

AERIAL SURVEYS OF BLACK-BILLED GULLS IN CANTERBURY 2014-2015



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Project Team:

Rachel McClellan - Report author

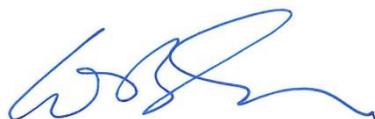
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Christchurch

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Reviewed and approved for release by:



W.B. Shaw
Director/Principal Ecologist
Wildland Consultants Ltd

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1. INTRODUCTION

The endemic black-billed gull *Larus bulleri* is classified as Threatened-Nationally Critical (Robertson *et al.* 2012), and has undergone a catastrophic population decline over three decades in its stronghold of Southland (McClellan 2009). The gulls are highly mobile, and numbers of colonies and birds can fluctuate markedly within rivers from year to year. This makes regional and within-river population trends difficult to accurately determine, particularly given the historical tendency toward one-off surveys and a relatively uncoordinated approach to river coverage within most regions.

The first use of aerial surveys for black-billed gull monitoring was in 1995, as part of a three-year national survey for black-billed gulls carried out by the former Ornithological Society of New Zealand (OSNZ; now known as Birds New Zealand). In Southland, observers in a small plane took photographs with the intention of counting the gulls from the oblique aerial photographs. In other regions, such as Canterbury, colonies were located and then visited on-the-ground for the purposes of counting (T. Crocker, pers. comm., 2014). Southland OSNZ members continued aerial surveys and photography of gull colonies in following years. McClellan (2009) extended the aerial monitoring programme for Southland from 2004-2006, and undertook a pilot study of variation in numbers of gulls within colonies within a season. The last aerial photographic survey of black-billed gulls in New Zealand was undertaken in 2006.

Environment Canterbury commissioned Wildland Consultants to undertake a region-wide, aerial photographic survey of black-billed gulls on Canterbury rivers during the 2014-2015 breeding season, with an additional focus on within-river variation in numbers and colonies through the season. It is hoped that this will be the first of three consecutive years of survey, with the aim being to create a baseline inventory of black-billed gull numbers with which results of future surveys can be compared.

This report summarises the results of the 2014-2015 surveys and provides recommendations for future monitoring.

2. METHODS

An aerial survey covering 21 Canterbury rivers, including six repeat flights of four river sections, was undertaken during the 2014-2015 breeding season, over the period 10 October to 2 December 2014 (refer to Figure 1). The surveys were flown in a Cessna 185 operated by Canterbury Aviation, piloted by Hugh Robertson. One repeat flight was piloted by Ivor Yockney. The photographer sat in the front passenger seat and was generally accompanied by one to two other passengers sitting in the back seats.

The plane followed a route along the left hand side of each river (true right or left, depending on whether the plane was flying up or downstream). This provided the photographer with the best views across the river. Two passes were undertaken on a small number of rivers where the bed was very wide, i.e. the upper Rakaia. The plane

flew at approximately 500-700 feet, and at approximately 100-110 knots groundspeed while surveying rivers.

When a black-billed gull colony was observed, the plane reduced speed and began circling the colony. The photographer opened the plane window (allowing the clearest photographs to be taken), and began taking a series of photographs (usually 5-20 shots). The camera used was a Nikon D5000 with a 28-200 mm lens. GPS coordinates were recorded for each colony location. However, given that these coordinates were not recorded while immediately above the colony, a better indication of colony location was obtained from observing the tracking of the plane around each colony. Neither provides an entirely accurate location.

Repeat surveys of four river sections - the lower Waimakariri, lower Rangitata, lower Rakaia, and Ashburton - were undertaken on six occasions (including the main survey) to examine the movements of birds during the laying and incubation period. These surveys followed the same route and began at approximately 9 a.m. (reducing the potential effect of time of day on numbers in the colonies).

The initial plan was to fly repeat surveys at seven day intervals, with two surveys before and two surveys after the main survey (refer to Figure 2). The main survey was to be undertaken when most birds were incubating. However, strong winds postponed many flights, and gulls began nesting much later than expected, resulting in four repeat survey flights before the main survey and only one after.

Photographs of colonies were examined and the best photograph(s) of each colony was chosen for counting. Photographs were counted by expanding them on a large computer screen, usually to 100%, and marking each gull as it was counted with a dot, for example using Microsoft Paint. Keeping a tally (for example, every 50 gulls) while counting ensured that 'observers' did not lose track while counting, or could take a break and return to counting later. Additionally, a number of photographs were counted by more than one observer to assess the relative precision of each count.

