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The use and sustainable development of marine animal drugs by the Kinh people in Beibu Gulf

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The Kinh people of China have historically migrated from Tushan and other areas of Vietnam since the 16th century. They are now settled in Fangchenggang City in the Beibu Gulf region of Guangxi, China. The local Kinh people have lived by fishing and have a rich fishing culture. Accordingly, the Kinh people of China have a long history of using traditional marine animal drugs for their daily medicinal needs. However, with the advent of modern medicine, there is a risk of losing the valuable traditional knowledge of marine animal drugs. Thus, this study aimed to document the types of marine animal drugs and related traditional knowledge of the Kinh people and explore the sustainability of their access to marine animal drugs. Ethnobiological methods, including snowball sampling and semi-structured interviews are used to collect information about the animal drugs used locally during the study. Through field investigations in the "Three Islands of Kinh," we collected ethnozoological data on 61 marine animal drugs belonging to 52 families across six animal phyla. Chordata and Mollusca are the most represented phyla, while Arthropoda, Echinodermata, Sipuncula, and Cnidaria are less represented. According to the analysis, animal meat is the most frequent medicinal part; the Kinh prefer decoction or making soup, and internal administration is the most frequent use mode. Our statistical analysis revealed that nourishing was the most common purpose for the recorded marine animal drugs in the study area. Our study found that 6 documented species are listed as threatened on the IUCN Red List but receive little targeted protection. The article provides recommendations for protecting traditional knowledge, promoting sustainable development of marine resources, and conserving endangered species.

KEYWORDS

Kinh people, marine drug, sustainability, Beibu Gulf, traditional knowledge

1 Introduction

Marine drugs are effective medications made from marine organisms and minerals, which possess unique characteristics and functions due to their marine origins (Papon et al., 2022; Cappello and Nieri, 2021). Some marine drugs have demonstrated excellent efficacy in treating complex diseases such as cancer, diabetes, cardiovascular and cerebrovascular diseases, immunodeficiency diseases, and Alzheimer's disease (Papon et al., 2022; Cappello and Nieri, 2021). Marine medicine has become an essential source of new drugs for preventing and treating these conditions. With more than 70% of the Earth's surface covered by the ocean, it boasts an extraordinary species diversity and resource potential, particularly regarding marine animals. In modern society, animal therapy has become a vital alternative to traditional treatments worldwide, and wild and domestic animals and their by-products are essential components in the preparation of drugs (Adeola, 1992; Angeletti et al., 1992). Therefore, acquiring a greater understanding of traditional marine animal drugs will aid in the rational formulation and development of marine drug resources. Otherwise, studying how the locals acquire or apply marine resources, especially marine animals, is of great help in protecting the related traditional culture and the marine ecosystem (Alves and Rosa, 2013).

The Kinh people of China have historically referred to themselves as "Kinh" and "Yue" (He, 2008). Since the Ming Dynasty (AD 1511), many Kinh people from Tushan and other areas in Vietnam have migrated and settled in Fangchenggang City in the Beibu Gulf region of Guangxi, China. They are mainly concentrated in Wanwei, Shanxin, and Wutou villages, collectively known as the "Three Islands of Kinh" (He, 2008). The Kinh people live along the coast, and fishing in the sea has naturally become their main livelihood. The local diet is based on rice, and they are good at cooking seafood such as fish, shrimp, and crab; local women have the habit of chewing betel nuts (He, 2008). Over a long period of historical development, the Kinh people have established a range of unique customs combined with local environmental features, such as welcoming ocean gods during the Ha Festival and fishing on stilts in shallow waters (He, 2008). The unique island environment makes it difficult for Kinh people to access medical treatment, so they have become adept at using local materials, coastal plants, and marine life for their daily medicinal needs (He, 2008; Du et al., 2015).

The Kinh people are the only ethnic minority in China with a significant focus on the marine fishery economy, and their traditional knowledge and experience in the acquisition, use, and sustainable development of marine resources are worth in-depth study. However, traditional fishery-related knowledge is threatened as the Kinh people begin to develop other industries, such as tourism. Thus, there is an urgent need to research and rescue the culture, management, and protection of marine animal drugs used by the Kinh people, which has not been systematically documented. Thus our study aims to 1) document the types of marine animal

drugs and related traditional knowledge of the Kinh people and 2) explore the sustainability of the Kinh people's access to marine animal drugs.

2 Methods

2.1 Study area

The Kinh ethnic group is one of the smallest ethnic minorities in Southern China and is primarily located in Dongxing City, a subdivision of Fangchenggang City in the Beibu Gulf area of Guangxi Province of China. They mainly reside in the "Three Islands of Kinh" in Jiangping Town, which includes Wutou, Shanxin, and Wanwei villages, as depicted in Figure 1. Due to the ocean and the Shiwandashan Mountains, the "Three Islands of Kinh" experience abundant sunshine and rainfall.

