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BIOLOGY OF THE PENAEID SHRIMP POPULATIONS EXPLOITED BY ESTUARINE SET BAGNET

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ABSTRACT: Results of analysis of part of the data collected during October, 1989 to December, 1990 are given on the biology and catch assessment studies on the Estuarine set bagnet from six sampling stations covering the entire coast line of Bangladesh. Length frequency analysis of seven most commonly occurring penaeid shrimp species have been done with complete ELEFAN software package. The result of exploitation patterns indicate that all penaeids except *P. stylifera* are being over exploited on their way back to the Sea from the nursery ground. This appeared to be the instances of serious growth over fishing. These species are exploited at a size much lower than the length at first maturity, which strongly suggests a complete withdrawal of the bagnet fishery from the coast of Bangladesh.

KEY WORDS: Biology, shrimp, estuarine set bagnet (ESBN).

INTRODUCTION

Among the coastal artisanal fisheries of Bangladesh, Estuarine Set Bagnet (ESBN), occupies the most extensive areas in the estuarine ecological condition covering the creeks, canals, river mouths, tributaries and extending further into the channel areas of brackishwater environment. About 13000 ESBN in different categories, as to their size and type are in operation throughout the coastline of Bangladesh.

It is a major concern that the bagnet fishery is responsible for the capture of a substantial amount of post-larvae juveniles and premature fish and shrimp of marine origin. The Estuarine Set Bagnets have very small mesh size, between 8 and 13 mm. Blocked by algae and nothing but water passes through.

Several authors have reported the indiscriminate fishing with gear of the juveniles. Some authors have recommended taking this gear out of operation (Ahmed 1978, 1981, Kashem and Iqbal 1986). Even knowing about its destructive effect there is no easy solution, because replacement/rehabilitation of this gear is not possible as shown by Islam *et al*, 1988; Islam *et al.* 1993, Khan *et al.* 1994.

Many most marine animals pass their early stages of life in the estuary and as they grow bigger they gradually move back to the sea to complete the life cycle. But the ESBN harvest the juveniles indiscriminately and thus obstructs their recruitment in the deep sea.

This paper presents results obtained from the study undertaken by the Department of Fisheries Marine Fishery Resources Management and Development Center during the period 1989-90 on ESBN with the technical assistance of the Bay of Bengal Programme

(BOBP/FAO). some observations on the penaeid shrimp biology are presented here.

MATERIALS AND METHODS

Length frequency (L/F) data were collected along with other biological and statistical parameters from the ESBN catches from six different stratum sets on the basis of similar ecological condition, such as Moheshkhali channel (Cox's Bazar zone, including Chakaria Sundarban), Kumira (Chittagong zone), Hatiya (Noakhali-Barisal zone), Khepupara (Potuakhali zone), Morrelgonj (Bagerhat zone, covering part of Sundarbans forest coast) and Kaligonj (Khulna area).

The L/F samples for each month and each species were separately raised to the sample catch level and then to the production level of each stratum from the effort and catch per unit effort data. The stratum wise production level L/F data for each month were then pooled at country level production chosen to avoid the smaller error points at lower level and to have a complete picture of the stages of life cycles exploited and the fishing intensity at different ages/life cycle stages of the penaeid shrimp species.

The pooled L/F data were then entered and processed through the ELEFAN and LFSA Programme Packages with ARC Proturbo 286 and Tendon 386 computer for analysis of the parameters of population biology such as growth parameters, mortality rates, recruitment and selection pattern and yield per recruit.

RESULTS

A number of species including marine and estuarine fishes and shrimps appear in the ESBN catches, it is not possible to give a detail description of all the species in this short paper. This paper presents only the population parameters of common penaeid shrimp species. A very brief description is given and the results are summarized in table 1.

Table 1: Population parameters of some important penaeid shrimp species exploited by ESBN fishery.

Sl. No.	Species	L_∞	K	M	F	L_∞	E
1.	*P. monodon*	31.36	0.720	1.423	8.377	13.79	0.855
2.	*P. indicus*	22.83	0.550	1.303	3.700	5.919	0.74
3.	*M. monoceros*	19.77	0.437	1.167	3.652	5.86	0.758
4.	*M. brevicornis*	15.57	0.310	0.997	4.235	4.809	0.809
5.	*M. spinulatus*	20.06	0.390	1.079	5.900	5.292	0.845
6.	*P. scuplitis*	16.90	0.760	1.752	4.150	15.30	0.703
7.	*P. stylifera*	14.37	1.665	3.062	3.00	-	0.495

The results have been expressed through a number of figures which would explain the exploitation situation for different species in detail and also highlight the variation in abundance, species diversification and the catchability with regard to time and space.

