

Assessment of aerial census techniques to robustly estimate population size of Gibson's albatross on Adams Island

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**Barry Baker, Katrina Jenz & Sheryl Hamilton
Latitude 42 Environmental Consultants**

Gibson's albatross

—endemic NZ species, biennial breeder

—Adams Is

3,159 annual pairs

(Francis et al 2012)

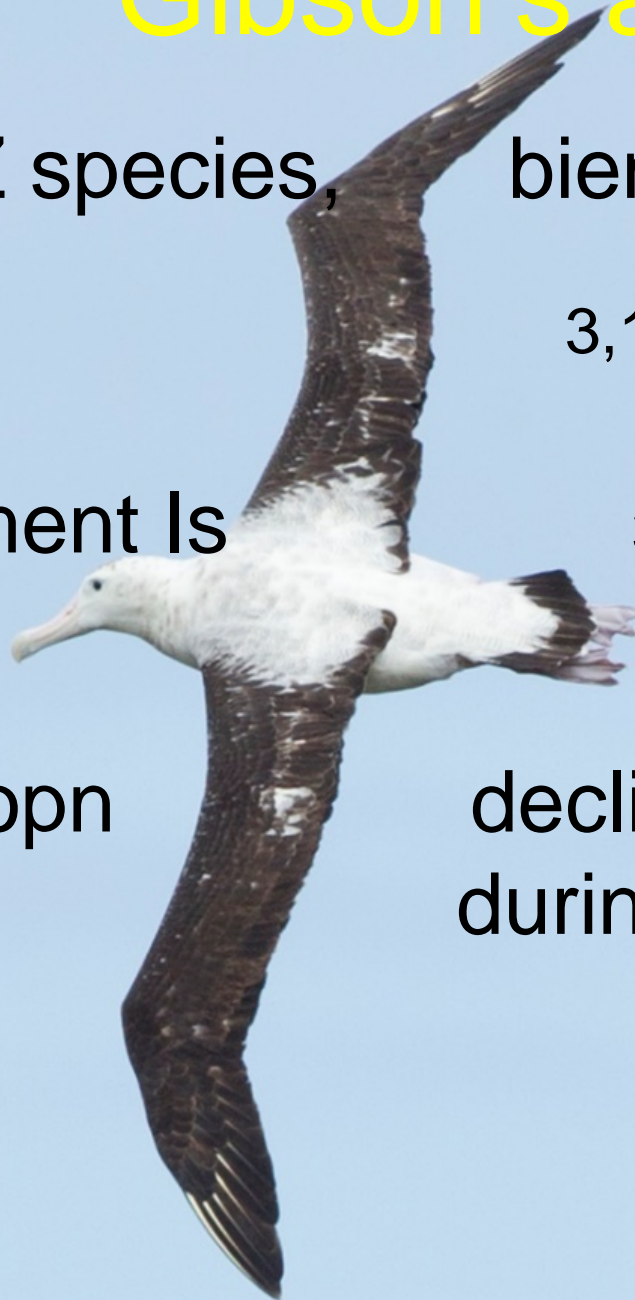
—Disappointment Is

352 annual pairs

(ACAP 2009)

—Adams Is popn

declined severely
during 2000s



Gibson's albatross

- since 1990s Kath Walker & Graeme Elliott studied Gibsons each summer:
 - CMR work in 3 study plots on Adams Is., comprising c.10% of the popn
 - tracking studies
 - whole island count conducted 1997
- population currently estimated each year by scaling up proportional change in plots by number of nests counted in 1997

background

- accurate estimation of numbers critical for determining conservation status of any animal
- aerial photography increasingly preferred as census method of choice for surface nesting seabirds, especially in remote locations (Wolfaardt & Phillips 2011)
- applied to a range of colonially nesting albatrosses BBA, WCA, SA, GHA

