Species Composition and Diversity of Fishes in The South china Sea, Area II: Sarawak, Sabah and Brunei Darussalam Waters

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ABSTRACT

The collaborative research on species composition and diversity of fishes in the Sabah and Sarawak waters was carried out by using otter-board trawling, through K.K. Manchong, including taxonomic survey for commercial coastal fishes landed in the markets of Sarikei, Bintulu, Miri, Labuan and Kota Kinabalu. Totally 518 species from 24 orders and 108 families were obtained. Hundred and three economic species were obtained from trawling survey and 106 species from the markets. The station point at St. 33 and 48 is the highest species richness, 69 and 70 species found. The highest CPUE were obtained at St. 44 and 48 (196 and 144 kg). Demersal species form main composition of the catchs with the 9 dominant economic species. This trawling survey obtained few amount of 37 pelagic species. This survey also found the third record of *Hapalogenys analis* and *Pomadasys auritus* from the Southeast Asian waters.

Key words: Species composition, Diversity, Fishes, Sabah and Sarawak waters.

Introduction

This collaborative surveys of fisheries and oceanography in the South China Sea; subject of fish diversity and species compositions in the Sabah and Sarawak waters was conduct during 1996-1997 through the orgasnizing by SEAFDEC/TD, DOF Thailand, and MFRDMD, DOF Malaysia. The objective of these surveys are; to update the status of fish diversity and stock of economic species in the Area II (see Map 1,2).

The fishery resource in the Sabah and Sarawak waters has been investigated since 1968 by Exploratory Fishery Division, DOF, Thailand (Exploratory Fishery Division, 1968, 1969, 1970 and 1972); Bejie & Gambang, (1981) and by Pheng (1985). Since then, this survey is the joint surveys with SEAFDEC, the Department of Fisheries of Thailand and Malaysia launced along the Sarawak and Sabah coast. Previously, several report on fish diversity in many areas of this region and adjacent areas, several ichthyological surveys and fieldguide for species was done by Fisher & Whitehead (1974) for the first FAO Species Identification Sheets; Rau & Rau (1980) for commercial fishes and La Paz & Interior (1979) report some deep sea species of the Philippines; Randall *et al*. (1997) for Ogasawara Islands waters; Chen (1993) for Taiwanese waters, and Kuiter & Debelius (1994), Debelius (1993), Allen (1997) for the Southeast Asian reef fishes; Randall, *et al.* (1997) for species found in the Great Barrier Reef and Coral Sea; and Mohsin & Ambak (1996) and Mansor *et al.*(1998) for the Malaysian waters.

Materials and Methods

Cruising and survey methods.

1. The survey for species diversity of the South China Sea fishes in the Area II, was carried out in the Sabah and Sarawak waters. Two cruises were conducted, during 9 July-5 August, 1996 and 25 April-30 May 1997, by the K.K. Manchong. The modified high opening otter-board bottom trawlnets was applied in these surveys, each station was done 1 hour trawling. Both cruise selected 15 and 18 station points of 79 oceanographic stations for trawling surveys (see Map 1,2).

2. During the Port of Call periods Sarawak River, Sarikei, Bintulu, Labuan and Kota Kinabalu,

additional survey for species that was fished from coastal waters of the Area, through purchasing and collecting from the fishing piers and markets.

3. Hand-lines surveys was done at the Station 35-45 and also dip netting, including sighting observation also applied for some occurrence of large species.

Collecting, recording and specimens handling.

1. Any species that was not obtained in the Area I (Gulf of Thailand and eastern Malay Peninsula) were recorded and collected for species representative. Each species representative was collected covering their sizes, sex and varieties. Some huge and uneffordable specimens was photo recorded or partially collected its important part e.g. shark and ray.

2. The representative species were photographed, by Ektachrome slides. Each specimens was treated in the same methods that applied in the Area I, both photographing and preservation.

3. All representative specimens in these survey have been deposited in the Museum and Aquarium Division, Dept. of Fisheries, Bangkok, Thailand.

Identification and classifications.

The classifications in this systematic account was based on Nelson (1994) for bony fishes and Compagno (1984), Last and Stevens (1994) for elasmobranches. The identifications of each family followed to several updated or previous references indicated in the result.

Results

Catching result

1. In the Cruise I, result of CPUE is ranged from 3.5-196 kg/hr, composed with commercial fishes 31.48-90.11 % (see Tab. 2.1). The Station (St) 44 is the highest CPUE obtained, 196 kg with 61.02 % of commercial fishes but the St 35 is lowest, 3.5 kg with 51.42 % of commercial fish. Although the fishes percentage of St 17 is the highest, but its CPUE is low, 17 kg obtained whereas the St 7 is high CPUE but % of commercial fishes is relatively low, 31.38.

2. In the Cruise II; the St. 48 was obtained the highest amout of commercial fishes, 144 kg but mainly *Ariomma indica* (92 kg). At the St. 16, only 4.7 kg fishes was obtained. At the St. 14 is failed in fish hauling, due to rough sea and net deforming (see Tab. 2.2).

3. The Cruise II, obtained commercial fishes 925.9 kg approximately, including 59 species but any species which was obtained less than 0.5 kg in any Station is omitted in the Table 3.

The first five ranked from this Cruise are *Ariomma indica*, *Priacanthus macracanthhus*, *Saurida undosquamis*, *Upeneus moluccensis* and *P. tayenus* (113.2, 54.8, 49, 48.8 and 38.3 kg, respectively). And the small squid *Loligo duvoucelli* is the dominant shellfish that obtained from every stations, 53.6 kg.

Diversity

1. In the Cruise I trawling survey, we obtained 359 species of 87 families. The highest species diversity was obtained in the St. 33 (69 species) following by St. 34, 44 (60, 56 species respectively). The bigeye *Priacanthus macracanthus* is the most abundant, occured in 14 station points and then *Saurida undosquamis, S. micropectoralis, Parupeneus cinabarinus, Gymnocranius griseus, Fistularia petimba, Pentaprion longimanus, Seriolina nigrofasciata* and *Abalistes stellatus*. The economic species survey in the markets in this cruise found 90 species.

2. The Cruise II, we obtained 454 species of 88 families from trawling survey and 97 species from the markets. The St. 48 is the highest diversity, 70 species found follow by St. 76, 31-32 and 15 (54, 55 and 53 species respectively). Saurida undosquamis is te most abundant, occured in 16 station points and follow by *Abalistes stellatus, Synodus hoshinonis, Fistularia petimba, Pentaprion longimanus, Priacanthus macracanthus, Seriolina nigrofasciata, Parupeneus cinabarinus* and *Nemipterus nemurus*.

At least 24 orders, 108 families and 523 species including 103 economic species were trawled and 160 species were collected in the markets (see checklist below: **m**). There systematic account with brief notice and checklist of all species obtained is provided below (see Appendix 1,2).

Thirty seven species (see checklist below: HL) were obtained by handline fishing around the Station 35-45, off Miri, 7 species are commonly obtained, there are; *Lutjanus malabaricus, Gymnocranius griseus, Cephalopholis miniatus, C. sonnerati, Diagramma pictum, Lethrinus lentjan and Arius bilineatus*. At the Sarawak River, we obtained 4 estuarine species by handlines; catfishes, *Arius maculatus, A. caelatus;* eel *Uropterygius* sp. and puffer, *Xenopterus naritus*.

Mainly coastal and estuarine fishes occured at the markets of Sarikei, Miri and Bintulu, taken by small scale fishing; trawl nets, gill nets and seins. At the Labuan and Kota Kinabalu markets, most of commercial species come from coral reefs through traps, gillnets, handlines and some species from offshore trawlings.

Systematic Account

Elasmobranchs

Twenty eight species of 11 families and 6 orders were obtained. From the Area I, in this survey 13 species were collected previously. References: Compagno (1984 a, b and pers. comm., 1997); Michael (1993) and Last & Stevens (1994). At least 13 orders, 49 families, 240 species known to the South China Sea and adjacent areas, mainly from coastal habitats (Compagno pers. comm., 1997).

Order Orectolobiformes

Family Hemiscyllidae; Two species obtained from trawling survey, *Chiloscyllium griseum* and *C. plagiosum*.

Order Heterodontiformes

Family Heterodontidae; Only one species *Heterodontus zebra* taken from the Stations 7, 14, 19 and 69.

Order Carcharhiniformes

Family Triakidae; Three species were taken from trawling in the deeper areas, *Mustelus griseus* and two species of *Mustelus* sp. and *Hemitrakis* sp. are unknown.

