Avian Diversity, Vegetation Composition, and Vegetation Structure of the Las Vegas Wash: 2005 to 2009

Prepared for:

Las Vegas Wash Coordination Committee

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INTRODUCTION

The lower Las Vegas Wash (Wash) is located on the southeastern side of the Las Vegas Valley, flowing west to east through Las Vegas and Henderson, Nevada and terminating at Lake Mead. Historically, the Wash was an ephemeral stream, draining spring flows and periodic storm flows from the Las Vegas Valley to the Colorado River. The Wash drainage has since been modified by significant land use changes associated with urbanization and industrialization. The discharge of highly treated wastewater and urban runoff as a result of the valley's increasing population has turned the Wash into a perennial stream. These flows, which began with the initial discharge of treated wastewater in the1950s, created over 2,000 acres of wetlands by the 1970s. However, over subsequent decades, increasing stream flows from urban sources and large storm events resulted in significant channel head cutting beginning at Lake Mead and moving west up the Wash. The wetlands were eroded to less than 200 acres.

The Las Vegas Wash Coordination Committee (LVWCC), a multi-agency and citizen stakeholder group, was created in 1998 to stabilize and enhance the Wash. By 2000, the LVWCC had prepared the Las Vegas Wash Comprehensive Adaptive Management Plan (CAMP), which outlined a strategy for achieving this mission. This plan describes activities to be conducted to reduce head cutting in the Wash. These activities include constructing 22 erosion control structures perpendicular to the Wash channel. Nine control structures were in place by January 2006, 10 structures were in place by January 2007 and 2008, and 11 control structures were in place by January 2009. Significant sections of the channel are lined with riprap to stabilize the banks. As a result, stream flow is being distributed more evenly across the channel and at reduced velocities. Intensive revegetation plans were devised and are being executed by the Las Vegas Wash Project Coordination Team (Wash Team), the implementation arm of the LVWCC, to mitigate the impacts of erosion control construction.

Nearly 200 acres will need to be revegetated with native plants to mitigate the impacts of the stabilization program. Revegetation efforts, planned and implemented coincident with the placement of erosion control structures, are an ongoing effort. The Wash Team also conducts revegetation activities in association with grants, through which they are planting approximately 200 additional acres of wetland, riparian and upland habitat along the Wash.

Bank stabilization, channel modifications, and revegetation efforts in the Wash are directed towards stabilizing the channel and improving the ecological function of the waterway. These activities will also enhance wildlife and recreational resource values. Associated with these efforts is the need to define baseline wildlife resources and to monitor improvements to those resources through time. Together, baseline information and long-term monitoring are essential elements to determining the success of the stabilization and enhancement project. Additionally, the CAMP directs the Wash Team to develop a management plan for the wildlife of the Wash, including fish. Consequently, the Wash Team has conducted or directed others to conduct extensive monitoring of the biological resources along the Wash, including amphibian, bat, fish, reptile, and small mammal surveys, as well as an ongoing avian monitoring program, to establish baseline inventories. These baseline data were used to develop the "Las Vegas Wash Wildlife Management Plan" which was finalized in March 2008 and is being implemented.

As of 2004, avian monitoring in the Wash was limited to a modified area search bird census conducted at a single site, the Bostick Weir. Although this census presented a detailed picture of the avian community at that site, baseline information and long-term monitoring were still needed for the avian community along the length of the lower Wash. Such monitoring

would be necessary to provide data on how stabilization efforts were affecting birds along the entire project area. Additionally, it would provide greater opportunity to detect federally endangered or threatened species, such as the Southwestern Willow Flycatcher and Yuma Clapper Rail, for which annual surveys are also conducted.

Consequently, San Bernardino County Museum biologists (SBCM) were contracted by the Wash Team in 2005 to initiate avian and vegetative data collection at multiple sites along the lower Wash. The resulting data serve two purposes. First, the data define the baseline avian and habitat resources. Baseline conditions are reported in Braden et al. (2007, 2009). Second, the data sets enable future monitoring to evaluate changes in avian and habitat resources as the bank and channel stabilization and revegetation efforts proceed. This document reports on the four years of SBCM's involvement in monitoring change in avian habitats and avian diversity of the Wash from 12 February 2005 through 25 January 2009.

METHODS

Study Area **-** The linear study area covers approximately 8.7 kilometers of the Wash (Figure 1). Habitats in the study area are a complex mix of creosote dominated Mojave Desert upland scrub and wet linear desert riparian. Tamarisk (*Tamarix ramosissima*), an invasive, non-native species, occurs the length of the study area and is the dominant perennial. Common reed, (*Phragmites australis)*, also an invasive non-native species (in most areas), occurs extensively as well. Lesser amounts of native vegetation are also present. Conspicuous native vegetation includes but is not limited to Goodding Willow *(Salix gooddingii*), Sandbar (aka Narrow-leaved) Willow *(S. exigua*), Seep Willow (*Baccharis salicifolia*), Fremont Cottonwood (*Populus fremontii*), Honey Mesquite (*Prosopis glandulosa*), Screwbean Mesquite (*P. pubescens*), Arrowweed (*Pluchea sericea*), Cattail (*Typha domingensis*), Bulrush (*Schoenoplectus spp.*), Saltgrass (*Distichlis spicata*), and native forbs. While most native broadleaf perennials are still largely restricted to revegetation sites, Goodding Willow, Seep Willow, Fremont Cottonwood and Arrowweed are dispersing along banks, sandbars, and weir faces downstream of these sites.

While habitat disturbances in the form of dirt roads, illegal trash dumping, and homeless encampments were found throughout the study area in 2005, they were largely eliminated by 2007. Temporary habitat clearings associated with channel stabilization projects and revegetation plots, are also increasingly common along the length of the study area.

Avian Data Collection **-** Avian data were collected using a standard five-minute point-count methodology (Ralph and Scott 1981, PSW 1995, Braden 1997). Censuses consisted of five-minute counts of all birds seen or heard within a 100 m radius of each census point. There were 29 census points spread strategically along the Wash (Figure 1, Appendix 1). Three points were added by the end of year two for a total of 32 census points. However, one point was lost due to private property access issues, reducing the total to 31. Census points were placed at locations where erosion control structures were already in place, at locations where erosion control structures are planned for future years, at revegetation locations, and locations with as yet undisturbed vegetation, usually tamarisk dominated. In short, census points were distributed to capture the present and anticipated habitats associated with present and planned channel modifications and revegetation efforts.

Censuses were conducted from sunrise to 10:00 AM PST and were coincident with the dawn chorus. The census points were censused on average every two weeks. One census of the 31 census points required two consecutive days to sample all points, hereafter referred to as a census event. The observers conducted 26 census events each year yielding a total of 104 census events from 12 February 2005 through 25 January 2009. The order in which the census points were sampled was rotated between census events to minimize temporal and spatial autocorrelation. The majority of the census events were limited to one of two alternate observers to minimize observer bias. A third observer was temporarily added to the rotation from 14 June 2008 to 9 December 2008. All observers had a minimum of 10 to 14 years experience identifying southwestern avian species by sight and sound, previous experience with the census methodology, and were familiar with the study area.

Avian Analyses - Avian analyses are focused on describing and comparing avian community diversity, the abundance of individual species, and the spatial distribution (frequency) of bird diversity in the Wash over the course of the study. The avian data span four years, a sufficient amount of time to establish trends in the overall avian community, species specific abundances and species specific frequencies. Trends were first analyzed by regression analyses. Trends should be cautiously interpreted. Trends are parsimoniously a consequence of vegetative changes in the Wash attributable to tamarisk removal, revegetation, placement of control structures and channel modifications. However, trends can also result from annual variation in migration patterns, normal population fluctuations and long-term climatological events.

Repeated Measures Analysis of Variance (RMANOVA) were used to examine significant trends in the avian community, species specific abundances and species specific frequencies identified by regression analyses. The Holm-Sidak multiple comparison test was used to identify where significant annual differences occurred. Concordance between regression and RMANOVA analyses are a conservative yet robust confirmation of any changes or lack thereof in the avian community, species specific abundances and species specific frequencies detected by regression analyses.

Additionally, only 28 of the 31 census points had continuous data for the entire four years of the study. Thus, inferential avian analyses are necessarily confined to data from those 28 points.

Avian community diversity - Avian community diversity was defined as the number of species (richness) and the number of birds (abundance) detected at census points in the Wash over the course of the study. The number of species was calculated as the number of species detected per census event. The number of individuals was calculated as the total number of unique individuals detected per census event.

Avian community diversity was partitioned into overall (annual), breeding and non-breeding seasons. Overall avian diversity was defined by the avian community diversity (abundance and richness) between 9 February and 29 January of successive years (these dates represent the earliest and latest dates upon which a study year began and ended over the course of the four years). The breeding season was somewhat arbitrarily defined as the period from 15 March through 31 August of each year. The breeding season as defined does include some migrant species that migrate through the Wash but are not known to breed in the Wash. The non-breeding season was defined as the period from 1 October through 29 January of successive years (29 January is the latest date upon which a census was conducted in January prior to the

beginning of the next study year). The non-breeding season was conservatively defined based on the time of year when over-wintering birds would most likely be present and resident birds would likely not be breeding. February and the first two weeks of March were not included in either the breeding or non-breeding seasons because breeding resident species coincident with over-wintering migrant species confounded any seasonal definition. September was not included in the seasonal analyses because resident birds, such as Verdin, Black-tailed Gnatcatcher, and Abert's Towhee, to mention a few, can have extended breeding periods, which overlap non-breeding periods of the migratory species.

Species-specific abundance analyses – Analyses (regression and RMANOVA) were restricted to those species with sufficient sample sizes for meaningful examinations. Individual species abundances were calculated as the sum of the maximum number of individuals of that species detected at each of the 28 census points for the given period (e.g. overall, breeding, and non-breeding periods). Sample sizes varied depending on status (migratory versus resident), variations in arrival/departure date of migratory species, and detectability. Descriptive statistics (absolute and relative abundances by year and season) for all species detected at the census points, regardless of significance, are reported in Appendix I.

Species-specific frequency analyses – Individual species frequencies were calculated as the number of 28 sample points where a specific species was detected for each census event. Sample sizes varied depending on status (migratory versus resident), variations in arrival/departure date of migratory species, and detectability. Friedman RMANOVA was used due to the non-parametric nature of the data. Likewise, Tukey Test instead of Holm-Sidak was used to determine where significant annual differences occurred. Analyses were restricted to those species with sufficient sample sizes for meaningful examinations. Descriptive statistics (absolute and relative frequencies by year and season) for all species detected at the census points, regardless of significance, are reported in Appendix II.

Data analyses considerations - The standard point-count methodology calls for excluding birds that fly over or are > 100 m from a census point. The rationale for these exclusions is to reduce the possibility of double-counting birds at the census point or birds that may occur at two or more census points per census event and, to reduce detection biases. The methodology is justified in that errors in abundance, occurrence, and frequency are controlled or at least minimized to the maximum extent possible, an important consideration for accurate inferential comparisons or trends analyses. The disadvantage of this conservative approach is that some predominately aerial species, such as swallows, swifts, ducks and raptors can be undercounted. The purpose of the study was to monitor and analyze potential avian community changes coincident with hydrologic and vegetative modifications in the Wash and to establish quantitative data sets suitable for inferential comparisons and long-term monitoring in the future. Thus, the conservative approach is warranted.

Vegetation Data Collection - Vegetation (habitat) data were collected at the census points in the fall of each year from 2005 through 2008, first to quantify baseline conditions in year one of the study and thence to quantify habitat changes coincident with channel modifications, placement of control structures, tamarisk removal and revegetation efforts. Annual vegetation data collection was designed to quantify habitat characteristics that are known to or suspected of

influencing bird diversity. More specifically, perennial species composition, perennial height, physiognomic cover types, the distribution of perennial structure in vertical space, and the heterogeneity (patchiness) of perennial structure in horizontal space can reasonably be expected to influence bird species diversity. Additionally, habitat data were collected to quantify the proportional contributions of native perennial (broadleaf) and tamarisk to perennial height and structure coincident with channel modifications, placement of control structures, tamarisk removal and revegetation efforts.

Vegetation data were collected at each census point using six 20 m transects. Three transects were arrayed in a radial pattern at 120^0 angles, initiating 20 m distant from the census point. The remaining three transects were appended 20 m past the distal ends of the first three transects for a total of six transects per census point. Perennial and annual species occurrences, perennial height, and vertical perennial structure were recorded at 2 m intervals along each 20 m transect, for a total of 60 sample points per census point. Perennial height was measured to within 0.1 m using a 9.5 m survey rod. Perennial height accuracy was limited to 0.5 m when perennial height exceeded 9.5 m, an infrequent occurrence. Perennial structure was measured as the number of vegetation contacts (hereafter referred to as hits) at 1 m vertical intervals along each of the 60 survey rods (sample points) per census point.

Vegetation Analyses - Habitat data were analyzed by a combination of RMANOVA and regression techniques. Perennial composition and cover, physiognomy, vertical and horizontal structure and habitat heterogeneity were analyzed by RMANOVA. Holm-Sidak multiple comparison tests were applied when RMANOVA were significant. Regression analyses were used to examine the proportional height and structural composition of native broadleaf and tamarisk.

Perennial cover at each census point was expressed as the number of sampling stations out of 60 per census point where a specific tree species occurred. Data were analyzed by RMANOVA for differences within tree species among the four years of data using the census point as the sample unit. Data were graphed as percentages for visual comparisons.

Perennial height at each census point was expressed as the average perennial height at 60 sample stations per census point. Distinctions were made between native or non-native perennials. Data were analyzed by RMANOVA for differences among the four years of data using the census point as the sample unit.

Physiognomic cover types were used to describe the physiognomy of the Wash. Cover types consisted of trees, shrubs, forbs, grasses, and cattails. Cover types were expressed as the number of times a cover type occurred at 60 sample stations per census point. Data were analyzed by RMANOVA for differences within cover types for the four years of data using the census point as the sample unit. Data were graphed as percentages for visual comparisons.

Vertical perennial structure was calculated by summing the number of rod hits at the 60 sample stations per census point in 2 meter foliage height class intervals, beginning with the 0 - 2 meter foliage height class and ending with the 8 - 10 meter height class, a total of five height classes. Data were analyzed by RMANOVA for differences among years within individual and overall height classes using the census point as the sample unit.

Horizontal perennial structural heterogeneity was assessed using the proportional diversity formula $1/\sum p_i^2$ (Hill 1973) where p_i is the proportion of perennial rod hits at each of six transects per census point. The result is a value from one to six for each census point. Proportional distribution values increase as the distribution of perennial structure becomes more

evenly distributed in horizontal space. Horizontal heterogeneity data were analyzed by RMANOVA for differences among years using the census point as the sample unit.

Relative contributions of non-native and native perennial species to the composition and structure of habitats in the Wash were assessed by regressing mean perennial height and total rod hits against native broadleaf and tamarisk cover using the census point as the sample unit. Perennial height and perennial structure were calculated as previously described. Results were graphed as percentages of native and tamarisk cover for visual comparisons. The linear relationship is an expression of the contribution of native broadleaf and tamarisk tree species to the perennial height and structure of the Wash. The correlation coefficients are indicators of the strength of those contributions. Changes in the slopes of the regressions are indicators of how the relative contributions of tamarisk and native perennial tree species towards height and structure changed over the course of the study. The purpose for these comparisons is to track changes in the relative contribution of native versus non-native tree species to perennial height and structure as control structure placements, tamarisk clearing and revegetation efforts proceed over the course of the study.

RESULTS

Avian Analyses

Avian community diversity – Regression results of avian richness are graphed in Figure 2. RMANOVA results of avian richness are presented in Table 1. Neither regression nor RMANOVA found either a significant trend or annual differences, respectively, in species richness. Likewise, neither breeding and non-breeding regressions nor seasonal RMANOVA indicated significant trends or annual differences in seasonal species richness. The number of species by census event averaged 32.4 species (std = 4.8, n = 104) annually. The average number of species by census event during the breeding season averaged 33.5 species (std = 4.7, n = 48) annually. The average number of species by census event during the non-breeding season averaged 30.8 species (std = 4.1, n = 36) annually. Results indicate species richness in the Wash did not change significantly over the course of the study.

Regression results of avian abundances are graphed in Figure 2. RMANOVA results of avian abundances are presented in Table 1. Regression results indicate a small but significant positive trend in overall bird abundance over the course of the study. However, RMANOVA found no significant differences in overall abundances per census event among the four years. Regression and RMANOVA results for breeding and non-breeding season avian abundances were not significant. Overall, the average bird abundance by census event averaged 291.2 individuals (std = 77.4, n = 104) annually. Bird abundance by census event during the breeding season averaged 297.0 individuals (std = 71.8, n = 48) annually. And, bird abundance by census event during the non-breeding season averaged 299.7 individuals (std = 80.5, n = 36) annually.

Results indicate a small but significant positive trend towards increasing overall avian abundance in the Wash over the four years of this study. However, the positive trend in overall bird abundance was either too small or too variable to be detected annually or during the breeding and non-breeding seasons.

Species-specific abundances – Of 152 species detected over the course of the study, 61 had sample sizes sufficient for meaningful inspection. Regressions of species-specific abundances

over the course of the study for the 61 species are plotted in Figures 3 through 10. Of the 61 species, 18 had significant trends in abundance.

Regression results found 13 of 18 species had significant positive trends in abundance. These species consisted of American Pipit, Common Yellowthroat, Great-tailed Grackle, Marsh Wren, Northern Flicker, Northern Rough-winged Swallow, Orange-crowned Warbler, Spotted Towhee, Verdin, Western Kingbird, White-crowned Sparrow, Yellow-rumped Warbler and Yellow Warbler. Regression results found that 5 of 18 species had significant negative trends in abundance. These species consisted of Abert's Towhee, Belted Kingfisher, Lucy's Warbler, Mourning Dove and Song Sparrow. Correlation coefficients (R^2 values) were low in all cases largely because normal population fluctuations, seasonality, variable detection probabilities, and variations in annual migration patterns were not accounted for. Thus, correlation coefficients are underestimates and should be viewed as minimum values.

RMANOVA results for the 18 species with significant regression trends in abundance are reported in Table 2. RMANOVA failed to detect significant differences in abundance for Northern Flicker, Northern Rough-winged Swallow, Spotted Towhee or White-crowned Sparrow even though regression analyses indicated significant positive trends in abundance. RMANOVA results were significant for Mourning Dove, but multiple comparisons could not identify the year(s) in which those differences occurred, even though regression results found a significant negative trend in abundance in abundance for this species.

Overall, species abundance analyses indicate the abundance of American Pipit, Common Yellowthroat, Great-tailed Grackle, Marsh Wren, Orange-crowned Warbler, Verdin, Western Kingbird, Yellow-rumped Warbler and Yellow Warbler have significantly increased over the four years of the study. Abundances of Northern Flicker, Northern Rough-winged Swallow, Spotted Towhee and White-crowned Sparrow may also be increasing. Abundances of Abert's Towhee, Belted Kingfisher, Lucy's Warbler, and Song Sparrow have significantly decreased. And, Mourning Dove may also be decreasing.

Species-specific frequencies - Of the 61 species with sufficient sample sizes for meaningful inspection, regression analysis of species-specific frequencies found significant trends for 21 species (Figures 11 through 18). Fourteen species had positive trends in frequency. American Coot, American Pipit, Common Yellowthroat, Gadwall, Great-tailed Grackle, Mallard, Marsh Wren, Northern Flicker, Northern Rough-winged Swallow, Red-winged Blackbird, Spotted Towhee, White-crowned Sparrow, Yellow-rumped Warbler and Yellow Warbler were significantly increasing in frequency. Seven species had significant negative trends in frequency. Abert's Towhee, Belted Kingfisher, Bewick's Wren, Killdeer, Lucy's Warbler, Song Sparrow and Virginia Rail were significantly decreasing in frequency.

Correlation coefficients (R^2 values) were again low in all cases largely because normal population fluctuations, seasonality, variable detection probabilities and variations in annual migration patterns were not accounted for. Thus, correlation coefficients are underestimates and should be viewed as minimum values.

Friedman RMANOVA results for the 21 species with significant frequency regression trends are reported in Table 3. Friedman RMANOVA failed to detect significant among year frequency differences for 7 of 14 species with significant increasing regression frequency trends. These species consisted of American Pipit, Common Yellowthroat, Gadwall, Northern Flicker, Northern Rough-winged Swallow, Spotted Towhee and White-crowned Sparrow. Conversely, Friedman RMANOVA failed to detect significant among year frequency differences for 3 of 7

species found to have significant decreasing frequency trends by regression analyses. These species consisted of Belted Kingfisher, Lucy's Warbler and Virginia Rail.

Overall, species frequency analyses indicate the frequency of American Coot, Great-tailed Grackle, Mallard, Marsh Wren, Red-winged Blackbird, Yellow-rumped Warbler and Yellow Warbler significantly increased over the four years of study. The frequencies of American Pipit, Common Yellowthroat, Gadwall, Northern Flicker, Northern Rough-winged Swallow, Spotted Towhee and White-crowned Sparrow may also be increasing. Frequencies of Abert's Towhee, Bewick's Wren, Killdeer and Song Sparrow significantly decreased in frequency over the four years of study. Belted Kingfisher, Lucy's Warbler and Virginia Rail frequencies may also be decreasing.

Vegetation Analyses

Vegetation composition and structure – Comparisons of changes in perennial tree cover over the course of the study are plotted in Figure 19. There were no significant changes among the four years of the study in overall tree cover ($F = 2.312$, $P = 0.081$, d.f. = 3, 27, 111), Cottonwood cover ($F = 1.454$, $P = 0.233$, d.f. = 3, 27, 111), Goodding Willow cover ($F = 0.504$, $P = 0.681$, d.f. = 3, 27, 111), Sandbar Willow cover ($F = 2.680$, $P = 0.052$, d.f. = 3, 27, 111), or Mesquite cover ($F = 1.059$, $P = 0.371$, d.f. = 3, 27, 111). There were significant increases in native riparian cover ($F = 3.438$, $P = 0.021$, d.f. = 3, 27, 111) when Cottonwood, Goodding Willow, and Sandbar Willow cover were combined. There was a significant decrease in tamarisk cover ($F = 4.773$ $P = 0.004$, d.f. = 3, 27, 111). Results indicate a significant reduction in tamarisk cover and a significant increase in combined native riparian cover over the course of the study.

Comparisons of perennial height are graphed in Figure 20. RMANOVA found no significant differences in perennial height ($F = 0.057$, $P = 0.982$, d.f. = 3, 27, 111). Results indicate there has been no significant change in perennial height in the Wash over the course of the study.

Comparisons of physiognomic cover types are plotted in Figure 21. RMANOVA found no significant changes in the tree ($F = 2.312$, $P = 0.081$, d.f. = 3, 27, 111), shrub ($F = 0.936$, $P = 0.427$, d.f. = 3, 27, 111) or cattail ($F = 1.340$, $P = 0.267$, d.f. = 3, 27, 111) cover types. RMANOVA did find a significant decrease in the forb ($F = 4.312$, $P = 0.006$, d.f. = 3, 27, 111) and grass ($F = 5.849$, $P = 0.001$, d.f. = 3, 27, 111) cover types. Results indicate forbs and grasses have declined over the course of the study while the tree, shrub and cattail cover types have remained constant.

Comparisons of vertical perennial structure over the course of the study are plotted in Figure 22. RMANOVA found no significant changes in total vertical structure ($F = 2.571$, $P = 0.060$, d.f. = 3, 27, 111). Likewise, RMANOVA found no significant changes in the 0-2 meter height class ($F = 1.833$, $P = 0.148$, d.f. = 3, 27, 111), 2-4 meter height class ($F = 2.307$, $P = 0.083$, d.f. = 3, 27, 111), 6-8 meter height class ($F = 1.318$, $P = 0.274$, d.f. = 3, 27, 111), or the 8-10 meter height class ($F = 0.945$, $P = 0.423$, d.f. = 3, 27, 111). RMANOVA did detect a significant difference, a decrease, in the 4-6 meter height class ($F = 2.921$, $P = 0.039$, d.f. = 3, 27, 111), but Holm-Sidak multiple comparisons could not resolve the year(s) in which those differences occurred. Results indicate that for the most part, vertical perennial structure has been stable over the course of the study, and any significant changes are associated with the 4-6 meter height class.

Comparisons of horizontal perennial heterogeneity (structure) are graphed in Figure 23. RMANOVA found no significant differences in horizontal perennial heterogeneity ($F = 0.851$, P

= 0.470, d.f. = 3, 27, 111). Results indicate there has been no significant change in horizontal perennial heterogeneity in the Wash over the course of the study.

Regressions of the proportions of native broadleaf and tamarisk cover accounting for overall perennial height are graphed in Figure 24. Regression slopes of native broadleaf perennials as a percentage of perennial height have progressively increased over the course of the study from a negative non-significant slope in 2005 to a positive significant slope in 2008. Regression slopes of tamarisk as a percentage of perennial height have progressively decreased from a positive significant slope in 2005 to a positive significant but declining slope in 2008. Results indicate the proportional contribution of native broadleaf perennials to perennial height increased while the proportional contribution of tamarisk to perennial height decreased over the course of the study.

