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FECUNDITY OF THE SHRIMP METAPENAEUS STEBBINGI NOBILI IN THE EGYPTIAN WATERS.

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ABSTRACT

The potential numbers of mature eggs (Yolked ova) that could be spawned during a reproductive season of Metapenaeus stebbingi Nobili grown in Mediterranean and Lake Qarun waters were determined. The average number of eggs was 29689 and 10827 for a total length range from 8.8 cm to 13.5 cm, for both Mediterranean and Lake Qarun populations respectively.

The relationships between the body length (total length, carapace length), body weight, or ovary weight of the shrimp and fecundity were estimated. It was found that the number of eggs produced strongly correlated with the total body weight in both habitats and proved to be the best predictor of fecundity of M. stebbingi for both populations. The relationships is :

$LnF = 23.6445 + 2.72827\ LnWt$ ($r^2 = 0.923096$) for Mediterranean population, and $LnF = 2019.3 + 0.78027\ LnWt$ ($r^2 = 0.91094$) for Lake Qarun population. This relation was found significantly different at $P < 0.05$ between the two populations.

The results also revealed a greater oocyte diameters in the different maturity stages of the studied species lived in Lake Qarun. This could be attributed to the good food and environmental conditions of the Lake.

INTRODUCTION

Fecundity has long been recognized as an ecologically important aspect of the population and life history studies of any species.

The present fecundity analysis is concentrated mainly on Metapenaeus stebbingi Nobili, which is considered one of the most important seven penaeid species inhabiting the Egyptian Mediterranean water and comprising an average of 25 % of shrimp landing (Abdel Razek et al 1993). The reproductive biology of M. stebbingi in Egyptian water was studied by Abdel Razek (1985 & 1992) and Gab Alla et al (1990).

Recently, M. stebbingi has shown a great success to acclimatize and reproduce in Lake Qarun as reported by Ishak et al (1980) and Abdel Razek (1991).

M. stebbingi is originally a Red Sea species, but has migrated to the eastern Mediterranean through the Suez Canal Holthuis (1980) as well as it was newly recorded in Pakistan waters by Tirmizi & Javid (1976).

Estimating fecundity in Crustaceans, either in terms of egg numbers or egg mass volumes, can become a very tedious and time consuming procedure, and any simplification of these processes would be advantageous in reproductive studies. Reid & Corey (1991 a & 1991 b) depend on the relationship between egg mass volume and carapace volum for the fecundity determination in carbs and lobsters, also Corey & Reid (1991) applied the same method in caridean shrimp. Estimation of fecundity in terms of egg numbers in the Egyptian waters was done for many species of Penaeid prawns such as P. japonicus (Abdel Razek 1974); P. semisulcatus Sallam 1993, and M. stebbingi (Gab Alla et al 1990). M. stebbingi as the other Penaeid shrimps are referred to as fractional spawners as mentioned by (Rao 1967; Abdel Razek 1985 and others. The problem with this reproductive category is how to identify the oocytes which are potentially capable of being released in the current season; but the acquisition of yolk is one of the most obvious signs of oocyte development as it is used in the present analysis.

It is expected that the aspects of fecundity covered by this study should contribute to the informations available and supply more data on fecundity of M. stebbingi caught off the different areas of the Egyptian coast.

MATERIALS & METHODS

About 50 ripe females of M. stebbingi were collected from the different fishing centers along Alexandria coast and the same number from Lake Qarun waters. Another 50 females of each maturity stage were collected from both populations for the oocyt frequency distribution. The scale of maturity stages

used was as described by Abdel Razek (1992) for this species The entire ovary was preserved after being taken from a females ranging in size between 8.0 14.0 cm total length in a vial containing 4 % neutral formalin The weight of each ovary was recorded to the nearest 0.01 mg. The numbers of ova were counted in three subsamples and fecundity was estimated according to the following formula

$$F = \frac{\text{mean no. of ova in the subsample}}{\text{mean weight of subsample (g)}} \times \text{ovary weight}$$

The ova diameters were measured for a fixed number of oocytes of each maturity stage using an occular micrometer, as well as the total number of eggs was estimated. Total length measurements were from tip of the rostrum to the end of telson. Carapace length involved the distance from the anterior tip of the rostrum to the end of the carapace.

