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Thazin Htet
Myanmar Coastal Conservation Lab, Myine Tharyar Quarter, Mawlamyine, Myanmar

Zun Pyae Oo
Myanmar Coastal Conservation Lab, Myine Tharyar Quarter, Mawlamyine, Myanmar

Bo Sann
International Union for Conservation of Nature, Corner of Myitkyina Street and Myat Lay Street, Oattara Thiri Township, Nay Pyi Taw, Myanmar

Kenneth T MacKay
Independent Researcher, Kisber Ave Victoria, BC, V8P2W5, Canada

Kyaw Thu Aung
Network Activities Group, Shukhinthar Street, Rose Garden, North Dagon Township, Yangon, Myanmar

Corresponding Author:
Thazin Htet
Myanmar Coastal Conservation Lab, Myine Tharyar Quarter, Mawlamyine, Myanmar

Monitoring fish landing to assess local fishery in the Sittaung River Estuary, Myanmar

Thazin Htet, Zun Pyae Oo, Bo Sann, Kenneth T MacKay and Kyaw Thu Aung

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Abstract
The Sittaung River Estuary supports a small-scale fishery that contributes to local livelihoods in the Gulf of Mottama, Myanmar. Since the fishery faces environmental and anthropogenic pressures, it is important to monitor exploited stocks for sustainable fisheries management. Long-term fish landing data were monthly collected from August 2016 to December 2024 from a local fish buyer in Sut Pa Nu Village near the estuary. This study aims to monitor fish species diversity and abundance across the years, examine seasonal landings and economic contribution of major species, and provide recommendations for sustainable management. Over eight years, the study recorded 30 fish species from 19 families. Hilsa shad, Pama croaker, and Mango fish were major species, accounting for 54% of total annual landing and 76% of total annual value. The fishery provided an annual gross income of 1,707 USD/fisher. Annual landings decreased sharply after the peak in 2020, and species diversity showed a gradual decline. Such dynamics were likely due to the presumed effect of illegal fishing, while considering the dynamics of hydrologic process. Seasonal peaks in landings were observed during the migration and spawning seasons of the major species. The government's fishing ban does not protect the spawning season of Hilsa shad and even prohibits fishing during the peak landing periods of Pama croaker and Mango fish. Hence, area-based conservation measures are recommended rather than seasonal closure. Strengthening law enforcement is urgently required to protect fish species, particularly the major species that contribute to local livelihoods.

Keywords: Economic contribution, fish landings, species diversity, seasonal variation, sustainable fisheries management

Introduction
The Sittaung River Estuary, located in the upper Gulf of Mottama (GoM) in southeast Myanmar, has a distinctive funnel shape with a broad opening toward the Andaman Sea (Choi *et al*., 2021) [1]. The outflow of the Sittaung river interacts with the tides from the sea and creates a brackish environment where several species of aquatic organisms thrive. The river carries significant sediment, and the interaction between freshwater flow and tidal forces shapes the estuary's coastline (Steijn *et al*., 2020) [2]. Hence, the estuary supports a diverse coastal landscape with tidal flats, mudflats, mangroves, and intertidal zones. Drastic changes in the estuary's morphology occasionally occur due to riverbank erosion, driven by the dynamic modulation of cyclic channel migration (Shimozono *et al*., 2019) [3]. The area is also characterized by rocky riverbanks, sandbanks, and shifting channels due to sediment deposition and ongoing erosion with the rate as high as 3 km/year in some places (Shimozono *et al*., 2019; Choi *et al*., 2021) [3, 1].
The Sittaung River, spanning 420 km in length, is thought to host numerous fish species, including both freshwater and marine varieties, though these species remain undocumented (Soe *et al*., 2020) [4]. Migratory species like Hilsa shad, Pama croaker, Mango fish, etc. used to go upstream through this brackish estuary to spawn in the Sittaung (Lunn *et al*., 2021; Oo *et al*., 2019) [5, 6]. These species are economically significant to local communities, providing a reliable source of annual income through a regular supply (Hte *et al*., 2023) [7]. Common fishing gear used in the estuary includes trammel nets, drift gill nets, set bag nets and beach seines (MacKay and Ko, 2017) [8].

Fish stocks in the estuary face threats from illegal fishing practices. Prior to 2017, local fishers reported a large decrease in fish catch due to the use of small mesh fence nets (stake net or locally called Than Za Gar Pike) that harvest large quantities of juvenile fish (Hte *et al*., 2023) [9]. Additional harmful methods included poison fishing, electrofishing, and upstream sand mining (Whitty, 2023) [10]. In response to this, the Mon Fisher Development Association (Mon FDA), a Civil Society Organization, led fisheries co-management efforts to combat illegal fence net fishing by organizing local fishers, the Mon State Myanmar Fisheries Federation, and Mon State Government Departments. Beginning in 2017, they conducted regular joint boat patrols in the gulf, which included seizing illegal fishing boats, confiscating and burning fishing nets, arresting fishermen, and fining boat owners. That resulted in an 85% reduction in illegal fishing nets and an increase in fisheries catch reported in our other work (unpublished). Unfortunately, COVID 19 and the political chaos since 2021 have led to a suspension of patrolling effort. Fishers reported a significant decrease in the fish catch since 2021, attributing this decline primarily to an increase in illegal fishing practices utilizing stake nets (Hte *et al*., 2023) [9]. A detailed analysis of annual species landings and diversity trends would provide valuable insights for monitoring the fishery's status over time.

