# Seasonal Abundance of *Notopterus notopterus* (Pallas, 1769) at Ayeyawady River segment in Maubin Township

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## Abstract

The abundance of fishes depends on a variety of reasons such as climate change, environmental conditions and variability of food resources. Habitat loss and environmental degradation assumes top most priority affecting the distribution and abundance of fishes. The seasonal abundance of *N. notopterus* from Ayeyawady River, Maubin Township was investigated between November 2015 and October 2017. Fishes were collected from the fishermen monthly. Physico–chemical parameters such as water temperature, pH, salinity, dissolved oxygen, turbidity and rainfall were recorded. The pattern of seasonal abundance of *N. notopterus* was quite similar between the two consective years. The abundance of *N. notopterus* was the highest in winter followed by summer and rainy season. Turbidity is highly different between the two years, however, there was no relationship between the turbidity and the rainfall. The water temperature, pH and salinity did not exceed the limit for the freshwater fishes. The results from this study clearly show that the physico–chemical and the environmental parameters of the study area might be suitable for fish life in the river. Our results provide baseline information about the pattern of seasonal abundance of *N. notopterus* in accordance with its abiotic environment.

**Keywords**: Seasonal abundance, baseline information, physico– chemical parameters

## Introduction

Rivers and lakes play an important role in ecological balance and economy of the country. They contribute to the basic human needs such as water for drinking, industrial use, irrigation, inland navigation, fishing and recreation. Many aquatic fauna particularly in rivers and lakes were declined rapidly throughout the world because of the anthropogenic activities and other environmental degradation. The abundance of fishes and its distribution pattern depends on a variety of reasons such as climate change, environmental conditions and variability of food resources. The knowledge on abundance and distribution pattern is important in determining the effects of fishing and environmental disturbances. The number of fishes will decrease if the stock are over exploited or threatened by environmental degradation. On the other hand, the numbers will increase if there are no limiting factors such as unlimited food, fishing and habitats. Habitat loss and environmental degradation assumes top most priority affecting the distribution and abundance of fishes. Among the causes for habitat degradation, water quality is an important factor to decline in aquatic faunas (Richter *et al.*, 1997). Hence, to assess and evaluate the abundance of fish and water quality has become an important role in conservation of aquatic life.

River and lake ecosystem contributes both biologically and ecologically important habitats for freshwater fishes in Myanmar. In addition, the shallow bodies of its water provide biological variations such as predation, competition and refuge (Gibson, 1994).

Several parameters influence the distribution of both the juveniles and adults of fish species. Hence, the relationship between environmental factors and the distribution of fish has received considerable attention. In this paper, we analyzed the seasonal abundance of *N. notopterus* and elucidated the potential abiotic factors, which influence the seasonal abundance of the target fish *N. notopterus*. The climate of Myanmar is classified into summer (March to May), rainy (June to October) and winter (November to February). *N. notopterus* is a seasonal

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monsoon breeders and the peak spawning season is often associated with increased rainfall and flood (Htar Ei Hlaing, 2009). During the rainy season, the rainfall is high in Myanmar and the water volume is increased due to South Westerly winds. In addition, water temperature is suitable for reproduction of fishes and hence in rainy season many freshwater fish were engaged in their reproductive activity in Myanmar (Thanda Tun, 2004). In winter, the water volume and temperature is decreased because of the North Eastern winds. In summer, the water volume is decreased and the water temperature is high. The aims of the present study are (1) to assess the seasonal abundance of *Notopterus notopterus* at Ayeyawady River in Maubin township (2) to investigate the variation of population of *N. notopterus* during the two consecutive years and (3) to examine the relationship between the abundance of *N.notopterus* and it's abiotic environment (physico-chemical parameters).

## Materials and methods

### Study area

The study area located between latitude 16˚ 43´ 52˝ N and 95˚ 29´ 08˝ E (Fig.1). Fishes were collected monthly during the study period from November 2015 to October 2017 with the help of local fishermen using gill nets (9144 cm long and 366 cm wide nylon gill net with a stretch mesh size) and then grouped by season. Fish caught by the nets were counted and recorded the monthly catch per unit effort (CPUE) = number of fish caught/day.

