

# **River System and Livelihood Status of Fisher Folk Communities in Temburong District of Brunei Darussalam**

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## **Abstract**

The intricate relationship between the river system in Temburong and the livelihoods of the Fisher Folk community highlights the vital role that rivers play in shaping both the environment and the socioeconomic fabric of the region. As we navigate the delicate balance between sustainable resource management and the well-being of local communities, it becomes evident that the conservation of the river system is not just an environmental imperative but a crucial aspect of safeguarding the very livelihoods that depend on it. By fostering responsible stewardship and collaborative efforts, we can strive to ensure the longevity of this intricate ecosystem, providing a foundation for both environmental resilience and the prosperity of the Fisher Folk community for generations to come. And lastly, the need for further study on this topic is underscored by the scarcity of information in existing published documentation. Given the limited available data, additional research is essential to fill the gaps in our understanding and acquire a more comprehensive insight into the subject. Exploring uncharted territories and conducting in-depth investigations will be instrumental in addressing the current knowledge limitations and expanding the scholarly discourse on this particular topic.

**Keywords:** *River system, Fisher Folk, Communities, Livelihoods, sustainability, Temburong, Brunei Darussalam.*

## **1. Introduction**

The Temburong River system, situated in the Temburong district of Brunei, holds a pivotal position within the country's hydrological landscape. It forms an integral part of Brunei's river basins, alongside the Brunei, Tutong, and Belait Rivers (Azffri et al., 2022; King and Knudsen, 2021). Flowing generally northward toward the South China Sea, this river serves as a significant water source for the region. In particular, the Temburong River and its environs play a crucial role in supporting agricultural endeavors, specifically by supplying water for irrigation purposes (Andersson, 2012). The river and its tributaries actively contribute to the diverse biodiversity of the area, sustaining a wide array of plant and animal species. In the context of Brunei's agricultural sector, the Temburong River system emerges as indispensable, ensuring a sustainable water supply for irrigation and thereby fostering the country's agricultural development (Azffri et al., 2022). Current environmental studies focus on assessing the quality

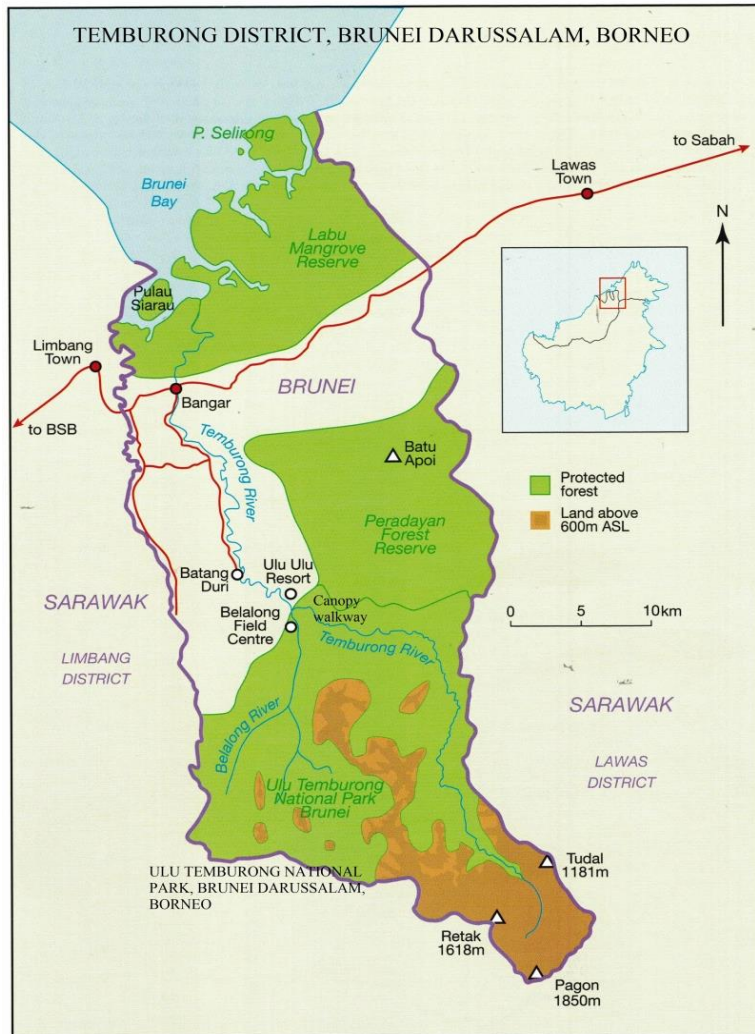
and suitability of the river's water resources for agricultural use, highlighting the system's importance in supporting the local agricultural industry (Azffri et al., 2023; King and Knudsen, 2021). The research intends to obtain deeper understanding on the current status of the Socio-spatial and livelihood of ethnic minorities in Temburong district of Brunei Darussalam. The focus is on selected ethnic minorities in Temburong which is the Iban community as they are relatively under reached (King and Knudsen, 2021). In spite of Iban ethnicity is rich with culture, languages and identity, they are not included as the indigenous group (Puak jati) of the sultanate country (King and Knudsen, 2021; Andersson, 2012).

