Journal of Species Research 15(1):73-82, 2026
https://doi.org/10.12651/JSR.2026.15.1.073

Open Access

Research trends in Korean amphibian and reptile studies using text mining

June Kim[1], Jaebeom Jeong[2], Sumin Lim[3], Ka Hyun Lee[4], Hyun Woo Jeon[5], Seok-Jun Son[6], Green Choi[7], Jihee Dang[8], Jongsung Lee[8,9], Sangdon Byeon[8,10], Min Seock Do[8,*] and Hyung-Kyu Nam[8,*]

[1]*Department of Life Sciences, Yeungnam University, Gyeongsan 38541, Republic of Korea*
[2]*Division of Science Education, Kangwon National University, Chuncheon 24341, Republic of Korea*
[3]*Department of Applied Biology, College of Agriculture and Life Sciences, Chungnam National University, Daejeon 34134, Republic of Korea*
[4]*Department of Biosciences & Bioinformatics Division, Myongji University, Yongin 17058, Republic of Korea*
[5]*Department of Animal Resources Science, Kongju National University, Yesan 32439, Republic of Korea*
[6]*National Science Museum, Daejeon 34143, Republic of Korea*
[7]*MEET GREEN, Seocheon 33646, Republic of Korea*
[8]*National Institute of Biological Resource, Incheon 22689, Republic of Korea*
[9]*Department Biological Sciences and Bioengineering, Inha University, Incheon 22212, Republic of Korea*
[10]*Department Biological Sciences, Kangwon National University, Chuncheon 24341, Republic of Korea*

**Correspondent: blackratsnake@hanmail.net, namhk2703@korea.kr*

Amphibians and reptiles, with their unique morphology, physiology, and developmental processes, play a vital role in biodiversity conservation. Globally, research on these taxa spans across fields such as ecology, histology, genetics, and veterinary medicine, and they are also widely utilized in literature and engineering as sources of inspiration. This study applies text mining techniques to analyze the characteristics and trends of publications related to amphibians and reptiles in Korea. We identified major research periods, academic disciplines, and focal species. The analysis revealed that literature on amphibians and reptiles in Korea began in the 1950s and has increased exponentially every decade through 2020. A total of 984 amphibian-related and 644 reptile-related publications were recorded from 1959 to 2022 and from 1960 to 2022, respectively. Among them, 563 amphibian studies (88.66%) focused on Anura, while 162 reptile studies (52.09%) focused on Testudines. The most frequently mentioned amphibian species was Oriental Fired-bellied Toad *Bombina orientalis*, and for reptiles, it was Reeves' Turtle *Mauremys reevesii*. In terms of academic disciplines, amphibian studies were predominantly published in the natural sciences (657 papers, 66.77%), whereas reptile studies had the highest proportion in the field of literature (290 papers, 45.03%). The most frequently occurring word in both amphibian and reptile texts was "species." Overall, the trends in amphibian and reptile research in Korea have been influenced by changing societal interests and contemporary issues, and the findings of this study may help guide future research directions for these important taxa.

Keywords: bibliometric analysis, big-data, Korea, research trends, text-mining

All content in the Journal of Species Research (JSR), published by the National Institute of Biological Resources (NIBR), is Open Access, meaning it is freely accessible online to everyone without fees or the need for authors' permission. Open Access articles are automatically archived in the Korea Institute of Science and Technology Information (KISTI)'s Open Access repository, AccessON. All JSR content is published and distributed under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). This license permits non-commercial use, distribution, and reproduction in any medium, provided the original author and source are properly credited. However, no modifications or derivative works are allowed.

©2026 National Institute of Biological Resources.
This article was authored by [June Kim, Jaebeom Jeong, Sumin Lim, Ka Hyun Lee, Hyun Woo Jeon, Seok-Jun Son, Green Choi, Jihee Dang, Jongsung Lee, Sangdon Byeon, Min Seock Do and Hyung-Kyu Nam] and is published by the National Institute of Biological Resources under the terms of the Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License (CC BY-NC-ND 4.0). Non-commercial use, distribution, and reproduction in any medium are permitted, provided the original authors are properly credited and the work is not modified in any way.

Introduction

The term "Amphibian" is derived from the Greek word *Amphibios*, where *amphi-* means "both" and *-bios* means "life," referring to organisms that live both in water and on land. The term "Reptile" comes from the Latin word *reptilis*, derived from *rept-* meaning "to crawl," referring to small crawling animals (Wareham, 2005; Pough *et al*., 2016). Amphibians and reptiles include animals such as turtles, snakes, lizards, frogs, and salamanders. Unlike mammals such as humans, these animals have either scaly or moist skin, which makes them morphologically distinct (Alibardi, 2003; Pough *et al*., 2016). These groups are ectothermic animals whose body temperature varies with their environment, and depending on the species, they may reproduce via oviparity (egg-laying) or ovoviviparity (live-bearing with eggs developing internally). Some species even possess lethal toxins for survival (Bullock, 1955; Packard *et al*., 1977; Debono *et al*., 2019). Globally, amphibians and reptiles are the focus of intensive biological research concerning their unique physiology, development, and ecology, and they are also utilized as materials in fields such as histology, genetics, veterinary science, literature, and engineering (Park *et al*., 2011; Shin, 2011; 2013; Lee *et al*., 2022).

