DISTRIBUTION AND ABUNDANCE OF YELLOWTAIL CATFISH *PANGASIUS MYANMAR*, ROBERTS AND VIDTHAYANON 1991, IN THE ESTUARY ENVIRONMENT OF YANGON RIVER*

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Abstract

This study investigates the abundance and distribution of the endemic yellowtail catfish, *Pangasius myanmar*, within the Yangon River estuary. Fish data, including length and weight measurements, were collected through field observations and interviews. Surface water samples were collected using standard sampling procedures for laboratory quality analysis. Pearson's correlation coefficient was used to evaluate the relationship between fish length and weight. Field observations and interviews revealed that the species is widely distributed across the coastal, river mouth, and intertidal zones, extending up to 23 miles (38.34 km) upstream from the river mouth, which itself stretches approximately 40 miles (63.37 km). Seasonal variations in catch were noted, with increased captures upstream during the dry season and active fishing in downstream during the wet season, particularly in the brackish water zone where freshwater and saltwater converge. Remarkably, fishing activity yielded the highest catches near mangrove areas during high tides, with fishermen using lift nets to exploit the catfish's foraging behavior. Over the study period from November 2023 to October 2024, a total of 2,839 fish were recorded, with monthly catches highest in November (475 fish) and reducing in May (75 fish). The total weight of the harvest reached 16,512.7 kg, with the highest monthly weight recorded in October (2,671.2 kg). The findings indicated the ecological significance of the Yangon River as a breeding and feeding habitat area for *Pangasius Myanmar* which is endemic species to Myanmar, Yangon Region. The correlation between fish length and weight is both strong and statistically significant, meaning that fish grow proportionally in both dimensions. This suggests healthy growth status in terms of both body length and weight. Fluctuations in water quality, particularly during the reproductive periods such as egg maturation in April directly influence the species' health and population viability. Therefore, the protection and appropriate fishery management of this estuarine ecosystem, which is rich in mangroves and salt marshes, is vital for the sustainability of the local fishery and the continued presence of this endemic species in the Yangon River.

Key words: Distribution, abundance, estuary habitats, Yangon River, *Pangasius myanmar*

Introduction

The fish species *Pangasius myanmar*, commonly known as the yellowtail catfish for its distinctive yellow tail, was first identified as a new species by the California Academy of Sciences in 1937. It was later scientifically documented by Roberts and Vidthayanon in 1991 and is locally known as "Myit Nga Tan" in Myanmar because it inhabits the rivers. It is native to Myanmar, particularly in the Yangon region and the Yangon River. This yellowtail catfish is a benthopelagic tropical species can grow up to 120 cm in length (FishBase, 2015). This species is one of the most commercially important and nutritious riverine fish (Monalisa et al., 2012). It is a carnivorous and voracious fish that also eats mangrove fruits, with juveniles found in high estuaries, sub-adults migrating to brackish waters, and adults reaching river mouths and inshore areas.

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Estuarine river waters where freshwater from rivers mixes with seawater, which serve as critical habitats for a range of aquatic species (NGS, 2023). These habitats characterized by mangrove ecosystems, salt marsh grasses and sediment-rich mudflats, provide food and shelter for various aquatic species including catfishes (NOAA Fishery, 2022). Distribution is narrow range, native only to the river systems of Myanmar, particularly the Yangon region. The fish plays a vital role both ecologically and commercially. This benthopelagic species feeds voraciously on smaller aquatic organisms and mangrove fruits, its feeding habits showing the connection between the estuary system, mangrove ecosystems, the survival of fish populations and its specific geographic location. Mangroves, with their dense roots, act as nurseries, offering shelter to juvenile fish while providing abundant nutrients through detritus and organic matter. As the fish grow, they move to brackish waters and eventually reach the open river mouth. Therefore, understanding the distribution of species, population and habitat preferences in the estuarine environment of Yangon River is essential for informing sustainable fisheries management and conservation efforts. The aim of this study is to examine the abundance and distribution of *Pangasius myanmar* within the Yangon River estuary.