Beyond its agricultural significance, the Temburong River system stands out as a prominent natural feature that contributes significantly to Brunei's rich biodiversity. The surrounding area, encompassing the river's watershed, serves as a habitat for diverse plant and animal species, solidifying its status as a crucial ecological zone in the country (King and Knudsen, 2021). The river and its tributaries actively support various forms of wildlife, playing an integral role in the region's natural heritage. The Temburong River system (Figure 1) is also a site of ecotourism, with initiatives such as the Sumbiling Eco Village promoting sustainable tourism practices in the area (Idris et al., 2019; Andersson, 2012). The region's natural beauty and diverse ecosystems make it an attractive destination for both locals and tourists. However, sustainable development in the area faces numerous challenges including the need for effective management of natural resources and the potential impact of human activities on the environment (Idris et al., 2019). Moreover, the Temburong River system faces several challenges in the modern era including the impact of urbanization, industrialization, and contemporary agricultural methods on water quality and aquatic life (Choy & PK, 1994). Overall, the Temburong River system stands as a vital element in Brunei's hydrology, playing a pivotal role in supporting agricultural activities and enriching the region's biodiversity. Its importance transcends environmental, economic, and ecological realms making it an invaluable natural resource for the country.

The Temburong River system is situated in the Temburong District, an exclave of Brunei enclosed by Malaysia and the Brunei Bay. Flowing through the district, the river, particularly the Sungai Pandaruan River, delineates the western border with Malaysia. Renowned for being Brunei's most mountainous and rugged area, it culminates at Mount Pagon, reaching 1,850 meters above sea level (see Fig 1). Approximately 75 percent of Brunei's territory, primarily the upper hills, is covered by dense, uninhabited tropical jungle. Serving as drainage for the entire Temburong District, the river is a crucial water source, supporting agriculture and contributing to biodiversity (Anak, 2016).

Brunei's undulating landscape features expansive green valleys and gentle, rolling hills (King and Knudsen, 2021). The narrow coastal plain is intersected by the Brunei, Belait, Tutong, and Temburong rivers, which drain into the sea. Mangrove swamps extend from the coast, covering much of the lowland estuaries of these rivers (Figure 1).

The Temburong River system plays a vital role in Brunei's geography, offering a diverse and scenic backdrop that sustains agricultural and ecological endeavors in the region (Fig. 1, 2, and 3). The Temburong River system is a vital resource for the Fisher Folk community in Brunei. The river system is home to a diverse range of fish species which are a significant source of food and income for the community. However, due to the transition towards modernization, there has been a noticeable reduction in the fisher folk community. This study has explored the relationship between the Temburong River system and the Fisher Folk community's livelihood status. The study has examined the challenges faced by the Fisher Folk community in sustaining their livelihoods and the impact of these challenges on their economic and social well-being. This study has also explored the measures that can be taken to address these challenges and promote sustainable livelihoods for the Fisher Folk community. The essay has been drawled on various sources including academic articles, reports and case studies to provide a comprehensive analysis of the topic.



**Figure 1:** The Map of Temburong District, Brunei Darussalam, of the Borneo Islam (Map)

source: <https://uluulublog.wordpress.com/2017/05/29/map-the-ulu-ulu-resort-and-the-belalong-canopy-walkway/>; retrieved on January 15, 2024).

## 2. The aim and Objectives of this Study

By examining the relationship between the Temburong River system and the Fisher Folk community's livelihood status, this study aims to;

- i) Analyze the impacts of the Temburong District development and the status of the Fisher Folk community in the region.

In order to achieve this aim, a few objectives are employed; there are,

- i) Drawing the connection between the river system and the population of Temburong district.
- ii) Examining the status of the fisher folk community and assessing the challenges and their turning points.

### 3. The Geographical Location and Characteristics of Brunei Darussalam

Brunei Darussalam, officially Nation of Brunei, the Abode of Peace, is lying in the Southeast Asian Malay Archipelago and is situated on the equatorial line between the southern and northern hemispheres and is placed at latitudes and longitudes of approximately 4° 30'N and 114° 40'E, respectively (Fig 2). Brunei Darussalam is located on the northwest coast of Borneo Island, an island that also belongs to Indonesia and Malaysia (Fig. 2). Its capital city is Bandar Seri Begawan. The country is divided into east and west areas throughout Malaysian northern part and state of Sarawak of the Island. The western part of Brunei is predominantly hilly lowland, whereas the eastern part consists of primarily rugged mountain terrain. So, apart from Brunei Darussalam coastline to the South China Sea (Fig. 2), it is surrounded by the East Malaysian state of Sarawak. Brunei shares a 266 km (165 mi) (CFE-DM, 2018) border with Malaysia and Sarawak has an enclave, the district of Limbang, along the Limbang River that splits Brunei Darussalam into that two separate parts (Fig. 2; GIS Lab UBD, 2020; comp. Flood Maps, 2020) (Brown, 1970, p.132; Hassan, 1988; CDD, 1993, 2008; Ibrahim, 2005; Khatib and Sirat, 2005). Brunei Darussalam is the one state located entirely on the island of Borneo (named in Indonesia Kalimantan Island). The summit ridge of Bukit Pagon, in the western part contains the highest point of the country with an elevation of 1850 m above sea level. The lowest point is the South China Sea (0 m). The coast has a vast, tidal and swampy plain.

Important for any to be developed recommendations or suggestions on approaches to mitigation measures is the appearance of spatial regional organization of any geographical location in order to provide a possible adaptability on the ground – and so for this case study location of Temburong District, together with its direct district surroundings: Brunei Darussalam consists of four districts (or daerah): 1) the extensive Belait District in the southwest, 2) the here assessed Tutong District in the middle, 3) the Brunei-Muara District that surrounds the capital Bandar Seri Begawan, and 4) the separate Temburong District in the east (Fig. 1 and 2), (CDD, 1993, 2008; Ibrahim, 2005; Khatib and Sirat, 2005). The daerah of Temburong is physically separated from the rest of Brunei by the Malaysian state of Sarawak (Fig. 2 and 1).

