Ethnographic Analogy and the Archaeological Record of Northern Thailand: Insights from Mlabri Hunter-Gatherers and the Tham Lod Rockshelter Archaeofauna[1]

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Abstract

Ethnographic analogy is commonly employed to understand artifactual data in the archaeological record. In mainland Southeast Asia, a rich ethnographic record provides several analogous examples to compare with the broad array of late Pleistocene and Holocene sites throughout the region. This article reviews the Mlabri, a hunter-gatherer group from northern Thailand, and examines the use of Mlabri ethnographic analogy to understand the zooarchaeological record at Tham Lod Rockshelter. The results suggest that Mlabri sex and age based foraging strategies are favorable ethnographic correlates that can be applied to the archaeological record. In late Pleistocene deposits at Tham Lod, differential sex (including children and elderly) based foraging strategies may be present.

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Introduction

Ethnographic analogy commonly provides contemporary (or historically recent) information for understanding aspects of the archaeological record.[3] In mainland Southeast Asia, a long history of both archaeological and ethnographic research allows comparison between select archaeological case studies and contemporary hunter-gatherer groups (see Figure 1 for locations of late Pleistocene to Holocene sites).[4] This article reviews the ethnographic record for the Mlabri, a northern Thai hunter-gatherer group, and compares this record with archaeological evidence from Tham Lod Rockshelter (northwest Thailand) to better understand the benefits and problems of using Mlabri ethnographic analogy in the Thai archaeological record.[5] This article focuses on four goals: (1) a synthetic review of the Mlabri ethnographic record to establish what material-cultural artifacts, or ecofacts, would remain in a perfectly preserved archaeological record; (2) a description of what artifacts, or ecofacts, would be expected to preserve in a 'realistic' archaeological record; (3) a quantification of the Tham Lod Rockshelter archaeofauna, focusing on identifying sex/age based foraging activities; and (4) an examination of the implications this record holds for utilizing Mlabri ethnographic analogy in the mainland Southeast Asian archaeological record. Mlabri hunter-gatherers are an ideal group to compare with the

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[3] Spriggs, "Ethnographic parallels and the denial of history"; Roscoe, "On the 'pacification' of the European Neolithic"; Hamilakis, "Archaeological Ethnography"; Ravn, "Ethnographic analogy from the Pacific"; Zarger, "Assessing Methodologies in Archaeological Ethnography".

[4] Higham, "Hunter-Gatherers in Southeast Asia". For ethnographic reviews, see: Fortier, "Regional hunter-gatherer traditions in South East Asia"; Nagata, "Subgroup 'names' of the Sakai (Thailand) and the Semang (Malaysia)"; Sather, "Sea Nomads and Rainforest Hunter-Gatherers"; Sponsel, "The Historical Ecology of Thailand". For archaeological examples, see: Surin, *Archaeological Research of the Hoabinhian Culture*; Rasmi, "Forager mobility organization in seasonal tropical environments of western Thailand"; Taha, *Archaeology of Ulu Kelantan*.

[5] Surin, "Ethnoarchaeology with the Phi Tong Luang (Mlabrai): forest hunters of northern Thailand"; Surin, *Archaeological Research of the Hoabinhian Culture*; Surin, *The Phi Tong Luang (Mlabri)*; Young, *The Hill Tribes of Northern Thailand*.

archaeological record because of their regional geographic proximity to Tham Lod Rockshelter, and their status as one of the last remaining hunter-gatherer groups in Thailand.[6]