Family Carcharhinidae; Six species found from trawling survey in a few individuals and *Carcharhinus hemiodon* is commonly sold in the markets of Miri to Kota Kinabalu.

Family Sphyrenidae; Four species occur in the Areas, two were taken from trawl survey *Sphyrna mokarran* and *M. leweni.*

Order Torpediniformes

Family Narcinidae; Two species taken, one specimens of *Narcine prodorsalis* was taken from the St. 6, *N. maculata* is very common.

Order Rajiformes

Family Rajidae; two species, an unkhown *Raja* (*Okamejei*) sp. and *O. boesemani* and taken from trawl in lower 70 m depth.

Order Myliobatiformes

Family Dasyatidae; Up to 30 species known from the South China Sea, 6 of them were taken and same as the species taken in the Area I.

Three species from 3 families more were taken from trawling and markets, there are *Aetomyleus nichoffi* (**Myliobatidae**), *Rhinoptera javanica* (**Rhinopteridae**) and *Gymnura poecilura* (**Gymnuridae**). *Mobula taracapana* (**Mobulidae**) was sigthed around the St. 35.

Bony fishes

In this survey, 18 orders, 96 families and 495 species were obtained. The most diverse family found in this survey are Carangidae, 40 species, Serranidae, 30 species and Nemipteridae, 26 species. The families indicated below are selected from the important or noticeable ones. Previously, 45 orders, 228 families and more 2500 species of bony fish known to the South China Sea.

Order Anguilliformes

Family Muraenidae

More than 30 species known from the South China Sea, seven species found including *Uropterygius* sp. taken from handline in the Sarawak River (Kuching).

Family Synaphobranchidae; only *Meadia abyssalis* was taken from the St. 34 (71 m depth); Ref. Masuda *et al*. (1984).

Family Muraenesocidae

Castle (1984) reviewed the species found in Western Indian Ocean, three species found in this survey.

Order Clupeiformes

Mainly inhabit pelagic and coastal, occasionally obtained by trawling but mainly caught by purse sein nets, most species are economic important. References: Whitehead (1985) and Whitehead, *et al.* (1988).

Family Clupeidae; 7 species of 5 genera found, mainly from trawling in small amount. *Tenualosa toli* is commonly found in the Bintulu market.

Family Engraulididae; 11species from 6 genera found. Five species of 2 genera, *Stolephorus* and *Encrasicholina* taken from trawling. Six coastal species were taken from the markets of Sarikei and Bintulu.

Order Ophiiformes

Family Ophiidae; 3 species found from trawling survey including an unknown species of *Sirembo*. References; Gloerfelt-Tarp & Kailola (1984) and Allen (1997).

A single specimens of *Carapus* sp. (**Carapidae**) symbiont with a cardiid bivalve was taken at the St. 31.

Order Siluriformes (Reference: Gomon, 1983; Jayaram, 1983)

Family Ariidae; 4 species of *Arius* found in the coastal area from trawling, the rest 3 species; *A. nella, A. venosus* and *Osteogeneiosus militaris* obtained from the markets of Sarikei and by handlines.

Order Osmeriformes; one species of *Glossanodon* sp. (**Argentinidae**) was taken from St. 35 (85-90 m depth).

Order Zeiformes; *Antigonia capros* (**Caproidae**) found at 87 m depth of the St. 46.

Order Beloniformes

Family Exocoetidae; 3 species of flyingfishes genus *Cypselurus* were taken by dip net and accidentally stranded on the deck of M.V. SEAFDEC.

Order Gasterosteiformes; Known from the South China Sea 8 families, more than 40 genrara and 150 species. This survey obtained 5 families 7 species including; *Solenostomus paradoxus* (**Solenostomidae**) from the St. 1. Three species of the **Centrisidae**, *Centriscus* sp., *C. scutatus* and *Aeoliscus* sp. from the shallow area, a single specimens of *Pegasus laternarius* (**Pegasidae**, Palsson & Pietsch,1989).

Family Fistulariidae; 2 species were commonly taken from trawling survey almost of the station points. *Fistularia petimba* and *F. commersoni* are similar species and always confused in identification. Reference; Fritzsche (1976).

Order Lophiiformes

Three species of *Lophiomus* (**Lophiidae**) taken from the St. 19-48. *Antennarius dorehensis* and *A. striatus* (**Antennaridae**) were obtained from the St. 76, including *Chaunax* sp. (**Chaunacidae**).

The **Ogcocephalidae** was taken 3 species of the genus *Halieutaea* (reference; Gloefelt-Tarp & Kailola, 1984 and Chen, 1993).

Order Scorpaeniformes

Family Scorpaenidae; Over 15 genera and 40 species known in this region, 10 species of 8 genera found from trawling suvey (References; Eschmeyer, et al., 1979a,b; Gloefelt-Tarp & Kailola, 1984; Masuda *et al*., 1984; Randall, 1995; Allen, 1997 and Randall *et al*. 1997).

Family Triglidae; 4 species of 3 genera found from below 5o m depth, *Lepidotrigla spiloptera* is the common species whereas two species of *Pterygotrigla* and *Satyrichthys rieffeli* are rarely found from below 90 m. References; Chen (1993) and Randall (1995).

Family Platycephalidae

More than 60 species of 19 genera known from Indo-Pacific, 9 species of 8 genera found mainly from trawling (references: Wongratana, 1975; Gloefelt-Tarp & Kailola, 1984 and Randall, 1995).

Order Perciformes

Family Priacanthidae; 13 species of 4 genera occur in the Area**,** 4 species found. *Priacanthus macracanthus* is commonly occurs below 50 m depth with uncommon species*, P. sagittarius* and *Pristigenys niphonia.*

Family Callionymidae; 6 species of 5 genera taken from trawling, including *Bathycallionemus* sp. References; Gloefelt-Tarp & Kailola (1984) and Masuda *et al*. (1984).

Family Serranidae; totally 30 species of 7 genera found in this survey, 10 species were trawled, including 11 species from handlines and 13 from the markets of Labuan and Kota Kinabalu. *Pseudanthius marcia* which known only from the western Indian Ocean is previously found at the St. 76 including *Pseudanthius* spp. and *Plectanthius* sp. (references: Masuda *et al*., 1984; Randall & Hoese, 1986; Randall & Heemstra, 1991; Heemstra & Randall, 1993, Randall, 1995 and Randall et al., 1997).

Family Apogonidae; About 100 species from 20 genera known from the South China Sea, 16 species found (references; Gloefelt-Tarp & Kailola, 1984; Masuda *et al*., 1984; Fraser & Lachner, 1985; Kuiter, 1992; Allen & Swainston, 1993 and Randall, 1995).

Family Carangidae; Seventeen genera and about 70 species known from Indo-Pacific, 40species of 14 genera found. Twenty-four species taken by trawling, including 5 from handlines and 11 from the markets of Labuan, Kota Kinabalu. References: Gushiken, 1983; Smith-Vaniz, 1984 and Randall (1995).

Family Leiognathidae; Known only from the Indo-Pacific region; 3 genera and about 24 species, 14 species found mostly from trawling (references: Kulmorgan-Hille, 1968; Premcharoen, 1993 and Randall, 1995).

Family Lutjanidae; At least 30 species, 8 genera known in the Indo-Pacific (Allen, 1985 and Allen & Talbot, 1985), 23 species of 4 genera found, mainly *Lutjanus* (17 species). *Symphorus nematophorus* and 3 species of *Pristipomoides* was taken from trawling and handlines. Eigth species including *Symphorichthys spilurus, Etelis cabunculus* found in the Labuan and Kota Kinabalu markets.

Family Caesionidae; consists of 4 genera and 20 species, more than 14 species occurs in the

South China Sea and adjacent areas. Five species found, *Pterocaesio chrysozona, Dipterygonotus balteatus* are commonly obtained as trashfish from trawling, 3 species of *Caesio* are commercial fishes of the Labuan and Kota Kinabalu markets (reference; Carpenter, 1987 and 1988).

Family Haemulidae; over 25 species, 10 genera known from the Indo-Pacific, 10 species of 4 genera found. *Hapalogenys analis* from the St. 7 is the third records from the Southeast Asia since Wongratana (1982) and Lim (1994). *Pomadasys auritus* is recently known from Sarawak waters, frequently sold in Kota Kinabalu market, the species was previously known from a single holotype and other one specimens obtained from the Indian Ocean (T. Wongratana perse. comm., 1997). Five species were obtained by trawling, *Diagramma pictum* is a common fish.