Table 1. Four districts (daerahs) in Brunei Darussalam (NIDM, 2014)

No.	District - <i>Capital</i>	Population (2019 Census)		Area (km <sup>2</sup> )
		Population	%	
1.	Belait - <i>Kuala Belait</i>	75,900	(16,5 %)	2,724
2.	Tutong - <i>Pekan Tutong</i>	52,700	(11.5 %)	1,166
3.	Brunei-Muara - <i>Bandar Seri Begawan</i>	319,500	(69.5 %)	571
4.	Temburong - <i>Pekan Bangar</i>	11,400	(2.5 %)	1,304

[No. District – Capital Population (2019 Census) Area (km<sup>2</sup>) Source: UN Population Senses, 2019.]

The case study area of this research is Temburong District is one of the four districts of Brunei Darussalam, making it the third-largest of the districts (comp. Fig. 1, Tab. 1). The district borders the South China Sea to the north, the Malaysian state of Sarawak to the east, and the Belait District to the west which the Bruneian government owns. The district is located at latitude 4.801890, longitude 114.652090 (or GPS

coordinates of 4° 48' 6.804" N, 114° 39' 7.524" E) (Fig. 1 and 2) (GIS Lab UBD, 2020; comp. FloodMaps, 2020). The countries – and partially Tutong Districts – land boundaries being covered together with the neighbouring country of Malaysia is approximately 381 km (Hassan, 1988; CDD, 1993, 2008; Ibrahim, 2005; Khatib and Sirat, 2005; Omar, 2005).



**Figure 2.** The geographical location of Kampong Ayer and characteristics of Brunei Darussalam ((Source: Brunei physical map <https://www.peta-hd.com/2019/03/peta-brunei-darussalam.html>, accessed on 27<sup>th</sup> November 2019).

So, each district consists of several sub-districts (mukims), which are 38 mukims in total. A mukim itself further consists of a group of kampongs or villages. The further Kampongs (Villages) are Bangar, Kampong Batu Apoi, Kampong Belais, Kampong Bokok, Kampong Buda-Buda, and Kampong Bukit Belalong etc. (DI, 1992). They are administered by a district officer being responsible for all district affairs, such as general administration, welfare, development, and progress.

#### 4. The river system of Temburong District of Brunei Darussalam

Figure 3 illustrates that the residents are situated majority near the rivers, providing benefits for the fisher folk community in terms of accessibility. The Temburong river system in Brunei Darussalam is home to a fisherman population that relies on fishing as a source of income. In Temburong District there are 5 Mukim (Sub-district) are available such as Mukim Labu, Mukim Bangar, Mukim Batu Apoi, Mukim Bokok and Mukim Amo. The figure shows the river system forest types in Temburong district. There are three main forest areas in the Temburong District. These forest areas are mainly preserved forest are 3 as are not meant to be distributed by any developments or human activities, the forest areas are labeled as follows- a) Labu Forest reserve b) Peradyan Forest Reserve and Ulu Temburong National Park.

There are four major rivers are flowing in Temburong district and the river catchment area have been covered mostly the norther part of the territorial part of the district. The following rivers are dominating the local socio economy and the community livelihoods. The Domination Rivers are Labu River, Kutop River, Kiri / Pendaruan River and Temburong River. The Temburong River is the longest river which is covering 1000 km<sup>2</sup> catchment area and the length is 98 km.

The river system of Temburong flows from the southern of the district towards Brunei Bay and this is due to the slightly elevated ground of the district at the bottom of the map in **Fig 3**. This also caused the development of the river basin, hence the formation of the Temburong River within the region.

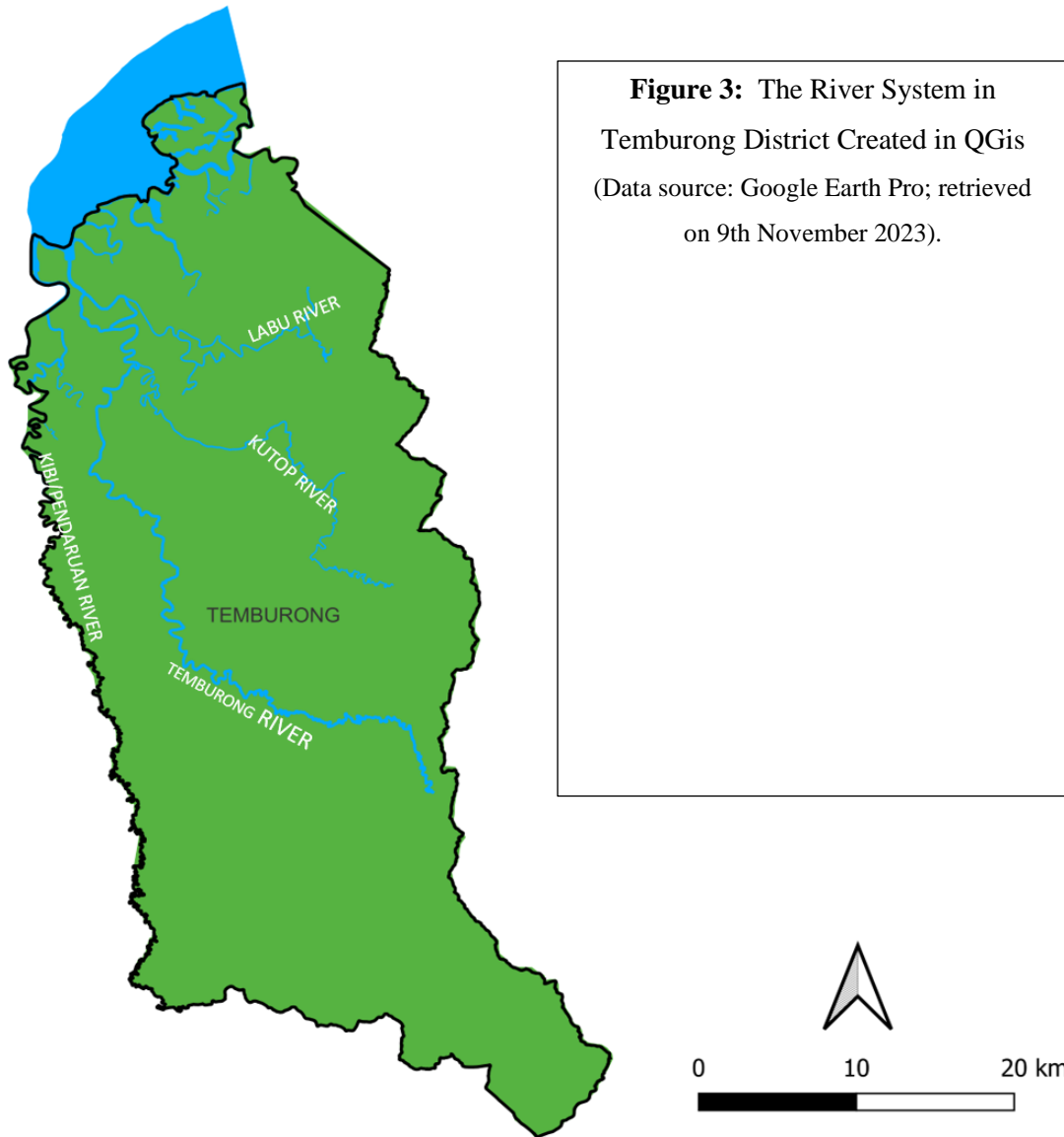
The Multiple River streams and water ways flow through the forest areas mentioned above. The primary water sources from Brunei Bay, the streams are then separated into different river streams flowing throughout the district, the several river streams are namely the Temburong River, Labu River, Belayang River, Kutop River, Lamaling Besar River, Latium River, Luangan River (Figure 3). These are the major rivers and streams have created their catchment area and river network on the surface which is the main river network and communication especially in the remote forest area in Temburong district where the ethnic fisher folk communities were living inside the forest and on the river bank sides. Therefore, the ethnic communities like Iban, Dusun, and Murut were dependent on natural resource-based activities and mainly fishing and small-scale agriculture

