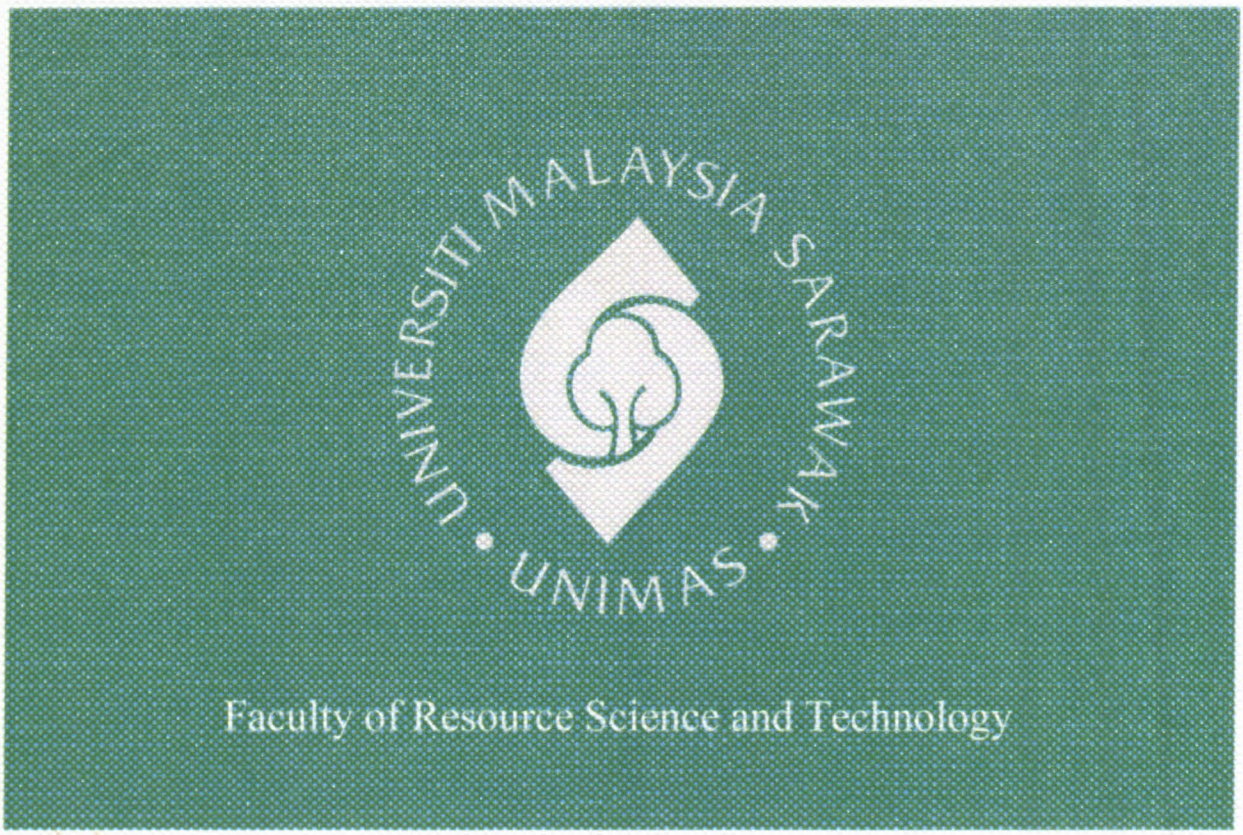

FISH COMMUNITY STRUCTURE AT COASTAL AND MANGROVE AREA OF LUNDU AND SEMATAN

Abdul Hakim Bin Mohd Sidek

Bachelor of Science with Honours
(Aquatic Resource Science and Management)
2015

Borang PTA4

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Laporan Projek Tahun Akhir (STF3015)

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Fish Community Structure of Coastal and Mangrove Area of Lundu and Sematan

Abdul Hakim Bin Mohd Sidek (35274)

This project is submitted in partial fulfilment of the requirements for the degree of
Bachelor of Science with Honours
(Aquatic Resource Science and Technology)

Aquatic Resources Science and Management
Department of Aquatic
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Universiti Malaysia Sarawak
2015

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DECLARATION

I hereby declare that no portion of this dissertion has been submitted in support of an application for another degree of qualification of this or any university or institution of higher learning.

