

Southern Buller's Albatross Survey at the Solander Islands 2016

Buller's Albatross at the Solander Islands

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Prepared by:

David Thompson, NIWA
Paul Sagar, NIWA
Barry Baker, Latitude 42 Environmental Consultants
Katrina Jenz, Latitude 42 Environmental Consultants

For any information regarding this report please contact:




David Thompson

Marine Ecology
+64-4-386 0582
david.thompson@niwa.co.nz

National Institute of Water & Atmospheric Research Ltd
Private Bag 14901
Kilbirnie
Wellington 6241

Phone +64 4 386 0300

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Executive summary

This project, funded by the Conservation Services Programme of the Department of Conservation, comprised one main objective: to produce an updated population estimate of southern Buller's albatross at the Solander Islands.

Solander Island/Hautere was visited by a two-person field team between 25 and 29 February 2016, and additionally on the return trip by helicopter by a photographer. A whole-island group (Solander Island and Little Solander Island) breeding population estimate was derived for southern Buller's albatross *Thalassarche bulleri bulleri* using a combination of direct ground counts, counts from vantage points on the ground and counts from photographs of the birds on the islands.

Overall, the Solander Islands population was estimated at 5,620 breeding pairs, with 5,280 of these on Solander Island and 340 pairs on Little Solander Island. This estimate is higher than the two previous whole-island estimates, from 2002 and 1996. Trend analysis using TRIM indicated an average population growth rate of 1.36% per year between 1996 and 2016.

The Snares Islands/Tini Heke still hold the majority of the southern Buller's albatross breeding population, with the current Solander Islands population representing approximately 40% of the total.

Solander Island is a difficult and challenging place to undertake ground-based census work. It is recommended that in the future aerial surveys, supplemented by ground-based research in specific, relatively easy-access locations, form the basis of population estimates at this site.

1 Background

Southern Buller's albatross *Thalassarche bulleri bulleri* is a New Zealand endemic, breeding at the Snares/Tini Heke and Solander/Hautere islands only (Sagar & Stahl 2005). While the whole-island population size for the Snares has been estimated on five occasions (1969, 1992, 1997, 2002 and 2014: Sagar 2014), and study colony population sizes at the Snares have been recorded annually for the last 25, consecutive years (for example, Sagar 2015), the southern Buller's albatross population at the Solander Islands has received far less attention. Whole-island population estimates exist for two years only, 1996 and 2002 (Sagar et al. 1999, Sagar & Stahl 2005), and there have been no repeated 'study colony' counts at this site. Sagar & Stahl (2005) estimated that there were 4,147 breeding pairs of southern Buller's albatrosses at the Solander Islands in 1996, and 4,912 pairs in 2002. Additionally, Baker & Jensz (2014) estimated there were 305 breeding pairs at Little Solander Island in 2014. The 2002 total of 4,912 pairs represents approximately 36% of the overall breeding population of 13,625 pairs at the Snares and Solander islands in that year (Sagar & Stahl 2005).

Because of the very difficult terrain at the Solander Islands, whole-island population estimates were obtained through a combination of direct ground counts, counts from vantage points and counts from aerial photographs (Sagar & Stahl 2005).

This project, funded by the Conservation Services Programme of the Department of Conservation, comprised one main objective: to produce an updated population estimate of southern Buller's albatross at the Solander Islands. This report describes fieldwork undertaken at the Solander Islands under Department of Conservation Entry Permit 49895-LND. As this project was commissioned by the Conservation Services Programme, a Wildlife Act Authority was not required nor issued for this work.

2 Methods

2.1 Logistics

The Solander Islands (46°35'S, 166°54'E) lie approximately 40 km south of the south coast of South Island in the western approaches to Foveaux Strait, and comprise Solander Island/Hautere (100 ha), Little Solander Island (8 ha) and several stacks and rocks. Access to and from Solander Island/Hautere was by helicopter (Southern Lakes Helicopters Ltd.), and the field team, comprising Thompson and Sagar, was dropped off towards the eastern end of the northern coastline on 25 February 2016. The field team remained on the island for four nights, before being picked up on 29 February 2016. Baker joined the pick-up trip, and an aerial photographic survey of all inaccessible areas of Solander Island, and a complete aerial survey of Little Solander Island, was completed before all personnel returned to Invercargill. The period of fieldwork coincided with the latter part of the incubation phase: pairs of actively breeding birds were in most cases represented by one member of each pair sitting on an egg while the bird's partner was foraging at-sea. It is likely that nearly all birds that were going to breed in 2016 would have laid an egg by the time of our visit, although it is also likely that some breeding attempts would have already failed.

