Language Inclusion in Ecological Systematic Reviews and Maps: Barriers and Perspectives

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ABSTRACT

Background: Systematic reviews and systematic maps are considered the most reliable form of research evidence in science, but they often neglect non-English-language literature. Non-English-language literature can provide important evidence, especially in ecological studies, which may also influence findings and alter conclusions. To understand the barriers that might limit authors' ability or intent to find and include non-English-language literature, we assessed factors that may predict the inclusion of non-English language literature in ecological systematic reviews and maps, as well as the review authors' perspectives.

Methods: We assessed all systematic reviews and maps published in the journal *Environmental Evidence* (n=72) prior to January 2022, extracting data related to the study's level of language inclusiveness and its potential predictors. We also surveyed the corresponding author from each paper (n=32 responses), gathering information on the barriers to the inclusion of non-English language literature.

Results: Thirty-two (44%) of the 72 assessed reviews did not search or include any non-English language literature. The most common justifications for this were resource and time constraints. Regression analysis showed that systematic reviews and maps involving more authors, authors from a greater number of countries, especially those where English is not the primary language, and author teams that spoke more languages searched in a significantly greater number of non-English languages. Our survey identified that the most common barriers to use of non-English language methods in reviews were the lack of relevant language skills within the review team and limited funding.

Conclusion: Our study suggests that greater language diversity in the review team could help increase language inclusion and thus create more comprehensive and less biased systematic reviews and maps. Machine translation combined with the use of the review team's language skills may help to reduce the financial and resource burdens of translation. The cost of translation could also be included in funding applications to alleviate the financial burden.

Keywords:

Evidence synthesis, language bias, biodiversity conservation, language barriers, non-English language literature

INTRODUCTION

Evidence-based decision-making relies upon evidence synthesis, which involves the collation of all available evidence about a specific topic. Combining a large pool of evidence in a way that minimises bias allows for greater validity of and confidence in the findings. Due to this, systematic reviews and systematic maps are widely regarded as the most robust form of evidence in science and have been used to inform decision-making and policy creation for addressing many global challenges including biodiversity conservation (Gillson *et al.*, 2019, Sutherland, 2022). The field of health science has long relied on evidence synthesis to inform healthcare decision-making (Hartling *et al.*, 2017).

Many authors make the choice to exclude non-English-language literature from their systematic reviews and maps (Neimann Rasmussen and Montgomery, 2018; Zenni *et al.*, 2023). However, this could bias results, reducing their relevance and usefulness, especially for decision-making. For example, the exclusion of non-English language literature can introduce language bias, wherein statistically significant results are more likely to be published in English (Egger et al., 1997). Similarly, there is a language bias in study characteristics because certain types of studies (e.g., specific species, topics and taxa, single species studies, studies conducted at the local scale) are more likely to be published in non-English languages (Konno *et al.*, 2020). Non-English-language literature, if included in systematic reviews and systematic maps, may also provide unique scientific knowledge, especially for those species or regions with little or no English-based knowledge (Amano., *et al.*, 2021; Angulo *et al.*, 2021).

Multiple factors could cause authors to exclude non-English-language literature from their systematic reviews and systematic maps. First, systematic reviews and systematic maps are often time and resource intensive. For example, systematic reviews and systematic maps published by the Collaboration for Environmental Evidence have been found to demand an average of 164 and 211 full-time equivalent days of working respectively (Haddaway and Westgate, 2019). This high demand of time and other resources can lead to the exclusion of non-English language literature since authors may simply not have time to complete the substantial extra work of including non-English language literature. Second, authors may believe that the quantity of relevant non-English-language literature is not high enough to be worthwhile, even though non-English language literature represents a large body of knowledge (Amano, González-Varo and Sutherland, 2016), and the rate of publication is increasing in many non-English languages, at least in biodiversity conservation

(Chowdhury *et al.*, 2022). Third, some may believe that it is not necessary to search in languages other than English due to the perceived lower quality of non-English language literature (Jüni *et al.*, 2002), despite an analysis showing that methodological quality in non-English language literature on biodiversity conservation is only slightly lower than English language literature (Amano *et al.*, 2021). Lastly, a lack of relevant language skills within the review team and inaccessibility of/lack of knowledge for how to find non-English language literature have also been shown to be major impediments to language comprehensiveness in science.

In systematic reviews in social sciences, it has been reported that international review teams are more likely to include non-English language literature in systematic reviews and maps (Neimann Rasmussen and Montgomery 2018), and that lack of time was also frequently cited as a barrier to including non-English language literature. However, the prevalence of, and barriers to, the use of non-English-language literature in environmental systematic reviews and maps are still poorly known. This is concerning, given that non-English-language literature seems to play an especially important role in biodiversity conservation (Amano et al. 2021). *Environmental Evidence* is the journal published by the Collaboration for Environmental Evidence (CEE). This is the only journal that focuses primarily on the publication of systematic reviews and systematic maps relevant to conservation decision-making. Due to rigorous review processes and editorial triage (Pullin *et al.*, 2022), the reviews published in the journal can be considered representative of the highest-quality systematic reviews being produced globally in the field. Topics range across a wide spectrum of ecology, environmental science, and conservation and include an array of authors from around the globe. The CEE guidelines explicitly discuss the issue of inclusion of non-English languages and recognise language bias as a serious potential issue for many systematic reviews (Collaboration for Environmental Evidence, 2022). The CEE guidelines also mention the need to search in multiple languages to achieve a representative sample of literature (Pullin *et al.*, 2022). Despite recommendations such as these, there is little information on whether systematic reviews and systematic maps typically include non-English-language literature, and what kinds of barriers are faced by authors in their pursuit of inclusion of non-English language literature.

Here we aimed to address this knowledge gap by quantifying the use of non-English-language literature in systematic reviews and systematic maps published in *Environmental Evidence* and identifying any factors that might predict the inclusion of non-English-language literature. We also aimed to understand the major barriers that limit the inclusion of non-English language literature, and the authors' perceptions of some suggested methods for overcoming these barriers.

Understanding these factors is a crucial step in mitigating barriers in the future and allowing for greater inclusion of non-English language literature in systematic reviews and systematic maps, critically important tools to inform decision-making and policy in conservation.

Overall, we expected several findings to emerge from our data. The number of non-English languages searched was expected to increase over time, since the understanding that there is relevant non-English language literature has also increased. We also expected systematic reviews and systematic maps with a broader spatial remit to include a wider range of languages, to encompass the knowledge from the countries being studied. It is expected that a larger or more diverse author team would allow for a greater number of languages to be searched through greater linguistic diversity of the review team.

METHODS

Database

This paper analysed systematic reviews and systematic maps published in the journal Environmental Evidence since its launch in 2012 until January 2022. All records were extracted using Scopus (https://www.scopus.com/). As this study aims to assess the use of non-English-language articles in systematic reviews/maps, only systematic reviews and systematic maps were included (i.e. not commentaries or methodologies), resulting in 72 articles for inclusion in this study (Supplementary Data S1).

Data extraction

Metadata containing bibliographical information (title, year of publication) and information about authors and their institutional affiliations were extracted from each of the 72 systematic reviews and systematic maps using the information downloaded from Scopus. Authors were also classified as being from a country where English is the primary language or not. Countries were defined as being English-speaking where English was listed as one of the official languages of the country according to Ethnologue (https://www.ethnologue.com/). Further data were manually extracted from each review/map (see Table S1 for the summary of data collected). Firstly, the abstract and title (and the main text, when needed) of each review/map were assessed to find information related to the study region of the review/map, which was recorded as both the spatial scale and the main region studied. The spatial scale was recorded in the following categories: global, multi-national, national, and regional. Articles that assessed a specific biome found globally were considered global despite having some biogeographic restrictions. The main region studied was recorded according to the spatial scope of the article. Multi-national articles were categorised into a potential 17 regions of the world based on the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' (IPBES) defined subregions (Brooks et al 2016). For national reviews/maps, the country was recorded, and for regional reviews/maps the specific region studied was recorded.

The topic covered by each systematic review and systematic map was also extracted from the abstract or the main text and was categorised into one or multiple categories, with the categories being agriculture, biodiversity conservation, climate change, environmental economics, human health, invasive species, pollution, and resource management. The number of each database/resource searched (bibliographic, web-based, and organisational websites) was recorded. Next, the methods section was assessed, providing information about the search strategy. The languages used for

literature searching, as well as the presence of any geographic limitations in search strings, were recorded. Data was also extracted from the methods section, which documented any imposed language restrictions on identified papers during the screening phase, as well as any justifications for the exclusion of certain languages. This section also occasionally referenced the methods used by the review team to analyse non-English language literature (e.g., review team language skills, the use of machine translation). If such information was available, it was recorded as well. The limitations section of each review/map was analysed to see if the authors acknowledged any imposed language restrictions as a limitation. Each review/map published in *Environmental Evidence* is required to include a *RepOrting standards for Systematic Evidence Synthesis* (ROSES) flow diagram. This provides information on the number of papers included/excluded at each stage of the review process and occasionally reveals the number of papers excluded specifically due to language. Each articles' additional file with metadata on the included systematic reviews or systematic maps was assessed to determine the total number of papers included and the language of each of these papers if this information is recorded by the authors. For 17 systematic reviews and systematic maps, metadata relating to the languages of included sources was not available. For 12 of these, this was manually extracted by excluding the reviews' included papers published in English-only journals, and then manually assessing the remaining papers to determine their language. For the remaining five systematic reviews and systematic maps, this manual extraction was not possible due to the formatting of the provided metadata and/or the large number of included papers. Finally, a global search was performed within the text of the review manuscript of each paper for "language", "English" and any relevant non-English languages, depending on the review's language inclusions (e.g., "French" or "Japanese") to ensure that no relevant information had been missed. Further information on the extraction process can be found in Supplementary Table S1.

