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SILVER GULLS AND EMERGING PROBLEMS FROM INCREASING ABUNDANCE

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Silver Gull populations have increased substantially in the past 50 years. This is primarily because they are scavengers and have been able to utilize human refuse. They have been implicated as problems to aircraft movements and water supplies, because they defaecate in water reservoirs and are known to be agents of human enteric diseases. Should a management programme be instigated to reduce gull numbers, a major priority should be to reduce access to artificial food sources.

INTRODUCTION

Around the world, gulls are increasingly attaining pest status (Brough 1985; Blokpoel and Tessier 1986; Furness and Monaghan 1987). This has been attributed to increasing numbers in urban environments. Most gulls, including the Silver Gull *Larus novaehollandiae* are scavengers and diet generalists. Populations have apparently increased because of increased availability of 'artificial' food at urban centres, where abundant food now exists at waste disposal depots, in parks, near sewage outfalls and around fishing boats, leading to greater fecundity and decreased mortality (Furness and Monaghan 1987). Some species are also highly adaptable in their nesting habits and this has led to nesting on human-made structures such as roof tops (Cramp 1971; Monaghan and Coulson 1977). The increase in numbers, coupled with the proximity of food sources to cities, has led to their becoming increasingly implicated as threats to aircraft safety and contaminators of water supplies.

Recent research on Silver Gulls in Australia has been management oriented, following at least three decades of ecological, biological and behavioural studies of the species. This paper reviews available information and discusses problems posed by the species and the measures taken to overcome them in Australia. The Australian localities referred to in the text are shown in Figures 1 and 2.

The Silver Gull has been placed in the *Larus cirrocephalus* species-group (Johnstone 1982). The four species from the southern hemisphere belonging to the group are the Grey-headed Gull (*L. cirrocephalus* Vieillot), Hartlaub's Gull (*L. hartlaubii* Bruch), Black-billed Gull (*L. bulleri* Hutton) and Silver Gull (*L. novaehollandiae* Stephens). There are three subspecies of Silver Gull: *L. n. forsteri*, *L. n. novaehollandiae* and *L. n. scopulinus*.

DISTRIBUTION

The Silver Gull can be found on most beaches around the Australian coastline, but also occurs far inland, along rivers, on lakes, in marshes and in inland towns. Breeding occurs mainly in colonies on coastal and inland islands throughout Australia, but also on artificial constructions in saltworks (Wheeler and Watson 1963), on causeways (Skira and Wapstra 1990) and pylons (Dalby *et al.* 1984). The largest colonies tend to be near large cities (Blakers *et al.* 1984).

L. n. forsteri is found along northern coasts of Australia and the nominate *L. n. novaehollandiae* is present elsewhere (Blakers *et al.* 1984). *L. n. forsteri* also occurs in New Caledonia. The Red-billed Gull *L. n. scopulinus* is found in New Zealand (Pringle 1987).

BREEDING

Timing of breeding varies between and within localities (Table 1). Age or retention of pair bonds have been found to affect various breeding parameters (Table 2). Retention of pair bonds appears to be related to the extent of courtship feeding by the male (Tasker and Mills 1977).

Breeding activity has mainly been recorded for birds which are three years old or older. At a colony in South Australia, one-year-old birds were absent from colonies; two-year-old birds were present during the breeding season but only 0.7 per cent produced eggs and 0.3 per cent raised pulli (Ottaway *et al.* 1988). Mills (1973) studying New Zealand birds also reported breeding at two years, but the majority bred for the first time between three and five years of age. He also found that males bred at a younger age than females. Females have been recorded breeding over 11 seasons (Ottaway *et al.* 1988).

In South Australia, it was found that less than 50 per cent of Silver Gulls which eventually bred did so at their natal colony (Ottaway *et al.* 1988). In New Zealand, less than half the birds returned to their natal colony, and males showed higher fidelity than females (Mills 1973). Fidelity may be higher on a regional basis. For example, at Beachport, South Australia, there are three colonies within an 8 km radius and while birds may not necessarily always nest on the same island they are possibly faithful to the area as a whole (Ottaway *et al.* 1988). Only a small percentage of adults in South Australia had high nest-site and mate fidelity over 3–4 years (Ottaway *et al.* 1988).