POPULATION BIOLOGY

Twenty five species were taken into consideration for the analysis of the population dynamics for which detailed L/F data were available. However for some species the data were adequate for the present only 19 penaeid species were analyzed with ELEFAN Program package for their growth rates, mortality rates, probabilities of capture, recruitment pattern and yield per recruit (YPR). The results for seven penaeid shrimp species which are of serious concern for management are described here.

GROWTH PARAMETERS

Growth parameters i.e. L_∞ (the asymptotic length) and K (the growth co-efficient) of the seven penaeid species it given in table 1. and figures 1-7.

GROWTH PATTERN

It can be seen that the rates of fishing mortality are very high in comparison to the rates of natural mortality. Exploitation rates (E) Show that all the penaeid species except *Parepenspes stylifera* panapeneopsis have being severely overfished by the ESBN. The exploitation rates varied from 0.5 to 0.85, *Penaeus monodon* being most severely affected.

The date indicate that ESBN from wear is raman in growth overfishing, i.e. the sheers caught at an age/length which is much lower than the desired length of first capture, corresponding to the length at first maturity.

The growth overhung in evident from the yield per recruit concept, particularly when they are analyzed at different levels of the L_∞ (length at first capture) for corresponding values of F and clearer when observed in the yield isopleth diagram (Khan and Sivasubramanium, 1992).

SELECTION PATTERN

For these overfished marine species it can be seen from the selection curves that the length at first capture (L_∞) is too low in comparison to the corresponding values of L_∞. For example the L_∞ of *P. indicus* was only 6.0 cm, for an L_∞ of 23.00 cm, the L_∞ of *M. monoceros* was 5.0 cm for an L_∞ of 16.00 cm.

SPAWNING AND RECRUITMENT

It was observed that the penaeid shrimps spawn throughout the year two peak seasons. *Penaeus monodon*, the tiger shrimp undergoes major spawning in October as in (Fig. la) and the peak recruitment followed by spawning, occurs in the ESBN fishery in February (Fig. lc), which indicates that they take about four months to grow to a size of 7.0 cm to be recruited to the ESBN fishery on their way to the sea. (Fig. la). *Penaeus indicus*, the white shrimp has also two peak spawning seasons. One of which is in July