3. RESULTS

3.1 Repeat surveys

The six repeat surveys observed significant levels of movement of colony locations throughout the two month survey period (Table 1; see Appendix 1 for GPS positions of colonies). The surveys also recorded substantial fluctuations in numbers of gulls within single colonies between surveys. The greatest movement was recorded in the lower Waimakariri where colonies were observed at a minimum of eight locations, but only a maximum of three colonies were recorded on a single survey. No colonies were observed by December on the Waimakariri, but were still present on the other three rivers.

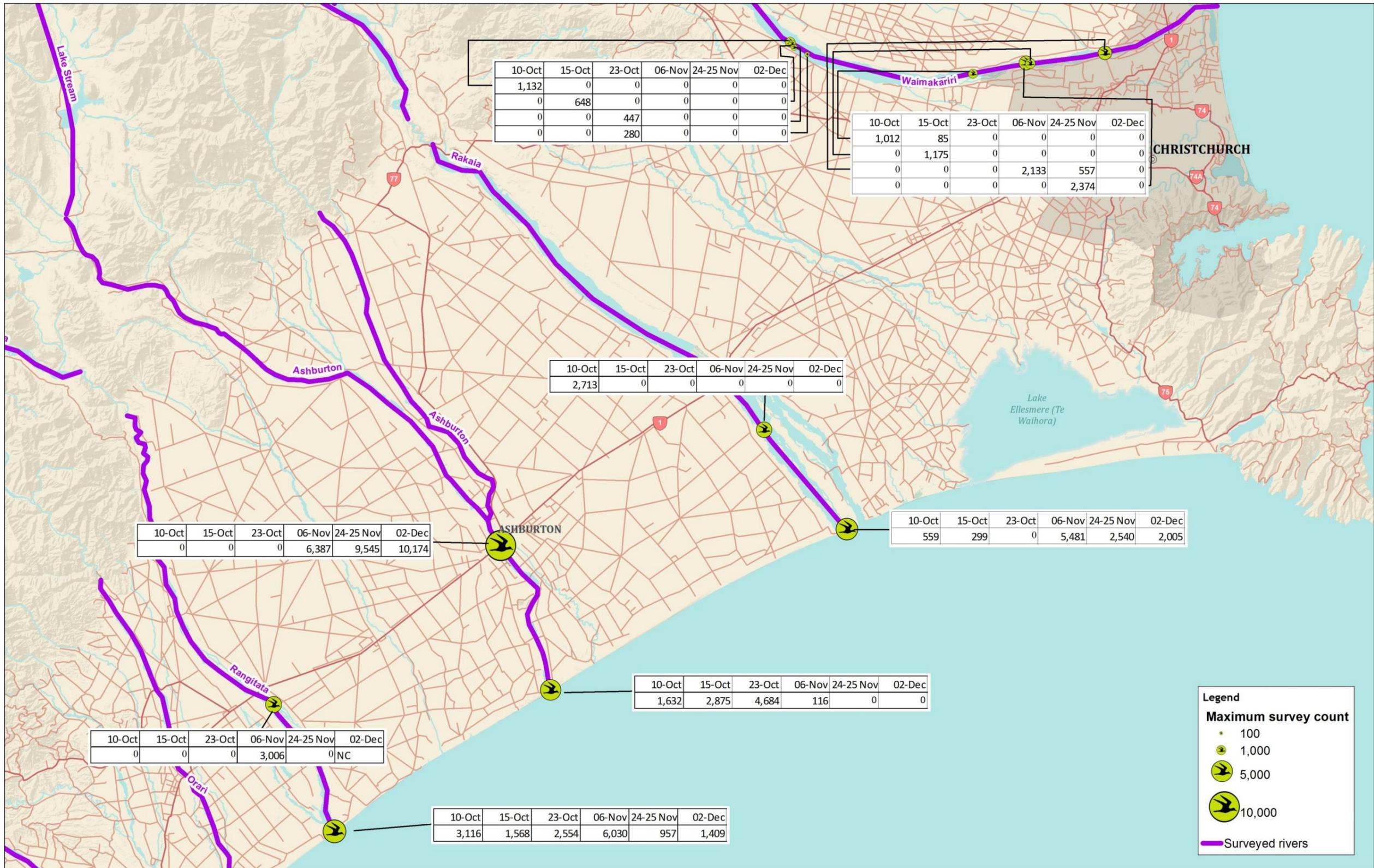
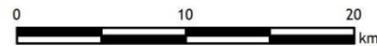


