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Aquatic Resource Management and Production in Pya-Phon District in Ayeyarwady Region

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Abstract

The present paper intended to highlight aquatic resource management and production in Pya-phon District in Ayayarwady Region within the period of October 2014 to May 2016. The main aim was to access the production from aquaculture and small scale fisheries in the study area with the following objectives to study the fishing frequencies and the use of fishing gears and boats in the study area; to examine the main target fish species composition and the production; to know the family income and the price of fish species. The questionnaire survey was completed for each individual fisherman where information about nominal catch quantity, fishing effort, fishing grounds visited, type and number of gears employed seasonally. During the study period, among a total of 127 individuals of local fishermen, totally 123 individuals (96.85 %) own the fishing boats. Of them, 97 fishermen (78.86%) used engines for their fishing boats. The seasonal variation of fishing effort was 52% in wet season, 37 % in the cool season and 11% in the dry season. Totally nine differenrt fishing gears were found to be used for the fishing of target species. The frequency of daily catchments of each fisherman was recorded as >3.0-4.5 kg of total catchments. The value changes of different recorded fish species, the highest exploitation of fishes were discussed.

Keywords: Fishing frequency, Fishing gears, Target species, Production.

I. Introduction

Aquatic resources management refers to the management and conservation of the aquatic resource based on the context of aquaculture, the concentration and capture of wild fish, as well as foraging for other aquatic resources such as crabs, prawns, snails, insects, aquatic plants, etc. Fish play an important role in the human food supply and constituting the main and often irreplaceable animal source food in poor rural households. It forms at least 50% of the essential animal protein and mineral intake for 400 million people from the poorest African and South Asian Countries (World Bank, 2004; FAO, 2007). Fish constitutes almost half of the total number of vertebrates in the world. They live in almost all conceivable aquatic habitats; approximately 21,723 living species of fish have been recorded out of 39,900 species of vertebrates (Jayaram, 1999). They could be subdivided into ecological groups of marine, freshwater, migratory and brackish-water fishes (FAO, 1999). Of these, 8,411 are freshwater species and 11,650 are marine (Kar*et al.*, 2006). Freshwater fishes also influence nutrient dynamics in freshwater ecosystems (Allan *et al.*, 2005).

A fishery can be defined as the exploitation of living aquatic resources held in some form of common or open access property regime (Smith *et al.*, 2005). Fisheries and aquaculture also differ significantly in their relation to natural ecosystems. Fishing can also have a direct environmental impact through removal of target species and the effects on the ecosystem that this causes (Welcomme, 2001; Pauly *et al.*, 2002). In contrast aquaculture

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technologies tend to reduce reliance on natural ecosystems and have a more indirect though sometimes significant environmental impact (Naylor *et al.*, 1998). In fact, the fishery sector contributes significantly to the national economies of the region (Revenga*et al.*, 2000).

Inland fisheries are worked out by two categories: the leasable fisheries and the open fisheries. The fisheries of inland waters have received only slight consideration within global analyses (FAO 1999). Open fishery is the process of catching fresh water fish in streams, ponds and rivers. The fishing in inland waters is among the most ancient of human practices and fishing tools have been found among the earliest human remains (Allan *et al.*, 2005). That inland fisheries in developing countries rely on diverse ecosystems and their physical attributes will influence the role that fishing may play in livelihood strategies and thus levels of fishing effort and incomes (Smith *et al.*, 2005) from fisheries improve food security by providing a source of protein and a livelihood for millions of people in this part of the world, especially the rural poor.

Therefore, national fisheries information systems globally are taken to provide a measure of the importance of fisheries resources at a country level, and a comparative measure of reliance on fisheries at a global scale. Understanding fisheries' livelihoods in developing countries requires a different set of metrics from those used in the developed world (Mills *et al.*, 2011). Smith *et al.* (2005) indicated that inland fisheries require relatively few resources from those exploiting them, making them often accessible and important in the livelihoods of poor people. Inland fisheries make an important but often neglected contribution to rural livelihoods in developing countries.

Nevertheless, over fishing, climate, and pollution are similar impacts on inland fish stocks. Likely the habitat destruction and overexploitation all threaten the well-being of freshwater fisheries. As a result, many of the fisheries with low current yield may reflect the reduction of yields from high non sustainable levels to lower sustainable levels (Hilborn*et al.*, 2003). Overexploitation of the world's fisheries is the subject of much recent concern (FAO 2002, Pauly*et al.* 2002, Hilborn*et al.* 2003). As overfishing reduces the mean size of individuals and species in the fish assemblage, therefore, the fisheries of inland waters have received only slight consideration within global analyses (FAO 1999, Hilborn*et al.* 2003, Kura *et al.* 2004).

