Faculty of Resource Science and Technology

Fisheries at Rambungan Mangrove Area

Sabriya bt. Abdull Jabbar

Bachelor of Science with Honours
(Aquatic Resource Science and Management)
2008

Fisheries at Rambungan Mangrove area

SABRIYA BT ABDULL JABBAR

This dissertation is submitted in partial fulfilment of the requirements for
The Degree of Bachelor of Science with Honours in
Aquatic Resource Science and Management

Faculty of Resource Science and Technology
UNIVERSITI MALAYSIA SARAWAK
2008

DECLARATION

No portion of the work referred to in this dissertation has been submitted in support of an application for another degree qualification of this or any other university or institution of higher learning.

Sabriya bt Abdull Jabbar

Department of Aquatic Science

Faculty of Resource Science and Technology

Universiti Malaysia Sarawak.

ACKNOWLEDGEMENT

Firstly, I would like to thank God for His Blessings, then I would like to express my gratitude to my supervisor Associate Professor Dr. Lee Nyanti for his valuable suggestions and guidance throughout this project. I would like to express my sincere thanks to the Mr. Jongkar Grinang who have helped me in identifying the prawn and spent precious time reading and adjust the description to ensure they are as accurate as possible. Thanks also to FRST's lab assistant Mr. Harris Norman, Mr. Zaidi Ibrahim and Mr. Zulkifli Ahmad, UNIMAS driver, the boatmen and my fellow coursemates, NurNadiah Mokhtar, Noor'ain Jalim, Nurdiana Hassan, Muniir Mohammad and Haryanti Seleman for aiding and assisting me especially during the interviews and sampling period. Finally I would like to thank my family for their support and encouragement and my lectures for their motivation and support. Thank you.

TABLE OF CONTENTS

Content **Page**

LIST OF TABLE

Page

LIST OF FIGURES

Fisheries at Rambungan Mangrove Area

Sabriya bt Abdull Jabbar

Department of Aquatic Science
Faculty of Resource Science and Technology
Universiti Malaysia Sarawak

ABSTRACT

This study was carried out to determine the present status of fisheries at Rambungan Mangrove Area. Field samplings were carried out for three times in October and December 2007 and March 2008 at five selected stations in the study area. A total of 120 individuals comprising 15 families and 20 species were caught from the five study stations. Four main villages were found in Rambungan mangrove area. Fishing methods employed by the villagers were mainly drift net, gill net and small trawlers. The main commercial species found at Rambungan mangrove area were *Arius* spp., *Epinephalus* spp., *Leiognathus* spp., *Penaeus* spp. and *Scylla* spp. From the survey and interviews carried out, it showed that Rambungan mangrove area is an important fishing ground for the villagers.

Key words: Fisheries, Rambungan mangrove area, commercial species.

ABSTRAK

Kajian telah dijalankan untuk mendapatkan status perikanan terkini di kawasan paya bakau Rambungan. Persampelan telah dijalankan sebanyak tiga kali pada bulan Oktober dan Disember 2007 dan Mac 2008 di lima stesen terpilih di kawasan kajian. Sebanyak 120 individu yang terdiri daripada 15 famili dan 20 spesies telah ditangkap daripada 5 stesen kajian tersebut. Terdapat empat buah kampung di kawasan paya bakau Rambungan. Kebanyakan orang kampung menangkap ikan menggunakan pukat hanyut, jaring dan pukat tunda (kecil). Spesies komersil utama yang dijumpai di kawasan paya bakau Rambungan adalah Arius spp.*,* Epinephalus spp.*,* Leiognathus spp.*,* Penaeus spp. *dan* Scylla spp. *Daripada kaji selidik dan temuramah yang telah dijalankan, ia menunjukkan kawasan paya bakau Rambungan merupakan tempat menangkap ikan yang penting bagi penduduk kampung tersebut.*

Kata kunci: Perikanan, kawasan paya bakau Rambungan, spesies komersial.

