

**Research** Effect of population density on burrow characteristics in the fiddler crab (*Uca bengali*)

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### **Abstracts**

This study was conducted at Mangrove Extension, HadModtanoi Kantang, Trang Province, Southern Thailand. A muddy area covering a 2 different area of high density and low density of fiddler crab. We used 50 X 50 cm<sup>2</sup> quadrats (n=5) to measure the density, sex ratio, body and claw sizes, burrow length and diameters. We collected sediment samples (100 g each) from each quadrat to analyze the percentage of sediment moisture content, organic matter and pH. Results showed that population density was  $92.80 \pm 8.67$  individuals/m<sup>2</sup> with a sex ratio of male per female as 2:1. The density of the fiddler crab in low density is  $17.60 \pm 4.56$  individuals/m<sup>2</sup> and the sex ratio is 7:4. Crab body size in the high density is larger than in low density. In both area we find the crab burrow in 2 shape as I and J. The ratio between I per J in high density is 12 :39 (male 6 :22, female 6 :17) and in low density is 8:14 (male 5 :10, female 3 :4) The study of burrow length and diameter found that the length of burrow in high density is longer than in the low density except the length of the female, J burrow as in low density is longer than high density. The soil texture in high density is sand loam and in low density is loamy sand. The organic matter in high density is higher than in low density. The sediment moisture and pH in high density is lower than in low density.

**Keyword** Mangrove forest, Fiddler crab

## Introduction

Fiddler Crab is in family of *Ocypodidae* all around the world there are 97 species, in Thailand there are 11 species and in the south of Thailand there are 9 species in both Andaman sea and gulf of Thailand. Fiddler crab lives in the tidal line between the river to the sea. Fiddler crab in different species live in different area. The general characteristics of the fiddler crab is that fiddler crab is a small crab with small and narrow of front carapace and its make theirs eye socket close to each other and embed in the groove of eye socket. The size of the claw is unequal. Some have lots of different in size. In male there are one large claw in the left side and this claw will always shoot and these characteristics only find in male. In female there is two equal size of claw. In male their shoot claw to show they territory which they live and demanded attention to female for reproductive. The male claw weight is 50% of the crab total weight. Nowadays fiddler crab has been called as an engineer of the environment because of their burrow and behavior make the soil quality better.

Fiddler crab in the family of *Uca bengali* are found in mangrove forest. Fiddler crab eat small seaweed and animal carcass as their food. Fiddler crab built burrow and theirs live in the burrow when there is a rising tide. This behavior is importance to environment because its make more dissolved of water and they increase the oxidation on the soil surface. The burrow also be a bunker from hunter and to detected female. Female will choose the deep burrow and stable for reproductive and control the temperature for incubate egg. Male and female crab will stay together in the burrow for about 2-3 days until female lay eggs then the male will come out and built new burrow.

Mangrove forest at Hadmodtanoi community Kantang, Trang province is an area that we interested because we found lots of fiddler crab and also the different of the density between the area near and far from the community. From that differences we want to study about the density of fiddler crab population, sex ratio of male per female crab, shape and burrow and the quality in the high density and low density area.

### **Research Questions**

1. Is there a differences of crab size between high density of fiddler crab area and low density of fiddler crab area ?
2. Is there a differences of burrow characteristics between high density of fiddler crab area and low density of fiddler crab area ?
3. Is there a differences of soil quality between high density of fiddler crab area and low density of fiddler crab area ?

### **Research Hypothesis**

1. There is a differences of crab size between high density of fiddler crab area and low density of fiddler crab area.
2. There is a differences of burrow characteristics between high density of fiddler crab area and low density of fiddler crab area.
3. There is a different of soil quality between high density of fiddler crab area and low density of fiddler crab area.

