SOME OBSERVATIONS ON THE PRAWN FISHERY OF GULF OF KHAMBHAT, GUJARAT

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ABSTRACT

The prawn fishery in the Gulf of Khambhat during August 1978 to July 1980 is dealt with. The prawn landings consisted principally of *Parapeneopepis sculptilis* (Heller) and *Metapenaeus dohsoni* (Miers) throughout the year. Seasonal abundance, maturity and spawning of these species together with certain environmental factors are discussed.

INTRODUCTION

Gulf of Khambhat (between long. 72°2' to 72°6'E and lat. 21° to 22°2'N) is one of the major fishing areas along Gujarat coast. It is characterised by several inlets and creeks formed by the confluence of rivers, Shetnuni, Narmada and Mahi. Although the prawn fishery of the Gulf of Kutch which is situated north of the Gulf of Khambhat was studied by several workers (Srivatsa 1953, Rama-murthy 1963, 1967, Deshmukh 1975), very little information is available on the prawn fishery of the latter area, except for the works of Karamchandani et al (1967), Trivedi et al (1979) and Gopalkrishna et al (unpublished).

Prawns constitute the major portion of the total marine fish catch of the Gulf of Khambhat. The present paper is the result of investigations carried out during August 1978 to July 1980 and deals with the commercially important species of prawns, *Parapeneopepis sculptilis* (Heller) and *Metapenaeus dohsoni* (Miers), caught in the Bhavanagar-Ghogha coast of Bhavnagar district, and Dahej-Kavi coast of Bharuch district. Their seasonal abundance, maturity and spawning along with the environmental factors such as salinity, dissolved oxygen, temperature and pH were studied.

The biology of *P. sculptilis* occurring in Australia was studied earlier by Kirkegaard and Walker (1967) and in India by Rajyalakshmi (1966). Extensive studies are available on *M. dohsoni*, particularly from the south west coast (Menon 1955, George 1969, 1970) where it contributes to a fishery of considerable magnitude.
The prawns, locally known as Sonia and Zinga, respectively, on the west and east coasts of the Gulf were collected fortnightly, by operating 10 stake nets at different centres of the Gulf (Fig. 1). The net is of a bag type and measures 6 m length having a mesh size of 25 mm at the mouth, decreasing to 7 mm at the cod end, made of nylon yarn. It is fixed to the bottom with the branches of Acasia sp. and is operated against the tide. The prawns were also collected once in a month from the catches of indigenous, motorised and/or non-motorised boats, locally known as Hodi or Wahan, operating the traditional net known locally as Jharia, in the inshore sea at about 10 m to 15 m depth.

The prawns caught by stake nets and inshore fishing were randomly sampled and pooled to calculate the percentage. The sex was noted and prawns were
measured from the tip of rostrum to tip of telson. The developmental stages of the ovary were determined macroscopically on the basis of colour of the ovary.

The water samples were collected from depth of 1-2 m and salinity and dissolved oxygen determined by Harvey's modified method for salinity and modified Winkler's method for dissolved oxygen as given by Martin (1972). The pH was measured by pH meter. The values were pooled and the means were calculated for each month.

The tidal range was recorded by fixing graduated wooden gauge in the coastal area at collection site and the tidal fluctuations in the open gulf were taken from the Tide Tables of Marine Survey Section, Dredging Cell, Government of Gujarat, Bhavnagar Port, Bhavnagar.

RESULTS AND DISCUSSION

The bottom soil is muddy at Bhavnagar coast, sandy-clay with top silt at Kavi coast and muddy blackish brown with sand at Dahej coast.

The average tidal fluctuations in the Gulf (open sea) varied from 2.56 m (neap) to 9.38 m (high) and the tidal range on the coasts varied from 1.3 m to 5.20 m as recorded by graduated wooden gauges during the study period.

Seasonal variation

The analysis of the prawn catch for the years 1978-79 and 1979-80 revealed that *P. sculptilis* constituted 47.3% and *M. dobsoni* 51.6% on an average and occurred throughout the year. The pooled landings of the inshore fishing and stake nets showed that *P. sculptilis* was relatively abundant in November and December 1978, January, June-September 1979 and May-July in 1980. *M. dobsoni* was abundant in August 1978, February to May 1979, and October to February 1980 (Fig. 2). The largest size of *P. sculptilis* encountered during the

![FIG. 2. Percentage abundance of *P. sculptilis* and *M. dobsoni*.](image)
study was 147 mm and that of *M. dobsoni* was 124 mm. The juveniles of both the species measuring 20 mm to 40 mm were found in most of the months. The individuals of *M. dobsoni* measuring more than 110 mm were less in number.

**Habitat**

Surface temperature of the sea, ranged from 16°C to 30°C with higher temperature in August 1978, June-July 1979, September-October 1979 and May-June 1980. The air temperature also had a similar trend of fluctuation (Fig. 3). The pH ranged from 6.7 to 8.9 while dissolved oxygen was from 1.2 STP to 2.9 STP. However, a direct relationship was found between the pH and the dissolved oxygen. The salinity ranged from 25.3% to 35.3% with the peaks in August 1978, July 1979 and February, March and May 1980 (Fig. 4).

