A global review of animal translocation programs

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Abstract

A global review of animal translocation programs. We performed a bibliometric analysis to investigate the efficiency of release techniques (soft and hard–release), to analyse the characteristics and outcomes of the translocation programs, to identify knowledge gaps, and to provide recommendations. Animal conservation studies involving animal release to the wild increased significantly over the 31 years studied and were more frequently performed with terrestrial mammals than with other taxonomic groups. Most of the studies were performed by researchers from developed countries. Translocations occurred mostly in temperate regions, with almost no translocations occurring in the tropics. Almost 60 % of the studies did not provide information regarding the success or failure of the translocation programs. The most commonly used technique was hard release. Wild–caught specimens were preferred for translocations. Translocation programs were less common for groups like amphibians, fishes, and invertebrates. If criteria for suitable translocation are met, this management tool should also be conducted for tropical threatened species, led by native researchers. Furthermore, criteria for successful translocation should be clearly identified in order to improve future conservation actions.

Key words: Bibliometric analysis, Conservation, Hard release, Knowledge gap, Soft release

Resumen

Un examen general de los programas de translocación de animales. Realizamos un análisis bibliométrico para estudiar la eficiencia de las técnicas de liberación (liberación suave y dura), con objeto de analizar las características y los resultados de los programas de translocación, señalar vacíos de información y formular recomendaciones. Los estudios de conservación animal que implican la liberación de animales al medio natural han aumentado significativamente en los 31 años que abarca el presente estudio y se han realizado más frecuentemente con mamíferos terrestres que con otros grupos taxonómicos. La mayoría de los estudios fueron realizados por investigadores de países desarrollados. Las translocaciones se produjeron mayoritariamente en regiones templadas, mientras que en los trópicos prácticamente no hubo ninguna. Casi en el 60 % de los estudios, no se informó del éxito o el fracaso de los programas de translocación. La técnica más utilizada fue la liberación dura. Se prefería a los ejemplares capturados en el medio natural para las translocaciones. Los programas de translocación de grupos como anfibios, peces e invertebrados eran menos habituales. Si se cumplen los criterios para una translocación adecuada, esta herramienta de gestión también debería utilizarse con especies tropicales amenazadas, bajo la dirección de investigadores nativos. Asimismo, los criterios para que una translocación dé buenos resultados deberían estar claramente establecidos, a fin de mejorar las futuras medidas de conservación.

Palabras clave: Análisis bibliométrico, Conservación, Liberación dura, Vacío de información, Liberación suave

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Introduction

More than 30,000 animal species are threatened with extinction in the world (IUCN, 2019). Animal populations are declining around the globe, mainly due to habitat destruction, hunting, urbanization, pollution, diseases, climate change, and competition with invasive species (Pimm et al*.,* 2014; IUCN, 2019). To avoid local animal extinctions, conservationists are applying strategies that can be very useful in specific scenarios, such as animal translocations. Translocations are defined as the human–mediated movement of living organisms from one area with release in another (Griffith et al., 1989; Fischer and Lindenmayer, 2000; Seddon et al., 2007; IUCN, 2013). There are different types of translocations: (a) reintroductions (the intentional movement and release of an organism inside its indigenous range from which it has disappeared); (b) reinforcement or supplementation (intentional movement and release of an organism into an existing population of conspecifics); and (c) introductions (the intentional movement and release of an organism outside its indigenous range) (all definitions taken from IUCN, 2013).

The efficiency of translocations as a conservation tool has been questioned. Some scientists argue that this strategy is unjustified or inadequate (Sarrazin and Barbault, 1996; Pons and Quintana, 2003; Pérez et al., 2012; Pressey et al., 2017). Others show that costs are high and success rates are low (Beauchamp et al., 2000; Ewen and Armstrong, 2007; Yott et al*.,* 2011; Taggart et al., 2015; Stuparyk et al*.,* 2018). Furthermore, the scientific literature shows that besides a bias towards publishing successful projects and towards popular organisms (Bonnet et al., 2002; Díaz et al., 2018), there is a geographical bias towards temperate regions (Lawler et al., 2006; Di Marco et al., 2017). To help direct future studies, a bibliometric analysis of the translocation literature is needed in order to develop better guidance for managers and conservationists and to identify knowledge gaps (Goulart et al*.,* 2009).