Lae (1997) stated that most tropical freshwater fisheries exploit many species of fish simultaneously, often with the same fishing gear. Species vary in their responses to exploitation, with small and short-lived ones remaining abundant and productive at much higher fishing effort than large and long-lived ones. With increasing fishing effort (number of fishers or time fished per unit area) there tends to be a shift in species composition from large to small species. The combined yield of all species increases initially with fishing effort but then levels off and remains approximately constant over a wide range of fishing pressure due to the use of different kinds of traditional fishing gear like nets, baskets, rod and line, spearing, fish traps and indigenous fish poison, as well as some destructive fishing methods such as insecticides, pesticides, dynamiting and electric fishing (Swar and Shrestha, 1997; Swar and Bisgaard, 1999).

Myanmar provides habitats for a considerable diversity of aquatic species. It has three coastal regions with a long coastline of nearly 3,000 km on the Bay of Bengal, with several large estuarine and delta systems, and numerous offshore islands, and possesses a considerable diversity of coastal habitats (FAO, 2003). Fishing communities are found in a vast area full of rivers and streams at several villages, located along the main rivers. In

fact, the fisheries sector plays a vital role in the culture and socio-economic life of country. In general, rural people whose livelihoods involve fishing but for whom this is not their primary or defining activity account for the largest share of inland fisheries catches.

Ayeyarwady Region lies at the central part of the coastal area comprising land area of 35,138 square kilometers and 152,038 sq km of fishing ground (Win Oo, 2002), possess coastal habitats as habitats for fishes, an extremely important coastal resource, and dominant intertidal vegetation in subtropical and tropical estuarine systems. Especially, fisheries have played a significant role for the income of rural households in the delta area. These local households catch fish for a part-time income and for food of meals. The fishing industry basically covers two types of fisheries. These are Marine Fishery and Inland Fishery. Marine fishery includes inshore and offshore fisheries. Inland fisheries are located in four main rivers, namely the Ayeyarwady River, Chin Dwin River, Sittaung River and Than Lwin River. It also contains leasable fisheries, open fisheries and aquaculture fisheries. Inland fisheries contributed approximately 25 percent of the total fisheries output (Win Oo, 2002).

There are many fishing gears employed in catching of Inland Fisheries in Myanmar. Nevertheless, fishery activities can have negative impacts upon biodiversity due to unsustainable management of marine and inland fisheries. As a result, wild stocks have rapidly declined over the past decades. Therefore, the fisheries management and research is part of strategies for biodiversity conservation. The information of production for the sustainability production from aquaculture and small scale fisheries, attention needs to be given to management. The present study was conducted at delta area, Phya-pon District, Ayeyarwady Region to assess the management and production of inland fisheries sector for future management strategies.

II. Materials and methods

Study area and study period

The present study was conducted at the study locations at 36 delta fishing village tracts in Pyar-phon District. Pyapon District composed of Dedaye Township, Kyaiklat Township, Pyapon Township and Bogalay Township. The study was carried out from 2014 to 2016.

Data collection and identification

A questionnaire survey was completed by each individual fisherman were information such as types of fishing gears, fishing frequency, fishing duration, fishing time, and catch quantity of fish, operation of the gears, fishing methods and their complementary equipment employed in the inland fisheries. Fishing gears were examined according to Khin Maung Aye, *et al* (2006). Also fish specimens collected from the fishermen were preserved in 70 % ethanol for further identification and photographs of the speciemen were taken.

Identification of fish species was carried out by the following references; F.A.O (1986); Talwar and Jhingran (1991). Catch Per Unit Effort (CPUE) was taken as the weight of fish per day caught by a type of individual fishing gear. CPUE (kg/day) of fishing gears were calculated to evaluate the effectiveness of fishing gears.