Solander Island is a difficult and challenging location at which to work. The coastal fringe is dominated by wave-washed boulder beaches and a narrow, in places non-existent, tussock and scrub-covered band of ground above the high tide mark leading to vertical or near-vertical cliffs, which in turn give way to a summit plateau. Only towards the western end of the north coast is this pattern broken, as steeply-sloping ground leads up to high bluffs and crags below the summit plateau: it is here that southern Buller's albatrosses have been previously banded. The period of fieldwork reported here coincided with a series of extreme weather events that made the normally difficult access to higher ground from the north coast impossible.

For consistency with earlier counts, main Solander Island has been divided into five discrete zones (Figure 2-1), with Little Solander Island counted separately from the air.

2.2 Definitions

The purpose of this study was to estimate the number of pairs of southern Buller's albatrosses breeding at the Solander Islands. We use the following terminology:

Annual breeding pair – any pair of albatrosses that lays an egg in the breeding season of interest.

Loafers – birds present in a colony but which do not appear to be associated with an active nest at the time of observation. These birds may be non-breeding birds or breeding birds away from their nest, or birds that have laid an egg earlier in the breeding season and subsequently lost it through breakage or predation.

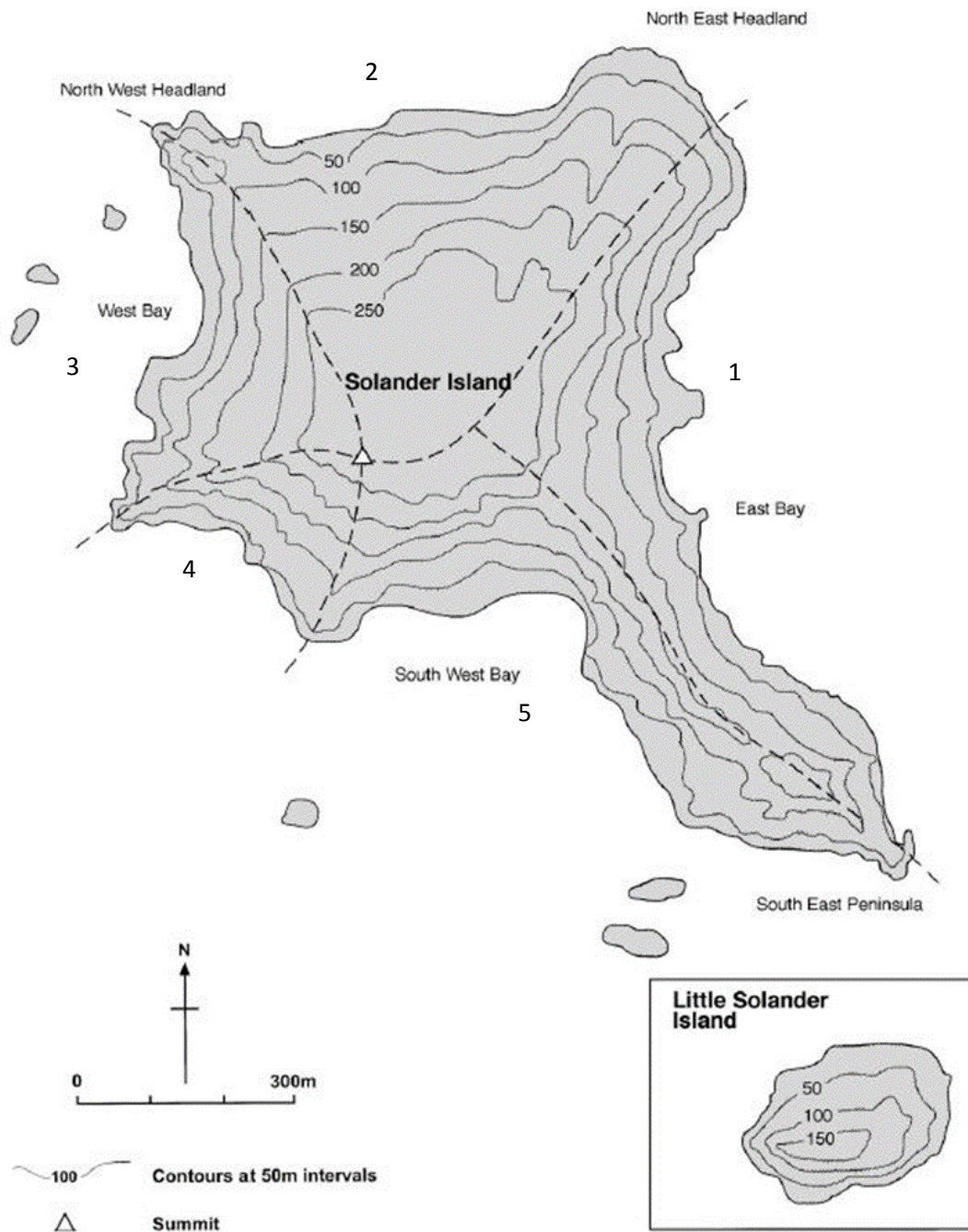


Figure 2-1: Map of main Solander Island/Hautere showing the divisions into five zones. Zones follow Sagar et al. 1999 and Sagar & Stahl 2005 for the 1996 and 2002 censuses, and are numbered 1 to 5 here (see Table 3-1). Little Solander Island lies approximately two kilometres to the west of North West Headland.

2.3 Ground and vantage point counts

Between North East and North West headlands, together with an area towards the northern end of East Bay under dense *Hebe sp.*, all nests were counted directly or from vantage points using binoculars. For areas containing accessible nest sites, the field team moved slowly and systematically through zones demarcated by clear topographic features and recorded all nesting birds using tally counters. Some areas were inaccessible and in such cases nesting birds were counted independently

by both members of the field team using binoculars from a vantage point. In all such cases, totals were less than 100 nesting birds, and independent counts were within 5% of each other before a mean total was calculated.

