



City of
Onkaparinga

Corella Research Project



Towards integrated management of
the Little Corella on the
Fleurieu Peninsula

Report by



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on the Fleurieu Peninsula**

FINAL REPORT



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Executive Summary

QED Pty Ltd was engaged by the City of Onkaparinga, Alexandrina Council and the Department for Environment and Heritage to study the ecology of the Little Corella on the Fleurieu Peninsula determine the impacts of this species and assist in the development of a management framework. This followed an increase in complaints in recent years to the City of Onkaparinga and Alexandrina Council of the impact of Little Corellas in Old Noarlunga and Strathalbyn and the methods being used to manage the species.

In Spring 2002, Little Corellas were widely distributed across the Fleurieu Peninsula. Four distinct aggregations were evident, with Little Corellas being found around Inman Valley/Yankalilla/Normanville, Strathalbyn/Currency Creek, Kangarilla/southern suburbs of Adelaide and Harrogate/Callington. There were six confirmed Little Corella breeding records during the course of the study, at Finnis, Ashbourne, Yankalilla and Normanville. All nest sites were in hollows of dead or dying *Eucalyptus* trees located in water bodies or in close proximity to major watercourses. In view of the numerous observations of small groups of Little Corellas across the study area during Spring and the extent of suitable breeding sites, it is likely that breeding is widespread across the Fleurieu Peninsula.

In early Summer the distribution of Little Corellas on the Fleurieu Peninsula became more concentrated, with a corresponding increase in flock size. There was an aggregation of Little Corellas around Strathalbyn and the apparent movement of birds from the Inman Valley/Yankalilla/Normanville area into the southern suburbs of Adelaide. By January 2003 Little Corellas were roosting regularly in both Old Noarlunga and Strathalbyn. The maximum number of Little Corellas recorded during the study was 5,500 in Old Noarlunga in late January and 5,000 in Strathalbyn in early April.

During Autumn 2003 there was an apparent dispersal of Little Corellas from Old Noarlunga to Willunga and the Clarendon–Kangarilla area. It is also possible that Little Corellas dispersing from Old Noarlunga joined flocks in the Strathalbyn area.

Focus group workshops and community questionnaires in Old Noarlunga and Strathalbyn were used to determine social impacts of Little Corellas. Respondents from both towns were in agreement that noise and damage to trees were the greatest impacts of Little Corellas. In Old Noarlunga there was a greater proportion of respondents opposed to the use of shooting as a control technique and a much greater willingness to be involved in future monitoring and management than in Strathalbyn.

Although difficult to quantify, economic impacts of the Little Corellas in Old Noarlunga and Strathalbyn included the cost to Councils of the 'Corella Control Programs' in time, wages and equipment, maintenance of public areas (i.e. ensuring parks and gardens are clean and safe, tree maintenance and street-sweeping) and infrastructure maintenance. Damage to private property was also reported.

In terms of environmental impacts, the noise levels generated by Little Corellas in both Old Noarlunga and Strathalbyn were in excess of the levels recommended by the World Health Organisation guidelines to avoid sleep disturbance and annoyance.

Damage to selected trees in Old Noarlunga and Strathalbyn by Little Corellas was negligible during the course of this study. This reduction in tree damage in comparison to previous years may be attributed to lower numbers of Little Corellas in affected towns this season, with control programs leading to different behaviour than in previous years. Extensive defoliation of trees by Little Corellas occurred in Willunga in April 2003, significantly affecting the appearance of a number of eucalypts.

Other impacts of Little Corellas identified were nutrient input into watercourses and competition with native bird species.

A framework for management of Little Corellas on the Fleurieu Peninsula is proposed. This consists of a process for determining acceptable levels of impacts of Little Corellas, along with a possible control program. A structure to deliver integrated management of the Little Corella is also detailed, comprising data, physical and social management components to be undertaken at the State, regional, Council and local level. This framework for assessing and managing Little Corella impacts can be adapted to other geographic locations and the management of other problem bird species.

The following recommendations are made:

State level

- Establishment of a database for recording the distribution and abundance of Little Corellas across South Australia, in particular the Fleurieu Peninsula, Adelaide Hills and the Adelaide metropolitan area.

Regional level

- Movement studies of marked or radio-tagged Little Corellas during autumn to determine dispersal patterns from Old Noarlunga and Strathalbyn.
- Undertake a regional assessment of the social, economic and environmental impacts of the Little Corella on the Fleurieu Peninsula.
- Undertake a regional assessment of the social, economic and environmental impacts of the Galah on the Fleurieu Peninsula.

Council level

- A review of 'Corella Control Programs' in Old Noarlunga and Strathalbyn.
- Employment of a dedicated officer or consultant by each Council to monitor, implement and manage the 'Corella Control Program' in Old Noarlunga and Strathalbyn.
- Use of 'Corella Watch Kits' designed for the car glovebox, provided to Council employees and the wider community following media campaign.
- Continue the 'Corella Hotline' and promote to the wider community.

Local level

- Continue surveys of Little Corellas in Old Noarlunga and Strathalbyn and involve people who expressed an interest in monitoring via the community questionnaire.
- Review the membership and role of the present Corella Management Groups in Old Noarlunga and Strathalbyn, to ensure that all relevant stakeholder interests are represented.

- Councils to produce regular information to keep the regional, sub-regional and local communities informed of Little Corella management activities.
- Continue to monitor tree health in Council-managed parks in Strathalbyn, Old Noarlunga and Willunga, in conjunction with an arborist. Tree maintenance programs should also be reviewed and replanting of endemic tree species encouraged.
- Watering points, especially water troughs, should be covered in the towns of Old Noarlunga and Strathalbyn.
- Spilt grain should be cleaned up at the flour mill in Strathalbyn.
- Councils should establish an incentive or compensation program to encourage the removal of non-commercial almond trees from Strathalbyn and Old Noarlunga.

Clearly there is no quick fix to the Little Corella problem on the Fleurieu Peninsula. The issue of Little Corellas is symptomatic of the extensive modification of the South Australian landscape since European settlement. This is more than a local issue and will require negotiation and cooperation between stakeholders at all levels to ensure that an appropriate long-term solution is reached.

1. Introduction

1.1 Ecology of the Little Corella

The Little Corella (*Cacatua sanguinea*) is a small species of cockatoo, from 36–39 cm in length and weighing 430–580 grams. The species is distinguished by a short, cap-like crest, whitish to horn coloured bill, a ring of bare blue-grey skin around the eye and a pink tinge to the underfeathers on the head and throat, while the underwing and undertail feathers are washed with yellow (Pizzey & Knight 1997; Rowley 1997). Little Corellas can only be reliably sexed by internal examination (St John 1994).

Vocalisations by the Little Corella consist of a variety of nasal and guttural sounds as well as high-pitched screeches.

The Little Corella is widespread throughout inland, northern and western Australia, but avoiding the higher rainfall areas east of the Great Dividing Range (Pizzey & Knight 1997; Morcombe 2000). Four subspecies are recognised within Australia and a fifth subspecies occurs in lowland New Guinea (Rowley 1997).

Typically a bird of tree-lined watercourses and adjacent plains, the Little Corella utilises a variety of habitats including savannah woodland, mallee, mulga, rangelands, spinifex sandhills, gibber, saltbush, native cypress, crops, stubble, mangroves, offshore islands, dams, tanks, cliffs and towns (Pizzey & Knight 1997; Morcombe 2000).

The Little Corella feeds mainly on the ground, with a diet consisting of seeds and bulbs. Cereal crops and grasses are particularly favoured. As with most bird species, food intake varies with availability. St John (1994) found over 20 different types of seeds in the crops of Little Corellas from the Flinders Ranges. Psyllid casings and Lepidopteran larvae, as well as leaf and bark pieces and gravel were also recorded in the crops of Little Corellas in the Flinders Ranges (St John 1994).

Breeding usually occurs from August – October in southern Australia, although it has been recorded as early as May (Rowley 1997). The nest site is usually in a tree hollow lined with decayed woody fragments, although cavities in cliffs and termite mounds may also be used. Two to three (occasionally four) white, oval eggs are laid per clutch (Rowley 1997). The incubation period is 24 – 26 days, with the parents sharing the incubation duties and care of the young. Nestlings remain in the nest hollow for about 7 weeks. After fledging, the young birds and their parents join a large nomadic foraging flock (Rowley 1997).

