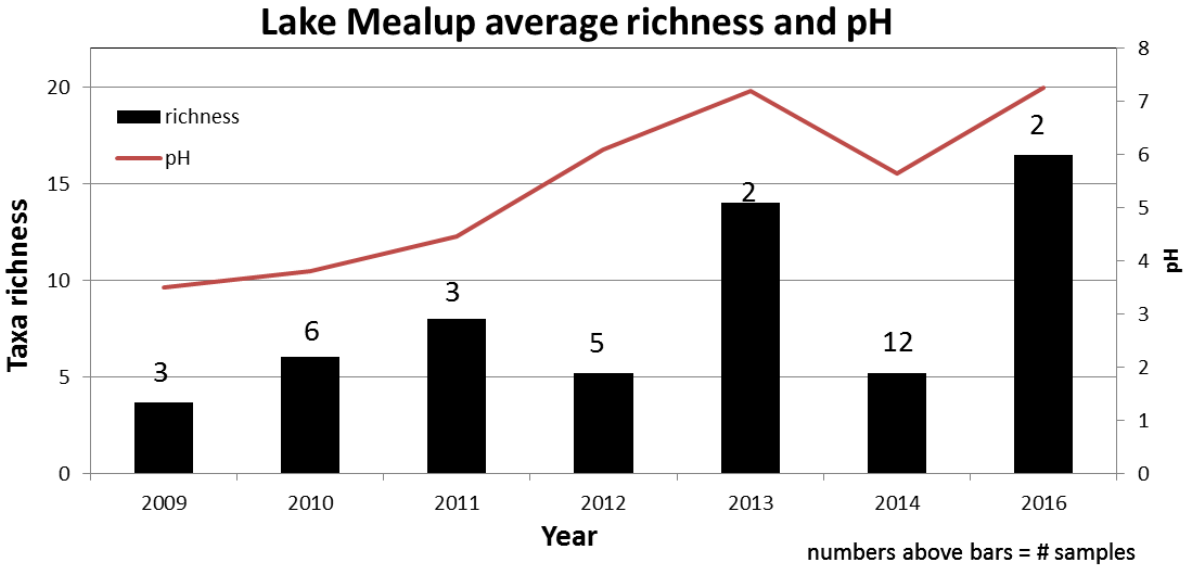

Figure 6. Average invertebrate richness per sample collected from Lake Mealup between 2009 and 2016 and pH levels measured at the time of sampling.

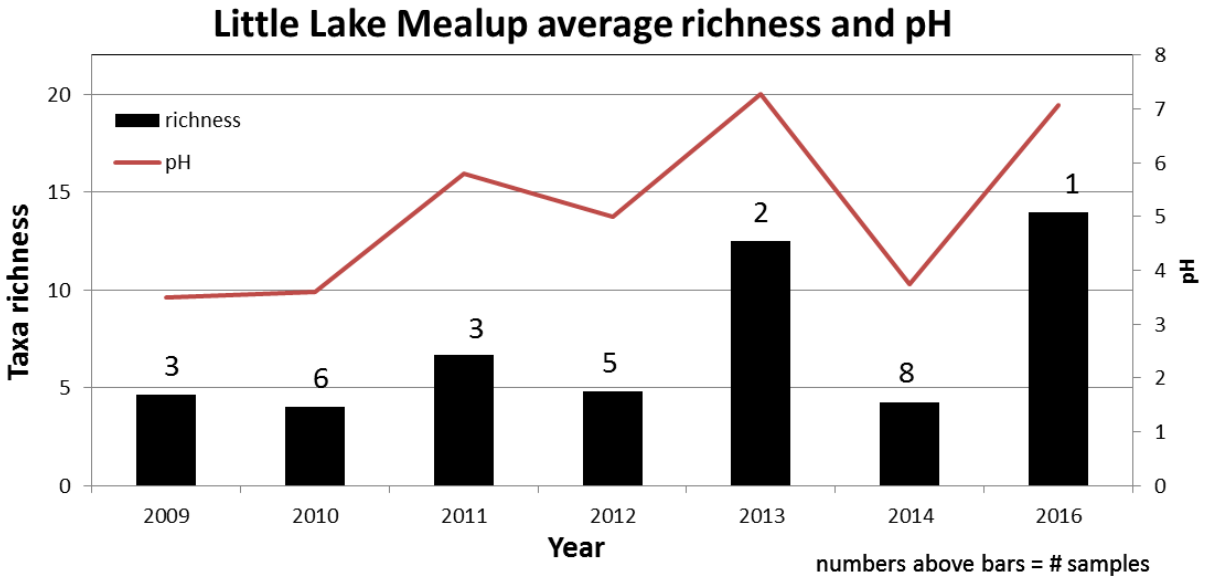

Figure 7. Average invertebrate richness per sample collected from LittleLake Mealup between 2009 and 2016 and pH levels measured at the time of sampling