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Department of Aquatic Science

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LIST OF ABBREVIATIONS

DO	Dissolved oxygen
SL	Standard length (cm)
TL	Total length (cm)
GPS	Global Positioning System
ppm	Parts per million
H'	Shannon-Weiner Diversity Index
D	Margalef Richness Index
J	Pielou Similarity Index

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Fish Community Structure of Coastal and Mangrove Area of Lundu and Sematan

Abdul Hakim Bin Mohd Sidek

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ABSTRACT:
This study was conducted to examine the current status of fish community structure and to record the water quality parameters at coastal area of Lundu and mangrove area of Sematan, Sarawak. Fish was collected using different types of fishing gears, which are monofilament gill net, three-layered gill net, beach seine net and cast net. A total of 795 individuals of fish were caught from all stations. Sciaenidae was recorded as a dominant fish family (22.52%), followed by the family Pristigastridae (10.94%), Engraulidae (8.43%), Leiognathidae (7.04%), Triacanthidae (6.92%), Scatophagidae (6.67%), Carangidae (6.29%), Ariidae (4.65%), Cynoglossidae (4.4%), Polynemidae (4.4%), Terapontidae (4.28%), Scombridae (2.64%), Gerreidae (2.52%), Synodontidae (2.39%), Charcharhinidae (1.51%), Mugilidae (1.26%), Muraenesocidae (0.63%), Hemiscyllidae (0.5%), Platycephalidae (0.5%), Belonidae (0.25%), Dasyatidae (0.25%), Drepaneidae (0.25%), Silaginidae (0.25%), Uranoscopidae (0.25%), Chirocentridae (0.13%) and Sphyreanidae (0.13%). Fish at the coastal area of Lundu was dominated by *Johnius belangerii* with 115 individuals caught. Meanwhile, fish at the mangrove area of Sematan was dominated by *Arius caelatus* with 8 individuals collected.

Keyword : Sarawak, mangroves, coastal, fish diversity, water quality

ABSTRAK:
Kajian ini dijalankan untuk menilai status semasa struktur ikan dan parameter kualiti air di kawasan pantai bagi daerah Lundu dan paya bakau bagi daerah Sematan, Sarawak. Sampel ikan ditangkap menggunakan alat tangkapan yang berbeza, iaitu jaring monofilamen, pukat tiga lapis, pukat pantai dan jala. 795 sampel ikan telah ditangkap dari semua stesen yang dipilih. Sciaenidae merupakan keluarga dominan (22.52%), diikuti oleh keluarga Pristigastridae (10.94%), Engraulidae (8.43%), Leiognathidae (7.04%), Triacanthidae (6.92%), Scatophagidae (6.67%), Carangidae (6.29%) , Ariidae (4.65%), Cynoglossidae (4.4%), Polynemidae (4.4%), Terapontidae (4.28%), Scombridae (2.64%), Gerreidae (2.52%), Synodontidae (2.39%), Charcharhinidae (1.51%), Mugilidae (1.26%), Muraenesocidae (0.63%), Hemiscyllidae (0.5%), Platycephalidae (0.5%), Belonidae (0.25%), Dasyatidae (0.25%), Drepaneidae (0.25%), Silaginidae (0.25%), Uranoscopidae (0.25 %), Chirocentridae (0.13%) dan Sphyreanidae (0.13%). Ikan di kawasan pantai Lundu dikuasai oleh *Johnius belangerii* dengan 115 individu ditangkap. Sementara itu, ikan di kawasan paya bakau Sematan dikuasai oleh *Arius caelatus* dengan 8 individu ditangkap.

Kata kunci: Sarawak, paya bakau, pantai, diversiti ikan, kualiti air

1.0 INTRODUCTION

Borneo is the world's third largest island which covered the land area of 743107 km^2 (Parenti & Lim, 2005). Thus, the geography of the Borneo is still less documented. Mangrove forest are highly productive and valuable ecosystem (Sasekumar, 1982).

Mangrove forest is usually is found at the mouth or the estuary of the river in tropical and sub-tropical coastal regions (Nyanti *et al.*, 2012). The coverage of mangrove forest in Sarawak approximately 174000 hectares and occupies about 60% of the 740 km length of its coastline. In Sarawak, mangrove forest is located along the sheltered coastline and estuaries bays of Kuching Division, Sri Aman Division, Rajang Delta and Limbang Division (Chai, 1982). The mangrove forest known as the important detritus contributor for the ecosystem food webs which given many advantages for the estuarine and near shore fisheries (Nyanti *et al.*, 2012). Thus, a lot species of fish use the mangrove areas to breed and act as their nursery ground especially the juvenile stages including exclusively found in that habitat (Robertson & Duke, 1987).