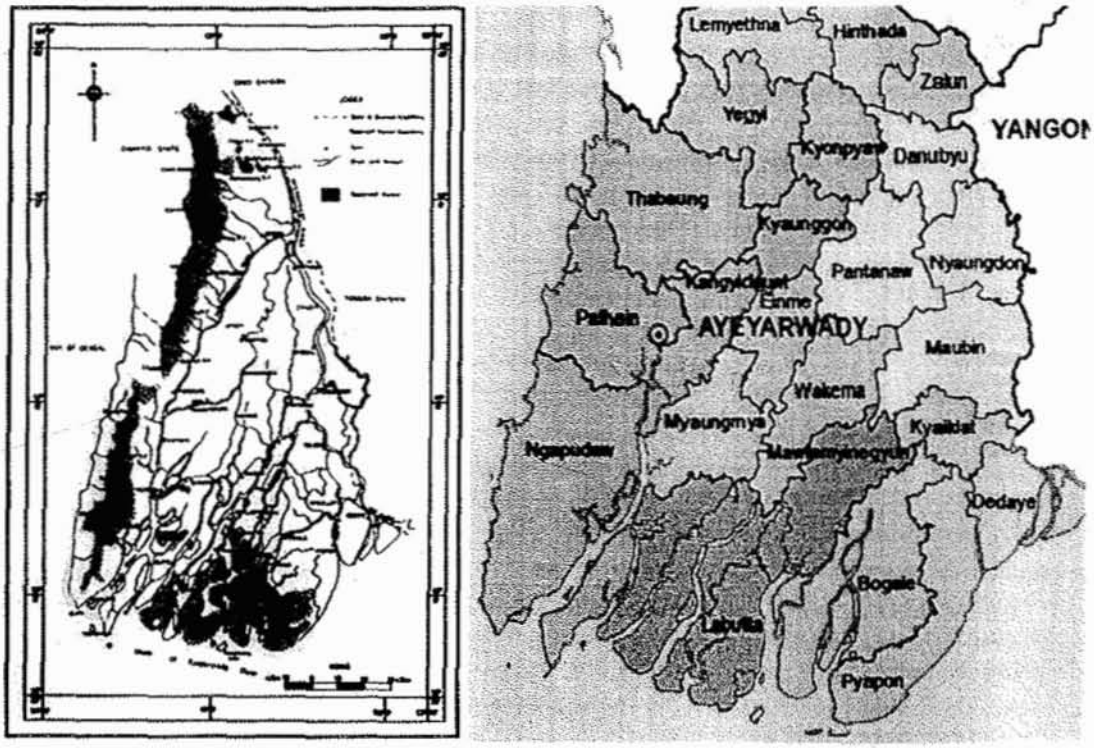

Figure 1. Ayeyawady Region and selected study location (Pya-phon District)

III. Results

During the study period, a total of 127 individuals of local fishermen were recorded. Among them, 123 individuals (96.85 %) owned the fishing boats and 97 boats (78.86%) were powered by engine. The sized of fishing boats used by local fishermen was shown in Figure 2. Their household size, monthly income and daily expense for their family were shown in Table 1.

Fishery was mostly concentrated from May to August because of the water level in the river was low during this period. The productivity was known to be influenced by the hydrological cycle, fishing efforts and the fishing gears used. Therefore, the fishing efficiency exhibited a seasonal pattern related to the hydrological cycle, fishing efforts and species diversity. Seasonal fishing effect was 52% in wet season, 37 % in cool season and 11% in dry season, respectively (Figure 3).

Nevertheless, as the respective location of fishing ground, in Pyarpon environs, the most frequency of fishing effort was found in the cool and dry seasons (0.75) and in the wet season (0.25). In Kyatlat environs, the fishing was performed only in wet and cool seasons. In Dadayae environs, only in cool season (0.5) and wet season (0.1), cool and dry (0.1), dry and wet season (0.05) and year-round (0.25). In Hmaw-kyun environs, the fishing effort was mostly in wet season (0.86) and cool season (0.14). Similarly in Bogalay environs, the most fishing effort was recorded in wet season (0.57), only on cool season (0.14), and dry season (0.08), cool and dry (0.03), dry and wet (0.03), wet and cool (0.15).

Table1. Family status, monthly income and daily expense of local fishermen (interviewees)

Family status		Monthly Income		Daily expense	
Household size	Number	Range	Number	Range	Number
2-4	58	50,000-100,000	49	Up to 2000	15
5-7	56	1110,000-200,000	47	2,100-3,000	45
8-10	12	210,000-300,000	6	3,100-4,000	24
>10	1	>500,000	3	>4000	28

