REGENT PARROT NEST SURVEY 2010

Results of the 2010 survey of Regent Parrot nests in the SA Murray Darling Basin

Prepared for the S.A. Regent Parrot Recovery Team

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Summary:

During the 2010 Regent Parrot breeding season a survey of nest sites was conducted along the river corridor in South Australia from the SA/NSW border downstream to Blanchetown. Ten colonies that had been selected and surveyed biannually since 2004 were surveyed and much of the river corridor between these colonies was searched for additional nest sites. 79.2% of the river corridor and adjacent creeks and backwaters were searched in this time.

The survey of ten previously monitored nest sites revealed an overall decline in nesting Regent Parrot pairs in these colonies of 40% over the period between 2004 and 2010. This survey approach was based on the previous observations of good nest site fidelity by Regent Parrots and had indicated reasonably stable numbers for the period 2004 to 2008. The large decline occurred over the past two years.

The greatest decline in nesting pairs was evident in colonies upstream of Lock 3 where drowned River Red Gums have been the traditional nesting sites for Regent Parrots over the last twenty years at least. The condition of these trees is in rapid decline as a result of decay.

From 2004 to 2008 the number of Regent Parrot nesting pairs downstream of Lock 3 in the selected colonies had increased but then declined by 26.5% over the past two years.

The survey of the river corridor between these selected colonies revealed that new colonies had established since the last total survey of the river in 2003/4. Regent Parrots appear to have abandoned their previous habit of nesting in set locations every year and moved to new sites. Thus the decline in the number of Regent Parrot breeding pairs in this state is not as great as was predicted from the monitoring of the 10 selected colonies.

Although only 300 nests were located and recorded, the whole river corridor was not searched and the areas missed are known to contain mature trees with hollows that could possibly be suitable for Regent Parrots to nest in. Some observers also saw several Regent Parrots in their area, but were unable to locate the colonies. Thus the 25% decline in nesting pairs predicted as a result of this survey from the 2003/4 survey is not justified.

The decline in Regent Parrot numbers is hypothesised to be a result of the prolonged drought and a lack of flooding of the floodplain leading to a decline in the health of the River Red Gum nest trees and the understorey vegetation.

Table of Contents

Introduction

Several Regent Parrot surveys have been conducted during the past decade (Beardsell 1983; Burbidge 1985; Harper 1889; Smith 1991; Smith 2000) in an effort to ascertain the status of the eastern sub-species of the Regent Parrot (*Polytelis anthopeplus monarchoides*) in South Australia. None of these surveys were sufficiently detailed enough to provide information about the number of Regent Parrots that occur in this state. These surveys were conducted during the breeding season, as it is at this time of the year when the birds are concentrated along the river corridor as they breed almost exclusively in River Red Gums (*Eucalyptus camaldulensis*). During the non-breeding season Regent Parrots disperse widely and move in flocks around horticulture and mallee areas. There have been reports of flocks in excess of 200 individuals in mallee areas north of the River Murray, however, these sightings are widely dispersed and any indication of total numbers is impossible to gauge. The number of nests present is a clear indication of the number of nesting pairs and hence the breeding population of this parrot in SA.

Harper(1989) and Smith(1991 and 2000) attempted to record all of the Regent Parrot nests in River Red Gums along the river corridor in SA. This proved to be a difficult task, with the best effort covering just one half of the river corridor in this state.

Over the two breeding seasons, 2003 and 2004, Smith managed to locate a large proportion of nests and by observing feeding flock sizes was able to provide an estimate of the total number of breeding pairs of Regent Parrots in SA. This survey estimated the population to number approximately 800 breeding individuals. Over 370 person hours of survey effort, each breeding season, was required to achieve this result. A total of 51 colonies were located, and these were distributed along the river from the SA/NSW border downstream to Swan Reach. Some of these colonies were very small, but several numbered in excess of 20 nesting pairs.

Smith (2004) recommended that a selection of these colonies should be surveyed every second year in an attempt to monitor Regent Parrot numbers. Ten of the largest breeding colonies that were distributed along the river corridor were selected for this biannual monitoring. These ten colonies were surveyed in 2006 and 2008. The current project was initially planned to repeat these surveys. A big effort by Local Action Planning Groups resulted in a number of volunteers agreeing to assist with the surveys and so an attempt was made to conduct a full survey of the whole river corridor in SA. Almost 30 individuals assisted with the survey and registered a total of over 1100 person hours. For some of this time volunteers worked in pairs and so the total effort was greater than this.

Aims:

- To record the number of breeding pairs of Regent Parrots in the ten selected colonies.
- To assess the habitat and tree character requirements of this parrot
- To assess likely competition from other species for nest hollows

- To complete a census of Regent Parrot nests along the river corridor from the NSW/SA border downstream to Swan Reach

Objectives:

- To visit each of the ten selected breeding colonies to record the numbers of breeding pairs and the location of their nests
- To assess trends in the numbers of Regent Parrots in these selected colonies from results of the past four biannual surveys
- To record details of the nest trees and the nest hollows
- To observe and record interactions with other hollow nesting species to assess the potential level of competition for nest hollows
- To survey the remainder of the river corridor to determine the number of breeding pairs of Regent Parrots in SA.

Methods:

A training day was organised for volunteers in early August to prepare them for the survey which commenced in mid August. Those volunteers who were unable to attend were trained individually in the field prior to the commencement of their survey effort. The volunteers were allocated one of the selected colonies or a section of the floodplain outside of these colonies to search for nest sites. The surveys continued for the next 10 weeks ceasing at the end of October when the presence of young birds in and around the colonies made it difficult to locate nest hollows.

At the selected nesting colonies along the river, observers watched for the male feeding flocks to return to the colony and followed individuals to nest hollows. A nest was confirmed when a female was observed entering a hollow and remaining in it or a male was seen to visit a hollow for a period to feed the female, or later in the season both birds were observed entering a hollow. In this latter part of the season, the visit of parent birds to hollows was often associated with the accompanying sound of begging nestlings.

Details of the nest tree and nest hollow were recorded and a photograph taken. Nest trees were classed from 0 to 7 for both cover and density of foliage with a 7 for both categories indicating a tree with 100% cover and a dense leaf canopy. An indication of the recovery of each nest tree after the prolonged drought was recorded on a scale from 0-4 for the presence of epicormic growth, tip growth, bud/flower, deep wood crack, leaf die and the presence of mistletoe. The characteristics of the nest hollows were recorded for hollow size, the position on the limb and the direction of the opening.
This process continued until no new nests were being found.

The search of the remainder of the river corridor involved the use of boats and/or canoes and a lot of walking. Boats and canoes moved slowly down the river or around backwaters and creeks wherever

there appeared to be River Red Gums of sufficient age to contain hollows suitable for nesting. The presence of Regent Parrots in an area was followed by a lot of searching on foot to determine if the parrots were breeding at that location. Having determined that Regent Parrots were nesting at that site, the process of locating nest hollows and recording all of the details of the colony, nest trees and nest hollows began.

Results:

PART A – the 10 selected colonies

(see map 2 in Appendix)

1. Number of Nests

In these surveys nest trees that are within 500 m of each other are deemed to be in the same colony. If nest trees are further than 500m apart, with no nests in between, they are deemed to be in a separate colony.

A total of 95 nest trees contained 105 nesting pairs of Regent Parrots across the ten selected colonies (a 40% decline in numbers since 2003/4.) This result is also far below the numbers recorded only two years ago and reflects a constant downward trend since detailed surveys of colonies commenced in 2003/4. Two of these selected colonies had been totally abandoned with no nesting Regent Parrots being recorded in them. Table 1 provides the numbers of nest trees and nests for the past four surveys. The colonies are listed in order from the upstream end of the river.

Table 1: Total Nests and Nest Trees 2004 - 2010

Colony	Colony Name	2003/2004			2006			2008			2010	
		trees	nests		trees	nests		trees	nests		trees	nests
A03	Nil Nil	16	20		7	9		4	4		0	0
A04	Lock 6	9	12		6	6		6	6		8	8
B01	Gal Gal	7	8		5	5		3	3		4	4
G03	Wachtels Lagoon	12	12		14	14		10	11		1	1
G04	Kingston Backwater	13	14		12	12		9	10		3	3
H01	Banrock Bend	36	37		36	38		22	25		21	22
J01	Island Reach	12	12		9	9		5	6		7	7
K02	Hogwash	22	29		33	39		42	53		38	47
L01	Morgan CP	14	15		15	17		14	19		13	13
M01	Murbko Flat	15	16		15	15		17	18		0	0
	Totals	**156**	**175**		**152**	**165**		**132**	**155**		**95**	**105**

Detailed surveys of colonies upstream of Lock 3 were conducted by Smith in 1991 and again in 2000. The first five colonies in the above table were surveyed at these times and showed that the numbers of Regent Parrots in these five colonies had changed little in the intervening 9 years. Table 2 shows the numbers of nest trees and nests recorded in these five upstream colonies in 1991, 2000 and 2003/4.

Colony	Colony name/year	1991			2000			2003/4	
		trees	nests		trees	nests		trees	nests
Totals		**69**	**81**		**75**	**88**		**57**	**66**
A03	Nil Nil	20	27		20	26		16	20
A04	Lock 6	14	15		23	28		9	12
B01	Gal Gal	13	15		8	8		7	8
G03	Wachtels Lagoon	13	13		13	13		12	12
G04	Kingston Backwater	9	11		11	13		13	14

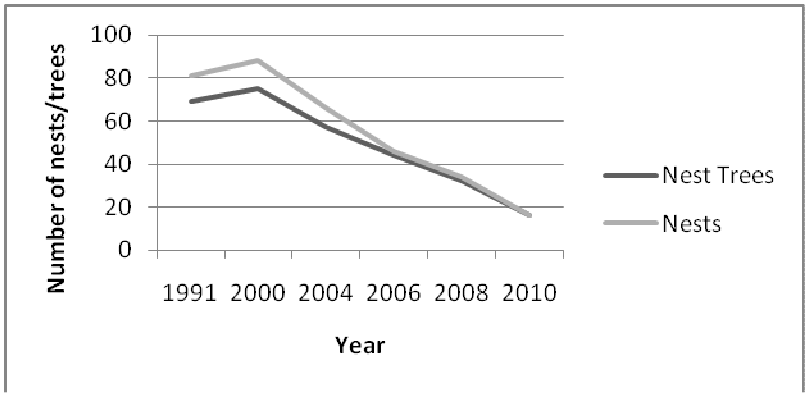
Table 2: Total Nests and Nest Trees 1991 -2004

The number of nests and nest trees in these five colonies that have been surveyed since 1991 shows a large decline began between the 2000 survey and the 2003/4 survey. Table 3 provides a comparison of the total numbers of nest trees and nests in these five selected colonies upstream of Lock 3 from 1991 to the present. Figure 1 illustrates this decline.

Table 3: Nests in Five Colonies upstream of Lock 3

Year	Nest Trees	Nests
1991	69	81
2000	75	88
2004	57	66
2006	44	46
2008	32	34
2010	16	16

Figure 1: Nests and Nest Trees in Five Colonies 1991 – 2010



2. Nest Tree Characteristics

2.1 Tree Species

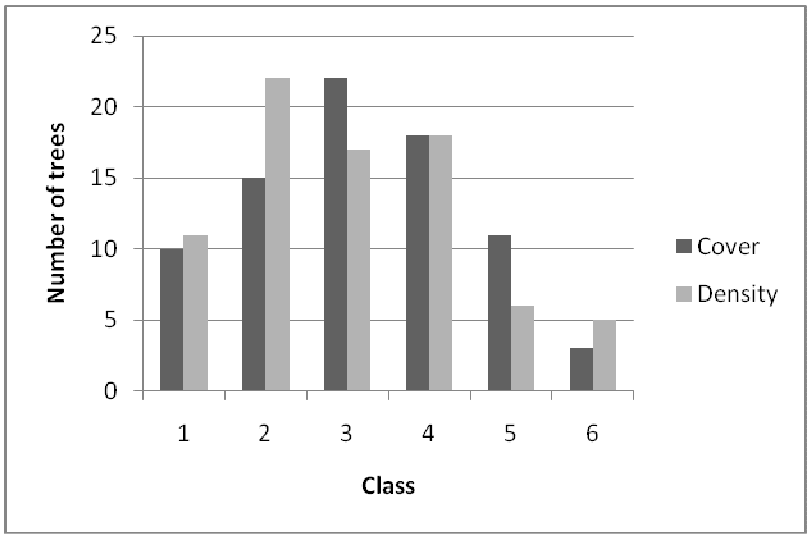
River Red Gum (*Eucalyptus camaldulensis*) was the only tree species used by Regent Parrots for nesting.

2.2 Tree Health

Out of the 95 nest trees, 78 (82.1%) were recorded as "alive". Of the remaining 17 trees used as nest sites, 16 were in the long dead drowned trees and only one nest was located in a tree that had died in the past few years. The 16 drowned trees were all in the 5 colonies upstream of Lock 3. All of the "live tree" sites (ie. all of the colonies downstream of Lock 3) contained trees that have died in recent years due to the combined effects of drought and a lack of flooding.

The majority of the live nest trees were within the 1-5 range for cover (94.9%) and the 1-4 range for density (84.8%). No nest trees were recorded in the highest health class (class 7). The distribution of these health indicator classes is shown in Figure 2.

Figure 2: Numbers of trees in cover/density class



The mean condition class (cover + density scores) for each of the remaining four "live tree" colonies is shown in Table 4. (The maximum condition class score possible is 14 ie. cover =7 and density =7.)

