Some aspects of the ecology of an urban Corvid: The Australian Raven (Corvus coronoides) in metropolitan Perth

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SOME ASPECTS OF THE ECOLOGY OF AN URBAN CORVID:
THE AUSTRALIAN RAVEN (*Corvus coronoides*) IN
METROPOLITAN PERTH.

BY

P. J. STEWART

A Thesis Submitted in Partial Fulfilment of the Requirements for the Award of Bachelor of Science (Environmental Management) Honours at the School of Natural Sciences, Faculty of Science and Technology and Engineering, Edith Cowan University.

USE OF THESIS

The Use of Thesis statement is not included in this version of the thesis.
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ABSTRACT

The relatively recent and noticeable increase in abundance and distribution of the Australian Raven (*Corvus coronoides*) in the Perth metropolitan area, has led to an increase in the amount of problems associated with the bird resulting in a need to quantify its ecology in an urban context. This research documented the abundance and distribution of the raven, possible reasons for its increase, the basic nesting characteristics, peoples attitudes, basic morphology, food items and problems associated with the bird in Perth and Kings Park. These aims were achieved by using observational field data, culled birds, a newspaper questionnaire and Geographic Information Systems. Results showed that the population of the raven in Perth has increased significantly since 1977, and that the bird was found in higher densities where remnant vegetation had been cleared, and in older suburbs that had high numbers of tall trees. Ravens nest in tall trees between ten and twenty five metres in well covered canopies. Eucalypts were the most common nest tree, though many Norfolk Island Pines and Maritime Pines were also used. Morphology was found to be no different to that found in previous studies, while food items were in significantly different proportions to other research completed on the diet of ravens. 40% of respondents to the questionnaire found the raven to be a problem with the main causes being noise, scavenging and attacks on other birds. Main problem areas were inner suburban areas which correlated with the higher densities of the bird populations. An increase in the availability of food sources is ultimately the cause for the raven population increase and an escalation in the problems associated with the bird. Numbers should be controlled using a systematic culling program in areas where problems are severe, but mainly by the instigation of management techniques aimed at reducing access to and the number of food sources available to the bird.
DECLARATION

I certify that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any institution of higher education; and that to the best of my knowledge and belief it does not contain any material previously published or written by another person except where due reference is made in the text.
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CHAPTER 1: INTRODUCTION

The Australian Raven (*Corvus coronoides*) has significantly increased in abundance and distribution in the Perth metropolitan area over the past two decades. The raven has adapted well to the urban environment which has brought them into greater contact with humans resulting in an increase in the number of problems associated with the bird. Consequently, there has been an escalation in the number of complaints about the ravens to the Department of Conservation and Land Management (CALM), to the Kings Park Authority, and to local councils throughout the metropolitan area. In parks they spread rubbish looking for food, in schools they have been breaking open schoolbags to access lunches and they often wake people in the mornings with their loud calling (P.R. Mawson, personal communication, March 17, 1997). This indicates that the bird may be at a level of abundance that requires management and control.

The fundamental objective of this research is to quantify some aspects of the ecology of the Australian Raven in an urban environment. This will lead to a series of management recommendations based on the findings of the study. The following sections, starting with an overview of human association of corvids in Australia and overseas, provides information which is necessary in understanding the purpose and nature of this research. A general description of the *Corvus* family in Australia follows which includes previous studies that have been completed. This chapter concludes with the rationale and aims of the study, which have been developed as a result of a need to investigate the interactions of wildlife in an urban environment.
1.1 The Genus *Corvus*.

The genus *Corvus* has forty members worldwide, are generally black in colour and are loud, gregarious birds known commonly as crows and ravens. They are often considered to be at the peak of avian evolution because of their intelligence, complex social behaviour, adaptability and success (Strahan, 1996). It is through this adaptability that they have been able to alter their behaviour to encompass a wide range of habitats including those associated with humans. Many corvids have a commensal relationship with humans and frequently come into contact with them, often becoming features of settled areas.

Historically, the reputation of corvids has been influenced by the stories of folklore and legend. The Bible, Shakespeare’s writings, Norse and Celtic mythology, and many native legends portray ravens and crows as either malevolent or benevolent supernatural beings (Armstrong, 1970). Many stories also prevail in Australian Dreamtime legends about the wily cunning of the crow/raven and their connection to fire (Bennell & Thomas, 1981; Mountford and Roberts, 1973; Mudrooroo, 1994). Perhaps it is past beliefs and stereotypic representations in the media that have influenced human opinion of corvids as being evil, dangerous, untrustworthy scavengers (Jones & Everding, 1993).

These beliefs are supported by the fact that some members of the genus *Corvus* have become pests in many countries overseas. Scotland, New Zealand, Canada, Sweden, America, Britain, Mauritius and other nations, have implicated ravens and
crows as being problem species (Andren, 1992; Clark et al., 1995; Conover, 1985; Dunnet and Patterson, 1968; Feare & Mungroo, 1990; Heinrich, 1989; Langham and Porter, 1991; Parker, 1984; Savage, 1997; Sullivan & Dinsmore, 1990; Wilson, 1990). In particular, corvids have become a nuisance in urban areas where there has been a noticeable increase in the abundance of birds. This parallels the phenomenon in Australia which also has experienced a rapid increase in populations within metropolitan areas.

1.2 Corvus in Australia

There are five species of Corvus in Australia, the Torresian Crow (C. orru), the Little Crow (C. bennetti), the Forest Raven (C. tasmanicus), the Little Raven (C. mellori) and the Australian Raven (C. coronoides) (Rowley, 1970a). It is most likely that these birds all stemmed from the same ancestor as they are the only members of the genus with white eyes (Rowley, 1973a). Nearly all species have been implicated as being problem birds and overlapping distributions has sometimes made identification difficult (Debus, 1995). The crows mainly inhabit the arid interior and tropical regions of the north, whereas the ravens generally inhabit the southern more temperate areas (Rowley, 1973d). Both are similar in appearance with ravens being slightly larger and having distinguishing throat hackles (elongated feathers), and voices and calls are also a diagnostic feature between species. Ravens are also often mistaken for, and wrongly called, crows by the layperson.

Agriculture and settlement has benefited most species of Corvus in Australia, though the mainland population of C. Tasmanicus has retreated as its forest refuges are
Cleared (Rowley, 1973a). *C. coronoides* has arguably been the best at adapting to the altered habitats and has increased its distribution into the northern extremes of the continent (Rowley, 1973d). The increase in abundance and distribution of the Australian Raven is a continentwide phenomena that can be attributed to a modern absence of persecution, and an increase in the availability of both water and food sources (Bell, 1984; Recher & Serventy, 1991).

The raven was thought to be a killer of new-born lambs and had a bounty placed on its head by Pastoral Protection Boards (Rolls, 1977). However corvids, in particular the Australian Raven, are responsible for less than 5% of lamb mortality (Madge & Burn). The raven is now regarded as beneficial and rids paddocks of dead and sickly lambs, and afterbirth (Rowley, 1969). All corvids are protected by law in Australia.

Rowley (1967a, 1967b, 1970a, 1973b, 1973c, 1973d, Rowley et al., 1973; Rowley & Vestjens, 1973) compared the ecology, social behaviour, breeding and food of the five species of corvid in Australia. However, this research was completed in rural areas where the birds were considered to be a problem. Little research has been conducted on corvids in an urban environment other than work completed recently on the Torresian Crow (*C. orru*) in Brisbane by Everding (1995) and Jones & Everding (1994).

The movement of the Australian Raven into urban areas is one that has been rather slow since settlement, but has increased in tempo significantly since the 1960s. This has seen it become the dominant *Corvus* species in Canberra, Sydney, Melbourne
(with *C. mellori*) and Perth (Debus, 1995; Jones & Everding, 1994; Taylor, 1992). While ravens are thought to be beneficial in rural areas, the same could be said of the bird in an urban environment. They perform a useful function in many areas by cleaning up discarded refuse and limiting the food available for unwanted vermin. Yet there is a degree of uncertainty associated with corvids in a metropolitan area. Problems are mainly anecdotal and as such tend to be either exaggerated or misconstrued. In Sydney they have been implicated as being nest predators, and in Brisbane *C. orru* has been found to be loud enough at roosting sites for residents to vociferously complain (Jones & Everding, 1994; Major et al., 1996).