## Materials and methods

### 1. Materials

- 1.1 0.25 m<sup>2</sup> (0.5×0.5m) quadrat
- 1.2 vernier caliper
- 1.3 candle
- 1.4 gas stove
- 1.5 boiler
- 1.6 planting spoon
- 1.7 plastic bucket
- 1.8 precision balance 2 digits
- 1.9 hot air oven
- 1.10 pH meter
- 1.11 furnace

### 2. Methods

#### 2.1 Study sites

The location of this study was Motanoi mangrove, Kantang, Trang Province (7°18'34''N 99°24'53''E)

#### 2.2 Time and specify the sampling point

We conducted the study from December 2020 to February 2021, during low tide. We studied was located in 2 different area as compare with the distance to the community from near to far area.



Fig. 1. Study site Motanoi mangrove, Kantang, Trang Province

### 2.3 Specify the sampling point

1. Survey around mangrove Motanoi mangrove, Kantang, Trang Province and compare population of fiddler crab in each area. Find high density of fiddler crab and low density of fiddler crab. We identified the sampling point into high density area and low density area by using the crab density as in low density area there is under 10 number of crab and in high density area there is above 20 number of crab.

2. Place five 0.25 m<sup>2</sup> (0.5×0.5m) quadrats in low density, as well as in high density area.

### 2.4 Density, sex-ratio, No. of male, No. of female and size of fiddler crab in high-density and low-density area.

1. Collect the fiddler crab in each quadrats and count the number of all fiddler crabs.

2. Separate sex of the fiddler crabs and find the sex ratio of fiddler crab. There are two ways to identify crab are by the shape of their “apron”. If you look at a crab’s underside, there’s a flap with a distinct shape. This flap is referred to as the apron. Male blue crabs (Jimmies) have a long, pointy apron as seen in the first picture below. Mature females (Sooks) have a rounded apron as in the second picture below. You may also see crabs with triangle-shaped aprons. These are immature females and are called “v-bottoms” and males will have one claw that is significantly larger than the other.

3. Measure size of the fiddler crab using vernier caliper by measure width and length of carapace and width and length of major claw.

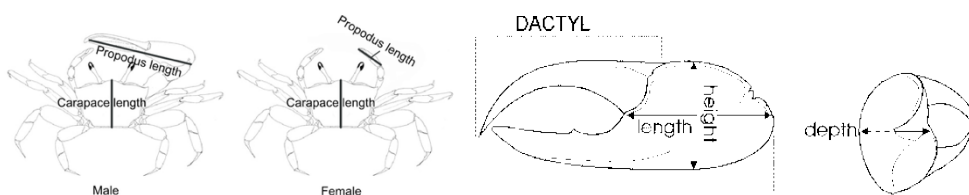


a. male fiddler crab



b. female fiddler crab

Fig. 2. external of male fiddler crab (a) and female fiddler crab (b)



- a. Measuring carapace size
- ข. Measuring major claw size

Fig. 3. Measuring carapace size (a) and major claw size

2.5 Size and shape of crab burrow in high-density and low-density area.

1. Pour melting wax in the burrow of fiddler crab. Left for fifteen minutes then dig the candles and clean it mess up.
2. Classify burrow characteristics and measure size of burrow by measure BD (mm.) and TBL (mm.)

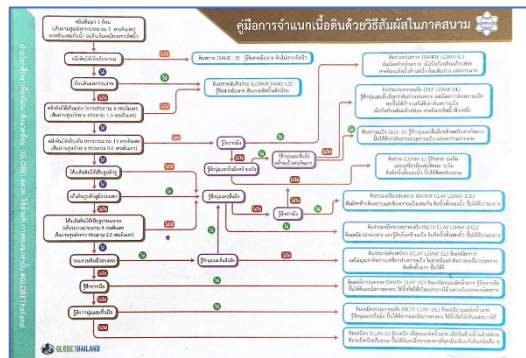


Fig. 4. Measuring size of crab burrow

2.6 Sediment characteristics in high-density and low-density area.

Collect sample of soil in each quadrat by use planting spoon scoop soil surface in quadrat.