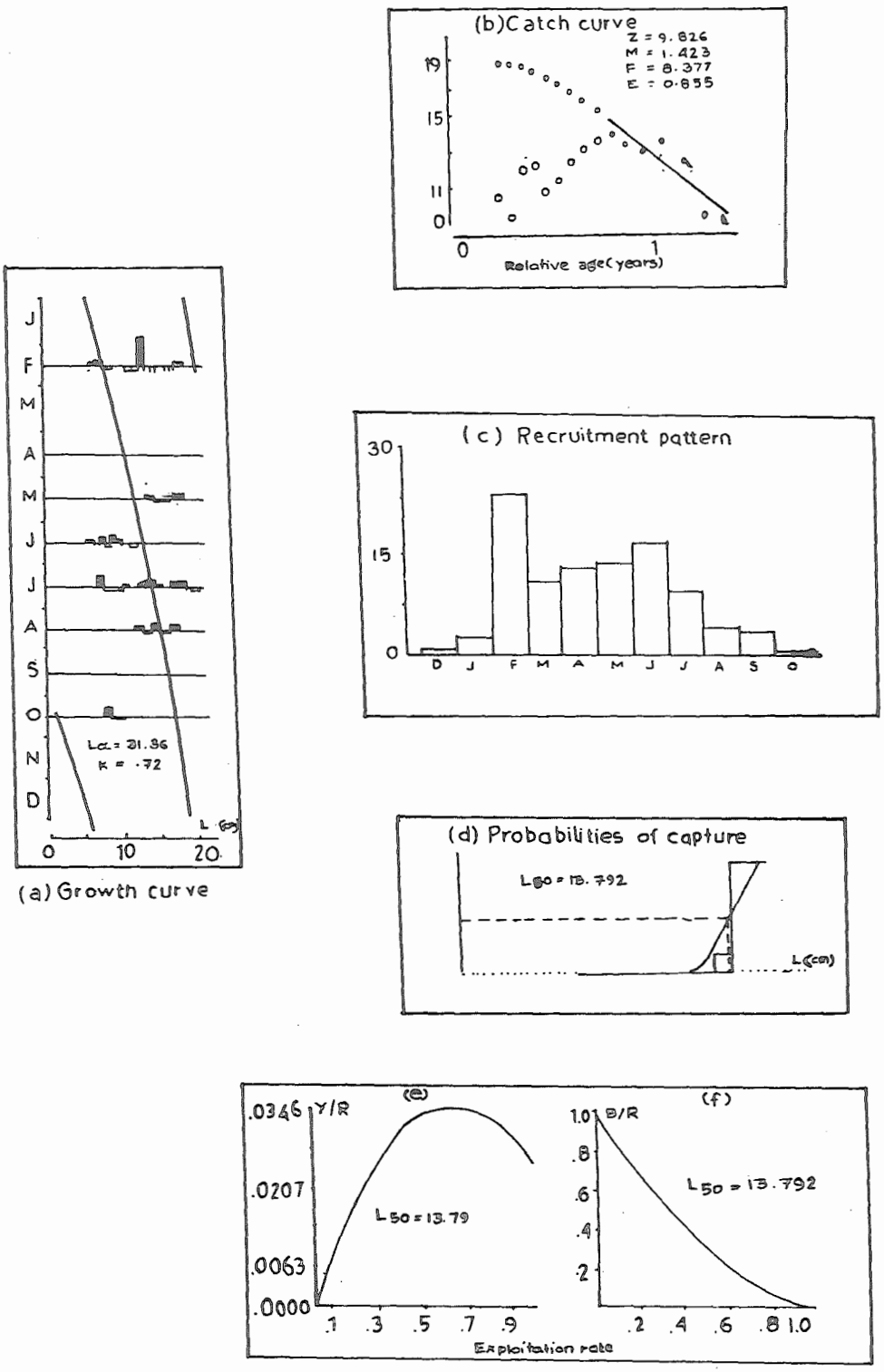

Fig. 1. Population parameters of *penaeus monodon*.

(Fig. 2). The summer cohort was recruited to the ESBN fishery in September.

Metapenaeus monoceros, the brown shrimp shows the highest peak spawning in February which is recruited to the ESBN fishery in May to June (Fig. 3 a and c) at a size of about 4.0 cm. The second recruitment to the fishery occurs in December. *Metapenaeus brevicornis* spawns in November - December and the batch is recruited to the ESBN fishery around May at a size of 3.0 - 4.0 cm which indicates that it takes a little longer time in the estuary (Fig. 4).

Parapenaeopsis stylifera spawns in November and the juvenile are recruited to the ESBN fishery in January - February at a length of 2-3 cm (Fig. 5 a and c) and the other recruitment takes place in July. *P. sculptilis* appears here to have the spawning peak in August. The recruitment to ESBN fishery appears to be in October. The recruitment level appears to be comparatively less fluctuating i.e. the peak has little differences than other months (Fig. 6). The October recruitment has an average size of 4.0 cm.

YIELD PER RECRUIT ANALYSIS

Yield per recruit. Here have been is presented in figures 1-7 (e and f). It may be noted that under F and L_o in ESBN the (YPR) values are at the minimum.

DISCUSSION

It is evident that the ESBN is destructive gear responsible for growth overfishing the penaeid shrimps. In order to have a clear idea of the different fishing gears responsible for harvesting different life cycles stages of penaeid shrimp, it is necessary to study other fisheries and their collective effort must be considered for biological basis of management. Snca the total fishing pressure on one stock from different fisheries work together to give directive to the exploitation rate Khan *et al.* (1994).

It is necasary to analyze the yield per recruit from different fishery at the present level of effort, or in other terms from the present level of F and the corresponding value of L_o in order to compare with those from other fisheries in relative terms to check the best L_o and best F for one species, to check from the yield isopleth diagram the best possible choice of the YPR parameters to give maximum return from the fishery on a sustainable basis.

The stady ievcsld that the L_o values showed unusually high figure in *P. monodon*. The L_o of *P. monodon* was catalyzed by the unusual capture of *P. monodon* adults by the ESBN in the month of May-June devastating cyclone and flood damaged the pond embankments and the cultured *P. monodon* the esturine area.

These results indicate the need for discontinuation of this gear. Some measures however be taken for gradual reduction of effort so that the withdrawal process can be enhanced to the desired level in the passage of time which includes adoption and extension of alternate fishing method sustainable to the environment.