Regression of the proportional contribution of native broadleaf and tamarisk attributable to perennial structure are graphed in Figure 25. The proportion of perennial structure attributable to native broadleaf perennials progressively increased over the course of the study from a negative non-significant slope in 2005 to a positive, though still non-significant, slope in 2008. The proportion of perennial structure attributable to tamarisk has progressively decreased from a positive significant slope in 2005 to a still positive significant but declining slope in 2008. Results indicate that tamarisk accounted for a significant proportion of the perennial structure in the Wash over the course of the study. Equally important, results indicate the proportional contribution of tamarisk to perennial structure was declining and the proportional contribution of native broadleaf perennials was increasing over the course of the study.

DISCUSSION

Avian community diversity – Changes in avian community diversity over the course of the study were subtle, but positive. Species richness did not change but species abundance increased slowly. The subtle changes in the avian community are likely attributable to a combination of two main factors. First, revegetation efforts likely played a major role in maintaining avian diversity over the course of the study. Revegetation occurred in three major classes; riparian natives, desert uplands, and riparian/upland transitions. The diversity of revegetation habitat classes can reasonably be expected to accommodate a variety of avian species' life histories, thus maintaining avian diversity in the Wash. Second the maturation of habitat classes proceeded at differential time scales. Tamarisk removal, revegetation, channel modifications and placement of control structures were spread out over the four years of the study. The result was a series of habitat types of varying ages that served to maintain the habitat requirements of a diverse avian community. Simply put, there was always some appropriate habitat somewhere in the Wash to maintain diversity.

Regardless of the causative factors, the lack of significant negative changes in the avian community and the small but significant increases in avian abundance over the course of the study indicate that activities in the Wash (tamarisk control, revegetation, placement of control structures and channel modifications) did not harm but rather benefited the avian community over the course of the study.

Species-specific abundances and frequencies – Although changes in the overall avian community were subtle, changes in abundance and frequency of individual species were not.

Concordance between regression and RMANOVA analyses provide strong evidence that species increasing in abundance in the Wash outnumbered species decreasing in abundance by a 9 to 4 ratio. Nine species; American Pipit, Common Yellowthroat, Great-tailed Grackle, Marsh Wren, Orange-crowned Warbler, Verdin, Western Kingbird, Yellow-rumped Warbler and Yellow Warbler convincingly increased in abundance. Four species; Abert's Towhee, Belted Kingfisher, Lucy's Warbler, and Song Sparrow convincingly decreased in abundance. A less conservative interpretation of the data (regression analyses alone) suggests the number of species increasing in abundances may have outnumbered the number of species decreasing in abundance by a 13 to 5 ratio.

Likewise, concordance of regression and RMANOVA provide strong evidence that species increasing in frequency in the Wash outnumbered species decreasing in frequency by a 7 to 4 ratio. Seven species; American Coot, Great-tailed Grackle, Mallard, Marsh Wren, Red-winged Blackbird, Yellow-rumped Warbler and Yellow Warbler increased in frequency. Three species; Abert's Towhee, Bewick's Wren, Killdeer and Song Sparrow decreased in frequency. The less conservative interpretation of the data (regression analyses alone) suggests the number of species increasing in frequency may have outnumber the number of species decreasing in frequency by a 2 to 1 ratio.

Regardless of the approach, conservative versus liberal, the number of species that increased in abundance and frequency over the course of the study were greater than the number of species that decreased in abundance and frequency. In short, habitat changes in the Wash associated with tamarisk removal, revegetation, control structure placements and channel modifications have benefited more species than have been harmed.

Commonalities in species life histories that increased or decreased in abundance or frequency are vague and difficult to disentangle. Increased native riparian habitats may be benefiting Yellow Warbler. Tamarisk removal may be increasing winter foraging habitat for American Pipit. Desertification of upland habitats following bank stabilization and upland desert revegetation maturation may be increasing Verdin habitat. Volunteer native riparian and cattail recruitment associated with control structure placements and bank stabilizations may be stabilizing Marsh Wren and Common Yellowthroat breeding habitat. Conversely, bank stabilization may be displacing Belted Kingfisher nesting cavities. Tamarisk removal may be eliminating Lucy's Warbler and Mourning Dove nesting sites. Tamarisk removal may be reducing Abert's Towhee habitat while promoting more open Spotted Towhee habitat. Tamarisk removal may be decreasing winter foraging habitat for Song Sparrow. There are many unanswered species specific questions that are beyond the scope of the present study. However, it is important to note that the intensity and frequency of data collection were in fact designed to examine such questions in future analyses.

Vegetation composition and structure – Habitat characteristics known or suspected of influencing bird diversity, specifically perennial composition, perennial height, physiognomic cover types, the distribution of perennial structure in vertical space, and the heterogeneity (patchiness) of perennial structure in horizontal space have remained relatively stable, with two exceptions. First and foremost, perennial species composition in the Wash changed. Tamarisk became less dominant. Native broadleaf perennial species increased in dominance. The dominance transformation is likely attributable to revegetation efforts and voluntary native perennial recruitment at the control structures and along bank stabilization. Regardless of the proximal causes, activities in the Wash (tamarisk control, revegetation, placement of control

structures and channel modifications) are ultimately resulting in a slow transformation of Wash habitats from tamarisk to native dominated habitats.

Tamarisk did however dominate Wash habitats over the course of the study. But, tamarisk declined significantly in cover (Figure 19), proportional height (Figure 24) and proportional structure (Figure 25). During the same period, native riparian significantly increased in cover (Figure 19) and proportional height (Figure 24). Additionally, there was an increasingly positive, though not significant trend, in the proportion of perennial structure attributable to native broadleaf perennials.

Secondary to changes in perennial dominance, significant changes also occurred in physiognomic cover types. Specifically, forb and grass cover types declined after the first year of study, but remained stable thereafter. The reason(s) for the decline in these cover types are not clear and may or may not be related to tamarisk control, revegetation, placement of control structures and channel modifications. The pattern of decline, high the first year then lower but stable thereafter, suggests forbs and grasses may have been high when the study began due to cyclic annual rainfall and thus, unrelated to tamarisk control, revegetation, control structure placements or channel modifications. On the other hand, a reasonable argument can be made that activities in the Wash altered microhabitat features that promote forbs and grasses. Neither possibility can be assessed with the data from this study.

The transformation from tamarisk to native dominated habitats had surprisingly little effect on other habitat characteristics. Overall tree cover (Figure 19), mean perennial height (Figure 20) and horizontal structure (heterogeneity) (Figure 23) did not change significantly over the course of the study. For the most part vertical perennial structure did not change, the exception being a small but significant reduction in the 4-6 m height class.

The lack, for the most part, of significant habitat changes during the transition from tamarisk to native habitat dominance is likely attributable to the scheduling of tamarisk removal, revegetation, control structure placements and channel modifications. Modifications to Wash habitats did not occur all at once, but rather in a gradual progression over the years. The slow but steady progression likely allowed for minimal changes in overall habitat features thought to influence bird species diversity. Habitat losses from tamarisk removal, channel modifications and control structure placements were staggered. Revegetation plots matured at differential intervals. Volunteer habitats following control structure placements and channel modifications varied in maturity coincident with the temporal variation in the placement of the control structures. The ultimate result, aside from changes in tamarisk versus native habitat dominance, was little to no change in other habitat characteristics.

SUMMARY

Avian Diversity:

1) Species richness was constant.

2) Species abundance increased.

Species specific abundances and frequencies:

1) Species significantly increasing in abundance outnumbered the species significantly decreasing in abundance by a 9 to 4 ratio.

2) Species significantly increasing in frequency outnumbered the species significantly decreasing in frequency by a 7 to 4 ratio.

Habitat:
1) Tamarisk significantly declined in cover. Native broadleaf riparian significantly increased in cover, but does not yet dominate the Wash.

2) Native broadleaf height significantly increased. Tamarisk height decreased but is still significant and dominant.

3) The proportional contribution of native broadleaf to vertical perennial structure increased, but is not yet significant. The proportional contribution of tamarisk to perennial structure is decreasing, but is still significant.

4) Vertical perennial structure declined significantly for the 4-6 m height classes. All other height classes were constant.

5) Horizontal perennial structure and overall mean perennial height were constant.

6) The grass and forb physiognomic cover classes declined significantly. All other cover types were constant.

RECOMMENDATIONS

1) Continue bi-weekly avian monitoring. Changes in the avian community and species specific abundances and frequencies are occurring in the Wash. Changes are parsimoniously attributable to habitat changes in the Wash from tamarisk removal, revegetation, control structure placements and bank stabilization. Habitat changes and their effects on the avian community and individual species are poorly understood. Information obtained is directly applicable to local and regional conservation, as well as the general body of scientific knowledge.

2) Continue tamarisk removal and revegetation projects. Tamarisk removal projects are common throughout the west. Associate revegetation with native broadleaf perennials is the stated goal of most tamarisk removal efforts, but much of this revegetation has been less than successful for a variety of reasons. Lack of long-term commitment, typically based on funding, has typically confounded completion of the projects. The habitat manipulation and revegetation projects in the Wash present a unique opportunity to examine the long term effects of tamarisk removal and revegetation projects on habitats, the avian community and individual avian species.

3) Analyze the current and future data sets for effects of tamarisk removal and revegetation on individual species. This type of focused individual species analyses was not part of the current study, but vegetation and avian data collection methodologies were designed to enable such analyses.

4) Initiate Brown-headed Cowbird and host nest monitoring studies in the Wash. Studies are equivocal on the impacts of Brown-headed Cowbird nest parasitism on host species except when nest parasitism exceeds 70%. Brown-headed Cowbird are abundant in the Wash. The overall and species specific parasitism rates in the Wash are presently unknown. Nest parasitism may be affecting reproduction of desirable bird species in the Wash.

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Table 1: Repeated Measures Analysis of Variance of avian diversity in the Wash from 12 February 2005 to 25 January 2009. Values are means and (standard deviations). Significance set at P < 0.05. "ns" = not significant. Birds that flew over or were > 100 m from the census stations are excluded.

	YEAR						
	2005-2006	**2006-2007**	**2007-2008**	**2008-2009**	***d.f.*** [a]	***F***	***P***
Richness							
Overall [1]	32.6 (5.2)	32.5 (4.8)	32.5 (5.1)	32.1 (4.2)	3/25/103	0.076	- ns -
Breeding [2]	34.3 (5.0)	32.8 (4.5)	34.1 (6.0)	32.7 (3.3)	3/11/47	0.465	- ns -
Non-breeding [3]	32.1 (4.7)	30.1 (4.1)	31.1 (3.3)	29.7 (4.7)	3/8/35	0.720	- ns -
Abundance							
Overall	271.9 (85.4)	284.8 (49.1)	292.9 (70.7)	315.3 (95.8)	3/25/103	1.885	- ns -
Breeding	293.7 (83.5)	292.7 (55.6)	289.0 (46.6)	312.8 (99.5)	3/11/47	0.370	- ns -
Non-breeding	291.8 (76.5)	275.4 (43.7)	302.1 (89.6)	329.3 (108.0)	3/8/35	0.877	- ns -

1 – 26 censuses between 9 February to 29 January of each period. 1 census = 1 five-minute count at each of 28 census points.
2 – 12 censuses between 15 March to 31 August of each period. 1 census = 1 five-minute count at each of 28 census points.
3 – 9 censuses between 1 October to 29 January of each period. 1 census = 1 five-minute count at each of 28 census points.
a - Degrees of freedom values are: between years/census events/total.

Table 2: Repeated Measures Analysis of Variance of 18 species in the Wash that had significant trends in abundance from 12 February 2005 to 25 January 2009. Annual values[1] are means and (standard deviations). Significance set at P < 0.05. "ns" = not significant. Birds that flew over or were > 100 m from the census stations are excluded. Multiple comparisons follow Holm-Sidak. Values with different superscripts are significantly different.

	YEAR						
Species	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	***d.f.*** [2]	***F***	***P***
Abert's Towhee *(Pipilo aberti)*	33.3 [a] (14.6)	31.3 [a] (10.0)	23.8 [b] (8.4)	24.4 [b] (12.1)	3/25/103	5.924	0.001
American Pipit (*Anthus rubescens*)	8.7 [a] (9.8)	11.6 [a] (12.8)	7.9 [a] (8.2)	33.0 [b] (26.9)	3/15/47	5.490	0.004
Belted Kingfisher (*Megaceryle alcyon*)	1.9 [a] (0.6)	1.2 [ab] (0.5)	1.1 [b] (0.4)	1.1 [ab] (0.4)	3/16/29	3.821	0.046
Common Yellowthroat (*Geothlypis trichas*)	13.6 [a] (8.0)	18.4 [ab] (6.4)	18.9 [ab] (7.8)	23.0 [b] (10.0)	3/16/56	5.780	0.002
Great-tailed Grackle (*Quiscalus mexicanus*)	2.9 [a] (2.0)	5.1 [ab] (4.6)	8.3 [b] (6.5)	10.7 [b] (11.2)	3/25/76	4.751	0.006
Lucy's Warbler (*Vermivora luciae*)	23.6 [a] (16.3)	14.5 [ab] (10.7)	11.7 [b] (7.1)	13.2 [b] (9.5)	3/12/50	4.838	0.006
Marsh Wren (*Cistothorus palustris*)	9.8 [a] (7.4)	12.2 [ab] (7.7)	15.0 [b] (8.9)	18.5 [c] (10.8)	3/25/100	15.211	<0.001
Mourning Dove (*Zenaida macroura*)	15.0 (23.4)	6.7 (4.9)	5.4 (3.9)	5.6 (4.9)	3/21/67	3.633	0.020
Northern Flicker (*Colaptes auratus*)	2.2 (1.3)	2.9 (1.7)	3.5 (3.3)	4.5 (2.4)	3/14/42	1.920	- ns -

Table 2 continued: Repeated Measures Analysis of Variance of 18 species in the Wash that had significant trends in abundance from 12 February 2005 to 25 January 2009. Annual values[1] are means and (standard deviations). Significance set at $P < 0.05$. "ns" = not significant. Birds that flew over or were > 100 m from the census stations are excluded. Multiple comparisons follow Holm-Sidak. Values with different superscripts are significantly different.

	YEAR						
Species	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	***d.f.*** [2]	***F***	***P***
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	1.3 (0.5)	1.9 (1.4)	3.7 (3.4)	5.8 (7.6)	3/15/30	1.130	- ns -
Orange-crowned Warbler (*Vermivora celata*)	5.6 [ab] (3.2)	3.3 [a] (3.2)	5.9 [ab] (5.4)	7.7 [b] (8.5)	3/20/67	2.835	0.049
Song Sparrow (*Melospiza melodia*)	25.6 [ab] (9.9)	28.1 [a] (9.1)	23.3 [ab] (8.1)	21.3 [b] (10.7)	3/25/103	4.821	0.004
Spotted Towhee (*Pipilo maculatus*)	1.3 (0.6)	1.2 (0.5)	1.5 (0.5)	2.0 (1.3)	3/13/22	0.480	- ns -
Verdin (*Auriparus flaviceps*)	7.7 [a] (4.0)	9.7 [ab] (5.1)	9.0 [ab] (4.1)	11.3 [b] (5.7)	3/25/103	3.967	0.011
White-crowned Sparrow (*Zonotrichia leucophrys*)	15.5 (15.3)	15.4 (12.8)	21.4 (18.6)	21.9 (22.5)	3/16/61	1.164	- ns -
Western Kingbird (*Tyrannus verticalis*)	1.9 [a] (5.0)	5.0 [ac] (2.8)	4.3 [bc] (2.3)	4.7 [bc] (2.3)	3/10/25	9.623	0.002
Yellow-rumped Warbler (*Dendroica coronata*)	24.1 [ab] (20.8)	10.2 [a] (8.3)	34.1 [b] (28.9)	35.8 [b] (39.7)	3/17/66	5.548	0.002
Yellow Warbler (*Dendroica petechia*)	5.4 [a] (3.4)	5.8 [a] (3.7)	6.7 [a] (4.4)	12.8 [b] (6.2)	3/11/43	15.838	<0.001

1 – Annual values are derived from 26 censuses between 9 February and 29 January of each period. 1 census event = 1 five-minute count at each of 28 points.
2 - Degrees of freedom values are: between years/census events/total.

Table 3: Friedman Repeated Measures Analysis of Variance of 21 species in the Wash that had significant trends in frequency from 12 February 2005 to 25 January 2009. Annual values[1] are means and (standard deviations), not ranks. Maximum frequency value = 28. Significance set at $P < 0.05$. "ns" = not significant. Birds that flew over or were > 100 m from the census stations are excluded. Multiple comparisons follow Tukey Test. Values with different superscripts are significantly different.

	YEAR						
Species	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	***d.f.***	***X^2***	***P***
Abert's Towhee *(Pipilo aberti)*	18.3 [a] (4.5)	16.9 [a,b] (3.1)	14.5 [b.c] (3.5)	14.2 [c] (4.1)	3	22.832	< 0.001
American Coot (*Fulica americana*)	2.7 [a] (2.6)	6.6 [b] (5.2)	5.8 [b] (5.0)	5.4 [ab] (3.7)	3	16.864	< 0.001
American Pipit (*Anthus rubescens*)	3.9 (2.6)	3.5 (2.6)	3.2 (2.6)	5.2 (2.9)	3	4.159	-ns-
Belted Kingfisher (*Megaceryle alcyon*)	1.7 (1.0)	2.5 (1.2)	2.2 (1.8)	1.4 (0.5)	3	1.500	-ns-
Bewick's Wren (*Thryomanes bewickii*)	12.2 [a] (3.2)	12.7 [b] (3.9)	9.3 [b] (3.4)	10.8 [a,b] (3.6)	3	9.880	0.020
Common Yellowthroat (*Geothlypis trichas*)	9.5 (5.1)	11.9 (2.8)	12.1 (4.3)	13.7 (5.5)	3	4.933	-ns-
Gadwall (*Anas strepera*)	1.5 (0.5)	3.2 (1.6)	3.6 (1.7)	3.5 (2.4)	3	2.372	-ns-
Great-tailed Grackle (*Quiscalus mexicanus*)	1.1 [a] (0.3)	2.2 [a,b] (1.5)	2.7 [b] (1.8)	3.6 [b] (3.0)	3	23.128	< 0.001
Killdeer (*Charadrius vociferus*)	2.6 [a] (1.8)	2.3 [a,b] (1.7)	1.1 [b] (0.3)	1.6 [b] (1.0)	3	17.173	< 0.001

Table 3 continued: Friedman Repeated Measures Analysis of Variance of 21 species in the Wash that had significant trends in frequency from 12 February 2005 to 25 January 2009. Annual values[1] are means and (standard deviations), not ranks. Maximum frequency value = 28. Significance set at $P < 0.05$. "ns" = not significant. Birds that flew over or were > 100 m from the census stations are excluded. Multiple comparisons follow Tukey Test. Values with different superscripts are significantly different.

	YEAR						
Species	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	***d.f.***	X^2	***P***
Lucy's Warbler (*Vermivora luciae*)	12.6 (6.8)	8.4 (5.2)	7.8 (4.1)	7.4 (4.6)	3	7.451	-ns-
Mallard (*Anas platyrhynchos*)	1.4 [a] (0.7)	2.1 [a] (1.6)	2.8 [b] (1.8)	2.6 [b] (2.0)	3	24.928	< 0.001
Marsh Wren (*Cistothorus palustris*)	6.8 [a] (4.6)	8.2 [ab] (4.8)	8.8 [a,b] (4.8)	9.6 [b] (5.3)	3	13.936	0.003
Northern Flicker (*Colaptes auratus*)	2.1 (1.2)	2.9 (1.7)	3.0 (2.3)	3.8 (2.1)	3	2.744	- ns -
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	1.0 (0.0)	1.1 (0.3)	1.2 (0.4)	1.8 (1.1)	3	4.726	- ns -
Red-winged Blackbird (*Agelaius phoeniceus*	3.9 [a] (2.3)	4.1 [ab] (2.9)	5.2 [ab] (5.4)	7.5 [b] (6.8)	3	8.302	0.040
Song Sparrow (*Melospiza melodia*)	16.5 [a] (4.7)	17.2 [a] (3.9)	15.3 [ab] (3.9)	13.3 [b] (5.8)	3	11.878	0.008
Spotted Towhee (*Pipilo maculatus*)	1.3 (0.6)	1.0 (0.0)	1.5 (0.5)	2.0 (1.2)	3	11.436	- ns -
Virginia Rail (*Rallus limicola*)	1.7 (0.6)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	3	0.853	-ns-

Table 3 continued: Friedman Repeated Measures Analysis of Variance of 21 species in the Wash that had significant trends in frequency from 12 February 2005 to 25 January 2009. Annual values[1] are means and (standard deviations), not ranks. Maximum frequency value = 28. Significance set at $P < 0.05$. "ns" = not significant. Birds that flew over or were >100 m from the census stations are excluded. Multiple comparisons follow Tukey Test. Values with different superscripts are significantly different.

	YEAR						
Species	**2005-2006**	**2006-2007**	**2007-2008**	**2008-2009**	***d.f.***	X^2	***P***
White-crowned Sparrow (*Zonotrichia leucophrys*)	6.4 (5.7)	6.2 (4.1)	8.3 (6.0)	8.4 (6.7)	3	1.994	- ns -
Yellow-rumped Warbler (*Dendroica coronata*)	10.5 ab (8.2)	6.2 a (4.7)	12.1 b (7.3)	11.6 b (7.2)	3	12.715	0.005
Yellow Warbler (*Dendroica petechia*)	4.0 [a] (2.0)	3.9 [a] (2.2)	4.5 [a] (2.8)	7.7 [b] (3.2)	3	17.036	< 0.001

1 – Annual values are derived from 26 censuses events of 28 census points between 9 February and 29 January of each period. 1 census event = 1 five-minute count at each of 28 census points.

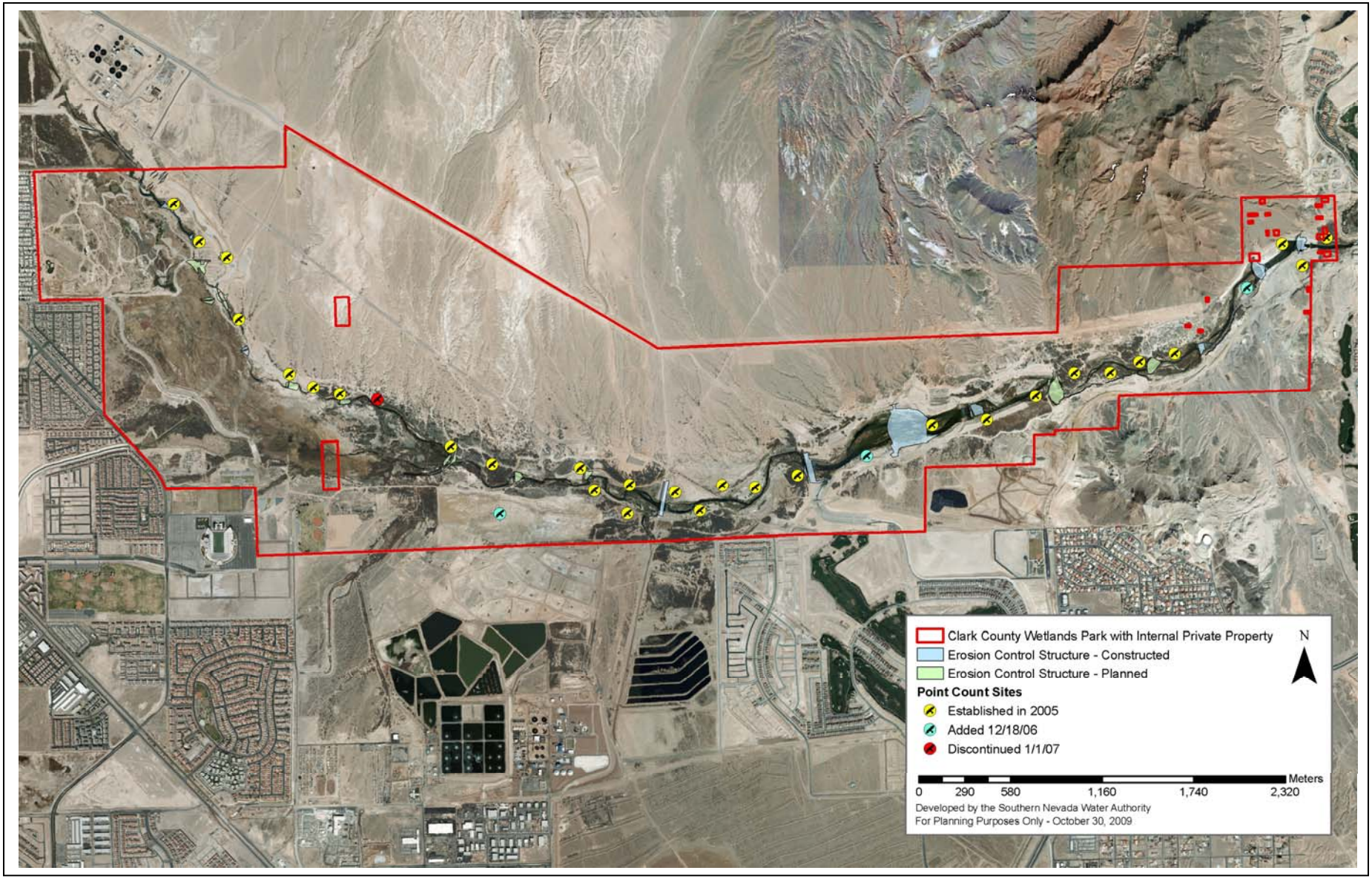

Figure 1: Study area and census point locations in the Wash.