Effective management and conservation of aquatic ecosystems rely on a comprehensive understanding of the spatial and temporal patterns of fish communities, ecological factors, and fishing activities (Mini *et al*., 2013; Fadli *et al*., 2021) [11, 12]. It is thus crucial to regularly assess exploited stocks and integrate the findings into the fisheries management to ensure the long-term sustainability of the fishery. Changes in species diversity in the Indian part of the Sundarbans have been linked to variations in water quality driven by climate change (Mitra *et al*., 2009) [13]. This phenomenon is further accelerated by anthropogenic pressures on the marine environment, contributing to species decline and disappearance (Jean-Renaud *et al*., 2023) [14]. Annual fluctuations in species abundance and diversity in landings could be influenced by a combination of environmental factors and human activities including overfishing. Additionally, in the GoM, sedimentation, coupled with channel shifts in the Sittaung River, may lead to habitat loss for certain species, particularly benthic ones.

Long-term monitoring is essential to inform effective fisheries management practices. While several studies have been conducted in the GoM, including Sut Pa Nu, there remains a gap in long-term monitoring of multi-species fish landing in Myanmar and specifically in the GoM. Oo *et al*. (2019) [6] identified that the high abundance of fish larvae was intricately linked to environmental factors critical for larval survival, particularly temperature and salinity and revealed a significant positive relationship between these environmental factors and the diversity of fish larvae in Kha War Chaung and Sut Pa Nu. Hte *et al*. (2023) [9] used local ecological knowledge to map spawning areas of economically important species such as Mango fish, Pama croaker, and Hilsa shad. Comparative studies in the Bay of Bengal, such as Bepari *et al*. (2019) [15], analyzed fish species composition over a decade, and Bhanja *et al*. (2023) [16] focused on species diversity and composition by family and order over nine months. This study bridges this gap by integrating long-term (2016-2024) data on species diversity, abundance, and economic contributions, providing actionable recommendations to support sustainable fisheries management in the Sittaung River Estuary and similar regions.

This study was initiated with three main objectives: to monitor long-term fishery dynamics in terms of species diversity and abundance; to examine seasonal landings and the economic contribution of major species; and to provide information and recommendations for sustainable fisheries management in the Sittaung River Estuary, GoM.

Materials and Methods

Study Area

Sut Pa Nu is a village located on the bank of the Sittaung River in the upper GoM (Figure 1) and influenced by tidal currents and river outflow. The village is bordered by a rocky riverbank, which helps mitigate erosion, which is otherwise a major issue in other parts of the gulf. The climate in this area is influenced by tropical monsoon patterns, with distinct wet and dry seasons. During the wet season, the salinity of the river water can approach 0 ‰ due to freshwater influx while the dry season sees higher salinity levels. The fishing community in Sut Pa Nu relies heavily on the estuary both for subsistence and income, with fishing grounds situated near the village. Sut Pa Nu was chosen for this study due to its distinctive ecological features, including the rocky riverbanks and the presence of benthic (bottom) feeder species, which are adapted to the conditions of the river. This area also serves as the entry point for the migratory route of fish species that spawn in freshwater such as Hilsa shad, Pama croaker and Mango fish. These ecological factors, influenced by natural cycles, make the area a compelling site for monitoring fishery dynamics that could affect the community's livelihoods. The Sut Pa Nu fishery operates on a small scale, using 7-8-meter-long boats powered by 6-7 horsepower engine. Fishers employ three-layered trammel nets with inner mesh sizes ranging from 3.8 to 7.6 cm and lengths between 270 and 500 meters. Fishing activities are typically employed near the village in the Sittaung River Estuary. The major regulation of the Department of Fisheries (DoF) is a closed season or fishing ban during May to July. This follows the Burmese lunar calendar, and exact dates vary from year to year. This regulation applies to both marine, inshore, and freshwater fisheries, and is intended to protect spawning fish.