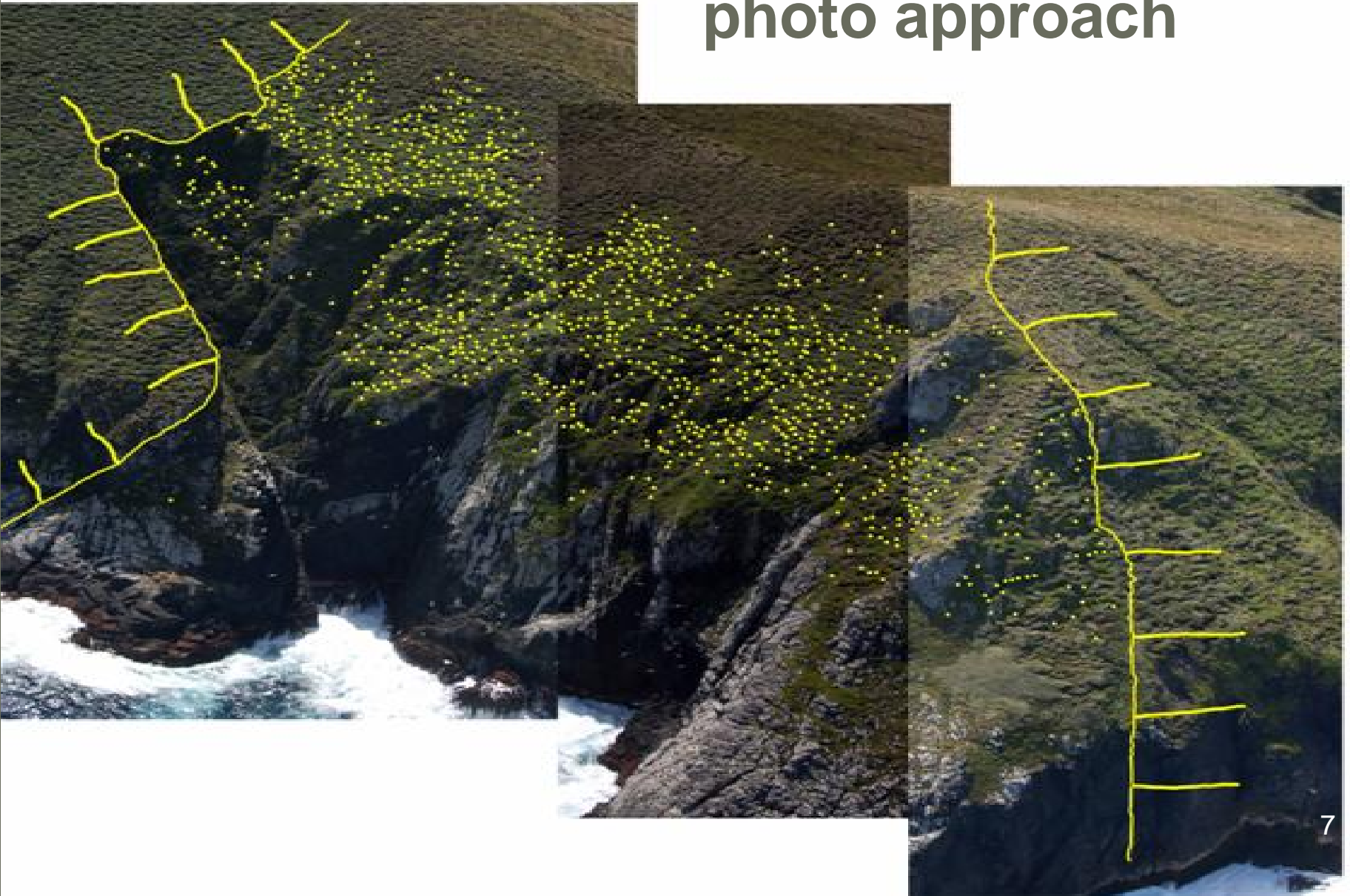
background

- techniques developed to date involve:
 - low level flights;
 - sequential overlapping photos;
 - stitching to produce photo montages of colonies; &
 - direct counting ‘scenic photo’ or ‘landscape’ approach
- most great albatrosses (*Diomedea* spp) not highly colonial, nests widely dispersed:
 - not suited to survey using existing aerial techniques.
- large distances between nests placed in essentially featureless topography pose challenges that may not be easily addressed through existing techniques
- effectiveness of aerial techniques needs to be tested for more dispersed species