The implications of this are that *C. coronoides* has the potential to become a problem to humans and may pose a threat to other urban wildlife. The factors that determine the limits of abundance and distribution may also influence the time of breeding, food habits and other characteristics of this species. A knowledge of these factors is fundamental to an understanding of the ecology of this bird (Rowley *et al.*, 1973). As such, the questions formulated in this research will help to achieve this goal by quantifying these aspects of the bird in an urban context.

### 1.3 Rationale and Aims

Currently, much effort is spent on carrying out research and designing management for the relatively small number of bird species that are threatened throughout Australia (Garnett, 1992). Since European settlement an alarmingly small amount of research has been documented on how Australian wildlife adjusts to
urbanisation. This research discovered some of the aspects of *C. coronoides* interactions within the metropolitan domain, and identified if and why the raven is increasing in numbers within the metropolitan area of Perth. These answers will prove relevant to other cities in Australia where corvids are a problem. This information leads to the formulation of sound management considerations for governing bodies, and perhaps an improved reputation for an intelligent member of the bird community.

The aims of this research project are:

- To quantify the general distribution and identify the population growth status of the Australian Raven within the Perth metropolitan area.

- To quantify the nesting characteristics of the raven in the Perth metropolitan area.

- To document the attitudes of the public, and the problems associated with the bird within the Perth metropolitan area.
CHAPTER 2: THE ABUNDANCE AND DISTRIBUTION OF THE
AUSTRALIAN RAVEN (Corvus coronoides) IN THE PERTH METROPOLITAN AREA.

INTRODUCTION:

The abundance and distribution of the Australian Raven has never been properly documented for the Perth metropolitan area, consequently the exact range and densities of the bird are unknown. With the increase in problems associated with the bird in the suburbs of Perth, there is a need to quantify these factors in the light of implementing management strategies to control numbers in areas where these problems are severe. A knowledge of the distribution and abundance is fundamental to understanding the ecology of an organism as it points out factors that influence its behaviour and limits. The objective of this study is to outline the distribution and abundance of the raven in the urban area, and to hypothesise possible reasons for increases in recent times.

2.1 Introduction

The Australian Raven is a social, gregarious and intelligent member of the bird community. Found throughout the southern part of mainland Australia, it lives in close association with people. It is conspicuous and abundant throughout the agricultural lands and is the most abundant large passerine in Perth and Melbourne. In Canberra and Sydney only the Pied Currawong (Strepera graculina) and the Australian Magpie (Gymnorhina tibicen) are more abundant (Slater, et al., 1997). Despite its abundance,
size and close association with people, there is little information on the ecology and behaviour of the Australian Raven in an urban environment. The lack of basic biological information on the raven is even more surprising given its rapid increase in abundance since the 1960's, and its often adverse effects on people and their property, and its predation on native fauna.

There are probably many reasons for the increased abundance and distribution of the raven in eastern and southern Australia since the 1960's. The expansion of agriculture since the Second World War and the clearing of extensive areas of native vegetation probably increased the area of habitat suitable for the raven. At the same time food and water sources have become more abundant which has allowed the bird to increase its pre-European range. Persecution and control of the raven relaxed after Rowley (1969) found that the raven had only a minor impact on agriculture, and was actually beneficial to farmers.

The rapid expansion of ravens within urban areas is probably unrelated to the changes found in the rural areas of Australia, but the possibility of the migration of country flocks into urban centres cannot be discounted. Indeed Serventy (1948) suggested that many of the ravens in the Swan River District (Perth) were visiting nomads that move seasonally throughout the area and along the Darling Scarp. It is not known whether these migratory patterns are presently followed by the raven.

However, the rapid growth of Australian cities since the 1950's also provided a vast new habitat for the raven with abundant food and water sources. What was required by this intelligent bird to utilise these resources was its habituation to people,
their pets and their associated machinery/paraphernalia. Once a few birds became adjusted to the urban environments, the social behaviour ensured the rapid habituation of the population.

2.1.1. PERTH.

The raven was first documented within the district of Perth in the early 1900s where they were found to be common along the Darling Scarp to the north east of the city area (Saunders & Ingram, 1995). Alexander (1921) noted that the birds were common throughout the Swan River District and were found on both Rottnest and Garden Islands. In the 1930s the raven was a regular visitor to Kings Park, but was not met with in the immediate environs of the city (Serventy, 1938). Serventy (1948) later noted that the raven had become particularly plentiful in the coastal limestone and dune zones of the Swan River District but was scarce near the city.

By the early 1960s the raven was a regular visitor to Perth and its suburbs with its predation habit of searching for the eggs of feral doves and pigeons (Storr & Johnstone, 1988). In the 1970s and 1980s the bird began to consolidate its niche within the metropolitan area as it spread across the district (Saunders & Ingram, 1995). The raven is now a ubiquitous part of Perth's avifauna, often sighted in parks, rubbish dumps, gardens and along roadsides & shorelines (Strahan, 1996).

2.1.2. FOOD & MORPHOLOGY.

The raven feeds chiefly on the ground with a varied diet which includes grain, fruit, plant material, invertebrates, fish, reptiles, eggs, nestlings, weak & sick lambs, rabbits, other birds, refuse and carrion (Barker & Vestjens, 1984; Dorfman & Read,
1996; Goodwin, 1986; Lepschi, 1994; Madge & Burn, 1994; Mykytowycz et al. 1959; Rowley, 1969; Rowley & Vestjens, 1973; Strahan, 1996). Richardson (1988) even noted that ravens have been spotted feeding from *Grevillea petrophiloides* flowers and have fine papillae on their tongues, enabling them to be opportunist nectarvores. Interestingly, almost all references to the Australian Raven state that it is primarily a carnivorous bird, though little has been documented on the diet of the raven in an urban environment.

Comparative studies on the morphological characteristics of the corvids in Australia was completed by Rowley (1970a, 1973a). It was found that there is a cline of decreasing size in the Australian Raven from north to south, and from east to west Rowley (1970a), with the Western Australian birds being the smallest specimens of the species. The birds measured by Rowley in Western Australia were of rural origins and as such any differences in morphology in urban birds was not realised.

This research aims at quantifying the distribution and abundance of the Australian Raven in the Perth metropolitan area. This will be achieved through the use of a Geographic Information System, and data obtained through previous studies conducted by “Birds Australia” (formerly the Royal Australasian Ornithologists Union - R.A.O.U). Possible reasons for these increases will be identified, and management solutions for controlling numbers investigated.
METHODS:

The question in this study asked 'What is the abundance and distribution of the Australian in the Perth metropolitan area?' The continental distribution and abundance was ascertained first, followed by a more concentrated view on the city of Perth. The research then looked into any associations that the raven may have in the suburban area. An opportunity arose to examine the cadavers of some culled ravens which produced data on the morphology and gut content of the birds. The approaches used to collect all aspects of the data are explained below.

2.2 Distribution and Abundance

Three databases were obtained from Birds Australia (formerly the RAOU) with similar data collection techniques used between each.

1) The Atlas Database (1977-81) - (from Melbourne Office)
3) The Perth Metropolitan Bird Survey (1996-Onwards) - (Perth Office)

2.2.1 AUSTRALIA

A distribution and abundance map scanned from the Royal Australasian Ornithologists Union (RAOU) publication by Blakers (1985), was used as a base map for digitising the distribution throughout Australia using the CAD software, Microstation. The original map was constructed of circles indicating density of observations. Distribution lines were added according to the division of density circles in an abundance gradient of absent, low, medium and high. This resulted in the final map that shows the abundance and distribution of the bird within Australia.
2.2.2. PERTH.

2.2.2.a. Distribution.

The information in these databases was collected by RAOU members submitting sheets indicating presence/absence data for birds found at sites on particular days. Point source information on raven presence was then accessed from the databases to give observation distribution throughout the suburbs. Members were not restricted to their own home bases and were sent to different areas to record their data, giving the data more reliable representation of a bird's range.

Not all the point source information was compatible so only the Australian Bird Count and the Perth Metropolitan Bird Survey databases were used in the formation of the distribution map. These were then transposed into Arcview format where they made up the distribution database. The information contained in the new database was flawed in that many records of the same point source were repeated. Consequently the data was thinned to reduce the file size and give a better visual representation of the distribution.

2.2.2.b. Abundance.

Abundance within the Perth area was ascertained with the use of the Atlas Database and the Perth Metropolitan Bird Survey databases. Abundance over the entire Perth area was calculated by dividing the number of bird cards submitted that listed the raven as present, by the total number of bird cards submitted, then multiplying this by 100 to give a percentage (see below). This was completed for the years spanning 1977 - 1981 and 1996.

