



Exploitation of Sergestid Shrimp (*Acetes* species) and its importance in the South-East Part Coastal Region at Chattogram, Bangladesh

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Abstract

The study was carried out during 2013-14 to 2017-18 on abundance of Sergestid shrimp (*Acetes* spp.), which is locally called Gura icha and focusing on exploitation method by selective gear Pakua jal (modified same mesh set bag net) in the selected nearer coast areas at Ananda bazar, Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria fish landing centers or ghats in south-east part at Chattogram district and recorded three sergestid shrimp species namely *A. indicus* (H. Milne-Edwards, 1830), *A. erythraeus* (Nobili, 1905) and *A. japonicas* (Kishinouye, 1905). The main harvesting periods of *Acetes* shrimp were in the month of November to April, but peak in February to March. During 2013-14 a total 346.75 MT of mixed juvenile shrimps, fishes and other marine resources were fished from the mentionable eight fish landing centers; among them only *Acetes* shrimp was contributed average 38.34% by weight (132.94MT) on the total pakua jal catch. In 2014-15 total 127.031MT of catch was landed, of which percentage composition of gura ichha was 30.82 MT or 24.26%. Among the total 262.90 MT catch during 2015-16, sergestid shrimp was contributed 37.13% or 97.61MT. In 2016-17 periods total 94.051MT resources were harvested, on which % composition of *Acetes* shrimp was 55.0% (51.73 MT). During 2017-18 among the recorded 444.782 MT catch, highest densities of *Acetes* species was contributed 270.21 MT or 60.75% of the total pakua jal catch.

At ghatwise highest catch of pakua jal during 2013-14 was 108.59MT in Anandabazar fish landing center and lowest in Banshbaria was 2.65MT. In 2014-15 maximum landing was found at Kattoli 16.05MT and minimum 5.53 MT in Katghar ghat. In the year 2015-16 highest and lowest catch were 98.83MT and 6.25MT at Gohira and Sitakunda fish landing centers respectively. Maximum landing volumes was recorded 47.04MT in Gohira ghat and minimum 0.40MT in Banshbaria during 2016-17. In 2017-18 periods highest and lowest catch were 240.34MT and 1.38MT at Gohira and Banshbaria fish landing center respectively.

In the monthlies total pakua jal fishing maximum densities during 2013-14 were found 104.69MT in Mar'14 and lower 4.65 MT in Apr'14. In the year 2014-15 highest catch was 50.75MT in Dec'14 and lowest in Mar'15 was 20.91MT. In 2015-16 periods' maximum and minimum catch were 74.34MT and 0.36 MT in Dec'15 and Mar'16 respectively. During 2016-17 maximum density were 42.05MT in Mar'17 and lowest 4.54 MT in Jan'17. In 2017-18 periods highest and lowest catch were recorded 321.02MT and 25.73 MT in Feb'18 and Jan' 18 in the total catch respectively.

During the total study periods recorded 33 juvenile of shrimps, fishes and other resources were in the pakua jal catch.

During 2017-18 highest average catch per net per trip per boat (CPUE) was 8.39 kg in the month of Feb'18 and lowest in the month of Mar'16 was 0.01kg.

Keywords: Exploitation, Sergestid shrimp, Pakua jal, percentage contribution and CPUE.

Introduction

The annual marine fish production of Bangladesh was 6, 26,528.0 MT. About 83.19 percent of its or 5, 21,180.0 MT is reported to be contributed in artisanal fisheries. Among them 1, 56,050.0 MT or 24.91 % was caught by set bag nets (Behundi nets), which were engaged by 48,452 number of set bag nets (DoF, 2015-16). There are three type of set bag nets namely ESNB (Estuarine Set Bag Net), MSBN (Marine Set Bag Net) and Pakua jal (Modified same mesh set bag net) are also fished in our territory. Pakua jal exploited spawn, fry and juveniles of commercial and non-commercial species (shrimp, fish and other species) as target and by-catch. As a target group, pakua jal mainly fished non commercial Sergestid shrimps– (*Acetes* spp.) which are locally called Gura ichha in the south - east part coastal areas of Bangladesh.

The *Acetes* shrimps are an important fisheries commodity in poor coastal communities of Chattogram district. In this district 8 fish landing centers or ghats are selected namely Ananda bazar, Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria for data collection and analyzing of *Acetes* shrimps. For the fished of gura ichha local coastal fishers engaged pakua jal and totals 1275.513 MT of different group of marine water resources were exploited within the 5 years during 2013-14 to 2017-18. Among thus coastal resources *Acetes* shrimp was one of the components and contributed the highest in position. The main harvesting periods of sergestid shrimp were in the month of November to April but peak in February to March. In these study periods 3 *Acetes* species- *A. indicus* (H. Milne-Edwards, 1830,) *A. erythraeus* (Nobili, 1905) and *A. japonicas* (Kishinouye, 1905) were recorded in the total pakua jal catch. Only the greater proportion of the catch is sold as fresh, but a small proportion are dried in various ways for foods mainly dry shrimp, poultry feed and fish meal.

The shrimps of the genus *Acetes* are planktonic (Omori, 1975) and which are living mainly in the estuarine and coastal waters of tropical and sub-tropical regions (Omori, 1977). These shrimps often become a major component in the diets of shore fishes, large shrimps and shore birds (Omori, 1974; Xiao and Greenwood, 1993) and play a significant role in the food web of neritic waters, particularly in mangroves and sea grass beds.

Many species of *Acetes* are fished for commercially and the different species are often not discriminated.

Acetes sp. is the most fished species of crustacean, with global production in 2008 of 558,124 tones. Fishers mostly use push nets and bag nets, as well as seines both on boats and from the shore (Internet, 2018). During certain part of the year, *Acetes* forms conspicuous aggregations near the shore. Such accumulations have been exploited as human food for many years in Asia and Africa. The Annual world catch of *Acetes* is estimated to be about 170,000 tons, or about 15% of the total shrimp catch in the world and about 13.5% of the world crustacean fisheries production (Omori, 1975).

Acetes affords a major source of protein to some of the people in Asia and East Africa. This shrimp is mainly fished with various kinds of push nets set near the shore against the flow of the tide (Omori, 1975). *Acetes* is a genus of small shrimp that resemble krills, which is native throughout the seas of Asia. Several of its species are important for the production of shrimp paste in Southeast Asian countries (Internet, 2018).

The *Acetes* spp. lie under the family Sergestidae is called sergestid shrimp. They are typically living in coastal estuarine water areas at certain stages of their life cycle, especially during their breeding period. Sergestid shrimps are small planktonic nearly transparent shrimps that swim in enormous numbers in the water column. Some are found in shallow offshore waters while many are found in depths of 500-700 m (1600-2300 ft) or more. They are slim-bodied with long slender appendages. They can sometime be so abundant as to form sound-scattering layers. Their predators include fish, whales and squid. Although small in size, they occur in such abundance that they are fished commercially in some countries and used for food or shrimp past (Internet, 2018).

In the coastal waters of Bangladesh, *Acetes* is one of the abundant groups of macro zooplankton (Zafar and Mahmood 1989; Zafar, 1995). Four species of *Acetes* shrimps are found (*Acetes indicus*, *Acetes erythraeus*, *Acetes japonicas* and *Acetes chinensis*) in the kutubdia island channel at southeastern coastal water of Bangladesh (Zafar and Alam, 1997).

Acetes fisheries operate mainly in Asia and to a much lesser extent in Africa and South America (Omori, 1975), *A. chinensis*, *A. erythraeus*, *A. indicus*, *A. japonicus*, *A. serrulatus*, *A. sibogae* and *A. vulgaris* form single or in combination, commercial fisheries in Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Philippines, Singapore and Thailand (Omori, 1975; Zafar, 2000).

Fishing grounds are usually located in calm, muddy, near intertidal zones, where waters are shallower than 5 m (Omori, 1975).

