SPECIES COMPOSITION AND ABUNDANCE OF *TENUALOSA* SPECIES IN NGA YOKE KAUNG COASTAL AREA

Soe Thaw Thaw Tun[1], Lwin Mar Aung[2]

Abstract

This study was conducted on the species composition and abundance of *Tenualosa* spp. in Nga Yoke Kaung coastal area from June 2018 to February 2019. Two species of *Tenualosa*, namely *Tenualosa ilisha* and *Tenualosa toli* were observed in study sites. The species composition of *Tenualosa* spp. and other fishes caught by drift gill net using mesh size of 2.5 – 3.5 inches are described monthly in this study. The catch composition showed that the high species composition of *Tenualosa ilisha* was found in Sin Ma during June to September and in Nga Yoke Kaung during June to August. In *Tenualosa toli*, the highest composition was found in Sin Ma in October and also in Nga Yoke Kaung in December. In order to estimate the abundance of *Tenualosa* spp. in study areas, catch per unit effort of each species were calculated from the catch weight (kg) during study periods. The best production of *T. ilisha* was June to September in both study sites and the maximum CPUE value was observed in August in Nga Yoke Kaung. *T. toli* was more abundant during September to February in study areas. The fishing areas and fishing gears used for Hilsa fishery were recorded in this study.

Keywords: *Tenualosa ilisha, Tenualosa toli*, species composition, CPUE, fishing gear

Introduction

With a coastline of nearly 3, 000 km, several large estuarine, delta systems and numerous offshore islands, Myanmar possesses a large diversity of coastal habitats, including coral reefs, mangroves, sandy beaches and mudflats (FAO, 2003). These vast areas are natural habitats and nursery ground for shell fish and fin fishes which are of economically importance in Myanmar fisheries. The present study was conducted in Sin Ma and Nga Yoke Kaung coastal areas which are situated in lower Rakhine coast. Sin Ma village is located at Shwe Thaung Yan Township, Pathein District and is about 9 miles far from Ngwe Saung Beach. Nga Yoke Kaung is situated at Ayeyaewady Region, Pathein District, Nga Pu Taw Township the west coast of Myanmar. Nga Yoke Kaung Bay is very close to Gaw Yan Gyi Island that is famous for new potential site of eco-tourism destination at present. Both Sin Ma and Nga Yoke Kaung coastal areas are famous for fishing activity and people who live in these areas depend on fisheries and its products for their livelihoods.

Tenualosa spp. is fishes belonging to the Family Clupeidae in all temperate and tropical coastal waters. This family consists of herrings, sardines, menhadens, shads, and their relatives. They have a worldwide distribution, inhabiting marine and brackish waters. The Hilsa shad, *T. ilisha* (Hamilton, 1822), locally known as "Nga Tha Lauk" in Myanmar, is a major contributor to fish consumption in Myanmar east of India and Bangladesh. The species is also found in Iran, Iraq, Kuwait, Malaysia, Oman, Pakistan, Qatar, Saudi Arabia, Sri Lanka, Thailand, United Arab Emirates and Viet Nam (Freyhof, 2014). The fish is extremely rich in amino acids, minerals and lipids, especially essential and poly-unsaturated fatty acids (Alam et al., 2012). This euryhaline anadromous species can be found in marine, coastal and freshwater environments and often demonstrates schooling behavior in coastal waters.

T.toli is also known as, "Nga Tha Lauk Yauk Pha" in Myanmar and occur in the estuaries and adjacent coastal areas of India to Java and to the South China Sea. This species is found along the coastal waters of countries in the Bay of Bengal Large Marine Ecosystem (BOBLME) region

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such as India, Sri Lanka, Bangladesh, Myanmar, Malaysia, Thailand and Indonesia except for Maldives (Preston, 2004). Among these two species T. toli was not recorded from the rivers and it may be strictly marine form. Only one species, *T. ilisha* was found to occur along the river as it is known to be a migratory species (Khaing Myat Myat Htwe, 2012).

