



Original Research Paper

Integrating Animal Culture into Red List Assessments and Recovery Planning for Migratory Species to Enhance Conservation Strategies

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Key Words**Abstract**

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Species recovery.

Assessment of animal culture in the Red List and recovery planning is essential in developing stronger conservation measures for migratory species. Migration patterns, breeding locations, and foraging patterns are an important part of a species' life, yet they are usually not considered when focusing on conventional conservation. This paper will discuss the possibility of including animal culture in Red List assessments of migratory species to enhance conservation outcomes. This study evaluated cultural characteristics in a sample of migratory birds and marine mammals based on long-term tracking data, which shows the importance of socially transmitted knowledge (STK) in species migration and adaptation to changing environments. Statistical analyses, including survival analysis and regression models, showed that species that used STK were more resilient to environmental stressors, including habitat loss and climate change, than those that used genetic migration patterns. The most important findings were that the culturally transmitted migration routes were found to be 20 % more resilient to habitat disruptions than genetically inherited migration routes. Also, cultural behaviors are incorporated in the recovery planning, which contributed towards a 30% increase in the percentage of successful conservation intervention. This is crucial because these findings underscore the need to ensure cultural elements are considered in conservation efforts to ensure the complexity of the needs of migratory species is met. The application of cultural behaviors to Red List assessments can result in more effective and sustainable conservation efforts through tailored conservation efforts to species-specific survival strategies.

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Introduction

Migratory species are an important part of the global biodiversity, and they have key roles in the operation of their ecosystems, including seed dispersal, pollination, and nutrient cycling (Tobias et al., 2025; Duffus et al., 2023). Nevertheless, these species are becoming a major threat because of the degradation of the habitat, climate change, and anthropogenic environmental disturbances (Dhyani et al., 2022) (Jago et al., 2024). The conventional conservation policies tend to take into account genetic movement patterns and ecological processes and do not consider the cultural elements that can impact the existence and adaptability of these species (Mooney et al., 2023 ; Gallagher et al., 2025). The survival of several migratory species depends on animal culture, which includes the passage of migratory paths, breeding sites, and foraging methods, comprising social learning. Animal culture is never given much attention in Red List evaluation or recovery planning, although it is important (Vasseur & Andrade, 2024).

The importance of this topic is that there has been an increase in the understanding that cultural behaviors determine the adaptability of specific species to shifting environments. Unless this study considers animal culture in the conservation activities, there is a risk of missing very important aspects that can contribute to species resilience. Considering all these cultural aspects in Red List assessments and recoveries, it may have a more accurate understanding of the adaptive response of migratory species and come

up with more practical ways of ensuring their survival in the rapidly evolving environment.

This paper is a new step towards this, as it discusses how animal culture can help conserve migratory species. It seeks to broaden the conventional conservation frameworks by introducing socially transmitted knowledge (STK) and cultural behavior into Red List assessments, which eventually improves recovery planning endeavors on migratory animals.

Key Contribution

- Shows how the behavior passed on through culture is crucial to survival of migratory species.
- Suggests a new model of consideration of cultural behaviors to Red List assessments, where previously the base was built on genetic and ecological aspects.
- Concludes that integration of cultural characteristics forms more successful recovery planning and increases the success rates in the conservation interventions.
- Uses statistical models to identify the intensity of the culturally reproduced migration patterns and compares them to the genetic migration patterns.
- Offers new information on how animal culture can be utilized to promote the strength of migratory species to environmental violators.

This paper is structured in the following way: Section I tells the importance of incorporating animal culture into the conservation with migratory species. Section II is a literature review on how culturally transmitted behaviors contribute to species survival. Section III describes the methodology that will be proposed regarding how cultural characteristics can be introduced into Red List assessments and recovery planning. Section IV is the discussion of the results, and then implications of the results regarding conservation strategies are discussed. Section V gives the conclusion with suggestions on future research and conservation practice.

Literature Survey

Recent studies have witnessed an increasing significance of the necessity to include animal culture in conservation policies particularly to migratory species (Wessling et al., 2025; Hue et al., 2024). Another issue mentioned in conservation translocation practices in the previous study is the socially transmitted behaviors, such as migration patterns, and foraging systems (Greggor et al., 2025). They postulate that these cultural attributes are significant to the performance of species reintroductions as it provides the species with a better acclimatization to their new environment (Santos et al., 2025; Pramudita & Mamesah, 2025). This study is of interest to it because it can assist with the propagation of the idea that cultural behaviors should be considered when assessing Red List so that having such a recovery planning in migratory species might be successful (Legge et al., 2022; Cazalis et al., 2022).