The objectives of the study are to examine the abundance and distribution of *Pangasius myanmar* (Yellowtail catfish) within the Yangon River estuary, to understand the role of estuarine habitats, particularly mangrove ecosystems and brackish waters/water quality, in supporting the life cycle and feeding habits of *Pangasius myanmar* and to provide insights for sustainable fisheries management and conservation efforts by studying the species' population, habitat preferences, and geographic distribution in the Yangon region.

Materials and Methods

Study area

The Yangon River was selected as the study area because it provides habitats for the species Pangasius in Myanmar. This study site is located along the Yangon River, near Chaung Wa Village in Kyauktan Township, Yangon Region (Figure 1). The study area, Yangon River estuary, formed by the confluence of the Pegu and Myitmaka rivers, is an estuarine system. It flows from Yangon to the Gulf of Martaban which is part of the Andaman Sea and experiences significant tidal influences. The river has strong water currents and turbid conditions particularly during the rainy season and on days of spring tides. Mangrove and salt marsh grass habitats are found in the segment of the Yangon River mouth, an estuary environment featured by the influence of the intertidal zone (Figure 2). A total of six mangrove species commonly occur in the mangrove area along the river within the study segment. They are *Avicennia officinalis* (Lame); *Sonneratia apetala* (Kambala); *Sonneratia caseolareis* (Lamu) *Nipa fruticans* (Dani); *Clerodendrum inerme* (Pinle-kyauk-pan); *Cyperus malaccensis* (Nil). In addition, there is a large area of salt marsh grass in the muddy area along the river bank downstream of the river. These mangrove and salt marsh habitats provide shelters, foods and nursery grounds for aquatic organisms, including study fish (NOAA, 2022). The Yangon River is highly productive and plays a vital role in supporting the local fishery. Many residents living along the river relies on fishing, as well as the selling and buying of fish, for their livelihoods. They use various types of fishing gear, including drift gill nets, stow nets, trammel nets, beach seine nets, cast nets, lift nets, and push nets. Of these, drift gill nets are the most commonly used, particularly for catching

commercially valuable fish such as pangas catfish, hilsa, and seabass. Approximately 350 fishing boats fish in the study area.

