



Original Article

## Distribution of blue swimming crab (*Portunus pelagicus* Linnaeus, 1758) in Trang Province

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### Abstract

The fishery of the blue swimming crab (*Portunus pelagicus* Linnaeus, 1758) is very important to the economy of small-scale fishermen. Greater knowledge about its distribution could lead to more efficient management. This study was conducted in Trang Province from October 2006 to August 2007 using collapsible crab traps. To reveal the spatial distribution of the species, we analyzed the data using geostatistical methods. The standard interpolate procedure was applied to model the crab distribution. There were clear spatial distribution differences among the small crabs, large crabs and ovigerous females in study area. The mapping showed that small crabs (carapace width < 10 cm) were most often found inshore and associated with seagrass beds, especially between April and September, whereas large crabs (carapace width > 10 cm) were farther offshore. Ovigerous females peaked in abundance during 2 periods: March – April and August – September. This information can be used to support decision making concerning the designation of fishing zones and the optimization of the blue swimming crab fishery in the study area.

**Key words:** blue swimming crab (*Portunus pelagicus*), fishing zone, fishery management, collapsible crab trap, Trang Province

### 1. Introduction

Production of blue swimming crab in Thailand during 2007 totaled 27,794 metric tons, which made Thailand the fourth largest producer in the world (FAO, 2009). Such production was largely based on small-scale fishery. However, it has shown a decreasing trend, possibly because of the increased capture of small-sized crabs and ovigerous

females that may have led to a decreased recruitment. The fishing of small-sized crabs occurs because of high market demand for crab meat. Crabs of any size can be sold in local fish markets, where there is no concern about the size of the product. Nitiratsuwan *et al.* (2004) reported that the catch in Trang Province comprised both small-sized crabs (approximately 64.2 % of total landing) and ovigerous females. Therefore, several agencies have proposed various solutions to those problems, including campaigns to reduce the number of crab traps or to regulate the mesh size of netting used on the traps. However, those campaigns were not based on any biological data, and there has been some conflict in under-

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standing with the fishing community. The use of spatial analysis approaches, combining geostatistics and geographic information system (GIS) has now become an option for the ecological assessment (Stelzenmüller *et al.*, 2010) and has been applied to small-scale fisheries management (Anuchiracheeva *et al.*, 2003; Close and Hall, 2005; Lunn and Dearden, 2006). This study was conducted to provide a rigorous estimate of the spatial distribution of blue swimming crab based on a geostatistical analysis of field sampling data. We also explore possible suggestions for future management.

## 2. Materials and Methods

### 2.1 Study site

The coastal waters of Trang Province are located between 99°10' 0" and 99° 35' 0" East and 7°5'0" and 7°27'0" North, and cover the intertidal and subtidal zones down to around 25 m in depth (Figure 1). Community based fisheries co-management has been implemented in several villages along the coastline. Some communities have demarcated coastal waters as aquatic preservation zones in co-operation with government agencies. A restocking program was also established for coastal fishing grounds. Those activities aimed to improve understanding for the sustainable management of community fisheries, especially of the blue swimming crab. The sampling area for this study was designed to cover the blue swimming crab fishing ground, approximately 656.2 km<sup>2</sup>, including two large seagrass beds. A total of 262 sampling points were established, which included 164 points in 2x2 km square grids and 98 additional points in boundary areas (Figure 1).

### 2.2 Sampling method

Sampling was carried out during the third to fourth quarter moon phases of each month from October 2006 to September 2007, except July due to strong winds and a storm surge. The sampling unit consisted of three rectangular collapsible crab traps (35x50x20 cm) (Archdale *et al.*, 2006, 2007) (Figure 2), tied together with a rope and kept at a distant of 10 m from each other. Each sampling unit was tied to a buoy. The traps were covered with green polyethylene net of 2.5 cm stretch mesh size. Fresh sardines were placed as bait in the center of the traps. Sampling units were collected after 24 hrs in the water, and the number of crabs caught, ovigerous females, and carapace widths (CW) were recorded.

