SOME ASPECTS ON REPRODUCTIVE BIOLOGY OF THREE CRAB SPECIES IN RAKHINE COASTAL REGION

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Abstract

Reproductive biology of three crab species, *Portunus sanguinolentus, P. pelagicus* and *Scylla serrata* collected from Sittway area were studied. A total of 30 individuals of each species were monthly sampled from September to December 2015. Morphometric measurement of crabs, sex ratio and their reproductive development stages were examined. In *Portunus sanguinolentus* and *P. pelagicus*, female individual were abundantly occurred throughout the study period. In contract, high male ratio was recorded in *Scylla serrata* in which more than 25 individual per month are male crab. The fecundity of mud crabs is five times higher than the other two species. *Poutunus sanguinolentus* and *P. pelagicus* carried eggs throughout the study period but *S. serrata* carried egg only in the September 2015. Due to the migration behaviour of *S. serrata*, it is assumed that they migrate from brackish water to deep sea of high saline water at the time of spawning.

Keywords: Reproductive biology, Morphometric measurement, Sex ratio, fecundity

Introduction

Decapods crustacean is a major component of commercial fisheries in Myanmar. The production of crab in fisheries sector is dominated by a few members of a single family, the Portunidae. They include four species of mud crab, *Scylla serrata*, the three-spotted crab, *Portunus sanguinolentus,* the blue swimming crab, *Portunus pelagicus* and the gazami crab, *P. trituberculatus* (Lai *et al.*, 2010).

In the coastal region in Rakhine state, crab production plays an important role in fisheries and aquaculture industry. Mud crab, *Scylla serrata*, farming has been developed in the region since 2003. Crab farming based on collection of crablets or crabs from the wild for fattening or grow-out has probably taken place for hundreds of years. However, there is an unmet demand for mud crabs and this has led to over-exploitation in many areas. Difficulties with obtaining wild caught juveniles for farming operations, plus concerns of further over-exploitation, have led to major investment in research into hatchery techniques. Of the four species of mud crabs, hatchery technology is only being developed for *S. serrata* and S. *paramamosain* (FAO, 2011).

However, production of crablets in Myanmar has not been developed yet and they are collected from natural resources. Myanmar Sustainable Aquaculture Project (MYSAP) supported crab hatchery in Labutta Township, Ayeyarwady Region for artificial production of crablets (Global New Light of Myanmar, 2019). However, they are still in trial stage. According to the conversation of crab trader in Rakhine environs said that production of *Portunus* spp. And *Scylla* spp. is decreasing day by day.

On the other hand, commercial fishery of marine crab species in Rakhine State have increased greatly during the last ten years due to market demand (DOF, 2013). Myanmar crab association located in Myanmar Fishery Federation (IWO are trying to develop *Portunus* spp. and *Scylla* spp. hatchery in Myanmar (Soe Tun, personal communication). To develop the crab industry in Myanmar, understanding on their reproductive biology, especially for egg carrying period and differentiation of male and female crab are fundamentally needed. The fulfill the requirement of

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aquaculture industry in Myanmar, the present study were conducted to investigate the male and female ratio of crab species in natural population and estimate the egg carrying period and fecundity in female crabs in Rakhine area.

Materials and Methods

Study site

Sittway Coastal region (20°08'N and 92 °53'E), Rakhine State is selected as study site (Fig.1). *Portunus sanguinolentus* and *P. pelagicus were* collected from fishing boats which are catching crab and fish in intertidal shallow areas. *Scylla serrata* was collected from muddy bottom of Kisapanadi River near Mangrove forest.

Study period

Study lasted from June to December 2015.

Sampling Methods

Three crab species *Portunus sanguinolentus,* three spotted crab, *P. pelagicus* blue swimming crab and *Scylla serrata,* mud crab were selected to be studied (Plate.1). A total of 30 individuals from each species were collected from September to December 2015. After collecting from the sample sites, the collected specimens were placed in ice box and sent to the Laboratory at Department of Zoology, Sittway University. Crabs were weighted when they were arrived to the laboratory. To record the morphometric measurements of male and female crab, carapace length, carapace width, short carapace width, chela length, carpus propodus, abdominal width, chela height and length of arm were measured.

Gonado-Somatic Index (GSI) and Fecundity

Gonado-Somatic Index (GSI) and Fecundity were calculated by following formula. Fecundity was calculated for female crabs that were carrying eggs in their abdomen.

Gonado-Somatic Index (GSI) (Rabia *et al.,* 2008)

GSI = (Gonad weight/total body weight-gonad weight) x 100

Fecundity (Rabia *et al.,* 2008)

Fecundity = F = nV/v

where n = number of eggs in the subsample, V = volume to which the total number of eggs is made up and v = volume of the subsample (1g)

In addition, diameter of 50 eggs from each species were measured monthly under the stereomicroscope to compare the egg sizes of different species.

