# ETHNOZOOLOGICAL INSIGHTS INTO ANIMAL-DERIVED NON-TIMBER FOREST PRODUCTS IN NORTH MACEDONIA

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**Abstract:** This study explores the cultural, ecological, and economic significance of animal-derived non-timber forest products (NTFPs) in North Macedonia, highlighting their roles in biodiversity conservation and local livelihoods. Despite the rich biodiversity of the region, previous research has largely neglected the use and cultural practices surrounding animal-origin NTFPs. Through qualitative methods, including in-depth interviews with 30 stakeholders—hunters, fishermen, teachers, local sellers, students, and park rangers—this research identified 43 animal species used for various purposes such as food, medicine, and cosmetics. *Apis mellifera* (honeybee) emerged as the most significant species with a Fidelity Level (FL) of 93.33%, underscoring its ecological and cultural importance. Other notable species included *Helix pomatia* and *Capreolus capreolus*, valued for their dietary and functional uses.
The study emphasizes the intergenerational transmission of traditional knowledge and its integration into sustainable biodiversity management frameworks. Findings reveal that community-based conservation strategies rooted in local practices can enhance ecological stewardship while preserving cultural heritage. This research provides a foundational understanding of animal-derived NTFPs in North Macedonia and advocates for interdisciplinary approaches to conservation and sustainable resource management.
**Keywords:** Ethnozoology, NTFPs, North Macedonia.

## 1. INTRODUCTION

Animals are the beauty of North Macedonia. They are used for human benefit in many ways including food, cosmetics, medicine, etc. Every group of insects, mammals, fish, reptiles, and amphibians, holds a unique place and function within the ecosystem, contributing to its prevention. The importance of animals in our society has a long history (Hristovski et al., 2015). This symbiotic relationship was established before civilization as we know it today. It was our ancestors who noted the benefits of using animals to aid in the performance of many daily tasks. And this has not gone unnoticed by scientists. Indeed, cultural transmission is the easiest way through which humans learn about a wide range of beliefs and behaviors about the environment and culture they live in and add to their knowledge (Henrich and Gil-White;2001). In this respect, researchers have hypothesized that cultural traits can be transmitted through at least three distinct -but not mutually exclusive- paths: 1) from parent to child (vertical transmission), 2) between any two individuals of the same generation (horizontal transmission), and 3) from non-parental individuals of the parental generation to members of the filial generation (oblique transmission) (Cavalli-Sforza & Feldman, 1981).
Currently, several studies have focused on recording this knowledge, though most are specifically related to plant resources (Rexhepi, Mustafa, Hajdari, & Pieroni, 2013; Pieroni et al., 2013). However, despite the rich biodiversity of the region, research into Non-Timber Forest Products (NTFPs) of animal origin remains absent. To date, no published studies are addressing the knowledge, cultural practices, or economic significance of animal-derived NTFPs within North Macedonia, leaving a gap in the comprehensive understanding of the country's traditional resource use.
Through this study, which includes animal-derived NTFPs from North Macedonia, we want to emphasize these resources' cultural, ecological, and economic roles. Animal-origin NTFPs, such as honey, beeswax, or traditional medicinal products derived from insects or small fauna, here in North Macedonia have the potential to contribute significantly to biodiversity conservation and local livelihoods within protected areas and beyond.
In other regions, studies on these products have revealed their importance for supporting sustainable practices and enhancing rural economies, providing models that could be adapted within North Macedonia (Bajuk, 2001; Pieroni et al., 2011; Yenmis 2019; Alves, 2009; 2007, Castilo and Ladio 2019; Adebe et al., 2022; Ávila-Nájera et al., 2019; Bobo 2015; Gerl et al., 2021; Kendie, 2018; Mardiastuti 2021; Patrick 2015; Seixas 2001; Solis 2019). Additionally, interdisciplinary research that incorporates ethnobiology, conservation science, and socio-economics would be essential for comprehensively understanding the uses and cultural relevance of these animal-derived resources. Such

findings could inform conservation policies and foster sustainable practices that benefit both communities and biodiversity, highlighting a promising avenue for future research in the country.

