BTO RESEARCH REPORT 709

Analysis of Wetland Bird Survey (WeBS) data for the Humber Estuary SSSI, SAC, SPA and Ramsar site: third appraisal – sector-level trends to winter 2016/17

Ian Woodward, Neil Calbrade & Graham Austin

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Analysis of Wetland Bird Survey (WeBS) Data for The Humber Estuary SSSI, SAC, SPA and Ramsar site: Third appraisal – sector-level trends to winter 2016/17

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Executive Summary

1. The Humber Estuary is a site of national and international importance for its wader and wildfowl populations, supporting approximately 134,000 waterbirds during the winter and passage periods (Frost *et al.* 2018). It has been designated as a Special Protection Area (the Humber Estuary SPA) for many waterbird species.

2. The Wetland Bird Survey (WeBS) is a long-running survey recording numbers of all waterbird species, monthly, on sites throughout the UK. This includes counts collected for some 40 count sectors which together cover the Humber Estuary. These data can be used to assess population trends in different parts of the Humber Estuary.

3. This study aimed to update the previous reports (Austin et al. 2008; Ross-Smith et al. 2013) that assessed population trends of waterbird species in different parts of the Humber Estuary, in order to identify areas where species were declining contrary to, or in excess of, the trend for the Humber Estuary as a whole and, furthermore, to identify sectors that support an increasing proportion of species that are declining across the Humber Estuary as a whole.

4. Smoothed population trends were generated using data from the period 2000/01 to 2016/17, and assessed for the most recent winter period for each of the 36 waterbird species specified by Natural England. For 28 species there were sufficient data on at least some sectors to assess sector trends, relative importance in relation to the whole Humber Estuary population and whether the proportion of the entire Humber Estuary population supported by each sector had increased or decreased significantly.

5. In contrast to the general declines described by Austin et al. (2008) and Ross-Smith et al. (2013), populations of most wader species have shown short-term increases across the Humber Estuary as a whole, and in particular on the middle and outer parts of the southern shore of the Humber Estuary, reversing or partially reversing the declines in these areas noted in the previous reports. However, recent declines have occurred across almost all sectors on the northern shore, and in many sectors within the inner part of the southern shore.

6. Population trends of other waterbird species were variable. There were mixed results amongst dabbling ducks but decreases for all three diving ducks for which trends could be produced, and increases for all geese species and for Little Egret.

7. Continuing the pattern described by the previous Humber reports, many of these population changes found in this report were in line with regional trends. However, the Humber had decreased in importance in terms of the proportion of the region's species held for Knot and Bar-tailed Godwit, and slightly for Shelduck and Curlew, indicating factors affecting Humber populations that are absent or less severe more widely in eastern England. In contrast, the proportion supported has recently increased for Oystercatcher, Ringed Plover (slightly) and Grey Plover, in all cases reversing or partially reversing previous decreases and suggesting that factors on the Humber which previously affected these three species on the Humber may have since improved.

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1. Introduction

1.1 Background

The Humber Estuary is the largest British macro-tidal coastal plain estuary on the North Sea, and is one of the finest examples of an estuary of its type. The Humber Estuary is also a site of national and international importance for its wader and wildfowl populations, in addition to a range of other habitats and species. It is one of the top seven sites in the UK for its waterbird population, having supported an average of approximately 134,000 waterbirds during winter and passage periods over the five-years up to winter 2016/17 (Frost *et al.*, 2018). This total includes nationally important numbers of 22 species in winter and of nine species during passage. As a result, it enjoys the highest levels of legal protection currently possible in this country and is designated as a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA), Special Area of Conservation (SAC), European Marine Site and Ramsar Site. The Humber Estuary SPA is thus designated for its internationally important populations of 23 species of wintering waterbird.

Under the Wildlife and Countryside Act 1981 (as substituted by CRoW 2000 and inserted by NERC 2006) Natural England (NE) must consider notices for operations on the Humber Estuary SSSI, such as wildfowling, and determine whether to consent or refuse these proposals, or to impose conditions on the way they are carried out. Under the auspices of the Conservation of Habitats and Species Regulations 2017, Natural England also undertakes and advises on Habitats Regulations Assessment (HRA) concerning the effects of plans and projects on the Humber Estuary as a European site (SPA, SAC and Ramsar Site). One of the major considerations in consenting activities and undertaking/advising on HRA is the likely impact of the proposed activity or development on SPA birds.

An analysis of Wetland Bird Survey (WeBS) data held by the British Trust for Ornithology (BTO) for each of the 40 different geographical count units (sectors) on the Humber Estuary was carried out by the BTO in 2008 to provide better understanding of fluctuations in bird numbers on the Humber Estuary and to assess the potential impact of activities and developments on SPA populations (Austin *et al.*, 2008). This report was updated in 2013 to include analysis of more recent data on bird population fluctuations in different parts of the Humber Estuary and to identify recent changes in bird population numbers within each sector as compared to the Humber Estuary as a whole (Ross-Smith *et al.*, 2013). Both reports have played an important part in the consenting of operations and HRA of plans and projects in Humber Estuary. This new update again incorporates the most recent data available (up to winter 2016/17) and includes analysis of additional species.

1.2 Objectives

The aim of this project is to update Ross-Smith et al. (2013) by including the most recent WeBS data in the existing analysis and interpretation of bird population trends in the Humber Estuary. This will allow a reappraisal of our understanding of fluctuations in numbers of certain waterbird species to inform the consenting of operations and appropriate assessments of plans and projects on the Humber Estuary by:

- providing updated abundance trends from those available in the 2013 report for each of the WeBS sectors of the Humber Estuary for the 23 internationally important wintering waterbird species and comparing these trends to the Humber Estuary as a whole. The species to be re-analysed are:

Pink-footed Goose	Shoveler	Lapwing
Dark-bellied Brent Goose	Pochard	Knot
Shelduck	Tufted Duck	Dunlin
Wigeon	Goldeneye	Black-tailed Godwit
Gadwall	Oystercatcher	Bar-tailed Godwit
Teal	Ringed Plover	Curlew
Mallard	Golden Plover	Redshank
Pintail	Grey Plover	

- undertaking analyses of the abundance trends for 13 further species and comparing these trends to the Humber Estuary as a whole, provided sufficient data are available to do so. The 13 additional species to be considered for analysis are:

Tundra Bean Goose	Little Egret	Green Sandpiper
European White-fronted Goose	Avocet	Greenshank
Greylag Goose	Sanderling	Turnstone
Scaup	Ruff	
Smew	Whimbrel	

- identifying those WeBS sectors in which substantial numbers of species are declining contrary to, or more rapidly than on the Humber Estuary as a whole, and assessing whether any changes have occurred since Ross-Smith *et al.* (2013).
- identifying those sectors that support a substantial proportion of each species and assessing whether any changes have occurred since Ross-Smith *et al.* (2013).

1.3 Species

The 36 species for which data were analysed for this report are listed in Table 1.1, along with their SPA status (Natural England 2007). Trends for one or more sectors could be produced for 28 of the 36 species but there were insufficient data to produce trends for the others (see further details under Methodology, Section 2.1 below).

Table 1.1 Species for which trends and analyses were considered, their designation and whether or not they occur in sufficient numbers and frequency for analysis of sector trends**.**

Species	SPA feature[1]	Sector level analysis
Tundra Bean Goose *Anser serrirostris*		x
Pink-footed Goose *Anser brachyrhynchus*		✓
European White-fronted Goose *Anser albifrons albifrons*		x
Greylag goose *Anser anser*		✓
Dark-bellied Brent Goose *Branta bernicla bernicla*	✓	✓
Shelduck *Tadorna tadorna*	✓*	✓
Wigeon *Anas penelope*	✓	✓
Gadwall *Anas strepera*		✓
Teal *Anas crecca*	✓	✓
Mallard *Anas platyrhynchos*	✓	✓
Pintail *Anas acuta*		✓
Shoveler *Anas clypeata*		✓
Pochard *Aythya ferina*	✓	✓
Tufted Duck *Aythya fuligula*		✓
Scaup *Aythya marila*	✓	x
Goldeneye *Bucephala clangula*	✓	✓
Smew *Mergus albellus*		x
Little Egret *Egretta garzetta*		✓
Oystercatcher *Haematopus ostralegus*	✓	✓

Species	SPA feature[1]	Sector level analysis
Avocet *Recurvirostra avosetta*	✓*	✓
Ringed Plover *Charadrius hiaticula*	✓	✓
Golden Plover *Pluvialis apricaria*	✓*	✓
Grey Plover *Pluvialis squatarola*	✓	✓
Lapwing *Vanellus vanellus*	✓	✓
Knot *Calidris canutus*	✓*	✓
Sanderling *Calidris alba*	✓	✓
Dunlin *Calidris alpina*	✓*	✓
Ruff *Philomachus pugnax*	✓*	x
Black-tailed Godwit *Limosa limosa*	✓*	✓
Bar-tailed Godwit *Limosa lapponica*	✓*	✓
Whimbrel *Numenius phaeopus*	✓	x
Curlew *Numenius arquata*	✓	✓
Green Sandpiper *Tringa ochropus*		x
Greenshank *Tringa nebularia*	✓	x
Redshank *Tringa totanus*	✓*	✓
Turnstone *Arenaria interpres*	✓	✓

[1] Identifies species which qualify as an SPA feature in their own right, as they occurred in nationally or internationally important numbers at the time of the SPA citation (marked *), and those which are listed as being part of the waterbird assemblage feature on the SPA citation (Natural England 2007). ***Note however that, with the exception of Greylag Goose (a re-established species), the other species listed in the table also qualify as an SPA feature as part of the SPA Assemblage feature, even though they were not specifically mentioned on the citation***.

2. Methodology

2.1 Waterbird data

WeBS is a long-running survey that monitors waterbird numbers on sites throughout the UK via monthly site visits, when numbers of all waterbird species are recorded (Frost *et al*., 2018). On large sites, such as the Humber Estuary, where it is not feasible, or indeed desirable, to make a single count for the entire site, synchronous counts of smaller count sectors are undertaken by teams of volunteer counters (Figure 2.1.i). These sector counts are routinely summed to give the overall site total, and during this process the completeness of the overall count assessed. This is required because all sectors are not necessarily counted on all occasions. This completeness assessment species specific because the absence of data from a given sector would not be expected to affect the overall total equally for all species. Furthermore, completeness is assessed on a month by month, year by year basis using algorithms that allow for both seasonal and long-term trends in site usage. Thus a consolidated count for a site composed of multiple sectors is considered complete when those sectors counted on the month in question would be expected to hold at least 75% of the site total for the species in question for the season and year in question. Whilst the division of large sites into sectors has evolved principally in response to the practicality of undertaking counts, the divisions between sectors typically follow distinctive features of the environment. Thus an analysis of waterbird trends on the individual sectors can inform in a biologically meaningful manner.

Over time, and particularly on larger sites a complex hierarchy of site structure can develop as sectors are subdivided by WeBS counters, however, importantly, existing sector boundaries are retained and incorporated into the new divisions to ensure that counts from divided sectors can be combined and numbers compared over long time series. Thus the hierarchical structure of the Humber Estuary count sectors (Figure 2.1.i) has evolved through time as existing sectors have been subdivided.

Forty constituent and extant WeBS sectors of the Humber Estuary were considered in this report (Figure 2.1.ii)[1].

[1] This report primarily considers these forty WeBS sectors for simplicity and parsimony. As shown in Figure 2.1.i, the Humber Estuary is composed of more than forty sectors. However, many of these are either no longer counted, or are composite sectors (e.g. Theddlethorpe to Grainthorpe Marsh, or Goole to Faxfleet), such that any information on trends therein encompasses that of the WeBS sectors at a finer spatial resolution. Analysis and interpretation in this report is carried out at the finest spatial resolution possible, although references to trends across larger parts of the Humber are included in species accounts (Section 4).

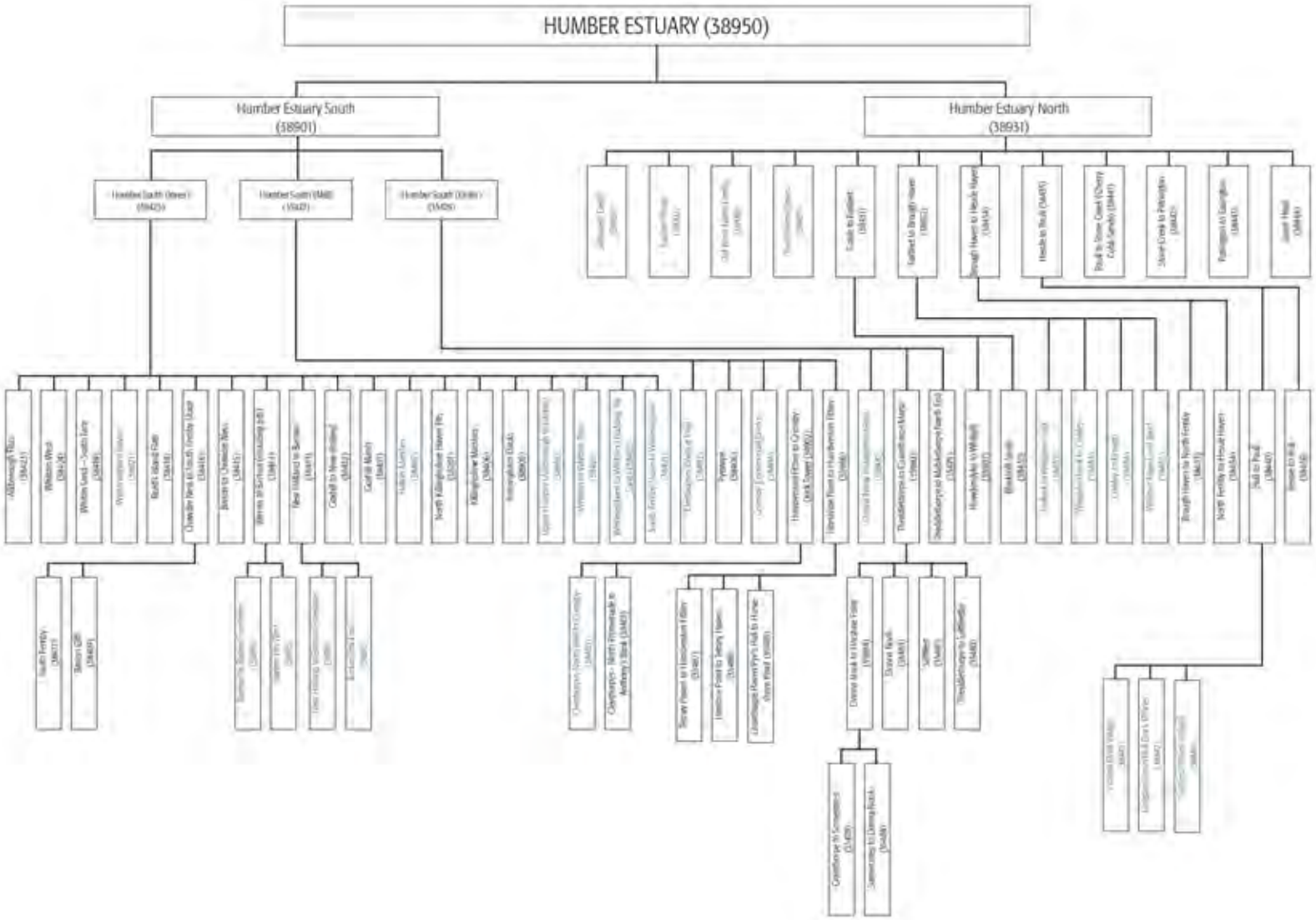

Figure 2.1.i Structural hierarchy of WeBS count sectors on the Humber Estuary. Greyed out boxes identify sectors for which data for at least the most recent five winters are unavailable. Sectors at the finest spatial scale are primarily considered for interpretation in this report. Note that birds at Easington Lagoons (Beacon Ponds) have been included within Spurn Head counts (38444). From 2018/19 sector 38444 is being counted as two separate count sectors.

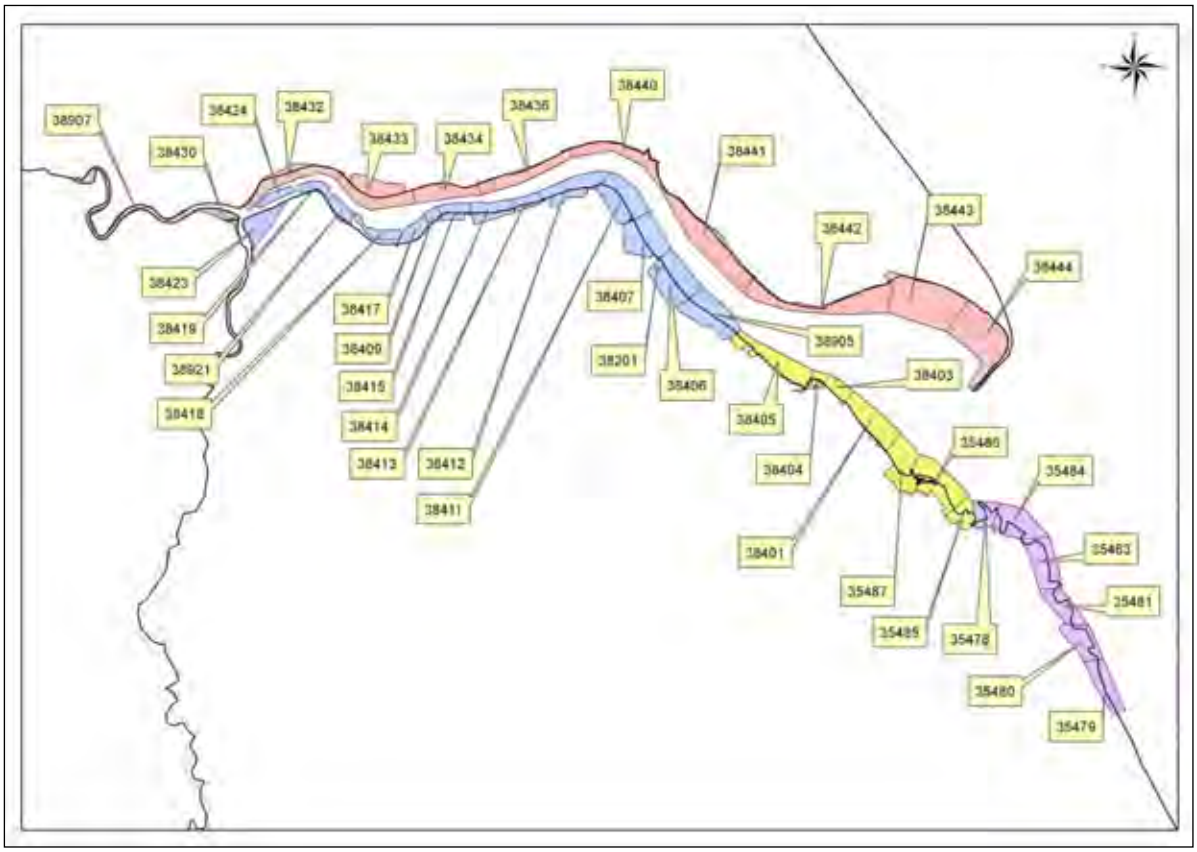

Figure 2.1.ii **Locations of each count sector on the Humber Estuary**. Four groupings of sectors are shown as follows: "Humber Estuary (North)" is shown in dark pink; "Humber South (Inner)" in light blue; "Humber South (Mid)" in pale yellow; and "Humber South (Outer)" in lilac. These WeBS sectors are the most recent subdivisions for WeBS counts on the Humber, and represent the finest spatial scale over which data are collected (see Figure 2.1.ii).

2.1.1 Smoothed waterbird trends and percentage change

The methodology used to produce smoothed site, regional and national trends as reported by WeBS Alerts (Cook et al, 2013) can be usefully extended to generate trends on smaller areas of interest such as single or appropriately grouped WeBS count sectors. It is, however, important to recognise that the numbers of birds underlying the observed trend on sectors are generally much lower than those underlying site trends reported by WeBS Alerts which, by definition, are at least equal to the national qualifying threshold. Consequently, individual trends should not be 'over-interpreted'. For example, a 50% decline from 30 birds to 15 birds would give much less cause for concern than a 50% decline from 1000 to 500 birds the latter being much more likely to reflect a real and substantial loss of birds from an area than the former. However, whilst acknowledging this, a consistent pattern of decline across multiple species, even when the numbers involved for some of them are comparatively low, is strongly indicative of adverse factors affecting the sector in question, and the particular suite of species showing a decline in numbers can guide us in where to look for problems (for example, does the suite of species represent those known to be particularly sensitive to disturbance or those with similar ecological requirements).

Thus, using the latest available validated WeBS data (those to winter 2016/17 inclusive), following Atkinson *et al*. (2000, 2006), smoothed trends were calculated using Generalized Additive Models (GAMs) for the relevant species. The smoothing is to ensure that year-specific factors, such as poor conditions on the breeding grounds or particularly harsh weather on the wintering grounds, that are not related to changes in the quality of the Humber Estuary itself, do not contribute overly to the trend. Percentage change has been calculated for short- (5 year) medium- (10 year) and long-term (15 year). To ensure statistical robustness, percentage change is calculated with reference to the penultimate winter in the time series available so as to avoid referring to the end points of the smoothed trend (which are less robust). WeBS does not have the necessary data collated at the sector level to support analysis of longer time-series. By way of analogy with the WeBS Alerts system, declines of at least 25% but below 50% are flagged as medium-declines (or moderate declines), and declines of 50% or greater are flagged as high-declines (or sharp declines). We specifically do not use the terms medium- and high-Alerts because unlike the percentage change reported by WeBS Alerts, medium and high declines reported at the sector level do not constitute a formal WeBS Alert. The corresponding percentage change required to balance the numbers to their former level following a decline are likewise termed medium- or moderate (at least 33% but below 100%) and high- or sharp (100% or greater) increases.

Trends can only be produced for species where sufficient data exist across the years being considered, and cannot be produced for species which are recorded irregularly and/or in very low numbers on the Humber Estuary in winter (Tundra Bean Goose, European White-fronted Goose, Scaup, Smew). In addition, trends are for the winter period only, and robust WeBS trends cannot be produced for species which are almost entirely recorded on passage (Ruff, Whimbrel, Green Sandpiper, Greenshank). Wintering trends rely on the assumption that the number of individuals present at a site usually remains relatively stable for several weeks at a time (or longer) and hence monthly WeBS counts are representative of the wintering population. This is not the case during passage months: numbers can fluctuate on a daily basis as birds arrive and depart, so counts may vary by chance from year to year according to whether or not the count date happens to coincide with a peak in passage. In addition, passage birds are present for a relatively short but unknown length of time, which may also vary from year to year. For both these reasons, numbers counted during passage months cannot be considered representative of the passage population in a particular year, and hence trends are not produced.

2.1.2 Placing the smoothed waterbird indices into context

Once the smoothed sector indices have been produced the observed trends are placed in context of the site trends. Following Banks and Austin (2004), the standard WeBS methodology as used to compare site trends with regional and national trends when reporting WeBS Alerts (Cook *et al.*, 2013) is extended here to compare counts sector trends with site trends. Where waterbird numbers of a given species on a given count sector follow those of the species across the site as a whole then the proportion of site numbers on the sector will remain constant. Any significant deviation from this gradient of zero would indicate that the waterbird populations on the relevant count sector are doing either better or less well than would be expected from the site trend. Consequently:

- where a decline on a sector reflects a decline across the site as a whole it is unlikely that the observed site trend is being driven by factors affecting that sector. If this is true of the majority of sectors, then this may indicate that the observed site decline in the species in

question is due to factors external to the site and are thus not due to site management issues *per se*;

- where a decline on a sector is more pronounced than that across the site as a whole, this may suggest that factors affecting that sector could be contributing to the overall decline;

- where a decline on a sector is less pronounced than the decline across the site as a whole, this suggests that relatively favourable conditions on that sector are helping buffer site declines;

- where an increase on a sector is less pronounced than that across the site as a whole, this suggests that the sector is already at carrying capacity for the species in question or, if historically it supported greater numbers, that the quality of the sector to that species has diminished;

- where an increase on a sector is greater than that across the whole site, this suggests that trends on that sector are driving the increase across the site or that the sector in question is relatively attractive compared to the site as a whole when increased numbers arrive at the site due to external factors.

The comparisons between sectors and site are derived from a logistic regression model with a binomial error term. The resulting plots depict the percentage contribution of the sector to the site as a whole and the associated confidence limits represent both variation in this proportion between months in a given year and the underlying sample size (for example, we would be more confident of our estimate that a sector contributed 10% of the site total if 100 birds out of 1000 on the site were counted there than we would be if this was 10 out of 100). This is based on the winter period as routinely used for all WeBS reporting (Nov-Mar for waders and Sep-Mar for other species). Only data from months where counts consolidated across the site as a whole had been assessed as complete were used - following standard WeBS protocol described above.

Having considered the trends on the sectors, each in the context of trends across the site as a whole, it is important to consider the site trends in the context of the region – here the area covered by the Environment Agency (EA)'s Anglian Region and Yorkshire and North East Region (following standard WeBS Alerts reporting), as this can modify our interpretation of the pattern of change across sectors. This is especially important where there has been an increase or decline regionally. Consequently:

- where there has been an apparent re-distribution of a species within the Humber Estuary (that is, declines on some sectors appear to be balanced by increases on other sectors), but the proportional contribution of the Humber Estuary to increasing regional numbers is declining, then this implies that those sectors on the Humber Estuary with static or declining numbers are actually of concern because we would expect them to be increasing in parallel with the other sectors. Thus, in such cases, the apparent redistribution within the Humber Estuary is misleading and the species in question may be facing problems on those sectors not supporting an increase in numbers;

- where a species is in regional decline we would expect declines on at least some of the sectors of the Humber Estuary regardless of whether birds are being affected by adverse factors locally. Thus, we would expect those sectors of least suitable habitat to a given species to be the first to show a decline in numbers.

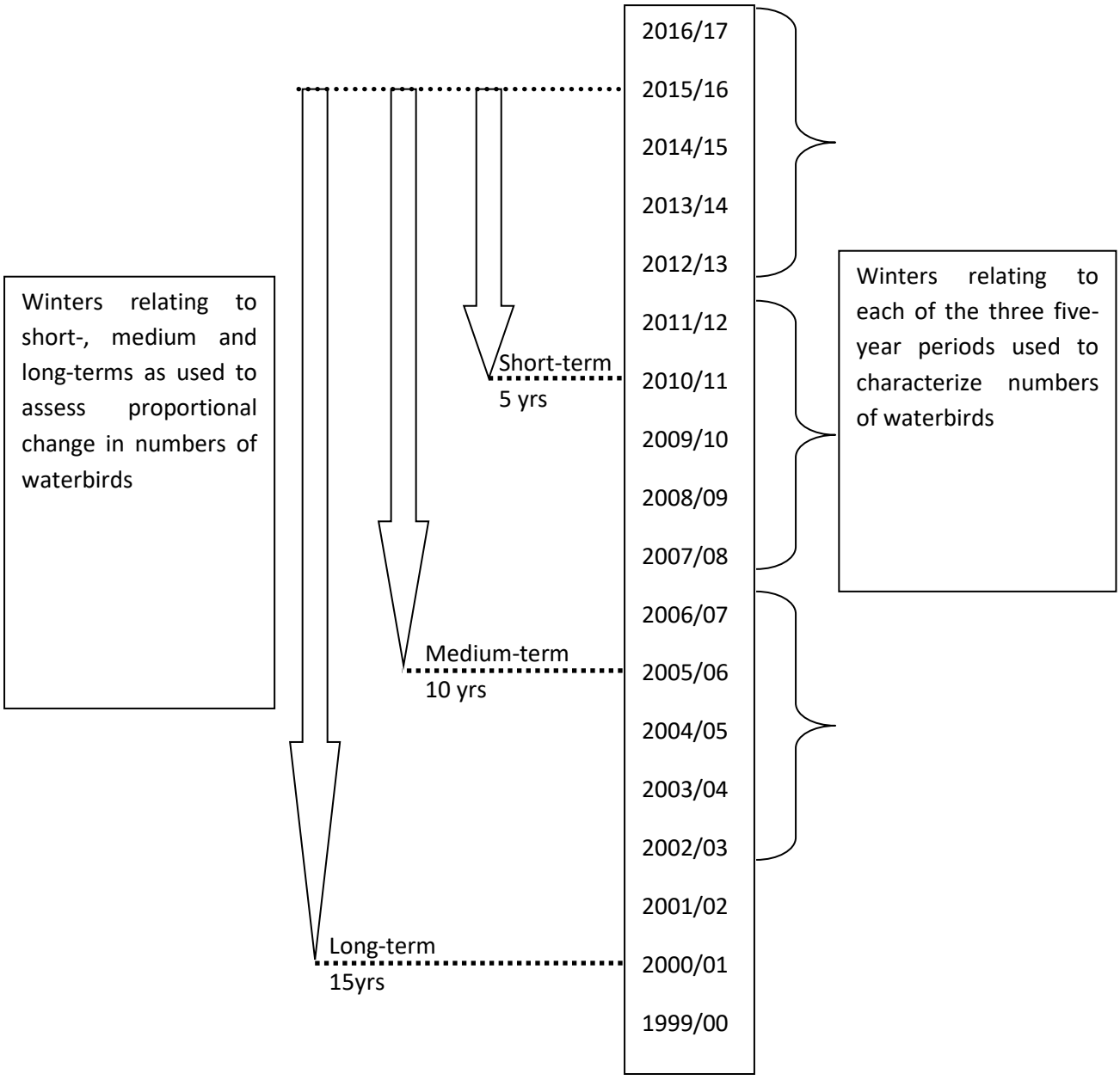

Figure 2.1.2.i Schematic of reference winters used for reported waterbird numbers and change.

2.1.3 Comparing figures and tables with previous reports

The tables and figures presented in this report contain all the information found in the previous analyses of WeBS count sector trends (Austin *et al.*, 2008; Ross-Smith *et al.*, 2013).

We draw your attention to the following:

- in the trend plots for sectors and site we present both winter averages (as previously) in blue and winter peaks in green. The latter have been requested by NE for sector level analyses because they are referred to in NE documentation on guidelines for consideration of wildfowling consents. However, interpretations in this report are based primarily on the

winter averages because unlike winter peaks they are robust against missing data or abnormal counts due to severe weather events, disturbance incidents or whatever. Also if there were to be a trend in over-winter carrying capacity of a sector this will be reflected in the winter-averages (essentially an index of bird-days supported by a sector) but easily missed by the winter peak.

- in the table of change (Table 3.1.i & 3.1.ii) each of the long-, medium- and short-term changes are colour coded independently in this report, as in Ross-Smith *et al.* (2013). In Austin *et al.* (2008), a single table cell was colour coded for the worst case scenario across all three time-frames. For example, under the old system a sector for which there was a high-decline in the long-term, a medium increase in the medium term and a high increase in the short-term would have been colour coded red despite a decline only being an issue over one of the three time-frames. Under the new scheme a triplet of adjoining table cells for the high-, medium- and short terms would be colour coded red, light-green, dark-green respectively thus reflecting the turnaround in the trend.

The tables in the current report can be compared directly with the corresponding tables from Austin *et al.* (2008) by taking the worst case scenario from each triplet.

Furthermore, the BTO has prepared a guidance document 'Guidance to interpretation of Wetland Bird Survey within-site trends' (Austin & Ross-Smith 2013) to aid the interpretation of WeBS sector trend analyses. This document is also provided in the supplementary material accompanying this report. These guidelines give full details of analyses included in this report and the rationale behind them as an aid to the interpretations of numbers and trends on WeBS count sectors. In summary these include:

- proportional change in the numbers of each species assessed over the long-, medium- and short-terms (Overview: Tables 3.1.i & 3.1.ii, for underlying values see sheet 'TableOfChange' in 'Humber 2018 Results Tables.xls').

- underlying linear trend across the 15 winter period and the significance of this trend from zero (see sheet 'TableOfProportions in 'Humber 2018 Results Tables.xls').

- means of peak counts of each species for the most recent five-winter period (Overview: Tables 3.1.iii & 3.1.iv, for underlying values together with equivalent values for the previous two five-winter periods and the Peak value in the most recent winter, see sheets 'TableOfPeaksA (5yr)' in 'Humber 2018 Results Tables.xls').

- Peak counts of each species for the most recent winter period available (2016/17) (Overview: Tables 3.1.v & 3.1.vi, for underlying values see sheet 'TableOfPeaksB (latest yr)' in 'Humber 2018 Results Tables.xls').

- the proportion of species assessed as falling into each of the five categories from high decline through to high increase (mapped pie-charts: Figure 3.1.i to 3.1.iv).

- for each species for each sector, graphs depicting both annual mean and annual peak numbers together with, where there is sufficient data, the smoothed trends through each. Accompanying each of these is a graph showing the proportional contribution of each sector to the overall numbers across the whole of the Humber. The equivalent graphs are also

available for the whole Humber relative to the entire East of England (EA Anglian and Yorkshire & North-East Regions) (Appendix A).

- density plots for each species across all sectors which focus attention on the most important areas for each species (Appendix B).

3. Results

3.1 Sector trend plots

The trends of each species on each WeBS sector are given in Appendix A, together with plots comparing the count sector trends with the site trends for the Humber Estuary. This series of plots puts each sector into the context of trends on the Humber Estuary as a whole. Plots are grouped by sector and species presented in taxonomic order. This information is summarised below (Tables 3.1.i and 3.1.ii)[2] and the underlying values representing percentage change to the Humber Estuary are available in the accompanying Excel™ Workbook ('BTO RR 709 Humber WeBS sector analysis - appraisal III.xlsx'). Colour coding is used to represent declines or increases; species are listed in taxonomic order and sectors have been listed to represent their geographical proximity to each other. Caution is advisable in interpreting individual cells in these tables at face value. For example, a 50% decline (shown in red) could represent a decline from 10,000 to 5,000 birds or could be a decline from 20 to 10. Consequently, it is important to be aware of the numbers of birds involved (obtainable from the plots in appendix A or the mean of peak numbers in the Excel Workbook. However, consistency between adjacent cells would suggest that either a group of species or a group of adjacent sectors have similar trends even when numbers of individuals involved are relatively low. Where this is the case, this may suggest that the trends represent real ecological changes. Note that trend graphs have not been presented for six species due to the very low numbers or intermittent occurrence during the winter on the Humber Estuary (Scaup, Smew, Ruff, Whimbrel, Green Sandpiper, Greenshank).

This information is further summarised in map format, which better facilitates a geographic interpretation of the trends (Figures 3.1.i to 3.1.iv) (see also Appendix B).

The importance of individual sectors for given species can be determined by considering the five-year mean of peak counts (Tables 3.1.iii and 3.1.iv) and underlying values are available in the supporting material ('Humber 2018 Results Tables.xls'); the importance of individual sectors to particular species clearly influences the level of concern regarding the characteristics of the trends. Peak counts from the most recent available winter (2016/17) are also provided in separate tables (Tables 3.1.v and 3.1.vi, and supporting material). However, caution is advisable in interpreting these tables of peak counts to identify important sectors for given species rather than Tables 3.1.iii and 3.1.iv, as peaks from a single year are less robust against missing data or abnormal counts (e.g. caused by disturbance in an adjacent sector on the day of a count).

[2] As explained on page 4, information in these tables does not include composite sectors (with the exception of Humber Estuary (North), Humber South (Inner), Humber South (Mid) and Humber South (Outer) or obsolete sectors. This is for simplicity of interpretation and parsimony.

Table 3.1.i Overview of population trends of wildfowl and Little Egret within the Humber Estuary over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms**.** Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%.

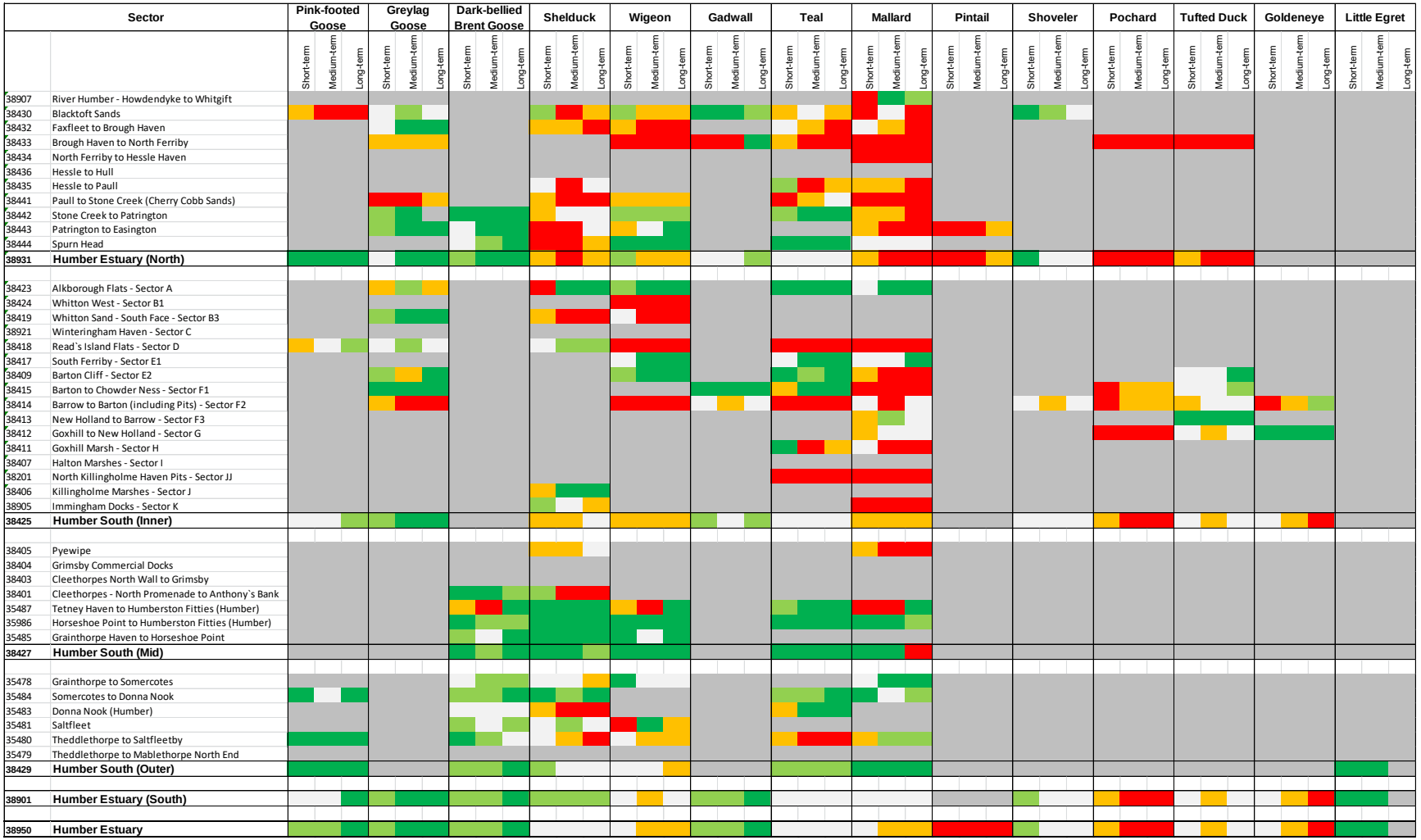

Table 3.1.ii Overview of population trends of waders within the Humber Estuary over the long- (2000/01 – 2015/16) the medium- (2005/06 – 2015/16) and the short- (2009/10 – 2015/16) terms**.** Cells are coloured to indicate trend status as follows: Red – a decline in numbers of at least 50%; Orange – a decline in numbers of at least 25% but less than 50%; White – a decline in numbers of less than 25% or an increase of less than 33%; Pale Green – an increase in numbers of at least 33% but less than 100%; Dark Green – an increase in numbers of at least 100%.

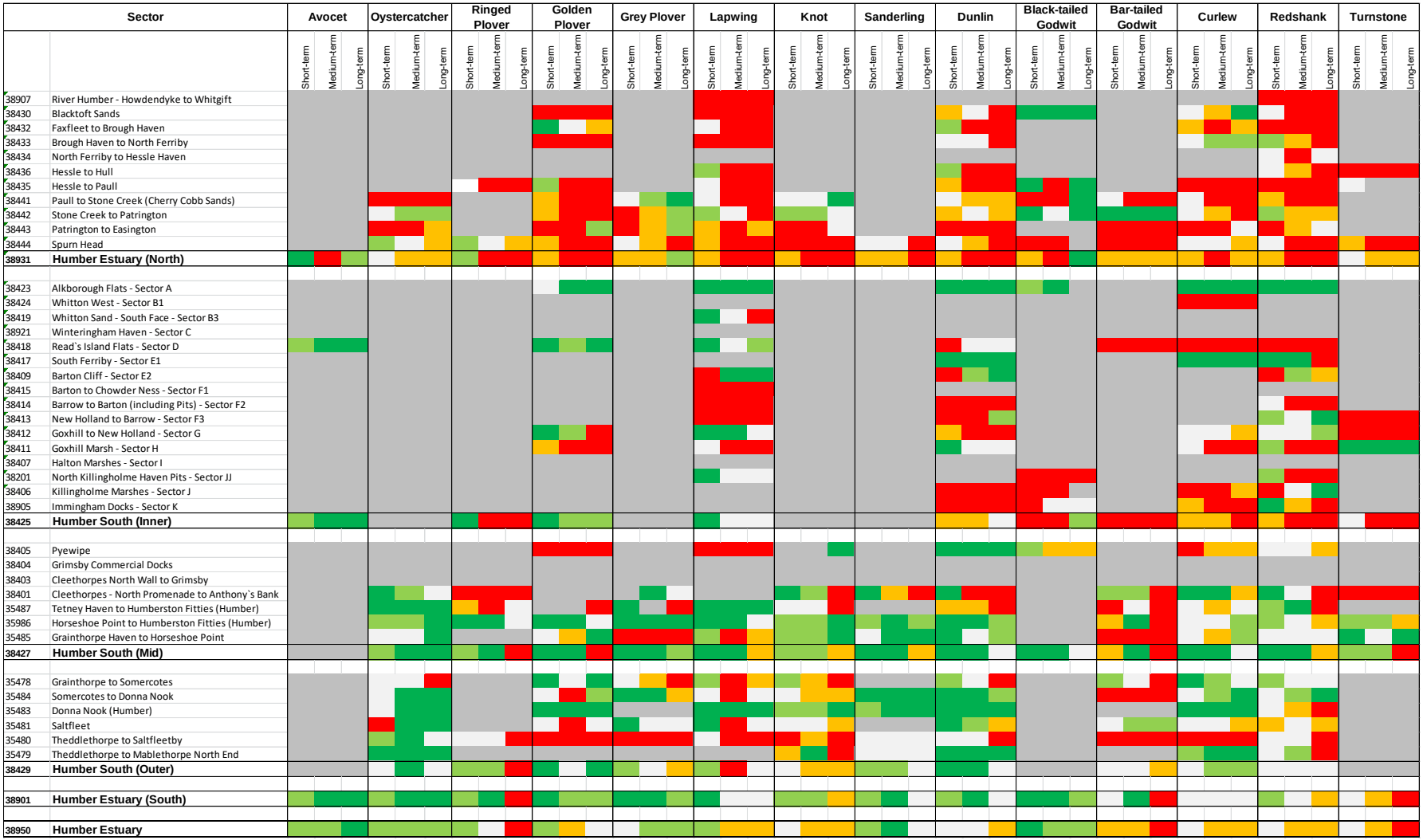

Table 3.1.iii The most important sectors for wildfowl species and little egret in the Humber Estuary shown by colour: **Dark Blue**- sectors with a mean peak count over the last five winters (2012/13 – 2016/17) that is at least 20% of the total mean peak counts for the Humber Estuary over the same period; **Light Blue** – sites with a mean peak count over the last five winters that is between 10% and 20% of the total mean of peak count for the Humber Estuary over the same period. **Light Grey** – sector was not covered during the last five winters, or all counts were considered to be 'Low'.

Sector		Tundra Bean Goose	Pink-footed Goose	European White-fronted Goose	Greylag Goose	Dark-bellied Brent Goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail	Shoveler	Pochard	Tufted Duck	Scaup	Goldeneye	Smew	Little Egret
38907	River Humber - Howdendyke to Whitgift																		
38430	Blacktoft Sands																		
38432	Faxfleet to Brough Haven																		
38433	Brough Haven to North Ferriby																		
38434	North Ferriby to Hessle Haven																		
38436	Hessle to Hull																		
38440	Hull to Paull																		
38441	Paull to Stone Creek (Cherry Cobb Sands)																		
38442	Stone Creek to Patrington																		
38443	Patrington to Easington																		
38444	Spurn Head																		
38931	**Humber Estuary (North)**																		
38423	Alkborough Flats - Sector A																		
38424	Whitton West - Sector B1																		
38419	Whitton Sand - South Face - Sector B3																		
38921	Winteringham Haven - Sector C																		
38418	Read`s Island Flats - Sector D																		
38417	South Ferriby - Sector E1																		
38409	Barton Cliff - Sector E2																		
38415	Barton to Chowder Ness - Sector F1																		
38414	Barrow to Barton (including Pits) - Sector F2																		
38413	New Holland to Barrow - Sector F3																		
38412	Goxhill to New Holland - Sector G																		
38411	Goxhill Marsh - Sector H																		
38407	Halton Marshes - Sector I																		
38201	North Killingholme Haven Pits - Sector JJ																		
38406	Killingholme Marshes - Sector J																		
38905	Immingham Docks - Sector K																		
38425	**Humber South (Inner)**																		
38405	Pyewipe																		
38404	Grimsby Commercial Docks																		
38403	Cleethorpes North Wall to Grimsby																		
38401	Cleethorpes - North Promenade to Anthony`s Bank																		
35487	Tetney Haven to Humberston Fitties (Humber)																		
35986	Horseshoe Point to Humberston Fitties (Humber)																		
35485	Grainthorpe Haven to Horseshoe Point																		
38427	**Humber South (Mid)**																		
35478	Grainthorpe to Somercotes																		
35484	Somercotes to Donna Nook																		
35483	Donna Nook (Humber)																		
35481	Saltfleet																		
35480	Theddlethorpe to Saltfleetby																		
35479	Theddlethorpe to Mablethorpe North End																		
38429	**Humber South (Outer)**																		
38901	**Humber Estuary (South)**																		
38950	**Humber Estuary**																		

Table 3.1.iv The most important sectors for wader species in the Humber Estuary shown by colour: **Dark Blue**- sectors with a mean peak count over the last five winters (2012/13 – 2016/17) that is at least 20% of the total mean peak counts for the Humber Estuary over the same period**; Light Blue** – sites with a mean peak count over the last five winters that is between 10% and 20% of the total mean of peak count for the Humber Estuary over the same period. **Light Grey** – sector was not covered during the last five winters, or all counts were considered to be 'Low'.

Sector		Avocet	Oystercatcher	Ringed Plover	Golden Plover	Grey Plover	Lapwing	Knot	Sanderling	Dunlin	Ruff	Black-tailed Godwit	Bar-tailed Godwit	Whimbrel	Curlew	Green Sandpiper	Greenshank	Redshank	Turnstone
38907	River Humber - Howdendyke to Whitgift																		
38430	Blacktoft Sands																		
38432	Faxfleet to Brough Haven																		
38433	Brough Haven to North Ferriby																		
38434	North Ferriby to Hessle Haven																		
38436	Hessle to Hull																		
38440	Hull to Paull																		
38441	Paull to Stone Creek (Cherry Cobb Sands)																		
38442	Stone Creek to Patrington																		
38443	Patrington to Easington																		
38444	Spurn Head																		
38931	**Humber Estuary (North)**																		
38423	Alkborough Flats - Sector A																		
38424	Whitton West - Sector B1																		
38419	Whitton Sand - South Face - Sector B3																		
38921	Winteringham Haven - Sector C																		
38418	Read`s Island Flats - Sector D																		
38417	South Ferriby - Sector E1																		
38409	Barton Cliff - Sector E2																		
38415	Barton to Chowder Ness - Sector F1																		
38414	Barrow to Barton (including Pits) - Sector F2																		
38413	New Holland to Barrow - Sector F3																		
38412	Goxhill to New Holland - Sector G																		
38411	Goxhill Marsh - Sector H																		
38407	Halton Marshes - Sector I																		
38201	North Killingholme Haven Pits - Sector JJ																		
38406	Killingholme Marshes - Sector J																		
38905	Immingham Docks - Sector K																		
38425	**Humber South (Inner)**																		
38405	Pyewipe																		
38404	Grimsby Commercial Docks																		
38403	Cleethorpes North Wall to Grimsby																		
38401	Cleethorpes - North Promenade to Anthony`s Bank																		
35487	Tetney Haven to Humberston Fitties (Humber)																		
35986	Horseshoe Point to Humberston Fitties (Humber)																		
35485	Grainthorpe Haven to Horseshoe Point																		
38427	**Humber South (Mid)**																		
35478	Grainthorpe to Somercotes																		
35484	Somercotes to Donna Nook																		
35483	Donna Nook (Humber)																		
35481	Saltfleet																		
35480	Theddlethorpe to Saltfleetby																		
35479	Theddlethorpe to Mablethorpe North End																		
38429	**Humber South (Outer)**																		
38901	**Humber Estuary (South)**																		
38950	**Humber Estuary**																		

Table 3.1.v The most important sectors in the latest year (2016/17) for wildfowl species and little egret in the Humber Estuary shown by colour: **Dark Green** – Sites with a peak count in the latest year that is at least 20% of the total peak count for the Humber Estuary in the same year**; Light Green –** sites with a peak count in the latest year that is between 10% and 20% of the total peak count for the Humber Estuary in the same year. **Light Grey** – sector was not covered during the latest winter.

Sector		Tundra Bean Goose	Pink-footed Goose	European White-fronted Goose	Greylag Goose	Dark-bellied Brent Goose	Shelduck	Wigeon	Gadwall	Teal	Mallard	Pintail	Shoveler	Pochard	Tufted Duck	Scaup	Goldeneye	Smew	Little Egret
38907	River Humber - Howdendyke to Whitgift																		
38430	Blacktoft Sands																		
38432	Faxfleet to Brough Haven																		
38433	Brough Haven to North Ferriby																		
38434	North Ferriby to Hessle Haven																		
38436	Hessle to Hull																		
38440	Hull to Paull																		
38441	Paull to Stone Creek (Cherry Cobb Sands)																		
38442	Stone Creek to Patrington																		
38443	Patrington to Easington																		
38444	Spurn Head																		
38931	**Humber Estuary (North)**																		
38423	Alkborough Flats - Sector A																		
38424	Whitton West - Sector B1																		
38419	Whitton Sand - South Face - Sector B3																		
38921	Winteringham Haven - Sector C																		
38418	Read`s Island Flats - Sector D																		
38417	South Ferriby - Sector E1																		
38409	Barton Cliff - Sector E2																		
38415	Barton to Chowder Ness - Sector F1																		
38414	Barrow to Barton (including Pits) - Sector F2																		
38413	New Holland to Barrow - Sector F3																		
38412	Goxhill to New Holland - Sector G																		
38411	Goxhill Marsh - Sector H																		
38407	Halton Marshes - Sector I																		
38201	North Killingholme Haven Pits - Sector JJ																		
38406	Killingholme Marshes - Sector J																		
38905	Immingham Docks - Sector K																		
38425	**Humber South (Inner)**																		
38405	Pyewipe																		
38404	Grimsby Commercial Docks																		
38403	Cleethorpes North Wall to Grimsby																		
38401	Cleethorpes - North Promenade to Anthony`s Bank																		
35487	Tetney Haven to Humberston Fitties (Humber)																		
35986	Horseshoe Point to Humberston Fitties (Humber)																		
35485	Grainthorpe Haven to Horseshoe Point																		
38427	**Humber South (Mid)**																		
35478	Grainthorpe to Somercotes																		
35484	Somercotes to Donna Nook																		
35483	Donna Nook (Humber)																		
35481	Saltfleet																		
35480	Theddlethorpe to Saltfleetby																		
35479	Theddlethorpe to Mablethorpe North End																		
38429	**Humber South (Outer)**																		
38901	**Humber Estuary (South)**																		
38950	**Humber Estuary**																		

Table 3.1.vi The most important sectors in the latest year (2016/17) for wader species in the Humber Estuary shown by colour: **Dark Green** – Sites with a peak count in the latest year that is at least 20% of the total peak count for the Humber Estuary in the same year; **Light Green** – sites with a peak count in the latest year that is between 10% and 20% of the total peak count for the Humber Estuary in the same year. **Light Grey** – sector was not covered during the latest winter.

Sector		Avocet	Oystercatcher	Ringed Plover	Golden Plover	Grey Plover	Lapwing	Knot	Sanderling	Dunlin	Ruff	Black-tailed Godwit	Bar-tailed Godwit	Whimbrel	Curlew	Green Sandpiper	Greenshank	Redshank	Turnstone
38907	River Humber - Howdendyke to Whitgift																		
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38433	Brough Haven to North Ferriby																		
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38436	Hessle to Hull																		
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38441	Paull to Stone Creek (Cherry Cobb Sands)																		
38442	Stone Creek to Patrington																		
38443	Patrington to Easington																		
38444	Spurn Head																		
38931	**Humber Estuary (North)**																		
38423	Alkborough Flats - Sector A																		
38424	Whitton West - Sector B1																		
38419	Whitton Sand - South Face - Sector B3																		
38921	Winteringham Haven - Sector C																		
38418	Read`s Island Flats - Sector D																		
38417	South Ferriby - Sector E1																		
38409	Barton Cliff - Sector E2																		
38415	Barton to Chowder Ness - Sector F1																		
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38413	New Holland to Barrow - Sector F3																		
38412	Goxhill to New Holland - Sector G																		
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38407	Halton Marshes - Sector I																		
38201	North Killingholme Haven Pits - Sector JJ																		
38406	Killingholme Marshes - Sector J																		
38905	Immingham Docks - Sector K																		
38425	**Humber South (Inner)**																		
38405	Pyewipe																		
38404	Grimsby Commercial Docks																		
38403	Cleethorpes North Wall to Grimsby																		
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35478	Grainthorpe to Somercotes																		
35484	Somercotes to Donna Nook																		
35483	Donna Nook (Humber)																		
35481	Saltfleet																		
35480	Theddlethorpe to Saltfleetby																		
35479	Theddlethorpe to Mablethorpe North End																		
38429	**Humber South (Outer)**																		
38901	**Humber Estuary (South)**																		
38950	**Humber Estuary**																		

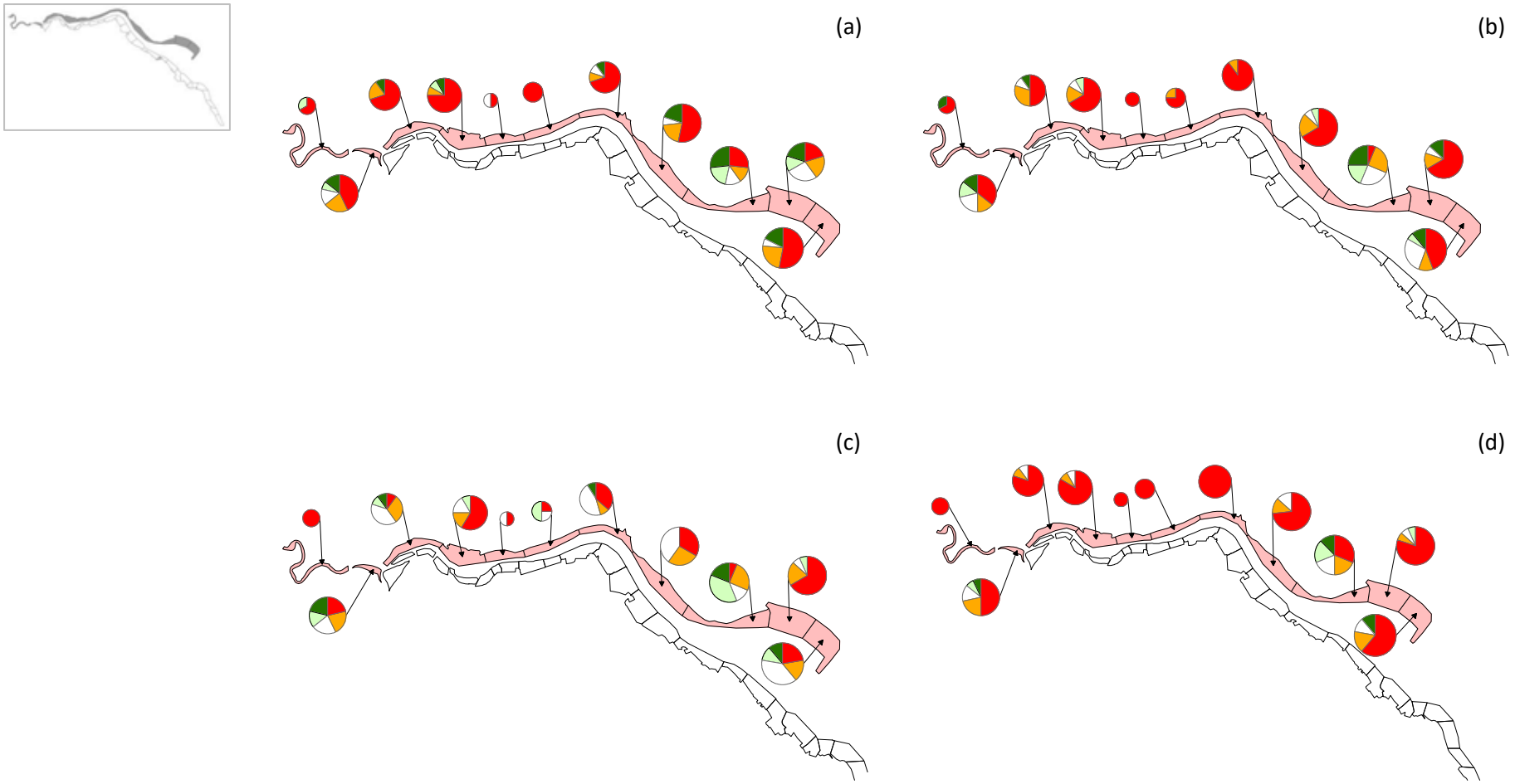

Figure 3.1.i **Population trends of waterbirds within the Humber Estuary (North) over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16).** The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

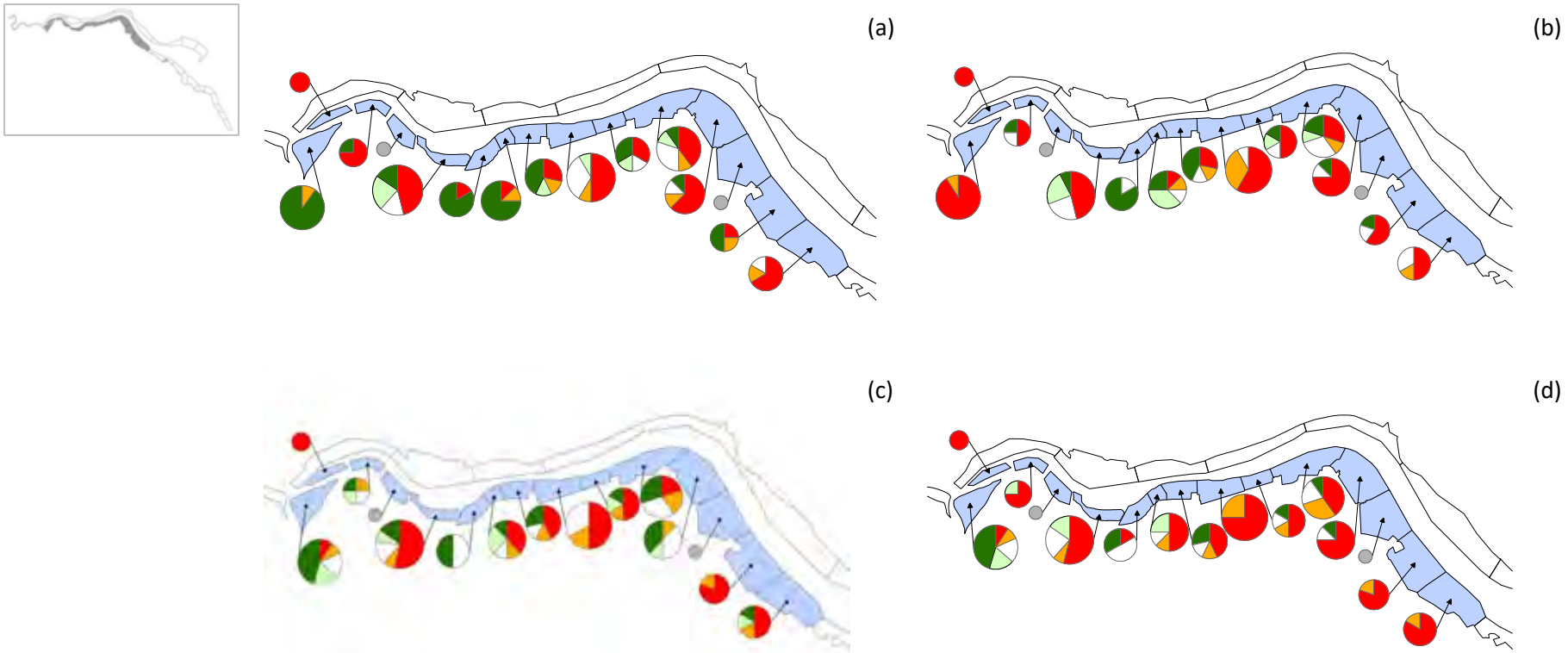

Figure 3.1.ii **Population trends of waterbirds within the Humber South (Inner) over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16)**. The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

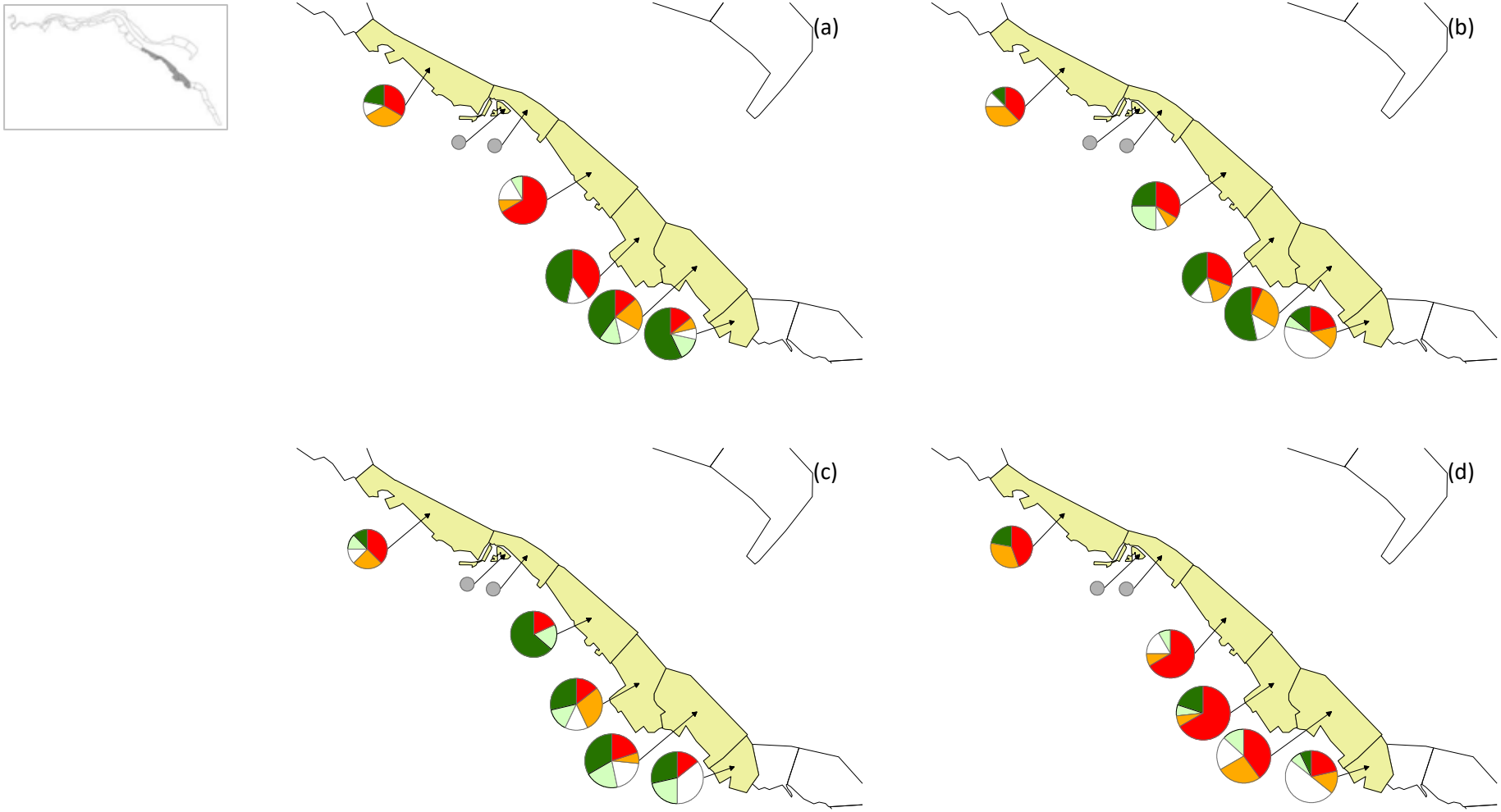

Figure 3.1.iii **Population trends of waterbirds within the Humber South (Mid) over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16)**. The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

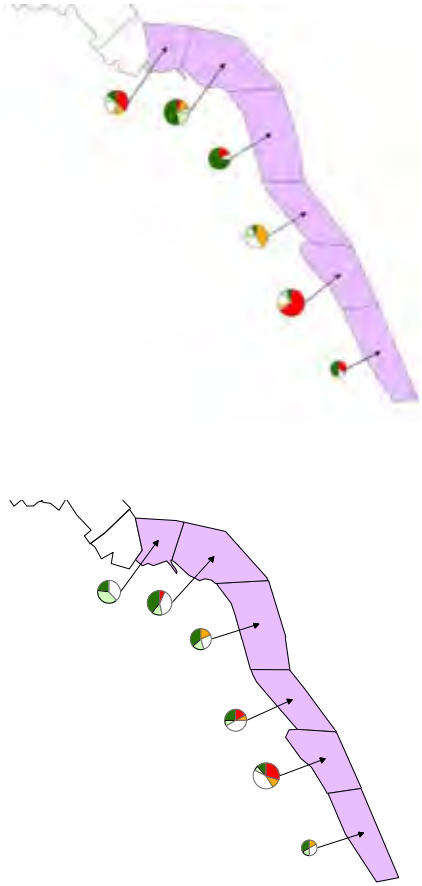

Figure 3.1.iv **Population trends of waterbirds within the Humber South (Outer) over (a) the long-term (2000/01 – 2015/16); (b) the medium-term (2005/06 – 2015/16); (c) the short-term (2010/11 – 2015/16) and (d) the "worst case" scenario (2000/01 – 2015/16)**. The area of each pie chart relates to the number of species for which trends could be determined on the WeBS count sector in question and within each pie chart the proportions of those species that have undergone a substantial decline (red), a moderate decline (orange), "no" change (white), moderate increase (pale green) and sharp increase (dark green).

4. Discussion and conclusions

4.1 Species trends

4.1.1 Tundra Bean Goose Anser serrirostris

This species is only occasionally observed within the Humber Estuary; hence robust sector level trends cannot be produced. Observations usually involve flocks present on the Humber for a short period only, and peak WeBS counts were of 81 in December 2011 and 30 in January 2015. Mean counts within the region increased from around 40 in the early 2000s to around 160 in 2011/12, though they have dropped back to around 70 in the two most recent winters. As this is a scarce wintering species in the UK, sectors on the Humber would become important for this species should they overwinter on a more regular basis in the future (as they did in 2011/12 when a flock was present for three consecutive months). Tundra Bean Goose was not appraised by either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.2 Pink-footed Goose *Anser brachyrhynchus*

Across the Humber Estuary the numbers of Pink-footed Goose increased substantially in the late-1990s so that the numbers counted from 2002 onwards were approximately four-times those counted in the early 1990s (Ross-Smith *et al.* 2013), and counts in the most recent three years have been approximately double again. This is shown as an overall moderate increase in pink-footed goose in the short- and medium-terms and a sharp increase in the long-term. This masks some fluctuations in the counts with decreases between 2009/10 and 2013/14 being followed by a substantial increase in 2014/15. Comparisons with regional numbers are not been considered here because, for most sites, this species is under-recorded by daytime WeBS counts, and accordingly WeBS does not routinely index them using WeBS data. They are preferentially monitored by roost counts organised outside of WeBS. However, the numbers nationally have increased markedly in England and the numbers on the Humber Estuary are in line with this increase. Notwithstanding that daytime WeBS counts for the Humber Estuary may similarly be under representative of true numbers using the site and may overlook important concentrations of roosting bird, reasonably large counts allow interpretation of daytime numbers and distributions across the site. There were short-term decreases but long-term increases at Read's Islands Flats (38418), short- and long-term increases at Somercotes to Donna Nook (35485), and increases over all three periods at Theddlethorpe to Saltfleetby leading to long-term increases overall for Humber Estuary (South) (38901), and undoubtedly contributing greatly to the Humber Estuary trend as Read's Islands Flats continues to hold a large proportion of Pink-footed Goose on the site, with more than 45% over many of the 15 winters to 2015/16; however this proportion has declined from the 70% supported in the 10 winters to 2010/11 (Ross-Smith *et al*., 2013). In recent years Goxhill Marsh (38411) has also become an important sector in the south with a mean peak count of 14% of the Humber Estuary population in the five winters to 2015/16. In the north, there were declines at Blacktoft Sands (38430) but sharp increases overall in Humber Estuary (North) (38931) over all three timeframes due to the species being counted in other sectors close to the Blacktoft Sands area.

4.1.3 European White-fronted Goose *Anser albifrons albifrons*

This species is only occasionally observed within the Humber Estuary, hence robust sector level trends cannot be produced. Observations usually involve flocks which are often present on the Humber for a short period only, with peak counts of more than ten birds being observed on WeBS counts in three of the years covered by this report (2010/11, 2011/12 and 2016/17). Mean counts within the region are usually between 400 and 800, but higher numbers are recorded across the region in some winters, including the three winters when WeBS recorded flocks on the Humber Estuary. Hence the Humber Estuary is of relatively low importance for this species. European White-fronted Goose was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.4 British/Irish Greylag Goose *Anser anser*

This species has increased across the Humber over the 15 years to 2015/16, matching the regional (and UK) trends. Sharp increases occurred widely across the Humber in the medium- and long-term, but have slowed more recently, with moderate increases occurring in the Humber South in the short-term, and numbers remaining stable on the north side of the estuary over the same period. At sector level, trends have been more variable with declines noted in some sectors suggesting some redistribution between sectors relative to earlier years. The highest counts of Greylag Geese occur on the innermost parts of the Humber Estuary, with the main concentration occurring on three adjoining sectors, River Humber - Howdendyke to Whitgift (38907), Blacktoft Sands (38430) and Faxfleet to Brough Haven (38432), which all recorded mean peak counts of more than 20% of the Humber population during the five years to 2015/16. Greylag Goose was not considered in the species accounts in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.5 Brent Goose (Dark-bellied) *Branta bernicla bernicla*

Overwintering numbers of Dark-bellied Brent Goose remained relatively stable overall on the Humber Estuary during the 15-winter period covered by Ross-Smith *et al*. (2013), but have subsequently increased. These trends loosely follow the wider regional trend. Consequently, the proportion of the regional population held on the Humber has remained relatively constant at around 5%. Ross-Smith *et al.* (2013) reported evidence of a redistribution of species from the south to the north of the outer Humber Estuary. However, the current analysis shows that similar increases have occurred in the short- and long-term periods in both the North and South, although there were slightly stronger increases in the North over the medium-term. Trends have remained stable or increased in all but one of the sectors for which they could be generated. The only exception is Tetney Haven to Humberston Fitties (35487), which is still a relatively important sector for the species, with peak counts of between 10% and 20% of the population over the last five years, but has dropped in importance following a sharp decline in the medium-term and a moderate decline in the short-term. The most important sectors for Dark-bellied Brent Geese (those holding a mean peak of more than 20% of the Humber population over the last five years) are now Spurn Head (38444), Horseshoe Point to Humberston Fitties (35986), Somercotes to Donna Nook (35484) and Saltfleet (35481).

4.1.6 Shelduck *Tadorna tadorna*

Overall numbers on the Humber remained consistent with Austin *et al.* (2008) and Ross-Smith *et al.* (2013), in that they have been relatively stable during the past 15 years, although there is again an

indication of a slight decrease in recent winters, as was the case in Ross-Smith *et al*. (2013), suggesting a very shallow decline may be occurring. Austin *et al.* (2008) reported that Shelduck numbers on the Humber were fairing better than other sites in the east-coast region, as the proportion of the regional population found on the Humber had increased. Ross-Smith *et al.* (2013) found that this trend had levelled off, and the current Humber trend continues to match the regional trend, with the Humber Estuary holding between about 15% and 20% of the wider region's Shelduck since the late-1990s. Austin *et al.* (2008) and Ross-Smith *et al*. (2013), reported evidence of some redistribution of Shelduck within the Humber Estuary, with a movement of birds away from the north and outer parts of the Humber, towards the inner southern shore. The current analysis indicates further redistribution has occurred, especially towards the outermost sectors in the mid-section of the southern shore, with sharp increases over all three time periods in these sectors (35487, 35986, 35485). Moderate short-term increases have also been recorded in the Humber South (Outer), resulting from sharp increases at Somercotes to Donna Nook (35484). However, declines in Humber Estuary North (38931) are still apparent, and Humber South (Inner) (38425) now shows moderate declines over both the short- and medium-term. As in the previous reports, sectors in Humber Estuary North still account for high proportions of the Humber Estuary Shelduck population despite the downward trend, especially Paull to Stone Creek (Cherry Cobb Sands) (38411) and Stone Creek to Patrington (38442). Elsewhere, Read's Islands Flats (38418) in the Inner South remains a populous sector for Shelduck, and Pyewipe (38405) in the Mid South is another important sector, despite moderate declines in the latter sector in the short- and medium-terms.

4.1.7 Wigeon Anas penelope

Austin *et al.* (2008) reported that Wigeon numbers on the Humber were relatively stable, although there had been a slight recent decline, and Ross-Smith *et al*. (2013) reported that this trend had continued with moderate declines shown over the short- and long-terms. More recently, the trend has been one of stability, although the earlier declines are still apparent in the current appraisal in the medium- and long-terms. The site trends continue to be broadly in line with recent wider regional trends, although the population decrease on the Humber commenced before that of the east-cost as a whole. The Humber has held a low and relatively constant proportion of the region's Wigeon population over the period covered by this report, at less than 5%. The marked declines noted by Ross-Smith *et al.* (2013) on Humber South (Mid) (38427), have since reversed, with sharp increases now apparent over each time period, due to sharp increases at Horseshoe Point to Humberston Fitties (35986) and Grainthorpe Haven to Horseshoe Point (35485), with the former sector now relatively important for Wigeon (mean peak counts of between 10% and 20% of the Humber population over five years). Sector level trends elsewhere were more variable, and contributed to an overall short-term moderate increase across Humber Estuary (North) (38931), but a moderate decline over the same period in Humber South (Inner) (38425). Humber Estuary (North) continues to account for the majority of Wigeon across the Humber Estuary, with peak numbers usually accounting for between 40% and 60% of the peak Humber population for this species. Paull to Stone Creek (Cherry Cobb Sands) (38411) was the most important sector in the north over the most recent five winters, but experienced moderate declines over all three timeframes. Elsewhere, Alkborough Flats (38423) was also highlighted as an important sector during the last five winters; however this seems to be due mainly to exceptionally high counts in 2013/14 and counts in other winters for this sector were relatively low.

4.1.8 Gadwall *Anas strepera*

The Humber supports only low numbers of this species. At the time of Austin *et al*. (2008), there were insufficient data to generate trends for any individual sector, but following increases in the first ten years of this century, Ross-Smith *et al.* (2013) were able to report trends for one sector, Blacktoft Sands (38430), which contributed to increases on the north side of the estuary. Since then, numbers have remained relatively stable, and the overall Humber Estuary trend shows moderate increases in the short- and medium- trends, and sharp increase in the long-term. Strong recent increases were recorded at Blacktoft Sands and at Barton to Chowder Ness (38415), and strong recent decreases at Brough Haven to North Ferriby (38433); however given the small numbers of gadwall found on the Humber Estuary all sector results should be interpreted with much caution. Given the small numbers, it is not surprising that the Humber Estuary is not an important site for this species on a regional scale, supporting a negligible proportion of east coast numbers.

4.1.9 Teal *Anas crecca*

Broadly in line with the wider regional trend, the number of Teal on the Humber as a whole increased sharply during the late-1990s and early-2000s (Ross-Smith *et al*., 2013) , but has since levelled off. The updated trend graph suggests further slight increases may have occurred over the last few years, but these have been very shallow and hence the overall trend for the Humber Estuary is stable over all three timeframes. Increases over all time frames have occurred in Humber South (Mid) (38427) and Humber South (Outer) (38429), although both support a relatively low proportion of numbers on the Humber Estuary. Stable trends are apparent in the more important areas for this species, Humber Estuary (North) (38931) and Humber South (Inner) (38425). The overall stability across these larger areas mask substantial variability at the sector level pointing towards localised redistribution of birds in recent winters. Following decreases, Read's Island Flats (38418) and Blacktoft Sands (38430) have become relatively less important than at the time of the last report, though peak counts for these sectors are still higher than 10% of the Humber population. Alkborough Flats (38423) now supports the highest proportion of Teal across the Humber Estuary following sharp increases over all three time periods.

4.1.10 Mallard Anas platyrhynchos

Austin *et al.* (2008) reported a long-term decline in Mallard numbers on the Humber, which had levelled off over the 15 years to 2009/10 considered by Ross-Smith *et al.* (2013). Numbers peaked during the mid-point of the period covered by Ross-Smith *et al*., and the subsequent slight decline has continued and is sufficiently large to be considered a moderate decline over the medium- and long-terms. This is consistent with regional trends, and accordingly the Humber has held approximately 5% of the region's Mallard since the early-1990s. At the sector level, declines have occurred across nearly all sectors within Humber Estuary (North) (38931) and Humber South (Inner) (38425), the two areas which support the highest proportion of the Humber population. The River Humber - Howdendyke to Whitgift (38907) was the most important sector of the Humber Estuary for this species, following increases in the medium- and long-term but a sharp decline is apparent over the most recent five years. Overall increases are apparent across Humber South (Mid) (38427) and Humber South (Outer) (38429) which may reflect a small degree of redistribution of Mallard from other parts of the estuary; however these areas support a much lower proportion of the overall numbers on the Humber Estuary.

4.1.11 Pintail *Anas acuta*

As reported in Austin *et al*. (2008) and Ross-Smith *et al.* (2013), only low numbers of Pintail occur on the Humber (total WeBS counts usually less than 100 individuals), such that all results should be interpreted with caution. Sharp increases in Pintail abundance occurred between the late-1990s and the late-2000s (Ross-Smith *et al*., 2013). However, there has been a subsequent drop off, with peak counts of under 50 for the entire estuary in recent winters, such that the overall trend for the Humber Estuary as a whole is a sharp decline in all three timeframes. There were insufficient data to generate trends at the sector level in all but one instance. Patrington to Easington (38443) in Humber Estuary (North) (38931) showed sharp decreases in the short- and medium-terms, and a moderate decrease in the long-term. This sector and the adjacent Stone Creek to Patrington (38442) were the key sectors in terms of the proportion of the Humber population recorded over the five years to 2015/16. However, as only small numbers of Pintail are involved, the Humber Estuary is not an important site for this species on a regional scale, supporting a negligible proportion of the east coast's population during the winters covered by this report.

4.1.12 Shoveler *Anas clypeata*

As detailed in Austin *et al.* (2008) and Ross-Smith *et al*. (2013), Shoveler numbers on the Humber are low (fewer than 100 birds counted in most years) and therefore trends should be interpreted with caution. Numbers increased during the late-1990s and then stabilised (Ross-Smith *et al*., 2013), before dipping slightly in the late 2000s, and have subsequently recovered. Hence the trend for the Humber Estuary as a whole is a moderate increase in the short-term (due to the recent dip and recovery), and stability in the medium- and long-term. For most sectors there were insufficient data to generate reliable trends. A sharp increase occurred in the short-term at Blacktoft Sands (38430) in Humber Estuary North (38931), and a moderate decline in the medium-term at Barrow to Barton (including pits) (38414), although the trend was stable on this sector in both the short- and long-term and numbers across the southern part of the Humber Estuary were stable in the medium- and long-term with a moderate increase in the short-term. In addition to the two sectors above, Alkborough Flats (38423), Barton to Chowder Ness (38415) and Theddlethorpe to Saltfleetby (35480) also supported important numbers in proportion to the Humber population. However, since only small numbers of Shoveler occur on the Humber, the Humber Estuary is a relatively unimportant site for this species on a regional scale, supporting a negligible proportion of numbers on the east coast during the period concerned.

4.1.13 Pochard Aythya ferina

Across the whole Humber Estuary, Pochard numbers fell sharply in the mid- to late-1990s, before stabilising (Ross-Smith *et al*., 2013), but have declined again since 2007/08. Numbers have been low across the entire time period considered, and have stood at 150 birds or less since the late-1990s. As these low numbers suggest, the Humber Estuary is a relatively unimportant site for Pochard at a regional scale, supporting only 1-2% of the regional numbers during the 15 winters considered in this report. Many individual sectors do not have sufficient data upon which to generate trends, but there were declines over the all three timeframes in all sectors for which trends were available and for the Humber Estuary as a whole. The south side of the Humber remains more important than the north side for Pochard in terms of the proportion of the overall numbers present, with Barton to Chowder Ness (38415) and Barrow to Barton (including Pits) (38414) being identified as the most important sectors in the five most recent winters.

4.1.14 Tufted Duck *Aythya fuligula*

Tufted Duck numbers on the Humber Estuary have fluctuated, increasing between the late-1990s and late-2000s before dropping in the two winters to 2010/11 (Ross-Smith *et al.*, 2013). Numbers have not changed substantially since then, and hence the overall trend is stable in the short- and long-term but a moderate decline is apparent for the medium-term, returning numbers to the earlier peak. This same trend was apparent for the Humber South (Inner) (38425) and Humber Estuary (South) as a whole, while in the Humber Estuary (North) (38931), which supports a negligible proportion of total estuary numbers, there were declines over all three timeframes. Humber South (Inner) was the most important area on the Humber Estuary, supporting 80% to 90% of the site total in most years. The most important individual sectors within this area remained those reported by Ross-Smith *et al*. (2013): Barrow to Barton (including Pits) (38414), and Goxhill to New Holland (38412). There was a moderate decline in the short-term at the former and in the medium-term at the latter but stability over other timeframes. Tufted Duck numbers on the Humber Estuary remain low, and as such, trends should be interpreted with caution. Given these low numbers, the Humber Estuary is relatively unimportant for tufted duck on a regional scale, supporting only 1% or less of regional numbers during the winters concerned.

4.1.15 Scaup Aythya marila

The Humber is not an important wintering area for this species, and numbers wintering on the Humber Estuary over the last 15 years have been too low to enable any robust trends to be produced, usually averaging fewer than three birds across the Humber Estuary each winter although occasionally larger flocks are recorded by WeBS,(e.g. 40 in 2016/17). Scaup is also relatively scarce at a regional scale, with mean counts of between 20 and 40 birds recorded in most of the years covered by this report. Scaup was not covered in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.16 Goldeneye *Bucephala clangula*

As detailed in Austin *et al*. (2008) and Ross-Smith *et al.* (2013), only low numbers of Goldeneye are found on the Humber and their numbers fluctuate widely between years, however the proportion of the regional numbers recorded on the Humber has remained relatively constant at around 5% during the 15 winters considered in this report. Unfortunately, the sector probably holding the majority of Goldeneye on the estuary (Goxhill to New Holland; 38412) averaging about 60% of the estuary total has been poorly covered by WeBS with fewer visits than ideal in recent years, including two winter when only a single January count was made, when what appear to be uncharacteristically high counts were been recorded. This, exacerbated by fluctuating numbers across the whole estuary, has compromised the estimate of proportional contribution of this sector. This probably negates the apparent sharp increase in importance of this sector over all time periods, and may underpin the anomaly of a large increase in numbers on the sector supporting the majority of this species within the estuary without a corresponding increase across the Humber South (Inner) (38425) or the whole estuary. Consequently, the paucity of visits to the Goxhill to New Holland sector in recent winters means that sector and site trends across the Humber Estuary, for this species, are not as robust as they otherwise might be.

4.1.17 Smew Mergus albellus

Numbers of Smew wintering on the Humber have been too low to enable any sector level or overall estuary trends to be produced, the mean winter count having been one or less in all 15 years covered by this report, with a peak count of four in February 2012. Smew is a relatively scarce wintering species in the UK, and numbers in the region have fluctuated over the period covered by this report, at between 10 and 40 birds, with lower numbers recorded in recent years, in line with the trend for the UK as a whole. This species was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.18 Little Egret *Egretta garzetta*

Numbers of Little Egret wintering on the Humber have increased slowly but consistently during the 15 years to 2015/16, as the distribution of this species has extended northwards after starting to colonise the UK in the 1990s. The increase is similar to the UK and regional trends, and the proportion of regional numbers on the Humber has increased slowly over the last ten years and is currently around 8%. Despite relatively high counts in the most recent winters, it has not been possible to fit trends for any of the sectors due to its absence or intermittent occurrence during much of the period covered by this report. However peak counts surpassed a total of 300 in September 2016. Most birds are observed on the outer parts of the Humber Estuary and numbers remain very low in Humber South (Inner) (38425). The most important sectors in terms of the proportion of the Humber population recorded were Stone Creek to Patrington (38443) in the north, and Horseshoe Point to Humberstone Fitties (35986) in Humber South (Mid) (38427). This species was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.19 Oystercatcher *Haematopus ostralegus*

Ross-Smith *et al*. (2013) reported fluctuations in the abundance of Oystercatcher in the 15 years to 2009/10, which equated to moderate-declines over the medium- and long-terms. Numbers have been increasing since around 2007/08, and the current analysis identifies moderate increases over all three timeframes. However, it should be remembered that this report only covers the most recent 15-years, and so excludes the period of sharp decline in the early 1990s; hence, although there have been recent increases, Oystercatcher abundance is now similar to that of the late-1990s. The recent trend on the Humber contrasts with a recent decline across the region, and as a result the proportion of the regional population on the Humber has grown to around 10%, having dipped to around 5% in the late 2000s. Despite this recent increase, the proportion still falls short of the 10% to 15% of the region's birds supported by the Humber Estuary in the late-1990s (Ross-Smith *et al*., 2013). The recent upward trend across the Humber Estuary as a whole has been driven mainly by changes in the south, evidenced by increases for most of the sectors for which trends are available in both Humber South (Mid) (38427) and Humber South (Outer) (38429). However, some of the decreases in Humber Estuary (North) reported by Ross-Smith et al. (2013) have continued, with sharp declines recorded over all three time periods at Paull to Stone Creek (Cherry Cobb Sands) (38441), and over both the short- and medium-terms at Patrington to Easington (38443), although a short-term moderate increase is apparent at Spurn Head and the overall short-term trend for the north side is stable. Following the changes over the last 15 years, the south side of the Humber Estuary is now far more important than the north side for this species in terms of the proportion of the Humber population. In particular, Humber South (Mid) now accounts for around 60-70% of the population, with the two Horseshoe Point sectors (35485 and 35986) recording the highest counts.

4.1.20 Avocet Recurvirostra avosetta

Numbers of Avocet wintering on the Humber Estuary have increased slowly during the 15 years to 2015/16, with notable annual fluctuations. Given past fluctuations it is too early to say whether the apparent steep upturn in the trend in the last two years is likely to be sustained or within the realms of natural fluctuation. The trend is in line with the UK and regional trends, and the proportion of the regional population on the Humber has remained relatively constant to slightly increasing, at around 2% to 5% over the 15 years to 2015/16. The most important sector for Avocet is Read's Island Flats (38418), which has held over 60% of the population during most winters since 2000/01, sharp increases are apparent in the medium- and long-terms and a moderate increase in the short-term. The shallower short-term increase for this sector may indicate that it is approaching carrying capacity, and recently high counts have occurred more frequently elsewhere on the southern side of the Humber Estuary, with South Ferriby (38417) and, to a lesser degree, Alkborough Flats (38423) being classified as important sectors based on peak counts during the most recent five years. This species was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.21 Ringed Plover Charadrius hiaticula

As reported in Austin *et al.* (2008) and Ross-Smith *et al*. (2013), wintering Ringed Plover numbers have declined on the Humber Estuary, since the late-1990s. Ross-Smith *et al*. (2013) suggested that the decline may have slowed in the late-2000s, and the latest results show a slight recovery, with a moderate increase recorded in the short-term. As a result of the previously reported decreases, the overall long-term trend is a sharp decline. Numbers of Ringed Plover have also declined across the wider region, and the proportion of the population on the Humber dropped to around 5% of the regional population in the winters leading up to 2010/11 (Ross-Smith *et al.* 2013). It has subsequently increased slightly following the recent partial recovery to around 6-8%, but remains below the 10-15% that was supported in the late-1990s. The sector level results suggest that estuary-wide rather than local factors have influenced the recent upturn, with short-term increases occurring across most sectors for which trends can be produced. The three most important sectors for this species, supporting more than 20% of the Humber population, were all in Humber South (Mid) (38427), including Tetney Haven to Humberstone Fitties (35487) one of only two sectors where numbers have decreased in the short-term. The other key sectors were Horseshoe Point to Humberstone Fitties (35986) and Grainthorpe Haven to Horseshoe Point (35485). However, another former key sector, Cleethorpes (North Promenade to Anthony's Bank) (38401), also in Humber South (Mid), was the other sector to experience short-term declines and no longer qualifies as important following sharp declines in all three timeframes. Counts remain low on all sectors where trends have been generated (typically fewer than 50 individuals, frequently fewer than 20) and should, therefore, be interpreted with caution.

4.1.22 Golden Plover *Pluvialis apricaria*

Austin *et al.* (2008) reported an increase in Golden Plover numbers for the Humber Estuary as a whole, but Ross-Smith *et al*. (2013) found that the trend had reversed, with a steep fall in the five winters up to 2009/10. The fluctuations have continued, with numbers increasing again slightly since 2009/10, though not reaching the same levels as in the mid-2000s. Consequently, the current trends for the Humber Estuary as a whole are variable: a moderate increase in the short-term, a moderate decline in the medium-term and relative stability in the long-term. These trends are in line with those found at a wider regional scale, although the proportion of the region's Golden

Plover recorded on the Humber Estuary has declined slightly (with some annual fluctuations), from 20% to 40% in the early 2000s, to around 15% to 30% in subsequent years up to 2015/16. At a sector level, the trends now show the opposite pattern to the one found by Ross-Smith *et al*. (2013), with declines occurring across the majority of sectors in Humber Estuary (North) (38931), but sector level trends being much more mixed in the south, leading to increases across most survey periods in all three wider Humber South areas (Inner, Mid and South). Following these changes, the majority of the Humber population of Golden Plover are now found in the Humber Estuary (South), although the Humber Estuary (North) remains important as a whole, with Paull to Stone Creek (Cherry Cobb Sands) (38441) supporting between 10% and 20% of the estuary total over the most recent five years. In the south, Read's Island Flats (38418) held the biggest proportion of Golden Plover in an individual sector following sharp short-term increases, with peak numbers in the last three years reaching 30% to 50% of the Humber Estuary total. Three other sector had mean peak counts of between 10% and 20% of the estuary total.

4.1.23 Grey Plover *Pluvialis squatarola*

As was the case in Austin *et al*. (2008) and Ross-Smith *et al*. (2013), numbers of Grey Plover on the Humber were relatively stable over the last 15 years, but with possible evidence of a recent slight upturn, with moderate increases recorded in the medium- and long-term and stability in the short-term. However numbers on the Humber have fluctuated widely, especially in the last five years, so the trends should be treated with caution. The Humber supported between about 3% and 5% of regional numbers in the 15 years to 2010/11 (Ross-Smith *et al*. 2013), but this has increased to between around 6% and 8% following the recent increases. Although the overall trend is upward, the latest analysis suggests some redistribution of this species within the Humber Estuary. Sharp increases have occurred in Humber South (Mid) (38427); reversing the sharp declines reported by Ross-Smith *et al.* (2013). This area now supports the largest proportion of the Humber Estuary total, and Horseshoe Point to Humberstone Fitties (35986) is now a key sector for this species. In contrast, declines have occurred in Humber Estuary (North) (38931), which was formerly the most important area, in particular at Stone Creek to Patrington (38442) and Patrington to Easington (38443). Paull to Stone Creek (Cherry Cobb Sands) (38441) was an exception and remains a key sector in terms of the proportion of total number of Grey Plover on the estuary, after a stable short-term trend and increases in the medium- and long-term. Ross-Smith *et al*. (2013) also reported that Grey Plover had continued to fair poorly on the Humber South (Outer) (38429), but the latest data indicate recent increases have occurred in most sectors, although overall this area remains relatively unimportant for Grey Plover.

4.1.24 Lapwing *Vanellus vanellus*

Austin *et al*. (2008) reported moderate medium-term decline for Lapwing on the Humber Estuary, which worsened over the following five years, leading Ross-Smith *et al*. (2013) to report substantial Lapwing decreases over the short-, medium- and long-terms to 2009/10. Since then, numbers have recovered only slightly, contributing to a moderate short-term increase for the Humber Estuary as a whole in the five years to 2015/16. The current downward medium- and long-term trends reflect the decreases identified by the earlier reports. These declines reflected those seen at a wider scale, and accordingly the Humber Estuary has consistently supported between approximately 10% and 20% of regional Lapwing numbers during the 15 winters covered by this report. Although the recent trend

has improved for the Humber Estuary as a whole, the short-term trend remains downwards for Humber Estuary (North) (38931). Short-term increases have occurred in each of the Humber South areas (Inner, Mid and Outer), although results are very mixed at the individual sector level suggesting some redistribution of Lapwing on the southern shore. Sharp short-term increases in Lapwing numbers are apparent on both Read's Island Flats (38418) and Alkborough Flats (38423)making them the two most important sectors for this species in terms of the proportion of the overall numbers on the Humber Estuary.

4.1.25 Knot Calidris canutus

Austin *et al*. (2008) and Ross-Smith *et al*. (2013) reported that numbers of Knot across the Humber Estuary remained relatively stable. Early indications of a downturn in the trend during the latter half of the period covered by Ross-Smith *et al.* (2013) were apparent although this was too shallow to be termed a decline. This downturn has continued and is now sufficiently large to be classified as a moderate decline in the medium- and long-terms. The regional trend is broadly stable, and consequently the proportion of birds in the region on the Humber has decreased from approximately 15% to around 10% during the years covered by this report. Austin *et al*. (2008) and Ross-Smith *et al.* (2013) described redistribution of Knot from the south to the north of the Humber, but the current analysis suggests some movement back to the south has occurred, with short-term increases being apparent for many sectors in Humber South (Mid) (38427) and Humber South (Outer) (38429) and declines in numbers for sectors in Humber Estuary (North) (38931), with the exception of Stone Creek to Patrington (38442), where moderate increases occurred. Despite declines, the adjacent Patrington to Easington sector (38443), remains one of the most important for Knot in terms of the proportion of total numbers on the Humber Estuary, although the other two key sectors for Knot are now on the south shore (Horseshoe Point to Humberstone Fitties, 35986 and Grainthorpe Haven to Horseshoe Point, 35485).

4.1.26 Sanderling *Calidris alba*

Numbers of Sanderling wintering on the Humber decreased in the early 2000s, followed by general increases between 2004/05 and 2015/16, although with notable annual fluctuations between years. As a result of these changes, there has been a moderate increase in numbers in the short- and a sharp increase in the medium-term, whilst remaining stable in the long-term. The increase is in line with the UK and regional trends, and the proportion of the regional population on the Humber has consistently been between 5% to 10% of the regional total. Increases have occurred in one or more timeframes across most of the sectors for which results can be produced on the southern side of the Humber Estuary, with the exception of the two Theddlethorpe sectors (35479 and 35480) where numbers remained stable over all three timeframes. Numbers have declined in the long-term at Spurn Head (38444) in Humber Estuary (North) (38931); however this side of the Humber Estuary has only supported around 5% of the Humber population in recent years. Five sectors in Humber South (Mid) (38427) and Humber South (Outer) (38429) are identified as key sectors for Sanderling, with mean peak counts of greater than 20% of Humber Estuary peak in the five years to 2015/16. This species feeds along the tide line and is known to be susceptible to disturbance; hence feeding flocks may use several different sectors across the same winter. This species was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.27 Dunlin *Calidris alpina*

Following declines reported by Austin *et al.* (2008) and Ross-Smith *et al.* (2013), Dunlin numbers on the Humber have since remained relatively stable. As a result, the trend in the 15 years to 2015/16 is stable in the short- and medium-term, with a shallow decline in the long-term reflecting the previous reports. The proportion of regional numbers found on the Humber Estuary has remained relatively stable (at around 15%), indicating that earlier declines occurred on a wider geographical scale in turn suggesting that declines on the Humber Estuary may not be related to local factors, as reported by Ross-Smith *et al*. (2013). Until 2009/10, declines on the southern shore were more marked on outer sectors than on the Humber South (Inner) section (Austin *et al.*, 2008; Ross-Smith *et al.*, 2013). However, the opposite is now the case with increases occurring over all three timeframes in most sectors in Humber South (Mid) (38427) and Humber South (Outer) (38429), and declines in most sectors in Humber South (Inner) (38425). Declines have also occurred over one or more timeframes in many sectors in Humber Estuary (North) (38931), and over all three timeframes at Patrington to Easington (38443). However, in spite of these decreases, Patrington to Easington remains the most important sector for this species in terms of the proportion of total numbers on the Humber Estuary.

4.1.28 Ruff Calidris pugnax

Ruff are infrequently recorded during WeBS visits on the Humber Estuary over the winter, numbers being insufficient to enable trends to be generated for any sectors. In the most recent five winters, Blacktoft Sands (38430) and Alkborough Flats (38423) are the only sectors on which an average peak count of one or more birds has been recorded (one and three birds respectively). The Humber therefore supports a negligible proportion of the Ruff wintering in the region (less than 1%). Peak counts for this species occur during autumn passage, usually in August or September. Total counts of over 100 occurred relatively often in the 1980s and 1990s, but the latest three figure count was in August 2003. During the most recent ten years the peak counts have been between 60 and 80 birds in most years, but sometimes lower. This species was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.29 Black-tailed Godwit *Limosa limosa*

Fluctuations in numbers of this Black-tailed Godwit on the Humber Estuary were described by Austin *et al*. (2008) and Ross-Smith *et al.* (2013). Although these fluctuations have continued, wintering numbers have been notably higher in the five years to 2015/16 and this translates into increases over all three timeframes for the Humber Estuary as a whole, including a sharp increase in the short-term trend. These fluctuations are reflected in the Humber's regional importance for this species, and the Humber Estuary has supported between around 3% and 10% of the region's Black-tailed Godwit during the 15 years covered by this report. The previous reports indicated that this species was doing better on the north shore of the Humber than on the south shore, but the latest data shows that this is no longer the case, with declines occurring in the short- and medium- term in Humber Estuary (North) (38931), although short-term increases have occurred in some sectors in this area. Declines have also occurred in all but one sectors for which trends can be calculated in Humber South (Inner) (38425); the exception was Alkborough Flats (38423) where numbers have increased in the short- and medium- terms. The most important sector for this species in the most

recent five years, in terms of the proportion of the Humber population supported, is Pyewipe (38405) in Humber South (Mid) (38427); the increases in this sector have led to the overall trend in spite of the decreases elsewhere across the Humber Estuary. The Humber Estuary is also important as a passage site for this species, and peak numbers between August and October are often substantially higher than those in the winter period. The raw data indicate that the key passage sectors, supporting much greater numbers during the autumn passage than during the winter include Goxhill Marsh, Killinghome Marshes – sector I and North Killingholme Haven Pits – sector II. Numbers on other sectors are relatively consistent across the two periods.

4.1.30 Bar-tailed Godwit *Limosa lapponica*

Numbers of Bar-tailed Godwit increased during the 1990s before declining (Austin *et al*., 2008), with the fall levelling off in the late 2000s (Ross-Smith *et al*., 2013). Numbers have subsequently decreased since 2011/12, hence the short- and medium- term trends show a moderate decline, reflecting the recent drop, and the long-term trend a sharp decline. At a wider regional scale, Bar-tailed Godwit numbers fluctuate markedly with no discernible trend. However, the Humber Estuary has diminished in importance as a site for this species, having held approximately 10% of the region's Bar-tailed Godwit between the late-1990s and the mid-2000s (Ross-Smith *et al*. 2013), but about 5% or less in subsequent winters. Recent declines and increases have occurred in adjacent sectors within different areas of the Humber Estuary, suggesting some within-estuary redistribution in recent winters, although the sector trends should be interpreted with caution due to the low number of Bar-tailed Godwit wintering on the Humber Estuary. The direction of trends on the more important sectors within the estuary are mixed. In Humber Estuary (North) (38931), decreases in Paull to Stone Creek (Cherry Cobb Sands) (38441) and Patrington to Easington (38443) contrast with sharp increases over all three timeframes at Stone Creek to Patrington (38442). In Humber South (Mid) (38425), numbers have fluctuated at Horseshoe Point to Humberstone Fitties (35986), which has recorded declines in the short- and long-term but a sharp increase in the medium-term.

4.1.31 Whimbrel Numenius phaeopus

Whimbrel are primarily a passage species on the Humber Estuary, only a very small number being present on the Humber Estuary and within the wider region during the winter; hence sector level trends cannot be produced. In recent years, peak passage counts during WeBS have typically been recorded in July or August during the 'autumn' passage, with three figure total counts occurring in five years since 2000 and including two counts greater than 150 (275 in July 2000 and 250 in July 2015). This species was not included in either Austin et al. (2008) or Ross-Smith et al. (2013).

4.1.32 Curlew Numenius arquata

Austin *et al*. (2008) reported an increase in Curlew numbers on the Humber Estuary, with an early indication of a decline from around 2007/08, which subsequently developed into a discernible downward trend. Consequently, numbers for the Humber Estuary as a whole exhibit a moderate decline in the medium- and long-term, levelling out somewhat in the short-term (the short-term trend is also negative but below the 25% threshold). The recent downturn is, nonetheless, steeper than that for the regional trend, and hence there is an indication that the Humber has decreased slightly in its regional importance as a site for

Curlew; however the Humber still supports around 10%-12% of regional numbers and so very important for this nationally declining pecies. At a sector level, results were variable across the Humber Estuary, but declines occurred in almost all sectors in Humber Estuary (North) (38931), and also in Humber South (Inner) (38425), despite sharp increases in a couple of the sectors within this part of the Humber Estuary. In Humber South (Mid) (38427), declines are apparent on most sectors, but there were sharp increases overall due mainly to increases at Cleethorpes (North Promenade to Anthony's Bank (38401) which have partially reversed the decline apparent here during the early 2000s. In contrast, increases occurred in most sectors and overall in Humber South (Outer) (38429), although sharp declines occurred over all three timeframes at Theddlethorpe to Saltfleetby (35480). The increases recorded in the south have not been sufficient to reverse the declines across the Humber Estuary as a whole, and the northern side of the Humber Estuary continues to support the largest proportion of Curlew in spite of the recent decreases (peak counts around 40% to 55% of the Humber population). The most important individual sector was Paull to Stone Creek (Cherry Cobb Sands) (38441).

4.1.33 Green Sandpiper *Tringa ochropus*

This species is recorded within the Humber Estuary primarily during the autumn passage, and only a few individuals remain on the Humber Estuary during the winter; hence sector level trends cannot be generated for any sector. Passage counts peak in July or August, usually at between ten and 20 birds. Green Sandpiper was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.34 Greenshank *Tringa nebularia*

This species is recorded within the Humber Estuary primarily during the autumn passage, and only a few individuals remain on the Humber Estuary and within the wider region during the winter. In fact the mean winter count for the whole estuary has not exceeded four birds in the 15 years covered by this report and a peak count during the same period was of only eight birds (November 2011); hence sector level trends cannot be generated. During autumn passage (July to September), much higher counts may be obtained in some years, the highest during the period covered by this report being 106 in August 2010, although in most years the peak has been between 30 and 60. Greenshank was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.1.35 Redshank *Tringa totanus*

Having been relatively stable (Austin *et al*., 2008), a decline in numbers of Redshank on the Humber Estuary because apparent from the late-1990s onwards (Ross-Smith *et al*. 2013). This decline ended around 2010/11 and numbers have since been stable, resulting in a stable short-term trend and moderate decreases in both the medium- and long-terms. The trend is broadly in line with regional trends, although the decline on the Humber Estuary during the mid- to late-2000s was slightly steeper than elsewhere in the region, and the estuary declined slightly in regional importance as a site for Redshank during this period. Since around 2010/11, the Humber Estuary has supported approximately 10% of regional numbers of this species. Ross-Smith *et al.* (2013) noted that there was stability in Redshank numbers on the outer southern shore of the Humber estuary, with declines apparent elsewhere. This general pattern has continued for the most part, with declines still

apparent in the short-term in both Humber Estuary (North) (38931) and Humber South (Inner) (38425), and increases in Humber South (Outer) (38425), although individual sector trends were variable, particularly within the inner Humber Estuary. Increases across most of the individual sectors in Humber South (Mid) (38427) have partially reversed the declines in this area noted by Ross-Smith *et al*. (2013). The northern side of the Humber Estuary remains the most important in terms of the proportion of total numbers, with recent peak counts reaching 35% to 45%, although this is much lower than in the 2000s when peak counts reached 50% to 70% of the total. Following the declines, none of the individual sectors now supports greater than 20% of birds, and peak total counts on both the Mid and Inner parts of the southern shore are now almost as high as in the north. Like in the north, there are no individual sectors in the south that support more than 20% of total numbers; however, there are seven sectors in total which support between 10% and 20% of the total (three in the north and four in the south). The variable sector trends and increasing importance of the south suggest some redistribution of Redshank within the estuary.

4.1.36 Turnstone Arenaria interpres

Numbers of Turnstone recorded on the Humber Estuary in the 15 years to 2015/16 have in general been declining, and mean numbers on the estuary have halved from around 300 to around 150, although the trend is not consistent and there is much between-year fluctuation. As a result, the overall trend is stable in the short-term, a moderate decrease in the medium-term and a sharp decrease in the long-term. This is broadly in line with the regional trend, and the proportion wintering on the Humber Estuary has varied along with the fluctuations in abundance, at between 5% and 10% of the regional population. Trends in numbers of Turnstone can only be generated for the relatively small number of sectors that attract this species. Decreases in numbers are apparent in Humber Estuary (North) (38931) and Humber South (Inner) (38425), although there were sharp increases over all three timeframes at Goxhill Marsh (38411) which falls within the latter area. The long-term trend for Humber South (Mid) (38427) is a sharp decline, matching other parts of the Humber Estuary; however, moderate increases have occurred in both the short- and medium- terms prompted at least in part by increases in the two sectors either side of Horseshoe Point (35485 and 35986), and despite sharp decreases over all three timeframes at Cleethorpes - North Promenade to Anthony's Bank (38401). These three sectors in the Mid South all support between 10% and 20% of the Turnstone wintering on the Humber Estuary. Four sectors appear to have been particularly important during the most recent five years, with peak counts of greater than 20% of the estuary total: two in the north (Hessle to Hull, 38436, and Hull to Paull, 38440) and two in the Inner South (Goxhill Marsh and Goxhill to New Holland (38412). Turnstone was not included in either Austin *et al*. (2008) or Ross-Smith *et al*. (2013).

4.2 Broad patterns

4.2.1 Waders and Shelduck

As in Austin *et al*. (2008) and Ross-Smith *et al*. (2013), Shelduck and waders are discussed together because all these species feed on mudflat invertebrates, and are therefore likely to respond in similar ways to changes in the environment. Of the 15 species considered, nine have declined at the Humber Estuary scale over at least one time period in the 15 winters covered by this report. Bar-tailed Godwit have declined in numbers over all timeframes and was the only species for which a decline was apparent over the short-term. Declines are apparent for Lapwing, Knot, Curlew,

Redshank and Turnstone in both the medium- and long-terms. Increases in numbers are apparent for eight species over at least one timeframe, including three species for which increases have been sustained over all three timeframes (Avocet, Oystercatcher and Black-tailed Godwit) and two species which experienced increases over two timeframes and stability in the third (Grey Plover and Sanderling). Numbers of Ringed Plover, Golden Plover and Lapwing all exibit moderate increases in the short-term following earlier declines The mixed results for waders at the Humber Estuary scale, and the mostly positive short-term trends, follow declines reported for many species by Ross-Smith *et al*. (2013) and so increases merely offset or partially offset the earlier declines in some cases (e.g. Oystercatcher and Ringed Plover).

In contrast to the previous report when declines in wader and Shelduck numbers were more severe and widespread on the southern shore of the Humber (Ross-Smith *et al*. 2013), the current data show that recent declines have been substantially more severe on the northern shore. Of the 15 species, declines are apparent for nine in Humber Estuary (North) (38931) over all three timeframes, and for two declines in the long- and medium- term and stability in the short-term. Trends for the remaining four species are a mixture of declines and increases. For Grey Plover and Black-tailed Godwit, the only increases were over the long-term and both the short- and medium- term trends were downward whereas for Ringed Plover sharp declines in numbers in the medium- and long-terms have been followed by a moderate increase in the short-term. The only species for which increases in the north are apparent over two different timeframes was Avocet (a sharp decrease in the medium-term with increase either side). The recent increases In wader numbers for the Humber Estuary as a whole have therefore mainly been the result of increases on the southern shore of the estuary, with six species increaseing over all three timeframes for Humber Estuary (South) (38901), three others having stable or increasing trends, and one stable across all three timeframes. Four of the remaining five species (Ringed Plover, Knot, Bar-tailed Godwit and Redshank) have declined in number in the long-term only but increases in one or both of the other periods. Turnstone was the only species to have decreased in number on the southern shore without any increases (declining in the medium- and long-term).

The increases in numbers of waders on the southern shore in general have been underpinned by increases in Humber South (Mid) (38427), reversing the substantial declines in this area reported by Ross-Smith et al. (2013), and to a lesser extent in Humber South (Outer) (38429). However, results in Humber South (Inner) showed declines in numbers of eight of the 11 species for which trends could be produced, and increases for only five (this includes two species for which the direction of change in numbers has been inconsistent over different timeframes, both with sharp decreases in two periods and an increase in the other). These overall patterns for waders and Shelduck represent a change from those reported by Austin *et al*. (2008) and Ross-Smith *et al*. (2013), suggesting that conditions may have improved somewhat in Humber South (Mid and Outer), but that problems such as habitat loss or degradation, are now more evident elsewhere. At the finest sector level, in contrast to the increases in numbers on neighbouring sectors within the Outer South, numbers on Theddlethorpe to Saltfleet have declined for all but one species. Meanwhile, on the north side of the estuary, where in general numbers of waders have recently declined, there have been recent increases of many species on Stone Creek to Patrington.

4.2.2 Dabbling ducks

There was a mixed picture for dabbling ducks in the Humber Estuary as a whole, with increases in numbers in all three timeframes for Gadwall, and in the short-term for Shoveler (with stability otherwise) and no overall trend for Teal. However moderate declines occurred in the medium- and long-term for Wigeon and Mallard (with stability in the short-term for both species), and sharp declines over all three periods for Pintail. However, numbers remain low for Gadwall, Pintail and Shoveler, such that trends (which could not be generated for many sectors) for these species must be interpreted with caution. As was the case for waders and Shelduck, dabbling duck numbers fared particularly well in Humber South (Mid) (38427), although this followed substantial declines in this area reported by Ross-Smith *et al*. (2013). Increases in numbers are also apparent in Humber South (Outer) (38429) for both Teal and Mallard, although numbers of Wigeon have decreased. This contrasted with declines in Humber Estuary (North) (38931) for Wigeon, Mallard and Pintail and in Humber South (Inner) (38425) for the first two species (no trend for this area could be produced for Pintail). Teal numbers were stable and Gadwall numbers increased in one or more timeframes in both these areas. This pattern somewhat reverses that described in Austin *et al*. (2008) and Ross-Smith *et al*. (2013).

4.2.3 Other wildfowl

Numbers of diving ducks recorded on the Humber Estuary have been low, and as such trends should be interpreted with caution, particularly those for Goldeneye due to poor coverage of the most important sector for this species in recent years. Nonetheless, numbers across the Humber Estuary as a whole have declined over at least one time period for all three species, with no increases recorded. In the case of Pochard, declines in numbers over all three timeframes in all sectors for which results could be produced reflect the long sustained decline in numbers of this species wintering in the UK of the past several decade. For Tufted Duck and Goldeneye, the picture at a lower scale was more mixed, with both increases and decreases apparent across different sectors.