Reproductive development of crab species

Reproductive developments of crab species are cartelized into three stages, stage 1, stage 2 and stage 3 according to egg color and shape followed by Paulo (2002).

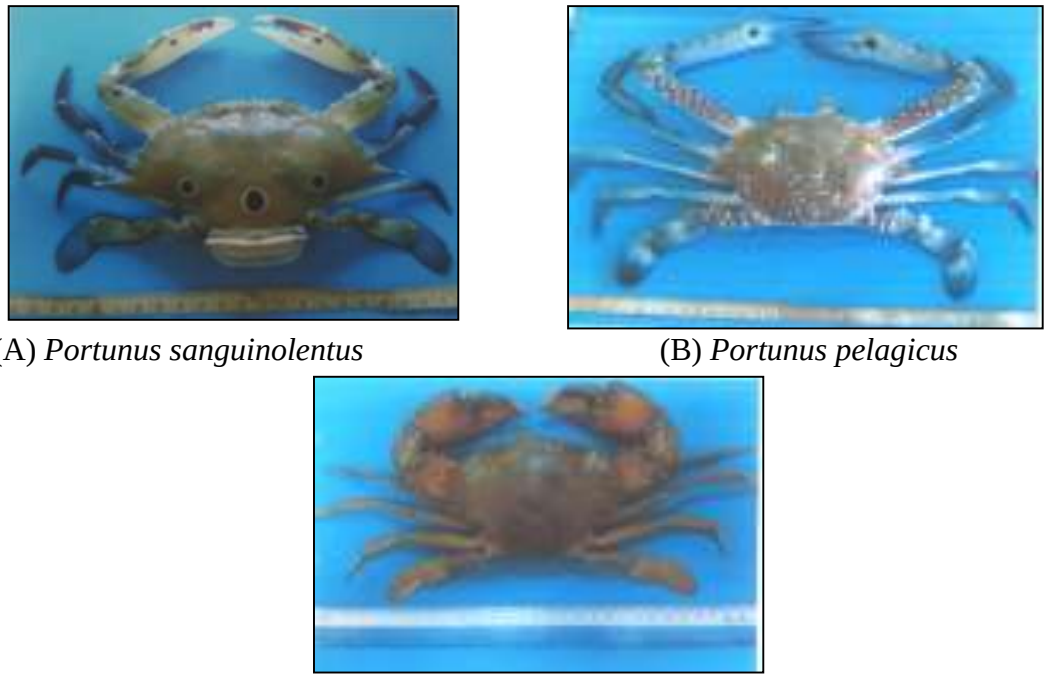
State 1- Freshly extruded egg mass sponge with an orange color due to a large quantity of yolk.

Stage 2- incubation at its halfway period, the egg mass sponge has a light brown col our tending to grey.

Stage 3- the egg mass sponge is dark brown tending to black and little yolk is left.

Source: googlemap.com

Figure 1 Map of showing the location of Sittway Seashore, sampling area



(A) *Portunus sanguinolentus* (B) *Portunus pelagicus*

(C) *Scylla serrata*

Plate 1 Three studied crab species

Results

Average body weight and length of three crab species

Body weight and length of each species were measured and sizes between male and female were compared. Body weight of *Portunus sanguinolentus* ranged from 52.4 g to 154.6g in male and 51.6 g to 150.3 g in female while *P. pelagicus* ranged from 187.5 to 243 g in male and 190.4 g to 243.2 g in female. In *Scylla serrata* lower body weight ranged from 99g to 142.5 g in male and 99.3 g to 141.3 g in female (Fig.2). In October 2015, body weight of *Portunus sanguinolentus* and *P. pelagicus* were higher than that of female. Apart from that month, the body weight of male and female was not differing much in all species.

Body length of *Portunus sanguinolentus* ranged from 21.8 to 28.9 cm in male and 20.5 to 28.4 cm in female while *P. pelagicus* ranged from 33.8 cm to 49.3 cm in male and 33.3 cm to 48.9 cm in female. In *Scylla serrata,* body weight of male crab ranged from 19.5 cm to 34 cm while it was 20 cm to 30 cm in female (Fig.3). In all species, the body length of male and female was not differing much.

Sex ratio of studied crab species

The sex ratio of crab species was described in (Fig.4). In *Portunus sanguinolentus,* female individual was abundantly occurred in September and October while high male ratio was found in November 2015. In *Portunus pelagicus,* high ratio of female was found thought the study period especially from September to November 2015. In contract, high male ratio was recorded in *Scylla serrata* in which more than 25 individual per month are male crab.

Gonado somatic index of three crab species

Gonado somatic indexes of studied crab species were described in (Fig 5). In *Portunus sanguinolentus,* high female GSI 6.7 was found in October 2015 and it decreased to 2.9 in November 2015. Similarly, in *P. pelagicus,* high GSI, 9.2, was found in September 2015 and it sharply decreased to 2.8 in October 2015. In *Scylla serrata,* GSI of female crab is as high as 3.8, 1.7, 8.2 and 4.5 in September, October, November and December, respectively.

