

Preliminary Study of Fish Richness and Management in the Upper Bweloklo and Its Tributaries in the Salween Peace Park



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**Bweloklo and its tributaries fish inventory: Biodiversity research and conservation,
KESAN Women's Research team supported by IUCN under the BRIDGE programme**

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FOREWORD

This research is conducted based on Karen Indigenous knowledge obtained from the people residing along the valley of Bweloklo River (Yuzalin) and its tributaries. These Karen people built their settlements along the river over centuries and depended on the river's resources physically and spiritually. Their deep knowledge of fish population management and conservation is rich and crucial to share with outside conservationists. The information is collected using local knowledge, and compiled during the survey by local villagers, facilitated by the KESAN women's research team and implemented jointly by the local Kawthoolei Forest Department and Kawthoolei livestock and fisheries department staff. These participatory surveys and information gathering enhance better opportunities for future cooperation for fish management and conservation. The objective of this first inclusive fish inventory survey is to inform all stakeholders, to help build their capacity for quantitative and qualitative information about fisheries ecology and social economics, together providing better fisheries management, water quality management and conservation practices to be able to sustain fisheries utilizations for both physical and spiritual purposes. From this survey we could record 46 fish species which are important for food sources, culture and the environment itself, showing us how important the survey is to prioritize fish conservation action.



EXECUTIVE SUMMARY

The Salween Peace Park and its rivers and tributaries hold cultural and spiritual significance to the Karen Indigenous peoples. The Bweloklo River is the largest Salween tributary, and it provides a consistent and nutritious source of food to local communities. Located in a region prone to conflict, local communities living alongside the Bweloklo River have remained isolated from the outside world for more than seven decades. This study presents the preliminary opportunity to systematically survey fish species found in the upper Bweloklo and its tributaries. The data provided insight into fish richness of the upper Bweloklo River, and key fish management strategies that support sustainable harvest of an important local source of food for Karen.

Through collaboration with local leaders, elders, fisherfolk, and community members, extensive fieldwork was carried out across seven streams, two lakes, and one paddy field, all feeding into the main Bweloklo River. This study sought to conduct (1) research on fish species in the upper Bweloklo, including the documentation of potentially endemic species, species of ecological importance, and species holding biocultural significance in local communities; (2) research on seasonal fish spawning sites for three different species to understand breeding cycles; and (3) research on the overall health of the watershed ecosystem of the Salween Peace Park to determine carrying capacity for sustainable harvest going forwards. The results were achieved using both qualitative and quantitative measures to inform conservation efforts at a scientific and social scale. Data regarding the cultural implications of the study was collected through storytelling, interviews, and focus group discussions open to those selected based on their expertise in the community. The capture-release method as well as traditional fish harvesting tools were used to catch fish for identification, incorporating both Western collection methods and traditional ecological practices.

A total of 45 species of fish were recorded (9 orders, in 13 families). 33% of species recorded could not be fully identified to the species level. Four species were identified as potentially endemic, one of which—the Nyanna—depends on active human protection of its eggs, demonstrating the importance of human–fish relationships in maintaining local biodiversity.

Fish richness and biocultural importance have never been the subject of prior scientific study in the targeted region. Therefore, this report provides the preliminary data necessary to conduct future research into other factors affecting fish biodiversity in different areas of the Bweloklo River. The collected records have been compiled into an inventory database to help guide local communities and have been published in this report to inspire future scientific research to take place in the Salween Peace Park region.

This preliminary study highlights several avenues for future research. Further investigation of temperature, dissolved oxygen, pH, and riparian vegetation could clarify how specific environmental conditions influence fish habitat use and spawning sites. As climate change increasingly affects watersheds in marginalized regions, improving understanding of riparian restoration as a mitigation strategy is essential for sustaining the livelihoods of Karen communities.

The Salween River flows along the Myanmar–Thailand border for a substantial portion of its course, rendering its water use, ecological integrity, and governance inherently transboundary concerns shared by both nations and the communities of the Salween River Basin. Research conducted in tributaries such as the Bweloklo River therefore contributes not only to local ecological knowledge but also to broader basin-scale management efforts that require cross-border cooperation.

Continued, multi-year research would enable the documentation of long-term ecological changes and the evaluation of sustainable fish management practices in the Bweloklo River. In parallel, training local community members in fish identification and supporting awareness and habitat restoration initiatives can strengthen community-led stewardship. Such efforts empower Karen communities to integrate scientific approaches with cultural practices, while fostering a new generation of Indigenous scientists equipped to address climate change and ongoing habitat degradation.

1. INTRODUCTION

1.1 Background

The watershed of Bweloklo (Yuzalin River)¹ lies on Lat N: 18° 29. 970° and Long: E: 096° 58.635' about 30 kilometers north of Hpa-Pu Town, Northern Karen State within the Salween Peace Park which was established in 2018. The Salween Peace Park falls within the upper reaches of the Bweloklo River watershed, the Belin watershed, the lower Salween River tributaries, and the Sittaung River tributaries. The Bweloklo River drains into the Salween River while the Bilin River drains into the gulf of Mottama. The other rivers, such as the Shwegen River, Bawgata River and Mon River originating from the western Salween Peace Park, drain into the Sittaung River. All the streams originate from the eastern range of Kheshorter, Eastern Butho range and watershed of Bweloklo drain into the Salween River. The highest peak in Salween Peace Park is Pworgaw Mountain (Nattaung)² 2,700 m.asl.

The climate of Salween Peace Park is characterized as the northern and western Thailand monsoon climate. There are three distinct seasons, including: winter season between November to February; summer from March to May; and rainy season between May to October. The rainfall can vary from 1,200 mm to 1,600 mm annually. The wet months start from May to October, which deliver almost 80% of the rainfall per year. There is rain in the winter seasons of November, December and March, but January and February remain the months without rain. The higher elevation seems to maintain more cloud moisture in other seasons, but becomes very cold in winter, with the temperature as low as -7 °C. The annual temperature can vary between -7 °C to 40 °C depending on elevation and forest types.

In the Salween Peace Park, forest covers approximately 80% of its total land area. The forest types raised up from dry dipterocarp forest, mixed deciduous forest, Pinus Forest, and montane evergreen forest. It forms diverse forest resources situated from 60 m to 2,700 m above sea level. There are at least five categorized forest types, which include dry dipterocarp forest, mix-deciduous forest, hill evergreen forest, Pinus Forest, and montane evergreen forests. There have been forest restoration efforts by the local communities through natural restoration and plantation.

Bweloklo is the largest Salween tributary in the Salween Peace Park, Pa-pun area. It originates from the highest point of northern Karen State Mountain, called Thawthee-Pworgaw, which flows through the entire Salween Peace Park for a distance of more than 253 km, to discharge into the Salween River at Kyaw Ka Yet. The Salween River flows along the Myanmar–Thailand border for a significant portion of its course, making its water use, ecological health, and governance a shared concern between the two countries and communities which live in the Salween River Basin. The river is located at Lat: 18°24'47.44"N, and Long: 97°13'38.10"E

¹ Bwelo Klo is the name in Sgaw Karen language, with Klo meaning river, and the author has chosen to use the Karen name in this paper.

Bweloklo River and its tributaries

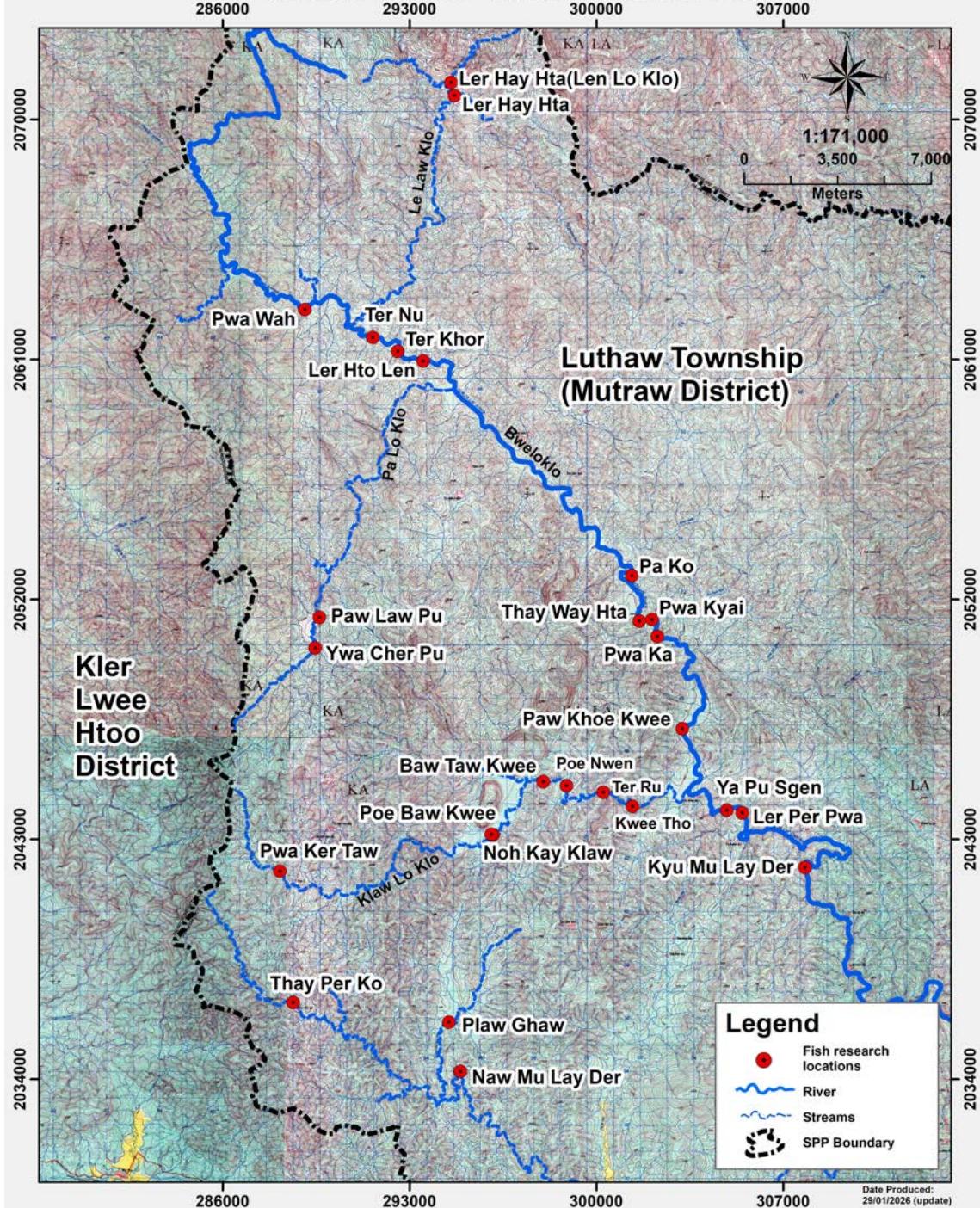


Figure 1. Map of Upper Bweloklo River, its tributaries and Sittuang River tributaries in the West

Bweloklo River and its tributaries

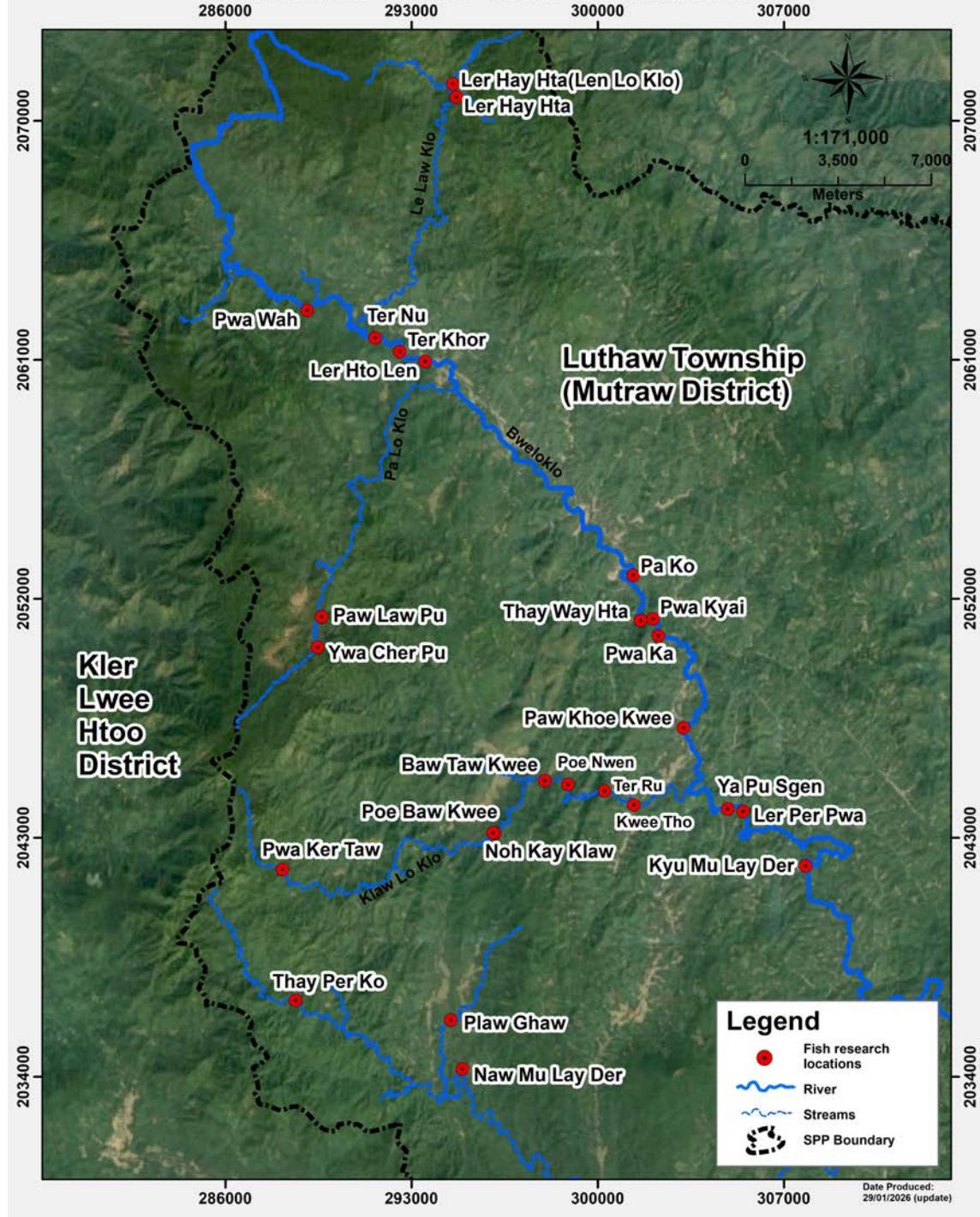


Figure 2. Bweloklo and its tributaries, Sittuang River tributaries watershed from the West

The research was conducted in response to a nature conservation need to understand the rich biodiversity of the Salween River tributaries and human-wildlife relationships in the upper Bweloklo. This region is a global biodiversity hotspot and is home to endangered species in need of urgent protection which prior to this study, were yet to be identified. Furthermore, the local community wished to discover why certain fish species in the upper Bweloklo are declining and/or disappearing from the riverbeds. Their decline directly impacts community nutrition, livelihoods, and the cultural and spiritual relationship with wildlife. However, local anecdotal evidence suggests that fish populations have increased in communities that have strengthened fish conservation practices.

This research addresses a critical knowledge gap and presents novel research opportunities. To date, most biodiversity studies in the Salween Peace Park have focused on terrestrial environments, and little is known about the upper Bweloklo. No comprehensive fish inventory exists for the area. While local communities identify many sites as spawning grounds and sacred areas, there is no documentation to support these observations. This study provides valuable insight into the diversity and status of fish populations in the upper Bweloklo, as well as the effectiveness of community-led fish conservation practices.