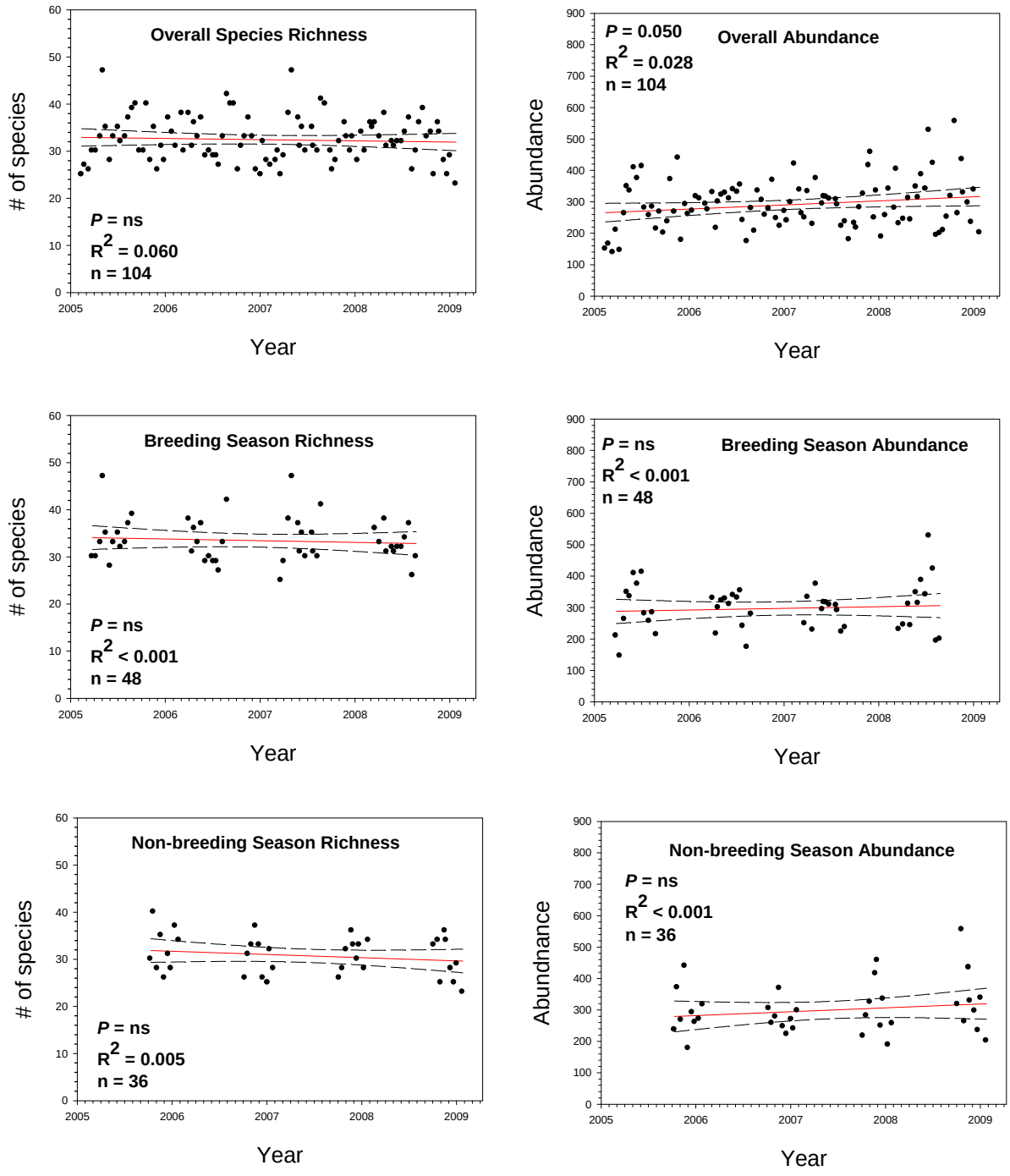

Figure 2: Regression results of overall, breeding and non-breeding season avian diversity (richness and abundance) in the Wash from 12 February 2005 through 25 January 2009. Values derived from 26 censuses per year at 28 point-count stations per census. Breeding season defined as 15 March through 31 August. Non-breeding season defined as 1 October through 29 January. Significance set at P < 0.05. "ns" = not significant.

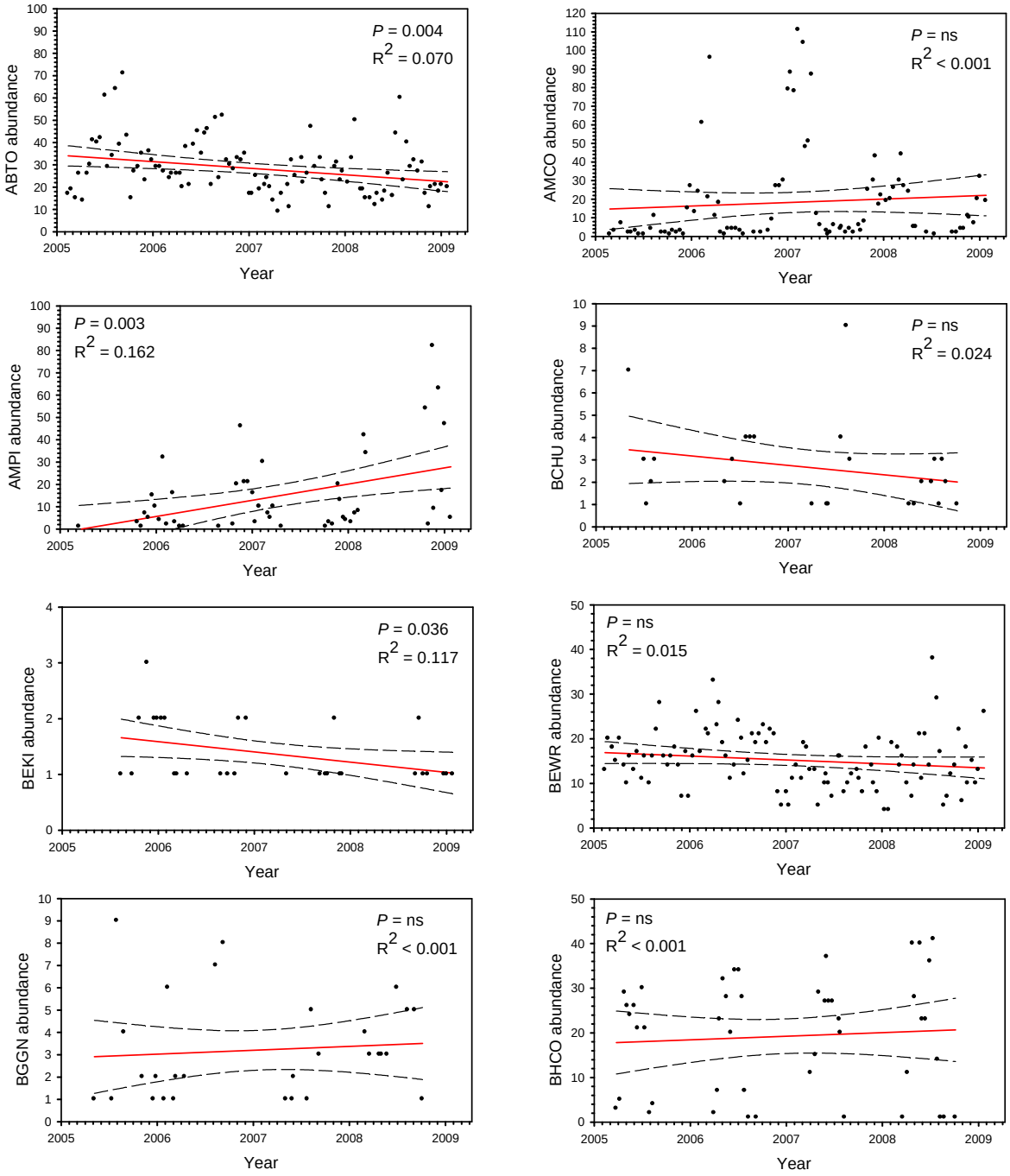

Figure 3: Regression of abundance by census event for ABTO (Abert's Towhee), AMCO (American Coot), AMPI (American Pipit), BCHU (Black-chinned Hummingbird), BEKI (Belted Kingfisher), BEWR (Bewick's Wren), BGGN (Blue-gray Gnatcatcher) and BHCO (Brown-headed Cowbird) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

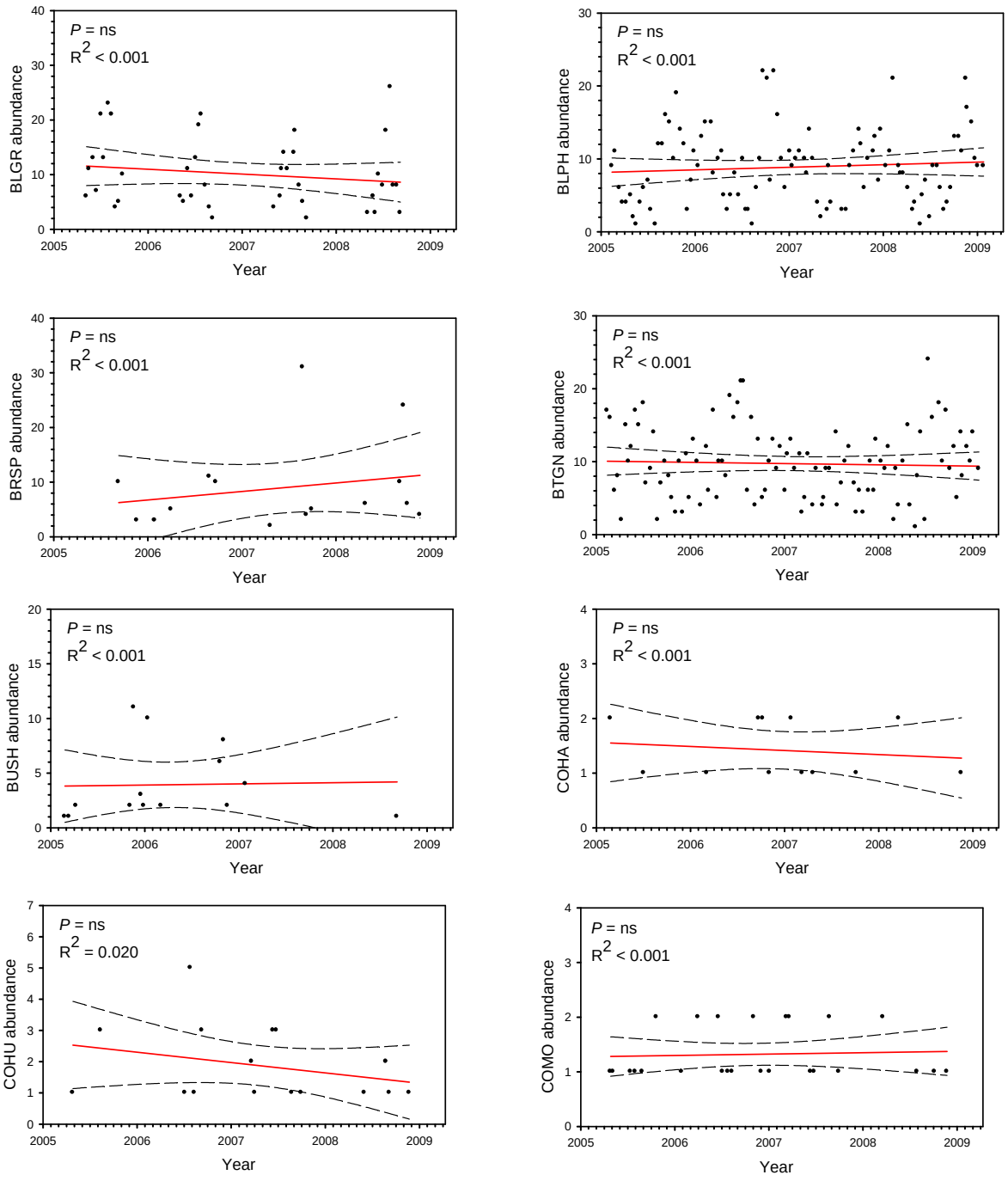

Figure 4: Regression of abundance by census event for BLGR (Blue Grosbeak), BLPH (Black Phoebe), BRSP (Brewer's Sparrow), BTGN (Black-tailed Gnatcatcher), BUSH (Bushtit), COHA (Cooper's Hawk), COHU (Costa's Hummingbird) and COMO (Common Moorhen) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

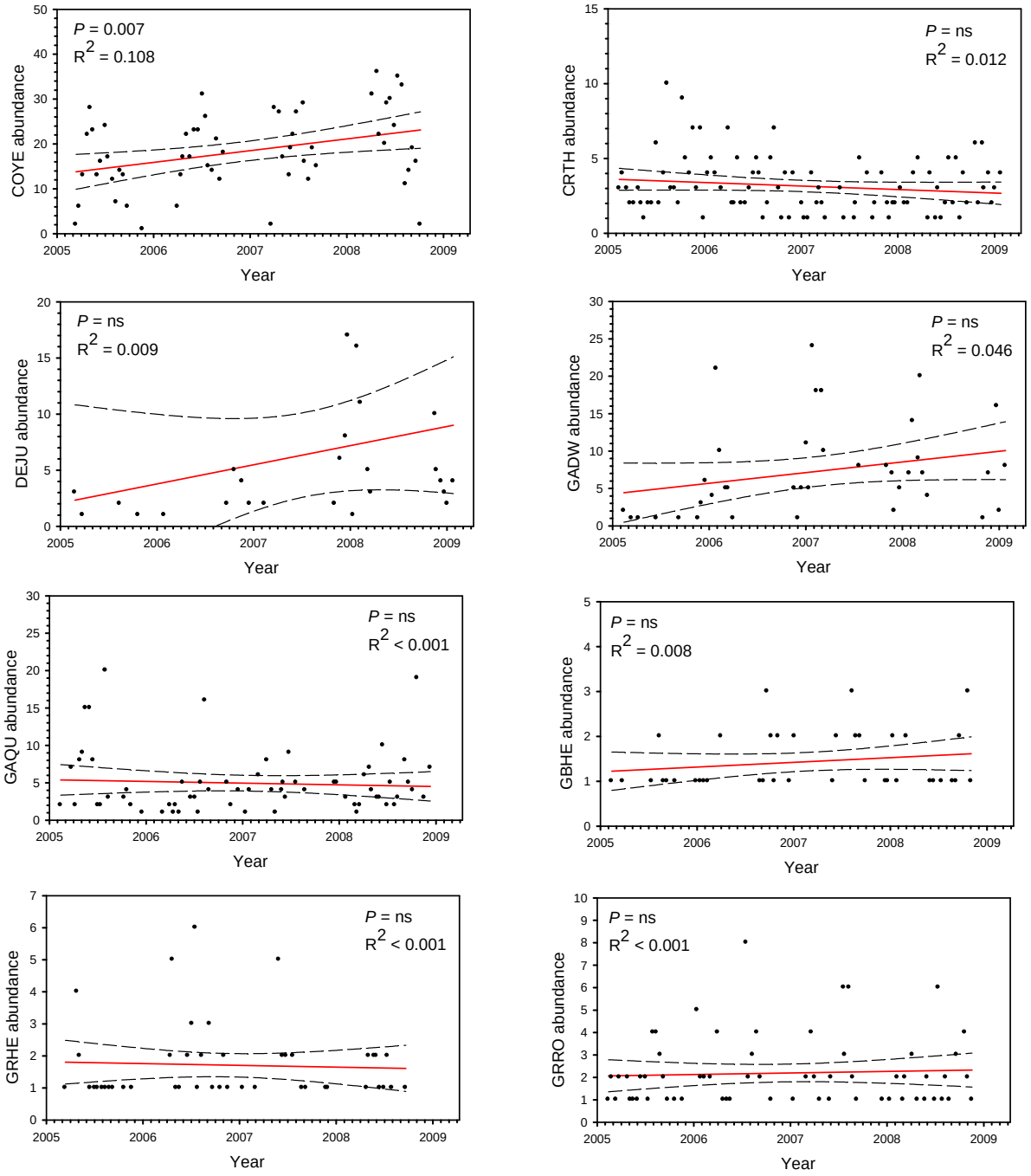

Figure 5: Regression of abundance by census event for COYE (Common Yellowthroat), CRTH (Crissal Thrasher), DEJU (Dark-eyed Junco), GADW (Gadwall), GAQU (Gambel's Quail), GBHE (Great Blue Heron), GRHE (Green Heron) and GRRO (Greater Roadrunner) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

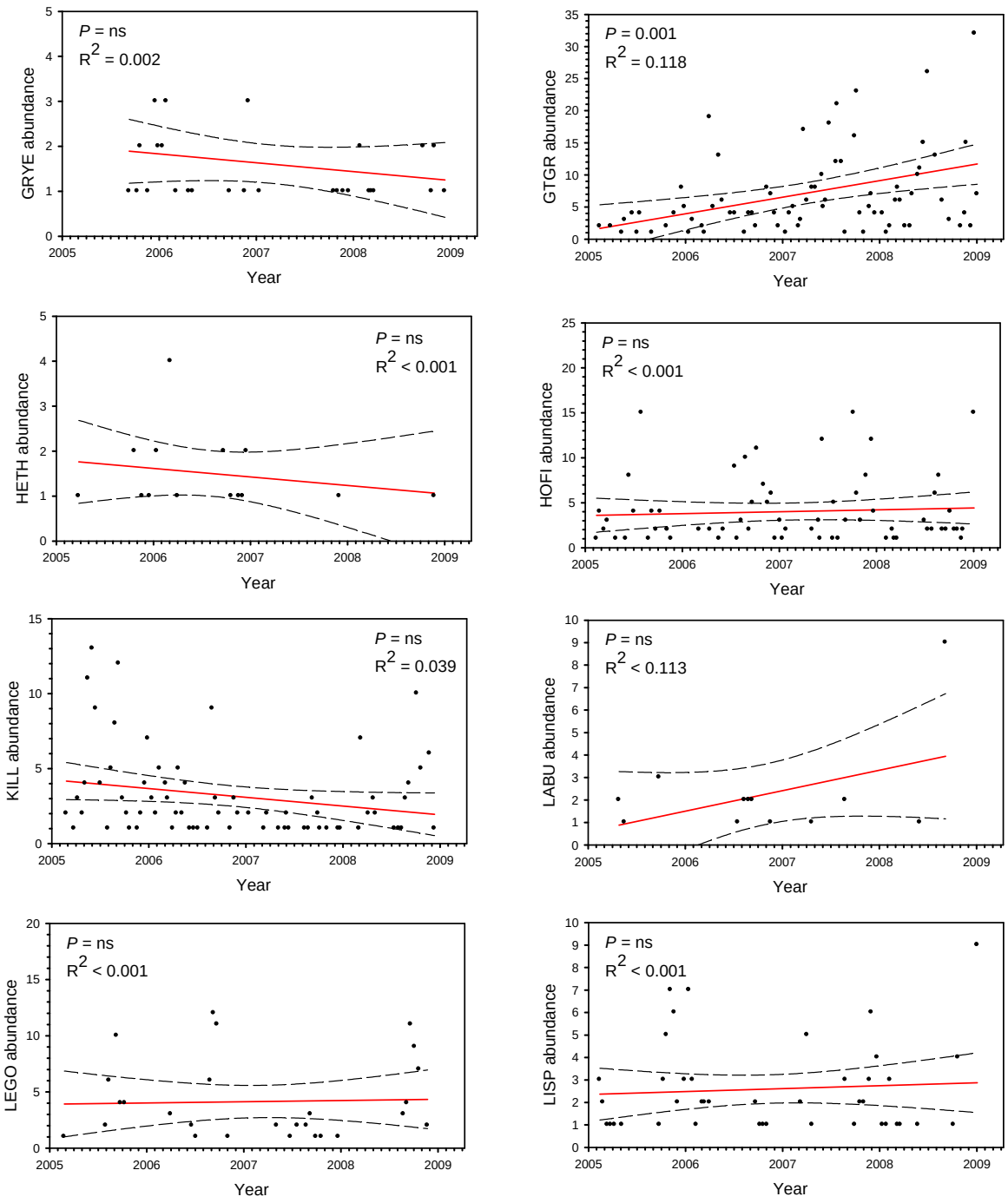

Figure 6: Regression of abundance by census event for GRYE (Greater Yellowlegs), GTGR (Great-tailed Grackle), HETH (Hermit Thrush), HOFI (House Finch), KILL (Killdeer), LABU (Lazuli Bunting), LEGO (Lesser Goldfinch) and LISP (Lincoln's Sparrow) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

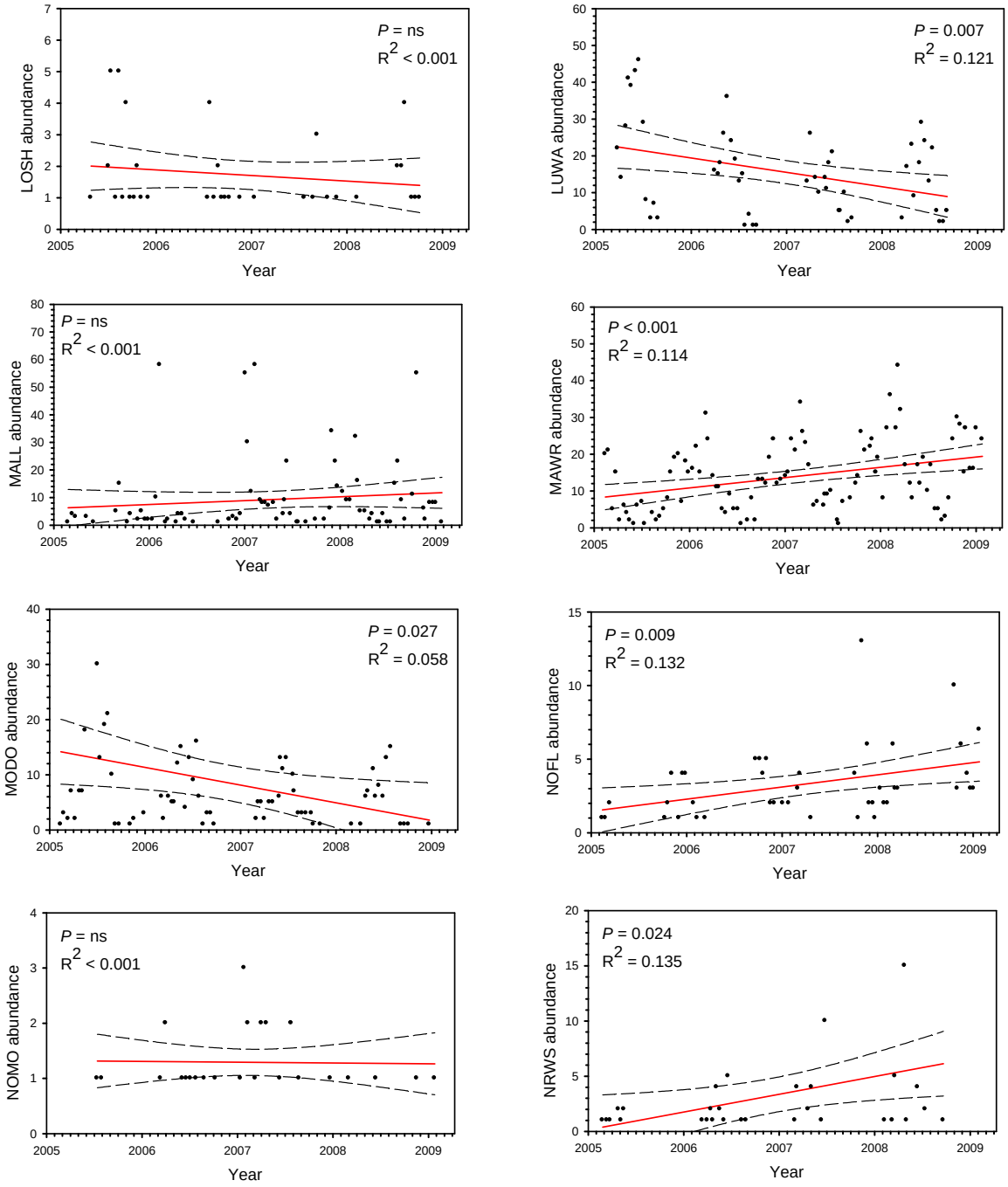

Figure 7: Regression of abundance by census event for LOSH (Loggerhead Shrike), LUWA (Lucy's Warbler), MALL (Mallard), MAWR (Marsh Wren), MODO (Mourning Dove), NOFL (Northern Flicker), NOMO (Northern Mockingbird) and NRWS (Northern Rough-winged Swallow) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at $P < 0.05$. "ns" = not significant.