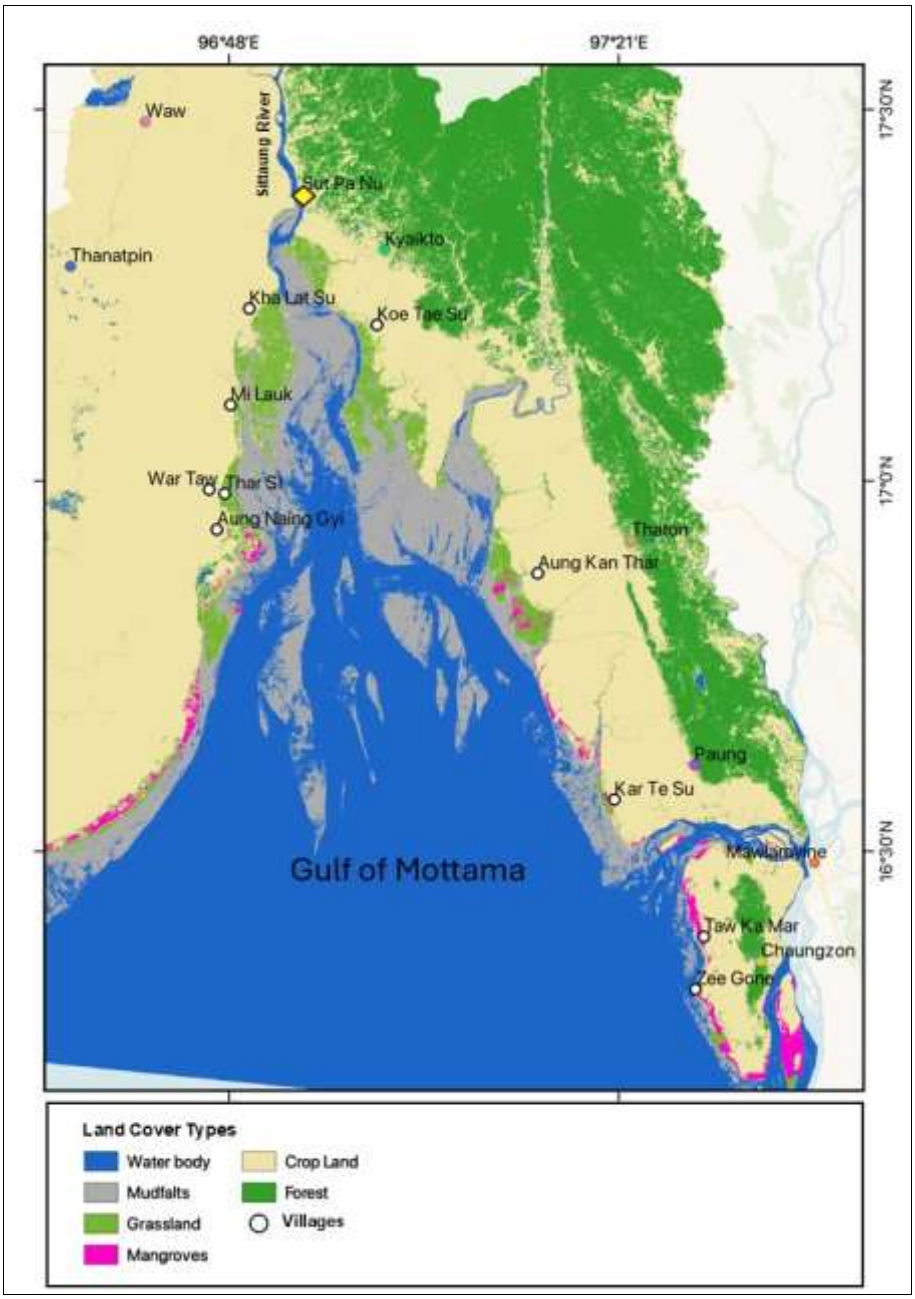

Fig 1: Location map of Sut Pa Nu Village in the Sittaung River Estuary, the GoM, Myanmar

Fish Landing and Data Collection

The fish landing data were collected from one of the two fish buyers in Sut Pa Nu from August 2016 to December 2024. The fish buyer provided advance payment to approximately 40 out of 70 fishers in the village to purchase their catches, which she then consolidates for aggregation, storage, and transportation to market. Before 2020, she primarily sold fish to Yangon Fish Market, with smaller quantities sold locally. Once the fish were aggregated, she arranges transportation, using motorcycles to deliver the fish to the highway where buses would take the fish to Yangon. The fish were often packed in Styrofoam containers, which helped preserve their freshness during transit. Political and economic events since 2021 have affected long distance transportation and she has shifted her focus more towards local markets. The fish buyer or her family member recorded the weight in viss (Myanmar unit of weight: 1 viss = 1.63293 kg) of daily landed fish according to species on a notebook and then filled in datasheet prepared by the Gulf of Mottama Project (GoMP). Through the coordination of GoMP Fishery Officer, a staff from Mon Fisher Development Association monthly collected landing datasheets and entered them into Excel spreadsheet. Starting from October 2021, additional price and value for each species were recorded. For the value calculation before October 2021, average yearly price for each species obtained through interviewing of the two fish buyers was retrospectively used to estimate annual values. Although data collection was thorough, occasional gaps occurred due to illness, family affairs, direct sales to carrier boats on the river. Some fishers from other villages sometimes sold their fish to the fish buyer. Rare and low-value species are likely under-reported in this study. To verify the collected data, frequent follow-up visits by the Fishery Officer of GoMP have been conducted. Accordingly, the facts and figures should be considered an indicator for the fishery dynamics, rather than an exact record.

Data Analysis

The data in the Excel spreadsheet were organized by year, month, day, species, weight in viss, local price and value in

Myanmar Kyat (MMK). Weight in viss was converted to kilograms by multiplying by 1.63293. Although data were collected from August 2016 to December 2024, the annual complete data from 2017 to 2024 are presented for most comparisons. Species diversity (Table 1) was calculated for each year using three different indices - Species Richness (*S*), Simpson's Index (1-*D*) and Shannon-Wiener's Index (*H'*) - using the following equations:

$S = Total\ count\ of\ species\ recorded$ ..... Equation (1)

$1 - D = 1 - \sum_{i=1}^{n} p_i^2$ ..... Equation (2)

$H' = -\sum_{i=1}^{n} (p_i * \ln p_i)$ ..... Equation (3)

where p_i is the proportional abundance of i^{th} species in the total abundance of all *n* species in a year.

