

A preliminary study on the distribution of spiny lobster (*Panulirus* spp.) in Labuan Island, Malaysia

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Abstract

There is a paucity of information on the global distribution and capture fisheries of the spiny lobster *Panulirus*, spp. Under the IUCN Red List produced by the International Union for Conservation of Nature that acts as a critical indicator of the health of the world's biodiversity, most of the *Panulirus* spp. are categorized under least concern category while some show a declining trend. Further investigations are needed due to data deficiency. The present survey was carried out in the western region of Labuan island. Seven random stations along the west coast of the Island were selected for observations during day dive. Generally, the density of the spiny lobsters was low throughout the present study. Only four individuals of two spiny lobster species were recorded. Two individuals of *P. versicolor* were observed in station 2 while the other two (*P. ornatus*) were spotted in station 4. This low number could be due to the preliminary nature and limited duration of the study. Spiny lobsters tend to have a wide range of depth preferences. Two adult specimens of *P. versicolor* were spotted in an environment where turbidity was low. Further investigations over extended period of time and covering larger sampling areas will be necessary to accurately establish the habitat preferences and other ecological aspects of *P. ornatus* and *P. versicolor*.

Keywords: Spiny lobster, *Panulirus* spp., Depth, Turbidity, Distribution

Introduction

Tropical spiny lobsters (*Panulirus* spp.) are considered high-value fisheries resources. *Panulirus ornatus*, *Panulirus versicolor* and *Panulirus penicillatus* are the most widely distributed species in the Philippines waters (Juinio-Menez and Gotanco, 2004) but *Panulirus homarus*, *Panulirus timpsoni* and *Panulirus longipes* are mostly preferred for culture in Khanh Hoa province and southern central Vietnam (Tuan and Mao, 2004). The sea cage culture of spiny lobster has been set up on the east coast of Queensland and Torres Straits in Australia. Torres Straits comprises islands in the coastal sea and provides suitable areas for the sea cage culture of spiny lobster, *P. ornatus* (Kenway et al., 2008). In Malaysia, limited data is available on the distribution of marine spiny lobster (*Panulirus* spp.). Only one species, *Panulirus polyphagus*, was recorded in Johor strait (Ikhwanuddin et al., 2014) and five species from Sabah waters (*P. ornatus*, *P. versicolor*, *P. longipes* and two unidentified species) (Busing and Chio, 2004). Besides, the main problems of spiny lobster in aquaculture industry are captive breeding and larval rearing. Challenges faced in maintaining the puerile and other developmental stages have been discussed by Fatihah et al. (2017), Fatihah et al. (2016) and Ikhwanuddin et al. (2015).

Due to high market demand, spiny lobster is targeted in capture fisheries, leading to overfishing in many regions. The fishing pressure is likely to continue increasing as landings decline in the near future. Currently, out of the total of 21 species recorded in the IUCN red list of

threatened species, nine species are currently categorized as "Data Deficient" while the other thirteen species are "Least Concern" (IUCN, 2018). Out of the current nine "Data Deficient" species, two species (*P. argus* and *P. regius*) have showed depletion and require more fisheries data in order to provide a more conclusive justification.

This study involved a day time dive around Labuan, off the coast of Sabah, East Malaysian state in Borneo, and was intended to collect preliminary ecological data on lobsters. It will require thorough investigations over a longer period of time to determine the habitat preferences, population density and other aspects of biology of the lobsters. This data will be helpful in their sustainable management.

Materials and Methods

The present ecological survey of the tropical spiny lobster, *Panulirus* spp. involved SCUBA diving and was conducted on 8th and 14 September 2017 in Labuan, Malaysia. Labuan is located off the coast of Sabah in East Malaysia and comprises the main island and the other six smaller islands. The study area was in the western region of the main island and included seven randomly selected stations (Figure 1, Table 1).