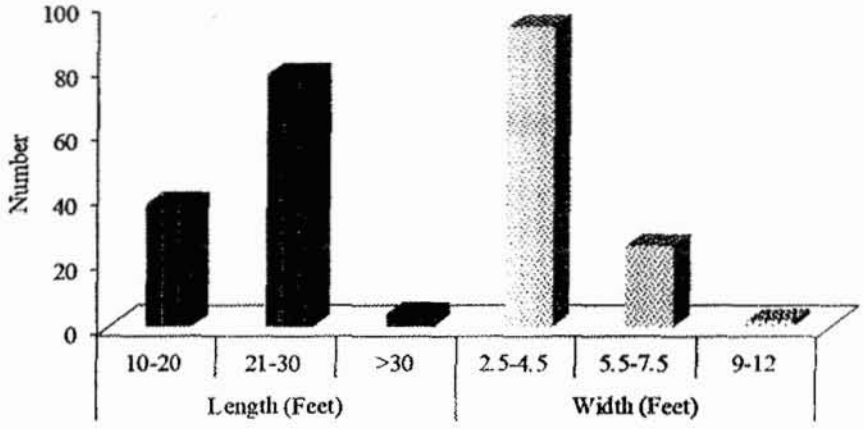

Figure 2. Size of fishing boat used by local fishermen in the study area

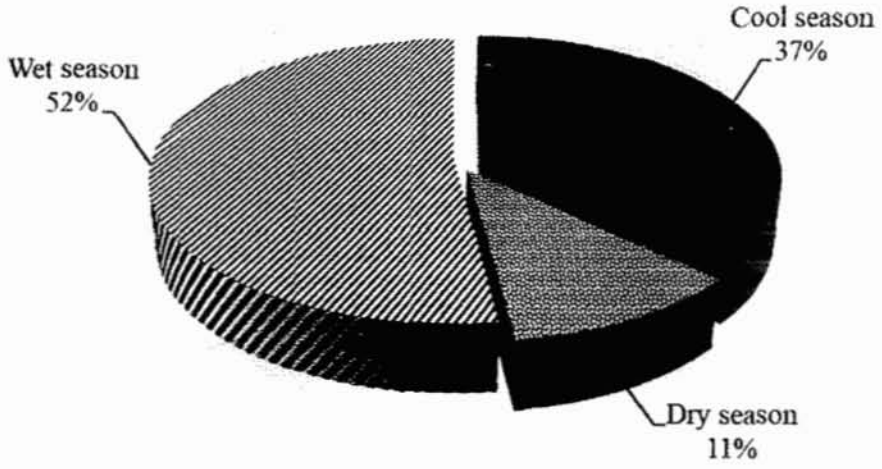

Figure 3. Seasonal variation of fishing effort in the study area

Fishing at night is also a common practice in the study area. As the frequency of fishing activity, most fishing afford was twice per day (56%) and followed by once a day (38%), four times and six times per day (1%) and five times per day (4%). Of them, the fishermen from Pyarpon and Kyatlat performed the fishing only twice per day whereas in Dadayae 90% of fishermen twice per day and 10% only once per day. In Hmawkyun, fishermen performed their daily fishing activity as once (57.14%) and twice (42.86%) per day whereas in Bogalay, the fishing was once a day (58.46%) and some twice per day (29.23%), five times per day (7.69%), six times per day (3.08%) and four times per day (1.54) (Figure 4).

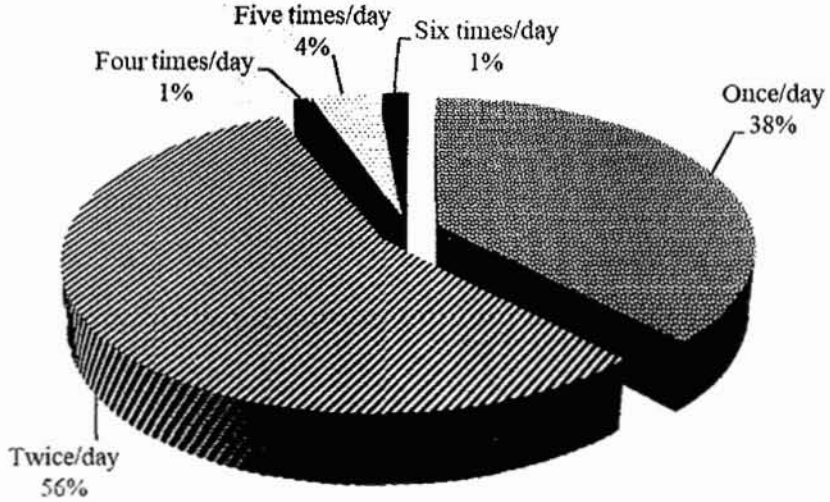

Figure 4. Fishing frequency per day by local fishermen in the study area

Table 2. The use of fishing gears, catches species, fishing season, catchment/ day in the study area

Sr.no	Types of fishing gear used	Local name	Catches species	Fishing seasons	Catchment/day (kg)
1	Trammel net-Hilsa	Nga-tha-lauk pike ThoneHtatpite	Hilsa shad, Toil shad	September-January	3.0-4.5
2	Trammel net-paradise thread fin	Nga-pon-nar-pike	Mango fish, Croaker	April-June	3.0-7.6
3	Stow net	Kyar-pa-zark-pike	Mango fish, Wallago, Dwarf catfish, Long tongue sole, Seabass, Croaker, Giant freshwater prawn	Year round	3.0-7.6
4	Drift gill net	Hmyaw-pike	Seabass, Croaker	June-September	3.0-7.6
5	Bottom set long line	Nga-myar-tan	Seabass, Pangasius, Wallago	November-March	1.5-7.6
6	Fence net	Bawun-pike	Dwarf catfish, Wallago, Mango fish, Croaker, Hilsa, Giant freshwater prawn	Year round	3.0-9.2
7	Drag bag net	Swe-pike	Giant freshwater prawn, Shrimp, small Miscellaneous fishes	Year round	7.6-13.8
8	Portable cast net	Let-pyit-con	Seabass, Croaker, Giant freshwater prawn, Miscellaneous fishes	Year round	3.0-7.6
9	Set gill net	Kwin-tar-pike/ Sein pike	Dwarf catfish, Snake head, Miscellaneous fishes	June-September	3.0-7.6

Table 3. The use of different fishing gears in the study area (Frequency is in the parenthesis)

