

Seasonal Abundance of Fish Species in Ga-Tan-Lay Creek, Laputta Township

Min Zaw Latt¹ and Khin Lay Nwe²

Abstract

Ga-Tan-Lay Creek situated between Ywe River and Pyamalaw River was chosen as the study area. The study period lasted from July, 2014 to February, 2015. The study area was divided into three study sites; Ga-Tan-Lay village was designated as Site I, Bo-Gon village as Site II and Baing-Doung-Gyaung as Site III. A total of 39 fish species from 37 genera under 28 families belonging to nine orders was recorded. The catch weight and the status of abundance association with wet and dry seasons were also recorded. Perciformes was found to be predominated order since most of the species caught belong to this order. Among 39 species, only eight species were collected from all study sites. The fish species and mean catch weight were the highest in Site II while the lowest in Site I. In the whole study area, the maximum fish species were recorded in July and minimum in October and February.

Keywords: Species, Genera, Families, Orders, Seasonal abundance, Ga-Tan-Lay Creek, Laputta Township

Introduction

Fish is crucial in Myanmar people while it is certainly recognized that fish is second only to rice in the diet of Myanmar. They have been a staple item in the diet of many people. Fisheries provide much of the human diet in many parts of the world (DoF, 2007).

The fishing sector is considered as the most important one after the agriculture sector to fulfill the protein requirement of the people of Myanmar. Fish is the major source of animal protein in developing countries. Inland capture fisheries provide an important source of aquatic products for rural people's nutrition and seasonal income. Inland fisheries are of considerable importance for people in many parts of Myanmar.

Fish communities are highly variable and often experience large temporal changes in species composition and abundance (Rountree & Able, 1992). Many individual species populations exhibit predictable seasonal patterns of abundance within a given estuary which effect both seasonal and annual estimates of species diversity (De Ben et al., 1990). The basal fish fauna have been established more detailed, especially they included the fishes collected from brackish waters around river mouth. Fisheries have the major role in social and economic development; the people of Myanmar are largely rice and fish eaters (Hla Win, 2004). Inland waters are considered as being overfished in many parts of the world and human pressure and changes in the environmental conditions have seriously degraded important bodies of freshwater (FAO, 2012).

The resources are threatened by the careless use of the resources, such as overfishing and the degradation of aquatic environment, overfishing undoubtedly has been major factors in the decline of many of the freshwater commercial and game fishes (Owen, 1985).

The Ayeyarwady delta zone is important aquatic resources and lies between Maw din point and the Gulf of Mottama. The Myanmar delta zone is situated at the center of the coastal zone with an area of 35,138 km². The delta region is a flat alluvial plain with a network of tributaries of the Ayeyarwady River (FAO, 2001)

¹Demonstrator, Department of Zoology, Hinthada University

²Lecturer, Dr., Department of Zoology, Hinthada University

Ga-Tan-Lay Creek is situated between Ywe River and Pyamalaw River. Laputta Township is located in Ayeyarwady delta region. Freshwater and brackish water fish fauna is abundant in delta. Ga-Tan-Lay Creek is fish productive and plays an important role in the ecology of the river system. The creek fauna includes a diverse and productive fish community, which provides an important food source for villagers along the creek.

Ga-Tan-Lay Creek is one of the chief fishing grounds in Laputta environs. Most of the freshwater and brackish water fishes caught by fishing vessels of Laputta environs were transported from these fishing grounds to bazaars and Laputta market. Thus, it enhances the chance to study the sea

Fishing gears used in river system are traditionally developed fishing activities. The fishing gears are selective and sample to use (DoF, 2007).

The present study was carried out with the following objectives:

- To record occurrence of fish species at the study area.
- To find out catch weight and catch number of fish species seasonally in the study sites.
- To investigate the efficiency of fishing gears.

Materials and Methods

Study area

Ga-Tan-Lay Creek, Laputta Township, was chosen as the study area. It is located between 16°04' 26.39" N and 16°01' 22.81" N and 94° 44' 56. 97" E and 94° 47'47.99" E. The study area was divided into three sites namely Ga-Tan-Lay village (Site I, 16°04' N and 94°44' E), Bo-Gon village (Site II, 16°02' N and 94° 46' E) and Baing-Doung-Gyaung village (Site III, 16° 01' N and 94° 47' E) (Figure - 1). Site I is beginning of the creek, Site II is middle of the creek and Site III is end of the creek (Plate 1).

Study period

The study period, lasted from July, 2014 to February, 2015, was divided into wet and dry seasons. The wet season was from July to October and the dry season was from November to February.

Sample collection

Specimen collection fortnightly conducted in collaboration with the local fishermen. Scaled photographs were instantly taken to get natural size and color. Each specimen was labeled with the local name before preserving them in 10 percent formalin. The total weight, number and local names of collected fish with respective fishing gears were noted. The preserved fishes were brought to the laboratory for further identification.

