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Family and species composition of fishes caught from Marudu Bay, Sabah, Malaysia

Abstract

The present study revealed that the biochemical constituent with respect to different maturity stages of *Nemipterus japonicus* fish is associated with reproductive cycle, storage and utilization of reserves. Gonadosomatic index *N. Japonicus* recorded high values (3.5 and 0.51) in May and low values (0.4 and 0.25) in February for female and male, respectively. The maturity stages was classified into 5 maturity stages as follow, 1) immature stage, 2) maturing stage, 3) mature stage, 4) ripe stage and 5) spent stage. The spawning season of *N. japonicus* extend from May to September. The biochemical composition in muscle, liver and gonad in both sexes are found higher in early stages of maturity and decreases during gonad maturation. The muscle had more fat and crude protein content during the immature stage. Early stages of maturation, hence offer greater food value in these species. With the advancement of maturity, a drop in the fat and soluble crude protein was observed, whereas a linear relationship with moisture was noted from immature to mature stage. The composition of muscle always demonstrated an inverse relationship with hepatic and gonadal composition. Highest crude protein percentage was in stage IV (72.0 ± 2.22) in ovary. The total crude lipid percentage of the ovary showed a gradual increase from Stage I (5.1 ± 0.47) to Stage IV (21.8 ±1.02).

Keywords: Family, Species, Fish composition, Marudu bay, Sabah

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Mohd Azim Bin Mohd Khatib
National Institute of Oceanography and Fisheries, Egypt

Correspondence: Mohd Azim bin Mohd Khatib, Department of Aquaculture, Faculty of Agriculture, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia, Tel +60199847392, Email azmm_1988@yahoo.com.my

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Introduction

Currently, there are various definition for estuaries, but generally, they are partially enclosed bodies of water where freshwater mixes with oceanic saltwater to produce a mixed and fluctuating salinity environment.[1-3] The estuaries can be perceived as an ideal environment for numerous aquatic species despite a constant change in salinity, temperature and turbidity.[4-8] Estuaries are recognized worldwide as main breeding centers and nurseries many fish species due to their highly diverse and productive macrofauna.[9-12] Hence, specific areas in estuaries such as mangrove forests and seagrass meadows are favorite places for estuarine fishes to spawn as they can ideally be used as sheltered areas for juvenile fishes.[13-16]

For the record, there had been several studies on fish identification and composition in the estuaries of Peninsular Malaysia.[17-23] The findings from those studies can be used to help researchers and government authorities in finding better ideas and actions in improving estuarine ecosystem management in Peninsular Malaysia. Unfortunately, the information and studies about fish composition in the estuarine areas of Sabah and Sarawak are still scarce due to the lack of funding, logistic and expertise.[24-26] Realizing this, for the past few years, the government reacts by beginning extensive fisheries research in Sabah and Sarawak. As a result, Marudu Bay, one of well-known estuary in Sabah, had been selected for the study of fish composition.

The role of Marudu Bay as one of important fishery areas in Sabah cannot be denied as nowadays, many fishery activities such as capture fishery, cage aquaculture, mollusk culture and fish-product processing are operated there.[27] As a result, adequate and update information about fisheries status in Marudu Bay are needed in order for the authorities to manage the fish stocks effectively. Unfortunately, recent records showed that there was very little or no comprehensive information about fish composition in Marudu Bay.[24] The knowledge and identification of fish assemblage in Marudu Bay is quite essential as the study of fish diversity at there cannot be executed unless the study of fish composition had been done first. Hence the objective of this chapter was to identify and find the composition of fishes, up to the species level, found in the estuaries from Marudu Bay, Sabah, East Malaysia. This study will provide first sufficient and comprehensive data about fish composition in Marudu Bay, thus enabling further studies about fish diversity in the later chapter.

Materials and methods

The study was conducted at Marudu Bay in the coastal waters of Kota Marudu, Sabah, East Malaysia (Figure 1). The coastline of Kota Marudu is short (70 km) compared to the other districts in Sabah, with only 4 km along the mainland, 33 km along lagoons and 33 km along islands. Monthly samplings were conducted between October 2012 and September 2013. The sampling activities were carried out during daylight when the tides were high. A medium sized motor boat with a 14 horse power engine was used as transportation to the sampling stations. Fish samples were collected by using gill nets. Upon being ready, the specimens were brought onto land and kept on crushed ice until analysis. The family and species identifications of the sample began by carefully looking at their morphological appearance. The fishes were identified by using a reference book[28] and fisheries manual.[29] The samples were then sorted according to the family and species level.

