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Community-Led Coastal Management in the Gulf of Mottama Project (CLCMGoMP)

FISHERIES ANALYSIS OF THE KYEIKHTO TOWNSHIP BASED MEDIUM SIZED BOAT FISHERY IN THE GULF OF MOTTAMA

MRes (THESIS)

THAZIN HTET

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This Dissertation is Submitted to the Board of Examiners
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March, 2017 **MA THAZIN HTET**

MRes MS. 1

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ABSTRACT

A total of 40 species belongs to 35 genera under 23 families and 10 orders were recorded in the study area during the study period from June 2016 to January 2017. The samples were collected from four stations of Kyeikhto Township at the medium sized boats. Among the recorded species *Otolithoides pama* and *Leptomelanosoma indicum* are commercial important species for Kyeikhto Township. A total of 190 samples of *O. pama* and 167 samples of *P. indicus* were measured for length-weight relationship. The length-weight relationship of *O.pama* and *P.indicus* were $W=0.0036L^{3.2138}$ and $W= 0.0029L^{3.3941}$. The biomass of fence net in Kyeikhto station are 208.16kg, 271.4kg, 320.24kg, 241kg, 236kg from September, 2016 to January, 2017. The biomass and CPUE of drift gill net in Bo Yar Gyi station are 140.8kg, 124.8kg, 132.8kg, 140.8kg, 145.6kg and 17.6 kg/boat/day, 15.6 kg/boat/day, 16.6 kg/boat/day, 17.6 kg/boat/day, 18.2 kg/boat/day from September, 2016 to January, 2017. The biomass and CPUE of trammel net in Bo Yar Gyi station are 121.6kg, 104.2kg, 124kg, 187.2kg, 124kg and 17.4 kg/boat/day, 14.9 kg/boat/day, 17.7 kg/boat/day, 26.7 kg/boat/day , 17.7 kg/boat/day from September, 2016 to January, 2017. The biomass and CPUE of trammel net in Kyauk Seik station are 157.92kg, 149.04kg, 152kg, 120kg, 56.8kg and 15.8 kg/boat/day, 14.9 kg/boat/day, 15.2 kg/boat/day, 12 kg/boat/day, 4.7 kg/boat/day from September, 2016 to January, 2017. The biomass and CPUE of trammel net in Sut Pa Nu station are 245.92kg, 168.08kg, 95.52kg, 50.02kg, 36.96kg and 7.64 kg/boat/day, 6.72 kg/boat/day, 3.82 kg/boat/day, 2 kg/boat/day, 1.49 kg/boat/day from September, 2016 to January, 2017. In study area, the three type of fishing gears were used in the medium sized boat; these were drift gill net, trammel net, and fence net.

CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF FIGURES

Chapter 1

INTRODUCTION

The Republic of the Union of Myanmar is situated in Southeast Asia and geographically located between Lat. 9° 32′ N to 28° 31′ N and Long. 92° 10′ E to 101° 11′ E. Myanmar has a long coastline of 2,400km. It can be divided geographically into three coastal regions: the Rakhine Coastal Region (from the mouth of the Naaf to Mawtin Point, about 740km in length), the Ayeyarwaddy Delta and the Gulf of Mottama (Martaban) Coastal Region (from the Mawtin Point to the Gulf of Mottama, about 460km in length) and the Taninthayi Coastal Region (from the Gulf of Mottama to the mouth of the Pakckan River, about 1200 km in length) in the Bay of Bengal and in the Andaman Sea.

Myanmar has terrestrial and aquatic ecosystems and. Marine waters cover a total area of approximately 486,000 km^2, and there are 8.1 million hectares of inland freshwater bodies including a large number of estuaries, rivers, creeks, streams, natural ponds, lakes and puddles. The marine fishing area extends about 167,573km^2 along the three Coastal regions; major freshwater fishing areas occur in the down streams tributaries of the Ayeyarwaddy, the Sittaung and the Thanlwin rivers. Marine fishes in Myanmar waters have habitats. A long coastline and the swamp along the coast of Myanmar serve as spawning, nursery, and feeding grounds for aquatic life (Anonymous, 2009). With a coastline of 2, 400 km, several large estuarine, delta systems and numerous offshore islands, Myanmar possesses a considerable diversity of coastal habitat, including coral reefs, mangroves, sandy beaches, and mudflats.

The Department of Fisheries (DoF) reported that fisheries are the fourth important source of exports earnings, valued at US$ 218 in 2001. Marine capture fisheries for 2001 are reported in official DoF statistics as 932, 090 tonnes, and freshwaters fisheries as 235,530 tonnes. During the monsoon season from May to September, inundated flooded plains are breeding

and nursery grounds for fresh water fishes. At that time of the year, DOF is stocking fish seed and brood stock in natural and man-made water bodies to enhance and sustain commercially important species.

Mon State is located between Lat. 15° 10′ N and 17° 30′ N and Long. 96° 46′ E and 98° 15′ E with a unique ecosystem. The Gulf of Mottama is located at the mouth of the Sittaung and the Thanlwin River along with two small rivers, the Gyine and Attran. This coastal area is characterized by the fluctuation of seawater and fresh water discharge. Most of the study area is covered by swamps, large areas of mud flats, and estuarine waters. Some areas of Mon State are covered with estuarine regions which are characterized by a variable salinity, a temperature range greater than the sea, and turbid water and muddy bottom. The Gulf of Mottama coastal area has a broad mud flat, sandy beaches and salt marshes. For that reason, it is suitable area as a spawning ground (Ohnmar Min, 2013).

The marine capture fishery comprises coastal or inshore fisheries, and offshore or deep sea fisheries. Various type of fishing gears are used to exploit the large diversity of marine species found in Myanmar waters. The fishing gear is classified into commercial such as trawl net, purse seines, drift net and gill net, and traditional including hook and line, cast net, bag net, trammel gill net and traps. However, the bulk of landings derive from trawls, purse seines, drift nets and gill nets (Ministry of Livestock and Department of Fishery).

Kyeikhto is located at the northern part of Mon State and is situated at (Lat. 17.31°N, Long. 97.01°E). The fisheries in Kyeikhto township operate inshore (within twenty nautical miles of shore) and within Sittaung river and harvest a wide range of species, mostly using Trammel net, Drift gill net and Fence net, especially in the medium sized boat (7-11m). One of the main fishing gears used in Kyeikhto is Fence net had been operated for various kind of fish species, it commercially target species are Croaker (Nga

Poat Tin) and Indian threadfin (Ka Khu Yan). These two species dominantly occur around the year and as major commercially important species for the study area.

If the fisheries collapse, the livelihoods of many people, especially those employed in the fisheries will be affected due loss of an income and loss of jobs. Many people will probably have to move to other jobs in urban areas, which will impact urban population's overseas again potentially lead to further social deprivation. Marine fisheries occupy a significant position in socio- economic aspect. The aims of the present study are

1) to know the variety of fishes which are collected from medium sized boats,
2) to know the occurrence of fishes in Kyeikhto township
3) to provide information for users in the fishery sector

Chapter 2

LITERATURE REVIEWS

Whitehead *et al*. (1988) described all clupeoids of the world including the family Engraulidae. This is the seventh worldwide species catalogue in the FAO fisheries series. This catalogue includes all clupeoid fishes. Munro (1955) studied the marine and fresh water fishes of Srilanka which also had much in common with Myanmar Ichthyic Fauna.

Fischer and Whitehead (1974) reported on the fishes of Eastern Indian Ocean, Fishing ground 57 and Western Central Pacific, Fishing ground 71. In addition, the observation of the fishes was reported by Rome (1974) who studied the Eastern Indian Ocean and Western Central Pacific. In 1967, Tint Hlaing published 465 species of 115 families under 17 orders. It was the first authoritative listings of fishes inhabiting the sea and fresh waters of Myanmar.

Day (1878) published 'The fish of India' including the fishes of the seas and fresh water of India, Burma and Ceylon. He described 1418 species of fishes and this was very useful for basic identification of fishes.

De Bruin *et al*. (1995) identified the marine species of some cartilaginous and bony fishes, invertebrates, turtles and edible algae of Sri Lanka. They described technical terms, list of important species, which included FAO names, local names, maximum size, and habitats in this book.

The fishes of Cambodia Mekong were made by Rainboth *et al.* in 1996. They described approximately 500 species of fresh water and marine species. The species account provides information on synonyms, sizes, diagnostic features, illustrations, distributions, habitat and biology.

There have been numerous studies in the biology and fisheries in Myanmar and particularly Mon State, some of them are described here.

Sann Aung (2003) described 41 species belonging to 19 families as a exportable species in Commercial fishes of Myanmar Seas. He considered 70 species under 29 families with a short biography as commercially important fishes. Hla Win *et al.* (2008) reported Commercial fishes of Myanmar, it includes 248 species diversities: they are 172 species of marine fishes, 40 species of freshwater fishes, 20 species of aquarium, 9 species of lobster and crabs, 4 species of shrimps and cuttlefishes. This is the first type published by Myanmar Fishery Products Professors and Exporters Association.

Su Su Hlaing (2010) reported a total of 70 species of commercially important ichthyologic fauna belonging to 61 genera of 42 families from 15 orders collected from Thanlwin River mouth and Adjacent Sea and also studied morphology, biology, habitat, distribution; fin formula and fishing gears were also described.

Tint Swe (2011) studied the biology and economics of fishery resources caught by stationary bag nets along the coast of Mon state, were recorded 73 species at five stations: Sabalar, Kadonebaw, Kyaikkhami, Setse and Asin along the coastline. He recorded two species of cartilaginous, 65 species of bony fishes, four species of shrimps and prawns and two species of cephalopods in his study areas. And he described the length-weight relationship and feeding habit of *Harpodon nehereus.*

Mya Than Tun (2001) recorded 11 species of anchovy in Myanmar coastal water. He reported 351 species belong to 86 families of the pelagic and demersal marine fishes of Myanmar.

Ohnmar Min (2013) studied the fishery biology of sciaenid fishes in Mon Coastal Waters. She described a total of 23 species under 13 genera of family Sciaenidae and

studied the biology, length frequency distribution, length-weight relationship, food and feeding habit, reproductive biology and fishing gears at selected areas.

Khaing Myat Myat Htwe (2012) studied the fishery biology of herring fishes at the Thanlwin river mouth and adjacent waters. A total of 11 species under 8 genera of family Clupeidae were identified. And she described the abundance and general distribution of study fishes in the study areas.

Mi Mya Mya Thet (2013) identified 5 species under 2 genera of polynemidae along the Mon State coastal waters and its adjacent waters in the Gulf of Martaban Coastal Region.

Khin Htwe Win (2010) reported species diversity and feeding habit of fish species from Sittaung River Segment (Theinzayat to Thabyegam Village). She described the species composition and diversity, investigation of water parameters, examination of food items consumed by the record fish species, investigation of the feeding habit of fishes in different seasons and the relationship between food weight and body weight of examined fish species.

In 1995, Min Oo studied the reproductive biology of some sciaenid fish from Mon State coastal area. Mi Mi Latt (1995) reported preliminary analysis of the growth and mortality of *Harpandon nehereus* from bag net fishery at Setse, based on the length composition of bag net landing during 1987-88 and during 1991-93.

Myat Thu (2013) reported the population parameter of *Harpadon nehereus* from Setse, Kayokopi and Kalegauk Island. He studied the length frequency distribution, length-weight relationship, mortality rate, growth rate, estimated exploitation rates and feeding habit of *Harpadon nehereus.*

In 1985, Kyaw Kyaw Htay recorded systematic and ecological study on deep sea fishes of Maungmagan coastal areas, Taninthayi Division. He described species

identification, the types of fishing gears, the population of fish and correlation between recorded deep sea fish species and catch weight.

Fishing Gear

Burdon, T.W. (2012) reported a consideration of the classification of fishing gear and methods. Khin Maung Aye *et al*. (2016) described the Inland fishing gear and methods in Myanmar and 8 important group of fishing methods such as gill nets, hook and lines, traps, surrounding net, filling net, lift nets, push nets and miscellaneous were also described.

Chapter 3

MATERIALS AND METHODS

3.1 Study site and study period

The fish samples were collected at medium sized boats (7 to 11m) mainly from four stations in Kyeikhto township: Kyeikhto (17.30° N 97.01° E), Sut Pa Nu (17.32° N 96.96° E), Bo Yar Gyi (17.39° N 96.89° E) and Kyauk Seik (17.44° N 96.87° E). Study period was from June, 2016 to January, 2017. The location of study sites were presented in Fig 3.1

3.2 Sample collections and method used

Monthly sample collection for measurement of length-weight relationship and length frequency distribution was conducted at Kyeikhto. In sampling, fish were collected randomly in fresh condition. The samples were recorded according to catches from different nets. The sampled fishes were recorded by digital camera and were measured for total length (for *Otolithoides pama*) and fork- length (cm) (for *Leptomelanosoma indicum*) by measuring-board in fresh condition. The weight of individual fish was determined to the nearest gram by a top balance. Some samples were preserved with 5-10% formaldehyde seawater solution and brought to the laboratory, Department of Marine Science, Mawlamyine University. Fisheries data such as type of gears and fishing methods, CPUE, market, and utilization were collected by interviewing and surveying with the fishermen. The identification was mainly based on FAO identification sheets, Vol. I- IV, 1974, Day et al. (1878), De Briun *et al*. (1995), http:// fishbase.org/ and catalogue for fishery purpose.

3.3 Length Frequency Distribution

Length frequency distribution of *Otolithoides pama* and *Leptomelanosoma indicum* were constructed from monthly collected data of medium sized boats in Kyeikhto from September, 2016 to January, 2017. The collected samples of *Otolithoides pama* and *Leptomelanosoma indicum* were grouped into 5 cm class intervals.

3.4 Length-weight relationship

For species *Otolithoides pama,* total length (from the snout to the end of caudal fin) was measured to the nearest millimeters and weighed by nearest gram. Forked length (from the snout to the cartilaginous tip of the shortest caudal fin ray) was measured to the nearest millimeters and weighed by nearest gram in *Leptomelanosoma indicum.* The equation $W = \alpha L^b$ (Le Cren, 1951) was used to calculate the length-weight relationship, where W = weight of fishes (g), L = length of fishes (cm), a = constant, b = the exponent.

3.5 Fishing Gears

Various kind of fishing gears such as trammel net, drift gill net and fence net with various mesh size are used in the fishing operation.

