Mary River Turtle Protection: Tiaro District of Southeast Queensland, 2005 - 2006 nesting season

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Cover Photograph: PhD student Natalie Mathie collecting eggs for research, December 2005. Photo provided by Marilyn Connell.

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The Tiaro and District Landcare Group in conjunction with the Mary River Catchment Committee led the study, conducted field work and produced this report, under the guidance of the Environmental Protection Agency/Queensland Parks and Wildlife Service, QLD Turtle Conservation Project. The EPA provided technical advice and volunteers assisted with field work.

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Burnett Mary Regional Group
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Introduction

Tiaro & District Landcare Group continues to be concerned about the survival of *Elusor macrurus* (Mary River turtle) (Figure 1). It is listed as endangered under federal legislation, Environment Protection and Biodiversity Conservation Act 1999 (Department of Environment and Heritage 2007) and under the Queensland Nature Conservation (Wildlife) Regulation 1994 Schedule 2 (Queensland Government 2005). Previous studies indicate that the breeding success of the species may be dramatically reduced due to nest predation and a decrease in numbers of breeding turtles. The work described here builds upon previous research (Flakus 2002), and knowledge and skills gained during conservation work undertaken each nesting season since October 2001 (Parkes *et al* 2002). As in previous years, nest protection was concentrated on most productive known nesting banks in the Tiaro reaches of the Mary River.

This report briefly describes work undertaken, results and some recommendations for future work.

Methods

Climate

The season started with approximately 99mm of rain falling on or about 14 October 2005. In the same period, the Bureau of Meteorology weather station at nearby Home Park registered 46mm. During the nesting season three significant rainfall events occurred: 14-18 October, 5-7 November, 2-5 December. The consequent rise in river height resulted in the need to relocate low nests further up the bank, and on one occasion, the need to relocate eggs to the laboratory for incubation (see below). The rises in river heights made walking across the river unsafe on three occasions when the electric powered 'turtle tubby' polycraft was used.

Nest protection

Each year nest protection is concentrated on two of the most productive nesting banks identified as nesting site 1 and nesting site 2 throughout this report.

As per last season's recommendation, electric fencing was installed in the immediate surrounds of the main nesting area to reduce the impact of cattle trampling on the nest protection and elsewhere on the nesting banks. A portable battery powered energiser was used on one site. This proved to be more effective than the previously used solar powered energiser. It is smaller, less expensive and has no light restrictions when selecting a suitable location for placement. The D batteries lasted approximately three weeks.

Possible nest cavities were carefully excavated by hand to locate the top of the egg clutch. Once the presence of eggs was confirmed, sand was replaced and a flat release plastic screen was placed over the nest. Flagging tape marked with nest number and date was buried in each nest. A cable tie was attached to the screen to mark the location of the nest. The nest number was recorded on the top right hand peg when facing away from the river.

Nests at high risk of being inundated by rising flood waters after rainfall events were relocated higher up the bank. Prior to December, a total of three nests were relocated at nesting site 1: one on the 15th October, one on the 8th November and one on the 17th November. At nesting site 2 a total of 4 nests were relocated: two on the 15th Oct, one on the 24th October and one on the 15th November. On the 2nd December, eggs were collected from all 11 nests at nesting site 1, as they were about to be inundated by rapidly rising floodwaters. To complete their incubation, these eggs were transported to the Queensland Parks and Wildlife Service laboratory at Mon Repos.

During the nesting season, Tiaro Landcare cooperated with University of Queensland PhD student Natalie Mathie who collected 30 eggs, which were artificially incubated and used as part of her freshwater turtle hatchling research.

Each year a range of predator control methods are used. This season, Tiaro Landcare funded the construction of a metal mesh trap which was designed to trap foxes and dogs. The local Department of Natural Resources and Water Land Protection Officer visited the site and gave advice. Unfortunately the trap was ineffective in trapping dogs or foxes.