1.0 INTRODUCTION

Mangrove forests in optimum conditions are one of the most productive ecosystems, with a net primary productivity of 23.3 tonnes/ha/year and litter productivity of 10 tonnes/ha/year was measured for a 15-year-old stand of *Rhizophora* recorded at Matang, Malaysia (Sasekumar, 1974). The calm water in the forests are ideal breeding and nursery grounds for young fish and shrimps, while the aerial roots, lower trunks and mud surface usually support a varied fauna of oysters, snails, barnacles, crabs and other invertebrates (Bennet & Reynolds, 1993).

Mangrove ecosystem is a necessity for a sustainable production of fisheries because it provides a very rich food source for many marine animals from nutrient circulation within the mangrove forest. Moreover, as the mangrove forest provides physical protection against strong waves and larger predators, it offers ideal conditions for breeding and nurturing the offspring. The complex root systems of mangroves act as a protective habitat for many aquatic species, such as juvenile shrimp (Thayer *et al*., 1987). Almost 75% of the commercially caught fish spend time in the mangrove ecosystems once in their lives, whether seeking shelter, food, or mating grounds (Robertson, 1992). One prime example is the barracuda. Many times this juvenile fish will use the mangrove ecosystem for shelter and food until it is large enough to makes its way to open water. According to Hussain & Acharya (1994), the mangrove waters support 53 species of pelagic fish belonging to 27 families and 124 species under 49 families of demersal fish. These core functions of the mangrove ecosystem contributes a significant social and economic benefits to coastal communities, especially from artisanal and commercial fisheries that are linked directly or indirectly to mangrove dominated estuaries and shorelines (Turner, 1977; Thayer *et al*., 1987).

In Australia, the importance of mangroves for fisheries has been recognized by the establishment of fishery habitat reserves in mangroves within which fishery is only permitted as commercial activity (Duke & Robertson, 1987). The relationship between pond culture and the remaining forest has not been thoroughly studied, but the mangrove trees serve as a wind-break and the mangrove ecosystem provides fry for the ponds and maintains a favorable water quality. For these reasons it is in the interest of aquaculturists to maintain a certain percentage of the mangrove area under forest cover (Macnae, 1974).

.

According to Shahidul and Wahab (2002), there are two basic types of capture fisheries in the mangrove areas, namely, inshore fishery and offshore fishery. For inshore fisheries, small boats usually fishing in relatively shallow waters, ranging in depths from 2 to 8 m constitute the inshore fishery. Various types of gears are used by artisanal and commercial fishermen and about one-third of annual fish production in the mangrove areas is attributable to inshore fishery. The offshore fishery covers estuarine and coastal waters. The most common types of fishing gears used by the fishermen are gill net, set bag net and long line.

Most of the productive mangrove area are concentrated at southeast of Asia which included Malaysia where mangrove area are important especially to the fisheries activities. The importance of mangrove ecosystems to coastal fisheries have been described among others by Pauly (1985), Twilley *et al*. (1996), Baran & Hambrey (1998), Kathiresan & Bingham (2001) and Yanez-Arancibia (1985). According to Ronnaback (2001), the role of mangroves is very important, both economically and ecologically as a natural resource and as protection to the environment. However, both aspects cannot be separated without causing damage to the area. Nowadays most coastal and estuarine fisheries are either fully

exploited or overexploited due to an increasing number of fishers and development of more efficient fishing gear and mechanization of boat. The effects of fishing on target organisms include decreases in their abundance, changes in age structure and size composition and changes in species composition.

Most tropical mangrove systems in developing countries such as Thailand, Philippines and Vietnam have lost far more than 50% of their mangroves and in Singapore only 0.5% of the mangrove area remains intake (Sasekumar & Wilkinson, 1994). One of the major factors in the loss of estuarine habitat in the subtropics and tropics has been the destruction of huge areas of mangroves for aquaculture, timber, and industrial developments. Thus many fishes, particularly in Southeast Asia are declining in abundance as a result of environmental degradation, such as removal of mangroves and overfishing (Blaber, 1980).