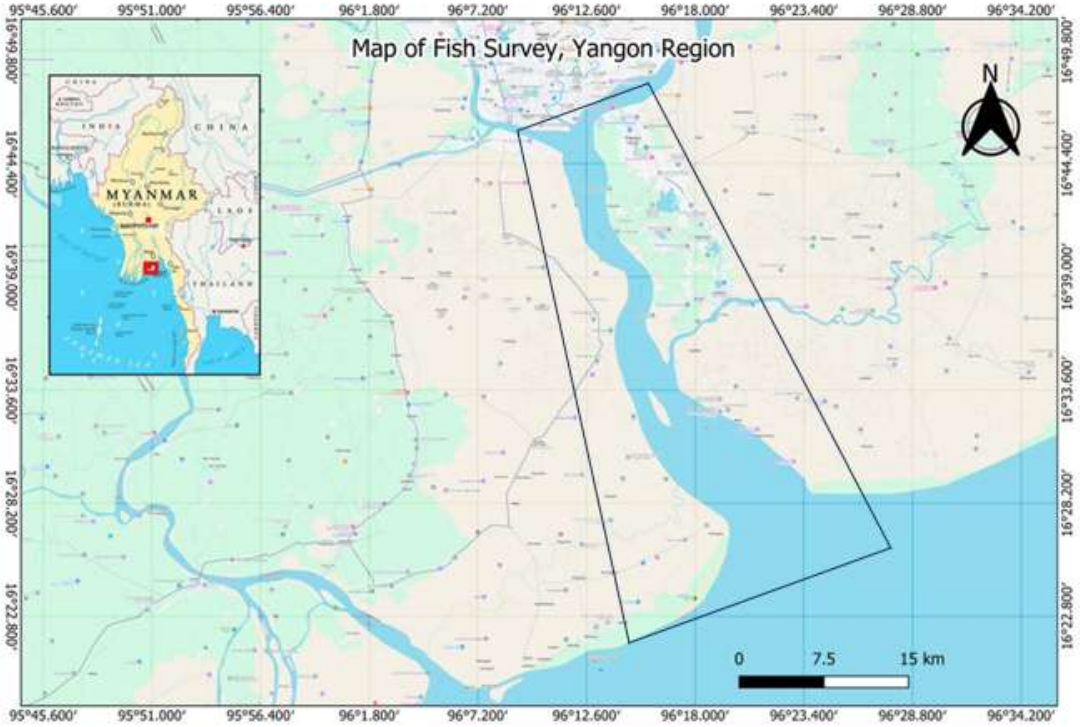

Figure 1. Study area of Yangon River estuary habitat influenced by the intertidal zone showing highlight by rectangle

(a) (b)

Figure 2. Mangrove and salt marsh grass habitats (a) and fishing catfish using lift net encircle the mangrove during high tide (b) in the segment of the Yangon River mouth, the estuary habitat influenced by the intertidal zone

Data Collection and Sampling

Field observations were conducted during both the dry and wet seasons. Observations were conducted in both the dry (April 2024) and wet (October 2024) seasons, focusing on fish caught using drift gill nets and lift nets. Sampling was based on fieldwork and interviews. Fish data were collected from fishermen catching the fish in the surrounding area of the Yangon River in the selected study area, as well as from fish purchase centers and through interviews. The distribution of mangrove and salt marsh grass habitats have been recorded which provide food and shelter for aquatic organisms, including studying catfish.

Water parameters relevant to the effects on health, growth, population and distribution of the study fish were measured both in the field and in the laboratory. Surface water sample was

collected from designated study sites. The water sample from 2 feet depth was collected for determining river water quality. The clear sampling plastic bottles of 1 L capacity was rinsed three times with deionized water and river water, then, filled and screwed tightly with cap. Some physicochemical parameters such as pH, temperature, electrical conductivity, total dissolved solids and dissolved oxygen of collected water samples were onsite tested and other parameters were determined within 24 hrs at the laboratory.

Those properties of water quality parameters such as temperature, pH and salinity were determined by Exact® pH+ meter master kit (S/N: PHP 1947513), dissolved oxygen (DO) was determined by Dissolved Oxygen Meter(HI 9146-04, Hanna, USA), turbidity, total hardness, ammonia and nitrate were determined by Exact micro 20 + photometer with Bluetooth SMART, 525 nm +638 nm wavelength (S/N: M 20 BTA 00009 HACH test kit), biochemical oxygen demand (BOD) was determined by APHA Standard Test Method. Some heavy metals such as mercury, lead and cadmium were determined by GBC-932 plus Atomic Absorption Spectrometer (GBC Scientific Equipment Ltd., Australia) at Fershwater Aquaculture Laboratory, Department of Fisheries, Ministry of Agriculture, Livestock and Irrigation. The results of water sample parameters and their effects on the health, growth, survival of fish distribution and abundance depending on the the river ecosystem are shown in Table (2).

Statistical analysis

Pearson's correlation coefficient was used to assess the relationship between fish length and weight. This measure assesses the linear correlation between two variables, with values ranging from -1 (perfect negative correlation) to 1 (perfect positive correlation). A correlation coefficient close to 1 suggests a strong positive relationship, meaning that as the fish's length increases, the weight also increases proportionally. A p-value is also computed to assess the statistical significance of this correlation.