Marketed either dried, boiled, salted, fermented, fresh or processed in other ways; consumed locally in the form of seasoning (shrimp paste/sauce). Planktonic in life, marine or brackish, but usually brackish and fished in the intertidal zone, inhabits estuarine waters with mangroves. In general, it is a suspension feeder, zooplanktivorous omnivore, wherein it primarily feeds on copepods, ostracods, other crustaceans and molluscan veligers. It is observed to forage intensively after midnight. Usually swims mid water or near the surface (Internet, 2018).

The continental shelf of Bangladesh covers an area of 66,440 sq.km of which 37,000sq.km is no deeper than 50m. These waters are relatively rich in plankton and contain oxygen (4.8ppm at the surface and 4.0ppm. at 35 m depth), nitrates and minerals. The salinity ranges from 12-33ppt in monsoon and 16-39 ppt in the dry season. In these areas operate fleets of small-scale fishing craft and gears such as motorized boats, set bag nets (behundies), trammel nets, beach seines, long lines, gill nets etc (Rahman,1995). The multi-gears and multi-species coastal fisheries and commercial levels comprise 120 species of brackish water and estuarine fish with crustaceans accounting for a sizable proportion of the annual biomass harvested. Coastal shrimp resources constitute important fisheries in countries around the Bay of Bengal, generating foreign exchange and providing jobs in the fishing and ancillary industries. In artisanal fishery shrimps are harvested as pre-adult, post-juveniles, juveniles and even the post-larvae because the younger individuals during the early phase of their life history spend in the estuarine and coastal areas.

Objectives:

To analyzed abundance of sergestid shrimp (*Acetes* spp.), exploitation method and its contributions on pakua jal fishing at artisanal sector.

Materials and Methods

Description of used gears:

Pakua jal is a mosquitoes' type modified same meshes size small set bag net, resembling a trawl net in the tidal stream by attaching it to holdfasts. It has a rectangular mouth which is kept open by two vertical

bamboo stakes, embedded some distance apart in the sea shore bed. During the intertidal period the net is set in the opposite/against in the sea current by attaching it to holdfasts. The net floats on the water surface, when water level raising the net sinks and stretches. Fish drift in with the current.

This gear is operated along the coast within 5-10 m depth during high tide. This gear is 5-10 m in length and divided into two main parts, mouth and cod end are mosquito type 5 - 6 mm mesh size which are same in all parts of the net. Generally 8-12 nos. of nets are engaged per boat.

This type of net is mainly engaged 7-8 days in each dala tithy or the neap tide periods, (neap tides, meaning that high tides are a little lower and low tides are a little higher than average. Neap tides occur during the first (Gibbous moon) and third quarter moon (Crescent moon), when the moon appears "half full."). This occurs twice in each month. Totally 15 - 16 active fishing days in each lunar month (a mean period of 29 days 12 hours and 44 minutes) at winter season for fished target species of gura ichha or sergestid shrimp (*Acetes* spp). Fishing is done generally 2 times during day time by pakua jal against the flow of tide, but sometimes fished 4 times (six hours interval) in most pick fishing periods. When water current will very high during full moon or new moon periods, then pakua jal fishing will be stopped. Spawn, fry and juveniles of non- commercial species (shrimp, fish and other species) are exploited by pakua jal fishing also.

Data collection system:

The survey, conducted during 2013-14 to 2017-18 (November to April) on Pakua jal fishing. The study was based on collection of primary data. Before collection of primary data, a questionnaires form was developed and data were collected with a field staff and a Scientific Officer /Marine Fisheries Officer in each fish landing center through direct observation from Ananda bazar, Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria fish landing centers or ghats of south- east parts at Chattogram district. Data have been collected by interview to stakeholder, boat owner and fishermen of each fish landing center in 3 days for each moon month in the 1st quarter, last quarter and full moon or new moon periods. In every landing center of the study area's each boat owner or fisherman engaged 8-12 number of pakua jal for 15-16 days in each month to fished sergestid shrimp.



Fig: Pakua jal fishing boats



Fig: Acetes shrimp in the pakua jal catch



Fig: ESNB catch during beginning of wet monsoon

Sampling:

The samples were obtained from the fishermen directly after the harvesting as mixed groups with sergestid shrimps of pakua jal catch. The samples were collected in each every month of the number of two from each station, which are continued more or less 4 to 6 month of the year. The specimens were preserved in 5% formalin just after collection.

Data analysis:

Total landed boats, active fishing days, no's of trip, total number of nets/gears used, catch per net/ trip/boat, catch per boat per day, total landing and species composition were recorded and analyzed from the sampling days; total fish landed was recorded in MT.

In pakua jal fishing operated by small scale fisher folk make short fishing trips (half an hour to 1 hour) close to the ashore in daily basis.

Calculate of total landing:

Active fishing days in a month estimated by the interview of fishermen ongoing/incoming from fishing at sea in each sampling's day, all active days was added and divided by the total number of fishers within the sampled days.

The average number of landed boats was estimated from the total number of boats landed in the sampling days was divided by the total sample days in a month.

Total landed boats was estimated by the average number of landed boats in a sampling day multiply by the number of active fishing days in a month.

The catch /net /boat (kg) was estimated from the total catch of sampled boats divided by the total number of nets used in a sample boat.

The Catch/boat/trip (kg) was estimated by the total catch per net multiple by the total number of nets used in a trip of sampling day.

The average catch/boat/trip was estimated from the total catch/boat/trip (kg) of sampled boats divided by the total number of sampling boats landed.

Catch per boat per day (kg) was estimated from the average catch/boat/trip (kg) multiplied by the average number of trip in the sampling days.

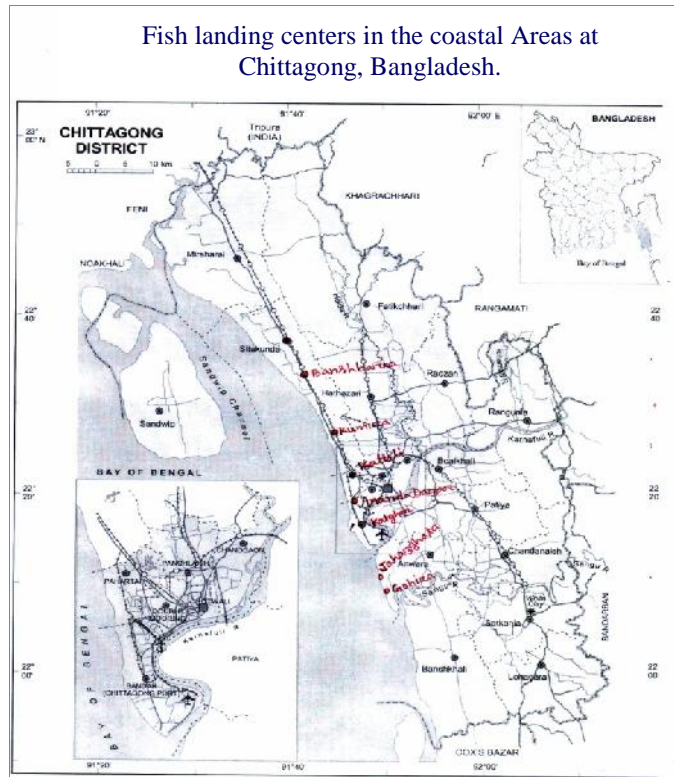
Total production or landing (MT) at the sampling station or landing center's was estimated from the catch / boat / day multiplied by the total number of landed boats operated in the fish landing center or ghat of a month.

All artisanal and industrial catch data processing and analysis were done separately and manually.

Results

The study was conducted during 2013-14 to 2017-18 on abundances of sergestid shrimps and its exploitation method by selective gear pakua jal at chosen 8 fish landing centers or ghats. The exploitation periods of *Acetes* shrimp mainly in the month of November to April. In pakua jal fishery different type of juvenile fish, shrimp and others water resources were exploited near the ashore areas within 10 meter depth during high tide. Sergestid shrimp is one of the highest components in the pakua jal catch. In these study periods a total of three different species of the genus *Acetes* (*A. indicus*- H. Milne-Edwards, 1830; *A. erythraeus*- Nobili, 1905 and *A. japonicas*- Kishinouye, 1905) were recorded from the eight sampling locations (Fig in the Map) in the south –east part Bangladesh coastal waters. Descriptions of *Acetes* spp. are given below:

Fish landing centers in the coastal Areas at Chittagong, Bangladesh.