Cards with raven present / Total number of cards x 100 = % Abundance
2.2.2.c. Densities.

The thinned data were used to produce density maps by the formation of grids over the inner metropolitan area. Arcinfo was used to design the GIS coverages by boxing unique observations into a series of different size grid squares to give an idea of abundance densities. A general overview was obtained by first using 20km x 20km grid squares, which was then reduced to 5 km grid squares to give more concise and localised densities.

2.2.2.d. Remnant Vegetation.

A map of the vegetation remnants in the metropolitan area was based upon a work created by Dr. Steven Connell who formulated a map based on aerial photo interpretation on ground truthings and previously accessed data.

2.3 Morphology & Stomach Contents.

Twenty birds were culled either by professional pest controllers subcontracting to CALM and the Kings Park Authority, or by the Rottnest Island Authority's Wildlife Branch. Morphological measurements of each specimen were taken and stomach contents analysed. All birds were processed within four hours of being shot except for the final seven which had been frozen whereby stomach contents were not analysed.

Stomachs were removed and stored in ethanol solution for dissection and documentation later. Contents were analysed under a dissecting microscope with
percentage breakdown being completed by personal estimation after all items were
identified.

Measurements were made according to the methods outlined by Rowley
(1970a), however only weight, bill length, tail length, and tarsus length were used in
this study. Comparisons were then made between the two studies. Birds in this study
were not selectively culled and some juveniles were included in the final tallies.

RESULTS:

2.4 Australian Distribution and Abundance.

The range of the raven extends to around two thirds of mainland Australia (Figure 2.1)
with the highest concentrations occurring in the southern regions. It does not occur in
Tasmania, the Cape York peninsula or in the north-west of the continent though there
is a diminishing cline of raven concentration from approximately the south-west corner
of Queensland north into the tropics and the Gulf of Carpenteria. The bird inhabits
almost all of the eastern part of South Australia where a connection is made in a
narrow southerly corridor to the western population. In Western Australia the bird is
found from Geraldton/Shark Bay across to the south eastern corner of the state. Its
range extends throughout the South West including the wheatbelt areas and may be
seen as far north as Carnarvon.
2.5 Perth Distribution.

The raven is found throughout the Perth metropolitan area (Figure 2.2) though an area to the north-east of the city, in the vicinity of the Gnangara Pine Plantations, recorded few observations. The most intense concentrations of the bird were found to be in the older suburbs central to the metropolitan area, whereas the more recently built
areas such as the far northern beaches supported relatively few birds. The main population occurs within a 35 kilometre radius of the city centre though outlying communities are found in satellite centres such as Armidale and Mandurah.

Figure 2.2 Map showing the distribution of the Australian raven in the Perth Metropolitan area.
2.6 Perth Abundance.

The abundance figure shows that the raven is gradually increasing in the metropolitan area and has been documented as doing so for the years shown in Figure 2.3. The histogram indicates that the raven increased between 1977 and 1981 at roughly 7% per year, except 1980 where it showed a decrease of 3.2%. The raven appeared in 87.7% of observations in 1996 indicating an increase of 19.3% since the 1980's. This number can be extrapolated to show a rate of increase of 1.38% over the 14 year period between the end of 1981 and the beginning of 1996. This graph also illustrates that the population of metropolitan ravens has increased by 27.3 % since the databases were begun in 1977.

Figure 2.3  Histogram showing the abundance of the Australian Raven in the Perth metropolitan area for the years of 1977 - 1981 and 1996.
2.7 Perth Population Densities.

The population densities of the raven in the Perth metropolitan area are displayed in two formats. Firstly in a wide grid pattern which displays the density as a broad overview of the suburbs, and secondly in a more specific localised map highlighted by smaller grid squares.

Figure 2.4 indicates that the raven is generally found in higher densities in the areas south of the Central Business District (CBD) of Perth. The suburbs to the north east of the city recorded the least amount of observations, with the south western suburbs and more centralised areas showed the highest number of recorded sightings. Suburbs east of these were the second highest densities found within the metropolitan area.
Figure 2.4 Map illustrating bird densities found in the Perth metropolitan area, based on observations made in the Australian Bird Count (1989-1995) and the Perth Metropolitan Bird Survey (1996). Grid size = 20 km x 20 km.
By reducing the size of the grid squares (Figure 2.5), a more accurate idea of bird densities can be ascertained. The raven is found in the highest densities in the suburbs directly to the south west of the city centre. Other high population regions are indicated to be around the southerly suburbs of Winthrop and Willetton. The north eastern suburbs showed a significantly lower number of observations than in other areas in the Perth metropolitan region with observations numbering less than 50 per five kilometre grid square.
Figure 2.5 Map illustrating bird densities found in the Perth metropolitan area, based on observations made in the Australian Bird Count (1989-1995) and the Perth Metropolitan Bird Survey (1996). Grid size = 5 km x 5 km.
2.8 Remnant Vegetation

The following map (Figure 2.6) showing vegetation remnants in the metropolitan area indicates how much clearing has occurred around Perth. The map shows very little in the way of remnant vegetation in the central suburbs of Perth and with only isolated pockets remaining in the form of community based parks.
Figure 2.6 Remnant vegetation map of the Perth metropolitan area.
2.9 Morphology

The cline of decreasing size from east to west suggested by Rowley (1970a) was evident in the results found by this study. Birds examined were smaller specimens than those found in the eastern states, and mean sizes in most measurements were only slightly smaller than readings taken by Rowley (1970a) on Western Australian samples. Figures 2.7 - 2.10 compare the measurements of the two studies and will be discussed further below. Pure chance resulted in ten males and ten female birds being gathered in this study, of which five were immature birds and two had recently fledged. It is assumed that the specimens examined in previous studies were all adult birds.

![Histogram showing the comparison of mean weights (+ S.D, n = 13, 1997) between sexes in Rowley's study (1970a) and this study.](image)

Figure 2.7 Histogram showing the comparison of mean weights (+ S.D, n = 13, 1997) between sexes in Rowley's study (1970a) and this study.

Lower mean weights were recorded in this study when compared to those recorded by Rowley in 1970. This is probably caused by younger birds being measured
in this study which would have lowered the overall average. The maximum and minimum weights in both studies were similar in both sexes.

![Histogram showing the comparison of mean bill lengths (± S.D, n = 13, 1997) between sexes in Rowley’s study (1970a) and this study.](image)

Bill length was virtually identical in both studies with a similar mean being recorded. Range of lengths was greater in this survey with one male specimen having an extremely long bill measuring 58.9 mm, which is longer than all birds of this species measured by Rowley in 1970.
Figure 2.9 Histogram showing the comparison of mean tail lengths (+ S.D, n = 13, 1997) between sexes in Rowley's study (1970a) and this study.

Again mean tail length was marginally shorter in this study than in the previous study due to the younger birds being recorded. There was very little difference in mean tail length between sexes in the 1997 study with measurements being within 1 mm of each other.

Figure 2.10 Histogram showing the comparison of mean tarsus lengths (+ S.D, n = 13, 1997) between sexes in Rowley's study (1970a) and this study.
Mean tarsus length was again very similar between the two studies. Females in this study displayed a slightly smaller mean tarsus measurement but this is probably due to the younger specimens recorded.

### 2.10 Gut Content

The raven had a widely varying diet within the metropolitan area with meat, insects, fruit and bread forming up over 70% of their total items (Figure 2.11). Other articles included seeds and berries from suburban garden trees, as well as some flower parts. Some roughage material was found in the form of sticks, rocks and paper which made up only a small proportion of the stomach contents examined. This latter material was probably stuck to other food material and was ingested in the eating process. It is unlikely that these substances would form a regular part of the ravens diet, though sample size was too small to allow for seasonal differences.
Rowley & Vestjens (1973) placed food items of the raven into three separate categories, flesh, invertebrates and plants. This can also be done with this study and the comparisons between the two studies are shown below in Figure 2.12. It must be remembered that the research completed in 1973 was done in a rural environment.
The previous rural study found the raven to have a higher amount of meat in its diet than did the urban birds of this research. Invertebrate consumption was also higher in the previous study than in this. The urban ravens of 1997 consumed more items of plant origin than was found by Rowley and Vestjens. However, the study by Rowley and Vestjens found that the raven would alter its diet according to availability of food types, which would fluctuate according to the season. This factor was also apparent in the Kings Park birds which had high percentages (100% and 80%) of insects in their stomachs.

