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

Tasmania

Natural Heritage Trust

Helping Communities Helping Australia

A Commonwealth Government Initiative

Water Quality In The Montagu River Catchment

Part 3

Authors:
Christopher Bobbi
David Blühdorn
David Andrews &
Mark Bantich

Environmental & Resource Analysis,
Hydro Tasmania
December 2003

Hydro Tasmania

the renewable energy business

Preferred Citation:

DPIWE (2003) *State of the River Report for the Montagu River Catchment.* Water Assessment and Planning Branch, Department of Primary Industries, Water and Environment, Hobart. Technical Report No. WAP 03/09

ISSN: 1449-5996

The Department of Primary Industries, Water and Environment

The Department of Primary Industries, Water and Environment provides leadership in the sustainable management and development of Tasmania’s resources. The Mission of the Department is to advance Tasmania’s prosperity through the sustainable development of our natural resources and the conservation of our natural and cultural heritage for the future.

The Water Resources Division provides a focus for water management and water development in Tasmania through a diverse range of functions including the design of policy and regulatory frameworks to ensure sustainable use of the surface water and groundwater resources; monitoring, assessment and reporting on the condition of the State’s freshwater resources; facilitation of infrastructure development projects to ensure the efficient and sustainable supply of water; and implementation of the *Water Management Act 1999*, related legislation and the State Water Development Plan.

2.4 Catchment Surveys

Snapshot surveys of the entire drainage system of the Montagu River catchment were undertaken in the summer (February) and winter (August) of 2000. As pointed out at the beginning of this section, this sampling technique relies upon stable hydrological conditions so that the confounding influence of rainfall distribution is avoided. The aim of the technique is to allow relative ‘hotspots’ of water quality deterioration to be mapped and highlighted. This technique is a useful tool for locating sites or reaches of streams that may require specific or targeted management measures.

River flows during the February 2000 survey were typical for the summer of that year (river flow at site MR1 = 0.18 m^3/s) and was carried out following a prolonged dry period. The winter survey was undertaken in August, about a week after rain in the catchment (peak flow of about 14 m^3/s at MR1), when the winter baseflow of 3 m^3/s had re-established. These hydrological conditions should be kept in mind when viewing the following figures.

While some of the sites were comprehensively sampled during routine monthly monitoring, and results from these sites has been discussed in more detail in previous sections, the aim of the following maps is to present a broader view of water quality across the entire catchment. With the exception of conductivity, which clearly shows the influence dolomite outcrops have on salt levels in the catchment, data collected on the more common physico-chemical parameters (ie turbidity, dissolved oxygen, pH, etc) will not be discussed here, as the seasonal changes in these parameters at all 16 sites have already been illustrated and discussed (see Section 2.1).

2.4.1 Conductivity

The data for conductivity from the summer survey is included here, as it shows quite clearly the impact of dolomite in the middle catchment, below where the Bass Highway crosses the Montagu River (Figure 2.24). The representation on the map shows that conductivity in the upper Motagu River is fairly consistent, with levels showing only a marginal increase from 144 μS/cm at MR16 (at the top of the catchment) to 200 μS/cm at MR8 (Montagu at Togari). Outcropping of dolomite can be seen in the river below MR8, and this causes a substantial increase in conductivity by the time water reaches MR6 (Rennison Rd). Samples for general ions at this site (Section 2.2) show that this increase is reflected in the large increases in alkalinity and calcium that are recorded at this site compared with the concentrations of these upstream.

The slightly elevated conductivity detected at MR9 – Fixters Creek at Brittons Swamp (345 μS/cm) and MR10 – Fixters Creek at Riseborough Rd (300 μS/cm) may also reflect the influence of underlying dolomite, however because it does not outcrop in the stream channel it may have less of an influence than is seen in the main Montagu River. The other factor that could cause these slightly higher conductivity levels may be the impact of dairy farming on inflows to this creek, particularly the discharge of effluent from dairy sheds, which can significantly increase conductivity when there is insufficient flow to cause dilution. Further investigation may be required to determine the exact cause of this.