Numbers of geese species for which trends can be produced (Pink-footed Goose, Greylag Goose and Dark-bellied Brent Goose) across the Humber Estuary as a whole have increased over all three timeframes and for the main reporting areas on the north and south of the Humber Estuary. Localised decreases are apparent for a small number sectors, although in the case of Dark-bellied Brent Goose numbers have declined on only occurred in one sector (Tetney Haven and Humberstone Fitties, 35487) being stable or increasing on the other 11 sectors for which results could be produced. The increases for all three species contrast with the stable trend for Dark-bellied Brent Goose and sharp declines for Pink-footed Goose reported by Ross-Smith *et al*. (2013), although this followed increases reported by Austin *et al*. (2008) (Greylag Goose was not included in the previous two reports).

Little Egret has also increased substantially on the Humber Estuary in the last 15 winters, as it continues to spread northwards across the UK as the UK population continues to increase unabated. Sharp increases were recorded in the short- and medium-terms in Humber South (Outer) (38429) and hence also in Humber Estuary (South) (38901) and the Humber Estuary as a whole.

4.2.4 Summary

Overall, trends in numbers of waders and ducks varied between species, whereas all three geese species for which trends could be analysed increased, as did the trend for Little Egret.

Of the 28 species for which trends could be assessed for the Humber Estuary, declines in numbers over at least one time period were detected in 15, and increases in 14, with stable trends recorded over all three timeframes for two species. Most of the declines were recorded in the medium- and long-term periods and the majority of the increases in the short- and medium-term. For three species trends in numbers are particularly inconsistent between timeframes - Ringed Plover, Golden Plover and Lapwing - although given that the majority of these species wintering birds in the UK occur on non-estuarine habitats this is not surprising as utilisation of estuarine habitats may fluctuate with weather conditions inland or on the open coast. In all three cases the increases occurred in the short-term (i.e. the most recent period), indicating at least a partial recovery following earlier declines. Short-term declines were apparent for only three species (Pintail, Pochard and Bar-tailed Godwit, all of which also decreased in numbers across the other two timeframes). These more positive results follow earlier declines affecting many species reported by Ross-Smith *et al*. (2013) and Austin *et al*. (2008). However, in addition to the three species for which numbers have declined in the short-term, a further nine species (five waders and four ducks), although stable in the short-term, had previously declined in numbers and so have not recovered to previous levels.

Increases in numbers were particularly apparent on the south side of the Humber, where 14 species increased over one or more timeframes with no declines, numbers of four species increased following earlier declines, numbers of two species have been stable and five have declined consistently across all time-frames (including all three diving ducks). These increases follow earlier declines on the southern shore noted by both Austin *et al*. (2008) and Ross-Smith *et al.* (2013) and were most apparent within the South (Mid) and South (Outer) sectors were more declines than increases were previously reported for 13 out of 21 species assessed for the South (Inner). However, Theddlethorpe to Saltfleetby contrasts the generally positive appraisal for for the Outer South sectors as declines for almost all species. In contrast to the increases on the south of the Humber Estuary, the trends in numbers on the northern shore were mostly downward. Fifteen species have declined without increases across any of the timeframes (including ten waders and Shelduck), and numbers of four of the species which have increased for one timeframe decline in the other two (including three waders). The three goose species were the only species to consistently increase in numbers on the north side of the estuary.

Most of the trends in numbers for the Humber Estuary during the 15 winters to 2016/17 were in line regional trends, suggesting that, in general, factors affecting waterbird numbers on the Humber Estuary are likely to be those that act at the broad-scale across the region or country as a whole, such a climate change and general population change. Nonetheless, the Humber Estuary in some cases numbers on the Humber Estuary have decreased in importance in terms of the proportion of the regional numbers of some species – Knot and Bar-tailed Godwit, and to a lesser extent Shelduck and Curlew. Consequently, for these species, site specific pressures may still be driving or exacerbating some declines, which if identified could potentially be addressed through management actions. In contrast, the proportion of regional numbers supported on the Humber has recently increased for Oystercatcher, Ringed Plover (slightly) and Grey Plover, reversing or partially reversing previous decreases, suggesting that either pressures on these species within the may have moderated.

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Appendix A: Population trends of each species for each sector of the Humber Estuary.

For each species in each sector, the y-axes of the left-hand graphs show the number of individuals counted, while the y-axes of the right-hand graphs are percentages (i.e. the percentage of the Humber population found in that sector per year).

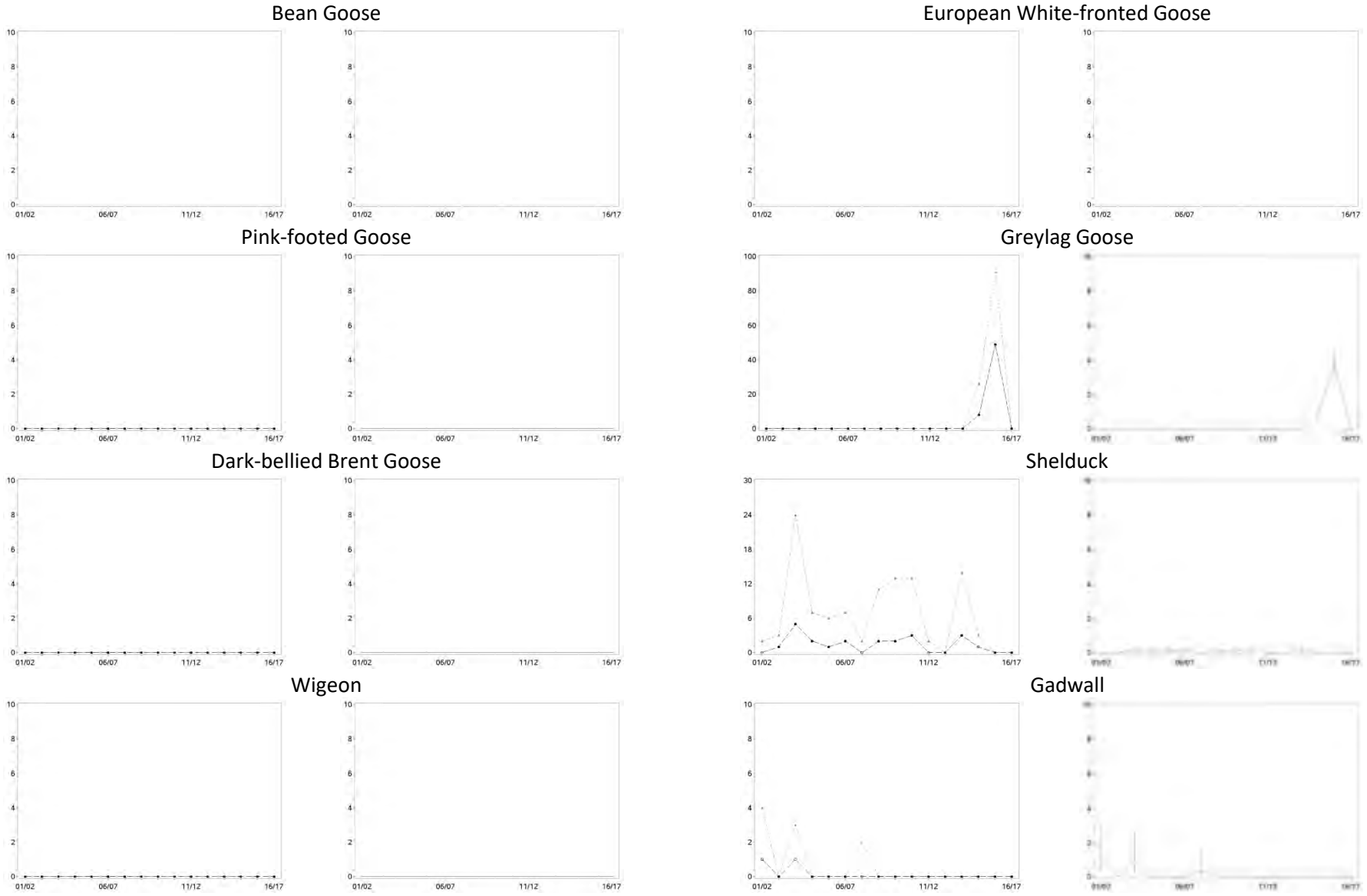
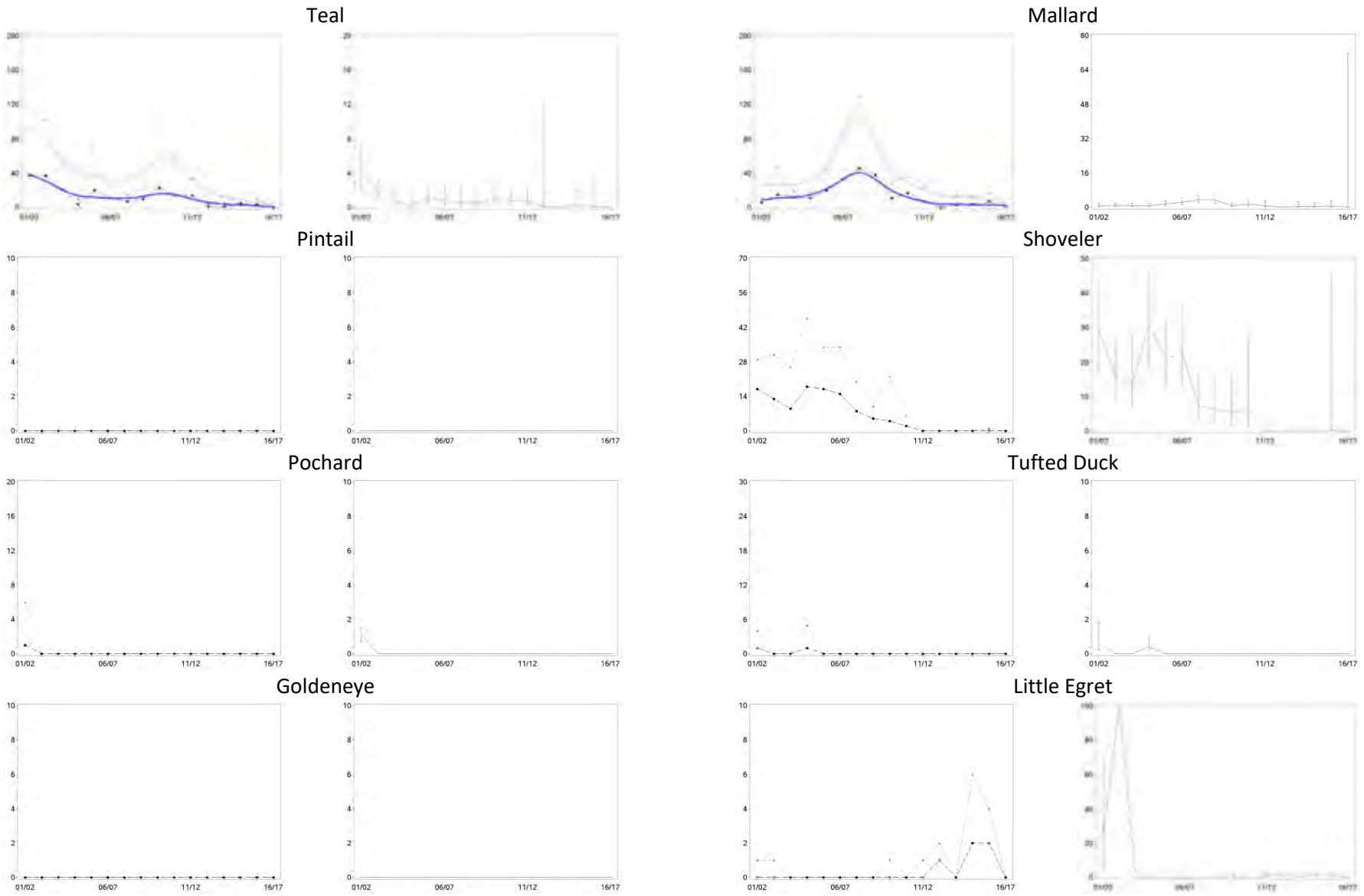


Figure A.38201. Population trends of each species in sector 38201 (North Killingholme Haven Pits - Sector JJ) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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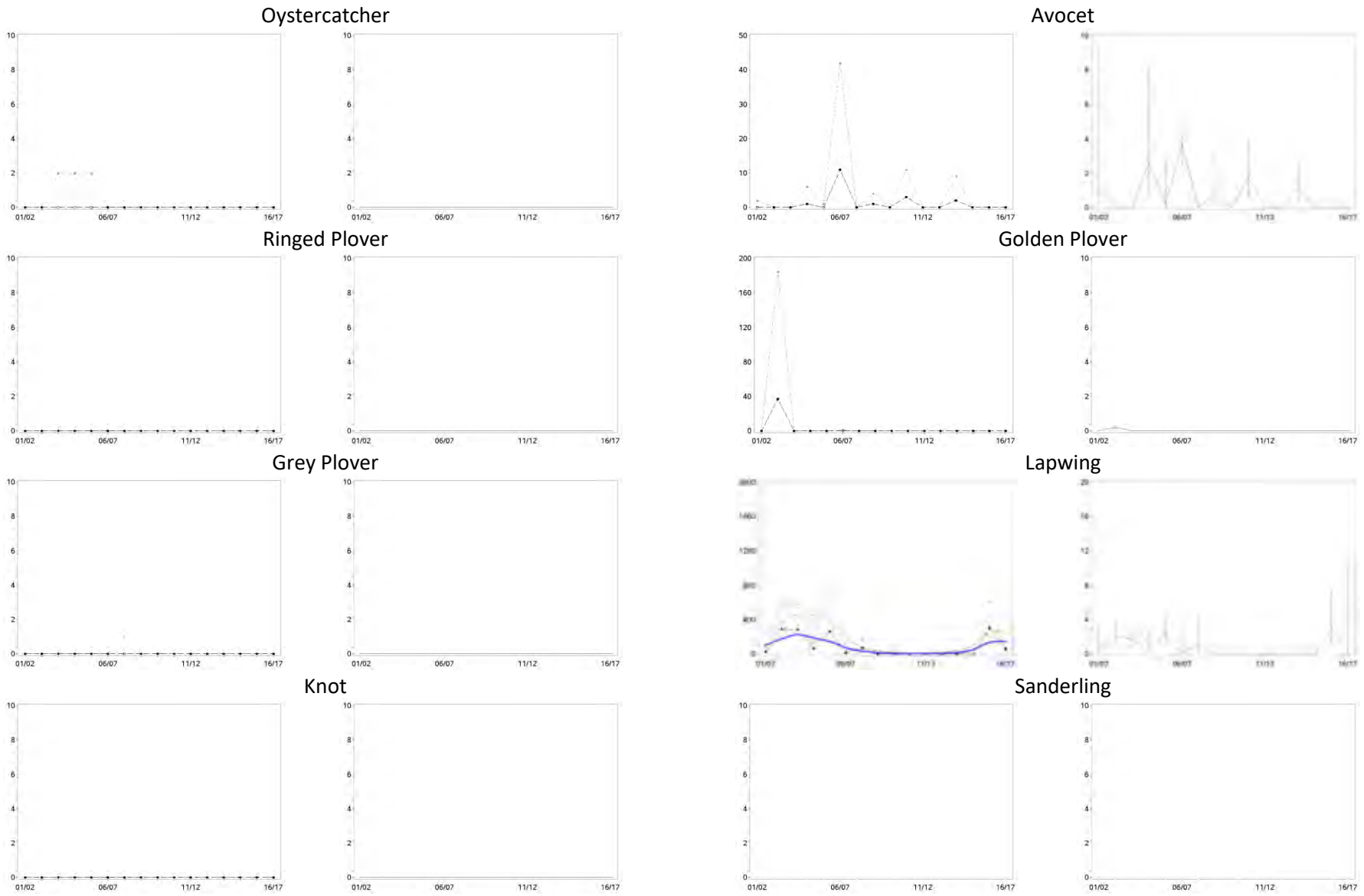

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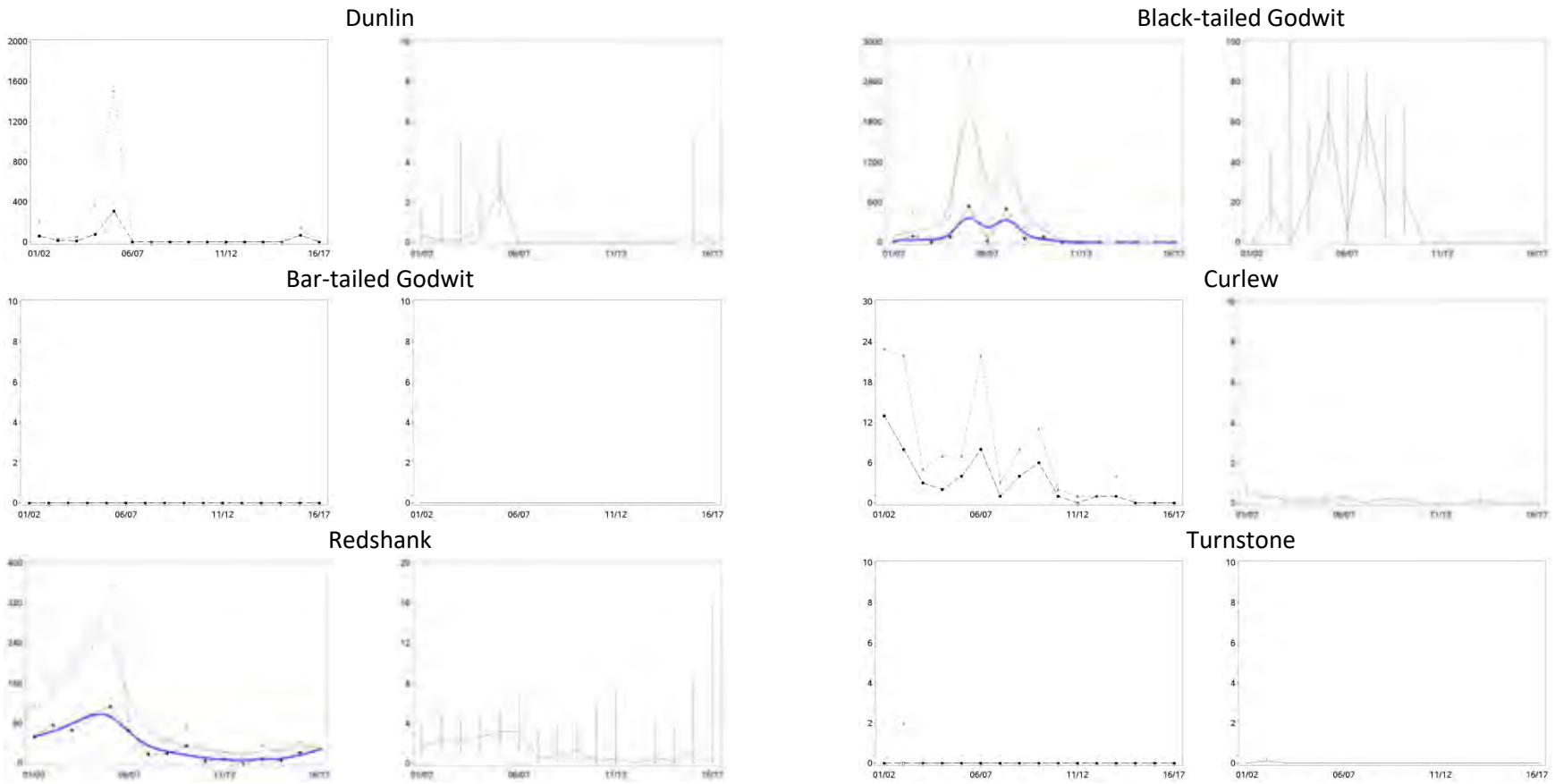

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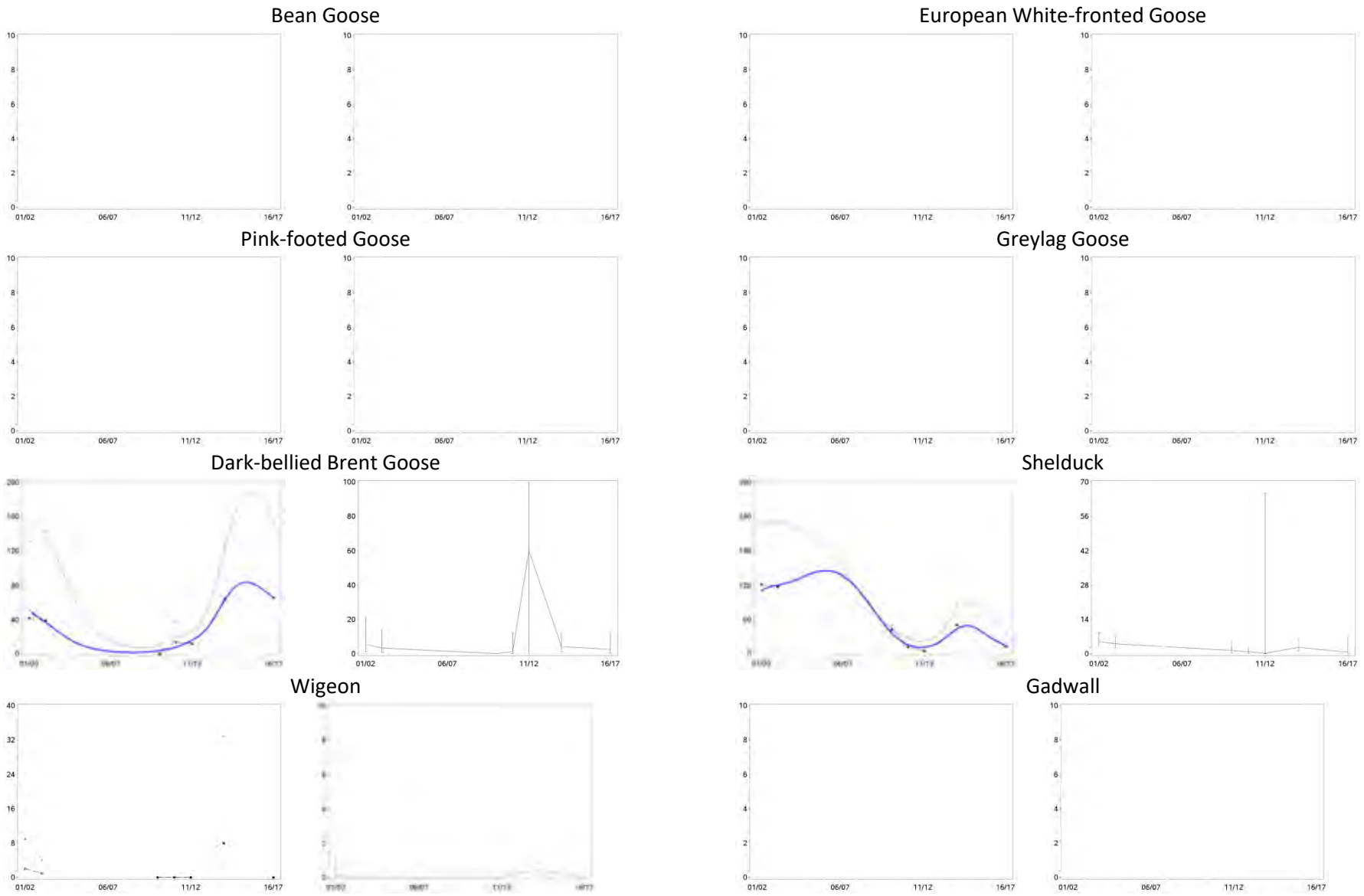
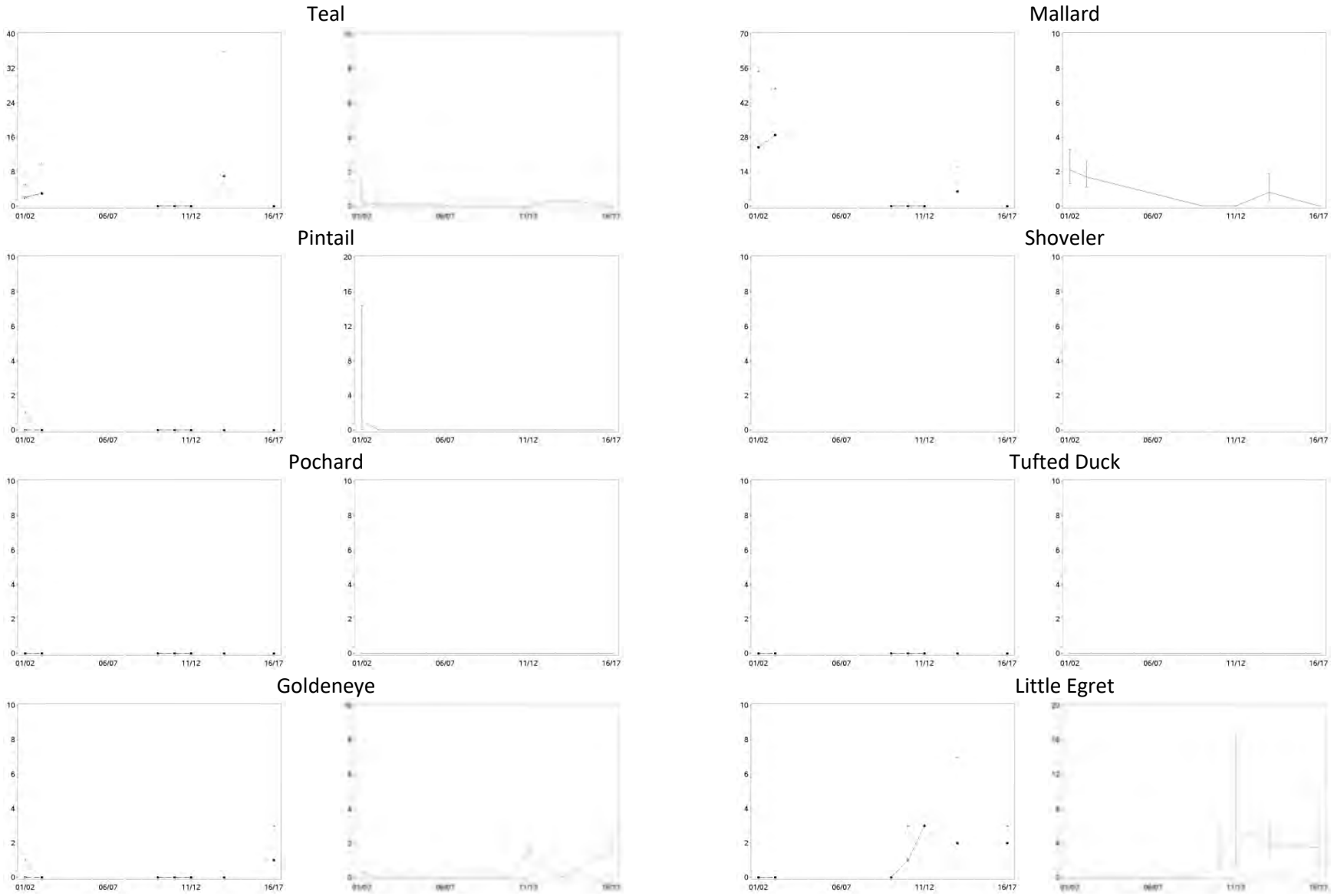


Figure A.38401. Population trends of each species in sector 38401 (Cleethorpes - North Promenade to Anthony`s Bank) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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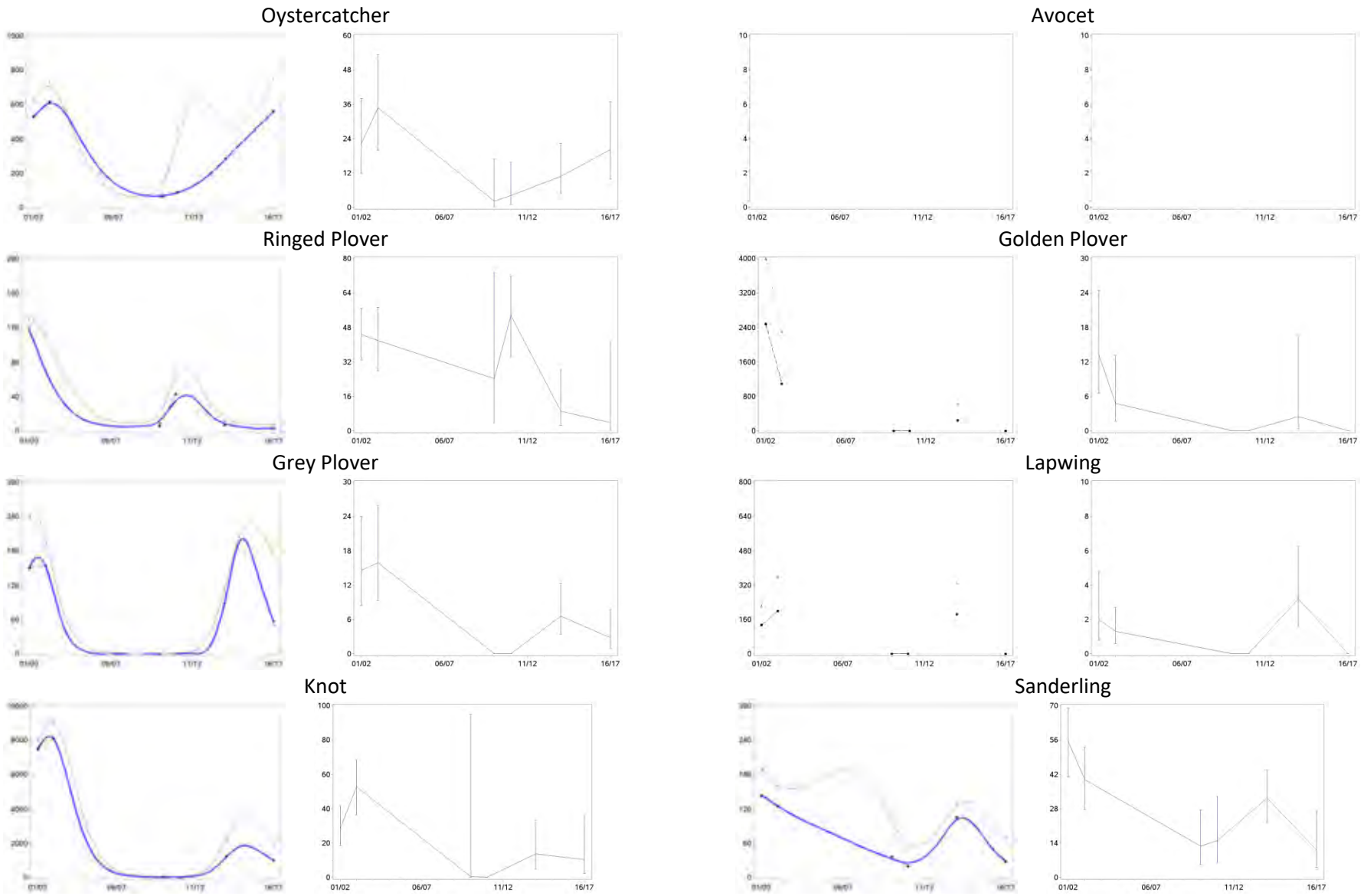

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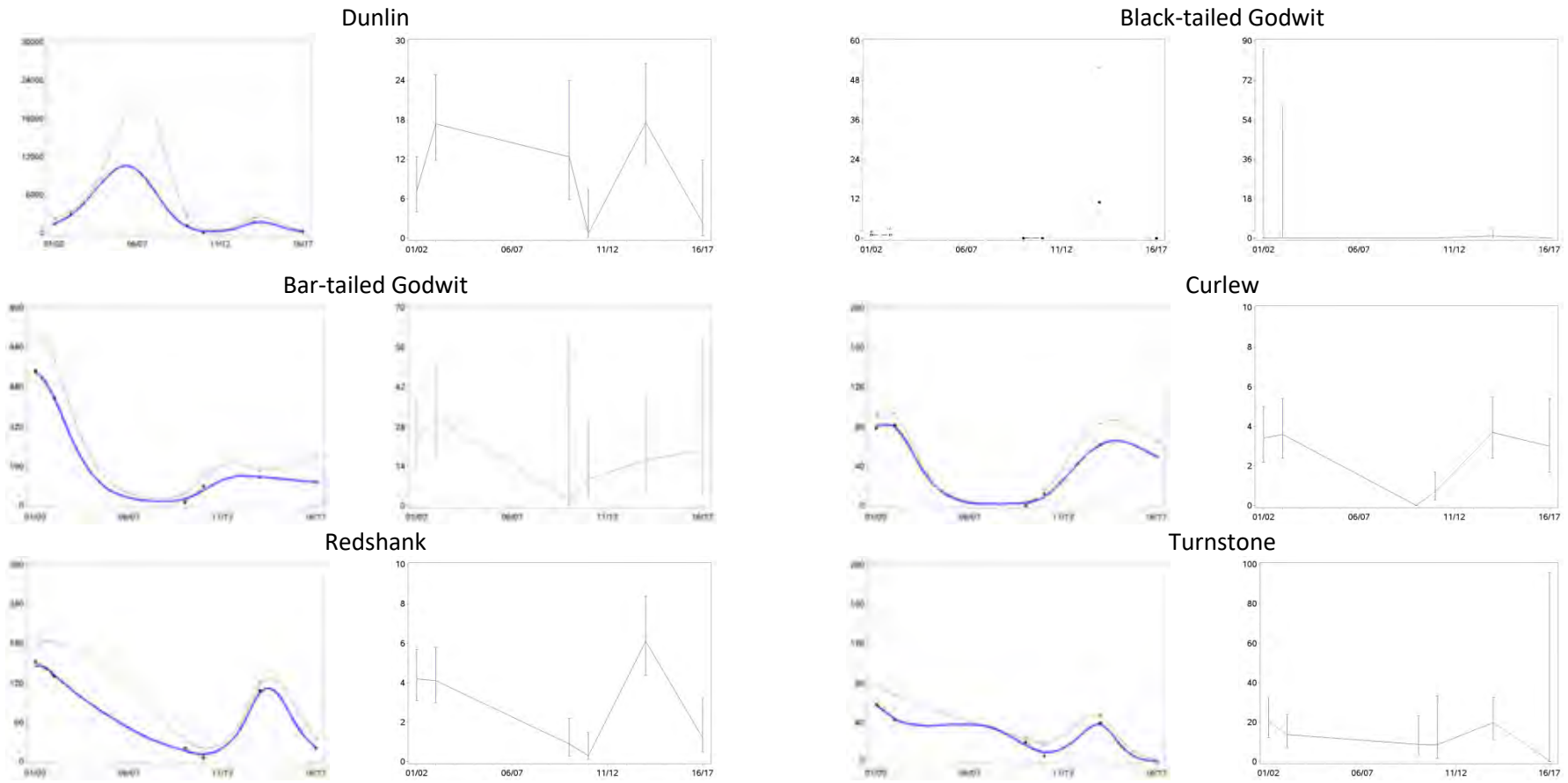

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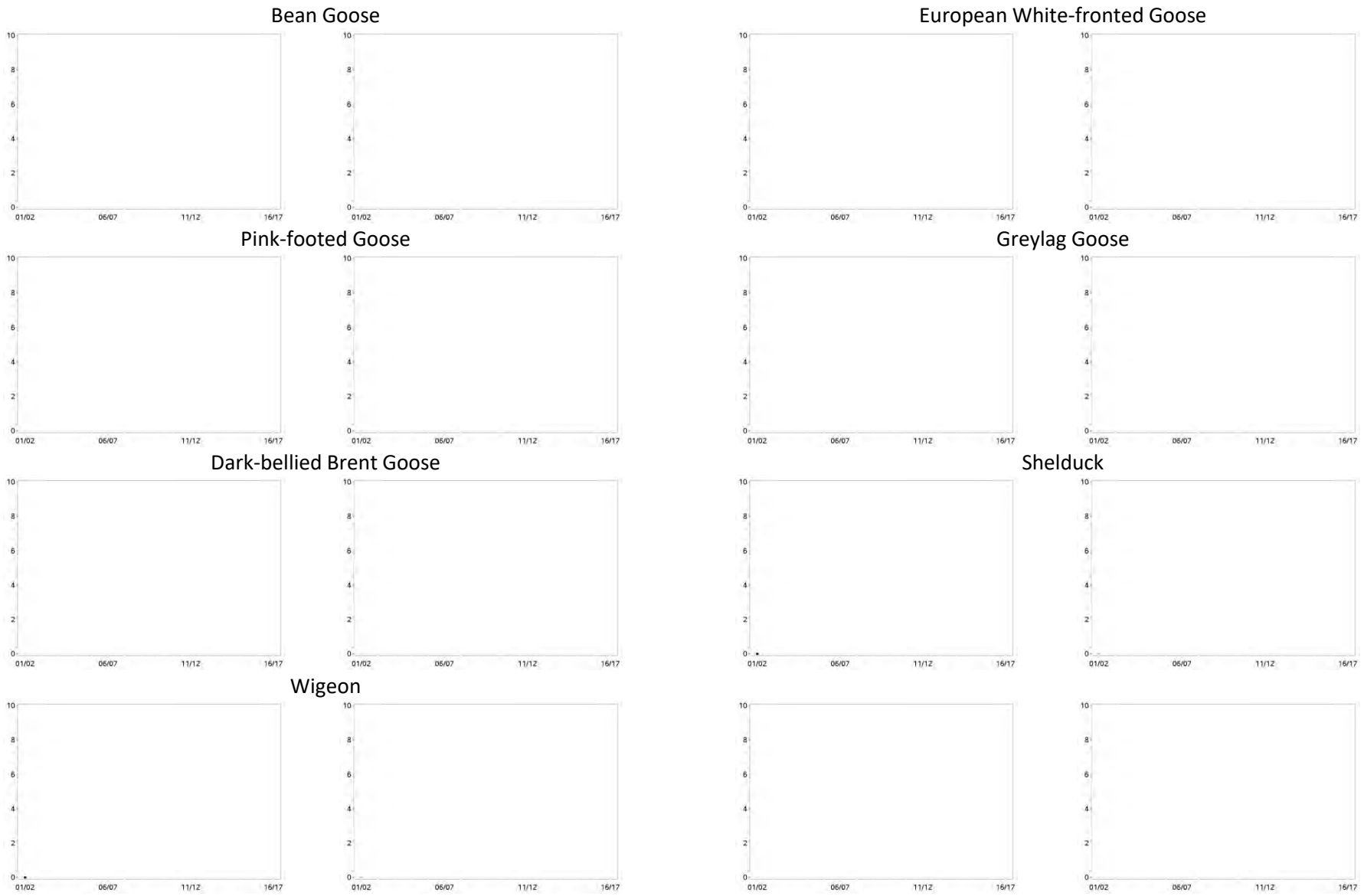
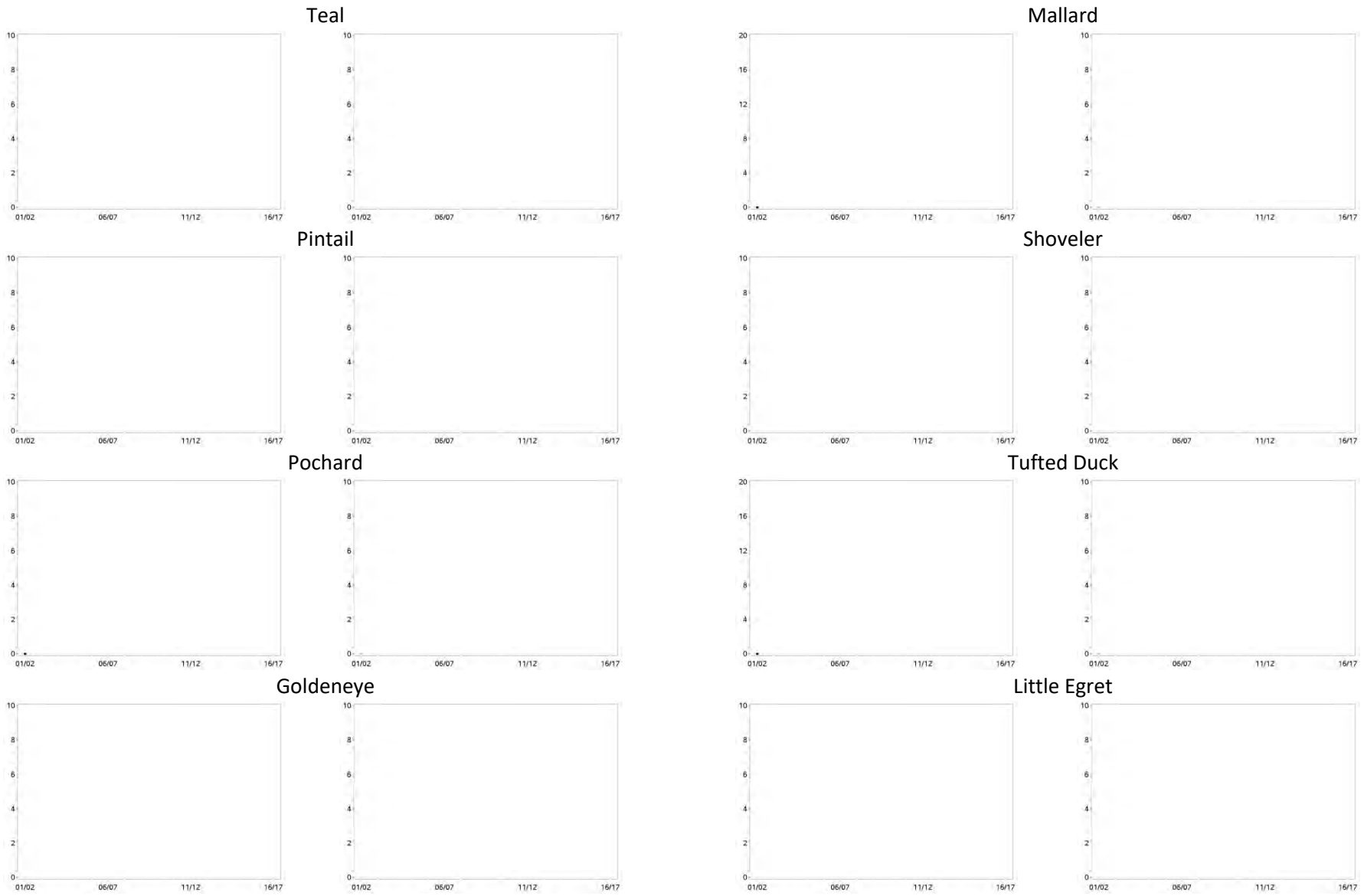


Figure A.38403. Population trends of each species in sector 38403 (Cleethorpes North Wall to Grimsby) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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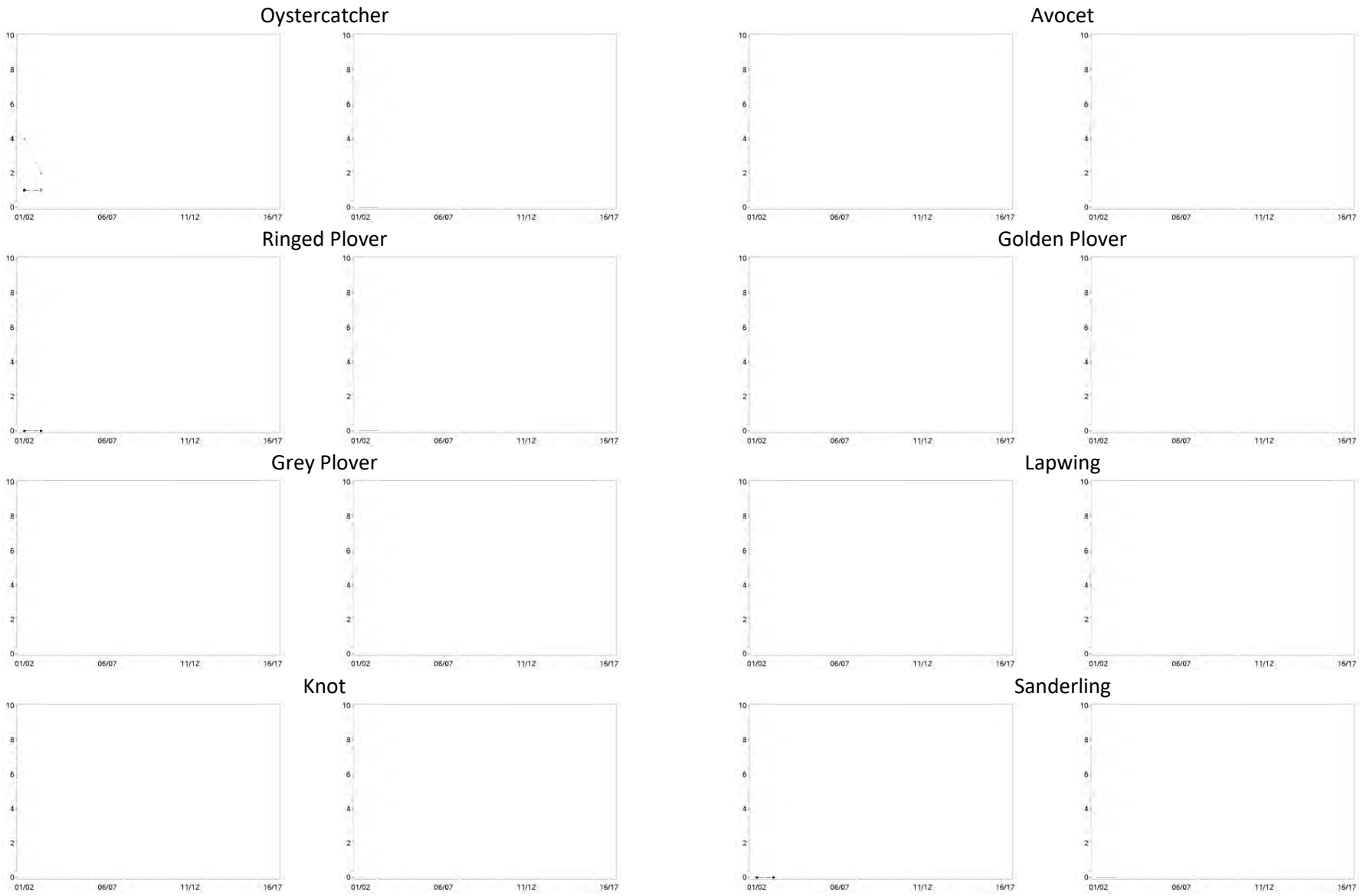

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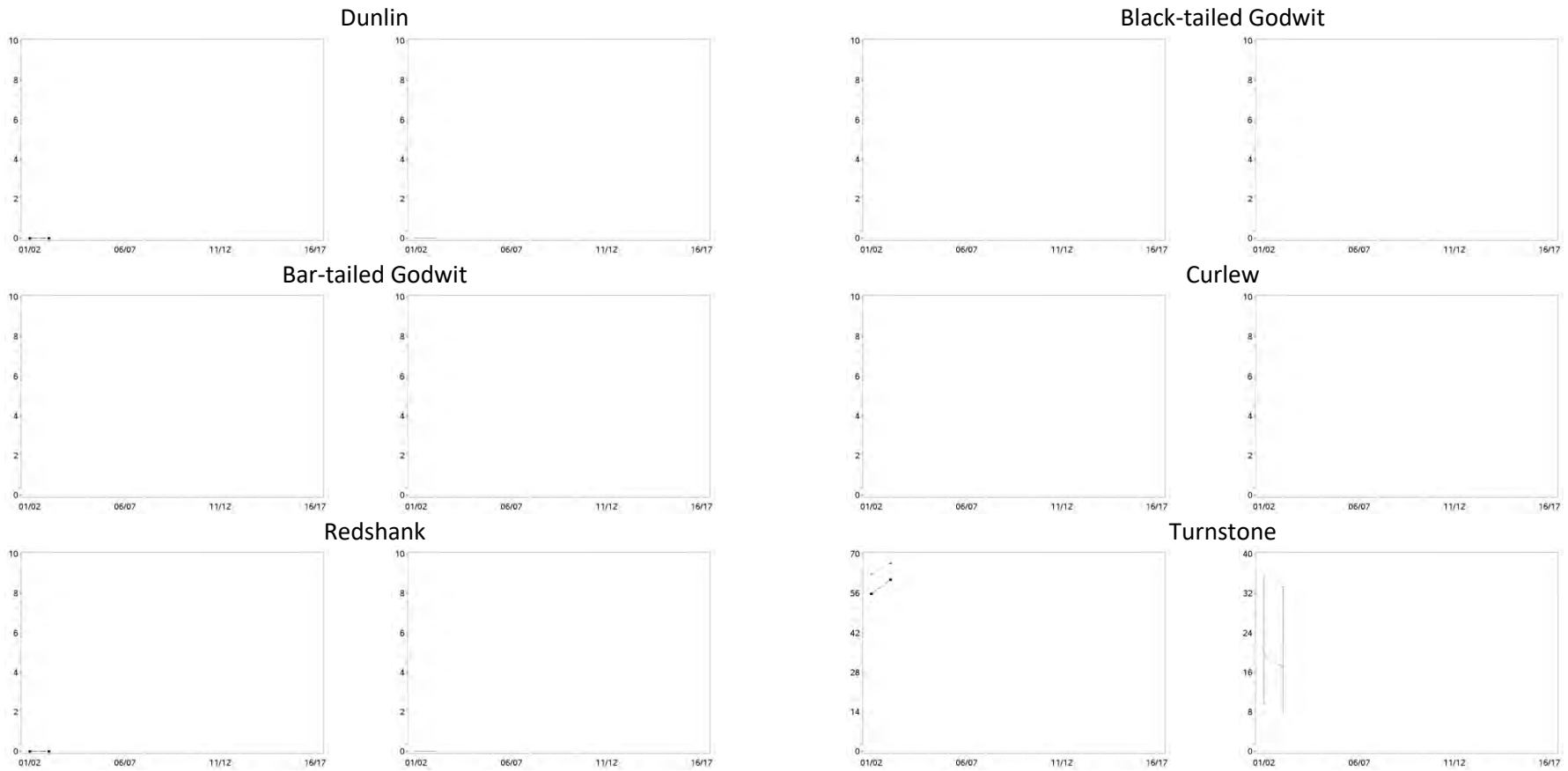

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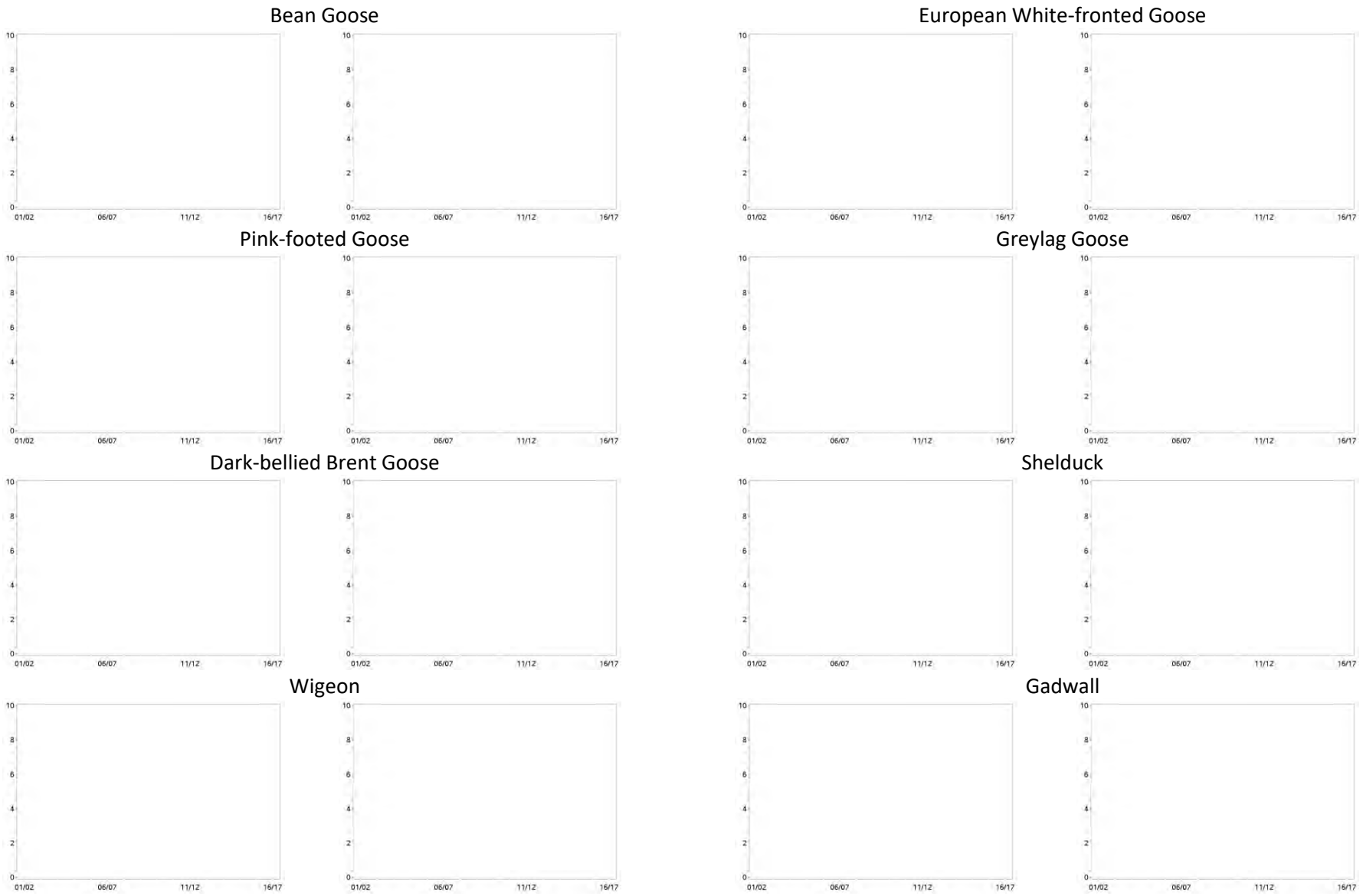
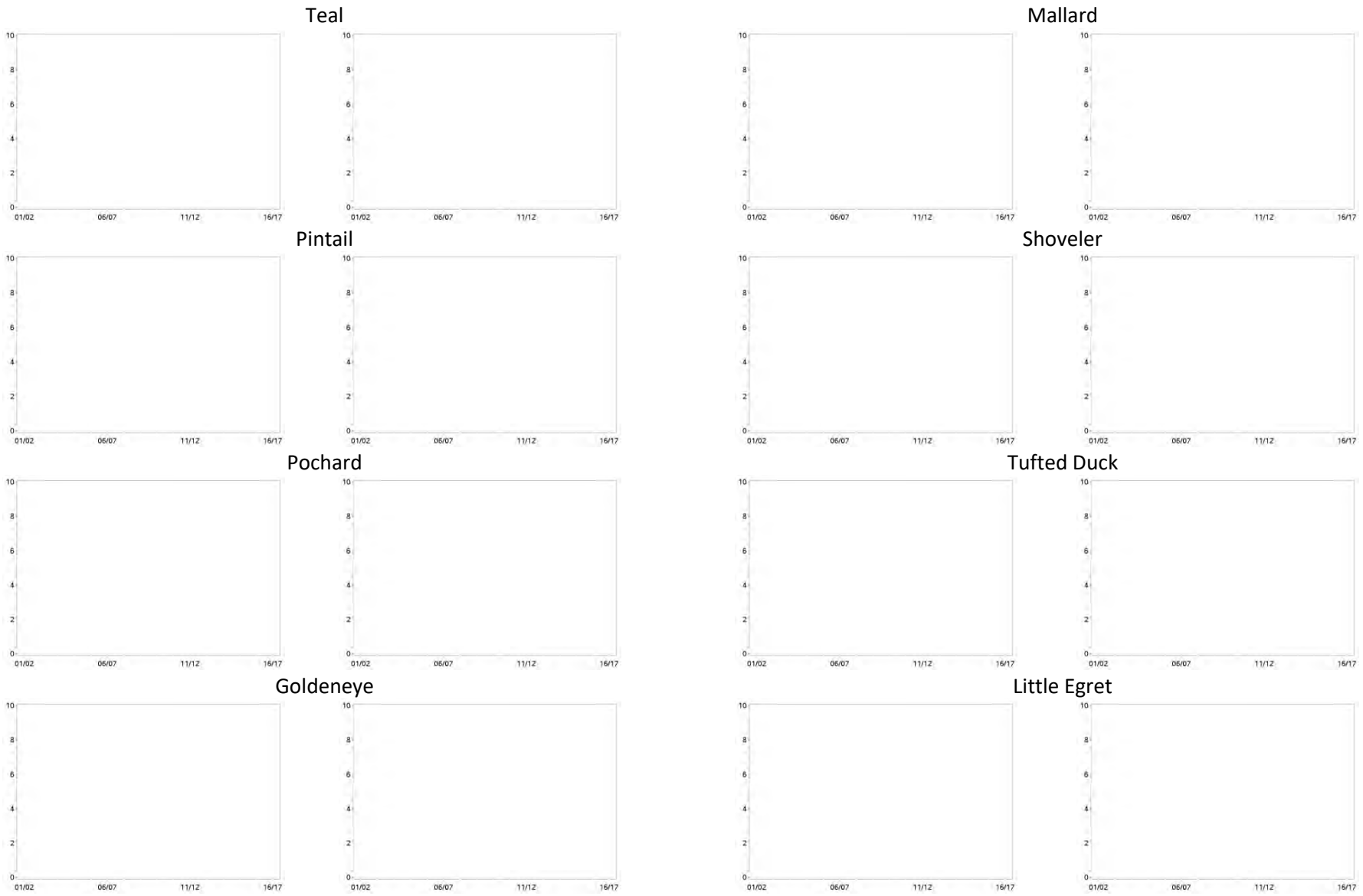


Figure A.38404. Population trends of each species in sector 38404 (Grimsby Commercial Docks) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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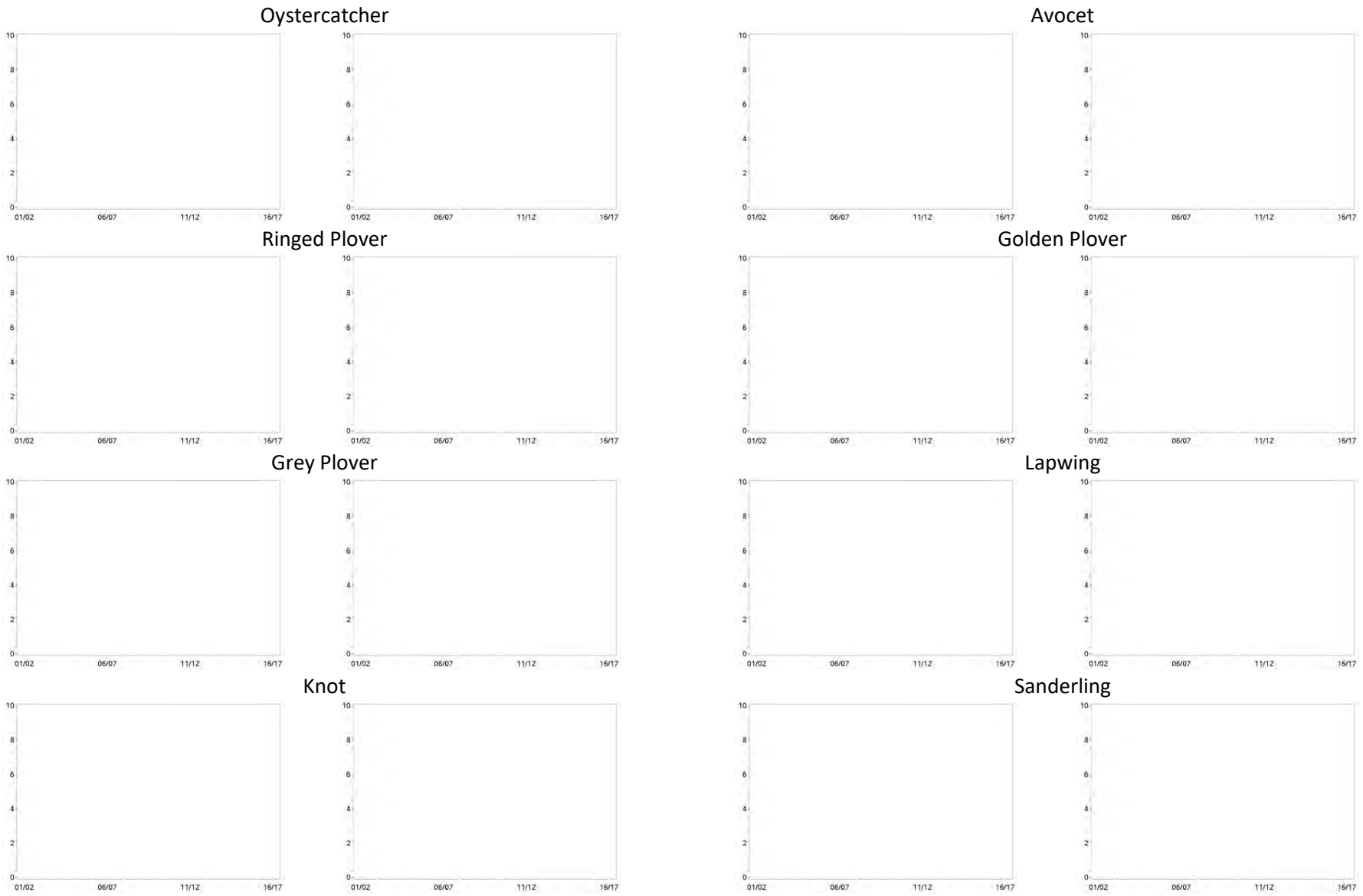

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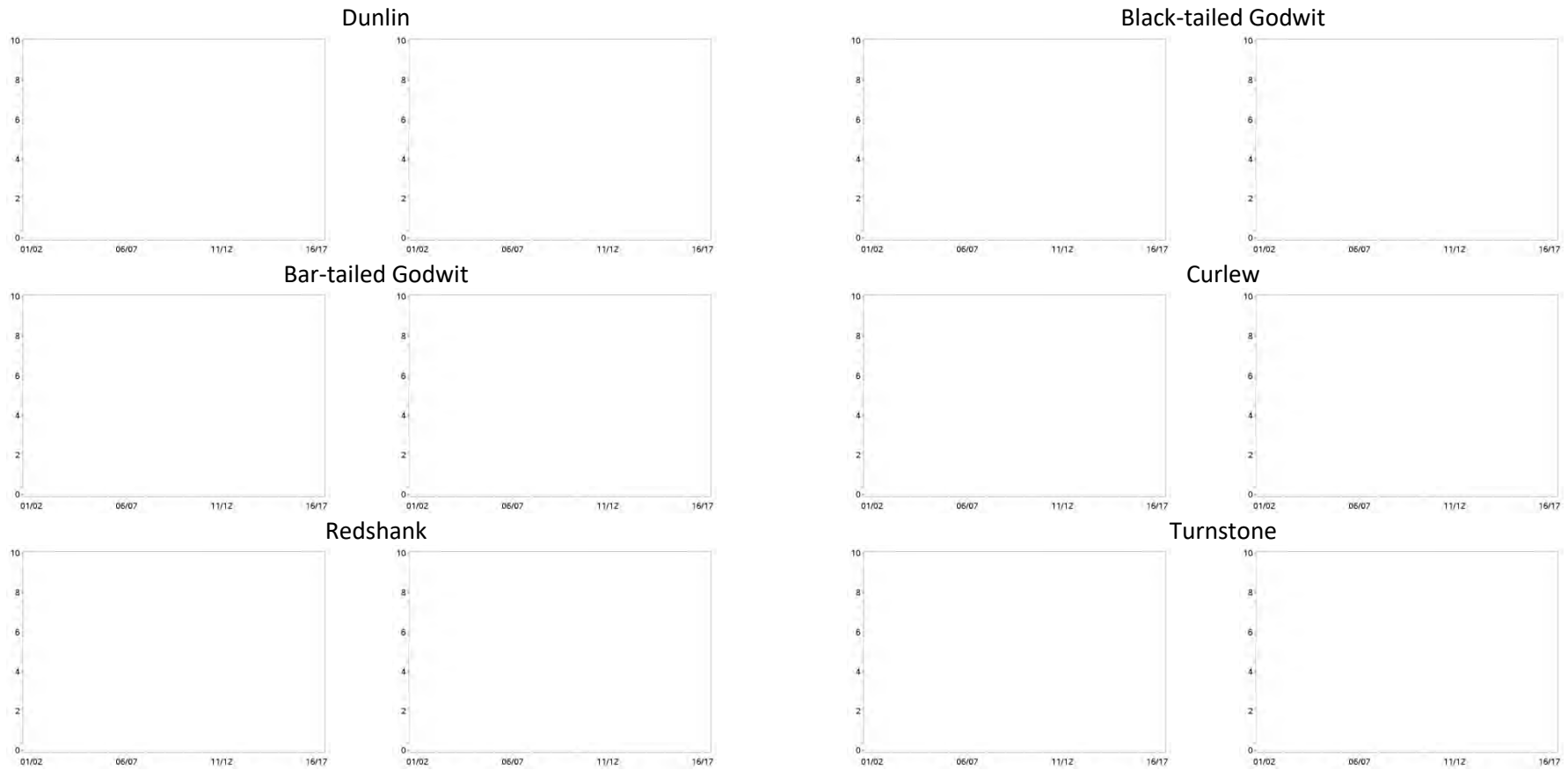

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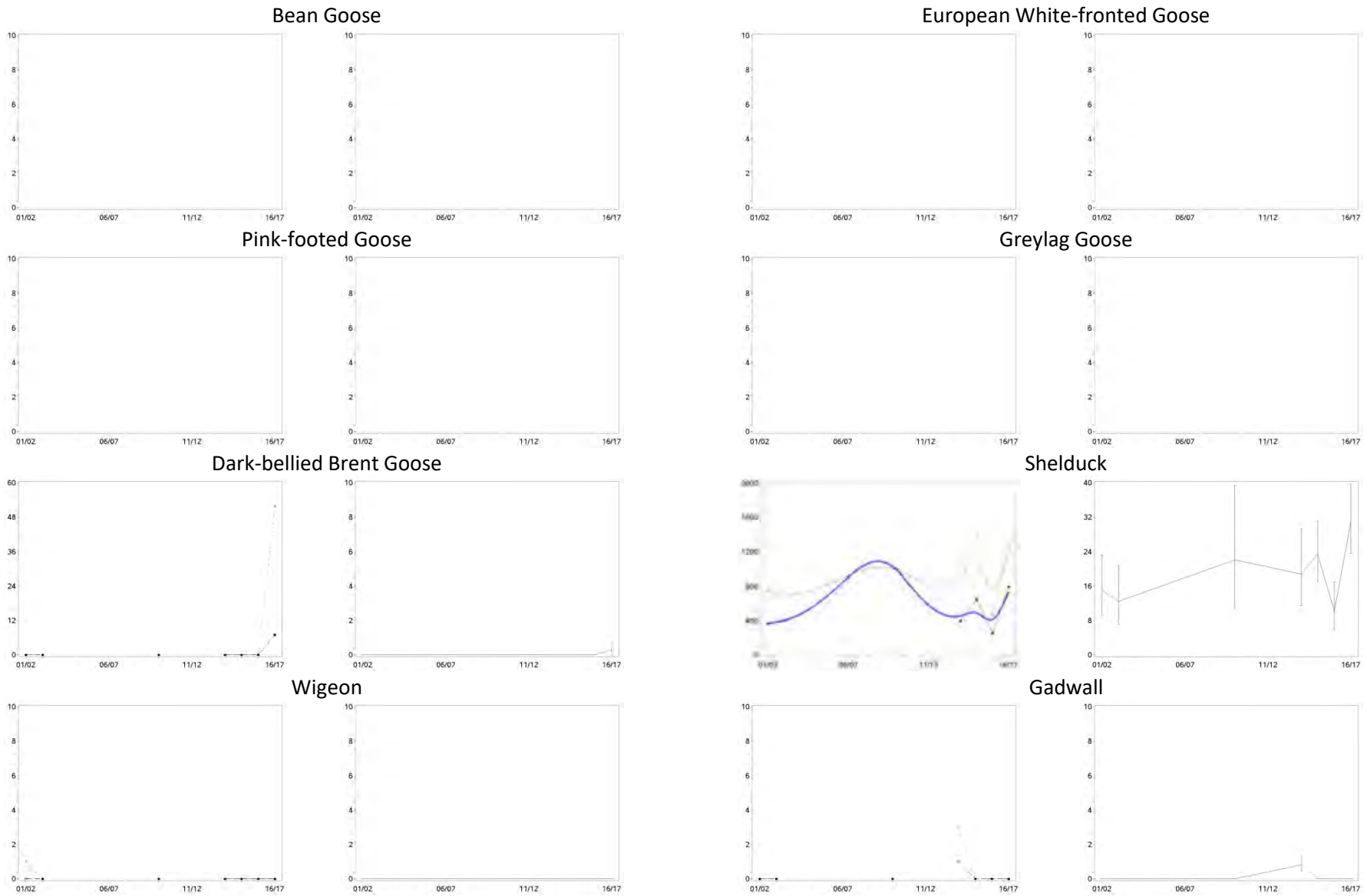
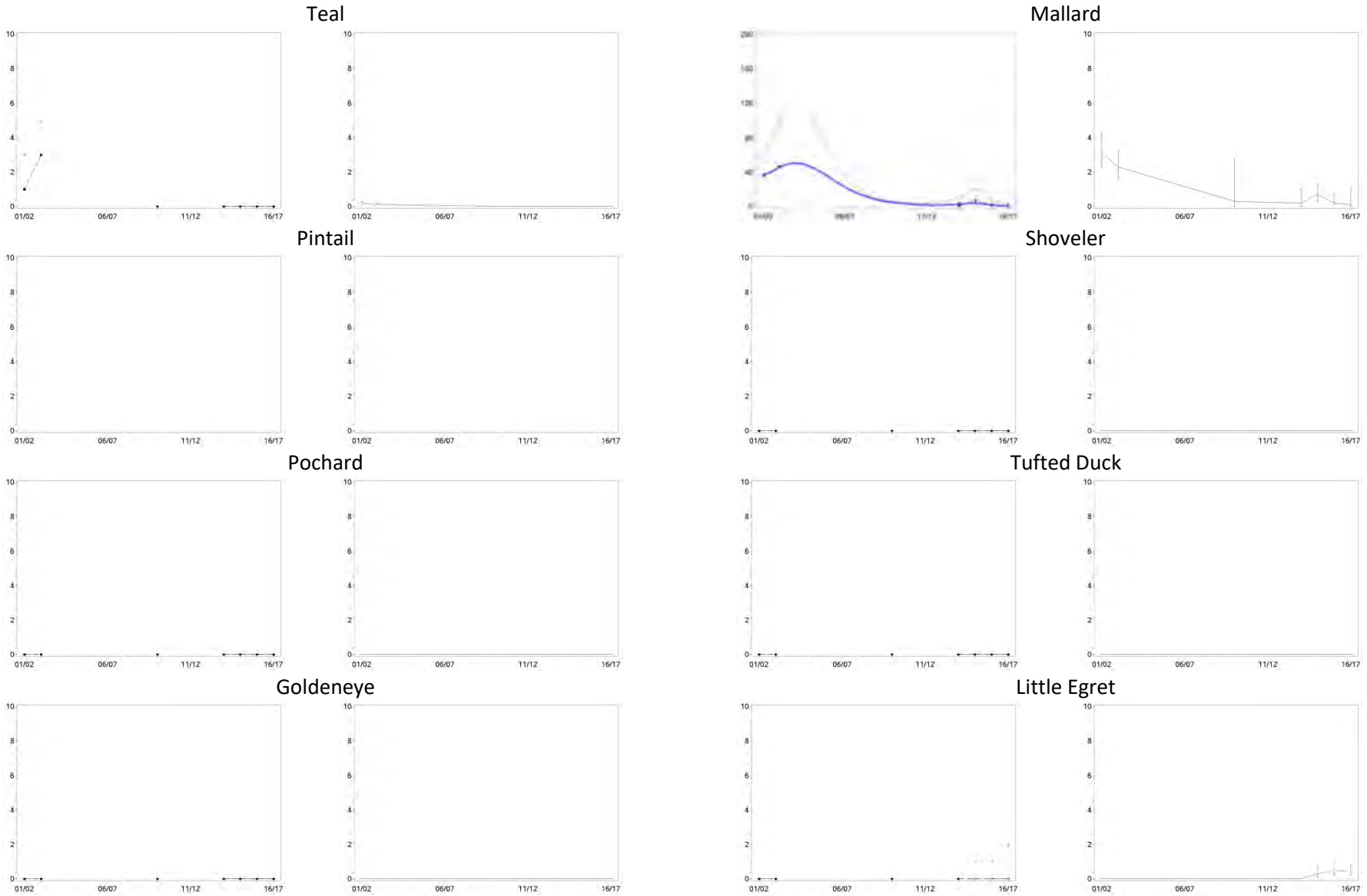


Figure A.38405. Population trends of each species in sector 38405 (Pyewipe) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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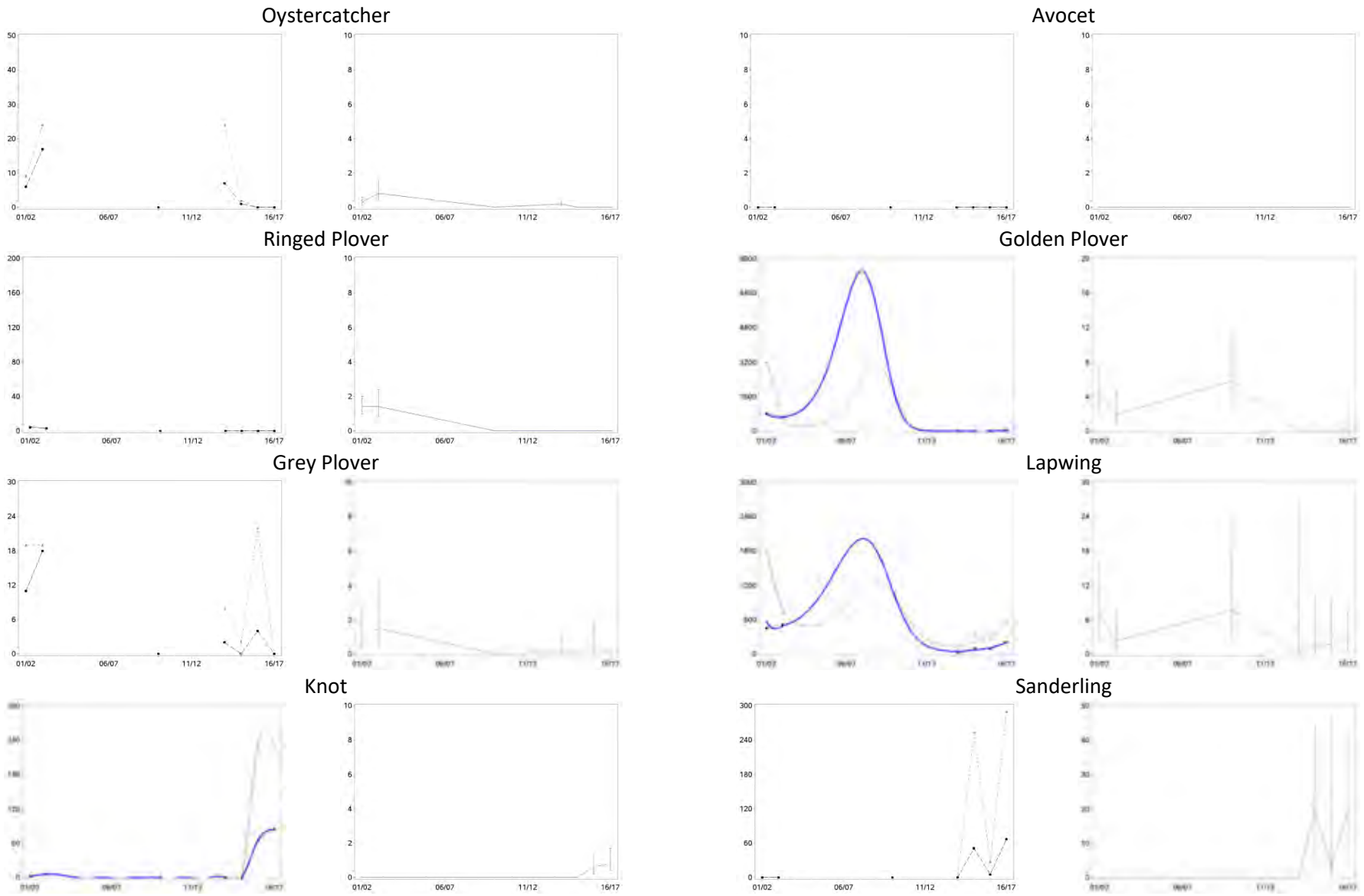

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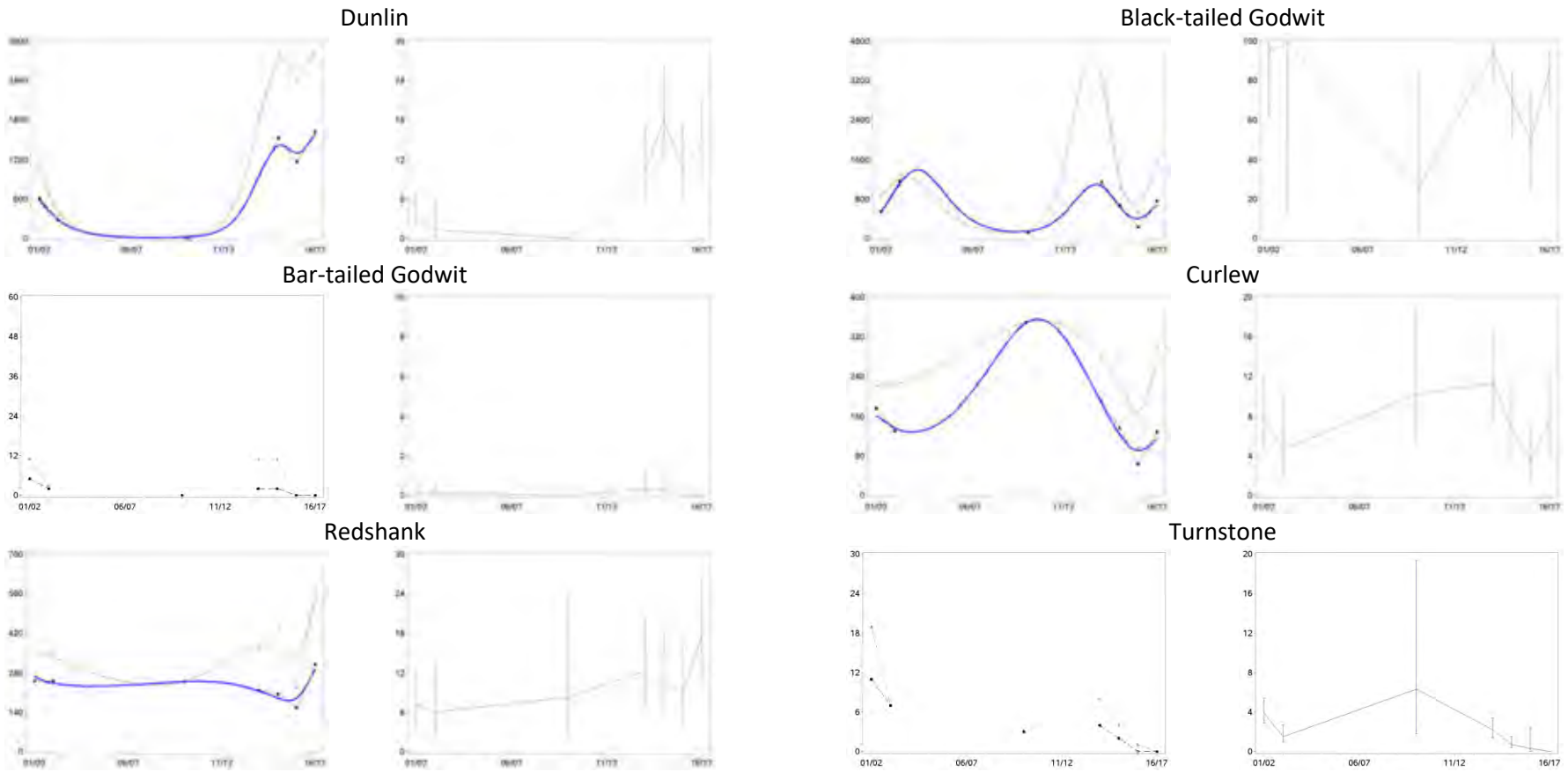

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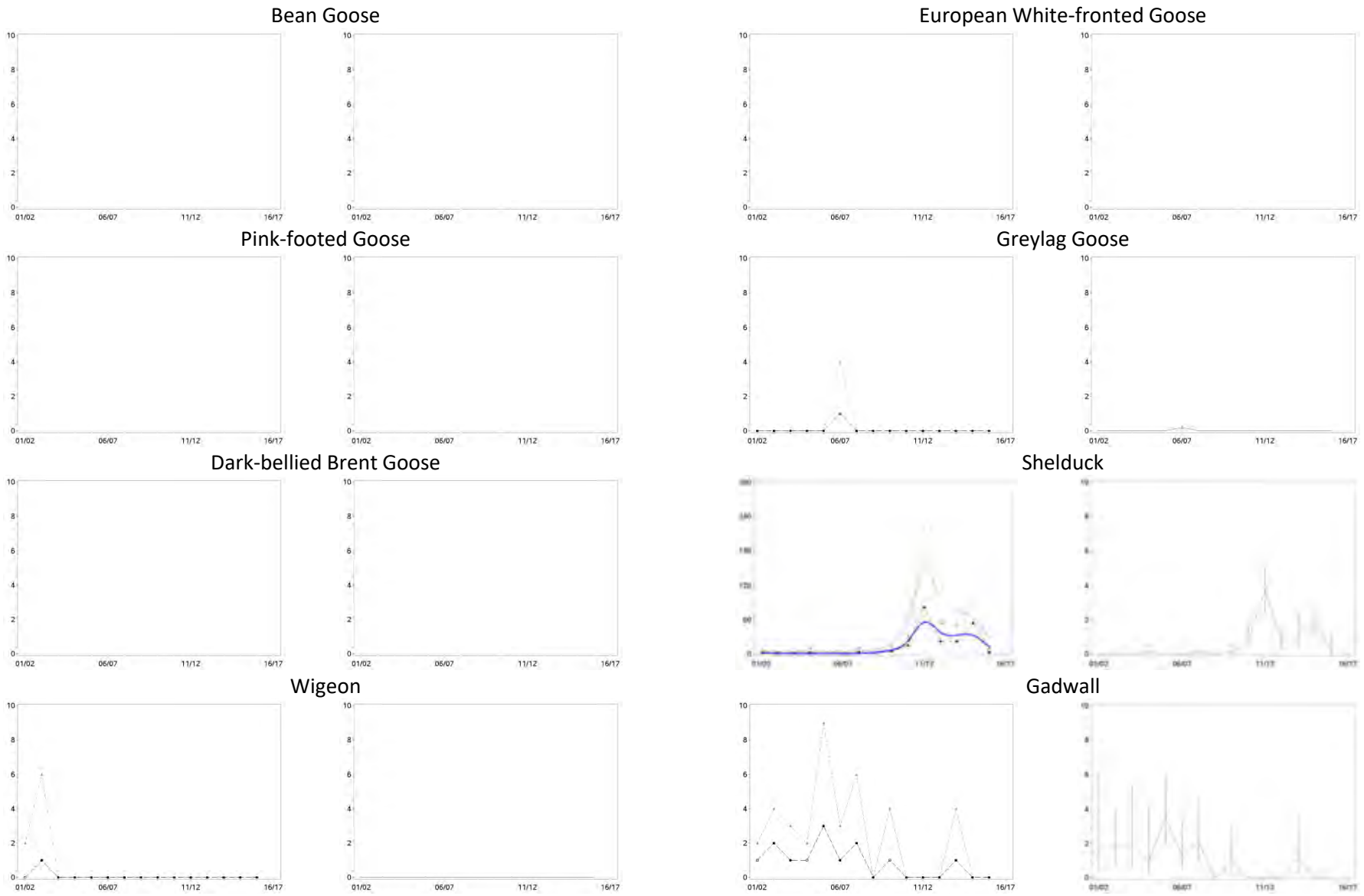
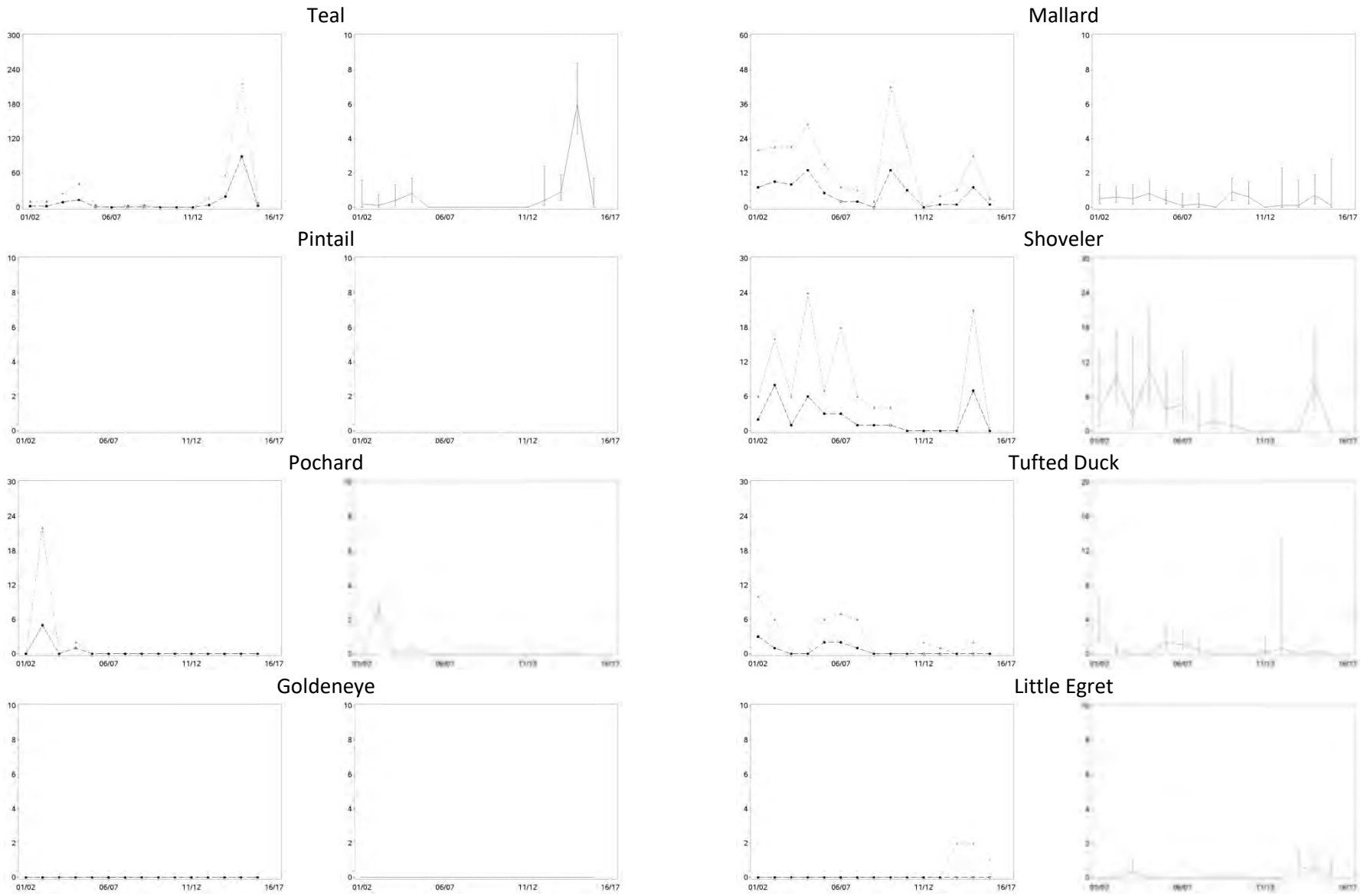


Figure A.38406. Population trends of each species in sector 38406 (Killingholme Marshes - Sector J) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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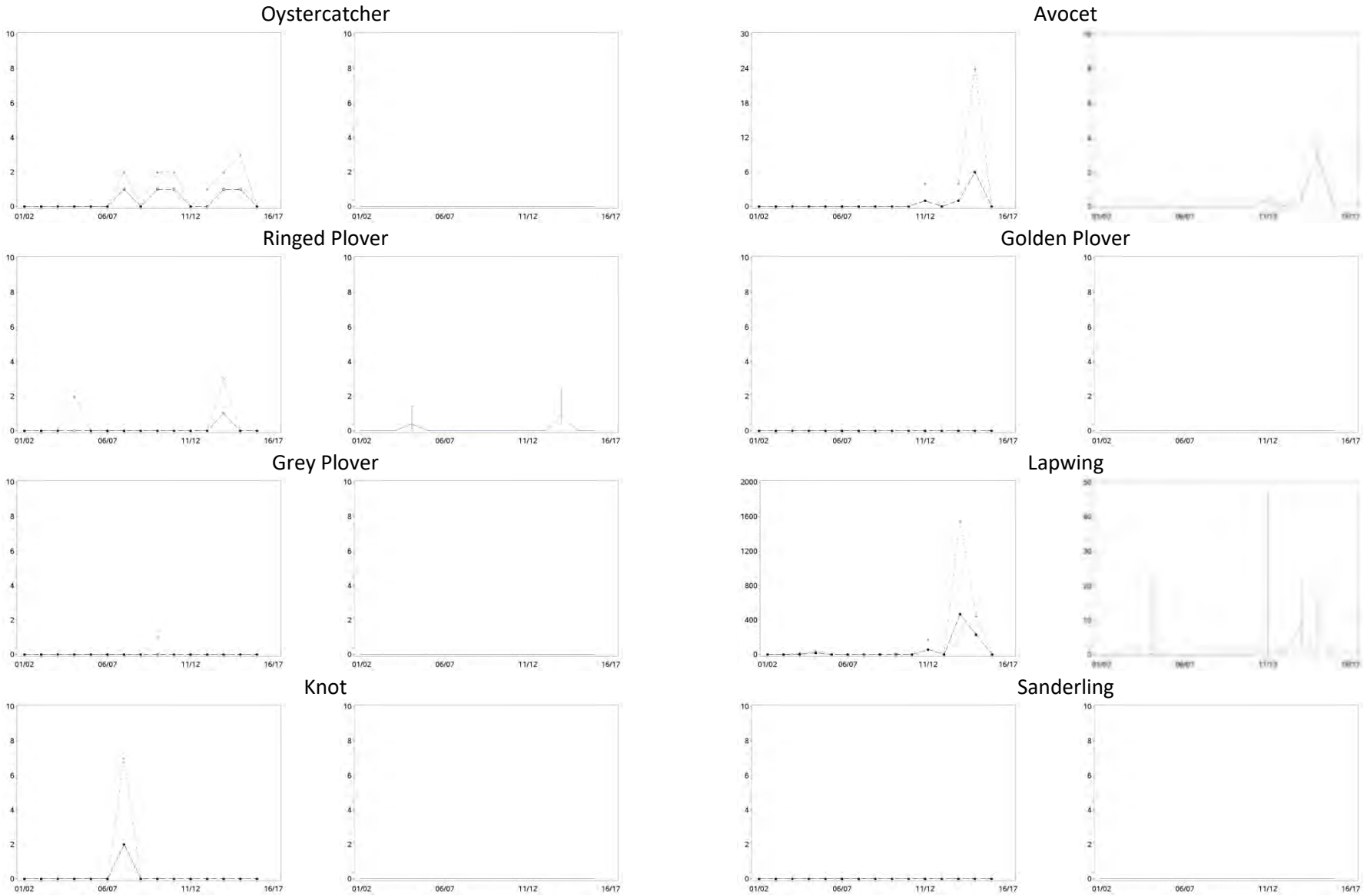

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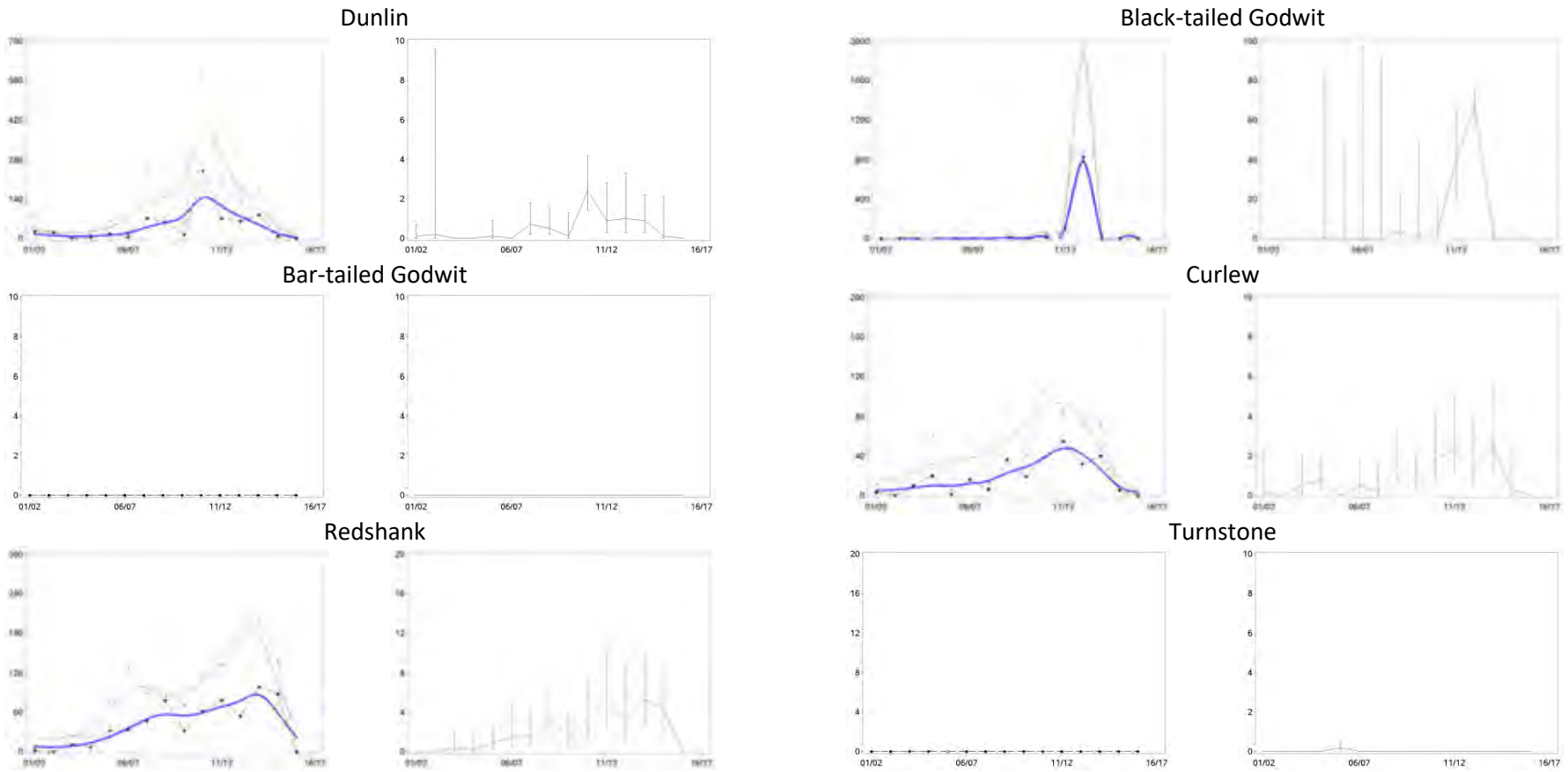

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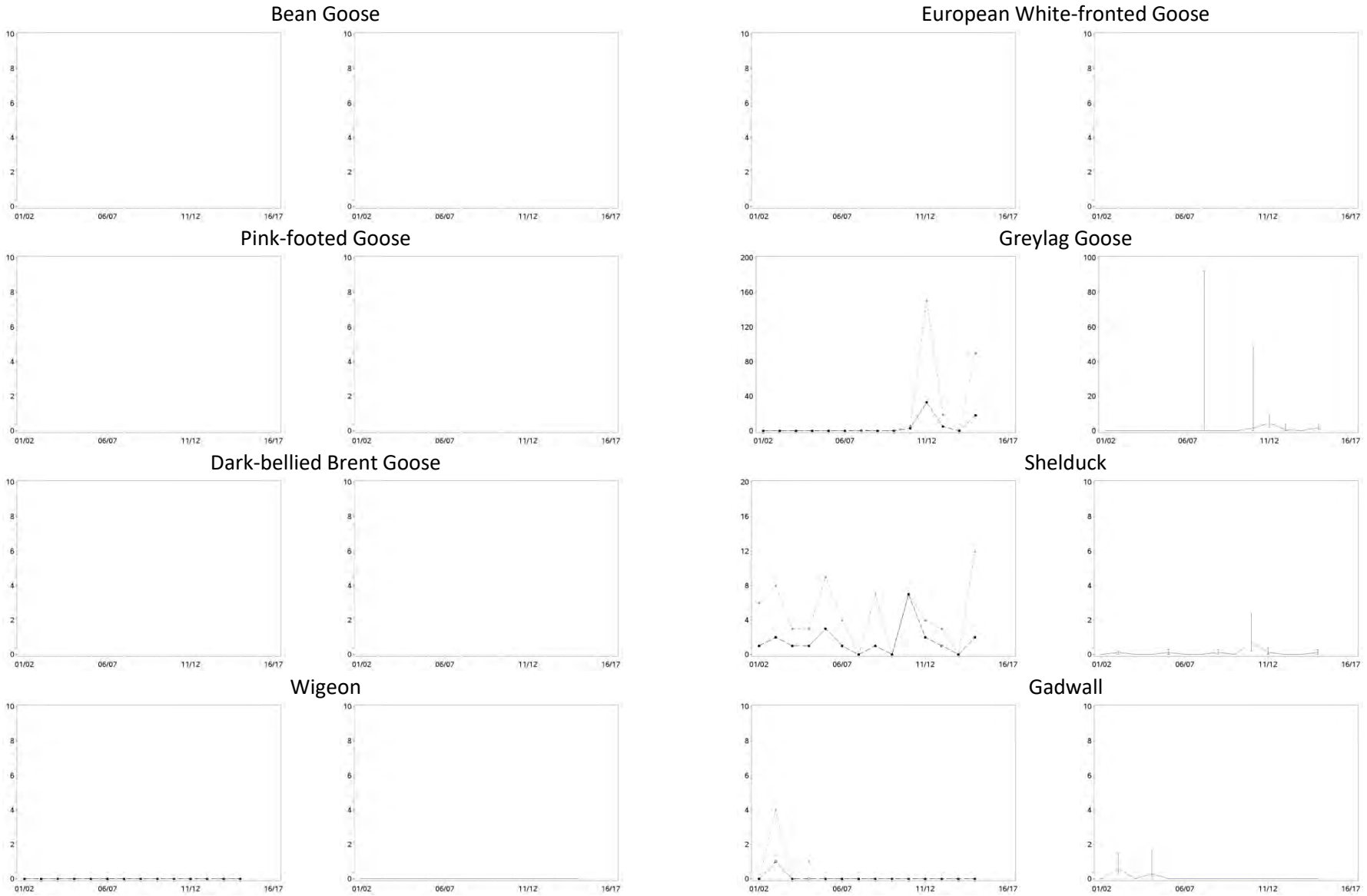
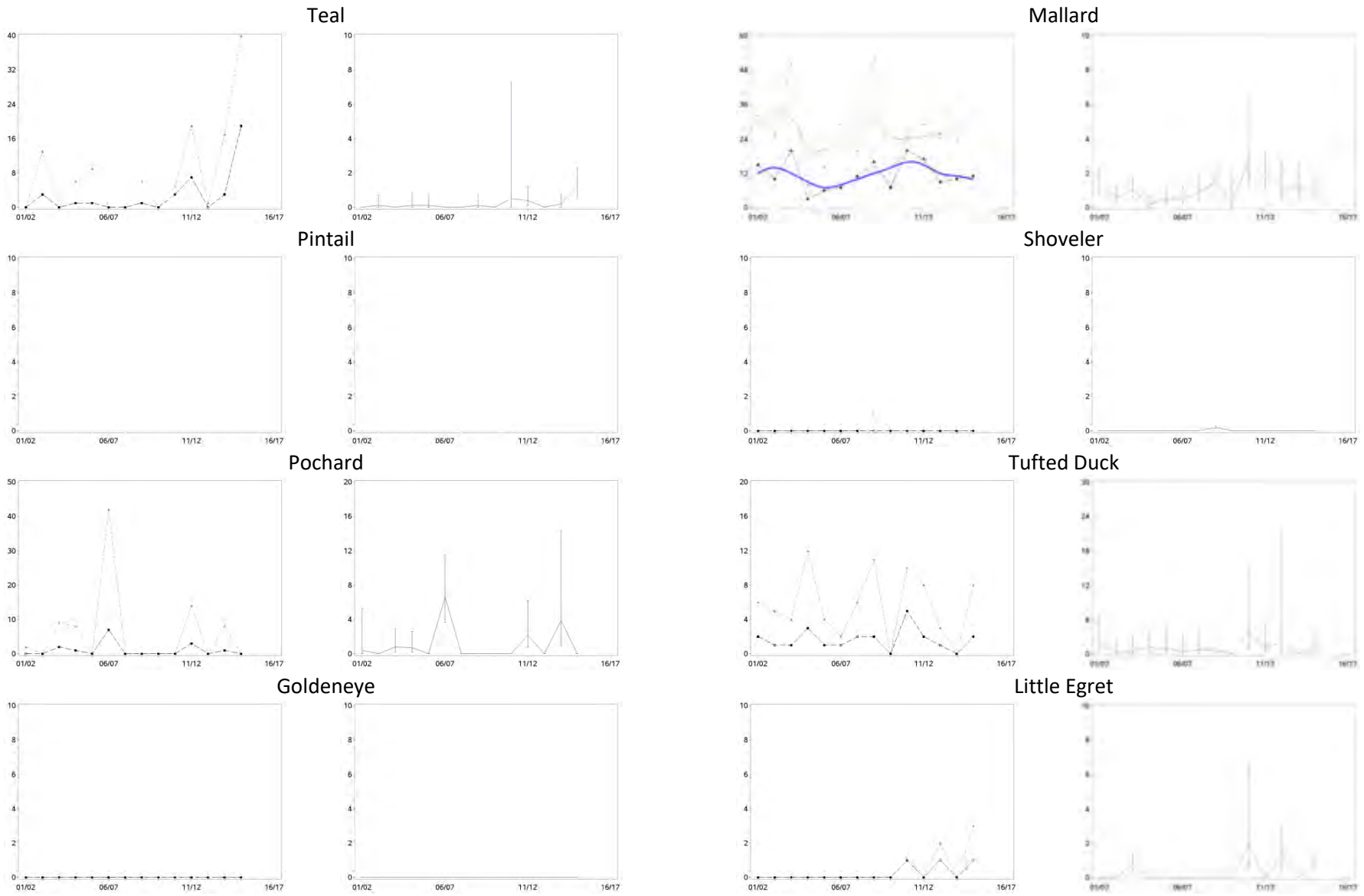


Figure A.38407. Population trends of each species in sector 38407 (Halton Marshes - Sector I) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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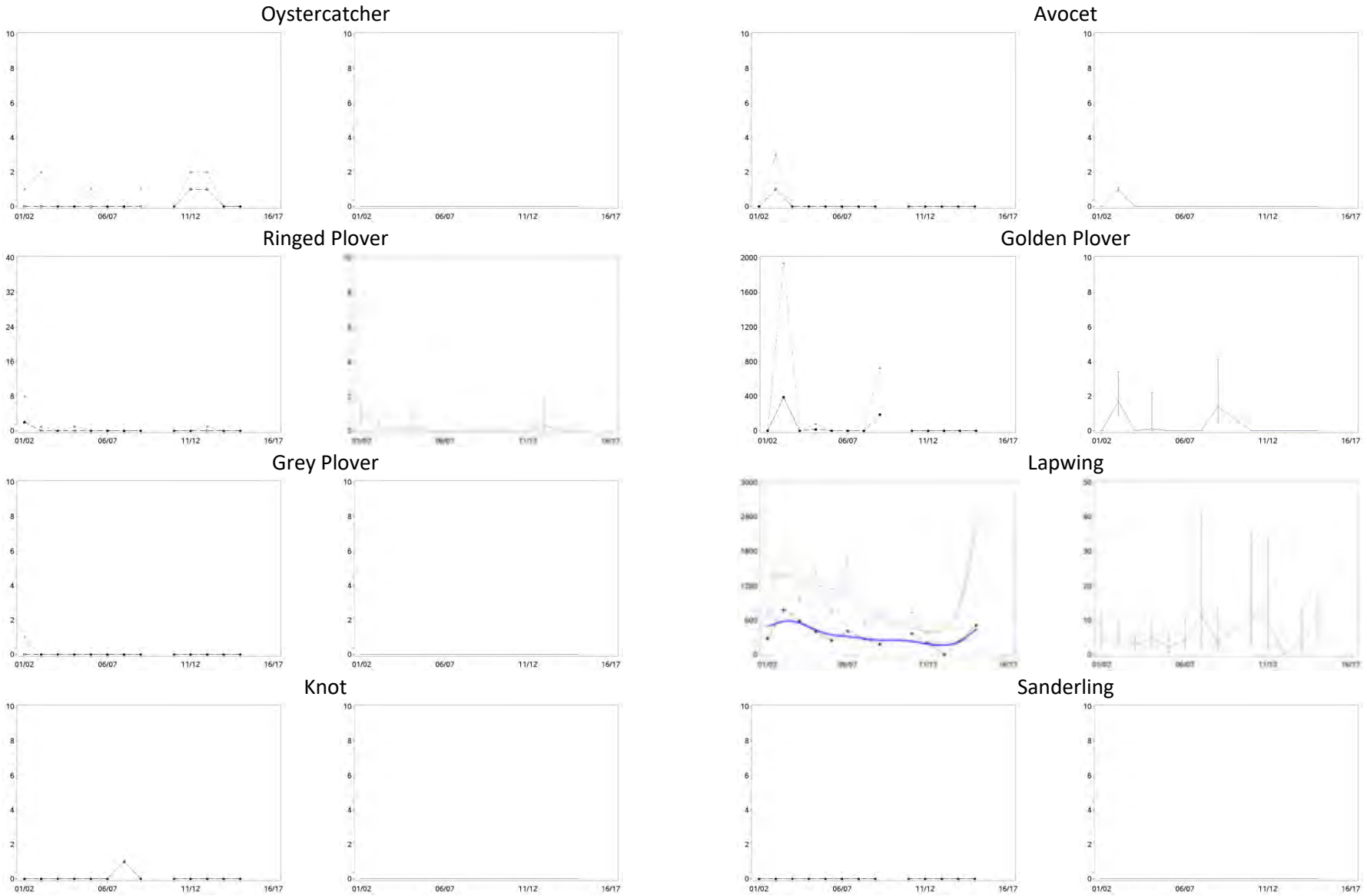

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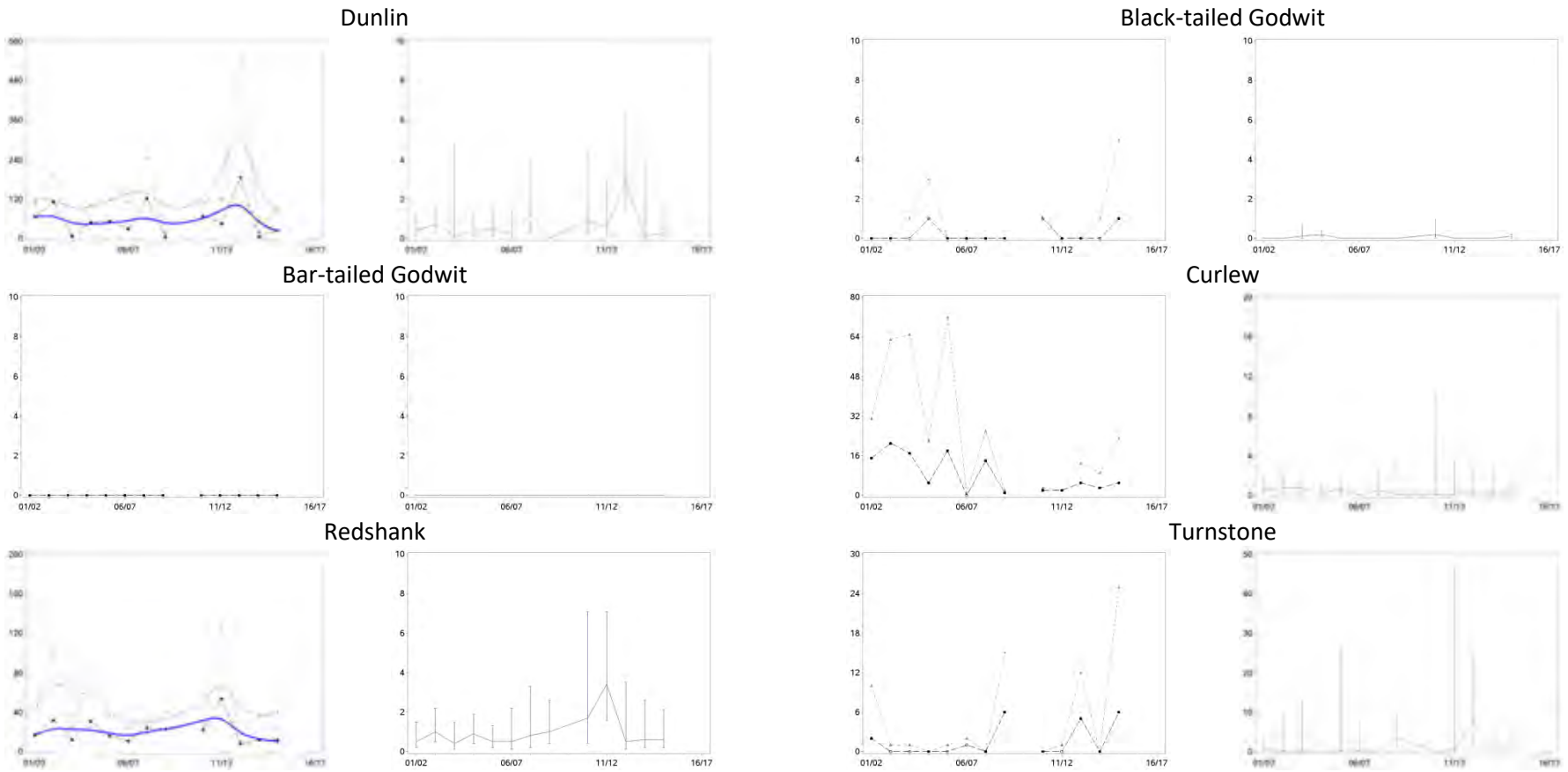