Figure 1. Black-billed gull repeat surveys: Colony locations by date



Legend

Maximum survey count

- 100
- 1,000
- 5,000
- 10,000

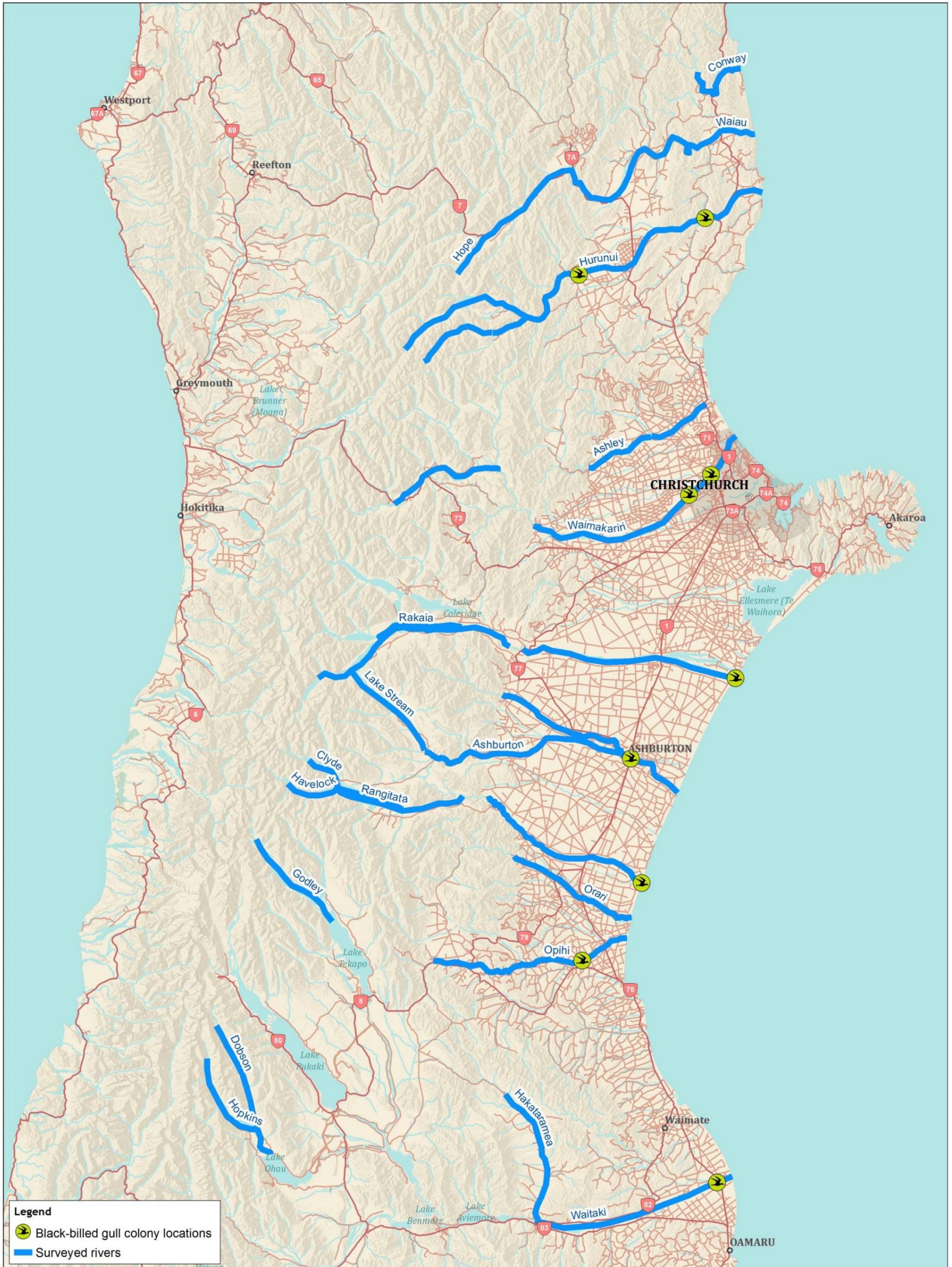
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The tendency of movement through the early part of the season was downstream in the Waimakariri (i.e. an upstream colony disappeared, and a colony appeared downstream of the first site), and downstream in the Rakaia. On the Ashburton and the Rangitata, groups of birds first appeared at the mouth, with later colonies appearing upstream, associated with declines at the downstream sites.