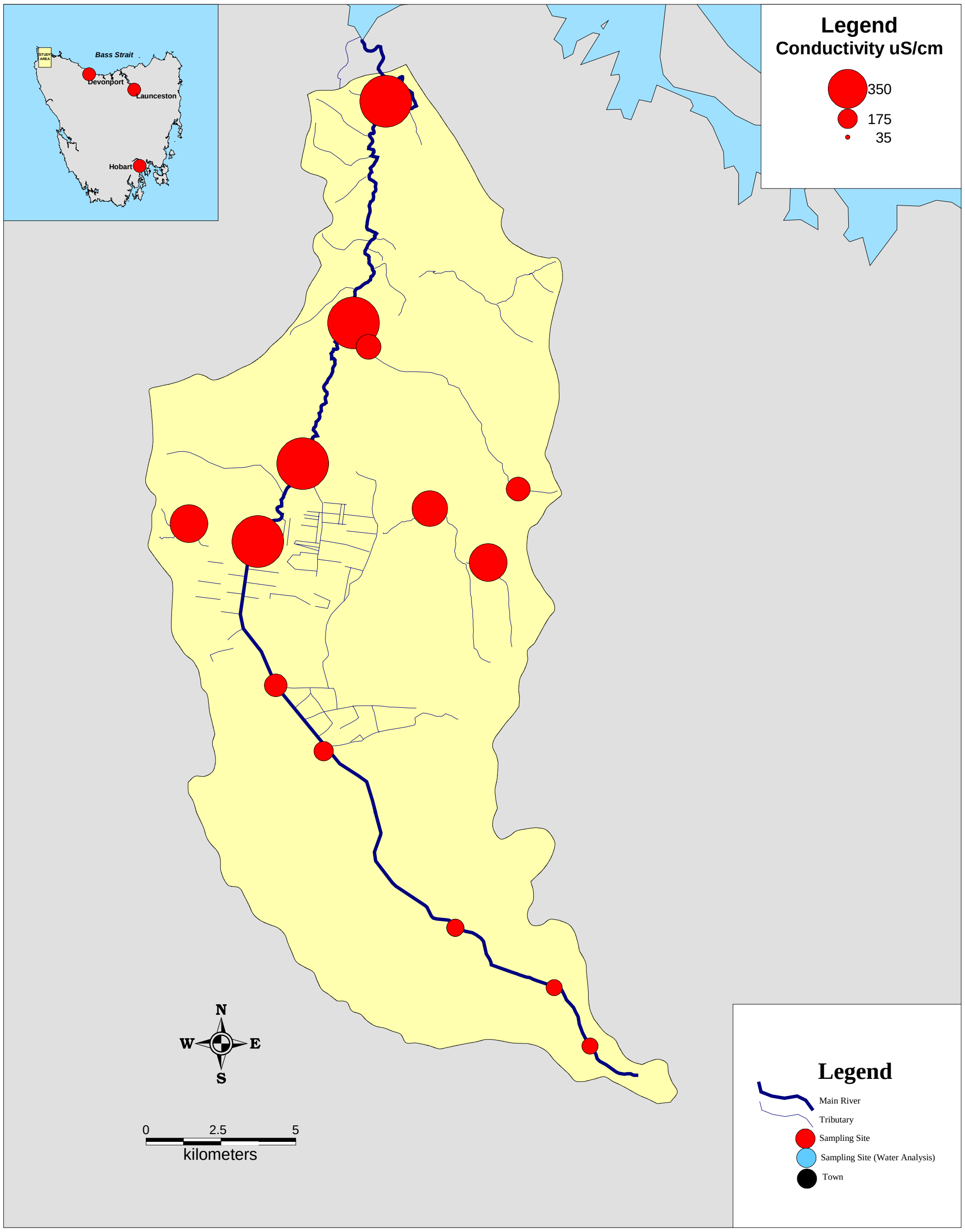

Figure 2.24: Snapshot of conductivity recorded in the Montagu catchment on 22 February 2000.

2.4.2 Total Nitrogen, Nitrate and Ammonia

The survey data for total nitrogen support the findings of the monthly monitoring, which identified site MR5, and the Fixters Creek area, as major sources of nitrogen. Spot samples at site MR9 (Fixters Creek at Brittons Swamp) also indicated that high nitrogen levels were occurring there (see Section 2.3).

Figure 2.25, illustrating the summer (February 2000) TN snapshot, shows that site MR9 recorded a value of 6.67 mg/L, much higher than any other site. It also shows that sites MR10 and MR5 (Canal off Barcoo Rd) also recorded elevated values during the survey.

Figure 2.26, illustrating the winter (August 2000) snapshot shows a similar pattern, with the Fixters Creek sites (MR9 and MR10) recording highest TN concentrations. During this survey the main channel sites of MR12, MR8 and MR6 also recorded high values.

Because nitrate-N throughout most of the catchment was low during the summer survey (February 2000) the figure for this survey has not been included. As has been discussed in Section 2.3.2, during the summer nitrate tends to be retained in the soil profile rather than transported into waterways. This stored nitrate tends to be flushed out during the heavier rainfall of late autumn early winter.

The notable exceptions were sites on Fixters Creek (MR10) and Farnhams Creek at Brittons Swamp (MR11), both of which had substantially higher nitrate-N concentrations than other sites during the summer survey. These sites are also highlighted in the winter snapshot (Figure 2.27), which also gives some indication that these high concentrations flow through to MR5 downstream. This lower site receives drainage water from both Fixters Creek and from the wider Togari area. These elevated nitrate-N concentrations reflect the flushing of nitrates (from fertiliser application) from the soil profile during winter.

The ammonia-N data tend to have a similar pattern for both summer (Figure 2.28) and winter (Figure 2.29). During both surveys, the sites associated with Fixters Creek (MR9 & MR10), and to a lesser extent upper Farnhams Creek (MR11) and MR6 in the main river channel recorded elevated ammonia levels. In the winter survey (August 2000), MR2 on the un-named tributary and sites MR13 & MR14 in the main river channel also recorded elevated levels. The cause of this anomalous reading at MR2 is not clear, although as has been mentioned earlier, this creek drains a swampy area enclosed by relatively undisturbed native forest, and decomposition within this swamp during the winter may naturally elevate ammonia-N concentrations. Further work is required to confirm this hypothesis.

2.4.3 Total Phosphorus

Both the summer (Figure 30) and winter (Figure 2.31) snapshot data for TP show that the Fixters Creek sites (MR9 & MR10), MR5 (which receives water from Fixters Creek and the greater Tongari area), MR6 in the main river channel and site MR7 on Galeford Creek recorded elevated TP values, especially during the summer survey (Figure 2.30). The concentration recorded at MR7 during the summer was unexpectedly high, seeing as the headwater of this stream has been dammed to form a water supply for the Togari district, and the local surroundings are relatively undisturbed.

In broad terms, the snapshot data reinforce the findings of the monthly nutrient data analysis that, there is a consistent pattern of high nutrient enrichment throughout the reaches of the catchment subject to the most intensive agricultural land use (namely dairy).