The river mouth is located slightly at the northwest of Temburong district where the river meets the Brunei Bay. The streams and tributaries are moderately dispersed, particularly the northern of district, which forms a layout of the estuary. The river system of Temburong flows from the southern of the district towards Brunei Bay, and this is due to the slightly elevated ground of the district at the bottom of the map in Figure 2 and 3. This also caused the development of the river basin, hence the formation of the Temburong River within the region.

#### **4. Literature Review**

The Temburong River system is important in Brunei Darussalam. The river system is home to a diverse range of freshwater fish species with a total of 44 species of fish from 10 families identified in the headwaters of the Belalong-Temburong River system (Choy & PK, 1994). The river system is also important to the fisher folk community, as it provides a source of livelihood for many people in the area (Chua et al., 1987). The importance of the river system to the community's livelihoods cannot be overstated. As stated by Chua et al. (1987), the river system is a source of food and income for many people in the area with fishing being a major economic activity. Moreover, the river system also supports other economic activities such as agriculture and tourism which are important to the local economy. However, the river system is facing challenges such as pollution, which can have negative impacts on the fish population and the livelihoods of the fisherfolk community; therefore, baseline assessments and monitoring of the river's water quality are important to ensure that the river system remains healthy and sustainable (Onifade et al., 2023).

The Temburong River system is located in the Temburong district of Brunei which is situated in the north-west of Borneo (My water stories, 2016). The river is the second smallest of the four main rivers in the country and drains a catchment area of around 840 square kilometers. According to Hays (2020), the river system is characterized by its winding rivers and pristine rainforests which are home to a diverse range of flora and fauna. In addition, this statement is backed by Choy and PK (1994) who stated that the river system is home to a variety of freshwater fish species, including 44 species belonging to 10 families and 30 genera that were collected from the headwater streams within the primary dipterocarp. Furthermore, according to Baker et al. (2016), the river system is also home to macro-invertebrates which are influenced by the fluvial biotopes in the area. The ecological importance of the Temburong River system lies in its role as a pristine tropical forest that supports a diverse range of flora and fauna. The river system is part of



the Ulu Temburong National Park which is dedicated to preserving one of the world's most diverse ecosystems (Hays, 2020). The river system is also important for its role in providing habitats for freshwater fish species and macroinvertebrates. The river system is a source of pure mountain waters that include several rivers and waterfalls, which provide refreshing dips and habitats for fish species (Hays, 2020).

The Fisher Folk community in Temburong, Brunei Darussalam is engaged in different types of fishing activities including small-scale fishing, commercial fishing, and aquaculture (Fabinyi et al., 2022). The livelihood status of the community is affected by various factors, including income, employment and poverty levels. According to a study by Siar and Kusakabe (2020), fishing households were not always the poorest and, in some cases, may be better off than farmers. However, another study found that poverty is a common issue among small-scale fishing communities and a lack of access to alternative skills and sources

of livelihood is a major challenge (Knudsen, 2016). The challenges faced by the Fisher Folk community in sustaining their livelihoods include overfishing, climate change and natural disasters (Fabinyi et al., 2022). In response to these challenges, various initiatives have been launched to support the community. For example, the Mindanao Inclusive Agriculture Development Project (MIADP) aims to increase agricultural productivity, resilience, and services while also protecting the natural resources of ancestral domains in Mindanao, benefiting around 120,000 farmers and fisherfolk (The World Bank, 2023). Similarly, the ATSEA project is developing alternative livelihoods for fishing communities in Southeast Asia, aiming to increase their market potential and reduce dependence on fishing (Kiningi, 2023).