1. Finding soil moisture bring 100g of soil from each quadrat to bake in hot air oven at 120 Celsius degree for 24 hours then weigh mass of soil after baking and find the soil moisture by minus mass of soil after baking from mass of soil before baking
2. Finding pH of soil dissolve 20g of soil from each quadrat in 40ml of water then stir up. Use pH meter for measure pH.
3. Identify soil texture from identify soil texture guide.

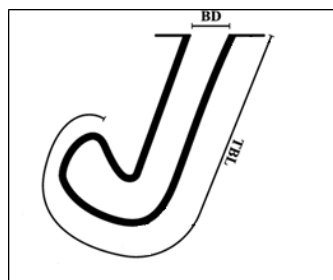
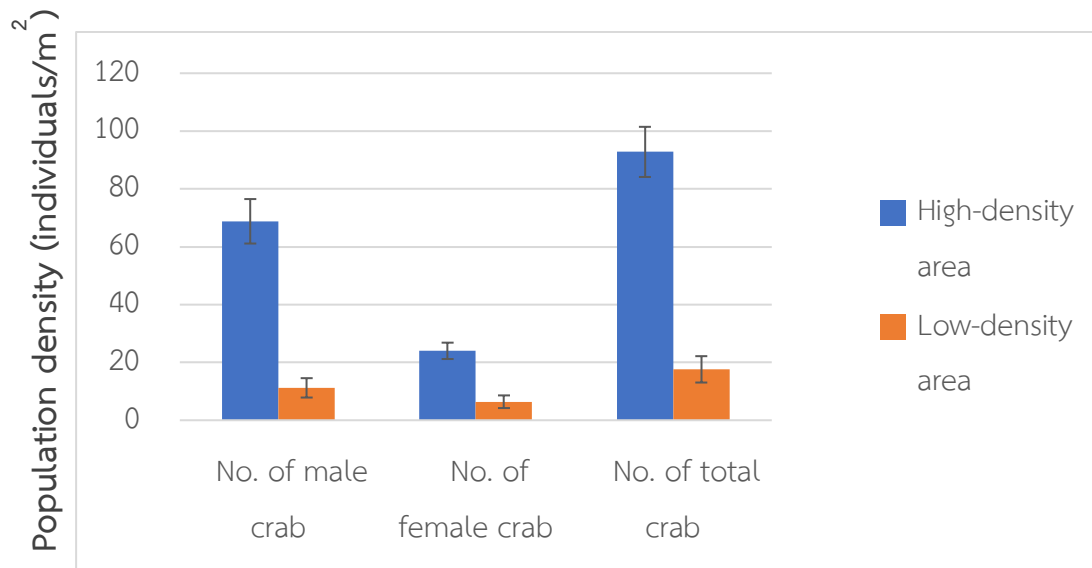


Fig. 5. Identify soil texture guide

## Results

### 1. Density, sex-ratio and size of fiddler crab in high-density and low-density area.

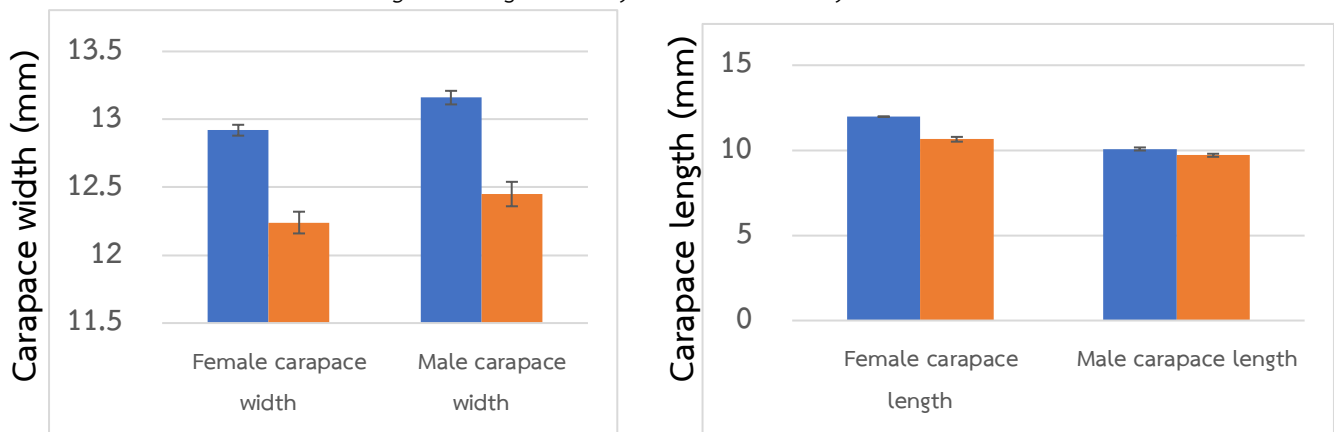
**Table 1** Density of *Uca Bengali* in high-density and low-density area.