According to Fisheries Department of Myanmar, livestock and fisheries sector contributed to 8% of national GDP in the 2017-2018 fiscal year with the total production 5.87 million metric tons of fish. Of which, 2.72 million metric tons that accounted for 46% of the total fish production was from freshwater fisheries, and 3.15 million metric tons accounted for 54% of the total production of fish was from marine fisheries. The amount of 11379.95 metric tons of hilsa was exported to 27 different countries worldwide, with 17 in Asia, six each in the Middle East and Europe, with the value at US$ 32.17 million, in 2017 – 2018. Hilsa has a large market demand and is currently among the top five fish export products in Myanmar.

Materials and Methods

Study sites and study period

The fish landed by commercial catch from Sin Ma and Nga Yoke Kaung landing sites are collected during June 2018 to February 2019. The study areas are shown in figure (1). The locations of sampling sites were:

(1) Sin Ma (Lat 16º 43′N Long 94º 22′ E) (Shwe Thaung Yan Township)

(2) Nga Yoke Kaung (Lat 16º 31′ N Long 94º17′ E) (Nga Pu Taw Township)

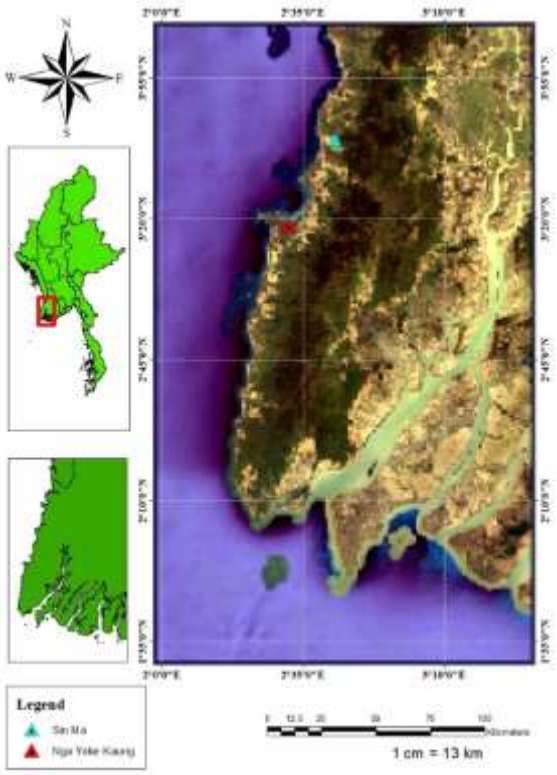

Figure 1 Map showing the study sites

Sample collection

Sample collections were conducted on commercial landing sites of study areas. Colour patterns and measurements of the samples were recorded immediately after collections. Also for later studies, specimens were photographed, using digital camera and then preserved in 10 percent formaldehyde solution. Monthly catch weight (kg/boat) of study fishes was taken from Sin Ma and Nga Yoke Kaung fish landing sites during June 2018 to February 2019. The fishing gears, species composition, volume of catch, fishing areas were recorded. Species composition was calculated in terms of percentages by weight.

Identification

The identification of this study followed the references of Day (1878), Munro (1955), FAO species identification sheets (1974), Jayaran (1981), Whitehead (1985), FAO species identification sheets (1985), Talwar and Jhingran (1991), De Bruin et al. (1995), Mya Than Tun (2001), Hla Win *et al*. (2008) and Khine Myat Myat Htwe (2012).

Catch Per Unit Effort

Abundance was estimated from the weight (kg) of the total catch of each site for each species over the study period. Catch per unit effort was calculated as: Where, C_i is the catch size (either in the number or mass of fish) per gear i,

$$CPUE = \Sigma \frac{(\frac{Ci}{Ei})}{n}$$

E_i is the effort expended by gear i and

n is the number of gears used (Pollock et al., 1994).

Effort was calculated by multiplying the total fishing hours by the length of net expressed in 100 m units. Effort units were standardized to 100 m net·hr^{-1}

Results

General description

Tenualosa ilisha: Body moderately deep, compressed and fairly elongated in shape, brilliant silvery, dark bluewish green on dorsal; A dark blotch behind gill opening, followed by a series of small spots along flank in juveniles but present or absent spots in the adults. Abdominal edge keeled with a row of scutes. Head moderate, compressed and scaleless. Mouth is terminal; upper jaw with a distinct median notch. Opercle smooth, without bony striae. Gill rakers fine and numerous. Eyes large. Dorsal-fin origin at midpoint of body; anal fin base fairly short and caudal fin deeply forked. Scales moderate, regularly arranged and cycloid type.