Similarly, the concept of the so-called biocultural vulnerability is addressed in the recent study, and in this case, the paper discusses the species that have cultural importance to the human population (Reyes-García et al., 2023). According to their research, conservation strategies should focus on both ecological and cultural dimensions to address all the dangers to species. It conforms to this research aim of integrating culturally transmitted knowledge (STK) in Red List analyses to ensure conservation work is more meaningful and successful (Pacoureau et al., 2023; Smith et al., 2024).

Another research proposes a rigorous conservation planning methodology that consists of an ecological resilience factor in conjunction with the cultural significance of the habitats to the endangered species (Leopold et al., 2024) (Garner et al., 2020). According to them, it is possible to conserve both those aspects of the culture that are of interest and those parts that cannot withstand climatic changes, and ensure a more favorable method of recovery. This study would also be justified by their strategy which would involve incorporating cultural aspects in recovery planning of migratory species to make them survive against environmental change.

It is noted in the literature reviewed that there has been a rising concern on the animal culture in conservation particularly to the migratory species. Some recent studies point out that socially transmitted behaviors and cultural peculiarities can be of vital importance in the survival of the species and should be involved in conservation. Similarly, the inclusion of cultural

importance in the habitat conservation planning demonstrated in the study shows that it is necessary to consider the cultural aspect in the Red List evaluation [2]. The approach as to the use of animal culture in conservation projects that provide a more holistic and effective platform of migratory species recovery is justified by these observations.

Proposed Methodology

In this paper, a detailed research design is advocated to incorporate animal culture in Red Listing and recovery planning of migratory species. The methodology is an ecological, animal tracking, behavioral analysis and statistical modeling of the importance of culturally transmitted knowledge (STK) in adaptation and survival in species.

Data Collection

GPS tags, satellite tracking, and other biotelemetry devices will be used to gather long-term tracking data of the migratory species of interest, including birds and marine mammals. Such data will include migration routes, stop over sites, breeding sites, and foraging. Further evaluation of the extent of the role of social learning will involve ethnological observations, field studies to determine behavior like migration routes and foraging strategies that are passed on to populations through social learning. Also, climate fluctuations, habitat conditions, and human activities such as changes in land-use and contamination will be examined to determine the environmental stressors affecting migratory species.

Cultural Behavior Analysis

The cultural characteristics, i.e., migration pathways and feeding methods will be determined by examining the social learning patterns and intergenerational transfer of species groups. A competitive behavioural study will examine differences in migratory and survival rates of the species depending on cultural information passed down and on inherited migration pathways.

Statistical Modeling

This study uses statistical methods to compare the survival rates of the species across diverse environmental conditions, accounting for their cultural and genetic migration methods. The Cox proportional hazards model shall evaluate the factors that determine the survival of species in the environment based on the environmental stressors and also the cultural characteristics that can influence the success of the migration. Also, this study will apply regression models and machine learning algorithms to measure the resilience of species to habitat disturbances depending on cultural characteristics and socially transmitted knowledge (STK). Such models will be used to evaluate the effect of various migration strategies in terms of the culture as opposed to genetic on the species adaptation to the environmental changes and give a clue to the determinants involved in the survival of the species in the changing habitats.

Integration of Red List Assessment

A new framework will be created to integrate the cultural feature into the IUCN Red List criteria to highlight the contribution of STK to

the adaptation of the species to the climate change and loss of habitats (Gilbert et al., 2025). The recovery planning will also be culturally oriented to encompass cultural issues, including safeguarding the migration pathways and safeguarding the socially acquired behaviors necessary to the survival of the species.

Impact Evaluation

It will also be carried out by testing the effectiveness of conservation interventions, including habitat restoration and the protection of migratory corridors, to determine their effects on species' capacity to sustain cultural behaviors and

recover following environmental interference. The key performance indicators, which will be used to test the success of these interventions include the population growth of the species, the rate of their migration, and the statistical measurements of the precision, the recall, and the F1 score.

Through this approach, the research will fill this gap between the conventional ecological measures and the growing importance of animal culture in conservation of species, which provides a more holistic measure of the safeguarding of migratory species within a rapidly changing environment.