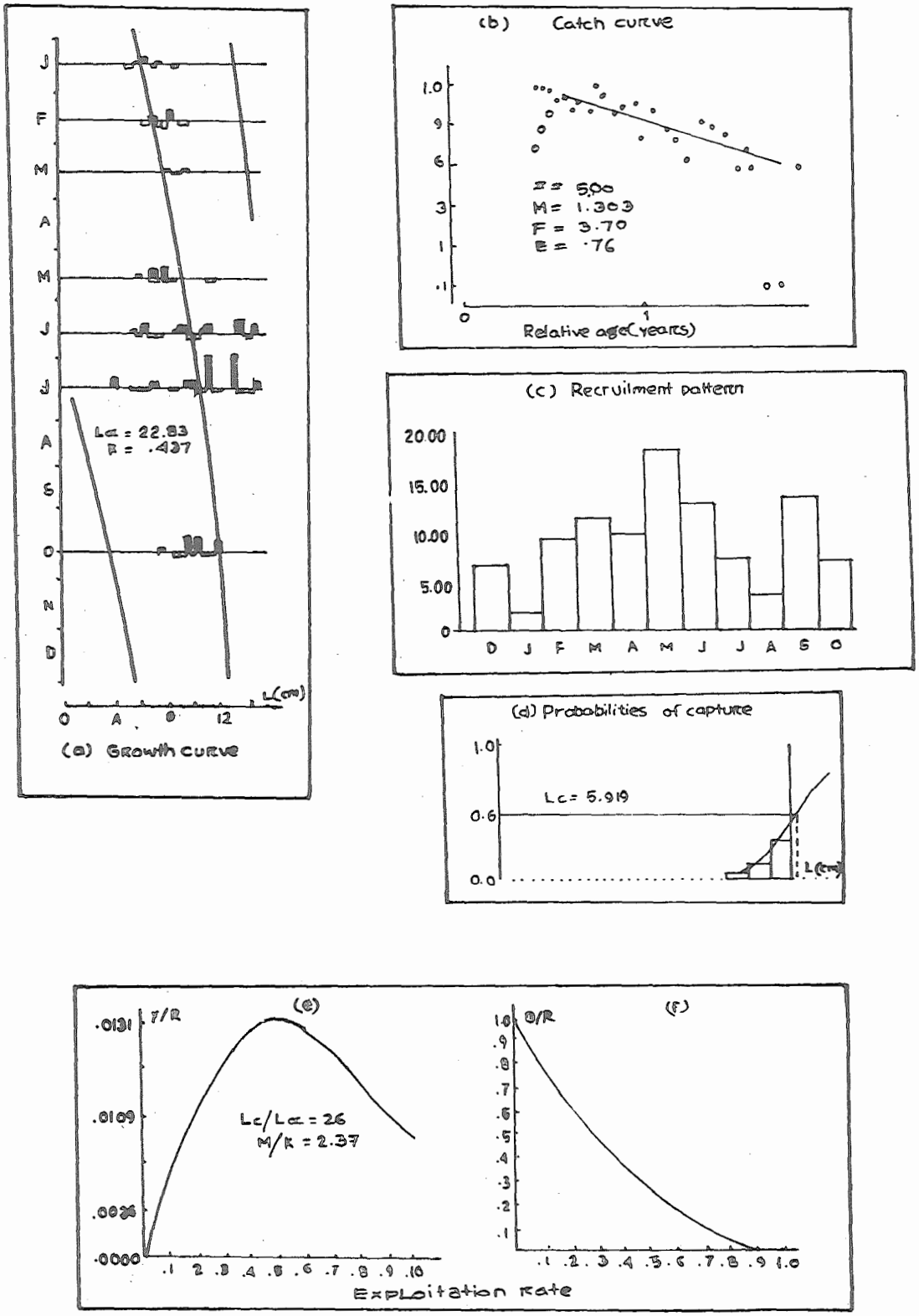

Fig. 2. Population parameters of *penaeus indicus*.