Identification of fish species

Identification was followed after Talwar & Jhingran (1991)

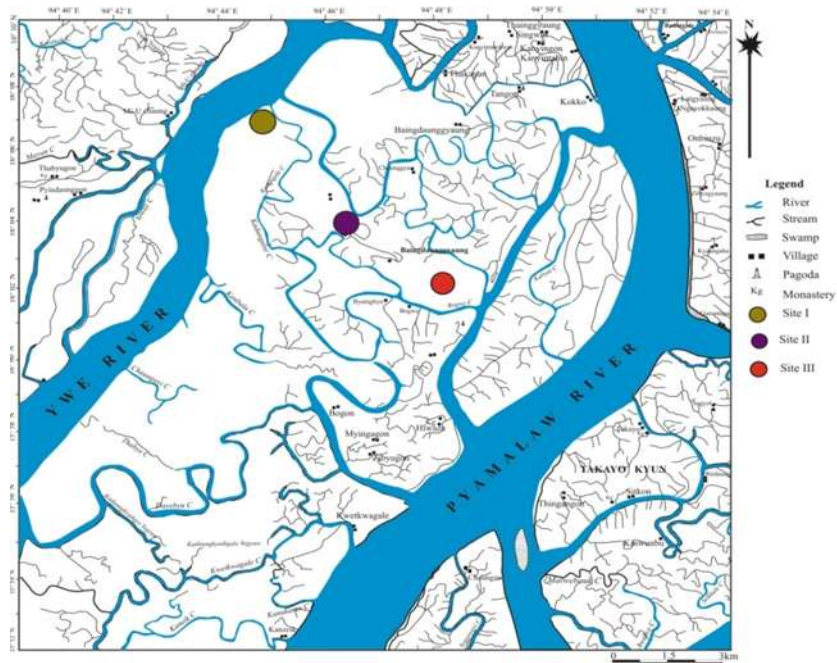


Figure (1) Map of the study area
(Source: Department of Geology, Hinhada University)



A. Near Ga-Tan-Lay Village
(Site I)



B. Near Bo-Gon Village
(Site II)



C. Near Baing-Doung-Gyaung
Village (Site III)

Plate (1) Different study sites

Results

Fish species recorded in the study area

A total of 39 species under 37 genera and 28 families belonging to nine orders of freshwater and brackish water fish were recorded from the study area during the study period (Table 1).

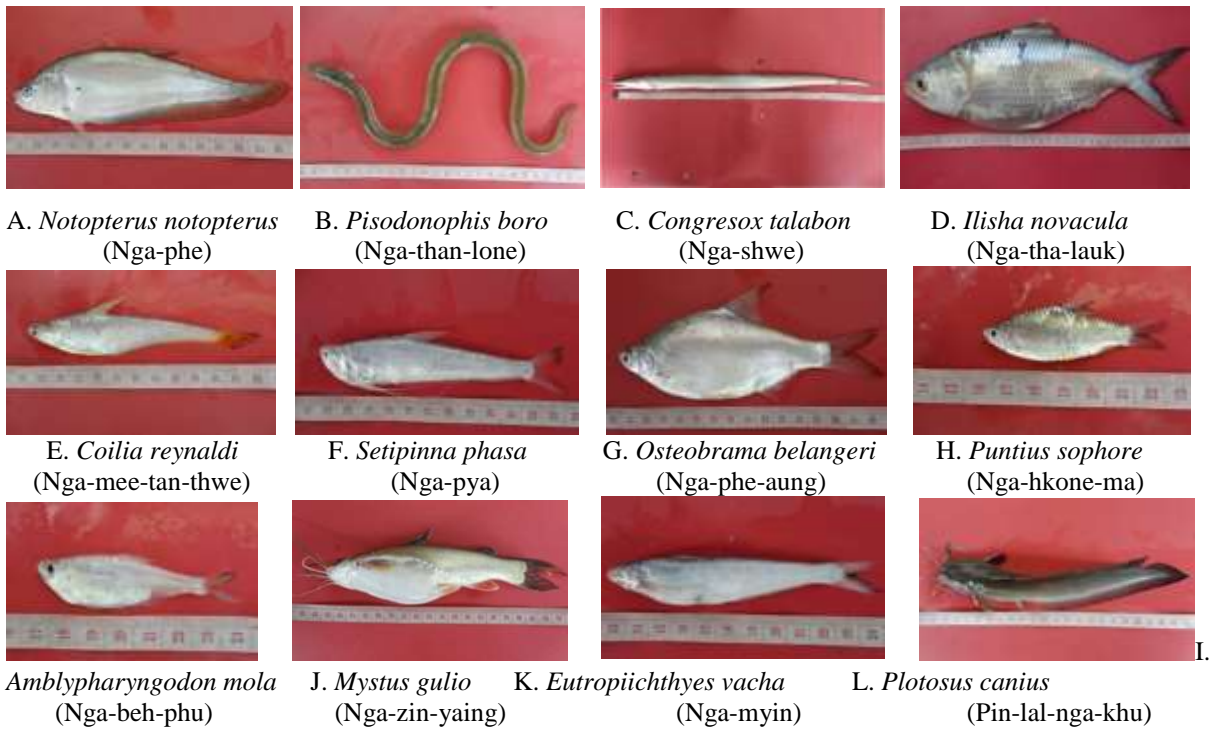


Plate (2) Recorded fish species of Order Osteoglossiformes (A), Anguilliformes (B,C), Cnuepeiformes (D-F), Cypriniformes (G-I), and Siluriformes (J-L)