Between June 2023 and May 2025, 12 communities in the Salween Peace Park, Luthaw Township, and Mutraw District (Table 1) were selected as core research sites. Sites were selected based on accessibility, security considerations due to the ongoing conflict, previous community participation in biodiversity research, and personal contacts of the female research team members. Locations were also chosen because they had not been studied before, were known to host diverse fish species, contained traditional fish conservation zones, and held significance for local food security.

This research holds social-scientific relevance. The upper Bweloklo environment is central to the local community's livelihood, nutrition, cultural identity, and well-being. The findings will strengthen locally led conservation and protection of water sources, enhancing food security both through new scientific knowledge and through participatory learning, which empowers community members to better manage local fisheries.

The Bweloklo and its tributaries are home to unique fish diversity, yet until recently, no academic study had documented them beyond local management and conservation practices. The river is a primary source of fish for the Karen people of Salween Peace Park. Approximately 50,000 residents live within the river basin, most of whom depend directly or indirectly on its fisheries for income and sustenance.

Fish in this region are vital not only for food security but also for cultural and spiritual practices. The rivers and streams are relatively pristine, free from herbicide and pesticide contamination, making fish consumption particularly safe. Ecologically, fish contribute to ecosystem health, supporting food webs, enhancing species diversity, and returning essential nutrients, such as nitrogen and

phosphorus, to primary producers like phytoplankton and algae. Despite their importance, there remains limited knowledge about which species are endemic, native, or introduced. A better understanding of the Bweloklo and its tributaries, including fish inventories, spawning sites, and current management practices, is therefore essential.

The initial survey of fish richness in the upper Bweloklo and its tributaries allowed us to identify primary species and observe spawning sites with guidance from local community members. Many of these species are crucial to daily life and spiritual practices of the Karen people, yet remain unknown to fish experts, even though local communities have managed them for centuries using traditional ecological knowledge and spiritual practices. These species are often considered biocultural species, reflecting both ecological and cultural importance.

Due to time and resource limitations, we focused on three priority species most actively managed by local communities: Nyanna, (*Bangana* sp.), Nya Ken Meh (*Ageneiogarra* sp.), and *Poropuntius bantamensis*. Our survey recorded a total of 45 species in the upper Bweloklo, approximately 33% of which are undocumented in Thai ichthyology.

This report presents the first findings of a fish inventory for the upper Bweloklo. While some rare species may have been missed during our survey, local communities indicated that additional species exist. The results provide a foundation for improved fish management and conservation and contribute to a growing database of local fish biodiversity.

The research adopts a multidisciplinary and 'Two-Eyed Seeing' approach, which integrates indigenous and western knowledge to understand the importance of fish in the Bweloklo both from a scientific and a local perspective². To the best of the researchers' knowledge, the fish richness and diversity and their biocultural importance has never been subject of scientific study before in the targeted areas. The research aims to obtain a significant amount of primary data.

Our fish surveys have multiple goals, but the immediate objectives focus on three main areas: (a) creating an inventory of fish species in the upper Bweloklo and its tributaries, (b) documenting traditional fish spawning areas, and (c) observing the management of three bioculturally significant fish species during their spawning periods. Throughout the survey period, we also recorded local village activities along the survey routes. Before finalizing this report, fish identification and spawning management practices were reviewed and discussed between our research team and local experts. In addition, we carefully considered and selected the most appropriate methodology for assessing fish diversity in the area.

² <https://journals.sagepub.com/doi/10.1177/1609406919869695>

1.2 Fish Spawning and the importance of local knowledge

Each mature species spawns at least once per year. For bigger and longer rivers, fish migration for spawning takes up to hundreds of kilometers. Unlike the other fishes in the other rivers of the Asian region, fish in the upper Bweloklo and its tributaries only migrated a few kilometers or even a few hundred meters for spawning. This is because a waterfall has totally blocked lower river fish migration routes. Therefore, some fish species in the upper river have never been recorded in the downstream region. Similarly, many fish species in the downstream river were not found in the upper river. To collect the fish present during spawning time, we depend on local knowledge and local fishing tools to capture the fish.

The local people suggested that most of the fish species spawn during the flooding season, which is mainly July and August of the year. This kind of spawning is difficult to manage, especially for species such as, *Scaphiodonichthys burmanicus*, *Garra* sp. *Devario* sp. *Neolissocheilus* sp. *Tor* sp. *Schistura* sp. *Glyptothorax* sp. *Oreoglanis* sp. *Pterocryptis* sp. *Exostoma* sp. *Nemacheilus* sp. *Lepidocephalichthys* sp. *Balitora* sp. *Anguilla* sp. etc. which spawn during flooding season when the water level is very high. There are a few species, particularly, the *Channa* sp. and *Clarias* sp. that we observed spawning during the rainy seasons that were easy to manage, guided by the local people. These two small fish species have been managed by the local farmers for generations for their use in pest control in wet rice paddies, particularly because they eat caterpillar, grasshoppers, and other insects. Even though the local people could not detect the other fish species spawning, they had good knowledge of when the fish species migration starts, of which route they use, of how long the migration will last and of the seasons of upstream migration and downstream migration. They often check the moon and weather to predict the migration and spawning times of each fish.

Apart from the flooding season spawning, there are three important species for the local people that spawn during the dry season. The species include: *Nyanna*, *Bangana* sp. *Ageneiogarra* sp. and *Poropuntius bantamensis* (Rendahl, 1920) which are very important for local people who have been managing their spawning and hatching sites for generations. Understanding this rich body of knowledge is essential for explaining how these systems function and why they have remained effective to this day. This knowledge has been passed down from generation to generation, enabling the continued protection of most spawning sites. Recognizing and valuing local knowledge is therefore crucial for fish species inventories, as well as for informing conservation actions and management strategies.

1.3 Using local knowledge

As a women-led research team, we place great value on all forms of knowledge, particularly traditional knowledge held by women and children, which is crucial for understanding fish in the upper Bweloklo and its tributaries. Accessing current knowledge of fish populations, ecological behaviors, and traditional conservation and management practices was a central goal of our study. We limited the use of conventional scientific methods during the survey to avoid creating trust issues with the communities. Instead, we engaged directly with local people and employed traditional fish-catching methods at each survey site.

We chose this approach because literature shows that incorporating traditional knowledge can lead to successful fish surveys and conservation outcomes (Jørgensen et al., 2020). All participants are Karen Indigenous People, who share similar ways of life and traditions. Many of our research team members are also Indigenous Karen and have learned to catch fish using local methods, which strengthened our collaboration.

Our aim extends beyond producing a fish species inventory. We sought to understand fish management and conservation strategies that local people have practiced for generations. We also recorded details of the physical and spiritual dependence on fish species, providing insights into the deep connections between people, the environment, and fish.

At the same time, we wanted to include the same people to get involved in fish resource management, as their knowledge is important on any level, from policy, to strategic plans. The local lifetime experiences of conserving, catching, and management of local fish species in any circumstances enriched them with ecological knowledge. The Karen traditional practice of taboo that protected certain biocultural fish species and enforced traditional law on fishing season and fishing tools acts as a beneficial strategy for fish conservation and management (S.S.B. Moo 2025).

Both Karen Indigenous knowledge and scientific knowledge aim to achieve accurate results in research and surveys. While Indigenous fishers rely on bare-hand techniques and direct observation, scientific researchers use electronic instruments—yet both approaches pursue the same goal. Scientific methods, however, can offer more detailed insights into species and environmental factors at the molecular level. Combining these forms of knowledge can therefore enrich the quality of fisheries research as well as ecological and environmental understanding. Key areas where this integrated approach should focus include taxonomic, spatial, temporal, and social perspectives (Jørgensen et al. 2020). For these reasons, we chose to apply a combined knowledge system in conducting this fish survey.

A recent study on fish migration and spawning that relied on local knowledge proved both successful and valid. It demonstrated that surveys provide not only scientific information about

fish but also valuable insights into local knowledge of fish management and traditional fisheries practices (Jørgensen et al., 2020). This study serves as a model for incorporating local knowledge into fish surveys.

Using local knowledge for fish sampling empowers communities to actively participate in data collection. Recognizing the value of their knowledge fosters trust and strengthens relationships, while employing their fishing sites and tools ensures that the survey aligns with local practices. Communities often have distinct fish management systems: some prohibit certain fishing tools for conservation or cultural reasons, while others allow tools like gillnets and cast-nets. Respecting these practices is essential for successful collaboration.

Most local people practice animism or naturalism, and their spiritual beliefs are closely linked to their respect for nature. During our field surveys, we observed traditional spiritual rituals before beginning work, and local experts guided us in selecting the best sites for surveying each species. By honoring their knowledge, conservation practices, and spiritual traditions, we were able to successfully collect fisheries information while maintaining strong community engagement.

1.4 Livelihoods

Most inhabitants of the Bweloklo Valley rely heavily on paddy rice farming, though many—especially animist communities—continue to practice rotational farming. Some households use both systems to meet family food needs and supplement household income. Villagers depend primarily on rice cultivation (both hill and paddy). Other crops such as sweet corn, potatoes, yams, chilies, eggplants, and medicinal herbs are grown along dikes and field edges.

Farming and livestock breeding form the main livelihoods, with few alternative sources of income. Only a small number of families can afford to raise cattle, buffalo, or pigs, which are sold occasionally for cash. Non-timber forest products (NTFPs) such as honey, nuts, mushrooms, oils, vegetables, seeds, and medicinal plants are also collected (Htoo and Grindley, 2010). Although villagers living along the river basin do fish, it is primarily for food and spiritual purposes rather than income. Fishing is carried out individually or communally, and the catch is shared or bartered within the community.

2 DESCRIPTIONS OF PARTICIPATING FISHERFOLK

2.1 Study area

The survey took place in the upper Bweloklo and its tributaries. The Bweloklo is about 253 km long. The sampling areas not only took place on the Bweloklo alone, but its tributaries. The Bweloklo and its tributaries are mainly sandy, stony, with a lot of rocky bottoms and on its runways, while some waterfalls occur along the way. It maintains clear water for at least 8 months a year but becomes muddy during the rainy season. Some of the places are slowly flowing while the rocky areas are very rapid. The depth of the river during summer in ponds is estimated at an average of 5 -10 meters in the dry season and 8 – 15-meter depth in flooding season. Again, we also conducted surveys in the small lakes or small ponds in Lermuplaw areas such as Porbawkwee and Norkayklaw, where its depth in the dry season can only be between 1–3 meters. However, Nor Lu Lake beside is about 5 meters Bweloklo deep in dry seasons. The water velocity is very low, and it is rather muddy during the dry season and Dissolved Oxygen (DO) is low in summer.

The most common plant along the Bweloklo and its tributary river sides is the willow-leaved water croton (*Homonoia riparia*). This small tree species is commonly found in all kinds of rivers and streamsides in the survey area. The species is very common and believed to protect bank erosion and changes in waterways. The other tree species called water Bessie (*Syzygium cordatum*) is very common on the Bweloklo side, particularly in sandy areas. The Indian willow (*Salix tetrasperma*) is the most common riverside tree species, followed by other *Ficus* sp. in the area. The perennial plant species include the castor bean (*Ricinus communis*), *Lasia* spp. and different varieties of ferns.

The characteristics of the river here are rapid in some areas, while calm in plain paddy field areas. The rapid area is rocky, stony, and pebbly, with small waterfalls, while the calm area maintains smaller stones, sands and even clay river sides. During the flooding period or rainy season, the water can be very muddy, but most of the time it maintains clarity. The composition of underwater plants includes *Spirogyra* sp., *Valonica utricularis* and other algae. There are also the most common aquatic invertebrate species occupying the underwater, including, Hellgrammite (aquatic larval stage of the Dobsonfly), Common water-measurer (*Hydrometra stagnorum*), Stonefly *Phanoperla constanspina*, Damselfly nymph, Dobsonfly Larvae, Common net spinner, Mayfly, Common demoiselle larvae. *Lethocerus indicus*, caddisfly larva etc. However, the small lakes beside the river are mostly calm and have low water velocity.



Figure 3. Bweloklo riverside is occupied with willow trees and giant bamboo. This river location is close to a paddy field where the rocky environment is absent.

Salween Peace Park Map

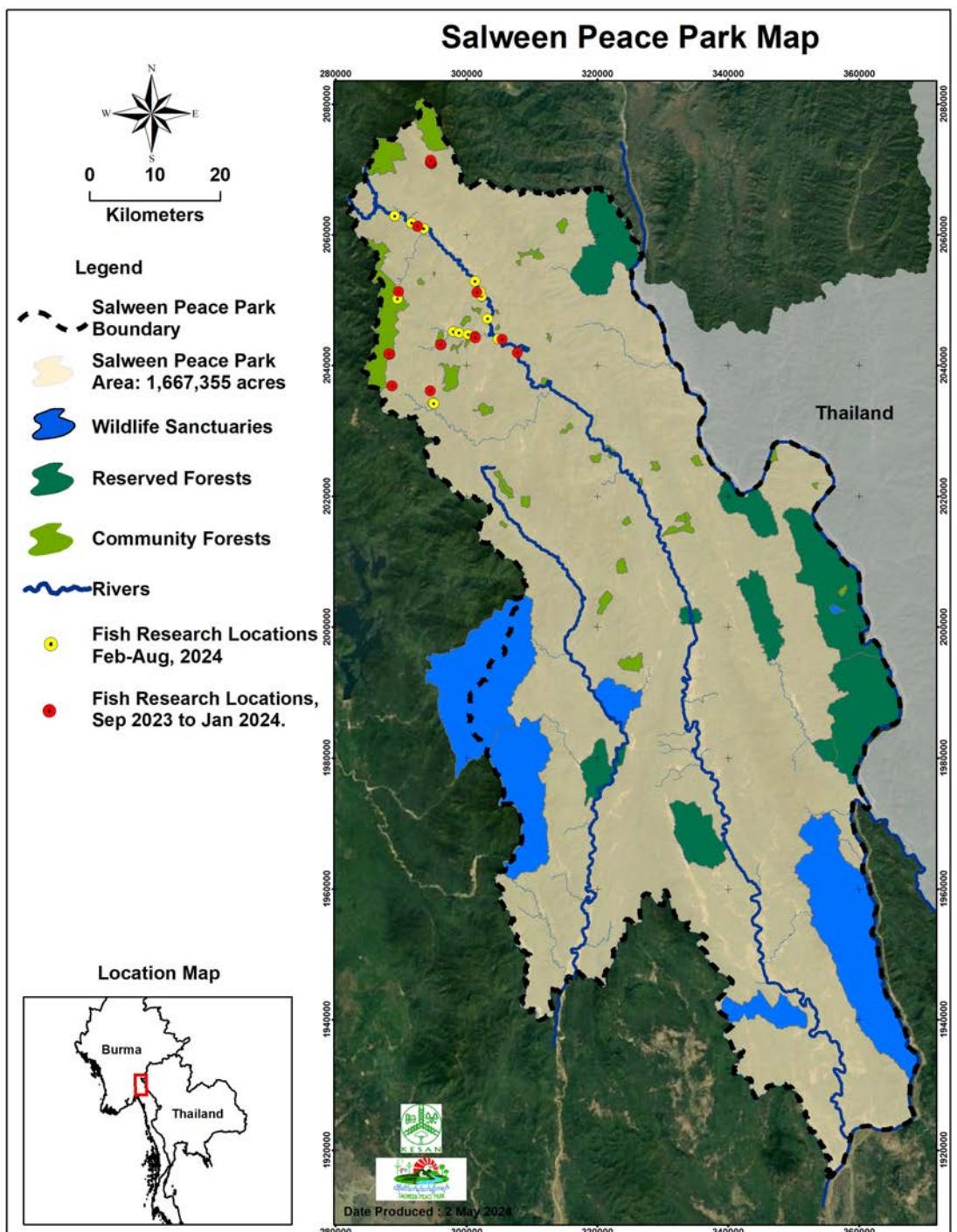


Figure 4. There are two main rivers of which the longest one from the East is the Bweloklo and the shorter one from the West is the Belin River. The survey sites are marked in red and yellow.