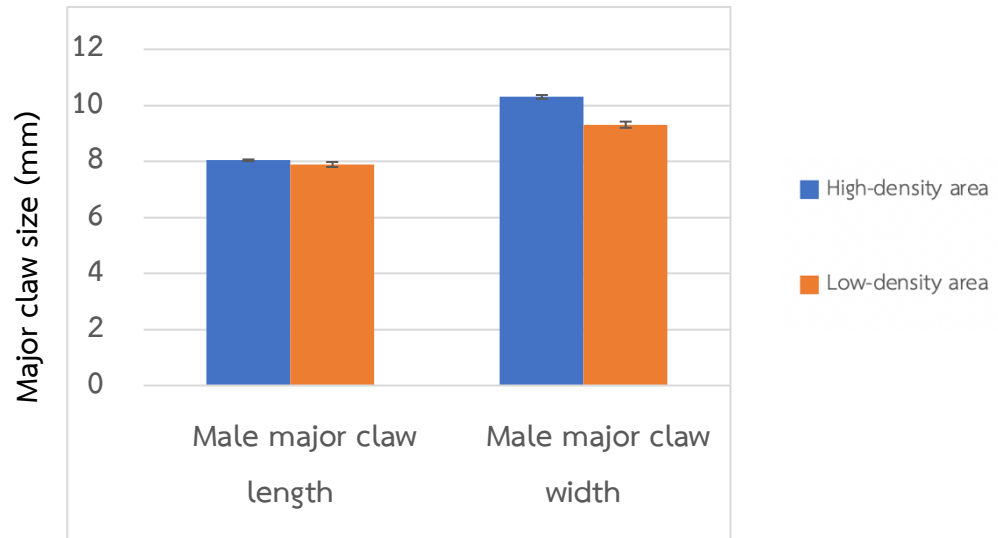


**Table 2** Sex-ratio of *Uca Bengali* in high-density and low-density area.

	Study areas	
	High-density area	Low-density area
Sex-ratio (Male:Female)	2:1	7:4

**Table 3** Size of *Uca Bengali* in high-density and low-density area.

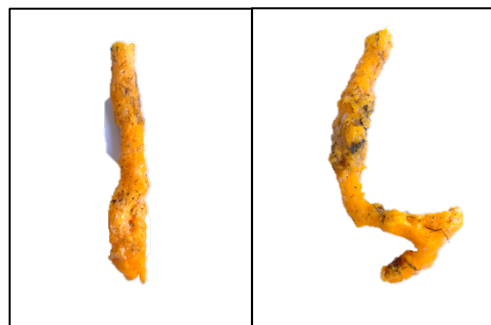




## 2. Size and shape of crab burrow in high-density and low-density area.

**Table 4** Shape of crab burrow in high-density and low-density area.

	Study areas	
	High-density area	Low-density area
<u>Burrow shape</u>		
Male burrow ( I: J )	6 :22	5 :10
Female burrow ( I: J )	6 :17	3 :4
Total burrow ( I: J )	12 :39	8 :14



