Assessing the impact of the traditional practice of frog consumption on amphibian population from Mizoram, India: Culture - Nature Perspectives.

Submitted by

MALSAWMDAWNGLIANA

For the award of the Degree of

MASTER OF SCIENCE
IN HERITAGE CONSERVATION AND MANAGEMENT

Under the guidance of

Dr Abhijit Das
Dr Lallianpuii Kawlni
Dr Samuel Lalronunga

Saurashtra University
Rajkot- 360 005

DECLARATION

I **Malsawmdawngliana,** hereby declare that the research work entitled **"Assessing the impact of the traditional practice of frog consumption on amphibian population from Mizoram, India: Culture - Nature Perspectives",** carried out in partial fulfilment of M.Sc. (Heritage Conservation and Management) degree of Saurashtra University, Rajkot is an original work. This work was carried out under the supervision of Dr. Abhijit Das, Scientist-D and co-supervision of Dr. Lallianpuii Kawlni, Scientist-C and Dr Samuel Lalronunga at the Wildlife Institute of India from January to July'2021. I hereby declare that this work has not been submitted in any form for any other degree or diploma at any university or other institutions.

(MDawna)

Date: 16/07/2021

Place: Dehradun

MALSAWMDAWNGLIANA
M.Sc. Heritage Conservation and Management
Wildlife Institute of India
Chandrabani, Dehradun
Uttarakhand

भारतीय वन्यजीव संस्थान
Wildlife Institute of India

CERTIFICATE

This is to certify that Mr. **Malsawmdawngliana** has carried out an original piece of research in partial fulfilment of Master's Degree in Heritage Conservation and Management of the Saurashtra University, Rajkot, Gujarat. The topic of his dissertation was "**Assessing the impact of the traditional practice of frog consumption on amphibian population from Mizoram, India: Culture - Nature Perspectives.**" The study was carried out under our supervision from January to July 2021. We hereby certify that this work has not been submitted for any degree to any university.

(Dr. Abhijit Das)
Supervisor
Scientist 'D'
Department of Endangered Species Management
Wildlife Institute of India
Dehradun - 248001

(Dr. Lallianpuii Kawlni)
Co-Supervisor
Scientist 'C'
Department of Endangered Species Management
Wildlife Institute of India
Dehradun - 248001

(Dr. Samuel Lalronunga)
Co-Supervisor
Research Associate
Department of Zoology
Mizoram University
Aizawl, Mizoram 796004

पत्रपेटी स. 18, चन्द्रबनी, देहरादून-248 001, उत्तराखण्ड, भारत
Post Box No. 18, Chandrabani, Dehradun - 248 001, Uttarakhand, INDIA
ई पी ए बी एक्स : +91-135-2640100, 2640114, 2640115, फैक्स : 0135-2640117
EPABX : +91-135-2640100, 2640114, 2640115, फैक्स : 0135-2640117
ई-मेल/E-mail :

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"More money, more power;

More control, every minute every hour

You need to feed your big ego

And will you ever be satisfied?

You don't even know"

- *Rudy Wallang*

This dissertation idea would not have come up if not for my PI, Dr Abhijit Das, as he suggested that I look at the linkage between Culture and Nature in my home state through herpetofauna, the taxa interest me the most. And also owe a lot to my Co-PI, Dr Lallianpuii Kawlni, for guiding me not just as a student but also as a small brother. The scolding, motivation and inspiration she gave me is a gift that one could always cherish. Dr Samuel Lalronunga, my external Co-PI, wouldn't have been here if it was not for you. The friendship we shared for all those years, the sarcastic comments to push me to the limit (though I haven't reached yet) were like gold among coals.

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Finally, a big thanks to the Almighty God who gave me the strength and chance to be what I am today. Thanks to my family, friends and foes in Mizoram for all the support and prayers I received from you.

Summary:

Cultural practices have shaped the natural resources around the area in all parts of the world. The traditional practices involving wildlife and their meat as food resources is widely practised by many tribes of the world. Such practice also involves amphibian exploitation as food, one of the critical reasons for the decline in the global amphibian population. Such practice is widespread in the Northeast part of India, including Mizoram. However, the population-level impact of such traditional practice is poorly known.

The study was carried out in the buffer and core zone of Dampa Tiger Reserve (DTR) to assess the abundance and species richness. We surveyed four villages around DTR to see how the pattern of frog consumption by the local communities. The study tried to understand how the species diversity and abundance is affected by the off-take of frogs for food in the study area. Time constrained nocturnal Visual Encounter Survey method was used to see the species composition and abundances in the study area. Random sampling using questionnaires and interactions were used to see the frogs' consumption pattern, medicinal use and preferred species for food of the local communities in the study area.

The study tried to understand the culture and nature linkage of the communities with special emphasis on the consumption of frogs for food.

Keywords: Cultural practice, consumption, linkage.

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Chapter 1: INTRODUCTION

The culture of society refers to a particular group of communities and their way of life that gives a sense of identity and belongingness through a set of values and practices, shared beliefs, or a cluster of learned behaviours (Lebron, 2013). Food is one of the core aspects of culture, and it often reflects native biodiversity. Indigenous people and their food systems are intricately related and contain treasures of knowledge from long-evolved cultures rooted in local ecosystems (Kuhnlein et al., 2013). Food heritage and heritagization reveal the dynamic role of history in understanding culture and the marketisation of culinary traditions. (Boutaud, Becuț & Marinescu, 2016).

The Indo-Burma Hotspot is ranked in the top 10 hotspots for irreplaceability and the top five for threat, with only 5 per cent of its natural habitat remaining and more people than any other hotspot. It includes Cambodia, Laos, Myanmar, Thailand, Vietnam, China and Northeast India (Mittermeier et al., 2004). Hunting wildlife in the tropical forests of Asia has been a tradition for more than 40,000 years. But due to rapid changes that happen in the past century, the hunter-gatherer society had changed rapidly to more advanced ways of hunting and gathering wildlife for markets, using modernised weapons such as guns (Corlett 2007). The use of Wildlife products as traditional medicine is a practice that has been happening in many parts of Asia (Guo et al., 1997). Northeast India tribals also have a long history of intactness with their surrounding nature. Many wild types of meat, including frogs, are used as traditional medicine (Talukdar et al., 2020, Prasad et al., 2014, Borah and Prasad 2017, Dhakal 2019, Jugli et al., 2010). Mizoram is a state in Northeast India well known for its enormous biodiversity value (Pawar and Birand, 2001., Mittermeier et al., 2004). Low to mid-elevation hill slopes with a vast forest cover contribute to its native biodiversity but remains largely unstudied. The Mizos were formerly known as 'Lushais'. They were animists before they became Christians in 1894. The Lushai Hills was full of jungles in the early days. Jhum cultivation and hunting were their primary subsistence which governs the order of events of the customs and ceremonies in the Mizo society. The ascend to "Pialral" or Paradise after death was also determined by a man's ability to perform "Thangchhuah", which solely depended on his success in agriculture or hunting during his lifetime. One such way was offering a feast to the community called 'Khuangchawi', which involved a great deal of money and food resources that only the Chiefs or a few well-to-do people could perform (Parry, 1928). Another way was to be an exceptional hunter-warrior and to have hunted down wild animals from a revered list which includes animals like bear, gaur, elephant, wild boar,

barking deer, sambar, king cobra, serpent eagle, giant flying squirrel and thereby granting them the title called 'Thangchhuah Pa' (Lalramnghinglova 1999).

Among three living orders of amphibians, Anurans (frogs and toads) has become a part of the food security of many tribes in Northeast India and are also traditionally used as a home remedy as well as medicine in many regions (Talukdar et al., 2020, Prasad et al., 2014, Borah and Prasad 2017, Dhakal 2019, Jugli et al., 2010). But the ongoing studies about anurans are mainly towards the taxonomic level, and the effect of these traditional food systems on the wild population is never assessed. Therefore, the impact of the consumption of frogs on the population level is poorly known. However, globally there are around 6000 species of Amphibians, but their population are declining rapidly (Stuart et al., 2008). About 43% of amphibians are declining in abundance, 32% are threatened with extinction, and 122 species are likely to be extinct. The threat to the population decline is habitat loss and over-harvesting. Amphibians are used as a food source in many countries and are also used as traditional medicines. More thorough and evenly applied monitoring is needed within harvesting and exporting countries to ensure that populations are not being harvested at unsustainable levels. International trade must be minimised and monitored, so the sources and destinations of frogs being traded can be more reliably traced (GAA: Stuart et al., 2004). Frogs are termed as "Jumping Chickens" in many parts of the World and are consumed in large numbers annually. Countries of Africa, Asia and Latin America collect frogs for sustenance and local consumption. However, these countries are also engaged in frogs' commercial trade to the European countries and the USA. To meet the demands of the global frog trade, millions of frogs are harvested from the wild. The large-bodied frogs are more preferred. Therefore, the current practice is a threat to the amphibian community as it is not sustainable. Countries like China, Taiwan, and Vietnam became the largest exporter of frogs' legs after banning this trade in India and Bangladesh in the '80s. The trade rate is threatening the wild population of Amphibians. Therefore, an effort should be made in reducing imports and exports to maintain a sustainable population. (Altherr et al., 2011).

Chapter 2: Review of Literature

2.1. Food as Heritage:

Food is one of the first cultural acts. We are related to food and food practices directly described to our cultural identity (Boutaud et al. 2016). Food is an important device that shapes the structural evolution of man. Individual food practices are related to humans' way of finding pleasure (Grimaldi, Fassino&Porporato 2019). UNESCO adopted the Convention for the Safeguarding of the Intangible Cultural Heritage in 2003; since then, they are spreading global awareness and recognition of the vital importance of intangible forms of heritage, with food playing an increasingly significant role. Heritage is a critical parameter that must be more explicitly considered in definitions of food security and relevant policies on a European and global level (Kapelari et al.,2020). Japan succeeded in designating its cuisine, *washoku*, as an Intangible Cultural Heritage (UNESCO 2013). Tribals are known for their proximity to nature worldwide. Their cultural lifestyles are shaped through their natural environment, and therefore, the trees, animals, landscapes etc. plays an essential role in their life. (Singh, B.P. 2017). There is a dialectical relation between human and non-human actors in the forests of Southeast Asia (Anna Tsing 1993) and also a relationship between hunters and the animals they hunt (McNiven and Feldman (2003)). Article 26 of the United Nations Draft Declaration on the Rights of Indigenous People,1994, has mentioned that 'indigenous peoples have the right to own, develop, control and use the lands and territories, including the total environment of the lands, air, waters, coastal seas, sea-ice, flora and fauna and other resources which they have traditionally owned or otherwise occupied or used.

Northeast India is rich in biodiversity and is home to around 145 tribal communities; most practise shifting cultivation and are dependent on forests. Hunting is widespread in this region. The wild meat preference is mainly due to taste and belief that wild meat is not contaminated like Domestic meat. Cash income from selling wild meat is also an essential method of generating livelihood (Aiyadurai 2010). Wildlife hunting is an age-old practice, and humans have been hunting wild animals for many generations. However, socio-political changes affect the cultural traditions of the tribal areas, and the culture-nature linkages are more directed towards cash generation, leading to selling animal products. (Aiyadurai 2011). Wildlife is an essential resource for those communities that live in and around forests and are exploited for various reasons, including food, additional income, cultural practices, and sports. (Bennett et al., 2002; Robinson & Bennett, 2000). The link between hunting and local

people's socio-economic needs is a significant reason wildlife hunting is challenging to address because of the need to balance the impact of hunting on wildlife populations with the dependency of some rural communities on wildlife for food. It is the only protein available in some regions (Fa et al., 2003). Northeast India tribals also have a long history of intactness with their surrounding nature. Many wild meats are used as traditional medicine (Talukdar et al., 2020, Prasad et al., 2014, Borah and Prasad 2017, Dhakal 2019, Jugli et al., 2010). It is also necessary to look at local people's attitudes and perceptions of wildlife for long term conservation (Htun et al., 2012, Choudhury et al., 2019). Through this, one can also assess people's resource use interest from the forest (Newmark et al., 1993), (Arjunan et al., 2006). Many tribes being socially and culturally associated with wildlife, it is necessary to look at its impacts. Htun et al. (2012) revealed that villagers' positive attitude towards protected area/ conservation was correlated to the sociodemographic characteristics and knowledge, whereas negative attitude related to economic loss.