Eggs, egg-laying and incubation

Clutches of one to three eggs were reported by Wheeler and Watson (1963) with the majority of nests containing either two or three eggs. The various factors that have been found to affect clutch size and size of eggs are given in Table 2.

Incubation is shared (Pringle 1987) but there is no display at the change-over when one bird relieves the other at the nest. Eggs are turned by the sitting bird at various times during the day and night, and more frequently when they are about to hatch (Wheeler and Watson 1963).

Chicks

Chicks are fed by the parents up to six weeks after hatching by regurgitation (Wheeler and Watson 1963). At the age of about one week, chicks begin to move actively out of the nest. If they stray too far they may be attacked and killed by other adults (Wheeler and Watson 1963). It has been estimated young birds are at least six to seven weeks old before they start flying (Wheeler and Watson 1963).

SURVIVAL AND LONGEVITY

The longest time between banding and recovery recorded for a Silver Gull in Australia is 26 years 9 months and 26 days (Recovery Round-up 1991). This bird was banded as a pullus 30 October 1963 at Fisherman's Bend, Victoria by C. Hall and recovered 152 kilometres away on 8 August 1990 at Sandy Point, Victoria by C. Bryant.

Between 30 October 1955 and 30 June 1984, 31 705 Silver Gulls were banded in New South

TABLE 1

Timing of breeding seasons of Silver Gulls within Australia, with other notes on breeding.

Locality	Months of laying	Comments	Source
Northern Great Barrier Reef, Qld	All months	Predominantly winter	B. King (pers. comm.); Seabird Island series, Corella.
Southern Great Barrier Reef, Qld	All months	Predominantly warmer months	Walker (1988).
Five Is, NSW	Late July–Mar.	2 peaks	Battam and Smith (1988).
Lake Bathurst, NSW	Aug.–Nov.		Frith (1969).
Mouth of Yarra River, Vic.	May–Oct.	2 peaks, June/July and Sept.–Oct.	(I. Temby, unpubl. data).
South Australia	June–Dec.		Ottaway *et al.* (1988).
Western Australia	Apr.–Nov.	2 peaks	Nicholls (1974); Wooller and Dunlop (1979); Dunlop (1986).

TABLE 2

The factors found to affect timing of breeding, fidelity to mate, clutch size, egg size, hatching and fledging rates of Silver Gulls. Subspecies are *L.n.n.* = *Larus novaehollandiae novaehollandiae* and *L.n.s.* = *Larus novaehollandiae scopulinus*.

Breeding parameter	Subspecies	Factors with an effect	Type of effect	Source
Timing of breeding	*L.n.s.*	Age of bird	Testis and ovary of old birds mature earlier each season, implying earlier laying date.	Mills (1973).
	L.n.s. and *L.n.n.*	Pair bond	Those retaining pair bonds lay earlier.	Mills (1973); Ottaway *et al.* (1988).
Clutch size	*L.n.s.*	Age of breeding female	Increases with increasing age.	Mills (1973).
	L.n.s.	Fidelity of pairs	Female retains mate of previous season, more eggs laid.	Mills (1973).
	L.n.n.	Rainfall	Low annual rainfall then decreasing clutch size in following season	Wooller and Dunlop (1981).
Egg size	*L.n.s.*	Order of laying in clutch.	Sequentially smaller.	Mills (1979).
		Season × age of birds	Egg size decreased as season progressed. Older birds lay at beginning of season. Early breeders laying replacement clutches tended to lay larger eggs than birds producing first clutch at same time in season.	Mills (1979).
Hatching and fledging rates	*L.n.s.*	Age of bird	Older bird higher rates hatching and fledging.	Mills (1973).

Wales. Based on band recoveries from these birds, which includes the data previously reported by Murray and Carrick (1964), the mortality of first year birds is 53.9 per cent (Purchase 1989). These data do not include birds that died as pulli, consequently the overall mortality of first-year-birds is probably considerably higher.