Table 4: Mean Condition Class for Live Tree Colonies

Colony Name	Condition Class
Banrock Bend	7.23 ± 2.49
Island Reach	7.66 ± 0.83
Hogwash	5.40 ± 2.83
Morgan CP	5.54 ± 2.38

No detailed analysis of the recovery and decline responses was attempted, as the interpretation of these parameters by the many volunteers varied considerably and some did not record data for this section. Although some of the data appears to be contradictory in parts, Table 5 lists the details recorded by volunteers and could be used as a rough guide to the health of the trees in the four "live tree" colonies.

Table 5: Tree Health Indicator

Colony	Number of Trees							
	Total Colony	Recovery Response				Decline Response		
		Epicormic	Tip growth	Flower		Wood crack	Leaf die	Mistletoe
Banrock Bend	21	19	19	19		0	0	0
Island Reach	7	6	6	6		1	0	0
Hogwash	38	27	21	29		4	15	1
Morgan CP	13	11	9	10		8	9	1

2.3 Distance to water

The trees in the four remaining upstream colonies (Lock 6, Gal Gal, Wachtels Lagoon and Kingston Backwater) were permanently standing in water and the nest trees in the downstream four remaining colonies were all on land. Just 16 (15.2%) of all nest trees were standing in water. Of the trees on land, 77 of the 79 (97.5%) were less than 250 m from water. One tree in the Morgan Conservation Park was estimated to be 500 m from water, and one tree at Hogwash was 400 m away from water. Table 6 shows the average distance of the nest trees in each colony from the water's edge and the range of distances of the trees from water.

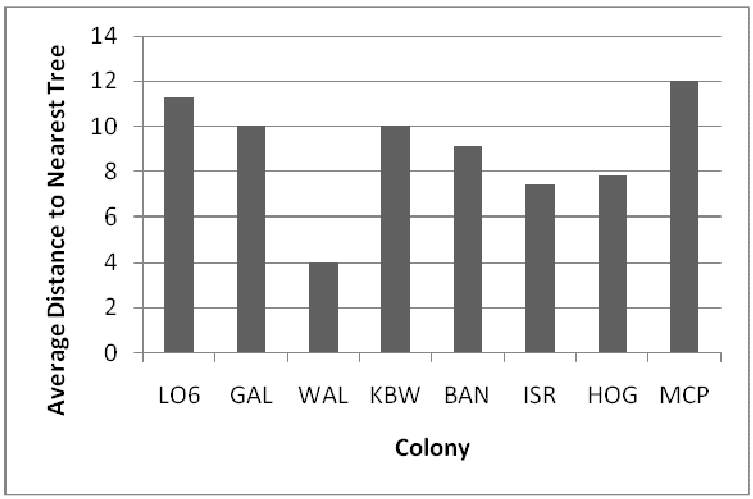
Table 6: Location of nest trees

Colony	**Percentage of nest trees on land (%)**	**Average distance to water (m)**	**Range (m)**
Nil Nil	-	-	-
Lock 6	0	0	0
Gal Gal	0	0	0
Wachtels Lagoon	0	0	0
Kingston Backwater	0	0	0
Banrock Bend	100	85	5 - 150
Island Reach	100	48	0 - 200
Hogwash	100	53	3 - 400
Morgan CP	100	63	0 - 500
Murbko Flat	-	-	-

2.4 Distance to Nearest Tree

The average distance of the nearest neighbouring tree to the nest tree for all colonies was 9.1 m. Figure 3 shows the average distance of the nearest neighbouring tree in each of the remaining 8 colonies.

Figure 3: Average distance to Nearest Tree (m)



2.5 Nest hollow characteristics

The majority of nest hollows were located in separate trees (92.6%), but there were some trees with multiple nests in them. Only one tree contained more than two hollows. Table 7 shows the distribution of nests in nest trees.

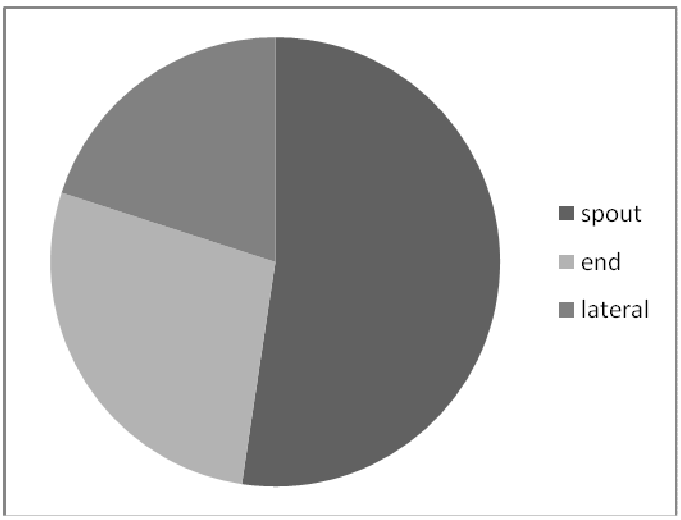
Table 7: Nests in nest trees

Number of nests / tree	Number of trees
1	88
2	6
3	0
4	0
5	1

The size of the nest hollow entrances were mainly at the small end of the range with 60 nest hollows (57.2%) being rated as small, 31 (29.5%) as medium and 14 (13.3%) as large. The hollows rated as small were ones where the bird was just able to squeeze through it to access the nesting chamber. Entrances that are much larger than 2-3 Regent Parrots could comfortably enter when grouped together were rated as large and were less favoured. Some of these larger entrances appeared to get narrower at a short distance down the hollow, although this was not always possible to observe. The majority (90.5%) of the nest hollows were located in branches with just 10 of the 105 (9.5%) nest entrances being located in a trunk.

55 (52.4%) of the nest entrances were in spouts, 29 (27.6%) at the end of a branch and 21 (20%) had a lateral entry point.

Figure 4: Location of Regent Parrot nest hollows



The direction the nest hollow entrances faced was recorded in degrees. Where a nest entrance was via a vertical entry point, it was recorded as vertical. All of the information was compiled according to the basic 8 major compass points (Table 8).

Table 8: Direction of Nest Entrances

Colony/Direction	N	NE	E	SE	S	SW	W	NW	Vert	Total
Lock 6	2	1		1	1		1	1	1	**8**
Gal Gal	1	1		1		1				**4**
Wachtels Lagoon				1						**1**
Kingston Backwater					1			1	1	**3**
Banrock Bend	3	1	1	5	1	2	2	2	5	**22**
Island Reach			1		2	1	1		2	**7**
Hogwash	9	2	6	9	3	5	3	6	4	**47**
Morgan CP	1	4		2	2	1	2	1		**13**
Total	**16**	**9**	**8**	**19**	**10**	**10**	**9**	**11**	**13**	**105**

3. The survey Effort

The volunteers who conducted the survey worked in a range of combinations and for a variety of time periods at each of the colonies. Only one volunteer was experienced in conducting this type of survey. All other helpers were either trained on the training day or given instruction in the field prior to them beginning the survey. The times listed in table 9 refer to the time spent surveying during prime Regent Parrot activity periods: ie. the first four hours after sunrise in the morning and the last 3 hours prior to sunset in the afternoon.

The hours in the table refer to the number of hours in the field (ie. the time spent by the group) and the volunteer column shows the combinations of volunteers who worked during that time.

Table 9: Survey Effort

Colony	No. nests	Time (Hours)	Volunteers
Nil Nil	0	8	single
Lock 6	8	7	single
Gal Gal	4	10	single
Wachtels Lagoon	1	6	2 groups of 2 – separate times
Kingston Backwater	3	12	single
Banrock Bend	22	36	single
Island Reach	7	14	single
Hogwash	47	45	2 groups of 2 – separate areas
Morgan CP	13	40	1 group of 3 , 1 group of 4 separate times
Murbko Flat	0	4	single
Total	**105**	**182**	

Discussion

Part A The 10 selected colonies

1. Number of Nests

The rationale for selecting the 10 colonies to be monitored biannually was determined from data collected in surveys from 1991 to 2003/4. During that period Smith conducted a full survey upstream of Lock 3 in both 1991 and 2003. In 2000 he visited a number of colonies including all of the colonies that were included in the selected 10. Table 2 shows the nest numbers for the 5 sites upstream of Lock 3 for these three surveys.

Of the nine largest nest colonies from the 1991 survey, eight were still being used in 2000, and the overall number of nests for these colonies fell from 115 to 110 (Smith 2000). It was interesting to note that one of the declining colonies was one of the few in this part of the river that was located in live trees. Despite the loss of some of the drowned River Red Gums (7%) and damage to others (18%), from the 1991 surveys (Smith 2000), the number of nests in these dead trees did not decline from 1991 – 2000.

The decline in nest numbers in the 3 seasons to 2003 was theoretically attributed to the drought and some anthropological activities in the horticulture districts. Regent Parrots spend much of the non-breeding season moving around mallee areas, particularly north of the river, where they feed on native species and use dams for water. The below average rainfall conditions experienced over the past few years has resulted in lower flower and seed production in both trees and understorey plants and few dams have held any water. It was reasonable to assume that these factors may have caused a reduction in Regent Parrot numbers. Reports of Regent Parrots being exterminated in recently developed almond orchards was also considered a possible contributor to the decline in the 2003 breeding season.

From 2003 to 2008 this decline continued for these 5 upstream colonies (Table 10) and the number of nests in the 5 colonies downstream of Lock 3 increased, with the overall effect being a very slight decline in overall figures for the whole 10 monitored colonies. This gradual decline overall could be attributed to the continuation of the drought. The decline in the upstream colonies coinciding with an increase downstream could be the result of some Regent Parrots moving nest sites downstream. This movement

could be the result of declining food resources upstream of Lock 3, declining availability of suitable nest hollows in this part of the river or changes in flight corridors (eg. Almond orchards)

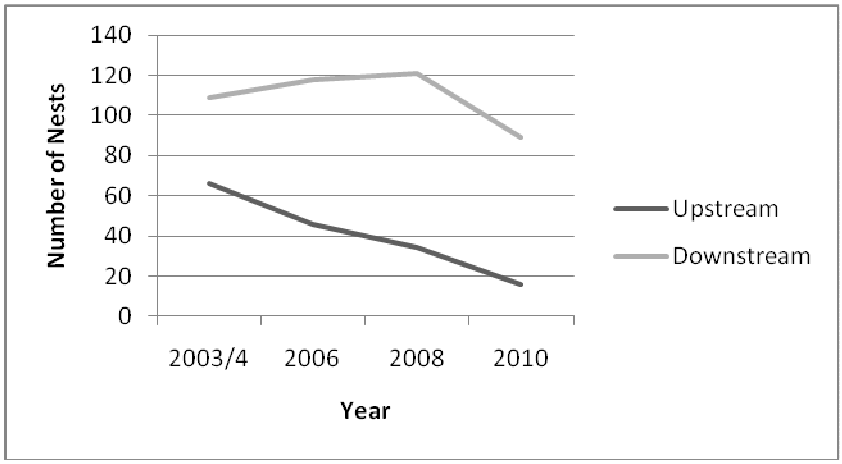
On the other hand, if the parrots are inclined to use the same nest sites each year, the decline in nest numbers in the upstream colonies to almost half from 2003 to 2008 suggests that the birds in this section of the river were in serious trouble.

Table 10: Nest Numbers 2003/4 to 2008

Year/colonies	Upstream of Lock 3	Downstream of Lock 3	Total
2003/2004	66	109	175
2006	47	118	165
2008	34	121	155

In 2010 the decline in the number of nests in upstream colonies continued with just 16 nests being recorded in the 5 selected colonies in this part of the river, a reduction of 52.9% since 2008. The 5 selected colonies downstream of Lock 3 also showed a decline in numbers from 121 in 2008 to 89 in 2010, a drop of 26.5%. This dramatic decline in the overall number of nests in these 10 colonies is clearly illustrated in Figure 5

Figure 5: Nest Numbers in the 10 Selected Colonies



The gradual decline in overall nest numbers from 2004 to 2008 was theoretically attributed to reduced foraging opportunities, illegal destruction of birds in orchards or loss of flight corridors/land use change (DEH Report 2009). The accelerated decline in 2010 is most likely to be a result of a reduction in available foraging areas as it would be difficult to contemplate a corresponding increase in either of the other two threatening processes both upstream and downstream of Lock 3.

The prolonged drought has resulted in a reduction in food resources for both breeding birds and the flocks of Regent Parrots that traditionally move around the mallee areas in the non-breeding season. This situation has been exacerbated by the loss of a large area of mallee north of the river in the Bookmark area, by a big wildfire that burnt through the area in late November 2006 further reducing

traditional Regent Parrot foraging areas. In the non-breeding season these flocks would have had to range further and the lack of surface water would have severely tested the stamina of these birds. The reduced food resources would have made it difficult for breeding birds to successfully raise their brood. A combination of these two events (drought and wildfire reducing foraging opportunities) could have caused the reduction in the numbers of breeding pairs evident in this survey.

