J. mar. biol. Ass. India, 1990, 32 (1 & 2) : 201-207

MATURATION AND SPAWNING OF COMMON PORGY *LETHRINUS NEBULOSUS* (FORSSKAL) IN THE NORTHWESTERN SHELF OF AUSTRALIA *

CHIN-LAU KUO AND SEIN-SEN LEE
Taiwan Fisheries Research Institute, Keelung, Taiwan, R.O.C.

ABSTRACT

Samples of common Porgy *Lethrinus nebulosus* were collected monthly from catches of pair trawlers which operated in the northwestern shelf of Australia from August 1985 to July 1986. From the study of maturity factor, ova diameter frequency and fecundity, the results are summarized as follows : (1) The spawning season is a prolonged one and spawning takes place some time during September-February. (2) The minimum size of fish maturity is estimated to be 25 cm. (3) The relationship between fecundity (Y) and fork length (X cm) is found to be $Y=0.0114 \times 4.9713$.

INTRODUCTION

THE CONTINENTAL shelf off northwestern Australia has been one of the most important trawling grounds for the Taiwanese pair trawlers since early 1970s. The catch of Taiwanese trawl fishes formed at least 40% of the total annual groundfish catch in this area (DFRRC 1982-1984). Porgy is one of the most economically important and abundant species in the groundfish catches.

In order to assess the population dynamics of the fish, two studies about the age and growth had been taken (Kuo and Lee, 1986 a, b). This is the third in this series and deals with the maturation of gonad, the spawning season, the minimum size of fish maturity and the fecundity.

The authors thank the National Science Council of the R.O.C. for the financial support of this study through the contract number NSC 75-0409-B 056-01. Also they are thankful to Messrs. C. Y. Chen, L. K. Lee and P. W. Shi of Demersal Fish Resource Research Center, National Taiwan University for their assistance in collecting samples.

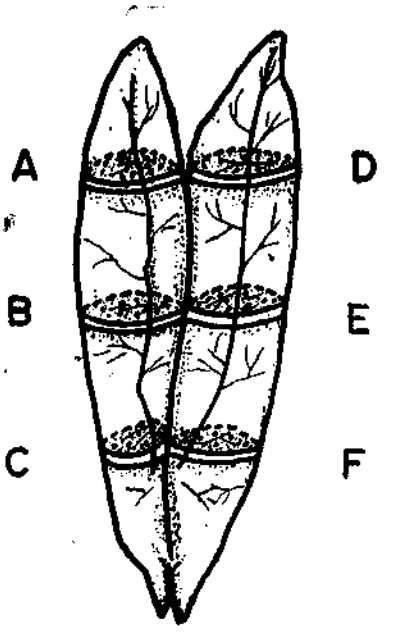

Fig. 1. Ovary showing the six positions in which the eggs were examined.

* Presented at the 'Symposium on Tropical Marine Living Resources' held by the Marine Biological Association of India at Cochin from January 12-16, 1988.

Materials and Methods

Samples of Porgy were collected monthly from the catches of Taiwanese pair trawlers which operated in the northwestern shelf of Australia from August 1985 to July 1986. After measurement of body length and weight, the gonad was removed and measured to 0.01 g. Then, six samples of 0.05 g each (Fig. 1) was taken from three gonads of different maturity to compare the similarity of egg number and frequency distribution of ova diameter between different portions of the same gonad, and between the corresponding portions of gonads of different maturity (Tzeng and Liu, 1972). As no significant difference of egg number was found between different portions of the same gonad (Table 1), and as high similarity in frequency distribution of ova diameter was observed between different portions of the same gonad (Fig. 2), the middle portion of the left gonad was used for egg

Table 1. *Two-way analysis of variance for testing the homogeneity of fecundity among six positions of each pair of ovaries from three individuals with different MF+*

Source of variation	DF	SS	MS	F
Positions ..	5	6697.61	1339.52	0.23^{ns}
Individuals ..	2	48335	24167.5	4.21*
Error ..	10	57400.39	5740.04	

\+ MF=3.58, 4.84, 3.95
ns=Not significant
* Significant at 5% level.