Results and discussion

In total 40 species of fish and crustaceans belonging to 29 families were identified from the estuary and coastal area of Marudu Bay, Sabah, East Malaysia (Table 1). In terms of species diversity, Carangidae (3 species) and Leiognathidae (3 species) were amongst the most dominant families. Seven families (Portunidae, Terapontidae, Serranidae, Clupeidae, Sciaenidae, Engraulidae and Scombridae) consisted of two species while the other 20 families

(Ariidae, Centriscidae, Penaeidae, Gerreidae, Paralichthyidae, Nemipteridae, Dasyatidae, Sillaginidae, Belonidae, Mugilidae, Mullidae, Scatophagidae, Lutjanidae, Tetraodontidae, Eleotridae, Soleidae, Cynoglossidae, Squillidae, Sphyraenidae and Atherinidae) had only one species per family.

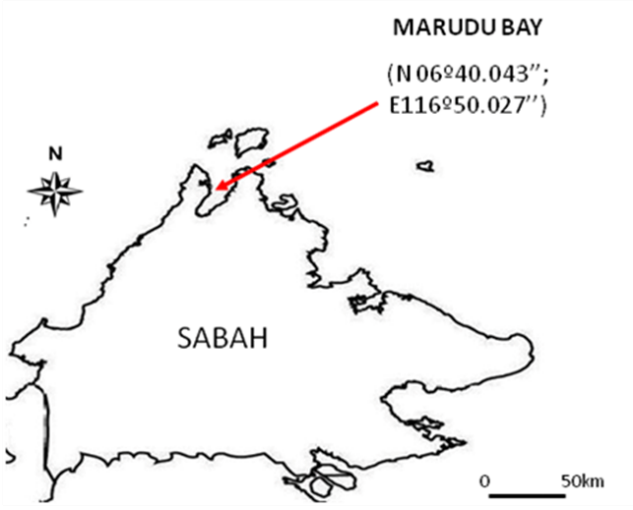

Figure 1 Geographical location of the sampling stations in the Marudu Bay, Sabah, Malaysia.

Based on Table 2, it can be said that each study used different types of fishing gear, resulting in species diversity differences. It is understood that the types of fishing gears (depending on the manpower and logistics) and also the time of fishing (during high or low tide; day or night) can be attributed as the main reasons for this diversity.[23] The present and previous studies also showed that neither fish larvae or juveniles , which were always abundant in the estuary areas, were caught during sampling as they can simply pass through the mesh net, implying that only big and mature fish were caught during sampling. Therefore, the collection of fish larvae and juveniles for more detailed studies of fish fauna in estuary areas can only be achieved by using suitable sampling gears. For example, a plankton net or bongo net have more suitable features such as micro mesh sizes and a fixed main frame for trapping small fish.[19, 23]

A previous study in Mengkabong Bay, Sabah, found 91 fish species belonging to 40 families.[19] They used three types of nets including a trammel net, gill net and cast net to catch the fish while our present study sampled fish by only using a gill net. The use of multiple types of nets may have contributed to the higher occurrence of species diversity and abundance than our present study as the practice of using several fishing gears at the same time can potentially lead to a higher catch rate of fish.[19] From this, we can suggest that it is a good idea to use various net types whenever commencing fish sampling as it can yield sufficient findings in terms of fish diversity and distribution.

Trammel and gill nets are considered to be more popular than other fishing gears for fish sampling as indicated in Table 2 where five out of seven previous studies used these nets as main fishing gears.[19,21,20,23,30] The yield from using these nets can be quite good for showing fish diversity and distribution of the targeted areas. Evidence can be observed by looking at the structures of these net, which have multiple mean mesh sizes that enable it to trap various fish species with varied body sizes. The passive principal of operation of trammel and gill nets involves casting instead of towing which can prevent much of the fish fauna from extinction as these nets only trap those that try to pass them.

Table 1 List of fish and crustacean species recorded from estuary and coastal area of Marudu Bay, Sabah