Site monitoring

Soil testing

A minimum/maximum soil thermometer was used to record variation in sand temperature at 10cm below the surface. Opportunistic soil temperatures were recorded and ranged from 21.9°C at 8:30am on 23rd October to 36.7°C at 4pm on 28 November 2005.

Water sample site A

Water sample site A is located on the Mary River near nesting site 1, upstream of Tiaro. Site conditions at nesting site 1 and nesting site 2 are similar and it is assumed that water quality between the two sites would be similar, therefore no water quality measurements were recorded at nesting site 2.

At this site, automatic sampling of dissolved oxygen (DO) and temperatures of the water was conducted from 10th-12th November 2005 and on the 20th February 2006, at two-hourly intervals. The automatic sampler – an FLT-90 – was deployed in the water at a depth of one metre below the surface. The depth of the water column at the site was one and a half metres. The unit was then fastened to the overhanging *Callistemon viminalis* (weeping bottlebrush). Sampling occurred in a shaded environment along the edge of the Mary River, approximately two metres from the edge of the bank. This environment is habitat for the Mary River Turtle.

Water testing sample site B

Water sample site B is located on the Mary River near Antigua, within the ponded section of the Mary River. While this site is some distance from the main nesting banks, Mary River Turtles have been observed nesting in this section of the river. The intention of sampling at this site was to determine the DO levels of the ponded section of the Mary River and compare those to the non-ponded section at water sample site A.

At this site automatic sampling of DO, temperature, electrical conductivity (salinity) and pH (acidity) was conducted from the 3rd -9th March 2006, at two-hourly intervals. River flow information at the Mary River Barrage was also obtained from Sunwater for the period sampled.

The automatic sampler – an FLT-90 – was deployed in the water at a depth of one metre below the surface, with aerator. The depth of the water column at the site was approximately one and a half metres. The unit was then secured to the riverbank. Sampling occurred in a shaded environment along the edge of the Mary River, approximately two metres from the edge of the bank.

Results

Nesting

The first signs of nesting activity were noted on 14 October 2005.

The two main nesting banks were visited at daybreak on 19 occasions between 14 October and 29 November 2005 to check for signs of nesting. On 22 October there was evidence of 12 'test holes' and no nests laid. A total of 37 nests were found over the two sites during site visits (Table 1).

The floodwaters had a significant impact on nests in nesting site 1. Hatching data is only known for the eleven nests whose eggs were incubated at Mon Repos. No results are known for the other six nests with the exception of eggs taken for research at University of Queensland (Table 2).

At nesting site 2, the impact of the floodwaters on the nests is unknown. Eggs could not be found in four nests. Twenty-six undeveloped eggs from four nests were root bound from nearby grasses (Figure 2). A total of 151 empty shells were found in 14 nests (Table 2).

On a number of occasions there was no nesting even though the Project Officers observed adequate moisture levels in the nesting bank (Table 1). Research undertaken by Flakus 2002, indicated that the adults move into gullies when there is 'a fresh' (a rain event that causes significant water level rise). It is assumed that this occurred frequently during this nesting season.

Nest disturbances

At all sites numerous lace monitor and dog/fox tracks were observed. When checking for results of nesting, it was noticed that approximately 10cm of sand had been dug out just below the cable tie on one nest. Despite this the screen and eggs were intact.

Nest protection

A total of 37 nests were protected at two locations (Table 2).

Thirteen empty shells were found lying on the surface; it is not known which nest/s they belonged to. This is an unusual occurrence at the end of the season. It is possible that the sand which covered the nest was shifted during the flood. This figure has not been included in the statistics as it is uncertain if they successfully hatched.

In one nest two live deformed hatchlings were found. They have been recorded as dead in nest (Table 2). This is the first time deformed hatchlings have been observed by the Project Officers.

Of the 30 eggs taken by University of Queensland for incubation, 25 hatched and five were undeveloped.

Of the 140 eggs sent to QPWS Mon Repos laboratory, 123 successfully hatched.