The relationship between the river system and the fisher folk community's livelihoods is a crucial one. According to the Food and Agriculture Organization (FAO) of the United Nations (2015), the river system is a significant source of livelihood for millions of people worldwide and the fisher folk community is one of the most dependent on it. The impact of the river system on the fisher folk community's livelihoods is significant. The river system provides fish and other aquatic resources that are essential for the community's food security and income generation (Sanctuary, 2021). The fisher folk community depends on the river system in various ways such as fishing, transportation, irrigation, and hydropower generation (Amabel & Parlee, 2020). However, the community faces several challenges in managing the river system sustainably. These challenges include overfishing, pollution, habitat destruction, and climate change (Amevenku et al., 2019). The fisher folk community's livelihoods are closely linked to the health of freshwater fisheries around the world (FAO, 2015). The community's dependence on the river system for their livelihoods is evident in the different ways they rely on it. For example, the river system provides fish for consumption and sale which is a significant source of income for the community (Amabel & Parlee, 2020). The river system also provides transportation for the community which is essential for accessing markets and other services (Sanctuary, 2021). Additionally, the river system provides irrigation for agriculture which is another source of income for the community (Cook et al., 2009). Managing the river system sustainably is crucial for the fisher folk community's livelihoods. Overfishing, pollution, habitat destruction, and climate change are significant challenges that the community faces in managing the river system sustainably (Amevenku et al., 2019). To address these challenges, the community needs to adopt sustainable fishing practices, reduce pollution, protect habitats, and adapt to the impacts of climate change. Additionally, the community needs to work with other stakeholders, such as governments, NGOs, and researchers, to develop and implement sustainable management strategies for the river system (Amabel & Parlee, 2020).

## **5. Methodology and Data Collection**

The methods employed for investigating the interplay between the river system in Temburong and the livelihoods of the Fisher Folk community involve a multifaceted approach. To comprehensively understand the geographic context, mapping plays a pivotal role. Utilizing QGIS and Google Earth Pro, detailed maps are created to visually represent the intricate river networks and spatial distribution of Fisher Folk settlements. This spatial analysis aids in identifying critical zones and their potential impact on the community's livelihoods. Simultaneously, a thorough exploration of online academic sources for secondary sources of data is conducted to gather theoretical frameworks, historical perspectives and empirical studies related to river systems and Fisher Folk livelihoods. This dual-method strategy ensures a robust foundation, combining the precision of geospatial tools with the depth of scholarly insights. By integrating mapping techniques and academic research, the study aims to provide a holistic understanding of the dynamics between the river system and the livelihoods of the Fisher Folk community in Temburong.



## 6. Result and Discussions

In exploring the intricate relationship between river systems in Temburong and the livelihoods of Fisher Folk communities, this study delves into three crucial aspects. First, it examines the population distribution of fishermen, unraveling the dynamics of their presence along the riverbanks. The subsequent focus shifts to the modernization after-effect, tracing the transformation of traditional fishing practices into diversified side-income sources through primary sources. Lastly, the discussion propels toward the future of fishing, envisioning sustainable practices and the potential challenges faced by Fisher Folk communities. This encapsulates a comprehensive exploration of the delicate balance between tradition, modernity and the future of this vital community.

### 6.1.The Population Distribution of Fisherman

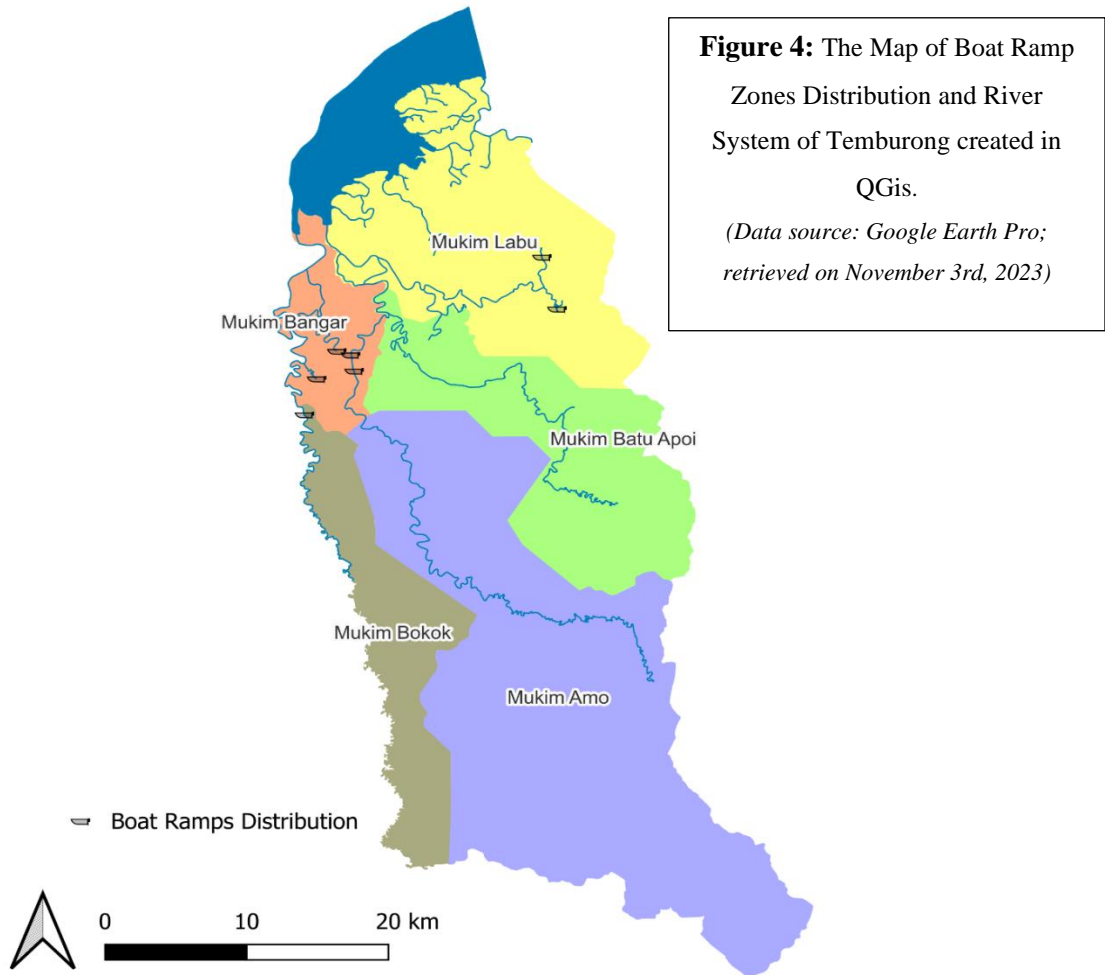
According to the City Population (2022) in 2021, the Temburong population as stated in The Population and Housing Census Report was around 9,444, making it the least populated district among the others with only 2.1% of the total Bruneians. Contradicted by the size of the district is the second to largest with 1,304 km<sup>2</sup> and a population density of 7 people for every km<sup>2</sup> (Ministry of Finance and Economy (MOFE, 2022). The majority of the population is found along the coast in the western part of Brunei which is separated from the eastern portion by Malaysia (Central Intelligence Agency (CIA), 2023). The population distribution in Temburong is not evenly distributed with the majority of the population concentrated in the administrative center of Bangar. The district is surrounded by Brunei Bay to the north and Sarawak, Malaysia to the east, south and west. The ethnic minority people were living inside the forest and on the bank of the major rivers in Temburong. 6 different ethnic people are living now in different places and some are still living in the forest and river bank areas (Table 2). Fisher folk communities still are practicing the primary economic activities and sustaining their livelihoods.