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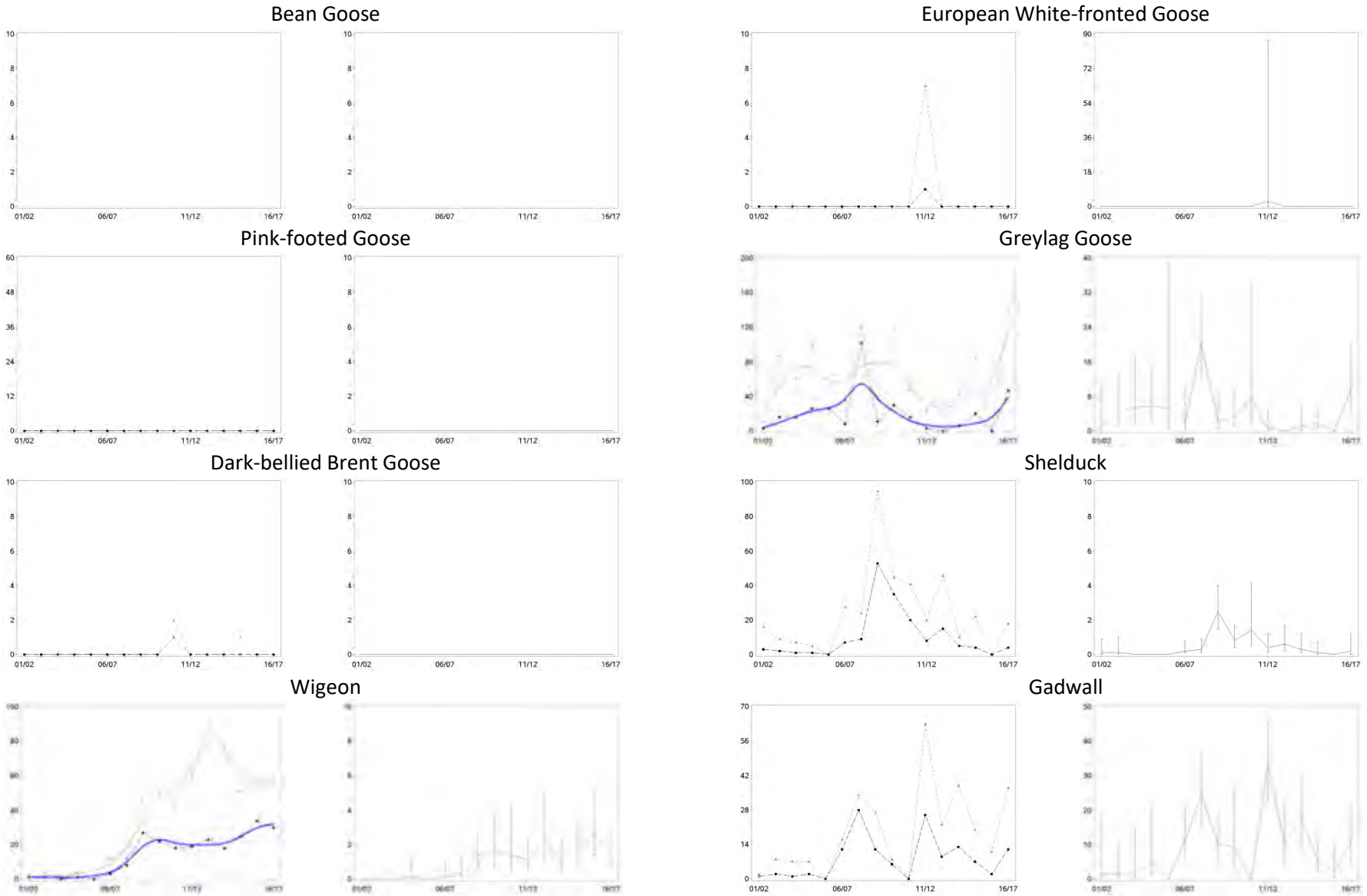
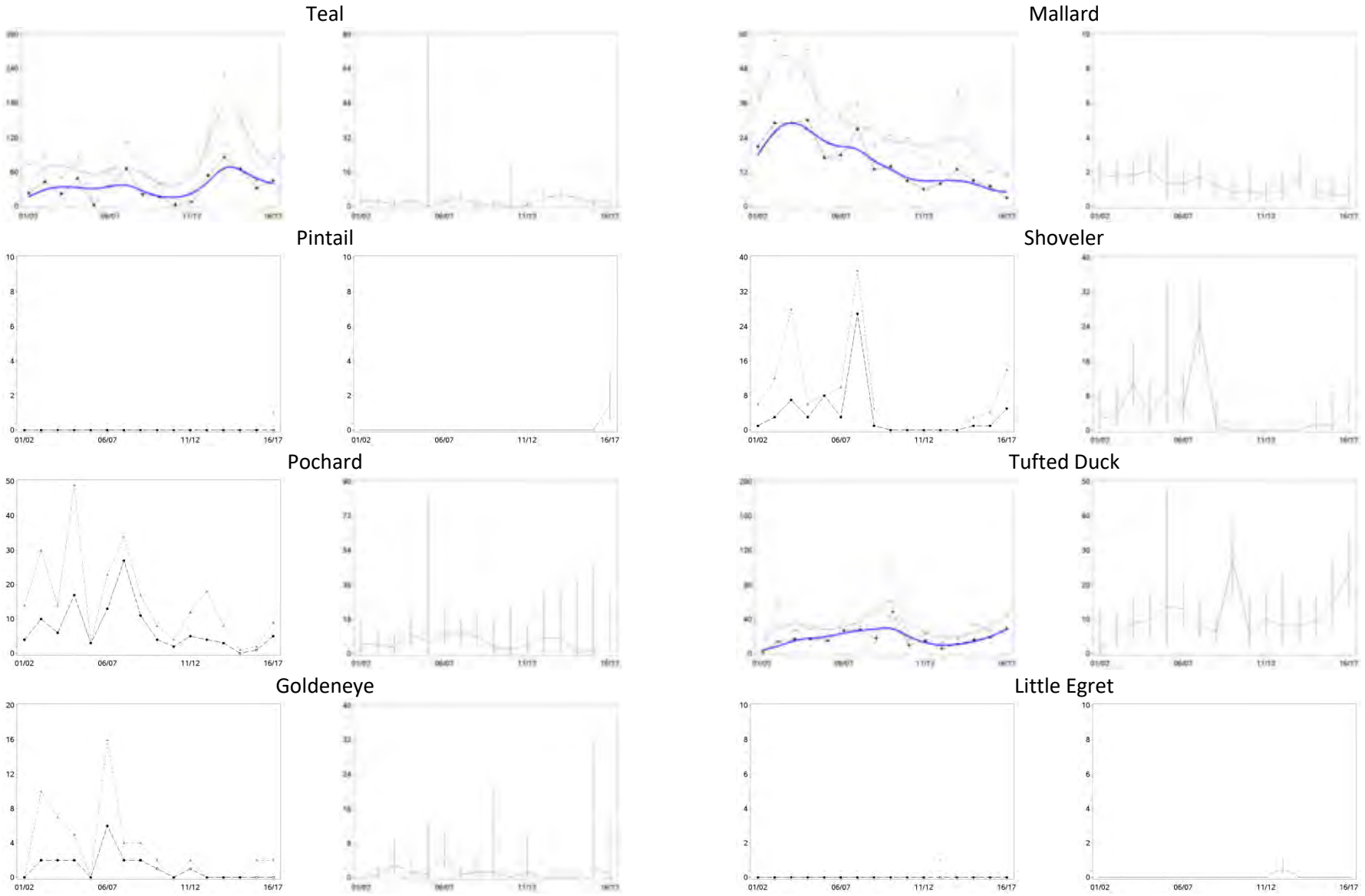


Figure A.38409. Population trends of each species in sector 38409 (Barton Cliff - Sector E2) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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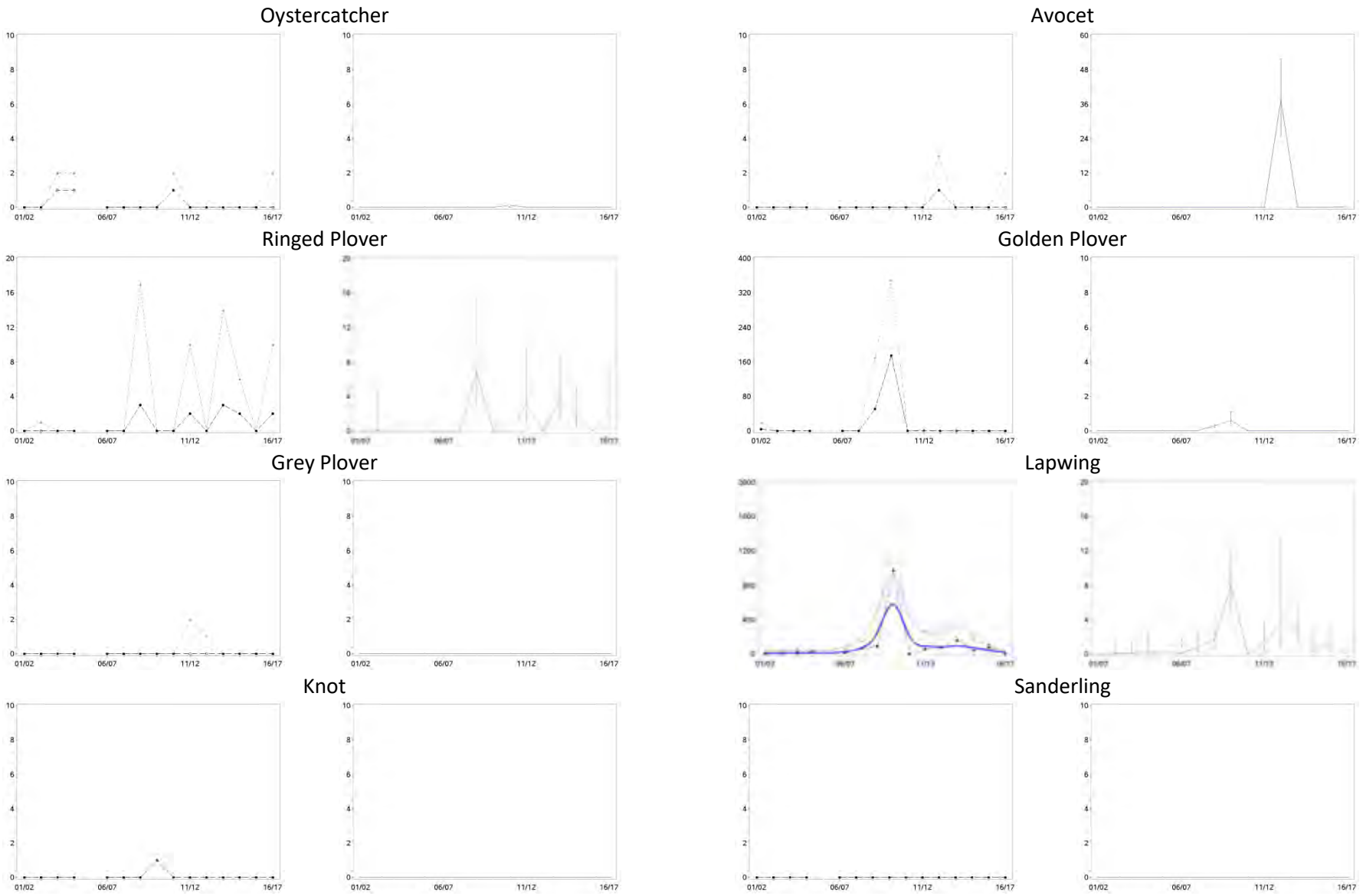

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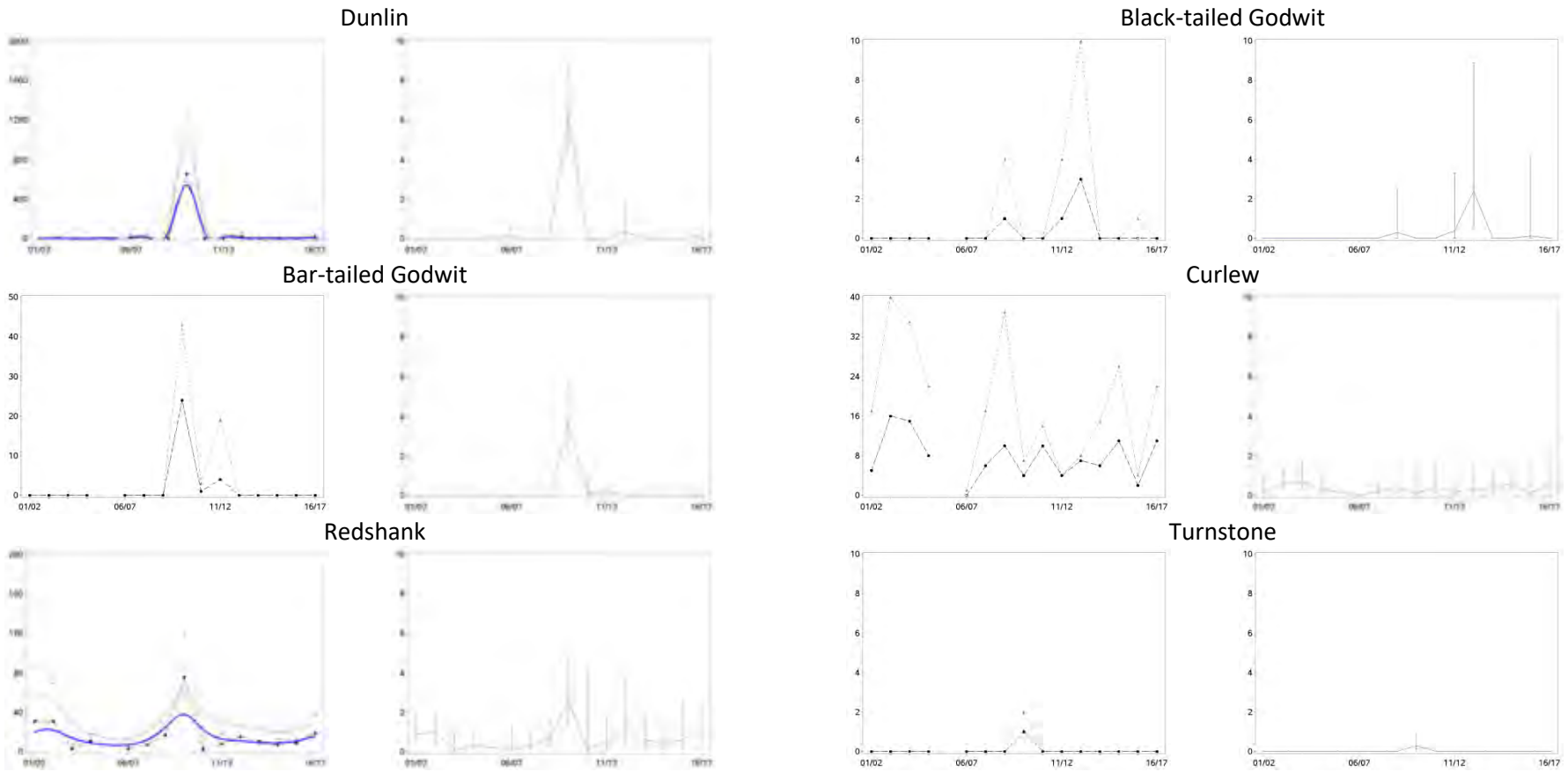

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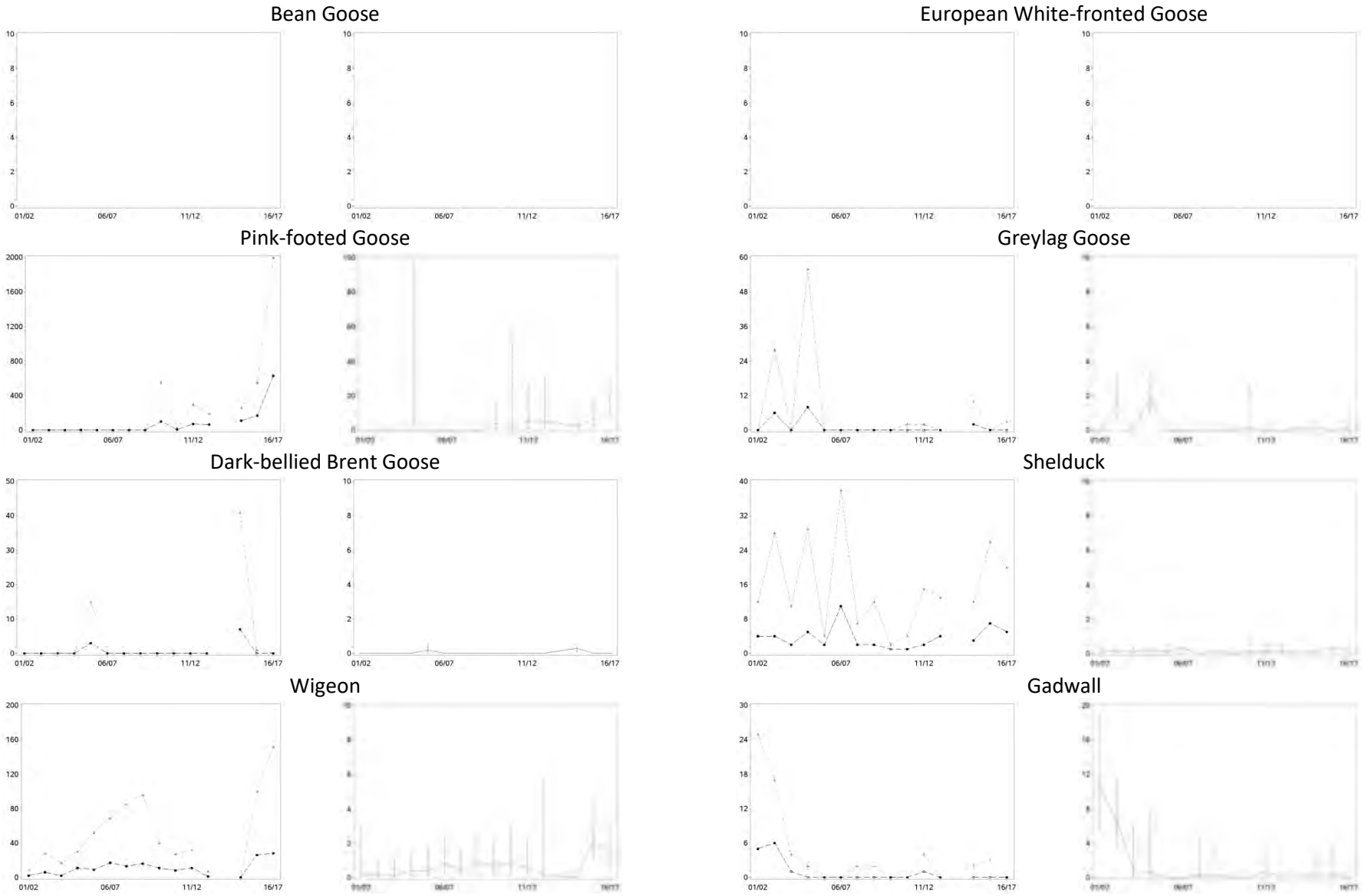
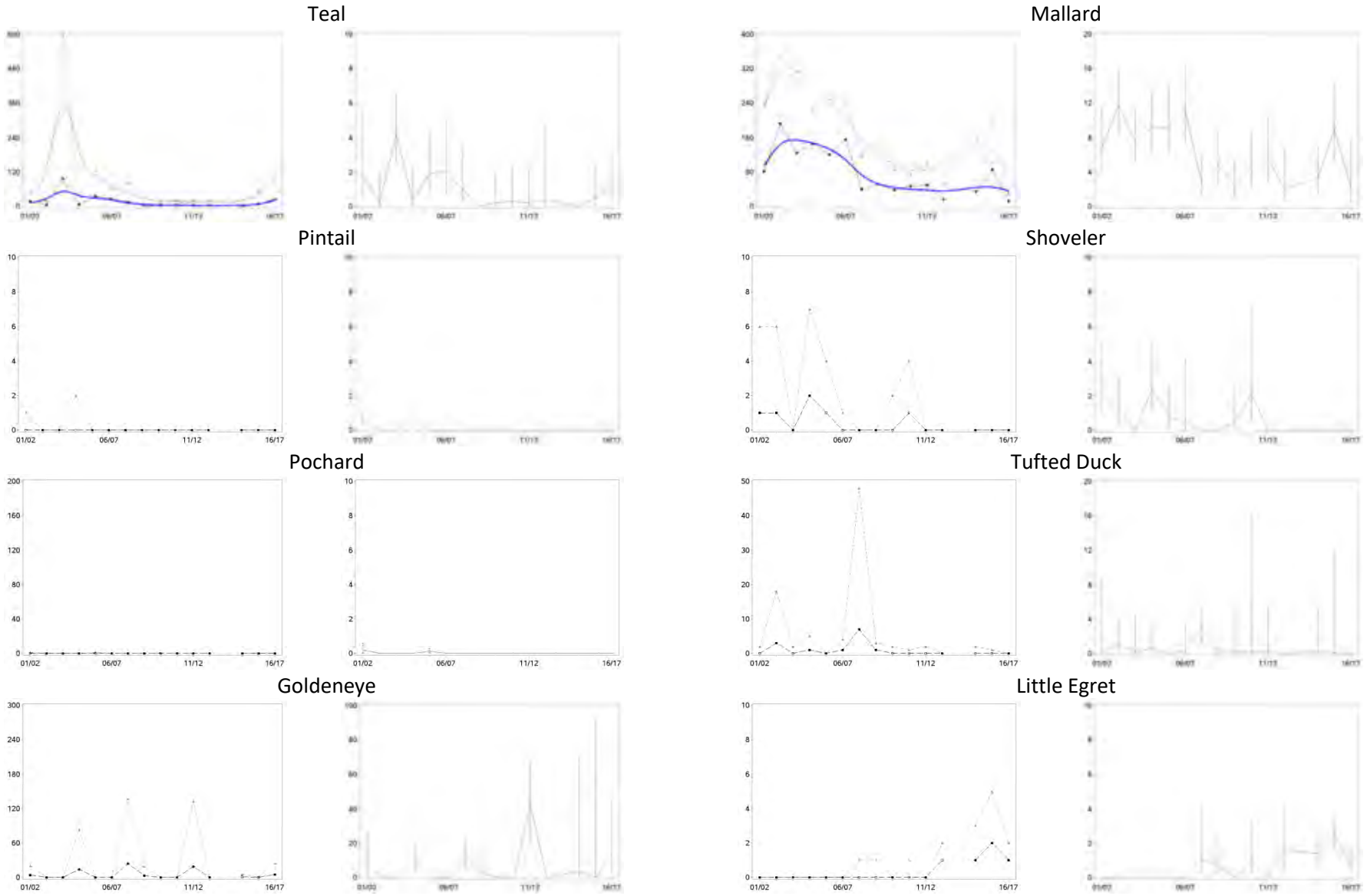


Figure A.38411. Population trends of each species in sector 38411 (Goxhill Marsh - Sector H) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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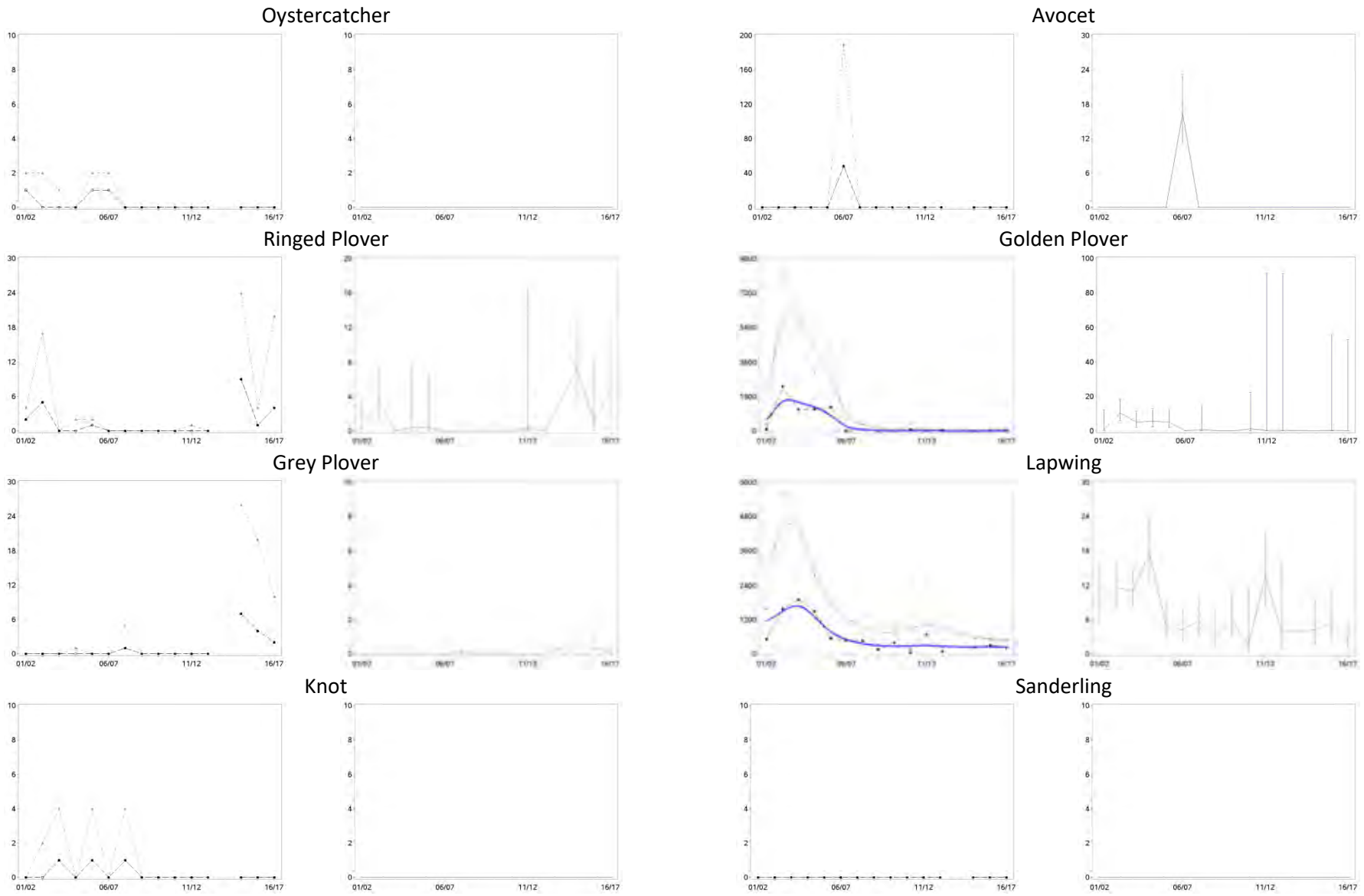

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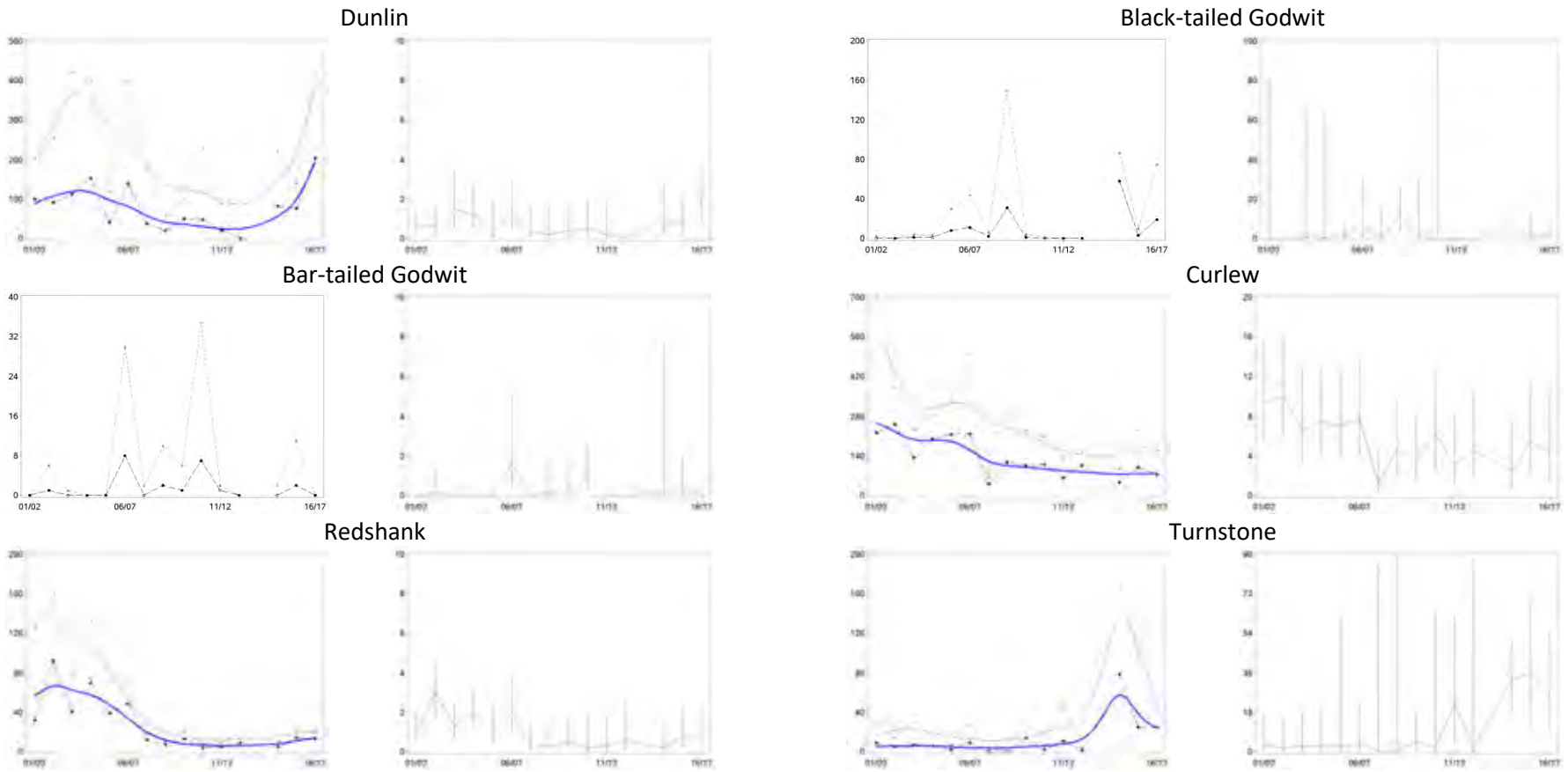

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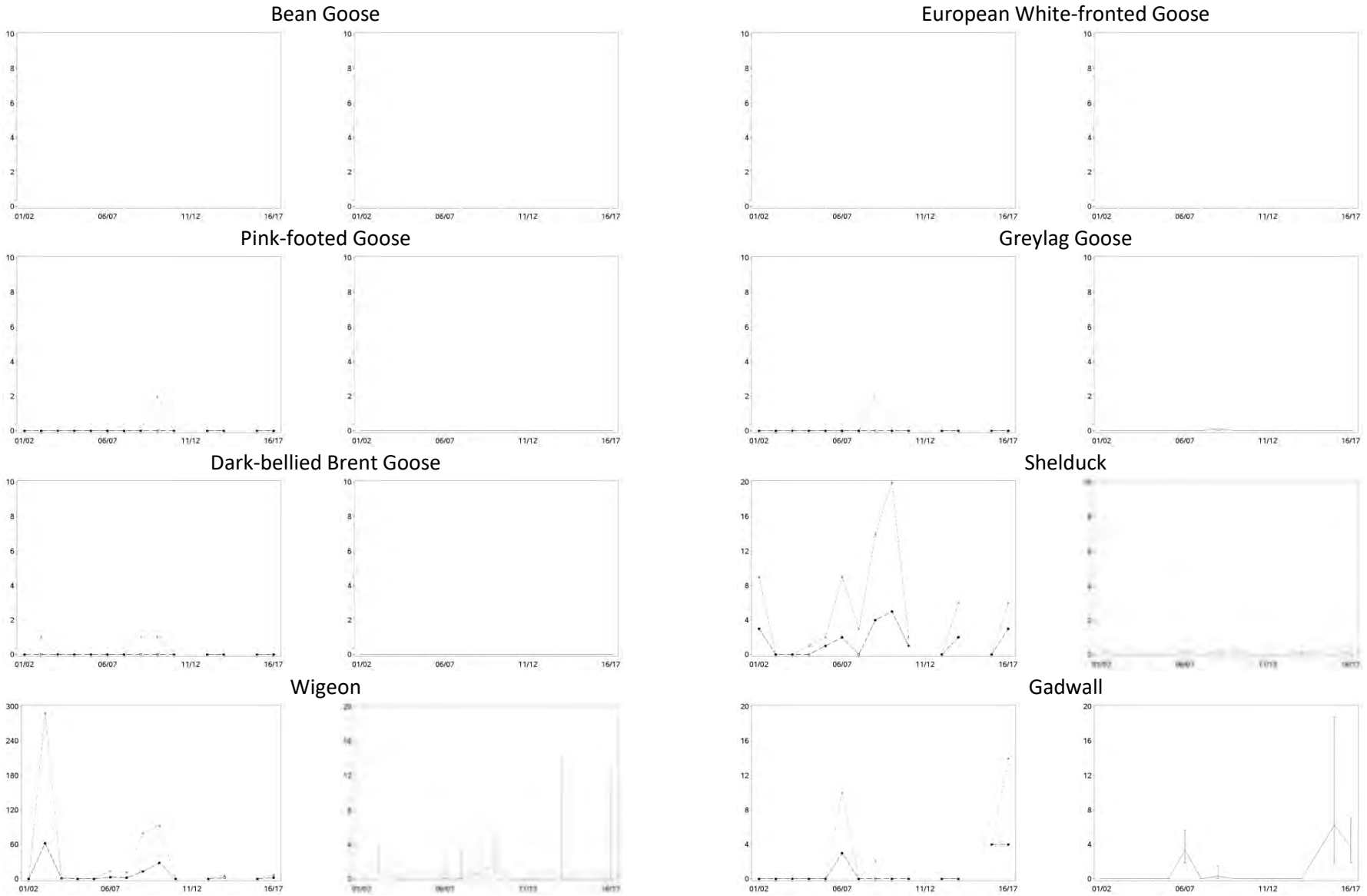
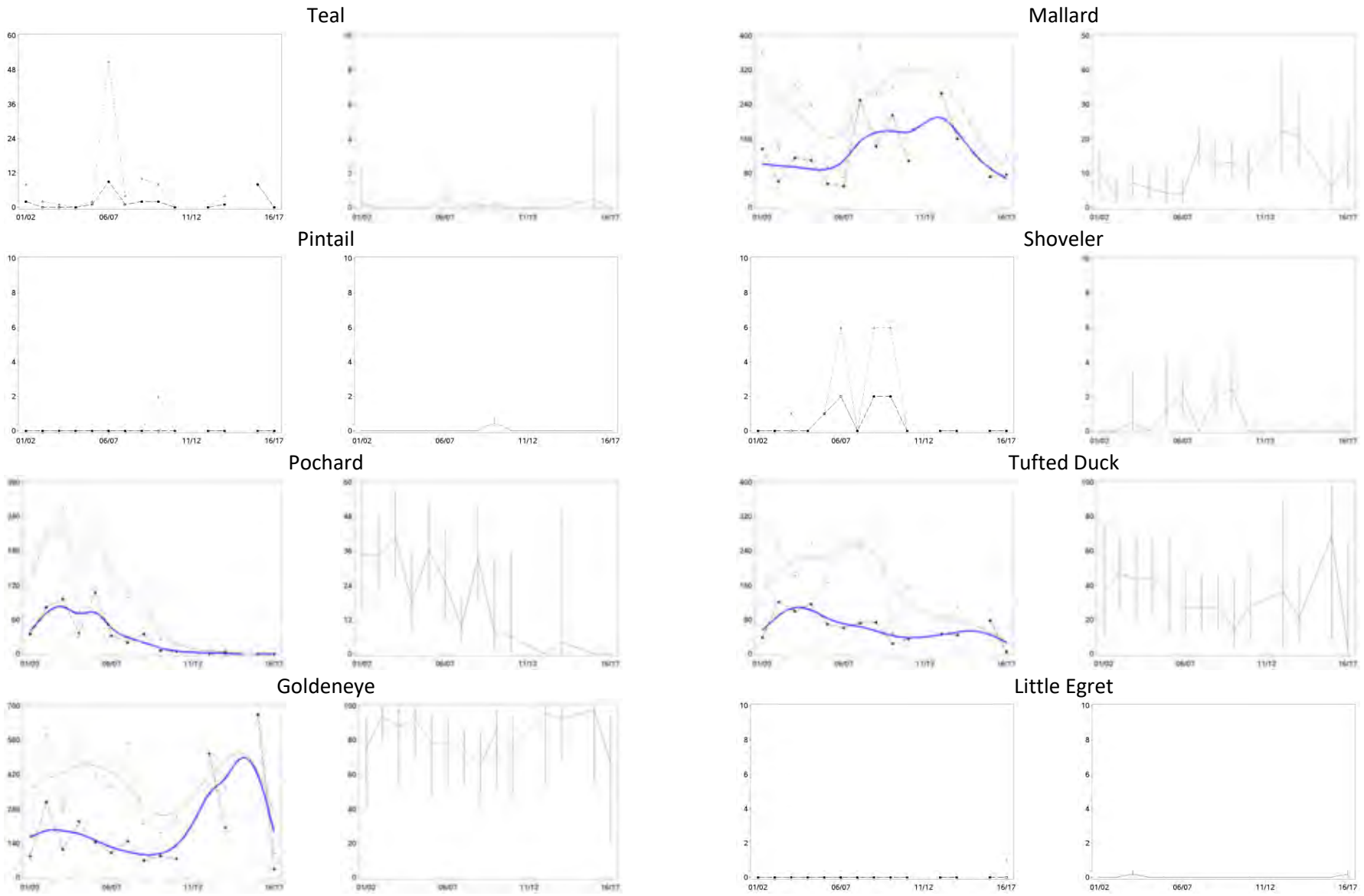


Figure A.38412. Population trends of each species in sector 38412 (Goxhill to New Holland - Sector G) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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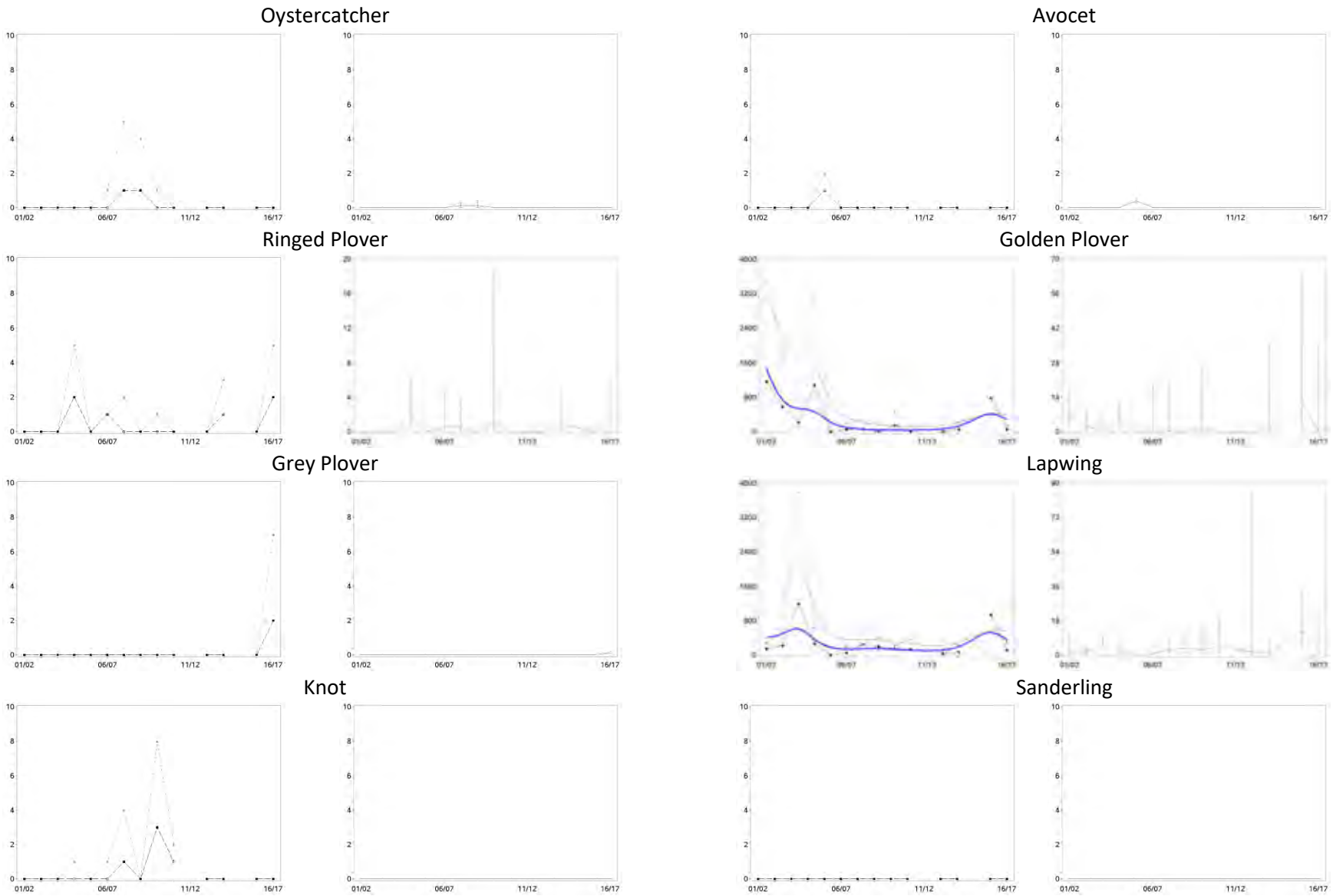

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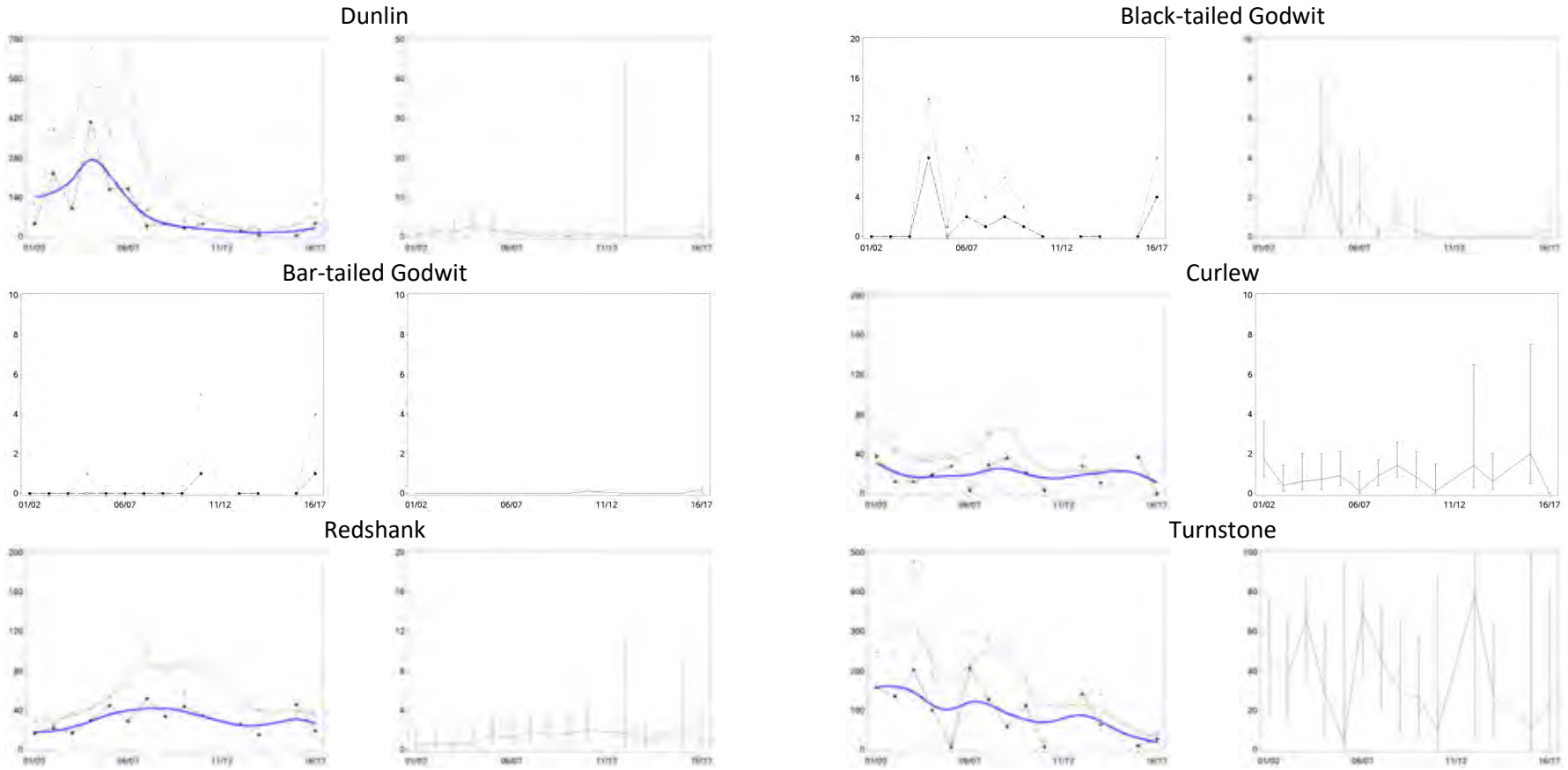

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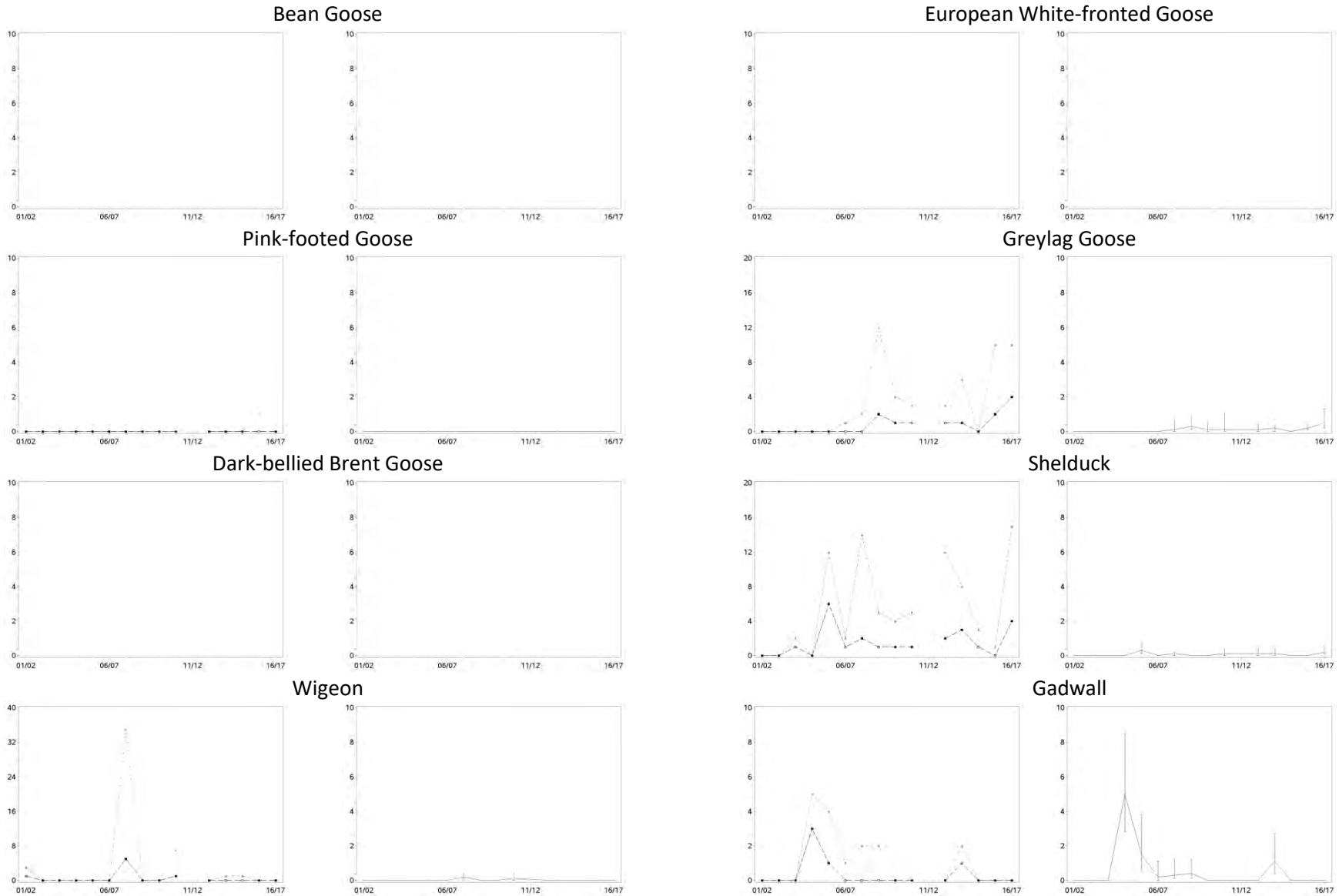
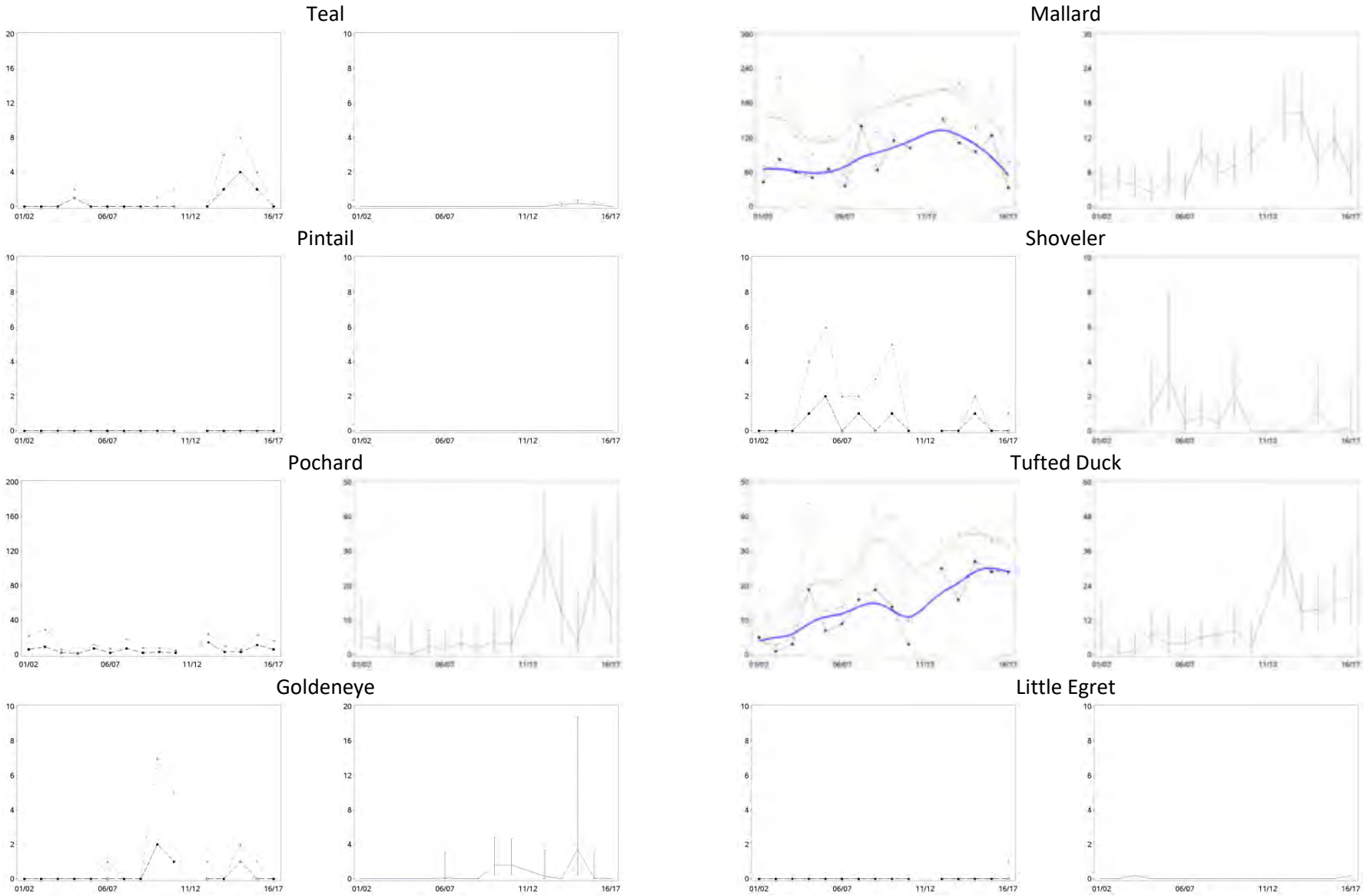


Figure A.38413. Population trends of each species in sector 38413 (New Holland to Barrow - Sector F3) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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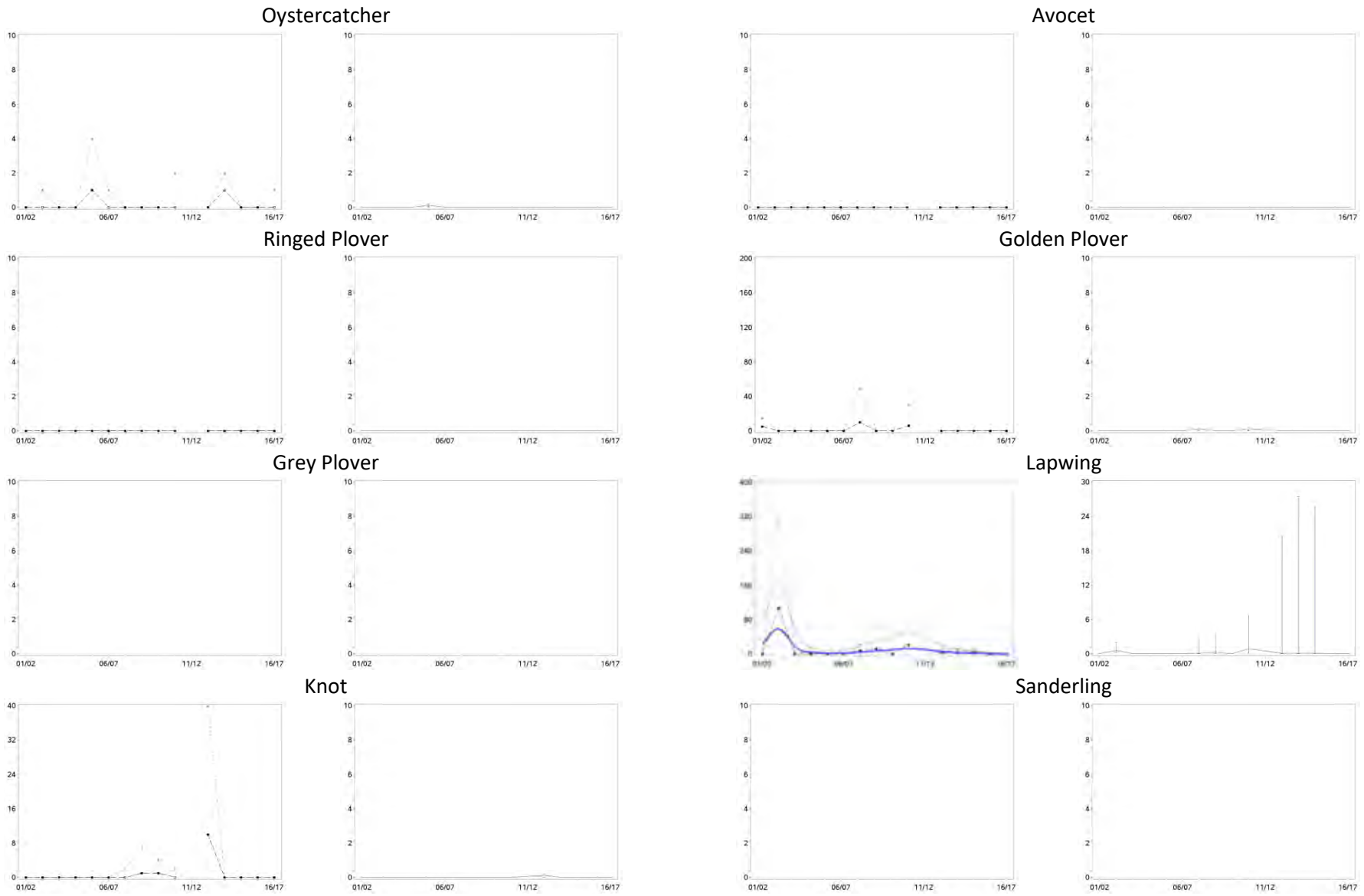

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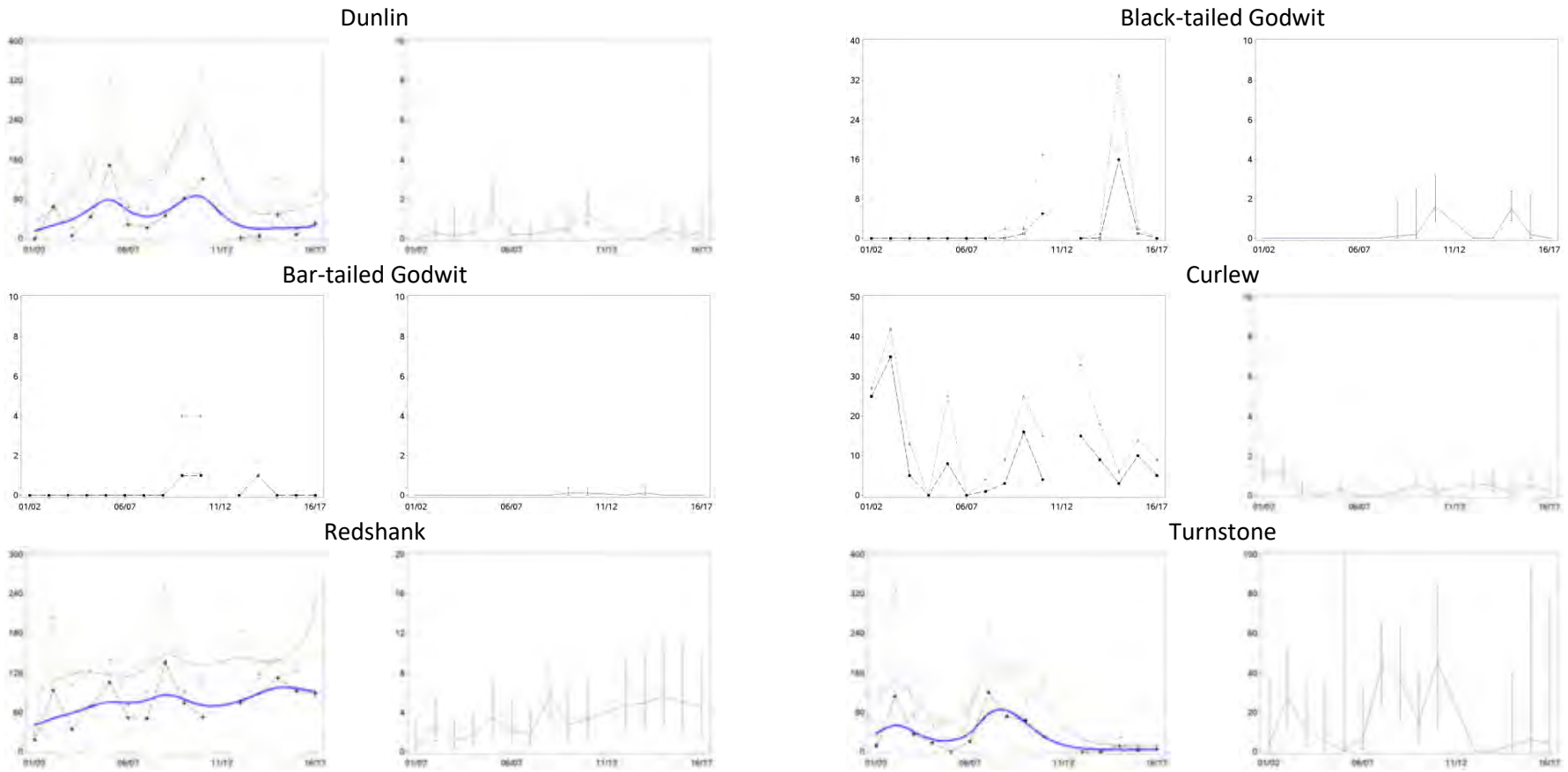

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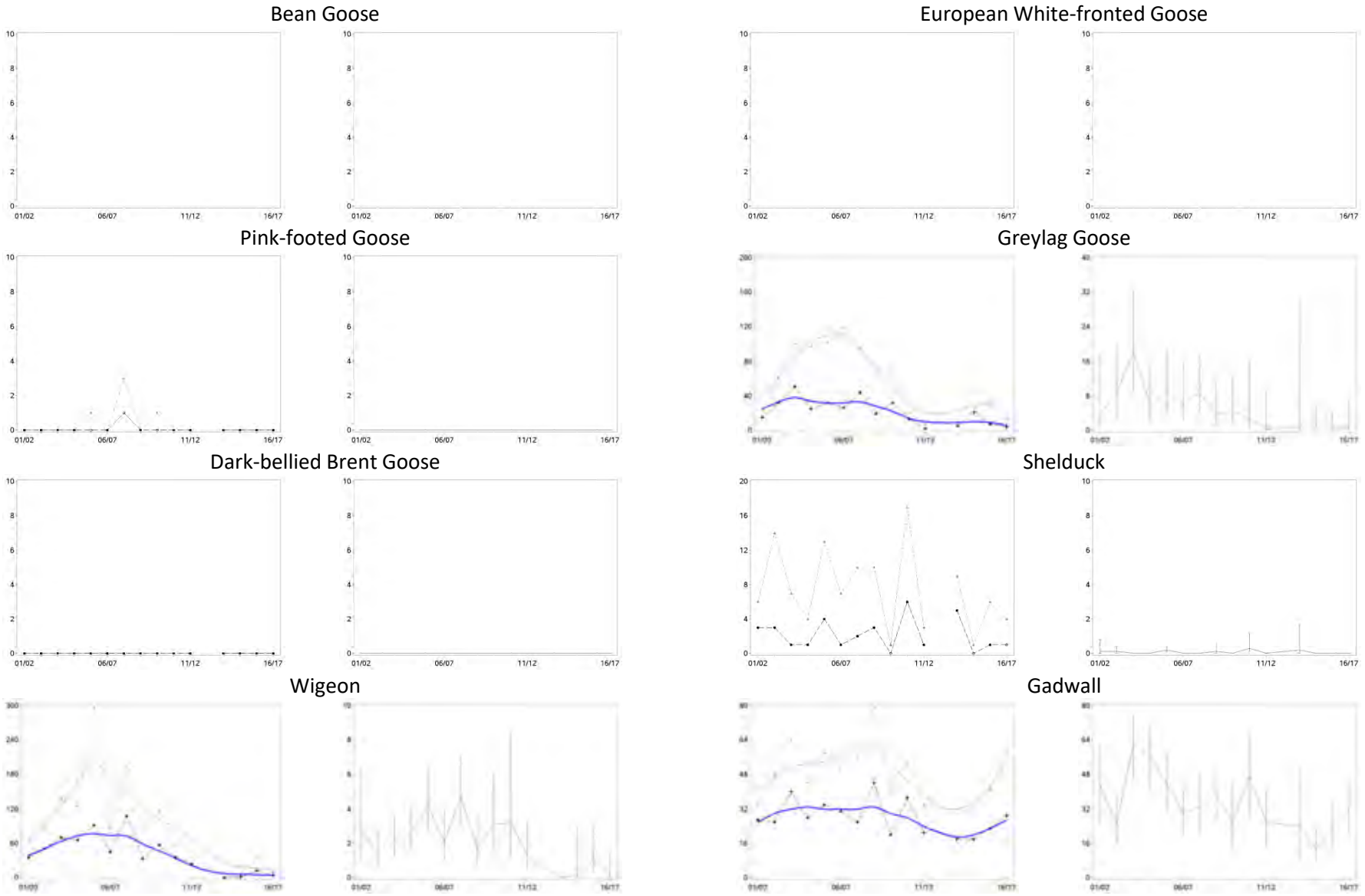
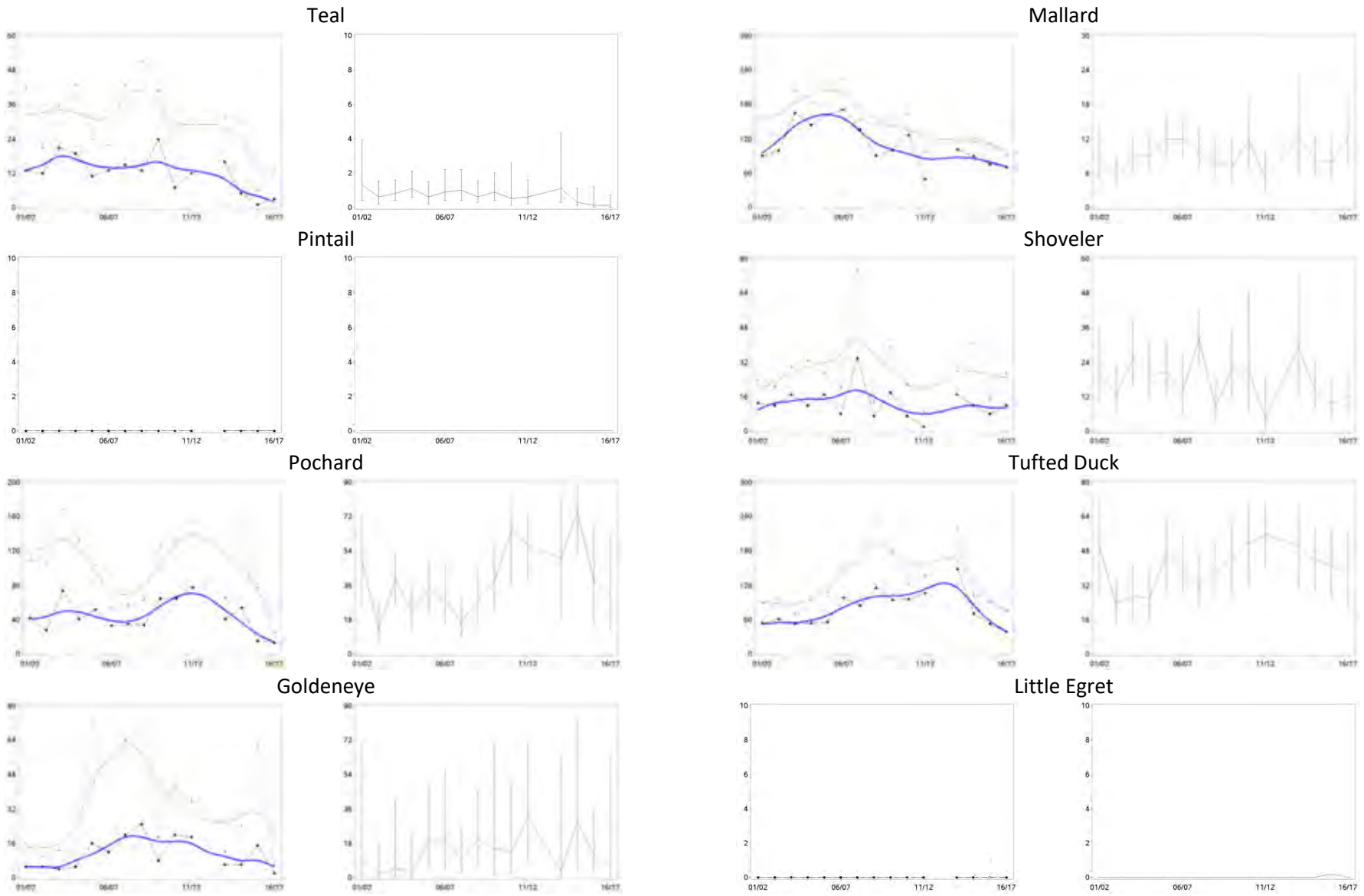


Figure A.38414. Population trends of each species in sector 38414 (Barrow to Barton (including Pits) - Sector F2) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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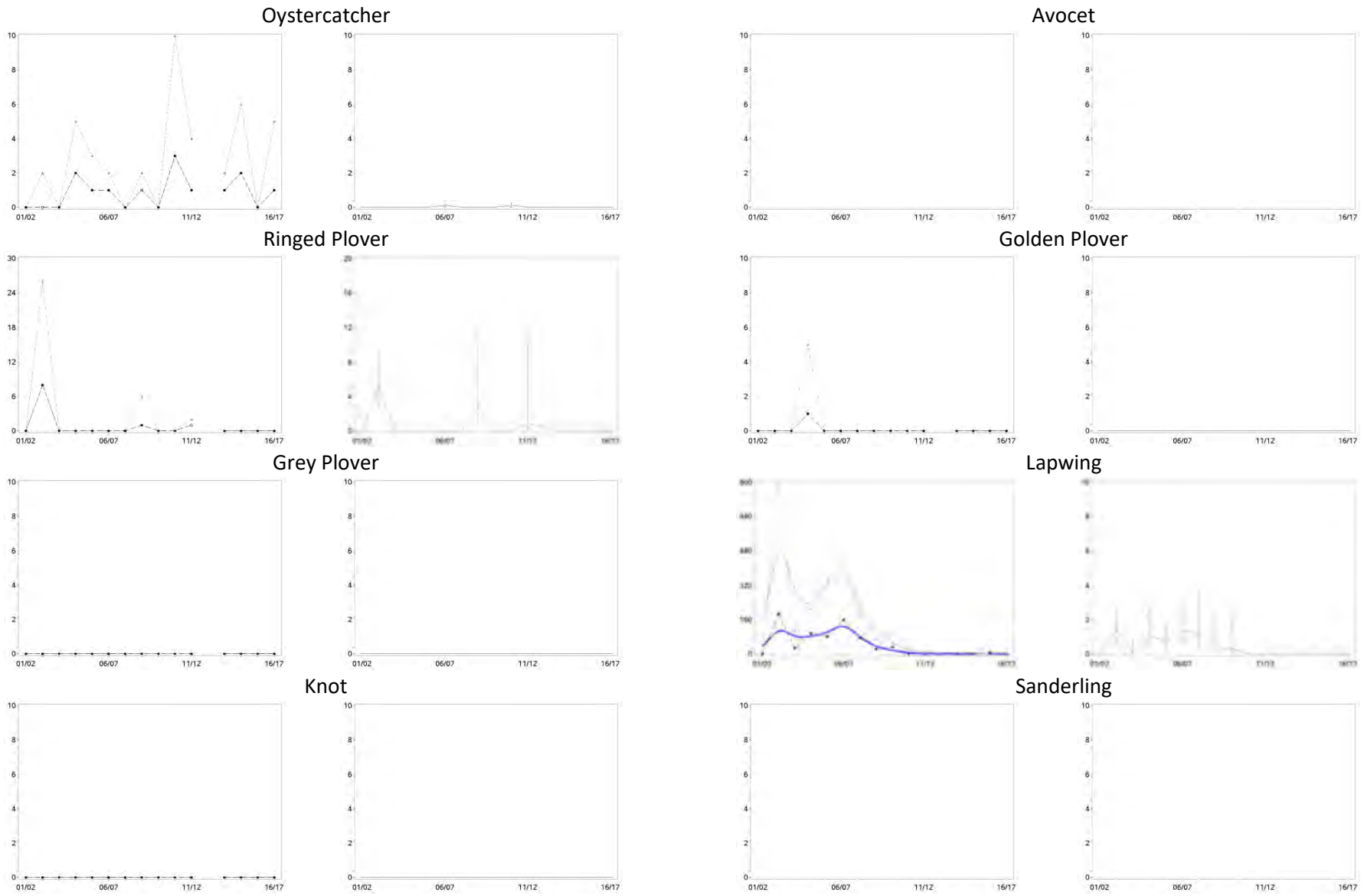

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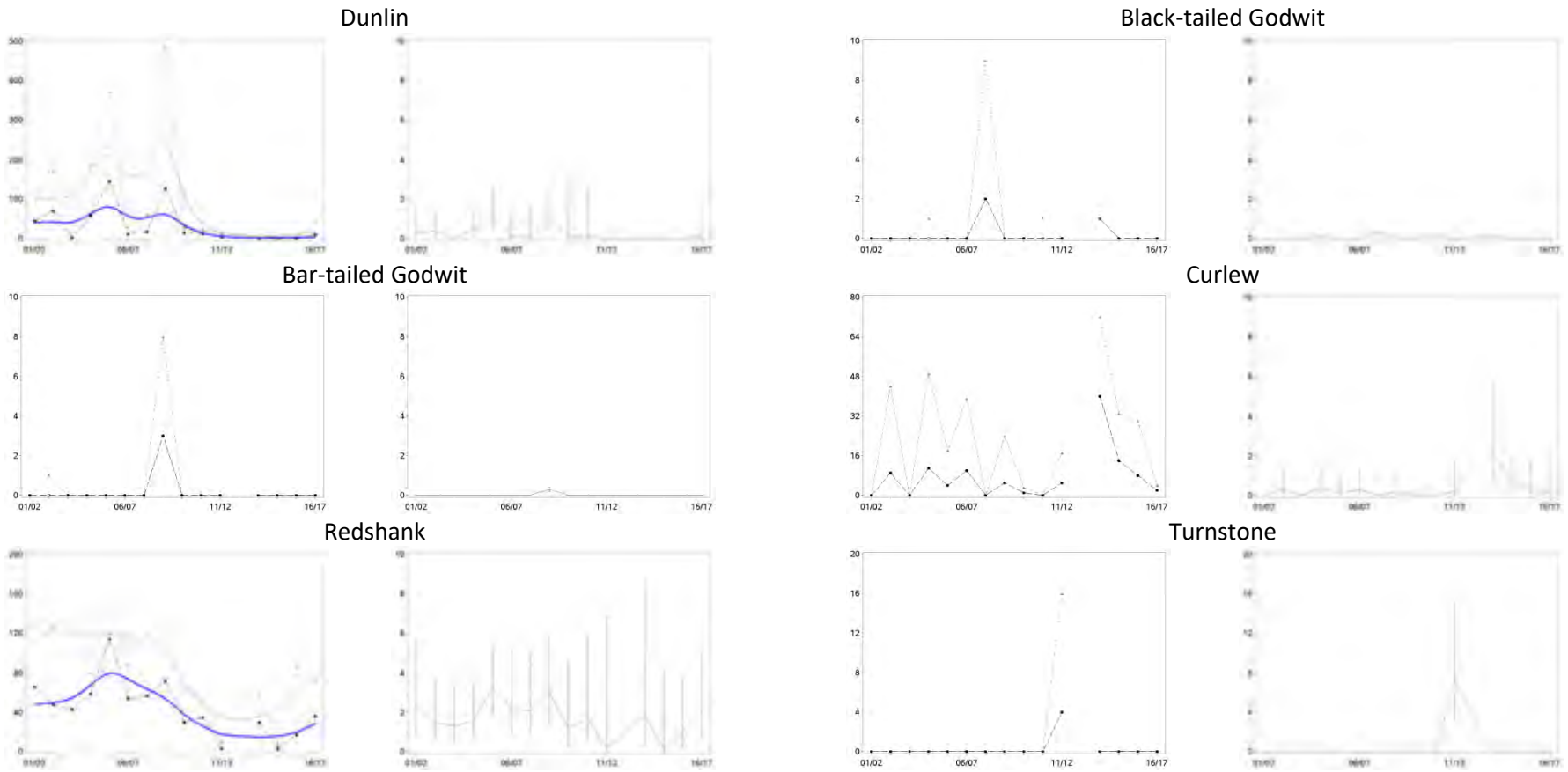

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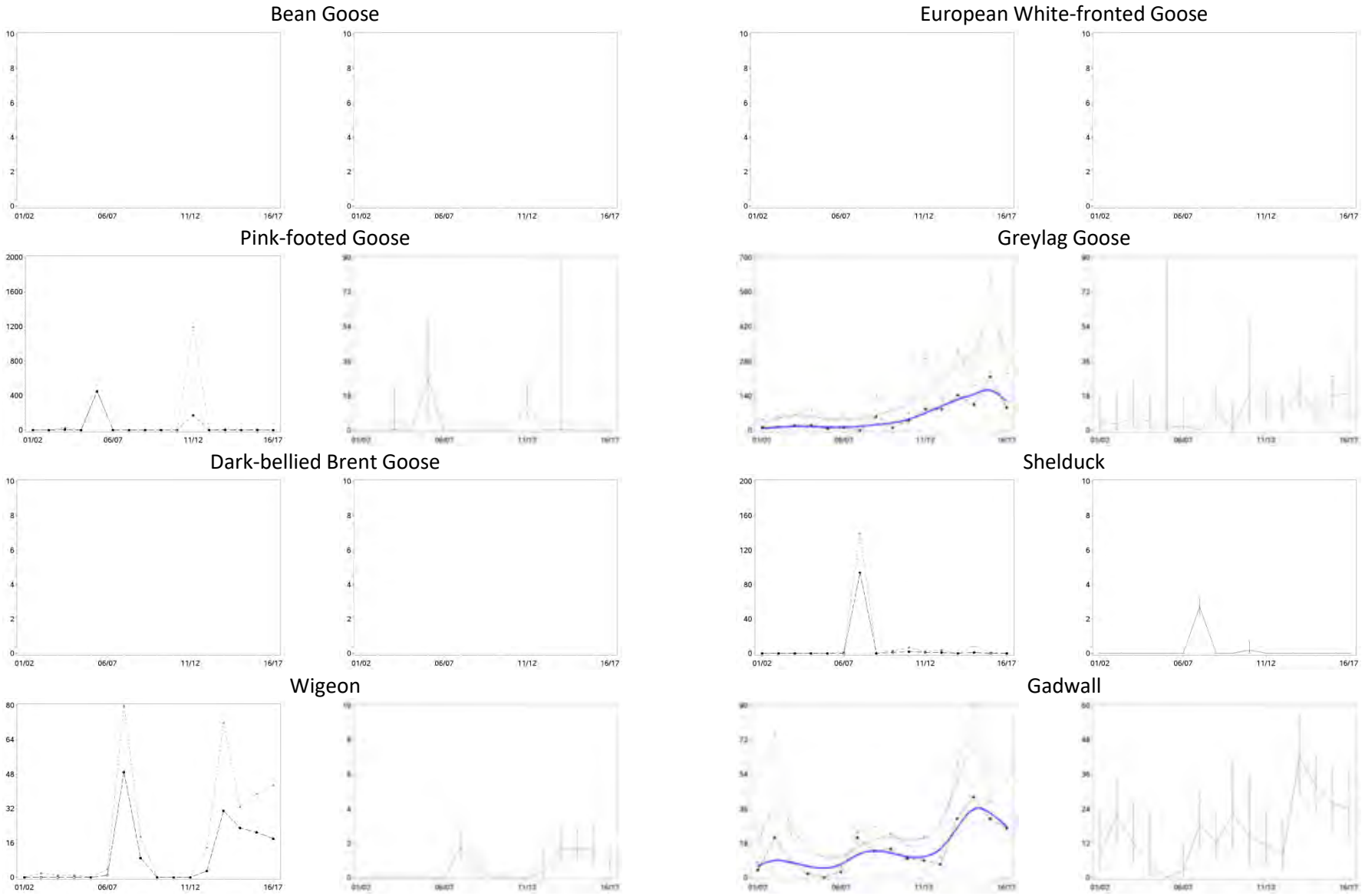
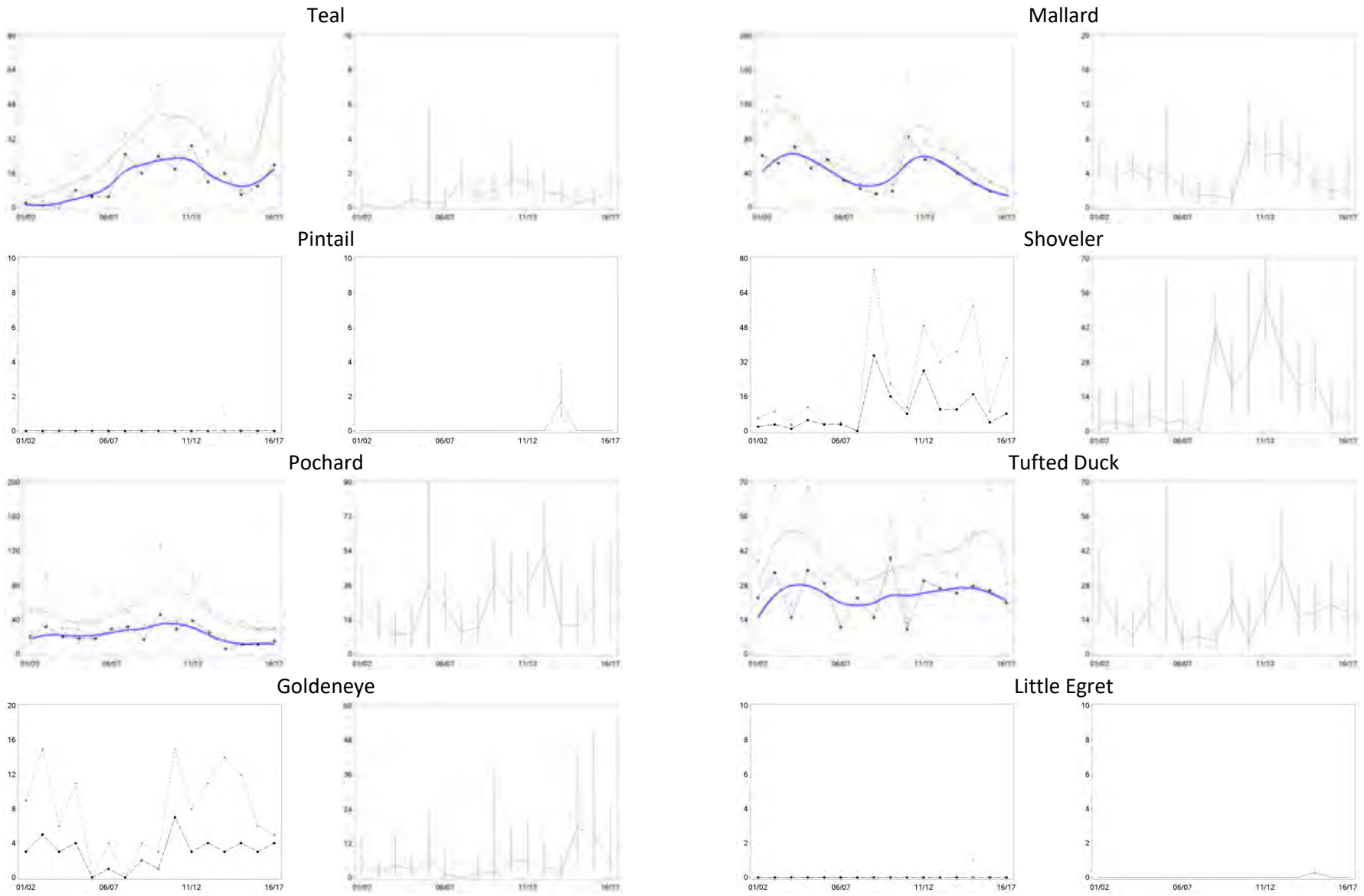


Figure A.38415. Population trends of each species in sector 38415 (Barton to Chowder Ness - Sector F1) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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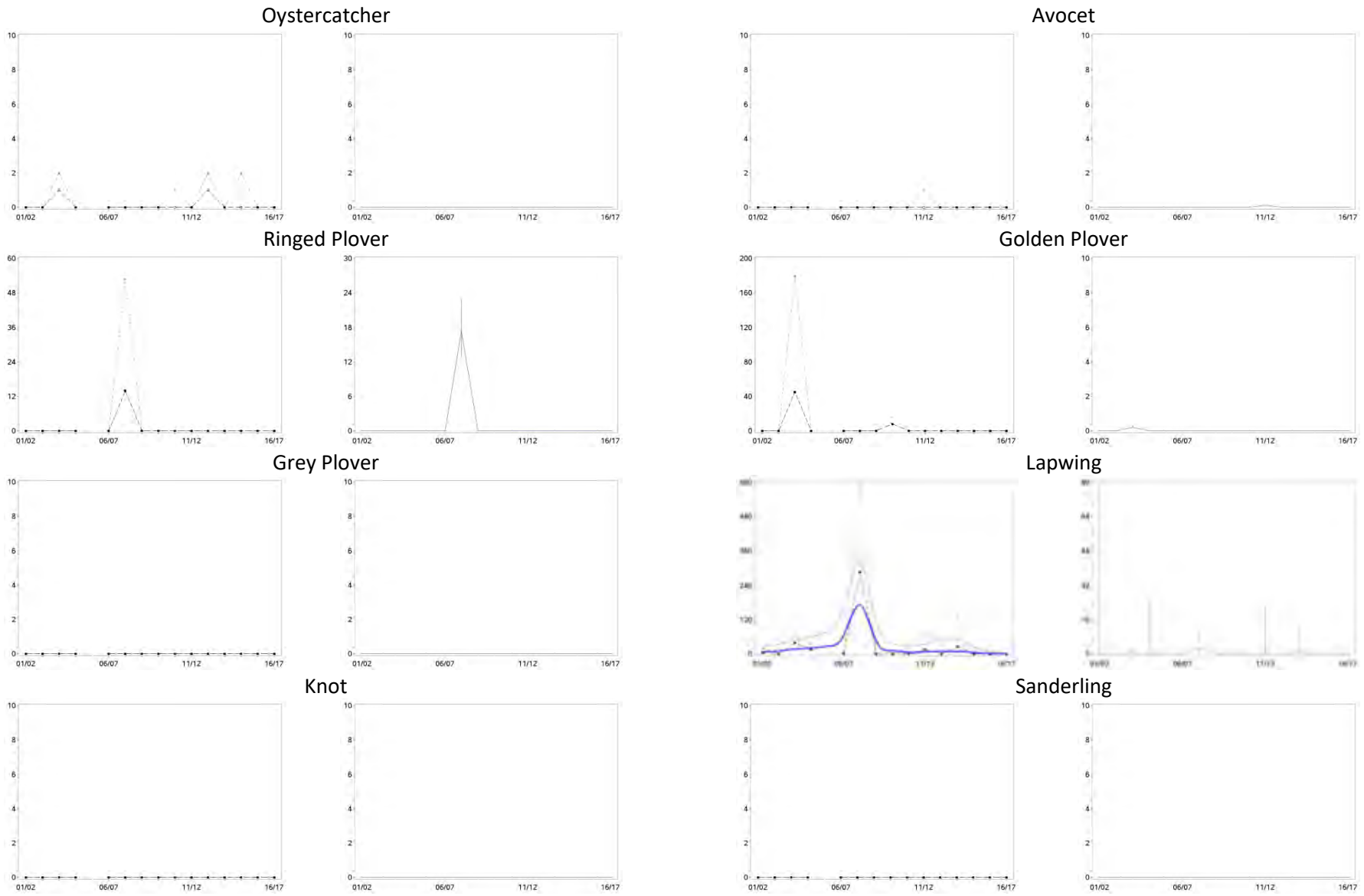

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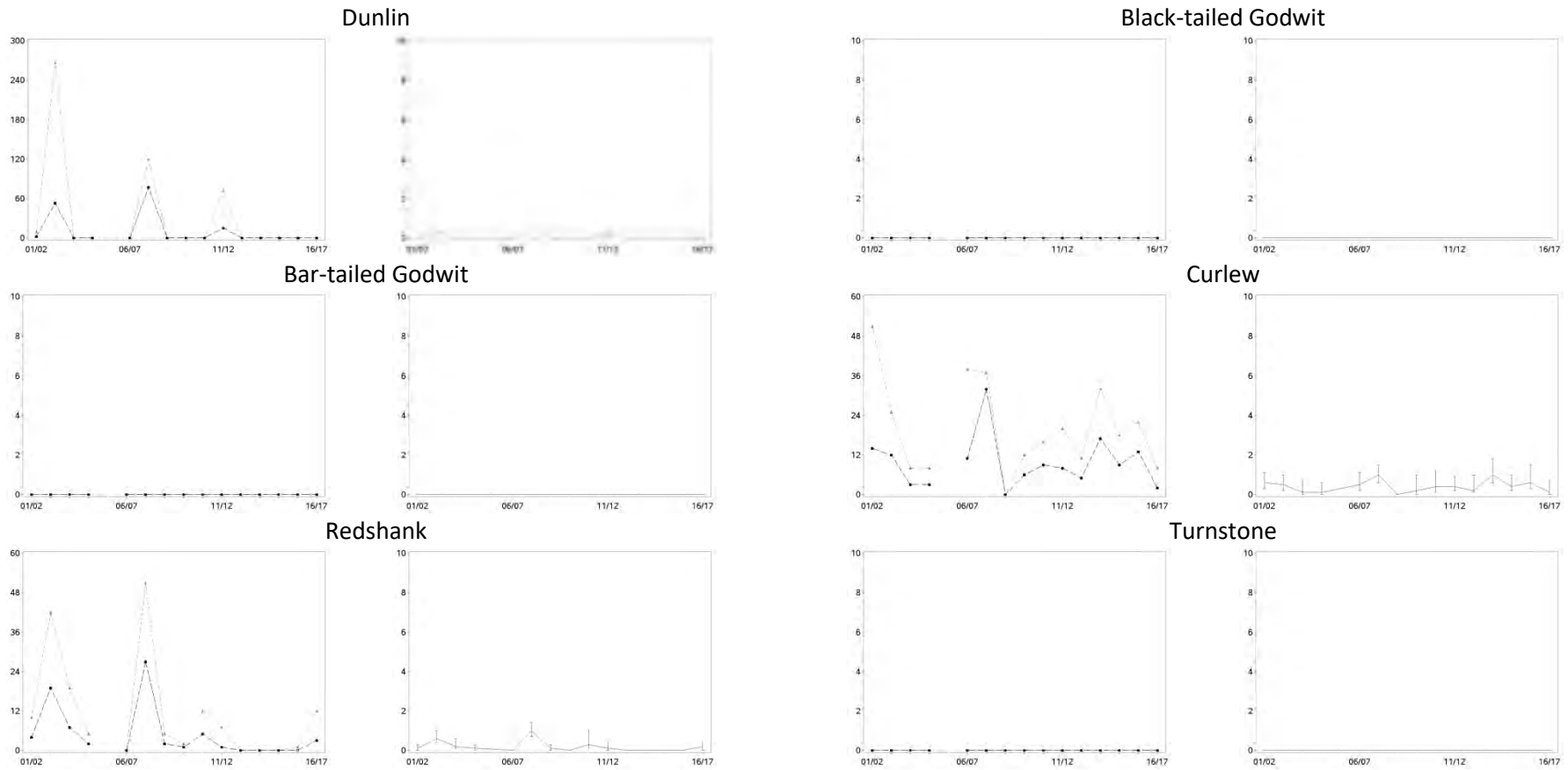

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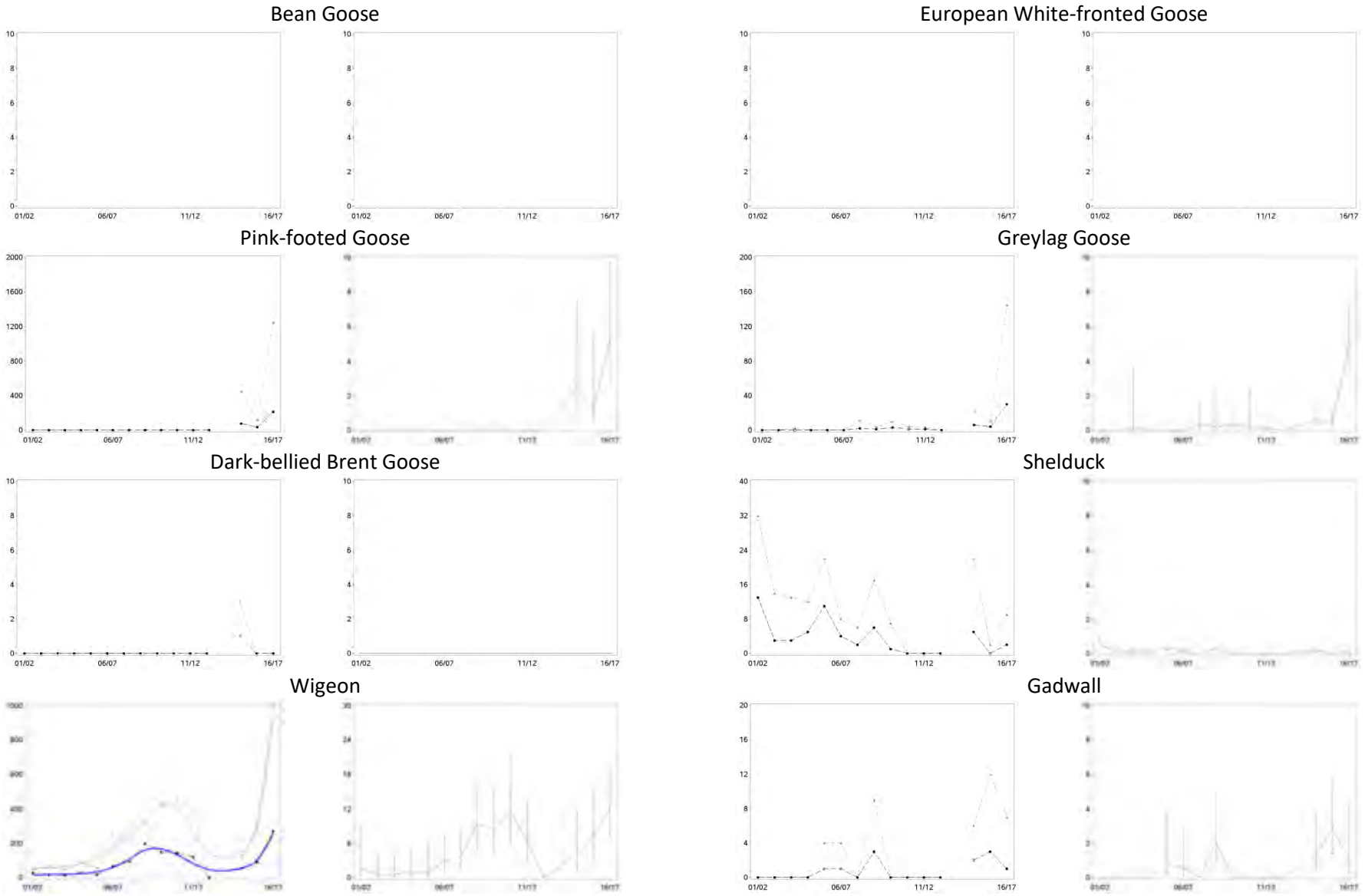
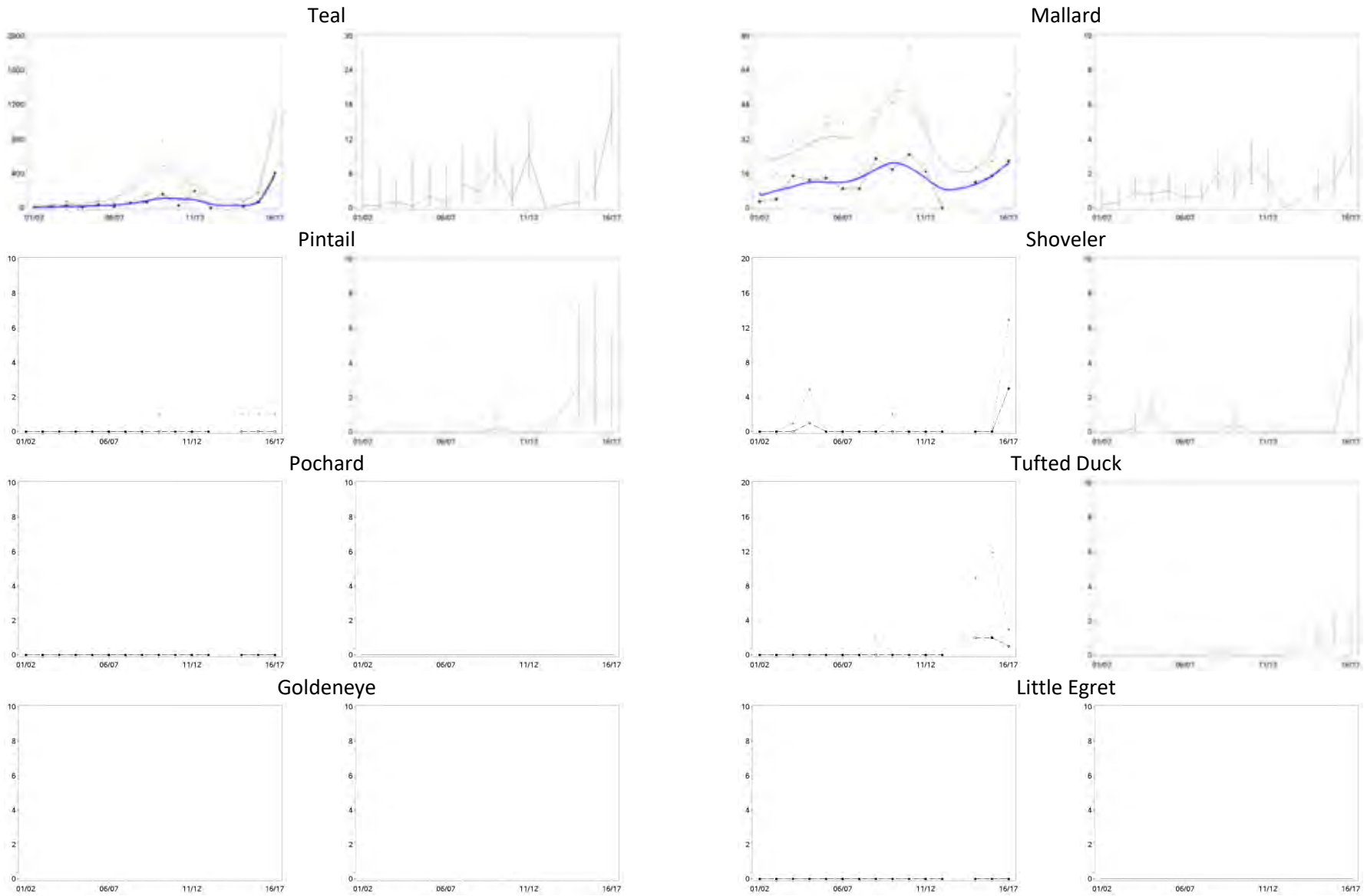


Figure A.38417. Population trends of each species in sector 38417 (South Ferriby - Sector E1) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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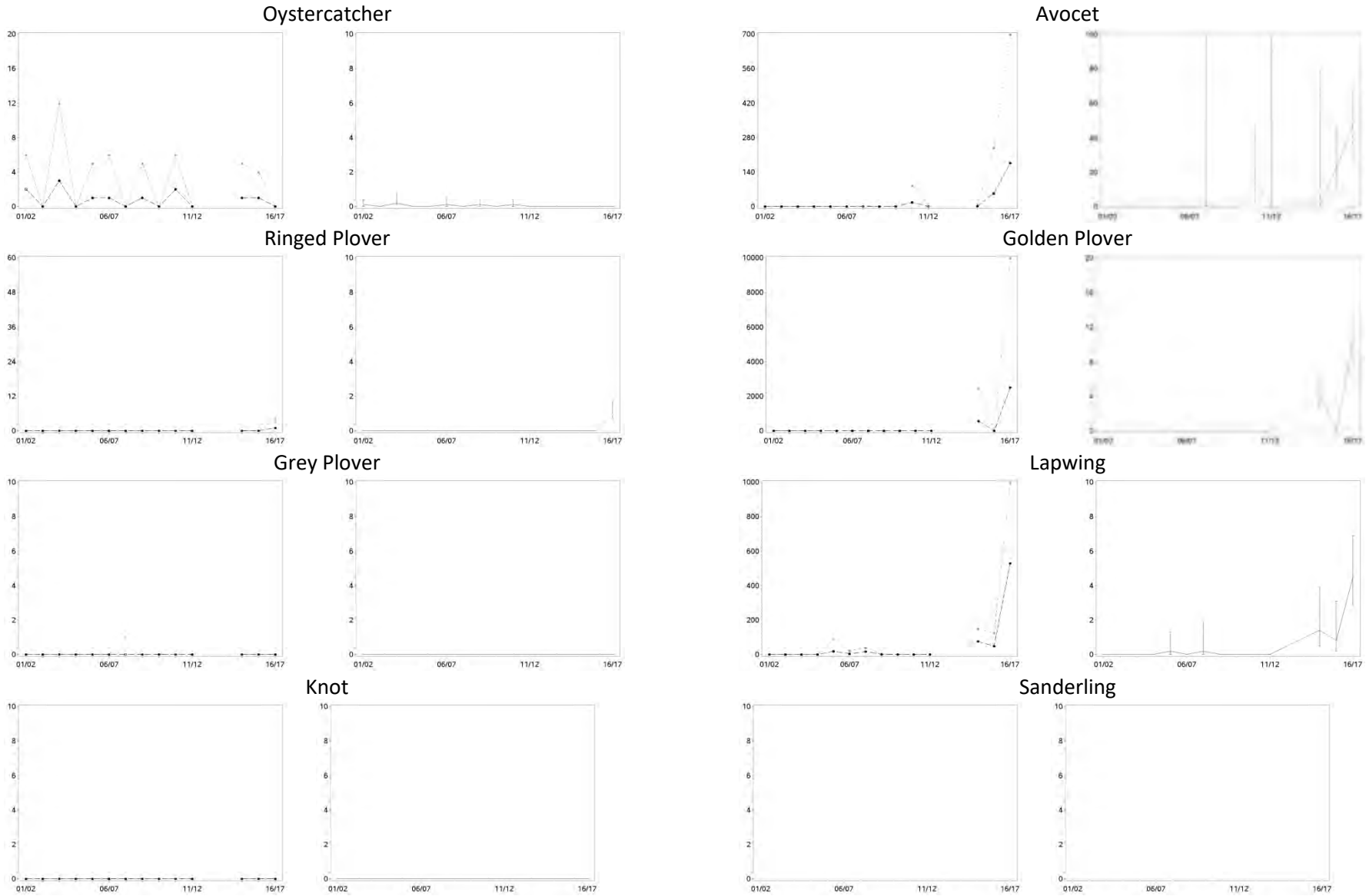

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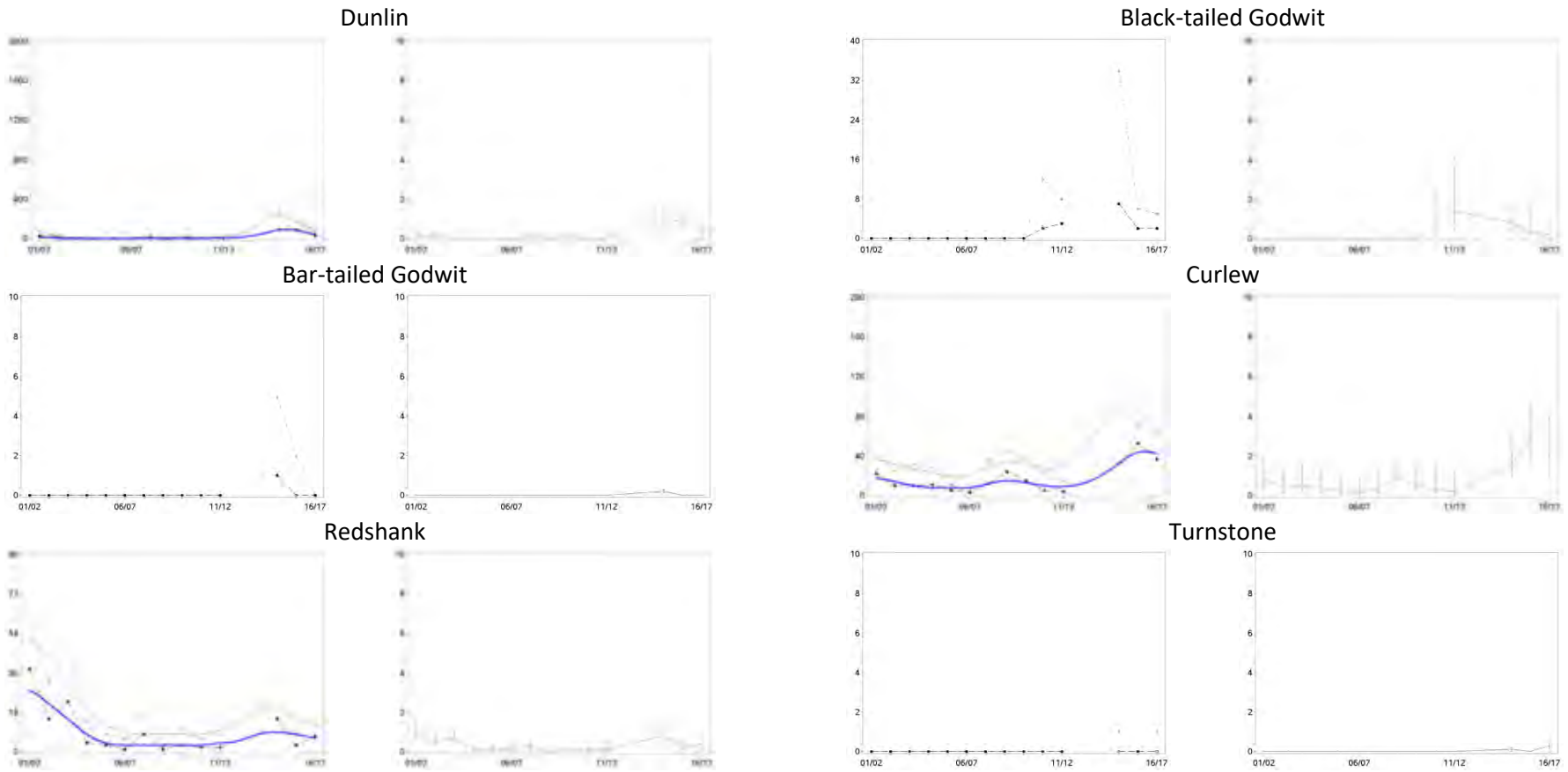

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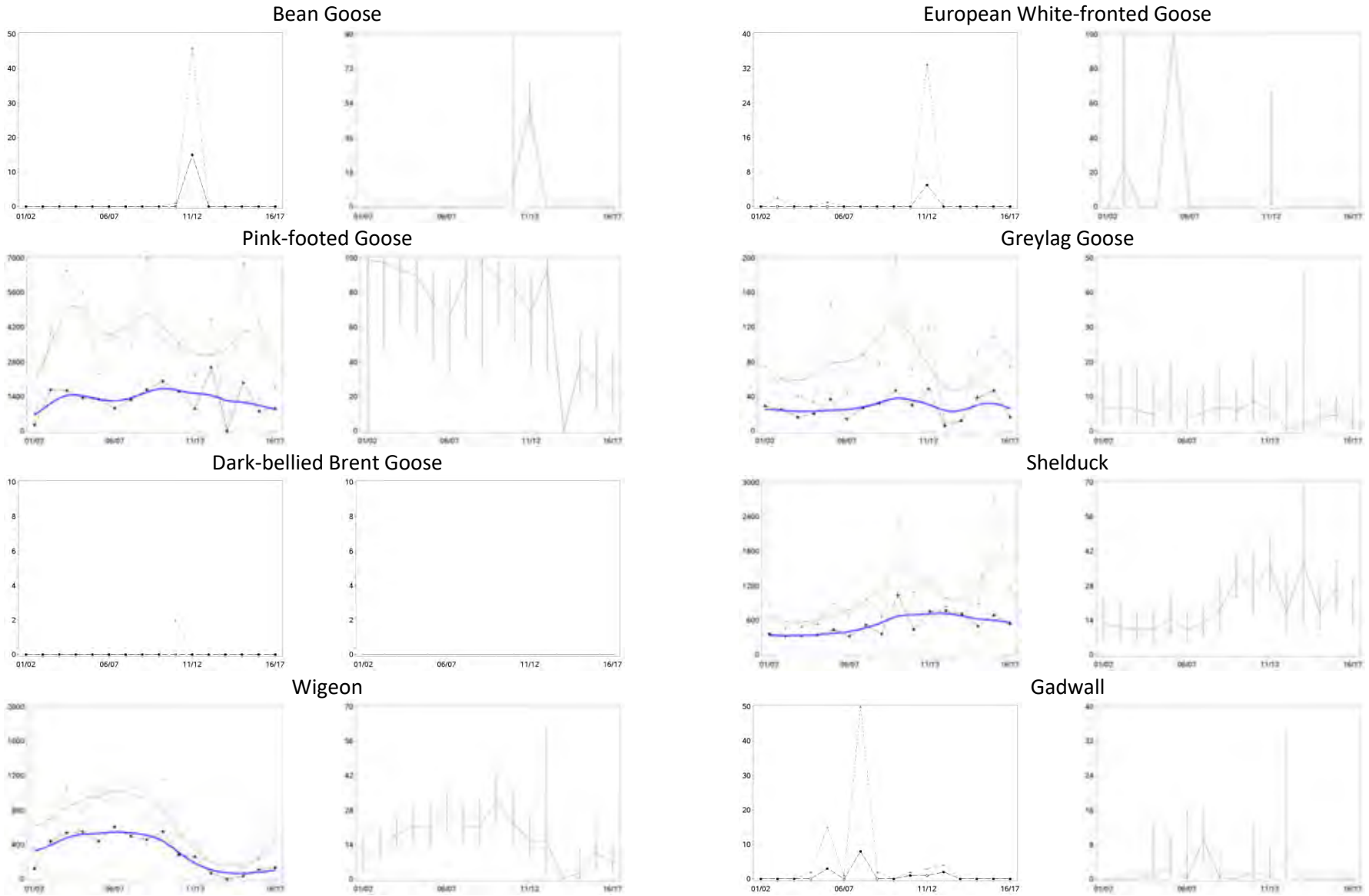
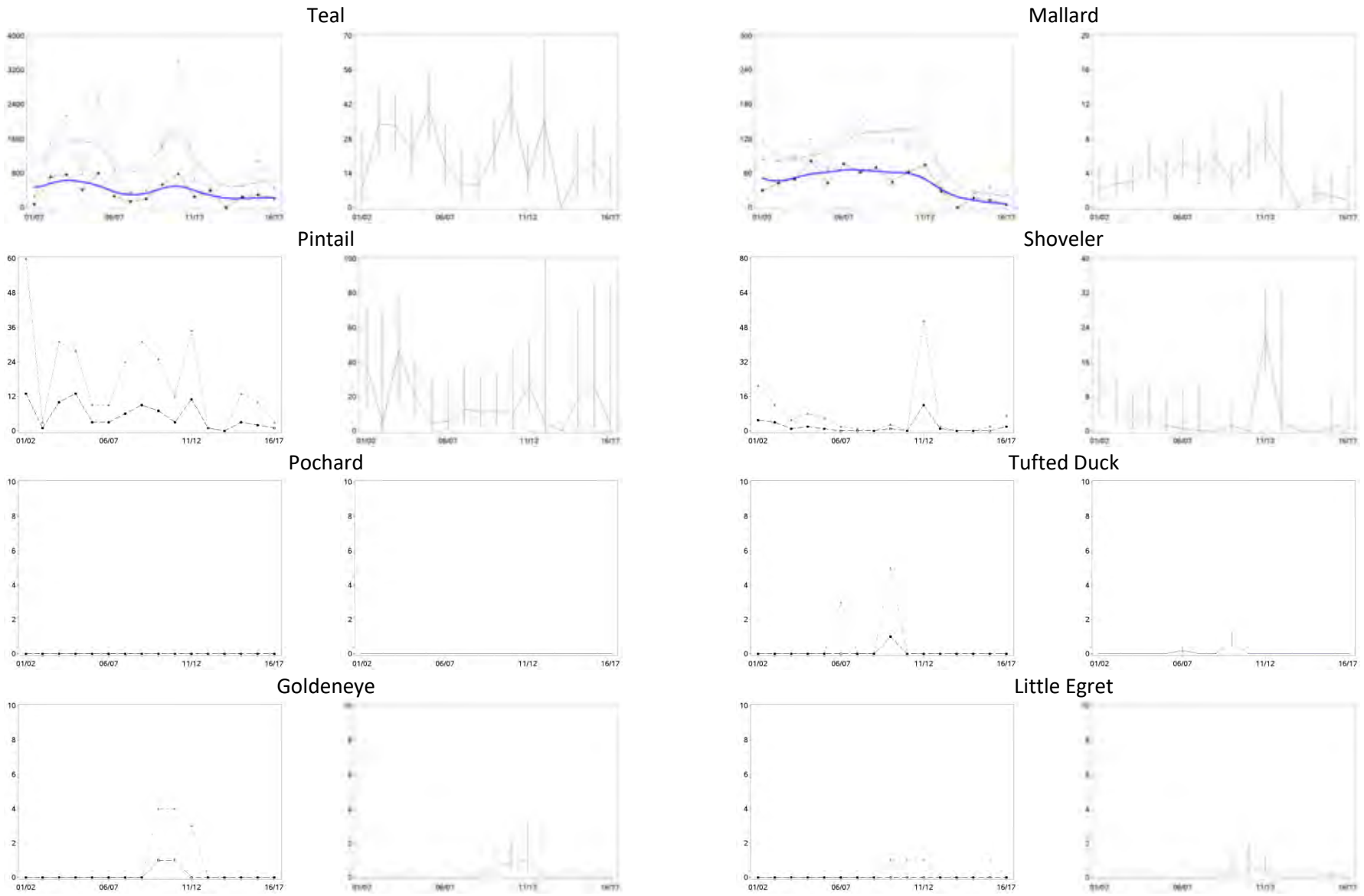