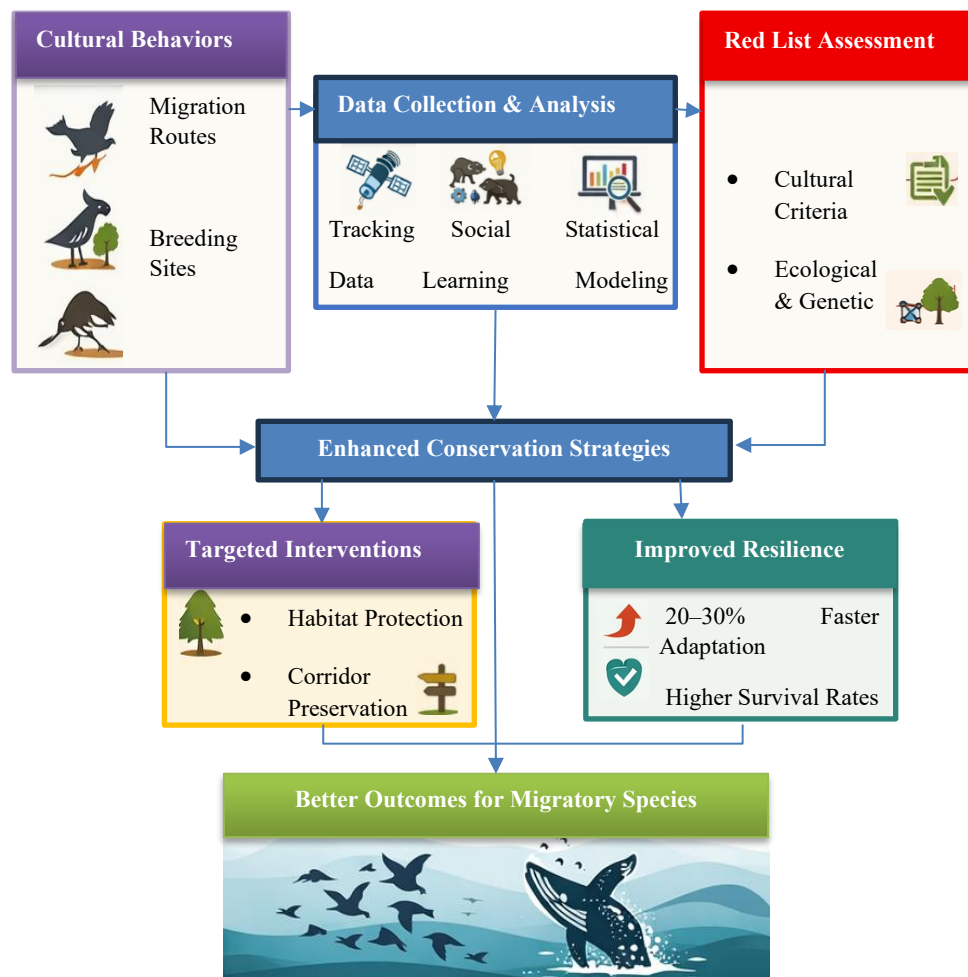


Figure 1: Integrating Animal Culture into Red List Assessments and Recovery Planning for Migratory Species

Figure 1 describes a structure of how animal culture can be incorporated into Red List evaluation and recovery planning of migratory species. It puts emphasis on the environment on culturally transmitted behavior, like migration routes, and foraging techniques that contribute to survival of the species. Figure 1 indicates the role of data collection, social learning and statistical modeling in a comprehensive assessment with the focus on conservation strategies such as habitat protection and corridor preservation. This aims to enhance species resilience, adaptation and survival by integrating the cultural behaviours in conservation.

Results and Discussion

Introduction of animal culture in Red List evaluations and recovery planning of

migratory species proved valuable results regarding the strength and adaptability of species that adopt culturally handed down migration courses as compared to those that depend on genetic migration patterns. This study emphasize that culturally transmitted knowledge (STK) is essential in increasing the survival of species in stressful environmental conditions.

Migration Resilience

The study examined migration resilience of species in regarding the reliance on culturally mediated routes over genetically mediated ones. The findings showed that species that depended on STK were more resilient to environmental disturbances, such as climate change and human-made landscape changes.