Survey

An online survey was sent to the corresponding author of 66 of the 72 articles. Six articles had one of the authors of this paper as their corresponding author and thus were excluded from the analysis. If we received no response from the corresponding author, the next listed author was contacted. Respondents were asked to provide information on the number of languages spoken by or understood by their review team (i.e., fluent enough to be able to interpret a scientific paper written in the language, whether or not this language skill was utilised in the review process, including those not listed as co-authors but who were involved in literature searching/screening/data extraction), to help understand the factors contributing to higher or lower inclusion of non-English language literature.

Respondents were also asked about the barriers that they have experienced in trying to include non-English-language literature in their systematic reviews and systematic maps and any processes they have used to overcome them. Specifically, we asked authors to identify which barriers (if any) they had faced when conducting their systematic review/map (e.g. lack of relevant language skills within review team, lack of time, inaccessibility of non-English language literature). Authors who had faced any barriers were then asked about how likely they would be to expand their review/map to include non-English language literature had this barrier been removed. This allowed us to understand the power that these barriers have to reduce authors willingness/capacity to include non-English language literature. Further questions regarding these methods of minimising or overcoming barriers when including non-English-language literature were asked to gain insight into the best methods and any necessary improvements to processes to overcome barriers to including non-English-language literature. We identified several common methods that authors may use to overcome barriers: machine translation (e.g., Google Translation or other machine translation tools); paid professional human translation; engagement with others with relevant language skills who were not involved as co-authors; and, engagement with others with relevant language skills who were involved as co-authors. Authors were asked about their use of these tools, and/or the main barriers to using these tools (e.g lack of resources, time, unsure how to use). The survey is provided as Supplementary Text S1.

The survey was implemented on Qualtrics (‘Qualtrics’, 2005). We created a link to the survey, which was used for its distribution. The corresponding author of each paper was first contacted via email and invited to respond to the survey and was later reminded if we had received no response after two weeks. The authors of multiple papers were invited to fill out the survey for each review or map that they were involved in. Authors were also asked to let us know if another author of their paper may be more suited to answering the survey and were invited to forward the invitation or provide us with their details. The authors were given one month to answer the survey, with a reminder at the two-week mark. If a month has passed without a response from the first-contacted author, we approached a second author from the paper, usually the senior author (assuming this is the last listed author) or the first author. In this round, authors were given a two-week time frame to complete the survey if they wished. The survey was completed between May and July 2022 in accordance with the University of Queensland’s Institutional Human Research Ethics Approval (approval number 2022/HE000517). All participants were at least 18 years old and provided written consent indicating their agreement to participate in the survey. The Participant Information Sheet clarified the voluntary

nature of participation, the aims of the research, how the data would be used, and that all data would be confidential. After the timeframe, the survey was closed to prevent any future responses.

Statistical analysis

Two multivariate models were developed in R version 3.6.0 (R Core Team, 2019). The first model was a Poisson generalised linear model (GLM) identifying factors associated with a higher number of languages searched by the authors. In this model, the response variable was the number of languages searched in each systematic review/map. We selected explanatory variables that we expected could potentially correlate with a higher number of languages searched: the year of publication, spatial level (two categories: national and provincial vs. multi-national and global as the reference category), number of authors, and number of author countries (defined as the number of distinct countries of the authors' affiliations) and the percentage of authors from countries where English is the primary language. The second model was a binomial GLM, which assessed whether a paper was language inclusive (searched for and/or screened non-English-language literature) or not as the response variable. For this, we used the same explanatory variables as the Poisson GLM above. Both models used data from the extracted information only and not the survey. In running these models, a clear outlier was detected in the Poisson GLM with the full dataset (figure 2). This model was rerun with this outlier removed to assess whether it affected the conclusion of the analysis (also see Supplementary Figure S1, Table S2). The Variance Inflation Factor (VIF) was sufficiently small (< 4.18, calculated with the package *car* in R (Fox and Weisberg, 2019)) for all explanatory variables.

The author's working country may not be a perfect measure of the linguistic capacity of a review team. For this reason, another Poisson GLM and another binomial GLM were run with a reduced dataset from the systematic reviews and systematic maps where the authors responded to the survey. Both the Poisson and Binomial models remained the same as described above with the addition of the variable *number of languages spoken by the review team* in each model. Also, for both models, the variable *number of author countries* was removed from the analysis due to high VIFs (> 5).

RESULTS

Searches for non-English-language articles

Of the 72 included reviews/maps, 44% (n=32) did not search or screen papers in any language other than English. A further 18% (n=13) did not search in any language other than English but did screen papers in multiple languages which were captured by their English-language search. The remaining 38% (n=27) searched for and screened papers in at least one language other than English. 47% (n=15) of the 32 reviews/maps that did not search or screen for non-English-language literature provided some justification for this restriction. Of the 13 reviews/maps that did not search in any language other than English but did screen papers in multiple languages, five (38%) also provided some justification. Across both categories, the most common justifications were resource and time constraints, the linguistic knowledge of the review team and that it was outside of the political or geographic context of the review (n=11, 6 and 2 respectively).

Of the 32 reviews/maps that performed searching and screening only in English, 59.4% (n=19) mentioned language as a limitation and acknowledged that relevant literature was likely to exist in other languages outside the review's-imposed language scope. A further four reviews mentioned language in the limitations section, but justified the exclusion of non-English language literature, stating that they do not believe it would have influenced their findings.

Of the 26 reviews/maps that searched for literature in languages other than English, the number of non-English languages searched ranged from one to seven (median = 3). The range of languages searched by those reviews/maps was extremely limited, with most (92%) languages being of European origin, despite that many of those reviews/maps had a global focus (Figure 1). The most common non-English languages used in the searching stage was Swedish, followed by French, and Finnish (n=18, 15 and 12). 42.3% of the 52 global-scale reviews/maps did not search or screen papers in any language other than English.

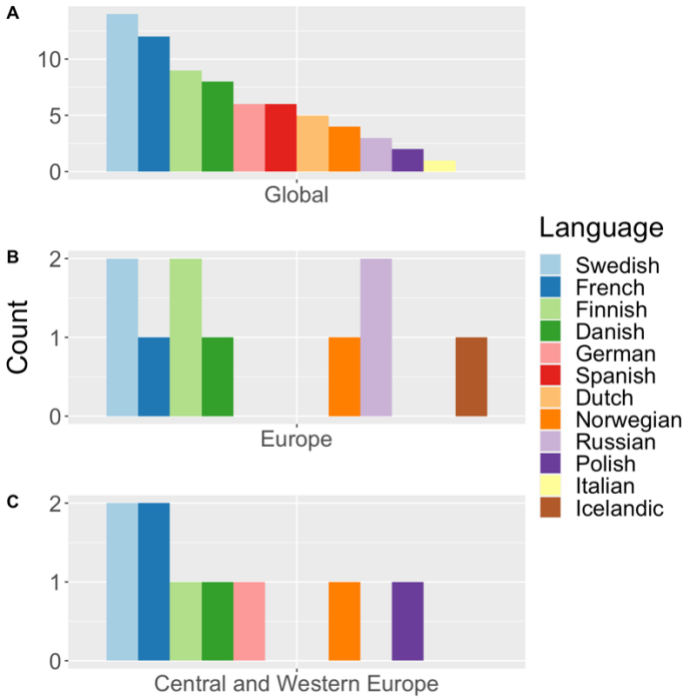

Figure 1: Non-English languages searched by systematic reviews/maps with a specific geographic scope. Scope has been split into (A) global, (B) continental (Europe), and (C) smaller regions (Central and Western Europe) to accurately reflect the spatial scope of the reviews. Some reviews/maps searched in multiple languages. Four other regions (n=2 Africa, n=2 North America, n=1 Southern Africa, n=1 North Asia) were covered in the reviews, but these regions did not search in any non-English languages. Every review/map performed searching in English. n = 72 in total, 55 for Global, 2 for Europe, 9 for Central and Western Europe.

Of the 40 reviews that screened non-English language literature, 22 provided information on how they assessed non-English language literature. Screening was enabled mostly through the language skills of the review team (n=14). A few other reviews utilised human and machine translation (n=1 and 3 respectively). Two reviews utilised both the language skills within their review team and translation (not specified if machine or human). Another two reviews only assessed English-translated titles and abstracts of the non-English-language papers identified.

