# APPENDIX 1

## Creating a 3D model of the Solander Islands

No digital elevation model exists for the Solander Island, which makes it difficult to estimate differences in nesting density around the islands. Consequently, one was built from the Toitū te Whenua Land Information New Zealand (LINZ) 1:50 000 20-m contour map of the islands (https://koordinates.com/from/data.linz.govt.nz/layer/50768-nz-contours-topo-150k/). This was superimposed on digital polygons of the islands derived from the LINZ 1:50 000 topographic map (https://koordinates.com/from/data.linz.govt.nz/layer/51153-nz-coastlines-and-islands-polygons-topo-150k/) and a 0-m contour added by digitizing the islands' coastlines. These surfaces were in turn overlain on a recent 0.5-m resolution satellite image of the islands obtained from LINZ (https://data.linz.govt.nz/layer/107366-nz-nearshore-islands-05m-satellite-imagery-2010-2021/, tiles CH05_5000_0201, …_0209 and …_0210) to check their integrity. Geospatial accuracy of the imagery was < 8.5 m (90% confidence): https://data.linz.govt.nz/layer/107366-nz-nearshore-islands-05m-satellite-imagery-2010-2021/metadata/iso/. All geospatial data sets were processed in QGIS 3.36.1 using the NZGD2000/New Zealand Transverse Mercator 2000 coordinate reference system (EPSG:2193).

To create a 3D model of the islands' surfaces, up to 100 random points, at least 10-m apart, were placed on each contour line using the QGIS vector tool *Random Points on Lines*. These points were used to create a Triangulated Irregular Network (TIN) of points and their elevations, which in turn were interpolated using the Clough-Toucher (cubic) algorithm to create a raster file of elevations with a 0.1-m resolution. The 3D area of these surfaces was then calculated using the GRASS routine *r.surf.area* in the QGIS Toolbox. Whereas the 3D surface area of Little Solander Island was calculated as a whole, that for Great Solander Island was evaluated for six adjacent, non-overlapping areas: the five areas used in earlier studies (Thompson et al., 2017), each separated by major ridges running down from the 240-m contour to the sea, and the island plateau above the 240-m contour (Fig. 2). Masks of these areas were digitized with the satellite image and 1:50 000 contour map as guides. The underlying 3D surfaces of each area were then extracted using these masks and the QGIS tool *Clip Raster by Mask Layer*, with their areas being calculated using *r.surf.area*, as described above.

# APPENDIX 2

Counts of Southern Buller's Mollymawk of different social status in the five areas of Great Solander Island (see Fig. 2 for locations) and for the whole island.[a] Total apparently active nests were calculated as the number of birds sitting on nests plus that proportion of birds of indeterminate status estimated to be nesting based on the joint probability that they were present at an active nest, $p(nest_{occ})$ and actually the one sitting, $p(sitting|nest_{occ})$. The probabilities associated with each area are the averages of those calculated separately for each of the count zones in an area, weighted by the number of birds counted at nests in each zone. See text for further details.

| | Great Solander | | | | | |
|---|---|---|---|---|---|---|
| Status | Area 1 East Bay | Area 2 North Bay | Area 3 West Bay | Area 4 WSW Bay | Area 5 SW Bay | Great Solander total |
| Bird sitting on nest | 694 | 1,113 | 559 | 279 | 1,228 | 3,873 |
| Partner to a sitting bird | 40 | 106 | 62 | 19 | 109 | 336 |
| Bird on empty nest or site | 118 | 111 | 45 | 24 | 153 | 451 |
| Partner to bird on empty nest | 20 | 14 | 6 | 1 | 23 | 64 |
| Loafing birds | 27 | 36 | 12 | 13 | 47 | 135 |
| Indeterminate | 297 | 412 | 274 | 96 | 277 | 1,356 |
| Vacant nest site | 224 | 132 | 50 | 154 | 1,052 | 1,612 |
| Total birds on ground | 1,196 | 1,792 | 958 | 432 | 1,837 | 6,215 |
| $p(nest_{occ})$ | *0.816* | *0.883* | *0.908* | *0.887* | *0.857* | *0.867* |
| $p(sitting\|nest_{occ})$ | *0.946* | *0.913* | *0.900* | *0.936* | *0.918* | *0.920* |
| Total apparently active nests | 923 | 1,445 | 783 | 359 | 1,446 | 4,955 |

[a] Total apparently active nests were calculated as the number of birds sitting on nests plus that proportion of birds of indeterminate status estimated to be nesting, based on the joint probability that they were present at an active nest, $p(nest_{occ})$ and actually the one sitting, $p(sitting|nest_{occ})$. The probabilities associated with each area are the averages of those calculated separately for each of the count zones in an area, weighted by the number of birds counted at nests in each zone. See text for further details.