2.2. Herpetofauna of Mizoram:

Mizoram hosts a diverse species of frogs and toads, and new species are being described continually from the area. More than 76 species of amphibian had been recorded from the Mizoram (Pawar&Birand 2001; Chanda 2007; Lalremsanga et al. 2007a, b; Sengupta et al. 2010; Lalronunga and Lalrinchhana, 2017; Lalronunga et al. 2017a, b; Lalremsanga 2017a, b; Chaitanya et al., 2017; Lalbiakzuala and Lalremsanga, 2019; Lalmuansanga et al. 2020; Malsawmhriatzuali et al. 2020; Lalronunga et al. 2020), but the identity of some of these species needs revalidation. However, faunal inventory is far from complete as species are often being added *Leptobrachella tamdil* (Sengupta et al., 2010), *Megophrys serchhipii* (Matthew and Sen, 2007), *Duttaphrynus mizoramensis* (Matthew and Sen, 2009) and *Duttaphrynus mamitensis* (Matthew and Sen, 2009), *Smithophis atemporalis* (Giri et al.,2019) *Blythia hmuifang* (Vogel et al., 2017). Abundance of amphibians is one of the factors that determines whether the ecosystem is healthy as they are one of the most sensitive vertebrates and are often called as Biological indicators (Veturino et al., 2003). The majority of the studies so far being made is towards faunal inventory and at the alpha taxonomic level. Relative abundance of a species and its population level has never been studied in Mizoram.

2.3. Amphibian as Food:

Amphibians' global population status declines drastically due to various reasons such as habitat degradation and land conversion, the impact of exotic species, infectious disease,

human exploitation, climate change, elevated UV-B radiation, weather pattern, synergistic effects etc. (Whittaker et al., 2013)

The Global Amphibian Assessment (GAA) shows that about 220 species of Amphibians are used as food in the World (Stuart et al.,2008). About 193 recipes of frogs and toads, mainly in North America. Commercial harvesting of frogs at a large scale and exporting frog legs at an international level is one of the significant threats that lead to the decline in amphibians' population (Liner, 2005). The frogs' leg trade depends mostly on wild frogs' collection from wild sources (FIRI 2005). The World's largest Frog Legs exporter is Indonesia, followed by Belgium, China, Vietnam, Malaysia, Thailand, and Madagascar. At the same time, the World's largest importers are France, followed by Belgium, the USA, Netherlands, Canada, etc. (Gratwicke, 2010). Indonesia is one of the largest exporters of frogs' legs for consumption as food. However, the current harvest level has not depleted Indonesia's edible frogs' population (Kusrini, & Alford, 2006).

Frogs' legs are on the menu from cafeterias in France, across Asia and in haute cuisine restaurants throughout the World. A mandatory certification process for the harvest of wild frog's legs must be established because most frog exports are skinned body parts. It will be necessary to develop a mechanism to monitor numbers and certify species identification of exported products at processing points (Warkentin et al., 2008). The investigation of the public knowledge and perception of toads and frogs in three areas of Southeast China shows that frogs are essential for pest control, medicinal purpose and consumption and about 75 per cent of amphibian species in China are used for human consumption or traditional medicine. (Jiminez and Matthies 2015). Frog meat is a highly digestible food used in a special diet. The hospital survey in hospitals and medical offices in Rio de Janeiro (R.J., Brazil) through interviews and suggests using frog meat as a functional food and preparing it as a special diet for adults and children (Oliveira et al., 2017).

The global frog legs trade can potentially spread pathogens, including *Batrachochytrium dendrobatidis* which has been linked to the disappearance and possible extinction of over 90 amphibian species around the World (Gratwicke et al., 2009). A novel bacterial disease *Laribacter hongkongensis* associated with gastroenteritis & diarrhoea in humans, is found in a Chinese tiger frog (*Hoplobatrachus chinensis*) (Lau et al., 2009). Assessment of the health of amphibians traded in Southeast Asian countries of Lao PDR, Cambodia,

Vietnam, and Singapore reported that some pathogens found in the traded frogs may have public implications and indicate the need to improve biosecurity amphibia trade and farming (Gilbert et al., 2012). Amphibian consumption is relatively high in the Indomalayan and Palearctic region, while using them as pets is relatively high in the Neotropical region. Trading exotic species of amphibians introduce novel disease and suggest breeding native species for human consumption rather than introducing exotic ones (Amphibian Conservation Action Plan, 2007).

2.3. Indian scenario:

India became the largest exporter of frog legs during the 1950s that lasted to over three decades. Green Pond Frog (*Euphlyctis hexadactylus*), Indian Bullfrog (*Hoplobatrachus tigerinus*), Jerdon's Bullfrog (*Hoplobatrachus crassus*), and the Indian Skittering Frog (*Euphlyctis cyanophlyctis*) are mainly targeted for the trade and produces more than 4000 tonnes of frog legs for export per year. However, the frog population's collapse led to the loss of agricultural products and increased use of pesticides leading to the ban of frog legs export in 1987. India has doubled its frog producing area in the last 30 years while harvesting and exports are increasing. The carrying capacity of frogs in irrigated land was 28 frogs/ha, and a 7% harvest may be optimal utilization. However, during that time, a ban on frog export would be a loss of 10 million U.S. dollars/annum and the loss of job for 0-16 million villagers. Therefore, a need for aquaculture of frogs to retain the use and revenue earned through the trade (Pandian and Marian 1986). The trade of frogs from India upon excessive harvesting is hampering the ecological balance, leading to extensive insecticide use that threatens the environment. Before I985, it has been estimated that about 200 million frogs were exported annually from Asia (Oza, 1990). The studies on the effects of removing frog species in the wild reveal that "the earning of every 35 paise (0.35 rupee) in terms of foreign exchange prevented the destruction of 1 kg of agricultural pests". With illegal Indian exports of frogs' legs reaching 3,000 tonnes annually, 9,000 tonnes of frogs are destroyed. Daily, an equivalent tonnage of insects, including mosquitoes and agricultural pests, survive and instead must be destroyed by other means, such as chemical sprays (Abdulali 1979). The study on the Purple frog (*Nasikabatrachussahyadrensis*), a unique and endemic frog in the Western Ghats, reveals that the local tribal people consume the tadpoles of this frog which

directly threatens Western Ghats' rare and unique flagship frog species. (Thomas and Biju, 2014).

North-East India is a part of the Indo-Burma biodiversity hotspot containing eight states and is one of the country's least-studied parts. Animals' cultural and ritual uses are traditional to practise in many tribal areas of Northeast India (Jugli et al., 2020). The usage of frogs as traditional medicine as well as for food in Northeast India is quite observable. Cascading frogs (*Amolops* sp.), Bullfrogs (*Hoplobatrachus* sp.) and Tree frogs (*Rhacophorus* sp.) are used as food locally in Assam (Sengupta et al., 2010). Toad and frogs are used as a traditional healing material for wounds, tongue blister, inguinal hernia and urinary retention by the ethnic group of KarbiAnglong district Assam (Verma et al., 2014). The traditional medicinal use of animals for traditional healing is practised by the tribes adjoining the Gibbon National Park in Assam. There are 44 different species of 44 genera, 36 families used for treatment, and 7.1% are Amphibians. The meat of common tree frog, Common toad and *Rana* sp. is used to treat asthma and branch pneumonia (Borah and Prasad 2017). A market survey in Nagaland reported that there is much wildlife displayed, including 11-13 species of frogs in the markets of Nagaland (Bhupathi et al., 2013, Talukdar et al., 2020). The tribes in the hills and the plains of Manipur consume dried amphibians, especially frogs. The dried frogs are sometimes made into fermented food, just like the fermented fish. The fermented frogs are roasted and prepared by grinding with chilly and salt, and eaten as chutney. The killed fresh frogs are also sold without processing in the markets of Senapati, Chandel and other hill districts of Manipur. (Chanu 2017). *Nanoranaliebigii* and *Amolopshimalayanus* are consumed for medicinal purpose in Sikkim (Dhakal 2019). Khasi and Garo tribes of Meghalaya consume frogs like the Indian Bullfrog, *Amolops* sp., *Nanorana* sp., (Vivek Sarkar, Anukul Nath, perscomm). The traditional use of animals for the Tangsa and Wancho tribes of Eastern Arunachal Pradesh reported using frog limb as a necklace to prevent them from evil spirits. And the meat is consumed so that they live longer. However, consuming toad is considered to be taboo (Jugli et al., 2020). Livelihood based organisation, Agri-Business and Market Study in Mizoram, MART, Noida, reported uchang rep (dried frog) in Mizoram markets.

2.4. Importance of the proposed project in the context of the current status

Mizoram is part of the Indo-Burma biodiversity hotspots, and the unique biodiversity is very much understudied. The indigenous tribes are extracting their sources of livelihood form the Natural heritage and there is strong linkage between the communities and their surrounding

natural heritage. The area has been very much unexplored, and the major study that has been going is mostly on the taxonomic level.

The study of Herpetofauna in the state is mostly at the taxonomic level and therefore there are no real study to assess the population level and threats. Therefore, the study plans to see the relative abundance of the species in the area.

Frogs' consumption in the proposed study area is observed through preliminary surveys and information from individuals of the area's communities. However, there are no real documentation of the species involved in consumption in the area.

This study will also help in finding the cultural significance of frogs in the daily lives of the communities, and how they utilize their biodiversity into their day-to-day life. This study is expected to generate the linkage between the tradition lifestyle of the communities i.e., the cultural heritage and the natural heritage around them.

2.5. OBJECTIVES:

Objective 1: To assess the diversity and relative abundance of stream frogs across the two streams.

Questions:

1. How the species richness and relative abundance varies across selected streams?
2. Is there any difference between the male and female ratio between the streams?

Objective 2: To assess the consumption pattern of frogs & its cultural significance in the study area

Questions:

1. What are the factors determining frog consumption in the area?
2. Is frog meat preferred over other wild meats with a traditional cultural connotation?

Chapter 3: Methodology:

3.1. Study Area:

Dampa Tiger Reserve (DTR) is located in the Mamit District of Mizoram along the Bangladesh border. It is situated at the western limit of the state, falls within 23°23'15"N - 23°42'20"N latitudes and 92°16'25"E - 92°25'55''E longitudes. It was notified as a wildlife sanctuary in 1985 with an area of ca. 681 sq km and re-notified as a sanctuary by excluding a portion of the initial area with an area of ca. 340 sq km. It was finally re-notified on attaining the status Project Tiger in 1994 as Dampa Tiger Reserve with a total area of 500 sq km, making it the largest protected area in Mizoram. The natural vegetation in reserve is tropical evergreen to semi-evergreen, corresponding to the Cachar Tropical Evergreen 1B/C3 and semi-evergreen 2B/C2 forest (Champion and Seth, 1968). The elevation ranges from 250-1100m asl with an average precipitation of 2150mm, mainly from southwest monsoon between May to December (Raman et al., 1998). The area has one of the last remaining natural low- to mid-elevation forests in western Mizoram (FSI, 1999). DTR is drained by two river systems (drainage): the Karnaphuli drainage consisting of Aivapui, Keisalam, Seling, and Mar rivers and the Barak drainage consisting of Teirei and Tut rivers (Lalramliana et al. 2020). Mizo, Bru and Chakma tribes inhabits inside the buffer area of the reserve. Tribals in and around the DTR are predominantlymeat eaters. Villagers also rear chicken, pig, and utilize cowsfor meat; they still prefer bush meat simply to aid delicacy inthe taste with no additional cost (Solanki 2016).