A total of seven clutches (60 plus eggs) were predated, presumably by dogs, prior to the nest being protected.

Analysis of hatching success is limited due to the significant impact of the flood.

In the 37 nests, a total of 411 eggs or egg remains were located (Table 3). In these nests it is assumed 151 hatchlings survived to leave the nest as determined by empty shells inside the nest and 148 hatchlings were successfully incubated and released (73% success) (Table 3 and Figure 3). However, this percentage is a percentage of eggs found and does not include the 10 nests for which there is no data (Table 3). If it is assumed that each of those nests contained 15 eggs, then the hatching success for the season would be 53%. It is not known how many hatchlings successfully reached the protection of the water.

Water sample site A

Dissolved Oxygen and temperature

The Dissolved Oxygen (DO) level of the Mary River at this site between 10 and 12 November 2005 did not meet the EPA Water Quality Guidelines for the Mary River[1]. These guidelines state a range of 85% - 110% is acceptable (Environmental Protection Agency 2006). The DO level fluctuated between 45.4% at 7am and 69.8% at 5pm (Figure 4). This is expected as the lowest dissolved oxygen is usually early in the morning, as photosynthesis ceases at night. The highest dissolved oxygen level is expected during the afternoon as sunlight is at its highest intensity, hence stimulating greatest quantity of photosynthesis.

The temperature during this period varied little, with the lowest temperature of 28.9^{o}C recorded at 7am, and the highest temperature of 30^{o}C recorded at 5pm (Figure 5). These temperatures are quite high for water temperatures but are consistent with other measurements taken on the Mary River during summer.

DO samples taken in February 2006 at this site did not meet the EPA water quality guidelines[1]. The dissolved oxygen logging during a 24 hour period in summer shows levels well below guideline values of 85% DO saturation (Figure 5). The figures show a similar trend to the data collected in November 2005 at the same site (Figure 4 and Figure 5), where the peak of dissolved oxygen is reached during the middle of the afternoon. The peak was still below the recommended guideline value of 85% for the Mary River. This represents a direct relationship with increased temperature of the water column.

Temperatures recorded in the February 2006 sample were higher than those recorded in November 2005 at the same site. Temperatures upwards of 32^{o}C were recorded in the shaded area where the logger was deployed. This is consistent with other samples taken on the Mary River during that period. Late January 2006 was exceptionally hot, which is reflected in the water temperatures. Hot water temperatures in early February 2006 are suspected of a major fish-kill in the Mary River near Kenilworth.

The February 2006 sample was limited to only 24 hours due to water rats (*Hydromys chrysogaster*) dislodging the sensor from the unit's handset. The equipment was deployed for five days, but only recorded the first day of results.

Turbidity sampling

During October 2005 an upstream rain event resulted in a rise in the Mary River. Opportunistic sampling of this small flow event was performed at Site A on 15 October 2005. The samplers observed a definite 'front' of sediment-rich waters and measured this front at various depths and time.

After sampling from a boat the observers noted that the sediment plume was flowing at the bottom of the river much stronger than the top of the river. When sampling the

[1]The EPA guidelines for Dissolved Oxygen are based on monthly data from 3 sites, collected over 8 years from 1993. The data was reasonably consistent over time, and within and between sites. It is important to note that EPA data were collected during the day and because DO varies over a day night cycle, the guidelines should only be compared with day time values recorded in this study.

bottom of the front a turbidity reading of 57 NTU was recorded while the surface turbidity reading was nine. However, 10 minutes later, at the same point in the river, a record of 77 NTU was observed at the surface and bottom of the river.

Water sample site B

Dissolved Oxygen and temperature

The DO level recorded from 3–9 March 2006 at this site did not comply with the EPA water quality guidelines for DO[1]. During the first day of sampling the lowest dissolved oxygen level was recorded of 31.4% saturation at 5am on 4 March 2006. The DO level steadily increased and remained consistent around 60-70% saturation (Figure 6). Most logically this was due to a small flow event experienced in the Mary River during the sampling. The flow event has had the effect of 'smoothing' out the results – particularly from day 2 to day 4 – when the flow peak occurred. This small flow event could have increased the dissolved oxygen level to above that normally experienced under baseflow conditions.