3.5.1 Trammel net (Thone Htat Pike)

The design of trammel net consists of three layers. The two outer layers have same twine and mesh size and number of vertical and horizontal meshes, the hanging rate is more stretched than the inner layer. The inner layer has smaller mesh size, finer twine and more slack. When the fish enter the first layer, they pass through eventually hitting the inner layer which envelops their bodies. They pass again to the 3rd layer where they are impounded. Trapping in the inner layer net does not allow the fish any chance of escape.

The length of the head rope is 30m to 360m and the height is 2m to 7.5m. The material of the trammel is made of nylon multifilament. Some trammel nets are made of nylon

monofilament at the layer and nylon multifilament at the outer layers. The setting operation of the trammel net is like the drift gill net, carried out either by day or night time. The net is set across the tide and allowed to drift for one to two hours before hauling. (Khin Maung Aung *et.al*, 2006)

3.5.2 Drift gill net (Hmyaw Pike)

There are many types of drift gill net used for different target species. Generally, their construction is a wall of net that is set across the water current and be allowed to drift according to the current direction. The head rope or float line is on the surface of the water or mid water hang by float. The lower part of the net is without sinker or with a sinker line depending on the target species and the characteristics of the fishing ground of river. Fishing with drigt gill netis commonly carried out by flood tide and ebb tide. Kept on the surface or a certain distance below it, by numerous floats, these net drift freely with the current, seperately or more often with the boat to which they are attached. The length og drift gill net depends on the size of boat, financial ability of fishermen. (Khin Maung Aung *et.al*, 2006)

3.5.3 Fence net (Thaung Wine Pike)

The fence net is a long wall net that is mounted along river banks using bamboo poles. It is temporary fence to enclose an area along the bank of a tidal creek or river at high tides. The net is set at low tide. Fishermen fix bamboo poles along the bank at about 5 m interval. The lower part of the net is dug into the mud. At high tide, the upper part of the net are raised and tied to the bamboo poles. At that time the net enclosed the area and fishes are trapped inside the fence and are caught by hand at low tides. The fishing season is from middle May to March and the target catch is miscellaneous fish. The small mesh size of this net (Than za kar pike) is widely used in Kyeikhto. (DOF, 2012)

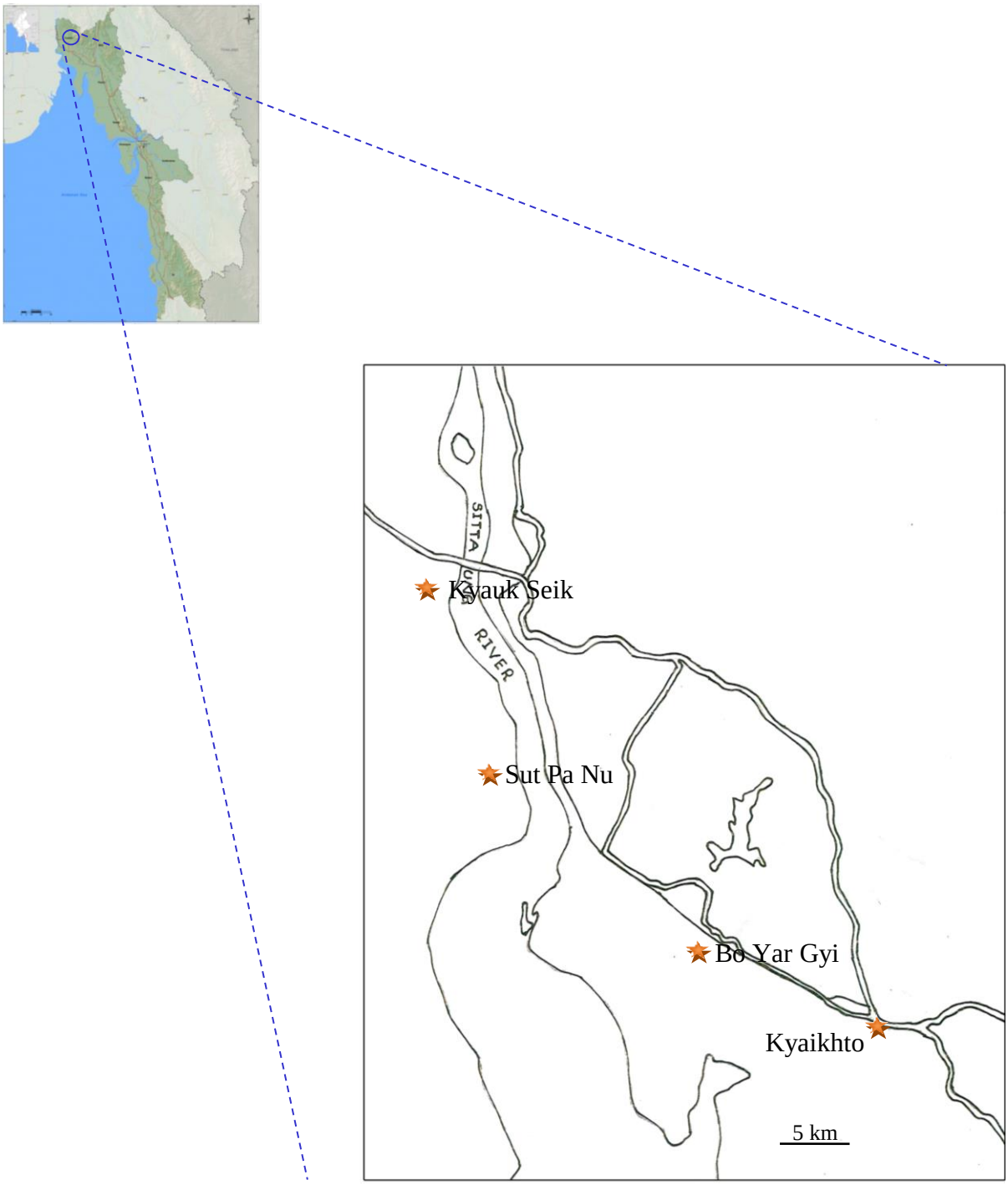


Fig.3.1 Map Showing the sample collecting site (i) Kyeikhto, (ii) Bo Yar Gyi, (iii) Sut Pa Nu, (iv) Kyauk Seik

Chapter 4

RESULTS

4.1 Identification of fishes

A total of 40 species belonging to 35 genera under 23 families and 10 orders were recorded in the study area during the study period from June 2016 to January 2017. The recorded species are *Congresox talabon, Strongylura strongylura, Thryssa mystax, Setipinna taty, Coilia dussumieri, Coilia ramcarati, Tenualosa ilisha, Tenualosa toli, Osteobrama belangeri, Puntius chola, Cirrhinus mrigala, Catla catla, Chela fasciata, Mugil cephalus, Rhinomugil corsula, Otolithoides biauritus, Otolithoides pama, Johnius coiter, Chrysochir aureus, Eleutheronema tetradactylum, Leptomelanosoma indicum, Polynemus paradiseus, Harpadon nehereus, Lobotes surinamensis, Lates uwisara, Scatophagus argus, Sillaginopsis panijus, Trichiurus lepturus, Channa striata, Terapon Jarbua, Cynoglossus bilineatus, Platycephalus indicus, Arius thalassinus, Arius maculatus, Osteogeniosus militarias, Wallago attu, Pangasius pangasius, Mystus vittatus, Mystus sp.* and *Scoliodon laticaudus.*

A list of systematic list of the species is given in Table 4.1. A key to the recorded species is given in Section 4.2, and pictures on each species along with a brief description are found in 4.3.

Table 4.1. Systematic list of recorded species from June, 2016 to January, 2017 in Kyeikhto Township Mon State.

Class	Order	Family	Genus	Sr no.	Species
Actinopterygii	Anguilliformes	Muraenesocidae	*Congresox*	1	*Congresox talabon* (Cuvier, 1829)
	Beloniformes	Belonidae	*Strongylura*	2	*Strongylura strongylura* (van-Hasselt, 1823)
	Clupeiformes	Engraulidae	*Thryssa*	3	*Thryssa mystax* (Bloch & Schneider, 1801)
			Setipinna	4	*Setipinna taty* (Valenciennes, 1848)
			Coilia	5	*Coilia dussumieri* Valenciennes, 1848
				6	*Coilia ramcarati* (Hamilton-Buchanan, 1822)
		Clupeidae	*Tenualosa*	7	*Tenualosa ilisha* (Hamilton, 1822)
				8	*Tenualosa toli* (Valenciennes, 1847)
	Cypriniformes	Cyprinidae	*Osteobrama*	9	*Osteobrama belangeri* (Valenciennes, 1844)
			Puntius	10	*Puntius chola* (Hamilton, 1822)
			Cirrhinus	11	*Cirrhinus mrigala* (Hamilton, 1822)

Continued

Class	Order	Family	Genus	Sr. no	Species
			Catla	12	*Catla catla* (Hamilton, 1822)
			Chela	13	*Chela fasciata* (Silas, 1958)
	Mugiliformes	Mugilidae	*Mugil*	14	*Mugil cephalus* Linnaeus, 1758
			Rhinomugil	15	*Rhinomugil corsula* (Hamilton, 1822)
	Perciformes	Sciaenidae	*Otolithoides*	16	*Otolithoides biauritus* (Cantor, 1849)
				17	*Otolithoides pama* (Hamilton, 1822)
			Johnius	18	*Johnius coitor* (Hamilton,1822)
			Chrysochir	19	*Chrysochir aureus* (Richardson, 1846)
		Polynemidae	*Eleutheronema*	20	*Eleutheronema tetradactylum (*Shaw,1804*)*
			Leptomelanosoma	21	*Leptomelanosoma indicum* (Shaw,1804)
			Polynemus	22	*Polynemus paradiseus* (Linnaeus, 1758)

Continued

Class	Order	Family	Genus	Sr no.	Species
		Harpadontidae	*Harpadon*	23	*Harpadon nehereus* (Hamilton, 1822)
		Lobotidae	*Lobotes*	24	*Lobotes surinamensis* (Bloch, 1790)
		Latidae	*Lates*	25	*Lates uwisara* (Pethiyagoda and Gill,2012)
		Scatophagidae	*Scatophagus*	26	*Scatophagus argus*(*Bloch,1758*)
		Sillaginidae	*Sillaginopsis*	27	*Sillaginopsis panijus* (Hamilton, 1822)
		Trichiuridae	*Trichiurus*	28	*Trichiurus lepturus* Linnaeus, 1758
		Channidae	*Channa*	29	*Channa striata* (Bloch,1793)
		Terapotidae	*Terapon*	30	*Terapon Jarbua*
	Pleuronectiformes	Cynoglossidae	*Cynoglossus*	31	*Cynoglossus bilineatus* (Lacepède, 1802)
	Scorpaeniformes	Platycephalidae	*Platycephalus*	32	*Platycephalus indicus* (Linnaeus, 1758)
	Siluriformes	Ariidae	*Arius*	33	*Arius thalassinus* (Rüppell,1837)
				34	*Arius maculatus* (Thunbreg,1792)
			Osteogeniosus	35	*Osteogeniosus militarias* (Linnaeus, 1758)
		Siluridae	*Wallago*	36	*Wallago attu* (Bloch & Schneider, 1801)

Continued

Class	Order	Family	Genus	Sr no.	Species
		Pangasiidae	*Pangasius*	37	*Pangasius pangasius* (Hamilton, 1822)
		Bagridae	*Mytus*	38	*Mystus vittatus* (Bloch, 1794)
				39	*Mystus sp.*
Elasmobranchii	Carcharhiniformes	Carcharhinidae	*Scoliodon*	40	*Scoliodon laticaudus* Müller & Henle, 1838

4.2 Key to the recorded species

Keys to the species of family Engraulidae

1 a. Body tapering to tail; caudal pointed 2

2 a. Longitudinal rows of golden spots on lower flanks .....……...*Coilia dussumieri*

2 b. No longitudinal spots on body.....*Coilia ramcarati*

1 b. Body compressed; caudal forked .....….3

3 a. Pectoral rays long, upper caudal lobes truncate……..…….....…*Setipinna taty*

3 b. Upper jaw (maxilla) rather long, caudal forked and equal lobes .... *Thryssa mystax*

Keys to the species of family Clupeidae

1 a. Caudal fin equal (as long as) to head, gill rakers fine and numerous (120- 200) ……..

……*Tenualosa ilisha*

1 b. Caudal fin longer than head, gill rakers less (70-95) …….....……...*Tenualosa toli*

Keys to the species of family Cyprinidae

1 a. Body very compressed, deep and oval- shaped, head small and pointed, bright silivery coloured on body……..……..*Osteobrama belangeri*

1 b. Body generally compressed and oblong, head large……..…….2

2 a. Body fusiform, head rather small and concave on nape, mouth upward…….……..

.... *Chela fasciata*

2 b. Head large and convex head profile, dorsal fin origin on about midpoint of body……..3

3 a. Body short, deep and compressed, pectoral white, pelvic and anal fins pinkish colored…….....……..…….....……..*Puntius chola*

3 b. Body more elongate,.....……..…….…….4

4 a. Head enormously large, body deep and little compressed.....…*Catla catla*

4 b. Head moderate large, body more slender, caudal deeply forked…….