The total number of gulls counted in each survey varied dramatically: the lowest number counted was during the 15 October 2014 survey (6,565 gulls), and the highest number three weeks later on 6 November 2014 (23,153 gulls). The main survey was undertaken almost three weeks after the 6 November survey, when numbers were significantly lower again.

Colonies formed at the mouths of three of the four rivers, and also at sites adjacent to or close to State Highway 1 on three of the four rivers. The Ashburton River supported the largest colony (over 10,000 birds counted on 2 December). Also notable for its size was the colony at the Rangitata mouth, which varied considerably in size over the survey period.

A colony appears to have been missed on the Rangitata, south of the State Highway bridge during the main survey (first sighted on 6 November, then again on 6 December). Something about the substrate in the river at this location made the gulls very difficult to see, and the 2 December photographs could not be counted as the contrast between the rocks and the gulls was negligible. The colony appeared to be significantly smaller on 2 December than on 6 November, and had moved location at the site.

A colony was present at the Rakaia mouth on every survey except for 23 October. However, observers were confident that no colony was present on this date.

Table 1: Numbers of black-billed gulls in colonies observed during surveys of the Lower Waimakariri, Lower Rakaia, Lower Rangitata, and Ashburton, October-December 2014 (NC = not counted).

River	Colony	10 Oct	15 Oct	23 Oct	6 Nov	24-25 Nov	2 Dec
Waimakariri	Downstream (1)	1,012	85				
	Downstream (2)		1,175				
	Downstream (3)				2,133	557	
	Downstream (4)					2,374	
	Upstream (1)	1,132					
	Upstream (2)		648				
	Upstream (3)			447			
	Upstream (4)			280			
Rakaia	SH1 bridge	2,713					
	Mouth	559	299		5,481	2,540	2,005
Ashburton	Mouth	1,632	2,875	4,684	116		
	SH1 bridge				6,387	9,545	10,174
Rangitata	Mouth	3,116	1,568	2,554	6,030	957	1,409
	SH1 bridge				3,006		NC
TOTALS		10,164	6,565	7,965	23,153	15,973	13,588

3.2 Main survey

The main survey covered 21 rivers and streams over two days on 24-25 November (see Appendix 2 for maps of river stretches covered by the survey). Some rivers were included as they formed a route to get from one key river to another, e.g. Lake Stream. The flights lasted approximately nine hours on the first day, and five hours on the second day. Rivers covered are listed below. Where end/start points are not stated, the waterway was flown until little upstream braided river habitat remained, and downstream to the sea.

- Conway (to Ngaroma)
- Waiau (through gorge to Hope confluence)
- Hope
- Hurunui (North Branch above Lake Sumner, South Branch, through gorge)
- Ashley (including Lees Valley)
- Waimakariri (through gorge to State Highway 73)
- Rakaia (to about Lauper Stream)
- Lake Stream
- Potts
- Rangitata
- Havelock
- Clyde
- Ashburton and Ashburton South Branch
- Godley
- Tasman
- Orari (to gorge)
- Opihi (to State Highway 79)
- Lower Waitaki (to dam)
- Hakataramea (to Scour Stream)
- Hopkins
- Dobson.

Nine colonies were recorded: two on the Hurunui, two on the Waimakariri, and one each on the Rakaia, Rangitata, Ashburton, Opihi, and Waitaki (Table 2; see Appendix 1 for GPS locations of colonies). Most colonies were under 1,000 birds (as counted using photographs). The Ashburton State Highway 1 colony comprised half of the total found in Canterbury.

Table 2: Numbers of black-billed gulls recorded in the main survey of Canterbury rivers, 24-25 November 2014.

Colony	Count
Hurunui upstream	472
Hurunui downstream	682
Waimakariri upstream	2,374
Waimakariri downstream	557
Rakaia	2,540
Ashburton	9,545
Rangitata	957
Opihi	707
Waitaki	685
Total	18,519

3.3 Precision of counts

Eleven photographs were counted by two observers, and a total of four observers were used for comparisons. Differences between the two counts was less than 10% for nine of the 11 photographs, less than 5% for six of the 11 photographs, but around 25% for two photographs. Colonies in these latter two photographs were primarily located on fallen tree trunks and branches. Extremely clear photographs appear to result in the most precise counts.

Table 3: Precision of photographic counts based on comparisons of four 'observers' for black-billed gull counts in Canterbury rivers, October-December 2014.

