Canterbury Southern Black-backed Gull/ Karoro management strategy

WMIL Wildlife Management International

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Contents

1. Summary

Southern Black-backed Gull/ Karoro numbers are super abundant in Canterbury, and all evidence indicates that they are likely to be continuing to increase and expand their range. Since European colonisation of New Zealand Southern Black-backed Gull/ Karoro have readily adapted to anthropogenic created habitats and food sources and their numbers and distribution have exploded. Recent research highlights that there is irrefutable proof that Southern Black-backed Gull/ Karoro are having a negative impact on the breeding success of braided river dependent shorebirds. This has led to a number of control operations being undertaken, of planned to be undertaken on rivers throughout Canterbury.

Given their widespread distribution, increasing population and the threat they poise to shorebirds, there is a clear need for a strategy to tackle this issue on a regional scale. Southern Black-backed Gull/ Karoro are increasing and impacting shorebirds on all braided rivers throughout the Canterbury region, this is a regional problem not a site specific one. Throughout all discussions with stakeholders and interest groups there was overwhelming support for the need a regional plan. The present approach to Southern Black-backed Gull/ Karoro control has each operation working independently, with little or no linkages.

As Southern Black-backed Gull/ Karoro present both an immediate and long-term threat to braided river dependent shorebird conservation a multiple control regime strategy is recommended. We make four key recommendations.

1. To protect key shorebird areas on high altitude inland river reaches we recommend a containment control approach, were as Southern Black-backed Gull/ Karoro numbers in upper river reaches already at low densities, these are further reduced and maintained at zero density within the next five years.
2. Within Canterbury there are a number of mammalian predator control projects aimed at improving the breeding success of shorebirds. We recommended that Southern Black-backed Gull/ Karoro control be carried out on all sections of rivers which have a mammalian predator programme.
3. Given their super abundance there is a clear need to manage the numbers of Southern Black-backed Gull/ Karoro in Canterbury to improve the breeding success of braided river dependent shorebirds throughout the entire region. In order to see a regional improvement in braided river dependent shorebird breeding success we recommended a reduction in the Canterbury Southern Black-backed Gull/ Karoro population of 5% per annum over the next 20 years.
4. We also recommend the establishment of a Southern Black-backed Gull/ Karoro management coordinator, and further research into gull movements, habitat use, and land-use management as future control options.

2. Introduction

The Southern Black-backed Gull/ Karoro is widespread and super abundant. It occurs throughout all non-forest habitats in New Zealand, from coastal areas to the high country. Following agricultural development in New Zealand, there has been a population explosion. Southern Black-backed Gull/ Karoro have adapted exceptionally well to modified environments (particularly intensive agriculture), readily utilising agricultural derived foods, fishing waste and landfills as new food sources. The last national population estimate in 2005 estimated that there was a total of over half a million birds (Biswell 2005).

With such abundance this has often seen them considered as a 'nuisance species' posing threats to other native birds, farmers (through predation of livestock and its propensity to carry disease), as well as a potential health threat to humans.

Braided rivers are a natural feature of the South Island, with 64% occurring in Canterbury. Braided rivers in New Zealand support unique communities of plants and animals, many of which are threatened with extinction (O'Donnell et al. 2016). Braided river birds are under threat from a diverse range of sources, including introduced mammalian predators, native avian predators, weed invasion, water abstraction, nitrification, dams, modified flow regimes associated with electricity generation, river protection works, gravel extraction, and human disturbance (O'Donnell et al. 2016).

Increasingly Southern Black-backed Gull/ Karoro have been implicated in the declines in braided river dependent shorebird populations. There is a growing body of evidence highlighting the predatory impacts gulls are having on these shorebirds.

With this in mind, Environment Canterbury has commissioned this report to develop a Southern Black-backed Gull/ Karoro strategy options paper for the Canterbury region. In this report we review the current knowledge of Southern Black-backed Gull/ Karoro biology and assess their threats to shorebirds, along with the other impacts they have on human health. We also review the current management methods being utilised in New Zealand. As part of this review we consulted widely, encouraging input from a diverse range of sectors. This consultation included a number of public meetings along with other specific meetings targeting agencies currently undertaking Southern Black-backed Gull/ Karoro control. Following advice from Environment Canterbury's Tuia team Rūnanga were engaged via Te Paiherenga where we meet to listen to the Rūnanga's values for Karoro and seek their input into the strategy development.

This report summarises the results of this review and is divided into five main sections (numbered in the report 3-7). Section 3 provides an overview of Southern Black-backed Gull/ Karoro biology, habits, population numbers and trends, and the gull's legal status. Section 4 of the report covers the effects and impacts of Southern Black-backed Gull/ Karoro, both on the endemic threatened shorebirds, but also on human health, farming, urban infrastructure and airport safety. Section 5 looks at the current control methods available to control Southern Black-backed Gull/ Karoro. Section 6 then brings these issues back into Canterbury context and investigates the significance of Canterbury's braided rivers, the current status and distribution of Southern Black-backed Gull/ Karoro in the region and why a regional strategy is warranted. Section 7 of the report provides recommended options for the development of a regional strategy for Southern Black-backed Gull/ Karoro in Canterbury.

3. The Southern Black-backed Gull/ Karoro

3.1 Southern Black-backed Gull/ Karoro *Larus dominicanus*

New Zealand status: Unprotected native

Conservation status: Not Threatened

Other common names: Dominican Gull, Kelp Gull (Australia), Black-backed Gull

The Southern Black-backed Gull/ Karoro is one of the country's most abundant, widespread and familiar bird species (Figure 1). The instantly recognisable large adult black and white gulls occur throughout all non-forest habitats in New Zealand, from coastal areas to high country farms. They have adapted exceptionally well to modified environments, especially agricultural land, whilst instantly utilising fishing waste and landfills as new food sources.

A native to New Zealand, the same species (referred to as Dominican, or Kelp Gulls), are found in similar latitudes of the southern hemisphere, including Australia and South America, and their sub-Antarctic offshore islands. Southern Black-backed Gull/ Karoro only became established in Australia in the 1940's, and have rapidly increased in numbers and distribution since the 1960's (Higgins and Davis 1996).

Following agricultural development in New Zealand, there has been a rapid population increase. The current national population has been quoted at over half a million birds (Biswell 2005), but is more likely to be approximately 500,000 individuals. This increase has often seen them considered a 'nuisance species' posing threats to other native birds, farmers (through predation of livestock and its propensity to carry disease), as well as a potential health threat to humans. Recent research has shown that Southern Black-backed Gull/ Karoro have significant impacts on braided river dependent birds; both directly as a major nest predator, but also indirectly by excluding such species from large sections of riverbed.

Figure 1. An adult Southern Black-backed Gull/ Karoro; one of the most widespread and recognisable bird species in New Zealand. Image © Rebecca Bowater FPSNZ www.floraandfauna.co.nz, Birds Online.

3.2 Identification

The Southern Black-backed Gull/ Karoro is New Zealand largest gull, measuring 60cm in length, weighing approximately 1kg with a wing span of 128-142cm. Adults have a white head, neck, underparts and tail, and a black back and upper wings (except for a narrow trailing white edge). They have yellow bills with a red spot at the tip of the lower mandible, pale yellow eyes with an orange outer ring and pale greenish yellow legs (Figure 1). Juveniles look very different, with dark brown plumage, black bills and legs in their first year. Their brown feathers have pale edges giving a mottled grey-brown appearance, which gradually lightens with age and seasonal wear, until they moult into

adult plumage by year four (Higgins and Davis 1996, Heather & Robertson 2005). Males are slightly bigger, however there is no visual difference between the sexes.

3.3 Habitat

In the New Zealand, Southern Back-backed Gull/ Karoro can be found inhabiting a variety of environments including, estuaries, harbours, beaches, rocky shores, riverbeds, farmland, and sparsely over subalpine tussock land. They readily occur in in towns and cities, utilising sports fields, roof tops, landfills and other manmade structures. They rarely venture far out at sea and usually forage within 10 kilometres of the shore. Breeding usually takes place on steep headlands, sea cliffs, sand or shingle spits and many outlying islands, as well as far inland on riverbeds, near lakes and alpine tarns. They are particularly abundant around wharves, sewage outlets, seafood processing plants, braided rivers and inshore fishing boats, scavenging on rubbish, organic waste and fish offal.

3.4 Breeding

Southern Black-backed Gull/ Karoro breed between October and February, in large colonies or in solitary pairs (Miskelly 2013). They are monogamous, with pair bonds continuing from one breeding season to the next. The number of gulls at colonies start building up in late July, with nests constructed almost immediately (mainly by the male). The nests are a bulky collection of dry grass, small sticks, seaweed, feathers and tidal debris, often built in a well-vegetated site on bare sand, rock or mud. The clutch is of 2-3 eggs (69 x 47mm, 80g), which are greyish green with dark brown blotches. Eggs are laid 2-3 days apart and are incubated by both parents for 23-27 days. Parents guard the chicks until fledging age at approximately 7-8 weeks. After fledging, chicks remain with their parents for a couple of months, and juveniles up to 6 months old are seen begging for food (Heather & Robertson 2005).

Southern Black-backed Gull/ Karoro begin to breed from four years old. Annual adult survival is high (93%), with a life expectancy of 14 years but have been known to live up to 28 years (Fordham 1985; Heather & Robertson 1996).

Figure 2. A newly hatched Southern Black-backed Gull/ Karoro chick and egg in nest. Image © Glenda Rees, Birds Online.

A Southern Black-backed Gull/ Karoro juvenile bird begging for food from an adult. It takes four years for birds to transition from the brown juvenile plumage to the black and white adult plumage. Image © Raewyn Adams, Birds Online.

3.5 Diet and Behaviour

The Southern Black-backed Gull/ Karoro prey on and scavenge a wide range of marine and terrestrial carrion, invertebrates, fish, lizards, small mammals, other birds and their eggs and chicks. They are opportunistic, their diet varying with season and surrounding environment depending on the availability of food. They have been recorded killing young lambs and poultry, as well as stealing food from other seabirds such as terns and penguins (Heather & Robertson 2005). The gulls scavenge organic waste from landfills, sewage outlets and farms, as well as fish offal from fishing boats and meat processing factories. Southern Black-backed Gull/ Karoro are able to dive briefly below the water surface to obtain food and have been seen breaking open shells for molluscs by carry it to some height and dropping them onto rocks.

Nest sites and colonies are aggressively defended by the gulls with a long series of strident persistent "ki-och" calls, as well as swooping to ward off an array of predators, including humans. They are conspicuous and generally gregarious, often roosting on rooftops in cities, attracted to food sources provided inadvertently or intentionally by people. Flocks will often follow behind inshore fishing boats or ploughs cultivating farmland. They capable of flying long distances to access food resources, being recorded travelling up to 50km from nesting areas (Fordham 1967; Horton *et al.* 1983) southern black-backed gulls will shift their diets to readily available, anthropogenic foods when possible.