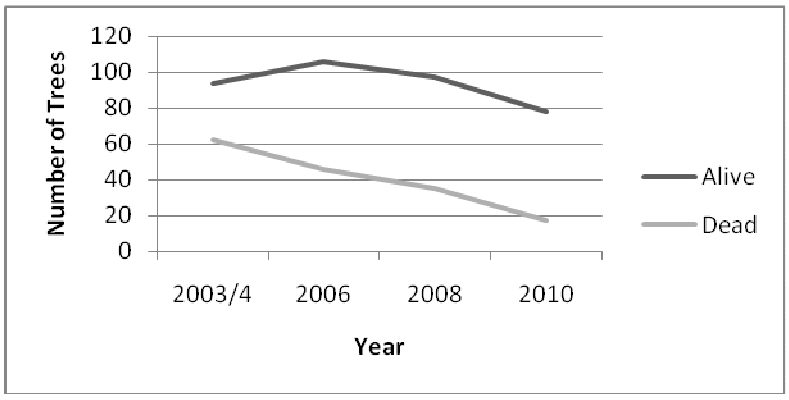
Another possible explanation for this decline in nesting pairs in the selected sites is that the Regent Parrots are not displaying the nest site fidelity that was assumed and they have moved their nesting areas to another locality. A detailed survey of the whole river could determine if this is a possibility. (see Part B)

2. Nest tree Characteristics

2.1 Tree Health

The decline in the number of nest trees in the 5 colonies upstream of Lock 3 has resulted in less dead trees overall being recorded as nest trees because all of these upstream colonies are located in drowned River Red Gums. This decline in the use of dead trees corresponds with the decline in nest numbers for this part of the breeding range. Figure 6 shows the change in use of live and dead trees over the 4 surveys of these 10 colonies.

Figure 6: Live/Dead Nest Trees 2003-2010



Regent Parrots could be moving away from the dead trees because the number of available nest hollows is declining due to the continuing loss of these types of trees. The remaining nest hollows may no longer be suitable for nesting. These drowned Red Gums are susceptible to termite and fungal attack. Some deep nesting hollows have been found to become very shallow over time as a result of these processes causing the hollow to fill with decayed wood (Vic Hurley – pers. comm.). The question arises as to whether the Regent Parrots are moving away from these drowned River Red Gum sites and into live trees in that part of the river, moving to locations further away eg. downstream of Lock 3 or this decline is real and the Regent Parrots in this part of their breeding range are gradually moving towards local extinction. A detailed survey of this area of the river would determine if they are using live trees in that part of the river, but further research is required if it is to be shown that they are moving further away.

The reason for the move from these drowned trees (if that is what is occurring) also requires further investigation.

Prior to the 2008 survey, the health of nest trees was estimated on a scale of 1-100% where 100% represented totally dead and 0 a very healthy tree. In 2008 this method was changed to record health classes for cover and density on a 7 class scale. No attempt has been made to try to compare these two scales at this stage.

In 2008 the majority of the live trees were within the 0-4 range for cover (81.3%) and density (91.7%). In 2010 the percentage of live trees within this same range (0-4) was 83.3% for cover and 84.8% for density. The difference in density can almost certainly be attributed to the continuing lack of flooding of the trees in the colonies of live trees. Attempts have been made to reverse this downward trend in tree health in the Hogwash colony by using sprinklers to water under the trees. The trees and understorey plants are exhibiting a marked Improvement in general health as a result (K. Bishop – pers. comm.).

2.2 Distance to Water

The average distance of the nest trees from water (Table 6) is an indication of the distance that the major stands of trees are from the water's edge. At Banrock Bend, the majority of Red Gums are in a band about 80 metres from the water's edge. These would have established following a single flood event, as most of the trees appear to be of a similar age. This applies to most of the other stands of nest trees. Where there are lower points in the level of the floodplain away from the main river, some trees are at variable distances, however, due to the reduction in the number of floods over past years, many of these trees that are not adjacent to water have died. Attempts have been made to return some of these flood events artificially by pumping water into lagoons. This is the situation at Morgan Conservation Park. Thus the average distance to water for the nest trees at this location varies considerably from one survey to the next depending on whether the lagoon is in a wet or dry cycle.

2.3 Distance of the Nearest Tree

If the average distance of nest trees from neighbours for Wachtels lagoon is disregarded (there was only 1 nest tree in this colony), the nest trees in the drowned River Red Gum colonies are mainly further apart than in the colonies where the nests are located in live trees. Morgan Conservation Park is an anomaly due to its unique setting on the edge of a lagoon rather than the river. The higher value in the drowned colonies could reflect the loss of trees that has been recorded at these locations.

2.4 Nest Hollow Characteristics

It seems that Regent Parrots prefer to nest in trees where they do not have interference from other Regent Parrots. During the period prior to nesting, when nest hollows are being selected, Regent Parrot pairs interact with one another constantly when they are investigating hollows in the same tree and even adjacent trees (pers. obs.). This interaction could deter birds from selecting hollows in the same tree unless there is a high demand for nest hollows. With 92.6% of Regent Parrot nests occurring in separate trees, it would seem that there are sufficient hollows available and the birds choose to nest in a tree away from others of the same species if possible. The rare occurrence of up to 5 nests in a single tree has been observed previously and may indicate that the hollows in that particular tree are so desirable that the birds are prepared to tolerate one another.

It is fortunate that Yellow Rosellas (*Platycercus elegans flaveolus*) nest a little later than Regent Parrots and are not generally interested in protecting nest trees at the early time when Regent Parrots are selecting their nest hollows. Later in the season, when these aggressive parrots start looking for nest hollows, there are considerable interactions with others of the same species and any other species that might be in the vicinity of the tree that they are proposing to nest in. The interactions of Yellow Rosellas with Regent Parrots always result in the Regent Parrot losing (pers. obs.). Many reports of these negative interactions were recorded by the range of volunteers assisting on this survey. Regent Parrots are prevented from getting anywhere near their nest tree if a Yellow Rosella pair select that tree or even one nearby. They have to wait at a distance until the Yellow Rosellas have gone away to feed, or fly rapidly from a distant tree, quite often chased by a Yellow Rosella right to the nest entrance. This harassment is continual once the Yellow Rosellas begin to start their nest selection process. It is not known if this behaviour eventually results in the failure of the Regent Parrot nest.

Yellow Rosellas have also been observed to enter Regent Parrot nest hollows when the parent birds have left after feeding their nestlings. The time spent in these hollows is of concern, as it is not known what is taking place in the nest hollow. This interaction between these two species warrants further investigation to determine if it is affecting the viability of Regent Parrot nesting attempts.

The majority of nest hollows (57.2%) were classified as small. These hollows are such that the birds can just squeeze into the hollow through the entrance. Only 13.3 % were stated to be large. These entrances may also be misleading in that some were observed to narrow just inside the entrance. When Regent Parrots do choose a large hollow or are forced to do so because of a shortage of hollows in that colony, the result can be disastrous for that pair. An open large hollow is not usually chosen due to the possibility of predation of the eggs or nestlings. Smith (1991) reported seeing an Australian Raven (*Corvus coronoides*) enter a large nest hollow and emerge with a nestling Regent Parrot. The female had left the nest to be fed by its mate. These corvids have been observed visiting other Regent Parrot nest hollows and hollows occupied by other hollow nesting birds. On one occasion Smith (2000) observed a Lace Monitor (*Varanus varius*) entering nest hollows.

Over half (52.4%) of nest hollows were in spouts with a further 27.6% at the end of a branch, so it is not surprising that most (90.5%) of nest hollows are located in branches. Many of the nests that were listed as being in trunks had entrances through lateral slits in the trunk.

As has been the situation with other Regent Parrot surveys, the direction that the nest hollows open shows no particular orientation being favoured above all others. 19 of the 105 hollows (18.1%) in this survey entered from the south-east. In 2008 this was the least favoured direction with just 5.1% of hollow entrances facing in that direction (DENR 2008).It appears that other factors are far more important to Regent Parrots when selecting a nest hollow than the direction the opening faces.

3. The Survey Effort

The effort required to locate nests in the various types of colonies is quite different. For the colonies in drowned trees it is a matter of sitting in a canoe at a spot where the whole of the stand of dead trees can be observed. By watching patiently during the prime times for activity, the birds can easily be observed flying to and from the nest trees. In these colonies the males return to the nest tree, the

female emerges and the pair fly to a nearby live tree where feeding occurs. The pair then returns to the nest tree, the female immediately enters the hollow and the male sits for a while in the tree before calling and flying away. Later in the season both male and female birds visit the nest together with each taking turns to enter the hollow. Thus a single person can survey these sites and be sure of locating all of the nests. When the stand of drowned trees is much larger and spread out, the colony needs to be addressed in sections. In this instance a pair or group of observers in canoes would make the task more efficient.

For colonies where the nests are in live trees and the whole of the stand of trees cannot be viewed at the same time, a team of observers working on allocated sections of the stand of trees makes the task far more attainable in a reasonable time.

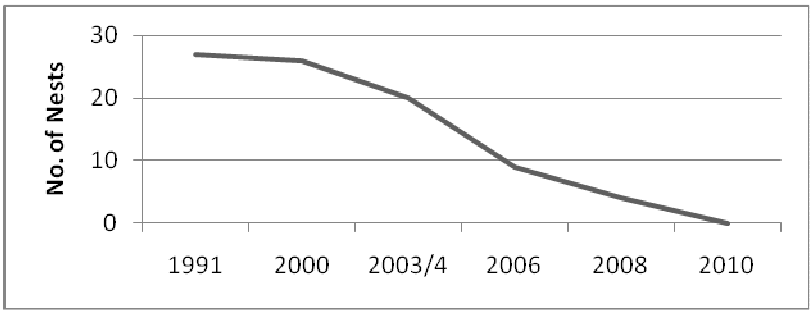
Volunteers who could only search for short periods each time they were in the field found it difficult to understand the movement of the Regent Parrot flocks and so became frustrated and locating nest trees was found to be a difficult task. Many of these volunteers were also attempting this type of survey for the first time and did not realise how much time and patient observing is required to achieve success.

From these observations it seems that surveys of the selected colonies can best be achieved by using a team of volunteers who have several whole days to devote to working in a colony in order for them to understand the movements of birds around the colony and hence locate nest hollows more easily.

4. The Colonies

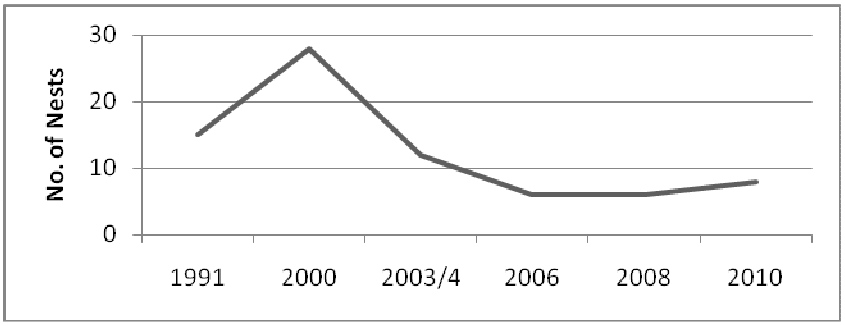
Each of the ten selected colonies has unique features and shows vastly different trends in the numbers of nests over the past 20 years for those upstream of Lock 3 and over 6 years for those downstream of Lock 3. The changes in the numbers of nests over time are shown below with a brief discussion of the different features of each colony that could be contributing to these changes.

Nil Nil



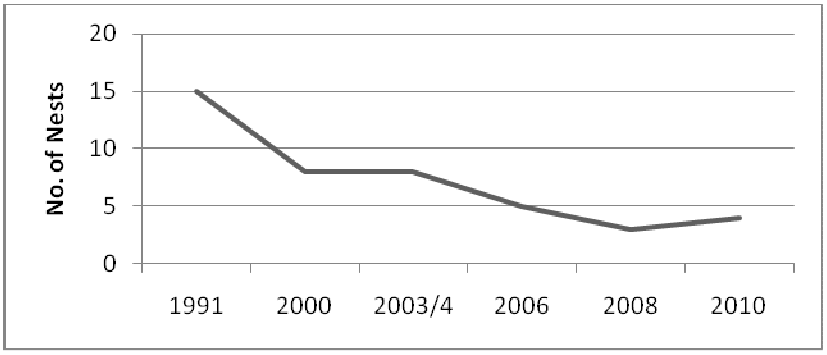
By the year 2000 the Nil Nil site had lost 10% of its nest trees from the 1991 survey (Smith 2000). Whilst there has been a continuing decline in the number of these drowned River Red Gums currently standing, there are still a number of the original nest trees remaining upright. Whilst there were a few other birds using the hollows in the remaining trees, there did not appear to be sufficient numbers to suggest that competition for nest hollows was a major factor in the total loss of Regent Parrots from this site that was thriving for the period 1991 – 2000.

Lock 6



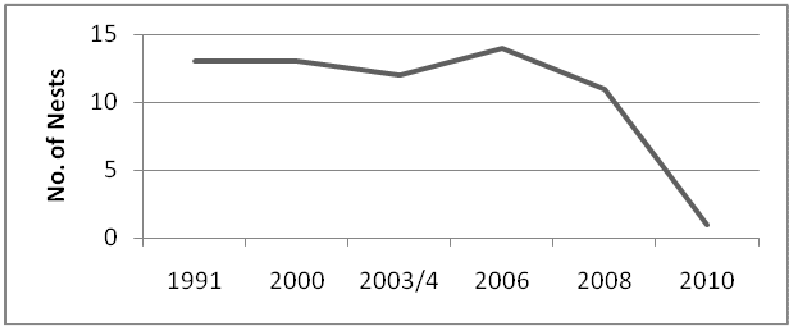
From 1991 to 2000 14% of Regent Parrot nest trees fell over. Despite this, there was a large increase in the number of nests in this colony during that period. The return to near 1991 numbers over the next 4 years makes this an intriguing nest site. Some of the original nest trees still remain in 2010, and some are still being used by Regent Parrots in addition to some different trees. Although the colony has declined in size, it has remained reasonably constant in numbers (6-12) since the large decline from 28 nests in 2000 to 12 nests in 2003. There has been a healthy number of Little Corellas and Sulphur-crested Cockatoos using this location to nest since 1991, but the numbers do not appear to have changed much in that time. The decline in tree numbers would thus have resulted in a decreased availability of nest hollows for all species, with a possible increase in competition for nest hollows, yet this colony of Regent Parrots continues to hold on.