Colony Name	Observer 1	Observer 2	Observer 3	Observer 4	Percent of Mean
Ashburton SH1 (25/11)	9,971			9,545	4.4
Ashburton SH1 (6/11)	6,387			5,923	7.5
Hurunui upstream	471		472		0.2
Lower Waitaki TR	425	329			25.5
Lower Waitaki TL	260	191			30.6
Opihi	707	713			0.8
Rangitata A	832	780			6.5
Rangitata A	187	177			5.5
Waimak. downstream	564		557		1.2
Waimak. upstream	2,280		2,374		4.0
Hurunui downstream	709		682		3.9

Figure 3 shows a segment of the Ashburton colony photograph, an extremely large, very dense colony. The photograph is reasonably typical of the clarity of aerial photographs. One observer counted 4% less gulls (c.400 individuals) than the other observer using this photograph.



Figure 3: Portion of Ashburton State Highway 1 colony aerial photograph from 24-25 November 2014 black-billed gull survey.

4. DISCUSSION

4.1 Within season variation

The repeat Canterbury surveys demonstrated the mobility of black-billed gulls during the 2014-2015 breeding season, particularly in the Waimakariri. Most colonies were not checked on the ground, and so it is not known at what time each colony began nesting. This information would clarify whether abandonments were of breeding colonies or pre-breeding congregations, or both. An Environment Canterbury contractor was monitoring black-billed gull colonies in the Waimakariri concurrently with the aerial surveys, and noted the two colonies forming in late September, and nest building taking place around 20-25 October (N. Muga, in litt., 2014¹), suggesting the first two aerial surveys were undertaken before nesting commenced (at least on the Waimakariri). This also indicates that colony movements continued well after nesting commenced.

A number of freshes occurred in the Waimakariri during the survey period (three of approximately 500 cumecs; Figure 4), which may have caused colony movements. Muga considered that a flood caused the relocation of at least one colony, and also observed significant black-backed gull harassment of another colony, and caught a

¹ Email from Niall Muga, dated 8 November 2014, sent to Courtney Thompson, Environment Canterbury.

relatively large number of mustelids at one location. Black-backed gull and mustelid disturbance and/or predation are both capable of causing colony abandonment.

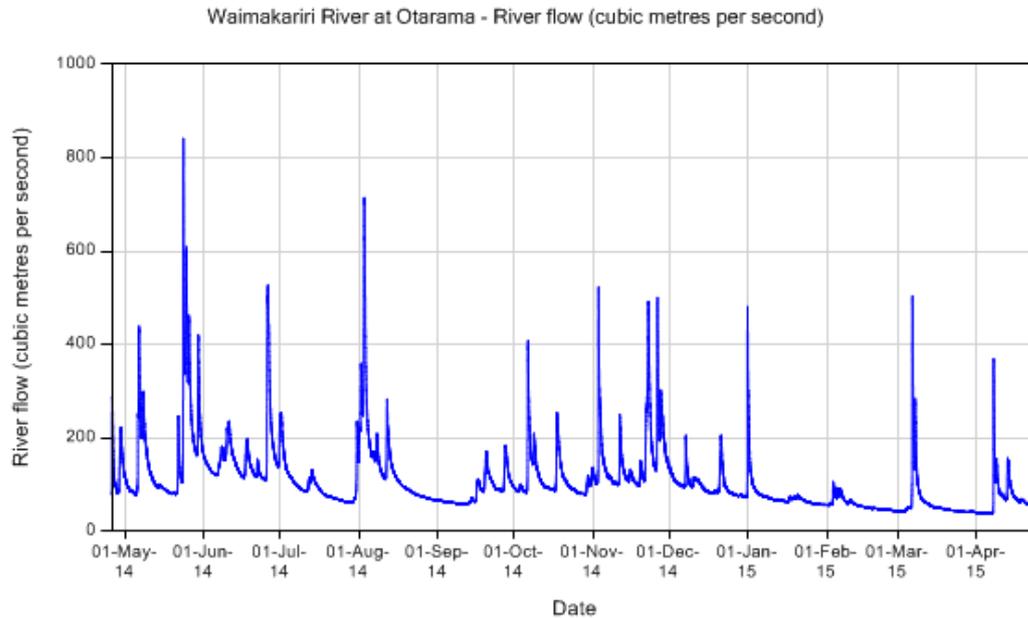


Figure 4: River flows at Otarama, Waimakariri River, May 2014 to April 2015, showing freshes that occurred during the aerial survey period (ECAN website).

