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Optimization of the wildlife protection list system from the biodiversity conservation perspective

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China's list of wild animals under state protection, as a core supporting system of the "Wildlife Protection Law," has been lagging for 32 years without systematic updates and has four major systemic defects: missing revision procedures, unclear listing standards, conflicting connections with international convention lists, and insufficient implementation guarantees. To strengthen biodiversity protection, this paper proposes five major optimization strategies: establishing a dynamic update mechanism with a three-year cycle, solidifying the entire process of standardizing the revision of the list, improving the legal standards for species inclusion and classification, improving the domestic conversion and application rules of international lists, and constructing a phased implementation path guarantee system, to save endangered species and maintain ecological balance through system improvement.

KEYWORDS

biodiversity conservation, endangered species, wildlife, wildlife list system, wildlife protection law

1 Introduction

The Red List of Endangered Species, updated by the IUCN at the end of 2022, shows that many new endangered wild animals have been added, with nearly 10% of the assessed marine species facing the risk of extinction (Lewin et al., 2024). The World Wide Fund (WWF) for Nature's Living Planet Report 2022 points out that since 1970, the population of wild animals, such as mammals, birds, amphibians, reptiles, and fish, has decreased by an average of 69% (Wang et al., 2024). The decline of wild vertebrate populations in tropical regions is particularly significant, with the average number of monitored populations in Latin America and the Caribbean decreasing by 94% from 1970-2018, and the decline in freshwater species populations reaching 83%. The overexploitation and destruction of nature by humans have caused severe threats to the survival of global wildlife (Begashe et al., 2024; Delplanque et al., 2024).

China is a country with the richest biodiversity. There are more than 30,000 higher plant species, including 17,300 endemic species, and 6,347 vertebrate species, including 667 endemic species (Huang et al., 2025; Yan et al., 2025). However, China has many endangered species and a high degree of endangerment. According to incomplete statistics, more than 120 species are listed in the Appendices of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 257 species are included in the National Key Protected Wildlife List, and 400 species of endangered birds,

amphibians, reptiles, and fish are included in the China Red Data Book of Endangered Animals (Liao and Cao, 2024). Data from the International Union for the Conservation of Nature show that the number of threatened species of wildlife in China is among the highest in international comparisons, and the task of biodiversity conservation is urgent (Liu et al., 2024).

At the beginning of its legislation, China's "wildlife protection law" incorporated the protection list into the law as an institutionalized norm. However, after decades of operation, its legal effect is still different from the social needs and legal expectations of endangered species protection. This article will analyze the evolution of China's wildlife protection list system, its biodiversity protection value, existing problems, and explore the path of system optimization.

2 Methodology

The methodology section of this paper mainly adopts the literature research method, historical analysis method, institutional comparison method, and normative analysis method, combined with the review of the development history of China's wild animal protection list system, the analysis of current problems, and reference to international experience, and systematically puts forward the path of institutional optimization.

First, the article uses the literature research method to sort out relevant legal texts, policy documents, statistical reports, and academic research results at home and abroad, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora, the Living Planet Report 2022, and China's Wildlife Protection Law, which provides a solid documentary basis for the study. Second, through the historical analysis method, the evolution process of China's wild animal protection list system since the legislation in 1988 is reviewed, including the formulation, revision process, and the implementation of relevant rescue projects of the list, revealing the stage and lag problems of the system development. Third, the institutional comparison method is adopted to compare and analyze the legislative practices of foreign countries, such as the US Endangered Species Act (ESA), especially its provisions on the revision procedures of the list, the standards for species inclusion, and habitat protection, which provide a reference for the improvement of the Chinese system. Finally, the article uses the normative analysis method to interpret the articles and evaluate the system of China's current Wildlife Protection Law and related supporting systems, pointing out the legal gaps and implementation obstacles in the current list in terms of the update mechanism, revision procedures, inclusion standards, and international connection, and puts forward targeted legal revision suggestions on this basis. In general, the research method focuses on the combination of legal texts and practice, the comparison of domestic experience and international experience, and the connection between problem diagnosis and system construction, which reflects the research logic from factual analysis to should-be promotion.