……..*Cirrhinus mrigala*

Keys to the species of family Mugillidae

1 a. Body rather stout, head broad and flattened on top...…… *Mugil cephalus*

1 b. Body rather slender, head slightly convex…….……. *Rhinomugil corsula*

Keys to the species of family Sciaenidae

1 a. Swim bladder with only one or two pairs of appendages…….....……2

1 b. Swim bladder with more than two pairs of arborescent appendages…..……..……..3

2 a. More soft rays in dorsal fin (40-45), also pectoral fin as long as head ……. …… *Otolithoides pama*

2 b. Less soft rays in dorsal fin (27-32), also pectoral fin little short to head (3/4 of head length) .....*Otolithoides biauritus*

3 a. Swim bladder carrot-shaped, canine in upper jaw only, mouth inferior…….… ....…*Chrysochir aureus*

3 b. Swim bladder hammer-shaped, teeth in both jaws….....…...….*Johnius coitor*

Keys to the species of family Polynemidae

1 a. Lower part of pectoral has four rays.....*Eleutheronema tetradactylum*

1 b. Lower part of pectoral has five or more pectoral rays .....….2

2 a. Pectoral rays very long, the longest twice to body length ……..….. .....*Polynemus paradiseus*

2 b. Pectoral rays short, the longest reaching to anal fin base …..... ……*Leptomelanosoma indicum*

Keys to the species of family Ariidae

1 a. Head depressed, only one pair of barbles present.....*Osteogeniosus milit*ari*as*

1 b. Head pointed, three pair of barbles present.....2

2 a. Teeth on plate granular or molar-like……..…….. *Arius maculatus*

2 b. Teeth on palatefine, villiform……...……..……*Arius thalassinus*

4.3 Description of collected samples

Congresox talabon (Cuvier, 1829)

(Fig. 4.3.1)

Synonyms	:	*Conger talabon* Cuvier, 1829; *Muraenesox talabon* (Cuvier, 1829)
FAO name	:	Yellow pike - conger
Local name	:	Nga-shwe
Diagnostic features	:	Body robust and eel-shaped fish without scales. Mouth very large, upper jaw extends well behind eye. Teeth on jaws in three rows; fang- like canine teeth at front of lower jaw and vomer, medium canines on vomer conical (needle-like, not blade-shaped). Dorsal fin inserted before gill opening. Pectoral fin relatively large.
Habitat	:	Lives in estuaries, over soft bottom down to about 100m
Distribution	:	Coast of India to Indonesia and Borneo, and Hong Kong
Utilization	:	Marketed fresh
Total Length	:	80cm

Strongylura strongylura (van-Hasselt, 1823)

(Fig. 4.3.2)

Synonyms : *Belone strongylura* van-Hasselt, 1823; *Belone saigonensis* Sauvage, 1879

FAO name : Spottail Needlefish

Local name : Nga-paung-yoe

Fin formula : D. 12-15; A. 15-18; P. 10-12; V. 59-65.

Diagnostic features : Head moderately compressed. Jaws greatly elongates, studded with sharp teeth. Body elongate and belly rounded; no caudal peduncle branch; Dorsal and anal fins with moderate lobes anteriorly; origin of dorsal fin posterior to anal fin origin; pectoral fin not falcate; caudal fin rounded or truncate. Body silvery white.

Habitat : Found in estuaries and marine

Distribution : Indo-West-Pacific, India and Sri lanka

Utilization : Marketed fresh

Total Length : 26 cm

Thryssa mystax (Bloch & Schneider, 1801)

(Fig. 4.3.3)

Synonyms : *Clupea myatax* Bloch & Schneider, 1801; *Thryssa* subspinosa (Swainson, 1839); *Thryssa* valenciennesi (Bleeker,1866)

FAO name : Moustached Thryssa

Local name : Nga-pyar

Fin formula : D.13-15, P. 12, V.7, A. 35-38, C. 19. LR. 45

Diagnostic features : Body somewhat deep, compressed; abdomen withm17-19 prepelvic and 8-13 postpelvic keeled scutes, 24-32 in total number. Teeth in jaws small or minute. Maxilla long, reaching or almost reaching posteriorly to base of first pectoral fin ray. Anal fin long, its origin posterior to vertical through end of dorsal fin base. Scales cycloid.

Habitat : Marine, pelagic and schooling, mainly coastal, but also entering estuaries

Distribution : Indian Oceans, western central Pacific

Utilization : Marketed fresh

Fork Length : 22cm

Setipinna taty (Valenciennes, 1848)

(Fig. 4.3.4)

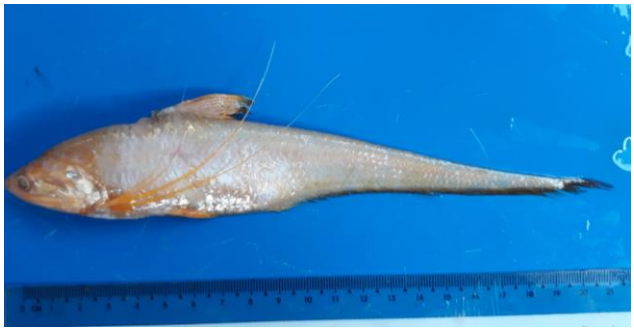
Synonyms	:	*Setipinna gilberti* Jordan & Starks, 1905
FAO name	:	Scaly hairfin anchovy
Local name	:	Nga-pyar
Fin formula	:	D.13-15, P. 15, V.7, A. 51-57, C. 19.
Diagnostic features	:	Body strongly compressed with 29-43 scutes from pectoral fin base to anus. A small spine likes scute (strongly ossified) anterior to dorsal fin origin. Snout moderately prominent. Maxilla short, not quite reaching posteriorly to margin of gill cover. Dorsal fin origin distinctly anterior to body midpoint. Scales cycloid. Scale present on dorsal and anal fins.
Habitat and biology	:	Marine, pelagic and schooling, mainly coastal, but also entering estuaries
Distribution	:	Indian Oceans, western central Pacific
Utilization	:	Marketed fresh
Fork Length	:	24.5cm

Coilia dussumieri Valenciennes, 1848

(Fig. 4.3.5)

Synonyms	:	*Coilia quadrifilis* Günther,1868*; Demicoilia margaritifera* Jordan & Seale, 1926*; Leptonurus chrysostigma* Bleeker, 1849
FAO name	:	Goldspotted grenadier anchovy
Local name	:	Mee-tan-thwe
Fin formula	:	D. I/13-14, P. VI/8-9, V.I/6, A. 105.
Diagnostic features	:	Body elongate, tapering to tail. Belly slightly rounded, with 5 or 6 sharp scutes. Before pelvic fin base. Maxilla short, not quite reaching posteriorly to margin of gill cover. Dorsal fin far forward beginning in first third of body length. Caudal fin very small and extremely pointed. Body yellowish silver, flanks and belly with golden or pearly spots.
Habitat	:	Inhabits coastal water and estuaries.
Distribution	:	Indian, Sri lanka and Burma, eastwards to Southeast Asia
Utilization	:	Marketed fresh and dried salted.
Total Length	:	15cm

Coilia ramcarati (Hamilton-Buchanan, 1822)



(Fig. 4.3.6)

Synonyms	:	*Coilia cantoris* Bleeker, 1853*; Coilia quadragesimalis Valenciennes, 1848*
FAO name	:	Ramacarat grenadier anchovy
Local name	:	Mee-tan-thwe
Fin formula	:	D. 14, P. 5-6, V.I/8-9, A. 95-110.
Diagnostic features	:	Body elongate, tapering to tail. Belly rounded before pelvic fins. Maxilla short and not reaching to edge of gill cover. A small sharp spine is before dorsal fin origin. Pectoral fins with 6 long filaments and shorter than those of pelvic fins. Colour golden, with a darkish stain behind the gill opening. The last half of the anal and the whole of the caudal are blackish. No golden spots on the body.
Habitat	:	Pelagic, brackish, marine.
Distribution	:	Indian Ocean, Myanmar, Pakistan, Sri Lanka, Vietnam
Utilization	:	Marketed fresh and dried salted.
Total Length	:	20cm

Tenualosa ilisha (Hamilton, 1822)

(Fig. 4.3.7)

Synonyms : *Hilsa* ilisha (Ham. Buch., 1822); *Hilsa palasah* (Cuvier, 1829)

FAO name : Hilsa-shad

Local name : Nga-tha-lauk

Fin formula : D. 18, P. 14, V. 9, A. 18-22, C. 19-22.

Diagnostic features : Body fusiform; belly with fairly sharply keeled scutes. Dorsal fin origin at about midpoint of body. Pelvic fins below anterior part of dorsal fin. Upper jaw with distinct medium notch when see from front. Gill rakers very fine and numerous. Top of head without pair of striated frontoparietal areas. Caudal fin as long as head. The back of the body greenish blue, flanks silvery. A series of black blotches along the flanks which disappear in larger adults.

Habitat : Inhabit coastal waters, estuaries and rivers

Distribution : Malaysia and Indonesia

Utilization : Marketed fresh

Fork Length : 15.5cm

Tenualosa toli (Valenciennes, 1847)

(Fig. 4.3.8)

Synonyms	:	*Clupea* (Alosa) toli: Weber & de Beaufort, 1913; *Alausa ctenolepis*; Bleeker, 1852; *Macruran sinensis*: Fowler, 1941; *Tenualosa sinensis* : Munro, 1955
FAO name	:	Toli-shad
Local name	:	Nga-tha-louk- york-pha
Fin formula	:	D. 16-17, P. 14, V. 9, A. 19-20.
Diagnostic features	:	Body fusiform; belly with fairly sharply keeled scutes. Dorsal fin origin a little before midpoint of body. Pelvic fins below anterior part of dorsal fin. Upper jaw with distinct medium notch when see from front: maxilla reaching to vertical from eye center or beyond. Gill rakers fine and numerous. Top of head without frontoparietal areas. Caudal fin larger than head. The back of the body greenish blue, flanks silvery.
Habitat	:	Inhabit coastal waters, estuaries and rivers.
Distribution	:	India to Java Sea and South China Sea, Thailand
Utilization	:	Marketed fresh.
Fork Length	:	35 cm

Osteobrama belangeri (Valenciennes, 1844)

(Fig. 4.3.9)

Synonyms	:	None
FAO name	:	Manipur Osteobrama
Local name	:	Nga-pham-ma
Fin formula	:	D. III/8, P. I/16, V. I/8, A. III/17
Diagnostic features	:	Body trapezoid and considerably compressed. Mouth small; barble absent. Dorsal spine strong and serrated. Scales small; lateral line with 70 to 80 scales.
Habitat	:	Found in rivers and lakes
Distribution	:	India: Manipur; Burma; and Yunnan (China)
Utilization	:	Marketed fresh
Total Length	:	22 cm

Puntius chola (Hamilton, 1822)

(Fig. 4.3.10)

Synonyms	:	*Cyprinus chola* (Hamilton, 1822); *Puntius titius* (Hamilton, 1822); *Barbus chola* (Hamilton, 1822)
FAO name	:	Swamp barb
Local name	:	Nga-khone-ma
Fin formula	:	D. III/8, A. II/5, P. I/ 14, V. I/8
Diagnostic features	:	Body fairly deep and compressed; its lower profile less convex than upper. Mouth moderate; barbles one short maxillary pair. Caudal fin inserted equidistant between snout-tip and base of caudal fin. Scale moderate, lateral line complete.
Habitat	:	Usually found among marginal vegetation in lakes and swamps with muddy substrates.
Distribution	:	Pakistan, India, Nepal, Bangladesh, Sri Lanka and Burma
Utilization	:	Marketed fresh
Fork Length	:	9 cm

Cirrhinus mrigala (Hamilton, 1822)

(Fig. 4.3.11)

Synonyms	:	*Cyprinus mrigala* Hamilton, 1822; *Cirrhina rubripinnis* Valenciennes, 1842
FAO name	:	Mrigal carp
Local name	:	Nga-gyin-phyu
Fin formula	:	D. III/12-13, A. III/5, P. I/17, V. I/8.
Diagnostic features	:	Body streamlined its depth about equal to length of head. Snout blunt, often with pores. Mouth broad; upper lip entire, lower lip most indistinct. Dorsal fin as high as body. Pectoral fin shorter than head. Caudal fin deeply forked.
Habitat	:	Inhabit rivers
Distribution	:	Pakistan: Indus plain and adjacent hilly areas, India and Bangladesh
Utilization	:	Marketed fresh
Fork Length	:	12.5 cm

Catla catla (Hamilton, 1822)

(Fig. 4.3.12)

Synonyms	:	*Catla buchanani* Valenciennes, 1844; *Cyprinus catla* Hamilton, 1822; *Leuciscus catla* (Hamilton, 1822)
FAO name	:	Catla
Local name	:	Nga-tine-goung-pwa
Fin formula	:	D. III-IV/14-16, A. III/5, P. I/20, V. I/8.
Diagnostic features	:	Body deep; head enormously large. Mouth wide and upturned. Pectoral fins long, extend to pelvic fins. Scale conspicuously large.
Habitat	:	Inhabiting weedy or turbid bond
Distribution	:	Pakistan, Indian: northern India; Bangladesh; Nepal and Burma
Utilization	:	Marketed fresh
Fork Length	:	31 cm

Chela fasciata (Silas, 1958)

(Fig. 4.3.13)

Synonyms	:	*Chela fasciata* Silas, 1958; *Chela fasciatus* Silas, 1958
FAO name	:	Malabar hatchet chela
Local name	:	Nga-da-mauk
Fin formula	:	D. II/7, A. III/14-15, P. I/8-9, V. I/5-6
Diagnostic features	:	Body greatly compressed. Head slightly turned upwards. Mouth small, obliquely directed upwards, its cleft extending to below front edge of eye. Pectoral fins long, lateral line complete.
Habitat	:	Occur in shallow and relatively deep areas of streams
Distribution	:	Peninsular India: Annamalai Hills
Utilization	:	Marketed fresh
Total Length	:	8 cm

Mugil cephalus Linnaeus, 1758

(Fig. 4.3.14)

Synonyms	:	*Mugil japonicas* Schlegel, 1845; *Mugil galapagensis* Ebeling, 1961
FAO name	:	Flathead grey mullet
Local name	:	Ka-be-luu
Fin formula	:	D. IV; I/9-10; P. 22-25, A. III/8
Diagnostic features	:	Body rather stout, head broad and flattened on top. Adipose tissue cover eye; Lower lip very thin; a large symphysial knot front of lower jaw. First dorsal fin originated nearer snout tip than tail base. Dorsal, pectoral and pelvic fins had distinct axillary scale. Caudal fin forked. All soft rays are branched and segmented. Dark green on dorsal and silvery on lateral and ventral.
Habitat	:	School enters fresh water and estuaries and spawning in the sea. They feed on microscopic organisms and organic detritus in bottom muds
Distribution	:	Especially Indo- Australian archipelago
Utilization	:	Marketed fresh and dried salted
Total Length	:	46 cm

Rhinomugil corsula (Hamilton, 1822)

(Fig. 4.3.15)

Synonyms	:	*Liza corsula* (Hamilton, 1822) ; *Mugil corsula* Hamilton, 1822
FAO name	:	Tidal creek mullet
Local name	:	Nga-zin
Fin formula	:	D. IV; I/8, P. 16, V. I/ 5, A. III/9.
Diagnostic features	:	Body slender, head slightly convex and rather broad, eye rounded by adipose tissue, mouth inferior, upper lip thick and lower thin. Dorsal fins have 4 spines, pelvic fin have one each and anal fin have 3 spines. Caudal forked and ctenoid scale
Habitat	:	Estuaries, River mouth, tidal creek.
Distribution	:	Indian Ocean, and Western Pacific.
Utilization	:	Marked fresh and dried salted
Total Length	:	24. 5 cm