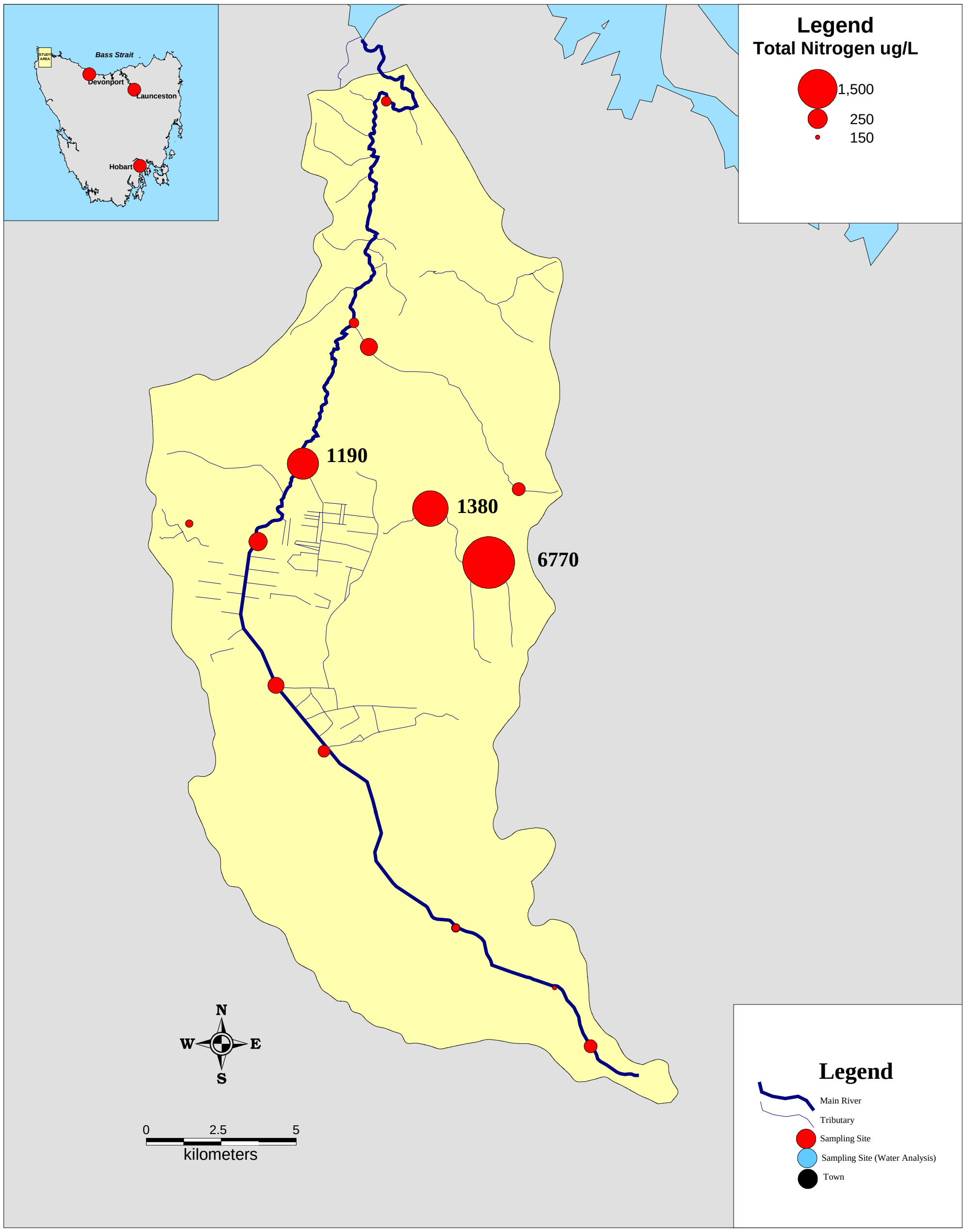

Figure 2.25: Snapshot of Total N concentrations (μg/L) recorded in the Montagu catchment on 22 February 2000.