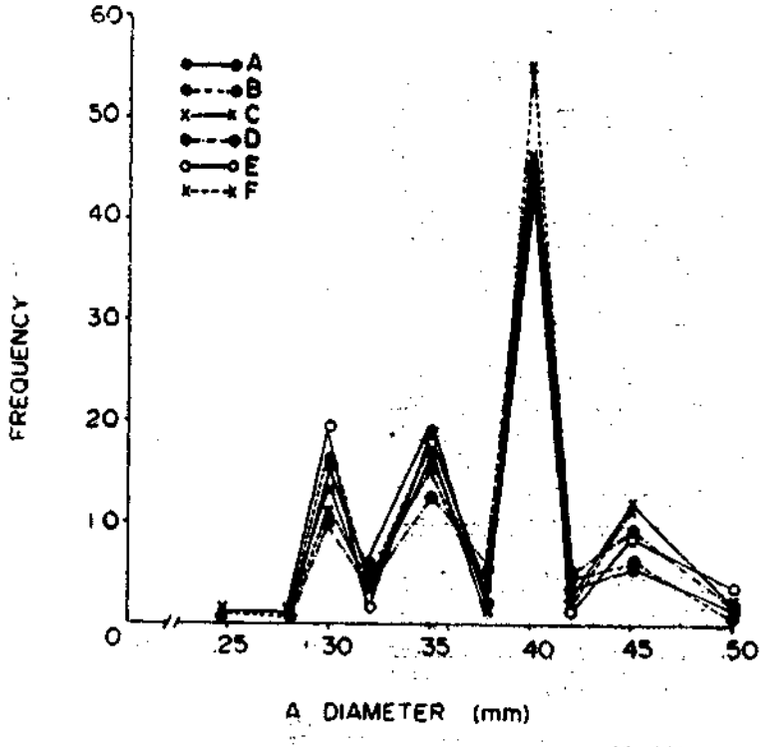

Fig. 2. Ova diameter frequency distribution of a pair of ovaries (Fork length 29 cm, Maturity Factor 3.95) on six positions.

sampling. The maturity factor (MF) of the fish calculated in % by :

$$\frac{\text{Total Gonad Weight (g)}}{\text{Body Weight (g)}} \times 100$$

The spawning season is estimated by examining the monthly change of mean and standard deviation of maturity factor. The minimum size of fish maturity is determined by investigating the MF of various lengths. The fecundity is estimated by weight method as : The number of eggs with the ova diameter ≥0.15 mm in 0.05 g sample X total weight of gonad/ 0.05.

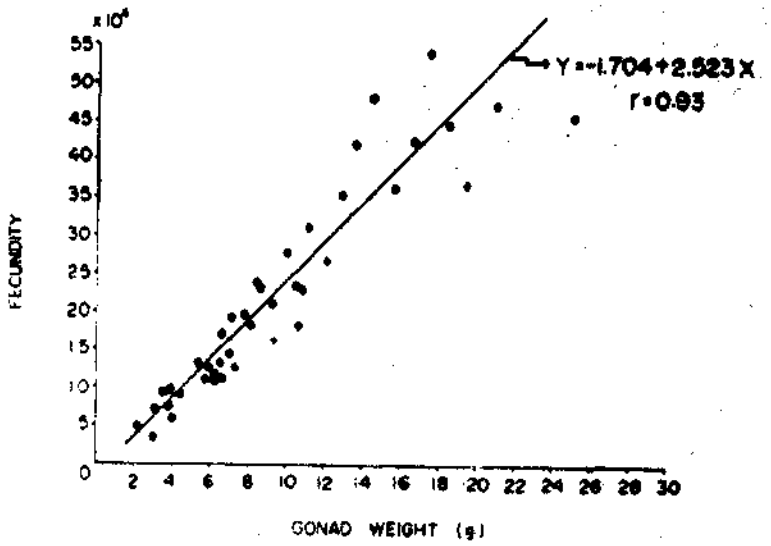

Fig. 3. The relationship between facundity and gonad weight.