In Malaysia, mangrove forest has traditionally been an essential resource for human coastal communities (Nyanti *et al*., 2005). In total, there are about 640,000 ha of mangrove forests in Malaysia of which 57% are found in Sabah, 26% in Sarawak and 17% in Peninsular Malaysia. In Sarawak, they are located mainly along the sheltered coastlines and estuaries within the major bays of Kuching Division, Sri Aman Division, Rajang Delta and Limbang Division (Chai, 1982).

Similarly, the mangrove area in Rambungan which is located at Batang Rambungan, is an important fishing ground for the local fishermen and villagers on the deltaic island. Four main villages were found in Rambungan. Kampung Rambungan and

Kampung Arang Telok were the two main villages. Fishing was the main economic activity in the area.

2.0 JUSTIFICATION

Little information is available on the fisheries at Rambungan mangrove area. Thus it is indeed important for this research to be done in order to determine the present status of fisheries and the importance of mangrove area to the local community at Kg. Rambungan. Surveys carried out would provide detailed information regarding the socio-economic status of the fishermen and the list of the main commercial species in the area.

3.0 OBJECTIVES

The objectives of this study were to:

- Record a baseline fisheries data for Rambungan mangrove area,
- Record the main commercial species of fish at Rambungan mangrove area,
- Determine the socio-economic status of the fishermen at Rambungan mangrove area,
- Identify the main fisheries problems at Rambungan mangrove area.

4.0 LITERATURE REVIEW

4.1 Estuarine ecology

Estuaries have been claimed to be the most productive natural habitats in the world. Estuary has been defined by Pritchard (1967) as ‘a semi-enclosed coastal body of water, which has a free connection with the open sea and within which sea water is measurably diluted with freshwater derived from land drainage’ (Blaber, 1997). Tropical estuaries are zones of very high biodiversity. Fishes form part of this conservation although many may only spend part of their lives in the estuary. Both estuaries and mangroves are biologically important as nursing grounds for many species of juvenile fish. Many commercial fish like grouper, croaker, snapper, horse mackerel, grey mullet and milkfish are typical migrants into mangrove waters, spending certain periods of their life cycle in this ecosystem (Attack, 2006). It has been demonstrated that many coastal fishes have a high percentage of mangrove detritus (debris) in their gut, implying that the adjacent coastal fishery may be dependent on the export from the mangrove ecosystem. Positive correlation has been established between the real extent of mangroves and the size of fisheries yields from adjacent waters (Macnae, 1974).

Kennish (1990) used breeding and ecological criteria to formulate six classes of estuarine fishes.

1. Freshwater fishes that occasionally enter brackish waters.
2. Truly estuarine species which spend their entire lives in the estuary.
3. Anadromous and catadromous species.

   Anadromous – fish that migrates from sea water to fresh water environment for spawning.

Catadromous – fish that migrates from fresh water environment to sea water environment for spawning.

4. Marine species which pay regular seasonal visits to the estuary, usually as adults.
5. Marine species which use the estuary primarily as a nursery ground, usually spawning and spending much of their adult life at sea but often returning seasonally to the estuary.
6. Adventitious visitors which appear irregularly and have and apparent estuarine requirements.

4.2 Fisheries

A fishery is an organized effort by humans to catch fish or other aquatic species, an activity known as fishing. Generally, fishery exists for the purpose of providing human food, although other aims are possible (such as sport or recreational fishing), or obtaining ornamental fish or fish products such as fish oil. The term fisheries refer to the industry, or occupation, of catching, processing, and selling fish, shellfish, and other aquatic products (Everhart & Youngs, 1981). It is an international industry that has become concerned not only with harvesting but also with the correct utilization and preservation of fish resources. Globally, fishing provides employment for millions of fishers and for workers in associated industries such as boat building, net making and retailing. In fisheries, one of the chief means of management is through modification of the means, times, places and efficiency of catching fish. Fishers buy boats and fishing gear, sell catches, spend income, invest profits and often receive subsidies. Macnae (1974) mentioned that, a very essential part of the equipment of the biologist or the fishermen is through the knowledge of the characteristic of each type of fishing gear.