As three species- Hilsa shad, Pama croaker, and Mango fish- accounted for higher proportions of the total landings over the years (Figure 2), they were classified as major species (Figure 3). The mean monthly landings (Figure 4) were calculated as the average total weights of all species landings for each specific month of the years 2016 to 2024. The average monthly landings of major species (Figure 5) were calculated as the average total weights of a specific major species for a specific month of the years 2016 to 2024. Although the fish buyer gave advance payments to 40 fishers to sell their catches, it was assumed that 60% of them (24 fishers) sold their catches regularly to the buyer within a month. Thus, yearly income per fisher was computed dividing the total value by 24 fishers (Table 2). Data analyses were primarily performed in Microsoft Excel after careful data validation, applying the Pivot Table function.

Results and Discussion

Species Diversity and Abundance

During the eight years of the study, a total of 31 species (30 fish species and one prawn) from 19 families were recorded (Figure 2). The category "Various Small Fish" included a mixture of juvenile and small fish that were not identified by species and these fish were primarily used for producing fish paste. The recorded number of fish species (30) was less than 40 species reported by Htet (2017) [17] and 51 species reported by Swe *et al*. (2017) [18] in the whole upper GoM. The number of fish species recorded in this study was similar to other regions, such as the Arabian Gulf in Iraq (35 species; Mohamed & Abood, 2020) [19], an estuary in Bangladesh (32 species; Chakraborty *et al*., 2020) [20], and the Surma River in Bangladesh (34 species; Ahammad *et al*., 2017) [21]. However, it was quite lower than the marine fish diversity reported in West Bengal, India, where over 148 species have been documented (Bhanja *et al*., 2023) [16].

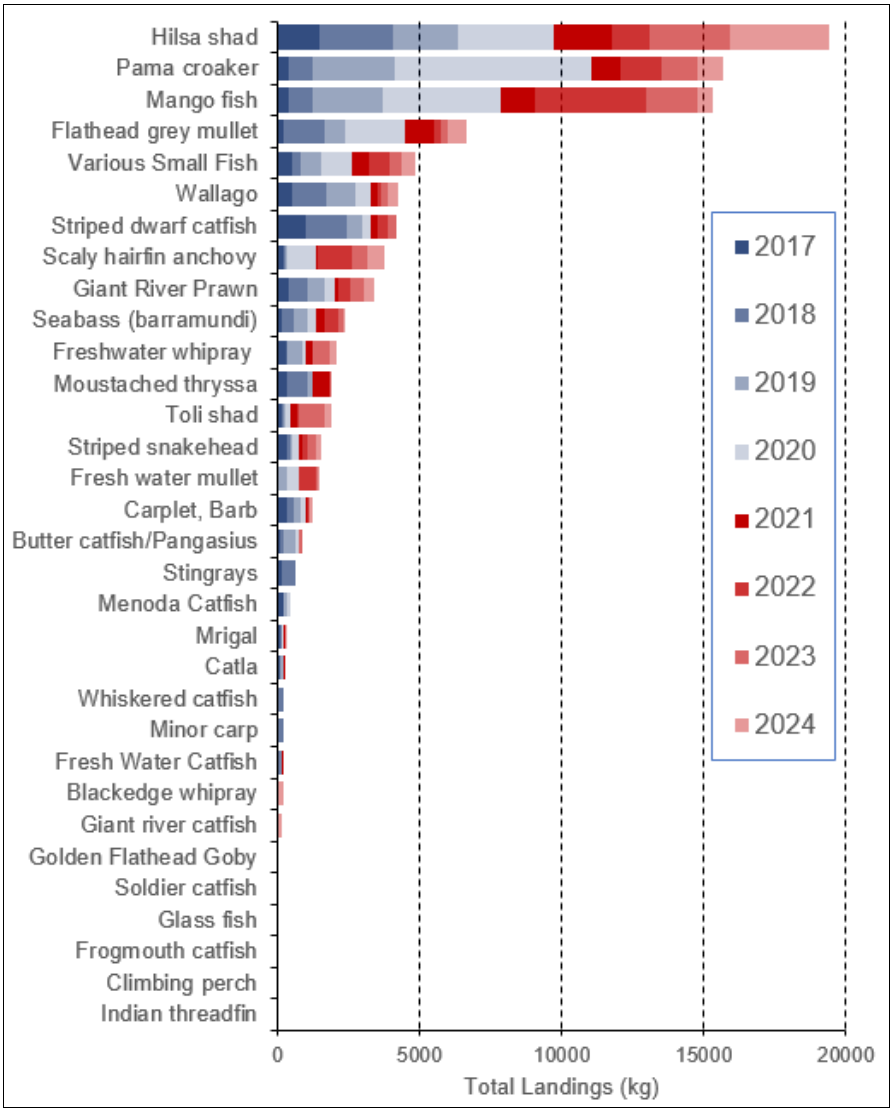

Fig 2: A total abundance of fish species landed at Sut Pa Nu from 2017 to 2024. See Appendix A for common names, scientific names and Myanmar names for all species

