A FORECAST FOR THE ENSUING OIL-SARDINE FISHERY

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The ability to forecast the course of events likely to be encountered during the approaching fishery season enhances the value of fishery research in the eyes of those in the industry. As Simpson (1956) has put it, "Apart from the value to the industry of forecasting, predicting what is going to happen and checking it against the actual events is to the fishery biologist one form of the universal research tool of formulating a hypothesis and putting it to test." In the case of the Indian oil-sardine, since the fishery comprises usually of two successive generations, even among which the younger of the two—the juvenile community recruited every year—forms the mainstay, the problem of great variations spread over long periods or the question of long-term prediction does not arise. On the other hand, the responsibility of the fishery researcher is formidable since a reliable forecast for the ensuing fishery has to be done very quickly with no background data on the juveniles that are going to appear for the first time. Thus, to evolve a method of prediction, which would per force have a short-term value for that season only, the basic requirement is the detection of the factor or factors responsible for the variations in the yield every year. Before reporting the outcome of this twin task of a fishery biology programme, it would be worthwhile to look at the performance record of this valuable resource.

RECORD

The fishery, true to its tradition, was having rich and lean seasons in the past but suddenly registered a shock to the industry in the early forties of the present century which culminated in almost a total decimation of the stock in 1946–47. It, however, recovered steadily in the fifties but made such a boom in the sixties that it has shattered all the previous records. Although the fishery has been continuously yielding since 1964 so good a harvest that it has averaged 2.4 lakh tonnes forming 10% of the entire Indian Ocean catch, it is not all roses! That the fairest things have fleest fortunes is true of the oil-sardine, for during the past two decades, it has been found to dip as low as 1% of the total marine catch in India as well as rise meteorically to a phenomenal portion of 33%! Hence, the problem is very much alive — the problem

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of finding the reason for the erratic fluctuations.

REASON

There are three major causes for the fluctuations in the fishery yields, namely, fluctuations in fishing effort, in accessibility and in population size. That fluctuations are not due to fishing effort has been indicated (Banerji, 1967). The problem of fluctuations in accessibility does not appear to arise, for the area and types of fishing have remained almost the same for years. So the fluctuations are due to variations in the population size, or more precisely, variations in the strength of the juveniles recruited every season. In other words, the fluctuations are fishery-independent and are governed by environmental factors at the time of recruitment, namely the period from June to September which is subjected to vagaries of monsoon.

RESEARCH

Since the fluctuations are traceable to the quantum of recruitment in every season, the researcher's concern would be to study the whole range of phenomena which lead to the reproductive act and those that subsequently lead to recruitment. As the intense spawning period of the oil-sardine coincides with the height of monsoon, the most important period from the recruitment point of view is June to August. The studies of Antony Raja (1972a & b) indicated that during certain years when the southwest monsoon is weak and the rainfall erratic or feeble during that is suspected as "spawning fortnight" (a week before and after New Moon day), a phenomenon called 'atresia' (breakdown of eggs in the ovary) takes place prior to spawning which causes heavy reduction in the potential stock of eggs for release. Together with the normal post-spawning atresia which is a characteristic feature of the oil-sardine's spawning habits (Antony Raja, 1967), the actual amount of ova released per individual gets considerably reduced with a cumulative effect for the whole population. As it is generally agreed that there must be a critical level of egg production below which recruitment to the stock would definitely decline (Parrish, 1956), it follows that greater attention is paid to the study of rainfall that appears to have a role in affecting the reproduction.

RAINFALL

The writer first proposed the study of the relation between the rainfall as obtained during the spawning fortnights of June to August and the strength of juveniles that enter the fishery immediately thereafter (Antony Raja, 1969). He made a preliminary analysis of 10 years data (1960 to 1969) pertaining to Calicut (Antony Raja, 1971) and followed it with a detailed study of these records to conclude that the deductions made from Calicut region appear to hold good for the oil-sardine fishery of the entire west coast (Antony Raja, MS.). These studies showed that a mean daily rainfall of 20-21 mm for June, 25-26 mm for June-July and 22-23 mm for June-August periods appear to be the threshold values for obtaining favourable environmental conditions for normal ripening of gonads and successful spawning. It was further pointed out that while any reduction below a mean daily rainfall of 20 mm in June may start affecting the process of ripening and spawning, the resulting effect would be greatly minimised if there is an adequate rainfall during the following two
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months. However, if the June rainfall is severely impaired to a level of less than 10 mm of daily average, then the damage caused may be beyond repair.

FORECAST

Based on the striking relationship between the rainfall, atresia and the strength of incoming juveniles, successful prediction of a fall in recruitment was made in 1963, 1965 and 1969. (vide Antony Raja, 1969). While in 1963, the catch records from the entire resource showed a precipitous fall, the landings data of 1965 and 1969 appeared to indicate that the catches had not been greatly affected. But it is necessary to point out that these were the seasons which were characterised by the support given by the adults — representing the spill-over fish after spawning — to the extent of partially masking the failure of the juvenile fishery. This incidence of departure from normal was due to the rich juvenile recruitment during the respective previous years, namely, 1964 and 1968, the year-classes of which continued to support the fishery during the respective succeeding seasons also.

The average daily rainfall (mm) during the current spawning season at different places of oil-sardine distribution, as taken from the daily meteorological bulletins, is given below:

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<th>Calicut</th>
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<tr>
<td>June</td>
<td>2.2</td>
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<td>6.2</td>
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<tr>
<td>June-July</td>
<td>17.2</td>
<td>17.7</td>
<td>21.4</td>
<td>19.2</td>
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<tr>
<td>June-August</td>
<td>16.7</td>
<td>20.4</td>
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Following the observations set forth earlier on the rainfall requirements, it is clear that the rainfall obtained during this season is distinctly below the minimum. In fact, it is comparable to the years 1963, 1965 and 1969 when the juvenile fishery suffered a setback. A similar fate, thus seems to await the ensuing fishery for the juvenile oil-sardine as the gonadial picture also supports that the spawning has been severely affected. It is also likely that, unlike 1965 and 1969, the spill-over generation would not be able to offset the fall in the recruitment of the juveniles during the current season since the strength of the former (1971 year-class) is found to be very much lower than that of 1964 and 1968 year-classes as seen from the general catch records. Thus, the prospects for the 1972-73 season seem to be rather bleak and it should not be a surprise if the crop falls below that of the 1965-66 and 1969-70 seasons.

SYMPTOM

It is not the intention of this author to imply that the rainfall amount per se is responsible for varying degrees of recruitment but it is quite certain that rainfall is symptomatic of general climatic/oceanographic conditions that would control the spawning process. What is suspected is that a chain reaction, brought about by the failure or even unequal distribution of monsoon during the spawning, begins by affecting the spawning potential of the fish and if this continues in all the major spawning months of June to August, the overall egg production is impaired. The survival rate of eggs and larvae may also suffer as they would be out of phase with the required normal environment for development, resulting finally in the availability of a weak stock for exploitation. As reproduction in fishes is controlled by both exogenous stimuli, the oil-sardine can be reasonably expected to have a habit pattern or a built-in reaction that requires a particular condition or a set of conditions to
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produce the trigger mechanism of spawning followed by an undisturbed rhythm of reproduction. The rainfall amount only suggests the likelihood of obtaining or not obtaining this complex set of requirements.

REFERENCES


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