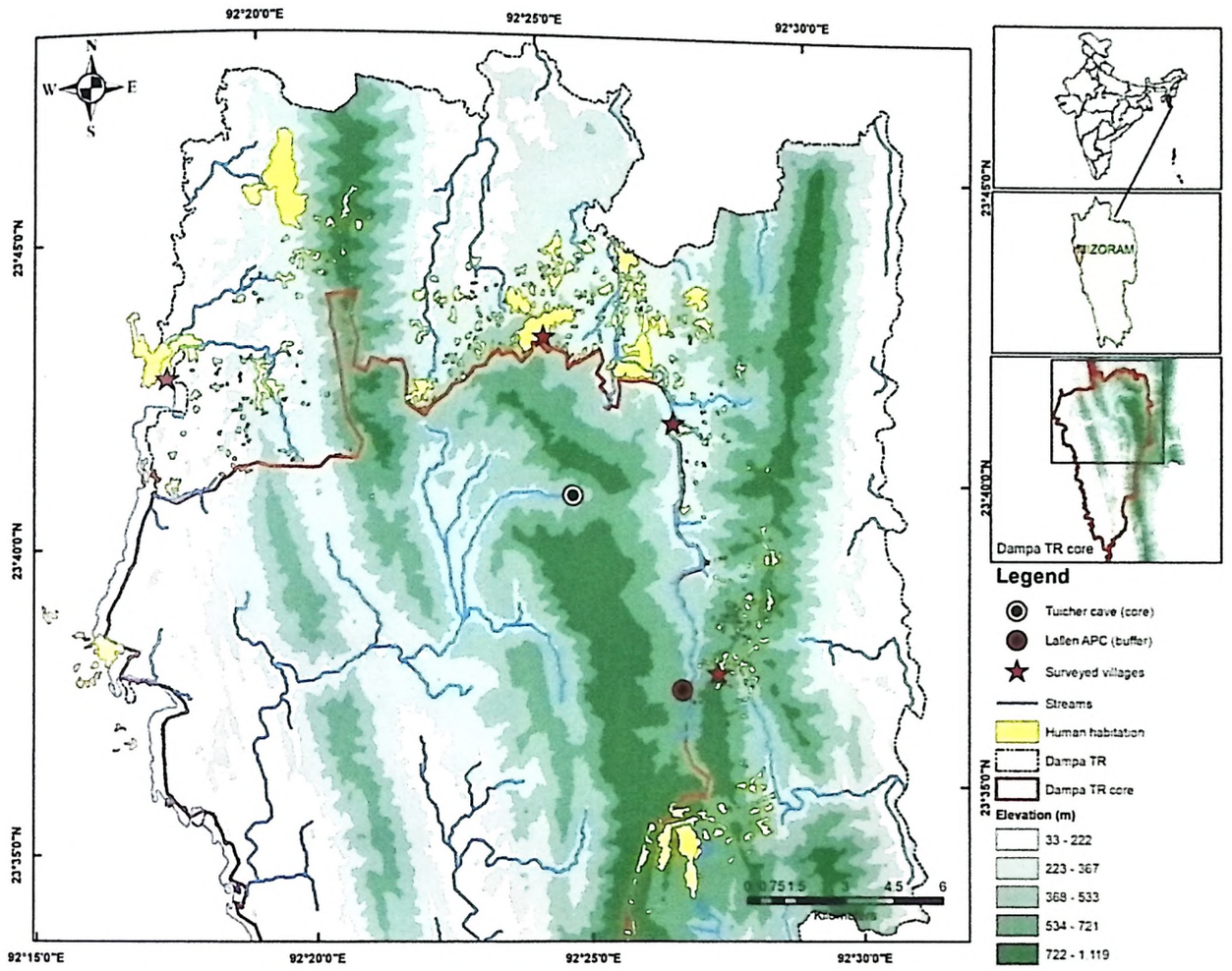

Figure 1: Map of study area

3.2. Field Methods to assess the diversity and relative abundance of frogs:

A reconnaissance period was carried out in the Month of late January to Early February for the delineation of study site.

The study was carried out in the core and Buffer zone of Dampa Tiger Reserve, Mizoram, Northeast India. Two streams were selected i.e., Tuichar stream inside the PA and Teirei Stream at Lallen outside the PA. Time constrained Nocturnal Visual Encounter survey was employed in a strip of 100m transect, to determine relative abundance and species richness in the study areas (Crump & Scott,1994). A total of 24 surveys was conducted between the month of March to May visiting the two sites 12 times each. Each species was identified based on the works of literatures (Decemson et al.,2021, Pawar&Birand 2001; Chanda 2007; Lalremsanga et al. 2007a, b; Sengupta et al. 2010; Lalronunga and Lalrinchhana, 2017;

Lalronunga et al. 2017a, b; Lalremsanga 2017a, b; Chaitanya et al., 2017; Lalbiakzuala and Lalremsanga, 2019; Lalmuansanga et al. 2020; Malsawmhriatzuali et al. 2020; Lalronunga et al. 2020). Relative abundance was calculated by the number of individuals of one species divided by the number of individuals of all species.

The species are considered into two groups: The frogs' species that can attain a Snout Vent Length (SVL) greater than 50 mm are classified as Large bodied frogs' species while the frog's species with SVL lesser than 50 mm are classified as Small bodied frogs' species. Measurements of the SVL are taken from already published literatures from Dampa Tiger Reserve and other Northeast area (Decemson et al.,2021, Humtsoe et al.,2020). The species encountered were identified male or female by listening to the call or the vocal sac as vocal sac are present only on male and also if the size as females is usually larger than males (Bulmer & Tyler,1968).

3.3. Field Methods to collect data for Community consumption pattern & Cultural significance of frogs:

A preliminary survey was done looking for the villages in the fringe of Dampa TR (Choudhury et al., 2019). A total of four villages viz., Teirei, Damparengpui, Rajivnagar and Lallen were selected to see the utilization of frogs and how the people are related to it. Lallen is a Mizo village representing the Mizo tribe, Damparengpui is a Bru village representing Bru tribe, Rajiv Nagar is a Chakma village representing Chakma tribe and Teirei Forest Village is mixture of both Mizo and Bru tribes. The population census of these villages is taken from the Mizoram Village Council Level Baseline Survey by the Directorate of Local Administration Department, Govt of Mizoram. After obtaining the basic information about the villages, a total of 260 households were sampled i.e., 40(~36.7%) household out of 109 in Teirei, 80 (~14.9%) household out of 540 families in Damparengpui, 100 (~11.1%) households out of 904 families in Rajivnagar and 40 (~27.4%) households out of 146 families in Lallen during February to March 2021. At least 10% of the population were surveyed randomly with one member representing one household, with attempting a proportionate representation of gender.

Table 1: Summary of sampled village

Sl no	Village	Total Population	Total no of households	No of sampled household
1	Teirei Forest	525	109	40
2	Damparengpui	2470	540	80
3	Rajiv Nagar	4190	904	100
4	Lallen	592	146	40
	TOTAL	7777	1699	260

3.4. Analytical Methods:

Using ARCGIS, the map of the study area was prepared and then stacked on to google earth to add up the villages surveyed. The data of Visual Encounter Survey was analysed using Microsoft excel, PAST and Program R. I used INEXT package in R-program to make the Species accumulation curve. The Shanon Diversity Index and Evenness was calculated and plotted using Microsoft Excel. Boxplot of Relative abundance and Encounter rates, boxplot of Male and Female ration for both the streams and boxplot for Large and Small bodied frogs were plotted using program PAST. Mann-Whitney test was run to see the significant difference between large bodied and small bodied frogs of the two streams.

Questionnaire data were analysed using Microsoft excel 2007, PAST & program R. The tables were prepared in Microsoft words, graphs were made from Microsoft excel model was run in R to see the significance between the variables on taking frog collection as the main factor.

Chapter 4: Results:

During the survey, a total of 12 Visual Encounter Survey was held each in both the streams, covering a distance of 150m for one hour by two persons along the streams. The survey was conducted at night as most frogs are more active at night (Table 1).

Table 2: Summary of Visual Encounter Survey

Study site	No of VES	No of person conducting survey	Day/Night survey	Total effort	No of species documented	Total no of individuals
Lallen kai (buffer)	12	2	Night	12 two-man hour	9	320
Tuichar(Core)	12	2	Night	12 two-man hour	14	272

Species Richness and diversity of the two streams:

During the study, a total of 16 species of frogs were recorded where 9 species were recorded in Lallen kai, the stream in the buffer and 14 species were recorded in Tuichar, the stream in the core. Seven species were mutually recorded in both the streams while 2 species (*Pterorana khare* and *Kurixalus yangi*) were recorded exclusively in the buffer and 7 species (*Duttaphrynus melanostictus*, *Ingerana borealis*, *Hydrophylax leptoglossa, Leptobrachium smithi, Microhyla berdmorei, Limnonectes khasianus* and *Rhacophorus tuberculatus*) were recorded exclusively in the core. (Fig. 2 & Fig. 3)

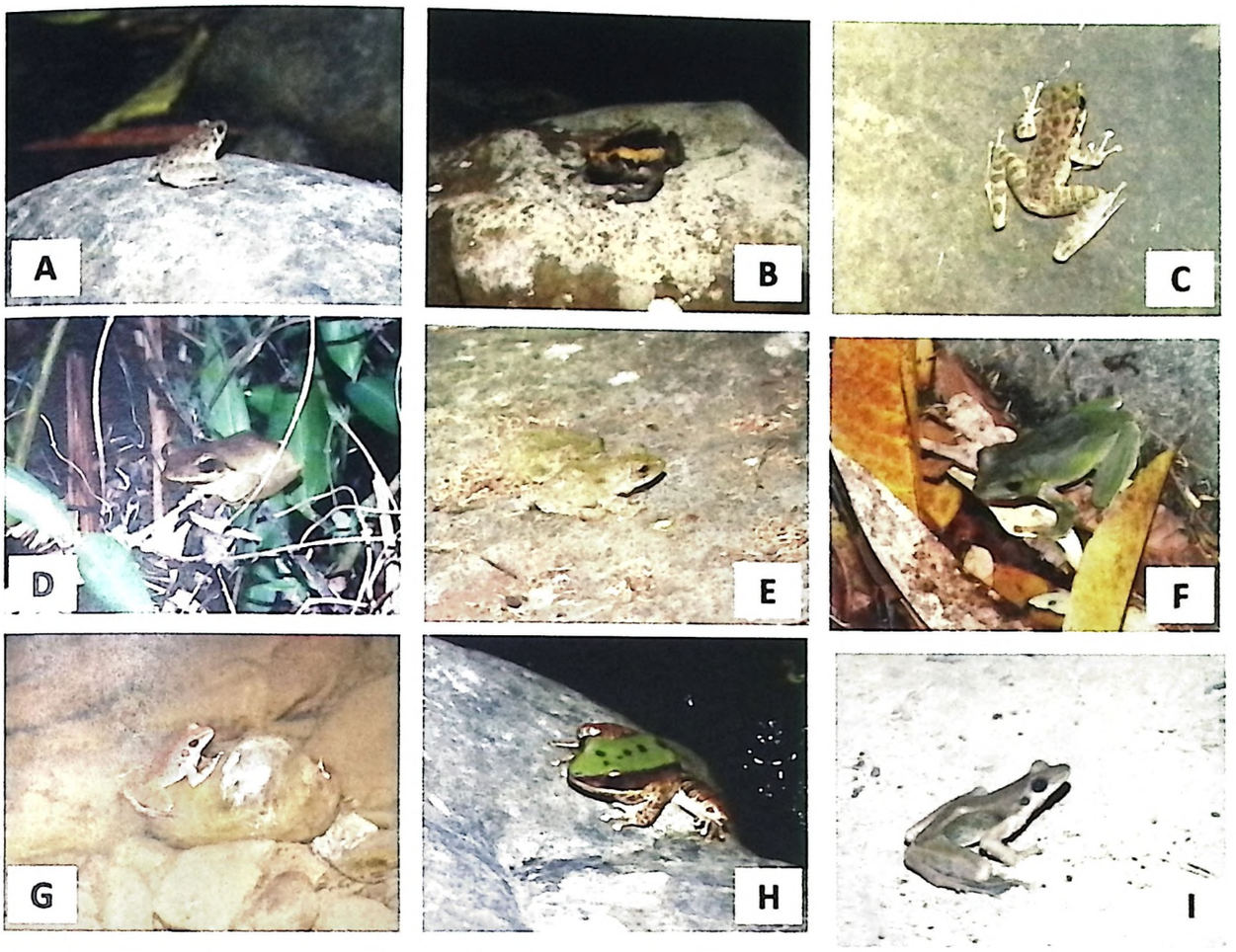

Figure 2: Figure 2: Species documented in Lallen (Buffer). A) *Minervarya asmati* B) *Kaloula pulchra* C) *Amolops indoburmanensis* D) *Polypedates teraiensis* E) *Kurixalus yangi* F) *Zhangixalus smaragdinus* G) *Sylvirana lacrima* H) *Odorrana chloronota* I) *Pterorana khare*