Family Nemipteridae; totally, 5 genera and 64 species were recognized, 26 species of 4 genera were found, 13 species of *Nemipterus* and 3 of *Parascolopsis* obtained mainly from trawling. *Scolopsis* and *Pentapodus* (7 species) are coral reef fishes, commonly found in the Labuan market. References: Russell (1990, 1991 and 1993).

Family Lethrinidae; Carpenter & Allen (1989) revised and regcognized 39 species of Indo-Pacific, 8 species of 2 genera obtained through trawling and handlines.

Family Sciaenidae; 8 species of 6 genera found, 5 from trawling and the rest from the Sarikei to Bintulu markets (references; Trevawas, 1977; Lal Mohan, 1983 and Sirimontraphorn, 1987).

Family Mullidae; over 20 species known in the Indo-West Pacific, 15 species found. Seven species of *Upeneus* are considered as trashfish of trawling, *U. asymmetricus* is the most common. *Parupeneus cinnabarinus* is only species of the genus was obtain by trawling, whereas the other 6 species found in the markets. (references: Gloefelt-Tarp & Kailola, 1984; Allen & Swainston, 1993; De Bruin *et al*., 1994 and Allen, 1997).

Family Labridae; estimated 500 species of 60 genera known from the Indo-Pacific. Six species of 3 genera were obtained from trawling, including 3 unknown *Halichoeres* and *Choerodon robustus* from 100 depth of St. 76, and 7 species of 4 genera found in the Labuan and Kota Kinabalu markets. Totally 13 species found.

Family Chaetodontidae; 3 species found from trawling in a few specimens (references: Chen, 1993; and Randall *et al*., 1997).

Family Pomacentridae; estimated 150 species found in the South China Sea, mostly coral reef inhabitant. Five species found, *Pristotis jerdoni* is commonly obtained from trawling, but a single specimens of *Chromis mirationis* was found in the St. 76 (100 depth).

Family Siganidae; Woodland (1990) reviewed the family, recognized 27 species; this survey obtained 6 species. *Siganus canaliculatus* is the most common trawled species, the others were obtained from the Labuan market.

Family Scombridae; over 25 species known from the South China Sea; 10 species, 5 genera found. Four species were obtained fron trawling, *Scomberomorus lineolatus* was found in the Bintulu market, 5 species of tunas and bonitos are commonly sold along the fish markets. Collette & Nuaen (1983) reviewed the family.

Family Acanthuridae; 4 species found from the Labuan and Kota Kinabalu markets.

Family Trichiuridae; Nakamura & Parin (1993) revised the family and their relatives; at least 5 species known in this region, 4 species found. A large specimens of *Lepturacanthus savala* was taken from handline, three species of 3 genera from trawling. *Trichiurus lepturus* is the most common.

Family Sphyraenidae; 10 species known from the area. This survey found 4 species, from trawling (reference; Gloefelt-Tarp & Kailola, 1984; Masuda *et al*., 1984 and Randall, 1995).

Family Gobiidae; five species found, including two unknown genera. *Priolepis* spp. was obtained with a large sponge.

Family Kurtidae; only *Kurtus indicus* known from the South China Sea, is uncommonly found in the Bintulu market.

Family Pinguipedidae; 3 species is uncommonly found from trawling, *Parapercis filamentosus*

Table 1 The previous catching statistic of trawling survey in the Area II
EFD : Exploratory Fishery division, Bangkok Thailand

Year	Catch/hr	% Fishes	% Trash	Reference
1968	186	53	47	EFD, 1968
1969	442	63.1	36.9	EFD, 1969
1970	286	56.9	43.1	EFD, 1970
1972	214	72	28	EFD, 1972
1973	210	73	27	Pheng, 1985
1975	200	61	39	Pheng, 1985
1977	149	62	38	Pheng, 1985
1979	142	55	45	Pheng, 1985
1980	154	47	53	Pheng, 1985
1981	141.9	55.4	44.6	Beije & Gambang, 1981

is the most common.

Order Pleuronectiformes

More than 60 species of 7 families known from the South China Sea, 27 species (see checklist below) were found in this survey. Three species of *Pseudorhombus* (**Paralichthidae**) are commonly taken from trawling. *Heteromycteris matsubarai* (**Soleidae**) is an uncommon, previously known from Japanese waters was taken at the St. 17. References: Punpoka (1964), Mongkolprasit (1967), Menon (1977), Gloefelt-Tarp (1984), Masuda *et al*. (1984), Chen (1993) and Randall (1995).

Order Tetraodontiformes

Over 80 species, 9 families known from the South China Sea. References: Tyler (1968), Gloefelt-tarp & Kailola (1984), Masuda et al. (1984), Kumchirtchuchai (1985), Chen (1993) and Randall (1995).

Family Balistidae; *Abalistes stellatus* (possibly undescribed species,: K. Matsuura pers. comm., 1997) is a very common species taken by trawling from most of the station points. Four coral reef species of 3 genera were obtained from the Labuan and Kota Kinabalu markets.

Family Monacanthidae; 12 species of 7 genera obtained from trawling, including *Acreichthys tomentosa* taken by dipnet at Labuan. *Aluterus monoceros* is a common economic species of family.

Family Tetraodontidae; nearly 100 species of 18 genera occur in the Indo-Pacific. Eleven species, 4 genera taken by trawling, but *Tetraodon nigroviridis* was taken by dipnet.

Checklist of fishes obtained and observed (by sight) in the Area II, Sabah and Sarawak. See Appendix 1,2 (m = fish market or from coastal fishing boat, HL= obtained from handlines)

Discussion

In this survey, 518 species were obtained. Previously, species diversity of the Area II has never been recorded but its fishery resources was assessed by several trawling expeditions, both from local and by the Thai DOF, cover 10-100 m depth along the Sarawak coast. Since 1968-1981, its catching unit per hour was very high, 123-442 kg/ hour (Exploratory Fishery Division, 1968; 1969; 1970 and 1972) and by Bejie & Gambang (1981) and Pheng (1985), see Tab. 1. In this collaborative survey, catching result is drastically declined to 3.5-196 kg/hr.

Four of the 23 stations are highly species-richness area, along the middle zone of Sarawak waters, there are Station 48 (70 species), St. 33 (69), 34 (60) and 31 (58 species). Around the western zone of the Sarawak, most of the species are coastal and estuarine species e.g. Ariidae, Clupeidae and Scieanidae. The eastern zone (St. 69, 76) we obtained several deep sea species of the family Moridae, Caproidae and Argentinidae. Demersal fish forms the main component of the trawls with few pelagic

Checklist of fishes obtained and observed (by sight) in the Area II, Sabah and Sarawak. See Appendix 1,2 (m = fish market or from coastal fishing boat, HL= obtained from handlines)

Order Orectolobiformes
- **Family Hemiscyllidae**
  - *Chiloscyllium griseum*
  - *C. plagiosum*

Order Carcharhiniformes
- **Family Triakidae**
  - *Mustelus* sp. 1
  - *M. griseus*
  - *Hemitriakis* sp. 1 **HL**
- **Family Carcharhinidae**
  - *Carcharhinus borneensis*
  - *C. dussumieri*
  - *C. hemiodon*
  - *C. plumbeus*
  - *C. sealei*
  - *C. sorrah*
  - *Loxodon macrorhinus*
- **Family Sphyrnidae**
  - *Sphyrna mokarran*
  - *S. leweni*

Order Rhinobatiformes
- **Family Rhinobatidae**
  - *Rhynchobatus australae*

Order Torpediniformes
- **Family Narcinidae**
  - *Narcine maculata*
  - *N. prodorsalis*

Order Rajiformes
- **Family Rajidae**
  - *Okamejei boesemani*
  - *Okamejei* sp. 1

Order Myliobatiformes
- **Family Dasyatidae**
  - *Dasyatis imbricatus*
  - *D. kuhlii*
  - *D. walga*
  - *D. zugei*
  - *Himantura gerraddi*
  - *H. jenkinsi*
- **Family Myliobatididae**
  - *Aetomyleus nichoffi*
- **Family Rhinopteridae**
  - *Rhinoptera javanica*
- **Family Gymnuridae**
  - *Gymnura poeciura*
- **Family Mobulidae**
  - *Mobula taracapana*