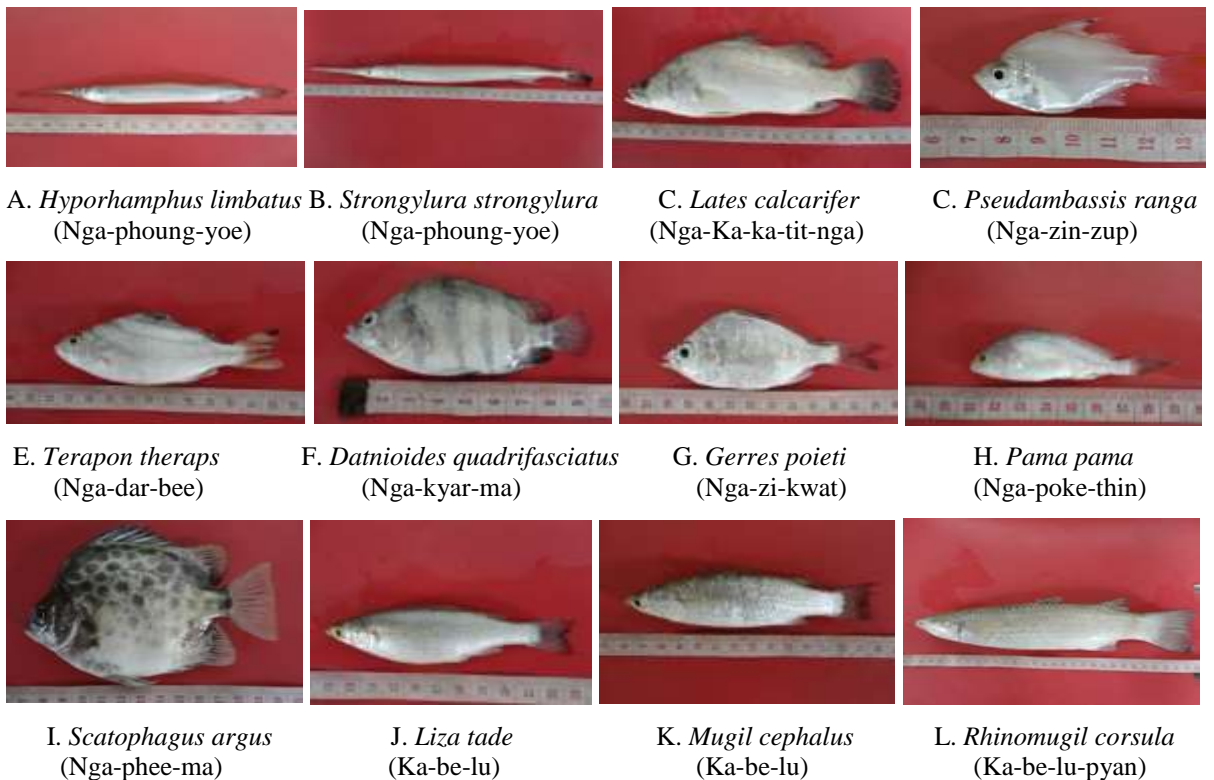


Plate (3) Recorded fish species of Order Cyprinodontiformes (A,B) and Perciformes (C-L)