Most cockatoos form lasting pair-bonds, with pairs remaining together throughout the year. Being a flocking species means that young Little Corellas can form pair bonds prior to the breeding season. Living in a flock also means that if one member of the pair dies, a replacement can be readily found from within the local flock (Rowley 1997).

Being a strong flier, the Little Corella is capable of travelling long distances to water or abundant and reliable food sources. Outside of the breeding season large flocks are formed with the members tending to roost together (Rowley 1997).

1.2 Background to the project

The Little Corella has been recorded on the Fleurieu Peninsula since the 1930s, with small summer aggregations in the Happy Valley and Hackham/Morphett Vale areas in the 1960s and 1970s (Figure 1a). Large numbers of Little Corellas were first observed in Old Noarlunga and Strathalbyn in about 1990 and the species has since become a regular visitor to these towns particularly over summer, with numbers increasing steadily. Flocks of up to 10,000 birds have been estimated to occur in these towns during summer. Anecdotal evidence also suggests that in recent years, the species is staying in the region for longer, to the point where smaller flocks have reportedly remained around Strathalbyn and Clarendon during the winter months. By 2001 Little Corellas were observed in Port Elliot, Port Noarlunga and Christies Beach for the first time. This may indicate that the species is not only increasing in numbers in the region, but extending its range.

Concomitant with the increase in numbers of the Little Corella was an increase in the number of complaints in recent years to the City of Onkaparinga and Alexandrina Council of the impacts of these birds.

1.3 The need for this project

While there was considerable anecdotal evidence concerning the increase in Little Corella numbers on the Fleurieu Peninsula and their impact, the need for a rigorous, objective assessment was recognised. To this end, this project was designed to:

- Provide quantitative data on the size and movements of Little Corella flocks on the Fleurieu Peninsula;
- Provide quantitative data information on the breeding, feeding and roosting habits of the Little Corella on the Fleurieu Peninsula;
- Objectively identify, assess and quantify the impacts of the Little Corella on the natural environment, built structures and the community on the Fleurieu Peninsula; and
- Assist in the development of a framework for defining acceptable levels of impacts from Little Corellas (including the development of a framework for impact assessment) and strategies to reduce impacts to acceptable levels.

This document reports on the outcomes of this project, undertaken between September 2002 and May 2003.

There were three main components to the research undertaken for this project, namely:

- (1) Documentation of the distribution and abundance of the Little Corella on the Fleurieu Peninsula;
- (2) Assessment of impacts by Little Corellas on the Fleurieu Peninsula; and
- (3) Determining community attitudes towards Little Corellas.

As the methodology used in these project components was quite distinct, they are addressed in separate sections in this report.

2. Distribution and abundance of the Little Corella on the Fleurieu Peninsula

2.1 Study area

The study area was broadly the Fleurieu Peninsula of South Australia, defined as the region south of a line from Adelaide to Harrogate, bounded to the east by the Bremer River, and to the south and west by the mainland coastline (Figure 1b).

2.2 Methods

2.2.1 Spring distribution and abundance

The Spring distribution of Little Corellas was determined by traversing the Fleurieu Peninsula systematically in a vehicle between 25th September and 30th October 2002. During this period approximately 4,000 km were driven within the study area, with all observations of Little Corellas recorded using the datasheet presented in Appendix A. Generally the vehicle was driven at speeds of between 60 – 80 km/hr while undertaking surveys for Little Corellas, and most surveys were undertaken by one observer (Dr Andrew Fisher or Mr Chris Kastelein). While the viewing distance from the vehicle varied considerably depending upon the nature of the vegetation, land use and surrounding landform, conservatively an average view of 100 m either side of the vehicle could be assumed. From this process it is estimated that between 20–25% of the study area was surveyed.

Data recorded included the date, time of observations, location (with GPS coordinates where possible) and the number of Little Corellas present. Additional data recorded as appropriate included the behaviour of the birds, other bird species present and any other information considered relevant.

The Little Corella survey was publicised through a number of avenues including Birds SA, the Fleurieu Birdwatchers as well as through interaction with landholders, friends and other acquaintances. The City of Onkaparinga hosted a Corella Hotline on which members of the public could record their observations of Little Corellas, particularly in the Old Noarlunga area. Data submitted through these other means was included in the overall analysis as appropriate.

2.2.2 Breeding on the Fleurieu Peninsula

Breeding by Little Corellas was recorded opportunistically while undertaking the survey of Little Corella distribution and abundance in Spring 2002. Where single birds or groups of two or three were sighted, particular attention was given to observing these birds in an effort to determine whether these birds were nesting.

Little Corellas were recorded as breeding if they were observed repeatedly returning to a tree hollow. The location of breeding records was recorded using the datasheet in Appendix B. Key data recorded included the date, time of observations, location (with GPS coordinates where possible). Additional data recorded as appropriate included the behaviour of the birds, other bird species present and any other information considered relevant.

2.2.3 Summer distribution and abundance

The Summer distribution and abundance of Little Corellas on the Fleurieu Peninsula from November 2002 – February 2003 was documented in three ways.

From 5th–26th November 2002 and 23rd December 2002 – 13th January 2003, systematic traverses of the Fleurieu Peninsula were undertaken by Dr Andrew Fisher or Mr Chris Kastelein, with data recorded in a similar fashion to the Spring survey. Around 2,000 km were travelled during the Summer survey period, meaning that approximately 10% of the study area was surveyed.

Data continued to be submitted by members of Birds SA, the Fleurieu Birdwatchers, landholders, friends and other acquaintances, as well as via the Corella Hotline. Data submitted through these other means was included in the overall analysis as appropriate.

In Old Noarlunga and Strathalbyn, weekly surveys were organised to enable comparative data to be collected on the distribution and abundance of Little Corella in these towns over the summer period. These surveys were conducted by local residents who were interested in Little Corellas or Little Corella management.

In Old Noarlunga, weekly surveys took place on a Monday evening, between 1830 – 2030 hours, coordinated by Mr Jon Bowman, a resident of Old Noarlunga. These surveys were designed to count the numbers of birds coming in to roost in the Onkaparinga Gorge National Park.

In Strathalbyn, an attempt was made to organise weekly surveys on a Monday afternoon, from 1600 – 1630 hours. Initially the difficulty in determining a time for surveying suitable to those involved and thereafter the lack of reliable volunteers meant this exercise proved generally unproductive. However, Mr William McGuinness, a resident of Strathalbyn, provided a daily diary of observations, mainly from the eastern side of the town.

For the purposes of data analysis, observations of Little Corellas using the different methods were considered separately, in order to prevent biases in the level of survey effort from unduly influencing the presentation of information.

2.2.4 Autumn distribution and abundance

The distribution and abundance of Little Corellas across the study area during March and April was monitored using methods similar to those used for the Summer survey.

Data continued to be collected by Jon Bowman in Old Noarlunga and William McGuinness in Strathalbyn. In addition, five days of field surveys were conducted by Dr Andrew Fisher across the study area, traversing much of the area covering in the Spring and Summer surveys.

2.3 Results

2.3.1 Spring distribution and abundance

Over the period 25th September – 30th October 2002, some 77 separate observations of Little Corellas were recorded or reported within the study area. Observations ranged from single birds up to flocks estimated to be in excess of 500 birds. Over 66% of all records during this period were of flocks of less than 10 birds (Figure 2). Mean flock size was 44.7 (\pm 96.9) birds.

Little Corellas were found from the Adelaide CBD in the north to Cape Jervis in the south, and were widely distributed across the study area (Figure 3).

There were four distinct aggregations of Little Corellas across the Fleurieu Peninsula during Spring 2002 (Figure 4):

- (i) Inman Valley/Yankalilla/Normanville;
- (ii) Strathalbyn/Currency Creek;
- (iii) Kangarilla/southern suburbs; and
- (iv) Harrogate/Callington.

2.3.2 Breeding on the Fleurieu Peninsula

There were six confirmed records of breeding by Little Corellas within the study area during Spring 2002. These were near the towns of Finniss (3 records), Ashbourne, Yankalilla and Normanville (Figure 5).

Each of the nest sites was within a large hollow of a dead or almost dead *Eucalyptus* tree (Table 1). Of the dead trees or stags, four were located within semi-permanent water bodies such as a swamp or farm dam. The two other nest sites were within or in close proximity to major drainage lines, within River Red Gum (*E. camaldulensis* var. *camaldulensis*) associations. All nest sites were in trees within scattered timber and not obviously within close proximity to patches of remnant native vegetation.

