SUPPLEMENTARY ELECTRONIC MATERIAL

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A GULL THAT SCARCELY VENTURES ON THE OCEAN: YELLOW-LEGGED GULLS *LARUS MICHAHELLIS ATLANTIS* ON THE OCEANIC ISLAND OF MADEIRA

UNA GAVIOTA QUE APENAS SE AVENTURA EN EL OCÉANO: LA GAVIOTA PATIAMARILLA *LARUS MICHAHELLIS ATLANTIS* EN LA ISLA OCEÁNICA DE MADEIRA

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Supplementary Material 1

Appendix 1, A1: Methods for point-counts of gulls in winter.

We carried out 19 point-counts at strategic sites around the island of Madeira (14 points) and at five other locations further inland to assess the distribution of the Yellow-legged Gull *Larus michahellis atlantis* (YLG) on that island. Counting points were initially selected from a 1km grid all around the island, but some quadrats that were not easily accessed by car were not counted. This work took place during two days in January 2017, and involved counting (with a telescope 20x) all individuals visible, whether landed, flying or feeding, within 1,000m. No distinction was made between adults and immature birds.

Appendix 1, A2: Filtering of the gull tracking data, and AIS-T and VMS data.

We deployed GPS-GSM devices on ten YLGs in Madeira island with the aim of describing the distribution of the population. Some technical problems arose causing for larger intervals between positions taken, leading to the need of data regularisation. Hourly positions were more frequent and congruent throughout all GPS devices; therefore, we regularised all trajectories by linear interpolation of fixes. Also, different GPS units recorded data over different periods. Therefore, some of the analyses were based on randomly sampled fixes from each individual, based on the GPS with the smallest number of fixes (n = 176). To study the areas used by the gulls in Madeira, both for foraging and resting, we excluded the fixes at colonies. At-sea positions between the breeding colony, Chão islet and the main island were completely linear and represented commuting movements between the islands, not foraging activity, so were also excluded. The previous conditions were applied to all tracking data analyses.

VMS and AIS-T data were used to characterise the activity area of fishing vessels in the vicinity of Madeira island at the time positions of YLGs were present in the sea. VMS data were preferably used while AIS-T data complemented the database with a few fishing vessels that were not present in the VMS dataset. The sampling intervals of VMS and AIS-T data differed among vessels and therefore we regularised the data by only keeping vessel positions that differed by at least one hour. Furthermore, we filtered these positions for speeds under 4 knots. The AIS-T and VMS data represented a total of 123 vessels and 10,854 vessel positions, and the analysed time span included 6 gulls. We then constructed a 50%, 75% and 95% kernel density of fishing vessels in activity, using filtered AIS-T and VMS data and the *adehabitatHR* package (h = 0.03, grid = 300; Calenge, 2017), under R software (R Core Team, version 1.0.143).

Appendix 1, A3: Stable Isotope Analysis and treatment of blood, feathers and muscle.

To assess the diet of the YLGs in the Archipelago of Madeira, we used stable isotope analysis of adults (blood) and chicks (feathers) of YLGs and their preys (muscles), collected in April 2016 and May 2017. The feathers collected from chicks

had just grown, which meant that the isotopic signature represented the diet consumed during the chick rearing period. Because feathers of adults start moulting later in August (Monteiro *et al*., 1996), after the chick rearing, they represented a different time period than that of the chick feathers. Therefore, blood of adults was collected for comparison of the same period as the chicks.
Spontaneous regurgitations of chicks provided some diet samples, and prey were identified to the lowest taxonomic level, using hard structures like vertebrae and/or otoliths, and an extensive reference collection. Among prey species identified were fish (*Scomber colias*, *Trachurus picturatus, Boops boops*), wart-biters (*Dectitus albifrons*), and pork and chicken meat.

Bulwer's Petrels have never been found in chick regurgitations or ever described as a dietary item, unlike in adults (Ramos *et al.,* 2009a, Arizaga *et al.,* 2010, 2013, Alonso *et al*., 2015). Therefore, Bulwer's Petrels were not considered to represent prey in the chick diet.

Feathers were washed with 10% NaOH solution to clean them from external particles (Bearhop *et al.,* 2000, Arizaga *et al.,* 2013), and then thoroughly washed with distilled water. Blood samples from adults did not undergo any treatment before isotopic analysis (Bearhop *et al.,* 2000, Granadeiro *et al.,* 2013). Prior to isotopic analysis of Carbon and Nitrogen, muscle samples from prey were treated with a 2:1 chloroform-methanol solution to extract the lipids of the tissues.

