ECOGRAPHY

Predicting temporal change of species distributions from a single snapshot

Journal:	*Ecography*
Manuscript ID	Draft
Wiley - Manuscript type:	Research Article
Keywords:	colonization, extinction, fractal, grid, species distributions, temporal change

Abstract:	Obtaining temporal biodiversity trends in the light of rapid global change is crucial to estimating future impacts – yet the lack of temporally replicated monitoring data limits our ability. Here, we identify imprints of temporal change in static data and utilize them to predict temporal biodiversity trends without requiring a time-series. We used data from temporally replicated breeding bird atlases from four regions worldwide and measured the change in each bird species by log ratio of occupancy change (measure of loss or gain) and by temporal Jaccard index (measure of turnover of sites). We calculated predictors from the configuration of each species' spatial distribution, traits, diversity metrics, and from study region characteristics and used machine-learning to link these to the temporal change. Static predictors failed to predict the log ratio of occupancy change, but they did predict the magnitude of site turnover. Variables that characterize the spatial configuration of the species range were sufficient to predict the change, while all others contributed only marginally. Here, we show that static data, especially the details of the spatial configuration of species ranges, provide signals of the processes of temporal change. This holds promise for estimating biodiversity change in situations without temporal data.

Predicting temporal change of species distributions from a single snapshot

Abstract:

Obtaining temporal biodiversity trends in the light of rapid global change is crucial to estimating future impacts – yet the lack of temporally replicated monitoring data limits our ability. Here, we identify imprints of temporal change in static data and utilize them to predict temporal biodiversity trends without requiring a time-series. We used data from temporally replicated breeding bird atlases from four regions worldwide and measured the change in each bird species by log ratio of occupancy change (measure of loss or gain) and by temporal Jaccard index (measure of turnover of sites). We calculated predictors from the configuration of each species' spatial distribution, traits, diversity metrics, and from study region characteristics and used machine-learning to link these to the temporal change. Static predictors failed to predict the log ratio of occupancy change, but they did predict the magnitude of site turnover. Variables that characterize the spatial configuration of the species range were sufficient to predict the change, while all others contributed only marginally. Here, we show that static data, especially the details of the spatial configuration of species ranges, provide signals of the processes of temporal change. This holds promise for estimating biodiversity change in situations without temporal data.

Key Words:

colonization, extinction, fractal dimension, grid, risk assessment, threat status, species distributions

1. Introduction:

The world is undergoing intensification of agriculture, pollution, climate change, overexploitation of resources, and changes in land use[1]. All this has been linked to temporal changes in a vital resource, biodiversity[2], and associated ecosystem functions that support human well-being[3]. Consequently, tracking temporal changes in biodiversity and geographic distributions of species that form biodiversity is of high interest.

Obtaining species distribution data over time, however, is challenging, expensive, and depends on the long-term commitment and consistency of biodiversity monitoring projects. As a result, there is a major lack of temporally replicated data[4]. Despite the fact that we have some data on trends in local population abundances in the wealthy Global North (e.g., refs [5,6]) and some data on global extinctions[7], we are missing data on temporal changes in geographic ranges and occupancy over continuous space and large spatial grains and extents.

Several model-based approaches have aimed to circumvent the lack of data, each with its advantages and limitations. A popular tool to predict species distributions and their change under future climate projections are species niche models, or species distribution models (SDMs); however, SDMs may be biased by false assumptions about the species being in equilibrium with the environment, the choice of environmental predictors, species inability to evolve their niche, and stationarity of relationships over time[8,9]. Additionally, when used with future climate projections, the results may be biased by the inaccuracy of the climate projections[10] and by dispersal limitations of the species[11]. An alternative to SDM projections is space-for-time substitution methods[12,13], although they, too, may falsely assume stationarity. Another promising solution has been extrapolating and interpolating good data to situations with poor data, which may address geographical data gaps[14], but the jury is still out on the method.

Yet, another relatively untested alternative involves deriving temporal change of species from static spatial patterns without requiring future climate projection models and without assuming the species' ecology is stationary. One published example of how this may work is based on the link between a species' spatial aggregation, spatial scaling, and temporal change[15–17]: Declining species may have sparser distributions due to patchy local extinctions, while expanding species have aggregated distributions due to distance-limited colonization to nearby patches[17]. This can be characterized by plotting the total area of occupancy (AOO) across several resolutions on a log-log scale, which is the Occupancy-Area Relationship (OAR). Its slope can be converted to the 'box-counting' fractal dimension ($D=-2*slope+2$)[18,19], which turned out to predict temporal occupancy change in butterflies in Britain, Flanders, and Belgium, and in rare plant species in Britain[17].

The drawback is that the method has a limited mechanistic understanding of the drivers of this change. Moreover, whether aggregation patterns can predict temporal change remains untested across large scales, different areas in the world, and many species. Another unanswered question is whether the method would work for predicting both the direction and magnitude of occupancy change.

Here, we argue that, besides the fractal dimension, there may be other static ecological variables, or patterns, that can predict the temporal change of species distributions and perhaps even provide insights into the drivers of temporal change. We propose that combining multiple variables that describe the ecology of a species, the geometry of their spatial distribution, local diversity patterns, and characteristics of the study area can enhance our ability to predict future species trajectories from static data. Furthermore, we propose that additional insights may be gained by separating the analysis of (i) the magnitude from (ii) the direction of temporal change. As far as we know, this has never been done.

Specifically, we present four hypotheses (H1-4), each with a different logic of why dynamic temporal changes can be predictable from static patterns:

- *Species traits (H1):* Traits related to dispersal and adaptive ability may be important predictors for range edge shifts, and it has been suggested that considering traits may advance our understanding of species range edges in fractal analysis[20]. Indeed, traits related to the ecology and morphology of northern passerines were found to be relevant drivers of range shifts in Great Britain birds[21]. We thus hypothesize that species traits can predict a species' capacity to adapt, move, or colonize new areas and thus its vulnerability to threat.

- *Species Range Geometry (H2):* The shape and location of a species' spatial distribution may indicate underlying population dynamics such as site colonization and extinction[22,23], similar to the fractal dimension. For example, circular ranges may enhance species' survival through reduced edge effects because of the small edge-to-area ratio. In addition, when species have rounded ranges, the individuals are likely to be closer to each other, increasing their mating probabilities and gene flow. In contrast, elongated ranges may face higher edge effects and lower encounter rates between individuals[24].
- *Mean Species Site-Level Diversity Indices (H3):* Information on site-level diversities that each species encounters may indicate their potential to compete and coexist through information about the association between species[25]. Species with limited competitive abilities (i.e., those that occupy sites with low α-diversity) may decline in area rather than expand, especially if they struggle to colonize new sites.
- *Spatial Characteristics of the Study Area (H4):* Characteristics of the study area, such as total area, shape, or elongation, can influence species distributions[26] and, thus, potentially also the temporal change of these distributions. For instance, small landlocked countries like the Czech Republic might exhibit different trends compared to large, elongated islands like Japan due to their geometrical differences and surrounding environments.

Here, we test these hypotheses using high-quality presence/absence data from four large-scale breeding bird atlas projects in temperate zones around the world, combined with tree-based machine learning (random forest[27]). We aim to determine which hypothesis and predictors explain the most variation and whether the (i) magnitude of change (turnover of occupied sites) or (ii) direction of change (total area of occupied sites lost or gained) can be better predicted.

2. Methods:

2.1 Species distribution data

We extracted species presence/absence information from four temporally replicated continuous-grid breeding bird atlases. Specifically, we used two atlas replications from each of the following regions (Table 1):

- Czech Republic [28,29]
- New York State [30,31]
- Japan [32–34]
- Europe [35–37]

These atlases aim to provide long-term data on species distributions across a continuous grid within given administrative borders[38]. Over several years, dedicated survey efforts have gathered information on the presence of breeding bird species during the breeding season within predefined grid cells (e.g., 5x5 km in New York or 20x20 km in Japan, Table 1). These surveys are conducted by hundreds of expert ornithologists and volunteers. Due to the goal of compiling comprehensive species lists, atlas data offer high-quality presence and absence information of species across continuous space, aggregated over a multi-year sampling period, which reduces the likelihood of false presences and absences. Although the data for the Czech Republic is embedded in the European dataset and is therefore not fully independent, their spatial scales and thus, distribution patterns are different. Therefore, we regard each atlas dataset as a different 'study region' and will refer to these two terms whenever differences between atlas datasets are highlighted or accounted for.

Bias corrections. Following ref. [36] for Europe, we only considered cells sampled in both atlas periods to avoid taxonomic and geographical sampling biases for all four atlas datasets (Table S1, Supplementary Information 1 for the number of removed species and cells at each step across atlases and sampling periods). Also, we only considered species present in both sampling periods since calculating the log ratio with zeroes in the numerator or denominator is mathematically impossible; therefore, we excluded species that were completely lost or gained between atlas periods (Table S1, Supplementary Information 1).

2.2 The response: species' temporal change

We calculated two measures of temporal change for each species. First, we calculated the *log ratio* of change in Area of occupancy (AOO) between two sampling periods. AOO is the sum of occupied areas (i.e., cells) in km^2. Its *log ratio* between two sampling periods is, therefore, a measure of both magnitude and direction of change for each species, where negative values indicate net area loss and positive values indicate net area gain on a logarithmic scale. The ratio was calculated as follows using the natural logarithm:

$$log\ Ratio\ AOO_{\ time2,\ time1} = log\left(\frac{AOO_{time2}}{AOO_{time1}}\right)$$

Second, we calculated the Jaccard (*J*) similarity index[39] across a species' occupied sites between both sampling periods (temporal *J*, Fig. S1, Supplementary Information 1). This application of *J* describes how much site turnover (i.e., magnitude of change) happened for each species between the two sampling periods, but it doesn't indicate if the change was positive or negative. *J* was calculated following, e.g., ref. [40]:

$$J\ (cells_{time1}, cells_{time2}) = \frac{|cells_{time1} \cap cells_{time2}\ |}{|cells_{time1} \cup cells_{time2}\ |}$$

Where $cells_{time1}$ denotes the list of sites (i.e., grid cells) that are occupied in sampling period one, and $cells_{time2}$ denotes the list of sites that are occupied in sampling period two. *J* ranges from 1 (= species is found at exactly the same set of sites in both time periods) to 0 (= species occupies a completely different set of sites in time one and in time two). *J* can be interpreted as the proportion of "stable" cells that are occupied in both time periods in the total number of cells that were ever occupied by the species. In comparison to the *log ratio*, *J* contains less information, but we expected that exactly for this reason it might be more predictable.

In Figure 2, we illustrate how the direction (*log ratio*) and magnitude (*J*), are related in our data.

2.3 Static predictors

We extracted and calculated a set of 56 predictors; their number was later reduced during data preparation and recursive feature selection. Each predictor relates to a certain hypothesis (H1-4). To facilitate the application of our approach to other study systems in the future, we chose predictors that are easy to gather (for any taxonomic group). A detailed description of the predictors and how they were calculated is in Supplementary Material S1. Here, we only provide a summary:

H1: Species traits. These predictors represent species' capability to adapt (or exapt - i.e., previously evolved traits become beneficial after changes in the environment) or disperse and may thus affect temporal change of distributions. Specifically, we extracted species traits from the AVONET database[41], and global threat status from IUCN[42]. We calculated global phylogenetic distinctness from the BirdTree phylogeny[43]. We used CHELSA global climate data[44,45] in combination with BirdLife International global range maps[46] to calculate species global climate niche breadth using an ordination (Supplementary Material S2). We produced the following predictors: 1) Global climate niche breadth (PC1), 2) global climate niche breadth (PC2), 3) global IUCN threat status, 4) hand-wing index, 5) global range size, 6) body mass, 7) trophic niche, 8) trophic level, 9) habitat type, 10) habitat density, 11) migration (sedentary, partially, migratory), 12) primary lifestyle (aerial, terrestrial, insessorial, aquatic), 13) global evolutionary distinctness.

H2: Species range geometry. These predictors describe the shape, fragmentation, and autocorrelation of the geographic distribution of each species in each atlas, as well as its (relative) location inside each atlas region. We standardized some of these predictors to relative proportions of the total extent of each atlas. The full list of geometric predictors is: 1) area of occupancy (AOO), 2) prevalence, 3) mean probability of co-occurrence, 4) fractal dimension, 5) Moran's I, 6) scale of spatial autocorrelation, 7) range centroid latitude, 8) range centroid longitude, 9) length of the minimum bounding rotated rectangle (MBRR), 10) width of the MBRR, 11) elongation of the MBRR, 12) north-bearing of the MBRR, 13) circularity, 14) bearing along the longest axis of the range, 15) southerness, 16) westernness, 17) relative maximum distance, 18) relative east-west distance, 19) relative north-south distance, 20) relative elongation ratio, 21) relative related circumscribing circle, 22) relative normalized circularity, 23) relative linearity index, 24) distance from the range centroid to the atlas 'center of gravity' (i.e., the average centroid of all species ranges in the study region), 25) maximum distance from the range border to the study region border, 26) maximum distance from the range centroid to the study region border, 27) minimum distance from the range centroid to the study region border.

H3: mean site-level diversity. We measured α- and β-diversity in all grid cells for each atlas. We then calculated the average α- and β-diversity for each species across all sites that are occupied by the species[25]. We expected mean α-diversity for each species to influence temporal range dynamics through the presence of more (or less) competing species. Additionally, species with high mean α-diversity can act as indicators for conservation as they are found in high-diversity sites. A high average β for a species may indicate that it occupies a wide range of habitats with different species assemblages, suggesting adaptability and ecological versatility. Additionally, higher values of β may indicate a larger spatial spread of the range covering various habitats, while species with low mean β may be restricted to specific, similar habitats. The predictors were: 1) mean species α-diversity, 2) mean species β-diversity, and 3) γ-diversity of the study region.

H4: spatial characteristics of the study area. Similarly to the species range for H2, we characterized the spatial configuration of each study region by calculating a set of geometric measures characterizing the shape of the study region (i.e., administrative borders) and individual sites. Species trend estimations are limited by the spatial configuration of the study area, meaning that larger areas can foster larger absolute changes. Since the occurrence datasets we used come at different resolutions, we aimed to include the temporal and spatial scale of each atlas dataset to account for regional differences. However, for reasons of collinearity in the predictors, this information had to be replaced by a classifier for the "dataset"

(Supplementary Information S1). The predictors for atlases were: 1) dataset, 2) mean cell area, 3) total area sampled, 4) total number of cells sampled, 5) mean cell length, 6) length of the MBRR, 7) width of the MBRR, 8) elongation of the MBRR, 9) circularity, 10) north-bearing of the MBRR, 11) north-bearing of the study region, 12) atlas center of gravity longitude, 13) atlas center of gravity latitude.

2.4 Machine learning

To link the static predictors to the two metrics of change (*log ratio* and *J*) in each species and region, we used machine learning in R Version 4.4.0[47]. We initially compared results for random forest (RF) (*'ranger'* R package[48] Version 0.16.0), extreme gradient boosting (*'xgboost'* R package[49] Version 1.7.7.1), and boosted regression trees (*'gbm'* R package[50] Version 2.1.9) for robustness and found that these were consistent across models. Therefore, we only report results for the RF.

Machine learning preparations. First, the data were prepared with stepwise processing following the recipes protocol (*'recipes'* R package[51] Version 1.0.11) to remove highly correlated predictors (r > 0.85) and to check for zero- and near-zero variance in each variable as these will explain little variation in the response. We used knn-imputation[52] (k = 5) to impute the missing traits of three species that have recently undergone taxonomical reclassification. Overall, 18 predictors were removed because of high collinearity between them, yielding a set of 38 final predictors before recursive feature elimination (RFE, see below). IUCN status was revealed to be a near-zero variance predictor, but we still decided to include it in the model as we regarded it as important to explain temporal change for species.

The data were then split into a training set (80%) and a testing set (20%) for later external validation. Furthermore, we applied 3x repeated 10-fold cross-validation for all modeling steps (recursive feature elimination, hyperparameter tuning, final modeling and predictor importance extraction, and variation partitioning).

Recursive feature elimination. We used recursive feature elimination (RFE) to identify the most significant features. RFE iteratively builds models, estimates predictor importances, and removes the least important features based on the model's performance. We again used RF (*'random forest'* R package[53] Version 4.7-1.1) for this purpose within the *'caret'* framework (*'caret'* R package[54] Version 6.0-94). The process continued until the optimal subset of features was identified, balancing model complexity and performance. Additionally, RFE is useful in reducing the number of predictors required to apply the model to new data, for which not all 38 predictors may be available. Predictor importance was determined through the permutation of variables and comparing the increase in inaccuracy (mean square error, MSE) to the non-permuted model. Based on these results, we chose the final predictor lists for hyperparameter tuning. Note that model results (e.g., R^2 or individual variable importances) between RFE and the final model may differ slightly since we performed hyperparameter tuning with a limited grid search for each model with a different predictor subset for RFE to reduce computing time and more thoroughly for the final model (see below).

Hyperparameter tuning. In addition to repeated cross-validation, we utilized a thorough grid search to find the best hyperparameters for the final models (using *'caret'*). The chosen hyperparameters for *J* were: ntrees = 5,000, mtry = 27, target node size = 5, and splitrule = extratrees. This configuration resulted in OOB-MSE (out of bag-mean square error) = 0.010 and OOB-R^2 = 0.875. For *log ratio,* the chosen hyperparameters were: ntrees = 5,000, mtry = 10, target node size = 5, and splitrule = variance. This configuration resulted in OOB-MSE = 0.272 and OOB-R^2 = 0.202.

Model performance evaluation. The predictive performance of the final models was evaluated using RMSE and R^2 on the independent test data (20% of the full data), while the performance of RFE models, variation partitioning, and hyperparameter tuning were directly evaluated based on OOB-R^2 and OOB-RMSE since the aim was not the prediction itself for these analyses. We selected the final hyperparameters to minimize RMSE.

Variation partitioning. We utilized variation partitioning[55] to understand the contribution of the four different hypotheses to the model's performance (i.e., to test the importance of sets of predictors, as opposed to individual predictors). This was done through the iterative building of RF models with all possible combinations of hypotheses as predictors (N_{models}= 15) for each response (ntrees = 5000). The variation was partitioned by subtracting the shared and unique contributions from the individual models following the same approach as '*varpart4()'* from the '*vegan'* R package[56] Version 2.6-6.1. Since models are built iteratively on different subsets of predictors, we performed automated hyperparameter tuning for each model.

2.5 Future projections

We also aimed to provide an example of the model's application. In the last part, we applied the final ('*ranger'*[48]) RF model to forecast temporal change from the data of the second sampling period of the atlases. These results are compared to the observed *Jaccard* and *log ratio AOO,* and we provide ranked species lists for each study region based on the magnitude of their future change prediction in Supplementary Information S2.

3. Results:

3.1 Summary of Trends in the Data

Examples of trends and spatial patterns in the atlas data, together with per-atlas summaries, are in Figure 1. There were differences in trends across the atlases. For instance, most species in Europe retained a stable AOO and underwent weak site turnover. In Japan, similar numbers of species underwent weak decreases, weak increases, and no trends of AOO but underwent stronger turnover than elsewhere. There was a higher number of species undergoing strong decreases in AOO in New York and Japan than in the Czech Republic and Europe.

3.2 Predictive Performance of Models

The predictive performance of the Jaccard (*J*) models was strong, with our model achieving an R^2 of 0.88 and an RMSE of 0.10 on the independent test dataset (Fig. 3a). Recursive feature elimination revealed that 18 predictors out of 58 were sufficient to achieve this level of model performance (Fig. 5a). For *log ratio AOO*, model predictive performance was variable and always low (test-R^2 = 0.14 and RMSE = 0.55, Fig. 3b; OOB-R^2 = 0.20).

3.3 Predictive Power of Hypotheses

The RF model including only predictors for species range geometry (H2) accounted for a higher proportion of the variation in *J* than the full model (R^2 = 0.85 for H2 alone, R^2 = 0.77 for the full model, Fig. 4a). Partitioning the variation explained by the full model into unique fractions explained by each hypothesis revealed that the largest proportion was again explained by the species range geometry (H2) alone (R^2 = 0.396), while fractions explained by the other hypotheses were negligible (R^2 = 0.006 or lower, and even negative for (H1) species traits and (H4) atlas characteristics).

Results for *log ratio* (Fig. 4b) indicate a low explanatory power for all hypotheses (full model R^2 = 0.177). The largest proportion of variation is explained by H1, H2, and H4 together (shared R^2 = 0.206), while the inclusion of H3 decreases the model performance strongly by R^2 = -0.22.

However, this strongly negative R^2 value may derive from a bad choice of hyperparameters on this model with only two predictors and indicates generally low explanatory power of diversity indices for this response.

3.4 Importance of Predictors

Recursive feature elimination for *J* determined that 18 out of 58 predictors were enough to yield sufficient accuracy in model predictions. Out of these 18 predictors, 14 belonged to H2 (species range geometry), two belonged to H3 (diversity indices) and one belonged to H4 (atlas characteristics) and H1 (species traits) (Fig. 5a). The most important predictors (in order of importance) to predict *J* were: prevalence and Moran's I, followed by fractal dimension and range circularity (Fig. 5a). Further, mean species α- and β-diversity were more important than individual species traits such as habitat type and global range size.

The marginal effects of predictors on *J* (Fig. 5b) show that the higher the prevalence (proportion occupied sites in the region), the lower site turnover *J* is expected. We also found a positive relationship between the fractal dimension and *J* and between spatial autocorrelation of distributions (Moran's I) and *J*. On the contrary, highly irregular range sizes (indicated by high values of circularity or lower values of the related circumscribing circle) suggest higher *J*. Both mean species α- and β-diversity show that species that, on average, share sites with many other species tend to have lower values of *J* than is the case for species that, on average, occupy sites with fewer species (Fig. S5, Supplementary Information 1).

Results for the *log ratio* should be regarded with caution due to the poor performance of the models. They were also more variable across different runs of the model, and the best model included all variables except species evolutionary distinctness, trophic level, migratory status, and hand-wing index, see Fig. S6, Supplementary Information 1). However, the fractal dimension has always emerged as the most important predictor across all hyperparameter tuning, and resampling runs for this response. Partial dependencies between predictors and *log ratio* were mostly flat, reflecting the poor performance of the models (Fig. S7, Supplementary Information 1).

3.5 Observed trends and future predictions

We projected species-level *J* values (but not change of AOO because the model was weak) into the future using the species distribution data from the second atlas generations. We provide comprehensive ranked lists of species undergoing temporal change observed and forecasted trends for each study region in Supplementary Information 2.

Comparing these future projections with past values of *J* revealed that several species are projected to undergo a change in range dynamics with time (Fig. 6), i.e., they are expected to slow down or accelerate their site turnover. Especially in Europe (Fig. 6b), we forecast species ranges to become less dynamic in the future, as indicated by more points falling below the 1-1 line in the lower right corner of the plot. Trends for Japan (Fig. 6c) are more variable and include several outlier species where ranges become very stable or very dynamic. Trends for the Czech Republic (Fig. 6a) are balanced besides three outlier species that are predicted to become much more dynamic in the future, while in New York state (Fig. 6d), species ranges will predominantly become less dynamic.

4. Discussion:

4.1 Predicting magnitude vs direction of temporal change

Our most striking result is that *J* (turnover of occupied sites) is highly predictable from a single snapshot, but the net change of occupancy is not. Thus, we can predict that a species is going through something very dynamic, but we do not know if it is an expansion, a decline, or a mix of both. The weak predictability of AOO change is partly in line with ref. [17]; although they claimed that change can be predicted from the fractal dimension of species' distribution together with AOO, the relationship was, in fact, weak (their $R^2 = 0.23$), which is similar to what we found (but note differences in the methodology). In comparison to ref. [17] and our results for the *log ratio*, the good predictability of the site turnover is truly striking.

The second main finding is that the best predictors of future site turnover are geometrical properties of the distributions, namely species prevalence, fractal dimension, autocorrelation, and range circularity. Specifically, species with compact, filled, round, and larger ranges will undergo less site turnover in the future than species with fragmented and small distributions with complex edges.

So far, we have used highly structured and standardized atlas data, but following the strong predictive performance of the range geometry for temporal change, we suggest that there is the potential to apply our approach to less structured data. This should be verified by comparing results for the same regions and taxa with other data. For instance, using data from the Global Biodiversity Information Facility (GBIF, https://www.gbif.org/). This can be done by overlaying a continuous grid over the retrieved distribution data. Despite the limitations and biases associated with biased sampling and unstructured (non-probability samples of) data, addressing these has been extensively studied recently. For example, ref. [57,58].

4.2 Theoretical implications and future directions

We propose the following theoretical explanation for what appears to be a novel finding: Imagine that the dynamical system of species' spatial distributions has two primary attractors that lead to stable equilibrium points: (i) The first attractor is a complete loss of the species, and (ii) the second attractor is a compact, filled, round, and relatively large range. The second attractor leads to a stable equilibrium because such a shape can protect the species against the negative impacts of demographic and environmental stochasticity. Any distribution pattern that falls between these two attractors would be fragmented, unfilled, and unstable, as it would inevitably either move towards the first attractor (leading to a net loss in AOO) or the second attractor (leading to a net gain in AOO).

Further, we can even observe a mixture of these attraction trends in the same region in a species with many fragments and/or with a complex and "unfilled" range. This would result in high site turnover. In contrast, since the compact, round, and filled distribution is a stable attractor, they would generate low site turnover. This may also explain why the net direction is less predictable, as the transition from an (unstable) fragmented distribution can lead either to loss or gain. We tentatively refer to this as the *equilibrium hypothesis of range* geometry, which we plan to develop further in future theoretical research.

One geometrical predictor that deserves special attention is the area of occupancy (AOO) since it could lead to a *regression-towards-the-mean effect*[59], a common statistical phenomenon in ecological temporal change studies (e.g., ref.[60]). It describes the tendency to yield values closer to the mean in a second random sample of a variable when the first random sample of the same variable is extreme. We have indeed detected that species with small AOO tend to increase in AOO (Fig. S3b, Supplementary Information S1) and that species with large AOO tended to experience less change. In contrast, we did not find a similar effect of AOO on J (i.e., not more turnover for species with extreme AOO, Fig. S3a). We incorporated this effect into our analysis by including AOO as a predictor for temporal change. However, there may still be other geometrical or statistical effects at play, and we suggest that these should be explored in future research.

Another remarkable result is the poor predictive performance of species traits. Despite traits (e.g., specialization, body size, and habitat preference) being proposed as useful predictors of range shifts and species responses to environmental changes [21,61], their effectiveness remains contested as their explanatory power has been shown to be generally low[62,63]. Our study aligns with the latter position, as we find traits to have little influence on the range dynamics in our chosen study system (i.e., birds) and/or at the large temporal and spatial scales that we assessed here. Yet, we admit that the result is limited to the specific traits that we assessed here. The validity of our finding across other traits, regions, scales, and taxa is yet to be established. Other approaches, such as those including phylogenetic information to assess predictors of range size and extinction, often emphasize complex interactions between current traits, evolutionary history, and environmental factors (e.g., in lizards[64], birds[65], and mammals[66]). Since our study only looked at the phylogenetic distinctness of species, we did not determine the direct strength of the phylogeny in our results. However, our findings suggest that the spatial configuration of species ranges, which is known to be influenced by phylogenetic history[67], can play a significant role in predicting temporal changes. Nevertheless, the scale at which this acts may be larger than what is assessed here.

4.4 Practical implications and future directions

We suggest that our results can be useful in risk assessments and in determining the conservation status (priority) of species. Because of temporal data deficits, risk assessments usually involve static indicators such as the geographic range size, while criteria based on temporal reductions are less frequently evaluated and more difficult to meet[68]. Our findings indicate that the magnitude of temporal dynamics in a species' range can be predicted from a single snapshot of the species distribution, where species with small, unfilled, and discontinuous ranges are prone to change in distribution. We thus suggest incorporating prediction models of simple but highly predictable metrics (e.g., J) in species risk assessments. Even though J alone does not indicate if the species is increasing or decreasing, we propose that a species' occupancy and the predicted J can be used to prioritize extreme species for the compilation of available data on change and, if necessary, promote new monitoring initiatives to determine if the change is going to be negative or positive (e.g., *Cercotrichas galactotes* in Europe or *Rostratula benghalensis* in Japan).

Along similar lines, the fact that *J* was predictable, but the net AOO change was not, may have implications for the choice of the response variable in ecological models. Specifically, the use of response variables with less information but higher predictability (e.g., temporal species-level *Jaccard* index) may be preferable over the use of high-information responses with low accuracy (e.g., temporal *log ratio AOO*) for species lacking baseline data. Furthermore, the high predictability of *Jaccard* offers novel interdisciplinary possibilities in the future for any binary dynamical data with spatial information, e.g., using eDNA, fossils, and in epidemiology (assessments of disease spread in space). Support for *Jaccard* being a good metric to compare different sets of patterns has been found across many different datasets and disciplines[69]. We suggest that the application of *Jaccard* as an index for the magnitude of temporal change will enhance our understanding of species distribution dynamics and improve conservation strategies globally

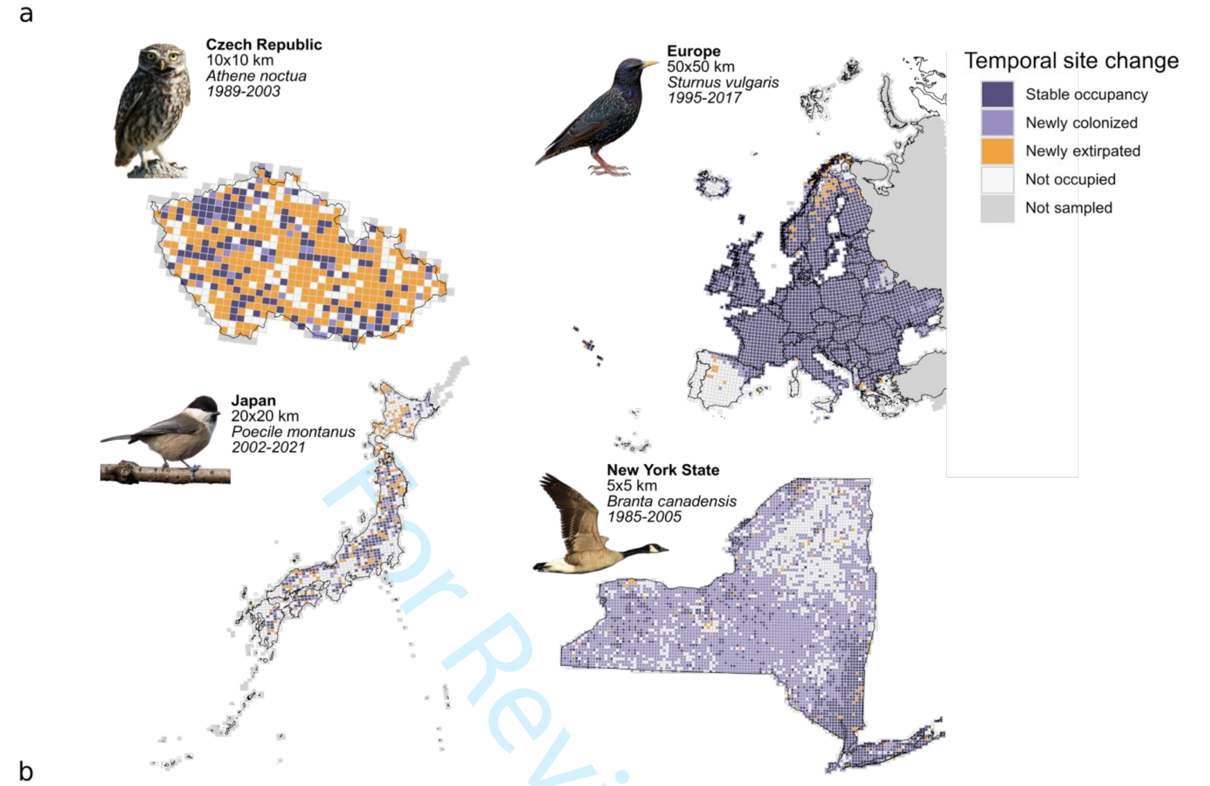
5. Tables and Figures.

Table 1: Overview of temporally replicated continuous-grid breeding bird atlases used in this study

Atlas	$N_{Species}$*	Spatial Scope	Temporal scope	Ref	Data type
Atlas of Breeding Birds of the Czech Republic	200	Czech Republic: 10x10 km	1985 - 1989, 2001 - 2003	[28,29]	Field survey
New York State Breeding Bird Atlas	237	New York State: 5x5 km	1980 - 1985, 2000 - 2005	[30,31]	Field survey
European Breeding Bird Atlas	503	Europe: 50x50 km	1972 - 1995, 2013 - 2017	[35–37]	Field survey
Japan National Bird Breeding Distribution Survey	208	Japan: 20x20 km	1997 - 2002, 2016 - 2021	[32,33,70]	Field survey, Questionnaires

* Final counts after removing species that were gained or lost completely and those that were only recorded in cells not sampled twice.

a



b

	Czech Republic	Europe	Japan	New York State
Species	*Athene noctua*	*Sturnus vulgaris*	*Poecile montanus*	*Branta canadensis*
Trend	strong decrease	stable	dynamic but stable AOO	strong increase
Log Ratio AOO	-0.94	0.04	-0.04	1.32
Jaccard	0.28	0.90	0.37	0.24
Fractal Dimension 1	1.65	1.78	1.51	1.34
Fractal Dimension 2	1.45	1.80	1.48	1.85
Prevalence 1	0.68	0.79	0.28	0.20
Prevalence 2	0.27	0.82	0.27	0.75

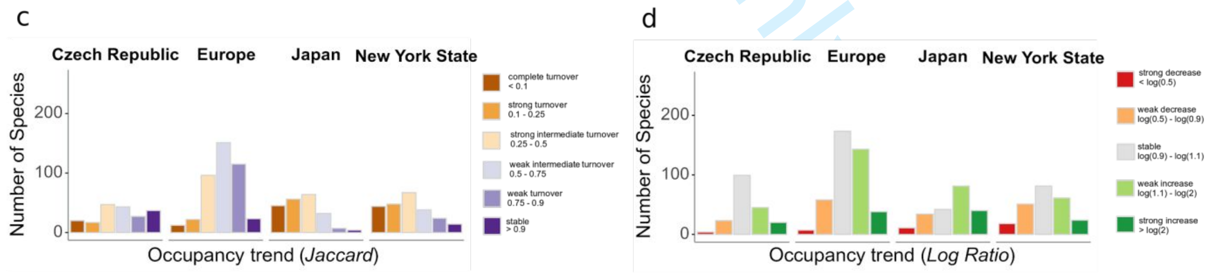


Figure 1: Examples of temporal species trends across the four study regions. (a) Example maps showing species change in occupancy between sampling periods. Gray cells indicate areas not sampled repeatedly. Significant occupancy decrease: *Athene noctua* in the Czech Republic (10x10 km, S-JTSK / Krovak East North); Substantial occupancy increase: *Branta canadensis* in New York State (5x5 km, NAD83 / New York Long Island);

High site turnover, but with stable area: *Poecile montanus* in Japan (20x20 km, JGD2011 / Japan Plane Rectangular CS XVI); Generally stable distribution with stable area and low site turnover: *Sturnus vulgaris* in Europe (50x50 km, ETRS89-extended / LAEA Europe). (b) Table summarizing some predictor and response values for the provided maps. 1 and 2 = sampling periods. (c) The number of species per observed trend in site turnover (*Jaccard*) across study regions. (d) The number of species per observed trend in occupied area (*log ratio*) across the study regions. Photo credits: *Athene noctua* by Arturo Nikolai, CC BY-SA 2.0; *Branta canadensis*, public domain; *Poecile montanus* by Francis C. Franklin, CC BY-SA 3.0; and *Sturnus vulgaris* by Pierre Selim, CC BY-SA 3.0.

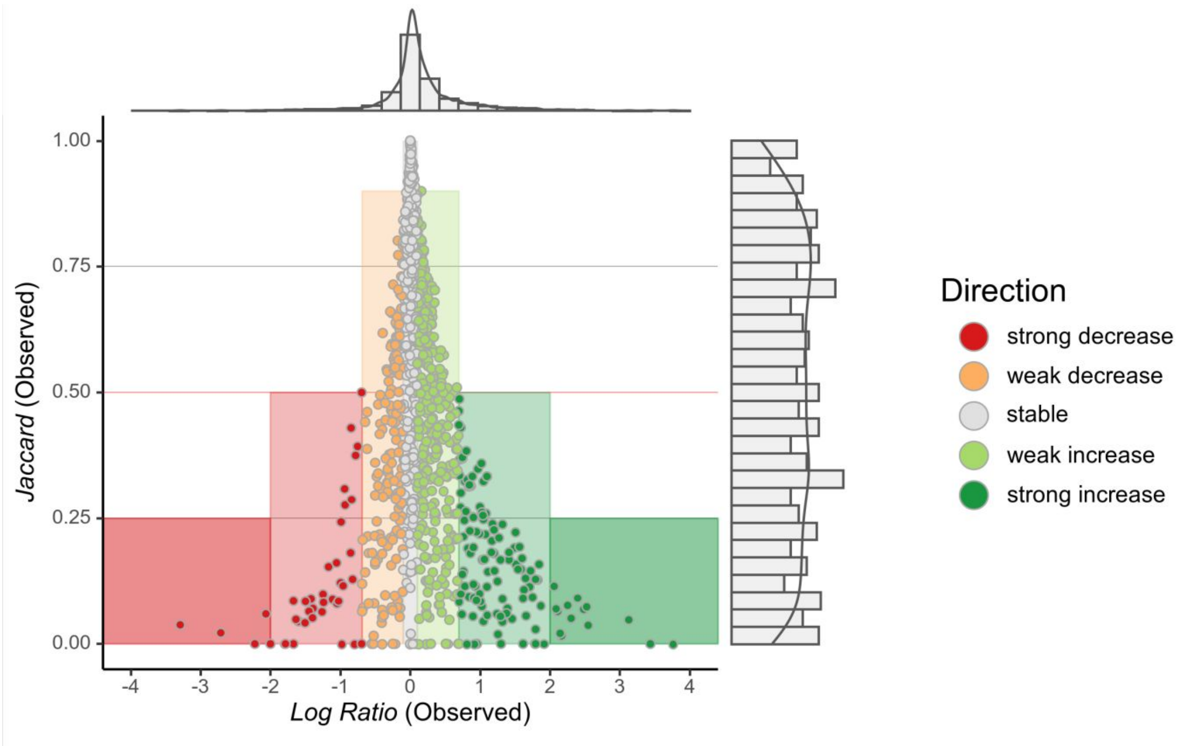


Figure 2: Relationship between the observed measures of temporal change: direction *(log ratio of area of occupancy*) and magnitude of site turnover (*Jaccard index*). Lower values of *Jaccard* (higher magnitude of change) may be accompanied by stronger trends in direction (lower part of the graph). High values of *Jaccard* (low magnitudes of change) are restricted to weak trends in direction (upper part of the graph). Each point represents a single species and is colored by categorical trends in *log ratio*. Note the marginal distributions of both variables: the highest proportion of values in *log ratio* is centered around zero, while values for *J* are evenly spread, indicating that most species that are estimated to undergo no net change in direction are still likely to experience turnover.