### 2.3 Data analysis

The geographical information system (GIS) and standard procedures of the ArcGIS 9 program (Johnston *et al.*, 2003) were applied to map the spatial distribution of blue swimming crab. As a first step, the presence of specimens was used to describe the distribution area of the species.

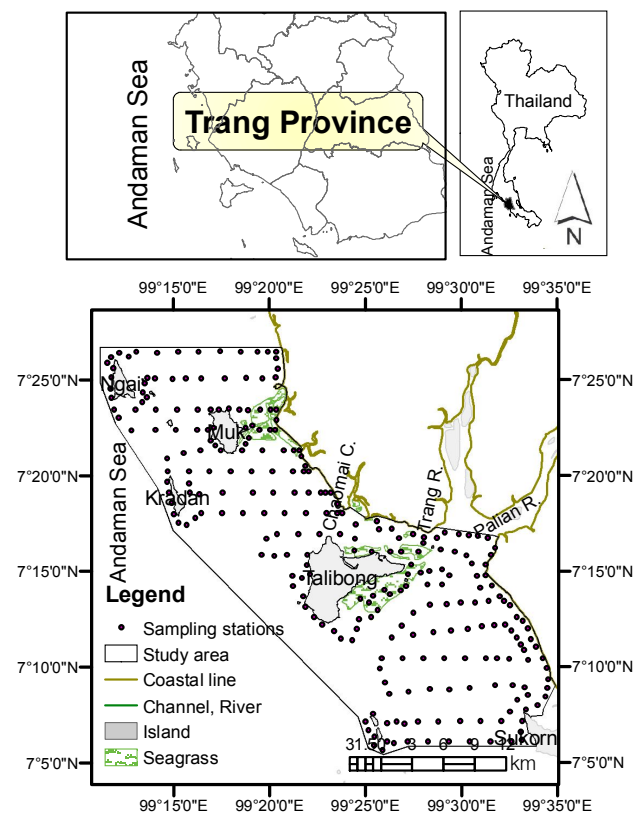


Figure 1. Study area (top) and sampling sites (below) in Trang Province, southern Thailand.

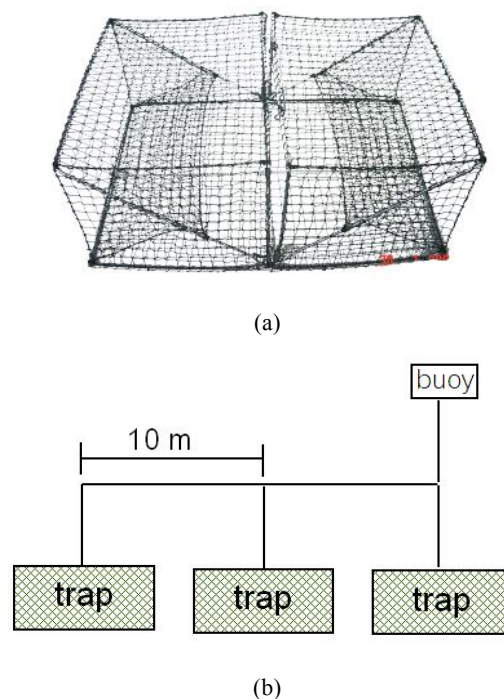


Figure 2. (a) Collapsible crab trap and (b) sample unit set for collecting blue swimming crabs.