SIA was carried out using continuous-flow isotope-ratio mass spectrometry (CF-IRMS) (Brand *et al.,* 2015). Results are represented in parts per thousand (‰) relative to the Pee Dee Belemnite (PDB) for $\delta^{13}C$, and atmospheric nitrogen for $\delta^{15}N$. The contribution of different food sources to the diet of YLG in Madeira was described using mixing models as implemented in the SIAR package for R (Parnell *et al.,* 2010). Prey were grouped according to their trophic guild: terrestrial herbivores (including snails, wart-biters and rabbits), refuse (chicken, pork and cow meat), marine fish (Atlantic chub mackerels, blue jack mackerels and bogues), and Bulwer's Petrel. We could not find discrimination factors for diet-blood and diet-feather for YLG, and therefore we calculated average values derived from literature (Hobson & Clark, 1992; Mizutani *et al.,* 1992; Bearhop *et al.,* 1999, 2002; Ogden *et al.*, 2004; Cherel *et al.,* 2005; Williams *et al.*, 2007; Ramos *et al.*, 2009b): diet-blood: 2.93 ± 0.45‰ for $\delta^{15}N$ and 0.39±0.96‰ for $\delta^{13}C$, and diet-feather: 4.00 ± 1.07‰ for $\delta^{15}N$ and 1.97 ± 1.54‰ for $\delta^{13}C$.

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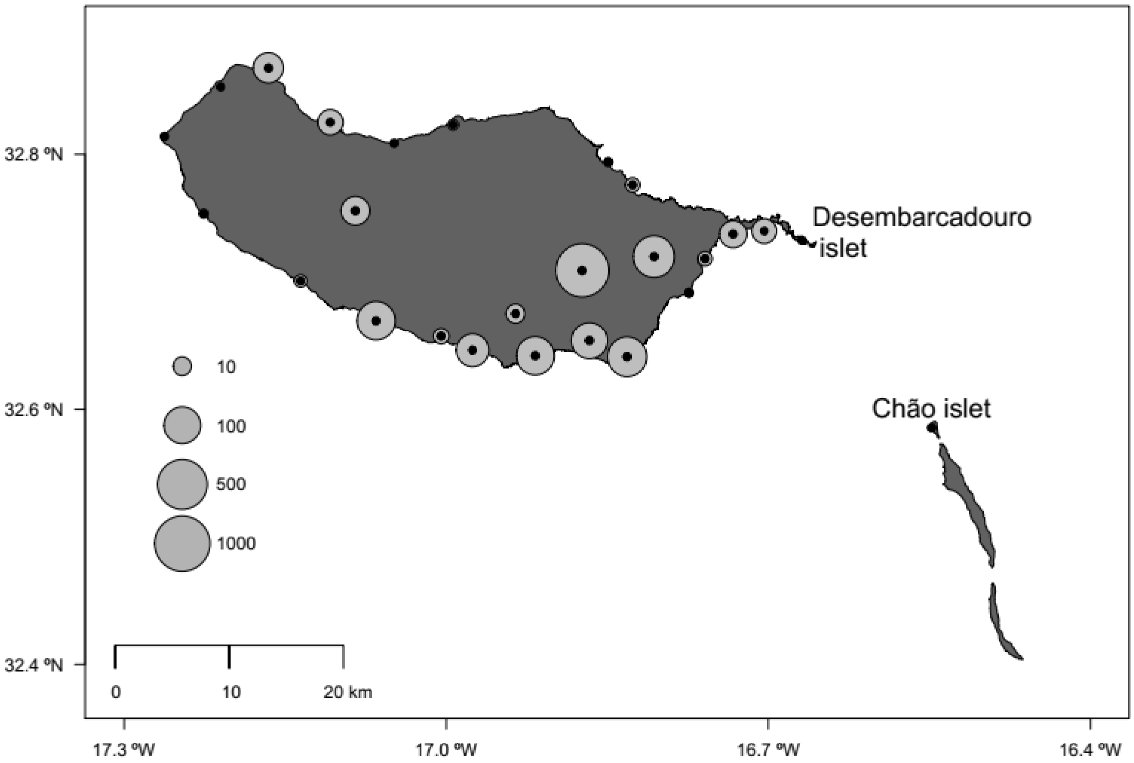
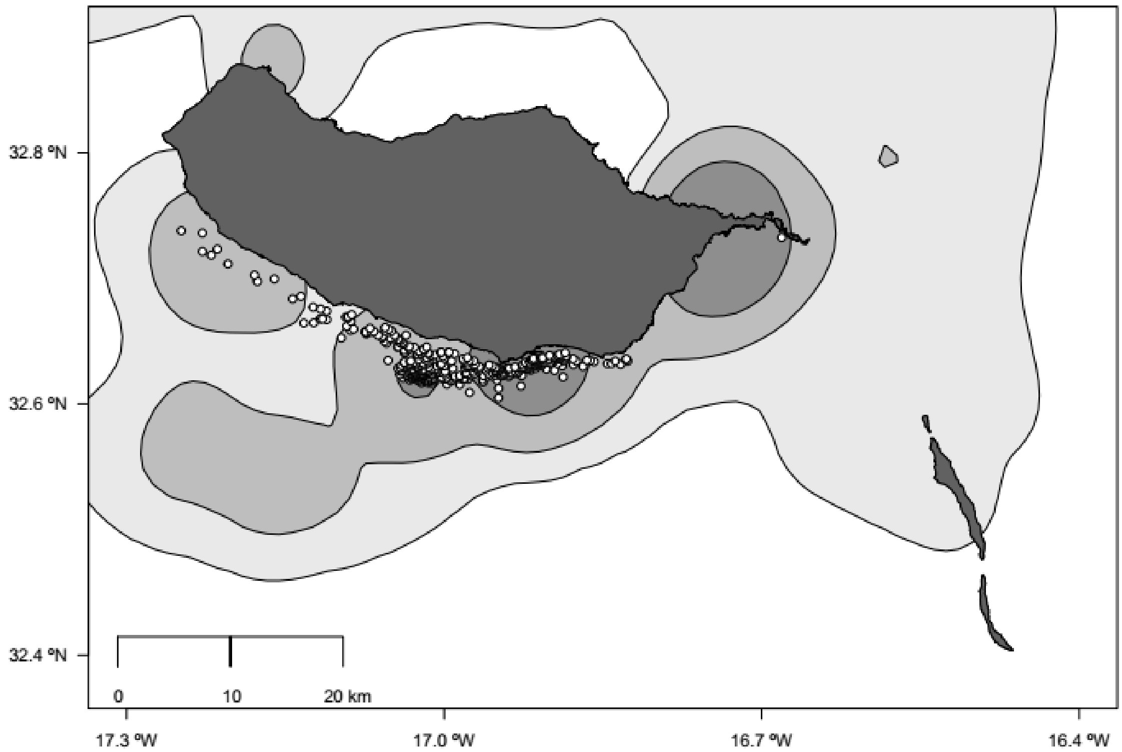
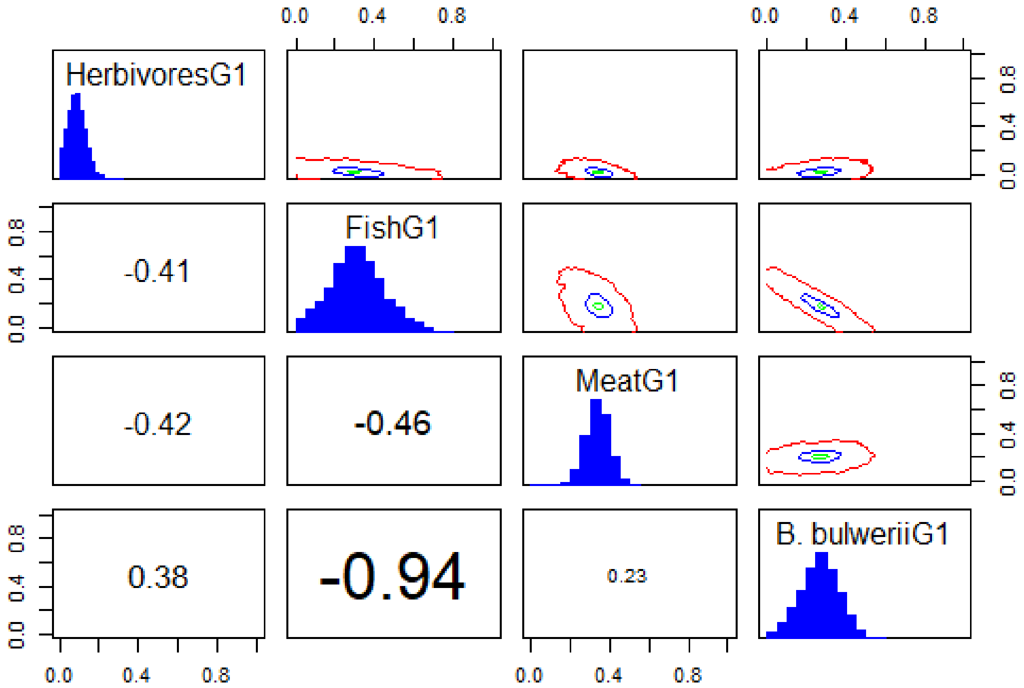