3.6 Population and distribution

Southern Black-backed Gull/ Karoro were recorded in New Zealand during James Cook's voyages in 1770 and 1773 (Biswell 2005), however population numbers were likely to have been relatively small at that time (Oliver 1955). Although there is no detailed account during the very early period of European settlement it is likely that numbers were small at this time, and were perhaps as low as a few thousand birds. With the development of agriculture numbers have rapidly increased and their range expanded (Higgins and Davis 1996).

Since European colonisation of New Zealand Southern Black-backed Gull/ Karoro population numbers have increased rapidly (Oliver 1955, Turbott 1967). Human activities such as the development of ports, meat-processing factories, refuse dumps and farmland, are key drivers to the Southern Black-backed Gull/ Karoro population increase. Between 1961 and 1985 the population more than doubled along the south-west of the North Island (Powlesland & Robertson 1987), some colonies increasing up to 11 times from the 1940s to 1964 (Fordham 1967). The population has increased where human influences are not as marked, such as the Waitaki Basin, where between the 1960s and 1990s Southern Black-backed Gull/ Karoro increased in density and range; likely still driven by human derived food sources (lambs, rabbits and refuse dumps) (Maloney 1999).

Southern Black-backed Gull/ Karoro are widely distributed in New Zealand, existing in over 76% of the map squares surveyed 1999-2004 for the *Atlas of Bird Distribution in New Zealand* (Robertson et al. 2007). On islands off New Zealand, Southern Black-backed Gull/ Karoro can be found breeding on the Chatham, Bounty, Antipodes, The Snares, Campbell and Auckland Islands. The have also been reported breeding as far as the Ross Dependency, Kermadec Islands and Norfolk Islands (Heather & Robertson 2005). Widespread throughout the North and South Islands, there are hundreds of colonies, many exceeding 100 pairs, some even over 1000 pairs. The species is considered as New Zealand's most common gull (Higgins & Davies 1996), and with an estimated population of over half a million, it is referred to as a "super abundant" species (Miskelly 2013).

3.7 Movements and dispersal

Southern Black-backed Gull/ Karoro are capable of long-distance flights, moving around New Zealand, and although unquantified are thought to make trans-Tasman crossings regularly (Williams *et al* 2006).

To study the species dispersal, a total of 3,455 Southern Black-backed Gull/ Karoro chicks were banded between 1959 and 1993 at four Canterbury localities (three being river colonies and one an island

colony). Most birds (96%) dispersed <100km from their banding sight, with 10% of recoveries from >200km (Rowe 2013). With these birds dispersing widely throughout New Zealand, traveling as far as Dipton in Southland (486km) and the Wairarapa in the North Island (282km) (Rowe 2013). Long-distance movements by Southern Black-backed Gull/ Karoro are not uncommon and have been recorded in the past; for example, 1320 km from Makarewa to Auckland (Robertson 1972), 840 km from Mataura River mouth to Masterton (Robertson 1973), and 530 km from Muriwai Beach to the Ruamahanga River in South Wairarapa (Robertson 1964a). Rowe (2013) concluded that the direction and dispersal distances of Southern Black-backed Gull/ Karoro are variable and can occur between the North and South Islands.

Daily movements of Southern Black-backed Gull/ Karoro are less well-known, although they have been known to fly up to 50km between feeding, roosting and nesting areas (Fordham 1967; Horton *et al.* 1983). In the 1970s, the diurnal dispersal of large gulls such as great black-backed gulls (*Larus marinus*) were observed in England. Flight paths appeared to follow topographical features such as river valleys, likely because feeding sites were coincidently associated with them (Horton *et al* 1983). Feeding sites included landfills, agricultural land and playing fields which gulls would arrive at shortly after first light. Other gulls arrived as late as mid-morning presumably after spending time at other sites and departed in the late afternoon back towards the roost. Pre-roosts assemblies were often formed at refuse tips closer to the roost (Horton *et al* 1983).

Similarly, Oliver (1973) found a correlation between the predominant flight paths Southern Black-backed Gull/ Karoro from colonies on Rangitoto Island to the location of eight open refuse tips in the coastal margins of Auckland. All of these refuse tips were within 50km of the Rangitoto colonies so were readily accessible to southern black-backed gulls for daily foraging trips. An aerial survey in 1965 counted 12,236 Southern Black-backed Gull/ Karoro in the Wellington area, 5977 (48.8%) of which located at or near refuse tips or meat works (Fordham 1968). This creates a clumped distribution and shows Southern Black-backed Gull/ Karoro flock to major 'artificial' feeding sites during the day.

3.8 Legal status of Southern Black-backed gull

The Wildlife Act 1953 is the legislation which provides protection to New Zealand wildlife. Essentially all wildlife in New Zealand is absolutely protected unless it is specified on one of five Schedules (Schedules 1 through 5).

Southern Black-backed Gull/ Karoro is listed on Schedule 5 of the Wildlife Act 1953, which means under Section 7 (Certain wildlife not protected) they are not protected. As such Southern Black-backed Gull/ Karoro are considered an unprotected species, and it is legal for any person to kill or be in possession of Southern Black-backed Gull/ Karoro.

Although Southern Black-backed Gull/ Karoro are unprotected, other legislation covering animal ill-treatment ensure that although the killing of Southern Black-backed Gull/ Karoro is legal, it must be carried out in a humane manner. Further there is legislation which covers the use of vertebrate toxic agents which prescribe the use of any toxin used in the control of Southern Black-backed Gull/ Karoro.

3.9 Tangata Whenua

Ngāi Tahu are the Kaitiaki of the southern islands of New Zealand – Te Waipounamu. In 1998 Ngāi Tahu settled their Treaty claims with the crown, and confirmed their place as Kaitiaki of Te Waipounamu.

Ngāi Tahu considered Southern Black-backed Gull/ Karoro as a Taonga species and it was listed on the Crown's Settlement Deed. Through this Settlement the Crown acknowledged Ngāi Tahu has a special relationship with a number of bird, plant and marine mammal species; and this includes Southern Black-backed Gull/ Karoro. The settlement further states that those responsible for the management of these species are required to consult with and have particular regard to Ngāi Tahu views about any management proposals.

Southern Black-backed Gull/ Karoro eggs and chicks were a traditional food source for Ngāi Tahu, and Mahinga Kai was used in the Crown's Settlement Deed. Mahinga Kai refers to Ngāi Tahu interests in traditional food and other natural resources and the places where those resources are obtained. Ngāi Tahu remain interested in the ability to harvest Southern Black-backed Gull/ Karoro eggs and chicks.

4. Effects and impacts of Southern Black-backed Gull/ Karoro

Southern Black-backed Gull/ Karoro abundance especially in urban environments has caused many conflicts with people, including the transmission of pathogens through contamination of water sources, hazards to aircrafts, damage to buildings from nesting material and defecation, along with causing a general nuisance. Increasingly they are also being identified as a major conservation issue, proving to be a significant predator of threatened endemic bird species.

4.1 Native birds

Southern Black-backed Gull/ Karoro have negative impacts on threatened and protected native bird species in New Zealand. They are known to harass other sea and shore birds, attempting to breed in the same place, as well as prey on their eggs and chicks. Previous studies in New Zealand have shown that Southern Black-backed Gull/ Karoro have preyed upon the following species;

White-fronted Tern (Williams 1963)
Australasian Gannet (Robertson 1964b)
Black-fronted Tern (Steffens *et al.* 2012; Bell *et al.* 2018)
New Zealand Dotterel (Willis *et al.* 2003)
Black Stilt (Brown and Keedwell 1998)
Black Swan (Miers and Williams 1969)
Black-billed Gull (Thierry *et al.* 2016; Bell and Harborne, in prep)
Banded Dotterel (BRAID website)
Wrybill (BRAID website, Biswell 2005)
Variable Oystercatcher (Moorhouse 2017)
Paradise Shelduck (Biswell 2005)
Shore Plover (Miskelly 2013)
Fairy Tern (Miskelly 2013)

Other species have also been observed being harassed by Southern Black-backed Gull/ Karoro and it is likely that they are being preyed upon For example takahe chicks have been seen to cower in the remote Murchison Mountains when the gulls fly overhead (Biswell 2005).

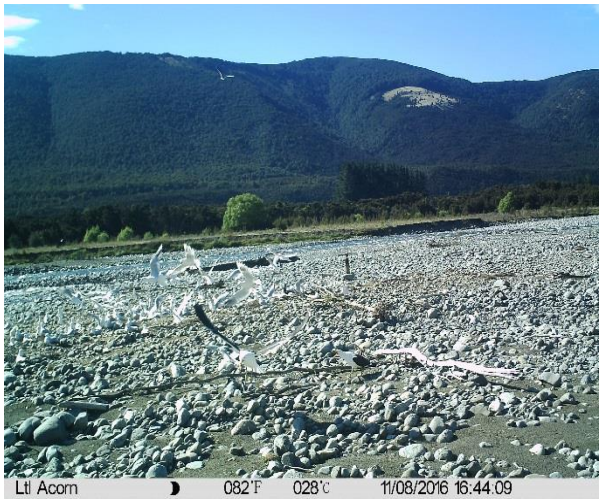
Southern Black-backed Gull/ Karoro are a significant predator to braided river dependant birds particularly black-fronted terns and black-billed gulls, whose colonies have been known to completely collapse due to on-going Southern Black-backed Gull/ Karoro predation. A recent study monitoring Black-fronted Tern on the Waitaki River, Canterbury, used remote cameras to film predation events (such as by mammalian predators) and concluded that Southern Black-backed Gull/ Karoro were the primary predator, responsible for 62.5% of the predation events (Schlesselmann, 2018). Predation by Southern Black-backed Gull/ Karoro took place throughout daylight hours and although black-fronted terns were often filmed bombarding the intruder, they were unable to deter the much larger species (Schlesselmann, Pers. Comm.). Similar black-fronted tern monitoring projects carried out in 2011 and 2017, filmed numerous predation events by Southern Black-backed Gull/ Karoro on the Wairau, Clarence and Acheron Rivers (Steffens 2011; Bell *et al.* 2018).

Southern Black-backed Gull/ Karoro predation can be severe, and cause total nesting failure at colonies of other braided river dependent species. In the late 1980s, Southern Black-backed Gull/ Karoro were observed predating eggs from a white-fronted tern colony wiping out 180 nests and as well as a colony of approximately 50 red-billed gulls on shell banks near Bowentown (Biswell 2005). Bell and Harborne (in prep) observed Southern Black-backed Gull/ Karoro harassing Black-billed Gull colonies on the Wairau and Clarence Rivers, grabbing chicks and predating eggs. Using time lapse photography, Southern Black-backed Gull/ Karoro were filmed taking chicks throughout daylight hours as well as during the night resulting in no chicks surviving to fledging (See case study below). A Black-billed Gull colony of 1,500 adults located on the Waimakariri River, failed due to pressure by

surrounding Southern Black-backed Gull/ Karoro colonies, who were observed entering the Black-billed Gull colony repeatedly eating eggs (Thierry *et al.* 2016).

The issue of Southern Black-backed Gull/ Karoro preying on other bird species has also been observed in other parts of the world. Southern Black-backed Gull/ Karoro have been recorded in Argentina preying on the eggs and the young of cormorants, penguins, terns, Black Oystercatchers and Southern Giant Petrels (Yorio *et al.* 1998). Among the species affected, terns appear to be particularly vulnerable to gull predation, and in several studies has resulted in the loss of nest contents and the abandonment of the breeding area (by individuals as well as by the entire colony) (Yorio and Quintana 1997).

