



Preliminary Studies on Species Diversity of Coastal Bivalves and the Traditional Knowledge on Bivalve Fishery in Sedili Kechil, Johor

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Abstract: Research on bivalves in Malaysia and documentation on bivalve fishery is still lacking in the recent years. Study on the diversity of bivalves will help contribute to the Malaysian database and the documentation of traditional knowledge on bivalve fishery will prevent the knowledge from going extinct. Therefore, this study was conducted to determine the species diversity of bivalves present in Sedili Kechil, Johor and also to gain access to the traditional knowledge of the fishermen involved in bivalve fishery practiced in the area. Bivalves were handpicked randomly throughout the coastal region and a total of 10 respondents make up the sample size of this study. The traditional knowledge was gathered with the aid of a semi-structured questionnaire through a combination of non-participant observation and in-depth interview method. This study has collected the first record of species of bivalves in Sedili Kechil. The bivalves' diversity in Sedili Kechil is medium to low diversity by using Shannon Wiener Index (1.26) and Pielou's Index of Evenness (0.41) and the traditional knowledge is documented regarding the variety of habitat preferences, fishery seasons, and exploitation and preservation methods. It is discovered that most bivalves occupy sandy substrates with four periods of availability and with different exploitation methods with respective to species. No preservation method is practiced by the villagers. The association with abiotic components and non-abiotic components and preference timing and depth for bivalve fishery are also noted. This record on species diversity and the documentation of traditional knowledge is hoped to be contributing to the Malaysian database and become preliminary data for future research.

Keywords: Shannon Wiener, Pielou's Index of Evenness, In-depth interview, non-participant observation, documentation

1. Introduction

Bivalves are marine organisms living in a bipartite shell that falls under the class Bivalvia [1]. They contribute greatly to the marine ecosystem by providing ecosystem services such as reduce the turbidity of water in the ocean, a great sequester of carbon and also provide structural habitat for fish and crustacean production [2]. They also serve significant roles to humanity as food resources and also as ornaments [3]. However, research study regarding bivalves is still incomprehensive and only cover certain areas in Malaysia [4]. The weak level of bivalves' database in Malaysia makes it impossible to track the species that are lost and plan for their future conservation actions. Data regarding bivalves from the local people such as availability of bivalves in particular habitats, effects of temperature to bivalves and association of bivalves with other species is deemed necessary as a preliminary data that could correlate to the scientific research done in the future. However, traditional knowledge regarding bivalve fishery has never been documented in Malaysia and this is attributed to the degradation of traditional knowledge due to modernization [5]. Eventually, only the communities who rely solely on them continue to practice the knowledge and pass them on to the next generation. Keeping this in view, there is an urgency to keep record of bivalve species and document the traditional knowledge regarding bivalve fishery for future references. Therefore, the objectives of this study are to determine the species diversity of bivalves present in Sedili Kechil, Johor and to document the traditional knowledge in bivalve fishery from the local people of Sedili Kechil. Data regarding bivalves can contribute to the Malaysian database and the traditional knowledge can be used as a preliminary data that sparks future research.

2. Materials and Methods

2.1 Study Site

This research study was conducted in Sedili Kechil which is a coastal region located in the district of Kota Tinggi, Johor and is approximately 40 km from the Kota Tinggi city (Figure 1). The communities involved in this study is the local people of Kampung Sedili Kechil comprises of 10 people that make up the sample size of this study. The criteria taken for selection of interviewees is based on their occupational background which is full time or part time fishermen at sea with direct experience in bivalve fishery.