Figure A.38418. Population trends of each species in sector 38418 (Read`s Island Flats - Sector D) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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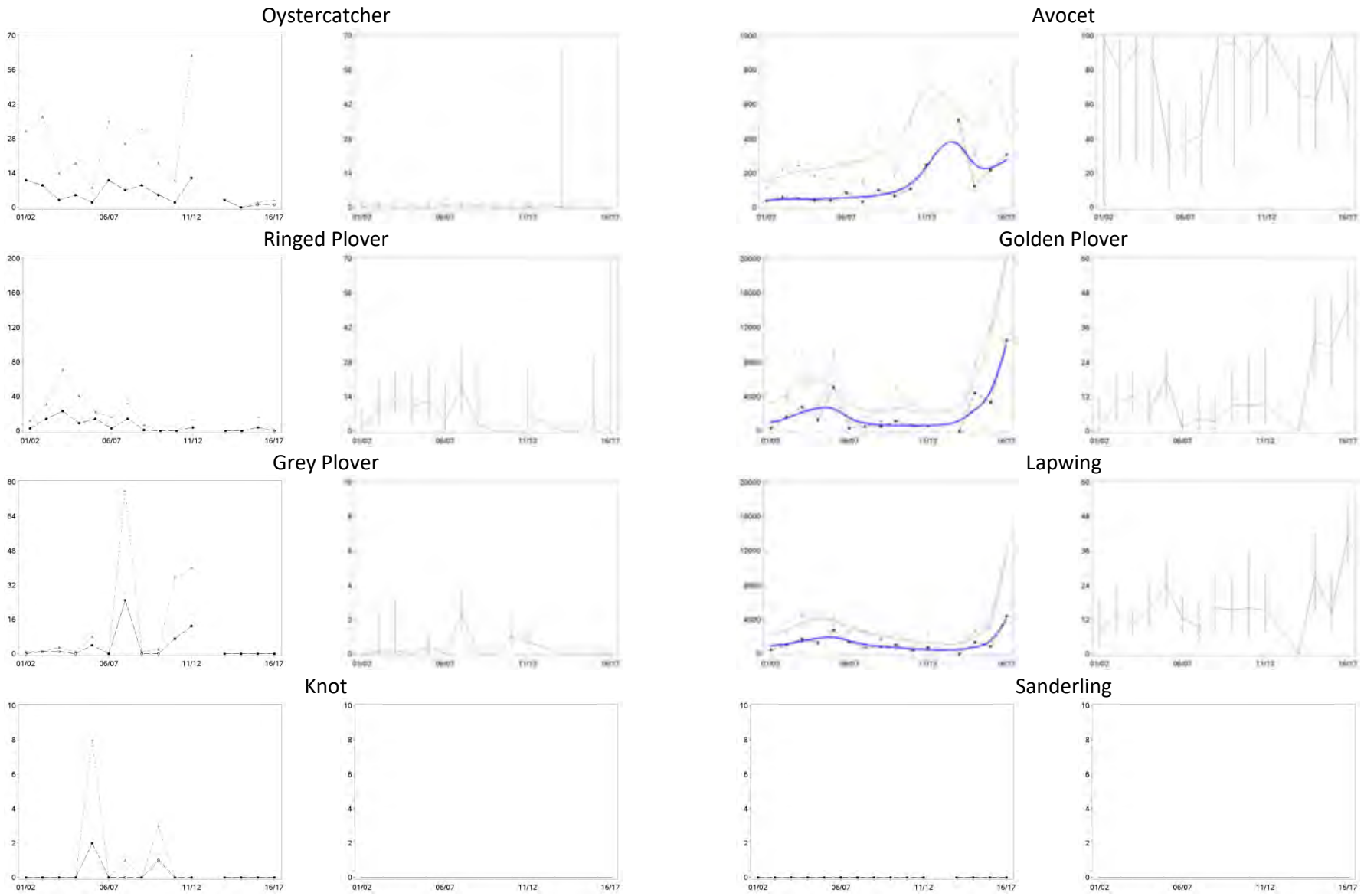

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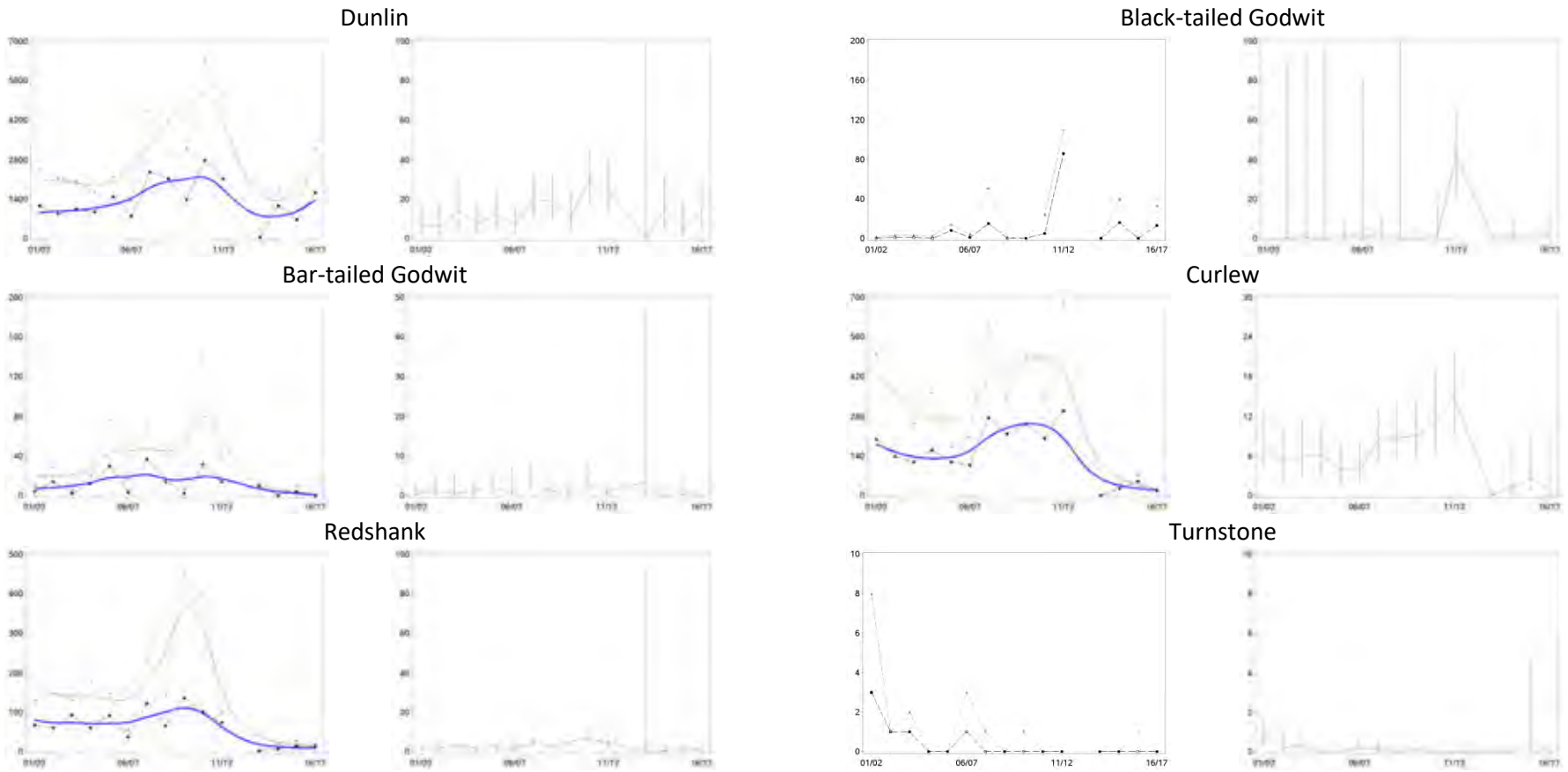

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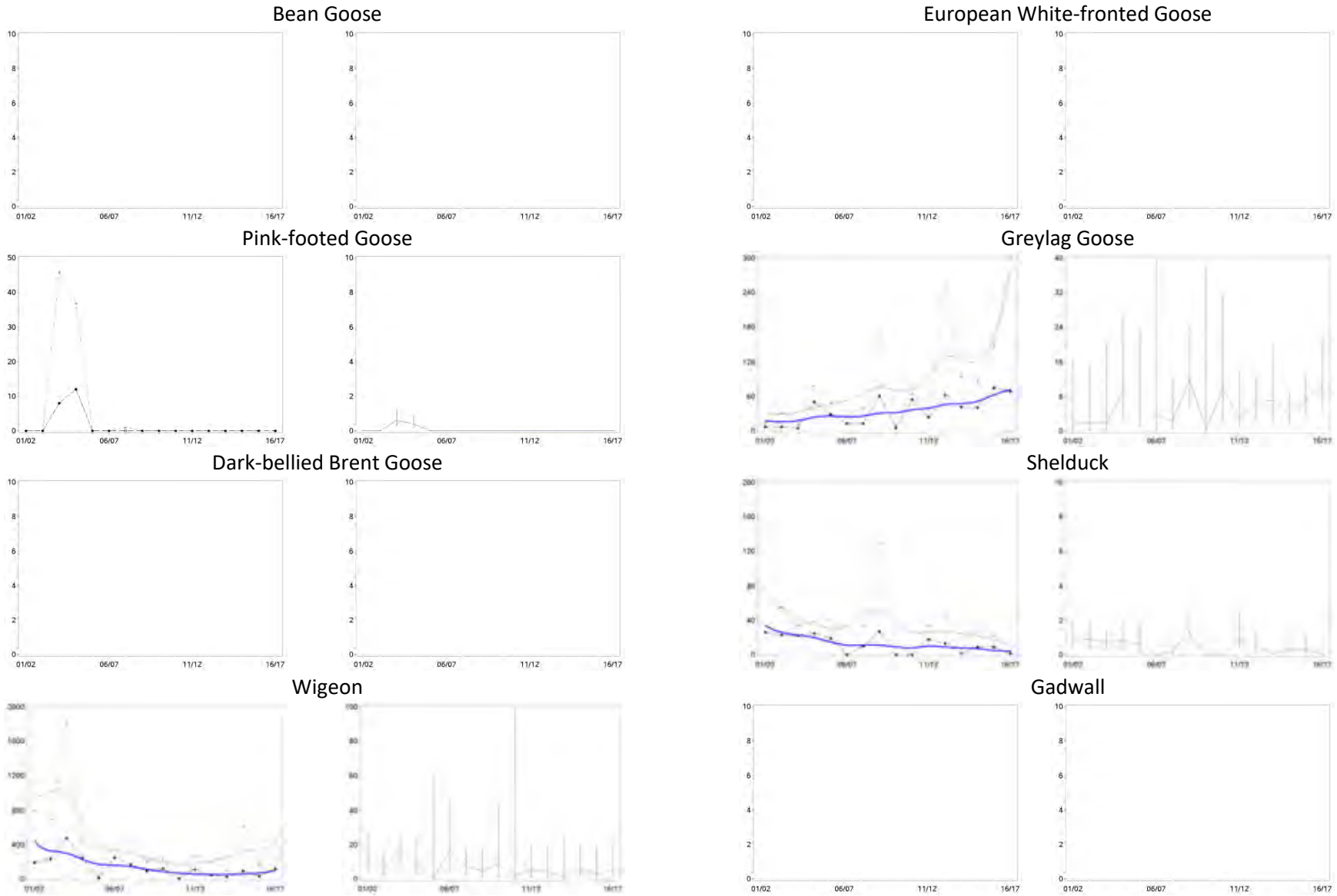
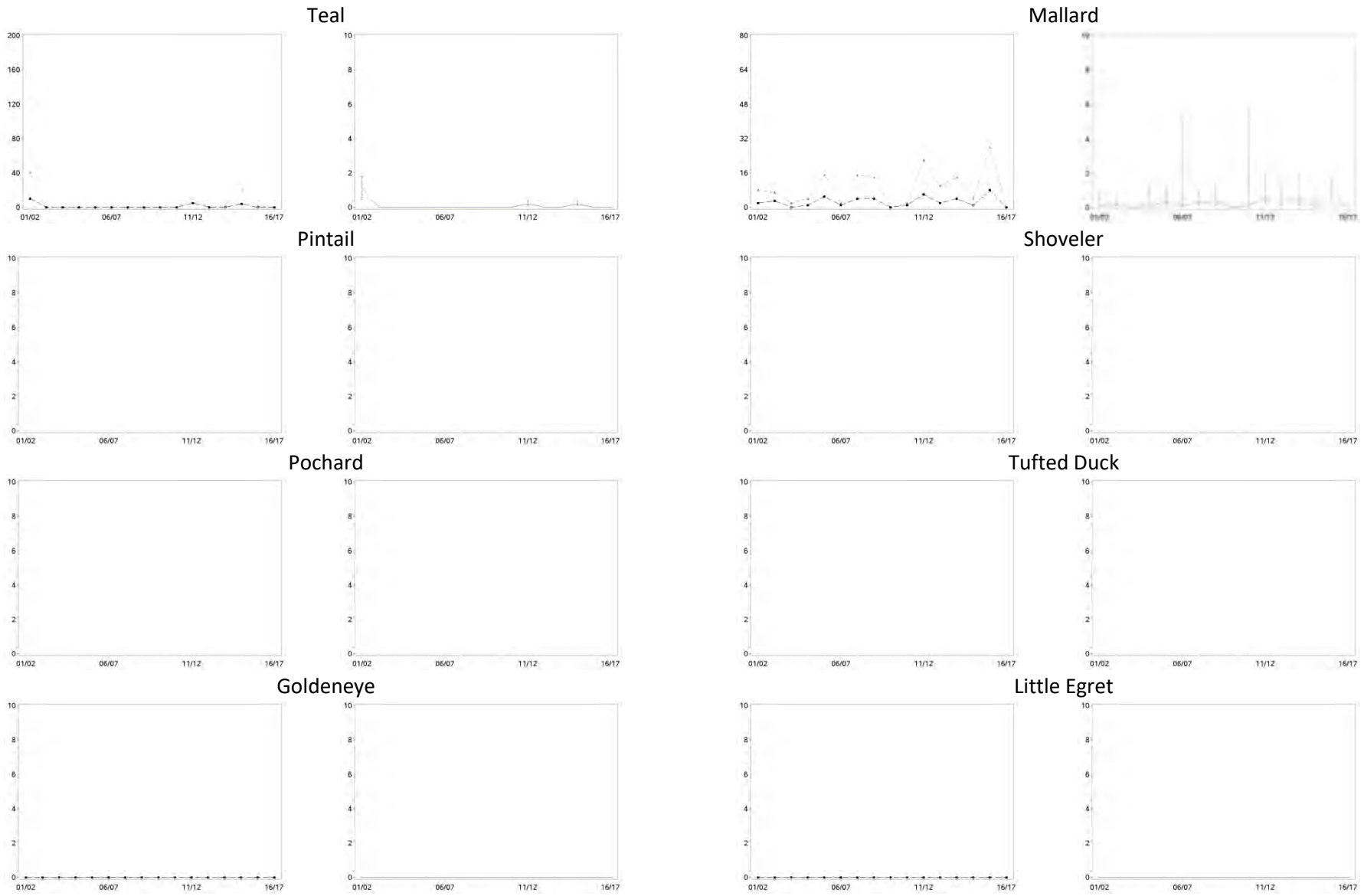


Figure A.38419. Population trends of each species in sector 38419 (Whitton Sand - South Face - Sector B3) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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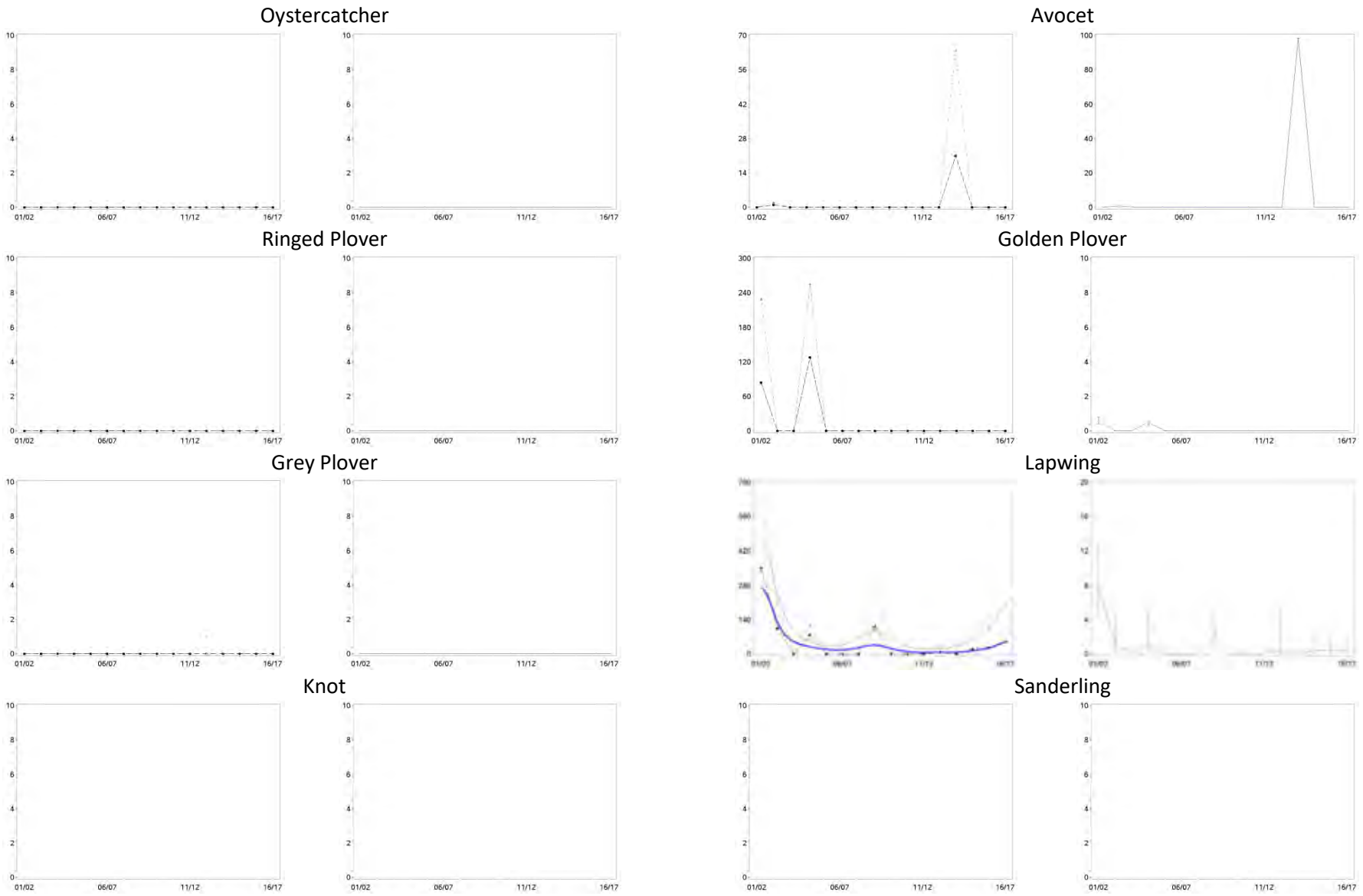

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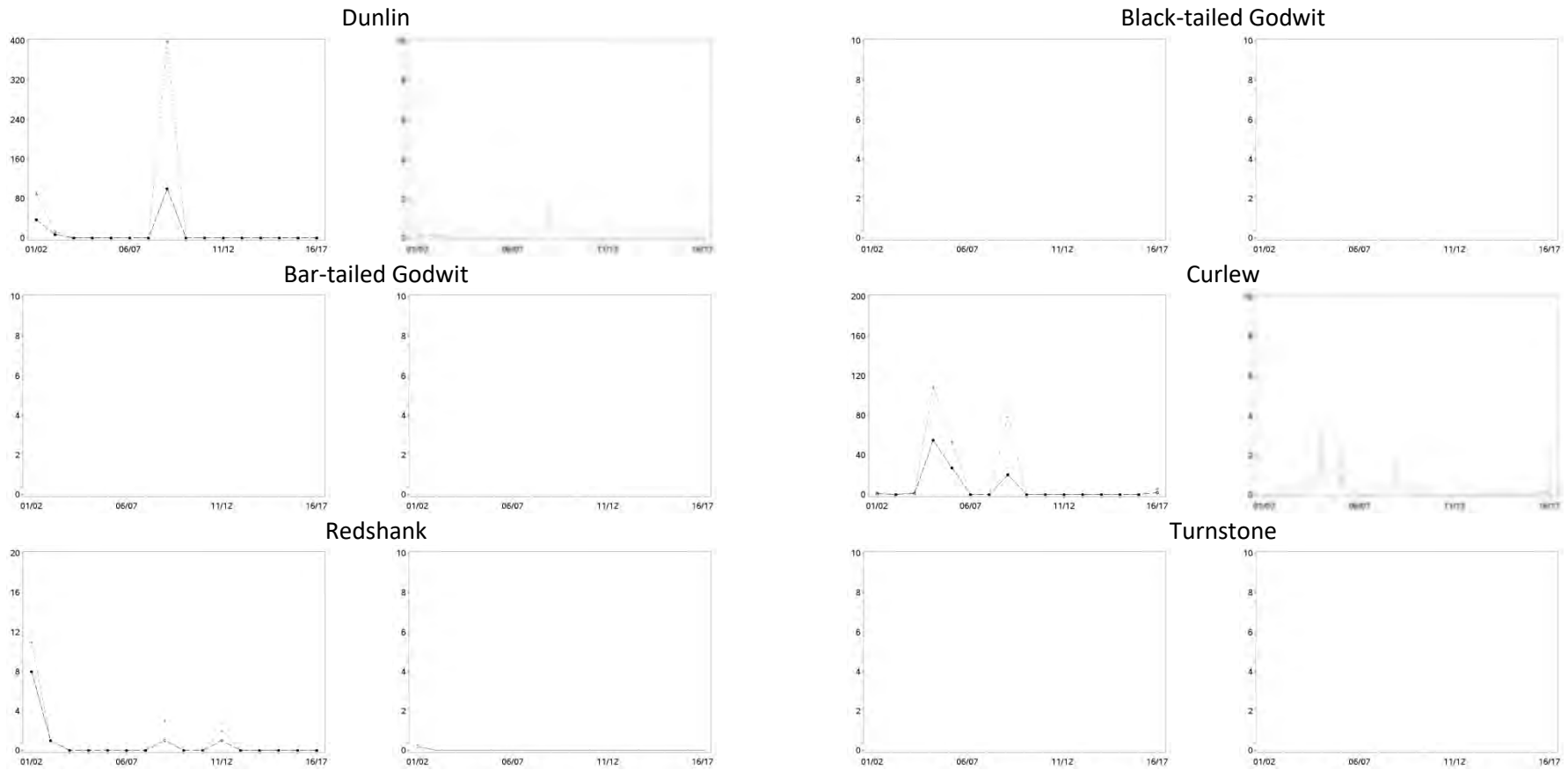

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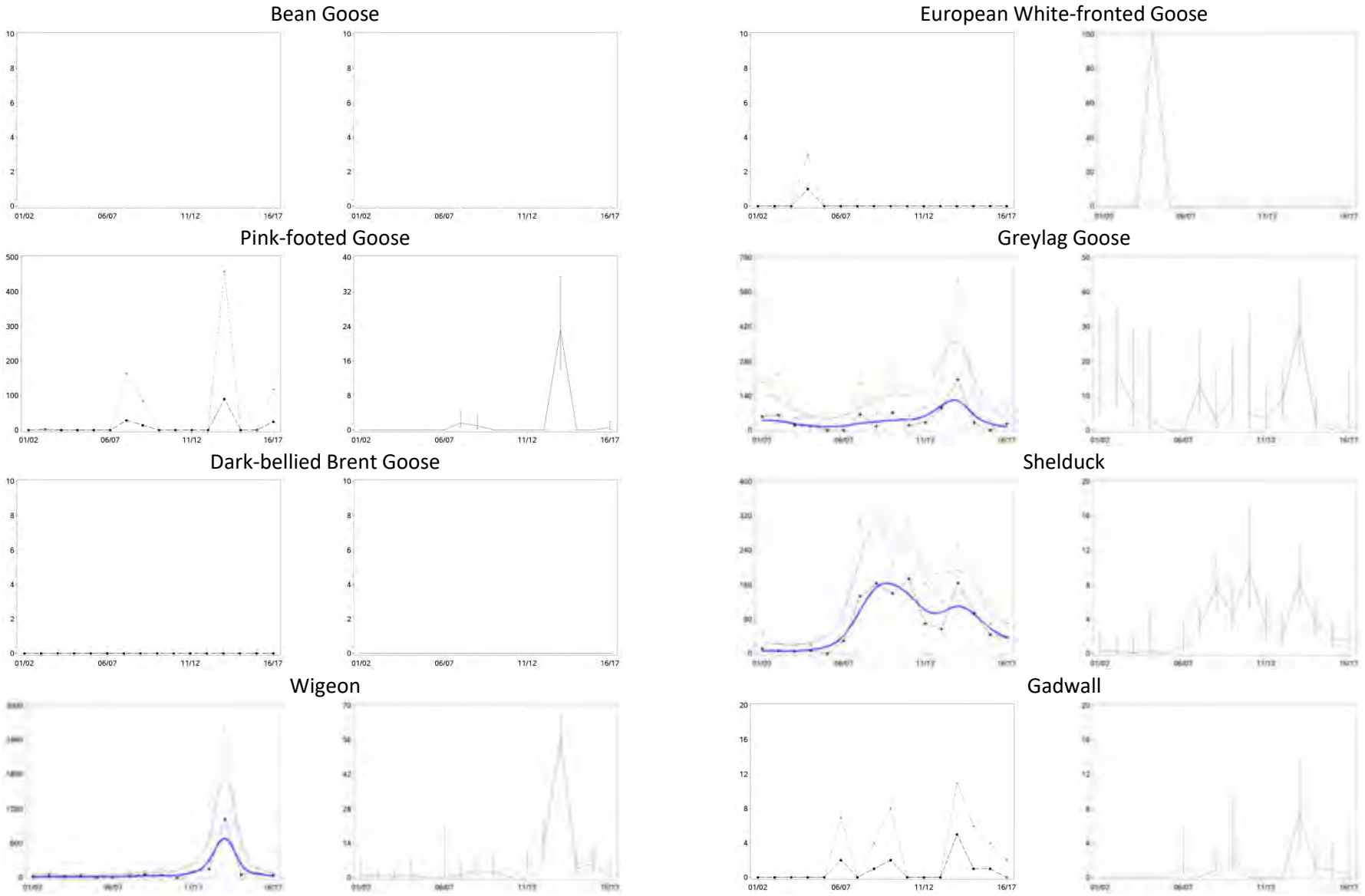
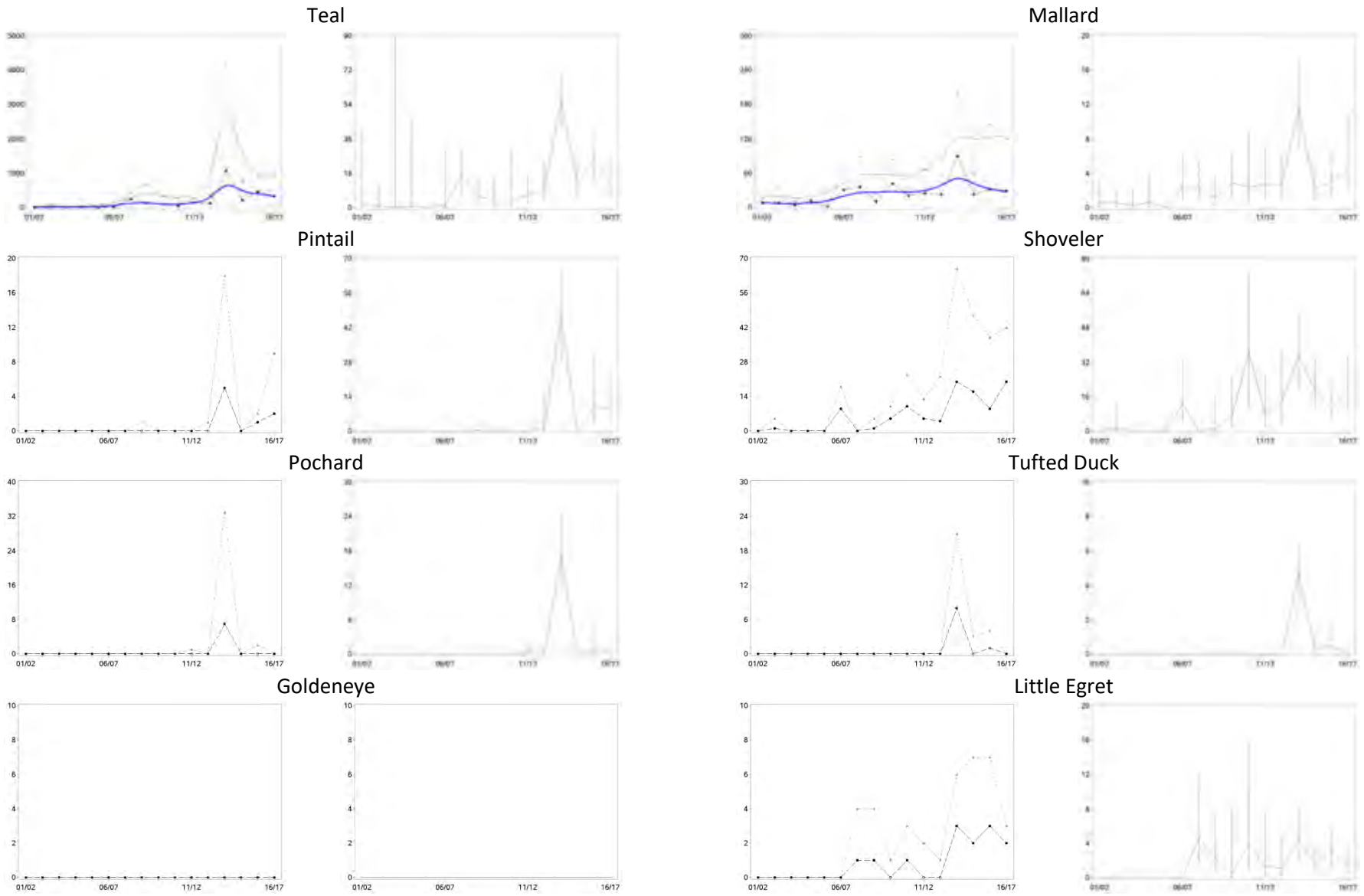


Figure A.38423. Population trends of each species in sector 38423 (Alkborough Flats - Sector A) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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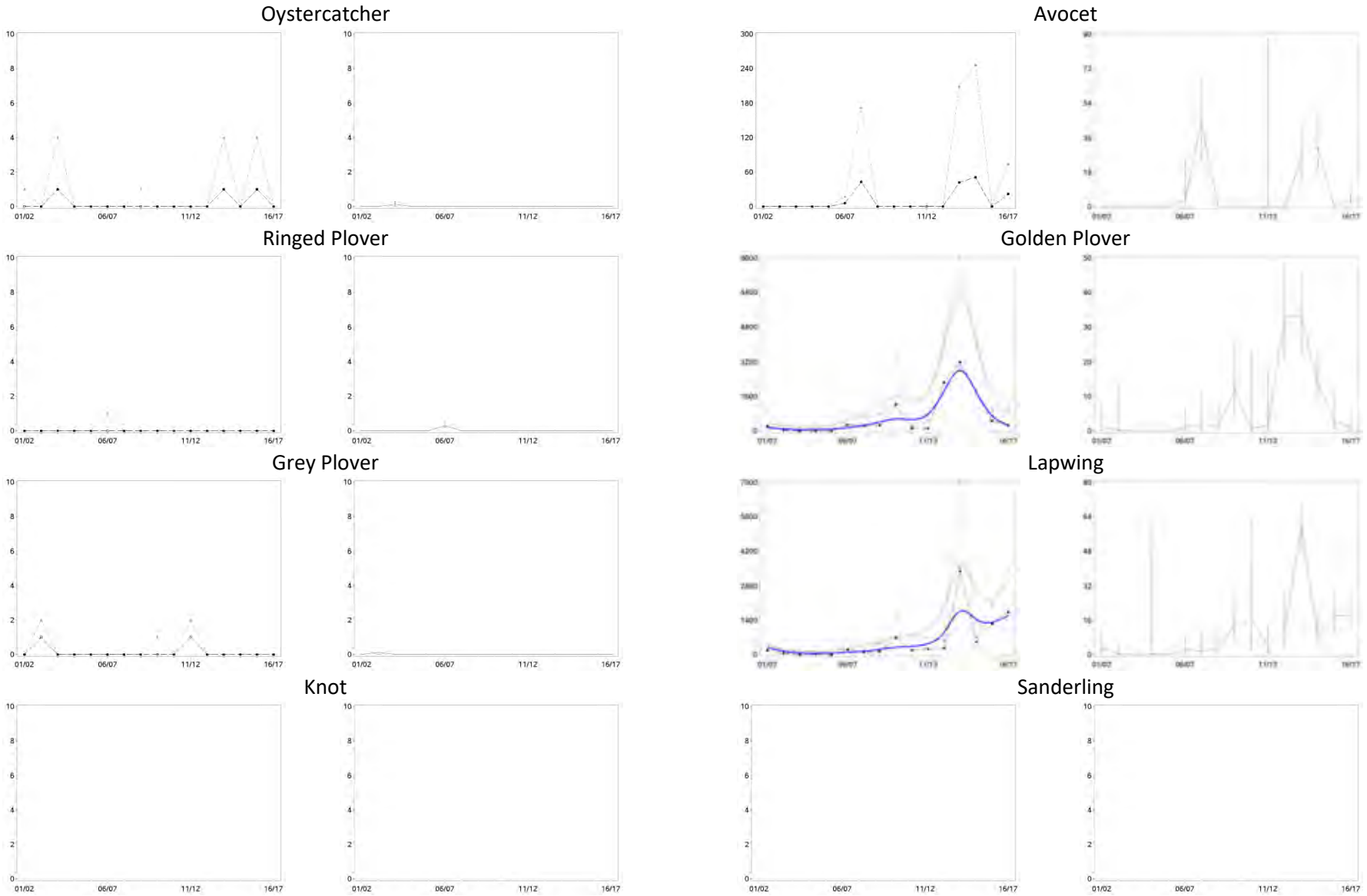

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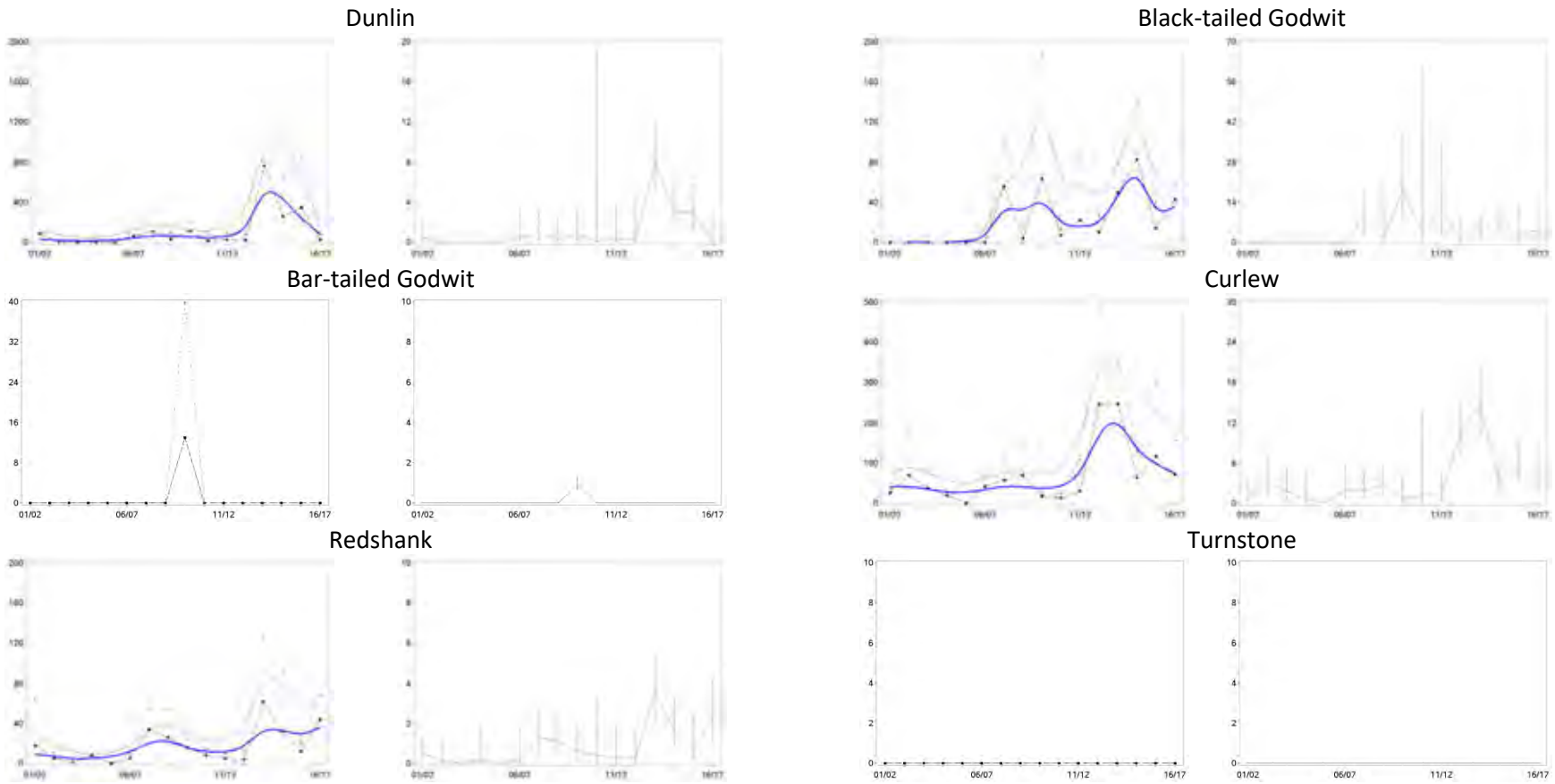

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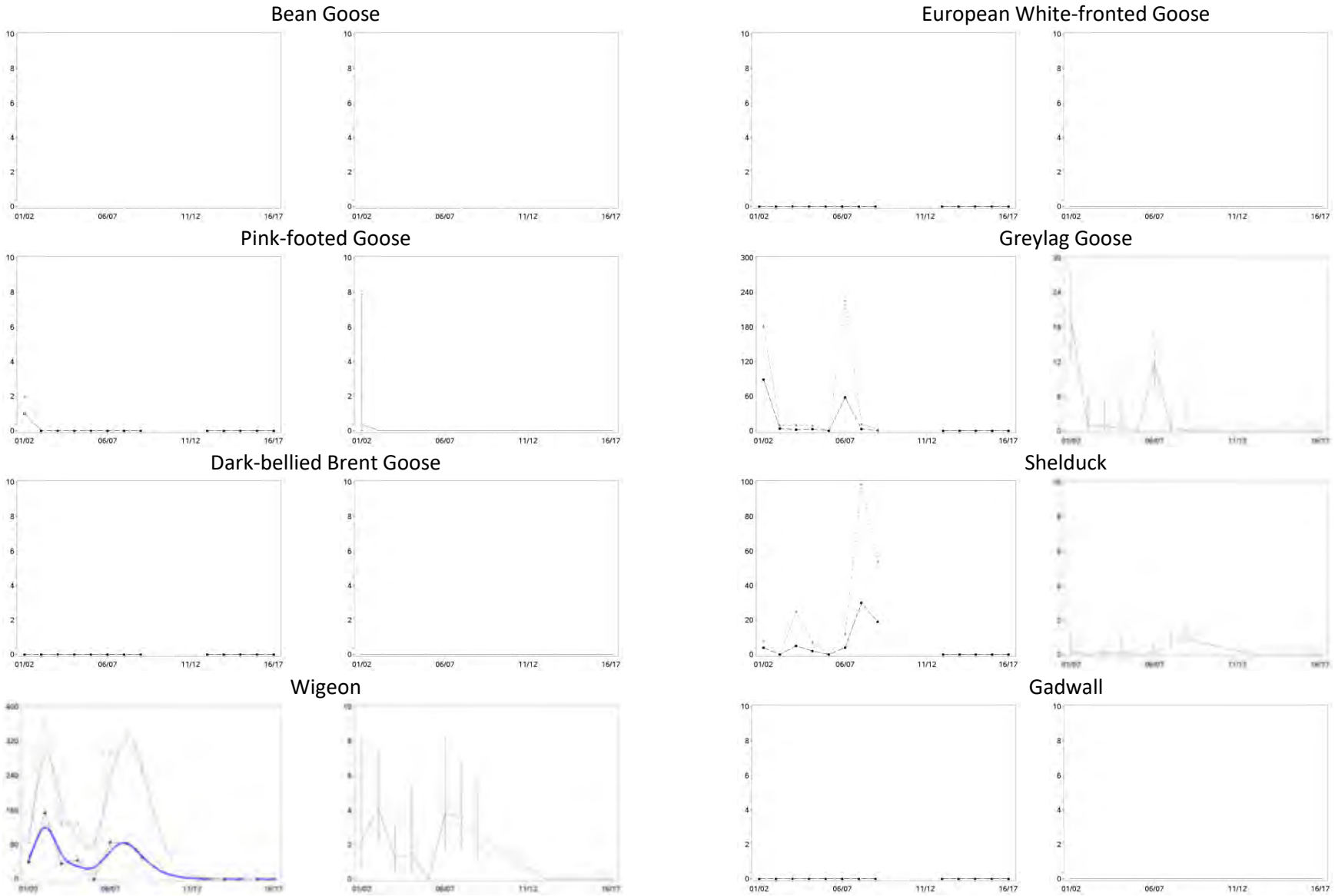
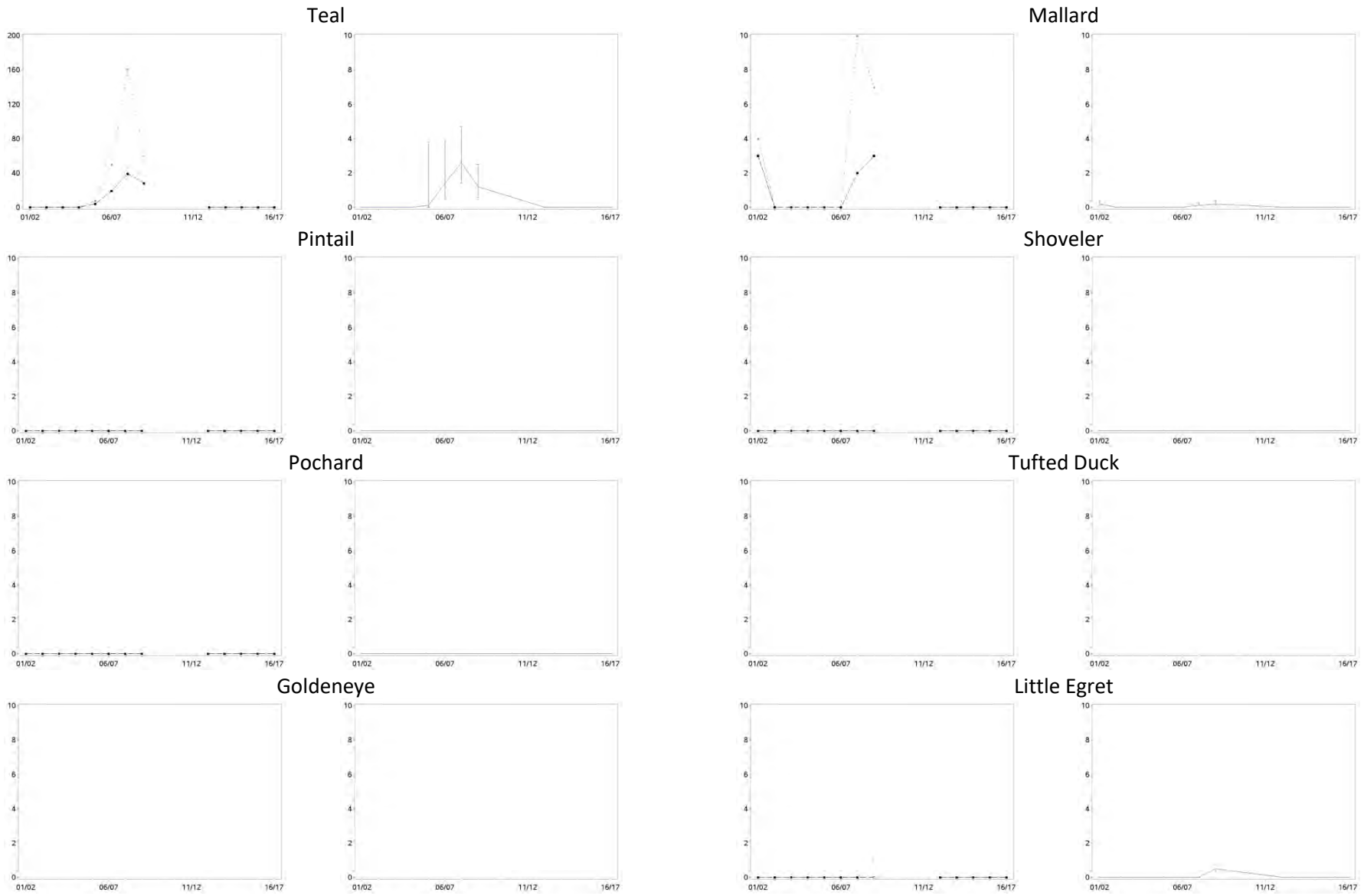


Figure A.38424. Population trends of each species in sector 38424 (Whitton West - Sector B1) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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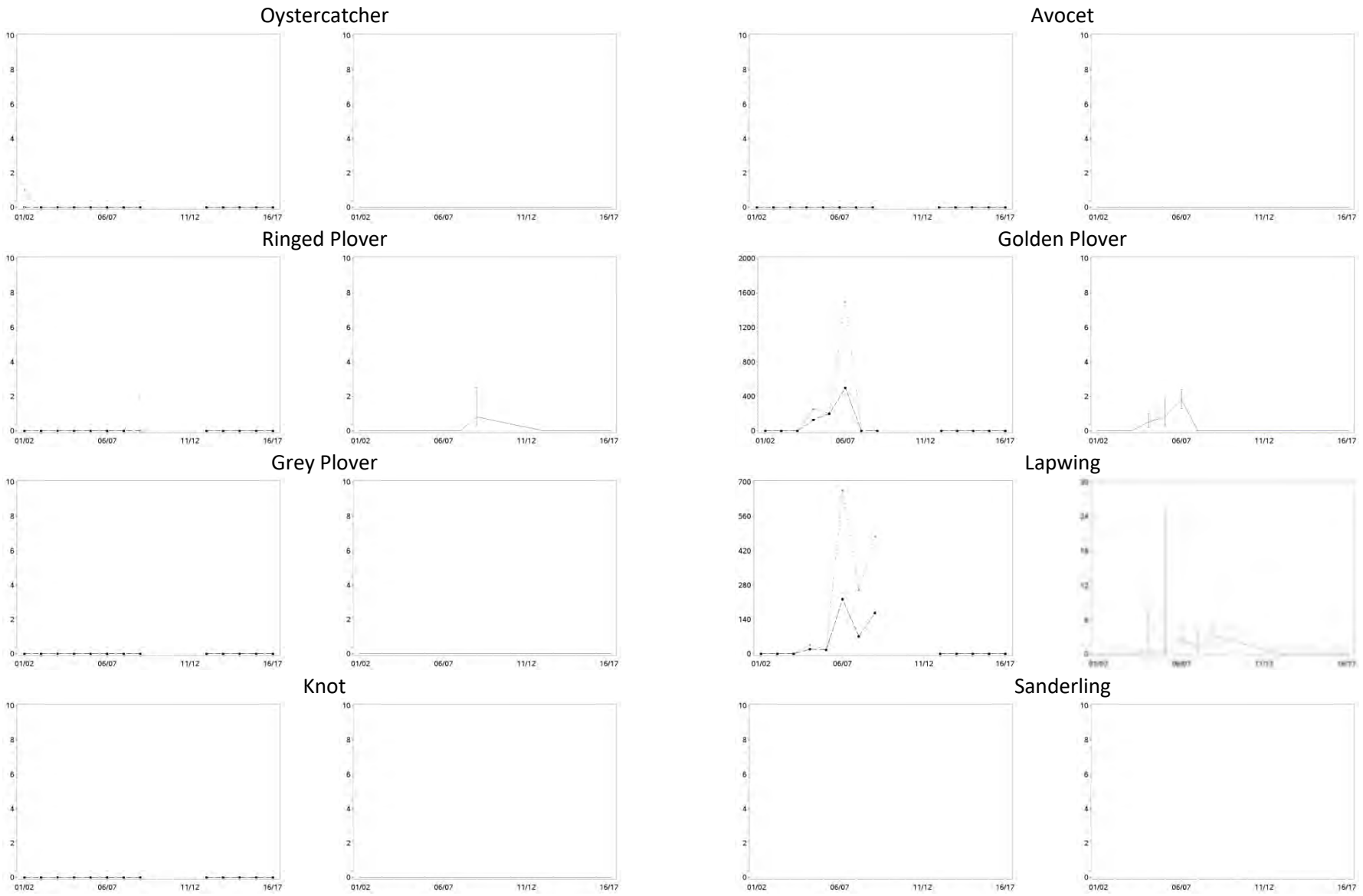

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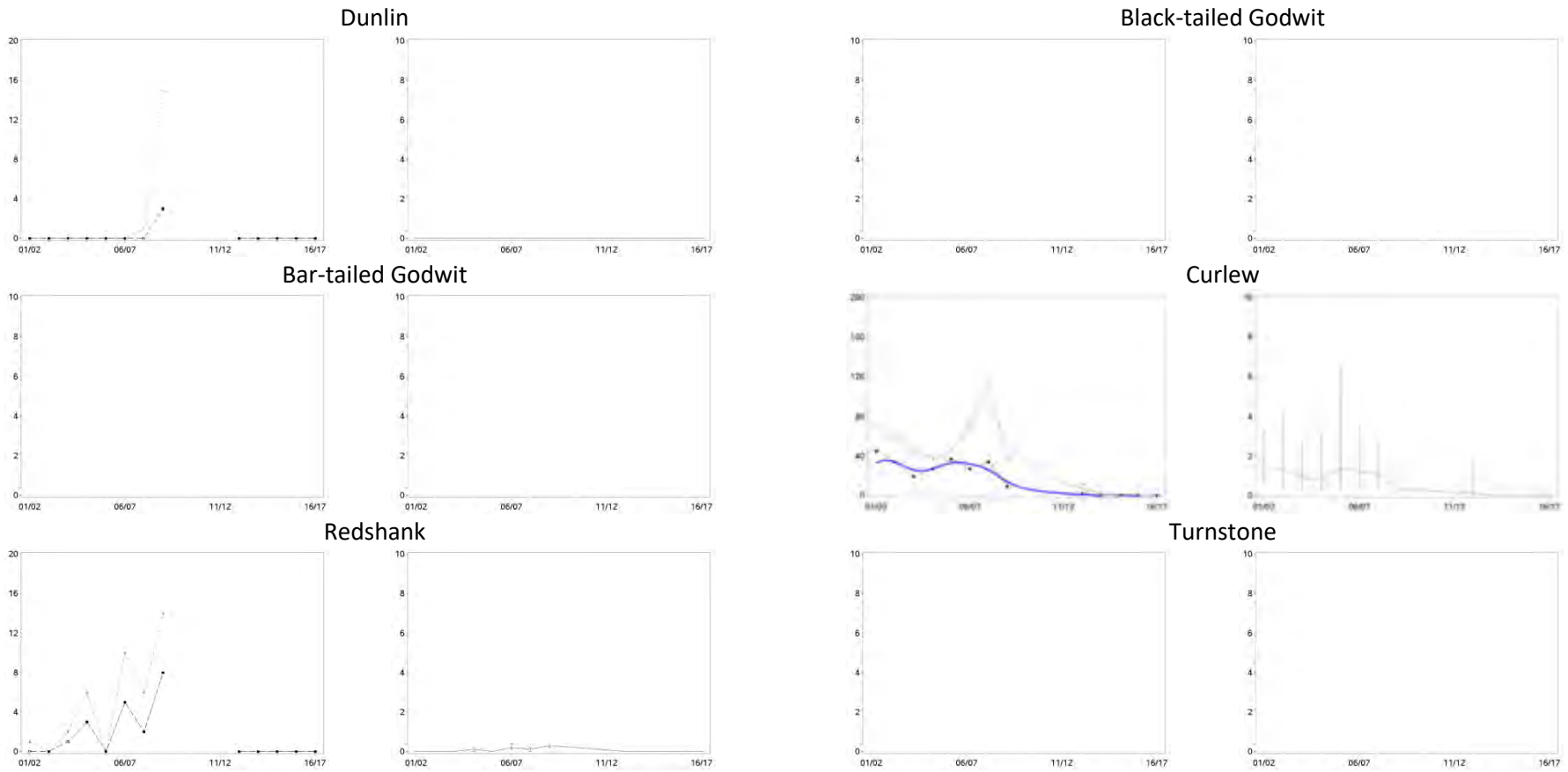

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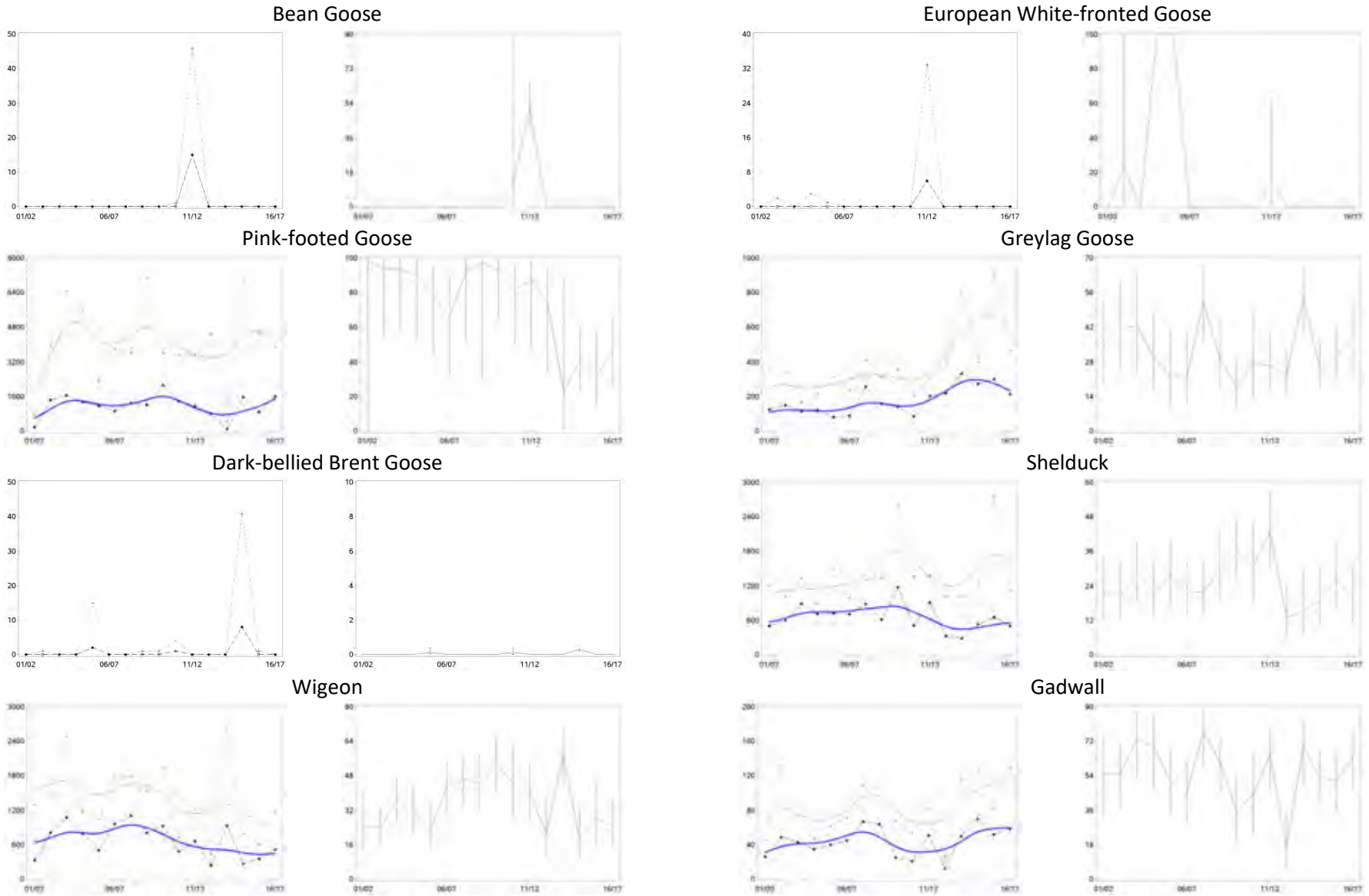
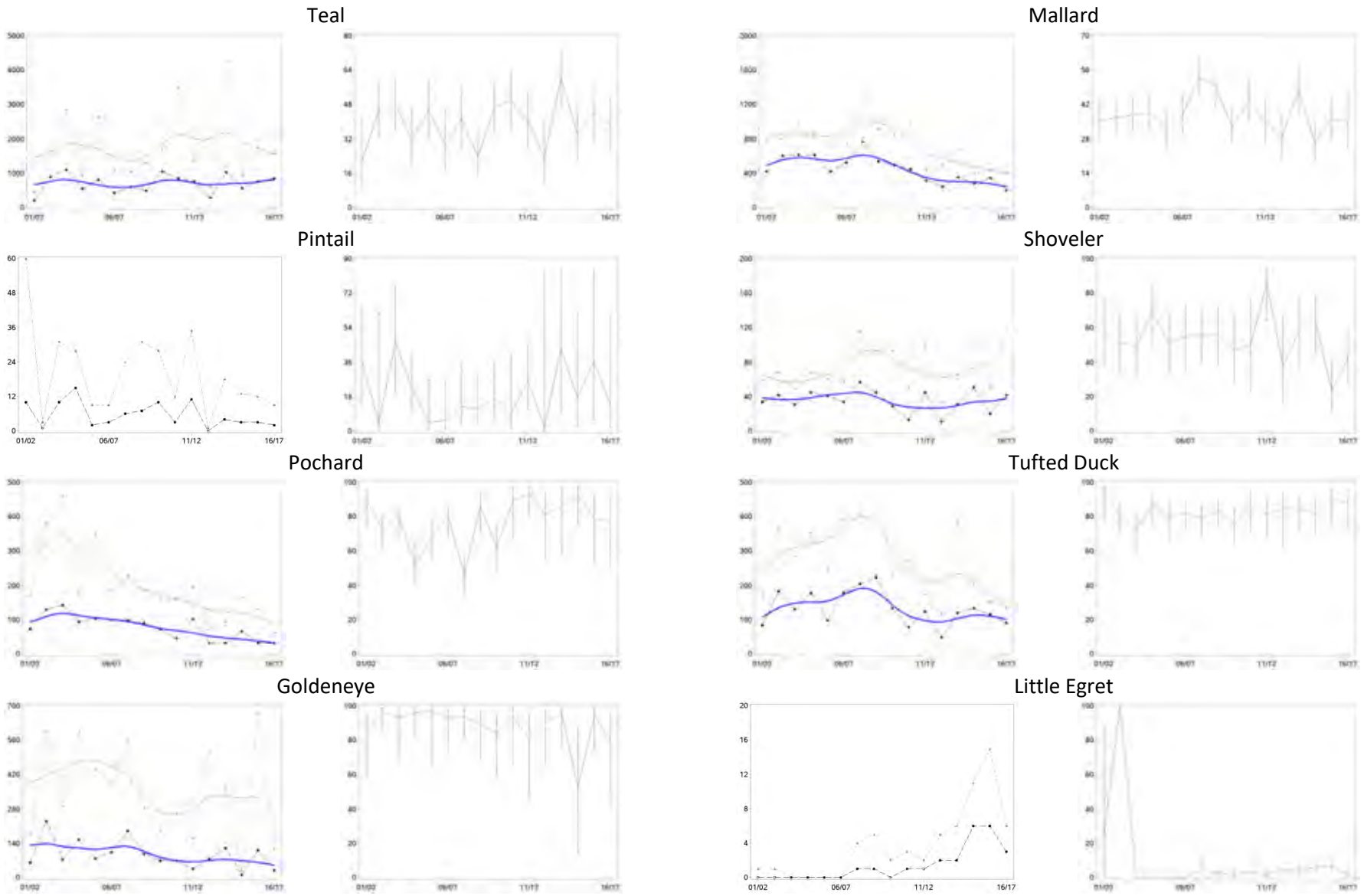


Figure A.38425. Population trends of each species in sector 38425 (Humber South (Inner)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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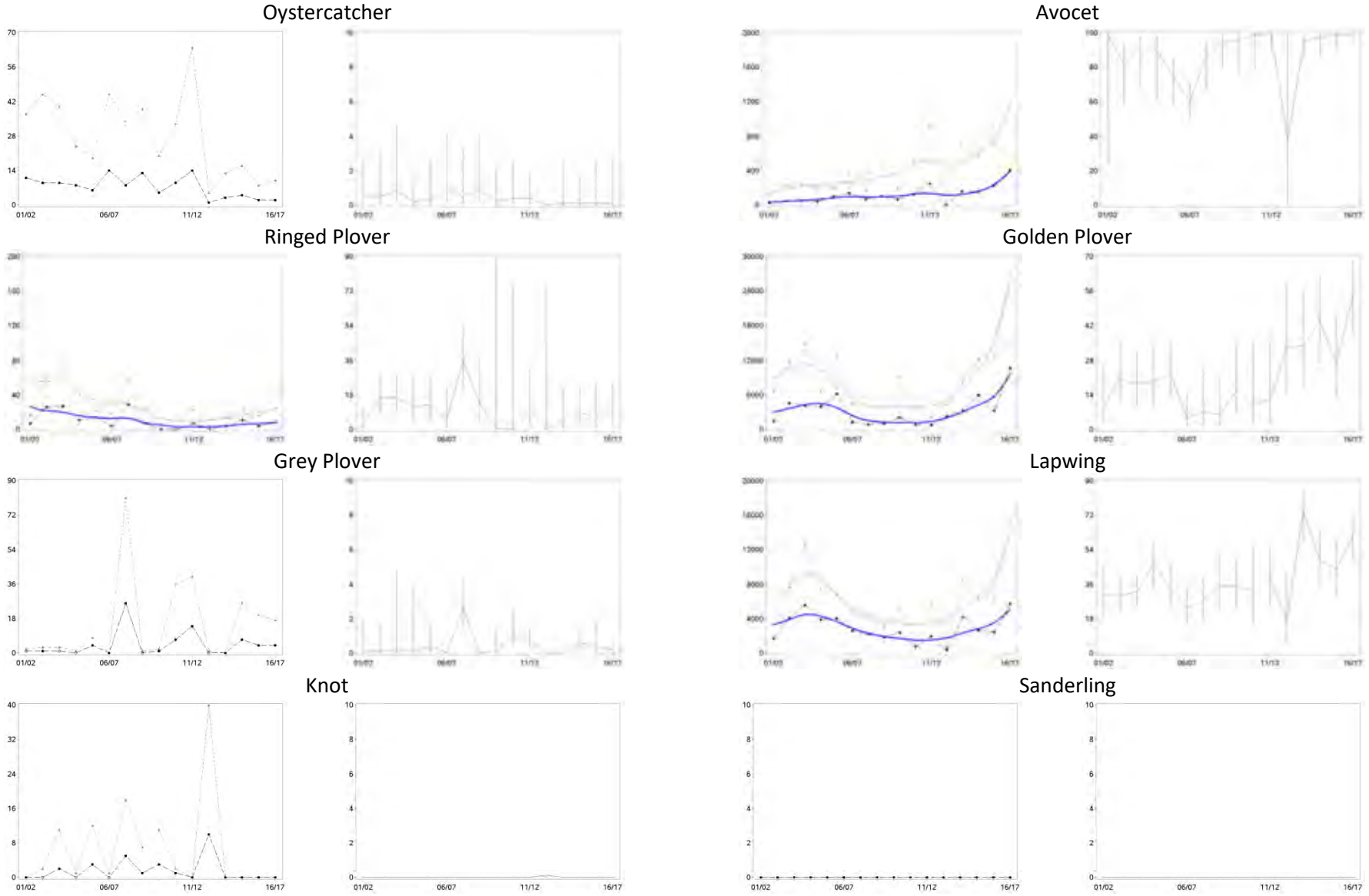

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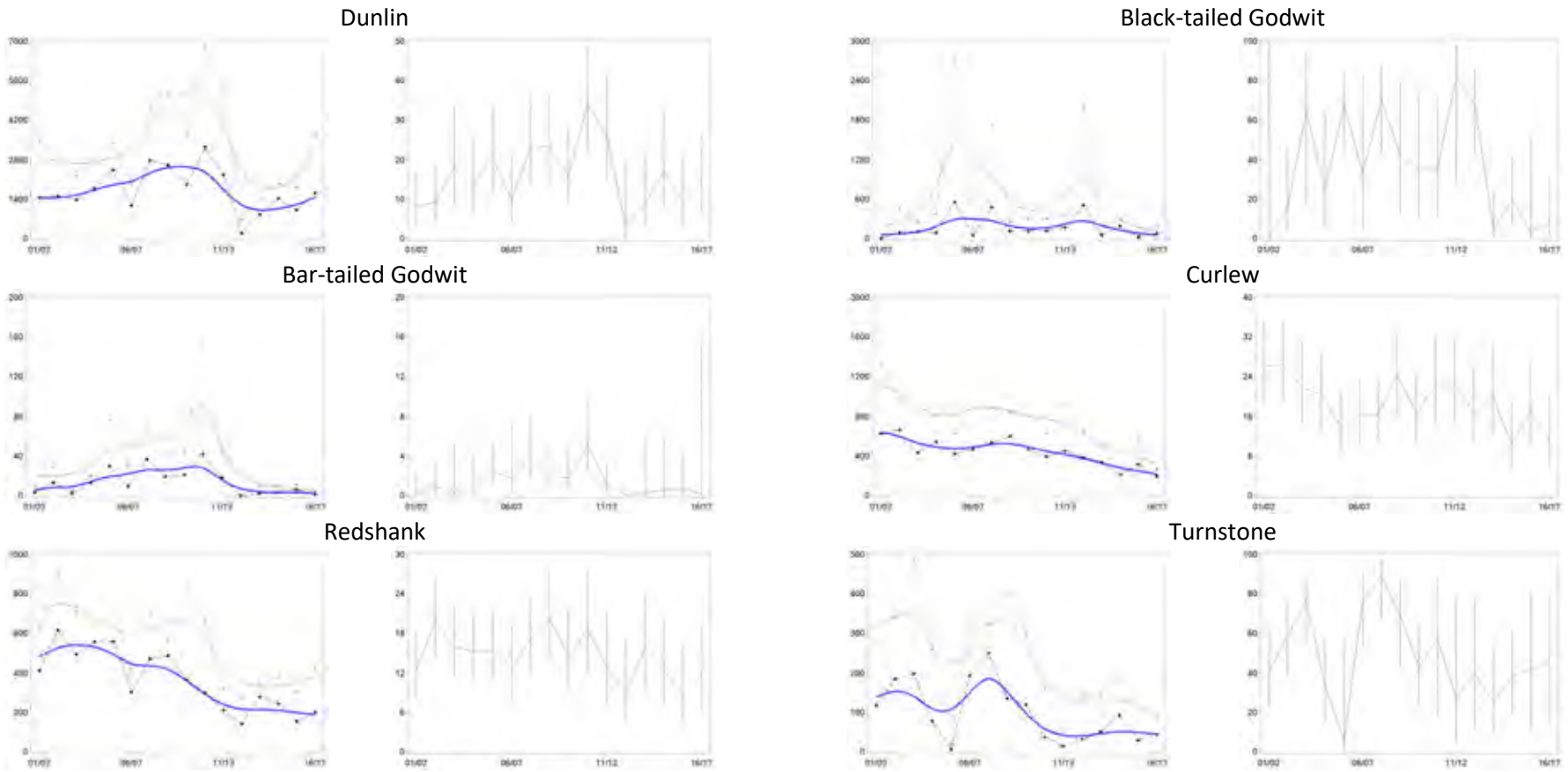

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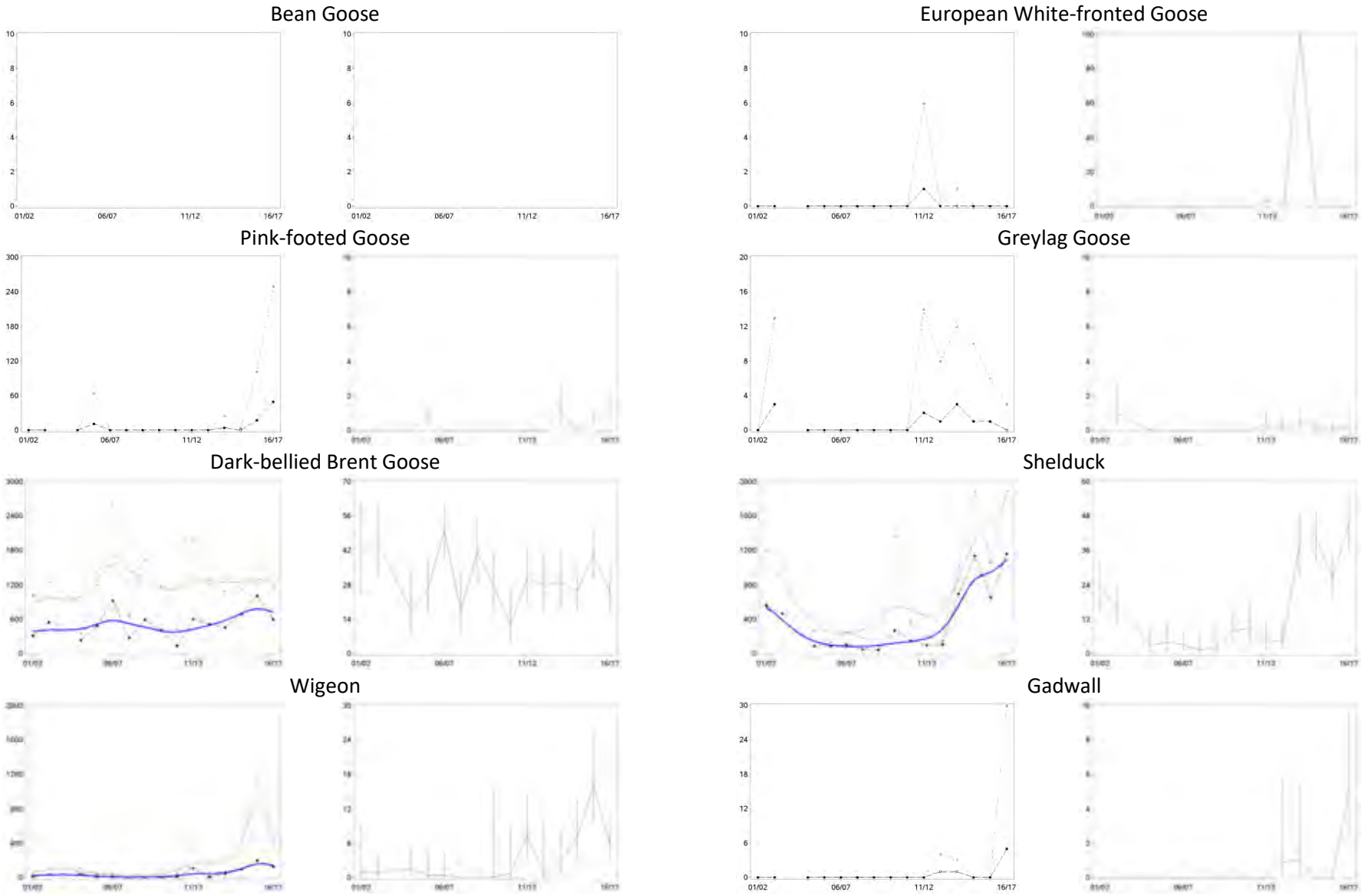
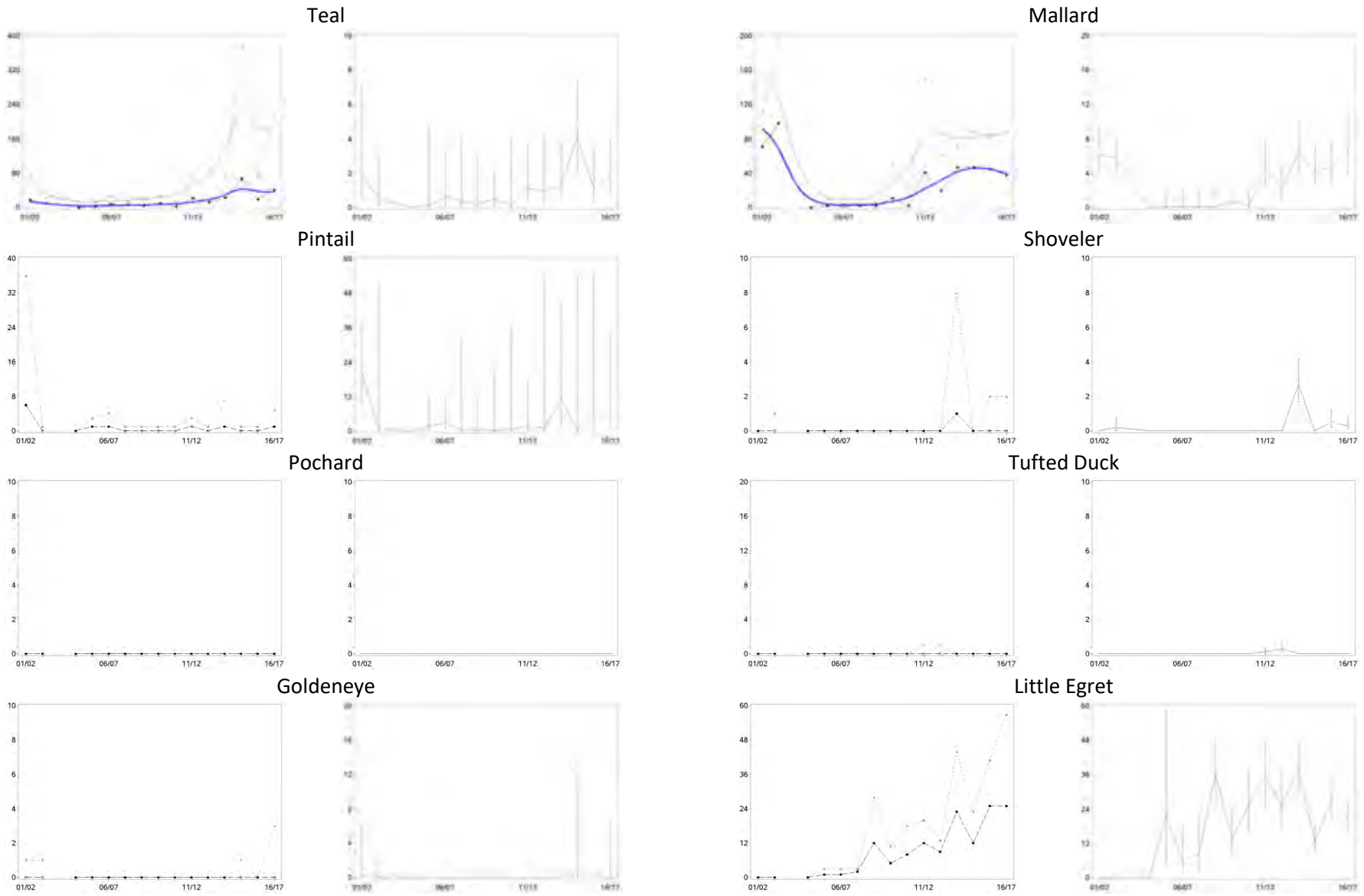


Figure A.38427. Population trends of each species in sector 38427 (Humber South (Mid)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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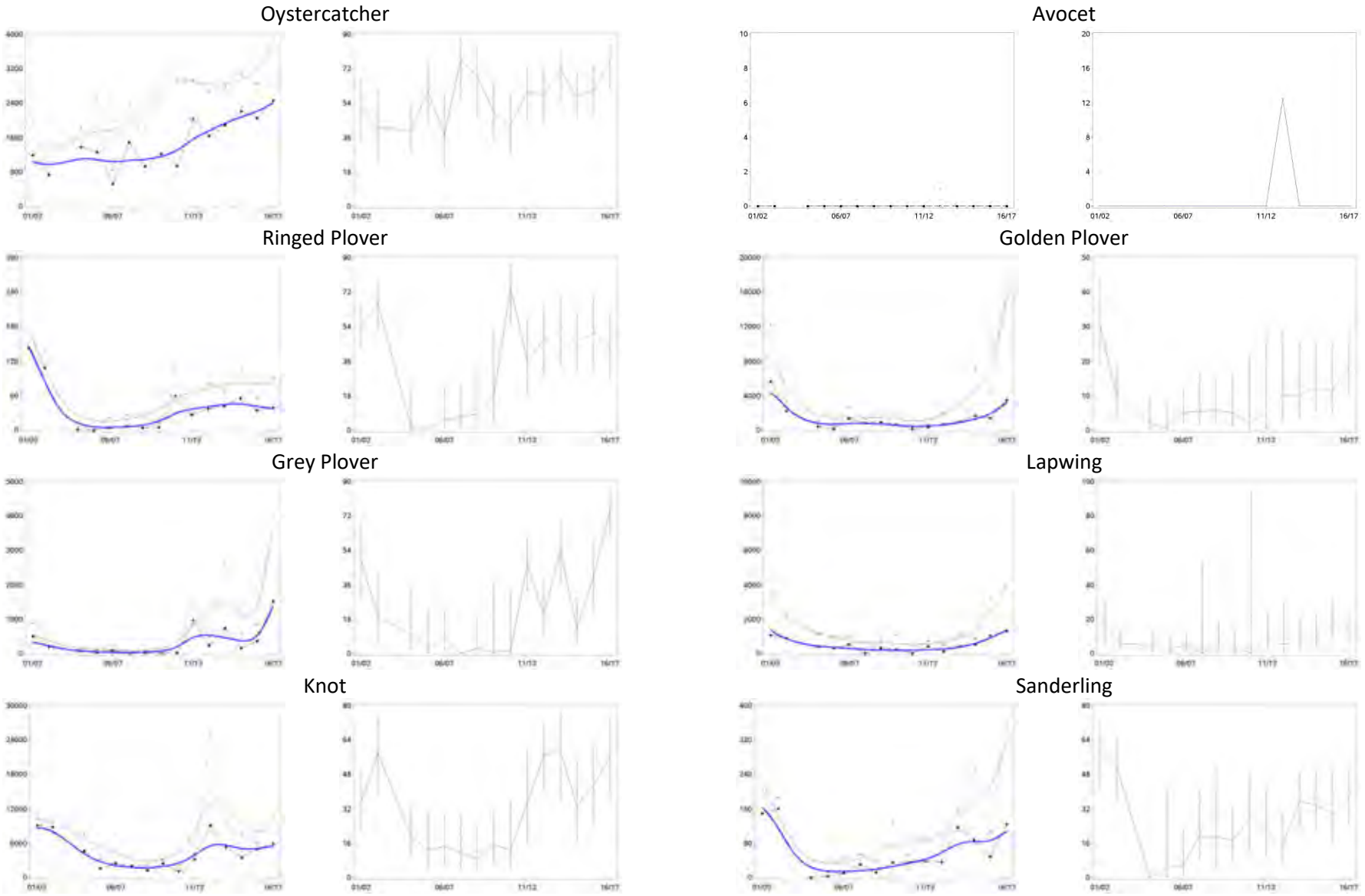

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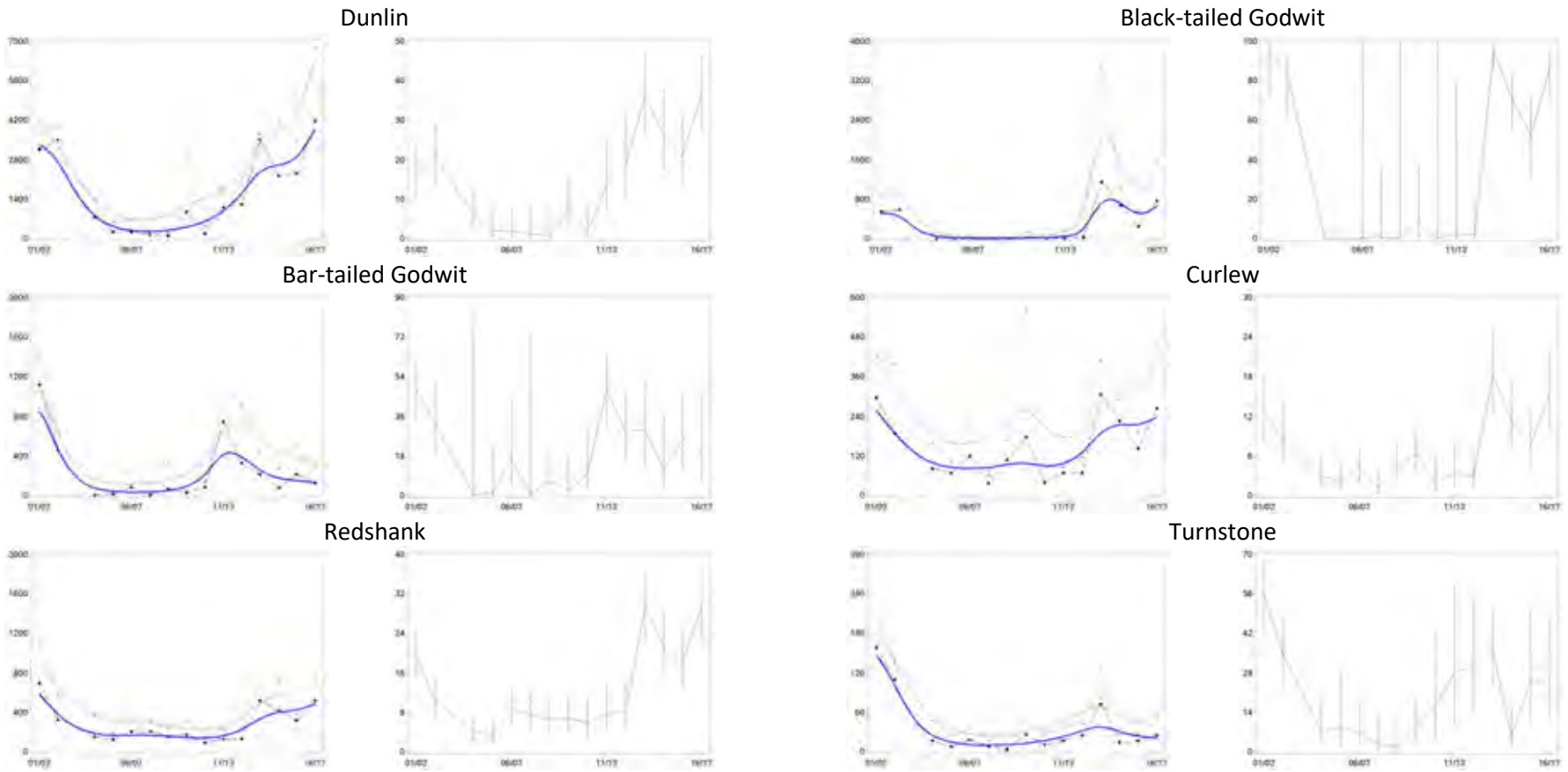

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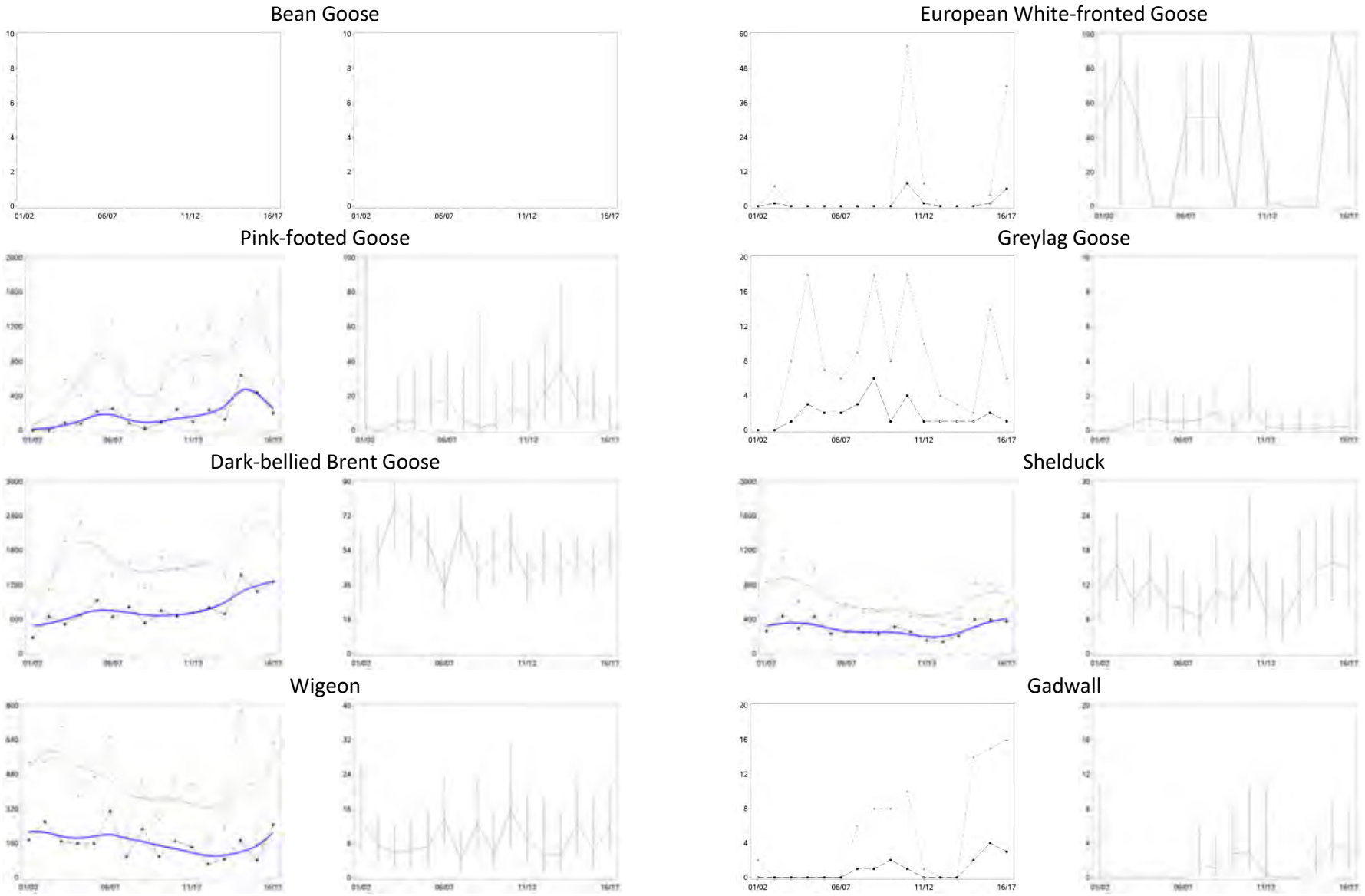
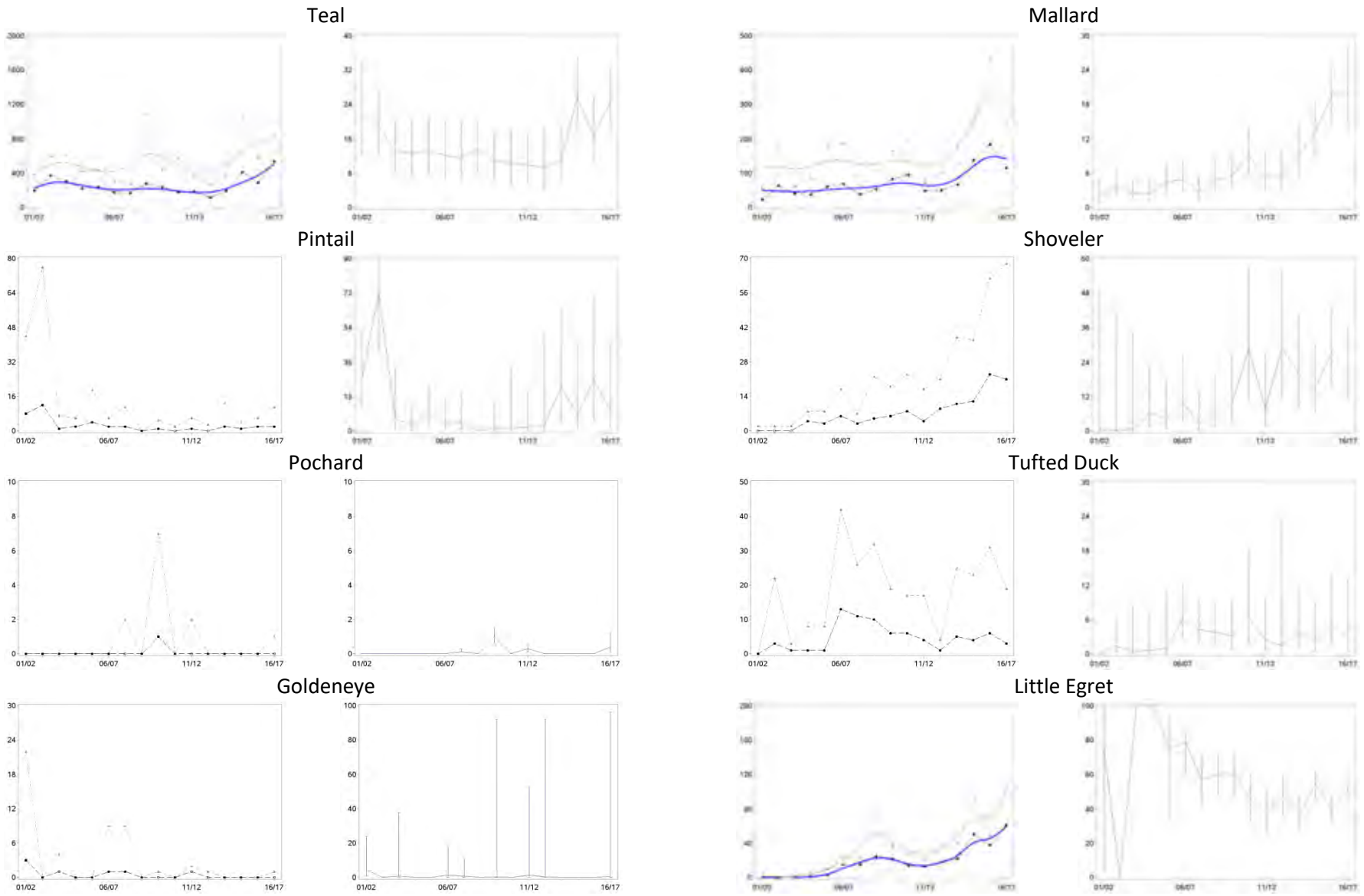


Figure A.38429. Population trends of each species in sector 38429 (Humber South (Outer)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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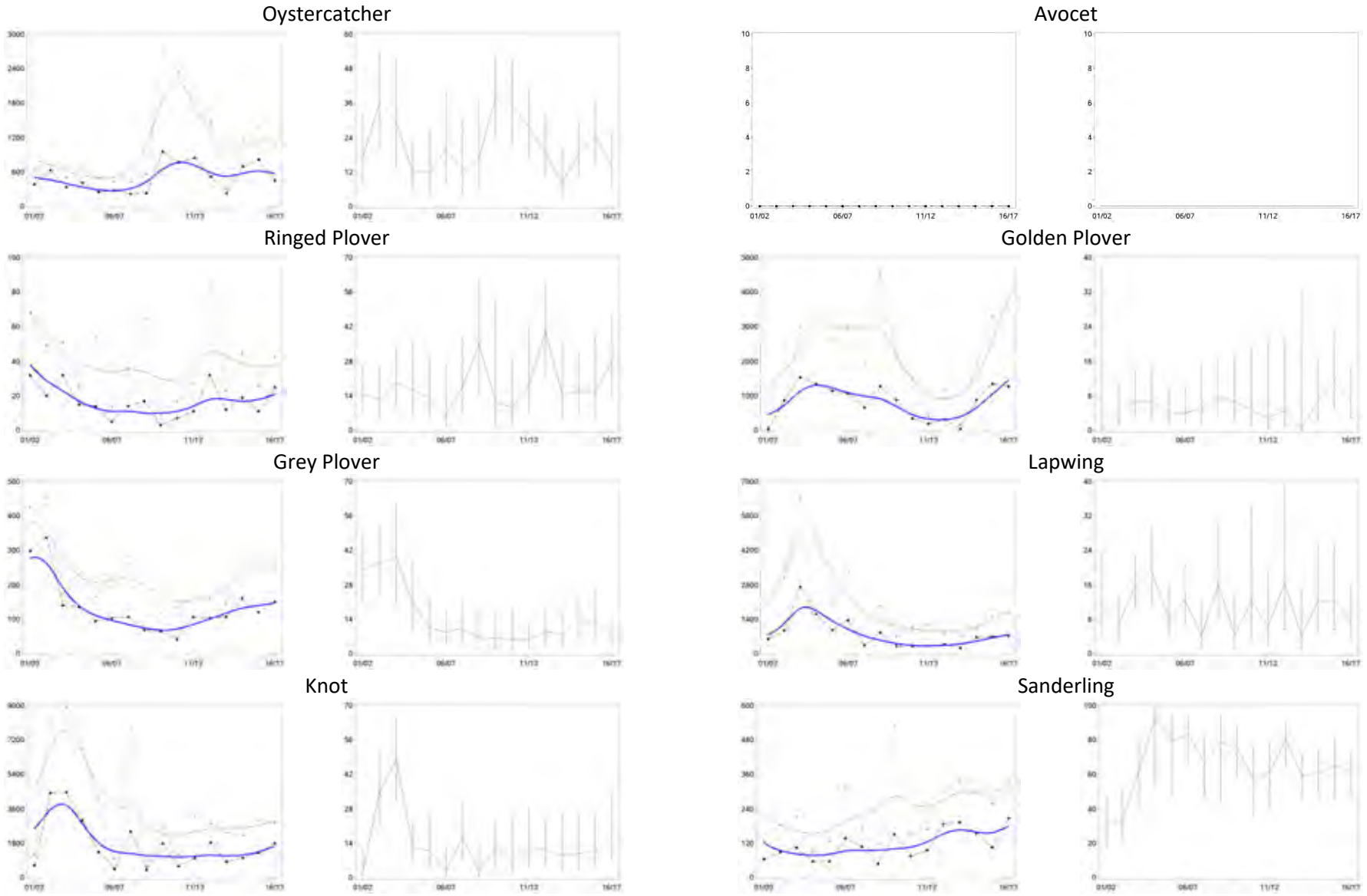

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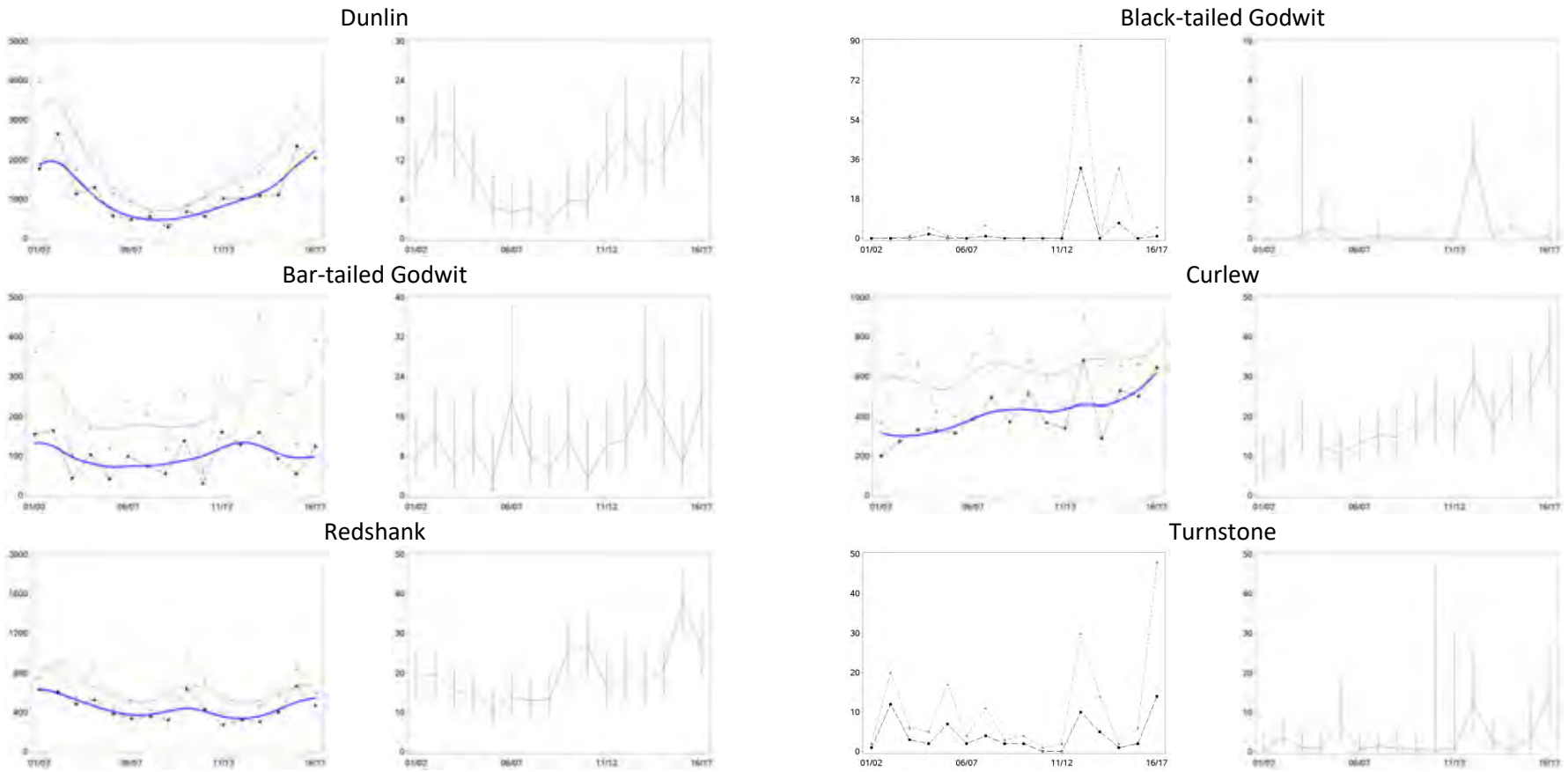

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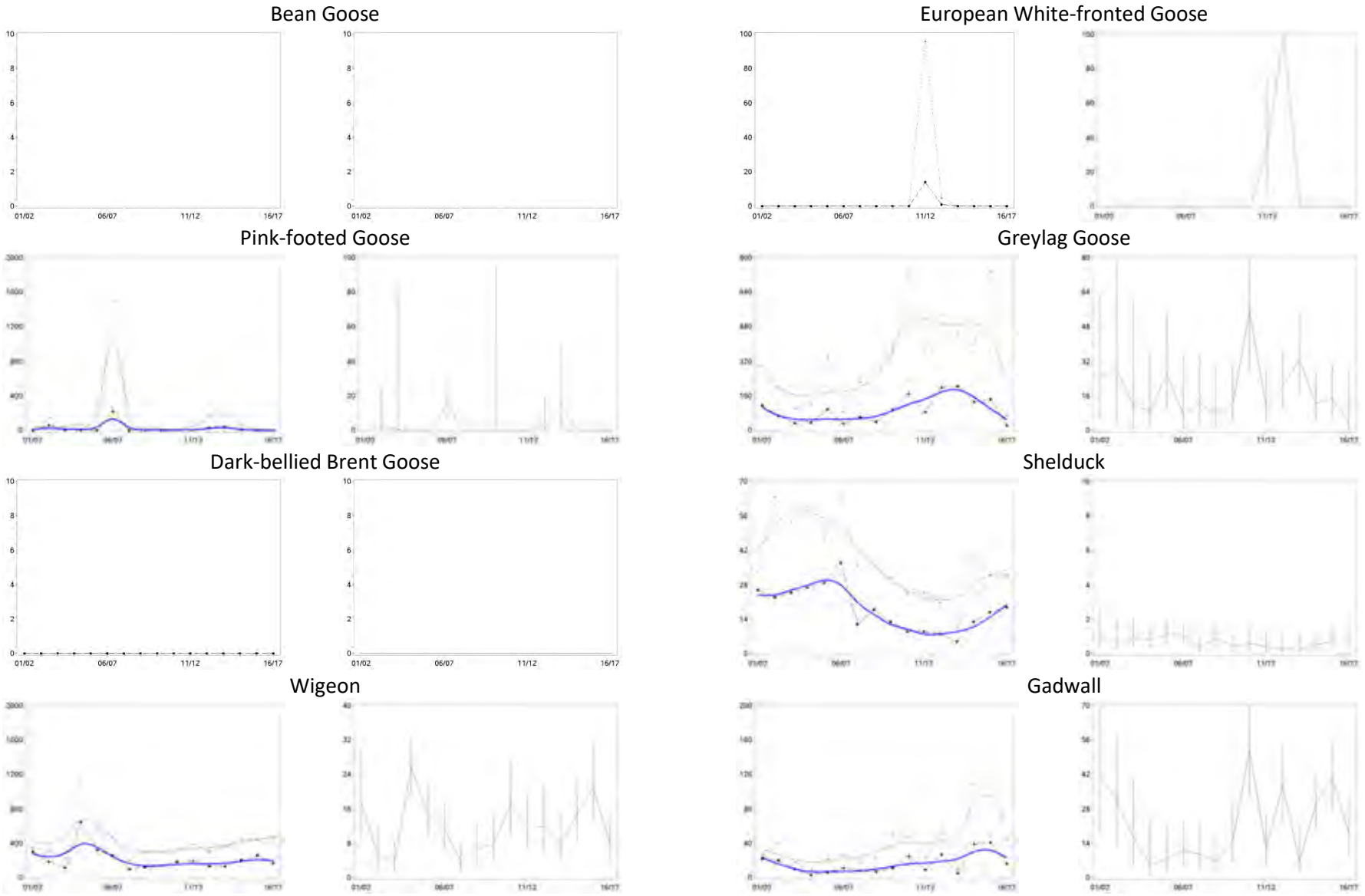
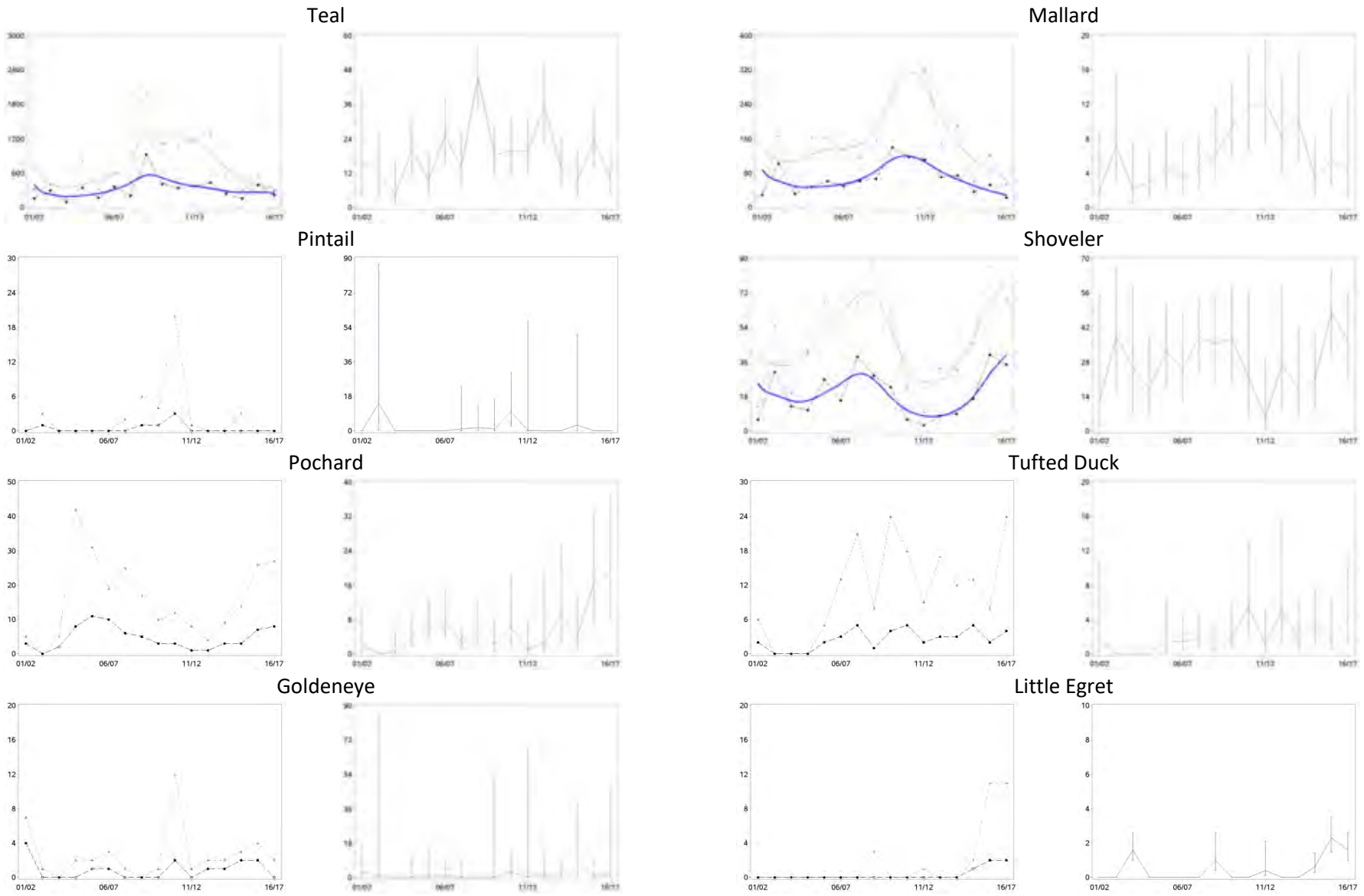


Figure A.38430. Population trends of each species in sector 38430 (Blacktoft Sands) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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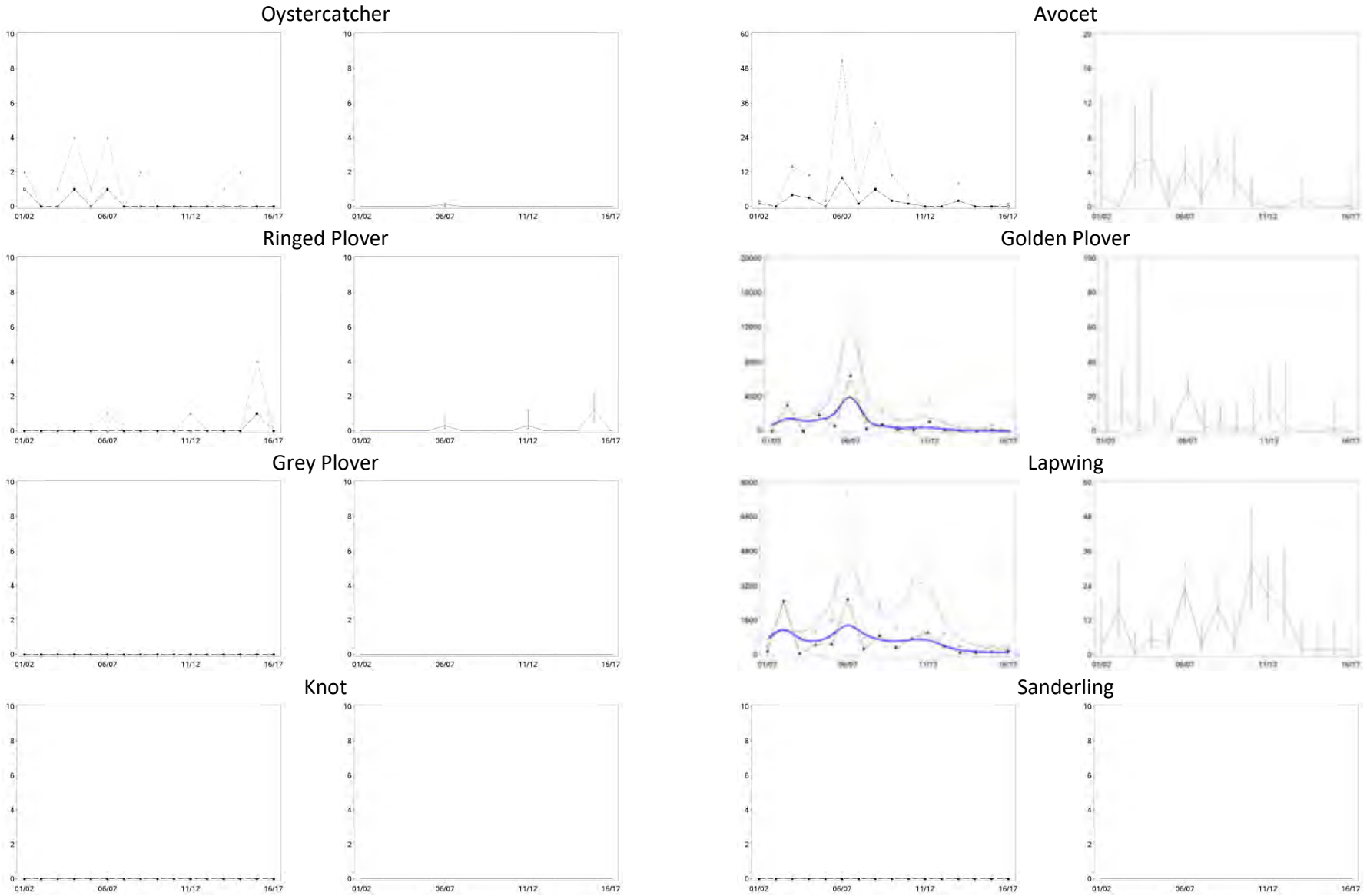

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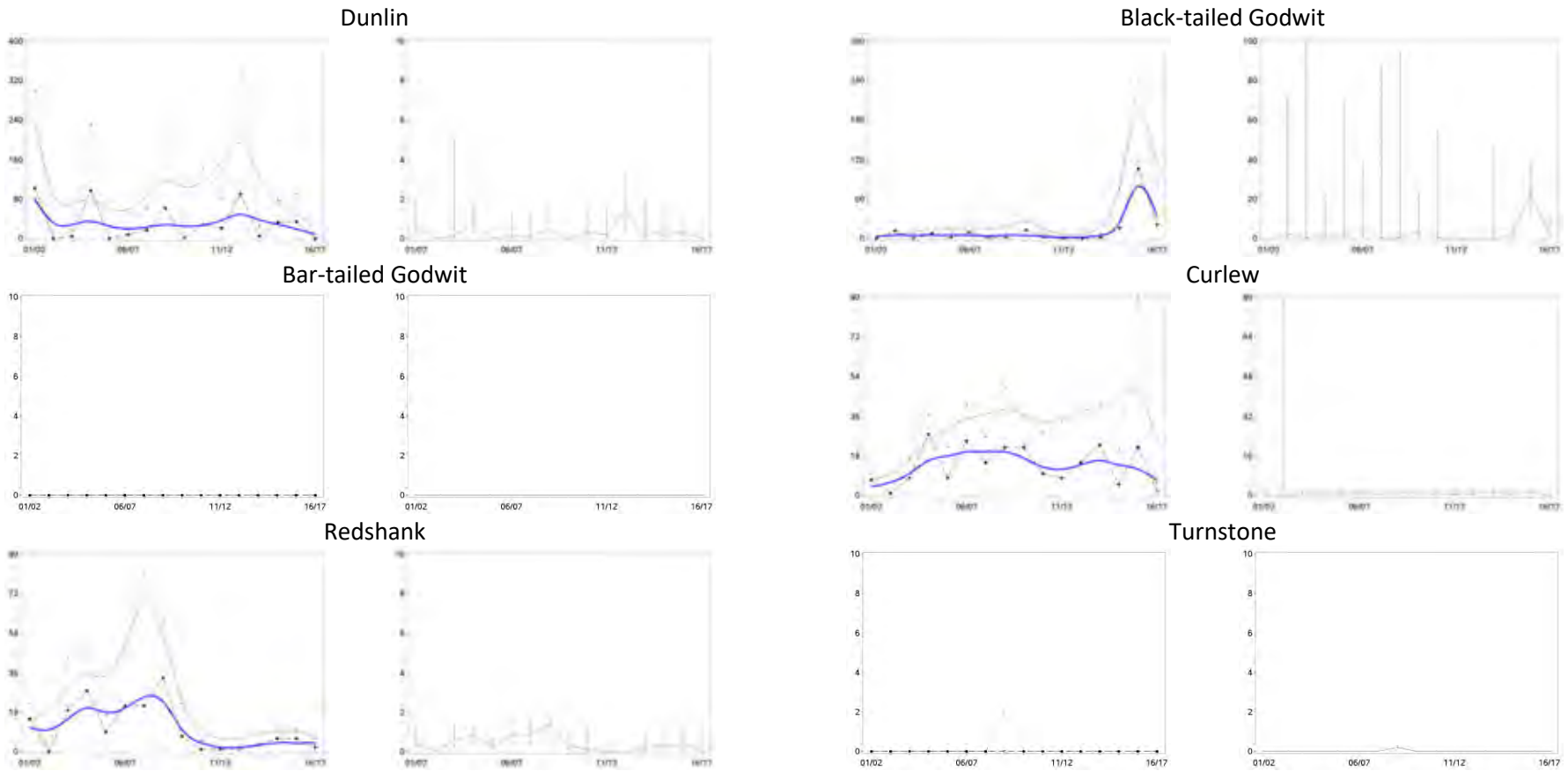