3 RESEARCH METHODOLOGY

The fish research took place following the seasonal cycles, with the team conducting research five times (June 2023, September 2023, December 2023, February 2024, and March 2024).

This research comprises three main activities:

1. Comparative research on fish species in the upper Bweloklo and its tributaries inside and outside fish conservation areas. This study notes all encountered fish species but looks out for: (potentially) endemic species; species of ecological importance; and species holding biocultural significance in the local community, including sacred species.
2. Research on seasonal fish spawning sites for three different species to understand breeding cycles. This focuses on three species only: Nyanna, Nya Khen Meh, and Nya Tho. These species were selected at the recommendation of local communities who identified them as priority species due to their sacred and nutritional importance. Nyanna, which depends on relationship with people for their hatching success (Figure 8), is traditionally used for spiritual purposes specifically during the feast about the rice spirit bird (*Hto bee gha*). Both the Nya Khen Meh and Nya are very important for both spiritual and nutrition purposes. Nya Tho is a fish species that can easily be caught year-round as it is one of the most common species in the area. Its hatching sites are also managed by local people because people make small dams to slow the current for the eggs to remain in the spawning site and hatch successfully.
3. Enquiry into the health of the riverbanks and watershed ecosystems surrounding the watershed and availability of food sources to determine the carrying capacity of each site.

3.1 Approach

Quantitative - to catch the fish, we used the capture - release method to be able to record information about the fish under close examination. We captured the spawning Nyanna only and counted the sex ratio. We utilized gillnets, fishing nets, and traditional bamboo traps for these purposes. We used snorkels and GoPro cameras to enumerate fish stocks and to check for small fish in shallow waters. We also built small temporary dams to divert the river to monitor/ catch fish outside of the sanctuaries see (Table 1).

We also measured the water velocity, pH level, temperature, dissolved oxygen (DO), location of spawning sites, time of spawning, size of spawning area, weather conditions at spawning sites (cloud cover, moon). The researchers used fish data collection forms they had designed to record fish species names and photos. The appearance of each species was described alongside the size, weight; sex-ratio; colour plate and formation of body parts of species colour of the scales and fins. After collecting data, the research team and local community members compared which fish

species inhabit the river, stream, and/or wetlands. The spawning behavior of the Nya Khen Meh was studied through a case study approach. We began by consulting with communities who hold traditional knowledge, asking how they wished the research to be conducted. We then followed the methods they identified as appropriate and respected all their guidance throughout the process.

Qualitative - to understand locally held perceptions of fish species we employed methods aimed at providing a way for people to informally share their knowledge, opinions, and personal experiences. These include storytelling, key informant interviews, and focus group discussions, which provided us with first-hand insights based on generational knowledge and many years of observation and relationship with the upper Bweloklo watershed. The researchers also conducted observation themselves of the local community members' interactions with the river landscape during the research. A total of 14 persons (12 by May 2024 and 2 due in July 2024; 7 men and 7 women) shared stories detailing locally held beliefs on fish species in the upper Bweloklo in semi-structured interviews. The people who were interviewed and/or took part in the focus groups were selected because of their expertise and included village heads, teachers, and religious leaders. People interviewed were estimated to be in the age range 40 to 70 (most people don't know their exact date of birth).

Our research was informed by a participatory action research (PAR) approach and devised to fit a Karen Indigenous community context. We aimed to situate the power during the research process with the local communities since they informed the research topic and are most affected by the outcome. The residing communities are actively involved in the design and implementation of our research. Villagers, local security staff, village tract leaders, and local students all took part in data collection.

3.2 Research team composition

The Indigenous Women's research team, established prior to the upper Bweloklo study, was initially formed from individuals who demonstrated a strong personal interest in biodiversity conservation within their communities. All members come from families in the Salween Peace Park who either manage community forests or oversee hunting—experience that was particularly relevant for their first research project on orchids. Some researchers are former volunteers who previously assisted the Karen KESAN consultant, who oversees the upper Bweloklo research, with other conservation activities. All team members have received basic training in research methods.

The team consists of seven members: five women and two men. The inclusion of men ensures cultural appropriateness and security in fieldwork, allowing women to carry out research safely. The women led the identification of data collection sites, conducted most of the community interviews, carried out the fish research, and engaged in awareness-raising activities to embed the project within broader conservation efforts. Before the fish survey began, they provided updates on the research progress and highlighted the importance of fish conservation to the communities involved.

The team is trained and guided by a Canada-based Karen Indigenous expert with an academic background in biodiversity conservation and anthropology, studied in both Thailand and Canada. He also grew up in the research area, learning indigenous knowledge on biodiversity conservation and anthropology within his customary land, and now serves as a consultant supporting the team's work.

3.3 Respecting local taboos and spiritual beliefs

During our survey we conducted data collection both within the fish sanctuaries and outside the protected areas. Within the protected areas, community leaders, especially religious leaders, are required to perform water ordination to seek permission from the spirit owners of water to allow such activities. Exploring this area requires strict rules, because if an accident happens that causes the loss of fish life, it is considered bad luck, so there will be another offering for forgiveness. The water ordination is conducted to lift restrictions just for research purposes for a couple of hours. So, after the water or fish sanctuaries ordination, the research team finished all their survey work, which then allowed enforcement again.

3.4 Equipment

Several discussions and meetings were conducted between our research team and the local community before we agreed to use 12 fishing methods to get the fish from the rivers and small lakes. However, not all the fishing gear was used at all sites, but we did indicate the places where the gear was allowed to be used or not, and the result of the use. This is because some fishing tools are considered too harmful for fish by some communities. The smaller the stream becomes, the fewer options for fish tools are allowed. The detailed information is listed in the table below (Table 1).

Table 1. The materials and tools that we used during our survey period (V) allow (X) not allow.

NO	Local names	Tools	names of the of survey sites, River, Lakes and Paddy Field											
			(Bweloklo-River)	(Bweloklo- Upper)	(Bweloklo-Lake)	(Klawklaw Lo-River)	(Klawklaw Lo-Lake)	Lermplaw (Paddy Field)	(Hteecheeloklo-River)	(Thetloklo-River)	(Sawmuloklo-River)	(Ploloklo- Upper River)	(Lenloklo-upper River)	(Lerhayloklo-River)
1	၃၅	Gill net	✓	✓	✓	✓	✓	X	X	✓	✓	X	X	X
2	၃၆	Cast-net	✓	✓	✓	✓	✓	X	X	✓	✓	✓	X	X
3	တ္ထံ တ္ထံခဲ့ ကမဲ	Hook and line	✓	X	X	✓	✓	X	X	✓	X	✓	X	X
4	၃၇	Small scoop net	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
6	တ္ထံ	Small Barrages	✓	✓	X	✓	X	X	X	✓	X	X	✓	✓
7	ဘာ၊ ကါ	Fishing bamboo basket traps	✓	✓	X	✓	✓	✓	X	✓	✓	✓	✓	✓
8	မိုက် ယုဝဲ	Swim Goggle	✓	✓	✓	✓	X	X	X	✓	X	✓	X	X
9	ခဲမရှိ ထံလှိ	GoPro	✓	✓	✓	✓	X	X	X	✓	X	✓	X	X
10	ခွဲကော်	Light vest	✓	✓	✓	✓	✓	✓	X	✓	X	✓	X	X
11	ဖို့လာစ	Bare hands	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

According to Table 1 above, some of the fishing tools were not allowed by the local villagers since they were prohibited by traditional taboos (customary law). The list of the fishing tools in the table was recommended to us by the local people after consultation meetings with the villagers from different communities, taking the time to understand their perspectives and suggestions. This is all the fishing equipment considered eco-friendly by the Indigenous Karen people.



Figure 5. Traditional traps called Bun - bamboo basket trap if translated in English.

3.5 Methods used

Discussion Before Selecting Survey Sites

Before conducting the survey, we first discussed the use of survey tools and site selection with local community members. They advised us on the most suitable locations for each species. For instance, they recommended building small barrages to increase water flow for collecting loach species, while surveys for larger fish needed to be conducted in deeper waters that were less accessible. In such cases, we joined community fishing days, particularly at community fish management sites. Each community maintains a protected fish reserve, opened only once every three years during major cultural events. Fishing is allowed for one day, after which restrictions are reinstated. Additionally, every community has at least one permanent fish sanctuary where people may observe and feed fish without harming them. With community permission, the research team used life vests, swim goggles, and GoPros to observe fish species at most sites.

Site Selection

Working closely with local fish experts and villagers, we relied on them to choose survey sites. Certain areas are protected for their sacred or community-conserved status, and some fishing tools are permitted or prohibited based on local oral traditions and cultural taboos (see Table 1).

Direct Observation

Surveys were conducted both day and night, following local recommendations for each species. Local fishers manage species differently across seasons, noting migration and spawning patterns that often align with lunar phases. As most species spawn at night, local knowledge was essential for identifying these behaviors. Apart from spawning observations, most surveys occurred during the daytime.

Semi-Structured Interviews

We conducted individual and group interviews to discuss sustainable fish use, management, and conservation practices. Conversations covered indigenous fish identification systems, species distribution, ecological timing, migration, spawning, and other resource-related topics. We also explored whether certain species are considered biocultural and how communities respond to environmental change.

Data Analysis

All field measurements were recorded on-site in a pre-designed Excel sheet. Notes from interviews included verbatim quotations, descriptive field notes on observed species, and analytic reflections by researchers on their observations.

3.6 Fish identification tools

Fish identification was carried out using *The Fish Guide Book of Northern Thailand and Cambodia* (Suvarnaraksha & Utsugi, 2023; So et al., 2018) and reference data from FishBase (<https://www.fishbase.org/search.php>). Identification criteria included:

- body regions and fins, including barbels;
- mouth position (terminal, inferior, subterminal, or superior);
- types of caudal fins (forked, truncate, pointed, or rounded); and
- measurements such as total length, weight, scales, and lateral line characteristics.

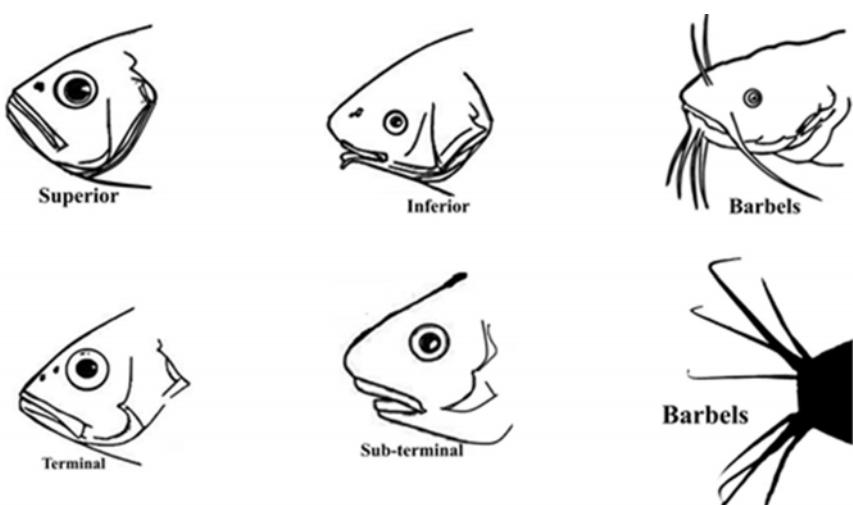


Figure 6. The mouth part species differentiation.

We identify the fish based on their mouth part differences, and the presence of barbels, using these figures (see above Figure 6) for reference. We also checked the barbels and counted the number of barbels on them and used them for identification. There were some fish that lack barbels, which are considered as absent barbel species.

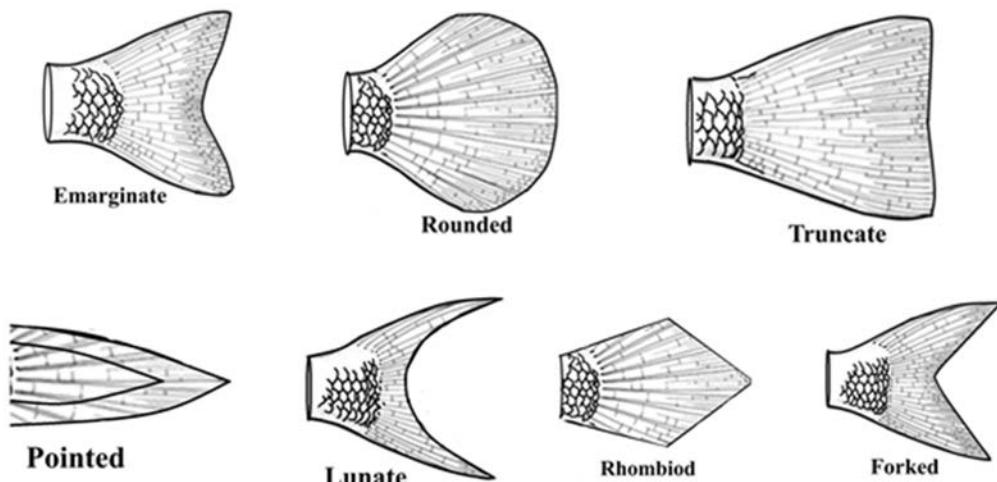


Figure 7. Different types of caudal fins.

Figure 7 helps with the identification of the caudal fin types which can be compared with our recorded species. The comparison of caudal fin types was used in the field survey to pre-identify each species. It is usual to record the fish data in the first place.

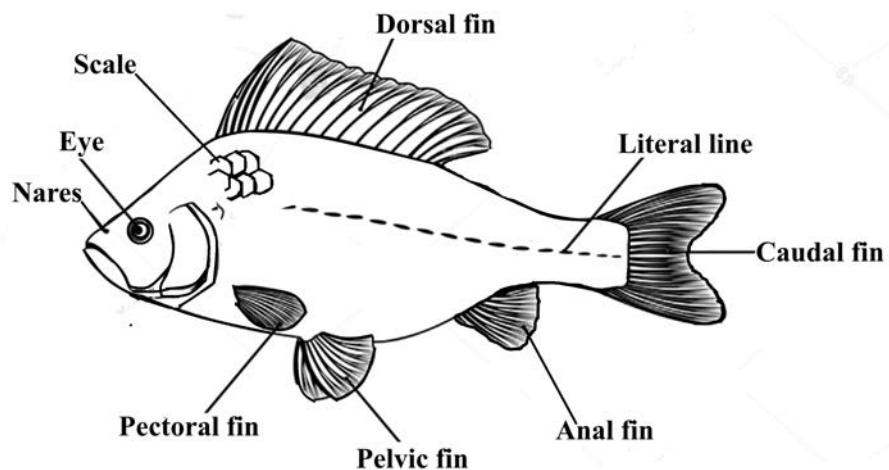


Figure 8. The general differences on the types of fins and scales on the fish

According to figure 6, the drawing presents images of different fin formations and shapes of fish in general. This is particularly good for identifying the Cyprinidae family. There are also color palate differences and marking differences to distinguish each species which were not included here in the reference drawing.