Figure 8 shows the number of acid-sensitive taxa groups (as defined by ECU and including molluscs) collected from Lake Mealup and Little Lake Mealup. Prior to 2013, only 1-2 taxa were present at either lake. Since 2013 the number of taxa and their abundance has increased with up to 5 groups being recorded from Lake Mealup in 2016 and 4 from Little Lake Mealup. In 2014 there was a decline in the number of taxa, with no molluscs being collected. This may be a consequence of the lower pH levels recorded that year indicating the high sensitivity molluscs have to acidic conditions due to the vulnerability of their calcified shells. In 2016 molluscs were again collected and amphipods (Ceinidae) were collected for the first time at Lake Mealup.

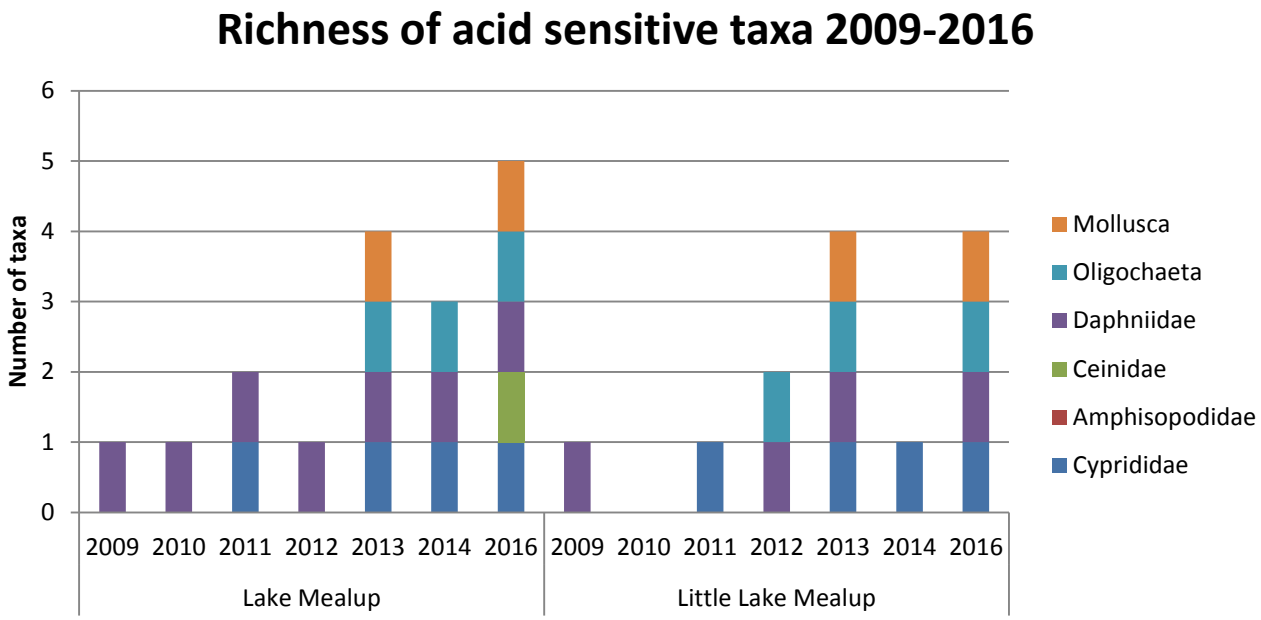

Figure 8. Richness of acid-sensitive taxa at Lake Mealup and Little Lake Mealup between 2009 and 2016.