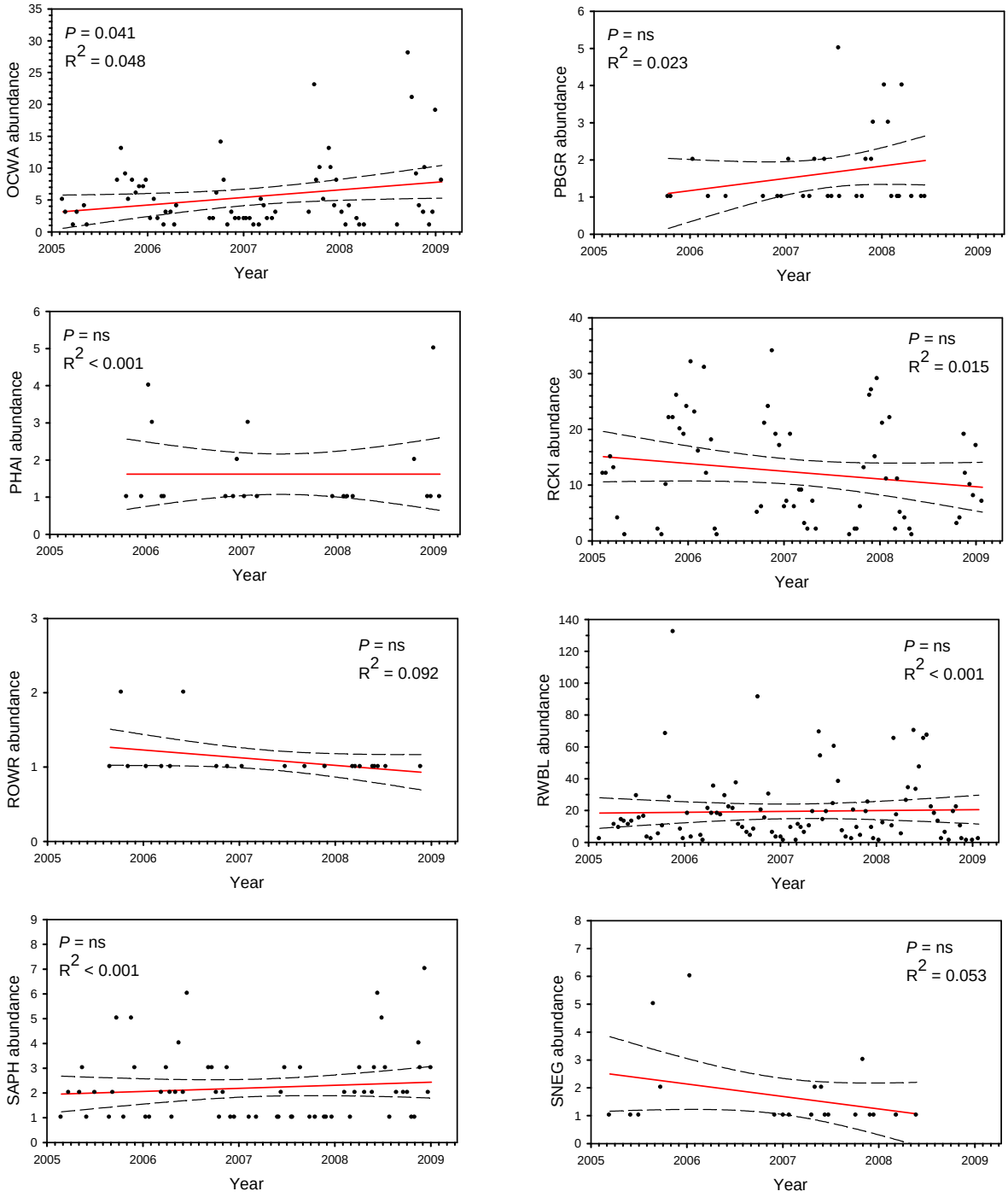

Figure 8: Regression of abundance by census event for OCWA (Orange-crowned Warbler), PBGR (Pied-billed Grebe), PHAI (Phainopepla), RCKI (Ruby-crowned Kinglet), ROWR (Rock Wren), RWBL (Red-winged Blackbird), SAPH (Say's Phoebe) and SNEG (Snowy Egret) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at $P < 0.05$. "ns" = not significant.

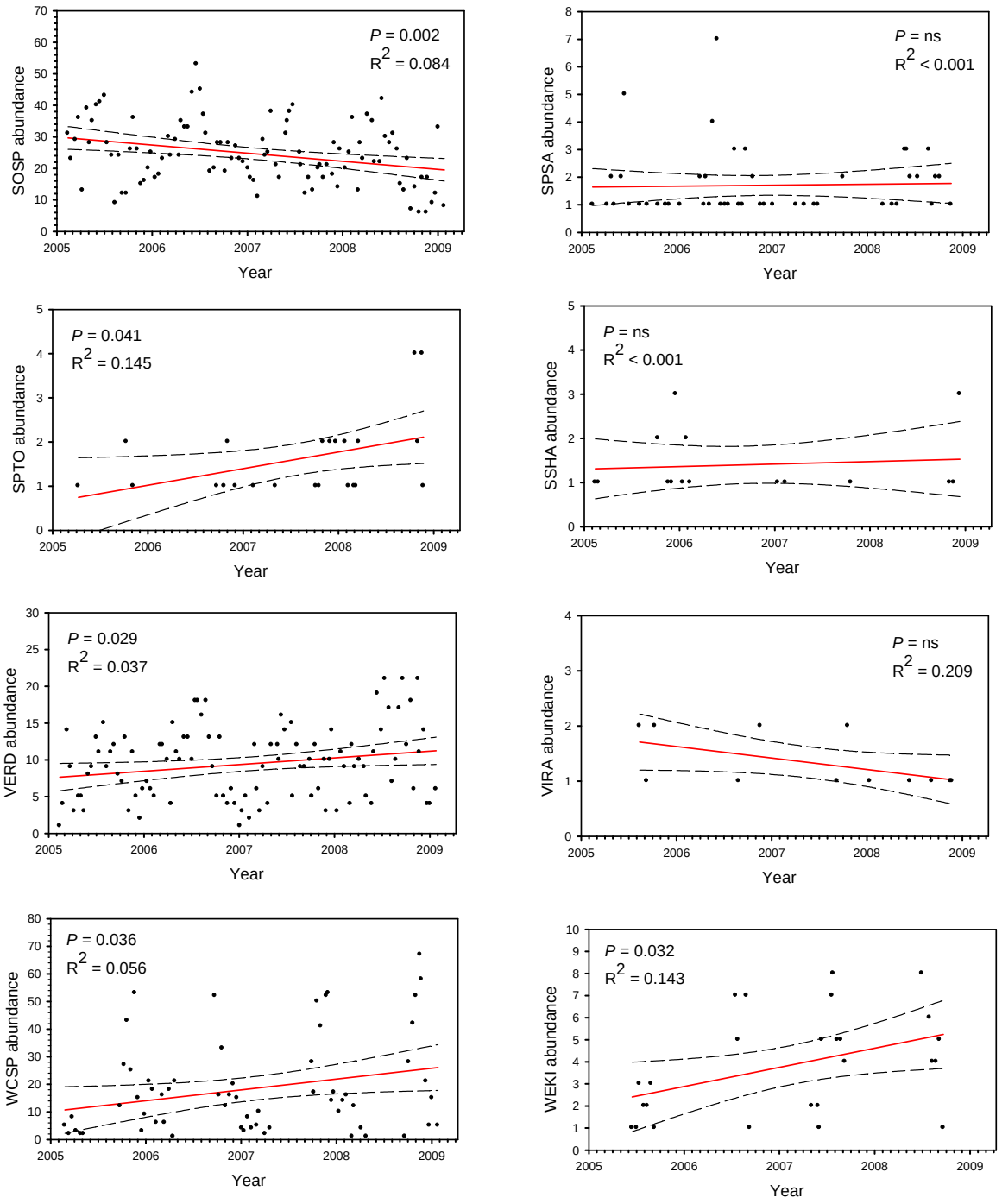

Figure 9: Regression of abundance by census event for SOSP (Song Sparrow), SPSA (Spotted Sandpiper), SPTO (Spotted Towhee), SSHA (Sharp-shinned Hawk), VERD (Verdin), VIRA (Virginia Rail), WCSP (White-crowned Sparrow) and WEKI (Western Kingbird) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

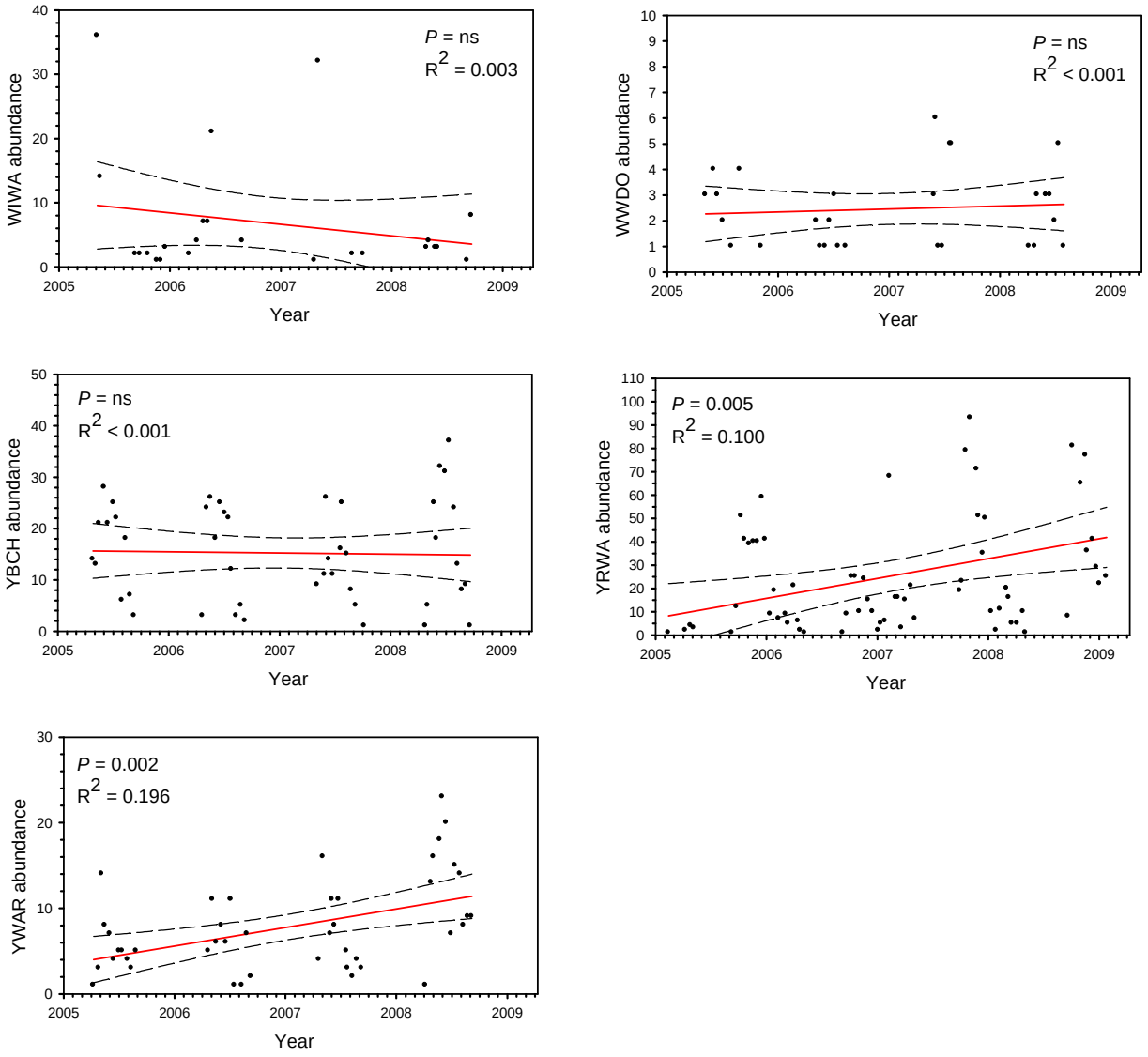

Figure 10: Regression of abundance by census event for WIWA (Wilson's Warbler), WWDO (White-winged Dove), YBCH (Yellow-breasted Chat), YRWA (Yellow-rumped Warbler) and YWAR (Yellow Warbler) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

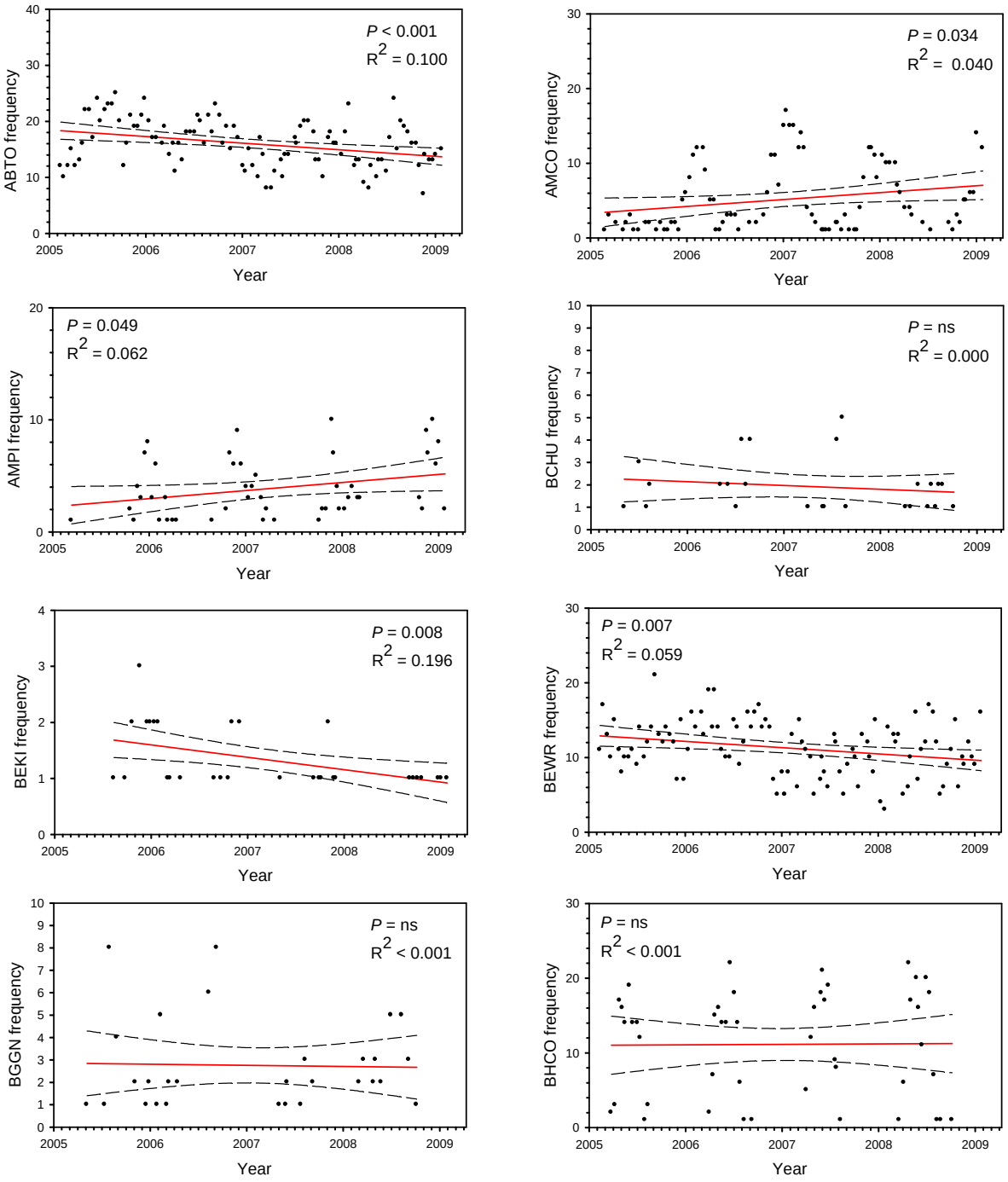

Figure 11: Regression of frequency by census event for ABTO (Abert's Towhee), AMCO (American Coot), AMPI (American Pipit), BCHU (Black-chinned Hummingbird), BEKI (Belted Kingfisher), BEWR (Bewick's Wren), BGGN (Blue-gray Gnatcatcher) and BHCO (Brown-headed Cowbird) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at $P < 0.05$. "ns" = not significant.

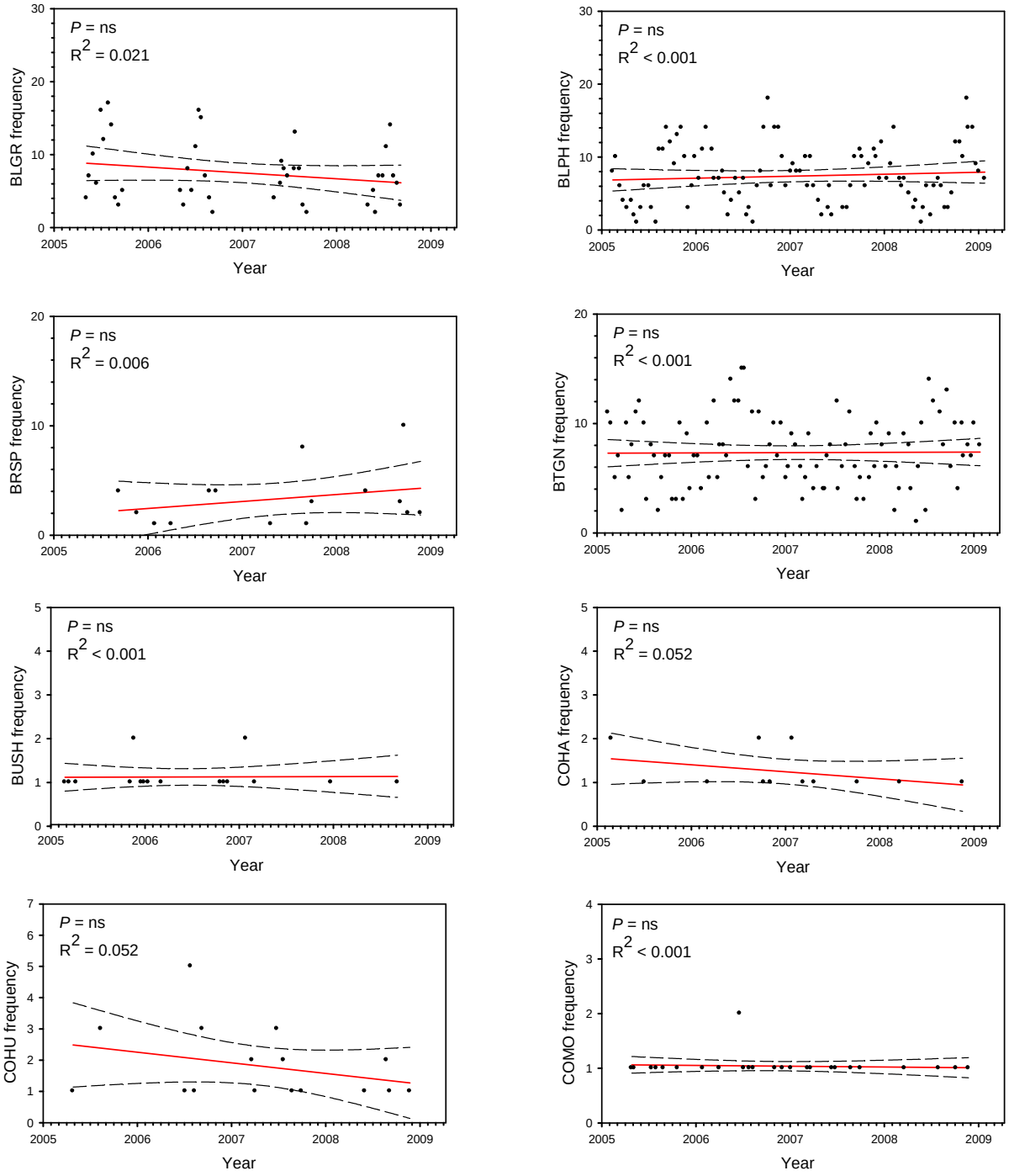

Figure 12: Regression of frequency by census event for BLGR (Blue Grosbeak), BLPH (Black Phoebe), BRSP (Brewer's Sparrow), BTGN (Black-tailed Gnatcatcher), BUSH (Bushtit), COHA (Cooper's Hawk), COHU (Costa's Hummingbird) and COMO (Common Moorhen) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

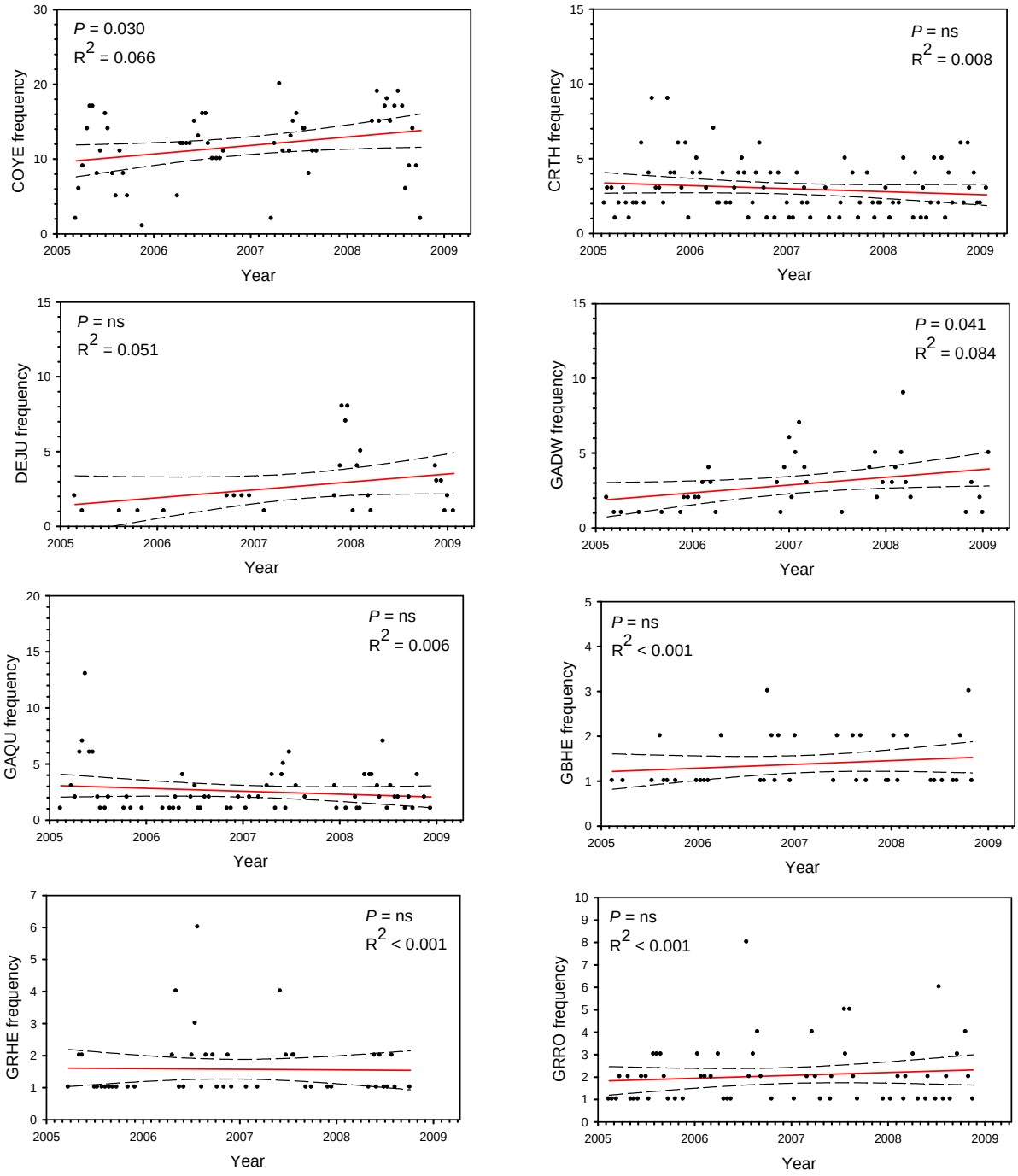

Figure 13: Regression of frequency by census event for COYE (Common Yellowthroat), CRTH (Crissal Thrasher), DEJU (Dark-eyed Junco), GADW (Gadwall), GAQU (Gambel's Quail), GBHE (Great Blue Heron), GRHE (Green Heron) and GRRO (Greater Roadrunner) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

