August 2000

PIECES OF SILVER: EXAMPLES OF THE ECONOMIC IMPACT AND MANAGEMENT OF THE SILVER GULL (*LARUS NOVAEHOLLANDIAE*) IN MELBOURNE, AUSTRALIA

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Abstract: Like a number of gull species, the silver gull *Larus novaehollandiae* has expanded its population in response to human food subsidy. The major anthropogenic food source is food waste at rubbish tips. Other sources of human food waste are also exploited. Many problems result from the activities of these birds, including human health and safety, economic impacts, and effects on the conservation of other species. My study examines aspects of the economic impacts of the silver gull on the human community of the Greater Melbourne Area comprising approximately 4065 km^2 (1569 square miles). My data collection method involves identifying sites where problems have been experienced and completing questionnaires during face to face interviews with the managers of those sites. Data collected at this early stage of the study demonstrate that there are significant, quantifiable economic impacts associated with the superabundance of the silver gull in this area. Other impacts, such as reduced amenity and potential health hazards are equally real but more difficult to quantify. Costs include damage to structures and products, damage prevention measures, and loss of production. Information about the costs of these problems will be presented to the relevant landfill management authorities to encourage them to consider alternative means of disposing of putrescible waste, rather than by open landfill disposal, because even current best practice management of open landfill sites (rubbish tips) provides ample opportunity for silver gulls and certain other bird species to exploit this food source. Controlling access by the silver gull to food at rubbish tips would be an important first step in managing the population of this species.

Key Words: anthropogenic food, economic impacts, landfills, *Larus novaehollandiae*, management, population increase, roof-nesting, silver gull, urban-nesting, wildlife damage management.

The silver gull *Larus novaehollandiae* is a small gull with a wingspan of 91-96 cm and a weight of 265-315 g. The nominate subspecies occurs around Australia, including Tasmania; subspecies *scopulinus* in New Zealand and associated islands; and subspecies *forsteri* in New Caledonia and the southwest Pacific Ocean (Higgins and Davies 1996).

As with many gull species in other countries, the silver gull has increased in numbers apparently through exploiting food provided inadvertently by humans (Meathrel et al. 1991, Smith and Carlile 1993). For example, the silver gull breeding population at the Five Islands, near Wollongong in New South Wales increased from a few pairs prior to 1940 to 51,500 pairs in 1978 (Smith 1995). At Mud Islands in Port Phillip Bay, Victoria, numbers increased from five pairs in 1959 to between 50,000 and 70,000 pairs in 1988 (Menkhorst et al. 1988). Smith (1995) observed that the nesting population represents only a portion of the actual gull population of a region and suggested that there may be 200,000 to 700,000 gulls in the Sydney-Wollongong region.

Silver gulls are very flexible in their choice of nest sites and, in addition to their "natural" sites on off-shore islands and inland swamps, they have been recorded nesting on jetties, boats, buildings, and on the ground on the mainland on many substrates including: rock, sand, grass, and low bushes (Higgins and Davies 1996). Roof-nesting in the silver gull has only been reported at 2 discrete locations in Australia: on wharf shed roofs in Fremantle, in southwestern Australia during the early 1990s (Meathrel, personal communication) and from the Melbourne area, where the earliest record is from 1982 (unpublished data). Several authors have suggested that the expanding phenomenon of roof-nesting may be an indicator of increasing population (e.g., Blokpoel and Tessier 1986, Vermeer and Irons 1991, Belant 1997, Raven and Coulson 1997). However, this is clearly not always the case, as in Great Britain, where the numbers of roof-nesting herring gulls (*Larus argentatus*) have been increasing at 10% per year since 1976, the overall population of this species is in decline while both the overall and the roof-nesting populations of the lesser black-backed gull (*L. fuscus*) have been increasing since the mid-1970s (Raven and Coulson 1997). Roof-nesting is increasing in the Melbourne area, with several thousand pairs of silver gulls nesting in 2000 (personal observation), but there are no recent data to indicate trends in the overall population.