Otolithoides biauritus (Cantor, 1849)

(Fig. 4. 3.16)

Synonyms	:	*Otolithoides biauritus:* Fowler, 1933; Chu, Lo & Wu, 1963 *Sciaenoides brunneus*: Day, 1876; *Otolithoides brunneus:* Fowler, 1933; Chu, Lo & Wu, 1963
FAO name	:	Bronze croaker
Local name	:	Nga-poat-tin
Fin formula	:	D. IX; I/ 27-32, P. 19, V. I/5, A. II/7, C. 17
Diagnostic features	:	Body elongated and large terminal mouth. Upper jaw reaching back well beyond eye. Teeth strong and spaced in both jaws, no canine teeth; a few smaller teeth present. Swim bladder carrot shaped, with a single pair of appendages, arising from posterior end of bladder and running forward beside main body of bladder and in front of it into the head, where they branch under the skull. Dorsal fin with 8-9 spines, second part of the fin with 1 spine, pectoral fin moderate, about ¾ of head length, anal fin with 2 spines. Caudal fin pointed. Scales cycloid on head. Head and back in green-grey color, flanks gold-orange and pale toward belly.
Habitat	:	Inhabits coastal and inshore waters.
Distribution	:	Indian Ocean and Western Central Pacific.
Utilization	:	Marketed fresh, frozen, salted dried and swim bladder dried
Total Length	:	64 cm

Otolithoides pama (Hamilton, 1822*)*

(Fig. 4.3.17)

Synonyms	:	*Bola pama* Ham . Buch. , 1822; *Sciaenoides pama* : Day, 1876; *Pama pama* : Fowler, 1933; Weber & de Beaufort, 1936 ; *Otolithoides pama:* Mohan, 1972
FAO name	:	Pama croaker
Local name	:	Nga-poat-thin, Nga-byat
Fin formula	:	D. X; I / 40-45, P. 17, V. I/ 5, A. II/ 7, C. 17
Diagnostic features	:	Body oblong and elongate, large terminal mouth. Snout conical. Upper jaw reaching back beyond of eye. Teeth enlarged in both jaws. Swimbladder carrot-shaped with a single pair of appendages, arising from posterior end of bladder and running forward beside it to enter the head where they branch under the skull. Dorsal fin with 10 spines, second part of the fin with 1 spine, Pectoral fins as long as or longer than head. Caudal fin pointed. Scales cycloid on head (smooth). Light brownish along the back becoming white beneath; head shot with gold and purple.
Habitat	:	Found in coastal waters, estuaries and enter rivers.
Distribution	:	Bay of Bengal, Tropical Indo-Pacific.
.Utilization	:	Marketed fresh, dried salted and swim bladder dried
Total Length	:	40 cm

Johnius coitor (Hamilton, 1822)

(Fig. 4. 3. 18)

Synonyms	:	*Sciaena coiter*: Day, 1876; *Wak coitor*: Lin, 1938; Chu, Lo & Wu, 1963
FAO name	:	Coitor croaker
Local name	:	Nga-myet-pyuu
Fin formula	:	D. X; I/26-28, P. 17, V.I/5, A. II/ 7, C. 17
Diagnostic features	:	Body elongate and small; dorsal profile more convex than ventral. Mouth inferior; upper jaw reaching to below middle of eye; no barble on chin. Teeth differentiated into large and small in upper jaw; no canine teeth. Swim bladder is hammer-shaped with 11-13 pairs of arborescent appendages. Dorsal fin with 10 spines, followed by a low notch, second part of the fin with 1 spine; pectoral fin moderate; anal fin with 2 spines; caudal fin rhomboid or rounded at tip. Light golden yellow color.
Habitat	:	Inhabit inshore and coastal waters, down to 40m and estuaries.
Distribution	:	Throughout the larger river of India
Utilization	:	Marketed fresh and dried salted, also swim bladder dried
Total Length	:	17 cm

Chrysochir aureus (Richardson, 1846)

(Fig. 4. 3. 19)

Synonyms	:	*Chrysochir aureus:* Trewavas & Yazdani, 1966; *Sciaena ophiceps* Alcock, 1889; *Johnius birtwistlei* Fowler, 1933; *Pseudosciaena acuta* Tang, 1937; *Nibea acuta:* Lin, 1938; Chu, Lu & Wu, 1963
FAO name	:	Reeve's croaker
Local name	:	Thin-war
Fin formula	:	D. X; I /27-30, P. 17, V. I/5, A. II /7, C. 17
Diagnostic features	:	A slender-bodied, dorsal and ventral profiles almost equally convex. Upper jaw extending back to below high margin of eye, lower jaw more than ½ of head length. Swim bladder carrot-shaped; with 27 to 30 pairs of arborescent appendages, none entering head. Dorsal fin with 10 spines; second part of the fin with 1 spine and 26 to 27 soft rays caudal fin pointed
Habitat	:	Inhabit Coastal waters, down to 40m
Distribution	:	Bay of Bengal to Southern China; India
Utilization	:	Marketed fresh, dried and swim bladder dried
Total Length	:	19 cm

Eleutheronema tetradactylum (Shaw, 1804)

(Fig. 4.3.20)

Synonyms	:	*Polynemus tetradactylus* Shaw, 1804; *Polydactylus rhadinus*, Jordon & Evermann, 1902; *Eleutheronema rhadinum* Jordon & Evermann, 1902
FAO name	:	Four finger threadfin
Local name	:	Nga-tha-yaw, nga- ywae
Fin formula	:	D.VIII; I-II/ 13-15, P. 16-17, V.7, A. II/ 15-17
Diagnostic features	:	Body more or less elongate and compressed. Snout is projecting; Mouth very large and Eyes too large. Pectoral fins in two parts, upper part all rays unbranched and lower with four free filaments. Dorsal fins two. Caudal forked with equal lobes. Scales small, ctenoid. Body silvery green above and cream below. Dorsal and caudal fins dusky at edges. Pelvic and anal fins are orange. Pectoral filamentous rays white.
Habitat	:	Live mainly over shallow muddy bottom in coastal waters; also enters river.
Distribution	:	Indo-West Pacific, Persian Gulf, East Asia.
Utilization	:	Marketed fresh and dried salted.
Fork Length	:	25.5 cm

Leptomelanosoma indicum (Shaw,1804)

(Fig. 4. 3. 21)

Synonyms : *Polynemus indicus* Shaw, 1804; *Trichidion indicum* (Shaw, 1804) ; *Trichidion indicus* (Shaw, 1804)

FAO name : Indian tassel fish

Local name : Ka-khu-yan

Fin formula : D.VIII; I/13-14, P. 15+v, V.I/5, A. III/11-12, C.17

Diagnostic features : Body elongated and somewhat compressed. Mouth large with small teeth. Eyes were very small. Pectoral fins in two parts; upper part most rays branched and lower with 5 free filamentous rays of which the upper is the longest, reaching nearly to anal fin origin; caudal fin deeply lunate, with pointed lobes ending in filaments. Scale small, ctenoid. Body purplish black with faint dusky stripes.

Habitat : Inhabits mainly over shallow muddy and sandy bottom of the continental shelf.

Distribution : Throughout northern part of Central Pacific and southward to New South Wales (Australia); also, westward to East Africa

Utilization : Marketed fresh, frozen and dried-salted.

Fork Length : 17.5 cm

Polynemus paradiseus (Linnaeus, 1758)

(Fig. 4.3.22)

Synonyms	:	*Polynemus hilleri* (Fowler, 1905)
FAO name	:	Paradise threadfin
Local name	:	Nga-pon-narr, Nga-mwe
Fin formula	:	D. VIII; I/12-13, P. 14+vii, A. III/12-13, C. 17.
Diagnostic features	:	Body elongate and somewhat compressed. Mouth large with small teeth. Eyes were small. Pectoral fins in two parts; upper part with all rays unbranched, lower with 7 free filamentous rays, of which the three upper ones are the longest-about twice the length of fish. Caudal fin deeply forked, with upper lobe longer than lower. Scales moderately large, ctenoid. Body generally golden; all fins greyish.
Habitat	:	Lives over shallow sandy bottoms, regularly entering freshwaters during breeding seasons.
Distribution	:	Bay of Bengal, along the coast of Myanmar.
Utilization	:	Marketed fresh
Fork Length	:	20.5 cm

Harpadon nehereus (Hamilton, 1822)

(Fig. 4.3.23)

Synonyms	:	*Osmerus nehereus* Hamilton, 1822; *Harpodon nehereus* (Hamilton, 1822)
FAO name	:	Bombay-duck
Local name	:	Nga-Hnut
Fin formula	:	D. 12-13, P. 11-12, V. 9, A. 13-15.
Diagnostic features	:	Body elongate and compressed. Eyes small, mouth very wide armed with slender, recurved and pointed teeth. Lower jaw longer than upper jaw. Dorsal fin followed by a conspicuous adipose fin; pelvic fins are very long. Caudal fin trilobed, scales restricted to posterior half of the body. Lateral line extending into pointed medium lobe of caudal fin. Head, back and sides, light grayish.
Habitat	:	Live in brackish, and marine.
Distribution	:	Indo-West Pacific: Somalia to Papua New Guinea, north to Japan and South to Indonesia.
Utilization	:	Marketed fresh and dried salted
Total Length	:	19 cm

Lobotes surinamensis (Bloch, 1790)

(Fig. 4.3.24)

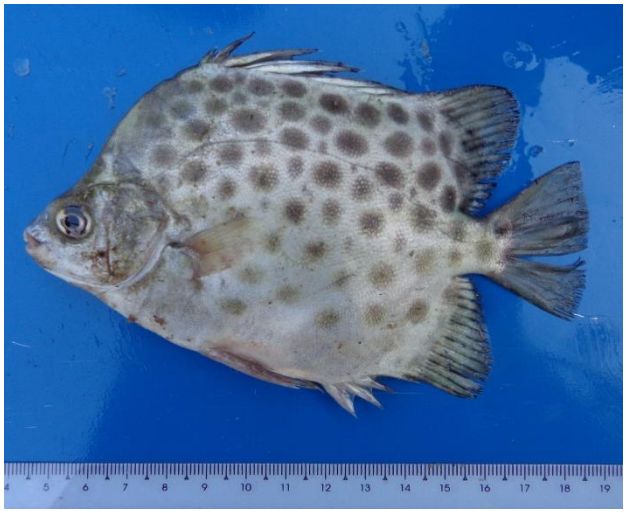
Synonyms	:	*Lobotes incurvus* Richardson, 1846; *Lobotes somnolentus* Cuvier, 1830
FAO name	:	Jumping cod
Local name	:	Pinlei-nga-pyay-ma
Fin formula	:	D. XI-XII / 15-16, A. III/ 11-12, P. I/16, V. I/5.
Diagnostic features	:	Body deep and compressed. Head; preoperculum coarsely dentate behind, with barbs at angle. Teeth-narrow bands of villi form teeth, outer series longer, curved conical. Fins darker than body, pectoral fin yellowish.
Habitat	:	Inhabit coastal water and estuarine.
Distribution	:	Philippine, South Africa, and japan and Solomon Islands.
Utilization	:	Human consumption
Total Length	:	38 cm

Lates uwisara (Pethiyagoda and Gill, 2012)

(Fig. 4.3.25)

Synonyms	:	*Lates calcarifer* (Bloch, 1790)
FAO name	:	Giant Perch
Local name	:	Ka-ka-dit
Fin formula	:	D.VII-VIII; I/11-12; A.III/ 8-9, P.18, V. I/5, C.16.
Diagnostic features	:	Body deep, elongate. Head and compressed. Head concave anteriorly, snout and jaws pointed lower edge of preopercle. Mouth large, slightly oblique, upper jaw reaching to behind eye. Scales firmly fixed, ctenoid, lateral line extending into caudal fin.
Habitat	:	Found in coastal marine and often in river mouth.
Distribution	:	Widely distributed in Indo-West Pacific.
Utilization	:	Sold fresh, dried and frozen
Total Length	:	38 cm

Scatophagus argus (Bloch, 1758)



(Fig. 4.3.26)

FAO name	:	Spotted scat
Local name	:	Nga-bee
Diagnostic features	:	Body short and strongly compressed. Dorsal head profile steep and the dorsal profile more convex than the abdominal profile. Snout rounded. Eyes are large. Mouth is small. Two dorsal fins, united at their base. Anal fin is of the same shaped as the second dorsal fin. Caudal fin is fan-shaped. Scales are small. Colour olive green, darker above, with numerous irregular large black spots larger on back.
Habitat	:	Reef associated, freshwater, brackish and marine
Distribution	:	Indo-Pacific region to Japan, south-eastern Australia
Utilization	:	Marketed fresh
Total Length	:	15cm

Sillaginopsis panijus (Hamilton, 1822)

(Fig. 4.3.27)

Synonyms	:	*Sillago panijus* Hamilton, 1822; *Sillaginopsis domina* Cuvier, 1829
FAO name	:	Flathead sillago
Local name	:	Nga-pa-lwe
Fin formula	:	D. X; I/25-27, V. 15, A. II/ 24-27, C. 27.
Diagnostic features	:	Body elongate and Head depressed, upper slightly convex. Snout pointed, sub cylindrical. Eyes very small. Mouth small, terminal, villiform teeth present in jaws. Tip of dorsal fin produced into a long filament. Dorsal fin slightly behind pectoral; first dorsal spine short, second of varying length. Caudal fin forked. Body silvery, olive-gray above, and with indistinct.
Habitat	:	Found in shallow sandy bottom of shores, bays and high salinity.
Distribution	:	Western Indian Ocean; Ganges delta and Myanmar.
Utilization	:	Marketed fresh and dried salted
Total Length	:	27 cm

Trichiurus lepturus Linnaeus, 1758

(Fig. 4.3.28)

Synonyms	:	*Trichiurus argenteus* Shaw, 1803; *Trichiurus japonicus* Temminck & Schlegel, 1844; *Trichiurus nitens* Garman, 1899
FAO name	:	Small-headed ribbonfish
Local name	:	Nga-ta-kon
Fin formula	:	D. 110-120, P. 11
Diagnostic features	:	Body extremely oblong and compressed, ribbon-like. Mouth large. A single dorsal fin running from behind head almost to end of body. Pectoral fins rather short, but extend beyond lateral line; caudal fin absent and pelvic fin also. No scales on body. Steel blue in color with silver reflection.
Habitat	:	Inhabit muddy Bottom of shallow coastal water and often enters estuaries.
Distribution	:	Western Central Pacific and Eastern Indian Ocean.
Utilization	:	Marketed fresh
Total Length	:	37 cm

