Population Dynamics of *Metapenaeus ensis* (Penaeidae) in the Gulf of Papua, Papua New Guinea*

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Abstract

Growth, total mortality and seasonality of recruitment of male *Metapenaeus ensis* (Penaeidae) were determined based on length-frequency data (n = 9007) collected in 1988 in the Gulf of Papua, Papua New Guinea.

Introduction

The Gulf of Papua trawl fishery - the only industrial fishery in PNG - lands about 1,200 t of prawn tails per year for a total export revenue of about US$20 million. The target species, *Penaeus merguiensis* (de Man) (Penaeidae) makes up 60% of the catch, while a further 20% consists of *Metapenaeus ensis*. The rest of the catches are packed as mix species consisting of *M. demani, M. eboracensis* and *Parapenaeopsis sculptilis*.

The trawling grounds of the Gulf of Papua are situated on a narrow margin of the continental shelf running parallel to the south coast of Papua New Guinea from the Fly River Delta in the southwest to the village of Iokea in the east (Fig. 1). The coast is characterized by a number of major river systems resulting from the high annual rainfall in both the highland and coastal regions. These rivers enter the sea either directly or as deltaic networks that include areas of coastal mangrove communities.

The area also experiences a complex pattern of seasonal rainfall. From April to October the southeasterly trade winds lead to a major wet season along the central coast of the Gulf. From November to March, the southwesterly monsoons blow less steadily and the rainfall in the central coastal areas is lower (Gwyther 1982). However, this latter period covers the major wet season in the southwest area of the fishery off the Fly River.

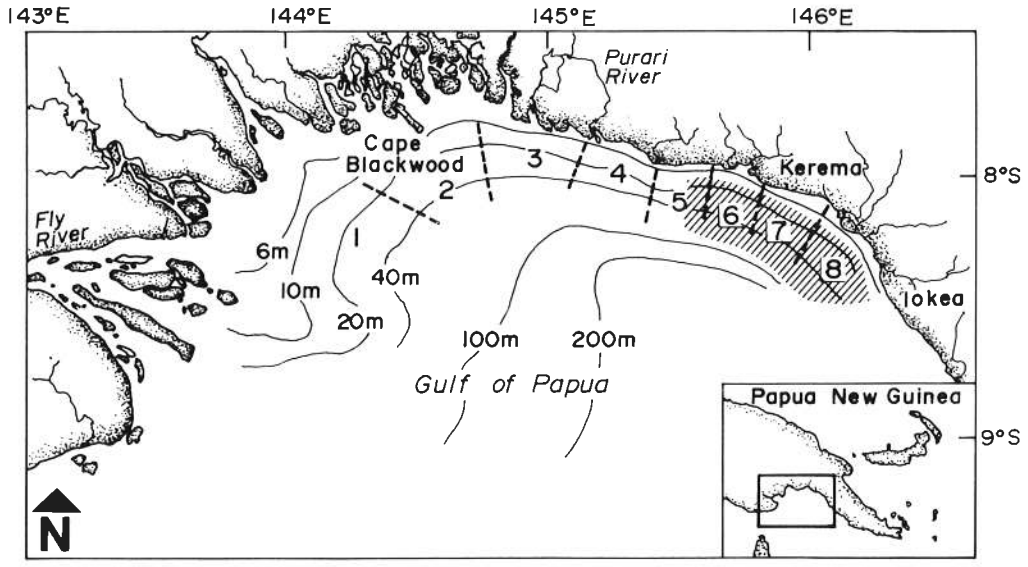

Fig. 1. Sampling area in the Gulf of Papua, Papua New Guinea.

*Preliminary results based on a paper written during a workshop on Length-Based Methods in Fish Analysis, 5-17 December 1988, Honiara, Solomon Islands (see Fishbyte 7(1):11-12)

This contribution discusses the population dynamics of male *M. ensis*, which is related to these seasonal patterns.

Materials and Methods

Random samples of 2 kg each were taken from each haul and sorted into species before the shrimps were sexed. Gonad stages were recorded and carapace lengths measured to the nearest 0.1 mm. Information on water temperature, salinity, currents, depth, fishing area and fishing effort were taken from captains' logbook. A computer-based analysis (using DBase III) provided a monthly summary of the distribution of catches and catch rates for each area at 10 m intervals.

The length-frequency data were analyzed using the Compleat ELEFAN software package of Gayanilo et al. (1988).

Results and Discussion

VBGF growth parameters

The growth parameters of male *M. ensis* were estimated as CL_∞ = 40.8 mm and K = 2.5 ($year^{-1}$) which is characteristic of a short-lived and fast-growing species (see Fig. 2). Longevity (t_{max}) is slightly over one year, as can be assessed from $t_{max} \approx 3/K$. Translating the estimate of asymptotic carapace length into body length (Body length = CL x 3), leads to $L_\infty \approx 122$ mm. Seasonality of growth may occur, with C = 0.954 and WP = 0.3 (Fig. 2). This, however, should be verified by further studies on possible relationships between the seasonality of shrimp growth and the monsoon season.

Mortality parameters

The seasonality of recruitment has very important economic consequences for the fishery. Industrial prawn fisheries tend to exploit the spatio-temporal distributions of prawns in the best possible way, concentrating their effort (hence, fishing mortality) on the highest prawn concentration.

