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THE FECUNDITY OF PAGILLUS ERYTHRINUS (Linnaeus, 1758) FROM AIN EL-GHAZALA GULF (LIBYA)

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ABSTRACT

The fecundity of the sea bream (Pagellus erythrinus) from the Libyan waters (Ain Al-Ghazala gulf) was assessed using 323 ovaries in pre-spawning stage from fish between 15 and 33 cm total length. Absolute and relative fecundities were estimated according to the fish length, fish weight and fish age. The absolute fecundity estimates ranged from 69,968 to 139,795 eggs in fish having total length range 15-33 cm. The mean relative fecundity varies from 4190 to 4665 and from 373 to 1399 eggs per cm and gram of fish, respectively.

Key words: *Absolute fecundity- Relative fecundity- Length- Weight- Age- Pagellus erythrinus.*

INTRODUCTION

According to Valdykov (1956), Macer (1972), Bagenal (1976) and El-Agamy (1974) fecundity is defined as the number of eggs which laid during the spawning season. Knowledge of fish fecundity is useful in investigating the population dynamics of a fish species and for fish culture purposes. The fecundity-size relationship has been used principally as a rapid means of predicting the fecundity of fish stocks when the length distribution is known. Family Sparidae includes a large variety of species, commercially known as porgies or breams and most of them are highly valued as food fish where it is widely distributed in the Atlantic, Indian and Pacific oceans (Rizkallah, 1986). Several authors were interested in studying spiradea fishes throughout the whole world, where Rizkallah (1986) studied the fishery biology of two species of spiradea (*Pagellus erythrinus* and *Pagellus acarne*); Marco et al. (2000) investigated the gonadal maturation in *Pagellus acarne* in the Strait of Messina (Sicily); Erzini et al (2002) studied age and growth of seven sparid species of the south coast of Portugal; El-Agamy et al. (2004) investigated the reproductive biology of family sparidae (Boops boops) in the Mediterranean environment; Klimogianni et al. (2004) studied the effect of temperature on the egg and yolk sac larval development of common Pandora, *Pagellus erythrinus;* Uluturhan (2006) studied the heavy metal contaminants in red pandora (Pagellus erythrinus) tissues from the Eastern Aegean sea Turkey and Bedoui et al. (2009) studied the feeding habits of *Pagellus acarne* in the Gulf of Tunis, central Mediterranean. There is a large variety of bony fishes living in the Libyan Mediterranean waters. So far little is known about the biology of these fishes. The aim of the study is to investigate and give

a detailed study of the reproductive biology of *Pagellus erythrinus*. Such a study of the biology of the fish is in fact very useful in order to improve their fisheries and improve the production of the spawners in the spawning grounds and during the spawning season, which is very important for the proper management as well as understanding and predicting the annual changes occurs in the population.

MATERIALS AND METHODS

The samples used in the present work were captured alive, three times a month from Ein El-Ghazala Gulf (Libya). Some samples were obtained from the commercial catch. 323 specimens of *Pagellus erythrinus*, ranging in length from 15 cm to 33 cm and ranging in weight from 50 gm to 375 gm were collected during the period from August 2006 to July 2007. The fishes were transported to the laboratory. The date of capture, total length and standard length to the nearest cm was recorded. Also total weight and gutted weight to the nearest gm were recorded. Directly after recording of length and weight, the fish were dissected to determine sex and maturity stage. The gonads were removed, weighed to the nearest 0.01 gm. To study the egg diameter in the fully matured ovaries, a known portion by weight was preserved in 4 % formalin for one day from a ripe ovary "free from ovarian wall". These portions were then taken and generally spread in small petri dish, and the diameter of all eggs were measured by using eye piece micrometer and then the measurement were converted into mm. A relationship was drawn between the egg diameters in mm against the percentage frequency. The weight method was used in studying fecundity, to minimize error due to sampling technique (May, 1967). The number of eggs in the weighted sample (0.1gm) was counted and then the total number of eggs in the ovaries was estimated by using the following formula:

Absolute fecundity (F) =Weight of ovary X number of eggs in the sample / weight of sample.

Also the relative fecundity was calculated for each of length and weight according to the following equation:

Relative fecundity (Fr) = Absolute fecundity / Total length (cm) or total weight (gm).

Estimation of mathematical equations that represent the relation between absolute fecundity or relative fecundity on one side and total length (cm) or gutted weight (gm) on the other side was done.

RESULTS

In general, fecundity is high where the eggs are liberated into open marine water. Difference in fecundity exists from year to year and from season to season almost resulting from the change in water temperature and densities. Two terms are generally applied in studying the fecundity of fishes. The first is the "absolute fecundity"; it entails the examination of the number of the mature eggs in the ovary and the second is the "relative fecundity"; it entails the number of eggs per unit length or weight of fish. Ripe eggs of *Pagellus erythrinus* ranging in diameter from 0.6 mμ to 1.7 mμ. The presence of different groups of ova in the ovary indicates the probability of a fractional or prolonged spawning habit of the fish (El-Agamy, 1990).