Channa striata (Bloch, 1793)

(Fig. 4.3.29)

Synonyms	:	*Channa stiata* (Bloch, 1793); *Ophiocephalus chena* Hamilton, 1822; *Ophicephalus planiceps* Cuvier, 1831
FAO name	:	Snakehead
Local name	:	Nga-yant
Fin formula	:	D. 37-46, A. 23-29, P. 15-17, V. 6
Diagnostic features	:	Body elongate and fairly rounded in cross section. Eye moderate; its diameter 6 to 7 times in head length, mouth large. Pectoral fin about 2 times in head length. Caudal fin rounded.
Habitat and biology	:	Inhabits freshwater ponds and streams.
Distribution	:	Pakistan, India, Sri Lanka, Bangladesh, Burma, Malay archipelago, Thailand, and South China Sea.
Utilization	:	Marketed fresh and dried salted
Total Length	:	27 cm

Terapon jarbua (Forsskål, 1775)

(Fig. 4.3.30)

Synonyms	:	*Terapon timorensis* Quoy & Gaimard, 1824; *Terapon jarbua Forsskål, 1775*
FAO name	:	Jarbua therapon
Local name	:	Nga-goan-kyarr
Fin formula	:	D. X-XII/ 9-10, A. III/ 8-9, P. 13, V. I/5, C. 17
Diagnostic features	:	Body oblong and compressed. Upper jaw extending to below the middle of eye. Operculum with strong and pungent spine. Spinous and soft parts of the dorsal fin separated by a deep notch. Caudal fin slightly forked. Scale small and ctenoid. Lateral line complete. Three or four curved dark-brown bands run from the nape to the part of the body, the lowermost across the middle of the caudal fin and lobes of caudal fin with two oblique dark bars and tips brackish.
Habitat and biology	:	Demersal, catadromous, freshwater, brakish, marine. Found in inshore waters, often brakish
Distribution	:	Red, Sea, East coast of Africa, Seas and estuaries of India, Malay Archipelago, North coast of Australia.
Utilization	:	Marketed fresh
Total Length	:	12 cm

Cynoglossus bilineatus (Lacepède, 1802)

(Fig. 4.3.31)

Synonyms	:	*Cynoglossus quadrilineata* (Bleeker, 1851); *Cynoglossus sindensis* Day, 1877
FAO name	:	Fourlined tongue sole
Local name	:	Nga-khway-shar
in formula	:	D. 100-114, A. 72-89, V. 4, C. 10
Diagnostic features	:	Flat and elongate, with dorsal and fins joined to caudal fin; eyes on left side of body, 2 lateral lines on eyed side and 2 on blind side; ctenoid scales eye side but cycloid on blind side. Snout rounded; rostral hook short, corner of mouth reaching beyond lower eye, nearer to gill opening than to tip of snout. Eye side brown with an irregular dark blotch
Habitat	:	Mud banks or a mixture of mud and sand, benthic.
Distribution	:	From northeastern coast of Indian to the Philippines and Indonesia: Indo-West Pacific.
Utilization	:	Fresh and dried salted
Total Length	:	19 cm

Platycephalus indicus (Linnaeus, 1758)

(Fig. 4.3.32)

Synonyms	:	*Callionymus indicus* Linnaeus, 1758; *Cottus insidiator* Forsskål, 1775; *Cottus madagascariensis* Lacepède, 1801; *Platycephalus insidiator* (Forsskål, 1775)
FAO name	:	Bartail flathead
Local name	:	Nga-sin-ninn
Fin formula	:	D.VII; 13-14, P. 17, V. I /5, A. 13, C. 15.
Diagnostic features	:	Body elongate and tapering posteriorly. Head strongly depressed. Eyes superior, without ocular flat; lower jaw slightly longer than the upper. Preopercular spines 2, and lower usually the longest. A small stout single spine before the first dorsal fin. Dorsal fins 2. Ventral fins at thoracic. Caudal fin obtuse. Ctenoid scales. Lateral line complete. Brownish gray color above and whitish below.
Habitat	:	Inhibit on sandy and muddy bottoms of coastal waters; frequently in estuaries.
Distribution	:	Eastern Indian Ocean and West-Central Pacific Ocean.
Utilization	:	Marketed fresh
Total Length	:	21.5 cm

Arius thalassinus (Rüppell, 1837)

(Fig. 4.3.33)

Synonyms : *Tachysurus thalassinus* (Rüppell, 1837); *Netuma thalassinus* (Rüppell, 1837)

FAO name : Giant catfish

Local name : Nga-yaung

Diagnostic features : Body elongate, robust; head shield finely granular. Snout angular in young, prominent and acute with age. Mouth inferior. Three pairs of barbels around mouth. Fine teeth arranged into 3 patches on each side of palate, villiform. Dorsal and pectoral fins short, with a spine at front; adipose fin small. The whole with bronze or silvery lustre.

Habitat : Inhabit coastal waters, marine and often found in estuaries.

Distribution : China Sea, northern and southern coasts of New Guinea, and Australia.

Utilization : Marketed fresh and frozen

Fork Length : 25.5 cm

Arius maculatus (Thunbreg, 1792)

(Fig. 4.3.34)

Synonyms	:	*Tachysurus maculatus* (Thunbreg, 1792)
FAO name	:	Spotted catfish
Local name	:	Shwe-nga-yaung
Fin formula	:	D. I/7, P. I/9-10, V. 6, A. 19-23
Diagnostic features	:	Body elongate and compressed; head, much depressed snout rounded, Dorsal-fin spine 2/3 to 4/5 of head length, a filament on its tip; pectoral-fin spine sub equal to dorsal-fin spine and slightly stronger, caudal peduncle slender. Body silvery in color.
Habitat	:	Inshore coastal waters, estuaries, and tidal reaches of rivers.
Distribution	:	Thailand, Indonesia (Sumatra. Java Kalimantan) and Malaysia.
Utilization	:	Marketed fresh
Fork Length	:	18 cm

Osteogeniosus militarias (Linnaeus, 1758)

(Fig. 4.3.35)

Synonyms	:	*Osteogeniosus longiceps* Bleeker, 1846; *Osteogeniosus macrocephalus* Bleeker, 1846; *Osteogeniosus sthenocephalus* Day,1877*; Osteogeniosus valenciennesi* Bleeker,1846; *Silurus militaris* Linnaeus, 1758
FAO name	:	Soldier catfish
Local name	:	Nga-yaung
Fin formula	:	D. I/ 7, A. 19-21, P. I/9-10
Diagnostic features	:	Body elongate; head strongly depressed, head shield smooth, without granulations only one pair of very stiff and bony barbles on upper jaw, their tips reaching to or beyond base of pectoral fin. Head top and back intense dark blue with silvery reflections.
Habitat	:	Found in turbid water of shallow continental shelf.
Distribution	:	India, Thailand and Indonesia.
Utilization	:	Marketed fresh
Fork Length	:	18 cm

Wallago attu (Bloch & Schneider, 1801)

(Fig. 4.3.36)

Synonyms : *Silurus boalis* Hamilton, 1822; *Silurus wallagoo* Valenciennes, 1840; *Silurus muelleri* Bleeker, 1846; *Wallago russellii* Bleeker,1853

FAO name : Boal

Local name : Nga-bat

Fin formula : D. I/4, A. 79-81, P. I/13-14, V. I/7-9

Diagnostic features : Head broad, snout depressed. Body elongate, strongly compressed. Mouth very deeply cleft, its corner reaching far behind eyes. Teeth in jaws set in wide bands; vomerine teeth in two small patches. Barbels two pairs; maxillary barbels extending to anterior margin posterior of anal fin, mandibularly barbles to angle of mouth. Dorsal fin small, anal fin very long.

Habitat : Inhabit deep water of rivers.

Distribution : Pakistan, India, Myanmar, Thailand, Vietnam and Malay Peninsula.

Utilization : Marketed fresh

Total Length : 70 cm

Pangasius pangasius (Hamilton, 1822)

(Fig. 4.3.37)

Synonyms	:	*Pimelodus pangasius* Hamilton, 1822; *Pangasius buchanani* Valenciennes, 1840
FAO name	:	Pangas catfish
Local name	:	Nga-dan
Fin formula	:	D. I/6; A. IV-V/26-29, P. I/12-13, V. I/5
Diagnostic features	:	Body elongate and compresed. Head slightly granulated above. Mouth sub- terminal or inferior. Barbels two pairs, fairly well-developed. Dorsal spine moderately strong. The greatest width of the head equals its length behind the angle of the mouth. Caudal fin deeply forked.
Habitat	:	Found in large rivers and estuaries.
Distribution	:	Pakistan, India, Myanmar, Thailand, Malay Peninsula and Java.
Utilization	:	Marketed fresh
Fork Length	:	19.5 cm

Mystus vittatus (Bloch, 1794)

(Fig. 4.3.38)

Synonyms	:	*Bagrus keletius* Valenciennes, 1840
FAO name	:	Striped dwarf catfish
Local name	:	Nga-zin-yine
Fin formula	:	D. I/7; 0, P. I/9, V. 6, A. II-III/ 7-9, C. 17
Diagnostic features	:	Body elongate and slightly compressed. Head compressed; Snout rounded; eyes moderate size. Mouth terminal, transverse and moderately wide. Four pairs of arbell, one each of maxillary, nasal and two of mandibular. Dorsal and pectoral fins each with a spine, anal fin short. Caudal fin forked; Scale absent, lateral line complete.
Habitat	:	Demersal, freshwater and brackish.
Distribution	:	India, Nepal, Myanmar, Malaysia, Thailand and Sri Lanka.
Utilization	:	Marketed fresh, fish paste and dried salted
Fork Length	:	11.5 cm

Mystus sp.

(Fig. 4.3.39)

Habitat	:	Demersal, freshwater and brackish.
Distribution	:	India, Nepal, Myanmar, Malaysia, Thailand and Sri Lanka.
Utilization	:	Marketed fresh and fish paste
Fork Length	:	14 cm

Scoliodon laticaudus Müller & Henle, 1838

(Fig. 4.3.40)

Synonyms	:	*Carcharias muelleri* J. P. Müller & Henle, 1839 *Carcharias palasoora* Bleeker, 1853
FAO name	:	Spadenose shark
Local name	:	Nga-mann
Diagnostic features	:	Body slender. Long snout pointed. Eyes moderately large; serrated teeth in both jaws. Gill slits short. First dorsal fin moderately large and triangular with bluntly pointed apex, second small and low. Pectoral fins small, with narrowly rounded apices. Above, gray color and below, white. Below tip of first dorsal whitish and caudal fins margins dusky.
Habitat	:	Inhabit coastal and oceanic waters; tropical shark, active and voracious predators.
Distribution	:	Indo-West Pacific, Java, China, Indonesia and Philippines.
Utilization	:	Used for its meat, fin and skin.
Total Length	:	33 cm

4.4 Fishing operation and gears used in the study area

Kyeikhto, Kyauk Seik and Bo Yar Gyi

Fishing operation is twice a month every neap tide. The duration of a fishing trip can be 7-12 days. The fishing craft used in Kyeikhto and Kyauk Seik area is medium sized boat with dimension of about 11m × 1.82m × 1.92m with engine power 25 hp. In Bo Yar Gyi, vessel dimension are about 10m × 1.31m × 1.1m with engine power 7.5 hp. About 360kg-550kg of ice block are carried in each boat for preserve the fish. All the landing of fishes are sold in fresh condition. They catch the fish both east and west coast of the Sittaung river mouth. The cost for the fishermen as a crew is 50,000 kyats for a trip and 3-5 fishermen work in each boat as crew. One skillful person is in charge of 3 boats and is paid 70, 000 kyats for each trip.

Sut Pa Nu

The boats in Su Pa Nu village go fishing the Sittaung River and last for 4-5 hours per day. Each boat consist 2 people. The dimensions of the boat are 8m × 0.9m × 0.76m in Sut Pa Nu village with engine power 6.5 hp. Some of boats that fish in the open sea stay out at sea for 5 months (from September to January) and selling the fishes at the operation area. The total fish landing and biomass are also recorded for each boat for each station and all data are calculated and converted into CPUE.