## 2. MATERIALS AND METHODS

This research was conducted from August 2024 to November 2024 to investigate the local knowledge and perceptions regarding NTFPs among various stakeholders in North Macedonia. The study employed a qualitative approach, utilizing in-depth interviews to gather nuanced insights from participants representing diverse backgrounds and experiences with NTFPs.

### Participant Selection

A total of 30 individuals were purposefully selected for this study, ensuring a comprehensive representation of perspectives on NTFPs. The participant cohort comprised: 5 hunters; 5 fishermen; 5 teachers; 5 local sellers; 5 university students; and 5 park rangers (safeguards in National Parks). This sampling strategy was designed to capture a wide array of knowledge and practices, reflecting the socio-economic and ecological contexts in which these stakeholders operate.

### Data Collection

Data were collected through semi-structured in-depth interviews. Each interview was guided by a predetermined set of questions that addressed participants' experiences, knowledge, and practices related to NTFPs. All interviews were audio recorded with the participants' consent.

### Species Identification

Before the commencement of the survey, we explained the nature and objectives of the research and asked the respondents for permission to respect intellectual property rights (Texeria et al., 2020). During the study period, a total of 42 species of NTFPs were recorded and identified by Xhezair Abdija (Full time professor of Zoology at the University of Tetova).

### Data Analysis

The collected data were summarized, organized, and analyzed using descriptive statistical methods such as percentage and frequency Kumera et al., 2022. The results were presented using tools such as tables and graphs. The fidelity level (FL) was calculated to determine the most commonly used animal species in the treatment of a particular disease category by the informants of the study area. The FL was calculated by the following formula:

$$FL\ (\%) = Np \times \frac{100}{1}$$

### Ethical Considerations

Ethical approval for the study was obtained from the University of Tetova (North Macedonia), ensuring compliance with ethical standards for research involving human subjects. Informed consent was secured from all participants prior to their involvement in the study, and measures were taken to ensure confidentiality and anonymity throughout the research process.

## 3. RESULTS AND DISCUSSIONS

### Sociodemographic Characteristics of the Respondents

The socio-economic particulars of the respondents are highlighted in Table 1. The study sample consists of 30 individuals, equally divided between males (15) and females (15), resulting in a balanced gender representation (sex ratio of 1:1). Participants range widely in age, with the majority falling in the 41-60 age group (17 individuals). Smaller proportions are found in the 18-25 age group (5 individuals), the 26-40 age group (3 individuals), and the 61 and above age group (5 individuals). This distribution indicates a strong representation of middle-aged adults, with fewer participants in the younger and older age brackets. The educational background of participants varies, with a majority (20 individuals) having completed high school. An additional 8 participants hold a Bachelor's degree, and 2 hold a Master's degree. There were no participants with a Ph.D. This distribution highlights a broad range of educational attainment, though most participants have secondary-level or undergraduate education. The sample includes an equal distribution across six distinct occupations, with 5 participants each representing hunters, fishermen, teachers, local sellers, university students, and park rangers. This variety captures a range of professional perspectives, from those directly engaged with natural resources (hunters, fishermen, park rangers) to those involved in educational, commercial, and academic sectors.

***Table 1. Sociodemographic profile of the respondents included in the survey (n=30).***

| Demographic characteristics | | No of respondents |
|---|---|---|
| **Sex ratio** | Male | 15 |
| | Female | 15 |
| **Age groups** | 18-25 | 5 |
| | 26-40 | 3 |
| | 41-60 | 17 |
| | 61 and above | 5 |
| **Education level** | High School | 20 |
| | Bachelor's Degree | 8 |
| | Master's Degree | 2 |
| | Ph.D. | - |
| **Occupation** | Hunters | 5 |
| | Fisherman | 5 |
| | Teacher | 5 |
| | Local seller | 5 |
| | University student | 5 |
| | Park ranger | 5 |

*Note: Data presented in this table are based on original research conducted by the author*

**Ethnozoological Analysis.**

The respondents used a total of 40 animal species. are described in Table 2. The animal group, scientific name, parts/products, and the purpose of use of the species are summarized in Table 3. These animal species belonged to both vertebrates (34 species) and invertebrates (6 species) distributed among five taxonomic groups where reptiles occupied the highest number of animals 11 (27.5%), followed by fish 8 (20%). In contrast, insects comprised the lowest range 6 (15%).