3 Historical evolution of China's list of wildlife

Wildlife refers to animals that depend on natural environments, such as forests and grasslands, for survival and that have not been artificially domesticated (Esteban-Sanchez et al., 2024). China's "Wildlife Protection Law" clearly defines its scope as "precious and endangered terrestrial and aquatic wild animals and terrestrial wild animals that are beneficial or have important economic and scientific research value". As an important natural resource, wildlife not only provides raw materials for human production and life but also plays an irreplaceable role in the ecosystem's material cycle, energy, and information transmission (Zhang et al., 2024).

At the international level, the United Kingdom was the first country to establish a wildlife list system (Gautschi et al., 2024). The "Animal Protection Act" of 1911 formed a prototype of the list in the "Definition" section by listing; the New Zealand "Wildlife Act" of 1953 mentioned "wildlife listed in the Appendix" in the chapter "Protection of Wildlife" but adopted a reverse exclusion list (Kilonzo et al., 2024); the Convention on International Trade in Endangered Species of Wild Fauna and Flora" (hereinafter referred to as the "Trade Convention") was concluded in 1973, and the list of species in the Appendix was determined by voting at the Conference of the Parties, establishing the Wildlife List System at the international law level (Kwan et al., 2023).

China acceded to the Convention on International Trade in Endangered Species (CITES) in 1980, and the convention officially came into effect in 1981. In 1988, the "Wildlife Protection Law" was promulgated, which not only responded to the relevant content of the CITES list but also stipulated the formulation, adjustment, and implementation methods of the "National Key Protected Wildlife List" and the "Local Key Protected Wildlife List", marking the official establishment of China's wildlife list system.

Before and after the promulgation of the "Wildlife Protection Law" in 1988, China implemented the "Seven Major Rescue Projects" for key endangered species, including giant pandas, crested ibis, and Yangtze alligators (Chen et al., 2021). The law clearly stipulates that the purpose of the legislation is to "protect and rescue rare and endangered wild animals, protect, develop, and rationally utilize wild animal resources, and maintain ecological balance." Chapter 2 establishes a wildlife protection system, prohibits illegal hunting and destructive activities, and divides national key protected wild animals into first- and second-level, forming a hierarchical list system, with reference to international practices and in combination with China's actual situation. In 1989, China promulgated the "National Key Protected Wildlife List", which includes 96 species or types of first-level protected species (such as giant pandas and golden monkeys) and 160 species or types of second-level protected species (such as black bears and swans) (Table 1).

From 1989 to 2021, the list was only adjusted in 2006 to change all musk deer species from the second to the first level. In June 2020, all pangolin species were adjusted from the second to the first level, without adjusting the protection level of other species or adding newly discovered species (Sun et al., 2024).

TABLE 1 Species on the national list of wildlife under national priority protection in 1989 and 2021.

Year	Type	Grade 1 protection	Grade 2 protection
1989	Aquatic animal (48)	13	35
	Terrestrial animal (208)	83	125
2021	Aquatic animal (302)	46	256
	Terrestrial animal (686)	189	497

The 2021 updated list saw a significant expansion in species numbers, with the total increasing from 256 species in 1989 to 980 species, representing an addition of 724 species. By taxonomic group, the additions include 686 terrestrial wildlife species, 294 aquatic wildlife species, and 8 categories. However, amphibians, reptiles, and certain small mammal groups remain the least represented, with their inclusion rates significantly lower than those of birds, large mammals, and other categories. This disparity in taxonomic distribution not only directly confirms the previous list's insufficient coverage of certain groups but also indicates that while the 2021 update significantly expanded the protection scope, the balance of conservation efforts across different taxonomic groups remains inadequate. This further supports the argument that the listing system requires continuous optimization to achieve comprehensive protection (see Table 1).