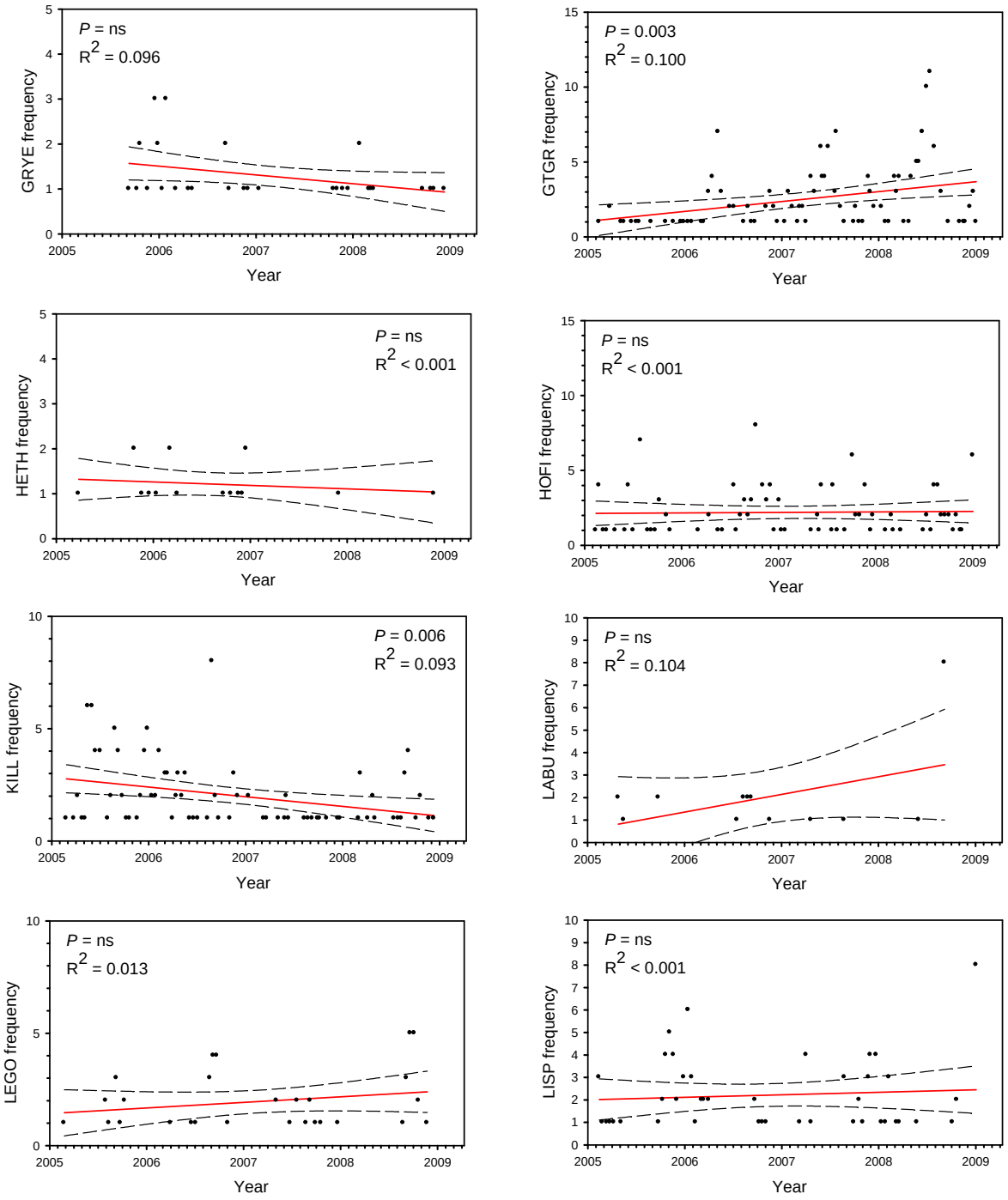

Figure 14: Regression of frequency by census event for GRYE (Greater Yellowlegs), GTGR (Great-tailed Grackle), HETH (Hermit Thrush), HOFI (House Finch), KILL (Killdeer), LABU (Lazuli Bunting), LEGO (Lesser Goldfinch) and LISP (Lincoln's Sparrow) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

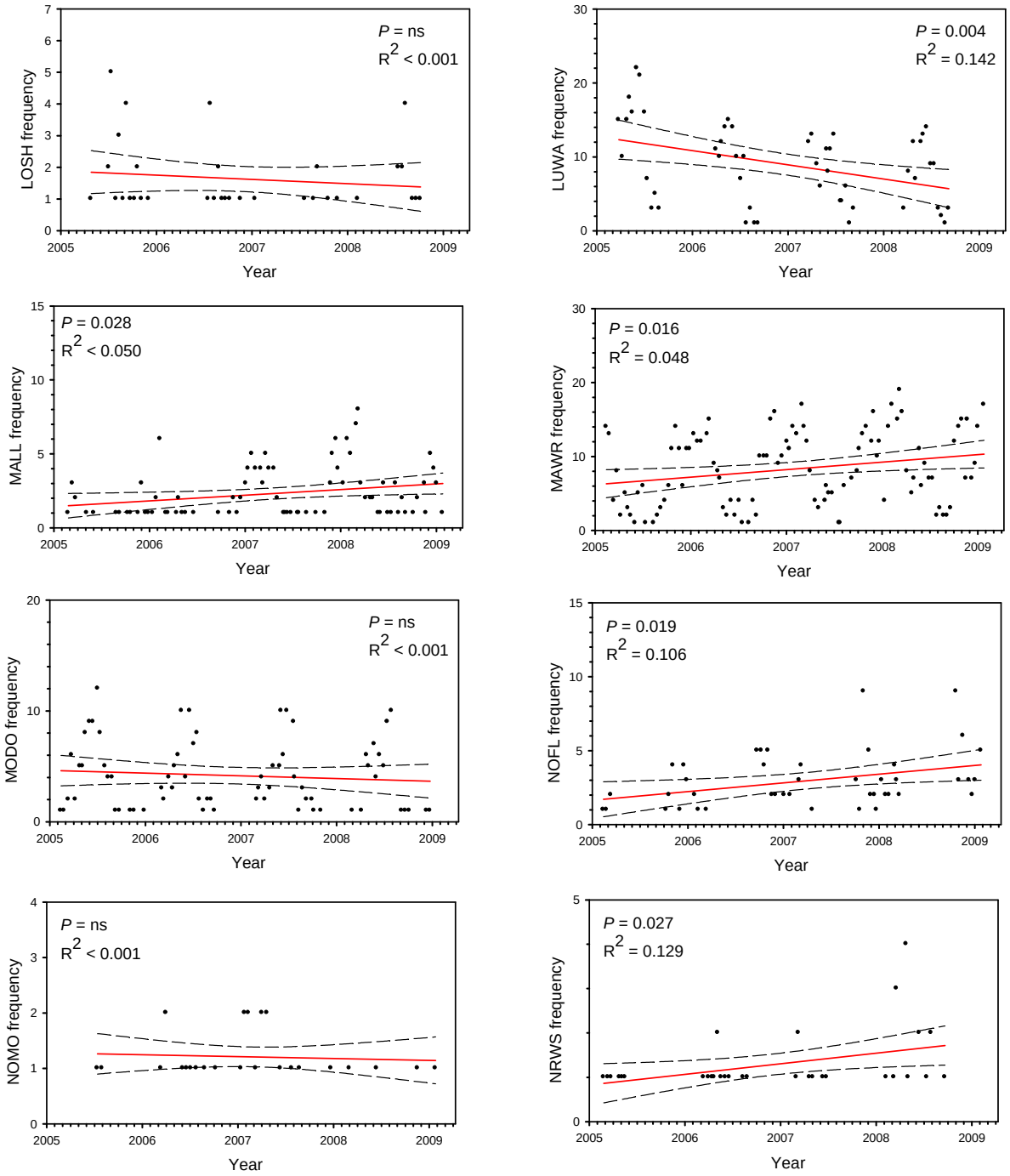

Figure 15: Regression of frequency by census event for LOSH (Loggerhead Shrike), LUWA (Lucy's Warbler), MALL (Mallard), MAWR (Marsh Wren), MODO (Mourning Dove), NOFL (Northern Flicker), NOMO (Northern Mockingbird) and NRWS (Northern Rough-winged Swallow) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at $P < 0.05$. "ns" = not significant.

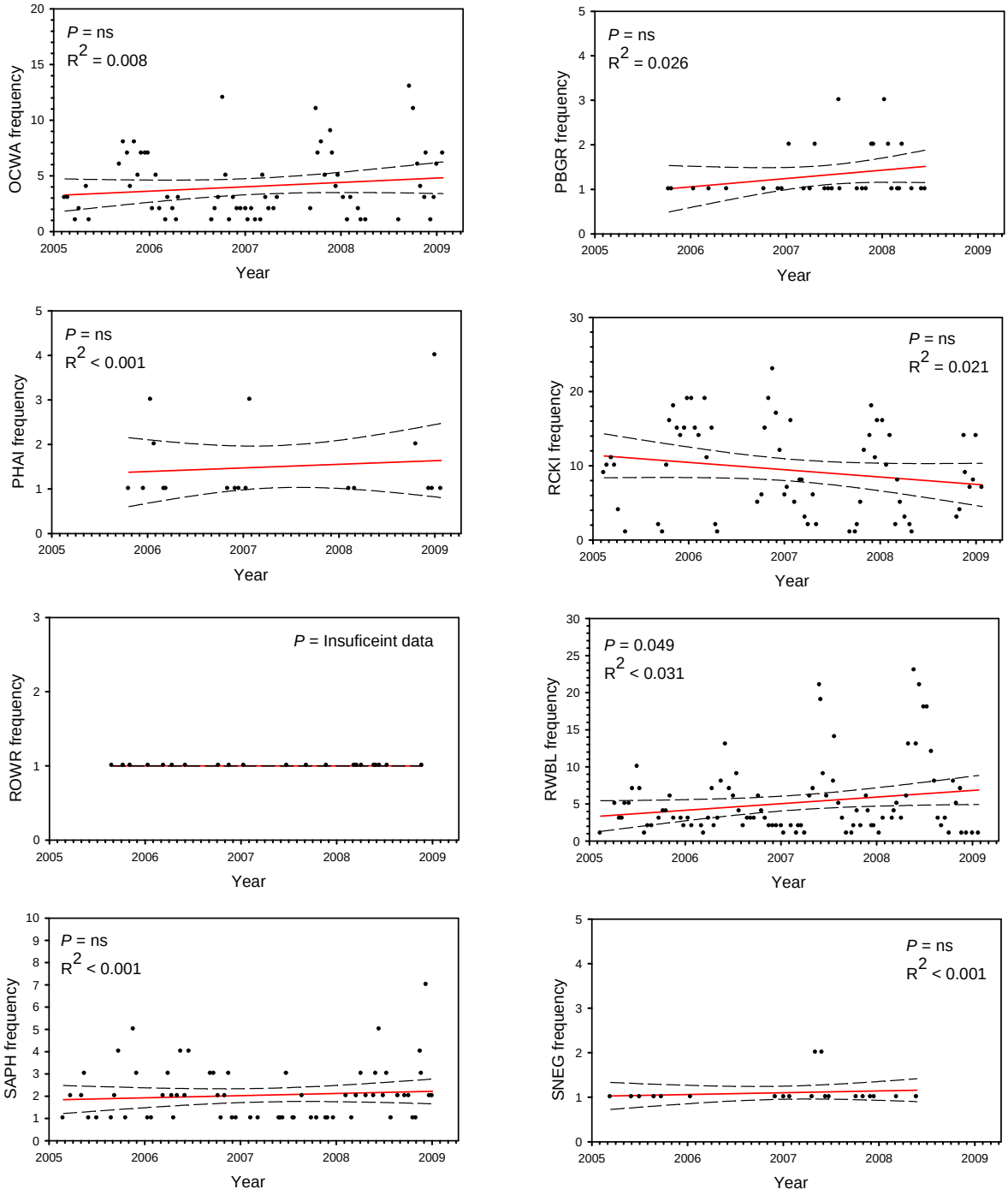

Figure 16: Regression of frequency by census event for OCWA (Orange-crowned Warbler), PBGR (Pied-billed Grebe), PHAI (Phainopepla), RCKI (Ruby-crowned Kinglet), ROWR (Rock Wren), RWBL (Red-winged Blackbird), SAPH (Say's Phoebe) and SNEG (Snowy Egret) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

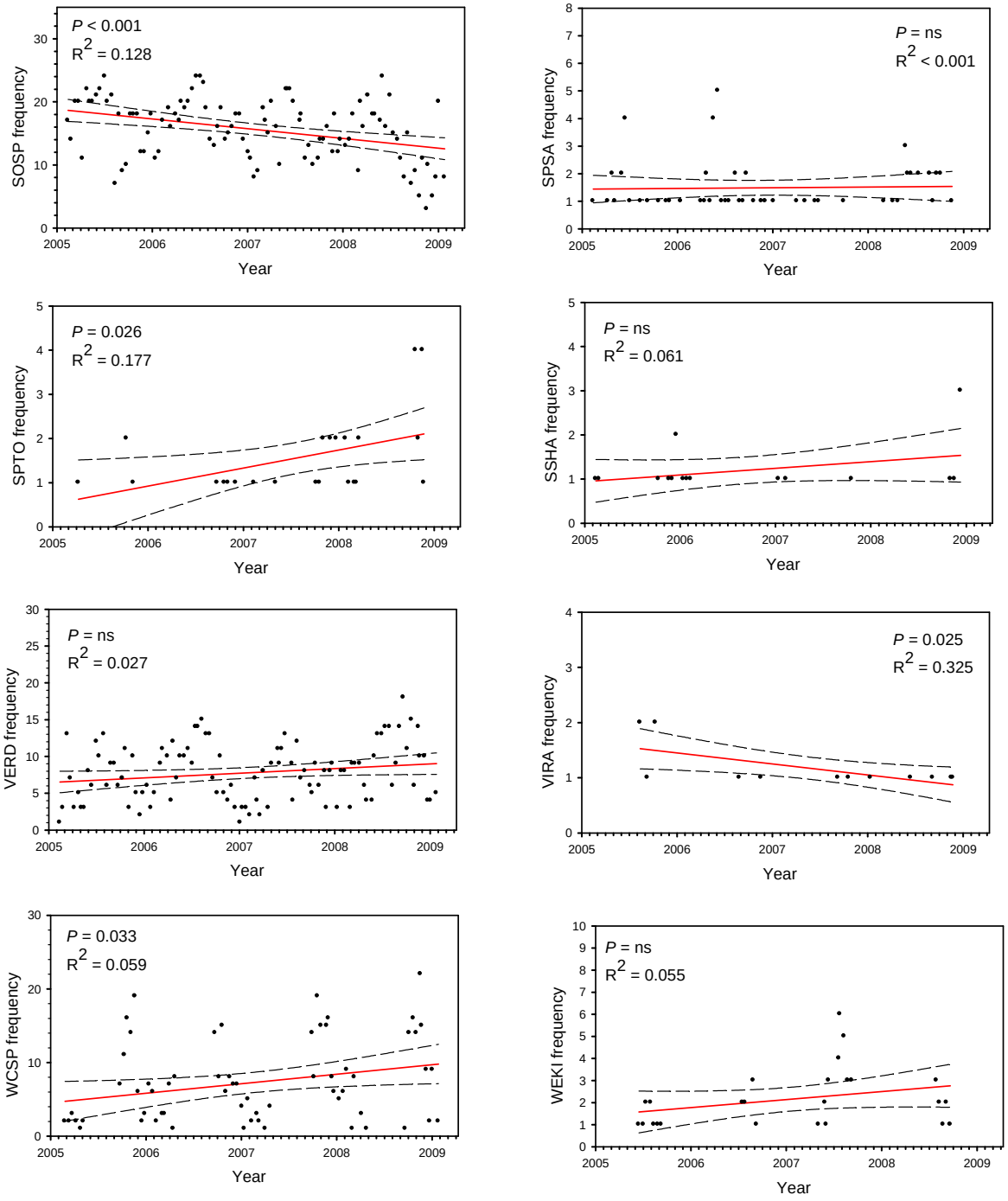

Figure 17: Regression of frequency by census event for SOSP (Song Sparrow), SPSA (Spotted Sandpiper), SPTO (Spotted Towhee), SSHA (Sharp-shinned Hawk), VERD (Verdin), VIRA (Virginia Rail), WCSP (White-crowned Sparrow) and WEKI (Western Kingbird) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

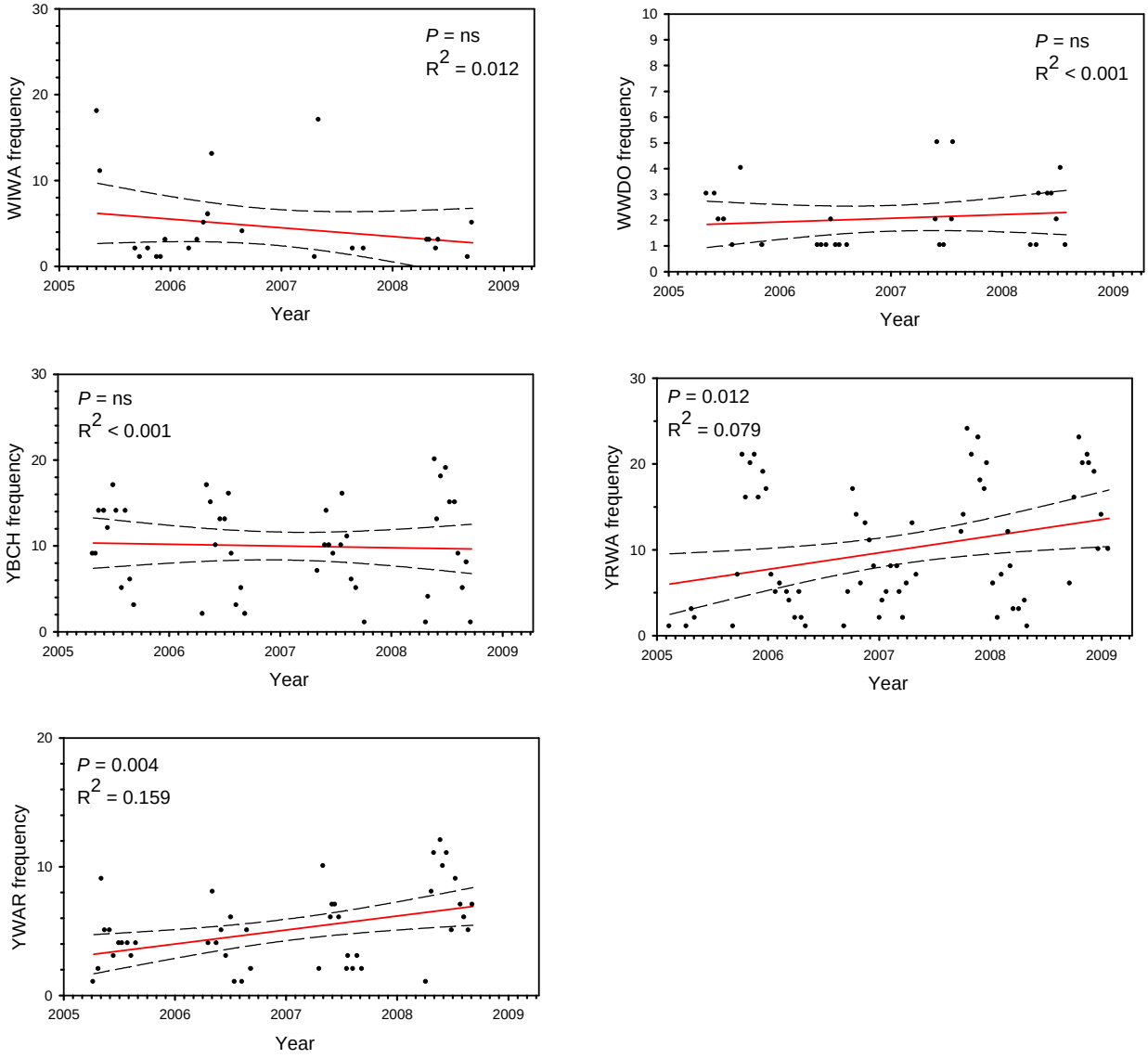

Figure 18: Regression of frequency by census event for WIWA (Wilson's Warbler), WWDO (White-winged Dove), YBCH (Yellow-breasted Chat), YRWA (Yellow-rumped Warbler) and YWAR (Yellow Warbler) in the Wash from 12 February 2005 through 25 January 2009. Dashes are 95% confidence intervals. Abundances derived from 26 censuses of 28 census points each year. Significance set at *P* < 0.05. "ns" = not significant.

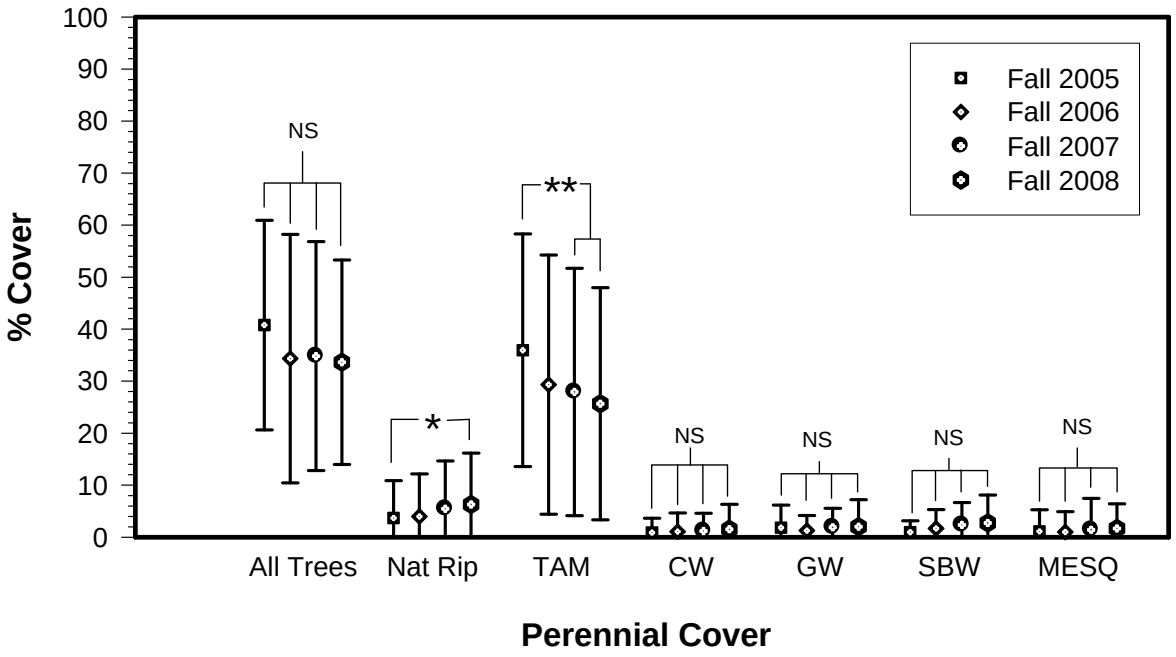

Figure 19: Results of Repeated Measures ANOVA of tree cover in the Wash from fall 2005 through fall 2008. Values are means and standard deviations of 60 measurements at 28 census points each year. Significance set at $P < 0.05$. * = $P < 0.05$. ** = $P < 0.01$. NS = not significant. Tam = Tamarisk. CW = Cottonwood. GW = Gooding Willow, SBW = Sandbar Willow, MESQ = Honey and Screwbean Mesquite. Nat Rip = CW + GW + SBW. All Trees = TAM + CW + SBW + MESQ.