Results and Discussion

Description of the study species

The *Pangasius myanmar* is a species of catfish that belongs to the family Pangasiidae, commonly known as the yellowtail catfish for its distinctive yellow tail (Figure 3(a)). Observation data indicated that *Pangasius myanmar* closely resembles *P. pangasius*, but differs from it by having a narrower and more transverse mouth; shorter barbels; palatal dentition with short oval palatine patches and a median oval vomerine patch; fewer gill rakers with several distinct morphological characteristics. It has streamlined body with a moderately elongated shape. The head is small, and the mouth is terminal with shorter barbels not reach to operculum. Its dorsal fin is relatively short but features a sharp spine while the pectoral fins are wide and strong also possessing spines. The caudal fin is forked. The body color is silver-gray with a lighter underside (Roberts and Vidthayanon , 1991).

Distribution

Based on field observations and interviews, yellowtail catfish were found throughout the coastal, river mouth, and intertidal areas of the Yangon River estuary, extending up to 23 miles (38.34 km) from the river’s mouth, which spans about 40 miles (63.37 km). During the dry season, more catfish are caught upstream, while in the wet season, the catch is higher downstream and near the river mouth, where saltwater and freshwater mix to form estuarine

waters. Additionally, the fish catch is greater in the waters near the mangrove area. The fisherman catches fish in the mangroves during high tide using a lift net, as the fish search for food among the mangrove. The yellowtail catfish is a carnivorous and voracious fish that eat fish, crustaceans, mollusks and also eats mangrove fruits with juveniles found in high estuaries, sub-adults migrating to brackish waters, and adults reaching river mouths and inshore area.

Its distribution in the estuary is closely tied to seasonal variations in water flow and salinity. During the early monsoon season, when rainfall increases freshwater input into the river, and during the late monsoon, when the last surge of rainwater mixes with marine water from the sea, *Pangasius myanmar* is particularly abundant in the estuarine zone. However, despite its economic importance and relatively high abundance in the region, little scientific attention has been given to the species and comprehensive data on its distribution and population trends is rare (Fishbase, 2015 ; Roberts and Vidthayanon , 1991).

During the field observation, the fish were primarily found near the river mouth, within estuary and mangrove habitats. This finding is revealed with the distribution of this species described by Fishbase, 2015. The data shows a similar count of fish during both seasons (7 in the dry season and 8 in the wet season), with an average total length of 96.68 cm (n=15). All observed fish were adults. In April, the presence of mature eggs in their abdomens (Figure 4B) indicated that reproductive activity began in April and happen during pre-monsoon (May to June), and breeding might occur in the study area, Yangon River. This suggests that the fish *Pangasius myanmar* not only inhabit but also breed in Yangon River, potentially influenced by habitat and environmental conditions.

(a) (b)

Figure 3. Recorded (a) *Pangasius myanmar* and (b) Examination of eggs in adult fish

Abundance

A total of 2,839 fish were recorded over the year with the highest number in November (475) and the lowest in May (75). The total weight harvested for the year was 16,512.72 kg with the highest monthly weight recorded in October (2,671.2 kg) and the lowest in May (490.6 kg). It summarizes the monthly recorded quantities *of Pangasius myanmar* (Yellowtail catfish) harvested from the Yangon River, collected from two purchase centers in Chaungwa village, Kyauktan Region, between November 2023 and October 2024 (Table 1 and Figure 4). The data indicates the highest abundance in November and the lowest in May, reflecting seasonal fluctuations in the fish population and availability in the Yangon River.It was suggested that Yangon River is home for endemic fish of *Pangasius myanmar.* This species plays a crucial role in the local fisheries, contributing to both livelihood and commercial markets in Yangon and surrounding areas. *Pangasius myanmar* is an estuarine and freshwater species native to the Yangon Region, recorded seasonally in Yangon River with a known distribution limited to this

area. IUCN (2015) described that its conservation status is Data Deficient (DD) that there is insufficient information to make a direct or indirect assessment of a species' risk of extinction. According to Gupta et al. (2016), the decline in fish populations is attributed to overfishing, habitat degradation, pollution, and migration barriers such as dams and embankments.