MOVEMENT

A considerable number of studies have analysed the movements of Silver Gulls in the short and long term (Murray and Carrick 1964; van Tets 1969; Carrick 1972; Hulsman 1986; Soans 1984; Ottaway *et al.* 1985; Walker 1988). It has been hypothesized that food supply is a critical factor determining dispersal patterns (Murray and Carrick 1964).

Peak gull movements occur at dawn and dusk, as the birds fly between feeding and roosting areas (van Tets 1969). Movements also peak before and after low tides as gulls move to and from intertidal areas where they feed (van Tets 1969; Hulsman 1986). Near Melbourne, hundreds of birds commute daily from islands and coastal sites, up to 25–50 km inland, to feed at waste depots (Blakers *et al.* 1984; Emison *et al.* 1987). In Western Australia, Soans (1984) found that Silver Gulls used waste depots throughout the day with a lull about midday.

Following breeding most birds disperse from breeding colonies (Pringle 1987). The majority from the Five Islands colony for example, fly north to Sydney (Murray and Carrick 1964; Purchase 1989). Around Adelaide the majority of gulls disperse eastwards following breeding. Dispersal from each colony correlates with a shift of the gull population into areas where food is available from human sources such as waste depots. The majority of gulls from colonies 80 km to the south-east of Adelaide dispersed north-west into the city and suburbs (Ottaway *et al.* 1985).

Longer movements are also common. The longest recorded movement was that of a bird banded 13 May 1987 as an adult in a Rockhampton waste depot by P. Ogilvie, which moved to Sandy Bay, Tasmania (recovered 28 February 1988 by W. C. Wakefield), a distance of 2 186 kms (Recovery Round-up 1989).

Murray and Carrick (1964) recorded a number of movements between major cities and towns, hundreds of kilometres apart, in south-eastern and eastern Australia. Such movements are by no means final. There are many records of birds which disperse long distances and return annually to their breeding island (Ottaway *et al.* 1988) and may even return briefly to the breeding island during the non-breeding season (Carrick and Murray 1970).

FOOD OF THE SILVER GULL

Silver Gulls are primarily scavengers and therefore eat a wide range of foods (Barker and Vestjens 1989). They will consume both naturally occurring food and human refuse. Analysis of regurgitations at a breeding colony revealed that 18 per cent were of natural derivation and 82 per cent human refuse, with the proportion of natural food changing through the breeding season (Smith *et al.* 1991).

Gulls are predators on eggs and chicks of their own species. They will also steal food (kleptoparasitism), eggs and chicks from other species. Dann (1979) reported Silver Gulls stealing food from Eastern Curlews *Numenius madagascariensis*, Curlew Sandpipers *Calidris ferruginea*, Pied Oystercatchers *Haematopus longirostris* and Bar-tailed Godwits *Limosa lapponica*. Hulsman (1984) and Smith (1991) observed gulls stealing fish from Crested Tern *Sterna bergii* adults attempting to feed their young. Gulls have also been known to prey on ducklings (Haddon 1987), eggs and chicks of terns (Hulsman 1977; Smith 1991; Egan 1991) and eggs of Banded Stilts *Cladorhynchus leucocephalus* (Robinson and Minton 1989).