Use of non-English-language literature

In 42 reviews/maps that identified at least one potentially eligible non-English-language article and reported their reasons for article exclusion, a median of 24.5 non-English-language articles (range: 1 - 323) were excluded before being screened, simply due to being outside of the imposed language scope. Thirty-five reviews provided a list of these excluded non-English articles to allow for further analysis. Of the 26 reviews/maps which searched or screened at least one non-English language, a

297 median of 3.5 non-English language articles (range: 0 - 164) were included in each systematic
298 review/map, constituting a median 4% (range: 0 – 41.4%) of the total number of articles included.
299
300 **Factors associated with language inclusiveness**

301 The Poisson GLM found that the total number of languages searched in each review was negatively
302 associated with the percentage of authors from countries where English is the primary language, and
303 positively with the total number of author countries (Table 1 and Figure 2). The model was run again
304 with the exclusion of an outlier visible in Supplementary Figure 1B, yielding qualitatively similar
305 results (Table 1 and Figure 2).
306
307 Table 1: Results of a Poisson generalised linear model testing associations between the number of
308 languages searched in each systematic review/map and five explanatory variables. The spatial level
309 was grouped into national or provincial vs multi-national or global (the reference category).
310 Significant results are highlighted in bold. See Supplementary Table 2 for the results with the
311 inclusion of the outlier. n = 71.

Variable	Coefficient	Standard error	Z	P
Intercept	0.201	71.665	0.031	0.975
Year	-0.0006	0.036	-0.017	0.987
Spatial level (national and smaller)	-0.096	0.322	-0.299	0.765
Number of authors	-0.046	0.026	-1.772	0.076
Number of author countries	**0.195**	**0.057**	**3.413**	**0.0006**
Percent of authors from countries where English is the primary language	**-0.95**	**0.231**	**-4.109**	**0.00004**

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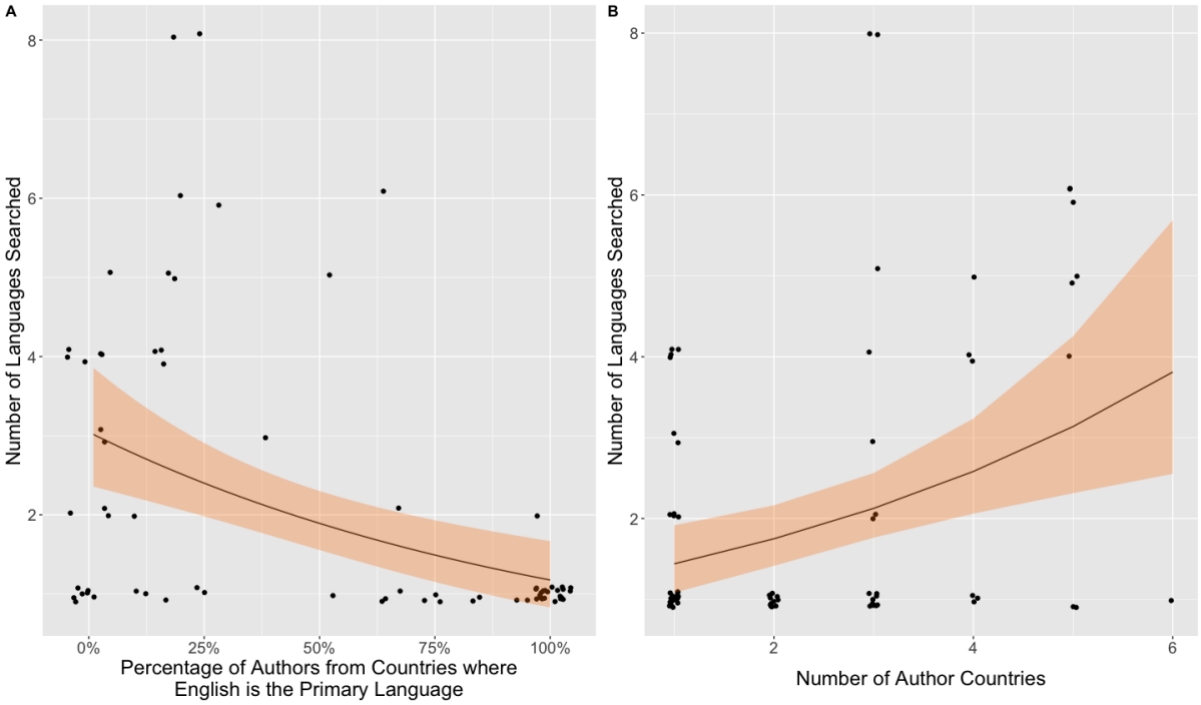

Figure 2: Relationships between the number of languages searched in each systematic review/map and (A) the number of authors and (B) the number of author countries. The regression lines are based on the fitted Poisson generalised linear model (Table 1) with 95% confidence intervals shown as shaded areas and with the exclusion of an outlier. Jitter is used to show all data points. The same figure with the outlier included can be found in Supplementary Figure S1. n = 71.

The above figure shows an obvious outlier, but when removed, the significance did not change.

With the reduced dataset including information from the survey (n=32), only the number of languages spoken by the review team showed a significant positive association with the number of languages searched (Table 2, Figure 3).

Table 2: Results of Poisson generalised linear model (with the reduced dataset including survey data) testing associations between the number of languages searched in each systematic review/map and four explanatory variables. The spatial level was grouped into national or provincial vs multi-national or global (the reference category). Significant results are highlighted in bold. n = 32.

Variable	Coefficient	Standard error	Z	P
Intercept	-117.1	151.5	-0.773	0.439
Year	0.058	0.075	0.774	0.469
Spatial level (national and smaller)	-0.174	0.372	-0.467	0.64
Number of authors	0.0004	0.013	0.034	0.973
Number of languages spoken by review team	**0.21**	**0.055**	**3.804**	**0.0001**
Percent of authors from countries where English is the primary language	-0.424	0.403	-1.052	0.293

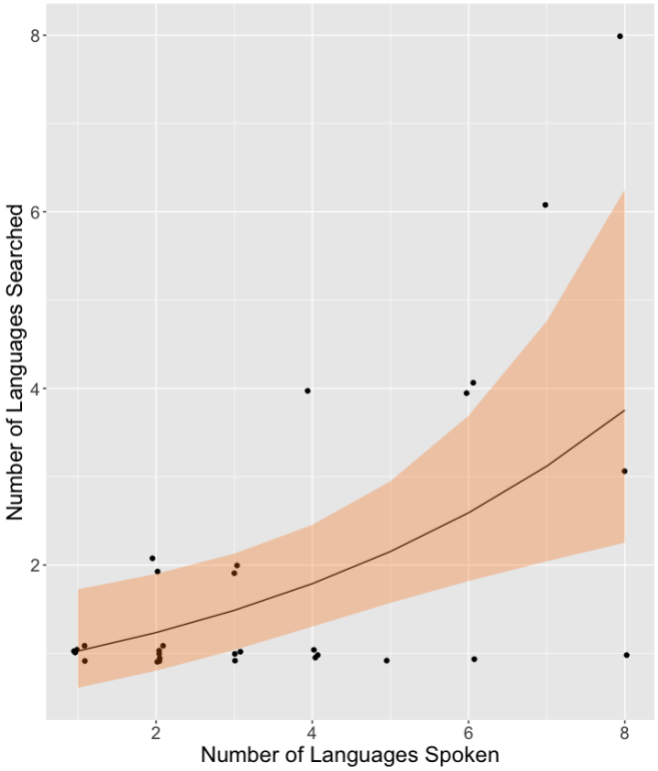

Figure 3: Relationship between the number of languages searched in each systematic review/map and the number of languages spoken by the review team. The regression line is based on the fitted Poisson generalised linear model using survey data (Table 2). The shaded area represents 95% confidence interval. Jitter is used to show all data points. n = 32.

The binomial GLM revealed that the level of language inclusiveness (searched for and/or screened non-English-language literature or not) also showed a significant negative association with the percentage of authors from countries where English is the primary language in both the full analysis (Table 3 and Figure 4) and survey analysis (Tables 4 and Figure 5). Neither of these results changed when the outlier was excluded from the analysis.

Table 3: Results of binomial generalised linear model testing the association between the level of language inclusiveness (searched for and/or screened non-English- language literature or not) in each systematic review/map and explanatory variable. Spatial level was grouped into two: national or provincial vs multi-national or global (the reference category). n = 72.