Fecundity of studied crab species

To estimate the fecundity of each crab species, number of egg per gram of female crabs were counted under stereomicroscope and calculated according to the formula. In *P. sanguinolentus,* number of egg is 39,975 average in September, 10,195 average in October and no egg was found in November 2015. In *P. pelagicus,* number of egg was much higher than *P. sanguinolentus.* Female collected in October and December 2015 carried egg and number of egg are 252,308 average and 234,613 average respectively.

Interestingly, an extremely high fecundity was found in *S. serrata* in which number of egg are exceed 198,387 average although female crab was found in only September 2015. (Fig.6)

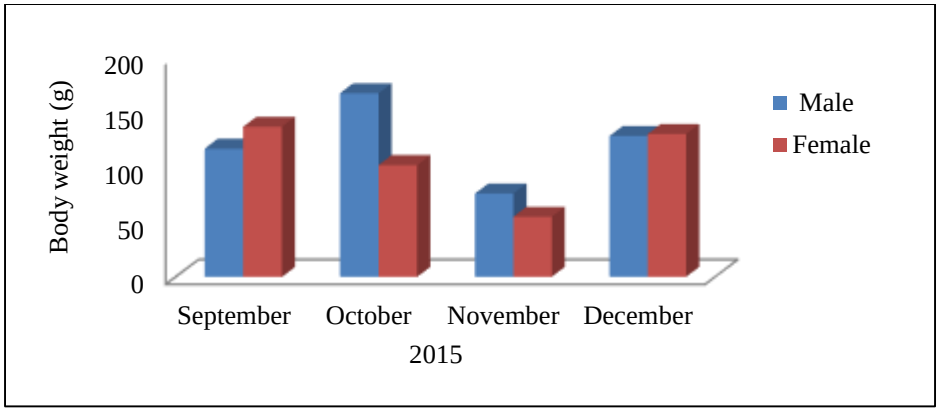
Mean diameter of eggs of studied crab species

Mean diameter of egg of each crab species was measured under the stereo microscope. Mean diameter of *Portunus sanguinolentus* is 398.35±7.9 um (n=800) *Portunus pelagicus* is 386.86 ±17.9um (n= 600) and *Scylla serrata* is 423.55±12.2 (n=500).

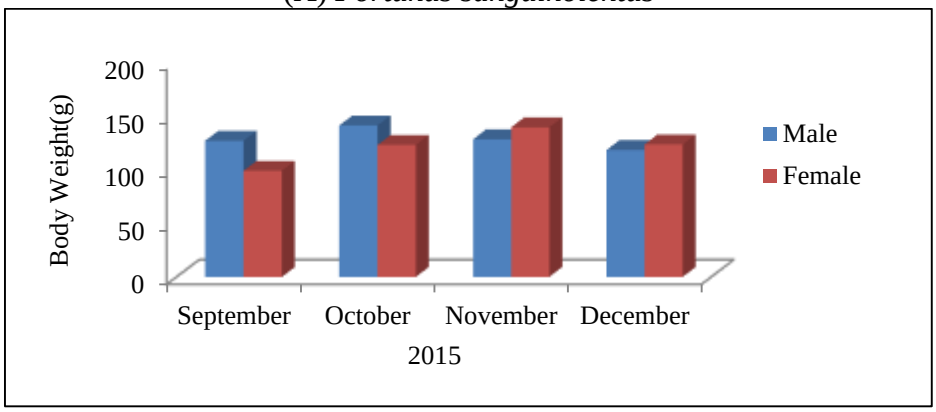
Reproductive development of crab species based on egg morphology of female crab species

Among the collected crab species, only female crab carrying eggs were classify for stages of reproductive development. In stage 1 the egg color was orange, in stage 2 the egg mass sponge was a light brown or grey and in stage 3 the egg was black (Fig.7 and 8).

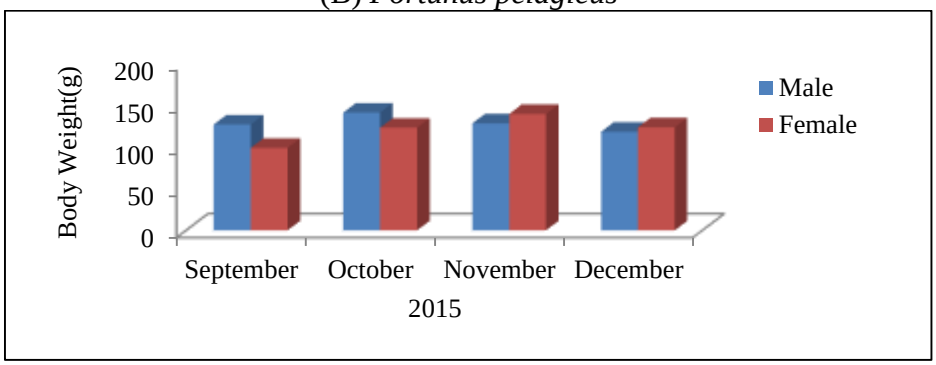
In *Portunus sanguinolentus,* more than 10 females crabs carried eggs throughout the study period, while one to six egg carrying female individuals were found in other two species. Three stages of reproductive development were found in all studied months from September to December 2015 in *Portunus sanguinolentus* and *P. pelagicus*. However, in *Scylla serrata,* two stages, stage 1 and 3 were found in September while only one stage either stag 1 or stage 3 was found in October and November (Fig. 9).