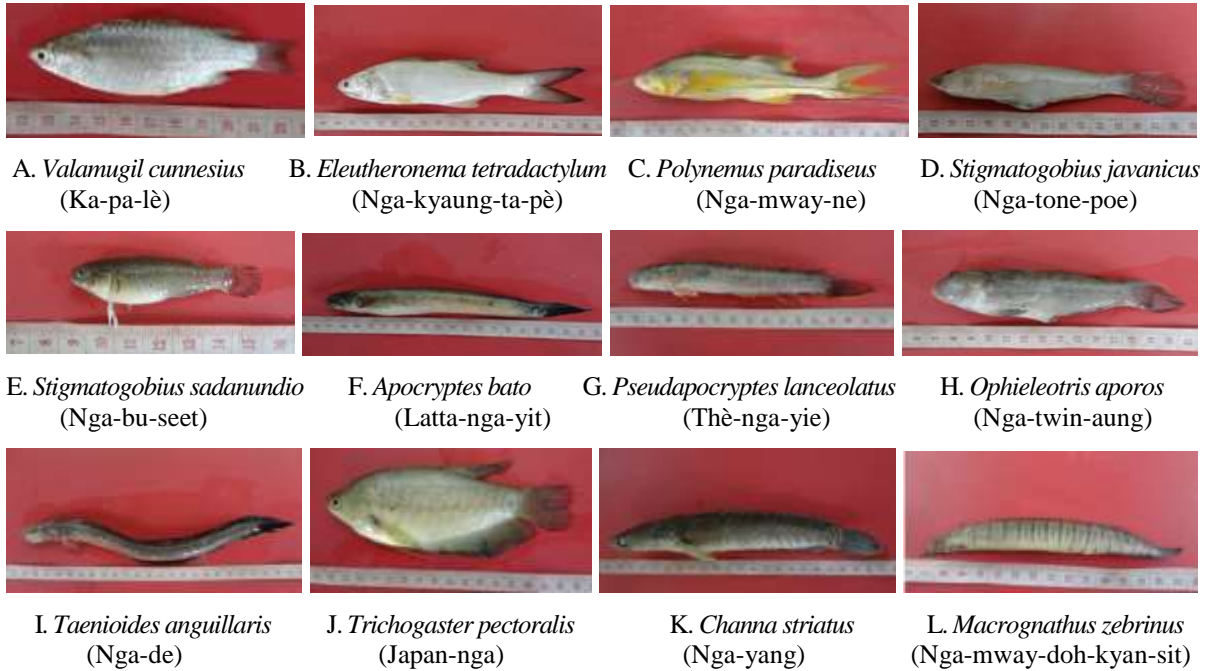


Plate (4) Recorded fish species of Order Perciformes

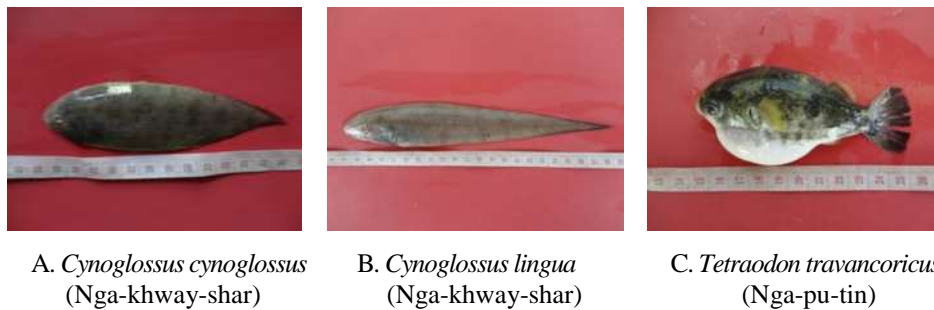


Plate (5) Recorded fish species of Order Pleuronectiformes (A, B) and Tetraodontiformes (C)

Species composition along Ga-Tan-Lay Creek

Of 39 species, 19 species were found to be freshwater and 20 species brackish water. Among the recorded species, 22 species belonged to the Order Perciformes. So, the fish collected in present study was composed mainly of fish species from Perciformes. During the study period, the percentage of fish species occurrence in Order Perciformes was found to be highest (56.4%). In percentage of collected species Order Clupeiformes, Cypriniformes and Siluriformes with 7.7% each; Order Anguilliformes, Cyprinodontiformes and Pleuronectiformes with 5.1% each and the rest Orders were found the lowest composition (2.6% each). Detailed species composition was described in (Table - 2, Figure - 2).

With respect to family, the percentage of species occurrence was found to be the highest (10.2 % each) in the family Mugilidae and Gobiidae, followed by Cyprinidae (7.6%), Engraulididae, Polynemidae and Cynoglossidae (5.1 % each) and the rest families were found the lowest composition (2.6 % and 2.5 % each).

Out of 39 species, *Coilia reynaldi*, *Mystus gulio*, *Lates calcarifer*, *Pama pama*, *Mugil cephalus*, *Eleutheronema tetradactylum*, *Stigmatogobius javanicus* and *Channa striatus* were found in all the study sites. Only 10 species, *Pisodonophis boro*, *Mystus gulio*, *Plotosus*

canius, *Lates calcarifer*, *Pseudambassis ranga*, *Mugil cephalus*, *Stigmatogobius javanicus*, *Apocryptes bato*, *Pseudapocryptes lanceolatus* and *Taenioides anguillaris* were also obtained throughout the study period. In different study sites, the maximum fish species were recorded in Site II while the minimum in Site I during the study period.

Fish species occurrence in different study sites

Of the recorded fish, 20.00% (14 species) from Site I (Ga-Tan-Lay village), 45.71% (32 species) from Site II (Bo-Gon village) and 34.29% (24 species) from Site III (Baing-Doung-Gyaung village) were recorded during the study period. (Table - 3, Figure - 3)

Based on monthly recorded data, the highest number of fish species occurred in July, August, January and February (8 species) while the lowest in October (5 species) at Site I. At Site II, the highest in July (23 species) while the lowest in October (8 species) and at Site III, the highest in July (20 species) and the lowest in February (10 species) (Table - 4, Figure - 4).

Monthly catch weight of fish species

The highest monthly mean weight occurred in October (17.95 kg) and the lowest in July (1.681 kg) at Site I, the mean weight in Site II was found to be highest in October (18.614 kg) and the lowest in July (2.2 kg) while that in Site III was the highest in September (10.548 kg) and lowest in July (0.605 kg). The maximum total mean weight was recorded from Site II while the minimum from Site I (Table - 5, Figures 5 A & B).

Occurrence and composition of total individual number of fish

In Site I, the maximum number of individuals was recorded in October (4772) and the minimum in July (575). The highest individual number in Site II was observed in November (12930) and the lowest in February (1678) while in Site III, the highest number (5770) in October and the lowest (1298) in July.

Monthly recorded individual numbers of fish from July to February were also presented in (Table - 6).

In terms of total individual composition on seasonal base during study period, at Site I, the higher composition markedly occurred in wet season (79.61%, 13455) than in dry season (20.39%, 3447). At Site II, dry season was higher in comprising total individuals (50.86%, 30600) than wet season (49.14%, 29571). At Site III, it was 50.74% (18925) in dry season and 49.26% (18374) in wet season (Table - 7, Figure - 6).

Types of fishing gears

The types of fishing gears recorded in the study sites are categorized into five groups; netting enclosure, large pouch net, cast net, line of fence and traps and fixed net.

Among the collected fish species, 38 species were caught by netting enclosure and large pouch net, 11 species with cast net, *Ilisha novacula* with fixed net and *Mystus gulio* was caught by line of fence and trap according to the interviewing from the local fishermen (Table - 8).