**DISCUSSION:**

The distribution of the Australian Raven in Australia roughly parallels the distribution of population of humans in Australia. Most Australians live along the east coast and in the south-west corner of the continent (Recher et al., 1992), which is more
or less mirrored by Figure 2.1. This pattern can also be seen in the distribution and densities of the raven in the Perth metropolitan area (Figures 2.2, 2.4, 2.5), which shows the main observations being found within 20 kilometres of the city centre. But relatively few sightings are made in the outlying newer urban areas suggesting that the bird finds older, more established suburbs more amenable to their requirements. This is probably characterised by the number of suitable nesting trees in these areas which have had time to mature and develop. Consequently, one would expect the abundance and distribution of the raven in Perth to increase as the newer suburbs mature and become more attractive to this mobile bird.

Of interest here is the correlation of the raven population to the clearing of remnant vegetation. Figure 2.2 inversely reflects the distribution vegetation remnants in the metropolitan area. That is, the bird is recorded in areas where the native vegetation has been cleared. Removal of vegetation, particularly for urban use, effectively removes nearly the whole avifauna (Ford, 1989). The raven has been quick to adapt to these changes in habitat and have prevailed better than most other species in the urban areas of Perth. As such a niche has been filled by this opportunistic scavenger where conditions have become favourable. Of relevance here is the fact that the clearing of remnant vegetation and the displacement of avifauna by an opportunistic, dominant species, has repercussions toward biodiversity and the maintenance of remaining population suites of birds within the metropolitan area of Perth.

A superabundance of food is probably the most pertinent factor that can be attributed to the increase in abundance of the Australian Raven in the metropolitan area.
The proliferation of food sources available to the bird has enabled the resident populations to increase over the past twenty or so years (Fig. 2.3). These food sources have resulted from the development of the metropolitan area as the urban regions themselves have expanded. Parks, shopping centres, take-away food outlets and schools have grown in number throughout the suburbs creating a plethora of sources for the opportunistic raven. The raven has reacted favourably to these changes in the urban landscape of Perth, and has adapted its feeding, breeding and social behaviour to best utilise these resources.

The morphological characteristics examined in this practical aligned with those found in previous studies and supported Rowley's findings in 1970 that these birds are the same species found in the eastern states. The food items utilised by the bird in this study reflect those of an omnivorous scavenger quite different to the results found by Rowley & Vestjens (1973). This relates to the fact that the previous study was conducted in a rural area and reflects the availability of food in these regions. Carrion from paddocks and road carcasses are plentiful in the country areas and would allow the bird to include a high proportion of meat in its diet. A much wider variety of foodstuffs is accessible to the raven in an urban environment and it consumes these items as they become available. While the raven has always been considered an omnivorous species, the broader food selection available in the suburbs is one possible reason for their significant increase in abundance.

A number of factors have combined in the increase in abundance and distribution of the raven in the Perth metropolitan area. Every indication shows that management of this
species is required to halt a continued increase over time. These need to be addressed in
the near future and continually reviewed to circumvent any loss in effectiveness resultant
from the adaptability of this intelligent bird.
CHAPTER 3: PROBLEMS AND ATTITUDES ASSOCIATED WITH THE AUSTRALIAN RAVEN IN THE PERTH METROPOLITAN AREA.

INTRODUCTION:

The increase in abundance and distribution of the Australian Raven (C. coronides) in the Perth metropolitan area has resulted in a significant increase in the number of problems associated with the bird, as well as an escalation in the number of complaints received by CALM. Many of these may be legitimate claims, but others may be influenced by modern portrayals of the bird and have little substance behind them. Therefore the objective of this section of the research was to document the problems involving the raven in Perth, and ascertain the scope of attitudes towards it in the metropolitan area.

3.1 Attitudes and Problems

Throughout history ravens and other members of the almost worldwide genus Corvus ('true crows') have suffered from an undesirable reputation connected to doom and deluge (Goodwin, 1986). The association of these birds with humans has led to countless myths and legends, from the earliest civilisations through to the present day. The 'crow' has received a notoriety that has wavered between reverence and fear. Some ancient societies looked upon crows and ravens as messengers of the gods with supernatural powers, while in others the birds were seen as harbingers of death and ill fortune (Armstrong, 1970). Almost everywhere that they have been in contact with humans, an opinion has been formed.
Attitudes towards corvids in Australia have also been of a mixed format. The indigenous people of Australia treated the raven with respect because they played an important part in their mythology and beliefs (Mudrooroo, 1994). All over Australia the corvids are the subjects of many legends which purport to their intelligence, guile and cunning (Bennell & Thomas, 1981; Mountford & Roberts, 1973). It is most probable that corvids long ago made an association with Aboriginal people and scavenged around their camp-sites and resting places (Goodwin, 1978).

The first reference of attitudes towards corvids by Europeans in Australia was made by Joseph Banks in 1770 who commented that they “...were so shy that we could not get near them by any means” and “... a crow in England tho in general sufficiently wary is I must say a fool to a New Holland crow...” (Rowley, 1970a). This suggests that the birds were at first extremely wary of the Europeans, and that Banks regarded them as being of higher intelligence than most other birds. The first settlers undertook an enthusiastic program of poisoning corvids because they were deemed 'likely to be troublesome'. However, the ravens and crows overcame poisoning events by learning what can harm them and regurgitated baits that did not agree with their stomachs (Rolls, 1977). By the 1930s a dichotomy of sorts had arisen across the continent concerning the reputation of 'crows'. In Queensland and New South Wales the birds were described as pests and fiends (Elliott, 1938), but on the other side of the country in Western Australia the birds were regarded as being beneficial (Serventy, 1931). This conflict of opinions did not last and, with the growth of the wool industry, corvids soon became regarded as a problem continentwide.
The increased problems associated with crows led to research that investigated the relationship of corvids with lamb mortality. It was found that corvids, in particular the Australian Raven, were responsible for less than 5% of lamb deaths (Madge & Burn, 1994). Lambs died more frequently from bad weather, poor feeding or abandonment by the ewe, than virtually all lambs fed upon by ravens which are starving or already dead (Strahan, 1996). The raven is now seen to be a benefit to the farmer by ridding the paddocks of dead, weak and sickly lambs and afterbirth (Rowley, 1969).

Reduced persecution from laws protecting the genus has resulted in increased abundance particularly in some of the urban areas of Australia. In Sydney, Melbourne, Canberra and Perth the common corvid is the Australian Raven (Goodwin, 1986). In these cities and some country towns they can be seen in parks, rubbish dumps, gardens, along roadsides and shorelines (Strahan, 1996). In Perth the raven has established itself as a resident species that remains within its environs throughout the year (Saunders & Ingram, 1995). But recently there has been a significant increase in the number of birds within the metropolitan area which has resulted in an escalation of both problems and complaints associated with the bird.

CALM regularly receives complaints about the bird from schools, petitions from suburban residents, grievances from individuals and calls for action around shopping centres (P. R. Mawson, personal communication, March 17, 1997). Another source of complaint is from urban park managers who look upon the bird as a nuisance to park users, and a threat to the native wildlife. As a result, this study looks into these aspects in an urban context, with Kings Park used as a basis for reviewing nuisance factors involved in public places.
3.2 Kings Park

The first documentation listing the raven as being present in Kings Park was between 1928 and 1937 by Dom Serventy (1938). Serventy (1948) noted that the ravens in Kings Park were most probably visiting nomads that exhibit seasonal passage movement throughout the district. Storr & Johnstone (1988) suggested that the raven became a regular visitor to Perth in the late 1960s searching for the eggs of feral pigeons in old buildings. These accounts suggest that the raven was not a resident species in Perth or Kings Park in the not too distant past. Presently the raven can be seen in Kings Park at almost any time of the day. They forage mainly in the various picnic grounds within the park, and nesting sites have been observed in several locations (Recher & Serventy, 1991; Stewart, 1996). Recher & Serventy (1991) suggested that the raven and its increased numbers may have been a factor in the decline of some birds in Kings Park in 1986.

The raven is seen as being a pest by both Kings Park staff and members of the public. In 1995 the Kings Park Authority closed its central refuse facility and changed the bin structure from an open to a closed format in an attempt to limit food resources to the raven (K. Burrell, personal communication, October 29, 1996). The effect of this strategy was a quite noticeable decrease in the birds in certain areas of the park. The Ernst Wittwer Playground was a heavily utilised resource to the raven in previous years and birds were almost always confronted at this site at any time of the year (Recher & Serventy, 1991).
The raven has adapted to these changes to the availability of food and has altered its behaviour so as to access food more readily from other sources. Stewart (1996) found that foraging was mostly carried out at the Arthur Fairall Playground and that numbers of ravens showed a positive correlation to numbers of humans utilising the area. Kings Park represents a tangible area of urban parkland in the Perth metropolitan area, and represents a well used public facility. For these reasons it was chosen for this research.