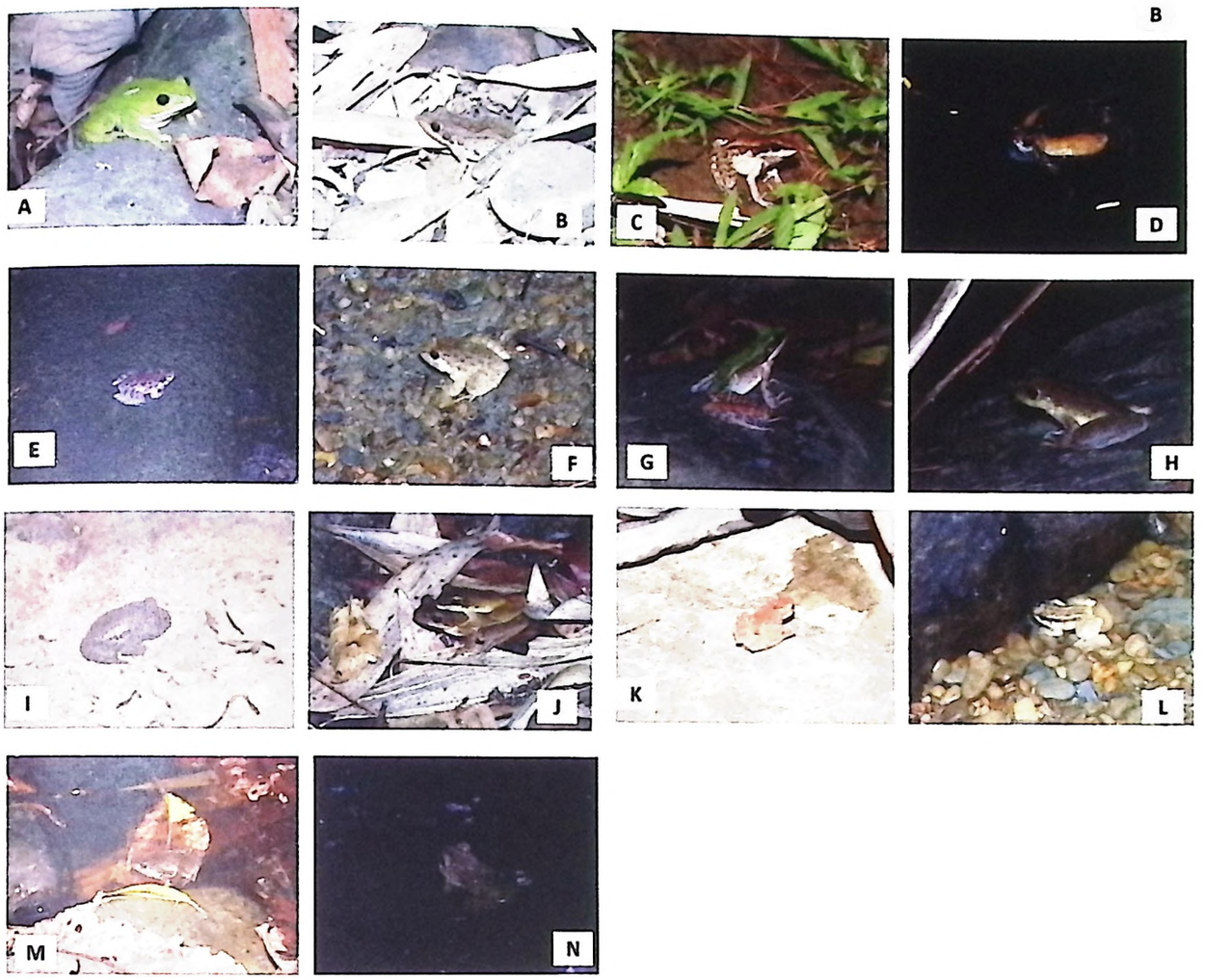

Figure 3: Species recorded in Tuichar (Core). ***A) Zhangixalus smaragdinus B) Sylvirana lacroma C) Hydrophylax leptoglossa D) Kaloula pulchra E) Minervarya asmati F) Limnonectes khasianus G) Odorrana chloronota H) Amolops indoburmanensis I)Leptobrachium smithi J) Polypedates teraiensis K) Rhacophorus tuberculatus L) Ingerana borealis M) Microhyla berdmorei N) Duttaphrynus melanostictus***

The species accumulation curve of the two streams showed the richness and number of individuals encountered showed asymptotes indicating the adequacy of the VES (Fig. 4).

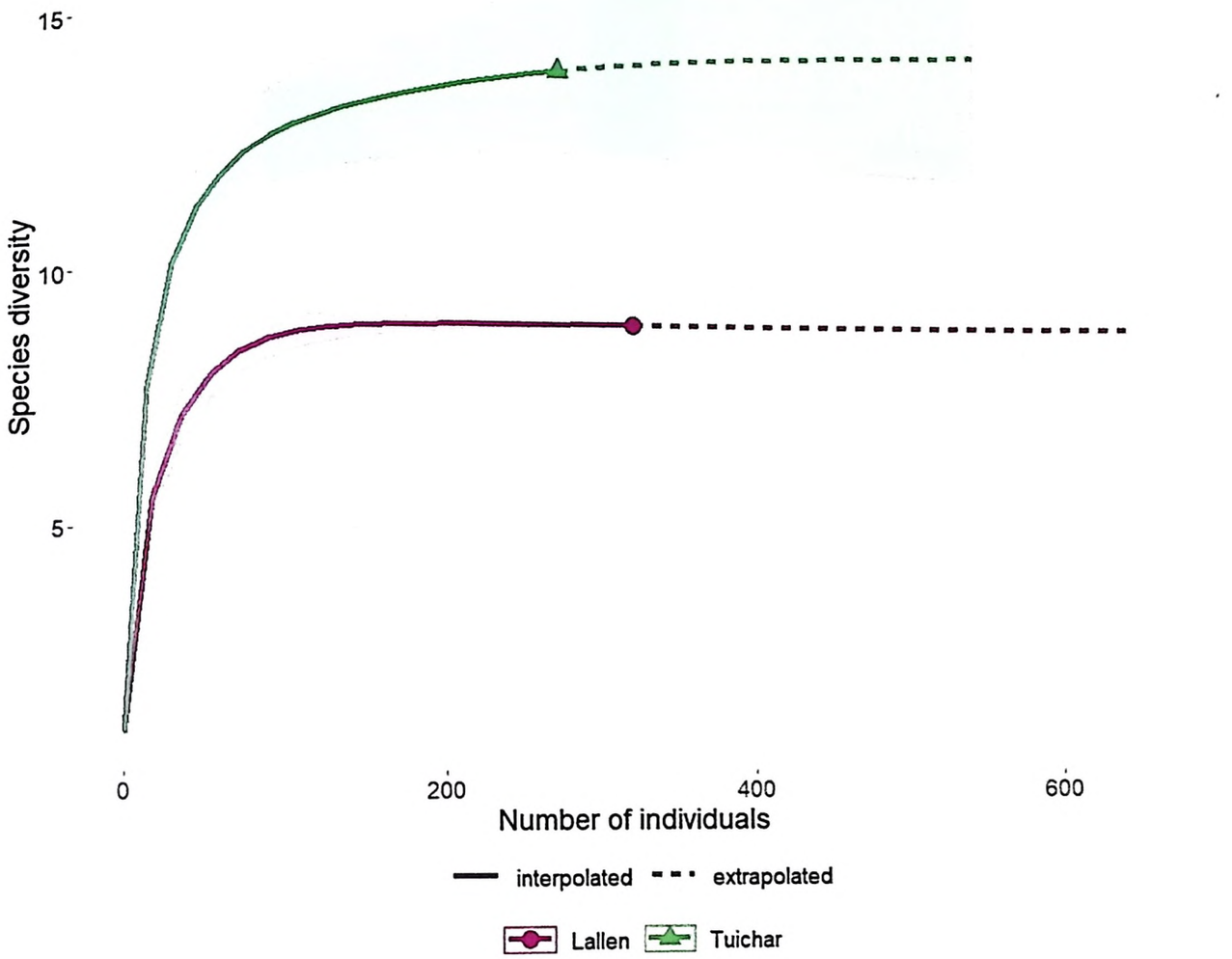

Figure 4: Species accumulation curve produced using number of species found and number of individuals in both the streams

The Shannon Diversity indices and evenness of the two streams shows that the core has higher species richness and the species are more evenly distributed. (Fig 5)

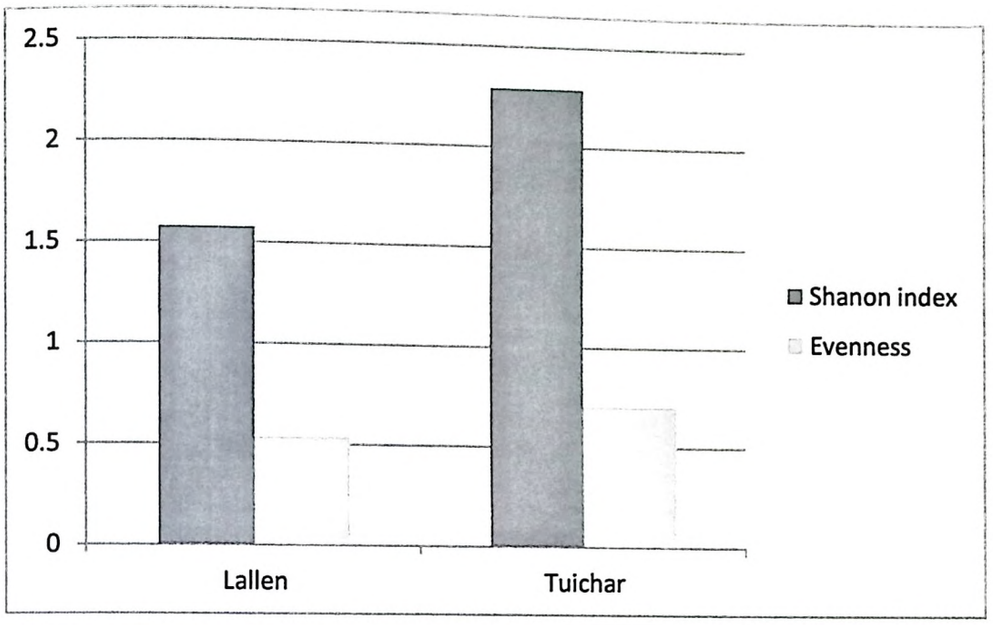

Figure 5: Graph of Shannon diversity index and evenness of the two streams

Relative abundance:

Amolops Indoburmanensis, Odorrana chloronota and *Sylvirana lacrima* are the most abundant species encountered in the buffer (Lallen) (Fig. 6).