Determining the success of animal release programs is complicated and there is no single definition of how to measure whether a release has been successful (Gusset et al*.,* 2008). Currently, the most commonly used measure of success of any animal release is the establishment of individuals at the release site and the formation of stable populations (Teixeira et al*.,* 2007). Although there is no overruling definition of success, programs may have short–term and long–term objectives to evaluate. As an example, Seddon (1999) identified a sequence of three objectives to assess success of reintroduction programs: (1) survival of the release generation; (2) breeding by the release generation and their offspring; and (3) persistence of the re–established population as predicted through the use of population extinction probability modelling. The first two objectives could be used as short–term measures of success, while the third objective could be used as long–term measure of success, with time frames for evaluation depending on the focal species' life history traits and the length of time that the program has been in existence (Gusset, 2009; Martínez–Abrain and Oro, 2010). The main IUCN criterion for a successful translocation is the production of a viable population that reaches their regulation phase (IUCN, 2013).

Translocation success may depend on characteristics of the released individuals (captive–raised or wild–caught: behaviour, stress level, age, genetics, life–history, etc.; Miller et al*.,* 1999; Griffin et al., 2000; Seddon et al*.,* 2007; IUCN, 2013; Neaves et al., 2015; Curik et al., 2017), type of release protocol (hard–release or soft–release: e.g. pre–release management and time with human contact; Hardman and Moro, 2006; Mitchell et al*.,* 2011; IUCN, 2013; Moseby et al., 2014; Sasmal et al., 2015), release site (e.g. food and shelter availability, predation; Barbosa et al., 2008; Polo–Cavia and Gomez–Mestre, 2014; Szymkowiak et al., 2017), and funding (e.g. trained personnel, veterinary care, captive maintenance, monitoring; Ferraro and Pattanayak, 2006; Bunge–Vivier and Martínez–Ballesté, 2017; Green et al., 2018). Thus, the evaluation of such characteristics is important to establish best practice for translocation programs.

The aim of the present study was to evaluate trends and assess the suitability of animal translocations by performing a bibliometric analysis (i.e. descriptive review of the literature; Xiau and Watson, 2019) from 1986 to 2017.

Material and methods

Data collection

The bibliometric analysis involved an Internet search for articles published over a period of 31 years, from 1986 to 2017, using Scielo©, Web of Science© and Scopus© databases. The searches used the following keywords: hard release, soft release, wildlife reintroduction, wildlife translocation, wildlife introduction, release of wild animals, animal reintroduction, animal introduction, and animal translocation (terms singly and in combination). The analysis included articles published in scientific journals only; conference abstracts, book chapters, reports and grey literature were disregarded.

After the initial search, references were exported to EndNote X7© software for reference management. Articles were initially filtered by reading the abstracts, so that only articles corresponding to the subject of interest were included. The following information was then obtained from each article: author, year, title, journal, language of the article, nationality of the researcher, country of the institution carrying out the study, co–authors, country where the study was conducted, region (temperate or tropical), degree of threat of the studied animals, origin of animals (captive or nature), pre–release management, management type, release coordinates, number of released individuals, sex, type of release (soft or hard), environment (aquatic or terrestrial), taxonomic group (mammals, birds, reptiles, amphibians, fishes, invertebrates), order, species, type of program

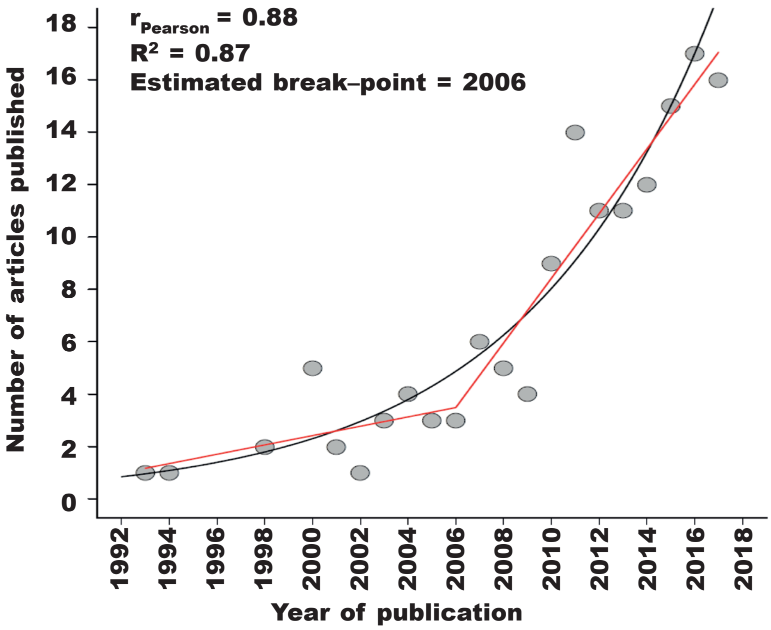

Fig. 1. Number of articles published between 1986 and 2017 related to animal introductions, reintroductions, and translocations. Articles were limited to conservation actions only. Black line represents the number of published papers over the years; red line represents the regression model showing the temporal breakpoint, where the number of published papers increased significantly.