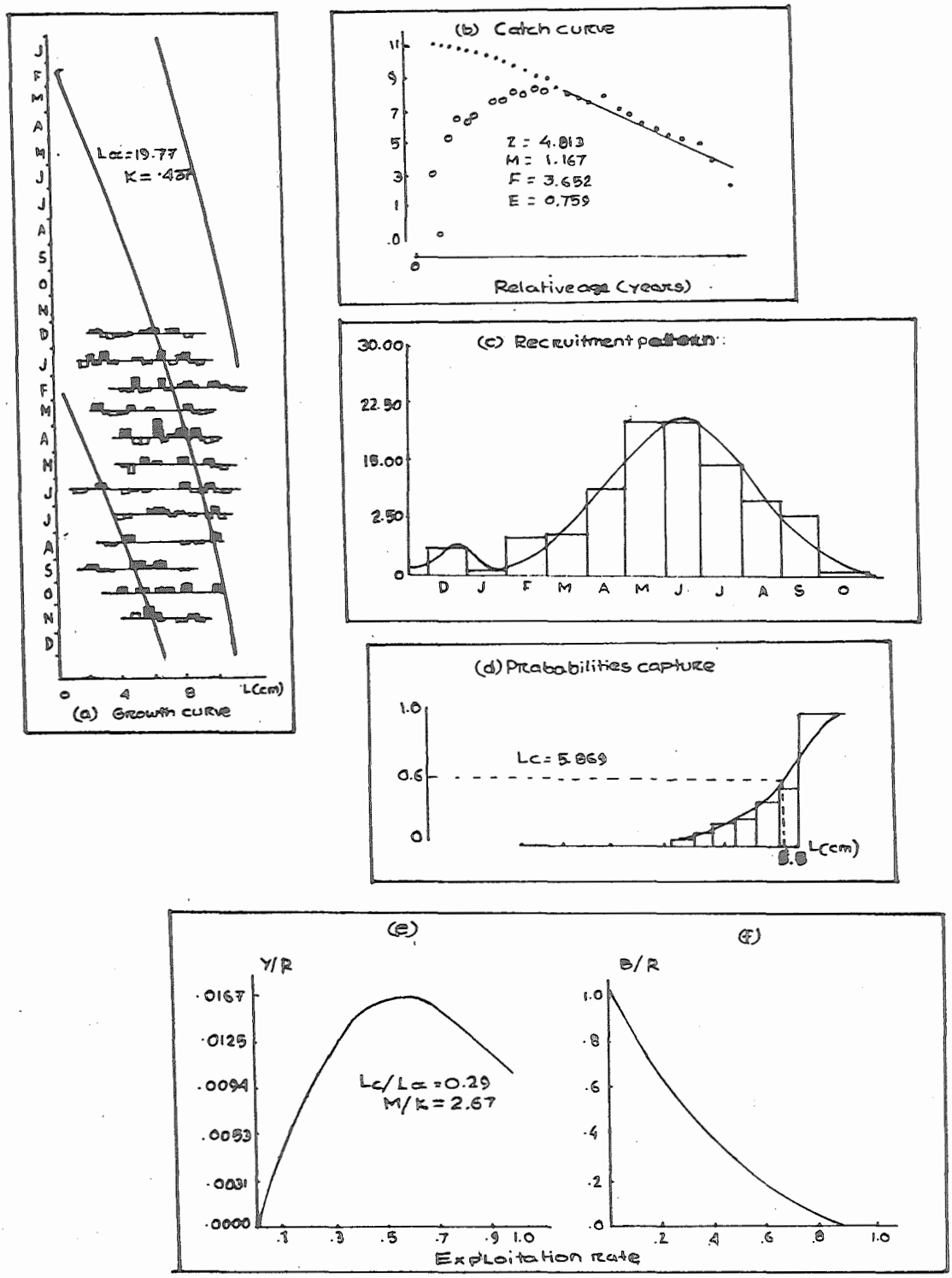

Fig. 3. Population parameters of *Metapenaeus monoceros*.