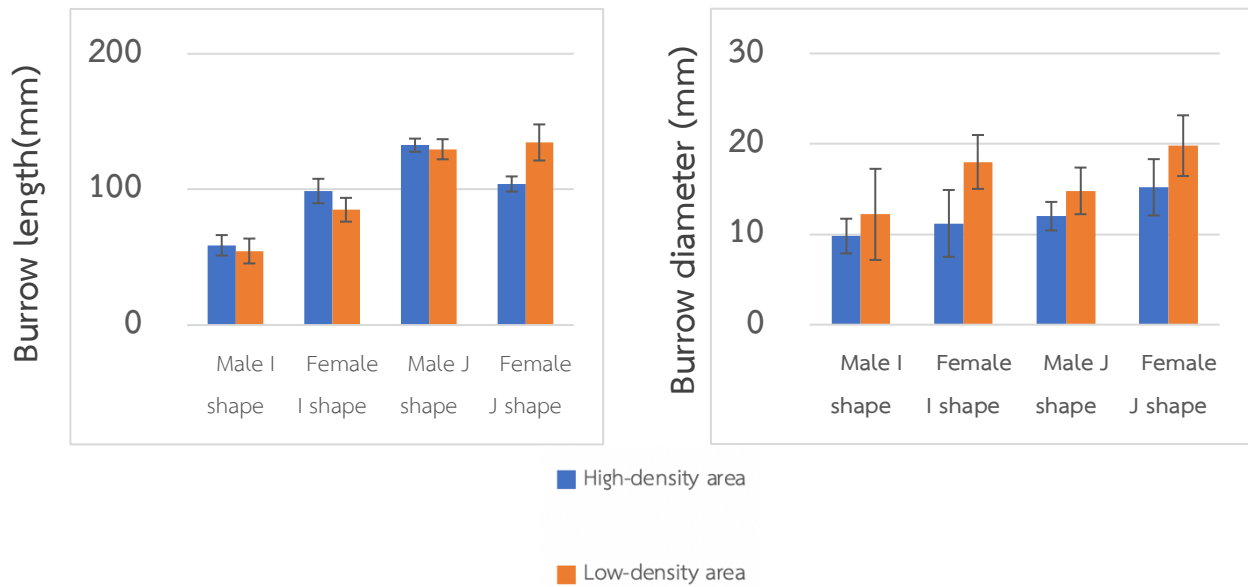
(a) I shape

(b) J shape

**Fig. 5.** Burrow shape



**Table 5** Size of crab burrow in high-density and low-density area



### 3. Sediment characteristics in high-density and low-density area.

**Table 6** Sediment characteristics in high-density and low-density area.

	Study areas	
	High-density area	High-density area
Soil texture	Sandy loam	Loaming sand
Moisture content (%)	20.35 ± 0.72	23.58 ± 0.56
Organic matter (%)	1.80 ± 0.19	1.40 ± 0.11
pH	5.33 ± 0.09	5.6 ± 0.24

### Conclusion and discussion

From the study of the number, sex ration and the size of the fiddler crab we found that in the high density area there is the average of the number of crab equal  $92.80 \pm 8.67$  individuals/m<sup>2</sup> with a sex ratio of male per female as 2:1. The density of the fiddler crab in low density is  $17.60 \pm 4.56$  individuals/m<sup>2</sup> and the sex ratio is 7:4. Crab body size in the high density is larger than in low density. The size of female fiddler crab in high density area (Carapace width  $12.92 \pm 0.04$ , Carapace length  $11.98 \pm 0.02$ ) is larger than the female fiddler crab in the low density area (Carapace width  $12.24 \pm 0.08$ , Carapace length  $10.65 \pm 0.14$ ) The size of male fiddler crab in the high density area (Carapace width  $13.16 \pm 0.05$ , Carapace length  $10.08 \pm$

0.09) is larger than the male fiddler crab in low density area (Carapace width  $12.45 \pm 0.09$ , Carapace length  $9.71 \pm 0.09$ ) and the large claw size of the male fiddler crab in high density (Claw width  $8.04 \pm 0.03$ , Claw length  $10.30 \pm 0.07$ ) is larger than the male fiddler crab in low density area (Claw width  $7.89 \pm 0.09$ , Claw length  $9.31 \pm 0.11$ ) because in the high density there is more of organic matter so there are more nutrients and it makes the size of fiddler crab in high density larger than in the low density. The female carapace length is longer than male because female carapace is used to collect eggs and male carapace width is longer than female because the male carapace needs to subtend male big claw as it is a half of the fiddler crab total weight.

