**Título EN:** Changes in numbers and distribution of Yellow-legged Gull *Larus michahellis* nestingin Portugal during the last two decades

**Título PT:** Alterações no tamanho populacional e distribuição das gaivotas-de-patas-amarelas *Larus michahellis* nidificantes em Portugal, ao longo das últimas duas décadas

**Título curto EN:** Yellow-legged Gulls nesting in Portugal

**Título curto PT:** As gaivotas-de-patas-amarelas nidificantes em Portugal

**Autores:**

Nuno Oliveira1\*

Hany Alonso1

Vitor Encarnação2

Dília Menezes3

Maria Magalhães4

Gilberto Carreira4

Sol Heber5

Rui Pimentel5

Valter Medeiros5

Jaime Bairos5

Pedro Raposo5

Rúben Coelho5

Rui Rufino6

Renato Neves6

Tânia Nascimento1

Elisabete Silva1

Joana Andrade1

**Filiação:** 1SPEA, 2ICNF – Instituto da Conservação da Natureza e das Florestas I.P., 3IFCN, IP-RAM – Instituto das Florestas e Conservação da Natureza, IP-RAM, Madeira, 4Regional Directorate for Maritime Policies (DRPM), 5Secretariat for the Environment and Climate Change (SRAAC), 6Mãe d’Água, Lda.