Total *apparent* mortality (Z = M + F + emigration) for male *M. ensis* was estimated as 21.5 $year^{-1}$ for lengths from 25 to 31 mm (Fig. 3) and drops to 5.7 $year^{-1}$ for lengths from 32 to 40 mm. This can be explained by considering the behavior of the species as it moves to deeper water (emigration). Thus, apparent total mortality for length classes from 25 to 31 mm also involves emigration, since effort is concentrated on depths between 20 and 30 meters. Tenakanai (1980) outlined the distributions of species and effort with depth and showed that mature *M. ensis* are abundant in waters deeper than 30 m. Hence, it can be assumed that Z for large shrimp does not include an emigration component, i.e., consists only of M + F.

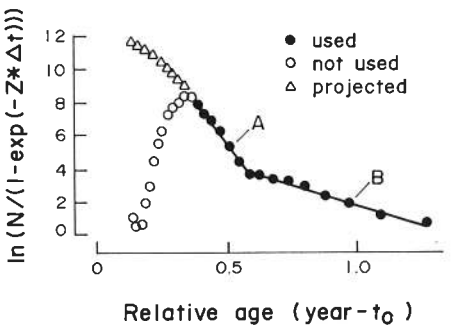

Fig. 3. Length-converted catch curve of male *M. ensis* in the Gulf of Papua. Note high apparent mortality (in A), succeeded by more realistic volumes of Z for adults (in B); see text.

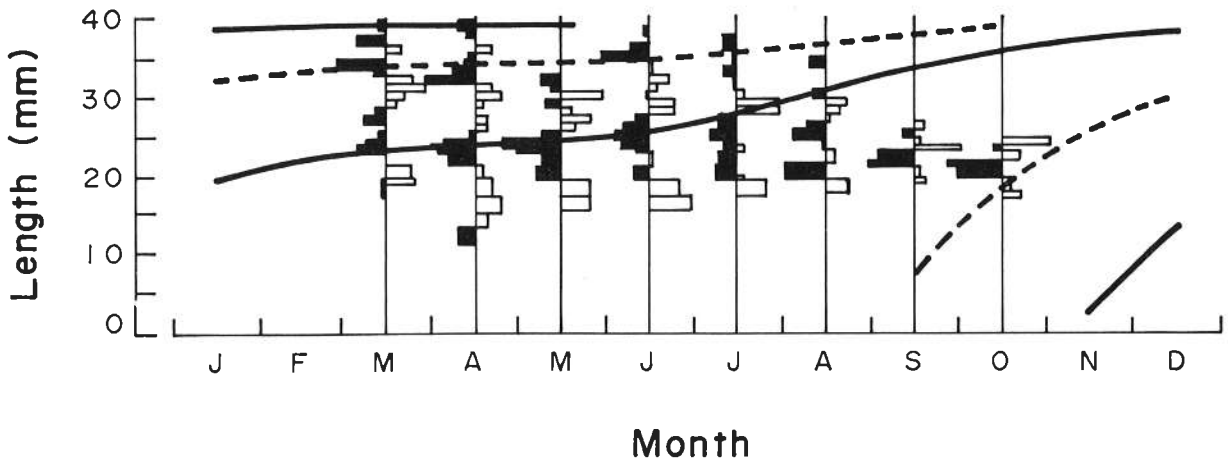

Fig. 2. Length-frequency samples of male *M. ensis* sampled in 1988 in the Gulf of Papua, as restructured using the ELEFAN I program. A tentative, seasonally oscillating growth curve is superimposed (see text).

Table 1. Length-frequency data on male *Metapenaeus ensis* from 1988 in the Gulf of Papua as used for this study.

ML	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
12.5		1						
13.5		0						
14.5		1						
15.5		2						
16.5		4	1	1				
17.5		14	3	7	2			3
18.5	4	35	11	10	5	1		8
19.5	4	83	36	27	13	2	3	14
20.5	11	207	130	68	29	11	5	27
21.5	34	413	183	86	28	8	10	31
22.5	60	720	249	134	44	12	9	10
23.5	116	864	344	236	36	21	1	12
24.5	116	768	347	332	51	29	3	1
25.5	106	459	193	365	58	44	2	
26.5	86	198	70	288	46	35	1	
27.5	91	107	20	184	34	19		
28.5	61	69	14	58	6	9		
29.5	28	32	9	33	3	3		
30.5	12	10	1	23	2	6		
31.5	2	8	3	12	0	0		
32.5	2	17	2	6	1	0		
33.5	3	12		6	1	0		
34.5	5	9		5	1	1		
35.5	0	6		8	1			
36.5	1	2		5	1			
37.5	2	0		3	1			
38.5	0	1		2				
39.5	1	1						
Sum	745	4043	1616	1899	363	201	34	106

The fecundity of *M. ensis* is very high - 500,000 eggs per female (Gwyther 1982) and this may compensate for the high observed mortalities

Recruitment pattern

Fig. 4 shows that annual recruitment occurs in two pulses, one of which is much larger than the other. The major recruitment of the species to the fisheries has been reported to occur from the period of March to May, while the other recruitment pulse occurs from November to January (see Gwyther 1980; Tenakanai 1980).

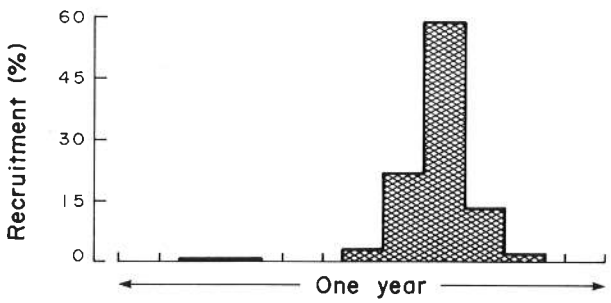

Fig. 4. Annual recruitment pattern of *Metapenaeus ensis* in the Gulf of Papua. Note major pulse occurring from March to may.

The occurrence of these pulses is probably related to the monsoon seasons described above.

References

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