This project aims to quantify the attitudes of people towards the raven in Perth. It also aims to identify the problems associated with the bird within Kings Park and throughout the metropolitan area. Results should help in the formulation of management guidelines in Kings Park and in the Perth suburban region.

**METHODS:**

3.3 Attitudes

Two methods were used to obtain information on the attitudes of Perth residents to ravens. A questionnaire was published in the Earth 2000 section of the West Australian newspaper on the 19th of May, 1997. This was followed up with a radio interview with Peter Kennedy on Channel 6WF asking for public assistance. The questionnaire (Figure 3.1.) was made simple to maximise responses and designed to determine the nature of problems that exist with the raven, and the identify the areas in Perth that these problems most frequently occur. In addition to the questionnaire visits were also made to particular individuals, schools and suburbs to verify observations and consolidate data.
All correspondence and phone calls were individually scrutinised and tabulated using a Microsoft Excel format. General descriptive statistics were performed where appropriate and percentages calculated for each category of answer supplied.
Q. 1. In which suburb do you live?

Q. 2. Do you have ravens in your neighbourhood?
YES / NO

Q. 3. Are the ravens a problem?
YES / NO

Q. 4. What problems are these?
Noisy  Attacks other birds
Swooping  Attacks children
Damage  Attacks pets
Droppings  Scavenging
Other (please state)

Q. 5. Do you have any general comments on this bird?

Figure 3.1. Raven Questionnaire that appeared with an article on 19/5/97 in the Earth 2000 section of the West Australian newspaper. Respondents were asked to cut out the questionnaire and send it to the researcher.

3.4 Kings Park

As a result of complaints given to the Kings Park Management Authority, research was completed by visiting the main areas of the park where humans congregate. Observations were made at four designated sites over the period of a full
day in daylight hours. Data collection times were from pre-dawn to midday, and from midday to post-dusk. Four sites were surveyed in total (Fig. 3.2.):

**SITES.**
A) The Restaurant Area.
B) The Ivy Watson Playground.
C) The Ernst Wittwer Playground.

Figure 3.2. Map of Kings Park showing the positions of sites where problem observation data was collected over an entire day (daylight hours).
Observations were noted of five feeding events per hour. These were categorised as being natural (ground or foliage foraging on naturally occurring flora/fauna), or as anthropocentric (human made or caused food items). Tallies of both human and raven numbers were noted on an hourly basis, while observations were also made of problems associated with the raven such as food theft or aggression.

3.5 Suburban Zoning

Suburbs were sorted into seven general geographic zones for the purpose of analysis and to ascertain localised patterns (Figure 3.3.). Questionnaire responses helped to formulate zones by frequency of replies and answers to questions 1 and 2.
ZONES
Zone 1 - South Eastern Suburbs.
Zone 2 - Southern Coastal Suburbs.
Zone 3 - Central Coastal Suburbs.
Zone 4 - Northern Coastal Corridor.
Zone 5 - Far Northern Beaches.
Zone 6 - North Eastern Suburbs.
Zone 7 - Central Eastern Suburbs.

Figure 3.3. Map showing the seven suburban zones of the Perth Metropolitan area.
RESULTS:

3.6 Questionnaire

Fifteen hundred responses were received from the questionnaire in Earth 2000 and following the radio interview. The highest responses came from City Beach (38) and Applecross (37). The average response rate per suburb was six. Many replies included additional detailed information including observations, anecdotes, cassette tapes, magazine articles, and photos.

The results indicate that the raven was found throughout the metropolitan area of Perth. Respondents reported an increase in raven abundance in 117 cases (7.8%), with the greatest increases appearing to be within four suburban regions. Zone 1 (23% of responses from that area) showed the second highest increase and Zone 3 (26.5%) the highest. Zones 1, 2, 3 and 4 contributed 72.7% of the total increase responses. 43.7% of people stated that they liked the bird, 17.2% said they didn’t like the bird and 9.4% advocated that culling should be considered in the metropolitan area.

3.6.1 PROBLEMS

Of the 1500 replies, 40 % of the total replies considered the bird a problem. Winthrop (90%) and Wilson (81.8%) recorded the highest percentage of problems. Problem suburbs were identified by two levels of criteria. Firstly, suburbs needed to have a response rate greater than 6, and secondly the number problem replies needed to be greater than 38.5% of the total responses for that suburb. Main problem regions were four of the inner suburban areas, Zones 1, 2, 3 and 4.
The main causes of complaint associated with the bird fell into a number of categories (Figure 3.4.) which are discussed in more detail below.

![Bar chart showing percentages of total problem categories](image)

**Figure 3.4. Main Problems associated with the raven within the suburbs of Perth.** Percentages of the total responses are given for each category.

### 3.6.1.a. Noise.

The biggest problem associated with the bird in the suburbs was that of noise with a return of 33.4% of total replies. People regarded them as being too loud with the birds disrupting classes, waking people, and drowning out other more desirable songbirds. A number of people remarked that they enjoyed the raven’s calls, while 1% of people suggested that their calls were a part of the Australian bush.

### 3.6.1.b. Attacks Birds.

19.9% of people had witnessed ravens attacking a variety of bird species (Table 3.1). 6.3% of the replies said that the raven was often the subject of attack from other birds, with many smaller species harassing them. 1.1% of people also said that the raven is gentle with other birds and will often wait for other species to vacate a food source
before beginning to feed. Domestic fowls were also mentioned as being a victim to raven attack with 4.4% stating that they steal the hens eggs or eat the chicks. Of interest here also is that 1.1% of people witnessed the killing and eating of the Long-necked Tortoise and the endangered Western Swamp Tortoise. Other animals attacked were frogs, possums, lizards and goldfish.

Table 3.1. Bird species predated upon by ravens (percentage of total).

<table>
<thead>
<tr>
<th>Birds</th>
<th>Doves</th>
<th>Ducks</th>
<th>Honey-eaters</th>
<th>Wagtails</th>
<th>Magpies</th>
<th>Wattle-birds</th>
<th>Parrots</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20.8%</td>
<td>13.1%</td>
<td>8.4%</td>
<td>6.4%</td>
<td>5.4%</td>
<td>4.4%</td>
<td>3.7%</td>
<td>37.8%</td>
</tr>
</tbody>
</table>

3.6.1.c. Scavenging.

Scavenging as a negative urban trait was recorded by 22.9% of people in the survey. 3.3% of people disliked ravens because they broke open rubbish bags and made a mess, yet 4.5% of people believed that they were a bonus in an urban environment as they cleaned up unwanted refuse and rubbish. One phonecall from the Subiaco wastewater treatment facility reported that ravens were seen eating corn that floated to the surface in the holding ponds of untreated sewage.

3.6.1.d. Droppings.

10.6% stated that droppings on furniture, cars, washing and walls was a problem. Also mentioned was the problem of birds scavenging on unsanitary food items then creating a health hazard by defecating in playgrounds and schools. An interesting point here is the fact that 5.7% of people stated that the birds often fouled bird baths or pet watering dishes by bathing in them, or by dunking food in the water before eating.
An amusing offshoot of this is the habit that some birds have of tipping over dishes after they have used them.

3.6.1.e. Damage.

While only accounting for 10.0% of the replies, many written responses included comment on the damage that ravens cause within the urban environment. The major complaints were that they: Wrecked flowers and plants (2.3%); steal, eat and destroy vegetables and fruit in gardens (1.9%); render milk useless by pecking holes in the cartons to drink (0.8%); rip off windscreen wipers; peck and destroy Flywire; bend T.V. antennas; break potplants; pull out window putty and insulation; pick insulation from roof; peck and scratch windows; wreck bike seats, reticulation, lawns, furniture and unsecured backpacks and bags. One respondent told how a raven caused a blackout by eating through an electrical insulation cable to a house.

3.6.1.f. Other Problems.

People also noticed in 5.5% of the cases that the raven had either outcompeted other birds in their observations, or contributed to the decline of other species in their area. 3.8% of people stated that they were victims of a swooping event, with the same percentage noticing attacks by ravens on pets. Noticeable anecdotes concerning ravens swooping humans were an instance of an eighteen month old child being harassed to drop a sandwich, a child and real estate agent being continuously divebombed, and a helpless elderly patient in palliative care under threat of losing his eyes from an adult raven. 3.0% also noted that the birds stole petfood and dog bones, sometimes from right under their noses. 2.8% of people also complained that they were continually finding
dog’s bones in either their bird baths or on their roofs. Ravens were also reported to have thieves golf balls from courses.