Fig. 1. Número de artículos publicados entre 1986 y 2017 en relación con introducciones, reintroducciones y translocaciones de animales. Los artículos se limitaron exclusivamente a actuaciones de conservación. La línea negra representa el número de artículos publicados a lo largo de los año y la línea roja representa el modelo de regresión que permite mostrar el punto de inflexión temporal, en el que el número de artículos publicados aumentó significativamente.

(conservation introduction, reintroduction or reinforcement), success, presence or absence of funding, funding value, and study time.

Data analysis

Descriptive statistics were calculated for bibliometric analysis. Pearson's correlation was used to test whether the number of articles was associated with year of publication. We ran a General Linear Model (GLM) with a Poisson distribution to evaluate whether the number of publications (response variable) was influenced by the year (explanatory variable). Finally, we ran a piecewise regression to evaluate the breakpoint, where the number of publications increased significantly. The geographical coordinates of the authors' and co–authors' institutions were used to create a global distribution map of collaborations and to evaluate geographical bias. A map was constructed to show locations where releases occurred. We determined the number of studies for each major animal group (fishes, amphibians, reptiles, birds, and mammals), the environment (terrestrial, aquatic or both), and conservation status (based on the IUCN Red List, 2018). We also recorded the release technique employed, pre–release management, and success status, as well as the origin of the released specimens (nature or captivity). The number of individuals, the time frame, and the amount of money used for conservation programs were also acquired from the papers. The results are given in absolute and relative numbers whenever necessary and the percentages always refer to the number of records in the evaluated papers (not the number of individuals or species). If a study evaluated three different species, we computed this as three records. Chi–square tests and GLMs were run whenever possible to evaluate differences in the recorded parameters. For GLMs, response variables were the number of papers or species and explanatory variables were the type of release (soft or hard), the origin of the animal (captive or nature), and the success of the program (success or failure). The analyses were run using R 3.5.0 software (R Development Core Team, 2010).

Results

The initial search found 1119 articles (500 in Scielo, 201 in Web of Science© and 418 in Scopus©). Of the-