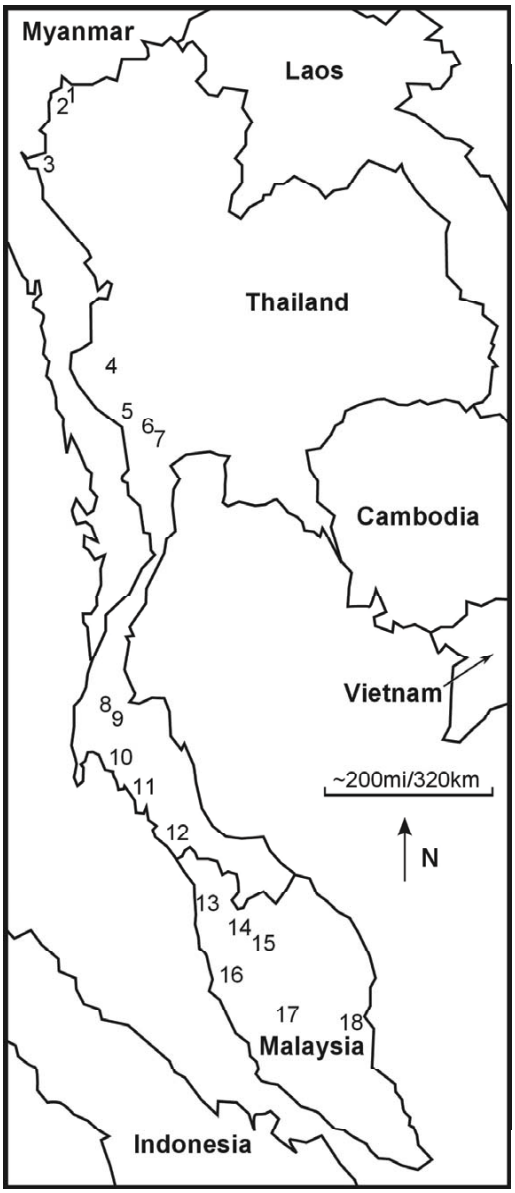

Figure 1: Late Pleistocene and Holocene cave, rockshelter and shellmound sites in Thailand and Peninsular Malaysia: 1: *Spirit Cave, Banyan Valley Cave, Steep Cliff Cave*; 2: *Tham Lod Rockshelter, Ban Rai Rockshelter*; 3: *Huai Hin*; 4: *Ongbah Cave*; 5: *Sai Yok Rockshelter*; 6: *Khao Talu Cave, Heap Cave, Ment Cave*; 7: *Lang Kamnan Rockshelter*; 8: *Pak Om Cave*; 9: *Buang Beab Cave*; 10: *Lang Rongrien Rockshelter, Khao Toh Chong Rockshelter, Moh Khiew Cave*; 11: *Sakai Cave*; 12: *Thung Nong Nien Rockshelter, La Sawang Rockshelter*; 13: *Guar Kepah*; 14: *Gua Gunung Runtuh, Gua Teluk Kelawar, Gua Ngaum, Gua Harimau*; 15: *Gua Peraling, Gua Chawas, Gua Cha*; 16: *Seberang Perak*; 17: *Gua Kechil*; 18: *Gua Tenggek, Gua Sagu*.[7]

[6] Surin, *The Phi Tong Luang (Mlabri)*.

[7] Sites in close-proximity are given a single number. For references, see Conrad, "Archaeozoology in Mainland Southeast Asia".

The Mlabri Ethnographic Record

The hunter-gatherers known as the Mlabri were first documented in northern Thailand in 1919 (Table 1 and Figure 2). Since that time, several researchers have described the group using different terms, most commonly the "Kha" and "Khon." Throughout the remainder of this work, I refer to the group as the Mlabri.[8] This group is unique to northern Thailand and mainland Southeast Asia because it is regarded as the most 'true' or 'traditional' hunter-gatherer group remaining in the region.[9]

Mlabri hunter-gatherers inhabit the hills of northern Thailand (Figure 2). This heavily forested region provides an abundance of natural resources for their subsistence activities.[10] Mlabri peoples are historically known for their banana leaf shelters that provide protection from both weather and wild animals.[11] These shelters are angled and constructed out of sticks and bamboo with green banana leaves covering the back half of the windbreak.[12] Small hearths and rattan mat bedding are typically laid under the shelters for warmth and comfort during the night. Windbreaks are connected together in a linear transect with multiple family groups (~8-10 people/2-3 families per group) inhabiting the camp during their

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[8] Surin's work with the Mlabri is not the most recent. Surin, *The Phi Tong Luang (Mlabri)*. Oota, et al. and Waters have recently debated the origin of the Mlabri based on genetic evidence. Oota, "Origin and Cultural Reversion of a Hunter-Gatherer Group"; Waters, "Comment on "Recent Origin and Cultural Reversion of a Hunter-Gatherer Group". Long, et al. also recently published an article discussing suicide among the Mlabri. Long, "Suicide among the Mla Bri Hunter-Gatherers of Northern Thailand." An additional ethnology of the Mlabri exists and was published by Trier. This work documents the work of Trier and his wife with a group of the Mlabri between 1977-1994. Trier, *Invoking the Spirits*.

[9] Surin, *The Phi Tong Luang (Mlabri)*.

[10] Surin, *The Phi Tong Luang (Mlabri)*.

[11] Seidenfaden, "Further Notes About the Chaubun, Etc"; Kerr, "Ethnologic Notes"; Kraisri, "Expedition to the 'Khon Pa'"; Surin, *The Phi Tong Luang (Mlabri)*. Trier, "The Mlabri People of Northern Thailand", Trier, *Invoking the Spirits*.

[12] Seidenfaden, "Further Notes About the Chaubun, Etc"; Kerr, "Ethnologic Notes"; Kraisri, "Expedition to the 'Khon Pa'"; Surin, *The Phi Tong Luang (Mlabri)*. Trier, "The Mlabri People of Northern Thailand", Trier, *Invoking the Spirits*.

stay.[13] Mlabri also choose camps based upon location to resources. Peaks of hills near streams and small rivers are considered the best locations for Mlabri habitation.[14] These locations provide fresh water and are often near abundant resources.

Material-culture for the Mlabri is based primarily upon the construction of bamboo and rattan tools and objects.[15] These hunter-gatherers are known to carve intricate bamboo pipes, rattan baskets and fashion long bamboo spears. In more recent periods, trading with local groups provided the Mlabri with crude metal objects and metal working capabilities, but these are not considered a traditional characteristic of their culture.[16] Descriptions of the Mlabri suggest that the group rarely wears clothes. Men are occasionally seen with banana leaf loincloths, but women generally live entirely naked.[17]

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[13] Seidenfaden, "Further Notes About the Chaubun, Etc"; Kerr, "Ethnologic Notes"; Kraisri, "Expedition to the 'Khon Pa'"; Surin, *The Phi Tong Luang (Mlabri)*. Trier, "The Mlabri People of Northern Thailand", Trier, *Invoking the Spirits*.

[14] Seidenfaden, "Further Notes About the Chaubun, Etc"; Kerr, "Ethnologic Notes"; Kraisri, "Expedition to the 'Khon Pa'"; Surin, *The Phi Tong Luang (Mlabri)*. Trier, "The Mlabri People of Northern Thailand", Trier, *Invoking the Spirits*.