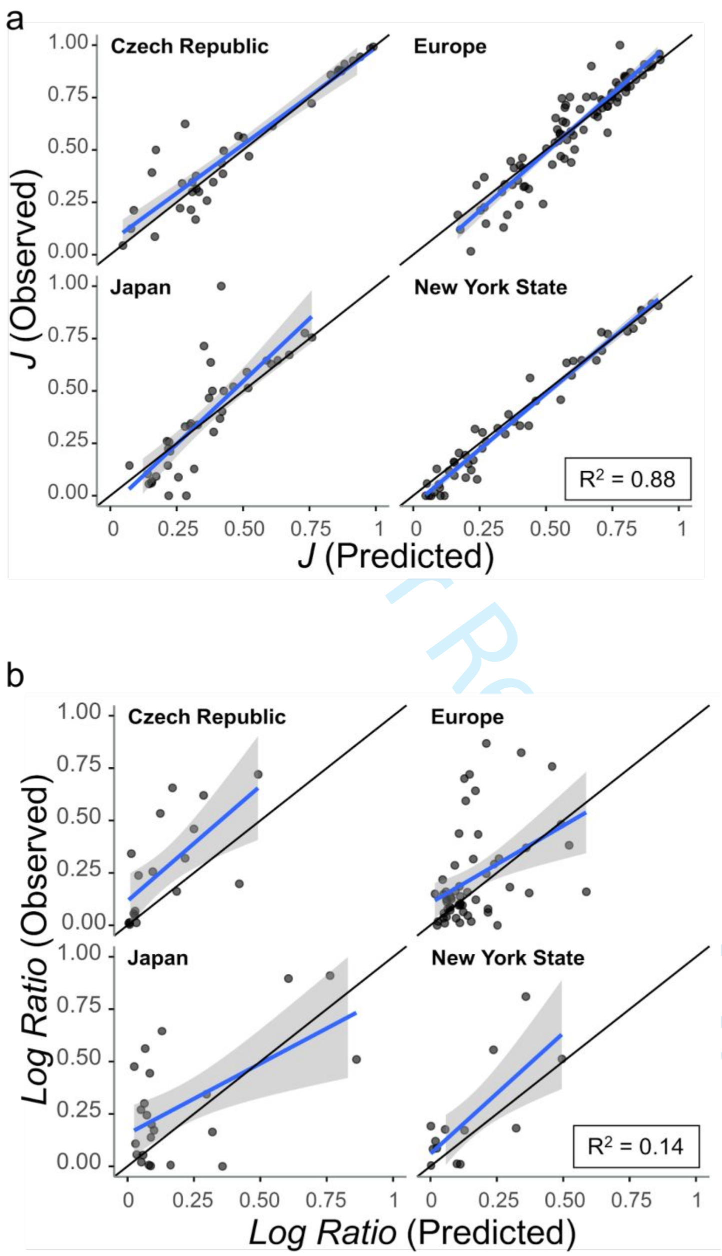


Figure 3: Scatterplots of observed and predicted values in the validation data of (a) *Jaccard* index (J) and (b) *log ratio area of occupancy.* Each point represents the relationship between observed values and model predictions for a single species in the validation data (20% random species subset of the full dataset). Species represented in this figure were not used to train the model. The 1:1 line (black) represents a perfect predictive performance for the model on new data. Subpanels show the differences in the predictive

performance across study regions. The blue line and confidence intervals represent the linear relationship and standard deviation. R^2 values represent the accuracy of the model when predicting using new data.

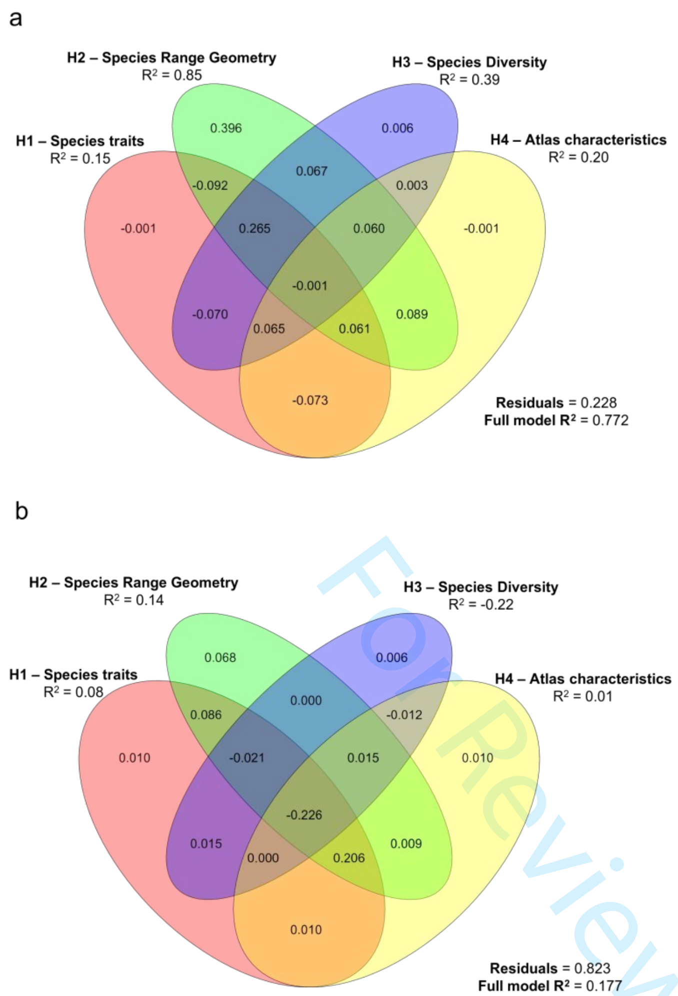


Figure 4: Variation partitioning results for (a) the magnitude of temporal change (*Jaccard index, J*) and (b) the direction of temporal change (*log ratio AOO*) across the four hypotheses. The results are presented in terms of OOB-R^2, which indicates the proportion of variance explained by each hypothesis evaluated against the out-of-bag sample during the Random Forest fitting. Negative fractions in panel (b) are likely an artifact due to the different hyperparameter tuning of individual models, all with poor performance. Inconsistencies in model performances (i.e., R^2) between this analysis and the final model similarly derive from different hyperparameter tuning of individual models.

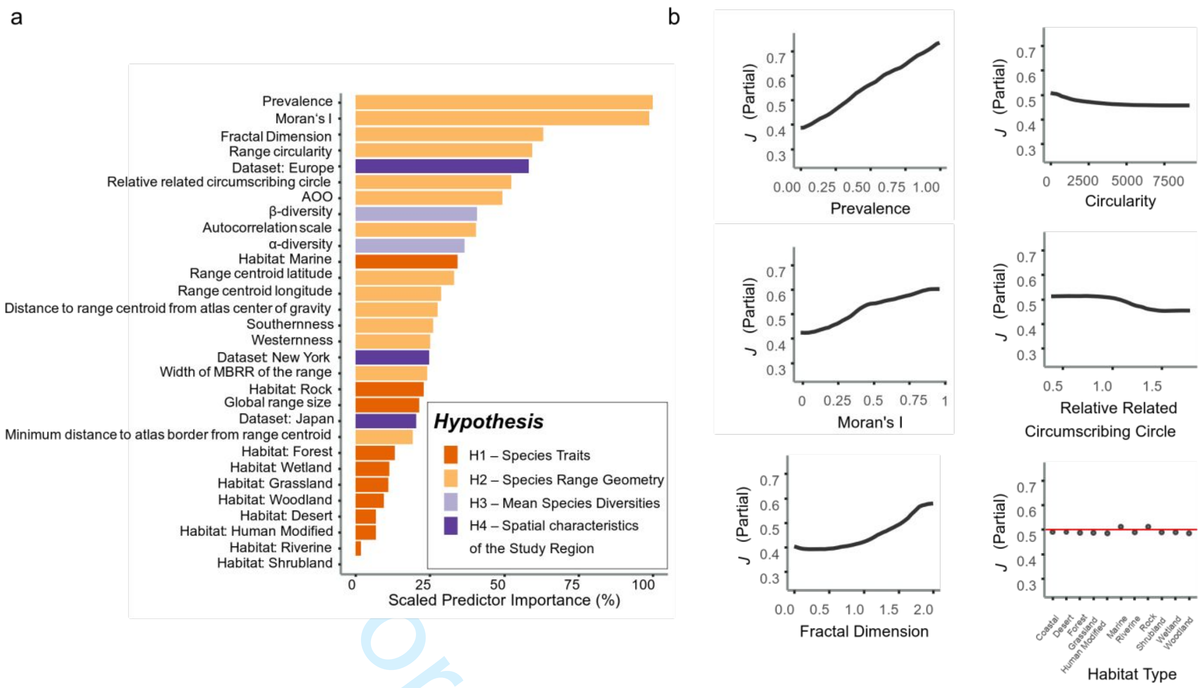


Figure 5: Predictor influences in the final model for *Jaccard index* (*J*). (a) Relative Importance of predictors after recursive feature elimination from the final Random Forest model. Relative predictor importance is the scaled increase in mean square error (MSE) when the variable is permuted. Bars are colored by the hypothesis to which the specific predictor belongs. (b) Partial dependence plots for a selection of the most interesting predictors (Random Forest). Plots were created using the '*partial()*' function from the '*pdp*' R package (Version 0.8.1). Dependencies represent the effect of the variable when all other variables are averaged (i.e., marginal effects). MBRR = minimum bounding rotated rectangle.

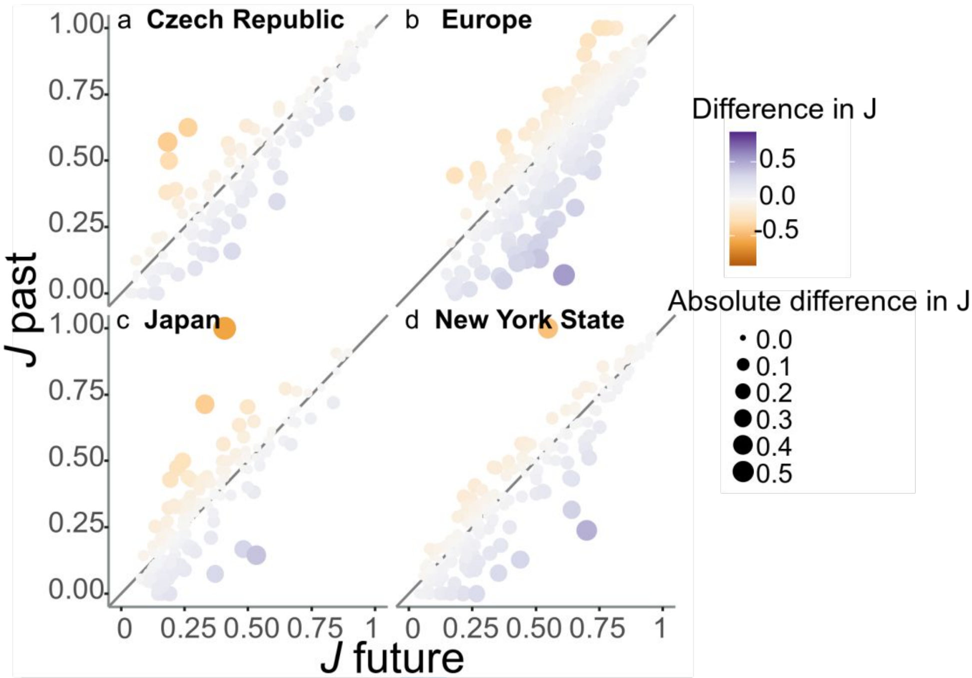


Figure 6: Comparison of past dynamics with future projections of range dynamics across (a) the Czech Republic, (b) Europe, (c) Japan, and (d) New York State. Each point represents a species, with past dynamics on the x-axis and future projected dynamics on the y-axis. Orange colors indicate decreases in *J* from past to future, and blue colors indicate increases in *J* with time. Points that fall on the 1-1 line (black) are not expected to undergo a change in their range dynamics (i.e., the change in the past is the same as the change in the future). The dots are sized by the absolute difference between *J* values (i.e., the 'magnitude' of the change in dynamics with time).

References

1. Díaz, S. *et al.* Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science* **366**, eaax3100 (2019).
2. IPBES. *Global Assessment Report on Biodiversity and Ecosystem Services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services*. https://zenodo.org/record/3831673 (2019) doi:10.5281/ZENODO.3831673.
3. Zhang, R., Tian, D., Wang, J. & Niu, S. Critical role of multidimensional biodiversity in contributing to ecosystem sustainability under global change. *Geography and Sustainability* **4**, 232–243 (2023).
4. Meyer, H. & Pebesma, E. Machine learning-based global maps of ecological variables and the challenge of assessing them. *Nat Commun* **13**, 2208 (2022).
5. Dornelas, M. *et al.* BioTIME: A database of biodiversity time series for the Anthropocene. *Global Ecology and Biogeography* **27**, 760–786 (2018).
6. Rosenberg, K. V. *et al.* Decline of the North American avifauna. *Science* **366**, 120–124 (2019).
7. Barnosky, A. D. *et al.* Has the Earth's sixth mass extinction already arrived? *Nature* **471**, 51–57 (2011).
8. Asch, R. G., Sobolewska, J. & Chan, K. Assessing the reliability of species distribution models in the face of climate and ecosystem regime shifts: Small pelagic fishes in the California Current System. *Frontiers in Marine Science* **9**, (2022).
9. Elith, J. & Leathwick, J. R. Species Distribution Models: Ecological Explanation and Prediction Across Space and Time. *Annual Review of Ecology, Evolution, and Systematics,* **40**, 677–697 (2009).
10. Santini, L., Benítez-López, A., Maiorano, L., Čengić, M. & Huijbregts, M. A. J. Assessing the reliability of species distribution projections in climate change research. *Divers. Distrib.* **27**, 1035–1050 (2021).
11. Marjakangas, E.-L. *et al.* Ecological barriers mediate spatiotemporal shifts of bird

communities at a continental scale. *Proc. Natl. Acad. Sci.* **120**, e2213330120 (2023).

12. Hudson, L. N. *et al.* The PREDICTS database: A global database of how local terrestrial biodiversity responds to human impacts. *Ecology and Evolution* **4**, 4701–4735 (2014).
13. Newbold, T. *et al.* Global effects of land use on local terrestrial biodiversity. *Nature* **520**, 45–50 (2015).
14. Keil, P. & Chase, J. Interpolation of temporal biodiversity change, loss, and gain across scales: a machine learning approach. (2022).
15. Hui, C. Forecasting Population Trend From the Scaling Pattern of Occupancy. *Ecological Modelling* (2011) doi:10.1016/j.ecolmodel.2010.10.020.
16. Pöyry, J., Heikkinen, R. K., Heliölä, J., Kuussaari, M. & Saarinen, K. Scaling distributional patterns of butterflies across multiple scales: Impact of range history and habitat type. *Diversity and Distributions* **24**, 1453–1463 (2018).
17. Wilson, R. J., Thomas, C. D., Fox, R., Roy, D. B. & Kunin, W. E. Spatial patterns in species distributions reveal biodiversity change. *Nature* **432**, 393–396 (2004).
18. Hartley, S. & Kunin, W. E. Scale Dependency of Rarity, Extinction Risk, and Conservation Priority. *Conservation Biology* **17**, 1559–1570 (2003).
19. Kunin, W. E. Extrapolating Species Abundance Across Spatial Scales. *Science* **281**, 1513–1515 (1998).
21. Thompson, L., Wells, K., Galiana, N. & Lurgi, M. Joint Effects of Species Traits and Environmental Preferences on Range Edge Shifts of British Birds. *Global Ecology and Biogeography* (2023) doi:10.1111/geb.13752.
22. Brown, J. H., Stevens, G. C. & Kaufman, D. M. THE GEOGRAPHIC RANGE: Size, Shape, Boundaries, and Internal Structure. *Annual Review of Ecology and Systematics* **27**, 597–623 (1996).
23. Lucas, P. M., González-Suárez, M. & Revilla, E. Range Area Matters, and So Does Spatial Configuration: Predicting Conservation Status in Vertebrates. *Ecography* (2019) doi:10.1111/ecog.03865.
24. Brown, J. H. On the relationship between abundance and distribution of species. *The*

american naturalist **124**, 255–279 (1984).

25. Arita, H. T., Christen, J. A., Rodríguez, P. & Soberón, J. Species Diversity and Distribution in Presence-Absence Matrices: Mathematical Relationships and Biological Implications. *The American Naturalist* **172**, 519–532 (2008).
26. Kunin, W. E. Sample shape, spatial scale and species counts: Implications for reserve design. *Biological Conservation* **82**, 369–377 (1997).
27. Breiman, L. Random forests. *Mach. Learn.* **45**, 5–32 (2001).
28. Štastnỳ, K., Bejček, V. & Hudec, K. *Atlas Hnızdnıho Rozšırenı Ptáku v České Republice 1985–1989*. (H & H, Jinocany, Czech Republic, 1996).
29. Šťastný, K., Bejček, V. & Hudec, K. *Atlas Hnízdního Rozšíření Ptáků v České Republice: 2001-2003*. (Aventinum, Praha, 2006).
30. Federation of New York State Bird Clubs, New York (State). Department of Environmental Conservation, & Cornell University Laboratory of Ornithology. *The Atlas of Breeding Birds in New York State*. (Cornell University Press Ithaca, Ithaca, 1988).
31. *The Second Atlas of Breeding Birds in New York State*. (Comstock Publishing Associates, Ithaca, 2008).
32. Ueta, M. & Uemura, S. *The Report of the Japan Breeding Bird Atlas - Mapping the Present Status of Japanese Birds 2016-2021*. (Bird Breeding Distribution Research Committee, Fuchu, Tokyo, 2021).
33. Ministry of the Environment, Natural Environment Bureau, Biodiversity Center. *Bird Breeding Distribution Survey Report*. (Ministry of the Environment, Natural Environment Bureau, Biodiversity Center, Fujiyoshida City, 2004).
34. Ueta, M. *et al.* The third dataset of ”the breeding bird atlas of Japan”. Japan Bird Research Association https://doi.org/10.57368/data.birdresearch.21957254.v2 (2023).
35. EBCC. European breeding bird atlas 2 website. http://ebba2.info/ (2022).
36. Keller, V. *et al. European Breeding Bird Atlas 2: Distribution, Abundance and Change*. (European Bird Census Council & Lynx Edicions, Barcelona, 2020).
37. *The EBCC Atlas of European Breeding Birds: Their Distribution and Abundance*. vol. 479

(T & A D Poyser, London, 1997).

38. Pototsky, P. C. & Cresswell, W. A new global review of bird atlases and their contribution to knowledge. *Bird Study* **70**, 84–98 (2023).
39. Jaccard, P. The distribution of the flora in the alpine zone. *New phytologist* **11**, 37–50 (1912).
40. Chung, N. C., Miasojedow, B., Startek, M. & Gambin, A. Jaccard/tanimoto similarity test and estimation methods for biological presence-absence data. *BMC Bioinf.* **20**, 644 (2019).
41. Tobias, J. A. *et al.* AVONET: Morphological, Ecological and Geographical data for all Birds. *Ecology Letters* **25**, 581–597 (2022).
42. IUCN. The IUCN Red List of Threatened Species. (2024).
43. Jetz, W., Thomas, G. H., Joy, J. B., Hartmann, K. & Mooers, A. O. The global diversity of birds in space and time. *Nature* **491**, 444–448 (2012).
44. Karger, D. N. *et al.* Climatologies at high resolution for the earth's land surface areas. *Sci Data* **4**, 170122 (2017).
45. Karger, D. N. *et al.* Climatologies at high resolution for the earth's land surface areas. 2.1 KB EnviDat https://doi.org/10.16904/ENVIDAT.228.V2.1 (2021).
46. BirdLife International and Handbook of the Birds of the World. Bird species distribution maps of the world. (2022).
47. R Core Team. *R: A Language and Environment for Statistical Computing*. (R Foundation for Statistical Computing, Vienna, Austria, 2024).
48. Wright, M. N. & Ziegler, A. ranger: A fast implementation of random forests for high dimensional data in C++ and R. *Journal of Statistical Software* **77**, 1–17 (2017).
49. Chen, T. *et al. Xgboost: Extreme Gradient Boosting*. https://CRAN.R-project.org/package=xgboost (2024).
50. Ridgeway, G. & GBM Developers. *Gbm: Generalized Boosted Regression Models*. https://CRAN.R-project.org/package=gbm (2024).
51. Kuhn, M., Wickham, H. & Hvitfeldt, E. *Recipes: Preprocessing and Feature Engineering*

Steps for Modeling. (2024).

52. Gower, J. C. A general coefficient of similarity and some of its properties. *Biometrics* 857–871 (1971).

53. Liaw, A. & Wiener, M. Classification and regression by randomForest. *R News* **2**, 18–22 (2002).

54. Kuhn & Max. Building predictive models in R using the caret package. *J. Stat. Softw.* **28**, 1–26 (2008).

55. Borcard, D., Legendre, P. & Drapeau, P. Partialling out the spatial component of ecological variation. *Ecology* **73**, 1045–1055 (1992).

56. Oksanen, J. *et al.* vegan: Community Ecology Package. 2.6-8 https://doi.org/10.32614/CRAN.package.vegan (2001).

57. Gonsamo, A. & D'Odorico, P. Citizen Science: Best Practices to Remove Observer Bias in Trend Analysis. *International Journal of Biometeorology* (2014) doi:10.1007/s00484-014-0806-8.

58. Isaac, N. J. B. & Pocock, M. J. O. Bias and Information in Biological Records. *Biological Journal of the Linnean Society* (2015) doi:10.1111/bij.12532.

59. Galton, F. Regression Towards Mediocrity in Hereditary Stature. *The Journal of the Anthropological Institute of Great Britain and Ireland* **15**, 246 (1886).

60. Mazalla, L. & Diekmann, M. Regression to the mean in vegetation science. *J Vegetation Science* **33**, e13117 (2022).

61. Devictor, V., Julliard, R. & Jiguet, F. Distribution of specialist and generalist species along spatial gradients of habitat disturbance and fragmentation. *Oikos* **117**, 507–514 (2008).

62. Beissinger, S. R. & Riddell, E. A. Why are species' traits weak predictors of range shifts? *Annual Review of Ecology, Evolution, and Systematics* vol. 52 47–66 (2021).

63. Angert, A. L. *et al.* Do species' traits predict recent shifts at expanding range edges? *Ecology Letters* **14**, 677–689 (2011).

64. Camacho, A. *et al.* Overcoming phylogenetic and geographic uncertainties to test for

correlates of range size evolution in gymnophthalmid lizards. *Ecography* **40**, 764–773 (2017).

65. Böhning-Gaese, K., Caprano, T., Ewijk, K. van & Veith, M. Range size: disentangling current traits and phylogenetic and biogeographic factors. *Am. Nat.* **167**, 555–567 (2006).

66. Fritz, S. A., Bininda-Emonds, O. R. & Purvis, A. Geographical variation in predictors of mammalian extinction risk: big is bad, but only in the tropics. *Ecology letters* **12**, 538–549 (2009).

67. Roy, K., Hunt, G., Jablonski, D., Krug, A. Z. & Valentine, J. W. A macroevolutionary perspective on species range limits. *Proc. R. Soc. B.* **276**, 1485–1493 (2009).

68. Mace, G. M. *et al.* Quantification of extinction risk: IUCN's system for classifying threatened species. *Conserv. Biol.* **22**, 1424–1442 (2008).

69. Fletcher, S. & Islam, M. Comparing sets of patterns with the Jaccard index. *Australas. J. Inf. Syst.* **22**, (2018).

Supplemental Information for:

Predicting temporal change of species distributions from a single snapshot

DBPR

Table of Contents:

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Supplementary Methods

The original atlas data was extensively pre-processed to yield the set of predictors. Here, we describe each step in detail. In addition, we provide our code in a separate repository (https://anonymous.4open.science/r/StaticPatterns_Code-80E1/). All steps were done in R Version 4.4.0[1] using RStudio[2] or Visual Studio Code.

Data integration and preparations. All bird atlases were standardized to the same data format, which included a table with presence information for all species in all cells across sampling periods and a spatial object with cells matching those from the data. We first checked the data and spatial grid files for misspelled names, non-UTF8 characters, misplaced spatial coordinates, or projection issues. Then, the data and the grid were spatially aggregated multiple times to capture several scales. Note that we did not perform any up-or downscaling to standardize the resolution of the assessment of different atlases but preferred to stick to the original resolution as the target scale for most analyses. Spatial objects were projected to local coordinate reference systems (CRS) that best captured local area properties for plotting (see figure captions for information about projections).

Raw atlas data filtering. To correct for spatial bias in the atlas data, we followed a simple filtering approach. Specifically, we followed the recommendations by ref. [3] to keep only cells that were quantitatively sampled (i.e., as opposed to occurrence records based on expert knowledge) in both atlas periods. For the European Breeding Bird Atlas (EBBA), this led to the exclusion of Russia, Kazakhstan, Turkey, Cyprus, Georgia, the Canary Islands, Armenia, and Azerbaijan, for which no (quantitative) data was available for the first atlas period (EBBA1). Naturally, the exclusion of certain cells from the data led to the exclusion of species that were exclusively found in these cells. Additionally, we excluded all species for which only occurrence data from one atlas was available. For an overview of filtering steps and related sample sizes, see Table S1.

Scaling. Gridded data enable easy upscaling via nested aggregation of neighboring cells to larger areas. We made multiple layers of aggregations to enable the calculation of scale-independent descriptors of the species range (fractal dimension). Specifically, we calculated 2x2, 4x4, 8x8, 16x16, 32x32, and 64x64 cell aggregations until the largest aggregation only captured a single cell of the entire country. The single-cell layer was then excluded[4]. When coarsening the grids, the lists of species present in cells of every coarser cell reflected records of all the smaller cells in the bigger cell. Note that different atlases come in different resolutions, with cell sizes ranging from 5x5 km in New York State to 50x50 km in Europe (Table 1, main text). We did not standardize the spatial resolution between atlases but rather aimed to account for it in the final machine-learning model.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Table S1: Data reductions during pre-processing and bias correction of temporally replicated atlas datasets*

Atlas	CZ		NY		EU		JP		TOTAL
Temporal replicate	**1**	**2**	**1**	**2**	**1**	**2**	**1**	**2**	**both**
N species	206	213	242	248	432	446	221	227	826
N sites	628	628	5323	5332	2826	2868	1095	1098	9926
N sp lost completely	13		5		0		11		29
N sp gained completely	6		11		14		29		60
N removed cells (1x1)	0		15		52		3		70
N removed cells (layer 2x2)	0		2		8		0		10
N removed cells (layer 4x4)	0		2		3		0		5
N removed cells (layer 8x8)	0		1		1		0		2
N final species	200		237		432		208		774
N species removed	19		16		14		32		52
N cells final	628		5320		2821		1095		9864
Mean cell area km2	130		25		1470 - 12769		468		
Avg. side length km	11		5		50		18.5		

* Cells were removed at the original resolution (1x1) if they were not sampled repeatedly over both atlas sampling periods. Cells in higher aggregations (2x2, 4x4, 8x8) were only removed if none of the cells that were merged to a larger cell were sampled. Additionally, species that were not found in both sampling periods were removed. The absence of species from the occurrence data indicates AOO = 0 and would thus lead to division by zero or taking the logarithm of zero during the calculation of log ratio AOO, which is mathematically impossible.

Measuring temporal change. In this study, we adapted the *Jaccard (J)* index of similarity[5], which was originally developed to highlight proportional differences in species composition between different sites. *J* is a straightforward index as it simply indicates the proportion between the union and the intersection between two sets of data. So far, most studies that use *J* have used it in one of the first three ways depicted in Fig. S1 (1-3), where (pairs of) sites are compared in terms of species composition (1) or pairs of species are compared in terms of their

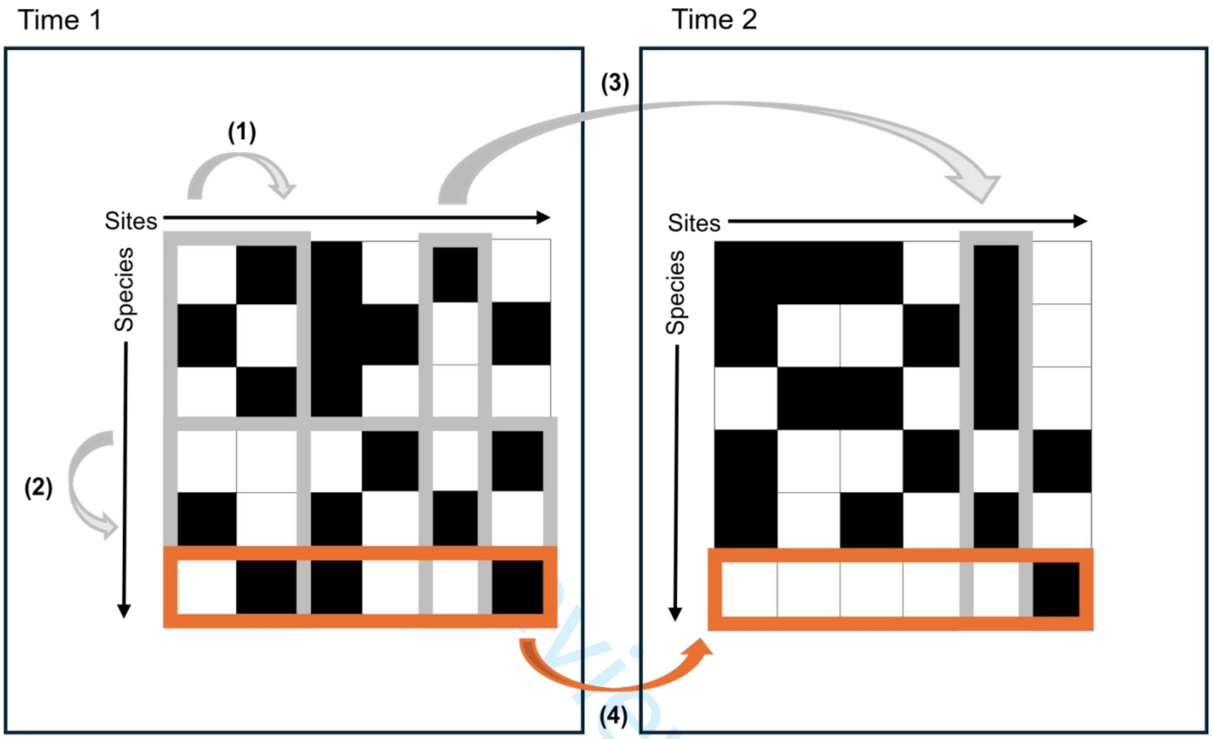
ECOGRAPHY Open Access A JOURNAL OF SPACE AND TIME IN ECOLOGY

spatial association (2) (for a review of 'turnover' indices see [6]. Recently, 'temporal β-diversity indices (TBI)'[7] have been applied to compare dissimilarities in species composition in sites across multiple sampling periods.

Here, we take a different approach and use *J* to compare the ratio between sites that are similar in both periods (intersection) to those sites that are occupied in all sampling periods (union). In the scheme below (Fig. S1), the union is Site 2, site 3, and site 6, and the intersection would be Site 6. In this simplified example, *J* would be 0.33, indicating that only ⅓ of sites are similar between periods and that there was a moderately high magnitude of temporal change in the species distribution.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Concept of *Jaccard* as a temporal species-level index.



(1) Turnover of species between two sites

(2) Interspecific spatial association between two species

(3) Turnover of species at a single site between two sampling periods

(4) Turnover of sites between sampling periods for a single species (*J*)

Figure S1: Diversity of turnover indices that can be calculated from presence-absence matrices highlighting our measure of 'magnitude of change' (orange). In traditional analyses, estimations of biodiversity change are often calculated from presence-absence matrices of species across sites in either one of the first three (1-3) approaches visualized here. We aimed at characterizing temporal change for each species separately and developed a fourth method on how this can be readily done from presence-absence matrices (4) by directly comparing the occupied sites for the same species across multiple sampling periods (time 1, time 2). Additionally, by summing up the area of all occupied sites for a single species and contrasting it between both sampling periods, we can estimate the *log ratio of AOO* while comparing whether occupied sites are similar between both periods can estimate *Jaccard (J)*.

Predictors.

In the following section, we provide detailed information about how the predictor variables were calculated for each hypothesis.

H1: Species traits

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

In addition to species traits extracted directly from AVONET[8], we calculated the species' global climate niche breadth from CHELSA climate data[9,10] and BirdLife International Range maps[11] using an ordination technique.

Global climate niche breadth. We calculated climatic niche breadth for each species as the standard deviation along the two major principle component (PC) axis that include the following CHELSA bio variables averaged across 1981-2010 across the species global range: mean annual air temperature, mean diurnal air temperature range, isothermality, temperature seasonality, mean daily maximum air temperature of the warmest month, mean daily minimum air temperature of the coldest month, annual range of air temperature, annual precipitation amount, precipitation amount of the wettest month, precipitation amount of the driest month, precipitation seasonality. These variables are known to characterize the water- and temperature demands of terrestrial species (e.g., following ref. [12]). Climate raster layers were stacked and aggregated from 0.008333 degrees to roughly 1 degree (or 110x110 km) resolution using the *'terra'* R package Version 1.7-78 [13] to enhance computation.

First, we calculated the global climate space for these variables using PCA (73% cumulative variation explained) using '*prcomp'* Version 4.4.0 in R [1]; for loadings of principal component axes, see Table S2. Climate variables were numerically scaled because of highly different variable dimensions. Second, BirdLife global range maps (subsetted to Breeding and resident, native or reintroduced, extant or possibly/probably extant) for each species in the atlas dataset were projected onto the climate stack, and average climate values were extracted for each species at occupied cells across the species global distribution. Extracted climate values were used to predict each species' global distribution into the climate space of the PCA (colored dots in Figure S1). Standard deviations (SD) of the first and second major axes were computed for each species to characterize the species' climatic niche breadth.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Table S2: Principal component analysis (PCA) loadings for calculating the global climate space in which species occurrences are projected to estimate climatic niches

Bio Name	CHELSA_1981-2010_Bio_Var_name*	PC1	PC2
bio1	mean annual air temperature	0.36	0.26
bio2	mean diurnal air temperature range	-0.15	0.48
bio3	isothermality	0.28	0.18
bio4	temperature seasonality	-0.36	0.14
bio5	mean daily maximum air temperature of the warmest month	0.28	0.41
bio6	mean daily minimum air temperature of the coldest month	0.39	0.14
bio7	annual range of air temperature	-0.34	0.25
bio12	annual precipitation amount	0.35	-0.13
bio13	precipitation amount of the wettest month	0.33	0.03
bio14	precipitation amount of the driest month	0.27	-0.30
bio15	precipitation seasonality	0.01	0.55
Proportion of variance		0.51	0.22
Cumulative proportion		0.51	0.73

*Averaged climate data for the period between 1981 and 2010 was downloaded from CHELSA [9,14]

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

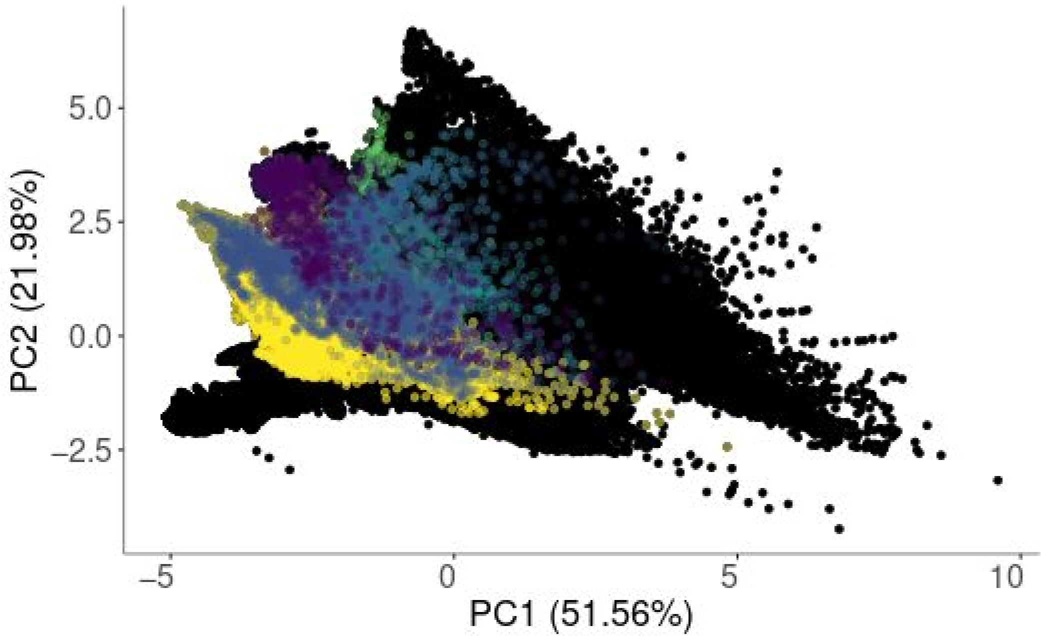


Figure S2: Example of climate space for four species (colored points) against the background of the global climate space (black points). Each point represents the average climatic conditions for the period between 1981-2010 at a certain 10x10 km site in the global grid.