Sr.no	Type of fishing gear	Local name	Phyarpon N = 8	Kyatlat N = 20	Daedayae N = 20	Hmaw-kyun N = 14	Bogalay N =65
1	Trammel net-Hilsa	Nga-tha-lauk pike	6 (0.75)	-	10 (0.50)	-	6 (0.09)
2	Trammel net-paradise thread fin	Nga-pon-nar-pike	1 (0.13)	-	7 (0.35)	-	2 (0.03)
3	Stow net	Kyar-pa-zark-pike	1 (0.13)	-	-	7 (0.50)	18 (0.28)
4	Drift gill net	Hmyaw-pike	-	20 (1.0)	2 (0.10)	-	-
5	Bottom set long line	Nga-myar-tan	-	-	1 (0.05)	2 (0.14)	1 (0.02)
6	Fence net	Bawun-pike	-	-	-	5 (0.36)	29 (0.45)
7	Drag bag net	Swe-pike	-	-	-	-	4 (0.06)
8	Portable cast net	Let-pyit-con	-	-	-	-	1 (0.02)
9	Set gill net	Kwin-tar-pike/ Sein pike	-	-	-	-	4 (0.06)

During the study period, a total of nine fishing gears were found to be used in Phyarpon District. They were Trammel net-Hilsa used from September to January, Trammel net-paradise thread fin from April to June, Drift gill net and Set gill net from June to September, Bottom set long line from November to March, and Stow net, Fence net, Drag bag net, Portable cast net which were used throughout the year. A variety of fish species were catched such as Trammel net-Hilsa for Hilsa shad and Toil shad; Trammel net-paradise thread fin for Mango fish and Croaker; Stow net for Mango fish, Wallago and Dwarf catfish; Long tongue sole, Seabass, Croaker and Giant freshwater prawn; Drift gill net for Seabass and Croaker; Bottom set long line for Seabass, Pangasius and Wallago; Fence net for Dwarf catfish, Wallago, Mango fish, Croaker, Hilsa and Giant freshwater prawn; Drag bag net for Giant freshwater prawn, Shrimp and small Miscellaneous fishes; Portable cast net for Seabass, Croaker, Giant freshwater prawn and Miscellaneous fishes; and Set gill net for Dwarf catfish, Snake head for Miscellaneous fishes.

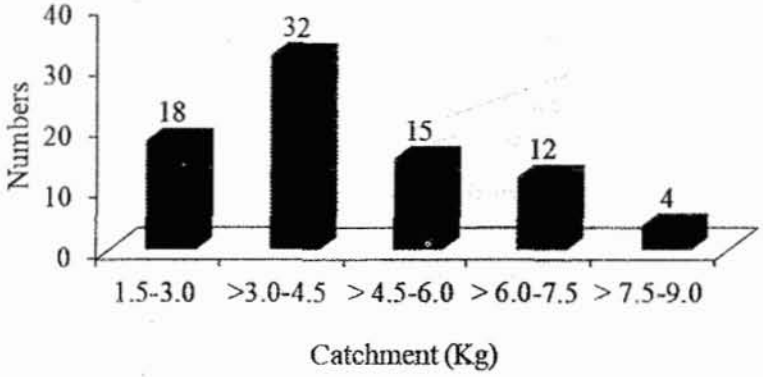

Figure 5. Daily catchments of local fishermen in the study area

The catchments of specific nets were for Trammel net-Hilsa (3.0-4.5 kg), Trammel net-paradise thread fin, Stow net, Portable cast net and Set gill net (3.0-7.6 kg), Bottom set long line (1.5-7.6 kg), Fence net (3.0-9.2 kg), Drag bag net (7.6-13.8viss) (Table.2).