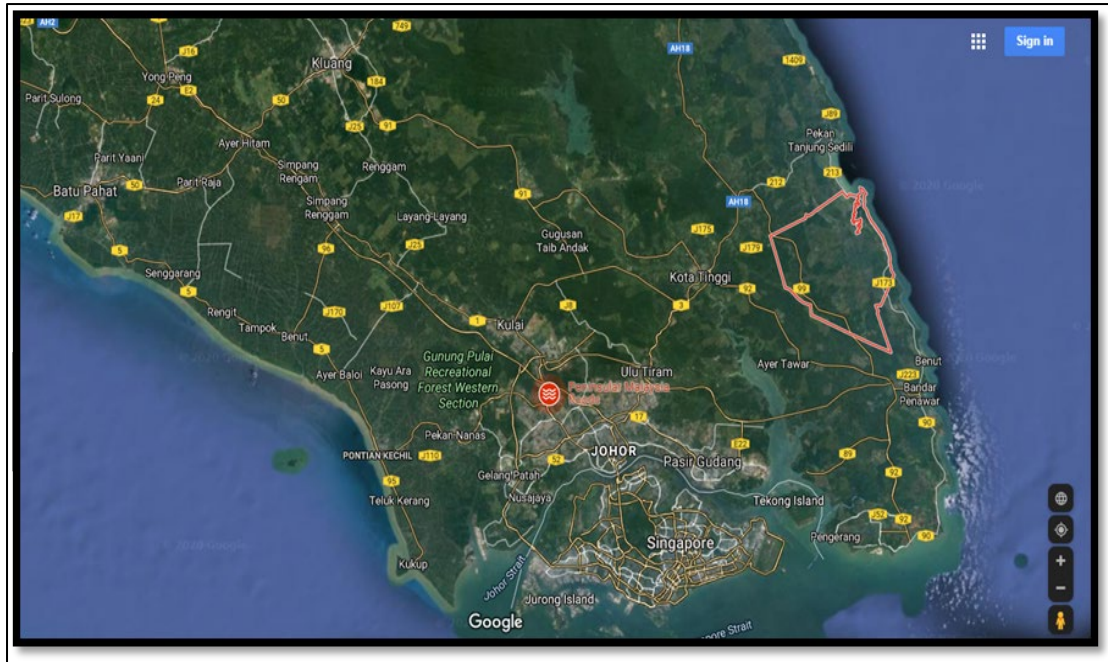


Fig. 1 - Sampling location of bivalves in Sedili Kechil, Johor. Source: Google Map

2.2 Materials

- Hand-held GPS
- Forceps
- Zip lock plastics
- Plastic containers with screw tops
- 70-80% ethanol
- Camera

2.3 Specimen Collection

Geographical location of study site is determined using a hand-held GPS. Bivalves are handpicked randomly throughout the coastal area and stored temporarily in zip lock plastics at the field and transferred into plastic jars with screw tops. All sampling activities were done during low tide to maximize the collection of bivalves [5]. Bivalve shells are cleaned and boiled according to their sizes where small shells are boiled for 30 seconds and larger shells are boiled for 1 minute to loosen the shells without force. Shells that are smaller than the regular cooking size is put directly into 70% ethanol without being boiled. The use of borax as buffer in ethanol is optional [6]. Quality photographs are taken for future references, Bivalves are identified using their morphological structures such as shape, size and colour with the help of local names. The database, iNaturalist is used to identify species name based on photos taken by the public in tropical countries. Validation of species name is done by referring to the World Register of Marine Species (WoRMS) database [7] and also confirmed with experts.

2.4 Documentation of Traditional Knowledge

Data regarding the traditional knowledge on bivalve fishery is collected by in-depth interview method and non-participant observation with the aid of a semi-structured questionnaires [8]. The fishermen of Kampung Sedili Kechil comprises 10 people are interviewed regardless of age and gender. All answers are noted on the spot and recorded using a recording device. The questionnaires consist of two main parts, where the first part focuses on the demographic profile of the respondents and the second part emphasizes on the bivalve fishery practiced by the local people in the area. The data gathered are analyzed by using tables and matched their correlations with previous scientific studies.

2.5 Data Analysis

The quantitative data are analyzed using two diversity indices; Shannon Wiener Index (H') and Pielou's Index of Evenness. The indices depicts the diversity of the site; either low, medium or high in diversity. The formula of Shannon Wiener Index is given by $H = - \sum H_i \ln H_i$ and the criteria to assess the level of diversity is referred to [9] when $E < 0.4$ = low diversity, $0.4 < E < 0.6$ = medium diversity and $E > 0.6$ = high diversity. The higher the value, the higher is the

diversity. Pielou's Index of Evenness is given by the formula $E = H'/H_{max}$ and the criteria to determine the level of diversity is with reference to [9] where $E < 0.4$ = low diversity, $0.4 < E < 0.6$ = medium diversity and $E > 0.6$ = high diversity. Qualitative data obtained from the interview session is analyzed and documented as the traditional knowledge of Sedili Kechil where the scientific correlations are verified using previous studies.

3. Results and Discussion

3.1 Species Diversity of Bivalves

This research has revealed the first record of bivalve species in Sedili Kechil, Johor (Figure 2). For a duration of 5 days of sampling, the total individuals collected was 443 individuals which is composed of 22 species distributed within 5 orders. The orders collected include Venerida, Cardiida, Arcida, Ostreida and Mytilida that originate from 7 families and 14 genera. The highest percentage of bivalves belongs to the family Veneridae (47%) followed by Cardidae (19%), Arcidae (14%), Ostreidae (5%), Mytillidae (5%) and Psammobidae (5%). *Perna viridis* becomes the most dominant species with 295 individuals collected altogether which is 66% of the total collection as shown in Figure 3. All species were identified up until the species level except for a species of razor clam called *baget* by the locals.