In August 2000, the State Forestry Administration promulgated the "National List of Beneficial or Economically and Scientifically Valuable Wild Animals", and the Chinese wildlife classification and grading management system was established. In January 2017, the State Council revised and implemented the "Wildlife Protection Law of the People's Republic of China" (hereafter referred to as the "Protection Law"), further clarifying the principle of "the state implements classified and graded protection of wild animals" and stipulating that the national key protected wildlife list shall be adjusted every 5 years based on the assessment situation (Ji et al., 2022). After the implementation of the "Wildlife Protection Law" in 2007, the State Council's forest and agricultural and rural departments successively released two batches of national key protected terrestrial wildlife lists for artificial breeding (the first batch of 9 species and the second batch of 18 species) and three batches of national key protected aquatic wildlife lists for artificial breeding (the first batch of 6 species, the second batch of 18 species, and the third batch of 10 species) (Liang et al., 2023).

4 Main problems existing in China's wildlife protection list system

Against the backdrop of increasing global attention to biodiversity conservation, the assessment and updating of wildlife protection lists is a scientific review of the current status of China's rare and endangered wild animals, which not only meets the protection needs of the new era but also conforms to international trends (Miao et al., 2021). China's wildlife

protection list system lays the legal foundation for wildlife protection, promotes the formulation of biodiversity protection policies, and the improvement of the "Wildlife Protection Law" (Kong et al., 2023). However, the current system still has the following problems:

4.1 Lag in updating the list system

As a supporting system of the "Wildlife Protection Law", the earliest "National Key Protected Wild Animal Protection List" has not undergone systematic updating and improvement from its release in 1989 to 2021, and the new version of the list was not released until 2021. In contrast, the "Wildlife Protection Law" has undergone five revisions in 30 years, and the direction of reform focuses on wildlife protection and biodiversity maintenance, but the list system has not kept pace with the times, and the lag is prominent.

With the development of the economy and society and the expansion of construction activities, the habitats and living conditions of many rare and endangered species have changed significantly, and some species have changed from no threat to "endangered" or even "critically endangered", and a few are on the verge of extinction. The lag of the list directly leads to the obstruction of the protection of many species: the Chinese Crested Tern was assessed as critically endangered by the IUCN in 2000, and was not included in the national first-level protection until 2021. During 21 years, breeding habitat was developed, and bird eggs were harvested, and the wild population was less than 50 in 2010; the Desert Cat was assessed as vulnerable in 2016 and included in second-level protection in 2021. During the 5 years, the habitat was fragmented, and poaching occurred frequently. The population decreased by more than 30% the Sichuan-Shaanxi Zhe Luo Salmon was classified as critically endangered in 2008 and included in the first-level protection in 2021. During the 13 years, the migration channel was destroyed, and only 30–50 tails remained in the wild in 2015; the Green Peafowl was classified as endangered in 2013 and was included in the first-level protection in 2021. During the 8 years, the habitat was occupied, and the population decreased from 800 to less than 500 (Shi et al., 2021).

Taking the Chinese Crested Tern as an example, during the period from 2000 to 2021, when it was not included in the list, the population dropped to 43 in 2010, and there were fewer than 20 breeding individuals. Due to the lack of a legal basis, its breeding ground could not be included in key protection; there was a shortage of special protection funds, there was a lack of cross-regional cooperation, and destructive behaviors were difficult to control. After being included on the list in 2021, the core breeding ground was designated an important habitat, a special rescue project was launched, a cross-regional protection mechanism was established, scientific research support was strengthened, and the population increased to about 150 by 2024, the breeding success rate increased from 35% to 68%, and two new breeding grounds were added, and the protection effect was remarkable. These cases fully demonstrate the serious impact of the lag in updating the list on species protection, and also highlight the urgency of timely updating.