[15] Surin, *The Phi Tong Luang (Mlabri)*; Trier, "The Mlabri People of Northern Thailand"; Trier, *Invoking the Spirits*.

[16] Surin, *The Phi Tong Luang (Mlabri)*; Trier, "The Mlabri People of Northern Thailand"; Trier, *Invoking the Spirits*.

[17] Seidenfaden, "Further Notes About the Chaubun, Etc"; Kerr, "Ethnologic Notes".

Table 1: Historical names for the Mlabri, translated meaning and location of interaction with the hunter-gatherer group in northern Thailand.

Name Used	Translation	Location of Study	Reference
Khā Dong Lüang	The withered leaves' savages	Pu Kio Mountain (between Chaiyaphum and Phetchabun Provinces)	Seidenfaden 1919
Khā Tam Bang	The savages who can make themselves invisible	-	Seidenfaden 1919
Kā Tawng Lûang	-	Bān Sītān, Udawn Circle, Loei Province	Kerr 1924
Khā Tong Lu'ang/ Phi Tong Lu'ang	The spirits of the withered leaves	Ban Nām Pu, 50 km north of Nakon Nan	Seidenfaden 1926
Khon Pā	People of the jungle	-	Seidenfaden 1926
Phi Tong Lu'ang	-	Ban Siew in Saantaw District, Uttaradit Province	Bourke-Borrowes 1926
Phi Tawng Luang	-	Nam Wa District, east of Nan	Wanadorn 1926
Phi Tong Luang/ Yumbri*	Spirits of the Yellow Leaves	East of Nan, Nan River, Nan Province	Bernatzik 1941 and 1958
Khon Pa/Phi Tong Luang	Spirits of the Yellow Leaves	West of Muang Nan, north of Fang Min, Nan Province	Kraisri and Hartland-Swann 1962
Khon Pa/Phi Tong Luang/Mrabri	People of the forest	Southeast of Muang Nan, Doi Khun Sataan Hill, Nan Province	Boeles 1963
Mlabri	People of the forest	Nan Province, Phrae Province	Surin 1992

*The Yumbri may not be the same hunter-gatherer group as the Mlabri.[18] Bernatzik's description does not provide suitable evidence to confirm this.

[18] Surin, *The Phi Tong Luang (Mlabri)*, 43.