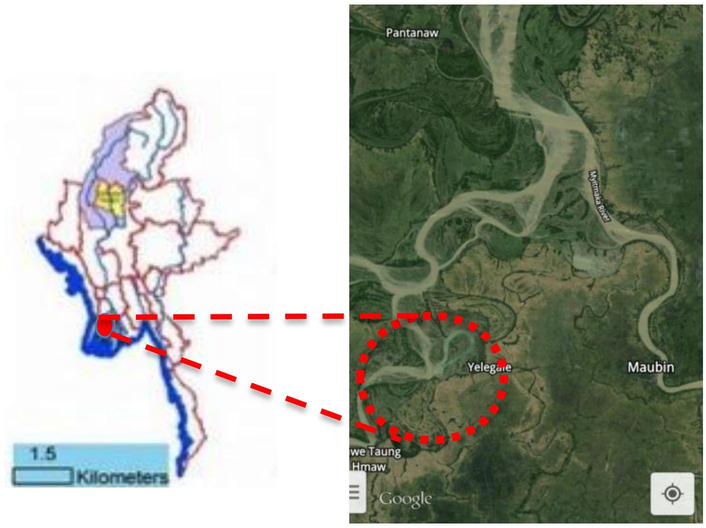



Fig. 1 Ayeyawady River, Maubin Township, Ayeyawady Region Source: Google Earth

### Water samples collection

Monthly water samples were collected in polythene cans from the study sites Ayeyawady River. Water temperature and pH were determined on the spot at the study site. For further analysis samples were transported to laboratory and analyzed other parameter such as DO, ammonium, salinity and turbidity using standard procedures. Monthly rainfall and air temperature were obtained from meteorological station, Yangon, Myanmar.

### Statistical analysis

Variations of seasonal abundance of the fish were calculated by summing up seasonal monthly data. The seasonal variation of fish abundance was analyzed with student T-test. Spearman correlation test was used to examine the relationship between abundance of fish and rainfall. Mean and standard deviation of each of the physico-chemical parameters were calculated. A multiple linear regression was used to analyze the relationship between the abundance of fishes and the following environmental variables: water temperature, rainfall, dissolved oxygen, turbidity, $NH_3$ and salinity.

## Results

A total of 4429 individuals were collected during the study period (from November 2015 to October 2017). *N. notopterus* were abundantly found in winter season (CPUE=18.29$\pm$3.37) followed by summer (16.36$\pm$3.12) and rainy season (11.4$\pm$6.60) (Fig. 6). In 2015–2016 study period, a significant difference of fish abundance was found between winter and rainy season (T–test: p=0.003, t=3.08, df=94.16) and between summer and rainy season (p=0.03, t = 2.19, df = 67.29). However, there was no significant difference between winter and summer (p=0.53, t=0.63, df=75.91). The same trend was found in 2016–2017 study period (winter–rainy: p=0.03, t = 2.26, df = 89.37; winter–summer: p=0.07, t = 1.82, df = 71.17; rainy–summer: p=0.40, t = 0.84, df = 78.77) (Fig. 2 and 3).

Rainfall is the highest in rainy season (19.11cm in August) and the lowest in winter and summer (0 cm in November, December, March and April) (Fig.11). A significant negative correlation was found between abundance of fish and rainfall (correlation: t = –4.724, p–value=0.039). There is no relationship between the other environmental factors (Fig.4, 5).

In 2015–2016, water temperature is the highest in summer (32°C in May) and the lowest in winter (24.5°C in January). In 2016–2017, water temperature is the highest in summer (32.5°C in May) and the lowest in winter (25°C in January). Monthly water temperature between the two years is not significantly different (Wilcoxon rank sum test: p=0.93, W = 74) (Fig. 7).