2.2 Collection and identification of ethnozoological data

From June 2020 to November 2022, we conducted six field investigations in Wutou, Shanxin, and Wanwei. During the visits, we primarily used the semi-structured interview method to collect information about Kinh marine medicine, including its biological source, vernacular name, medicinal part, usage, treatment of diseases, and resource acquisition (Jaroli et al., 2010; Borah and Prasad, 2017). The selection of information reporters included village cadres, community leaders, inheritors of traditional medicine culture, and experienced fishermen. We used the "snowball sampling method" to select a total of 65 informants, including 37 males and 28 females, all over 30 years old. Before the interview, each participant was informed of the nature and purpose of the study, and their consent was obtained. Throughout the survey, we strictly observed the ethical guidelines of the International Society for Ethnobiology (<http://www.ethnobiology.net/>). We also obtained consent and trust from each participant by presenting the main theme of the study to them, allowing them to communicate more freely and openly. The recorded information was subsequently reviewed by the informants to avoid errors and falsifications.

For species identification, we mainly used three methods: (1) analysis of specimens donated by the interviewees, (2) analysis of photos of animals and raw animal medicines collected during the interview, (3) use of vernacular names with the assistance of taxonomists familiar with the local situation. Professor Fajun Jiang, from Guangxi Beibu Gulf Marine Research Center of Guangxi Academy of Sciences, helped to confirm the species' taxonomic identification. Additionally, we used the Global Biodiversity Information Facility (<https://www.gbif.org>) and the Catalogue of Life (<https://www.catalogueoflife.org>) to verify and correct the scientific names of species.

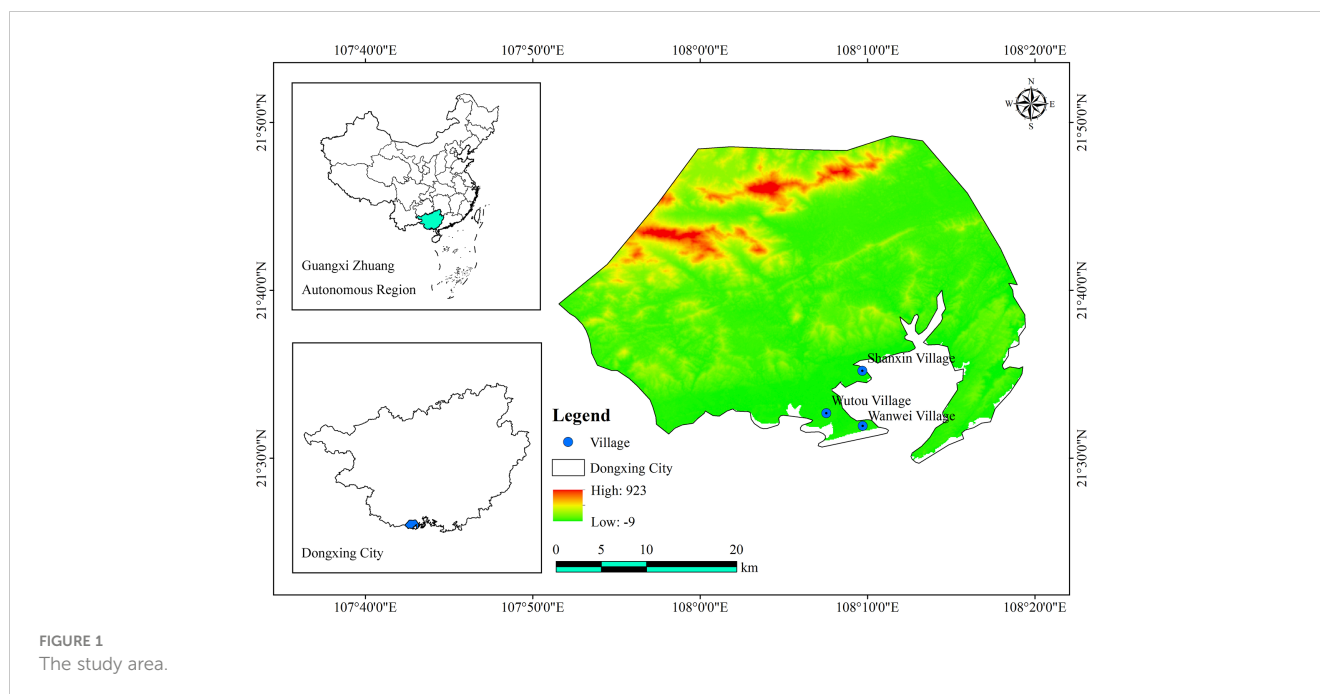


FIGURE 1
The study area.