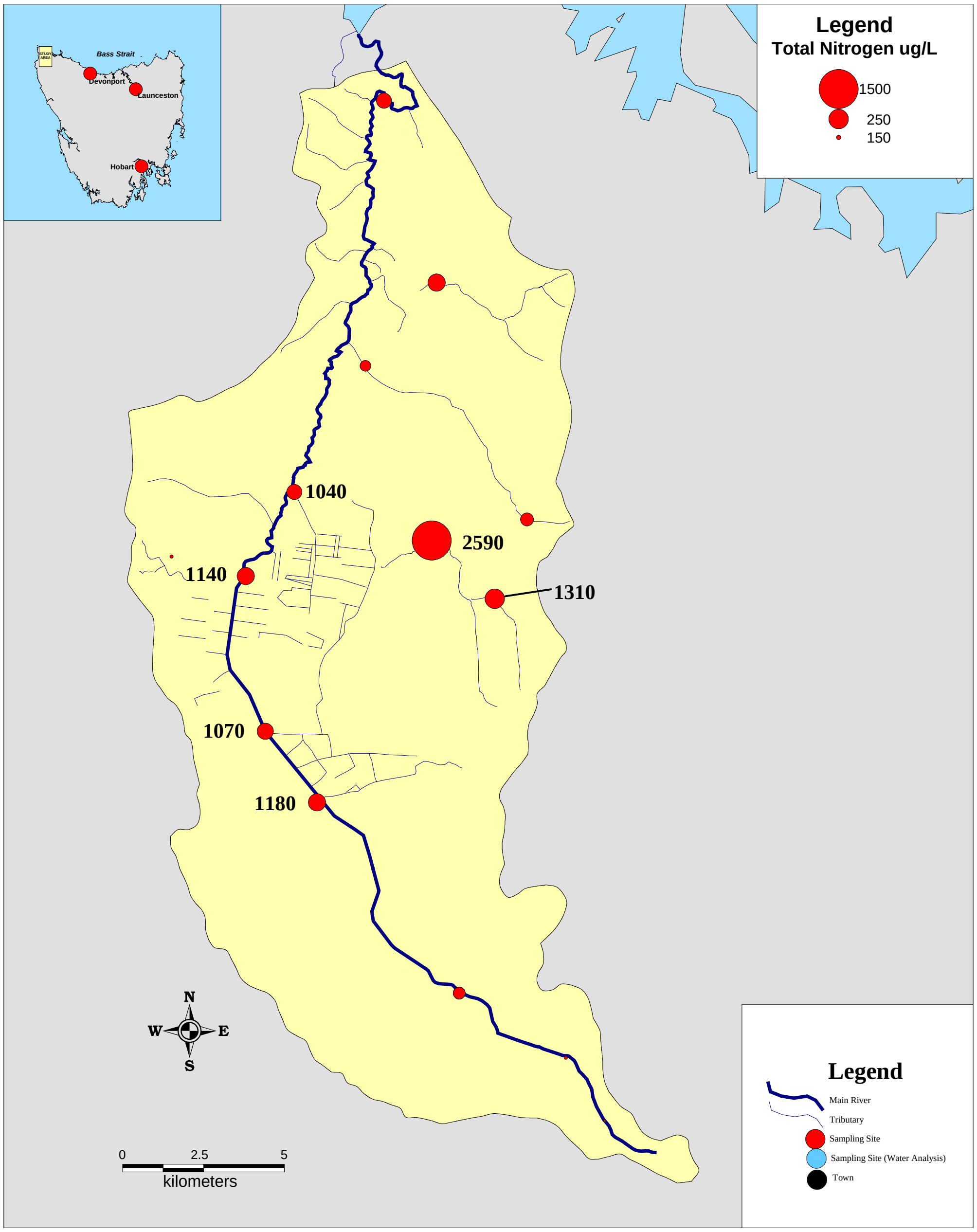

Figure 2.26: Snapshot of Total N concentrations (μg/L) recorded in the Montagu catchment on 30 August 2000.

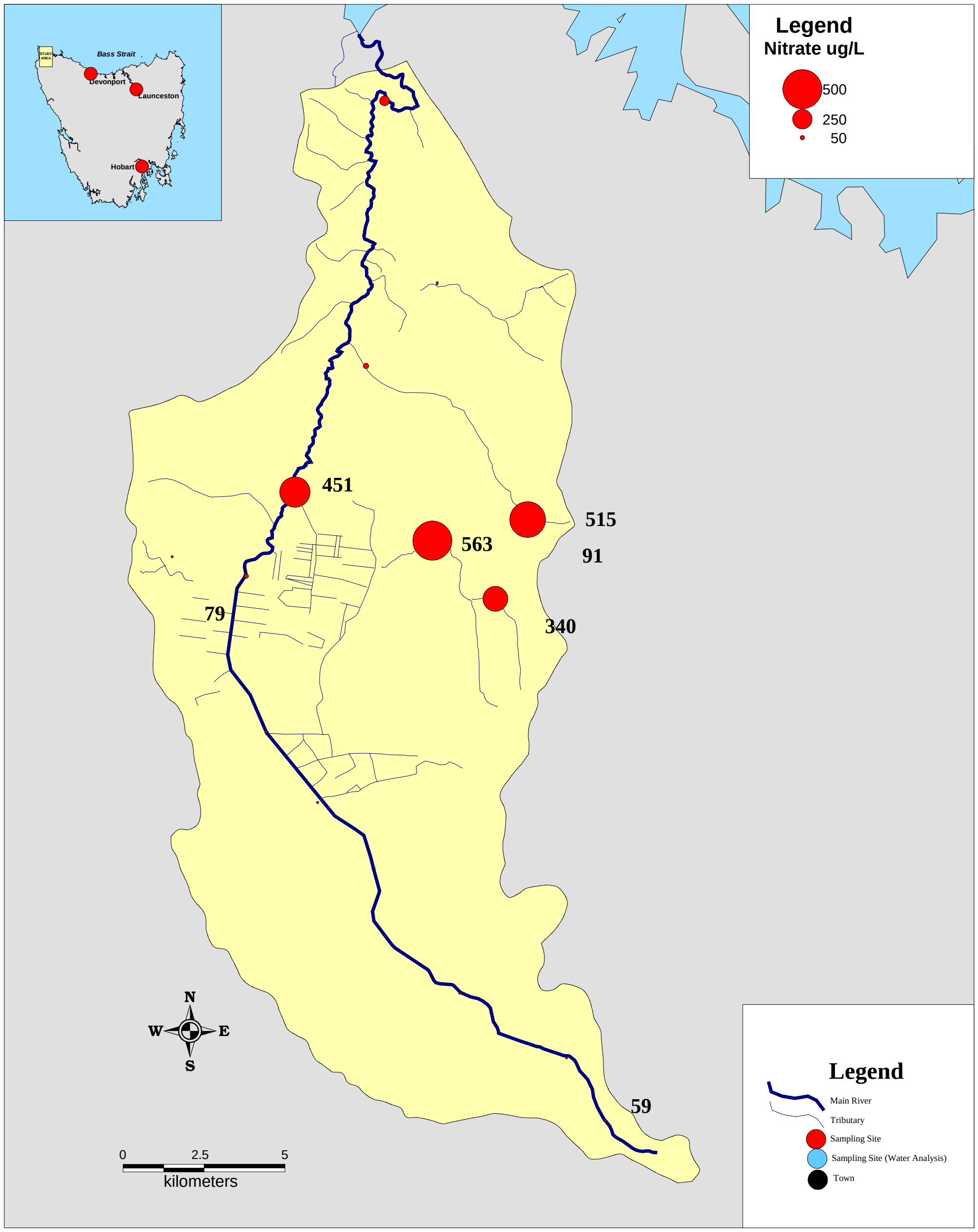

Figure 2.27: Snapshot of Nitrate-N concentrations (μg/L) recorded in the Montagu catchment on 30 August 2000.
Figure 2.28: Snapshot of Ammonia-N concentrations (μg/L) recorded in the Montagu catchment on 22 February 2000.