Tenualosa toli: Body is fusiform, compressed and fairly elongated in shape, silvery in colour and golden shot on flanks when fresh; dark greenish blue on back and on snout; a diffuse dark mark behind gill opening, but no other spots on flank. Abdomen rounded scutes. Head short, compressed. Mouth is terminal; upper jaw with distinct median notch Opercle smooth without bony striae. Gill rakers fine but not numerous; eyes large and covered by broad adipose lids. Dorsal-fin origin slightly anterior to midpoint of body; last dorsal-fin ray not elongated. Anal-fin base short; the caudal fin deeply forked and longer than the head length, its lobes are equal. Scales moderate and fairly thick, cycloid type.

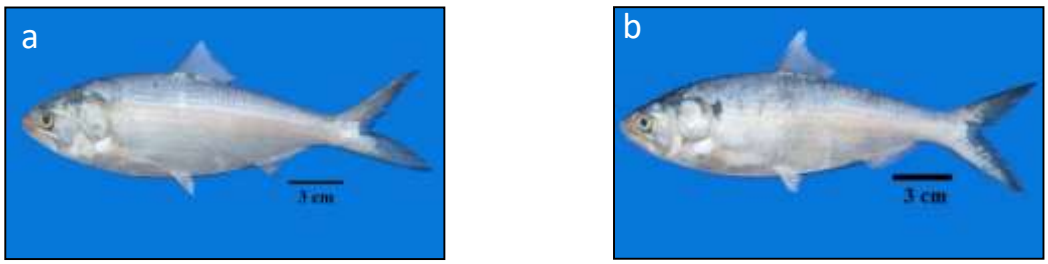

Figure 2 (a) *Tenualosa ilisha*, (b) *Tenualosa toli*

Species composition of *Tenualosa* spp. in study sites

The species composition of *Tenualosa* spp. caught by drift gill net using mesh size of 2.5 – 3.5 inches was observed. Species composition was calculated in terms of percentages by weight. Monthly species composition of *Tenualosa* spp. in Sin Ma was shown in figure. 3 and also in Nga Yoke Kaung as described in figure 4. In Sin Ma landing site, the high catch composition of *Tenualosa ilisha* was observed from June to September, with the peak percentage (62.12%) in July and the low amount in composition was found during the remaining months. *T. toli* was the highest account in composition of total catch in October among the study months. In Nga Yoke Kaung, the highest composition of *T.ilisha* was recorded during June to August as 75.07% in August, 73.69% in June and 63.95% in July. In the case of *T. toli*, the high catch composition was dominant as recorded from August to February.

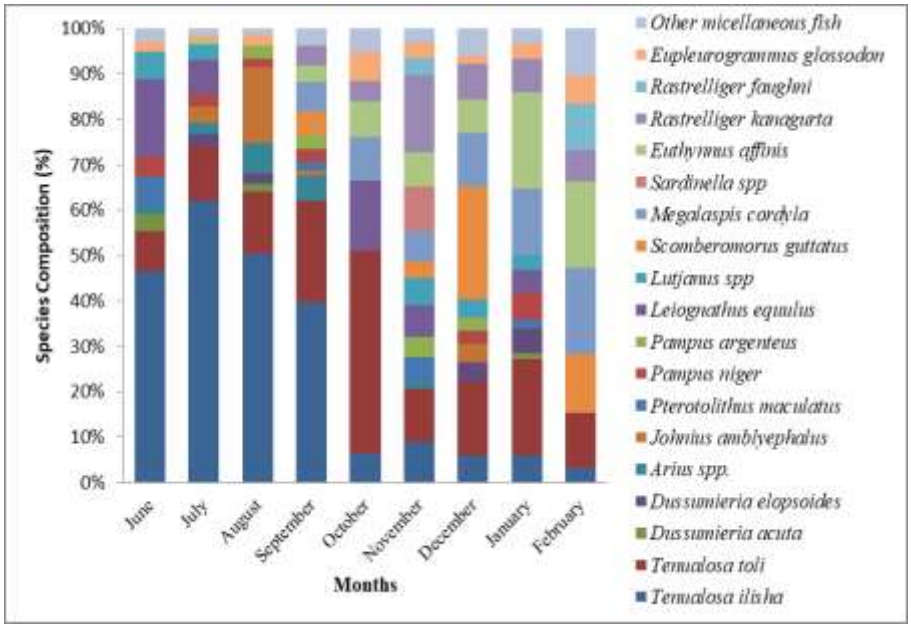

Figure 3 Monthly species composition of *Tenualosa* spp. and other fish caught by drift gill net in Sin Ma