Table 1. Little Corella nest sites, Fleurieu Peninsula, Spring 2002.

Easting	Northing	Site description	Hollow location	Other species nesting in same tree
302832	6081389	Swamp	Dead eucalypt	Galah; Common Starling
302844	6081395	Swamp	Dead eucalypt	Common Starling
302845	6081391	Swamp	Dead eucalypt	-
253119	6069485	Creekline	Dead eucalypt	Galah
265341	6077156	Farm dam	Dead eucalypt	
296469	6093014	Adjacent to creekline	Dying eucalypt	-

In view of this spread of confirmed records, it is likely that breeding by Little Corellas is widespread on the Fleurieu Peninsula. Given that this species pairs off to breed (Rowley 1997) and only forms large flocks after breeding, the location of groups of 1 – 4 birds could be used as an indication of breeding activity (Figure 6).

2.3.3 Summer distribution and abundance

The distribution of Little Corellas across the Fleurieu Peninsula from November 2002 – January 2003 is presented in Figures 7 – 9. In November the concentrations of Little Corellas were around Strathalbyn and Normanville, with new observations from Port Elliot and Goolwa. In December there was a marked increase in the numbers of Little Corellas observed in the southern suburbs, while the species was still regular in Strathalbyn. By January observations of Little Corellas were mainly from the southern suburbs and Old Noarlunga, as well as Strathalbyn.

Observed flock size changed considerably over the course of the summer survey. Observations of 25 birds or less constituted 52.1% of the observations in November, 27.7% in December and 8.5% in January (Figure 10).

Old Noarlunga

The numbers of Little Corellas in Old Noarlunga during summer 2002 – 2003 is presented in Figures 11 and 12.

Observations by City of Onkaparinga rangers (Figure 11) indicate that numbers were low until 27th December when a flock of 650 birds was recorded. Thereafter numbers increased to 1750 on 2nd January, then oscillated between 100 and 2,500 birds for most of January. On 28th January an influx of birds saw Little Corella numbers peak at 5,500.

Weekly evening counts of Little Corellas in Old Noarlunga by Jon Bowman follow a similar pattern (Figure 12). Numbers grew steadily until 13th January when 2,430 birds were recorded. Following a slight decrease in numbers, a peak of 4,800 Little Corellas was observed on 3rd February. By late February numbers began to decline and from 10th March onwards no birds were recorded as roosting in Old Noarlunga on a Monday night.

A comparison of the two counting methods in Old Noarlunga reveals similarity in the general trend and close correspondence in terms of the actual number of birds recorded (Figure 13).

Strathalbyn

An indication of the numbers of Little Corellas in Strathalbyn throughout the summer and autumn months is shown in Figure 14. Up to 1,000 birds were present by early November, with numbers reaching 5,000 in early April, before dropping back to around 1,000 birds.

Observations by Alexandrina Council staff, focussing on Soldiers' Memorial Gardens (Appendix C), indicate that between 1,000 to 2,000 birds were present in November. From December through to March around 3,000 birds were present in the town.

2.3.4 Autumn distribution and abundance

The distribution of Little Corellas across the study area during Autumn 2003 is shown in Figure 15, along with an indication of the relative size of the flocks observed.

Over 1,000 Little Corellas were regularly reported in Strathalbyn during March and April (see Figure 14 – McGuinness data). In Old Noarlunga approximately 500 Little Corellas were observed in early March, but by 10th March this species had ceased roosting in Old Noarlunga (see Figure 12 - Bowman data). Corresponding with the decline in numbers in Old Noarlunga large flocks were observed in Willunga. During Autumn Little Corellas were also recorded at Milang as well as in the Kangarilla – Clarendon area and at various locations around Adelaide.

2.4 Discussion

The distribution of Little Corellas across the Fleurieu Peninsula during Spring 2002 was similar to that found during atlas surveys conducted by the South Australian Ornithological Association (now Birds SA) in 1984-85 (Paton *et al.* 1994). As this survey was designed to document changes in bird distribution between 1974-75 and 1984-85, a 10,000 yard grid system was used for atlassing. In the decade between these surveys, the number of grid squares in which the Little Corella was recorded increased from 62 to 90, with this increase occurring in the Adelaide Plains, Fleurieu Peninsula and Southern Mt Lofty Ranges regions. The distribution of Little Corellas in the Adelaide region in 1974-75 and 1984-85 as reported in Paton *et al.* (1994) is shown in Figure 16.

Little Corellas are widely distributed across the Fleurieu Peninsula during Spring. Favoured areas as indicated by flocking of birds during this period are Inman Valley – Yankalilla – Normanville, Strathalbyn – Finniss – Currency Creek, Kangarilla – Clarendon and Harrogate – Callington.

By early summer the distribution of Little Corellas on the Fleurieu Peninsula becomes more concentrated, with a corresponding increase in flock size. In particular an aggregation of birds occurs around Strathalbyn and the southern suburbs of metropolitan Adelaide (Figure 17). It appears that there is a movement of birds from the Inman Valley – Yankalilla – Normanville area into the southern suburbs, with a flock estimated at 5,000 birds recorded at Happy Valley Reservoir during November (Penny Paton, pers. comm.). By January Little Corellas were roosting regularly in both Old Noarlunga and Strathalbyn.

During Autumn 2003 there was an apparent dispersal of the Old Noarlunga birds to Willunga and the Clarendon – Kangarilla area. Little Corellas were also observed around Adelaide and the Adelaide Hills. Little Corellas were still concentrated around Strathalbyn in April 2003 although a small flock was observed at Ashbourne indicating some post-summer dispersal. It is possible that some of the birds from the Old Noarlunga area joined the Strathalbyn flocks. By late May 2003 it appears that there were no Little Corellas remaining in Strathalbyn (David Cooney, pers. comm.), indicating that overwintering was unlikely to occur in the town this year.

A comparison of the numbers of Little Corellas in Old Noarlunga in 2002–2003 with the previous two years indicates a similar trend in numbers, although the build-up to over 1,000 birds was about 3 weeks later during the project period than in previous years (Figure 18). The decline in numbers of Little Corellas in Old Noarlunga occurred around 12 weeks earlier in 2003 than in previous seasons.

When compared with the numbers of Little Corellas observed during Summer, the results of the Spring survey indicate that the majority of the birds congregating in Old Noarlunga and Strathalbyn are from within the Fleurieu region. These roosts of Little Corellas appear to be a supplemented by birds from the east and to the north of the Fleurieu.

Little Corellas are opportunistic in terms of their use of food resources. During the Spring survey Little Corellas were typically recorded feeding on grass seeds and bulbs in paddocks or other grassed areas. During Summer Little Corellas were observed congregating to feed in large numbers in paddocks where stubble remained following harvest. During late Summer and into Autumn, Little Corellas were regularly observed taking grain around stock feed troughs and areas where stock were provided with hay. The extent of agricultural production on the Fleurieu Peninsula indicates that future changes in the numbers of Little Corellas within the study area are not limited by the availability of food resources.

Breeding by Little Corellas proved difficult to substantiate given the time and logistic constraints of this project. It is apparent, however, that the species favours hollows in dead or dying River Red Gums along watercourses or wetlands, including swamps and farm dams. Given that small groups of Little Corellas were observed across a large proportion of the study area during Spring and the extent of suitable breeding sites, it is likely that breeding is widespread across the Fleurieu Peninsula. Breeding birds are quiet in comparison to Summer flocks and thus many go potentially undetected in the absence of intentional surveys.

The small number of roosting sites used by Little Corellas during the period of this study made analysis of roost site characteristics problematic. Favoured roost trees were eucalypts, particularly River Red Gums, and various *Pinus* species. Some roost sites were close to water in the form of creeks or dams, however Little Corellas were rarely observed drinking in the immediate vicinity of the roost site, indicating that the selection of trees over water may be as protection against predation. This may also reflect the occurrence of large River Red Gums along watercourses. Site attachment appears to play an important part in roosting, with Little Corellas returning to given sites in successive years. The gregarious nature of this species means that following breeding, individual birds are likely to join established roosts, thereby increasing the numbers of birds at a given roost.