![FIG. 3. Mean Temperature °C of seawater and air.](image)

**Ovarian development and spawning**

Changes in the colour and shape of the penaeid ovary with development have been commonly used in the field studies to classify the maturation stages (King 1948, Tuma 1967, Penn 1980). Five maturity stages were distinguished in the ovarian development of *P. sculptillii*. These are (i) opaque and slender, (ii) light green and slightly elongated, (iii) dark green and distended, (iv) dark green, granular and fully distended and (v) orange-yellow and flaccid. In *M. dobsoni* four stages, namely, (i) opaque and slender, (ii) dirty-white and slightly distended, (iii) pigmented and fully distended and (iv) whitish yellow with less
pigments, were discernable. Observations of a large number of live females of *P. sculptilis* and *M. dobsoni* revealed that some developing females had a noticeable expansion of the posterior lobes of the ovary in the region of the first to third abdominal segments. This feature has been described by George (1969), Rodriguez (1977) and Penn (1980) in other penaeids. The females belonging to maturity stages III and IV for *P. sculptilis* and III for *M. dobsoni* were considered for determination of the spawning season.

The females of *P. sculptilis* attains the ovarian development at the size of 70 mm and that of *M. dobsoni* at 55 mm. The majority of the females of *P. sculptilis*, measuring 70 mm to 140 mm, collected during August, September, October and March-April of 1978-80 had the developed ovaries indicating the spawning season during these months. For *M. dobsoni*, females measuring 55 mm to 120 mm collected during April, May and June of 1978-80 had the developed ovary indicating their spawning season during these months (Table 1).
TABLE 1. Percentage of spawning females.

<table>
<thead>
<tr>
<th>Month</th>
<th>Number examined</th>
<th>Developed (%)</th>
<th>Month</th>
<th>Number examined</th>
<th>Developed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. sculptus</td>
<td></td>
<td></td>
<td>P. sculptus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aug. 78</td>
<td>32</td>
<td>81.25</td>
<td>Aug. 79</td>
<td>16</td>
<td>62.5</td>
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<tr>
<td>Sept. 78</td>
<td>35</td>
<td>88.57</td>
<td>Sept. 79</td>
<td>20</td>
<td>95.0</td>
</tr>
<tr>
<td>Oct. 78</td>
<td>26</td>
<td>77.0</td>
<td>Oct. 79</td>
<td>26</td>
<td>80.3</td>
</tr>
<tr>
<td>Nov. 78</td>
<td>29</td>
<td>10.3</td>
<td>Nov. 79</td>
<td>23</td>
<td>13.1</td>
</tr>
<tr>
<td>Feb. 79</td>
<td>23</td>
<td>4.4</td>
<td>Feb. 80</td>
<td>19</td>
<td>Nil</td>
</tr>
<tr>
<td>March 79</td>
<td>22</td>
<td>91.0</td>
<td>March 80</td>
<td>21</td>
<td>66.7</td>
</tr>
<tr>
<td>April 79</td>
<td>19</td>
<td>84.2</td>
<td>April 80</td>
<td>26</td>
<td>96.2</td>
</tr>
<tr>
<td>May 79</td>
<td>16</td>
<td>37.5</td>
<td>May 80</td>
<td>23</td>
<td>17.4</td>
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<tr>
<td>June 79</td>
<td>24</td>
<td>12.5</td>
<td>June 80</td>
<td>18</td>
<td>5.6</td>
</tr>
<tr>
<td>M. dobsani</td>
<td></td>
<td></td>
<td>M. dobsani</td>
<td></td>
<td></td>
</tr>
<tr>
<td>March 79</td>
<td>16</td>
<td>6.25</td>
<td>March 80</td>
<td>14</td>
<td>7.2</td>
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<tr>
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<td>5.0</td>
<td>July 80</td>
<td>21</td>
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</tr>
</tbody>
</table>

Bhimachar (1963) and Rajyalakshmi (1966) have recorded that the spawning of *P. sculptus* takes place from December-January to April-May and the species reaches sexual maturity at 75 mm. The present observation on the size at maturity confirm their earlier observations.

The prolonged breeding and spawning period of *M. dobsani* described by George (1969) is not recorded in this area. Perhaps the majority of the large-size females might be going deeper in the sea for spawning as summarised by Bhimachar (1963) and George (1969-70). The size at sexual maturity for the species recorded by George (1969) is 64 mm. This size is slightly higher than that observed in the present study.

**Sex-ratio**

Month-wise sex ratio (male/female) was calculated and it was found to be in the range of 0.16 to 0.72 for *P. sculptus* and 0.14 to 0.77 for *M. dobsani*.

**Conclusion**

The average dissolved-oxygen concentration in the Arabian Sea, as recorded by Deshadrai and Bhargava (1972) is higher than that of average oxygen concentration in the Gulf of Khambhat observed during our study. However, the abundance of *P. sculptus* was found to be directly proportionate to the dissolved-oxygen concentration, while no remarkable variations were found for *M. dobsani* even at different oxygen concentration (Figs. 2 and 4). This suggests
that *P. sculptilis* is sensitive and *M. dobsoni* is tolerant to low oxygen concentration. Salinity is similarly higher in Arabian sea waters (Jayaraman and Gogate 1957) and the Gulf of Khambhat. The spawning of *P. sculptilis* and *M. dobsoni* is associated with high-temperature seasons. Salinity as well as pH showed no influence on spawning as also summarised by Anderson (1955). The spawning females of *M. dobsoni* were found during a few months of the year in the study area but the presence of juveniles measuring 20-40 mm in most of the months is suggestive of prolonged spawning of *M. dobsoni*. Females of *P. sculptilis* spawn in the inshore waters.

*P. sculptilis* and *M. dobsoni* are permanent inhabitants of the Gulf of Khambhat which forms a good nursery, with estuarine areas on both the coastal belts.

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