Regarding species diversity dynamics, 17-25 species were landed at Sut Pa Nu annually (Table 1). The Simpson's index values ranged from 0.780 to 0.903, while the Shannon-Wiener index values ranged from 1.80 to 2.40. These values of Simpson's index were comparable to the seasonal mean value (0.88±0.007) reported for the Surma River in Bangladesh (Ahammad *et al*., 2017) [21]. However, these values of Shannon-Wiener's index were slightly lower than those (2.49 to 4.47) reported in West Bengal, India (Mini *et al*., 2013) [11]. Based on these indices, species diversity in terms of species richness and evenness has exhibited a gradual decreasing trend in the Sittaung River Estuary since 2017 (Table 1). Decrease in species diversity could be attributed to not only changes in hydrologic process such as river channel shift and sedimentation due to riverbank erosion and consequently high-water temperature in lower river depth but also anthropogenic factors such as illegal fishing with stake nets and reduction in fishing effort due to economic and political events.

Table 1: Species diversity indices in the study areas across the years

Year	Species Richness (S)	Simpson's Index (1 - D)	Shannon-Wiener's Index (H')
2017	24	0.903	2.40
2018	25	0.893	2.18
2019	23	0.867	2.11
2020	19	0.807	1.87
2021	20	0.856	2.00
2022	17	0.797	1.91
2023	20	0.855	1.97
2024	19	0.780	1.80

The total landings varied considerably from year to year, ranging from 7342 to 21,871 kg (Table 2). Out of 30 fish species, three major species dominated the landings. Hilsa shad accounted for the highest proportion (20.8%) of the total landings, followed by Pama croaker (16.7%) and Mango fish (16.4%), (Figure 2; Appendix A). The dominance of a few major species observed in this study (54% by five out of 30 species) was similar to findings from other studies. For example, in the eastern Mediterranean, five out of 238 species accounted for 70% of the total landing (Palmer *et al*., 2024) [22]. In the Arabian Gulf in Iraq, three out of 35 species contributed about 30% of the total landing (Mohamed & Abood, 2020) [19] while in the Surma River in Bangladesh, 11 out of 34 species comprised 76% of the total landing (Ahammad *et al*., 2017) [21].

Table 2: Total gross value of fish species landed annually at Sut Pa Nu Village from 2017 to 2024

Year	Total Landing (kg)	Total Value		Yearly Income/Fisher	
		MMK#	USD*	MMK	USD
2017	7,342	40,099,000	30,845	1,670,792	1,285
2018	12,259	70,432,000	54,178	2,934,667	2,257
2019	13,722	80,915,000	62,242	3,371,458	2,593
2020	21,871	89,646,000	68,958	3,735,250	2,873
2021	8,202	53,110,000	28,708	2,212,917	1,196
2022	11,110	58,569,000	27,890	2,440,375	1,162
2023	11,112	72,283,900	31,428	3,011,829	1,309
2024	8,771	91,995,000	23,588	3,833,125	983
Average	11,799	69,631,238	40,980	2,901,302	1,707

#Total values (MMK) in italics are retrospectively estimated based on average prices by species obtained through interview.
*Due to fluctuating inflation rates, different exchange rates were used to convert MMK to USD for each year: 1 USD = 1300 MMK (2017-20), 1850 MMK (2021), 2100 MMK (2022), 2300 MMK (2023), and 3900 MMK (2024).

Annual Landings and Monthly Landings

Figure 3 presents the trends in annual fish landings over the period of 2017 to 2024. A gradual increase of annual fish landings was observed from 2017 until the highest total landing peaked in 2020. However, this was followed by a sharp decline, with landings stabilizing at about 50% of the 2020 peak. The annual total landings of other species remain relatively stable across the years (Figure 3) and therefore, the increase or decrease of annual landings was largely driven by the three major species (Hilsa shad, Pama croaker and Mango fish). All three of these species are anadromous and migrate up the Sittaung River to spawn, and fishers report that historically they have shown considerable variability from year to year. Nevertheless, the gradual increase in landings up to 2020 is likely linked with the removal of 85% of the illegal long stake nets by the Mon FDA and local authorities. In contrast, the decrease in landings since 2021 is probably more complex. It could partially be attributed to the presumed reintroduction of the illegal nets following political instability. However, there may have also been changes in fishing effort as security has decreased and fishing costs have increased due to devaluation of the MMK. Unfortunately, our study was not able to monitor fishing effort. As this study focused solely on the weight of fish landings, it was not possible to infer population abundance for each species. Further research incorporating additional parameters, such as size classes, the number of individuals and fishing effort, is needed to provide a more comprehensive understanding of population dynamics.