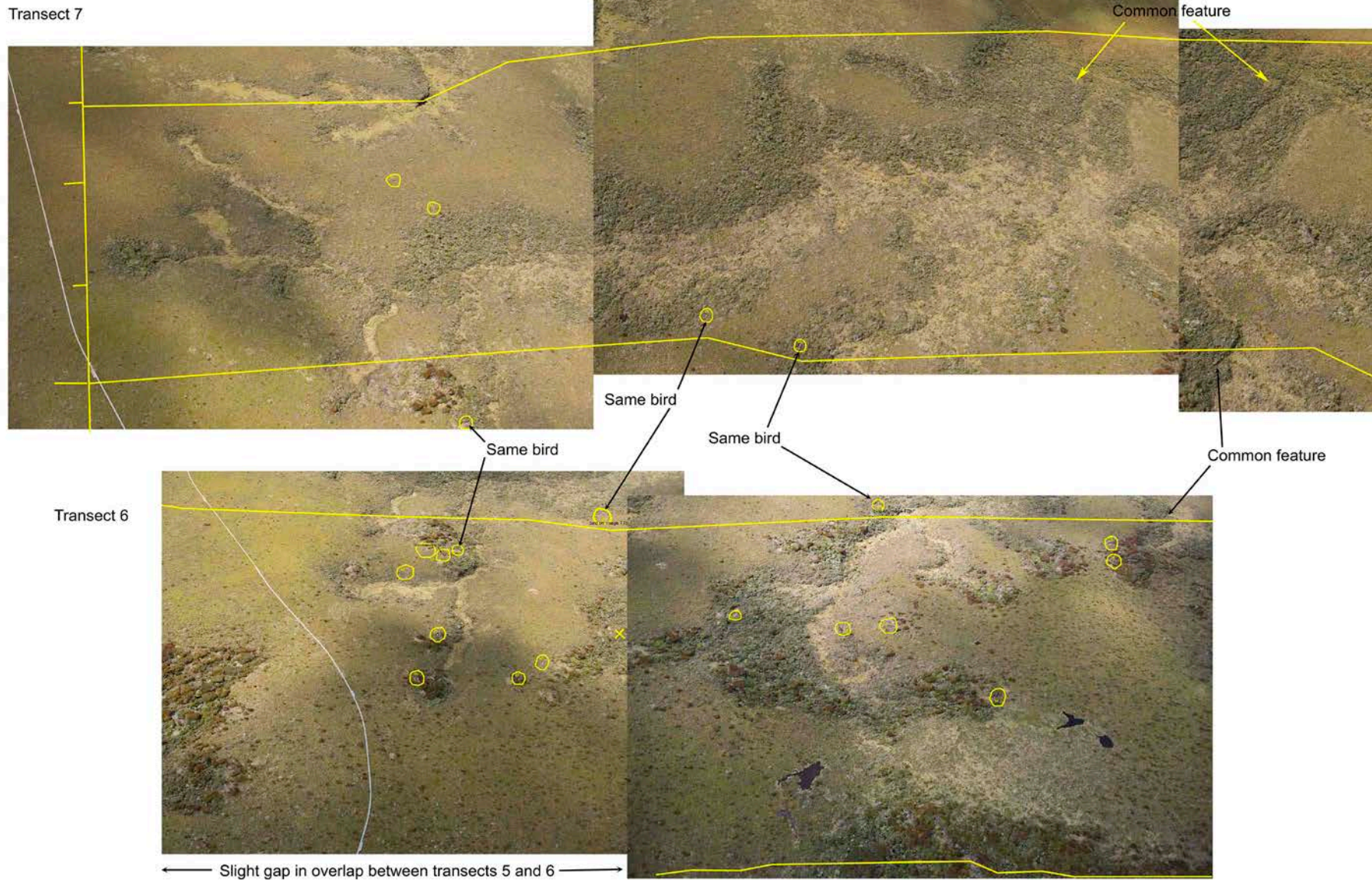
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- 2012 & 2013 trials conducted on: Enderby Is – Southern royal albatross
Disappointment Is – Gibson's albatross
- 2 approaches adopted:
 - construction of landscape-style montage
'scenic photo' or 'landscape' approach
 - use of transects to construct strip montages
'transect photo' approach
- CSP TWG meeting June 2014 discussion