Amphibians and reptiles play an important role in biodiversity conservation, as they occupy a mid-level position in the food web—acting both as prey for birds, fish, and mammals, and as predators of terrestrial and aquatic insects (Katayama *et al*., 2012; 2013; Valencia-Aguilar *et al*., 2013; Cortés-Gomez *et al*., 2015; Do *et al*., 2022b). Moreover, most terrestrial amphibians and reptiles are known to have limited dispersal ability due to their short movement range and small home range, making them highly vulnerable to habitat destruction and climate change (Parmesan, 2006; Hoffmann and Sgrò, 2011; Do *et al*., 2017; Lee *et al*., 2021). In recognition of the importance of biodiversity, the Korean Ministry of Environment began designating endangered species for legal protection in 1989 to enhance the conservation and management of wildlife. Currently, four species of amphibians and four species of reptiles are designated as legally protected endangered wildlife (Ministry of Environment, 2015). In Korea, there are 28 species of amphibians across 2 orders, 7 families, and 12 genera, and 36 species of reptiles across 2 orders, 11 families, and 26 genera, including nine marine reptile species and three introduced reptile species (Do *et al*., 2022b; NIBR, 2022). While a wide range of taxonomic and ecological research on amphibians and reptiles has been conducted in Korea, no comprehensive study has yet summarized the main research periods, academic disciplines, or target species over time. Therefore, a systematic review focusing on the characteristics and trends of amphibian- and reptile-related publications in Korea is necessary (Park and Ko, 2015; Lee *et al*., 2021; Park and Oh, 2021; Do *et al*., 2022a; 2023).

With the recent surge in big data applications, text mining—a big data analytical technique—has been increasingly employed across various academic disciplines to uncover intellectual structures and analyze research trends (Rajman and Besancon, 1998; Sahadevan *et al*., 2012; Nalon *et al*., 2021). Text mining is particularly suitable for analyzing unstructured textual data such as titles, keywords, and abstracts, enabling the identification of public perception, research trends, and academic directions, while minimizing researcher subjectivity and enhancing objectivity (Do *et al*., 2020; Son *et al*., 2023a; 2023b). Furthermore, it allows for the discovery of new knowledge and perspectives through visualization techniques based on pattern analysis and helps prioritize future research directions (Rajman and Besancon, 1998; Ko and Eo, 2017).

Since the 1950s, numerous publications on amphibians and reptiles in Korea have appeared across diverse disciplines, including natural sciences, literature, engineering, and medicine (Kang, 1959; Paik *et al*., 1990; Shin *et al*., 2011; Park and Oh, 2021). However, no study has systematically synthesized this body of literature to identify the major publication fields, time periods, research characteristics, and overall trends. Therefore, the application of text-mining methods is necessary to provide readers with insights into research patterns and emerging trends. In this study, we applied text mining to analyze the research characteristics and trends of amphibian and reptile literature published in Korea. Specifically, we collected Korean publications related to amphibians and reptiles and examined the publication trends and research characteristics, focusing on key time periods, academic fields, and target species.

Materials and Methods

Collection of amphibian and reptile research data

To collect literature related to amphibians and reptiles published in Korea, we used the Harzing's *Publish or Perish 3* (PoP3) software (source: www.harzing.com/index.htm). This free tool allows for efficient acquisition of scientometric information and can be integrated with Google Scholar for data retrieval. For the data collection, we conducted keyword searches in Korean using the following terms: "양서류" (Amphibian), "도롱뇽" (Salamander), "두꺼비" (Toad), "맹꽁이" (Narrow-mouthed Toad), "개구리" (Frog), "파충류" (Reptile), "뱀" (Snake), "살모사" (Viper), "구렁이" (Rat Snake), "거북" (Turtle), "자라" (Softshell Turtle), and "남생이" (Reeves' Turtle). In this study, species that were the primary focus of each document were defined as "focal species." These could include single or multiple species depending on the research topic. All focal species were recorded using currently accepted scientific names (NIBR, 2022). For Soft-shelled Turtle

Pelodiscus maackii and Chinese Soft-shelled Turtle *P. sinensis*, which were often not clearly distinguished in the literature, we classified them collectively as the genus *Pelodiscus* spp..

The types of collected documents included journal articles, academic presentation abstracts, literary magazines, and books. From each document, we extracted the title and abstract (in Korean or English), year of publication, journal name, and publisher, thereby compiling a corpus composed entirely of text data. We also classified each document according to its academic field. The academic fields were broadly categorized into four main areas: Literature, Natural Sciences, Engineering, and Medicine. These were further subdivided as follows: Literature into essays, novels, and poetry; Engineering into robotics, materials science, landscape architecture, environmental engineering, and biotechnology; Medicine into veterinary science and emergency medicine; and Natural Sciences into paleontology, embryology, pathology, physiology, ecology, genetics, and histology.

Analysis of the compiled data

To identify important keywords in scientific and literary publications related to amphibians and reptiles in Korea, we analyzed the frequency of word occurrences found in the titles and abstracts. A word cloud was generated to visually represent the frequency of these keywords, with weights assigned based on the number of occurrences within each individual publication. This weighted approach allows for the assessment of not only the overall word frequency but also the relative importance of terms across different publications (Do *et al*., 2020; Son *et al*., 2023a; 2023b). In the resulting word cloud, terms with higher frequencies appear larger in size and are positioned closer to the center. All analyses were conducted using the R statistical software (version 3.6.2) (R Core Team, 2023), and the word cloud visualization was created using the wordcloud2 package (Dawei and Guan-tin, 2018).

Results

Temporal trends in research

An examination of Korean publications related to amphibians and reptiles revealed an exponential increase in the number of publications over time for both taxa (Fig. 1). For amphibians, a total of 984 publications were recorded between 1959 and 2022, with natural science studies consistently accounting for the highest proportion across all decades (Fig. 1A, C). In the case of reptiles, 644 publications were recorded from 1960 to 2022. While literature-related studies dominated from the 1950s through the 2000s, natural science research has taken the lead from the 2010s onward (Fig. 1B, D).