These figures are still below 85% saturation recommended by EPA for the Mary River.

Temperature remained reasonably static from day 1 until day 6 at around 26^{o}C. This can be attributed to the flow event experienced during the sampling. Temperature levels then spiked on day 6 at 30 degrees at 5pm in the afternoon of 8 March 2006 once baseflow conditions were returned. The weather conditions on the day the equipment was deployed were overcast with some rain recorded upstream on the Mary River.

Electrical conductivity and river flow

During the sampling of water sample site B a small flow event was experienced at the site. Rain from upstream in the catchment had caused the river to rise. River flow information was obtained which illustrates on day 1 flow was at normal levels – approximately 20 cumecs. On day 3 the flow peaked at approximately 85 cumecs, and then tapered back to approximately 20 cumecs (Figure 7). During this flow event the salinity level (electrical conductivity) also had a corresponding increase proportional to the quantity of flow.

Days prior to the sampling at this site, rain was received in the Munna, Wide Bay and Gutchy Creek sub-catchments – all upstream of the sampling site. These sub-catchments all experience higher surface water salinity levels than the Mary River, and probably explain why salinity levels increased proportionally to river flow levels. Generally rainfall causes dilution of the salt levels in the river water during flow events.

Discussion and recommendations

Some of the nest numbers marked on the plastic pegs were not legibile by the end of the season. It is recommended that the nest number be marked on the side of the peg.

The electric fence and nest caging are proving to be successful methods in controlling predators. If the nests weren't protected by individual mesh, using 1080™ bait as advised by a Land Protection Officer seems to be the only method of controlling feral dogs and foxes. These baits would need to be set throughout the nesting season.

Fresh predator tracks were common at every nesting bank. Wild dogs, dingoes, foxes and goannas would predate all eggs laid if nests were not protected. Methods developed using flat release plastic screens to protect eggs from predators continue to be very effective in assisting with hatching success. However, it does rely on intensive monitoring of nesting banks and protection of each nest laid.

It is still not known if numbers of adult nesting turtles are decreasing or increasing and if the naturally incubated hatchlings are successfully reaching the river.

When transporting hatchlings from Mon Repos to Tiaro, a shallow layer of moist sand should be placed in the bottom of the container, in order to reduce any possible impacts from transportation on the hatchlings.

A nest number should be allocated to all nests, including predated clutches. This will give a more accurate understanding of total clutches laid for the nesting season.

The success of nest protection has been demonstrated, and should continue. However, it is not a long term solution to ensuring turtle nesting success. The method is limited by lack of resources and difficulties in the timely access to all nests.

Although Mary River turtle habitat, nesting banks and turtle populations still exist, low numbers of turtle nests found indicate that the population could be in decline. A formal recovery plan is urgently needed for the Mary River Turtle.

The low DO levels recorded during this study may be explained by the low flows the Mary River has experienced in recent years. Over time, low flows can cause water to stagnate and build up organic matter, resulting in reduced DO levels. This explanation is supported by the fact that when a small fresh was experienced at water sample site 2, DO levels increased to 60-70% saturation. Also, there was no obvious evidence of pollution at either site sampled, which further suggests that natural factors such as low flow can explain low DO levels. There is a need to monitor DO and temperature over a longer period to gain an accurate understanding of the impacts of seasonal fluctuations on DO levels in the lower section of the Mary River, and to determine if DO values will improve to those levels recorded by EPA when flows return to normal. Further research is required to determine the range of dissolved oxygen levels necessary to maintain Mary River turtle habitat.

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Table 1. Dates and locations of nests found and rainfall. * rainfall data as recorded by Bureau of Meteorology.