In order to assess the proportion of apparently incubating birds that were actually incubating an egg, both members of the field team recorded the number of birds on an egg and the number of birds on an empty nest in an area towards the western end of the northern coastline on Solander Island.

2.4 Aerial counts

The numbers of nesting birds from all areas of main Solander Island, except between North West and North East headlands and from the northern section of East Bay, and of Little Solander Island were counted from aerial photographs taken on 29 February 2016.

Photographs were taken between 09:52 and 09:58 (Little Solander Island) and 10:30 and 11:05 (Solander Island) with clear views of both islands. Methodology followed that described by Baker et al. (2015). In summary, for the photography, one photographer was positioned on the port side of the aircraft and photographs were taken through the open door using a Nikon D800 digital camera and image-stabilised Nikkor 70-200 mm lens. Shutter speeds were set at 1/1000 second or faster to minimise camera shake, and most photographs were taken with the zoom lens set at a focal length of 70 mm, with every effort made to ensure that the photographs were taken perpendicular to the land surface. The focal length of the zoom lens was not adjusted within each pass sequence over the island. A complete series of overlapping images was produced, with all photographs of the colonies taken as raw files and then subsequently saved as fine JPG files. The photographs of Solander and Little Solander islands were taken at an altitude of about 400 metres, well above the minimum limit of 300 metres recommended by the Department of Conservation. A full collection of photographs will be submitted to the Department of Conservation.

Counting protocols used here largely followed those reported previously for white-capped albatross *Thalassarche steadi* aerial censuses (e.g. Baker et al. 2014). Briefly, photographic montages of Solander and Little Solander islands were constructed from overlapping photographs using the image editing software package ADOBE PHOTOSHOP (<http://www.adobe.com/>). The boundaries of the photographic montages for Solander Island were aligned so as to coincide with the boundaries of areas used for previous counts (Figure 2-1). Counts of all southern Buller's albatrosses on each montage were then made by magnifying the image to view birds and using the paintbrush tool in PHOTOSHOP to mark each bird with a coloured circle as they were counted. To assist with counting we used MOUSECOUNT software (<http://www.kittyfeet.com/mousecount.htm>) and a hand-held tally counter. Once all birds had been counted on a photo-montage, the file was saved to provide an archival record of the count.