Phylogenetic distinctness. We used the *'phyloregion'* R package Version 1.0.8 [15] to calculate phylogenetic distinctness as fair-proportion. We did so on the complete bird phylogeny [16] and subsequently extracted values only for species present in our data to get a global measure of phylogenetic distinctness that is comparable between different study regions. Phylogenetic distinctness is a measure of evolutionary isolation and is used by global nature conservation initiatives such as the 'EDGE of Existence' programme to identify and preserve species with evolutionary distinct genomes.

Red Lists. We used the IUCN API via the '*taxize*' R package Version 0.9.100.1 [17] to retrieve the threat status for all species (and synonyms) in our data on 22nd April 2024. In addition, we harvested local threat statuses from the National Red List database [18] for the Czech Republic, Japan, and Europe. For New York state, we had to convert the state's species list and their legal status [19] to something comparable to a red list. Since the data for New York was strongly different from the data that was collected for the rest of the regions, we abandoned this approach and continued with the global threat statuses from IUCN.

H2: Species Range Geometry
Area of occupancy (AOO) was calculated for each species-time-atlas combination as the sum of the area of all cells occupied by the species across the filtered set of cells. We checked for *regression-towards-the-mean*[20,21] effects in the distribution of AOO between both time periods.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

We did not find strong trends in the data. We then checked whether it affected the relationship between *log ratio AOO* and log AOO, as well as *Jaccard* and log AOO (Fig. S3). If such an effect were present, we would expect a bell-shaped distribution for Jaccard and log AOO (i.e., strong turnover for extreme values of log AOO and high stability for intermediate values of log AOO). For the log ratio, we would expect a negatively linear relationship (i.e., increases for small ranges, decreases for large ranges). Indeed, we found a weak tendency for the regression-towards-the-mean in *log ratio*, although it was stronger for very small ranges compared to very large ones (which seemed to be stable rather than decreasing).

Prevalence was calculated as the number of cells occupied by the species divided by the total number of cells sampled per atlas. It indicates how dominant a species is across the study area.

Occupancy-Area relationships (OAR) were calculated for each species-time-atlas combination across all spatial scales that were not saturated by the species (i.e., Prevalence < 1). This step led to the exclusion of species that saturated at the original resolution (i.e., Prevalence = 1 at the original resolution). Next, we fit a linear regression model with the formula log(AOO) ~ log(mean area) for each species-time-atlas combination. From this, we extracted the slopes and calculated the **fractal dimension** as $D = -2 * b + 2$ to scale it between 0 and 2 and account for the area (instead of cell side length) in the regression formula.

Mean probability to co-occur was calculated from a presence/absence community matrix using the R package *'coocurr'* Version 1.3 [22]. First, we computed the community presence-absence matrices for each scale-atlas-time period combination with the R package *'fossil'*[23] Version 0.4.0. Next, we used the '*coocurr'* package to probabilistically model the co-occurrence of species among sites. For each species, the model estimates an expected frequency based on the distribution of each species being independent of the other species and returns the probabilities for species pairs as having positive, negative, or random associations. We averaged these probabilities for single species across all co-occurring pairs to yield the mean probability to co-occur for each species.

Spatial Autocorrelation. We used the *'ncf'* R package Version 1.3-2 [24] to calculate Moran's I from the correlogram of species presence/absences based on the first distance increment at the original cell size of the specific atlas. To include diagonally adjacent cells in addition to the neighboring cells into the calculation (i.e., queen formation), we set the increment to calculate Moran's I as: increment= cell side length * 1.75. This was necessary as cells are not equally shaped, and we wanted to prevent the inclusion of cells that do not directly surround the focal cell. Additionally, we extracted the x-intercept of the correlogram, which indicates the distance at which the autocorrelation becomes zero and can be used as a scale of autocorrelation.

Geometric features: Landscape Ecology Indices

ECOGRAPHY Open Access A JOURNAL OF SPACE AND TIME IN ECOLOGY

The geometric features of polygons of grids and species ranges were calculated in R Version 4.4.0 with the packages *'terra'* Version 1.7-78 and '*sf*' Version 1.0-16 [25]. Every polygon was first reprojected to WGS84 to obtain their latitude and longitude coordinates and minimize shape and distance distortion over large areas. This is especially important when the study areas cover more than a single UTM zone. By using latitude and longitude, we implicitly used a spherical model of the earth and spherical trigonometry as implemented in '*terra'*.
Some features were calculated on the minimal bounding rotated rectangle (hereafter: MBRR) (*'terra'* function *'minRect()'*), which is the smallest rotated rectangle that can be drawn around the polygon.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

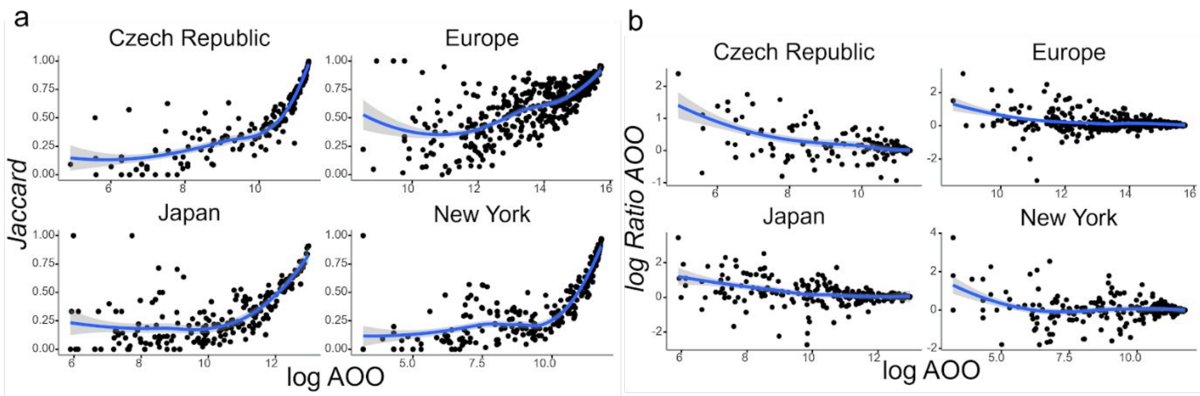


Figure S3: Checking for regression-to-the-mean effects in *Jaccard* and log AOO (a) and *log ratio AOO* and log AOO (b). We expect a bell-shaped distribution for *Jaccard* and a negatively linear relationship for the log ratio to identify the effect. No smoothing method was applied.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Table S3: Geometric indices calculated from the country shapes and species range shapes.

Geometry index	Formula / Description
East-West distance	Distance from easternmost to westernmost longitude
North-South distance	Distance from northernmost to southernmost latitude
Maximum distance	Maximum distance between any two points on the borders
Elongation ratio	E = 1 – S/L (S = short-axis length; L = long-axis length; axes are the one that connects the two more distant points in opposite polygon boundaries (long axis) and the distance between opposite points in an axis perpendicular to the first (short axis). It measures polygon direction in addition to overall elongation.
Circularity	C = Perimeter^2/ Area, where a circle has C = 1 and everything else C > 1 (▯ INF)
Normalized circularity	CNORM = (perimeter^2) / (4 * pi * area), where a circle has C = 1 and everything else C < 1 (▯ 0)
Length of the MBRR*	Length of the smallest optimally oriented rectangle needed to cover the polygon
Width of the MBRR*	Width of the smallest optimally oriented rectangle needed to cover the polygon
Elongation of the MBRR*	E = 1 – S/L of the smallest optimally oriented rectangle able to cover the whole polygon [26]
Related circumscribing circle	RCC = 1 - A / Ac; ranges from 0 to 1, where 0 indicates a circular polygon and 1 is a highly elongated polygon. It is a measure of polygon elongation
Linearity index	The coefficient of determination (r^2) calculated from a regression analysis of the x and y coordinates of the exterior convex hull nodes. A measure of how well the polygon can be described by a straight line. It is more efficient than the elongation ratio as it does not require finding the MBRR first
North bearing of the MBRR*	The angle of the MBRR along its longest axis, measured clockwise from the north angle.
Bearing along the longest axis	The angle of the polygon's longest axis, measured clockwise from the north angle
Center of gravity of the atlas long	Mean longitude of all species population centroids in the atlas
Center of gravity of the atlas lat	Mean latitude of all species population centroids in the atlas
Species Centroid lat	Mean latitude of species range inside atlas
Species Centroid long	Mean longitude of species range inside atlas
Distance centroid-CoG	Distance from the species centroid to the center of gravity of the atlas

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Min dist centroid-border	Minimum distance from the species centroid to the border of the atlas
Min dist border species-border atlas	Minimum distance from the species range border to the border of the atlas
Max dist centroid-border	Maximum distance from the species centroid to the border of the atlas
Max dist border species-border atlas	Maximum distance from the species range border to the border of the atlas
Southerness	Divided the atlas into half, set values above the centroid to northern and below the centroid to southern and assigned a scaled score where 1 = most northern and 0 = most southern. Extracted the lat and long values for these classes, classified species by the lat and long of the range centroid, and transformed the values so that Southerness = 1-Northerness.
Westerness	Divided the atlas into half, set values right of the centroid to Eastern, left of the centroid to Western, and assigned a scaled score where 1 = most eastern and 0 = most western. Extracted the lat and long values for these classes, classified species by the lat and long of the range centroid, and transformed the values so that Westerness = 1-Easterness.
Relative maximum distance	rel_maxDist =maxDist / atlas_maxDist
Relative east-west distance	rel_ewDist = ewDist / atlas_ewDist
Relative north-south distance	rel_nsDist = nsDist / atlas_nsDist
Relative elongation ratio	rel_elonRatio = elonRatio / atlas_elonRatio
Relative related circumscribing circle	rel_relCirc = relCirc / atlas_relCirc
Relative linearity	rel_lin = lin / atlas_lin
Relative normalized circularity	rel_circNorm = circNorm / atlas_circNorm

*MBRR = minimal bounding rotated rectangle

ECOGRAPHY Open Access A JOURNAL OF SPACE AND TIME IN ECOLOGY

H3: Mean species site-level diversities:

We calculated taxonomic **γ-diversity** as the total species richness of each atlas in each time period. Then we estimated local site diversities (**α**) and turnover (**β**) (*sensu* ref. [27]; β=/) for all cells in each atlas. Next, we summarized this spatial information for each species by averaging over all **α- and β-diversity** values in the cells in which the specific species is present [28], thereby creating a species-level measure of **mean α- and β-diversity.** We used Whittaker's β-diversity as β is independent of the species richness of the system and thus comparable across different study regions.

H4: Spatial Characteristics of the Study Region:
Similarly to H2, we calculated spatial characteristics of the study region and additionally included information about areas and scale of the specific atlas project. Table S4 summarizes all predictors for H4.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Table S4: Characteristics collected for each study region as predictors for H4**

Predictor	Description
dataset	corresponds to the specific atlas project (categorical)
mean cell area, i.e., spatial scale	mean(cell area)
total area sampled	the total area that was sampled during field campaigns
total number of cells sampled	total number of cells that were sampled during field campaigns
mean cell length	mean(cell side length)
length of the MBRR*	
width of the MBRR*	
elongation of the MBRR*	
circularity	
north-bearing of the MBRR*	
north-bearing of the study region	
atlas center of gravity longitude	mean centroid longitude for all species ranges in the study region
atlas center of gravity latitude	mean centroid latitude for all species ranges in the study region
temporal scale	number of years for each sampling period

*MBRR = minimal bounding rotated rectangle. **Predictors without specific description were already described in Table S2.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Predictor collinearity. We calculated correlations between predictor variables, estimated their significance, and filtered predictors for correlation coefficients r < 0.85 to exclude highly collinear predictors. Figure S4 shows the plotted clustered matrix of correlations between predictors. Notably, spatial characteristics of the study region were highly collinear and would have thus been excluded from the analysis. Therefore, we aimed to include this information by constructing relative predictors that combine the information from species ranges within specific study regions. We then continued to remove highly collinear variables.

These removed variables were: 1) maximum distance from the range centroid to the border of the study region, 2) length of the MBRR of the atlas, 3) maximum distance from the range border to the border of the study region, 4) atlas mean cell length, 5) atlas mean cell area, 6) atlas total area sampled, 7) atlas bearing of the MBRR, 8) atlas gamma-diversity, 9) circularity of the study region, 10) atlas elongation of the MBRR, 11) range length of the MBRR, 12) relative east-west distance of the range, 13) atlas center of gravity latitude, 14) relative north-south distance of the range, 15) atlas width of the MBRR, 16) relative normalized circularity of the range, 17) atlas center of gravity longitude, 18) mean probability of co-occurrence.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

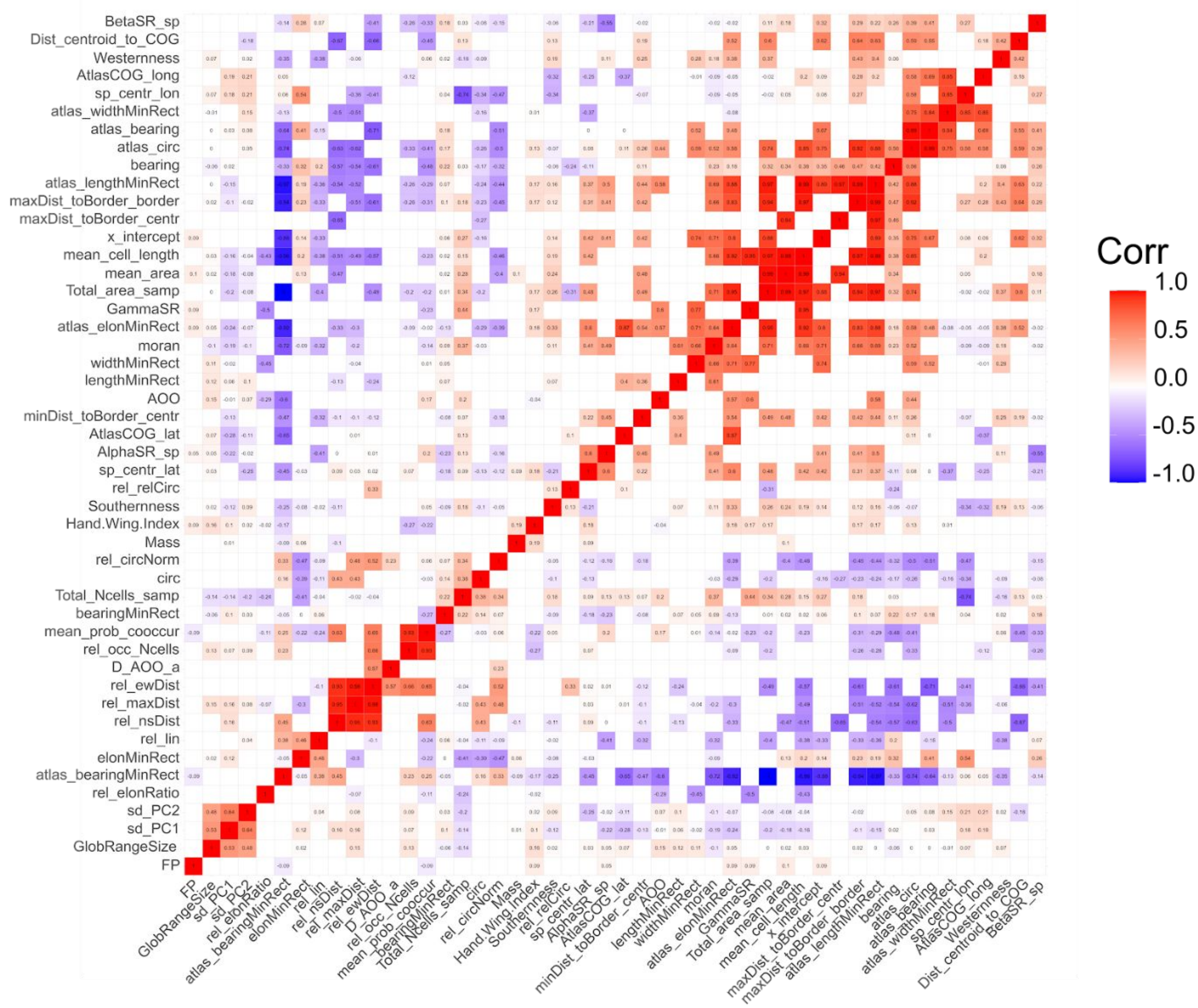


Figure S4: Correlation matrix across all predictor variables. Insignificant values were removed from the matrix (blank, white fields). Red cells indicate a positive correlation, while blue cells indicate a negative correlation. We removed variables with r > 0.85 from the analysis.

ECOGRAPHY Open Access A JOURNAL OF SPACE AND TIME IN ECOLOGY

Caveats. Some limitations or uncertainties of our analysis should be noted, which can be divided into issues with (1) data quality and (2) issues of scale. The results presented here should be interpreted in the light of these uncertainties.

First, (1) sampling bias, varying detection probability in the field (e.g., nocturnal species, raptors - these groups of species are difficult to detect during field campaigns in the day using acoustic methods), and varying data collection methods between and within datasets affect the overall data quality. Diversity estimates and species spatial distributions may be especially affected by biased data collection in space and time. In this study, we applied a simple filtering approach to rule out spatial sampling biases but otherwise assumed a structured data collection process for all atlas datasets involving expert ornithologists, thereby making these data potentially less biased than unstructured data sources[29,30].
Second, (2) combining datasets of different spatial and temporal scales comes at a disadvantage: Although we can disentangle differences between study regions, we cannot provide explanations about underlying local processes as we did not measure the influence of the different scales using this approach. Here, we assumed that for each atlas project, the original (temporal and spatial) scale was chosen to reflect a combination of time- and effort constraints over the total area of the sampling region and that it at least reflects the scale over which ecologically accurate knowledge about regional bird distributions can be generated.

Lastly, we admit that the way we calculated specific predictor variables, i.e., including the relative circularity of a species' distribution within the boundaries of the circularity of the study region, played a role in determining the importance of hypotheses and predictors in this study. Nevertheless, we suggest that incorporating the limits of the dataset into the calculation of species range predictors can advance the predictability of change - although at the cost of information.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Supplementary results

Predicting AOO change.

Although predictors did not capture much variation in the log ratio of AOO change, we still think that the results provide interesting insights that should accompany the results for site turnover, as they add to our understanding of change dynamics. Specifically, those species for which the log ratio of AOO change was close to zero, indicating very little change in the amount of area occupied by the species, tended to have strong trends in terms of site turnover. These species that do not tend to lose area but still experience site turnover are potentially vulnerable to future change. These patterns indicate that dispersal outweighs stable site occupancy, suggesting that species are under pressure to disperse as their previously occupied sites have become unsuitable. On the other hand, species that show zero change in AOO and zero change in site turnover are those that can be labeled “stable”. However, this pattern was only detected rarely, and if so, for species that occupied the full area of the study region (and potentially beyond the administrative borders).

Partial dependencies between the log ratio and predictors were mostly inconclusive and centered around zero, although some stronger relationships were detected (Figure S4b). Specifically, the *log ratio* is highest for ranges with low fractal dimensions between 0 and 0.5 (i.e., indicating range expansion for ranges comparable to a point pattern) but decreases to zero for higher fractal dimensions. In contrast, the *log ratio* is lowest for low values of the related circumscribing circle (i.e., range declines for species with irregular ranges) and for high mean α-diversity (i.e., range declines for species that, on average, occur in highly diverse sites). Regarding species body mass, the *log ratio* is lowest for species with very low body mass but stabilizes rapidly for species with low to high body mass without further influence of increasing weight. Nevertheless, it is important to note that the performance of the model was low for *the log ratio,* which affected the accuracy of estimating these parameters.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Partial dependencies between *Jaccard* and predictors.

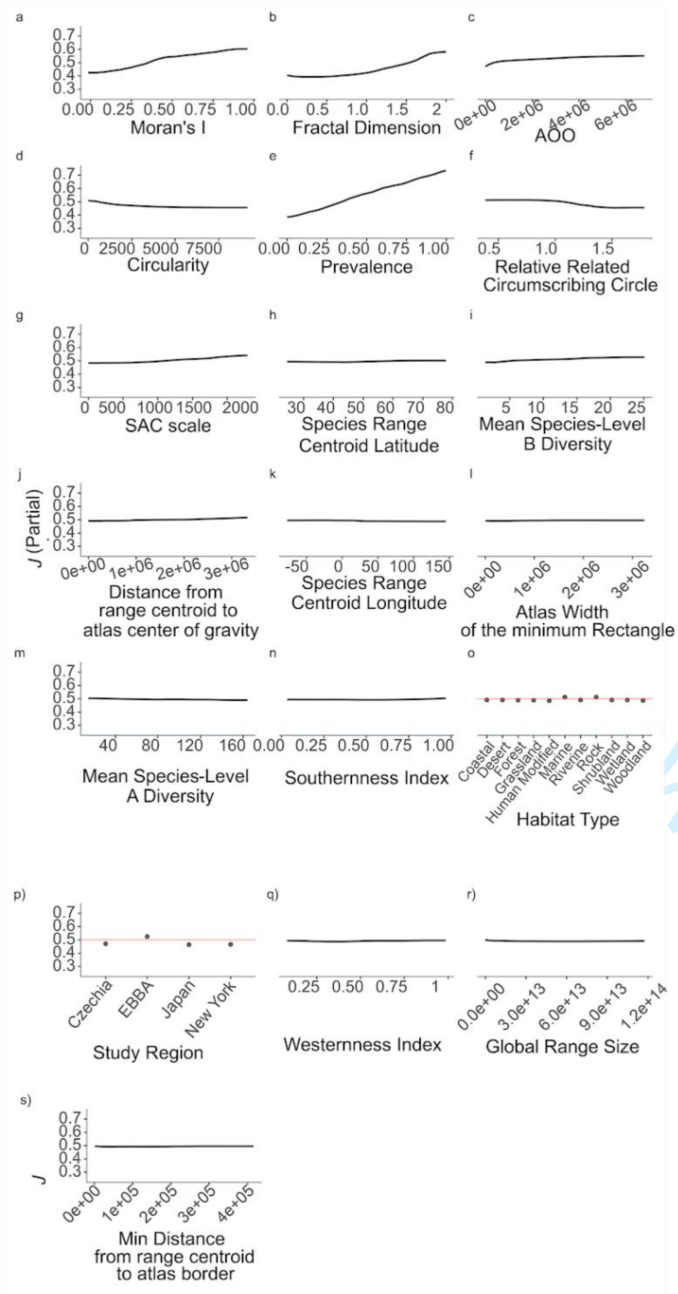


Figure S5. Full set of partial dependence plots for *Jaccard (J)*. Dependencies are 'marginal' dependencies for each predictor variable when all other predictors are average and were calculated using the *'pdp'* R package. Partial dependence plots for all predictors (Random Forest). Plots were created using the '*partial()*' function from the '*pdp*' R package (Version 0.8.1). Dependencies represent the effect of the variable when all other variables are averaged (i.e., marginal effects). MBRR = minimum bounding rotated rectangle.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

Supporting results from *log ratio.*

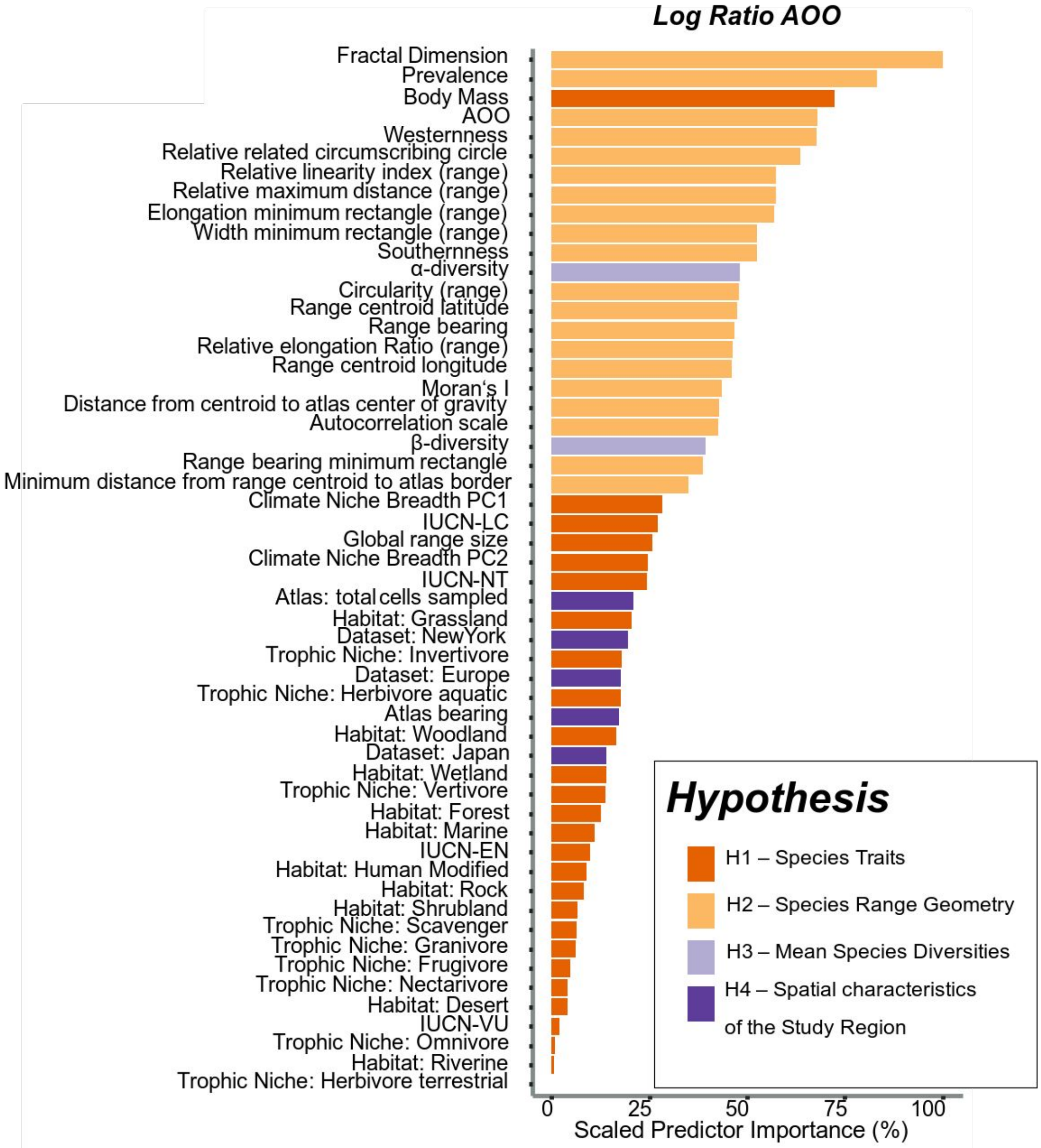


Figure S6: Relative predictor importance for modeling *log ratio AOO.* Relative Importance of predictors after recursive feature elimination from the final Random Forest model. Relative predictor importance is the scaled increase in mean square error (MSE) when the variable is permuted. Bars are colored by the hypothesis to which the specific predictor belongs. Model performance was low, and results should, therefore, be regarded with caution.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

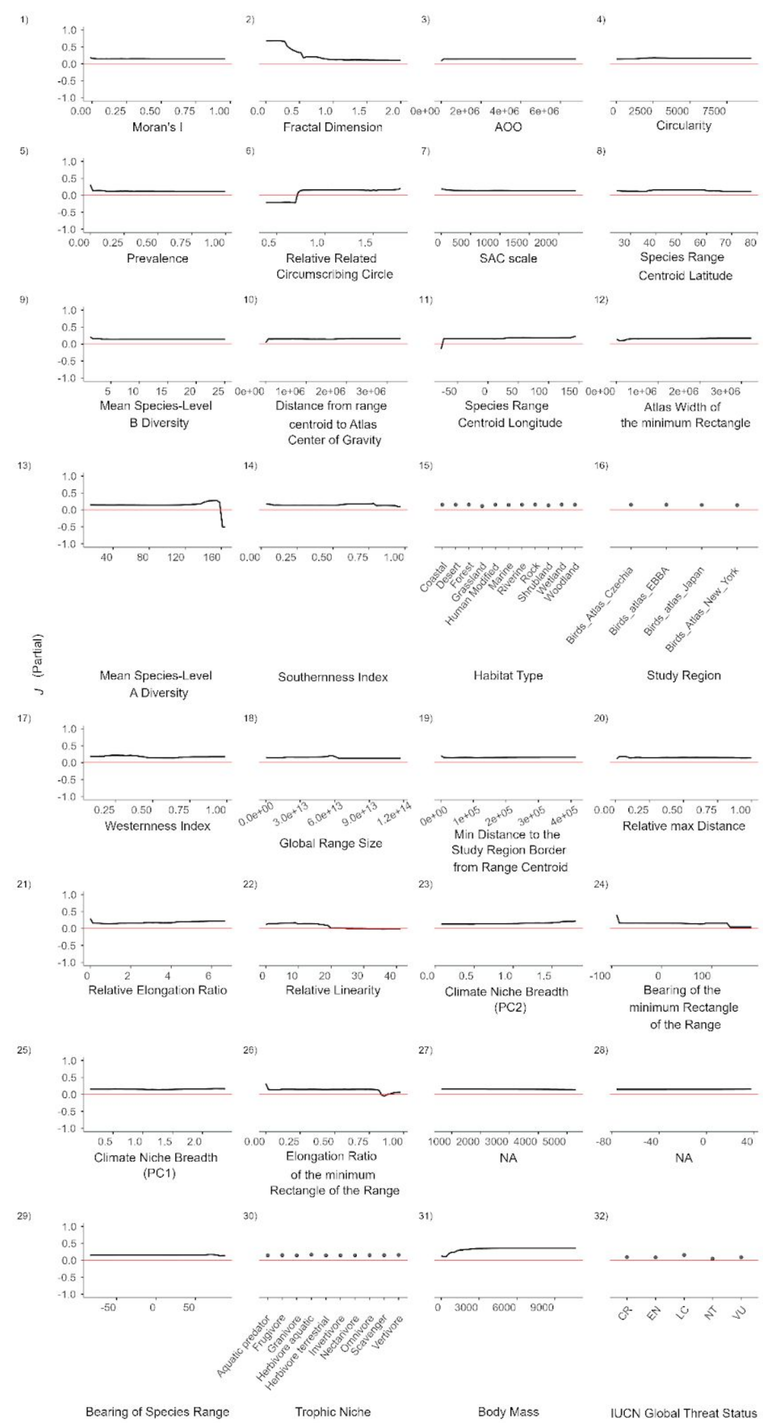


Figure S7: Partial dependence plots for all predictors of Log Ratio AOO. Partial dependence plots for all predictors (Random Forest). Plots were created using the '*partial()*' function from the '*pdp*' R package (Version 0.8.1). Dependencies represent the effect of the variable when all other variables are averaged (i.e., marginal effects). MBRR = minimum bounding rotated rectangle.

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

References

1. R Core Team. *R: A Language and Environment for Statistical Computing*. (R Foundation for Statistical Computing, Vienna, Austria, 2024).
2. Posit team. *RStudio: Integrated Development Environment for R*. http://www.posit.co/ (2024).
3. Keller, V. *et al. European Breeding Bird Atlas 2: Distribution, Abundance and Change*. (European Bird Census Council & Lynx Edicions, Barcelona, 2020).
4. Halley, J. M. *et al.* Uses and abuses of fractal methodology in ecology. *Ecology Letters* **7**, 254–271 (2004).
5. Jaccard, P. The distribution of the flora in the alpine zone. *New Phytol.* **11**, 37–50 (1912).
6. Koleff, P., Gaston, K. J. & Lennon, J. J. Measuring beta diversity for presence–absence data. *Journal of Animal Ecology* **72**, 367–382 (2003).
7. Legendre, P. A temporal beta-diversity index to identify sites that have changed in exceptional ways in space–time surveys. *Ecol. Evol.* **9**, 3500–3514 (2019).
8. Tobias, J. A. *et al.* AVONET: morphological, ecological and geographical data for all birds. *Ecology Letters* **25**, 581–597 (2022).
9. Karger, D. N. *et al.* Climatologies at high resolution for the earth's land surface areas. 2.1 KB EnviDat https://doi.org/10.16904/ENVIDAT.228.V2.1 (2021).
10. Karger, D. N. *et al.* Climatologies at high resolution for the earth's land surface areasCHELSA V2.1 (current. 2 1 (2021) doi:10.16904/ENVIDAT.228.V2.1.
11. BirdLife International and Handbook of the Birds of the World. Bird species distribution maps of the world. (2022).
12. Coelho, M. T. P. *et al.* The geography of climate and the global patterns of species diversity. *Nature* **622**, 537–544 (2023).
13. Hijmans, R. J. *Terra: Spatial Data Analysis*. https://CRAN.R-project.org/package=terra (2024).
14. Karger, D. N. *et al.* Climatologies at high resolution for the earth's land surface areas. *Sci Data* **4**, 170122 (2017).
15. Daru, B. H., Karunarathne, P. & Schliep, K. phyloregion: R package for biogeographic regionalization and macroecology. *Methods in Ecology and Evolution* **11**, 1483–1491 (2020).
16. Jetz, W., Thomas, G. H., Joy, J. B., Hartmann, K. & Mooers, A. O. The global diversity of birds in space and time. *Nature* **491**, 444–448 (2012).
17. Scott Chamberlain & Eduard Szocs. taxize - taxonomic search and retrieval in R. *F1000Research* (2013).
18. ZSL & IUCN National Red List Working Group. National Red List Database. (2022).
19. Federation of New York State Bird Clubs, New York (State). Department of Environmental Conservation, & Cornell University Laboratory of Ornithology. *The Atlas of Breeding Birds in New York State*. (Cornell University Press Ithaca, Ithaca, 1988).

ECOGRAPHY Open Access
A JOURNAL OF SPACE AND TIME IN ECOLOGY

20. Galton, F. Regression Towards Mediocrity in Hereditary Stature. *The Journal of the Anthropological Institute of Great Britain and Ireland* **15**, 246 (1886).
21. Mazalla, L. & Diekmann, M. Regression to the mean in vegetation science. *J Vegetation Science* **33**, e13117 (2022).
22. Griffith, D. M., Veech, J. A. & Marsh, C. J. **cooccur** : Probabilistic Species Co-Occurrence Analysis in *R. J. Stat. Soft.* **69**, (2016).
23. Vavrek, M. J. Fossil: palaeoecological and palaeogeographical analysis tools. *Palaeontologia electronica* **14**, 16 (2011).
24. Bjornstad, O. N. *Ncf: Spatial Covariance Functions*. https://CRAN.R-project.org/package=ncf (2022).
25. Pebesma, E. Simple features for R: Standardized support for spatial vector data. *The R Journal* **10**, 439–446 (2018).
26. Dražić, S., Ralević, N. & Žunić, J. Shape elongation from optimal encasing rectangles. *Computers & mathematics with applications* **60**, 2035–2042 (2010).
27. Whittaker, R. H. Evolution and measurement of species diversity. *Taxon* **21**, 213–251 (1972).
28. Arita, H. T., Christen, J. A., Rodríguez, P. & Soberón, J. Species Diversity and Distribution in Presence-Absence Matrices: Mathematical Relationships and Biological Implications. *The American Naturalist* **172**, 519–532 (2008).
29. Boakes, E. H. *et al.* Distorted Views of Biodiversity: Spatial and Temporal Bias in Species Occurrence Data. *PLOS Biology* **8**, e1000385 (2010).
30. Boyd, R. J., Stewart, G. B. & Pescott, O. L. Descriptive inference using large, unrepresentative nonprobability samples: An introduction for ecologists. *Ecology* **105**, e4214 (2024).

Column Name	Explanation
Rank_J_predicted	Rank from 1:N(species) in the dataset indicating the magnitude of site turnover that is predicted for the future basec
trend_J_Predicted	Categorical trend that is predicted for the species
dataset	Atlas data (either: Czech Republic, Europe, Japan or New York State)
verbatim_name	Original species name used in the atlas project
J_Predicted	Future prediction of Jaccard value
Rank_J_observed	Rank from 1:N(species) in the dataset indicating the magnitude of site turnover that has happend between both atla
J_Observed	Observed Jaccard value for the temporal change that happened between two consecutive atlas generations.
trend_J_Observed	Categorical trend that is observed for the species
LR_Predicted	Predicted value of log ratio AOO for the future from the occurrence data in the second atlas generation
trend_LR_Predicted	Categorical trend that is predicted for the species
LR_Observed	Observed value of log ratio AOO for the future from the occurrence data in the second atlas generation
trend_LR_Observed	Categorical trend that is predicted for the species
Rank_LR_predicted	Rank from 1:N(species) in the dataset indicating the direction of temporal change that is predicted for the future bas
Rank_LR_observed	Rank from 1:N(species) in the dataset indicating the direction of temporal change that is observed from the compar

d on the occurrence data from the second atlas generation.

as periods in the study

sed on the occurrence data from the second atlas generation.
rison of two consecutive atlas generations.

