Larval forms: Larval forms included young ones of copepods and cladocerans. The group constituting 11.8% of zooplankton, ranged in number from 4000/m$^3$ in June to 21,000/m$^3$ in February. The trend in fluctuation was similar to that of copepods.

The foregoing observations indicate that the tank is in oligotrophic condition. The reasons for poor plankton production, in particular the phytoplankton, are permanent turbid waters subject to turbulence caused by strong winds and low nutrient status of the soil and water.

The author is thankful to Dr. K. L. Chadha, Director, and Dr. P. Parvathan Reddy for the encouragement.

REFERENCES


A NOTE ON THE FISHERY OF THE NORTH INDIAN FRESHWATER PRAWN, MACROBRACHIUM BIRMANICUM CHOPRAI, IN THE MIDDLE STRETCH OF RIVER GANGA*

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The indices in variability of catch and the relative abundance of Macrobrachium birmanicum choprai show three distinct seasons in landing pattern, with relatively unimportant cyclical movements. Gradual decline of fisheries from year to year, increase in bulk from upper to lower centres and direct co-relation with rainfall have been observed.

The northern Indian freshwater prawn, Macrobrachium birmanicum choprai, is the only economic variety of prawn available in the middle stretch*

* A part of the thesis of the first author approved for Ph.D. degree of B.H.U., Varanasi.
of the river Ganga, considering its size, weight and abundance (Tiwari 1947). But there exists a lack of adequate knowledge on its production and biology. Except for a brief mention, in the account of the prawn fisheries of the river Ganga at Buxar (Jhingran 1956), no information is available on the species.

The catch data were collected regularly at intervals of about 15 days by direct observations and from the records maintained by wholesale fish merchants, which furnished daywise catch statistics in respect of each major consignment. The landing centres at Varanasi, Zamania, Buxar, Araha and Patna, scattered along about 380 km stretch of the river, were regularly visited. These being the important landing centres, landings here were deemed as generally representative of the long stretch of Gangetic belt. The handling of the catches could easily be done here with the co-operation of the fishermen community.

On the basis of daily catch statistics collected from various observation centres, monthly, seasonal and annual catches have been estimated. Seasonal indices have been constructed by the method of percentages of monthly moving average (Croxton and Cowden 1950) based on the data of the years 1979, 1980 and 1981. The years refer to the period January to December. Multiplicative time series model \( Y = T \times S \times C \times I \) has been employed, where \( T \) is trend effect, \( S \) is seasonal effect, \( C \) cyclical effect and \( I \), the irregular movement. An estimate of \( T \times C \) is available from the 10-month (since in December and January fishery is nil) average of monthly landings on the assumption that cyclical movements are over large periods. The ratio of observed monthly landings to the moving average (expressed as percentage) of annual values of seasonal effect for a month provides the seasonal index, corrected for rounding errors.

*Macrobachium biramunicum* choprai contributed 16.54% in 1979, 14.39% in 1980 and 12.45% in 1981 to the total annual landings of the middle stretch of Ganga river system (Varanasi to Patna). Although the prawn generally starts appearing in the catch in February, its quantitative abundance begins only from March and lasts till October each year. Thereafter it starts declining, to completely disappear by the end of November. Thus, the period March to September constitutes the main season of the fishery, the peak generally appearing in the months of May-June and August-September. The indices show three distinctly marked seasons in the landing pattern (Fig. 1). The winter season (November to February) with an average seasonal index of 24.45 is followed by monsoon (June to September) which dominates with an average index of 166.60. The summer fishery extends from March to May with an average seasonal index of 74.42. The October landings present characteristically different index (65.40), possibly representing a transitional stage between monsoon and winter seasons. The pattern of monthly landings is more or less similar in all the years showing that the cyclical movements are relatively unimportant. The moving average method, therefore, seems to be sufficiently accurate.
for providing an estimate of $T \times C$ in the model. The seasonal indices of centre-wise landings of different months and their abundance in different years show similar pattern of fluctuation (Table 1). The centres of observations show three distinct seasons and a pattern more or less similar to that shown by the indices of total landings (Fig. 2). The landings show a marked stability all round the year. A gradual decline in abundance of catch from 1979 to 1981 and increase in prawn catch from higher (Varanasi) to lower (Patna) centres are well-marked in all the three years.