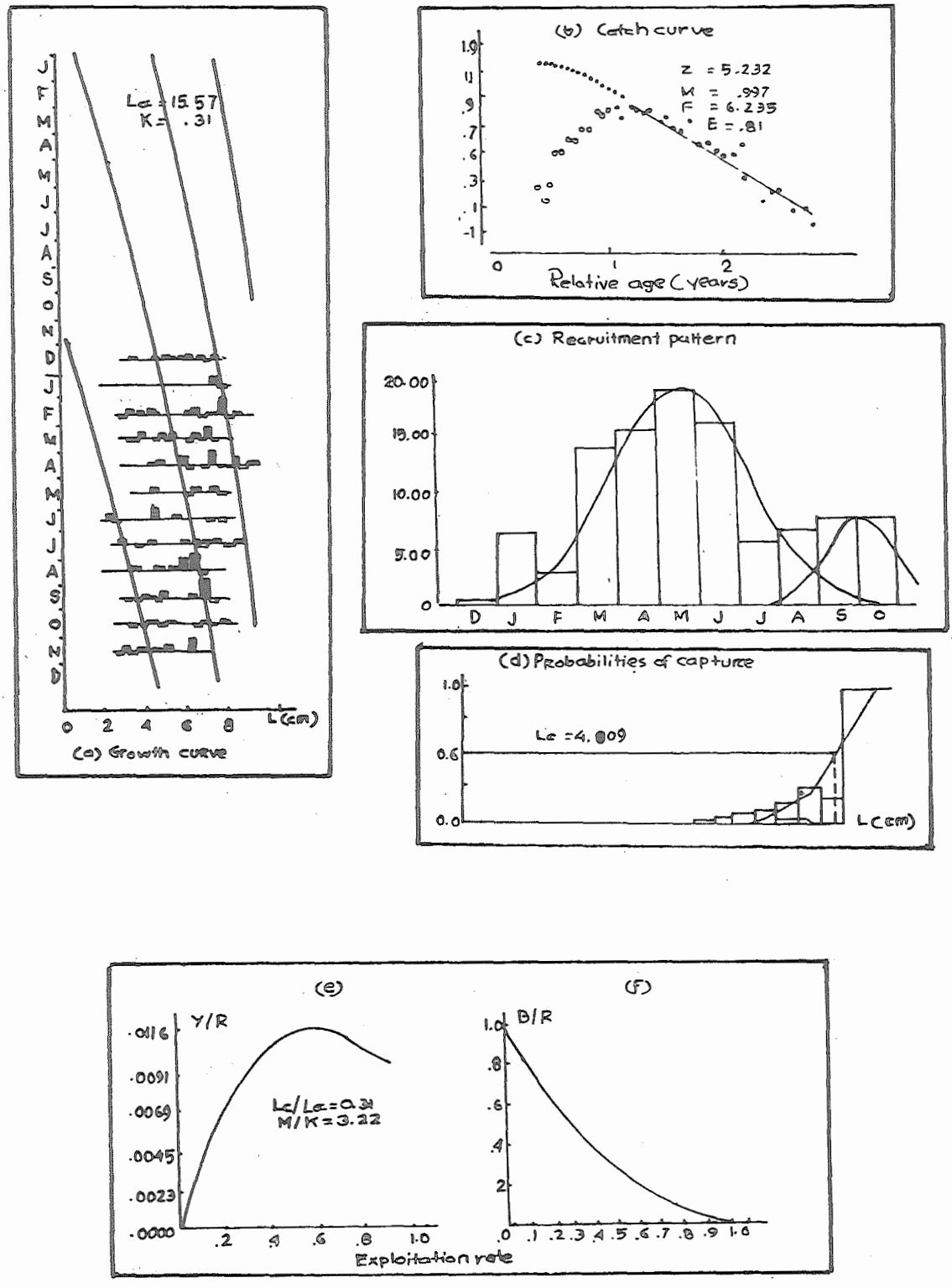

Fig. 4. Population parameters of *Metapenaeus brevicornis*.