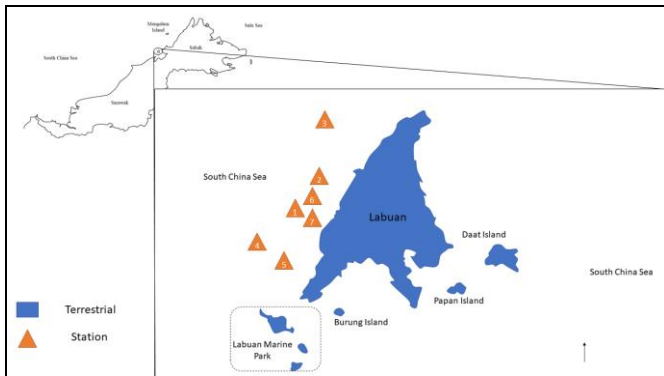


Figure 1. Location of the Labuan Island in Borneo together with the sampling stations.

Global Positioning System (Garmin GPS 78s) was used to detect the coordinate of each study station. The depth of the stations was recorded by depth sounder while the turbidity of the water was measured using TN-100 Turbidimeter (Eutech Instruments, United States of America). The temperature, salinity, dissolved oxygen and pH were determined using YSI-Multiparameter (Xylem Inc, Oklahoma, United States of America). In each station, three transect lines were set up at 10 metre distance from the dive point. The covered area was nearly 314 m². All the data were analyzed by the help of SPSS computer software (Chicago, USA). Non-parametric kruskal wallis test was applied to compare the physico-chemical parameters of the seawater and differences, if any, in the number of specimens of *Panulirus* spp. between the stations were tested for significance ($p < 0.05$).

Results

The results of the non-parametric Kruskal-Wallis test identified depth of each station to be significantly different ($p = 0.004$). Most of the study stations were recorded with the depth around 4- 5 m except stations 3, 4 and 5. Station 3 was the deepest (22.67 m) followed by station 4 (21.40 m). Water temperature showed significant differences between the stations ($p = 0.004$) with little fluctuations. The dissolved oxygen concentration markedly varied ($p = 0.005$); the highest was in station 2 as compared to station 7 (Table 1). Both salinity and pH also showed significant differences between stations ($p = 0.003$; 0.006 , respectively). Salinity was low in all the stations (22.91 – 24.40 ppt). Lower pH (7.75) was recorded in station 1. Water transparency was high due to low turbidity, with the lowest at station 2 (0.053 NTU) which was different from other stations ($p = 0.030$). The most turbid station in the present study was station 5 (1.15 NTU).

Low population density of the spiny lobsters (*Panulirus* spp.) was observed during this study. Only four individuals of two spiny lobster species were recorded (Table 2). The Pearson correlation indicated that the occurrence of *P. ornatus* was positively correlated with the depth ($r = 0.446$; $p = 0.043$), indicating the depth preference of the species in nature (Figure 2). Besides, *P. versicolor* was negatively affected by the turbidity ($r = -0.523$; $p = 0.022$) due to its preference for clearer water (Figure 3).

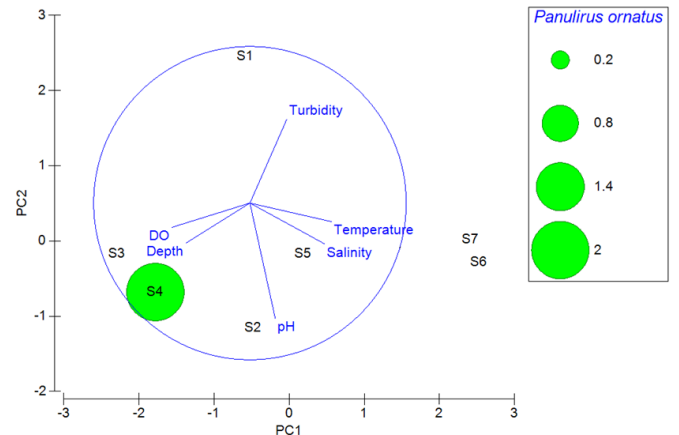


Figure 2. Principal Component Analysis of the *in situ* environmental parameters at all the sampling stations in Labuan coastal waters.