Each single bird was assumed to represent a breeding pair. While most birds were alone at nest sites, we also counted instances when two birds were sitting close together and assumed both to be members of a nesting pair, and where birds were loafing and not obviously associated with a nest. Furthermore, some birds classified here as 'nesting birds' on Solander Island (see Appendix A) were, in fact, birds that were not completely visible in photos i.e. weren't clearly pairs or loafers, but were 'unknown'. A more detailed assessment of a sample of the photos showed that 57 of 543 (10.5%) 'nesting birds' were 'unknown'. Therefore, the estimate of nesting birds on Solander Island may have overestimated the number of annual breeding pairs by 10.5%. Accordingly, all counts derived from photos for Solander Island (the 2016 'aerial' counts presented in Table 3-1 and Table 3-2) have been

adjusted downwards by 10.5% to account for ‘unknowns’. For Little Solander Island it was possible to identify ‘unknown’ birds directly from photographs for the entire colony, and so the total count of nesting birds for Little Solander Island accounts for the number of ‘unknowns’ (see Appendix A). All ground and vantage point counts from 2016 were definitely of birds sitting on a nest and have not been adjusted.

2.5 Trend analysis

Trend analyses were run using software program TRIM (Trends and Indices for Monitoring Data; Pannekoek & van Strien 1996). TRIM is a freeware program, developed by Statistics Netherlands and is the standard tool used by the Agreement for the Conservation of Albatrosses and Petrels (ACAP) to analyse trends.

3 Results

Table 3-1 summarises numbers of breeding southern Buller’s albatrosses at the Solander Islands in February 2016. Data are presented by area (see Figure 2-1) and by method, with the majority (86% of the overall total) acquired from the aerial survey. It should be noted that counts from the 2016 survey are of apparently nesting birds, excluding birds identified as either loafing, birds comprising a breeding pair or birds of ‘unknown’ status (e.g. see Methods and Appendix A), and as such are comparable with counts from earlier years presented in Table 3-2. Also, the Little Solander Island count data from 2014 incorporated an adjustment to account for the early timing of the count in that survey (Baker & Jensz 2014).

Table 3-1: Numbers of breeding southern Buller's albatrosses at the Solander Islands, February 2016.

Count data collected by area (see Figure 2-1) and by method. These data do not take account of the proportion of apparently incubating birds actually sitting on an egg.

Area	Area Number	Ground	Vantage	Aerial	Totals
Solander Island					5280
East Bay	1	68	12	586	666
North East to North West headlands	2	507	214	57	778
West Bay	3			819	819
West Bay to South West Bay	4			481	481
South West Bay to South East Peninsula	5			2536	2536
Little Solander Island				340	340
Totals		575	226	4819	5620

Overall, the southern Buller’s albatross population at the Solander Islands in 2016 (5,620 nesting birds, Table 3-1 and Table 3-2) was 14% higher than in 2002 and 36% higher than in 1996. The only two areas of main Solander Island that did not exhibit this pattern were East Bay and the northern coast between North East and North West headlands (Figure 2-1), both of which contained fewer nesting birds than in 2002 (Table 3-2).

In addition to the relatively large areas for which there are count data for 1996, 2002 and 2016 (Table 3-2), two relatively small, discrete areas on Solander Island could be unequivocally identified in each of the three census years: an area of *Hebe sp.* towards the northern end of the east coast and

an area on the eastern face of North West Headland. Numbers of nesting birds in 1996, 2002 and 2016 in the *Hebe* sp. area were 60, 82 and 80, respectively, and on the eastern face of the headland were 80, 79 and 97, respectively.

Trend analysis using TRIM and the linear trend model, allowing for two time-steps (1996 and 2002), indicated an average growth rate of 1.36 % per year ($\lambda = 1.0136 \pm 0.001$) over the 21 years for which data were available, which was assessed by TRIM as a moderate increase ($p < 0.01$).

