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Communication

Distribution of berried female blue swimmer crabs (*Portunus pelagicus* Linneaus, 1758) in the coastal waters of Trang province, southern Thailand

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Abstract: The distribution of berried female blue swimming crabs (*Portunus pelagicus*) was studied on the coast of southern Thailand in Trang province between Talibong Island and Had Chao Mai National Park. Crab data were gathered using crab gill nets 1.5 m wide and 1,200 m long. Six sets of nets were placed 300 m apart. Crab samplings were done in April, August, October and December 2011. Berried females accounted for 12.1, 3.9, 29.7 and 9.5 % of the total catch in April, August, October and December respectively, while they accounted for 29.2, 8.7, 55.0 and 4.4 % of the female catch in the same time period. The percentage of berried females carrying orange, yellow and black eggs were 50.0%, 31.8% and 18.2% respectively. Berried female crabs were found in the depth of 2.8-13.3 m where the grain size of the bottom sediment was smaller than 425 μm.

Keywords: blue swimmer crab, *Portunus pelagicus*, Trang province

INTRODUCTION

The blue swimmer crab (*Portunus pelagicus* Linneaus, 1758) is one of the most important species for small-scale fisheries in Thailand. However, the commercial catches of *P. pelagicus* have declined from 36,350 tons in 2001 to 23,529 tons in 2009 [1]. The crab has been heavily exploited because of its high market value. Most small-scale fishermen in Thailand have noticed, and complained about, a drastic decline in both the catch rate and size of individuals over time [2]. The catch per unit effort (CPUE), size-structure, sex ratio and number of spawning females are important data for assessing the stock of crabs and understanding the behaviour of fishermen and how the fishery might affect the stock. Catches and distributions of blue swimmer crabs have been studied in the eastern Gulf [2] and the Andaman Sea of Thailand [3]. Catching small-sized, berried females

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 52-59

(those carrying eggs on the abdomen) is a major factor in the decline of the crab fishery. Nitiratsuwan *et al.* [4] reported that the catches in Trang province comprised both small-sized crabs (approximately 64.2 % of total landings) and berried females. Although catching of berried females could be the main cause of the declining stock, little investigation has been done on the distribution of the females. The information from this study could be used for assessing the spawning period, thus offering tools for future sustainable management of the blue swimmer crab resources.

MATERIALS AND METHODS

Study Area

The study was conducted in southern Thailand on the Andaman Sea coast of Trang province in Kantang district between Talibong Island and Had Chao Mai National Park, between 7°5′-7°27′N and 99°10′-99°05′E (Figure 1). The water depths were between 5-25 m. The climate of the area is influenced by seasonal displacements of the south-west and north-east monsoons. The dry season extends from December to April and the rainy season from May to November. The area is sensitive to ecological changes as it is covered by large seagrass meadows [5] and has small-sized blue swimmer crabs in abundance [6]. The area is also the last habitat of the dugong and spinner dolphin on the coast of Trang province [7, 8] and has been used by small-scale fishermen as fishing grounds for blue swimmer crabs. Community-based co-management of fisheries has been implemented in several villages along the coast.

Crab Data Collection

Crab gill nets are most suitable for collecting crab data as they have less impact on the seagrass ecosystem than trawl or push nets. Collapsible crab traps are not suitable because bait does not attract berried female crabs [9]. Nitiratsuwan [10] also reported that crab gill nets caught more berried crabs than collapsible crab traps.

In this study, crab samples were gathered using 1.5-m-wide gill nets with 4-inch mesh set for a length of 1,200 m. Six sets of nets were placed 300 m apart and left for 24 hr before collection. Each crab collected was sexed, the egg colour recorded, and the width between the tips of the two lateral spines of the carapace measured [11]. Sampling was done during neap tides in April (dry season), August and October (rainy season). Each sampling site was reached by boat and its position was checked using a GPS unit.

Environmental Data Collection

Stations for environmental data collection were set at regular intervals of 300 m along the gillnet lines as shown in Figure 1. The stations were reached by boat and positions were checked using a GPS unit. Water salinity and depth were measured *in situ* using a hand-held refractometer and GPS depth sensor (Garmin 421S) respectively. Bottom sediment was collected using an Ekman-Berge dredge. The sediment samples were analysed soon after returning to the laboratory. They were dried in a hot air oven for 24 hr before the grain sizes were graded using a sieve shaker.