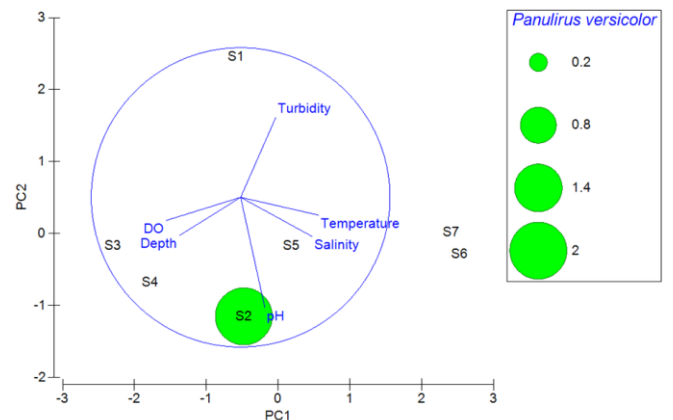


Figure 3. Principal Component Analysis of the *in situ* environmental parameters at the sampling stations in Labuan coastal waters.

Discussion

Low number of the *Panulirus* spp. was probably due to day dive sampling. All the species of genus *Panulirus* are mainly nocturnal and live in coral or rocky reefs in depths less than 40 m (Chan, 1998). The adults are usually active at night and use sand areas for foraging (Senevirathna et al., 2017). Frisch (2007) conducted a short-term (10 days) study of the movement of *P. versicolor* and concluded that the male moves over a greater distance than the female (36 m vs. 18 m). The farthest distance reported is 459 m, and that reflects the level of this activity of the *Panulirus* spp. during night time. Both the *P. ornatus* were observed in the artificial shelters (unused truck tyre) during the day dive (Figure 4). The present results supported the findings of Priyambodo et al. (2015) that *P. ornatus* does not prefer hard substrates. Booth (2001) noted that most of the Palinuridae preferred small holes and crevices in hard substrates. However, the hard substrates that are easily covered by barnacles are expected to decrease the colonization of the *P. ornatus*.

Table 1. Geographical coordinates and *in situ* physico- chemical water parameters of each study station.

Station	Geographical coordinates	Depth (m)	Temperature (°C)	Dissolved oxygen (mg/L)	Salinity (ppt)	pH	Turbidity (NTU)
1	N05°20'12.1" E115°11'06.1"	4.97 ± 0.32	30.37 ± 0.058	3.73 ± 0.058	23.28 ± 0.00	7.75 ± 0.17	1.12 ± 0.19
2	N05°20'43.0" E115°11'01.9"	5.80 ± 0.00	30.60 ± 0.00	4.23 ± 0.23	24.11 ± 0.058	8.10 ± 0.048	0.053 ± 0.038
3	N 05°22'56.0" E 115°10'15.5"	22.67 ± 0.058	30.13 ± 0.058	4.27 ± 0.11	22.91 ± 0.058	8.12 ± 0.090	0.61 ± 0.21
4	N 05°18'51.3" E 115°09'27.0"	21.40 ± 0.20	30.23 ± 0.12	4.04 ± 0.055	23.20 ± 0.012	8.16 ± 0.026	0.44 ± 0.25
5	N 05°17'10.0" E 115°09'22.3"	13.83 ± 1.05	30.77 ± 0.058	3.67 ± 0.058	23.72 ± 0.015	8.20 ± 0.058	1.15 ± 0.31
6	N 05°20'21.3" E 115°11'17.9"	4.37 ± 0.31	31.63 ± 0.058	3.00 ± 0.10	24.40 ± 0.058	8.19 ± 0.058	0.75 ± 0.29
7	N 05°20'13.3" E 115°11'05.6"	4.53 ± 0.058	31.43 ± 0.058	2.97 ± 0.058	24.29 ± 0.058	8.21 ± 0.058	0.90 ± 0.20

Table 2. Distribution of *Panulirus* spp. in each study station: Presence (+) or absence (-).

Station	<i>P. ornatus</i>	<i>P. versicolor</i>
1	-	-
2	-	+
3	-	-
4	+	-
5	-	-
6	-	-
7	-	-

**Figure 4.** *Panulirus ornatus* in the artificial shelter recorded in station 4

Conclusion

The results of the present preliminary daytime survey indicated only two species of *Panulirus* spp. represented by two individuals of each in Labuan coastal waters. Depth and turbidity appear to influence the distribution of *Panulirus* spp. in the area in addition to the presence of sheltered environment for protection. However, due to small sample size during the preliminary survey it is not possible to generalize the pattern of distribution or habitat preferences of *Panulirus* spp. This topic deserves importance for management of lobsters in Malaysian waters.

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