Taxonomic account: Order- Decapoda, Family-Sergestidae, Genus- *Acetes* (H. Milne Edwards)

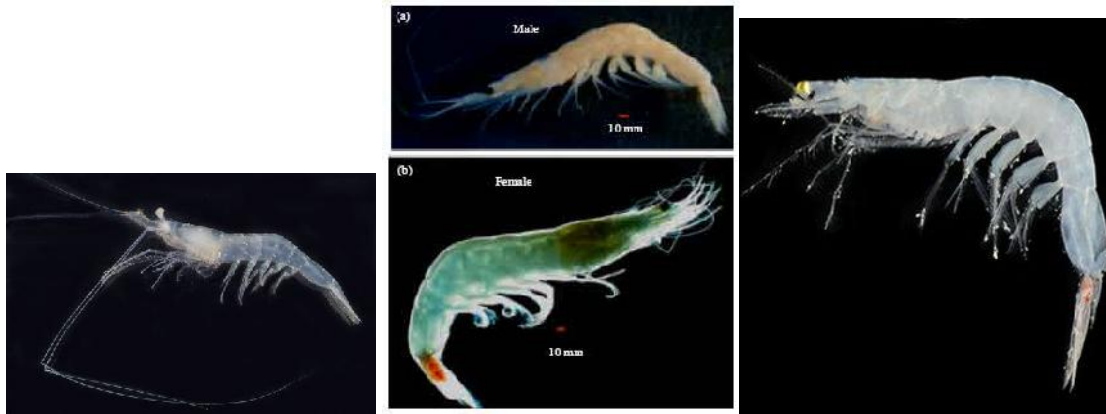


Fig: *Acetes indicus*

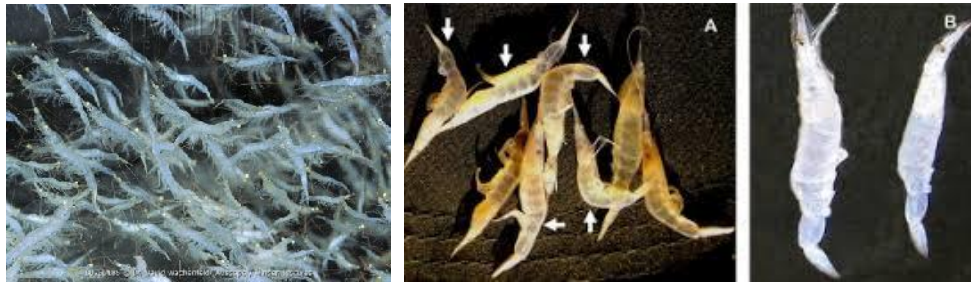


Fig. *A. erythraeus*



Fig: *Acetes japonicus*

(All picture of *Acetes* shrimp were collected from internet)

Characters of *Acetes* species: Small- sized shrimps, the adult total length ranging between 1 to 4 cm. The body is translucent or semi translucent, with black eyes and several pairs of red pigment spots on the basis and endopods of uropods. Rostrum shorter than the eye-stalk, generally small and sometimes even absent.

1. *Acetes indicus* (Milne-Edwards, 1830) Jawla paste shrimp

Characters: Pelagic; brackish; depth range - 50 m, Max length: 2.5 cm BL male/unsexed; 4 cm BL (female). Inhabits shallow, sometimes brackish coastal waters. Usually swims mid water or near the surface. Members of the order Decapoda are mostly gonochoric. Mating behavior: Precopulatory courtship ritual is common (through olfactory and tactile cues); usually indirect sperm transfer.

2. *Acetes erythraeus* (Nobili, 1905). Tsivakihini paste shrimp

Characters: Benthopelagic; brackish; depth range 0 - 55 m. Max length : 3.2 cm BL male/unsexed; 4.8 cm BL (female). Rostrum, which has two dorsal denticles or teeth, is shorter than eyes. Elongated first 3 pereopods and no fourth and fifth pereopods. Larger female than males. Color: in life, whole body almost transparent. Milky or yellowish when dead.

3. *Acetes japonicus* (Kishinouye, 1905), Akiami paste shrimp

Characters: Pelagic; depth range 1 - 100 m Tropical, preferred 23°C. Maturity range 2 - 1.8 cm. Max

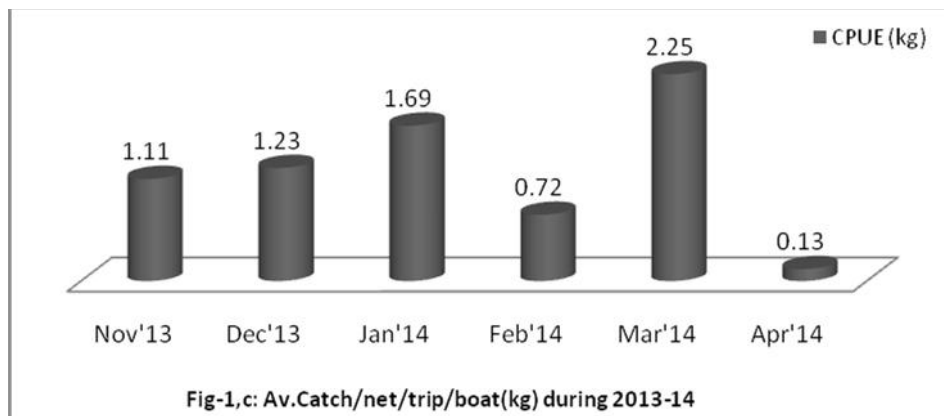
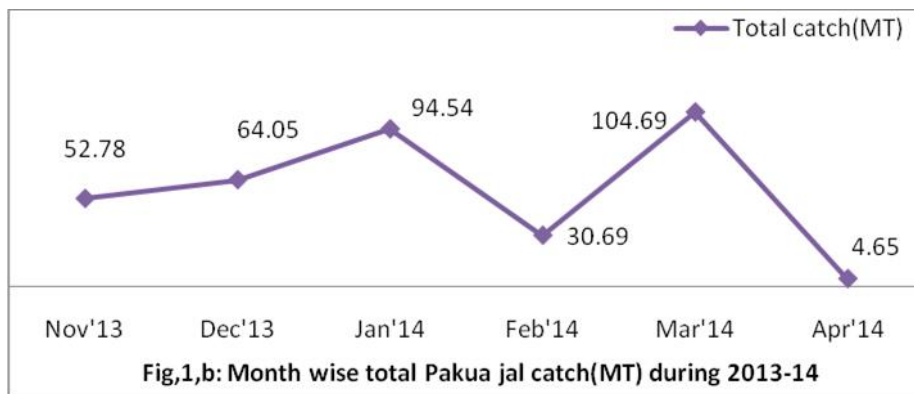
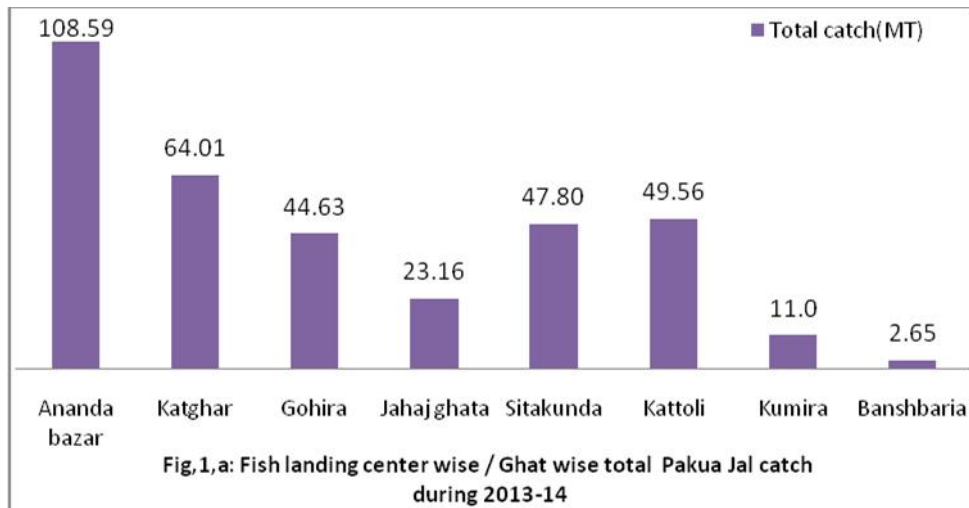
length: 2.4 cm BL male/unsexed; 3 cm BL (female). Epipelagic, inhabits shallow coastal waters over muddy bottoms. Members of the order Decapoda are mostly gonochoric. Mating behavior: Precopulatory courtship ritual is common (through olfactory and tactile cues); usually indirect sperm transfer.

