Waterwatch Victoria

QA/QC Week 2007

Report on State-wide results
Physical-chemical parameters and macro invertebrates

Report prepared by:

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1. Background

Waterwatch Victoria is a state-wide community water quality monitoring organisation that aims to increase local community understanding and ownership of waterway and catchment issues. Community volunteers and Waterwatch Coordinators are involved in the monitoring of waterway health including water quality and macro-invertebrate indicators.

Waterwatch Victoria's annual Quality Assurance/Quality Control (QA/QC) Week program is an annual event coordinated at a state-wide level. It involves the testing of laboratory-prepared, quality controlled samples ('Mystery Samples') by Waterwatch co-ordinators and monitors. QA/QC Week is one quality control check that Standard 3 and 4 monitors are encouraged to undertake each year to ensure that their equipment and monitoring techniques are accurate. For more information on Waterwatch Victoria's data confidence framework, guidelines and data confidence plans, visit www.vic.waterwatch.org.au.

This report summarises the state-wide data from phys-chemical and macro-invertebrate "Mystery Samples" tested by Waterwatch Victoria coordinators and monitors during QA/QC Week 2007 (July 22 to June 28, 2007). Similar QA/QC programs have been undertaken since 1998.

2. Methods

Stable 'Mystery' reference water samples for pH, electrical conductivity (EC), turbidity and orthophosphates were prepared at two ranges (low and high) by Australian Chemical Reagents (Roach Analysts), QLD. 'Mystery' macro-invertebrate samples of known taxonomic composition were prepared by Ecowise Environmental (Victoria). Ecowise Environmental (Victoria) tested a subset of the reference water samples at their NATA-accredited laboratory during QA/QC Week to check sample homogeneity and stability.

Two hundred and thirty five sets of low range physical-chemical mystery samples, one hundred sets of high range physical-chemical mystery samples, and one hundred macro-invertebrate reference samples were distributed by Waterwatch Victoria to regional Waterwatch programs during QA/QC Week 2007. The results from the coordinator and monitor data analysis sheets were collated by Kirsten Hogan (Goulburn Broken Waterwatch). Final report prepared by Sara Johnson, State Program and Projects Officer, Waterwatch Victoria.

QA/QC Codes (numbers, some with letter suffixes) are provided to all participants in QA/QC Week to allow their results to be included in the state-wide analysis anonymously.

2.1 Physical - chemical parameters

Physical-chemical mystery solutions were prepared to specifications recommended by the state Waterwatch Victoria office. Values listed in Table 1 are the averaged solution concentrations of the subset measured during QA/QC Week by Ecowise. Individual parameter solutions were provided in separate bottles with labelled instructions for sample preservation and use.

Table 1: Reference values for "Mystery Sample" parameters.

Parameter	Mystery Sample A (low range) value	Mystery Sample B (high range) value
EC (µS/cm)	590	4900
pH (pH units)	6.7	8.2
Turbidity (NTU)	35	125
Orthophosphate mg/L as P	0.055	0.30

Acceptable upper and lower quality control limits for each parameter tested were chosen by the state Waterwatch office to determine compliance with quality standards (refer to Table 2). These quality control limits are sensitive to the wide array of equipment used by Waterwatch coordinators and monitors and are consistent with those set in the Waterwatch Victoria Data Confidence Guidelines.

This state-wide analysis assumes that results were determined using equipment that meets minimum requirements of the Data Confidence Guidelines. These include:

Electrical conductivity – meters have a maximum resolution of 10EC for Sample A (low range) and meters have a maximum resolution of 100EC for Sample B (high range).

pH – pH meters (not strips)

Turbidity – determined with either a turbidity meter or turbidity tube.

Reactive phosphates (orthophosphates) - determined using either a visual colour comparator or a colorimeter.

Results may have been submitted by Waterwatch monitors that do not meet these criteria. In these instances, the results are still included in the appended spreadsheet of results, but are not included in the statistical analysis. Blank spaces are considered 'No response', not incorrect.

Table 2: Quality limits and upper and lower limits for physical - chemical parameters (Low Range).