Date	Rainfall *	# Nests found	
		Nesting site A	Nesting site B
14 Oct 05	46mm Home Park	1	0
15 Oct 05	5mm	8	6
17 Oct 05	28mm	1	1
19 Oct 05	87mm	1	0
23 Oct 05	11mm	2	1
24 Oct 05	0mm	0	5
7 Nov 05	43mm	0	0
15 Nov 05	0mm	3	5
17 Nov 05	0mm	2	1
28 Nov 05	38mm	0	0
Total		**18**	**19**

Table 2. Nest details and the fate of eggs. # = eggs root bound,* = eggs incubated at University of Qld,✦ = eggs incubated at QPWS Mon Repos laboratory.

Nest number	Date eggs laid	Dead in nest	Unhatched eggs	Un-developed eggs	Empty shells	Eggs incubated	Total eggs
1	14 Oct					15✦	15
2	15 Oct					11✦	11
3	15 Oct	Eggs missing				2*	2
4	15 Oct	Eggs missing				2*	2
5	15 Oct		15	1		2*	18
6	15 Oct					2* + 8✦	10
7	15 Oct					15✦	15
8	15 Oct					16✦	16
9	15 Oct					4* + 6✦	10
10	15 Oct	Eggs missing					
11	15 Oct		10	2	3		15
12	15 Oct			2	19		21
13	15 Oct		1		15		16
14	15 Oct			2 #	9	3*	14
15	15 Oct			6#	5	3*	14
16	17 Oct	Nest flooded					
17	17 Oct	2		3#	6		11
18	19 Oct					2* + 15✦	17
19	23 Oct					2* + 12✦	14
20	23 Oct					2* + 15✦	17
21	23 Oct			5	10		15
22	24 Oct		8	3			11
23	24 Oct			1	14		15
24	24 Oct			15#			15
25	24 Oct		3		14		17
26	24 Oct		3		8		11
27	15 Nov	Nest flooded				2*	2
28	15 Nov	Nest flooded				2*	2
29	15 Nov					13✦	13
30	15 Nov	Nest flooded					
31	15 Nov			6	2		8
32	15 Nov				20		20
33	15 Nov		2		8	2* + 14✦	26
34	15 Nov				18		18
35	17 Nov	Eggs missing					
36	17 Nov	Nest flooded					
37	17 Nov	Nest flooded					
TOTALS		**2**	**42**	**46**	**151**	**170**	**411**

Table 3. Summation of hatching success. ^ = incubated eggs not hatched.

	Dead in nest	Unhatched eggs	Un-developed	Empty shells	Incubated hatchling	Total eggs	No. of nests
TOTAL	2	42	46 + 22^	151	148	411	27
% of Total	0.5%	10%	16.5%	37%	36%	100%	

Figure 1. Mary River Turtle hatchling, *Elusor macrurus*.

Figure 2. Root bound egg.

Figure 3. Releasing artificially incubated hatchlings.