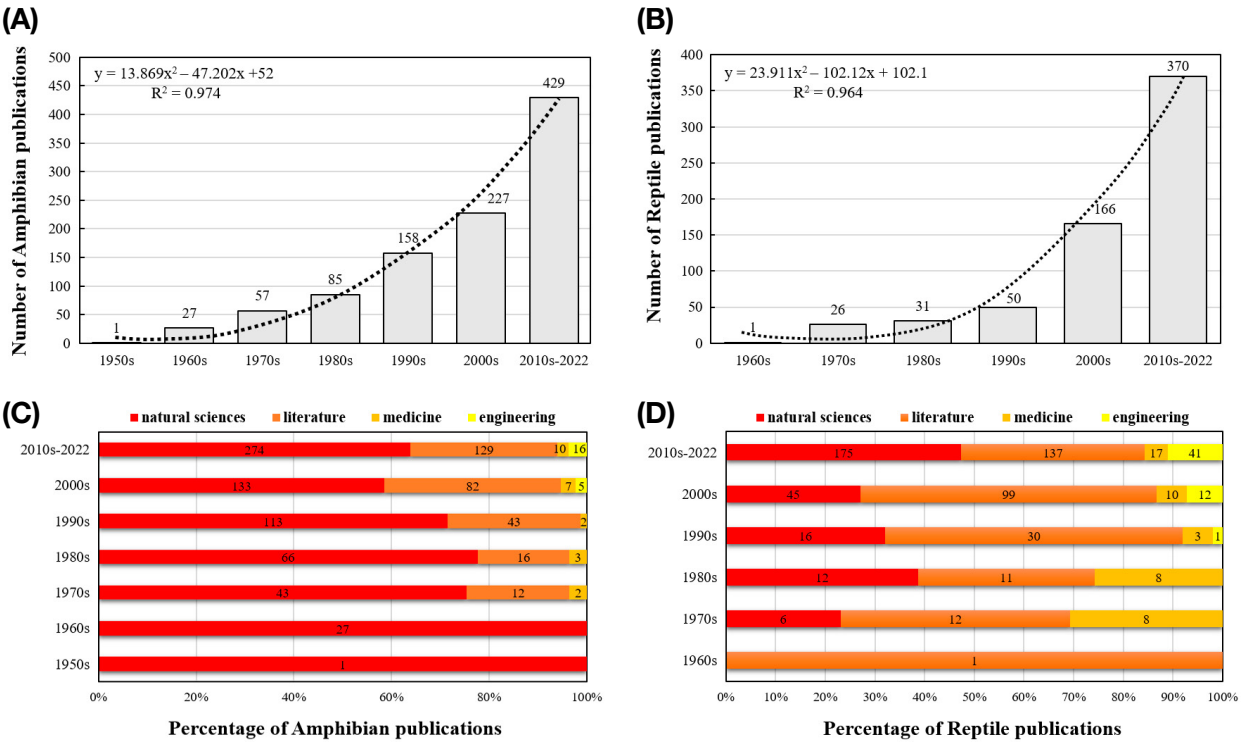

Fig. 1. Research article publication trends in Korea for (A) amphibians and (B) reptiles. Publication frequency by academic field for (C) amphibians and (D) reptiles research.

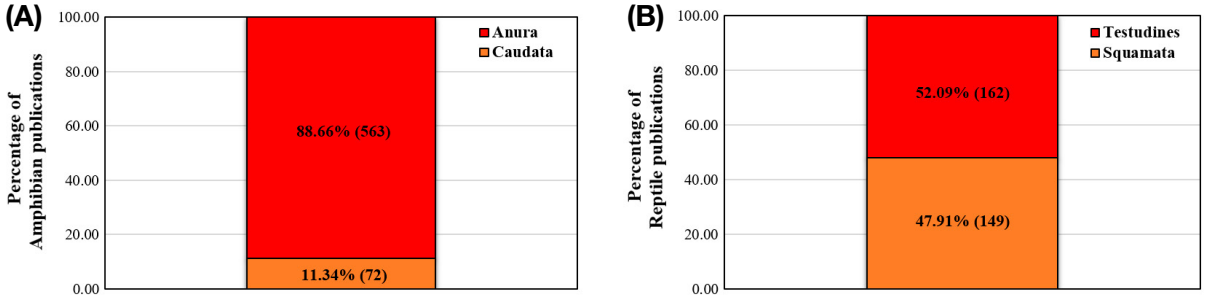

Fig. 2. Proportion of publications by taxonomic group for (A) amphibians and (B) reptiles.