3.7 Research Limitations

The main limitation of this research was the limited geographic scope due to financial and time constraints. The team had more chances to conduct surveys on the Bweloklo more than any other waterway due to the resources received. It is unlikely our measurements on fish species carry validity outside of our research areas since the upper Bweloklo is separated by a very big waterfall which cuts off the fish migration route completely. Many species found in the upper Bweloklo are not found in the lower Bweloklo. This could be due to a variety of reasons including differences in temperature, riparian vegetation, dissolved oxygen levels, pH or sources of nutrition. For any research conducted on the Bweloklo going forward, it is worth noting that different species of fish will prefer certain portions of the river over another. For example, the Nyanna was found to only exist in a 60 km stretch of the river, existing only in rocky portions of the river facing strong currents.

There is no translation-related limitation during the research itself since the research team members all speak the same (S'gaw Karen) language as the local communities. It is however challenging and time consuming to translate the local names of species to English/Latin. However, we had completed the identification of fish names before the production of the guidebook.

Finally, our research does not yet specifically address local occurrence or locally held beliefs of species known elsewhere to be spiritually significant or important for nutrition/livelihood, but a few selected species which are often considered important for local people were lightly discussed.



4 SURVEY RESULTS

Out of all the fish species discovered throughout the duration of this research, almost all of the species were identified. This research also mapped key spawning areas and documented species of significant biocultural importance. Two sacred species, Red Gara and Nyanna were not found during the first research phase. By May 2024, most surveys outside the conservation areas had been completed. Overall, the findings demonstrate that conservation areas in the Salween Peace Park are able to protect fish and provide an adequate growth period for fish to reach their mature age. Outside of the protected areas, fish were found to be less abundant and smaller in size. Habitats inside protected areas are functionally diverse and provide environmental conditions that can host various fish species.

A gender factor also became clear. Women play an important role in fishing and other river-related work, unlike in hunting, where their involvement is minimal. The study also highlights the crucial role of elders in passing down knowledge on managing traditional spawning sites. Most of those who hold this knowledge are elderly, and as they pass away or migrate, traditional spawning sites are disappearing along with their knowledge. Some of these sites have been cared for by local communities for generations, and successful spawning depends on their continued care.

The research also found that for the local community, the majority of their nutrition comes from river sources rather than forests, such as fish, mollusks, crabs, shrimp, algae, and plants, showing the importance of the upper Bweloklo for community sustenance, especially since no chemicals are used in the study area's waterways.

The research has also uncovered evidence on the dependency of the Nyanna fish on the local community for its reproduction. Local communities have helped protect their spawning sites for centuries by building protective ponds and covers using leaves for shading. This prevents the eggs and hatchlings for up to two weeks old after which they are released from floating away and being eaten by other animals and protects them from direct light that would destroy the yolk.

This research also identified an area of interest for future ethno-botanical research, which is the importance of the many (often planted) fruit trees alongside the upper Bweloklo as a food-base for fish.

We witnessed Nya Khen Meh fish get together for spawning. Males and females went to the spawning site together and spawned in the area for several days. It remains unclear where they came from, but community assumption is that they might have come from different areas since before coming to spawn, big individuals were never seen in this area.

This report's findings provide information on (a) water quality, (b) species richness, (c) priority species spawning management of biocultural species, and (d) other introduced species. The finding discussed some priority species, specifically their migration and spawning, but not all species were recorded

from the sites. There are only four considered new species, three of which are biocultural species which this report has detailed more on their spawning management and conservation priorities using indigenous knowledge, particularly, Nyanna, (*Bangana spp.*), Nya Ken Meh (*Ageneiogarra sp.*) and *Poropuntius bantamensis*. The other locally common species are only discussed lightly in this report. The discussion also includes the use of spiritual beliefs for fish management and conservation.

4.1 Water Quality

Since the Bweloklo and its tributaries are freshwater rivers, far from the sea, the salinity is not relevant with this finding. Water quality here focused only on the temperature of the water, pH, TDS, DO and velocity of the water during the survey season.



Figure 9. Water temperature measurement using a thermometer.



Figure 10. pH water quality measure



Figure 11. TDS (Total Dissolved Solid in Water)



Figure 12. DO (Dissolved Oxygen in water using bio-indicators)

The water quality parameters are indicated in Table (2) below.

Table 2. The Temperature, pH, DO and TDS during survey seasons

Seasons	Month	Sites	Temperature(°C)	pH	DO%	TDS/ppm
Rainy Season	September	Thet loklo	22	6.5	75.5	100
	July	Lermuplaw Paddy Field	23.4	6	65	130
	July	KlawKlaw Lo Klo	23	6.4	70	120
Winter	December	KlawKlaw Lo-Lake	23.5	6.5	50	110
	December	Thetloklo-River	13	6.5	79	85
	December	Bweloklo-Lake	21.2	7	60	105
	December	Bweloklo-River	20.8	6.5	80.5	95
	January	Klawklaw Lo-River	17.7	6.5	78.5	85
	December	Ploloklo-Upper River	17.7	6.5	75.5	90
	January	Sawmuloklo-River	19.5	6.5	75	100
	January	Lerhayloklo-River	13.4	6	82.3	80
	January	Lerhayloklo-River	13.5	6	82	90
Summer	March	Bweloklo River	21.5	6.64	78.5	102
	March	Klawklaw Lo-River	18.5	6	75.5	105
	March	Ploloklo-Upper River	18	6	80	100
	Averages		19.11333333	6.37	73.82	104

Table 2 shows four categories of water quality measurements, which are water temperature, pH, DO and TDS. The average water measurement results from the field were 19.11 °C from water temperature, 6.37 from the pH, 73.82% from dissolved oxygen and 104 ppm for the water TDS.

The water quality in the Bweloklo River and its tributaries seems to be clear and healthy for drinking because there has been no pesticide, chemical fertilizer or herbicide used for agricultural purposes. The upstream mining has not occurred in the area when rivers and streams look very clear during the winter and summer seasons. Therefore, rivers and streams seem to look clear in almost all seasons except flooding time of one or two months from July and part of August of the year. However, the toxic metal in the water is low in all seasons. Other lab work for water quality has not been done before, so sampling and different methods which will be more precise than this would be required.

4.2 Species richness

The team could successfully record 45 fish species into our fish inventory list. During this survey, (9) orders, (13) families and (45) species were recorded. The species are arranged here from the most diverse family to the least diverse one: here the most diverse family is Cyprinidae, which is 15 species, followed by Nemacheilidae 11 species, Cobitidae 4 species, Anabantidae 3 species, Sisoridae

3 species, Siluridae 2 species, Synbranchidae 2 species, Anguillidae 1 species, Balitoridae 1 species, Cichlidae 1 species, Clariidae 1 species, and Heteropneustidae 1 species. The details of the fish species, orders, and families, are shown in the Table (3) below.

Table 3. Fish richness recorded in upper Bweloklo (Bweloklo) and its tributaries.

List of fish orders, Families, Species and Local names			
Orders	Families	Species	Local names
Anguilliformes	Anguillidae	<i>Anguilla bengalensis</i> (Gray, 1831)	ည်ထံ
Cypriniformes	Balitoridae	<i>Balitora burmanica</i> (Hora, 1932)	ည်ဖော်လုံ
Cypriniformes	Cobitidae	<i>Lepidocephalichthys berdmorei</i> (Blyth, 1860)	ည်ထံးခဲး
		<i>Lepidocephalichthys guntea</i> (Hamilton, 1822)	ည်ထံးခဲးခဲး
		<i>Cobitis sp.</i>	ပုံးနှံးရွှေ
		<i>Acantopsis spectabilis</i> (Blyth, 1860)	ထံးကာသံ့

List of fish orders, Families, Species and Local names			
Orders	Families	Species	Local names
Cypriniformes	Cyprinidae	<i>Hypsibarbus sp</i>	ည်သို့သို့
		<i>Neolissochilus stracheyi</i> (Day, 1871)	ည်ပူ
		<i>Poropuntius bantamensis</i> (Rendahl, 1920)	ည်သို့
		<i>Devario browni</i> (Regan, 1907)	ည်ပို့
		<i>Devario regina</i> (Fowler, 1934)	ည်ပို့ဘို့
		<i>Scaphiodonichthys burmanicus</i> (Vinciguerra, 1890)	ည်ထံ
		<i>Garra nasuta</i> (McClelland, 1838)	ည်ပတိနား
		<i>Garra cf. salweenica</i>	ပတိနား
		<i>Ageneiogarра sp.</i>	ည်လဲမဲ
		<i>Bangana sp.</i>	ည်နှု
		<i>Garra sp.</i>	ည်ပတ္တ
		<i>Garra sp.</i>	ပတိနားနှုဂါး
		<i>Neolissocheilus sp.</i>	ည်ပူ
		<i>Garra surinbinnani</i>	ပတိနားနှုယူ
		<i>Tor tambroides</i> (Bleeker, 1854)	ည်ပူဘွဲ့
Cypriniformes	Nemacheilidae	<i>Nemacheilus sp.</i>	ထိုးဆံ့နှုန်းတို့
Cypriniformes	Nemacheilidae	<i>Exostoma berdmorei</i> (Blyth, 1860)	ည်ဖော်

List of fish orders, Families, Species and Local names			
Orders	Families	Species	Local names
		<i>Schistura moeiensis</i> (Kottelat, 1990)	ဘာပလျှို
		<i>Schistura pantherina</i>	ဘာပလျှိုဘို့သို့
		<i>Exostoma peregrinator</i> (Ng & Vidthayanon, 2014)	ညုံဖော်
		<i>Schistura cf. poculi</i>	ထေးကံ့နုံလုံဂို့မဲ့
		<i>Schistura cf. poculi</i>	ထေးကံ့နုံလုံ
		<i>Schistura reidi</i> (Smith, 1945)	ဘာပလျှိုကံ့နုံ
		<i>Exostoma</i> sp.	ညုံဖော်
		<i>Schistura</i> sp.	ဘာပလျှိုပံ့ကူ့
		<i>Schistura vinciguerrae</i> (Hora 1935)	ဘာပလျှိုကံ့နိုး
Perciformes	Anabantidae	<i>Anabas testudineus</i> (Bloch, 1792)	ညုံသုံး
		<i>Channa limbata</i> (Cuvier, 1831)	ညုံလံ့နှီး
		<i>Channa punctata</i> (Bloch, 1793)	ညုံလံ့
Perciformes	Cichlidae	<i>Oreochromis niloticus</i> (Linnaeus, 1758)	ညုံပီလာ
Siluriformes	Clariidae	<i>Clarias batrachus</i> (Linnaeus, 1758)	ညုံကို့ဘီ
		<i>Clarias macrocephalus</i> (Günther, 1864)	ညုံကို့လါ
Siluriformes	Heteropneustidae	<i>Heteropneustes fossilis</i> (Bloch, 1794)	ညုံဆါ
Siluriformes	Siluridae	<i>Pterocryptis burmanensis</i> (Thant, 1966)	ညုံပုံ
		<i>Pterocryptis cochininchinensis</i> (Valenciennes, 1840)	ညုံပုံလါ
Siluriformes	Sisoridae	<i>Glyptothorax cf. burmanicus</i>	ညုံဖော်နုံ
		<i>Oreoglanis</i> sp.	ညုံဖော်ဘုံမို့
		<i>Glyptothorax trilineatus</i> (Blyth, 1860)	ညုံဖော်ဘုံဘီ
Synbranchiformes	Synbranchidae	<i>Monopterus albus</i> (Zuiew, 1793)	တံ့တူလါ
		<i>Monopterus javanensis</i> (Lacepède, 1800)	တံ့တူဘီ

From Table 3, we can clearly see the orders, families, and species recorded. Some species were identified only to the genus level because this is the first survey ever conducted at these sites. It is possible that some species are endemic or new to science, which would require molecular analysis that we are not yet equipped to carry out.

Table 4. Species present in each river, lakes and paddy field (+) recorded (-) not recorded

NO	Scientific Names	Species present in River, Lakes and Paddy Field									
		(YBweloklo-River)	(Bweloklo-Lake)	(Klawklaw Lo-River)	(KlawKlaw Lo-Lake)	Lermplaw (-Paddy Field)	(Hteecheeloklo-River)	(Thetloklo-River)	(Sawmuloklo-River)	(Ploloklo- Upper River)	(Lenloklo-upper River)
1	<i>Anguilla bengalensis</i> (Gray, 1831)	+	-	+	-	-	-	-	-	-	-
2	<i>Balitora burmanica</i> (Hora, 1932)	+	-	+	+	-	+	+	+	+	-
3	<i>Lepidocephalichthys berdmorei</i> (Blyth, 1860)	+	+	+	+	+	+	+	+	+	+
4	<i>Lepidocephalichthys guntea</i> (Hamilton, 1822)	+	+	+	+	-	-	+	+	-	-
5	<i>Cobitis sp.</i>	+	-	+	-	-	-	+	+	+	+
6	<i>Acantopsis spectabilis</i> (Blyth, 1860)	+	-	-	-	-	-	-	-	-	-
7	<i>Hypsibarbus sp.</i>	-	-	+	+	-	-	+	+	-	-
8	<i>Neolissochilus stracheyi</i> (Day, 1871)	+	+	+	-	+	+	+	+	-	-
9	<i>Poropuntius bantamensis</i> (Rendahl, 1920)	+	+	+	-	+	+	+	+	-	-
10	<i>Devario browni</i> (Regan, 1907)	+	+	+	+	+	+	+	+	+	-
11	<i>Devario regina</i> (Fowler, 1934)	+	-	+	-	-	-	+	-	-	-
12	<i>Scaphiodonichthys burmanicus</i> (Vinciguerra, 1890)	+	-	+	-	-	+	+	+	-	-
13	<i>Garra nasuta</i> (McClelland, 1838)	+	-	+	-	-	+	+	+	-	-
14	<i>Garra cf. salweenica</i>	+	-	+	-	-	+	+	+	-	-
15	<i>Ageneiogarра sp.</i>	+	-	+	-	-	-	+	-	-	-
16	<i>Bangana sp.</i>	+	-	+	-	-	-	+	-	-	-
17	<i>Garra sp.</i>	+	-	+	-	-	-	+	-	-	-
18	<i>Garra sp.</i>	+	-	+	-	-	-	+	-	-	-
19	<i>Neolissocheilus sp.</i>	+	+	+	-	-	+	+	+	-	-
20	<i>Garra surinbinnani</i>	+	-	+	-	-	+	+	+	-	-
21	<i>Tor tambroides</i> (Bleeker, 1854)	+	-	+	-	-	+	+	+	-	-
22	<i>Nemacheilus sp.</i>	+	-	+	-	-	+	+	+	+	+
23	<i>Exostoma berdmorei</i> (Blyth, 1860)	+	-	+	-	-	+	+	+	+	+
24	<i>Schistura moeiensis</i> (Kottelat, 1990)	+	+	+	+	+	+	+	+	+	+
25	<i>Schistura pantherina</i>	+	-	+	-	-	+	+	+	+	+

NO	Scientific Names	Species present in River, Lakes and Paddy Field										
		(YBweloklo-River)	(Bweloklo-Lake)	(Klawklaw Lo-River)	(KlawKlaw Lo-Lake)	Lermplaw (-Paddy Field)	(Hteecheeloklo-River)	(Thetloklo-River)	(Sawmuloklo-River)	(Pioloklo-Upper River)	(Lenloklo-upper River)	(Lerhayloklo-River)
26	<i>Exostoma peregrinator</i> (Ng & Vidthayanon, 2014)	+	-	+	-	-	+	+	+	+	+	+
27	<i>Schistura</i> sp.	+	-	+	-	-	-	-	-	-	+	+
28	<i>Schistura cf. poculi</i>	+	-	+	-	-	+	+	+	+	+	+
29	<i>Schistura reidi</i> (Smith, 1945)	+	-	+	-	-	+	+	+	+	+	+
30	<i>Exostoma</i> sp.	+	-	+	-	-	+	+	+	+	+	+
31	<i>Schistura</i> sp.	+	-	+	-	-	+	+	+	+	+	+
32	<i>Schistura vinciguerrae</i> (Hora 1935)	+	-	+	-	-	+	+	+	+	+	+
33	<i>Anabas testudineus</i> (Bloch, 1792)	-	+	-	+	+	-	-	-	-	-	-
34	<i>Channa limbata</i> (Cuvier, 1831)	+	+	+	+	+	+	+	+	+	+	+
35	<i>Channa punctata</i> (Bloch, 1793)	+	+	+	+	+	+	+	+	+	+	+
36	<i>Oreochromis niloticus</i> (Linnaeus, 1758)	-	+	-	+	+	-	-	-	-	-	-
37	<i>Clarias batrachus</i> (Linnaeus, 1758)	+	+	+	+	+	+	+	+	-	-	-
38	<i>Heteropneustes fossilis</i> (Bloch, 1794)	-	-	+	+	+	-	-	-	-	-	-
39	<i>Pterocryptis burmanensis</i> (Thant, 1966)	+	+	+	+	+	+	+	+	+	-	-
40	<i>Pterocryptis cochinchinensis</i> (Valenciennes, 1840)	+	+	+	+	+	+	+	+	+	-	-
41	<i>Glyptothorax cf. burmanicus</i>	+	-	+	-	-	-	+	-	-	-	-
42	<i>Oreoglanis</i> sp.	+	-	+	-	-	+	+	+	+	+	+
43	<i>Glyptothorax trilineatus</i> (Blyth, 1860)	+	-	+	-	-	-	+	-	-	-	-
44	<i>Monopterus albus</i> (Zuiew, 1793)	+	+	-	+	+	-	-	-	-	-	-
45	<i>Monopterus javanensis</i> (Lacepède, 1800)	+	+	-	+	+	-	-	-	-	-	-

There are some species that were not recorded from other survey sites. Some species in the lakes were not recorded in the river. However, there are still some species in the stream that were not recorded in other streams. This could be due to environmental factors or physical access to the areas. This is because there are many waterfalls in the paths of some streams. The Cyprinidae family was not recorded in the streams of Lenloklo and Lerhayloklo.