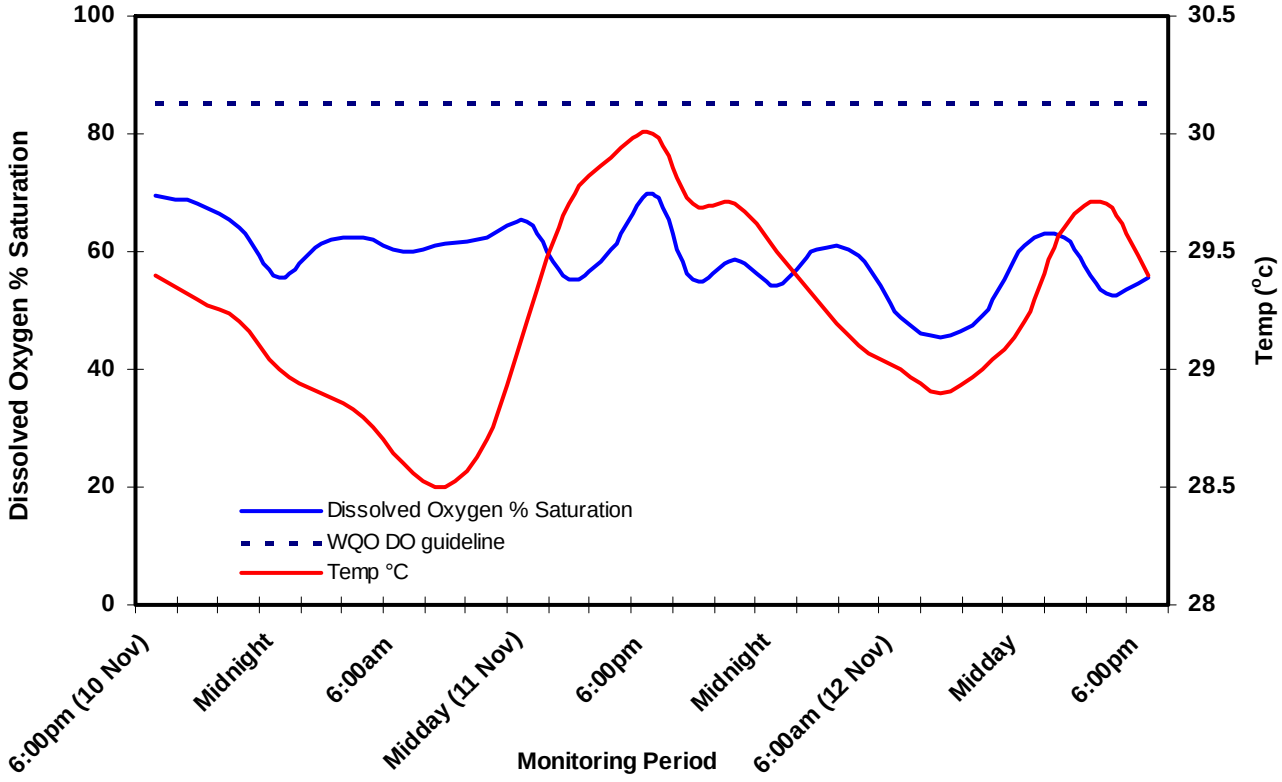

Figure 4. Dissolved Oxygen data from the Mary River at water sample site A, 10 -12 November 2005