***Table 1. NTFPs of animal origin***

| INSECTS | | | |
|---|---|---|---|
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL (%)** |
| *Apis mellifera* | Honey, beeswax, propolis, Royal jelly | Medicinal use (cough, bronchitis), functional food, cosmetics | 93.33 |
| *Meconema thalassinum* | Complete specimen | The adult forms are used as bait in bite fishing. | 23.33 |
| *Tettigonia viridissima* | Complete specimen | The adult forms are used as bait in bite fishing. | 20 |
| *Poecilimon thoracicus* | Complete specimen | The adult forms are used as bait in bite fishing. | 30 |
| *Onychogomphus forcipatus* | Complete specimen | The adult forms are used as bait in bite fishing. | 26.67 |
| *Harmonia axyridis* | Complete specimen | Used as a beneficial insect | 10 |
| BIRDS | | | |
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL** |
| *Phasianus sp* | Eggs; meat | Functional Food | 40 |
| *Perdix perdix* | Eggs | Functional Food | 26.67 |
| *Columba palumbus* | Eggs | Functional Food | 30 |
| *Columba oenas* | Eggs | Functional Food | 23.33 |
| MAMMALS | | | |
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL** |
| *Sus scrofa* | Eggs; meat; fat | Functional Food; bronchitis | 30 |
| *Lepus europaeus* | Eggs | Functional Food | 46.67 |
| *Rupicapra rupicapra* | Eggs | Functional Food | 36.67 |
| *Capreolus capreolus* | Eggs | Functional Food | 63.33 |
| FISH | | | |
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL** |
| *Salmo sp* | Whole; Eggs (caviar); Complete specimen | Food; Bait in fishing; dried as functional food | 53.33 |
| *Cyprinus carpio* | Complete fish utilized for consumption | Food | 26.67 |
| *Squalius sp.* | Complete fish utilized for consumption | Food | 16.67 |
| *Chondrostoma sp* | Complete fish utilized for consumption | Food | 16.67 |
| *Barbus sp* | Complete fish utilized for consumption | Food | 13.33 |
| *Rutilus rutilus* | Complete fish utilized for consumption | Food | 10 |
| *Gobio sp* | Complete fish utilized for consumption | Food | 13.33 |
| *Silurus glanis (Siluridae)* | Complete fish utilized for consumption | Food | 10 |
| **REPTILES** | | | |
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL** |
| *Testudo graeca* | **Parts used** | **Purpose of Use** | 20 |

| | | | |
|---|---|---|---|
| *Testudo hermanni* | Eggs | Food | 10 |
| *Cyrtopodion kotschyi* | Eggs | Food | 6.67 |
| *Vipera ursinii* | Complete specimen | Bait in fishing | 46.67 |
| *Vipera berus* | Complete specimen | Snake oil as pseudo-medical therapy | 40 |
| *Vipera ammodytes* | Complete specimen | Snake oil as pseudo-medical therapy | 26.67 |
| *Malpolon monspessulanus* | Complete specimen | Snake oil as pseudo-medical therapy | 20 |
| *Elaphe quatuorlineata* | Complete specimen | Snake oil as pseudo-medical therapy | 26.67 |
| *Zamenis situla* | Complete specimen | Snake oil as pseudo-medical therapy | 23.33 |
| *Zamenis longissimus* | Complete specimen | Snake oil as pseudo-medical therapy | 30 |
| *Natrix natrix* | Complete specimen | Snake oil as pseudo-medical therapy | 26.67 |
| AMPHIBIANS | | | |
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL** |
| Rana sp | Tadpole (late stages) | Bait in fishing | 13.33 |
| INVERTEBRATA | | | |
| **Scientific Name** | **Parts used** | **Purpose of Use** | **FL** |
| *Lumbricus rubellus* | Complete specimen | Bait in fishing | 20 |
| *Aporrectodea rosea* | Complete specimen | Bait in fishing | 23.33 |
| *Helix pomatia* | Complete specimen | Food | 60 |
| *Astacus astacus* | Complete specimen | Food | 23.33 |
| *Caucasotachea vindobonensis* | Complete specimen | Food | 20 |
| *Helix aspersa* | Complete specimen | Food | 50 |
| *Ochridaspongia rotunda* | Complete specimen | Cosmetics | 10 |