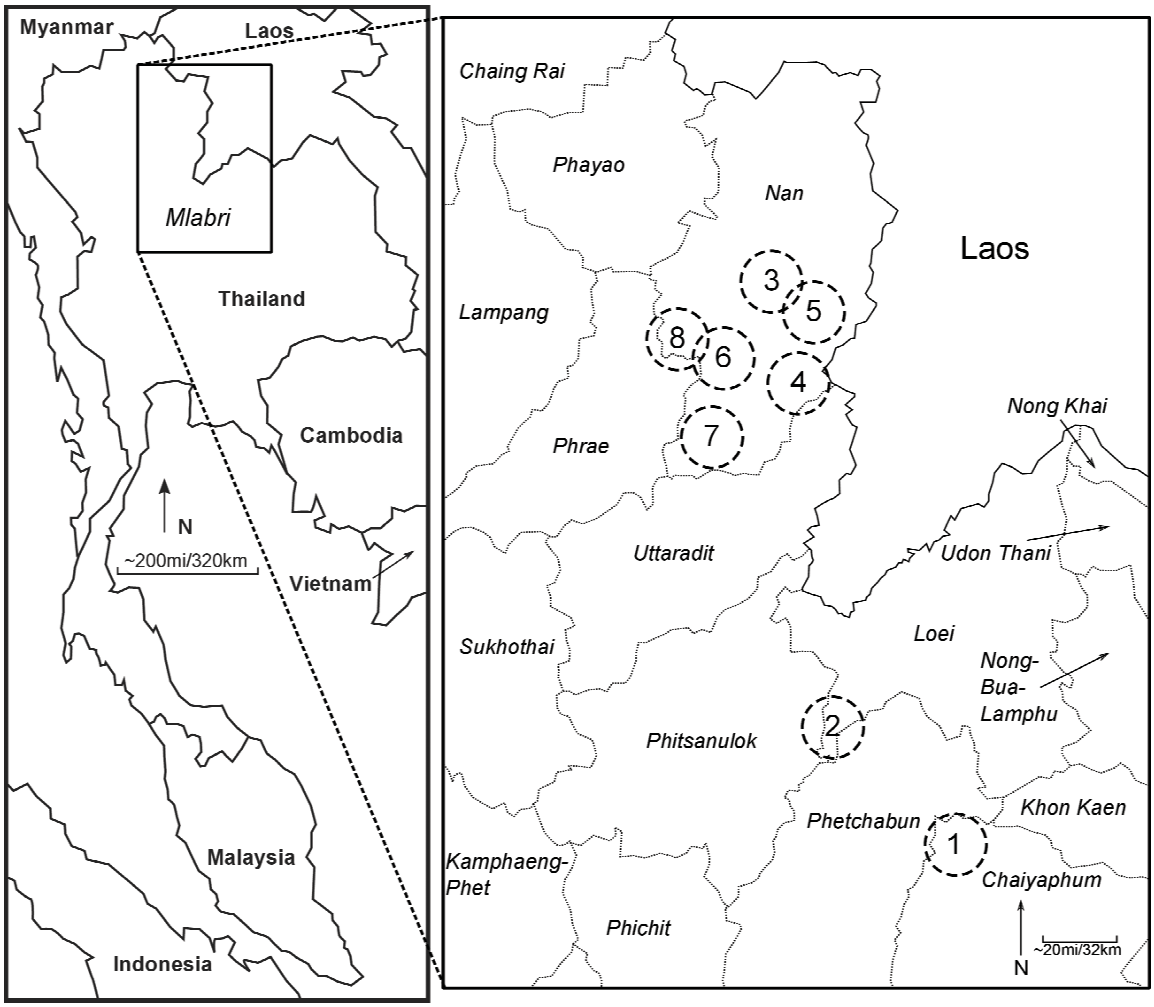

Figure 2: Location of historically documented occurrences of Mlabri hunter-gatherers in the ethnographic literature. The circles do not reflect foraging radius, only the approximate location of encounter or study.[19]

Due to the nature of their subsistence, Mlabri hunter-gatherers are highly mobile. When a camp location is chosen, the Mlabri build banana leaf shelters and begin foraging for food.[20] Camps tend to be abandoned

[19] 1: Seidenfaden, "Further Notes About the Chaubun, Etc", 47-53; 2: Kerr, "Ethnologic Notes", 135-146; 3: Seidenfaden, "The Khā Tong Lu'ang"; 4: Wanadorn, "Some information concerning the 'Phi Tawang Luang' "; 5: Bernatzik, *Die Geister der gelben Blätter*, *The Spirits of the Yellow Leaves*; 6: Kraisri, "Expedition to the 'Khon Pa'", 165-186; 7: Boeles, "Second Expedition to the Mrabri of North Thailand"; 8: Surin, *The Phi Tong Luang (Mlabri).*

[20] Surin, *The Phi Tong Luang (Mlabri).*

after 5-10 days because the local food base has been depleted. Once this occurs, Mlabri peoples move to a new camp and begin a new round of foraging. Mlabri tend to move within a non-symmetrical 30-kilometer radius following this pattern of subsistence driven mobility.[21] In fact, the name 'Phi Tong Luang' or "Spirits of the Yellow Leaves," was used to describe the Mlabri because their abandoned camps would be spotted, abandoned, and covered in dead, yellow banana leaves – the leaves of banana trees turn yellow in approximately the same amount of time that the Mlabri exhaust the local food supply (~5-10 days).[22]

Large-game hunting activities are almost entirely male oriented in Mlabri society. Male Mlabri use long bamboo spears to hunt for a variety of forest game including wild boar, deer, porcupine, wild elephants, bears, monkeys, tigers, and rhinoceros.[23] Occasionally, the tips of spears are poison dipped with sap,[24] but overall, Mlabri men are skilled hunters with sharpened spears without the aid of additional technological implements. The Mlabri do not use blowpipes for hunting, but do use digging sticks to capture burrowing fauna (rodents).[25]

While men hunt larger game, women, children and elderly adults forage for wild fauna and smaller, more easily catchable prey including mollusks, turtles, tortoises and crabs. A significant portion of Mlabri subsistence also comes from wild yams and plant resources. Men leave camp and hunt away (>1 km) from women, children and elderly adults who typically forage for wild plants and small prey-types within a 1 kilometer radius of their shelters.[26] Abandoned Mlabri camps are known for their pockmarked appearance after the local supply of wild yams has been dug up and consumed. Mlabri boil and cook all of their food in bamboo tubes or directly over the fire. Only wild honey and nuts are

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[21] Surin, *The Phi Tong Luang (Mlabri)*, 175-184.
[22] Kerr, "Ethnologic Notes", 142.
[23] Surin, *The Phi Tong Luang (Mlabri)*; Bernatzik, *Die Geister der gelben Blätter*; Bernatzik, *The Spirits of the Yellow Leaves.*
[24] This is an extremely rare occurrence.
[25] Surin, *The Phi Tong Luang (Mlabri)*; Bernatzik, *Die Geister der gelben Blätter*; Bernatzik, *The Spirits of the Yellow Leaves*; Trier, "The Khon Pa of Northern Thailand: An Enigma",
[26] Surin, *The Phi Tong Luang (Mlabri)*; Bernatzik, *Die Geister der gelben Blätter*; Bernatzik, *The Spirits of the Yellow Leaves.*

eaten raw. Whole animals, for example wild boar, are roasted in a fire until strips of meat can be torn off from the carcass and consumed.[27] Mlabri hunters practice very little butchering and no food items are saved or processed for later consumption (i.e., dried meat). As Surin Pookajorn aptly describes, almost all aspects of Mlabri life are analogous to the archaeological record, including subsistence, mobility, site placement/use, band size, and social relations.[28]

The Mlabri 'Archaeological' Record

Ethnographic data from the Mlabri provide an interesting question: If archaeologists were able to temporarily stop time and complete a holistic survey of Mlabri camps, what would they find? From cursorily and ethnographic accounts of the Mlabri there are several possible expectations for what a 'perfect' archaeological record of this group may include. For instance, archaeologists may come across several camps in various stages of use and activity. One camp, a current habitation site, may have sets of rattan mats between small hearths with bamboo poles and banana leaf shelter windbreaks all near a mountain stream. Rattan bags and bamboo tubes may be intermixed with the sleeping mats as storage containers for supplies. Carved bamboo smoking pipes or earplugs may be present. Discarded spears would likely be identified. Little evidence of food storage would occur, but the burnt and discarded carcasses of animals may be found near hearths or outside of camp away from the water supply. Small holes would pockmark the immediate area surrounding the camp as evidence of wild yam and root exploitation. Outside of this primary site location, abandoned camps would be found in various stages of use and discard. One site may have collapsed windbreaks with hearths and small charred bamboo containers mixed in with the leaf litter of the forest floor.