Gal Gal



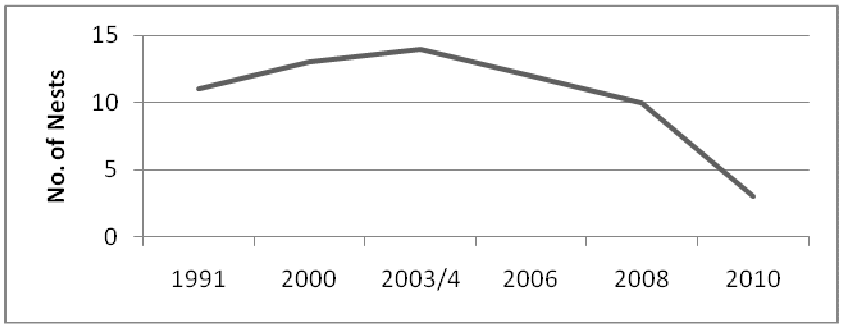
This colony of Regent Parrots was never as large as some of its near neighbours, but it has suffered a similar decline in both the number of available trees and colony size. Many of the remaining trees at this location appear to be in a precarious state. Many limbs have fallen and the trees are showing visible signs of decay. It seems that this colony will soon follow the Nil Nil one to being another lost nesting site.

Wachtels Lagoon



This nest site is a long way from the previous three sites, but like them, is located in a stand of drowned River Red Gums. Again there has been some loss of trees, but a substantial number of trees remain standing. The astounding decline in nest numbers from 11 in 2008 to just 1 in 2010 cannot be attributed to loss of available nest trees alone. Other factors may be responsible for this actual/apparent decline. Observer experience and application could be a part of this problem. At sites where the nests are in the drowned trees, the feeding flocks often roost in adjacent live trees for a time before individually making a brief visit to their nest. Thus surveying such sites for a short period of time or paddling past in a canoe is unlikely to produce an accurate data set.

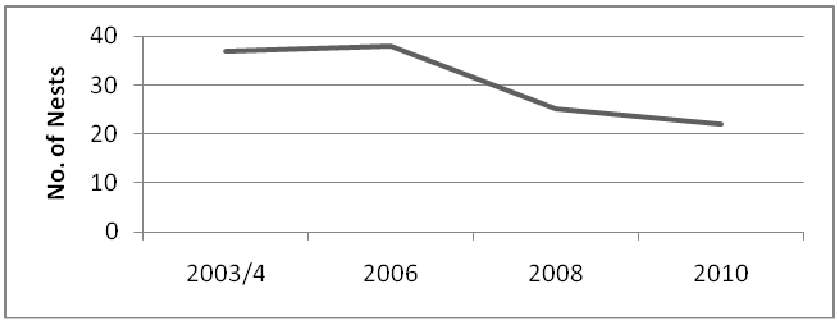
Kingston Backwater



This is another nesting area located in drowned trees. Again there has been a decline in numbers of trees standing, but there are still many remaining in this large group. There are a number of other species using hollows at this location, including Little Corellas, Sulphur-crested Cockatoos and Red-

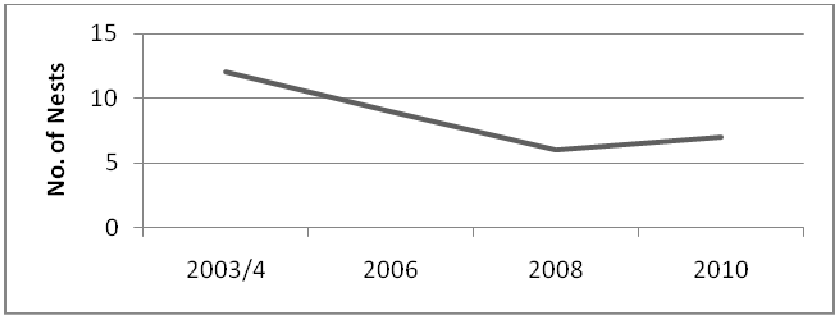
rumped Parrots. Of interest is the significant number of Yellow Rosellas present at this site. These aggressive parrots seem to take particular delight in harassing Regent Parrots and preventing them from reaching their nesting hollows when they return to feed their nestlings. Another issue with this site is that a number of Regent Parrots fly through the live trees adjacent to this colony on their way to and from the feeding area. Their nests appear to be located upstream of Kingston – probably in the Loch Luna area. These birds often gather in the live trees near this nest site together with the resident breeding birds. This makes it difficult to determine which group of birds to watch for those who will move to hollows in the drowned trees.

Banrock Bend



This is a large stand of mostly live River Red Gums on the inside of a large bend in the river. A number of trees on a backwater behind the main stand have died in the past 6 years. Some of these trees were used as nest trees by Regent Parrots in 2004. There is also a large number of Little Corellas and Sulphur-crested Cockatoos nesting at this location which makes hearing calls other than their raucous alarm calls rather difficult. There is also a significant number of Yellow Rosellas present in this location and these aggressive parrots were seen to harass Regent Parrots at several of the nest hollows. The decline in the Regent Parrot population at this site could be attributed to the amount of competition for nest hollows and the continual harassment by the rosellas.

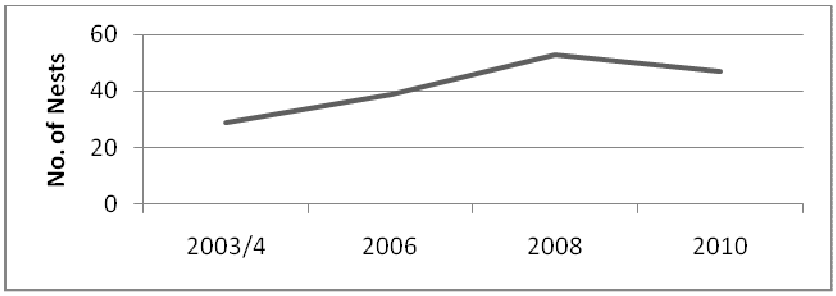
Island Reach



Like many other areas on the floodplain this location has deteriorated considerably since 2004. The River Red Gums that line the river's edge are in good health but those trees a short distance away and in

the ephemeral wetlands are in poor health or have died. The ground cover has changed from being mainly native species to predominantly introduced gazanias. There are some other hollow nesting birds including Galahs and Red-rumped Parrots present, but like the Regent Parrots they are in low numbers. Many of the hollows that were used previously by Regent Parrots were not being utilized in 2010. The decline in health of the nest trees and the lack of native ground cover are two factors that could have influenced the decline in Regent Parrot nests over the past 6 years.

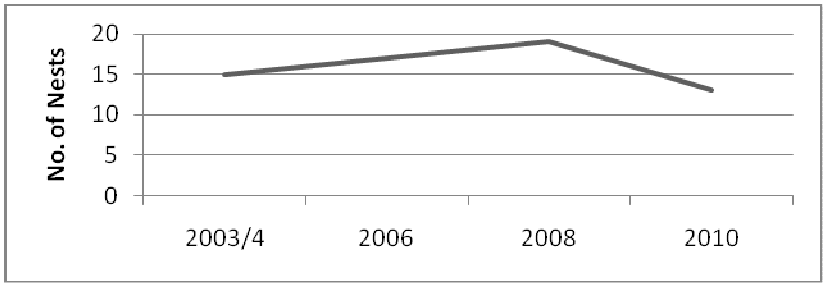
Hogwash



This large stand of mainly healthy River Red Gums supports the largest breeding site for Regent Parrots in South Australia. The area has been "adopted" by the Riverland West Local Action Planning group. Considerable effort has been expended to irrigate the area around some of the nest trees using a sprinkler system, and the health of the trees monitored. In addition to improving the density of the canopy of the trees, this watering has also resulted in a significant increase in the health of the understorey plants (R Schmitke pers. obs.). Fencing the area has restricted camping and some trail bike activity. The area has just recently been declared a Conservation Park.

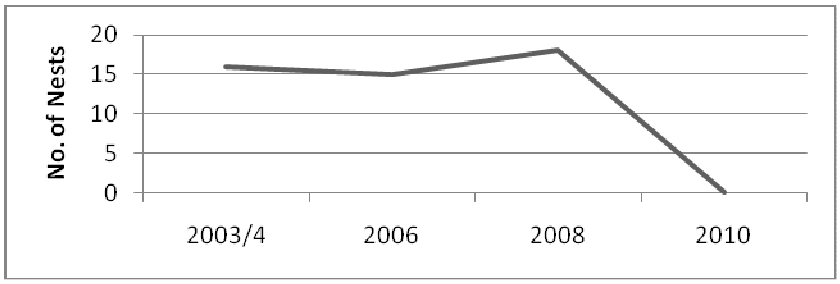
This site has been surveyed by two teams of two by students from Flinders University since 2006. Numbers of Regent Parrots move through this area on their way to and from the feeding area from other nest sites. It was also reported that many of these feeding flocks were visiting native ground cover plants on the floodplain adjacent to the Hogwash colony. Water has been pumped onto these adjacent floodplain areas in recent years and has improved the health of the vegetation. The number of Regent Parrot nests in these areas adjacent to Hogwash has also dramatically increased since 2004 (see Part B).

Morgan Conservation Park



This colony is located in River Red Gums adjacent to a lagoon that has seen the benefit of water being pumped into it during the past few drought years. This has resulted in the Red Gums near the lagoon remaining moderately healthy, however, the health declines rapidly away from the lagoon such that there is a large area of dead gums behind this live stand. The number of Regent Parrots nesting at this site has remained steady over the past 6 years. There has been no noticeable increase in other hollow nesting species occupying the site, and the health of the floodplain understorey has changed little in that time. Actions by DENR to establish a "Friends" group to work on improving the general health of the area and to monitor illegal camping and trail bike activity should add to the value of this site for Regent Parrots.

Murbko Flat



River Red Gums line the river and a permanent creek that carries water into the lagoon. The trees along the watercourses are healthy, but those only a short distance from the water are deteriorating and some have died. Regent Parrots were recorded as moving through this area but not stopping. The 2006 and 2008 surveys reported similar movements of Regent Parrots but still located nests in the area. As only part of one day was spent in this area during the current survey, the nil result may not accurately reflect the status of this colony.

Conclusions

The drop in numbers of breeding Regent Parrots in these 10 selected colonies from 175 pairs in 2003/4 to 105 in 2010 (40% decline) would suggest that the population of this vulnerable species is in serious decline. If the situation in these colonies is a true reflection of the overall Regent Parrot numbers, then the current total population in SA has plummeted to 60 % of the 2003/4 total of 400 pair ie. to approx. 240 pair. A full search of the river corridor from the SA/NSW border downstream to Swan Reach would test this prediction (see Part B).

The most likely cause for this decline is hypothesised to be a reduction in foraging opportunities in both the breeding and non-breeding seasons in mallee areas due to drought and also the wildfire in the mallee north of the river in 2006. There are sufficient breeding pairs remaining to mount a recovery, particularly now that seasonal conditions have improved. With the end of the drought, the mallee should quickly recover and again provide the resources to sustain this recovery of Regent Parrot numbers. Another alternative for these birds is to rely less on the mallee and seek alternative food sources such as on the floodplain.

The decline in the number of Regent Parrot nests upstream of Renmark is of particular concern. The large decline in nesting pairs in this part of the range could be due to the effects of drought, but is more pronounced than elsewhere and so other factors are likely to be contributing to this decline. The drowned River Red Gums that have been the traditional nesting sites in this part of the river corridor since detailed surveys commenced in 1991 have continued to deteriorate. Lower numbers of these trees are remaining upright and it is visibly evident (pers. obs.) that the remaining trees are suffering from decay. As most of the Regent Parrot nests further downstream are in live trees, it is reasonable to assume that the remaining pairs in this upstream section will adapt and move to nest in live trees as their drowned tree sites disappear.

The surveys that have been conducted over the past few years show that Regent Parrots are favouring live trees with hollows that have small spout or end of branch entrances but with no particularly favoured orientation. These trees need to be within 250 m of water and in groups to allow colonial breeding. Little competition for hollows, particularly from aggressive Yellow Rosellas, would also be advantageous.

The reduction in frequency of overbank flows is resulting in these live trees and the associated understorey plants declining in health, with many trees already having been lost. It has been reported that Regent Parrots abandon trees that have recently died (Smith 2006). It is therefore imperative for the survival of Regent Parrots that actions be implemented to maintain the health of remaining stands

of mature River Red Gums. The current high river flows will provide a brief respite for the remaining trees of this type, but in the long term an integrated engineering and water use solution is likely to be the only feasible option if these mature trees are to survive into the future.

Results: Part B - Whole of river survey

The total length of river corridor from the SA/NSW border downstream to Swan Reach is approximately 365 km. In addition to the River Red Gums along the main river channel, there are large areas of backwaters and creeks with similar vegetation and so the total length of waterway with potential nest sites is much larger than this figure suggests. When the survey finished at the end of October, the total river corridor that had been surveyed was 289 km (79.2%). This area also included all of the associated creeks and backwaters in the vicinity of the river for that length of river, making the total distance covered almost twice this figure. Map 1 (Appendix 1) shows the sections of the river corridor (76 km) that were not searched during this survey.

Altogether 25 people assisted with the survey. Two groups of university students concentrated their efforts on two of the selected 10 colonies (Hogwash and Morgan CP). Two of the volunteers spent most of the ten weeks surveying large distances along the system and together contributed 623 of the 1115 hours (55.9%) spent on the survey. All of the other volunteers had time constraints that resulted in some spending less than 25 hours and others contributing up to 134 hours.