(A) *Portunus sanguinolentus*

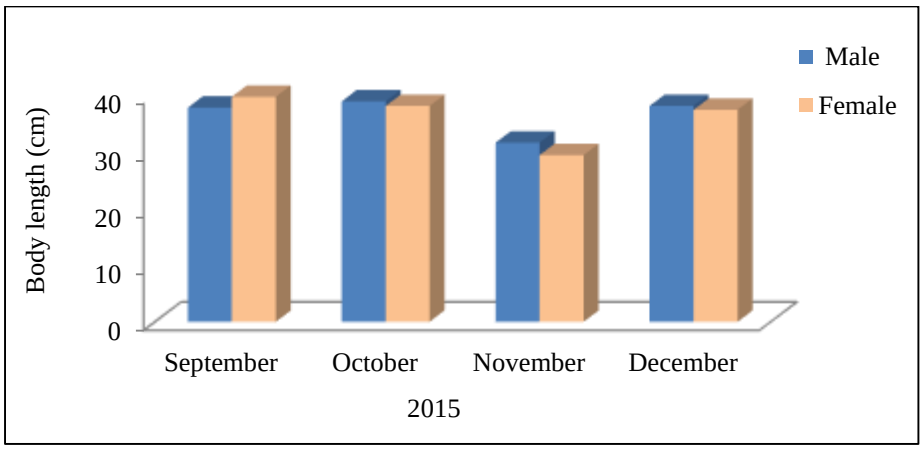


(B) *Portunus pelagicus*

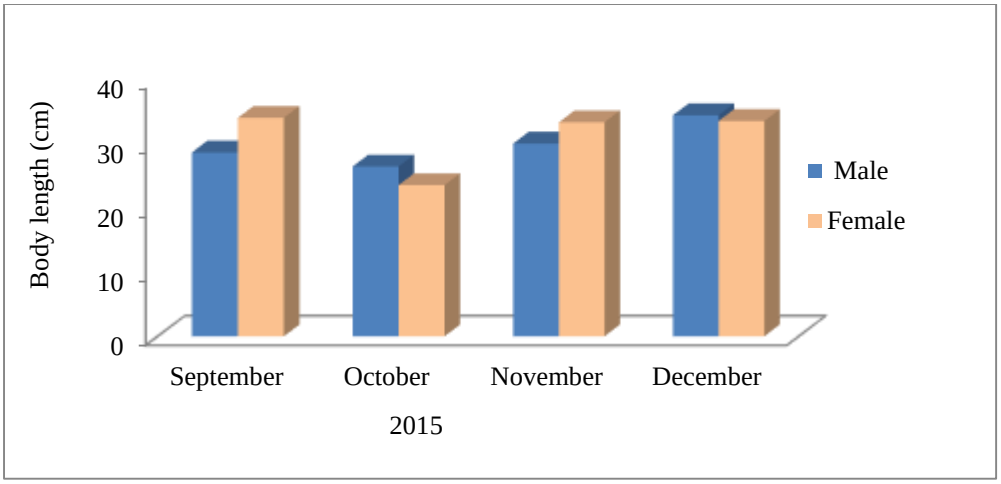


(C) *Scylla serrata*

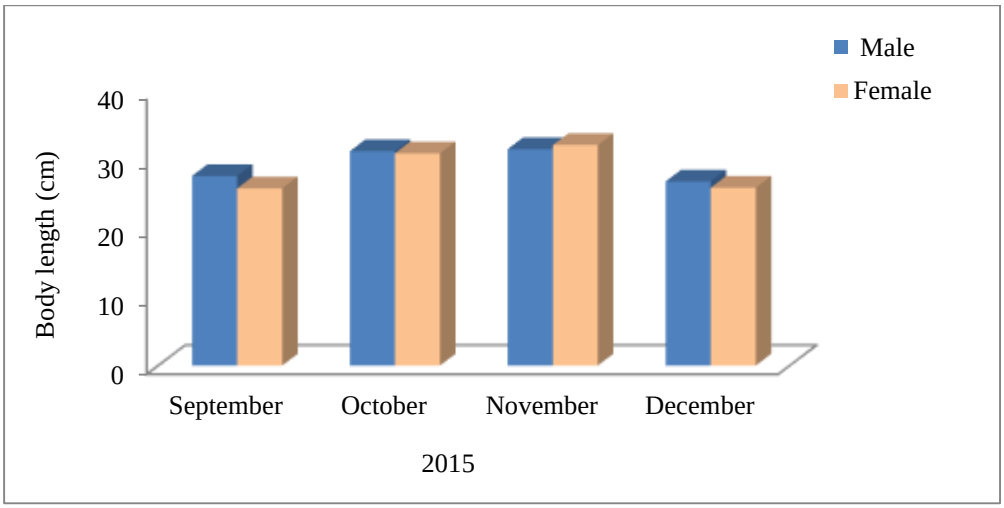
Figure 2 Average body weight (g) of three crab species