The assemblages found in Lake Mealup and Little Lake Mealup are indicative of acidic conditions rather than poor water quality. Most of the invertebrates, including the coleopteran (beetle) families Hydrophilidae and Dysticidae, the dipteran families Chironomidae(midges) and Ceratapogonidae (non-biting midges) and the Hemipteran families Notonectidae (backswimmers) and Corixidae (boatmen) are known to be acid-tolerant and to increase in abundance following drought induced acidification (Sommer & Horwitz, 2009). Figure 9 shows the acid-tolerant taxa present at Lake Mealup and Little Lake Mealup. It is interesting to note in 2013 the number of acid-tolerant taxa decreased and there was a corresponding increase in acid-sensitive taxa that year, although a similar trend is not seen in 2016 when a higher number of acid-sensitive taxa were recorded.

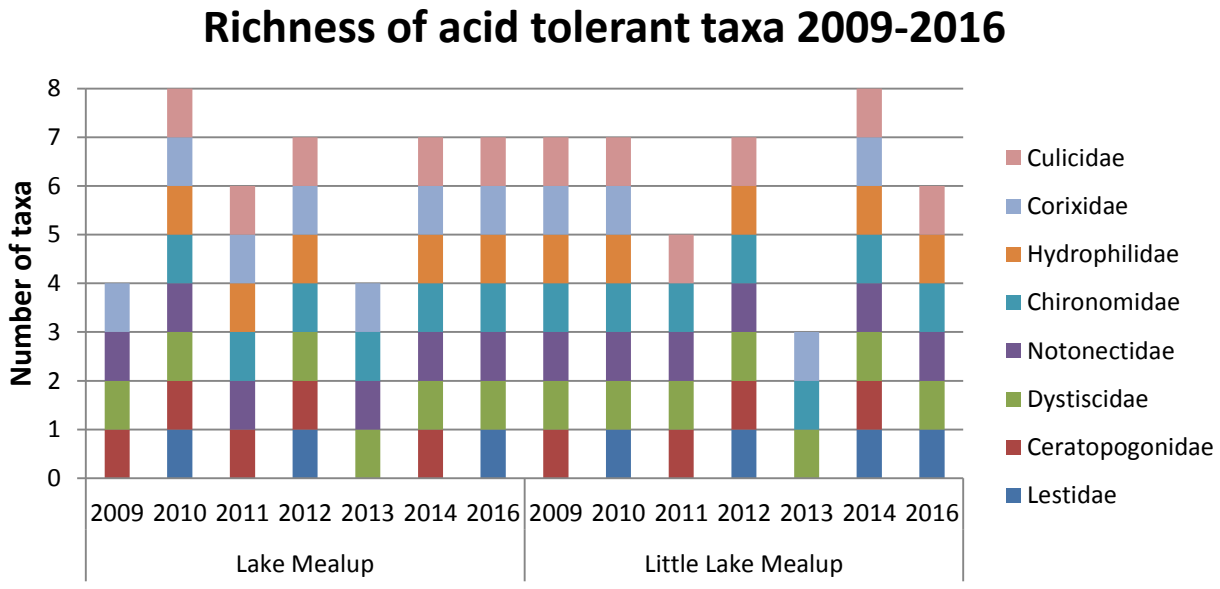

Figure 9. Richness of acid-tolerant taxa at Lake Mealup and Little Lake Mealup between 2009 and 2016.

Conclusions

The results for Lake Mealup and Little Lake Mealup from this year's survey show an increase in invertebrate richness and abundance since 2009. There was a decrease in richness between 2013 and 2014 at Little Lake Mealup which may be related to low pH levels prior to sampling, but richness recovered in 2016 to a similar richness as recorded for 2013. Overall there has been an increase in the number and abundance of acid-sensitive taxa present at both lakes. Further surveys and comparisons to historical data are recommended to show trends in the community composition and improvement in diversity.

It should also be noted that small fish were recorded at the time of invertebrate sampling. Although these were not identified, fish are considered a positive indicator representing more complete food cylces and general improvement in ecosystem health.

References

Chessman B.C. (2003) New sensitivity grades for Australian river macroinvertebrates. Marine and Freshwater Research, 54, 95-103.

Chessman B.C., Trayler K.M. & Davis J.A. (2002) Family- and species-level biotic indices for macroinvertebrates of wetlands on the Swan Coastal Plain, Western Australia. Marine and Freshwater Research, 53, 919-930.

Sommer B. & Horwitz P. (2009) Macroinvertebrate cycles of decline and recovery in Swan Coastal Plain (Western Australia) wetlands affected by drought-induced acidification. Hydrobiologia, 624, 191-203.