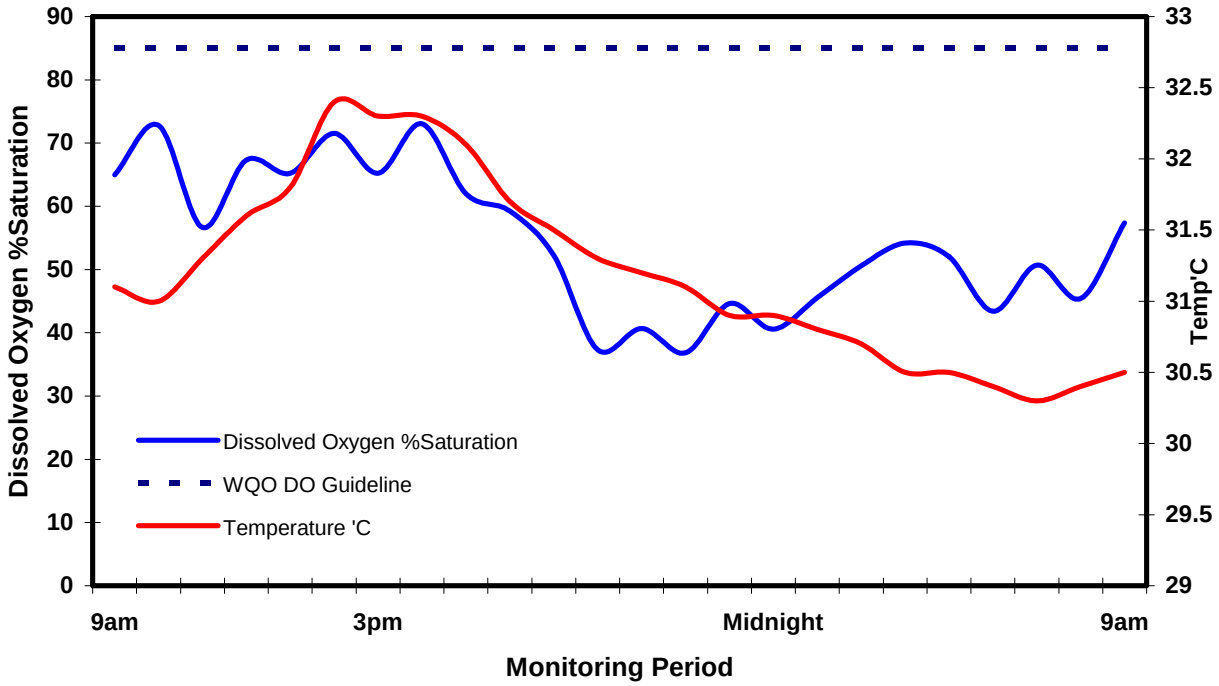

Figure 5. Dissolved Oxygen data from the Mary River water sample site A, 20 February 2006.