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 52-59

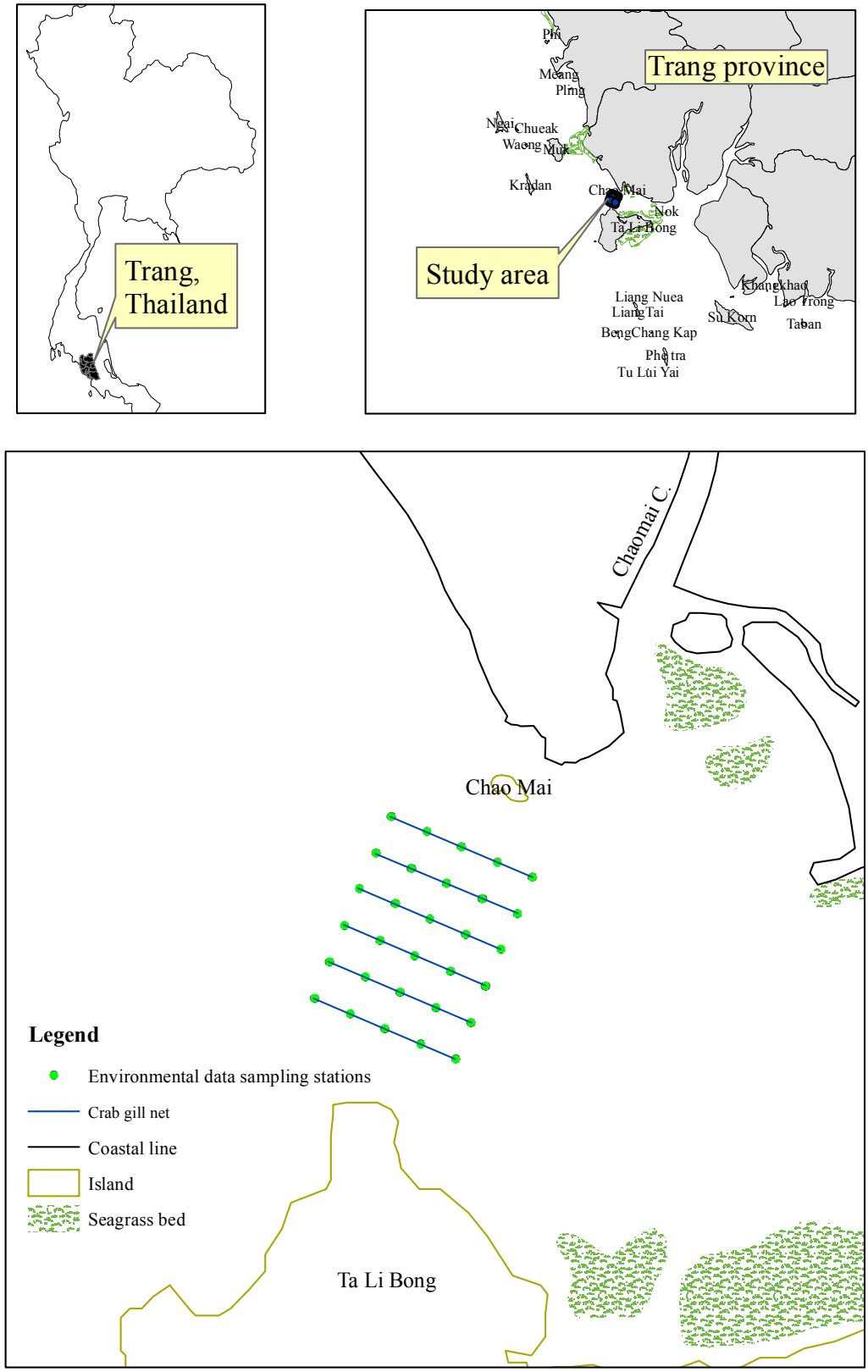

Figure 1. Location of study area and environmental data sampling stations

Data Analysis

Possible deviation from the expected 1:1 sex ratio was tested with the Chi-square test. The water depth at each station was adjusted to the lowest indicated in the tide tables [12]. The water

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 52-59

depth data was interpolated by Kriging analysis [13]. The grain size proportions of the bottom sediment were analysed by cluster analysis [14].