Table 2. Ethnic minority population in Temburong District

Ethnic Category	Population	Comments
Malay	5,852	23% of the total population
Iban	2,092	Many Murut refer to themselves as Lun Bawang
Murut	811	
Chinese	204	
Dusun	21	
Others	211	The ethnic composition in Temburong in 2010
Total	9,103	

The number of fishermen in the area and their distribution across different areas of the river system have changed over time. While there is limited information on the exact number of fishermen in the area, it is known that the river system is suited for small-scale cage culture of brackish water fish species (Chua et al., 1987). The types of fishing activities that are most common among the fisherman population in the Temburong River system include hand netting and cage culture (Zaheer Afie, 2020). The demographic characteristics of the fisherman population, such as age, gender and ethnicity are not well documented. However, it is known that the area is home to the Malays, Murut and Iban communities (Hays, 2020). The economic status of the fisherman population including their income levels and the extent to which fishing is their primary source of income also remains unknown.

The map (Fig 4.), represents the locations where slipways or boat deployers are available for the local fishers. From this, the pattern can be seen that the slipways are situated near the small rivers and within the community area of the residents in Temburong. Changes in the river system such as changes in water quality or the introduction of new fish species have had an impact on the fisherman population. For example, the introduction of new fish species may have affected the availability of traditional fish species which could have had an impact on the livelihoods of the fisherman population (Choy & PK, 1994).



The role of government policies and programs in supporting or regulating the fisherman population in the Temburong River system is also not well documented. However, it is known that the area is home to the Ulu Temburong National Park, which is a protected area that supports sustainable fishing practices (Baker et al., 2016). Sustainable fishing practices have the potential to support the livelihoods of the fisherman population while also protecting the river system and its ecosystem.

### **6.2. The Modernization After-Effect: From Primary Sources to Side-Income**

Fishing has been considered the primary source of income for the fisherfolk community in Temburong due to the region's abundant river systems and coastal areas (Marsal et al., 2023). However, modernization has brought significant impacts to the fishing industry and the river system in Temburong. The use of primary sources of income by the fisherfolk community has changed over time due to

modernization, with the emergence of side-income opportunities such as ecotourism and aquaculture (Shams, 2022; Chua et al., 1987). Technology has played a significant role in modernizing the fishing industry, but it has also affected the livelihoods of the fisherfolk community. The challenges faced by the fisherfolk community in adapting to modernization have led to the need for government intervention to support their livelihoods. The emergence of aquaculture has been a booming sector in the fisheries industry, and it has experienced the fastest increase over the last five years, rising by 14% (Marsal et al., 2023). However, aquaculture is at risk from the impact of climate change which can cause a decline in production due to toxic algae, parasites or deteriorating farming affected by red tides (Shams, 2022). Sustainable fishing practices are essential in ensuring the long-term viability of the fishing industry and the livelihoods of the fisherfolk community. The cultural significance of fishing in the Temburong region has been impacted by modernization and further research is needed to understand the complex relationship between modernization, river systems, and the livelihoods of the fisherfolk community (Shams, 2022). The Temburong River has also been affected by pollution caused by negligent construction-related activities resulting in the destruction of the local ecosystem and the livelihoods of people living in the area who are dependent on natural resources provided by the waterways (Biro Penerangan, 2013). In terms of economic statistics regarding aquaculture/fishing in Temburong, Brunei has implemented programs to stimulate local fisheries and within a decade, it was producing more fish domestically than it imported (Britannica, 1999). However, overfishing has been a growing concern, despite the government's emphasis on sustainable development. River systems in Temburong are suited for small-scale cage culture of brackish water fish species and the economic impact on fish biomass production should be considered in the development of the fishing industry (Chua et al., 1987).