Roosting or loafing Little Corellas only become a concern when they are impacting upon human concerns, as demonstrated subsequently in this report. Based upon observations during this study it is not possible to accurately predict the location of future roosting or loafing sites. Indications are, however, that any settled area with parks, ovals or other grassed areas which offer a food source, adjacent to stands of eucalypts or pine trees which offer a shelter resource, could become a potential roosting or loafing site for Little Corellas. Further research is needed to determine the features of roosting or loafing sites which make them attractive to Little Corellas.

Little Corellas were often observed in association with Galahs (*Cacatua roseicapilla*) and to a lesser extent Sulphur-crested Cockatoos (*Cacatua galerita*). This was particularly the case when flocks were feeding on the ground in paddocks or on grassed areas. Both Galahs and Common Starlings (*Sturnus vulgaris*) were recorded as nesting in the same trees as Little Corellas. All of these species have benefited from the modification of the landscape of Fleurieu Peninsula since European settlement.

3. Impacts of Little Corellas on the Fleurieu Peninsula

The impacts of Little Corellas are various and some are not readily categorised. However for the sake of clarity, in this report Little Corella impacts are considered under three broad groupings of social, economic and environmental impacts.

3.1 Social impacts: Community attitudes towards Little Corellas

3.1.1 Methods

(a) Focus group workshops

In order to determine community attitudes towards Little Corellas within the study area, two approaches were used to collect information, namely focus group workshops and mail-out questionnaires.

Focus group workshops were held in both Old Noarlunga and Strathalbyn in order to explore community understanding about Little Corellas and provide information for the development of the community questionnaires.

A list of focus group participants from each town was provided by the respective Councils, consisting of members of existing Little Corella working parties or residents who had previously been involved in Little Corella management.

A copy of the PowerPoint presentations used at each workshop is included in Appendix D. The Old Noarlunga workshop was held on 29th November 2002 and involved five participants, while the Strathalbyn workshop held on 11th December 2002 involved seven participants.

(b) Community Questionnaire

A survey of community attitudes to Little Corellas was undertaken in each of the study towns in January 2003.

A copy of these questionnaires is provided in Appendix E.

Each questionnaire consisted of 9 questions, generally designed to elicit Yes or No responses. Space was provided for extra comments from respondents. A Reply Paid envelope was included with each questionnaire.

These questionnaires were distributed direct to all letterboxes in Old Noarlunga (380 houses) on 8th January 2003 and selected streets within the Strathalbyn town centre (213 houses) on 9th January 2003. The due date of return of these surveys was 31st January 2003. The distribution of these surveys was limited in Strathalbyn by the availability of Reply Paid envelopes at Alexandrina Council.

3.1.2 Results

(a) Focus group workshops

Participants' perceptions of numbers of Little Corellas in each town varied considerably, as did their understanding of the breeding distribution of the species. Participants did however generally agree on the location of major roost sites.

Impacts of Little Corellas were considered under the headings of environmental, economic and social impacts. A number of suggestions were put forward for managing the species.

The information recorded during the workshops is presented in Appendix F.

(b) Community Questionnaire

Old Noarlunga

In Old Noarlunga there was a 41.3% response rate to the community survey, with 157 respondents. The responses to individual questions are detailed in Table 2.

Table 2. Responses to Community Questionnaire, Old Noarlunga.

Question	Yes	No	Nil or other response
1. Do you believe Corellas are having an impact in the township of Old Noarlunga?	126 (80.2%)	29 (18.5%)	2 (1.3%)
2. Do Corellas affect your day-to-day activities at present?	74 (47.1%)	78 (49.7%)	5 (3.2%)
3. Have your day-to-day activities been affected by Corellas in the past?	82 (52.2%)	69 (43.9%)	6 (3.9%)
4. Do you think tourists are coming to the township of Old Noarlunga to see Corellas?	40 (25.5%)	104 (66.2%)	13 (8.3%)
5. Do you think that the current Corella control program being undertaken by Council is working?	50 (31.9%)	82 (52.2%)	25 (15.9%)
6. Do you believe that killing Corellas by shooting is necessary for their management in Old Noarlunga?	91 (58.0%)	54 (34.4%)	12 (7.6%)
7. Do you think that some damage to trees in Old Noarlunga would be acceptable provided the trees were able to recover?	88 (56.1%)	63 (40.1%)	6 (3.8%)
8. Do you think it is acceptable for Corellas to move through town in the early morning and evening, provided they are not in town for the entire day?	77 (49%)	66 (42%)	14 (9%)
9. Do you think that the residents of Old Noarlunga should play a more active role in the management of Corellas in their town?	76 (48.4%)	56 (35.7%)	25 (15.9%)

Of the respondents who believed that Little Corellas were having an impact in Old Noarlunga, the majority considered that noise and damage to trees were the greatest impacts (Figure 19a).

Other impacts identified by residents included damage to television antennae and phone and electricity cables, accumulated leaves and droppings on the ground and in the Onkaparinga River, droppings on washing and displacement of other birdlife.

A number of respondents in Old Noarlunga expressed their concern about the noise generated by shooting and the way in which this disturbed children, the elderly and dogs.

42 of the 157 respondents (26.8%) in Old Noarlunga indicated a willingness to be involved in future monitoring and management of Little Corellas by providing their contact details.

Strathalbyn

In Strathalbyn there was a 37.1% response rate to the community survey, with 78 respondents. The responses to individual questions are detailed in Table 3.

Table 3. Responses to Community Questionnaire, Strathalbyn.

Question	Yes	No	Nil or other response
1. Do you believe Corellas are having an impact in the township of Strathalbyn?	69 (87.3%)	7 (8.9%)	3 (3.8%)
2. Do Corellas affect your day-to-day activities at present?	22 (27.9%)	55 (69.6%)	2 (2.5%)
3. Have your day-to-day activities been affected by Corellas in the past?	21 (26.6%)	54 (68.3%)	4 (5.1%)
4. Do you think tourists are coming to the township of Strathalbyn to see Corellas?	11 (13.9%)	61 (77.2%)	7 (8.9%)
5. Do you think that the current Corella control program being undertaken by Council is working?	8 (10.1%)	50 (63.3%)	21 (26.6%)
6. Do you believe that killing Corellas by shooting is necessary for their management in Strathalbyn?	47 (59.5%)	23 (29.1%)	9 (11.4%)
7. Do you think that some damage to trees in Strathalbyn would be acceptable provided the trees were able to recover?	43 (54.4%)	29 (35.7%)	7 (8.9%)
8. Do you think it is acceptable for Corellas to move through town in the early morning and evening, provided they are not in town for the entire day?	47 (59.3%)	19 (24.0%)	13 (16.5%)
9. Do you think that the residents of Strathalbyn should play a more active role in the management of Corellas in their town?	31 (39.2%)	30 (38.0%)	18 (22.8%)

Of the respondents who believed that Little Corellas were having an impact in Strathalbyn, the majority considered that damage to trees was the greatest impact along with noise (Figure 19b). Other impacts identified included droppings on roofs and in rainwater, damage to cars by falling pine cones, and damage to ovals and the bowling green. A high proportion of Strathalbyn's respondents were elderly and indicated that although they were interested, they felt unable to assist practically with monitoring or control because of their age.

In addition to the 50 people who did not think that the control program being undertaken by Alexandrina Council was working (Question 5), 26.6% indicated that they were not aware that Council was conducting a control program.

Only 5 of the 78 respondents (6.4%) in Strathalbyn indicated a willingness to be involved in future monitoring and management of Little Corellas by providing their contact details.

3.1.3 Discussion

There were a number of similarities but also some important differences between Old Noarlunga and Strathalbyn in terms of their responses to the community questionnaire.

Not surprisingly, residents in both towns were in agreement that noise and the damage to trees were the greatest impacts of Little Corellas.

Old Noarlunga had a slightly higher response rate and a much greater expression of willingness to be involved in future monitoring and management than Strathalbyn.

In Old Noarlunga there was a greater proportion of people whose daily activities had been affected by Little Corellas, although Old Noarlunga also had a higher proportion of residents who did not think that Little Corellas were having an impact in their town.

Over one quarter of respondents from Old Noarlunga thought that tourists were visiting their town to see Little Corellas, while in Strathalbyn less than 14% of respondents believed this to be the case.

Some respondents were quite vehement in their responses, e.g. “get rid of the greenies” on the one hand and “Please, get the guns out of our town” on the other. A number of respondents did acknowledge the importance of the community being involved in the management of Little Corellas and made comments such as “thank you for listening”.

Clearly the human dimension of Little Corella management in these towns is of high importance.