The geographical information system (GIS) and standard procedures of the ArcGIS 9 programme [13] were applied to map the spatial distribution of the different-coloured eggs carried by berried females with respect to water depth and grain size of the bottom sediment.

RESULTS AND DISCUSSION

A total 191 crabs were caught. The ratio of males to females was 1.17:1 with no significant difference from 1:1 sex ratio (χ^2 = 1.18, p > 0.05) (Table 1). A similar result was reported by Bellchambers and Lestang [11] using seines and otter trawls**.** The berried crabs were 11.5% of the total crabs and 25.0% of total females caught over all study periods. The percentage was especially high in October, when berried crabs were 55.0% of the total females and 29.7% of the total crabs, as summarised in Table 1.

Table 1. Number of blue swimmer crabs caught in each sampling period

Month	Male (n)	Female (n)	Total (n)	χ^2	Berried female (n)	% of total	% of females
April	34	24	58	1.72 ^{ns}	7	12.1	29.2
August	28	23	51	0.49 ^{ns}	2	3.9	8.7
October	17	20	37	0.24 ^{ns}	11	29.7	55.0
December	24	21	45	0.02 ^{ns}	2	9.5	4.4
Total	103	88	191	1.18 ^{ns}	22	25.0	11.5

The egg colour which are attached to the pleopods of berried female crabs can be used to estimate the hatching time of eggs: 7 days for dark yellow or orange, 6 days for yellow, 5 days for brown, 3 days for brown-black and 1 day for gray-black [15]. In the present study, 45.0% of berried female crabs had orange eggs. The remaining eggs were yellow (35.0%) and black (25.0%) (Table 2). The results indicate that the study area on the coast of Trang province could serve as spawning grounds during the study period, especially in October when the proportion of berried crabs was the highest. Similar results were found in the Gulf of Thailand by Trisak *et al.* [2], who found that the stock appeared to have its spawning peak during October to February. Similarly, Xiao and Kumar [9] in South Australia found that berried blue swimmer crabs migrate to deep water to hatch their larvae from October to December.

Table 2. Eggs carried by berried female crabs in each study period

Egg colour	April	August	October	December	Total
Orange	1(14.2%)	1(50.0%)	7(63.6%)	2(100.0%)	11(50.0%)
Yellow	3 (42.8%)	1(50.0%)	3(27.3%)	0(0.0%)	7(31.8%)
Black	3(42.8%)	0(0.0%)	1(9.1%)	0(0.0%)	4(18.2%)
Total	7(31.8%)	2(9.1%)	11(50.0%)	2(9.1%)	22

The geographic area of this study was a channel with a mean water depth of 5.9 ± 2.6 m and a range of 1.1-14.1 m. Berried female crabs were distributed across water depths of 2.8-13.3 m.

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 52-59

Regression analysis showed no relationship between the carapace width of berried females and water depth ($p > 0.05$). The grain size of bottom sediment could be divided into three groups: large (>425 μm), medium (425-250 μm) and small (<250 μm). Most of the study area was covered by medium-sized sediment while berried female crabs had a greater occurrence on sediment with small- or medium-sized grains (Figure 2). Xiao and Kumar [9] reported that berried females normally migrate to sandy-bottom sediment for spawning. After hatching and development, the small crabs migrate to seagrass beds which serve as nursery grounds and shelter [6, 16].

The mean carapace width of berried crabs in this study was 112.2 ± 21.46 mm with a range of 64.5-141.5 mm. Under Australian regulations, the permitted catch size for blue swimmer crabs is greater than 110 mm of carapace width [16]. In Thailand, there was a regulation prohibiting catches of berried female crabs from October to December. Violation of the law was found to be due to the lack of law enforcement and unawareness of the regulation on the part of small-scale fishermen. With the distribution data of berried female crabs, the authority could protect the area as spawning and nursing grounds and also cooperate with the local fishermen to preserve the crab stock for the sake of sustainability of the blue swimmer crab fishery.

CONCLUSIONS

Berried female blue swimmer crabs occurred in the coastal waters of Trang province mostly in October. They were found in water depths of 2.8-13.3 m and on bottom sediment with grain size smaller than 425 μm.