In 2015–2016, the concentration of dissolved oxygen was the highest in winter (8mg/l in January) and the lowest in rainy season (4.6 mg/l in August). In 2016–2017, highest DO was found in summer (7.8 mg/l in March) and lowest in rainy season (5 mg/l in August). DO was not significantly different between the two year study period (p=0.73, W = 78.5)(Fig. 8).

In 2015–2016, turbidity is the highest in rainy season (328 NTU in October) and the lowest in winter (54 NTU in February). In 2016–2017, the highest turbidity was found in rainy season (680 NTU in July) and the lowest in summer (68 NTU in March). Turbidity was significantly different between the two years (p=0.01, W = 29). However, there was no relationship between the rainfall and turbidity (Pearson correlation: p=0.29, t = 1.0908, df = 20) (Fig. 9).

In 2015–2016, monthly pH value was not significantly different (6.0–7.7). The same trend was found in 2016–2017 (6.7–7.5). Monthly pH value between the two years was not significantly different (p=0.08, W = 41) (Fig. 10). Low salinity (0.01 ppt) was found throughout the study period. In 2015–2016, the level of $NH_3$ was (0–0.9 mg/l), however, in 2016–2017 the level was slightly increased (0–1.4 mg/l) (Table 1).

Table 1 Physico-chemical parameters of Ayeyawady River at Maubin Township

| Months | Temperature | | Turbidity | | Dissolved oxygen | | pH | | Salinity | | NH3 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2015–16 | 2016–17 | 2015–16 | 2016–17 | 2015–16 | 2016–17 | 2015–16 | 2016–17 | 2015–16 | 2016–17 | 2015–16 | 2016–17 |
| November | 28 | 28 | 98 | 620 | 6.2 | 5.8 | 7.00 | 7.50 | 0.1 | 0.1 | 0 | 1.4 |
| December | 27 | 25 | 92 | 422 | 6.4 | 5.8 | 7.30 | 7.20 | 0.1 | 0.1 | 0.9 | 0 |
| January | 24.5 | 25 | 86 | 170 | 8 | 7.2 | 6.80 | 6.70 | 0.1 | 0.1 | 0 | 1.3 |
| February | 25 | 27.4 | 54 | 218 | 7.6 | 6.6 | 7.40 | 7.50 | 0.1 | 0.1 | 0 | 0.6 |
| March | 30 | 29.3 | 72 | 68 | 4.8 | 7.8 | 6.00 | 7.20 | 0.1 | 0.1 | 0.7 | 0.2 |
| April | 31.3 | 28 | 62 | 280 | 7 | 6 | 7.70 | 7.50 | 0.1 | 0.1 | 0 | 0.4 |
| May | 32 | 32.5 | 205 | 168 | 6.4 | 5.4 | 6.90 | 7.40 | 0.1 | 0.1 | 0 | 1.2 |
| June | 29.7 | 31.7 | 85 | 288 | 6.2 | 6.6 | 6.40 | 6.90 | 0.1 | 0.1 | 0 | 0.4 |
| July | 25.2 | 29.5 | 264 | 680 | 4.8 | 6.2 | 6.90 | 7.10 | 0.1 | 0.1 | 0 | 0 |
| August | 31 | 29 | 132 | 220 | 4.6 | 5 | 7.10 | 7.40 | 0.1 | 0.1 | 0 | 0 |
| September | 30 | 30.8 | 188 | 370 | 6 | 5.6 | 6.80 | 7.40 | 0.1 | 0.1 | 0 | 0 |
| October | 31 | 30.8 | 328 | 126 | 6.4 | 5.6 | 7.30 | 7.20 | 0.1 | 0.1 | 0 | 0 |