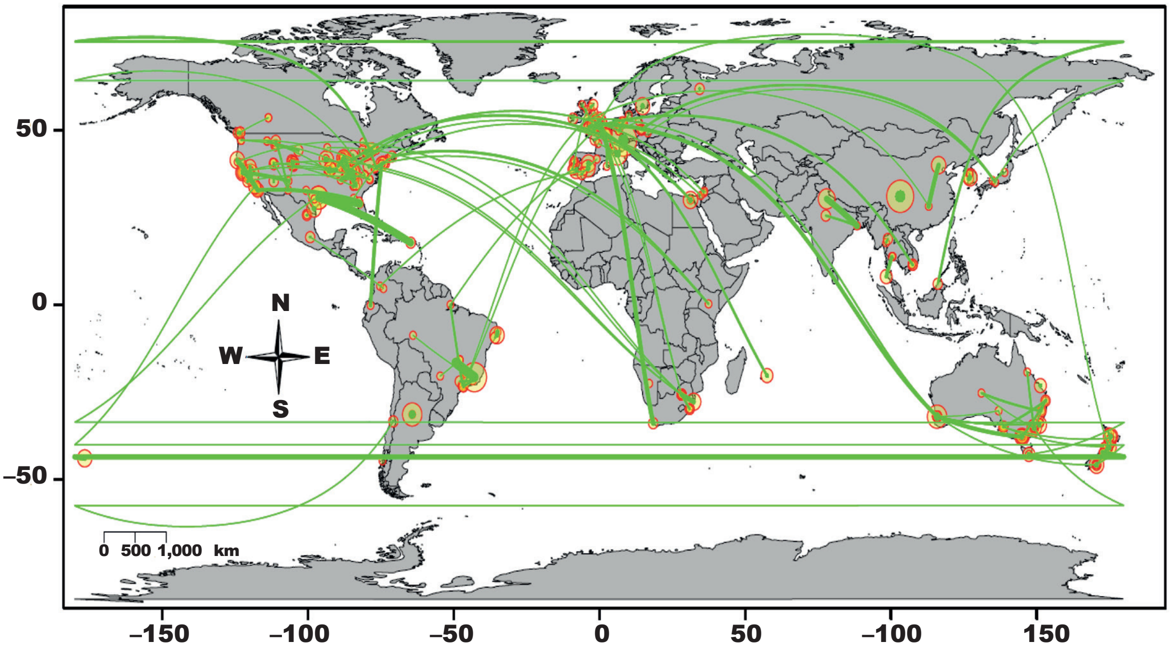

Fig. 2. Number of articles published between 1986 and 2017 according to the 145 cities and 30 countries of the first authors' institutions. The bigger the circle, the greater the number of papers published by that institution. Green lines represent the collaboration net among the institutions. Number in X and Y axis represent the parallels and the meridians.

Fig. 2. Número de artículos publicados entre 1986 y 2017, según las 145 ciudades y 30 países de las instituciones de los primeros autores. Cuanto mayor es el círculo, mayor es el número de artículos publicados por dicha institución. Las líneas verdes representan la colaboración neta entre las instituciones. Los números de los ejes X e Y indican los paralelos y meridianos.

se, we eliminated 209 because they were duplicates and 765 because they were not about the subject of interest. Thus, the final bibliometric analysis included 145 articles with a total of 275 records (each species studied was computed as a single record).

The number of articles published on animal release for conservation purposes increased over the 31 years of the analysis period (fig. 1), with a statistically significant increase in the number of published articles (r = 0.88, R^2 = 0.87, $F_{1, 19}$ = 67.58; p < 0.0001).

The articles were associated with institutions from 30 different countries, with 33.1% from the United States of America (n = 48), 13.8 % from Australia (n = 20) and the remaining from 28 different countries (F = 0.98, d.f. = 29, p = 0.52; fig. 2). Most collaborations were between researchers of the United States, Europe, and Australia (fig. 2).

Animals were released in 41 different countries; one article did not give a study site, and another reported the study was conducted on the African continent but did not specify which country. Most of the studies were conducted on releases in the United States 27.6 % (n = 40), Australia 11.0 % (n = 16) and New Zealand 9.7 % (n = 14) (F = 2.36, d.f. = 38, p < 0.001). Releases that provided geographical information occurred at 82 different locations, while 10 countries had records with no specified coordinates (fig. 3). Of the 275 records, 115 (41.8 %) occurred in the temperate region and 76 in the tropical region (27.6 %), while the region could not be determined for 84 (30.6 %) (χ^2 = 9.26, d.f. = 2, p < 0.01).

Among the taxonomic groups released, mammals were the most common, followed by birds, reptiles, amphibians, and insects (χ^2 = 536.77, d.f. = 6, p < 0.001; fig. 4), with a total of 213 species from 32 different orders. The most highly represented order was Diprotodontia (number of records: Marsupialia: n = 43, 15.6 %), while the most representative species were *Bettongia penicillata* and *Lagorchestes hirsutus* (n = 5, 1.8 % each) (χ^2 = 507.65, d.f. = 36, p < 0.001). One article did not mention the species or the order of the animal studied. Most species were terrestrial (number of records: n = 250, 90.9 %), followed by species living in both environments (n = 18, 6.6 %) and aquatic species (n = 6, 2.2 %); it was not possible to determine the environment for one article because the species was not given.

Among the 213 species that were release targets for conservation purposes, 43.6 % (n = 120) were classified as Least Concern, 19.6 % (n = 54) as Vul-