Maximum abundance of most of the freshwater prawns, viz., *Macrobrachium malcolmsoni*, *M. Carcinus*, *M. idae*, *M. rudis*, *M. brevicornis*, *M. serratus*, *M. styliiferus*, *M. monoceros*, *M. affinis* and *M. dobsoni*, have been reported to be during pre-monsoon to post-monsoon months (Chopra 1943, Shaikh-mahmud and Tembe 1960 and George 1961). However, in the case of *M. brevicornis* of lower Hooghly and Sunderbans and in the Matlah estuary the same has been recorded in winter months from August to March (Rajyalakshmi...
<table>
<thead>
<tr>
<th>Centres</th>
<th>Feb</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
<th>Nov</th>
<th>Total</th>
<th>Percentage</th>
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<tr>
<td>Varanasi</td>
<td>32.80</td>
<td>72.30</td>
<td>101.36</td>
<td>130.24</td>
<td>182.80</td>
<td>226.15</td>
<td>145.81</td>
<td>183.33</td>
<td>86.66</td>
<td>35.61</td>
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<td>30.44</td>
<td>66.02</td>
<td>92.85</td>
<td>120.28</td>
<td>167.41</td>
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<td>133.45</td>
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<tr>
<td>Buxar</td>
<td>32.94</td>
<td>76.00</td>
<td>103.81</td>
<td>130.78</td>
<td>183.56</td>
<td>227.09</td>
<td>146.42</td>
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<td>87.02</td>
<td>35.76</td>
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<tr>
<td>Arrah</td>
<td>34.32</td>
<td>75.26</td>
<td>105.33</td>
<td>136.47</td>
<td>191.53</td>
<td>236.95</td>
<td>152.78</td>
<td>192.30</td>
<td>90.80</td>
<td>37.31</td>
<td>1253.05</td>
<td>20.17</td>
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<tr>
<td>Patna</td>
<td>39.90</td>
<td>87.04</td>
<td>123.35</td>
<td>158.44</td>
<td>222.40</td>
<td>275.14</td>
<td>177.40</td>
<td>223.29</td>
<td>105.43</td>
<td>43.32</td>
<td>1458.71</td>
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<tr>
<td>Total</td>
<td>170.40</td>
<td>376.54</td>
<td>528.70</td>
<td>676.21</td>
<td>947.80</td>
<td>1172.44</td>
<td>755.95</td>
<td>951.49</td>
<td>449.28</td>
<td>184.61</td>
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<td>2.74</td>
<td>6.04</td>
<td>8.47</td>
<td>10.88</td>
<td>15.27</td>
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| Monthly indices | 20.40 | 51.90 | 61.34 | 111.04 | 164.20 | 210.10 | 126.32 | 165.80 | 65.40 | 22.50 | 1000 |
| Chi-square value | 44.65 | 38.54 | 34.49 | 29.06 | 24.12 | 19.35 | 28.60 | 24.04 | 36.56 | 44.33 | 323.84 |

Note: In December and January landing has been found nil.
M. malcolmsoni showed a higher magnitude of fishery during the period May to September, with peak in June and July, while in December the catches were comparatively low, but improved by February (Ibrahim 1962). Similar trends in freshwater prawns of Indian and Malayan waters have been reported (Bhimachar 1962, Johnson 1967). However, Rajyalakshmi and Randhir (1967) have recorded maximum abundance in winter also in the case of M. Malcolmsoni of R. Godavari (January to November), with two breeding peaks, one in July and the other in October. May to January, May to November and March to October have also been recorded as the fishery seasons in respect of M. rosenbergii of the St. Paul river of Liberia (Miller 1971) and Hooghly estuary (Rao 1967) and in the case of M. malcolmsoni of Hooghly estuary and Godavari river (Rajyalakshmi 1980).

In the case of M. birmanicum choprai also, the fishery season has been recorded from March to October with peak during May to August, showing a close similarity of landing seasons with that of above mentioned species. Thus, in agreement with the observations of Raman (1976), the summer and monsoon may be regarded as the fishery seasons of freshwater prawns, the magnitude depending on the amount of rainfall. The latter seems to be mainly responsible for breeding and spawning.

The authors are greatful to the Head, Department of Zoology, Banaras Hindu University, Varanasi, and Director, Central Inland Fisheries Research Institute, Barrackpore, for providing facilities to carry out this investigation.
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