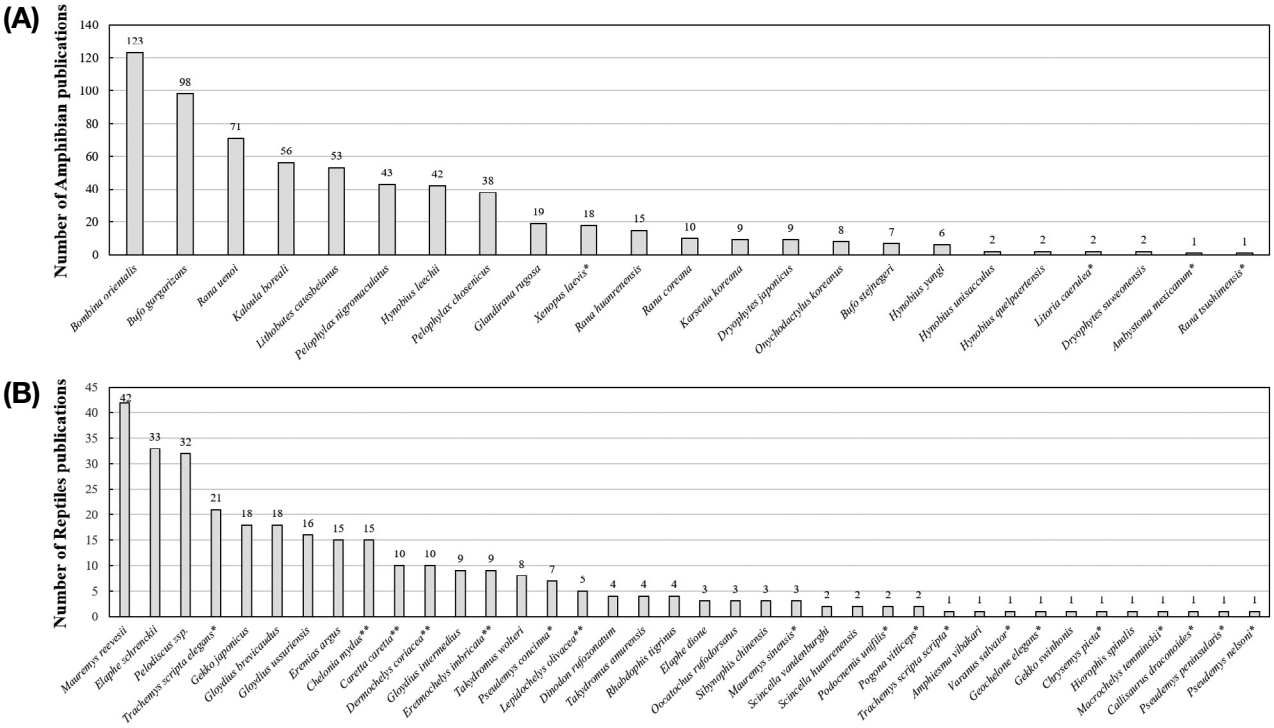

Fig. 3. The number of publications by species in (A) amphibians and (B) reptiles. Note: *Pelodiscus* spp. includes both *P. sinensis* and *P. maackii*. *: Invasive species, **: Marine reptiles.

Taxonomic trends in research

All publications focused on 23 amphibian species from 14 genera across 2 orders, and 38 reptile species from 28 genera across 2 orders. Among amphibian-related studies, 563 papers (88.66%) focused on Anura, followed by 72 papers (11.34%) on Caudata. Among reptile studies, 162 papers (52.09%) addressed Testudines, followed by 149 papers (47.91%) on Squamata (Fig. 2).

A review of the most frequently studied species revealed that Oriental Fire-bellied Toad was the most commonly mentioned amphibian, appearing in 123 publications. This was followed by Asiatic Toad *Bufo gargarizans* in 98 papers and Korean Large Brown Frog *Rana uenoi* in 71 papers (Fig. 3A). For reptiles, Reeves's Turtle *Mauremys reevesii* was the most frequently mentioned species with 42 papers, followed by Amur Rat Snake *Elaphe schrenckii* with 33 papers, and Softshell Turtles *Pelodiscus* spp. with 32 papers (Fig. 3B).

Research trends by academic field

When examining the academic fields by taxonomic group, amphibian studies were most frequently published in the natural sciences (657 publications, 66.77%), followed by literature (282 publications, 28.66%), medicine (24 publications, 2.44%), and engineering (21 publications, 2.13%). Within the natural sciences, the major fields were ecology (248 publications, 37.75%), physiology (166 publications, 25.27%), and embryology (128 publications,

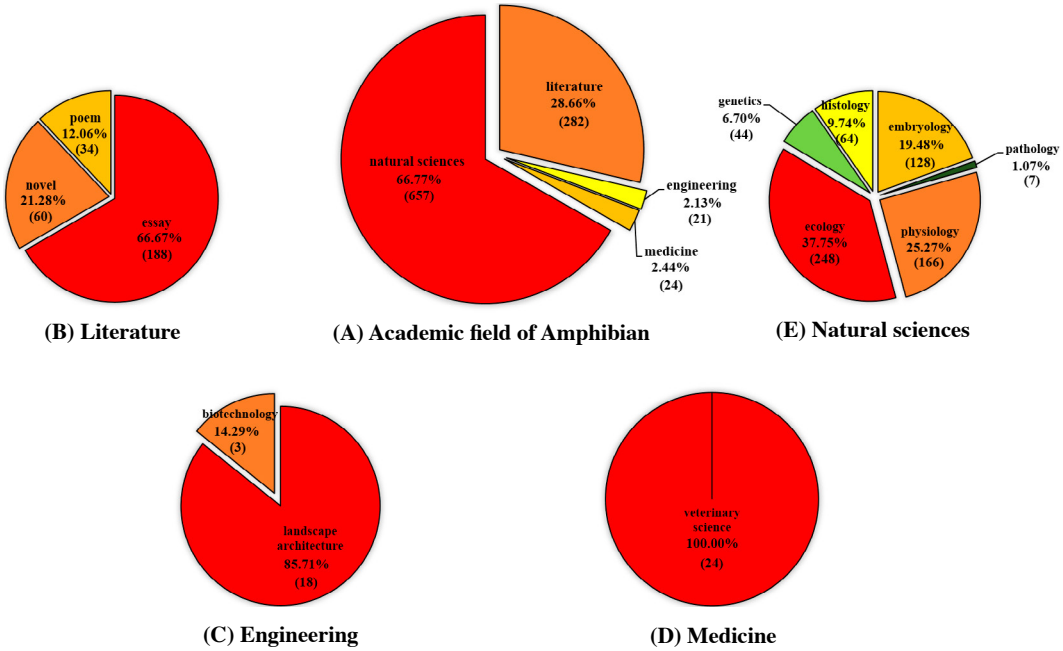

Fig. 4. (A) Relative number of publications about Amphibians by academic field, (B) Literature, (C) Engineering, (D) Medicine, and (E) Natural sciences: The numbers in parentheses indicate the number of publications.