(A) *Portunus sanguinolentus*

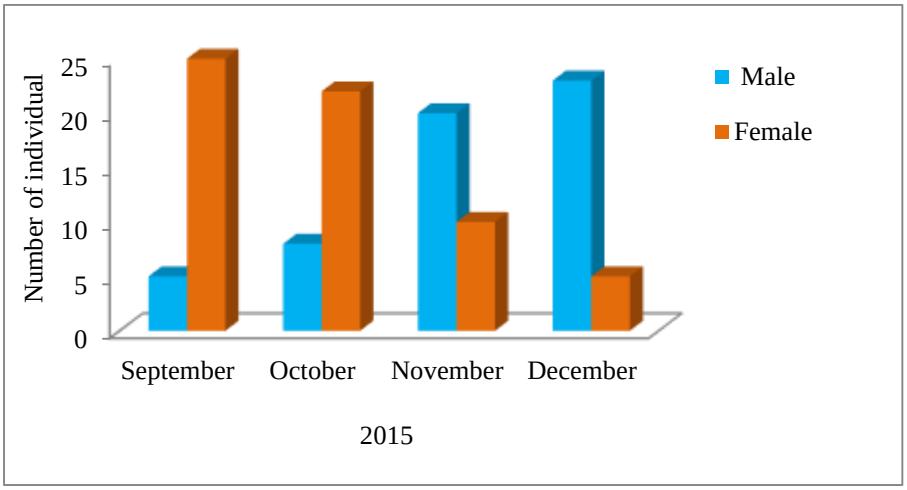


(B) *Portunus pelagicus*

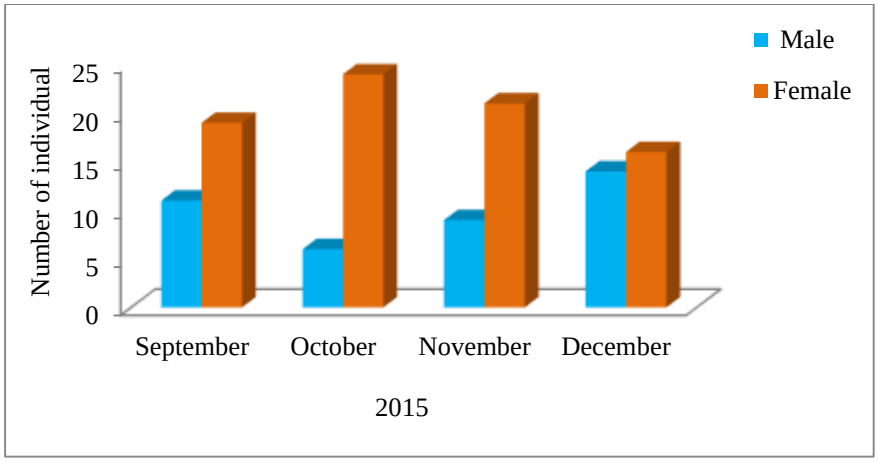


(C) *Scylla serrata*

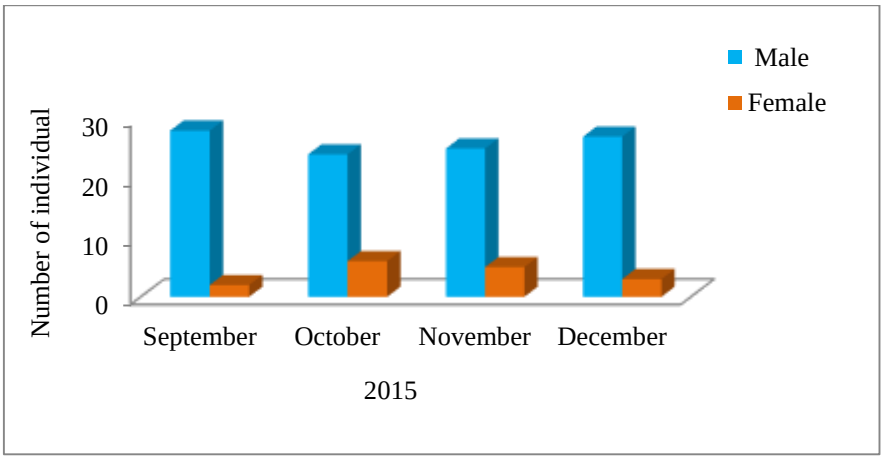
Figure 3 Average body length (cm) of three crab species