Over one third of Old Noarlunga respondents considered that Council’s current control program was working, however in Strathalbyn this figure was only 10%. In Strathalbyn, a considerable proportion of respondents to the community questionnaire were not aware of the Council’s control program. Alexandrina Council needs to ensure that its management program is clearly communicated to residents throughout the town. Those five people who provided contact details should be used in future monitoring programs.

In Old Noarlunga a meeting should be convened of all those who indicated a willingness to be involved in future management and monitoring and who provided their contact details. The purpose of this meeting would be to explore ways in which interested residents could assist the City of Onkaparinga with data collection and management activities and enable an agreed community approach to be determined and implemented.

Misinformation is a major problem with any program seeking to manage problem species. Involving interested groups and individuals in the monitoring and management process, coupled with informing all other residents of activities and the reason for them through the use of a mailout to residents, will help to minimise misinformation.

3.2 Economic impacts

The principal economic impact of Little Corellas is to local Councils. This is due to the cost of 'Corella Control Programs' which includes:

- employee time (field rangers and managers);
- vehicle usage;
- bird deterring devices (shotguns, starter pistols, helikites, etc); and
- employment of contracted shooter.

In addition, maintenance programs to keep public areas clean and safe are required, particularly in areas where Little Corellas cause tree damage. This incorporates park maintenance, tree maintenance and street-sweeping. Some maintenance of Council-owned buildings is also required.

As an indication of the costs involved, in Old Noarlunga the City of Onkaparinga spends an estimated \$30,000 per year on additional park maintenance and streetsweeping, and around \$1,000 on building maintenance in Old Noarlunga during the Little Corella congregation period.

As subsequently discussed in section 3.3.2, the contribution of damage by Little Corellas to tree health is difficult to separate from other factors. The valuation of trees in Council-managed parks in Old Noarlunga and Strathalbyn is provided as part of the arborist's report. The cost of a tree replacement program will clearly depend on a number of factors, such as the timeframe of the program and the species of trees planted.

It has been regularly stated that the noise and pollution of parks caused by Little Corellas leads to a decline in business in both Old Noarlunga and Strathalbyn as visitors to towns do not stay and spend money in the towns. Despite enquiries to the Strathalbyn Chamber of Commerce, Fleurieu Economic Development Board and the Old Noarlunga Traders' Association, no data were made available on the effect of these birds on business in the towns. Financial figures would be available for individual businesses to enable comparisons of turnover during periods when Little Corellas are present with periods when they are not, however there was a reluctance to provide such information. In the course of these discussions it was suggested that the Little Corella causes greater economic losses to the agriculture and horticulture industries, in particular through damage to almond crops (K. Kaak, Fleurieu Economic Development Board, pers. comm.). As the Little Corella has been implicated in the damage of a range of crops throughout Australia (e.g. sunflower, sorghum, millet, canola, wheat, barley, oats, pulses and nuts; see Bomford & Sinclair 2002), this warrants further economic appraisal.

Little Corellas have been blamed for damage to electricity and telephone lines, but despite enquiries to the relevant authorities, no data were made available on the extent of this problem.

Damage to television antennae, roof tiles and trees on private property were reported in a number of ways in the course of this project. It is difficult to quantify the losses incurred in this regard. Damage to cars from falling pine cones was identified through the course of the community questionnaire, but this is likely to be a relatively isolated occurrence.

3.3 Environmental impacts

3.3.1 Noise

Methods

Sonus Pty Ltd was engaged to measure the noise generated by Little Corellas in Old Noarlunga and Strathalbyn. Full details are contained in Appendix G. Noise levels were measured at a number of locations in Old Noarlunga on 4th March 2003 and Strathalbyn on 5th March 2003. Noise levels were also logged from 5pm on 4th March to 7:30pm on 5th March near the Little Corella roost site in the Onkaparinga Gorge National Park.

Results

Average noise levels of Little Corellas were from 52 – 76 dB(A), whilst maximum noise levels ranged between 60 dB(A) and 83 dB(A) (Appendix G). A maximum of around 500 birds were present during these measurements.

Noise from the roost site at Old Noarlunga was highest between 6pm – 7:30 pm and 5am – 7:30am.

Discussion

The noise levels generated by Little Corellas in both Old Noarlunga and Strathalbyn exceed the levels recommended by the WHO guidelines to avoid sleep disturbance and annoyance. For comparative purposes, these levels are also well in excess of the maximum allowable noise levels for industries in a predominantly industrial area, based on the Environmental Protection (Industrial Noise) Policy. Noise levels adjacent to classrooms in Strathalbyn also exceed maximum recommended design sound levels for primary and secondary school classrooms, as determined by the Australian/New Zealand Standard AS/NZS2107.

The noise levels of Little Corellas were determined for flocks of around 500 birds in both towns. A greater number of birds would, not surprisingly, be expected to generate more noise. A flock of 5,000 birds would generate an average noise level approximately 10 dB(A) above that measured, i.e. as high as 86 dB(A), which is clearly well in excess of the guidelines for noise levels discussed above.

3.3.2 Tree health

Methods

Arbortech Tree Services Pty Ltd was engaged to undertake an assessment of the impacts of Little Corellas in relation to tree health in Old Noarlunga and Strathalbyn. Full details are provided in Appendix H. Detailed assessments were undertaken of six trees in Old Noarlunga and ten trees in Strathalbyn in mid-December 2002, with a follow-up visit for comparative purposes in April 2003. As the behaviour of Little Corellas during the study period was somewhat different from previous years, Arbortech also provided general comments as to the impacts of Little Corellas on tree health in Old Noarlunga more generally and in Willunga.

Results

In relation to the trees selected for monitoring during this study, damage to trees by Little Corellas was negligible (Appendix H).

In Old Noarlunga, there were minimal changes in the appearance and health status of the trees assessed. There was a minor change in tree appearance of one of the River Red Gums (Tree 4) in Market Square. It was noted that this tree had been pruned between assessments, and no damage could be categorically attributed to Little Corellas.

In the Soldiers' Memorial Gardens in Strathalbyn, there were generally minimal changes in the appearance and health status of the trees assessed. The Moreton Bay Fig (Tree 9) underwent a thickening of foliage in the higher sections of the crown and epicormic regrowth along the stems. The Sugar Gum (Tree 14) had declined in health and appearance between December 2002 and April 2003.

The extensive defoliation by Little Corellas of trees in Willunga in April 2003 significantly affected the appearance of eucalypts in the Willunga Park in the vicinity of the Rose Garden, with masses of twigs and leaves on the ground beneath these trees.

Discussion

There were negligible changes in appearance and health status evident in the trees monitored over the course of this study in both Old Noarlunga and Strathalbyn. In view of the observations of Council staff and long-term residents in both towns this was not a typical season in terms of Little Corella damage to trees. This is due in part to reasonably successful control programs in the Council-managed parks in both towns in combination with lower than anticipated Little Corella numbers leading to different behaviour than in previous years. A reduction in tree damage may be attributed to fewer birds and a broader distribution of birds this season. It is recommended that further surveys be undertaken in future years to monitor and assess the long term impact of Little Corella damage on trees.

The effect of damage to trees by Little Corellas is cumulative, in that it occurs incrementally over many seasons. From 'snapshot' inspections, it is difficult to separate the impact of Little Corellas from other potential impacts, such as soil, compaction, inappropriate watering regimes and root disturbance. Any damage caused by Little Corellas will be in addition to the stresses already being placed on trees. The tree maintenance regime in Council-managed parks in both Old Noarlunga and Strathalbyn should be reviewed in line with the recommendations in the arborist's report (Appendix H). A tree replacement program should be initiated for Council-managed parks in both towns, in addition to tree planting/habitat restoration programs currently proposed.

3.3.3 Other environmental impacts

Although difficult to quantify, anecdotal evidence from numerous sources suggests that the influx of Little Corellas into Old Noarlunga and Strathalbyn is correlated with a decline in the abundance of native bird species. As a successful competitor for breeding sites the species has the capacity to significantly affect native hollow nesting species.

Little Corellas have the potential to significantly increase the nutrient input into watercourses through:

- leaf and twig fall from defoliation of vegetation;
- erosion from digging into soil along river banks or adjacent cliffs; and
- faecal deposition at roost sites adjacent to watercourses.

4. Towards management of Little Corellas on the Fleurieu Peninsula

4.1 Framework for defining acceptable levels of impacts of Little Corellas

The process for determining acceptable levels of impacts of Little Corellas as outlined in Figure 20 has been developed based upon the insights gained during this project.