The Sarawak coastline is 1050 km long which is located in a south-west to the north-east direction (Edwards *et al.*, 1986). Basically, any area of coastal zone existed in the state recorded for the highest population density. It is one of the national asset that is very valuable which known as the most bio-productive area for marine and the associated life, fish and wildlife (Sharifah Mastura, 1992). Coastal area also serves as gateways for the world commerce and inland trade, port facilities, industry, oil wells and power plants. Coastal zone has a valuable aesthetical value which serve as an attractive residential, commercial and recreational areas. It has a continental shelf which covered the area of 125000 km^2 (Garces *et al.*, 2003). In fact, the marine waters in both mangrove forest and coastline area were influenced by the monsoon patterns.

The study on diversity and distribution of fish fauna are often used as an indicator for environmental and fisheries management as it provide a great value of information that relate to the fish distribution in responds to the quality of the environment. The study of fish distribution that relate to the environmental including Parenti and Lim (2005) at Rajang Basin, freshwater fauna of Sarawak and Brunei by Kottelat and Lim (1995) and Nyanti *et al.* (2012) at Lutong river. However, there is still minor of fish fauna publication in Sarawak waters especially at coastal and mangrove area of Lundu and Sematan and surrounding areas.

1.1 OBJECTIVES

1. To evaluate the current status of fish community structure at the coastal area and mangrove area of Lundu and Sematan, Sarawak.
2. To record the water quality parameters at selected stations of coastal area and mangrove area of Lundu and Sematan, Sarawak.

2.0 LITERATURE REVIEW

2.1 Diversity and fish composition in mangrove area

The mangrove forest of Sarawak have been traditionally an important resource for the coastal communities (Nyanti *et al.*, 2012). The demanding for mangrove resources has been rapidly increase especially for the conversion into sites for human settlement, industries, agriculture and aquaculture for shrimp and fish culture (Bennett & Reynolds, 1993). In fact, the study area of Lutong River, Miri, and the Semariang mangrove, Kuching, Sarawak have a similar geography with the present study location.

Nyanti *et al.* (2012) conducted a study of fish composition in Lutong River, Miri, Sarawak. Among the 23 families of fishes encountered, two major families of fishes, the Ambassidae and Penaeidae represent the most diverse families. As in fishes encountered in a mangrove area of Lutong River in Miri, it was observed that the family Ambassidae was more abundance than the Penaeidae with 171 individual caught compared to the 66 individual caught of penaeids. Overall, the three least diverse families are Megalopidae, Scatophagidae and Centropomidae with 24, 17 and 12 number of species caught respectively.

However, two major families of fishes in Semariang mangrove area in Kuching represent the Mugilidae and Leiognathidae as a dominant family (Nyanti *et al.*, 2012). Both families has same total number of individual caught with the total number of 36 individual. The three least diverse families are Ariidae, Lutjanidae and Plotosidae with 20, 18 and 13 number of individual caught respectively.

2.2 Current status of coastal marine fishes in Malaysia

According to Mazlan *et al.* (2005), the total number of fish species in Malaysian waters is 1500 species. However, Mohsin and Ambak (1996) found a total up of 710 species which listed two classes of Elasmobranchii and Teleostei. Mansor *et al.* (1998) reported that a total number of 358 species of commercially important marine fishes in the South China Sea. In addition, Chin (1998) has listed a total number of 376 species of marine fishes indicating the dominant groups of food fishes which commonly found in Sabah Malaysia with the excepting of Elasmobranchii class.

The total number of fish species studied by Tan (1978) indicated more species diversity in coastal and estuarine area of Peninsular Malaysia east coast. Great numbers of fish species were found including family Engraulidae, Hemirhamphidae, Mugilidae, Gerreidae and Leiognathidae in Tioman Island. Apart from Tioman Island, study by Tan (1978) also was conducted at Sedili Kecil and Teluk Mahkota in Johor. Dominant species caught includes families of carangids, sciaenids and scomberomorids which caught using beach seine net. In addition, study also was conducted at the beach area near Tanjung Gelang, Pahang. In term of species dominant caught, families Engraulidae, Leiognathidae and commercial juvenile stages of Mugilidae, *Caranx* sp., *Chorinemus lysan*, *Scomberomorus* sp. and penaeid prawns also were caught. The same study by Tan (1978) of fish fauna also was done at Cherating river and Ular river estuaries in Pahang. Common species caught in the estuaries includes *Ambassis* sp.. *Leiognathus* sp. and *Gerres* sp. However, there were no present family of carangids, scomberomorids and penaeid prawn while study being conducted.