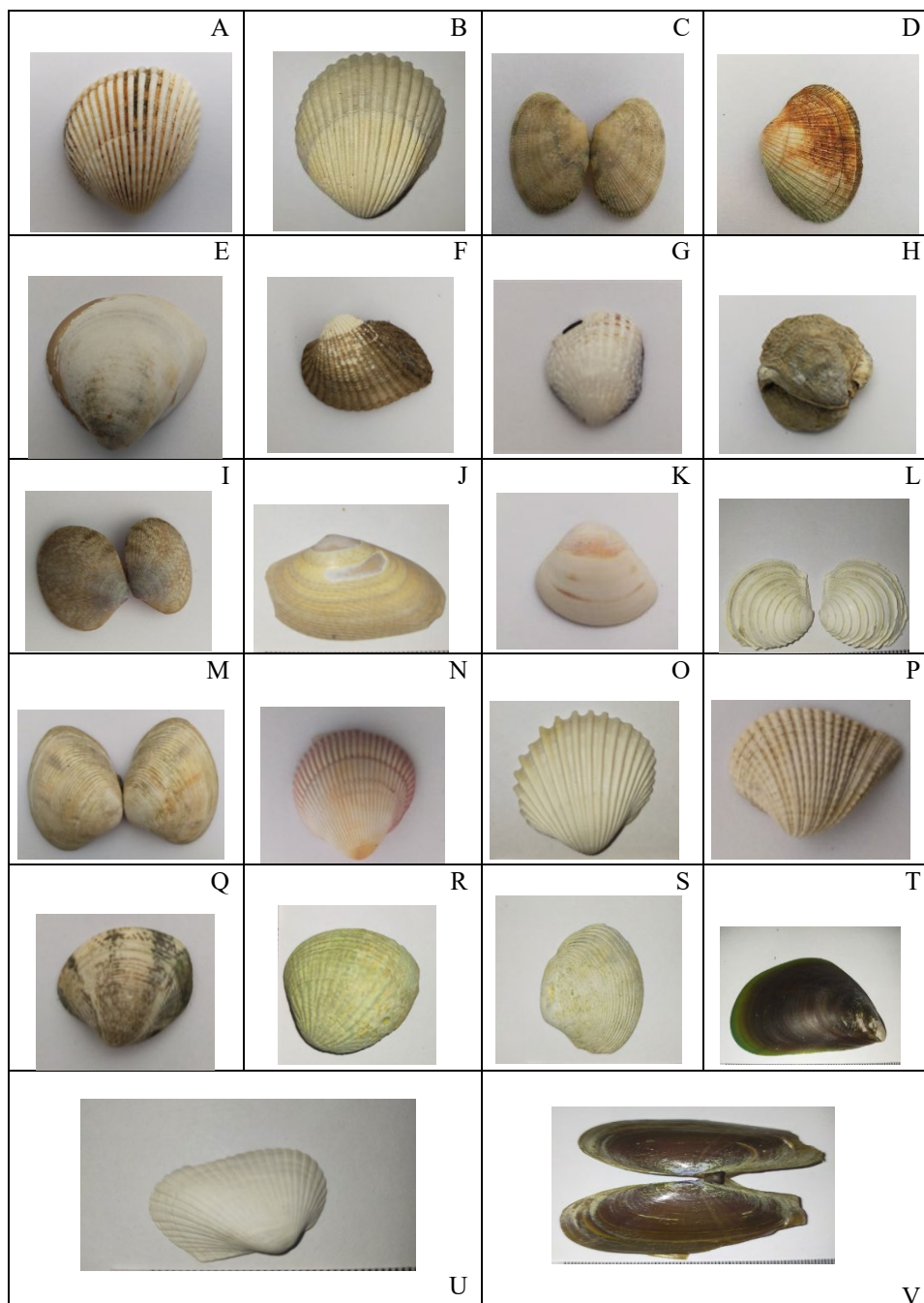


Fig. 2 - Bivalves recorded in Sedili Kechil: (A) *Vasticardium elongatum*, (B) *Vasticardium flavum*, (C) *Paphia euglypta*, (D) *Asaphis violascens*, (E) *Meretrix meretrix*, (F) *Anadara pilula* (G) *Gafrarium pectinatum*, (H) *Ostrea denselamellosa*, (I) *Paratapes textilis*, (J) *Paratapes undulatus*, (K) *Meretrix lusoria*, (L) *Placamen chloroticum*, (M) *Meretrix lusoria*, (N) *Maoricardium pseudolima*, (O) *Vepricardium sinense*, (P) *Tegillarca granosa*, (Q) *Paphia rotundata*, (R) *Gafrarium tumidum*, (S) *Semele carnicolor*, (T) *Perna viridis*, (U) *Anadara subgranosa*, (V) *baget*