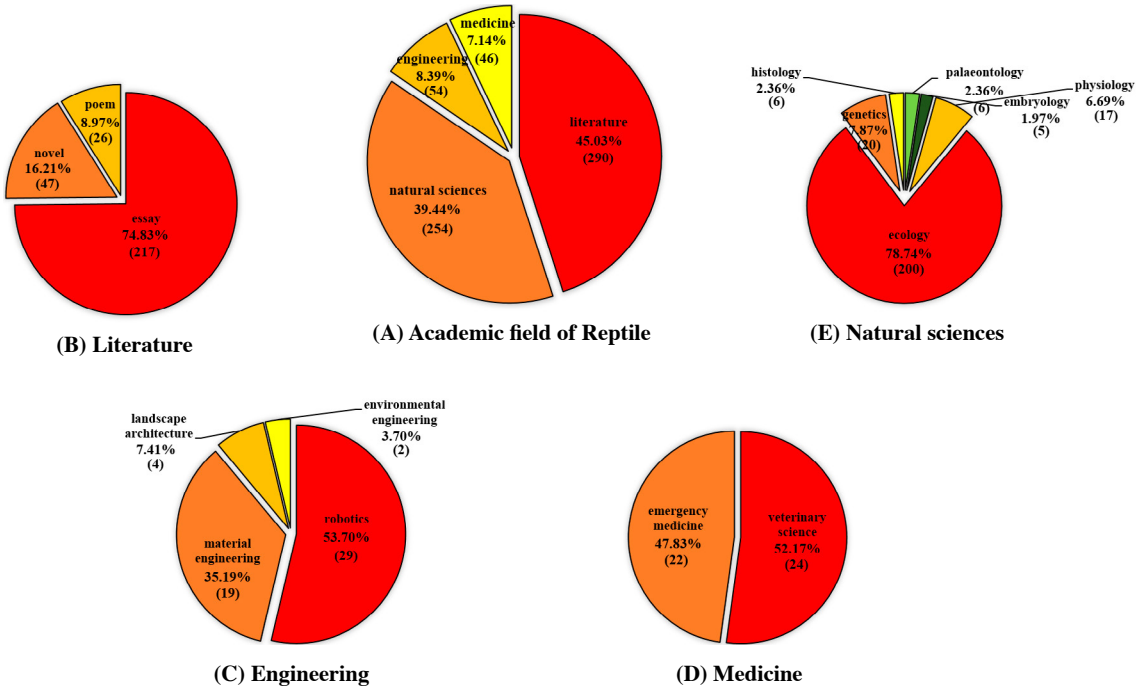

Fig. 5. (A) Relative amount of publication about Reptile by academic field, (B) Literature, (C) Engineering, (D) Medicine, and (E) Natural sciences: The numbers in parentheses indicate the number of publications.

19.48%) (Fig. 4).

Reptile studies were primarily published in literature (290 publications, 45.03%) and natural sciences (254 publications, 39.44%), followed by engineering (54 publications, 8.39%) and medicine (46 publications, 7.14%). In literature, essays accounted for the largest portion (217 publications, 74.83%), and in natural sciences, ecology was the dominant field (200 publications, 78.74%) (Fig. 5).

Table 1. The number of publication related to the Amphibian and Reptile by journal.

Rank	Journal name	Subject	No. paper
Amphibian			
1	Korean Journal of Herpetology	Biology	114
2	Korean Journal of Environment and Ecology	Ecology	83
3	Korean Journal of Zoology	Biology	76
4	Korean Journal of Environmental Biology	Ecology	68
5	Criticism of Korea Children's Literature	Literature	23
6	Korean Journal of Genetics	Genetics	20
7	Korean Journal of Microscopy	Natural science	15
8	Korean Journal of Veterinary Research	Medicine	14
9	Korean Journal of Limnology	Ecology	13
10	Chonbuk University Medical Journal	Medicine	12
11–269	Other journal	–	546
Total		–	984
Reptile			
1	Korean Journal of Herpetology	Biology	53
2	Korean Journal of Environment and Ecology	Ecology	25
3	Korean Journal of Veterinary Research	Medicine	18
4	Journal of Mechanical Science and Technology	Engineering	12
5	Journal of the Korean Society for Precision Engineering	Engineering	10
6	Poetry and World	Literature	9
7	Poem and Photo	Literature	7
8	Korean Journal of Ecology and Environment	Engineering	6
9	Samtoh Magazine	Literature	6
10	Chung-Ang Journal of Medicine	Medicine	6
11–267	Other journal	–	492
Total		–	644

The journal with the highest number of amphibian and reptile-related publications was the *Korean Journal of Herpetology* (114 amphibian papers and 97 reptile papers), followed by the *Korean Journal of Environment and Ecology* (83 amphibian papers and 47 reptile papers) (Table 1).

Major keywords

An analysis of weighted word frequency revealed that for amphibians, the most frequently occurring terms were "species" and "frog," followed by "rana" and "cell," as well as "temperature" and "toad." For reptiles, "species" and "snake" were the most frequent, followed by "turtle," with other notable terms including "serpent" and "population" (Fig. 6).

Discussion

In this study, we examined the publication trends and research characteristics of amphibian and reptile literature published in Korea, focusing on key periods, academic fields, and target species. The number of studies and publications related to amphibians and reptiles has gradually increased over time. Among amphibians, the most frequently studied group was the order Anura, particularly Fire-Bellied Toad, while among reptiles, the order Testudines and the species Reeves' Turtle were the most frequently featured. The most common keyword across both groups was "species," with "frog" frequently appearing in amphibian-related literature and "snake" in reptile-related literature. In terms of academic focus, a majority of publications for both taxa fell under the categories of natural sciences and literature, with essays dominating the literary field and ecology being the primary subfield within the natural sciences.

Amphibian- and reptile-related literature in Korea first appeared in the 1950s and increased exponentially by decade through 2020 (Fig. 1). By taxonomic group, amphibian-related literature totaled 984 publications, with steady twofold increases every decade from the 1950s to the