Table 4.2. Fishery Status of Four Stations from the Study Period

Station	Dimension of Boat (L×W×D)m	Type of net	Mesh Size(cm)	Net Height(m)	Net Length(m)	Water Depth(m)	Target Fish	Fishing Area	Total Catch (Kg)
Kyeikhto	(11× 1.82 × 1.92) 25 hp	Fence net	3.8	1.8	2743.2	3.7	Croaker, Indian threadfin.	Inshore	1276.8
Bo Yar Gyi	(10 × 1.31 ×1.1) 7.5hp	Drift gill net	10.2	3.2	1280.2	3.7 – 4.5	Indian threadfin, Sea bass	Inshore	800
Bo Yar Gyi	(10 × 1.31 ×1.1) 7.5hp	Trammel net	5.1	2.7	2487.2	10.9	Croaker	Inshore	661
Kyauk Seik	(11 × 1.82×1.92) 25 hp	Trammel net	7.6	5.3	4267.2	9.1	Croaker, Indian threadfin.	Inshore	635.76
Sut Pa Nu	(8 × 0.9 × 0.76) 6.5hp	Trammel net	3.8	1.8m	137.2	5.5	Mango fish	Sittaung river	
			5.1	3.6	182.9	5.5	Herring	Sittaung river	596.5
			7.6	3.6	182.9	5.5	Herring	Sittaung river	

Table 4.3. Monthly fishing gears usages in the study areas

Fishing gears	Local name	Mesh size(cm)	Fishing seasons
Trammel net	Thone htat pike (Nga Mwe Pike)	3.8	From May to June
	Thone htat pike (Nga Tha Lout Pike)	7.6	From July to March
	Thone htat pike (Nga Poat Tin Pike)	5.1 7.6	From July to March From May to August From May to March From May to March
Drift gill net	Hmyaw pike (Lay Thit Pike)	10.2	From September to March
Fence net	Taung Wine Pike	3.8	From May to March

Table 4.4. Type of species catch from various nets

Species	Fishing gears		
	Trammel net	Drift gill net	Fence net
Congresox talabon	+	-	+
Strongylura strongylura	+	-	+
Thryssa mystax	+	-	+
Setipinna taty	+	-	+
Coilia dussumieri	+	-	+
Coilia ramcarati	+	-	+
Tenualosa ilisha	+	-	+
Tenualosa toli	+	-	+
Osteobrama belangeri	+	-	-
Puntius chola	+	-	-
Cirrhinus mrigala	+	-	+
Catla catla	+	-	+
Chela fasciata	+	-	+
Mugil cephalus	+	-	+
Rhinomugil corsula	+	-	+
Otolithoides biauritus	+	+	+
Otolithoides pama	+	+	+
Johnius coitor	+	-	+
Chrysochir aureus	+	-	+
Eleutheronema tetradactylum	+	+	+
Leptomelanosoma indicum	+	+	+
Polynemus paradiseus	+	-	+
Harpadon nehereus	+	-	+
Lobotes surinamensis	+	-	+
Lates uwisara	+	+	+
Scatophagus argus	+	-	+
Sillaginopsis panijus	+	-	+
Trichiurus lepturus	+	-	+
Channa striata	+	-	-

Species	Fishing gears		
	Trammel net	Drift gill net	Fence net
Terapon Jarbua	-	-	+
Cynoglossus bilineatus	+	-	+
Platycephalus indicus	+	-	+
Arius thalassinus	+	-	+
Arius maculatus	+	-	+
Osteogeniosus militarias	+	-	+
Wallago attu	+	-	-
Pangasius pangasius	+	-	+
Mystus vittatus	+	-	+
Mystus sp.	+	-	+
Scoliodon laticaudus	+	-	-
Total	39	5	35

Table 4.5. Occurrence and distribution of fishes in study area during study period

Sr. no	Species	Local name	Kyeikhto	Bo Yar Gyi	Kyauk Seik	Sut Pa Nu
1	*Congresox talabon*	Nga-shwe	+	-	+	-
2	*Strongylura strongylura*	Nga-phaung-yoe	+	-	-	+
3	*Thryssa mystax*	Nga-pyar	+	+	+	+
4	*Setipinna taty*	Nga-pyar	+	+	+	+
5	*Coilia dussumieri*	Mee-tan-thwe	+	-	+	+
6	*Coilia ramcarati*	Mee-tan-thwe	+	+	+	+
7	*Tenualosa ilisha*	Nga-tha-louk	+	+	+	+
8	*Tenualosa toli*	Nga-tha-louk-york-pha	+	+	+	+
9	*Osteobrama belangeri*	Nga-phan-ma	+	-	-	+
10	*Puntius chola*	Nga-khone-ma	-	-	-	+
11	*Cirrhinus mrigala*	Nga-gyin-phyu	+	+	-	+
12	*Catla catla*	Nga-thine-goung-pwa	+	+	-	+
13	*Chela fasciata*	Nga-da-mauk	+	-	-	+
14	*Mugil cephalus*	Ka-be-luu	+	+	+	+
15	*Rhinomugil corsula*	Nga-zim	+	+	-	+
16	*Otolithoides biauritus*	Nga-poat-thin	+	+	+	-
17	*Otolithoides pama*	Nga-poat-thin	+	+	+	+
18	*Johnius coiter*	Nga-myet-pyuu	+	+	+	+
19	*Chrysochir aureus*	Nga-sar-khone	-	-	-	+
20	*Eleutheronema tetradactylum*	Nga-tha-yaw	+	+	-	-
21	*Leptomelanosoma indicum*	Ka-khu-yan	+	+	+	+
22	*Polynemus paradiseus*	Nga-mwe	+	+	+	+
23	*Harpadon nehereus*	Nga-hnut	+	+	+	+
24	*Lobotes surinamensis*	Pinlei-nga-pyay-ma	+	-	+	-
25	*Lates uwisara*	Ka-ka-tit	+	+	+	+
26	*Scatophagus argus*	Nga-bee	+	+	-	+
27	*Sillaginopsis panijus*	Nga-pu-lwe	+	+	+	+
28	*Trichiurus lepturus*	Nga-ta-kon	+	-	-	+
29	*Channa striata*	Nga-yant	-	-	-	+

Sr. no	Species	Local name	Kyeikhto	Bo Yar Gyi	Kyauk Seik	Sut Pa Nu
30	*Terapon Jarbua*	Nga-goan-kyar	+	-	-	-
31	*Cynoglossus bilineatus*	Nga-khway-shar	+	-	+	+
32	*Platycephalus indicus*	Nga-sin-nin	+	+	+	+
33	*Arius thalassinus*	Nga-yaung	+	+	+	+
34	*Arius maculatus*	Shwe-nga-yaung	+	-	+	-
35	*Osteogeniosus militarias*	Nga-yaung	-	+	+	+
36	*Wallago attu*	Nga-bat	-	-	-	+
37	*Pangasius pangasius*	Nga-dan	+	+	+	+
38	*Mystus vittatus*	Nga-zin-yine	+	-	-	+
39	*Mystus sp*	Nga-zin-yine	+	+	+	+
40	*Scoliodon laticaudus*	Nga-man	-	-	+	-
		Total	34	24	25	33

4.5 Length Frequency Distribution

In sampling, samples were collected randomly in fresh condition and were grouped by 5 class intervals according to respective body length (cm) of individual fishes. The present study was conducted at Kyeikhto from September, 2016 to January, 2017.

4.5.1 *Otolithoides pama*

Totally 190 number of *Otolithoides pama* were used to examine and fishes were grouped into seven classes with five intervals of 14cm-19cm, 19cm-24cm, 24cm-29cm, 29cm-34cm, 34cm-39cm, 39cm-44cm, 44cm-49cm. The maximum length of *Otolithoides pama* was 48 cm and the minimum length was 14 cm in the study period. The most abundance size ranges was 19 cm to 29cm. The most dominant size group was 19-24 cm and 24-29 cm in September, 2016. In October, November and December, the most dominant size group was 24-29 cm. But the most dominant size group was found 14-19cm in January, 2017. (Fig 4.3.37). The longest mean length of *Otolithoides pama* was 30.4038 ± 9.0322 found in September, 2016 and the smallest was 18.369±2.44 found in January, 2017. (Table 4.6)

Table 4.6. Monthly Mean length of *Otolithoides pama* in Kyeikhto Station

	September	October	November	December	January(2017)
Mean	30.4038	29.5652	26.9193	25.673	18.369
SD ±	±9.0322	±4.79422	±4.1273	±3.5126	±2.44

4.5.2 *Leptomelanosoma indicum*

Totally 167 number of *Leptomelanosoma indicum* were used to examine and fishes were grouped into seven classes with five intervals of 14cm-19cm, 19cm-24cm, 24cm-29cm, 29cm-34cm, 34cm-39cm, 39cm-44cm, 44cm-49cm. The maximum length of *Leptomelanosoma indicum* was 47 cm and the minimum length was 12 cm. The most abundance size ranges was observed 37cm to 47cm. In September, the most dominant size group was 22-27 cm. In October, the most dominant size group of fish was observed 32-37 cm and 37-42 cm was dominant size group in November. In December, 2016 and January, 2017, the most dominant size group of fish was observed 17-22 cm. (Fig 4.3.38). The longest mean length of *Leptomelanosoma indicum* was 35.0697 ± 4.0629 , 35.3125 ± 6.3943 found in October and November, 2016 and the smallest was 24.642 ± 6.3754 found in January, 2017. (Table 4.7)

Table 4.7. Monthly Mean length of *Leptomelanosoma indicum* in Kyeikhto Station

	September	October	November	December	January
Mean	32.1346	35.0697	35.3125	25.16	24.642
SD ±	±7.3981	±4.0629	±6.3943	±5.9138	±6.3754

4.6 Length-weight relationship

4.6.1 *Otolithoides pama*

The present study was based on 190 samples of *Otolithoides pama* ranging from 14cm to 46cm length and 20g to 700g weight. The length-weight relationship of *O.pama* was Log W= -2.445+ 3.2138 Log L (R^2= 0.9215). The result show that b value was 3.2138 and greater than 3. Thus the growth of *O.pama* was allometric (positive) growth.

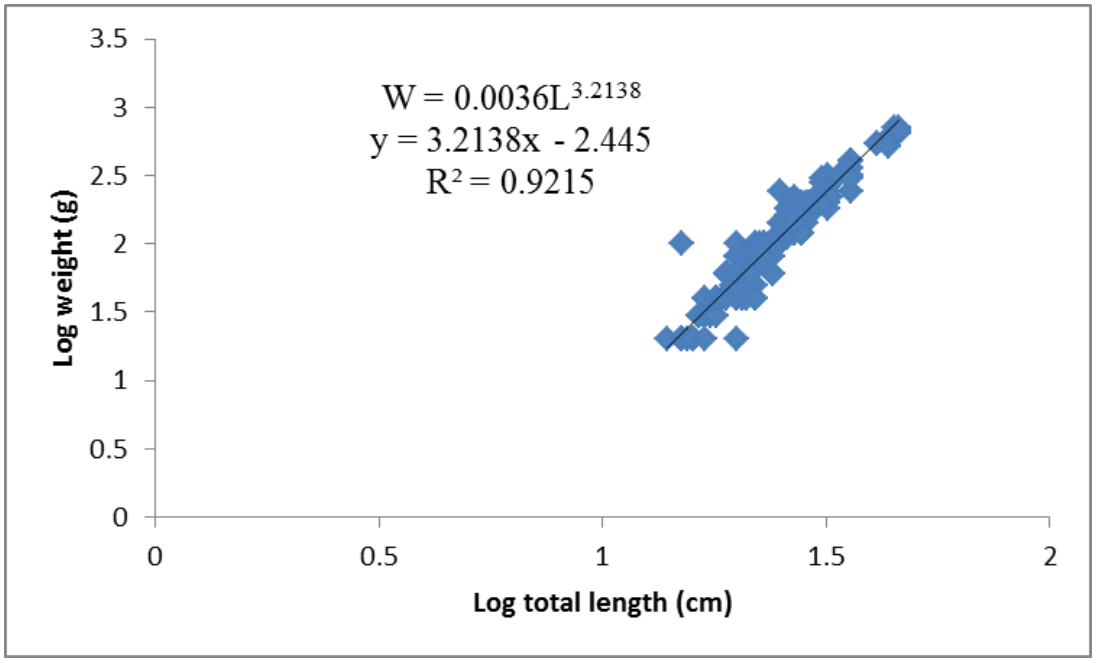


Fig. 4.3.41 Length-weight relationship of *Otolithoides pama* from September, 2016 to January, 2017

4.6.2 *Leptomelanosoma indicum*

The study was based on 167 samples *Leptomelanosoma indicum* ranging from 12 cm to 47 cm length and 20g to 1400g weight. The length-weight relationship of *L.indicum* was Log W= -2.532+ 3.3941 Log L (R^2= 0.8956). The result show that b value was 3.3941 and greater than 3. Thus the growth of *L. indicum* was allometric (positive) growth.

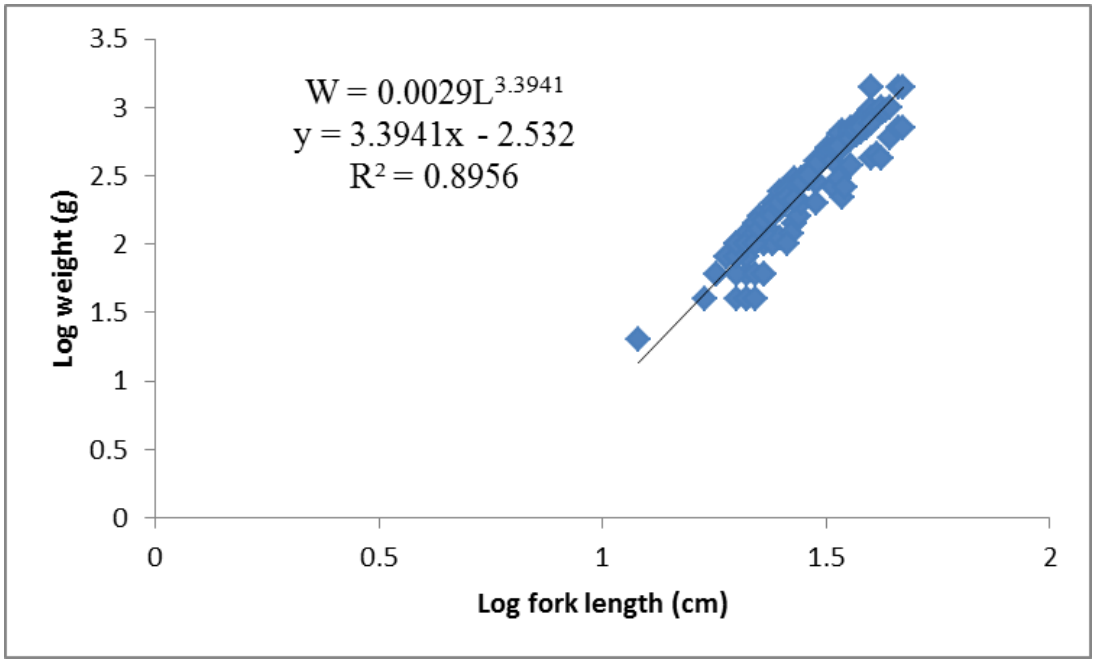


Fig.4.3.42 Length- weight relationship of *Leptomelanosoma indicum* from September, 2016 to January, 2017

4.7 Biomass

In the present study, biomass was calculated based on one boat for one tide in Kyeikhto, Bo Yar Gyi and Kyauk Seik station. But in Sut pa nu station, it was based on one boat for one month.

The highest biomass of landed fishes was 320.24kg in November, 2016 and lowest was 208.16 kg in September, 2016 from Fence net of Kyeikhto Station. Table (4.8). The highest biomass of landed fishes was 145.6kg in January, 2017 and lowest was 124.8 kg in October, 2016 from Drift gill net of Bo Yar Gyi Station. Table (4.9).