Parameter	Quality Limits	Mystery Sample A		
		Reference Value	Lower Limit	Upper Limit
EC (µS/cm)	± 10%	590	530	650
pH (pH units)	± 0.3pH unit	6.7	6.4	7.0
Turbidity (NTU)	± 20%	35	28	42
Orthophosphate mg/L PO4-P	± 20%	0.055	0.04	0.07

Table 3: Quality limits and upper and lower limits for physical - chemical parameters (High Range).

Parameter	Quality Limits	Mystery Sample B		
		Reference Value	Lower Limit	Upper Limit
EC (µS/cm)	± 10%	4900	4400*	5400*
pH (pH units)	± 0.3pH unit	8.2	7.9	8.5
Turbidity (NTU)	± 20%	125	100	150
Orthophosphate mg/L PO4-P	± 20%	0.30	0.24	0.36

*EC values have been rounded to the nearest 100EC

2.2 Macro-invertebrates

Macro-invertebrate samples were provided to test coordinators and monitors identification skills at variable taxonomic resolutions. Macro-invertebrate 'mystery' samples consisted of six macro-invertebrates (Table 3) identified by an Ecowise aquatic ecologist. Macro-invertebrates selected are those that are naturally found in the majority of Victorian bioregions (Figure 1), so not to disadvantage participants. Coordinators and monitors identified the macro-invertebrates at the class, order, family and/or common name level. Analysis of results was carried out on all four levels. A non-attempt at identification was interpreted as a row on the results sheet with all blank spaces and recorded as "No response".

Table 3: Macro-invertebrate "Mystery Sample" taxa list.

Class	Order	Family	Common Name	Found in Victorian Bioregions
Insecta	Coleoptera	Psephenidae	Water Penny	Highlands, Forest A, Forest B, Cleared Hills and Coastal Plains.
Insecta	Odonata (Suborder Zygoptera)	Coenagrionidae	Damselfly	Forest B, Cleared Hills and Coastal Plains, Murray and Western Plains.
Insecta	Trichoptera	Ecnomidae	Caddisfly	Forest A, Forest B, Cleared Hills and Coastal Plains, Murray and Western Plains.
Insecta	Ephemeroptera	Leptophlebiidae	Mayfly	Highlands, Forest A, Forest B, Cleared Hills and Coastal Plains, Murray and Western Plains.
Insecta	Hemiptera	Veliidae	Water Strider	Forest A, Forest B, Cleared Hills and Coastal Plains, Murray and Western Plains.
Gastropoda	-	Hydrobiidae	Freshwater Snail	Forest B, Cleared Hills and Coastal Plains, Murray and Western Plains.

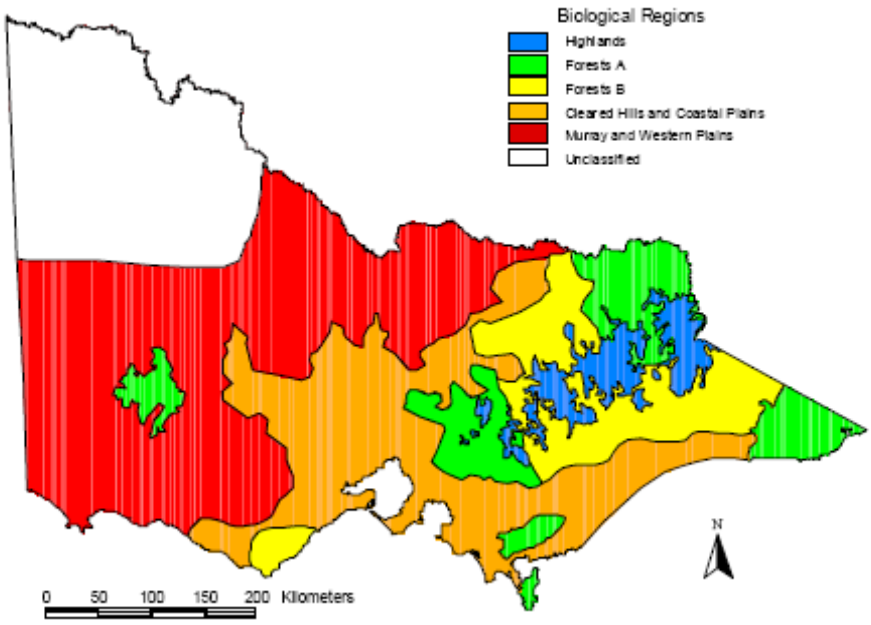

Figure 1: Victorian Macro invertebrate Bioregions (reproduced from Victorian EPA rapid bio-assessment methodology).