A. Analysis of fecundity-length relationship:

The relation between fecundity and the fish

length was determined by the method of least squares. There are considerable variations in fecundity at any length group, the regression equation can be written as:

$$Fa = 10524 + 3866\ L$$

Where (Fa) is the absolute fecundity and (L) is the mean total length in cm. This equation is used to calculate the individual regression fecundity at each length group of **Pagellus erythrinus.** The observed and calculated absolute fecundity related to each length group is represented in Table (1). The interpretation of different lengths in this equation indicates 0.997 correlation coefficient. On the other hand, a curvilinear relation exists between the relative fecundity and total fish length. Its equation can be expressed as follows:

$$Fr = 7866\ L^{-0.19} \quad \text{or}$$

$$\text{Log Fr} = 3.8957 - 0.19\ \text{Log L}$$

Where (Fr) is the relative fecundity and (L) is the total length in cm. The correlation coefficient of estimated values for the relative fecundity is found to be 0.996. The observed and calculated relative fecundity related to each length group is represented in Table (2).

B. Analysis of fecundity-weight relationship:

The average absolute fecundity related to each mean gutted weight is shown in Table (3) the regression equation can be expressed as follows:

$$Fa = 63918 + 211.5\ W$$

Where (Fa) is the absolute fecundity and (W) is the mean total weight in grams with a correlation coefficient equal 0.992. This shows a strong satisfactory agreement of both observed and calculated absolute fecundity for mean total weight from 50 gm to 375 gm. The observed and calculated relative fecundity related to mean total weight were also shown in Table (4), the equation is as follows:

$$Fr = 18423\ W^{-0.66} \quad \text{or}$$

$$\text{Log Fr} = 4.2654 - 0.66\ \text{Log W}$$

Where (Fr) is the relative fecundity and (W) is the total weight in grams with a correlation coefficient equal 0.997.

B.Analysis of fecundity-age relationship:

Fishes below the age group of two years were not observed to spawn. The fecundity in the second year specimens was about 75299 and increased with the advancement of age. In the sixth year of life, the fecundity increased to 137661. The relation between fecundity and age (Table, 5) was found to be represented by the equation:

$$Fa = 44031 + 15834\ Ag$$

Where (Fa) is the absolute fecundity and (Ag) is the age in year with a correlation coefficient equal 0.998. It has been observed that the larger fish of age group are more fecund than the smaller ones. Also, considerable overlap was observed in the lengths of the different age groups examined.

The relative fecundity ranged between 22943 and 37649 eggs per one year of fish (Table 6), the equation is as follow:

$$Fr = 42526 - 3485\ Ag$$

Where (Fr) is the relative fecundity and (Ag) is the age in year with a correlation coefficient equal 0.912.

Table (1): Total length-absolute fecundity relationship of *Pagellus erythrinus* collected during the period from August 2006 to July 2007.

Mean total length (cm)	No. of fish	Observed absolute fecundity	Calculated absolute fecundity
15	29	69968	68514
16	19	73535	72380
17	25	77076	76246
18	24	80617	80112
19	19	84158	83978
20	22	87762	87844
21	14	91113	91710
33	26	94844	95576
23	18	98322	99442
24	16	101863	103308
25	18	105404	107174
26	15	108945	111040
27	14	114911	114906
28	13	118452	118772
29	18	122721	122638
30	10	126989	126504
31	9	131258	130370
32	8	135526	134236
33	6	139795	138102

Table (2): Total length-relative fecundity relationship of *Pagellus erythrinus* collected during the period from August 2006 to July 2007.

Mean total length (cm)	No. of fish	Observed relative fecundity	Calculated relative fecundity
15	29	4665	4702
16	19	4596	4644
17	25	4534	4591
18	24	4479	4541
19	19	4429	4495
20	22	4388	4451
21	14	4339	4410
33	26	4311	4372
23	18	4275	4335
24	16	4244	4300
25	18	4216	4267
26	15	4190	4235
27	14	4256	4205
28	13	4230	4176
29	18	4232	4148
30	10	4233	4121
31	9	4234	4096
32	8	4235	4071
33	6	4236	4047

Table (3): Total weight-absolute fecundity relationship of *Pagellus erythrinus* collected during the period from August 2006 to July 2007.

Mean total weight (gm)	No. of fish	Observed absolute fecundity	Calculated absolute fecundity
50	29	69968	74493
56	19	73535	75762
66	25	77076	77877
78	24	80617	80415
91	19	84158	83165
107	22	87762	86549
123	14	91113	89933
141	26	94844	93740
157	18	98322	97124
175	16	101863	100931
192	18	105404	104526
211	15	108945	108545
235	14	114911	113621
253	13	118452	117428
270	18	122721	121023
288	10	126989	124830
322	9	131258	132021
349	8	135526	137732
375	6	139795	143231

Table (4): Total weight-relative fecundity relationship of *Pagellus erythrinus* collected during the period from August 2006 to July 2007.