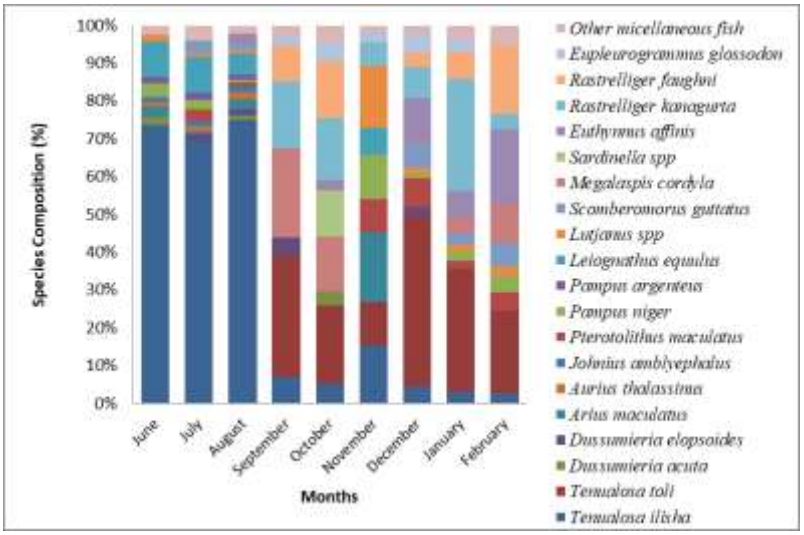

Figure 4 Monthly species composition of *Tenualosa spp*. and other fish caught by drift gill net in Nga Yoke Kaung

Abundance of *Tenualosa* spp. in study areas

Average catch weight (kg/boat) of *Tenualosa* spp. were randomly collected at the study areas as shown in figure 5 and 6. At Sin Ma landing site, the fishing time of *T. ilisha* was observed from June to September, which is the good production of the year for the catch of this species and the catch weight was high in July and August, amounted to 1100.75 kg/boat (25.94%) and 1256.77 kg/boat (29.61%) respectively and the size of fish caught in these months are usually large and marketable size (>0.65 kg) for export. The lowest catch was found in October and February.

In Nga Yoke Kaung, it was found that the good production of *T. ilisha* had been recorded from June to August, with peak in August, amounted to 1714.58 kg/boat (34.20 %). The size of *T. ilisha* caught in these months are recorded as large as marketable for local and export. The low catch weights were occurred from December and February. In the case of *T.toli*, the highest catch weights are recorded in September, amounting to 458.55 kg/boat (19.07%), and in October, amounting to 450.87 kg/boat (18.75%) in Sin Ma. In Nga Yoke Kaung, the high production was found in December and January, 547.35 kg/boat (22.52%) and 723.87 kg/boat (29.78%) respectively. In order to estimate the abundance of *Tenualosa* spp. in study sites, catch per unit effort of each species were calculated from the catch weight (kg) during study periods. The value of catch per unit effort of *Tenualosa* spp. for both study sites was shown in Table.1 and 2.

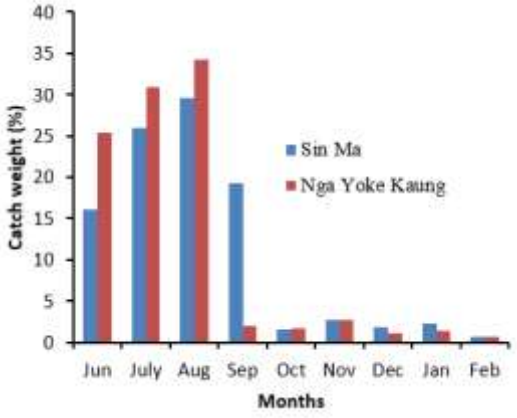

Figure 5 Monthly catch weight of *T. ilisha* at Sin Ma and Nga Yoke Kaung

Table 1 Monthly catch per unit effort (kg/100 m-net^{-1}·hr^{-1}) of *T.ilisha* in the study areas.