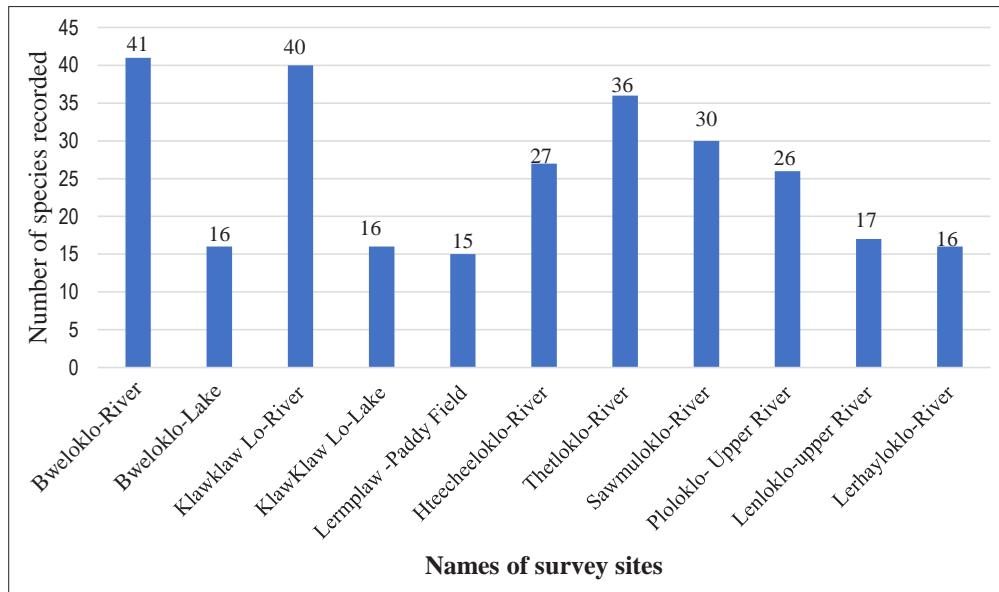


Figure 13. Number of species recorded across survey sites.

More fish were recorded in rivers than lakes and paddy fields, but the river like Bweloklo and its tributaries Klawklawlo river and Thetloklo river has a higher number of fish than other tributaries.

The Bweloklo has the most diverse species, followed by the Klawklawlo river and then Thetloklo river. However, the team had more chances to conduct surveys on the Bweloklo than on any other waterway. The other rivers more upstream, such as Ploloklo, Lenloklo and lerhayloklo, show a decrease in fish diversity since they are blocked by many waterfalls along the way.

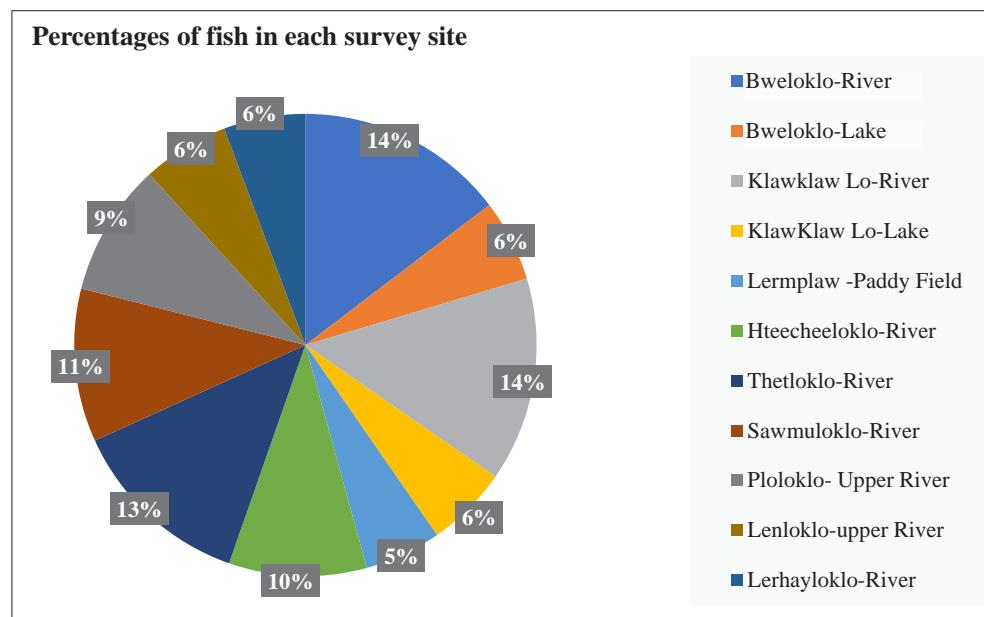


Figure 14. The percentages of species recorded in each survey site

Since the Bweloklo is the biggest in the area, it maintains the highest percentages of the fish diversity.

During our survey, we only recorded species, but not as individuals, so we could determine the richness of the species, but not the abundance of each species. We recorded the number of different species in each survey in figure 8 and the percentages of the species occupied in each survey site.

First, the species of the most diverse family will be discussed foremost, then follow with the less diverse. The most diverse family here recorded by our survey team is known as the Cyprinid family, which is composed of fifteen species as shown in Section B of species richness. Details of each species:

4.3. Species recorded

1. Cyprinid family

A. (ည်လောင်) Nya Ken Meh, presumed to be *Ageneiogarria* sp.

This remaining unknown species is described in both figures 1-2 below with its pictures. The fish body is elongated and slender measuring 21 cm TL or 210 mm TL. The female appeared bigger and lighter in color, while the male appeared to be darker during the time of spawning or during the week before spawning time, based on field observation. Figure 15 indicates color and sex differences, while Figure 16 shows different views of the fish's head and tail. It has slender body parts, which are dark brown to black with longitudinal stripes alongside. Lateral line scales where the mouth is strongly inferior without barbels (Lothongkham and Ratmuangkhwang, 2018).



i) A Female during spawning



ii) A male during spawning

Figure 15. A. female carrying eggs is lighter in color while B. male with sperm is darker in color. The pictures are from upper Bweloklo, of Salween Peace Park.

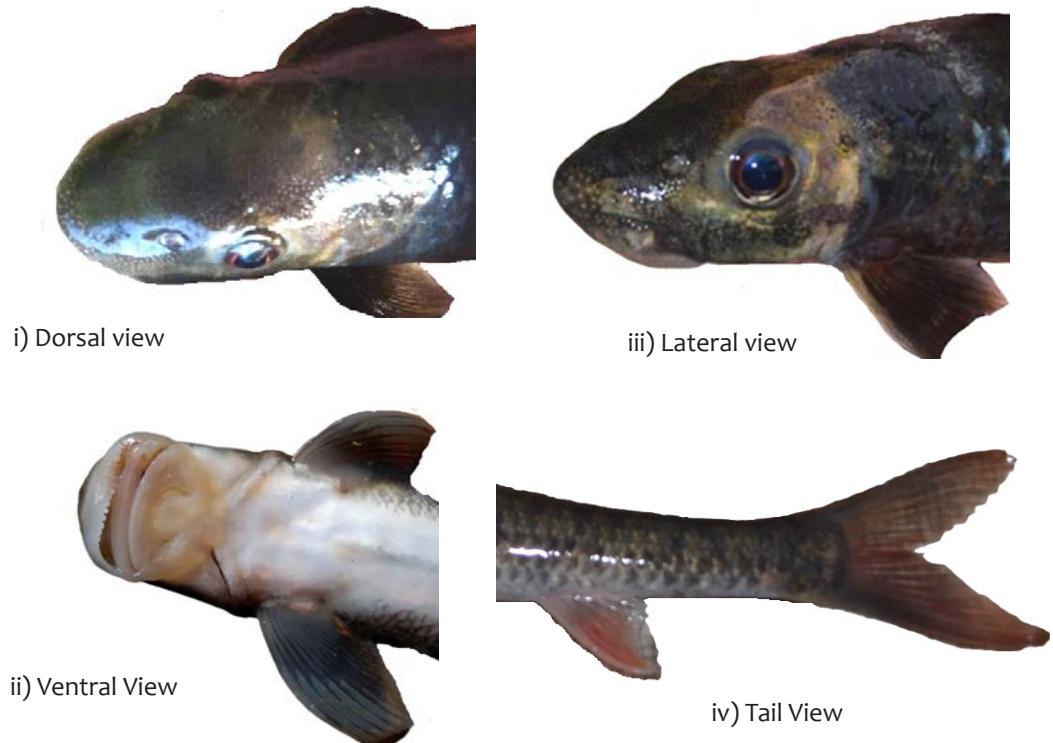


Figure 16. Indicated the head of the fish as i) Dorsal view, ii). Ventral View, iii) Lateral view and iv) Tail view.

Figure 16. Indicated the head of the fish as i) Dorsal view, ii). Ventral View, iii) Lateral view and iv) Tail view.

Distribution: Upper Bweloklo and its tributaries. This larger fish could not be found in most watershed area as the water temperature had decreased or because other environmental factors. It is because we could only record the species up towards the rotational farming areas where the temperature is much higher compared to the dense forest of the watershed.

Ecological Habitat and behavior: The species is found in clear, fast-flowing streams and rivers with rocky to stony waterways with multiple underwater stone caves. The depth of the water is less than 2 meters in the dry season. These fish migrate during September and October for spawning. They spawn mostly in shallow water with strong currents, estimated at a water velocity of 1 meter/second, figure 3. The depth of the spawning site is less than 0.5-meter, at pH 6.5, where the water temperature is between 18 -22 °C. The weather during the spawning day is mostly cloudy. They commonly feed on algae, aquatic insect larvae, zooplankton, and phytoplankton.

During the spawning period, the female has a rounded abdomen with a lighter color while the male develops a darker color. When the female is captured, their eggs will fall if they are ready to spawn. Similarly, the female organ will look open and swollen before a day or two before spawning. On the other hands, the captured male will emit sperm in a day or two before spawning when ready.



Figure 17. Spawning sites of *Ageneiogarra* sp. October

B. Known by the local people as Nyanna (ညုန္ယာ) presumed to be *Bangana* sp.



Figure 18. This fish size is 650 mm, 65 cm TL or 2.13 ft TL. The weight of this fish was 2.11 kg.

This unknown Nyanna species, presumed to be *Bangana* sp. (ညုန္ယာ) is described in Figures 19-21 below with its respective pictures. The fish body is elongated and slender at 55 cm TL or 550 mm TL. However, before the survey, one of the surveyors had encountered a female in the non-breeding season which weighed about 2.11 kg with the total length being 65 cm or 650 mm TL. The female appeared bigger and lighter in color while the male developed a dark mid-lateral stripe during the time of spawning or during a week before spawning time based of field observation. The mouth part is inferior, it lacks barbels and the caudal fin is forked type (Suvarnaraksha and Utsugi 2023). Figure 19 indicates color and sex differences, while Figure 20 shows a different view of the fish head parts and eggs. It has a slender body part, with olive, blue, to black colors with longitudinal

stripes alongside (BOX1). Lateral line scales where the mouth is strongly inferior without barbels (Lothongkham and Ratmuangkhwang, 2018).

Distribution: The fish is restricted to upper Bweloklo as its tributaries are divided by a major waterfall called Pubwalay.

Ecological Habitat and behavior: The species is found in clear, fast-flowing streams and rivers with rocky to stony waterways with multiple underwater stone caves where the depth of the water is less than 10 meters in the dry season. The species does not tolerate hot weather or and polluted water well, according to field observations. When observing the unique habitat of Nyanna, you will obviously see rocks and stone underwater at a depth between 0.3 m – 1 m deep, which is very slippery, without mosses in clear, crystal clean.

This species migrates during December and January to spawn in the mid-river. In the upper rivers close to the watershed, they spawn during late January and throughout February when the water is very clean. They spawn mostly in shallow water with strong currents, estimated between water velocity of 0.5 m to 1 m/second. The depth of the spawning site is less than 0.4-meter, at pH 6.5, where the water temperature is between 18 -22 °C. The weather during the spawning day is mostly cloudy. They commonly feed on algae, aquatic insect larvae, zooplankton and phytoplankton. Since this species plays a culturally significant role for the local people, they prepared spawning sites for the fish to be more successful. During summer, most of them lie deep in sediment in a sandy pond for foraging or rest, like a mat of leaves on the water floor. In most places, the local people manage their spawning sites and care for their juveniles for weeks to prevent them from decomposing, being eaten by wildlife, wild birds or succumbing to extreme heat. Sometime after spawning, the eggs pile up on the sand far from the water, so local people are required to put the eggs back into the spawning site for successful hatching.

On 21 December 2024, our team observed a spawning site and captured 190 fish of which the average weight was around 0.8 kg-1 kg. Of the population of 190 fish captured there were only 7 females, so the ratio is 1 female to 27 males. The water temperature at night there, during the spawning night, was between 15 – 20 °C, pH 6.5, and the water velocity of 0.5 m to 1.0 m/second, with a cloudy sky. These fish feed on insect larvae, mollusks, algae, zooplankton and detritus.

This kind of Nyanna (*Bangana sp.*) has different colors, sizes, and shapes. We recorded three different colors: olive, blue and black. This color could change during the time of spawning - which we witnessed during the survey - particularly of the lateral line of the male individual becomes very dark along the line as shown in picture (ii). Female genital papilla is distended and swollen. The first picture is a female Nyanna fish, after spawning, capture, and release.



i) Olive color with length 550 mm TL a female after spawning, capture and release



ii) The male developed the dark lateral site which is only see during spawning time; observed during spawning at night at spawning site



iii) Blue color captured in Feb 22 cm or 560 mm TL



iv) Black variety captured in March 21 cm or 540 mm TL.

Figure 19. Shows the different colors of the fish captured during the survey and male color change as darker color at the lateral site during spawning season.