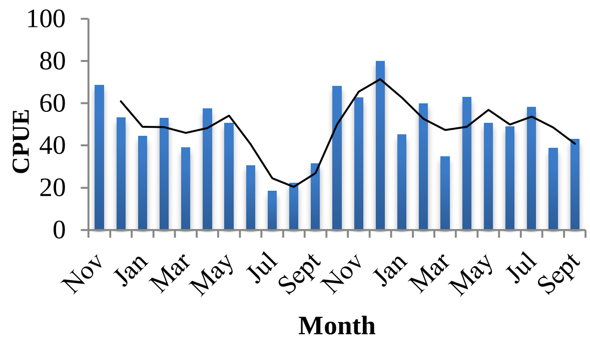



Fig. 2 Monthly variation of mean CPUE (abundance) of *N.notopterus* (2015–2017)

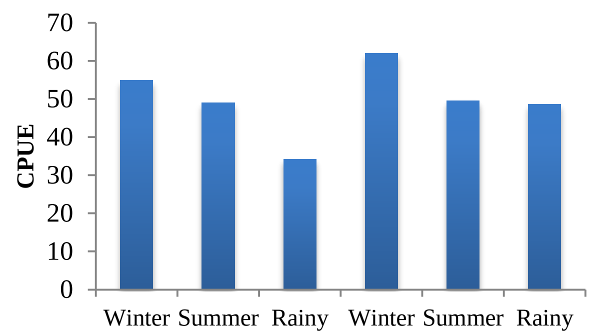



Fig. 3 Seasonal variation of mean CPUE(abundance) of *N. notopterus* (2015–2017)

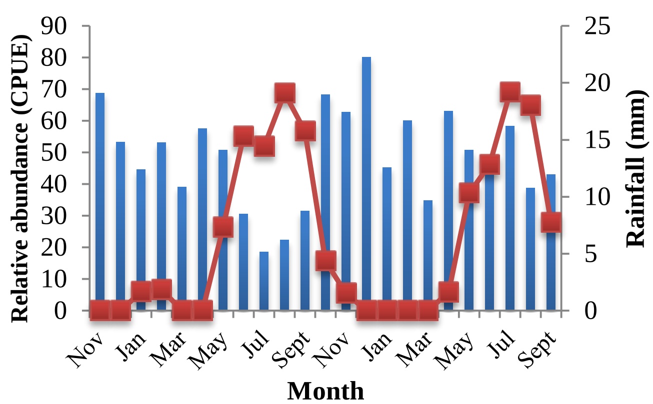



Fig. 4 Relationship between monthly mean CPUE and rainfall

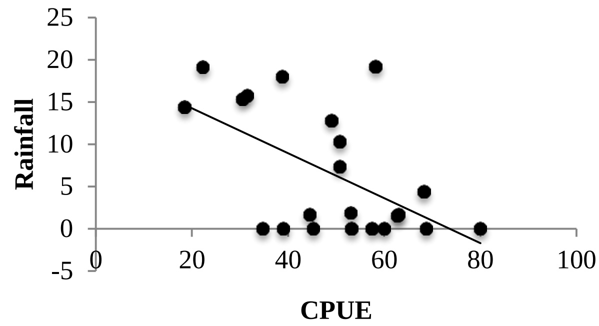



Fig. 5 Relationship between mean CPUE and rainfall

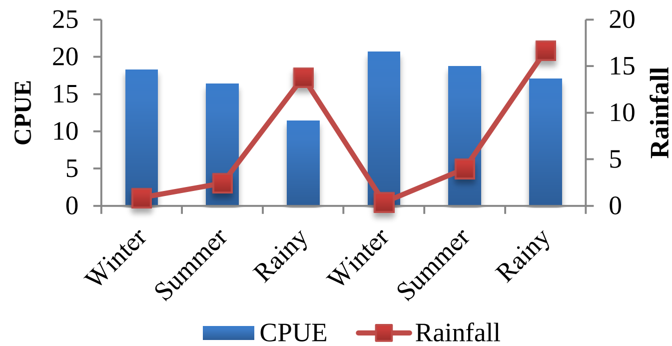



Fig. 6 [illegible]

