**Appendix 1: Phenological patterns for the forty most abundant species in the Tejo estuary high tide roosts**

The graphs below present the average monthly counts (±SD) for each of the forty most abundant waterbirds species using the high tide roosts of the Tejo estuary. Species are ordered alphabetically by Latin name.

*Actitis hypoleucos* Common sandpiper

*Anas clypeata* Shoveler duck

*Anas crecca* Common teal

*Anas penelope* Eurasian wigeon

*Anas platyrhynchos* Mallard

*Ardea cinerea* Grey heron

*Arenaria interpres* Ruddy turnstone

*Bubulcus ibis* Cattle egret

*Calidris alba* Sanderling

*Calidris alpina* Dunlin

*Calidris canutus* Red knot

*Calidris ferruginea* Curlew sandpiper

*Calidris minuta* Little stint

*Charadrius alexandrinus* Kentish plover

*Charadrius hiaticula* Common ringed plover

*Egretta garzetta* Little egret

*Fulica atra* Common coot

*Haematopus ostralegus* Eurasian oystercatcher

*Himantopus himantopus* Black-winged stilt

*Larus fuscus* Lesser black-backed gull

*Larus melanocephalus* Mediterranean gull

*Larus ridibundus* Black-headed gull

*Limosa lapponica* Bar-tailed godwit

*Limosa limosa* Black-tailed godwit

*Numenius arquata* Curlew

*Numenius phaeopus* Whimbrel

*Phalacrocorax carbo* Great cormorant

*Philomachus pugnax* Ruff

*Phoenicopterus roseus* Greater flamingo

*Platalea leucorodia* Eurasian spoonbill

*Plegadis falcinellus* Glossy ibis

*Pluvialis squatarola* Grey plover

*Recurvirostra avosetta* Pied avocet

*Sternula albifrons* Little tern

*Tachybaptus ruficollis* Little grebe

*Thalasseus sandvicensis* Sandwich tern

*Tringa erythropus* Spotted redshank

*Tringa nebularia* Common greenshank

*Tringa totanus* Common redshank

*Vanellus vanellus* Northern lapwing

**Appendix 2: Population trends over the ten years of study for the most abundant species using the high tide roost of the Tejo estuary.**

Below we present the population trends, over the period 2007-2016, for 37 of the 40 most abundant species in the high tide roosts of the Tejo estuary, as obtained from the modelling approach explained in the methods. For the other three species, cattle egret *Bubulcus ibis*, Eurasian oystercatcher *Haematopus ostralegus* and ruff *Philomachus pugnax*, there were years for which the total count was zero, which violates model assumptions. For wintering populations, we present the trends derived from count data for the months of December, January and February, and present graphically the trend for January which is used in the main text of the article. We also present the trends for the breeding population of black-winged stilt *Himantopus himantopus*, Kentish plover *Charadrius alexandrinus* and little tern *Sternula albifrons* for which data refer to May counts. Species are ordered alphabetically by Latin name. In each graph the blue line and symbols indicate the numbers counted in all roosts each year, the red line indicates the modelled trend over the ten year period, and the grey areas show the error associated with the modelled trend.

*Actitis hypoleucos* Common sandpiper

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.028±0.023 | n.s. | Uncertain |
| January | 0.046±0.059 | n.s. | Uncertain |
| February | -0.038±0.040 | n.s. | Uncertain |

Ahyptrend.tif

*Anas clypeata* Shoveler duck

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.267±0.009 | <0.001 | Strong increase |
| January | 0.206±0.007 | <0.001 | Strong increase |
| February | 0.188±0.011 | <0.001 | Strong increase |

Aclytrend.tif

*Anas crecca* Common teal

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.248±0.017 | <0.001 | Strong increase |
| January | 0.399±0.014 | <0.001 | Strong increase |
| February | 0.370±0.011 | <0.001 | Strong increase |

Acretrend.tif

*Anas penelope* Eurasian wigeon

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.435±0.700 | n.s. | Uncertain |
| January | 0.591±0.448 | n.s. | Uncertain |
| February | 0.388±0.511 | n.s. | Uncertain |