Yet, if archaeologists were able to fast-forward time by 10,000 years and complete a holistic survey of a 30 kilometer Mlabri camp radius (without the Mlabri continuing to inhabit this zone), what would

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[27] Surin, *The Phi Tong Luang (Mlabri)*; Bernatzik, *Die Geister der gelben Blätter*; Bernatzik, *The Spirits of the Yellow Leaves.*

[28] Surin, *The Phi Tong Luang (Mlabri)*, 198.

they find? Mlabri material-culture is based primarily on vegetal materials and only through recent (nineteenth century) interaction with outside groups has acquisition of metal occurred. This results in a significant bias in the archaeological record because organic material, such as rattan, bamboo, banana leaves, wild yams and all other wild plants utilized by the group, decomposes within a short period of time (~10 years or less).[29] This results in a loss of almost all material-culture for the hunter-gatherer group. Decomposition of organic matter is particularly high during the rainy season in Southeast Asia because of increased bacterial, fungal and detritivorous activity.[30] One study identified complete decomposition (95%) of leaf litter within 4.5 to 9.4 years after deposition on the forest floor in southwest China.[31]

This research suggests that based upon the Mlabri ethnographic record, only human remains in burials, faunal remains (bones and shells) from subsistence activities, and metal knives and spear tips obtained through trade might be expected to survive this 10,000 year interval. Since animals are generally roasted whole with meat torn off of the carcass once it is cooked, this may also leave a fairly ambiguous record of butchery activity on the faunal skeletal remains.

Mlabri adaptations focus on utilizing forest and plant resources for the majority of their day-to-day activities, including shelter and sleeping mat construction, food storage, cooking, tools and spiritual activities[32]. These adaptations are remarkably successful for this hunter-gatherer group who continue to occupy the heavily forested mountainous habitat of northern Thailand, yet these adaptations also make objective artifactual, or ecofactual, correlates with archaeological assemblages difficult to establish. At Tham Lod Rockshelter the artifact and ecofact remains suggest that Mlabri ethnographic analogy may be particularly

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[29] Aerts, “Climate, Leaf Little Chemistry and Leaf Litter Decomposition”; Liu, “Leaf litter decomposition of canopy tress”; O’Connor, “Non-Indigenous Bamboo along Headwater Streams”; Tian, “Biological Effects of Plant Residues”; Zech, “Factors controlling humification and mineralization”.

[30] Aerts, “Climate, Leaf Little Chemistry and Leaf Litter Decomposition”, 439-440; Liu, “Leaf litter decomposition of canopy tress”, 443.

[31] Liu, “Leaf litter decomposition of canopy tress”, 444.

[32] Trier, *Invoking the Spirits*.

well suited as an explanatory framework for understanding the processes of human behavior at the site. To examine these processes in detail, I focus on the zooarchaeological assemblage.

Tham Lod Rockshelter

Late Pleistocene zooarchaeological deposits at Tham Lod Rockshelter provide an excellent database to test the use of Mlabri ethnographic analogy with the archaeological record. Supported by the Thailand Research Funds Council and Silpakorn University, the Highland Archaeology Project in Pang Mapha District, Mae Hong Son Province, northwest Thailand aimed to investigate the distinct paleoenvironmental conditions, human-environmental interactions and cultural dynamics of hunter-gatherer groups inhabiting this region of mainland Southeast Asia throughout the Pleistocene to Holocene (Figure 1).[33] As a result of a five-year project between 2001-2006, Tham Lod Rockshelter was identified and excavated under the direction of Rasmi Shoocongdej and colleagues at Silpakorn University.[34] Subsequent research at Tham Lod (and the additional site of Ban Rai Rockshelter) has provided a robust record of archaeological and paleoenvironmental data corresponding to the Pleistocene (Table 2).[35] Since the complete faunal record from Ban Rai is still under investigation,[36] this overview focuses on the faunal remains from late Pleistocene levels at Tham Lod (Table 3).[37] Human burials and taphonomic processes have disturbed the Holocene dated levels at the site, but the late Pleistocene deposits are capped, at unit 6, by a roof fall

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[33] Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter".

[34] Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter".

[35] Cherdsak, "Patterns of Habitation and Burial Activity"; Natthamon, "Recent Investigation of Early People"; Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter"; Anusorn, *Temporal and Spatial Analysis of Faunal Remains from Tham Lod Rockshelter Site*; Marwick, "Late Pleistocene monsoon variability in northwest Thailand"; Marwick, "Multiple Optima in Hoabinhian flaked stone artifact".

[36] Cherdsak, "Patterns of Habitation and Burial Activity"; Personal communication with Rasmi Shoocongdej and Cherdsak Treerayapiwat 2014.