SUPPLEMENTARY MATERIAL 2



Appendix 2, Figure B1. Total numbers of Yellow-legged Gulls *Larus michahellis atlantis* at each point-count site (black points) in January 2017, in Madeira island. Desembarcadouro and Chão islet are the breeding colonies studied.



Appendix 2, Figure B2. Kernel density estimates of fishing activity (vessels travelling at <4 knots) around Madeira island, from 1st April 2016 to 30th September 2016 and at-sea positions of Yellow-legged Gulls *Larus michahellis atlantis* during the study period. The kernel density is represented by the 95%, 75% and 50% contours, with increasing shading. White points represent at-sea gull locations during the study period.



Appendix 2, Figure B3. Matrixplot of the proportions of food categories consumed by adult Yellow-legged Gulls *Larus michahellis atlantis* in Madeira. Terrestrial herbivores (snails, wart-biters and rabbits), Marine fish (Blue Jack Mackerel, Atlantic Chub Mackerel and Common Bogue), Refuse (chicken, pork and cow meat), and Bulwer's Petrel.

Appendix 2, Video B4. Example of the animation of time-matched Yellow-legged Gulls *Larus michahellis atlantis* and fishing vessels movements in the Archipelago of Madeira between April and September 2016. Fishing vessels are represented by black points and gulls by red points.