Rank_J_predicted	trend_J_Predicted	dataset	verbatim_name	J_Predicted
1	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Otus scops*	0.0361
2	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Larus cachinnans*	0.0389
3	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Luscinia luscinia*	0.0407
4	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Anas acuta*	0.0463
5	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Podiceps grisegena*	0.0556
6	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Larus melanocephalus*	0.0594
7	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Turdus iliacus*	0.0615
8	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Himantopus himantopus*	0.0841
9	complete turnover (< 0.1)	Birds_Atlas_Czechia	*Asio flammeus*	0.0876
10	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Phylloscopus trochiloides*	0.1066
11	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Numenius arquata*	0.1129
12	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Emberiza hortulana*	0.1247
13	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Mergus merganser*	0.1273
14	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Aythya nyroca*	0.1297
15	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Porzana parva*	0.1333
16	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Ardea purpurea*	0.1411
17	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Aquila pomarina*	0.143
18	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Anthus campestris*	0.1516
19	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Egretta garzetta*	0.1584
20	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Limosa limosa*	0.1629
21	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Recurvirostra avosetta*	0.1657
22	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Falco peregrinus*	0.1689
23	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Falco cherrug*	0.177
24	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Prunella collaris*	0.1824
25	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Grus grus*	0.1869
26	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Charadrius morinellus*	0.189
27	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Panurus biarmicus*	0.2142
28	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Platalea leucorodia*	0.2234
29	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Larus canus*	0.2237
30	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Chlidonias niger*	0.2246
31	strong turnover (0.1 - 0.25)	Birds_Atlas_Czechia	*Corvus frugilegus*	0.2413

32	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Anthus spinoletta*	0.2637
33	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Upupa epops*	0.2654
34	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Botaurus stellaris*	0.2734
35	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Tetrao urogallus*	0.2743
36	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Oenanthe oenanthe*	0.2771
37	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Milvus migrans*	0.2821
38	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Caprimulgus europaeus*	0.2866
39	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Circus cyaneus*	0.2871
40	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Ixobrychus minutus*	0.2871
41	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Circus pygargus*	0.2915
42	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Porzana porzana*	0.2981
43	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Netta rufina*	0.3092
44	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Galerida cristata*	0.3148
45	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Haliaeetus albicilla*	0.3252
46	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Phalacrocorax carbo*	0.327
47	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Tringa totanus*	0.3424
48	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Motacilla flava*	0.3425
49	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Dendrocopos leucotos*	0.345
50	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Bucephala clangula*	0.3456
51	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Athene noctua*	0.3503
52	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Tringa ochropus*	0.355
53	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Carpodacus erythrinus*	0.356
54	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Anser anser*	0.3583
55	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Sterna hirundo*	0.3642
56	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Anas clypeata*	0.3668
57	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Merops apiaster*	0.3671
58	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Ficedula parva*	0.3715
59	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Podiceps nigricollis*	0.3734
60	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Milvus milvus*	0.3813
61	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Locustella luscinioides*	0.3883
62	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Lullula arborea*	0.3886

63	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Nycticorax nycticorax*	0.4002
64	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Anas crecca*	0.4168
65	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Anas querquedula*	0.4177
66	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Riparia riparia*	0.4194
67	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Tetrao tetrix*	0.4277
68	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Picoides tridactylus*	0.4291
69	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Dendrocopos syriacus*	0.4324
70	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Strix uralensis*	0.4369
71	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Actitis hypoleucos*	0.4455
72	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Gallinago gallinago*	0.4597
73	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Miliaria calandra*	0.4629
74	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Aegolius funereus*	0.4686
75	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Tyto alba*	0.469
76	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Corvus monedula*	0.4703
77	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Acrocephalus arundinace*	0.4745
78	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Falco subbuteo*	0.4783
79	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Rallus aquaticus*	0.4893
80	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Turdus torquatus*	0.4926
81	strong intermediate turnover (0.25	Birds_Atlas_Czechia	*Scolopax rusticola*	0.4956
82	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Larus ridibundus*	0.5018
83	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Dendrocopos medius*	0.5028
84	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Saxicola torquata*	0.5038
85	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Anas strepera*	0.5054
86	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Glaucidium passerinum*	0.5101
87	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Carduelis flammea*	0.5158
88	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Ficedula hypoleuca*	0.5232
89	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Remiz pendulinus*	0.5235
90	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Anthus pratensis*	0.5418
91	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Nucifraga caryocatactes*	0.572
92	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Ficedula albicollis*	0.5722
93	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Acrocephalus schoenoba*	0.5819

94	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Luscinia megarhynchos*	0.5846
95	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Picus canus*	0.5867
96	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Pernis apivorus*	0.6004
97	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Columba oenas*	0.6071
98	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Crex crex*	0.6131
99	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Cinclus cinclus*	0.6211
100	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Aythya ferina*	0.6229
101	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Podiceps cristatus*	0.6232
102	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Charadrius dubius*	0.626
103	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Ardea cinerea*	0.6282
104	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Loxia curvirostra*	0.6494
105	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Certhia brachydactyla*	0.6653
106	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Bubo bubo*	0.6731
107	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Jynx torquilla*	0.6868
108	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Tachybaptus ruficollis*	0.6918
109	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Gallinula chloropus*	0.6921
110	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Lanius excubitor*	0.6958
111	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Ciconia ciconia*	0.7026
112	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Oriolus oriolus*	0.7096
113	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Parus montanus*	0.7153
114	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Ciconia nigra*	0.7159
115	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Carduelis spinus*	0.7171
116	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Aythya fuligula*	0.7252
117	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Regulus ignicapillus*	0.734
118	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Columba livia*	0.7381
119	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Dendrocopos minor*	0.7437
120	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Cygnus olor*	0.745
121	weak intermediate turnover (0.5 -	Birds_Atlas_Czechia	*Acrocephalus scirpaceus*	0.7471
122	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Saxicola rubetra*	0.7647
123	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Asio otus*	0.7809
124	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Alcedo atthis*	0.7821

125	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Perdix perdix*	0.7901
126	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Locustella fluviatilis*	0.8067
127	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Circus aeruginosus*	0.8088
128	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Fulica atra*	0.8097
129	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Locustella naevia*	0.8099
130	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Emberiza schoeniclus*	0.8129
131	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Parus cristatus*	0.8137
132	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Accipiter gentilis*	0.8388
133	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Strix aluco*	0.8388
134	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Pyrrhula pyrrhula*	0.8614
135	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Acrocephalus palustris*	0.8663
136	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Phasianus colchicus*	0.8692
137	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Corvus corone*	0.872
138	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Phylloscopus sibilatrix*	0.8731
139	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Muscicapa striata*	0.8769
140	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Parus palustris*	0.8809
141	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Turdus viscivorus*	0.8814
142	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Sylvia borin*	0.8853
143	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Aegithalos caudatus*	0.8889
144	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Coturnix coturnix*	0.8889
145	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Regulus regulus*	0.8893
146	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Turdus pilaris*	0.8912
147	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Picus viridis*	0.8914
148	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Passer montanus*	0.8985
149	weak turnover (> 0.75)	Birds_Atlas_Czechia	*Streptopelia turtur*	0.8987
150	stable (> 0.9)	Birds_Atlas_Czechia	*Hippolais icterina*	0.9009
151	stable (> 0.9)	Birds_Atlas_Czechia	*Motacilla cinerea*	0.9019
152	stable (> 0.9)	Birds_Atlas_Czechia	*Parus ater*	0.9032
153	stable (> 0.9)	Birds_Atlas_Czechia	*Phoenicurus phoenicurus*	0.9049
154	stable (> 0.9)	Birds_Atlas_Czechia	*Accipiter nisus*	0.909
155	stable (> 0.9)	Birds_Atlas_Czechia	*Dryocopus martius*	0.9101

156	stable (> 0.9)	Birds_Atlas_Czechia	*Carduelis cannabina*	0.914
157	stable (> 0.9)	Birds_Atlas_Czechia	*Coccothraustes coccothra*	0.9192
158	stable (> 0.9)	Birds_Atlas_Czechia	*Pica pica*	0.9209
159	stable (> 0.9)	Birds_Atlas_Czechia	*Anas platyrhynchos*	0.9355
160	stable (> 0.9)	Birds_Atlas_Czechia	*Apus apus*	0.9443
161	stable (> 0.9)	Birds_Atlas_Czechia	*Streptopelia decaocto*	0.946
162	stable (> 0.9)	Birds_Atlas_Czechia	*Prunella modularis*	0.9565
163	stable (> 0.9)	Birds_Atlas_Czechia	*Phylloscopus trochilus*	0.9646
164	stable (> 0.9)	Birds_Atlas_Czechia	*Falco tinnunculus*	0.9735
165	stable (> 0.9)	Birds_Atlas_Czechia	*Phylloscopus collybita*	0.9743
166	stable (> 0.9)	Birds_Atlas_Czechia	*Lanius collurio*	0.9744
167	stable (> 0.9)	Birds_Atlas_Czechia	*Carduelis carduelis*	0.9748
168	stable (> 0.9)	Birds_Atlas_Czechia	*Alauda arvensis*	0.9758
169	stable (> 0.9)	Birds_Atlas_Czechia	*Serinus serinus*	0.9758
170	stable (> 0.9)	Birds_Atlas_Czechia	*Passer domesticus*	0.9761
171	stable (> 0.9)	Birds_Atlas_Czechia	*Sturnus vulgaris*	0.9761
172	stable (> 0.9)	Birds_Atlas_Czechia	*Delichon urbica*	0.9781
173	stable (> 0.9)	Birds_Atlas_Czechia	*Cuculus canorus*	0.9782
174	stable (> 0.9)	Birds_Atlas_Czechia	*Buteo buteo*	0.9784
175	stable (> 0.9)	Birds_Atlas_Czechia	*Garrulus glandarius*	0.979
176	stable (> 0.9)	Birds_Atlas_Czechia	*Troglodytes troglodytes*	0.9796
177	stable (> 0.9)	Birds_Atlas_Czechia	*Columba palumbus*	0.9826
178	stable (> 0.9)	Birds_Atlas_Czechia	*Parus caeruleus*	0.9835
179	stable (> 0.9)	Birds_Atlas_Czechia	*Erithacus rubecula*	0.9838
180	stable (> 0.9)	Birds_Atlas_Czechia	*Sitta europaea*	0.9838
181	stable (> 0.9)	Birds_Atlas_Czechia	*Turdus philomelos*	0.9838
182	stable (> 0.9)	Birds_Atlas_Czechia	*Sylvia atricapilla*	0.984
183	stable (> 0.9)	Birds_Atlas_Czechia	*Dendrocopos major*	0.9843

Rank_J_observed	J_Observed	trend_J_Observed	LR_Predicted	trend_LR_Predicted	LR_Obser
1	0	complete turnover (< 0.1)	0.7186	strong increase (> doubling)	0.689
2	0	complete turnover (< 0.1)	0.8705	strong increase (> doubling)	-0.217
3	0	complete turnover (< 0.1)	0.5073	weak increase (< doubling)	0.536
4	0	complete turnover (< 0.1)	0.6991	strong increase (> doubling)	0.001
11	0.054	complete turnover (< 0.1)	0.2682	weak increase (< doubling)	-0.155
21	0.125	strong turnover (0.1 - 0.25)	0.4062	weak increase (< doubling)	1.249
14	0.073	complete turnover (< 0.1)	-0.0699	stable	-0.185
5	0	complete turnover (< 0.1)	0.7018	strong increase (> doubling)	0.23
6	0	complete turnover (< 0.1)	0.4148	weak increase (< doubling)	0.955
12	0.071	complete turnover (< 0.1)	0.1142	weak increase (< doubling)	-0.145
25	0.156	strong turnover (0.1 - 0.25)	0.3201	weak increase (< doubling)	-0.275
15	0.086	complete turnover (< 0.1)	0.211	weak increase (< doubling)	-0.181
9	0.045	complete turnover (< 0.1)	0.5419	weak increase (< doubling)	1.046
7	0	complete turnover (< 0.1)	0.277	weak increase (< doubling)	-0.801
10	0.05	complete turnover (< 0.1)	0.4595	weak increase (< doubling)	1.453
28	0.208	strong turnover (0.1 - 0.25)	0.5392	weak increase (< doubling)	0.641
8	0	complete turnover (< 0.1)	0.4144	weak increase (< doubling)	0.072
20	0.097	complete turnover (< 0.1)	0.1432	weak increase (< doubling)	-0.362
16	0.091	complete turnover (< 0.1)	0.4596	weak increase (< doubling)	2.394
30	0.214	strong turnover (0.1 - 0.25)	0.1776	weak increase (< doubling)	-0.608
22	0.143	strong turnover (0.1 - 0.25)	0.6675	weak increase (< doubling)	1.108
19	0.095	complete turnover (< 0.1)	0.3444	weak increase (< doubling)	0.623
61	0.381	strong intermediate turnover	0.2824	weak increase (< doubling)	0.201
93	0.571	weak intermediate turnover	0.2509	weak increase (< doubling)	0.181
17	0.093	complete turnover (< 0.1)	0.5166	weak increase (< doubling)	1.746
83	0.5	strong intermediate turnover	0.91	strong increase (> doubling)	-0.7
63	0.392	strong intermediate turnover	0.415	weak increase (< doubling)	0.198
13	0.071	complete turnover (< 0.1)	0.7663	strong increase (> doubling)	1.387
31	0.217	strong turnover (0.1 - 0.25)	0.3757	weak increase (< doubling)	0.584
53	0.341	strong intermediate turnover	0.4225	weak increase (< doubling)	-0.318
44	0.3	strong intermediate turnover	0.1835	weak increase (< doubling)	-0.18

102	0.625	weak intermediate turnover (	0.3156	weak increase (< doubling)	-0.155
35	0.226	strong turnover (0.1 - 0.25)	0.145	weak increase (< doubling)	0.212
38	0.258	strong intermediate turnover	0.3761	weak increase (< doubling)	0.362
59	0.377	strong intermediate turnover	0.3097	weak increase (< doubling)	-0.303
32	0.218	strong turnover (0.1 - 0.25)	0.0627	stable	-0.439
34	0.222	strong turnover (0.1 - 0.25)	0.175	weak increase (< doubling)	0.32
27	0.168	strong turnover (0.1 - 0.25)	0.1315	weak increase (< doubling)	-0.465
36	0.245	strong turnover (0.1 - 0.25)	-0.0159	stable	-0.039
48	0.323	strong intermediate turnover	0.232	weak increase (< doubling)	0.079
18	0.094	complete turnover (< 0.1)	0.3216	weak increase (< doubling)	0.836
42	0.283	strong intermediate turnover	0.2101	weak increase (< doubling)	0.175
49	0.323	strong intermediate turnover	0.3711	weak increase (< doubling)	0.78
43	0.287	strong intermediate turnover	0.0984	weak increase (< doubling)	-0.84
24	0.149	strong turnover (0.1 - 0.25)	0.4959	weak increase (< doubling)	1.585
33	0.218	strong turnover (0.1 - 0.25)	0.4873	weak increase (< doubling)	1.074
68	0.408	strong intermediate turnover	0.1849	weak increase (< doubling)	-0.086
57	0.362	strong intermediate turnover	-0.0603	stable	0.077
65	0.404	strong intermediate turnover	0.1711	weak increase (< doubling)	-0.027
58	0.367	strong intermediate turnover	0.4608	weak increase (< doubling)	0.711
41	0.276	strong intermediate turnover	-0.0539	stable	-0.936
23	0.145	strong turnover (0.1 - 0.25)	0.1382	weak increase (< doubling)	1.206
56	0.353	strong intermediate turnover	0.1127	weak increase (< doubling)	0.195
45	0.301	strong intermediate turnover	0.4377	weak increase (< doubling)	0.72
52	0.333	strong intermediate turnover	0.221	weak increase (< doubling)	0.135
74	0.444	strong intermediate turnover	0.081	stable	-0.085
29	0.212	strong turnover (0.1 - 0.25)	0.338	weak increase (< doubling)	0.62
47	0.314	strong intermediate turnover	0.1391	weak increase (< doubling)	0.163
72	0.438	strong intermediate turnover	0.0879	stable	-0.433
39	0.259	strong intermediate turnover	0.1002	weak increase (< doubling)	0.535
51	0.332	strong intermediate turnover	0.2426	weak increase (< doubling)	0.525
50	0.33	strong intermediate turnover	0.054	stable	0.174

37	0.246	strong turnover (0.1 - 0.25)	0.467	weak increase (< doubling)	0.772
69	0.419	strong intermediate turnover	0.0153	stable	-0.18
70	0.431	strong intermediate turnover	-0.0175	stable	0.032
91	0.566	weak intermediate turnover	0.0604	stable	-0.236
81	0.495	strong intermediate turnover	0.0329	stable	-0.429
88	0.543	weak intermediate turnover	0.2123	weak increase (< doubling)	-0.143
46	0.313	strong intermediate turnover	0.2919	weak increase (< doubling)	0.834
26	0.158	strong turnover (0.1 - 0.25)	0.2614	weak increase (< doubling)	1.511
66	0.405	strong intermediate turnover	0.001	stable	0.004
77	0.47	strong intermediate turnover	-0.0263	stable	-0.246
40	0.271	strong intermediate turnover	0.0516	stable	0.719
67	0.407	strong intermediate turnover	0.0781	stable	0.472
60	0.379	strong intermediate turnover	-0.1261	weak decrease (< halfing)	-0.265
89	0.546	weak intermediate turnover	-0.1035	stable	-0.339
85	0.526	weak intermediate turnover	0.057	stable	0.058
54	0.346	strong intermediate turnover	0.0689	stable	0.239
82	0.497	strong intermediate turnover	0.0271	stable	0.343
105	0.632	weak intermediate turnover	0.1097	weak increase (< doubling)	-0.029
73	0.439	strong intermediate turnover	0.0208	stable	0.121
78	0.474	strong intermediate turnover	-0.0272	stable	-0.144
64	0.399	strong intermediate turnover	0.186	weak increase (< doubling)	0.34
76	0.459	strong intermediate turnover	0.1224	weak increase (< doubling)	0.236
75	0.449	strong intermediate turnover	0.1522	weak increase (< doubling)	0.321
62	0.387	strong intermediate turnover	0.0789	stable	0.656
84	0.507	weak intermediate turnover	0.0748	stable	0.114
80	0.489	strong intermediate turnover	0.0332	stable	0.045
101	0.62	weak intermediate turnover	0.0179	stable	-0.081
92	0.57	weak intermediate turnover	-0.0204	stable	0.036
99	0.609	weak intermediate turnover	0.0531	stable	0.069
86	0.53	weak intermediate turnover	0.1236	weak increase (< doubling)	0.095
90	0.558	weak intermediate turnover	0.0079	stable	0.197

97	0.597	weak intermediate turnover	0.0479	stable	0.218
96	0.58	weak intermediate turnover	0.0159	stable	0.011
79	0.488	strong intermediate turnover	0.0662	stable	0.157
87	0.53	weak intermediate turnover	0.0526	stable	0.323
55	0.346	strong intermediate turnover	-0.0301	stable	0.659
119	0.704	weak intermediate turnover	0.0388	stable	0.04
115	0.686	weak intermediate turnover	-7.00E-04	stable	-0.091
114	0.685	weak intermediate turnover	0.0249	stable	-0.046
95	0.576	weak intermediate turnover	-0.0042	stable	0.038
71	0.436	strong intermediate turnover	0.2037	weak increase (< doubling)	0.46
107	0.646	weak intermediate turnover	0.0426	stable	0.121
98	0.603	weak intermediate turnover	0.0443	stable	0.069
106	0.632	weak intermediate turnover	0.1124	weak increase (< doubling)	0.01
94	0.572	weak intermediate turnover	0.0722	stable	0.055
116	0.698	weak intermediate turnover	-0.0049	stable	-0.019
111	0.676	weak intermediate turnover	-0.0022	stable	0.015
103	0.63	weak intermediate turnover	0.0052	stable	0.027
122	0.727	weak intermediate turnover	0.1195	weak increase (< doubling)	0.048
120	0.72	weak intermediate turnover	0.024	stable	0.06
109	0.667	weak intermediate turnover	0.0336	stable	0.146
104	0.631	weak intermediate turnover	0.1324	weak increase (< doubling)	0.235
117	0.699	weak intermediate turnover	0.0484	stable	0.028
123	0.738	weak intermediate turnover	0.0044	stable	0.018
100	0.614	weak intermediate turnover	0.0559	stable	0.256
126	0.748	weak intermediate turnover	-0.0657	stable	0.012
113	0.681	weak intermediate turnover	0.0118	stable	0.093
127	0.763	weak turnover (> 0.75)	0.1222	weak increase (< doubling)	-0.001
124	0.744	weak intermediate turnover	-0.0076	stable	0.041
130	0.801	weak turnover (> 0.75)	0.0283	stable	-0.034
121	0.722	weak intermediate turnover	0.0224	stable	-0.011
108	0.654	weak intermediate turnover	0.0419	stable	0.238

129	0.787	weak turnover (> 0.75)	-0.0417	stable	-0.074
118	0.699	weak intermediate turnover	0.0574	stable	0.158
110	0.671	weak intermediate turnover	0.0419	stable	0.286
136	0.837	weak turnover (> 0.75)	0.0248	stable	-0.002
125	0.747	weak intermediate turnover	0.0326	stable	0.102
128	0.778	weak turnover (> 0.75)	-0.0032	stable	0.079
134	0.829	weak turnover (> 0.75)	0.0372	stable	-0.004
138	0.842	weak turnover (> 0.75)	0.039	stable	-0.025
135	0.834	weak turnover (> 0.75)	0.0367	stable	0.023
146	0.883	weak turnover (> 0.75)	0.0398	stable	-0.004
133	0.827	weak turnover (> 0.75)	0.0272	stable	0.061
147	0.884	weak turnover (> 0.75)	0.0257	stable	-0.042
143	0.873	weak turnover (> 0.75)	0.014	stable	-0.026
139	0.846	weak turnover (> 0.75)	0.027	stable	0.04
137	0.84	weak turnover (> 0.75)	0.0313	stable	0.048
131	0.82	weak turnover (> 0.75)	0.0279	stable	0.043
132	0.824	weak turnover (> 0.75)	0.0103	stable	0.113
141	0.86	weak turnover (> 0.75)	0.022	stable	0.016
148	0.885	weak turnover (> 0.75)	0.0224	stable	0.036
112	0.679	weak intermediate turnover	0.0135	stable	0.301
154	0.911	stable (> 0.9)	0.04	stable	0.013
151	0.899	weak turnover (> 0.75)	0.0291	stable	0.017
142	0.87	weak turnover (> 0.75)	0.0276	stable	0.042
158	0.937	stable (> 0.9)	0.0257	stable	-0.022
157	0.926	stable (> 0.9)	-0.0554	stable	-0.003
150	0.897	weak turnover (> 0.75)	0.031	stable	0.007
152	0.906	stable (> 0.9)	0.0248	stable	0.054
156	0.917	stable (> 0.9)	0.0282	stable	0.019
144	0.876	weak turnover (> 0.75)	0.0212	stable	0.057
145	0.877	weak turnover (> 0.75)	0.0272	stable	0.046
149	0.894	weak turnover (> 0.75)	0.0195	stable	0.041

153	0.906	stable (> 0.9)	-0.002	stable	0.04
140	0.849	weak turnover (> 0.75)	0.0303	stable	0.079
155	0.915	stable (> 0.9)	0.0061	stable	0.025
160	0.942	stable (> 0.9)	0.0221	stable	0.023
161	0.944	stable (> 0.9)	0.0072	stable	0.015
163	0.971	stable (> 0.9)	-0.0249	stable	-0.007
159	0.941	stable (> 0.9)	0.0158	stable	0.015
162	0.965	stable (> 0.9)	0.0161	stable	0.003
165	0.976	stable (> 0.9)	0.0159	stable	0.015
172	0.989	stable (> 0.9)	0.015	stable	0.002
170	0.987	stable (> 0.9)	0.0049	stable	0.006
166	0.976	stable (> 0.9)	0.0136	stable	0.008
178	0.994	stable (> 0.9)	-0.0161	stable	-0.003
171	0.987	stable (> 0.9)	0.0278	stable	0.003
179	0.994	stable (> 0.9)	0.003	stable	-0.003
175	0.99	stable (> 0.9)	0.0098	stable	0
182	0.997	stable (> 0.9)	0.0087	stable	0
167	0.979	stable (> 0.9)	0.0146	stable	0.008
180	0.995	stable (> 0.9)	0.0149	stable	-0.002
164	0.975	stable (> 0.9)	0.017	stable	0.016
169	0.984	stable (> 0.9)	0.024	stable	0.01
168	0.981	stable (> 0.9)	0.012	stable	0.013
177	0.992	stable (> 0.9)	0.0202	stable	0.005
176	0.99	stable (> 0.9)	0.0146	stable	0.006
173	0.989	stable (> 0.9)	0.0153	stable	0.008
181	0.995	stable (> 0.9)	0.0126	stable	0.002
183	0.997	stable (> 0.9)	0.0126	stable	0
174	0.989	stable (> 0.9)	0.0112	stable	0.008

trend_LR_Observed	Rank_LR_predicte	Rank_LR_observed
weak increase (< doublin	180	164
weak decrease (< halfing	182	18
weak increase (< doublin	173	157
stable	178	56
weak decrease (< halfing	148	23
strong increase (> doublir	161	177
weak decrease (< halfing	3	19
weak increase (< doublin	179	139
strong increase (> doublir	163	172
weak decrease (< halfing	121	25
weak decrease (< halfing	154	14
weak decrease (< halfing	141	20
strong increase (> doublir	176	173
strong decrease (> halfin	149	3
strong increase (> doublir	167	179
weak increase (< doublin	175	161
stable	162	113
weak decrease (< halfing	130	10
strong increase (> doublir	168	183
weak decrease (< halfing	135	5
strong increase (> doublir	177	175
weak increase (< doublin	157	160
weak increase (< doublin	150	136
weak increase (< doublin	146	132
strong increase (> doublir	174	182
strong decrease (> halfin	183	4
weak increase (< doublin	164	135
strong increase (> doublir	181	178
weak increase (< doublin	159	158
weak decrease (< halfing	165	12
weak decrease (< halfing	136	22

weak decrease (< halfing	153	24
weak increase (< doublin	131	137
weak increase (< doublin	160	152
weak decrease (< halfing	152	13
weak decrease (< halfing	107	7
weak increase (< doublin	134	147
weak decrease (< halfing	126	6
stable	16	35
stable	144	117
strong increase (> doublir	155	171
weak increase (< doublin	140	131
strong increase (> doublir	158	169
strong decrease (> halfin	116	2
strong increase (> doublir	172	181
strong increase (> doublir	171	174
stable	137	29
stable	5	114
stable	133	38
strong increase (> doublir	169	165
strong decrease (> halfin	7	1
strong increase (> doublir	128	176
weak increase (< doublin	120	133
strong increase (> doublir	166	167
weak increase (< doublin	143	125
stable	114	30
weak increase (< doublin	156	159
weak increase (< doublin	129	129
weak decrease (< halfing	115	8
weak increase (< doublin	117	156
weak increase (< doublin	145	155
weak increase (< doublin	102	130

strong increase (> doublir	170	168
weak decrease (< halfing	47	21
stable	14	90
weak decrease (< halfing	106	17
weak decrease (< halfing	84	9
weak decrease (< halfing	142	27
strong increase (> doublir	151	170
strong increase (> doublir	147	180
stable	24	61
weak decrease (< halfing	11	16
strong increase (> doublir	99	166
weak increase (< doublin	112	154
weak decrease (< halfing	1	15
weak decrease (< halfing	2	11
stable	104	108
weak increase (< doublin	109	143
weak increase (< doublin	71	151
stable	118	37
weak increase (< doublin	57	123
weak decrease (< halfing	10	26
weak increase (< doublin	138	150
weak increase (< doublin	124	141
weak increase (< doublin	132	148
weak increase (< doublin	113	162
weak increase (< doublin	111	122
stable	85	101
stable	54	31
stable	13	91
stable	101	112
stable	125	119
weak increase (< doublin	31	134

weak increase (< doublin	97	138
stable	50	72
weak increase (< doublin	108	127
weak increase (< doublin	100	149
weak increase (< doublin	9	163
stable	89	96
stable	23	28
stable	67	33
stable	19	93
weak increase (< doublin	139	153
weak increase (< doublin	95	124
stable	96	111
stable	119	71
stable	110	106
stable	18	42
stable	21	76
stable	28	88
stable	122	104
stable	63	109
weak increase (< doublin	86	126
weak increase (< doublin	127	140
stable	98	89
stable	26	83
weak increase (< doublin	103	144
stable	4	73
stable	36	118
stable	123	52
stable	17	97
stable	78	36
stable	61	43
weak increase (< doublin	93	142

stable	8	32
weak increase (< doublin	105	128
weak increase (< doublin	94	145
stable	65	51
weak increase (< doublin	83	120
stable	20	115
stable	88	45
stable	90	40
stable	87	86
stable	91	46
stable	72	110
stable	68	34
stable	42	39
stable	70	95
stable	82	103
stable	76	100
weak increase (< doublin	34	121
stable	59	81
stable	62	92
weak increase (< doublin	40	146
stable	92	75
stable	79	82
stable	74	99
stable	69	41
stable	6	47
stable	81	65
stable	66	105
stable	77	84
stable	58	107
stable	73	102
stable	55	98

stable	22	94
stable	80	116
stable	29	87
stable	60	85
stable	30	77
stable	12	44
stable	49	78
stable	52	59
stable	51	79
stable	46	58
stable	27	63
stable	41	67
stable	15	48
stable	75	60
stable	25	49
stable	33	54
stable	32	53
stable	43	68
stable	45	50
stable	53	80
stable	64	70
stable	37	74
stable	56	62
stable	44	64
stable	48	69
stable	38	57
stable	39	55
stable	35	66

Rank_J_predicted	trend_J_Predicted	dataset	verbatim_name	J_Predicted	J_Observe	trend_J_Observe
1	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Pastor roseus*	0.1484	0.073	complete turnove
2	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Anser erythropus*	0.1504	0.071	complete turnove
3	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Xenus cinereus*	0.166	0.19	strong turnover (
4	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Circus macrourus*	0.1715	0.02	complete turnove
5	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Larus ichthyaetus*	0.1806	0.444	strong intermedi
6	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Glareola nordmanni*	0.1831	0	complete turnove
7	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Emberiza aureola*	0.1862	0.038	complete turnove
8	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Pelecanus onocrotalu*	0.1862	0.143	strong turnover (
9	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Zapornia pusilla*	0.2047	0.081	complete turnove
10	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Oxyura jamaicensis*	0.2172	0.072	complete turnove
11	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Bucanetes githagineu*	0.2252	0.3	strong intermedi
12	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Spilopelia senegalens*	0.2336	0.222	strong turnover (
13	strong turnover (0.1 - 0.	Birds_atlas_EBBA	*Aix sponsa*	0.2391	0.016	complete turnove
14	strong intermediate turn	Birds_atlas_EBBA	*Falco biarmicus*	0.2563	0.215	strong turnover (
15	strong intermediate turn	Birds_atlas_EBBA	*Clanga clanga*	0.2596	0.12	strong turnover (
16	strong intermediate turn	Birds_atlas_EBBA	*Marmaronetta angusi*	0.2613	0.412	strong intermedi
17	strong intermediate turn	Birds_atlas_EBBA	*Plegadis falcinellus*	0.2618	0.213	strong turnover (
18	strong intermediate turn	Birds_atlas_EBBA	*Fulica cristata*	0.2654	0.227	strong turnover (
19	strong intermediate turn	Birds_atlas_EBBA	*Pelecanus crispus*	0.2703	0.471	strong intermedi
20	strong intermediate turn	Birds_atlas_EBBA	*Calidris minuta*	0.2749	0.375	strong intermedi
21	strong intermediate turn	Birds_atlas_EBBA	*Phoenicopterus roseu*	0.275	0.167	strong turnover (
22	strong intermediate turn	Birds_atlas_EBBA	*Aegypius monachus*	0.2769	0.446	strong intermedi
23	strong intermediate turn	Birds_atlas_EBBA	*Acrocephalus paludic*	0.2817	0.253	strong intermedi
24	strong intermediate turn	Birds_atlas_EBBA	*Tringa stagnatilis*	0.2888	0.078	complete turnove
25	strong intermediate turn	Birds_atlas_EBBA	*Larus genei*	0.299	0.259	strong intermedi
26	strong intermediate turn	Birds_atlas_EBBA	*Amandava amandava*	0.3043	0.219	strong turnover (
27	strong intermediate turn	Birds_atlas_EBBA	*Cercotrichas galactot*	0.3125	0.393	strong intermedi
28	strong intermediate turn	Birds_atlas_EBBA	*Microcarbo pygmaeu*	0.3133	0.252	strong intermedi
29	strong intermediate turn	Birds_atlas_EBBA	*Syrmaticus reevesii*	0.3178	0.333	strong intermedi
30	strong intermediate turn	Birds_atlas_EBBA	*Acrocephalus agricol*	0.3184	0.326	strong intermedi
31	strong intermediate turn	Birds_atlas_EBBA	*Oxyura leucocephala*	0.324	0.371	strong intermedi

32	strong intermediate turn	Birds_atlas_EBBA	*Acrocephalus melanc*	0.3263	0.321 strong intermedi
33	strong intermediate turn	Birds_atlas_EBBA	*Bubo scandiacus*	0.3267	0.242 strong turnover (
34	strong intermediate turn	Birds_atlas_EBBA	*Cyanistes cyanus*	0.3338	0.333 strong intermedi
35	strong intermediate turn	Birds_atlas_EBBA	*Phylloscopus borealis*	0.3458	0.387 strong intermedi
36	strong intermediate turn	Birds_atlas_EBBA	*Sterna dougallii*	0.3466	0.245 strong turnover (
37	strong intermediate turn	Birds_atlas_EBBA	*Hydrobates leucorhou*	0.3501	0.3 strong intermedi
38	strong intermediate turn	Birds_atlas_EBBA	*Eremophila alpestris*	0.352	0.423 strong intermedi
39	strong intermediate turn	Birds_atlas_EBBA	*Alaudala rufescens*	0.3536	0.39 strong intermedi
40	strong intermediate turn	Birds_atlas_EBBA	*Aquila heliaca*	0.3558	0.259 strong intermedi
41	strong intermediate turn	Birds_atlas_EBBA	*Puffinus puffinus*	0.356	0.442 strong intermedi
42	strong intermediate turn	Birds_atlas_EBBA	*Myiopsitta monachus*	0.3568	0.065 complete turnove
43	strong intermediate turn	Birds_atlas_EBBA	*Anthropoides virgo*	0.3684	0.433 strong intermedi
44	strong intermediate turn	Birds_atlas_EBBA	*Phylloscopus orientai*	0.3689	0.366 strong intermedi
45	strong intermediate turn	Birds_atlas_EBBA	*Alectoris chukar*	0.3697	0.425 strong intermedi
46	strong intermediate turn	Birds_atlas_EBBA	*Morus bassanus*	0.3725	0.426 strong intermedi
47	strong intermediate turn	Birds_atlas_EBBA	*Tarsiger cyanurus*	0.3731	0.048 complete turnove
48	strong intermediate turn	Birds_atlas_EBBA	*Gelochelidon nilotica*	0.3742	0.339 strong intermedi
49	strong intermediate turn	Birds_atlas_EBBA	*Hydroprogne caspia*	0.3745	0.591 weak intermedia
50	strong intermediate turn	Birds_atlas_EBBA	*Lanius nubicus*	0.3763	0.468 strong intermedi
51	strong intermediate turn	Birds_atlas_EBBA	*Hippolais olivetorum*	0.3832	0.414 strong intermedi
52	strong intermediate turn	Birds_atlas_EBBA	*Platalea leucorodia*	0.3857	0.248 strong turnover (
53	strong intermediate turn	Birds_atlas_EBBA	*Emberiza caesia*	0.3861	0.308 strong intermedi
54	strong intermediate turn	Birds_atlas_EBBA	*Ficedula semitorquat*	0.3862	0.33 strong intermedi
55	strong intermediate turn	Birds_atlas_EBBA	*Colinus virginianus*	0.387	0.545 weak intermedia
56	strong intermediate turn	Birds_atlas_EBBA	*Aythya nyroca*	0.3881	0.337 strong intermedi
57	strong intermediate turn	Birds_atlas_EBBA	*Falco cherrug*	0.3882	0.257 strong intermedi
58	strong intermediate turn	Birds_atlas_EBBA	*Larus melanocephalu*	0.3932	0.205 strong turnover (
59	strong intermediate turn	Birds_atlas_EBBA	*Apus caffer*	0.3933	0.18 strong turnover (
60	strong intermediate turn	Birds_atlas_EBBA	*Sternula albifrons*	0.3969	0.462 strong intermedi
61	strong intermediate turn	Birds_atlas_EBBA	*Otis tarda*	0.4006	0.426 strong intermedi
62	strong intermediate turn	Birds_atlas_EBBA	*Glareola pratincola*	0.4027	0.508 weak intermedia