During November, 2013 to April, 2014 totals 346.75 MT of different groups of species were caught in pakua jal fishing. Among them, 52.78 MT was exploited in Nov'13 followed by 64.05MT, 94.54MT, 30.69MT, 104.69 MT and 4.65MT were in Dec'13, Jan'14, Feb'14, Mar'14 and Apr'14 respectively.

In fish landing center or ghat wise total landing was recorded 108.59MT in Ananda bazar ghat followed by 64.01MT, 44.63MT, 23.16MT, 47.80MT, 49.56MT, 11.0MT and 2.65MT were in Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria ghat respectively.

During 2013-14 highest average catch per net per trip per boat (CPUE) was 2.25 kg in the month of Mar'14 and lowest CPUE was 0.13 kg in Apr'14 (Fig- 1: a, b and c).

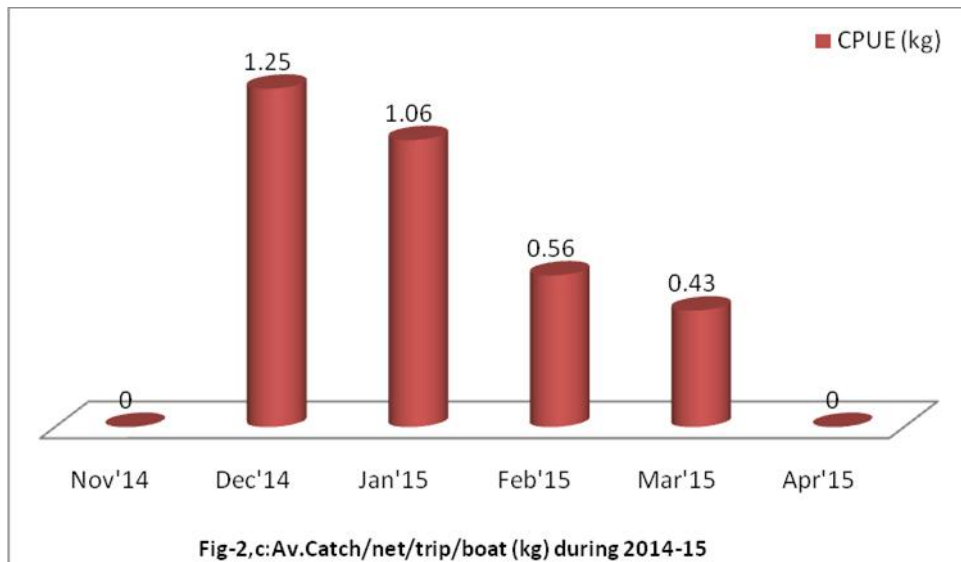
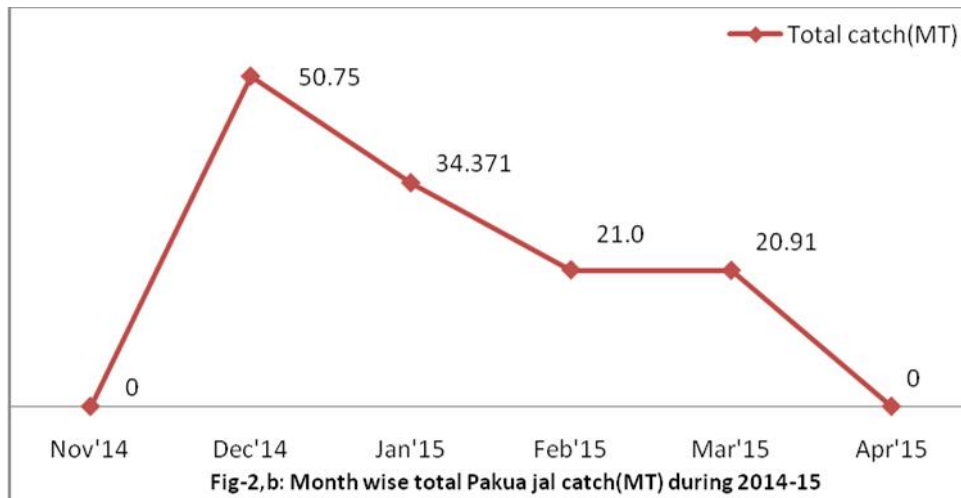
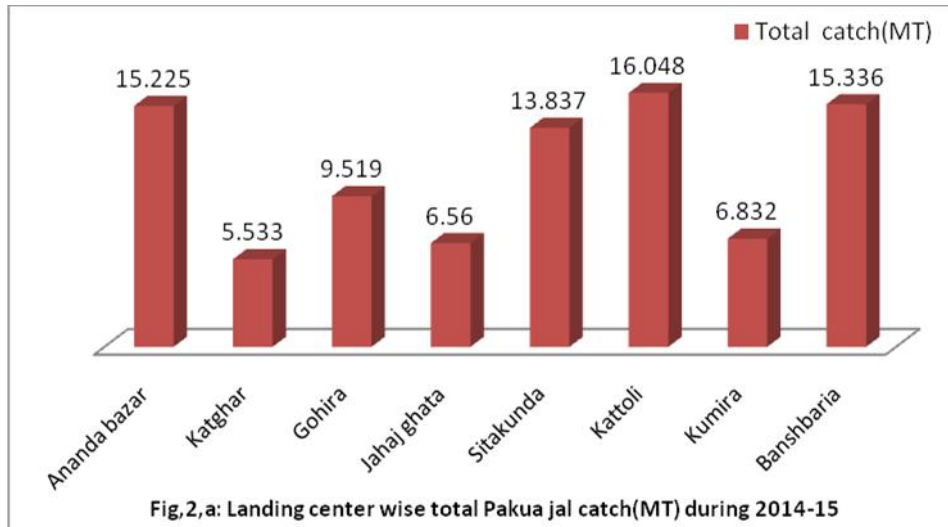
In November 2014 and April, 2015 no pakua jal fishing observed. Totals 127.031MT catch was recorded during December, 2014 to March, 2015. On which in Dec'14 period total landing volume was 50.75MT followed by Jan'15, Feb'15 and Mar'15 were in 34.37 MT, 21.0MT and 20.91 MT respectively.



In ghat wise catch 15.23MT resources was recorded from Ananda bazar ghat followed by 5.53MT, 9.519MT, 6.56MT, 13.84MT, 16.05MT, 6.83MT and 15.34MT were in Katghar, Gohira, Jahajghata, Sitakunda, Kattoli, Kumira and Banshbaria ghat respectively. During this study periods maximum

density of sergestid shrimp was 24.26% of the total pakua jal catch.

In the 2014-15 periods maximum and minimum CPUE were 1.25 kg and 0.43 kg in the month of Dec' 14 and Mar' 15 respectively (Fig- 2: a, b and c).