Variable	**Coefficient**	**Standard error**	**Z**	**P**
Intercept	63.31	256.297	0.247	0.805
Year	-0.031	0.127	-0.241	0.809
Spatial level (national and smaller)	-0.828	1.189	-0.697	0.486
Number of authors	0.079	0.095	0.832	0.405

Number of author countries	0.023	0.234	0.098	0.922
Percent of authors from countries where English is the primary language	**-3.554**	**0.85**	**-4.184**	**0.00003**

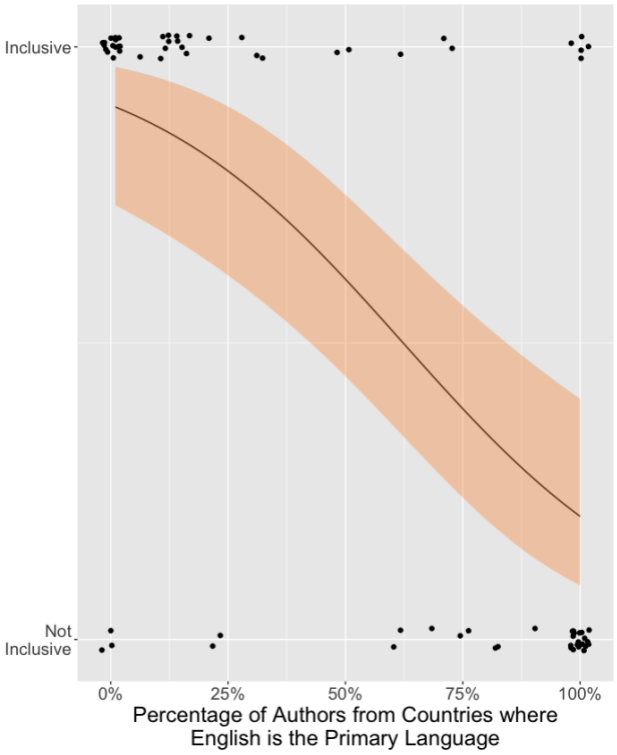

Figure 4: Relationship between whether a review was inclusive of other languages at either the searching or screening stage and the percentage of authors from a country where English is the primary language. The regression line is based on the fitted binomial generalised linear model (Table 3). The shaded area represents 95% confidence interval. Jitter is used to show all data points. n = 72.

Table 4: Results of binomial generalised linear model (with the reduced dataset of survey data, testing the association between the level of language inclusiveness (searched for and/or screened non-English- language literature or not) in each systematic review/map and explanatory variable. Spatial level was grouped into two: national and smaller vs multi-national or global (the reference category). n = 32.

Variable	**Coefficient**	**Standard error**	**Z**	**P**
Intercept	-302.2	461.7	-0.655	0.513
Year	0.151	0.229	0.66	0.509
Spatial level (national and smaller)	-0.796	1.322	-0.602	0.547
Number of authors	-0.004	0.065	-0.057	0.954

Number of languages spoken by review team	-0.07	0.227	-0.307	0.759
Percent of authors from countries where English is the primary language	**-3.501**	**1.479**	**-2.368**	**0.018**

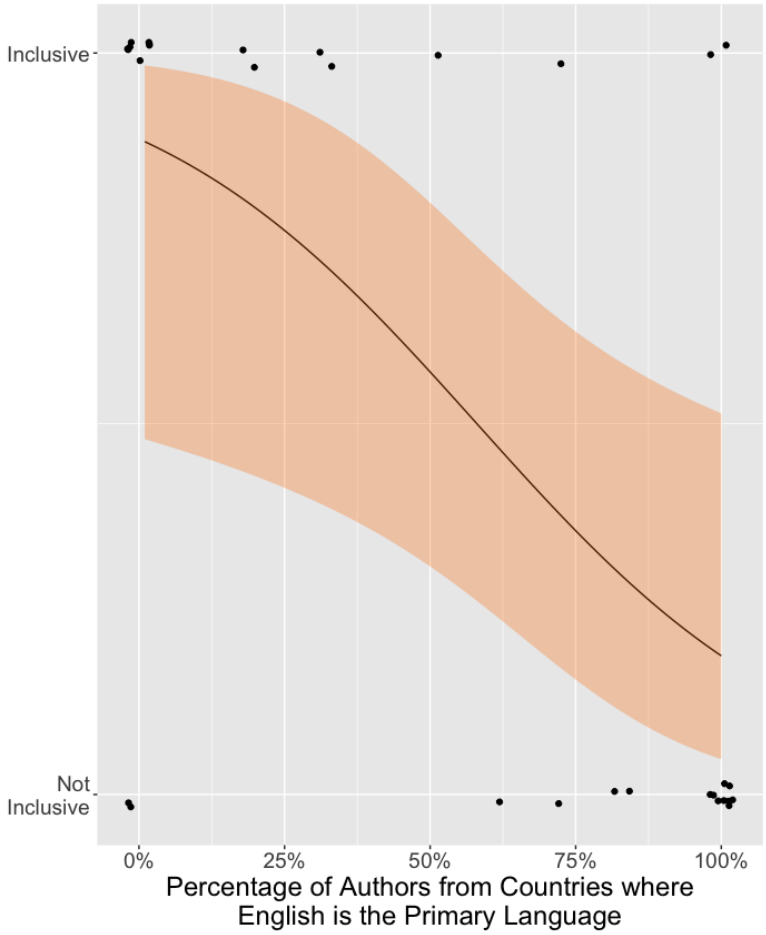

Figure 5: Relationship between whether a review was inclusive of other languages at either the searching or screening stage and the percentage of authors from a country where English is the primary language. The regression line is based on the fitted binomial generalised linear model using survey data (Table 4). The shaded area represents 95% confidence interval. Jitter is used to show all data points. n = 32.

Language barriers experienced by review teams

Our survey received 32 responses from authors of our 66 different systematic reviews/maps (response rate = 48%). Fifty-three authors listed as the corresponding authors of the papers were contacted in the first round. Twenty-eight authors were contacted in the second round if no response was given in the first round. The second round of authors consisted of the highest listed author other

than the corresponding author. Responses revealed that the review team spoke a median of three languages (range: 1 - 9, including English for all reviews). The most common barriers that impeded the searching and screening of non-English-language articles were a lack of relevant language skills within the review team (n = 21), followed by limited time (n = 18, Figure 6). Only four authors stated that they had not experienced any barriers in preparing their review. For authors who had faced some sort of barrier, 68% stated that if they had been removed, they would have been somewhat (32%) or extremely (36%) likely to expand their search to include non-English language literature.

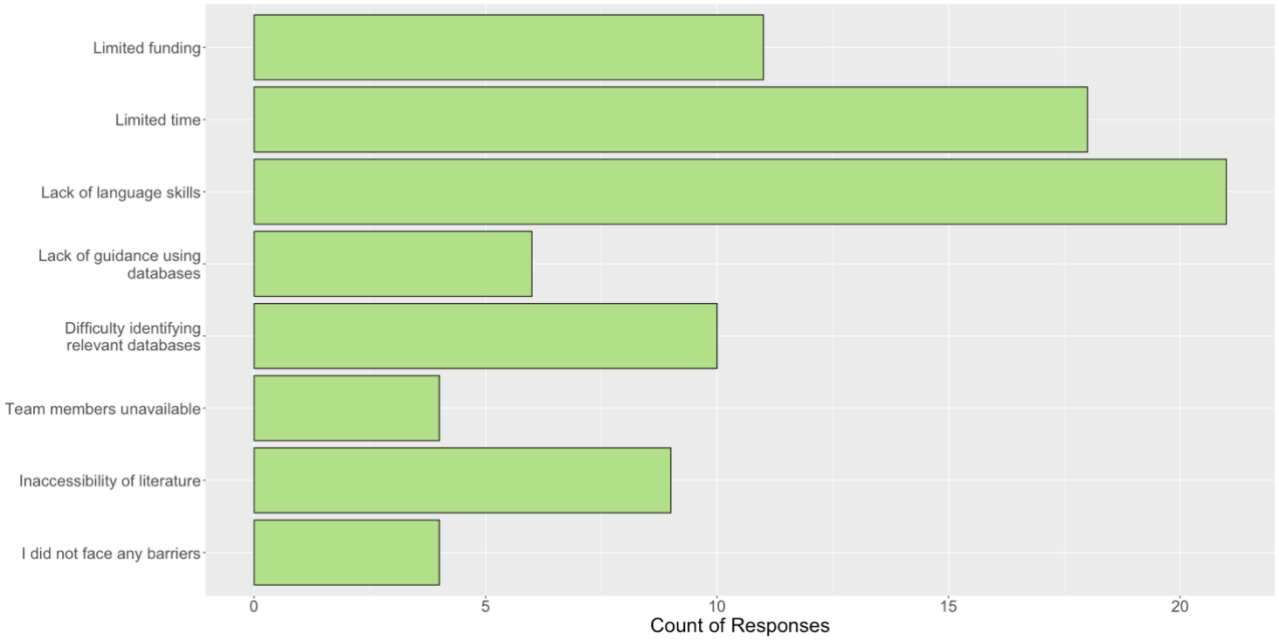

Figure 6: Count of barriers that impeded the searching and screening of non-English-language articles in the specific systematic review/map published in Environmental Evidence. The 32 respondents were allowed to select multiple barriers, so the total count of barriers exceeds the number of respondents.