Order Anguilliformes
- **Family Muraenidae**
  - *Gymnothorax javanicus*
  - *G. flavimarginata*
  - *G. fimbriata*
  - *Gymnothorax* sp.
  - *Encheloycore* sp.
  - *Strophidon* sp.
  - *Uropterygius* sp.
- **Family Congridae**
  - *Conger myriaster*
- **Family Synaphobranchidae**
  - *Meadia abyssalis*
- **Family Muraenisocidae**
  - *Muraenesox cinereus*
  - *Congresox talabonoides* **HL**

Order Clupeiformes
- **Family Engraulididae**
  - *Stolephorus insularis*
  - *S. dubiosus*
  - *S. insularis*
  - *S. indicus*
  - *Encrasicholina heterolol*
  - *Setipinna melanochir* **m**
  - *S. taty* **m**
  - *Thryssa hamiltoni* **m**
  - *T. mystax* **m**
  - *T. setirostris* **m**
  - *Coilia macrognathos* **m**
- **Family Chirocentridae**
  - *Chirocentrus dorab*
  - *C. nudus* **m**
- **Family Clupeidae**
  - *Amblygaster sirm*
  - *A. lemuru*
  - *Sardinella fimbriata*
  - *Sardinella* sp. 1
  - *Tenualosa toli* **m**
  - *Dussumieria* sp.
  - *Ilisha macroptera*

Order Aulopiformes
- **Family Synodontidae**
  - *Saurida elongata*
  - *S. longimanus*
  - *S. tumbil*
  - *S. undosquamis* **HL**
  - *Saurida* sp.
  - *Synodus hoshinonis*
  - *Trachinocephalus myops*

Order Ophiiformes
- **Family Ophiidae**
  - *Sirembo jerdoni*
  - *Sirembo imberis*
  - *Sirembo* sp.
- **Family Carapidae**
  - *Carapus* sp.

Order Siluriformes
- **Family Ariidae**
  - *Arius bilineatus* **HL**
  - *A. caelatus* **HL**
  - *A. nella* **m**
  - *A. thalassinus* **HL**
  - *A. venosus* **m**
  - *A. maculata*
  - *Osteogeniosus militaris* **m**
- **Family Plotosidae**
  - *Plotosus caninus* **m**
  - *P. lineatus*

Order Osmeriformes
- **Family Argentinidae**
  - *Glossanodon* sp.

Order Zeiformes
- **Family Caproidae**
  - *Antigonia copros*

Order Myctophiformes
- **Family Myctophidae**
  - *Diaphus* sp.

Order Gadiformes
- **Family Bregmacerotidae**

Bregmaceros sp.

Family Moridae

Physiculus sp.

Order Beloniformes (reference: Collette, 1984 a, b; Petchsathit, 1992)

Family Belonidae

Ablennes hians **m**

Tylosurus crocodilus

Family Hemiramphidae

Hemiramphus far

Hyporhamphus dussumieri **m**

Rhynchorhamphus malabaricus

Family Exocoetidae

Cypselurus oligolepis

C. poecilopterus

Cypselurus sp.

Order Atheriniformes

Family Atherinidae

Hypoatherius bleekeri

Order Beryciformes

Family Holocentridae

Sargocentron rubrum **HL**

Ostichthys japonicus

Family Berycidae

Centroberyx rubicaudus

Order Gasterosteiformes

Family Pegasidae

Pegasus laternarius

Family Centriscidae

Centriscus scutatus

Centriscus sp.

Aeoliscus sp.

Family Syngnathidae

Hippocampus kuda

Hippocampus sp.

Family Solenostomidae

Solenostomus paradoxus

Family Fistularidae

Fistularis petimba

F. commersoni

Order Lophiiformes

Family Antenaridae

Antennarius striatus

A. dorehensis

Family Lophiidae

Lophiomus setigerus

Lophiomus sp. 1

Lophiomus sp. 2

Family Ogcocephalidae

Halieuteae sp. 1

Halieuteae indica

H. stellata

Family Chaunacidae

Chaunax sp.

Order Scorpaeniformes

Family Scorpaenidae

Choridactylus multibarbus

Pterois russelli

P. mombasae

Scorpaenopsis cirrhosa

Brachypterois serrulata

Scorpaenodes scaber

Scorpaenodes sp.

Minous pictus

Cottapistus cottoides

Inimiscus sinensis

Family Platycephalidae

Elates ransoneti

Sorsogona tuberculata

Sorsogona sp.

Rogadius pristiger

Kamococcius radericensis

Grammoplites scaber

Inegocia japonicus

Thrysanophrys macracanthu

Platycephalus indicus **m**

Family Trigidae

Lepidotrigla spiloptera

Satyricthys rieffeli

Pterygotrigla hemisticta

Pterygotrigla sp.

Family Dactylopteridae

Dactyloptena papilio

D. orientalis

Order Perciformes

Family Priacanthidae

Priacanthus tayenus

Priacanthus sp.

P. macracanthus **HL**

P. sagittarius

Pristigenys niphonia

Family Callionemidae

Repomucenus virgis

Calliruichthys japonicus

Callionemus filamentosus

Callionemus sp.

Dactylopus dactylopus

Bathycallionemus sp.

Family Champsodontidae

Champsodon arafurensis

Champsodon sp.

Family Uranoscopidae

Uranoscopius oligolepis

Family Centropomidae

Lates calcarifer **m**

Psammoperca waigiensis **m**

Family Ambassidae

Ambassis commersoni

Family Serranidae

Cephalopholis boenak **HL**

C. miniatus **HL**

C. cyanostigma **HL**

C. urodeta **m**

C. sonnerati **HL**

C. igarashiensis **m**

Epinephelus areolatus **HL**

E. quoyanus

E. heniochus **HL**

E. sexfasciatus **HL**

E. bleekeri

E. erythurus **HL**

E. diacanthus

E. caeruleopunctatus **m**

E. ongus **m**

E. latifasciatus **m**

E. amblycephalus **m**

E. coioides **HL**

E. fasciatus **HL**

E. merra **m**

E. poecilonotus **m**

Plectopoma leopardus **m**

P. oligacanthus **m**

P. maculatus **m**

Chelidoperca sp.
Pseudanthias marcia
Pseudanthias sp.
Plectanthias sp.
Variola louti **m**
V. albimarginata **m**

Family Apogonidae
Apogon septemstriatus
A. semilineatus
A. quadrifasiatus
A. elioti
A. lineatus
A. melas **m**
A. aureus
A. albimaculatus
A. poecilopterus
A. taeniopterus
A. sealei
A. fasciatus
C. ceramensis
A. carinatus
Rhapdamia gracilis
Sphaeramia orbicularis

Family Sillaginidae
Sillagosihama

Family Lactaridae
Lactarius lactarius

Family Rachycentridae
Rachycentron canadum

Family Carangidae
Parastromateus niger
Selar boops
S. cruemenophthalmus
Alepes kleinii
A. melanoptera
A. djedaba
A. macrura **m**
Carangoides armatus **HL**
C. gymnostethus **m**
C. caerulaeopinnatus **HL**
C. hedlandensis **HL**
C. malabaricus
C. talamparoides **HL**
C. chrysophrys
C. uii
C. fulvoguttatus **m**
C. plagiotaenia **m**
C. bajad **m**
C. equula
C. praeustus **m**
C. ferdau **m**
C. dinema **HL**
C. oblongus
Uraspis uraspis
Atule mate
Selaroides leptolepis
Seriolina nigrofasciata
Alectes indicus
A. cilialis
Atropus atropus
Decapterus russelli
D. kurroides
D. macarellus **HL**
D. macrosoma
Megalaspis cordyla
Caranx sexfasciatus
C. ignobilis **m**
Scomberoides commersonianus **m**
S. tol
S. tala **m**

Family Ariommatidae
Ariomma indicum

Family Nomeidae
Psenopsis anomala

Family Echeinidae
Echeineus naucrates

Family Meneidae
Mene maculata **m**

Family Gerreidae
Gerres macrosoma
G. filamentosus
G. abbriviatus **m**
G. acinaceus
G. poieti **m**
Pentaprion longimanus

Family Leiognathidae
Leiognathus bindus
L. equulus
L. stercorarius
L. fasciatus
L. leuciscus
L. brevirostris **m**
L. lineolatus
L. elongatus
L. splendens
L. blochi
L. smiththurstri **m** (= *L. longipinnis*, D.W. Woodland, pers. comm., 1998)
Secutor indicius **m**
S. ruconius
S. insidiator