5.7% of people said how either they or their neighbour fed the birds on a regular basis. A small portion of these people did not like the fact that nearby residents fed the raven as it attracted too many birds which created problems. 2.1% of people stated that they enjoyed the antics of the raven, others thought that they were amusing and a part of the environment.

3.6.2. COMMENTS.

7.20% (108) of the comments referred to the damage and nuisance aspects of the bird, other remarks were categorised into either observations about their intelligence or a miscellaneous section.

3.6.2.a. Intelligence

Twenty comments were made on how clever the bird is with half of these involving the bird showing some sort of ingenuity in the quest for food. The most common response was in regard to ravens obtaining food from a pet. This took the form of one bird distracting the dog/cat while another stole the food item away. Other comments in this category referred to the birds knowledge of firearms and ability to count.

3.6.2.b. Miscellaneous

This category contained 60 comments over a wide range of subjects. Thirty two responses were interesting and different observations of the bird partaking in a variety of
activities. Seven others were ways to control or prevent them from being such a problem. Others defended the bird against persecution or stated something of their evil reputation, while a small number were seemingly ill considered thoughts. Still others pointed to the Bible and religion and gave short stories into the role of the raven in ancient history.

3.7 Kings Park

3.7.1. Bird & People Numbers

The Arthur Fairall Playground was by far the most popular area used by ravens within Kings Park. This site and the Ivy Watson Playground showed similar high levels of human usage, while the Ernst Wittwer Playground was used very little by both Humans and ravens (Table 3.2). The highest number of birds counted was at the A. Fairall Playground with a count of 49 ravens, which also recorded the highest number of people using the area at over 200 at 2.00pm in the afternoon. Both the higher usage Playground recorded numbers of humans over 100 for a period of four hours. All sights recorded a count of zero per hour in both categories at one stage or another.

Table 3.2. Illustrating the average number of birds and people at each site in Kings Park.

<table>
<thead>
<tr>
<th></th>
<th>AF P/ground</th>
<th>IW P/ground</th>
<th>Restaurant</th>
<th>EW P/ground</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average Bird No's per Hour</td>
<td>28.9</td>
<td>3.9</td>
<td>2.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Average People No's per Hour</td>
<td>59.6</td>
<td>60.2</td>
<td>25.8</td>
<td>11.2</td>
</tr>
</tbody>
</table>
3.7.2 Food.

Of the observations made of foraging activities in the morning 72.22% of these were of naturally occurring food articles such as invertebrates, berries etc. In the afternoon (ie. between midday and dusk) 78.13% of the foraging events were of human origin, or caused by human activity. Of the food of human origin, bread (36.73%) and chips (30.61%) made up the majority of food items observed in the survey. Other items consumed were: biscuits (10.20%), fruit (10.20%), chocolate (6.12%), hot dogs (4.08%) and pies (2.04%).

3.7.3 Other Observations.

Eight incidences of people feeding the raven were witnessed with the age groups of those doing the feeding ranging from young children (2 to 5 years old) to elderly people (70's - 80's). Ivy Watson Playground recorded the only incidents of nuisance problems with the bird. These included jumping onto tables while people ate lunch, moving in to bags etc. as soon as a back was turned, and standing near a table of diners calling loudly for food. Also, Ivy Watson Playground had a visitors book which listed 12 separate comments that cited the raven as a problem in the area. Seven of these occurred in August of 1996, four after this month and one before. These comments concerned the safety of the children, health risks and food theft. At all other sites only scavenging events of discarded food scraps and rubbish were seen.

Recently the raven has also been implicated in the damage to rare and endangered species in the plant nursery section at the north-east corner of the park. Numbers associated with this phenomenon range from 6 to 8 birds (N. McQuoid,
personal communication, 14 August, 1997), and this is considered to be a major problem to the staff at this facility.

DISCUSSION:

3.8 Kings Park

The increase in raven numbers and the associated problems in areas of the park subject to frequent human use, indicates that the bird has become dependant on anthropocentric food sources. Despite the problems associated with this dependence, the raven reduces rubbish and consequently the associated pest species such as flies, rats and mice. Worth noting here is that Stewart (1996) found very few ravens in the bush areas of the park indicating that they are attracted to the areas where food is easy to access. It is close contact with humans that has given rise to the majority of complaints which is evident by the remarks in the Ivy Watson Playground (IWP) comments book.

The intelligent and adaptable nature of the raven has given rise to its ability to learn and identify food sources as they become available (Savage, 1997). The IWP attracts only small numbers of ravens but complaints are proportionally higher at this picnic site because of the large number of young children using the facilities there. The raven has adapted its behaviour to gain access to food by scaring children, cawing loudly at the kiosk, and by stealing food from picnic hampers as unwary parents attend to their offspring.
The highest raven numbers evident at the Arthur Fairall Playground (AFP) is indicative of the abundant resources, both natural and anthropocentric. Where the birds were observed feeding on mainly natural food sources in the morning, in the afternoon these were largely anthropocentric. Here the birds are viewed as beneficial, ridding the park of unwanted food scraps. Health considerations are of importance here where the bird comes in close contact with park facilities such as water fountains, picnic tables and barbecue areas.

A resident pair were found at the Restaurant area which would keep numbers of ravens down owing to territorial demands. Most foraging was completed in the direct vicinity of the kiosk though birds were often seen feeding in the carpark behind. Only human associated food was consumed by the bird here again indicating that the bird is beneficial by cleaning up unwanted refuse.

3.8.1. MANAGEMENT IMPLICATIONS

There are a number of management considerations that the Kings Park Authority could use to decrease the problems associated with the raven. Firstly, management should instigate a public awareness campaign by positioning signs at main raven feeding areas, and at the entrances to playgrounds plus kiosks. These should discourage the feeding of any birds within the park, warn of raven problems and promote the self cleaning use of the parks facilities. Secondly, management could increase the density of secure bins at these main problem points to prompt better rubbish disposal by the park users. Thirdly, culling or trapping of birds is an option where problems become severe
and abundance is high. This is only a temporary answer as numbers would be filled rapidly by others as vacancies occurred.

At the plant nursery where birds are damaging seedlings, a trapping program should be implemented to catch the offending birds. Another option may be to fence off the areas so access is denied to the ravens though this may prove expensive. Models of predators and some type of sound device that drives birds away may also be considered. Research is needed into methods of effectively reducing problems associated with the raven. Kings Park is an ideal location to study this because of the location and the number of birds that reside in the park.

3.9 Questionnaire

The questionnaire found that the raven was considered to be a problem in four of the seven zones allocated to the Perth metropolitan area. These inner suburban areas have abundant food sources in the form of schools, universities, shopping centres and fast food outlets. Large numbers of tall trees for nesting and roosting are also a feature which help to fulfil two main habitat requirements of the raven. In addition to this these four regions also contributed to 72% of questionnaire responses stating that the bird had increased noticeably in abundance over the last ten to twenty years. This suggests that problems associated with the raven have only become apparent in the suburbs where numbers reach a certain level.

The problem zones 1, 2, 3 and 4 correlated with the clearing of remnant vegetation in the Perth metropolitan area (Fig 3.5). This map shows the distribution of
remnant vegetation over the Perth metropolitan area. This map can be compared to Figure 3.3 in that the main problem suburbs can be associated with the parts of Perth that have little remaining vegetation remnants. Again this reinforces the fact that the raven has adapted well to settlement, and indicates that the primary food source of this bird in Perth is a result of human activity.
Figure 3.5 Remnant vegetation map of the Perth metropolitan area.
3.10 Problems

Most problems associated with the raven are relatively minor and are simply a product of the bird's natural instincts that can be explained in the terms of the bird testing for edibility of substances, searching for nesting material, territorial behaviour or general mischievous conduct. But the increase in the abundance of birds within the suburbs has meant that problems have intensified and will continue on this path unless management measures are incorporated to control numbers.

The majority of problems are anthropocentric in nature and are a result of a lack of tolerance by people, and a general misunderstanding of the requirements of urban wildlife. Most are minor annoyances and can easily be rectified with a little ingenuity and better maintenance of urban premises and property. Problems such as noise, damage and attacking of pets are often misconstrued by individuals that are influenced by modern media portrayals of the birds as being supernatural creatures. This prejudiced viewpoint has resulted in the raven having a reputation that it does not deserve.