The fishes at most subtropical and tropical estuaries are very valuable and have form the basis for the development of a great variety of fisheries. Blaber (1997) mentioned that most tropical estuaries are in developing country and such fisheries often constitute the main source of both food and income for people living along their shores. There are three types of fisheries found in the tropical estuaries (Jones 1994; Rawlinson *et al*., 1995): subsistence- where the fishers predominantly consume all of their catch or give it away but do not sell it; artisanal- where the fishers sell part of their catch but they retain part of their own consumption and commercial- where the fishers sell all of their catch.

4.3 Fisheries in Asia

Southeast Asia region is the major producer and consumer of world fish supplies. Most people in the region are by tradition fish consumers. On average, fish provides about 28% of the total animal protein consumed in Asia, compared with 21% in Africa, 8% in Latin America, 7% in North America, and 10% in Western Europe. In some countries, e.g., Bangladesh, Maldives, Philippines, and the Pacific Islands, fish supplies over 75% of the total animal protein consumed by the human population (Blaber, 1997). The importance of the sector is even more pronounced in the small island developing states, where fisheries play a dominant role as a source of food, employment, and export earnings. Much of the nutrition, welfare, culture, recreation, and government revenue of these countries are based on their living marine resources. The trend of current lifestyles, opportunities for future development and food security in the developing countries are all highly dependent on fisheries (Asian Development Bank, 2004). There are many studies that have been conducted in Asian region about the fish faunistic composition, diversity, feeding habitat and its relation to environmental factors. In Indonesia for instant, Martosubroto and Naamin (1979) carried out a study to determine the contributions of mangrove forest

towards fisheries and its function as a nursery ground for various types of fishes and crustaceans. In Malaysia, Chong and Sasekumar (2002) have carried out a study at Sungai Johor and Sungai Pulai estuaries. The study highlighted the function of mangrove estuarine system of Sungai Johor and Sungai Pulai that function as feeding, nursery and breeding areas for many marine fishes and invertebrate.

4.4 Fisheries in Malaysia

Fish in Malaysia are heavily fished by both commercial and artisanal sectors and are similar to many such areas in Southeast Asia (Sasekumar *et al*., 1994). According to Chong (1999), of the 130 fish species recorded in Sg. Johor, 91 species (70%) were commercially exploited. Commercially valuable species such as *Lates calcarifer* (siakap), *Megalops cyprinoids* (bulan-bulan), *Lutjanus johni* (jenahak) and *Liza* spp. (belanak) were observed in the estuary as adults. At Kapar mangroves, Sarawak, about 30 species of fish and nine species of prawn have been obtained by using cast nets, which gives some idea of diversity. An interesting fishery is that for jellyfish, which are routinely harvested in the Rajang estuaries of Sarawak between February and June each year. They are brined and processed for export markets in Japan and Taiwan (Chong *et al*., 1990). In Lupar estuary, 100 species from 35 families were recorded base upon gill netting and market sampling. It is a large open estuary which opens gradually into estuarine coastal waters (Blaber, 1997). The dominant families are the Ariidae (5 species), Clupeidae (8 species), Engraulidae (10 species) and Sciaenidae (11 species).

Recent research by Nyanti *et al*. (2005) about fish fauna at the mangrove area in Paloh which is located at Lower Rajang River shows that it is an important fishing ground for the Melanau and Iban communities. The Melanau community normally fish along the

coast except during the monsoon season when they will fish in the *loba* (channels of the mangrove area). However, the Iban community fish in the *loba* all year around.