### 6.3. The Present Landscape Scenario of the Fisher Folk Community Areas in Temburong

The landscape of the kampongs (Villages) of fisher folk communities in Temburong District are changing very rapidly. The figure 5 has demonstrated the newly formed landscapes of the fisher folk community's settlement and living places as well as the hose and housing architecture. The living places and the location also changing in Temburong. Some parts are huge changed from different aspects. The changing pattern also been changed in fisher folk communities are located in Temburong in Figure 5 (a, b, c, d, e, f, g, h).

Centralized settlement pattern towards the Temburong River, this can be seen with the satellite image. A few basic details were taken into account during our interview in field investigation, all the 3 longhouses chosen for this study had agricultural land around their houses and here usually they plant a few vegetables like tapioca, calamansi lime and chilly. All 3 longhouses\* would also have small chicken corps, residents of the longhouse would also have an agricultural land walking distance from the longhouse\* always near the river. This is one example that the fisher folk communities are gradually changing their livelihoods occupation in all ethnic communities (Iban, Dusun, Murut and others). Having the statement said, Brunei ethnic Minorities (Dusun, Iban, Penan, Murut and Kedayan) who used to make a living from forest product and fishing activities, traditionally are attached to wage employment, resulting influx of movement from remote district to central areas, employing the kampongs or rural villages (Ellen & Bemstein, 1984). Thus, this shows and also displays the reality at present in figure 5 shows the across of interest plays a role in determining the mobility of Iban in Temburong (De' et al., 2020).

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*\*Residence for indigenous people of Brunei Darussalam. They are built raised off the ground on stilts and are divided into a more or less public area along one side and a row of private living quarters lined along the other side. Many place names in that area have "Long" in their name (which means river). In brief, longhouse means, a long dwelling especially of the Iroquois for several families.*

*The Iban are one of many groups of Ethnic minority people still living in Temburong District in Brunei Darussalam of Borneo Island and unlike the Panan tribe, who hunt and move around every few days, the Iban are 'settlers' who live in a communal longhouse. If another Iban native or family arrives to join the community then the house is simply elongated to accommodate them, hence its name.*

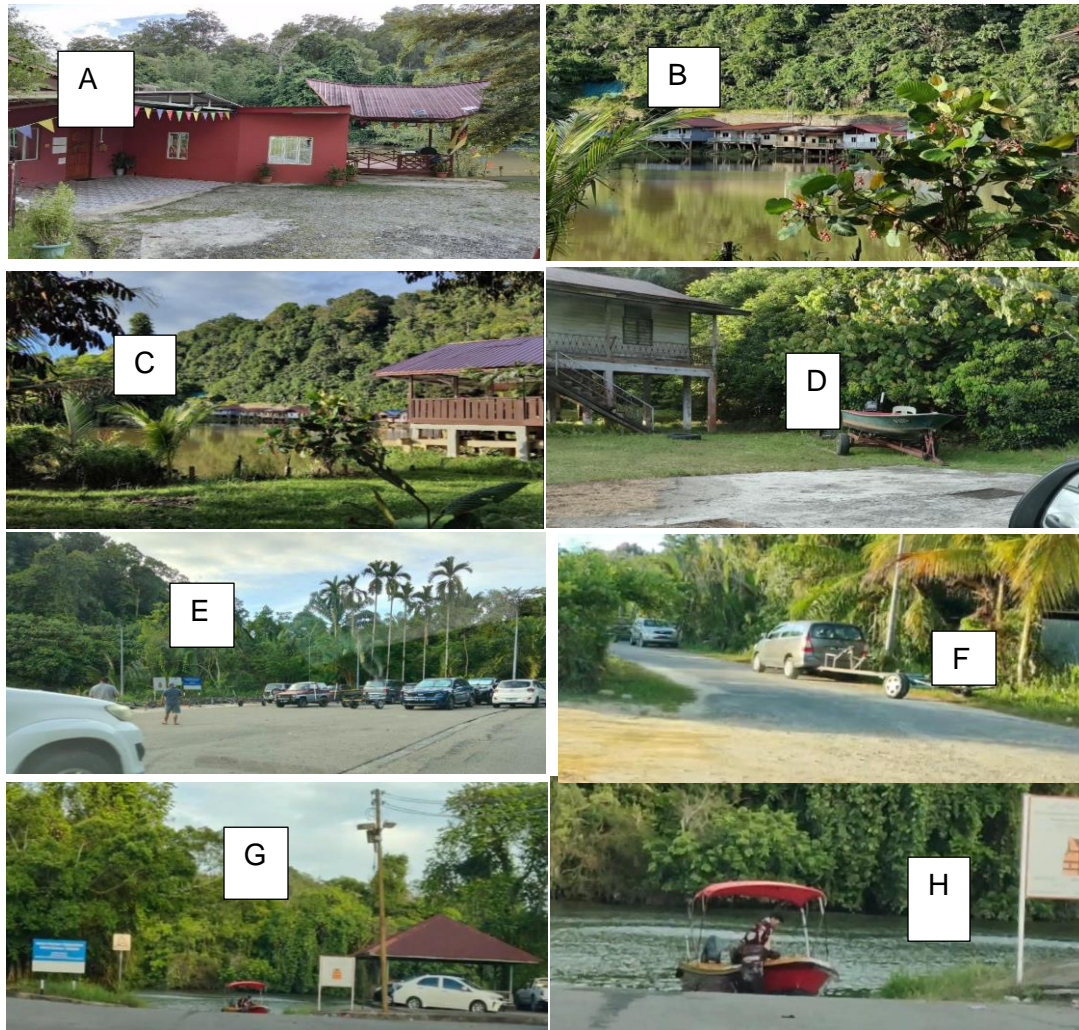


Figure 5: Present landscape changing pattern of Fisher folk community's living and settlement locations and activities in Temburong district of Brunei Darussalam

