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ON THE FECUNDITY OF THE GOATFISH *PARUPENEUS PLEUROTAENIA* PLAYFAIR*

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Abstract

It was found that absolute fecundity of *Parupeneus pleurotaenia* Playfair from Qatari waters, increased at a rate proportional to the power of 3.35, 1.23, 0.97 and 0.94 of the total length, body weight age and ovary weight, respectively. The fecundity estimates ranged from 27,000 to 152,000 eggs in the size range 180-300 mm total length. The mean relative fecundity varies from 1190 to 3485 and from 259 to 556 eggs per cm and gram of fish respectively. Ova counts per gram of the ovary weight were calculated for estimating the number of eggs spawn in different batches.

Introduction

According to Vladykov (1956), Macer (1972), Bagenal (1973) and El-Agamy (1974), fecundity is defined as the number of eggs which are laid during the spawning season. Nikolsky (1963) pointed out that absolute fecundity represents the total number of ripe eggs contained in the fish ovaries, while the relative fecundity is the number of ripe ova per unit length or weight of that fish.

Fecundity has been reported as a function, of length, weight and age of various fish species (Nikolsky *et al.*, 1973 ; Bagenal and Braum, 1978 ; Al-Zahaby *et al.*, 1983 ; Somvanshi, 1985 ; Abdin 1986 ; El-Agamy, 1987).

Information on the general biology of *Parupeneus pleurotaenia* Playfair, in the Arabian Gulf is scarce (El Agamy, 1987) despite their commercial importance as food in the Gulf area. Hence, the fecundity of *P. pleurotaenia* is investigated.

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Material and Methods

During April to June 1987, 85 mature ovaries of *P. pleurotaenia* were collected from fish of different lengths and body weights and preserved in 4% formalin for a period of not less than two weeks. The ovaries were then weighed to the nearest milligram after removing excess moisture with filter paper. For egg counting, two separate samples from middle and posterior regions of each ovary were taken and accurately weighed using a Mettler balance H 31AR. Only those ova which were visible to the naked eye in the weighed samples were counted under a binocular microscope and mean egg weight was determined. The total egg number was then determined from the total weight of the ovaries and the mean count of the samples. Fecundity (F) was determined in relation to fish length (L) in mm, fish weight (W) in g, ovary weight (GW) in g, and fish

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age (Ag) in years, by using regression analysis (Zar, 1974). Fish age was determined from the annulations of the scales.

Results

Ripe yolk laden *P. pleurotaenia* eggs are nearly rounded, yellowsih in colour and measure 0.7 mm-1.1 mm in diameter. The presence of different groups of ova in the ovary indicates the probability of a fractional or prolonged spawning habit of the fish.

Fecundity in relation to fish length

The scatter diagram of fecundity against body length (Fig. 1) showed that fecundity

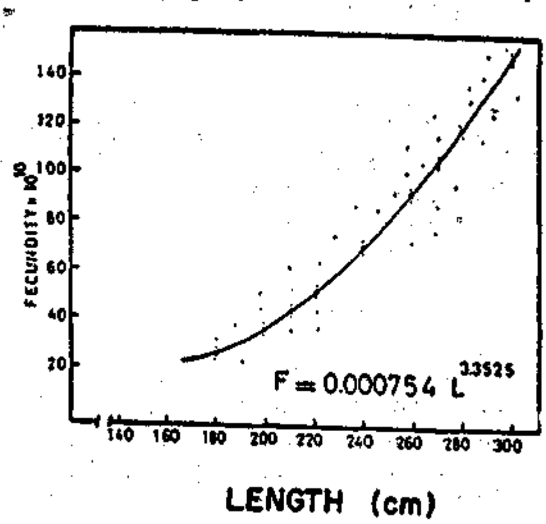

Fig. 1. Relation between fecundity and total fish length.

increases at a rate greater than the increase in fish length. For any fish length, fecundity varies greatly.

The relationship between fecundity and fish length was found to be curvilinear and is expressed by the formula

$F=0.0000754\ L^{3.3525}$ *i.e.* fecundity increases at a rate greater than the cube of length. A high degree of correlation between fecundity and fish length also occurs (Correlation Coefficient $r=0.87$, $P=<0.001$). On the other hand, mean relative fecundity varied between 1190 and 4485 eggs (mean 2870) per one centimetre of fish length and may be simply represented by the equation:

$$F\ (\text{relative}) = 2870\ L$$

Fecundity in relation to body weight

The relationship between fecundity and weight also shows a curvilinear trend (Fig. 2) and may be expressed by the equation