Table 1. Monthly recorded *Pangasius myanmar* (yellowtail catfish) from Yangon River, data collected from two purchase centers at Chaungwa village, Kyauktan Region.

ZMT+ UHW	Nov	Dec	Jan	Feb	M	A	May	Jun	Jul	Aug	Sep	Oct	Total
No. of fish	475	330	159	182	75	100	180	220	268	200	235	415	2839
Weight (kg)	2402.4	2217.6	860.2	1008	490.6	630	924	1108.8	1344	1344	1512	2671.2	16512.7

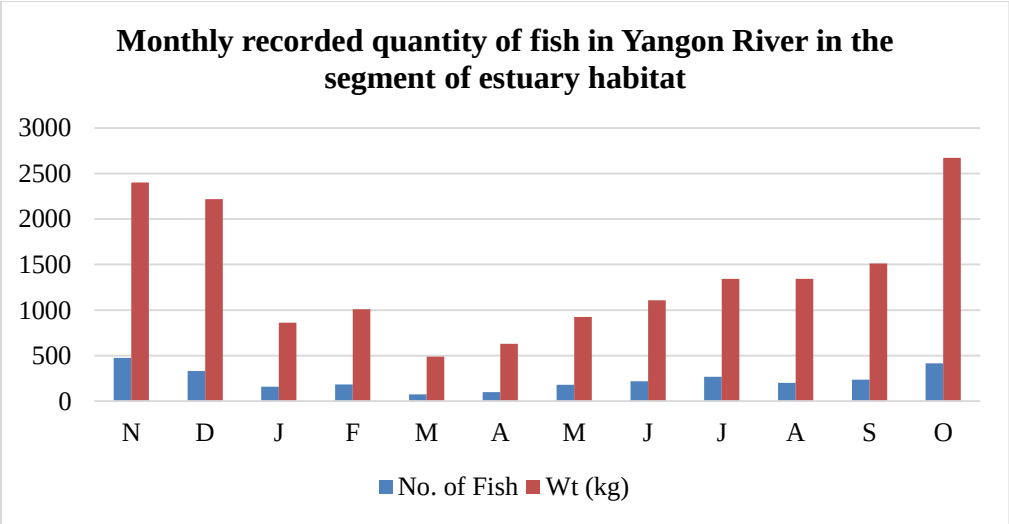

Figure 4. Monthly recorded *Pangasius myanmar* from Yangon River, data collected from two purchase centers at Chaungwa village, Kyauktan Region

Relationship of length and body weight of Catfish

The statistical analysis yielded a Pearson's correlation coefficient (r): 0.936. This value indicates a very strong positive correlation between the length and weight of fish. P-value: 3.08 x 10 -14, which is extremely small, suggesting that this correlation is statistically significant (Figure 5). The scatter plot above also visualizes this relationship, with a best-fit line showing that as the fish's length increases, its weight increases in a near-linear fashion. The correlation between fish length and weight is both strong and statistically significant (Figure 6), meaning that fish grow proportionally in both dimensions. This finding suggests a healthy growth status where body dimensions increase proportionally.