(A) *Portunus sanguinolentus*

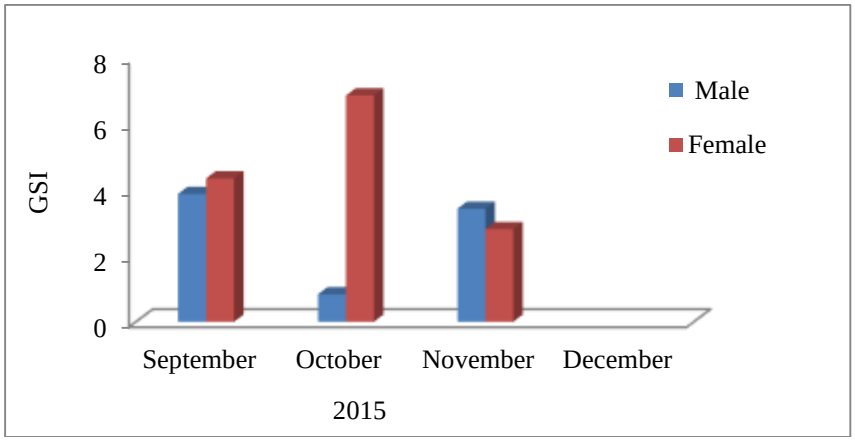


(B) *Portunus pelagicus*

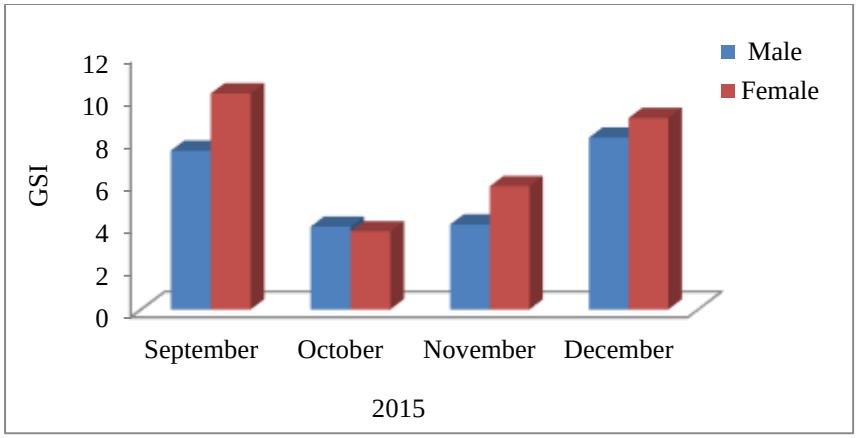


(C) *Scylla serrata*

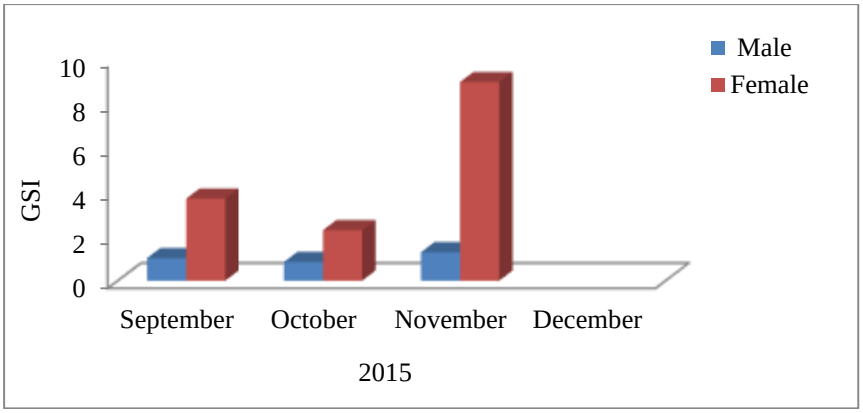
Figure 4 Sex ratio of three crab species