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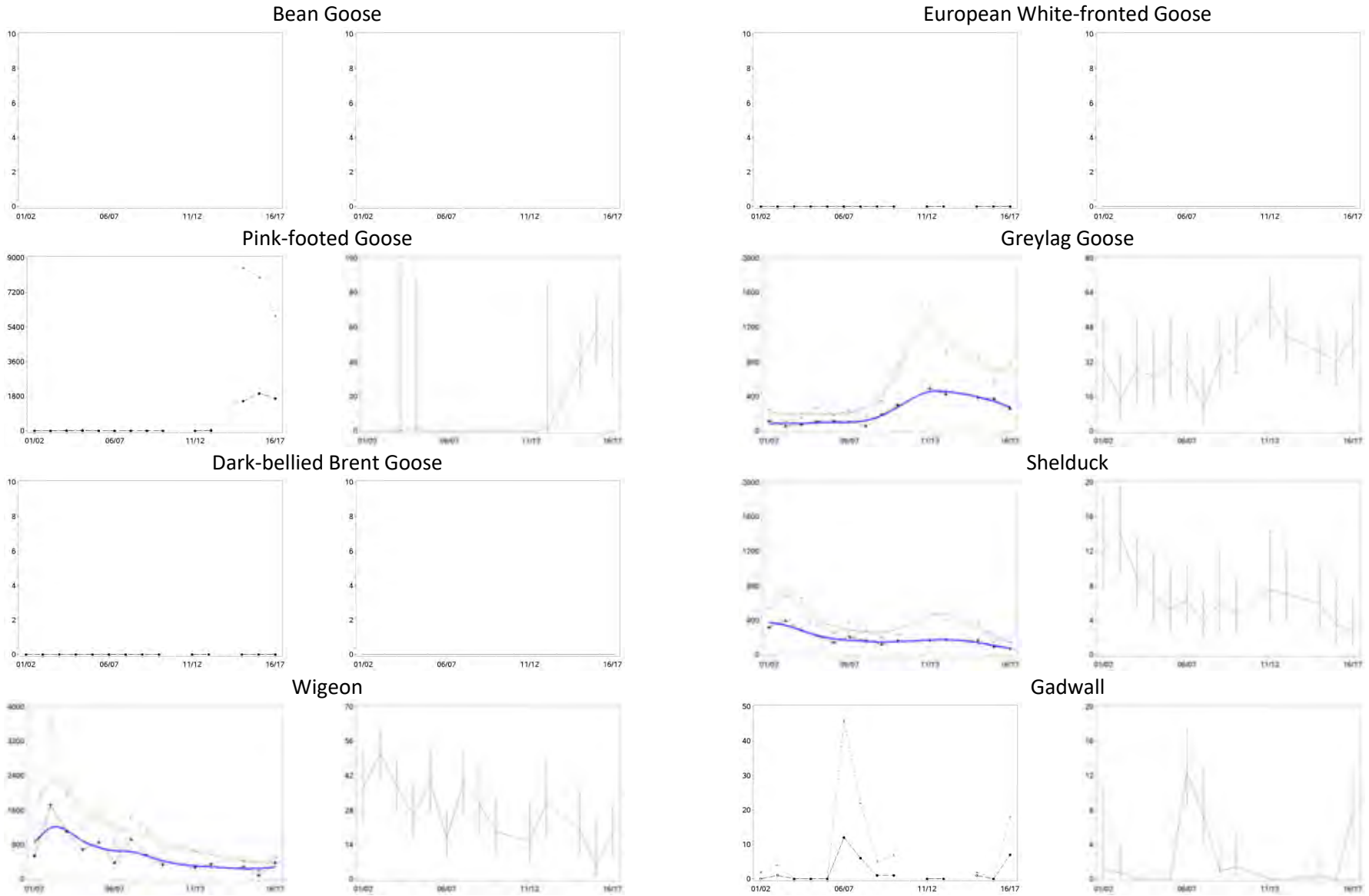
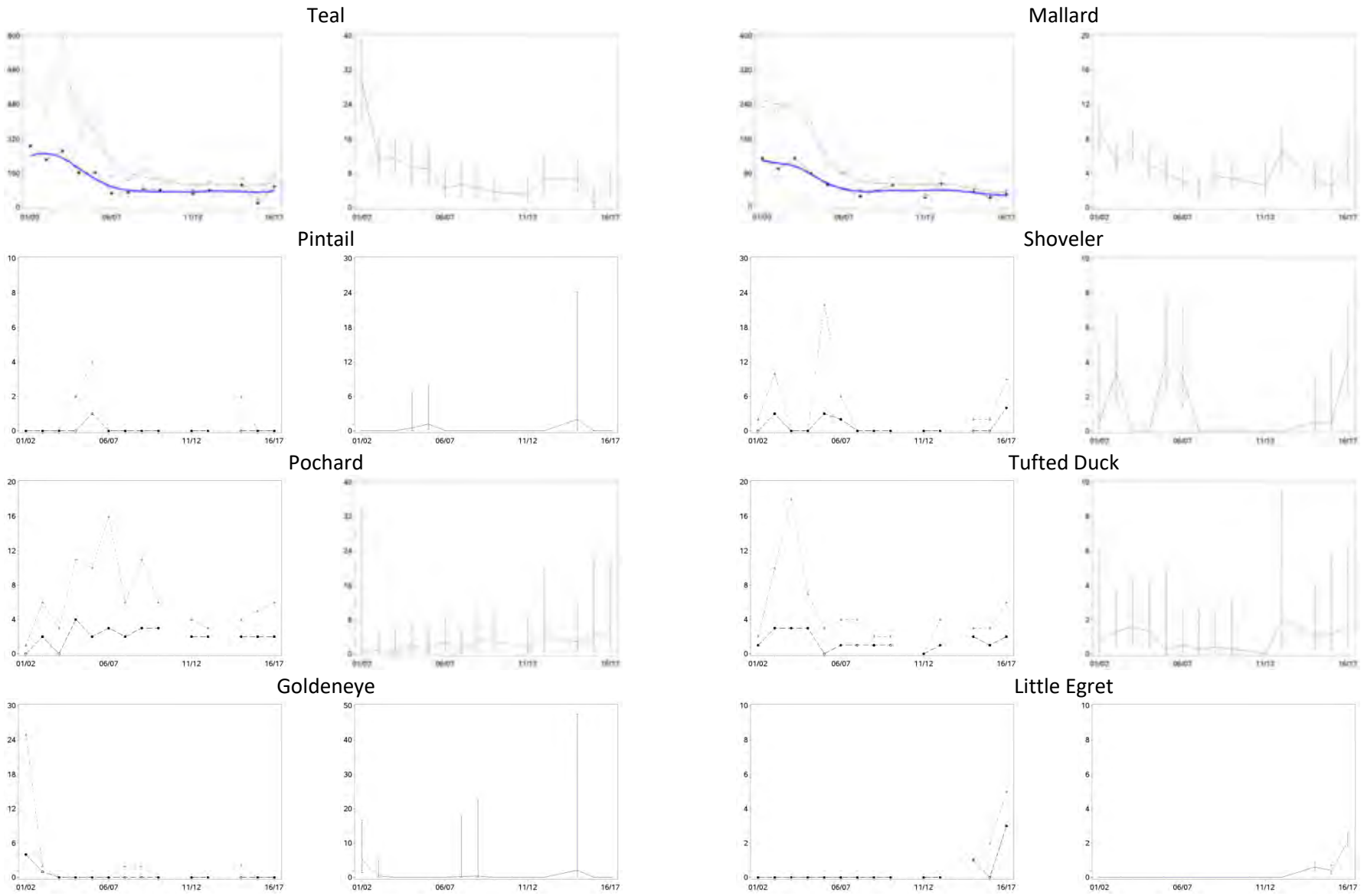


Figure A.38432. Population trends of each species in sector 38432 (Faxfleet to Brough Haven) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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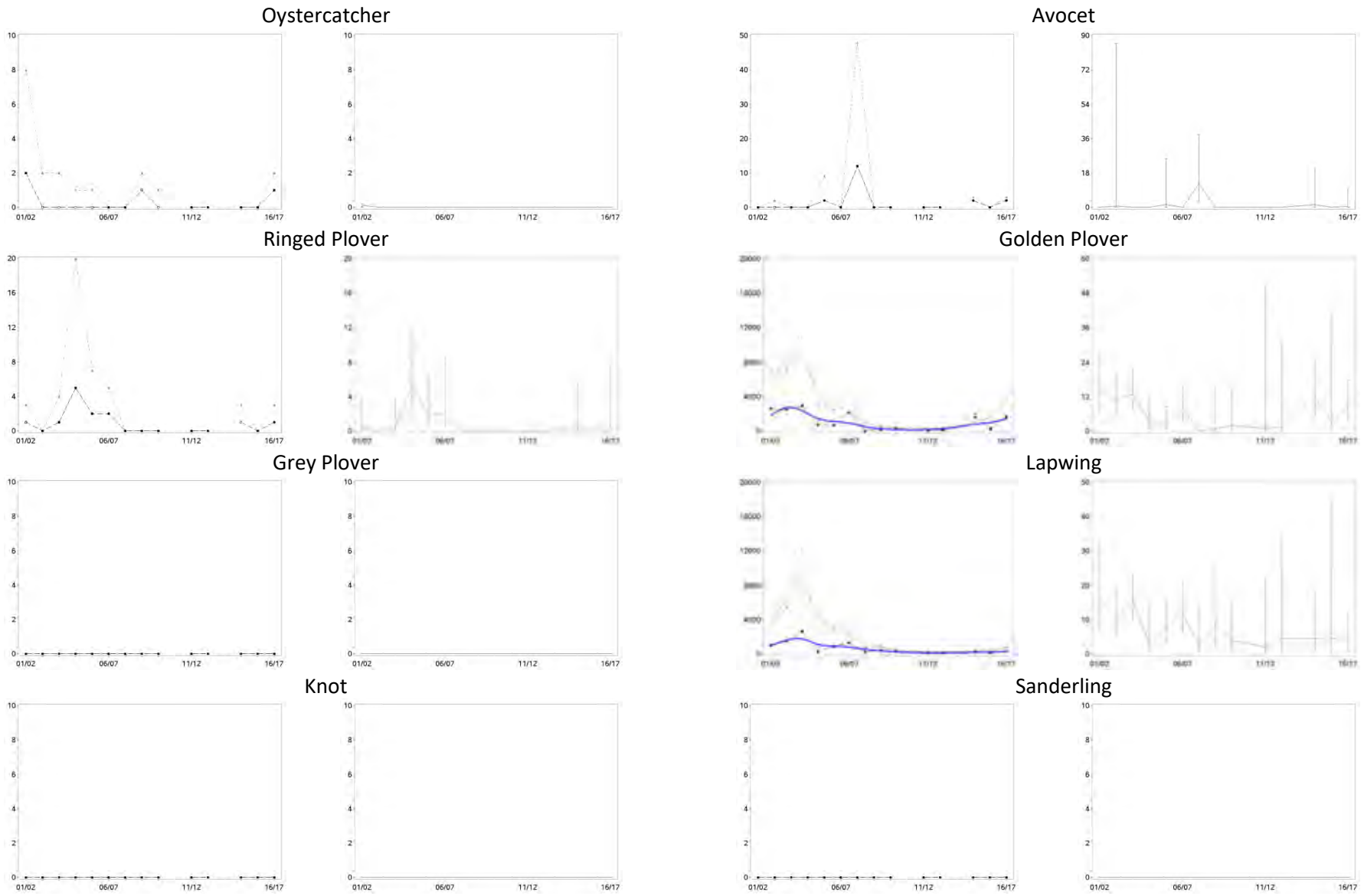

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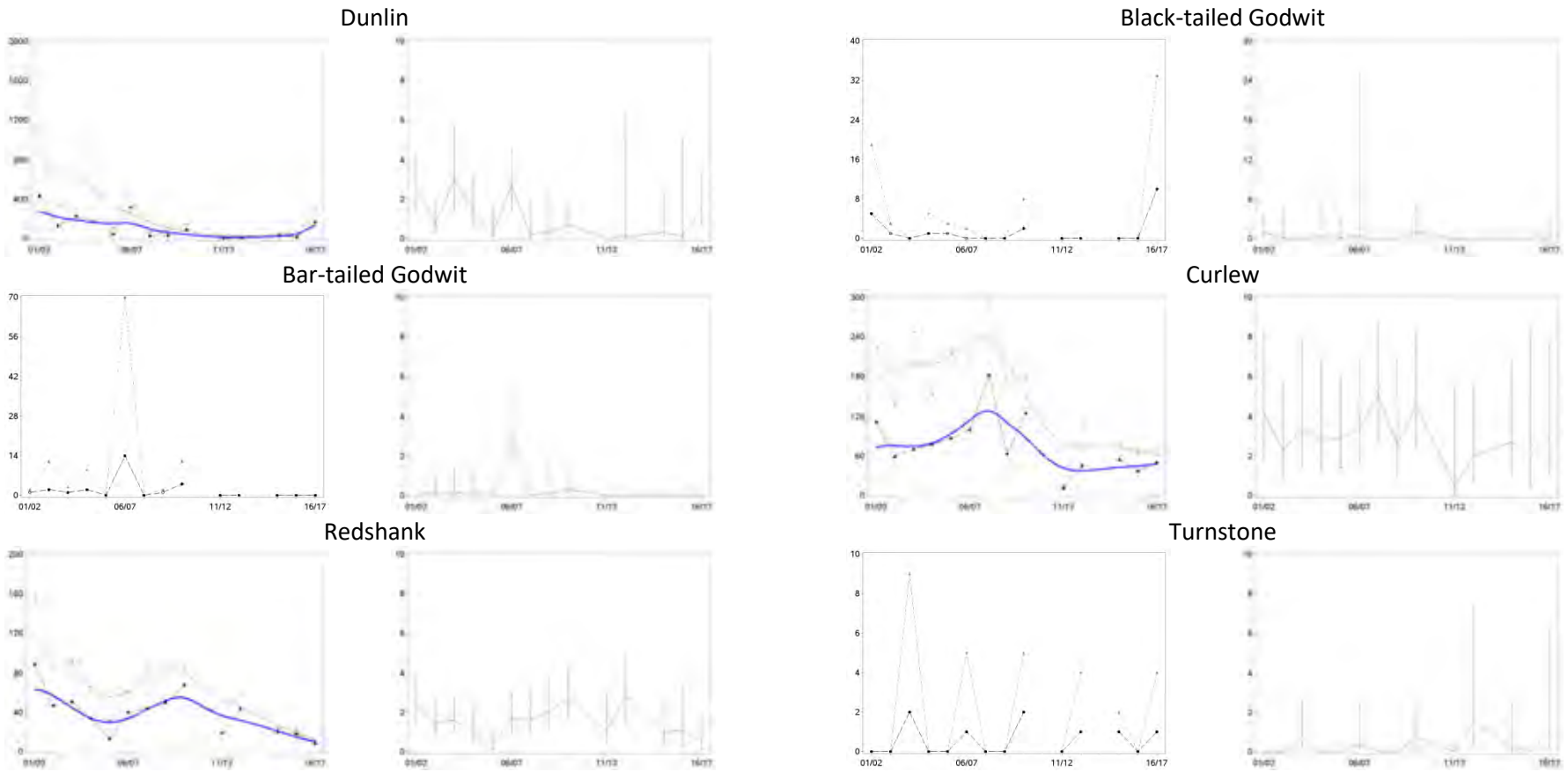


Figure A.38432. Continued

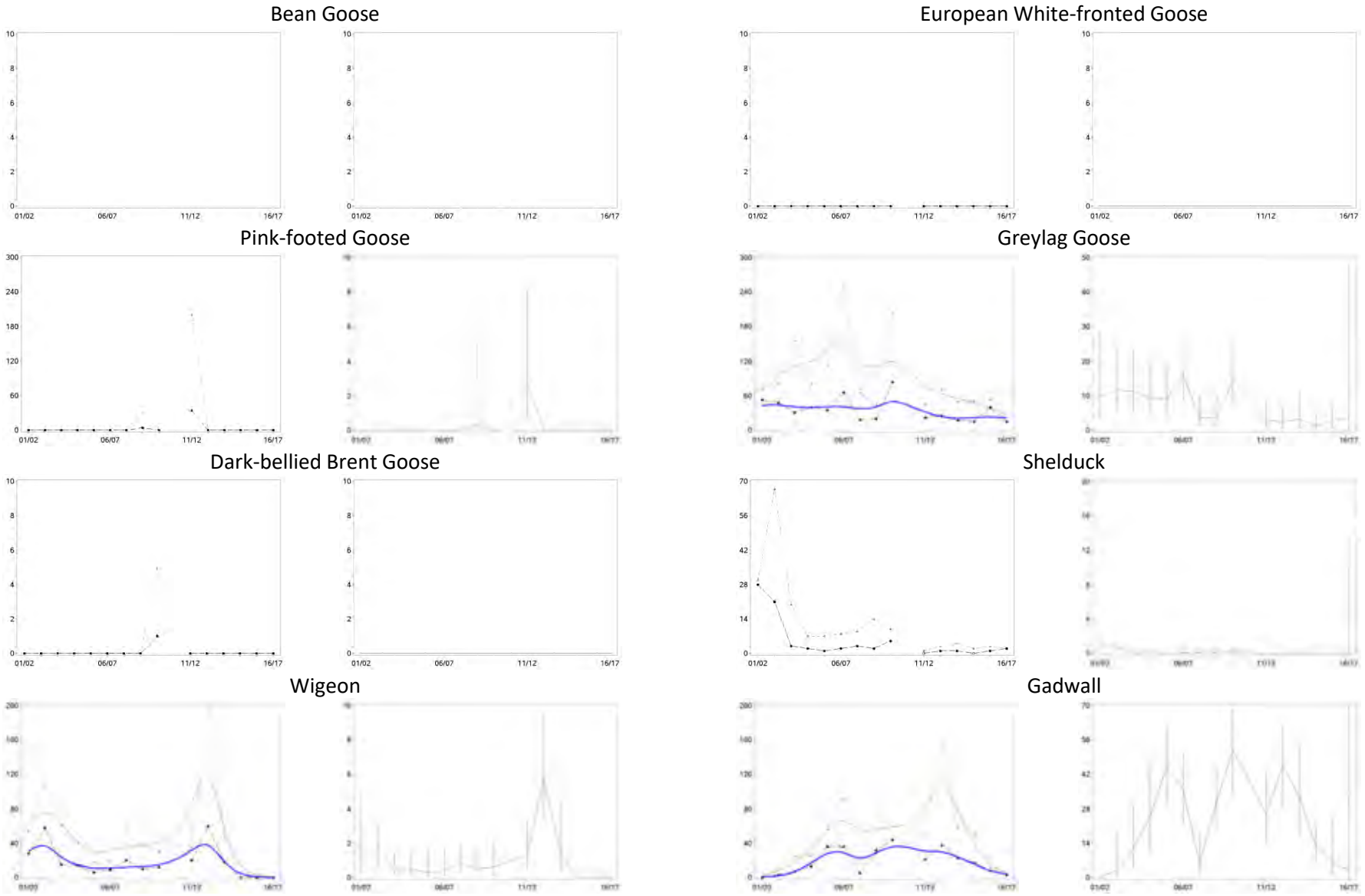


Figure A.38433. Population trends of each species in sector 38433 (Brough Haven to North Ferriby) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

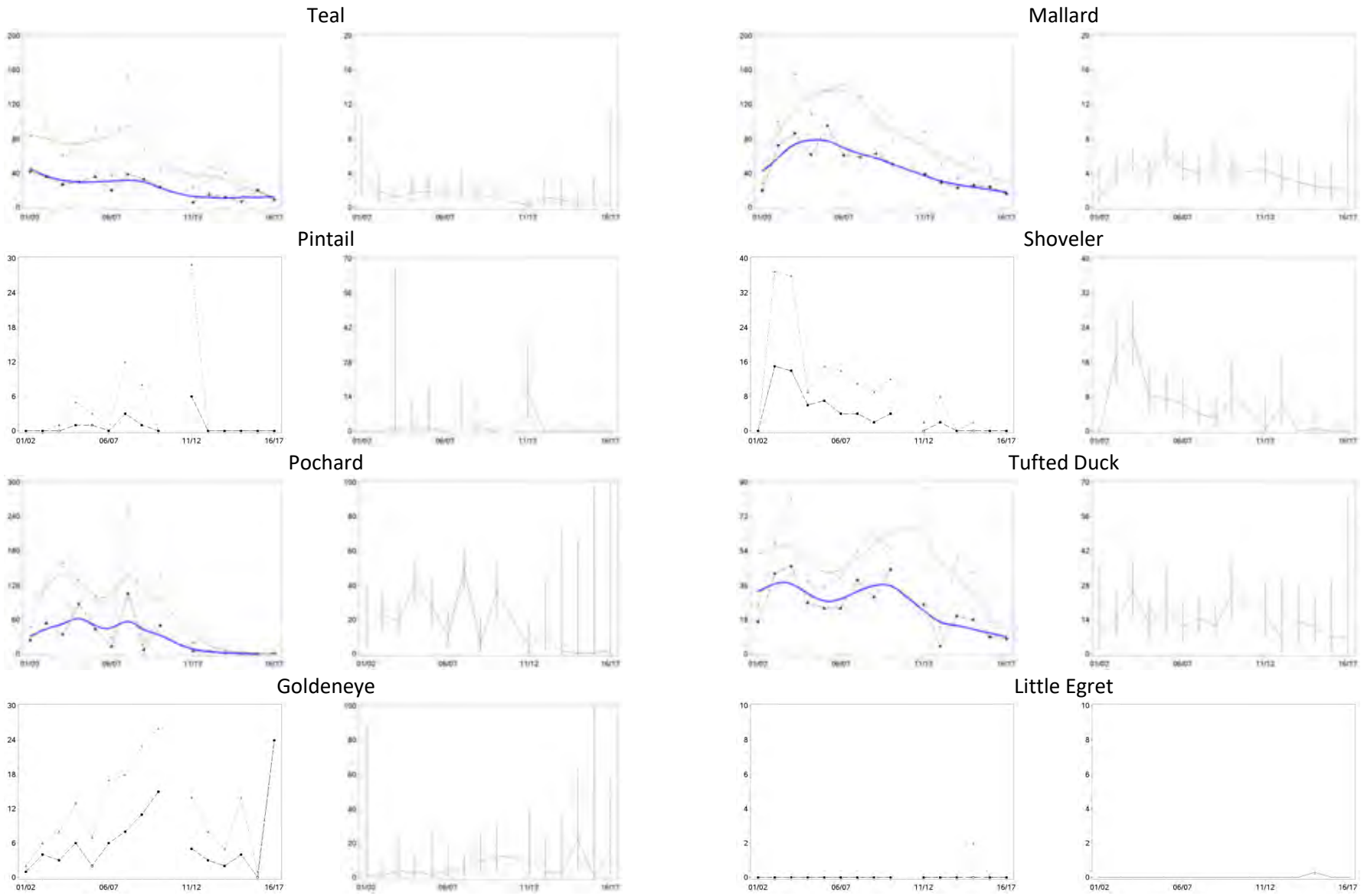
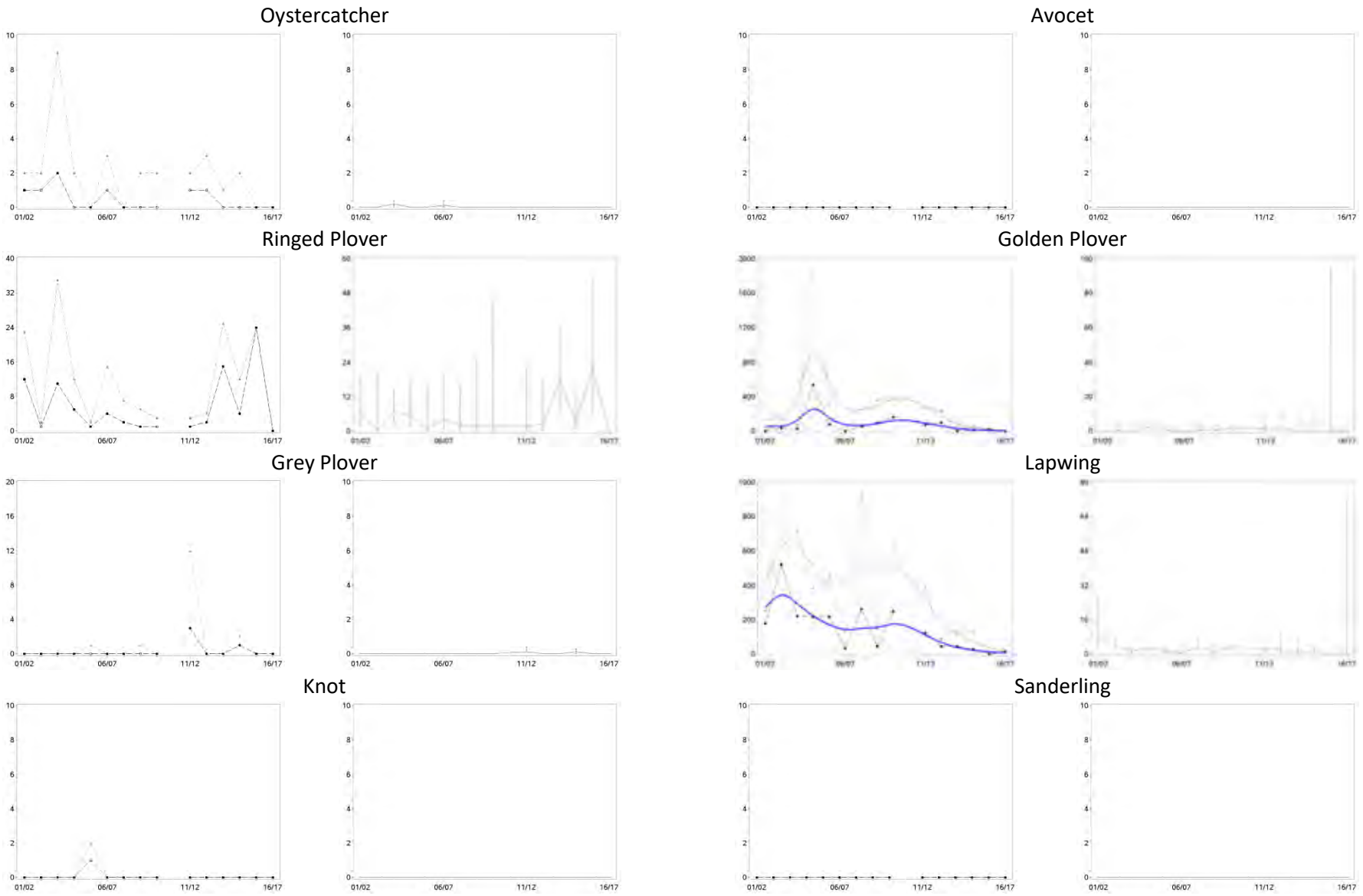


Figure A.38433. Continued



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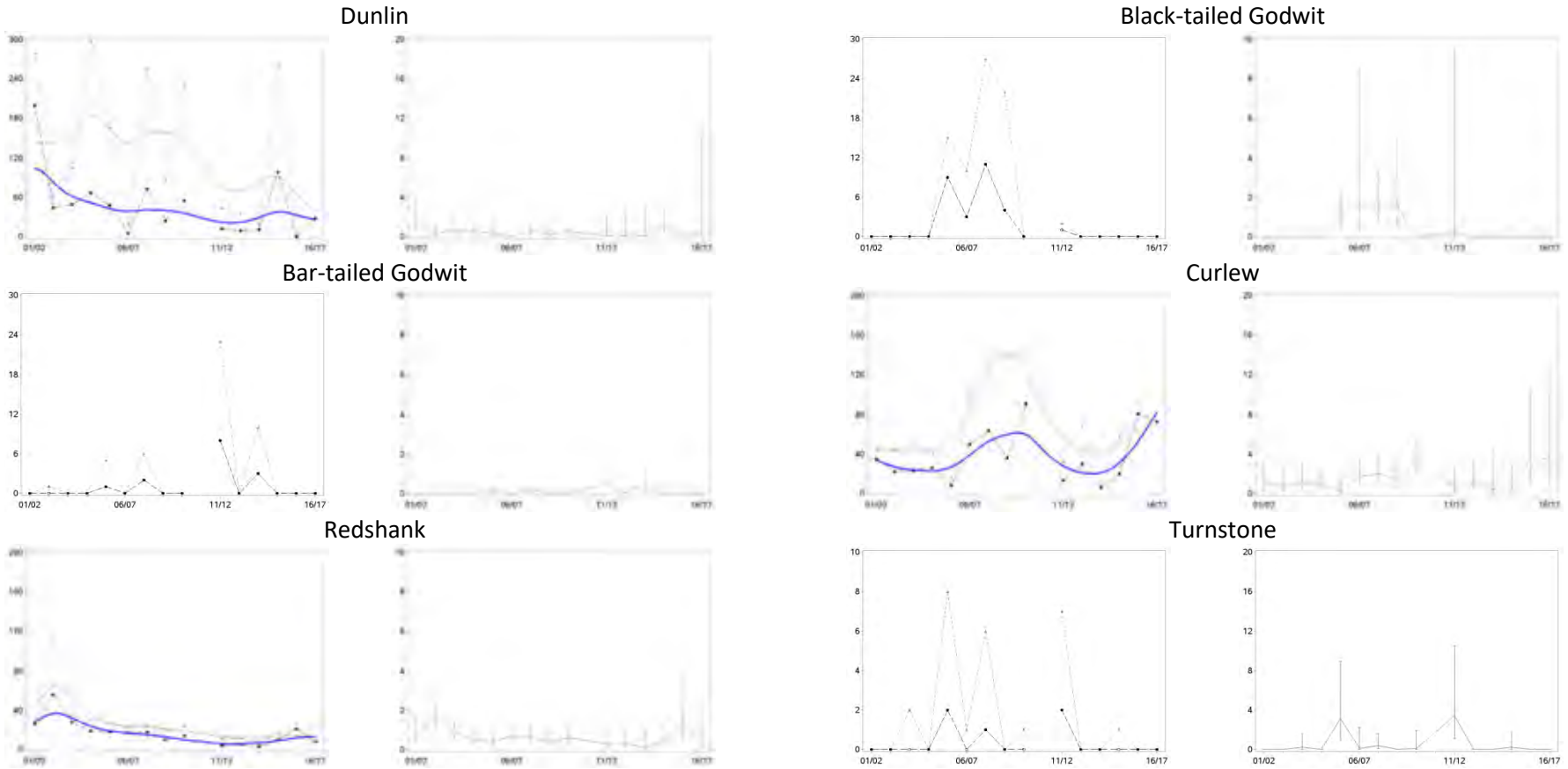

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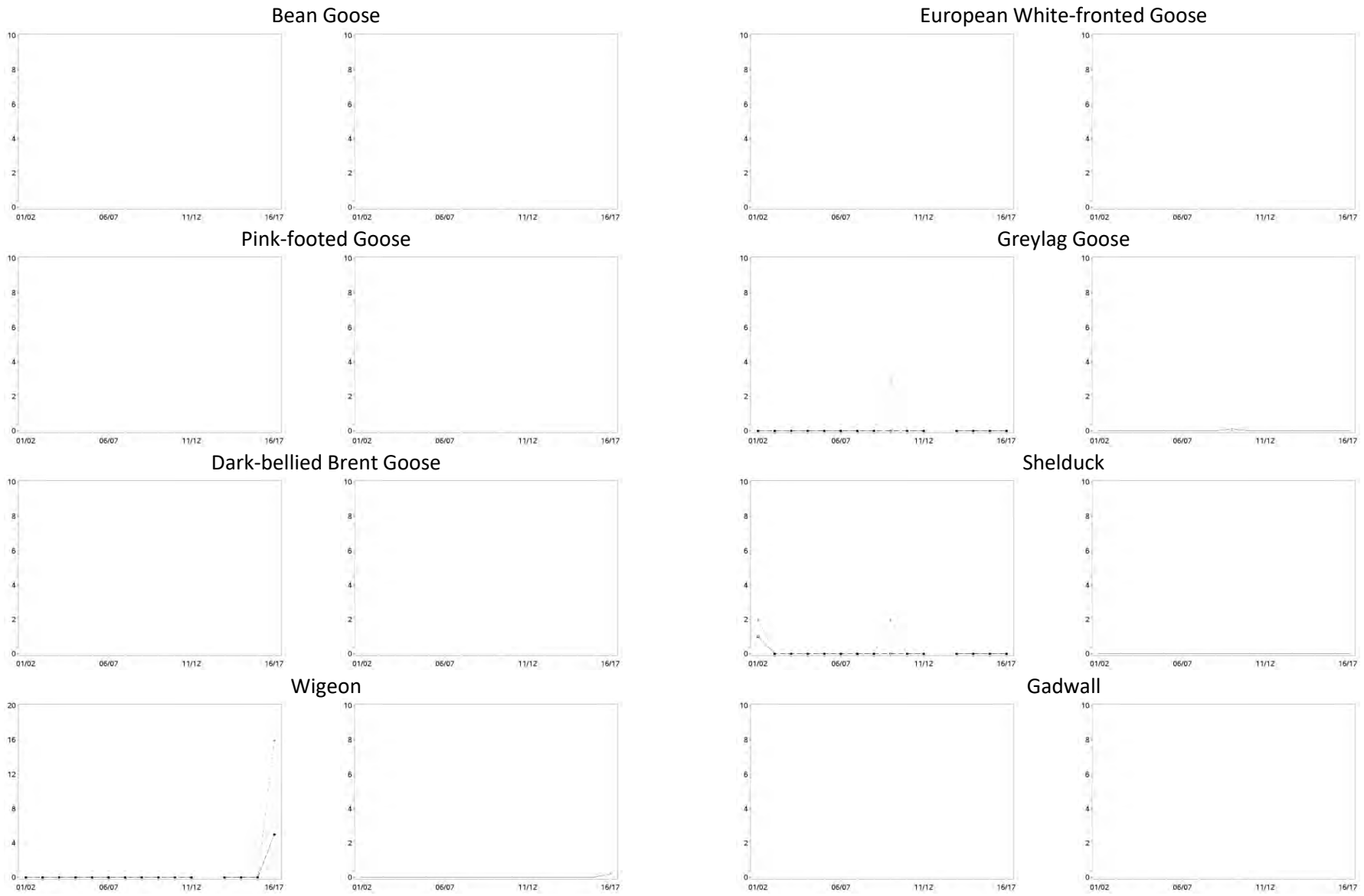
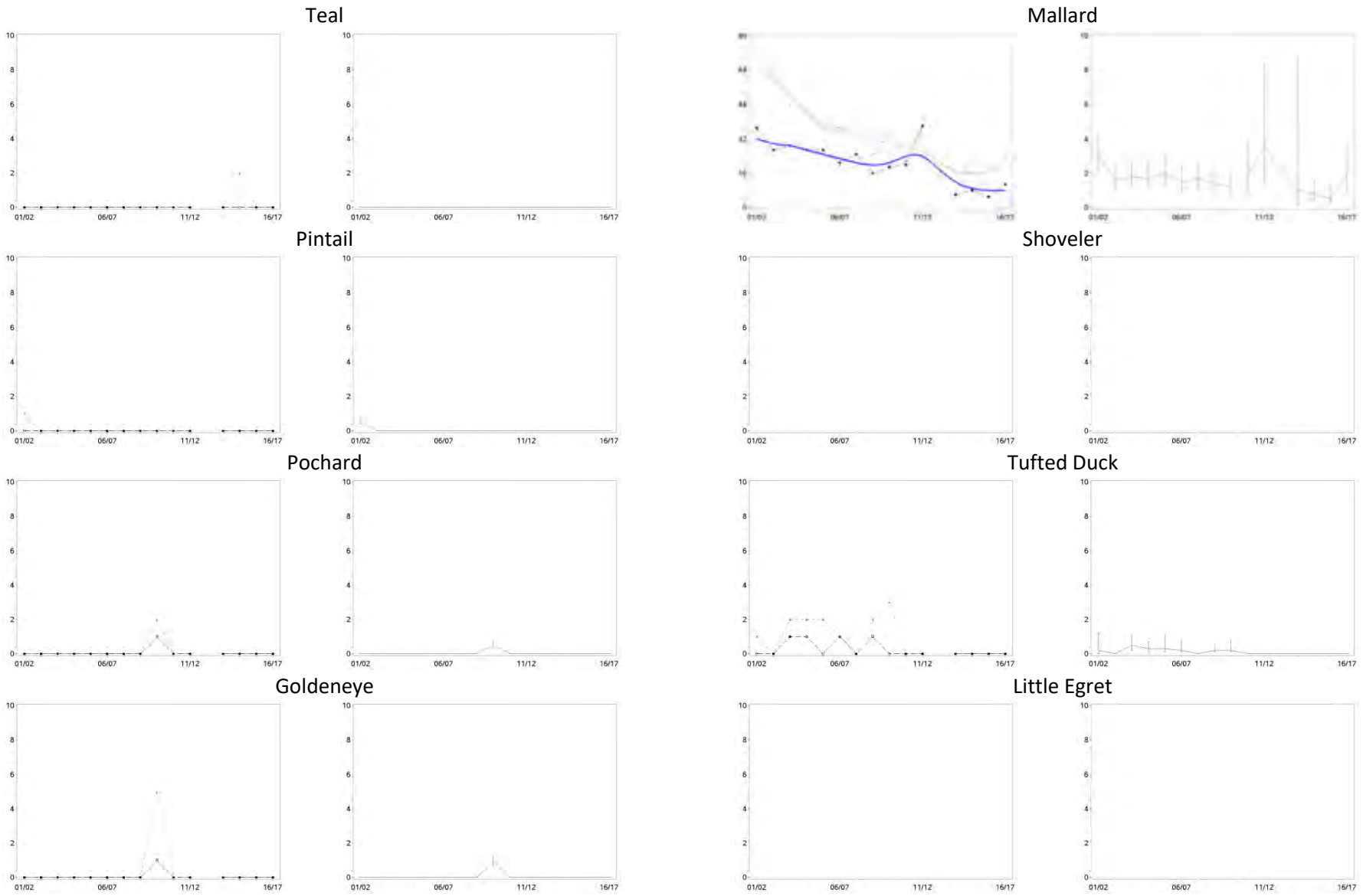


Figure A.38434. Population trends of each species in sector 38434 (North Ferriby to Hessle Haven) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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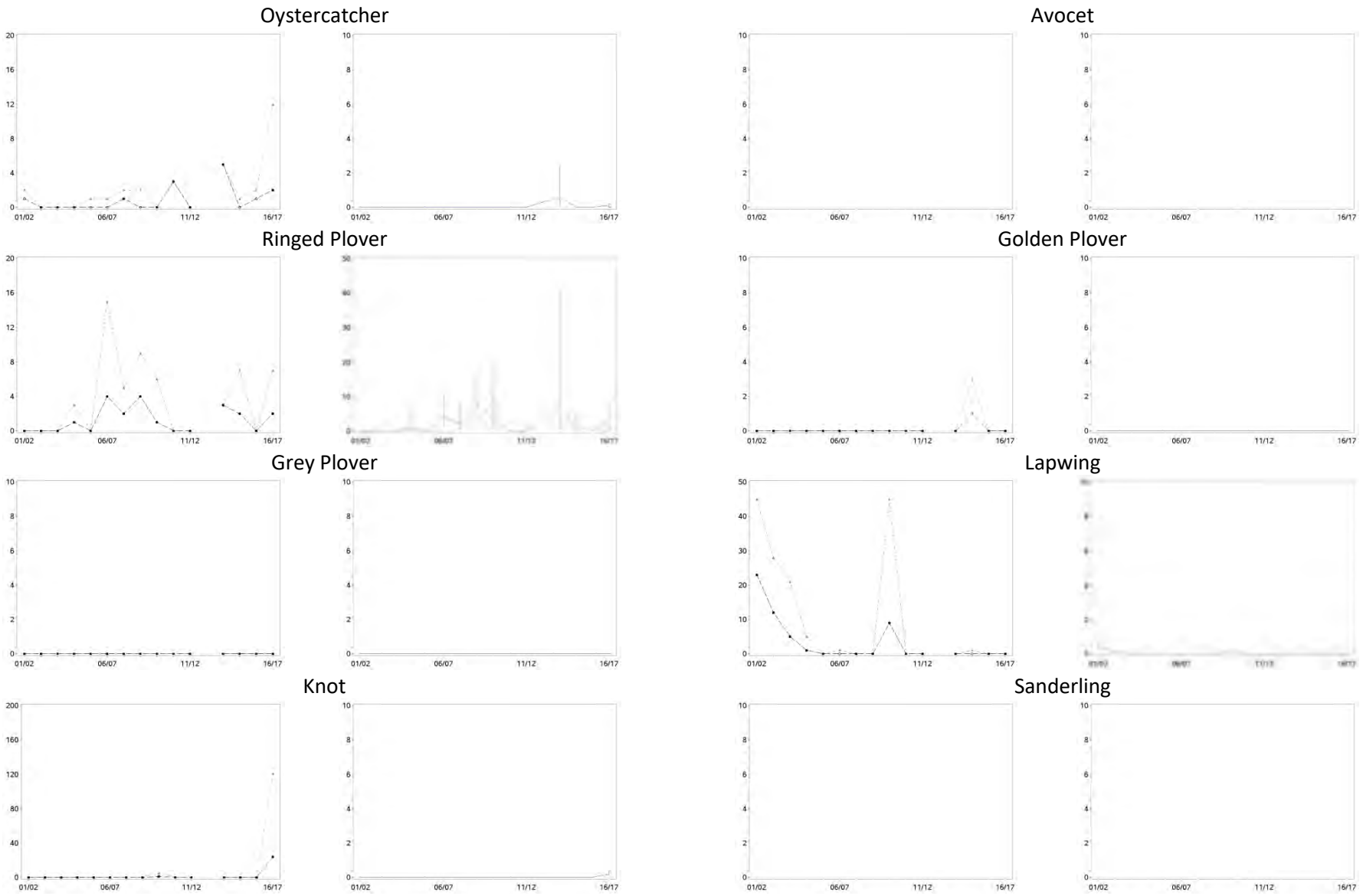

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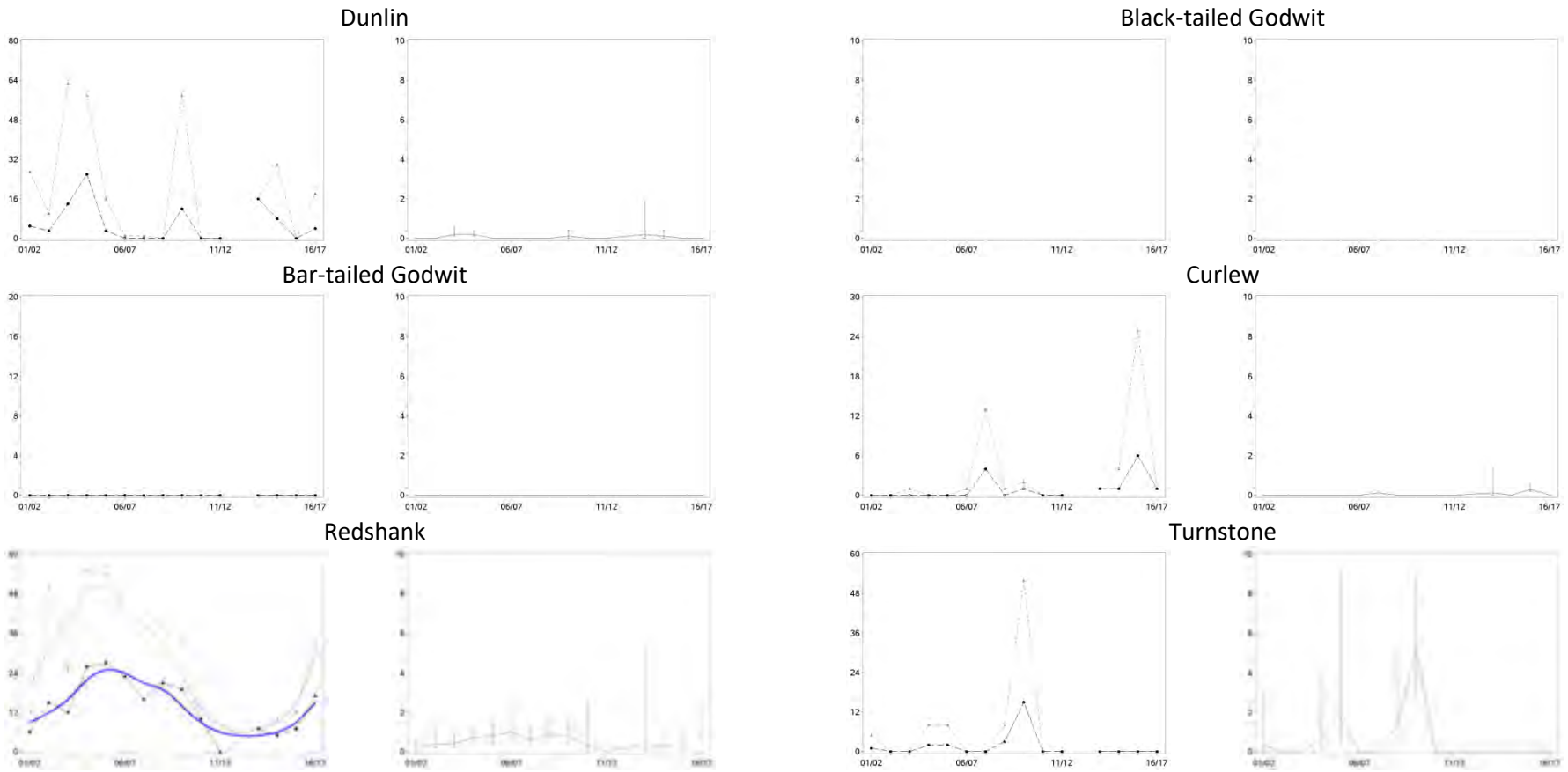


Figure A.38434. Continued

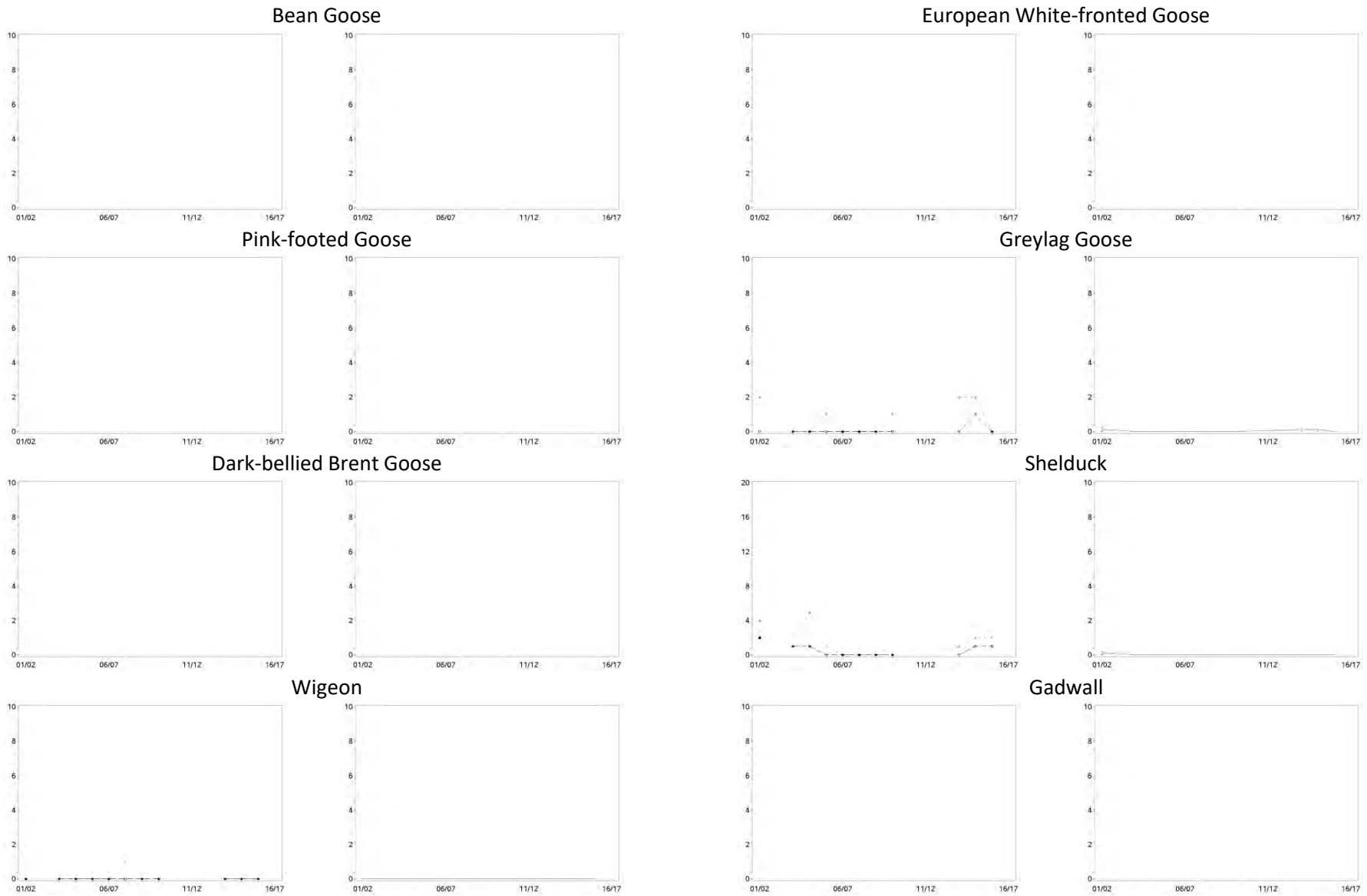
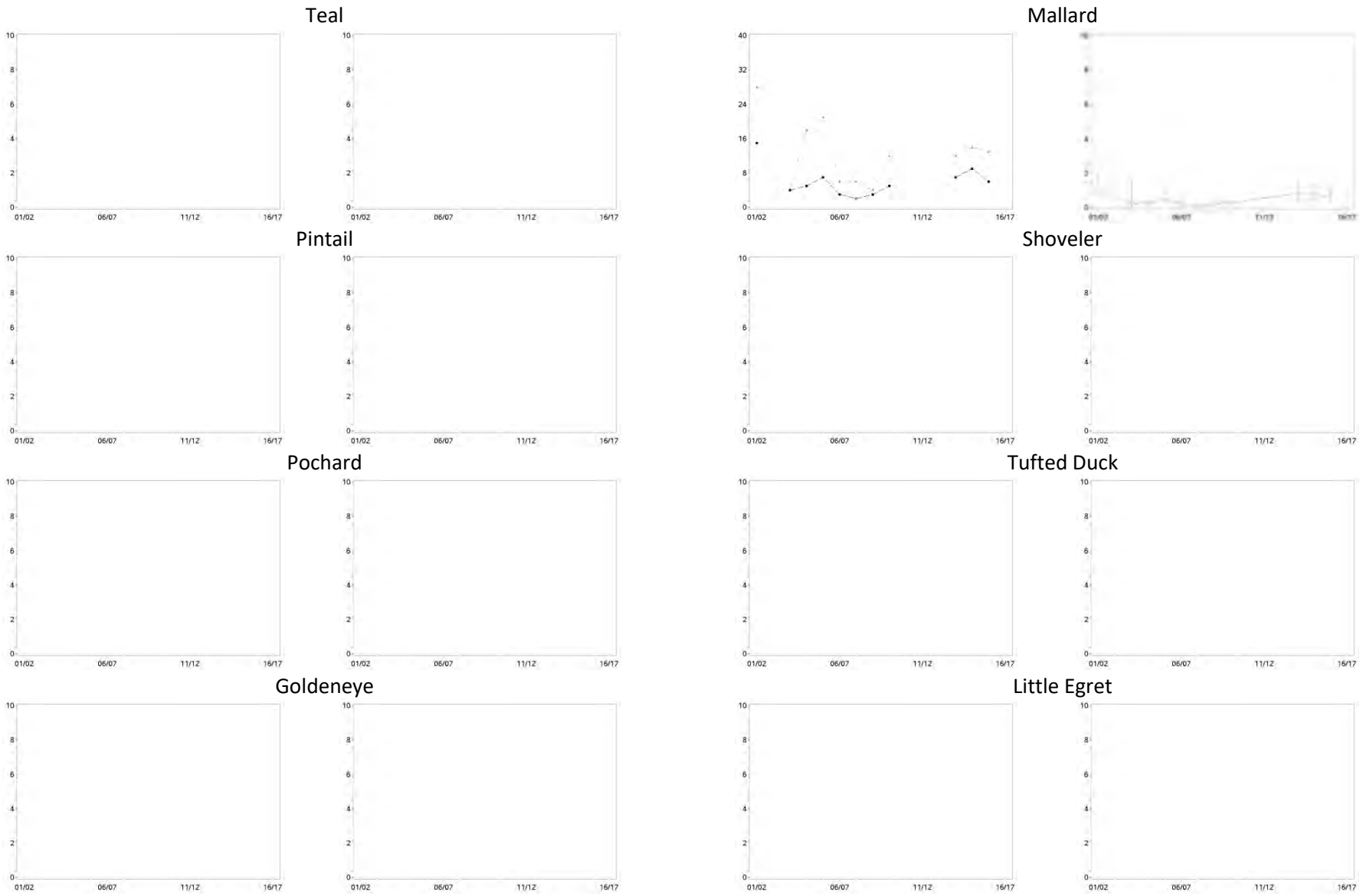


Figure A.38436. Population trends of each species in sector 38436 (Hessle to Hull) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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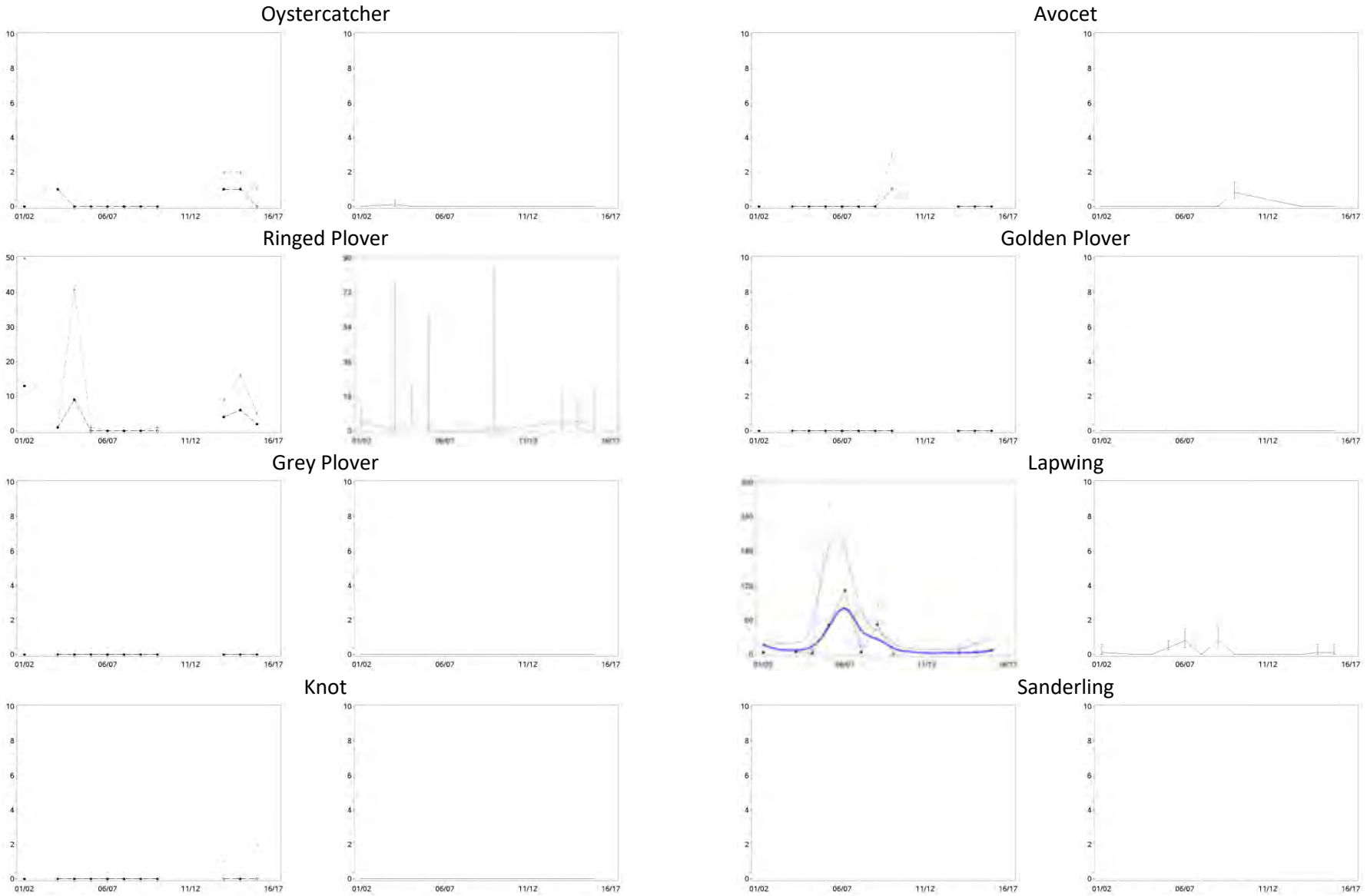

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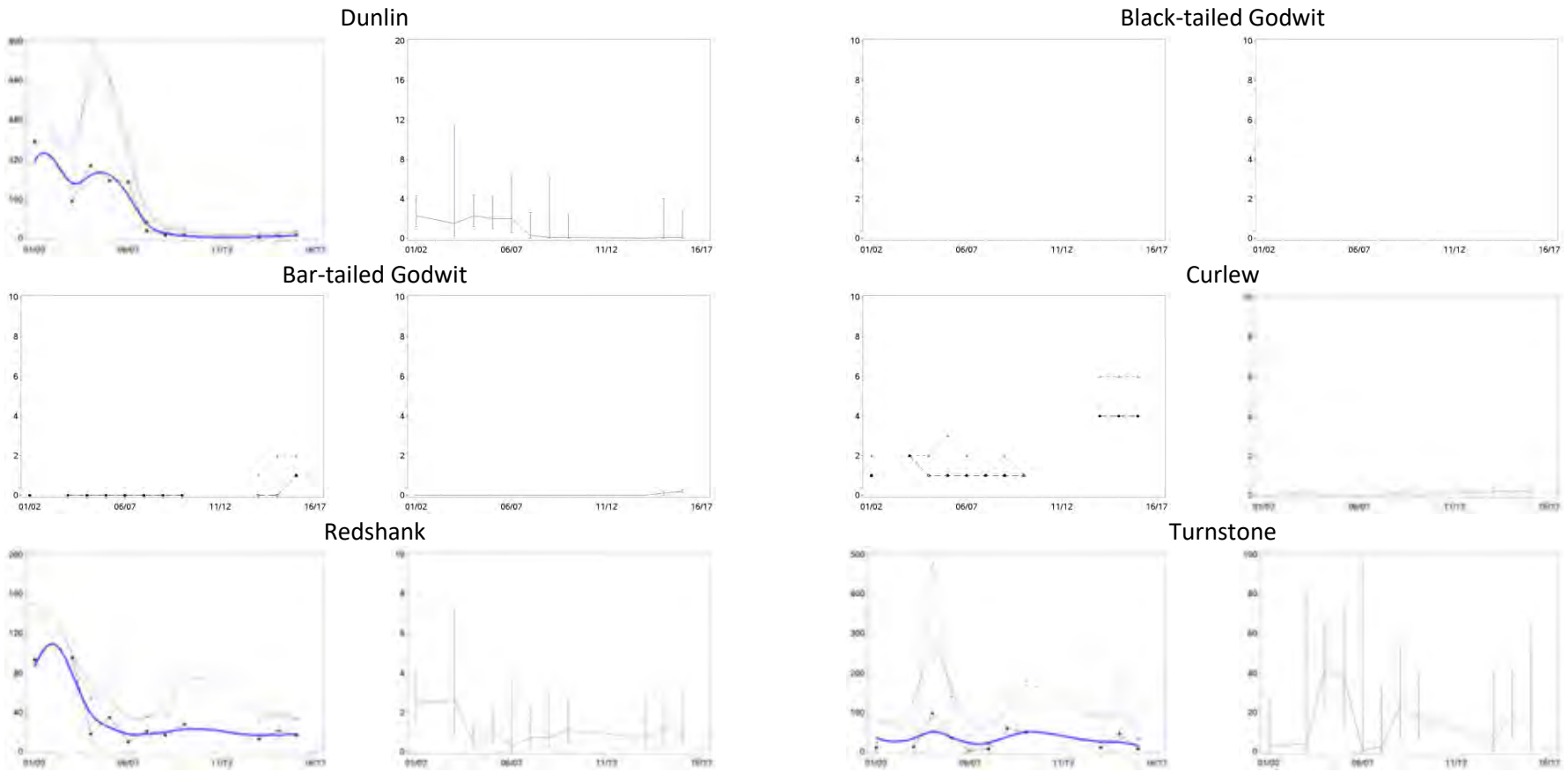

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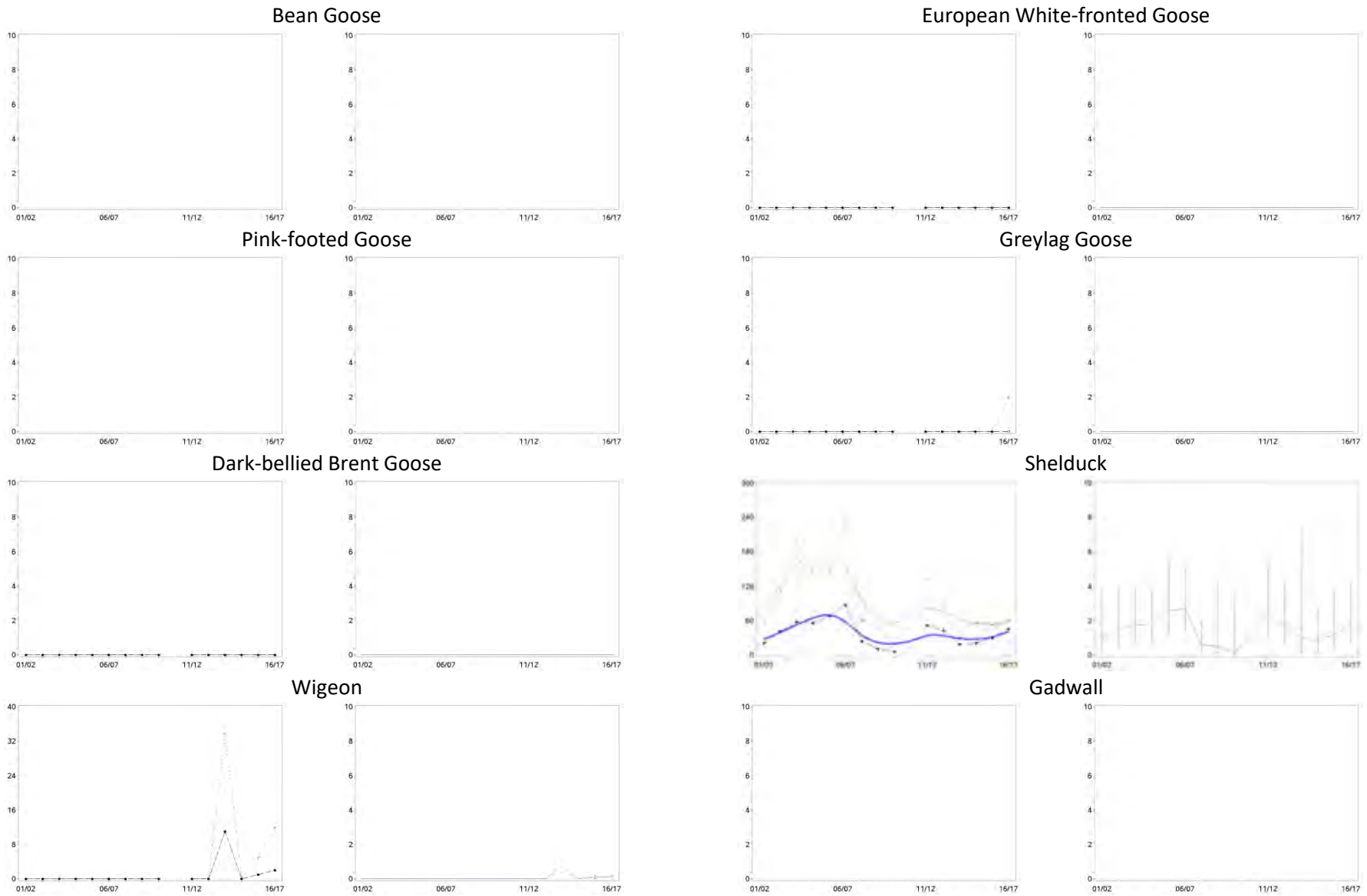
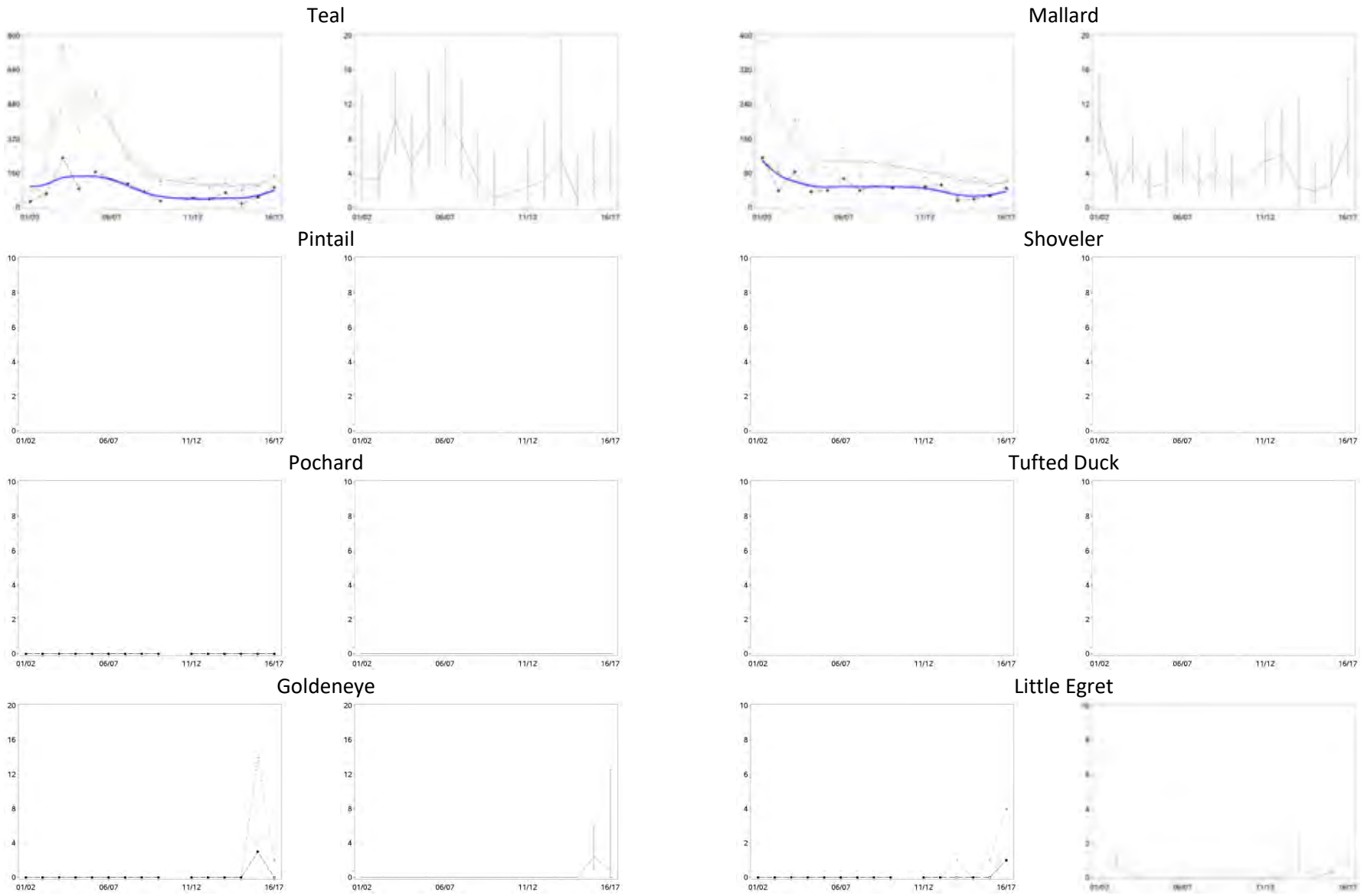


Figure A.38440. Population trends of each species in sector 38440 (Hull to Paull) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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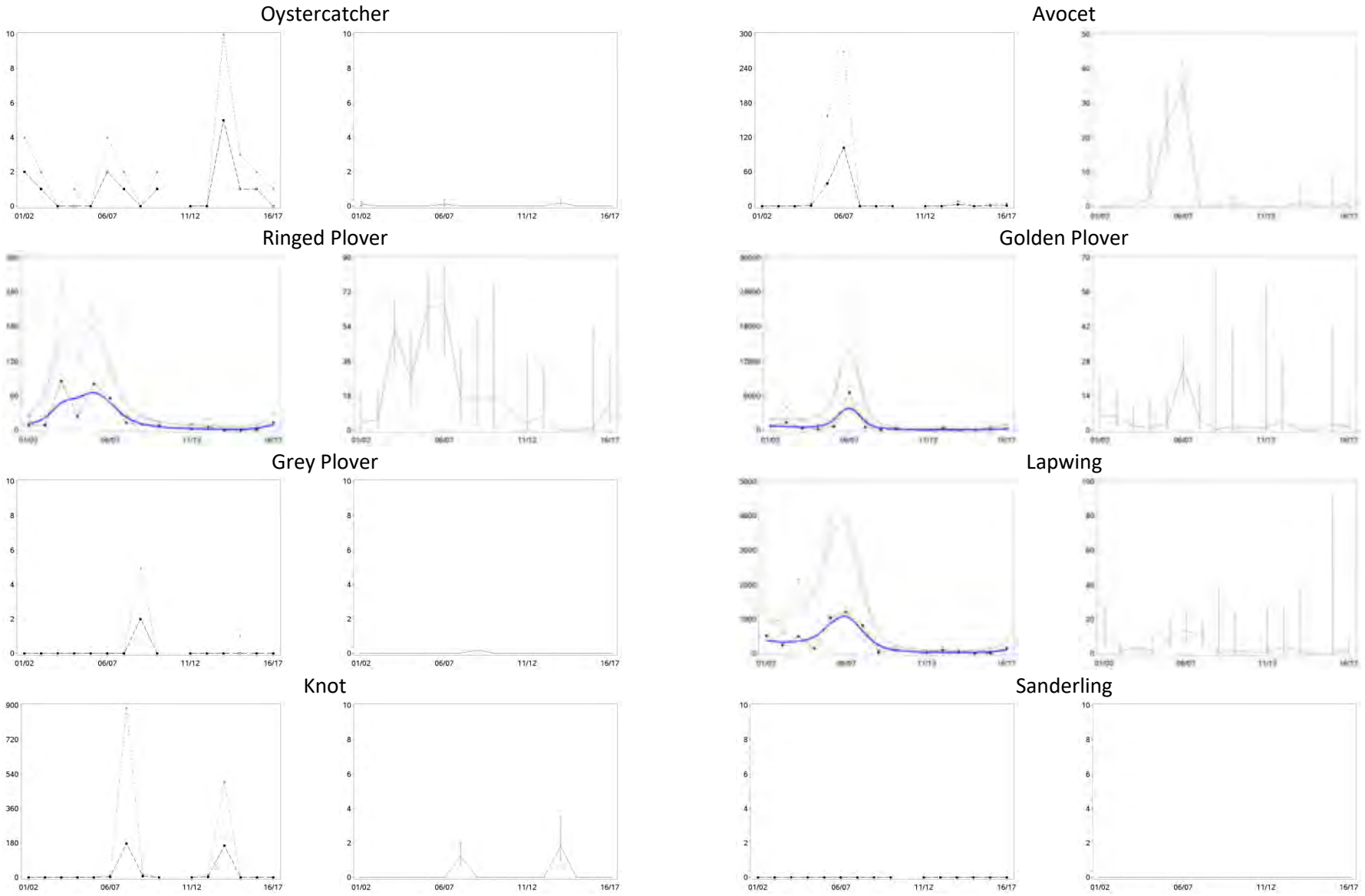

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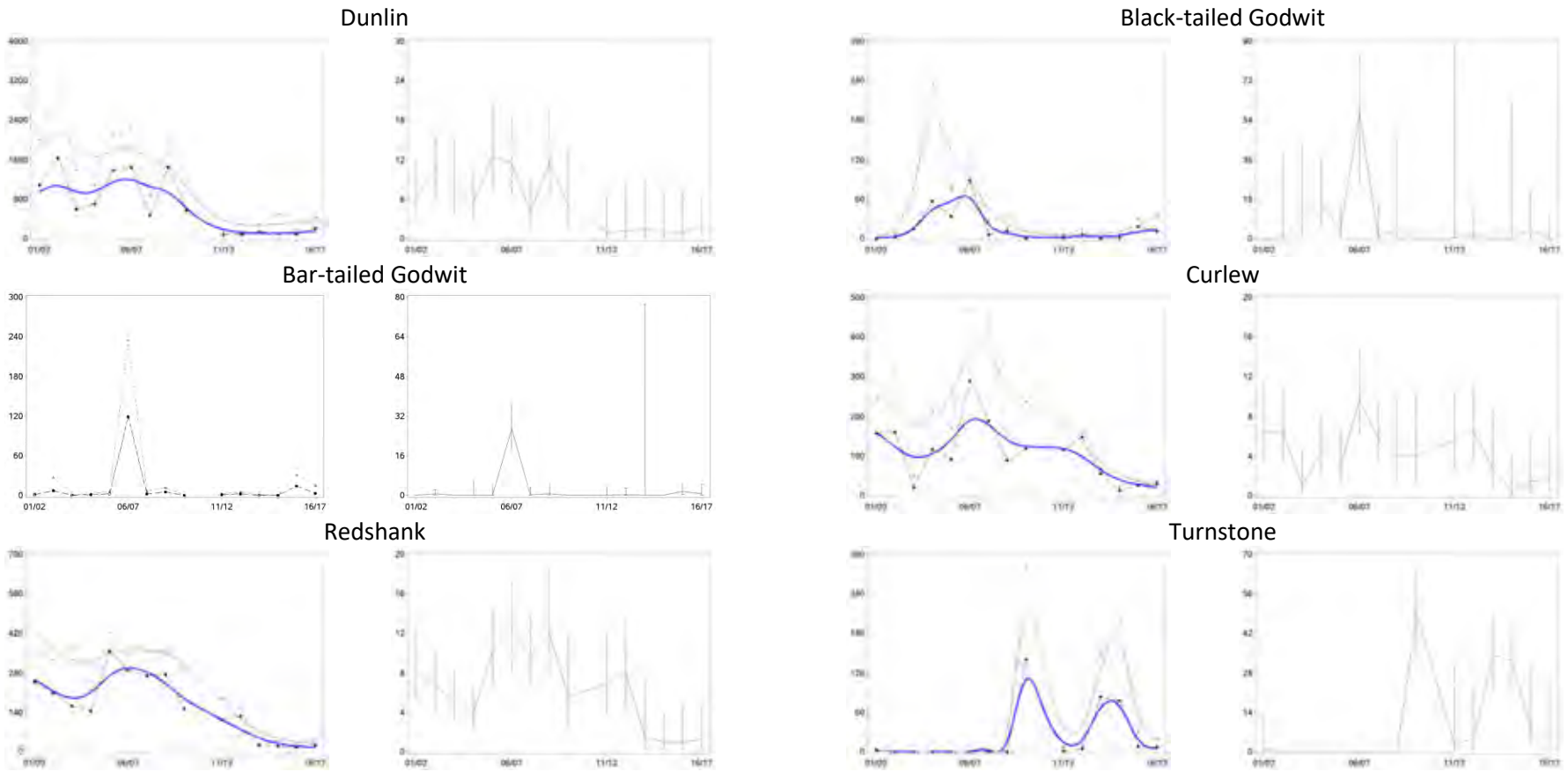

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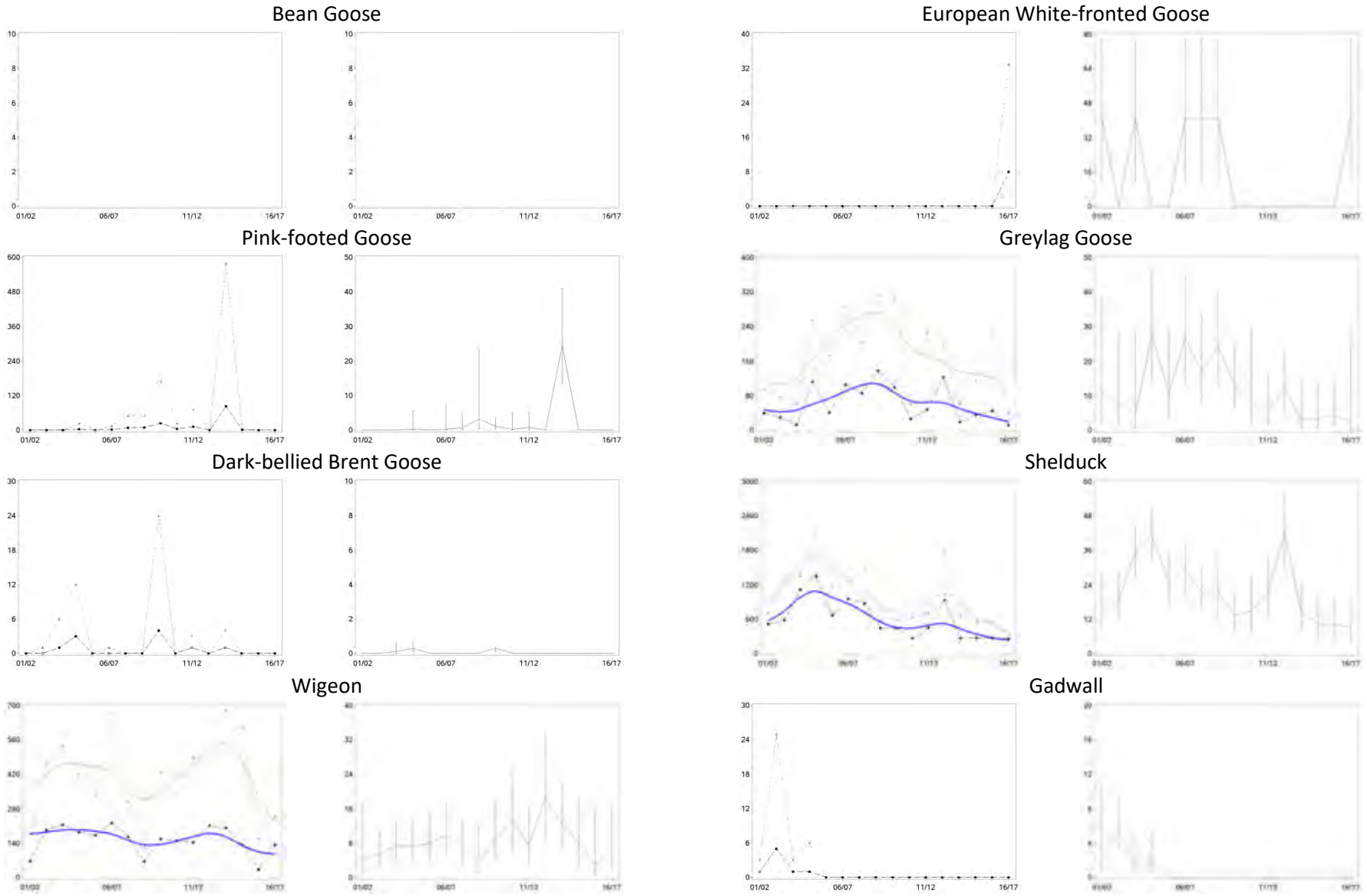
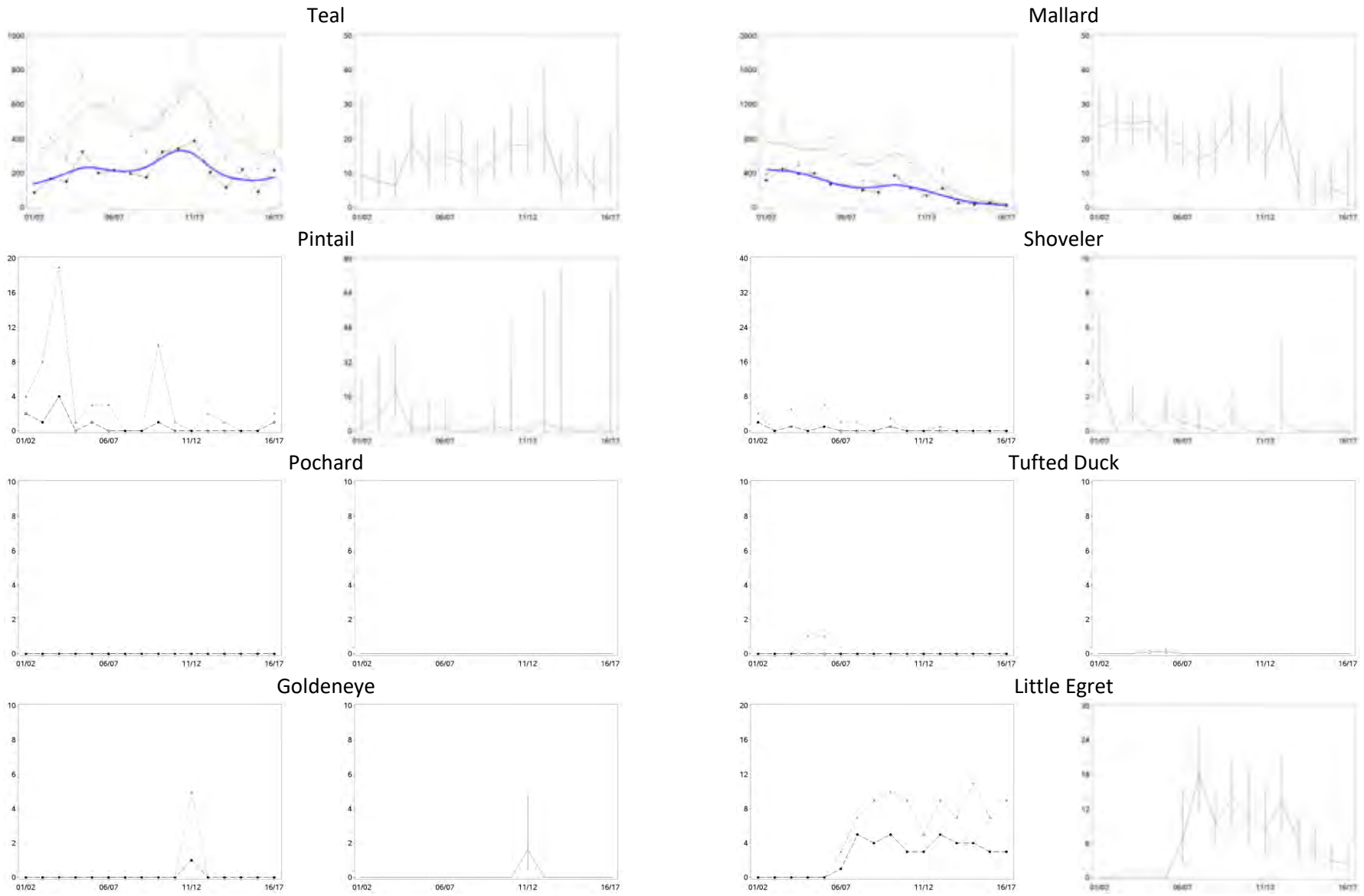


Figure A.38441. Population trends of each species in sector 38441 (Paull to Stone Creek (Cherry Cobb Sands)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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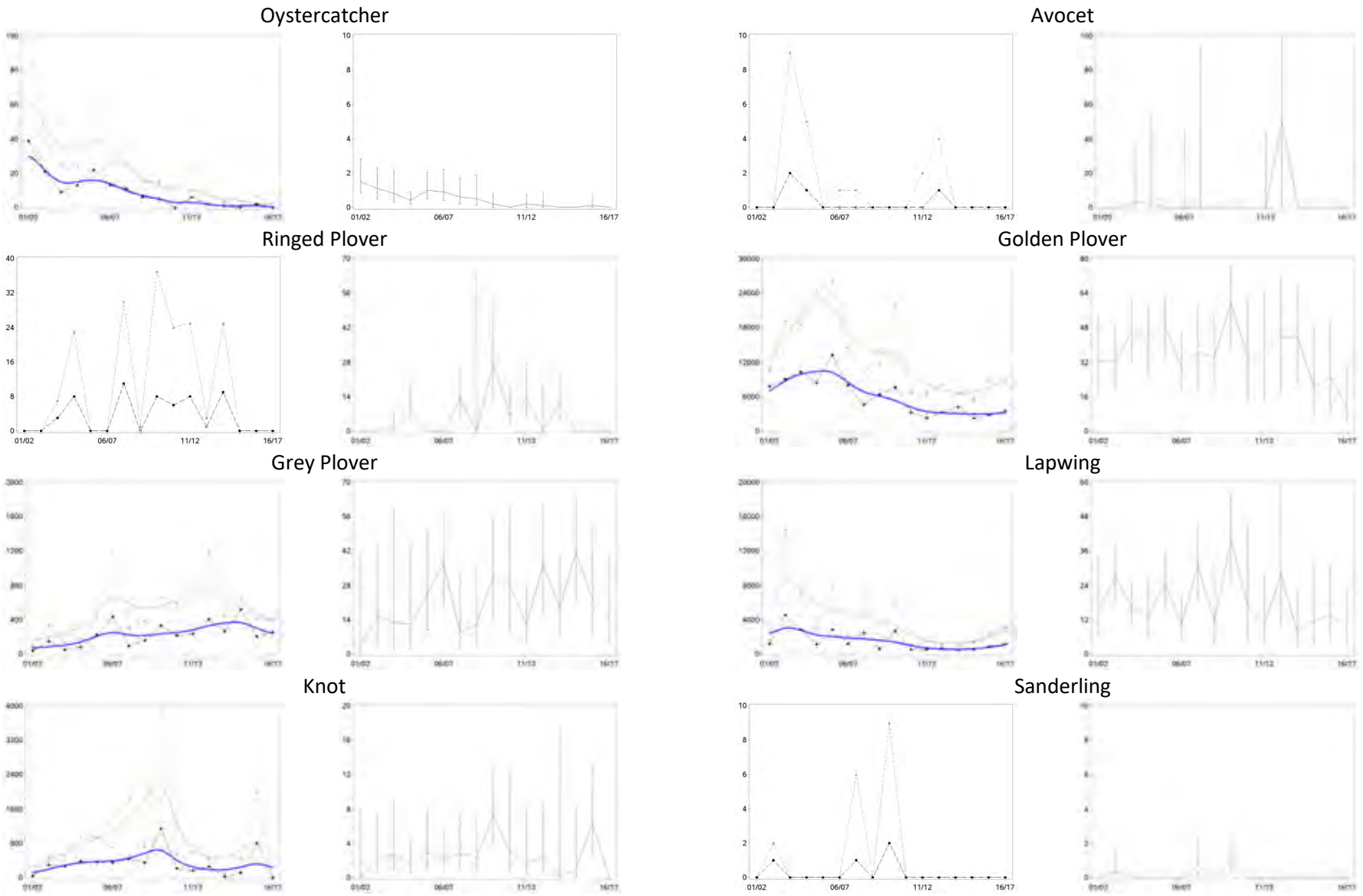

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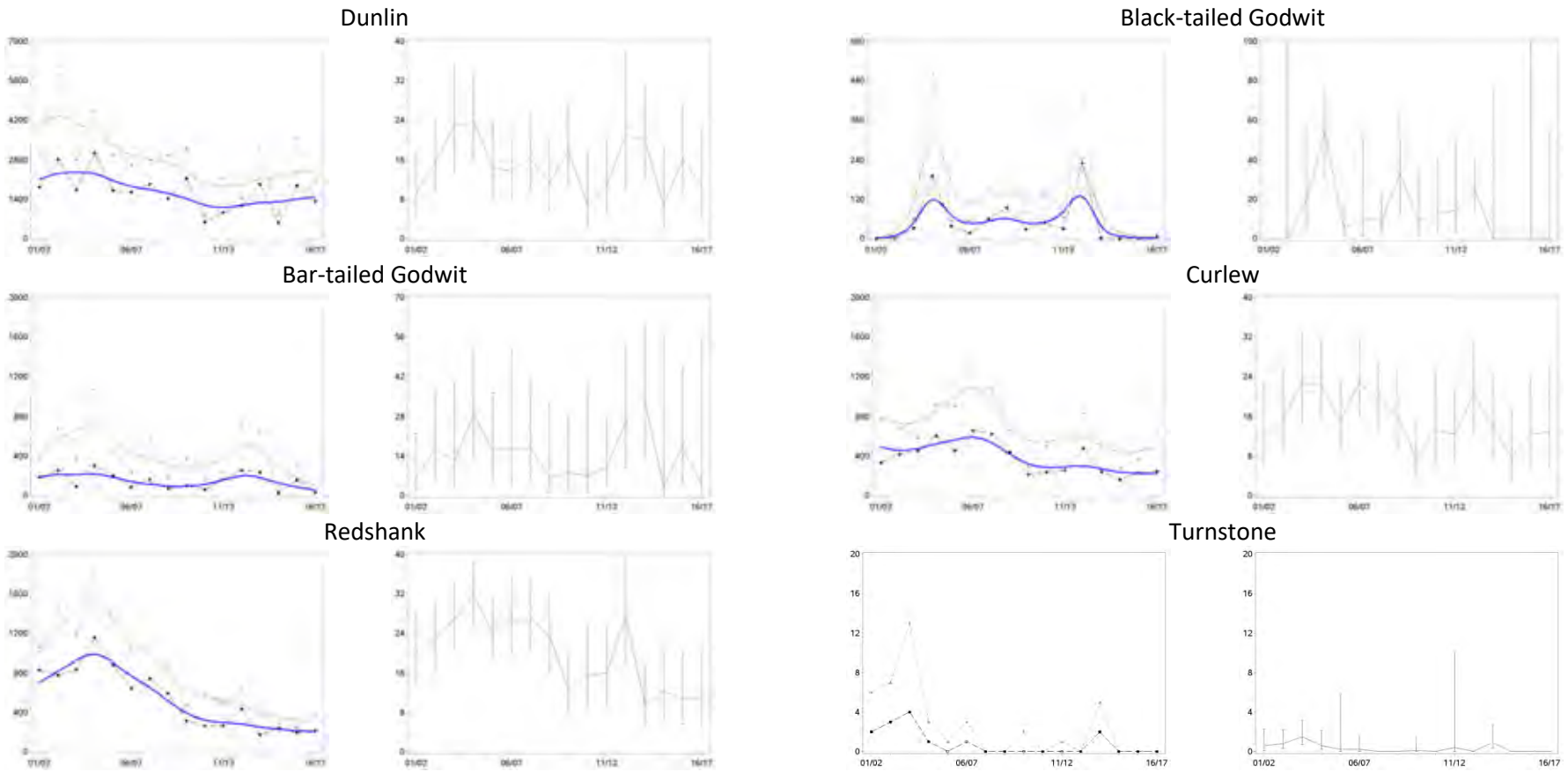


Figure A.38441. Continued

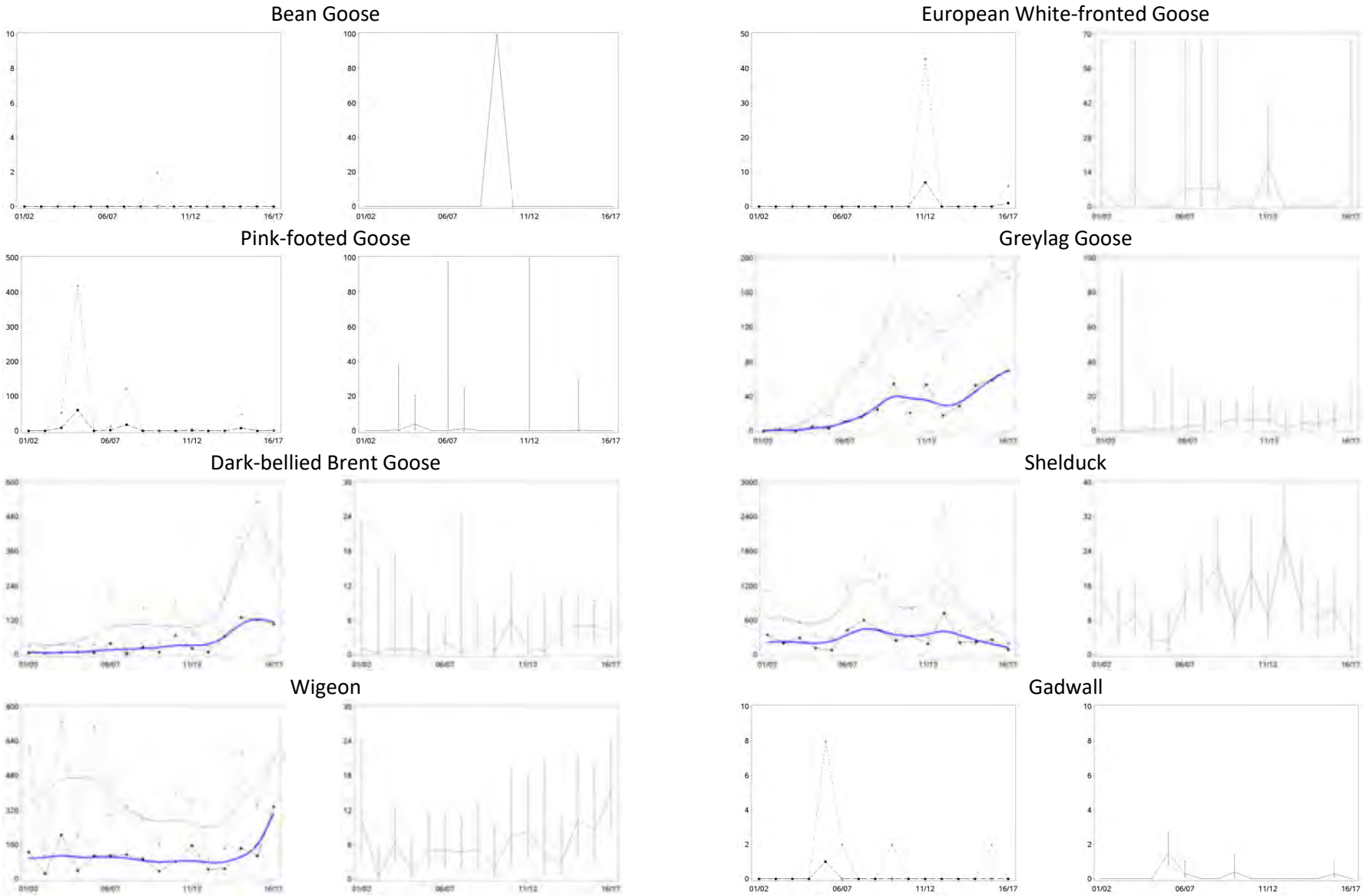
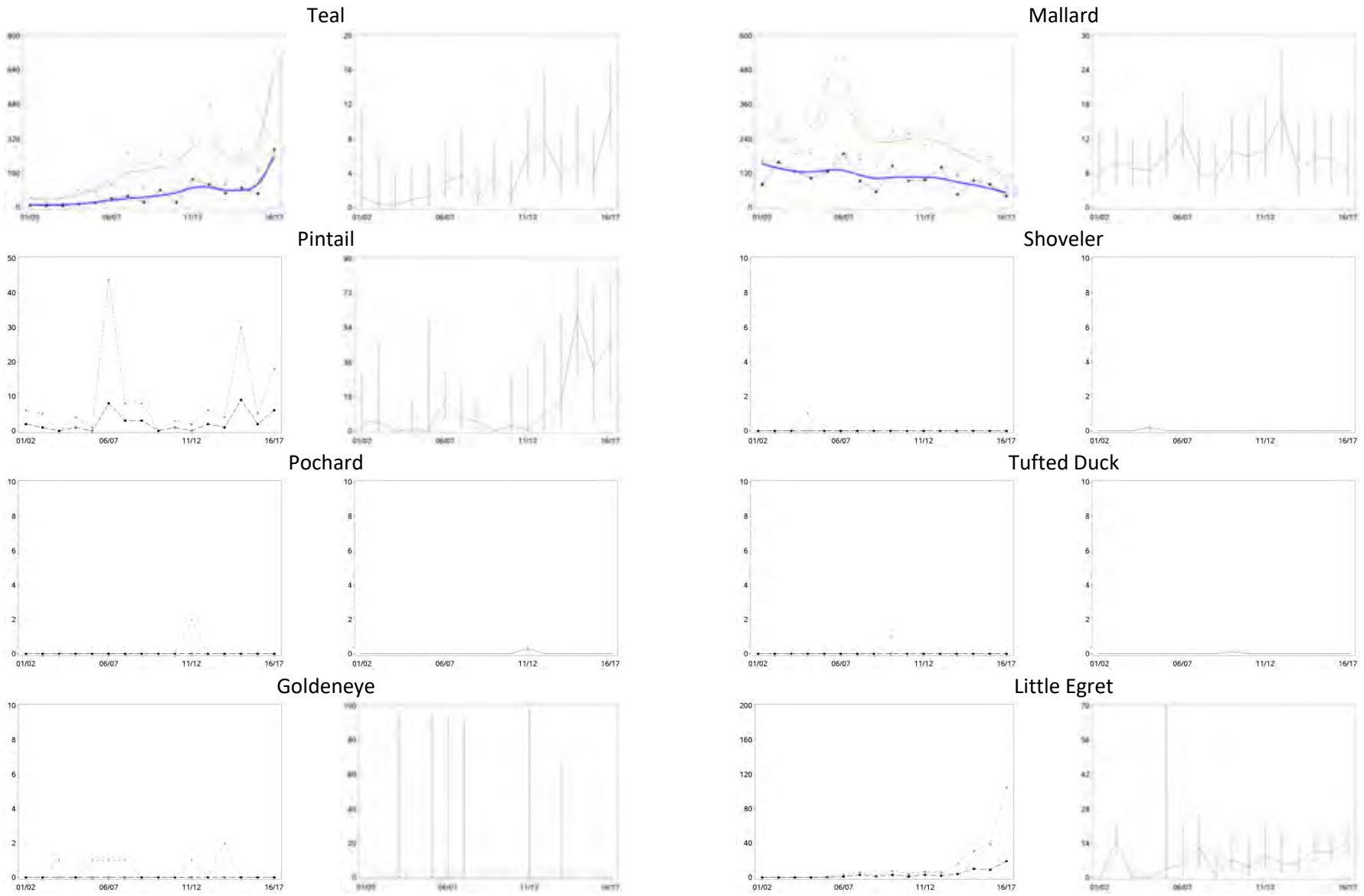


Figure A.38442. Population trends of each species in sector 38442 (Stone Creek to Patrington) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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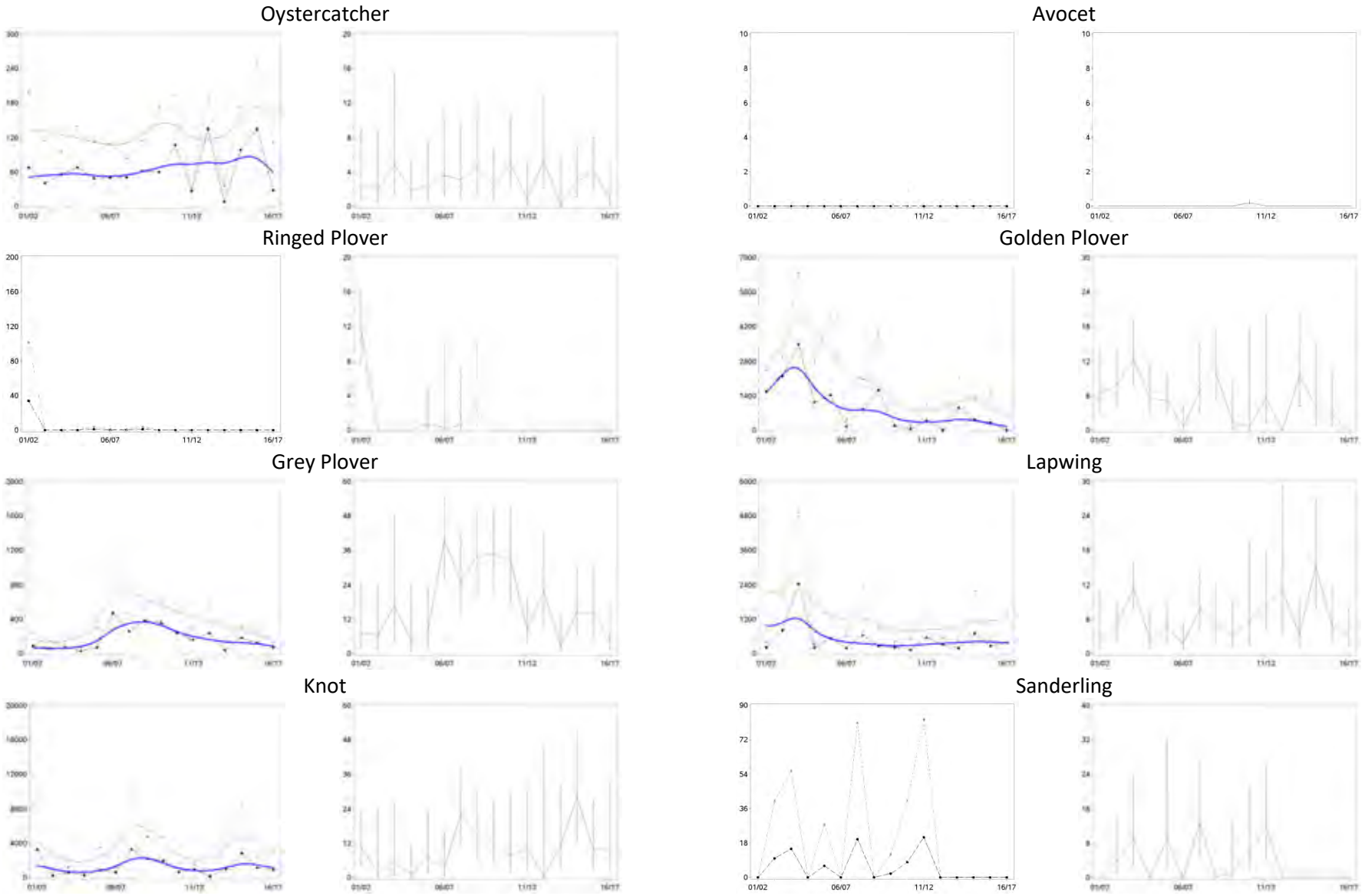


Figure A.38442. Continued

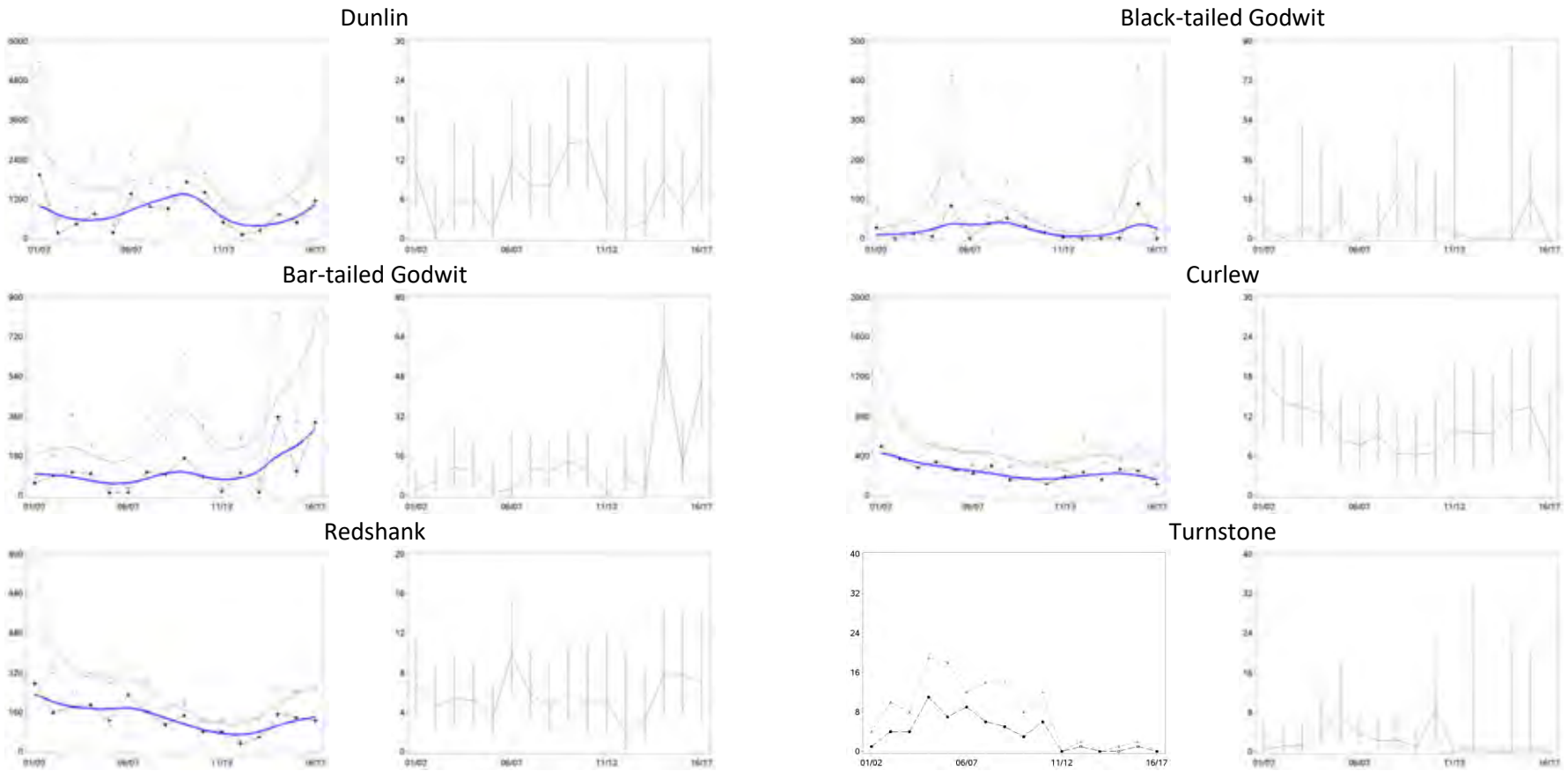


Figure A.38442. Continued

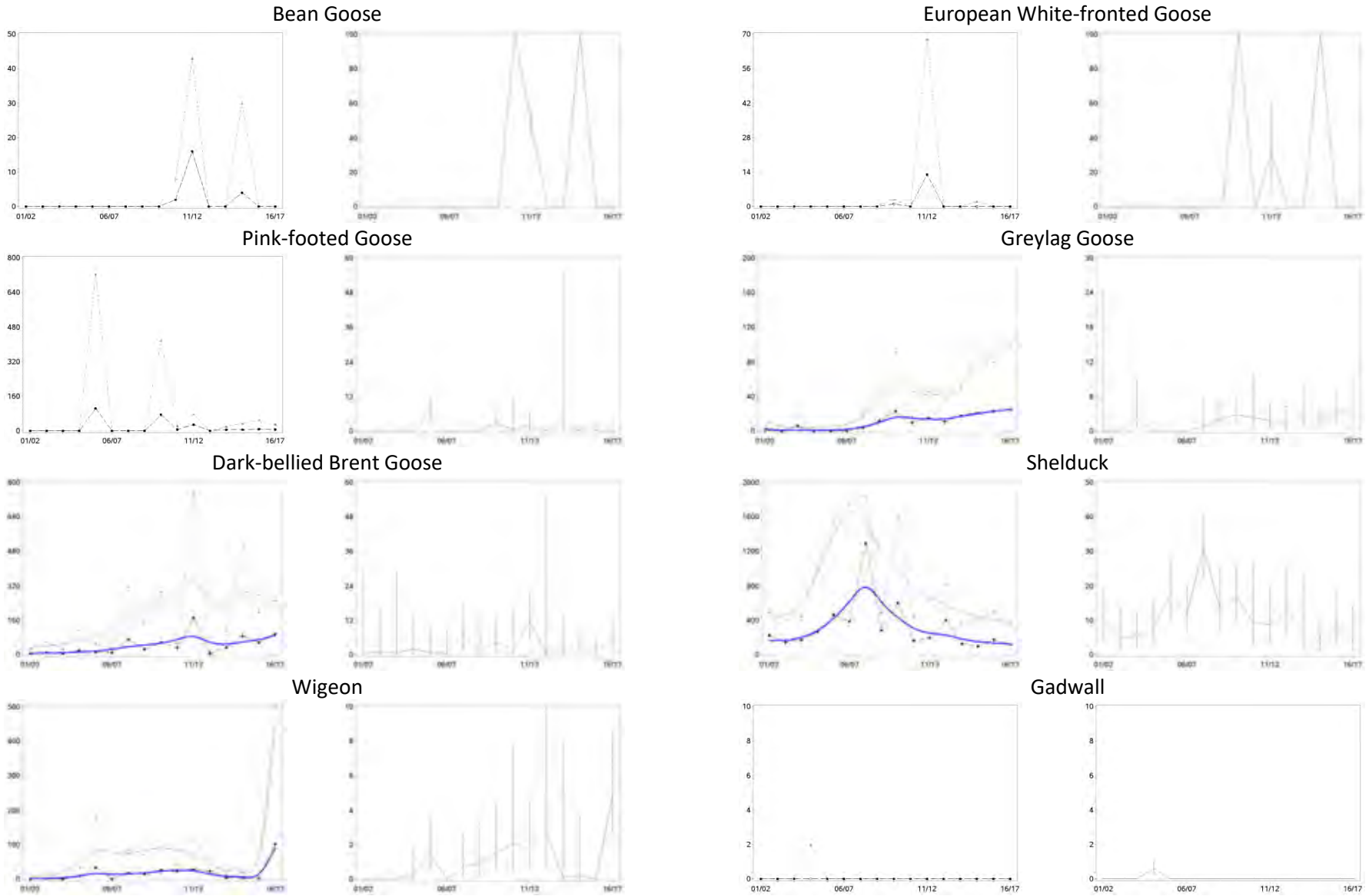
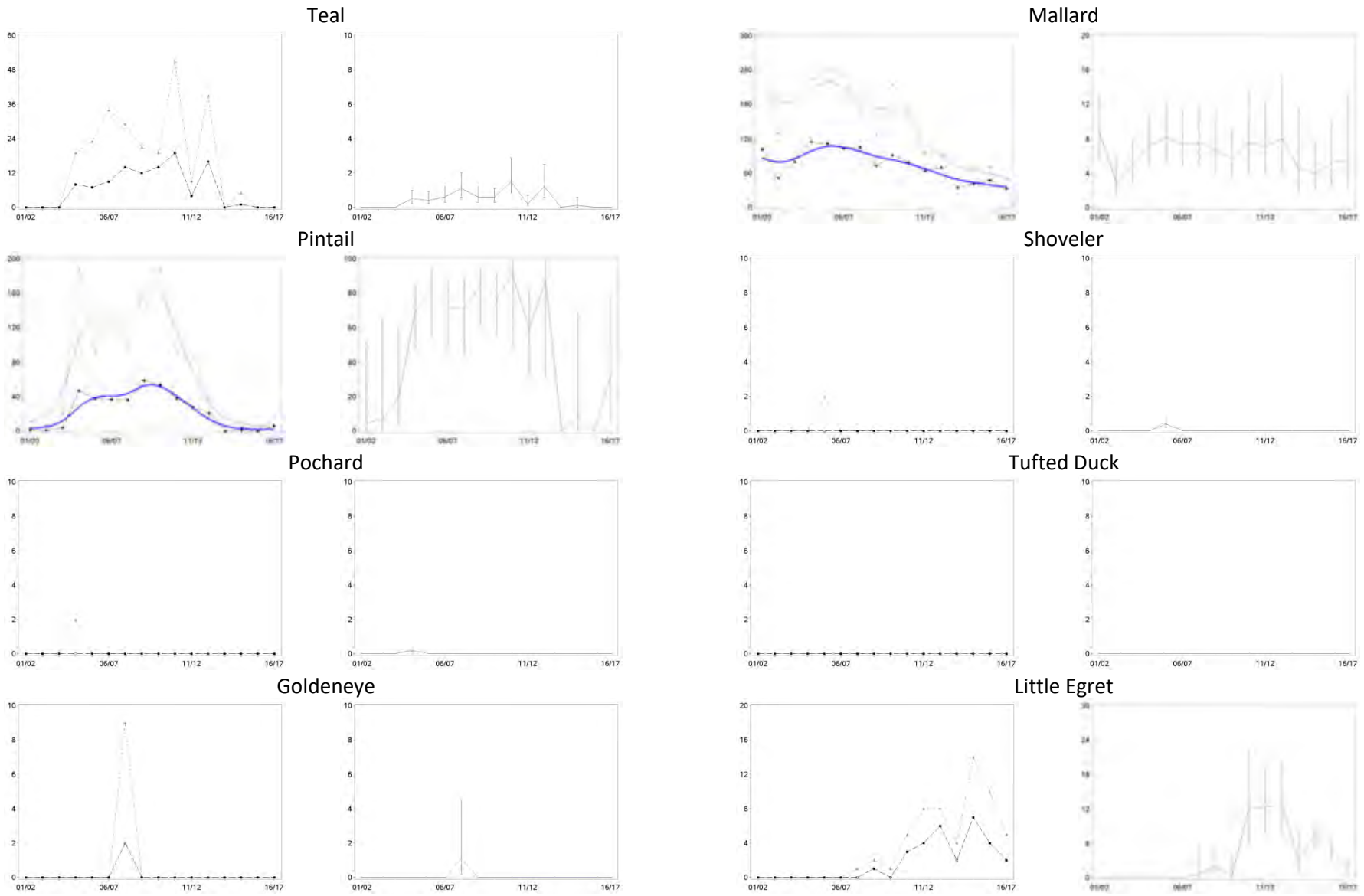