Table (1) Summarized recorded fish species

Sr. No.	Order	Family	Species
1	Osteoglossiformes	Notopteridae	<i>Notopterus notopterus</i>
2	Anguilliformes	Ophichthidae Muraenesocidae	<i>Pisodonophis boro</i> <i>Congresox talabon</i>
3	Clupeiformes	Pristigasteridae Engraulididae	<i>Ilisha novacula</i> <i>Coilia reynaldi</i> <i>Setipinna phasa</i>
4	Cypriniformes	Cyprinidae	<i>Osteobrama belangeri</i> <i>Puntius sophore</i> <i>Amblypharyngodon mola</i>
5	Siluriformes	Bagridae Schilbeidae Plotosidae	<i>Mystus gulio</i> <i>Eutropiichthyes vacha</i> <i>Plotosus canius</i>
6	Cyprinodontiformes	Hemiramphidae Belonidae	<i>Hyporhamphus limbatus</i> <i>Strongylura strongylura</i>
7	Perciformes	Centropomidae Ambassidae Teraponidae Lobotidae Gerreidae Sciaenidae Scatophagidae Mugilidae Polynemidae Gobiidae Eleotrididae Gobioididae Belontiidae Channidae Mastacembelidae	<i>Lates calcarifer</i> <i>Pseudambassis ranga</i> <i>Terapon theraps</i> <i>Datnioides quadrifasciatus</i> <i>Gerres poieti</i> <i>Pama pama</i> <i>Scatophagus argus</i> <i>Liza tade</i> <i>Mugil cephalus</i> <i>Rhinomugil corsula</i> <i>Valamugil cunnesius</i> <i>Eleutheronema tetradactylum</i> <i>Polynemus paradiseus</i> <i>Stigmatogobius javanicus</i> <i>Stigmatogobius sadanundio</i> <i>Apocryptes bato</i> <i>Pseudapocryptes lanceolatus</i> <i>Ophieleotris aporos</i> <i>Taenioides anguillaris</i> <i>Trichogaster pectoralis</i> <i>Channa striatus</i> <i>Macrognathus zebrinus</i>
8	Pleuronectiformes	Cynoglossidae	<i>Cynoglossus cynoglossus</i> <i>Cynoglossus lingua</i>
9	Tetraodontiformes	Tetraodontidae	<i>Tetraodon travancoricus</i>

Table (2) Percentage of recorded fish species composition by orders

Sr. No.	Order	Family	Genus	Number of Species	Percentage (%)
1	Osteoglossiformes	1	1	1	2.60
2	Anguilliformes	2	2	2	5.10
3	Clupeiformes	2	3	3	7.70
4	Cypriniformes	1	3	3	7.70
5	Siluriformes	3	3	3	7.70
6	Cyprinodontiformes	2	2	2	5.10
7	Perciformes	15	21	22	56.40
8	Pleuronectiformes	1	1	2	5.10
9	Tetraodontiformes	1	1	1	2.60
Total		28	37	39	100.00

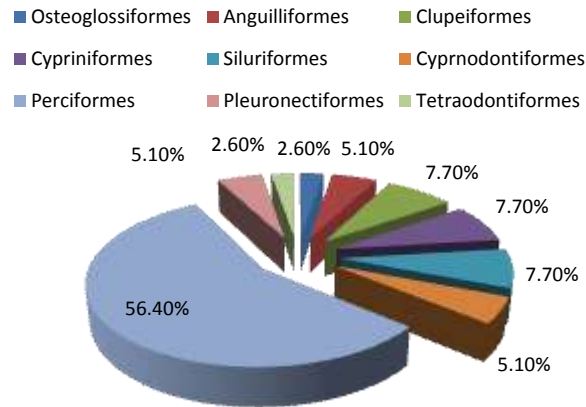


Figure (2) Percentage of fish species composition by orders from the study area

Table (3) Spatial changes of fish species occurrence from the different study sites

Sr. No.	Species name	Site I (Ga-Tan-Lay Village)	Site II (Bo-Gon Village)	Site III (Baing-Doung- Gyaung Village)
1	<i>Notopterus notopterus</i>	∅	∅	
2	<i>Pisodonophis boro</i>		∅	∅
3	<i>Congresox talabon</i>		∅	
4	<i>Ilisha novacula</i>	∅		
5	<i>Coilia reynaldi</i>	∅	∅	∅
6	<i>Setipinna phasa</i>		∅	∅
7	<i>Osteobrama belangeri</i>		∅	∅
8	<i>Puntius sophore</i>		∅	
9	<i>Amblypharyngodon mola</i>		∅	∅
10	<i>Mystus gulio</i>	∅	∅	∅
11	<i>Eutropiichthyes vacha</i>			∅
12	<i>Plotosus canius</i>	∅	∅	
13	<i>Hyporhamphus limbatus</i>		∅	∅
14	<i>Strongylura strongylura</i>			∅
15	<i>Lates calcarifer</i>	∅	∅	∅
16	<i>Pseudambassis ranga</i>		∅	∅
17	<i>Terapon theraps</i>		∅	∅
18	<i>Datnioides quadrifasciatus</i>		∅	
19	<i>Gerres poieti</i>		∅	
20	<i>Pama pama</i>	∅	∅	∅
21	<i>Scatophagus argus</i>			∅
22	<i>Liza tade</i>			∅
23	<i>Mugil cephalus</i>	∅	∅	∅
24	<i>Rhinomugil corsula</i>	∅		
25	<i>Valamugil cunnesius</i>	∅		∅
26	<i>Eleutheronema tetradactylum</i>	∅	∅	∅
27	<i>Polynemus paradiseus</i>	∅	∅	
28	<i>Stigmatogobius javanicus</i>	∅	∅	∅
29	<i>Stigmatogobius sadanundio</i>		∅	
30	<i>Apocryptes bato</i>		∅	∅
31	<i>Pseudapocryptes lanceolatus</i>		∅	
32	<i>Ophieleotris aporos</i>		∅	∅
33	<i>Taenioides anguillaris</i>		∅	∅
34	<i>Trichogaster pectoralis</i>		∅	