\***Endereço para correspondência:** nuno.oliveira@spea.pt

Table S1\_ Predicting variables included in the analysis to evaluate the effect of anthropogenic food sources on the number of Yellow-legged Gull pairs breeding in Portugal in 2021. The mean distance between the location of all nests in a given municipality and the nearest landfill or fishing harbour was calculated as the centroid of all nest locations and the respective facility. The mean ± standard deviation weight of residues delivered to the nearest landfill (as amount of deliveries in tons), the mean weight of residues delivered to all landfills located within a radius of 35 km from the nest locations (as deliveries <35 km in tons), the amount of fish landed at the nearest fishing harbour (as fish landings in tons), the amount of fish landed at all fishing harbours located within a radius of 35 km from the nest locations (as fish landings <35 km in tons) and the mean weight of non-differentiated residues collected in a given municipality (as urban residues in tons). The number of breeding pairs and the annual growth rate of the Yellow-legged Gull population breeding in each municipality, compared to historical data (see Table 3), are also given.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Region/ District** | **Municipality** | **Landfills** | | | | **Fishing harbours** | | | | **Urban residues (t)** | **Yellow-legged Gulls** | |
| **Nearest landfill** | **Distance (km)** | **Deliveries (t)** | **Deliveries <35km (t)** | **Nearest harbour** | **Distance (km)** | **Fish landings (t)** | **Fish landings <35km (t)** |  | **N pairs** | **Growth rate** |
| ***Mainland*** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Braga** | Braga | Póvoa de Lanhoso | 9.25 | 98700.83 ± 15511.69 | 387478.47 ± 23376.94 | Povoa de Varzim | 35.22 | 1835.74 ± 532.73 | 1835.74 ± 532.73 | 65061.08 ± 4480.05 | 6 | 4.18 |
|  | Esposende | Viana do Castelo | 12.91 | 122653.17 ± 3147.89 | 122653.17 ± 3147.89 | Povoa de Varzim | 17.21 | 1835.74 ± 532.73 | 1835.74 ± 532.73 | 18355.38 ± 744.89 | 1 | 0.00 |
|  | Guimarães | Guimarães | 8.45 | 52356.03 ± 3796.46 | 369537.31 ± 26605.59 | Povoa de Varzim | 40.6 | 1835.74 ± 532.73 | 0.00 ± 0.00 | 54860.62 ± 2024.04 | 3 | 2.54 |
| **Coimbra** | Figueira da Foz | Coimbra | 30.5 | 120127.83 ± 18579.37 | 120127.83 ± 18579.37 | Figueira da Foz | 1.22 | 10967.26 ± 3627.8 | 10967.26 ± 3627.8 | 28557.92 ± 3274.37 | 27 | 7.82 |
| **Faro** | Aljezur | Portimão | 31.28 | 174554.67 ± 9952.00 | 174554.67 ± 9952.00 | Lagos | 26.8 | 2724.58 ± 619.34 | 2724.58 ± 619.34 | 3440.54 ± 383.78 | 4 | -5.65 |
|  | Faro | Loulé | 34.75 | 148694.72 ± 8477.63 | 148694.72 ± 8477.63 | Olhão | 8.38 | 12123.26 ± 3021.52 | 12123.26 ± 3021.52 | 32437.69 ± 3375.15 | 485 | 15.18 |
|  | Lagoa | Portimão | 13.21 | 174554.67 ± 9952.00 | 174554.67 ± 9952.00 | Portimão | 1 | 6578.26 ± 2229.82 | 6578.26 ± 2229.82 | 16999.62 ± 1745.09 | 5 | -5.88 |
|  | Lagos | Portimão | 18.46 | 174554.67 ± 9952.00 | 174554.67 ± 9952.00 | Lagos | 1.5 | 2724.58 ± 619.34 | 2724.58 ± 619.34 | 20138.77 ± 2067.59 | 90 | -0.64 |
|  | Loulé | Loulé | 24.73 | 148694.72 ± 8477.63 | 148694.72 ± 8477.63 | Olhão | 25.04 | 12123.26 ± 3021.52 | 12123.26 ± 3021.52 | 46158.62 ± 4368 | 2 | 1.60 |
|  | Olhão | Loulé | 33.1 | 148694.72 ± 8477.63 | 148694.72 ± 8477.63 | Olhão | 3.75 | 12123.26 ± 3021.52 | 12123.26 ± 3021.52 | 21446.85 ± 2468.19 | 57 | 9.68 |
|  | Portimão | Portimão | 11.02 | 174554.67 ± 9952.00 | 174554.67 ± 9952.00 | Portimão | 1.37 | 6578.26 ± 2229.82 | 6578.26 ± 2229.82 | 30505.62 ± 3220.85 | 96 | -0.81 |
|  | Silves | Portimão | 19.12 | 174554.67 ± 9952.00 | 174554.67 ± 9952.00 | Ferragudo | 14.57 | -- | -- | 19653 ± 2093.51 | 4 | 3.22 |