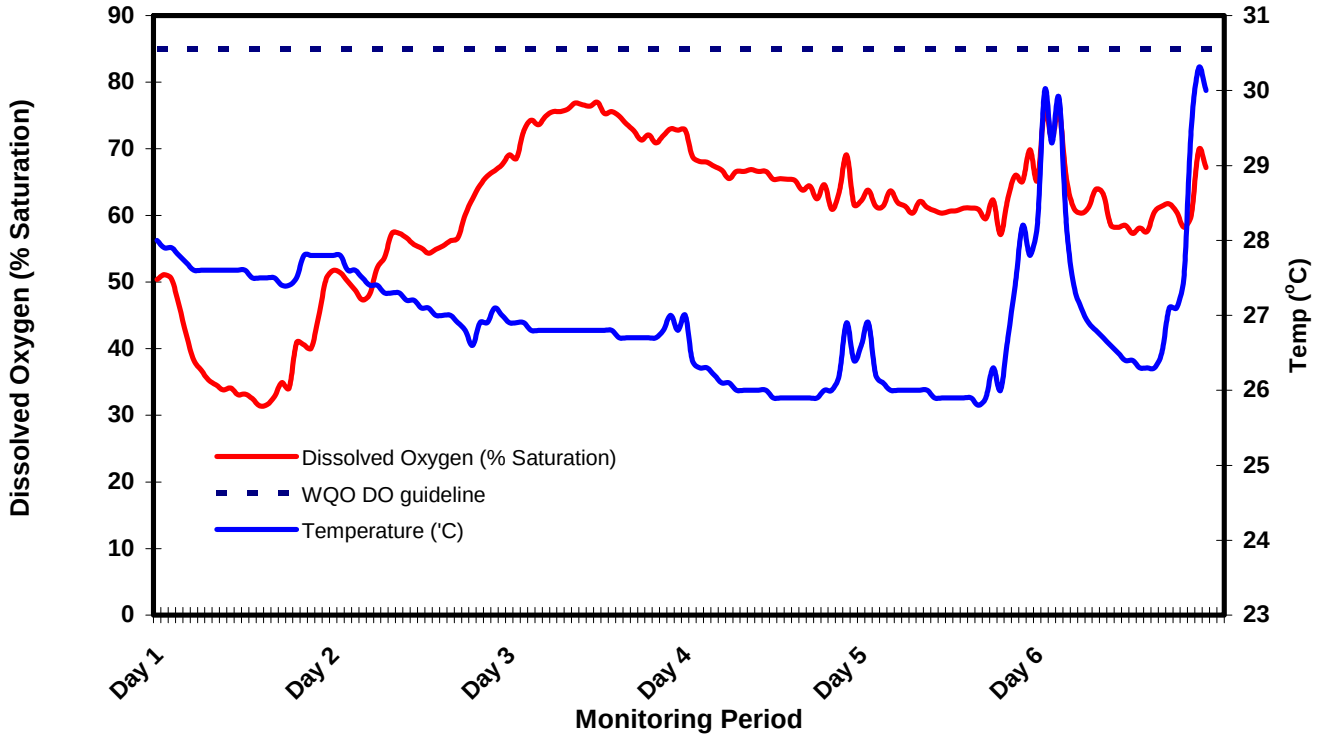

Figure 6. Dissolved Oxygen data from water sample site B on the Mary River 3-9 March 2006

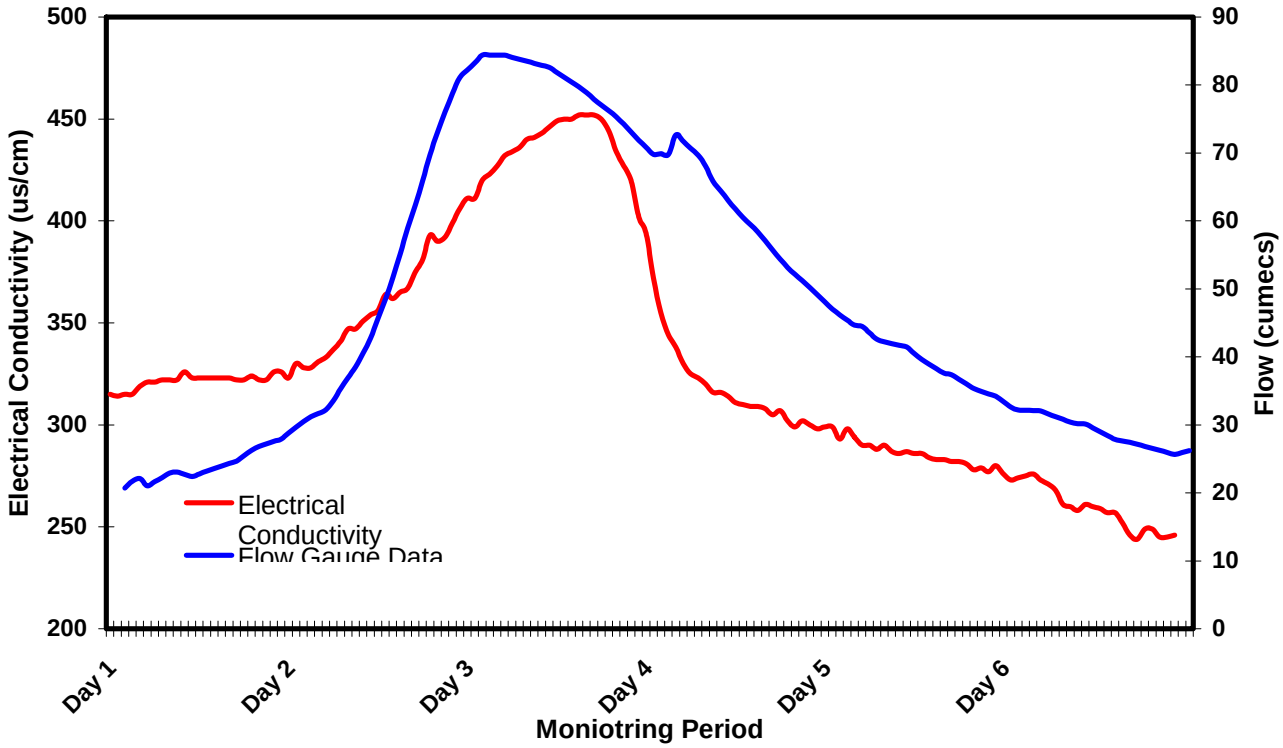

Figure 7. Electrical conductivity and flow data recorded from water sample site B on the Mary River 3-9 March 2006.