Month	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Sin Ma	1.76	2.85	3.25	2.11	0.17	0.30	0.20	0.26	0.08
Nga Yoke Kaung	5.37	6.55	7.24	0.41	0.34	0.59	0.22	0.29	0.15

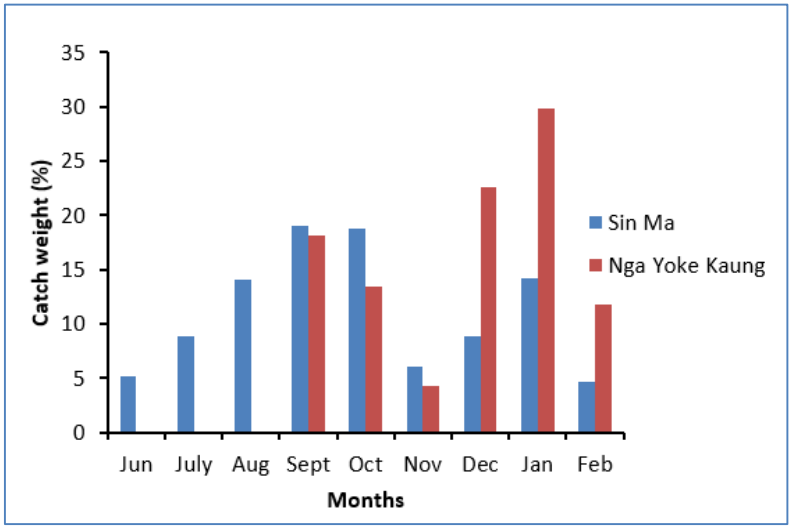

Figure 6 Monthy catch weight *T. toli* at Sin Ma and Nga Yoke Kaung

Table 2 Monthly catch per unit effort (kg/100 m-net^{-1}·hr^{-1}) of *T. toli* in the study areas.

Month	Jun	July	Aug	Sept	Oct	Nov	Dec	Jan	Feb
Sin Ma	0.32	0.55	0.88	1.19	1.17	0.38	0.55	0.89	0.29
Nga Yoke Kaung	0	0	0	1.86	1.38	0.44	2.31	3.05	1.21

Fishing gear and fishing area

Figure 7 (a) hilsa fishing net mesh size; (b) Lead sinker; and (c-e) Some floats used in the head rope; (f) fishing area (WCS, Myanmar)

Discussion

Species and composition is an indicator of the habitat of a particular fish species in a certain aquatic environment. In present study, monthly species composition of *Tenualosa* spp. and other fishes caught by drift gill net were recorded in Sin Ma and Nga Yoke Kaung landing sites. According to the result, the species composition of *T. ilisha* in Sin Ma was the highest value found from June to September, greater than one third of the total catch (>35%), it was dropped to the lowest from October to February, less than (<10%) of total species composition. In Nga Yoke Kaung, the high composition of *T. ilisha* was found in June to August, the highest value was recorded in August, constituted to 75.09% of the total composition and the catch composition was declined noticeably in all remaining months. In 2012, Khaing Myat Myat Htwe recorded that *Tenualosa ilisha* was found in Hyeingyi Kyun and Pathein, and remarked this species as a migratory one, and *T. toli* was found as dominant species in open sea (saline water) and was not observed in river. She also discussed that the fishing season for *T. ilisha* was from September to November, with peak in November in Ngawun River Areas, Pathein.

In Myanmar, hilsa are mainly spread along the Ayeyarwady Delta, migrating from marine areas though brackish waters to freshwater areas. Baran *et al*. (2015) proposed this migration takes place through three main routes: the Pathein River, the Ayeyarwady River in the central dry zone and the Ayeyarwady River in the delta. They identified two periods of upstream migration: one in the wet or southwest monsoon season (August to October or even December), and one in the dry season around March.