Figure A.38443. Population trends of each species in sector 38443 (Patrington to Easington) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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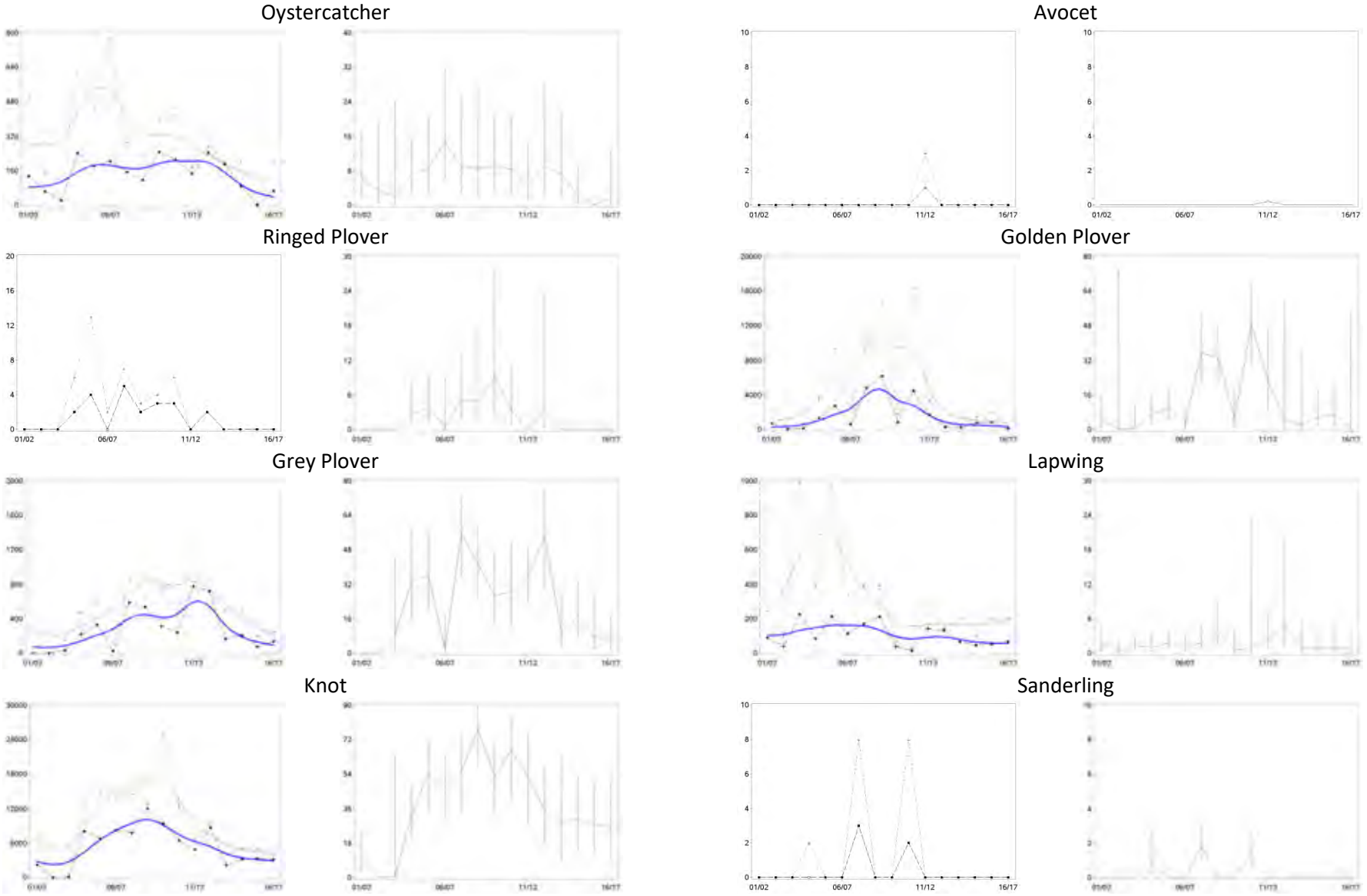
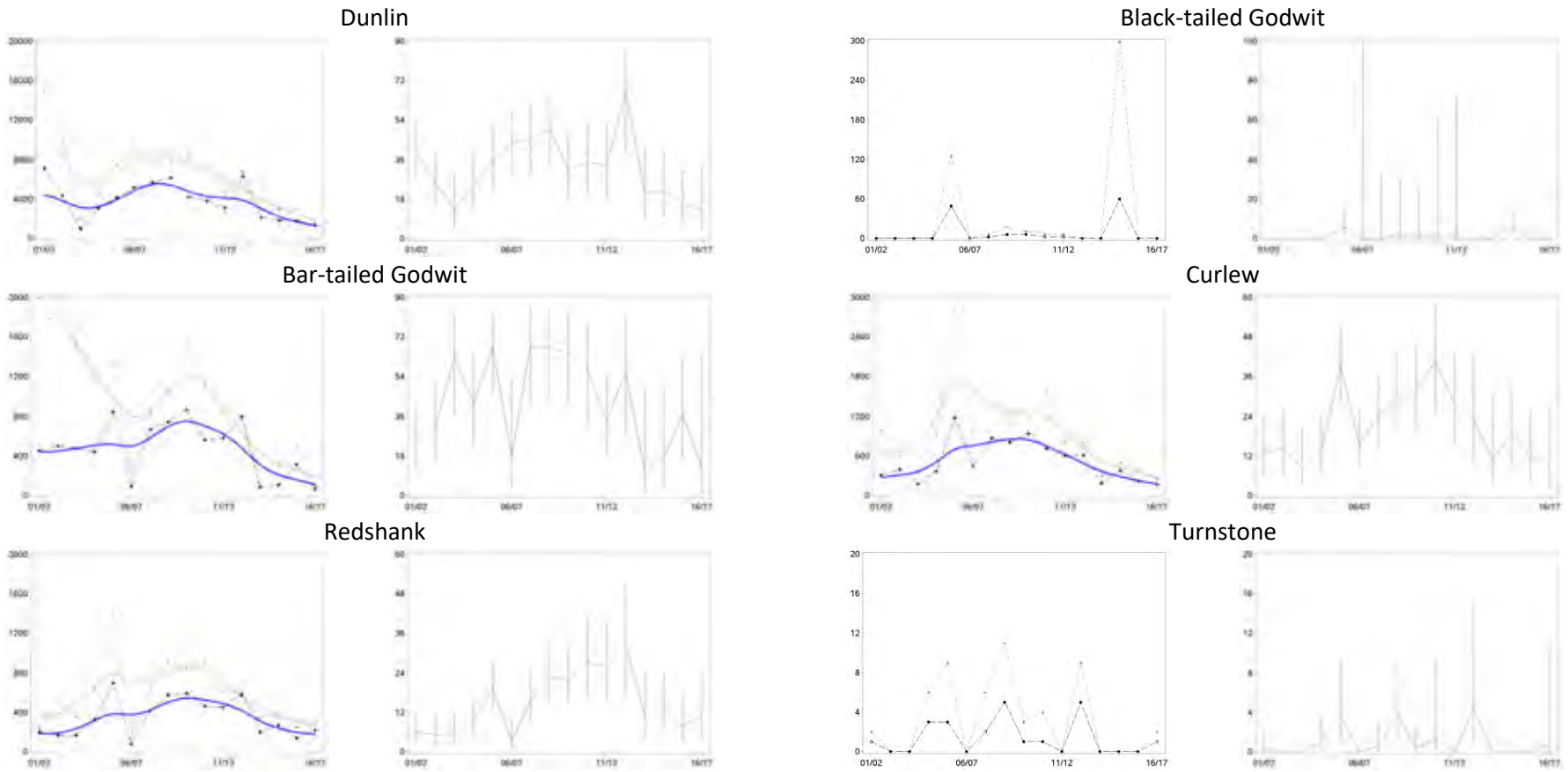


Figure A.38443. Continued



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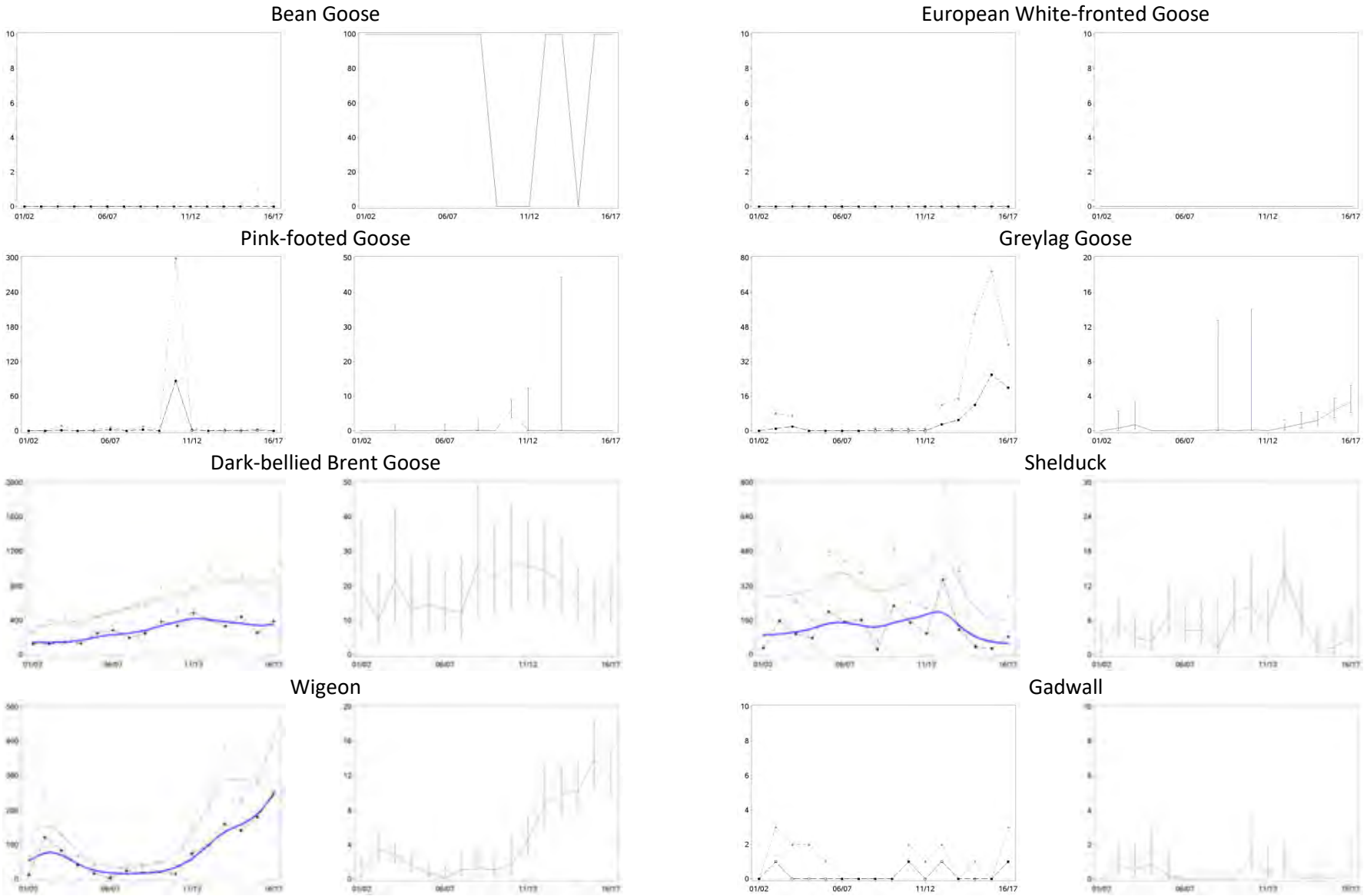


Figure A.38444. Population trends of each species in sector 38444 (Spurn Head, including Easington Lagoons) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

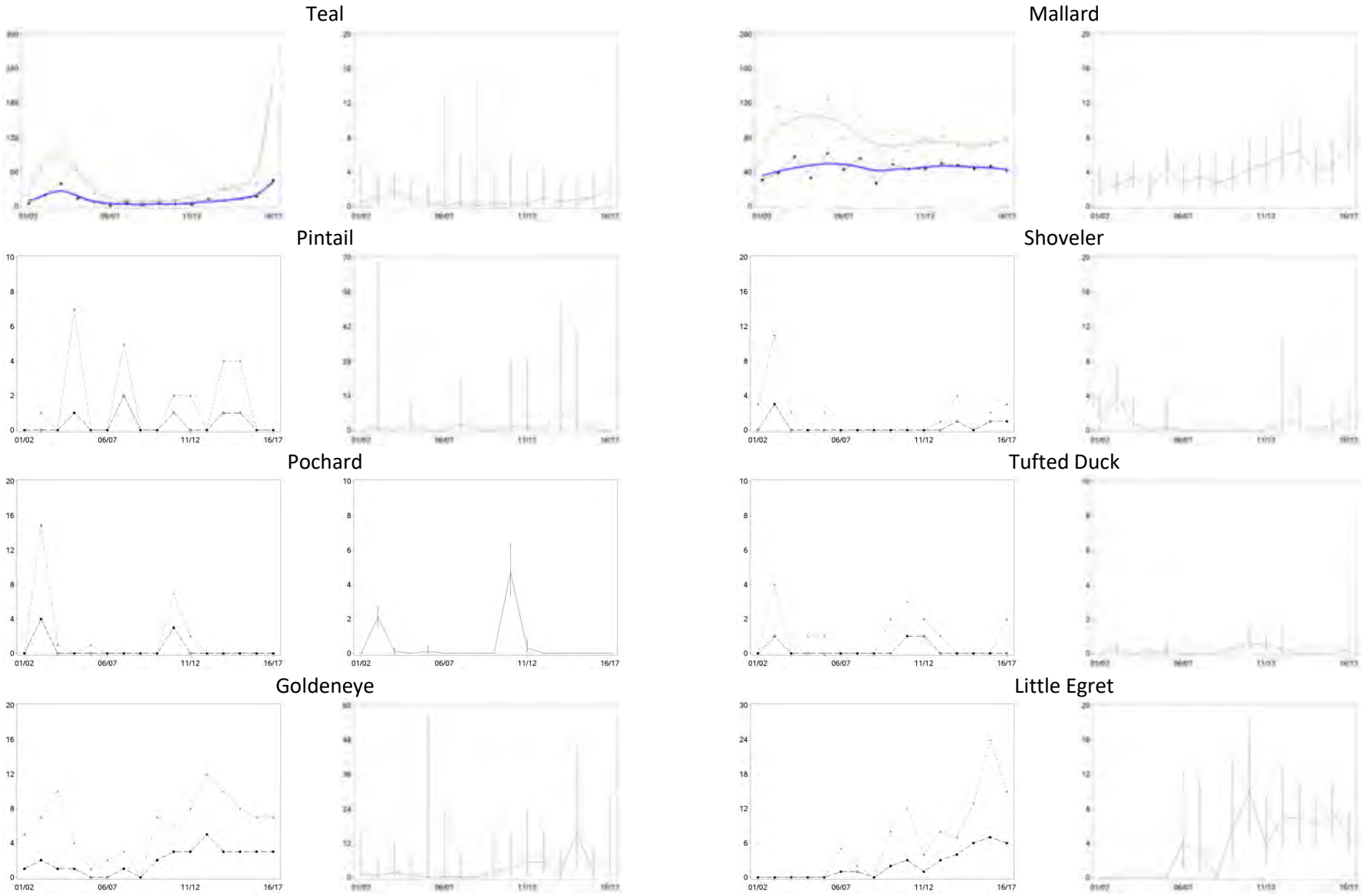
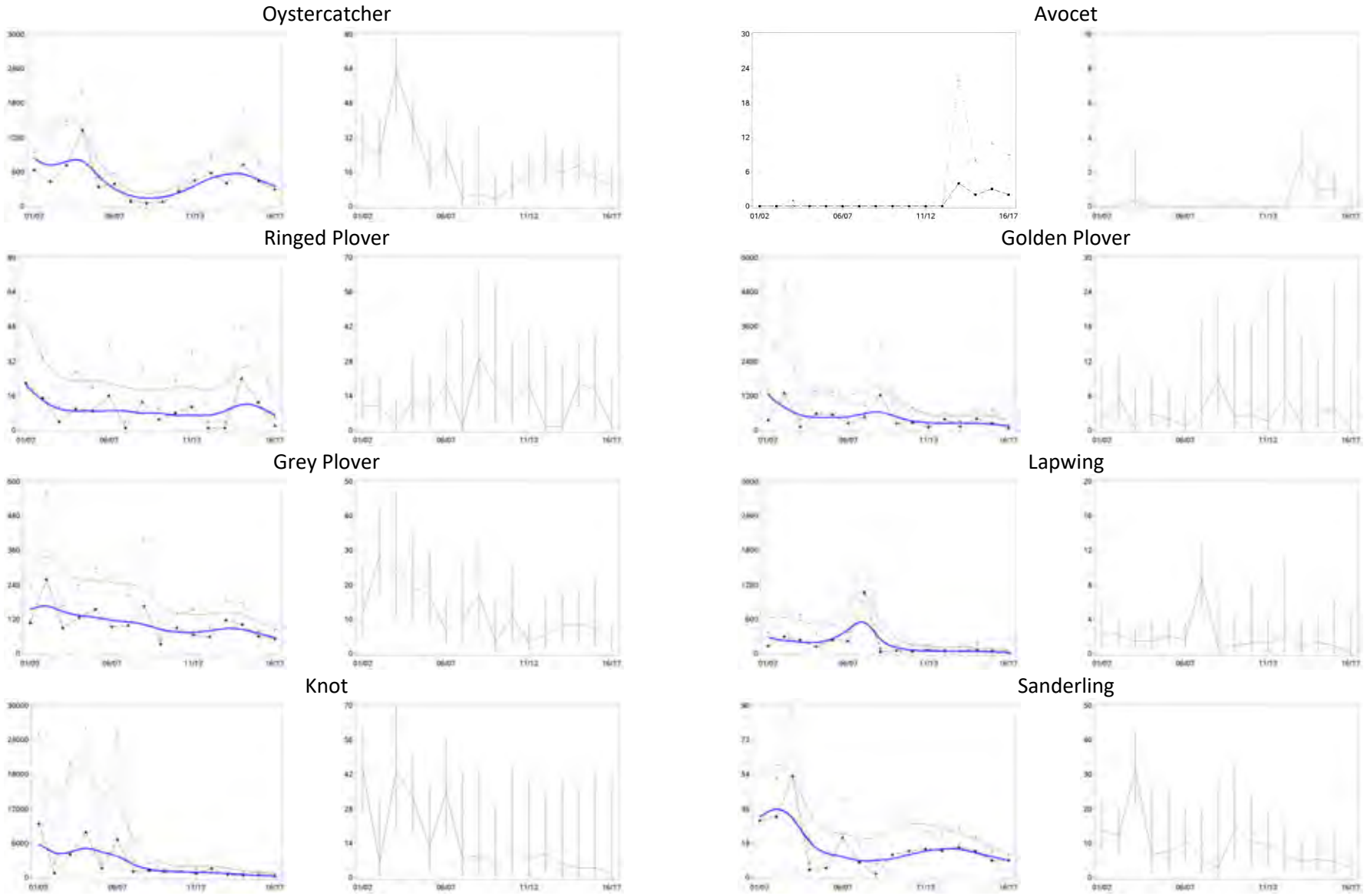


Figure A.38444. Continued



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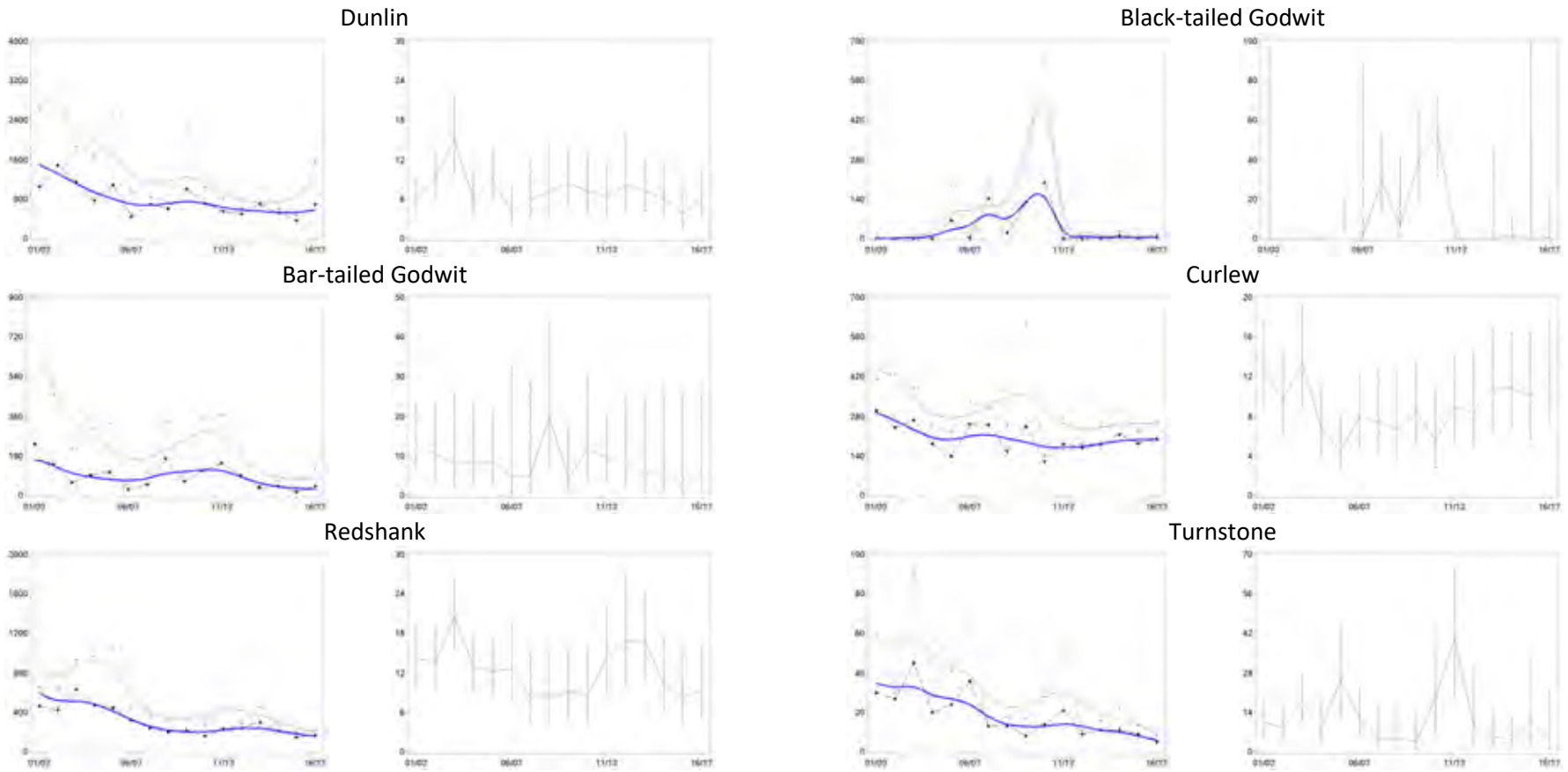

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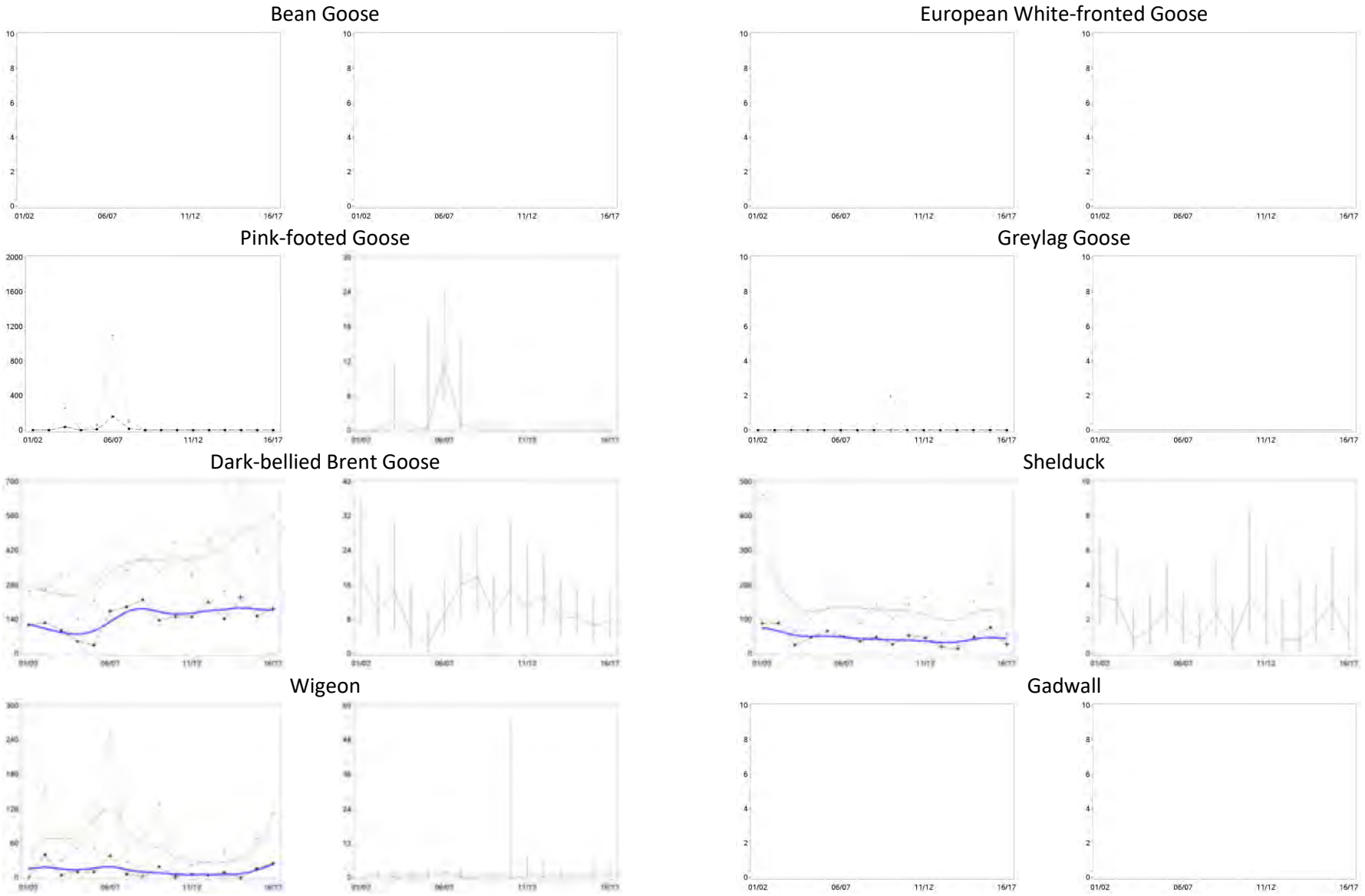
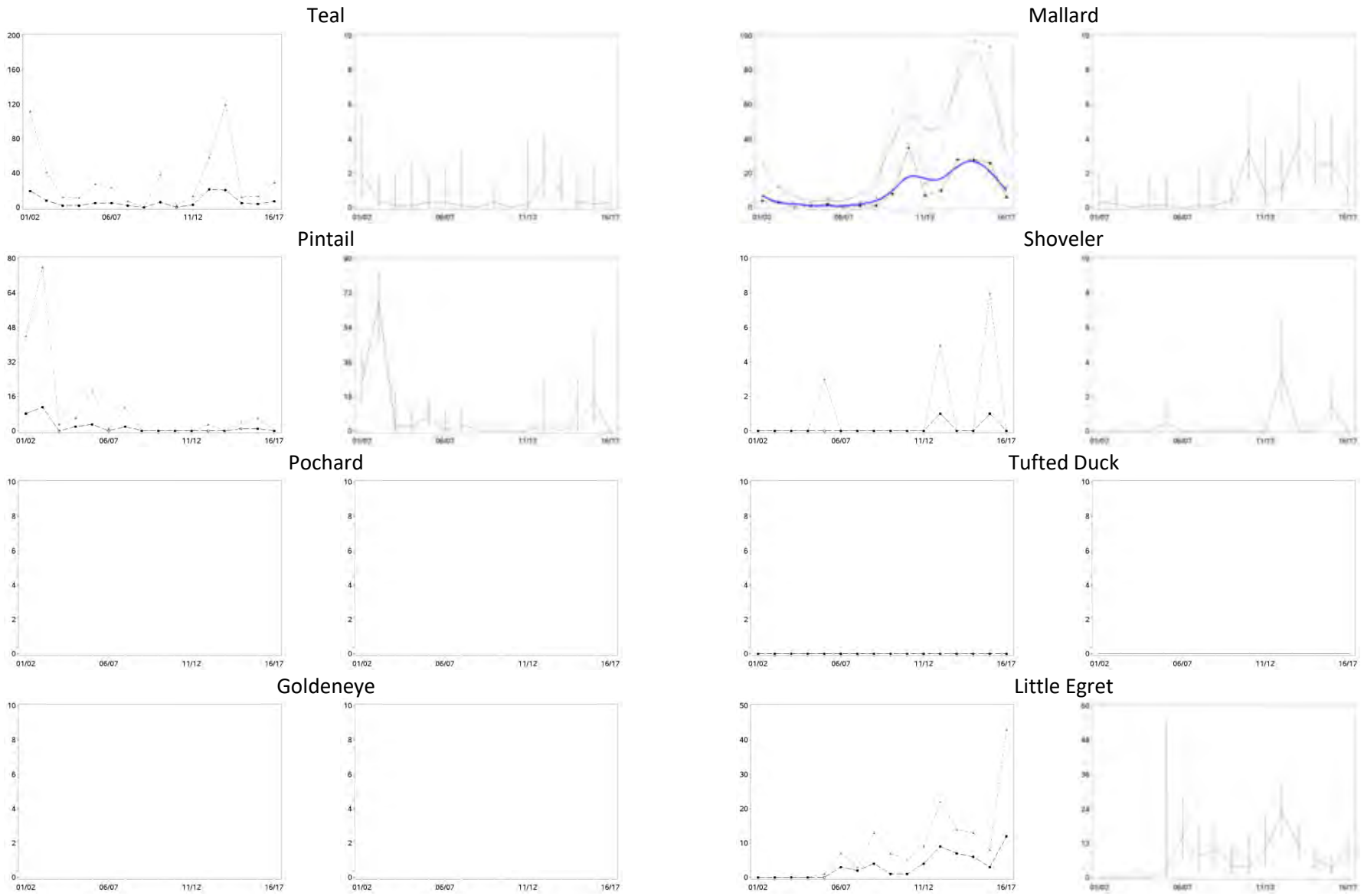


Figure A.35478. Population trends of each species in sector 35478 (Grainthorpe to Somercotes) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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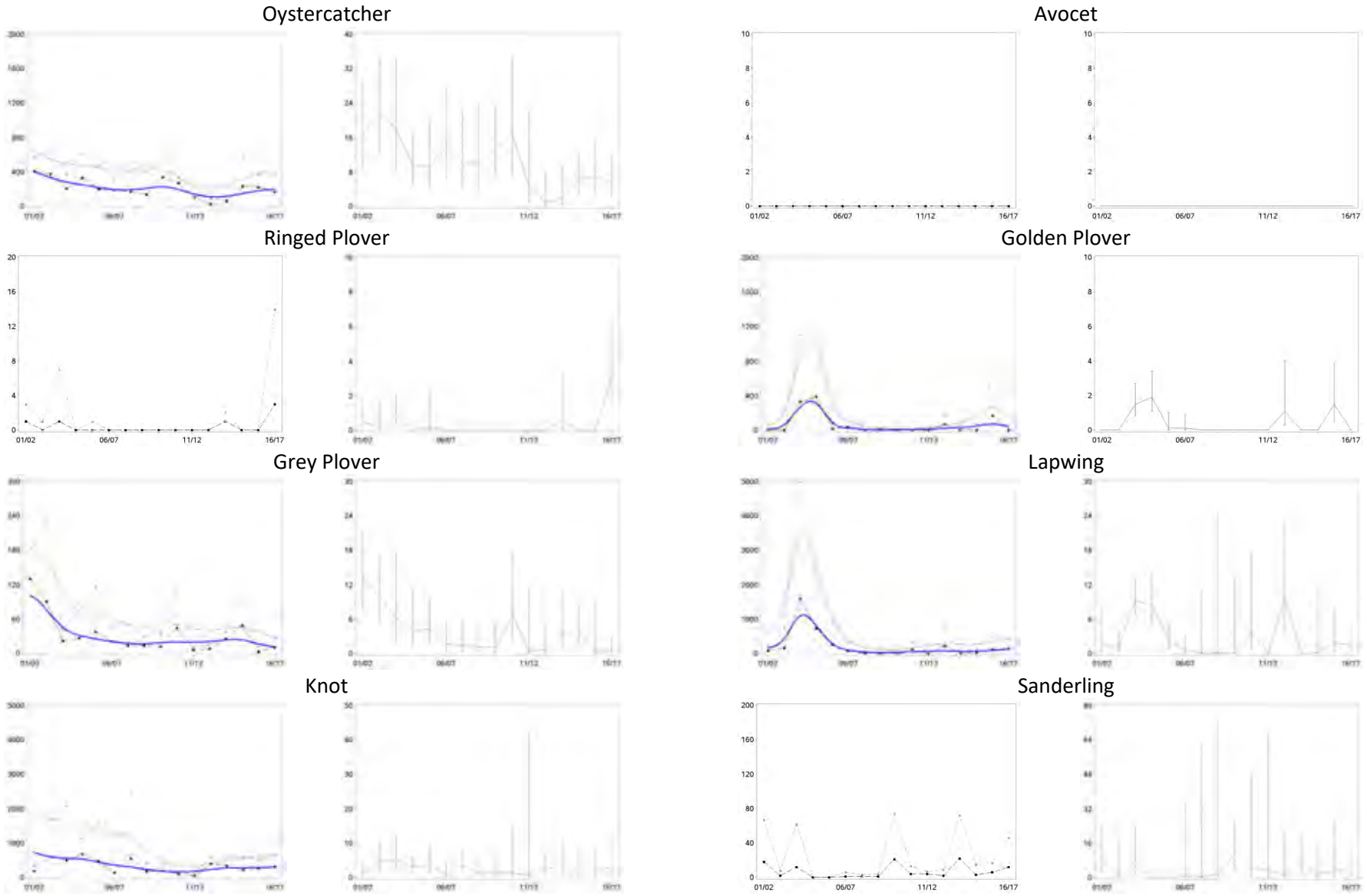

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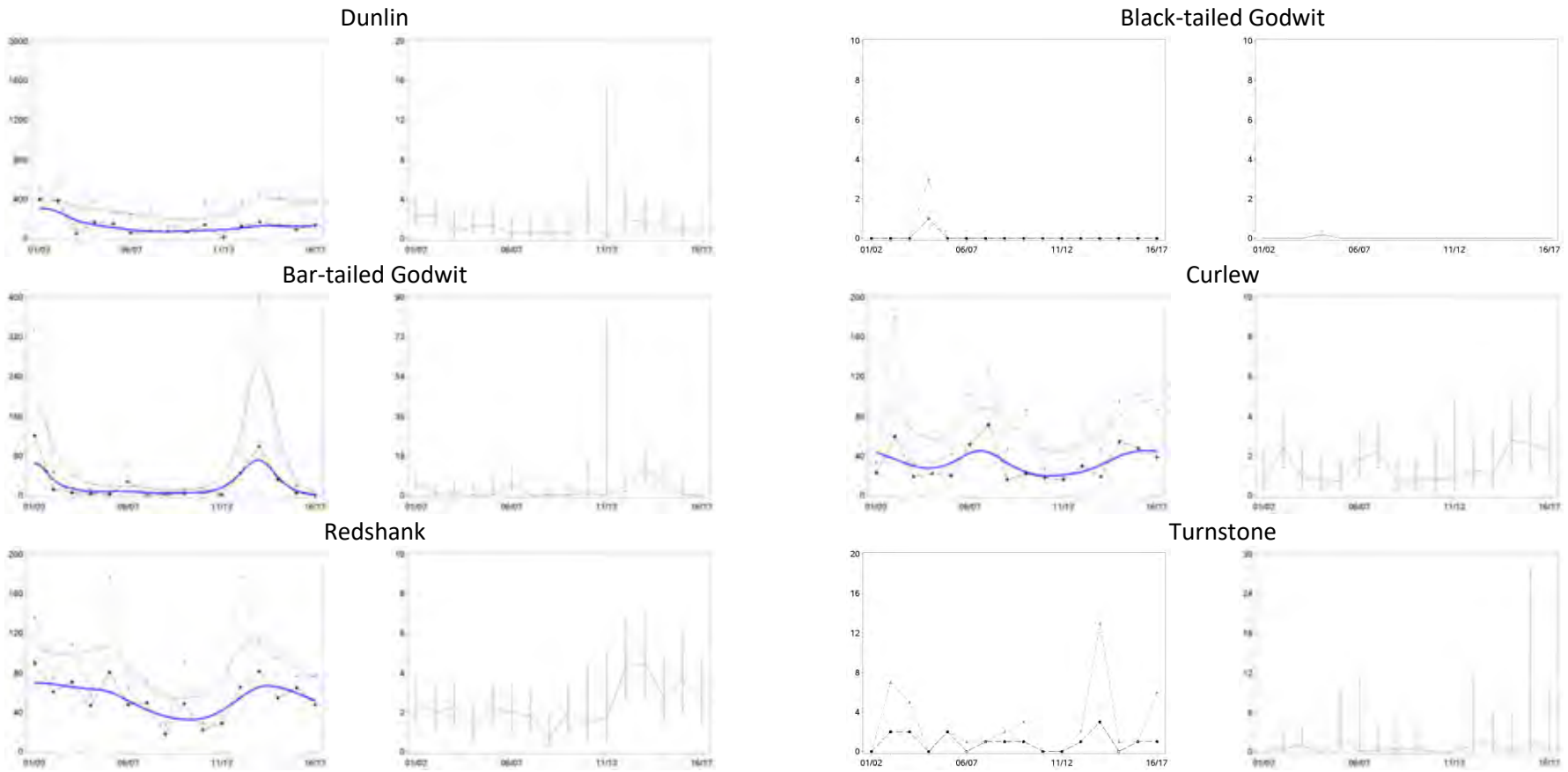


Figure A.35478. Continued

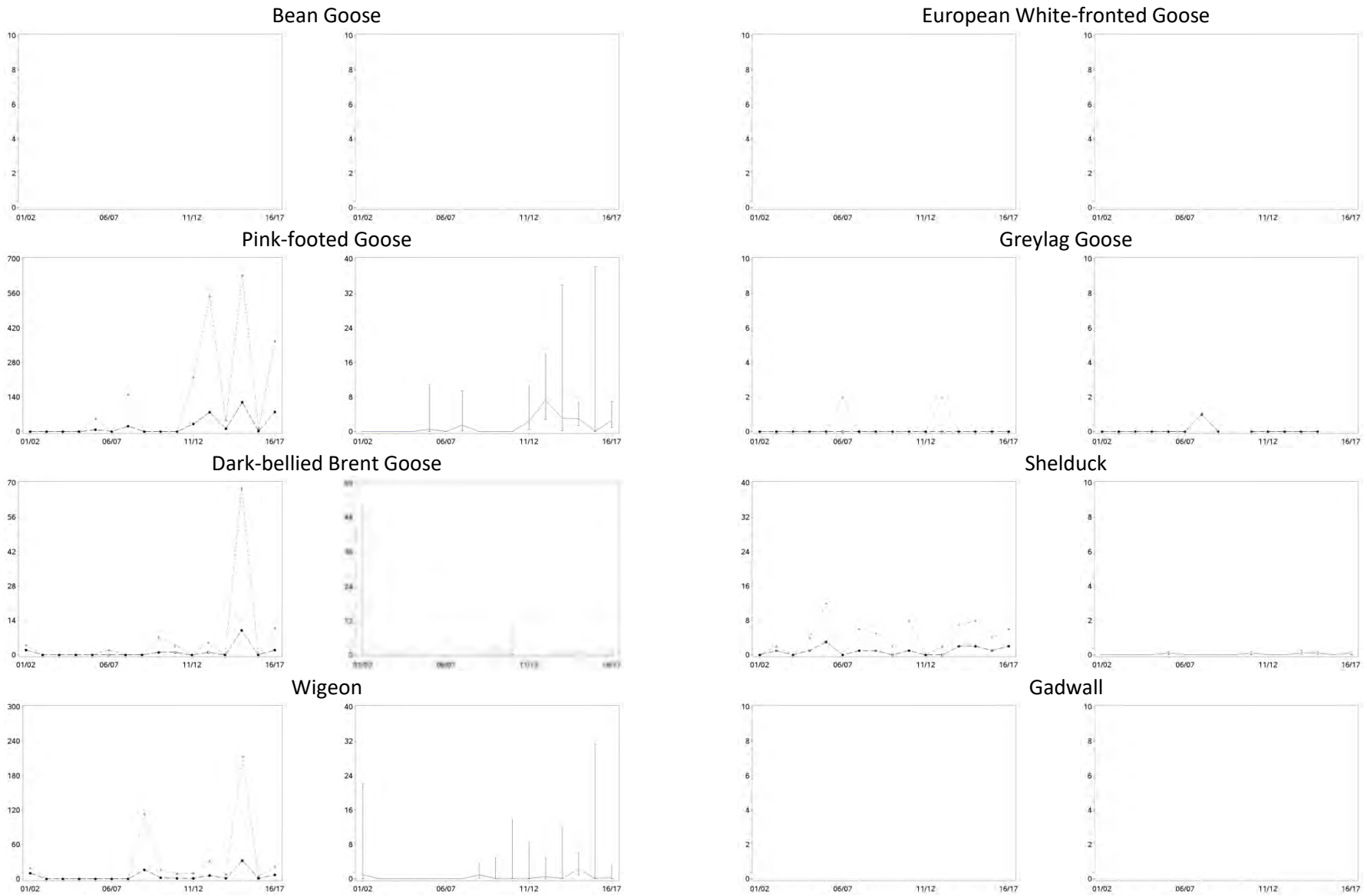
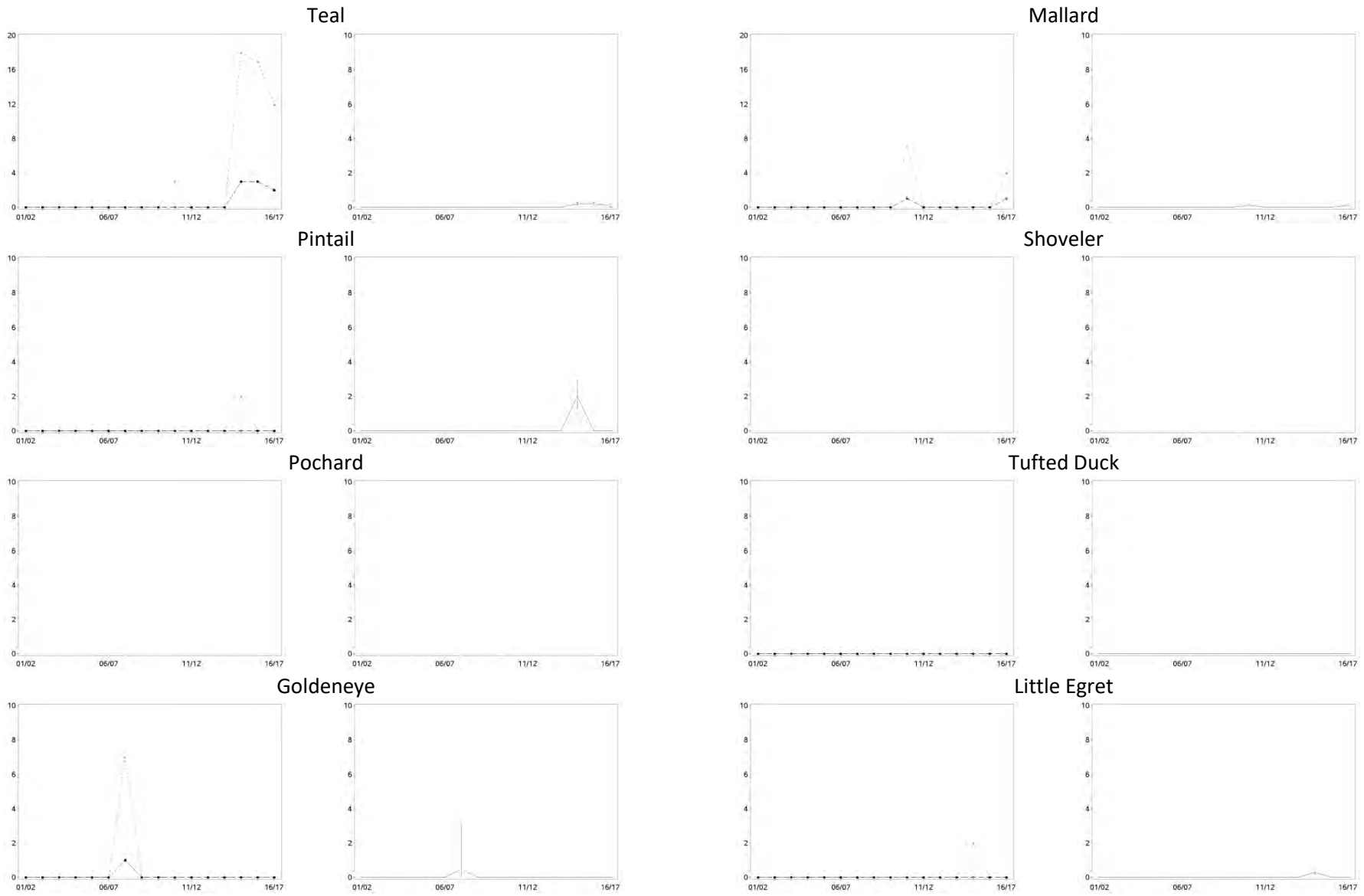


Figure A.35479. Population trends of each species in sector 35479 (Theddlethorpe to Mablethorpe North End) **(**left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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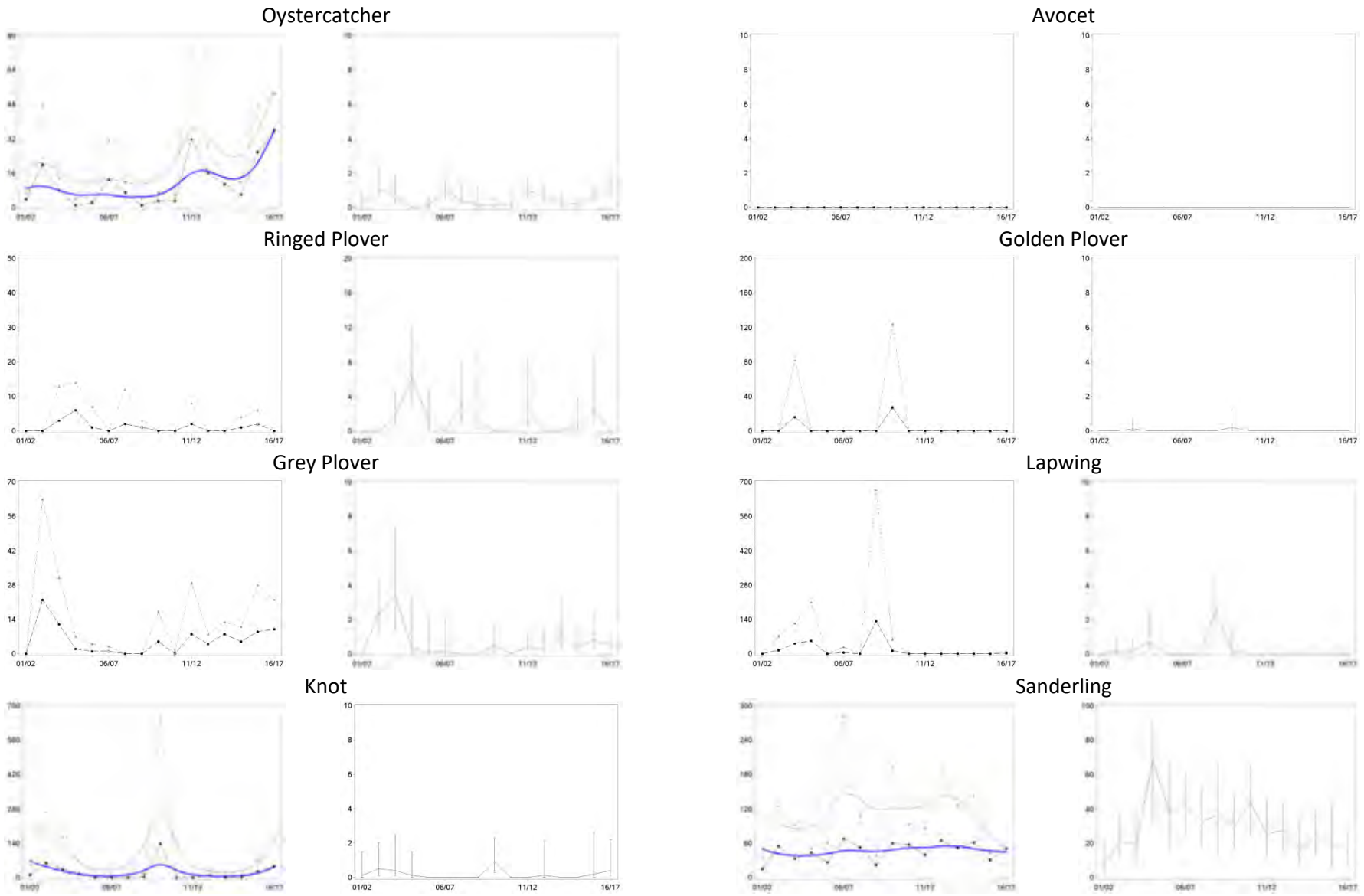

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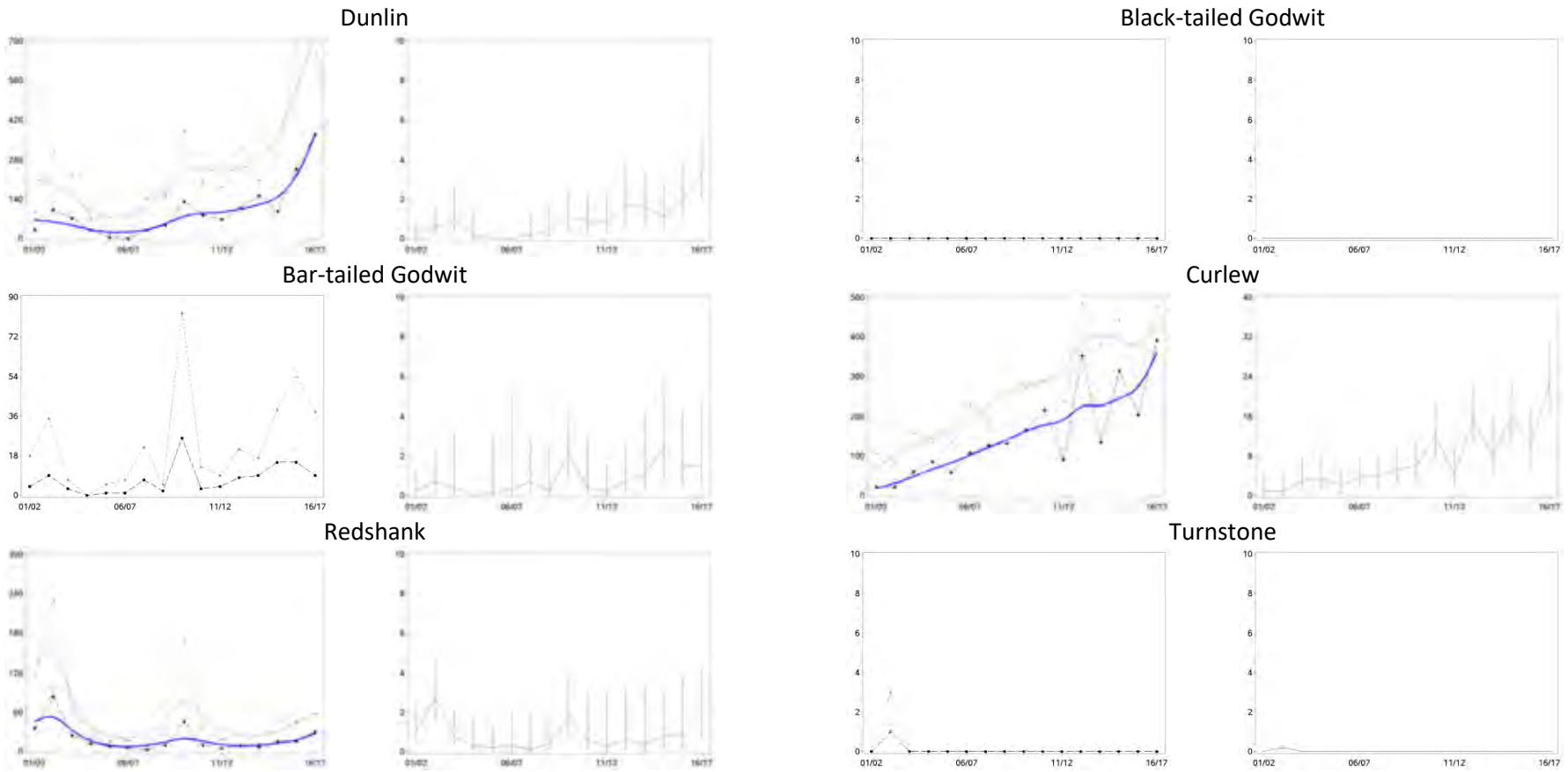

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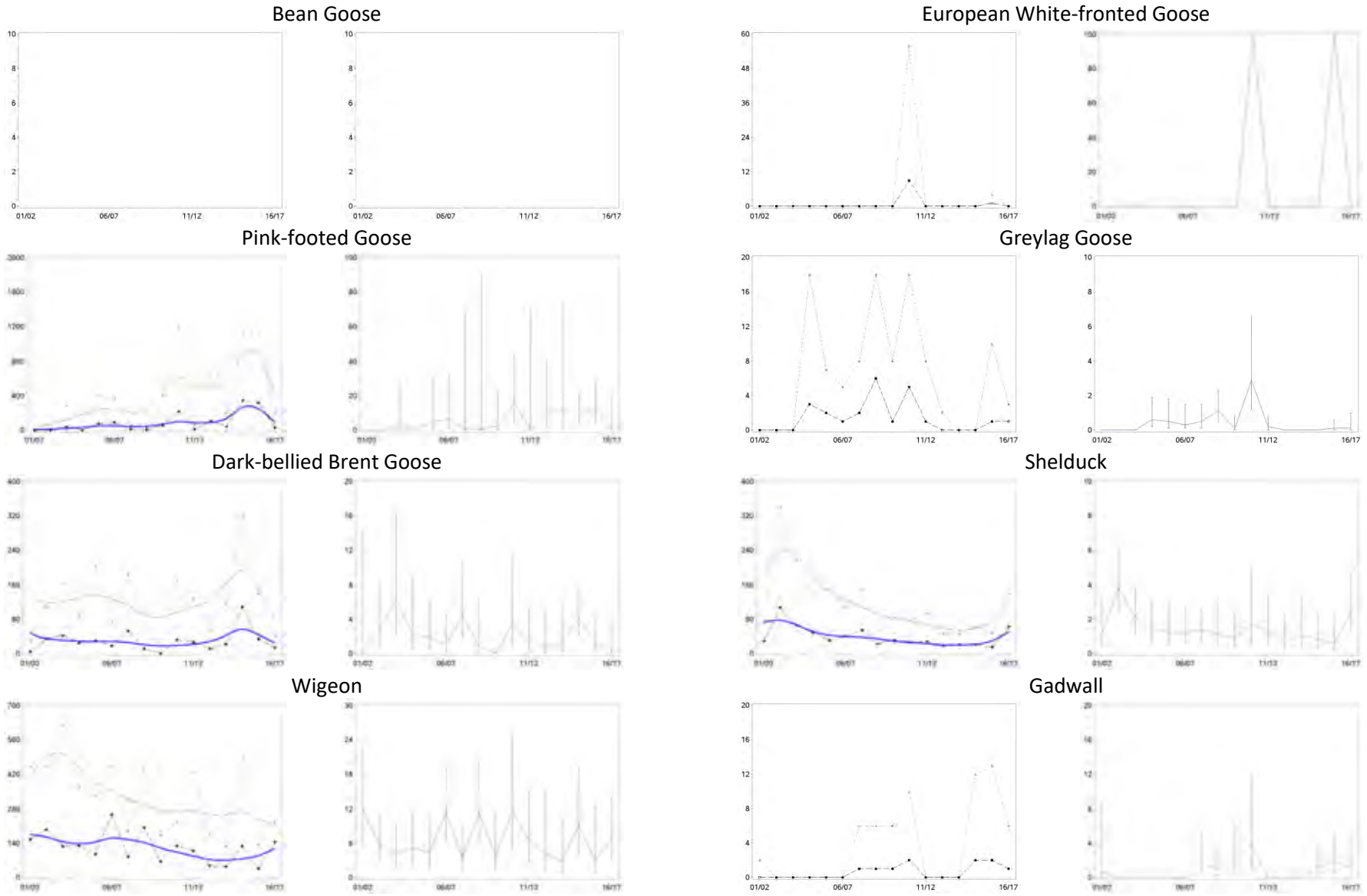


Figure A.35480. Population trends of each species in sector 35480 (Theddlethorpe to Saltfleetby) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

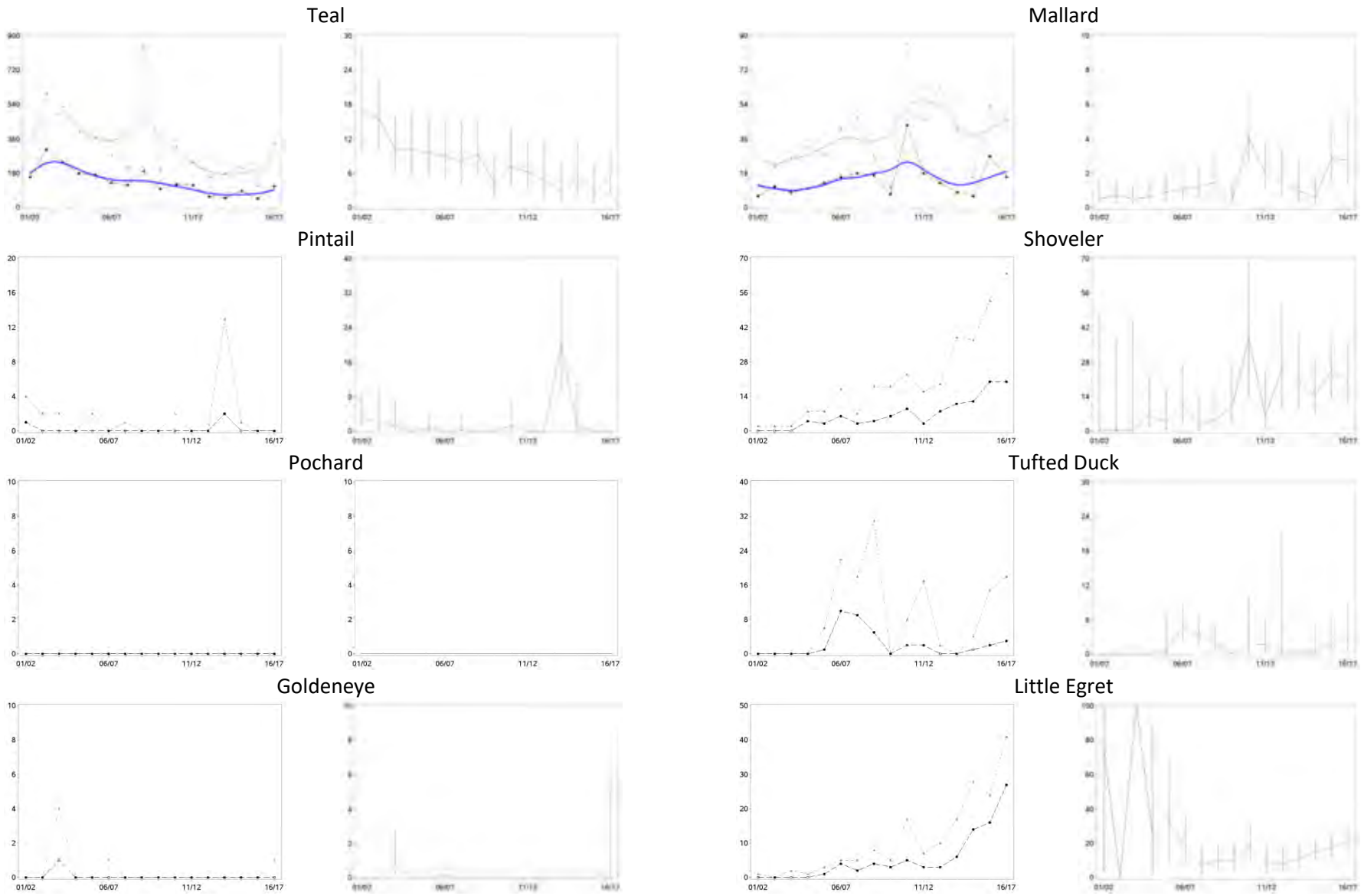


Figure A.35480. Continued

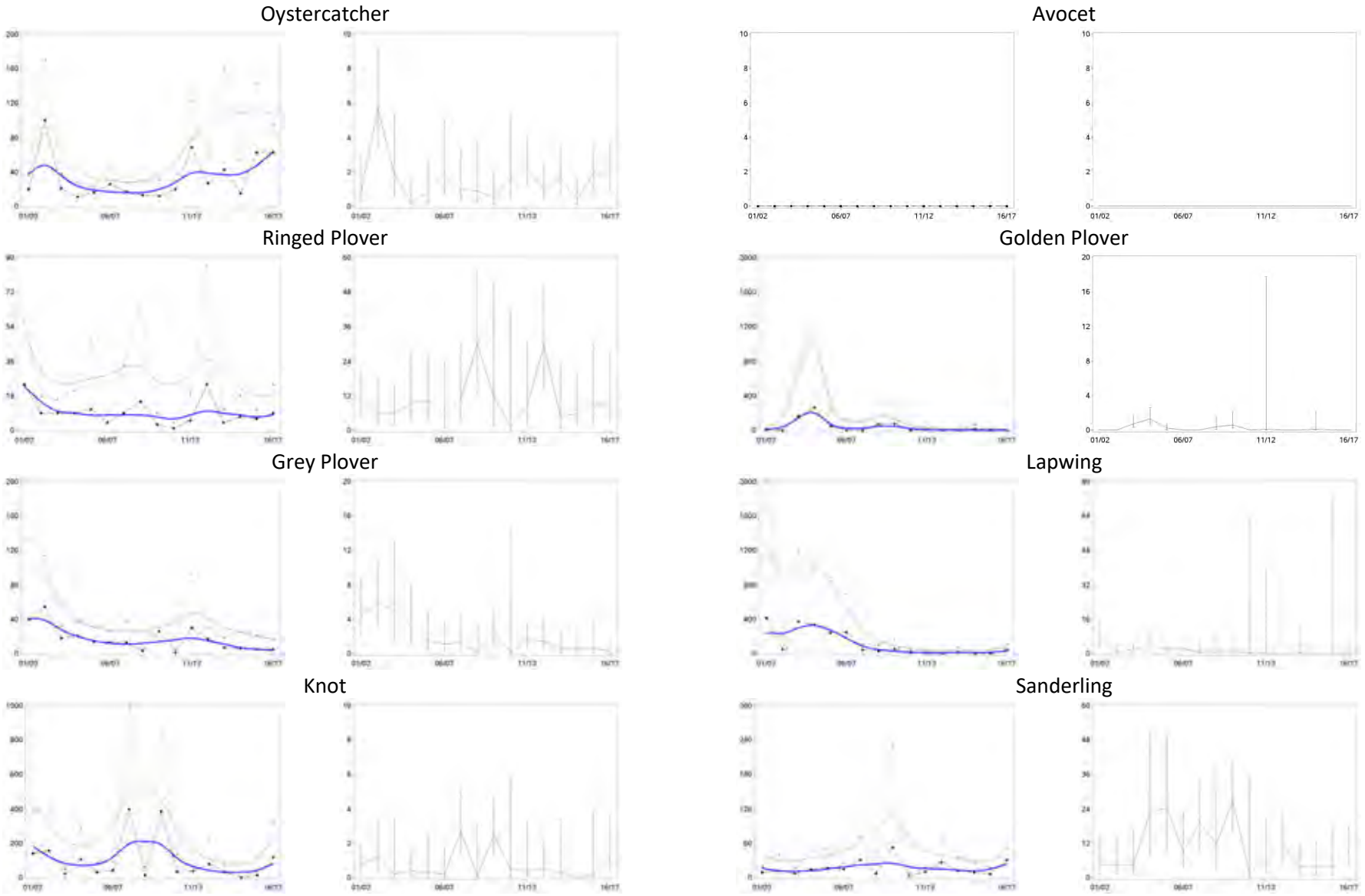
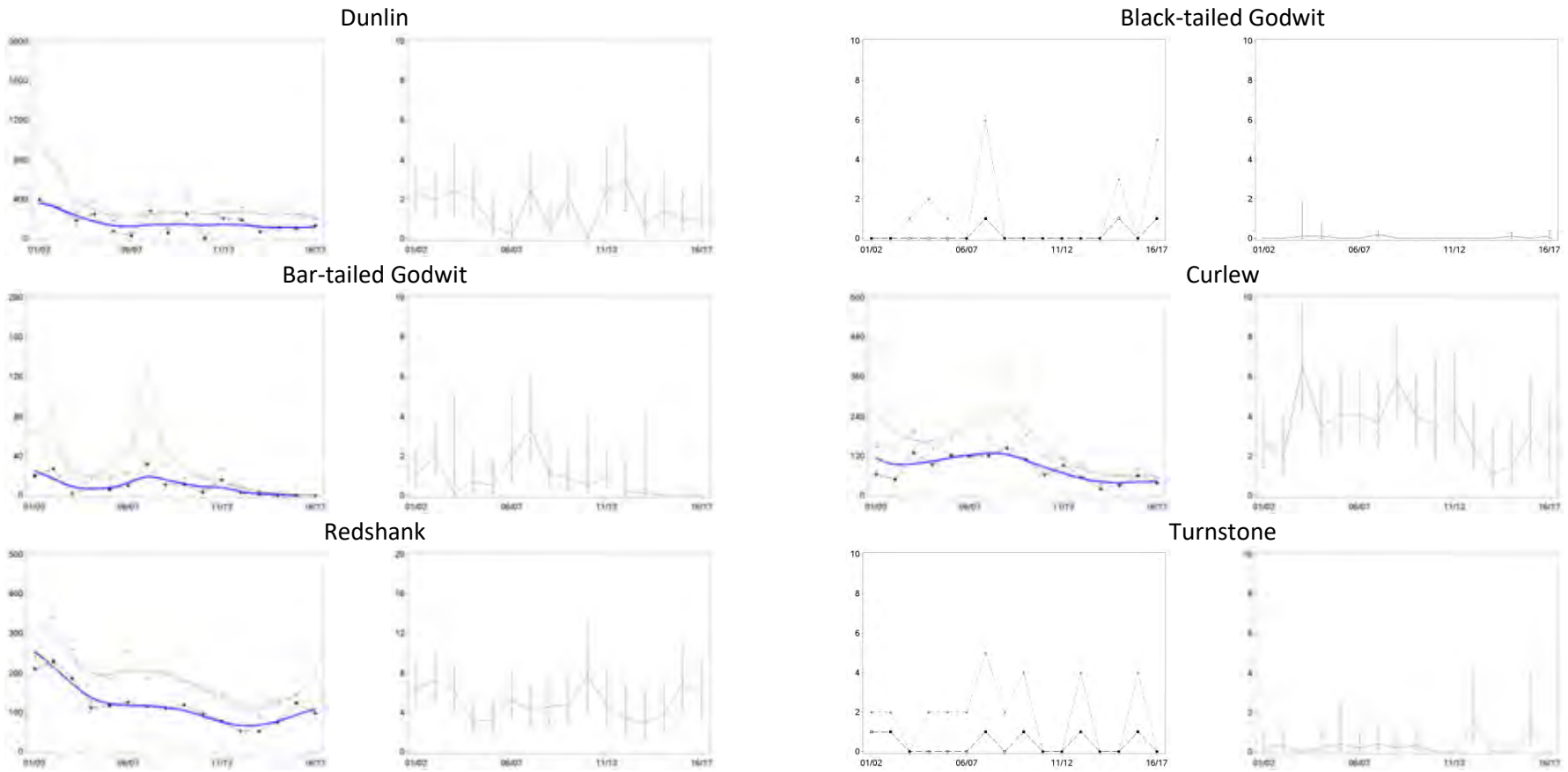


Figure A.35480. Continued



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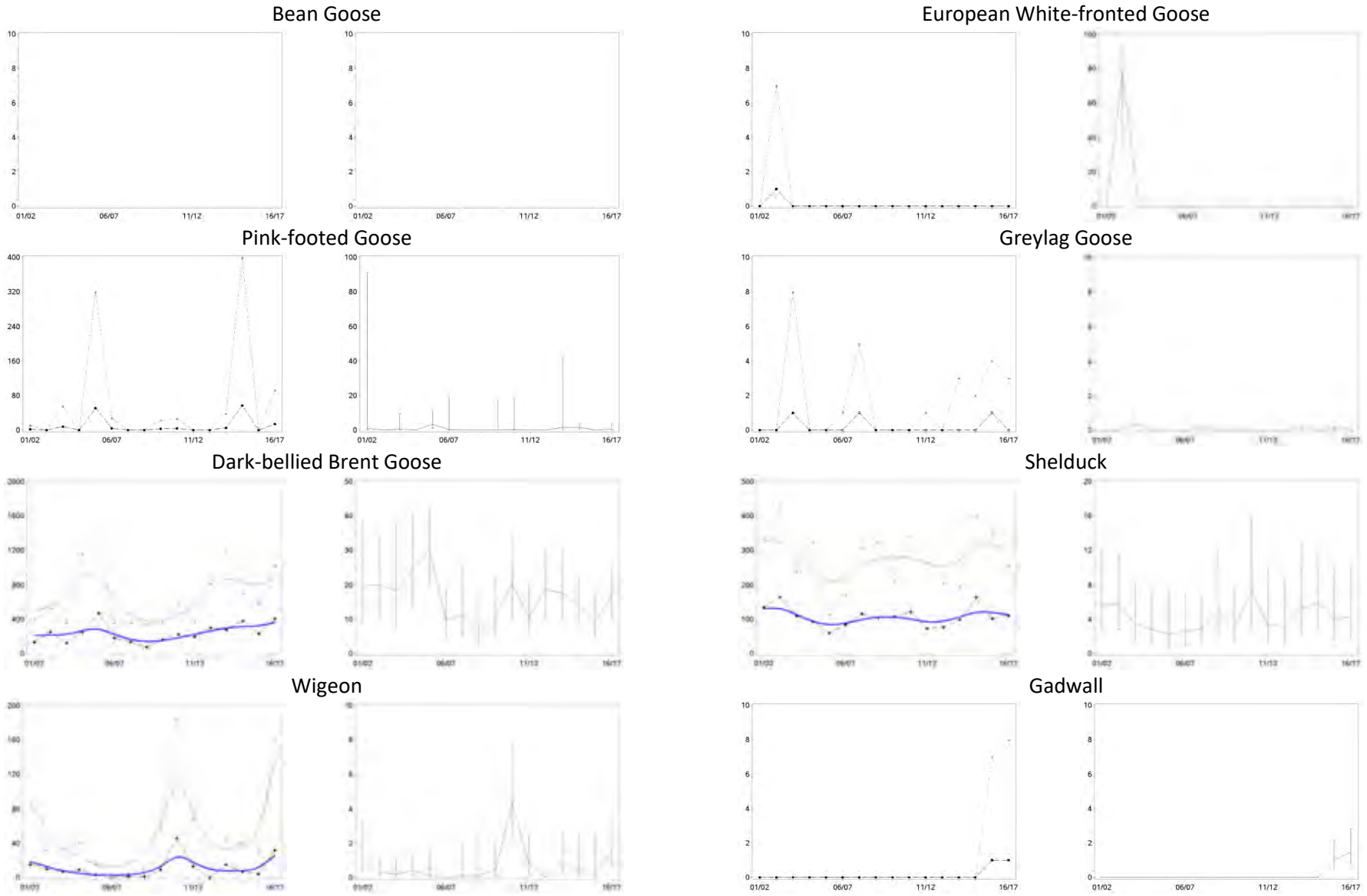


Figure A.35481. Population trends of each species in sector 35481 (Saltfleet) **(**left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

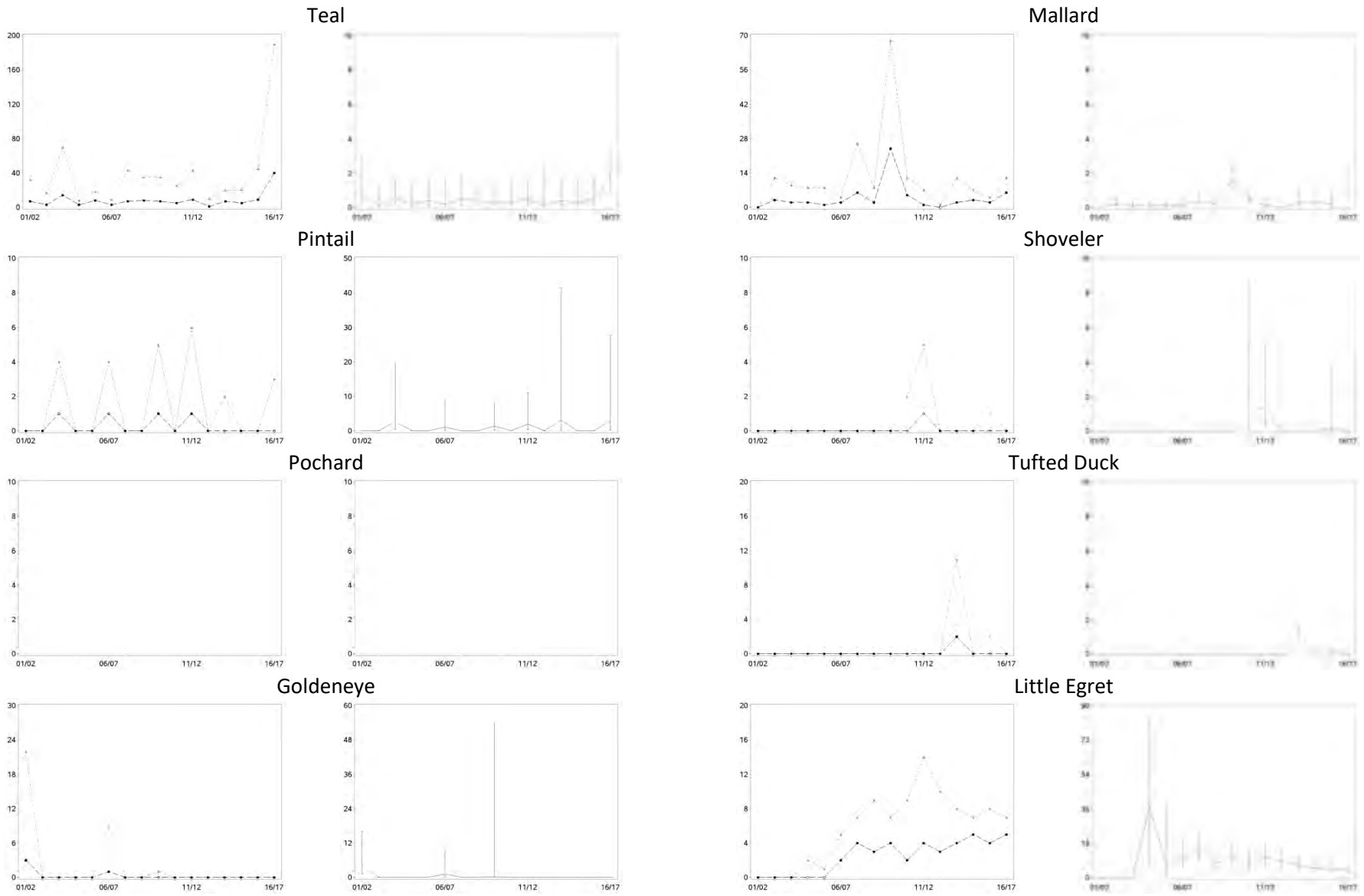


Figure A.35481. Continued

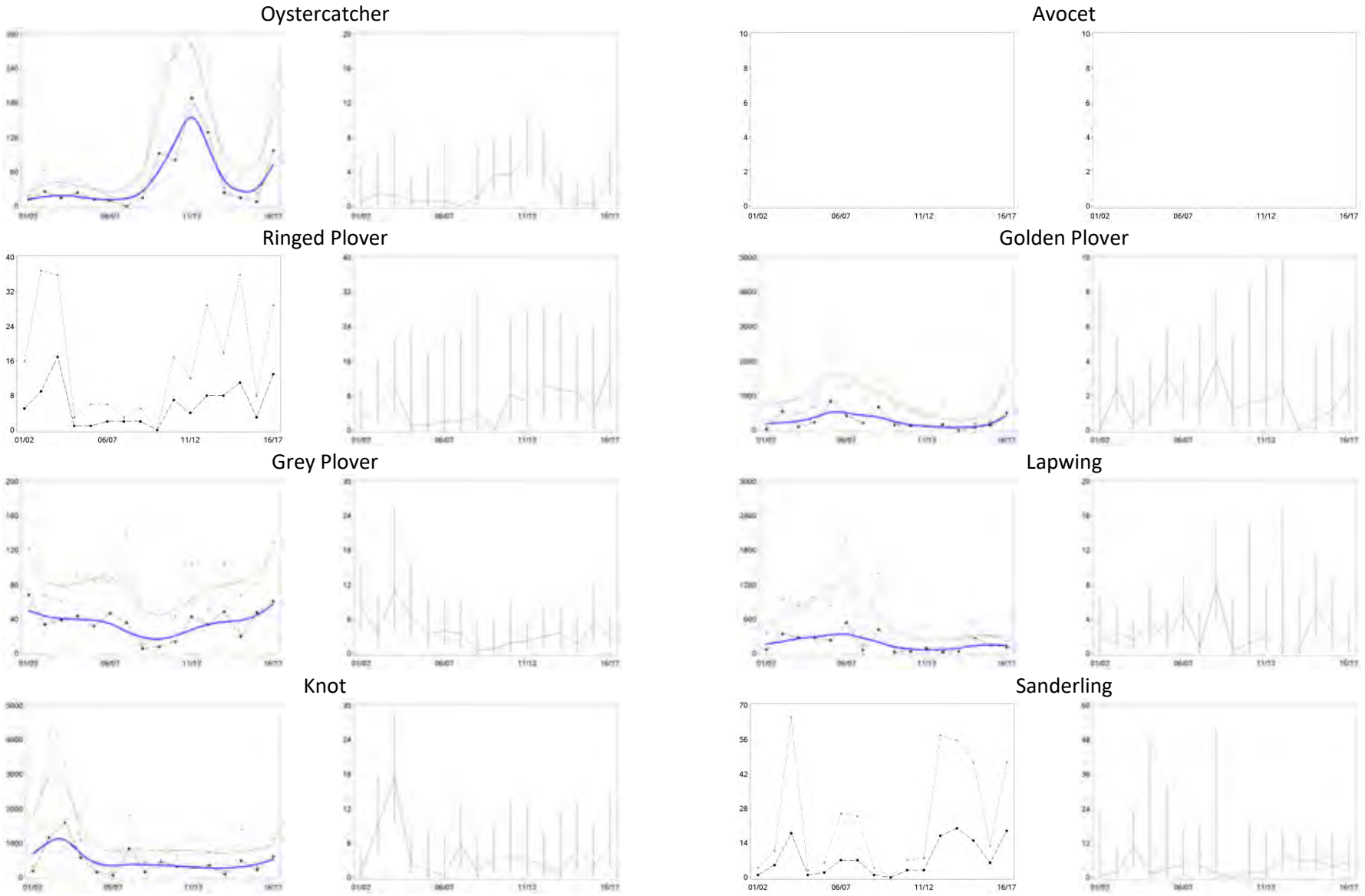


Figure A.35481. Continued

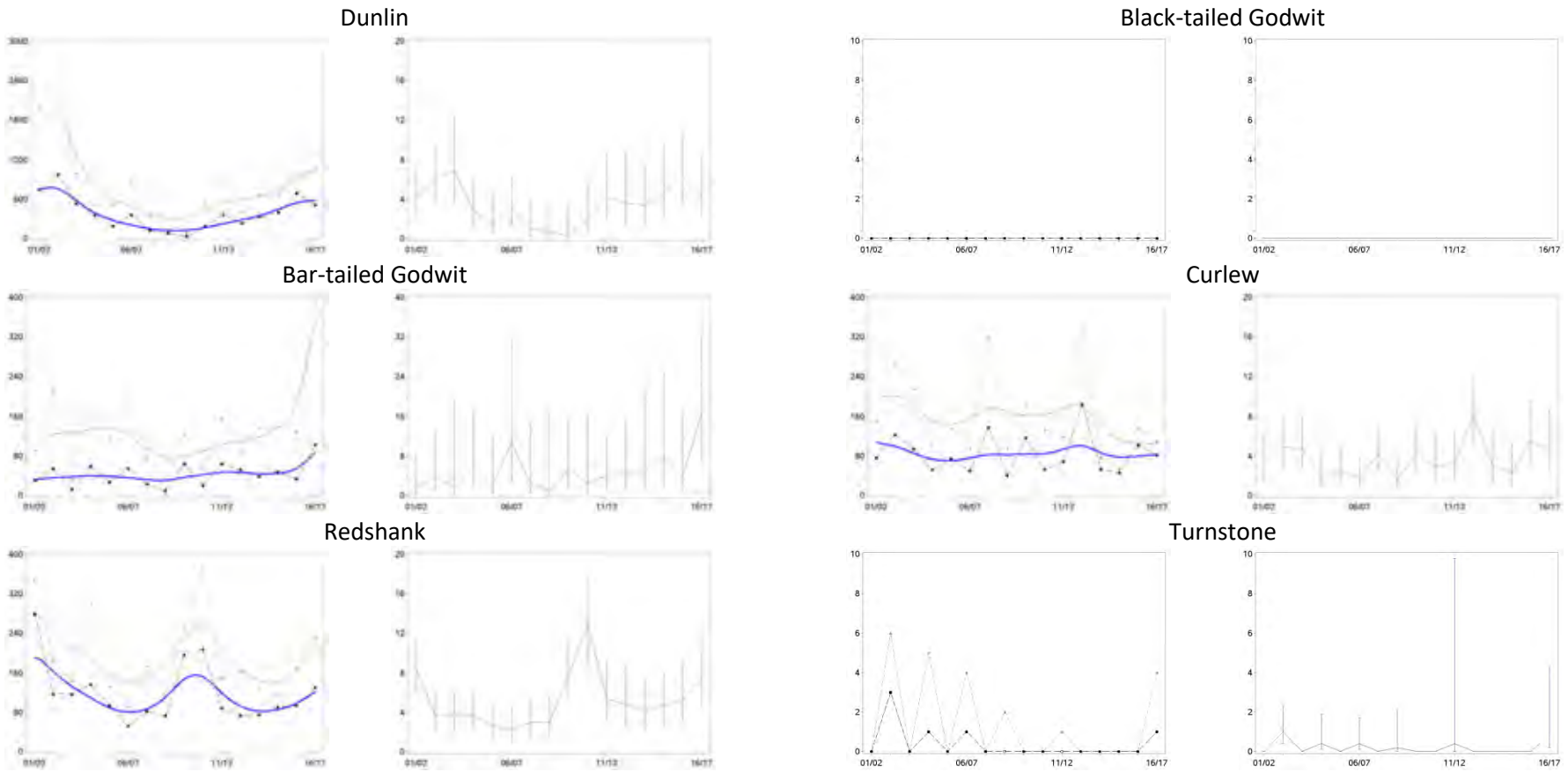


Figure A.35481. Continued

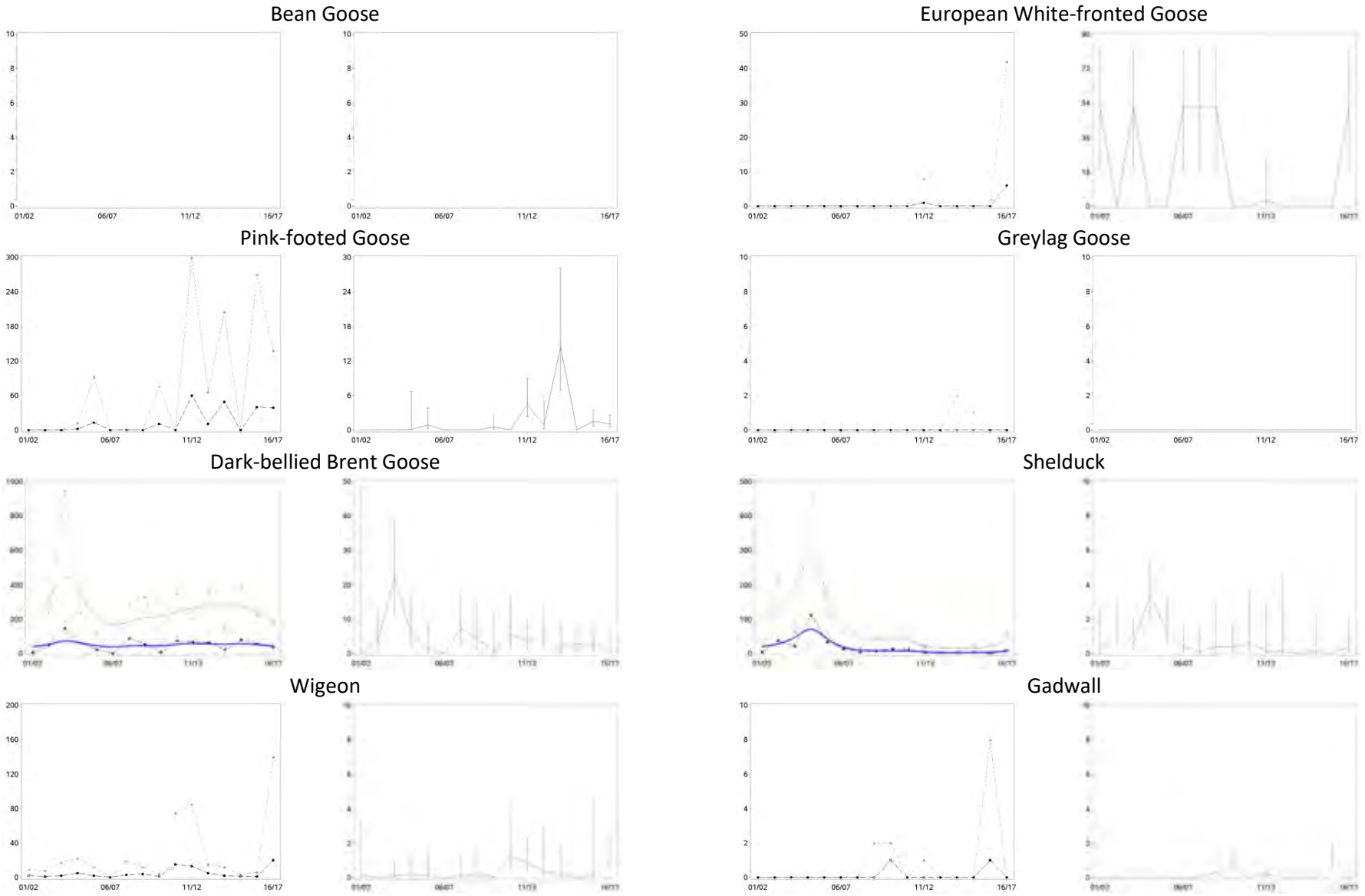
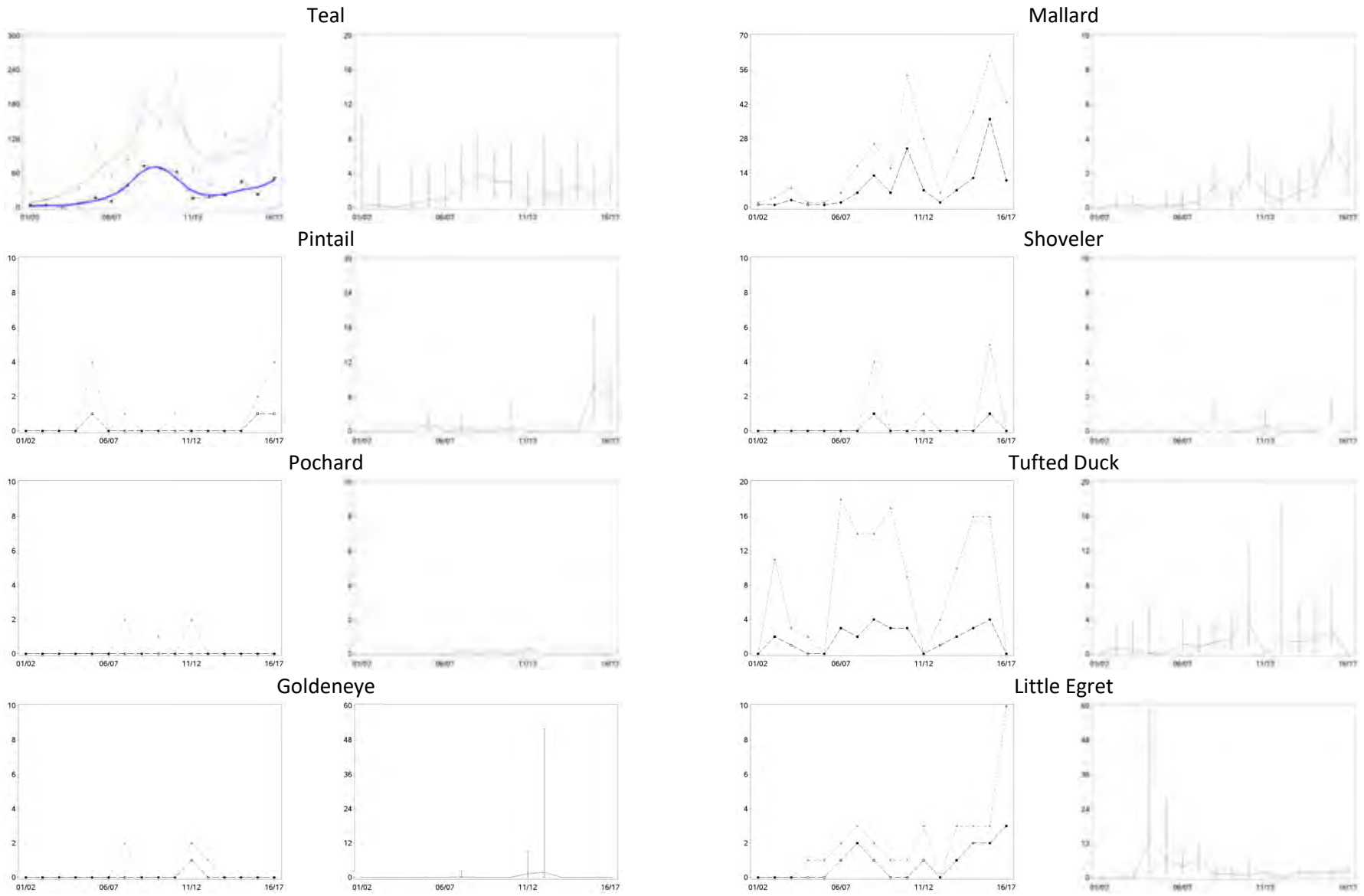


Figure A.35483. Population trends of each species in sector 35483 (Donna Nook (Humber)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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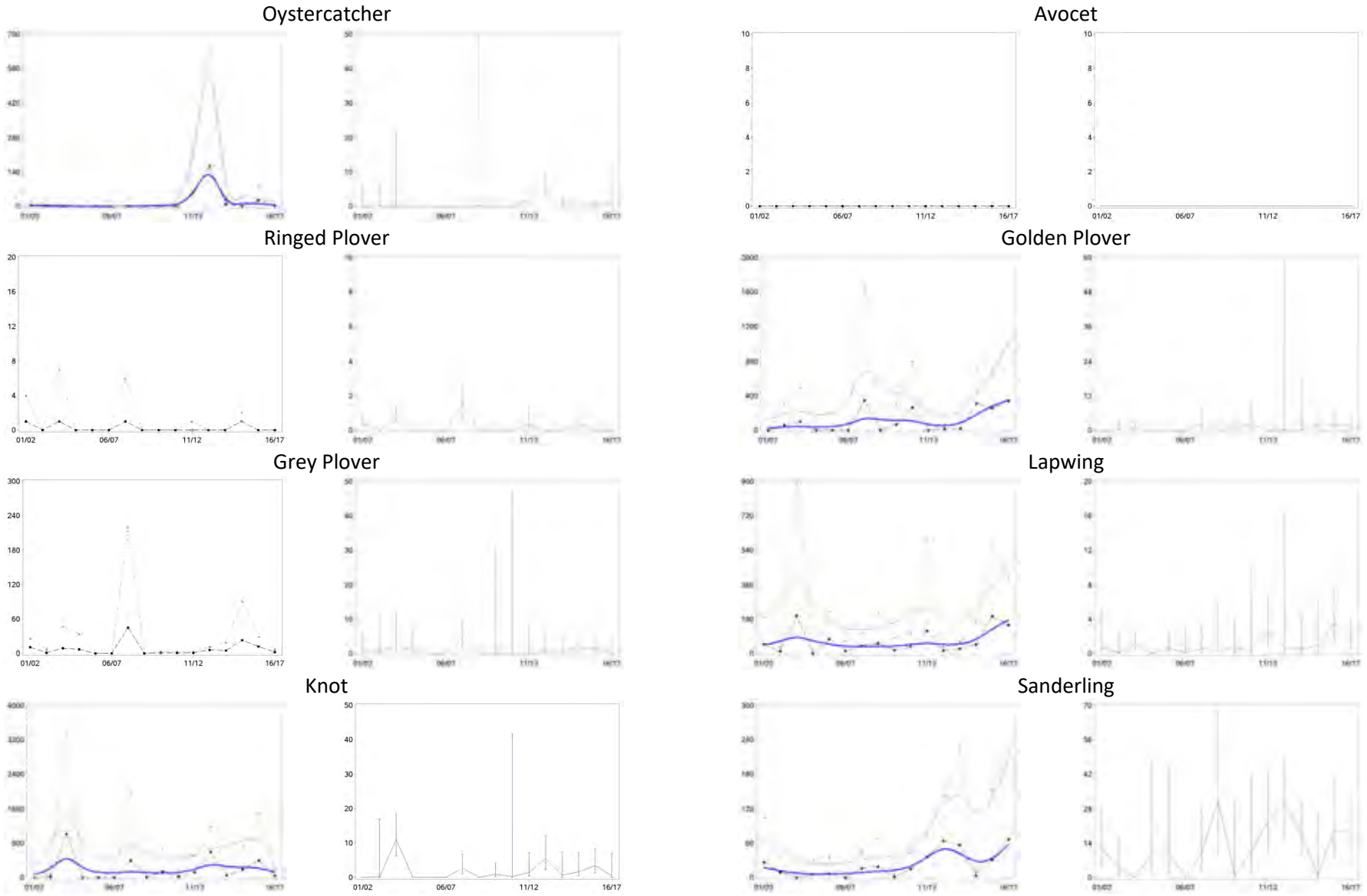


Figure A.35483. Continued

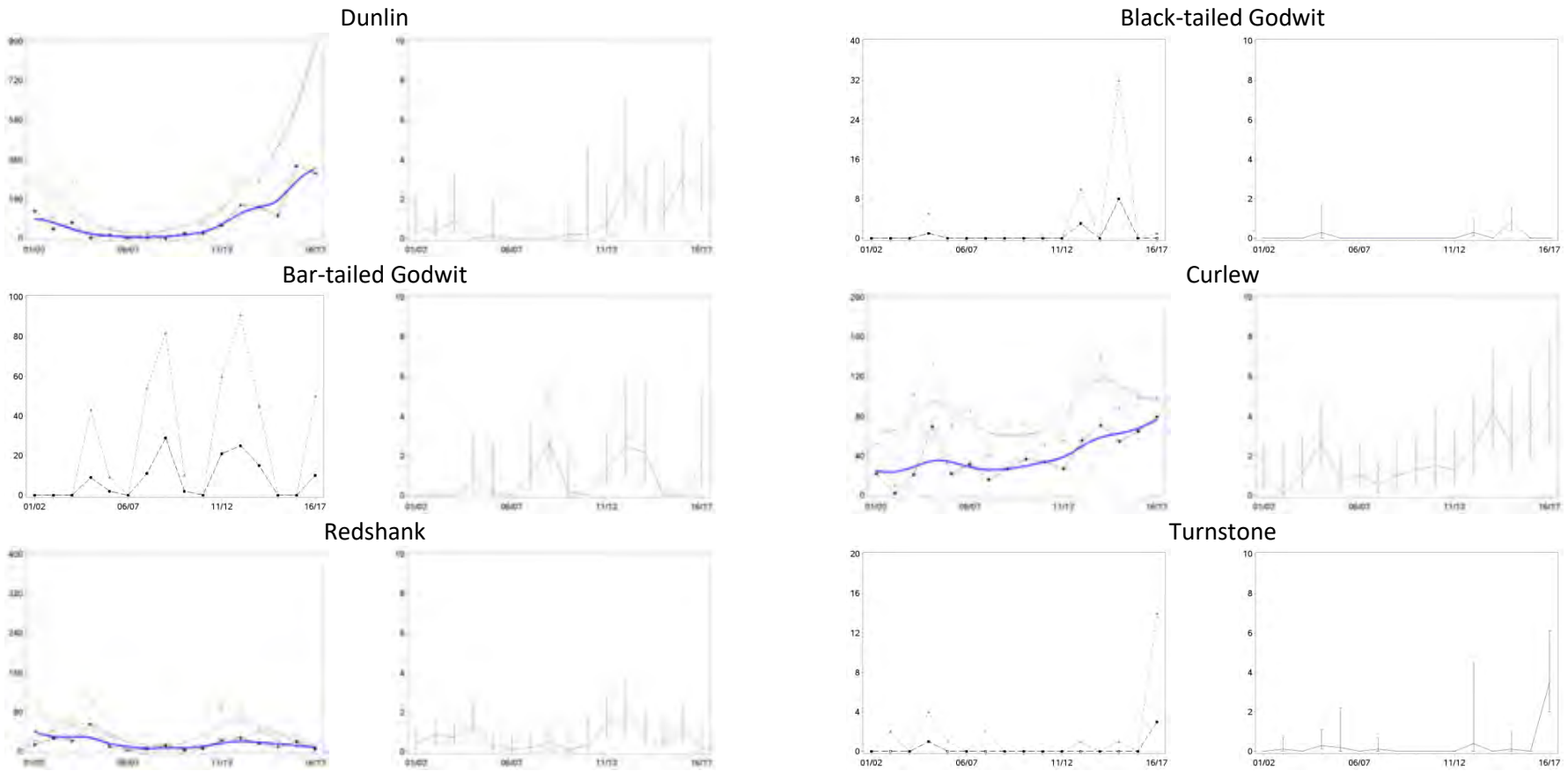


Figure A.35483. Continued

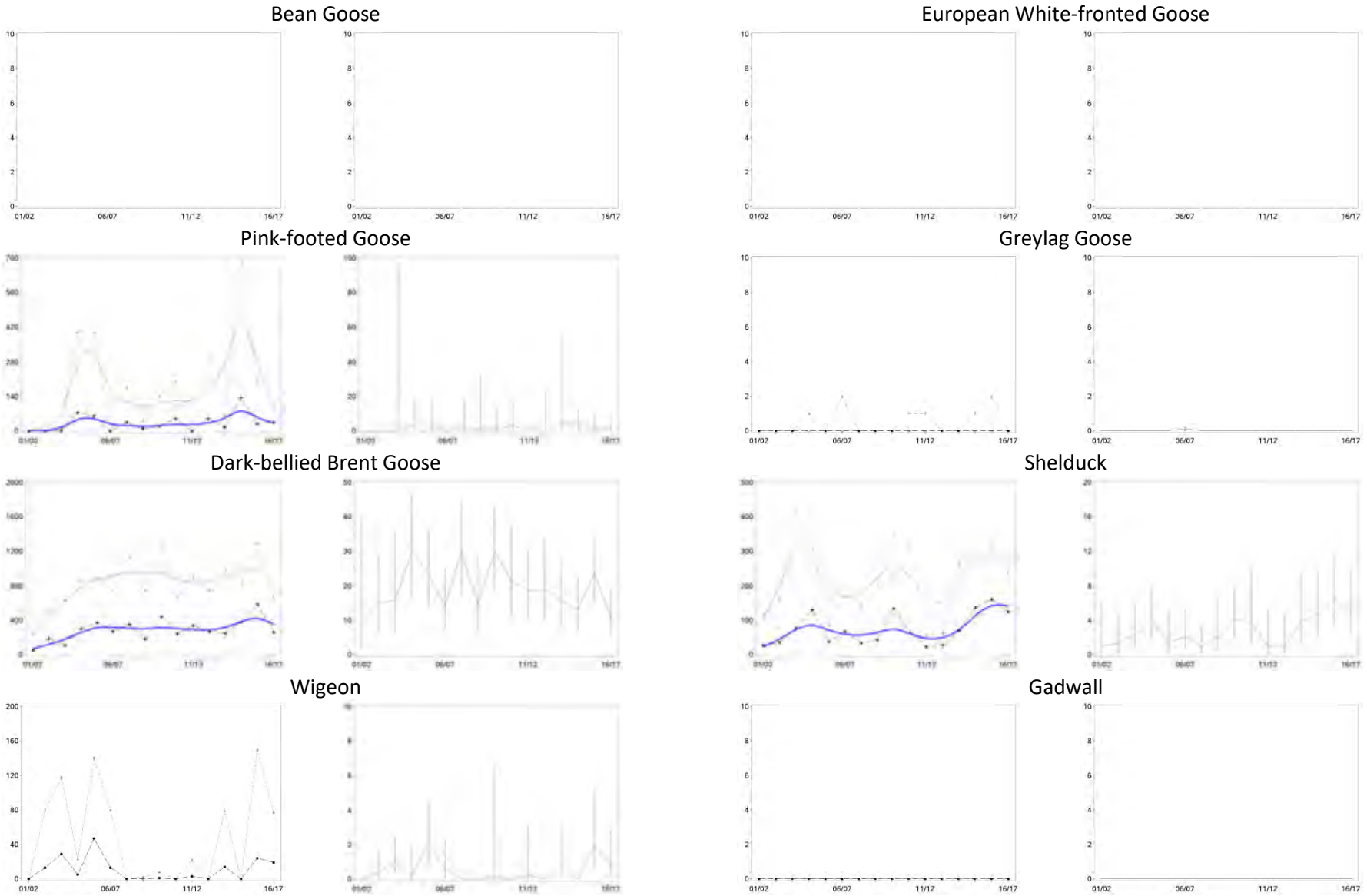


Figure A.35484. Population trends of each species in sector 35484 (Somercotes to Donna Nook) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

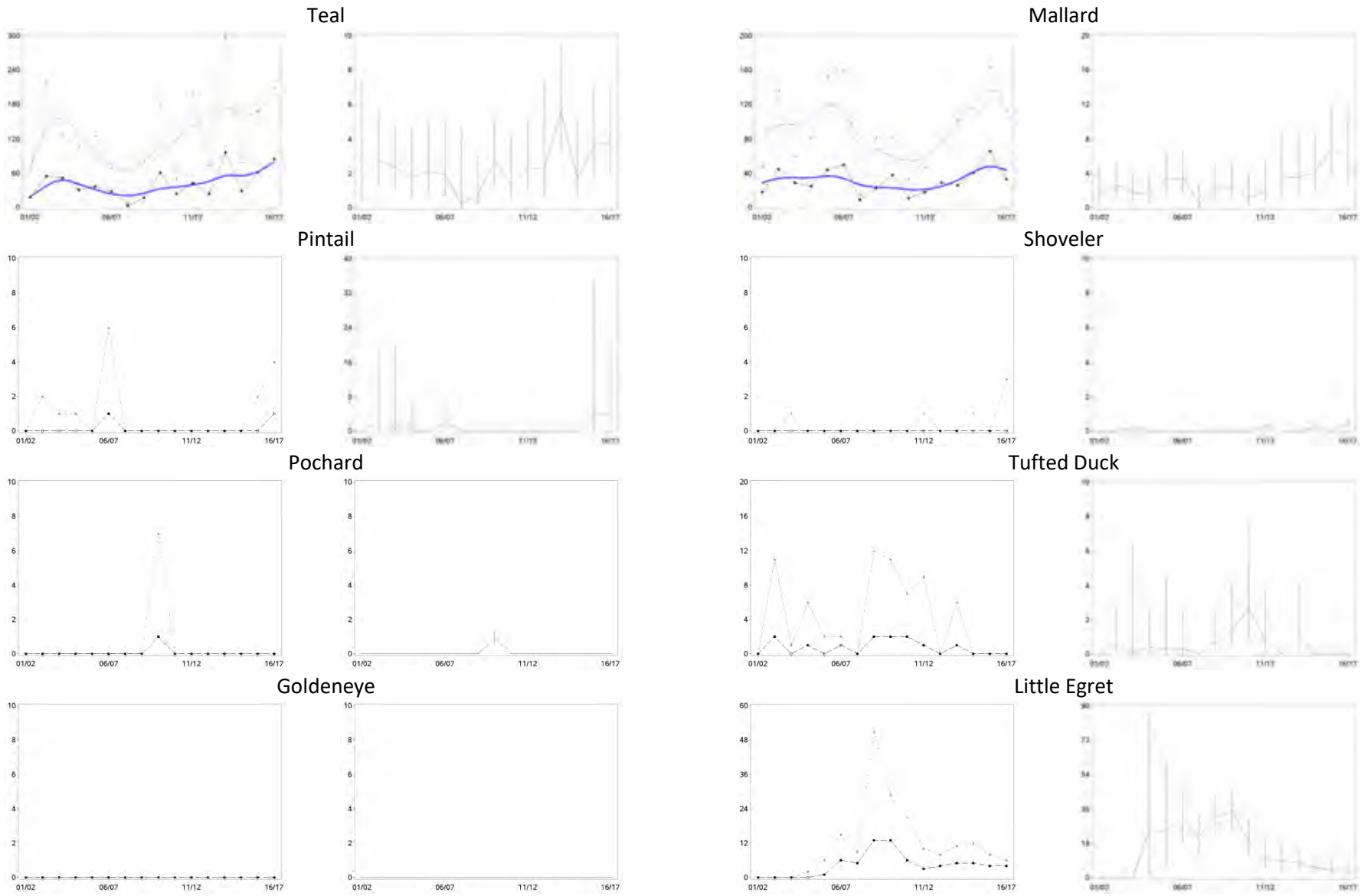


Figure A.35484. Continued

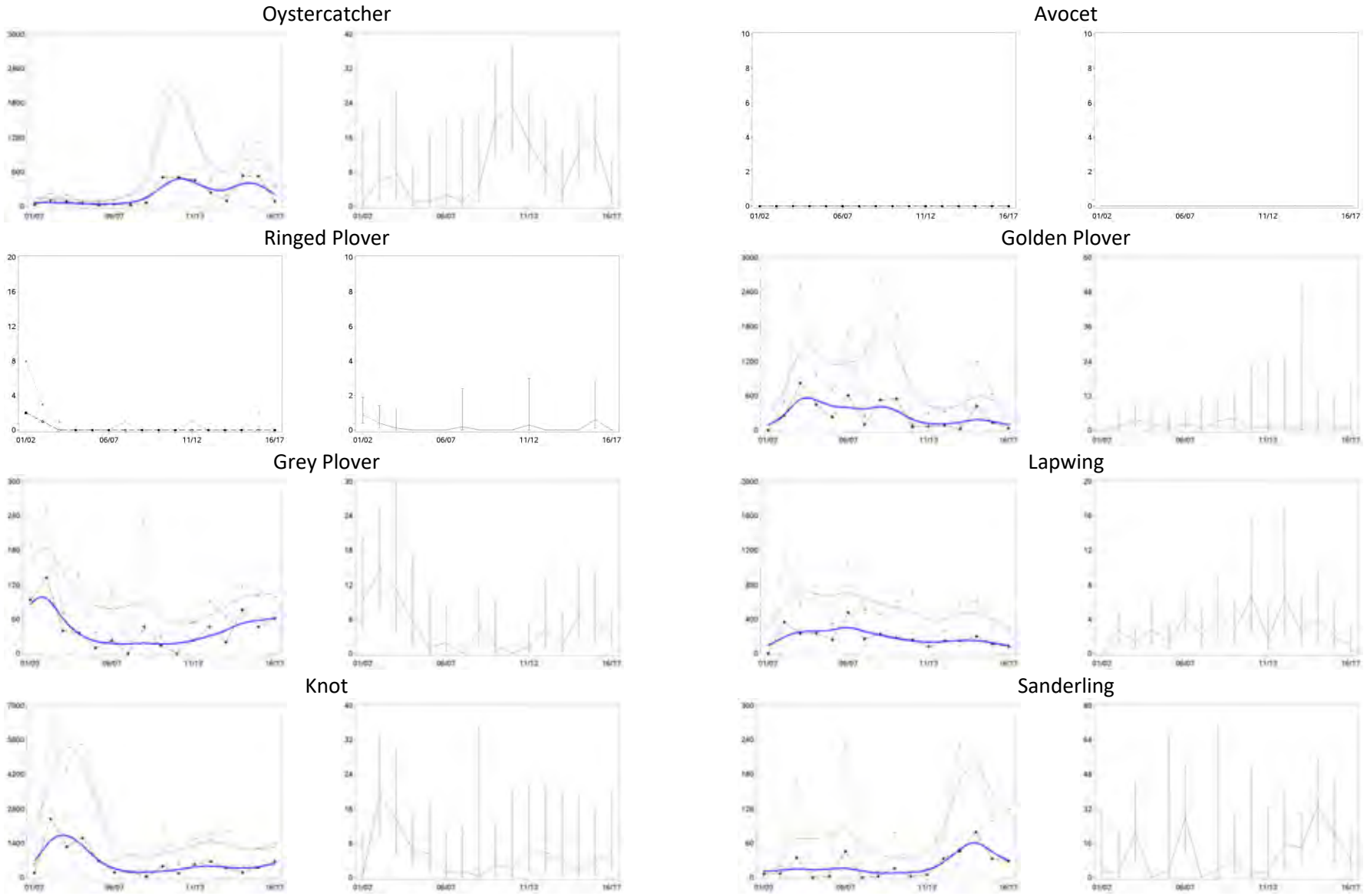


Figure A.35484. Continued

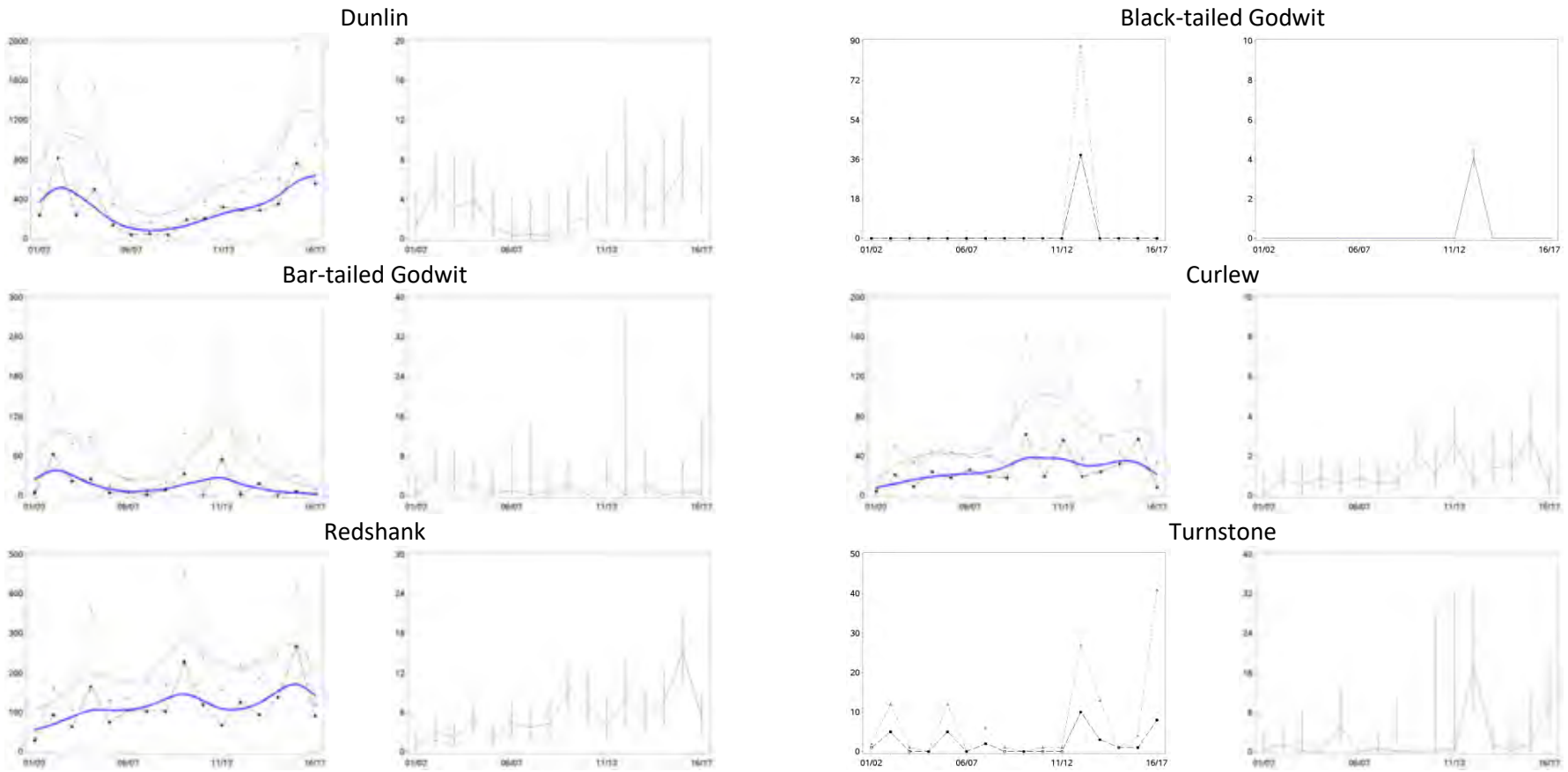


Figure A.35484. Continued

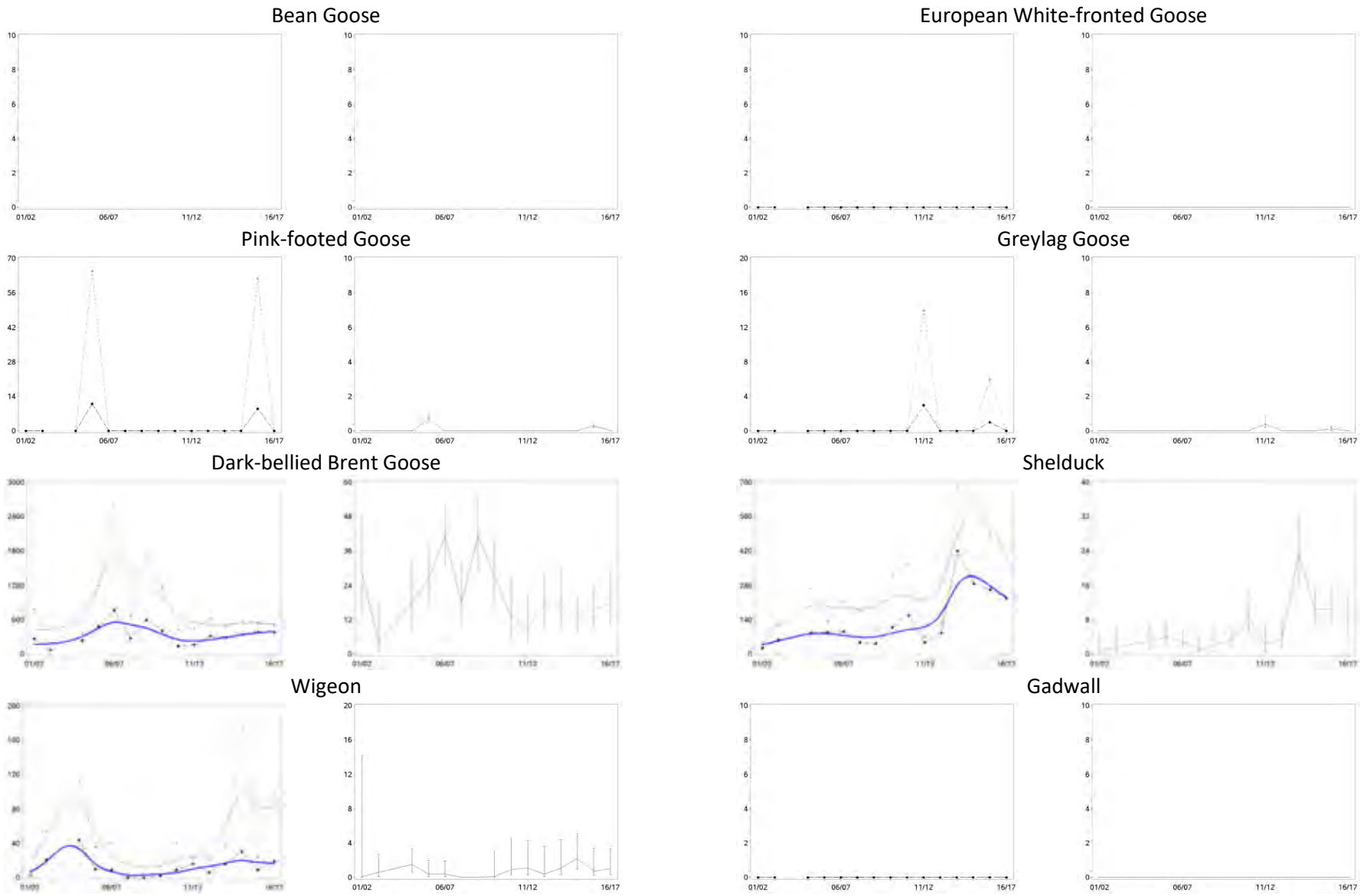


Figure A.35485. Population trends of each species in sector 35485 (Grainthorpe Haven to Horseshoe Point) **(left**-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