Table (3) Continued

Sr. No.	Species name	Site I (Ga-Tan-Lay Village)	Site II (Bo-Gon Village)	Site III (Baing-Doung- Gyaung Village)
35	<i>Channa striatus</i>	Å	Å	Å
36	<i>Macrornathus zebrinus</i>		Å	
37	<i>Cynoglossus cynoglossus</i>		Å	
38	<i>Cynoglossus lingua</i>		Å	Å
39	<i>Tetraodon travancoricus</i>		Å	
	Total	14	32	24

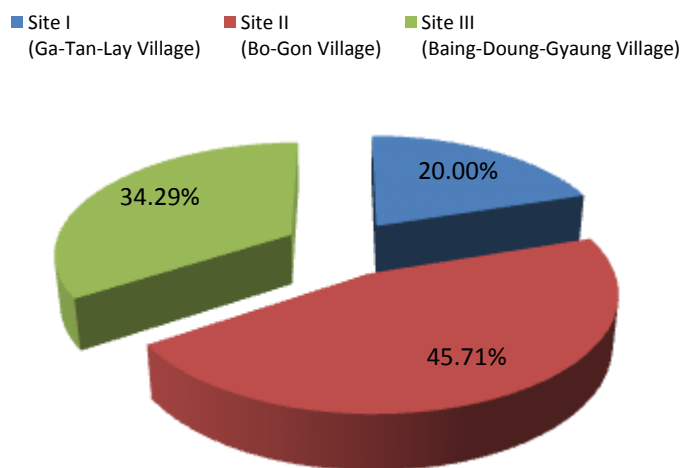


Figure (3) Spatial changes of fish species occurrence from the different study sites during the study period

Table (4) The number of fish species occurred at the study sites on monthly base in study period

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Site I	8	8	7	5	6	6	8	8
Site II	23	18	13	8	15	19	20	13
Site III	20	18	11	12	12	17	16	10

Table (5) Monthly and total mean weight (Kg) of fish species during the study period

Site	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Total mean weight
Site I	1.681	8.344	14.901	17.95	6.287	7.475	4.02	2.87	51.49
Site II	2.2	6.259	10.528	18.614	11.923	9.408	3.321	6.406	114.67
Site III	0.605	4.22	10.548	10.113	5.193	2.894	3.357	3.28	65.44

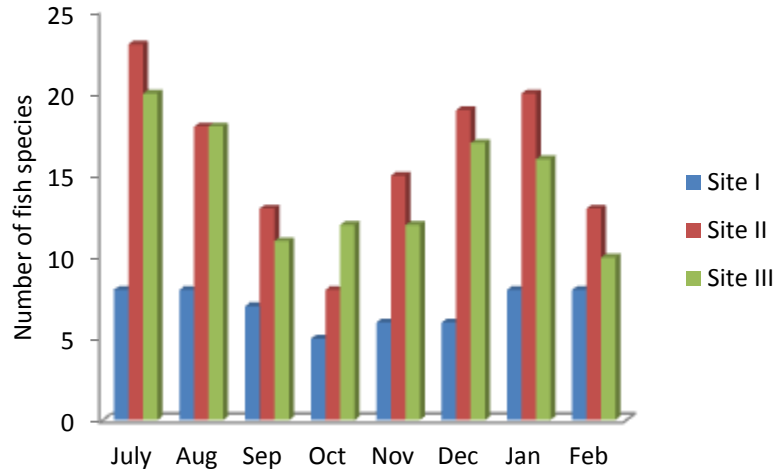


Figure (4) The number of fish species occurred at the study sites on monthly base in study period