However, the problems of scavenging and defecation are potentially serious health threats to humans, and both are issues that need to be addressed. Schools, playgrounds and outside eating areas are favoured foraging areas for the raven and could feasibly be the source of sickness. The transmission of disease to humans may occur not only by the spreading of garbage and refuse, but also by the contamination of water from droppings, inhalation of faecal dust, direct contact with faeces and contact with the birds associated parasites (Bird Barrier, 1997). Ravens have been witnessed drinking from water fountains in the school playground at Applecross Senior High School (personal
communication). This offers a health risk which is probably applicable to other Perth schools, and as such points to the need for management considerations.

The adverse effect that ravens have on other native fauna has been documented before with Recher and Serventy (1991) suggesting that they were a factor in the decline in some bird species within the park in 1986. Questionnaire responses also implicated the raven in predation upon reptiles, frogs and other birds, while CALM noted ravens predating on the endangered Western Swamp Tortoise (*Pseudemydura umbrina*) at Ellenbrook Nature Reserve (P.R. Mawson, personal communication, March 17, 1997). These factors imply that the increase in abundance of the raven may also have a considerable effect on other urban dwelling fauna.

### 3.11 Attitudes

The majority of the respondents were either indifferent or in favour of the raven in the suburbs. Many of the negative responses towards the raven were adamant disapproval of the bird with little or erroneous explanation given for the reasoning. Again this may stem from misrepresentation in the modern media and past folklore that influences the way some respondents thought.

The raven is continually adapting to life in the suburbs and will continually come into conflict with humans so long as an association prevails. The way that wildlife alters its behaviour to cater for changes in its environment is a measure of how successful they are in the confines of an urban habitat. The raven is fortunate in that it can adapt but is
this to the detriment of other urban species? Further research should be undertaken to look into the impact of these birds on other urban fauna.
CHAPTER 4: NESTING BEHAVIOUR OF AN URBAN CORVID. THE
AUSTRALIAN RAVEN (*Corvus coronoides*) IN THE PERTH METROPOLITAN
AREA.

INTRODUCTION:

The Australian Raven (*Corvus coronoides*) has increased in abundance over the past two to three decades. The adaptive ability of this bird suggests that it has found urban habitats favourable which in turn points towards a successful breeding strategy. Little is known about the factors that influence the nesting habits of ravens in Australian cities, yet the factors that determine this are fundamental to gaining an understanding of the bird in an urban context. The objective of this part of the research is to look at the nesting behaviour of the raven within suburban areas.

4.1 Introduction

*C. coronoides* is a territorial, monogamous bird that reaches sexual maturity between two and three years of age (Rowley *et al.* 1973). Before becoming resident and paired adults, ravens wander in aggregations of independent juveniles, immatures and non-breeding adults (Rowley, 1973* b*). These groups roam constantly, but may remain within an area for extended periods where food is found in abundance. Individuals remain moving within a flock until they are paired off, though sometimes periodic visits are made to the respective birds natal area (Rowley, 1973* b*).
Breeding pairs of birds are sedentary and occupy permanent territories which they vigorously defend against intruders of the same species. Territories in rural environments are approximately 100 to 120 hectares in size with the nest centrally located in a tall tree that can oversee all boundaries (Rowley, 1973b). Extensive clearing, fragmentation of habitat, altered food sources, an abundance of food and water and building structures may change the effective size and shape of territories in an urban environment. This may allow for lower sizes and higher densities of territories which in turn would help to increase the abundance of the birds within the suburbs.

*C. coronoides* was found to have a regular breeding season that ran between July and October, and peaked in early August (Rowley *et al.*, 1973). This pattern was found to rarely alter unless a clutch failed, or some other mishap befell the breeding pair. Polygyny is a rare occurrence in *C. coronoides* though two cases have been documented by Rowley (1973b).

The *C. coronoides* pair construct a large, bowl-shaped nest in anything from five days to three week (Rowley, 1973c). It is a rough configuration of larger, coarse twigs on the outside, lined with any type of soft material lining the inside. They are generally built anywhere between the heights of 6 to 24 metres, and have been known to use human-built structures (windmills, scaffolding, telephone poles, etc) as bases (Rowley, 1973c). Ravens have also been known to re-use nesting trees, nesting sites and even old nests over successive years (Rowley, 1973c).
Rowley (1973c) suggests that four main factors are involved in nest site selection in Australian corvids: the preferred height above ground, the species of tree available, the branching characteristics, and the site of previous nests. Nest site selection in an urban environment may also fall into these criteria, however other factors may also influence their positioning. Distance from a food source and availability of suitable trees may also affect choice.

The adaptive nature of the raven and favourable conditions in an urban environment may have led to changes to one or more of the factors that influence the birds' nesting behaviour and breeding cycles. A basic understanding of these requirements is central to gaining an ecological appreciation of the raven in an urban environment.

The aim of this part of the research is to quantify some of the basic parameters involved in the nesting and breeding of ravens in the Perth metropolitan area.

METHODS:

4.2 Zones

Seven zones were identified within the Perth metropolitan area (Figure 4.1), which corresponded to suburban regions identified in the previous chapter. A minimum of five nests per zone were located, measured and monitored as discussed below.
**ZONES**
Zone 1 - South Eastern Suburbs.
Zone 2 - Southern Coastal Suburbs.
Zone 3 - Central Coastal Suburbs.
Zone 4 - Northern Coastal Corridor.
Zone 5 - Far Northern Beaches.
Zone 6 - North Eastern Suburbs.
Zone 7 - Central Eastern Suburbs.

*Figure 4.1. Map showing the seven suburban zones of the Perth Metropolitan area.*
4.3 Measurements

Each zone was visited for a morning and an afternoon for a period of four to six hours depending on the ease of locating nests, longer was taken if the quota of five nests was not reached. Nests were found by two methods:

1) Public assistance - people informing the researcher the whereabouts of nest locations.
2) Also located by searching for the tallest trees within range of the resident pair.

Measurements were taken of the nest tree and nest height. The locations of nests were taken and tree species identified. Aspect of nest, activity at the nest, surrounding land use and any other general observations were also noted. Where possible the number of chicks raised to fledge was also documented.

Similar measurements were also taken of nests at Kings Park to gain an idea of spatial requirements of ravens, and to ascertain the breeding densities within urban parklands. Distribution of nests within the Park and surrounds was also mapped.

RESULTS:

In this section data will be presented on the different aspects of nesting that were measured in this study. General observations, landuse, nesting trees, nest heights, nest height vs tree height comparisons, aspect and the Kings Park nesting distribution are presented.
4.4 General Observations

Forty one nests were found and measured in the Perth Metropolitan Area, six of which were in Kings Park. The breeding seasons for these pairs was between June and October, though the main nesting period was in July and August. At least three instances of secondary clutch preparation were recorded in the monitored nests after a pair had successfully fledged at least one offspring. Another four pairs were observed preparing second nests in non-monitored sites. Two nests were found to be extremely close to each other (25 metres apart) which both had chicks of around the same age. It is not known whether these nests were from two separate pairs, or from one male with two mates. 78% of nests were found on the northern half of the tree with the rest having either a southerly or easterly facing aspect.

4.5 Nest Heights

The highest nest found was at a height of 30.2 metres in a Norfolk Island Pine at Claremont, with the lowest situated in a jarrah at Redcliffe measuring 8.7 metres. In general the nest height ranged between ten and twenty five metres (Fig. 4.2.) with only a small number being recorded outside these limits. Mean nest height 18.6 metres with a standard deviation of 4.8 metres with twenty six of the nests falling within this range.
A regression and correlation was completed between nest height and tree height to ascertain if any relationship was present between these two factors. As expected there was a strong positive correlation indicating that nest height is dependent on the height of the tree available (Figure 4.3).
Figure 4.3 Scattergram illustrating the relationship between nest height and tree height. The correlation coefficient is close to 1 indicating a strong positive correlation ($r = 0.9471$).

4.6 Nesting Trees

Four different species of tree were used by the raven in the metropolitan area (Fig 4.4.), Tuart (*Eucalyptus gomphocephala*), Jarrah (*E. marginata*), Maritime Pine (*Pinus pinaster*) and Norfolk Island Pine (*Araucaria heterophylla*). All are tall growing species with eucalypts being the more often used trees though others were often used in areas where these were absent. Stands of pines in some suburbs provided another nesting source for the birds and in some areas were chosen over the eucalypts. Foliage coverage seemed to influence species selection with few trees being chosen that had sparse canopies of leaves. 85.0% of nests found in the northern suburbs were in eucalypts, where in the southern suburbs only 38.1% of nests were in these trees. Norfolk Island Pines or Maritime Pines were mainly used for nesting in the southern areas.
Figure 4.4. Bar graph showing the preferred tree species used by the raven in the Perth metropolitan area.