Table 1 shows the species collected at the coastal area of Sedili Kechil, Johor with their respective International Union for Conservation of Nature (IUCN) status. All species are categorized under 'Not Evaluated' by the IUCN which indicates that none of the bivalves obtained are assessed by the IUCN [1]. The diversity of bivalves in Sedili Kechil is considered medium to low diversity which is proven by Shannon Wiener Index (1.26) and Pielou's Index of Evenness (0.41). A low Shannon Wiener Index indicates an unstable condition for the bivalves [9]. The Pielou's Index of Evenness revealed that the study site falls in the medium diversity category near the border between low and medium diversity. A low evenness index suggests that the site has low number of species that dominate research site or large disparity between the numbers of individuals collected for each species [10].

Table 1 - Bivalve species in Sedili Kechil

Order	Family	Scientific name	IUCN status
Mytilida	Mytilidae	<i>Perna viridis</i> (Linnaeus, 1758)	Not evaluated
Ostreida	Ostreidae	<i>Ostrea denselamellosa</i> (Lischke, 1869)	Not evaluated
Arcida	Arcidae	<i>Anadara pilula</i> (Reeve, 1843)	Not evaluated
		<i>Anadara subgranosa</i> (Dunker, 1869)	Not evaluated
		<i>Tegillarca granosa</i> (Linnaeus, 1758)	Not evaluated
Venerida	Veneridae	<i>Paratapes textilis</i> (Gmelin, 1791)	Not evaluated
		<i>Paratapes undulatus</i> (Born, 1778)	Not evaluated
		<i>Meretrix meretrix</i> (Linnaeus, 1758)	Not evaluated
		<i>Meretrix lusoria</i> (Röding, 1798)	Not evaluated
		<i>Meretrix lyrata</i> (G. B. Sowerby II, 1851)	Not evaluated
		<i>Gafrarium tumidum</i> (Röding, 1798)	Not evaluated
		<i>Gafrarium pectinatum</i> (Linnaeus, 1758)	Not evaluated
		<i>Paphia euglypta</i> (Philippi, 1847)	Not evaluated
		<i>Paphia rotundata</i> (Linnaeus, 1758)	Not evaluated
		<i>Placamen chloroticum</i> (Philippi, 1849)	Not evaluated
Cardiida	Cardidae	<i>Vasticardium elongatum</i> (Bruguière, 1789)	Not evaluated
		<i>Vasticardium flavum</i> (Linnaeus, 1758)	Not evaluated
		<i>Maoricardium pseudolima</i> (Lamarck, 1819)	Not evaluated
		<i>Vepricardium sinense</i> (G. B. Sowerby II, 1839)	Not evaluated
	Psammobidae	<i>Asaphis violascens</i> (Forsskål in Niebuhr, 1775)	Not evaluated
	Semelidae	<i>Semele carnicolor</i> (Hanley, 1845)	Not evaluated
		Unidentified	Unidentified

3.2 Traditional Knowledge on Bivalve Fishery

The people of Sedili listed 17 species maximum that they are familiar with in the coastal waters of Sedili (Table 2) and these species are eaten for their own consumption and not sold to the public. Only 12 species stated by the fishermen were obtained during sampling activities while 5 species were not spotted. All fishermen agreed that each species is available in different substrates at a variety of depths in their respective seasons. For example, *P. viridis* can be found clinging on rocks in deep water and during pre-monsoon or post-monsoon seasons because they cannot tolerate low salinity level. During low tides, fishermen collect bivalves with water level at the very most at the knee-level to maximize bivalve collection. Water level higher than that makes searching difficult. The use of a knife/*parang*, coconut shell, rattan and *gerat* are common during bivalves-searching. Most of the fishermen claimed that biotic components can be found inside the living shells such as algae and tiny crabs, which is one of the diets of the bivalves. Lunar cycle does not give any effect to availability of bivalves according to most of the fishermen. This is because most of them only collect bivalves during daytime. However, some fishermen reported that more catch can be obtained during low tides during a full moon as the low tides during full moon is lower than the ordinary low tides. When it comes to storage, fishermen do not store bivalves for a long period of time, thus no preservation methods are known to be practiced in Sedili Kechil, Johor.