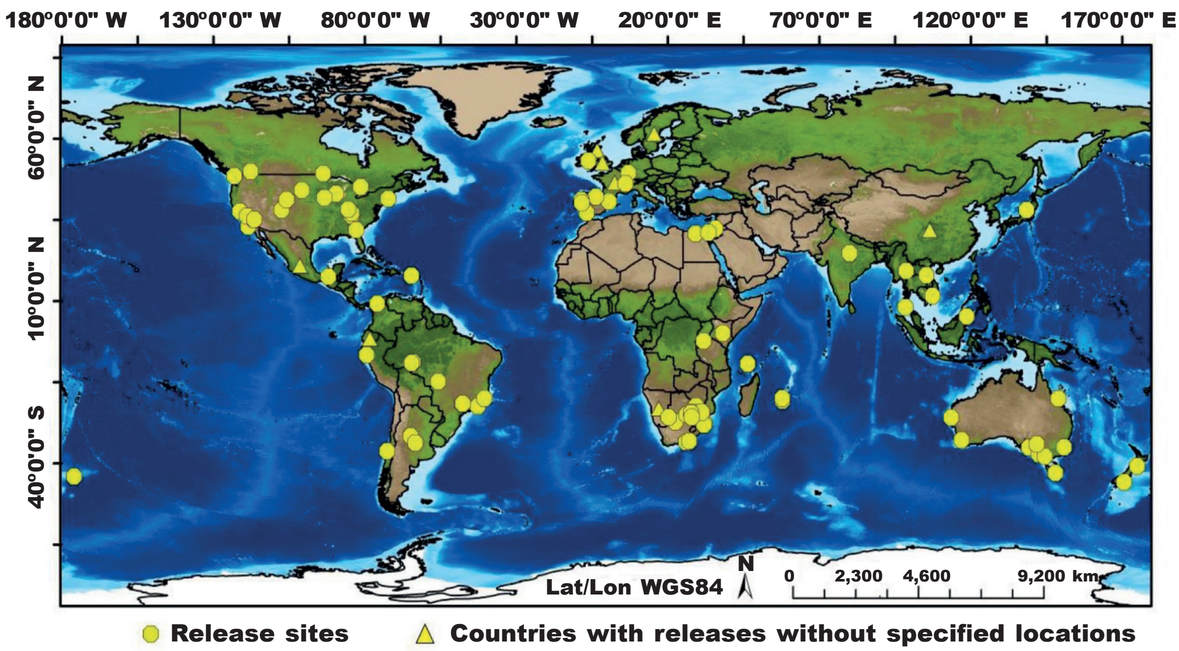

Fig. 3. Countries where the animal releases occurred between 1986 and 2017 (yellow circles). Some articles did not inform the coordinates of the releases; thus, the country was marked with a yellow triangle.

Fig. 3. Países en los que se produjeron las liberaciones de animales entre 1986 y 2017 (círculos amarillos). Algunos artículos no aportaron información sobre las coordenadas de las liberaciones; por consiguiente, el país se marcó con un triángulo amarillo.

nerable, 12.4 % (n = 34) as Endangered (N = 6) and 8.0 % (n = 22) as Critically Endangered; 2.2 % (n = 6) were not on the IUCN's Red List, and 1.1% (n = 3) were listed as Data Deficient (values referred to the number of species and not the number of records). The species *Anaxyrus baxteri* was listed as Critically Endangered, but according to the IUCN (2018), it is already extinct in nature. According to the IUCN (2018), the captive population of *A. baxteri* is declining, so we assumed that this species is critically endangered. The most common type of release program was conservation translocation (n = 134, 48.7 %) (in this case the authors did not provide explicit information about the type of translocation). This was followed by conservation reintroduction (n = 116, 42.2 %), conservation introduction (n = 14, 5.1 %), and conservation supplementation (n = 8, 2.9 %). Three papers not mentioning the type of release program (1.1 %). More animals were translocated from the wild (57.1 %, n = 157) than from captivity (22.9 %, n = 63), while 14.9 % (n = 41) were translocated both from the wild and from captivity; 4.4 % (n = 12) did not state the origin of the released individuals and 0.7 % (n = 2) came from semi–captivity.

Hard release was used in 28.0 % (n = 77) of the records, soft release in 22.6 % (n = 62), and both types simultaneously in the same conservation project in 20.7 % (n = 57); the type of release was not reported for 28.7 % (n = 79) of the records.

Among the studies that used soft release, 46.8 % (n = 29) used wild caught animals, while 41.9 % (n = 26) used animals from captivity. Among the studies that used hard release, 90.9 % (n = 70) used animals from the nature, while 7.8 % (n = 6) used animals from captivity. The remaining individuals either came from semi–captivity or from both nature and captivity.

A total of 46.6 % (n = 128) of the records reported success in terms of their project goals, 9.9 % (n = 25) reported failure, 39.3 % (n = 108) did not report on their success, 1.8 % (n = 5) claimed an intermediate levels of success, and 3.3 % (n = 9) classified the situation as pending. In general, soft–release resulted in more success of the translocations than hard–release ($F = 4.44$, d.f. = 2, $p = 0.03$; table 1), but success for captive and wild individuals was similar ($F = 0.27$, d.f. = 2, $p = 0.76$; table 1). However, almost 60 % of the studies did not provide information about the success of the release (table 1).

Table 2 shows the most representative taxonomic groups (more than 10 recorded releases) among the studies according to type of release.