|  | Vila do Bispo | Portimão | 43.45 | 174554.67 ± 9952.00 | 174554.67 ± 9952.00 | Sagres | 3.43 | -- | -- | 4366.54 ± 901.98 | 254 | 1.44 |
| **Leiria** | Caldas da Rainha | Cadaval | 24.39 | 96892.23 ± 12365.36 | 96892.23 ± 12365.36 | Nazaré | 20.31 | 5880.79 ± 8161.57 | 5880.79 ± 8161.57 | 20892.46 ± 975.62 | 1 | 0.00 |
|  | Nazaré | Leiria | 22.42 | 112668.67 ± 12423.24 | 112668.52 ± 12423.25 | Nazaré | 1.73 | 5880.79 ± 8161.57 | 5880.79 ± 8161.57 | 9040.69 ± 655.25 | 19 | 6.96 |
|  | Peniche | Cadaval | 28.32 | 96892.23 ± 12365.36 | 96892.23 ± 12365.36 | Peniche | 1.71 | 14410.84 ± 3430.31 | 14410.84 ± 3430.31 | 15583.15 ± 1132.03 | 247 | 0.18 |
| **Lisboa** | Cascais | Seixal | 26.46 | 175553.67 ± 9371.08 | 325491.04 ± 133660.22 | Cascais | 1.41 | 429.79 ± 348.46 | 429.79 ± 348.46 | 87516.23 ± 8584.82 | 25 | -2.78 |
|  | Lisboa | Seixal | 13 | 175553.67 ± 9371.08 | 501044.68 ± 140927.45 | Cascais | 20.63 | 429.79 ± 348.46 | 429.79 ± 348.46 | 255766 ± 31732.47 | 187 | 12.70 |
|  | Mafra | Abrunheira | 11.86 | 149937.33 ± 126669.55 | 149937.39 ± 126669.63 | Cascais | 0.37 | 429.79 ± 348.46 | 429.79 ± 348.46 | 30541.69 ± 4250.82 | 16 | 6.54 |
|  | Odivelas | Seixal | 17.7 | 175553.67 ± 9371.08 | 501044.68 ± 140927.45 | Cascais | 20.34 | 429.79 ± 348.46 | 429.79 ± 348.46 | -- | 1 |  |
|  | Oeiras | Seixal | 14.3 | 175553.67 ± 9371.08 | 501044.68 ± 140927.45 | Cascais | 16.49 | 429.79 ± 348.46 | 429.79 ± 348.46 | 58709.23 ± 4128.24 | 5 | 3.75 |
|  | Torres Vedras | Cadaval | 19.02 | 96892.23 ± 12365.36 | 246829.62 ± 124332.86 | Peniche | 21.61 | 14410.84 ± 3430.31 | 14410.84 ± 3430.31 | 32208.62 ± 1677.66 | 1 | 0.00 |
| **Porto** | Gondomar | Maia | 10.46 | 23461.5 ± 9586.32 | 307526.97 ± 12064.11 | Matosinhos | 12.87 | 22797.21 ± 6828.56 | 22797.21 ± 6828.56 | 60042.31 ± 3937.05 | 1 | 0.00 |
|  | Maia | Maia | 3.08 | 23461.5 ± 9586.32 | 307526.97 ± 12064.11 | Matosinhos | 8.95 | 22797.21 ± 6828.56 | 22797.21 ± 6828.56 | 42147.38 ± 3927.9 | 15 | 6.39 |
|  | Matosinhos | Maia | 5.45 | 23461.5 ± 9586.32 | 246114.51 ± 9637.36 | Matosinhos | 1.98 | 22797.21 ± 6828.56 | 22797.21 ± 6828.56 | 71267.31 ± 5236.19 | 94 | 10.94 |
|  | Penafiel | Lustosa | 12.81 | 65584.83 ± 3224.18 | 249447.97 ± 17104.45 | Matosinhos | 35.09 | 22797.21 ± 6828.56 | 0.00 ± 0.00 | -- | 1 |  |
|  | Porto | Sermonde | 10.9 | 163117.83 ± 12218.99 | 272909.57 ± 12102.33 | Matosinhos | 10.06 | 22797.21 ± 6828.56 | 22797.21 ± 6828.56 | 115140.23 ± 11403.48 | 487 | 15.19 |
|  | Póvoa de Varzim | Maia | 19.45 | 23461.5 ± 9586.32 | 198470.84 ± 6354.93 | Povoa de Varzim | 0.92 | 1835.74 ± 532.73 | 1835.74 ± 532.73 | 28728.54 ± 2451.44 | 118 | 11.52 |
|  | Valongo | Maia | 13.76 | 23461.5 ± 9586.32 | 272909.57 ± 12102.33 | Matosinhos | 17.37 | 22797.21 ± 6828.56 | 22797.21 ± 6828.56 | 30981.23 ± 1722.32 | 1 | 0.00 |
|  | Vila do Conde | Maia | 16.23 | 23461.5 ± 9586.32 | 198470.84 ± 6354.93 | Póvoa de Varzim | 2.88 | 1835.74 ± 532.73 | 1835.74 ± 532.73 | 34970.31 ± 2215.36 | 19 | 6.96 |
|  | Vila Nova de Gaia | Sermonde | 9.8 | 163117.83 ± 12218.99 | 272909.57 ± 12102.33 | Matosinhos | 9.82 | 22797.21 ± 6828.56 | 22797.21 ± 6828.56 | 130756.92 ± 5886.32 | 77 | 10.44 |
| **Setúbal** | Almada | Seixal | 7.33 | 175553.67 ± 9371.08 | 351107.29 ± 18742.14 | Sesimbra | 26.44 | 19960.79 ± 6826.27 | 19960.79 ± 6826.27 | 86669.77 ± 10594.21 | 32 | 8.24 |
|  | Sesimbra | Seixal | 18.78 | 175553.67 ± 9371.08 | 351107.29 ± 18742.14 | Sesimbra | 1.29 | 19960.79 ± 6826.27 | 19960.79 ± 6826.27 | 30306.00 ± 4470.91 | 59 | 9.77 |
|  | Sines | Ermidas do Sado | 45.01 | 53155.83 ± 6879.02 | 0 ± 0 | Sines | 4.17 | 9293.58 ± 1738.20 | 9293.58 ± 1738.20 | 8127.46 ± 561.9 | 1165 | 4.10 |