Figure 3. Southern Black-backed Gull/ Karoro predating a Black-fronted Tern nest on the Upper Clarence River. Image © Wildlife Management International Limited



Southern Black-backed Gull/ Karoro predating a chick from a Black-billed Gull colony on the Wairau River. Image © Wildlife Management International Limited

Case study: Southern black-backed gulls at Black-billed gull colonies

Using time lapse photography, Wildlife Management International Limited (WMIL) identified predators at Black-billed Gull colonies and identified Southern Black-backed Gull/ Karoro is the most significant predator (Bell and Harborne, in prep).

The Black-billed Gull is a small endemic gull, largely restricted to the braided rivers of the eastern South Island and is listed as 'Nationally Critical' by the New Zealand Threat Classification System (Robertson *et al*. 2017). To determine productivity and threats facing the species, WMIL carried out a camera study in the 2014/2015 and 2015/16 breeding seasons at the Clarence River mouth, as well as on the Wairau River in the 2016/17 and 2017/18 breeding seasons.

Video evidence showed that Southern Black-backed Gull/ Karoro appeared to target the Black-billed Gull colonies following chick hatching. Southern Black-backed Gull/ Karoro surrounded the colonies during early incubation but little predation by gulls were recorded (Mischler and Bell 2016). As chicks started to hatch, gull predation increased rapidly, suggesting that Southern Black-backed Gull/ Karoro were selectively predating Black-billed Gull chicks, not eggs (Table A).

Table A. Predators caught on camera during day-time hours at Black-billed Gull colonies on the Clarence and Wairau Rivers. Disturbance by predators are shown per month, and any disturbance that could not be identified is labelled as unknown. SBBG = Southern Black-backed Gull/ Karoro, Harrier = Swamp Harrier.

Colony	Date	Total hours filmed	Predator present (hours)			Predator present (%)		
			SBBG	Harrier	Unknown	SBBG	Harrier	Unknown
Clarence	Nov 2014	108.1	0.12	1.06	0.70	0.1%	1.0%	0.7%
	Dec 2014	132.3	42.61	0.08	0.87	32.2%	0.6%	0.7%
Clarence	Nov 2015	183.7	0.10	0.18	0.20	0.1%	0.1%	0.1%
	Dec 2015	395.9	0.10	1.05	0.87	0.1%	0.3%	0.2%
	Jan 2016	172.8	16.81	1.13	0.45	9.7%	0.7%	0.3%
Upper Wairau	Nov 2016	257.5	42.37	0.00	0.35	16.5%	0.0%	0.1%
Mid Wairau	Nov 2016	277.0	0.12	0.00	0.05	0.1%	0.0%	0.1%
	Dec 2016	327.8	10.08	0.00	0.12	3.1%	0.0%	0.1%
Lower Wairau	Nov 2017	325.8	3.60	0.05	0.38	1.1%	0.1%	0.1%

Southern Black-backed Gull/ Karoro were recorded harassing colonies throughout the day, but a significant amount of predation from gulls was also occurring at night (Figure A). Predation pressure from Southern Black-backed Gull/ Karoro caused complete breeding failure at the Clarence colony in 2014/15 and at one of the Wairau River colonies (Mid-Wairau colony) in the 2016/17 breeding season (Bell and Harborne, in prep).

Figure A. *Southern Black-backed Gull/ Karoro predating Black-billed Gull colonies on the Wairau River, although most predation occurred during the day, predation also occurred at night. In the lower image predation was recorded at 2.04 AM.*

4.2 Public health

Adapting well to modified environments, Southern Black-backed Gull/ Karoro population numbers have rapidly increased in New Zealand taking to feeding at landfills, sewage outlets, meat processing factories and farmland (Figure 3). Foraging through urban and organic waste in their hundreds creates a public health issue, as they have been shown to carry pathogenic organisms (McDiarmid 1962). Due to their opportunistic and gregarious nature, gulls are known to be important vectors for pathogens (e.g. *Salmonella*). So although they may not be the casual source, they act as efficient dispersal agents (Hatch 1996).

Southern Black backed Gull/ Karoro have been reported to carry anthropogenically derived enteric bacteria such as *Campylobacter* spp., *Salomonella* spp. and *Esherichia coli* (Fenlon 1981; Quessey and Messier 1992; Nelson *et al*., 2008; More *et al.,* 2017) which are considered the most common causes of food-borne zoonotic. As Southern Black-backed Gull/ Karoro can travel long distances, they can effectively spread these diseases via faecal contamination of pasture and surface waters used for drinking, recreation or irrigation (Reed *et al.* 2003).

The relationship for the transmission of diseases from gulls to humans can prove difficult, however international studies suggests that gulls such as the Southern Black-backed Gull/ Karoro are important vectors (Belant 1997). Monaghan *et al.* (1985) describes the occurrence of *Salmonella* spp. in gulls (*Larus* spp.) in England, determining a substantial positive correlation between the incident of salmonellosis in the human population and the proportion of gulls tested carrying salmonellae in that urban area. In Scotland, gull faeces in public water supplies has been specified as the most credible source for disease transmission (Jones *et al.* 1978). In a second Scottish study, gull faeces contamination of water supplies was the cause of 26 occurrences of human and animal salmonellosis (Reilly *et al.* 1981). Nelson *et al.* (2008) compared populations of *Escherichia coli* among gulls (*Larus* spp.) to wastewater and landfills in the US. Using ribotyping, a genotypical bacteria source tracking method, it was determined that gulls obtain faecal bacteria from wastewater and rubbish, which they may transport to recreational beaches and waters (Nelson *et al.* 2008).

Pathogens like *Salmonella* spp. have a high survival rate in aquatic environments and if water sources are contaminated by Southern Black-backed Gull/ Karoro droppings it is both an economic and public health concern (Winfiel and Groisman, 2003).

Figure 4. Southern Black-backed Gull/ Karoro scavenging as a digger spreads and buries rubbish at the Oamaru Rubbish Tip. Gulls have adapted ready to food sources such as refuse stations and from these can spread pathogens to surround rural land and urban centres. Image © Rob Morris

Southern Black-backed Gull/ Karoro have rapidly adapted to agricultural development of New Zealand. From the earliest creation of pastoral farming, gulls expanded their range to exploit this new food resource. Southern Black-backed Gull/ Karoro are now a significant element of the avifauna on farmland, and are especially abundant in areas of intensive agriculture. As such, this has often put gulls in conflict with farmers as their impacts affect farming operations.

Southern Black-backed Gull/ Karoro are often considered a pest on farmland, where some attack cast ewes and new born lambs. In areas of high gull concentrations, this can often result in significant loses of lambs in some seasons. As such most sheep farmers consider Southern Black-backed Gull/ Karoro a pest.

Salmonella Brandenburg is a disease that has caused widespread abortions and deaths in pregnant ewes since 1996 around Canterbury, Otago and Southland. In 1998, the causative organism also spread to cattle herds, leading to diarrhoea, dysentery and deaths in both adults and calves, as well as abortions in adult cattle (Clark 2001). This disease has caused major financial losses and is an important occupational hazard, with several farmers, farm workers and veterinary practitioners having contracted the disease (Clark 2000). Principal factors involved in the local spread of the disease is environmental contamination from a high number of organisms excreted by affected animals, as well as by faecal excretion of the bacteria by Southern Black-backed Gull/ Karoro.

Southern Black-backed Gull/ Karoro are known to scavenge on aborted sheep foetuses and membranes, which have high concentrations of *Salmonella* Brandenburg. The Ministry of Agriculture and Forestry funded a project to determine the likely role the gulls have, as farmers were quick to observe and hold them responsible for the local spread of the disease (Clark 2001). In September 1999, up to 25 million *Salmonella* Brandenburg organisms per gram of intestinal contents were verified in Southern Black-backed Gull/ Karoro on affected farms, as well as on non-affected neighbouring farms (Clark *et al.* 1999). Their faeces can contaminate grazing land and pollute sources of stock water (Johnston *et al.* 1979, Fenlon 1981). They have the ability to spread the disease to other farms during abortion season, when travelling long distances to feed. The infection is highly unlikely to be carried from one season to another and does not affect the Southern Black-backed Gull/ Karoro clinically.

4.3 Urban infrastructure

Southern Black-backed Gull/ Karoro are seen in many places around New Zealand as a nuisance, especially by nesting on rooftops. They can cause structural damage to buildings from nesting material and defecation, obstruct roof drainage systems with debris, defecate on nearby vehicles, and disturb the inhabitants of buildings due to noise. Roof-nesting by Southern Black-backed Gull/ Karoro typically occurs during rapid growth of colonies on natural sites in surrounding areas and is successful due to their exploitation of anthropogenic food (Belant 1997). They are observed nesting on top of buildings and on ledges mainly in coastal towns which can have an affect businesses and home owners.

Porirua business owners located between the Spicer landfill and the harbour, have complained to the City Council about southern black-backed gulls dropping waste onto their roofs, such as animal parts, bones and condoms (Nicoll 2017). Southern black-backed gulls have become a financial nuisance in urban areas harassing maintenance personnel. One business has had to remove staff members from their top storey due to southern black-backed gull excrement on the rooftop causing a horrid smell and maggots to drop down inside from the ceiling (O'Neil 2013).

This issue is also observed in other parts of the world, where gulls (*Larus spp.*) are colonising on buildings and other man-made structures such as bridges, jetties, pipelines and in 1993 an oil platform in the Irish Sea. Surveys in 1976 and 1994 in Britain and Ireland have determined that gulls *(Larus spp.)* nesting on urban infrastructure have increased in terms of breeding pairs (Herring Gulls by 10% per annum; Lesser Black-backed Gulls by 17% per annum) as well as by the number the number of sites colonised (Herring gulls by 5% per annum; Lesser black-backed gulls by 13% per annum) (Raven and Coulson 1997). Due to the disturbances that nesting gulls cause, the spread of gulls into urban areas is a matter of growing concern for Britain and Ireland, as well as elsewhere in Europe, North America and other parts of the world.

4.4 Airstrike risk

In many airports around the world, bird strike can pose a great risk to aircrafts. In New Zealand, Southern Black-backed Gull/ Karoro are considered one of the most hazardous bird species for aircrafts due to their comparatively large size, abundance and that they are often observed at between 1000 and 3000 feet above ground level (Robertson 1992; Avisure 2016). Airports can be in close proximity to cities, farmland, landfills and coastal environments where Southern Black-backed Gull/ Karoro are commonly found feeding. When the gulls are feeding they may cross the flight path of an aircraft and are at risk of getting sucked into the engine, causing damage to the plane.

At the Christchurch Airport, there have been 38 strikes by Southern Black-backed Gull/ Karoro, including one damaging one between 1993 and 2005. An additional 57 strikes including four damaging ones have been by unidentified gulls and is suspected a large proportion of these is likely by Southern Black-backed Gull/ Karoro. During a two and a-half-year period in the 1990s, 74 birds were hit at Wellington Airport, as well as 362 recorded near-misses. Of these 63% were recorded Southern Black-backed Gull/ Karoro (Hutching 2006). A number of airports around New Zealand such as Wellington Airport have monitoring and control action plans in place for Southern Black-backed Gull/ Karoro at airfields.