**Note for figure 5:** Caption of the above pictures **A)** Pondok Bangkutut fishing camp, Kampong Belais (Village Belais), Mukim Bokok, **B)** Recreational and Fishing Huts of Kampong Belais, Kampong Buda-Buda, along Pandaruan River, **C)** Fishing Activities by the renter of Pondok Ikan Lawang, Kampong Belais, Temburong, **D)** One of the regular boat used by the fishing community at Kampong Buda-Buda. The boat ramp zone of Kampong Belais- Buda Buda, Temburong, is located less than 500 m from the settlement of fisher folk communities. **E)** One of the popular parking area and boat ramp zone of Kampong Belais- Kampong Buda Buda, Temburong, along the Pandaruan River. The ima fishers' community live near to illustrated the peak hour of fishing activities (Friday Sunday –Weekend). **F)** A couple of fishers arriving at the Kampong management boat Ramp zone, Bangar, **G)** Parked vehicle with attached boat trailer at Kampong Sungai Tanit Boat Ramp, Bangar, Temburong, **H)** The Fishers community live near the boat loading area, which provide accessibility for them to their source of food or income, **H)** A couple of Fisher folk community live near the boat loading area which accessibility for them to their source of food or income.

Furthermore, the fisher folk communities (Iban, Dusun and Murut) way of life is not as indigenous as the past ancestors as they are exposed to gaming environment. They have adapted and adapting to the change

in the environment and trying survive within their settled environment in Temburong District in Brunei Darussalam. The fisher folk communities belong Iban, Dusun, Murut, Chines and other small ethnic community in Temburong district. In general, there are about 20 per cent of Iban lives in Temburong longhouses which accounts for 500 to 600 total of population (King Knudsen, 2021).

## **7. Concluding Remarks**

In conclusion, the complex interplay between the river system in Temburong and the life of the fishing community highlights the profound importance of rivers in shaping both the environmental landscape and the socio-economic fabric of the region. This complicated relationship brings to light the indispensable role that rivers play in sustaining not only ecological balance but also in the livelihoods that depend on them. As we navigate the delicate balance between sustainable resource management and the well-being of local communities, it is becoming increasingly important that the conservation of the river system is not just an ecological necessity but a fundamental aspect of safeguarding the complex web of livelihoods that which is closely interwoven with the river system. The fate of the Fisher Folk community is closely tied to the health and vitality of the river system. Therefore, it is essential for us to take a holistic approach that takes into account the symbiotic relationship between environmental sustainability and human well-being. The call for responsible stewardship and collaborative efforts resonates strongly in the efforts to ensure the longevity of this complex ecosystem. It requires a shift toward sustainable practices that prioritize the health of the river system while responding to the needs and aspirations of the fishing community. This transition demands the active participation of all stakeholders – from local communities to policymakers, scientists and conservationists – and the promotion of a shared responsibility to protect and care for the lifeline that sustains both nature and humanity. The river system is fundamental to the livelihoods of the Fisher Folk group in Temburong. On the wooded slopes close to the river, they have long engaged in swidden agriculture, depending on the river for both their financial and dietary needs. As stewards of the land and forest for future generations, their sustainable resource usage is informed by traditional knowledge. We can lessen the possible harm that human activity may cause to the river system by encouraging responsible usage. A few examples of actions that can help to preserve this important ecosystem are the adoption of efficient waste management plans, habitat restoration programs and sustainable fishing methods. In order to guarantee that the Fisher Folk community actively engages in the conservation activities that directly impact their way of life, it is also imperative to provide them with the information and abilities necessary for sustainable resource management. Cooperation will raise the likelihood that the river system can be successfully preserved. For the Temburong River system to face its many issues, forming alliances between government agencies, non-governmental organizations, local communities and academic institutions can offer a thorough and coordinated response. These partnerships can encourage a synergistic effort that surpasses individual capacities and enable the sharing of information, resources and experience.

Furthermore, conserving the river system is not just an altruistic endeavor, but a strategic investment in the long-term resilience of the region. Healthy rivers help regulate climate, protect biodiversity, and maintain water quality, benefiting not only the immediate community but the entire ecosystem. The interconnectedness of ecosystems highlights the need for a holistic perspective that takes into account the broader ecological context and emphasizes that the health of the river system is closely linked to the well-being of the entire region. In this context, the need for further investigation is highlighted by the scarcity of information in the existing published documentation. The limited data available emphasizes the need for additional research to fill the gaps in our understanding and provide a more comprehensive insight into the topic. Exploring uncharted territories and conducting in-depth investigations will be instrumental in eliminating current knowledge limitations and expanding scientific discourse on this

particular topic. Additional research may address the specific ecological dynamics of the Temburong River system, the socio-economic intricacies of the Fisher Folk community and the potential impacts of climate change on both. Long-term monitoring projects, community-based participatory research, and interdisciplinary studies can provide valuable data and perspectives and enrich our understanding of the complex relationship between rivers and livelihoods. To conclude, the fate of the Temburong River system and the Fisher Folk community are closely linked, highlighting the inextricable link between environmental health and human well-being. Through responsible stewardship, collaborative efforts, and a commitment to further research, we can strive to ensure the resilience and longevity of this vital ecosystem. The conservation of the river system is not merely an environmental imperative; it is a commitment to sustaining the complicated tapestry of life that thrives on its banks – a commitment that will resonate through generations and ensure the prosperity of the Fisher Folk community for years to come.

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