4.7 Landuse

The nesting sites occurred in a variety of different land-use types (Fig. 4.5.), with the most nests being found in urban parks with large trees. These parks were considered to be those areas that are for recreational use and have large expanses of lawn. In residential areas, older suburbs that had mature, tall trees supported a number of nesting ravens. Conversely the newer suburbs like Beaumaris and Currambine, with trees that were young and small, had few raven nests. Six nests were found in Kings Park which was considered to be a bushland remnant. One of the nests found near shops was in the heart of the Central Business District of Perth, at the western end of the Hay St. Mall.
4.8 Kings Park

Six nests were found in Kings Park (Fig. 4.6.), with four of these adjacent to areas with significant amounts of human traffic. The Restaurant area and the Ivy Watson Playground/Tennis Club area had four of the nests found while the other two were within 0.5 to 1 kilometre away from a major food source. Two other nesting pairs were sighted but the nests for these birds were not located. The approximate size of Kings Park is 400 hectares (Bennett, 1988). Other nests were found nearby but outside the confines of the park indicating that nesting densities in this part of Perth are relatively high.
Figure 4.6. Aerial photograph of Kings Park showing the distribution of nesting sites in and around Kings Park.
DISCUSSION:

The nesting behaviour of the raven in suburban Perth showed a general similarity to the studies carried out by Ian Rowley in the 1960's. However, there were some anomalies that were noticeable throughout the project that should be discussed. To begin with, the breeding season seems to be slightly longer and earlier in the Perth metropolitan area than what was observed by Rowley et al. (1973) in the rural areas of New South Wales. Ford (1989) suggests that the ultimate factor in determining breeding season of a bird is food supply. The superabundance of non-natural food sources in the metropolitan area has removed the need for ravens to nest in times of peak food abundance which, in turn, has allowed them to breed over a longer period. Proximity to the coast, lower latitude, availability of nesting trees, mild winters and less severe seasonal variance in weather extremes may all have an influence on the length of breeding season of the raven. Another indication of favourable nesting conditions in the suburbs was the fact that seven pairs were observed preparing secondary nests after successfully rearing offspring to fledging. This is an uncommon trait in Australian Ravens, only observed where the birds have had a failed clutch (Rowley et al., 1973).

Rowley (1973c) found that *C. coronoides* used many different tree species with eucalypts being the most common (77% of one area were yellow box, *E. melliodora*). This pattern followed for the ravens nests found to the north of the river in the metropolitan area with 85.0% of nesting trees being eucalypts. However, south of the river the main nesting trees were the two introduced species *P. pinaster* and *A. heterophylla* at 61.9%. Both these species were recorded as nesting trees throughout the suburbs as they ideally meet the desired nesting criteria of ravens. Rowley (1973c)
found that ravens usually utilise a tree for nesting that is taller than the others around it so that they can oversee their territory. The clearing of Pine plantations for suburban housing meant that some small stands were left for aesthetic and recreational purposes. The ravens find these areas ideal for nesting as they provide good vision over the suburbs and access to reliable food sources.

Nesting sites were not limited to specific types of surrounding landuses with nests being found in a variety of different areas. Urban parklands, residential zones and vegetation remnants were preferred by the raven though this is possibly linked to the distribution of suitable nesting trees in these places. Ravens were generally not found within the city area though were sighted near parks. One pair was found to be nesting within fifty metres of the Hay St. Mall, illustrating the adaptability of the bird to a largely altered habitat. This fact is backed up by Rowley (1973c) who found ravens nesting on structures such as windmills, telephone poles and power line towers. This was not documented in the Perth metropolitan area though it may readily occur.

The increase in abundance of the Australian Raven in metropolitan Perth may be a result of favourable nesting conditions relating to the availability of nesting trees and the superabundance of food sources. Decreased home range and territorial demands, and a protracted breeding season are hypothesised as possible reasons for this, and further research is needed on these subjects to further define the breeding success of the raven in Perth.
CHAPTER 5: CONCLUSIONS AND MANAGEMENT IMPLICATIONS.

5.1 Synthesis

The Australian Raven has increased significantly in abundance and distribution in the Perth metropolitan area since 1977. This can be attributed to a number of different factors which are presented below as a visual synthesis of the raven phenomenon in Perth, and possibly other capital cities in Australia (Figure 5.1.). The Australian Raven has adapted to the urban environment better than many other species of birds, which is related to their intelligence and opportunistic feeding habits.

![Figure 5.1. Flow diagram summarising the reasons for increases in abundance and distribution in the metropolitan area, and hence the increase in problems associated with the bird.](image_url)

Ravens adapting - changes in social behaviour allowing for increase in population densities therefore an increase in the amount of problems.
The ultimate reason behind the success of the raven within the metropolitan area of Perth is the availability of food sources that have increased significantly over the past twenty or thirty years. This influences three major areas of the bird's lifecycle, which in turn has an ultimate effect on population numbers. The superabundance of food has possibly allowed for a higher survival rate of the young resulting in higher clutch success ratios. An abundant food supply means that the parent birds bring more food to the nest thus giving all nestlings a greater chance of survival.

The increase in the availability of food sources has reduced the raven's reliance on the variability of seasonal change. The parameter of optimum food availability that previously restricted the breeding season of the raven, is no longer as applicable in an urban environment as resources are more constant. This has quite possibly extended the breeding season of the raven in an urban environment although other factors may play a part in this part of the ecology of the raven. Further research is needed on this aspect to quantify it fully.

Food source increases may also have led to the contraction of home ranges and territories within the suburbs. The territorial demands found in a rural environment would be expected to be quite different to those of urban birds. However, it would also be expected that a greater number of food resources in the suburbs would create less need for ravens to maintain large territories. If smaller areas contained all the territorial requirements of the birds then less energy is expended in the search for food and the defense of boundaries. And as a consequence more time is spent raising the young, which in turn allows for higher survival rates in offspring. The territory size can also be linked to the large number of nesting trees in the suburbs of Perth. A large selection of
potential nesting trees adjacent to food sources means the raven does not need to be so particular in finding a suitable home range that fulfills the needs of the pair.

The combination of all these factors and the reduction in the persecution and control of the birds by humans has ultimately led to the increase in the abundance of ravens in the Perth metropolitan area, as well as an increase in the density of populations. This has brought them into greater contact with humans, which in turn has meant an increase in the amount of problems associated with the bird. The learning ability, intelligence and adaptive habits of the raven has enabled the bird to alter its behaviour to suit conditions as they occur. The implications of this are that the raven will continue to increase in the suburbs, and continue to be a problem unless control and management techniques are implemented.

5.2 Management Implications

The most obvious and probably the most effective method in controlling numbers of ravens in the Perth metropolitan area is to restrict access to, or reduce the numbers of food sources available to the bird. This could be achieved in a number of ways:

- Increased numbers of bins (with lids) would prevent birds accessing scraps in public places.
- Covers or lids on industrial bins to stop birds getting into deposited rubbish.
- Formulation of a public awareness campaign to halt the practice of actively feeding ravens and other native urban wildlife.
• A campaign aimed at management and reduction of available food sources within school grounds.

Reducing the food sources would effectively reduce most of the components that have led to the problems associated with the bird by reducing the numbers found in the suburbs. Other management options could include:

• An urban ‘Action Plan’ similar to that completed for the Silver Gull in Perth (CALM, 1993) could be formulated on the raven to highlight management issues to the public and shire councils.

• The introduction of selective culling events in areas where problems associated with the raven are severe. eg. schools, Kings Park, Rottnest Island and others.

• The implementation of further research to investigate other aspects of the ecology of the raven in the urban environment, breeding strategies, scaring techniques, predation rates on birds, disease harbouring and transmission are just some areas which could be studied.

5.3 Conclusion

The Australian Raven is a conspicuous member of the urban wildlife community that is often misunderstood. Intelligent, cunning and adaptable it often comes into conflict with humans which is where the main problems arise. However, these problems are more the result of poor planning and management practices that can be rectified with a few simple solutions. The effect of urbanisation on wildlife is often neglected but is a subject that should be considered more carefully in the future.
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