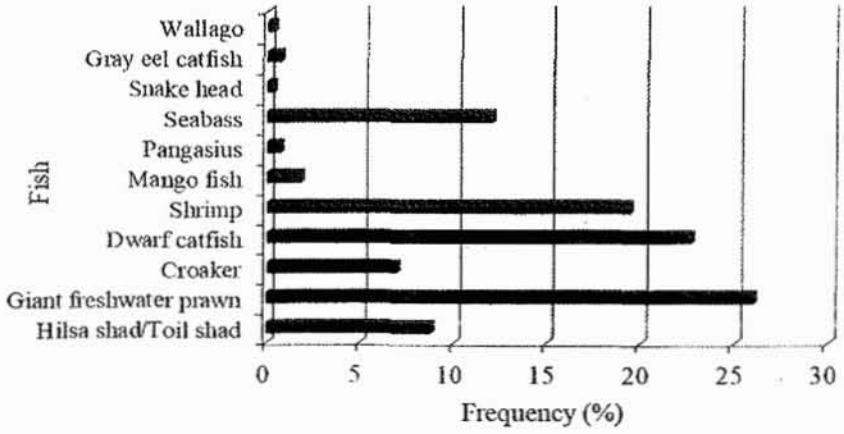

Figure 6. Comparative production of fishes in the study area

The most important fish of catches were mango fish, Hilsa shad, Toil shad, and Giant freshwater prawn. As the different locations, Trammel net-Hilsa net was responsible for more than 75% of total catches in Pyarpon. Stow net and Trammel net-paradise thread fin were used independently. In Kyatlat, the most frequent season of fishing was in the cool and the wet season. They only used drift gill net. In Dadayae, Trammel net-Hilsa (0.50) was used more than Trammel net-paradise thread fin (0.35), Drift gill net (0.10) and Bottom set long line (0.05). In Hmâw-kyun, Stow net was used mostly (0.50) and followed by Fence net (0.36) and Bottom set long line (0.14). In Bogalay environs, Fence net was used mostly by local fishermen than other nets such as Trammel net-Hilsa (0.09), Trammel net-paradise thread fin (0.03), Stow net (0.28), Bottom set long line and Portable cast net (0.02), Drag bag net and Set gill net (0.06) (Table.3).

The daily catchments of each fisherman wre varied. The most frequency was above 3.0-4.5 kg catchments of 32 fishermen which followed by 1.5-3.0 kg catchments of 18 fishermen, above 4.5-6. kg catchments of 15 fishermen, above 6.0-7.5 kg catchments of 12 fishermen and above 7.5 -9.0 kg catchments of 4 fishermen (Figure. 5). The value changes of different recorded fish species was shown in Table 4.
The highest exploitation of fishes was Giant freshwater prawn, dwarf catfish, shrimps and sea bass, Hilsa shad/Toil shad and croaker. Other recorded fish species had only a small amount of production (Figure 6).

Table.4 Local price of different fish species in the study area

Sr.no	Common name	Local name	Price (Kyats/viss)
1	Seabass	Kakadit-Ka-tha-paung	2,500-8,000
2	Croaker	Nga-poke-thin	3,000-10,000
3	Dwarf catfish	Nga-zin-yine	1,500-2,000
4	Giant freshwater prawn	Pazun-htoke	15,000
5	Gray eel catfish	Pinlae-nga-khu	2,000-3,000
6	Hilsa shad and Toil shad	Nga-tha-lauk	7,000-20,000
7	Long tongue sole	Nga-khwe-shar	3,000
8	Mango fish	Nga-pon-ngar	4,000-8,000
9	Pangasius	Nga-dan	3,000
10	Shrimp	Pazun-seik	800-2,000
11	Snake head	Nga-yant	2,500
12	Wallago	Nga-bat	8,000

VI. Discussion

The fishery sector is the most important sector in the Ayeyarwady Delta after the agriculture sector because fishing and processing of fishery products provide an opportunity for landless people to earn income for their livelihood. The present study noted that the used of fishing gears depend on the fishing ground and species specific. Their useage can be varied highly upon the season. A total of nine different fishing gears were used in the present study area. Some fishers specialize in the use of one gear type, particularly in the professional sector. Allan *et al.*, (2005) stated that the multigear

fisheries are generally designed to catch all species and ages of the target assemblage, so the total number of species in the catch is high initially and declines as large species are fished out. Besides, the time of fishing activity is important. Smith *et al* (2005) stated that fishing at night or in the early hours is also a common practice, using time not otherwise used for productive activities. Alternatively, the low energy requirements of passive fishing at night may complement more strenuous daytime employment (again relevant to the merits of part-time fishing). In contrast fishing by full-time fishers, wealthier households and by men tends towards use of higher cost for the fishing gears, boats. Such of active fishing methods in pursuit of larger and higher value species in deeper water or is concentrated on adult fish in the dry season. It was noted that the catching capacity was depend on the fishing effort and the combined efficiency of the useage of fishing gears and vessels.Both of active and passive fishing gears were recorded in the study area. Passive fishing gears as nets, hooks and line fishing, traps were most suitable for small scale-fishing as "stationary" fishing gears and some moving gears such as drift nets for the capture of target species depend on their movement towards the gear. A variety of target species were caught in the study sites.

Based on information from the key informants' survey, all catch fishes were being used as a source of food; fisheries provide an important source of income for the family. The highest commercial value in fish species were Hilsa shad, Toil shad and prawn. Among them prawn is the most important source of income in the aquaculture industry in the villages and is given first priority for earning income. Dry prawn, fried fish and prawn paste making industries are found in most villages. Fishing activity was carried out the whole year but the amount of fish-catch is higher in July and August. During the period of more fishing activity, price falls due to higher supply and local people have low income. The average income of a fisherman is about 3000 Kyats per day. The results showed the range of family income was 50,000->500,000 kyats with the highest frequency of low income. Nevertheless, the daily expense was 2,000 -3,000 kyats. The young family members shifted to other areas for their regular income. Also the present results noted the unequability of fish exploitation among the fishermen in the present study area. The value of catch varied with the type of fishing gear and net used by fishermen. They used different fishing gears and net due to the target fish species seasonally. Catch Per Unit Effort (CPUE) for particular fishing gear uses were examined in the studied areas. Overall volumes of catchment were in different study sites by using "Drag bag net" fishing gear.