Following the reporting of Little Corellas as causing a problem, it is essential to determine if the species is having an impact. In order to do this the nature of the social, economic and environmental impacts need to be determined. Table 4 provides a framework for assessing these impacts, indicating the type of data required and a method for collecting these data. Deciding what constitutes an acceptable level of impact will be the result of agreement between the given Council and affected stakeholders, by way of focus group meetings, community questionnaires and liaison with a Community Reference Group. If the level of impact at a given point in time is considered to be acceptable, the situation should be monitored and reviewed on a regular basis. If the level of impact by Little Corellas is not acceptable then a strategy of reducing impacts to an acceptable level needs to be put in place. Table 5 outlines a possible staged approach for such a Corella Control Program. Critical to the success of any control program is the regular monitoring of Little Corella numbers and the impact of the species, enabling management to be adaptive.

4.1.1 Framework for impact assessment

As indicated above, Table 4 provides a framework for assessing the impacts of Little Corellas. Social impacts need to consider the extent to which people are affected by Little Corellas in undertaking their normal daily activities. Economic impacts will include examining the cost of Corella Control Programs to a given Council, increased Council maintenance costs, costs to individual property owners, decline in revenue to local businesses and the cost to agricultural and horticultural industries through expenditure on Little Corella control and lost production. Environmental impacts to be examined include noise disturbance, effects on tree health, competition with native bird species and other factors such as increased erosion and nutrient input into waterways.

Table 4. Framework for assessing the impacts of Little Corellas

Type of Impact	Nature of Impact	Data Required	Method of Assessment
Social	Disturbance to daily activities	Proportion of community affected and degree to which affected What level of impact is acceptable?	Community survey Community consultation
Economic	Cost to Council of control program Cost to Council of maintenance of parks and infrastructure Cost to individual residents due to damage to property Decline in revenue to local businesses Cost to agricultural/horticultural industry	Annual expenditure on control Annual expenditure on maintenance of Council property Average annual individual expenditure on repairs to property Estimate of annual income lost to town Annual expenditure on control; estimate of lost production	Interviews with Council staff Interviews with Council staff Community survey/Interviews with residents Community survey/Interviews with business owners Survey of agricultural/horticultural companies/Interviews with business owners
Environmental	Disturbance due to noise Decline in tree health Competition with native bird species Other environmental effects (e.g. erosion, increased nutrient input into waterways)	Average and maximum noise levels of birds in affected areas Extent of damage to individual trees over time Predicted survivorship of individual trees Changes in abundance of native bird species over time; proportion of available nesting hollows used Extent of sediment increase and nutrient input into waterways	Monitoring by acoustic engineer Monitoring of individual trees by Council staff using photopoints in conjunction with arborist's assessment Bird atlassing; seasonal survey of hollow use Monitoring of water quality at affected sites

Note: This assessment framework is applicable in determining the impacts of other problem bird species. Additional items may need to be considered under the 'Nature of Impact' depending upon the species and location under consideration.

Table 5. Proposed staged approach for the control of the Little Corella.

This staged approach to control is adapted from action plans developed by the Department for Environment and Heritage in conjunction with the City of Onkaparinga and Alexandrina Council.

Observation	Level of Response	Action
Irregular occurrence of individual Little Corellas at site to be protected, <20 birds	Concealed threat posed	No consistent use of vehicle. Birds approached inconspicuously by ranger on foot. Shooting of scout birds.
Irregular occurrence of individual Little Corellas at site to be protected, <100 birds	Concealed threat posed	No consistent use of vehicle. Birds approached inconspicuously by ranger on foot. Vary use of starting pistol and live shell.
Regular occurrence of Little Corellas at site to be protected, 100–500 birds	Concealed threat posed and associated with other devices	No consistent use of vehicle. Birds approached inconspicuously by ranger on foot. Vary use of starting pistol, Bird Frite and live shell. Use of tinsel in trees to be protected. Use of bird of prey kites. Use of helikites.
Regular occurrence of Little Corellas at site to be protected, 500–2,000 birds	Obvious threat posed and used in combination with other devices	Use of vehicle with flashing light. Birds approached by ranger wearing coloured vest. Vary use of starting pistol, Bird Frite and live shell. Use of tinsel in trees to be protected. Use of bird of prey kites. Use of helikites. Use of remotely activated flashing lights.
Constant occurrence of Little Corellas at site to be protected, >2,000 birds	Direct threat	Use of vehicle with flashing light. Birds approached by ranger wearing coloured vest. Vary use of starting pistol, Bird Frite and live shell. Free feeding at decoy site then trapping and euthanasia. Population reduction at roost sites.

Note: This approach this will generally be applied at the local level (Table 4).

Details for control for a given location should be determined by the relevant Council in consultation with the Community Reference Group and Department for Environment and Heritage (Figure 20). Devices and techniques should only be used in locations from which Little Corellas are to be excluded. Devices should be removed and techniques discontinued as soon as they become ineffective, in order to minimise habituation.

The actions suggested here should be undertaken in conjunction with the other recommendations made in this report (e.g. management of food sources, preventing access to watering points, tree planting activities, etc).

4.1.2 Strategies to reduce impacts

This study has demonstrated that Little Corellas are a problem in the towns of Old Noarlunga and Strathalbyn. This is principally due to the noise generated by roosting flocks although there is some evidence that damage to trees is also occurring.

Table 5 outlines a potential staged approach for the control of the Little Corella at a given location. Such a control program must be adaptive, responding to the numbers and behaviour of Little Corellas in a given season.

Comments on the Corella Control Programs operating in the affected towns during the study period are included under 'Local management' in the following section.

Clearly the key question in terms of management revolves around whether or not population reduction is required or whether birds can be discouraged from congregating in areas where humans are affected. As demonstrated by the movement of birds into Willunga in Autumn, deterring birds from one area may mean that the problem is effectively transferred to another location.

There is a view in some sections of the community that the Little Corella is a native species and therefore it should not be subject to population control measures. However records indicate that it is not endemic to the Fleurieu Peninsula. The first record of Little Corellas from Strathalbyn was in 1939 (Strathalbyn Naturalists Club 2000). By the mid 1970s the species was well established on the Fleurieu Peninsula (Paton *et al.* 1994). Little Corellas arrived on Kangaroo Island in the late 1960s where they rapidly established themselves. Due to their aggressive invasion of nesting hollows and predation of eggs and young, Little Corellas have been implicated in the low breeding success of the threatened Glossy Black-Cockatoo on Kangaroo Island (Garnett & Crowley 2000).

Simberloff (2003) observed that:

The most effective way to deal with invasive introduced species, short of keeping them out, is to discover them early and attempt to eradicate or at least contain them before they spread. This approach has often been successful, but its success has usually relied upon brute-force chemical and mechanical techniques...

In view of the distribution of Little Corellas documented in this study, its adaptability to human-modified landscapes, the availability of suitable feeding, roosting and breeding habitat and its capacity for population increase, it is likely that the species will become more abundant and widespread across the Fleurieu Peninsula. It is the prediction of the author that within 10 years the Little Corella will become a major problem in other towns on the Fleurieu Peninsula as well as in parts of metropolitan Adelaide and the Adelaide Hills if appropriate control measures are not implemented.

St John (1994) demonstrated that large-scale population reduction of Little Corellas in the southern Flinders Ranges was temporarily effective, with bird numbers at roost sites reduced for up to six weeks. Although not conclusively demonstrating a reduction in roost sizes or changes to roost location, habitat modification through restricting access to water and food was advocated by St John (1994) as a means of reducing impacts of Little Corellas, principally because it was a more cost effective approach.

4.2 A structure for delivering integrated management of the Little Corella

In order to management of the Little Corella on the Fleurieu Peninsula to be effective, it needs to be considered from the state, regional, sub-regional and local perspectives. At each of these management levels, social and physical components need to be combined with data collection to ensure a comprehensive and integrated approach. Table 6 provides a proposed framework for delivering integrated management of Little Corellas on the Fleurieu Peninsula.

Table 6. Framework for delivering integrated management of Little Corellas.