Many problems arise from elevated gull populations, including: *inter alia* impacts on other avian species (Bergman 1982, Higgins and Davies 1996, Harris and Wanless 1997, O'Neill and Channels 1997; impacts on vegetation through trampling, introduction of weeds or changing the fertility of sites (Smith 1995, Higgins and Davies 1996); damage to roofs, cars, and products through roosting and nesting activities (Vermeer and Irons 1991, Belant 1997, Raven and Coulson 1997, this study); hazard to aircraft (Blokpoel and Scharf 1991, Smith 1995, Dolbeer 1999); and deterioration of water quality at water reservoirs and municipal swimming pools and other water bodies used for recreation (Hatch 1996, Levesque et al. 1993).

It is frequently suggested that controlling access by gulls to anthropogenic food sources would lead to a reduction in numbers or relocation of the birds (e.g., Meathrel et al. 1991, Vermeer and Irons 1991, Smith and Carlile 1993, Belant 1997, Kilpi and Ost 1998). The economic costs of changing waste management practices to deter gulls can be significant; therefore, it is important to determine cost-effectiveness (Vermeer and Irons 1991, Belant 1997, this study). A knowledge of the economic impacts of the problems caused by gulls is required. Such knowledge may support a case for employing methods to exclude access by gulls to food at rubbish tips. The aim of my study is to identify the kinds of problems caused by the silver gull that may result in economic costs and gather data on as many examples of these problems as possible. My study area is approximately 4,065 km^2 (1,569 square miles) and comprises a strip of land of varying width around Port Phillip Bay (Fig. 1).

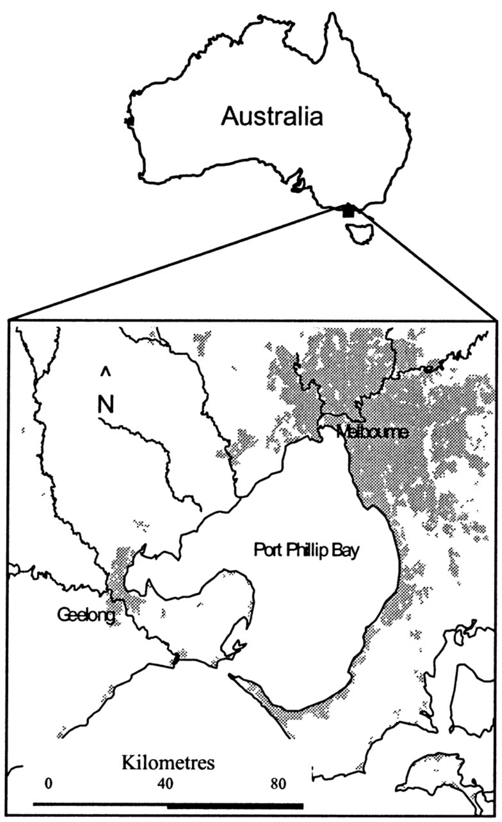

Fig. 1. Map of Australia showing location of study area.

METHODS

Information about the location of sites where silver gulls were causing problems, or may cause problems, was sought from a variety of sources. Letters were sent to all municipalities within the study area, to pest control companies, bird watching groups, rubbish tip managers, and marina managers. The records of the Department of Natural Resources and Environment were searched for details of permits issued for the removal of silver gull nests and eggs. Site visits were then undertaken to interview site managers where gull problems had been identified. Some of these site managers referred me to other sites they knew of in the vicinity where gulls were causing problems. Several further sites experiencing problems were found following systematic searching in the vicinity of known problem sites for evidence of gull activity. *Ad hoc* visits were made to interview the occupants when gull activity was found. Data were collected by completion of questionnaires during face-to-face interviews. Up to the present time, at every site visited where an interview was sought, a questionnaire has been completed.

A standard set of questions was asked at each interview that sought to establish:

- how long gulls had been present, and how long they had been causing problems;
- the number of gulls involved in 1998;
- seasonality of gull problems;
- any change in numbers over the past 10 years;
- actual problems caused by gulls at the site;
- potential problems associated with the continued presence of gulls;
- measures employed to reduce or eliminate problems, and their effectiveness;
- annual cost of damage to structures or products by gulls;
- annual cost of cleaning, maintenance or repairs required;
- annual cost of control actions taken and detail of actions;
- kind of business or operation.