Family Lutjanidae
Lutjanus bohar **m**
L. carponotatus **m**
L. erythropterus **HL**
L. fulviflamma **HL**
L. gibbus **m**
L. johni **m**
L. kasmira **m**
L. lemniscatus **m**
L. lineolatus
L. lutjanus **HL**
L. malabaricus **HL**
L. monostigma **HL**
L. quinqueliniata
L. rivulatus **m**
L. russelli **HL**
L. sebae
L. vittus **HL**
Symphorus nematophorus **m**
Symphoricthys spilurus **m**
Etelis cabunculus **m**
Pristipomoides filamentosus
P. multidens **HL**
P. typus

Family Caesionidae
Caesio cuning **m**
C. xanthonota **m**
C. capricornis **m**
Pterocaesio chrysozona
Dipterygonotus balteatus

Family Haemulidae
Diagramma pictum **HL**

Plectorhinchus gibbosus
P. picus **m**
P. lineatus **m**
Hapalogenys analis
Pomadasys kaakan
P. auritus **m**
P. argyreus
P. argentius
Pomadasys sp. **m**

Family Lethrinidae
Gymnocranius elongatus **HL**
G. griseus **HL**
G. frenatus
Lethrinus lentjan **HL**
L. laticaudus **HL**
L. microdon **HL**
L. miniatus
L. ornatus **HL**

Family Sparidae
Argyrops spinifer **HL**

Family Nemipteridae
Nemipterus aurorus
N. bathybius
N. furcosus
N. hexodon **HL**
N. isacanthus
N. japonicus
N. mesoprion
N. nematophorus
N. nemurus
N. peronii
N. tambuloides
N. thosaporni
N. virgatus
Scolopsis monogramma
S. taeniopterus
S. vosmeri
S. margaritifer **m**
S. affinis **m**
S. frenatus **m**
S. ciliatus **m**
Parascolopsis tanyactis
P. inermis
P. eriomma
Pentapodus emeryi **m**
P. bifasciatus **m**
P. setosus

Family Kyphosidae
Kyphosus cinerescens **m**
Proteracanthus sarissophorus **m**

Family Sciaenidae
Otolithoides sp. **m**
Pennahia anea
P. macrocephalus
P. pawak
Chrysochir aureus **m**
Protonibia diacanthus
Nibia albiflora
Johnius sp.

Family Mullidae
Upeneus asymetricus
U. sulphureus
U. moluccensis
U. sondaicus
U. tragula
U. luzonius
U. taeniopterus
Parupeneus cinnabarinus
P. multifasciatus **HL**
P. barberinus **m**
P. barberinoides **m**
P. indicus **m**
P. cyclostoma **m**
P. pleurostigma **m**
Mulloidichthys vanicolensis **m**

Family Pempheridae
Pempheris oualensis **m**
P. xanthopterus **m**

Family Teraponidae
Terapon theraps
T. jarbua

Family Cirhithidae
Cirhithichthys aureus

Family Ephippidae
Ephippus orbis
Platax batavianus **m**
P. orbicularis **m**

Family Drepanidae
Drepene punctata
D. longimana

Family Labridae
Xiphocheilus typus
Cheilinus fasciatus **m**
C. diagrammus **m**
C. chlorurus **m**
C. undulatus **m**
Epibulus insidiator **m**
Choerodon schoenleini **m**
C. robustus
Halichoeres hartzfeldi
Halichoeres sp. 1
Halichoeres sp. 2
Halichoeres sp. 3
Hemigymnus melapterus **m**

Family Scaridae
Scarus pyrrhurus **m**
S. rivulatus **m**
S. sordidus **m**
Scarus sp. **m**
Leptoscarus waigiensis **m**

Family Pomacentridae
Abudefduf sexfasciatus **m**
Chromis mirationis
Hemiglyphidodon plagiometopon **m**
Pomacentrus melas **m**
Pristotis jerdoni

Family Chaetodontidae
Coradion chryszonus
C. altivelis
Chaetodon guentheri

Family Scatophagidae
Scatophagus argus **m**

Family Monodactylidae
Monodactylus argenteus **m**

Family Toxotidae
Toxotes jaculatrix **m**

Family Siganidae
Siganus canaliculatus
S. virgatus **m**
S. puellus **m**
S. stellatus **m**
S. fuscescens **m**
S. argenteus **m**

Family Acanthuridae
Naso lopezi **m**
Acanthurus bleekeri **m**
A. xanthoptera **m**
A. olivaceus **m**

Family Scombridae
Rastelliger kanagurta
Scomberomorus commersoni **HL**
S. guttatus
S. lineolatus **m**
Scomber australisicus
Katsuwonus pelamis **m**
Auxis rochei **m**
A. thazard **m**

Family Trichiuridae
Trichiurus lepturus
Eupleurogrammus glossodon
Tentoriceps cristatus
Lepturacanthus savala **HL**

Family Stromateidae
Pampus argenteus
P. chinensis **m**

Family Polynemidae
Eleutheronema tetradactylum **m**
Polynemus borneensis **m**
P. plebeius **m**
P. sextarius

Family Sphyraenidae
Sphyraena jello **HL**
S. forsteri
S. obtusata **m**
S. putnami **m**

Family Bleniidae
Xiphasia setifer

Family Gobiidae
Trypauchen vagina
Priolepis sp. 1
Priolepis sp. 2
Unidentified Gobiid 2 genera, 2 species

Family Kurtidae
Kurtus indicus **m**

Family Pinguipedidae
Parapercis pulchellus
P. filamentosa
Parapersis sp.

Order Pleuronectiformes

Family Psettodidae
Psettodes erumei

Family Bothidae
Engyprosopon grandisquama
Arnoglossus aspilos
Arnoglossus sp. 1
Arnoglossus sp. 2
Grammatobothus polyophthalmus
Laeops parviceps

Family Paralichthyidae
Pseudorhombus arsius
P. elevatus
P. diplospilus
P. quinqueocellatus
P. malayanus
P. duplicatus
Pseudorhombus sp.1

Family Citharidae
Branchypleura novaezeelandiae
Branchypleura sp.
Citharoides macrolepidota

Family Pleuronectidae
Samaris cristatus
Samaris sp.
Samariscus longimanus

Family Soleidae
Heteromycteris matsubarai
Synaptera marginata **m**

Family Cynoglossidae
Cynoglossus arel
Cynoglossus sp.1
Cynoglossus sp.2
C. kopsii
C. bilineata **m**

Order Tetraodontiformes

Family Triacanthidae
Trixiphichthys weveri
Tripodichthys oxycephalus
Triacanthus biaculiatus

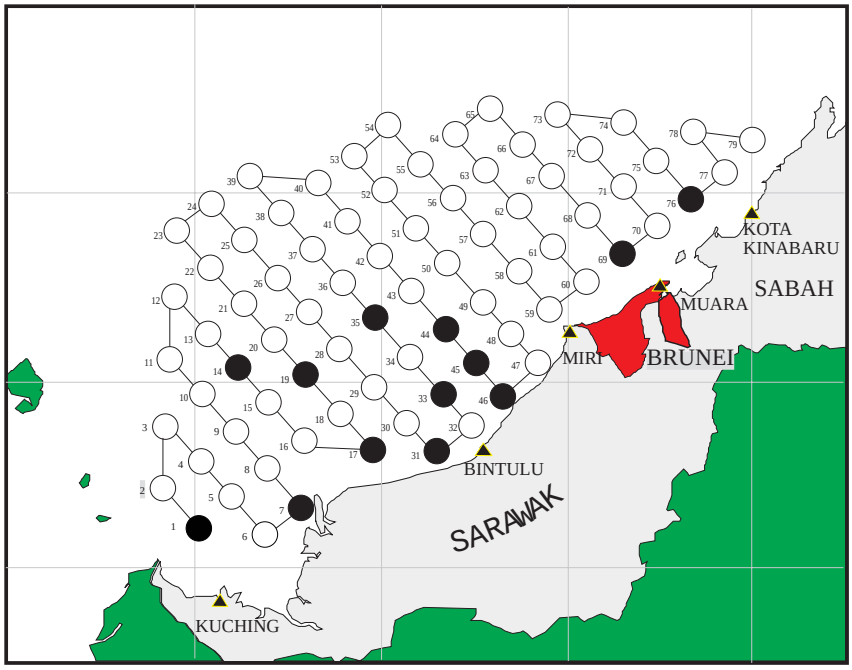
Family Balistidae
Abalistes stellatus
Balistoides viridescens **m**
Odonus niger **m**
Sufflumen frenatus **m**
S. chrysopterus **m**

Family Monacanthidae
Acreicththys tomentosa
Paramonacanthus japonicu
Paramonacanthus sp. 1
Paramonacanthus sp. 2
Paramonacanthus sp. 3
Aluterus monoceros
Chaetoderma penicilligeral
Anacanthus barbatus
Pseudoalutarius nasicornis
Thamnaconus hypogyreas
T. striatus
T. modestoides
Thamnaconus sp.