5. Southern Black-backed Gull/ Karoro Control Methods

With their threats to human health and welfare, and their impacts on threatened wildlife Southern Black-backed Gull/ Karoro have been the target of control operations for more than 60 years (Caithness 1968). A range of management techniques have been employed in New Zealand.

5.1 Alpha Chloralose

Alpha Chloralose is a narcotic, often used to sedate and capture wildlife (Gregory and Wilkins, 1997), however due to its strong toxic effect on avian species it is now frequently used as a control method in New Zealand. The oral toxin induces birds first into a state of dissociation, before they become motionless and sleepy, and then usually die in a sleeping position by hypothermia. Some try to make an effort to fly and recover their equilibrium, however when the drug is administered at a high dosage death will follow relatively quickly with minimal disturbance. This method of control is regarded as a humane form of poisoning.

Alpha Chloralose poisoning has been widely used as a control method to reduce the number of nesting Southern Black-backed Gull/ Karoro in New Zealand. Prior to a poisoning operation monitoring is carried out to determine the area, size and distribution of a gull colony, the surrounding land use, and to estimate the timing of egg-laying. Southern Black-backed Gull/ Karoro are targeted during the peak nesting period, when the gulls are sitting on eggs and the first chicks are hatching. During this time the parent gulls' instincts keep them in close proximity to their nests, which therefore will help reduce the spread of gulls after poisoned. Performing a poisoning operation during the time of peak incubation will reduce the number of chicks needing to be humanely disposed of, as well reduce the risk of by-kill. Non-target species such as other braided river birds are less likely to enter Southern Black-backed Gull/ Karoro colonies during incubation time (see case study below).

To achieve the best results when using Alpha Chloralose, pre-feeding is a crucial to condition the gulls to the same type of bait that is going to be used to carry the toxin. Pre-feeding should be carried out 3-5 days immediately before the Alpha Chloralose baits are laid out, so that the gulls become accustomed to human presence and readily eat the toxic baits when they are laid out. The same carrier in a non-toxic form should be used during the pre-feeding, so the gulls are less likely to be deterred when it comes to the laying of toxic baits.

Toxic baits should be laid during calm weather, as windy conditions may blow poisoned gulls away from the colony before dying, making the recovery of carcasses laborious. As Alpha Chloralose is more effective at lower temperatures, toxic baits should ideally be laid out as close to dusk or daylight as possible. Weather can become a limitation to Alpha Chloralose operations, as a minimum 5-day good weather gap is essential. Another limitation to this control method is that it can become very labour intensive, especially during the recovery and disposal of the gull carcasses for large colonies.

Prior to carrying out an Alpha Chloralose poisoning, the appropriate approvals and Approved Handler Test Certificates are needed for the operation and poison handling. The adjacent land owners to the control site should be notified prior, in case any poisoned Southern Black-backed Gull/ Karoro do advance outside the target colony area. Appropriate signage must be established at all major access locations prior to the Alpha Chloralose operation and should remain until all toxic baits and poisoned gulls are retrieved.

The use of Alpha Chloralose sometimes raises the concerns of members of the public, and some operations have encountered some resistance of its use. Information about Alpha Chloralose and the need to control Southern Black-backed Gull/ Karoro, are not well known by the public, and this can create unease. Currently most Alpha Chloralose operations have been small scale (<1,000 birds) and localised, without the need for wide-scale public notification. In a larger scale Alpha Chloralose operation planned across 30km of the Hurunui River in December 2018, wider neighbouring landowner consultation required significantly more consultation to resolve issues (land owner access,

the use of toxins in the environment, and the safe disposal of bodies) and ensure the operation was approved.

Case study: Waiau Toa/ Clarence River mouth Southern Black-backed/Karoro control

At the Waiau Toa/ Clarence River mouth a mixed colony of Black-billed Gull, Red-billed Gull and White-fronted Tern have been studied since the 2012 breeding seasons. Monitoring has shown that Black-billed Gull breeding success has been extremely low. Video evidence showed Southern Black-backed Gull/ Karoro continuously entering the colony taking chicks, causing complete breeding failure in the 2014/15 and 2015/16 seasons (Mischler and Bell 2016).

In order to improve breeding success Environment Canterbury and the Department of Conservation contracted Wildlife Management International Limited (WMIL) to control a nearby Southern Black-backed Gull/ Karoro colony.

In preparation for the operation all nests we located and mapped. A total of 350 nests were identified. As egg laying was protracted at this colony, egg pricking was undertaken for two weeks to ensure all birds remain incubating, and no chicks hatched prior to the toxin operation.

Figure A. WMIL staff member carrying out egg pricking at the Waiau Toa/ Clarence River southern black-backed gull colony prior to the Alpha Chloralose operation, November 2017

Figure B. The distribution of Southern Black-backed Gull/ Karoro nests at the Waiau Toa/ Clarence River mouth as mapped during planning of the control operation.

Gull control was carried out using an Alpha Chloralose operation, prior to commencing this, the appropriate permissions were gained. Including landowner and neighbouring landowner consent. Warning signs were displayed at points of entry to the operational area (Figure C), and these remained in place until one month after the operation (Figure D).

Pre-feeding using non-toxic baits started on 17 November and continued until the toxic operation on 21 November (4 days pre-feeding). Each nest had 9-10 baits scattered around the rim, pre-feeding continued until the gulls were keyed in to the baits.

On 21 November non-toxic baits were replaced with toxic baits containing 10% Alpha Chloralose. These were presented to birds in the same way, with 9-10 baits at each nest. Baiting started at the top end of the colony with a team of seven spread out across the colony, ensuring baits were spread throughout the colony in a timely manner. The gulls formed a feeding frenzy immediately after the first toxic baits were laid out, and all the baits were readily consumed.

As Alpha Chloralose is fast acting, poisoned Southern Black-backed Gull/ Karoro were collected two hours after the operation. With a second sweep through the area the following morning. A total of 600 gulls were collected immediately, and a further 50 the following morning (Bell, 2018). All gull carcases were disposed of at the Blenheim Landfill in accordance with their biological waste disposal protocols.

Following the operation, a maximum count of 55 adult Southern Black-backed Gull/ Karoro were recorded within the colony area, with the operation being regarded as successful, with a resulting 90 – 95% reduction in gulls (Bell, 2018).

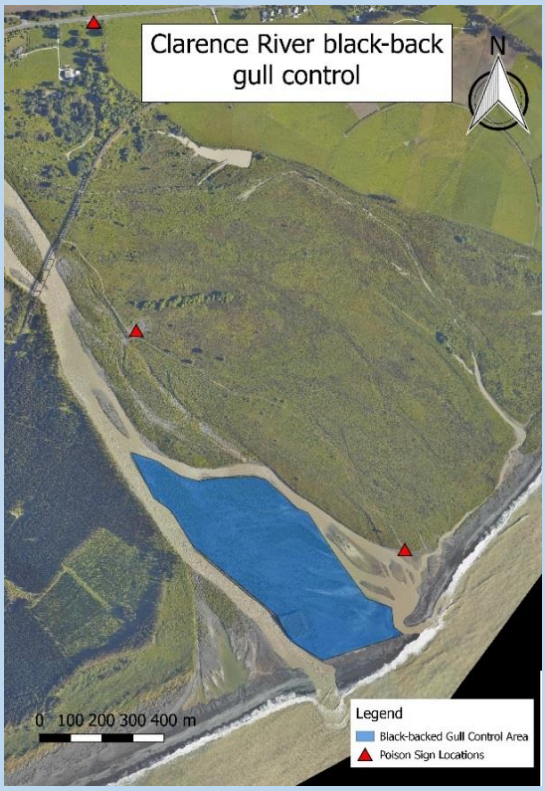


Figure C. Southern Black-backed Gull/ Karoro control area and locations of warning signs erected at normal points of entry to the Waiau Toa/ Clarence River mouth.

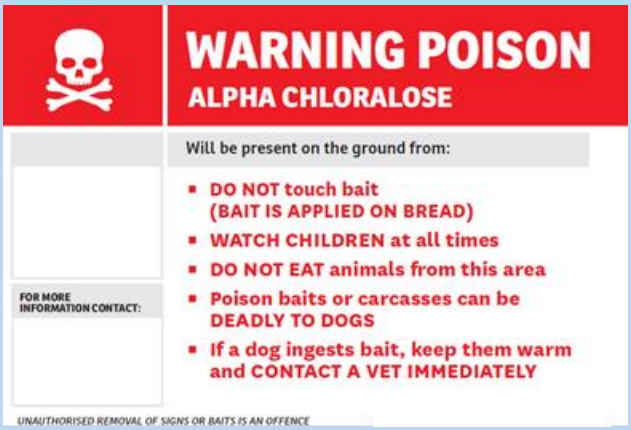


Figure D. Example of warning sign erected at normal points of entry to the Waiau Toa/ Clarence River mouth.

5.2 Shooting

Shooting has been a control method for the used to systematically reduce Southern Black-backed Gull/ Karoro numbers. The methods has some advantages over other methods as it is not critically weather dependant nor reliant on a large number of workers.

Prior to a shooting operation, monitoring needs to be carried out at the operational area to determine the activity (i.e. feeding zones, nest sites etc.), the stage of nesting, and to estimate the number of gulls present. Operations should be timed for the height of egg-laying, when the gulls are sitting on eggs or when the first chicks are hatching. During this period the parent gulls are most protective, their instincts keeping them in close proximity to the nest site, making for the most productive time of shooting. Carrying out shooting operations before large numbers of chicks are present reduces the number of chicks needing to be humanely disposed of.

Several methods can be undertaken during a shooting operation to draw gulls to the shooter, especially when nests are scattered over a large area. An approach can be to pre-feed at the site and (i.e. rabbit carcases) to attract gulls into a known feeding zone. Using dead gulls to create curiosity is a method proved successful in previous operations, by throwing them into the air and propping them up with wire to act as decoys. Another approach is to move in and around the riverbed and re-enter the nesting site, to trigger new outbreaks of activity giving the opportunity to target gulls.

Shooting has less potential risk to non-target species, as the shooter identifies each gull shot. Further, shooting requires no specific permissions or consents, other than operators having a valid firearms licence. Shooting has been commonly used as a follow up to toxin operations, and is likely most efficient in smaller colonies (<500 pairs).

However, shooting can cause gulls to disperse from the control area, and it appears that birds can become gun shy both over a few days of the control period, but also over successive years of control, which reduces the efficiency of shooting.

A range of different shooting methods have been utilised:-

5.2.1 Sniping

This technique is proficient for targeting gulls that are sitting/nesting at ranges of up to 250 metres. It is especially useful when targeting individual gull's occurring in separate feeding locations or post control operation of colonies. Limitations encountered include strong winds, heavy rain and that the gulls can be reluctant to land for long periods of time when other dead gulls are present on the ground.