The highest biomass of landed fishes was 187.2 kg in December, 2016 and lowest was 104.2 kg in October, 2016 from Trammel net of Bo Yar Gyi Station Table (4.10)

The highest biomass of landed fishes was 157.92 kg in September, 2016 and lowest was 56.8 kg in January, 2017 from Trammel net of Kyauk Seik Station. Table (4.11)

The highest biomass of landed fishes was 245.92 kg in September, 2016 and lowest was 36.96 kg in January, 2017 from Trammel net of Sut Pa Nu Station (Table 4.12)

Table 4.8. Monthly biomass of Fence net of Kyeikhto Station

Family	September		October		November		December		January	
	Weight(Kg)	Percent(%)	Weight(Kg)	Percent(%)	Weight(Kg)	Percent(%)	Weight(Kg)	Percent(%)	Weight(Kg)	Percent(%)
Sciaenidae	144	69.2	192	70.74	112	34.96	112	46.47	100.8	42.71
Polynemidae	56	26.9	79	29.11	80	24.97	72	29.88	96	40.68
Latidae	8	3.8	0	0	32	9.99	0	0	0	0
Ariidae	0	0	0.32	0.12	0.16	0.05	32	13.28	0	0
Engraulididae	0	0	0	0	24	7.49	0	0	0	0
Mugilidae	0	0	0	0	0	0	0	0	8	3.39
Harpadontidae	0	0	0	0	24	7.49	0	0	0	0
Muraenesocidae	0	0	0	0	0	0	0	0	3.2	1.36
Sillaginidae	0	0	0	0	48	14.99	24	9.96	24	10.17
Belonidae	0	0	0.08	0.03	0	0	0	0	0	0
Cynoglossidae	0	0	0	0	0.08	0.03	0	0	3.2	1.36
Platycephalidae	0.16	0.08	0	0	0	0	0	0	0	0
Shrimp and Prawn	0	0	0	0	0	0	1	0.42	0.8	0.34
Total	208.16	100	271.4	100	320.24	100	241	100	236	100

Table 4.9. Monthly biomass of Drift gill net of Bo Yar Gyi Station

Family	September		October		November		December		January	
	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)
Polynemidae	24	17.1	24	19.2	48	36.1	72	51.1	80	54.9
Latidae	112	79.6	96	76.9	80	60.2	64	45.5	64	44
Sciaenidae	4.8	3.4	4.8	3.9	4.8	4	4.8	3.4	1.6	1.1
Total	140.8	100	124.8	100	132.8	100	140.8	100	145.6	100

Table 4.10. Monthly biomass of Trammel net of Bo Yar Gyi Station

Family	September		October		November		December		January	
	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)
Sciaenidae	96	78.9	80	77.75	112	90.3	128	68.4	80	64.5
Polynemidae	16	13.2	16	15.4	8	6.5	3.2	1.7	0.8	0.7
Sillaginidae	1.6	1.3	1.6	1.5	3.2	2.6	16	8.6	16	12.9
Mugilidae	1.6	1.3	1.6	1.5	0.8	0.7	0	0	0	0
Harpadontidae	0	0	0	0	0	0	40	21.4	24	19.4
Ariidae	1.6	1.3	0.16	0.2	0	0	0	0	0	0
Clupeidae	4.8	3.96	4.8	4.6	0	0	0	0	3.2	2.6
Total	121.6	100	104.2	100	124	100	187.2	100	124	100

.

Table 4.11. Monthly biomass of Trammel net of Kyauk Seik Station

Family	September		October		November		December		January	
	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Weight (Kg)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)
Sciaenidae	128	81.05	128	85.89	96	63.16	80	66.67	51.2	90.14
Polynemidae	16	10.13	9.6	6.44	16	10.53	16	13.33	4.8	8.45
Clupeidae	5.6	3.55	9.6	6.44	0	0	0	0	0	0
Ariidae	1.6	1.01	1.6	1.07	8	5.26	24	20	0	0
Engraulididae	6.4	4.05	0	0	0	0	0	0	0	0
Platycephalidae	0.32	0.2	0.24	0.16	0	0	0	0	0	0
Harpadontidae	0	0	0	0	32	21.1	0	0	0	0
Carcharhinidae	0	0	0	0	0	0	0	0	0.8	1.41
Total	157.92	100	149.04	100	152	100	120	100	56.8	100

Table 4.12. Monthly biomass of Trammel net of Sut Pa Nu Station

Family	September		October		November		December		January	
	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)	Weight (Kg)	Percent (%)
Clupeidae	32	13.01	48	28.55	24	25.13	31.2	62.38	32	86.58
Cyprinidae	39.2	15.9	23.28	13.85	0	0	1.6	3.2	0	0
Bagridae	128	52.08	80	47.6	64	67	0	0	0	0
Latidae	12.8	5.2	0	0	0	0	0	0	0	0
Channidae	32	13.01	16	9.52	0	0	0	0	0	0
Pangasiidae	0.16	0.1	0.32	0.2	0	0	0	0	0	0
Ariidae	0.16	0.1	0.32	0.2	0	0	0	0	0	0
Sillaginidae	0.8	0.33	0	0	0	0	0	0	0	0
Polynemidae	0.8	0.33	0	0	0	0	0.9	1.8	0	0
Cynoglossidae	0	0	0.08	0.05	0	0	0	0	0	0
Belonidae	0	0	0.08	0.05	0	0	0	0	0	0
Engraulididae	0	0	0	0	0.16	0.17	0	0	1.28	3.46
Platycephalidae	0	0	0	0	0.16	0.17	0.32	0.64	0.4	1.1
Sciaenidae	0	0	0	0	4.8	5.03	4.8	9.6	0	0
Siluridae	0	0	0	0	0		8	15.99	0	0
Trichiuridae	0	0	0	0	0		0	0	0.08	0.22
Prawn	0	0	0	0	2.4	2.51	3.2	6.4	3.2	8.66
Total	245.92	100	168.08	100	95.52	100	50.02	100	36.96	100

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4.8 Catch Per Unit Effort (CPUE)

Catch Per Unit Effort (CPUE) is also called catch rate and is frequently the single most useful index for long- term monitoring of a fishery. (Ei Mon Aung, 2013) The present study was calculated based on kilograms per boat per day.

CPUE value for drift gill net in Bo Yar Gyi were 17.6 kg/boat/day in Seprember, 15.6 kg/boat/day in October, 16.6 kg/boat/day in November, 17.6 kg/boat/day in December, 18.2 kg/boat/day in January, 2017. CPUE value was highest in January, 2017 and lowest in October. Table(4.13).

CPUE value for trammel net in Bo Yar Gyi were 17.4 kg/boat/day in September , 14.9 kg/boat/day in October, 17.7 kg/boat/day in November, 26.7 kg/boat/day in December, 17.7 kg/boat/day in January, 2017. CPUE value was highest in December, 2017 and lowest in October. Table(4.14).

CPUE value for trammel net in Kyauk Seik were 15.8 kg/boat/day in September, 14.9 kg/boat/day in October, 15.2 kg/boat/day in November, 12 kg/boat/day in December, 4.7 kg/boat/day in January, 2017. CPUE value was highest in September and lowest in January, 2017. Table(4.15).

And CPUE value for trammel net in Sut Pa Nu were 7.64 kg/boat/day in September, 6.72 kg/boat/day in October, 3.82 kg/boat/day in November, 2 kg/boat/day in December, 1.49 kg/boat/day in January, 2017. CPUE value was highest in January, 2017 and lowest in September. Table(4.16)

Table 4.13. Mean catch weight (kg) and CPUE (Kg/boat/day) from Drift Gill Net in Bo Yar Gyi station

	September	October	November	December	January
Catch(kg)	140.8	124.8	132.8	140.8	145.6
CPUE	17.6	15.6	16.6	17.6	18.2

Table 4.14. Mean catch weight (kg) and CPUE (Kg/boat/day) from Trammel Net in Bo Yar Gyi station

	September	October	November	December	January
Catch(kg)	121.6	104.2	124	187.2	124
CPUE	17.4	14.9	17.7	26.7	17.7

Table 4.15. Mean catch weight (kg) and CPUE (Kg/boat/day) from Trammel Net in Kyauk Seik station

	September	October	November	December	January
Catch(kg)	157.92	149.04	152	120	56.8
CPUE	15.8	14.9	15.2	12	4.7

Table 4.16. Mean catch weight (kg) and CPUE (Kg/boat/day) from Trammel Net in Sut Pa Nu station

	September	October	November	December	January
Catch(kg)	213.92	168.08	95.52	50	36.96
CPUE	7.64	6.72	3.82	2	1.49

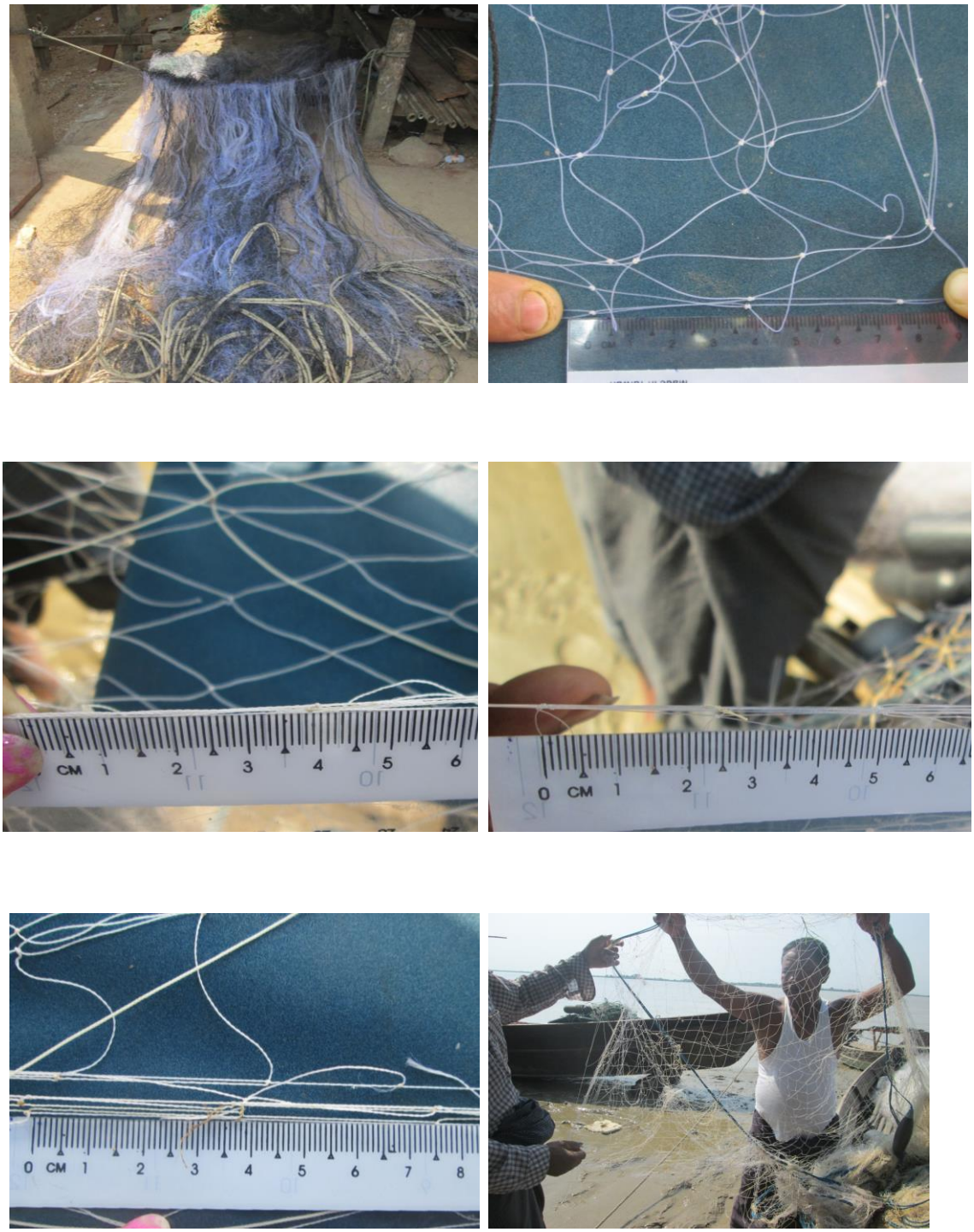

Fig. 4.3.43 Different mesh size of Trammel net

Fig. 4.3.44 (a) Drift Gill Net (i) 10.2 cm mesh size,
(b) Fence Net (i) 3.8 cm mesh size

Chapter 5

DISCUSSION

Kyeikhto Township is situated at the northern part of Mon State. The fishes are among the most important products caught in Kyeikhto township by local fishers for four stations; Kyeikhto, Bo Yar Gyi, Kyauk Seik and Sut Pa Nu village. The landing fishes are caught in trammel net (Thone htat pike- three layers net), drift gill net (Hmyaw pike), and fence net (Thaung wine pike). The catches are landed almost year-round by the operation of Artisanal fishery. In this present study, the study period begin from June, 2016 to January, 2017. A total of 36 species of 33 genera under 21 families and 10 orders were recorded in the study period.

According to the study record (Table 4.2), the trammel net mesh size ranges were 3.8-7.6cm, 137.2m-4267.2 m. The target fishes were Mango fish, Herring, Croaker and Indian threadfin. The fishing was operated in Sittaung River (from Sut Pa Nu to near Kyaik Ka Thar village) and the longest nets fishing were operated in inshore areas (Sittaung river mouth). The mesh size of fence net was 3.8cm, the width was 1.8m and the length was 2743.2m. The target fishes were Croaker and Indian threadfin and the fishing were operated in inshore areas. The drift gill net's mesh size was 10.2cm and the width was 3.2m and the length was 1280.2m. The target fishes were Indian threadfin and Sea bass and were operated in inshore area.

Seasonal usages of fishing gears in study areas were mentioned in Table (4.3). Trammel net (Local name- Nga Mwe Pike) with 3.8cm mesh size was used only from May to June and the fishermen change the mesh size (Local name- Nga Tha Lout Pike, Nga Poat Tin Pike) with (7.6cm, 5.1cm) were used from July to March in Sut Pa Nu station. Drift gill net (Local name- Lay Thit Pike) with 10.2 mesh size was used from September to March and change Trammel net (Local name-Nga Poat Tin Pike)

with 5.1 mesh size was used from May to August in Bo Yar Gyi station. But some fishermen use only Trammel net (Local name-Nga Poat Tin Pike) with 5.1cm mesh size from May to March in Bo Yar Gyi station. In Kyauk Seik station, Trammel net (Local name- Nga Poat Tin Pike) with 7.6 mesh size was used from May to March. Fence net (Local name- Taung Wine Pike) with 3.8 mesh size was used from May to March in Kyeikhto station.