The fish of the Matang estuary and mangroves on the west coast of Malaysia has been well documented by Khoo (1989), Chong *et al*. (1990) and Sasekumar *et al*. (1994). A total of 117 species have been recorded with the most abundant families being the Sciaenidae, Engraulididae, Ambassidae, Clupeidae, Ariidae, and Leiognathidae. Approximately 15% of the species are estuarine residents with the majority being in the marine migrant category. The most abundant species in the mangrove channels are *Ambassis gymnocephalus, Anodontostoma chacunda, Arius venosus, A. maculatus, A. caelatus* and *Thryssa kamalensis*. Most of clupeids and engraulids were more abundant over the mudflats while near the estuarine *Johnius carouna, Ilisha melastoma* and *Stolephorus tri* were the most abundant species. Penaeid prawns are also abundant and an important commercial component of mangrove ecosystem in most tropical regions around the world.

4.5 Economic potential

Most fished stocks are exploited for economic gain. Even when fishers rely on fishing effort to get their own food, they usually sell catches as well as eat them. In developing countries with extensive coastline, fishing is the key contributor to national economic activity. In Malaysia, the fisheries sector plays an important role in providing fish as a source of food and protein. It contributes to national gross product (GDP), as a source of employment where the sector provides direct employment to 89,453 fishermen and 21,507 fish culturist. Statistically, the fisheries sector recorded an overall increase in production by 3.64 % and in value by 6.17 % in 2004 (Department of Fisheries, 2004).

5.0 MATERIALS AND METHOD

5.1 Study Site

5.1.1 Rambungan Mangrove Area

Rambungan mangrove area is located at the south western part of the Sarawak (fig 1). This studies were conducted at estuarine area along Batang Rambungan and its associated tributaries.

Figure 1: Location of Rambungan Mangrove area in relation to Sarawak.

5.1.2 Field samplings

Field samplings of the fish fauna at Rambungan mangrove area were carried out in October and December 2007 and March 2008. Fish fauna were sampled from five stations, namely S1 to S5 (fig 2). The coordinates for each location were determined using a Global Positioning System (GPS) (Table 1). These stations were selected to represent all the habitats found in the study area, which include the coastal areas (inshore waters), estuaries and rivers.