4.2 Lack of revision procedures

As a legal mechanism for managing wildlife conservation at the national level, the List System review process must naturally be subject to procedural norms. However, China's Wildlife Protection Law currently addresses only limited legal matters concerning the list system, such as species classification tiers, adjustment cycles, and the authorities responsible for formulation and approval, without elaborating on the specific revision procedures for the list. This leaves key aspects of the revision process legally undefined, including the initiation of revisions, species assessment, and public participation during the revision process, the division of revision authority, and revision timelines. This has left China's listing system, which has been in operation for more than 30 years, lacking procedural safeguards to ensure its adjustment processes' standardization and timeliness. During the 2021 revision process, intense disputes frequently arose among the scientific community, conservation organizations, and certain user industries despite the competent authorities organizing expert deliberations and soliciting public feedback regarding whether specific species (such as certain snakes or birds) should be listed and how their protection levels should be determined. The absence of legally mandated, transparent evaluation procedures, information disclosure mechanisms, and objection resolution processes has sometimes called into question the scientific rigor, fairness, and social consensus of final decisions. This undermines the list's authority and enforceability (Sun et al., 2024).

4.3 Lack of scientific listing criteria

China's current species protection listing standards suffer from significant fragmentation and ambiguity, lacking a systematic and scientific framework for inventory development and classification criteria. Existing regulations only provide general references in the Wildlife Protection Law of the People's Republic of China to two categories: "precious and endangered wildlife" and "terrestrial wildlife of significant ecological, scientific, and social value." These classifications lack quantitative assessment metrics. While some local revisions attempt to incorporate simplified indicators like population size and habitat area, they remain insufficient. terrestrial wildlife of significant ecological, scientific, and social value" without supporting quantitative assessment metrics. While some local revisions to lists have attempted to incorporate simplified indicators like population size and habitat area, the absence of nationally unified threshold standards and operational guidelines has resulted in insufficient applicability and consistency of criteria. This absence of scientifically grounded listing criteria fundamentally reflects a disconnect between conservation systems and practical operational needs. It not only deprives the formulation and revision of lists of robust justification but also triggers cascading issues such as decision-making biases and enforcement confusion due to ambiguous standards, severely undermining the precision and authority of conservation efforts.

The absence of standards has repeatedly created decision-making dilemmas in the practice of revising protected species lists. For instance, in determining the protection level for a locally

endemic bird species, some experts recommended classifying it as "Endangered" based on the significant reduction in its habitat, due to the lack of unified quantitative standards. while others opposed this, arguing the population size did not meet the traditional threshold for "precious" status. Ultimately, the intense disagreement led to prolonged uncertainty over the species' protection level, causing the critical window for habitat restoration and population conservation to be missed. At the core of such decision-making dilemmas lies the inadequacy of qualitative descriptions in addressing the dynamic changes in species survival status and complex ecological scenarios. This approach fails to accurately identify species requiring urgent protection while also hindering timely adjustments to the conservation status of species with recovering populations. Consequently, it leads to the dual problem of wasted conservation resources and species that should be protected but remain unprotected (Xiao et al., 2021).

4.4 Conflicts with international convention lists

The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was signed in June 1973 and entered into force in July 1975. China acceded to CITES in December 1980. Its core objective is to prevent species from being endangered by overexploitation by regulating international trade. The Convention divides protected species into three appendices: Appendix I lists species threatened with extinction due to trade, and trade is only permitted in special circumstances; Appendix II lists species that are not necessarily threatened with extinction but require strict trade controls to prevent them from becoming endangered; Appendix III lists native species for which member states require the cooperation of other countries to control trade (Liu et al., 2017).