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Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 52-59

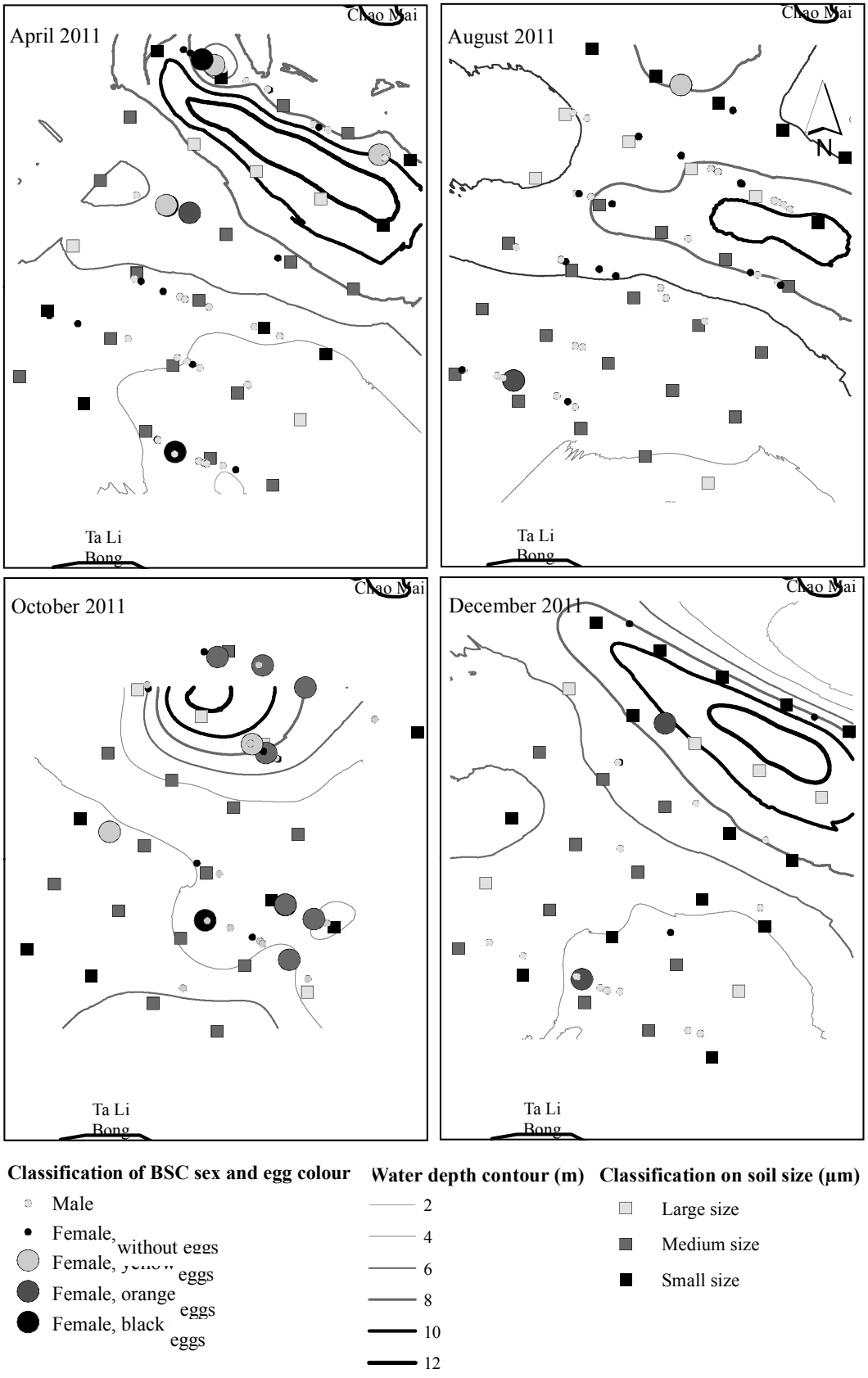

Figure 2. Distribution of berried female blue swimmer crabs classified by water depth and grain size of bottom sediment

Maejo Int. J. Sci. Technol. **2013**, *7*(Special Issue), 52-59

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