Management Level	Management component		
	Data management	Physical management	Community consultation
State	Coordinated database of Little Corella distribution and abundance	Research into ecology and behaviour of Little Corella Refine methods for assessing impacts of Little Corellas	
Regional	Maintain database of Little Corella distribution and abundance	Movement studies of marked or radio-tagged birds	Regional community kept informed through regular media releases Promotion of 'Corella Watch Kits'
Sub-regional (Council)	Maintain database of Little Corella distribution and abundance All Council employees issued with 'Corella Watch Kits'	Review of efficacy of control methods	Sub-regional community kept informed through regular media releases Promotion of 'Corella Watch Kits'
Local (Town)	Little Corella monitoring program involving local volunteers Assessment of impacts (Table 4)	Management of food resources - clean up spilt grain - remove non-commercial almonds Management of water resources - cover watering points Implement staged control program (Table 5)	Develop comprehensive consultation strategy involving all stakeholders Establish Community Reference Group Local community kept informed through regular media releases and householder mailouts Promotion of 'Corella Watch Kits'

NB: This framework, in particular the regionalisation of Little Corella management, builds on the Action Plan for Managing the Impacts of Native Birds (Wildlife Advisory Committee 1998).

4.2.1 State management

The Little Corella problem demonstrated in Strathalbyn and Old Noarlunga also occurs at a number of locations across South Australia (e.g. Quorn/Melrose in the Flinders Ranges; Kapunda and Gawler in the mid-north; the Barossa Valley; Loxton and Barmera in the Riverland). Little Corellas, as with all birds, do not recognise the boundaries that humans place on the landscape. This study has demonstrated while the majority of birds congregating in Old Noarlunga and Strathalbyn over-winter and breed on the Fleurieu Peninsula, a substantial proportion of birds congregating in towns come from outside of the region, particularly to the east and north.

A State-based approach to management is needed to ensure that information gathered in relation to Little Corella management in one area is effectively transferred to other regions. A State agency or organisation (e.g. Department for Environment and Heritage, Local Government Association) should coordinate a State-wide database of observations of Little Corella distribution and abundance. Web-based Geographic Information Systems (GIS) provide a tool for enabling people in any location to enter their observations into a user-friendly database. The nature of the data (e.g. location details, number of birds, date, time and behaviour) can be controlled and updated in real-time.

The relevant State agencies (principally the Department for Environment and Heritage) must continue to support investigations into the ecology and behaviour of the Little Corella, as well as providing a focus for refining the methods for assessing impacts of the species.

4.2.2 Regional management

At a regional level, the database of Little Corella observations generated by this project should be continued to allow changes in distribution and abundance over time to be readily determined. The need for a coordinated database of Little Corella observations at a regional scale is highlighted by the fact that membership of Little Corella flocks changes on a regular basis, as determined by the tagging of individual birds (St John 1994). The mobility of individual Little Corellas means that birds inhabiting a given local area should not be considered as a closed population.

Movement patterns of Little Corellas have been inferred from observational data during this study, so it is recommended that movement studies of marked or radio-tagged birds be undertaken so as to ascertain dispersal patterns in autumn.

It is important that the regional community is kept informed of developments in relation to Little Corella management through regular media updates. This includes updates of the numbers and location of Little Corellas, as well as the management strategies being employed and the reason for these activities.

4.2.3 Sub-regional management

Management at the sub-regional or Council level includes continuing the database of Little Corella observations established during the course of this project.

The continued local monitoring of changes in Little Corella numbers and behaviour is critical in enabling the execution of a responsive control program.

Building on the methodology used in this study, all employees in both Councils should be issued with 'Corella Watch Kits' designed to fit into a car glovebox, containing datasheets (such as in Appendix A) and an explanation as to the importance of the contribution that they can make to the management of the species through their observations. An incentive system could also be adopted with a regular small reward for the most datasheets submitted. Having a large proportion of the Council workforce and their families documenting their observations of Little Corellas, a clearer picture of the ecology of the species would be developed and the capacity for rapid response to potential population increases in undesirable areas improved. This 'Corella Watch' program could be extended to the broader community as a whole.

The efficacy of strategies used for the control of the Little Corella should be assessed at the Council level, as part of the responsive, integrated management program for this species (Tables 5 and 6).

It is important Councils keep the sub-regional community informed of developments in relation to Little Corella management through regular media updates. As with the regional community, this includes updates of the numbers and location of Little Corellas, as well as the management strategies being employed and the reason for these activities.

4.2.4 Local management

Locally, physical management activities involve making the daily activities of drinking, feeding and roosting as difficult as possible for Little Corellas in the affected towns.

Wherever possible, watering points should be covered to prevent access for drinking by Little Corellas, given that around both Old Noarlunga and Strathalbyn, these birds were observed congregating at water troughs. In Old Noarlunga this was on Dungey's property and in Strathalbyn in the paddocks associated with the Eastern Fleurieu School (7–12 campus). Covering of watering points will involve Councils liaising with landholders as appropriate.

Similarly, feeding opportunities such as at the silos associated with the flour mill at Strathalbyn, should be addressed by cleaning up spilt grain. This will have the added benefit of making this area less attractive for other bird species such as the Domestic Pigeon (*Columba livia*). Consideration should be given to the removal of non-commercial almond trees from each of the affected towns. Little Corellas are attracted to these nuts in suburban gardens or abandoned almond groves following breeding, and having established a pattern of arriving at a particular site then move to impact adjacent areas when this food supply is exhausted. An incentive or compensation program may be required from Councils in this respect.

Strategies to deter Little Corellas from establishing regular patterns of activity, particularly roosting, should be undertaken in affected towns. The approaches used in both towns were partially successful over the study period. In Strathalbyn a concerted effort to prevent a build up in Little Corella numbers in the Soldiers' Memorial Gardens through the use of shooting and gas guns saw the birds moved to the eastern side of the town. In Old Noarlunga the shooting of scout birds followed by regular disturbance of flocks congregating in the town using starter pistols and bird frite, largely prevented large numbers of birds from congregating in the town itself. It was evident that Little Corellas had come to associate the flashing light of the rangers patrol vehicle with danger and moved on when this vehicle approached. Little Corellas did however roost in the Onkaparinga Gorge National Park over Summer.

The use of other means such as helikites and tinsel placed in tree tops was also useful for a period. It was noted during this study that Little Corellas became very agitated when birds of prey (e.g. Wedge-tailed Eagle *Aquila audax*, Little Eagle *Hieraaetus morphnoides*, Black Kite *Milvus migrans*, Brown Falcon *Falco berigora*) were present. While falconry is illegal in Australia, options for attracting birds of prey to known roost sites should be explored. The judicious use of simulated raptor figures or kites may prove a useful deterrent in conjunction with other techniques.

In future, similar strategies to deter Little Corellas should be employed in both towns, with the control programs used documented clearly using a daily diary and reviewed on a monthly basis. The key to a successful local bird deterrent program is “vigilance and variation” (Fisher 1992). Vigilance is required in order to be responsive to the arrival of birds, changes in bird behaviour and build-ups in bird numbers. This requires daily observation at both set and random times. In the early stages of this study, Little Corellas were allowed to settle in areas where they were not wanted (e.g. Soldiers’ Memorial Gardens) for some period before any control activities were undertaken. Variation in the methods used is essential because of the capacity of birds to habituate to regular activities. If a particular method is not proving effective, it should be replaced by another. Birds must not be allowed to establish a routine with which they are comfortable. A staged approach to management similar to that already determined for both towns in their ‘Corella Control Programs’ should be adhered to (Table 6). The Action Plan for Managing the Impacts of Native Birds (Wildlife Advisory Committee 1998) and the Victorian Environment and Natural Resources Committee (1995) report on problems caused by cockatoo species should be consulted in the development of local programs for controlling Little Corellas. It is recommended that each Council employing someone to monitor, implement and manage this control program as their sole duty. Without a dedicated person often the response to a build-up in bird numbers comes too late.

Population reduction should be considered at established roost sites in each of the affected towns. Any such activity would need to be done humanely with no effect on non-target species through an approach jointly developed by the local Council, Department for Environment and Heritage and any contractors engaged. Removing a large number of birds from a roost site within a town would provide the opportunity to effectively implement a staged control program. Methods for population reduction include shooting, euthanasia following free-feeding and trapping. It is important that any population reduction activities target adult birds rather than non-breeding birds, given that natural mortality rates in birds are known to be highest in the first two years of life (St John 1994).

In association with the use of ‘Corella Watch Kits’, the Corella Hotline should be continued, with promotion during late winter and spring to maximise data collection opportunities. The counts of Little Corellas being undertaken in both towns should be continued and other people who expressed an interest in assisting with monitoring via the community questionnaire should also be involved.