RESULTS

This study is continuing, and results provided here are preliminary. Data presented are drawn from interviews undertaken during visits to 27 sites where gull activity caused problems that resulted in the expenditure of money. These problems fall broadly into two areas: problems caused by roosting or nesting activity; and problems caused by feeding activity. In some situations a combination of these activities occurs on the one site. Roosting is defined here as any period of relative inactivity, whether during the day or overnight, when the birds are perched on some substrate, but excludes bathing in, or sitting on, water. In contrast to some other gull species, such as black-headed gulls (*Larus ridibundus*), lesser black-backed gulls, common gulls (*L. canus*), herring gulls and great black-backed gulls (*L. marinus*) that commonly roost on water reservoirs in Britain (Monaghan et al. 1985, Gosler et al. 1995), in southern Australia, the silver gull typically roosts on a variety of natural or human structures, but not on water (Smith 1995).

Apart from the 27 sites mentioned above, at another 4 sites, gull exclusion devices had been installed at the request of previous owners, but the costs were not known. A further 39 sites were visited where gull roosting or nesting activity on roofs was apparent, but where data on costs were not yet collected. This was for a variety of reasons: the occupants or owners were not able to be contacted (n=23); the gulls were not perceived to be causing problems (n=3); the gulls used the roof only for a short time (n=2); the occupants were not aware that the gulls were using the roof (n=5); the building was unoccupied or derelict (n=3); the occupants did not own the building and had been unable to get the owner to address the problems caused (n=1); and the occupants knew of the presence of the birds, and were planning to take action, but had not done so at the time of my visit (n=2). Data will be taken from many of these sites later in the study.

In the Greater Melbourne Area, silver gulls roost and nest in increasing numbers on the roofs of buildings and other structures, including on the tops of bulk storage tanks (unpublished data). Such roosting and nesting activity was the case at 15 of the 27 premises visited (Table 1). Many of the problems described were common to most sites. The year-round breeding on artificial structures observed during this study exacerbates these problems. Principal concerns were associated with water damage resulting from blockage of gutters due to regurgitated bones, feathers and gull carcasses and/or nesting material. Most interviewees considered that gull feces and other debris would accelerate corrosion of the roof fabric, but had no idea how to quantify this, although at Site 1 a concrete tile roof used by gulls for roosting was replaced due to damage attributed to the gulls. It was common to find feathers inside and around buildings where gulls were roosting, and this was a particular concern at food processing premises. Feathers also caused blockage of roof-mounted air intakes, reduced the visual amenity of sites, and were thought to be a possible trigger for respiratory problems. After rain in warm weather, the smell from debris on occupied roofs was said to be nauseating, and the noise and swooping by nesting gulls upset staff at some premises. Many respondents were concerned about possible health hazards associated with the presence of gulls and their debris. Where gulls were nesting on bulk storage tanks that have to be inspected frequently, there was not only a potential slip hazard from feces on the structure, but aggressive swooping by nesting gulls meant that 2 staff had to undertake inspections that would normally have required only 1 person.

Roosting by silver gulls at marinas caused fouling of jetties, walkways and boats with feces, causing a slip hazard and unquantified damage to the gel coat on fiberglass boats. Roosting on a helipad on the Yarra River in the centre of Melbourne created a bird strike hazard for approaching aircraft, and a slip hazard for alighting passengers. Polythene greenhouse roof-covers at a large commercial flower-growing premises were perforated by roosting gulls, and feces on the covers reduced light availability for plants. Gulls nesting on cranes used for unloading shipping containers caused malfunction of automatic proximity sensors, and corrosion of the crane structure.

Other problems associated with roosting behavior have not yet been studied in detail, but at 2 silver gull nesting sites on the ground, vegetation was modified by the introduction of exotic, woody weed species (African box-thorn *Lycium ferocissimum* and mirror-bush *Coprosma repens*), as seeds regurgitated by the gulls germinated (personal observation). At these sites, considerable effort was expended on control of these weeds. Gulls also bathed in and roosted at municipal swimming pools, blocking filters with feathers and causing concern about a potential health hazard through the possible introduction of pathogenic organisms. This concern led to the dumping of fouled water and refilling of pools and to doubling the dose of chlorine for disinfection.