[37] Anusorn, *Temporal and Spatial Analysis of Faunal Remains from Tham Lod Rockshelter Site*. Suwangpong, *Late Pleistocene mammal teeth from the Tham Lod rockshelter*.

event.[38] Thus, the stratigraphic levels below unit 6 are non-disturbed, intact contexts.[39]

Table 2: Summary radiocarbon and thermoluminescence determinations for Tham Lod from Rasmi and Marwick.[40]

Excavation Unit	Material	Lab Code	Uncal. Age (yr ± 1σ)	Cal. Age (yr BP ± 1σ)
TL4	Organic sediment	Beta-168223	12,100 ± 60	14,070 ± 140
TL7	Organic sediment	Beta-168224	13,640 ± 80	14,764 ± 60
TL9	Calcrete	Akita-TL7	13,422 ± 541	-
TL17	Charred material	Beta-194122	24,920 ± 200	29,910 ± 270
TL18	*Margaritanopsis laosensis*	Wk-20398	20,000 ± 117	23,900 ± 180
TL24	Sedimentary quartz	Akita-TL12	22,257 ± 154	-
TL27	*Margaritanopsis laosensis*	Wk-20399	29,318 ± 336	34,500 ± 500
TL28	Shell (unidentified)	Beta-172226	22,190 ± 160	26,740 ± 400
TL31	Organic sediment	Akita-TL10	32,380 ± 292	-
TL32	*Margaritanopsis laosensis*	Wk-20400	34,029 ± 598	39,960 ± 1050

[38] Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter"; Marwick, "Multiple Optima in Hoabinhian".
[39] Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter"; Marwick, "Multiple Optima in Hoabinhian".
[40] Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter"; Marwick, "Multiple Optima in Hoabinhian", 556.

Table 3: Number of identified specimen (NISP) counts, associated stratigraphic contexts from Tham Lod. Faunal data transcribed from Anusorn.[41]

	Depth (cm)	**200-290**	**290-450**	**450-700**	
Taxon	**Stratigraphic Unit**	**6-13**	**14-29**	**30-33**	**Σ**
Muntiacus sp.	Muntjac Deer	18	28	-	46
Cervus unicolor	Sambar Deer	406	1142	640	2188
Naemorthedae	Goral	47	117	69	233
Bovidae	Bovids	89	144	92	325
Bos sp.	Banteng, Gaur, Kouprey	3	-	-	3
Sus scrofa	Eurasian Wild Pig	78	257	21	356
Carnivora	Carnivore	6	7	-	13
Ursidae	Bear	5	83	5	93
Felidae	Cat	-	1	-	1
Rhinocerotidae	Rhinoceros	2	1	5	8
Primate	Primate	-	10	-	10
Cercopithecinae	Monkey	4	6	-	10
Colobinae	Monkey	1	2	-	3
Elephas maximus	Asian Elephant	1	8	-	9
Rodentia	Rodent	10	84	-	94
Hystricidae	Porcupine	16	65	1	82
Rhizomyidae	Bamboo Rat	2	52	3	57
Reptilia	Reptile	2	16	1	19
Testudines	Tortoise/Turtle	47	669	30	746
Serpentes	Snake	-	4	-	4
Varanidae	Lizard	-	1	-	1
Osteichthyes	Bony Fish	4	22	1	27
Brachyura	Crab	-	1	-	1
	Σ	741	2720	868	4329

[41] Anusorn, *Temporal and Spatial Analysis of Faunal Remains from Tham Lod Rockshelter Site*.

Methods

Measures of dietary diversity provide insight into changing subsistence strategies. Here, I use evenness, richness, and the Chelonian abundance index to assess shifts in subsistence for hunter-gatherers occupying Tham Lod.

Dietary Evenness: the Reciprocal of Simpson's Index

Dietary evenness provides a numerical derivation of the equality of taxonomic classes within a faunal assemblage.[42] I use the reciprocal of Simpson's index (1/D) quantified as follows: $1/\Sigma Pi^2$.[43] When 1/D is high, or rises, the assemblage is more even (all taxonomic classes equally represented), lower values (closer to 1.0) represent an uneven assemblage. An uneven assemblage is expected if forager diets are based on a narrow diversity of prey types. At Tham Lod, I expect that male dominated foraging activities are represented by a diet focused on large-sized game based on Mlabri ethnographic analogy. Female, children and elderly foraging activities should be represented by a diet of smaller-sized game.

Chelonian Abundance Index

Abundance indices are commonly utilized to understand forager optimization of resources.[44] For example, analyses of the artiodactyl index, the ratio of artiodactyls (i.e., deer) to lagomorphs (i.e., rabbits), is useful when determining forager efficiency because it describes the shifting exploitation of large-to-small bodied prey types.[45] Several large-sized artiodactyls, perissodactyls and a single small-sized lagomorph

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[42] Jones, "Dietary evenness, prey choice, and human-environmental interactions"; Magurran, *Measuring Biological Diversity*; Jones, "Subsistence Change among the 17th-Century Diné?".

[43] Magurran, *Measuring Biological Diversity*.

[44] Badenhorst, "Faunal changes in farming communities".