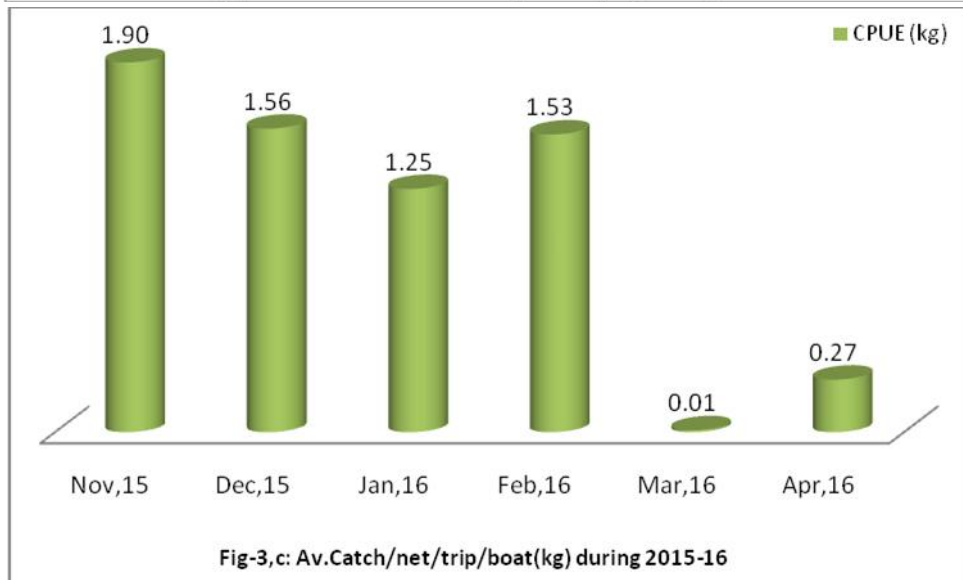
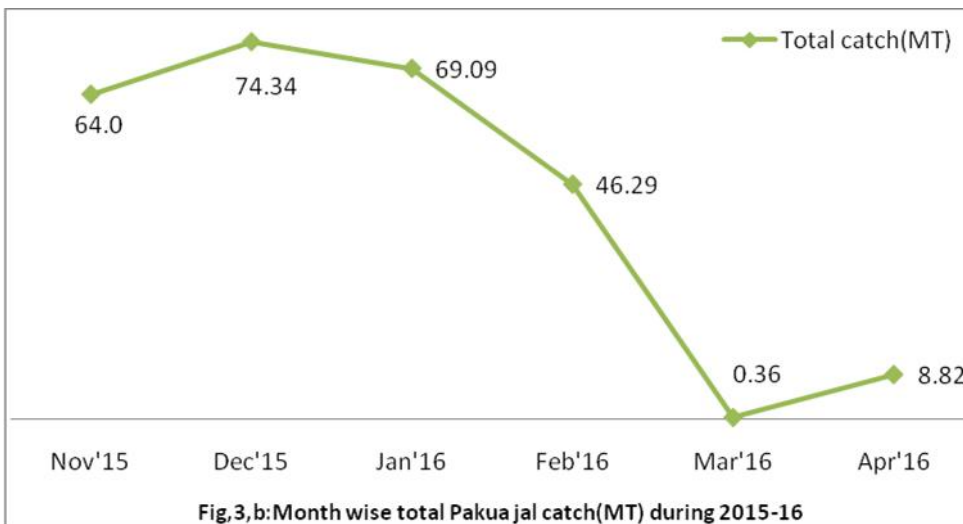
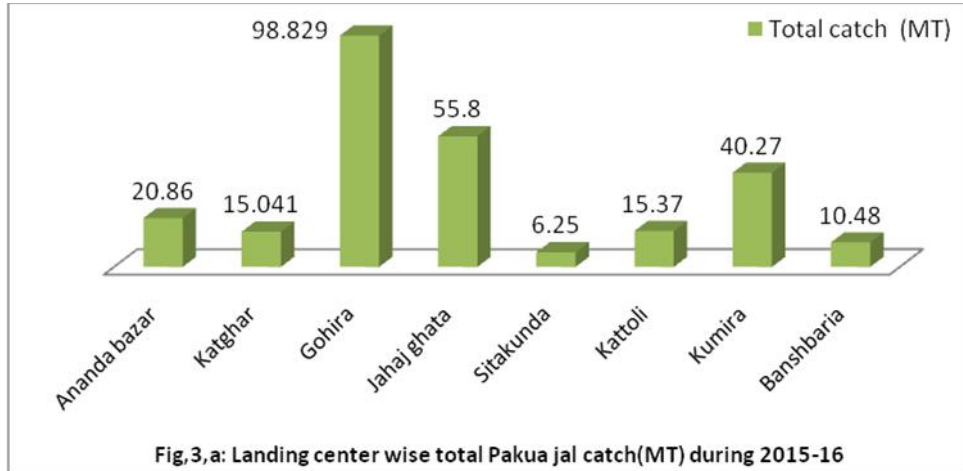


During 2015-16 a total 262.90 MT of pakua jal catch was recorded. In the month of Nov'15 total 64.0 MT resources was landed followed by Dec'15, Jan'16,

Feb'16, Mar'16 and Apr' 16 were in 74.34MT, 69.09MT, 46.29MT, 0.360 MT and 8.82MT respectively.

Ghat wise catch of Ananda bazar was 20.86MT followed by Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria were in 15.04MT, 98.83 MT, 55.80 MT, 6.25 MT, 15.37 MT, 40.27 MT and 10.48 MT respectively. In these sampling periods' highest densities of *Acetes* shrimps was 37.13% of the total catch of Pakua jal fishing.

During 2015-16 highest CPUE was 1.90 kg in Nov'15 and lowest 0.01kg in the month of Mar'16 (Fig- 3: a, b and c).

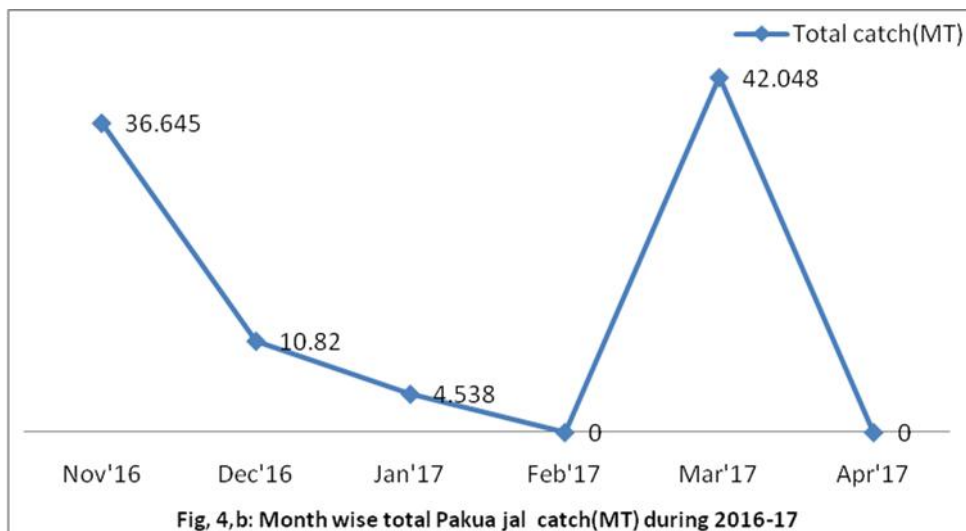
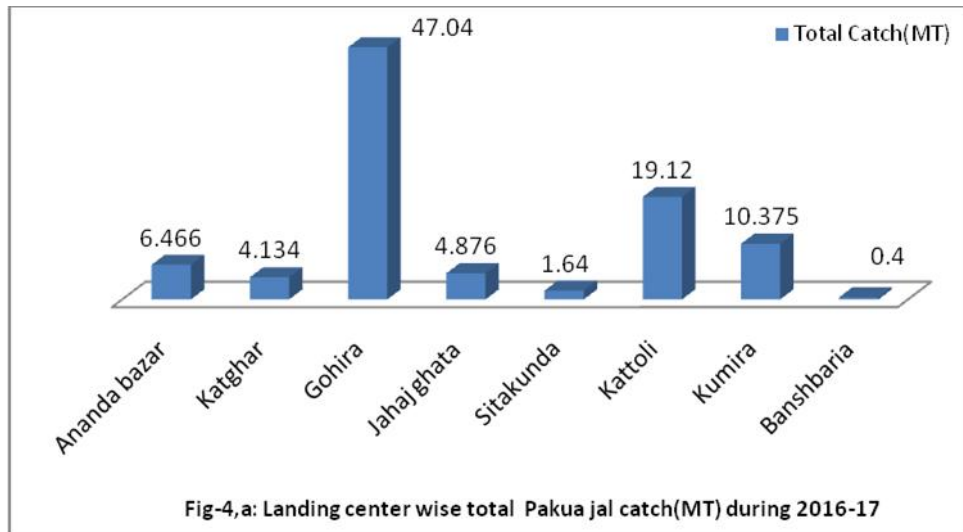