Scenic or landscape photo approach



Transect approach



project objectives

- identify range of feasible options for aerial survey of Gibson's albatross on Adams Island.
- for each option identify & review:
 - operational factors relevant to research at Adams Island which may limit cost-effective use of option.
 - analytical requirements to estimate popn size
 - likely accuracy of resulting estimates.

methodology

1. Literature review of aerial photographic census techniques for surveying breeding birds:

Method	Target species
Static cameras, kite-born cameras, drones	seabirds including penguins NZSLs gulls
Fixed wing/helicopter surveys - whole colony photo montages	small albatrosses shags
Fixed wing/helicopter surveys - line & strip transects	common scoters – visual counts, video camera, still camera
Fixed wing/helicopter surveys - Whole colony photo montages - Line & strip transects	Great albatross – N royal, S royal, Gibson's

2. Field work on Adams Is, January 2015

Static cameras, kite-born cameras, drones

Technique	Species	Reference	Suitable for Adams Is / Gibson's
Pole mounted camera + distance sampling	Adelie penguin	Low et al (2008)	No
Kite + camera	NZ sea lion	Cawthorn 1993	No. Weather dependent
Drones (UAS)	Black-headed gull	Sarda-Palomera et al. 2012	No. Weather dependent, large spatial surveys not practical;

Fixed wing/helicopter surveys - whole colony photo montages

Technique	Species	Reference	Suitable for Adams Is / Gibson's
Fixed wing + camera	Black-browed alb. Grey-headed alb. s.giant petrel Atlantic yellow-nosed Shy albatross	Arata 2003 Robertson 2007 Reid & Huin 2008 Cooper 2014 Alderman 2011	No effective for large dense colonies
Helicopter + camera	White-capped alb Shy albatross Auckland Is	Baker 2015 Alderman unpubl.	No effective for large dense colonies

Fixed wing/helicopter surveys - line & strip transects

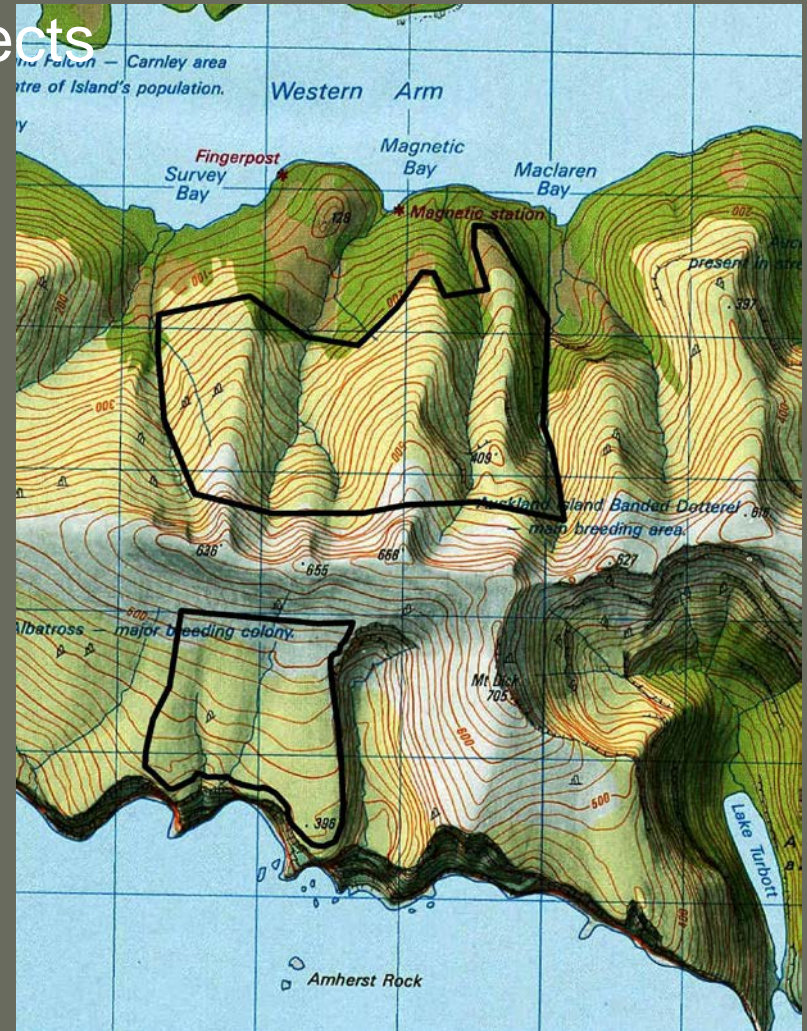
Technique	Species	Reference	Suitable for Adams Is / Gibson's
Fixed wing + aerial visual line transect sampling	Common scoter	Buckland 2012	No. Did not perform as well as other two measures
Fixed wing + digital video + strip transect sampling	Common scoter	Buckland 2012	Yes? Assumptions of detectability require resolution
Fixed wing + digital SLR + strip transect or grid sampling	Common scoter	Buckland 2012	Yes?