Family Ostracionidae
Tetrosomus gibbosus
T. republicae
Rhyncotracion nasus
R. rhinorhynchos **m**

Family Tetraodonidae
Lagocephalus gloveri
L. lunaris
L. scleratus
L. spadiceus
Lagocephalus inermis
Arothron immaculatus
A. stellatus
Torquigener pallimaculatus
T. parcuspinus
T. kicksi
Tetraodon nigroviridis
Canthigaster rivulata
Xenopterus naritus **HL**

Family Diodontidae
Cyclicthys spilostylos
Diodon histrix
D. holacanthus
Tragulichthys jaculiferus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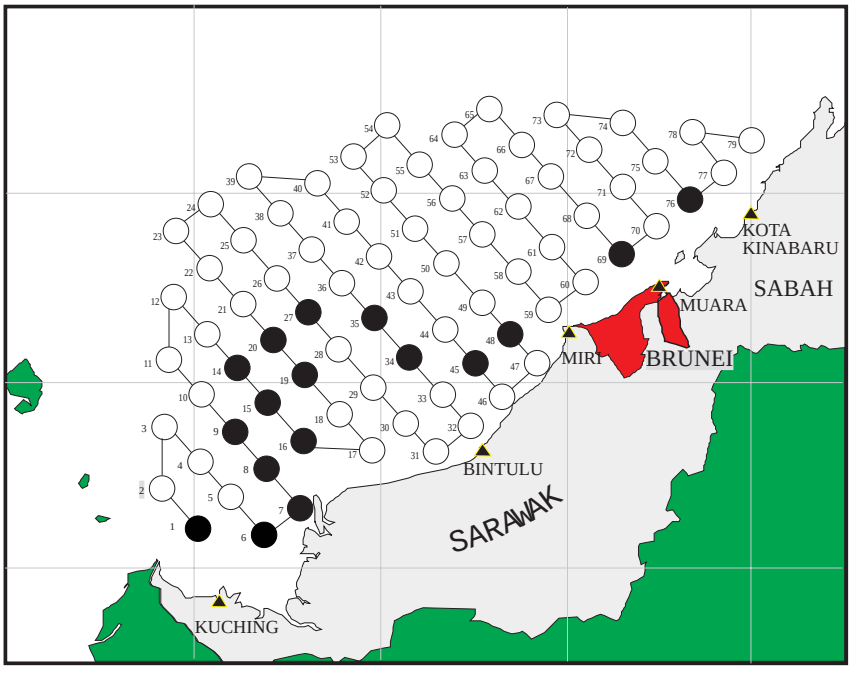
KUCHING

Fig. 1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BINTULU
SARAWAK
KUCHING

Fig. 2

Table 2.1 Catching results of the Cruise No.1 in the Area II

Station No.	Catch / hr.	% of Fishes	Species	Depth
1	13.9	73.38	18	36-38
5..6	34.5	83.13	31	38-35
7	108	31.48	46	31
10..11	17.6	73.86	30	90-92
14	21.4	67.29	31	91-96
15	22.7	88.1	32	64
17	17	90.11	25	63
19	32	57.81	52	67
31	86	53.49	58	27-30
33	162.91	57.82	69	49
34	104.8	58.2	60	71
35	3.5	51.42	17	85-90
44	196	61.02	56	82-86
45	60	36.33	51	66
46	22	43.18	49	87
69	68	63.23	52	92
76	38	71.05	38	95

Table 2.2 Catching results of the Cruise No.2 in the Area II

Station No.	Catch/hr	Fishes (kg)	Species	Depth
1		25	37	36-37
6		44	44	38-39
7		66	41	-
8		28	37	38
9		23	27	-
14		-	-	88
15		25	53	65
16		4.7	16	45
17		30	49	41
19		34	39	69
20		37	27	90
27		71	43	33
31/32		78	55	21
34		88	47	70-72
35		80	43	87
45		20	45	66
48		144	70	78-79
69		29	48	79
76		90	54	97-87

Table 3 Economic species catching results in each station of the survey Area II

	1	6	7	8	9	14	15	16	17	19	20	27	31/32	34	35	45	48	69	76	
Ariomma indica														6	1.7		92		14	113.2
Priacanthus macracanthus							0.5					5.6		9.5	5.1	2	2.5	2.1	28	54.8
Saurida undosquamis				1.9	7.1					1.2	1.5		9.3	8	17				3.5	49
Upneus moluccensis												22		10	5.3		10		1.3	48.8
Priacanthus tayenus											1		2.3	6	24		1.5	3.5		38.3
Nemipterus nemurus	8	3.3		1.2	4	5	5		1.1	4.2	1.9	1.1							1.1	35.9
Abalistes stellatus					1.4	1	1	1.5	13	2.6	1.2	3.2		2	1.5	2.7	2.5	1.2		35.1
Nemipterus bathybius										4.5	9.3	11							10	35.1
Pentaprion longimanus			9.5		2.2								5.5	12	3.5					32.7
Himantura gerradi			2.3										26							28.1
Decapterus spp.				1.7						2.6							7.6	2.5	13	27.4
Nemipterus nematophorus														7.7	4.7	6.3	3.7			22.4
Lutjanus malabaricus															0.7			4.4	17	22.3
Nemipterus japonicus			5										7	7						19
Diagramma puctum	13			5.6																18.6
Pristipomoides multidens											6.7				8			3.5		18.2
Carongoides malabaricus			14										3.3							16.8
Gymnocranium grisseum							4					9.2			3.5					16.7
Stolephorus spp.														1	0.6		14			15.6
Atule mate		9.5														3.5				13
Upeneus sulphureus													13							12.5
Therapon theraps			12																	12
Saurida tumbil.											2.3	8.3								10.6
Selaroides leptolepis				10																10
Arius bilineatus			8.3											1.5						9.8
Sargocentron rubrum											7.2	2.3								9.5
Gymnura poecilura										1.7	5							2.3		9
Sharks							1.4							7.5						8.9
Sillago shihama	3			5.5																8.5
Nemipterus virgatus												1.4		3.5	1.1	0.9	1			7.9
Nemipterus tambuloides	1	3.6							2.3											6.9
Parupeneus cinnabaricus	0.4						2.3		0.3	3.4										6.4
Scolopsis taeniopterus		4.8							1.3											6.1
Lutjanus lutjanus							1.1							2	2					5.1
Saurida spp.										5										5
Nemipterus thosaporni										1.4		1				1			1.3	4.7
Sardinella spp.																	1.7	3		4.7
Epinephelus coioides									4.5											4.5
Ephippus orbis			4.4																	4.4
Congresox talabonoides													4.1							4.1
Nemipterus isacanthus														2.7		1.3				4
Nemipterus mesoprion		0.3											3.5							3.8
Carangoides malabaricus							1.1										2.5			3.6
Sphyraena forsteri								3.2												3.2
Platax batavianus							2.8													2.8
Seriolina nigrofasciatus									1.4									1.4		2.8
Psettodes erumei													2.7							2.7
Alepes djedaba							2.6													2.6
Rastelliger kanagurta		2.4																		2.4
Pentapodus setosus									1.7											1.7
Scomberomorus guttatus														1.6						1.6
Selar cruemenophthalmus																		1.6		1.6
Lutjanus erythopterus																		1.5		1.5
Uraspis uraspis															1.5					1.5
Epinephelus areolatus							1.4													1.4
Siganus guttatus			1.1																	1.1
Trichiurus lepturus							0.8													0.8
Lutjanus vittatus							0.7													0.7
Megalaspis cordylar			0.6																	0.6
Shellfishes																				
Loligo duvoucelli		15	6.6			3.9			3.5	6	1.2	5.3	2			2.1	5	1.6	1.4	53.6
Loligo chinensis		1.2	2.7		8.4															12.3
Thenus orientalis		3.5								1.4										4.9
Amusium buillotti				2.1					1											3.1
Total	**25**	**44**	**66**	**28**	**23**	**9.9**	**25**	**4.7**	**30**	**34**	**37**	**71**	**78**	**88**	**80**	**20**	**144**	**29**	**90**	**925.9**

fishes, 37 species were obtained in small amount and mostly carangiid fish. Nine demersal economic species which occur almost every station, there are; *Saurida undosquamis, Synodus hoshinonis, Fistularia* spp. *Seriolina nigrofasciata, Pentaprion longimanus, Nemipterus furcosus, Parupeneus cinnabarinus, Abalistes stellatus* and *Gymnocranius grisseus*. Most of the dominant species obtained in this survey are relatively low price species, most of valuable species inhabit in the rocky shoals and near coast areas that the trawling staions are not covered.