3 Result

In this study, we documented 61 marine animal drugs (Table S1) used by the Kinh people for daily medical care, which belong to 52 families across six animal phyla. Chordata (32 species) and Mollusca (20 species) are the most represented phyla, while Arthropoda (4 species), Echinodermata (2 species), Sipuncula (2 species), and Cnidaria (1 species) are less represented.

The Kinh people use animal meat (33, 34.0%) as the most frequent medicinal part, followed by shells (18.6%) and whole animal objects (18.6%). Fish swim bladder (5, 5.2%), liver (3, 3.1%), skin (3, 3.1%), tail (3, 3.1%), gallbladder (3, 3.1%), sepia (2, 2.1%), gills (2, 2.1%), as well as other parts like scales, eel head, eel blood, fins, teeth, pearls, and fat are less common.

Decoction or making medicinal soup (52, 65.00%) is the primary processing method for marine animal drugs among the Kinh people, followed by grinding into powder (15, 18.75%), stewing in porridge (6, 7.50%), calcining into ash (3, 3.75%), soaking in wine (3, 3.75%), and water steaming (1, 1.25%) which are less commonly used. Internal administration (66, 81.48%) is the primary mode of use for marine animal drugs, followed by an external application (14, 17.28%), while exterior washing (therapeutic washing) was mentioned only once, accounting for 1.24% of the total frequency.

We identified 128 ailments treated by marine animal drugs used by the Kinh people, which were categorized into ten ailment categories (Table 1) based on the medication characteristics of the Kinh people and the International Classification of Diseases 11th (<https://icd.who.int/en>).

Our statistical analysis revealed that nourishing (61, 24.90%) was the most common purpose for the recorded marine animal drugs in the study area, followed by the treatment of digestive system illnesses (45, 18.37%), nervous and psychosomatic problems (28, 11.02%), and skin diseases (20, 8.16%). Other health problems,

such as immune system diseases, respiratory system diseases, and urinary system diseases, were relatively less commonly treated.

Based on the List of Wild Animals under National Key Protection in China (No. 3 of 2021) (<http://www.forestry.gov.cn/main/5461/20210205/122418860831352.html>), only one of the marine animal drugs used by the Kinh nationality is listed as a national II protected animal, which is *Tachypleus tridentatus*. So at present, only this species is prohibited from fishing and use nationally and locally. In addition, our study revealed that 27 of the documented species are listed on the IUCN Red List of Threatened Species. Out of these, *Larimichthys croce* and *Sphyrna mokarran* are classified as critically endangered (CR), while *Tachypleus tridentatus*, *Chelonia mydas*, and *Holothuria nobilis* are listed as endangered (EN), and *Hippocampus kelloggi* is categorized as vulnerable (UV). Furthermore, 11 species are classified as least concerned (LC), and there is insufficient data to evaluate ten species (DD).

4 Discussion

4.1 The potential risks of using marine animal drugs

The use of marine animals in traditional Kinh medicine has been practiced for centuries and is deeply rooted in the culture and beliefs of the Kinh people (Zhang et al., 2022). According to our documentation, when it comes to processing marine animal drugs, the Kinh people prefer decoction or making soup, and internal administration is the most frequent use mode. The Kinh people believe that “spiritual injury means illness, while a spiritual loss means death” (Huang and Xu, 2014), and as a result, they attach great importance to the use of marine animal drugs to strengthen the body and regulate the spirit to enhance

TABLE 1 Categories of diseases in the study area.

Category	Recorded frequency	Percentages
Strong body (nourishing)	61	24.90
Digestive system	45	18.37
Muscle, skeletal system problems and traumatic injury	33	13.47
Nerves and psychosomatic problems	27	11.02
Skin diseases	20	8.16
Immune diseases	13	5.31
Gynecological and pregnancy problems	10	4.08
Respiratory system	9	3.67
Urinary system	6	2.45
Inner heat	7	2.86
Other Uses	14	5.71

their immunity and resist diseases. This long-term use of marine resources may have certain scientific connotations, but many have not been proven scientifically.

Otherwise, the long-term use of marine resources for medicinal purposes may pose a significant risk for zoonotic disease transmission. To prevent the spread of zoonotic diseases, reducing the consumption of wild animals and promoting sustainable alternatives is crucial (Ferreira et al., 2016; Van Vliet et al., 2017). This can involve promoting plant-based diets and alternative protein sources and supporting the development of sustainable aquaculture and fish farming practices (Van Vliet et al., 2017). Additionally, promoting evidence-based medicine and ensuring that traditional remedies are rigorously tested for safety and efficacy can contribute to protecting marine life and preventing zoonotic disease transmission.