$$F = 223.8206\ W^{1.1269}$$

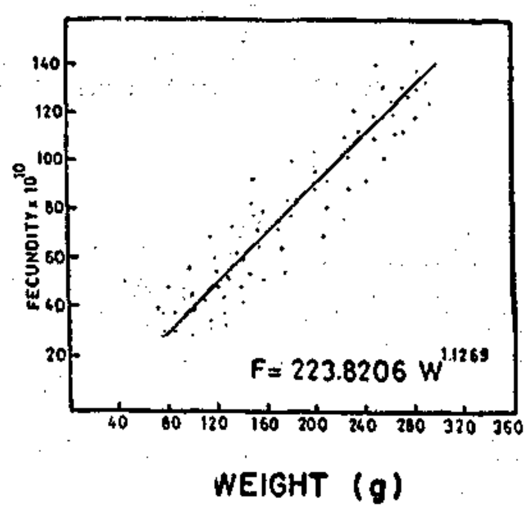

Fig. 2. Relation between fecundity and body weight.

A significant ($P<0.001$) between fecundity and fish weight also occurs ($r=0.81$).

Since fecundity has been shown to increase at a rate greater than the cube power of the length (3.3525), it was considered necessary to examine the relationship between fish length and weight (Fig. 3) and expressed by the formula $W=0.0133\ L^{2.98}$ *i.e.* weight is proportional to *Ca* the cube of length which conforming the generally accepted fact, that for *P. pleurotaenia*, as for most fish species, weight is approximately proportional to the cube of the length (Hile, 1936; Le Cren, 1951).

Thus when the relationship between log-fecundity and Log-weight, is treated by the least squares method, the equation $F = a\ W^n$ may be obtained (Where n is about 1.13 since n = 3.35/2.98 or 1.124). This is confirmed by the fecundity weight relationship.

The mean relative fecundity varied between 259 and 556 eggs (mean 420) per g fish weight and may be represented by the equation F (relative) = 420 W.

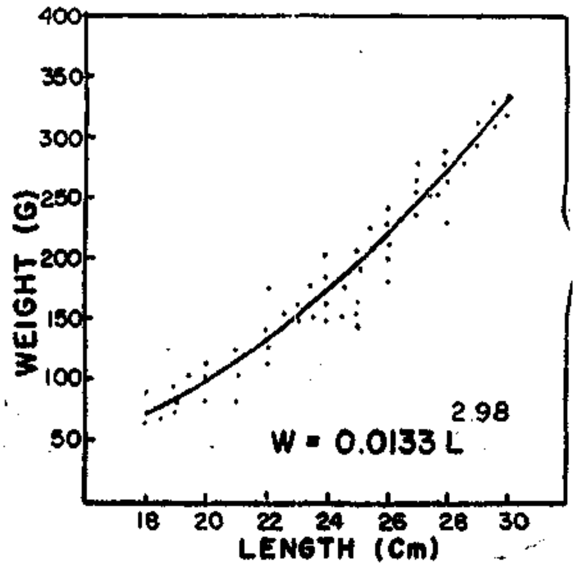

Fig. 3. Relation between fish length and weight.

Fecundity in relation to fish age

The relationship between fecundity and age (Fig. 4) was found to be represented by the equation $F = 15642.278\ Ag^{0.9693}$.

A highly significant ($P<0.001$) positive correlation occurs between fecundity and age ($r = 0.95$), although the variation in the fecundity of fish of the same age varied greatly. Also, a considerable variation in the number of eggs within the same age group occurred owing to the great variation in the size of fish of the same age group. It is observed that the larger fish of an age group are more fecund than the smaller ones. Also considerable overlap was observed in the lengths of the different age groups exaimned.

The relative fecundity ranged between 12985 and 15820 eggs (mean 15020) per one year of fish age and may be represented by the equation : F = 15020 Ag

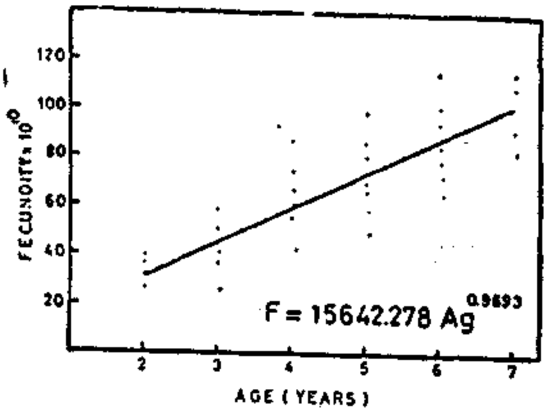

Fig. 4. Relation between fecundity and fish age.