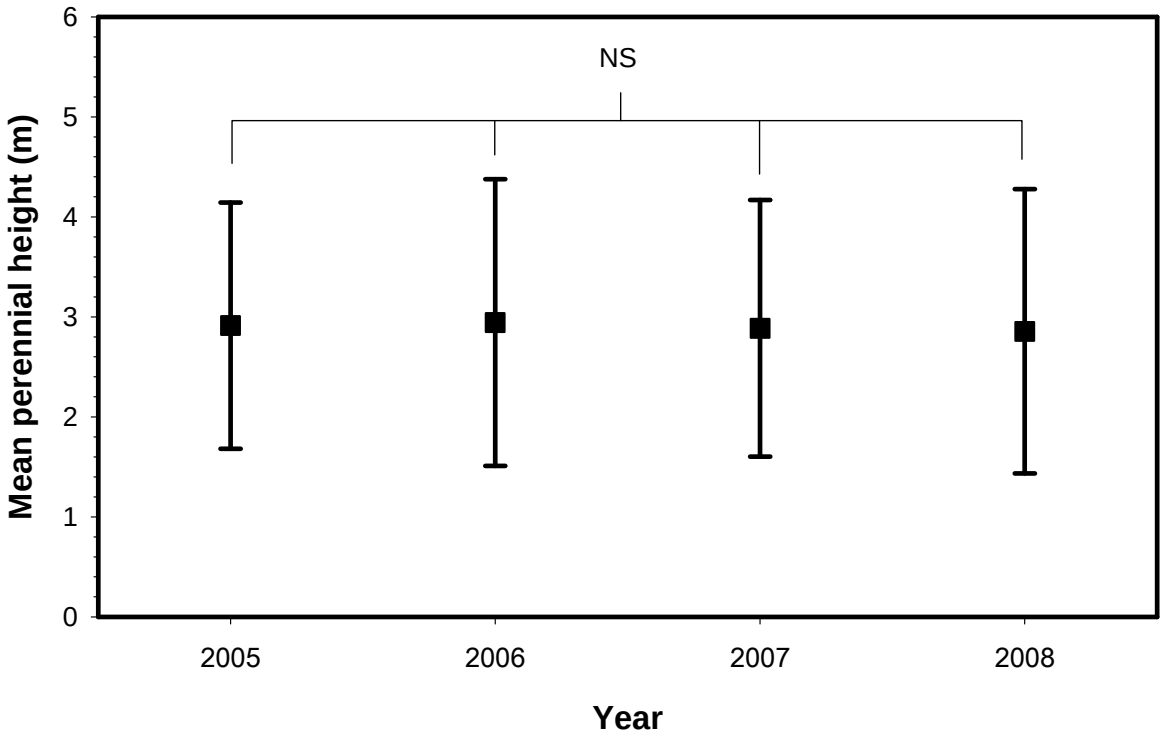

Figure 20: Results of Repeated Measures ANOVA of perennial height in the Wash for fall 2005 through fall 2008. Values are means and standard deviations of perennial heights of 60 measurements at each of 28 census points each year. Significance set at $P < 0.05$. NS = not significant.

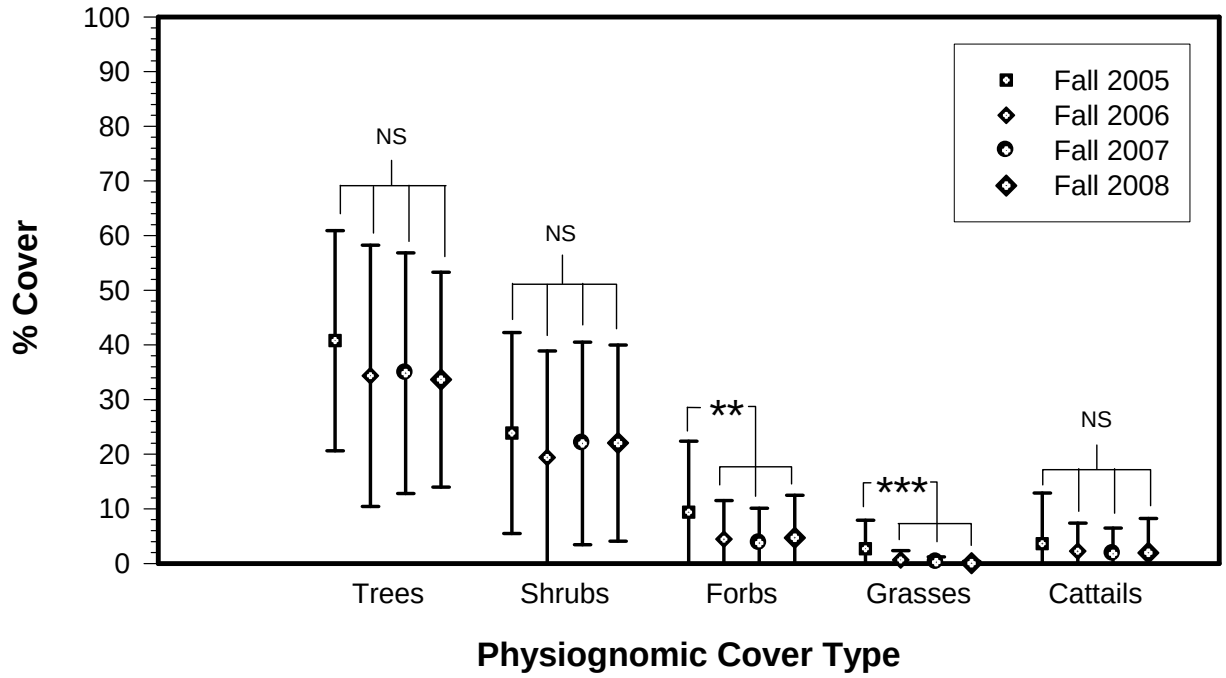

Figure 21: Results of Repeated Measures ANOVA of physiognomic cover types in the Wash from fall 2005 through fall 2008. Values are means and standard deviations of 60 measurements at 28 census points each year. Significance set at $P < 0.05$. ** = $P < 0.01$. *** = $P < 0.001$. NS = not significant. Trees = native and non-native trees. Shrubs = desert and riparian shrubs. Forbs = native and non-native flowering annuals not including grasses. Grasses = native and non-native annual and perennial grasses. Cattails = cattail spp.

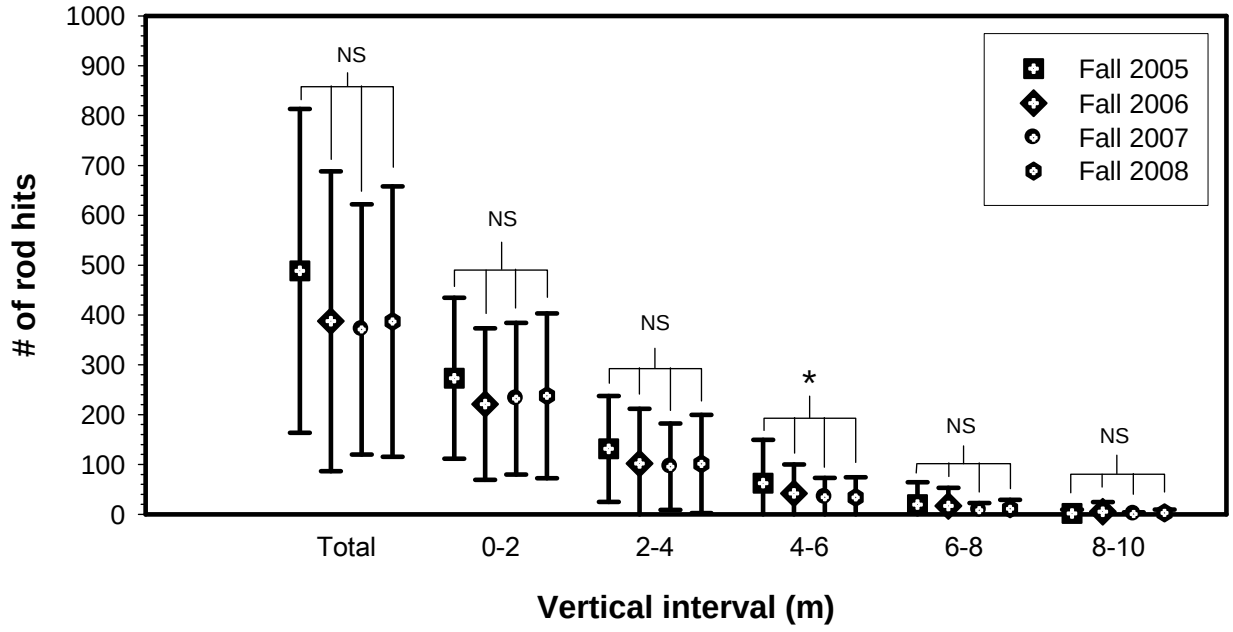

Figure 22: Results of Repeated Measures ANOVA of perennial structure in the Wash at 2 meter intervals from fall 2005 through fall 2008. Values are means and standard deviations of 60 measurements at 28 census points each year. Significance set at $P < 0.05$. * = $P < 0.05$. NS = not significant.

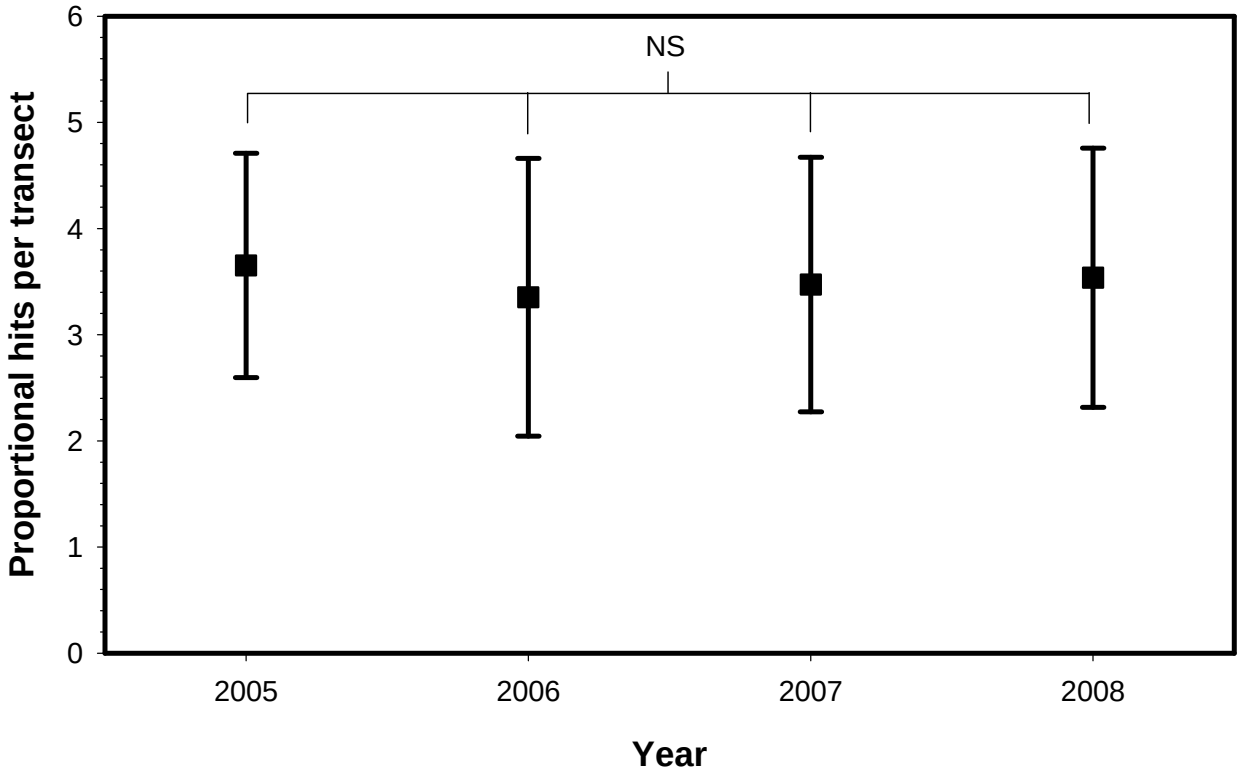

Figure 23: Results of Repeated Measures ANOVA of horizontal heterogeneity in the Wash from fall 2005 through fall 2008. Values are means and standard deviations of 60 measurements at 28 census points each year. Higher values indicate homogeneous horizontal perennial structure. Significance set at $P < 0.05$. NS = not significant.

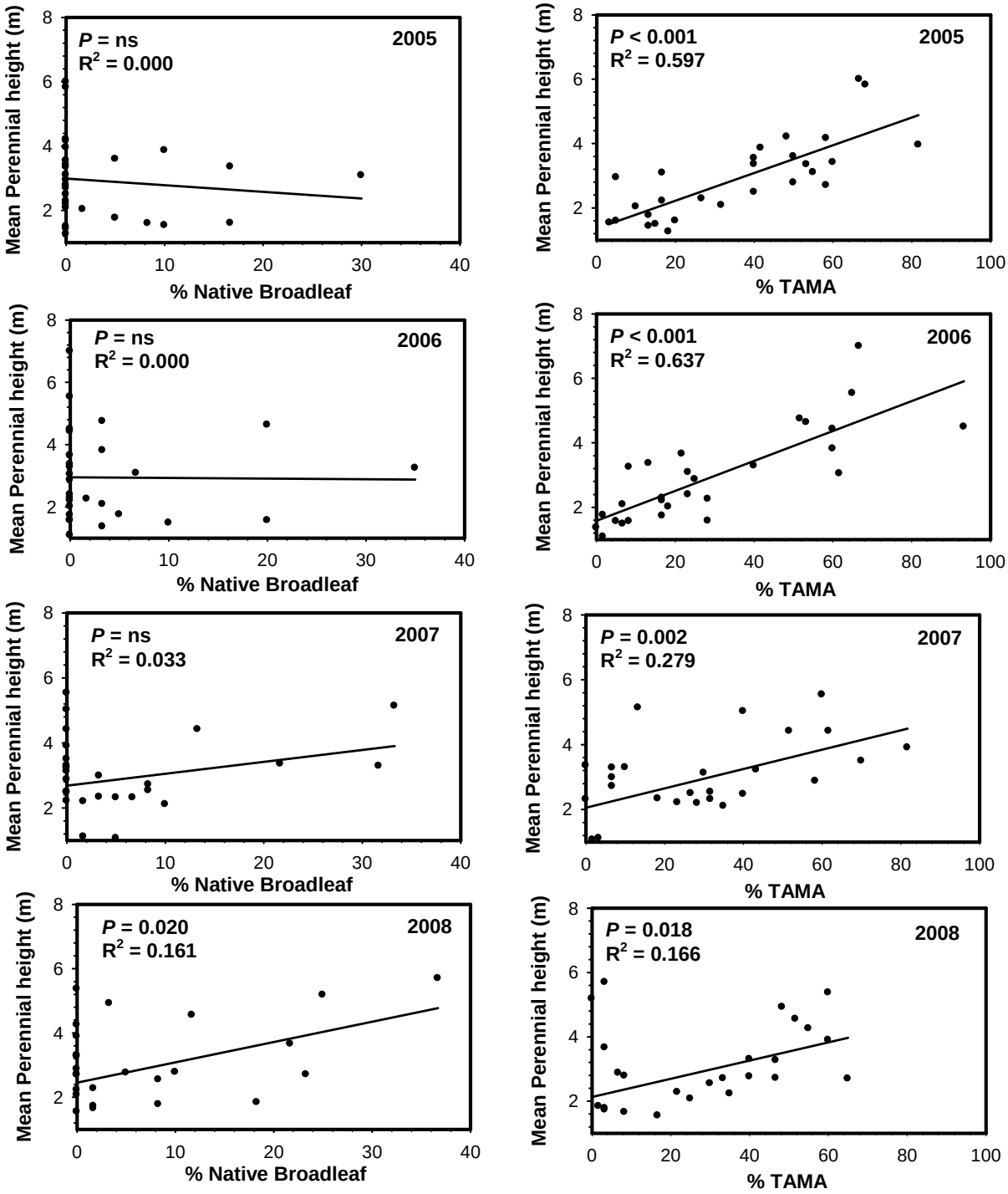

Figure 24: Regression results of native broadleaf and tamarisk versus average perennial height in the Wash from fall 2005 through fall 2008. Perennial height datum points are averages of 60 measurements at 28 census points each year. Native broadleaf = Cottonwood, Goodding Willow and Sandbar Willow. Significance set at $P < 0.05$. "ns" = not significant.

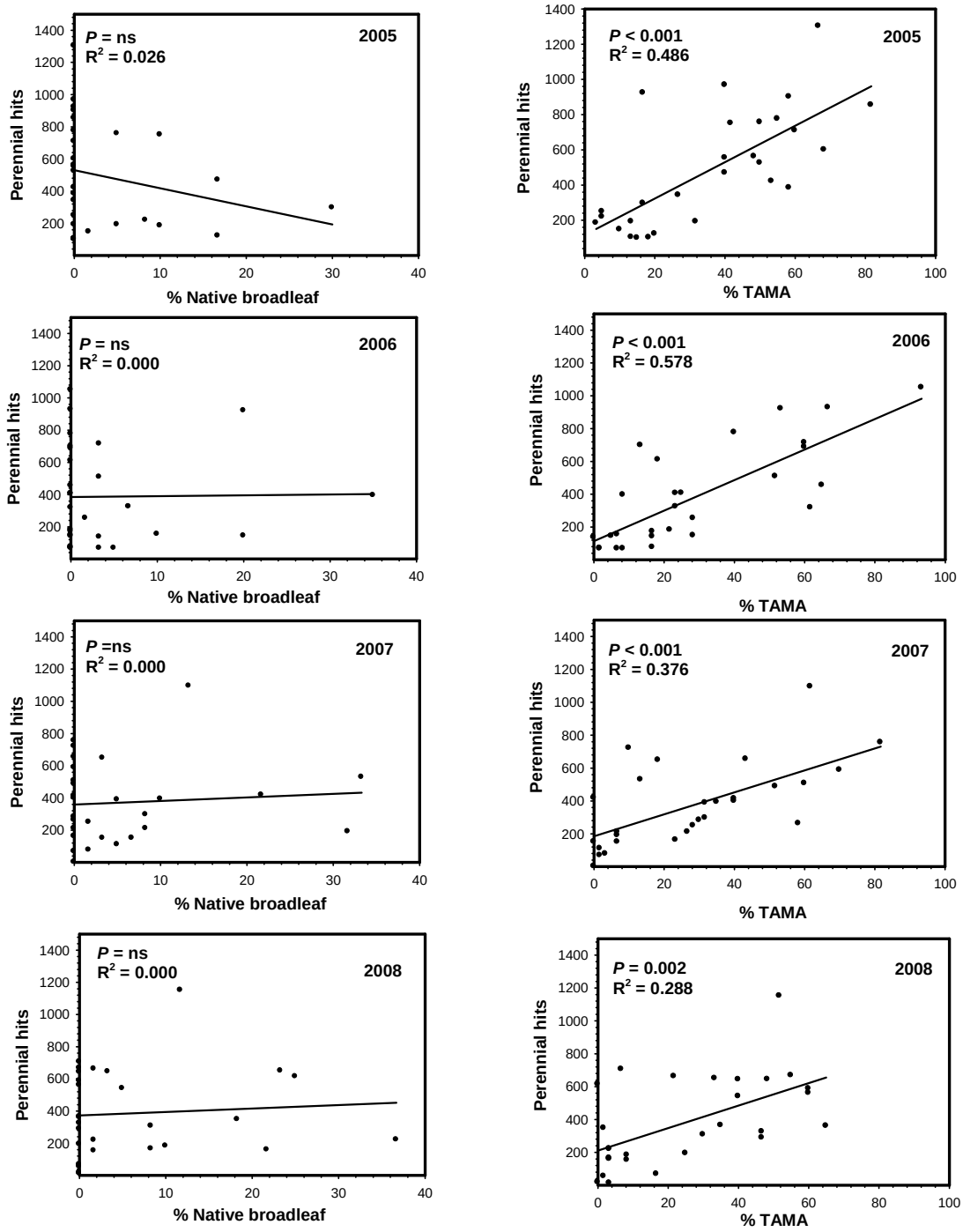

Figure 25: Regression results of native broadleaf and tamarisk versus perennial structure (hits) in the Wash from fall 2005 through fall 2008. Perennial structure datum points are sums of the number of perennial contacts on 60 vertical rods at 28 census points each year. Native broadleaf = Cottonwood, Goodding Willow and Sandbar Willow. Significance set at *P* < 0.05. "ns" = not significant.

Appendix I: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Red-winged Blackbird (*Agelaius phoeniceus*)	132 (10.5)	29 (3.5)	132 (19.3)	91 (7.8)	37 (5.1)	91 (13.4)	69 (5.1)	69 (7.4)	25 (3.8)	70 (4.9)	70 (8.4)	22 (2.5)
Mourning Dove (*Zenaida macroura*)	98 (7.8)	98 (11.7)	3 (0.4)	16 (1.4)	16 (2.2)	0 (0.0)	13 (1.0)	13 (1.4)	1 (0.2)	15 (1.1)	15 (1.8)	1 (0.1)
Abert's Towhee (*Pipilo aberti*)	71 (5.7)	64 (7.7)	36 (5.3)	52 (4.4)	51 (7.0)	35 (5.2)	47 (3.5)	47 (5.1)	33 (5.0)	60 (4.2)	60 (7.2)	31 (3.5)
Yellow-rumped Warbler (*Dendroica coronata*)	59 (4.7)	4 (0.5)	59 (8.6)	25 (2.1)	21 (2.9)	25 (3.7)	93 (6.9)	21 (2.3)	93 (14.0)	156 (11.0)	10 (1.2)	156 (17.7)
White-crowned Sparrow (*Zonotrichia leucophrys*)	53 (4.2)	8 (1.0)	53 (7.7)	52 (4.4)	21 (2.9)	33 (4.9)	53 (3.9)	4 (0.4)	53 (8.0)	67 (4.7)	4 (0.5)	67 (7.6)
Lucy's Warbler (*Vermivora luciae*)	46 (3.7)	46 (5.5)	0 (0.0)	36 (3.1)	36 (5.0)	0 (0.0)	26 (1.9)	26 (2.8)	0 (0.0)	29 (2.0)	29 (3.5)	0 (0.0)
Song Sparrow (*Melospiza melodia*)	43 (3.4)	43 (5.2)	36 (5.3)	53 (4.5)	53 (7.3)	28 (4.1)	40 (3.0)	40 (4.3)	28 (4.2)	42 (3.0)	42 (5.1)	33 (3.7)
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)	40 (3.2)	40 (4.8)	1 (0.2)	11 (0.9)	2 (0.3)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	7 (0.5)	6 (0.7)	7 (0.8)
Wilson's Warbler (*Wilsonia pusilla*)	36 (2.9)	36 (4.3)	3 (0.4)	21 (1.8)	21 (2.9)	0 (0.0)	32 (2.4)	32 (3.4)	0 (0.0)	8 (0.6)	4 (0.5)	0 (0.0)
American Pipit (*Anthus rubescens*)	32 (2.5)	0 (0.0)	32 (4.7)	46 (3.9)	1 (0.1)	46 (6.8)	30 (2.2)	10 (1.1)	20 (3.0)	82 (5.8)	0 (0.0)	82 (9.3)
Ruby-crowned Kinglet (*Regulus calendula*)	32 (2.5)	13 (1.6)	32 (4.7)	34 (2.9)	18 (2.5)	34 (5.0)	29 (2.2)	7 (0.7)	29 (4.4)	22 (1.6)	5 (0.6)	19 (2.2)
Brown-headed Cowbird (*Molothrus ater*)	30 (2.4)	30 (3.6)	0 (0.0)	34 (2.9)	34 (4.7)	0 (0.0)	37 (2.7)	37 (4.0)	0 (0.0)	41 (2.9)	41 (5.0)	1 (0.1)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Bewick's Wren (*Thryomanes bewickii*)	28 (2.2)	22 (2.6)	26 (3.8)	31 (2.6)	31 (4.3)	22 (3.4)	20 (1.5)	18 (1.9)	20 (3.0)	38 (2.7)	38 (4.6)	26 (3.0)
Common Yellowthroat (*Geothlypis trichas*)	28 (2.2)	28 (3.4)	1 (0.2)	31 (2.6)	31 (4.3)	0 (0.0)	29 (2.2)	29 (3.1)	0 (0.0)	36 (2.5)	36 (4.4)	2 (0.2)
Yellow-breasted Chat (*Icteria virens*)	28 (2.2)	28 (3.4)	0 (0.0)	26 (2.2)	26 (3.6)	0 (0.0)	26 (1.9)	26 (2.8)	1 (0.2)	37 (2.6)	37 (4.5)	0 (0.0)
American Coot (*Fulica americana*)	27 (2.1)	11 (1.3)	27 (3.9)	96 (8.2)	18 (2.5)	88 (13.0)	111 (8.2)	87 (9.4)	43 (6.5)	44 (3.1)	27 (3.3)	32 (3.6)
Blue Grosbeak (*Passerina caerulea*)	23 (1.8)	23 (2.8)	0 (0.0)	21 (1.8)	21 (2.9)	0 (0.0)	18 (1.3)	18 (1.9)	0 (0.0)	26 (1.8)	26 (3.1)	0 (0.0)
Marsh Wren (*Cistothorus palustris*)	22 (1.7)	15 (1.8)	22 (3.2)	31 (2.6)	14 (1.9)	24 (3.5)	34 (2.5)	23 (2.5)	27 (4.1)	44 (3.1)	32 (3.9)	30 (3.4)
Gadwall (*Anas strepera*)	21 (1.7)	1 (0.1)	21 (3.1)	24 (2.0)	1 (0.1)	24 (3.5)	18 (1.3)	8 (0.9)	5 (1.2)	20 (1.4)	7 (0.8)	16 (1.8)
Gambel's Quail (*Callipepla gambelii*)	20 (1.6)	20 (2.4)	4 (0.6)	16 (1.4)	16 (2.2)	5 (0.7)	18 (1.3)	9 (1.0)	5 (0.8)	19 (1.3)	10 (1.2)	19 (2.2)
Black Phoebe (*Sayornis nigricans*)	19 (1.5)	12 (1.4)	19 (2.8)	22 (1.9)	11 (1.5)	22 (3.2)	14 (1.0)	14 (1.5)	14 (2.1)	21 (1.5)	9 (1.1)	21 (2.4)
Black-tailed Gnatcatcher (*Polioptila melanura*)	18 (1.4)	18 (2.2)	13 (1.9)	21 (1.8)	21 (2.9)	13 (1.9)	14 (1.0)	14 (1.5)	13 (2.0)	24 (1.7)	24 (2.9)	14 (1.6)
House Finch (*Carpodacus mexicanus*)	15 (1.2)	15 (1.8)	4 (0.6)	11 (0.9)	10 (1.4)	11 (1.6)	15 (1.1)	12 (1.3)	15 (2.3)	15 (1.1)	8 (1.0)	15 (1.7)
Mallard (*Anas platyrhynchos*)	15 (1.2)	5 (0.6)	10 (1.5)	58 (4.9)	4 (0.5)	55 (8.1)	58 (4.3)	23 (2.5)	34 (5.1)	55 (3.9)	23 (2.8)	55 (6.2)
Verdin (*Auriparus flaviceps*)	15 (1.2)	15 (1.8)	13 (1.9)	18 (1.5)	18 (2.5)	13 (1.9)	16 (1.2)	16 (1.7)	14 (2.1)	21 (1.5)	21 (2.5)	21 (2.4)
Yellow Warbler (*Dendroica petechia*)	14 (1.1)	14 (1.7)	0 (0.0)	11 (0.9)	11 (1.5)	0 (0.0)	16 (1.2)	16 (1.7)	0 (0.0)	23 (1.6)	23 (2.8)	0 (0.0)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