2.3 Importance of coastal and mangrove ecosystem to fisheries

According to Sasekumar (1982), the mangrove area is well known for its great productivity and value. Thus, the fisheries sector always got a benefit from the contribution of fish resources. This is because many species of aquatic life made a mangrove area as their breeding, nursery and feeding ground basically during the juvenile stage (Chong *et al.*, 1990). Most of the juvenile stages were well-known for its exclusively found in mangrove area which is commercially important species to the fisheries sector. The fish juvenile generally choose the mangrove as their protection from the predator and abundance of food resources (Baldo & Drake, 2002) shown the common fish species found in most mangrove areas are glass fish (*Ambassis gymnocephalus*), tenpounder (*Elops machnata*), ponyfish (*Leiognathus equulus*) and thornfish (*Terapon jarbua*).

Coastal area is defined as an area which the sea and the land meet. According to Hail (1980), coastal zone is defined as an area of variable width which extends seaward to the edge of the continental shelf, but which no distinct landward demarcation. The meaning of coastal zone are varies and flexible. Eventhough it is flexible, the management of the coastal zone is very important as they also well known for the contribution of many species of marine fishes. The coastline of Sarawak waters is about 1050 km (Edwards *et al.*, 1986). The common fish species found in most coastal areas are Talang queenfish (*Scomberoides commersonnianus*), barracuda (*Sphyraena barracuda*), and greenback mullet (*Liza subviridis*).

2.4 Physico-chemical water quality

Salinity is one of the parameter to study the water quality. Basically, marine water organism can tolerate in salinity up to 40000 ppm. According to Eaton *et al.* (1995), salinity was studied to measure the dissolved salts in a given mass of solution. It is very important to study about the salinity as it may affect the fish composition.

pH is frequently used test in water quality study. The pH scale is ranging between 1 which indicate as the most acidic water condition to 14 which indicate as the most alkaline water condition. The extreme pH also may affect the fish life cycle which leading to mortality. At acidic pH, death can occurs due to respiratory and osmoregulatory failure as acid water increase the permeability of fish gills to water thus affecting gill function (Lopes & Silva, 2001). pH also known indicator for the reproduction and growth of aquatic species. According to Boyd (1982), reproduction and growth of aquatic species will be less if the periods constantly extended at a pH of less than 6.5 or exceeding 9.0. This is because each species of fish has different tolerance towards its normal water pH.

Turbidity is study to measure the scattering of light by the refractive properties of the material suspended (Tchobanaglous & Schoeder, 1985). Greater turbidity can affect the aquatic life by reducing the penetration of light. The food sources for aquatic life such as periphyton and algae are directly impacted from the reducing of light penetration. According to MacDonald *et al.* (1991), the reducing of food sources can affect the macroinvertebrate community which may affect the fish population. It also can restrict the fish respiration by blocking the gills (Dunlop *et al.*, 2005). Eventhough the sediment can be remove away from the gills by the action of expelling water in reverse direction, it consumed greater energy reserves thus resulting to ultimate death if it is extended.

Dissolved oxygen (DO) is one of the important factors in aquatic ecosystem. According to Rand *et al.* (1995), DO is vital for respiration process to occur and involve in

regulating metabolic processes and other physiological processes. Basically, DO concentration will be reduced by eutrophication process (von Westernhagen & Dethlefsen, 1983). Aquatic life needs sufficient DO to survive. The recommend minimum DO for cold water fish is 6.0 mg/L, for tropical freshwater fish is 5.0 mg/L and for tropical marine fish is 5.0 mg/L (Mallay, 2007). It is important to grow, repairing of body tissue and reproduction. Most of fish cannot survive at DO below 3.0 mg/L (Svobodova *et al.*, 1993). The falling of dissolved oxygen by 1.5 mg/L to 2.0 mg/L also will indicates the unusual sign to the fish life cycle. Murphy (2007) stated that the ideal dissolved oxygen for many fish is between 7.0 mg/L to 9.0 mg/L.

2.5 Coastal development

Coastal zone was an unique zone. In fact, this bio-productive region should be preserve to maintain the resource ecosystem. Coastal area has been known as an important national assets which provide many benefits towards either the human or to the environment itself. As the example, this area provide a commercial and international trade to the country as well as contribute many habitat for marine species development (Hanim Kamarudin, 1998).