Fecundity in relation to ovary weight

There was no significant difference between the two ovary lobes of *P. pleurotaenia*. The fecundity and ovary weight relationship (Fig. 5) may be expressed by the equation $F=17518.62\ Gw^{0.9436}$ (*i.e.* the number of ova increased at a rate of 0.9436 with the ovaryweight) with a significant ($P<0.001$) positive corrlaetion ($r=0.82$).

The ovary weight in percentage of total fish weight or relative fecundity ranged between 15198 and 19708 eggs (mean 16150) per one gram ovary weight, thererore F (relative) = 16150 Gw.

From the above observations, it is clear that the estimated fecundity (F) computed from the several variables differed from the observed fecundity. Therefore, a standard error of estimate is calculated in each case to find out the reliable variables from which the more

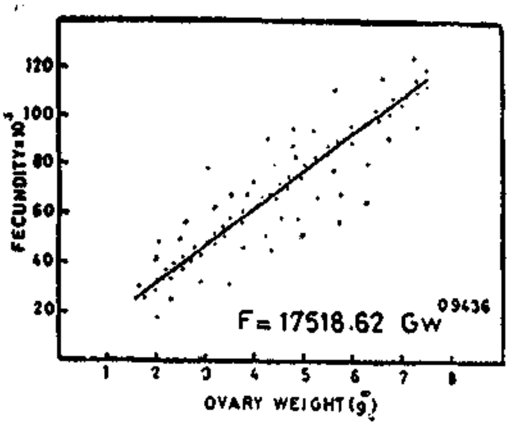

Fig. 5. Relation between fecundity and ovary weight.

accurate fecundity estimates can be obtained. The standard errors of estimated fecundity are presented with their respective variables can be clearly seen in Table 1.

Discussion and Conclusion

The present investigation showed that the fecundity of *Parupeneus pleurotaenia* increases at a rate greater than the length, weight, ovary weight and Age of the fish. Fecundity was found to vary at a rate proportional to more than the cube power of the length. This value of exponent is considerably in agreement to those reported by other authors for other fish species. Raitt (1933) for North Sea haddock, Simpson (1951) for *Pleuronectes platessa*, Thomson (1962) for *Gadus macrocephalus* Hodder (1972) for Grand Bank haddock, Al-Zahaby *et al.* (1983) for *Clarias Lazera*, somvanshi (1985) for *Garra mullya* and El-Agamy (1987) for *Gerres oyena*, have used this relationship and their exponent values generally ranged between 3 and 5.

A direct relationship also was obtained between fecundity and body weight with a linear relationship. This was confirmed with the observations made by Somvanshi (1985) in *Garra mullya*. However Simpson (1951) in *Pleuronectes platessa*, Hodder (1972) in Grand Bank haddock and El-Agamy (1987) in *Gerres oyena* had noted a curvilinear relationship between fecundity and body weight.

When fecundity is related to fish age, it is found that there is a definite positve correlation between these, 2 parameters, although the variation in fecundity at any one age is even greater than that observed between fish of the same length or weight. The present results showed that fecundity, in fish of the same size, was greater for older fish. This fact is supported by the observations of Raitt (1933), Al-Zahaby *et al.* (1983) and El-Agamy (1987) for different fish species. However Simpson (1951) for North Sea plaice and Hodder (1972) for Grand Bank haddock, found that the older fish were not more fecund than younger ones of the same size.

In the present study a positive correlation between fecundity and ovary weight is obtained

Table 1. *The standard errors of estimated fecundity with their variables*

Variables	Intercept (a)	Regression coefficient (b)	Correlation coefficient (r)	Statistical significant (P)	Standard error of estimates (F)
Fish length (L) ..	−3.1226	3.3525	0.87	< 0.001	2340
Fish weight (W) ..	2.3499	1.1269	0.81	< 0.001	2406
Fish age (Ag) ..	4.1943	0.9693	0.89	< 0.001	2577
Gonad weight (Gw)	4.2435	0.9436	0.82	< 0.001	2387

in *P. pleurotaenia*. Also the number of ova produced was closely related to the weight of the ovary. This was in agreement with the observations made by Hickling (1940) in North Sea herring, Somvanshi (1985) in *Garra mullya* and El-Agamy (1987) in *Gerres oyena*. They stated that since production of eggs was the dominant function of an ovary, a close relationship could be expected between the weight of the ovary and the number of ova produced.

In conclusion, it is clear that fish length alone can give a good estimate of fecundity when a single variable is considered as it has minimum standard error of estimate. According to Bagenal and Braum (1978), Somvanshi (1985) and El-Agamy (1987) fish length, being an easier measure than fish weight, gonad weight and age that can be taken in the field, is more suitable to make predictions of fecundity when time is limited and large samples have to be dealt with. Moreover the probability of error in age interpretation and the calculation of fecundity from age results in a rather hazardous guess.

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