Apentrend.tif

*Anas platyrhynchos* Mallard

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.211±0.018 | <0.001 | Strong increase |
| January | 0.149±0.013 | <0.001 | Strong increase |
| February | 0.166±0.009 | <0.001 | Strong increase |

Aplatrend.tif

*Ardea cinerea* Grey heron

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.083±0.030 | <0.05 | Moderate decrease |
| January | -0.048±0.012 | <0.05 | Moderate decrease |
| February | -0.061±0.019 | <0.05 | Moderate decrease |

Acintrend.tif

*Arenaria interpres* Ruddy turnstone

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.123±0.013 | <0.001 | Strong decrease |
| January | -0.089±0.009 | <0.05 | Strong decrease |
| February | -0.079±0.007 | <0.01 | Strong decrease |

Ainttrend.tif

*Calidris alba* Sanderling

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.126±0.256 | n.s. | Uncertain |
| January | -0.138±0.262 | n.s. | Uncertain |
| February | -0.116±0.220 | n.s. | Uncertain |

Calbtrend.tif

*Calidris alpina* Dunlin

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.006±0.001 | <0.05 | Moderate decrease |
| January | -0.016±0.001 | <0.001 | Moderate decrease |
| February | -0.015±0.001 | <0.001 | Moderate decrease |

Calptrend.tif

*Calidris canutus* Red knot

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.178±0.457 | n.s. | Uncertain |
| January | -0.241±0.719 | n.s. | Uncertain |
| February | -0.273±0.021 | <0.001 | Strong decrease |

Ccantrend.tif

*Calidris ferruginea* Curlew sandpiper

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.087±0.387 | n.s. | Uncertain |
| January | -0.115±0.415 | n.s. | Uncertain |
| February | -0.107±0.563 | n.s. | Uncertain |

Cfertrend.tif

*Calidris minuta* Little stint

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.106±0.030 | <0.05 | Moderate decrease |
| January | -0.234±0.016 | <0.001 | Strong decrease |
| February | -0.082±0.015 | <0.001 | Moderate decrease |

Cmintrend.tif

*Charadrius alexandrinus* Kentish plover (breeding population)

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| May | -0.126±0.016 | <0.05 | Strong decrease |

Calebretrend.tif

*Charadrius alexandrinus* Kentish plover (wintering population)

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.173±0.142 | n.s. | Uncertain |
| January | 0.052±0.141 | n.s. | Uncertain |
| February | -0.076±0.089 | n.s. | Uncertain |

Caleinvtrend.tif

*Charadrius hiaticula* Common ringed plover

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.063±0.009 | <0.001 | Strong increase |
| January | 0.076±0.012 | <0.001 | Strong increase |
| February | 0.324±0.027 | <0.001 | Strong increase |

Chiatrend.tif

*Egretta garzetta* Little egret

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.067±0.021 | <0.05 | Moderate increase |
| January | -0.003±0.011 | n.s. | Stable |
| February | -0.007±0.005 | n.s. | Stable |

Egartrend.tif

*Fulica atra* Common coot

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.261±1.893 | n.s. | Uncertain |
| January | 0.497±0.429 | n.s. | Uncertain |
| February | 0.402±0.789 | n.s. | Uncertain |

Fatrtrend.tif

*Himantopus himantopus* Black-winged stilt (breeding population)

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| May | -0.005±0.005 | n.s. | Stable |

Hhimtrend.tif

*Himantopus himantopus* Black-winged stilt (wintering population)

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.009±0.005 | n.s. | Stable |
| January | -0.013±0.007 | n.s. | Stable |
| February | 0.028±0.009 | <0.05 | Moderate increase |

Hhiminvtrend.tif

*Larus fuscus* Lesser black-backed gull

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.004±0.003 | n.s. | Stable |
| January | -0.007±0.004 | n.s. | Stable |
| February | 0.006±0.005 | n.s. | Stable |

Lfustrend.tif

*Larus ridibundus* Black-headed gull

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.007±0.003 | n.s. | Stable |
| January | 0.010±0.002 | n.s. | Stable |
| February | 0.011±0.004 | n.s. | Stable |

Lridtrend.tif

*Limosa lapponica* Bar-tailed godwit

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.136±0.608 | n.s. | Uncertain |
| January | 0.044±0.010 | <0.05 | Moderate increase |
| February | 0.064±0.011 | <0.001 | Moderate increase |