Family	Species (Scientific Name)	Local Name
1. Ariidae	*Arius maculates*	Ikan duri tompok
	Atule mate	Ikan pelata
2. Carangidae	*Scomberoides tol*	Ikan talang lampai
	Carangoides malabricus	Ikan demudok cermin
3. Sillaginidae	*Sillago sihama*	Ikan puntung-damar perak
	Eubleekeria splendens	Ikan kekek mahkota
4. Leiognathidae	*Leiognathus equulus*	Ikan kekek gedabang
	Secutor ruconius	Ikan sekiki india
5. Tetraodontidae	*Lagocephalus gloveri*	Ikan buntal pisang-perang
6. Paralichthyidae	*Pseudorhombus cinnamoneus*	Ikan sebelah kayu manis
7. Centriscidae	*Centriscus cristatus*	Ikan pisau lipat
8. Gerreidae	*Gerres oyena*	Ikan kapas laut
9. Serranidae	*Epinephelus coiodes*	Ikan kerapu bintik jingga
	Epinephalus sexfasciatus	Ikan kerapu bebeh
10. Sciaenidae	*Otolithes ruber*	Ikan tengkerong panjang
	Dendrophysa russselii	Ikan gelama-janggut tanda
11. Nemipteridae	*Nemipterus nemurus*	Ikan kerisi spina merah
12. Clupeidae	*Sardinella melanura*	Ikan tambam-sisik hujung hitam
	Sardinella zunasi	Ikan tambam
13. Engraulidae	*Encrasicholina devisi*	Ikan bilis laut
	Thryssa hamiltonii	Ikan kasai minyak
14. Terapontidae	*Pelates quadrilineatus*	Ikan kerong empat jalur
	Rhynchopelates oxyrhynchus	Ikan kerong tompok
15. Belonidae	*Tylosurus acus melanotus*	Ikan todak banang
16. Dasyatidae	*Himantura walga*	Ikan pari ketuka tanjung
17. Scombridae	*Scomberomorus semifasciatus*	Ikan Tenggiri Papan kuning
	Rastrelliger kanagurta	Ikan kembung borek
18. Scatophagidae	*Scatophagus argus*	Ikan kitang

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Table Continued...

Family	Species (Scientific Name)	Local Name
19. Mugilidae	*Liza tade*	Ikan belanak tade
20.Mullidae	*Parupeneus forsskali*	Ikan biji nangka karang
21. Lutjanidae	*Lutjanus lemniscatus*	Ikan jenahak jalur kuning
22. Eleotridae	*Butis butis*	Ikan ubi muncung itik
23. Soleidae	*Synaptura commersonnii*	Ikan lidah-daun tirus
24. Cynoglossidae	*Cynoglossus bilineatus*	Ikan lidah pasir
25. Sphyraenidae	*Sphyraena putnamae*	Ikan alu-alu gigi gergaji
26. Atherinidae	*Atherinomorus duodecimalis*	Ikan paku-renyau perak
27. Portunidae	*Portunus pelagicus*	Ketam bunga
	Scylla serrate	Ketam nipah
28. Squillidae	*Harpiosquilla harpax*	Udang lipan
29. Penaeidae	*Metapenaeus ensis*	Udang pasir

Table 2 Comparison table of fish classification (total number by family and species) and types of gears that were used to catch fish between the present study and previous regional studies

S. No	Location	Fish Classification		Type Of Gears	Source
		Family	Species		
1	Marudu Bay (Malaysia)	29	40	Gill net	Present study
2	Sungai Pulai seagrass beds (Malaysia)	37	72	Trammel net	Jimmy[23]
3	Tanjung Pelepas (Malaysia)	30	47	Trammel net	Arshad et al.[21]
4	Merchang estuary and seagrass areas (Malaysia)	19	32	Trammel net and cast net	Suryana[20]
5	Mengkabong Bay (Malaysia)	40	91	Trammel net, gill net and cast net	Mazlan et al.[19]
6	Bangrong estuary (Thailand)	48	95	Push net and gill net	Poovichiranon & Satapoomin[30]
7	Gulf of Thailand (Thailand)	29	38	Trawl net	Sudara et al.[31]
8	North Bais Bay (Philippines)	48	49	Beam trawl	Dollar[32]

Instead of using small nets, the neighboring countries of Malaysia such as Thailand and Philippines use big nets like trawl nets[31] and beam trawls[32] as the main method of sampling fish. The results from those studies were not much different from the present study as observed from Table 4.2. The number of families and species obtained were 29 families, 38 species[31] and 48 families, 49 species,[32] respectively, almost close with the present study in which 29 families and 40 species were obtained. The degree of fish family and species diversity that were recorded from those studies should be distinctively higher than the present study, considering the fact that gill nets are a passive fishing gear while trawl nets and beam trawls are active fishing gears. However, this was not the case as the main reason lies on the operation of those nets. The trawling operation by trawl nets and beam trawls indiscriminately sweep all forms of fishes (juveniles and adults) found in the study areas, with a high chance of getting a high catch yield of only several dominant species, thus ignoring other less dominant species that are scattered in the study areas.[23] Due to this inefficiency, it is suggested that the use of trawl nets should be limited and instead, passive fishing gears should be encouraged in any fish sampling activities to ensure better results in the observations of fish diversity. In conclusion, further detailed studies on the family and species composition of the fish and crustacean are needed from more geographical locations of Malaysia for fisheries management in these waters.

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None.

Conflicts of interest

None.

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