The number of ova holds some exponential relation with length of the shrimp in the same way as does the weight and all the relation ships were in a logarithmic manner.

Regression line slopes for each relationship were tested for significant differences Snedecor & Cochron (1980) between locations. Differences were accepted as significant at the 95 % level of confidence in all comparisons.

RESULTS

Fecundity estimates were obtained for only yolked oocyts greater than 100 um of late mature stage of both populations. The average number of eggs of Mediterranean sample was 29689, ranging from 1904 for shrimps of 8.8 cm T.L, 3.0 cm C.L. and 4.77 g. to 141372 for shrimps of 13.5 cm T.L, 4.8 cm C.L and 18.92 g.

On the other hand, the average number of eggs of Lake Qarun sample was 10827, ranging from 6780 for shrimps of 9.2 cm T.L 3.4 cm C.L and 6.4 g to 14400 for shrimps of 11.2 cm T.L, 4.6 cm C.L and 10.4 g.

- Fecundity and shrimp length :

In the present study it is apparent from the data of M. stebbingi that the carapace length fecundity and total length fecundity relationships are nonlinear and a logarithmic transformation was used becaous the relationship was of the form $Y = a X^b$ The relationships between fecundity and length either total or carapace length of M. stebbingi were determined by the least squares Fecundity and shrimp length show a high degree of positive correlation with the coefficient of correlation. The relationship can be expressed by the equations as in Table 1) and presented in Figures (1 and 2) for both areas

Table (1): The regression equations for the fecundity and total length, carapace length, Total weight, relationships of M. stebbingi in Mediterranean and Lake Qarun populations.

Relationship	Mediterranean	Lake Qarun
F / T.L.	LnF=0.036187+6.23214 LnT.L	LnF=25.27433+2.59804 LnT.L
	r^2 = 0.91648	r^2 = 0.89671
	The relationship is insignificantly different	
F / C.L.	LnF= 2.70698+6.03609 LnC.L	LnF=1512+1.4295 LnC.L
	r^2 = 0.91861	r^2 = 0.81658
	The relationship is significantly different	
F / T.wt	LnF= 23.6445+2.72827 LnWt	LnF=2019.3+0.78027 LnWt
	r^2 = 0.923096	r^2 = 0.91094
	The relationship is significantly different at $P < 0.05$	

Table (2): The relationship between fecundity and ovary weight of M. stebbingi for the ripe groups and non-ripe groups of Mediterranean and Lake Qarun populations.

Area	The relationship	Non-ripe
Mediterranean	F= -14370+53058 OW	F= -1389.6+20593 OW
	r^2 = 0.83475	r^2 = 0.97882
Lake Qarun	F= -155.3+14890 OW	F= 1794.7+11181 OW
	r^2 = 0.9999	r^2 = 0.9994