Mean total weight (gm)	No. of fish	Observed relative fecundity	Calculated relative fecundity
50	29	1399	1393
56	19	1313	1293
66	25	1168	1160
78	24	1034	1039
91	19	925	939
107	22	820	843
123	14	741	769
141	26	673	703
157	18	626	655
175	16	582	610
192	18	549	573
211	15	516	539
235	14	489	502
253	13	468	478
270	18	455	458
288	10	441	439
322	9	408	408
349	8	388	368
375	6	373	369

Table (5): Age-absolute fecundity relationship of *Pagellus erythrinus* collected during the period from August 2006 to July 2007.

Age group (year)	No. of fish	Observed absolute fecundity	Calculated absolute fecundity
II	97	75299	75699
III	81	91240	91533
IV	52	107781	107367
V	60	124855	123201
VI	43	137661	139035

Table (6): Age-relative fecundity relationship of *Pagellus erythrinus* collected during the period from August 2006 to July 2007.

Age group (year)	No. of fish	Observed relative fecundity	Calculated relative fecundity
II	97	37649	35556
III	81	30413	32071
IV	52	26945	28586
V	60	24971	25101
VI	43	22943	21616

DISCUSSION

Annual fecundity of a population is of biological interest. Its modulation is a contributor to population homeostasis, and the large variations seen from year to year, and over decades, reflects the amelioration or deterioration of the habitat in relation to the individual fish (Nikolskii, 1969). Fecundity represents an important item in the study of reproduction of fishes. In the present study a linear relationships were obtained for fecundity against total body length, total body weight and fish age respectively. It was concluded that the length of the female *Pagellus erythrinus* is the best expression of its absolute fecundity where the two parameters are satistically more significantly correlated with each other. The present study is in agreement with that of El-Agamy et al. (2004) who showed that there is a good agreement between the observed and the calculated values of both absolute and relative fecundity.

The present results contradict that of *Hassan* (1990) who worked on the same family. He concluded that the mean observed absolute fecundity ranges from 5185 to 52208 eggs, while total lengths ranging from 13 to 22 cm and that the relative fecundity varied between 399 to 2373 egg per cm.

Guerra et al. (1993) found that the total number of eggs per female fish ranged from 36,926 to 143,900(average 65,659) for the black sea bream from the Saharan Bank (eastern Atlantic). This result is in agreement with the present study. Similar findings were observed by Larraneta (1953) and Krug (1990). There are few references and data on fecundity of other sparid fishes. From the data presented it is obvious that the values of relative fecundity oscillate considerably depending on the species and geographical location (Jakov et al., 1998).

CONCLUSION

The present study aims to recognize the fecundity of the fish *(Pagellus erythrinus)* in the Libyan waters since it is considered as one of the most economically important fish in this area, so that the authors suggest to prevent fishing in the time of spawning to increase the rate of production of the fish.

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الملخص العربى

دراسة الخصوبة لأسماك المرجان الأحمر بخليج عين الغزالة - ليبيا

إيمـــان فـــاروق محمـــد عبدالهـادى عبـاس هـــادى

سـامى فاضـل علـوان

قسم علـم الحيـوان ، كلية العلـوم ، جامعـة عمـر المختـار (طـبرق)

تنتشر أسماك عائلة السباريدى Family Sparidae فى المحيط الأطلنطى والهندى والباسفيكى، ويعتبر جنس *Pagellus* من أهم أجناس تلك العائلة وهو ممثل فى مياه البحر المتوسط بأربعة أنواع من أكثرها إنتشاراً المرجان الأحمر *Pagellus erythrinus*.

تناولت هذه الدراسة تعيين درجة الخصوبة لأسماك المرجان الأحمر بخليج عين الغزالة (ليبيا)، تم قياس الخصوبة عن طريق عد البيض فى مبيض الإناث الناضجة، كما تم حساب العلاقات بين عدد البيض وكل من الطول والوزن والعمر، ولقد وجد أن البيض الناضج مستدير الشكلك يتراوح قطره بين ٦ر٠ - ٦ر١ مللى ميكرون ومتوسط قطره ١ر١ مللى ميكرون.

ويتراوح عدد البيض بين ٦٩٩٦٨ إلى ١٣٩٧٩٥ بيضة فى الإناث التى تتراوح أطوالها بين ١٥ إلى ٣٣ سبتمبر، وأوزانها بين ٥٠ إلى ٣٧٥ جرام، كما يتراوح عدد البيض لكل سنة عمرية للسمكة بين ٢٢٩٤٣ إلى ٣٧٦٤٩ بيضة بازدياد عمر السمكة من سنتين إلى ستة سنوات.

ويـزداد عـدد البيض من ٧٥٢٩٩ إلى ١٣٧٦٦١ بيضة بازديـاد السمكة فى العمـر من ٢ إلى ٦ سنوات.

وكانت العلاقة بين درجة الخصوبة وعمر السمكة أكثر إرتباطاً (معامل الارتباط = ٩٩٨ر٠) من العلاقة بين درجة الخصوبة والطول (معامل الارتباط = ٩٩٧ر٠) ودرجة الخصوبة والوزن (معامل الارتباط = ٩٩٢ر٠).

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