Numbers within colonies also varied significantly between surveys. Trends in colony size appear to illustrate increases in numbers as the season progresses, and sometimes declines, possibly as non-breeders or failed breeders leave. However, observed changes are also less easy to assign a possible reason, such as the Rangitata mouth colony which increased and decreased throughout the two months.

A pilot study examining variation within colonies through the breeding season was also undertaken in Southland in 2006 (McClellan 2009). Three rivers were surveyed three times over a two week period. Six colonies were present on the rivers: the smallest colony numbered 2,311 gulls and the largest 7,235 gulls at the time of the initial survey. The three flights showed no changes in colony locations, but significant changes in numbers within colonies (of up to 60%). Several of these colonies were being monitored intensively, and all were well into breeding at the commencement of the flights. All colonies declined from the first to the third survey, but four of six of the colonies increased in numbers between the first and the second survey.

Little is known about the movements of gulls daily and through the breeding season, making it very difficult to interpret the observed changes in numbers. Daily foraging patterns are not known, i.e. are more gulls likely to be in the colony at certain times of the day. The number of non-breeding gulls in colonies is highly variable, and some colonies comprise significant numbers of non-breeding birds, e.g. an extreme example was a Southland colony photograph that was found to number 3.95 gulls to each nest (McClellan 2009). These non-breeding gulls may be highly mobile. The factors that drive the initiation of nesting, the probability of re-nesting (once a nest has failed),

and the likelihood of a gull abandoning a colony, are not well understood. Also, the frequency of aerial and terrestrial predators causing the abandonment of a colony location is not known for Canterbury.

4.2 Timing of main survey

The initial plan was for the main survey to coincide with the ‘peak laying’ period (see McClellan 2009 for details). Intensive monitoring of 21 Southland colonies over three years indicated that peak laying occurred towards the end of October, at a very similar time in each of the years 2004-2006. It was assumed that Canterbury would be similar, but perhaps earlier, given the more northern latitude. However, observations made during the repeat surveys of the four Canterbury rivers combined with observations on the ground indicated that most gulls were not laying by this time. This was evidently also the case in Otago and Marlborough, although Southland gulls had begun laying at a similar time to that previously recorded. It is not known whether the start of laying in Canterbury was relatively late in 2014, or if this timing is characteristic of the species in this region.

From the repeat surveys, it can be assumed that if the main survey had been undertaken at a different time of the breeding season (e.g. one week earlier or later), a significantly different count may have been obtained. Ideally, the main survey should be undertaken when most birds are sitting on nests, i.e. are incubating, or brooding small chicks. Chicks and adults leave the nest site within a few days of chicks hatching, and failed breeders may potentially be leaving the colony location at this point. However, it is difficult to accurately determine when incubation is at its peak across a region without significant ground observation. Additionally, this may not be the same approximate date from year-to-year; although Southland research suggested peak laying was similar from year-to-year (based on three years of data; McClellan 2009). The within-season fluctuations are a key reason for undertaking three consecutive years of surveys.

4.3 Accuracy and precision of counts

Accuracy of the aerial photography survey method for black-billed gulls - that is, its ability to detect colonies when they are present, and the validity of the method as an index - is not well understood. At least one colony is known to have been missed during the main survey. Department of Conservation staff were also aware of a colony on the Hakataramea that had not been seen by the aerial crew and checked its continued existence. The colony was estimated to number 140 birds (C. Thyne, Department of Conservation, pers. comm. 2014). Interestingly, the three observers in the plane had seen black-billed gulls flying shortly after joining the Hakataramea, and a rather animated conversation ensued about the likelihood of spotting a colony, given it had been many hours since anyone had last seen a gull (having just completed all of the high country rivers). At this point, the plane had probably just gone over the colony. It is possible that a combination of tiredness from seven hours of flying and ‘lack of action’ caused the missed sighting, as even a colony of this size should have been easy to sight on a small river.

Clearly, not all colonies are detected, but the extent of non-detection is unknown. In Southland, repeat aerial surveys and ground surveys never identified a colony that had

been missed on any waterway. However, Southland rivers are all comparatively narrow, and the wide expanses of many of Canterbury's rivers present a challenge for the method, and presumably an increased risk of non-detectability. Checking of detectability would need a coordinated approach in which ground surveys and aerial surveys were carried out concurrently, i.e. ideally on the same day. Ground counts could also then be undertaken, which would allow for a comparison of the precision of the two count methods.