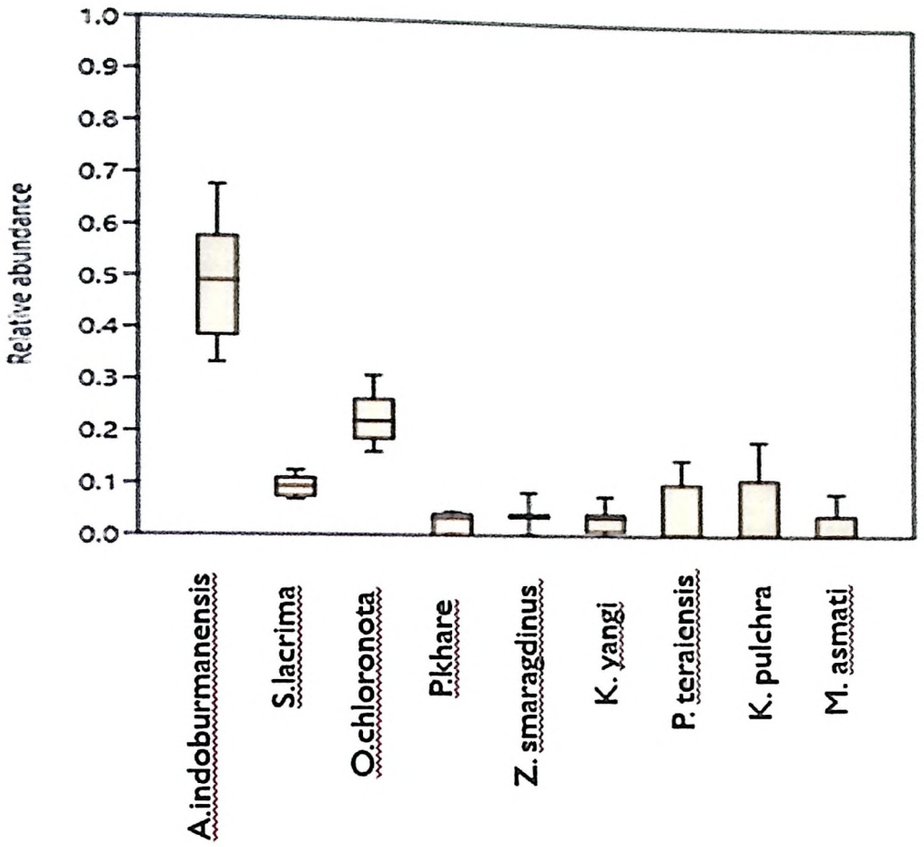

Figure 6: Relative abundance of species recorded in Lallen (buffer)

Amolops Indoburmanensis, Odorrana chloronota, Kaloula pulchra and *Sylvirana lacrima* are the most abundant species encountered in Tuichar (Core) (Fig. 7).

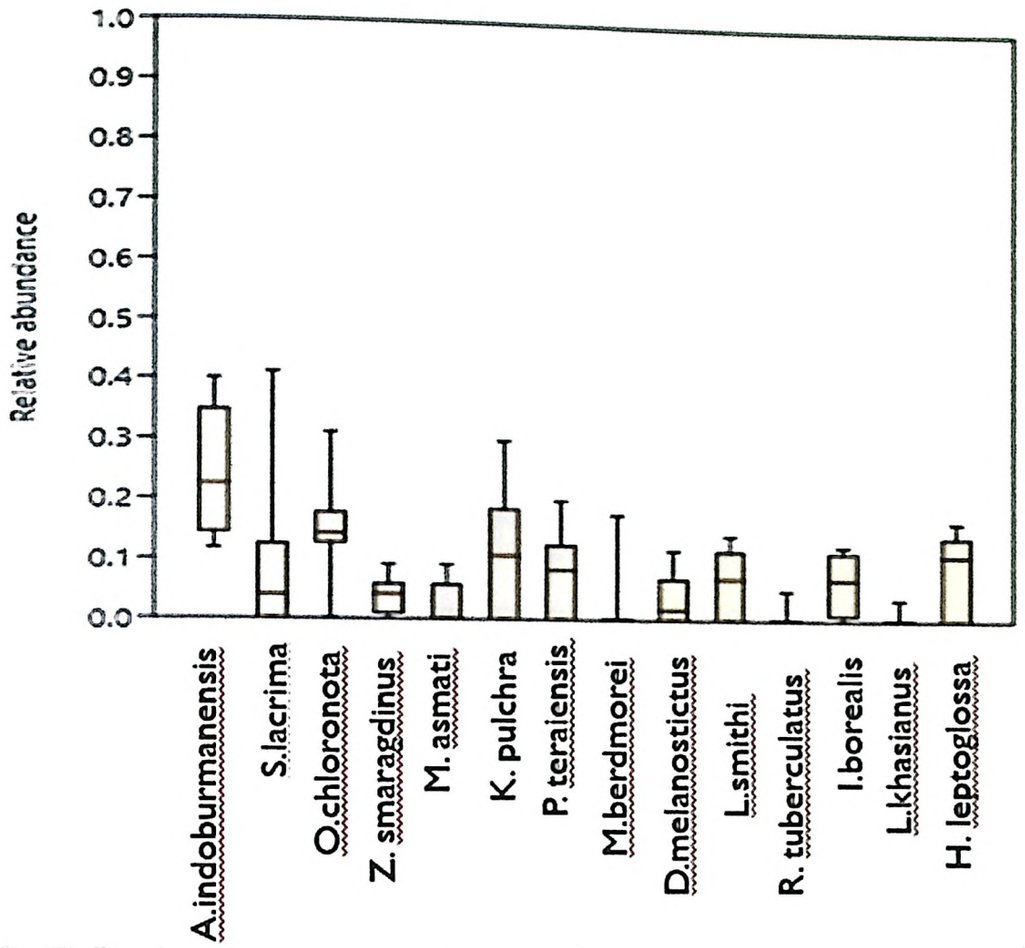

Figure 7: Relative abundance of species recorded in Tuichar (core)

Male and Female frogs encountered:

The number of males encountered during the survey was signifcantly higher in Lallen (buffer) (Fig. 8). (Mann-whitney test, U=17, z= 2.0923, p=0.0363 and N=9)

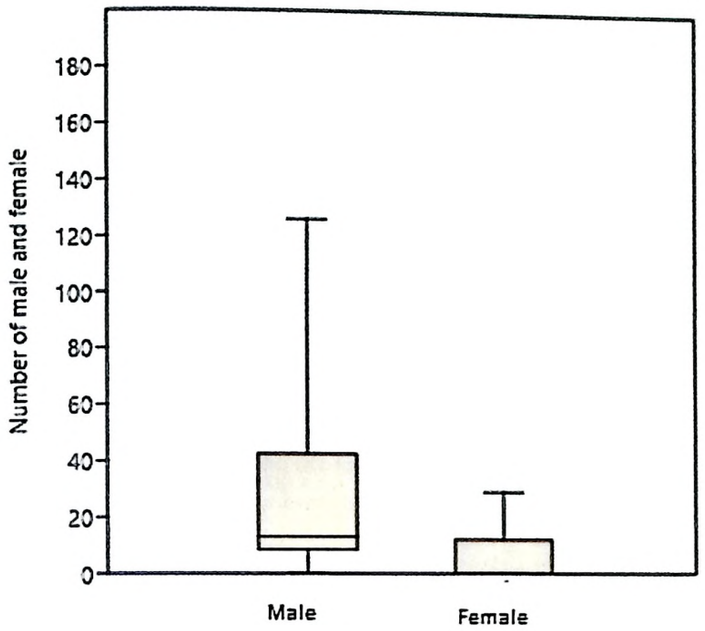

Figure 8: Male and female frogs encountered in Lallen (buffer)

The number of males encountered during the survey was significantly different in Tuichar (core) (Fig. 9). (mann-whitney test, U=11.5, z= 4.045, p=5.2319E-05 and N=14)

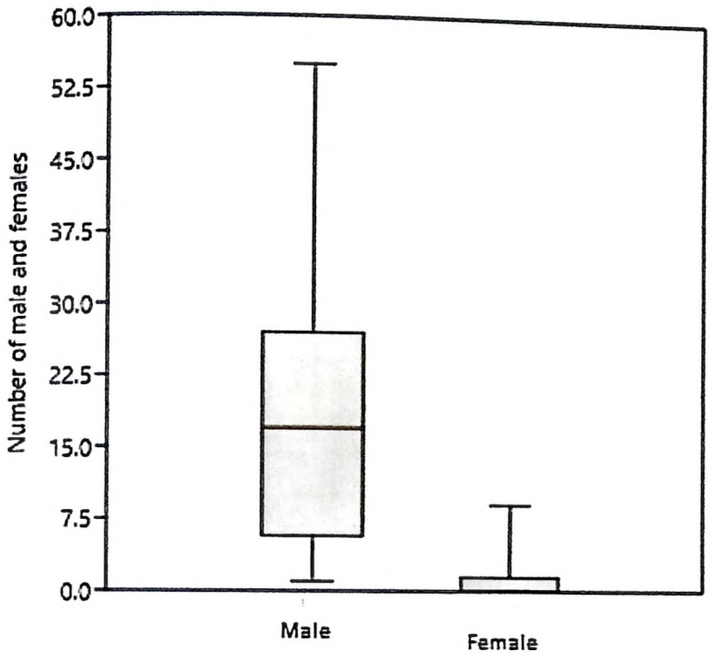

Figure 9: Male and Female frogs encountered in Tuichar (core)

Large bodied and Small bodied Species of frogs:

The large bodied frog species encountered in the two study areas are compared using Mann-Whitney test and they are significantly different. (U=25, z=2.6974, p=0.0058 and N=12) (Fig. 10)

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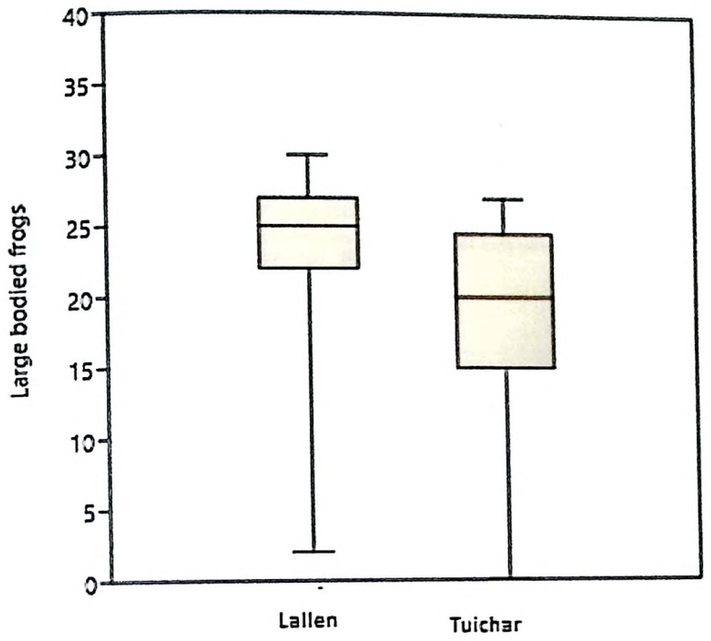


Figure 10: Large bodied frog species of the two streams

Using Mann-whitney test, we compared the small bodied frogs recorded in the two streams and we get a significant difference (U=25, z=2.6974, p=0.0058 and N=12) (Fig. 11)

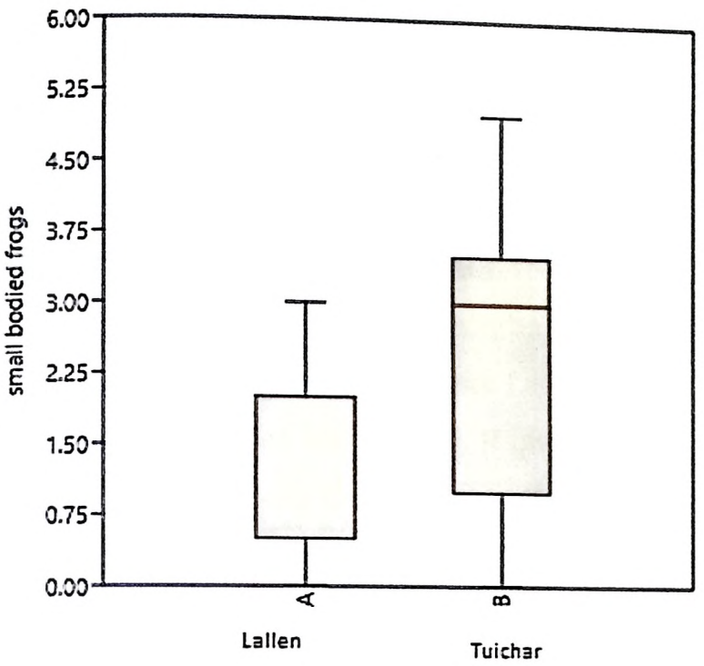


Figure 11: Small bodied frogs species in the two streams

4.2. Assessing the consumption pattern of frogs & its cultural significance in the study area:

Basic profile and characteristics of the sampled household and respondents in the study area:

The basic profile of the sampled villages of the study area is shown in Table 3.