From the study of the size and shape of fiddler crab burrow in the high density area and low density area we found 2 different shapes of burrow as I and J shape. The average ratio of I shape per J shape in high density is equal 12 : 39 (male 6 : 22, female 6 : 17) In the low density area the ratio is equal 8 : 14 (male 5 : 10, female 3 : 4) The study of the crab burrow size, the length of the burrow in high density area is longer than in low density area except the length of female J burrow as in low density area is longer than high density area. The diameter of the burrow in high density area is longer than in low density area. We found the J shape more than I shape as J shape is more suitable for living and incubating eggs so that J shape is a permanent burrow and I shape is just for temporary. The curve of the J shape is used for control the temperature. In high density area male fiddler crab built J burrow more than female as male burrow is used for reproductive and lay egg but female burrow is just used for living. In the low density area female J burrow is larger than male because female burrow is used for lay eggs.

From the study of the soil quality we found that the soil texture in high density is sand loam and in low density is loamy sand. The organic matter in high density is higher than in low density. The sediment moisture and pH in high density is lower than in low density because in the high density area is far from the estuary and have the composition of sand so can absorb more water so that makes the sediment moisture lesser and from the organic matter, pH in low density is higher because the soil contaminated the effluent from the community.

## Acknowledgment

Thank you Assoc.Prof. Mallika Charoensuthasinee Walailak and Assoc.Prof.Krisanadej Jaroensutasinee University Teacher Patcharapong Manawut, Teacher Advisor, Science Group Teacher, Chulabhorn Science School, Chulabhorn Science School, Trang, everyone, as well as parents who are there to help. In collecting data and studying this research

## References

- TINA, F. W., M. JAROENSUTASINEE & K. JAROENSUTASINEE, 2015a. Effects of body size, resident status and handedness on fighting behaviour of the fiddler crab, *Uca Bengali Crane*, 1975. *Crustaceana*, 88: 775-789.
- TINA, F. W., M. JAROENSUTASINEE & K. JAROENSUTASINEE, 2015. Effects of population density on female and male burrow characteristics in the fiddler crab, *Uca Bengali Crane*, 1975
- Jeffrey S. Levinton, 2559. Bilateral linkage of monomorphic and dimorphic limb sizes in fiddler crabs, *Uca Bengali Crane*
- LIM, S. S. L. & C. H. DIONG, 2003. Burrow-morphological characters *Uca annulipes* (H. Milne Edwards, 1837) and ecological correlates in a lagoonal beach on Pulau Hantu, Singapore. *Crustaceana*, 76: 1055-1069.
- KOGA, T., M. MURAL, S. GOSHIMA & S. POOVACHIRANON, 2000. Underground mating in the fiddler crab *Uca tetragonon*: the association between female life history traits and male mating tactics. *J. Exp. Mar. Biol. Ecol.*, 248: 35-52.
- MURAI, M., 1992. Courtship activity of wandering and burrow holding male *Uca arcuata*. *Ethology*, 92: 124-134.
- RINGOLD, P., 1979. Burrowing, root mat density, and the distribution of fiddler crabs in the eastern United States. *J. Exp. Mar. Biol. Ecol.*, 36: 11-21.
- QURESHI, N. A. & N. U. SAHER, 2012. Burrow morphology of three species of fiddler crab (*Uca*) along the coast of Pakistan. *Belg. J. Zool.*, 142: 114-126.