Based on the pictures above, the local people believe that the darker color at the lateral site for male individuals during the spawning season indicated the readiness of the sperm for spawning. Therefore, upon capturing the male at the darker lateral site during our survey times, the males displaying this colored line released its sperm all over the hands of the surveyors.



i) Dorsal view



ii) Ventral view, similar to a shark mouth



iii) Lateral view



iv) Eggs: after spawning the eggs are white and about 6 millimeters in diameter

Figure 20. Shows different view of the fish head parts as dorsal view, ventral view, lateral view and eggs after spawning.



Figure 21. Fish spawning during the night at management site.



Figure 22. The spawning management prepared by the local people.

C. (ပုဂ္ဂနိုင်ရို့) Pen Naday Khaw, presumed to be *Garra* sp.

This fish is presumed to be a red *Garra* sp., is a locally uncommon species, which is considered a new species by the fish experts of Thailand. However, there are no further studies on the specimen genotype at the molecular level, specifically their DNA. Currently, the research team members could only provide the species with photos to check their phenotypes, particularly, their sizes, forms, and color plates. This *Garra* sp. can be distinguished from other species based on their red scale color and blue eyes. The mouth part is inferior, it lacks barbels and the caudal fin is forked type (Suvarnaraksha and Utsugi 2023).



i) This red *Garra* sp. length is about 160 mm TL



ii) The mouth part is inferior without barbel with blue eyes

Figure 23. This red *Garra* sp. Considered sacred by the local people

Distribution: Upper Bweloklo and its tributaries. However, the fish cannot be found in the watershed area when the weather is colder and where there is less fish diversity.

Ecological Habitat and behavior: The species is found in clear, fast-flowing streams and rivers with rocky to stony waterways with multiple underwater stone caves where the depth of the water is less than 2 meters in the dry season. However, they migrate during July and August for spawning. They spawn mostly in shallow water with strong currents, estimated at a water velocity of 0.2 m to 1.5 meters/second. The depth of the spawning site is less than 0.5-meter, at pH 6.5 where the water temperature is between 22 -30 °C. The weather during the spawning day is mostly cloudy with a lot of rain creating muddy water along the river. They commonly feed on algae, aquatic insect larvae, zooplankton and phytoplankton.

D. (ညံ့ဝေး) Nya P' Tay, presumed to be Brownish olive Garra sp.

This brownish olive colour Garra sp fish is another locally common species considered a new species by fish experts from Thailand. However, there are no further studies on the specimen genotype at the molecular level, specifically their DNA. Currently, the research team members could only provide the species with photos to check their phenotypes, particularly, their sizes, forms and color plates. This Garra sp. can be distinguished from other species based on their brownish olive color, scale color, sizes and shapes. The mouth part is inferior, lacks barbels and the caudal fin is a forked. (Suvarnaraksha and Utsugi 2023).



i) This Brownish olive Garra sp. length is about 230 mm or 9.0 cm TL



ii) The fish is rounder compared to other Garra sp.

Figure 24. This a Garra species with brown and olive color of the scales

Ecological Habitat and behavior: The species is found in clear, fast-flowing streams and rivers with rocky to stony waterways with multiple underwater stone caves where the depth of the water is less than 3 meters in the dry season. However, they migrate during June, July and August for spawning. They spawn mostly in shallow water with strong currents estimated between the water velocity of 0.2 m to 1 meter/second. The depth of the spawning site is less than 0.5-meter, at pH 6.5, where the water temperature is estimated to be between 22 -30 °C. The weather during the spawning day is mostly cloudy with a lot of rain creating muddy water along the river. They commonly feed on algae, aquatic insect larvae, zooplankton and phytoplankton.

***E. Devario browni* (Regan, 1907)**

Salween's Devario (သုတေသန) Nyapaw Baw



Size: 10 cm or 100 mm TL³.

Distribution: Bweloklo and its tributaries

Remarks: Body stout with bluish irregular blotches surrounded by golden brown lines on the flank, tail with 2 golden brown stripes to caudal fin base. Feeds on aquatic and terrestrial insects (Suvarnaraksha and Utsugi, 2023).

Migration: There is no record on spawning site but during raining season it moves upstream.

***F. Devario regina* (Fowler, 1934)**

Queen danio (သုတေသန) Nyapaw Baw



Size: 10.8 cm TL⁴

Distribution: Bweloklo and its tributaries

Habitat: Occurs in both fast-flowing and slow flowing streams and rivers with sandy bottom.

Remarks: Body is stout with bluish green lateral scale divided by three golden stripes with forked caudal fins. Feeds on aquatic and terrestrial insects

Migration: There is no record on spawning site but during raining season it moves upstream.

3 <https://www.fishbase.se/summary/Devario-browni>

4 <https://www.fishbase.se/summary/Devario-regina>

G. *Garra nasuta* (McClelland, 1838)

Khasi Garra (ညုပတ္တနီး) Nya P'taw Nie Day



Size: 10 cm or 100 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Fast-flowing streams with rocky and gravelly substratum.

Remarks: Body slender with plain brown. Snout with a depression in front of the eyes.

Migration: Its migration takes place during rainy season when water in streams and rivers is at its peak which is when spawning is also taking place.

H. *Garra surinbinnani*

Nose logsucker (ညုပတ္တနီး) Nya P'taw Nie Thoo



Size: 13 cm or 130 mm TL

Distribution: Upper Bweloklo and its tributaries

Habitat: Fast-flowing streams with rocky and gravelly substratum.

Remarks: Body elongated, and snout broadly rounded when viewed dorsally. With a big dark mark along lateral line

Migration: Its migration takes place during rainy season when water in streams and rivers is at its peak which is also when spawning is taking place.

I. *Garra cf. salweenica*

Salween stone lapping fish (ညုပတ္တနီး) Nya P'taw Nie Day



Size: 12 cm or 120 mm TL

Distribution: Bweloklo and its tributaries

Habitat: Occurs in fast-flowing streams with rock bottom.

Remarks: Body slender, dark green with scattered whitish scales. Dorsal fin hyaline. Caudal fin with white tip and submarginal dark band.

Migration: Its migration take place during rainy season when water in streams and rivers at its peak which is also when spawning is taking place.

J. *Hypsibarbus sp.*

Ray-finned fish (ညုပသို့ဟိုး) Nya Thobaw Di



Size: 30 cm or 300 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Recorded in clear water with both from slow and fast-flowing forest streams with sandy, rocky gravelly and stony bottom,

Remarks: Body slender, silvery with a golden fin. The mouth type is terminal and caudal fin is forked types.

Migration: This fish does not migrate a long-distance during spawning; the spawning season takes place from February – March in the survey area.

K. Neolissochilus stracheyi (Day, 1871)

Blue masheer ဗုံးပူရ (Nya Plar)



Size: 120 cm or 1,200 mm TL (Suvarnaraksha an Utsugi, 2023)

Distribution: Upper Bweloklo (Bweloklo) and its tributaries.

Habitat: Commonly recorded in the fast-flowing rivers, streams, in rocky floor strata, sandy pond floors and small stone fast flowing streams. Again, it was found mostly in the fish sanctuaries sites during survey period.

Remarks: It has dorsal fins, forked tail, and terminal mouth types.

Migration: Its large migration happened for spawning during rainy seasons. However, there is no evidence of spawning site during our fish survey period.

L. Poropuntius bantamensis (Rendahl, 1920)

Bantam brook carp ဗုံးသိုံး (Nya Tho)



i) Female individual without dark mid-lateral stripe



ii) The male develops a dark mid-lateral stripe when the sperm is mature

Figure 25. If captured at spawning time, the male emits sperm, evident on surveyors' hands.

Size: 35 cm or 350 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Recorded in clear water with both slow and fast-flowing forest streams with sandy, rocky, gravelly and stony sites

Remarks: Body is slender, silvery with a dark mid-lateral stripe on the male during the spawning times. At least 11 lateral line scales. The mouth type is terminal and caudal fin without submarginal stripes (Suvarnaraksha and Utsugi 2023).

Migration: This kind of fish does not migrate a long-distance during spawning, but the spawning season takes place from February – March of the year in the area. Many local people prepare and manage their spawning sites.

Cultural importance: It is a very important fish species for the local food because it is used for cultural and spiritual feasts in different ways. Also, this fish is one of the most common fish species in the upper Bweloklo and its tributaries. The velocity of water at the spawning site ranges between 0.5 ft to 1.5 ft/second. The depth of the water at the spawn is about 0.5 ft to 1 ft. It spawns mostly in a clear and sandy site. So, the local people often dam the strong flowing water with willow leaves to control water flow and to create sandy sites for spawning.

Unlike Nyanna (Bangana sp.), people do not take care of their eggs after spawning because the eggs are small and do not attract other wildlife to eat them. However, the juveniles of the fish are often eaten by birds and *Neolissochilus stracheyi* fish species. They gather for spawning and use the same spawning sites for several years if the condition of the site remains conducive.



M. Scaphiodonichthys burmanicus (Vinciguerra, 1890)

Burmese Transverse mouth barb ပျော်စိုး (Nya Htaw)



i) During the non-breeding season



ii) The male develops a dark lateral strip during spawning period

Figure 26. Illustrating different appearance of fish during breeding and non-breeding season.

Size: 30 cm or 300 mm TL

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurred in fast running clear water with sandy, stoney and rocky bottom of stream and river.

Remark: Lateral line scales 36-39. Dorsal fin with 9-11 branched rays. Males develop dark scale along lateral line during breeding season. Mouth is sub-terminal type and Pharyngeal teeth in 2 rows. (Suvarnaraksha and Utsugi 2023).

Migration: There is no record of mass migration and group spawning locally, but the recorded species show evidence of their eggs and sperm developed during April and May of the year.

Cultural importance: This is also one of the most important species for local food as the villagers could capture them all season using fishing net and fish trap. However, this kind of fish species are not attracted by bait so using fishing line and bait is not possible to capture the fish. The species is also used for cultural feasts and traditional events.

N. Neolissocheilus sp.

Black stripe mahseer ညုပ္ပါတ္ထ (Nya Plakwin)



Size: 60 cm or 600 mm TL.

Distribution: Bweloklo and its tributaries

Habitat: Occurs in forest streams, with gravelly, sandy, to rocky substratum. This is found in higher elevation and watershed.

Remarks: Body with a mid-lateral stripe. Dorsal profile convex. Dorsal fin with 8 branched rays. The terminal mouth types. Caudal fin is forked with golden color as mature. This kind of fish can be caught using fishing line with bait.

Migration: Migrates during flooding season, but there has been no record of mass spawning in local areas.

O. Tor tambroides (Bleeker, 1854)

Thai mahseer ညုပ္ပါဘူ (Nya Plar Thoo)



Size: 80 cm or 800 mm TL

Distribution: Bweloklo and its tributaries.

Habitat: Occurs in fast-flowing large rivers with gravelly to stony and rock stratum. During survey time this kind fish was commonly seen in the fish sanctuaries and protected areas in summer where the depth of the water is between 1- 4 meter.

Remarks: With stout body, shining silvery without marked lateral stripe. The mouth is terminal types, and it has a forked caudal fin with dark or plain color.

Migration: The species movement is recorded during the flooding season between June to August of the year. However, there has been no record of mass spawning sites and mass migration.

2. Family: *Nemacheilidae*

A. *Nemacheilus* sp.

Linsang whip loach (လိုးဆံ့နို့တို့) Htochee Nortaw



Size: 5 cm or 50 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurs from the slow flowing to fast-flowing streams river with sandy to rocky substratum.

Remarks: Body slender, olive brown with dark blotches along lateral line and along the back.

Migration: It is often captured with bamboo basket traps during the raining season, so it could migrate and spawn during that season along with the other loach.

B. *Exostoma berdmorei* (Blyth, 1860)

Mustache stream batfish ညှိုးတစ်ဦး (Nyaper Sah)



Size: 8 cm or 80 mm TL

Distribution: Upper Bweloklo and its tributaries.

Habitat: Occurred in clear fast flowing water in small creeks, stony, sandy with rocky bottom.

Remarks: Caudal fin slightly forked. When surveyors use head lights at night to conduct survey, the eyes shine red, making it easy to find at night. They are more active at night.

Migration: The fish migrate to their annual spawning site during July to spawn.

C. Schistura moeiensis (Kottelat, 1990)

Moei's stream loach ခားပလ္လာ (Berperloo)



Size: 6 cm 60 mm TL.

Distribution: Bweloklo and its tributaries

Remarks: Body slender, brownish with black bar at the caudal fin base not.

Habitat: Occurs in clear flowing streams with silt, sand, gravel, and pebbles.

Migration: The migration or movement occurred during July and August. This is because the fish spawn during the flooding time.

D. Schistura similis Kottelat, 1996

Stream ခားပလ္လာ (Berperloo)



Size: 5 cm or 50 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurs in clear fast-flowing streams with sand, gravel, boulders, pebbles, and rocks on the bottom.

Remarks: Body slender, with complete lateral line. Black stripe on the based caudal fin. Red color line on the upper caudal fin.

Migration: Migration and spawning during July and August

E. Schistura pantherine

Leopard Loach ဘာပလ္းဘီးဘိုး (Berpalo Bortho)



Size: 7 cm or 70 mm TL

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurs in clear flowing streams with silt, sand, gravel, and pebbles.

Remark: It has an elongated body with a pale color of its truncate caudal type.

Migration: Took place during spawning time in early rainy season around July of the year.

F. Exostoma peregrinator (Ng & Vidthayanon, 2014)

Mustache stream batfish ညှိဖား (Nyaper Baw)



Size: 8 cm or 80 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurs in small creeks, streams, and medium rivers with rocky bottom.

Remarks: The body is not elongated with broader head to pointed tails. It has strong barbels and large peddles fin.

Migration: It migrates between mid-July to mid-Aug of the year, spawning inside holes beside the stream bank. The spawning sites are used every year.

G. Schistura cf. poculi

Stone loach ဝေးကံ့လူရိုချိုး Htie Keeghay Ghawmeh



Size: 6 cm 60 mm TL

Distribution: Upper Bweloklo and its tributaries.

Habitat: Occurs in clear flowing streams with silt, sand, gravel, and pebbles.

Remarks: Caudal fins black stripes and dorsal fin forked with red. Red started at the dorsal and fin and anal fins based to the tail with black spot and black stripes.

Migration: The migration or movement occurred during July and August of the year. This is because the fish spawn during the flooding time.

H. Schistura cf. poculi

Split bars stream loach (ဝေးကံ့လူ) (Htie Kee Ghay)



Size: 7 cm 70 mm TL

Distribution: Upper Bweloklo and its tributaries.

Habitat: Occurs in clear flowing streams with silt, sand, gravel, and pebbles.

Remarks: caudal fins and dorsal fin with black stripes. Along the back there are banded spots with black.

Migration: The migration or movement occurred during July and August of the year. This is because the fish spawn during the flooding time.

I. *Schistura reidi* (Smith, 1945)

Reid's stream loach ဘာပလ္းကံ့သူ (Berpaloo Keethoo)



Size: 8 cm or 80 mm TL.

Distribution: Upper Bweloklo and its tributaries, and endemic to the Salween River Basin (Suvarnaraksha et al 2023).

Habitat: Recorded in fast-flowing streams sties with sand, gravel, rocks on the bottom and bottom with litter.

Remarks: Body slender, brownish yellow, plain dorsal fin and caudal fins

Migration: Migration and spawning during July and August

J. *Exostoma* sp.

Sisorid catfish ညှိဖော် (Nya Per Blay)



Size: 5 cm 50 mm TL.

Distribution: Upper Bweloklo and its tributaries.

Habitat: Occurs in clear fast-flowing streams with sand, gravel, and rocky bottom.

Remarks: Whitish pink, body is slippery with a very silky appearance.

Migration: Migration and spawning during July and August.