However, the poor planned coastal development has bring a damage to the coastal area. Obviously, urban and agriculture development contribute a major usage of coastal land conversion (Darus, 1994). Impact of the poor-managed development depend on the project scale itself. These includes water quality degradation, coastal erosion, flooding as well as the habitat loss for marine species as the effect of large scale of conversion. A mitigating measures should be taken to prevent the problem from widespread thus worsen the issues. According to Cicin-Sain *et al.* (1998), proposal of coastal development must be submit to the National Coastal Erosion Control Council (NCECC) for approval before

proceed to Coastal Engineering Technical Center (CETC). In fact, the coastal development can be monitored properly thus can prevent the widespread issues. However, this action has not achieved its aims as the lack of integration and coordination (Ahmad, 2001).

2.6 Overfishing

Overfishing is defined as the rapid caught of fish than they were reproduce (Giuliani *et al.*, 2004). In fact, this issue was a worldwide problem in fishing industries. An excessive fishing effort may contribute to overfishing neither from the fishing fleets nor the small-scale fishers which has an open access to the water zone with exceed overcapacity than it should.

In addition, by-catch also were include into overfishing. This issue happened as the usage of smaller mesh sizes thus the non-target species also will be includes instead of target species. In some cases of catch, they will kept the unwanted fish for markets (Giuliani *et al.*, 2004). However, most of the fishermen will dumped back into the water due to the less commercial value. According to Food and Agriculture Organization (FAO) (2004), 47% of world's marine fish stocks were fully exploited compared to 18% which were overexploited. The statistics may changes from time to time as the invention of technology getting advanced thus may worsen the issues of overfishing. More advance technology such as trawlers that may reach 170 metres and Global Positioning System (GPS) facilitate the fishing effort, thus more fish will be caught. The dragging of trawler by the water body may harmful the habitat of aquatic species as well as decrease the abundance of fish. The effect includes declines of economic, tourism and food security sector (United Nations Environment Programme, n. d.).

2.7 Illegal fishing method

Illegal fishing method is one of the common issue in fishery industries as well as overfishing. The methods used were destructive especially towards the habitat of the fish species. These method includes bottom trawling, bomb fishing and cyanide fishing (UNEP, n. d.). As the examples is bottom trawling in Gulf of California which damaged the habitat of bethic communities. Bomb fishing or blast fishing were well-known method used for centuries (Giuliani *et al.*, 2004). In fact, this method used a fertilizer and sugar as the explosive component. Instead of target species, bomb fishing also damage the ecosystem without indiscriminate. This method is possibly spreading thus it is very dangerous towards the abundance of fish species. Cyanide fishing also known as a type of destructive methods. Basically, this method use a cyanide or bleach to kill or faint the target species located on coral reef in limited of time (UNEP, n. d.). In fact, the fish species of highly value catch dominantly sold to the restaurant or ornamental fishery.

3.0 MATERIAL AND METHODS

3.1 Study site

The study area located in two mainly area of Sarawak namely Lundu and Sematan (Figure 2). Fish samples and physicochemical water quality data was collected from several stations within the area. Lundu is located in the Northwest part of Kuching Division of Sarawak, Malaysia (1° 40' N 109° 50' E). Geographicaly, it is bordered by the Indonesian Province of West Kalimantan. On the east part of this town is Batang Kayan (Kayan River) which is the main river presence geographically. Lundu also did not far from the South China Sea.

Sematan is located in the West Northwest part of Kuching Division of Sarawak, Malaysia (1° 48′ N 109° 46′ E). Generally, Sematan is known as a Malay fisherman village which has well-looking beaches on those area. Both areas were selected as it represent of overall habitat and the accessibility during the study period.