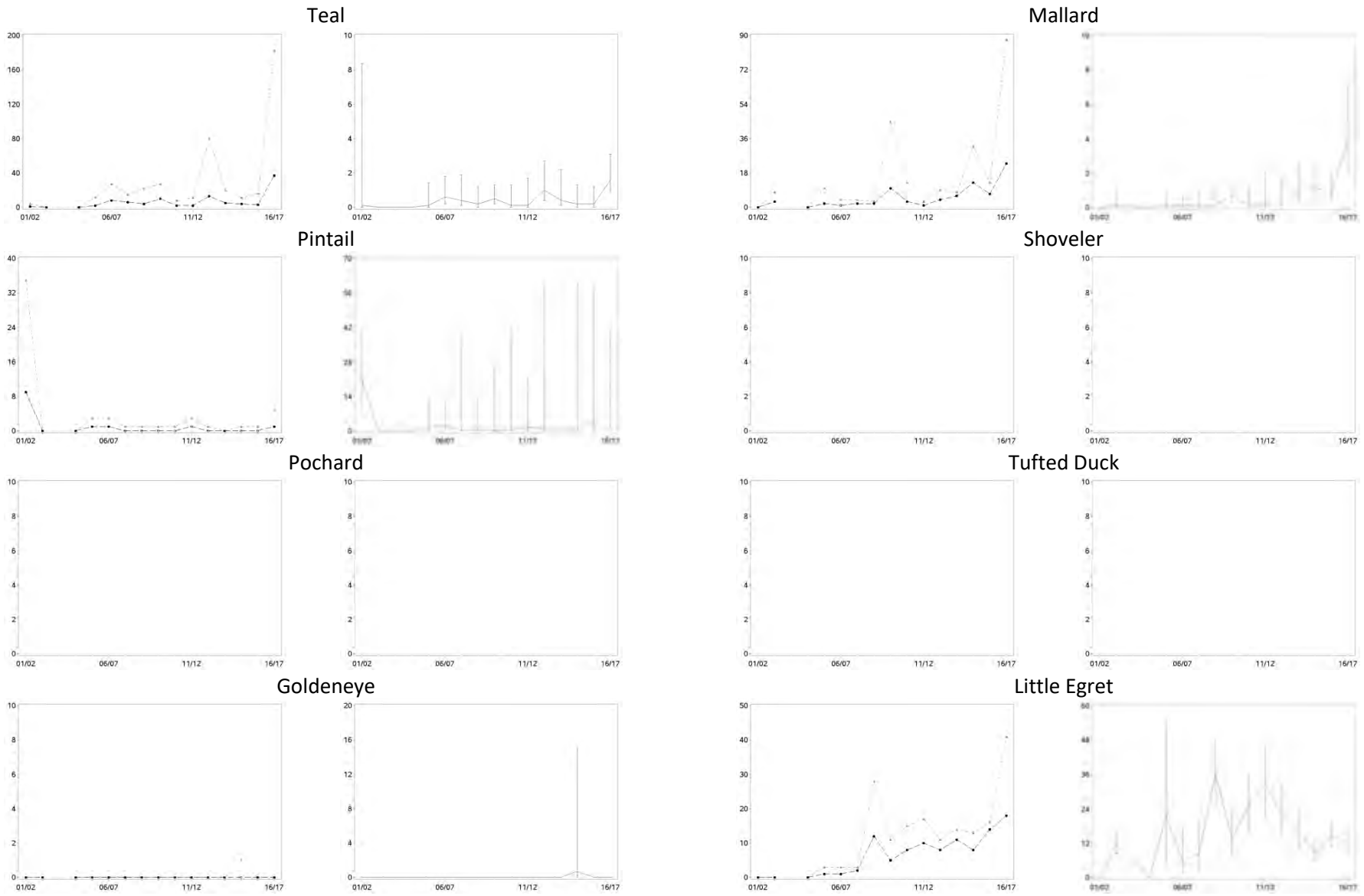
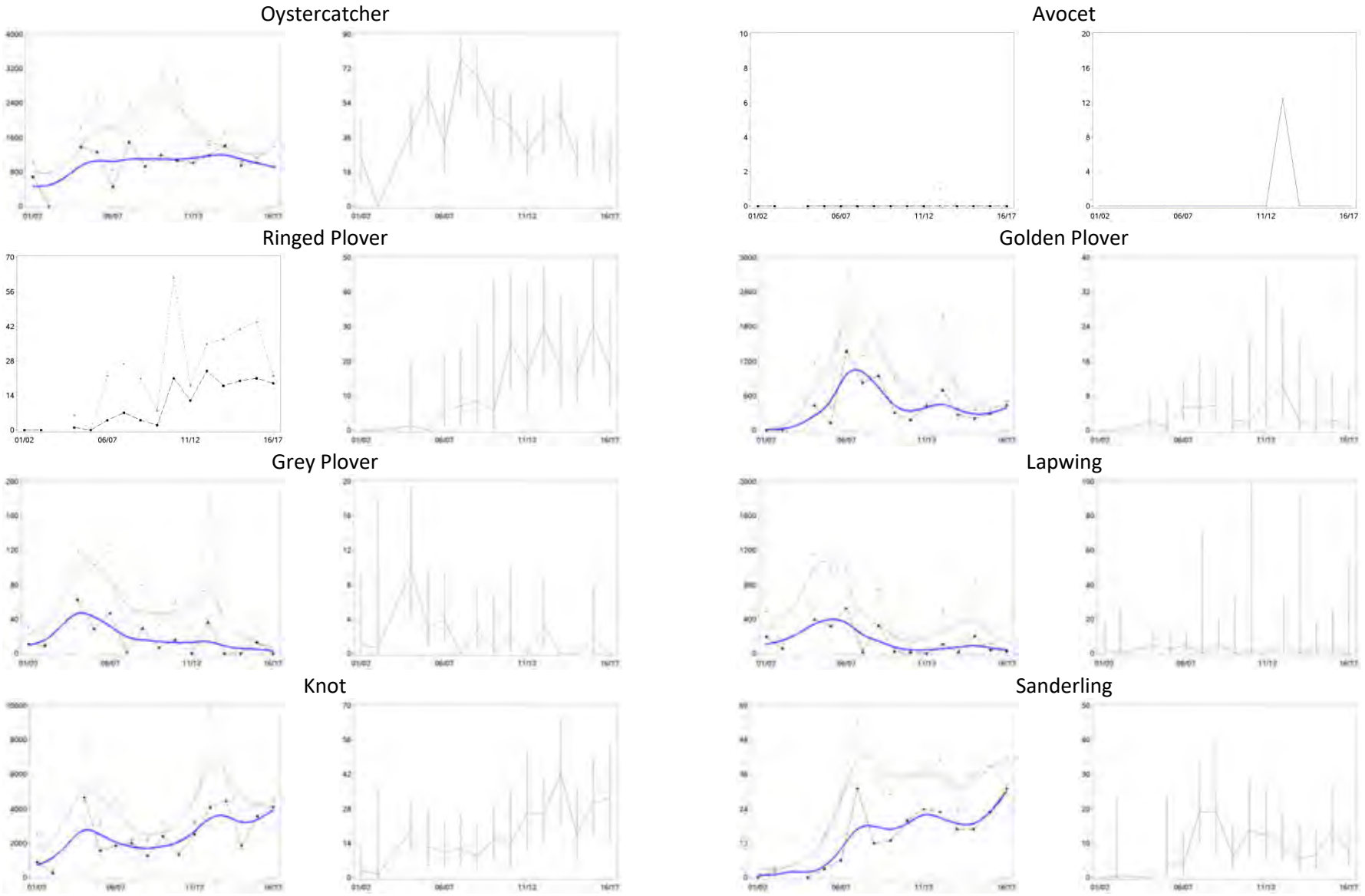


Figure A.35485. Continued



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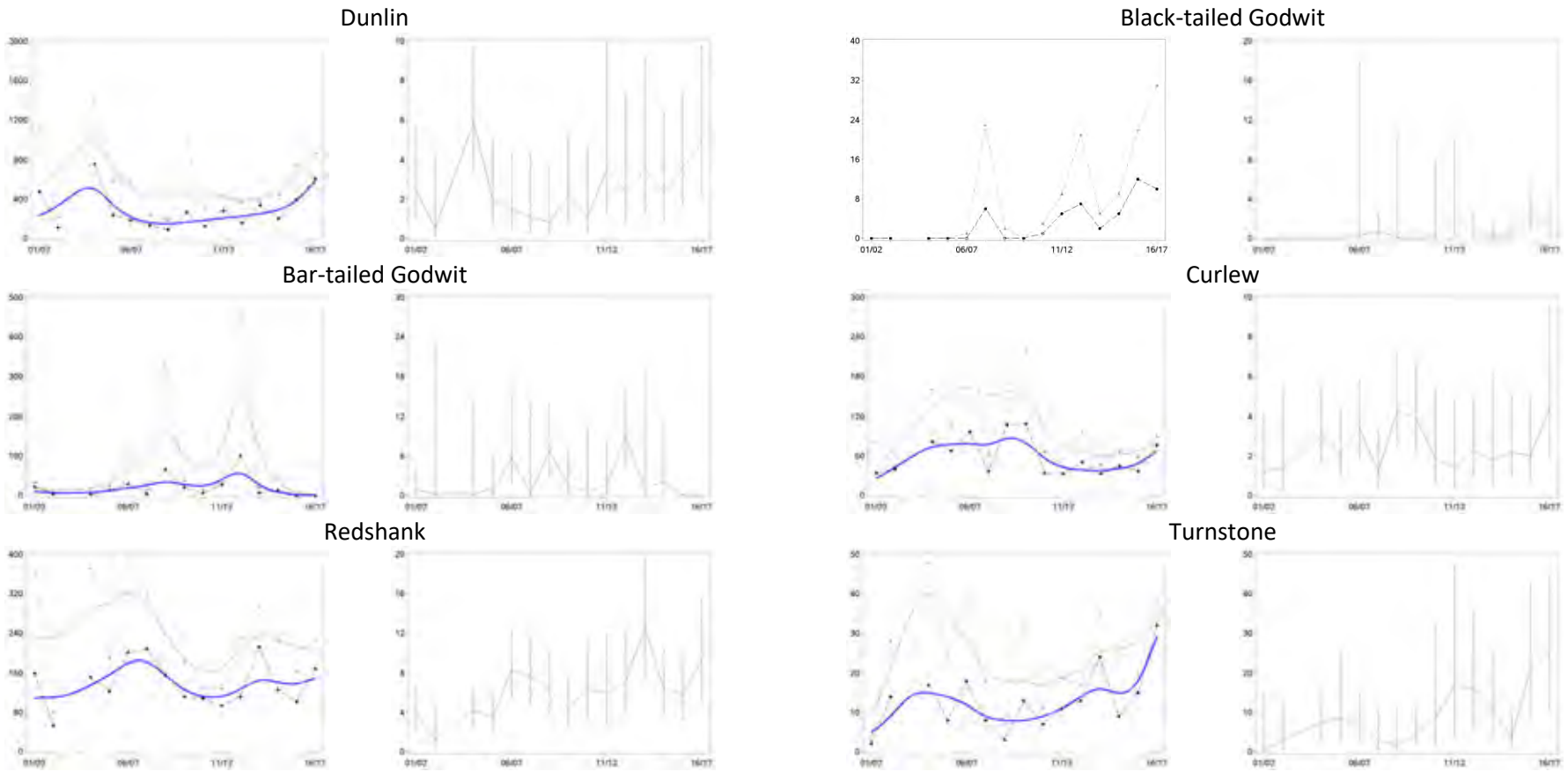


Figure A.35485. Continued

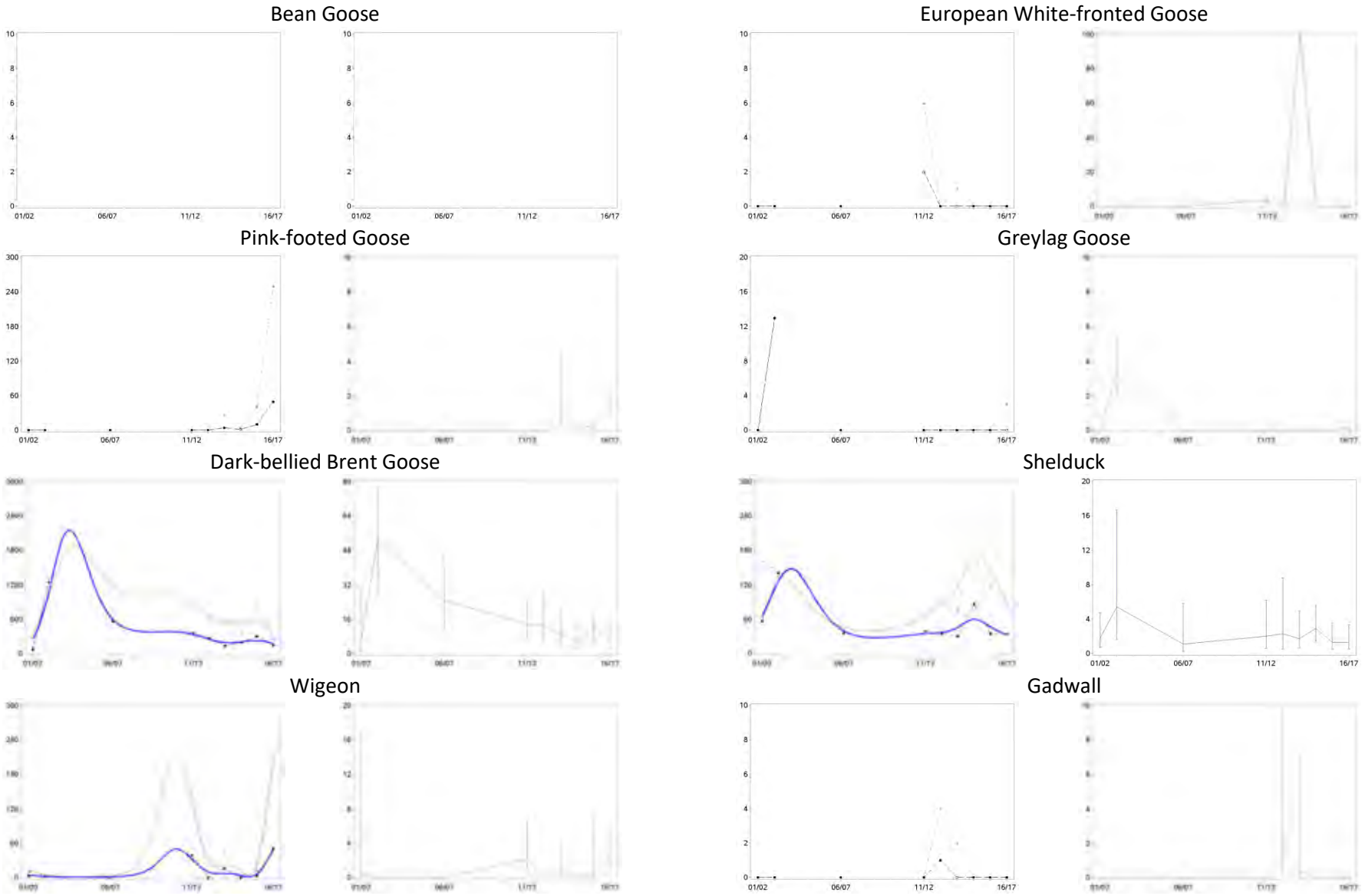
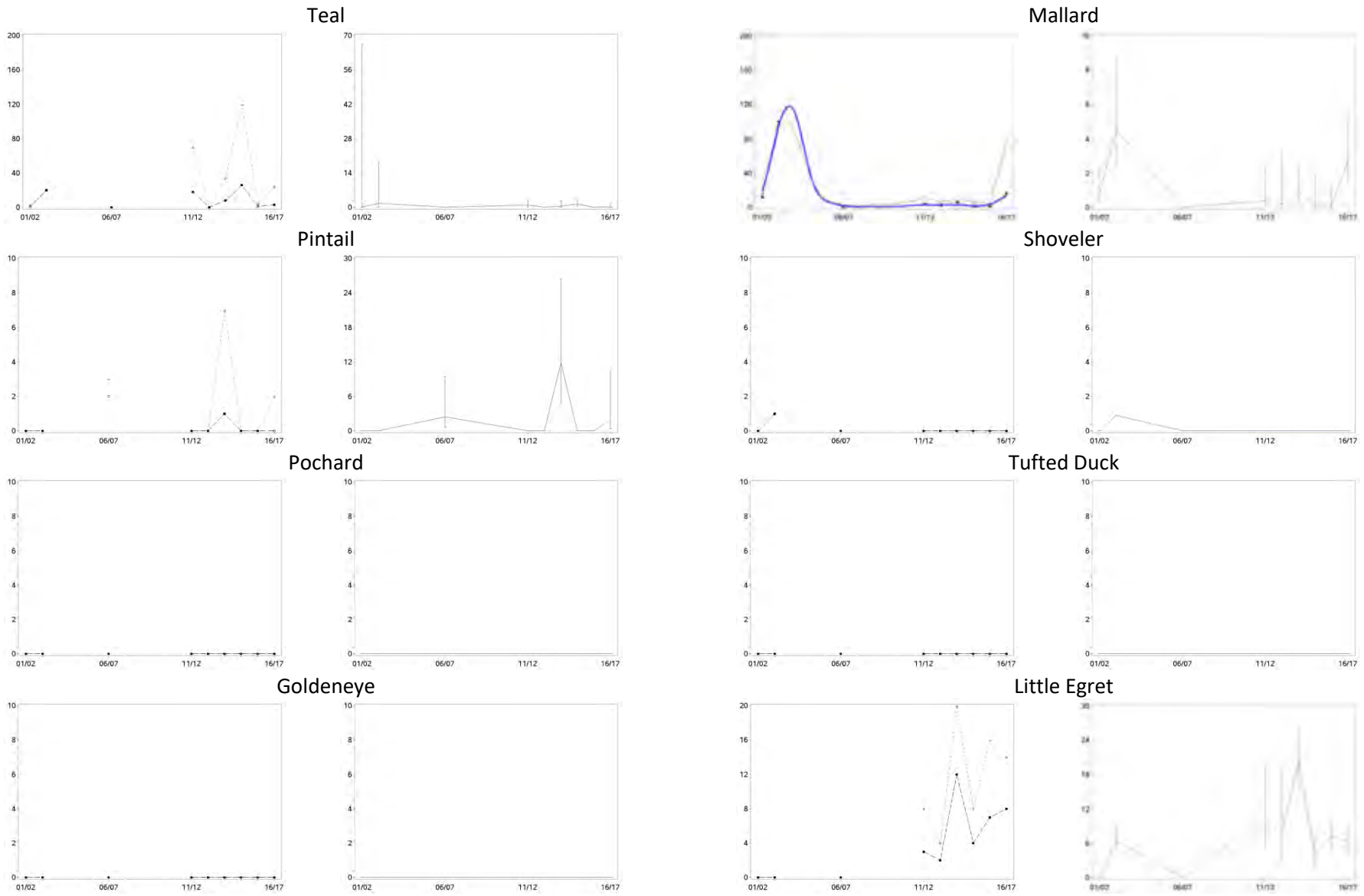


Figure A.35486. Population trends of each species in sector 35486 (Horseshoe Point to Tetney Haven (Humber)) **(left**-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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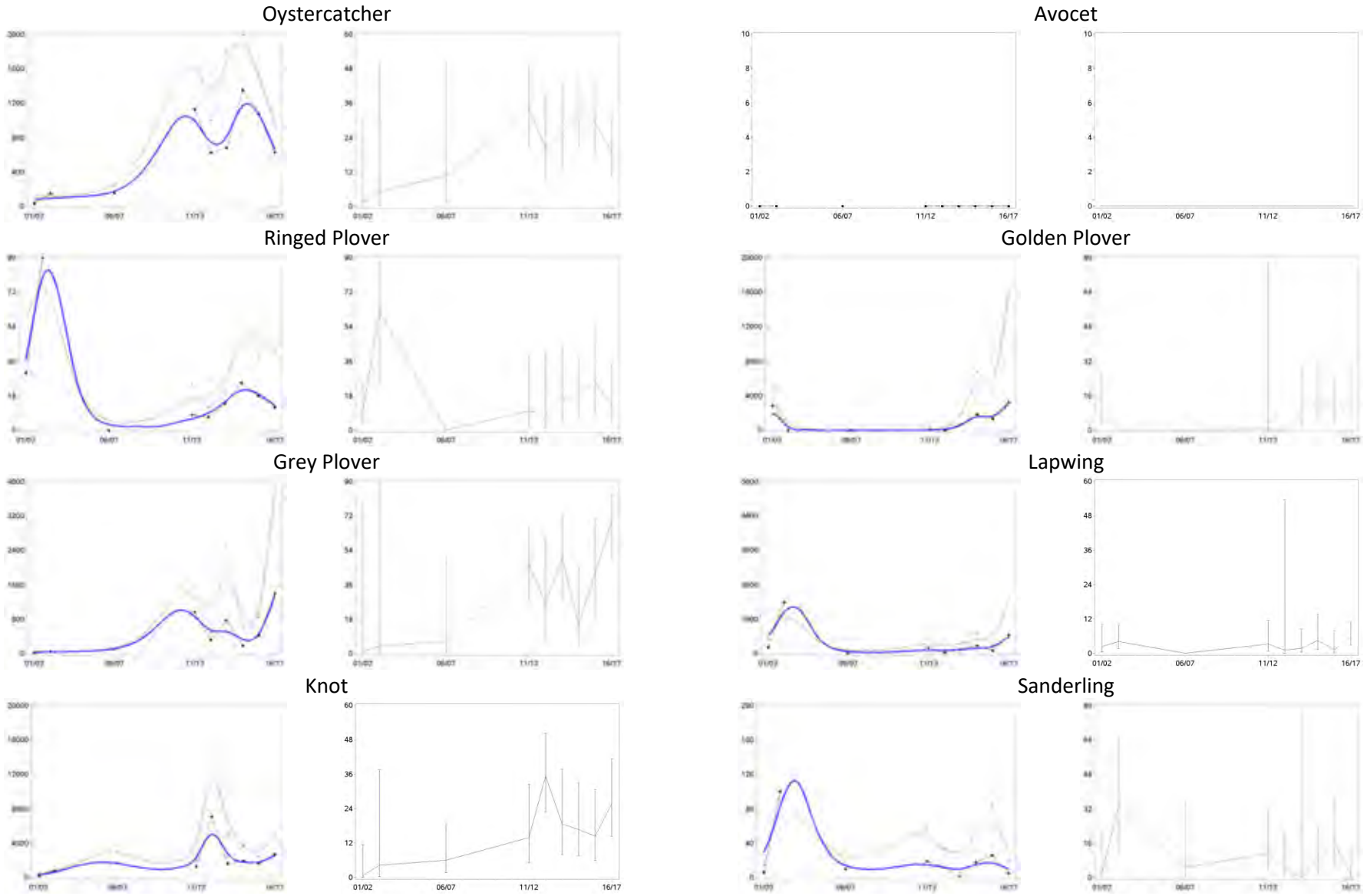


Figure A.35486. Continued

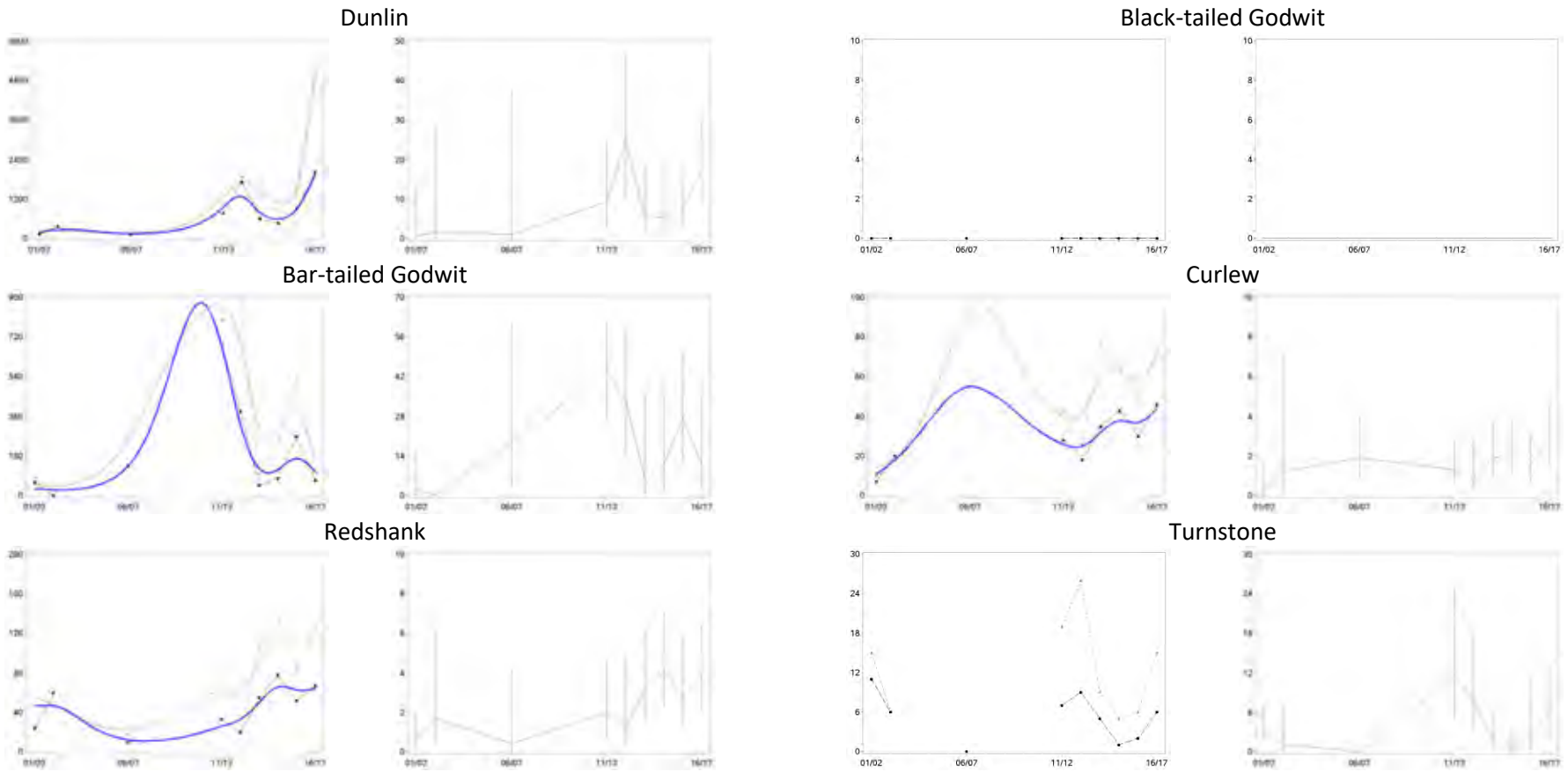


Figure A.35486. Continued

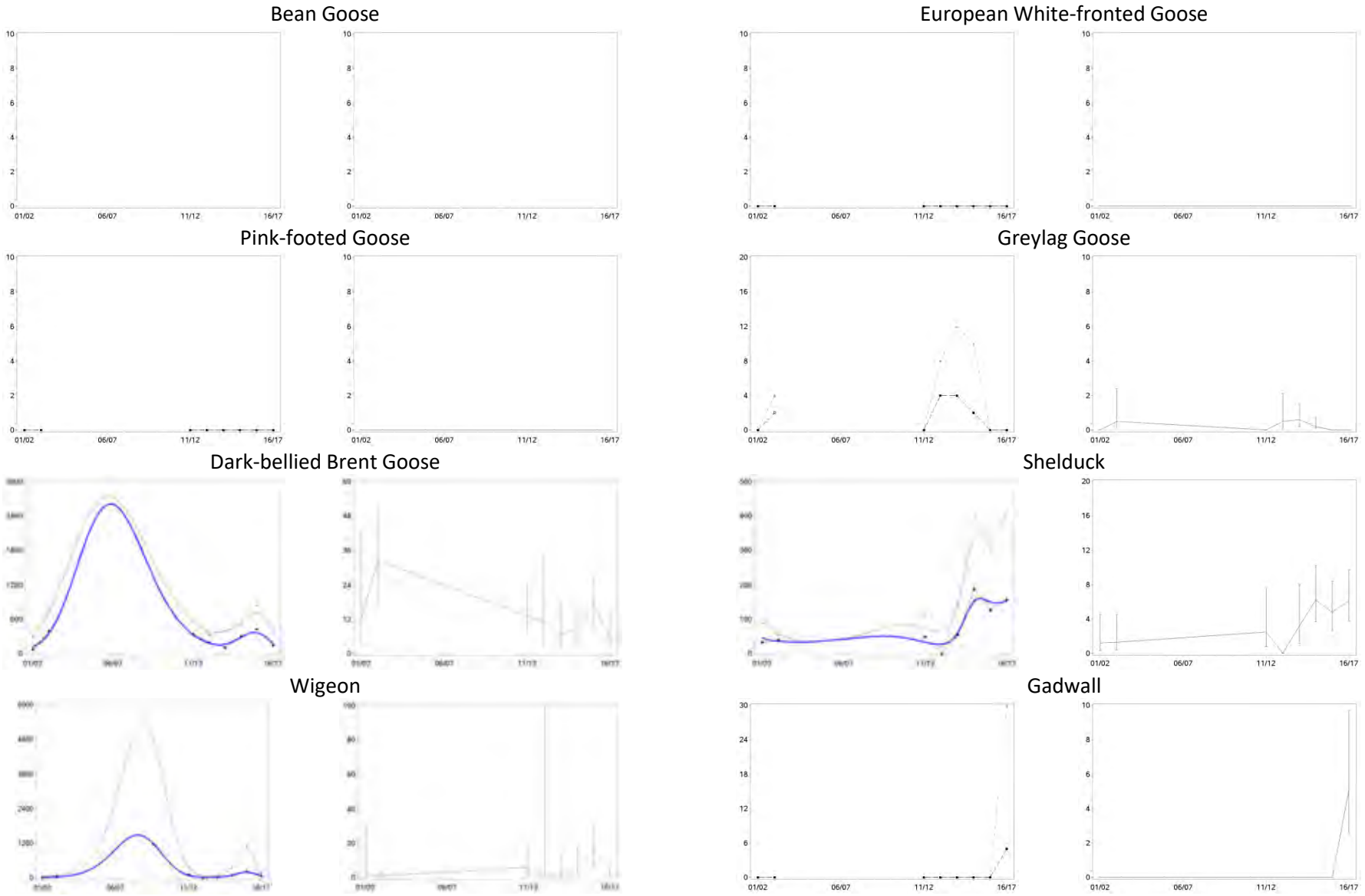


Figure A.35487. Population trends of each species in sector 35487 (Tetney Haven to Humberston Fitties (Humber)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

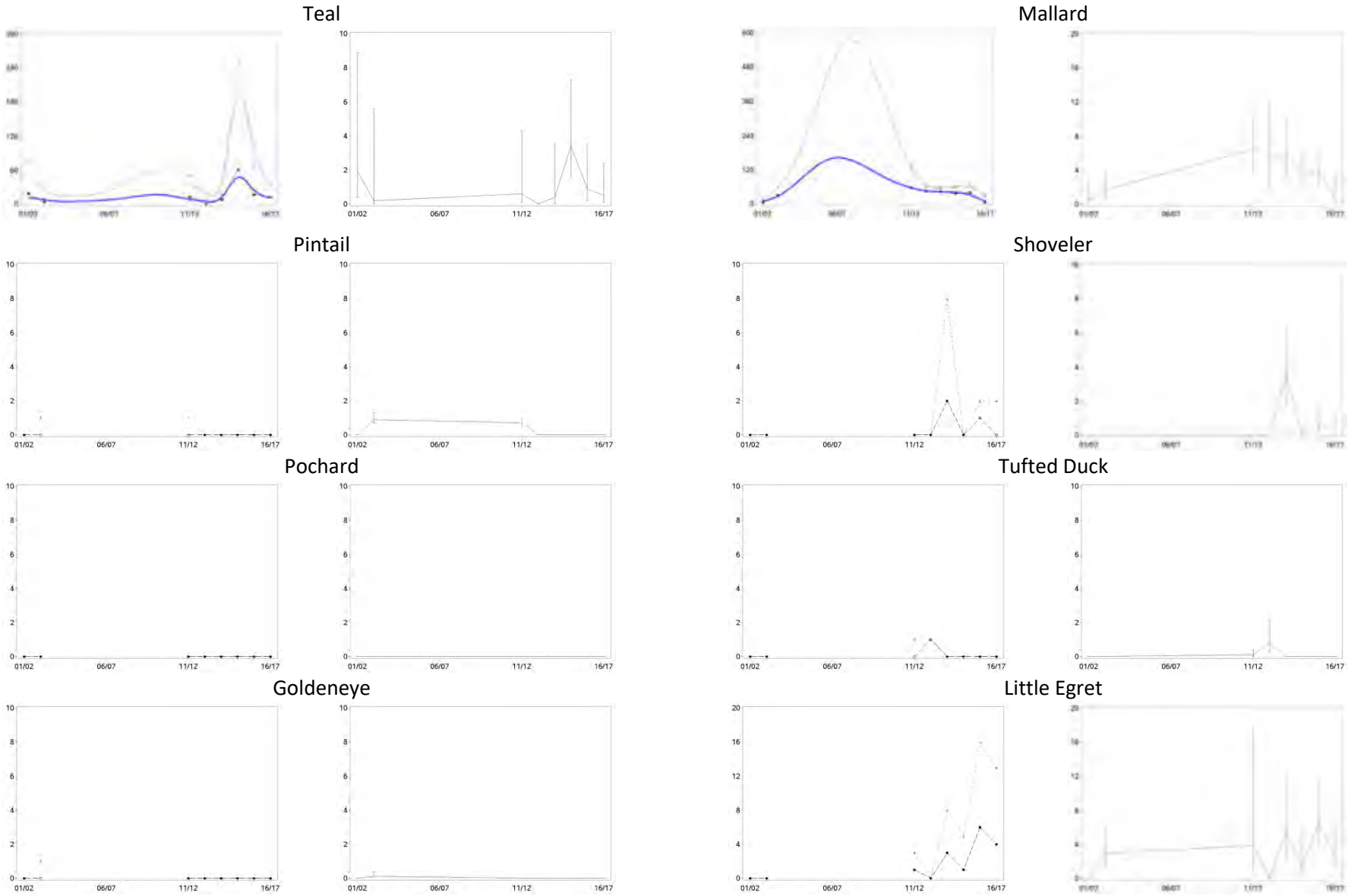


Figure A.35487. Continued

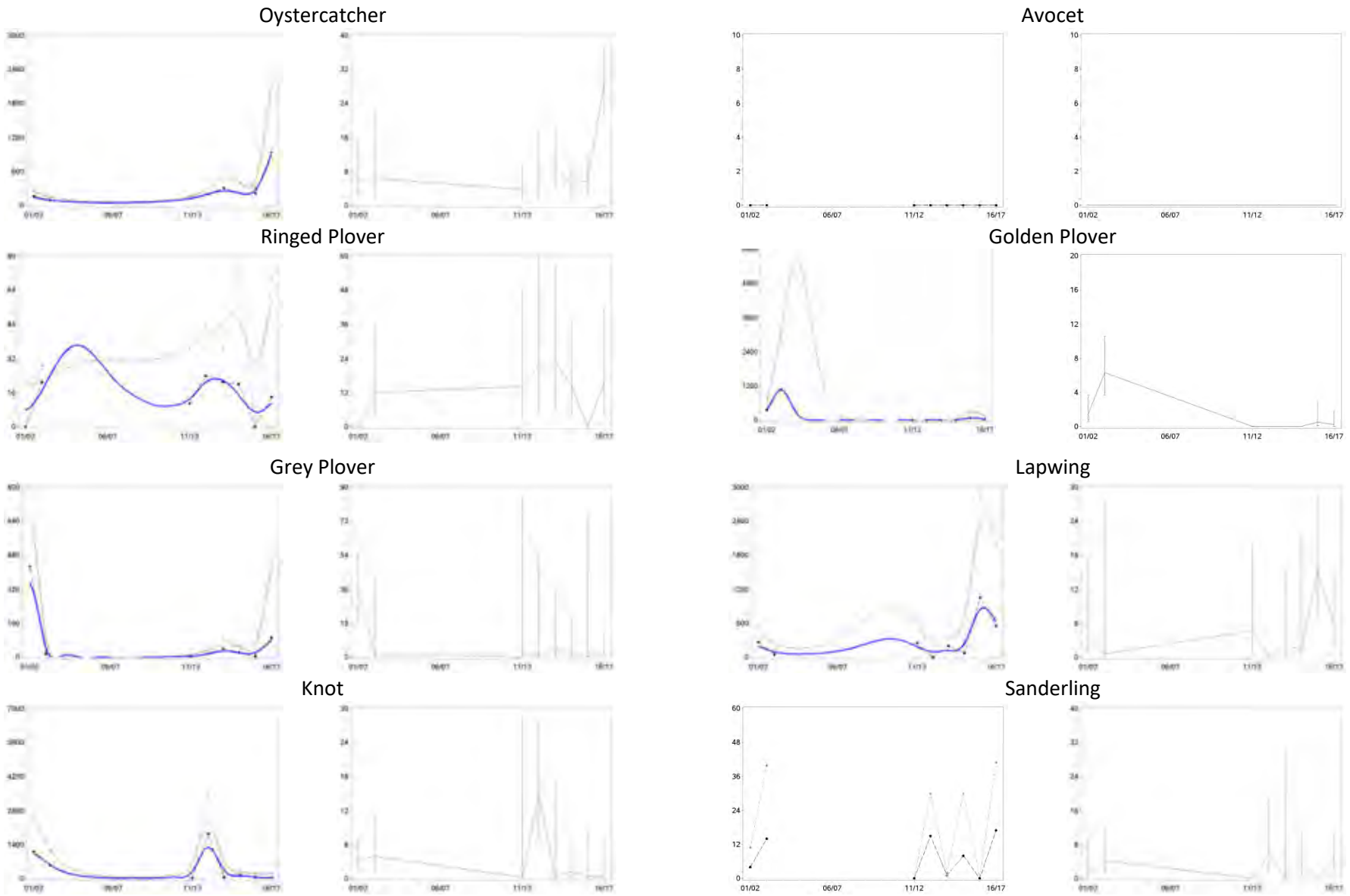


Figure A.35487. Continued

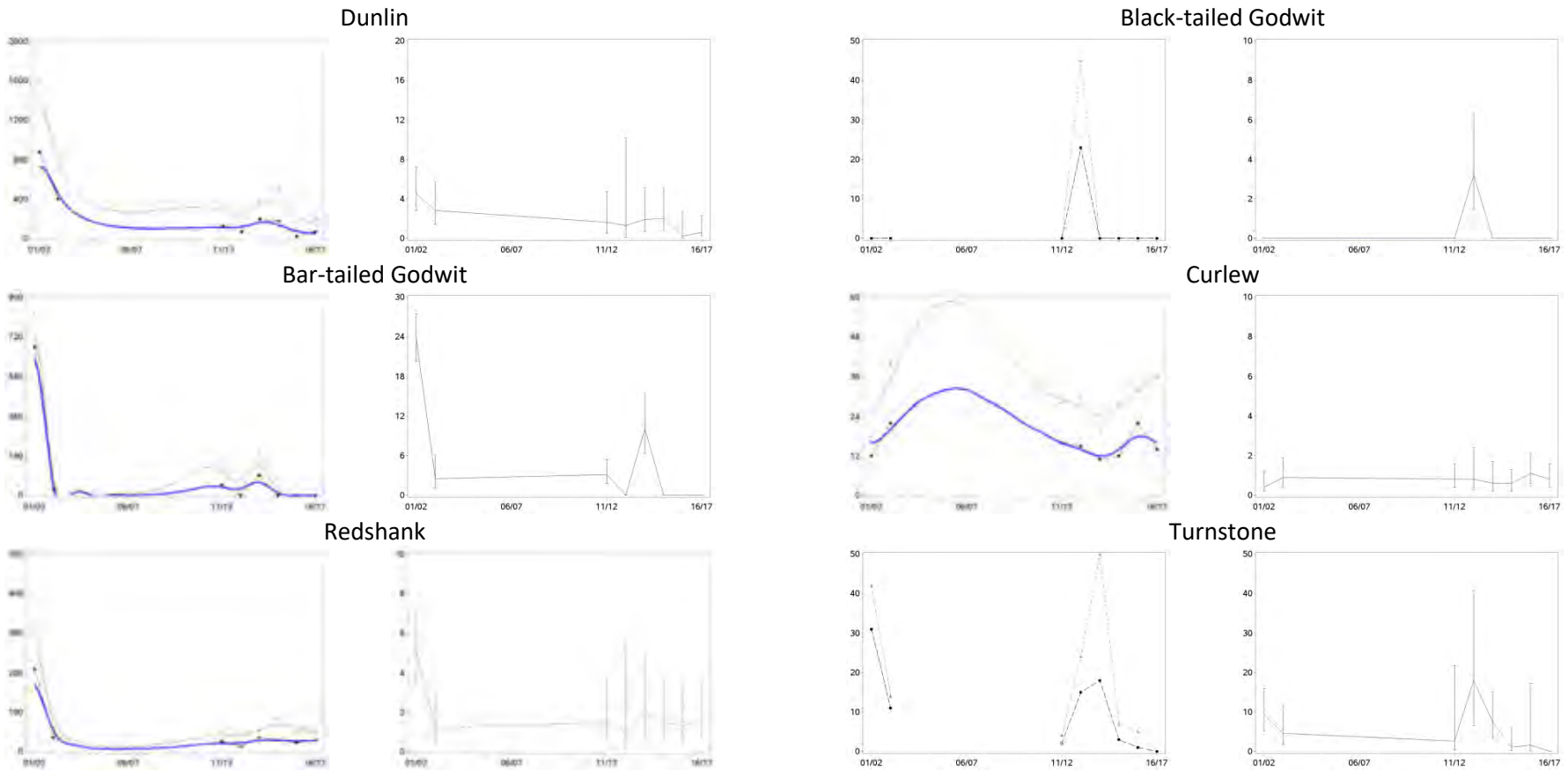


Figure A.35487. Continued

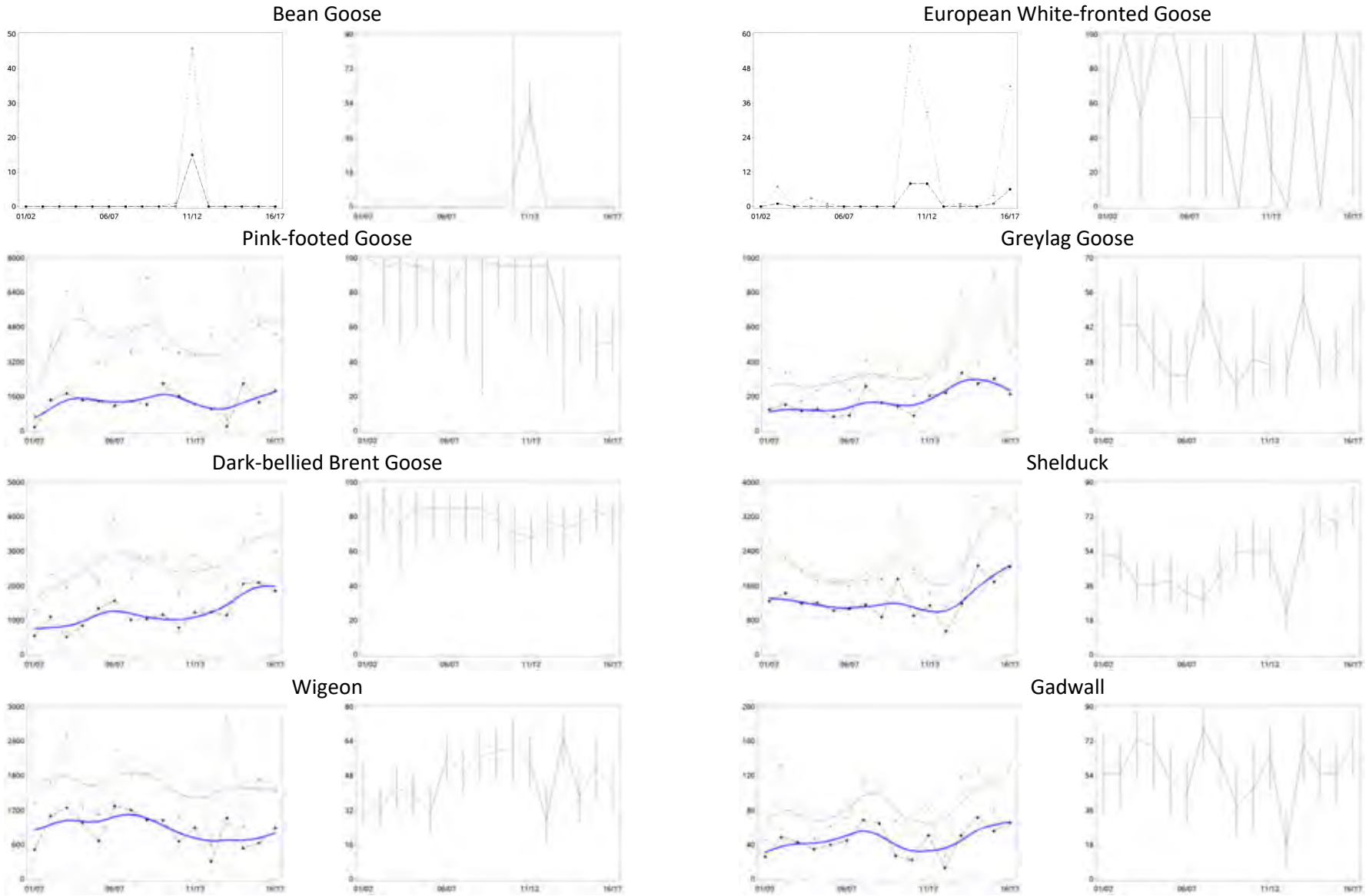
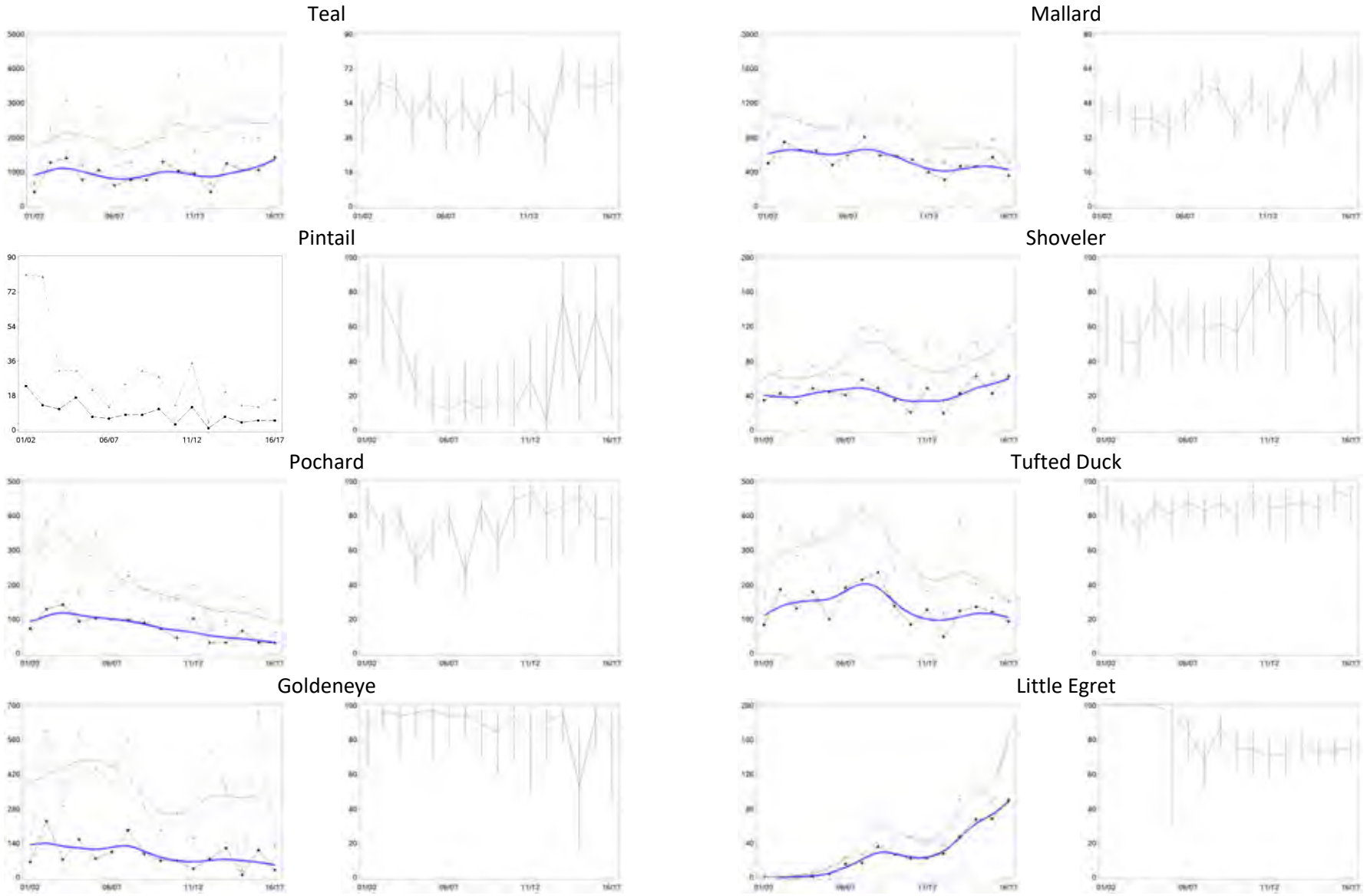


Figure A.38901. Population trends of each species in sector 38901 (Humber Estuary (South)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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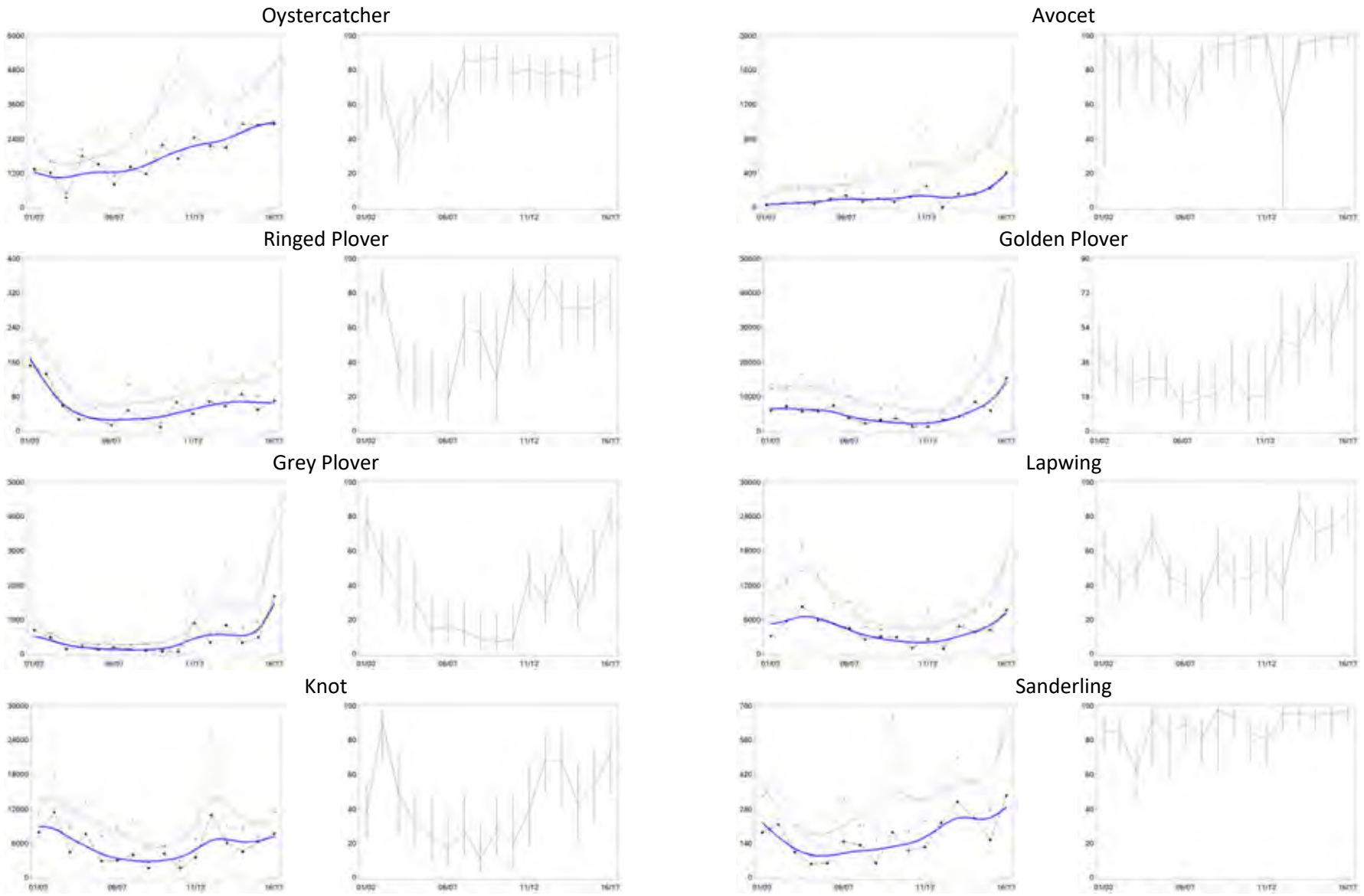


Figure A.38901. Continued

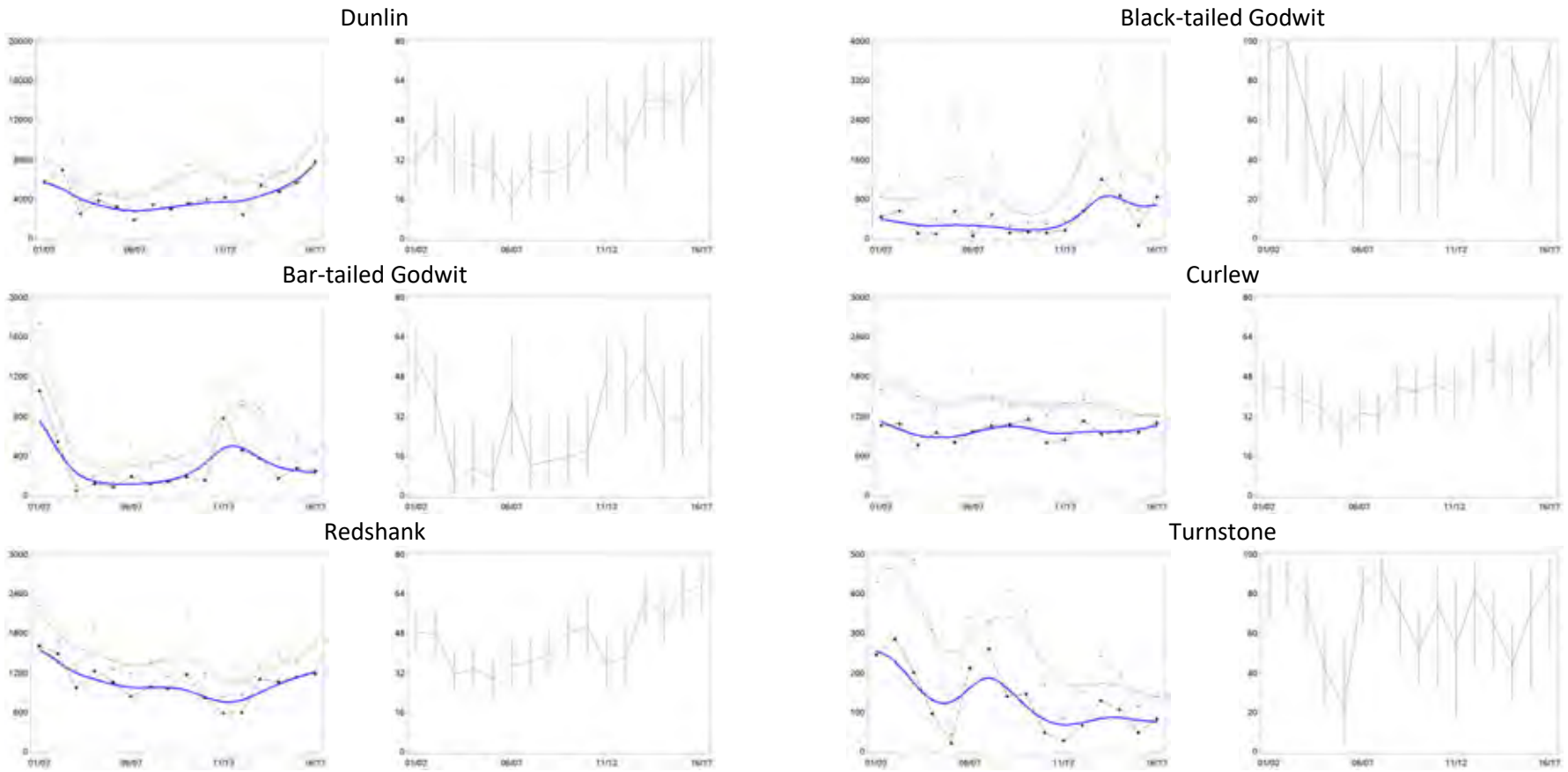


Figure A.38901. Continued

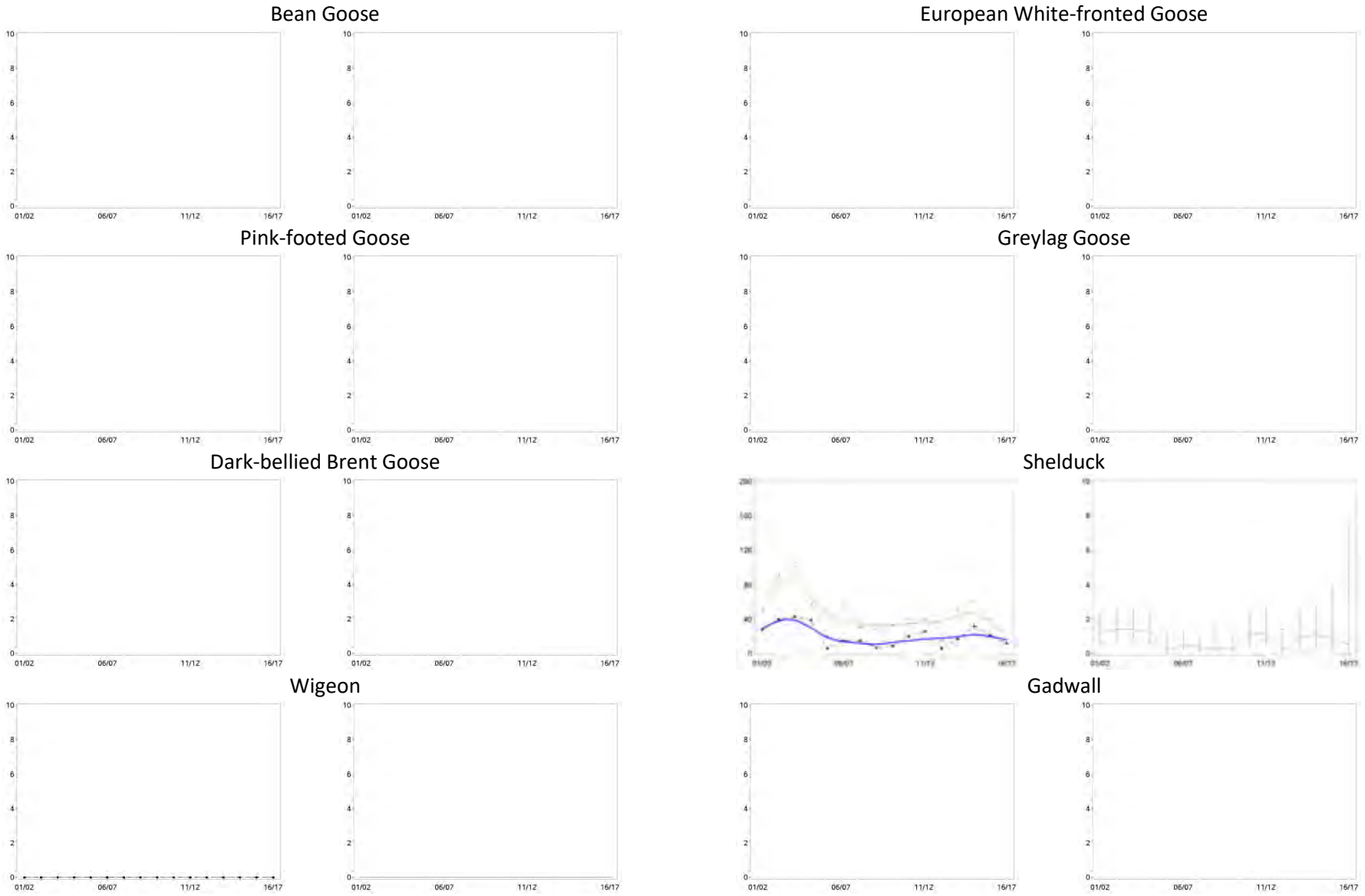
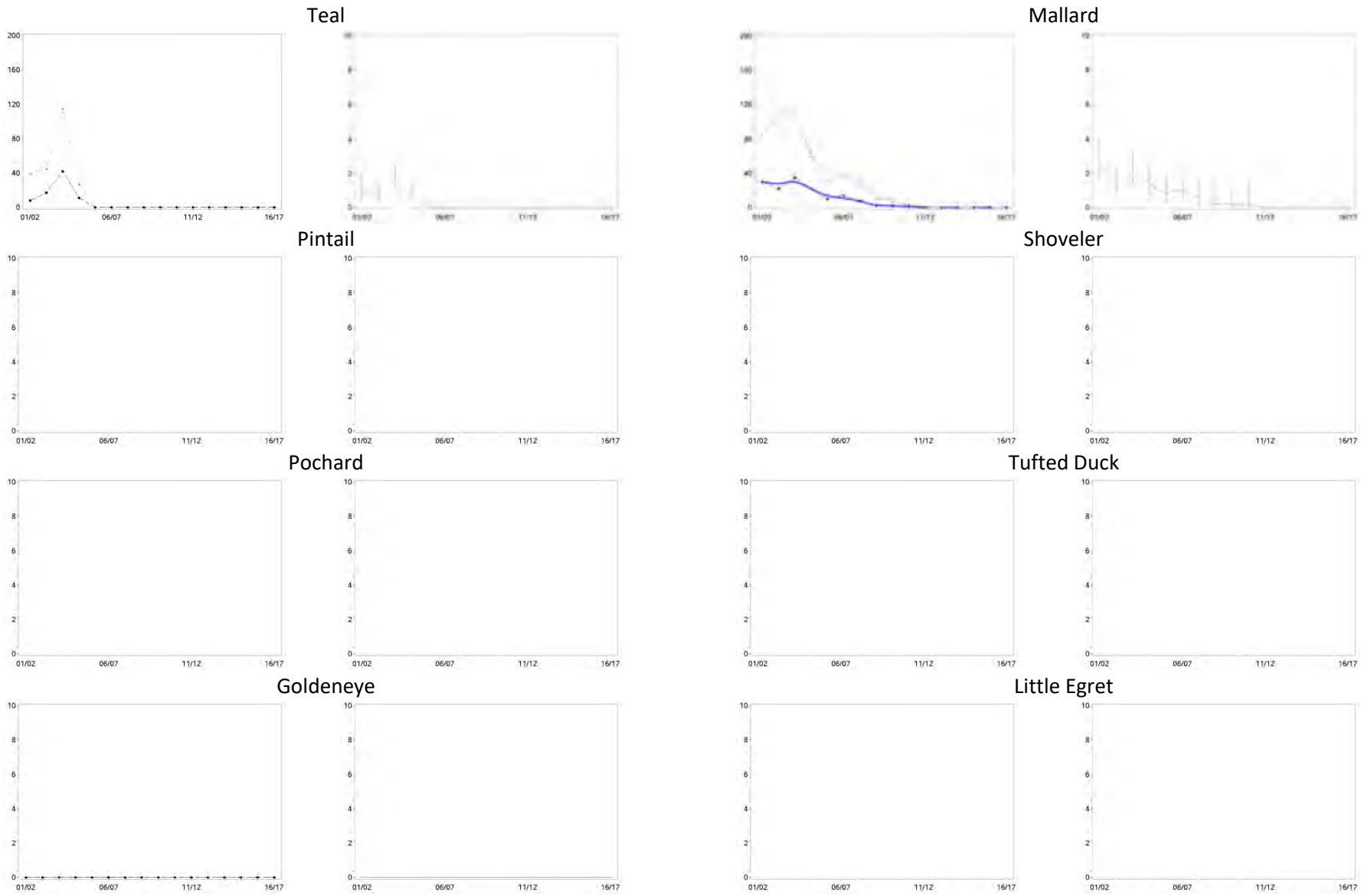


Figure A.38905. Population trends of each species in sector 38905 (Immingham Docks - Sector K) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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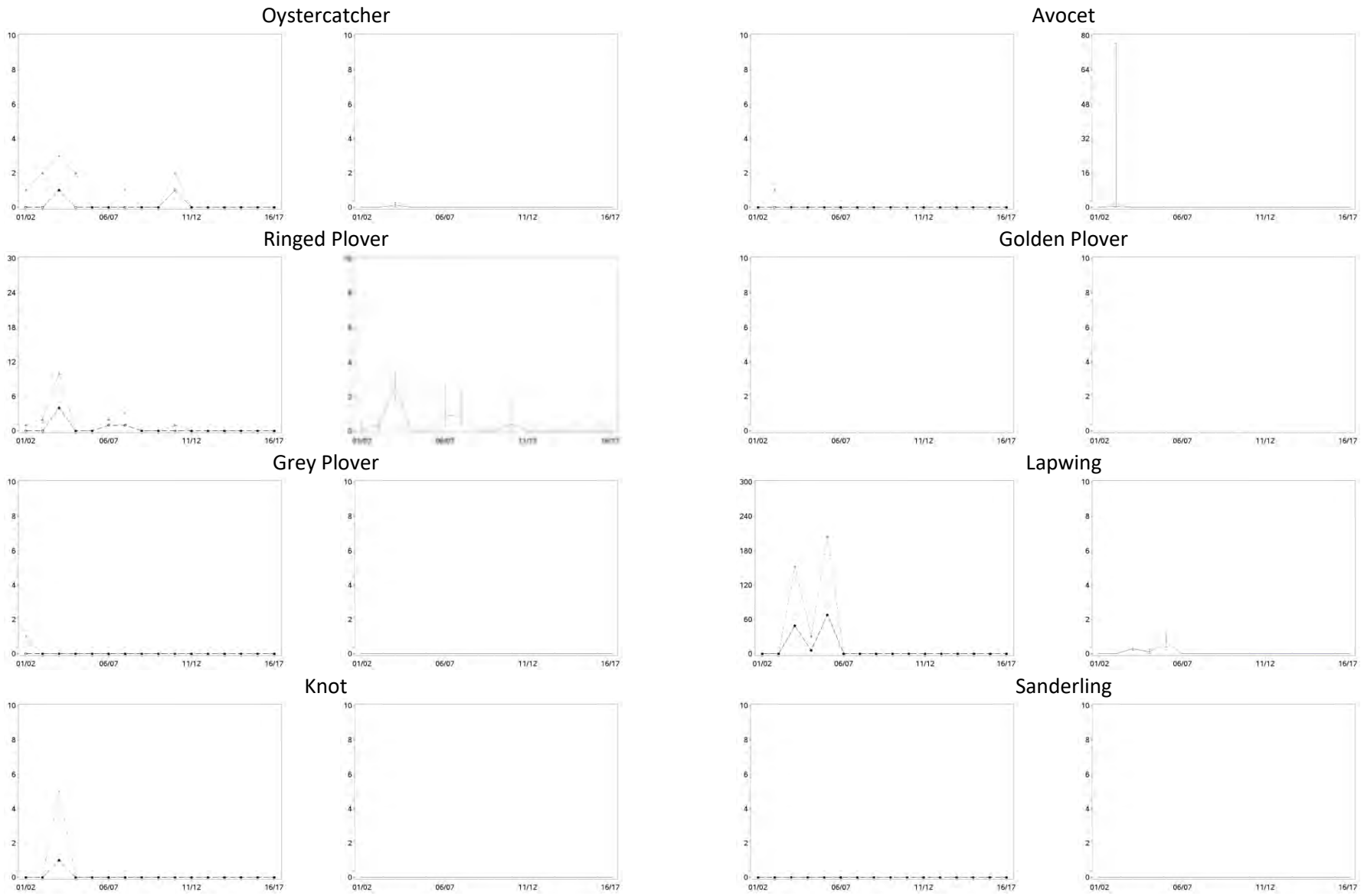


Figure A.38905. Continued

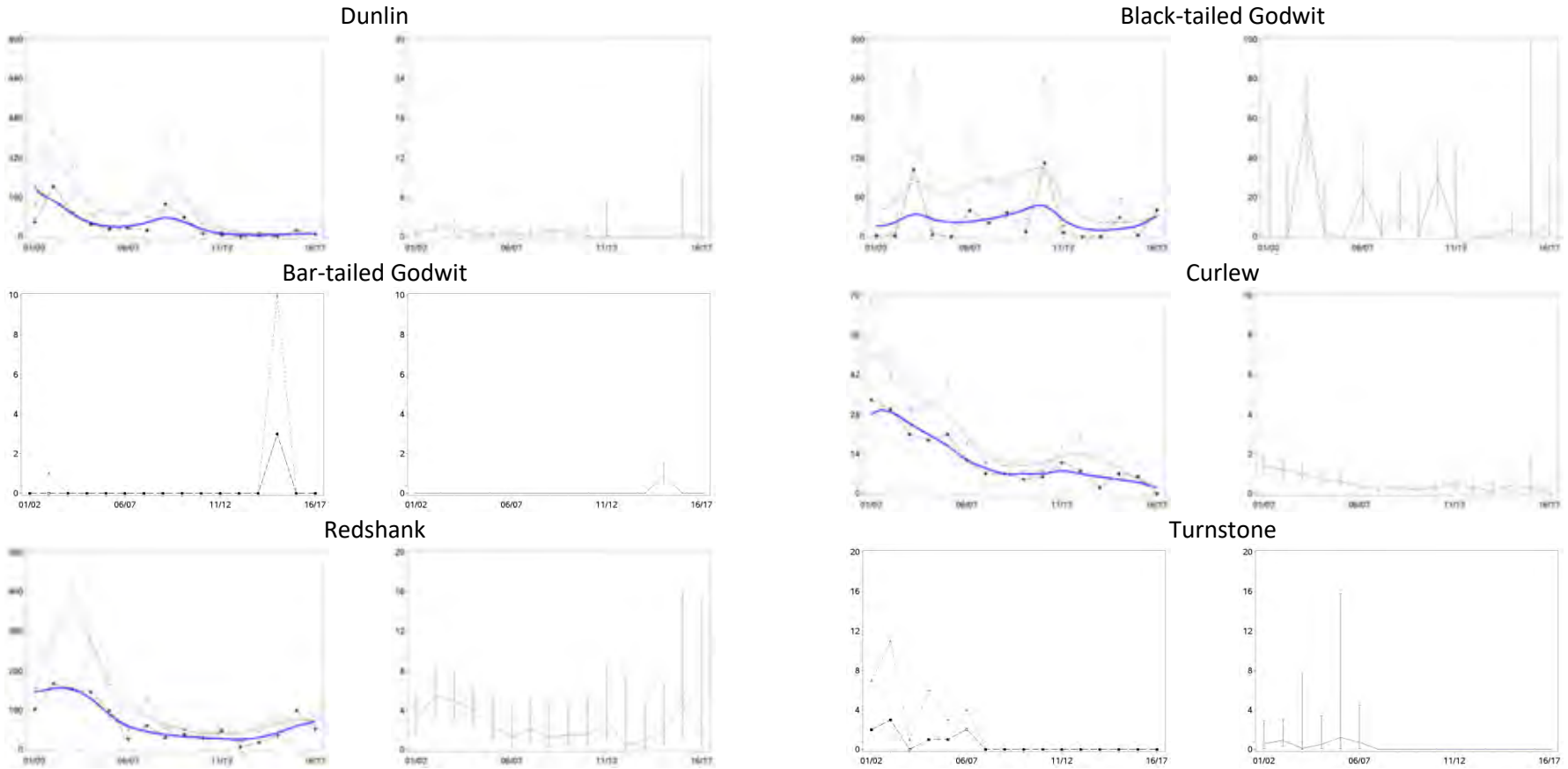


Figure A.38905. Continued

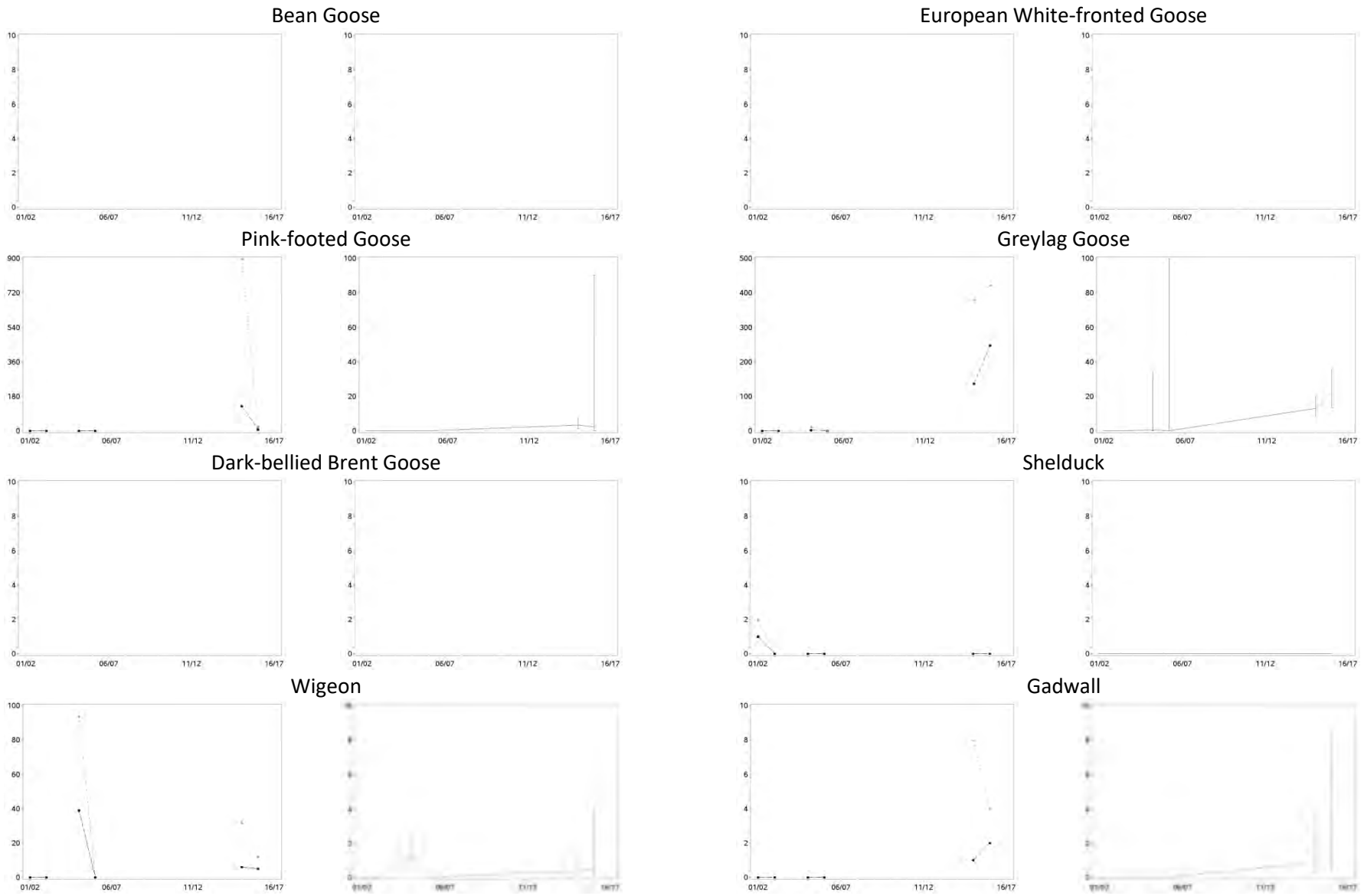
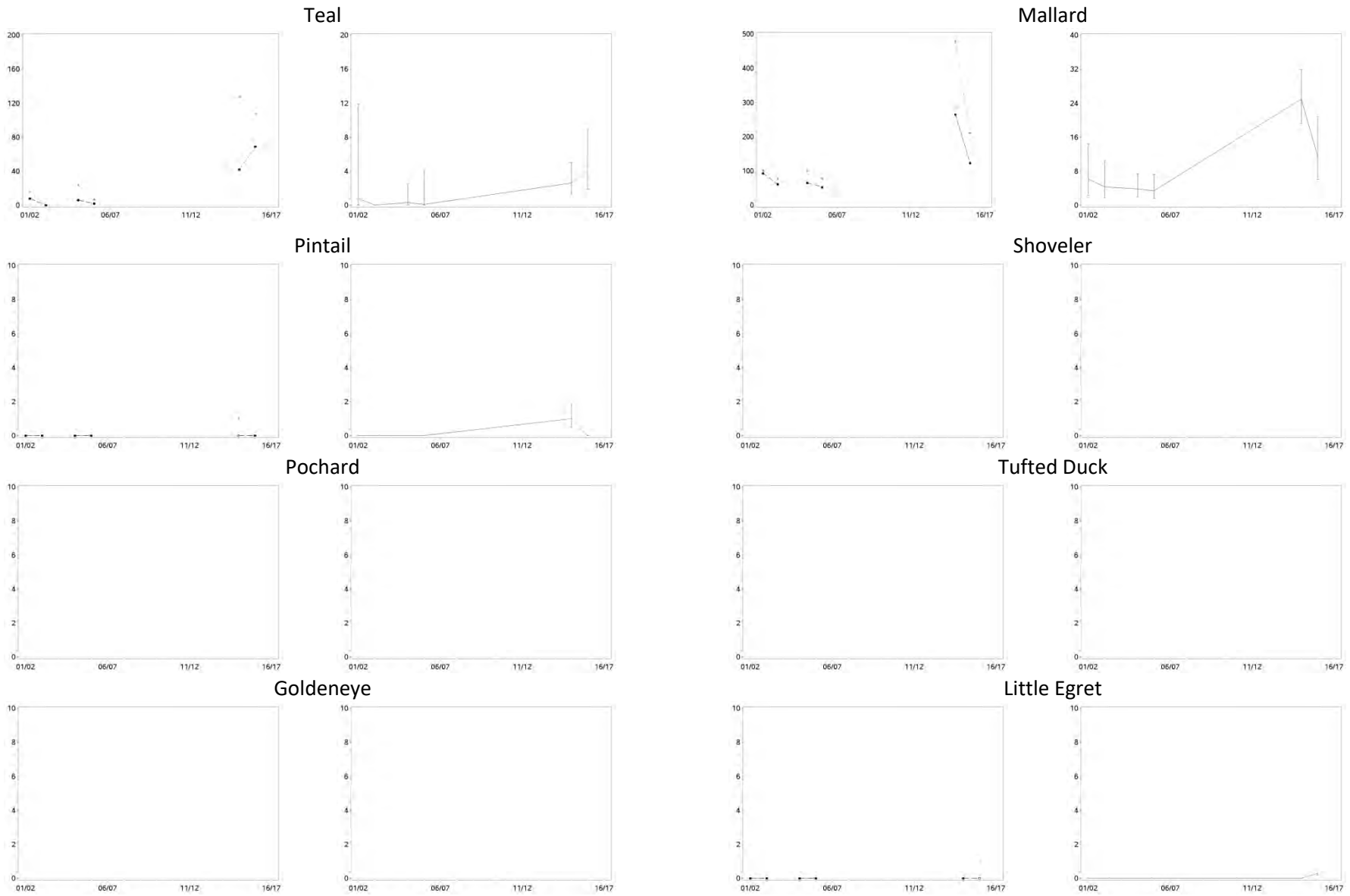


Figure A.38907. Population trends of each species in sector 38907 (River Humber - Howdendyke to Whitgift) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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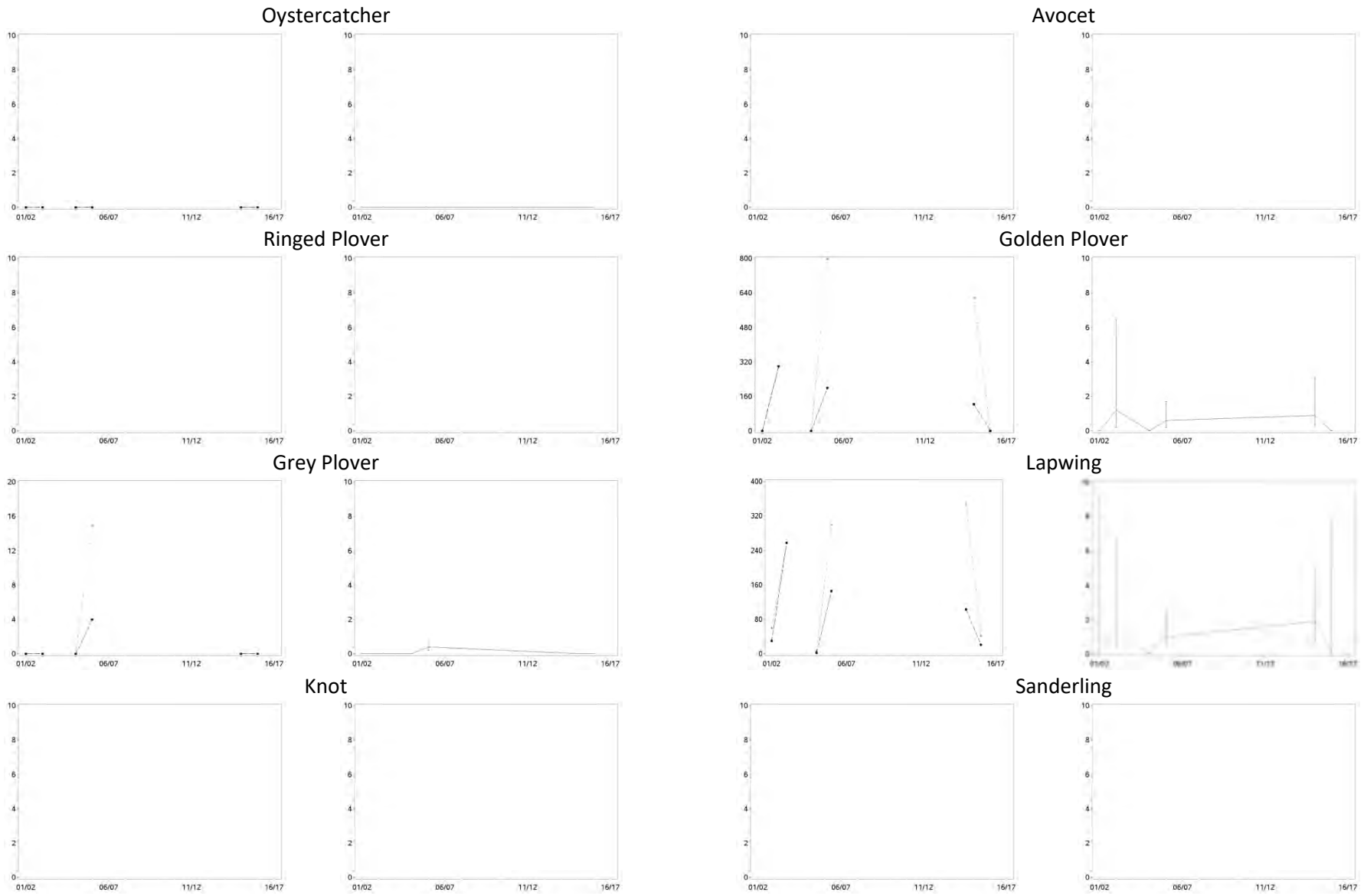
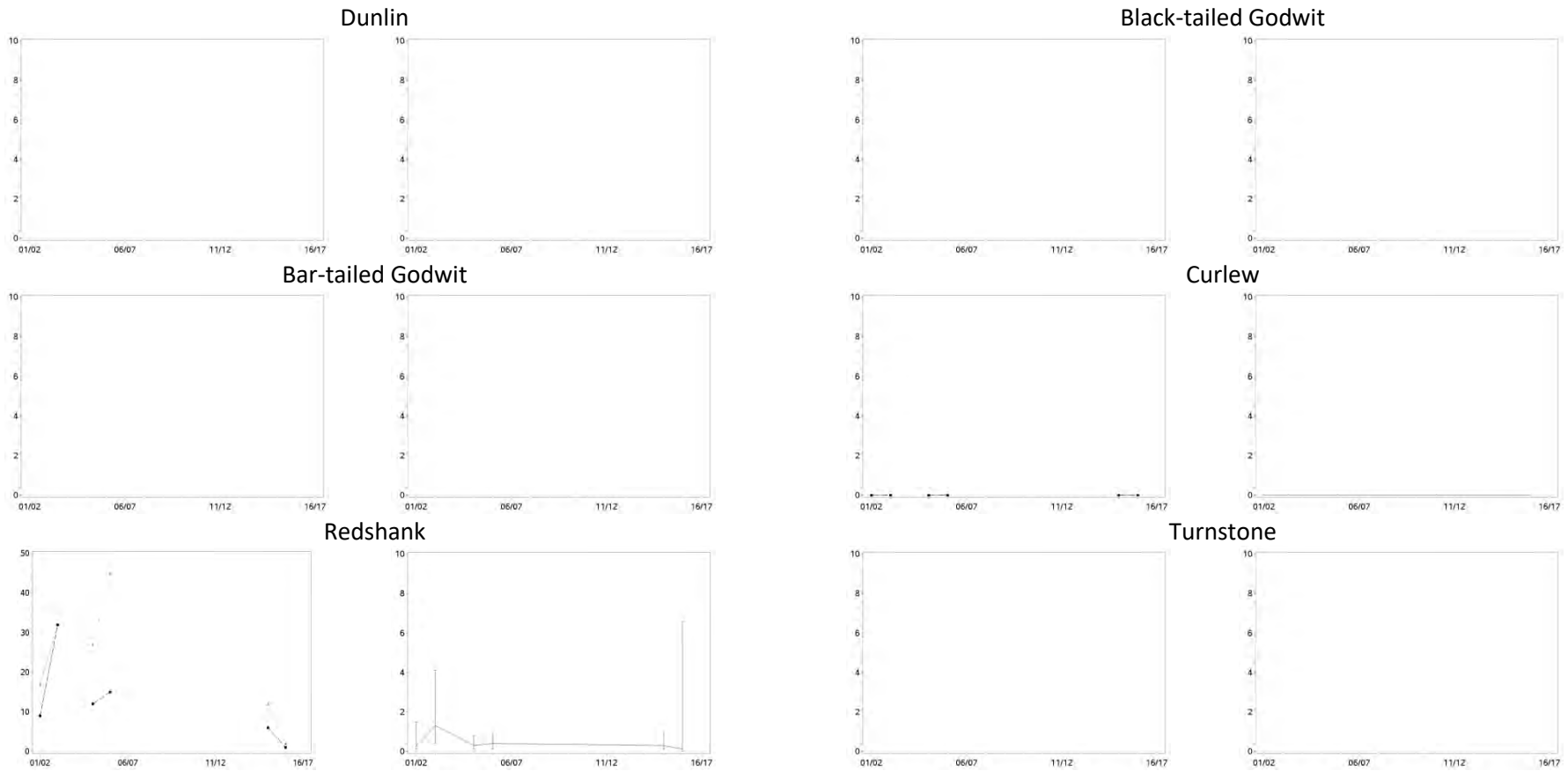


Figure A.38907. Continued



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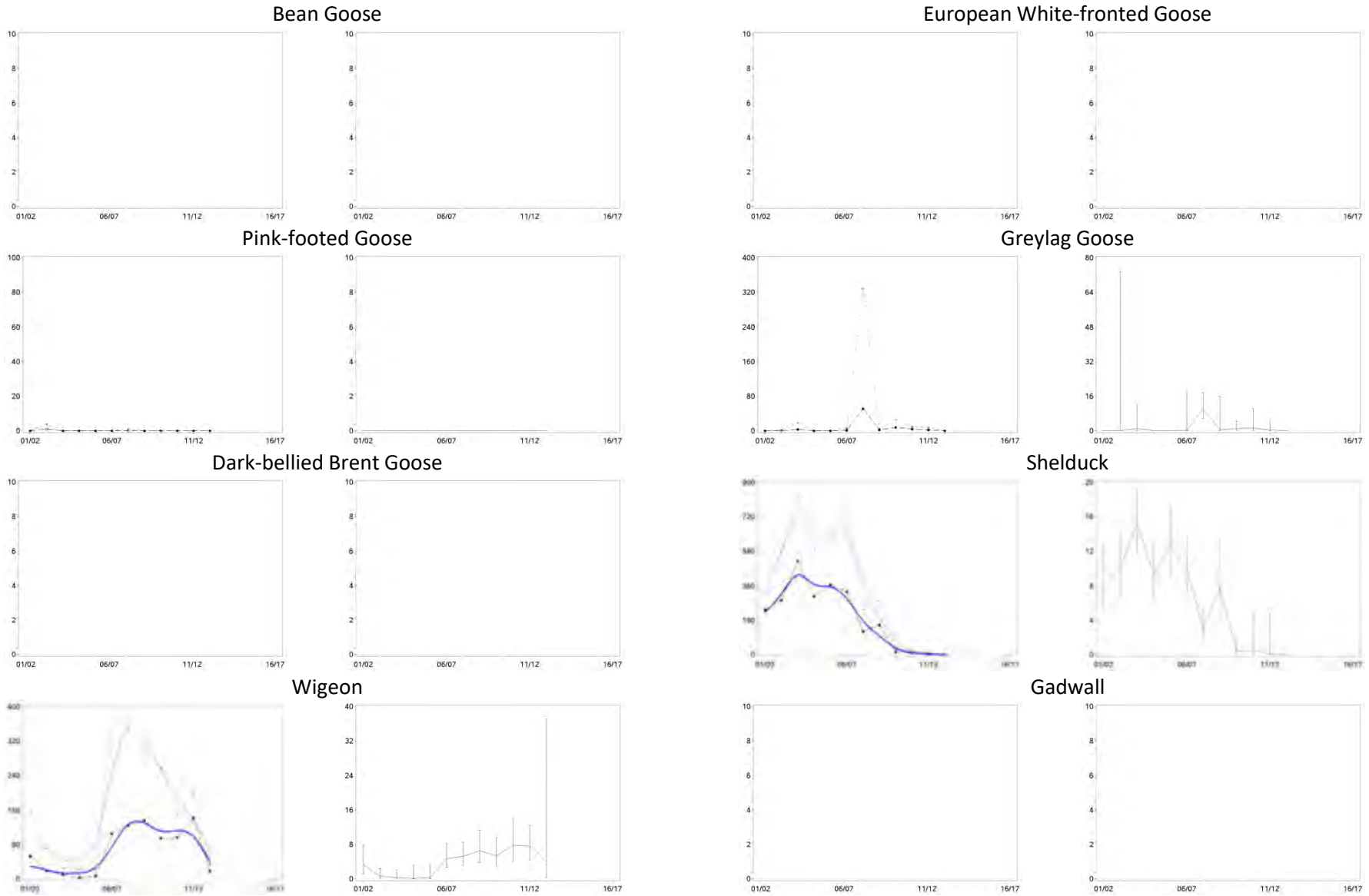
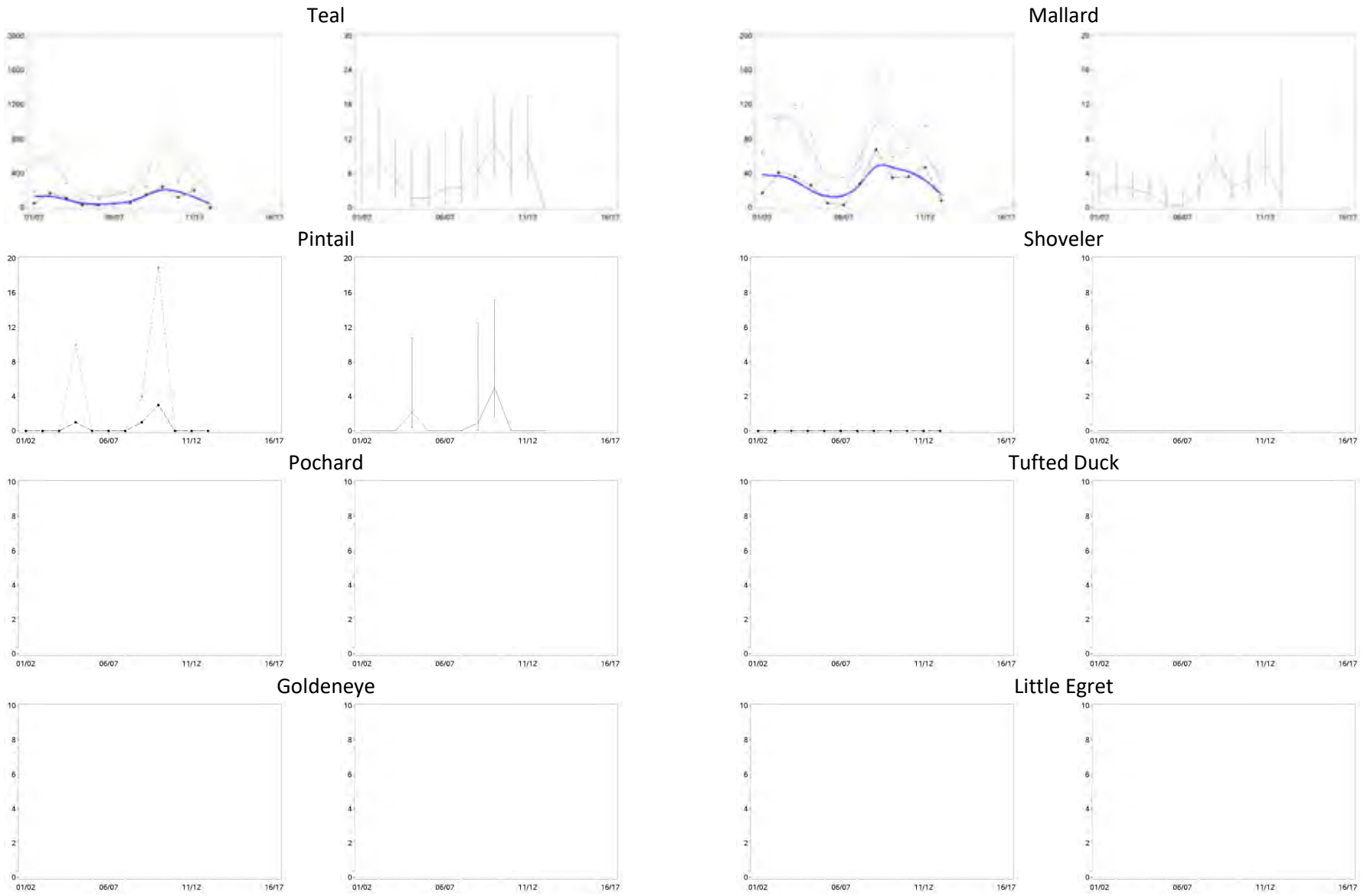


Figure A.38921. Population trends of each species in sector 38921 (Winteringham Haven - Sector C) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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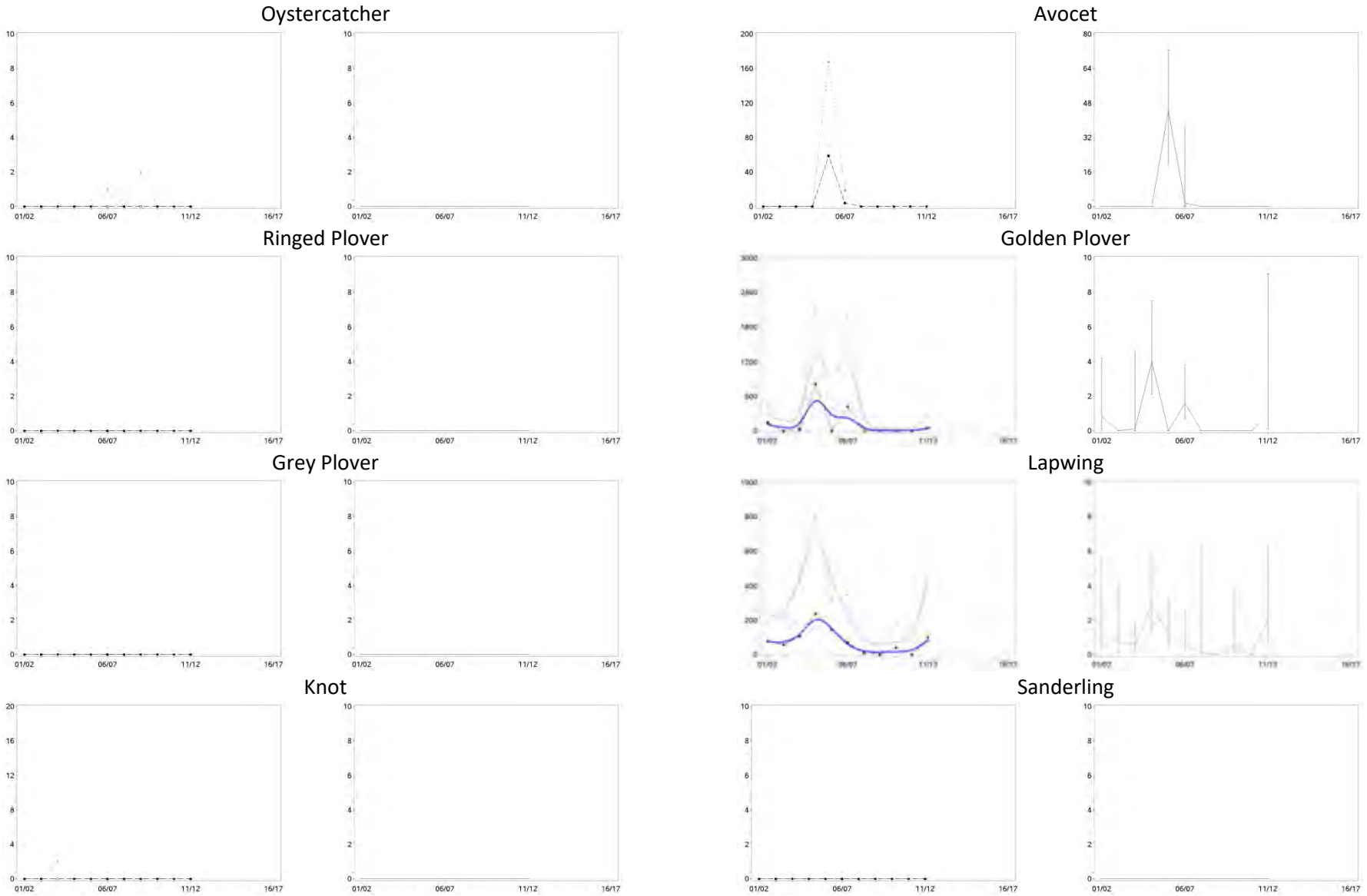

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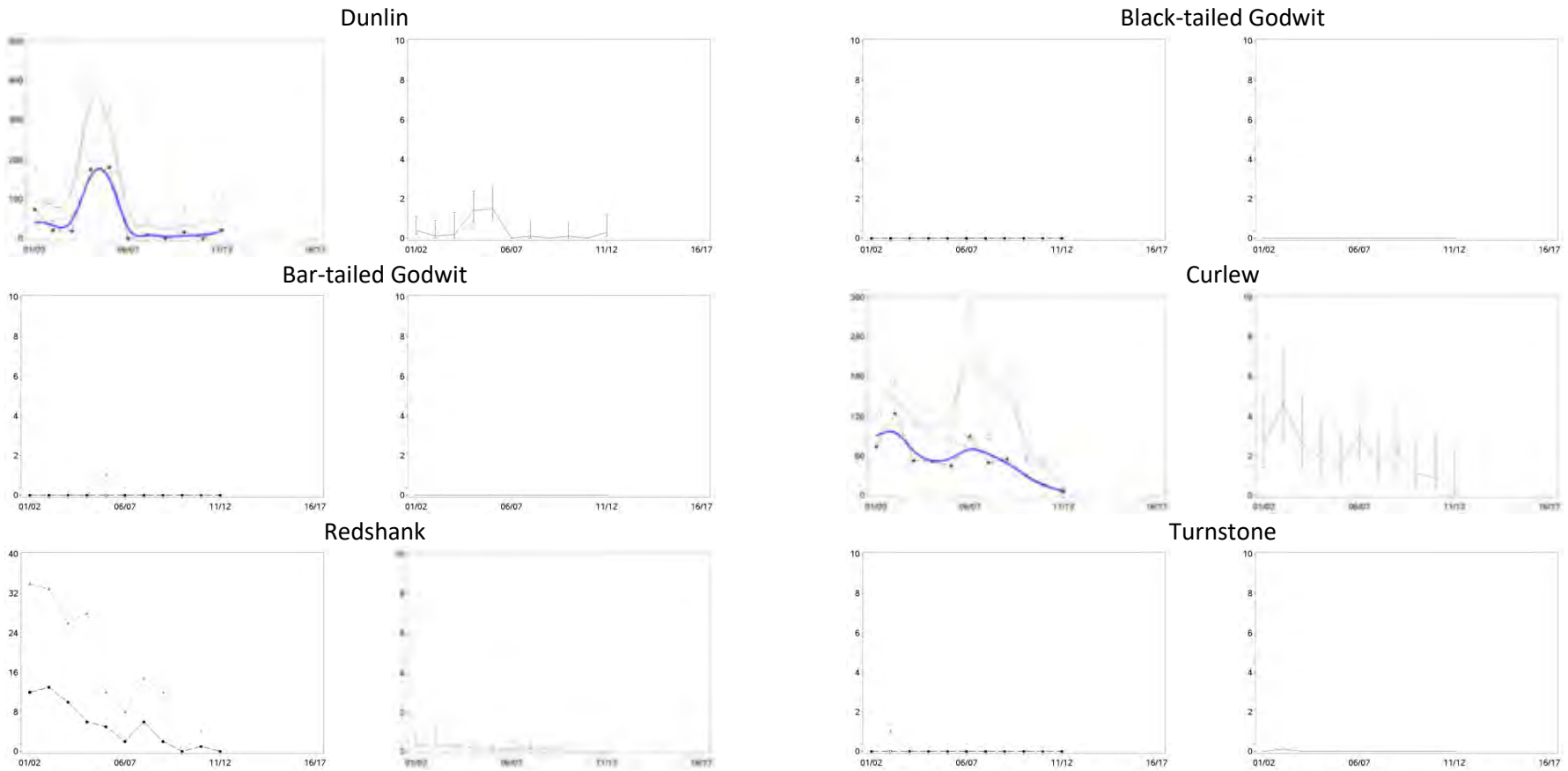


Figure A.38921. Continued

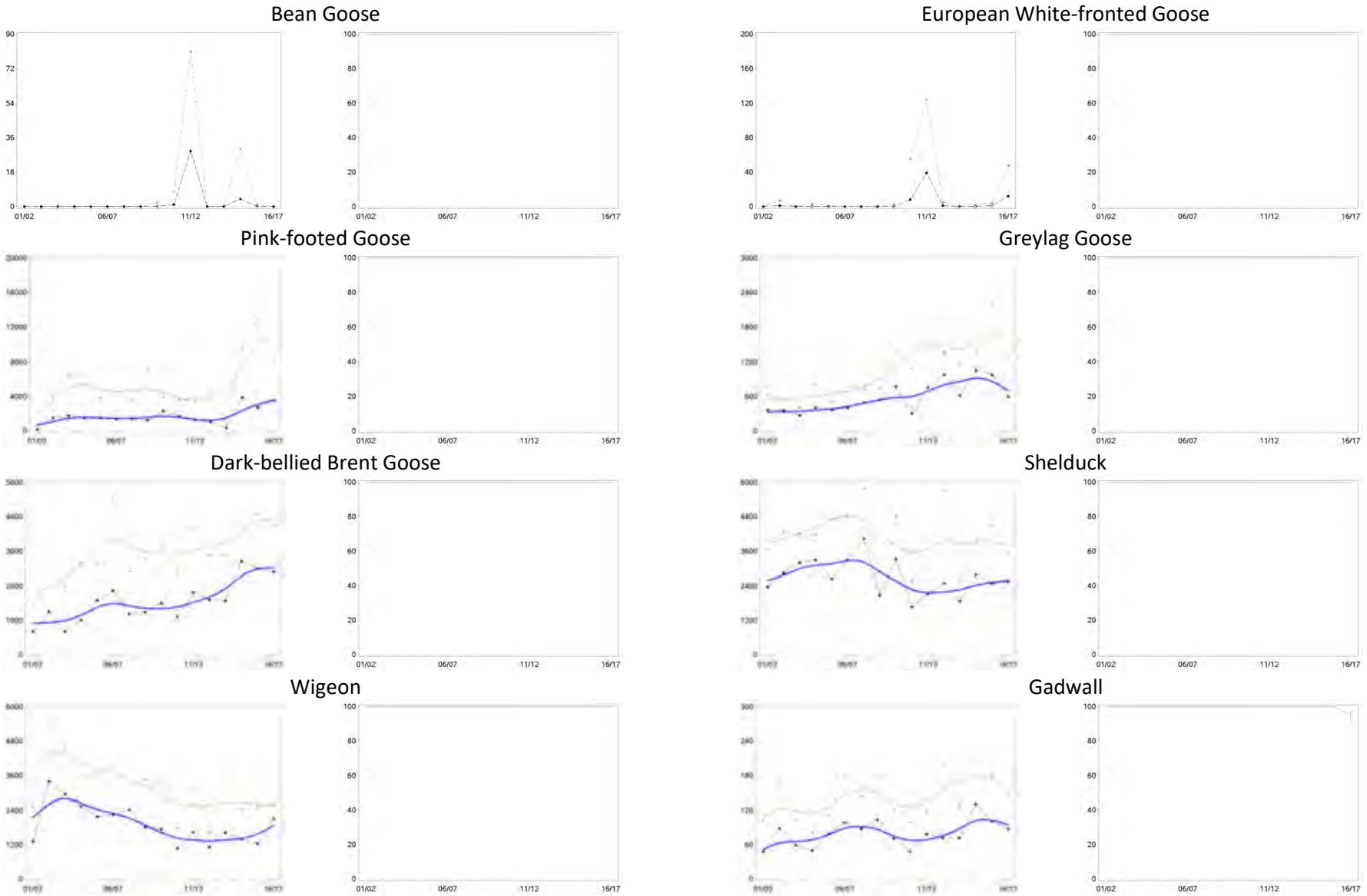


Figure A.38930. Population trends of each species in sector 38930 (Humber Estuary (North and South)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

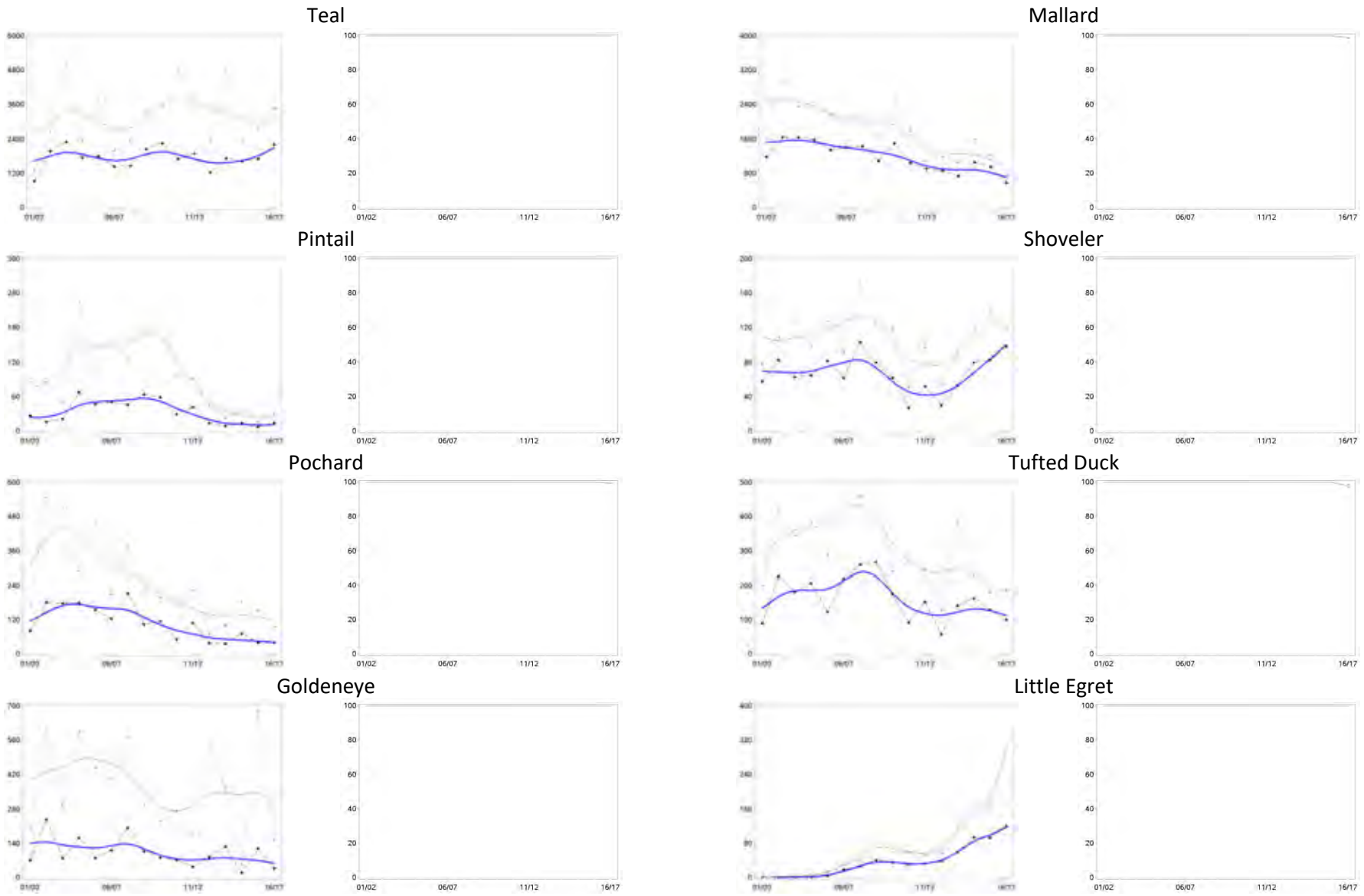


Figure A.38930. Continued

Figure A.38930. Continued

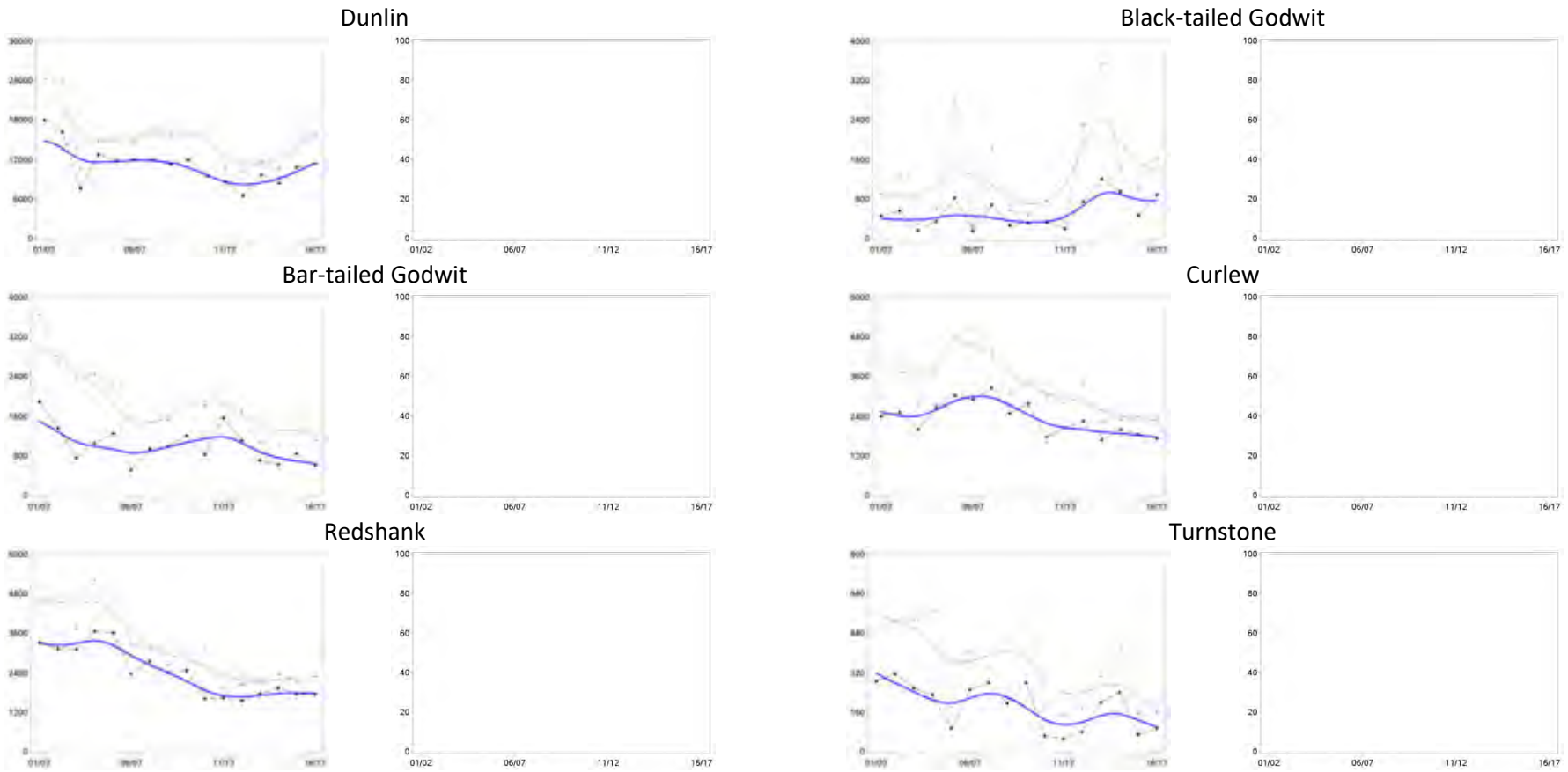


Figure A.38930. Continued

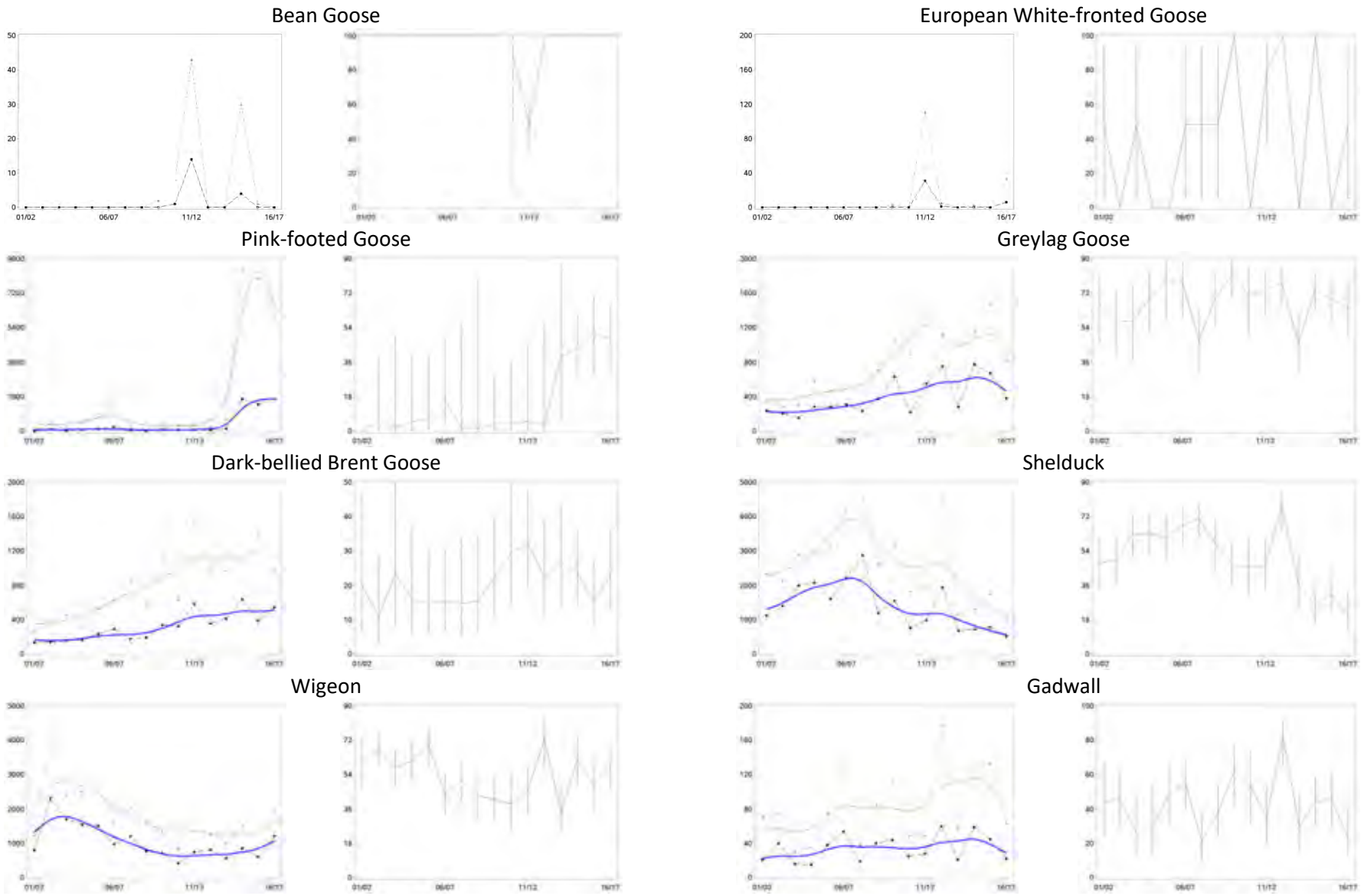
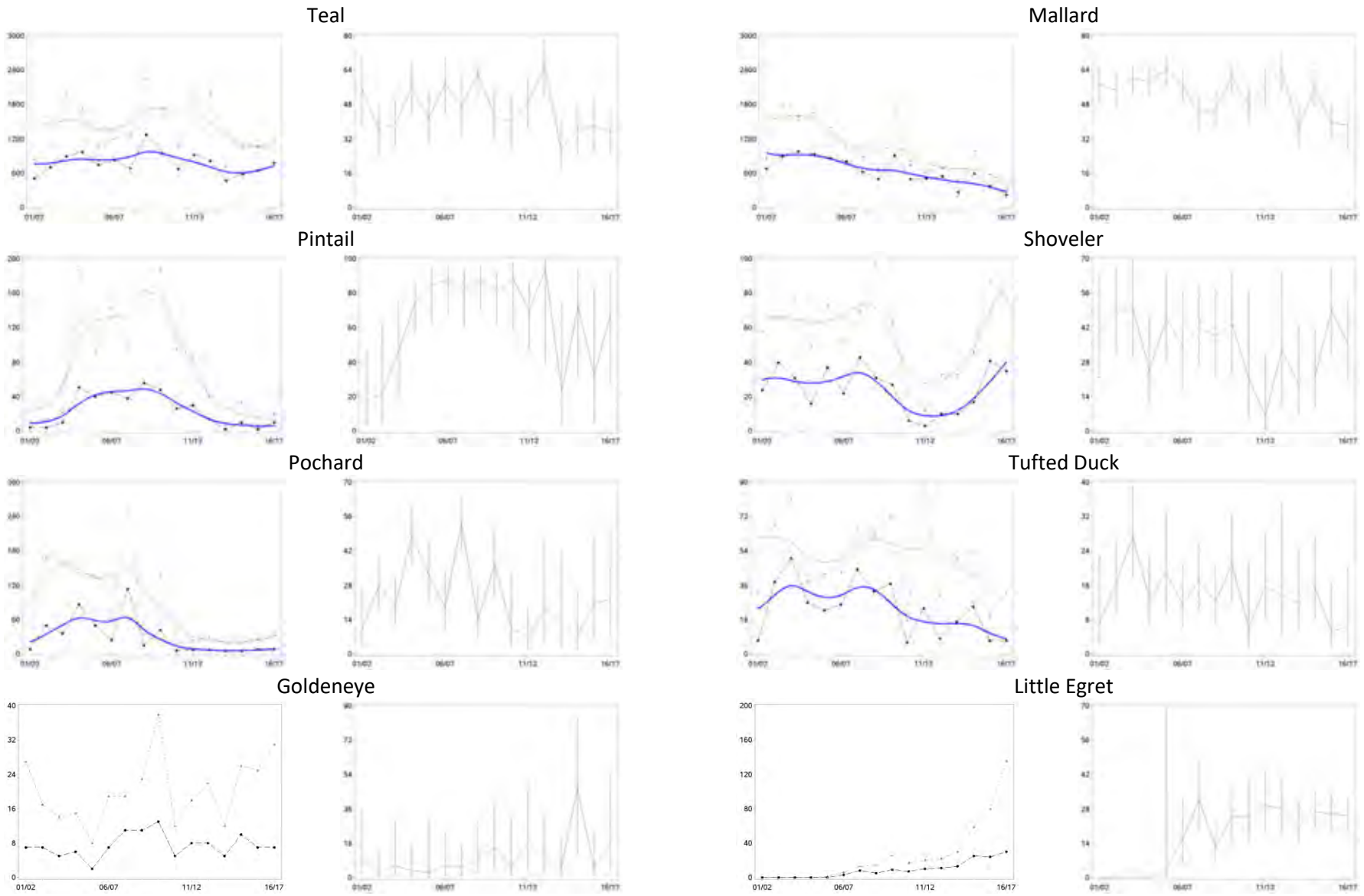


Figure A.38931. Population trends of each species in sector 38931 (Humber Estuary (North)) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).