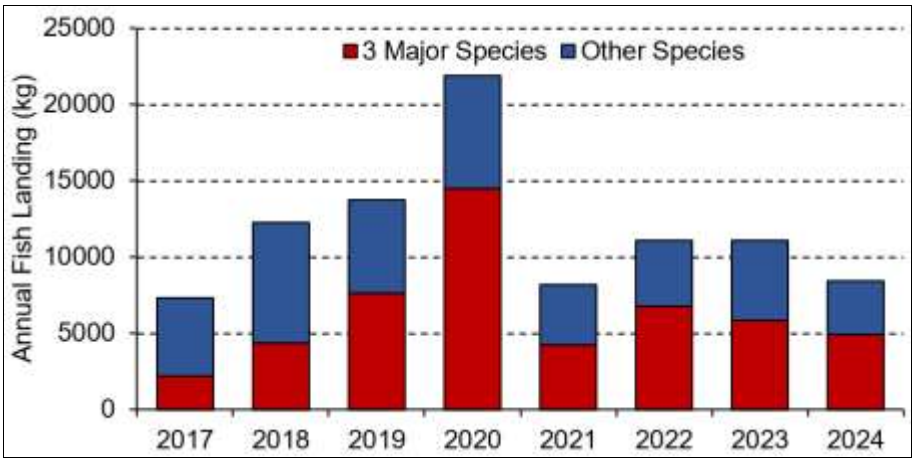

Fig 3: Annual landings of all fish species across the years, grouping into three major species - Hilsa shad, Pama croaker, and Mango fish - and other species

Mean monthly landings of all fish species, as shown in Figure 4, revealed two distinct peak seasons: May to July and October to February. The first peak season is associated with the higher landings of Pama croaker and Mango fish while the second peak season is related to the higher landings of Hilsa shad (Figure 5). These peaks likely resulted from the seasonal migration of these species up to the Sittaung River for spawning (This will be discussed in Seasonal Variations in Landings of Major Species), with the fishers targeting them during these periods and switching their fishing gears accordingly. The present study observed the lowest fish landings in April and August. This may be attributed to a cessation of fishing activities during the traditional Water Festival in April, and unfavorable fishing conditions due to high tide and strong currents in August.

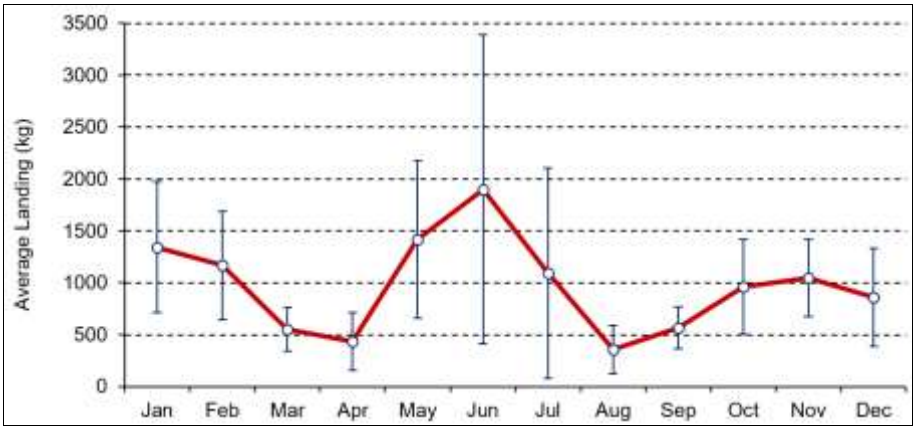

Fig 4: Monthly landings of all fish species averaged over the period of 2016 to 2024 at Sut Pa Nu Village. Error bars represent 95% confidence intervals of the monthly means

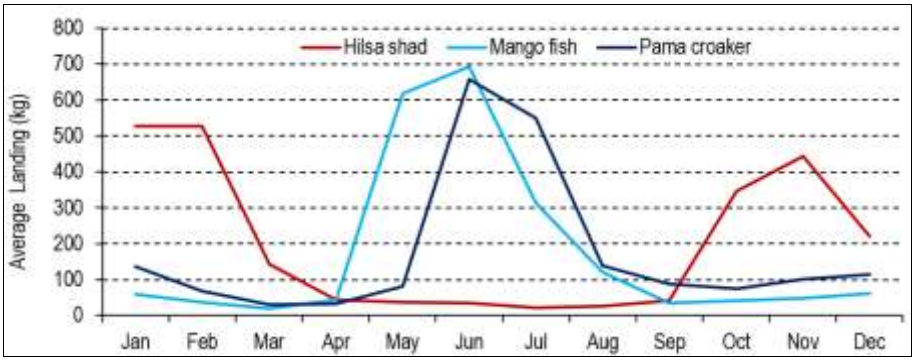

Fig 5: Seasonal variation of average monthly landings of major species in Sut Pa Nu Village over the period of 2016 to 2024

The confidence intervals, as shown by the error bars in Figure 4, were wider during the first peak period (May, June, and July) and the second peak period (December, January, and February). This suggests greater variability of year-to-year landings for the same months of the year, playing a critical role in determining annual landings. A year with higher landings in one or both of these peak periods could be considered a year of high overall landings, and vice versa. The government's closed season from May to July has proven ineffective, as freshwater species spawn during this period, while many marine and estuarine species are not affected. Additionally, the regulation is neither respected nor enforced

in the GoM and across Myanmar. In Sut Pa Nu, May to July is a crucial fishing season, accounting for much of the annual catch.