The result showed that the use of drag bag net was more affective than other fishing gears in the study areas. Relative proportions of the catch volumes per village were observed and the highest volumes of catchment were in Kyon-da-min village, Set-pine village at DedayeTownship, Sein-ya-ti village at Mawlamyine-kyun Township, and Da-min-taung, Set-san villages at Bogalay Township. Comparing the catch composition, Pyapon Township had the highest volumes of catchment followed by the villages of Bogalay Township. Based on the personal communication with fisherman, the yearly decline of catchments were in the study areas. The major threats of fish species diversity and abundance were loss of natural habitats, use of small mesh sized gears, dewatering, use of insecticides and pesticides in agricultural sector, industrial and domestic pollution, siltation of water bodies, invasion of exotics and disease. the present study found that the unsustainable fisheries activities can have negative impacts upon biodiversity due to over-exploitation, and the use of destructive gears such as the use of 1.5" monofilament gill

nets, battery shock fishing and the non-respect of fishing activities in the closed season (June-July) which impact the reduction of indigenous fishes in the study area.

V. Conclusion and recommendation

The major points of challenge of fishery are as follows:

i. The most commercial fish species were recorded and identified in various study sites.
ii. The promotion of management approaches plays a vital role in river fisheries that are crucial in maintaining aquatic biodiversity.
iii. The impact of illegal fishing operations and selective fishing gears not only on the target species, but also on bycatch of or other effects on non-commercial species or habitats.
iv. Other specific factors, as their socio-economic implications of local peoples could be added to a specific evaluation for the guideline to future management strategies in an area.
v. Specific fishery should be analysed in more detail and the proposed ecosystem factors should also be weighted according to their importance in a local or regional case.

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Figure 7. Questionnaire survey in the field