| **Viana do Castelo** | Caminha | Viana do Castelo | 21.04 | 122653.17 ± 3147.89 | 157171.18 ± 3675.23 | Viana do Castelo | 14.77 | 1991.68 ± 433.29 | 1991.68 ± 433.29 | 10032.85 ± 624.22 | 21 | 7.21 |
|  | Viana do Castelo | Viana do Castelo | 7.74 | 122653.17 ± 3147.89 | 157171.18 ± 3675.23 | Viana do Castelo | 0.74 | 1991.68 ± 433.29 | 1991.68 ± 433.29 | 33454.69 ± 1314.24 | 37 | 8.60 |
| **Vila Real** | Vila Real | Boticas | 15.48 | 52356.03 ± 3796.46 | 52356.03 ± 3796.46 | Viana do Castelo | 84.18 | 1991.68 ± 433.29 | 0.00 ± 0.00 | 19528.23 ± 919.33 | 2 | 1.60 |
| ***Azores*** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Corvo** | Vila do Corvo | Corvo | 278.84 | 113.00 ± 88.30 | 113.00 ± 88.30 | Corvo | 5.82 | 20.84 ± 8.25 | 20.84 ± 8.25 | 198.92 ± 41.41 | 41 | -2.02 |
| **Flores** | Lajes das Flores | Flores | 271.14 | 319.89 ± 98.39 | 319.89 ± 98.39 | Flores | 12.65 | 92.68 ± 24.67 | 92.68 ± 24.67 | 473.77 ± 261.18 | 12 | -2.55 |
|  | Santa Cruz das Flores | Flores | 273.14 | 319.89 ± 98.39 | 319.89 ± 98.39 | Flores | 8.04 | 92.68 ± 24.67 | 92.68 ± 24.67 | 1133.83 ± 593.29 | 32 | -3.61 |
| **Graciosa** | Santa Cruz da Graciosa | Graciosa | 74.34 | 354.44 ± 136.90 | 354.44 ± 136.9 | Graciosa | 5.99 | 137.53 ± 26.24 | 137.53 ± 26.24 | 1522.38 ± 187.77 | 46 | -4.84 |
| **Pico** | Madalena | Pico | 11.86 | 3303.33 ± 1595.82 | 3303.33 ± 1595.82 | Pico | 9.15 | 2129.21 ± 1411.54 | 2129.21 ± 1411.54 | 2295.77 ± 114.37 | 17 | -2.91 |
|  | Lajes do Pico | Pico | 18.16 | 3303.33 ± 1595.82 | 3303.33 ± 1595.82 | São Jorge | 24.84 | 294.86 ± 163.48 | 294.86 ± 163.48 | 1557.23 ± 149.13 | 39 | -0.68 |
|  | São Roque do Pico | Pico | 14.2 | 3303.33 ± 1595.82 | 3303.33 ± 1595.82 | São Jorge | 19.92 | 294.86 ± 163.48 | 294.86 ± 163.48 | 1249.38 ± 196.80 | 66 | -4.38 |
| **Santa Maria** | Vila do Porto | São Miguel | 100.71 | 59288.67 ± 2634.45 | 59288.67 ± 2634.45 | Santa Maria | 9.51 | 678.89 ± 495.24 | 678.89 ± 495.24 | 2008.92 ± 369.22 | 93 | -0.11 |
| **São Miguel** | Ponta Delgada | São Miguel | 15.31 | 59288.67 ± 2634.45 | 59288.67 ± 2634.45 | São Miguel | 14.31 | 5175.47 ± 1369.18 | 5175.47 ± 1369.18 | 33793.62 ± 5690.18 | 182 | -0.99 |
|  | Ribeira Grande | São Miguel | 12.14 | 59288.67 ± 2634.45 | 59288.67 ± 2634.45 | São Miguel | 10 | 5175.47 ± 1369.18 | 5175.47 ± 1369.18 | 13471.46 ± 1830.36 | 442 | -0.79 |
|  | Vila Franca do Campo | São Miguel | 17.23 | 59288.67 ± 2634.45 | 59288.67 ± 2634.45 | São Miguel | 17.34 | 5175.47 ± 1369.18 | 5175.47 ± 1369.18 | 4961.31 ± 678.00 | 64 | 11.21 |
| **Terceira** | Angra do Heroismo | Terceira | 12.11 | 12924.33 ± 7097.64 | 12924.33 ± 7097.64 | Terceira | 10.4 | 1155.42 ± 251.95 | 1155.42 ± 251.95 | 18887.31 ± 5514.76 | 548 | -1.25 |
|  | Praia da Vitória | Terceira | 13.01 | 12924.33 ± 7097.64 | 12924.33 ± 7097.64 | Terceira | 11.91 | 1155.42 ± 251.95 | 1155.42 ± 251.95 | 8705.62 ± 1448.37 | 42 | 3.48 |
| ***Madeira*** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Madeira** | Funchal | Madeira | 32.76 | 3751.71 ± 515.05 | 3751.71 ± 515.05 | Madeira | 35.73 | 6452.26 ± 1288.18 | 0.00 ± 0.00 | 51813.31 ± 14061.95 | 10 | -9.26 |
|  | Machico | Madeira | 18.7 | 3751.71 ± 515.05 | 3751.71 ± 515.05 | Madeira | 6.09 | 6452.26 ± 1288.18 | 6452.26 ± 1288.18 | 8886.62 ± 1619.20 | 37 | -8.32 |
|  | Santa Cruz | Madeira | 40.25 | 3751.71 ± 515.05 | 3751.71 ± 515.05 | Madeira | 41.92 | 6452.26 ± 1288.18 | 0.00 ± 0.00 | 14911.00 ± 1978.18 | 6 | 4.18 |
| **Porto Santo** | Porto Santo | Madeira | 6.38 | 3751.71 ± 515.05 | 0.00 ± 0.00 | Porto Santo | 3.36 | 38.00 ± 33.79 | 38.00 ± 33.79 | 2843.77 ± 952.50 | 46 | -4.83 |
| ***Selvagens*** |  |  |  |  |  |  |  |  |  |  |  |  |
| **Selvagem Grande** |  | Madeira | 298.48 | 3751.71 ± 515.05 | 0.00 ± 0.00 | Madeira | 294.85 | 6452.26 ± 1288.18 | 0.00 ± 0.00 | 0.00 ± 0.00 | 6 | -2.37 |