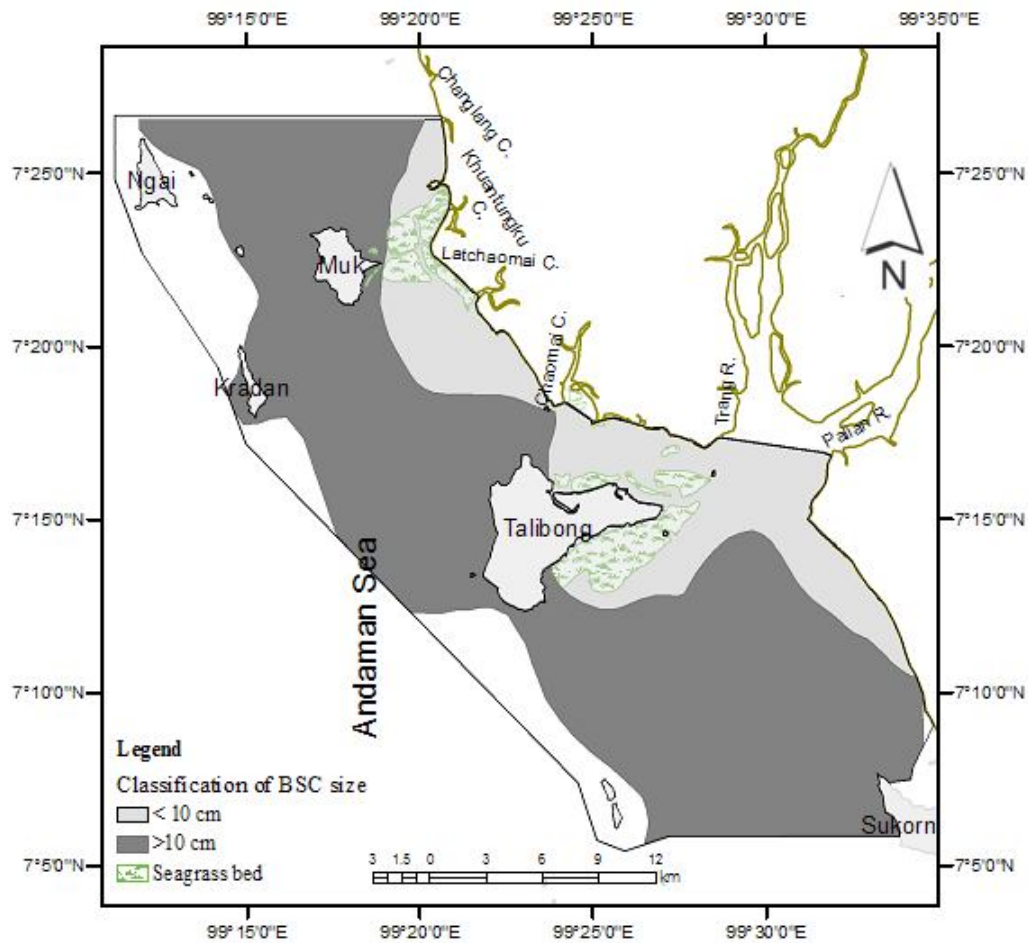


Figure 3. Distribution of blue swimming crab classified by carapace widths (cm) from October 2006 - September 2007; BSC size = blue swimming crab size.

Then, the data on average carapace width of crabs and the number of ovigerous females at each sampling point were interpolated into the geographical information system (GIS) data. The spatial distribution of crabs was mapped based on the mature ( $>10$  cm CW) and immature size ( $<10$  cm CW) (Jindalikit, 2001).

### 3. Results

Data from a total of 1,071 individual blue swimming crabs (BSC) were used to map their spatial distribution. The GIS map (Figure 3) highlights the near-shore distribution of immature crabs in three major areas: the east side of the Palian river mouth, and around the seagrass meadows of Muk and Talibong Islands. In contrast, mature crabs occurred farther from the shore. However, the percentage of the area that mature crabs dominated varied in each month (Figure 4). Large crabs dominated a relatively large area between October and March, whereas small crabs increased the area they occupied between April and September. We can assume

that there was juvenile recruitment into the study area during that period.