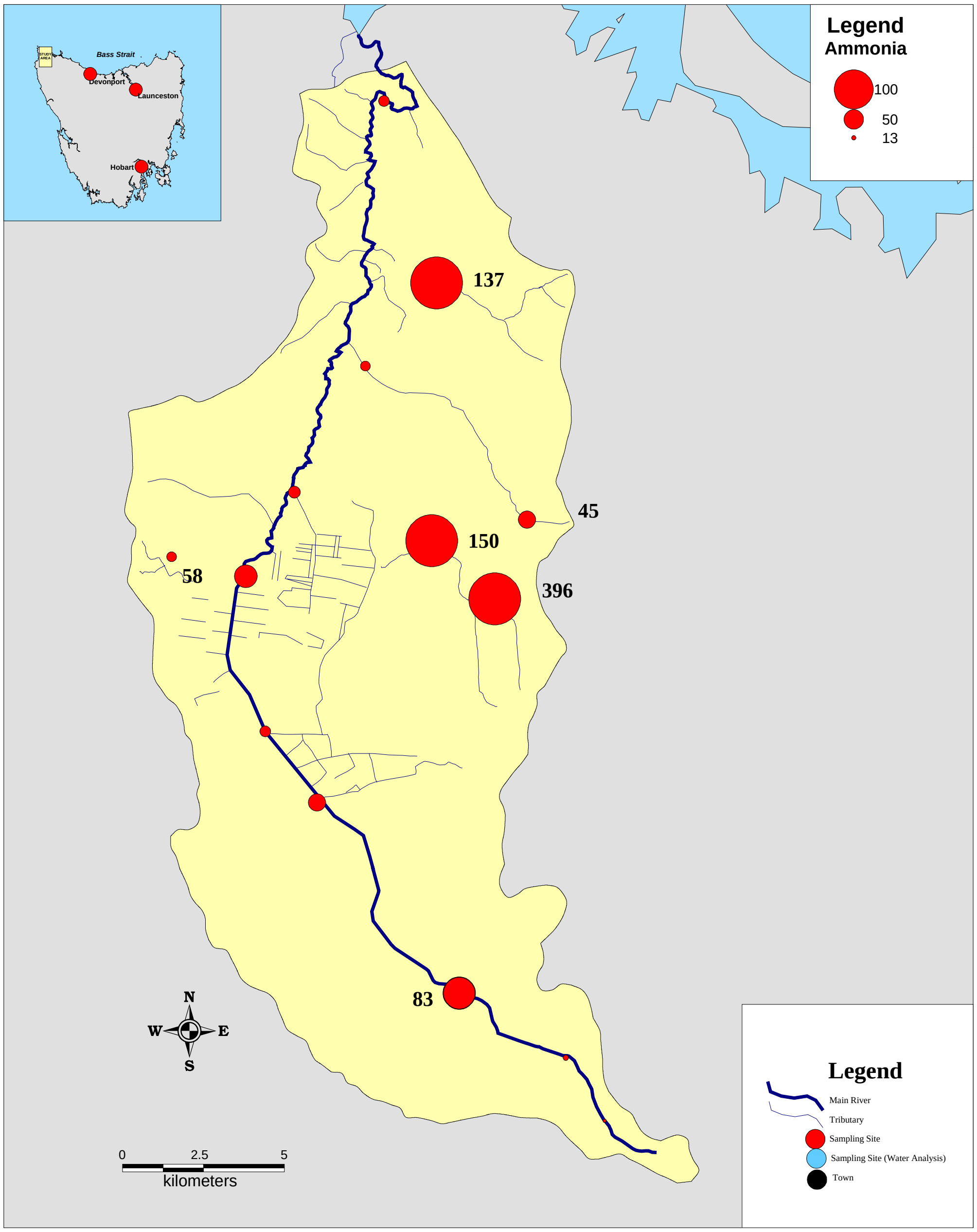

Figure 2.29: Snapshot of Ammonia-N concentrations (µg/L) recorded in the Montagu catchment on 30 August 2000.