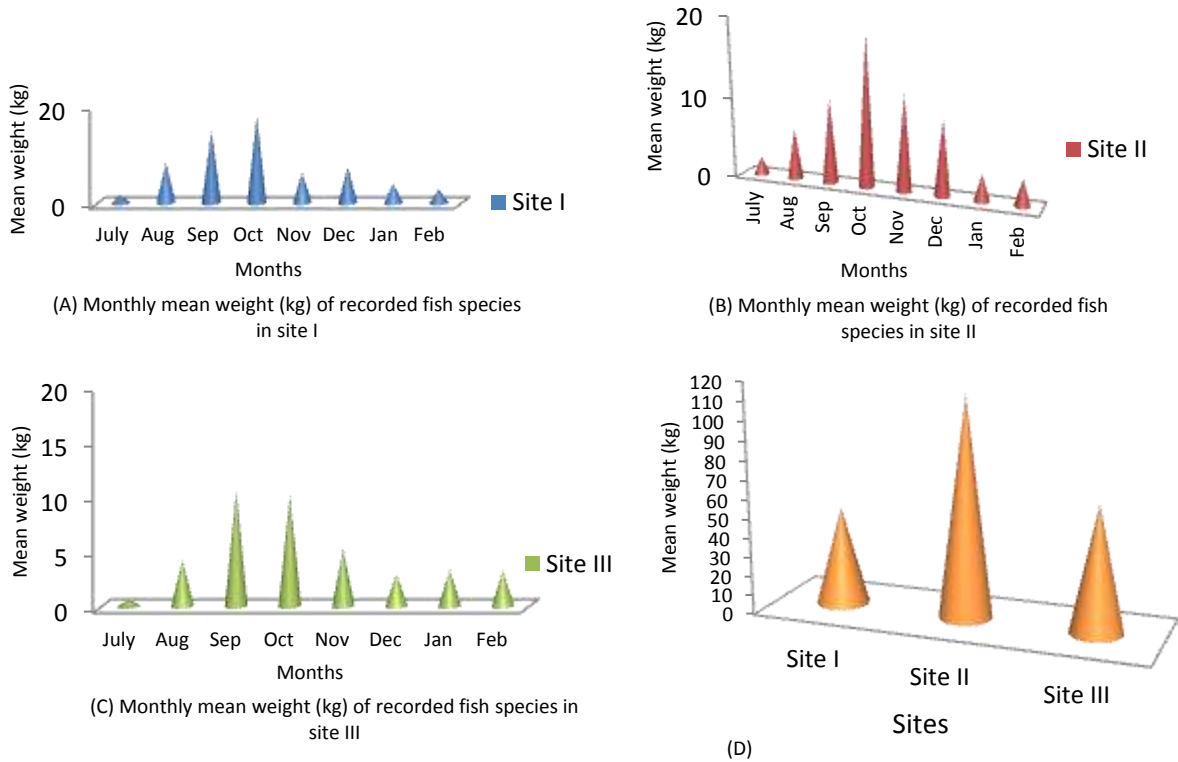


Figure (5) Monthly mean weight (Kg) of recorded fish species in different study sites from the Ga-Tan-Lay Creek, (A) Site I, (B) Site II, (C) Site III, (D) Comparison of respective different study sites

Table (6) Monthly variation of total individual number of fish at three sites in study period

Month	Wet season				Total	Dry season				Total
	July	Aug	Sep	Oct		Nov	Dec	Jan	Feb	
Site I	575	3369	4739	4772	13455	1057	978	659	753	3447
Site II	3739	6584	8988	10160	29571	12930	12146	3846	1678	30600
Site III	1098	5678	5628	5770	18374	5700	4635	5380	3210	18925

Table (7) Seasonal composition of total individual at three study sites (in per cent)

Site	Wet Season	Dry Season
Site I	79.61	20.39
Site II	49.14	50.86
Site III	49.26	50.74

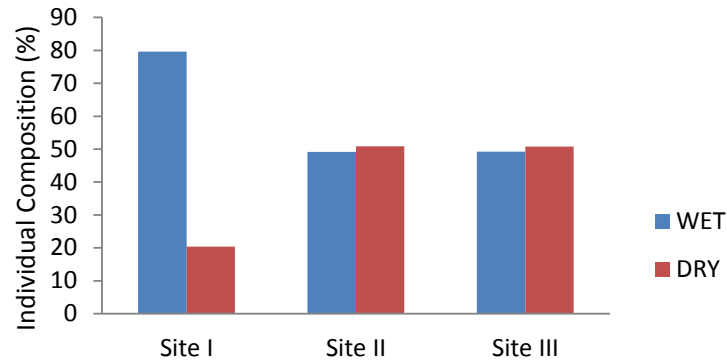


Figure (6) Seasonal variation of individual composition of fish at three study sites

Table (8) Types of fishing gears and collected fish species from the study area

Sr. No.	Species name	Netting enclosure	Large pouch net	Cast net	Line of fence and trap	Fixed net
1	<i>Notopterus notopterus</i>	Å	Å			
2	<i>Pisodonophis boro</i>	Å	Å			
3	<i>Congresox talabon</i>	Å	Å			
4	<i>Ilisha novacula</i>					Å
5	<i>Coilia reynaldi</i>	Å	Å			
6	<i>Setipinna phasa</i>	Å	Å			
7	<i>Osteobrama belangeri</i>	Å	Å			
8	<i>Puntius sophore</i>	Å	Å			
9	<i>Amblypharyngodon mola</i>	Å	Å			
10	<i>Mystus gulio</i>	Å	Å	Å	Å	
11	<i>Eutropiichthyes vacha</i>	Å	Å			
12	<i>Plotosus canius</i>	Å	Å	Å		
13	<i>Hyporhamphus limbatus</i>	Å	Å			
14	<i>Strongylura strongylura</i>	Å	Å			
15	<i>Lates calcarifer</i>	Å	Å	Å		
16	<i>Pseudambassis ranga</i>	Å	Å			
17	<i>Terapon theraps</i>	Å	Å			
18	<i>Datnioides quadrifasciatus</i>	Å	Å			
19	<i>Gerres poieti</i>	Å	Å			
20	<i>Pama pama</i>	Å	Å	Å		
21	<i>Scatophagus argus</i>	Å	Å			
22	<i>Liza tade</i>	Å	Å			
23	<i>Mugil cephalus</i>	Å	Å	Å		
24	<i>Rhinomugil corsula</i>	Å	Å			

Table (8) Continued

Sr. No.	Species name	Netting enclosure	Large pouch net	Cast net	Line of fence and trap	Fixed net
25	<i>Valamugil cunnesius</i> <i>Eleutheronema</i>	∅	∅			
26	<i>tetradactylum</i>	∅	∅	∅		
27	<i>Polynemus paradiseus</i>	∅	∅			
28	<i>Stigmatogobius javanicus</i>	∅	∅	∅		
29	<i>Stigmatogobius sadanundio</i>	∅	∅			
30	<i>Apocryptes bato</i> <i>Pseudapocryptes</i>	∅	∅			
31	<i>lanceolatus</i>	∅	∅			
32	<i>Ophieleotris aporos</i>	∅	∅	∅		
33	<i>Taenioides anguillaris</i>	∅	∅			
34	<i>Trichogaster pectoralis</i>	∅	∅			
35	<i>Channa striatus</i>	∅	∅	∅		
36	<i>Macrogonathus zebrinus</i>	∅	∅			
37	<i>Cynoglossus cynoglossus</i>	∅	∅	∅		
38	<i>Cynoglossus lingua</i>	∅	∅	∅		
39	<i>Tetraodon travancoricus</i>	∅	∅			

Discussion and Conclusion

A total of 39 species belonging to nine orders was recorded. The recorded species number may be said to be few in number because of limited in duration of study period and study area. Although the number of species caught was few, most of these were found to be commercially important. Regarding species composition of the Perciformes 73.9% was recorded to be of highest percentage in the catch (Yin Yin Moe, 2005). Based on finding data, species composition of Perciformes 56.4% were recorded to be of highest percentage in different study sites during the study period.