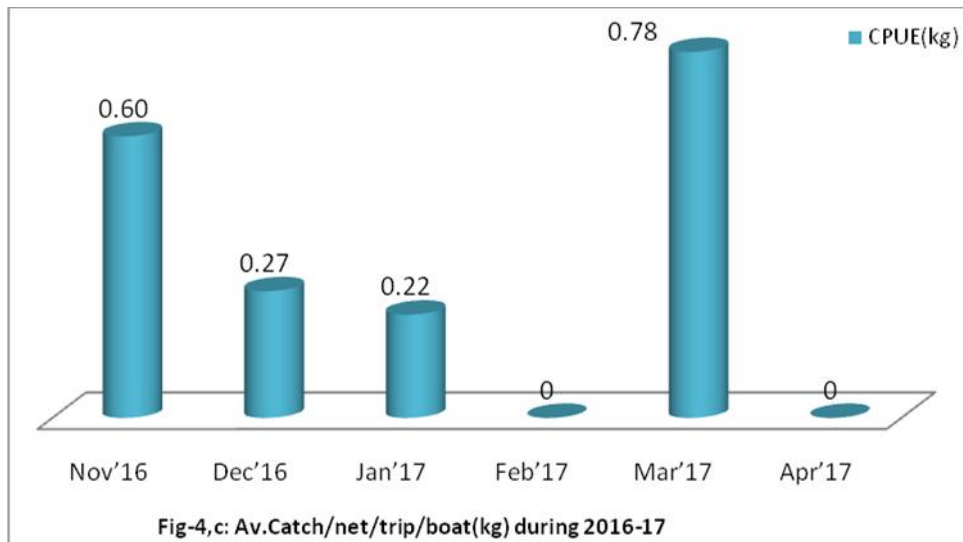
Total landing volumes was recorded 94.05MT during November, 2016 to March, 2017. In month wise catch 36.645MT was in period of Nov' 16 followed by 10.82 MT, 4.53 MT and 42.048MT were in Dec'16, Jan'17 and Mar'17 respectively. In Feb'16 and Apr'17 no fishing observed.

In ghat wise catch 6.47MT was landed in Ananda bazar fish landing center followed by 4.13MT, 47.04MT, 4.88MT, 1.64MT, 19.12MT, 10.38 MT and 0.4MT

0.4MT were in Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria landing center respectively. Average percentage contribution of sergestid shrimps was 55.0 in total pakua jal catch during same study periods.

In the year 2016-17 maximum and minimum CPUE were 0.78 kg and 0.22 kg in the month of Mar'17 and Jan'17 respectively (Fig-4: a, b and c).



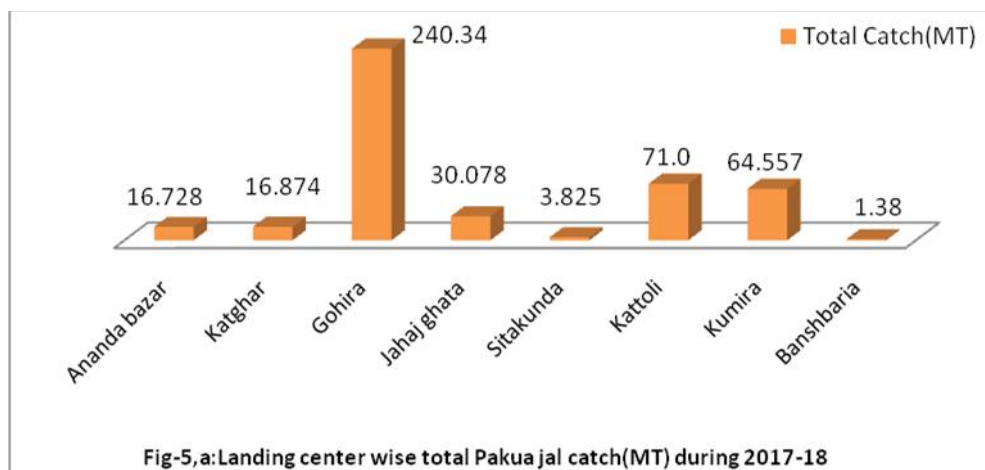


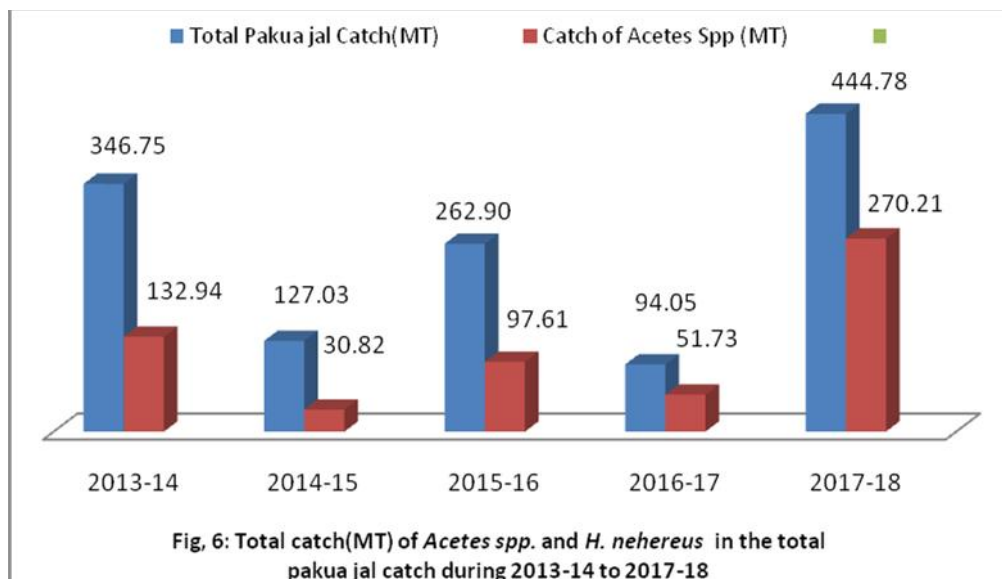
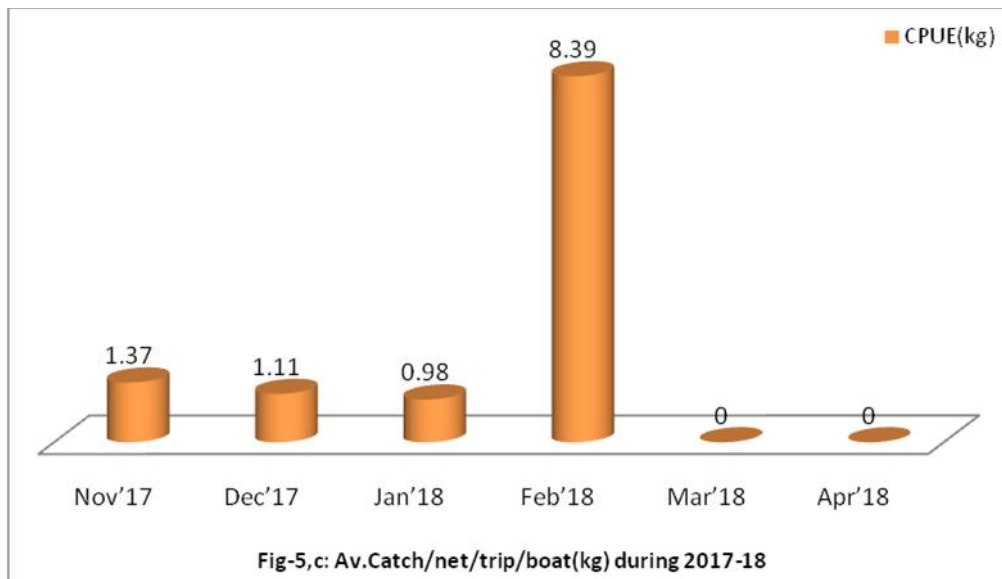
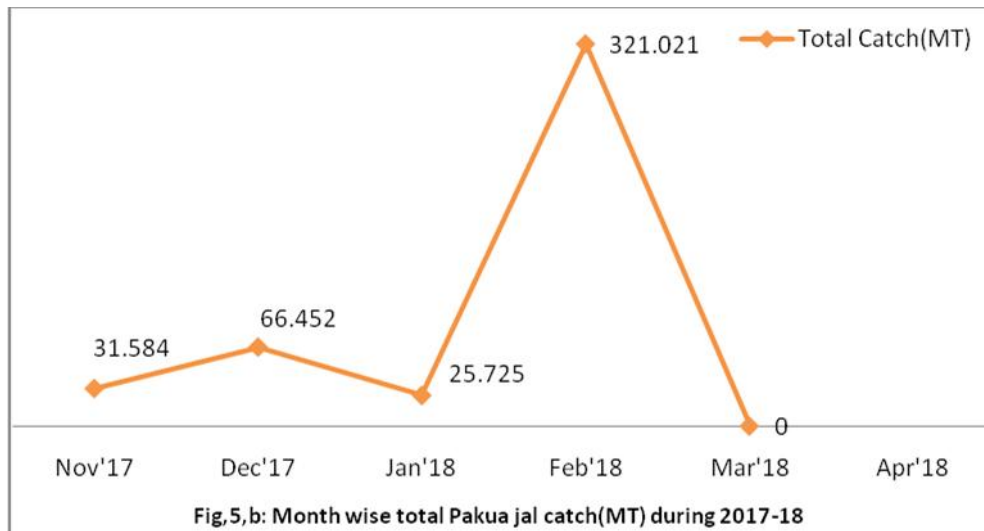
During 2017-18 in total pakua jal catch volume was recorded 444.782MT in the month of November, 2017 to March, 2018. Among them 31.584MT was landed during Nov' 17 followed by 66.452 MT, 25.725MT and 321.021MT were in Dec' 17, Jan' 18 and Feb' 18 respectively.