Aerial census of great albatrosses

Technique	Species	Reference	Suitable for Adams Is / Gibson's
Fixed wing + digital SLR + photo montage analysis	N. Royal albatross	Scofield 2012 ¹	No. effective for large dense colonies only
Helicopter + digital SLR + photo montage analysis	Gibson's albatross	Baker 2014	No. effective for large dense colonies only
Helicopter + digital SLR + transect analysis	S. Royal albatross	Baker 2014	Yes

field work – Adams Island

- S block flew series of 11 transects spaced at 200 m running West to East
- N block 13 transects, running East to West
- squirrel helicopter
- Flight height c.1000 ft agl, tracking contours using GPS
- Nikon D800 DSLR, 36 mp raw images, 50 mm lens

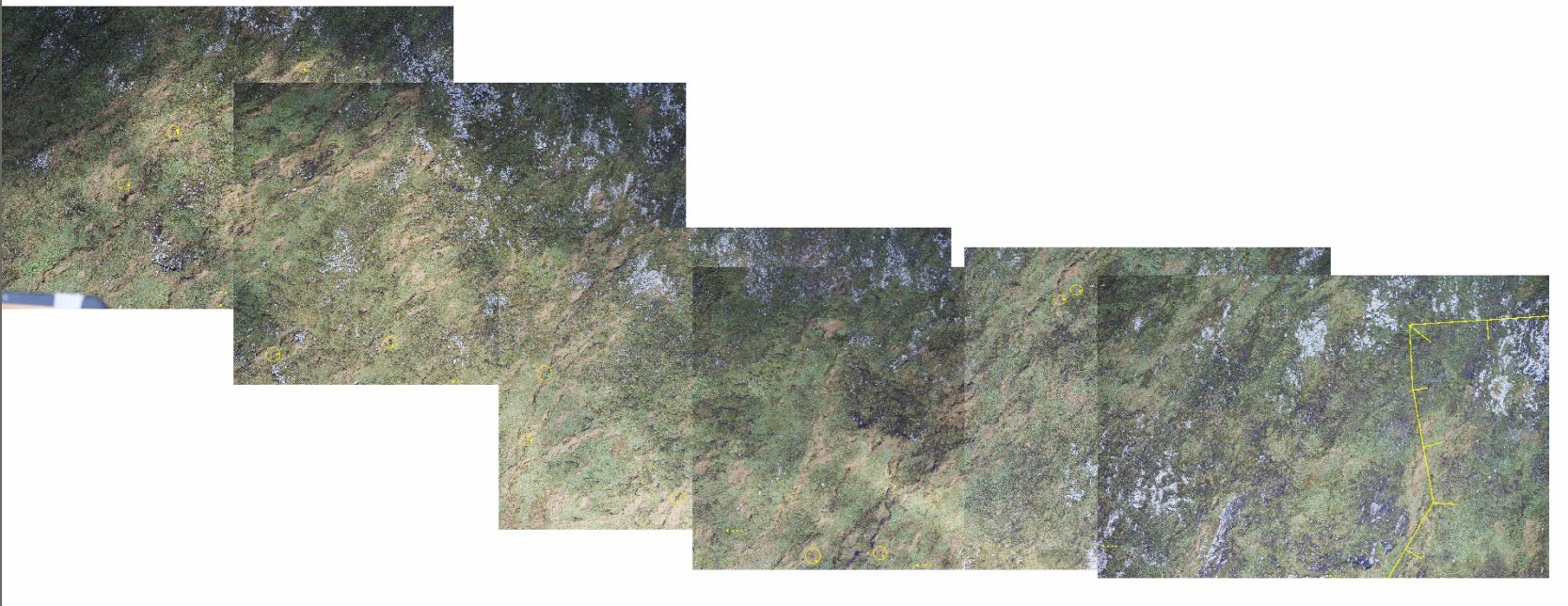


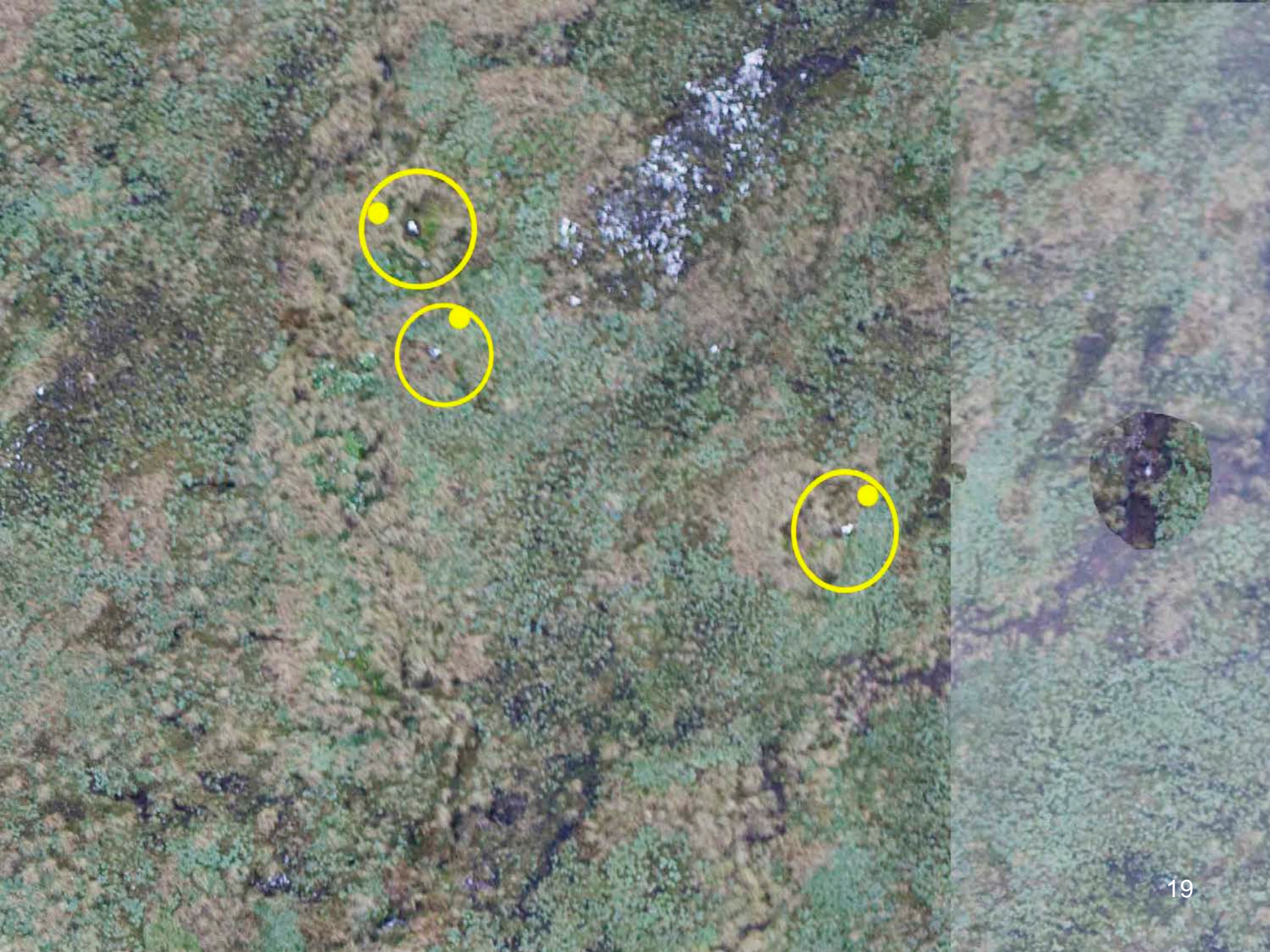
field work

- camera held facing downward at an angle of 70 degrees
- ensured plane of focus was as parallel to ground surface as possible.
- all photos GPS stamped to assist in aligning adjoining transects during processing
- ground counts conducted in the colony at the time of the flight