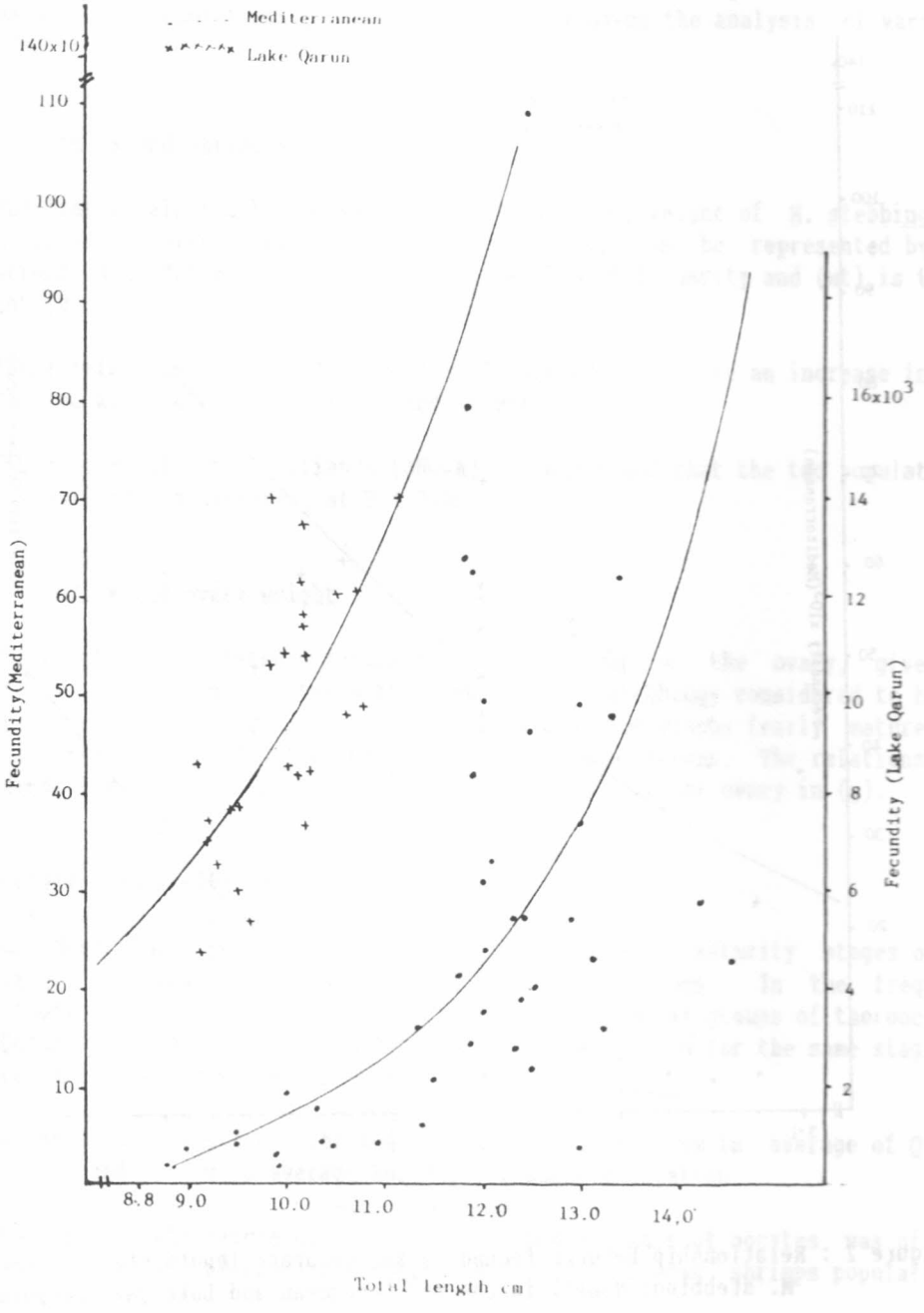

Figure 1 : Relationship between fecundity and total length of M. stebbingi Nobili in the Mediterranean and Lake Qarun populations.