In landing center wise catch at Ananda bazar was 16.73MT, followed by 16.87MT, 240.34 MT, 30.08MT, 3.83MT, 71.0MT, 64.56MT and 1.38MT were in Katghar, Gohira, Jahazghata, Sitakunda, Kattoli, Kumira and Banshbaria fish landing centers respectively. Highest densities of *Acetes* species was contributed 60.75% during 2017-18 in total pakua jal catch.

During 2017-18 highest CPUE was 8.39 kg in the month of Feb' 18 and lowest 0.98 kg in Jan' 18 (Fig- 5: a, b and c).

During 2013-14 total 346.75 MT mixed juvenile of shrimps, fishes and marine resources were caught on pakua jal fishing, among them only *Acetes* species contributed 132.94 MT or 38.34% followed by 127.031MT (gura ichha composition was 30.82 MT or 24.26%), 262.90 MT (Sergestid shrimp contributed only 97.61MT or 37.13%), 94.051MT (*Acetes* shrimp densities was 51.73 MT or 55.0%) and 444.782 MT catch (total volumes of *Acetes* species was 270.21MT or 60.75%) were in 2014-15, 2015-16, 2016-17 and 2017-18 respectively (Fig:6).





During 2013-14 total percentage contribution of *Acetes* shrimp was 38.34 and *H. nehereus* 27.03 in the pakua jal catch. In 2014-15 *Acetes* shrimp and *H. nehereus* densities were 24.26 and 28.56 respectively. In the year 2015-16 *Acetes* species contributed 37.13 and *H. nehereus* was 22.91. During 2016-17 *Acetes* shrimp and *H. nehereus* composition were in 55.0 and 37.04 respectively. At 2017-18 percentages composition of *Acetes* species was 60.75 and *H. nehereus* was 15.25 (Fig, 6).

Discussion

In the total pakua jal catch maximum densities of Gura ichha or Sergestid shrimp (*Acetes* species) was contributed by weight 38.34% during 2013-14 followed by 2014-15, 2015-16, 2016- 17and 2017-18 were in 24.26, 37.13, 55.0 and 60.75% at data collection periods mainly in the month of November to April in each year's which shown in fig. 6. In these study periods three sergestid shrimp species namely *Acetes indicus*, *A. erythraeus* and *A. japonicus* were recorded in 8 fish landing centers or ghats within 10 m. depth coastal zone in high tide.

Beside this, 1st highest catch component of Sergestid shrimp (*Acetes spp.*) was trapped large amount in the month of January, February and March when salinity is increases and water current decreases. In the winter periods *Acetes spp.* migrates from deep water to coastal areas may be for breeding or grazing and exploited large in densities by pakua jal mainly in dala periods.

Another component of Loittya fishes are caught in large amount in the far way of same coastal areas at different juvenile stages during wet monsoon (a seasonal prevailing wind in the region of South and South East, blowing from the south-west and bringing rain), mainly in April, May and June by engaged of Estuarine Set Bag Net (ESBN) also; another group of Gobiidae (*Gobioides*, *Apocryptes* and *Trypauchen* spp) are caught moderately large amount in these periods. It was observed that, if Loittya fish are caught in large amount then *Acetes* shrimp are exploited in lower densities, because of Loittya fish feed on *Acetes* species. Fig 6 shown that, average percentage composition by weight of *H. nehereus* (F. Hamilton, 1822) during 2013-14 was 27.03 followed by 2014-15, 2015-16, 2016-17and 2017-18 were in 28.56, 22.91, 37.04 and 15.25% respectively in the same total pakua jal catch.

Nevertheless, prawn and shrimp larvae fishing have the highest by catch rates of any fishery in the world, resulting in the loss of more than 98 thousand million juvenile fish and crustaceans every year (EJF) 2004; (FAO) 2001 and Latif et al. 2002). In the Pakua jal catch of same study periods different types of commercially important water resources are exploited in their larval or juvenile stages for the mosquito types of net, which are related on (EJF) 2004; (FAO) 2001 and (Latif), 2002 reported.

In our southeastern coastal water areas 4 species of *Acetes* shrimps are recorded and they are *Acetes indicus*, *Acetes erythraeus*, *Acetes japonicas* and *Acetes chinensis* (Zafar and Alam, 1997). But in our study periods *Acetes indicus*, *A. erythraeus* and *A. japonicus* were recorded which are related to the Zafar and Alam, (1997) study. *Acetes* fisheries operate mainly in Asia and to a much lesser extent in Africa and South America (Omori, 1975), *A. chinensis*, *A. erythraeus*, *A. indicus*, *A. japonicus*, *A. serrulatus*, *A. sibogae* and *A. vulgaris* form single or in combination, commercial fisheries in Bangladesh, China, India, Indonesia, Japan, Korea, Malaysia, Pakistan, Philippines, Singapore and Thailand (Omori, 1975; Zafar, 2000). Fishing grounds are usually located in calm, muddy, near intertidal zones, where waters are shallower than 5 m (Omori, 1975).

Acetes indicus was most abundant (120 individuals/haul) in March. Omori (1977) found that *A. indicus* was distributed from the west coast of India through the Andaman sea, Gulf of Sian and the Java sea, to the South China sea. Mahmood (1978) stated the presence of *Acetes indicus* in the Karnafuli estuary throughout the year. *A. indicus* were found in lower densities during winter months and maximum in February-March months.