During the searching stage, 28% (n=9) of authors utilised one of more tools to enable the assessment of non-English-language literature. The most frequently reported processes were engagement with others with relevant language skills who were included as co-authors (n=7), followed by machine translation (n= 3). A further 31% (n=10) considered using those processes but ultimately decided against it, due to time constraints (n=8), lack of funding (n=3), limited resources (n=3), and the thought that non-English languages would not hold much relevant literature (n=3). During the screening stage, 22% (n=7) of authors utilised some process to enable the assessment of non-English language literature, and a further 38% (n=12) considered it but ultimately decided against it, due to

time financial and/or resource limitations (n=8), or because the author team did not have experience using processes such machine translation (n=2).

Authors were concerned that using machine translation in both the searching and screening stage might cause loss of some of the original meaning (Figure 7A). The quality of translations and the time-consuming nature of machine translation were selected as the next major barriers in the searching and screening stages, respectively. The authors stated the major barrier to using professional human translation in the searching and screening stage was financial limitations, followed by difficulty finding translators with relevant subject-specific language skills (Figure 7B). Respondents identified the main barriers to engaging others with relevant language skills as the difficulty in finding contributors with relevant subject-specific language in both the searching and screening stages (Figure 7C).

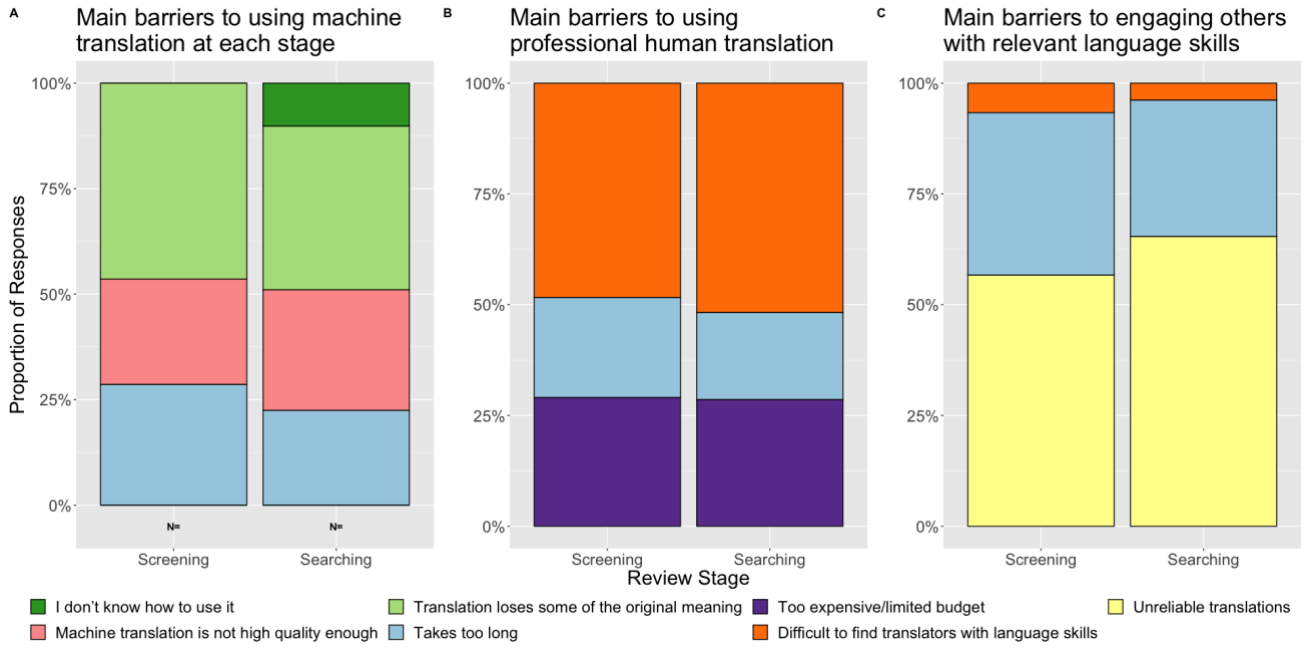

Figure 7: Barriers relating to different known methods to facilitate the inclusion of non-English-language literature in the screening and searching stages of systematic reviews/maps: (A) machine translation, (B) professional human translation, and (C) engaging others with relevant language skills. Authors could select multiple barriers. n=32 for every bar as every author answered every survey questions.

Finally, the authors were asked questions regarding a study by Khelifa, Amano and Nuñez (2021), which proposes a system where skills in a non-English language (reading and interpreting papers) can be exchanged for skills in another non-English language or English language proofreading. When asked how likely authors would be to access a system like this, 49% of authors responded that they would be somewhat or extremely unlikely to participate (Figure 6A). Most authors stated that

participants' time intensity and unbalanced workloads were the main reasons not to access such a system (Figure 8B)

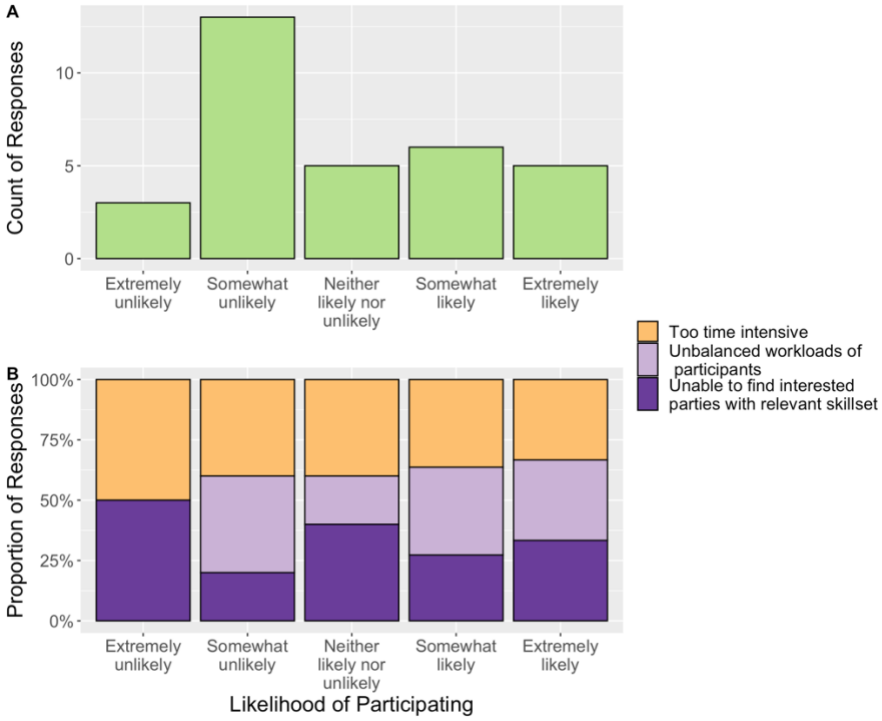

Figure 8: (A) The count of responses of participants likelihood to participate in a language exchange system proposed by Khelifa et al (2021). (B) Proportion of selected barriers to the use of this system. Respondents were allowed to select only one measure of likeliness, but multiple barriers. n = 32.

DISCUSSION

We found that inclusion of non-English-language literature in ecological systematic reviews and maps at any stage was not widespread, although the journal's guidelines strongly recommend searching in multiple languages for reviews to identify relevant articles in as unbiased way as possible (Pullin *et al.*, 2022). Our study revealed that only 38% of the 72 reviews/maps, and 36.5% of the 52 global reviews/maps, published in *Environmental Evidence* included non-English languages at the searching stage. Even in those reviews/maps that identified potentially eligible non-English-language articles.

This represents a large number of articles that were picked up in the searching stage and potentially could have been relevant to the review. Articles that searched in multiple languages identified a median of 4 non-English language studies (range 0-164) that were deemed relevant and included in the review/map. This supports the need for article searching in multiple languages, as information could easily be missed if searching is restricted to English. Excluding relevant non-English language articles from systematic reviews/maps can be problematic. The inclusion of relevant non-English language articles could reduce the effect of language bias in published research, potentially increasing the validity of conclusions drawn (Egger *et al.*, 1997; Konno *et al.*, 2020), or potentially increase the taxonomic or geographic coverage of the data (Amano., et al., 2021).

Contrary to our hypothesis, we did not find an increase through time in the number of reviews/maps which searched for/screened non-English language literature. Limiting search languages to those spoken by the author team can cause studies to exclude relevant literature in other languages. To ensure all relevant information is captured, the languages used in searching should reflect the geographic scope of the review or the topic. While this should be a consideration that authors incorporate into all work, this can also be enforced by journals through journal guidelines and checked by editors and reviewers during the review process to ensure that the breadth of languages searched is appropriate for the geographic scope of the review. This scope should be dictated by what is applicable to the focus of the study. Studies may declare a global scope but often will be geographically restricted to the assessed species ranges. In this, a smaller array of languages may appropriately cover the scope of the review. It is recommended that authors aim to include major languages within their review's geographic scope, and any other minor languages which are believed to be relevant. However, we understand that resources dictate that this is not always possible. We recommend greater transparency in articulating the scope of a review is applied. Specifically,

geographically, or linguistically biased evidence should be declared, and the review's scope should be adjusted accordingly.