Although the number of ovigerous females captured throughout our survey was small, the data showed a distribution trend. Ovigerous females were mostly found during March and April (late dry season) in the upper and lower part of the study area, and also during August and September (rainy season, Figure 5) in inshore areas. We found the highest number of individuals in seagrass areas around Muk and Talibong Islands, and in the non-vegetated area between Talibong and Sukorn Islands (Figure 6)

### 4. Discussion and Recommendations

The map describing the spatial distribution of immature blue swimming crabs showed that they occupied near-shore areas, especially around seagrass meadows and river mouths, whereas mature crabs inhabited more far-shore areas. Such findings were in accordance with those of Tantigul (1979), King (1995), Kenyon *et al.* (1999), Jindalikit

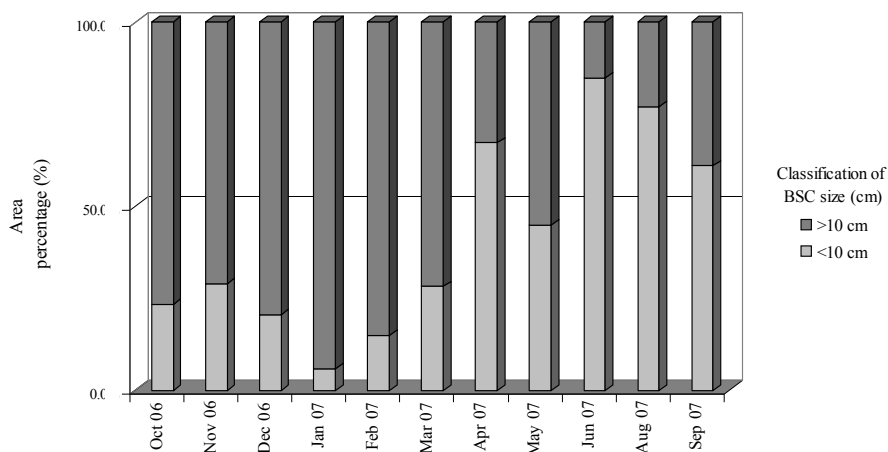


Figure 4. Percentage of the distribution area of blue swimming crab classified by carapace widths (cm) and month from October 2006 - September 2007; BSC size = blue swimming crab size.

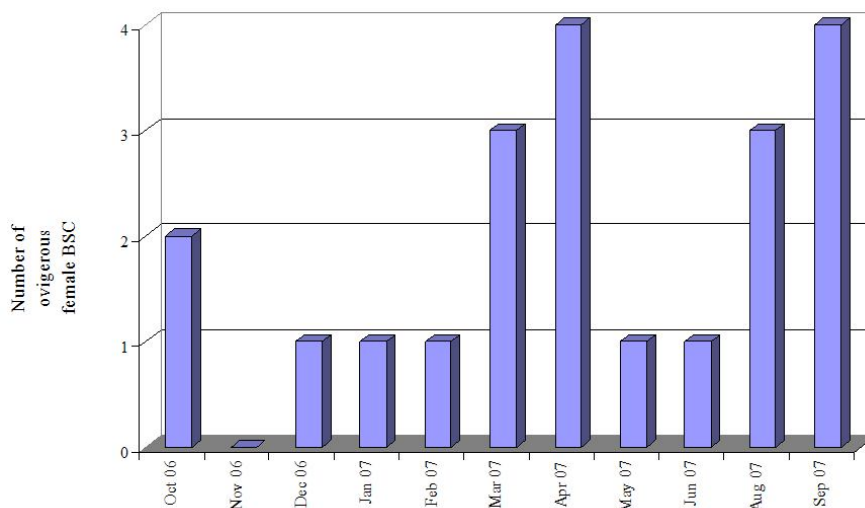


Figure 5. Number of ovigerous female blue swimming crabs by month from October 2006 - September 2007.

*et al.* (2004), and Tanasomwang *et al.* (2004). The information confirmed that small crabs preferred seagrass and near-shore areas are nursery grounds, and that there may be an association between different stages of the life cycle and environmental conditions. Small crabs may use the shade of seagrass shoots as shelter areas (Kenyon *et al.*, 1999). In addition, low salinity (20-30 psu) is an important environmental factor, which may increase the survival rate of the larval stage of crabs (Tanasomwang and Chutpoom, 2005; Romano and Zeng, 2006; Tanasomwang *et al.*, 2006). Differences in the areas inhabited by juvenile and adult crabs during the year indicated that there was movement between those two sub-populations.