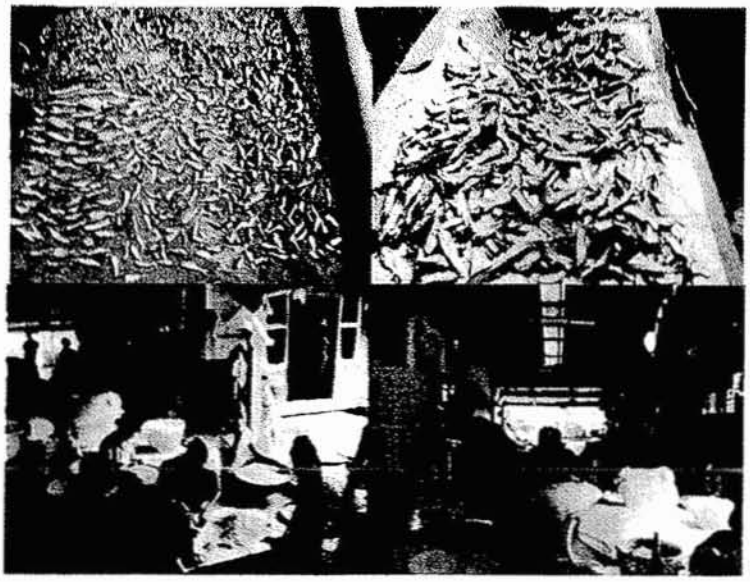

Figure 8. Fish product processing

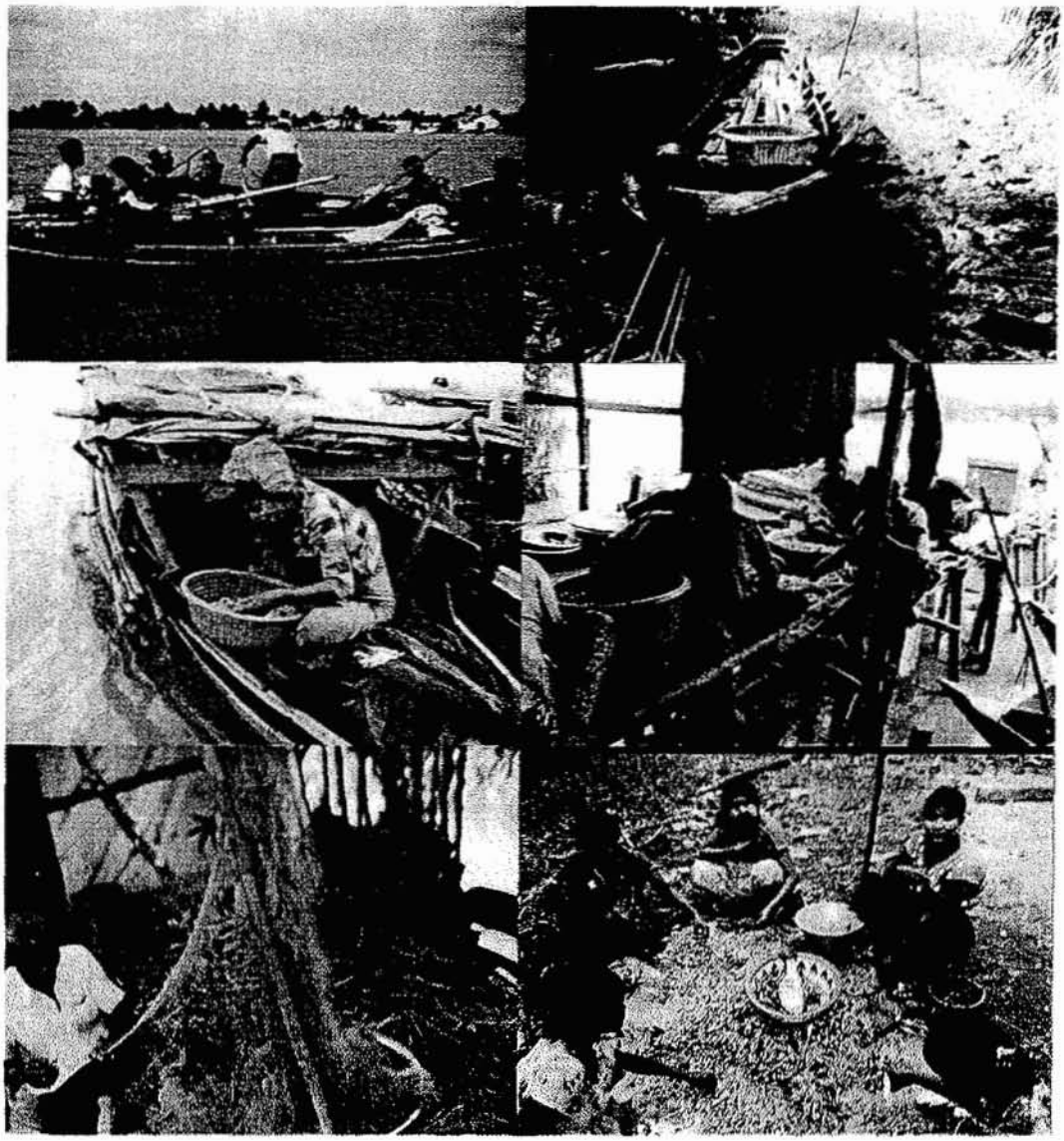

Figure 9. Fishing operation in the study area

APPENDICES

Appendix I. DATA COLLECTION FORM (I)

ရက်စွဲ-

မြို့နယ်-

ကျေးရွာ-
ငါးဖမ်းသမားအရေအတွက်-

အမည်-

အသက်-

ပညာအရည်အချင်း-

အလုပ်အကိုင်-

လက်ရှိအလုပ်အကိုင်-

မိသားစုဦးရေ-

မိန်းမအသက်-

မိန်းမလက်ရှိအလုပ်အကိုင်-

မိန်းမပညာအရည်အချင်း-

ခလေးအရေအတွက်-

ခလေးများ ပညာအရည်အချင်း-

အခြားမှီခိုသူဦးရေ-

ငါးလုပ်ငန်းအမျိုးအစား-

ငါးဖမ်းသည့်နေရာ-

ငါးဖမ်းရာသီ-

ငါးဖမ်းကရိယာများ
အမျိုးအစား-
အရေအတွက်-

တနေ့ဖမ်းဆီးသည့်
အကြိမ်အရေအတွက်-

အများဆုံးမိသောလများ-

တစ်ကြိမ်ရရှိမှု(အထိအမိ) -

ငါးဖမ်းလေ့ရှိ ။မရှိ

ရည်ရွယ်ချက်-
ရောင်းရန်။ စားရန်
အင်ဂျင်အမျိုးအစား-

ရောင်းချမှု-
လက်လီ။လက်ကား
ငါးဖမ်းလေ့အလျား-

အင်ဂျင်- ရှိ။မရှိ

ဖြင်းကောင်ရေ-

ငါးဖမ်းလေ့အနံ-

ရောင်းချသည့်နေရာ-

ရောင်းချပုံ-
(ငါးအိုး။ငါးခြောက်။ကြပ်တိုတ်။
ဆားနယ်။ ငါးပိ)

တစ်လဝင်ငွေ-

တစ်ရက်ကုန်ကျငွေ-

အများဆုံးဖမ်းမိသောငါး အမျိုးအစား။ဈေးနှုန်း-

အနဲငယ်သာဖမ်းမိသောငါး အမျိုးအစား။ဈေးနှုန်း-

Appendix II. DATA COLLECTION FORM (II)

Township - Village -

Household/ total fisherman -

SR.NO	HOUSEHOLD SIZE	FISHING SEASON	FISHING FREQUENCY	CATCHMENT	PURPOSE OF FISHING	USED OF FISHING GEAR	KINDS OF FISHING BOAT	USED ENGINE	SIZE OF BOAT		FISHING LANDED	MONTHLY INCOME	DAILY EXPENSE	FISH SPECIES	PRICES	REMARK
									LENGTH	WIDTH						

Contents