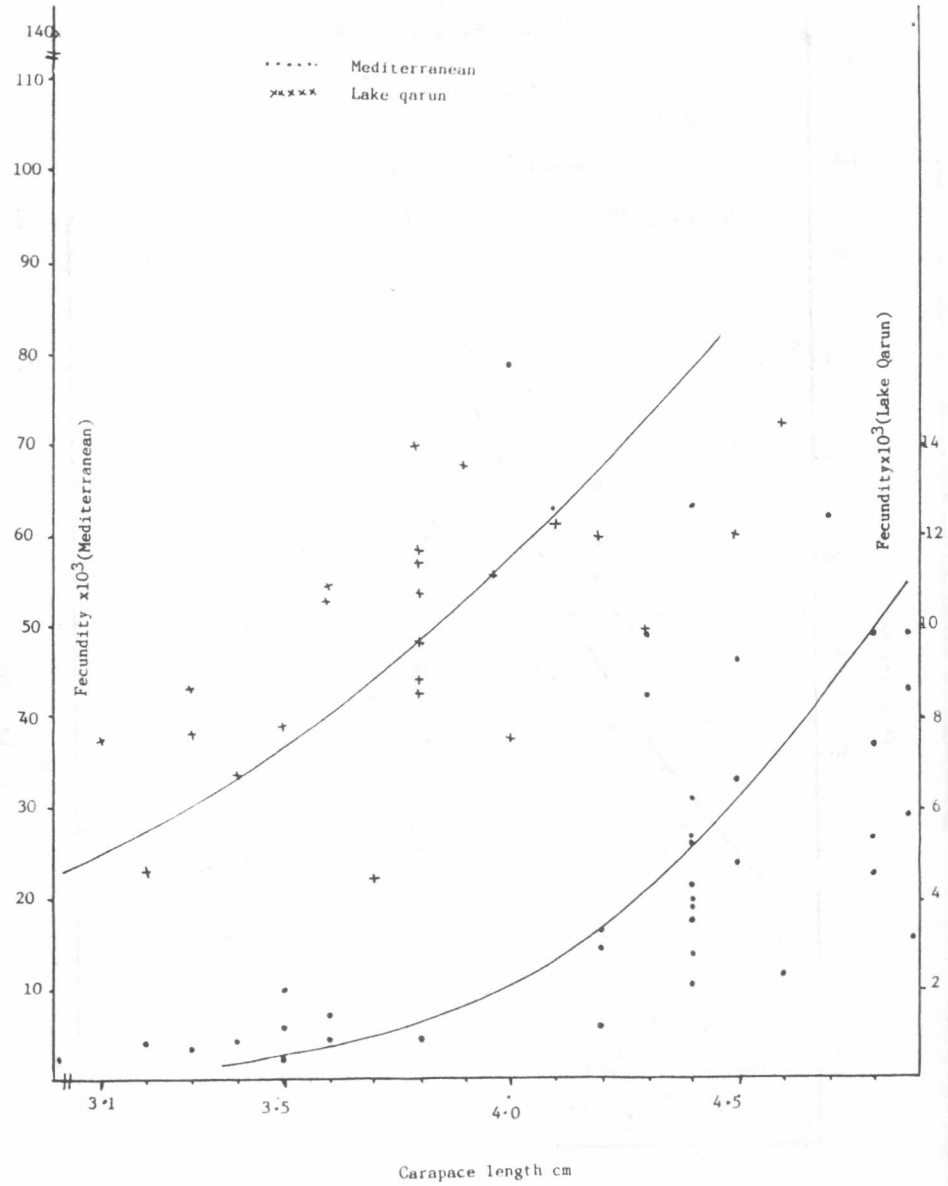

Figure 2 : Relationship between fecundity and carapace length of:
M. stebbingi Nobili in the Mediterranean and Lake Qarun populations.

In this relationship it was found that there is insignificant difference between both populations of M. stebbingi by using the analysis of variance (ANOVA).

b- Fecundity and shrimp weight :

The linear relationship between fecundity and body weight of M. stebbingi in both areas, Mediterranean and Lake Qarun waters, can be represented by the equations as in Table (1) where (F) is the absolut fecundity and (wt) is total weight (g).

These relationships as illustrated in Figure (3) indicate an increase in egg production with increase in length and weight.