The results suggest that local management of the blue swimming crab fishery should consider both the spatial and

temporal variation in the population before implementing regulations and other management measures. If the local community prefers the establishment of zones to preserve juvenile crabs of this species, they should create zones covering up to 3 km from shore, and especially include seagrass beds. However, the ability of local fishermen to fish outside those areas should be considered because areas of mature crab are far from shore where the costs of operation are higher. If a limited fishing period is considered, our results indicate that the appropriate time to restrict fishing would be between April and September because that is when the recruitment of juvenile crabs occurs. It appears possible to implement those two suggestions as the attitudes of fishermen in the study area, suggesting that they would accept such measures when they are based on clear biological data

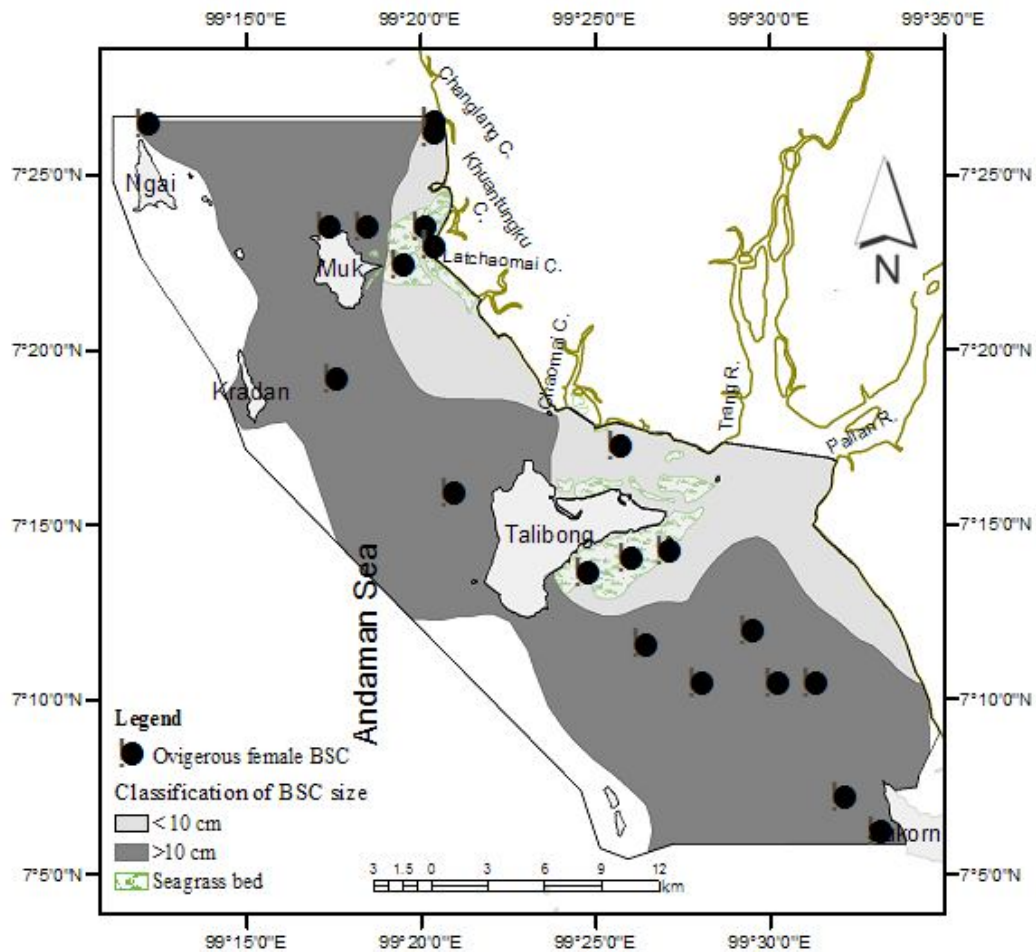


Figure 6. Distribution of ovigerous female blue swimming crabs with classification by carapace widths from October 2006 - September 2007; BSC size = blue swimming crab size.

(Nitiratsuwan *et al.*, 2010). Local regulations and other management measures should also be integrated with an understanding of social aspects of the local communities.

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