Seasonal Variations in Landings of Major Species

Figure 5 illustrates the average monthly landing distributions for three major species. Hilsa shad exhibited a pronounced peak in landings from October to February, with relatively consistent but lower numbers during the remaining months. This probably represents the migration of mature fish from the Bay of Bengal to the Sittaung River for spawning in freshwater. Interviews with fishers suggest that some spawning may occur at the Sittaung River mouth, but it is confirmed to take place at least 100 km upstream.

Pama croaker showed a peak in landings during June and July with a steady catch during the rest of the months. Fishers reported that approximately 75% of the Pama croaker females in June were carrying eggs, suggesting that this was a spawning migration. Additional information from fishers suggests that spawning takes place near the mouth of the Sittaung River. Mango fish had its highest landings from May to July, maintaining a steady catch during the rest of the months, as they migrated to spawning grounds at the mouth of the Sittaung River. The fishers claim that this is normal being very high in some years and much lower in others. The fishers claim that almost all the Mango fish females have eggs, and we assume that they are migrating up to spawn in the Sittaung River in May and July. These findings were also supported by other study which reported the presence of larvae and/or juveniles of Mango fish and Pama croaker recorded in May and June, and Hilsa shad from September to November and January to March in Sut Pa Nu water of the Sittaung River (Oo *et al*., 2019) [6].

These resulting trends of three major species indicate distinct seasonal patterns, with Hilsa shad being most abundant during the cold season and Pama croaker and Mango fish being predominant during the rainy season. This finding was also supported by a local ecological assessment of spawning area of (Hte *et al*., 2023) [9] that the fishers stated that Mango fish and Pama croaker were mainly caught in the rainy season and Hilsa in the cold season. The three major species are supposed to be anadromous, undertaking migrations upstream past Sut Pa Nu Village to spawn in the Sittaung River.

Total Value and Contribution of Major Species

The economic contribution of the small-scale fishery at Sut Pa Nu Village to local livelihoods is described in Table 2. With an average annual landing of 11,799 kg, the annual gross income amounted to 40,980 USD, although both landings and income showed a marked decline starting in 2021. The annual gross income per fisher varied from 983 to 2,873 USD with an average of 1707 USD, possibly based on fish availability, market price and value of MMK. These figures are consistent with findings (average of 1200 USD/fisher/year) from an ecosystem valuation study recently conducted including Sut Pa Nu Village (Hte *et al*., 2023) [7] and exceed the annual incomes of fishers (840-1824 USD/fisher/year converted from monthly income in INR) in the Rupnarayan River, India (Dey & Panigrahi, 2024) [23]. However, these earnings from fishing alone may not be sufficient to cover the monthly living expenses of an average household unless supplemented by alternative income sources.

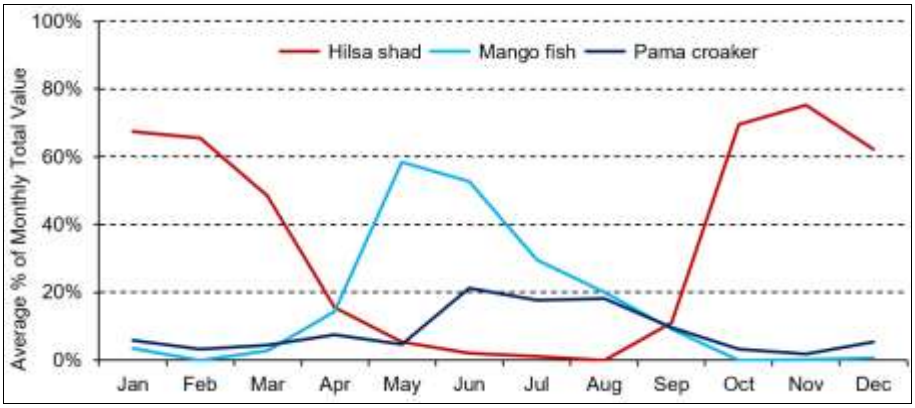

Fig 6: Economic contribution of three major species to monthly total value landed at Sut Pa Nu Village over the period of 2021 to 2024

The three major species represented 76% of the total value of the landings (Appendix A). Hilsa shad has consistently contributed the largest share to the economic value of the fishery, accounting for 43% of the total value, while Pama croaker and Mango fish have contributed 19% and 14%, respectively, highlighted their significance both in landings and economic contribution. The fishers benefited from regular monthly earnings through these species, with regular income generated by Pama croaker year-round, higher earnings from Hilsa shad during October to March, and higher earnings from Mango fish during April to September (Figure 6). Therefore, the fishing ban from May to July, regulated by the DoF, is not well-suited to protecting the economically important Hilsa shad. Moreover, it poses challenges for fishers, as this period coincides with the peak landing months for the other two economical species of Pama croaker and Mango fish (Figure 5). Hence, as one of the alternative strategies for sustainable fisheries management, area-based conservation measures, such as establishing no-take Fish Conservation Zones in strategic locations of the river, should be explored rather than a seasonal closure.