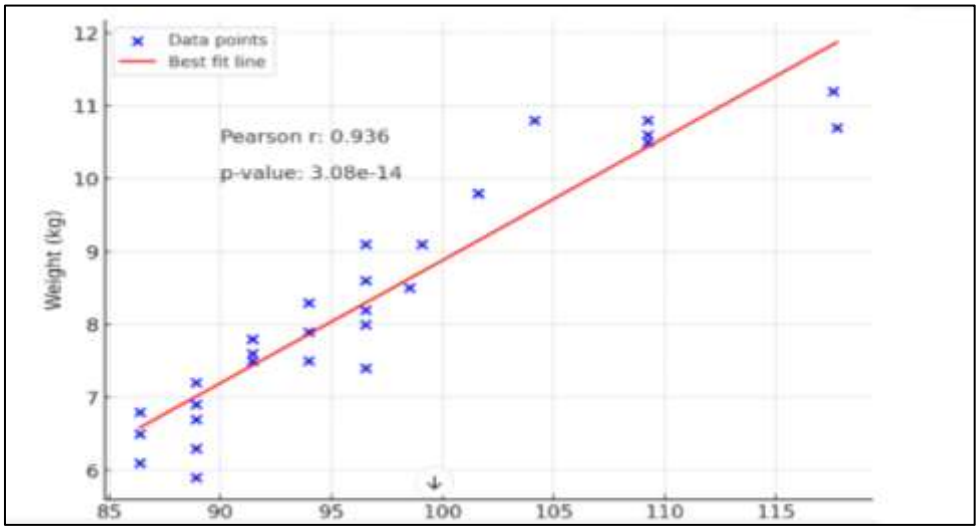

Figure 5. Correlation between length and weight of *Pangasius Myanmar*

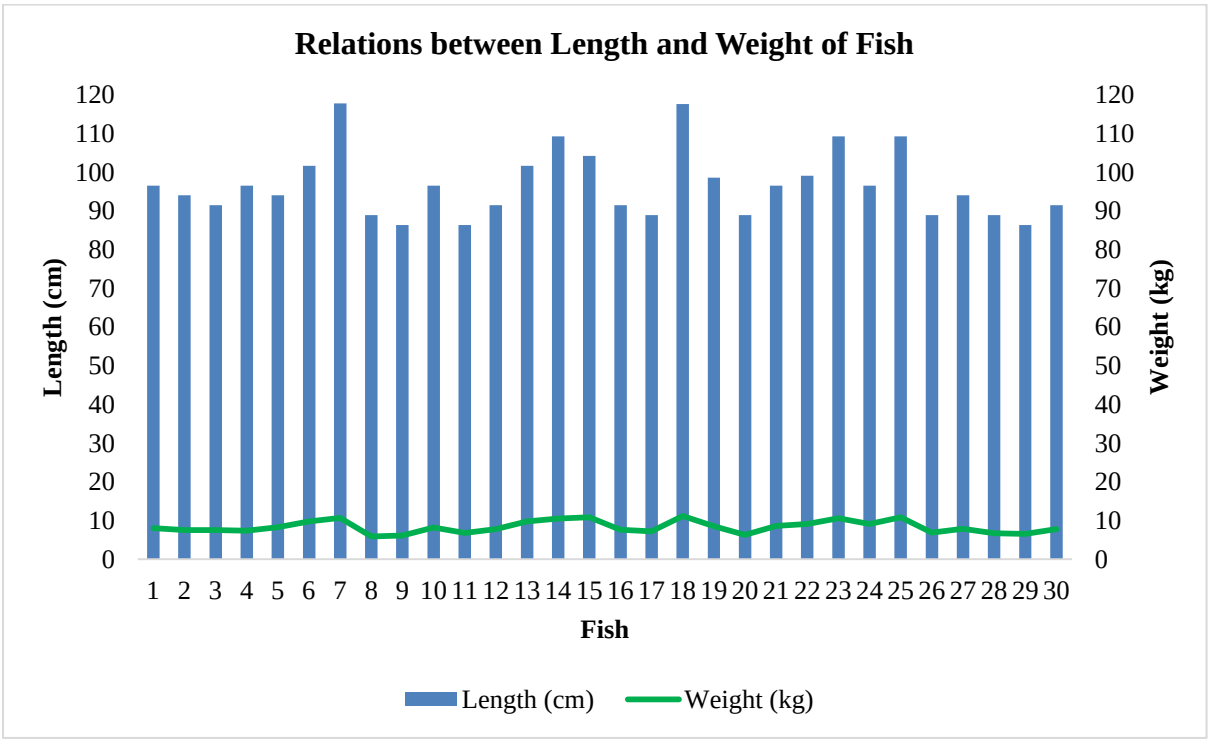

Figure 6. Relationship between length and weight of-*Pangasius myanmar*

Relationship between water quality, health and survival of fish

The water quality in the study area of Yangon River as shown in Table 2, plays a critical role in the ecology of *Pangasius myanmar*, an endemic species adapted to salinity fluctuations. Key parameters such as temperature, pH, dissolved oxygen (DO), salinity, and turbidity significantly influence the reproduction, population dynamics, health, and survival of this species. Temperature fluctuations between 26-29°C align with the optimal range (25-30°C) for metabolic processes, behavior, and reproduction. Similarly, pH levels (6.5-7.5) support metabolic functions and reproductive health within the tolerable range for the species. DO concentrations (6.29-12 mg/L) are conducive for respiration and survival, while BOD levels are low, indicating

favorable conditions for aquatic health. However, elevated salinity (0.02-15 ppt) suggests the estuarine environment's fluctuations, which *Pangasius myanmar* can adapt to as they thrive in variable salinity. High turbidity (15-50 NTU) may inhabit feeding and reproduction, especially if it crosses the threshold of 20 NTU, affecting visibility and oxygen exchange. Low levels of harmful substances like ammonia (0.033 mg/L) and nitrates (5.0 mg/L) suggest a relatively safe environment for growth, though heavy metals like cadmium (0-0.19 mg/L) and lead (0-0.03 mg/L) could present long-term health risks. In this estuarine system with mangroves, the water quality fluctuations directly impact *Pangasius myanmar's* reproductive cycles (notably egg maturation in April), population viability, and overall health, especially as they adapt to the freshwater and brackish environments (Table 2).

Table 2. Summary of surface water quality parameters and their effects on the health, growth, survival of fish,-and the river ecosystem