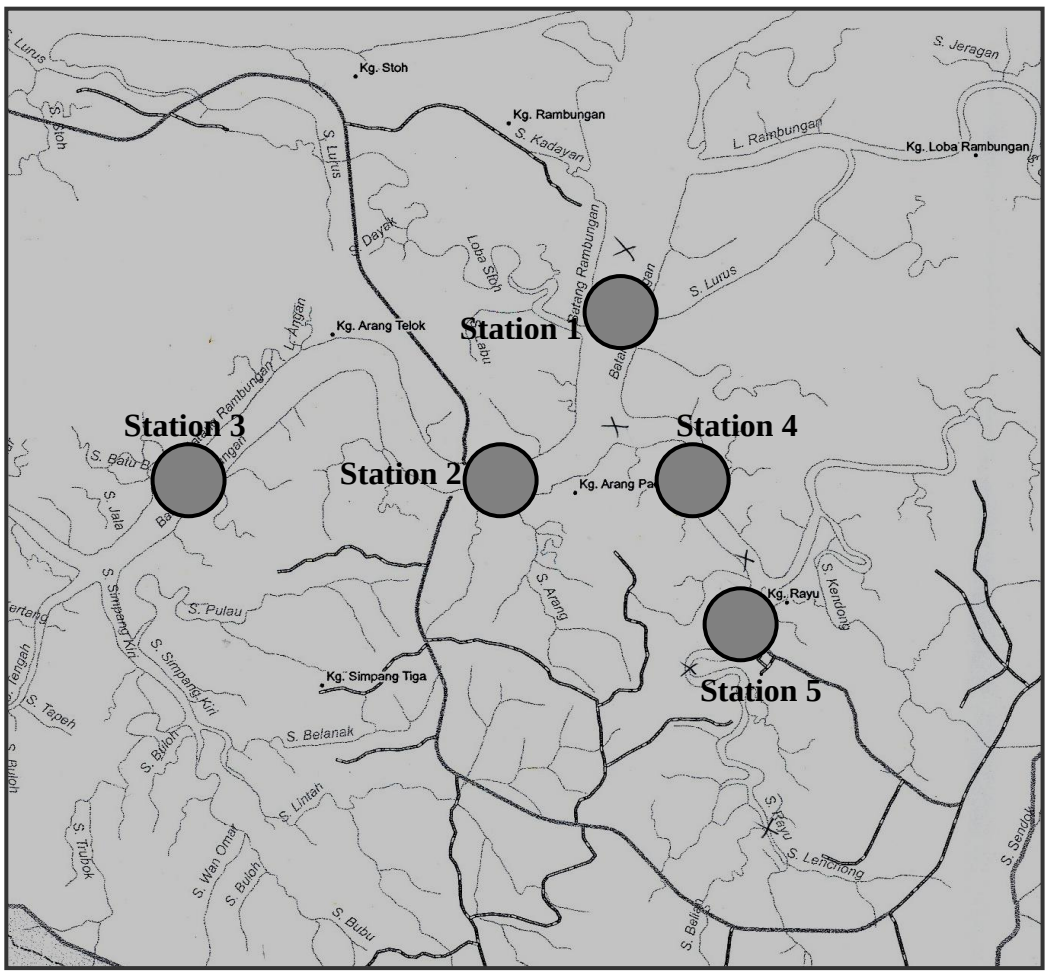

Figure 2: Sampling stations namely station 1 to station 5.

5.2 Sampling methods

Two types of fishing gear were used in this research, namely gill net and cast net. Each fishing method was employed in the same manner in all stations.

5.2.1 *Gill net*

Gill net of 30 m length and 4 m depth were used during the field sampling. Gill net was placed at each station overnight, with two different mesh sizes, 3.5 cm and 4 cm. The net were checked early the next morning.

5.2.2 *Cast net*

Cast net was used during low tide since it is used to sample fishes in shallow water. Ten throws of cast net were made at each station by the same person.

5.3 Sample preservation

All the samples obtained were placed in bottles and fixed using 10% formalin for 48 hours before being transferred to 70% ethanol for long-term preservation. Essential data such as the date of capture, location and station number were labeled on the bottles.

5.4 Sample identification

Fish species were identified based on their morphological characteristics either *in situ* or at the laboratory. At the lab, species were identified based on Kottelat *et al*. (1993), Palmer (1927) for crabs and Hall (1962) for prawn species. Only fishes that have reached market size were collected and identified.

5.5 Data measurement

Data on total length, standard length and weight of each individual fish caught was recorded. Total length is the measurement from tip of mouth to end of tail and the standard length was measured from the anteriormost point of the upper lip to the base of the median caudal rays to caudal peduncle (Kottelat *et al*., 1993). For crabs, the body weight and the carapace length were measured. All lengths were measured using a ruler and weights of the each sample were recorded by placing the sample on a portable electronic balance.

5.6 Catch Per Unit Effort

This data collection exercise involved interviewing the local people especially the fishermen. For gill net catches, the fish catch per unit effort (CPUE) was computed in terms of kg catch/hour.

5.7 Survey

Observation and survey on commercial fishermen samples were conducted. Interviews comprised an open-ended questionnaires (Appendix B) related to their socio-economic status, fishing season, fishing methods employed and mode of selling were carried out randomly on the local people and fishermen at Batang Rambungan.

6.0 RESULTS

6.1 River Characteristics

The characteristics and morphology of each station are described in Table 1. Generally, the condition of the waters at most of the stations is calm and slow moving except during rainy season, where the waters can be swift flowing. Rambungan has a large open estuary that opens gradually into South China Sea. The water temperature at the study area ranged from 30 °C to 32 °C (Noor'ain Jalim, 2008).

TABLE 1: The characteristics of each sampling station at the study area.