Table 3-2: Numbers of breeding southern Buller's albatrosses at the Solander Islands in 2016, 2014, 2002 and 1996. Data for Little Solander Island in 2014 are from an aerial survey (Baker & Jensz 2014), those from 2002 and 1996 are from a combination of ground, vantage and aerial counts (see Sagar & Stahl 2005).

Area	2016	2014	2002	1996
Solander Island	5280		4579	3885
East Bay	666		876	709
North East to North West headlands	778		1162	1086
West Bay	819		489	387
West Bay to South West Bay	481		362	306
South West Bay to South East Peninsula	2536		1690	1397
Little Solander Island	340	305	333	262
Totals for Solander group	5620		4912	4147

The proportion of birds sitting on a nest that were also incubating an egg (as opposed to sitting on an empty nest) was determined from two independent counts of 49 and 74 separate nests. The proportion of birds sitting on a nest that were also incubating an egg was 0.82 for both samples of nests. Applying this factor to the overall count of nesting birds in 2016, yields a total of 4,579 incubating birds. Because this correction was not applied to count data from the 2002 and 1996 surveys, this result is not discussed further in this report.

4 Discussion

Previous whole-island censuses in 1996 and 2002 (Sagar et al. 1999, Sagar & Stahl 2005) were carried out at a similar time of year (late February) as the 2016 census, and although the Little Solander Island aerial survey in 2014 was undertaken approximately six weeks earlier (20 January 2014), those data have been corrected to account for birds that had yet to start incubating an egg (Baker & Jensz 2014). Given the relatively consistent timing of counts across all surveys of the Solander Islands, it would seem reasonable to conclude that the southern Buller's albatross population has increased from the late 1990s to the present day. This conclusion is supported by trend analysis which showed that there has been a moderate population increase between 1996 and 2016.

The Snares Islands, approximately 180 km to the south of the Solander Islands, support the majority of the southern Buller's albatross population, with an estimated total of 8,704 breeding pairs in 2014 (Sagar 2014). Interestingly, the southern Buller's albatross population at the Snares Islands also increased from the 1990s (total population estimates 7,683 and 8,242 pairs in 1992 and 1997, respectively: Sagar (2014)) to 2002 (total population estimate 8,713 pairs: Sagar (2014)), but, in contrast to the population at the Solander Islands, has since remained more or less the same from

2002 to the present (Sagar 2014). Combining the 2014 estimate from the Snares Islands with the 2016 estimate from the Solander Islands gives an overall population for southern Buller's albatross of approximately 14,300 annual breeding pairs.

The Solander Islands pose several challenges to accurately estimating southern Buller's albatross population size. The main island is extremely difficult to navigate across in order to conduct direct ground counts and vantage point counts. Indeed, it is almost certainly impossible to complete a census based solely on counts made from the ground. Not only is it hazardous to personnel to undertake such a ground census, but also a ground survey would cause damage to vegetation and the generally fragile and unstable ground cover. An aerial survey, of the type employed here, represents the only viable option for this site, yet this approach also incorporates an unquantifiable level of error. A proportion of the breeding population will effectively be invisible from the air, with birds breeding under a dense canopy of vegetation (Baker & Jensz 2014), and will, in a practical sense, be inaccessible on the ground. Nevertheless, the approach adopted here represents a repeatable protocol and the numbers recorded in the present survey, and those noted in previous censuses, should be considered as minimum estimates of the southern Buller's albatross population size.

Finally, it is perhaps worth noting that during the course of our visit to the Solander Islands in February 2016, and also during a later visit by staff from Te Papa Tongarewa in May 2016, there were several major landslips that removed considerable debris onto the shoreline and which also removed nesting albatrosses from the slopes where the slips occurred. The slips were not confined to a particular area of the island, but were noted from various locations around the coast. The island would appear to be relatively prone to landslips following major rainfall events, and could potentially remove or re-locate nesting albatrosses.