(A) *Portunus sanguinolentus*

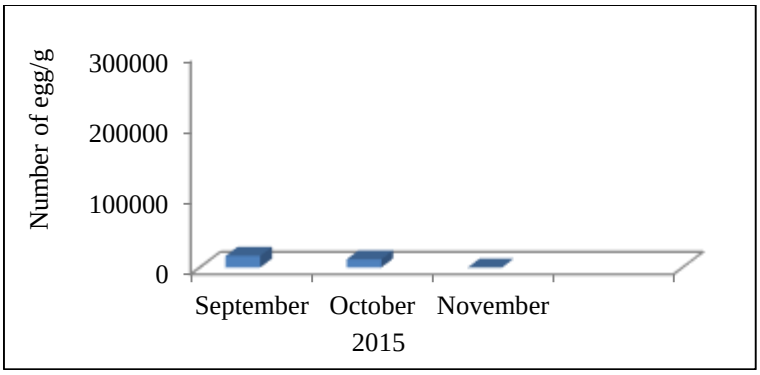


(B) *Portunus pelagicus*

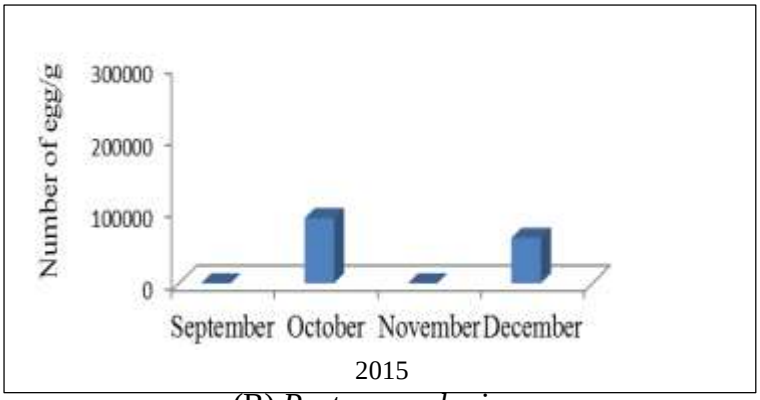


(C) *Scylla serrata*

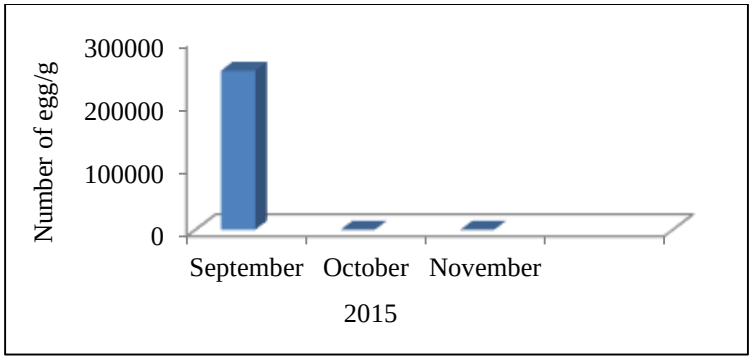
Figure 5 Gonodo somatic index of three crab species