Table 2: Profile of sampled village in study area

Village	Total household	Sampled household	Total population	Sampled population
Teirei	109	40	525	233
Dampareng pui	540	80	2470	430
Rajiv	954	100	4190	515

Nagar				
Lallen	146	40	592	211

Table 4 shows the characteristics of respondents such as gender, education qualification and occupation and is shown in percentage wise. Out of 40 respondents in Teirei, 57.5% were male and 42.5% were female. Out of 80 respondents in Damparengpui, we have a 50-50 male-female respondent. Out of 100 respondents in Rajiv nagar, 60% are males while 40% are females and out of 40 respondents from Lallen, we have 50-50 distributions in male and female. Among the sampled respondents, Rajiv nagar had the highest illiteracy rate. Lallen village had no illiterate among the sampled respondents.

Table 3: Characteristics of the respondents surveyed

Village		**Teirei (%) N=40**	**Damparengpui (%) N=80**	**Rajiv nagar (%) N=100**	**Lallen (%) N=40**
Gender	**Male**	57.5	50	60	50
	Female	42.5	50	40	50
Education	**Illiterate**	12.5	8.75	28	0
	<10th	85	71.25	59	77.5
	>10th	2.5	20	13	22.5
Occupation	**Agriculture**	12.5	38.75	31	55
	Daily wage	85	37.5	29	30
	Business	0	20	14	2.5
	Govt	2.5	0	10	12.5
	Others	0	3.75	16	0

The table 5 shows the basic socio-economic profile of the sampled households. The average family size of Teirei was 5.57±1.76, Damparengpui was 5.37±1.87, Rajiv nagar wasc5.15±1.76 and Lallen 5.27±1.32. About 55% of respondents from Teirei, about 81.25% respondents from Damparengpui, 76% respondents of Rajiv nagar and 65% respondents from Lallen said that they collected frogs.

Table 4: Socio-Economic profile of the sampled households

Village	# sampled household	Total population of sampled house	Average family size (Mean± sd)	House type (of sampled households)			Number of households with frog collection (%)	Average livestocks (Mean± sd)
				% With Thatch (Bamboo) hut	% Of Assam type houses	% Of RCC houses		
Teirei	40	223	5.57± 1.76	87.5	12.5	0	55	1.97±4.40
Damparengpui	80	430	5.37 ± 1.87	52.5	45	2.5	81.25	2.6±3.77
Rajiv Nagar	100	515	5.15± 1.70	20	70	10	76	1.29±2.67
Lallen	40	211	5.27± 1.32	20	70	10	65	2.1±3.25

Table 5: Profile of household collecting frogs in each village

Village		Teirei(%) N=40	Damparengpui(%) N=80	Rajiv Nagar (%) N=100	Lallen(%) N=40
Frog Collection (sampled household)		55	81.25	76	65
Occupation	Agriculture	12.5	38.75	31	55

	Daily wage	85	37.5	29	30
	Business	0	20	14	2.5
	Govt	2.5	0	10	12.5
	Others	0	3.75	16	0

Out of 40 respondents from Teirei, it was found that 55% are collecting frogs in which 12.5% are farmers, 85% are daily wage laboures and 2.5% Govt. employee. In Damparengpui, it was found that 81.25% out of 80 households are collecting frogs in which 38.75% are working in agriculture fields, 37.5% are Daily wage labours, 20% are business workers and other 3.75% do not have specific job. In Rajiv nagar, out of 100 respondents we found that 76% were collecting frogs out of which 31% are working in agriculture fields, 29% are daily wage workers, 14% in business, 10% are Govt employees and 16% do not have a specified job. In Lallen, it was found that 65% out of 40 respondents collected frogs where 55% are agriculture workers, 30% are daily wage labours, 2.5% in business and 12.5% are Govt employees.

Factors Determining the Frog Consumption Pattern:

The Generalized Linear Modelling with predictive variables was run and it was found that the interactive effect of tribe and gender was the best model.

Table 6: GLM modelling

Generalised Linear Model	**Log-Likelihood**	**AICC**	**Delta**	**Weight**	df
Frog collection~Tribe*Gender	-145.645	303.6	0.000.00	0.877	6

The model summary is given in Table 9.

Table 7: Summary of GLM

Variable	Estimate	Std.Error	z	p-value
(Intercept)	1.1527	0.3311	3.481	0.0005
Bru: Male	-0.5545	0.7233	-0.767	0.4433
Chakma:Male	1.6724	0.6728	2.486	0.0129

This indicates that a cross over effect of gender and tribe explains the frog consumption patterns in the study area, based on the comparison of all the candidate models.

This is an indication of the role played by gender in the frog consumption pattern, interlinked with the tribe the respondent belongs to.

Tribe-Wise Frog Collection:

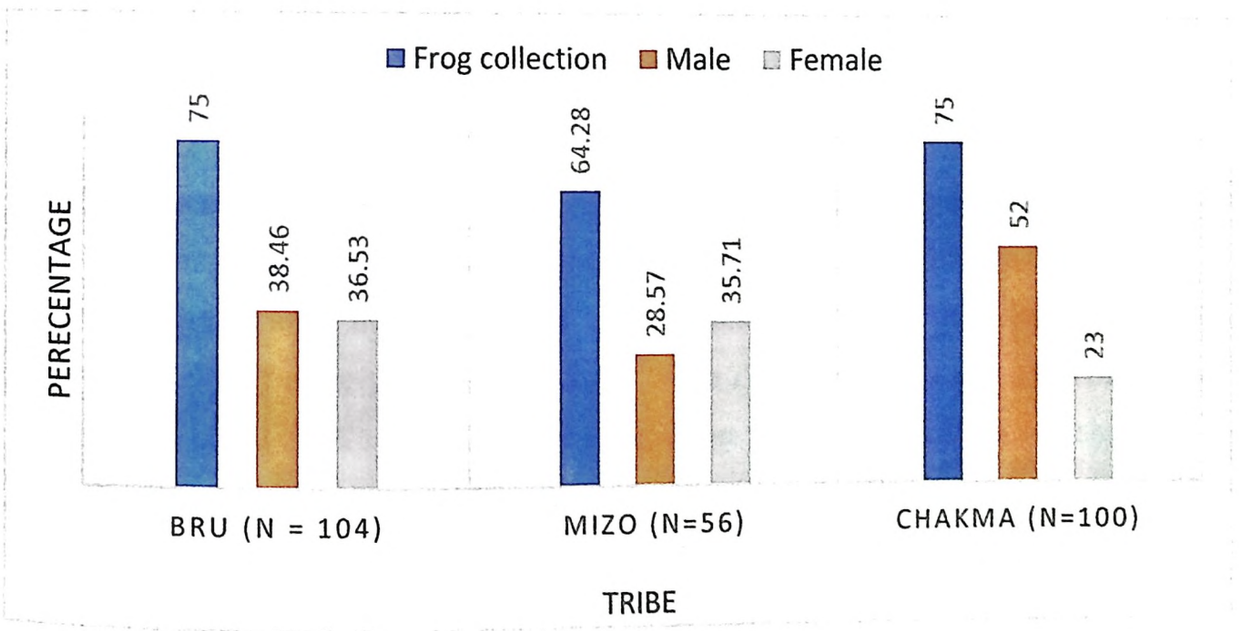


Figure 12: tribe-gender wise frog collection data

The above table (table 7) and fig (Fig 12) shows the graph depicting the percentage of each tribe that collects and do not collect frogs for food.

Perception of the tribes towards the responsibility of conservation of frogs:

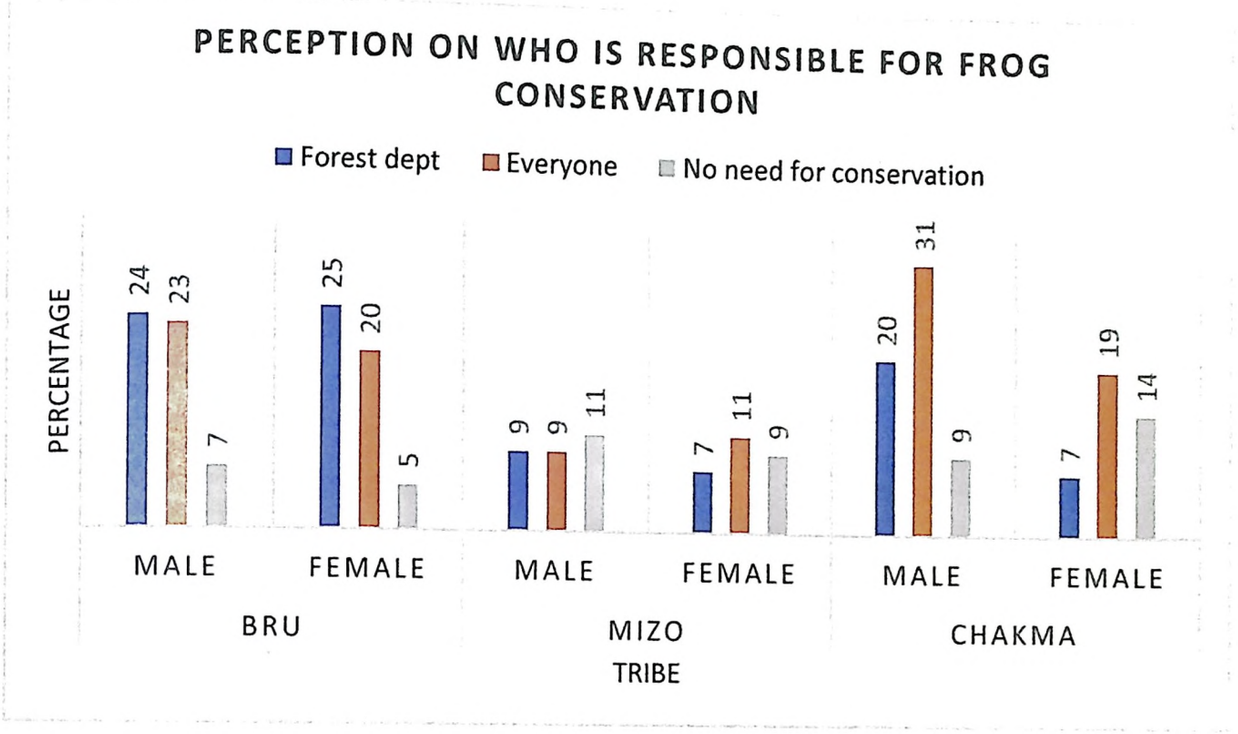
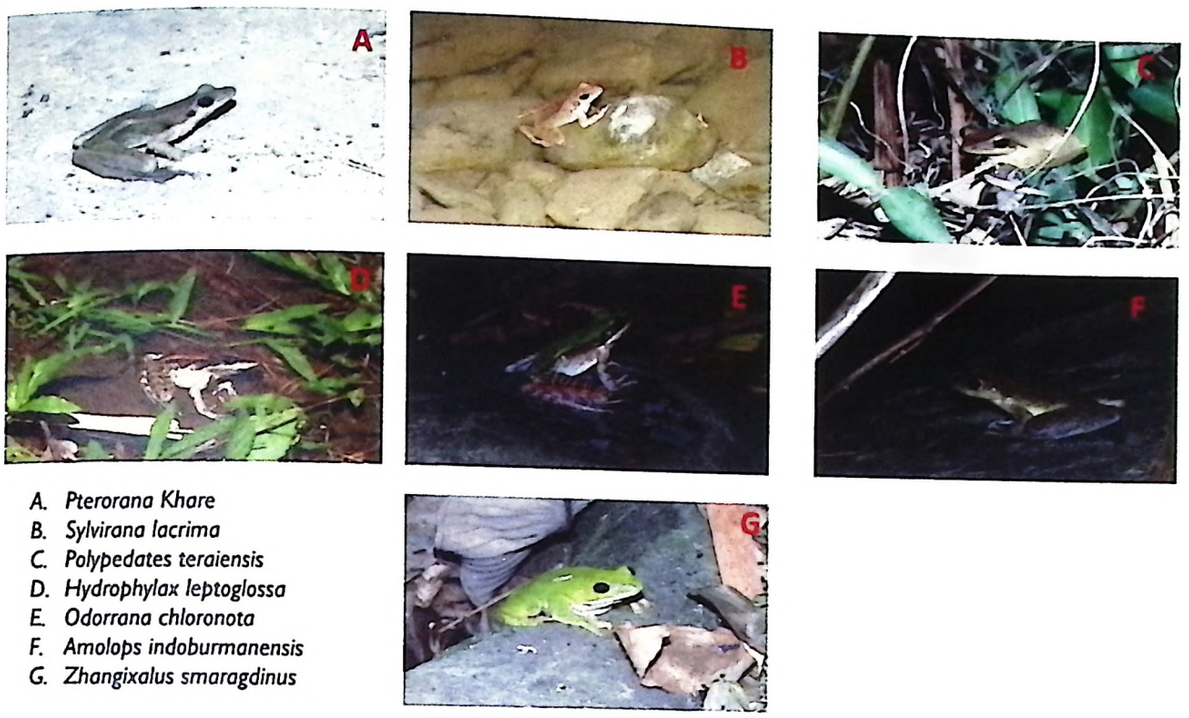