In the present study, 39 species were caught with trammel net, 35 species with fence net and 5 species with drift gill net. The trammel nets caught the most species in the study areas. (Table 4.4)

A total of 34 species belong to 22 genera under 20 families and 9 orders were found in Kyeikhto during the study period and a total of 24 species belong to 20 genera under 13 families and 6 orders were recorded in Bo Yar Gyi village and 25 species belong to 21 genera under 15 families and 8 orders were recorded in Kyauk Seik village. In Sut Pa Nu village, 33 species belong to 31 genera under 19 families and 9 orders were observed. So Sut Pa Nu station was the most occurrence species in this study. (Table 4.5)

Monthly length frequency distribution was made for five months from September 2016 to January, 2017. The total length for *Otolithoies pama* (Nga poat tin) and forked length for *Leptomelanosoma indicum* (Ka Khu Yan) were measured in Kyeikhto based medium sized boat for five months. The maximum length of *O. pama* (Nga Poat Tin) was 48 cm and the minimum length was 14 cm in the study period and the maximum length of *Leptomelanosoma indicum* was 47 cm and the minimum length was 12 cm.

The length frequency distribution of *Otolithoides pama* (Nga Poat Thin) was measured from September, 2016 to January, 2017. The most abundance size ranges

was 19 cm to 29cm. The most dominant size group was 19-24 cm and 24-29 cm in September, 2016. In October, November and December, the most dominant size group was 24-29 cm. But the most dominant size group was found 14-19cm in January, 2017. Regarding to small size caught in January, 2017 it is possible that the catch of juvenile fish in this area is due to the recruitment of that fish stock. (Fig 4.3.37)

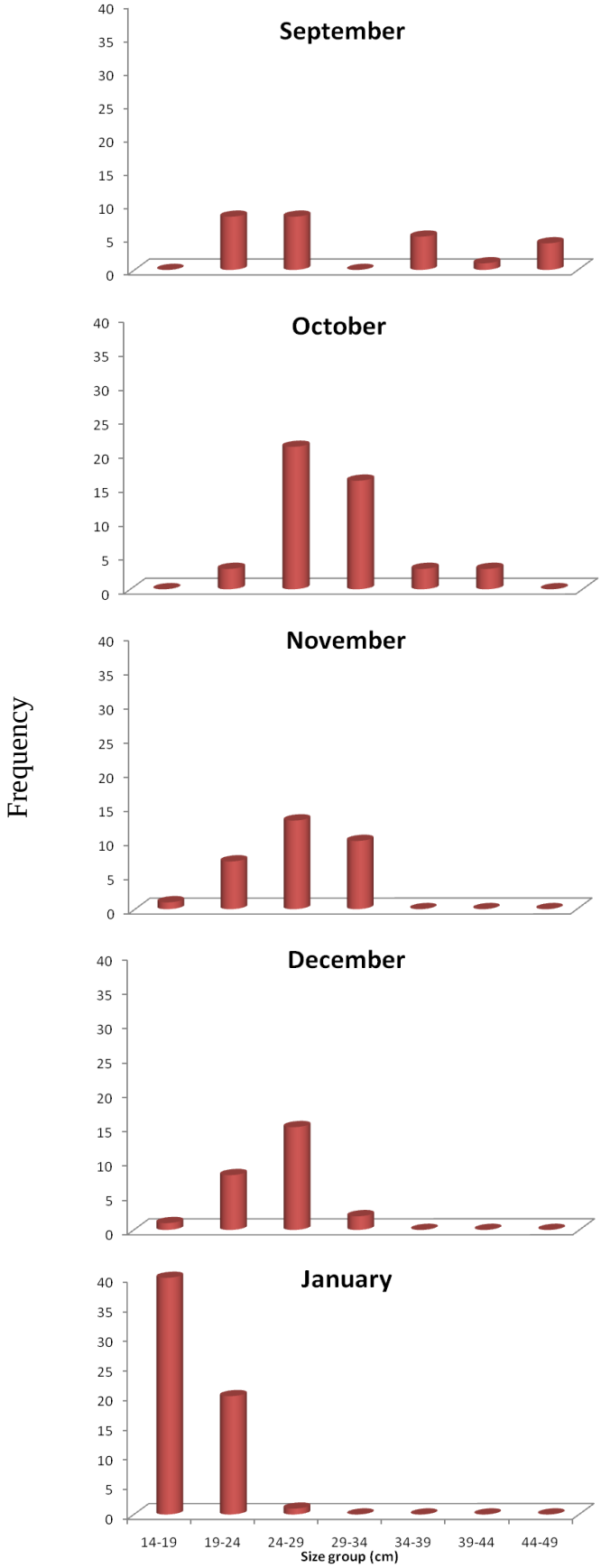

Fig. 4.3.45 Length frequency distribution of *Otolithoides pama* from September 2016 to January 2017.

The length frequency distribution of *Leptomelanosoma indicum* (Ka Khu Yan) was measured from September 2016 to January, 2017. The most abundance size ranges was observed 37cm to 47cm. In September, the most dominant size group was 22-27 cm 32-37 cm in October. In November 37-42 cm was the most dominant size group. In December, 2016 and January, 2017 the most dominant size group of fish was observed 17-22 cm. (Fig 4.3.38) Regarding to small size caught in December, 2016 and January, 2017 it is possible that the catch of juvenile fish in this area is due to the recruitment of that fish stock.

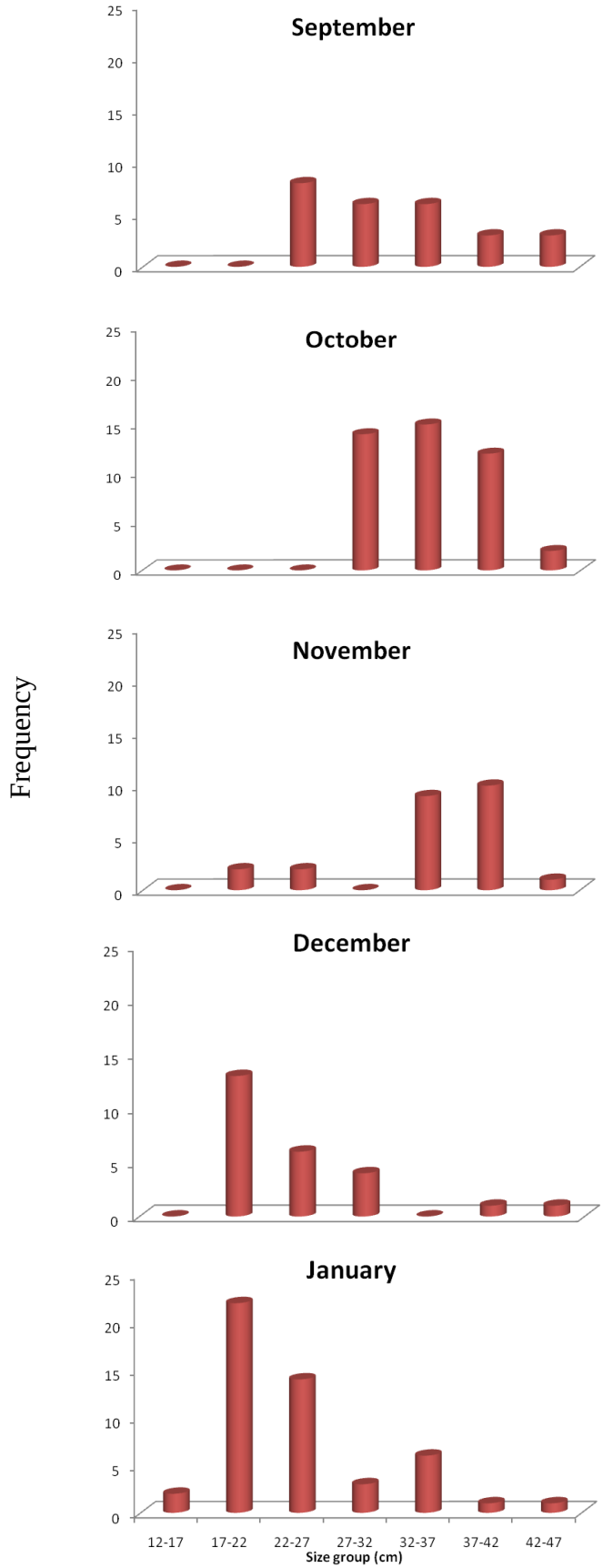

Fig. 4.3.46 Length frequency distribution of *Leptomelanosoma indicum* from September 2016 to January 2017.

According to Table (4.6), the longest mean length of *Otolithoides pama* was 30.4038 ± 9.0322 found in September, 2016 and the smallest was 18.369 ± 2.44 found in January, 2017. The longest mean length of *Leptomelanosoma indicum* was 35.0697 ± 4.0629 , 35.3125 ± 6.3943 found in October and November, 2016 and the smallest was 24.642 ± 6.3754 found in January, 2017. Table (4.7)

As regards length-weight relationship, Hile (1936) and Martin (1936) stated that the values of the exponent b usually range between 2.5 and 4.0, while Allen (1938) suggested that the value for b remains constant at 3 for the ideal fish. In the present study, the length-weight relation of b value in *Otolithoides pama* was 3.2138 (Fig 4.3.40) and that of *Leptomelanosoma indicum* was 3.3941 (Fig 4.3.41) The value 'b' for the length-weight relation of these two speicies were greater than 3 show that the fish growth was fast that may be due to superflorous availability of food and favourable condition of water.

According to the observations, (Table 4.8) the recorded monthly biomass of fence net in Kyeikhto station, the highest biomass of landed fishes was 320.24kg in November, 2016 and the lowest was 208.16 kg in September, 2016. The recorded monthly biomass of drift gill net in Bo Yar Gyi station, the highest biomass of landed fishes was 145.6 kg in January, 2017 and the lowest was 124.8 kg in October, 2016. (Table 4.9) The recorded monthly biomass of trammel net in Bo Yar Gyi station, the highest biomass of landed fishes was 187.2 kg in December, 2016 and lowest was 104.2 kg in October,2016. (Table 4.10) The recorded monthly biomass of trammel net in Kyauk Seik station, the highest biomass of landed fishes was 157.92 kg in September, 2016 and the lowest was 56.8 kg in January, 2017. (Table 4.11) The recorded monthly biomass of trammel net in Sut Pa Nu station, the highest biomass of landed fishes was

213.92 kg in September, 2016 and the lowest was 36.96 kg in January, 2017. (Table 4.12)

Lobotes surinamensis (Pinlei Nga Pyay Ma) was found only once in June. Another rare species was *Scoliodon laticaudus* (Nga-mann) was found only once from Kyauk Seik.

Otolithoides pama is target fish at Kyeikhto and Kyauk Seik. The fishermen get this species throughout the year (from May to March). The large fishes (above 80g) were sold to the wholesalers and other fishes were sold in the market and made dried salted. And the swimbladder of croaker was widely dried in Kyeikhto.

Various fishing gears were used to catch fish species. In the study areas, three types of fishing gears were recorded such as drift gill net, trammel net, and fence net. Catch per unit effort (CPUE) was determined in three stations based medium sized. In Bo Yar Gyi village (Drift gill net), CPUE value was highest in January (18.2 kg/boat/day) and lowest in November (16.6 kg/boat/day). In Bo Yar Gyi village (Trammel net), CPUE value was highest in December (26.7 kg/boat/day) and lowest in October (14.9 kg/boat/day). In Kyauk Seik (Trammel net), CPUE values was highest in September (15.8 kg/boat/day) and lowest in January (4.7 kg/boat/day). In Sut Pa Nu (Trammel net), CPUE values was highest in September (7.64 kg/boat/day) and lowest in January (1.49 kg/boat/day).

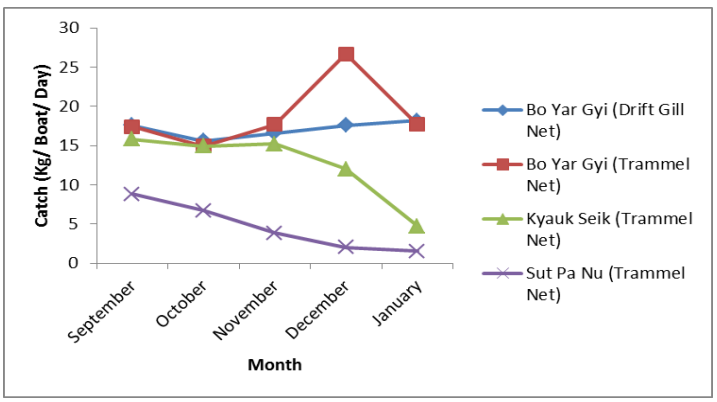

Fig. 4.3.47 Catch per unit effort (CPUE) from the study area.

CONCLUSION

In the study area, the three type of fishing gears were used in the medium sized boats; these were drift gill net, trammel net, and fence net. A total of 40 species belong to 35 genera, 23 families, and 10 orders were recorded from four stations of Kyeikhto Township. The families Muraenesocidae, Belonidae, Engraulidae, Clupeidae, Cyprinidae, Mugilidae, Sciaenidae, Polynemidae, Harpadontidae, Lobotidae, Latidae, Scatophagidae, Sillaginidae, Trichiuridae, Channidae, Teraponidae, Cynoglossidae, Platycephalidae, Ariidae, Siluridae, Pangasiidae, Bagridae and Carcharhinidae were included in the recorded species. *Otolilthoides pama* and *Leptomelanosoma indicum* were commonly abundance during the study period. *Lobotes surinamensis* and *Scoliodon laticaudus* were rarely found in the study areas. The longest mean length of *Otolithoides pama* was 30.4038±9.0322 found in September, 2016 and smallest was 18.369± 2.44 found in January, 2017. For *Leptomelanosoma indicum*, the longest mean length was 35.0697± 4.0629, 35.3125± 6.3942 found in October and November, 2016 and smallest was 24.642± 6.3754 found in January, 2017. The length-weight relationships of the value of r^2 for regression curve of these two species are 0.9215 and 0.8956. So, these values indicate the length and weight are strongly correlated. The value of b (3.2138 and 3.3941) for these two species was round about 3 that indicate these species are positive allometric growth. The catch of Kyeikhto station is higher than other three stations because of the fence net is more effective than other fishing nets. The reproductive biology and spawning season for *Otolithoides pama* and *Leptomelanosoma indicum* are also needed for further research. This study contributes important basic data about the fisheries of the Gulf of Mottama. These fisheries have not been studied extensively, and there is a lack of information on their catch and operations. This information is needed to develop good management plans for these fisheries.

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