Station	Coordinates	Site	Method of Capture	Habitat Description
1	N 01º 40' 32.9'' E 110º 07' 46.6''	Sungai Muara Stoh	Gill net Cast net	Inshore waters of Rambungan, low tide, turbid water enclosed by mudflat and mangroves
2	N 01º 39' 50.8'' E 110º 07' 32.7''	Muara Sungai Arang Rambungan	Gill net Cast net	Low tide, turbid water, slow lotic system enclosed with mudflat and mangroves
3	N 01º 39' 49.0'' E 110º 06' 00.1''	Sg. Beradik Hulu	Gill net Cast net	Low tide, turbid water enclosed by mudflat and mangroves
4	N 10º 40' 01.6'' E 110º 08' 10.4''	Confluence of Sg. Rayu and Sg. Batang Air Rayu	Gill net Cast net	Turbid water, slow flowing, enclosed by mudflat and mangroves
5	N 01º 39' 15.4'' E 110º 08' 26.6''	Lubuk Cermin	Gill net Cast net	The trees along the river have wide and small branches that shade the riverside, slow flowing water

6.2 Catch Per Unit Effort (CPUE)

From the survey carried out in Rambungan, the fishermen spent 6 - 8 hours per day fishing. Thus the catch per unit effort is shown in Table 2:

TABLE 2: The weight of catch and CPUE of five fishermen.

Fishermen	Effort (hours)	Weight of Catch (kg)	CPUE (kg/hr)
Fishermen 1	6	25	4.2
Fishermen 2	8	30	3.8
Fishermen 3	7	23	3.3
Fishermen 4	9	30	3.3
Fishermen 5	6	20	3.3
Average	7.2 ± 1.3	25.6 ± 4.4	3.6 ± 0.4

Fishing time of five fishermen in Table 2 ranged from 6 to 8 hours per day. The weight of fish caught ranged from 20 kg to 30 kg per fishing trip and the CPUE ranged from 3.3 kg/hr to 4.2 kg/hr. The average quantity caught per fishing trip is 25.6 kg and the average CPUE is 3.6 kg/hr (Table 2).

6.3 Fisheries

The various fish species caught at different stations at Batang Rambungan according to habitat which consist of mangrove channels and inshore water are shown in Table 3. Majority of the families of fish and crustacean caught from the study are commercially important species that are mostly exploited by the local communities. The main commercial species found at Rambungan mangrove area is *Arius* spp., *Epinephalus* spp., *Siganus* spp., *Portunus pelagicus* and *Penaeus* spp.

Catfish, *Arius* spp was found in abundant at Batang Rambungan and was common in the catches of gillnet. Other fishes which were caught in small numbers include species from the families Engraulidae, Clupeidae, Leiognathidae, Mennipidae, Sciaenidae, Serranidae, Platycephalidae and Portunidae. All of these species are important source of protein to the villagers. The juveniles of two commercially important penaeid prawn species in Rambungan (*Penaeus merguiensis* and *Metapenaeus ensis*) were amongst the top species of crustaceans captured in the study, and both are significantly more abundant in the mangrove habitat. The fishermen usually used cast net to catch prawns, but unfortunately the juvenile fish will be caught together with the net. From the survey, it also showed that crab is one of the main sources of commercial species in Rambungan mangrove area. The main commercial crab species is *Scylla olivacea*, locally called *ketam bako.* This species is the favourite catch among the fishermen in Rambungan.

TABLE 3: List of fish species and the numbers caught from Rambungan mangrove area together with their category (M, marine migrant; E, estuarine species).

Family	**Species**	**Category**	**Number Caught**
Ariidae	*Arius* sp.	M	17
	Osteogeneiosus sp.	M	20
Clupeidae	*Anadontostoma chacunda*	M	8
Elopidae	*Megalops cyprinoids*	M	1
Engraulidae	*Coilia borneensis*	E	4
	Setipinna breviceps	E	7
Gobiidae	*Periophthalmodon schlosseri*	E	1
Apogonidae	*Apogon hyalosoma*	E	21
Leiognathidae	*Leiognathus equula*	M	3
Menippidae	*Myomenippe hardwicki*	E	3
Myliobatilidae	*Aetobatus narinari*	E	1
Platycephalidae	*Platycephalus indicus*	M	2