5.2.2 Shotgun shooting

This is an efficient technique for undertaking multiple shots at gulls in flight, and has proven to be effective at reduce numbers in breeding colonies. All gulls provoked that come into range when the shooter enters the nesting area have the opportunity to be shot. Throwing a dead gull into the air and moving in and out of the colony, can attract curious gulls closer, which were not previously in shooting range. The limitation to using a shotgun is the difficulty of shooting fast flying gulls and the shooter needs to be an experienced wing shooter to ensure the operation is achieved effectivity.

5.2.3 Aerial shooting

Aerial shooting is a developing and evolving method to control Southern Black-backed Gull/ Karoro numbers, and has been used effectively in the Mackenzie Basin. It has evolved from ground shooting as gulls appeared to becoming wary following repeated ground shooting operations. Aerial shooting is effective for small scattered colonies as the operator can cover large distances in a short period of time. The use of both experienced pilots, and shooters, is paramount in ensuring a successful control operation. The location of non-target species needs to be assessed prior to operations, due to the risk of disturbance to their colonies and breeding activity.

5.3 Sterilisation of eggs

To control Southern Black-backed Gull/ Karoro sterilisation of eggs can be employed to reduce productivity. The reduction of productivity by egg sterilisation will led to long term population declines, however this method is a long term control as it can take decades to see significant population reduction.

A considerable amount of care must be taken to keep eggs and nests intact while undertaking egg sterilisation. As this will help to prevent adult gulls to recognise their eggs are no longer viable and lay replacement clutches. Therefore reducing the need for repeated treatments per nest.

Egg sterilisation is labour intensive and requires frequent visits to the breeding colony to achieve effective control. The method is often seen by the public as more humane and preferable to other lethal control methods targeting adult birds.

There is a series of procedures can be done to treat eggs so that they do not hatch -

5.3.1 Egg puncturing

Egg puncturing is carried out by striking a heavy-gauge needle into the egg shell and membrane. The piercing can be performed by hand or done by embedding the needle onto a long stick. This will effectively sterilize it by affecting the water balance inside killing the developing embryo. Incubating gulls can sometimes recognise eggs that have been treated by puncturing, causing them to be rejected and subsequent relaying to occur (Corkhill 1970).

5.3.2 Egg shaking

Egg Shaking is carried out by vigorously shaking eggs by hand to disrupt the internal membranes. Eggs need to be shaken until internal fluids can be heard sloshing around inside. This sterilising process can be time consuming for sizeable colonies. Again some re-laying following desertion has been observed, but not to the same extent as egg puncturing (Corkhill 1970).

5.3.3 Egg pricking

Hypodermic injecting eggs with a preservative (such as formalin), is a common technique used to control gull numbers. A needle is first used to prick a small hole in the eggshell, before using a syringe to inject 5 ml of formalin (10 %) into the egg, then sealing the hole with nail polish. This both kills the developing embryo and preserves the egg. This method reduces the number of birds which recognise that their eggs have failed, so birds continue to incubate. Reducing the number of birds that abandon nests and relay.

5.3.4 Egg oiling (dipping)

Egg oiling is a sterilising treatment used to kill the embryo, while keeping the egg still intact. It involves completely coating the egg in a thin film of non-toxic mineral oil (such as paraffin oil) or vegetable oil. By dipping the egg in oil, it prevents gases from moving through the eggshell, therefore suffocating the embryo. As with egg pricking, oiling seems to cause less abandonment and re-laying.

5.4 Other possible control methods

Although not currently in use, other control methods, or modifications of existing methods could be investigated for Southern Black-backed Gull/ Karoro control such as the below.

5.1 DRC-1339 (Starlicide)

DRC-1339, commercially known as Starlicide, is an oral toxicant currently registered in New Zealand to control rooks (*Corvus frugilegus*) and starlings (*Sturnus vulgaris)*. It has been successfully used as an avicide elsewhere in the world to control blackbirds, pigeons, crows, ravens, magpies and gulls (USDA 2001). It is used in the United States to control nesting Herring Gulls, Greater Black-backed Gulls

around coastal areas, where high gulls' populations are negatively impacting less abundant colonial water birds (Solman 1994).

DRC-1339 can be applied in a variety of baits including bread, walnuts, oats, maize, brown beetles and more recently macaroni (Nelson 1994). Pre-feeding is essential to achieve the most effective results, as it keys in the target species to the baits. Non-toxic baits should be in the same form and laid out in the exact fashion as the baits containing DRC-1339. The compound is a slow acting avicide and takes up to 24 hours to be completely metabolized by the target species. Once in the bloodstream it starts to weaken the birds' liver and body functions. This causes necrosis of the birds' kidneys and circulatory impairment, leading to a non-violent death from uremic poisoning and congestion of major organs.

DRC-1339 would however need to be registered to use as a control method for Southern Black-backed Gull/ Karoro in New Zealand.

5.4.2 Non-breeding season control

Most Southern Black-backed Gull/ Karoro control operations have targeted gulls at the breeding colonies during the breeding season, historically when gulls are incubating eggs before chicks start hatching. As such this leaves a small window for the control operation. Issues with weather or other operation problems can therefore impact the operation and cause delays. Control targeting gulls outside of the breeding season may minimise risks to non-target species and reduce animal welfare concerns.

Control operations outside of the breeding season will mean that there is no risk of chicks being present. Removing any animal welfare concerns around the difficulty of locating all chicks for humane euthanasia following a control operation. Further, non-breeding season control may be able to be done in farmland, reducing the risks to non-target species, especially aquatic species also present on braided rivers (i.e. eels).

As such further investigation into undertaking control at other times of the season or in foraging areas away from colonies should be investigated.

5.4.2.1 Landfill control

The control of Southern Black-backed Gull/ Karoro at landfills and other refuse sites has been employed in New Zealand, including Alpha Chloralose operations and shooting. There is a greater risk to non-target species especially in toxin operations as other species are present at landfills.

5.4.2.2 Shoulder season control

Southern Black-backed Gull/ Karoro start occupying colonies as early as August, and there would be the opportunity to undertake control operations during this pre-breeding period. Although currently few operations have targeted this period, this would greatly increase the time available to undertake control at breeding colonies, especially valuable when multiple colonies on a river or district are being controlled.

5.4.2.3 Off river farmland winter control

Currently most control operations are carried at breeding colonies or at landfills and refuse sites. Within rural areas Southern Black-backed Gull/ Karoro numbers often build up on farmland during the non-breeding season. Control operations could target these winter aggregations of birds. However, any control operation would need to ensure that there is no risk to non-target species. In particular Black-billed Gull and Red-billed Gull often also form winter flocks on farmland, especially near the coast.

6. Canterbury

6.1 Braided rivers in Canterbury

Braided rivers are a natural feature of the South Island. They are rivers, which over at least part of their reach have multiple, mobile channels that flow across a gravel flood plan (Gray and Harding 2007). Braided rivers in New Zealand support unique communities of plants and animals, many of which are threatened with extinction (O'Donnell et al. 2016).

Braided river birds are under threat from a diverse range of sources, including introduced mammalian predators, native avian predators, weed invasion, water abstraction, nitrification, dams, modified flow regimes associated with electricity generation, river protection works, gravel extraction, and human disturbance (O'Donnell et al. 2016).

Braided rivers are found throughout the country, covering a land area of over 250,000ha, although this total represents only 0.9% of the country's total land area (O'Donnell et al 2016). All but 2% occurring in the South Island, with Canterbury having 64% of New Zealand's braided rivers.

6.2 The status of braided river dependent shorebirds in Canterbury

A number of endemic braided river birds have their stronghold in Canterbury, with a significant proportion of the New Zealand population breeding in Canterbury. The National population and Canterbury population for six key endemic shorebirds are listed in Table 1 below. Both national and Canterbury estimates are derived from multiple sources and expert opinion. This highlights that Canterbury holds a significant proportion of the population of many braided river dependent shorebird, especially Black Stilt, Wrybill and South Island Pied Oystercatcher.

Table 1. Conservation status (national threat ranking), national population estimate and trend, and estimated Canterbury population for endemic braided river dependent shorebird species.

Species	National threat ranking	Estimated National population	National trend	Estimated Canterbury population
South Island Pied Oystercatcher	Declining	50,000	Declining	70%
Black Stilt	Nationally Critical	130	Increasing under intensive conservation management	100%
Banded Dotterel	Nationally Vulnerable	50,000	Declining	50%
Wrybill	Nationally Vulnerable	5,000	Declining	95%
Black-billed Gull	Nationally Endangered	75,000	Declining	35%
Black-fronted tern	Nationally Endangered	7,000	Declining	60%

Using Ornithological Society of New Zealand bird atlas data Walker and Monks (2017) highlighted significant range declines in wading birds, terns and gulls in South Island braided rivers between 1969-79 and 1999-2004. There was a contraction of the breeding range on the South Island from a relatively wide distribution of inland squares to a narrow inland distribution centred on the Mackenzie Basin. They concluded that loss of habitat due to intensive land use and predation contributed to declines in braided river shorebirds, which become less widespread across inland South Island.

The Department of Conservation maintain a database of bird counts on braided rivers across Canterbury. These are a combination of river surveys carried out by the Department, Environment Canterbury and other community conservation groups. Mapping the last decade's results from these counts confirms the results of Walker and Monks (2017). Black Stilt, Wrybill, Banded Dotterel and South Island Pied Oystercatcher all have the most significant populations in the upper river reaches (WMIL unpublished data).

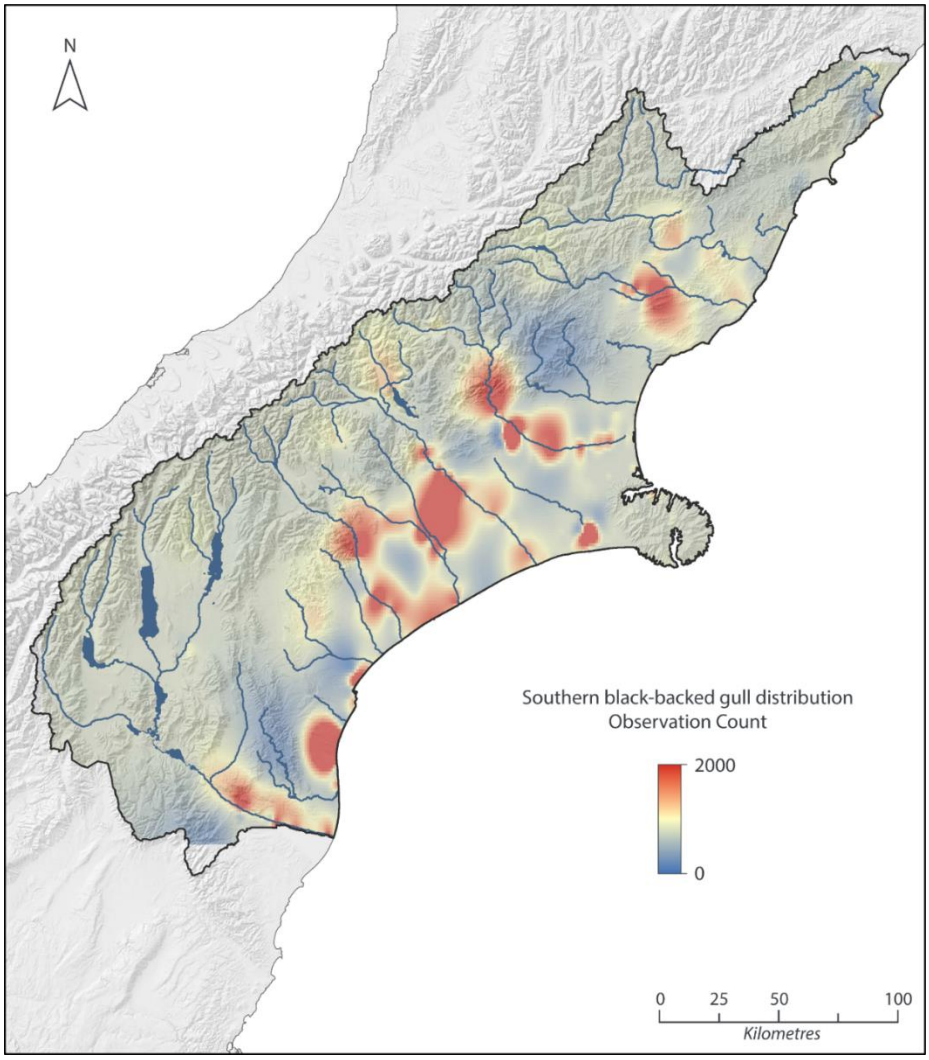
6.3 Southern Black-backed Gull in Canterbury