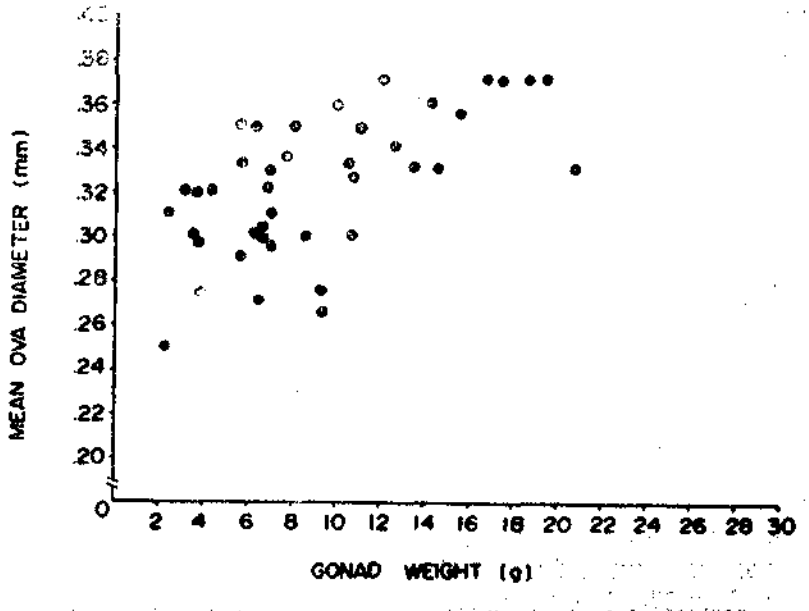

Fig. 4. The relationship between mean ova diameter and gonad weight

Results and Discussion

Maturation of gonad

Fig. 3 shows the relationship between gonad weight and fecundity. The fecundity increased linearly with gonad weight. This relationship can be expressed as Y=—1.704+2.523X (Where Y is fecundity, X is weight of gonad). Fig. 4 shows the relationship between gonad and mean ova diameter. The eggs become larger when the gonad gets larger. But when the weight of gonad is over 12 g the mean ova diameter keep above 0.35 mm, but not increase with the weight of gonad. From these two figures, it can be concluded that at first the gonads become mature due to the increase of both egg number and ova diameter till the gonad reached some level, but later the maturationis continued mainly by the increasing of egg number only.

The frequency distribution of ova diameter in various MF is shown in Fig. 5. The ova diameter showed poly-modal frequency distribution in each MF. From the position of the modes, the eggs are broadly categorised into three groups :

Group I : Eggs with diameter <0.25 mm
Group II : Eggs with diameter 0.25-0.35 mm
Group III : Eggs with diameter ≥ 0.35 mm

With this grouping of eggs, the fish may be said to have 'Group-synchronous oocyte development' (Marza, 1963) and perhaps is a 'multiple spawner' or 'fractional spawner' (deVlaming, 1983).

Relationship between maturity factor and mean ova diameter

The mean ova diameter reached 0.35 mm (Fig. 6) when the MF is above 1.5. Comparing this figure with Fig. 4, it is clear that the weight of gonad will reach 12 g when the mean ova diameter is about 0.35 mm. Also, it may be noted from Fig. 5 that the eggs of Group III form a large part of the gonad eggs

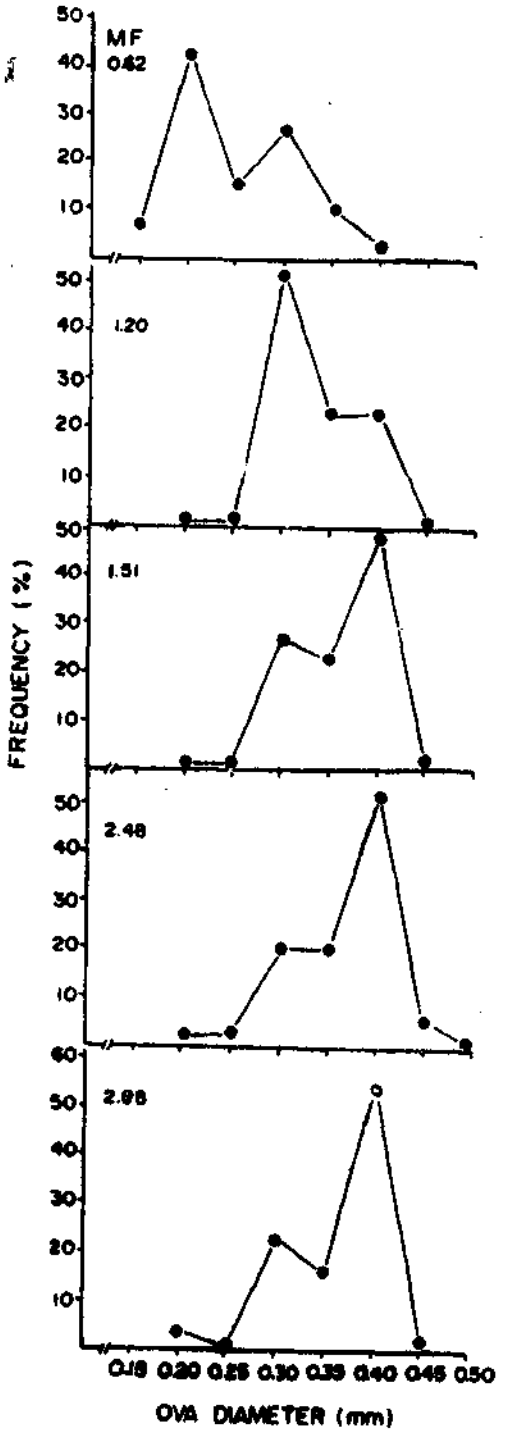

Fig. 5. The frequency distribution of ova diameter in various maturity factor levels.

