Preregistration

DDD meta-analysis preregistration form

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Study Information

Density-dependent animal dispersal meta-analysis	DDD meta-analysis preregistration form
Description	The aim of this study is to review empirical studies of animal dispersal in relation to conspecific density to examine the evidence for density-dependent dispersal among taxa and test whether reports of its occurrence are taxon-specific and/or biased by the methodology employed.
Hypotheses	If effect size is significantly correlated with one or more methodology categorical variables, then density-dependent dispersal could be considered to be substantially method-dependent.

Design Plan

Study type	**Meta-Analysis**. A systematic review of published studies.

Blinding No blinding is involved in this study.

Study design To gather studies for use in the meta-analysis, we conducted a thorough review of the literature using the Google Scholar database with the keywords “density” and “dispersal” or “emigration” in articles published from January 1st, 2000, through February 28th, 2021, excluding citations. We only retained studies that referred to conspecific density rather than heterospecific or interspecific density, measured animal density at the starting point of dispersal rather than at the end point of dispersal, reported a statistical effect specifically of density on dispersal, and reported results from empirical observations and not from simulations or theoretical models. Studies that had prominent confounding variables (such as an effect of body size or patch quality) were also excluded from the meta-analysis. This search yielded 81 studies in 59 articles that fit our criteria of inclusion.

Randomization Enter your response here.

Sampling Plan

Existing data **Registration prior to analysis of the data**. As of the date of submission, the data exist and you have accessed it, though no analysis has been conducted related to the research plan (including calculation of summary statistics). A common situation for this scenario when a large dataset exists that is used for many different studies over time, or when a data set is randomly split into a sample for exploratory analyses, and the other section of data is reserved for later confirmatory data analysis.

Data collection procedures To derive comparable effect sizes, we extracted the correlation coefficient, Pearson’s r, from all studies of density in relation to dispersal where it was available. Where not available, we calculated r if there was sufficient information provided (Cook et al. 1992).

Sample size	k = 81 studies from n = 52 articles.
Sample size rationale	This sample size corresponds to all literature found to comply to our criteria of inclusion for this study.

Variables

We defined four categorical variables descriptive of the individual animals involved in the study – Taxonomic Group, Sex, Age, and Migratory Behavior – and five categorical variables descriptive of the study methodology – Study Design, Density Metric, Dispersal Metric, Spatial Scale, and Temporal Scale. We recognized five categories of Taxonomic Group: Birds (k = 22), Fishes (k = 8), Herpetofauna (k = 7, consisting of both amphibians and reptiles), Invertebrates (k = 22, consisting of insects and arachnids), and Mammals (k = 22). The variable, Sex, consisted of three categories: males (k = 17), females (k = 17), and males + females (k = 47, studies that did not distinguish between sexes). Age consisted of two categories: adults (k = 51) and juveniles (k = 30) for studies that did distinguish between age groups. Migratory Behavior described whether the animals were 'migratory' (k = 31), i.e., if they performed long-distance migratory movements as part of their life history, such as for breeding, mating, or hibernation, or were 'non-migratory' (k = 50) if they did not perform these movements. Among the methodology variables, Study Design had two categories: 'manipulated' (k = 32), including all experimental studies that employed artificial enclosures, microcosms, mesocosms, or laboratory set-ups, and 'natural' (k = 49) consisting of studies of wild populations in nature. The variable Density Metric had three categories of studies based on assessment location: 'natal' (k = 27) for studies measuring density at a birth or developmental site, 'breeding' (k = 17) for studies measuring density at a breeding site, and 'population' (k = 37) for studies that assessed abundance of individuals in the whole population. Dispersal Metric also had three categories based on dispersal assessment method: 'propensity' (k = 36) for studies assessing the probability or frequency of emigration, 'rate' (k = 15) for studies measuring movement distance per unit time, or 'distance' (k = 30) for studies recording either average or net distance moved by an animal between two points. We divided studies into two categories of Spatial Scale: 'between patches' (k = 43) whereby the start and end point at each patch was recorded, and 'out of a patch' (k = 38) whereby the starting point of the displacement was recorded but the destination (or settlement point) was not recorded in the study. Finally, Temporal Scale of dispersal observations recorded on a scale of a year or less was categorized as 'intra-annual' (k = 41), those recorded between years as 'inter-annual' (k = 31), and those recorded over the course of short-term experimental studies as 'per trial' (k = 9).

Analysis Plan

Statistical models	To examine the impact of each methodology categorical variable on Zr, we will use a multilevel mixed-effects model with all variables added as fixed effects and Taxonomic Group added as a random effect.
Transformations	We will apply Fisher's Z-transform to linearize r values (Corey et al. 1998), then weight each value by the reciprocal of its sampling variance (Borenstein et al. 2021). The resulting weighted effect sizes Zr will be used in subsequent analyses, where a positive value indicates conspecific repulsion (i.e., higher dispersal with increasing density) and a negative value indicates conspecific attraction (i.e., lower dispersal with increasing density).
Data exclusion	We will test for publication bias among studies using a funnel plot of weighted effect sizes versus standard error and an Egger's test for funnel plot asymmetry (Egger et al. 1997) for all studies individually and within categories. We will also apply a trim-and-fill analysis to identify and correct for funnel plot asymmetry (Sterne and Egger 2001).
Missing data	There is no missing data in this dataset.

References

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