The efficiency of the volunteers also varied considerably, with some finding it difficult to find many nests despite the presence of Regent Parrots in the area. This was often due to the restricted times that they had available.

1. Number of Nests

A total of 300 nests were located and they occupied 247 trees. These figures are well below the 346 nests in 316 trees recorded in the only other full river survey conducted over the 2003 and 2004 nesting seasons. Table 11 summarises this data.

Table 11: Results of Whole of River Surveys

Survey year	Total nest trees	Total Nests	Distance (km)
2003/2004	316	346	365
2010	247	300	289

The river corridor upstream of Lock 3 was fully searched in 1991, again in 2003/4 (Smith 1991, 2004) and in 2010. This 191 km stretch of the river shows a continuing decline in Regent Parrot nest numbers. In

the latter two surveys the numbers of nests downstream of Lock 3 remained constant. Table 12 compares the results of these surveys.

Table 12: Survey Results Upstream/Downstream of Lock 3

	Upstream of Lock 3				Downstream of Lock 3		
Year	**Colonies**	**Nest Trees**	**Nests**		**Colonies**	**Nest Trees**	**Nests**
1991	32	160	175		-	-	-
2003/4	25	102	113		26	214	233
2010	17	62	66		17	185	234

The number of nests for the area upstream of Lock 3 would have been greater than 66 for 2010 as the area around Loch Luna (just upstream of Lock 3) is one area where the volunteers had difficulty locating nests. The feeling of these volunteers was that there were in the vicinity of another 20 nests in this area. This was based on the size of the feeding flocks seen in the area. Even if this estimate is accurate, the number of nests upstream of Lock 3 has declined markedly since 1991. The drop from 175 nests in 1991 to approx. 86 in 2010 represents a 50.9% decline.

Downstream of Lock 3, the only previous full river survey was in 2003/4. The 2010 survey thoroughly searched some areas (eg. near the major known colonies), but some long stretches of this part of the river were not searched.

The 2010 survey recorded nest trees in 34 colonies, whereas in 2003/4 there were 51 separate colonies discovered along the river in SA. Table 13 summarises this data by dividing it into sections that have been used as administrative boundaries for Regent Parrot surveys (see appendix 1 map)

Table 13: Whole of river surveys

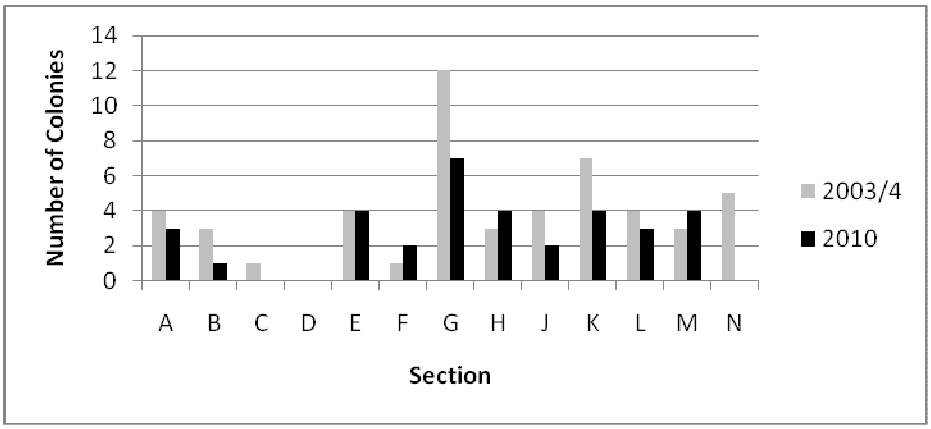
			2003/2004			2010		
Sect.	**Location**	**Dist.**	**Colonies**	**Trees**	**Nests**	**Colonies**	**Trees**	**Nests**
A	Border - Chowilla HS	33	4	27	34	3	20	22
B	Chowilla HS - Renmark	36	3	8	9	1	4	4
C	Renmark - Lyrup	27	1	2	2	0	0	0
D	Lyrup - Lock 4	20	0	0	0	0	0	0
E	Lock 4 - Pyap Lagoon	41	4	12	12	4	25	27
F	Pyap Lagoon - Cobdogla	23	1	3	3	2	2	2
G	Cobdogla - Lock 3	11	12	50	53	7	11	11
H	Lock 3 - Banrock Creek	7	3	53	54	4	41	42
J	Banrock Creek - Waikerie	36	4	22	22	2	12	12
K	Waikerie - Cadell	45	7	65	76	4	82	110
L	Cadell - Pelican Point	26	4	34	37	3	25	28
M	Pelican Point - Blanchetown	32	3	28	32	4	25	42

N	Blanchetown - Swan Reach	28	5	12	12	0	0	0
Total		**365**	**51**	**316**	**346**	**34**	**247**	**300**

A number of colonies from the 2003/4 survey have disappeared. These were generally small colonies consisting of less than 5 nests. The loss of the large Nil Nil and Murbko Flat colonies (see part A) were the most notable.

Figure 7 shows the distribution of the colonies along the river corridor for the two surveys.

Figure 7: Distribution of Nest Colonies 2003/4 and 2010



Map 3 (Appendix 3) shows the location of the Regent Parrot nesting colonies recorded during the 2010 survey.

There have been a number of locations where new colonies have been established. Some of these are only small clusters of nests, but there were some significant colonies that were either absent altogether in 2003/4 or have significantly increased in size. These larger new colonies are described below.

New Colonies

Wiela

This colony is located in a big stand of live River Red Gums on both sides of the river 5km downstream of Lock 6. This area was searched in 1991 and again in 2003/4 but no nests were located in this part of the river. The trees in this stand are suffering from the lack of flooding with many of the younger ones back from the river in low lying areas of the floodplain in poor health or dead. Recently a number of these low lying areas have received the benefit of environmental water. Water was pumped into the lower areas and there are signs of improved health, with trees sprouting new growth and understorey plants beginning to recover.

Rilli Island

Rilli Island is 10 km upstream of Loxton. It is a small (500m x 100m) piece of land only 20 m from the bank of the river and consists of a forested area of live and dead river Red Gums with a fringe of large old Red Gums along the edge of the mainland. The trees on the island vary in age with some old trees with hollows and some younger ones. All of the trees on the mainland and on the island are showing the effects of a lack of flooding with many dead and the health of the others declining.

Southcorp Flat

This area is almost contiguous with the largest recorded Regent Parrot colony in this state at Hogwash. The Hogwash colony is on the southern side of the river and this new colony is on the north side and less than 2km away with the Markaranka colony linking the two. In 2003/4 this area was searched and just 2 nests were located in almost dead trees on the edge of an ephemeral backwater. Since that time, the managers of this stretch of floodplain have donated water so that the area has received environmental flows by artificially pumping water into the low lying areas. The trees and understorey plants have responded well.

Pelican Point

This colony is 15 km downstream of Morgan and is located in a large stand of River Red Gums on the eastern side of the river. There are many old trees with hollows, some alive and some dead, and the general health of the trees is indicative of the lack of flooding in recent years. This colony is 3km upstream of one of the selected 10 colonies (Murbko Flat) that were surveyed every second year from 2004. Murbko Flat had supported a stable number of nesting pairs of Regent Parrots from 2003/4 to 2008, but no nests were located in that area during a brief visit in 2010.

2. Nest Tree Characteristics

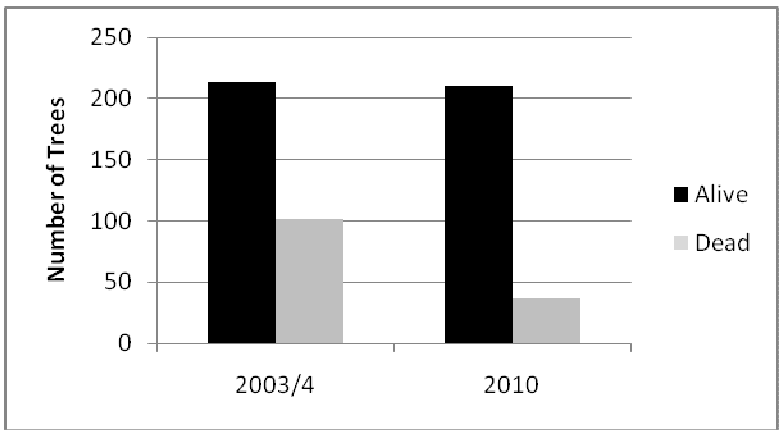
2.1 Tree Species

All Regent Parrot nests were located in live or dead River Red Gums (*Eucalyptus camaldulensis*).

2.2 Tree Health

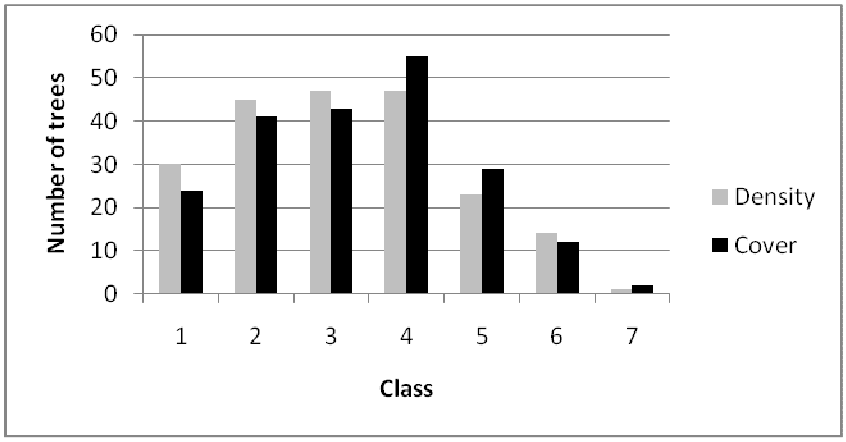
The large decline in the number of Regent Parrot nests upstream of Lock 3 is reflected in the number of nest hollows in dead trees overall. Most of the nests in that upstream section of the river in previous surveys were in dead trees. In 2003/4, 102 of the 316 nest trees (32.3%) were in dead trees. The 2010 survey found that 39 of the 247 nest trees (15.8%) were in dead trees (Figure 8). 30 of these dead trees were drowned River Red Gums in the area upstream of Lock 3. The 9 dead trees downstream of Lock 3 were distributed through the remaining colonies.

Figure 8: Number of Live and Dead Trees per survey



The majority of the nests in live trees were in the 1 to 5 range for cover (92.8%) and density (93.3%). The distribution of these health indicator classes is shown in Figure 9. Only one tree was rated as the maximum (ie.7) for both cover and density.

Figure 9: Number of live nest trees per density/cover class



The mean condition class (cover + density scores) was calculated for trees in the largest colonies ie.those containing more than 10 nest trees. Table 14 provides these figures and shows that the healthiest trees are in the Wiela and Banrock Bend colonies whilst the health of the trees in the newly located Rilli Island colony are very poor, with 7 of the 17 (41.2%) dead.

Table 14: Mean Condition Class for Trees in Large Colonies

Colony name	Mean condition class (Max score = 14)		Colony name	Mean condition Class
Wiela	7.54 ± 3.76		Markaranka	6.79 ± 3.25
Banrock Bend	7.23 ± 2.49		Morgan CP	5.54 ± 2.38
Rilli Island	1.41 ± 1.84		Wombat Hollow	6.33 ± 2.22
Hogwash	5.40 ± 2.83		Pelican Point	3.92 ± 2.40
Southcorp. Flat	6.66 ± 3.84			

2.3 Distance to Water

Most of the nest trees (225 out of the total of 247 found) were located on land (91.1%) with just 22 (8.9%) being located in dead River Red Gums standing in water. All of the nests in drowned trees were in the area upstream of Lock 3. The sections labelled A-G in the following table are located in the area upstream of Lock 3.

The nest trees located on land varied in their distance from the water's edge. Only two of these trees were estimated to be more than 250m from the water (see part A). Table 15 shows the average distance of the nest trees in each section of the river corridor from water and the range of distances of the trees from water.

Table 15: Distance of Nest Trees to Water

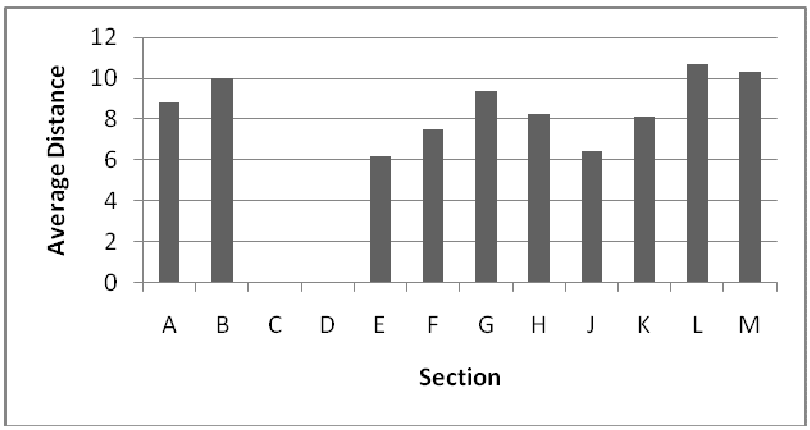
		Number of Trees		Distance to Water	
Label	Location	In Water	On Land	Average dist.(m)	Range (m)
A	Border – Chowilla HS	8	12	91	1-250
B	Chowilla HS – Renmark	4	0	0	0
C	Renmark – Lyrup	0	0	0	0
D	Lyrup – Lock 4	0	0	0	0
E	Lock 4 – Pyap Lagoon	0	25	29	2-60
F	Pyap Lagoon – Cobdogla	0	2	4	0-7
G	Cobdogla – Lock 3	10	1	10	10
H	Lock 3 – Banrock Creek	0	41	55	5-150
J	Banrock Creek - Waikerie	0	12	22	0-200
K	Waikerie – Cadell	0	81	66	0-400
L	Cadell – Pelican Point	0	25	48	0-500
M	Pelican Point - Blanchetown	0	26	15	0-50
Total		**22**	**225**		

Of the 225 nest trees located on land, 198 (88%) were located within 100 m of water. This is even higher than the 2003/4 survey, which found 74% of nest trees located on land were within 100m of water.