63	strong intermediate turn	Birds_atlas_EBBA	*Accipiter brevipes*	0.4029	0.338 strong intermedia
64	strong intermediate turn	Birds_atlas_EBBA	*Puffinus yelkouan*	0.4029	0.369 strong intermedia
65	strong intermediate turn	Birds_atlas_EBBA	*Larus audouinii*	0.4093	0.354 strong intermedia
66	strong intermediate turn	Birds_atlas_EBBA	*Chersophilus duponti*	0.4107	0.433 strong intermedia
67	strong intermediate turn	Birds_atlas_EBBA	*Porphyrio porphyrio*	0.4117	0.256 strong intermedia
68	strong intermediate turn	Birds_atlas_EBBA	*Ardeola ralloides*	0.4124	0.337 strong intermedia
69	strong intermediate turn	Birds_atlas_EBBA	*Oenanthe pleschanka*	0.4171	0.325 strong intermedia
70	strong intermediate turn	Birds_atlas_EBBA	*Chlidonias leucopteru*	0.4177	0.42 strong intermedia
71	strong intermediate turn	Birds_atlas_EBBA	*Pterocles alchata*	0.4186	0.44 strong intermedia
72	strong intermediate turn	Birds_atlas_EBBA	*Falco vespertinus*	0.4199	0.284 strong intermedia
73	strong intermediate turn	Birds_atlas_EBBA	*Tadorna ferruginea*	0.4201	0.148 strong turnover (
74	strong intermediate turn	Birds_atlas_EBBA	*Oenanthe isabellina*	0.4222	0.272 strong intermedia
75	strong intermediate turn	Birds_atlas_EBBA	*Netta rufina*	0.4224	0.263 strong intermedia
76	strong intermediate turn	Birds_atlas_EBBA	*Larus cachinnans*	0.4265	0.114 strong turnover (
77	strong intermediate turn	Birds_atlas_EBBA	*Hydrobates pelagicus*	0.4353	0.466 strong intermedia
78	strong intermediate turn	Birds_atlas_EBBA	*Iduna opaca*	0.4394	0.415 strong intermedia
79	strong intermediate turn	Birds_atlas_EBBA	*Limosa limosa*	0.4422	0.506 weak intermedia
80	strong intermediate turn	Birds_atlas_EBBA	*Recurvirostra avosett*	0.4465	0.476 strong intermedia
81	strong intermediate turn	Birds_atlas_EBBA	*Falco eleonorae*	0.4473	0.427 strong intermedia
82	strong intermediate turn	Birds_atlas_EBBA	*Calonectris diomedea*	0.4488	0.435 strong intermedia
83	strong intermediate turn	Birds_atlas_EBBA	*Loxia leucoptera*	0.449	0.396 strong intermedia
84	strong intermediate turn	Birds_atlas_EBBA	*Thalasseus sandvice*	0.4491	0.327 strong intermedia
85	strong intermediate turn	Birds_atlas_EBBA	*Pinicola enucleator*	0.4527	0.441 strong intermedia
86	strong intermediate turn	Birds_atlas_EBBA	*Gallinago media*	0.4529	0.389 strong intermedia
87	strong intermediate turn	Birds_atlas_EBBA	*Limosa lapponica*	0.4569	0.6 weak intermedia
88	strong intermediate turn	Birds_atlas_EBBA	*Motacilla citreola*	0.4586	0.193 strong turnover (
89	strong intermediate turn	Birds_atlas_EBBA	*Emberiza pusilla*	0.4589	0.5 strong intermedia
90	strong intermediate turn	Birds_atlas_EBBA	*Podiceps nigricollis*	0.4624	0.437 strong intermedia
91	strong intermediate turn	Birds_atlas_EBBA	*Aix galericulata*	0.4641	0.127 strong turnover (
92	strong intermediate turn	Birds_atlas_EBBA	*Puffinus mauretanicu*	0.4655	0.5 strong intermedia
93	strong intermediate turn	Birds_atlas_EBBA	*Anas acuta*	0.4828	0.464 strong intermedia

94	strong intermediate turn	Birds_atlas_EBBA	*Chlidonias hybrida*	0.4858	0.335 strong intermedia
95	strong intermediate turn	Birds_atlas_EBBA	*Anser fabalis*	0.4877	0.636 weak intermedia
96	strong intermediate turn	Birds_atlas_EBBA	*Nycticorax nycticorax*	0.4944	0.427 strong intermedia
97	weak intermediate turnc	Birds_atlas_EBBA	*Mergellus albellus*	0.5002	0.533 weak intermedia
98	weak intermediate turnc	Birds_atlas_EBBA	*Himantopus himantop*	0.5011	0.371 strong intermedia
99	weak intermediate turnc	Birds_atlas_EBBA	*Charadrius alexandrii*	0.5013	0.584 weak intermedia
100	weak intermediate turnc	Birds_atlas_EBBA	*Estrilda astrild*	0.5019	0.359 strong intermedia
101	weak intermediate turnc	Birds_atlas_EBBA	*Bubulcus ibis*	0.5022	0.17 strong turnover (
102	weak intermediate turnc	Birds_atlas_EBBA	*Egretta garzetta*	0.5031	0.314 strong intermedia
103	weak intermediate turnc	Birds_atlas_EBBA	*Neophron percnopter*	0.5049	0.497 strong intermedia
104	weak intermediate turnc	Birds_atlas_EBBA	*Lymnocryptes minimu*	0.5054	0.549 weak intermedia
105	weak intermediate turnc	Birds_atlas_EBBA	*Calidris falcinellus*	0.5087	0.503 weak intermedia
106	weak intermediate turnc	Birds_atlas_EBBA	*Zapornia parva*	0.5092	0.353 strong intermedia
107	weak intermediate turnc	Birds_atlas_EBBA	*Prunella collaris*	0.5103	0.59 weak intermedia
108	weak intermediate turnc	Birds_atlas_EBBA	*Aythya marila*	0.5129	0.46 strong intermedia
109	weak intermediate turnc	Birds_atlas_EBBA	*Ardea alba*	0.5132	0.191 strong turnover (
110	weak intermediate turnc	Birds_atlas_EBBA	*Branta leucopsis*	0.5134	0.131 strong turnover (
111	weak intermediate turnc	Birds_atlas_EBBA	*Ardea purpurea*	0.5166	0.518 weak intermedia
112	weak intermediate turnc	Birds_atlas_EBBA	*Gypaetus barbatus*	0.5198	0.414 strong intermedia
113	weak intermediate turnc	Birds_atlas_EBBA	*Asio flammeus*	0.5207	0.486 strong intermedia
114	weak intermediate turnc	Birds_atlas_EBBA	*Chlidonias niger*	0.5217	0.596 weak intermedia
115	weak intermediate turnc	Birds_atlas_EBBA	*Catharacta skua*	0.5257	0.511 weak intermedia
116	weak intermediate turnc	Birds_atlas_EBBA	*Anthus cervinus*	0.5264	0.538 weak intermedia
117	weak intermediate turnc	Birds_atlas_EBBA	*Phylloscopus trochilo*	0.5302	0.414 strong intermedia
118	weak intermediate turnc	Birds_atlas_EBBA	*Calidris pugnax*	0.5303	0.461 strong intermedia
119	weak intermediate turnc	Birds_atlas_EBBA	*Tadorna tadorna*	0.5303	0.509 weak intermedia
120	weak intermediate turnc	Birds_atlas_EBBA	*Phalacrocorax carbo*	0.5311	0.261 strong intermedia
121	weak intermediate turnc	Birds_atlas_EBBA	*Gyps fulvus*	0.5316	0.539 weak intermedia
122	weak intermediate turnc	Birds_atlas_EBBA	*Eudromias morinellus*	0.5331	0.557 weak intermedia
123	weak intermediate turnc	Birds_atlas_EBBA	*Tetrax tetrax*	0.534	0.534 weak intermedia
124	weak intermediate turnc	Birds_atlas_EBBA	*Hydrocoloeus minutu*	0.5383	0.426 strong intermedia

125	weak intermediate turnc	Birds_atlas_EBBA	*Strix nebulosa*	0.5383	0.355 strong intermedia
126	weak intermediate turnc	Birds_atlas_EBBA	*Coracias garrulus*	0.5423	0.406 strong intermedia
127	weak intermediate turnc	Birds_atlas_EBBA	*Arenaria interpres*	0.5446	0.667 weak intermedia
128	weak intermediate turnc	Birds_atlas_EBBA	*Aquila adalberti*	0.5453	0.487 strong intermedia
129	weak intermediate turnc	Birds_atlas_EBBA	*Panurus biarmicus*	0.5465	0.345 strong intermedia
130	weak intermediate turnc	Birds_atlas_EBBA	*Poecile cinctus*	0.5468	0.618 weak intermedia
131	weak intermediate turnc	Birds_atlas_EBBA	*Carduelis citrinella*	0.5471	0.652 weak intermedia
132	weak intermediate turnc	Birds_atlas_EBBA	*Melanitta fusca*	0.549	0.635 weak intermedia
133	weak intermediate turnc	Birds_atlas_EBBA	*Poecile lugubris*	0.5512	0.5 strong intermedia
134	weak intermediate turnc	Birds_atlas_EBBA	*Buteo rufinus*	0.5522	0.239 strong turnover (
135	weak intermediate turnc	Birds_atlas_EBBA	*Clangula hyemalis*	0.5527	0.57 weak intermedia
136	weak intermediate turnc	Birds_atlas_EBBA	*Calcarius lapponicus*	0.5535	0.611 weak intermedia
137	weak intermediate turnc	Birds_atlas_EBBA	*Falco naumanni*	0.554	0.45 strong intermedia
138	weak intermediate turnc	Birds_atlas_EBBA	*Calidris temminckii*	0.5556	0.607 weak intermedia
139	weak intermediate turnc	Birds_atlas_EBBA	*Anthus petrosus*	0.5561	0.746 weak intermedia
140	weak intermediate turnc	Birds_atlas_EBBA	*Dendrocopos leucoto*	0.5565	0.493 strong intermedia
141	weak intermediate turnc	Birds_atlas_EBBA	*Stercorarius longicau*	0.5604	0.592 weak intermedia
142	weak intermediate turnc	Birds_atlas_EBBA	*Pterocles orientalis*	0.5612	0.59 weak intermedia
143	weak intermediate turnc	Birds_atlas_EBBA	*Calandrella brachyda*	0.562	0.506 weak intermedia
144	weak intermediate turnc	Birds_atlas_EBBA	*Podiceps grisegena*	0.5628	0.515 weak intermedia
145	weak intermediate turnc	Birds_atlas_EBBA	*Emberiza melanocep*	0.5631	0.481 strong intermedia
146	weak intermediate turnc	Birds_atlas_EBBA	*Larus michahellis*	0.5637	0.43 strong intermedia
147	weak intermediate turnc	Birds_atlas_EBBA	*Clamator glandarius*	0.5669	0.581 weak intermedia
148	weak intermediate turnc	Birds_atlas_EBBA	*Uria aalge*	0.5669	0.63 weak intermedia
149	weak intermediate turnc	Birds_atlas_EBBA	*Phalaropus fulicarius*	0.5684	0.538 weak intermedia
150	weak intermediate turnc	Birds_atlas_EBBA	*Melanitta nigra*	0.5724	0.594 weak intermedia
151	weak intermediate turnc	Birds_atlas_EBBA	*Tichodroma muraria*	0.5751	0.595 weak intermedia
152	weak intermediate turnc	Birds_atlas_EBBA	*Acrocephalus dumetc*	0.5753	0.348 strong intermedia
153	weak intermediate turnc	Birds_atlas_EBBA	*Sitta neumayer*	0.5754	0.584 weak intermedia
154	weak intermediate turnc	Birds_atlas_EBBA	*Anthus spinoletta*	0.5768	0.703 weak intermedia
155	weak intermediate turnc	Birds_atlas_EBBA	*Calidris alpina*	0.5771	0.542 weak intermedia

156	weak intermediate turnc	Birds_atlas_EBBA	*Calonectris borealis*	0.5774	0.65 weak intermedia
157	weak intermediate turnc	Birds_atlas_EBBA	*Gulosus aristotelis*	0.5775	0.603 weak intermedia
158	weak intermediate turnc	Birds_atlas_EBBA	*Burhinus oedicnemus*	0.578	0.626 weak intermedia
159	weak intermediate turnc	Birds_atlas_EBBA	*Elanus caeruleus*	0.579	0.369 strong intermedia
160	weak intermediate turnc	Birds_atlas_EBBA	*Pyrrhocorax graculus*	0.5814	0.753 weak turnover (>
161	weak intermediate turnc	Birds_atlas_EBBA	*Branta bernicla*	0.5827	0.28 strong intermedia
162	weak intermediate turnc	Birds_atlas_EBBA	*Strix uralensis*	0.5828	0.544 weak intermedia
163	weak intermediate turnc	Birds_atlas_EBBA	*Haematopus ostraleg*	0.5835	0.714 weak intermedia
164	weak intermediate turnc	Birds_atlas_EBBA	*Phalaropus lobatus*	0.5847	0.591 weak intermedia
165	weak intermediate turnc	Birds_atlas_EBBA	*Larus fuscus*	0.5858	0.626 weak intermedia
166	weak intermediate turnc	Birds_atlas_EBBA	*Montifringilla nivalis*	0.586	0.717 weak intermedia
167	weak intermediate turnc	Birds_atlas_EBBA	*Iduna pallida*	0.5891	0.598 weak intermedia
168	weak intermediate turnc	Birds_atlas_EBBA	*Tringa erythropus*	0.5895	0.696 weak intermedia
169	weak intermediate turnc	Birds_atlas_EBBA	*Aquila fasciata*	0.5926	0.564 weak intermedia
170	weak intermediate turnc	Birds_atlas_EBBA	*Podiceps auritus*	0.5947	0.609 weak intermedia
171	weak intermediate turnc	Birds_atlas_EBBA	*Spatula clypeata*	0.6014	0.572 weak intermedia
172	weak intermediate turnc	Birds_atlas_EBBA	*Monticola saxatilis*	0.6024	0.572 weak intermedia
173	weak intermediate turnc	Birds_atlas_EBBA	*Apus pallidus*	0.6033	0.388 strong intermedia
174	weak intermediate turnc	Birds_atlas_EBBA	*Linaria flavirostris*	0.6036	0.633 weak intermedia
175	weak intermediate turnc	Birds_atlas_EBBA	*Porzana porzana*	0.6037	0.549 weak intermedia
176	weak intermediate turnc	Birds_atlas_EBBA	*Emberiza rustica*	0.6075	0.715 weak intermedia
177	weak intermediate turnc	Birds_atlas_EBBA	*Alopochen aegyptiac*	0.6111	0.069 complete turnove
178	weak intermediate turnc	Birds_atlas_EBBA	*Circus cyaneus*	0.6113	0.522 weak intermedia
179	weak intermediate turnc	Birds_atlas_EBBA	*Falco rusticolus*	0.6133	0.527 weak intermedia
180	weak intermediate turnc	Birds_atlas_EBBA	*Gavia immer*	0.6134	0.72 weak intermedia
181	weak intermediate turnc	Birds_atlas_EBBA	*Calidris maritima*	0.6144	0.596 weak intermedia
182	weak intermediate turnc	Birds_atlas_EBBA	*Melanocorypha calan*	0.6159	0.628 weak intermedia
183	weak intermediate turnc	Birds_atlas_EBBA	*Anser brachyrhynchu*	0.6166	0.689 weak intermedia
184	weak intermediate turnc	Birds_atlas_EBBA	*Uria lomvia*	0.6166	0.702 weak intermedia
185	weak intermediate turnc	Birds_atlas_EBBA	*Larus marinus*	0.6172	0.694 weak intermedia
186	weak intermediate turnc	Birds_atlas_EBBA	*Alectoris graeca*	0.6212	0.651 weak intermedia

187	weak intermediate turnc	Birds_atlas_EBBA	*Somateria spectabilis*	0.6233	0.476 strong intermedia
188	weak intermediate turnc	Birds_atlas_EBBA	*Oenanthe leucura*	0.6261	0.639 weak intermedia
189	weak intermediate turnc	Birds_atlas_EBBA	*Mareca strepera*	0.6287	0.408 strong intermedia
190	weak intermediate turnc	Birds_atlas_EBBA	*Alca torda*	0.6313	0.706 weak intermedia
191	weak intermediate turnc	Birds_atlas_EBBA	*Turdus torquatus*	0.6315	0.722 weak intermedia
192	weak intermediate turnc	Birds_atlas_EBBA	*Pyrrhocorax pyrrhocc*	0.6317	0.673 weak intermedia
193	weak intermediate turnc	Birds_atlas_EBBA	*Tetrao urogallus*	0.6344	0.756 weak turnover (>
194	weak intermediate turnc	Birds_atlas_EBBA	*Tachymarptis melba*	0.6353	0.621 weak intermedia
195	weak intermediate turnc	Birds_atlas_EBBA	*Passer hispaniolensis*	0.6355	0.511 weak intermedia
196	weak intermediate turnc	Birds_atlas_EBBA	*Pandion haliaetus*	0.6376	0.609 weak intermedia
197	weak intermediate turnc	Birds_atlas_EBBA	*Emberiza hortulana*	0.6386	0.555 weak intermedia
198	weak intermediate turnc	Birds_atlas_EBBA	*Anser anser*	0.641	0.5 strong intermedia
199	weak intermediate turnc	Birds_atlas_EBBA	*Plectrophenax nivalis*	0.6425	0.658 weak intermedia
200	weak intermediate turnc	Birds_atlas_EBBA	*Nucifraga caryocatac*	0.643	0.678 weak intermedia
201	weak intermediate turnc	Birds_atlas_EBBA	*Anthus campestris*	0.6436	0.551 weak intermedia
202	weak intermediate turnc	Birds_atlas_EBBA	*Oenanthe hispanica*	0.6457	0.701 weak intermedia
203	weak intermediate turnc	Birds_atlas_EBBA	*Hieraaetus pennatus*	0.6467	0.47 strong intermedia
204	weak intermediate turnc	Birds_atlas_EBBA	*Fratercula arctica*	0.6472	0.694 weak intermedia
205	weak intermediate turnc	Birds_atlas_EBBA	*Ixobrychus minutus*	0.6476	0.576 weak intermedia
206	weak intermediate turnc	Birds_atlas_EBBA	*Botaurus stellaris*	0.6482	0.598 weak intermedia
207	weak intermediate turnc	Birds_atlas_EBBA	*Circus pygargus*	0.6484	0.573 weak intermedia
208	weak intermediate turnc	Birds_atlas_EBBA	*Ficedula parva*	0.6499	0.608 weak intermedia
209	weak intermediate turnc	Birds_atlas_EBBA	*Aquila chrysaetos*	0.6503	0.682 weak intermedia
210	weak intermediate turnc	Birds_atlas_EBBA	*Locustella luscinioide*	0.6532	0.512 weak intermedia
211	weak intermediate turnc	Birds_atlas_EBBA	*Haliaeetus albicilla*	0.655	0.323 strong intermedia
212	weak intermediate turnc	Birds_atlas_EBBA	*Picoides tridactylus*	0.6585	0.693 weak intermedia
213	weak intermediate turnc	Birds_atlas_EBBA	*Aythya ferina*	0.6588	0.608 weak intermedia
214	weak intermediate turnc	Birds_atlas_EBBA	*Clanga pomarina*	0.6597	0.58 weak intermedia
215	weak intermediate turnc	Birds_atlas_EBBA	*Larus argentatus*	0.6621	0.717 weak intermedia
216	weak intermediate turnc	Birds_atlas_EBBA	*Mareca penelope*	0.6627	0.666 weak intermedia
217	weak intermediate turnc	Birds_atlas_EBBA	*Spatula querquedula*	0.663	0.656 weak intermedia

218	weak intermediate turnc	Birds_atlas_EBBA	*Charadrius hiaticula*	0.6645	0.705	weak intermedia
219	weak intermediate turnc	Birds_atlas_EBBA	*Remiz pendulinus*	0.6657	0.617	weak intermedia
220	weak intermediate turnc	Birds_atlas_EBBA	*Larus hyperboreus*	0.6666	0.8	weak turnover (>
221	weak intermediate turnc	Birds_atlas_EBBA	*Ficedula albicollis*	0.667	0.513	weak intermedia
222	weak intermediate turnc	Birds_atlas_EBBA	*Glaucidium passerinu*	0.6676	0.485	strong intermedia
223	weak intermediate turnc	Birds_atlas_EBBA	*Cecropis daurica*	0.6695	0.539	weak intermedia
224	weak intermediate turnc	Birds_atlas_EBBA	*Branta canadensis*	0.6704	0.49	strong intermedia
225	weak intermediate turnc	Birds_atlas_EBBA	*Emberiza cia*	0.6706	0.692	weak intermedia
226	weak intermediate turnc	Birds_atlas_EBBA	*Aegolius funereus*	0.672	0.647	weak intermedia
227	weak intermediate turnc	Birds_atlas_EBBA	*Cinclus cinclus*	0.672	0.72	weak intermedia
228	weak intermediate turnc	Birds_atlas_EBBA	*Falco columbarius*	0.673	0.704	weak intermedia
229	weak intermediate turnc	Birds_atlas_EBBA	*Circaetus gallicus*	0.6732	0.586	weak intermedia
230	weak intermediate turnc	Birds_atlas_EBBA	*Numenius arquata*	0.6775	0.721	weak intermedia
231	weak intermediate turnc	Birds_atlas_EBBA	*Sterna hirundo*	0.6794	0.698	weak intermedia
232	weak intermediate turnc	Birds_atlas_EBBA	*Milvus milvus*	0.68	0.553	weak intermedia
233	weak intermediate turnc	Birds_atlas_EBBA	*Tringa totanus*	0.6811	0.69	weak intermedia
234	weak intermediate turnc	Birds_atlas_EBBA	*Sterna paradisaea*	0.6819	0.774	weak turnover (>
235	weak intermediate turnc	Birds_atlas_EBBA	*Carpodacus erythrinu*	0.6823	0.701	weak intermedia
236	weak intermediate turnc	Birds_atlas_EBBA	*Mergus merganser*	0.6841	0.61	weak intermedia
237	weak intermediate turnc	Birds_atlas_EBBA	*Bubo bubo*	0.6848	0.591	weak intermedia
238	weak intermediate turnc	Birds_atlas_EBBA	*Cygnus cygnus*	0.6848	0.487	strong intermedia
239	weak intermediate turnc	Birds_atlas_EBBA	*Rissa tridactyla*	0.6859	0.717	weak intermedia
240	weak intermediate turnc	Birds_atlas_EBBA	*Puffinus lherminieri*	0.6902	0.583	weak intermedia
241	weak intermediate turnc	Birds_atlas_EBBA	*Lanius minor*	0.6904	0.475	strong intermedia
242	weak intermediate turnc	Birds_atlas_EBBA	*Hydrobates castro*	0.692	0.9	weak turnover (>
243	weak intermediate turnc	Birds_atlas_EBBA	*Milvus migrans*	0.6921	0.669	weak intermedia
244	weak intermediate turnc	Birds_atlas_EBBA	*Alle alle*	0.6927	0.8	weak turnover (>
245	weak intermediate turnc	Birds_atlas_EBBA	*Petronia petronia*	0.6954	0.72	weak intermedia
246	weak intermediate turnc	Birds_atlas_EBBA	*Surnia ulula*	0.6985	0.729	weak intermedia
247	weak intermediate turnc	Birds_atlas_EBBA	*Larus ridibundus*	0.7006	0.7	weak intermedia
248	weak intermediate turnc	Birds_atlas_EBBA	*Perisoreus infaustus*	0.7015	0.842	weak turnover (>

249	weak intermediate turnc	Birds_atlas_EBBA	*Cyanopica cooki*	0.7021	0.76 weak turnover (>
250	weak intermediate turnc	Birds_atlas_EBBA	*Caprimulgus ruficollis*	0.7031	0.589 weak intermedia
251	weak intermediate turnc	Birds_atlas_EBBA	*Somateria mollissima*	0.7031	0.772 weak turnover (>
252	weak intermediate turnc	Birds_atlas_EBBA	*Mergus serrator*	0.7039	0.807 weak turnover (>
253	weak intermediate turnc	Birds_atlas_EBBA	*Monticola solitarius*	0.7051	0.752 weak turnover (>
254	weak intermediate turnc	Birds_atlas_EBBA	*Alectoris barbara*	0.706	0.95 stable (> 0.9)
255	weak intermediate turnc	Birds_atlas_EBBA	*Fulmarus glacialis*	0.7067	0.816 weak turnover (>
256	weak intermediate turnc	Birds_atlas_EBBA	*Stercorarius parasitic*	0.7076	0.729 weak intermedia
257	weak intermediate turnc	Birds_atlas_EBBA	*Anas crecca*	0.7126	0.74 weak intermedia
258	weak intermediate turnc	Birds_atlas_EBBA	*Gavia stellata*	0.7163	0.722 weak intermedia
259	weak intermediate turnc	Birds_atlas_EBBA	*Larus canus*	0.717	0.777 weak turnover (>
260	weak intermediate turnc	Birds_atlas_EBBA	*Locustella fluviatilis*	0.7174	0.635 weak intermedia
261	weak intermediate turnc	Birds_atlas_EBBA	*Grus grus*	0.7175	0.712 weak intermedia
262	weak intermediate turnc	Birds_atlas_EBBA	*Ciconia nigra*	0.7207	0.671 weak intermedia
263	weak intermediate turnc	Birds_atlas_EBBA	*Lagopus lagopus*	0.7227	0.802 weak turnover (>
264	weak intermediate turnc	Birds_atlas_EBBA	*Loxia curvirostra*	0.7227	0.683 weak intermedia
265	weak intermediate turnc	Birds_atlas_EBBA	*Actitis hypoleucos*	0.723	0.706 weak intermedia
266	weak intermediate turnc	Birds_atlas_EBBA	*Lagopus muta*	0.7244	0.806 weak turnover (>
267	weak intermediate turnc	Birds_atlas_EBBA	*Falco peregrinus*	0.7245	0.458 strong intermedia
268	weak intermediate turnc	Birds_atlas_EBBA	*Loxia pytyopsittacus*	0.7269	0.787 weak turnover (>
269	weak intermediate turnc	Birds_atlas_EBBA	*Bombycilla garrulus*	0.7277	0.51 weak intermedia
270	weak intermediate turnc	Birds_atlas_EBBA	*Passer italiae*	0.7283	0.855 weak turnover (>
271	weak intermediate turnc	Birds_atlas_EBBA	*Tringa glareola*	0.7301	0.762 weak turnover (>
272	weak intermediate turnc	Birds_atlas_EBBA	*Lanius excubitor*	0.7309	0.629 weak intermedia
273	weak intermediate turnc	Birds_atlas_EBBA	*Lanius senator*	0.7309	0.667 weak intermedia
274	weak intermediate turnc	Birds_atlas_EBBA	*Dendrocopos syriacu*	0.7315	0.687 weak intermedia
275	weak intermediate turnc	Birds_atlas_EBBA	*Lyrurus tetrix*	0.7334	0.793 weak turnover (>
276	weak intermediate turnc	Birds_atlas_EBBA	*Tyto alba*	0.737	0.736 weak intermedia
277	weak intermediate turnc	Birds_atlas_EBBA	*Spinus spinus*	0.7375	0.754 weak turnover (>
278	weak intermediate turnc	Birds_atlas_EBBA	*Bucephala clangula*	0.7385	0.728 weak intermedia
279	weak intermediate turnc	Birds_atlas_EBBA	*Cepphus grylle*	0.7392	0.798 weak turnover (>

280	weak intermediate turnc	Birds_atlas_EBBA	*Scolopax rusticola*	0.7399	0.75 weak intermedia
281	weak intermediate turnc	Birds_atlas_EBBA	*Ptyonoprogne rupest*	0.74	0.708 weak intermedia
282	weak intermediate turnc	Birds_atlas_EBBA	*Numenius phaeopus*	0.7402	0.79 weak turnover (>
283	weak intermediate turnc	Birds_atlas_EBBA	*Corvus frugilegus*	0.7404	0.761 weak turnover (>
284	weak intermediate turnc	Birds_atlas_EBBA	*Gallinago gallinago*	0.7408	0.823 weak turnover (>
285	weak intermediate turnc	Birds_atlas_EBBA	*Galerida cristata*	0.7439	0.73 weak intermedia
286	weak intermediate turnc	Birds_atlas_EBBA	*Merops apiaster*	0.7453	0.574 weak intermedia
287	weak intermediate turnc	Birds_atlas_EBBA	*Columba oenas*	0.7476	0.709 weak intermedia
288	weak intermediate turnc	Birds_atlas_EBBA	*Aythya fuligula*	0.7479	0.766 weak turnover (>
289	weak intermediate turnc	Birds_atlas_EBBA	*Tringa ochropus*	0.7488	0.762 weak turnover (>
290	weak turnover (> 0.75)	Birds_atlas_EBBA	*Tringa nebularia*	0.7509	0.792 weak turnover (>
291	weak turnover (> 0.75)	Birds_atlas_EBBA	*Apus unicolor*	0.7518	1 stable (> 0.9)
292	weak turnover (> 0.75)	Birds_atlas_EBBA	*Circus aeruginosus*	0.7546	0.701 weak intermedia
293	weak turnover (> 0.75)	Birds_atlas_EBBA	*Acrocephalus arundi*	0.7552	0.735 weak intermedia
294	weak turnover (> 0.75)	Birds_atlas_EBBA	*Rallus aquaticus*	0.7553	0.708 weak intermedia
295	weak turnover (> 0.75)	Birds_atlas_EBBA	*Cisticola juncidis*	0.7575	0.681 weak intermedia
296	weak turnover (> 0.75)	Birds_atlas_EBBA	*Pluvialis apricaria*	0.759	0.805 weak turnover (>
297	weak turnover (> 0.75)	Birds_atlas_EBBA	*Otus scops*	0.7611	0.641 weak intermedia
298	weak turnover (> 0.75)	Birds_atlas_EBBA	*Turdus iliacus*	0.7658	0.799 weak turnover (>
299	weak turnover (> 0.75)	Birds_atlas_EBBA	*Cygnus olor*	0.7659	0.679 weak intermedia
300	weak turnover (> 0.75)	Birds_atlas_EBBA	*Motacilla cinerea*	0.7663	0.754 weak turnover (>
301	weak turnover (> 0.75)	Birds_atlas_EBBA	*Galerida theklae*	0.7664	0.724 weak intermedia
302	weak turnover (> 0.75)	Birds_atlas_EBBA	*Caprimulgus europae*	0.7665	0.709 weak intermedia
303	weak turnover (> 0.75)	Birds_atlas_EBBA	*Ficedula hypoleuca*	0.7675	0.793 weak turnover (>
304	weak turnover (> 0.75)	Birds_atlas_EBBA	*Fringilla montifringilla*	0.7678	0.773 weak turnover (>
305	weak turnover (> 0.75)	Birds_atlas_EBBA	*Crex crex*	0.7684	0.668 weak intermedia
306	weak turnover (> 0.75)	Birds_atlas_EBBA	*Picus canus*	0.7706	0.657 weak intermedia
307	weak turnover (> 0.75)	Birds_atlas_EBBA	*Buteo lagopus*	0.7714	0.793 weak turnover (>
308	weak turnover (> 0.75)	Birds_atlas_EBBA	*Leiopicus medius*	0.7772	0.661 weak intermedia
309	weak turnover (> 0.75)	Birds_atlas_EBBA	*Anthus berthelotii*	0.7789	1 stable (> 0.9)
310	weak turnover (> 0.75)	Birds_atlas_EBBA	*Luscinia luscinia*	0.7802	0.844 weak turnover (>

311	weak turnover (> 0.75)	Birds_atlas_EBBA	*Acrocephalus schoer.*	0.7808	0.808 weak turnover (>
312	weak turnover (> 0.75)	Birds_atlas_EBBA	*Acanthis flammea*	0.7821	0.772 weak turnover (>
313	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phasianus colchicus*	0.7833	0.776 weak turnover (>
314	weak turnover (> 0.75)	Birds_atlas_EBBA	*Ardea cinerea*	0.7856	0.723 weak intermedia
315	weak turnover (> 0.75)	Birds_atlas_EBBA	*Regulus ignicapilla*	0.7873	0.702 weak intermedia
316	weak turnover (> 0.75)	Birds_atlas_EBBA	*Gavia arctica*	0.7876	0.847 weak turnover (>
317	weak turnover (> 0.75)	Birds_atlas_EBBA	*Perdix perdix*	0.7876	0.795 weak turnover (>
318	weak turnover (> 0.75)	Birds_atlas_EBBA	*Lanius meridionalis*	0.7904	0.833 weak turnover (>
319	weak turnover (> 0.75)	Birds_atlas_EBBA	*Alectoris rufa*	0.7914	0.809 weak turnover (>
320	weak turnover (> 0.75)	Birds_atlas_EBBA	*Hippolais polyglotta*	0.7914	0.845 weak turnover (>
321	weak turnover (> 0.75)	Birds_atlas_EBBA	*Ciconia ciconia*	0.7927	0.78 weak turnover (>
322	weak turnover (> 0.75)	Birds_atlas_EBBA	*Tachybaptus ruficollis*	0.7934	0.737 weak intermedia
323	weak turnover (> 0.75)	Birds_atlas_EBBA	*Cettia cetti*	0.7949	0.784 weak turnover (>
324	weak turnover (> 0.75)	Birds_atlas_EBBA	*Lophophanes cristatu*	0.7957	0.83 weak turnover (>
325	weak turnover (> 0.75)	Birds_atlas_EBBA	*Locustella naevia*	0.797	0.773 weak turnover (>
326	weak turnover (> 0.75)	Birds_atlas_EBBA	*Vanellus vanellus*	0.7979	0.828 weak turnover (>
327	weak turnover (> 0.75)	Birds_atlas_EBBA	*Riparia riparia*	0.798	0.79 weak turnover (>
328	weak turnover (> 0.75)	Birds_atlas_EBBA	*Alcedo atthis*	0.8001	0.799 weak turnover (>
329	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phylloscopus bonelli*	0.8005	0.784 weak turnover (>
330	weak turnover (> 0.75)	Birds_atlas_EBBA	*Acrocephalus scirpac*	0.8006	0.742 weak intermedia
331	weak turnover (> 0.75)	Birds_atlas_EBBA	*Hippolais icterina*	0.8006	0.806 weak turnover (>
332	weak turnover (> 0.75)	Birds_atlas_EBBA	*Podiceps cristatus*	0.8053	0.759 weak turnover (>
333	weak turnover (> 0.75)	Birds_atlas_EBBA	*Regulus regulus*	0.8071	0.842 weak turnover (>
334	weak turnover (> 0.75)	Birds_atlas_EBBA	*Charadrius dubius*	0.8087	0.755 weak turnover (>
335	weak turnover (> 0.75)	Birds_atlas_EBBA	*Fulica atra*	0.8091	0.828 weak turnover (>
336	weak turnover (> 0.75)	Birds_atlas_EBBA	*Periparus ater*	0.8099	0.815 weak turnover (>
337	weak turnover (> 0.75)	Birds_atlas_EBBA	*Coccothraustes cocc*	0.81	0.729 weak intermedia
338	weak turnover (> 0.75)	Birds_atlas_EBBA	*Sturnus unicolor*	0.8111	0.892 weak turnover (>
339	weak turnover (> 0.75)	Birds_atlas_EBBA	*Certhia familiaris*	0.8124	0.804 weak turnover (>
340	weak turnover (> 0.75)	Birds_atlas_EBBA	*Emberiza cirlus*	0.8128	0.837 weak turnover (>
341	weak turnover (> 0.75)	Birds_atlas_EBBA	*Acrocephalus palustr.*	0.8138	0.786 weak turnover (>

342	weak turnover (> 0.75)	Birds_atlas_EBBA	*Bulweria bulwerii*	0.8141	1 stable (> 0.9)
343	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phylloscopus sibilatri*	0.8161	0.819 weak turnover (>
344	weak turnover (> 0.75)	Birds_atlas_EBBA	*Gallinula chloropus*	0.8167	0.851 weak turnover (>
345	weak turnover (> 0.75)	Birds_atlas_EBBA	*Athene noctua*	0.8189	0.805 weak turnover (>
346	weak turnover (> 0.75)	Birds_atlas_EBBA	*Dryobates minor*	0.8194	0.767 weak turnover (>
347	weak turnover (> 0.75)	Birds_atlas_EBBA	*Asio otus*	0.8208	0.777 weak turnover (>
348	weak turnover (> 0.75)	Birds_atlas_EBBA	*Oenanthe oenanthe*	0.8208	0.817 weak turnover (>
349	weak turnover (> 0.75)	Birds_atlas_EBBA	*Accipiter gentilis*	0.8214	0.798 weak turnover (>
350	weak turnover (> 0.75)	Birds_atlas_EBBA	*Lullula arborea*	0.8218	0.765 weak turnover (>
351	weak turnover (> 0.75)	Birds_atlas_EBBA	*Poecile montanus*	0.8219	0.837 weak turnover (>
352	weak turnover (> 0.75)	Birds_atlas_EBBA	*Motacilla flava*	0.8227	0.823 weak turnover (>
353	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phoenicurus phoenic*	0.8241	0.817 weak turnover (>
354	weak turnover (> 0.75)	Birds_atlas_EBBA	*Upupa epops*	0.8247	0.852 weak turnover (>
355	weak turnover (> 0.75)	Birds_atlas_EBBA	*Emberiza schoeniclu*	0.8261	0.87 weak turnover (>
356	weak turnover (> 0.75)	Birds_atlas_EBBA	*Turdus pilaris*	0.8265	0.856 weak turnover (>
357	weak turnover (> 0.75)	Birds_atlas_EBBA	*Dryocopus martius*	0.8267	0.803 weak turnover (>
358	weak turnover (> 0.75)	Birds_atlas_EBBA	*Pernis apivorus*	0.8277	0.743 weak intermedia
359	weak turnover (> 0.75)	Birds_atlas_EBBA	*Poecile palustris*	0.8291	0.853 weak turnover (>
360	weak turnover (> 0.75)	Birds_atlas_EBBA	*Saxicola rubetra*	0.8315	0.826 weak turnover (>
361	weak turnover (> 0.75)	Birds_atlas_EBBA	*Jynx torquilla*	0.8325	0.807 weak turnover (>
362	weak turnover (> 0.75)	Birds_atlas_EBBA	*Picus viridis*	0.8327	0.844 weak turnover (>
363	weak turnover (> 0.75)	Birds_atlas_EBBA	*Emberiza calandra*	0.8331	0.751 weak turnover (>
364	weak turnover (> 0.75)	Birds_atlas_EBBA	*Certhia brachydactyl*	0.8338	0.861 weak turnover (>
365	weak turnover (> 0.75)	Birds_atlas_EBBA	*Serinus serinus*	0.8348	0.821 weak turnover (>
366	weak turnover (> 0.75)	Birds_atlas_EBBA	*Falco subbuteo*	0.835	0.768 weak turnover (>
367	weak turnover (> 0.75)	Birds_atlas_EBBA	*Sylvia borin*	0.8352	0.841 weak turnover (>
368	weak turnover (> 0.75)	Birds_atlas_EBBA	*Coturnix coturnix*	0.8356	0.744 weak intermedia
369	weak turnover (> 0.75)	Birds_atlas_EBBA	*Luscinia megarhynch*	0.8393	0.862 weak turnover (>
370	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phoenicurus ochruro*	0.8403	0.803 weak turnover (>
371	weak turnover (> 0.75)	Birds_atlas_EBBA	*Anthus pratensis*	0.8432	0.897 weak turnover (>
372	weak turnover (> 0.75)	Birds_atlas_EBBA	*Saxicola torquatus*	0.8435	0.729 weak intermedia