6.3.1 Population numbers and distribution

The Southern Black-backed Gull/ Karoro population in Canterbury is extremely large, with an estimated 35,000 breeding pairs. Allowing for pre-breeding birds (all birds <4 years old) the estimated total population of Southern Black-backed Gull/ Karoro in Canterbury is 105,000 individuals.

This population is not evenly distributed across the entire region. Using data from the citizen science bird recording database eBird the distribution of Southern Black-backed Gull/ Karoro in Canterbury was mapped (Figure 5). Mapping all gull observation highlights that gull numbers are greater in low lying areas within 60km of the coast; with braided rivers being focal points for the population, from which birds dispersing to forage across adjacent farmland. Intensive agriculture in the low lying areas has allowed Southern Black-backed Gull/ Karoro numbers to explode to current levels.

Figure 5. Distribution and density of Southern Black-backed Gull/ Karoro in Canterbury mapped using data from eBird.



Braided rivers in Canterbury hold a significant proportion of the breeding Southern Black-backed Gull/ Karoro population. A November 2016 aerial survey of most of the braided rivers in Canterbury recorded over 150 Southern Black-backed Gull/ Karoro colonies (Figure 6). Gull colonies were not evenly distributed, with a higher proportion of both colonies and breeding pairs found nearer the coast. Mean colony size within 50km of the coast was significantly larger (mean 185 pairs, T-test p=0.0029) than colonies >50km from the coast (mean 74 pairs) (Figure 7).

Figure 6. Location and size of Southern Black-backed Gull/ Karoro colonies on Canterbury Braided Rivers in November 2016.

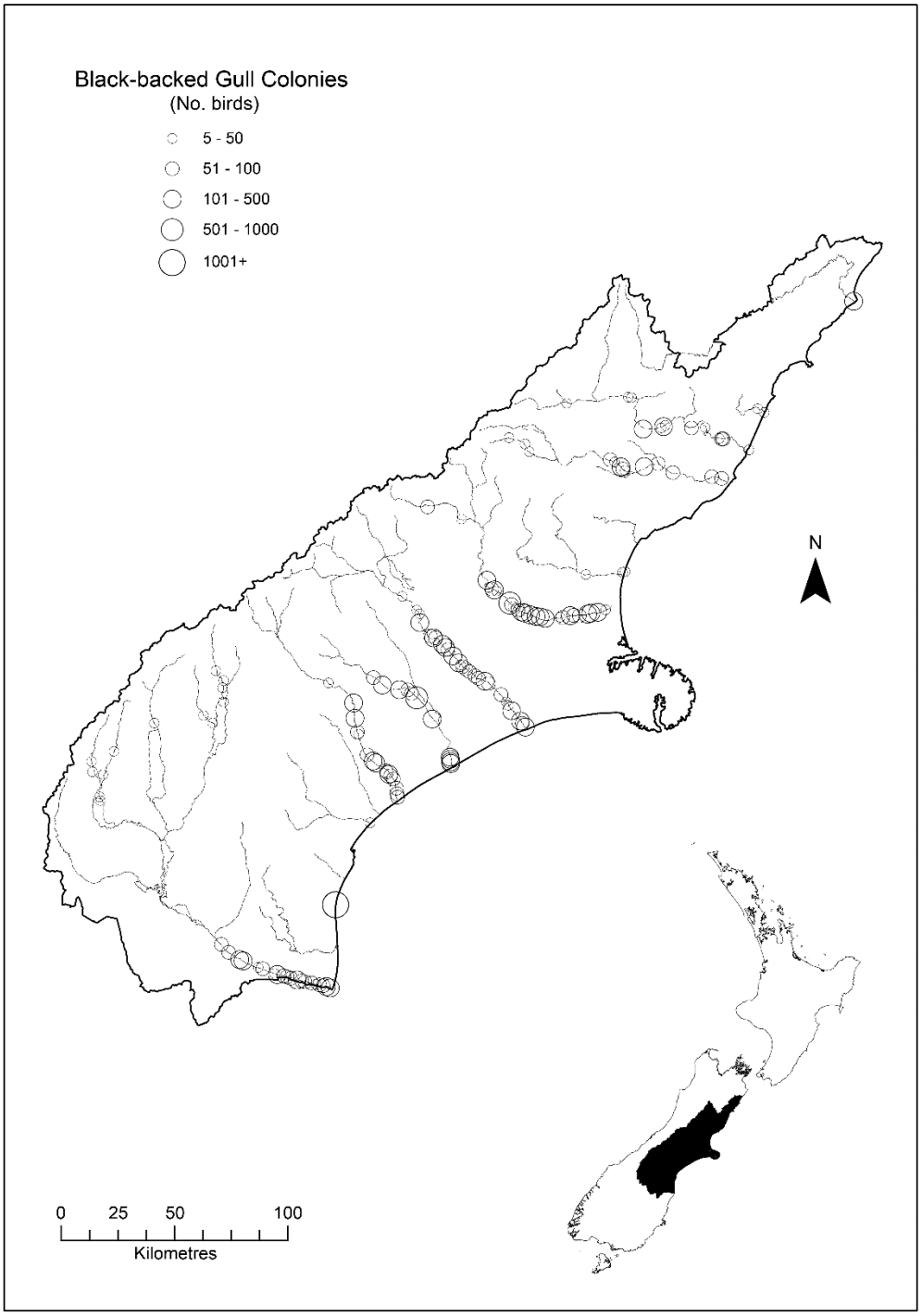
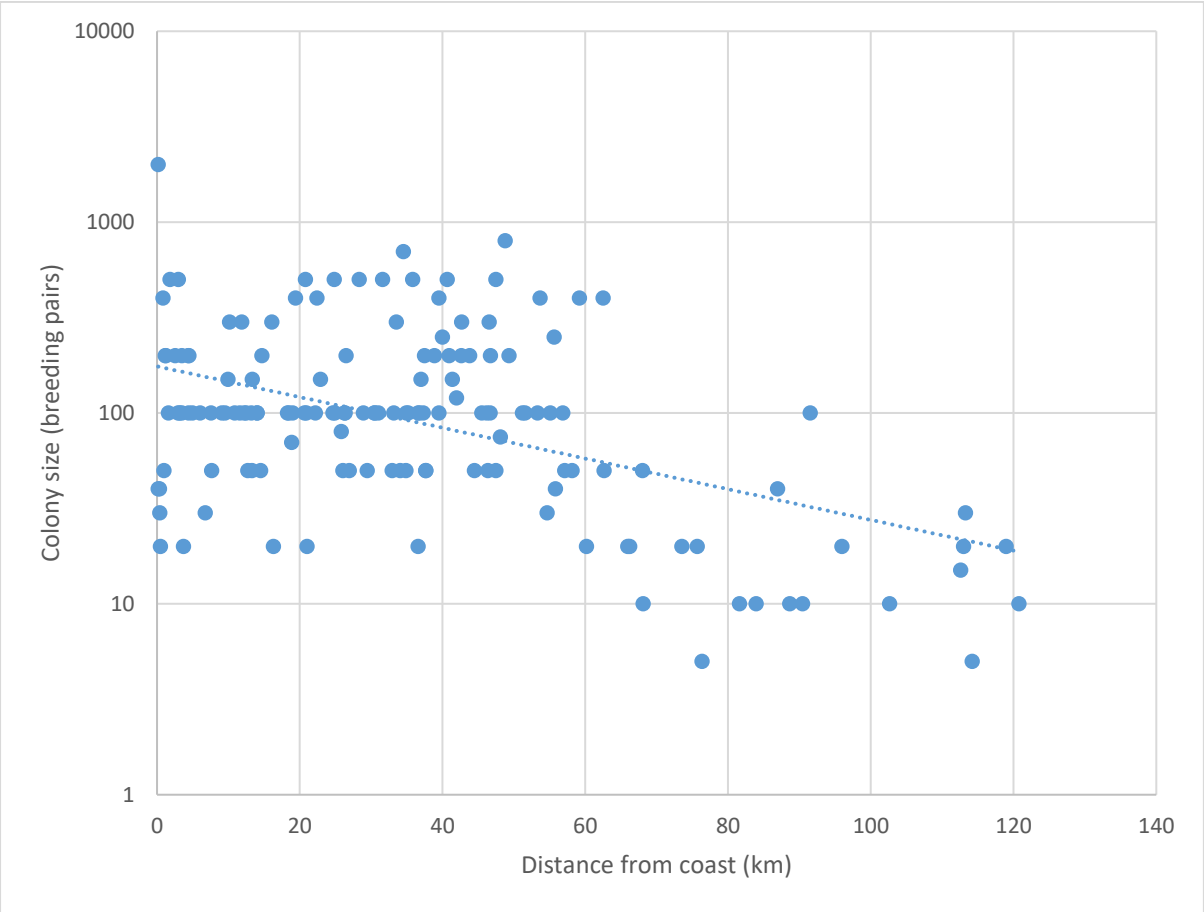


Figure 7. Size of Southern Black-backed Gull/ Karoro colonies in relation to distance from the coast.



The population of Southern Black-backed Gull/ Karoro in Canterbury is certainly continuing to increase, with marked increases seen on many of the regions braided rivers. Although there is no specific data, from anecdotal evidence it appears that breeding success of colonies on braided rivers is very high. This high breeding success is likely continuing to drive population increases and enable the Canterbury Southern Black-backed Gull/ Karoro population to continue to increase.

6.3.2 Effects of Southern Black-backed Gull/ Karoro on Canterbury's shorebirds

Southern Black-backed Gull/ Karoro are known to be impacting on shorebirds in Canterbury. Almost all braided river shorebird projects on several rivers throughout the region have recorded predation by Southern Black-backed Gull/ Karoro.