The both trawling surveys in some stations we obtained relatively low CPUE because of the deformation of the net during rough climate and also rough bottom interupted trawling to be emergency hauls. The trawling period in 1 hour is may not enough in purpose to investigate te CPUE and in several station points that high potency for coastal fishes habitats were shifted for security of pipeline and oilfield.

Handline in rocky shoal areas and fish markets survey are neccessary to assess the species diversity of the Area that the trawling is unaccessible. Market survey are need to carry out with caution, by select for the landing place that obtained coastal species or from the small-scale fishing activities.

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References

Anonymous, 1969. Results of fisheries and oceanographic surveys on Sunda continental Shelf and South China Sea by R.V. Fisheries reserch No. 2. cruise No. 1/2511. Exploratory Fishing Unit; Dept. Fish., Bangkok; Spec. Publ. SR. 012: 1969, 79 pp. (Thai).

Allen, G.R. FAO species catalogue Vol.6. Snappers of the world. An annotated and illustrated catalogue of Lutjanid species known to date. FAO. Fish. Synop.,(125) Vol.6 : 1985, 208 pp.

_____ . 1997. Marine fishes of South-east Asia. Western Australian Museum. 292 pp.

Allen , G.R. and Talbot , F.H. 1985. Review of the snappers of the genus *Lutjanus* (Pisces : Lutjanidae) from the Indo-Pacific, with the description of a new species. Indo-Pacific Fishes. No.11: 87 p.

Allen, G.R. and Swainston, R.1993. Reef fishes of New Guinea. Publication No.8 Christensen Research Institute, Papua New Guinea.132 p.

_____. 1988. The marine fishes of North-western Australia. Western Australian Museum, Perth:201 pp.

Bejie, A. and Gambang, A.C. 1981. Demersal fish resources in Malaysian waters. Fifth trawlsurvey off the coast of Sarawak. (10th July-10th August 1979). Ministry of Agriculture Malaysia.

Carpenter, K.E. 1987. Revision of the Indo-Pacific fish family Caesionidae (Lutjanoidea) , with descriptions of five new species. Indo-Pacific Fishes. No.15: 56 p.

_____1988. FAO species catalogue. Vol.8. Fusilier Fishes of the world. An Annotated and Illustrated Catalogue of Caesionid Species Known to Date. FAO. Fish. Synop.,(125) Vol.8 : 75 p.

Carpenter K.E. and Allen, G.R. 1989. FAO species catalogue. Vol.9 Emperor fishes and large-eye breams of the world (Family Lethrinidae). An Annotated and illustrated catalogue of lethrinidae species known to date. FAO. Fish. Synop.(125) Vol.9:118 p.

Castle, P.H.J. 1984. Muraenesocidae. In W. Fischer and G. Bianchi(eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol.3. FAO,Rome. pag. var.

Chen, S.C. (eds.), 1993. Fishes of Taiwan. National University of Taiwan, Dept. Zool. xx+960 (Chinese).

Collette, B.B. 1984a. Belonidae. In W. Fischer and G. Bianchi(eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol.1. FAO,Rome. pag. var.

Collette, B.B. 1984b. Hemiramphidae. In W. Fischer and G. Bianchi(eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol. 2.FAO,Rome. pag. var.

Collette, B.B. and Nauen, C. 1983. FAO. species catalogue. Vol.2. Scombrids of the world. An annotated and illustrated catalogue of tunas , mackerels, bonitos and related species known to date. FAO. Fish. Synop. (125) Vol.2 : 137 p.

Compagno, L.J.V. 1984. FAO. species catalogue. Vol.4,Part 1. Sharks of the world :Hexanchiformes to Lamniformes. An annotated and illustrated catalogue of shark species known to date. FAO. Fish. Synop. (125) Vol.4,Part 1 : 249 p.

_____ . 1984. FAO. species catalogue. Vol.4,Part 2. Sharks of the world :Carcharhiniformes. An annotated and illustrated catalogue of shark species known to date. FAO. Fish. Synop. (125) Vol.4,Part 2 : 655 p.

De Bruin, G.H.P. , Russell, B.C. and Bogusch, A. 1994. The marine fishery resources of Sri Lanka. FAO. species identification field guide for fishery purposes. FAO. Rome. 400 p.

Debelius, H. 1993. Indian Ocean tropical fish guide. Ziethen Farbdruckmedien, Cologne. 321 p.

Eschmeyer, W.N., Hallacher and L.E. Rama-Rao, K.V. 1979a. The Scorpionfish genus *Minous* (Scorpaenidae , Minoinae) including a new species from the Indian Ocean. Proceedings of the California Academy of Sciences (20) Vol. XLI, pp. 453-473.

Eschmeyer, W.N. , Rama-Rao, K.V. and Hallacher, L.E. 1979b. Fishes of the Scorpionfish subfamily Choridactylinae from the Western Pacific and the Indian Ocean. Proceedings of the California Academy of Sciences (21) Vol.XLI, pp. 475-500.

Exploratory Fishery Division, 1968. The results of fishing ground and oceanography survey in the Sunda Shelf and South China Sea, 1968. by R.V. Fishery Exploratory I. Dept. Fisheries, Thailand (Thai):466 p.

_____ . 1969. The operation report of demersal and pelagic fishes survey in the South China Sea and Sarawak 1969, by R.V. Fishery Exploratory I and II. Dept. Fisheries, Thailand (Thai): 283 p.

_____. 1970. Results of the fishing ground survey by R.V. Fishery Exploratory II, 1970. Dept. Fisheries, Thailand (Thai):368 p.

_____. 1972. Results of the fishing ground survey by R.V. Fishery Exploratory II, 1972. Dept. Fisheries, Thailand (Thai):542 p.

Fischer, W. and P.J.P. Whitehead. 1974. (eds). FAO species identification sheets for fisheries purpose, 4 vols. FAO of the United Nation, Rome, no pagination.

Fraser, T.H. and Lachner, E.A. 1985. A Revision of the cardinalfish subgenera *Pristiapogon* and *Zoramia* (Genus *Apogon*) of the Indo-Pacific Region (Teleostei : Apogonidae). Smithsonian Contribution to Zoology. 47 p.

Fritzsche, R.A. 1976. A review of cornetfishes, genus *Fistularia* (Fistularidae) with a discussion of intrageneric relationships and zoogeography. Bull. Mar. Sci. 26(2);196-204.

Gloerfelt-Tarp, T. and Kailola, P.J. 1984. Trawled fishes of Southern Indonesia and Northwestern Australia. The Australian Development Assistance Bureau; Directorate General of Fisheries, Indonesia; German Agency for Technical Cooperation, 406 pp.