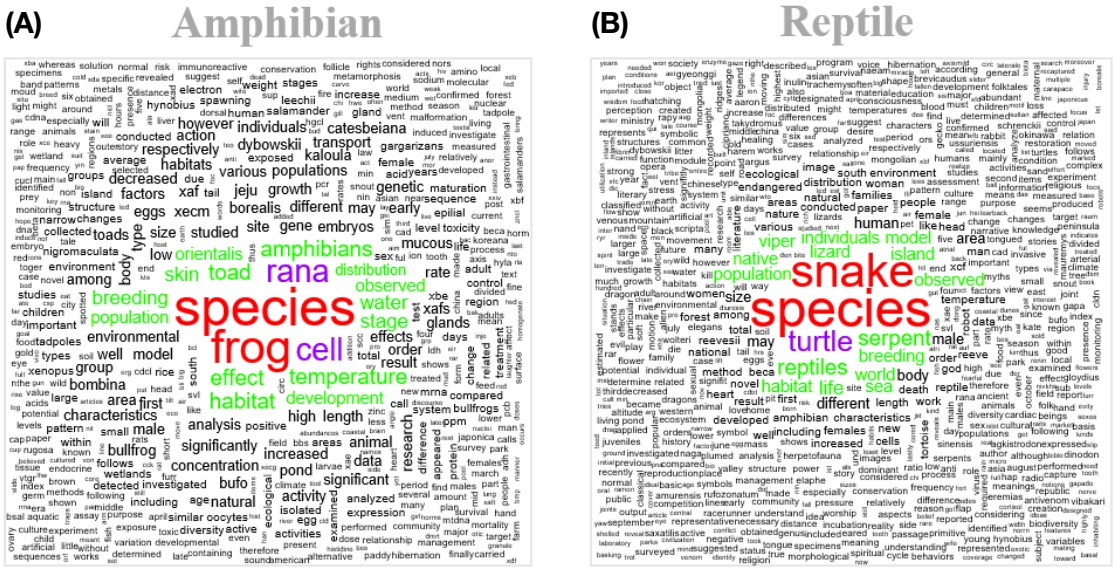

Fig. 6. Word cloud of (A) amphibian and (B) reptile publications. This word cloud illustrates the most frequently used words in the titles and abstracts of (A) 984 amphibian-related and (B) 644 reptile-related publications in Korea. Font size reflects word frequency, with more frequently occurring words appearing larger and closer to the center.

2010s. Fewer than 100 publications were produced up to the 1980s. Reptile-related literature totaled 644 publications, beginning in the 1960s, with fewer than 50 publications up to the 1990s. However, from the 2000s and especially the 2010s, the number of reptile publications grew by two- to threefold. In general, amphibians are easier to observe in the field than reptiles such as snakes and lizards, making it more feasible to collect data on them. As a result, studies on reptiles often face data acquisition challenges, require more time for analysis, and have slower research outputs (Pough *et al*., 2016; Do *et al*., 2020). Consequently, research on reptiles in the natural sciences is less active than on amphibians. On the other hand, snakes—due to their deep connections to mythology and religion—appear more frequently in literary works than in other academic disciplines (Kim, 2014; Kim, 2018). Overall, amphibians have been studied more actively than reptiles in Korea, as reflected in the larger number of publications and the earlier onset of amphibian-related literature by about a decade (Fig. 1A, B).

From the 1950s to the 2010s, amphibian research in Korea was predominantly conducted in the field of natural sciences each decade. In contrast, reptile-related publications were mainly concentrated in the field of literature from the 1960s to the 2000s. However, since the 2010s, the natural sciences have become the dominant field for reptile research (Fig. 1C, D). This shift in reptile research focus can be attributed to several factors: the rise of ecological issues such as endangered species conservation and the spread of invasive species, along with advances in research techniques. Methods such as radio telemetry, improved capture techniques, and the commercialization of tools like habitat prediction models have made ecological research more accessible and widely adopted (Do *et al*., 2016; Koo *et al*., 2017; Park *et al*., 2019). In general, the number and focus of research topics reflect researchers' interests and social contexts, which tend to vary over time (Neff and Corley, 2009). In Korea, studies on endangered species have been consistently conducted since the 1980s, and the volume of research has increased exponentially over time. More recently, easily observable invasive reptiles in the wild—especially turtles—have garnered attention in the media and academic research due to their ecological impact and safety concerns (Koo *et al*., 2017; Do *et al*., 2020; Park and Oh, 2021). As a result, the order Testudines was the most frequently mentioned reptile group in this study. The most frequently cited species included the endangered Reeves' Turtle and Amur Rat Snake, followed by *Pelodiscus* spp. and the invasive Red-eared Slider *Trachemys scripta elegans* (Fig. 3B). These findings indicate that reptile research has shifted from literature to natural sciences in recent years. In addition, engineering-related studies have shown an increasing trend. Prior to the 1990s, engineering research on amphibians and reptiles was virtually nonexistent. However, since the 2000s, fields such as robotics—drawing inspiration from snake locomotion—and materials science—utilizing adhesive toe pads of Gecko *Gekko japonicus*—have grown, alongside landscape architecture studies aimed at creating substitute habitats for endangered species like Narrow-mouthed Toad and Korean Golden Frog *Pelophylax chosenicus* (Shin, 2011; 2013; Shim *et al*., 2014). Overall, research trends on amphibians and rep-

tiles in Korea have appropriately reflected shifting societal contexts and interests over time. Technological development and emerging ecological issues have played a significant role in shaping changes in research focus and disciplinary trends.

An analysis of the research fields related to amphibians and reptiles in Korea shows that amphibian studies were most frequently conducted in the natural sciences (66.77%), with a primary focus on ecology (33.75%), particularly concerning species conservation, reproduction, and distribution. This was followed by physiology (25.27%), which addressed the effects of toxic substances such as mercury, nickel, and pesticides, and embryology (19.48%) (Park and Ko, 2015; Lee and Ko, 2017; Lee *et al*., 2021). For reptiles, literature (45.03%) accounted for the highest proportion, consisting mainly of essays on endangered species habitat conservation and reflections on myths and fiction involving snakes and turtles (74.83%) (Kim, 2014; Kim, 2018). The second most prominent field was the natural sciences (39.44%), primarily focused on ecological studies (78.74%) regarding the distribution, morphology, and conservation of reptiles (Do *et al*., 2016; Park and Oh, 2021). Both amphibian and reptile research was predominantly ecological in nature, and the journals with the highest number of related publications were the *Korean Journal of Herpetology* and the *Korean Journal of Environment and Ecology*, both of which emphasize ecological topics. The most frequently occurring word in the titles and abstracts was "species," indicating that amphibian and reptile studies in Korea have primarily been conducted at the species level rather than at the community level (Park and Ko, 2015; Park and Oh, 2021; Lee *et al*., 2021). For amphibians, other frequently occurring keywords included "frog," "rana," and "toad," all referring to members of the order Anura, which accounted for the majority of amphibian publications (88.66%). These keywords were directly associated with the three most frequently studied species: the Oriental Fire-bellied Frog, the Asiatic Toad, and the Korean Large Brown Frog. For reptiles, the most common keywords included "snake," "turtle," and "serpent," which correspond to the most frequently studied reptile subgroups—Testudines (52.09%) and Serpentes (30.55%)—and were linked to the two most frequently cited species: the Reeves' Turtle and the Amur Rat Snake. In conclusion, research on amphibians and reptiles in Korea has primarily focused on ecology, particularly in relation to species distribution, reproduction, and conservation. Most studies have been conducted at the species level, with reptile research centered on snakes and turtles, and amphibian research focused on frogs and toads.