K. Schistura sp.

Yuzalin Loach သာပလှိုပးကဲ့ (Berperloo Pie Kyie)



Size: 8 cm 80 mm TL.

Distribution: Upper Bweloklo and its tributaries.

Habitat: Occurs in clear fast-flowing streams with sand, gravel, and rocky bottom

Remarks: Blackish grey, barbel short with plain color caudal.

Migration: Migration and spawning during July and August

L. Schistura vinciguerrae (Hora 1935)

Stream loach (သာပလှိုင်ခိုခုလှို) (Berpalo Kee Ghaw)



Figure 27. i) the lateral view and b) Dorsal view of the fish

Size: 8 cm or 80 mm TL.

Distribution: Uper Bweloklo and its tributaries,

Habitat: Recorded in the areas of clear flowing stream with sand, stones, gravel, and bottom rocks.

At the time of writing, this specie is considered endemic to Salween River Basin (Suvarnaraksha et al., 2023).

Remarks: Body slender, with black vertical stripes and red bottom caudal fin.

Migration: The fish migrate up stream early raining season while their eggs are present in the body and migrate down in later raining season and spawn during July- August or the year.

3. Family: *Cobitidae*

A. *Cobitis* sp.

Dragon whip loach (ဗျို့နိုးလျှော့) P' Yoe Norplay



Figure 28. the photos A: dorsal view when the body is straight and B: dorsal view when the body is curved.

Size: 6 cm or 60 TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurs in fast-flowing streams with sandy to rocky substratum.

Remarks: Body slender, greenish brown to olive color. The small barbels present at the mouth part. The dorsal fin forms at the middle above the anal fin origin.

Migration: The migration behavior had not been observed, so the migration status in the local area is unknown.

B. *Lepidocephalichthys berdmorei* (Blyth, 1860)

Burmese mud loach ဗျို့ဝါးလျှော့ (Nya htie Ket)



Size: 8 cm or 80 mm TL.

Distribution: Bweloklo and its tributaries

Habitat: Found in slow-flowing streams, lakes, swamp paddy, canals with soft substratum.

Remarks: Body rather stout, light brownish with a series of irregular black spots along mid-lateral line. Caudal fin truncated or rounded. Scales absent on top of head. Caudal fin with 3-6 dark bars. A distinct black spot on the upper half of caudal fin case.

Migration: It migrates upstream in early rainy season for spawning and migrates downstream in late rainy season.

C. *Lepidocephalichthys guntea* (Hamilton, 1822)

Burmese mud loach ညုၢားဂံုံး (Nya Htie Ghee Met)



Site: 8 cm or 80 mm TL

Distribution: Bweloklo and its tributaries

Habitat: Occurs in slow flowing water, motionless water as well as clear standing waters⁵.

Remarks: Elongated body with dorsal spines, and anal soft rays.

Migration: Migrates upstream in early rainy season. If captured in early rainy season, some individuals are full of eggs.

D. *Cobitis sp. Acantopsis spectabilis* (Blyth, 1860)

Salween horse face loach ဥ္ပားကသွိုံ (Htie Ket kthay)



Size: 20 cm or 200 mm TL

Distribution: Bweloklo and its tributaries

Habitat: Found in slow- to fast-flowing streams with sandy and muddy bottom.

Remarks: Body slender, light brown with black blotches along the lateral line. Snout long with a stripe from tip to eye. Mouth is inferior.

Migration: Unknown

⁵ https://www.fishbase.org/summary/Lepidocephalichthys_guntea.html

4. Family: *Anabantidae*

A. *Anabas testudineus* (Bloch, 1792)



Climbing perch ညုသုသံ (Nyathue)

Size: 15 cm 150 mm TL.

Distribution: Bweloklo and its tributaries lakes, and swamp.

Habitat: Found in slow-flowing rivers, lakes, swamps, and canals.

Remarks: Body stout, greenish gray with black freckles, a round blotch on gill cover and on caudal fin base. Dorsal fins with spines. It is an air-breathing species.

Migration: Breeding has been not recorded, but often seen with eggs inside the body and has been seen caring for its juvenile during August and September.

B. *Channa limbata* (Cuvier, 1831)



Dwarf snakehead ညုလုပ်ဖို (Nyalee Plo)

Size: 30 cm or 300 TL.

Distribution: Bweloklo and its tributaries

Habitat: Found almost everywhere in mountain streams, canals, swamps, rice fields and rivers.

Remarks: Body slender, brownish. Dark bands on pectoral fin base. Margin of median fins white, orange, or reddish (Suvarnaraksha an Utsugi, 2023).

Migration: It observed by the research team member that during early rainy season, migrates upstream and migrates downstream in late rainy season. The spawning site is found in river sides, paddy fields and lake sides around May and June of the year. This fish is attentive to survival of

their eggs and juveniles.



C. *Channa punctata* (Bloch, 1793)

Size: 31 cm or 310 TL but the common size is 15 cm TL⁶

Distribution: Bweloklo and its tributaries

Habitat: Found in ponds, swamps, brackish water, canals, rice fields and rivers with slow flowing water.

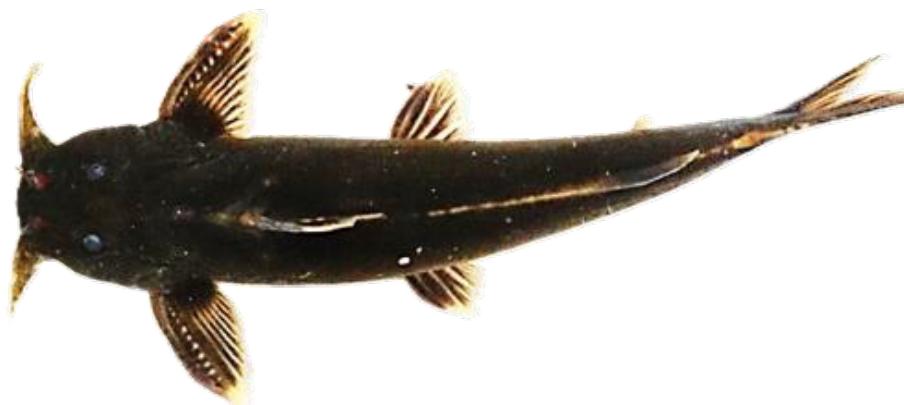
Remarks: Body slender, brownish. Dark bands on pectoral fin base. Margin of median fins white, orange, or reddish

Migration: Spawns in early raining season around May and June with strong parental care.

5. Family: *Sisoridae*

A. *Glyptothorax cf. burmanicus*

Burmese stream sisorid ညုပ်ဖွေ့နှုန်း (Nyaper Shu Thoo)



Size: 22 cm or 220 TL.

Distribution: Bweloklo and its tributaries

Habitat: Found in clear and fast-flowing streams with pebbles and rocks on the bottom.

Remarks: Body slender, dark grey with small, ovoid yellow patches in the nuchal region and the anterior quarter of the adipose fin. Skin smooth. Depressed area in the thoracic adhesive apparatus in 'laurel wreath shape' with a round space in the center (Suvarnaraksha an Utsugi, 2023).

Migration: Migrates during July and August for spawning

6 https://www.fishbase.org/summary/Channa_punctata.html

B. Oreoglanis sp.

Stream batfish ညုံဖော်ပို့ခို့ (Nyaper beeko)



Size: 8 cm or 80 TL.

Distribution: Bweloklo and its tributaries

Habitat: Occurs in fast-flowing creeks and streams with pebbles, stones, and rocks on the bottom.

Remarks: Flat head with nasal barbels, fin tip not reaching pelvic-fin origin, short pelvic fin, long pre-dorsal length, and thick and short caudal peduncle.

Migration: Migrates during July and August for spawning.

C. Glyptothorax trilineatus (Blyth, 1860)

Stream sisorid ညုံဖွေ့ချုံ (Nyaper shu)



Figure 25. Dorsal and ventral view of Glyptothorax trilineatus

Size: 18 cm or 180 mm TL.

Distribution: Bweloklo and its tributaries

Habitat: Occurs in clear and fast-flowing water with sandy, stoney streams and rocks on the bottom.

Remarks: Body rather stout, brownish with nasal barbel reaching eye. Thoracic adhesive apparatus in heart shape.

Migration: It migrates during the July for spawning upstream and moves downstream around September of the year.

6 Family: *Siluridae*

A. *Pterocryptis burmanensis* (Thant, 1966)



Size: 20 cm or 200 TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Recorded in the small streams, small ponds with rocky and sandy bottom, and paddy field especially during the raining season.

Remarks: Has elongated form with light brownish pink. It has long barbels and caudal of truncate types.

Migration: There is no clear evidence of the fish migrating as a group to spawn in any seasons, but it is caught using bamboo basket traps during the early raining season as it migrates upstream and later downstream in the raining season.

B. *Pterocryptis cochinchinensis* (Valenciennes, 1840)

Catfish ပွဲဝါးလာ (Nya Peh Lah)



Size: 40 cm or 400 mm TL

Distribution: Upper Bweloklo and its tributaries

Habitat: Recorded in the small streams, small ponds with rocky and sandy bottom, and paddy field especially during the raining season.

Remarks: Has elongated form with dark greenish brown coloring. It has long barbels and caudal of truncate types.

Migration: There is no evidence recorded yet of the fish migrating as a group to spawn in any season, but it is caught using bamboo basket traps during the early raining season as it migrates upstream and later downstream in the raining season. Mostly active at night feeding on small fish, insects and crustaceans.

7 Family: *Synbranchidae*

A. *Monopterus albus* (Zuiew, 1793)

Rice Swamp Eel တံ့တ္ထဲလို (Teetue Lah)

Size: 100.0 cm or 1,000 mm TL

Distribution: Swamp, small lakes, marshes beside Bweloklo and its tributaries

Habitat: Recorded in marshes slow flowing ponds or motionless water and in the mud of freshwaters.

Remarks: Anguilliform body; no scales; no pectoral and pelvic fins; dorsal, caudal and anal fins confluent and reduced to a skin fold; gill openings merged into single slit underneath the head. Body elongated, brownish green with some dark freckles. No fins, only one gill-opening on the ventral side but large mouth and small eyes. Body shape is eel-like⁷.

Migration: Eels are often seen migrating upstream during rainy season and moving upstream to downstream in late raining season, but there has been no record of spawning sites.



B. *Monopterus javanensis* (Lacepède, 1800)

Oriental Swamp Eel တံ့တ္ထဲဘိ (Teetue Baw)



Size: 100.0 cm or 1,000 mm TL

Distribution: Paddy, swamp, lakes, muddy areas beside Bweloklo and its tributaries

Habitat: Occurs in slow-flowing or stagnant freshwaters.

Remarks: Anguilliform body; no scales; no pectoral and pelvic fins; dorsal, caudal and anal fins confluent and reduced to a skin fold; gill openings merged into single slit underneath the head. Has greatly reduced fins, and a single V-shaped gill-opening beneath the throat rather than twin lateral gill-openings as in other fishes⁸. It has yellow skin with grey spots on it. They are mainly nocturnal, emerging to feed on fishes, crustaceans, and other invertebrates.

Migration: Eels are often seen migrating upstream during rainy season and moving downstream in late raining season, but there has been no record of spawning sites.

7 https://www.fishbase.org/summary/Monopterus_albus.html

8 <https://www.ecologyasia.com/verts/fishes/asian-swamp-eel.htm>

Below are the fish families of which only one species in each family has been recorded;

8 Family: *Anguillidae*

A. *Anguilla bengalensis* (Gray, 1831)

Indian mottle eel ဥပါဝါ (Nya Htee)



Sizes: 150 cm SL

Distribution: Upper Bweloklo and its tributaries.

Habitat: Occurs in freshwater streams, pools and reservoirs and commonly found in mud substrates of tanks and in deep rock pools of rivers

Remarks: Dorsal fin origin at the midway between gill opening and origin of anal fin. It has elongated body, terminal mouth type⁹.

Migration: Migration and spawning season is locally unknown to the local villagers at the survey site.

9 Family: *Balitoridae*

A. *Balitora burmanica* (Hora, 1932)

Burmese stream loach ဥပါဝါလူး (Nyapern Dollei)



Size: 7 cm or 70 mm TL

Distribution: Upper Bweloklo and its tributaries.

Habitat: Mostly in the clear fast flowing water when sand, stone and rocky bottom occurred in the river.

Remarks: Dorsal fin origin above pelvic fin origin. It has circular island like look on the dorsal view.

Migration: There has been no record of mass migration during the spawning time of the year around July and August of the year.

Cultural importance: This fish species is considered a sacred species, so the Indigenous Karen people, especially the Animist community, do not eat this fish.

⁹ <https://www.fishbase.org/summary/SpeciesSummary.php?ID=1272&genusname=Anguilla&speciesname=bengalensis&AT=Anguilla+bengalensis&lang=English>

10. Family: *Cichlidae*

A. *Oreochromis niloticus* (Linnaeus, 1758)

Nile Tilapia ညုပိုဘာ (Nyapaw Gha)

Size: 30 cm or 300 mm TL.

Distribution: Small lakes beside upper Bweloklo and its tributaries.

Habitat: Occurs in both still water and slow-flowing waters particularly lake like habitat.

Remarks: Body deep, compressed, with about 10 dark bars. Caudal fin rounded with many dark stripes. Dorsal fin with 15-18 spines and 6-8 soft rays.



Migration: This fish species has not been seen not to migrate at all because the spawning time is locally unknown, but commonly seen from the late summer to the early rainy season beside their habitat.

11. Family: *Clariidae*

A. *Clarias batrachus* (Linnaeus, 1758)

Walking catfish ညုကို့သီ (Nyakobaw)



Size: 30 cm or 300 mm TL.

Distribution: Upper Bweloklo and its tributaries

Habitat: Occurs in main canals, tributaries, swamps, ditches, reservoirs, peat swamps with sandy, muddy, and silty bottom.

Remarks: Body robust and relatively short, dark grey. It also has pointed pectoral spines and long barbels.

Migration: This fish is often seen traveling upstream from the lake to the paddy fields and spawning around lakes, riversides, and paddy fields during the month of May-June of the year. Their parental care of their eggs and juveniles was easily and obviously observed. There are some farmers who strongly protect this fish during their spawning times, because they use the fish as pest control in their paddy fields to eat caterpillar and other insects.

12. Family: *Heteropneustidae*

A. *Heteropneustes fossilis* (Bloch, 1794)

Asian stinging catfish ညှိဆို (Nya Cha)



Size: 30 cm or 300 mm TL

Distribution: Lermuplaw paddy fields, Klawklaw Lo lakes and swamp areas.

Habitat: Recorded irrigation canals, swamps, ditches, reservoirs, peat swamps, muddy, silty bottom, still water and slow-flowing waters.

Remarks: It has slim body, dark grey to purple. It has long barbels and pointed pectoral spines. Its spine is venomous, which is very painful for humans.

Migration: It has been observed moving during rainy season and breeding during the season close to its original habitat.

4.4 Spiritual Practices and the Protection of Fish Sanctuaries

Different religious ceremonies are held throughout the year at customary territories and protected fishponds. The main faiths in the area are Animism and Christianity. During our survey period, five ordination ceremonies were conducted by animist communities to bless their fish sanctuaries, while Christian groups held prayer ceremonies at three of their own protected sites.

These sanctuaries hold deep cultural and ecological significance. They serve as refuges that help maintain fish genetic diversity and allow species to mature and spawn successfully. The ceremonies reflect the deep spiritual connection local communities maintain with their environment. By combining human care with spiritual guardianship, people believe their protection efforts are strengthened and more effective.

4.5 Priority species spawning management of biocultural species

Information on migration seasons, migration routes (upstream or downstream), spawning sites, and spawning periods of each species was collected through interviews with local community members. These data are important for understanding species identification, ecological behavior, and habitat preferences.