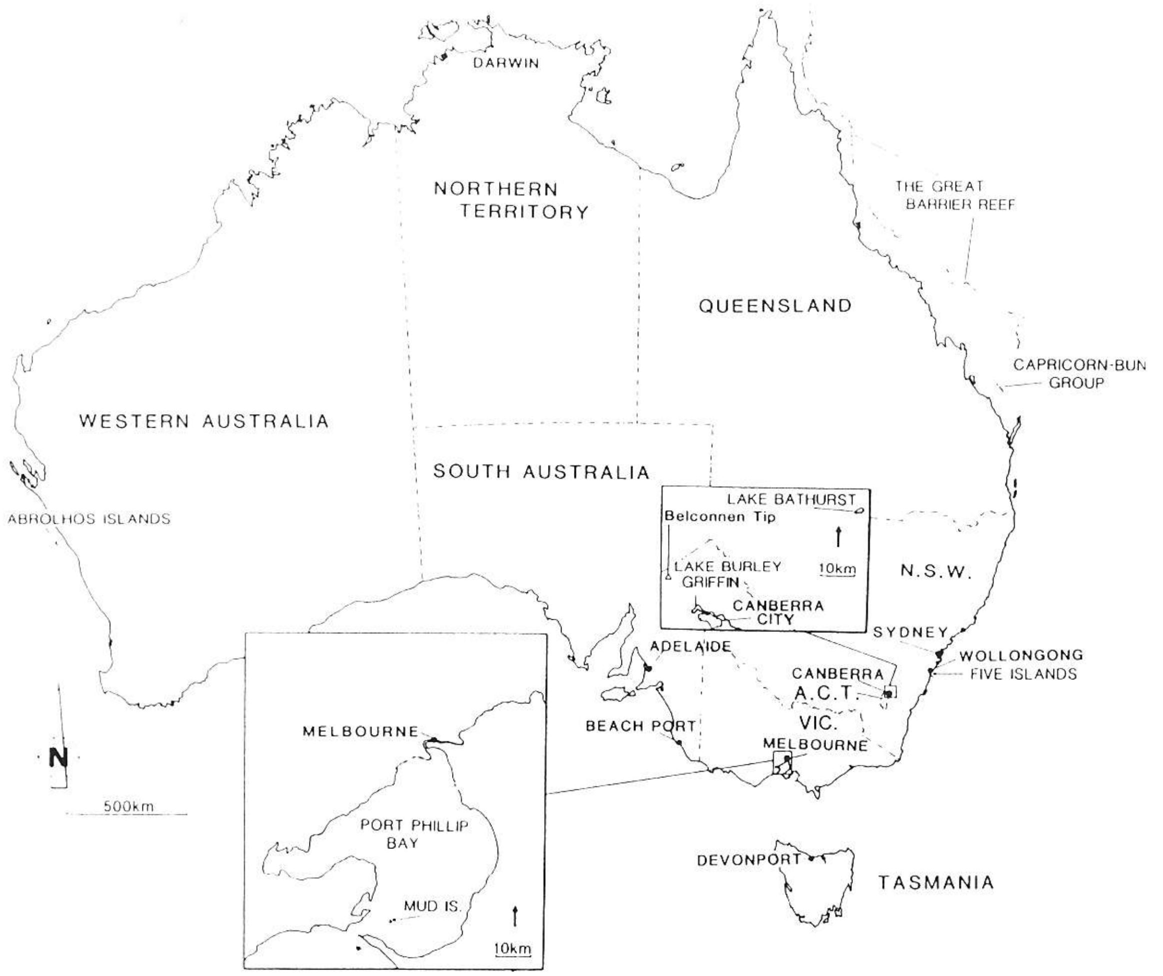

Figure 1. *Map showing places mentioned in the text.*

DEMOGRAPHIC CHANGES — THE HUMAN INFLUENCE

The abundance of food at waste depots and the Silver Gull's habit of scavenging food from humans at other localities has undoubtedly contributed to its increase in numbers (Gibson 1979; Blakers *et al.* 1984; Walker 1988). Populations appear to be expanding around and throughout the continent, mostly in areas of highest human density and, therefore, mainly on the coast.

On the Five Islands, numbers have expanded from 1 000 pairs prior to 1940 to 50 000 pairs in 1978, in direct correlation with the increase in the human population in the area (Gibson 1979). It is believed that 70 per cent of coastal breeding in New South Wales occurs at the Five Islands (Lane 1979). Other new breeding sites have recently been established in Sydney Harbour.

At Mud Island, numbers rose from five pairs in 1959 to 50 000 pairs in 1986 (Menkhorst *et al.* 1988). This is now the largest colony in Victoria.