3. Results

3.1 Physical-chemical:

The following Tables summarise the pass rates for Coordinators and Monitors for each of the physical-chemical parameters and sample ranges, alongside supporting statistics and information.

Coordinator pass rates were high, above 80% for low and high range sample parameters (orthophosphate Sample A being the only exception) – refer to Tables 4 and 5. Monitor pass rates were above 80% for EC and pH, and above 70% for turbidity and orthophosphate results. Orthophosphate Sample B had the lowest participation rate (only 57 participants) and the lowest pass rate for Waterwatch monitors (61.4%). Refer to Table 6 and 7 for Waterwatch Monitor data results.

Table 4: Coordinator pass rates for low range (Sample A) samples.

Sample A (low range value)	Number of Results (n)	Pass Rate %	Median	Minimum	Maximum
EC (590 uS/cm)	61	91.8	581	364	700
pH (6.7 pH units)	23	100	6.71	6.4	7.0
Turbidity (35 NTU)	48	89.6	35.5	30	58
Reactive phosphate (0.055 PO4-P mg/L)	45	77.8	0.06	0.02	0.11

Table 5: Coordinators pass rates for high range (Sample B) samples.

Sample B (high range value)	Number of Results (n)	Pass Rate %	Median	Minimum	Maximum
EC (4900 uS/cm)	45	91.2	4770	4200	5850
pH (8.2 pH units)	41	92.6	8.2	7.5	8.4
Turbidity (125 NTU)	39	92.3	125	80	200
Reactive phosphate (0.30 PO4-P mg/L)	31	96.8	0.30	0.24	0.50

Table 6: Monitor pass rates for low range (Sample A) samples.

Sample A (low range value)	Number of Results (n)	Pass Rate %	Median	Minimum	Maximum
EC (590 uS/cm)	266	90.2	590	253.3	800
pH (6.7 pH units)	181	91.0	6.7	6.4	8.02
Turbidity (35 NTU)	225	82.7	35	17	75
Reactive phosphate (0.055 PO4-P mg/L)	214	73.4	0.05	0.01	0.25

Table 7: Monitor pass rates for high range (Sample B) samples.

Sample B (high range value)	Number of Results (n)	Pass Rate %	Median	Minimum	Maximum
EC (4900 uS/cm)	160	87.5	4700	2171	6300
pH (8.2 pH units)	113	87.6	8.2	7.3	9.85
Turbidity (125 NTU)	101	70.3	120	60	400
Reactive phosphate (0.30 PO4-P mg/L)	57	61.4	0.32	0.18	0.5

A comparison of Coordinator and Monitor results against parameter and sample ranges is provided in Figure 2 and 3.