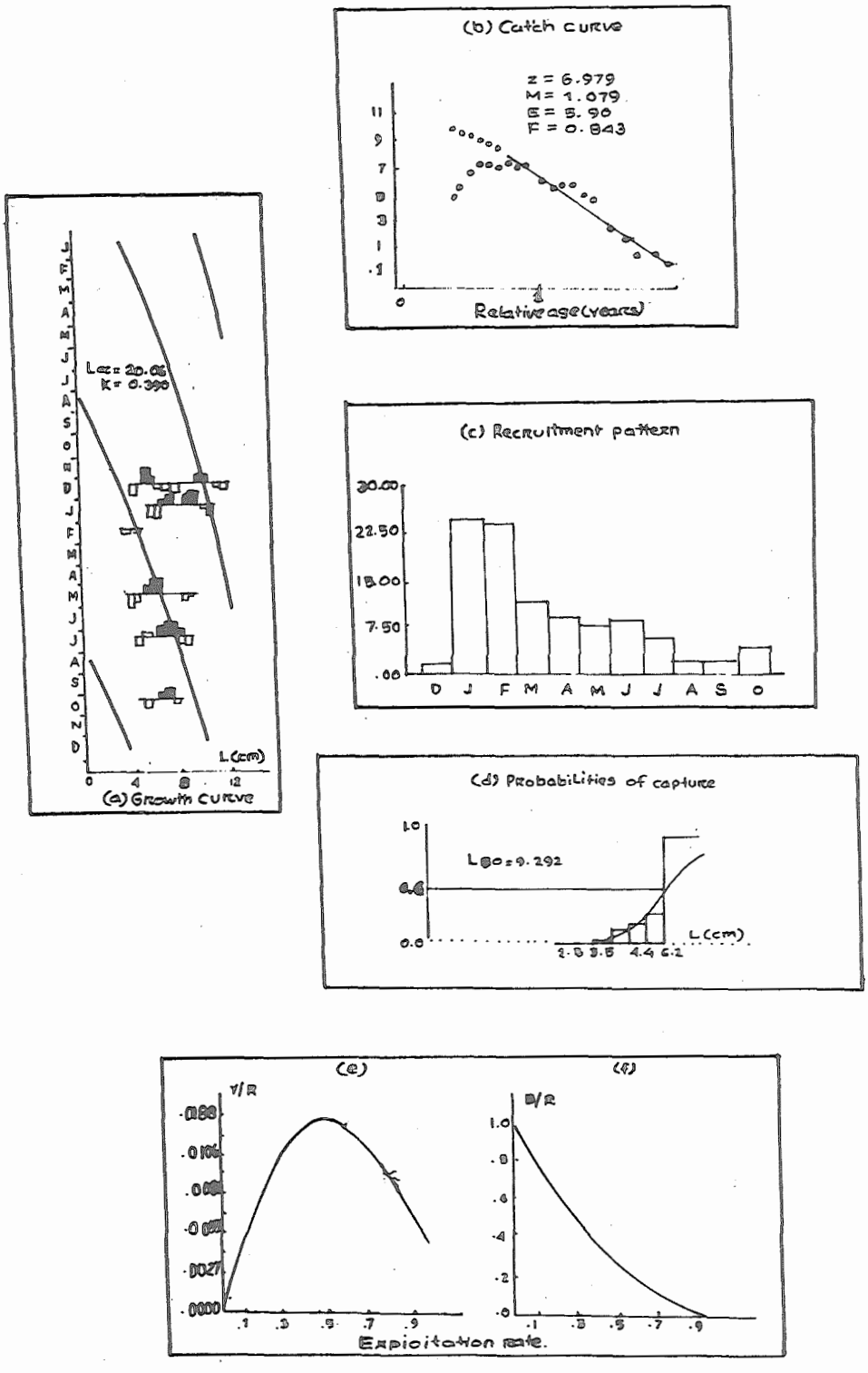

Fig. 5. Population parameters of *Metapenaeus spinulatus*.

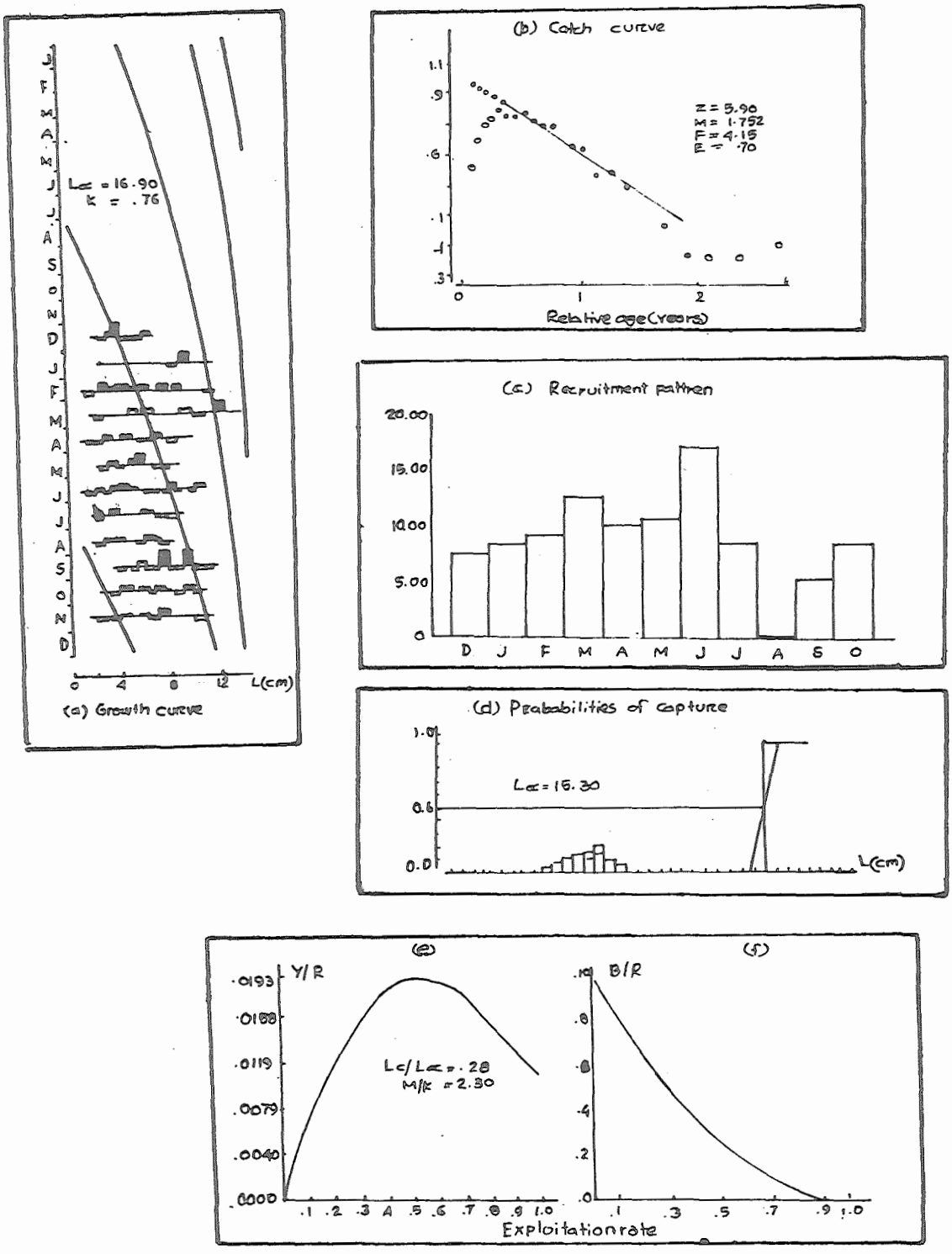

Fig. 6. Population parameters of *Parapenaeopsis sculptitis*.