After discussion, three species were selected for future community hatching experiments: Nyanna, (Bangana sp.), Nya Ken Meh (Ageneiogarра sp.), and Poropuntius bantamensis. These species were chosen because they spawn during the winter and summer seasons, which allows easier control of water level, water quality, and other environmental conditions at breeding sites. In addition, collecting eggs and sperm, as well as assessing spawning readiness, was relatively straightforward for these species. They are also easy to feed, and their natural food sources are readily available.

4.6 Other introduced species

The introduced species include: *Oreochromis niloticus* (Nile tilapia) ဥပါဒီလာ and *Heteropneustes fossilis* ဥပါဆု (Stinging Catfish)

These introductions occurred at different times and under different circumstances. In 1975, for example, Pastor Carn Thin introduced Blue Tilapia (*Oreochromis aureus*) from Rangoon into his personal pond. The fish was first raised in small ponds but later escaped into the river system during heavy floods. Over time, the species spread into small ponds, paddy fields, and swamp areas around Lermuplaw village. Its presence provided both nutritional benefits to local people and pest control for farmers. Many farmers believe that this fish lives in shallow water in the paddy fields, shaking the rice plants to feed on falling insects and spiders. Blue Tilapia is widely appreciated among local people.

In 1988, a villager named Saw Thine Lay introduced Stinging Catfish into his pond to deter others from stealing his fish. However, this species also escaped and spread throughout the area. It later became an important food source and helped control pests, although people generally dislike it because of its painful sting and quick adaptation to the local environment. Over time, it has become an invasive species that many locals believe has reduced the population of other native catfish, particularly *Clarias batrachus*.

Today, both Blue Tilapia and Stinging Catfish are found not only in lakes but also in community ponds, where villagers, especially paddy farmers, regularly raise and harvest them. Despite their mixed reputations, these species remain an important part of the local diet and contribute to food security.

4.7 Reflection on community fish identification

The meeting conducted with the local expert for final fish identification, which was attended by more than 50 local experts and leaders, concluded with a very fruitful response. One of the responses was that the Luthaw Township chairperson, Saw Lay Ker, who was also a Karen Indigenous knowledge expert, stated:

“We do not recognize how many fish species exist in our area. We cannot even name all of them, so this research is very useful and important for understanding our resources. It helps us to gain knowledge of our own fish biodiversity and to understand the need for ongoing studies to better manage and protect these species”

After the meeting, many discussed priority species among themselves in their areas and how they would take actions after that meeting which included awareness raising and protecting the fish diversity.



5. DISCUSSION

In the duration of the survey, which was only about one year with three seasons, we were able to cover mostly all-important parts of the fish survey. Combining the use of local knowledge and western science, the team could record about 90% of fish species in the upper Bweloklo and its tributaries. According to the interview of local villager Saw Plo Hser, only 4 species of fish known by the local people excluded from this recorded. We used a variety of methods that are good for fish data collection in the field. The additional materials that we used included reference books, Google searches, and local help. We could successfully identify 30 species recorded from the river. The other 10 species were able to be identified up to the genera by Dr. Apinun Suvarnaraksha and Ajarn Sahat Ratmuangkhwang, while the rest of the (4) other species remain either unknown or new species to our team and fish experts.

Our main weakness is the lack of proper materials, such as a good camera, especially one with a micro zoom function to take clearer photos for experts to help identify the fish species. The unclear photos made it more difficult for experts to identify some of the unknown fish. In addition, some species identified by experts were marked as uncertain at the species level.

In the future, we plan to extract DNA samples for further identification, since some of these fish have never been recorded in the Salween River. Moreover, some species occur only in the upper Bweloklo and its tributaries, but not in the lower river. The lower river refers to the waters below a hundred-meter-high waterfall that divides the Bweloklo into upper and lower parts, completely blocking fish migration.

Further research is still needed to locate additional species mentioned by local people as either sacred or rare. With the help of local knowledge sharing and storytelling activities, we were able to detect most species in the field survey sites. We also obtained valuable information on fish management and conservation practices.



6. CONCLUSIONS

This first survey of the Upper Bweloklo and its tributaries combines Western scientific identification methods with Indigenous Karen knowledge of the environment. The results indicate that the Bweloklo basin remains relatively intact and highly diverse, yet until recently, little was known about its fish diversity and abundance. Threats to the river ecosystem had also never been studied to guide conservation action, even though local communities have long expressed concern about declining fish populations and their effects on livelihoods that depend on a healthy and functioning ecosystem.

This fish research project therefore marks an important step toward understanding and documenting fish species in the upper Bweloklo region of Luthaw Township, Mutraw District, within the Salween Peace Park. No previous fish survey in this area had ever been conducted in collaboration with groups outside the local communities. Located in a conflict-affected zone, the region has remained isolated from the outside world for more than seven decades. This survey represents the first opportunity to systematically study fish in the upper Bweloklo and its tributaries.

Through collaboration with local leaders, elders, fishers, and community members, extensive fieldwork was carried out across seven streams, two lakes, and one paddy field. A total of 46 fish species were recorded, many of which are previously unknown to science. The survey also led to the discovery of four new species. These records have been compiled into a fish inventory database and published in this report.

Although this is the first survey, its findings are highly significant. By focusing on species identification, local knowledge, and habitat observations, this study produced important insights into the ecology of the region. Comparing traditional knowledge with scientific classification has helped to improve understanding of local biodiversity and laid a strong foundation for community-based conservation and research.

This project has also strengthened knowledge among both researchers and local villagers, many of whom have developed a greater interest in protecting their rivers and fish populations. Our goal is to continue this work through ongoing training on fish identification, awareness programs, and support for spawning and habitat restoration activities. The knowledge gained will enable future surveys to expand to other rivers and tributaries in the region.

In addition, the water quality data collected during this study will help monitor seasonal changes and track population trends, particularly among rare or declining species. By involving more community members, youth, and women's groups in future research, we aim to strengthen community capacity for fish management and conservation practices. We are deeply grateful to the local villagers who welcomed us into their protected fish sanctuaries and conducted fish ordination ceremonies before our surveys. These rituals reflect mutual respect and solidarity between researchers and the community.

We extend our sincere thanks to all local experts, leaders, and youth who participated in this work. This research was made possible through your knowledge, guidance, and commitment to the future. Together, we can continue learning from the rivers, protecting the fish, and caring for the lands that sustain us. We hope this study will serve as a model for other villages and communities within the Salween Peace Park and beyond. Protecting fish is not only about conserving biodiversity, but also about safeguarding food sources, cultural traditions, and the balance of freshwater ecosystems. With continued effort, we believe our rivers will remain healthy and full of life for generations to come.

The Karen Environmental and Social Action Network (KESAN) women research team will continue studying fish and other forms of biodiversity across Karen State and is maintaining a growing collection of data and photographs. Further research is encouraged, and the KESAN women research team welcomes collaboration with external researchers to expand upon this study. KESAN can also provide training, capacity building, and fieldwork support for local people to carry out additional studies and share their results. We invite anyone interested in advancing the understanding of the Bweloklo and its tributary ecosystems within the Salween Peace Park to join this effort.

7. RECOMMENDATIONS

The following six recommendations are emerging after one year of research.

- 1) The findings and recommendations of our research need to be translated into policy recommendations for the Karen National Union to establish localised conservation strategies.
- 2) Research should be conducted on the effect of fruit trees that grow next to the river. These have long been planted by local communities in order to provide food for fish. This biocultural research could inform the protection of the habitat and food-base of fish in the upper Bweloklo and its tributaries. Trees are also planted next to the river to cool water and create safe spawning sites, which are increasingly important as climate change impacts the future. These and other climate mitigation efforts are also in need of more research to better understand and support them.
- 3) The research should be continued in a subsequent (ideally 3-year) phase that would enable the observation of the research sites/findings over a longer period. This will give us a chance to research subspecies and find species that have been reported in the area by local people before but which we haven't found yet. These include rare and culturally significant species such as the Axe Nyanna fish and red Nya Khen Meh (red colour), which are believed to be endemic. There is also a sucker species/loach and a small hill stream eel that we haven't found yet.
- 4) Locally held beliefs and cultural/spiritual practices related to the upper Bweloklo and certain species should be better understood and researched. The first phase of the survey conducted covered a wide range of topics, such as the name, description, and habitat of species and their

colour, size, nutritional importance, and best times to capture them. The species' role in culture and religion was also included, but people are reticent to speak about this.

- 5) Awareness of the biological and cultural importance of the Bweloklo and its species should be raised in local communities and schools to motivate and educate them. This will increase support for locally-led conservation efforts. Young people should be trained by their elders in managing traditional spawning sites.
- 6) As a scientific recommendation to explore the possible implementation of ex-situ / in-situ artificial hatchings. Nyanna species are suitable for this experiment since, unlike other species, it is easy to collect eggs and teste during spawning.

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APPENDIX I

Order	Family	Scientific names	Common names	Local Name	IUCN
Anguilliformes	Anguillidae	<i>Anguilla bengalensis</i> (Gray, 1831)	Indian mottled eel	ဘုရား	NT
Cypriniformes	Balitoridae	<i>Balitora burmanica</i> (Hora, 1932)	Burmese stone loach	ဘုရားလှိုင်	LC
Cypriniformes	Cobitidae	<i>Lepidocephalichthys berdmorei</i> (Blyth, 1860)	Burmese loach	ဘုရားခဲ့ခဲ့	LC
Cypriniformes	Cobitidae	<i>Lepidocephalichthys guntea</i> (Hamilton, 1822)	Burmese loach	ဘုရားခဲ့ခဲ့	LC
Cypriniformes	Cobitidae	<i>Cobitis</i> sp.	True loaches	ပယာနိုင်များ	LC
Cypriniformes	Cobitidae	<i>Acantopsis spectabilis</i> (Blyth, 1860)	Horseface loach	ဝေးခဲ့ကုသ္ထု	
Cypriniformes	Cyprinidae	<i>Hypsibarbus</i> sp	Ray-finned fish	ဘုရားပိုင်သို့	LC
Cypriniformes	Cyprinidae	<i>Neolissochilus stracheyi</i> (Day, 1871)	Minnows	ဘုရားပျော်	
Cypriniformes	Cyprinidae	<i>Poropuntius bantamensis</i> (Rendahl, 1920)	Ray-finned fish	ဘုရားသို့	
Cypriniformes	Cyprinidae	<i>Devario browni</i> (Regan, 1907)	Danio	ဘုရားခိုး	VU
Cypriniformes	Cyprinidae	<i>Devario regina</i> (Fowler, 1934)	Queen 'Danio	ဘုရားဘိုး	LC
Cypriniformes	Cyprinidae	<i>Scaphiodonichthys burmanicus</i> (Vinciguerra, 1890)	Ray-finned fish	ဘုရား	
Cypriniformes	Cyprinidae	<i>Garra nasuta</i> (McClelland, 1838)	Khasi garra	ဘုရားတို့နဲ့	LC
Cypriniformes	Cyprinidae	<i>Garra</i> cf. <i>salweenica</i>	Black Garra	ပတို့နဲ့	
Cypriniformes	Cyprinidae	<i>Ageneiogarra</i> sp.	Giant Garra	ဘုရားလှိုင် (ဘုရားခဲ့တို့)	
Cypriniformes	Cyprinidae	<i>Bangana</i> sp.	Carp	ဘုရားနဲ့	

Order	Family	Scientific names	Common names	Local Name	IUCN
Cypriniformes	Cyprinidae	<i>Garra</i> sp.	Karin-hills Garra	လျှို့ပတ္တာ	DD
Cypriniformes	Cyprinidae	<i>Garra</i> sp.	Red Garra	ပတ္တာနားဒွို့	
Cypriniformes	Cyprinidae	<i>Neolissocheilus</i> sp.	Minnows	လျှို့ပုံး	
Cypriniformes	Cyprinidae	<i>Garra surinbinnani</i>	Nose logsucker	ပတ္တာနားခွဲသူ	
Cypriniformes	Cyprinidae	<i>Tor tambroides</i> (Bleeker, 1854)	malseer	လျှို့ပုံး	DD
Cypriniformes	Nemacheilidae	<i>Nemacheilus</i> sp.	Ray-finned fish	ထိုးဆံ့ပုံးနှင့်တိုး	
Cypriniformes	Nemacheilidae	<i>Exostoma berdmorei</i> (Blyth, 1860)	sisorid catfish	လျှို့စော်	
Cypriniformes	Nemacheilidae	<i>Schistura moeiensis</i> (Kottelat, 1990)	Ray-finned fish	ဘာပလ္လာ	LC
Cypriniformes	Nemacheilidae	<i>Schistura pantherina</i>	Leopard-käärtrull	ဘာပလ္လာဘို့	
Cypriniformes	Nemacheilidae	<i>Exostoma peregrinator</i> (Ng & Vidthayanon, 2014)	sisorid catfish	လျှို့စော်	
Cypriniformes	Nemacheilidae	<i>Schistura cf. poculi</i>	stone loach	ထုံးကံ့ပုံးလွှာ	
Cypriniformes	Nemacheilidae	<i>Schistura cf. poculi</i>	Ray-finned fish	ထုံးကံ့ပုံး	
Cypriniformes	Nemacheilidae	<i>Schistura reidi</i> (Smith, 1945)	Ray-finned fish	ဘာပလ္လာဘို့	
Cypriniformes	Nemacheilidae	<i>Exostoma</i> sp.	sisorid catfish	လျှို့စော်	
Cypriniformes	Nemacheilidae	<i>Schistura</i> sp.	Ray-finned fish	ဘာပလ္လာပုံး	
Cypriniformes	Nemacheilidae	<i>Schistura vinciguerrae</i> (Hora 1935)	Red Tail Zebra Loach	ဘာပလ္လာဘို့	
Perciformes	Anabantidae	<i>Anabas testudineus</i> (Bloch, 1792)	Climbing perch	လျှို့သုံး	LC
Perciformes	Channidae	<i>Channa limbata</i> (Cuvier, 1831)	dwarf snakehead	လျှို့လုံးပုံး	LC

Order	Family	Scientific names	Common names	Local Name	IUCN
Perciformes	Channidae	<i>Channa punctata</i> (Bloch, 1793)	Spotted snakehead	ညားလွှာ	LC
Perciformes	Cichlidae	<i>Oreochromis niloticus</i> (Linnaeus, 1758)	Nile tilapia	ညားဘဲလွှာ	LC
Siluriformes	Clariidae	<i>Clarias batrachus</i> (Linnaeus, 1758)	Walking catfish	ညားကိုး	LC
Siluriformes	Heteropneustidae	<i>Heteropneustes fossilis</i> (Bloch, 1794)	Stinging catfish	ညားဆဲ	LC
Siluriformes	Siluridae	<i>Pterocryptis burmanensis</i> (Thant, 1966)	Catfish	ညားပုံ	DD
Siluriformes	Siluridae	<i>Pterocryptis cochinchinensis</i> (Valenciennes, 1840)	Catfish	ညားပုံလွှာ	LC
Siluriformes	Sisoridae	<i>Glyptothorax cf. burmanicus</i>	Three-lined catfish	ညားစုံအိုး	
Siluriformes	Sisoridae	<i>Oreoglanis</i> sp.		ညားစုံဘိုး	
Siluriformes	Sisoridae	<i>Glyptothorax trilineatus</i> (Blyth, 1860)	Three-lined catfish	ညားစုံအိုး	LC
Synbranchiformes	Synbranchidae	<i>Monopterus albus</i> (Zuiew, 1793)	Rice Swamp eel	တံတွေလွှာ	
Synbranchiformes	Synbranchidae	<i>Monopterus javanicus</i> (Lacepède, 1800)	Rice Swamp Eel	တံတွေဘိုး	





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