The studies lasted on average of (± SD) 76.6 ± 170.5 months. Studies involving the orders Carnivora (10.9 months), Rodentia (9.8 months), Passeriformes and Squamata (8.6 months), Testudines (8.1 months), Diprotodontia (5.8 months) and Cetartiodactyla (5.2 months) lasted longer than those

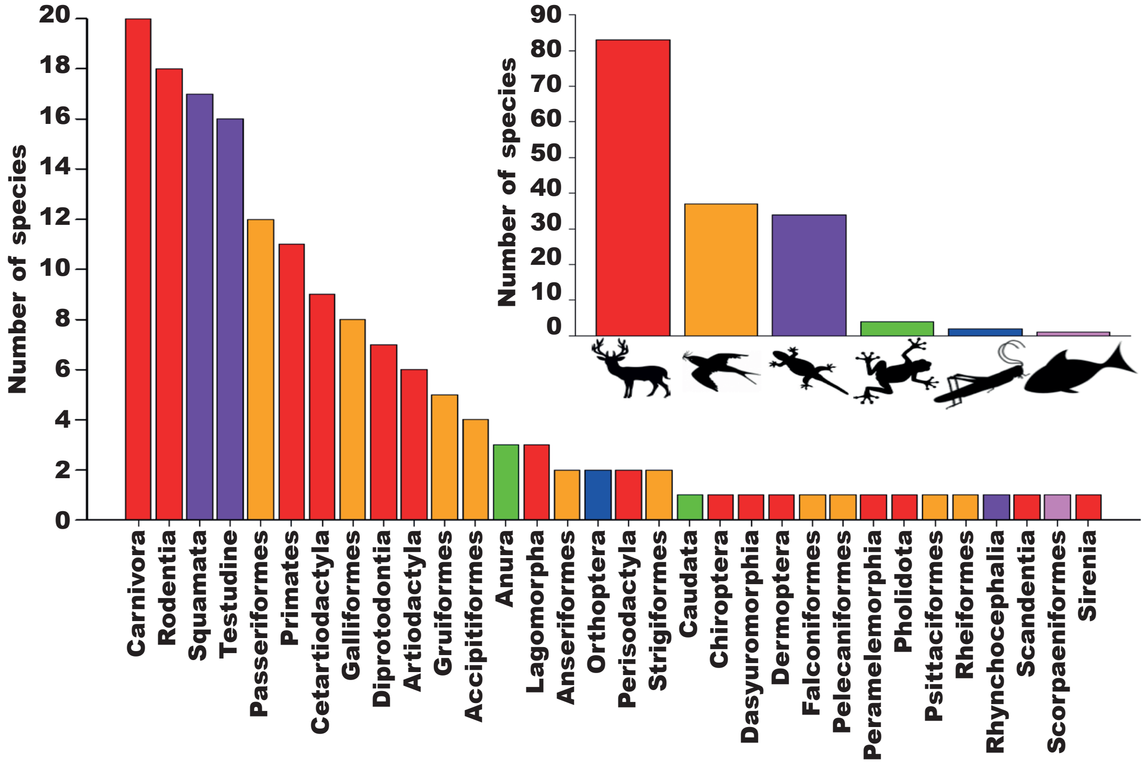

Fig. 4. Taxonomic groups (classes and orders) most released in conservation programs across the globe. Colours represent the major animal classes (red, mammals; yellow, birds; purple, reptiles; green, amphibians; blue, arthropods; pink, fishes).

Fig. 4. Los grupos taxonómicos (clases y órdenes) más liberados en programas de conservación en todo el planeta. Los colores representan las principales clases de animales (rojo, mamíferos; amarillo, aves; violeta, reptiles; verde, anfibios; azul, artrópodos; rosa, peces).

for all the other orders, but no statistical difference was observed (F = 1.23, d.f. = 35, p = 0.20). There were nine different types of pre–release management with the most representative being the use of an acclimatization enclosure with food supplementation, the use of acclimatization enclosure only, and food training, which accounted for 79.8 % of all the types of pre–release management (table 3).

Of the 145 studies, 104 (71.7 %) reported some financial support, but only four (3.8 %) stated the amount spent on the project; the mean amount was US $ 145.757 (mean duration of the project: 66 months), with a range of US $ 35.983–US $ 5,000 (duration of the projects: 24 and 60 months, respectively).