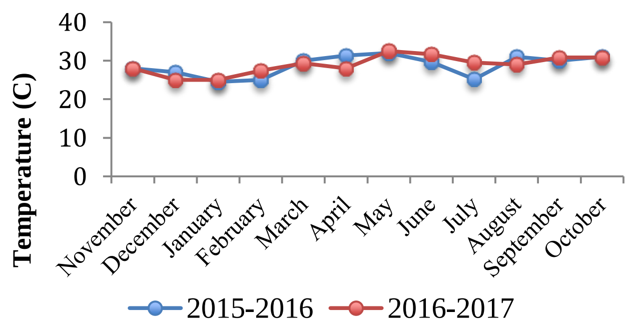



Fig. 7 Variation of monthly water temperature during the study period

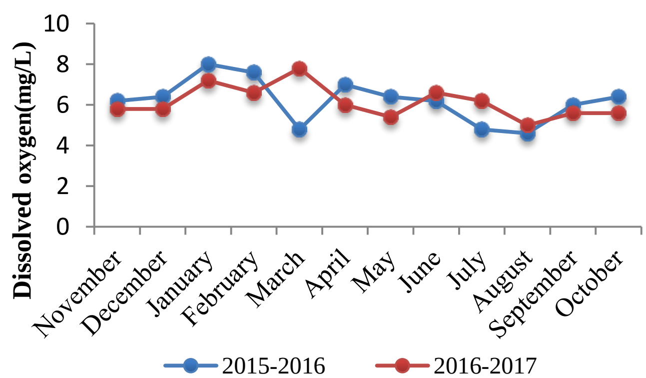
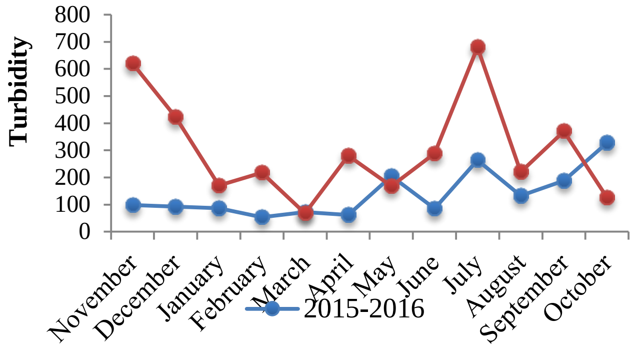



Fig. 8 Variation of monthly dissolved oxygen during the study period

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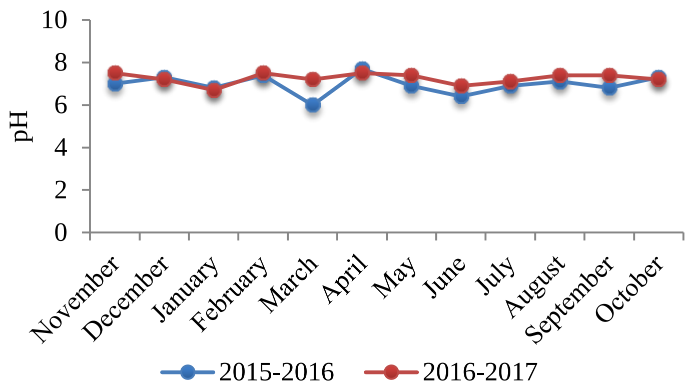