when the MF is over 1.5. Therefore, MF of 1.5 mean ova diameter of 0.35 mm can be used as a criterion to distinguish the matured from the immature fish.

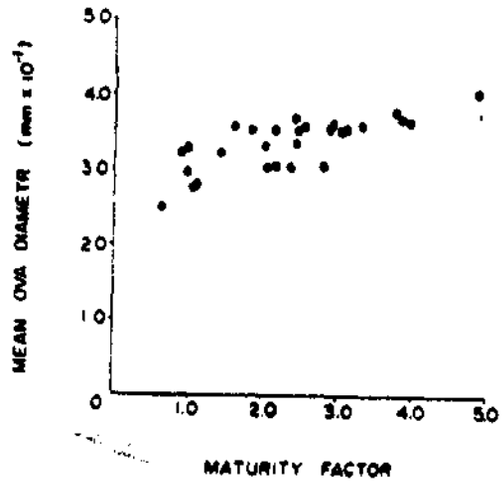

Fig. 6. The relationship between maturity factor and mean ova diameter.

Estimation of spawning season

Monthly change of mean and standard deviation of maturity factor is shown in Fig. 7. The MF which increased from August 1984, formed a peak in October, decreased to the lowest value in June 1985 and once again increased till August, and then decreased gradually. As the period in which the MF decreased from the highest value to the lower value is adopted to indicate the onset of the spawning (Tzeng and Liu, 1972), *L. nebulosus* could have spawned during November 1984 February 1985 and during September-December 1985.

The spawning season coincides with the formation time of rings on the vertebra (Kuo and Lee, 1986 b) and intimately related to inner or environmental changes (Kubo and Yoshihara, 1969).

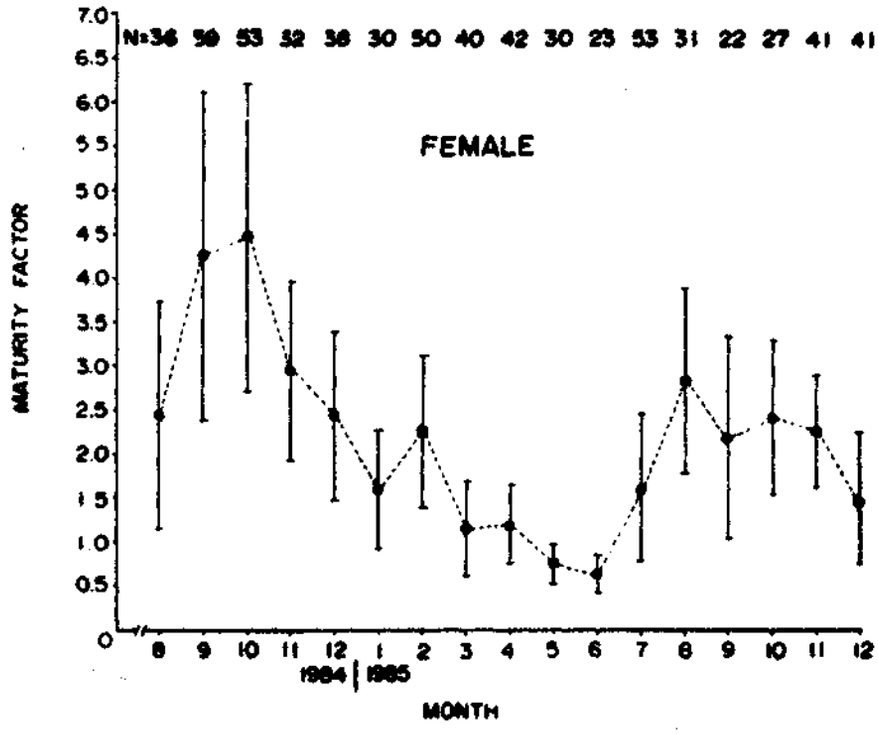

Fig. 7. Monthly changes in maturity factor.