Numbers have increased in Canberra city since the mid-1960s probably in association with the creation of Lake Burley Griffin, the increase in the human population and the availability of food at Belconnen Waste Depot. A long established breeding colony occurs nearby on the islands of Lake Bathurst (Frith 1969).

Silver Gulls have also become more common in the Darwin area, Northern Territory since 1970 (McKean 1981). More recently, they have increased in numbers on the Capricorn-Bunker group of islands, Great Barrier Reef, Queensland (Walker 1988) and on the Abrolhos Islands off Western Australia (Burbidge and Fuller 1989).

PROBLEMS WITHIN AUSTRALIA

Silver Gulls and aircraft

Most gull problems within Australia have been at airports where collisions with aircraft have caused serious damage. Gulls have been involved in at least 158 bird strikes between 1981 and 1989 at Sydney's Airport (CAA data). The possibility of a crash is a real threat (van Tets 1972).

Van Tets (1969) found that birds declined at Sydney's Kingsford Smith Airport when exposure of nearby household refuse was stopped, airfield drainage was improved, frequency of mowing the airfield was increased and the airfield was treated with an insecticide. The main runway extends into Botany Bay across traditional gull flightpaths, and feeding and 'loafing' habitat. Thus, gulls are still a problem and daily deterrence involving live ammunition and 'Birdfrite' cartridges is necessary.

In Victoria, Silver Gulls present a serious hazard to aircraft at Tullamarine, Essendon and Moorabbin airports, largely because of the proximity of waste depots. Gulls also pose a danger to aircraft in Devonport, Tasmania (Skira and Wapstra 1990) and in Adelaide, South Australia (CAA data). In Tasmania, large scale culling of adult gulls using alpha-chloralose has been carried out (Skira and Wapstra 1990).

Waste depots, water reservoirs and human health

Overseas studies indicate that gulls can spread enteric diseases of humans (Gould and Fletcher 1978; Fenlon 1981; Reilley *et al.* 1981; Butterfield *et al.* 1983; Monaghan *et al.* 1985; Girdwood *et al.* 1985), and recently Silver Gulls have been viewed with concern in Australia because they may be agents in the spread of *Salmonella* and *E. coli* (Iveson 1979a and b; Iveson and Hart 1983). However, it would seem that only a small percentage of the population probably carry *Salmonella* (Anderson 1988).

Problems in the Sydney-Wollongong region

The problem of gulls spreading enteric diseases of the human population of Sydney became a threat in 1985, when it was evident that a build-up in the number of Silver Gulls at Prospect Reservoir, the main reservoir servicing Sydney, was leading to serious pollution of the water supply. The gulls were feeding at the newly established Eastern Creek Waste Depot and flying to the reservoir to bathe and preen. Lowering of the reservoir level, to facilitate work on the dam wall, had exposed muddy shorelines around the reservoir which attracted gulls. Correlated with this increase in gull numbers on the shoreline at the reservoir, was an increase in the coliform counts in the vicinity of these gull roosts to alarming levels (Water Board data). Concern for the health of Sydney residents was expressed. Gull faeces and regurgitates clearly contributed to a high nutrient level in the water, which probably led to the high coliform levels derived from bacteria already present in the water and those the gulls may have carried to the reservoir.

A current study was initiated in 1988 to review the extent of the Silver Gull problem within New South Wales and to devise management strategies to control gull populations in the Sydney-Wollongong area. The objectives were to minimize risks of water pollution and aircraft accidents, to minimize the food available to gulls at waste disposal depots and to maintain a viable population of the species in the Sydney-Wollongong area.

In Sydney, the Waste Management Authority, in consultation with a private pest control company and working with the Water Board, has been controlling gull numbers at the Eastern Creek Landfill Depot and Prospect Reservoir since 1987 using a combination of taped distress calls, a hallucinogen ('Avitrol' or 4 amino-pyridine) and cracker shells ('Birdfrite') to distress birds and cause panic in flocks (Doig 1989). While the deterrence programme was intensive initially, less effort is now required and only when sporadic influxes of gulls occur.