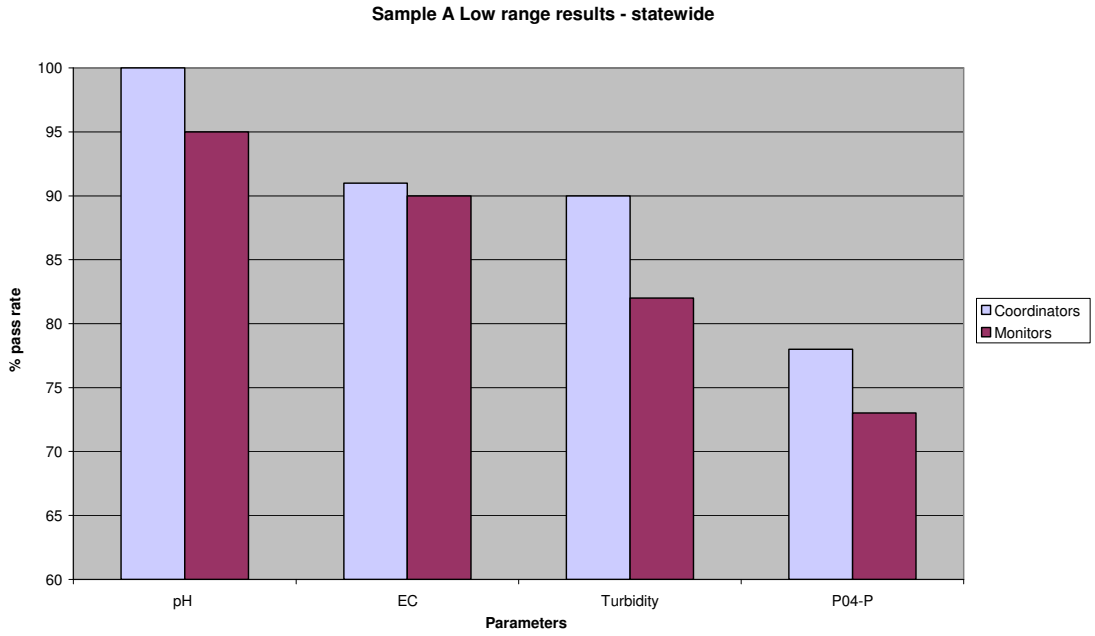

Figure 2: Comparison of Coordinator and Monitor results for Sample A (low range) samples.

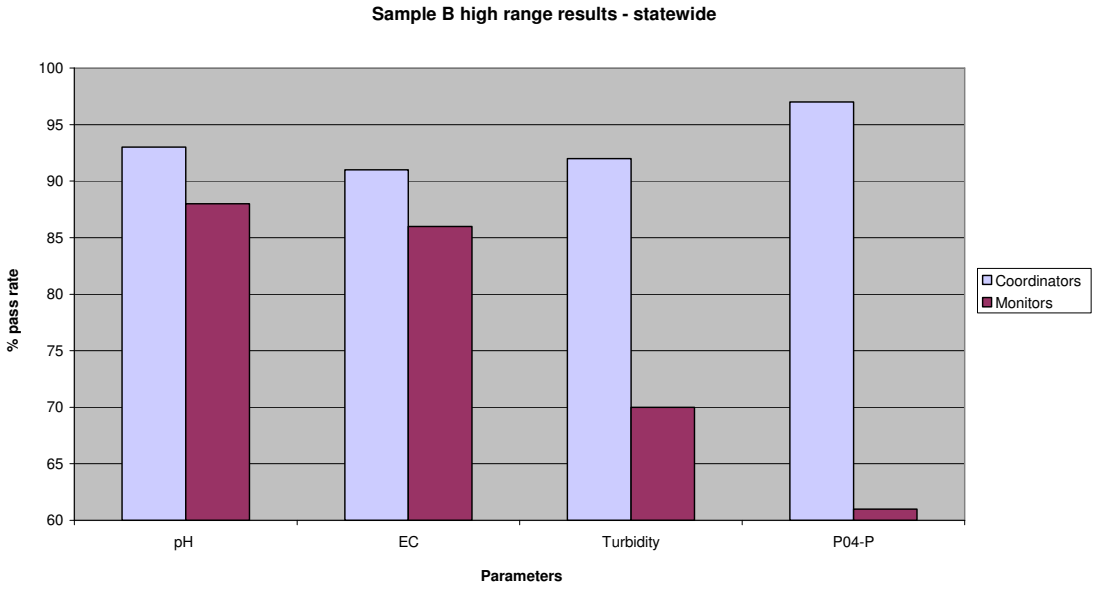

Figure 3: Comparison of Coordinator and Monitor results for Sample B (~~low~~ high range) samples.

3.2 Macro-invertebrates:

Results varied between Coordinator and Monitor identifications of macro-invertebrates. Identification to order level and common name level was high for both Coordinators and Monitors for most invertebrates (the hemipteran (Small) Water Strider being the only exemption). Family level identification was variable. Refer to Tables 8 and 9 for more information.

Table 8: Coordinator identification pass rates for 'mystery' macro-invertebrates.