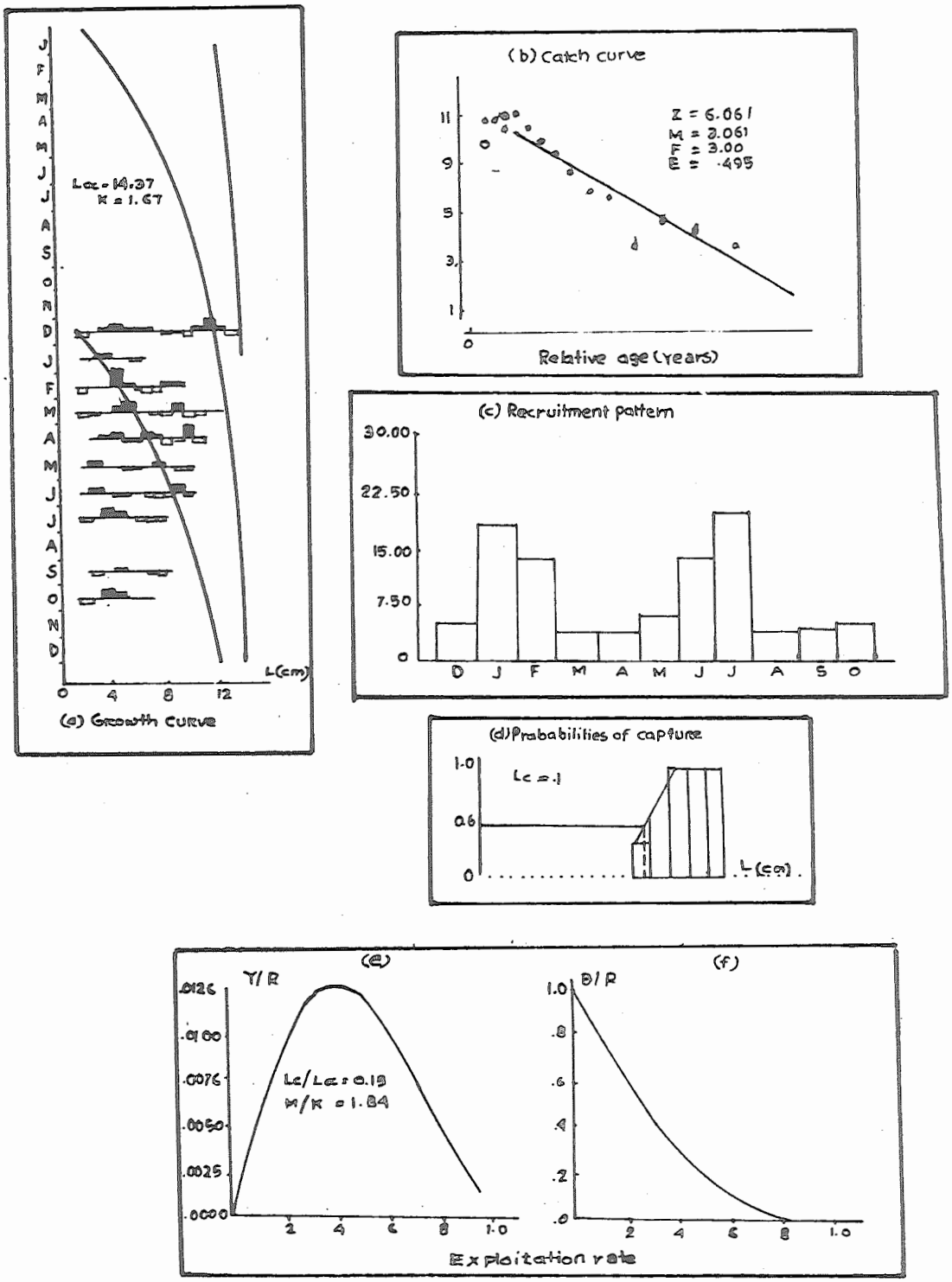

Fig. 7. Population parameters of *Parapenaeopsis stylifera*.

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