With the super abundant size of the population, and their widespread distribution across the region focused on braided rivers Southern Black-backed Gull/ Karoro are impacting on shorebird populations on nearly every river. Further, it is likely that these gulls are also impacting on shorebirds in other habitats in Canterbury (see case study below).

Case study: Burwood Landfill closure and impacts on Charlesworth Wetland

Burwood Landfill is located northeast of Christchurch City and covers approximately 87 hectares. From July 1984, the landfill ran as the primary refuse disposal facility for Christchurch, with approximately 230,000 tonnes of waste internment each year (AECOM 2016). The unlined waste disposal facility attracted a large number of Southern Black-backed Gull/ Karoro daily until it closed in June 2005. The Burwood Landfill's closure largely altered the distribution and foraging behaviour of Christchurch's Southern Black-backed Gull/ Karoro, which had negative impacts on a number of local river and wetland birds.

In 1985, the population of the Southern Black-backed Gull/ Karoro on the Waimakariri River was estimated at approximately 10,000 (Avisure 2016). Following the closure of the landfill the local population reduced significantly on the Waimakariri to less than half this number, with river flood events and control efforts also contributing to this decline. Numbers of Southern Black-backed Gull/ Karoro present at the landfill plummeted from 2500-3500 to 0-10, and many of these gulls relocated to nearby coastal estuaries (A. Crossland pers comm) and likely to farmland to the north of the city.

Christchurch's estuaries and wetlands then saw a substantial increase in predation by Southern Black-backed Gull/ Karoro on other bird species. Mallard and Scaup ducklings, Pied Stilt chicks and small native gulls' eggs and chicks were observed preyed on by Southern Black-backed Gull/ Karoro This increase heavily suppressed the breeding success of these targeted species in areas such as the Avon-Heathcote estuary, Bexley Wetland, Brooklands Lagoon, Charlesworth Wetland and Bromley oxidation ponds.

A mixed colony of Red-billed Gull and Black-billed Gull at Charlesworth Wetland failed due to Southern Black-backed Gull/ Karoro predation in the 2015/16 breeding season. Southern Black-backed Gull/ Karoro from a nearby colony of approximately 20 were observed harassing the mixed colony taking chicks over several weeks. Many Pied Stilt chicks at Charlesworth Wetland were also observed being predated during this period. The on-going pressure from Southern Black-backed Gull/ Karoro resulted in Red-billed Gull and Black-billed Gull abandoning the site, and not returning in the following breeding seasons. Currently Charlesworth Wetland is home to a colony of more than 30 Southern Black-backed Gull/ Karoro which have displaced the mixed colony, with very few other wetland bird species breeding there.

Figure A. Southern Black-backed Gull/ Karoro breeding at Charlesworth Wetland.

Image and information from Christchurch City Council (A Crossland Pers. Comm.)

6.3.3 Current Southern Black-backed Gull/ Karoro control operations

The Department of Conservation, Environment Canterbury, Christchurch International Airport and a number of community conservation groups are currently undertaking or proposing Southern Black-backed Gull/ Karoro control operations on braided rivers throughout Canterbury for conservation purposes. The majority of these operations are to protect braided river dependent birds, with Christchurch International Airport undertaking control to reduce bird strike risk to aircraft.

Current or planned (with funding already in place) control operations are occurring on the Clarence River, Waiau river, Hurunui River, Waimakiriri river, Ashburton River, Rangitata River, Lower Waitaki River and rivers in the Mackenzie Basin.

Although there are some connections between many of these projects, at present these control operations are operated independently of each other, with no regional coordination. Further, there is no forum for the sharing of results and dissemination of learnings from control operations.

6.3.4 Cost of Southern Black-backed Gull/ Karoro control operations

The current costs of Southern Black-backed Gull/ Karoro control operations were reviewed, although this review was limited by the available data on the cost of Southern Black-backed Gull/ Karoro operations. Data was only available for 16 operations; 4 Alpha Chloralose operations, 2 ground shooting operations and 10 aerial shooting operations.

From these 16 operations the average cost was $52.8/ gull killed. However for most operations the figures provided were only operational costs, and did not include the planning (including the permissions process) phase of the operation. As such this figure does not reflect the true cost of the operation, and we estimate that the true cost is $62/ gull culled.

7. Southern Black-backed Gull/ Karoro Management Strategy options or recommendations for Canterbury Region

Southern Black-backed Gull/ Karoro numbers are super abundant in Canterbury, and all evidence indicates that they are likely to be continuing to increase and expand their range. Linked to this there is irrefutable proof that Southern Black-backed Gull/ Karoro are having a negative impact on the breeding success of braided river dependent shorebirds. This has led to a number of control operations being undertaken, of planned to be undertaken this season.

Given their widespread distribution, increasing population and the threat they pose to shorebirds, there is a clear need for a strategy to tackle this issue on a regional scale. Southern Black-backed Gull/ Karoro are increasing and impacting shorebirds on all braided rivers throughout the region, this is a regional problem not a site specific one. Throughout all discussions with stakeholders and interest groups there was overwhelming support for the need a regional plan. The present approach to Southern Black-backed Gull/ Karoro control has each operation working independently of each other, with little or no linkages.

Their current numbers, and rate of population increase are entirely derived from anthropogenic improvements in food supply. Southern Black-backed Gull/ Karoro have readily adapted to an agricultural landscape and endless food supply from poor waste management practises.

The increasing Southern Black-backed Gull/ Karoro populations are having significant negative impacts on braided river dependent shorebird populations and are likely to be one of the key drivers in decreasing population trends in threatened shorebirds. Furthermore, burgeoning populations of Southern Black-backed Gull/ Karoro are having harmful effects on human health and public safety.

Because of these impacts, currently a range of organisations are undertaking Southern Black-backed Gull/ Karoro control operations throughout Canterbury. These programmes are happening independently of each other, with no co-ordination and little communication between practitioners.

There is a clear need to develop a regional strategy to address the issues of a super abundant and increasing Southern Black-backed Gull/ Karoro population in Canterbury.

There is irrefutable proof that Southern Black-backed Gull/ Karoro are having a negative impact on braided river dependent shorebirds, and with increasing populations this is likely to exert even more pressure on shorebird populations.

Southern Black-backed Gull/ Karoro have clearly adapted well to increased food supplies from human sources, and their populations have exploded well beyond natural levels. It is their adaption to human induced change which has created an imbalance, with now super abundant Southern Black-backed Gull/ Karoro predating other shorebird species that have significantly smaller, and declining populations.

Therefore, there is a clear need to undertake some form of population control within Canterbury. With a large, increasing population spread over a wide geographical area a multi option strategy is required. There is a need to protect current shorebird values without further population declines, whilst working towards a regional reduction in Southern Black-backed Gull/ Karoro numbers, which would lead to large scale benefits to braided river dependent shorebirds.

7.1 Land use

Southern Black-backed Gull/ Karoro numbers in Canterbury are not evenly distributed, with significantly greater numbers in low lying coastal areas (See figure 5 and 6). This distribution is almost entire driven by high intensity agriculture throughout this area. This land use has provided gulls with

an abundant food source and enable their population numbers to explode. Furthermore poor waste management practises at landfills have added to this, helping to drive population growth.

Land use needs to be taken into consideration when developing a Canterbury-wide strategy. With Southern Black-backed Gull/ Karoro having high breeding success and population growth in low lying areas, any control regime may be compromised. A significant part of public opposition to gull control is that gulls have managed to adapt well to human induced change, and that the problem is entirely human caused. There are increasing calls for better land and waste management that will readdress these issue into the future, so the need for lethal control options are not required in the future.

Although intensive agriculture will remain as the primary land use in all low lying areas, efforts should be made to develop ways that this land use will no longer be able to support such high populations and even enable long term reductions in gull numbers. Pivotal to this will be ensuring that waste management practises are improved, especially at landfills and offal disposal. Through their regulatory powers Environment Canterbury should ensure that all future resource consents take into consideration the potential food sources for Southern Black-backed Gull/ Karoro and ways to minimise its availability.

Land use change in upper river reaches is potentially the single biggest threat to Canterbury's shorebird populations. Any increases in intensive agricultural in the high country are likely to see increased immigration and/or an improvement in breeding success for Southern Black-backed Gull/ Karoro, leading to significant population increases. Left unchecked this will almost certainly cause further declines in threatened shorebird populations in these areas.

Environment Canterbury should take into account the impacts of Southern Black-backed Gull/ Karoro on braided river bird breeding habitat when considering resource consents related to high country land-use. This would also be consistent with the Canterbury Management Strategy braided river goals and targets for protecting braided river bird breeding habitat.

7.2 Southern Black-backed Gull/ Karoro control options

With an estimated regional population of 105,000 individuals, spread across the entire region Southern Black-backed Gull/ Karoro control presents some significant challenges. However, to ensure that the conservation status of braided river dependent shorebirds does not continue to decline, gull control in key shorebird areas is needed immediately (in conjunction with other conservation efforts). Over the long term, to improvement braided river habitats for shorebirds throughout the region, a long-term reduction in Southern Black-backed Gull/ Karoro numbers regionally wide is also needed.

The timescales, conservation outcomes, and costs of these two goals are different; but both are linked. Long term the most effective solution is a reduction in Southern Black-backed Gull/ Karoro numbers regionally. Gull control in high value shorebird areas will require ongoing management due to reinvasion; as such regional shorebird conservation status will only be significantly improved by restoring braided rivers throughout the region, including significant reductions in Southern Black-backed Gull/ Karoro numbers throughout Canterbury.

We recommend undertaking three Southern Black-backed Gull/ Karoro control approaches in Canterbury.

7.2.1 Containment control; high country rivers (short to medium term)

The current distribution of Southern Black-backed Gull/ Karoro in Canterbury is not even, with numbers on the inland rivers significantly fewer than on lower river stretches (see section above). In addition, braided river dependent shore bird numbers are higher in these inland rivers. Both Walker

and Monks (2017) and an analysis of DOC held river survey data have highlighted that shorebirds in the eastern South Island have retracted to higher altitude inland river reaches.

We recommend a containment control approach, were Southern Black-backed Gull/ Karoro numbers in upper river reaches are reduced to zero density. Ongoing management would be needed to ensure that these river reaches are not re-colonised by Southern Black-backed Gull/ Karoro. This control regime should be initiated immediately to protect shorebirds, and continue for five years to remove Southern Black-backed Gull/ Karoro from upper reaches. Following this control period ongoing follow up control to prevent gulls re-establishing should be carried out annually.

This approach would require the control of an estimated 3,000 birds and would see control operations focused on key shorebird breeding habitat. This approach would likely to be more socially acceptable as it would require the culling of fewer birds and is more values focused.

A containment approach would see key shorebird habitats protected and enable a more sustainable control regime. Currently Southern Black-backed Gull/ Karoro numbers are highest in areas of intensive agricultural and population centres (low lying coastal areas). With effectively an unlimited food supply, gull numbers are continuing to expand. Therefore, any control carried out in these areas may be less effective as high breeding success means culled birds are rapidly replaced. The control of gulls in upper reaches where the surround farmland is less intensively managed is likely to be more successful. These areas are currently supporting significantly fewer gulls with a more limited food supply, making it likely that gulls can be removed from these areas long term with less management.