Gull feeding activity caused a variety of problems. At the Royal Melbourne Zoological Gardens (Site 21), silver gulls stole food from animals on exhibit and took food from the hands of inattentive children. Elsewhere, gulls attracted to picnic areas in the hope of getting hand-outs or discarded scraps fouled seats, tables and grass, and reduced the visual amenity of these areas. At rubbish tips, where large numbers of gulls feed daily, tip managers are required by the Environment Protection Authority (EPA) to keep gull numbers below a threshold of 900 birds at any time to minimize problems caused by the birds off-site. Even at rubbish tips operated strictly according to EPA guidelines to minimize the attraction of birds, some thousands of silver gulls may be present on a daily basis (personal observation). At 1 tip visited, elevated *E. coli* counts in water holding ponds, believed to result from use of the water by gulls after feeding, restricted discharge of the water to stormwater drains. Milling gulls at the active tip face obscured the vision of compactor drivers, creating a hazard. Tip managers faced legal costs associated with arriving at license conditions that were acceptable to nearby airport operators, or associated with legal actions taken by neighbors affected by gulls visiting their properties after feeding at the tip site.

In addition to the issues identified above, the presence of gulls at many sites creates the potential for other problems to occur. For example, gulls nesting on the roof of an aluminum smelter (Site 15) could lead to blockage of gutters and flooding that could cause an explosion if water entered a smelting pot. Gull feathers could enter food products being packaged, and lead to adverse publicity, loss of market share, and even legal action (Site 12).

Costs were associated with most of the problems described above, including the cost of cleaning, maintenance or repairs required; and the cost of control actions taken, such as physical barriers, repellent sprays and scaring devices. Some of these costs are recurring, and can be considered on an annual basis, while others are one-time costs. In most cases, costs were associated principally with cleaning and deterrent measures rather than actual damage to structures and products. Two-thirds of the respondents described in detail (Table 1) did not identify damage as a component of the costs they incurred as a result of the presence of the gulls.

Property owners vary in their knowledge of the implications of having gulls on the roof, and of how best to deter them or even where to get information about effective gull deterrent methods. This knowledge was judged subjectively and was based on the responses obtained during the interviews, particularly those relating to the effectiveness of deterrent measures used (see below). In this situation, unscrupulous or ignorant purveyors of bird control devices find a ready market for equipment that will have little or no effect as gull deterrents (owl effigies, rubber snakes, electronic noise-makers (as opposed to distress call machines), deterrent sprays, helium balloons, gas guns). Some managers seem to need to progress through a range of often relatively cheap but ineffective options "just in case they will work," before they accept that they will need to install physical barriers such as overhead lines or netting over a roof, if indeed they know about this option. At the same time, they may be paying contractors to remove nests and eggs and clean the roof and for the repair of damage caused by the gulls. Other property owners who use, perhaps fortuitously, methods that do deter gulls, may avoid further damage, cleaning, and nest and egg removal costs.

Costs of deterring gulls can thus vary considerably between sites. For example, at Site 16 annual cleaning costs of A$7,600 were eliminated after installation of nylon monofilament over the roof and car park, at a total cost of A$23,000. No maintenance has been required after 4 years, and any maintenance costs are expected to be minimal, being restricted to replacement of broken lines. If the costs of cleaning are projected over 10 years, (A$76,000) there is a 3.3:1 benefit:cost derived from the use of monofilament overhead lines at this site. In contrast, at Site 26 monofilament overhead lines were installed over the active tip face. There was an initial reduction in gull numbers, but the lines were not maintained, and damage by vehicles rendered the lines ineffective. In this case, the cost of installing the monofilament (A$40,000) was wasted through lack of maintenance, and there is a substantial annual outlay for cracker cartridges (A$20,400) used to scare the gulls from the site. Overhead lines are not necessarily an effective deterrent in all situations. Monofilament overhead lines were installed where practicable at the marina (Site 3), but were not sufficient to deter the birds, and it seems that there is little option but to continue with the cleaning regime costing nearly A$25,000 per year at this site. Similarly, at Site 18, use of monofilament overhead lines has not been practical, because there are no suitable structures for attaching the lines to the tanks.

Table 1. Costs[a] associated with problems caused by silver gulls.