Currently, China mainly incorporates nonnative wild animals listed in CITES Appendices I and II into the scope of national key protected wild animals after being approved by the wildlife protection authorities of the State Council, in accordance with Article 35 of the "Wildlife Protection Law" and the "Notice of the Ministry of Forestry on Approving Some Endangered Wild Animals as National Key Protected Wild Animals." (Luo et al., 2016) However, in practice, there are significant conflicts between the domestic list and the international convention list, including problems caused by improper application of conversion rules and loopholes caused by the absence of clear conversion rules.

First, the protection level does not match. According to CITES standards, Appendix I species are classified as "species threatened with extinction" and should enjoy national first-level protection. However, after China's approval, only 19 species are listed as national second-level protection. Among Appendix II species, 84 species are approved as national second-level protection, and 1 species is approved as national first-level protection. Among Appendix III species, 10 species are approved for national second-level protection. Protection of some species does not meet the requirements of the Convention (see Table 2). Second, some species are omitted from protection. According to statistics, 107 species of wild animals in the lists of other international treaties,

TABLE 2 Differences between the international convention list and China’s approval and protection.

CITES appendix level	Level after China’s approval		Current list protection level	
	National first-level protected animal	National second-level protected animal	National first-level protected animal	National second-level protected animal
One	44	19	4	17
Two	1	84	6	7
Three	0	10	4 s	0

such as the Convention on Migratory Species and the Convention on Biological Diversity, have not been included in China’s list and cannot be protected by domestic law, such as the African wild dog and the blue-throated macaw (see Table 3). Third, there is a risk of overprotection of alien species (Zhou and Li, 2024). Approving all non-native convention appendix species as national key protected species without distinguishing their impact on the local ecology may lead to alien species crowding out the living space of native species and disrupting the ecological balance (Song et al., 2020).

5 Optimization measures for China’s wildlife protection list system

To improve the effectiveness of biodiversity protection and strengthen the protection of endangered wild animals, the wildlife protection list system must be improved in the following aspects:

5.1 Establish a dynamic updating system for the list

Based on the list adjustment cycle established by current legislation, combined with international practices and China’s protection needs, the adjustment rules of the appendices to the Convention on International Trade in Endangered Species of Wild Fauna and Flora can be referred to, the update cycle can be optimized and shortened, and a more dynamic and scientific adjustment mechanism for the list of key protected wild animals can be constructed. There are differences in the frequency of updates of the list in different countries and international organizations. China’s current 5-year adjustment cycle is significantly longer than that of some countries. The specific comparison is as follows:

As can be seen from the Table 4, the update cycle of our country’s list is not only longer than IUCN’s annual update and the United States’ dynamic adjustment, but also slower than the 3-year cycle of the European Union and Australia. In the past, there was a situation where there was no systematic update for as long as 32 years, which is not adapted to the dynamic needs of global wildlife protection. To this end, it is necessary to strengthen scientific research support, increase the tracking, research, and monitoring of species resources, scientifically assess population status, and fully consider multiple factors such as ecosystems, species diversity, and biological genetic resources. Based on this, the existing 5-year evaluation cycle should be shortened to 3 years, and the list should be updated, adjusted, and supplemented promptly to ensure a more rapid and accurate reflection of wildlife population dynamics and to carry out rescue and protection of endangered species promptly (Liu et al., 2024).

At the same time, based on strengthening the protection of species in the list, we can draw on the advanced experience of ESA in “habitat management of species under the list” to raise the protection of species habitats to the same important position as wildlife protection, and take the systematic theory of wildlife protection as the guidance to coordinate the protection of species themselves and their natural habitats, to avoid artificially separating precious and endangered wild animals and their living environment in the top-level design.

5.2 Revision procedure for establishing the list

5.2.1 Core content of program design

Drawing on the procedural framework of the US ESA and combining it with China’s national conditions, clarify the entire process of list revision, and solidify key links in legal form: First, the

TABLE 3 Examples of important international treaty species not included in the China List.