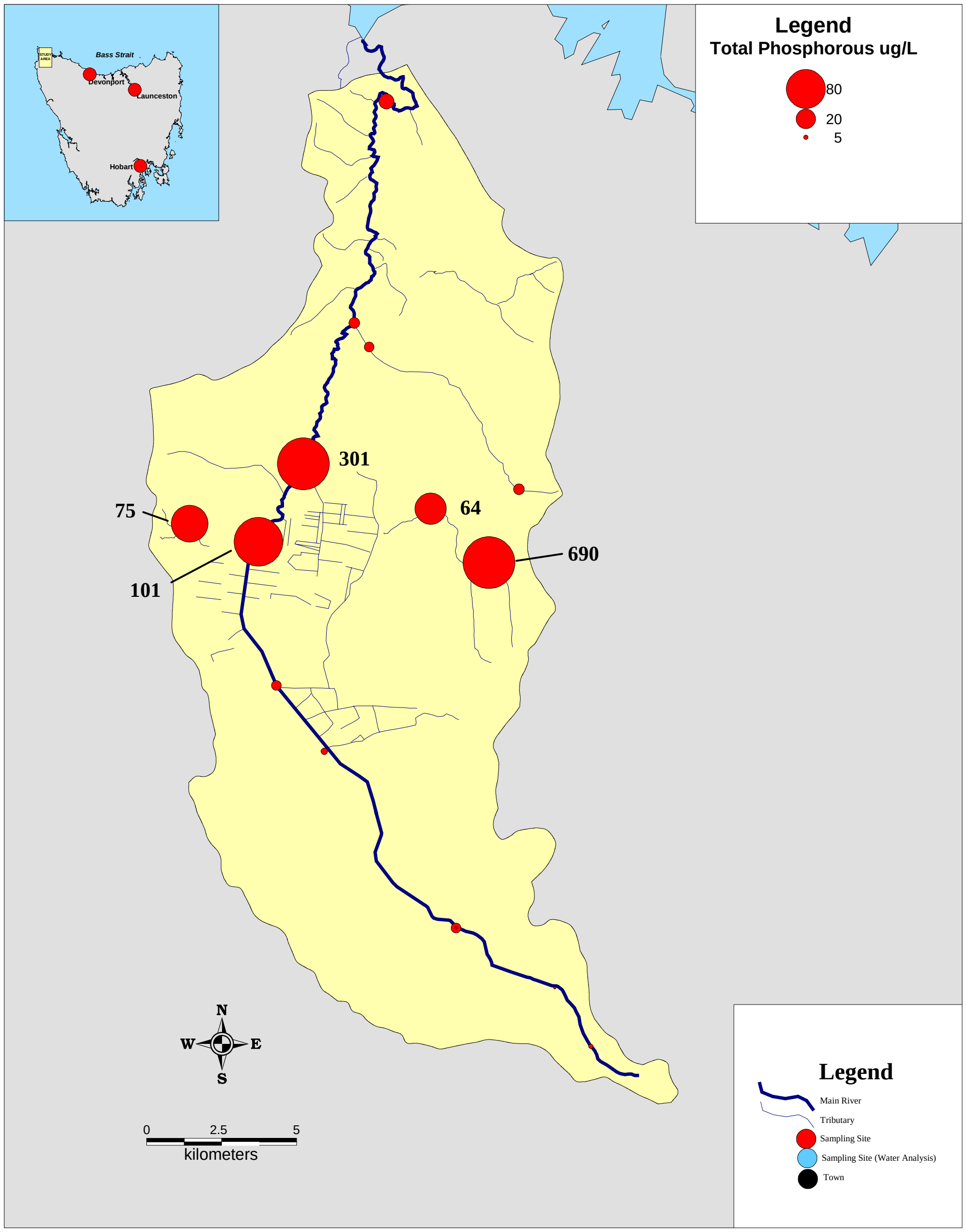

Figure 2.30: Snapshot of Total P concentrations (μg/L) recorded in the Montagu catchment on 22 February 2000.

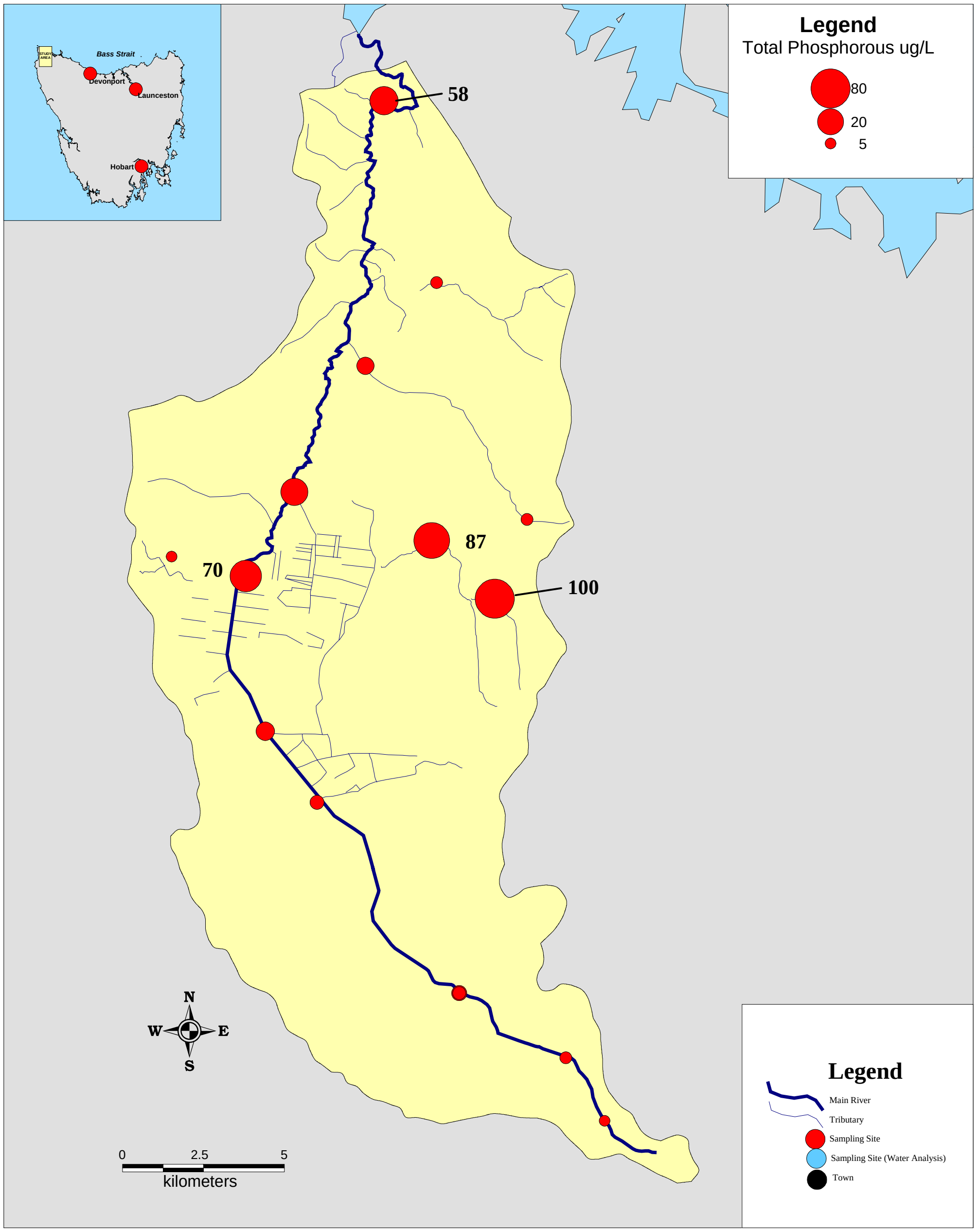

Figure 2.31: Snapshot of Total P concentrations (µg/L) recorded in the Montagu catchment on 30 August 2000.

2.4.4 Catchment Surveys - Metals

Samples taken during snapshot surveys were analysed for some of the main metals commonly found in environmental waters that may pose some risk to aquatic organisms or human health. Due to budget limitation, only total metal concentrations were determined. The detection limits for those metals analysed are listed below.

Metal	**Limit of Detection**
Aluminium	5µg/L
Arsenic	5µg/L
Cadmium	1µg/L
Copper	1µg/L
Lead	5µg/L
Zinc	1µg/L

Similar to many other parameters commonly tested for in surface waters, metals can be present in various forms. Trace amounts of some metals are naturally present in surface waters as a consequence of the weathering of rocks and soil. Metals can be present attached to suspended matter, colloids, or complex organic compounds (ie. humic and fulvic acids). The relative toxicity of metals is dependant upon the degree of oxidation of the metal ion together with the form at which it is associated (UNESCO, 1992). The toxicity of metals can also vary upon the environment in which they are found. Acidic conditions tend to increase the toxicity of the majority of metals. Whilst for others high concentrations of hardness reduce toxicity (ANZECC, 1992). Metals can also be present in dissolved forms which is generally the fraction toxic to aquatic life (Bobbi, 1999b.)