Our survey revealed that most (87.5%) authors had faced at least one barrier which hindered their use of non-English language literature in their systematic review/map, but most (67.9%) authors would also be at least somewhat likely to expand their search had this barrier been removed. This reveals that most authors have some desire to include a broader range of languages but have found the barriers too great to overcome. When asked about processes to reduce the barriers and enable greater assessment of non-English language literature, the majority (78%) of authors did not utilise any tools or processes. This may be because of some of the seemingly immovable barriers, such as lack of time or funding which are not primarily controlled by the authors themselves (Stolerman and Stenius, 2008).

The most common method to screen non-English articles was utilising language skills within the review team. We found that author teams with a higher proportion of authors from countries where English is not the primary language tended to search in more non-English languages and were more likely to include any papers in non-English languages in either the searching or screening stage. Similarly, our analysis also demonstrated that more diverse review teams, in terms of author countries and languages spoken, used more languages in searching. These results suggest that a purposeful expansion of author teams to include a wider representation of linguistic abilities would allow the systematic review/map to perform a more comprehensive synthesis of evidence sourced from multiple languages. More diverse research teams are also able to provide varied cultural perspectives on a topic, which may result in a deeper understanding of the topic and the context surrounding it (Blicharska et al., 2017). The identification of relevant necessary language skills can be done in the initial stages of planning the review and should consider the geographic scope and where relevant literature may have been produced.

One alternative to increasing the size or composition of the review team would be a language skill exchange system, such as proposed by Khelifa, Amano and Nuñez (2022). To our knowledge, systems such as this exist within other disciplines (e.g., Cochrane Engage, The Cochrane Collaboration, no date), but not within conservation science. However, this system would still require addressing the issue of the time intensity and balancing the workloads of participants, both raised by authors of systematic reviews/maps in this study.

Another method used by research teams to identify and assess non-English language literature was translation, in the form of both human translation (outside of the author team) and machine translation. Professional human translation is a translation option that is often overlooked due to expense. Although professional translation will usually produce better results than machine translation, it can be expensive and difficult to find someone with subject-specific language skills. For this reason, translation costs could be built into funding applications, and/or could be distributed at an institutional level. Machine translation is a lower-cost alternative, but authors were concerned about potential alterations of meaning, and an observed low quality of machine translations. This is important to overcome, as any alterations of meaning may entirely alter the interpretation of the work, leading to inaccurate conclusions (Patil and Davies, 2014; Sutrisno, 2020). Understanding the validity of using machine translation in academic work is crucial but is largely understudied. There are several methods that can be employed to decrease the chance of errors, mostly requiring additional human input to assess the translation systems output (Rivera-Trigueros, 2022; Sun *et al.*, 2022). Machine translation combined with the utilisation of the review team's knowledge may reduce the financial and resource burden of translation. The combination of both methods might reduce the inaccuracy of machine translation through manual checking while reducing the individual time burden of authors performing full translations (Steigerwald et al., 2022).

Another major barrier faced by authors was a lack of time and lack of funding. These limitations may cause authors to inflict restrictions that would otherwise not exist on reviews, such as restricting the languages used in searching and screening. These barriers are often not directly influenced by the authors themselves and are instead imposed by restrictions and pressures from institutions and funding bodies. These organisations could take responsibility for overcoming this barrier by encouraging the use of non-English language literature through funding and support for authors (Stolerman and Stenius, 2008; Walpole, 2019). Consideration of language inclusion at the grant application and planning stage will also help to minimise these barriers by building these costs into the overall estimates for the time and financial requirements of a project. However, we do recognise that these kinds of studies are often already considered expensive, so additional costs may be perceived as unreasonable by some. In this, there is a need for more studies to quantify the time requirements versus benefits in terms of rigour at each stage. When resources are limited, a cost-benefit analysis of each process may be advantageous in identifying which parts of a review are the most beneficial to emphasise.

We acknowledge the limitations of our study. Firstly, our study's relatively small sample size may limit the broad applicability of findings, though this study investigated all systematic reviews and maps published in Environmental Evidence, the only journal that specifically publishes ecological systematic reviews and systematic maps in the field of conservation. Reviews published by CEE are of a high quality due to the rigorous standards authors must adhere to. Appraisal of this body of work highlights meaningful areas of improvement and methodological ideals to work towards. Expanding this scope to include a wider pool of systematic reviews and maps could result in the appraisal of studies with poorer methodological standards, meaning that the results of the analysis would be less meaningful.

Zenni et al (2023) have undertaken a similar study, assessing the use of non-English language literature in ecological evidence synthesis. This study also identified a large proportion of articles that did not include non-English language literature, as well as a limited change in rates of inclusion over time. Studies similar to ours, over a wider range of databases would be recommended to accurately describe the state of non-English-language use in systematic reviews and systematic maps. Nevertheless, given that systematic reviews/maps published in this journal follow the strictest guidelines, we expect that the level of use of non-English-language articles among broader ecological studies is much lower. Our study was also limited by the information provided in the papers. For some of the reviews/maps, relevant information to our study (e.g., the number of non-English-language articles included) could not be found. Our survey received a good response rate (48%), although the absolute sample size was still rather small. We also acknowledge that the working country of authors is not a perfect measure of the diversity in languages that may be understood by a review team. For this reason, we conducted our analysis with the language data provided in the survey, on the limited sample of survey respondents to compare the outcomes, which was also found to significantly affect the number of languages used in searching.

This research extends a body of work that exists in other disciplines but has not been explored within conservation science. Understanding the impact that language barriers have on conservation research shows what pools of knowledge are being utilised most, and what is being ignored. Since systematic reviews are often designed to be used by practitioners and decision-makers, any bias or missed information from restricted language reviews could be detrimental to the usefulness of the review. However, there is no simple solution, so it is imperative to understand why authors put these restrictions in place to create more effective solutions. Our survey allowed us to understand the authors' perspectives of these reviews, the difficulties they have faced including multiple languages

559 and the approaches they have utilised to overcome this issue. Careful consideration of language as a
560 barrier should be exercised by any authors looking to undertake a systematic review or systematic
561 map, any editors and reviewers who assess the validity of a systematic review/map, and any funding
562 body that supports relevant projects. Understanding the most effective use of resources for the
563 specific review will allow teams to build provisions for the assessment of non-English language
564 literature into their planning and could lead to greater inclusion of non-English language literature.

Supplementary materials are supplied in an additional document.

Acknowledgements

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Conflict of interest

The authors reported no conflict of interest.

Data availability statement

Supplementary data is available at the end of this document. The data used in the analysis and all codes used in the analysis is provided at https://github.com/KHannah12/UseofNEL/. We are unable to make data on participants' responses to the survey questions publicly available, as per our agreement with the University of Queensland Ethics office and due to the confidentiality of the data.

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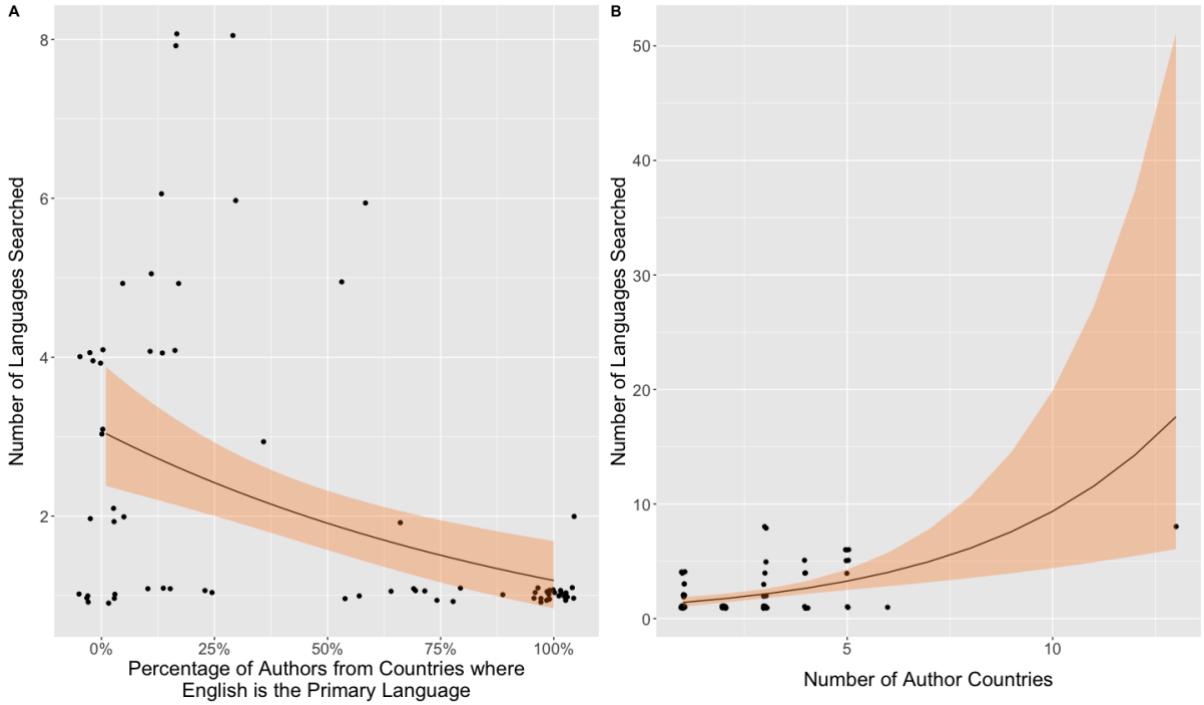
Supplementary Materials



Supplementary Figure S1: Relationships between the number of languages searched in each systematic review/map and (A) the number of authors and (B) the number of author countries. The regression lines are based on the fitted Poisson generalised linear model (Table S2) with 95% confidence intervals shown as shaded areas and with the inclusion of an outlier. Jitter is used to show all data points. n = 71. The same figure with the outlier excluded can be found in the main text figure 2.