Species name	IUCN status	International treaty affiliation	CITES appendix level
African Wild Dog	Endangered (EN)	Convention on Migratory Species	Appendix II
Olive Ridley Sea Turtle	Vulnerable (VU)	Convention on Migratory Species	Appendix I
Blue-throated Macaw	Critically Endangered (CR)	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Appendix I
Asiatic Wild Ass	Near Threatened (NT)	Convention on Biological Diversity	Appendix II
Chinese Bahaba	Critically Endangered (CR)	Convention on Migratory Species	Appendix II

TABLE 4 Comparison of the update frequency of wildlife-related lists in some countries and international organizations.

Country/ international organization	List name	Update cycle
China	National Key Protected Wild Animal List	Statutory 5 years (since 2017), no systematic updates from 1989-2021
United States	Endangered Species Act (ESA)	No fixed cycle, dynamically adjusted based on species monitoring and assessment results (average annual update 1–2 times)
European Union	List of Wildlife Trade Supervision	Evaluated and adjusted every 3 years
International Union for Conservation of Nature (IUCN)	Red List of Threatened Species	Updated annually
Australia	List of Threatened Species>>	Comprehensive assessment and update every 3 years.

initiation mechanism, giving scientific research institutions and environmental protection organizations the right to propose based on monitoring data, and the competent department must respond to whether or not to accept the proposal within 60 days; second, the evaluation specification, forming an independent evaluation committee composed of experts in ecology, biology, law and other fields, and using IUCN evaluation standards combined with local data to carry out scientific argumentation; third, public participation, publicizing species assessment reports, protection level recommendations and other information through government websites, local announcements, and other channels, setting up a public comment solicitation period of no less than 30 days, and organizing hearings for major controversial species; fourth, time limit requirements, clarifying that the entire process from proposal acceptance to final list publication shall not exceed 12 months, and special complex situations may be extended by 6 months, and the reasons must be explained in writing.

5.2.2 Adaptation of the reference and localization of the US ESA

The procedural advantage of the US ESA lies in its rigid constraints and diverse participation, but direct transplantation has significant limitations. The core challenges facing the ESA include frequent litigation disputes (such as frequent lawsuits between environmental organizations and industry around the scope of species protection, with more than 2000 related lawsuits between 1990 and 2020), property rights conflicts (resistance from private landowners due to habitat protection restrictions), and political intervention (fluctuations in attitudes toward list revisions during different party administrations). These problems stem from the fundamental differences between the US separation-of-powers system, the land system dominated by private property rights, and China's national conditions (Ji et al., 2022).

China's adaptation path must be based on the administrative-led governance model. First, weaken the dependence on litigation, establish a dispute resolution mechanism that combines internal administrative error correction and public supervision, and the higher-level competent department will supervise the compliance of the revision procedure to avoid excessive judicialization; Second, coordinate property rights relations, focusing on regulating the conflict between state-owned land development and habitat protection in view of the current situation in China where public ownership of land is the main focus, and provide the corresponding ecological compensation for protection measures on collectively owned land; Third, avoid political fluctuations, clarify the independence of the revision procedure through law, and use evaluation data and standards as the core basis to reduce administrative intervention space. At the same time, maintain the universal characteristics of the ESA, such as "public participation" and "time limit constraints," and transform them into operational norms that comply with China's administrative procedures, such as incorporating public opinions into the statutory links of major administrative decision-making procedures.

5.3 Improve the legal standards for the listing of species

5.3.1 Specific content of the standard system

Construct a full-chain legal standard of "listing, grading, and deletion", clarifying the core basis and operating rules: The listing standard needs to comprehensively consider four indicators, including population size (priority should be given to listing terrestrial animal wild populations of less than 2000 and aquatic animals of less than 500), distribution range (only distributed in a single or a few isolated habitats, with an area of less than 1000 square kilometers), population trend (population size has decreased by more than 30% in the past 10 years and there is no sign of reversal), and degree of threat (habitat destruction rate exceeds 50% or faces direct threats such as illegal hunting); the grading standard needs to be linked to international conventions and local realities, and CITES Appendix I species should correspond to the national first-level protection, and Appendix II species can be designated as first-level or second-level depending on the domestic population status, and endemic endangered species should be given priority to be listed as first-level; the deletion standard needs to meet the conditions such as "continuous three times of monitoring the stable recovery of the population, effective restoration of the habitat, and complete elimination of the threat factors", and the deletion procedure can be started after a two-year observation period (Li et al., 2021).