Interaction with other species

Because of their habits of stealing food and eggs and chicks from other bird species, large numbers of gulls in localized areas can sometimes cause other species to suffer. In Queensland, gulls raid tern colonies for food and affect breeding success (Hulsman 1976, 1977, 1984; Hulsman and Smith 1988; Smith 1991), particularly since gull numbers have increased due to tourism. In Sydney, gulls have been observed to pull a nesting Little Tern *Sterna albifrons,* an endangered species, from its nest and the contents were then predated by other gulls (Egan 1990).

Silver Gulls can also cause habitat changes to the detriment of other species. At the Five Islands, Kikuyu grass *Pennisetum clandestinum* may have been introduced by gulls as nesting material and is now fertilized by their faeces. Big Island is currently almost entirely covered by this grass, the thick runners of which make an almost impenetrable barrier to burrowing species such as the shearwaters (*Puffinus pacificus* and *P. tenuirostris*) that nest there. Shearwaters are often

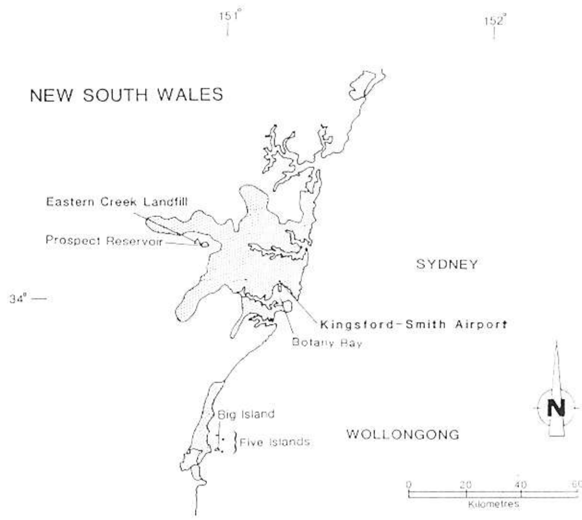

Figure 2. Detailed map of the Sydney-Wollongong region showing places mentioned in the text.

found entangled in grass runners at the entrance to their burrows. Perhaps the introduction of Kikuyu has also led to the disappearance of the White-faced Storm Petrel *Pelagodroma marina* in recent times.

DISCUSSION

Although many basic aspects of the breeding and dispersal of Silver Gulls have been studied, there is a lack of data on population dynamics. Moreover, there have been few attempts to estimate the sizes of colonies and intrinsic rates of increase other than Barrowclough (1980). Furthermore, there have been few attempts to quantify the foods which gulls use and their dependence on human refuse. The extent to which gulls utilize different habitats in obtaining their food has also not been quantified.

Despite these inadequacies in the data, few would dispute that Silver Gulls have increased enormously over the past 50 years and that this is directly attributable to an enhanced food supply available in waste depots, from food scraps in parks and on beaches, and directly from human feeding. Effective control of the gull population can only be achieved if these food supplies are reduced significantly.

In general, populations are more vulnerable to manipulation of their habitat than they are to direct population control (Caughley 1977). While culling is an option for reducing numbers, it will only provide an immediate and temporary solution (Skira and Wapstra 1990) unless food resources are reduced concurrently. Evidence from overseas, indicates that reduction in density without diminishing the food resource leads to higher reproductive success (Coulson *et al.* 1982; Spaans *et al.* 1987). Removal of part of a population will furthermore result in rapid replacement by birds from surrounding areas.

Long-term strategies must incorporate measures to reduce artificial sources of food available to gulls. While gulls have been deterred from some tip sites using various frightening agents (Thomas 1972; White and Weintraub 1983; Blokpoel and Tessier 1986) this is not always a practical solution. Sound management principles, such as frequent covering of refuse and the elimination of ponds in the vicinity of waste depots, should be adopted. Alternatives to landfill (e.g. medium density baling and incineration) should also be reviewed as the technology improves. However, abundant food at waste depots is not the sole cause of the problem. The public too play a part, and will need to be discouraged from feeding gulls and littering, and encouraged to compost their home organic refuse.

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