Uisng the analysis of variance (ANOVA) it was found that the two populations were significantly different at $P < 0.05$.

c- Fecundity and ovary weight :

The relationship between fecundity and the weight of the ovary, gives an interesting relationship between those shrimps M. stebbingi considered to be in a ripe group (late mature) and those in a non-ripe groups (early mature and maturing stages) for Mediterranean and Lake Qarun shrimps. The relationships are described in Table (2), where (Wo) is the weight of the ovary in (g).

d- Oocyte size-frequency distributions :

The distribution of oocyte diameter over a range of maturity stages of M. stebbingi is shown in Fig. (4) for both populations. In the frequent distribution of oocytes in early mature groups, the modal groups of the oocytes for Qarun sample were of 110 um and 170 um in average and for the same stage of Mediterranean sample was of 95 um in average.

In the maturing stage, the modal group was of 190 um in average of Qarun population and 125 um in average for Mediterranean population.

Finally, in the mature or ripe stage the modal groups of oocytes was of 190 um and 175 um in average for Qarun and Mediterranean shrimps populations respectively.

As described before, the oocyte diameters in Lake Qarun populations shrimps of M. stebbingi were larger than those observed in Mediterranean population in the different maturity stages.

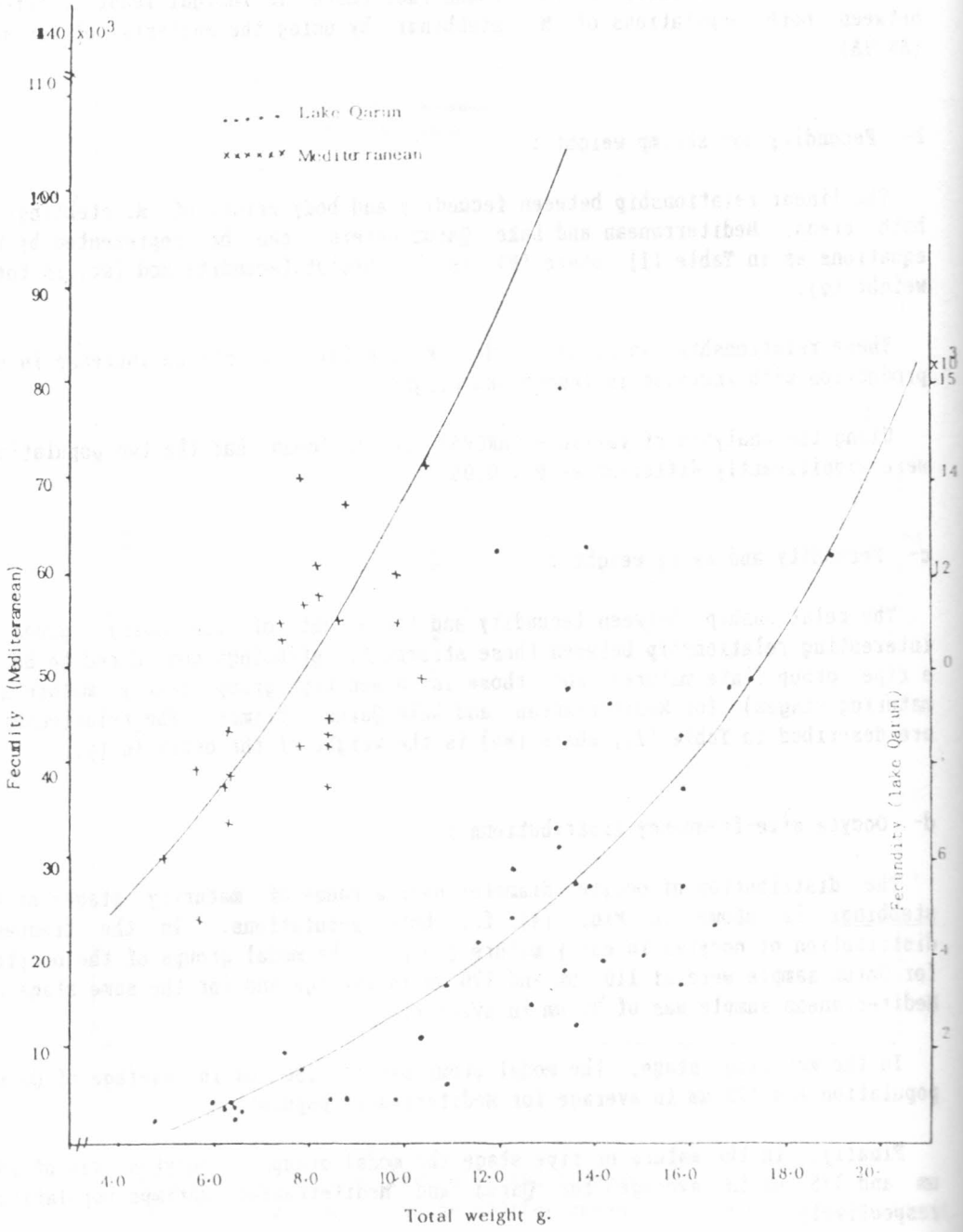

Figure 3 : Relationship between fecundity and total weight of M. stebbingi Nobili in Mediterranean and Lake Qarun populations.