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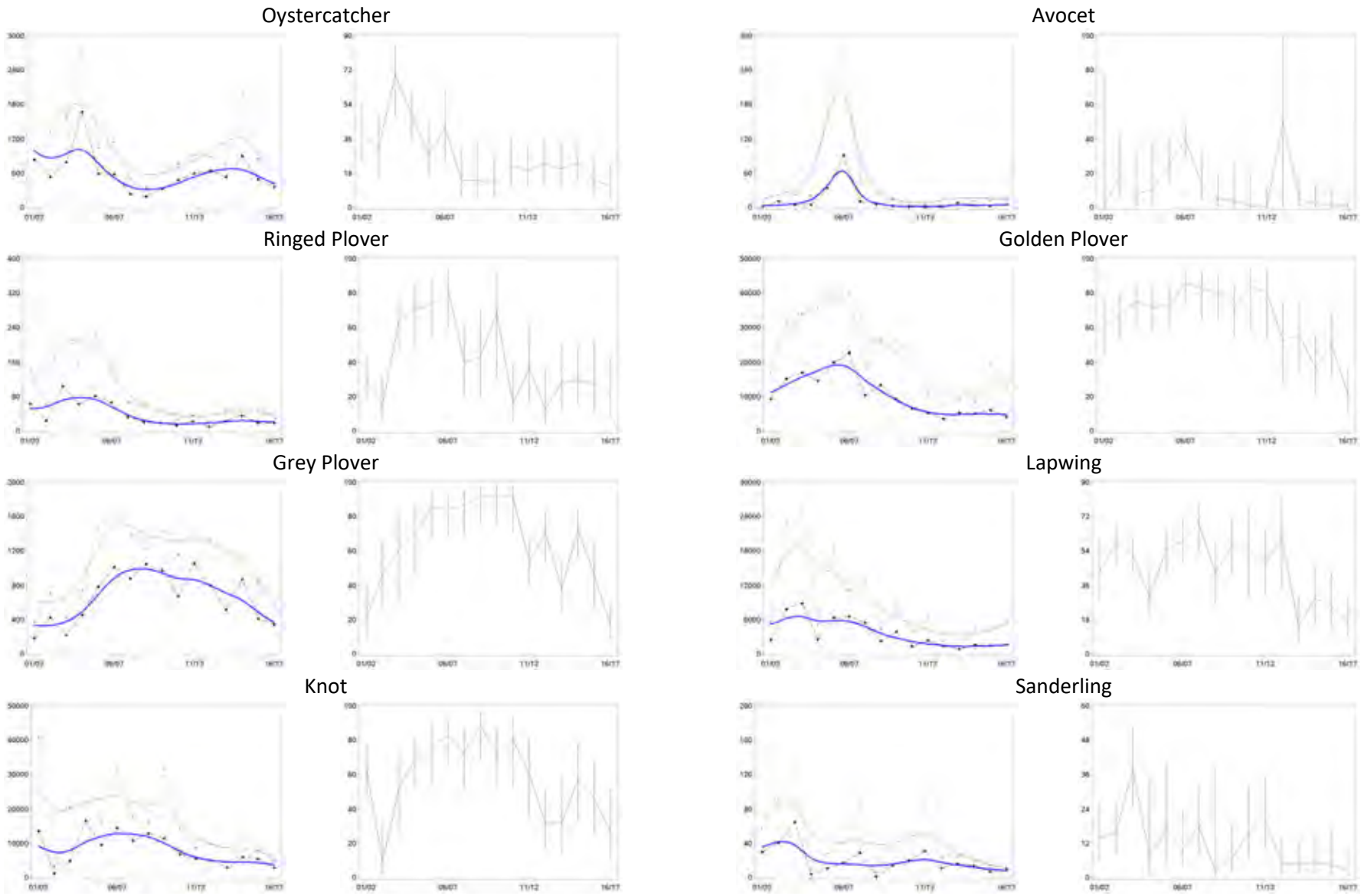


Figure A.38931. Continued

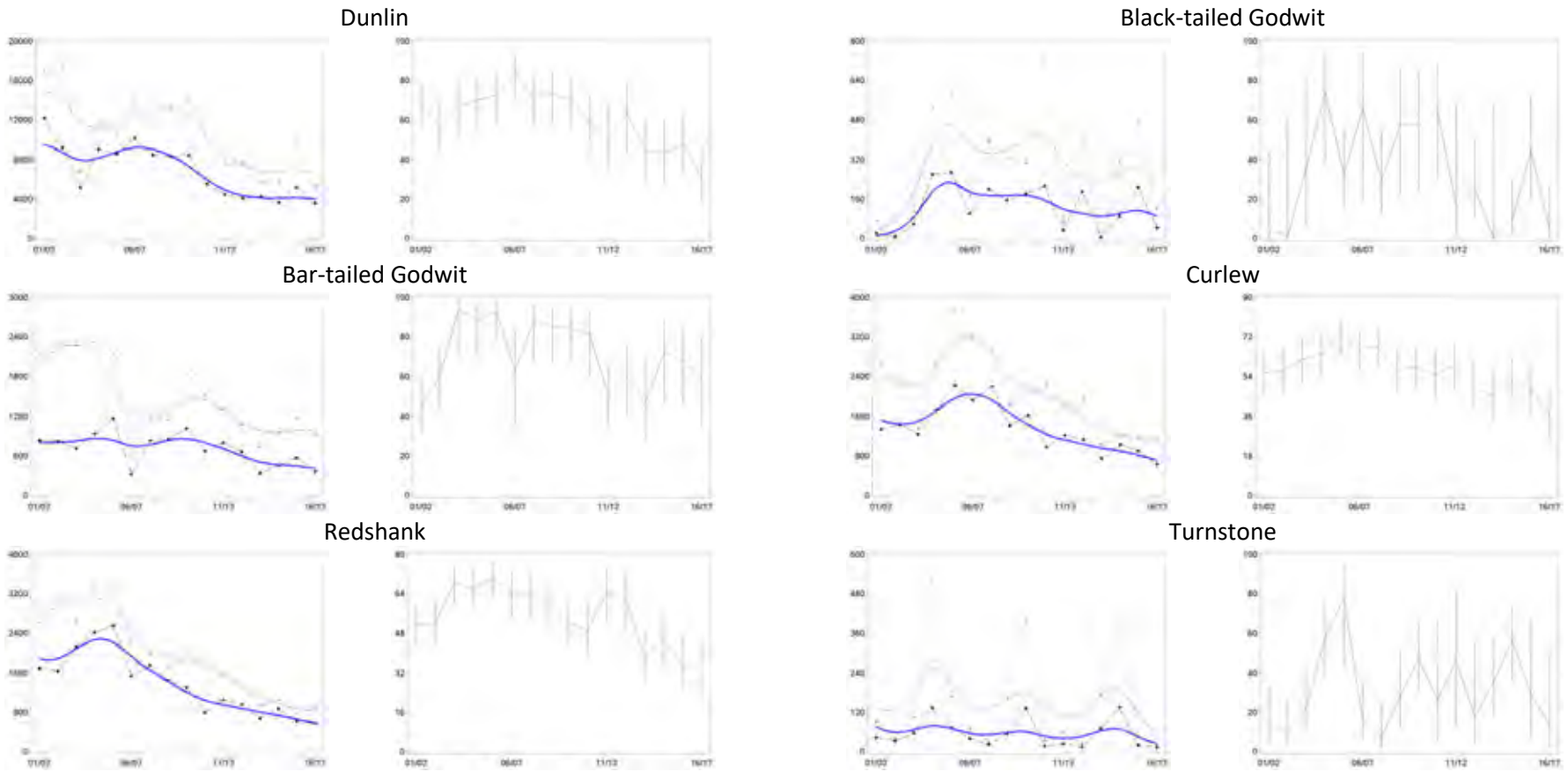


Figure A.38931. Continued

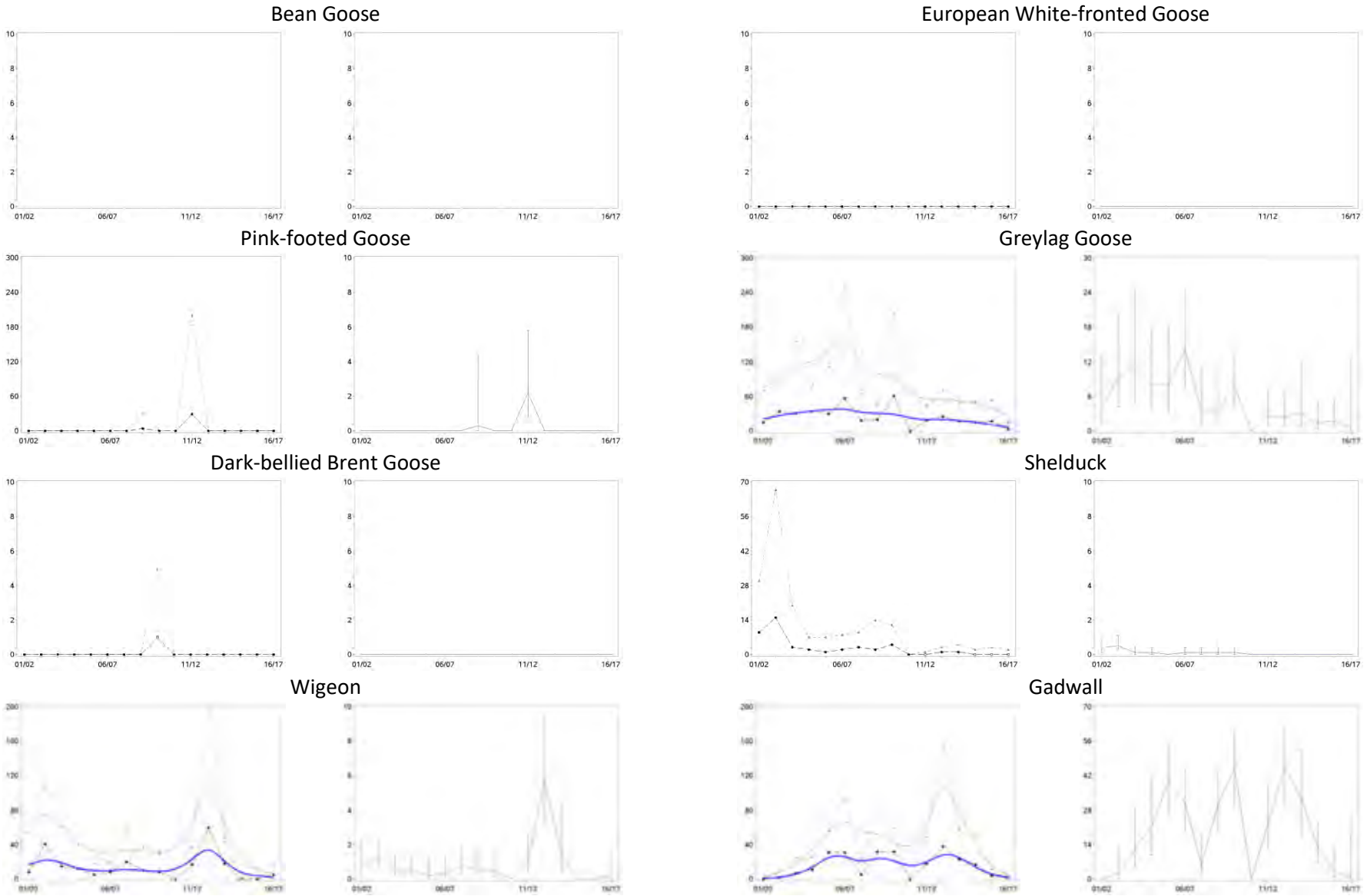


Figure A.38934. Population trends of each species in sector 38934 (Brough Haven to Hessle Haven) (left-hand graphs), and the proportion of The Humber Estuary population found in this sector per year (right-hand graphs).

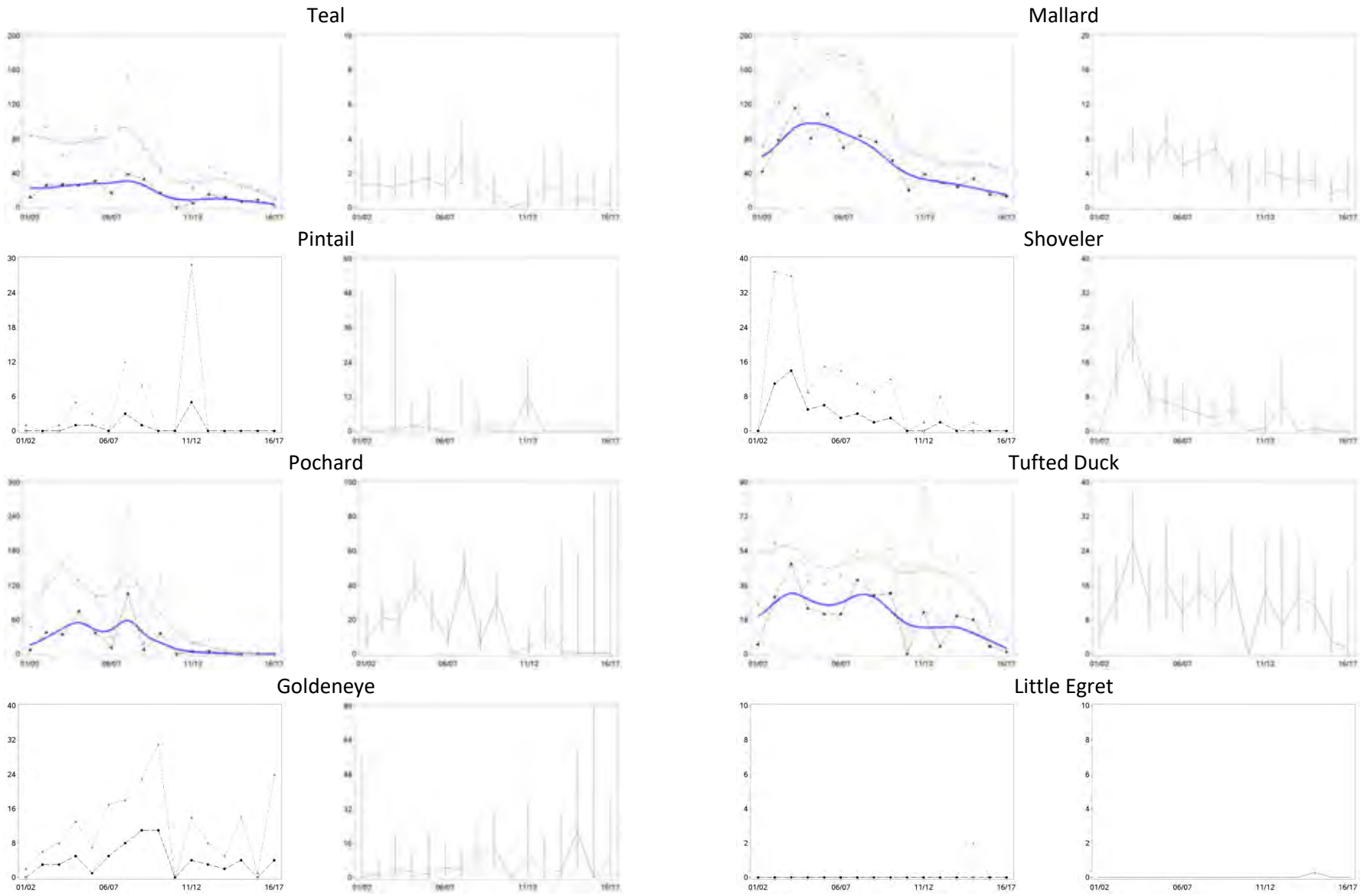


Figure A.38934. Continued

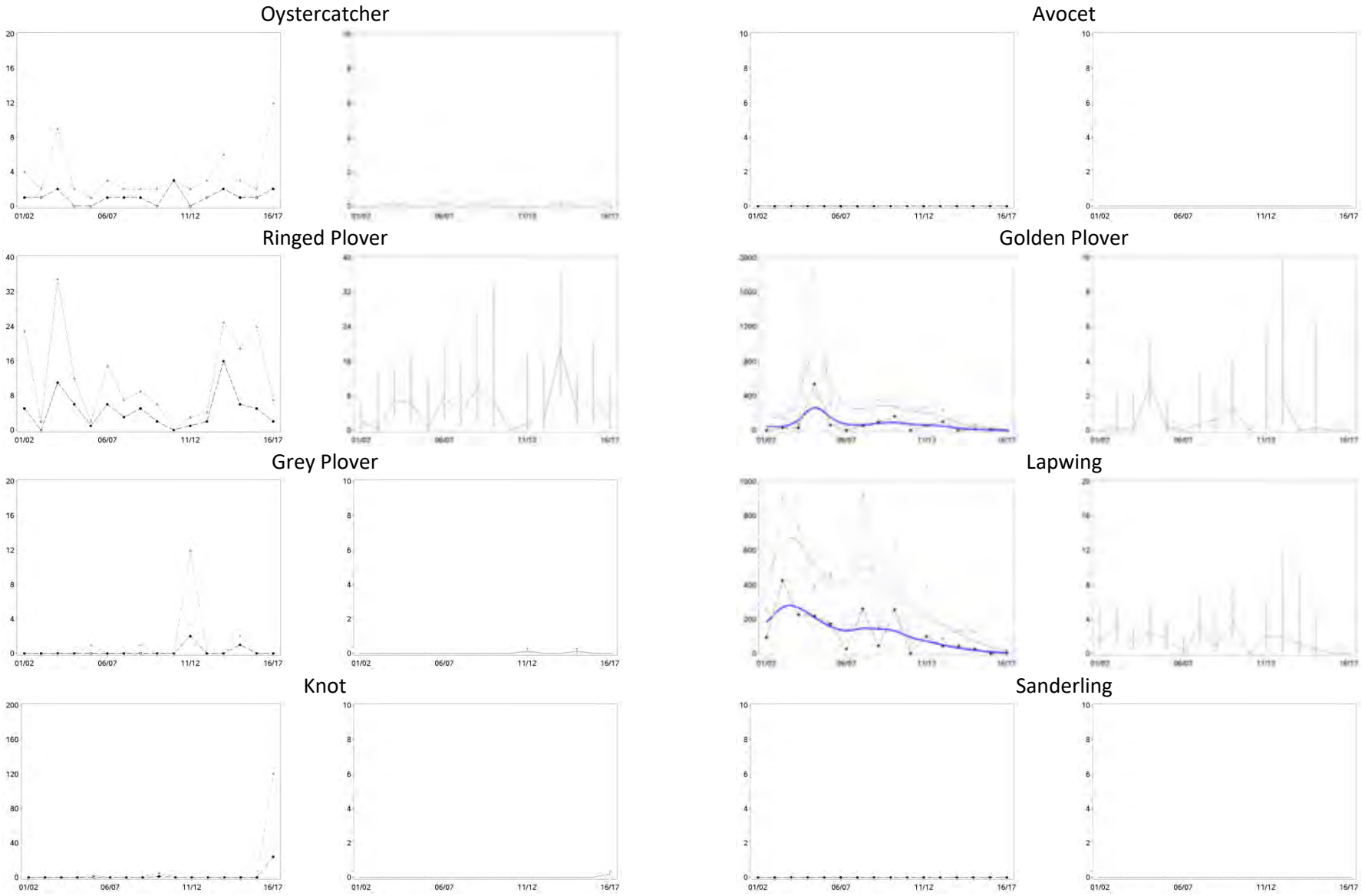


Figure A.38934. Continued

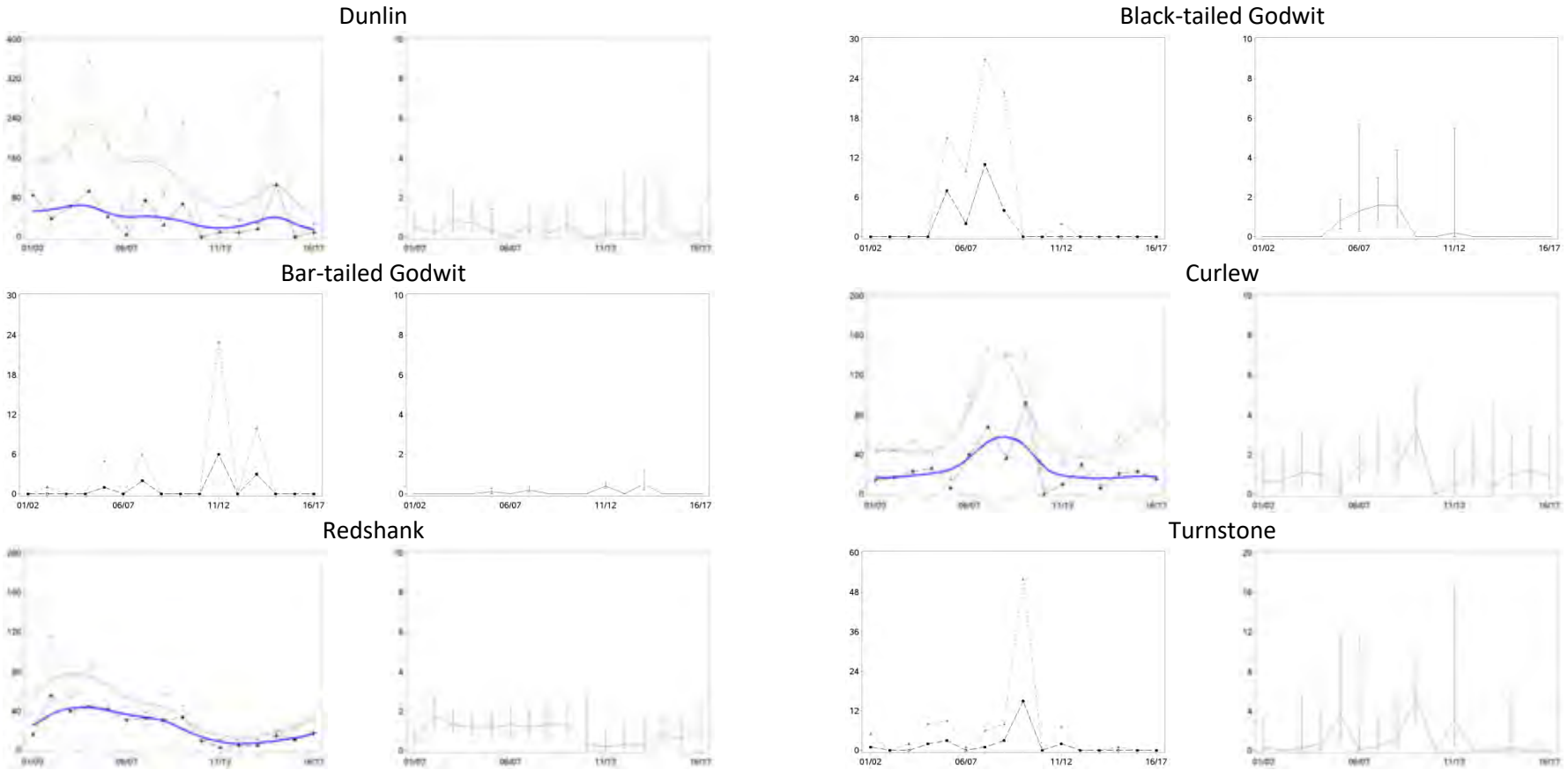


Figure A.38934. Continued

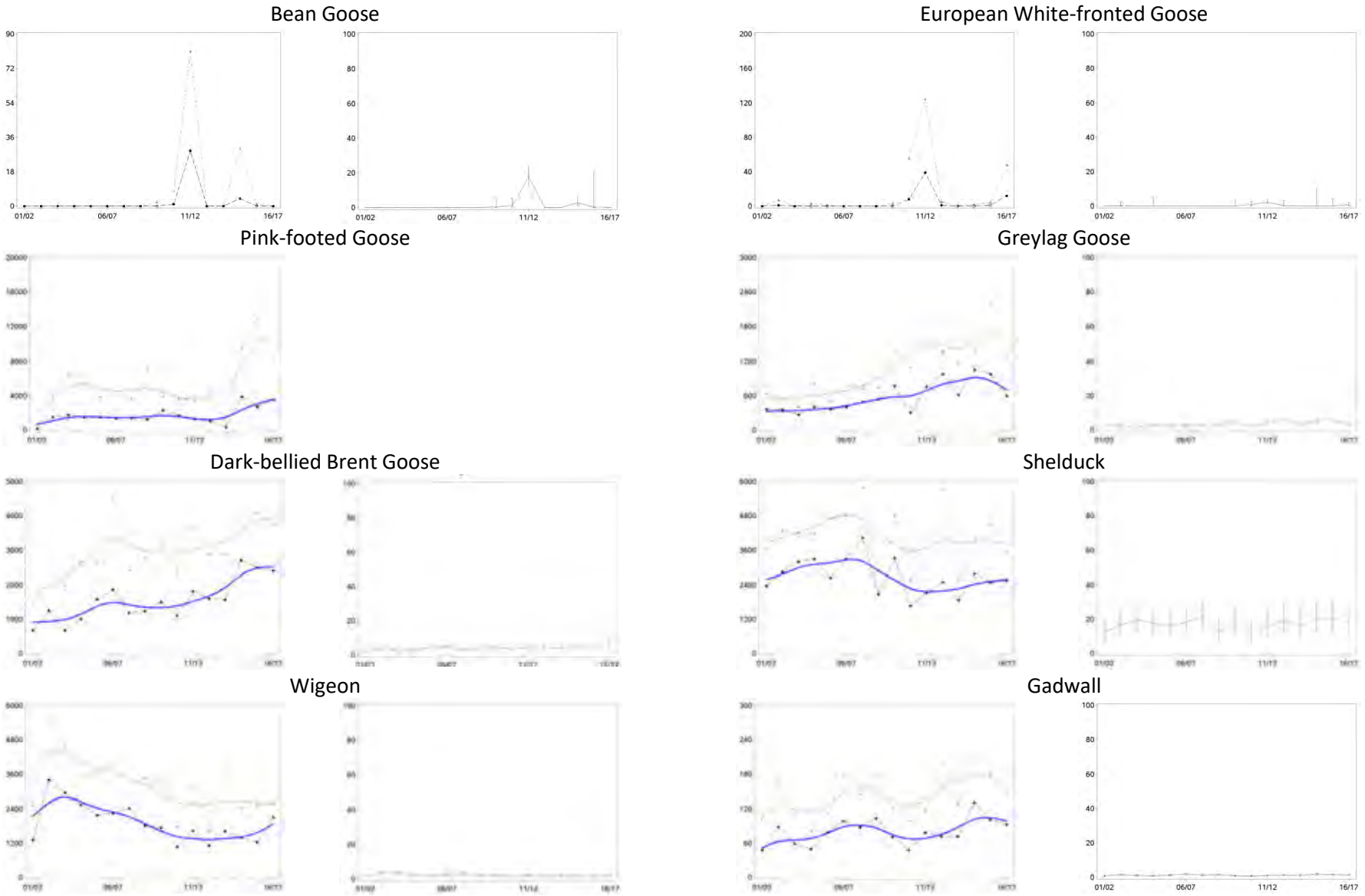
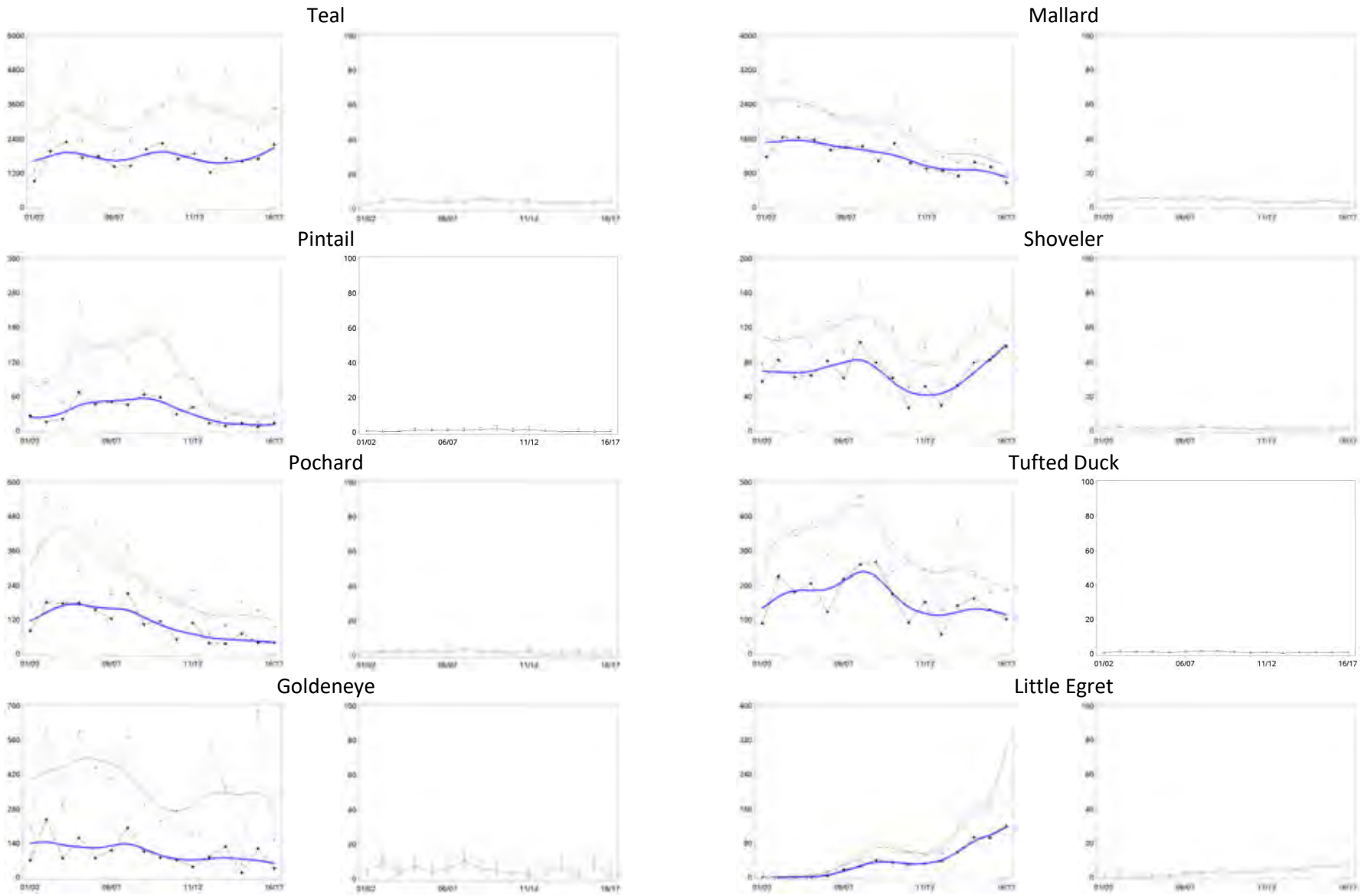


Figure A.38950. Trends of each species for site 38950 (Humber Estuary) (left-hand graphs), and the proportion of the regional total found on this site per year (right-hand graphs). The region used includes Anglian, Yorkshire and North East Environment Agency regions.



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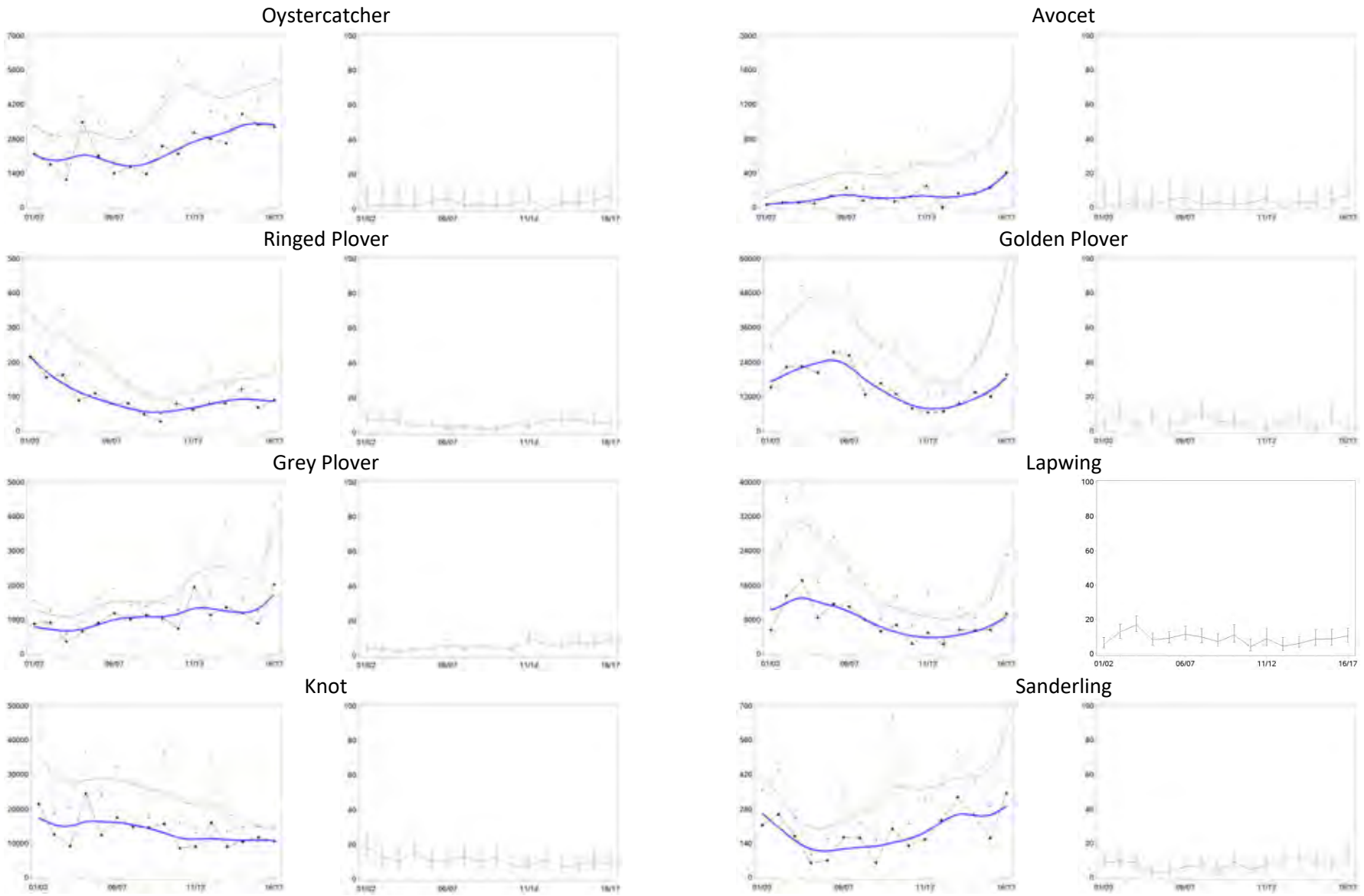

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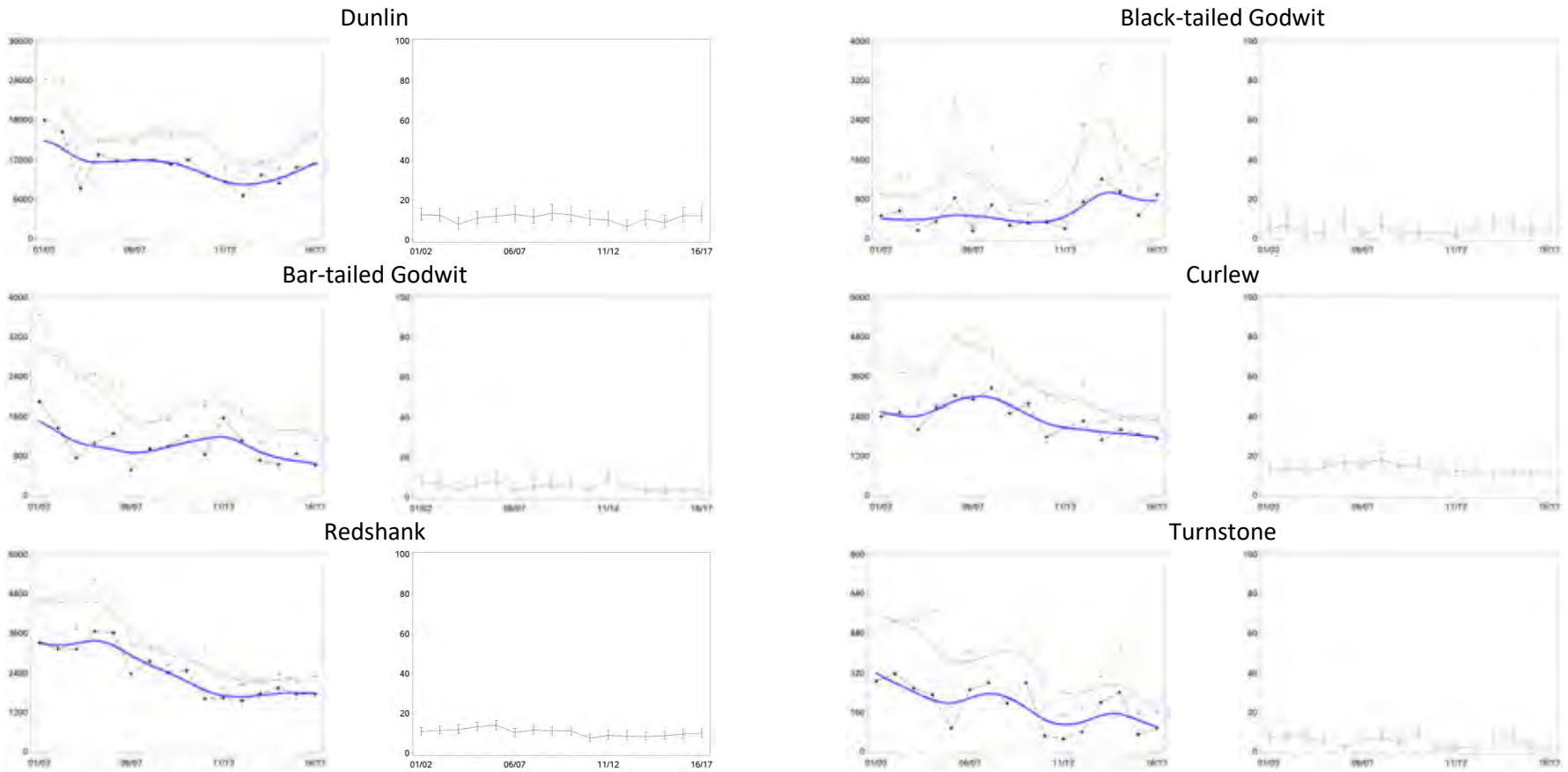

Figure A.38950. Continued

Appendix B: Maps of species density across Humber WeBS sectors.

The darker the shading the higher the density of birds, and numbers are the five-year mean of peaks for 2012/13 – 2016/17.

Figure B.XR: Tundra Bean Goose

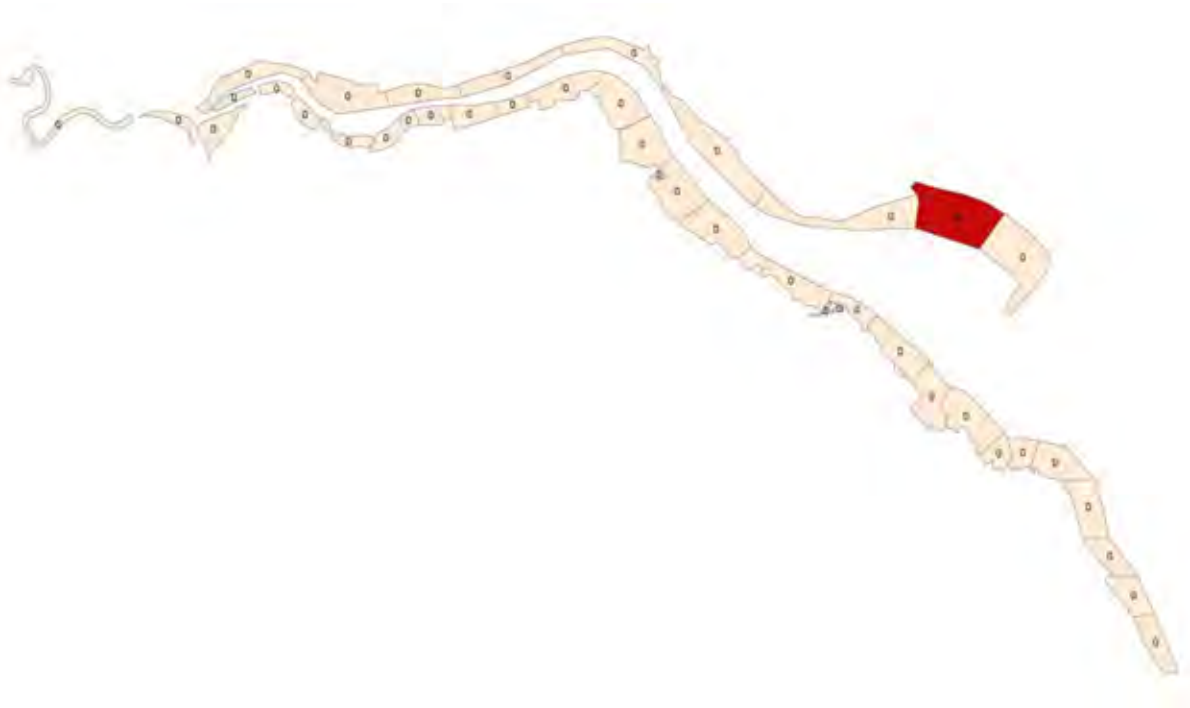

Figure B.PG: Pink-footed Goose

Figure B.EW: European White-fronted Goose

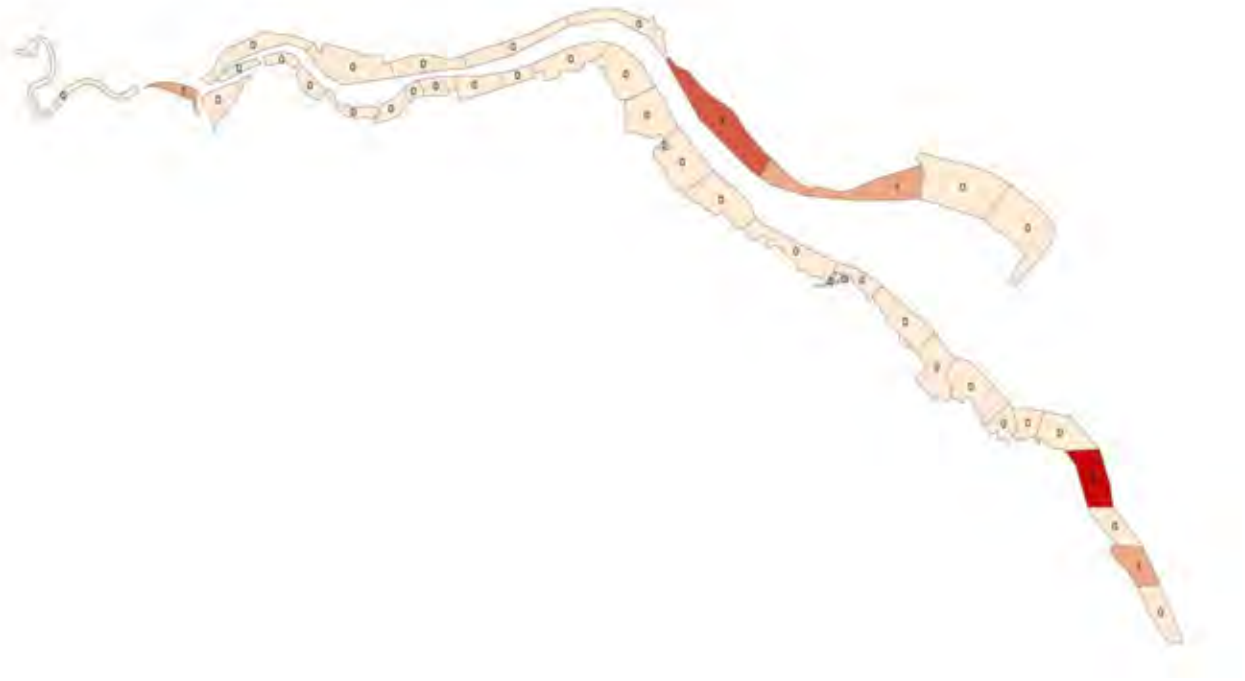

Figure B.JA: British/Irish Greylag Goose

Figure B.DB: Dark-bellied Brent Goose

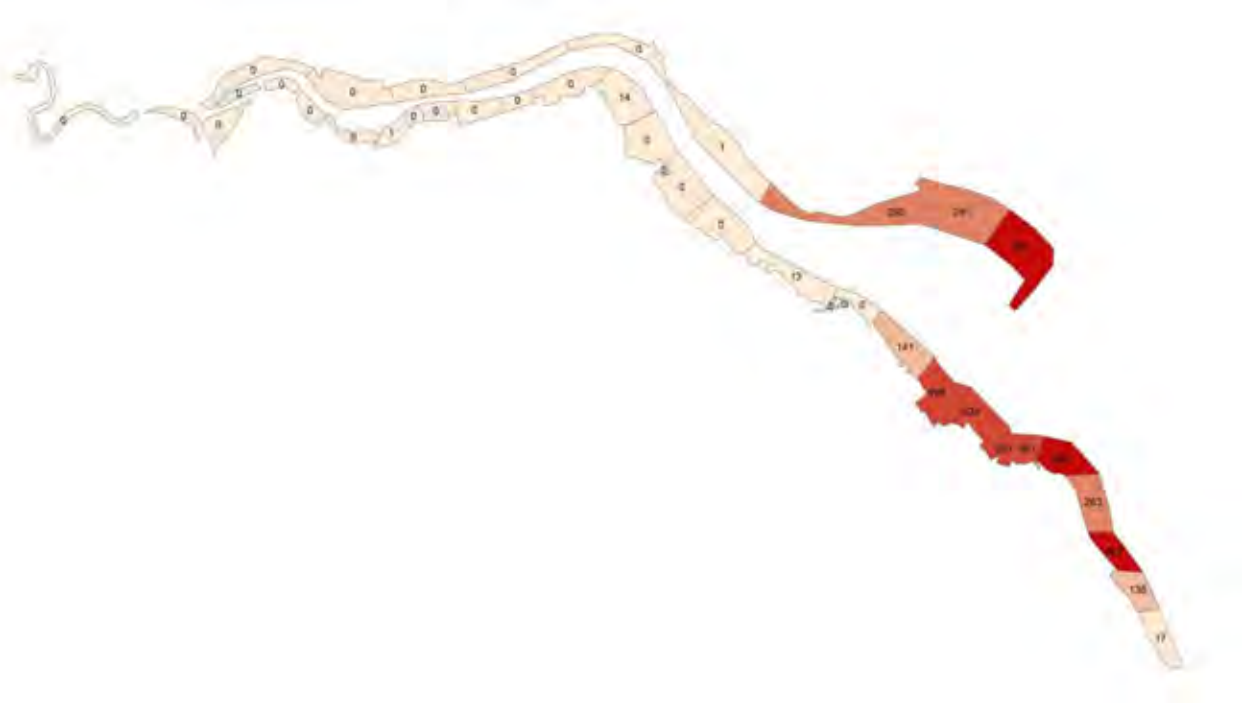

Figure B.SU: Shelduck

Figure B.WN: Wigeon

Figure B.GA: Gadwall

Figure B.T.: Teal

Figure B.MA: Mallard

Figure B.PT: Pintail

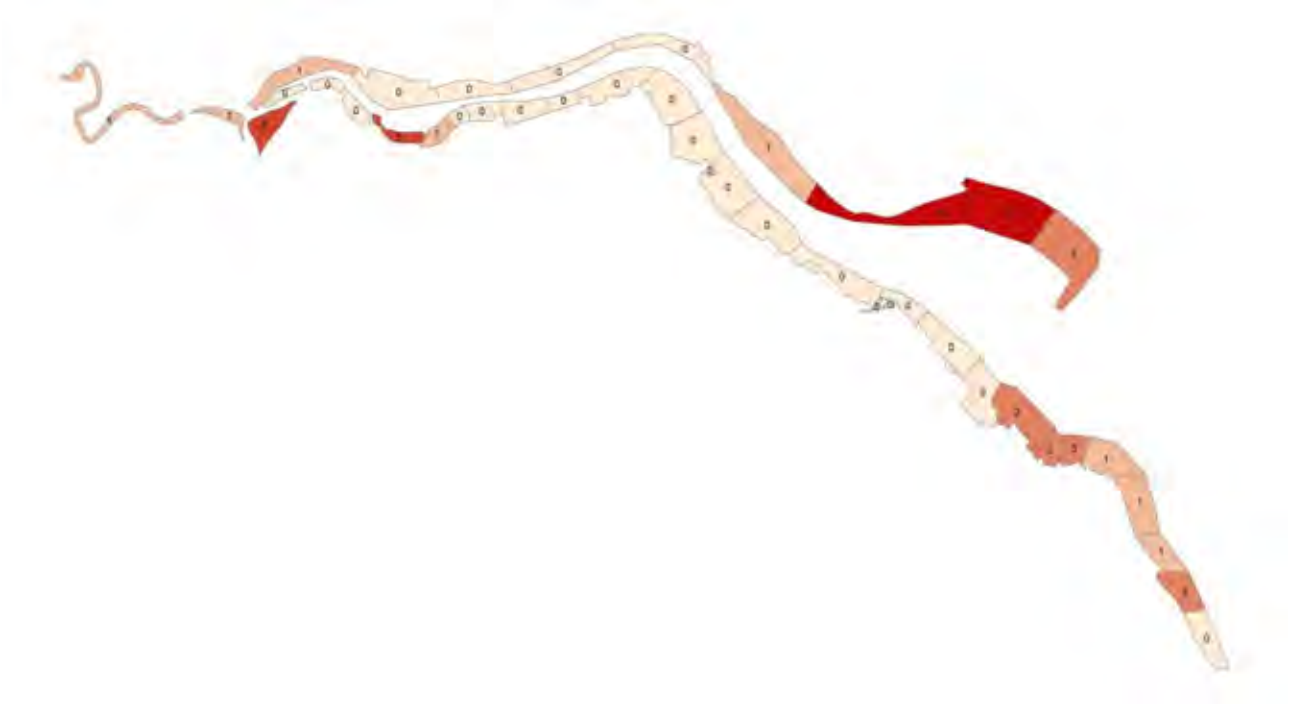

Figure B.SV: Shoveler

Figure B.PO: Pochard

Figure B.TU: Tufted Duck

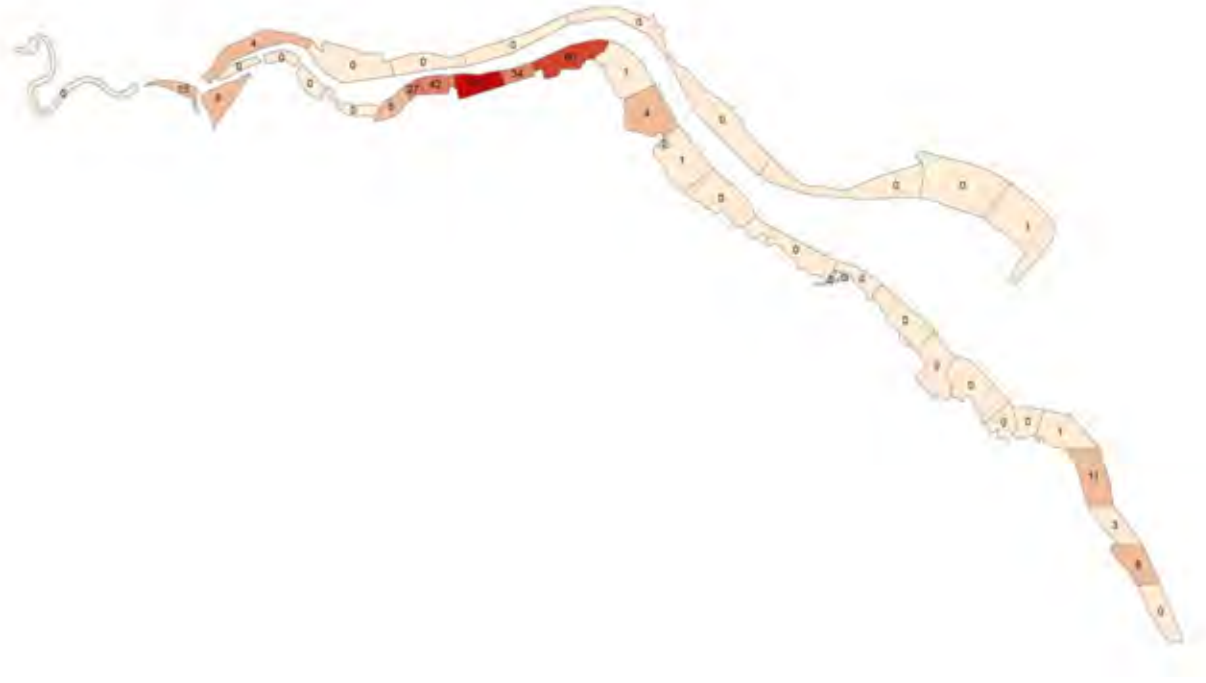

Figure B.SP: Scaup

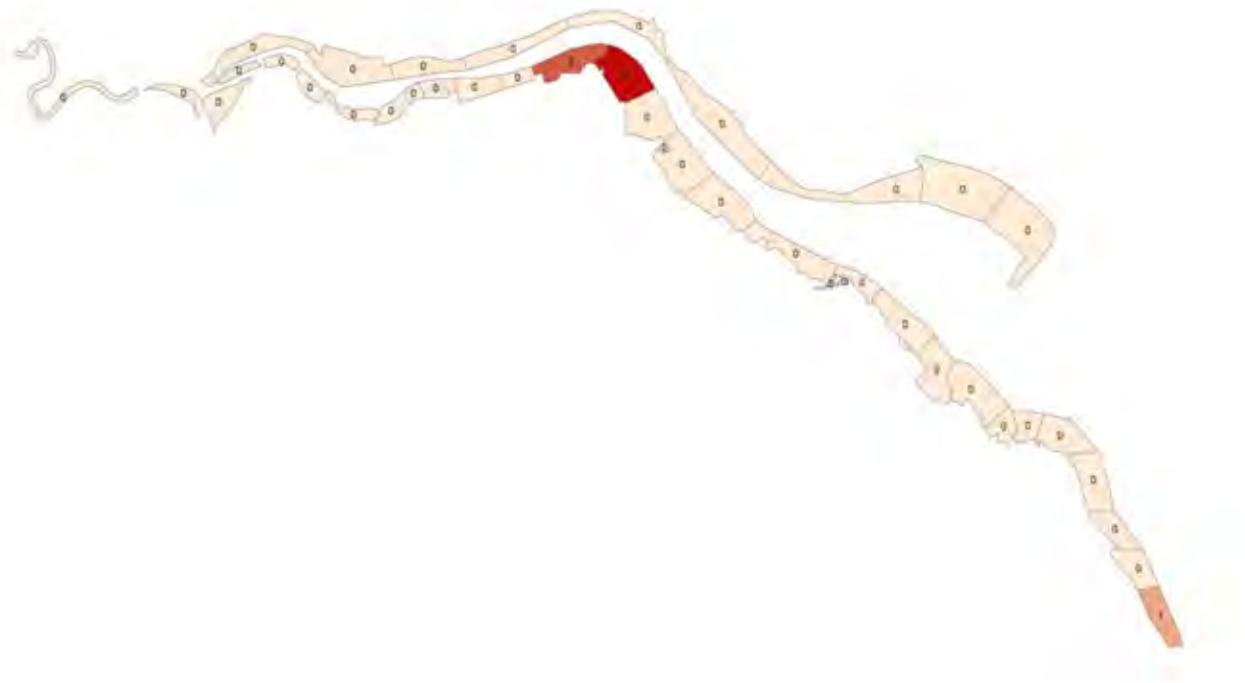

Figure B.GN: Goldeneye

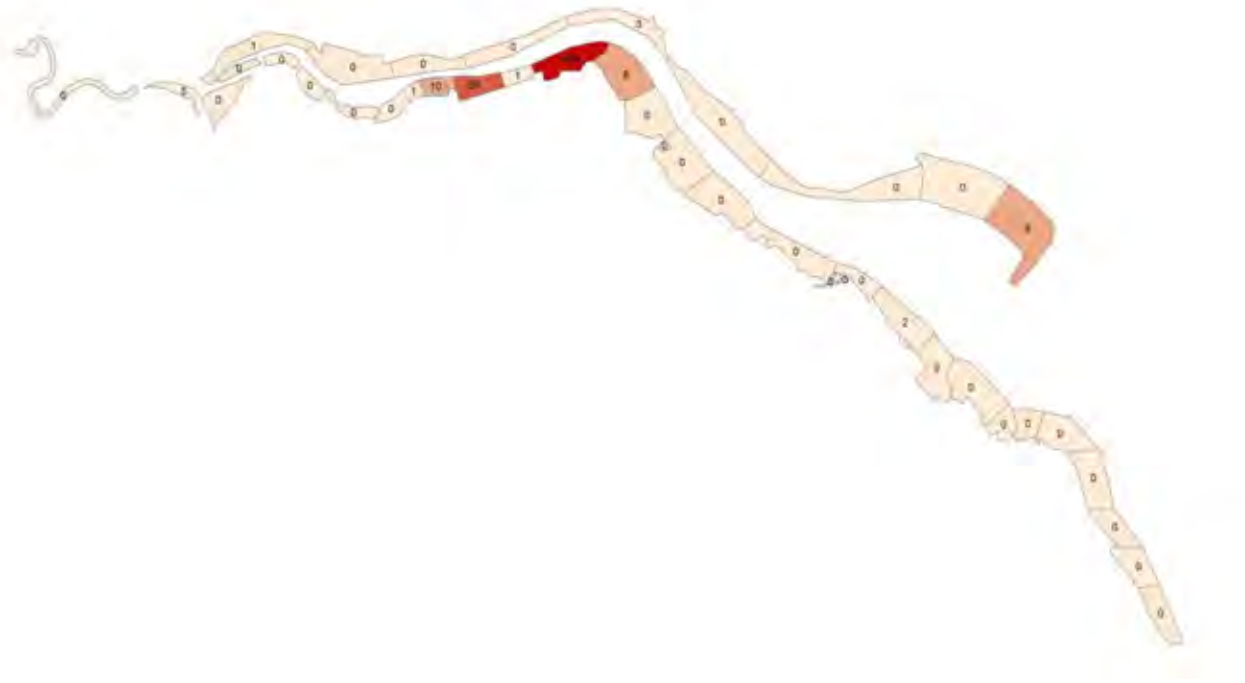

Figure B.SY: Smew – map not produced due to insufficient observations (5-year mean of peaks is equal to zero on all sectors).

Figure B.ET: Little Egret

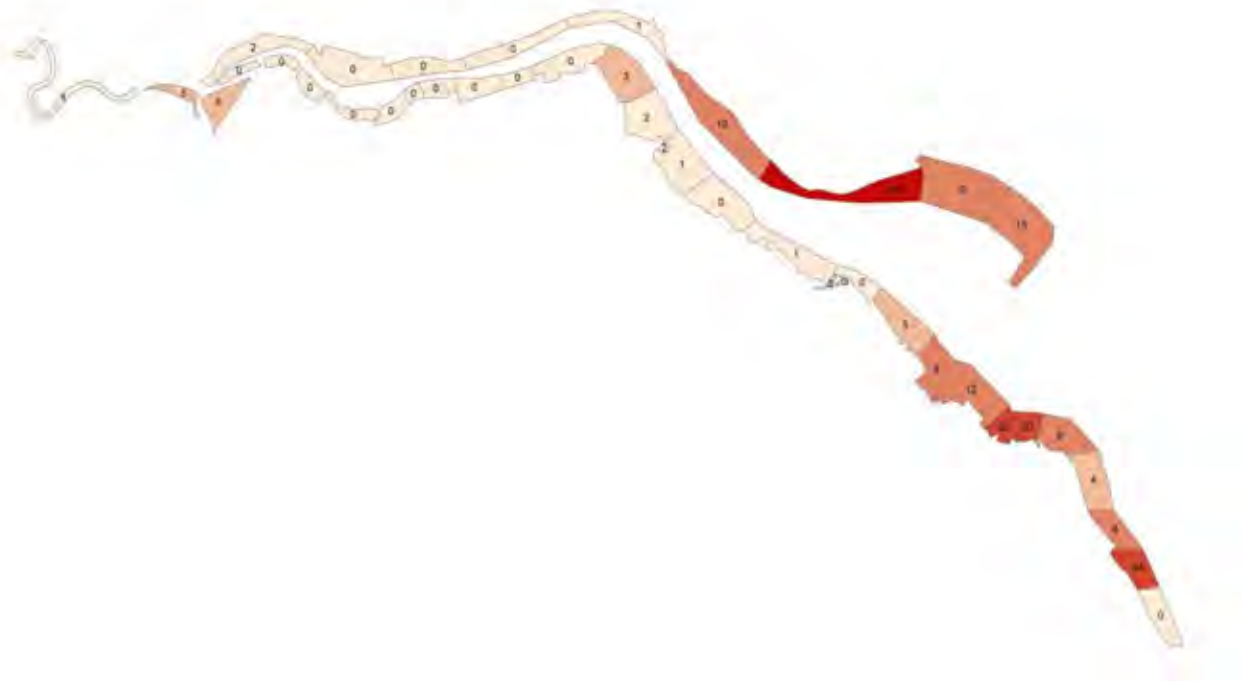

Figure B.AV: Avocet

Figure B.OC: Oystercatcher

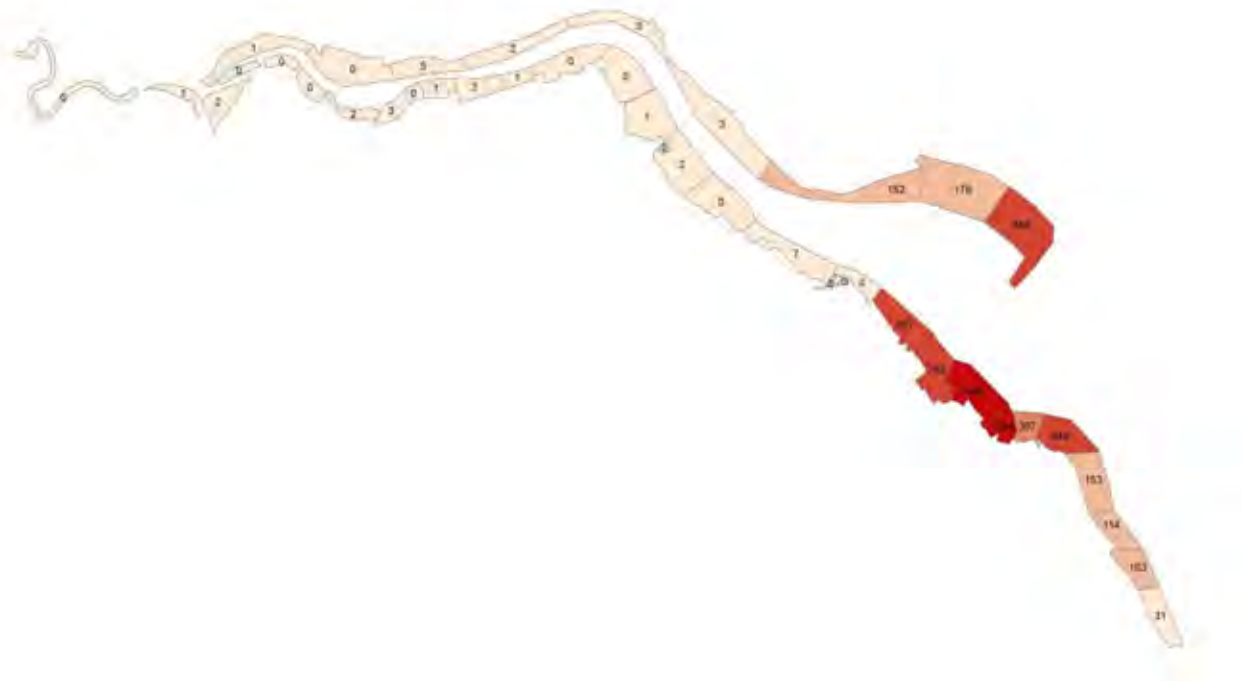

Figure B.RP: Ringed Plover

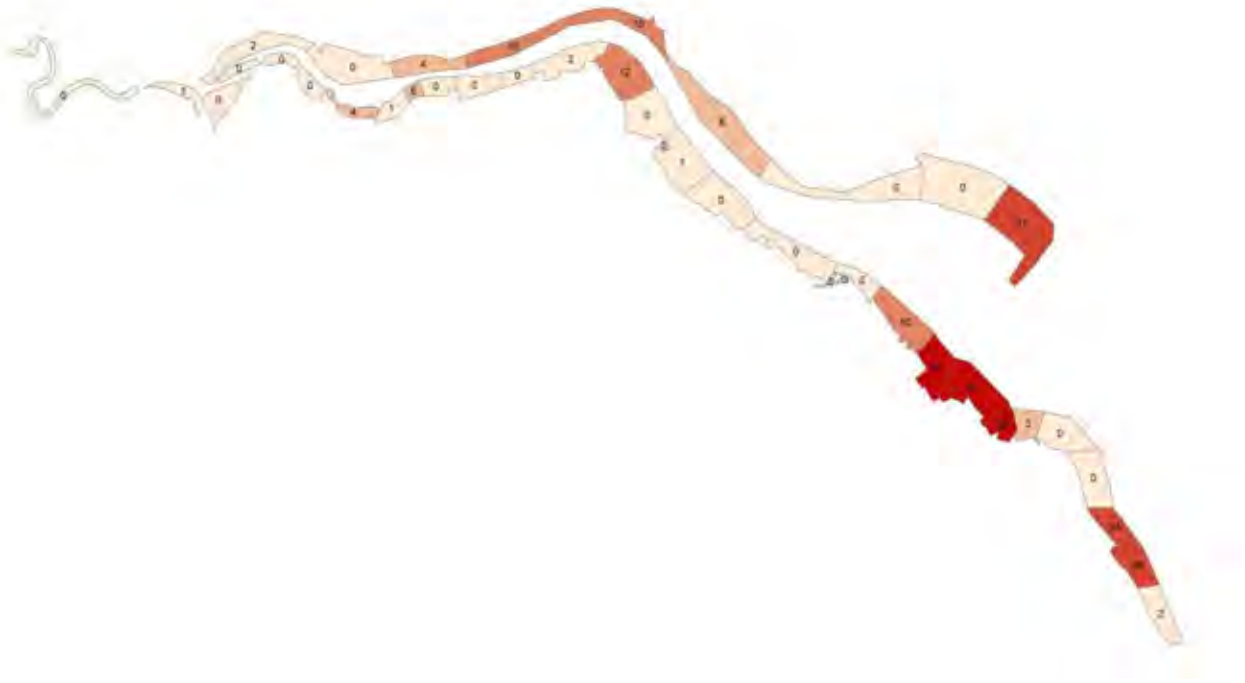

Figure B.GP: Golden Plover

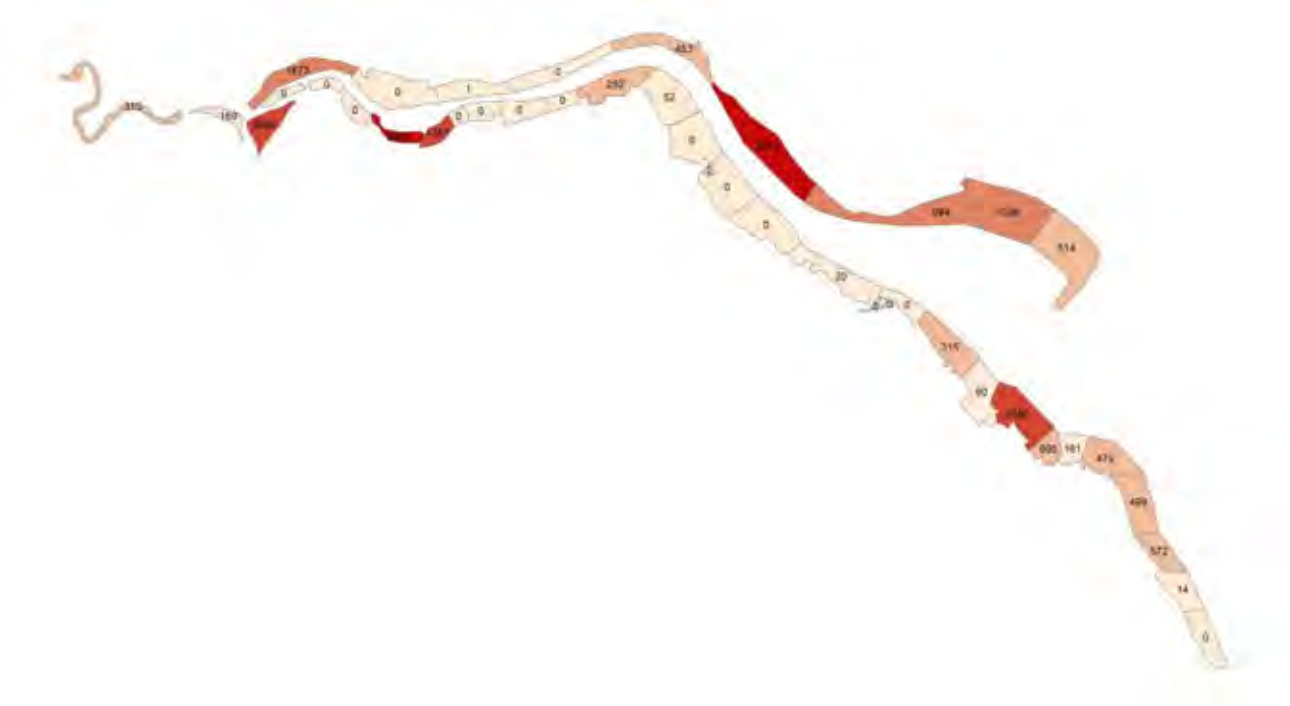

Figure B.GV: Grey Plover

Figure B.L.: Lapwing

Figure B.KN: Knot

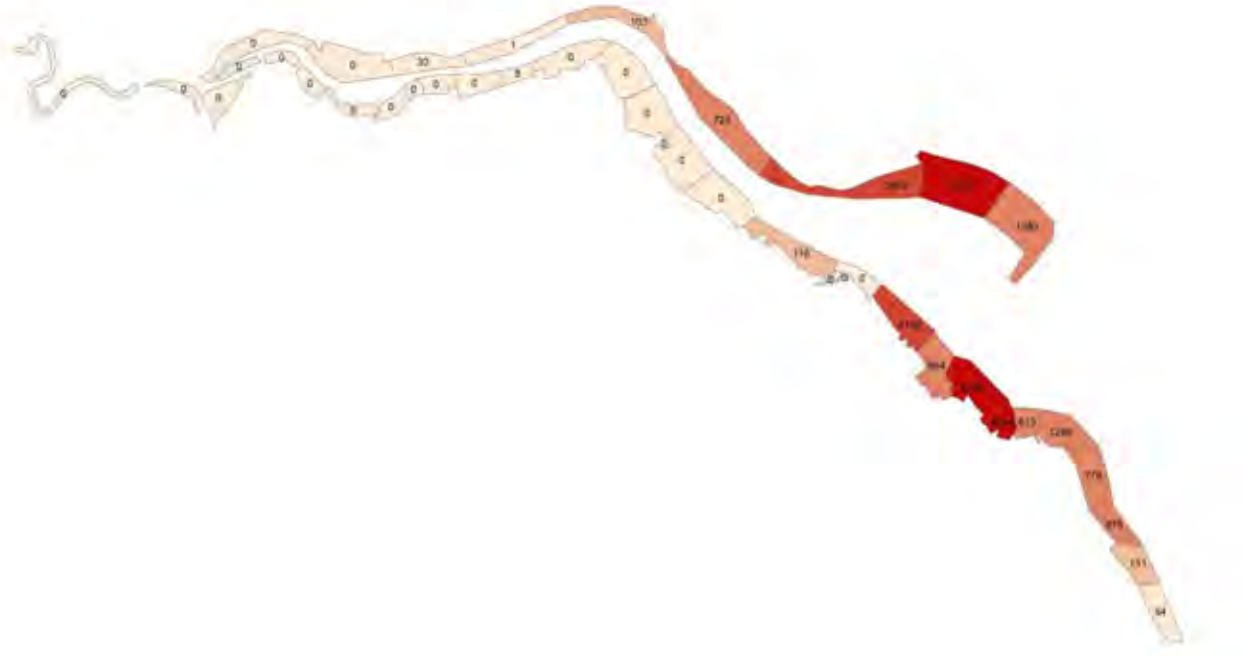

Figure B.SS: Sanderling

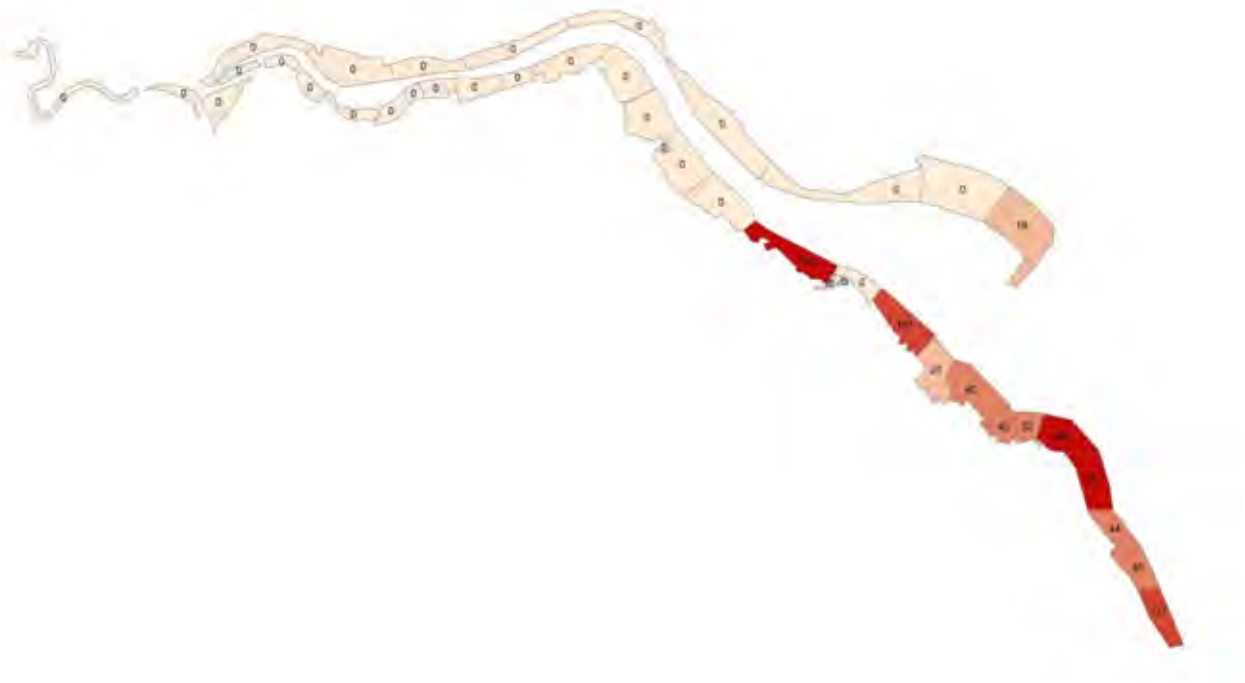

Figure B.DN: Dunlin

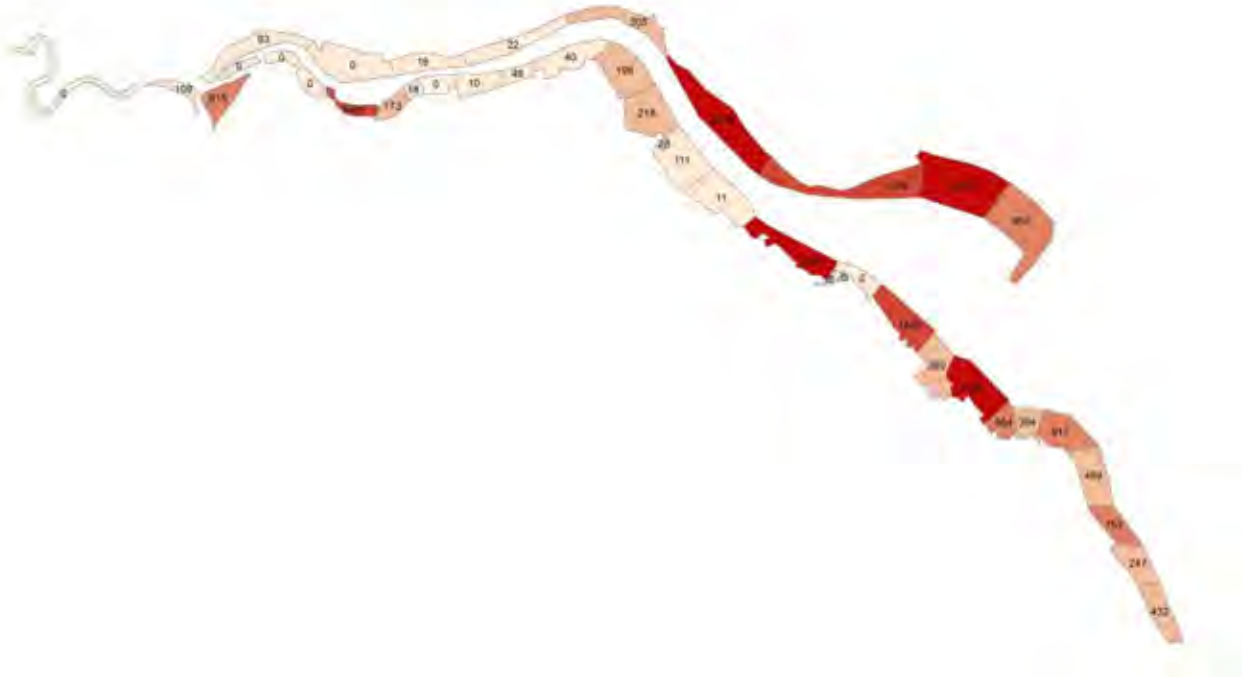

Figure B.RU: Ruff

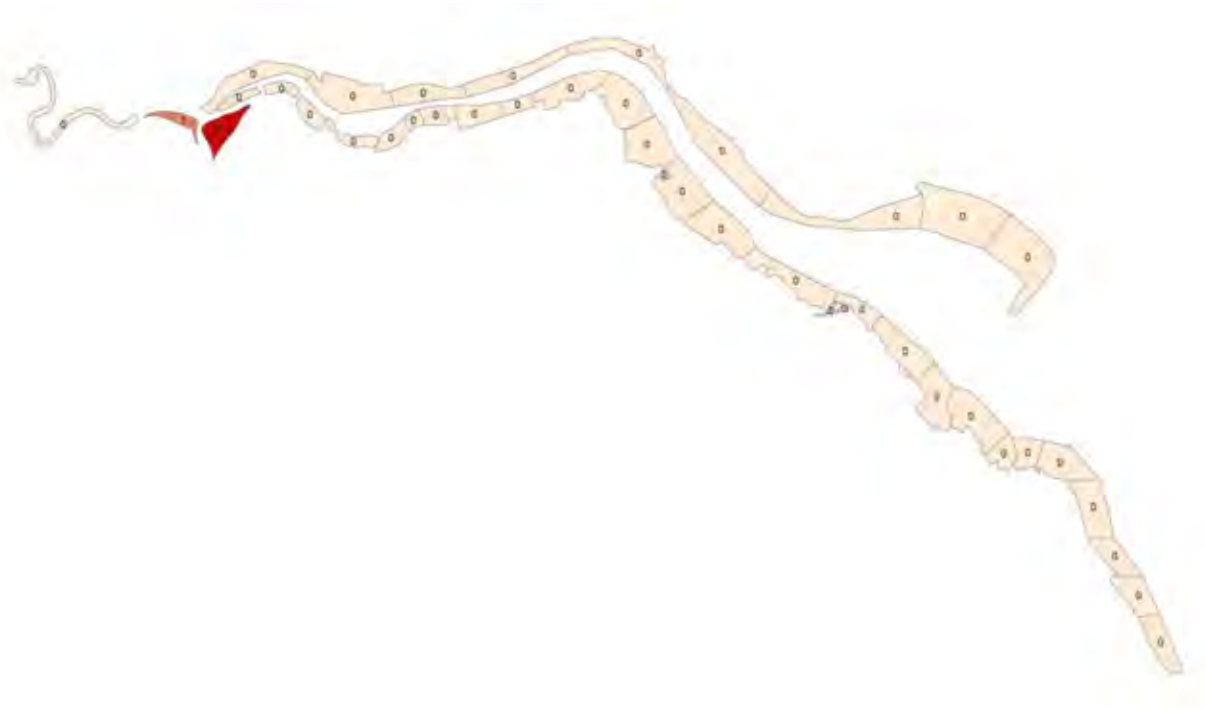

Figure B.BW: Black-tailed Godwit

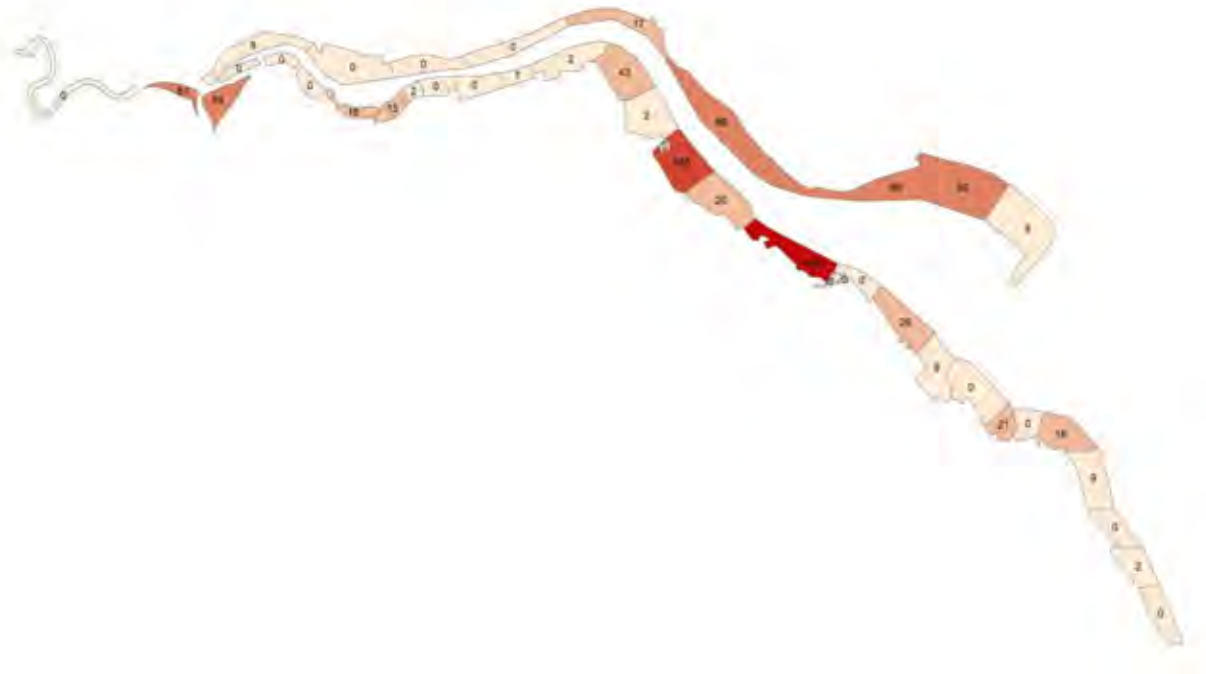

Figure B.BA: Bar-tailed Godwit

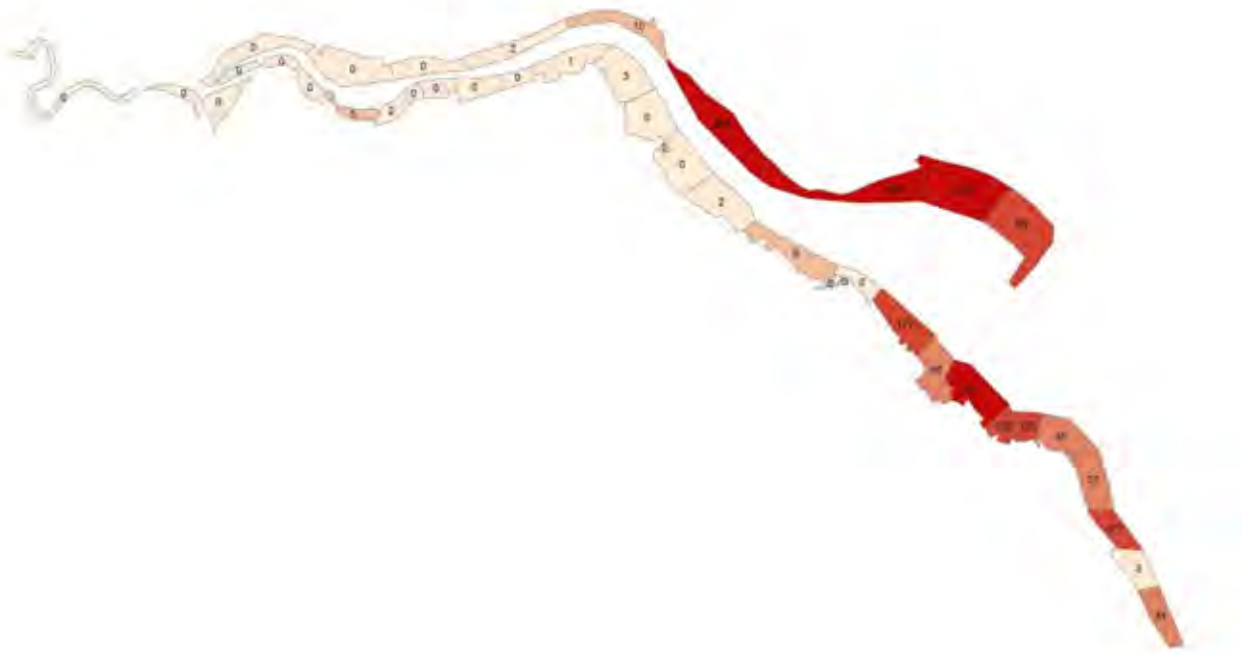

Figure B.WM: Whimbrel

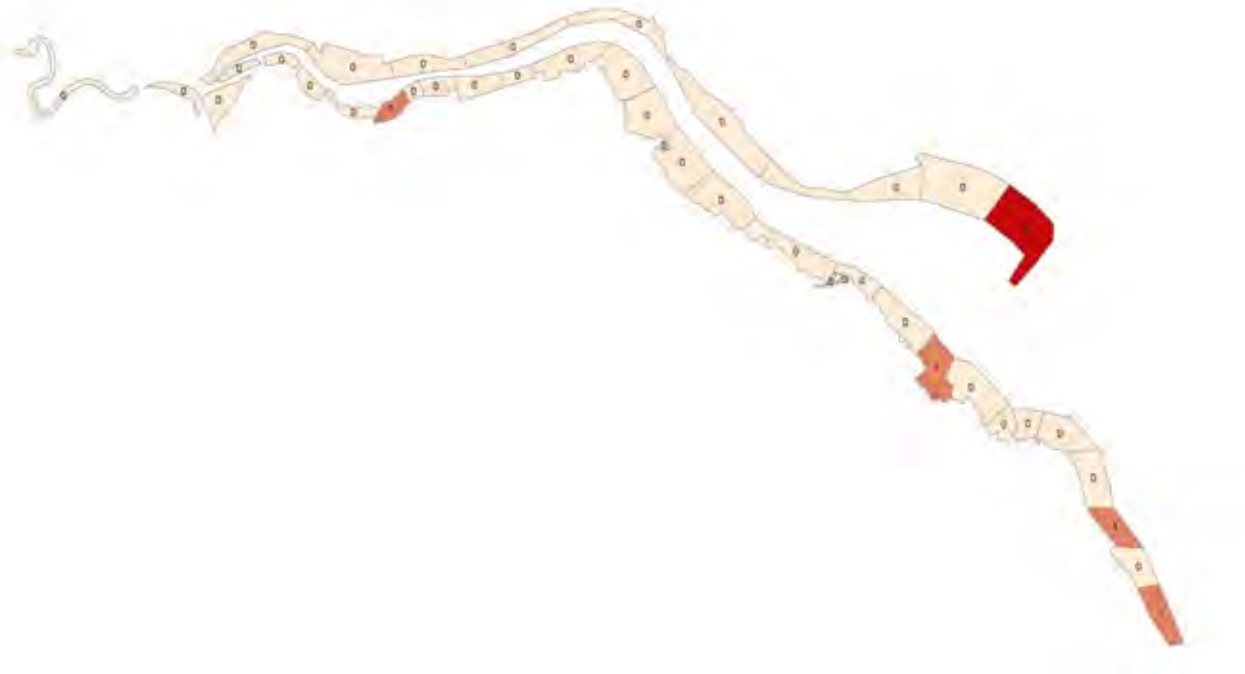

Figure B.CU: Curlew

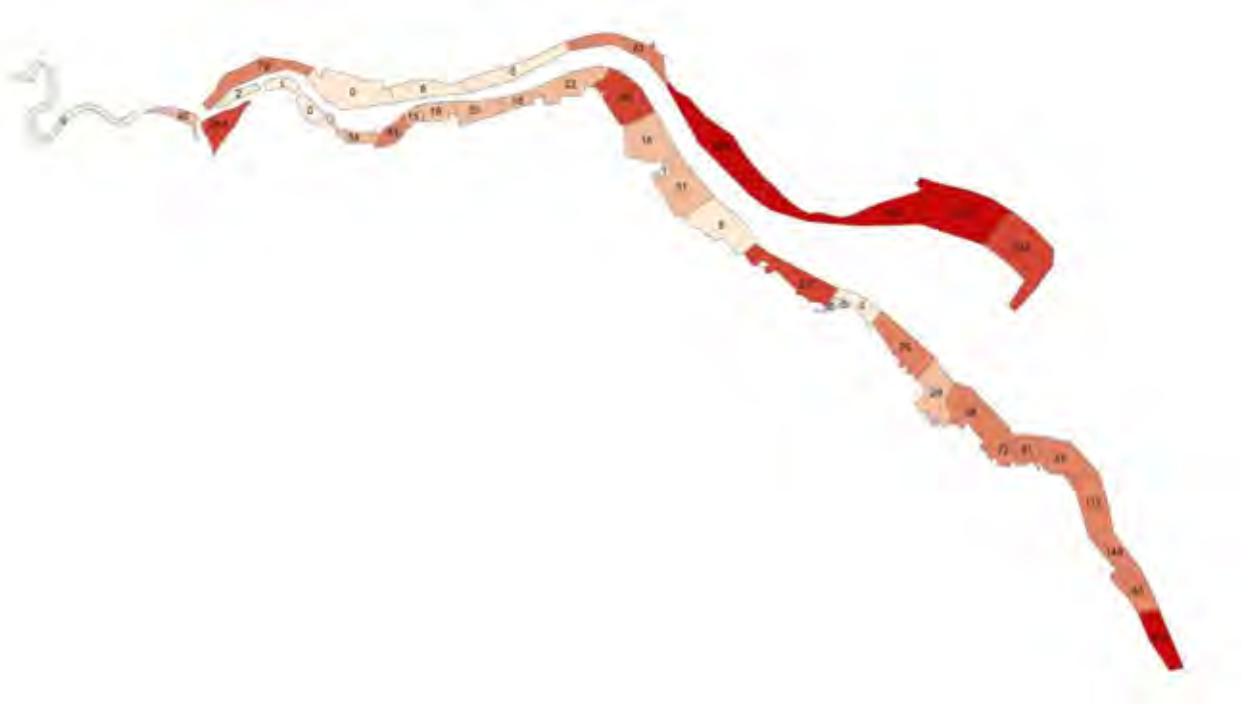

Figure B.GE: Green Sandpiper – map not produced due to insufficient observations (5-year mean of peaks is equal to zero on all sectors).

Figure B.GK: Greenshank

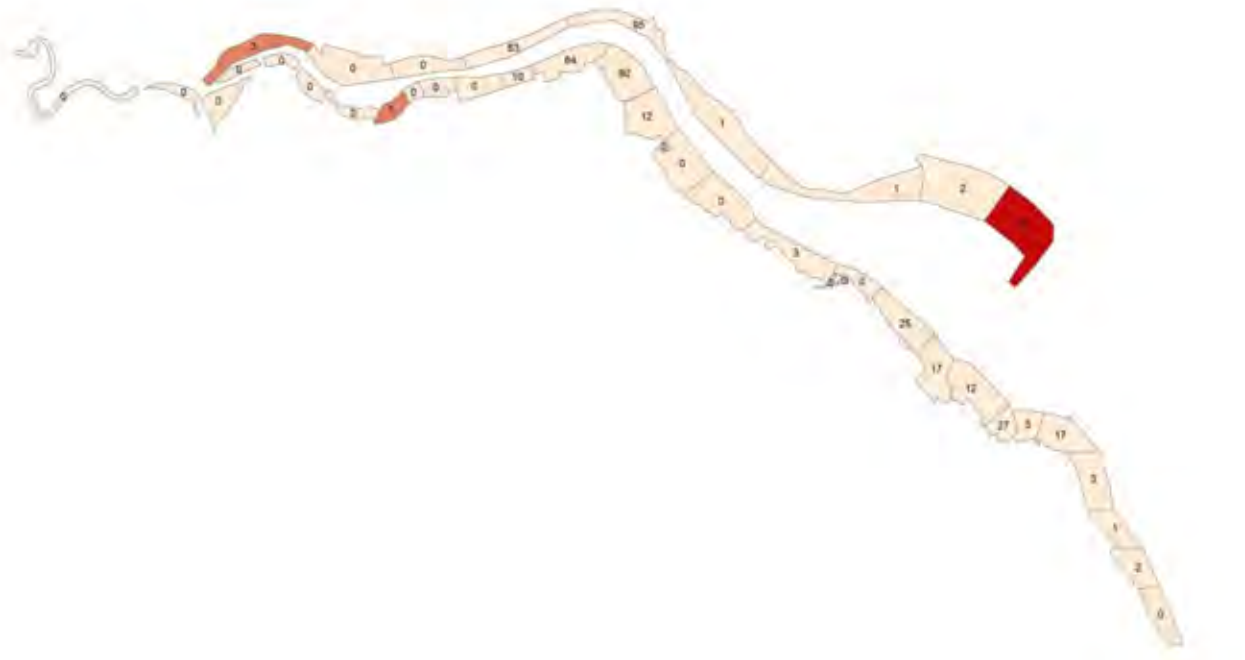

Figure B.RK: Redshank

Figure B.TT: Turnstone

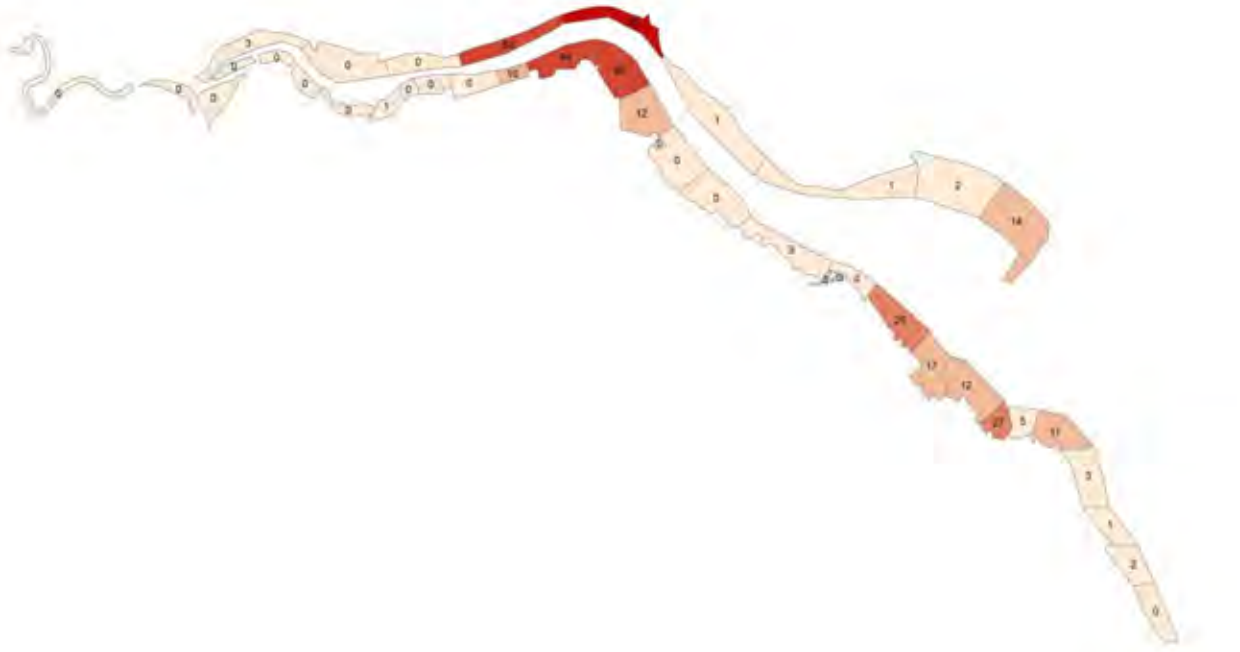

Image: Liz Cutting. Cover image: Edmund Fellowes

Analysis of Wetland Bird Survey (WeBS) data for the Humber Estuary SSSI, SAC, SPA and Ramsar site: third appraisal – sector-level trends to winter 2016/17

The Humber Estuary is a site of national and international importance for its wader and wildfowl populations, supporting approximately 134,000 waterbirds during the winter and passage periods (Frost et al. 2018). It has been designated as a Special Protection Area (the Humber Estuary SPA) for many waterbird species.

The Wetland Bird Survey (WeBS) is a long-running survey recording numbers of all waterbird species, monthly, on sites throughout the UK. This includes counts collected for some 40 count sectors which together cover the Humber Estuary. These data can be used to assess population trends in different parts of the Humber Estuary.

This study aimed to update the previous reports (Austin et al. 2008; Ross-Smith et al. 2013) that assessed population trends of waterbird species in different parts of the Humber Estuary, in order to identify areas where species were declining contrary to, or in excess of, the trend for the Humber Estuary as a whole and, furthermore, to identify sectors that support an increasing proportion of species that are declining across the Humber Estuary as a whole.

I.D. Woodward, N.A. Calbrade, & G.E. Austin (2018). Analysis of Wetland Bird Survey (WeBS) data for the Humber Estuary SSSI, SAC, SPA and Ramsar site: third appraisal – sector-level trends to winter 2016/17. BTO Research Report 709.

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