Class	% Pass (number of responses)	Order	% Pass (number of responses)	Family	% Pass (number of responses)	Common Name	% Pass (number of responses)
Insecta	100% (33)	Coleoptera	100% (33)	Psephenidae	100% (33)	Water Penny	100% (33)
Insecta	100% (33)	Odonata (Suborder Zygoptera)	100% (33)	Coenagrionidae	66% (33) Mistakes – Protoneuridae, Lestidae, Megapodagrionidae	Damselfly	97% (33)
Insecta	100% (32)	Trichoptera	100% (33)	Ecnomidae	97% (33) Mistake – Philopotamidae	Caddisfly	97% (33) (Ecnomid listed)
Insecta	100% (32)	Ephemeroptera	97% (33) Mistake - Odonata	Leptophlebiidae	85% (33) Mistakes – Oniscigastridae, Baetidae, Austropetalidae	Mayfly	93% (33) (Dragonfly and Leptophleb listed)
Insecta	100% (32)	Hemiptera	93% (33) Mistake - Coleoptera	Veliidae	85% (33) Mistakes – Mesoveliidae, Hebridae, Elmidae	(Small) Water Strider	79% (33) Most common mistake – Wingless Water treader, Velvet Water bugs, Riffle Beetle.
Gastropoda	88% (33) Mistake- Mollusca	Order results were not analysed. Order taxonomy is difficult for Gastropods, and is rarely recorded by scientists.		Hydrobiidae	66% (33) Mistakes – Planorbidae, Lymnaeidae, Pomotiopsidae, Physidae,	Snail	97% (33) (all variations on Snail accepted) Mistake - Coxiella

Table 9: Monitor identification pass rates for 'mystery' macro-invertebrates.

Class	% Pass (number of responses)	Order	% Pass (number of responses)	Family	% Pass (number of responses)	Common Name	% Pass (number of responses)
Insecta	100% (43)	Coleoptera	96% (48) Mistakes – Hirudinea, Isopoda	Psephenidae	98% (47) Mistake: Glossiphoniidae	Water Penny	86% (58) Mistakes: beetle, backswimmer, leech, water slater.
Insecta	100% (47)	Odonata (Suborder Zygoptera)	98% (52) Mistake – Trichoptera	Coenagrionidae	77% (36) Mistakes – Protoneuridae, Lestidae, Polycetropodidae, Megapodagrionidae, Sialidae	Damselfly	98% (58) Mistake - Stonefly
Insecta	100% (42)	Trichoptera	96% (50) Mistakes – Anostraca, Coleoptera	Ecnomidae	66% (42) Mistakes – Polycentropodidae, Dytiscidae, Ptilodactylidae, Leptoceridae, Hydrobiosidae	Caddisfly	89% (55) Mistakes – Fly larvae, beetle larvae, brine shrimp, blackfly larva, mosquito larva
Insecta	100% (42)	Ephemeroptera	96% (48) Mistakes: Odonata, Diptera	Leptophlebiidae	80% (35) Mistakes – Baetidae, Epiproctophora, Caenidae, Polycentropodidae, Oniscigastridae	Mayfly	96% (51) Mistakes – Dragonfly, mosquito larvae
Insecta	100% (45)	Hemiptera	64% (50) Mistakes – Coleoptera, Diptera	Veliidae	48% (38) Mistakes – Mesoveliidae, Elmidae, Dytistidae, Gerridae , Hebridae	(Small) Water Strider	46% (56) Mistakes – velvet water bug, riffle beetle, water boatman, true bug, beetle, ~~riffle beetle~~, water treader, creeping water bug.
Gastropoda	93% (55) Mistakes – Mollusca, Insecta	Order results were not analysed. Order taxonomy is difficult for Gastropods, and is rarely recorded by scientists.		Hydrobiidae	62% (42) Mistakes – Lymnaeidae, Anclidae, Leptoceridae, Planorbidae, Pomatiopsidae, Bithyniidae	Snail	100% (58) (all variations on Snail accepted)

4. Conclusion

As identified in the introduction, this QA/QC Program is just one quality control check provided by Waterwatch to support volunteer monitors and coordinators. This year, over 400 data sheets were received for physical-chemical results, and over 90 datasheets for macro-invertebrate results. Pass rates for most parameters were high, with certain parameters and invertebrate groups standing out for improvement. Regional Waterwatch programs are responsible for providing feedback to individual monitors, and for providing support to identify possible sources of error.

Appendix 1: Data

Raw data from QA/QC Week 2007 can be accessed in excel spreadsheet format upon request from Waterwatch Victoria.

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