4.2 Conservations status of reported species

According to our documentation, 27 species are listed on the IUCN Red List of Threatened Species. However, only *Tachypleus tridentatus* is nationally and locally prohibited from fishing and use. In order to protect the resources of *T. tridentatus*, the Chinese government has implemented a series of research and conservation measures, such as evaluating *T. tridentatus* resources, establishing protected areas, and improving breeding techniques, which have promoted the sustainable utilization of *T. tridentatus* resources (Zhu et al., 2020). Based on the research results, it can be concluded that some medicinal species we documented, such as those listed as “Critical Endangered” on the IUCN Red List, are even more endangered than *T. tridentatus*. However, no additional targeted protection measures were found during our investigation. It also appears that Jing fishermen did not carry out targeted releases during fishing operations.

The impact of fishing on the endangerment of some exploited species cannot be accurately determined due to insufficient data in this

study. Factors such as fishing, anthropogenic pollution, and climate change may contribute to the endangerment of some species. The population status of these endangered species, especially those in the wild, is largely unknown and may face ongoing threats. Therefore, we believe it is urgent and necessary to prohibit the fishing and use of threatened populations through regulations. On the one hand, in terms of scientific research, we should conduct population surveys and conservation-related studies of wild species. On the other hand, increasing relevant policies and regulations and involving communities in management and restraint can further enhance the sustainable utilization of relevant marine resources.

Although prohibiting fishing for endangered species may negatively impact the preservation of traditional knowledge regarding their usage, we need to document it as comprehensively as possible for future reference. Moreover, it is crucial to enhance the implementation of benefit-sharing mechanisms by local governments.

4.3 The sustainability of the local marine ecosystem

During interviews with the local Kinh people, it was evident that they have developed a simple concept of sustainable utilization of marine resources due to their longstanding relationship with the sea. They are well-versed in the practice of abstinence and have customs such as releasing big fish back into the sea after catching their first net fish to ensure a good harvest with the protection of the Dragon King. Moreover, they sort fish by species, put back any that are unnecessary, and exchange their catches according to their needs to prevent overfishing. These practices highlight the Kinh people’s deep respect for the environment and commitment to sustainable fishing practices.

As a traditional coastal nation, the Kinh people have long relied on shallow sea fishing as their primary livelihood. However, with the development of national policies and economic growth, their livelihoods have diversified to include sea product aquaculture,

processing, commerce, and tourism. This transition has provided the necessary conditions for the sustainable development of local marine ecology. The support of national policies and the diversified development of local livelihoods provide new opportunities to mitigate the environmental impacts of single-fishing and crop cultivation practices.

Despite these positive developments, the Kinh people face challenges posed by pollution and damage to the coast caused by living pressures, sewage discharge, and tourism pollution resulting from population growth. Thus, there is an urgent need to prioritize protecting and preserving the marine ecosystem and promote responsible and sustainable development in the region.

5 Prospects

In conclusion, the Kinh people of China have a long history of utilizing marine animal drugs for medicinal purposes, with a significant focus on the marine fishery economy. This study aimed to document the types of marine animal drugs and related traditional knowledge of the Kinh people and explore the sustainability of their access to these drugs. Through six field investigations, 61 marine animal drugs belonging to 52 families across six animal phyla were documented. The study emphasizes the importance of preserving the traditional knowledge and experiences of the Kinh people, especially as they begin to develop other industries, threatening their traditional fishery-related knowledge. The documentation of traditional marine animal drugs provides a foundation for the rational formulation and development of marine drug resources.

Based on our findings, the traditional knowledge of using marine animal drugs in Kinh medicine is facing potential threats. To protect this knowledge and the sustainable application of marine animal populations it relies on, we suggest the following:

- 1) Systematically conduct ethnobiological studies to document the traditional use of marine animal species in Kinh medicine to preserve related knowledge as much as possible.
- 2) Utilize modern scientific techniques and collaborate with traditional medicine practitioners, as well as chemical or medical researchers, to identify active compounds and validate the medicinal properties of marine animal-derived drugs.
- 3) Enhance research on dynamic monitoring and conservation of endangered wild species, and strive to restore the population of relevant species as much as possible.
- 4) Promote sustainable use of marine resources through community-based management, regulations, and policies that protect marine resources and the livelihoods of local communities from pollution, overexploitation, and other threats. Implement measures related to benefit-sharing.

By implementing these suggestions, we can preserve cultural heritage, discover new treatments, and promote sustainable development in traditional Kinh medicine.

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 authors.

Ethics statement

The studies involving human participants were reviewed and approved by the Ethics Committee of the Guangxi Institute of Traditional Medical and Pharmaceutical Sciences. Written informed consent for participation was not required for this study in accordance with national legislation and institutional requirements.

Author contributions

BL, RH, and SZ contributed to the conception and design of the study. YN and TZ performed the data collection and statistical analysis. BL and RH wrote the first draft of the manuscript. All authors contributed to the manuscript's revision and read and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fmars.2023.1175316/full#supplementary-material>

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