Type of site, problems and mitigation measures	One-time costs: Mitigation	One-time costs: Damage	Annual costs: Mitigation	Annual costs: Damage	Annual costs X 10
Site 1: Hotel – gulls roosting on roof					
Deterrent spray	$5,000				
Re-roof hotel		$85, 000			
Site 2: Hotel/casino complex – gulls roosting on roof garden and furniture on promenade area					
Daddy longlegs on umbrellas	$500				
Distress call machine	$1,000				
Site 3: Marina – gulls roosting on piers					
Monofilament on piers	$770				
Owl effigies	$300				
Extra lights	$9,600				
Pressure washer	$400				
Cleaning			$24,960		$249, 600

Table 1. Continued

Type of site, problems and mitigation measures	One-time costs		Annual costs		Annual costs X 10
	Mitigation	Damage	Mitigation	Damage	
Site 4: Stevedore – gulls roosting and nesting on container cranes; fouling stored cars					
Monofilament over car park	$20,000				
Refurbishment of crane		$1,200,000			
Site 5: Stevedore – gulls nesting on machinery and harassing staff					
Nest and egg removal from roof	Nil				
Driving at roosting flock (car damage)	$3,000				
Monofilament over roof	$500				
Trap and kill gulls	$2,400				
Site 6: Stevedore – gulls nesting on roof					
Nest, egg removal and roof cleaning			$7,500		$75,000
Imitation snakes	$10				
Netting over roof	$2,000				
Wires over roof	?				
Monofilament over roof	$2,000				
Air monitoring		$1,890			
Site 7: Airport – gulls cause hazard and damage to aircraft				$500,000	$5,000,000
Scaring patrols			N/C		
Tip licence conditions	N/C				
Site 8: Airport – gulls cause hazard and damage to aircraft				$100-1000	
Scaring patrols (cracker shell cost)			$2,000		$20,000
Eliminate water ponding	N/C				
Monitor tipping practices			N/C		
Legal costs for tip licence appeals			$20,000		$200,000
Site 9: Helipad – gulls roost, leading to air safety hazard and slip hazard for passengers					
Purchase water blaster	$500				
Cleaning			$1,088		$10,880
Site 10: City office complex – gulls roosting on roof and fouling ornamental ponds					
Distress call system	$5,280				
Pressure clean twice	$10,000				
Site 11: Commercial building – gulls nesting on roof					
Estimated cost of roof corrosion				$5,000	$50,000
Cleaning roof and gutters			$2,500		$25,000
Site 12: Food importer, processor and distributor – gulls roosting on roof, feathers inside building					
Distress calls (loaned)	N/C				
Blower-vac purchase	$400				
Monofilament proposed for roof	$10,000				
Clean feathers within factory			$900		$9,000
Site 13: Manufacturing industry – gulls roosting on roof					
Monofilament over roof	$5,000				
Roof, ceiling, gutter cleaning	$10,000				

Table 1. Continued

	One-time costs		Annual costs		Annual costs X
Type of site, problems and mitigation measures	Mitigation	Damage	Mitigation	Damage	10
Site 14: Manufacturing industry – gulls nesting and roosting on roof					
Electronic distress calls	$9,000				
Nest, egg and feather removal			$6,240		$62,400
Owl effigies	$200				
Mobile noise maker	$200				
Monofilament lines proposed	$20,000				
Blower-vac purchase	$500				
Site 15: Metal rolling mill – gulls nesting on roof					
Owl effigies	$200				
Nest and egg removal			$10,000		$100,000
Damage to metal roll		$18,000			
Cleaning			$20,000		$200,000
Monofilament proposed for roof	$30,000				
Site 16: Car maker – gulls roosting on roof and fouling employees' cars					
Gas Gun	Nil				
Plastic hawks on poles	$116				
Monofilament over roof	$19,000				
Monofilament over car park	$4,000				
Roof cleaning			$4,000		$40,000
Removal of dead birds, etc.			$3,600		$36,000
Site 17: Chemical manufacturer – gulls nesting on tanks, swooping					
Nest and egg removal	$5,000				
Diversion of labour to deter gulls			$6,400		$64,000
Site 18: Bulk liquid storage – gulls nest on tank tops					
Monofilament over tanks	$275				
Monofilament between tanks	Nil				
Rags on poles	Nil				
Repainting tanks				$45,000	$450,000
Clean tanks			$2,100		$21,000
Site 19: Flower and plant grower – gulls roost on greenhouse roofs					
Gas gun	$1,400				
Patch holes				$3,120	$31,200
Replace polythene covers				$2,700	$27,000
Site 20: Golf course – gulls roost near ornamental lake; foul area, drop bones on course, peck greens					
Use of cracker cartridges			$7,137		$71,370
Taped distress calls			$10,400		$104,000
Fill holes in greens				$15,600	$156,000
Remove feathers, bones			$5,200		$52,000
Site 21: Zoo – gulls steal animals' food, foul kiosk area					
Enclose fish thawing area	$1,000				
Overhead lines on kiosk roof	$450				
Noise scarers	Nil				
Extra cleaning			$5,639		$56,390
Site 22: Municipal Health Dept. – gulls nesting on roofs perceived to be health hazard					
Gull surveys undertaken	$1,500				
Consultant report on nesting	$1,900				
Serve abatement notices			$500		$5,000