2.4 Distance to Nearest Tree

The average distance of the nearest tree to the nest tree for all nest trees located was 8.52 m. Figure10 shows the average distance of the nearest neighbouring tree to the nest tree in each of the sections of river.

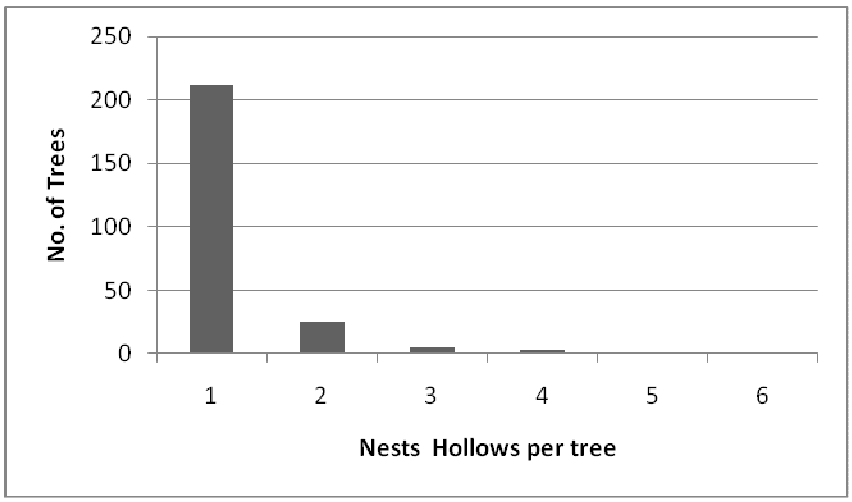
Figure 10: Average Distance to Nearest Neighbour Tree (m)



2.5 Nest Hollow Characteristics

212 (70.7%) of the 300 Regent Parrot nests were in individual trees. Thus 212 (85.8%) of the 247 nest trees had a single nest in them, 25 (10.1%) of the nest trees had 2 nests in them and 5 (2.0%) had 3 Regent Parrot nests in each. 3 trees (1.2%) had 4 nests in them and a single tree contained 5 nests and another 6 nests. Figure 11 shows the distribution of nests in nest trees.

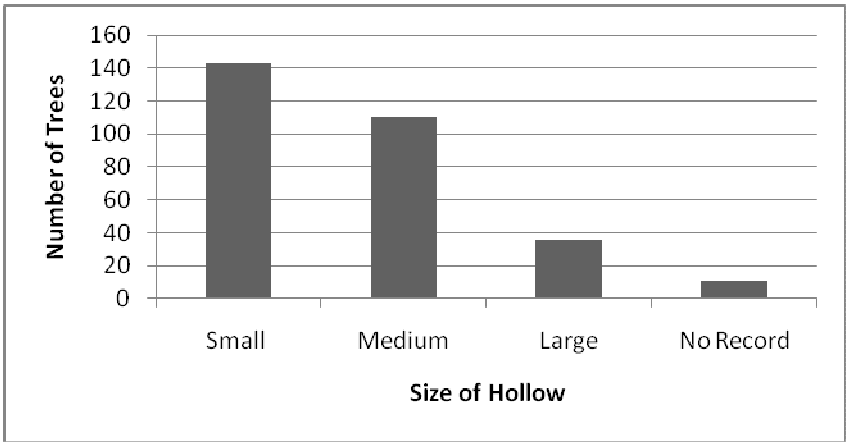
Figure 11: Nest Hollows in a Tree



The 2003/4 survey found 92.1% of nests in individual trees and 6.6% had two nests in them. In that survey 3 trees contained 3 nests and only one tree contained 4 nests. No trees were located with more than 4 nests in them.

In the 2010 survey most of the nest entrances were classified as being in the small to medium range in size (see part A for a description of these sizes). 143 (49.5%) nest entrances were classed as small and 110 (36.7%) were in hollows with medium sized hollows. Figure 12 shows the distribution of nest hollow entrances across the three size ratings. It was interesting to note that most of the large entrances were in trees in the larger colonies in the downstream end of the river corridor.

Figure 12: Size of Nest Hollow Entrance



The majority of the nest hollows were located in branches with 268 (89.3%) of the 300 nests in a branch and only 31 (10.3%) in trunks. One nest was not classified for location.

Spouts situated along branches were the most recorded locations for nests. Branch ends and lateral entrances were each only half as frequently recorded as the spouts. Table 16 shows the distribution of the nest hollow entrances in the nest trees.

Table 16: Location of Nest Hollow Entrances

Location	Number of nests	Percentage
Spout	155	51.7
Branch end	72	24.0
Lateral	73	24.3
Total	**300**	

The direction that the nest entrances faced was recorded in degrees. For ease of interpretation these have been compiled in the eight major compass directions. These nest entrance directions have been assembled in the sections along the river corridor beginning from the SA/NSW border (section A). This data is shown in Table 17. The numbers in brackets show the nest entrances not recorded.

Table 17: Direction of Nest Entrances

Section/Direction	N	NE	E	SE	S	SW	W	NW	Vert.	Total
A	4	1	2	1	2	4	3	3	2	**22**
B	1	1		1	1					**4**
C										**0**
D										**0**
E	3	4	2	3	5	3	3	3	1	**27**
F										**0** (2)
G	2		1	1	2		1	1	3	**11**
H	10	5	4	5	3	2	4	4	5	**42**
J	1	2	1	3		1	1		3	**12**
K	18	8	18	11	11	7	14	13	7	**107** (2)
L	6	8	1	3	2	3	3	1	2	**29**

M	9	2	6	6	9	2	3	1	1	**39** (3)
Total	**54**	**31**	**35**	**34**	**35**	**22**	**32**	**26**	**24**	**293** (7)

3. Behavioural observations

3.1 The Yearly Cycle

The behaviour exhibited by the Regent Parrots can provide an indication as to the stage in the breeding cycle the birds are in at any time. A detailed description of these stages was provided by Smith (2006). The times used as a guide in that report are for average seasons and those times that the majority of birds have been involved. These were average times determined over a period of 16 years. Some individual pairs vary from these times each year, and when seasons are particularly good many more pairs will commence breeding at an earlier time. This was the situation in 2010 when a good season followed a long run of drought years.

3.2 Watering Points

Regent Parrots at each nest colony tended to visit the same site to drink (pers. obs.). These sites varied in the nature of the location, but did tend to have some things in common. One thing in common with most watering sites was the presence of trees with a good canopy cover where the Regent Parrots could rest and survey the area before descending to the water. The water was generally quite shallow and in a protected area behind a reed bed or in a depression eg creek bed. In some places there were fallen branches that the birds landed on prior to moving down the branch to the water. At other locations, the birds used a grassy verge where they could land close to the water and take a few steps to the water's edge. Other colonial breeding species eg. Sulphur-crested Cockatoos and Little Corellas also regularly used a set site for drinking, but their favoured sites were in open positions on large snags in the river.

3.3 Food

During the detailed surveys of Regent Parrots from 1991 to the present, the feeding flocks have been observed flying away from the river to mainly feed in adjacent dryland areas. However, isolated observations of birds feeding on floodplain understorey plants were made during past surveys (Smith 2004, 2006). During this current survey, most volunteers observed groups of Regent Parrots feeding on these floodplain species. Several reports were also received (pers. comm.) of flocks of up to 20 birds feeding on oats that had been planted as a cover crop between rows of vines. The oats that was being targeted was at a milky immature stage of development. These milky seeds seemed to receive even more attention immediately after the plants were cut and left to lie on the ground. A number of other native and non-native species were reported as being utilized by these flocks, but it is beyond the scope of this report to investigate all of these reports. Higgins, P.J. (ed) (1999) provides a comprehensive account of species that have been reported as food plants for this species.

3.4 Competition

Reports of interactions with Yellow Rosellas (*Platycercus elegans flaveolus*) at nest sites have been recorded over the past 20 years (Smith 1991, 2000, 2004. 2006). Most volunteers in the current survey reported interactions with this species (see part A) and to a lesser degree with Little Corellas (*Cacatua pastinator*) resulting in Regent Parrots "giving way" to these more aggressive species.

Discussion

Part B Whole of River Survey

A comparison of two different approaches used in this survey provides an insight into what is required to achieve success in a survey of this nature. The Hogwash colony is located in a woodland of mature River Red Gums that covers an area of 75 Hectares. The university students who surveyed this site worked in two groups of two and each group covered half of the area. With this intensive effort over 4 days and 45 hours for each group, 38 trees with 47 nests were located. Thus, when working in pairs in a confined colony it required 90 hours effort to locate 47 nests. ie.1.91 hours per nest.

In the Katarapko area there is 45 km of creek and river with mature River Red Gums lining the banks, many of which contain what appear to be suitable hollows for Regent Parrots to nest in. This area was surveyed on foot and in places by canoe with 21 hours needed to search the area. The searching was conducted during peak times for Regent Parrot activity. There were 4 colonies located in this section. One colony was located on an island that is 5 Hectares in area. The other three colonies were small groups of 3-4 nests spread over 3 km of creek frontage. The survey of these four colonies involved another 53 hours of searching which located 25 trees containing 27 nests in total. ie. 1.96 hours per nest. Thus in this instance 45 km of river/creek was surveyed and 27 nests were located and recorded and this total effort required 74 hours (21hours to search for sites and 53 hours to find the nests in the colonies) ie.2.74 hours per nest. Table 18 compares these survey times.

Table 18: Time Spent on Surveys

Area	Method	Time per nest
Confined colony	Pairs of first-time volunteers	1.91 hours /nest
Dispersed colony	Single experienced volunteer	1.94 hours/nest
Total corridor search	Single experienced volunteer	2.74 hours/nest

Locating and recording Regent Parrot nests that are in a restricted and defined area is obviously easier and took less time to achieve than surveying colonies where the nests are more widely spread. By dividing the confined area to be searched into two sections and working in pairs, the university students were able to complete the survey of the area most efficiently. Other volunteers also found that working in pairs makes the search more proficient and more enjoyable. A lone surveyor searching a dispersed colony found the effort needed to walk back and forth through the stand of trees to locate nests more time consuming and frustrating. The task of searching large areas of the river, creek and backwaters for

the presence of nesting colonies is one that a single observer can accomplish, but is very time consuming.

Those who found the greatest difficulty in locating nest colonies and nest trees in colonies were the volunteers who had limited times when they were able to conduct the survey. Some of these volunteers found this very frustrating, as several trips were needed to confirm a single nest. Others saw many Regent Parrots moving about an area but were unable to determine the nesting site.

Those volunteers who were most successful in locating colonies and recording the nests in them were able to devote whole days for several days at a time to the survey effort. It requires a great deal of commitment and dedication to achieve this.

The rates calculated for two different types of survey (Table 18) indicate that searching colonies that are already known or ones that have been recently located requires about 2 hours effort for every nest tree present in the colony. The full river survey requires the whole area to be thoroughly searched to locate colonies and then record all of the nests in any colonies located. An experienced observer working all day on this total river search required 2.74 hours of effort per nest located. Using these figures as a guide and taking the 2003/4 estimate of 400 nests in SA, a total of 1100 hours of effort would be needed to thoroughly search the total river corridor from the border downstream to Swan Reach. Dedicated volunteers found that they were able to commit between 350 – 400 hours over the 10 week period of the survey. This figure allows for poor weather when no survey work was possible and personal commitments. To achieve a complete and thorough search of the river corridor and record all Regent Parrot nests in the colonies found, using volunteers, would require 3 volunteers who were willing to allocate the whole 10 weeks to the survey. A larger team of similarly trained people, who are able to devote several whole days to the survey could achieve the same result, but would need to be carefully organised, supervised and monitored.

1. Number of Nests

The reduction in the number of nests located in 2010 compared to the 2003/2004 survey can be attributed to the fact that there were areas of the river corridor that were not searched during this survey. Some observers also experienced difficulty locating nests even though Regent Parrots were present in their area which also contributed to a lower number of nests being located. Because of time constraints towards the end of the breeding season, decisions were made to concentrate on areas where there were known to be Regent Parrots nesting in 2003/2004. However, the areas that were not visited during this survey do contain River Red Gums that appear to contain hollows that would be suitable as nest hollows. Thus there is insufficient data to determine whether the total number of breeding pairs of Regent Parrots in South Australia has changed since the last full survey in 2003/2004.

There are areas that have been fully searched in the three full surveys since 1991 that show a definite trend. The number of Regent Parrots breeding in the area upstream of Renmark has declined quite markedly in these 20 years and there has also been a movement away from the drowned River Red Gums into live trees (Table 19)

Table 19: Regent Parrot nests upstream of Renmark

		Trees	

Year	Colonies	Alive	Dead	Total	Nests
1991	10	0	65	65	76
2003/2004	7	2	33	35	43
2010	4	11	13	24	26

The biannual surveys conducted in the three selected colonies in an attempt to monitor Regent Parrot numbers also show a decline in nest numbers for this section of the river (Table 20).