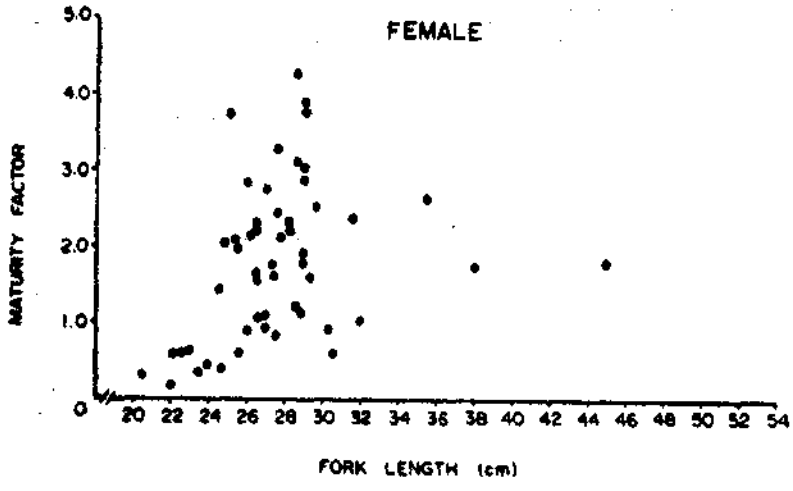

Fig. 8. The relationship between maturity factor and fork length.

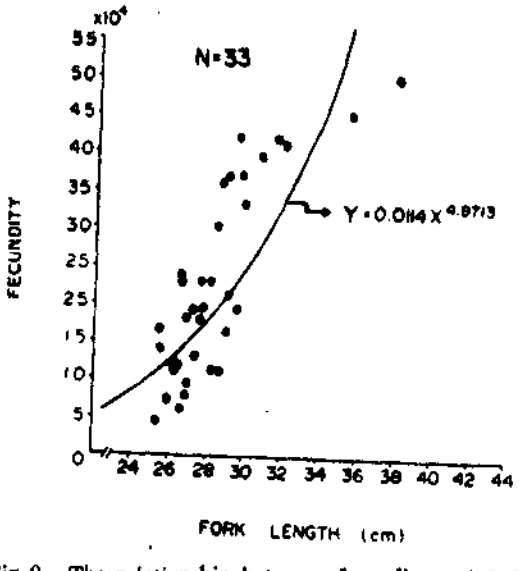

Fig. 9. The relationship between fecundity and fork length of porgies.

Minimum size at first maturity

The relationship between fork length and MF is shown for female in Fig. 8. The MF value of 1.5 is attained when the fish reached about 25 cm. Therefore, the minimum size of first maturity is estimated to be 25 cm. As for the male, the gonad was small even in the spawning season. Therefore, the minimum size of first maturity for the male is not known.

Relationship between fork length and fecundity

The relationship between fork length and fecundity is shown in Fig. 9. The fecundity increased with the fork length (X, cm), the relationship can be expressed as $Y = 0.0114.X^{4.9713}$.

References

DEVLAMING, V. 1983. Oocyte development patterns and hormonal involvements among teleosts. In : J. C. Rankin, T. J. Pitcher and R. Duggon (Ed.) *Control processes in fish endocrinology*. Croom Helm Ltd., pp. 176-199.

DFRRC, NTU 1982-1984. *Annual report of effort and catch statistics by area on Taiwan demersal fish fisheries*. Demersal Fish Resource Research Center, National Taiwan Univ., Taipei, Taiwan.

KUBO, I. AND T. YOSHIHARA 1969. *Suishanshigangaku*. Kyolitsu Press, Japan, 484 pp.

KUO C. L. AND S. S. LEE 1986 a. Suitability and reliability of characters for age-determination of porgies *Lethrinus nebulosus* (Forsskal) in waters of Australia *J. fish. Soc. Taiwan*, 13 (1) : 1-10.

——— AND ——— 1986 b. Age and growth of common porgy *Lethrinus nebulosus* (Forsskal) in shelf waters off northern Australia. *Ibid.*, 13 (2) : 22-31.

MARZA, V. D. 1963. *The ecology of fishes*. New York, Academic Press (Translated from the Russian by L. Birkett).

TZENG, W. N. AND H. C. LIU 1972. Maturity and fecundity of white croaker *Argyrosomus argentatus* (Houttuyn) in the East China Sea and the Taiwan Strait. *J. fish. Taiwan*, 1 (2) : 20-30.