Table 1. Continued

Type of site, problems and mitigation measures	One-time costs		Annual costs		Annual costs X 10
	Mitigation	Damage	Mitigation	Damage	
Site 23: Animal Health Laboratory – gulls nest on roofs and in grounds					
Bird-ban deterrent	$582				
Distress call machine	$2,664				
Nest and egg removal			$5,184		$51,840
Monofilament on island	$432				
Site 24: Tug boat operator – gulls roost and nest on boats, roofs, creating noise, fouling and slip hazard					
Install wire tangles behind funnels to deter nesting	$100				
Hawk effigy	$29				
Gas gun	Nil				
Reposition air conditioner	$4,000				
Clean boats daily			$10,400		$104,000
Clean gutters twice yearly			$1,200		$12,000
Site 25: Rubbish tip – gulls attracted by food, cause off-site problems					
Model aircraft to chase gulls	$3,000				
Whip-cracker for 24 days	$4,224				
Helium balloons	$500				
Dog to chase gulls	$500				
Cracker cartridges			$16,000		$160,000
Replacement shotguns			$2,000		$20,000
Site 26: Rubbish tip – gulls attracted by food, cause off-site problems					
Install monofilament overhead	$40,000				
Cracker cartridges			$20,400		$204,000
De-water shallow areas	$12,000				
Consultant hire			$1,000		$10,000
Legal advice associated with dispute with neighbor affected by gulls	$20,000				
Site 27: Rubbish tip – gulls attracted by food, cause off-site problems					
Model aircraft to chase gulls	$3,000				
Gull distress call system	$3,000				
Whip-cracker for 1 year only	$35,000				

[a]All values are represented as Australian dollars (2000).

Given the cost of painting these tanks projected over 10 years, it may be cost effective to install masts for a monofilament grid spanning the whole area occupied by the tanks.

A number of respondents were concerned about accelerated corrosion of the roof fabric where gulls were present, but had no idea how to quantify this. Vermeer et al. (1988, cited in Vermeer and Irons 1991) reported that a new roof costing A$315,000 was expected to have its life reduced by half because of chemical erosion caused by the feces of glaucous-winged gulls. A Melbourne-based roofing contractor agreed with this prediction, and estimated the life of a metal roof close to salt water at 10 years, by which time discoloration and rust will be apparent. If gulls are using the roof, then these effects could be expected within 5 years. Replacement cost for a modern metal roof was estimated at A40\cdot$m^{-2} (L. Kuter, Hueston Roofing, personal communication). The annual cost of a roof based on a life of 10 years is therefore A4\cdot$m^{-2}. If gulls are using the roof to the extent that roof life is halved, the extra cost is A4\cdot$m$^{-2}\cdot$yr^{1}. Twenty-six metal roofs used by gulls for roosting or nesting inspected during this study had a median area of 582 m^2 (range 192-46,800 m^2) so the annual extra cost for roof deterioration ranged from (192 X 4) - (46,800 X 4) = A$768 - A$187,200, with a median cost of A$2,328. The total extra cost per year for all the roofs inspected is A$424,860. The few larger roofs in this sample were mostly large warehouses and industrial premises, the smaller roofs being commercial premises.