In this study, we collected and analyzed literature using the Publish or Perish (PoP3) program linked to Google Scholar. However, since databases such as the Korea Citation Index (KCI), Research Information Sharing Service (RISS), DBpia, and Web of Science were not utilized, some studies or publications may have been omitted. Therefore, future research should address this limitation by incorporating multiple databases to enhance the completeness and reliability of the results.

In summary, amphibian and reptile-related literature in Korea first appeared in the 1950s and has increased exponentially every decade up to 2022. Amphibian research has consistently been most heavily focused on the natural sciences, while reptile publications were primarily centered on literature prior to the 2010s. However, since the 2010s, the proportion of natural science research on reptiles has surpassed that of literature, largely due to advancements in research technologies and methodologies. Additionally, studies in the field of engineering have increased for both amphibians and reptiles since the 2000s. These research trends appear to have been strongly influenced by the changing societal context, interests, and issues of each era. Research on amphibians and reptiles in Korea has commonly focused on ecological topics, with reptile studies concentrating on snakes and turtles, and amphibian studies on frogs and toads, primarily at the species level. Moving forward, it is hoped that continued ecological research with a focus on amphibian and reptile conservation will yield tangible outcomes at the species level, contributing meaningfully to biodiversity conservation.

Conflicts of Interest

The authors of this paper have no affiliation with any interests and are solely responsible for the paper.

References

Alibardi, L. 2003. Adaptation to the land: the skin of reptiles in comparison to that of amphibians and endotherm amniotes. Journal of Experimental Zoology Part B: Molecular and Developmental Evolution 298(1):12-41.

Bullock, T.H. 1955. Compensation for temperature in the metabolism and activity of poikilotherms. Biological Reviews 30(3):311-342.

Cortés-Gomez, A.M., C.A. Ruiz-Agudelo, A. Valencia-Aguilar and R.J. Ladle. 2015. Ecological functions of Neotropical amphibians and reptiles: a review. Universitas Scientiarum 20(2):229-245.

Dawei, L. and C. Guan-tin. 2018. wordcloud2: Create word cloud by 'htmlwidget'. R package version 0.2.1.

Debono, J., M.H. Bos, M.S. Do and B.G. Fry. 2019. Clinical implications of coagulotoxic variations in Mamushi (Viperidae: *Gloydius*) snake venoms. Comparative Biochemistry and Physiology Part C: Toxicology and Pharmacology 225:108567.

Do, M.S., G. Choi, J.W. Hwang, J.Y. Lee, W.H. Hur, Y.S. Choi

and H.K. Nam. 2020. Research topics and trends of endangered species using text mining on Korea. Journal of Asia-Pacific Biodiversity 13(4):518-523.

Do, M.S., J.W. Lee, H.J. Jang, D.I. Kim and J.C. Yoo. 2016. Interspecific competition and spatial ecology of three species of vipers in Korea: an application of ecological niche-based models and GIS. Korean Journal of Environment and Ecology 30(2):173-184.

Do, M.S., K.B. Nam and J.C. Yoo. 2017. Distribution and movement tendencies of short-tailed viper snakes (*Gloydius saxatilis*) by altitude. Asian Herpetological Research 8(1): 39-47.

Do, M.S., S. Choi, H.J. Jang and J.H. Suh. 2022a. Predicting the distribution of three Korean pit viper species (*Gloydius brevicaudus*, *G. ussuriensis*, and *G. intermedius*) under climate change. Russian Journal of Herpetology 29(5):262-274.

Do, M.S., S.J. Son, G. Choi, N. Yoo, D.I. Kim, K.S. Koo and H.K. Nam. 2022b. The establishment of ecological conservation for herpetofauna species in hotspot areas of South Korea. Scientific Reports 12(1):14839.

Do, M.S., S.J. Son, J.H. Jung, S.C. Lee, G. Choi and H.K. Nam. 2023. Effects of environmental factors and intraspecific niche overlap on the body and ecological characteristics of red-tongued pit vipers (*Gloydius ussuriensis*). Scientific Reports 13(1):21310.

Hoffmann, A.A. and C.M. Sgrò. 2011. Climate change and evolutionary adaptation. Nature 470(7335):479-485.

Kang, S.H. 1959. Studies on the Composition of Amino Acid in Retina and Lens Body of the Frogs. The Korean Journal of Zoology 2(2):10-14.

Katayama, N., T. Amano, G. Fujita and H. Higuchi. 2012. Spatial overlap between the intermediate egret *Egretta intermedia* and its aquatic prey at two spatiotemporal scales in a rice paddy landscape. Zoological Studies 51:1105-1112.

Katayama, N., T. Goto, F. Narushima, T. Amano, H. Kobori and T. Miyashita. 2013. Indirect positive effects of agricultural modernization on the abundance of Japanese tree frog tadpoles in rice fields through the release from predators. Aquatic Ecology 47(2):225-234.