Fig.10 Variation of water pH during the study period

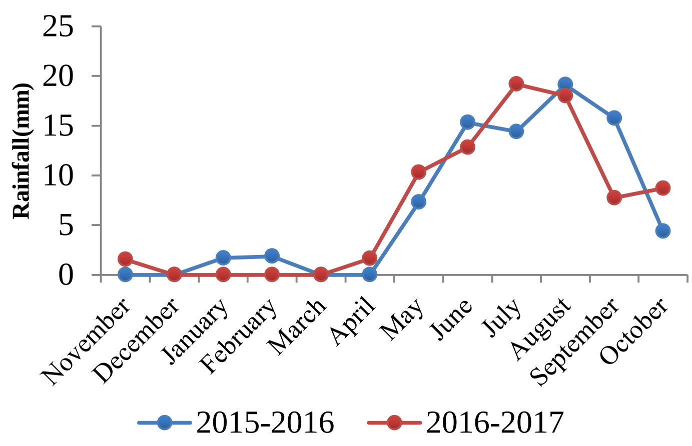


Fig. 11 Variation of monthly rainfall during the study period

## Discussion

The abundance of fish was the highest in winter (November to February) and the lowest in rainy season (June to October). Thanda Tun (2004) explained that in rainy season the water volume is increased in the river and the fish dispersed to the adjacent water areas. Thus, increased water volume might be one possible reason for less fish captivity in rainy season and our result was inclusive to the former empirical research. In addition, Htar Ei Hlaing (2009) reported that *N. notopterus* is a seasonal monsoon breeders and the peak spawning activity is associated with rainfall and flood. Reproduction represents one of the most important aspects of the fishery biology of many species, because the maintenance of viable populations depends on its breeding success (Lampert *et al.*, 2004).

Thus, survival of any fish species depends on its reproductive potential (Bankole, 1989). In rainy season, the environmental condition (water temperature, high food availability) is suitable for reproduction. Thus, adult *N. notopterus* might spend their time and energy in reproduction rather than in feeding. This might be another possible reason for low fish captivity in rainy season. Moreover, the same trend of fluctuation in fish abundance was found during the study period. Thus, the results from this study clearly show that there might be a seasonal variation of abundance of *N. notopterus* in the study area.

The water temperature is not markedly different between the two years: highest in summer (32.5°C in May) and lowest in winter (24.5°C in January). Khin Moe Kyi (2016) stated that temperature fluctuation was not too high between the seasons in Myanmar and that could be a favourable condition for aquatic fauna. Thus, slight variation of temperature between the seasons might not be correlated with the abundance of fish, which indicated that the temperature is suitable for survival of *N. notopterus*.

In this study, the concentration of DO was the highest in winter (8 mg/l in January) and the lowest in rainy season (4.6 mg/l in August). Although there is a relationship between DO and water temperature, the correlation between DO and temperature was not found in this study because the variation of temperature between the seasons was not highly different. According to WHO (1978), the suitable level of DO for freshwater aquaculture is 4.0–6.0 ppm. Ayeyawady River was coincided within the standard level showing the level of DO which was suitable for aquatic fauna.

Aquatic organisms cannot live if pH level is too high or too low and these can cause stress and reduce hatching and survival rates (New, 2002). pH ranges from 6.0 to 7.7 indicated that the water quality of the study site was suitable for the aquatic organisms. The standard pH level for aquarium and fish culture is within 4–9mg/l. Hence, the pH of Ayeyawady River in Maubin Township is appropriate for aquatic organisms.

Turbidity is a measure of how particles suspended in water and affect the water clarity. It is an important indicator of suspended sediment and erosion levels. Typically, it will increase sharply during and after a rainfall, which causes sediment to be carried into the creek. Lloyd *et al.*, (1987) stated that standardized turbidity value, no more than 5 NTU is natural for fish and wildlife. Turbidity is the highest in rainy season (680 NTU in July) and the lowest in winter (54 NTU in February). Elevated turbidity will also raise water temperature, lower dissolved oxygen, prevent light from reaching aquatic plants which reduces their ability to photosynthesize, and harm fish gills and eggs (Behar, 1997). Thus, the result of turbidity clearly explained the highest fish abundance in winter and followed by summer. In rainy season, the turbidity is high because of the heavy rain and this may increase the availability of the habitats for the fish and aquatic fauna.

Nitrogen compounds may enter into the water from agricultural fertilizers, human sewage, industrial wastes, livestock wastes, and farm manure. $NH_3$ (0–1.43) and salinity (0.01 ppt) were not harmful to aquatic life.

Hence, the results from this study clearly explained that rainfall might be one of the important factors which influence the abundance of *N. notopterus*. The other physic – chemical parameters attribute the suitable condition for the survival of *N. notopterus*.

## Acknowledgements

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