Managers interviewed were asked to comment on the effectiveness of measures employed to deter silver gulls. Effectiveness was defined as a major reduction in gull numbers or elimination of gulls from the site, and was scored on an arbitrary scale of 0 = no effect; 1 = effective for up to 4 months; and 2 = effective for more than 4 months. It was clear that some of these measures represented poor value. In particular, hawk and owl effigies, kites intended to resemble raptors and rubber snakes were used at seven sites and were reported to have either no effect or habituation by the gulls occurred within 1 or 2 days. A similar result was reported by 8 respondents who used electronic noise makers and gas guns. This contrasted with taped or digitized gull distress calls that were reported to be effective deterrents for at least 4 months. Bird deterrent sprays were used at 3 premises and were reported to have no effect. One of these was a polybutene perching or tactile repellent, but the nature of the other products was not known. In only 1 of 6 instances when nest and egg removal was undertaken was this reported to have been effective, in that the gulls did not return. Physical barriers used on 14 occasions (netting, nylon monofilament or wires) were reported to have been partially or completely successful at preventing gull access in 11 cases (Score 1: n=2; Score 2: n=9). Poor installation or inadequate maintenance can reduce the effectiveness of such barriers (personal observation). A person patrolling landfills and cracking a stock whip was reported to be an effective gull deterrent at the 3 sites where this method was tried. At Site 27 this strategy provided the main gull deterrent method for 1 year.

Recurrent costs can be quite substantial over a 10-year period (Sites 3, 6, 7, 8, 11, 14, 15, 18, 20 and 24), and installation of physical barriers to deter gulls can be very cost-effective, where this is practicable. At several sites, the cost of cleaning required as a result of gull presence had not been quantified until my interview, and managers were surprised at their magnitude (e.g., Sites 3,6 and 24). Several managers interviewed commented that gulls only started to roost or nest on their roofs after physical barriers (overhead lines or netting) were installed on another premises in the vicinity.

DISCUSSION

The overall costs to the community as a result of the superabundance of the silver gull in the Greater Melbourne Area are not clear. The limited data available thus far indicate that the costs may be substantial, but attempts to extrapolate the costs of problems caused by gulls across the Greater Melbourne area are complicated by the lack of a uniform approach to these problems. The most reliable way to determine the totality of costs incurred as a result of silver gull activity is to identify all sites where such problems occur, and record the costs involved at each site. This is further complicated by the result of actions taken to deter roosting or nesting on a roof that, in most cases observed in this study, simply shifted the problem to another roof, and increased the overall expense to the community. Belant (1997) and Raven and Coulson (1997) reported a similar response with roof-nesting gulls of several species in North America and Britain. Rather than attacking the symptoms of a large gull population, attention should be directed at reducing the cause – access to apparently unlimited anthropogenic foods, primarily from rubbish tips, but also from fishery waste, open rubbish bins at food processing works, fast food outlets and from direct feeding by the public. As Caughley (1977) observed, ". . . the treatment of a population by changing to its detriment the key components of its habitat is the most powerful and elegant technique of population control."

Knowledge of the magnitude of the costs to the community may provide the political leverage necessary to ensure the implementation of metropolitan-wide rubbish tip management changes that will prevent access to this food source by gulls and other birds. At the same time, there would need to be a public education program to encourage the use of gull-proof rubbish bins and to discourage the feeding of gulls. Food processing works and other industrial sites where food for gulls is currently available would need to ensure food waste was disposed of in secure containers. In the event of such actions being taken, there would be a sound argument for reducing the gull population by direct culling to prevent hungry gulls from turning to other food resources not currently exploited, such as vegetable or fruit crops, as has been reported with the ring-billed gull in North America (Blokpoel and Tessier 1986). Whether culling would be achievable would depend upon the prevailing public sentiment and political will.

In the interim, preparation, provision and dissemination of information about effective methods to address problems caused by gulls would reduce the costs incurred by managers.

ACKNOWLEDGMENTS

The support of Alcoa of Australia Ltd, the South Eastern Regional Waste Management Group, Deakin University and the Department of Natural Resources and Environment are acknowledged with gratitude.

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