counting protocol & data assessment

- photomontages constructed of each transect
- only southern area stitched & counted
- no attempt made to stitch adjoining transects, but overlap assessed
- potential birds identified during stitching 'circled', later counted & marked off with PS paintbrush tool,
- all birds on the ground counted and assessed as breeding 'pair' or loafer if possible.
- all images counted by one observer





results

- photo resolution fit for purpose, but greater resolution would have assisted aligning transects
- transect spacing / camera/lens extension/ flight height combo should have ensured slight overlap with adjacent transects
- complete overlap only achieved on c. 40% of images, but not much missed
 - pilot error – slight deviations in flight path?
 - photographer error – insufficient care with framing?
- few birds likely to be missed - low colony density

results

- weather conditions (cloud) caused photography to be abandoned during photo runs on 2 occasions
- cloud cover is likely to be an ongoing problem and flight plans need to be flexible if good coverage is to be achieved
- aerial platform needs to be based in the Auckland Islands to permit rapid response to suitable photographic conditions. At present this limits aircraft selection to helicopters

SRA results

Aerial count	Ground count
574 'nesting pairs'	To be provided

Total birds	pairs	loafers	uncertain
590	12		43

—Western boundary of study site unclear from photos, to be resolved

Gibson's albatross results

—452 birds counted on all photomontages
(plus 11 partners of nesting birds)

nesting	loafer	uncertain
238	29	185

—proportion nesting birds to all birds where status certain = 0.89

—**estimate 403 annual breeding pairs**

—high number of birds classified as 'uncertain' because any nests obscured by surrounding vegetation

Gibson's albatross nesting birds (left panel)
with an extreme crop (right panel).



Gibson's non-breeding birds (left panel)
with an extreme crop (right panel).



Discussion – transects v areas

- **Transects preferred method for loosely colonial species**
- Stitching along transects easily achieved compared with stitching colony areas (ridge lines very time consuming with latter)
- Determining areas of spatial overlap between transects often difficult due to parallax error - distortion between the top & bottom of each transect
- This would be resolved with belly-mounted camera setup

photo prescriptions

- necessary to specify lens/camera/overflight height specification that has been field tested, and not rely on manufacturers gear specs to determine appropriate camera/lens combination
- theoretical calculations are hampered by inaccurate camera specifications
- Recommended specification for future survey of great albatross on Adams Island is combination of:
Nikon D800/810 camera /Nikkor 50 mm lens/
overflight height 600 feet, or similar, on full frame camera:

recommendations

- transect spacing / camera/lens extension/ flight height combo should be adjusted to improve photo resolution
 - 600 ft asl, 100 m transects & 50 mm lens on full frame camera would appear adequate, but conduct tests with proposed gear
 - aim to ensure 25% overlap with adjoining transects
- belly-mount camera in pod under aircraft & operate camera remotely

recommendations

- Consider island coverage over couple of seasons to reduce costs, given standby for helicopters during January field season
- Such an approach would also acknowledge weather issues. It may not be possible to achieve full island coverage in years when weather is poor for extended periods.
- Consider simultaneous ground and aerial counts so that ground-truthing is conducted in real-time

future work

- refine technique for use with larger populations & colonies where spatial extent is greater
- consider use of randomised & stratified transects for large areas
- undertake more work to accurately measure transect width (coverage) under defined camera / lens focal length / overflight heights
- Consider use of longer focal length telephoto lenses in addition to standard photos to take an adequate sample of 'close up' photos in future surveys. This will aid estimation of proportion of breeding & non-breeding birds in colonies

Acknowledgements

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