The new National trigger values for toxicants (ANZECC, 2000) were derived using a statistical distribution method calculated at 4 different protection levels. Where each level signifies the percentage of species expected to be protected. In the majority of cases the 95% protection level should be used for most ecosystems which can be classified as slightly to moderately disturbed and is suggested here as the default value (Table 2.2).

Table 2.2: Trigger values for observed metals at alternate levels of protection. Values in the grey shaded areas are the trigger values applying to typical slightly to moderately disturbed ecosystems (ANZECC, 2000).

Metals	**Trigger Values for freshwater ($\mu g/L^{-1}$)**			
	Level of Protection (% species)			
	99%	95%	90%	80%
Aluminium pH > 6.5	27	55	80	150
Aluminium pH < 6.5	ID	ID	ID	ID
Arsenic (As III)	1	24	94[a]	360[a]
Arsenic (As V)	0.8	13	42	140[a]
Cadmium H	0.06	0.2	0.4	0.8[a]
Copper H	1.0	1.4	1.8[a]	2.5[a]
Lead H	1.0	3.4	5.6	9.4[a]
Zinc H	2.4	8.0[a]	15[a]	31[a]

In Table 2.2, 'H' represents those metals for which values have been calculated using a hardness of 30mg/L as $CaCO_3$. These should be adjusted based on site-specific hardness. In the Montagu catchment hardness varies geographically due to the distribution of dolomite outcropping. Sites more elevated than Togari generally have a hardness of between 30-45 mg/L, and as such the trigger values suggested above broadly apply. At sites that are influenced by the dolomite (namely sites downstream from MR8) hardness can reach levels greater than 300 mg/L during the summer, but were typically 100-200 mg/L. For these sites the following trigger values are suggested for metals whose toxicity is affected by hardness:

Table 2.3: Trigger values for observed metals at sites in the Montagu catchment where hardness is typically between 100-200 mg/L as $CaCO_3$.

Metal Species	Trigger Level for sites with high hardness (Level of Protection – 95%)
Cadmium	0.7 μg/L
Copper	6.3 μg/L
Zinc	32 μg/L
Lead	25.5 μg/L

In the Montagu catchment surveys, many of the metals that were tested for were near or below detection limits. No significant concentrations of cadmium or arsenic were recorded at any of the sites during either the summer or winter survey. Lead was not detected at any site during the summer survey, but was found in appreciable concentration at MR7 during the winter survey, when lead (31 μg/L) was found to exceed the catchment trigger value suggested in Table 2.3 above.

Copper concentrations at most sites during the summer survey were only marginally above the detection limit, and below the catchment trigger level proposed Table 2.3. The only significant value was recorded during the summer survey was at MR9 (Fixters Creek at Brittons Swamp) where a concentration of 7 μg/L was recorded.

During the winter, concentrations of copper at all sites were slightly higher, with most copper concentrations recorded between 1-5 μg/L. Copper values slightly in excess of the 6.3 μg/L trigger level were found once again at MR9 (8 μg/L), and at MR8 (9 μg/L) and MR13 (8 μg/L). The cause for the generally higher winter values at all sites is unclear, though it is likely to be related to natural geological or soil characteristics rather than human induced.

Like copper, there was also a distinct difference between concentrations of zinc found during the summer and winter surveys, with higher values recorded at all sites during the winter. The data from these two surveys is given in Table 2.4, and shows that while Fixters Creek at Brittons Swamp (MR9) is once again highlighted, similar high values for zinc were also recorded within the State Forest of the upper catchment (MR13 & MR14). These three sites all exceed the catchment trigger level for zinc suggested above and may require further investigation regarding the threat this may pose to the environment. The results for aluminium could not be reported here as samples from the surveys appear to have been contaminated or poorly preserved.

Table 2.4: Zinc concentration (in µg/L) recorded at sites in the Montagu catchment during 'snapshot' surveys conducted in February and August of 2000.

Site Name	Code	February 2000	August 2000
Montagu at Stuarts Road	MR1	< 1	16
Un-named tributary at Barcoo Road	MR2	-	9
Montagu off Barcoo Rd at Thorpes Plains	MR3	5	-
Farnhams Creek at Barcoo Road	MR4	2	7
Canal, off Barcoo Rd at 14 Mile Plain	MR5	3	17
Montagu at Rennison Road at Togari	MR6	5	20
Galeford Ck. 700 m d/s of dam	MR7	3	11
Montagu at Bass Highway at Togari	MR8	4	20
Fixters Ck at Bass H'way at Brittons swamp	MR9	10	54
Fixters Creek at Riseborough Road	MR10	5	20
Farnhams Ck at Bass H'way at Brittons swamp	MR11	4	9
Montagu off Eldridges Rd at Montagu Swamp	MR12	6	19
Montagu at Christmas Hills Road u/s of bridge	MR13	7	53
Montagu at Christmas Hills Road d/s of bridge	MR14	3	41
Montagu at Donalds Road	MR15	-	6
Montagu at Roger River Rd	MR16	3	6

2.4.5 Catchment Surveys - Bacteria

Due to local interest in the bacterial condition of waterways in the catchment, some monitoring of bacteria was undertaken during the course of the project. Unfortunately, the nearest registered laboratory for analysing samples was too remote from the catchment to make rigorous and accurate testing feasible. It was therefore decided to undertake testing using new technology (NALGENE® 'Micro Monitors') that allowed meaningful results to be gained locally at relatively low expense. While this testing was not able to be quality assured in the way that registered laboratories might choose, some comparative tests were carried out against a registered laboratory in Launceston to determine whether results from this procedure were likely to reflect 'true' environmental conditions. These preliminary tests showed that results gained from this newer, technically simpler methodology are capable of yielding data that are within acceptable limits for accuracy and could be used to show 'relative bacterial condition' with some degree of confidence.