373	weak turnover (> 0.75)	Birds_atlas_EBBA	*Sitta europaea*	0.847	0.841 weak turnover (>
374	weak turnover (> 0.75)	Birds_atlas_EBBA	*Prunella modularis*	0.8472	0.868 weak turnover (>
375	weak turnover (> 0.75)	Birds_atlas_EBBA	*Pyrrhula pyrrhula*	0.8498	0.884 weak turnover (>
376	weak turnover (> 0.75)	Birds_atlas_EBBA	*Streptopelia turtur*	0.8502	0.87 weak turnover (>
377	weak turnover (> 0.75)	Birds_atlas_EBBA	*Oriolus oriolus*	0.8526	0.856 weak turnover (>
378	weak turnover (> 0.75)	Birds_atlas_EBBA	*Anthus trivialis*	0.8574	0.867 weak turnover (>
379	weak turnover (> 0.75)	Birds_atlas_EBBA	*Emberiza citrinella*	0.8581	0.909 stable (> 0.9)
380	weak turnover (> 0.75)	Birds_atlas_EBBA	*Lanius collurio*	0.8603	0.894 weak turnover (>
381	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phylloscopus trochilu*	0.8605	0.893 weak turnover (>
382	weak turnover (> 0.75)	Birds_atlas_EBBA	*Columba livia*	0.8661	0.763 weak turnover (>
383	weak turnover (> 0.75)	Birds_atlas_EBBA	*Passer montanus*	0.8699	0.826 weak turnover (>
384	weak turnover (> 0.75)	Birds_atlas_EBBA	*Turdus viscivorus*	0.8699	0.838 weak turnover (>
385	weak turnover (> 0.75)	Birds_atlas_EBBA	*Strix aluco*	0.8704	0.87 weak turnover (>
386	weak turnover (> 0.75)	Birds_atlas_EBBA	*Accipiter nisus*	0.8724	0.838 weak turnover (>
387	weak turnover (> 0.75)	Birds_atlas_EBBA	*Aegithalos caudatus*	0.875	0.858 weak turnover (>
388	weak turnover (> 0.75)	Birds_atlas_EBBA	*Sturnus vulgaris*	0.8759	0.901 stable (> 0.9)
389	weak turnover (> 0.75)	Birds_atlas_EBBA	*Corvus monedula*	0.8765	0.875 weak turnover (>
390	weak turnover (> 0.75)	Birds_atlas_EBBA	*Alauda arvensis*	0.8769	0.884 weak turnover (>
391	weak turnover (> 0.75)	Birds_atlas_EBBA	*Linaria cannabina*	0.878	0.898 weak turnover (>
392	weak turnover (> 0.75)	Birds_atlas_EBBA	*Phylloscopus collybita*	0.8811	0.879 weak turnover (>
393	weak turnover (> 0.75)	Birds_atlas_EBBA	*Streptopelia decaoctc*	0.8833	0.783 weak turnover (>
394	weak turnover (> 0.75)	Birds_atlas_EBBA	*Troglodytes troglodyt*	0.8839	0.892 weak turnover (>
395	weak turnover (> 0.75)	Birds_atlas_EBBA	*Turdus philomelos*	0.8875	0.892 weak turnover (>
396	weak turnover (> 0.75)	Birds_atlas_EBBA	*Carduelis carduelis*	0.8912	0.904 stable (> 0.9)
397	weak turnover (> 0.75)	Birds_atlas_EBBA	*Buteo buteo*	0.8915	0.894 weak turnover (>
398	weak turnover (> 0.75)	Birds_atlas_EBBA	*Dendrocopos major*	0.8915	0.896 weak turnover (>
399	weak turnover (> 0.75)	Birds_atlas_EBBA	*Garrulus glandarius*	0.8936	0.899 weak turnover (>
400	weak turnover (> 0.75)	Birds_atlas_EBBA	*Apus apus*	0.8944	0.898 weak turnover (>
401	weak turnover (> 0.75)	Birds_atlas_EBBA	*Passer domesticus*	0.8967	0.945 stable (> 0.9)
402	stable (> 0.9)	Birds_atlas_EBBA	*Anas platyrhynchos*	0.9016	0.909 stable (> 0.9)
403	stable (> 0.9)	Birds_atlas_EBBA	*Muscicapa striata*	0.9021	0.882 weak turnover (>

404 stable (> 0.9)	Birds_atlas_EBBA	*Sylvia atricapilla*	0.9105	0.908 stable (> 0.9)
405 stable (> 0.9)	Birds_atlas_EBBA	*Corvus corax*	0.9114	0.832 weak turnover (>
406 stable (> 0.9)	Birds_atlas_EBBA	*Erithacus rubecula*	0.9122	0.909 stable (> 0.9)
407 stable (> 0.9)	Birds_atlas_EBBA	*Turdus merula*	0.9139	0.93 stable (> 0.9)
408 stable (> 0.9)	Birds_atlas_EBBA	*Columba palumbus*	0.9141	0.889 weak turnover (>
409 stable (> 0.9)	Birds_atlas_EBBA	*Chloris chloris*	0.9179	0.924 stable (> 0.9)
410 stable (> 0.9)	Birds_atlas_EBBA	*Fringilla coelebs*	0.9189	0.949 stable (> 0.9)
411 stable (> 0.9)	Birds_atlas_EBBA	*Falco tinnunculus*	0.9192	0.931 stable (> 0.9)
412 stable (> 0.9)	Birds_atlas_EBBA	*Motacilla alba*	0.9195	0.947 stable (> 0.9)
413 stable (> 0.9)	Birds_atlas_EBBA	*Cyanistes caeruleus*	0.9202	0.906 stable (> 0.9)
414 stable (> 0.9)	Birds_atlas_EBBA	*Pica pica*	0.9202	0.959 stable (> 0.9)
415 stable (> 0.9)	Birds_atlas_EBBA	*Hirundo rustica*	0.9221	0.946 stable (> 0.9)
416 stable (> 0.9)	Birds_atlas_EBBA	*Parus major*	0.9221	0.958 stable (> 0.9)
417 stable (> 0.9)	Birds_atlas_EBBA	*Cuculus canorus*	0.9231	0.93 stable (> 0.9)
418 stable (> 0.9)	Birds_atlas_EBBA	*Delichon urbicum*	0.9237	0.94 stable (> 0.9)
419 stable (> 0.9)	Birds_atlas_EBBA	*Corvus corone*	0.9241	0.956 stable (> 0.9)

LR_Predicted	trend_LR_Predicte	LR_Observed	trend_LR_Observe	Rank_J_observed	Rank_LR_p	Rank_LR_observed
0.1436	weak increase (< (	-0.268	weak decrease (<	10	241	25
0.4222	weak increase (< (	-1.393	strong decrease (>	8	401	3
-0.8015	strong decrease (>	0.824	strong increase (>	22	2	390
-0.622	weak decrease (<	0.004	stable	3	5	135
0.5493	weak increase (< (	0.1	weak increase (< (	104	414	245
0.5181	weak increase (< (	-2.002	strong decrease (>	1	410	2
1.6872	strong increase (>	-3.296	strong decrease (>	4	419	1
0.6692	weak increase (< (	0.318	weak increase (< (	17	418	343
-0.0173	stable	-0.52	weak decrease (<	12	55	12
0.5146	weak increase (< (	-0.673	weak decrease (<	9	409	8
0.6503	weak increase (< (	0.161	weak increase (< (	46	416	278
0.6636	weak increase (< (	1.504	strong increase (>	29	417	409
0.4221	weak increase (< (	2.166	strong increase (>	2	400	417
0.1695	weak increase (< (	-0.508	weak decrease (<	27	274	13
-0.3006	weak decrease (<	0.483	weak increase (< (	14	8	365
0.3163	weak increase (< (	0.124	weak increase (< (	83	373	262
0.444	weak increase (< (	0.758	strong increase (>	26	403	387
0.5259	weak increase (< (	1.195	strong increase (>	30	412	407
0.3352	weak increase (< (	0.557	weak increase (< (	115	384	370
0.018	stable	-0.786	strong decrease (>	74	72	6
0.6338	weak increase (< (	1.028	strong increase (>	19	415	399
0.3253	weak increase (< (	-0.351	weak decrease (<	105	379	17
-0.839	strong decrease (>	-0.12	weak decrease (<	36	1	58
-0.6456	weak decrease (<	0.406	weak increase (< (	11	4	356
0.1769	weak increase (< (	1.078	strong increase (>	39	284	403
0.5203	weak increase (< (	0.986	strong increase (>	28	411	395
0.2148	weak increase (< (	-0.756	strong decrease (>	79	319	7
0.4076	weak increase (< (	0.889	strong increase (>	35	399	392
0.2322	weak increase (< (	0.371	weak increase (< (	56	331	352
0.3934	weak increase (< (	0.813	strong increase (>	53	394	389
0.3708	weak increase (< (	0.293	weak increase (< (	72	391	332

0.2984	weak increase (< (	-0.157	weak decrease (<	50	362	49
-0.1464	weak decrease (<	-0.993	strong decrease (>	32	11	4
-0.4618	weak decrease (<	0.891	strong increase (>	57	6	393
0.3261	weak increase (< (	-0.62	weak decrease (<	75	380	10
0.0521	stable	-0.153	weak decrease (<	33	104	53
0.1547	weak increase (< (	0.207	weak increase (< (	47	256	311
-0.0063	stable	-0.11	weak decrease (<	89	60	63
0.0186	stable	0.016	stable	78	73	149
0.2143	weak increase (< (	0.059	stable	40	317	204
-0.0521	stable	-0.263	weak decrease (<	103	37	28
0.1204	weak increase (< (	2.108	strong increase (>	6	204	416
0.3587	weak increase (< (	0.353	weak increase (< (	97	389	351
0.3234	weak increase (< (	-0.094	stable	69	377	73
-0.0847	stable	0.083	stable	90	25	227
0.302	weak increase (< (	0.182	weak increase (< (	91	364	291
0.354	weak increase (< (	3.125	strong increase (>	5	388	419
0.2073	weak increase (< (	0.624	weak increase (< (	62	310	375
-0.3835	weak decrease (<	0.177	weak increase (< (	176	7	287
0.3288	weak increase (< (	-0.09	stable	113	383	74
0.1056	weak increase (< (	0.122	weak increase (< (	84	184	259
0.5269	weak increase (< (	1.043	strong increase (>	34	413	401
0.0839	stable	-0.94	strong decrease (>	48	156	5
0.3493	weak increase (< (	0.215	weak increase (< (	55	387	312
0.212	weak increase (< (	-0.236	weak decrease (<	153	315	32
0.2889	weak increase (< (	0.19	weak increase (< (	59	360	297
0.2156	weak increase (< (	0.178	weak increase (< (	38	320	288
0.472	weak increase (< (	1.165	strong increase (>	25	406	404
0.4876	weak increase (< (	1.193	strong increase (>	21	408	406
0.3117	weak increase (< (	0.079	stable	110	369	224
0.1305	weak increase (< (	-0.4	weak decrease (<	92	223	14
0.0719	stable	0.005	stable	134	137	136

0.3266 weak increase (< (	0.49 weak increase (< (	61	381	366
0.0276 stable	-0.353 weak decrease (<	70	79	16
-0.0375 stable	0.595 weak increase (< (	66	42	373
0.3997 weak increase (< (	0.251 weak increase (< (	98	395	325
0.4581 weak increase (< (	1.036 strong increase (>	37	405	400
0.1358 weak increase (< (	0.438 weak increase (< (	60	230	359
0.4572 weak increase (< (	0.383 weak increase (< (	52	404	353
0.3188 weak increase (< (	0.3 weak increase (< (	88	375	334
0.3199 weak increase (< (	-0.214 weak decrease (<	101	376	37
0.0425 stable	-0.051 stable	45	90	90
0.4046 weak increase (< (	1.54 strong increase (>	18	397	410
0.3163 weak increase (< (	0.998 strong increase (>	43	372	396
0.4003 weak increase (< (	0.792 strong increase (>	42	396	388
0.4063 weak increase (< (	2.057 strong increase (>	13	398	415
0.0719 stable	0.058 stable	112	136	202
0.0894 stable	0.012 stable	87	159	144
0.1394 weak increase (< (	-0.276 weak decrease (<	132	234	22
0.2771 weak increase (< (	0.498 weak increase (< (	117	358	367
-0.0287 stable	0.22 weak increase (< (	94	50	314
0.1085 weak increase (< (	-0.001 stable	99	188	125
0.1236 weak increase (< (	-0.108 weak decrease (<	80	214	65
0.2017 weak increase (< (	0.286 weak increase (< (	54	304	329
-0.0525 stable	-0.648 weak decrease (<	102	36	9
0.1614 weak increase (< (	0.191 weak increase (< (	77	266	300
0.0055 stable	0.116 weak increase (< (	186	67	255
0.3641 weak increase (< (	1.561 strong increase (>	24	390	411
0.0996 weak increase (< (	0.115 weak increase (< (	127	174	254
0.3278 weak increase (< (	0.094 stable	100	382	237
0.4232 weak increase (< (	1.823 strong increase (>	15	402	414
0.2144 weak increase (< (	0.288 weak increase (< (	128	318	331
0.1624 weak increase (< (	-0.276 weak decrease (<	111	267	23

0.2423 weak increase (< (	0.7 strong increase (>	58	337	382
0.2904 weak increase (< (	-0.002 stable	206	361	121
0.2607 weak increase (< (	0.436 weak increase (< (	95	350	358
0.3126 weak increase (< (	0.454 weak increase (< (	145	370	362
0.3082 weak increase (< (	0.742 strong increase (>	73	367	386
0.137 weak increase (< (	0.04 stable	170	232	182
0.1795 weak increase (< (	1.015 strong increase (>	68	285	397
0.3395 weak increase (< (	1.595 strong increase (>	20	385	412
0.2327 weak increase (< (	0.868 strong increase (>	49	333	391
0.1285 weak increase (< (	-0.294 weak decrease (<	126	220	20
0.2204 weak increase (< (	-0.109 weak decrease (<	154	324	64
-0.0878 stable	-0.255 weak decrease (<	131	23	30
0.1205 weak increase (< (	0.449 weak increase (< (	65	205	361
-0.0374 stable	-0.191 weak decrease (<	174	43	42
-0.0581 stable	-0.256 weak decrease (<	108	34	29
0.2731 weak increase (< (	1.489 strong increase (>	23	355	408
0.2886 weak increase (< (	1.65 strong increase (>	16	359	413
0.2447 weak increase (< (	0.287 weak increase (< (	142	338	330
0.2227 weak increase (< (	0.057 stable	85	326	199
0.0775 stable	0.061 stable	121	146	206
0.2044 weak increase (< (	-0.214 weak decrease (<	182	308	36
0.1264 weak increase (< (	0.194 weak increase (< (	137	216	302
-0.019 stable	-0.271 weak decrease (<	147	54	24
-0.711 strong decrease (>	0.69 weak increase (< (	86	3	381
0.0245 stable	-0.618 weak decrease (<	109	75	11
0.3016 weak increase (< (	0.526 weak increase (< (	135	363	369
0.4798 weak increase (< (	1.026 strong increase (>	41	407	398
0.2012 weak increase (< (	0.095 stable	149	303	238
-0.1189 weak decrease (<	-0.226 weak decrease (<	159	16	33
0.1211 weak increase (< (	-0.155 weak decrease (<	146	207	51
0.0962 weak increase (< (	0.191 weak increase (< (	93	170	299

0.1221 weak increase (< (	0.565 weak increase (< (	67	211	372
0.0405 stable	-0.202 weak decrease (<	81	88	40
-0.0792 stable	-0.128 weak decrease (<	218	28	57
0.2295 weak increase (< (	0.504 weak increase (< (	122	329	368
0.3044 weak increase (< (	0.67 weak increase (< (	63	365	379
-0.1207 weak decrease (<	-0.394 weak decrease (<	196	15	15
0.2399 weak increase (< (	0.035 stable	212	336	172
0.0517 stable	-0.197 weak decrease (<	204	103	41
0.1487 weak increase (< (	0.2 weak increase (< (	129	248	306
0.3904 weak increase (< (	1.172 strong increase (>	31	393	405
-0.0846 stable	-0.095 stable	161	26	70
-0.1394 weak decrease (<	-0.204 weak decrease (<	194	13	39
0.0666 stable	-0.173 weak decrease (<	106	130	47
-0.1495 weak decrease (<	-0.189 weak decrease (<	188	10	43
0.0116 stable	-0.014 stable	280	69	111
0.2572 weak increase (< (	0.35 weak increase (< (	125	347	349
-0.1002 stable	-0.089 stable	179	18	75
0.2217 weak increase (< (	-0.054 stable	175	325	89
-0.0302 stable	-0.094 stable	133	49	72
-0.0672 stable	0.119 weak increase (< (	141	30	256
0.1459 weak increase (< (	0.316 weak increase (< (	119	243	340
0.1889 weak increase (< (	0.72 strong increase (>	96	298	384
0.0844 stable	0.219 weak increase (< (	168	158	313
0.0723 stable	-0.003 stable	202	139	120
-0.1046 stable	-0.181 weak decrease (<	148	17	44
-0.0691 stable	-0.172 weak decrease (<	180	29	48
0.0961 weak increase (< (	-0.218 weak decrease (<	181	169	35
-0.0912 stable	0.965 strong increase (>	64	22	394
0.0781 stable	0.125 weak increase (< (	171	147	263
0.056 stable	-0.116 weak decrease (<	244	111	59
-0.1464 weak decrease (<	-0.33 weak decrease (<	151	12	18

0.1579 weak increase (< (	0.314 weak increase (< (	210	259	339
0.2727 weak increase (< (	0.181 weak increase (< (	187	354	289
0.0555 stable	0.047 stable	198	109	192
0.2761 weak increase (< (	0.742 strong increase (>	71	357	385
0.0257 stable	0.009 stable	284	77	141
0.0471 stable	0.343 weak increase (< (	44	97	347
0.2544 weak increase (< (	0.319 weak increase (< (	152	345	344
0.0088 stable	0.15 weak increase (< (	254	68	272
-0.1384 weak decrease (<	-0.283 weak decrease (<	177	14	21
0.1309 weak increase (< (	0.182 weak increase (< (	199	224	290
0.0503 stable	0.029 stable	256	101	163
0.1047 weak increase (< (	0.097 weak increase (< (	184	182	240
0.0251 stable	-0.149 weak decrease (<	236	76	54
0.0984 weak increase (< (	-0.067 stable	160	172	82
0.1097 weak increase (< (	0.039 stable	191	193	178
0.2291 weak increase (< (	0.159 weak increase (< (	162	328	276
0.0216 stable	-0.226 weak decrease (<	163	74	34
0.1395 weak increase (< (	0.674 weak increase (< (	76	235	380
-0.0937 stable	-0.064 stable	203	21	83
0.2107 weak increase (< (	-0.017 stable	155	314	109
0.1118 weak increase (< (	-0.248 weak decrease (<	255	195	31
0.3096 weak increase (< (	2.482 strong increase (>	7	368	418
0.0657 stable	-0.309 weak decrease (<	143	127	19
0.0126 stable	0.036 stable	144	71	173
0.2025 weak increase (< (	0.068 stable	259	305	215
-0.0954 stable	-0.267 weak decrease (<	183	20	26
-0.0146 stable	-0.059 stable	200	59	85
0.1412 weak increase (< (	0.223 weak increase (< (	230	239	316
0.0946 stable	-0.079 stable	242	167	78
0.1128 weak increase (< (	0.126 weak increase (< (	234	196	265
-0.031 stable	-0.153 weak decrease (<	211	47	52

0.2345 weak increase (< (	-0.095 stable	118	334	71
0.19 weak increase (< (	-0.209 weak decrease (<	207	299	38
0.3072 weak increase (< (	0.656 weak increase (< (	82	366	377
-0.001 stable	0.014 stable	247	63	146
-0.015 stable	-0.041 stable	263	57	96
0.121 weak increase (< (	0.036 stable	223	206	174
0.2126 weak increase (< (	-0.114 weak decrease (<	288	316	60
0.0639 stable	0.186 weak increase (< (	197	125	294
0.0613 stable	0.439 weak increase (< (	138	121	360
0.1875 weak increase (< (	0.099 weak increase (< (	192	296	243
0.1851 weak increase (< (	-0.156 weak decrease (<	158	292	50
0.2585 weak increase (< (	0.607 weak increase (< (	130	348	374
-0.0995 stable	-0.265 weak decrease (<	215	19	27
0.1864 weak increase (< (	0.122 weak increase (< (	224	295	260
0.0928 stable	0.074 stable	156	162	218
0.0688 stable	-0.142 weak decrease (<	239	132	55
0.1513 weak increase (< (	0.317 weak increase (< (	114	251	341
-0.0461 stable	-0.043 stable	235	39	94
0.2321 weak increase (< (	0.246 weak increase (< (	166	330	321
0.208 weak increase (< (	0.278 weak increase (< (	185	312	328
0.2027 weak increase (< (	0.221 weak increase (< (	164	306	315
0.1795 weak increase (< (	0.196 weak increase (< (	189	286	303
0.1762 weak increase (< (	0.199 weak increase (< (	227	282	305
0.2585 weak increase (< (	0.35 weak increase (< (	139	349	350
0.3238 weak increase (< (	1.046 strong increase (>	51	378	402
0.1885 weak increase (< (	0.112 weak increase (< (	233	297	252
0.173 weak increase (< (	0.106 weak increase (< (	190	281	249
0.316 weak increase (< (	0.319 weak increase (< (	167	371	345
0.0721 stable	0.062 stable	257	138	209
0.0404 stable	0.003 stable	217	87	134
0.1583 weak increase (< (	0.008 stable	213	261	139

0.0118 stable	0.009 stable	246	70	140
0.2105 weak increase (< (	0.171 weak increase (< (	195	313	285
0.122 weak increase (< (	0.163 weak increase (< (	324	210	279
0.2399 weak increase (< (	0.402 weak increase (< (	140	335	355
0.2326 weak increase (< (	0.401 weak increase (< (	120	332	354
0.1092 weak increase (< (	0.47 weak increase (< (	150	192	363
0.2484 weak increase (< (	0.559 weak increase (< (	124	341	371
0.0606 stable	0.04 stable	232	116	180
0.1589 weak increase (< (	0.164 weak increase (< (	209	263	281
0.0266 stable	-0.01 stable	260	78	112
-0.0147 stable	-0.101 stable	245	58	69
0.2452 weak increase (< (	0.318 weak increase (< (	172	339	342
0.0739 stable	-0.025 stable	262	141	102
0.1326 weak increase (< (	0.079 stable	237	227	223
0.2741 weak increase (< (	0.246 weak increase (< (	157	356	322
0.041 stable	0.018 stable	231	89	150
-0.0833 stable	-0.023 stable	303	27	104
0.1563 weak increase (< (	0.186 weak increase (< (	240	257	295
0.2186 weak increase (< (	0.338 weak increase (< (	193	322	346
0.2184 weak increase (< (	0.172 weak increase (< (	178	321	286
0.317 weak increase (< (	0.704 strong increase (>	123	374	383
-0.0661 stable	-0.073 stable	258	31	79
0.1722 weak increase (< (	0.435 weak increase (< (	169	278	357
0.0807 stable	0.075 stable	116	150	219
0.3451 weak increase (< (	0.154 weak increase (< (	396	386	274
0.1926 weak increase (< (	0.1 weak increase (< (	221	300	244
0 stable	-0.006 stable	325	64	116
0.0632 stable	-0.061 stable	261	124	84
-0.0396 stable	0.014 stable	268	41	145
0.0972 weak increase (< (	-0.005 stable	238	171	119
-0.0354 stable	-0.105 stable	359	44	67

-0.2199 weak decrease (<	0.107 weak increase (< (	290	9	250
0.0771 stable	0.24 weak increase (< (	173	145	319
0.0448 stable	0.078 stable	299	95	220
0.037 stable	-0.058 stable	334	83	86
0.114 weak increase (< (	0.139 weak increase (< (	283	197	268
0.0991 weak increase (< (	0.042 stable	413	173	185
-0.0303 stable	-0.054 stable	339	48	87
-0.0849 stable	-0.105 stable	269	24	66
0.0818 stable	-0.019 stable	276	151	106
0.0326 stable	0.09 stable	264	81	234
0.0537 stable	0.033 stable	305	106	168
0.2515 weak increase (< (	0.308 weak increase (< (	205	343	337
0.25 weak increase (< (	0.306 weak increase (< (	253	342	336
0.2672 weak increase (< (	0.302 weak increase (< (	222	351	335
-0.0245 stable	-0.179 weak decrease (<	326	51	45
0.1055 weak increase (< (	0.149 weak increase (< (	228	183	271
0.0592 stable	-0.04 stable	248	114	97
-0.0424 stable	-0.03 stable	332	40	100
0.1525 weak increase (< (	0.642 weak increase (< (	107	254	376
0.1116 weak increase (< (	-0.071 stable	312	194	80
-0.0223 stable	0.666 weak increase (< (	136	53	378
0.0014 stable	-0.001 stable	368	65	122
0.0837 stable	0.007 stable	292	155	138
0.109 weak increase (< (	-0.049 stable	201	190	92
-0.0224 stable	-0.081 stable	219	52	77
-0.0641 stable	0.251 weak increase (< (	229	32	323
0.1198 weak increase (< (	-0.113 weak decrease (<	316	203	61
0.1647 weak increase (< (	0.047 stable	274	269	193
0.1269 weak increase (< (	0.06 stable	285	218	205
0.1517 weak increase (< (	0.2 weak increase (< (	267	252	307
-0.0628 stable	-0.033 stable	320	33	99

0.1606 weak increase (< (	-0.025 stable	281	265	103
0.0959 weak increase (< (	0.189 weak increase (< (	249	168	296
-0.0171 stable	-0.007 stable	313	56	114
0.1586 weak increase (< (	0.09 stable	291	262	236
0.0676 stable	-0.085 stable	344	131	76
0.0323 stable	-0.132 weak decrease (<	272	80	56
0.1472 weak increase (< (	0.478 weak increase (< (	165	244	364
0.2268 weak increase (< (	0.05 stable	251	327	196
0.1293 weak increase (< (	0.019 stable	296	221	153
0.1766 weak increase (< (	0.059 stable	293	283	203
-0.0318 stable	0.043 stable	315	46	188
0.2674 weak increase (< (	0 stable	417	353	131
0.1796 weak increase (< (	0.252 weak increase (< (	241	287	326
0.2078 weak increase (< (	0.135 weak increase (< (	273	311	267
0.1931 weak increase (< (	0.105 weak increase (< (	250	301	248
0.1195 weak increase (< (	0.229 weak increase (< (	226	202	317
-0.0521 stable	-0.041 stable	330	38	95
0.1002 weak increase (< (	0.251 weak increase (< (	208	175	324
-0.0557 stable	-0.102 stable	322	35	68
0.2672 weak increase (< (	0.346 weak increase (< (	225	352	348
0.1229 weak increase (< (	0.185 weak increase (< (	286	212	292
0.1633 weak increase (< (	0.256 weak increase (< (	266	268	327
0.1352 weak increase (< (	0.097 weak increase (< (	252	229	241
0.14 weak increase (< (	-0.05 stable	317	236	91
-0.0037 stable	-0.176 weak decrease (<	301	62	46
0.1072 weak increase (< (	0.161 weak increase (< (	220	186	277
0.1809 weak increase (< (	0.244 weak increase (< (	214	289	320
-0.0342 stable	-0.111 weak decrease (<	318	45	62
0.3883 weak increase (< (	0.308 weak increase (< (	216	392	338
0.2527 weak increase (< (	0 stable	418	344	130
0.1843 weak increase (< (	0.046 stable	361	291	190

0.1154 weak increase (< (	0.001 stable	336	199	132
0.034 stable	0.132 weak increase (< (	300	82	266
0.1819 weak increase (< (	0.102 weak increase (< (	304	290	247
0.2461 weak increase (< (	0.196 weak increase (< (	265	340	304
0.2052 weak increase (< (	0.3 weak increase (< (	243	309	333
0.1192 weak increase (< (	-0.018 stable	364	201	107
0.1704 weak increase (< (	-0.071 stable	319	275	81
0.0608 stable	-0.03 stable	352	117	101
0.061 stable	0.119 weak increase (< (	337	118	257
0.1518 weak increase (< (	0.097 weak increase (< (	363	253	242
0.2548 weak increase (< (	0.192 weak increase (< (	307	346	301
0.1406 weak increase (< (	0.148 weak increase (< (	275	237	270
0.109 weak increase (< (	0.165 weak increase (< (	309	191	283
0.1953 weak increase (< (	0.046 stable	350	302	191
0.1855 weak increase (< (	0.096 weak increase (< (	302	293	239
0.0768 stable	0 stable	348	144	128
0.138 weak increase (< (	0.014 stable	314	233	148
0.1858 weak increase (< (	0.018 stable	323	294	151
0.1319 weak increase (< (	0.037 stable	310	226	175
0.1481 weak increase (< (	0.201 weak increase (< (	277	246	308
0.1566 weak increase (< (	0.034 stable	333	258	170
0.1729 weak increase (< (	0.185 weak increase (< (	289	280	293
0.1025 weak increase (< (	0.048 stable	360	177	194
0.1407 weak increase (< (	0.112 weak increase (< (	287	238	251
0.1592 weak increase (< (	0.081 stable	349	264	225
0.1217 weak increase (< (	0.038 stable	338	209	177
0.1796 weak increase (< (	0.204 weak increase (< (	270	288	310
0.0841 stable	0.101 weak increase (< (	385	157	246
0.1678 weak increase (< (	0.064 stable	329	272	213
0.0724 stable	0.09 stable	353	140	235
0.1485 weak increase (< (	0.142 weak increase (< (	311	247	269

0.1299 weak increase (< (	0 stable	419	222	129
0.1711 weak increase (< (	0.011 stable	342	277	143
0.1412 weak increase (< (	0.065 stable	365	240	214
0.1032 weak increase (< (	-0.015 stable	331	180	110
0.1506 weak increase (< (	0.12 weak increase (< (	297	250	258
0.1281 weak increase (< (	0.087 stable	306	219	233
0.0043 stable	-0.017 stable	340	66	108
0.1457 weak increase (< (	0.056 stable	321	242	198
0.1728 weak increase (< (	0.164 weak increase (< (	295	279	282
0.1264 weak increase (< (	-0.01 stable	354	217	113
0.0612 stable	0 stable	345	119	127
0.1066 weak increase (< (	0.053 stable	341	185	197
0.2186 weak increase (< (	0.062 stable	366	323	210
0.0711 stable	-0.005 stable	376	135	118
0.1314 weak increase (< (	0.014 stable	369	225	147
0.1687 weak increase (< (	0.124 weak increase (< (	327	273	261
0.1582 weak increase (< (	0.163 weak increase (< (	278	260	280
0.2042 weak increase (< (	0.022 stable	367	307	155
0.0899 stable	-0.054 stable	346	160	88
0.1141 weak increase (< (	0.079 stable	335	198	221
0.1502 weak increase (< (	0.002 stable	362	249	133
0.0663 stable	0.087 stable	282	129	232
0.1672 weak increase (< (	0.084 stable	372	270	229
0.093 stable	0.042 stable	343	164	184
0.1362 weak increase (< (	0.165 weak increase (< (	298	231	284
0.1233 weak increase (< (	-0.001 stable	357	213	126
0.125 weak increase (< (	0.204 weak increase (< (	279	215	309
0.1027 weak increase (< (	0.046 stable	373	178	189
0.1534 weak increase (< (	0.153 weak increase (< (	328	255	273
-0.0048 stable	0.006 stable	392	61	137
0.0836 stable	0.239 weak increase (< (	271	154	318

0.1676	weak increase (< (	0.061	stable	358	271	208
0.0613	stable	-0.046	stable	375	122	93
0.075	stable	-0.001	stable	382	142	124
0.0603	stable	-0.007	stable	377	115	115
0.1332	weak increase (< (	0.042	stable	370	228	187
0.1215	weak increase (< (	0.032	stable	374	208	167
0.1037	weak increase (< (	-0.02	stable	401	181	105
0.108	weak increase (< (	0.031	stable	389	187	166
0.0707	stable	-0.001	stable	388	134	123
0.0916	stable	0.126	weak increase (< (	294	161	264
0.0944	stable	0.085	stable	347	166	230
0.1086	weak increase (< (	0.114	weak increase (< (	355	189	253
0.1704	weak increase (< (	0.021	stable	378	276	154
0.0936	stable	0.049	stable	356	165	195
0.1172	weak increase (< (	0.079	stable	371	200	222
0.0617	stable	0.035	stable	397	123	171
0.1027	weak increase (< (	0.042	stable	379	179	186
0.0564	stable	-0.039	stable	383	112	98
0.0612	stable	0.03	stable	393	120	165
0.0661	stable	0.082	stable	380	128	226
0.0834	stable	0.191	weak increase (< (	308	152	298
0.0541	stable	0.028	stable	386	108	162
0.0761	stable	0.086	stable	387	143	231
0.0806	stable	0.084	stable	398	149	228
0.0834	stable	0.072	stable	390	153	217
0.0929	stable	0.064	stable	391	163	212
0.0783	stable	0.034	stable	395	148	169
0.0586	stable	0.027	stable	394	113	160
0.0555	stable	-0.006	stable	409	110	117
0.1022	weak increase (< (	0.061	stable	402	176	207
0.0499	stable	0.024	stable	381	100	158

0.0481 stable	0.058 stable	400	99	201
0.1474 weak increase (< (	0.155 weak increase (< (	351	245	275
0.0538 stable	0.04 stable	403	107	179
0.0525 stable	0.041 stable	405	105	183
0.0691 stable	0.071 stable	384	133	216
0.043 stable	0.058 stable	404	91	200
0.0432 stable	0.028 stable	412	92	161
0.0648 stable	0.04 stable	407	126	181
0.037 stable	0.03 stable	411	84	164
0.0436 stable	0.064 stable	399	93	211
0.0473 stable	0.019 stable	416	98	152
0.0505 stable	0.023 stable	410	102	156
0.0463 stable	0.026 stable	415	96	159
0.0382 stable	0.038 stable	406	85	176
0.0386 stable	0.011 stable	408	86	142
0.0444 stable	0.024 stable	414	94	157