*Note: Data presented in this table are based on original research conducted by the author*

**Quantitative Analysis**

The Fidelity Level (FL) analysis reveals substantial variation in the significance attributed to different species among the participants. In the insect category, *Apis mellifera* exhibits the highest FL at 93.33%, underscoring its pivotal role within the community, likely due to its association with honey production and its ecological importance as a pollinator. Conversely, other insect species such as *Harmonia axyridis* and *Tettigonia viridissima* show lower FL values (10% and 20%, respectively), suggesting these species are less frequently recognized for specific uses, potentially reflecting limited traditional or practical applications.

For the bird and mammal categories, *Phasianus sp.* (40%) and *Capreolus capreolus* (63.33%) stand out, indicating their significant roles in local practices, possibly linked to their uses in subsistence hunting or cultural symbolism. Salmo sp. ranks highest within fish species with an FL of 53.33%, which could reflect its value as a staple in local diets or traditional fishing practices. Among reptiles, *Vipera ursinii* and *Vipera berus* hold notable positions with FLs of 46.67% and 40%, respectively, possibly due to their unique cultural or medicinal significance, while amphibians and certain fish species display generally lower FL values, suggesting limited utility or lesser recognition within the community.

In the invertebrate category, *Helix pomatia* and *Helix aspersa* (60% and 50%) reveal high fidelity, likely due to their edibility and popularity in local diets. This comprehensive FL analysis highlights the varying levels of traditional knowledge and cultural or utilitarian importance associated with these species, providing valuable insights into local ecological relationships and species-specific knowledge.

**Conservation Implications**

An example of the unintended consequences of human intervention in natural ecosystems is the case of glacial lakes where non-native species, such as trout, have been artificially introduced. While often well-intentioned, these actions can have severe impacts on native biodiversity. Non-native species may act as strong competitors or predators to local species, leading to a decline or even extinction of key organisms, such as the critically important newts and other endemic fauna of these fragile ecosystems.

In this particular case, the introduction of trout into a glacial lake risk disrupting the ecological balance. Trout may prey on newt larvae or compete with them for food resources, triggering cascading effects on the lake's ecosystem. These changes negatively affect not only the local biodiversity but also the cultural and ecological value of the lake as a unique habitat. To safeguard glacial ecosystems and prevent further degradation, it is crucial to enforce policies prohibiting such interventions and to prioritize ecological restoration through habitat rehabilitation and conservation of endangered species.

## 4. CONCLUSIONS

This study reveals the rich diversity and cultural significance of animal-derived non-timber forest products (NTFPs) within the region, with valuable contributions from fishermen, hunters, students, teachers, and local sellers. Each

group offers unique insights into the local fauna, underscoring the interconnectedness of traditional knowledge and biodiversity. These practices, rooted in generational knowledge, reflect the community's reliance on and stewardship of natural resources, positioning local actors as key stakeholders in sustainable management.

Documenting this knowledge is crucial for creating conservation strategies that respect and incorporate these diverse perspectives. Integrating traditional practices into biodiversity management frameworks not only enhances conservation outcomes but also reinforces the cultural heritage that supports these ecosystems. As such, this study emphasizes the importance of community-based approaches to conservation, highlighting how local practices can inform sustainable resource use while contributing to the preservation of biological diversity.

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