The maximum density of *A. erythraeus* was in February (153 individuals/haul) and minimum in October (5 individuals/haul). This *Acetes* shrimps in the Kutubdia channel species has the most extensive geographical distribution in the Indo-west Pacific. Its range extends from the coast of South Africa to the South China Sea, through the south and west coast of India, the Malay Archipelago and the Java Sea. *A. erythraeus* was also recorded near the Mossman, Australia (Omori 1975). This species appeared in the coastal water of south India during January to April (Nataraj, 1947). Reste (1970) stated that higher density was recorded during spring season.

A. japonicus was first recorded from Kutubdia channel during the present investigation. It was recorded throughout the period of investigation except in November - January. Two peaks occurrence of *Acetes japonicus* in the studied area, one peak in August (10 individuals/haul) and in March (21 individuals/ haul). *Acetes japonicus* were recorded from the coasts of India and from the Andaman Sea to the southern Japan (Omori 1977).

Seven species of sergestid shrimps (*A. erythraeus*, *A. indicus*, *A. japonicus*, *A. serrulatus*, *A. johni*, *A. sibogae* and *A. vulgaris*) are reported by Pathansali (1966) from the Indo-Malaysian region. Ten species are distributed in the Indo-West Pacific and the Indo-Malaysian region according to Omori (1975). Six species were recorded by Zafar (2000) from Bangladesh waters. In the present study five species of the sergestid shrimps were found from the different coastal waters of Malaysia; their identifying characters were very closely similar with the descriptions given by Omori (1975) and Zafar (2000).

Six species of *Acetes* are reported very briefly from the Malay Peninsula and Singapore: *A. erythraeus* - Nobili, *A. indicus* -Milne-Edwards, *A. japonicus* -Kishinouye, *A. sibogae* -Hansen, *A. serrulatus* -Hansen and *A. vulgaris* -Hansen (Pathansali, 1966). Five sergestid shrimps; *A. indicus*, *A. japonicus*, *A. intermedius*, *A. vulgaris* and *A. serrulatus* were identified from different coastal waters of Malaysia. Among them *A. intermedius* from Malacca and *A. serrulatus* from south-western Johor were recorded for the first time. These two species are new record to the coastal waters of Malaysia. Our study still requires further updates, as there are other locations that are not yet included in the sample acquisition (Amin, 2011), which are almost similar to our study because *A. indicus*, *A. erythraeus* and *A. japonicus* were recorded in the south-east coastal areas in study periods.

In the world 14 *Acetes* species were recorded, which are listed here with their FAO endorsed: *Acetes americanus* (Ortmann, 1893), *Acetes binghami* (Burkenroad, 1934), *Acetes chinensis* (Hansen, 1919), *Acetes erythraeus* (Nobili, 1905), *Acetes indicus* (H. Milne-Edwards, 1830), *Acetes intermedius* (Omori, 1975), *Acetes japonicus* (Kishinouye, 1905), *Acetes johni* (Nataraj, 1947), *Acetes marinus* (Omori, 1975), *Acetes natalensis* (Barnard, 1950), *Acetes paraguayensis* (Hansen, 1919), *Acetes serrulatus* (Krøyer, 1859), *Acetes sibogae* (Hansen, 1919), *Acetes vulgaris* (Hansen, 1919).

Acetes shrimp play important roles in the food chain and are an important food source for larger water resources ranging from fish to whales. The muscular tails of many shrimp are edible to humans and they are widely caught and farmed for human consumption. It's also an excellent source of selenium and vitamin B12. This shellfish is a very good source of protein, phosphorus, choline, copper and iodine. Sergestid shrimp is also a good source of the mineral zinc. They provide key nutrients. Aside from protein, shrimp provide a pretty impressive array of nutrients (Internet, 2018).

Zafar and Mahmood (1989) reported that *Acetes* shrimps were present throughout the year in the Satkhira estuarine system. May be due to its migratory character, the species could not be found in other months except February and March in the study area. It is one of the most important commercial shrimp resources and is also an important component of the marine ecosystem in the coastal waters of south-west Taiwan (Chiou, 2000).

In south-east coast areas *Acetes* shrimp are considered as non - commercial fishery products for low cost and treat as the food in poor communities. The small mesh mosquito type pakua jal fishery mainly engaged near the ashore within 10 m depth are considered as grazing or nursery grounds for most of all fish and shrimp species, these areas are now banning for any type of fishing. But this fishery were fished juveniles and larvae of shrimps, fishes and other marine water resources; so for characterized of high fishing mortality rates of the most commercially important groups or species indicates this pakua jal as destructive gear, which now is banning. Increasing number of fishing boats and gears in each fish landing center of the study areas continuously increasing growth overfishing or fishing effort represented rapid decline of the most commercial marine resources have a serious effect on our marine ecosystem. If it is not fished, as a component of ecosystem this migratory sergestid shrimp group would more contribution in our coastal biodiversity.

The lifetime and size of sergestid shrimp's are very small and caught large densities only in winter season; on the other hand for the migratory characteristics local poor coastal fisher's community modified this puse net type gear to caught gura ichha as target group for their livelihood, prepared to fish and poultry feed and cheaply protein supply to fresh and dry form. The second highest catch of *Harpadon neherus* and as

third Gobiidae group and other water resources were feeding this *Acetes* shrimp from the same coast areas probably in nursery ground; which contributed in fish production. During last decade the abundance of larger predatory and commercially important fish species were decreased in number; may be for this reason the forage fish (Anchovies, squid, menhaden, sardine, shrimp, krill and others small fishes which are preyed on by larger predators for food) were increased large in densities to recover these place naturally. In few years ago, sergestid shrimp were caught less in amount, but now fished in large densities. Sergestid shrimp has low worth and non commercial, but economically important and abundant species in a particular periods, which are used varieties of food sources for the coastal and others poor communities.

Highest average catch/net/trip/boat (CPUE) was 8.39 kg in the month of Feb'18 and lowest in Mar'16 was 0.01kg, which are indicates recently the forage species increased in densities but the big size of economically important species decreased in number and weight.

Limitation:

In this study periods only exploitation system and landing center wise total catch and CPUE of Sergestid shrimp (*Acetes spp.*) were analyzed combinable; but species wise were not recorded due to the scientific instrument and proper knowledge. Little is known about the fishery of *Acetes* shrimp and this fishery statistics are particularly inadequate, because mainly consumed locally as non economic value. All pictures of *Acetes* shrimp were collected from internet.

Conclusions

During 2013-14 total 346.75 MT mixed marine resources of juveniles were caught on pakua jal fishing, among them only *Acetes* species contributed 132.94MT or 38.34% followed by 127.031MT (on which gura ichha was 30.82MT or 24.26%), 262.90 MT (Sergestid shrimp was 97.61MT or 37.13%), 94.051MT (*Acetes* shrimp densities 51.73 MT or 55.0%) and 444.782 MT catch (total amount of *Acetes* species was 270.21 MT or 60.75%) were in 2014-15, 2015-16, 2016-17 and 2017-18 respectively.

Acetes spp. trapped large amount in the month of December to March, when salinity is increased and water current decreased. In the winter periods *Acetes spp.* migrate from deep water to coastal areas for breeding or grazing and are caught large in amount

engaging by Pakua jal fishing within 10m depth near the ashore areas. But in the fishing time high by-catch rate of huge number of fish and other crustacean larvae and juveniles are caught indicates its destructive gears in coastal biodiversity. So, for the eco-friendly exploitation of sergestid shrimp need more analyzing to replace these gears, because migratory characters, highly abundance, cheaply protein supply from *Acetes* shrimp by engaging small mesh pakua jal destruct others many marine water resources need more analyzing.

Acknowledgement: Md. Abul Kalam Azad,

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	Subject: Marine Biology
Quick Response Code DOI: 10.22192/ijarbs.2019.06.03.003	

How to cite this article:

Bikram Jit Roy, Nripendra Kumar Singha, Md. Gaziur Rahman, Sanjay Kumar Mohanta (2019). Exploitation of Sergestid Shrimp (*Acetes* species) and its importance in the South-East Part Coastal Region at Chattogram, Bangladesh. *Int. J. Adv. Res. Biol. Sci.* 6(3): 11-27.
 DOI: <http://dx.doi.org/10.22192/ijarbs.2019.06.03.003>