Conclusion

This study on the multi-species fish landings at Sut Pa Nu Village provides critical insights into local fisheries in the Sittaung River Estuary, highlighting annual and seasonal variation in species abundance, diversity, and economic contributions over eight years. While annual landings exhibited an increasing trend until 2020, a sharp decline has been observed since then. Additionally, species diversity has gradually decreased in terms of richness and evenness over the years. Hilsa shad, Pama croaker, and Mango fish were identified as the three major species, each with distinct seasonal patterns. These species not only contributed

substantially to the total landings but also accounted for a significant proportion of the economic value. The variability in seasonal landings of these key species significantly influenced overall annual yields, indicating their importance to sustainable fisheries management. They provided fishers with a steady income through two peak seasons-one driven by the migrations of Pama croaker and Mango fish, and the other by Hilsa shad. Policy makers should revise the fishing ban period to better align with spawning seasons of all major species, ensuring both ecological sustainability and economic viability. As temporal restriction of fishing is not feasible, spatial conservation approaches, such as community-managed no-take FCZs, should be implemented to safeguard key species in their preferred habitats throughout the year. Although hydrologic process may have contributed to the reduction in fish landings, which cannot be addressed through human intervention, law enforcement on illegal use of stake nets is urgently needed to protect fish diversity and local livelihoods. The findings from this study would not represent precise information due to some limitations but could be regarded as an indicator of fishery dynamics in the Sittaung River Estuary. Targeted monitoring of the three major species would contribute to sustainable fisheries management, supporting local livelihoods in the area.

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Appendix A. Average annual landing and value by fish species landed at Sut Pa Nu Village over the period of 2017-2024

No.	Common Name	Local Name	Scientific Name	Average Annual Landing		Average Annual Value	
				kg	%	MMK	%
1	Hilsa shad	Nga Tha Lauk	*Tenualosa ilisha*	2776	20.8	39,603,411	45.8
2	Pama croaker	Nga Poke Tin	*Otolithoides pama*	2237	16.7	14,825,013	17.1
3	Mango fish	Nga Mway	*Polynemus paradiseus*	2187	16.4	11,018,227	12.7
4	Flathead grey mullet	Ka Ba Lu	*Mugil cephalus*	950	7.1	2,496,907	2.9
5	Various Small Fish	Nga Sone	-	691	5.2	1,591,265	1.8
6	Wallago	Nga Bat	*Wallago attu*	610	4.6	2,581,666	3.0
7	Striped dwarf catfish	Nga Zin Yaing	*Mystus vittatus*	599	4.5	889,582	1.0
8	Scaly hairfin anchovy	Nga Pyar	*Setipinna taty*	537	4.0	1,602,455	1.9
9	Giant River Prawn	Pa Son Htoke	*Macrobrachium rosenbergii*	489	3.7	5,828,260	6.7
10	Seabass (barramundi)	Ka Ka Tit	*Lates uwisara*	335	2.5	1,604,125	1.9
11	Freshwater whipray	Nag Lake Kyaut	*Himantura marginata*	294	2.2	837,110	1.0
12	Moustached thryssa	Nga Pyar	*Thryssa mystax*	270	2.0	673,274	0.8
13	Toli shad	Nga Tha Lauk Yauk Pha	*Tenualosa toli*	270	2.0	495,481	0.6
14	Striped snakehead	Nga Yant	*Channa striata*	220	1.6	574,263	0.7
15	Fresh water mullet	Nga Zin	*Rhinomugil corsula*	213	1.6	600,230	0.7
16	Carplet, Barb	Nga Phar Ma	*Osteobrama alfredianus*	178	1.3	336,343	0.4
17	Butter catfish	Nga Myin	*Silonia silonia*	125	0.9	162,997	0.2
18	Stingrays	Nga Lake Kyaul	Hypanus americanus	89	0.7	164,340	0.2
19	Menoda Catfish	Nga Eike	*Hemibagrus menoda*	67	0.5	72,021	0.1
20	Mrigal	Nga Gyin Phyu	*Cirrhinus mrigala*	41	0.3	94,851	0.1
21	Catla	Nga Thai Gaung Pwa	*Catla catla*	36	0.3	74,851	0.1
22	Whiskered catfish	Nga Gyaung	*Sperata aor*	30	0.2	32,509	0.0
23	Minor carp	Nga Gyin	*Labeo bata*	30	0.2	49,890	0.1
24	Fresh Water Catfish	Nga Khu	*Clarias batrachus*	29	0.2	49,150	0.1
25	Blackedge whipray	Nag Lake Kyaut	*Himantura chaophraya*	26	0.2	110,571	0.1
26	Giant river catfish	Nga Yaung	*Netuma thalassina*	18	0.1	58,072	0.1
27	Golden Flathead Goby	Ka Tha Boe	*Glossogobius aureus*	8	0.1	22,571	0.0
28	Soldier catfish	Nga Yaung	*Osteogeneiosus militaris*	7	0.1	12,856	0.0
29	Glass fish	Nga Zin Zut	*Parambassis ranga*	4	0.0	7,713	0.0
30	Frogmouth catfish	Nga Kyauk Phar	*Chaca chaca*	3	0.0	4,714	0.0
31	Climbing perch	Nga Pyay Ma	*Anabas testudineus*	2	0.0	4,285	0.0
32	Indian threadfin	Ka Ku Yan	*Leptomelanosoma indicum*	2	0.0	9,000	0.0