To facilitate the production of reliable results for the Montagu catchment, a small laboratory was set up in Smithton, and contained sterilisation equipment, an incubation oven and a clean environment in which to operate. This setup was used to prepare and incubate samples collected in the field. Duplicates were frequently taken as an internal quality assurance measure. The limitations of this technique meant that there was an upper maximum for readings of 12,000 cfu/100ml.

This technique was used during the summer and winter surveys in the Montagu catchment. The summer results are plotted in Figures 2.34, with sites low in the catchment on the left-hand side and those in the headwaters on the right. The results do not reveal a clear, downstream pattern for increasing contamination, although there is significant faecal contamination at MR6. The data shows that from MR14 to the catchment outlet at MR1 most sites show moderate faecal contamination (counts between 60-300 per 100mL).

Problems with the culturing medium mean that no data was collected during the winter survey.

Monthly monitoring for faecal coliforms was also conducted during 2000-2001, with 18 samples collected at three sites, one being used as a pseudo-control site (MR16 -Montagu at Roger River Rd). The data from this monitoring is summarised in the boxplot of Figure 2.35, and clearly shows that the Montagu River at MR6 (Rennison Rd) is consistently contaminated, supporting the findings of the summer snapshot survey. Median concentration for both the lower catchment sites exceeds the National guidelines for recreational contact (150 cfu/100mL). As a comparison, only a single sample from MR16 at the top of the catchment exceeded this level.

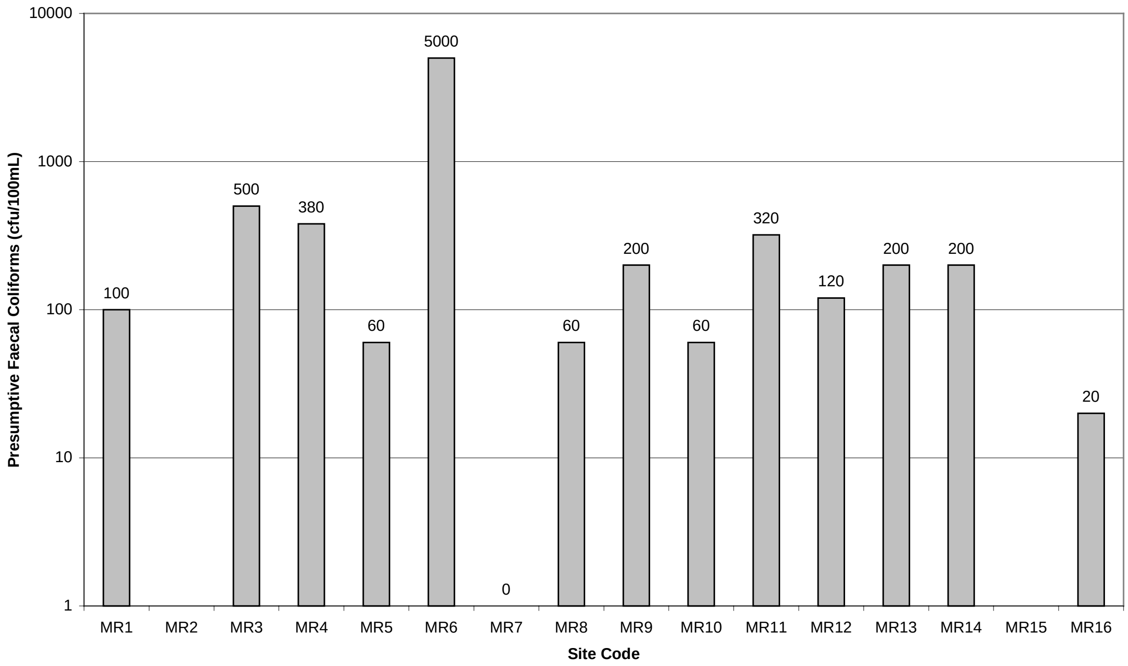

Figure 2.34: Snapshot survey for thermotolerant (faecal) coliforms in ambient waters of the Montagu catchment in February 2000.

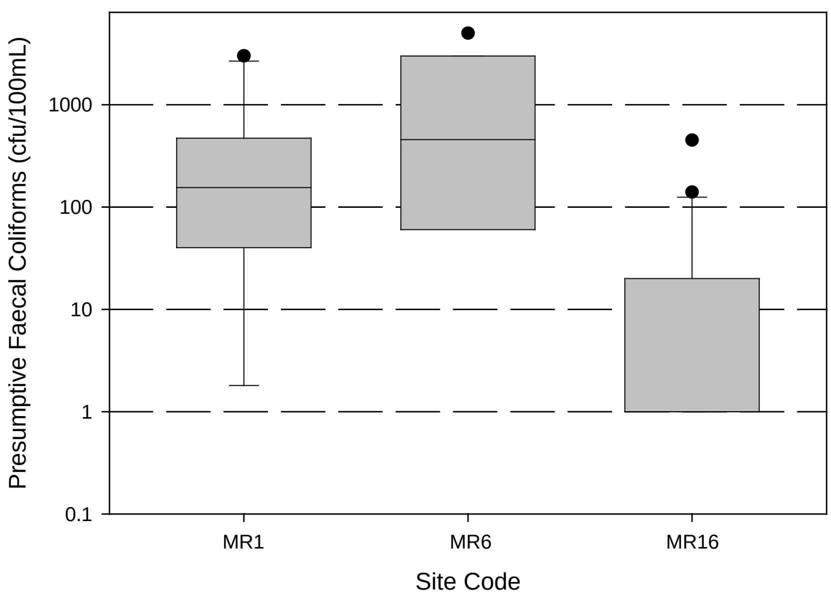

Figure 2.35: Thermotolerant (faecal) coliforms in ambient waters of the Montagu catchment sampled monthly between January 2000 and June 2001 (n = 18)