Figure 13: Perception towards responsibility of frog's conservation

Fig 13 shows about how the tribes in the study areas perceive on the conservation of frogs. From this we can see that about 24% of male and 25% of female in the Bru tribes think that the conservation should be on the hands of the Forest dept. 23% males and 20% females think that it should be everyone's responsibility while 7% male and 5% female do not feel the need for conservation. While in the Mizo tribe, about 9% of male and 7% of female in the think that the conservation should be on the hands of the Forest dept. 9% males and 11% females think that it should be everyone's responsibility while 11% male and 9% female do not feel the need for conservation. In the Chakma tribe, about 20% of male and 7% of female think that the conservation should be on the hands of the Forest dept. 31% males and 19% females think that it should be everyone's responsibility while 9% male and 14% female do not feel the need for conservation.

Common frogs consumed in the study area:

Through the questionnaire survey, we found that the frogs shown in the figure below are consumed locally by the tribes in the study area. (Fig. 14)



A. *Pterorana Khare*
B. *Sylvirana lacrima*
C. *Polypedates teraiensis*
D. *Hydrophylax leptoglossa*
E. *Odorrana chloronota*
F. *Amolops indoburmanensis*
G. *Zhangixalus smaragdinus*

Figure 14: Common frogs consumed in the study aea

Meat Preferences of the tribe in the study area:

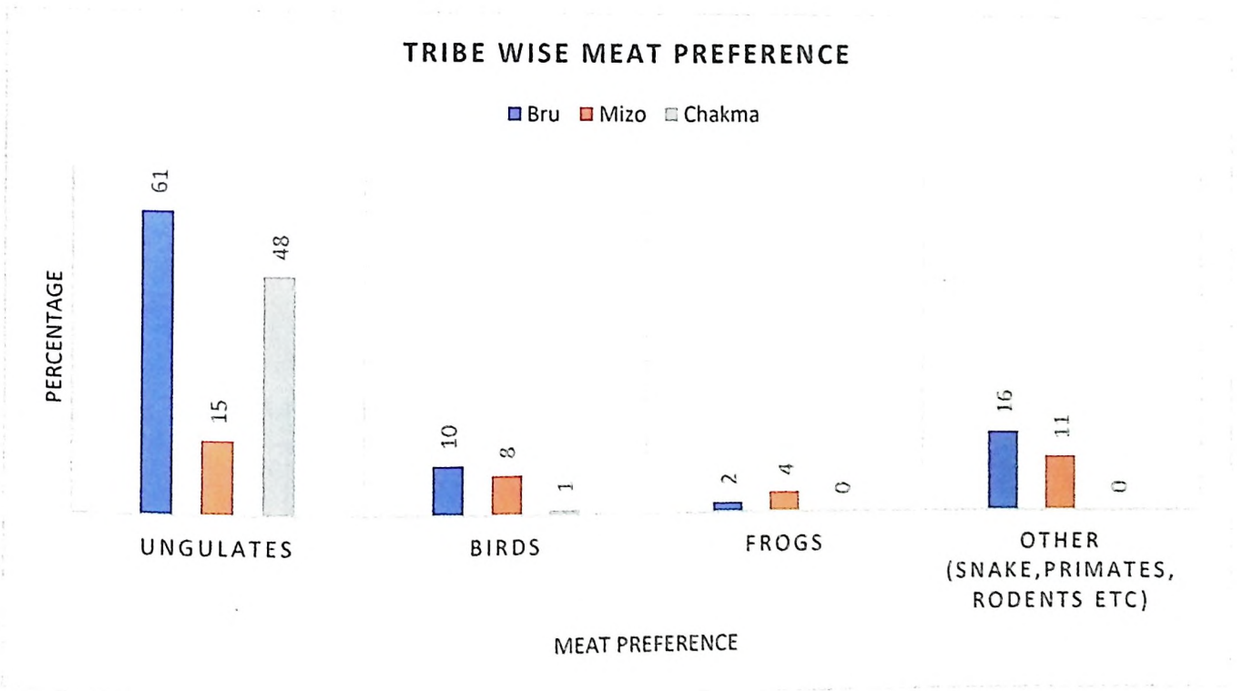


Figure 15: Tribe-wise meat preferences

The above table shows that 61 % of Bru, 15% of Mizo and 48% of Chakma tribes prefer ungulates the most while 2% of Bru and 4% of Mizo tribe prefer frogs.

Use of Frogs as Traditional Medicine in the Study Area:

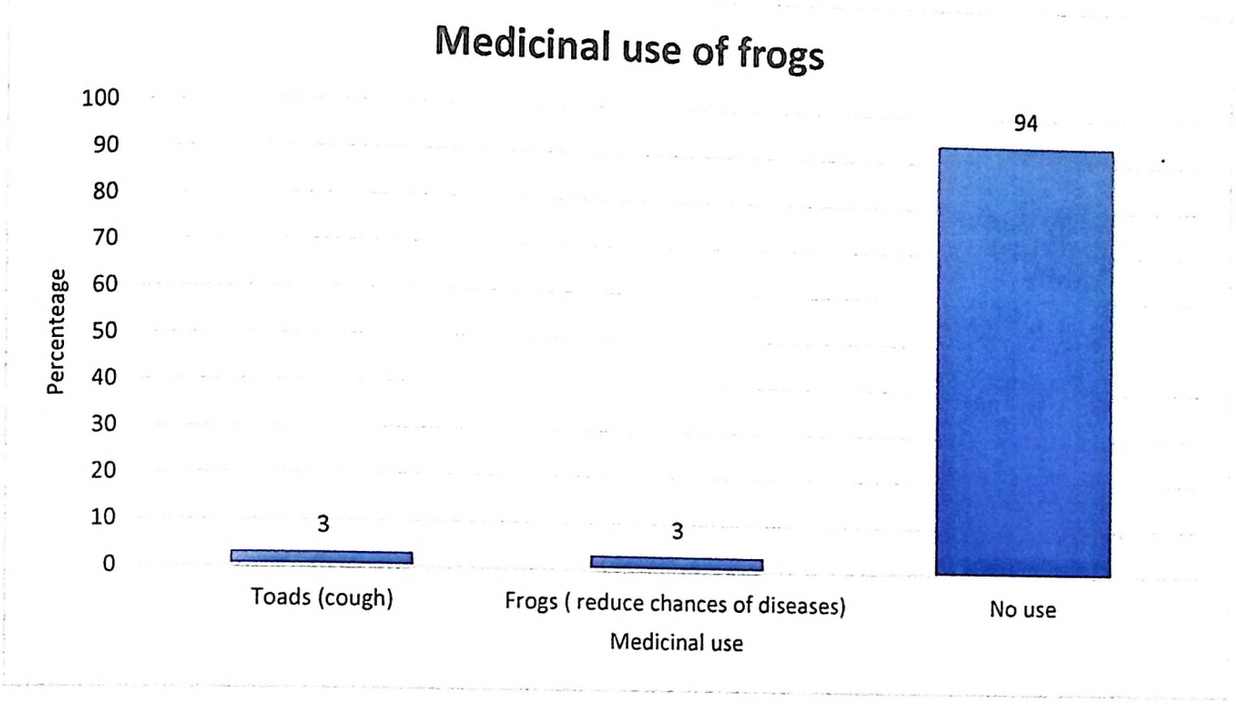


Figure 16: Medicinal use of frogs by Chakma tribe

Among the Mizo and Bru tribe, the respondents do not specify the use of frogs as a traditional medicine. However, 3% of the Chakma tribe use Toads for the treatment of cough and another 3% take any species of frogs thinking that it reduces the chances of getting disseases.

CHAPTER 5: DISCUSSION

A total of 24 VES was held during the study, a 12-night survey each on the buffer stream and core stream by two people, each survey covering an area of 150m in one man-hour. Sixteen species were encountered during the study period, out of which 9 species were encountered from the buffer stream while 14 were encountered from the core stream. There are seven species recorded mutually on both the streams, while two frogs *Pterorana khare* and *Kurixalus yangi* were only recorded in the buffer stream during the study period. On the other hand, *Duttaphrynus melanostictus*, *Ingerana borealis*, *Hydrophylax leptoglossa, Leptobrachium smithi, Microhyla berdmorei, Limnonectes khasianu s*and *Rhacophorus tuberculatus* were recorded only in the core.

Areas with minimum disturbances are considered to be more diverse and richer in species than the area with more disturbances (Hazell et al., 2004). A higher number of individuals of stream frog's species was recorded in Lallen (buffer) while species diversity is higher in the core. The high species richness in the core compared tocompared to the buffer zone may be due to habitat fragmentation (Krishnamurthy 2003) and sampling methods and efforts. However, disturbed areas can lead to an influx of species. Hence, only certain species of frogs are adaptive towards disturbed areas (Wong 2004), which may be why the species encountered in the buffer are more in numbers than the core. *Amolops indoburmanensis* & *Odorrana chloronata* were the most abundant species in both the streams. However, the most abundant species of the two streams are large bodied frogs' species, and through questionnaire survey we found that they are among the preferred frog species for consumption, this warrants further studies.

The numbers of males encountered were higher than females. However, previous studies show that the sex ratio in vertebrates may show a bias due to various abiotic environmental factors such as temperature, contaminants etc., interfering with the sex determination (Hayes,1998; Badaway and Wallace, 1999). Male-Female ratio studies usually result in male dominance (Galliard et al., 2005; Dyson & Hurst, 2003; Madsen & Shine, 1992, Sakisaka et al., 2000). However, Alho et al., 2007 have reported a case where the ratio is biased towards females, possibly due to a higher male mortality ratemale mortality rate. Female frogs are larger than male frogs in adult size. Hence, the larger body size may influence the off-take rate of females and could contribute to why the rate of encounters of males is higher. This emphasizes the need for further studies to understand the reasons influencing the sex ratio.