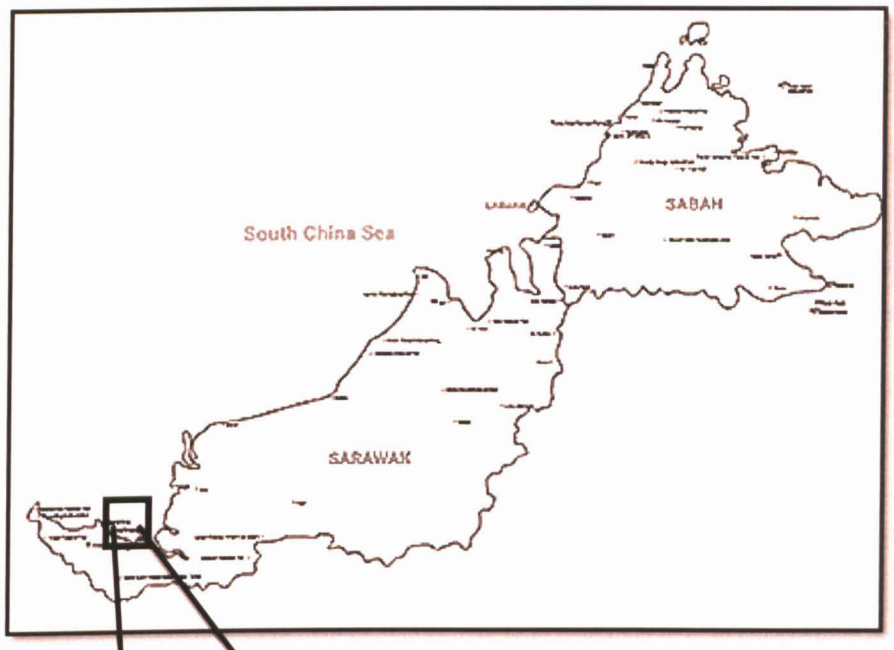

Figure 1. Map of Sarawak, Malaysia.

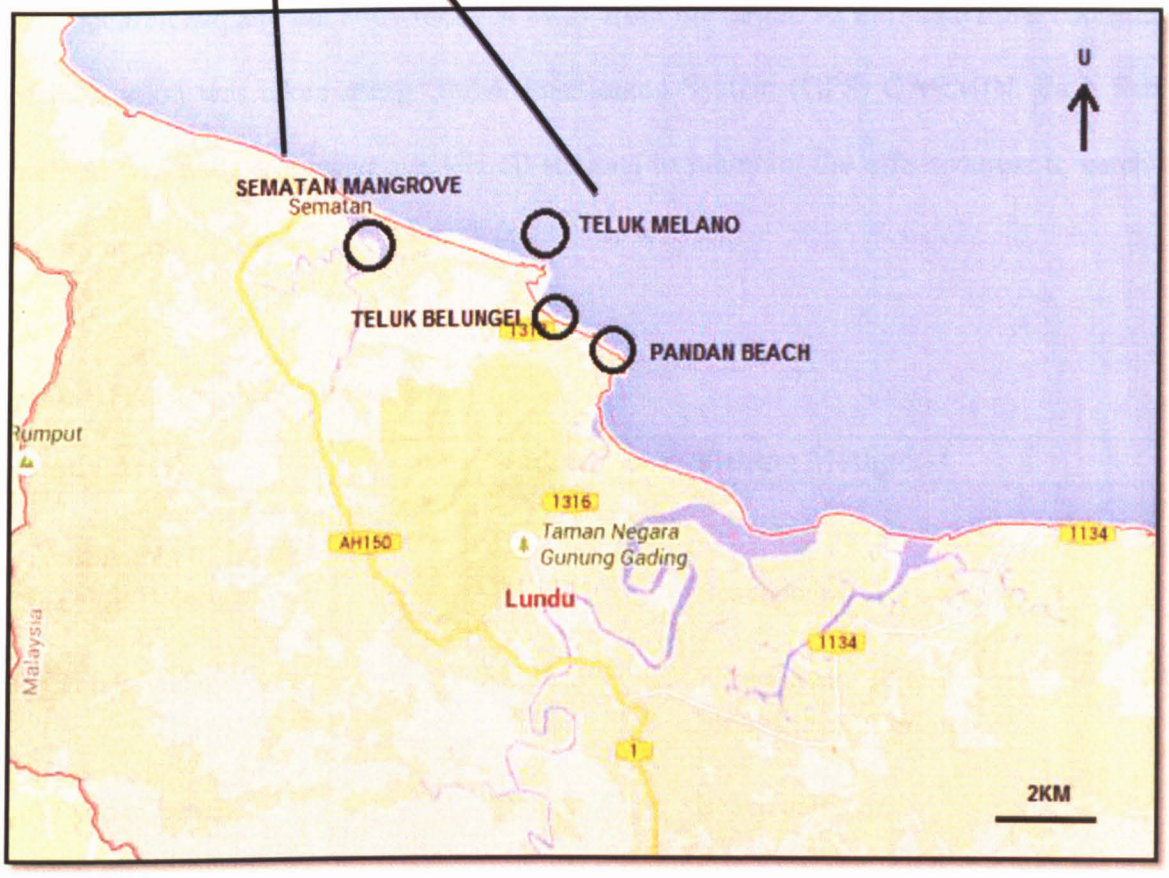

Figure 2. Location of study sites in Kuching Division of Sarawak, Malaysia.