Discussion

Our results show that studies on translocations have been performed more frequently with terrestrial mammals than with any other taxonomic group. Geographical bias was observed, with most studies and translocations being conducted by researchers in temperate regions. A bias towards popular, charismatic animals was recorded, with mammals and birds being the most commonly relocated animals. Most of the releases occurred via hard release with animals originating from nature, and outcomes (success or failure) were not reported.

The number of studies translocating animals increased significantly over the three decades with a sharp increase beginning in 2007. Changes to the public's perspective on conservation during this time stimulated both zoos and governments to increase conservation measures, including animal releases (Seddon et al., 2007). This increase in the number of publications may also reflect the publication of IUCN Reintroduction guidelines (IUCN, 1998, 2013). It could also reflect the pressure to publish that researchers all around the globe face from their institutions, funding agencies, and governments (De Rond and Miller, 2005; Fanelli, 2010).

Animal releases are mostly performed in the temperate region, exhibiting a geographical bias that did not coincide with conservation hotspots. This geographical bias was also observed in other

Table 1. Success of the studies involving hard and soft–release between 1986 and 2017: Ni, not informed; Mix, mix methods were used (hard and soft–release); Varied, cases that inform success and failure of releases at the same study; C, captivity, W, wild; M, individuals from captivity and wild.

Tabla 1. Resultado de los estudios realizados entre 1986 y 2017 que implicaron liberaciones duras y suaves: NI, no se informó; MIX, se utilizaron métodos mixtos (liberación dura y suave); Varied, casos en los que se informó de los éxitos y los fracasos de las liberaciones en el mismo estudio; C, en cautividad; W, en el medio natural; M, individuos en cautividad y en el medio natural.

	Success			Failure			Ni			Varied			Total
	C	W	M	C	W	M	C	W	M	C	W	M	
Soft–release	9	9	6	1	0	2	10	18	2	0	0	0	57
Hard–release	2	4	0	1	2	0	5	10	1	1	0	0	26
Mix	4	5	1	0	1	0	7	9	6	0	0	0	33
Ni	1	5	3	0	0	1	3	12	3	1	0	0	29
Total	16	23	10	2	3	3	25	49	12	2	0	0	145

studies (Martin et al., 2012; Di Marco et al., 2017). Sixteen of the 36 biodiversity hotspots are located in the tropics, mostly in developing countries (Myers et al., 2000; Myers, 2003; Hrdina and Romportl, 2017; Weinzettel et al., 2018). In fact, the highest number of studies on animal release were conducted in developed countries (PNUD, 2015), especially the United States and Australia, and only 21 % of these were carried out in biodiversity hotspots. This is understandable given that these countries provide more financial resources for such studies. Furthermore, release projects in tropical countries also had collaborating researchers from North American and Australian. Therefore, participation by North American and Australian researchers in the conservation of species is not restricted to their home countries, and the collaboration map shows that these countries are contributing to conservation efforts worldwide, especially with European countries.

Most of the studies we evaluated focused on mammals and birds, with mammals accounting for almost 60 % of the total. These data corroborate the similar review of Fischer and Lindenmayer (2000), who found that 50 % of the studies they considered were performed with mammals and 43 % with birds. Similar results were reported by Seddon et al. (2005) who investigated reintroduction projects and found that 41 % of the evaluated studies were performed with mammals and 33 % with birds.

Historically, mammals and birds have been considered charismatic species, which attract more public attention and thus make it easier to find funding for conservation programs (Kleiman, 1989; Seddon et al., 2005; Colléony et al., 2017; Krause, 2017). Another aspect that has been considered is the value that humans attribute to species.

As shown in the present study, taxonomic groups such as fish, reptiles, amphibians and invertebrates are still poorly represented in conservation programs involving animal release. However, the conservation of charismatic, wide–ranging species can also help to conserve species of these less represented groups because such actions often result in greater habitat protection (Simberloff, 1998).

Some studies have indicated that successful conservation projects are more likely to be published (Seddon et al., 2007; Bajonin et al., 2010; Fischer and Lindenmayer, 2000; Miller et al., 2014; Díaz et al., 2018), and that animal release programs, especially those with charismatic species, attract more attention from the public (Bajomi et al., 2010) and thus receive more financial support. In addition, successful actions can also have a more positive popular impact, while the lack of success may not be as attractive to funding sources, making researchers wary of publishing unsuccessful results (Seddon et al., 2007; Bajomi et al., 2010). This may explain the low number of unsuccessful releases found in the present study.