5.3.2 Technical support for standard implementation

Relying on the national biodiversity monitoring network, establish a unified national species data sharing platform, integrate monitoring data from forestry, agriculture, and research institutions, and provide an accurate basis for standard application. Develop special monitoring guidelines for previously

underprotected groups such as small mammals, amphibians, and reptiles to compensate for data shortcomings. At the same time, regularly update the “Technical Specification for Species Conservation Level Assessment”, adjust index parameters according to scientific research progress, and ensure the scientific nature and timeliness of the standard (Xu et al., 2017).

5.4 Improving the rules for the application of international lists domestically

5.4.1 Core rules for conversion and application

Establish the conversion rule of full conversion as the principle, exception exclusion as the exception, and revise Article 35 of the ‘Wildlife Protection Law’: expand ‘the list of wild animals or their products prohibited or restricted from trade by international conventions concluded or acceded to by the People’s Republic of China’ to ‘the list of wild animals or their products in international treaties concluded or acceded to by the People’s Republic of China’, covering international documents in many fields such as the Convention on Migratory Species and the Convention on Biological Diversity; modify ‘can be managed in accord with wild animals under national key protection’ to ‘include corresponding lists of wild animals for protection and management, except for wild animals that are not suitable for protection and management domestically’ (Li et al., 2020).

Exceptional circumstances should be strictly limited, and the reasons should be explained in writing, including: alien species with no natural distribution in China (and protection may endanger the native ecology), species with sufficient domestic populations and no risk of endangerment, and situations that conflict with the mandatory provisions of Chinese laws and cannot be coordinated. At the same time, establish a dynamic tracking mechanism for international lists, synchronize the revision and adjustment of international conventions, and ensure the timeliness of conversion and application (Li et al., 2023).

5.4.2 Solution paths for connecting conflicts

In response to the problem of mismatched protection levels, a special assessment will be carried out on the 19 species in CITES Appendix I that were originally approved as secondary protection, and those that meet the conditions for first-level protection will be upgraded; for the protection of nonnative species, distinguish between the dual needs of “endangered protection” and “ecological prevention and control”, establish a hierarchical list of alien species protection, and avoid excessive protection from crowding out the living space of native species. For the 107 international treaty species that have not been included in the domestic list, assessments will be carried out in batches, and critically endangered and endangered species will be given priority for inclusion in the scope of protection. The first batch of 30 species will be added to the list before 2025.

5.5 Implementation obstacles and path guarantees

5.5.1 Main institutional barriers

First, the difficulty of cross-agency coordination. Forestry, agriculture, and rural areas, ecological environment, and other departments have overlapping functions in species monitoring, list revision, law enforcement supervision, and other links; data sharing is not smooth, and coordination efficiency is low. For example, the division of protection responsibilities for terrestrial and aquatic wild animals is blurred, resulting in “vacuum” or “duplication” in the protection of some species. Second, insufficient capacity building. The three-year update cycle requires supporting and improving the monitoring infrastructure and professional talent teams. At present, the coverage rate of grass-roots monitoring stations in China is less than 60%, the technical means for monitoring small and medium-sized species are lagging, and there is a lack of sufficient professional assessment personnel, which makes it difficult to support high-frequency list revisions. Third, the pressure to balance development and protection. The habitats of some species overlap with economic activities such as mineral development, agricultural planting, and engineering construction. Local governments face the dual pressure of protection responsibilities and development tasks, and are prone to passively respond to list revisions. Fourth, the risk of continuity in policy implementation. The lack of phased implementation plans can lead to the failure of optimization measures due to insignificant short-term results and insufficient resource investment.