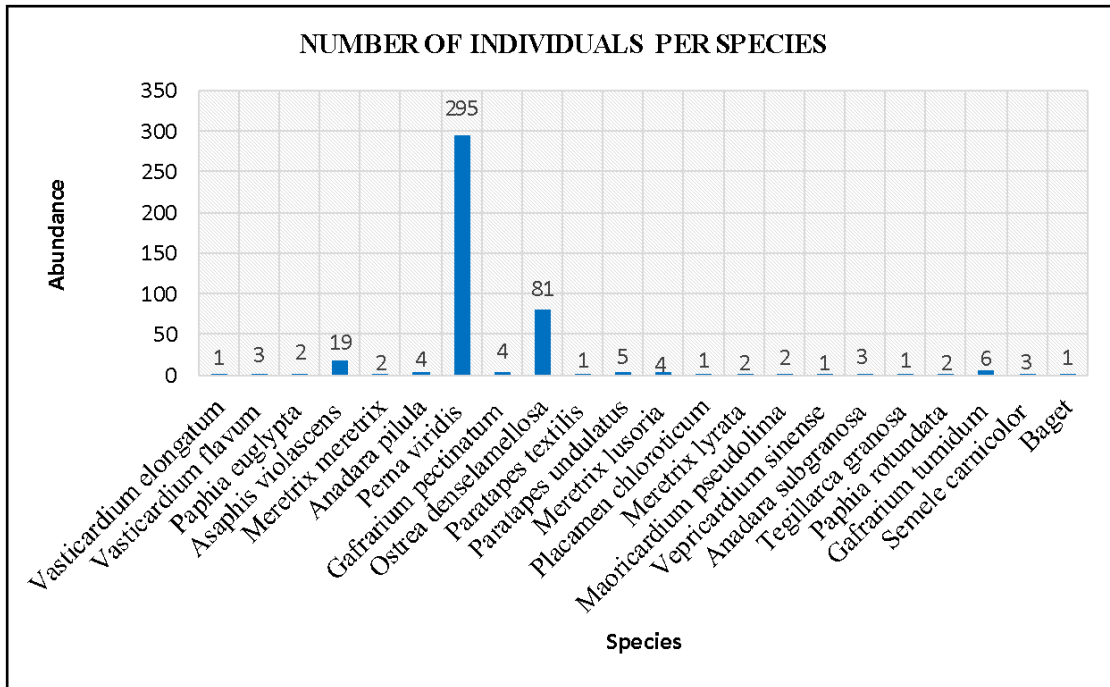


Fig. 3 - Number of individuals per species

Table 2 - Traditional knowledge on availability of different bivalve species

Scientific name	Local name
<i>Perna viridis</i> (Linnaeus, 1758)	Kupang
<i>Ostrea denselamellosa</i> (Lischke, 1869)	Tiram
<i>Anadara pilula</i> (Reeve, 1843)	Kerang bulu
<i>Anadara subgranosa</i> (Dunker, 1869)	Kerang merah
<i>Paratapes textilis</i> (Gmelin, 1791)	Remis
<i>Paratapes undulatus</i> (Born, 1778)	Lala
<i>Meretrix meretrix</i> (Linnaeus, 1758)	Kepah pantai
<i>Meretrix lusoria</i> (Röding, 1798)	Kepah sungai
<i>Meretrix lyrata</i> (G. B. Sowerby II, 1851)	Kepah
<i>Gafrarium tumidum</i> (Röding, 1798)	Gurap
<i>Maoricardium pseudolima</i> (Lamarck, 1819)	Kerang shell
Unidentified due to incomplete structure	Baget
Unidentified due to specimen not found	Pepahat
Unidentified due to specimen not found	Kapis
Unidentified due to specimen not found	Beliung
Unidentified due to specimen not found	Serombong
Unidentified due to specimen not found	Keris

4. Conclusion

A total of 22 species were found in Sedili Kechil, Johor with the diversity indices indicating medium to low diversity by using Shannon Wiener Index and Pielou's Index of Evenness. The traditional knowledge was documented from the local fishermen of Sedili Kechil regarding the tools needed, method of collection, depth, season, rainfall, tides, lunar cycle and also preservation methods.

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