Rank_J_predicted	trend_J_Predicted	dataset	verbatim_name	J_Predicted	J_Observe	trend_J_Observe	LR_Predicted
14	strong turnover (0.1 - 0.	Birds_atlas_	*Rostratula benghalen*	0.1238	0.181	strong turnover (	-0.7729
9	strong turnover (0.1 - 0.	Birds_atlas_	*Otus sunia*	0.1123	0.042	complete turnove	-0.612
55	strong turnover (0.1 - 0.	Birds_atlas_	*Apus nipalensis*	0.1929	0.114	strong turnover (	-0.4608
94	strong intermediate turn	Birds_atlas_	*Agropsar philippensis*	0.2551	0.298	strong intermedia	-0.2635
114	strong intermediate turn	Birds_atlas_	*Halcyon coromanda*	0.3277	0.344	strong intermedia	-0.1648
71	strong turnover (0.1 - 0.	Birds_atlas_	*Sterna albifrons*	0.2215	0.474	strong intermedia	-0.1568
87	strong turnover (0.1 - 0.	Birds_atlas_	*Hirundo daurica*	0.2486	0.309	strong intermedia	-0.1336
16	strong turnover (0.1 - 0.	Birds_atlas_	*Eurystomus orientalis*	0.1254	0.158	strong turnover (	-0.1285
15	strong turnover (0.1 - 0.	Birds_atlas_	*Gorsachius goisagi*	0.125	0.104	strong turnover (	-0.119
134	strong intermediate turn	Birds_atlas_	*Cisticola juncidis*	0.4027	0.563	weak intermedia	-0.096
118	strong intermediate turn	Birds_atlas_	*Pericrocotus divarica*	0.3386	0.348	strong intermedia	-0.0733
62	strong turnover (0.1 - 0.	Birds_atlas_	*Charadrius placidus*	0.2036	0.223	strong turnover (	-0.0673
129	strong intermediate turn	Birds_atlas_	*Cyanopica cyanus*	0.3923	0.417	strong intermedia	-0.0651
98	strong intermediate turn	Birds_atlas_	*Sterna sumatrana*	0.2638	0.438	strong intermedia	-0.063
153	weak intermediate turno	Birds_atlas_	*Bambusicola thoracic*	0.5221	0.65	weak intermedia	-0.0624
44	strong turnover (0.1 - 0.	Birds_atlas_	*Ninox scutulata*	0.1748	0.179	strong turnover (	-0.058
141	strong intermediate turn	Birds_atlas_	*Uragus sibiricus*	0.451	0.528	weak intermedia	-0.05
69	strong turnover (0.1 - 0.	Birds_atlas_	*Prunella collaris*	0.2148	0.324	strong intermedia	-0.0426
136	strong intermediate turn	Birds_atlas_	*Gallinago hardwickii*	0.4063	0.438	strong intermedia	-0.0339
131	strong intermediate turn	Birds_atlas_	*Egretta garzetta*	0.3962	0.465	strong intermedia	-0.0334
51	strong turnover (0.1 - 0.	Birds_atlas_	*Prunella rubida*	0.1863	0.323	strong intermedia	-0.032
97	strong intermediate turn	Birds_atlas_	*Gallinula chloropus*	0.2629	0.349	strong intermedia	-0.025
126	strong intermediate turn	Birds_atlas_	*Butastur indicus*	0.369	0.38	strong intermedia	-0.025
143	strong intermediate turn	Birds_atlas_	*Treron formosae*	0.4651	0.636	weak intermedia	-0.0249
65	strong turnover (0.1 - 0.	Birds_atlas_	*Megaceryle lugubris*	0.2082	0.211	strong turnover (	-0.0198
42	strong turnover (0.1 - 0.	Birds_atlas_	*Caprimulgus indicus*	0.1663	0.128	strong turnover (	-0.0178
157	weak intermediate turno	Birds_atlas_	*Cuculus canorus*	0.5349	0.549	weak intermedia	-0.002
109	strong intermediate turn	Birds_atlas_	*Charadrius dubius*	0.3038	0.344	strong intermedia	2.00E-04
181	weak turnover (> 0.75)	Birds_atlas_	*Emberiza cioides*	0.8476	0.907	stable (> 0.9)	0.0084
117	strong intermediate turn	Birds_atlas_	*Cinclus pallasii*	0.3379	0.422	strong intermedia	0.0115
82	strong turnover (0.1 - 0.	Birds_atlas_	*Columba livia*	0.2435	0.278	strong intermedia	0.0129

53	strong turnover (0.1 - 0.	Birds_atlas_	*Butorides striata*	0.1873	0.231	strong turnover (	0.0133
91	strong intermediate turn	Birds_atlas_	*Actitis hypoleucos*	0.2519	0.269	strong intermedi	0.0135
92	strong intermediate turn	Birds_atlas_	*Emberiza fucata*	0.2533	0.321	strong intermedi	0.0179
60	strong turnover (0.1 - 0.	Birds_atlas_	*Locustella lanceolata*	0.2012	0.208	strong turnover (	0.0189
96	strong intermediate turn	Birds_atlas_	*Bubulcus ibis*	0.2619	0.259	strong intermedi	0.0193
147	strong intermediate turn	Birds_atlas_	*Spodiopsar cineraceu*	0.489	0.537	weak intermedia	0.0242
163	weak intermediate turno	Birds_atlas_	*Lanius bucephalus*	0.5841	0.574	weak intermedia	0.0272
107	strong intermediate turn	Birds_atlas_	*Vanellus cinereus*	0.2919	0.303	strong intermedi	0.0277
175	weak intermediate turno	Birds_atlas_	*Passer montanus*	0.6919	0.763	weak turnover (>	0.0345
179	weak turnover (> 0.75)	Birds_atlas_	*Chloris sinica*	0.7879	0.776	weak turnover (>	0.037
155	weak intermediate turno	Birds_atlas_	*Motacilla grandis*	0.5289	0.513	weak intermedia	0.0412
144	strong intermediate turn	Birds_atlas_	*Alauda arvensis*	0.4817	0.59	weak intermedia	0.0414
57	strong turnover (0.1 - 0.	Birds_atlas_	*Egretta sacra*	0.1942	0.21	strong turnover (	0.0484
140	strong intermediate turn	Birds_atlas_	*Delichon dasypus*	0.4319	0.371	strong intermedi	0.0487
168	weak intermediate turno	Birds_atlas_	*Hirundo rustica*	0.6469	0.772	weak turnover (>	0.0505
105	strong intermediate turn	Birds_atlas_	*Anthus hodgsoni*	0.2786	0.31	strong intermedi	0.0509
125	strong intermediate turn	Birds_atlas_	*Terpsiphone atrocauc*	0.3645	0.38	strong intermedi	0.0529
77	strong turnover (0.1 - 0.	Birds_atlas_	*Muscicapa dauurica*	0.2367	0.209	strong turnover (	0.0531
113	strong intermediate turn	Birds_atlas_	*Tachybaptus ruficollis*	0.3265	0.431	strong intermedi	0.0537
165	weak intermediate turno	Birds_atlas_	*Picus awokera*	0.5893	0.6	weak intermedia	0.0554
159	weak intermediate turno	Birds_atlas_	*Eophona personata*	0.5478	0.515	weak intermedia	0.0575
169	weak intermediate turno	Birds_atlas_	*Motacilla cinerea*	0.6479	0.65	weak intermedia	0.0575
133	strong intermediate turn	Birds_atlas_	*Acrocephalus orienta*	0.3992	0.499	strong intermedi	0.058
174	weak intermediate turno	Birds_atlas_	*Poecile varius*	0.6897	0.645	weak intermedia	0.0582
116	strong intermediate turn	Birds_atlas_	*Monticola solitarius*	0.3378	0.442	strong intermedi	0.0593
184	weak turnover (> 0.75)	Birds_atlas_	*Cettia diphone*	0.8938	0.909	stable (> 0.9)	0.0601
80	strong turnover (0.1 - 0.	Birds_atlas_	*Syrmaticus soemmer*	0.2421	0.226	strong turnover (	0.0606
164	weak intermediate turno	Birds_atlas_	*Cuculus poliocephalu*	0.5873	0.557	weak intermedia	0.0632
167	weak intermediate turno	Birds_atlas_	*Aegithalos caudatus*	0.6416	0.576	weak intermedia	0.0702
149	strong intermediate turn	Birds_atlas_	*Motacilla alba*	0.4984	0.401	strong intermedi	0.073
43	strong turnover (0.1 - 0.	Birds_atlas_	*Falco tinnunculus*	0.17	0.084	complete turnove	0.0763

183	weak turnover (> 0.75)	Birds_atlas_	*Hypsipetes amauroti*	0.8671	0.891 weak turnover (>	0.0797
89	strong intermediate turn	Birds_atlas_	*Egretta intermedia*	0.2505	0.229 strong turnover (	0.0807
160	weak intermediate turnc	Birds_atlas_	*Dendrocopos major*	0.565	0.53 weak intermedia	0.0823
28	strong turnover (0.1 - 0.	Birds_atlas_	*Accipiter gularis*	0.1511	0.059 complete turnove	0.0921
74	strong turnover (0.1 - 0.	Birds_atlas_	*Ixobrychus sinensis*	0.2331	0.221 strong turnover (	0.093
29	strong turnover (0.1 - 0.	Birds_atlas_	*Accipiter nisus*	0.1539	0.079 complete turnove	0.0948
176	weak intermediate turnc	Birds_atlas_	*Cyanoptila cyanomel*	0.696	0.697 weak intermedia	0.0952
148	strong intermediate turn	Birds_atlas_	*Poecile palustris*	0.4944	0.519 weak intermedia	0.0958
85	strong turnover (0.1 - 0.	Birds_atlas_	*Apus pacificus*	0.2448	0.237 strong turnover (	0.0966
171	weak intermediate turnc	Birds_atlas_	*Garrulus glandarius*	0.6732	0.672 weak intermedia	0.1028
90	strong intermediate turn	Birds_atlas_	*Phylloscopus xanthoc*	0.2511	0.204 strong turnover (	0.1041
161	weak intermediate turnc	Birds_atlas_	*Emberiza spodoceph*	0.5732	0.577 weak intermedia	0.1054
76	strong turnover (0.1 - 0.	Birds_atlas_	*Picus canus*	0.2351	0.217 strong turnover (	0.1055
70	strong turnover (0.1 - 0.	Birds_atlas_	*Emberiza variabilis*	0.218	0.21 strong turnover (	0.1059
182	weak turnover (> 0.75)	Birds_atlas_	*Streptopelia orientalis*	0.8487	0.838 weak turnover (>	0.1064
142	strong intermediate turn	Birds_atlas_	*Luscinia cyane*	0.464	0.5 strong intermedia	0.1066
132	strong intermediate turn	Birds_atlas_	*Sitta europaea*	0.3976	0.402 strong intermedia	0.1092
88	strong turnover (0.1 - 0.	Birds_atlas_	*Hierococcyx hyperyth*	0.2488	0.337 strong intermedia	0.1098
172	weak intermediate turnc	Birds_atlas_	*Urosphena squameic*	0.6743	0.646 weak intermedia	0.1135
170	weak intermediate turnc	Birds_atlas_	*Ficedula narcissina*	0.6694	0.562 weak intermedia	0.1138
104	strong intermediate turn	Birds_atlas_	*Larus crassirostris*	0.2763	0.427 strong intermedia	0.1147
146	strong intermediate turn	Birds_atlas_	*Turdus chrysolaus*	0.4837	0.471 strong intermedia	0.1157
40	strong turnover (0.1 - 0.	Birds_atlas_	*Charadrius alexandri*	0.1651	0.244 strong turnover (	0.1158
178	weak intermediate turnc	Birds_atlas_	*Dendrocopos kizuki*	0.7461	0.66 weak intermedia	0.1164
177	weak intermediate turnc	Birds_atlas_	*Corvus corone*	0.7352	0.755 weak turnover (>	0.1172
67	strong turnover (0.1 - 0.	Birds_atlas_	*Strix uralensis*	0.2133	0.145 strong turnover (	0.1179
47	strong turnover (0.1 - 0.	Birds_atlas_	*Dendrocopos leucoto*	0.178	0.224 strong turnover (	0.1187
166	weak intermediate turnc	Birds_atlas_	*Periparus ater*	0.592	0.613 weak intermedia	0.1287
123	strong intermediate turn	Birds_atlas_	*Alcedo atthis*	0.3624	0.304 strong intermedia	0.1288
37	strong turnover (0.1 - 0.	Birds_atlas_	*Pitta nympha*	0.1631	0.029 complete turnove	0.13
180	weak turnover (> 0.75)	Birds_atlas_	*Corvus macrorhynch*	0.8351	0.72 weak intermedia	0.1308

150	strong intermediate turn	Birds_atlas_	*Hirundo tahitica*	0.4987	0.704 weak intermedia	0.132
158	weak intermediate turn	Birds_atlas_	*Turdus cardis*	0.5452	0.482 strong intermedi	0.1327
135	strong intermediate turn	Birds_atlas_	*Passer rutilans*	0.4058	0.436 strong intermedi	0.1335
122	strong intermediate turn	Birds_atlas_	*Phylloscopus borealo*	0.3615	0.368 strong intermedi	0.1369
154	weak intermediate turn	Birds_atlas_	*Treron sieboldii*	0.5228	0.383 strong intermedi	0.1379
162	weak intermediate turn	Birds_atlas_	*Phylloscopus coronat*	0.5734	0.534 weak intermedia	0.138
21	strong turnover (0.1 - 0.	Birds_atlas_	*Carduelis spinus*	0.1371	0.099 complete turnove	0.1396
102	strong intermediate turn	Birds_atlas_	*Luscinia akahige*	0.2714	0.367 strong intermedi	0.1428
103	strong intermediate turn	Birds_atlas_	*Pica pica*	0.2718	0.286 strong intermedi	0.1463
64	strong turnover (0.1 - 0.	Birds_atlas_	*Dryocopus martius*	0.2074	0.168 strong turnover (	0.1511
39	strong turnover (0.1 - 0.	Birds_atlas_	*Hirundapus caudacut*	0.1648	0.163 strong turnover (	0.1521
124	strong intermediate turn	Birds_atlas_	*Zoothera dauma*	0.3642	0.271 strong intermedi	0.1573
45	strong turnover (0.1 - 0.	Birds_atlas_	*Anas crecca*	0.1759	0.084 complete turnove	0.1588
32	strong turnover (0.1 - 0.	Birds_atlas_	*Zoothera sibirica*	0.1578	0.195 strong turnover (	0.1657
119	strong intermediate turn	Birds_atlas_	*Emberiza sulphurata*	0.3448	0.329 strong intermedi	0.1666
19	strong turnover (0.1 - 0.	Birds_atlas_	*Porzana fusca*	0.1339	0.088 complete turnove	0.1678
78	strong turnover (0.1 - 0.	Birds_atlas_	*Pyrrhula pyrrhula*	0.237	0.256 strong intermedi	0.1698
112	strong intermediate turn	Birds_atlas_	*Acrocephalus bistrigi*	0.3079	0.392 strong intermedi	0.1751
73	strong turnover (0.1 - 0.	Birds_atlas_	*Regulus regulus*	0.2243	0.188 strong turnover (	0.1753
83	strong turnover (0.1 - 0.	Birds_atlas_	*Coccothraustes cocc*	0.2439	0.189 strong turnover (	0.1761
138	strong intermediate turn	Birds_atlas_	*Saxicola torquatus*	0.4124	0.462 strong intermedi	0.1769
151	strong intermediate turn	Birds_atlas_	*Troglodytes troglodyt*	0.4997	0.468 strong intermedi	0.1841
18	strong turnover (0.1 - 0.	Birds_atlas_	*Nucifraga caryocatac*	0.1326	0.253 strong intermedi	0.1887
79	strong turnover (0.1 - 0.	Birds_atlas_	*Tarsiger cyanurus*	0.2411	0.26 strong intermedi	0.1939
152	weak intermediate turn	Birds_atlas_	*Phasianus colchicus*	0.5003	0.503 weak intermedia	0.1971
11	strong turnover (0.1 - 0.	Birds_atlas_	*Lanius cristatus*	0.1164	0.065 complete turnove	0.1992
93	strong intermediate turn	Birds_atlas_	*Columba janthina*	0.2545	0.229 strong turnover (	0.1994
48	strong turnover (0.1 - 0.	Birds_atlas_	*Riparia riparia*	0.1823	0.273 strong intermedi	0.2155
130	strong intermediate turn	Birds_atlas_	*Poecile montanus*	0.3928	0.368 strong intermedi	0.2234
108	strong intermediate turn	Birds_atlas_	*Amaurornis phoenicu*	0.2925	0.158 strong turnover (	0.2296
128	strong intermediate turn	Birds_atlas_	*Nycticorax nycticorax*	0.3843	0.371 strong intermedi	0.2518

173	weak intermediate turn	Birds_atlas_	*Milvus migrans*	0.6779	0.688 weak intermedia	0.2735
110	strong intermediate turn	Birds_atlas_	*Spilornis cheela*	0.3047	0.333 strong intermedia	0.2739
120	strong intermediate turn	Birds_atlas_	*Luscinia calliope*	0.3532	0.418 strong intermedia	0.2747
84	strong turnover (0.1 - 0.	Birds_atlas_	*Emberiza schoeniclus*	0.2446	0.33 strong intermedia	0.2764
5	strong turnover (0.1 - 0.	Birds_atlas_	*Muscicapa sibirica*	0.1032	0.068 complete turnove	0.2919
121	strong intermediate turn	Birds_atlas_	*Ardea alba*	0.3541	0.211 strong turnover (	0.3035
115	strong intermediate turn	Birds_atlas_	*Luscinia komadori*	0.3296	0.714 weak intermedia	0.3115
58	strong turnover (0.1 - 0.	Birds_atlas_	*Sterna dougallii*	0.1978	0.1 complete turnove	0.3146
86	strong turnover (0.1 - 0.	Birds_atlas_	*Accipiter gentilis*	0.2481	0.09 complete turnove	0.3165
17	strong turnover (0.1 - 0.	Birds_atlas_	*Falco subbuteo*	0.1303	0.063 complete turnove	0.3195
22	strong turnover (0.1 - 0.	Birds_atlas_	*Jynx torquilla*	0.1402	0.144 strong turnover (	0.3219
63	strong turnover (0.1 - 0.	Birds_atlas_	*Aix galericulata*	0.206	0.115 strong turnover (	0.3258
13	strong turnover (0.1 - 0.	Birds_atlas_	*Dendrocopos minor*	0.1202	0.094 complete turnove	0.3309
6	strong turnover (0.1 - 0.	Birds_atlas_	*Loxia curvirostra*	0.1053	0.044 complete turnove	0.333
106	strong intermediate turn	Birds_atlas_	*Buteo buteo*	0.28	0.173 strong turnover (	0.3347
31	strong turnover (0.1 - 0.	Birds_atlas_	*Certhia familiaris*	0.1571	0.125 strong turnover (	0.339
24	strong turnover (0.1 - 0.	Birds_atlas_	*Scolopax rusticola*	0.1461	0.148 strong turnover (	0.3414
7	strong turnover (0.1 - 0.	Birds_atlas_	*Rallus aquaticus*	0.1068	0.077 complete turnove	0.3473
56	strong turnover (0.1 - 0.	Birds_atlas_	*Lagopus muta*	0.1938	0.429 strong intermedia	0.3493
81	strong turnover (0.1 - 0.	Birds_atlas_	*Emberiza yessoensis*	0.2425	0.5 strong intermedia	0.3509
25	strong turnover (0.1 - 0.	Birds_atlas_	*Aythya fuligula*	0.1463	0.144 strong turnover (	0.3527
137	strong intermediate turn	Birds_atlas_	*Garrulus lidthi*	0.4076	1 stable (> 0.9)	0.3545
23	strong turnover (0.1 - 0.	Birds_atlas_	*Otus lempiji*	0.145	0 complete turnove	0.3575
59	strong turnover (0.1 - 0.	Birds_atlas_	*Nisaetus nipalensis*	0.2005	0.129 strong turnover (	0.3916
111	strong intermediate turn	Birds_atlas_	*Turnix suscitator*	0.3068	0.412 strong intermedia	0.3983
145	strong intermediate turn	Birds_atlas_	*Pycnonotus sinensis*	0.4819	0.167 strong turnover (	0.4023
101	strong intermediate turn	Birds_atlas_	*Anas platyrhynchos*	0.2689	0.18 strong turnover (	0.4048
34	strong turnover (0.1 - 0.	Birds_atlas_	*Histrionicus histrionic*	0.1612	0.167 strong turnover (	0.4109
139	strong intermediate turn	Birds_atlas_	*Grus japonensis*	0.4208	0.5 strong intermedia	0.4328
12	strong turnover (0.1 - 0.	Birds_atlas_	*Aythya ferina*	0.1187	0.056 complete turnove	0.4377
66	strong turnover (0.1 - 0.	Birds_atlas_	*Chalcophaps indica*	0.2092	0.333 strong intermedia	0.4449

10	strong turnover (0.1 - 0.	Birds_atlas_	*Anas clypeata*	0.1149	0.06 complete turnove	0.4688
1	complete turnover (< 0.	Birds_atlas_	*Himantopus himantop*	0.0747	0.061 complete turnove	0.4821
27	strong turnover (0.1 - 0.	Birds_atlas_	*Circus spilonotus*	0.1469	0.113 strong turnover (	0.4951
99	strong intermediate turn	Birds_atlas_	*Pandion haliaetus*	0.2648	0.168 strong turnover (	0.5003
61	strong turnover (0.1 - 0.	Birds_atlas_	*Falco peregrinus*	0.2015	0.075 complete turnove	0.5091
49	strong turnover (0.1 - 0.	Birds_atlas_	*Pernis ptilorhynchus*	0.1846	0.055 complete turnove	0.5533
127	strong intermediate turn	Birds_atlas_	*Phalacrocorax carbo*	0.3704	0.074 complete turnove	0.5567
20	strong turnover (0.1 - 0.	Birds_atlas_	*Anas falcata*	0.1348	0.115 strong turnover (	0.5573
52	strong turnover (0.1 - 0.	Birds_atlas_	*Ardea purpurea*	0.1873	0.1 complete turnove	0.561
46	strong turnover (0.1 - 0.	Birds_atlas_	*Fulica atra*	0.1765	0.268 strong intermedi	0.5673
95	strong intermediate turn	Birds_atlas_	*Larus schistisagus*	0.2576	0.223 strong turnover (	0.568
41	strong turnover (0.1 - 0.	Birds_atlas_	*Glareola maldivarum*	0.1651	0.091 complete turnove	0.5728
26	strong turnover (0.1 - 0.	Birds_atlas_	*Podiceps cristatus*	0.1466	0.021 complete turnove	0.6161
156	weak intermediate turn	Birds_atlas_	*Ardea cinerea*	0.533	0.145 strong turnover (	0.6204
68	strong turnover (0.1 - 0.	Birds_atlas_	*Phalacrocorax capilla*	0.214	0.191 strong turnover (	0.634
54	strong turnover (0.1 - 0.	Birds_atlas_	*Motacilla flava*	0.1919	0 complete turnove	0.6502
100	strong intermediate turn	Birds_atlas_	*Sapheopipo noguchi*	0.2682	0.333 strong intermedi	0.6732
8	strong turnover (0.1 - 0.	Birds_atlas_	*Anas strepera*	0.1114	0.051 complete turnove	0.7107
36	strong turnover (0.1 - 0.	Birds_atlas_	*Cepphus carbo*	0.1624	0.125 strong turnover (	0.7373
38	strong turnover (0.1 - 0.	Birds_atlas_	*Mergus merganser*	0.1646	0.055 complete turnove	0.7441
4	complete turnover (< 0.	Birds_atlas_	*Lanius tigrinus*	0.0872	0.052 complete turnove	0.753
75	strong turnover (0.1 - 0.	Birds_atlas_	*Haliaeetus albicilla*	0.2342	0.108 strong turnover (	0.7775
50	strong turnover (0.1 - 0.	Birds_atlas_	*Phalacrocorax pelagi*	0.1856	0.19 strong turnover (	0.8148
2	complete turnover (< 0.	Birds_atlas_	*Asio otus*	0.0801	0.053 complete turnove	0.82
72	strong turnover (0.1 - 0.	Birds_atlas_	*Ixobrychus cinnamon*	0.2224	0.222 strong turnover (	0.8233
30	strong turnover (0.1 - 0.	Birds_atlas_	*Calonectris leucomel*	0.1546	0.211 strong turnover (	0.8285
33	strong turnover (0.1 - 0.	Birds_atlas_	*Tringa totanus*	0.1582	0.125 strong turnover (	0.9258
3	complete turnover (< 0.	Birds_atlas_	*Pinicola enucleator*	0.0867	0.143 strong turnover (	0.9329
35	strong turnover (0.1 - 0.	Birds_atlas_	*Sula leucogaster*	0.1615	0 complete turnove	0.9567

trend_LR_Predicte	LR_Observed	trend_LR_Observe	Rank_J_observed	Rank_LR_	Rank_LR_observed
strong decrease (>	-0.6	weak decrease (<	60	1	6
weak decrease (<	-0.408	weak decrease (<	6	2	12
weak decrease (<	1.704	strong increase (>	36	3	177
weak decrease (<	-0.319	weak decrease (<	96	4	19
weak decrease (<	0.245	weak increase (< (	111	5	106
weak decrease (<	-0.136	weak decrease (<	140	6	35
weak decrease (<	-0.343	weak decrease (<	99	7	15
weak decrease (<	-0.503	weak decrease (<	50	8	9
weak decrease (<	-0.108	weak decrease (<	33	9	37
stable	-0.163	weak decrease (<	157	10	33
stable	-0.323	weak decrease (<	112	11	17
stable	-0.078	stable	77	12	39
stable	-0.438	weak decrease (<	126	13	11
stable	0.267	weak increase (< (	133	14	110
stable	-0.187	weak decrease (<	167	15	28
stable	-0.405	weak decrease (<	58	16	14
stable	0.289	weak increase (< (	150	17	113
stable	0.144	weak increase (< (	103	18	89
stable	-0.002	stable	134	19	53
stable	0.25	weak increase (< (	137	20	108
stable	-0.049	stable	102	21	43
stable	-0.123	weak decrease (<	113	22	36
stable	-0.169	weak decrease (<	120	23	32
stable	0.3	weak increase (< (	164	24	116
stable	-0.285	weak decrease (<	72	25	20
stable	-0.825	strong decrease (>	42	26	5
stable	-0.226	weak decrease (<	154	27	25
stable	0.065	stable	110	28	67
stable	-0.011	stable	182	29	51
stable	-0.229	weak decrease (<	128	30	22
stable	-0.141	weak decrease (<	94	31	34

stable	0.068	stable	83	32	68
stable	-0.17	weak decrease (<	91	33	31
stable	-0.33	weak decrease (<	101	34	16
stable	-0.277	weak decrease (<	67	35	21
stable	0.645	weak increase (< (	88	36	147
stable	0.001	stable	153	37	55
stable	-0.199	weak decrease (<	158	38	26
stable	0.475	weak increase (< (	97	39	134
stable	-0.024	stable	177	40	49
stable	0.108	weak increase (< (	179	41	79
stable	0.055	stable	147	42	65
stable	-0.074	stable	161	43	40
stable	0.08	stable	69	44	72
stable	0.216	weak increase (< (	118	45	98
stable	-0.04	stable	178	46	46
stable	0.102	weak increase (< (	100	47	77
stable	0.046	stable	119	48	62
stable	-0.039	stable	68	49	47
stable	-0.044	stable	131	50	45
stable	0.137	weak increase (< (	162	51	85
stable	0.096	weak increase (< (	148	52	76
stable	0.075	stable	168	53	71
stable	0.053	stable	142	54	64
stable	0.27	weak increase (< (	165	55	111
stable	0.113	weak increase (< (	135	56	80
stable	0.064	stable	183	57	66
stable	-0.198	weak decrease (<	80	58	27
stable	0.074	stable	155	59	70
stable	0.126	weak increase (< (	159	60	84
stable	0.561	weak increase (< (	123	61	145
stable	0.999	strong increase (>	24	62	162

stable	0.083	stable	181	63	73
stable	0.54	weak increase (< (	81	64	142
stable	0.155	weak increase (< (	151	65	91
stable	0.735	strong increase (>	14	66	153
stable	-0.171	weak decrease (<	75	67	30
stable	0.419	weak increase (< (	23	68	128
stable	0.121	weak increase (< (	172	69	82
weak increase (< (	0.444	weak increase (< (	149	70	130
weak increase (< (	0.17	weak increase (< (	84	71	94
weak increase (< (	0.006	stable	170	72	58
weak increase (< (	0.346	weak increase (< (	66	73	121
weak increase (< (	0.084	stable	160	74	74
weak increase (< (	-0.227	weak decrease (<	74	75	23
weak increase (< (	0.68	weak increase (< (	70	76	151
weak increase (< (	0.051	stable	180	77	63
weak increase (< (	0.172	weak increase (< (	145	78	95
weak increase (< (	0.227	weak increase (< (	124	79	102
weak increase (< (	-0.047	stable	109	80	44
weak increase (< (	0.199	weak increase (< (	166	81	97
weak increase (< (	0.255	weak increase (< (	156	82	109
weak increase (< (	0.12	weak increase (< (	129	83	81
weak increase (< (	0.137	weak increase (< (	139	84	86
weak increase (< (	-0.481	weak decrease (<	85	85	10
weak increase (< (	0.216	weak increase (< (	169	86	99
weak increase (< (	0.005	stable	176	87	57
weak increase (< (	0.034	stable	47	88	61
weak increase (< (	0.019	stable	79	89	59
weak increase (< (	0.124	weak increase (< (	163	90	83
weak increase (< (	0.306	weak increase (< (	98	91	118
weak increase (< (	1.792	strong increase (>	5	92	180
weak increase (< (	0.16	weak increase (< (	175	93	92

weak increase (< (	0.352 weak increase (< (	173	94	122
weak increase (< (	0.233 weak increase (< (	141	95	104
weak increase (< (	0.353 weak increase (< (	132	96	123
weak increase (< (	0.087 stable	115	97	75
weak increase (< (	0.393 weak increase (< (	121	98	126
weak increase (< (	-0.054 stable	152	99	42
weak increase (< (	0.676 weak increase (< (	30	100	150
weak increase (< (	0.294 weak increase (< (	114	101	115
weak increase (< (	0.555 weak increase (< (	95	102	143
weak increase (< (	0.241 weak increase (< (	55	103	105
weak increase (< (	-0.507 weak decrease (<	52	104	8
weak increase (< (	0.19 weak increase (< (	92	105	96
weak increase (< (	0.698 strong increase (>	25	106	152
weak increase (< (	-0.323 weak decrease (<	65	107	18
weak increase (< (	0.137 weak increase (< (	104	108	87
weak increase (< (	-1.114 strong decrease (>	26	109	3
weak increase (< (	0.344 weak increase (< (	87	110	120
weak increase (< (	-0.059 stable	122	111	41
weak increase (< (	0.462 weak increase (< (	61	112	132
weak increase (< (	0.531 weak increase (< (	62	113	141
weak increase (< (	0.145 weak increase (< (	136	114	90
weak increase (< (	0.418 weak increase (< (	138	115	127
weak increase (< (	-0.227 weak decrease (<	86	116	24
weak increase (< (	0.673 weak increase (< (	89	117	148
weak increase (< (	-0.007 stable	146	118	52
weak increase (< (	-1.448 strong decrease (>	18	119	1
weak increase (< (	0.14 weak increase (< (	82	120	88
weak increase (< (	0.302 weak increase (< (	93	121	117
weak increase (< (	-0.035 stable	116	122	48
weak increase (< (	1.839 strong increase (>	51	123	181
weak increase (< (	0.358 weak increase (< (	117	124	124

weak increase (< (	0.027	stable	171	125	60
weak increase (< (	0.51	weak increase (< (	108	126	135
weak increase (< (	0.376	weak increase (< (	127	127	125
weak increase (< (	0.335	weak increase (< (	105	128	119
weak increase (< (	-0.406	weak decrease (<	19	129	13
weak increase (< (	1.268	strong increase (>	73	130	168
weak increase (< (	0.163	weak increase (< (	174	131	93
weak increase (< (	0.992	strong increase (>	32	132	161
weak increase (< (	1.317	strong increase (>	27	133	171
weak increase (< (	0.226	weak increase (< (	17	134	101
weak increase (< (	0.001	stable	45	135	56
weak increase (< (	0.78	strong increase (>	38	136	155
weak increase (< (	0.423	weak increase (< (	29	137	129
weak increase (< (	1.319	strong increase (>	7	138	172
weak increase (< (	0.51	weak increase (< (	57	139	136
weak increase (< (	0.249	weak increase (< (	39	140	107
weak increase (< (	-0.103	stable	49	141	38
weak increase (< (	0.229	weak increase (< (	22	142	103
weak increase (< (	-0.848	strong decrease (>	130	143	4
weak increase (< (	0.107	weak increase (< (	143	144	78
weak increase (< (	0.757	strong increase (>	46	145	154
weak increase (< (	0	stable	184	146	54
weak increase (< (	-0.529	weak decrease (<	1	147	7
weak increase (< (	0.451	weak increase (< (	43	148	131
weak increase (< (	0.511	weak increase (< (	125	149	138
weak increase (< (	1.29	strong increase (>	54	150	169
weak increase (< (	0.858	strong increase (>	59	151	156
weak increase (< (	1.414	strong increase (>	53	152	174
weak increase (< (	0.47	weak increase (< (	144	153	133
weak increase (< (	1.652	strong increase (>	13	154	176
weak increase (< (	0.51	weak increase (< (	106	155	137

weak increase (< (	1.24 strong increase (>	15	156	167
weak increase (< (	1.375 strong increase (>	16	157	173
weak increase (< (	1.093 strong increase (>	35	158	165
weak increase (< (	1.061 strong increase (>	56	159	164
weak increase (< (	1.023 strong increase (>	21	160	163
weak increase (< (	0.896 strong increase (>	12	161	157
weak increase (< (	2.522 strong increase (>	20	162	184
weak increase (< (	0.931 strong increase (>	37	163	159
weak increase (< (	0.519 weak increase (< (	31	164	140
weak increase (< (	0.513 weak increase (< (	90	165	139
weak increase (< (	0.942 strong increase (>	78	166	160
weak increase (< (	0.91 strong increase (>	28	167	158
weak increase (< (	2.141 strong increase (>	4	168	182
weak increase (< (	1.721 strong increase (>	48	169	178
weak increase (< (	0.558 weak increase (< (	64	170	144
weak increase (< (	1.786 strong increase (>	3	171	179
weak increase (< (	1.098 strong increase (>	107	172	166
strong increase (>	2.302 strong increase (>	8	173	183
strong increase (>	0.218 weak increase (< (	41	174	100
strong increase (>	1.291 strong increase (>	11	175	170
strong increase (>	-1.403 strong decrease (>	9	176	2
strong increase (>	1.627 strong increase (>	34	177	175
strong increase (>	0.569 weak increase (< (	63	178	146
strong increase (>	0.27 weak increase (< (	10	179	112
strong increase (>	-0.177 weak decrease (<	76	180	29
strong increase (>	0.069 stable	71	181	69
strong increase (>	0.675 weak increase (< (	40	182	149
strong increase (>	-0.014 stable	44	183	50
strong increase (>	0.293 weak increase (< (	2	184	114

Rank_J_predicted	trend_J_Predicted	dataset	verbatim_name	J_Predicted	J_Observe	trend_J_Observe
1	complete turnover (< 0.	Birds_Atlas_New_York	*Lanius ludovicianus*	0.0407	0	complete turnove
2	complete turnover (< 0.	Birds_Atlas_New_York	*Wilsonia pusilla*	0.0412	0	complete turnove
3	complete turnover (< 0.	Birds_Atlas_New_York	*Dendroica castanea*	0.0463	0	complete turnove
4	complete turnover (< 0.	Birds_Atlas_New_York	*Aquila chrysaetos*	0.047	0	complete turnove
5	complete turnover (< 0.	Birds_Atlas_New_York	*Spiza americana*	0.0516	0	complete turnove
6	complete turnover (< 0.	Birds_Atlas_New_York	*Dendroica tigrina*	0.0523	0.067	complete turnove
7	complete turnover (< 0.	Birds_Atlas_New_York	*Vermivora peregrina*	0.0526	0	complete turnove
8	complete turnover (< 0.	Birds_Atlas_New_York	*Hydropogne caspia*	0.0592	0	complete turnove
9	complete turnover (< 0.	Birds_Atlas_New_York	*Anas acuta*	0.0619	0.098	complete turnove
10	complete turnover (< 0.	Birds_Atlas_New_York	*Protonotaria citrea*	0.062	0.065	complete turnove
11	complete turnover (< 0.	Birds_Atlas_New_York	*Dendroica dominica*	0.0628	0	complete turnove
12	complete turnover (< 0.	Birds_Atlas_New_York	*Icteria virens*	0.0713	0.042	complete turnove
13	complete turnover (< 0.	Birds_Atlas_New_York	*Rallus elegans*	0.0722	0.111	strong turnover (
14	complete turnover (< 0.	Birds_Atlas_New_York	*Bubulcus ibis*	0.0726	0.08	complete turnove
15	complete turnover (< 0.	Birds_Atlas_New_York	*Asio otus*	0.0747	0.016	complete turnove
16	complete turnover (< 0.	Birds_Atlas_New_York	*Asio flammeus*	0.075	0.053	complete turnove
17	complete turnover (< 0.	Birds_Atlas_New_York	*Oporornis formosus*	0.0762	0.064	complete turnove
18	complete turnover (< 0.	Birds_Atlas_New_York	*Aythya affinis*	0.0794	0	complete turnove
19	complete turnover (< 0.	Birds_Atlas_New_York	*Oxyura jamaicensis*	0.0807	0.087	complete turnove
20	complete turnover (< 0.	Birds_Atlas_New_York	*Larus delawarensis*	0.084	0.169	strong turnover (
21	complete turnover (< 0.	Birds_Atlas_New_York	*Mergus serrator*	0.0897	0.103	strong turnover (
22	complete turnover (< 0.	Birds_Atlas_New_York	*Spizella pallida*	0.0936	0.057	complete turnove
23	complete turnover (< 0.	Birds_Atlas_New_York	*Anas crecca*	0.0947	0.081	complete turnove
24	complete turnover (< 0.	Birds_Atlas_New_York	*Aegolius acadicus*	0.0957	0.05	complete turnove
25	complete turnover (< 0.	Birds_Atlas_New_York	*Tyto alba*	0.0958	0.085	complete turnove
26	complete turnover (< 0.	Birds_Atlas_New_York	*Anas americana*	0.0988	0.143	strong turnover (
27	complete turnover (< 0.	Birds_Atlas_New_York	*Perdix perdix*	0.0989	0.049	complete turnove
28	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Aythya americana*	0.1053	0.048	complete turnove
29	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Chordeiles minor*	0.1136	0.083	complete turnove
30	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Cistothorus platensis*	0.1145	0.057	complete turnove
31	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Bucephala clangula*	0.1162	0.17	strong turnover (