5.5.2 Phased implementation paths and protective measures

Phase 1 (2024-2026): Infrastructure Development and Pilot Promotion

Coordination Mechanism: Establish an interministerial joint meeting system led by the National Forestry and Grassland Administration, with the participation of the Ministry of Agriculture and Rural Affairs, the Ministry of Ecology and Environment, the Ministry of Science and Technology, etc. Establish a unified data sharing platform, clarify the division of responsibilities of each department in the review of the list, and focus on solving the problem of connecting the responsibilities and rights of terrestrial and aquatic wildlife protection.

Capacity Building: Invest special funds to add 50 new grassroots monitoring stations in key ecological areas, promote monitoring technologies such as infrared cameras and satellite tracking, and conduct special training for grassroots staff and evaluation experts, with an annual training scale of no less than 1,000 people.

Pilot work: Select provinces with rich biodiversity, such as Sichuan, Yunnan, and Zhejiang, to carry out pilot projects for the revision of the list and accumulate localized experience in public participation and expert evaluation.

Phase 2 (2027-2029): Comprehensive Implementation and Mechanism Improvement

Comprehensive implementation: Based on the pilot, promote a three-year update cycle and standardized revision procedures nationwide, complete the first batch of additions of international treaty species not included in the domestic list, and establish a dynamic adjustment mechanism for species protection levels.

Ecological Compensation: Improve ecological compensation policies, provide financial transfer payments to areas restricted by habitat protection, explore market-oriented ecological compensation models, and encourage social capital to participate in species protection.

Supervision and Evaluation: Establish an evaluation system for the effect of optimization measures implementation, perform a special evaluation every 3 years, adjust the implementation strategies according to the results of the evaluation, and solve new problems in implementation.

Phase 3 (2030 and beyond): System Maturity and Long-term Operation

Form a stable list management system, achieve full coverage of monitoring capabilities, normalize cross-departmental collaboration, and mechanize the coordination mechanism between development and protection, so that the list system becomes the core support for biodiversity protection and promotes China's level of wildlife protection to reach an international advanced level.

At the same time, clarify the funding guarantee mechanism for the revision of the list through legislation and incorporate relevant working funds into the central and local financial budgets; establish an assessment and accountability system, and incorporate the timeliness of list updates and the implementation of protection measures into the assessment indicators of local governments' ecological civilization construction to strengthen the driving force for implementation.

6 Conclusions

The China Wildlife Protection Animal List is the core method for the classification and management of wild animals, dividing them into two categories according to the status of the resource: rare and endangered, and non-rare and endangered. Rare and endangered wild animals are further divided into first-class national and second-class protected wild animals. Local governments also determine the key protected wild animals in their respective regions, forming a multilevel protection system.

As a supporting regulation to the "Wildlife Protection Law" and a core system for wildlife protection, the wildlife protection list system possesses a complete system structure and operational mechanism. It legally confirms the protected status of rare and endangered wild animals within the scope of the "Wildlife Protection Law," providing institutional guarantees for wildlife protection. Its core objective is to save endangered species, alleviate the biodiversity loss crisis, and promote the modernization of wildlife protection in China. It responds to the severe reality of the survival and development of China's rare and endangered species at the institutional level, not only providing survival guarantees for endangered species but also being a

requirement for China to build an ecological civilization legal system and promote ecological civilization construction.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material. Further inquiries can be directed to the corresponding author.

Author contributions

QW: Writing – review & editing, Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Writing – original draft. ZZ: Data curation, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. GH: Writing – review & editing, Funding acquisition, Project administration, Resources, Software, Supervision, Validation, Visualization.

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