Out of the 16 species encountered during the study, 10 species met the classification we made for the large-bodied frogs. Out of 10 species that we classified as large-bodied, 7 were documented in the buffer stream while 9 were documented in the core, out of which 6 species are recorded in both the streams. Out of these 6 species, 4 species are more abundant in the buffer while 2 species are more abundant in the core. However, the 4 abundant species in the buffer are known to be consumed by local communities (pers comm.). Harvesting frogs translate directly to off-take. Hence, this does not explicitly explain why the large-bodied frogs' species, which are preferred for consumption, were more abundant in the buffer. This warrants further studies.

A questionnaire survey revealed that tribe and gender play a significant role compared to other variables in frog collection. Out of the three tribes sampled during the study, 75% of Chakmas (out of which 52% are male and 23% are female), 75% of Brus (38.46% are male and 36.53% are female) collected frogs and about 64.28% of the Mizos (out of which 28.57 are male & 35.71% are female) collected frogs. And the data shows that Frogs are an essential component of food security for the local communities

The local perception of the conservation of frogs differs among the tribes. Among the Bru tribes, 23.07% of Male and 24.04% of Females think that the Forest department is responsible for conserving frogs. 22.11% of Male and 19.23% of Females think that it is everyone's job to conserve frogs, while 6.73% of Male and 4.80% of Females either have no idea or think that frogs do not need conservation. Among the Mizo tribe, 16.07% of Male and 12.5% of Females think that it is the Forest Dept. job to conserve frogs. 16.07% of Male and 19.64% of female think that it is everyone's responsibility to conserve frogs while 19.64% of Male and 16.07% of Female have no idea or think there are no need to conserve frogs. Among the Chakma tribe, 20% Male and 7% Female thinks that it is the responsibility of the Forest dept. 9% of Male and 14% of Female either have no idea or thinks that frogs do not need conservation. But majority of them i.e., 31% of Male and 19% of Female thinks that it is everyone's responsibility Our data reveals that higher percentage of Chakma tribe participate in frog harvesting and ironically, at the same time, accept the conservation of frogs as their responsibility. This could be taken on a positive note as it shows that the local communities will support conservation efforts if the efforts focus on developing agreeable strategies with the people through securing livelihoods and food.

The common species consumed among the three tribes show that the species preferred by the three tribes do not differ much as they live in the same region. The use of frogs as traditional medicine is not relevant in the study area among the Mizo and Bru tribes. However, 3% of the respondents mentioned that they take Toad to treat cough among the Chakma respondents. Another 3%mentioned that eating frog meat improves immunity. No specific body parts were preferred as traditional medicine, and except for the innards, the whole frog is consumed.

When given a choice, the three tribes prefer ungulates meat the most, followed by birds. The drivers of frog meat consumption were revealed to be a livelihood, socio-economic status and availability.

Since taking food from wild sources is a traditional cultural practice in the region, it forms a strong bond between the cultural practices and the region's natural heritage. Hence, we can see that the. The strong culture-nature linkages through wild meat consumption reveal that consumption is not purely motivated by necessity for every household in the tribe. Although socio-economic status plays a part, it is primarily driven by non-financial factors tightly interwoven with tradition and culture like social esteem, cultural delicacy, and enjoyment. Therefore, the impact on traditional frog meat harvesting needs to be thoroughly visited to find solutions or alternatives both ecologically and socially as cultural and natural heritage are strongly intertwined.

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Chapter 7: APPENDIX

Questionnaire sample:

Village_____ Settlement area: _____ GPS Location: _____

1. Name of Respondent/Alphanumeric code: _____

2. Age: _____

3. Gender: _____

4. Religion/Ethnicity/Tribe/Clan: _____

5. Social status/remark: _____

6. Qualification:

    a) Illiterate

    b) Primary

    C) High School/ Higher Secondary

    d) Graduate and above:

    e) others

7. Occupation:

    a) Agriculture

b) Animal husbandry

c) Business

d) Govt. Job

e) Private

f) others

8. Number of family members: _____

9. Basic amenities (type of house, source of water, source of energy, sanitation, land holding): _____

10. Location of the house with respect to stream: _____

11. Do you consume frog meat?

Yes/No

If Yes, How Often? _____

12. Do you like it?

Yes/No

13. Types (species) of frogs preferred and not preferred? _____

14. Have you gone for frog collection?

Yes/No

If Yes, for sustenance/recreation or other reasons? _____

15. IS there any festival/occasion/season when you particularly catch frog? (species, type, size etc) _____

16. Is there any season/reason you avoid catching/consuming frogs? (species, type, size or age class) _____

17. Are frogs/frog products used in traditional medicine? (species, type, size or age class) _____

18. What do you think about frogs (food, some other creature etc.)? _____

19. Do you think that the frogs' abundance is declining over the years?

Yes/No

If Yes, reasons? _____

20. Do you think that frogs have any role in nature?

Yes/No

21. Do you think frog need any conservation measures?

Yes/No

If Yes, what kind of measures? _____

Who should be in-charge? _____

22. Do you know any folklore/stories about frogs in your culture/tribe/history?

Yes/No

If Yes, From whom? _____

Field validation – location, species, how often they come, will they sell?

Tables:

Table 1: Total species and individuals encountered

Species	Lallen (Buffer)	Tuichar (Core)
Amolops indoburmanensis	155	64
Sylvirana lacrima	30	18
Pterorana Khare	7	0
Zhangixalus smaragdinus	13	10
Odorrana chloronota	72	41

Kurixalus yangi	10	0
Minervarya asmati	6	6
Kaloula pulchra	14	33
Polypedates teraiensis	13	24
Microhyla berdmorei	0	5
Duttaphrynus melanostictus	0	9
Leptobrachium smithi	0	16
Rhacophorus tuberculatus	0	1
Ingerana borealis	0	18
Limnonectes khasianus	0	2
Hydrophylax leptoglossa	0	25

Table 2: Relative Abundance of species of species in each survey (Buffer)

	Amolops indoburmanensis	Sylvirana lacrima	Odorrana chloronota	Pterorana khare	Zhangixalus smaragdinus	kurixalus yangi	Polypedates teraiensis	Kaloula pulchra	Minervarya asmati
VES 1	0.482759	0.103448	0.275862	0.034483	0.034483	0.034483	0	0	0.034483
VES 2	0.535714	0.107143	0.178571	0.035714	0.035714	0.035714	0	0	0.071429
VES 3	0.416667	0.083333	0.25	0.041667	0.083333	0.041667	0	0	0.083333
VES 4	0.5	0.125	0.208333	0.041667	0.041667	0.041667	0	0	0.041667
VES 5	0.615385	0.076923	0.192308	0	0.045455	0.076923	0	0	0
VES 6	0.590909	0.090909	0.227273	0.045455	0.038462	0	0	0	0
VES 7	0.677419	0.111111	0.16129	0.032258	0	0.032258	0	0	0

VES 8	0.538462	0.074074	0.269231	0.038462	0.038462	0	0	0	0
VES 9	0.407407	0.074074	0.222222	0	0.037037	0	0.111111	0.111111	0
VES 10	0.333333	0.068966	0.222222	0	0.037037	0.074074	0.148148	0.111111	0
VES 11	0.333333	0.096774	0.185185	0	0.037037	0.037037	0.148148	0.185185	0
VES 12	0.37931	0.115385	0.310345	0	0.034483	0.034483	0.068966	0.103448	0

Table 3: Relative abundance of species in each survey (Core)

Relative abundance	A.indobur manensis	S.lacrima	O.chlorono ta	Z.smaragdinus	M.asmati	K.pulchra	P.terai ensis	M.berdmorei	D.melanostictus	L.smithi	R.tuberculutus	I.boreal is	Limnonecte s sp.	H.leptogloss a
VES1	0.117647	0.411765	0	0.058824	0	0	0	0.176471	0.117647	0	0	0.117647	0	0
VES2	0.352941	0.176471	0.176471	0.058824	0	0	0	0.117647	0.117647	0	0	0	0	0
VES3	0.4	0.1	0.2	0.05	0	0	0	0	0.05	0.05	0.05	0.1	0	0
VES4	0.375	0.125	0.3125	0.0625	0.062	0	0	0	0.0625	0	0	0	0	0

					5									
VES5	0.333333	0.047619	0.142857	0	0	0.142857	0.095238	0	0	0.142857	0	0.047619	0	0.047619
VES6	0.24	0.04	0.12	0	0	0.2	0.12	0	0	0.12	0	0.04	0	0.12
VES7	0.208333	0	0.166667	0.041667	0	0.208333	0.125	0	0	0	0	0.125	0	0.125
VES8	0.136364	0	0.136364	0.090909	0.090909	0.090909	0.136364	0	0	0.090909	0	0.090909	0	0.136364
VES9	0.285714	0	0.142857	0.035714	0	0.071429	0.071429	0	0.035714	0.107143	0	0.107143	0	0.142857
VES10	0.178571	0	0.178571	0.035714	0	0.142857	0.071429	0	0.071429	0.107143	0	0.035714	0	0.142857
VES11	0.166667	0	0.133333	0	0.066667	0.3	0.2	0	0	0	0	0	0.035714	0.1
VES12	0.125		0.125	0.041667	0.041667	0.125	0.125	0	0	0.125	0	0.125	0.033333	0.166667

Table 4: Male and female ratio (of total encounters) in the buffer

Species	Male: Female
Amolops indoburmanensis	126:26
Odoranna chloronota	55:17
Sylvirana lacrima	30:0
Polypedates teraiensis	13:0
Kaloula pulchra	14:0
Zhangixalus smaragdinus	12:0
Minervarya asmati	6:0
Kurixalus yangi	11:0
Pterorana khare	0:7

Table 5: Male and Female ratio (of total encounter) in the core

Species	Male: Female
Amolops indoburmanensis	55:9
Odoranna chloronota	34:7
Sylvirana lacrima	18:0
Polypedates teraiensis	21:3
Kaloula pulchra	33:0
Zhangixalus smaragdinus	10:0
Minervarya asmati	6:0
Hydrophylax leptoglossa	25:0
Leptobrachium smithi	16:0
Duttaphrynus melanostictus	8:1
Limnonectes khasianus	2:0
Ingerana borealis	18:0
Rhacophorus tuberculatus	1:0
Microhyla berdmorei	5:0

Table 6. Total large bodied frogs observed in both the sites

Species	Lallen	Tuichar
Amolops indoburmanensis	155	64
Sylvirana lacrima	30	18
Pterorana Khare	7	0
Zhangixalus smaragdinus	13	10
Odorrana chloronota	72	41
Kaloula pulchra	14	33
Polypedates teraiensis	13	24
Duttaphrynus melanostictus	0	9
Hydrophylax leptoglossa	0	25
Leptobrachium smithi	0	16

Table 7: Total small bodied frogs observed in both sites

Species	Lallen	Tuichar
Kurixalus yangi	10	0
Minervarya asmati	6	6
Microhyla berdmorei	0	5
Rhacophorus tuberculatus	0	1
Ingerana borealis	0	18
Limnonectes khasianus	0	2

Table 8: Tribe-wise frog collection data

		Bru N=104	Mizo N=56	Chakma N=100
Frog collection	Yes	75	64.28	75
	No	25	35.71	25
Collect frogs	Male	38.46	28.57	52

	Female	36.53	35.71	23
Not collecting frogs	Male	13.46	23.21	8
	Female	11.53	12.5	17

Table 9: Tribe-wise perception on the responsibility of frogs' conservation

Perception towards conservation		Bru N=104	Mizo N=56	Chakma N=100
Forest dept	Male	23.07	16.07	20
	Female	24.04	12.5	7
Everyone	Male	22.11	16.07	31
	Female	19.23	19.64	19
No Need	Male	6.73	19.64	9
	Female	4.80	16.07	14