Figure 5: Portion of Rakaia mouth colony photograph from 24-25 November aerial survey, showing gulls on unusual pale substrate and woody substrate.

The aerial survey method allows for precise estimates of numbers in colonies at that point in time. The precision of ground counts has not been estimated, at least to our knowledge. Precise counts of black-billed gull colonies are important. For example, it is conceivable that a series of ground estimates made by different observers of the 10,000-strong Ashburton colony could differ by thousands. Given that this colony comprised half the Canterbury region's population in 2014, this could have quite some impact on the overall results. In Southland, most colonies number in the

thousands, and aerial survey there provides a rapid, precise method for monitoring, with a very low risk of non-detectability.

McClellan (2009) tested the precision of counts using three observers who each counted the same sample of five good quality aerial colony photographs. Overall, results varied by 8.5%, varying from 3.7-21.3%. These counts were less precise than the Canterbury counts, possibly due to the lower resolution of the digital camera used in 2005-2006 (8MB).

4.4 Canterbury population size and trends

The main Canterbury survey covered 21 rivers in two days and recorded 18,519 gulls in colonies. A number of other colonies were observed on-the-ground: Hakataramea (140 gulls), two small colonies on the Tangawai, a colony on the Maruia (*c.*400 gulls), and a colony in the Waimakariri gorge section that was not flown (*c.*600).

Prior to this survey, the most rivers surveyed in one season in Canterbury was 13 in 1995, and again in 2008 (Ornithological Society and Department of Conservation, unpublished data; some smaller rivers may have also been surveyed but this has not been verified). The total counts of black-billed gulls made on these early surveys were 12,719 and 11,527 gulls, respectively. It is not possible to draw any conclusions regarding population trends from these data given that fewer and different rivers were surveyed, and at different times of the season. Annual regional fluctuations in the numbers of breeding birds, as identified in Southland in 2004-2006, means that in any one year, significantly fewer black-billed gulls appear to attempt to breed, for reasons that are not known.

McClellan (2009) estimated - from Southland research - that there were 0.56 nests for every gull in a photograph, and used this proportion to estimate the maximum number of breeding adults in Southland colonies over the period 2004-2006 (see McClellan 2009 for details). Using Powlesland's (1998) assumption of 70% of the population breeding in Southland, 25% in Canterbury, and 5% elsewhere, and applying a 'correction factor', McClellan (2009) arrived at a national figure of 90,000 breeding individuals in 2006. Using the Canterbury data from 2014, and applying the same rules, the national population can be estimated at 83,000 breeding individuals in 2014, a decline of 8% in eight years.

It was hoped to have achieved South Island-wide aerial surveys in 2014, but Southland photographs were of insufficient quality to count. This would have enabled the calculation of a more accurate estimate of the total population.

5. FUTURE SURVEYS

Two further annual surveys should be undertaken, covering as many of the same rivers as possible, and using the same methods. This will clarify the extent of annual variation in the Canterbury breeding population, and will provide a relatively robust baseline with which future surveys can be compared.

Ideally, the aerial survey should be spread over three consecutive days, to avoid extremely long spells of flying. Some of the alpine rivers could possibly be cut out of the survey.

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BLACK-BILLED GULL COLONY LOCATIONS OCTOBER-NOVEMBER 2014

Canterbury main survey results - colony location

Colony	Northing	Easting
Hurunui upstream	5259509.4	1566293.2
Hurunui downstream	5252110.8	1605258.1
Waimakariri upstream	5189660.4	1555897.8
Waimakariri downstream	5190772.1	1564382.7
Rakaia	5138917.6	1536675.7
Ashburton	5137258.2	1498799.5
Rangitata	5106165.6	1480879.3
Opihi	5097725.6	1454164.7
Waitaki	5023354.8	1449259.7