Like in other paper, the Order Perciformes constitute the highest percentage (56.4%) of species composition of the fish collected from all study sites. Only one species represented each of the Orders Osteoglossiformes and Tetraodontiformes that made up (2.60%) each in species composition. The fish species collected from all study sites were *Coilia reynaldi*, *Mystus gulio*, *Lates calcarifer*, *Pama pama*, *Mugil cephalus*, *Eleutheronema tetradactylum*, *Stigmatogobius javanicus* and *Channa striatus*.

Mugil cephalus was the only species that was found to be collected from all three study sites in all months involved in study period. Thus, this species may be regarded as predominant one. The other one, *Mystus gulio*, absent only in January at Site I and present in all months at both Site II and III was also regarded as predominated species. The occurrence of species varied according to collection site. *Lates calcarifer* was present all the studied months in both Site I and II; *Pseudambassis ranga* and *Apocryptes bato* were present only in Site III whereas the species *Stigmatogobius javanicus* only in Site III.

According to the data *Mugil cephalus* and *Mystus gulio* were assumed to be the most widely distributed in Ga-Tan-Lay Creek. Of the recorded 39 species; 32 species were present in Site II, 24 species in Site III and 14 species in Site I. So, it may be assumed that Bo-Gon village attained the highest species richness, followed by Baing-Doung-Gyaung village and the least in Ga-Tan-Lay village. Chang et al. (1999) stated that an unstable physical habitat may contribute to change in fish assemblages by reducing food supplies, disrupting reproduction or possibly eliminating some species from a river section. Variation of species

occurrence, total catch number, distribution and mean catch weight were observed in different months as well as in different sites of study area. So, this finding was agreed with Chang *et al.* (1999). Silvano *et al.* (2000) also reported that combined samples from different locations and number of samples varied for each habitat type between wet and dry seasons. This statement was coincided with the result of present study, the highest seasonal variation was observed is Site I where percentage highest total catch number (79.43%) was observed in wet season and lowest (20.57%) in dry season.

Fishing gears used in present study were netting enclosure, large pouch net, cast net, line of fence and trap and fixed net. Of there, netting enclosure and large pouch net were found to be more effective than others since all recorded fish species except *Ilisha novacula* were caught by fixed nets. Of may be assumed that the effectiveness of fishing gear in fish catching depends on mesh size, position and depth of placing nets. The result and finding of present work will give some important information about species richness, abundance, seasonal variation and were catch weight of recorded fish species to both academic field and fisheries workers.

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References

- Chang, M. H., Lin, Y. S., Chaung, L. C., 1999. Effect of dams on fish assemblages of the Tachia River, Taiwan. *Acta Zoologica Taiwanica* **10**(2): 77-90.
- De Ben, W. A., W. D. Clothier, G. R. Ditsworth and D. J. Baumgartner, 1990. Spatio-temporal fluctuations in the distribution and abundance of demersal fish and epibenthic crustaceans in Yaquina Bay, Orgeon. *Estuaries* **13**: 469-478
- DoF, 2007. Fishing gears and methods of introduction in rural of Myanmar (internet). (cited 2007 November 8). Available from [http://map.seafdec.org/monograpy... Myanmar/Marine.php](http://map.seafdec.org/monograpy...Myanmar/Marine.php).Cached.
- FAO, 2001. Dams, fish and fisheries. *FAO fisheries technical paper*: **419**. Food and Agriculture Organization. Rome.
- FAO, 2012. State of World Fisheries, *Aquaculture Report 2012*.
- Hla Win, 2004. Opportunities and challenges in Myanmar aquaculture. *Sustainable aquaculture. Aquaculture Asia*. 12-14.
- Owen, O. S., 1985. *Natural resource conservation and ecological approach*. 4th edition. Department of Biology, University of Wisconsin-Eau Claire. Macmillan publishing Company, New York, Collier Macmillan Publishers, London.
- Rountree, R. A. and K. W. Able, 1992. Fauna of polyhaline subtidal march creeks in southern New Jersey: composition, abundance and biomass. *Estuaries* **15**: 171-185.
- Silvano, R. A. M., B. D. do Amaral and O. T. Oyakawa. 2000. Spatial and temporal patterns of diversity and distribution of the Upper Jurua River fish community (Brazilian Amazon). *Environ. Biol. Fish.* **57**: 25-35.
- Talwar, P. K., and A. G. Jhingran, 1991. Inland fishes of India and adjacent countries, **I & II**, Oxford, TBH Publishing Co. PVT. Ltd., New Delhi, Bombay,
- Yin Yin Moe, 2005. *Seasonal abundance of marine fish species based on the catch in Nyaung Dan Jetty, Yangon Division*. Unpublished, Master of Research Thesis, Department of Zoology, University of Yangon.