Table 20: Biannual surveys Upstream of Renmark

		Trees		
Year	Colonies	Alive	Dead	Nests
2003/4	3	0	32	40
2006	3	0	18	18
2008	3	0	13	13
2010	3	0	12	13

The extent of the decline is markedly different depending on the method used to measure the decline. The survey of the selected colonies shows the number of nesting pairs fell from 40 to 13 (67.5% decline) in 7 years. By considering the full river surveys of 2003/4 and 2010 the number of nesting pairs has fallen from 43 to 26 (39.5% decline). Thus although the downward trend is evident from both survey methods, a true measure of the decline cannot be obtained from the selected colony approach.

The decline in the number of available trees in these drowned tree areas and the possible decline in the quality of the nest hollows (see part A) could account for this decline. If this was the sole reason for the decline, it could be expected that the Regent Parrots would still be present in the area but nesting in live trees. This has occurred to some degree, but does not account for the extent of the decline. Another possibility is that the birds have moved further downstream to locations where there are more live trees to nest in. However, this decline in the number of breeding pairs in the upper reaches of the river in SA could mean that these birds have been lost from the overall population. There have been reports of Regent Parrots being shot (pers. comm.) in almond orchards adjacent to these declining colonies, but this needs further investigation.

The movement of Regent Parrots to adjacent breeding sites is evident in other parts of the river and does not involve drowned River Red Gums. One site that shows this is located in a distinct area of the river and is separate from other colonies. Banrock Station has 4 distinct breeding locations with birds from all 4 sites being a part of the feeding flocks that leave this area. The nearest upstream colony is above Lock 3 at a site 4 km from the Banrock colonies, and the nearest known downstream colony is over 20 km away.

The largest of the Banrock colonies is at Banrock Bend and is one of the 10 selected colonies that were monitored every 2 years from 2003/4. Table 21 shows the decline in numbers that were recorded for

this colony over the 4 biannual surveys. These results indicate that this colony has declined by 40.5% in the number of nesting pairs in the 7 years since 2003/4.

Table 21: Biannual Surveys Banrock Bend

Year	Trees	Nests
2003/4	36	37
2006	36	38
2008	22	25
2010	21	22

The figures for all four of the Banrock Station colonies from the full river surveys in 2003/4 and 2010 are shown in table 22.

Table 22: Banrock Station Nest Numbers from Full surveys

	Banrock Bend		Banrock Creek		Heron Bend		Ball Island		Total	
	Trees	Nests	Trees	Nests	Trees	Nests	Trees	Nests	**Trees**	**Nests**
2003/4	36	37	11	11	0	0	6	6	**53**	**54**
2010	21	22	7	7	5	5	8	8	**41**	**42**

These figures show that the number of nesting pairs in this part of the river has declined by 22.2%. Again the trend is evident, but the extent is grossly overstated when only the selected colonies are considered. In this instance the nests are in live trees and so the movement away from drowned River Red Gums does not account for this decline in population. The drop in numbers could be attributed to the drought (see part A) or some of the breeding pairs could have moved to the nearest colony which is upstream of Lock 3. However this latter move is unlikely to be the case as most of the trees in this upstream site are in drowned River Red Gums. This site upstream of Lock 3 is also one of the sites where the volunteers had difficulty locating the nests.

Three sections of the river (sections E, K and M - see Map 1 in appendix) contained more Regent Parrot nests in 2010 than were recorded in 2003/4 (Table 11). In the other 9 sections of the river that were searched during this survey there was a decline in numbers. The movement of Regent Parrots from these declining colonies to the areas that have increasing numbers of nesting pairs would appear to be a possible answer. This raises the question as to why some areas have become less attractive to these Regent Parrots or why these other areas have become more attractive. The declining numbers and quality of hollows in drowned River Red Gums could partly account for this movement, but this factor was not an issue in four of the declining sections of the river. More research is needed to ascertain if the sites that are declining are becoming less attractive and the reasons for this reduction in suitability.

The establishment of four new colonies since the 2003/4 survey may provide some insight into what has made some areas more favourable for breeding. One of these new colonies is in a section of the river where the number of breeding pairs of Regent Parrots has declined dramatically since 2000. This colony at Wiela (upstream of Renmark) is located in live trees and is within a few kilometres of declining or lost colonies that are/were in drowned River Red Gums. The Red Gums in this newly discovered colony are large old live trees that contain a number of hollows.

Good numbers of Regent Parrots nested in the drowned trees upstream of Renmark until 2000 (Table 2) and then numbers began to decline. As no nests were located at Wiela in the 2003/4 survey, the growth of this colony did not coincide with the large decline elsewhere in this section of the river. This colony has established in the past 7 years. The site has experienced the same general health trends exhibited by similar stands of large old Red Gums on the inside of river bends all along the river. The lack of river flows and years of drought have combined, causing the trees to decline in health and many of the younger ones to die, particularly those farther from the river. However, in 2009 environmental water was pumped into the lower lying areas surrounding this stand of trees giving the area some relief from the conditions of the past few years. This artificial flooding has resulted in an improvement in the health of the Red Gums and the condition of the understorey plants.

The other three new colonies are in sections of the river where numbers have increased. The Southcorp Flat site has also been the recipient of environmental water, as has the nearby Hogwash colony and both of these have increased in the numbers of breeding Regent Parrots since 2003/4. It was also reported by R. Schmitke (pers. comm.) that the Regent Parrots from these colonies were observed feeding on the understorey plants that have regenerated as a result of this environmental watering.

Thus it would appear that improving the health of nest trees and the associated understorey plants by simulating past flooding regimes has resulted in an increase in the numbers of Regent Parrots breeding in some areas. The question arises as to whether this increase is a result of improved breeding conditions for the resident population, or because birds have moved to these locations from other areas. This needs further investigation.

The new colonies at Rilli Island and Pelican Point have not received any environmental flows and the health of the trees in both colonies is at the lower end of the health scale (Table 14).

The result of this array of changes has made it too difficult to determine from this survey whether the Regent Parrot population has altered since the last full survey of the river in 2003/4. Parts of the river corridor were not searched, some were poorly searched, some have increased in numbers of breeding pairs and some have declined. Only a thorough whole of river survey over a single season will provide answers. This needs to be coupled with research on the movement and behaviour of individual birds if we are to gain a full understanding of the population dynamics of this species.

2. Nest Tree Characteristics

2.1 Tree Species

All of the Regent Parrot nests recorded during this survey were located in River Red Gums. However, there have been reports of this species breeding in locations away from the river corridor. Native Pine trees were reportedly used as nest trees in Victoria (V. Hurley – pers. comm.). In SA a young bird that was suffering from poor feather development and was thus unable to fly was located in a mallee area 4 km from the river corridor. These observations add to the intriguing behaviour of this parrot.

2.2 Tree Health

The fall in the numbers of drowned River Red Gums being used as nest trees from 32.3% in 2003/4 to 15.0% in 2010 clearly shows that these trees are being discarded by Regent Parrots as nest sites. The combined effects of the loss of available trees due to them falling over and the probable decline in the

nature of the nest hollow due to decay and termite activity appears to have made these areas unattractive as nest sites. It is reasonable to assume that all of the remaining colonies in these drowned trees will disappear in the near future. This is having the greatest effect on the Regent Parrot population upstream of Renmark where most of the nests were previously located in these drowned trees. There are many areas in this part of the river corridor with large old River Red Gums with what appear to be suitable hollows. The newly established colony at Wiela is an indication that some Regent Parrots have moved into live trees. However, the overall number of Regent Parrots nesting in this part of the river corridor has declined by 39.5% in 7 years. It would appear that the loss of these drowned trees is not the only reason for this decline. Loss of suitable feeding areas, drought and interactions with orchardists are possible causes.

The colonies that have increased in size and most of the newly located colonies are generally those containing trees with the highest mean condition class (Table 14). The nine largest colonies from the 2010 survey include a number that have received environmental water in recent years in an attempt to reverse the decline in health of these areas due to the combined effects of a lack of flooding and drought. Four of these colonies (Wiela, Hogwash, Markaranka and Southcorp Flat) have received this supplementary water. These four colonies together contain 39.7% of the nest trees located during the 2010 survey. Hogwash, Markaranka and Southcorp Flat are located adjacent to each other along a 6 km stretch of the river. They contain 106 of the 300 nests (35.3%) in just 2.1% of the river corridor that was surveyed.

The number of Regent Parrots observed feeding on floodplain plants appeared to be much higher than was observed in 2003/4. Several volunteers made a note of this behaviour in their observation diaries. Thus it could be tree health or the health of the understorey that is making some areas more attractive for Regent Parrots to entice them to move their nesting location.

The one colony of the largest 9 from this survey that does not meet these criteria is Rilli Island. The trees are in poor health overall and hollows in several dead trees are being utilized as nest sites. These dead trees appear to be in better condition than most of those further upstream that have been abandoned. They do not show the signs of decay and termite attack present in the upstream dead trees. Perhaps these were more recent casualties. The understorey vegetation is quite healthy, but was not seen to be a common source of food for the Regent Parrots during the time the author spent surveying this island and surrounds. The birds breeding at this site were seen feeding on healthy saltbush and associated understorey plants on the floodplain adjacent to this colony. However, the feeding flocks did not rely on this area alone. When the larger groups of adult birds formed into feeding flocks and set out as a group, they flew well beyond the floodplain. There was not time during this survey to follow any of these feeding flocks.

At Banrock Bend, the main stand of Red Gums is on the inside of a big bend in the river and these trees are amongst the healthiest in any of the colonies. The trees in the ephemeral backwater immediately behind this stand have nearly all died as they have not received any additional water in the past few drought years. The decline in the number of Regent Parrots nesting at this site would appear to be a result of a number of things. When the trees in the backwater died, Regent Parrots ceased to use these trees for nesting. This site is also a favourite breeding site for large numbers of Sulphur-crested Cockatoos and Little Corellas. Many Galahs and Yellow Rosellas were also making use of the hollows at this site. It is reasonable to assume that the competition for nest hollows is a significant issue at this site,

and the mild nature of Regent Parrots would make them the least likely to secure a nest hollow in the presence of such competition, possibly causing them to move away.

The prolonged drought has resulted in poor flower and seed production in adjacent mallee areas and this has caused a significant drop in bush bird populations in these areas (pers. obs.). Food resources for Regent Parrots would also be scarce and so other sources of food would need to be obtained. Almonds growing in areas that previously produced suitable food for Regent Parrots and flourishing new growth on floodplains could fill this gap. The number of breeding Regent Parrots has increased close to recently watered sites. Thus it seems that in time of drought the health of the understorey plants on the floodplain is a possible key factor in determining if a site is to be utilized as a breeding site.

The combined effects of drought (reducing the mallee food source), environmental watering of some sites , the loss of drowned trees as nest sites due to the deterioration of these sites and possibly interactions with almond growers could have resulted in Regent Parrots moving from traditional nesting sites to form new colonies or to increase the size of existing colonies.

2.3 Distance to Water

The higher proportion of nest trees that are within 100 m of water in this survey compared to the 2003/4 survey can partly be attributed to recent tree deaths. The trees in backwaters that have died due to a lack of flooding and drought have mostly been abandoned as nest trees. It appears that Regent Parrots favour live trees and long dead trees with hollows for nesting in preference to trees that have died in the past few years.

Some sites (eg Markaranka and Southcorp Flat) that contained few nests in 2003/4 possibly due to the deteriorating health of the trees, have dramatically increased in the number of nests contained in them since those sections of the floodplain received pumped environmental water. These trees are adjacent to backwaters that contained water during the 2010 survey and so adds further to the number of nests that were less than 100 m from water.

The two live trees that were located at distances of 400m and 500m from the water's edge were in poor health and would be expected to die in the near future, however, the high river flows after the 2010 breeding season should see these trees flourish for the next year or two. Research would suggest that these trees will quickly decline unless they are provided with water again within another year or two after this watering (M Schultz pers. comm.).

2.4 Nest Hollow Characteristics

The number of trees containing more than one Regent Parrot nest in the 2003/4 survey was 7.9% of the total. In the 2010 survey 35 (14.2%) of the 247 nest trees contained more than a single nest. This could be an indication that the number of available hollows in the increasing colonies and also the new ones is a restricting factor. This could mean that these colonies are near the maximum size possible and may not be able to accommodate many more breeding pairs. Any further growth in the size of these colonies would thus not be likely and so the Regent Parrots would need to find new sites to breed. This may necessitate a move back into less favoured sites that have recently declined in numbers of breeding pairs. The recent high river flows and subsequent flooding of large areas of the floodplain could improve conditions to make these attractive to Regent Parrots again. There is some sense in continuing the

biannual surveys, at least in the short term, to see if the 2010/11 natural flood event will rejuvenate these sites as breeding areas for Regent Parrots. Conversely, if the move away from these declining sites has been for some other reason, there would not be expected to be any recovery in the numbers of nesting Regent Parrots.

The use of small and medium sized nest hollow entrances is hypothesised to be related to predator avoidance. Competition for nest hollows in some colonies may be the reason for some pairs resorting to nesting in hollows with larger entrances. This is particularly evident in the growing and new colonies in the downstream sections of the river. With a finite number of hollows with suitable entrance size, it appears that some pairs have taken the risk of being predated rather than not nest at all.

The small and medium sized hollow entrances are more likely to be located in branches. Hollow trunks are generally large in internal dimensions and have large entrances. Where a trunk hollow has a smaller entrance, it is generally a lateral split in the trunk. These can be small enough to attract nesting Regent Parrots, but are not that common, resulting in only 10.3% of nests being located in trunks. Spouts provide the best opportunity for finding one of the desired size entrances with 51.7 % of all nests recorded in this survey being through spouts.

The orientation of the nest entrances appears to be random. This result is consistent with results obtained in other surveys (Smith 2006). It appears that other factors are more important when selecting a suitable nest hollow than the direction that the nest entrance faces.