Kim, H.R. 2018. "Woman's offspring" as the church in revelation 12. Journal of Korea Evangelical Theological Society 17(2):242-276.

Kim, J.H. 2014. The snake as cultural archetype and its epic acceptance in Romania. East European Studies 38(1):109-132.

Ko, B.J. and S.H. Eo. 2017. Mammalian research topics and trends in Korea. Korean Journal of Environment and Ecology 31(1):30-41.

Koo, K.S., S. Kwon, M.S. Do and S. Kim. 2017. Distribution characteristics of exotic turtles in Korean wild-based on Gangwon-do and Gyeongsangnam-do. Korean Journal of Ecology and Environment 50(3):286-294.

Lee, H.B. and S.K. Ko. 2017. The effects of lead (II) nitrate on the embryo development in native amphibians. Korean Journal of Environmental Biology 35(4):706-714.

Lee, S.Y., S.Y. Choi, Y.S. Bae, J.H. Suh, H.J. Jang and M.S. Do. 2021. Distribution prediction of Korean clawed salamander (*Onychodactylus koreanus*) according to the climate change. Korean Journal of Environment and Ecology 35(5): 480-489.

Lee, Y.S., M.S. Do, W. Kim, H.S. Jeon, S.C. Lee, J.H. Jung and J. An. 2022. Phylogenetic relationships between three Korean pit viper *Gloydius* (Serpentes: Crotalinae) species using mitochondrial DNA genes. Genes & Genomics 44(5): 517-526.

Ministry of Environment. 2015. List of prohibited wildlife such as capture and harvesting. Ministry of Environment, Seoul.

Nalon, E., B. Contiero, F. Gottardo and G. Cozzi. 2021. The welfare of beef cattle in the scientific literature from 1990 to 2019: a text mining approach. Frontiers in Veterinary Science 7:588749.

Neff, M.W. and E.A. Corley. 2009. 35 years and 160,000 articles: a bibliometric exploration of the evolution of ecology. Scientometrics 80(3):657-682.

NIBR. 2022. National Species List of Korea. National Institute of Biological Resources, Incheon, Korea.

Packard, G.C., C.R. Tracy and J.J. Roth. 1977. The physiological ecology of reptilian eggs and embryos, and the evolution of viviparity within the class Reptilia. Biological Reviews 52(1):71-105.

Paik, N.K., H.Y. Lee and E.K. Jung. 1990. Heteroplasmy in mitochondrial DNA of Chinese viper, *Agkistrodon blomhoffii brevicaudus*. Genes & Genomics 12(4): 331-336.

Park, C.J., H.S. Ahn, H.M. Ahn and M.C. Gye. 2011. Developmental toxicity of alkylphenols in amphibians: a review. Korean Journal of Ecology and Environment 44(2):103-112.

Park, I.K., D.I. Kim and D.S. Park. 2019. Habitat use and home range of Schlegel's Japanese gecko (*Gekko japonicus*) in South Korea. Proceedings of the 12th Korean Amphibian and Herpetology Society Conference. p. 9.

Park, S.H. and S.K. Ko. 2015. A study on the ovarian cycle of Asian toad (*Bufo gargarizans*). Korean Journal of Environmental Biology 33(4):419-424.

Park, S.M. and H.S. Oh. 2021. First report of Yellow-spotted amazon river turtle (*Podocnemis unifilis*) in neolb-eun pond area in Jeju Island. Journal of Wetlands Research 23(2): 116-121.

Parmesan, C. 2006. Ecological and evolutionary responses to recent climate change. Annual Review of Ecology, Evolution, and Systematics 37:637-669.

Pough, F.H., R.M. Andrews, J.E. Cadle, M.L. Crump, A.H. Savitzky and K.D. Wells. 2016. Herpetology. Sinauer Associates, Incorporated, Publishers.

R Core Team. 2023. R: a language and environment for statistical computing. Available at http://www.R-project.org/.

Rajman, M. and R. Besançon. 1998. Text mining: natural language techniques and text mining applications. In: Data Mining and Reserve Engineering Springer US press. pp.

50-64.

Sahadevan, S., M. Hofmann-Apitius, K. Schellander, D. Tesfaye, J. Fluck and C.M. Friedrich. 2012. Text mining in livestock animal science: introducing the potential of text mining to animal sciences. Journal of Animal Science 90(10):3666-3676.

Shim, Y.J., D.G. Cho, S. Park, D.J. Lee, Y.H. Seo, S.H. Kim, D.H. Kim, S.B. Ko, J.Y. Cha and H.C. Sung. 2014. Development of habitat suitability index for habitat restoration of narrow-mouth frog (*Kaloula borealis*). Journal of the Korean Society of Environmental Restoration Technology 17(2):109-123.

Shin, H., C.H. Kim and H.H. Lee. 2013. Development of a snake robot for unstructured environment. The Journal of Korea Robotics Society 8(4):247-255.

Shin, H.C., K.M. Jeong and J.J. Kwon. 2011. Development of a snake robot with 2-DOF actuator modules. Journal of Institute of Control, Robotics and Systems 17(7):697-703.

Son, S.J., M.S. Do, G. Choi and H.K. Nam. 2023a. Identifying research trends in avian migration tracking in Korea using text mining. Journal of Asia-Pacific Biodiversity 17(2): 303-308.

Son, S.J., M.S. Do, G. Choi, Y. Park and H.K. Nam. 2023b. Analysis of avian research trends related to rice fields in South Korea using text mining. Journal of Asia-Pacific Biodiversity 16(4):459-464.

Valencia-Aguilar, A., A.M. Cortés-Gómez and C.A. Ruiz-Agudelo. 2013. Ecosystem services provided by amphibians and reptiles in Neotropical ecosystems. International Journal of Biodiversity Science, Ecosystem Service and Management 9(3):257-272.

Wareham, D.C. 2005. Elsevier's Dictionary of Herpetological and Related Terminology. Elsevier.

Submitted: August 5, 2025
Revised: September 10, 2025
Accepted: October 13, 2025