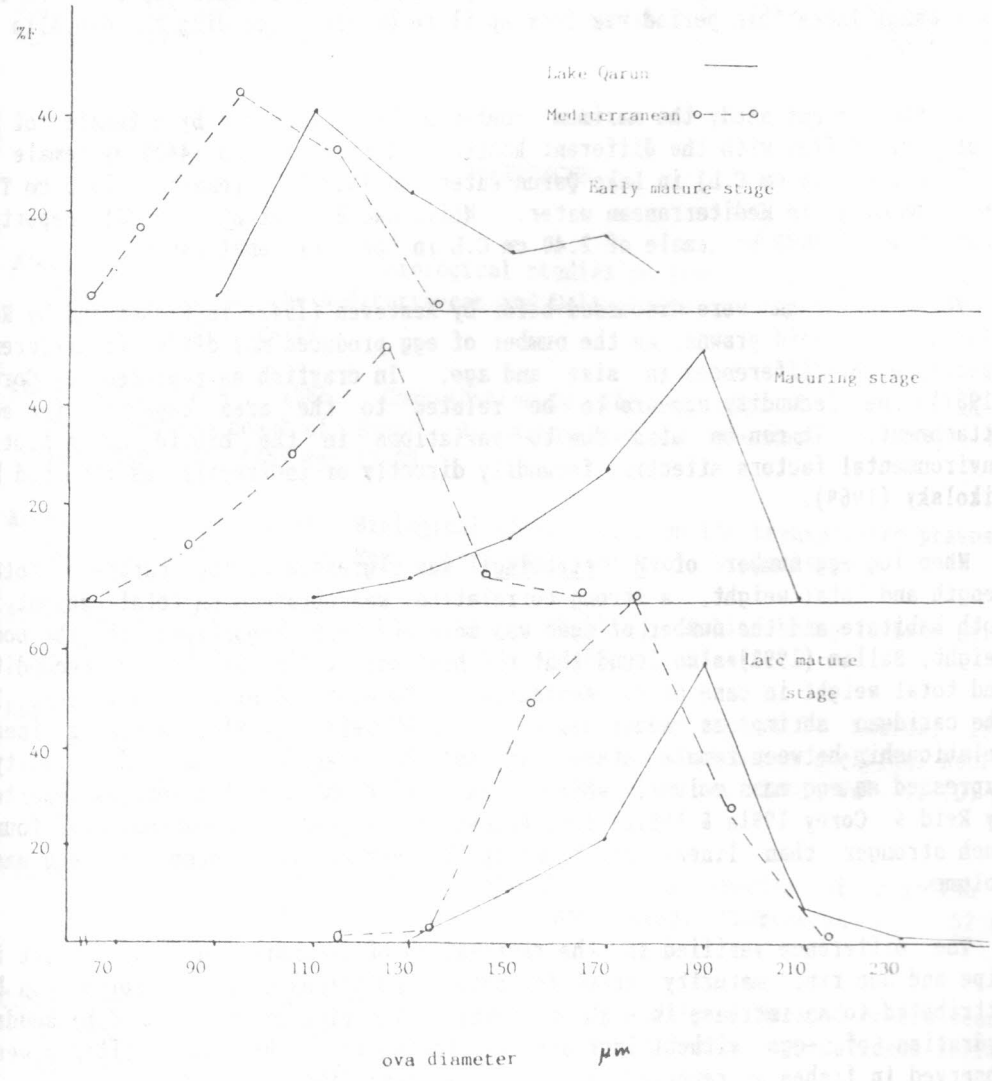

Figure 4 : Ova diameter frequency distribution in the different maturity stages of M. stebbingi Nobili in the Mediterranean and Lake Qarun populations.

DISTRIBUTION

The reproductive capacity of a population is a function of the fecundity of females. M. stebbingi showed a prolonged breeding period in the different studied areas as from June to October in Qarun Lake water and from April to October in the Mediterranean water as reported by Abdel Razek (1992). In the Suez Canal lakes this period was from April to October according to Gab Alla et al, (1990).

In the present study the maximum number of eggs produced by a female of M. stebbingi differ with the different habitat and size, it was 14400 by female of 11.2 cm T.L (4.6 cm C.L) in Lake Qarun water and 141372 by female of 13.5 cm T.L (4.8 cm C.L) in Mediterranean water. While Gab Alla et al, (1990), reported that it was 104000 by female of 2.40 cm C.L in the Suez Canal Lakes.

These variations were discussed befor by Kesteven (1942) in fishes and by Rao (1967) in Penaeid prawns, as the number of egg produced may differ in different species with differences in size and age. In crayfish as reported by Corey (1987) the fecundity appears to be related to the area capacity for egg attachment. It can be also due to variations in the biotic or a biotic environmental factors affecting fecundity directly or indirectly as reported by Nikolsky (1969).

When log egg number of M. stebbingi was regressed on log carapace, total length and total weight, a strong correlation was obtained on total weight in both habitate and the number of eggs was more or less proportional to the body weight, Sallam (1993) also found that the best correlation was between fecundity and total weight in case of P. semisulcatus De