32	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Ammodramus henslo*	0.118	0.045	complete turnove
33	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Anas clypeata*	0.1203	0.128	strong turnover (
34	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Melanerpes erythroce*	0.1207	0.09	complete turnove
35	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Sturnella neglecta*	0.121	0	complete turnove
36	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Loxia curvirostra*	0.1274	0.085	complete turnove
37	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Falco peregrinus*	0.1298	0.076	complete turnove
38	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Vireo philadelphicus*	0.1339	0.063	complete turnove
39	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Aythya valisineria*	0.1347	0	complete turnove
40	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Accipiter gentilis*	0.1374	0.096	complete turnove
41	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Ammodramus savanı*	0.141	0.181	strong turnover (
42	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Ixobrychus exilis*	0.1465	0.178	strong turnover (
43	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Fulica americana*	0.1498	0.162	strong turnover (
44	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Caprimulgus caroline*	0.1564	0.115	strong turnover (
45	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Porzana carolina*	0.1604	0.148	strong turnover (
46	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Empidonax virescens*	0.1612	0.186	strong turnover (
47	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Anas discors*	0.1625	0.121	strong turnover (
48	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Bartramia longicauda*	0.1628	0.161	strong turnover (
49	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Gallinula chloropus*	0.163	0.203	strong turnover (
50	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Piranga rubra*	0.1644	0.2	strong turnover (
51	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Dendroica palmarum*	0.1649	0	complete turnove
52	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Podilymbus podiceps*	0.1663	0.117	strong turnover (
53	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Egretta caerulea*	0.1701	0.121	strong turnover (
54	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Botaurus lentiginosus*	0.1775	0.188	strong turnover (
55	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Pooecetes gramineus*	0.1793	0.207	strong turnover (
56	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Haliaeetus leucoceph*	0.1794	0.037	complete turnove
57	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Spinus pinus*	0.1865	0.157	strong turnover (
58	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Rallus limicola*	0.1868	0.194	strong turnover (
59	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Anas strepera*	0.1909	0.225	strong turnover (
60	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Cistothorus palustris*	0.1926	0.289	strong intermedia
61	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Dendroica cerulea*	0.1928	0.219	strong turnover (
62	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Progne subis*	0.2072	0.295	strong intermedia

63	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Anas rubripes*	0.2108	0.209	strong turnover (
64	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Circus cyaneus*	0.2123	0.218	strong turnover (
65	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Passerina caerulea*	0.2134	0	complete turnove
66	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Caprimulgus vociferu*	0.2139	0.181	strong turnover (
67	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Coccothraustes vesp*	0.2143	0.171	strong turnover (
68	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Larus marinus*	0.2162	0.366	strong intermedi
69	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Vermivora chrysopter*	0.2222	0.12	strong turnover (
70	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Lophodytes cucullatu*	0.226	0.138	strong turnover (
71	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Aythya collaris*	0.2263	0.099	complete turnove
72	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Icterus spurius*	0.2269	0.157	strong turnover (
73	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Nycticorax nycticorax*	0.2287	0.266	strong intermedi
74	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Egretta tricolor*	0.2292	0.333	strong intermedi
75	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Nyctanassa violacea*	0.2303	0.302	strong intermedi
76	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Picoides arcticus*	0.2309	0.217	strong turnover (
77	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Buteo lineatus*	0.2313	0.173	strong turnover (
78	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Euphagus carolinus*	0.2355	0.207	strong turnover (
79	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Ardea alba*	0.2367	0.205	strong turnover (
80	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Leucophaeus atricilla*	0.2384	0.086	complete turnove
81	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Pandion haliaetus*	0.2387	0.192	strong turnover (
82	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Loxia leucoptera*	0.2398	0.198	strong turnover (
83	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Chlidonias niger*	0.2459	0.36	strong intermedi
84	strong turnover (0.1 - 0.	Birds_Atlas_New_York	*Seiurus motacilla*	0.2499	0.324	strong intermedi
85	strong intermediate turn	Birds_Atlas_New_York	*Petrochelidon pyrrho*	0.2532	0.281	strong intermedi
86	strong intermediate turn	Birds_Atlas_New_York	*Plegadis falcinellus*	0.2539	0.288	strong intermedi
87	strong intermediate turn	Birds_Atlas_New_York	*Polioptila caerulea*	0.2545	0.318	strong intermedi
88	strong intermediate turn	Birds_Atlas_New_York	*Larus argentatus*	0.2551	0.303	strong intermedi
89	strong intermediate turn	Birds_Atlas_New_York	*Gelochelidon nilotica*	0.256	0.143	strong turnover (
90	strong intermediate turn	Birds_Atlas_New_York	*Contopus cooperi*	0.2569	0.309	strong intermedi
91	strong intermediate turn	Birds_Atlas_New_York	*Sterna hirundo*	0.2596	0.407	strong intermedi
92	strong intermediate turn	Birds_Atlas_New_York	*Sterna forsteri*	0.2599	0.091	complete turnove
93	strong intermediate turn	Birds_Atlas_New_York	*Dendroica pinus*	0.2607	0.182	strong turnover (

94	strong intermediate turn	Birds_Atlas_New_York	*Megascops asio*	0.2644	0.257 strong intermedia
95	strong intermediate turn	Birds_Atlas_New_York	*Coccyzus americanus*	0.2647	0.237 strong turnover (
96	strong intermediate turn	Birds_Atlas_New_York	*Myiopsitta monachus*	0.2673	0 complete turnove
97	strong intermediate turn	Birds_Atlas_New_York	*Phasianus colchicus*	0.2688	0.314 strong intermedia
98	strong intermediate turn	Birds_Atlas_New_York	*Rynchops niger*	0.2711	0.292 strong intermedia
99	strong intermediate turn	Birds_Atlas_New_York	*Seiurus noveboracen*	0.2713	0.248 strong turnover (
100	strong intermediate turn	Birds_Atlas_New_York	*Accipiter cooperii*	0.273	0.119 strong turnover (
101	strong intermediate turn	Birds_Atlas_New_York	*Egretta thula*	0.2739	0.333 strong intermedia
102	strong intermediate turn	Birds_Atlas_New_York	*Riparia riparia*	0.277	0.319 strong intermedia
103	strong intermediate turn	Birds_Atlas_New_York	*Mergus merganser*	0.2779	0.225 strong turnover (
104	strong intermediate turn	Birds_Atlas_New_York	*Empidonax flaviventr*	0.2786	0.261 strong intermedia
105	strong intermediate turn	Birds_Atlas_New_York	*Gallinago delicata*	0.2792	0.281 strong intermedia
106	strong intermediate turn	Birds_Atlas_New_York	*Colinus virginianus*	0.2797	0.33 strong intermedia
107	strong intermediate turn	Birds_Atlas_New_York	*Eremophila alpestris*	0.2818	0.339 strong intermedia
108	strong intermediate turn	Birds_Atlas_New_York	*Catharus bicknelli*	0.2884	0.391 strong intermedia
109	strong intermediate turn	Birds_Atlas_New_York	*Vireo griseus*	0.3026	0.328 strong intermedia
110	strong intermediate turn	Birds_Atlas_New_York	*Cygnus olor*	0.3064	0.359 strong intermedia
111	strong intermediate turn	Birds_Atlas_New_York	*Perisoreus canadens*	0.3071	0.321 strong intermedia
112	strong intermediate turn	Birds_Atlas_New_York	*Wilsonia canadensis*	0.3089	0.36 strong intermedia
113	strong intermediate turn	Birds_Atlas_New_York	*Bubo virginianus*	0.3102	0.293 strong intermedia
114	strong intermediate turn	Birds_Atlas_New_York	*Strix varia*	0.3154	0.243 strong turnover (
115	strong intermediate turn	Birds_Atlas_New_York	*Poecile hudsonicus*	0.3176	0.332 strong intermedia
116	strong intermediate turn	Birds_Atlas_New_York	*Helmitheros vermivor*	0.3179	0.366 strong intermedia
117	strong intermediate turn	Birds_Atlas_New_York	*Accipiter striatus*	0.3181	0.151 strong turnover (
118	strong intermediate turn	Birds_Atlas_New_York	*Dendroica striata*	0.3195	0.297 strong intermedia
119	strong intermediate turn	Birds_Atlas_New_York	*Actitis macularius*	0.3214	0.303 strong intermedia
120	strong intermediate turn	Birds_Atlas_New_York	*Scolopax minor*	0.3289	0.27 strong intermedia
121	strong intermediate turn	Birds_Atlas_New_York	*Coccyzus erythropthа*	0.3329	0.283 strong intermedia
122	strong intermediate turn	Birds_Atlas_New_York	*Sterna dougallii*	0.3333	0.476 strong intermedia
123	strong intermediate turn	Birds_Atlas_New_York	*Regulus satrapa*	0.3339	0.32 strong intermedia
124	strong intermediate turn	Birds_Atlas_New_York	*Dendroica discolor*	0.3363	0.376 strong intermedia

125	strong intermediate turn	Birds_Atlas_New_York	*Stelgidopteryx serripe*	0.3375	0.322 strong intermedi
126	strong intermediate turn	Birds_Atlas_New_York	*Corvus ossifragus*	0.339	0.342 strong intermedi
127	strong intermediate turn	Birds_Atlas_New_York	*Parula americana*	0.34	0.323 strong intermedi
128	strong intermediate turn	Birds_Atlas_New_York	*Ammodramus maritin*	0.3433	0.474 strong intermedi
129	strong intermediate turn	Birds_Atlas_New_York	*Quiscalus major*	0.353	0.077 complete turnove
130	strong intermediate turn	Birds_Atlas_New_York	*Thryothorus ludovicia*	0.3614	0.182 strong turnover (
131	strong intermediate turn	Birds_Atlas_New_York	*Vireo flavifrons*	0.3626	0.366 strong intermedi
132	strong intermediate turn	Birds_Atlas_New_York	*Oporornis philadelphi*	0.3745	0.371 strong intermedi
133	strong intermediate turn	Birds_Atlas_New_York	*Buteo platypterus*	0.3746	0.371 strong intermedi
134	strong intermediate turn	Birds_Atlas_New_York	*Melospiza lincolnii*	0.3759	0.333 strong intermedi
135	strong intermediate turn	Birds_Atlas_New_York	*Rallus longirostris*	0.3836	0.443 strong intermedi
136	strong intermediate turn	Birds_Atlas_New_York	*Gavia immer*	0.393	0.499 strong intermedi
137	strong intermediate turn	Birds_Atlas_New_York	*Catharus ustulatus*	0.3941	0.475 strong intermedi
138	strong intermediate turn	Birds_Atlas_New_York	*Vermivora ruficapilla*	0.3957	0.353 strong intermedi
139	strong intermediate turn	Birds_Atlas_New_York	*Wilsonia citrina*	0.3974	0.251 strong intermedi
140	strong intermediate turn	Birds_Atlas_New_York	*Butorides virescens*	0.4115	0.469 strong intermedi
141	strong intermediate turn	Birds_Atlas_New_York	*Corvus corax*	0.4386	0.128 strong turnover (
142	strong intermediate turn	Birds_Atlas_New_York	*Ammodramus caudac*	0.4404	0.565 weak intermedia
143	strong intermediate turn	Birds_Atlas_New_York	*Toxostoma rufum*	0.4416	0.479 strong intermedi
144	strong intermediate turn	Birds_Atlas_New_York	*Certhia americana*	0.4447	0.365 strong intermedi
145	strong intermediate turn	Birds_Atlas_New_York	*Mimus polyglottos*	0.4458	0.514 weak intermedia
146	strong intermediate turn	Birds_Atlas_New_York	*Haematopus palliatus*	0.4567	0.569 weak intermedia
147	strong intermediate turn	Birds_Atlas_New_York	*Tringa semipalmata*	0.4578	0.451 strong intermedi
148	strong intermediate turn	Birds_Atlas_New_York	*Sternula antillarum*	0.4589	0.55 weak intermedia
149	strong intermediate turn	Birds_Atlas_New_York	*Chaetura pelagica*	0.4757	0.501 weak intermedia
150	strong intermediate turn	Birds_Atlas_New_York	*Charadrius melodus*	0.4803	0.562 weak intermedia
151	strong intermediate turn	Birds_Atlas_New_York	*Sitta canadensis*	0.4958	0.446 strong intermedi
152	strong intermediate turn	Birds_Atlas_New_York	*Vermivora pinus*	0.4986	0.498 strong intermedi
153	weak intermediate turnc	Birds_Atlas_New_York	*Troglodytes troglodyt*	0.5025	0.431 strong intermedi
154	weak intermediate turnc	Birds_Atlas_New_York	*Aix sponsa*	0.5028	0.377 strong intermedi
155	weak intermediate turnc	Birds_Atlas_New_York	*Bonasa umbellus*	0.5075	0.458 strong intermedi

156	weak intermediate turnc	Birds_Atlas_New_York	*Empidonax traillii*	0.5082	0.469 strong intermedia
157	weak intermediate turnc	Birds_Atlas_New_York	*Empidonax alnorum*	0.5274	0.387 strong intermedia
158	weak intermediate turnc	Birds_Atlas_New_York	*Dendroica fusca*	0.5286	0.518 weak intermedia
159	weak intermediate turnc	Birds_Atlas_New_York	*Dendroica caerulesce*	0.5306	0.558 weak intermedia
160	weak intermediate turnc	Birds_Atlas_New_York	*Melanerpes carolinus*	0.5346	0.384 strong intermedia
161	weak intermediate turnc	Birds_Atlas_New_York	*Dendroica magnolia*	0.5451	0.506 weak intermedia
162	weak intermediate turnc	Birds_Atlas_New_York	*Laterallus jamaicensi*	0.5478	1 stable (> 0.9)
163	weak intermediate turnc	Birds_Atlas_New_York	*Mniotilta varia*	0.5521	0.573 weak intermedia
164	weak intermediate turnc	Birds_Atlas_New_York	*Melospiza georgiana*	0.5522	0.539 weak intermedia
165	weak intermediate turnc	Birds_Atlas_New_York	*Sturnella magna*	0.5644	0.661 weak intermedia
166	weak intermediate turnc	Birds_Atlas_New_York	*Catharus guttatus*	0.5712	0.552 weak intermedia
167	weak intermediate turnc	Birds_Atlas_New_York	*Vireo solitarius*	0.5785	0.502 weak intermedia
168	weak intermediate turnc	Birds_Atlas_New_York	*Carpodacus purpureu*	0.5916	0.554 weak intermedia
169	weak intermediate turnc	Birds_Atlas_New_York	*Megaceryle alcyon*	0.5945	0.593 weak intermedia
170	weak intermediate turnc	Birds_Atlas_New_York	*Dendroica coronata*	0.6067	0.547 weak intermedia
171	weak intermediate turnc	Birds_Atlas_New_York	*Falco sparverius*	0.6089	0.612 weak intermedia
172	weak intermediate turnc	Birds_Atlas_New_York	*Pipilo erythrophthalm*	0.6188	0.692 weak intermedia
173	weak intermediate turnc	Birds_Atlas_New_York	*Dryocopus pileatus*	0.6239	0.494 strong intermedia
174	weak intermediate turnc	Birds_Atlas_New_York	*Junco hyemalis*	0.6239	0.606 weak intermedia
175	weak intermediate turnc	Birds_Atlas_New_York	*Dendroica virens*	0.6258	0.598 weak intermedia
176	weak intermediate turnc	Birds_Atlas_New_York	*Baeolophus bicolor*	0.6348	0.436 strong intermedia
177	weak intermediate turnc	Birds_Atlas_New_York	*Meleagris gallopavo*	0.6409	0.316 strong intermedia
178	weak intermediate turnc	Birds_Atlas_New_York	*Cathartes aura*	0.6443	0.433 strong intermedia
179	weak intermediate turnc	Birds_Atlas_New_York	*Carpodacus mexican*	0.6497	0.634 weak intermedia
180	weak intermediate turnc	Birds_Atlas_New_York	*Passerculus sandwic*	0.6539	0.692 weak intermedia
181	weak intermediate turnc	Birds_Atlas_New_York	*Spizella pusilla*	0.6557	0.704 weak intermedia
182	weak intermediate turnc	Birds_Atlas_New_York	*Dolichonyx oryzivoru*	0.6656	0.754 weak turnover (>
183	weak intermediate turnc	Birds_Atlas_New_York	*Vireo gilvus*	0.6664	0.643 weak intermedia
184	weak intermediate turnc	Birds_Atlas_New_York	*Empidonax minimus*	0.6762	0.646 weak intermedia
185	weak intermediate turnc	Birds_Atlas_New_York	*Ardea herodias*	0.6934	0.574 weak intermedia
186	weak intermediate turnc	Birds_Atlas_New_York	*Columba livia*	0.6954	0.78 weak turnover (>

187	weak intermediate turnc	Birds_Atlas_New_York	*Sphyrapicus varius*	0.6961	0.546 weak intermedia
188	weak intermediate turnc	Birds_Atlas_New_York	*Branta canadensis*	0.7008	0.238 strong turnover (
189	weak intermediate turnc	Birds_Atlas_New_York	*Picoides villosus*	0.704	0.646 weak intermedia
190	weak intermediate turnc	Birds_Atlas_New_York	*Sialia sialis*	0.7104	0.512 weak intermedia
191	weak intermediate turnc	Birds_Atlas_New_York	*Anas platyrhynchos*	0.7121	0.595 weak intermedia
192	weak intermediate turnc	Birds_Atlas_New_York	*Charadrius vociferus*	0.7216	0.775 weak turnover (>
193	weak intermediate turnc	Birds_Atlas_New_York	*Buteo jamaicensis*	0.7284	0.692 weak intermedia
194	weak intermediate turnc	Birds_Atlas_New_York	*Myiarchus crinitus*	0.7385	0.736 weak intermedia
195	weak intermediate turnc	Birds_Atlas_New_York	*Dendroica pensylvan*	0.7386	0.69 weak intermedia
196	weak turnover (> 0.75)	Birds_Atlas_New_York	*Archilochus colubris*	0.7517	0.627 weak intermedia
197	weak turnover (> 0.75)	Birds_Atlas_New_York	*Catharus fuscescens*	0.7613	0.762 weak turnover (>
198	weak turnover (> 0.75)	Birds_Atlas_New_York	*Passer domesticus*	0.7634	0.856 weak turnover (>
199	weak turnover (> 0.75)	Birds_Atlas_New_York	*Piranga olivacea*	0.7677	0.762 weak turnover (>
200	weak turnover (> 0.75)	Birds_Atlas_New_York	*Cardinalis cardinalis*	0.7707	0.812 weak turnover (>
201	weak turnover (> 0.75)	Birds_Atlas_New_York	*Setophaga ruticilla*	0.774	0.738 weak intermedia
202	weak turnover (> 0.75)	Birds_Atlas_New_York	*Contopus virens*	0.7936	0.784 weak turnover (>
203	weak turnover (> 0.75)	Birds_Atlas_New_York	*Sitta carolinensis*	0.7939	0.743 weak intermedia
204	weak turnover (> 0.75)	Birds_Atlas_New_York	*Pheucticus ludoviciar*	0.7986	0.804 weak turnover (>
205	weak turnover (> 0.75)	Birds_Atlas_New_York	*Passerina cyanea*	0.801	0.787 weak turnover (>
206	weak turnover (> 0.75)	Birds_Atlas_New_York	*Molothrus ater*	0.8046	0.798 weak turnover (>
207	weak turnover (> 0.75)	Birds_Atlas_New_York	*Seiurus aurocapilla*	0.8224	0.772 weak turnover (>
208	weak turnover (> 0.75)	Birds_Atlas_New_York	*Icterus galbula*	0.8257	0.852 weak turnover (>
209	weak turnover (> 0.75)	Birds_Atlas_New_York	*Tyrannus tyrannus*	0.8295	0.859 weak turnover (>
210	weak turnover (> 0.75)	Birds_Atlas_New_York	*Troglodytes aedon*	0.8301	0.87 weak turnover (>
211	weak turnover (> 0.75)	Birds_Atlas_New_York	*Picoides pubescens*	0.8336	0.802 weak turnover (>
212	weak turnover (> 0.75)	Birds_Atlas_New_York	*Hylocichla mustelina*	0.834	0.838 weak turnover (>
213	weak turnover (> 0.75)	Birds_Atlas_New_York	*Sayornis phoebe*	0.8578	0.821 weak turnover (>
214	weak turnover (> 0.75)	Birds_Atlas_New_York	*Dendroica petechia*	0.8584	0.881 weak turnover (>
215	weak turnover (> 0.75)	Birds_Atlas_New_York	*Hirundo rustica*	0.8674	0.897 weak turnover (>
216	weak turnover (> 0.75)	Birds_Atlas_New_York	*Tachycineta bicolor*	0.8702	0.841 weak turnover (>
217	weak turnover (> 0.75)	Birds_Atlas_New_York	*Sturnus vulgaris*	0.8725	0.92 stable (> 0.9)

218	weak turnover (> 0.75)	Birds_Atlas_New_York	*Colaptes auratus*	0.8778	0.883 weak turnover (>
219	weak turnover (> 0.75)	Birds_Atlas_New_York	*Dumetella carolinens*	0.8782	0.919 stable (> 0.9)
220	weak turnover (> 0.75)	Birds_Atlas_New_York	*Zenaida macroura*	0.8929	0.887 weak turnover (>
221	weak turnover (> 0.75)	Birds_Atlas_New_York	*Quiscalus quiscula*	0.8993	0.906 stable (> 0.9)
222	stable (> 0.9)	Birds_Atlas_New_York	*Spizella passerina*	0.9031	0.916 stable (> 0.9)
223	stable (> 0.9)	Birds_Atlas_New_York	*Bombycilla cedrorum*	0.9136	0.899 weak turnover (>
224	stable (> 0.9)	Birds_Atlas_New_York	*Agelaius phoeniceus*	0.9144	0.931 stable (> 0.9)
225	stable (> 0.9)	Birds_Atlas_New_York	*Spinus tristis*	0.9154	0.915 stable (> 0.9)
226	stable (> 0.9)	Birds_Atlas_New_York	*Corvus brachyrhynch*	0.9196	0.929 stable (> 0.9)
227	stable (> 0.9)	Birds_Atlas_New_York	*Vireo olivaceus*	0.944	0.929 stable (> 0.9)
228	stable (> 0.9)	Birds_Atlas_New_York	*Melospiza melodia*	0.9484	0.963 stable (> 0.9)
229	stable (> 0.9)	Birds_Atlas_New_York	*Cyanocitta cristata*	0.9496	0.956 stable (> 0.9)
230	stable (> 0.9)	Birds_Atlas_New_York	*Geothlypis trichas*	0.9496	0.955 stable (> 0.9)
231	stable (> 0.9)	Birds_Atlas_New_York	*Poecile atricapillus*	0.9545	0.962 stable (> 0.9)
232	stable (> 0.9)	Birds_Atlas_New_York	*Turdus migratorius*	0.9603	0.973 stable (> 0.9)

LR_Predicted	trend_LR_Predicte	LR_Observed	trend_LR_Observe	Rank_J_observed	Rank_LR_p	Rank_LR_observed
0.0767	stable	-1.792	strong decrease (>	1	143	1
0.9423	strong increase (>	-0.405	weak decrease (<	2	232	37
0.1053	weak increase (< (	-0.981	strong decrease (>	3	152	16
0.3413	weak increase (< (	0.118	weak increase (< (	4	213	153
-0.1227	weak decrease (<	1.792	strong increase (>	5	38	228
-0.1155	weak decrease (<	-0.251	weak decrease (<	28	40	47
-0.412	weak decrease (<	0.036	stable	6	8	132
0.5728	weak increase (< (	0.51	weak increase (< (	7	226	200
0.2615	weak increase (< (	-1.253	strong decrease (>	41	207	10
0.0167	stable	-0.693	weak decrease (<	27	113	19
0.0541	stable	0.511	weak increase (< (	8	131	201
-0.0549	stable	-1.508	strong decrease (>	17	53	6
0.0315	stable	0	stable	44	122	106
0.4004	weak increase (< (	-1.049	strong decrease (>	31	219	13
-0.0409	stable	-0.523	weak decrease (<	15	63	25
-0.2967	weak decrease (<	-0.405	weak decrease (<	22	12	35
0.0659	stable	-1.266	strong decrease (>	26	135	9
0.6141	weak increase (< (	-0.406	weak decrease (<	9	228	34
-0.1092	weak decrease (<	0.944	strong increase (>	37	41	220
-0.43	weak decrease (<	-0.204	weak decrease (<	62	6	52
0.3051	weak increase (< (	0.252	weak increase (< (	43	210	176
0.0205	stable	1.099	strong increase (>	23	117	221
0.2067	weak increase (< (	-0.598	weak decrease (<	32	195	23
0.1482	weak increase (< (	0.124	weak increase (< (	21	178	155
-0.4642	weak decrease (<	-1.504	strong decrease (>	34	4	7
-0.1862	weak decrease (<	-0.647	weak decrease (<	54	24	22
-0.0192	stable	-1.638	strong decrease (>	20	80	4
0.0697	stable	0.559	weak increase (< (	19	138	207
-0.1337	weak decrease (<	-1.24	strong decrease (>	33	33	11
-0.054	stable	0.233	weak increase (< (	24	55	172
-0.0561	stable	0.256	weak increase (< (	63	52	177

-0.4827 weak decrease (<	-1.603 strong decrease (>	18	3	5
-0.0953 stable	0.274 weak increase (< (	51	44	179
-0.2397 weak decrease (<	-1.42 strong decrease (>	38	16	8
0.9398 strong increase (>	-1.791 strong decrease (>	10	231	2
-0.0111 stable	-1.025 strong decrease (>	35	90	14
0.3003 weak increase (< (	1.867 strong increase (>	29	209	229
0.1424 weak increase (< (	0.448 weak increase (< (	25	174	199
0.719 strong increase (>	0 stable	11	229	107
0.3736 weak increase (< (	-0.224 weak decrease (<	40	216	49
-0.3527 weak decrease (<	-0.544 weak decrease (<	67	11	24
-0.2567 weak decrease (<	-0.096 stable	66	15	68
-0.2941 weak decrease (<	0.093 stable	61	13	146
0.1182 weak increase (< (	-0.965 strong decrease (>	45	165	17
-0.0171 stable	0.143 weak increase (< (	56	81	157
0.1175 weak increase (< (	0.389 weak increase (< (	71	164	192
-0.1304 weak decrease (<	-1.001 strong decrease (>	49	35	15
-0.0723 stable	-1.059 strong decrease (>	60	48	12
-0.0208 stable	-0.405 weak decrease (<	77	77	36
0.3839 weak increase (< (	-0.001 stable	76	218	104
-0.0022 stable	3.761 strong increase (>	12	100	232
-0.0338 stable	0.38 weak increase (< (	46	66	191
-0.2206 weak decrease (<	-0.054 stable	50	18	82
0.0898 stable	-0.111 weak decrease (<	72	147	67
-0.3668 weak decrease (<	-0.683 weak decrease (<	79	10	21
0.527 weak increase (< (	2.543 strong increase (>	16	224	231
0.219 weak increase (< (	0.012 stable	58	200	120
-0.1336 weak decrease (<	0.189 weak increase (< (	74	34	167
0.171 weak increase (< (	0.009 stable	85	184	117
-0.0506 stable	0.049 stable	100	57	138
-0.2185 weak decrease (<	-0.134 weak decrease (<	84	19	63
-0.2678 weak decrease (<	-0.504 weak decrease (<	103	14	27

0.1466 weak increase (< (	-0.416 weak decrease (<	81	176	33
-0.1264 weak decrease (<	-0.014 stable	83	36	96
0.116 weak increase (< (	0.81 strong increase (>	13	161	214
-0.0873 stable	-0.854 strong decrease (>	68	47	18
0.1958 weak increase (< (	0.359 weak increase (< (	64	192	187
0.2329 weak increase (< (	-0.058 stable	131	205	81
-0.1692 weak decrease (<	-0.691 weak decrease (<	48	26	20
0.2189 weak increase (< (	0.745 strong increase (>	53	199	212
0.1321 weak increase (< (	0.725 strong increase (>	42	170	211
0.3781 weak increase (< (	0.556 weak increase (< (	59	217	206
0.3542 weak increase (< (	0.009 stable	94	214	118
0.0591 stable	0.167 weak increase (< (	121	134	160
-0.2274 weak decrease (<	-0.322 weak decrease (<	105	17	41
0.0845 stable	0.108 weak increase (< (	82	145	150
0.2194 weak increase (< (	0.209 weak increase (< (	65	201	170
-0.0494 stable	-0.255 weak decrease (<	80	58	46
0.1701 weak increase (< (	0.535 weak increase (< (	78	183	204
0.1069 weak increase (< (	-1.674 strong decrease (>	36	153	3
0.4397 weak increase (< (	0.901 strong increase (>	73	220	219
0.1664 weak increase (< (	0.13 weak increase (< (	75	181	156
-0.4853 weak decrease (<	-0.506 weak decrease (<	128	2	26
0.0509 stable	-0.23 weak decrease (<	117	130	48
-0.0877 stable	-0.125 weak decrease (<	96	46	66
0.0666 stable	-0.213 weak decrease (<	99	137	51
0.1129 weak increase (< (	0.171 weak increase (< (	111	159	161
0.2114 weak increase (< (	-0.139 weak decrease (<	106	198	62
0.5747 weak increase (< (	0.511 weak increase (< (	55	227	202
-0.0623 stable	-0.422 weak decrease (<	108	50	32
-0.0977 stable	-0.016 stable	141	43	94
0.1457 weak increase (< (	1.609 strong increase (>	39	175	225
0.037 stable	1.161 strong increase (>	69	123	222

0.0464 stable	0.011 stable	92	125	119
0.0932 stable	0.031 stable	87	150	130
0.1736 weak increase (< (	1.61 strong increase (>	14	185	226
0.0477 stable	-0.464 weak decrease (<	109	127	29
-0.4421 weak decrease (<	-0.392 weak decrease (<	101	5	38
0.0716 stable	0.039 stable	90	139	134
0.117 weak increase (< (	0.901 strong increase (>	47	163	218
-0.137 weak decrease (<	-0.483 weak decrease (<	122	32	28
-0.0392 stable	-0.325 weak decrease (<	112	64	40
0.4645 weak increase (< (	0.849 strong increase (>	86	221	216
0.2106 weak increase (< (	0.348 weak increase (< (	93	197	184
0.0747 stable	0.021 stable	97	140	125
-0.0493 stable	-0.299 weak decrease (<	119	59	42
-0.6005 weak decrease (<	-0.458 weak decrease (<	124	1	31
0.1392 weak increase (< (	0.379 weak increase (< (	140	172	190
-0.0463 stable	-0.071 stable	118	62	76
0.5405 weak increase (< (	0.624 weak increase (< (	127	225	209
0.091 stable	0.156 weak increase (< (	114	148	159
0.055 stable	-0.263 weak decrease (<	129	132	45
0.2757 weak increase (< (	-0.193 weak decrease (<	102	208	54
0.2476 weak increase (< (	0.354 weak increase (< (	89	206	186
0.0813 stable	0.115 weak increase (< (	120	144	151
0.2196 weak increase (< (	-0.009 stable	132	202	99
0.1162 weak increase (< (	0.516 weak increase (< (	57	162	203
0.003 stable	-0.083 stable	104	106	70
0.0029 stable	-0.134 weak decrease (<	107	105	64
0.0255 stable	0.038 stable	95	121	133
0.0223 stable	0.034 stable	98	118	131
-0.1167 weak decrease (<	-0.46 weak decrease (<	153	39	30
0.127 weak increase (< (	0.116 weak increase (< (	113	169	152
0.1784 weak increase (< (	0.18 weak increase (< (	136	189	164

-0.0059	stable	0.191	weak increase (< (	115	97	168
0.2094	weak increase (< (	0.434	weak increase (< (	125	196	198
0.2045	weak increase (< (	0.407	weak increase (< (	116	194	194
-0.4209	weak decrease (<	-0.288	weak decrease (<	151	7	43
-0.3927	weak decrease (<	2.251	strong increase (>	30	9	230
0.1682	weak increase (< (	1.411	strong increase (>	70	182	224
0.0197	stable	-0.074	stable	133	116	74
0.0764	stable	0.043	stable	134	142	136
0.0749	stable	0.007	stable	135	141	112
0.1374	weak increase (< (	-0.148	weak decrease (<	123	171	60
-0.1966	weak decrease (<	-0.035	stable	145	21	88
0.4862	weak increase (< (	0.349	weak increase (< (	157	222	185
0.0924	stable	-0.182	weak decrease (<	152	149	55
0.1895	weak increase (< (	-0.075	stable	126	191	72
-0.1464	weak decrease (<	0.9	strong increase (>	91	30	217
-0.0485	stable	-0.14	weak decrease (<	149	60	61
0.4863	weak increase (< (	1.791	strong increase (>	52	223	227
-0.1955	weak decrease (<	-0.166	weak decrease (<	172	22	57
-0.0209	stable	-0.358	weak decrease (<	154	76	39
0.0892	stable	0.048	stable	130	146	137
0.1745	weak increase (< (	0.093	stable	162	186	148
-0.0154	stable	0.413	weak increase (< (	173	84	195
-0.1781	weak decrease (<	0.569	weak increase (< (	147	25	208
-0.1486	weak decrease (<	-0.22	weak decrease (<	167	29	50
-0.0897	stable	-0.164	weak decrease (<	158	45	58
-0.1942	weak decrease (<	0.027	stable	171	23	127
0.0477	stable	0.309	weak increase (< (	146	128	182
0.1099	weak increase (< (	0.152	weak increase (< (	156	155	158
0.2287	weak increase (< (	0.396	weak increase (< (	142	204	193
0.1185	weak increase (< (	0.37	weak increase (< (	137	166	188
0.1156	weak increase (< (	-0.203	weak decrease (<	148	160	53

-0.0087 stable	0.304 weak increase (< (	150	95	181
0.0587 stable	0.373 weak increase (< (	139	133	189
0.178 weak increase (< (	0.174 weak increase (< (	163	188	162
0.1975 weak increase (< (	0.096 weak increase (< (	170	193	149
0.1798 weak increase (< (	0.802 strong increase (>	138	190	213
0.1657 weak increase (< (	0.228 weak increase (< (	160	180	171
0.8262 strong increase (>	0 stable	232	230	108
0.0481 stable	-0.009 stable	174	129	98
-0.023 stable	0.056 stable	164	74	139
-0.2114 weak decrease (<	-0.286 weak decrease (<	186	20	44
0.1085 weak increase (< (	0.266 weak increase (< (	168	154	178
0.177 weak increase (< (	0.329 weak increase (< (	159	187	183
0.0664 stable	0.004 stable	169	136	111
-0.0261 stable	-0.061 stable	176	70	79
0.1656 weak increase (< (	0.3 weak increase (< (	166	179	180
-0.1489 weak decrease (<	-0.153 weak decrease (<	180	28	59
-0.0119 stable	-0.126 weak decrease (<	188	89	65
0.1121 weak increase (< (	0.251 weak increase (< (	155	157	175
0.1207 weak increase (< (	0.207 weak increase (< (	179	167	169
0.1468 weak increase (< (	0.25 weak increase (< (	178	177	174
0.0935 stable	0.695 strong increase (>	144	151	210
0.3675 weak increase (< (	0.845 strong increase (>	110	215	215
0.2243 weak increase (< (	0.536 weak increase (< (	143	203	205
-0.024 stable	0.175 weak increase (< (	182	73	163
-0.1056 weak decrease (<	0.021 stable	189	42	122
-0.0643 stable	-0.173 weak decrease (<	191	49	56
-0.1555 weak decrease (<	-0.086 stable	195	27	69
0.0157 stable	0.12 weak increase (< (	183	112	154
0.1125 weak increase (< (	-0.041 stable	184	158	85
0.3264 weak increase (< (	0.182 weak increase (< (	175	212	165
-0.0618 stable	-0.008 stable	200	51	101

0.1248 weak increase (< (	0.419 weak increase (< (	165	168	196
0.3263 weak increase (< (	1.321 strong increase (>	88	211	223
-0.0046 stable	0.081 stable	185	98	141
0.0235 stable	0.433 weak increase (< (	161	120	197
0.1392 weak increase (< (	0.236 weak increase (< (	177	173	173
-0.0546 stable	-0.042 stable	199	54	84
0.1116 weak increase (< (	0.062 stable	190	156	140
-0.0137 stable	-0.034 stable	192	86	89
0.0103 stable	0.093 stable	187	110	147
0.0468 stable	0.188 weak increase (< (	181	126	166
-0.0084 stable	-0.027 stable	196	96	91
-0.0524 stable	-0.065 stable	211	56	77
0.0137 stable	0.008 stable	197	111	115
-0.0161 stable	0.085 stable	206	83	142
0.0192 stable	0.021 stable	193	115	124
0.0094 stable	-0.044 stable	201	109	83
0.0062 stable	0.028 stable	194	108	129
0.0226 stable	-0.065 stable	205	119	78
-0.01 stable	-0.009 stable	202	94	97
-0.0134 stable	-0.072 stable	203	87	75
0.038 stable	0.086 stable	198	124	145
-0.03 stable	-0.036 stable	210	69	87
-0.0248 stable	-0.076 stable	212	72	71
-0.0471 stable	-0.032 stable	213	61	90
-0.0107 stable	0.024 stable	204	93	126
-0.0131 stable	-0.074 stable	208	88	73
-0.0111 stable	0.085 stable	207	91	143
-0.0324 stable	0 stable	214	68	105
-0.0249 stable	-0.061 stable	217	71	80
-0.0169 stable	0.04 stable	209	82	135
-0.0343 stable	-0.016 stable	223	65	95

-0.1264	weak decrease (<	-0.008	stable	215	37	100
-0.0203	stable	-0.037	stable	222	78	86
-0.0335	stable	0.086	stable	216	67	144
-0.1424	weak decrease (<	-0.02	stable	219	31	92
0.0011	stable	0.003	stable	221	103	110
-4.00E-04	stable	0.021	stable	218	102	123
-0.0201	stable	-0.018	stable	226	79	93
-0.003	stable	0.017	stable	220	99	121
-0.0217	stable	0.008	stable	224	75	113
0.0179	stable	0.027	stable	225	114	128
-0.011	stable	-0.007	stable	230	92	102
-0.0146	stable	0.003	stable	228	85	109
0.0046	stable	-0.003	stable	227	107	103
0.0019	stable	0.009	stable	229	104	116
-0.0011	stable	0.008	stable	231	101	114