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Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Killdeer (*Charadrius vociferus*)	13 (1.0)	13 (1.6)	7 (1.0)	9 (0.8)	9 (1.2)	3 (0.4)	3 (0.2)	2 (0.2)	1 (0.2)	10 (0.7)	3 (0.4)	10 (1.1)
Orange-crowned Warbler (*Vermivora celata*)	13 (1.0)	4 (0.5)	9 (1.3)	14 (1.2)	4 (0.5)	14 (2.1)	23 (1.7)	4 (0.4)	13 (2.0)	28 (2.0)	1 (0.1)	21 (2.4)
Western Sandpiper (*Calidris mauri*)	12 (1.0)	12 (1.4)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Bushtit (*Psaltriparus minimus*)	11 (0.9)	2 (0.2)	11 (1.6)	8 (0.7)	0 (0.0)	8 (1.2)	12 (0.9)	0 (0.0)	3 (0.4)	1 (0.1)	0 (0.0)	0 (0.0)
Brewer's Sparrow (*Spizella breweri*)	10 (0.8)	0 (0.0)	3 (0.4)	11 (0.9)	11 (1.5)	0 (0.0)	31 (2.3)	31 (3.3)	0 (0.0)	24 (1.7)	6 (0.7)	6 (0.7)
Crissal Thrasher (*Toxostoma crissale*)	10 (0.8)	10 (1.2)	9 (1.3)	7 (0.6)	7 (1.0)	4 (0.6)	5 (0.4)	5 (0.5)	4 (0.6)	6 (0.4)	5 (0.6)	6 (0.7)
Lesser Goldfinch (*Carduelis psaltria*)	10 (0.8)	6 (0.7)	4 (0.6)	12 (1.0)	6 (0.8)	1 (0.1)	3 (0.2)	2 (0.2)	1 (0.2)	11 (0.8)	3 (0.4)	9 (1.0)
American Avocet (*Recurvirostra americana*)	9 (0.7)	9 (1.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Blue-gray Gnatcatcher (*Polioptila caerulea*)	9 (0.7)	9 (1.1)	2 (0.3)	8 (0.7)	7 (1.0)	0 (0.0)	5 (0.4)	5 (0.5)	0 (0.0)	6 (0.4)	6 (0.7)	1 (0.1)
Great-tailed Grackle (*Quiscalus mexicanus*)	8 (0.6)	4 (0.5)	8 (1.2)	19 (1.6)	19 (2.6)	8 (1.2)	23 (1.7)	21 (2.3)	23 (3.5)	45 (3.2)	45 (5.4)	32 (3.6)
Lincoln's Sparrow (*Melospiza lincolnii*)	7 (0.6)	1 (0.1)	7 (1.0)	2 (0.2)	2 (0.3)	1 (0.2)	6 (0.4)	5 (0.5)	6 (0.9)	9 (0.6)	1 (0.1)	9 (1.0)
Savannah Sparrow (*Passerculus sandwichensis*)	6 (0.5)	6 (0.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.3)	4 (0.4)	0 (0.0)	4 (0.3)	0 (0.0)	2 (0.2)
Snowy Egret (*Egretta thula*)	6 (0.5)	5 (0.6)	6 (0.9)	1 (0.1)	0 (0.0)	1 (0.2)	3 (0.2)	2 (0.2)	3 (0.4)	1 (0.1)	1 (0.1)	0 (0.0)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
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Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Black-headed Grosbeak (*Pheucticus melanocephalus*)	5 (0.4)	5 (0.6)	0 (0.0)	2 (0.2)	2 (0.3)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cinnamon Teal (*Anas cyanoptera*)	5 (0.4)	5 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.2)	2 (0.2)	0 (0.0)	2 (0.1)	2 (0.2)	0 (0.0)
Greater Roadrunner (*Geococcyx californianus*)	5 (0.4)	4 (0.5)	5 (0.7)	8 (0.7)	8 (1.1)	1 (0.2)	6 (0.4)	6 (0.6)	1 (0.2)	6 (0.4)	6 (0.7)	4 (0.4)
Loggerhead Shrike (*Lanius ludovicianus*)	5 (0.4)	5 (0.6)	2 (0.3)	4 (0.3)	4 (0.6)	1 (0.2)	3 (0.2)	1 (0.1)	1 (0.2)	4 (0.3)	4 (0.5)	1 (0.1)
Say's Phoebe (*Sayornis saya*)	5 (0.4)	3 (0.4)	5 (0.7)	6 (0.5)	6 (0.8)	3 (0.4)	3 (0.2)	3 (0.3)	1 (0.2)	7 (0.5)	6 (0.7)	7 (0.8)
Spotted Sandpiper (*Actitis macularius*)	5 (0.4)	5 (0.6)	1 (0.2)	7 (0.6)	7 (1.0)	2 (0.3)	2 (0.2)	1 (0.1)	0 (0.0)	3 (0.2)	3 (0.4)	2 (0.2)
Anna's Hummingbird (*Calypte anna*)	4 (0.3)	4 (0.5)	1 (0.2)	2 (0.2)	2 (0.3)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	1 (0.1)
Black-necked Stilt (*Himantopus mexicanus*)	4 (0.3)	4 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Green Heron (*Butorides virescens*)	4 (0.3)	4 (0.5)	1 (0.2)	6 (0.5)	6 (0.8)	2 (0.3)	5 (0.4)	5 (0.5)	1 (0.2)	2 (0.1)	2 (0.2)	0 (0.0)
Northern Flicker (*Colaptes auratus*)	4 (0.3)	0 (0.0)	4 (0.6)	5 (0.4)	0 (0.0)	5 (0.7)	13 (1.0)	1 (0.1)	13 (2.0)	10 (0.7)	3 (0.4)	10 (1.1)
Northern Shoveler (*Anas clypeata*)	4 (0.3)	0 (0.0)	4 (0.6)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Phainopepla (*Phainopepla nitens*)	4 (0.3)	0 (0.0)	4 (0.6)	3 (0.3)	0 (0.0)	3 (0.4)	1 (0.1)	0 (0.0)	1 (0.2)	5 (0.4)	0 (0.0)	5 (0.6)
White-winged Dove (*Zenaida asiatica*)	4 (0.3)	4 (0.5)	1 (0.2)	3 (0.3)	3 (0.4)	0 (0.0)	6 (0.4)	6 (0.6)	0 (0.0)	5 (0.4)	5 (0.6)	0 (0.0)

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	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Belted Kingfisher (*Megaceryle alcyon*)	3 (0.2)	1 (0.1)	3 (0.4)	2 (0.2)	1 (0.1)	2 (0.3)	2 (0.2)	1 (0.1)	2 (0.3)	2 (0.1)	0 (0.0)	1 (0.1)
Black-chinned Hummingbird (*Archilochus alexandri*)	3 (0.2)	3 (0.4)	0 (0.0)	4 (0.3)	4 (0.5)	0 (0.0)	9 (0.7)	9 (1.0)	0 (0.0)	3 (0.2)	3 (0.4)	1 (0.1)
Chipping Sparrow (*Spizella passerina*)	3 (0.2)	2 (0.2)	0 (0.0)	6 (0.5)	0 (0.0)	0 (0.0)	4 (0.3)	4 (0.4)	0 (0.0)	3 (0.2)	0 (0.0)	3 (0.3)
Costa's Hummingbird (*Calypte costae*)	3 (0.2)	3 (0.4)	0 (0.0)	5 (0.4)	5 (0.7)	0 (0.0)	3 (0.2)	3 (0.3)	0 (0.0)	2 (0.1)	2 (0.2)	1 (0.1)
Dark-eyed Junco (*Junco hyemalis*)	3 (0.2)	2 (0.2)	1 (0.2)	5 (0.4)	0 (0.0)	5 (0.7)	47 (3.5)	0 (0.0)	47 (7.1)	11 (0.8)	3 (0.4)	10 (1.1)
Greater Yellowlegs (*Tringa melanoleuca*)	3 (0.2)	0 (0.0)	3 (0.4)	6 (0.5)	1 (0.1)	3 (0.4)	2 (0.2)	0 (0.0)	2 (0.3)	2 (0.1)	1 (0.1)	2 (0.2)
Lazuli Bunting (*Passerina amoena*)	3 (0.2)	2 (0.2)	0 (0.0)	2 (0.2)	2 (0.3)	1 (0.2)	2 (0.2)	2 (0.2)	0 (0.0)	9 (0.6)	1 (0.1)	0 (0.0)
Sharp-shinned Hawk (*Accipiter striatus*)	3 (0.2)	0 (0.0)	3 (0.4)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.2)	3 (0.2)	0 (0.0)	3 (0.3)
Western Bluebird (*Sialia mexicana*)	3 (0.2)	0 (0.0)	3 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Kingbird (*Tyrannus verticalis*)	3 (0.2)	3 (0.4)	0 (0.0)	7 (0.6)	7 (1.0)	0 (0.0)	8 (0.6)	8 (0.9)	0 (0.0)	8 (0.6)	8 (1.0)	0 (0.0)
Barn Owl (*Tyto alba*)	2 (0.2)	2 (0.2)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
Bell's Vireo [Arizona] (*Vireo bellii arizonae*)	2 (0.2)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.3)	4 (0.4)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Black-crowned Night-Heron (*Nycticorax nycticorax*)	2 (0.2)	2 (0.2)	0 (0.0)	2 (0.2)	2 (0.3)	2 (0.3)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)

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Brown-crested Flycatcher (*Myiarchus tyrannulus*)	2 (0.2)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cedar Waxwing (*Bombycilla cedrorum*)	2 (0.2)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cooper's Hawk (*Accipiter cooperii*)	2 (0.2)	1 (0.1)	0 (0.0)	2 (0.2)	0 (0.0)	2 (0.3)	1 (0.1)	1 (0.1)	1 (0.2)	2 (0.1)	2 (0.2)	1 (0.1)
Common Moorhen (*Gallinula chloropus*)	2 (0.2)	1 (0.1)	2 (0.3)	2 (0.2)	2 (0.3)	2 (0.3)	2 (0.2)	2 (0.2)	0 (0.0)	2 (0.1)	2 (0.2)	1 (0.1)
Great Blue Heron (*Ardea herodias*)	2 (0.2)	2 (0.2)	1 (0.2)	3 (0.3)	2 (0.3)	2 (0.3)	3 (0.2)	3 (0.3)	2 (0.3)	3 (0.2)	1 (0.1)	3 (0.3)
Hermit Thrush (*Catharus guttatus*)	2 (0.2)	1 (0.1)	2 (0.3)	4 (0.3)	1 (0.1)	2 (0.3)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.1)
Horned Lark (*Eremophila alpestris*)	2 (0.2)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.4)	5 (0.5)	0 (0.0)	8 (0.6)	7 (0.8)	8 (0.9)
Long-eared Owl (*Asio otus*)	2 (0.2)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	2 (0.2)	2 (0.2)	0 (0.0)	5 (0.4)	5 (0.7)	0 (0.0)	10 (0.7)	10 (1.1)	0 (0.0)	22 (1.6)	22 (2.7)	0 (0.0)
Pied-billed Grebe (*Podilymbus podiceps*)	2 (0.2)	0 (0.0)	2 (0.3)	2 (0.2)	1 (0.1)	2 (0.3)	5 (0.4)	5 (0.5)	4 (0.4)	4 (0.3)	4 (0.5)	0 (0.0)
Red-tailed Hawk (*Buteo jamaicensis*)	2 (0.2)	0 (0.0)	2 (0.3)	1 (0.1)	1 (0.1)	1 (0.2)	2 (0.2)	0 (0.0)	2 (0.3)	1 (0.1)	1 (0.1)	1 (0.1)
Rock Wren (*Salpinctes obsoletus*)	2 (0.2)	1 (0.1)	2 (0.3)	2 (0.2)	2 (0.3)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)
Sora (*Porzana carolina*)	2 (0.2)	0 (0.0)	2 (0.3)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)

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Spotted Towhee (*Pipilo maculatus*)	2 (0.2)	1 (0.1)	2 (0.3)	2 (0.2)	0 (0.0)	2 (0.3)	2 (0.2)	1 (0.1)	2 (0.3)	4 (0.3)	2 (0.2)	4 (0.4)
Summer Tanager (*Piranga rubra*)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Virginia Rail (*Rallus limicola*)	2 (0.2)	2 (0.2)	2 (0.3)	2 (0.2)	1 (0.1)	2 (0.3)	2 (0.2)	0 (0.0)	2 (0.3)	1 (0.1)	1 (0.1)	1 (0.1)
Warbling Vireo (*Vireo gilvus*)	2 (0.2)	2 (0.2)	0 (0.0)	2 (0.2)	2 (0.3)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	2 (0.1)	1 (0.1)	0 (0.0)
Western Wood-Pewee (*Contopus sordidulus*)	2 (0.2)	2 (0.2)	0 (0.0)	2 (0.2)	2 (0.3)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	3 (0.2)	3 (0.4)	0 (0.0)
White-faced Ibis (*Plegadis chihi*)	2 (0.2)	2 (0.2)	0 (0.0)	13 (1.1)	13 (1.8)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
American Robin (*Turdus migratorius*)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.2)	2 (0.2)	0 (0.0)	2 (0.3)	2 (0.1)	0 (0.0)	2 (0.2)
Ash-throated Flycatcher (*Myiarchus cinerascens*)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	2 (0.2)	2 (0.2)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Bendire's Thrasher (*Toxostoma bendirei*)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Blue-winged Teal (*Anas discors*)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Bullock's Oriole (*Icterus bullockii*)	1 (0.1)	1 (0.1)	0 (0.0)	4 (0.3)	4 (0.6)	0 (0.0)	3 (0.2)	3 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Canyon Wren (*Catherpes mexicanus*)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cliff Swallow (*Petrochelidon pyrrhonota*)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.4)	5 (0.5)	0 (0.0)	22 (1.6)	22 (2.7)	0 (0.0)

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Common Merganser (*Mergus merganser*)	1 (0.1)	1 (0.1)	0 (0.0)	2 (0.2)	0 (0.0)	1 (0.2)	3 (0.2)	0 (0.0)	3 (0.4)	1 (0.1)	1 (0.1)	1 (0.1)
Double-crested Cormorant (*Phalacrocorax auritus*)	1 (0.1)	1 (0.1)	0 (0.0)	2 (0.2)	2 (0.3)	2 (0.3)	6 (0.4)	4 (0.4)	6 (0.9)	2 (0.1)	2 (0.2)	2 (0.2)
Dusky Flycatcher (*Empidonax oberholseri*)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	8 (0.6)	8 (0.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Eared Grebe (*Podiceps nigricollis*)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	9 (0.7)	9 (1.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Golden-crowned Kinglet (*Regulus satrapa*)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.3)	0 (0.0)	4 (0.6)	2 (0.1)	0 (0.0)	2 (0.2)
Gray Flycatcher (*Empidonax wrightii*)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.4)	5 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Great Egret (*Ardea alba*)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	1 (0.1)
House Sparrow (*Passer domesticus*)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
House Wren (*Troglodytes aedon*)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ladder-backed Woodpecker (*Picoides scalaris*)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Least Bittern (*Ixobrychus exilis*)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
MacGillivray's Warbler (*Oporornis tolmiei*)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Northern Harrier (*Circus cyaneus*)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	0 (0.0)	0 (0.0)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Northern Mockingbird (*Mimus polyglottos*)	1 (0.1)	1 (0.1)	0 (0.0)	3 (0.3)	2 (0.3)	3 (0.4)	2 (0.2)	2 (0.2)	1 (0.2)	1 (0.1)	1 (0.1)	1 (0.1)
Olive-sided Flycatcher (*Contopus cooperi*)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Osprey (*Pandion haliaetus*)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	1 (0.0)	1 (0.1)	1 (0.1)	1 (0.1)
Pine Siskin (*Carduelis pinus*)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	15 (1.1)	0 (0.0)	15 (2.3)	0 (0.0)	0 (0.0)	0 (0.0)
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)
Semipalmated Plover (*Charadrius semipalmatus*)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Tanager (*Piranga ludoviciana*)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)
"Western Type" (Cordilleran?) Flycatcher (*Empidonax occidentalis*)	1 (0.1)	0 (0.0)	0 (0.0)	2 (0.2)	1 (0.1)	0 (0.0)	5 (0.4)	5 (0.5)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Winter Wren (*Troglodytes troglodytes*)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
American Bittern (*Botaurus lentiginosus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
American White Pelican (*Pelecanus erythrorhynchos*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.1)	2 (0.2)	0 (0.0)
American Wigeon (*Anas americana*)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.3)	0 (0.0)	0 (0.0)	5 (0.4)	0 (0.0)	2 (0.3)	3 (0.2)	3 (0.4)	2 (0.2)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Barn Swallow (*Hirundo rustica*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	75 (5.6)	75 (8.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Black-throated Sparrow (*Amphispiza bilineata*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Brewer's Blackbird (*Euphagus cyanocephalus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	22 (1.6)	0 (0.0)	22 (2.5)
Bufflehead (*Bucephala albeola*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.3)	1 (0.1)	4 (0.6)	16 (1.1)	0 (0.0)	0 (0.0)
Canada Goose (*Branta canadensis*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	5 (0.4)	5 (0.5)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Canyon Towhee (*Pipilo fuscus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Clark's Grebe (*Aechmophorus clarkii*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Common Goldeneye (*Bucephala clangula*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.2)	0 (0.0)	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)
Great Horned Owl (*Bubo virginianus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Green-tailed Towhee (*Pipilo chlorurus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Green-winged Teal (*Anas crecca*)	0 (0.0)	0 (0.0)	0 (0.0)	6 (0.5)	1 (0.1)	6 (0.9)	6 (0.4)	0 (0.0)	2 (0.3)	4 (0.3)	3 (0.4)	1 (0.1)
Hairy Woodpecker (*Picoides villosus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Hooded Oriole (*Icterus cucullatus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.2)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Lark Sparrow (*Chondestes grammacus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Lesser Nighthawk (*Chordeiles acutipennis*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Long-billed Dowitcher (*Limnodromus scolopaceus*)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.2)	2 (0.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Merlin (*Falco columbarius*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Mountain Bluebird (*Sialia currucoides*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.1)
Nashville Warbler (*Vermivora ruficapilla*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.2)	3 (0.3)	0 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)
Northern Pintail (*Anas acuta*)	0 (0.0)	0 (0.0)	0 (0.0)	7 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Peregrine Falcon (*Falco peregrinus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Red-breasted Nuthatch (*Sitta canadensis*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.1)
Redhead (*Aythya americana*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.1)	0 (0.0)	0 (0.0)
Ring-billed Gull (*Larus delawarensis*)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Rock Pigeon (*Columba livia*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.1)
Rufous-crowned Sparrow (*Aimophila ruficeps*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Appendix I continued: Overall, breeding[1], and non-breeding[2] bird species abundances (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Semipalmated Sandpiper (*Calidris pusilla*)	0 (0.0)	0 (0.0)	0 (0.0)	4 (0.3)	4 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Solitary (Plumbeous?) Vireo (*Vireo plumbeus?*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	1 (0.2)	1 (0.1)	1 (0.1)	0 (0.0)	4 (0.3)	4 (0.4)	0 (0.0)
Tree Swallow (*Tachycineta bicolor*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (0.2)	3 (0.4)	0 (0.0)
Violet-green Swallow (*Tachycineta thalassina*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (0.2)	2 (0.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Virginia's Warbler (*Vermivora virginiae*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Grebe (*Aechmophorus occidentalis*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.2)	1 (0.1)	1 (0.1)	0 (0.0)
Western Meadowlark (*Sturnella neglecta*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.1)
Willow Flycatcher (*Empidonax traillii*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	1 (0.1)	0 (0.0)
Wood Duck (*Aix sponsa*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.1)	0 (0.0)	1 (0.1)

1- Breeding season defined as 15 March through 31 August. Includes spring and fall migrant observations.
2- Non-breeding season defined as 1 October through 29 January.
3- Total number of individuals detected.
4- Percentage of individuals detected per species relative to the total number of individuals detected

Appendix II: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Abert's Towhee (*Pipilo aberti)*	28 (100.0)	28 (100.0)	28 (100.0)	28 (100.0)	28 (100.0)	28 (100.0)	27 (96.4)	26 (92.9)	26 (92.9)	27 (96.4)	26 (92.9)	26 (92.9)
Black Phoebe (*Sayornis nigricans*)	28 (100.0)	24 (85.7)	26 (92.9)	28 (100.0)	23 (82.1)	27 (96.4)	28 (100.0)	19 (67.9)	25 (89.3)	27 (96.4)	23 (82.1)	27 (96.4)
Ruby-crowned Kinglet (*Regulus calendula*)	28 (100.0)	13 (46.4)	28 (100.0)	27 (96.4)	15 (53.6)	26 (92.9	27 (96.4)	12 (42.9)	26 (92.9)	25 (89.3)	9 (32.1)	23 (82.1)
Song Sparrow (*Melospiza melodia*)	28 (100.0)	28 (100.0)	27 (96.4)	27 (96.4)	26 (92.9)	26 (92.9)	28 (100.0)	28 (100.0)	28 (100.0)	28 (100.0)	27 (96.4)	26 (92.9)
Yellow-rumped Warbler (*Dendroica coronata*)	28 (100.0)	5 (17.9)	28 (100.0)	27 (96.4)	9 (32.1)	27 (96.4)	27 (96.4)	19 (67.9)	27 (96.4)	27 (96.4)	10 (35.7)	27 (96.4)
Bewick's Wren (*Thryomanes bewickii*)	27 (96.4)	24 (85.7)	26 (92.2)	28 (100.0)	27 (96.4)	25 (89.3)	26 (92.9)	25 (89.3)	26 (92.9)	27 (96.4)	24 (85.7)	27 (96.4)
Brown-headed Cowbird (*Molothrus ater*)	27 (96.4)	27 (96.4)	0 (0.0)	27 (96.4)	27 (96.4)	0 (0.0)	27 (96.4)	27 (96.4)	0 (0.0)	27 (96.4)	27 (96.4)	1 (3.6)
Blue Grosbeak (*Passerina caerulea*)	27 (96.4)	27 (96.4)	0 (0.0)	24 (85.7)	24 (85.7)	0 (0.0)	22 (78.6)	21 (75.0)	0 (0.0)	22 (78.6)	22 (78.6)	0 (0.0)
Black-tailed Gnatcatcher (*Polioptila melanura*)	26 (92.9)	24 (85.7)	22 (78.6)	27 (96.4)	25 (89.3)	23 (82.1)	26 (92.9)	23 (82.1)	22 (78.6)	26 (92.9)	23 (82.1)	21 (75.0)
Common Yellowthroat (*Geothlypis trichas*)	26 (92.9)	26 (92.9)	1 (3.6)	25 (89.3)	25 (89.3)	0 (0.0)	26 (92.9)	26 (92.9)	0 (0.0)	26 (92.9)	26 (92.9)	2 (7.1)
Lucy's Warbler (*Vermivora luciae*)	26 (92.9)	26 (92.9)	0 (0.0)	25 (89.3)	25 (89.3)	0 (0.0)	23 (82.1)	23 (82.1)	0 (0.0)	24 (85.7)	22 (78.9)	0 (0.0)
Marsh Wren (*Cistothorus palustris*)	26 (92.9)	13 (46.4)	24 (85.7)	23 (82.1)	15 (53.6)	20 (71.4)	23 (82.1)	17 (60.7)	23 (82.1)	25 (89.3)	22 (78.6)	23 (82.1)
Mourning Dove (*Zenaida macroura*)	26 (92.9)	26 (92.9)	2 (7.1)	22 (78.6)	20 (71.4)	0 (0.0)	24 (85.7)	23 (82.1)	2 (7.1)	21 (75.0)	21 (75.0)	2 (7.1)