[45] Broughton, "Declines in Mammalian Foraging Efficiency"; Byers, "Holocene Environmental Change"; Byers, "Holocene artiodactyl population histories"; Broughton, "Prey Body Size and Ranking in Zooarchaeology".

inhabit Thailand (see footnote for species).[46] The single lagomorph species known in Thailand, the Burmese Hare (*Lepus peguensis*), is currently distributed in the north, but was not identified at Tham Lod.[47] However, chelonians (tortoises, hard-shell turtles and soft-shell turtles) appear in large diversity throughout this region and were identified in abundance at Tham Lod as "Testudines".[48] To understand sex and age based foraging dynamics, the chelonian index is quantified as follows: (NISPChelonian)/(NISPChelonian+NISPArtiodactyla+NISPPerissodactyla). Based upon NISP counts, this measure provides a ratio value between 1.0 and 0.0. A high Chelonian index (approaching 1.0) indicates a dominance of tortoise/turtle exploitation. I expect the Chelonian index to

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[46] Lekagul, *Mammals of Thailand*; Francis, *A Field Guide to the Mammals of Thailand and South-East Asia*. Species include the wild pig (*Sus scrofa*), greater mouse deer (*Tragulus napu*), lesser mouse deer (*Tragulus javanicus*), common muntjac (*Muntiacus muntjak*), Fea's muntjac (*Muntiacus feae*), hog deer (*Cervus porcinus*), sambar deer (*Cervus unicolor*), Eld's deer (*Cervus eldi*), Schomburgk's deer (*Cervus schomburgki*), water buffalo (*Bubalus bubalis*), banteng (*Bos javanicus*), gaur (*Bos gaurus*), kouprey (*Bos sauveli*), serow (*Capricornis sumatraensis*), goral (*Naemorhedus goral*), Malayan tapir (*Tapirus indicus*), Javan rhinoceros (*Rhinoceros sondaicus*), Sumatran rhinoceros (*Dicerorhinus sumatrensis*) and Siamese hare (*Lepus peguensis*).

[47] Lekagul, *Mammals of Thailand*; Duckworth, *Lepus peguensis*; Francis, *A Field Guide to the Mammals of Thailand and South-East Asia*. See Charles Higham and Amphan Kijngam for evidence of *L. peguensis* exploitation at Ban Chiang. Higham, "Ban Chiang and Northeast Thailand".

[48] Rasmi, "Forager mobility organization"; Vetter, *Turtles of the World*; Mudar, "New Evidence for Southeast Asian Pleistocene Foraging Economies"; Pritchard, "Distinguishing Species of Geoemydid and Trionychid Turtles from Shell Fragments"; Das, *A Field Guide to the Reptiles of South-East Asia*; Ernst, *Turtles of the World*. Species include the Malayan softshell turtle (*Dogania subplana*), Asiatic softshell turtle (*Amyda cartilaginea*), Asian giant softshell turtle (*Pelochelys bibroni*), Indian narrow-headed softshell turtle (*Chritra indica*), big-headed turtle (*Platysternon megacephalum*), northern river terrapin (*Batagur baska*), ainted terrapin (*Callagur borneoensis*), south Asian box turtle (*Curoa amboinensis*), black-breatest leaf turtle (*Geomyda spengleri*), Asian leaf turtle (*Cyclemys dentata*), giant Asian pond turtle (*Heosemys grandis*), spiny turtle (*Heosemys spinosa*), yellow-headed temple turtle (*Hieremys annandali*), Mekong snail-eating turtle (*Malayemys subtrijugata*), Burmese eyed turtle (*Morenia ocellata*), Malayan flat-shelled turtle (*Notochelys platynota*), Malaysian giant turtle (*Orlita borneensis*), keeled box turtle (*Pyxidea mouhotti*), (*Siebenrockella crassicola*), impressed turtle (*Manouria impressa*), elongated tortoise (*Indotestudo elongata*), and (*Geochelone/Manouriaemys*).

be high during periods of lowered male hunting success, indicating an increased reliance on subsistence resources based on female, child, and elderly foraging.

Archaeofaunal Composition: Sample Size

To investigate possible biases in sample size, I also use a linear regression analysis of logarithmically transformed NISP to NTAXA (species richness).[49] If sample size is not biasing the assemblage, then a statistically significant relationship should exist. Due to differential recording techniques, additional tests for sample size and fragmentation biases are not investigated. Still, sample size provides one indication of possible taphonomic biases occurring at the site that may influence these results.

Results

Faunal data from Tham Lod indicate that differing foraging activities may have occurred during the late Pleistocene (Table 4). 1/D is extremely uneven in units 14-33, but broadens dramatically in units 6-13. When diets are most uneven, approximately 33,000 years B.P., the Chelonian index is lowest, suggesting that male dominated foraging activities occurred. The Chelonian index rises sharply in units 14-29 suggesting that female, children, and elderly individuals contributed more to the subsistence base. Slight increases in overall dietary evenness during this period match this pattern. In the most recent levels at Tham Lod, diets broaden and the Chelonian index decreases. This period may reflect a foraging transition as hunter-gatherers diversified their dietary strategies to include alternative prey-types. Male foraging appears to dominate the diet (Chelonian index results), but a generally broad-based diet (1/D results) suggests that all foragers are consuming more abundant medium and smaller-sized prey during recent periods. Finally, biases in sample size suggest that taphonomic processes may also hamper the overall

[49] Marshall, "NISP vs. MNI in Quantification of Body-Part Representation"; Lyman, *Vertebrate Taphonomy*; Grayson, "Changing Diet Breadth"; Cannon, "A Mathematical Model of the Effects of Screen Size"; Lyman, *Quantitative Paleozoology*; Cannon, "Bone Fragmentation, and the Measurement of Taxonomic Abundance".

integrity and reliability of the zooarchaeological data. This may be caused by the aggregation of faunal remains for comparison with the stratigraphic and chronological records (see Table 3).