Whether or not a release has been successful is difficult to establish (following the IUCN's criterion that success means establishing a viable population in the release area), because it usually requires a long time for released individuals to populate an area (Gusset et al., 2008; Tavecchia et al., 2009; Oro et al., 2011; IUCN, 2013). The mean time for the studies in the present research was 76.6 months, but in 39.3 % of the articles, authors did not explicitly declare whether release was successful or not. Some researchers may have been unable to determine success due to time constraints regarding study length. However, it is important to state that success in the present revision was defined using criteria such as dispersion/movement, survival in the initial months, and reproduction of the released animals, showing that success can be variable depending on the duration and criteria set by authors. No studies declared a success by evaluating the establishment of viable populations or the achievement of the regulation phase, as suggested by IUCN (2013). Instead, they limited their outcomes to short–term measures of success. In fact, almost 60 % of the studies did not inform success or failure of the translocation programs. This is a very important result and a crucial information gap that needs to be filled in future studies.

Most animals from the wild were subjected to hard release, while the origin of animals for soft release was equally from captivity or nature. Hard release may be more advantageous for animals from nature that were in captivity for only a short time, since there would be less time for their natural behaviours to change (Fritts et al., 2001; Rummel et al., 2016). Animals that were born in captivity or had spent most of their life in captivity may be released via soft release because it allows different types of training to be applied (e.g., anti–predation, feeding, flight, etc.) during the pre–release period to facilitate adaptation to the new wild environment (Sutherland et al., 2010). Captive–born individuals are more likely to be predated since they have had little if any contact with their predators (Mathews et al., 2006).Therefore, soft release with a period of acclimatization may increase their chance of establishing themselves (Reading et al., 2013). Through meta–analysis, Tetzlaff et al. (2019) showed the advantages of pre–release management.

The present study found most studies failed to clearly state the costs involved in releasing animals for conservation purposes. Such information would be useful for planning future releases. The need for economic analysis to guide decision–making in conservation is an important issue because a ba-

Table 2. Number of hard and soft releases for the most studied animal groups between 1986 and 2017. (Each species accounted as one register; studies that release individuals using hard and soft–release concomitantly were not accounted).

Tabla 2. Número de liberaciones duras y suaves de los grupos de animales más estudiados entre 1986 y 2017. (Cada especie se cuenta como un único registro; los estudios en los que se produjeron liberaciones duras y suaves de forma simultánea no se tuvieron en cuenta).

	Bird	Mammal	Reptile
Soft	19	28	11
	(63.3%)	(40.0%)	(34.8%)
Hard	11	42	21
	(36.7%)	(60.0%)	(65.6%)
Total	30	70	32

Table 3. Type of pre–release management used between 1986 and 2017. The types of pre–release management were not exclusive and could be used in combination: [a] individuals who were injured and remained in the enclosure until they were able to be released; [b] released during the hibernation period of the species, which prevents its dispersion from the release site; [c] individual who escaped from the acclimatization enclosure and was recaptured and released immediately.

Tabla 3. Tipo de gestión utilizada antes de la liberación entre 1986 y 2017. Los tipos de gestión antes de la liberación no eran exclusivos y se podían utilizar de forma combinada: [a] individuos heridos que se mantuvieron en la jaula hasta que se les pudo liberar; [b] liberados durante el período de hibernación de la especie, a fin de evitar su dispersión desde el lugar de la liberación; [c] individuo que escapó de la jaula de aclimatación y fue capturado de nuevo y liberado inmediatamente.

Type of management	N° of records	%
Acclimatization enclosure with food supplementation	39	32.8
Acclimatization enclosure without food supplementation	31	26.1
Pre–release food training	25	21.0
Acclimatization enclosure with food supplementation and anti–predator training	15	12.6
Rehabilitation in enclosure [a]	3	2.5
Acclimatization enclosure with food supplementation and food training	2	1.7
Forced to remain in hibernation site [b]	2	1.7
Food Supplementation after release	1	0.8
Acclimatization enclosure for a few days until escape, followed by recapture and immediate release [c]	1	0.8

sic objective for setting conservation priorities is to maximize the biodiversity conserved within a usually finite budget. In a conservation project of the waterbird crested coot (*Fulica cristata*), for example, the costs varied between €166.000 and €270.000 for 55 individuals (Martínez–Abraín et al., 2011).

In conclusion, the release of animals for conservation has increased over recent decades and can be important for restoring biodiversity. In general, soft release brings more success to conservation programs than hard release, especially for captive–born animals. More detailed information on matters such as techniques, type of translocation, costs, pre–release management, and success should be included in publications so that researchers can develop the most efficient management procedures.

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