It is essential to appropriately address the social dimension of Little Corella management at the local level. As demonstrated by the focus group workshops and community questionnaires, it is the fact that the birds’ activities are at odds with those of local residents that management of the species is an issue.

Given the interest expressed in assisting with monitoring and management of Little Corellas in Old Noarlunga, the City of Onkaparinga's present Corella Management Group should be designated the Old Noarlunga Little Corella Community Reference Group and membership reassessed following a meeting of the Council with all relevant stakeholders. This will provide the basis for a comprehensive consultation strategy involving all stakeholders in Old Noarlunga.

In Strathalbyn the Corella Management Group established by Alexandrina Council should be revitalised to ensure relevant stakeholders are adequately represented, and it should similarly be designated the Strathalbyn Little Corella Community Reference Group.

In both Old Noarlunga and Strathalbyn, it is essential that the local community is kept informed about management activities to prevent misinformation. Regular Council newsletters mailed to households in conjunction with media updates would ensure a transparent process in this regard.

4.3 A generic framework for managing problem bird species

Clearly the issue of managing Little Corellas in a human-dominated landscape is not an easy one. In addition to the ecological idiosyncrasies of the species, people's attitudes to the bird and its control must be addressed (Conover 2002). What is proposed in Figure 20 and Tables 4, 5 & 6 is a broad framework for managing the species on the Fleurieu Peninsula, and particularly in affected towns. This generic framework can be modified as necessary for application to other geographic areas, building on the basic elements of data management combined with physical and social activities. It can also be adapted for use in relation to the management of other problem bird species in the same manner.

5. Limitations of this study

This study was limited to a single time period and as such the conclusions reached should be tempered with the caveat that the survey period may have been atypical. In particular the drought conditions prevalent in the study area and more significantly across the mid-north and mallee regions may have reduced Little Corella numbers. Conversely, the large flocks of birds still apparent at the end of this study, particularly around Strathalbyn, may be a result of the absence of environmental triggers for post-summer dispersal. The movement of Little Corellas out of Old Noarlunga and into Willunga and possibly Strathalbyn has not previously been observed.

Discussions with Council staff and local residents indicate that damage to trees by Little Corellas during the course of this study was not as severe as in previous years. While it is not possible to quantify this, it should be borne in mind when considering the arborist's reports.

The survey methodology used to determine the distribution and abundance of Little Corellas was not a comprehensive atlas survey. This study was restricted by time, budget and access constraints. As an initial approach to understanding the movements of the species throughout the Fleurieu Peninsula over a season, it was however sufficient to demonstrate general patterns. Given that this was purely an observational study, movements of Little Corellas have been inferred from changes in distribution and abundance.

The community questionnaire provided an assessment of the attitudes of local residents over a three-week period in January 2003. Potentially greater impacts of Little Corellas occurred in both Old Noarlunga and Strathalbyn later in the study period, however the findings from this survey were consistent with the focus group workshops which took a longer-term view of impacts.

6. Directions for further research

As indicated previously, the movement of Little Corellas has been inferred from observations during this study. The Spring observations suggest that at least a proportion of birds which flock in Old Noarlunga and Strathalbyn over Summer are from outside of the Fleurieu Peninsula, possibly from the Flinders Ranges or mid-north or mallee areas to the east. Large flocks of Little Corellas are known to occur at Murray Bridge and Tailem Bend to the east of the study area, and were also incidentally observed at Williamstown and Roseworthy to the north. A study using marked or radio-tagged birds would enable the extent of movements by this species to be determined.

The use of a 'Corella Watch Kit' as suggested earlier, would enable a more thorough coverage of Little Corella distribution and abundance to be obtained, as well as providing the opportunity for decisive instigation of control strategies where appropriate.

The impacts of the Little Corella identified in this study are such that a regional assessment is required. Economic losses in the agricultural/horticultural industries and the conservation implications of the species out-competing native species for breeding sites should be examined across the Fleurieu Peninsula.

Like the Little Corella, the Galah has benefited from agricultural development on the Fleurieu Peninsula, and was not recorded in the region prior to the 1914 drought (J. Eckert, pers. comm.). Galahs have the capacity to form extensive flocks which can damage grassed areas such as ovals and parks, as well as pruning trees while loafing or at roost sites. Being generally quieter than the Little Corella, Galahs may often go unnoticed in terms of their economic and environmental impact. It is also possible that in some situations, Little Corellas are being blamed for the impacts caused, at least in part, by Galahs. The potential impact of Galahs on the Fleurieu Peninsula warrants further investigation.

7. Recommendations

- **Distribution and abundance database**

Establish a database for recording the distribution and abundance of Little Corellas across South Australia, in particular the Fleurieu Peninsula, Adelaide Hills and Adelaide metropolitan area. The use of web-based GIS is recommended, coordinated by a consultant in collaboration with the Department for Environment and Heritage and or the Local Government Association.

- **Movement studies**

Undertake movement studies of marked or radio-tagged Little Corellas during autumn to determine dispersal patterns from Old Noarlunga and Strathalbyn.

- **Review of Corella Control Programs**

The 'Corella Control Programs' operating in Old Noarlunga and Strathalbyn should continue to be reviewed on a regular basis. All management activities and their effects on bird numbers and behaviour should be recorded. Management should be implemented using an adaptive, staged approach, responsive to bird numbers and behaviour, and incorporating new elements or control options as appropriate.

- **Project Officer**

A dedicated officer or consultant should be engaged by each Council to monitor, implement and manage the 'Corella Control Program' in Old Noarlunga and Strathalbyn.

- **Corella Watch Kits**

Implement 'Corella Watch' program in affected Councils, issuing all Council employees with 'Corella Watch Kits' designed for the car glovebox; extend to wider community following media campaign.

- **Corella Hotline**

Continue the 'Corella Hotline' and promote to wider community.

- **Little Corella monitoring**

Continue Little Corella counts in Old Noarlunga and Strathalbyn and involve people who expressed an interest in monitoring via the community questionnaire.

- **Review Community Reference Groups**

The Corella Management Groups currently operating in Old Noarlunga and Strathalbyn should be reviewed, to clearly determine their purpose and ensure their membership is representative of all relevant stakeholder interests.

The City of Onkaparinga's present Corella Management Group should be designated the Old Noarlunga Little Corella Community Reference Group and membership reassessed following a meeting of those who expressed an interest in being involved in future monitoring and management via the community questionnaire.

Alexandrina Council's Corella Management Group in Strathalbyn needs to be revitalised to ensure relevant stakeholders are adequately represented, and it should similarly be designated the Strathalbyn Little Corella Community Reference Group.

Under this model a Community Reference Group would be established in each town where Little Corellas pose a potential problem (e.g. Willunga, Milang) to provide local input into the management of the species being undertaken by the relevant Council.

- **Improved Communication**

Councils to produce regular information, such as media releases, articles in Council newsletters and householder mailings, to keep the regional and local community informed of Little Corella management activities.

- **Restrict Little Corella access to water**

Councils should liaise with landholders to ensure that watering points, especially water troughs, are covered in the towns of Old Noarlunga and Strathalbyn.

- **Management of spilt grain**

Spilt grain should be cleaned up at the flour mill in Strathalbyn in order to restrict feeding opportunities for Little Corellas.

- **Removal of non-commercial almond trees**

Councils should establish an incentive or compensation program to encourage the removal of non-commercial almond trees from Strathalbyn and Old Noarlunga. This will remove a food source attracting Little Corellas to these towns following breeding.

- **Monitor tree health**

Continue to monitor tree health in Council-managed parks in Strathalbyn, Old Noarlunga and Willunga, in conjunction with an arborist.

- **Tree maintenance and replacement**

Review the tree maintenance programs in Old Noarlunga and Strathalbyn and initiate tree replacement program in accordance with recommendations in arborist's report (Appendix H). In addition the establishment of more endemic tree species should be encouraged in both Council areas, particularly in the form of riparian vegetation along watercourses.

- **Regional assessment of Little Corella impacts**

Undertake a regional assessment of the impact of the Little Corella on the Fleurieu Peninsula. This would include an examination of the economic losses in the agricultural and horticultural industries and examination of the extent to which the Little Corella is out-competing native species for breeding sites.

- **Regional assessment of Galah impacts**

Undertake a regional assessment of the impact of the Galah on the Fleurieu Peninsula.

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