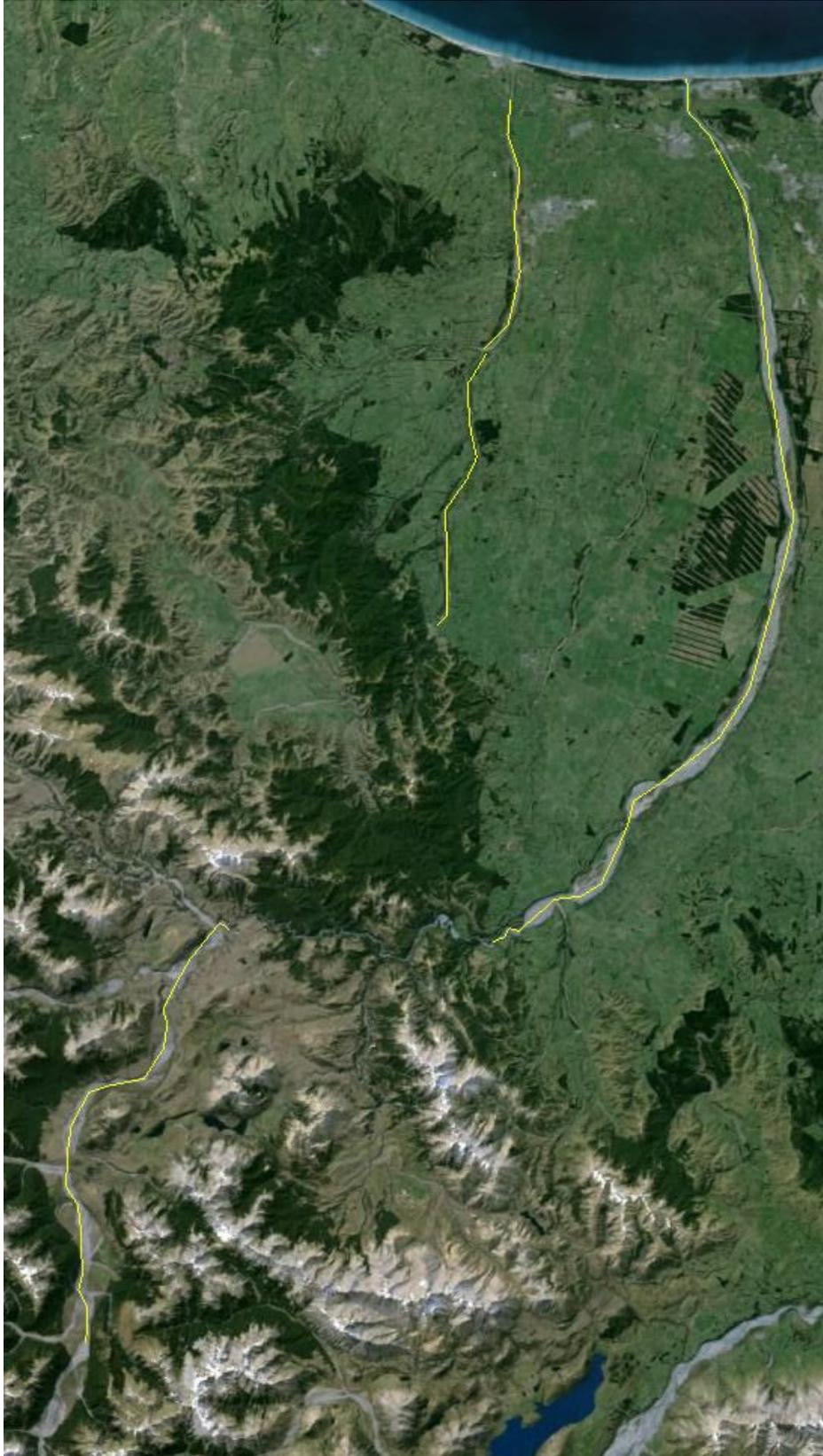
Repeat survey results - colony location

River	Colony	Northing	Easting
Waimakariri	Downstream (1)	5188479.6	1550107.5
	Downstream (2)	5189586.0	1556362.8
	Downstream (3)	5190741.5	1564452.5
	Downstream (4)	5189660.4	1555897.8
	Upstream (1)	5191900.6	1530288.3
	Upstream (2)	5191718.7	1530460.7
	Upstream (3)	5191353.9	1530680.5
	Upstream (4)	5190591.7	1532096.1
Rakaia	SH1 bridge	5149866.8	1527411.6
	Mouth	5139079.6	1536434.7
Ashburton	Mouth	5121643.2	1504249.9
	SH1 bridge	5137258.2	1498799.5
Rangitata	Mouth	5106249.7	1480742.8
	SH1 bridge	5120039.9	1474150.9

RIVER STRETCHES COVERED
BY THE MAIN
CANTERBURY SURVEY



Conway, Waiiau, Hope, Hurunui



Upper and Lower Waimakariri and Ashley



Upper and Lower Rakaia, North and South Branch Ashburton, Upper and Lower Ranigtata, Havelock, Clyde, Orari, Opihi



Godley, Hopkins, Dobson



Hakataramea, Waitaki



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