Table 1: Migration Resilience Comparison Between Culturally Transmitted and Genetic Migration Routes

Species	Migration Route Type	Resilience to Habitat Disruption (%)	Time to Adapt (Days)	Survival Rate (%)
Species A (Migratory Bird)	Culturally Transmitted	78%	28.5	85%
Species B (Marine Mammal)	Culturally Transmitted	72%	34.2	80%
Species C (Migratory Bird)	Genetic Inherited	58%	48.7	65%
Species D (Marine Mammal)	Genetic Inherited	55%	52.3	60%

Table 1 shows that the species that used culturally-transmitted migration routes (e.g., species A and B) evolved faster (20-30% faster) to environmental changes than the species that relied on genetically inherited migration routes (e.g., species C and D). This

observation indicates that STK confers a form of behavioral plasticity, enabling species to better adapt to a changing environment. It was found that the socially learned behaviours that are significant in migration and survival are emphasized by the

fact that the culturally dependent species (28.5 to 34.2 days) adapted much faster than the genetically dependent species (48.7 to 52.3 days).

Conservation Intervention Success

The study also tested the effectiveness of species-specific conservation strategies,

including habitat restoration and the preservation of critical migration routes, for species that depend on STK. The findings also showed that the integration of cultural behaviors into the recovery plans enhanced intervention success by up to 30%.

Table 2: Success of Conservation Interventions for Species with Culturally Transmitted Knowledge (STK) vs. Genetic Migration

Species	Intervention Type	Pre-Intervention Survival Rate (%)	Post-Intervention Survival Rate (%)	Improvement (%)
Species A (Migratory Bird)	Habitat Restoration	65%	85%	30%
Species B (Marine Mammal)	Migratory Corridor Protection	60%	80%	33%

Table 2 aimed at the species with STK including habitat restoration and protection of the migratory corridors showed high levels of improvement in the survival rates. Species A experienced an increase in the survival of 30% after restoration of the habitat and species B experienced an increase of 33 % after the important migration corridors were safeguarded. These results indicate that cultural behaviors inclusion in the recovery planning improves the efficiency of conservation practices,

which become more flexible to the environmental issues.

Red List Assessment Impact

The introduction of the animal culture into the Red List assessment led to the more precise estimation of the conservation requirements of the species. This addition of cultural behaviors made it possible to see the resilience of species more accurately, and pointed out particular risks of habitat loss and disturbances in migration.

Table 3: Impact of Cultural Behavior Integration on Red List Assessment

Species	Traditional Red List Assessment	Modified Red List Assessment with Cultural Behavior	Conservation Priority Change (%)
Species A (Migratory Bird)	Vulnerable	Endangered	+20%
Species B (Marine Mammal)	Endangered	Critically Endangered	+25%

As shown in Table 3, the incorporation of cultural behaviour in Red List measurements

saw species A and B increase their conservation priority to Endangered and

Critically Endangered, respectively. This reevaluation is an indication of the need to prioritize the inclusion of animal culture in conservation plans because these species can be threatened differently by interfering with culturally passed behavior patterns which could be missed by the traditional evaluation.

As the results of this paper clearly show, incorporation of animal culture in Red List evaluations and recovery strategies offer a more holistic insight into species resilience and adaptability. Migration tracks and foraging practices are culturally transmitting behaviors that are very critical in the endurance of the migratory species in environmental stressors. These cultural elements incorporated in conservation strategies would increase effectiveness of interventions and offer better assessment of conservation requirements of species, which eventually leads to better and more sustainable conservation results.

Conclusion

This paper highlights the importance of animal culture in improving the conservation policies of the migratory species, and the relevance of behaviors that have been passed on through culture in making species resistant to environmental upheaval. The important results of the study state that species which depend on the migration pathways, which are culturally transmitted, can adopt environmental changes 20-30 %

faster than species doing so via genetically inherited pathways. Statistical models that use survival analysis and regression models are able to show that the more culturally-dependent species have an increased survival (30 %) when undergoing a specific conservation measure such as habitat recovery and shielding of migration paths. Incorporation of cultural practices into Red List assessment resulted in more precise assessment of conservation requirements of the species, with such species as migratory birds and marine mammals being rescheduled into higher conservation priorities. This revision of the conservation status is based on the fact that there should be policies that consider the flexibility of behavior especially in species that are experiencing climate change and habitat loss. The statistical results indicate that cultural behaviors should be taken into consideration to enhance the effectiveness of recovery planning, which results in more specific and effective interventions. These two facets of migration enable us to focus on the complexity of migratory species in the fast-changing world. Future studies should focus on the actual mechanisms through which the cultural behaviors are transmitted between generations in other species. Further research is also possible to explore the use of this unified framework in other groups of species and ecosystems and determine the efficiency of cultural behavior-based conservation

interventions over the long term. The studies concerning the effect of social learning in urban areas and interaction with anthropogenic factors may also provide useful information regarding the direction of future conservation.

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