Llaptrend.tif

Black-tailed godwit *Limosa limosa*

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.036±0.003 | <0.001 | Moderate increase |
| January | -0.080±0.003 | <0.001 | Strong decrease |
| February | -0.031±0.003 | <0.001 | Moderate decrease |

Llimtrend.tif

*Numenius arquata* Curlew

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.215±0.025 | <0.001 | Strong decrease |
| January | -0.095±0.010 | <0.05 | Strong decrease |
| February | -0.087±0.011 | <0.01 | Strong decrease |

Narqtrend.tif

*Numenius phaeopus* Whimbrel

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.199±0.247 | n.s. | Uncertain |
| January | 0.253±0.182 | n.s. | Uncertain |
| February | -0.097±0.057 | n.s. | Uncertain |

Nphatrend.tif

*Phalacrocorax carbo* Great cormorant

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.090±0.016 | <0.05 | Strong increase |
| January | 0.110±0.021 | <0.05 | Strong increase |
| February | 0.124±0.017 | <0.001 | Strong increase |

Pcartrend.tif

*Phoenicopterus roseus* Greater flamingo

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.213±0.070 | <0.05 | Strong decrease |
| January | -0.007±0.005 | n.s. | Stable |
| February | 0.062±0.005 | <0.05 | Strong increase |

Prostrend.tif

*Platalea leucorodia* Eurasian spoonbill

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.009±0.029 | n.s. | Uncertain |
| January | 0.093±0.021 | <0.05 | Moderate increase |
| February | 0.074±0.014 | <0.001 | Moderate increase |

Pleutrend.tif

*Plegadis falcinellus* Glossy ibis

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.183±0.329 | n.s. | Uncertain |
| January | 0.260±1.535 | n.s. | Uncertain |
| February | 0.374±0.614 | n.s. | Uncertain |

Pfaltrend.tif

*Pluvialis squatarola* Grey plover

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.049±0.003 | <0.001 | Moderate increase |
| January | 0.059±0.003 | <0.05 | Strong increase |
| February | 0.056±0.004 | <0.001 | Strong increase |

Psqutrend.tif

*Recurvirostra avosetta* Pied avocet

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.048±0.003 | <0.01 | Moderate decrease |
| January | 0.006±0.003 | n.s. | Stable |
| February | 0.027±0.004 | <0.001 | Moderate increase |

Ravotrend.tif

*Sternula albifrons* Little tern (breeding population)

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| May | -0.047±0.014 | <0.05 | Moderate decrease |

Salbtrend.tif

*Tachybaptus ruficollis* Little grebe

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.112±0.203 | n.s. | Uncertain |
| January | 0.219±0.176 | n.s. | Uncertain |
| February | 0.227±0.264 | n.s. | Uncertain |

Truftrend.tif

*Thalasseus sandvicensis* Sandwich tern

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.103±0.170 | n.s. | Uncertain |
| January | 0.049±0.091 | n.s. | Uncertain |
| February | -0.027±0.061 | n.s. | Uncertain |

Ssantrend.tif

*Tringa erythropus* Spotted redshank

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.205±0.314 | n.s. | Uncertain |
| January | -0.035±0.048 | n.s. | Uncertain |
| February | -0.006±0.076 | n.s. | Uncertain |

Terytrend.tif

*Tringa nebularia* Common greenshank

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.028±0.034 | n.s. | Uncertain |
| January | -0.019±0.012 | n.s. | Stable |
| February | -0.024±0.017 | n.s. | Stable |

Tnebtrend.tif

*Tringa totanus* Common redshank

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | -0.006±0.004 | n.s. | Stable |
| January | -0.008±0.003 | <0.05 | Moderate decrease |
| February | -0.011±0.003 | <0.05 | Moderate decrease |

Ttottrend.tif

*Vanellus vanellus* Northern lapwing

|  |  |  |  |
| --- | --- | --- | --- |
| **Month** | **Yearly change** | **P-value** | **Trend class** |
| December | 0.126±0.171 | n.s. | Uncertain |
| January | 0.234±0.233 | n.s. | Uncertain |
| February | -0.077±0.129 | n.s. | Uncertain |

Vvantrend.tif