Gomon, J.R., 1983. Plotosidae. In W. Fischer and G. Bianchi (eds.) FAO species identification sheets

for fishery purposes. Western Indian Ocean fishing area 51. Vol. 1. FAO,Rome. pag. var.
Gushiken, S. 1983. Revision of the Carangid Fishes of Japan. Galaxea 2:135-264.
Heemstra, P.C. and Randall, J.E. 1993. FAO species catalogue.Vol.16. Groupers of the world. (Family Serranidae , Subfamily Epinephelinae). An annotated and illustrated catalogue of the grouper, rockcod, hind, coral grouper and lyretail species known to date. FAO. Fish. Synop. (125) Vol.16 :382 p.
Hora, S.L. 1924.a. Zoological result of tour in far east , Fishes of Talesap, Peninsular Siam. Mem. Asiatic Soc. Bengal, 6 (pt. 1): 463-476.
Jayaram, K.C. 1983. Ariidae. In W. Fischer and G. Bianchi(eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol. 1. FAO,Rome. pag. Var.
Johnstone, J. 1903. Report on the marine fishes. Fasciuli Malayenses-Zoology, 1: 294-302.
Kuiter, R.H. 1992. Tropical reff-fishes of the Western Pacific Indonesia and adjacent waters. Percetakan PT Gramedia, Jakarta. 314 p.
Kuiter, R.H. and Debelius,H. 1994. Southeast Asia tropical fish guide. IKAN-Unterwarrearchiv, Germany. 321 p.
Kuhlmorgen-Hille, G. 1968. An illustrated field key to the family Leiognathidae in the Gulf of Thailand. Contribution No. 12, Marine Fish. Lab., Dept. Fisheries, Bangkok: 7pp.
Kumchirtchuchai, P. 1985. Taxonomy of the puffers found in the waters of Thailand. Master Thesis Department of Marine Sciences, Chulalongkorn University. 163p. (Thai).
Lal-Mohan, R.S., 1983. Sciaenidae. In W. Fischer and G. Bianchi(eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol. 1. FAO,Rome. pag. var.
Last, P.R. and Stevens, J.D. 1994. Skarks and rays of Australia CSIRO. Australia. 513 p.
Lim, K.K.P. 1994. First record of *Hapalogenys analis* (Teleostei: Perciformes: Haemulidae)from the Indo-Australian region. the Raffles Bull. Zool. 42(4):983-985.
Mansor, M. I., Kohno, H., Ida, H., Nakamura, H. T., Aznan, Z. and Abdullah, S. 1998. Field guide to important commercial fishes of the South China Sea. SEAFDEC MFRDMD/SP/2.
Masuda, H.; Amaoka, K.; Araga, C. and Yoshino, Y.(eds.) 1984. The fishes of the Japanese Archipelago. Tokai Univ. Press. 456p.
Menon, A.G.K. 1977. A Systematic Monograph of the Tongue Soles of the Genus *Cynoglossus* Hamilton-Bochanan. (Pisces : Cynoglossidae). Smithsonian Contribution to Zoology No 238:129 p.
Michael, S.W. 1993. Reef sharks and ray of the world. Sea Challengers. Monterey, California.107 p.
Monkolprasit, S.P. 1967. Addenda additions to the Pleuronectiformes fauna of the Gulf of Thailand. Kasetsart University Museum of Fisheries.
Nakamura, I. and Parin, N.V. 1993. FAO species catalogue. Vol. 15. Snake mackerels and cutlassfishes of the world. (Family Gempylidae and Trichiuridae). An annotated and illustrated catalogue of the snake mackerels, snoeks, escolars, gemfishes, sackfishes, domine, oilfish, cutlassfishes, scabbardfishes, hairtails and frostfishes known to date.FAO. Fish. Synop. (125) Vol.15 : 136 p.
Nelson, J. S. 1994. Fishes of the world, ed 3. John Wiley & Sons, Inc. New York. 600 p.
de la Paz and Interior, R. 1979. Deep sea fishes off Lubang Island, Philippines. Natural and Applied Science Bull. 31(3-4):101-175.
Palsson , W.A. and Pietsch , T.W. 1989. Revision of the Acanthopterygian fish family Pegasidae (order Gastrosteiformes). Indo-Pacific Fishes. 18:38 p.
Petchsathit, B. 1992. Taxonomy of halfbeak and needdlefish (Pisces:Hemiramphidae, Belonidae) in Thai waters. Master Thesis Department of Biology, Chulalongkorn University (Thai).
Pheng , K. S.. 1985. Coastal Resources of Sarawak. Final Report submitted to Petroleum Nasional Berhad ans Sarawak Shell Berhad. Universiti Sains Malaysia.123 p.
Premcharoen, S. 1993. Toxonomy of Ponyfishes and Silver-Biddles (Pisces: Leiognathidae and Gerreidae) in Thai waters. Master Thesis Department of Marine Sciences, Chulalongkorn University. 176 pp.

Punpoka, S. 1964. A review of The Flatfishes (Pleuronectiformes = Heterosomata) of the Gulf of Thailand and its tributaries in Thailand. Bull. of Kasetsart Univ. 86 p.

Randall, J.E. 1995. Coastal fishes of Oman. Hawaii Univ. Press., 438 p.

Randall , J.E. and Heemstra , P.C. 1991. Revision of Indo-Pacific Groupers (Percifomes : Serranidae : Epinephelinae), with Descriptions of Five New Species. Indo-Pacific Fishes. No.20. Hawaii. 338 p.

Randall , J.E. and Hoese , D.F. 1986. Revision of the groupers of the Indo-Pacific genus *Plectopomus*(Perciformes:Serranidae: Epinephelidae). Indo-Pacific Fishes. No.13:31 p.

Randall, J.E.; Allen, G.R. and Steene, R.C. 1997. Fishes of the Great Barrier Reef and Coral Sea. Crawford House Publ. 557 p.

Randall, J.E.; Ida, H.; Kato, K.; Pyle, R.L. and Earle, J.L. 1997. Annotated checklist of the inshore fishes of the Ogasawara Islands. Nat. Sci. Mus. Monographs No 11, Tokyo.

Rau, N. and Rau, A. 1980. Commercial marine fishes of the central Philippines (Bony fish).D &V Paul Dieriech K.G. & Co.Eschborn, 623p.

Russell, B.C. 1990. FAO species catalogue. Vol.12. Nemipterid fishes of the world (Threadfin breams , whiptail breams , monocle breams , dwarf monocle breams, and coral breams) family Nemipteridae. An annotated and illustrated catalogue of nemipterid species known to date. FAO. Fish. Synop. (125) Vol.12 : 149 p.

_____ 1991. Description of a new species of *Nemipterus* (Pisces: Perciformes: Nemipteridae) from the Western Pacific, with redescription of *Nemipterus maginatus* (Valenciennes), *N. mesoprion* (Bleeker) and *N. nematophorus* (Bleeker). J.Nat. Hist. 25:1379-1389.

_____ . 1993. A review of the threadfin breams of the genus *Nemipterus* (Nemipteridae) from Japan and Taiwan, with description of a new species. Jap. J. Ichthyol. 39(4): 295-310.

Sirimontaporn, P.1987. Description of the fishes family Gerreidae and Sciaenidae occuring in the Gulf of Thailand. National. Institute of Coastal Aquaculture Department of Fisheries, Thailand. 46 p.

Smith-Vaniz, W.F. 1984. Carangidae. In W. Fischer and G. Bianchi(eds.) FAO species identification sheets for fishery purposes. Western Indian Ocean fishing area 51. Vol. 1. [pag. var.]. FAO,Rome.

Trewavas , E. 1977. The Sciaenid Fishes of the Indo-West-Pacific. Trans. Zool. Soc. 33. London. 253-541 p.

Tyler, J.C. 1968. A monograph on Plectognath fish of the superfamily Triacanthoidea. Monograph No. 16, The Academy of Natural Sciences of philadelphia. 344 p.

Whitehead, P.J.P. 1985. FAO species catalogue. Vol.1,Part 1. Clupeoid fishes of the world (Suborder Clupeoidei):Chirocentridae, Clupeidae and Pristigasteridae. An annotated and illustrated catalogue of the herrings, sardines, pilchards, sprats, shads, anchovies and wolf-herrings. FAO. Fish. Synop. (125) Vol.7,Part 1:303 p.

Whitehead, P.J.P., Nelson, G.J. and Wongratana, T. 1988. FAO species catalogue. Vol.1,Part 2. Clupeoid fishes of the world (Suborder Clupeoidei):Engraulididae. An annotated and illustrated catalogue of the herrings, sardines, pilchards, sprats, shads, anchovies and wolf-herrings. FAO. Fish. Synop. (125) Vol.7,Part 2 : 579 p.

Wongratana, T. 1975. A record of a flatheadfish. *Thysanophrys papillolabium* Schulty, in the Andaman Sea, with a key to fourteen species of the Platycephalidae from Thai waters(Pisces : Platycephalidae) Phuket Mar. Biol. Cent. Res. Bull. No.7:9 pp.

_____ .1982. Ichthyological observations made during the Andaman cruise of the "Nagasaki-Maru", 1-14 November 1981. Nat. Hist. Bull. Siam Soc. 30(2):105-124.

Woodland , D.J. 1990. Review of the fish family Siganidae with descriptions of two new species and comments on distribution and biology. Indo-Pacific Fishes. No.19. 136 p.