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Orange-crowned Warbler (*Vermivora celata*)	26 (92.9)	7 (25.0)	22 (78.6)	23 (82.1)	6 (21.4)	19 (67.9)	22 (78.6)	8 (28.6)	20 (71.4)	25 (89.3)	3 (10.7)	20 (71.4)
Verdin (*Auriparus flaviceps*)	26 (92.9)	21 (75.0)	20 (71.4)	27 (96.4)	27 (96.4)	16 (57.1)	25 (89.3)	25 (89.3)	20 (71.4)	27 (96.4)	23 (82.1)	24 (85.7)
White-crowned Sparrow (*Zonotrichia leucophrys*)	26 (92.9)	8 (28.6)	24 (85.7)	28 (100.0)	13 (46.4)	25 (89.3)	27 (96.4)	4 (14.3)	27 (96.4)	27 (96.4)	3 (10.7)	27 (96.4)
Crissal Thrasher (*Toxostoma crissale*)	25 (89.3)	20 (71.4)	20 (71.4)	23 (82.1)	18 (64.3)	11 (39.3)	22 (78.6)	13 (46.4)	12 (42.9)	22 (78.6)	16 (57.1)	14 (50.0)
Yellow-breasted Chat (*Icteria virens*)	25 (89.3)	25 (89.3)	0 (0.0)	21 (75.0)	21 (75.0)	0 (0.0)	23 (82.1)	23 (82.1)	1 (3.6)	24 (85.7)	24 (85.7)	0 (0.0)
Gambel's Quail (*Callipepla gambelii*)	21 (75.0)	20 (71.4)	4 (14.3)	14 (50.0)	12 (42.9)	6 (21.4)	15 (53.6)	14 (50.0)	5 (17.9)	20 (71.4)	17 (60.7)	6 (21.4)
Red-winged Blackbird (*Agelaius phoeniceus)*	21 (75.0)	17 (60.7)	14 (50.0)	24 (85.7)	21 (75.0)	21 (42.9)	27 (96.4)	27 (96.4)	13 (46.4)	27 (96.4)	27 (96.4)	14 (50.0)
Wilson's Warbler (*Wilsonia pusilla*)	21 (75.0)	21 (75.0)	4 (14.3)	18 (64.3)	18 (64.3)	0 (0.0)	18 (64.3)	18 (64.3)	0 (0.0)	13 (46.4)	9 (32.1)	0 (0.0)
Greater Roadrunner (*Geococcyx californianus*)	19 (67.9)	16 (57.1)	6 (21.4)	19 (67.9)	17 (60.7)	2 (7.1)	19 (67.9)	15 (53.6)	2 (7.1)	21 (75.0)	13 (46.4)	7 (25.0)
Lincoln's Sparrow (*Melospiza lincolnii*)	18 (64.3)	3 (10.7)	18 (64.3)	8 (28.6)	2 (7.1)	2 (7.1)	17 (60.7)	8 (28.6)	10 (35.7)	10 (35.7)	2 (7.1)	9 (32.1)
American Pipit (*Anthus rubescens*)	17 (60.7)	0 (0.0)	17 (60.7)	17 (60.7)	3 (10.7)	17 (60.7)	21 (75.0)	2 (7.1)	20 (71.4)	17 (60.7)	0 (0.0)	17 (60.7)
American Coot (*Fulica americana*)	16 (57.1)	5 (17.9)	15 (53.6)	20 (71.4)	13 (46.4)	19 (67.9)	21 (75.0)	14 (50.0)	20 (71.4)	21 (75.0)	9 (32.1)	18 (64.3)
House Finch (*Carpodacus mexicanus*)	16 (57.1)	12 (42.9)	5 (17.9)	21 (75.0)	12 (42.9)	14 (50.0)	16 (57.1)	8 (28.6)	12 (42.9)	18 (64.3)	9 (32.1)	11 (39.3)

Appendix II continued: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Killdeer (*Charadrius vociferus*)	16 (57.1)	13 (46.4)	10 (35.7)	16 (57.1)	13 (46.4)	4 (14.3)	8 (28.6)	6 (21.4)	4 (14.3)	14 (50.0)	8 (28.6)	3 (10.7)
Northern Flicker (*Colaptes auratus*)	16 (57.1)	0 (0.0)	14 (50.0)	18 (64.3)	0 (0.0)	16 (57.1)	18 (64.3)	1 (3.6)	15 (53.6)	22 (78.6)	2 (7.1)	18 (64.3)
Loggerhead Shrike (*Lanius ludovicianus*)	15 (53.6)	11 (39.3)	5 (17.9)	9 (32.1)	6 (21.4)	2 (7.1)	3 (10.7)	2 (7.1)	1 (3.6)	10 (35.7)	7 (25.0)	1 (3.6)
Yellow Warbler (*Dendroica petechia*)	15 (53.6)	15 (53.6)	0 (0.0)	14 (50.0)	13 (46.4)	0 (0.0)	15 (53.6)	15 (53.6)	0 (0.0)	17 (60.7)	16 (57.1)	0 (0.0)
Blue-gray Gnatcatcher (*Polioptila caerulea*)	14 (50.0)	11 (39.3)	5 (17.9)	17 (60.7)	6 (21.4)	0 (0.0)	9 (32.1)	7 (25.0)	0 (0.0)	17 (60.7)	14 (50.0)	1 (3.6)
Say's Phoebe (*Sayornis saya*)	14 (50.0)	7 (25.0)	8 (28.6)	14 (50.0)	10 (35.7)	6 (21.4)	9 (32.1)	6 (21.4)	4 (14.3)	18 (64.3)	12 (42.9)	13 (46.4)
White-winged Dove (*Zenaida asiatica*)	13 (46.4)	12 (42.9)	1 (3.6)	6 (21.4)	6 (21.4)	0 (0.0)	12 (42.9)	12 (42.9)	0 (0.0)	8 (28.6)	8 (28.6)	0 (0.0)
Belted Kingfisher (*Megaceryle alcyon*)	12 (42.9)	1 (3.6)	11 (39.3)	8 (28.6)	1 (3.6)	5 (17.9)	5 (17.9)	1 (3.6)	3 (10.7)	6 (21.4)	0 (0.0)	4 (14.3)
Gadwall (*Anas strepera*)	9 (32.1)	2 (7.1)	7 (25.0)	10 (35.7)	1 (3.6)	8 (28.6)	11 (39.3)	1 (3.6)	8 (28.6)	13 (46.4)	4 (14.3)	8 (28.6)
Greater Yellowlegs (*Tringa melanoleuca*)	9 (32.1)	0 (0.0)	9 (32.1)	3 (10.7)	1 (3.6)	2 (7.1)	4 (14.3)	0 (0.0)	4 (14.3)	4 (14.3)	1 (3.6)	2 (7.1)
Great-tailed Grackle (*Quiscalus mexicanus*)	9 (32.1)	7 (25.0)	2 (7.1)	12 (42.9)	11 (39.3)	4 (14.3)	15 (53.6)	14 (50.0)	6 (21.4)	20 (71.4)	19 (67.9)	4 (14.3)
Mallard (*Anas platyrhynchos*)	9 (32.1)	4 (14.3)	6 (21.4)	12 (42.9)	6 (21.4)	9 (32.1)	18 (64.3)	10 (35.7)	12 (42.9)	19 (67.9)	12 (42.9)	10 (35.7)
Spotted Sandpiper (*Actitis macularius*)	9 (32.1)	7 (25.0)	3 (10.7)	10 (35.7)	10 (35.7)	3 (10.7)	3 (10.7)	3 (10.7)	0 (0.0)	10 (35.7)	9 (32.1)	3 (10.7)
Bushtit (*Psaltriparus minimus*)	8 (28.6)	1 (3.6)	6 (21.4)	6 (21.4)	0 (0.0)	5 (17.9)	2 (7.1)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)

Appendix II continued: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Sharp-shinned Hawk (*Accipiter striatus*)	8 (28.6)	0 (0.0)	7 (25.0)	2 (7.1)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	5 (17.9)	0 (0.0)	5 (17.9)
Great Blue Heron (*Ardea herodias*)	7 (25.0)	5 (17.9)	3 (10.7)	12 (42.9)	3 (10.7)	6 (21.4)	8 (28.6)	4 (14.3)	3 (10.7)	8 (28.6)	4 (14.3)	4 (14.3)
Lesser Goldfinch (*Carduelis psaltria*)	7 (25.0)	2 (7.1)	2 (7.1)	9 (32.1)	6 (21.4)	1 (3.6)	9 (32.1)	6 (21.4)	2 (7.1)	10 (35.7)	1 (3.6)	7 (25.0)
Western Kingbird (*Tyrannus verticalis*)	7 (25.0)	6 (21.4)	0 (0.0)	5 (17.9)	4 (14.3)	0 (0.0)	17 (60.7)	16 (57.1)	0 (0.0)	10 (35.7)	9 (32.1)	0 (0.0)
Anna's Hummingbird (*Calypte anna*)	6 (21.4)	4 (14.3)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	4 (14.3)	2 (7.1)	2 (7.1)
Brewer's Sparrow (*Spizella breweri*)	6 (21.4)	0 (0.0)	2 (7.1)	7 (25.0)	4 (14.3)	0 (0.0)	11 (39.3)	9 (32.1)	0 (0.0)	16 (57.1)	4 (14.3)	4 (14.3)
Dark-eyed Junco (*Junco hyemalis*)	6 (21.4)	2 (7.1)	2 (7.1)	5 (25.0)	0 (0.0)	6 (21.4)	18 (64.3)	0 (0.0)	18 (64.3)	12 (42.9)	1 (3.6)	7 (25.0)
Green Heron (*Butorides virescens*)	6 (21.4)	4 (14.3)	2 (7.1)	16 (57.1)	14 (50.0)	4 (14.3)	9 (32.1)	7 (25.0)	2 (7.1)	7 (25.0)	6 (21.4)	0 (0.0)
American Kestrel (*Falco sparverius*)	5 (17.9)	3 (10.7)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)
Black-chinned Hummingbird (*Archilochus alexandri*)	5 (17.9)	6 (21.4)	0 (0.0)	11 (39.3)	12 (42.9)	0 (0.0)	9 (32.1)	9 (32.1)	0 (0.0)	9 (32.1)	8 (28.6)	1 (3.6)
Bell's Vireo [Arizona] (*Vireo bellii arizonae*)	5 (17.9)	5 (17.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (10.7)	3 (10.7)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Chipping Sparrow (*Spizella passerina*)	5 (17.9)	2 (7.1)	0 (0.0)	12 (42.9)	0 (0.0)	0 (0.0)	4 (14.3)	3 (10.7)	0 (0.0)	3 (10.7)	0 (0.0)	2 (7.1)
Lazuli Bunting (*Passerina amoena*)	5 (17.9)	3 (10.7)	0 (0.0)	7 (25.0)	5 (17.9)	1 (3.6)	2 (7.1)	2 (7.1)	0 (0.0)	8 (28.6)	1 (3.6)	0 (0.0)

Appendix II continued: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

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Northern Rough-winged Swallow (*Stelgidopteryx serripennis*)	5 (17.9)	4 (14.3)	0 (0.0)	6 (21.4)	5 (17.9)	0 (0.0)	6 (21.4)	4 (14.3)	0 (0.0)	13 (46.4)	12 (42.9)	0 (0.0)
Phainopepla (*Phainopepla nitens*)	5 (17.9)	0 (0.0)	5 (17.9)	8 (28.6)	0 (0.0)	6 (21.4)	1 (3.6)	0 (0.0)	1 (3.6)	7 (25.0)	0 (0.0)	7 (25.0)
Black-headed Grosbeak (*Pheucticus melanocephalus*)	4 (14.3)	3 (10.7)	0 (0.0)	4 (14.3)	3 (10.7)	0 (0.0)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Costa's Hummingbird (*Calypte costae*)	4 (14.3)	4 (14.3)	0 (0.0)	6 (21.4)	5 (17.9)	0 (0.0)	8 (28.6)	7 (25.0)	0 (0.0)	4 (14.3)	3 (10.7)	1 (3.6)
Common Moorhen (*Gallinula chloropus*)	4 (14.3)	3 (10.7)	2 (7.1)	4 (14.3)	4 (14.3)	1 (3.6)	4 (14.3)	2 (7.1)	0 (0.0)	3 (10.7)	2 (7.1)	1 (3.6)
Great Egret (*Ardea alba*)	4 (14.3)	1 (3.6)	2 (7.1)	2 (7.1)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	1 (3.6)	1 (3.6)
Hermit Thrush (*Catharus guttatus*)	4 (14.3)	1 (3.6)	3 (10.7)	8 (28.6)	1 (3.6)	5 (17.9)	1 (3.6)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)
Rock Wren (*Salpinctes obsoletus*)	4 (14.3)	1 (3.6)	3 (10.7)	4 (14.3)	1 (3.6)	3 (10.7)	2 (7.1)	1 (3.6)	1 (3.6)	4 (14.3)	3 (10.7)	1 (3.6)
Red-tailed Hawk (*Buteo jamaicensis*)	4 (14.3)	0 (0.0)	4 (14.3)	3 (10.7)	1 (3.6)	1 (3.6)	3 (10.7)	0 (0.0)	3 (10.7)	3 (10.7)	1 (3.6)	2 (7.1)
Savannah Sparrow (*Passerculus sandwichensis*)	4 (14.3)	4 (14.3)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	4 (14.3)	4 (14.3)	0 (0.0)	4 (14.3)	0 (0.0)	2 (7.1)
Spotted Towhee (*Pipilo maculatus*)	4 (14.3)	1 (3.6)	3 (10.7)	4 (14.3)	0 (0.0)	3 (10.7)	5 (17.9)	1 (3.6)	5 (17.9)	10 (35.7)	2 (7.1)	10 (35.7)
Virginia Rail (*Rallus limicola*)	4 (14.3)	2 (7.1)	2 (7.1)	2 (7.1)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	2 (7.1)	1 (3.6)	2 (7.1)

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Warbling Vireo (*Vireo gilvus*)	4 (14.3)	4 (14.3)	0 (0.0)	4 (14.3)	3 (10.7)	0 (0.0)	2 (7.1)	1 (3.6)	0 (0.0)	2 (7.1)	1 (3.6)	0 (0.0)
Ash-throated Flycatcher (*Myiarchus cinerascens*)	3 (10.7)	3 (10.7)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	5 (17.9)	5 (17.9)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Barn Owl (*Tyto alba*)	3 (10.7)	2 (7.1)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)
Black-crowned Night-Heron (*Nycticorax nycticorax*)	3 (10.7)	3 (10.7)	0 (0.0)	3 (10.7)	1 (3.6)	3 (10.7)	2 (7.1)	0 (0.0)	2 (7.1)	1 (3.6)	1 (3.6)	1 (3.6)
Cedar Waxwing (*Bombycilla cedrorum*)	3 (10.7)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cooper's Hawk (*Accipiter cooperii*)	3 (10.7)	1 (3.6)	0 (0.0)	5 (17.9)	0 (0.0)	4 (14.3)	3 (10.7)	1 (3.6)	1 (3.6)	2 (7.1)	1 (3.6)	1 (3.6)
Snowy Egret (*Egretta thula*)	3 (10.7)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	4 (14.3)	4 (14.3)	3 (10.7)	2 (7.1)	1 (3.6)	0 (0.0)
Western Sandpiper (*Calidris mauri*)	3 (10.7)	3 (10.7)	0 (0.0)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Tanager (*Piranga ludoviciana*)	3 (10.7)	3 (10.7)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)
Western Wood-Pewee (*Contopus sordidulus*)	3 (10.7)	3 (10.7)	0 (0.0)	5 (17.9)	4 (14.3)	0 (0.0)	4 (14.3)	3 (10.7)	0 (0.0)	6 (21.4)	4 (14.3)	0 (0.0)
Yellow-headed Blackbird (*Xanthocephalus xanthocephalus*)	3 (10.7)	2 (7.1)	1 (3.6)	2 (7.1)	2 (7.1)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	5 (17.9)	5 (17.9)	1 (3.6)
American Avocet (*Recurvirostra americana*)	2 (7.1)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

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Brown-crested Flycatcher (*Myiarchus tyrannulus*)	2 (7.1)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Common Merganser (*Mergus merganser*)	2 (7.1)	2 (7.1)	0 (0.0)	2 (7.1)	0 (0.0)	1 (3.6)	3 (10.7)	0 (0.0)	1 (3.6)	2 (7.1)	1 (3.6)	1 (3.6)
Double-crested Cormorant (*Phalacrocorax auritus*)	2 (7.1)	2 (7.1)	0 (0.0)	4 (14.3)	2 (7.1)	2 (7.1)	3 (10.7)	1 (3.6)	3 (10.7)	3 (10.7)	2 (7.1)	2 (7.1)
House Wren (*Troglodytes aedon*)	2 (7.1)	0 (0.0)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Northern Mockingbird (*Mimus polyglottos*)	2 (7.1)	2 (7.1)	0 (0.0)	9 (32.1)	7 (25.0)	3 (10.7)	7 (25.0)	5 (17.9)	1 (3.6)	4 (14.3)	1 (3.6)	2 (7.1)
Pied-billed Grebe (*Podilymbus podiceps*)	2 (7.1)	0 (0.0)	2 (7.1)	5 (17.9)	1 (3.6)	3 (10.7)	8 (28.6)	5 (17.9)	7 (25.0)	5 (17.9)	5 (17.9)	0 (0.0)
Pine Siskin (*Carduelis pinus*)	2 (7.1)	0 (0.0)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)
Red-naped Sapsucker (*Sphyrapicus nuchalis*)	2 (7.1)	1 (3.6)	1 (3.6)	3 (10.7)	0 (0.0)	3 (10.7)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)
Sora (*Porzana carolina*)	2 (7.1)	0 (0.0)	2 (7.1)	2 (7.1)	1 (3.6)	2 (7.1)	2 (7.1)	1 (3.6)	1 (3.6)	2 (7.1)	1 (3.6)	1 (3.6)
White-faced Ibis (*Plegadis chihi*)	2 (7.1)	2 (7.1)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Winter Wren (*Troglodytes troglodytes*)	2 (7.1)	0 (0.0)	2 (7.1)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
American Robin (*Turdus migratorius*)	1 (3.6)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	5 (17.9)	0 (0.0)	5 (17.9)	4 (14.3)	0 (0.0)	3 (10.7)
Bendire's Thrasher (*Toxostoma bendirei*)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

Appendix II continued: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Black-necked Stilt (*Himantopus mexicanus*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Bullock's Oriole (*Icterus bullockii*)	1 (3.6)	1 (3.6)	0 (0.0)	6 (21.4)	6 (21.4)	0 (0.0)	5 (17.9)	5 (17.9)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Blue-winged Teal (*Anas discors*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Canyon Wren (*Catherpes mexicanus*)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Cinnamon Teal (*Anas cyanoptera*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Cliff Swallow (*Petrochelidon pyrrhonota*)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)
Dusky Flycatcher (*Empidonax oberholseri*)	1 (3.6)	1 (3.6)	0 (0.0)	2 (7.1)	1 (3.6)	0 (0.0)	7 (25.0)	7 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Eared Grebe (*Podiceps nigricollis*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Golden-crowned Kinglet (*Regulus satrapa*)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	3 (10.7)	0 (0.0)	3 (10.7)	1 (3.6)	0 (0.0)	1 (3.6)
Gray Flycatcher (*Empidonax wrightii*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Horned Lark (*Eremophila alpestris*)	1 (3.6	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	2 (7.1)	2 (7.1)	1 (3.6)
House Sparrow (*Passer domesticus*)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Ladder-backed Woodpecker (*Picoides scalaris*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)

Appendix II continued: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Least Bittern (*Ixobrychus exilis*)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Long-eared Owl (*Asio otus*)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
MacGillivray's Warbler (*Oporornis tolmiei*)	1 (3.6)	1 (3.6)	0 (0.0)	1 (0.1)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Northern Harrier (*Circus cyaneus*)	1 (3.6)	0 (0.0)	1 (3.6)	3 (10.7)	0 (0.0)	2 (7.1)	4 (14.3)	1 (3.6)	4 (14.3)	1 (3.6)	0 (0.0)	0 (0.0)
Northern Shoveler (*Anas clypeata*)	1 (3.6)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Olive-sided Flycatcher (*Contopus cooperi*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Osprey (*Pandion haliaetus*)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	3 (10.7)	2 (7.1)	1 (3.6)	1 (3.6)	1 (3.6)	1 (3.6)
Semipalmated Plover (*Charadrius semipalmatus*)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Summer Tanager (*Piranga rubra*)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Bluebird (*Sialia mexicana*)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
"Western Type" (Cordilleran?) Flycatcher (*Empidonax occidentalis*)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	1 (3.6)	0 (0.0)	4 (14.3)	4 (14.3)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
American Bittern (*Botaurus lentiginosus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
American White Pelican (*Pelecanus erythrorhynchos*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)

Appendix II continued: Overall, breeding[1], and non-breeding[2] bird species frequencies (absolute[3] and relative[4]) in the Wash from 12 February 2005 to 25 January 2009. Data were collected at two week intervals at 28 point-count stations along the Wash. Birds that flew over or were > 100 m from the census stations are excluded. Species names follow the AOU checklist of North American Birds, 7th edition. Values are absolute and (relative %).

	YEAR											
	2005-2006			2006-2007			2007-2008			2008-2009		
Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
American Wigeon (*Anas americana*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	5 (17.9)	0 (0.0)	4 (14.3)	3 (10.7)	2 (7.1)	1 (3.6)
Barn Swallow (*Hirundo rustica*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Black-throated Sparrow (*Amphispiza bilineata*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Brewer's Blackbird (*Euphagus cyanocephalus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)
Bufflehead (*Bucephala albeola*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)
Canada Goose (*Branta canadensis*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Canyon Towhee (*Pipilo fuscus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Clark's Grebe (*Aechmophorus clarkii*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Common Goldeneye (*Bucephala clangula*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	0 (0.0)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)
Great Horned Owl (*Bubo virginianus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Green-tailed Towhee (*Pipilo chlorurus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Green-winged Teal (*Anas crecca*)	0 (0.0)	0 (0.0)	0 (0.0)	5 (17.9)	1 (3.6)	2 (7.1)	4 (14.3)	0 (0.0)	2 (7.1)	2 (7.1)	1 (3.6)	2 (7.1)
Hairy Woodpecker (*Picoides villosus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Hooded Oriole (*Icterus cucullatus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)

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Species	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**	**Over-all**	**Breed-ing**	**Non-breeding**
Lark Sparrow (*Chondestes grammacus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Lesser Nighthawk (*Chordeiles acutipennis*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Long-billed Dowitcher *(Limnodromus scolopaceus*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Merlin (*Falco columbarius*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Mountain Bluebird (*Sialia currucoides*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)
Nashville Warbler (*Vermivora ruficapilla*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)
Northern Pintail (*Anas acuta*)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Peregrine Falcon (*Falco peregrinus*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Red-breasted Nuthatch (*Sitta canadensis*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)
Redhead (*Aythya americana*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)
Ring-billed Gull (*Larus delawarensis*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Rock Pigeon (*Columba livia*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)
Rufous-crowned Sparrow (*Aimophila ruficeps*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)

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Semipalmated Sandpiper (*Calidris pusilla*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Solitary (Plumbeous?) Vireo (*Vireo plumbeus?*)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)	6 (21.4)	6 (21.4)	0 (0.0)
Tree Swallow (*Tachycineta bicolor*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Violet-green Swallow (*Tachycineta thalassina*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Virginia's Warbler (*Vermivora virginiae*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Western Grebe (*Aechmophorus occidentalis*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)	1 (3.6)	1 (3.6)	0 (0.0)
Western Meadowlark (*Sturnella neglecta*)	0 (0.0)	0 (0.0)	0 (0.0)	2 (7.1)	1 (3.6)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)
Willow Flycatcher (*Empidonax traillii*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	1 (3.6)	0 (0.0)
Wood Duck (*Aix sponsa*)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (3.6)	0 (0.0)	1 (3.6)

1- Breeding season defined as 15 March through 31 August. Includes some spring and fall migrant observations.

2- Non-breeding season defined as 1 October through 29 January.

3- Total number of census points where a species was detected.

4- Percentage of census points where a species was detected of the 28 total census points.