A containment approach would require ongoing management to maintain gulls at zero density. Although currently not well understood, there would almost certainly be some immigration into the containment area from the lower river reaches. Based on current estimates of gull control operations a containment approach would be estimated to cost $186,000 over 5 years ($37,200 per annum). However, given the isolated nature of some of the upper river reaches, these costs may be an underestimate. In addition, after initial control, there would be ongoing regular costs to maintain zero densities of gulls.

7.2.2 Values-based (site led); individual river control programmes (short to medium term)

Canterbury has significant populations of braided river dependent shorebirds and currently there are a number of mammalian predator control projects operating in Canterbury aimed at improving the breeding success of these shorebirds. There is a range of projects, with a number of project leaders; including the Department of Conservation, Environment Canterbury and Community Conservation Groups.

Although a review of these projects was outside the scope of this project, most appear to have be initiated because of the high shorebird values occurring on that river. It is recommended that Southern Black-backed Gull/ Karoro control be carried out in conjunction with mammalian predator control on rivers sections deemed of high value.

As pointed out by O'Donnell et al (2016) predator control projects on braided rivers must target the entire predator guild, including native avian predators. Any mammalian predator control project should also incorporate Southern Black-backed Gull/ Karoro control. Existing projects which do not include Southern Black-backed Gull/ Karoro control should immediately incorporate this, and all future projects should include Southern Black-backed Gull/ Karoro control during their development, planning and fund sourcing.

This approach would again require localised community engagement and support, and as long as the values of the river warranted gull control, should be socially acceptable. To ensure ongoing community support control operations must be well planned and implemented, ensuring that non-target risks (especially to domestic pets) are minimised.

Individual values-based control operations would require additional funding to current (or planned) mammalian predator control projects. Control operation cost would vary between rivers depending on the number of gulls. Depending on the size of the Southern Black-backed Gull/ Karoro population on each river section tentative costs are $50,000 - $220,000 for each river in Canterbury. As each project would be working independently, it is likely (especially in projects on lower river reaches) that ongoing immigration from surrounding rivers would require ongoing maintenance.

7.2.3 Regional wide population reduction (long term)

Given their super abundance there is a clear need to manage the numbers of Southern Black-backed Gull/ Karoro in Canterbury to improve the breeding success of braided river dependent shorebirds. Current population numbers are far in excess of pre-human levels and to help achieve a marked improvement in shore bird breeding success across the entire Canterbury region, significant reductions in the regional Southern Black-backed Gull/ Karoro populations are needed.

Southern Black-backed Gull/ Karoro numbers have exploded due to human derived food sources, so regional wide control will need to be coupled with improved land use practises (see above). This would see gull numbers stabilising at a more natural, pre-human level. Regional wide control would reduce predation pressure on shore birds, increase breeding habitat available, and eliminate harassment, hopefully leading to improved breeding success. Further, regional wide control provides a more sustainable long term solution as it reduces reinvasion

In order to help see a regional improvement in braided river dependent shorebird breeding success we recommend a reduction of the Canterbury Southern Black-backed Gull/ Karoro population by 5% per annum over the next 20 years. Over time this would mean reducing numbers to approximately 2,000 breeding pairs, and would require the culling of an estimated 101,000 birds.

This approach would require significant community engagement to ensure support. Current Southern Black-backed Gull/ Karoro control operations can generate some negative feedback, and require careful management to enable them to be carried out successfully. To date all of these control operations have been small scale (single colony focused) that don't require public notification. With more widespread control across entire river systems or districts this would require a higher level notification. Moving to a regional control strategy would require a significant increase in the level of community engagement and consultation.

A regional wide control strategy would require significant funding. A review of the costs of current control operations indicates that the current cost is $62/per gull controlled. As such a tentative cost for regional wide Southern Black-backed Gull/ Karoro control over the next 20 years would be in excess of $6.3 million ($310,000 per annum). However, as this approach works in combination with the short term objectives above, there would be cost efficiencies with coordination of control regimes.

7.3 Control coordination

Currently there are a number of Southern Black-backed Gull/ Karoro control operations occurring throughout Canterbury, from the Mackenzie Basin to the Clarence River Mouth.

However, as discussed, current Southern Black-backed Gull/ Karoro control operations are currently being undertaken with no coordination. In order to deliver a regional Southern Black-backed Gull/ Karoro strategy there is a clear need for a Regional Coordinator.

At present there is no central depository for information and advice on undertaking Southern Black-backed Gull/ Karoro control, and each project is essentially learning as they go. During meetings with agencies undertaking Southern Black-backed Gull/ Karoro control there was a clear message that a centralised system with regional coordination was the best way forward.

The role of a Regional Coordinator would be to provide specialist advice; including:

- Provide advice during operation planning. This should include site visits to determine the best control method to utilise.
- Provide advice and material to assist the advocacy campaign around control operations to assist public engagement.
- Collate data and summarise control programmes outcomes to centralise information.
- Maintain and update Standard Operating Practises to incorporate latest learnings.
- Guide research needs and report findings to control practitioners.
- Assist and coordinate with Mahinga Kai

7.4 Technical control method plan

Throughout Canterbury there is a number of control operations being carried out which are utilising a range of control methods. Alpha Chloralose and shooting are the main methods used, with some egg sterilisation also occurring (often in conjunction with other control methods). Currently each agency maintains their own best practise or standard operating procedures.

In discussions with control operators throughout Canterbury, there was a clear message that together with a regional strategy there is a need for a single best practise guidelines for Southern Black-backed Gull/ Karoro control, and that these need to be updated.

There is a need for a review of control methods, both in relation to operational procedures, but also effectiveness, and then an update to guidelines and standard operating processes for control operations.

In particular there is a need to review the use of Alpha Chloralose, and especially the permissions requirements for its use. Alpha Chloralose is the most commonly used method to Southern Black-backed Gull/ Karoro, but there is a number of differences and inconsistencies in its use throughout Canterbury. In particular there was a desire for the application process required for approval to be used to be streamlined for Department of Conservation operations.

There was widespread agreement that there is a need for a more detailed technical control methods document, and that the current best practise document currently isn't providing the information needed when planning an operation. Currently there is no guidance on selecting which control method to employ, and the current Department of Conservation approvals process is cumbersome. We strongly recommend the development of a single best practise guide for Southern Black-backed Gull/ Karoro control. This document should include a decision making process for selecting control methodology, and best practise guidelines for each control method.

7.5 Research

The development of regional strategy options/ recommendations or this report has been hampered by the lack of knowledge in several key areas. Making informed decisions on the best approach has been challenging. Filling these information gaps is a key recommendation of this report or paper, and we identify several significant research requirements.

7.5.1 Southern Black-backed Gull/ Karoro foraging behaviour

Little is known about the daily foraging behaviour and range of Southern Black-backed Gull/ Karoro. With no in-depth studies undertaken in New Zealand, foraging range has just been estimated up to 50km, but there has been no detailed studies to investigate this.

Likewise, the ecology and behaviour of gulls on braided rivers have not been studied. Gulls use rivers for breeding, foraging, roosting and when transiting between sites throughout the year, however,

there is no knowledge on how gulls utilise both the river, and surrounding environments (farmland or urban centres). As such there is no measure how this relates to the impacts on braided river dependent shorebirds.

Research into the foraging behaviour and range of Southern Black-backed Gull/ Karoro on braided rivers is recommended. A GPS tracking study Southern Black-backed Gull/ Karoro should be undertaken to determine the foraging regime of gulls. In particular this study should aim to investigate how Southern Black-backed Gull/ Karoro are using the braided river and other adjacent habitats.

7.5.2 Effectiveness of control methods

A range of control methods have been employed to reduce Southern Black-backed Gull/ Karoro numbers at colonies. At present the majority of these control operations have worked independently from each other.

In order to assess the effectiveness (including cost effectiveness) a monitoring component should be incorporated into all control programmes. Ensure standardised recording so that different operations can be compared and evaluated. This should include standardised recording of number of birds targeted, control methods, results (number of cull gulls collected) and detailed costings of the operation.

Results of operations and learnings should be made available to others, and a forum established to link such practitioners (see above section relating to control coordination).

7.5.3 Immigration rates and direction post control

Southern Black-backed Gull are known to disperse some distance from natal colonies (Rowe 2013). However, despite multiple Southern Black-backed Gull/ Karoro control operations occurring in Canterbury, there has been no study looking at immigrating post control.

With significant Southern Black-backed Gull/ Karoro populations on many Canterbury rivers, there is no knowledge of the effects of removing colonies, and the immigration rate of birds into these colonies. Does removal of breeding birds create a “sink” where immigrating birds immediately fill vacated territories?

Inland rivers have fewer Southern Black-backed Gull/ Karoro, and one recommendation is to potentially treat these as containment areas. However immigration rates may need to be determined to better understand how to maintain these areas gull free.

Research into the immigration rates of Southern Black-backed Gull/ Karoro into control areas is recommended. To achieve this would require a large-scale, long-term banding project in colonies nearby current or planned control operations. Again, this would require coordination at a regional scale, (see above section relating to coordination).

7.6 Tangata Whenua – Mahinga Kai

Southern Black-backed Gull/ Karoro eggs and chicks have been a traditional food of Ngāi Tahu, and there is a number or Hapu that have expressed interest in resuming the collection of eggs and chicks for a food source.

Under current legislation there is nothing preventing the collection of eggs or chicks now, as Southern Black-backed Gull/ Karoro are an unprotected species.

The removal of eggs and chicks as Mana Kai is unlikely to provide a significant reduction in population numbers. However, it could form a part of a long term management programme aimed at reducing population growth, and/or immigration into control areas. The targeted collecting of eggs and chicks from specific colonies, or regions could help reduce overall breeding success and limit population growth.

The resumption of use of Southern Black-backed Gull/ Karoro eggs for Mana Kai is recommended, and should be encouraged. In order to promote this, greater communication of the location and size of Southern Black-backed Gull/ Karoro colonies should occur between Environment Canterbury and Tangata Whenua. Potentially the Te Paiherenga forum is the best platform for this to occur. Ideally, harvesting would be structured to manage colonies and help lead to reduced numbers over time.

7.7 Public perception

Although there is a growing body of evidence which highlights the negative impacts Southern Black-backed Gull/ Karoro on braided river dependent shorebirds, this is not well known by the wider public.

There needs to be greater emphasis by braided river managers to ensure that the results of their work are disseminated to the wider public – not just the conservation movement. There are numerous platforms that can be utilised for this. The aim should be to ensure that this includes mainstream media to be sure a wide reach is achieved.

In addition to the impacts of Southern Black-backed Gull/ Karoro, further work to educate the public on the reasons for their control is warranted. Currently many control operations have some level of resistance from the public, either concerns over the need to control gulls, or the methods employed. As more gull control is undertaken, it is likely that these issues are only going to increase. A specific campaign to engage the public about the conservation concerns and need to control Southern Black-backed Gull/ Karoro is recommended.

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