5 Recommendations

1. An aerial survey of the entire group should be undertaken as the primary means of estimating the breeding population of southern Buller's albatross at the Solander Islands. The field component of such a survey could be completed in a single day.
2. The frequency of whole-island aerial surveys could be carried out on an annual basis: even if ground-based work was also considered (see paragraphs 3 and 4 below), a single day with suitable weather would be sufficient to complete a full aerial survey and a number of ground-based tasks.
3. If low tide occurred around noon on the day of the aerial survey it would be beneficial to drop a field team on the main island for 4-5 hours in order to conduct ground-based research towards the western end of the north coast of Solander Island. Tasks could include determining the proportion of apparently incubating birds sitting on an egg, and demographic work focused on one or more 'study plots', analogous to those established on the Snares. Banding of breeding birds and chicks has produced a relatively small population of marked individuals in this western area, which could be augmented with further, targeted banding within clearly-defined areas.
4. With a ground-based team on the island, an additional breeding area towards the northern end of East Bay could be easily and quickly counted. This area differs from the open habitat towards the western end of the north coast (see paragraph 3 above) in that birds are nesting under dense *Hebe* sp. In 2016 there were 80 accessible and active nests in the '*Hebe* area', and several hundred active nests towards the western end of the north coast.

6 Acknowledgements

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Appendix A Summary aerial count data for Solander Island and Little Solander Island. For Solander Island, images and count data have been assigned to one of five areas as illustrated in Figure 2-1.

Solander Island

Image	Area	Figure 2-1 Area	Pairs	Loafers	Total birds	Nesting birds
1a	NW Headland	3	3	3	72	66
1b	NW Headland	2	4	9	77	64
2a	West Bay - low	3	32	51	614	531
2b	West Bay - low	3	0	6	39	33
2c	West Bay - low	3	3	16	112	93
3a	West Bay - high	3	6	29	193	158
3b	West Bay - high	3	0	1	17	16
4	West Bay - ridge	3	1	3	22	18
5	Bay S of West Bay - low	4	22	164	589	403
6a	Bay S of West Bay -high	4	4	10	65	51
6b	Bay S of West Bay -high	4	5	42	130	83
7a	SW Bay to Peninsula - low	5	17	72	574	485
7b	SW Bay to Peninsula - low	5	25	132	891	734
7c	SW Bay to Peninsula - low	5	15	102	406	289
7d	SW Bay to Peninsula - low	5	12	123	447	312
7e	SW Bay to Peninsula - low	5	6	43	237	188
7f	SW Bay to Peninsula - low	5	1	29	97	67
8a	SW Bay to Peninsula - high	5	8	26	234	200
8b	SW Bay to Peninsula - high	5	3	18	82	61
8c	SW Bay to Peninsula - high	5	5	53	277	219
8d	SW Bay to Peninsula - high	5	8	79	328	241
9a	Peninsula - West face	5	2	6	45	37
9b	Peninsula - East face	1	2	9	63	52
10a	East face - low	1	0	6	34	28
10b	East face - high	1	1	5	28	22
11a	East Bay - low	1	0	1	3	2
11b	East Bay - high	1	2	10	54	42
11c	East Bay - high	1	3	11	90	76
11d	East Bay - high	1	1	6	42	35
11e	East Bay - high	1	1	3	16	12
11f	East Bay - high	1	0	5	30	25
11g	East Bay - high	1	0	2	8	6
12a	East Bay - low	1	2	5	25	18
12b	East Bay - low	1	6	8	74	60
12c	East Bay - low	1	3	12	73	58
12d	East Bay - low	1	3	33	162	126
12e	East Bay - low	1	2	8	67	57

13a	NE Headland - low	1	2	3	26	21
13b	NE Headland - high	1	1	5	21	15
Totals			211	1149	6364	5004

Little Solander Island

Image	Pairs	Loafers	Unknown	Total birds	Nesting birds
2	3	5	5	48	35
3	1	4	5	42	32
4	5	10	3	48	30
5	2	20	5	94	67
6	1	32	7	144	104
7	3	13	3	47	28
8	2	12	7	65	44
Totals	17	96	35	488	340

Appendix B Example photographs illustrating birds identified as nesting, loafing and unknown.



Figure A-1: Image showing two birds identified as nesting (red) and two identified as loafing (yellow).



Figure A-2: Image showing two birds identified as nesting (red), one as loafing (yellow) and two birds as a pair (green) associated with a nest.



Figure A-3: Image showing one bird identified as nesting (red) and one as unknown (blue).