3. Behavioural observations

3.1 The Yearly Cycle

The rainfall in 2010 was well above average across eastern Australia resulting in improved food resources and tree health both on the floodplain and in the mallee. The increased river flows resulted in much of the floodplain being flooded, which has further enhanced the health of the trees and understorey plants in the breeding areas. This improvement in conditions should improve the chances of Regent Parrots surviving through to the next breeding season and provide an ideal opportunity for a highly successful breeding season next year with increased chances of improving recruitment. Surveys to locate traditional feeding sites and possibly flight corridors would be best approached under such conditions.

3.2 Watering Points

Whilst the good rainfall season and flooding will have no influence on the availability of water near the river in the coming breeding season, the good rains will be advantageous for birds in the non-breeding season.

Large flocks of Regent Parrots seen in mallee areas in summer through to winter have been observed drinking from dams and other opportunistic watering points. Dams have been established in low lying areas throughout the mallee north of the river in situations where water would have previously accumulated after rain. Where these dams hold water for some time Regent Parrots have used them throughout the non-breeding season. On Gluepot Reserve most of these dams have been closed, but have been replaced with elevated water troughs with bird hides. Large flocks of up to 200 Regent

Parrots have been recorded visiting these locations. With all of these water sources available, the Regent Parrots will be able to range widely to access abundant resources.

3.3 Food

Many of the traditional mallee areas where Regent Parrots previously fed during the breeding season have been replaced by horticulture crops, and so the flocks have had further to go to reach suitable native food supplies. These flocks fly through corridors of vegetation wherever possible and sometimes these corridors of vegetation have an attraction as a source of food. Green almonds come into this category, and there have been some prosecutions of people who have killed Regent Parrots in other states. There have been unsubstantiated reports of Regent Parrots being shot in almond orchards in this state.

The perceived greater reliance on floodplain vegetation reported in this survey will reduce the chances of these interactions. Both the higher rainfall and the flooding should make even more areas of this floodplain understorey available for the next breeding season. Meanwhile, efforts should be made to further educate and inform growers about Regent Parrots and enlist their assistance in caring for this species.

At the end of the breeding season the flocks that feed in the towns and the horticulture district have been observed feeding on a range of native and non-native species. Where native species still occur in areas throughout the rural district, Regent Parrots have been observed making use of these foods, but flocks have been observed feeding on spilt grain on roadsides and around farming properties. However, some choose to feed closer to orchards and vineyards which can result in conflict with horticulturalists. Destruction permits have been sought for Regent Parrots where they have gathered in big flocks to feed in these fruit growing areas (M. Gemmel – pers. comm.) Investigations revealed that in some cases the birds were visiting those areas to feed on grasses that grow between the vines or trees and may have caused minimal damage to crops when they used the trees to land in prior to descending to the grasses to feed. At other times it was obvious that fruit trees were the food being sought. This was particularly evident where fruit was left on the trees to mature and the grower was not utilizing the crops. Where fruit was being harvested as it ripened there appeared to be little conflict (pers. obs.).

The large flocks reported in mallee areas north of the river, where there are no crops or orchards obviously survive on native species. These resources should be much improved as a result of the good seasonal rains and improve the chances of these birds surviving to the next breeding season.

Conclusions

If all of the river corridor in South Australia is to be successfully surveyed in a single year to obtain an accurate estimate of the Regent Parrot population, more planning and preparation will be required prior to the survey period. The resources required to achieve this goal would be difficult to obtain without the use of volunteers. Even though many volunteers were keen to assist on this survey, those that were unable to devote whole days over a period of days found the task difficult and frustrating. Ideally a small number of volunteers who have a period of several days/weeks to devote to the survey would be able to complete the task most successfully. These people could be trained and then practice their skills during a training course over a few days in a season prior to the survey year. This would enable them to not only learn what is to be recorded but also to gain experience in locating colonies and nest hollows and to become familiar with Regent Parrot behaviour. The involvement of groups of university students could still be accommodated, but an experienced surveyor should spend a couple of days working with these in the field at the commencement of their survey period, because prior training of these volunteers is not possible.

The recording of 100 less Regent Parrot breeding pairs this year than were located in 2003/4 is possibly not a reason for concern at this stage. Because part of the river was not surveyed and some surveyors had difficulty locating colonies and nests, this decline (if indeed there has been a decline) is not as great as the figures suggest. Some decline would also be likely due to the prolonged drought and the big mallee fire combining to reducing foraging opportunities in traditional mallee feeding areas. However, the large decline in the number of Regent Parrots breeding in the area upstream of Renmark is of considerable concern. A detailed study of this section of the river relating to all aspects of Regent Parrot ecology is urgently required, because the total loss of Regent Parrots from this large area would seriously impact on the amount of available habitat for this species in this state.

The movement of nesting sites away from drowned and recently dead River Red Gums shows the need to improve and maintain the health of those still surviving and to enhance recruitment of trees for the future. More regular flooding similar to the conditions experienced prior to the over allocation of water would meet these requirements. It is unlikely that the Murray-Darling Basin Authority will be able to achieve this goal through its basin plan, so engineering options need to be implemented urgently to capitalize on the effects of the current high water flows before the trees again start to decline in health

and eventually die. The predicted effects of climate change with reduced water availability for the Murray-Darling Basin are likely to make these actions even more urgent.

The perceived greater reliance of Regent Parrots on floodplain understorey plants recorded during this survey is of interest and raises a number of questions. Could it be that prior to river regulation Regent Parrots utilized this resource more than has been the situation post the installation of weirs and locks? These structures have enabled large areas of the floodplain to be used for irrigation. Many other floodplain areas have declined in health due to salinity which is a direct result of this river regulation. The regularity of over bank flows that are necessary for healthy floodplain vegetation has also declined significantly in recent years. All of these combined could have made it necessary for Regent Parrots to move out into mallee areas to forage, particularly during the breeding season. The feeding flocks have been reported feeding in mallee vegetation since surveys of this species began back in the 1980's, so we only have a short time of observations to call upon. Burbidge (1985) suggested that "mallee appears to be the most important food source". In this report he made 50 observations of Regent Parrots feeding and only 4% was on native plants not in mallee areas. Could it be that the improved condition of understorey plant on the floodplain is drawing Regent Parrots back to their original food resource and this has resulted in the establishment of some new colonies in areas where this watering has occurred? If this is true, there is a strong case for investigating the possibility of repeating these environmental watering actions at many more locations, particularly near colonies in live trees that appear to be declining.

The converse of this argument could also be true. Regent Parrots could have been forced to reduce their forays into mallee areas due to the effects of the drought and the 2006 fire. This could have resulted in them relying more on foraging on the floodplain and in orchards or other horticulture areas. The frequent reports of Regent Parrots feeding on floodplain plants and on oats support this idea. This raises further questions. Do these food sources provide sufficient nutritional value to enable the Regent Parrots to successfully raise their brood? Will this change of diet bring the Regent Parrots into even more interactions with orchardists in both the breeding and non breeding season?

With the return of good seasons, the Regent Parrots could return to the feeding behaviour observed previously. This may even result in some of the declining colonies increasing again.

The questions posed above and many more need to be investigated if we are to be assured of the survival of this species in South Australia.

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The team of volunteers listed below contributed time and effort to making this survey possible:

Keith Baseley	Sue Nettlefold
Trevor Caldwell	Ellen Ryan-Colton
Barb Dalziel	Bruce Richter
Don Dalziel	Helen Richter
Benita Dillon	Raelene Schmitke
Glen Drogemuller	Roger Schmitke
Dennis Francis	Kevin Smith
Luke Ireland	Phil Strachan
Neil Kroemer	Kate Thorn
Nancy McMurray	Uni of Adelaide Students (3)
John Nettlefold	Uni of SA Students (4)

Recommendations

Recommendation 1:

The population of Regent Parrots in South Australia can only be determined accurately by conducting a full survey of the whole river corridor in this state. A team of trained volunteers who can commit several to many full days to work in the field is essential if this task is to be achieved.

Recommendation:

A team of committed volunteers be assembled and trained well in advance of a full river corridor survey.

Recommendation 2:

Full river surveys require a great deal of planning, organization and commitment by a number of volunteers and so it is not possible to conduct this type of survey more often than every five to six years. However, there is a need to conduct some form of interim survey more often to monitor the status of the birds to detect any dramatic changes in population. The 10 selected colony procedure conducted every 2 years from 2004 to 2010 relied on Regent Parrots exhibiting nest site fidelity that had been observed previously both here and interstate. The establishing of new colonies and the movement away from some traditional nesting locations made the results of these surveys less reliable. They detected the changes in those colonies surveyed, but if broader population trends are deduced from the subset of fixed colonies, then the overall decline trend was overestimated..

The breaking of the drought and the improved health of the floodplain due to the increased river flows may alter the trend of recent years and even reverse this trend. It may be useful to repeat the 10 selected colony surveys for at least another survey season in 2012 to ascertain whether this movement is a permanent one.

Recommendation:

A survey of the 10 selected colonies should be conducted in 2012.

Recommendation 3:

Alternative methods of monitoring Regent Parrot numbers more easily in between full river surveys should be investigated. If resources are available it could be useful to attempt a survey of two or three sections of the river corridor rather than selected colonies to monitor any changes. The section of river below Lock 2 and downstream to Molo Flat would be one possible location for this type of monitoring as it currently contains the largest population of breeding Regent Parrots anywhere in this state. This survey would require a team of volunteers working cooperatively to achieve a successful outcome rather than a single volunteer which has been the case in most of the recent interim surveys. By selecting another section of the river where the numbers are declining for a similar effort, a more accurate monitoring of numbers may be possible.

Recommendation:

Conduct biannual surveys in two sections of the river corridor to test this for monitoring changes in the Regent Parrot population.

Recommendation 4:

The large decline in Regent Parrot numbers upstream of Lock 3 and in particular above Renmark is of considerable concern. There is a need for a detailed investigation into the availability of nest trees and hollows in the drowned River Red Gum colony areas, the extent of possible alternative nesting sites in live trees in that part of the breeding range and the possibility of anthropological interactions resulting in unfavourable outcomes for Regent Parrots.

Recommendation:

Conduct a detailed investigation into all aspects of Regent Parrot survival in the area upstream of Renmark.

Recommendation 5:

Regent Parrot numbers have been monitored for a number of years and incidental observations of behaviour recorded during these surveys. There is a need to understand all aspects of this species' ecology if we are to be able to be certain as to how to enhance its chances of survival into the future.

Recommendation:

A student or students be enlisted to conduct detailed investigations into all aspects of Regent Parrot ecology

Recommendation 6:

The perceived greater reliance of Regent Parrots on areas of the floodplain that have recently received environmental water and the movement of nest sites to these "healthier" areas needs further investigation. This link between environmental watering and Regent Parrot breeding could provide the solution to arresting the decline in this species. Environmental watering should continue to be used to maintain the health of the floodplains in the vicinity of known Regent Parrot nesting areas until this link can be fully researched. Where the health of the vegetation around other known Regent Parrot breeding colonies is declining due to a lack of regular flooding, investigations should be conducted to determine if it is feasible to deliver environmental water to these sites also.

Recommendation:

Continue to seek funding to obtain environmental water for watering floodplain areas that support Regent Parrot breeding colonies.

References

Beardsell, C. (1985) *The Regent Parrot. A report on the nest site survey in south-eastern Australia 1983 to January 1984*. Australian National Parks and Wildlife Service. Report Series No 1.

Burbidge, A (1985) *The Regent Parrot. A report on the breeding distribution and habitat requirements along the Murray River in south-eastern Australia.* Australian National Parks and Wildlife Service. Report Series No. 4.

Department for Environment and Heritage, Murraylands Region. (2009) *Results of the 2008 Regent Parrot Nest Surveys in the SA Murray Darling Basin.* Department for Environment and Heritage, Berri , South Australia.

Harper, M.J. (1989) *Regent Parrot Polytelis anthopeplus Breeding Sites in the Riverland, South Australia, 1989*. Unpubl. Report to S.Aust. NPWS, Adelaide.

Higgins, P.J. (Senior Ed.) (1999) *Handbook of Australian, New Zealand and Antarctic Birds. Vol 4.* (Oxford University Press, Melbourne.)

Hurley, V.G. (2009) *Results of nest site monitoring of active Regent Parrot (Polytelis anthopeplus monarchoides) nests, in the Outlet Creek System, Wyperfield National Park, during spring 2008.* Department for Sustainability and Environment, Mildura, Victoria.

Smith, Kevin. (1992) *The Regent Parrot in South Australia.* Unpubl. Rep. to S. Aust. NPWS, Adelaide.

Smith, Kevin W. (2001) *Regent Parrot Nest Survey 2000. A report on Regent Parrot nesting and monitoring in the South Australian Riverland, September 2000 to January 2001.* Unpubl. Rep. to the South Australian National Parks and Wildlife Council.

Smith, Kevin W. (2004) *Regent Parrot Nest Survey 2003-2004. A report on Regent Parrot nest sites in the SA section of the Murray-Darling basin.* Unpubl. Rep. to the Threatened Species Network.

Smith, Kevin W. (2006) *The Regent Parrot (Polytelis anthopeplus monarchoides). A survey of selected*

nesting sites in South Australia in the 2006 breeding season. Unpubl. Rep. to the South Australian National Parks and Wildlife Council.

Appendices

Appendix 1: **Map 1** Administrative River Sections for Regent Parrot Surveys

Appendix 2: **Map 2** Locations of the 10 Selected Colonies

Appendix 3: **Map 3** Distribution of Nest Colonies in the 2010 Survey

Appendix 4: **Map 4** Areas not surveyed in 2010

Appendix 1: Map 1 Administrative River Sections for Regent Parrot Surveys

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