Sr. No	Parameter	Effects on health and survival fish	Observed value	Standard value for fish (Clesceri *et a.l,* 1999)
1	Temperature (°C)	Effects on metabolism, behavior, reproduction, and overall health	26-29	25-30
2	pH	Effects on metabolism, growth, and reproductive health	6.5 -7.5	6.5 - 9
3	DO (mg/l)	Effect on respiration	6.29 -12	5-14
4	Salinity (ppt)	Effect on metabolism, growth and reproduction	0.02 -15	10-25
5	Turbidity (NTU)	Effects on feeding, breathing, and reproduction	15- 50	<20
6	BOD (mg/l)	Effect on the health of aquatic environments and the survival of fish	2.5	<3
7	Ammonia(mg/l)	Effect on growth and health	0.033	<0.25
8	Total hardiness (mg/l)	Effect on growth and health	100-150	>200
9	Nitrate (mg/l)	Effect on growth and health	5.0	0.5 -10
10	Hg (mg/l)	Poses significant risks to fish health and toxic to the ecosystems they inhabit	0	~ 0
11	Pb (mg/l)	Poses significant risks to fish health and toxic to the ecosystems they inhabit	0 – 0.03	~ 0
12	Cd (mg/l)	Poses significant risks to fish health and toxic to the ecosystems they inhabit	0 - 0.19	~ 0

Conclusion

The Yangon River is home of *Pangasius myanmar* which has been observed the whole year. The Yangon River, particularly in its estuarine segment downstream, serves not only as a

breeding ground but also as a favorable habitat. This species is not only ecologically significant but also economically important to local fisheries. Known locally as "Myit Nga Tan", its high protein and fat content make it a prized catch, contributing to the livelihoods of fishing communities in this region. In this estuarine system with mangroves, the water quality fluctuations directly impact *Pangasius myanmar's* reproductive cycles (notably egg maturation in April), population viability, and overall health, especially as they adapt to the freshwater and brackish environments. Protecting the delicate balance of the estuarine habitats, especially the mangrove and salt marsh areas, is the key to ensuring sustainable local fisheries and the preservation of *Pangasius myanmar* in the Yangon River.

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