Supplementary Table S1: Factors extracted from the each paper for use in analysis and the methods of extraction used.

Variable	**Value**	**Methods**
Author names and institutional affiliation	Author names and the country of their institutional affiliation	Downloaded from Scopus
Year of publication	Year	Downloaded from Scopus
Article type	Systematic Review or Systematic Map	Extracted from the article title
Geographic search scope	Do the search strings feature any geographic limitations	Methods section was searched for relevant information. If not recorded in the methods,

		additional files were searched for the list of exact search strings
Number of bibliographic databases	Number of bibliographic databases used in the literature search	Whole article and additional files searched for relevant information
Number of web-based search engines	Number of web-based search engines used in the literature search	Whole article and additional files searched for relevant information
Number of organisational websites	Number of organisational websites used in the literature search	Whole article and additional files searched for relevant information
Spatial Scope of Review	Recorded as: global, multi-national, national, provincial/state, local (being anything smaller than provincial/state) or other (anything which does not fit in the prescribed categories)	Whole article was assessed for relevant information
Main Region Studied	Main region studied was recorded from a potential 17 regions of the world based on IPBES's defined subregions described in Brooks *et al* (2016). Studies which assessed a specific biome found globally were considered global despite having some geographic restrictions.	Whole article was assessed for relevant information
Topic(s) Covered	Categorised into agriculture, biodiversity conservation, climate change, environmental economics, human health, invasive species, pollution, and resource management. Papers can fit into one or multiple categories.	Abstract and title was assessed to find relevant information
Searched LOE? (Language other than English)	Was LOE used in searching for papers (Yes/No). If yes, what languages?	Methods section was searched for relevant information. If not recorded in the methods, additional files were searched for the list of

		exact search strings and languages used
LOE-related screening inclusion/exclusion criteria	Level of inclusion at the screening stage. Recorded as: LOE-Restricted (does not include LOE), LOE-Open (Includes all languages), LOE-Inclusive (Included some languages), Not Specified (Authors do not mention language inclusion. Categories based on language inclusiveness categories from Neimann Rasmussen and Montgomery (2018)	Methods section was assessed for relevant information pertaining to languages
	Split into 3 categories capturing the authors intention to include LOE throughout the searching and screening staged. Recorded as: No attempt (did not search in any LOE and did not allow LOE at the screening stage), some attempt (did not search in LOE but did screen papers in multiple languages) and language inclusive (searched in multiple languages and screened papers in multiple languages)	Based on the previous two criteria. Determined based on information found in the methods section.
Are language restrictions justified?	Yes/No/NA	Methods and discussion were assessed for relevant information pertaining to languages
Method of assessing LOE papers	If recorded, the methods used to assess non-English language papers was recorded	Methods section was assessed for relevant information pertaining to languages
Wording of LOE inclusion/exclusion criteria	Exact paragraph discussing language inclusion/exclusion	Methods section was assessed for relevant information pertaining to language. Section relating to language inclusion was copied exactly
Reason given	Summary of inclusion/exclusion paragraph	Any reflections and justifications from the

		copied paragraph were extracted
Do they mention language as a limitation?	Are languages discussed as a limitation? (Yes/No). If yes, how? (e.g., paper acknowledges that evidence is likely to exist in other languages)	Limitations section of the discussion was searched for relevant information
Number of studies found in the initial search after duplicate removal	Total number of papers	Information extracted from included flow diagram outlining the included wither in the paper or the additional files.
Number of studies after title and abstract screening	Total number of papers	Information extracted from the RoSES flow diagram included wither in the paper or the additional files
Number of full-text articles assessed	Total number of papers	Information extracted from the RoSES flow diagram included wither in the paper or the additional files
Number of studies included in SR	Total number of papers	Information extracted from the RoSES flow diagram included wither in the paper or the additional files
Number of studies excluded for being non-English	Total number of papers excluded due to not fitting in the imposed language restrictions	Methods, RoSES diagram, and additional files assessed. Only some papers included this information
Number of non-English Studies included	Total number of non-English language papers included in the systematic review/map	Methods, RoSES diagram, and additional files assessed. Only some

		papers included this information
Number of studies included for each language	Total number of papers included in the systematic review/map for each different language	Methods, RoSES diagram, and additional files assessed. Only some papers included this information

Supplementary Table S2: Results of Poisson generalised linear model testing associations between the number of languages searched in each systematic review/map and five explanatory variables using full data with the exclusion of one outlier. Spatial level was grouped into two: national or provincial vs multi-national or global (the reference category). Significant results are highlighted in bold. See Table 1 for the results with the exclusion of the outlier n = 72.

Variable	Coefficient	Standard error	Z	P
Intercept	5.1	72.029	0.071	0.944
Year	-0.002	0.036	-0.059	0.953
Spatial level (national and smaller)	-0.055	0.319	-0.173	0.863
Number of authors	-0.03	0.018	-1.708	0.088
Number of author countries	**0.21**	**0.053**	**3.966**	**0.00007**
Percent of authors from countries where English is the primary language	**-0.947**	**0.231**	**-4.094**	**0.00004**

Supplementary Text S1

Chapter 1 Survey - Final

Start of Block: Block 1

Consent Form

Participant Information Sheet

Research Title: Patterns and Predictors of the Use of Non-English Language Literature in Ecological Systematic Reviews and Systematic Maps

Researcher(s): Kelsey Hannah and Dr Tatsuya Amano

Thank you for your interest in participating in this research project. Please read the following information about the project to decide whether you would like to take part in this research. Please feel free to ask any questions you might have about your involvement in the project.

If you decide to participate in this research, please keep in mind that your participation is entirely voluntary. If you do not wish to take part, you do not have to. If you decide to take part and later change your mind, you are free to stop at any time, and you would not need to give any explanation for your decision to stop participating. If you choose to stop participating, simply do not submit the online survey (i.e., do not click the 'submit' icon at the end of the survey) and close the web browser.

What is this research about?

English is often considered the international language of science communication. Despite this, it has been established that English-language science may not be representative of all research. This project will aim to quantify the patterns and predictors of use of non-English language literature in Systematic Reviews and Maps published in the journal Environmental Evidence. We will also attempt to understand how authors view this issue and what they perceive to be the major barriers to the inclusion of non-English language literature in order to make recommendations of solutions.

Risks

Participation in this study should involve no physical or mental discomfort, and no risks beyond those of everyday living. If, however, you should find any question to be invasive or offensive, you are free to omit answering or participating in that aspect of the study. The survey will take about 15 minutes to complete and can be undertaken at any time or place that is convenient to you.

Benefits of your participation in the study

Your participation will allow us to understand the barriers faced by authors when it comes to including non-English language literature, as well as the intention of authors to overcoming these barriers. By understanding different barriers and assessing methods of overcoming these barriers we aim to improve practice and outcomes in future synthesis, allowing for more seamless inclusion of non-English language literature in systematic reviews.

What will happen to the information about me?

All information collected about you will remain confidential. Only the first question, pertaining to the language skills of the review team, will be linked to the specific review of the corresponding author to include this factor in analysis as a predictor. In this, the data relating to specific reviews will be used in statistical analysis and will not be presented as raw data linked to the specific review. All remaining questions, including all opinion/experience-based questions will not be identifiable, and will only be presented as an aggregate in results.

It is anticipated that the results of this research project will be published and/or presented in a variety of forms. In any publication and/or presentation, information will be provided in such a way that you cannot be identified.

Who can I contact if I have any concerns about the project?

This study has been cleared in accordance with the ethical review guidelines and processes of the University of Queensland. These guidelines are endorsed by the University's Human Ethics Committee and registered with the Australian Health Ethics Committee as complying with the National Statement (2022/HE000517). You are free to discuss your participation in this study with project staff (contactable at kelsey.hannah@uqconnect.edu.au or t.amano@uq.edu.au). If you would like to speak to an officer of the University not involved in the study, you may contact the University of Queensland Ethics Officer on +61 (07) 3365 3924. If you would like to learn the outcome of the study in which you are participating, please feel free to email Kelsey Hannah (kelsey.hannah@uqconnect.edu.au) or Tatsuya Amano (t.amano@uq.edu.au) and we can organise to send you a summary of the study once it is complete. You can also obtain general information on the

project at: https://translatesciences.com/.