Haan off Alexandria waters. In the caridean shrimp as mentioned by Corey & Reid (1991), a strong linear relationship between female size, expressed as carapace volume and fecundity, expressed as egg mass volume, while in case of crabs and lobsters as reported by Reid & Corey 1991a & 1991b) long transformed regression equations were found much stronger than linear relationship between carapace volume and egg mass volume.

The difference verified in the regression of fecundity on gonad weight in ripe and non-ripe maturity group for both populations of M. stebbingi can be attributed to an increase in wight of ovary in the ripe groups caused by suddan hydration of eggs without increase of fecundity. The same criteria were observed in fishes as reported by Juras & Yamaguti (1989).

The present study revearled a greater oocyte diameters in the different maturity stages of M. stebbingi inhabited Lake Qarun in comparison with the Mediterranean population of the same species. This is expected to be due to the suitable environmental conditions of Lake water especially the availability of food and the absence of inter and intraspecific competition as reported by Abdel Razek (1991).

Nikolsky (1969) showed that the quality and size of the eggs, and the yolk content, are dependent on the age and the food supply and vary from year to year; the same author stated that the tendency for the increase of egg size and decrease of fecundity during the course of spawning, can be an adaptation to the poorer food supply in the environment for the larvae. The eggs with more yolk reserve would provide food for the future larvae for a larger period of poor supply in the sea. A similer tendency was observed by Jurase & Yamagyti (1989) and Ware (1975) in case of fish.

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