(A) *Portunus sanguinolentus*

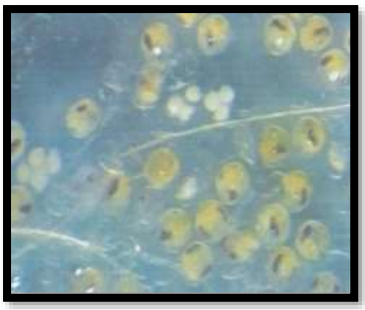


(B) *Portunus pelagicus*



(C) *Scylla serrata*

Figure 6 Mean fecundity of studied crab species



(A) *Portunus sanguinolentus*

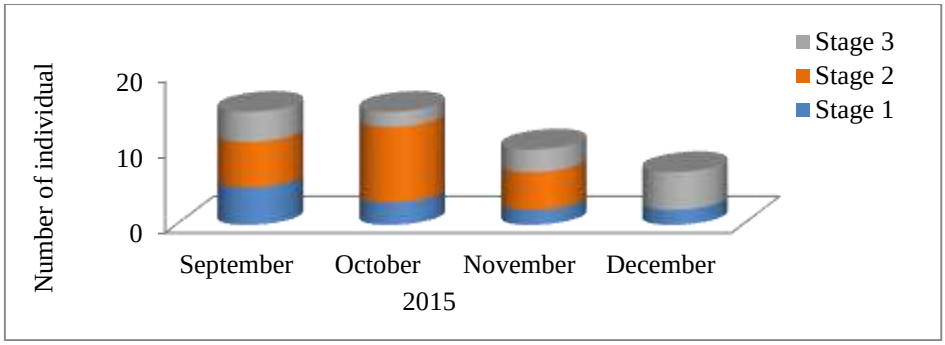
(B) *Portunus pelagicus*

(C) *Scylla serrata*

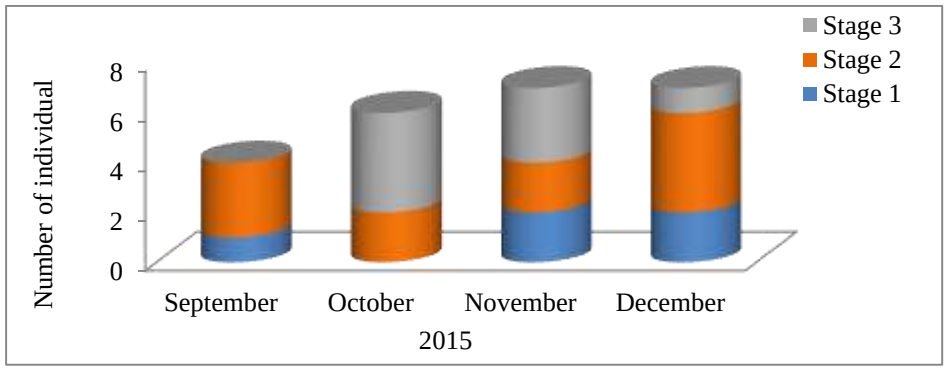
Figure 7 Egg morphology of three crab species

Stage (1) Stage (2) Stage (3)

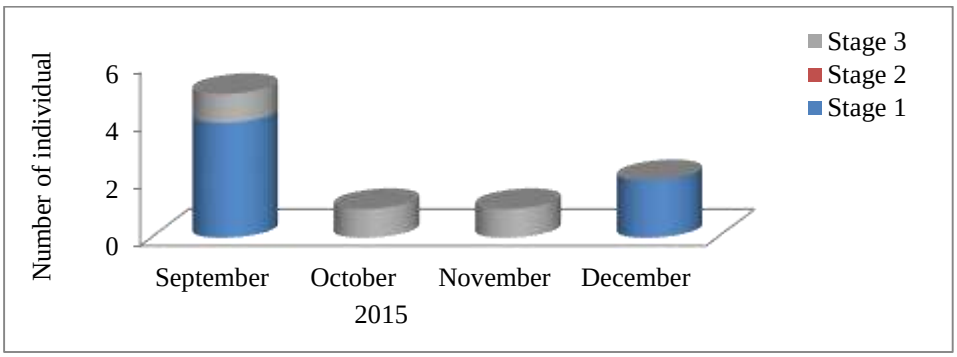
Figure 8 Reproductive stage of crab based on egg morphology (A) Stage 1 of *Scylla serrata* **(B)** Stage 2 of *Portunus sanguinolentus* (C) Stage 3 of *Portunus pelagicus*



(A) *Portunus sanguinolentus*



(B) *Portunus pelagicus*



(C) *Scylla serrata*

Figure 9 Stages of gonad of studied crab species

Discussion

In the present study, three crab species *Portunus sanguinolentus*, *P. pelagicus* and *Scylla serrata* were collected from September to December in 2015 and their gonadal development and sex ratio were studied. Except *Portunus sanguinolentus* collected in September 2015, body weight of male and female crab did not differ in all species. However, Normant *et al*., (2004) reported that the weight of male mud crab *Rhithropanopeus harrisii*, was heavier than that of female. They concluded that the difference is caused by the much larger, and heavier, male claws: the claw weight accounts for up to 64% of the body weight in males and for 11.1-28.0% in females. In the present study, although body weight of male and female crab are not much differ in each species, it was notice that chelae size of male is lager than the female. Hardnoll (1989) has shown that chela are secondary sexual character of the male. He proved that the size of chela in male significantly increase after the first molt of their life as sexual character.

Male and female population of *Scylla serrata* was a tread towards a contently higher percentage of male. The pattern likely emerged because the studied was carried out in monsoon to winter season. The migration of female *S. serrata* to offshore has been reported during their spawning season and it was only few female left in the mangrove forest (Sara, 2006; Jirapunpipat *et al*., 2008). We collected mud crab in the mangrove forest only although the other two species were obtained from offshore. Long term study is needed to estimate the actual sex ratio of the mud crab.

Portunus sanguinolentus and *P. pelagicus carried* egg throughout the study period while *Scylla serrata* mostly carried in September and did not carried at all in October and November. The migration behaviour of mud crabs suggests that at the time of spawning they migrate from brackish water to deep sea of high saline water (Ali *et al*., 2020). Due to this reason, mud crabs with stage 2 and 3 were rare in the mangrove area.

Several authors have recently reviewed the reproductive pattern of commercial crabs (Emmerson, 1994; Yamaguchi, 2001a; Costa and Negreiros-Fransozo, 2003; Litulo, 2004a), and most of them are based on the frequency of egg-bearing females. The number of eggs produced by mud crabs is five times higher than the other two species. The fecundity of crabs can vary even in different individual of same crab species within the same area and among females of the same species in different areas within the same region and is influenced by several intrinsic and extrinsic factors. According to Ramirez-Llodra (2002), the major intrinsic factors contributing to differences in fecundity among females in the same population include variation in individual female size or maternal size, nutritional history related to food availability and quality, age and the age at sexual maturity or first reproduction. According to the results of the present study, it is concluded that the larval production of mud crab is higher than the other two species.

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