Consent form

Please take the time to read the project information that is provided above. Your participation is voluntary, and you can choose to withdraw at any point. Should you wish to clarify any aspect of your potential participation or need more information you can also speak directly to a lead researcher before agreeing or disagreeing to take part in the evaluation. If you understand the purpose of the research project and the nature of your involvement, then please complete the following:

☐ I have read the information provided about the research project and understand the nature of my involvement. I understand any information I provide will not be individually identifiable. I agree to take part and understand I can withdraw at any time. (4)

☐ I am over 18 years of age (5)

End of Block: Block 1

Start of Block: Review Title

Q1 What is the title of the relevant systematic review or map you are an author on
(This will be in the email that was sent to you with the link)

_____

End of Block: Review Title

Start of Block: Composition of review team and review info

Q2 Please describe all languages spoken or understood within your review team that you are aware of.

i.e fluent enough to be able to interpret a scientific paper by your review team (whether or not this language skill was utilised in the review process), including those not listed as co-authors but who

were involved in literature searching/screening/data extraction
(Select all that apply)

- [ ] Arabic (2)
- [ ] Bengali (21)
- [ ] Danish (20)
- [ ] Dutch (3)
- [ ] English (4)
- [ ] Finnish (5)
- [ ] French (6)
- [ ] German (7)
- [ ] Hindi (19)
- [ ] Italian (8)
- [ ] Japanese (9)
- [ ] Korean (22)
- [ ] Norwegian (10)
- [ ] Polish (11)
- [ ] Portuguese (12)
- [ ] Russian (13)

- [ ] Simplified Chinese (17)
- [ ] Spanish (14)
- [ ] Swedish (15)
- [ ] Turkish (23)
- [ ] Traditional Chinese (18)
- [ ] Vietnamese (24)
- [ ] Other (Please describe) (16) _____

End of Block: Composition of review team and review info

Start of Block: Perceived barriers to the inclusion of non-English literature

Q3 What barriers did you face that limited your ability or intent to search for/screen non-English language literature in your systematic reviews/systematic maps (Select all that apply)

- ☐ Lack of relevant language skills within review team (1)
- ☐ Team members not available enough to use their language skills in searching/screening (11)
- ☐ Limited funding (2)
- ☐ Limited time (3)
- ☐ Inaccessibility of non-English language literature (e.g. article PDF unavailable) (4)
- ☐ You thought non-English language studies were of low quality, thus can be excluded (6)
- ☐ Lack of relevance for the review question (e.g., your review focused on an English-speaking country) (7)
- ☐ Difficulty identifying relevant databases for non-English language literature (8)
- ☐ Lack of guidance searching for/operating non-English language databases (12)
- ☐ Other (please describe) (9) _____
- ☐ ⊗ I did not face any barriers (10)

Display This Question:

If What barriers did you face that limited your ability or intent to search for/screen non-English l... != I did not face any barriers

Q4 Had this barrier(s) been removed; how likely would you be to expand your review to include relevant non-English language literature?

- ○ Extremely unlikely (1)
- ○ Somewhat unlikely (2)
- ○ Neither likely nor unlikely (3)
- ○ Somewhat likely (4)
- ○ Extremely likely (5)

End of Block: Perceived barriers to the inclusion of non-English literature

Start of Block: Potential Solutions

Q5 Did you use, or did you consider utilising any processes to enable the assessment of non-English language literature during the **searching stage** for this specific review? eg. Machine translation, human translation, engaged with colleagues with relevant language skills.

- ○ I used them while searching for literature (1)
- ○ I considered it but ultimately did not (please explain why not) (2) _____
- ○ I did not consider it (3)

Display This Question:

If Did you use, or did you consider utilising any processes to enable the assessment of non-English... = I used them while searching for literature

Q6 What processes did you utilise to enable the assessment of non-English language literature during the **searching stage** for this specific review?
(Select all that apply)

- ☐ Machine translation (e.g., Google Translate) (1)
- ☐ Paid for human translations (2)
- ☐ Engaged those with relevant language skills, who were not involved as co-authors and not paid (3)
- ☐ Engaged those with relevant language skills, who were included as co-authors (4)
- ☐ Other (please describe) (5)
  _____

Page Break

Q7 Did you use, or did you consider utilising any processes to enable the assessment of non-English language literature during the **screening stage** for this specific review? eg. Machine translation, human translation, engaged with colleagues with relevant language skills.

- ○ I used them during screening (1)
- ○ I considered it but ultimately did not (please explain why not) (2) _____
- ○ I did not consider it (please explain why not) (3) _____

Display This Question:

If Did you use, or did you consider utilising any processes to enable the assessment of non-English... = I used them during screening

Q8 What processes did you utilise to enable the assessment of non-English language literature during the **screening stage** for this specific review?
(Select all that apply)

- ☐ Machine translation (e.g., Google Translate) (1)
- ☐ Paid for human translations (2)
- ☐ Engaged those with relevant language skills, who were not involved as co-authors and not paid (3)
- ☐ Engaged those with relevant language skills, who were included as co-authors (4)
- ☐ Other (please describe) (5) _____

Page Break

Q9 What do you think are the main barriers to using machine translation (e.g., Google Translate) for facilitating the **search** for non-English-language literature for use in systematic reviews/maps? (Select all that apply)

- ☐ Machine translation is not high quality enough (e.g., it doesn't translate well) (1)
- ☐ It is time-consuming to use (e.g., need to copy and paste relevant sentences into the service) (2)
- ☐ Translation loses some of the original meaning/meanings may be altered in direct translation (3)
- ☐ I don't know how to use it (4)
- ☐ Other (Please describe) (5) _____

Q10 What do you think are the main barriers to using machine translation (e.g., Google Translate) for facilitating the **screening** of non-English-language literature for use in systematic reviews/maps? (Select all that apply)

- ☐ Machine translation is not high quality enough (e.g., it doesn't translate well) (1)
- ☐ It is time-consuming to use (e.g., need to copy and paste relevant sentences into the service) (2)
- ☐ Translation loses some of the original meaning/meanings may be altered in direct translation (3)
- ☐ I don't know how to use it (4)
- ☐ Other (Please describe) (5) _____

928

Page Break

929

Q11 What do you think are the main barriers to using professional human translation for facilitating the **search** for non-English-language literature for use in systematic reviews/maps? (Select all that apply)

- ☐ Too expensive/limited budget (1)
- ☐ Takes too long (2)
- ☐ Difficult to find translators with relevant subject-specific language skills (3)
- ☐ Other (Please explain) (4) _____

Q12 What do you think are the main barriers to using professional human translation for facilitating the **screening** of non-English-language literature for use in systematic reviews/maps? (Select all that apply)

- ☐ Too expensive/limited budget (1)
- ☐ Takes too long (2)
- ☐ Difficult to find translators with relevant subject specific language skills (3)
- ☐ Other (Please explain) (4) _____

Page Break

Q13 What do you think are the main barriers to engaging those with relevant language skills, either as co-authors or not, for facilitating the **search** for non-English-language literature in systematic reviews/maps?
(Select all that apply)

- ☐ Difficult to find contributors with relevant subject specific language skills (1)
- ☐ Unreliable translations (2)
- ☐ Takes too long (3)
- ☐ Other (Please explain) (5)
  _____

Q14 What do you think are the main barriers to engaging those with relevant language skills, either as co-authors or not, for facilitating the **screening** of non-English-language literature in systematic reviews/maps?
(Select all that apply)

- ☐ Difficult to find contributors with relevant subject specific language skills (1)
- ☐ Unreliable translations (2)
- ☐ Takes too long (3)
- ☐ 4 (4)
- ☐ Other (Please explain) (5)
  _____

Page Break

Q15 A recent paper (https://doi.org/10.1016/j.tree.2021.11.003) proposed a system where skills in a non-English language (reading and interpreting papers published in a non-English language) can be exchanged for skills in another non-English language or English language proofreading. If your field had access to a system like this, how likely would you be to offer your skills in exchange for assistance with reading and interpreting non-English-language literature?

- ○ Extremely unlikely (1)
- ○ Somewhat unlikely (2)
- ○ Neither likely nor unlikely (3)
- ○ Somewhat likely (4)
- ○ Extremely likely (5)

Q16 What difficulties would you expect with a system such as this?
(Select all that apply)

- ☐ Too time intensive (1)
- ☐ Unbalanced workloads of participants (2)
- ☐ Lack of interest/inability to find someone willing to assist (3)
- ☐ Other (please describe) (4) _____

Page Break

Q18 Please provide any final comments/thoughts you have on the topic. To submit your responses please click the arrow below to the final page.

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End of Block: Potential Solutions