Table 4: Results of the dietary evenness, chelonian index and sample size analyses at Tham Lod. All analyses included the complete set of taxonomic classes identified by Anusorn[50] transcribed in Table 3.

Site/Unit	Simpson's Index	Chelonian Index	logNISP-NTAXA
Tham Lod	-	-	(r=0.7, p=.253)
6-13	16.84	0.07	-
14-29	3.95	0.28	-
30-33	1.78	0.04	-

Implications for Tham Lod Rockshelter

Mlabri ethnographic analogy is useful for understanding the archaeofaunal record at Tham Lod Rockshelter. Sex and aged foraging dynamics identified in the ethnographic record provide a possible basis for determining differences in exploited prey-types for hunter-gatherers occupying the site. When male dominated subsistence activities occur, specifically in the oldest levels at Tham Lod, this suggests a wide foraging radius in which males may have traveled extensive distances to capture prey. For the Mlabri, male-hunting parties traveling upwards of 30 kilometers from camp is common.[51] When female, child, and elderly foraging activities increase this suggests that hunting and gathering occurred closer to camp, or in this case nearer to Tham Lod Rockshelter itself. Given that the paleoenvironmental record suggests a wetter climate during 33,000-20,000 years B.P.,[52] the increase in female, child, and elderly foraging activities (i.e., the Chelonian index) may be driven by better habitat conditions for turtles and tortoises. Lithic analyses from Tham Lod and Ban Rai also suggest that hunter-gatherer mobility and stone procurement was influenced by paleoenvironmental conditions.[53]

[50] Anusorn, *Temporal and Spatial Analysis of Faunal Remains.*
[51] Surin, *The Phi Tong Luang (Mlabri)*, 175-184.
[52] Marwick, “Late Pleistocene monsoon variability in northwest Thailand”.
[53] Marwick, “Multiple Optima in Hoabinhian flaked stone artifact”.

Future analyses of turtle and tortoise remains from this region may provide further insights into these activities.[54]

Conclusions

As documented at Tham Lod, little organic material was recovered outside of charcoal remains, bones and shells.[55] No evidence of handcrafted rattan or bamboo tools, mats, containers, cooking tubes, pipes or clothing were identified. Therefore, how can the Mlabri ethnographic record be utilized to better understand forager adaptations during the Pleistocene and Holocene in northern Thailand when their material-cultural record does not preserve? Mlabri analogy does not provide an object framework to understand the material-culture of foragers utilizing Tham Lod; instead Mlabri ethnographic analogy succeeds in helping describe aspects of the subsistence strategies employed by prehistoric hunter-gatherers occupying Tham Lod. As Surin Pookajorn writes, Mlabri women, men and children have distinct activities that are completed throughout the day.[56] While men leave camp and hunt wild terrestrial game, women stay closer to camp, collect wild yams and forage for small-sized prey, generally within a 1 kilometer radius. The Mlabri also position their shelters close to streams on mountains so that women, children and elderly adults have access to mollusks (gastropods and bivalves), turtles and tortoises, crabs and a variety of other small-sized prey.[57] Men, if successful, will return to camp with a deer, wild boar, or various other terrestrial and arboreal species. Often in archaeological contexts, aggregation of faunal data obscures the distinct record of sex and aged based foraging activities. This may be occurring at Tham Lod, but by using dietary evenness and the chelonian index, greater insight into the zooarchaeological record at this site is possible. Several late Pleistocene to Holocene sites throughout mainland Southeast Asia have large aggregated assemblages of turtles, tortoises and mollusks alongside large artiodactyls and perissodactyls (e.g., Lang Kamnan

[54] cf. Conrad, "Archaeozoology in Mainland Southeast Asia".
[55] Rasmi, "Late Pleistocene Activities at the Tham Lod Rockshelter".
[56] Surin, *The Phi Tong Luang (Mlabri)*, 19-20.
[57] Surin, *The Phi Tong Luang (Mlabri)*.

Rockshelter, Lang Rongrien Rockshelter, Khao Toh Chong Rockshelter, Moh Khiew Cave, Sakai Cave Gua Kechil, Gua Tenggekl Gua Sagu – see Figure 1).[58] These sites suggest that the ethnographic record of the Mlabri, which leaves little material-cultural evidence, is useful as an analogy for understanding subsistence practices in tropical forested regions of mainland Southeast Asia.

Mlabri hunter-gatherers represent a unique cultural group with a distinct subsistence adaptation for inhabiting the mountainous forests of northern Thailand. Throughout this region, the late Pleistocene and Holocene archaeological record is comprised almost exclusively of lithic and subsistence refuse (vertebrate and invertebrate remains) with occasional stone adzes and pottery sherd artifacts appearing during later periods. The Mlabri do not manufacture or use pottery or stone tools, but they do subsist off of a diverse variety of wild plants and animals. The utility of the Mlabri ethnographic record lies not in their material-culture base, but in their hunting and foraging adaptations as explored with data from Tham Lod Rockshelter. Food acquisition by the Mlabri matches food utilization in the archaeological record, with many of the same species being consumed. While further taphonomic investigations are needed to understand any potential biases in this dataset, this review of the Mlabri and the Tham Lod Rockshelter faunal data indicates that this ethnographic analogy is beneficial for determining sex and age based foraging strategies in Pleistocene and Holocene archaeological contexts in mainland Southeast Asia.

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[58] Conrad, “Archaeozoology in Mainland Southeast Asia”.

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