Merayo *el at* (2020) described on the migratory patterns of hilsa shad in the Myanmar Ayeyarwady delta. They stated that mature hilsa in saline areas of the Pathein route are most

abundant in summer (June–August) and in October–November and largest fish were more abundant in July and September. According to the finding of Bladon (2019), hilsa specimens caught in fresh water were significantly smaller and lighter than those caught in brackish and saline water. This finding showed that hilsa spawn in the freshwater zone, which also provides a nursery area for juveniles before they migrate towards the coast, where they reach maturity. Eighty percent of mature fish were found more abundant in coastal waters than immature fish, while in fresh water, immature fish dominated. In October, the catch weight of *T. ilisha* dropped to the lowest and in November, the smaller fish (<0.65 kg) of this species were landed in small amount in study site during the present. For marine capture, it was concluded that the good production time for *T.ilisha* was June to September in both Sin Ma and Nga Yoke Kaung.

According to BOBLME (2015) stock assessment *Tenualosa ilisha* in Myanmar, the fishing season for inland fishery started from October to February in Nga Pu Taw, Pyapon and Pathein. As *T.ilisha* was the anadromous species, they have to migrate to river for breeding and spawning. In the case of *T. toli,* the species composition was found higher in both study sites during September to February 2019. The highest value was recorded in Sin Ma in October (44.6%) and in Nga Yoke Kaung in December (45.23%) of total catch.

By the comparison of CPUE value of *T. ilisha* for both study sites, it was higher in Nga Yoke Kaung than Sin Ma in June, July and August. As the maximum value was found in August in Nga Yoke Kaung (7.24), it was concluded *T.ilisha* was more abundant in Nga Yoke Kaung than in Sin Ma. Both study sites were famous and commercially important for hilsa shad fishery for local and especially export to other countries.

The comparison of CPUE value in Sin Ma and Nga Yoke Kaung showed that there was no significantly difference, so that the estimation of abundance of *T. toli* is high during September to February in both landing sites. By comparison of *Tenualosa ilisha* with *T. toli, T. ilisha* was found at both study sites during the study period, and both the catch volume and the size of landed fish of *T. ilisha* was greater than those of *T. toli.* Khin Swe Mya el (2019) at reported that the high catch weight of *T. ilisha* was found in Pyanmalot river, one of the Ayeyarwady Delta areas in January and February.

According to the data on the observation of local fishermen, the production of two *Tenualosa* species is declining than the previous years. Catch weight of hilsa for study sites was low in October to February. Local fishermen mentioned that the amount of catches during fishing time of *Tenualosa* species is varied depending on the weather. Heavy rainfalls also decrease the catch and disturb the fishing operation. Climate change, including increasingly variability in weather patterns, was a major threat to fishing activity.

The fishing gear used in catching hilsa fishes was mainly on monofilament gill net. The choice of net for hilsa fishery operation in different areas and different seasons depends on the current velocity, the nature of the catch, and to a large amount, on their financial condition. The effective fishing gear for hilsa was drift gill net (hilsa net) as shown in fig 7(a-e). It has an average length of 1316 – 4389 m and the height of it depends on the target species and has an average length of 4.57 – 6.8 m. The mesh sizes are from 2.5 – 3.5 inches. It is made of monofilament nylon. It is set at the depth of (40 – 60 m). As hilsa fishery of Sin Ma and Nga Yoke Kaung Coastal Areas constituted to only marine capture fishery, the fishing areas could not be determined exactly because of migration of fish information gathering rather than survey had to be done. Information was obtained from questionnaires or interviews with local fishermen during study periods. Fig. 7(f) represented the fishing areas of drift gill net, estimated to 1487 km^2 in Sin Ma coastal area and Nga Yoke Kaung coastal areas.

Conclusion

The present study focused on the species composition occurrence of *Tenualosa* spp. and their monthly catch weights and CPUE values. The result has clearly shown the peak fishing season of *Tenualosa* species in study landing sites throughout the study period. Thus, a ban should be taken on catches of adult hilsa fish in July and August in study sites, when the largest brood mature fish are found in both the Ayeyarwady and Pathein route areas. This would provide protection for mature hilsa, particularly the large, older females predominantly in the coastal zone.

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