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POPULATION BIOLOGY OF SPARID FISHES IN QATARI WATERS
2. AGE, GROWTH AND MORTALITY OF BLACK-BANDED BREAM, *MYLIO BIFASCIATUS* (Forsskal)

By

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بيولوجية المجموع لأسماك عائلة سباريدي في المياه القطرية
٢ - دراسة العمر والنمو والوفاة في أسماك الفسكر

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لقد اجريت هذه الدراسة لتقدير العمر ومعدلات النمو والنفوق في سمك الفسكر في المياه القطرية خلال الفترة من يناير ١٩٩٢ إلى مايو ١٩٩٣م . وقد أوضحت نتائج الدراسة أن أقصى عمر يمكن ان تصل إليه هذه الأسماك هو ١٤ سنة . وكانت العلاقة بين الطول الكلي للأسماك وقطر قشورها علاقة خط مستقيم ممثلة بالمعادلة الآتية :

الطول الكلي = ٣,٥٩٦ + ٠,١٤٦٥ × طول قطر القشرة ،

بينما كانت علاقة الطول بالوزن علاقة خط منحني تمثلها المعادلة :

الوزن الكلي = ٠,٠١٧٢٧ × (الطول الكلي) ٣,٠١٦٢١

أما معادلة فون برتلانفي والتي تمثل معدلات النمو للأسماك المدروسة فكانت :

$$L_t = 47.12\ (1-e^{-0.14(t+1.69)})$$

وبحساب أطوال وأوزان الأسماك عند الأعمار المختلفة إتضح أن معدلات النمو في الطول كانت أعلى ما يمكن عند نهاية السنة الأولى ثم حدث تناقص تدريجي بها مع التقدم في العمر . أما النمو في الوزن فلم يسلك مسلكاً محدداً . وبدراسة منحنى الصيد تبين ان هذه الأسماك تدخل المصيد وبذلك يمكن صيدها عندما يصير عمرها ثلاث سنوات وأن معدل الوفيات السنوية يصل إلى ٠,٣٩٨ ، بينما يصل معدل الاعاشة إلى ٦٧٪ بعد السنة الثالثة من العمر .

Key Words: Arabian Gulf, Faskar, Growth, Mortality, *Mylio bifasciatus*, Sea bream, Sparidae, Qatar.

ABSTRACT

Age, growth and mortality of black-banded bream (faskar) *Mylio bifasciatus* from the Arabian Gulf waters off Qatar were estimated. The study was conducted on 314 fish obtained from the trawl catch of Qatar National Fishing Company during January 1992 - May, 1993. The study revealed that the maximum age of fish sampled was 14 years. The length / scale relationship was TL = 3.596 + 0.1465 TS. The relationship between total length and total weight was best fit by the following curvilinear equation: $TW = 0.01727\ TL^{3.01621}$. The Von Bertalenffy growth equation was $L_t = 47.12\ (1-e^{-0.14\ (t+1.69)})$. The back-calculated data indicated that the growth in length of faskar was highest at the end of the first year of life, followed by a gradual, continuous decrease throughout the fish life. The growth in weight showed an irregular pattern with an annual increment ranging from 77-167%. The total mortality estimate (Z), calculated from the catch curve was 0.398/year, while the survival rate(S) was 0.67, indicating that 67% of faskar survive per year after the third year of life.

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INTRODUCTION

Sparid Fishes are considered among the most economic fishes in the Arabian Gulf region (Morgan, 1985, Samuel and Mathews, 1987; El-Sayed, 1992). The annual catch of sparid fishes in Qatari waters is represented mainly by three species; *Mylio bifasciatus, Crenidens crenidens* and *Argyrops spinifer*. These fishes are highly demanded in Qatari fish market. They represented 5.7% of the total annual production and 6.2% of the total selling value from 1980 to 1990 (El-Sayed, 1992). In addition, the annual production of sparid fishes in Qatar has increased from 41 MT in 1980 to 319 MT in 1990 (Anonymous, 1980-1990).

Studies regarding the biology, feeding habits, reproduction patterns, abundance and population dynamics of fishes of family Sparidae are very limited in the Arabian Gulf waters in general, and in Qatari waters, in particular. As far as the authors know, no studies have been conducted on sparid fishes in Qatari waters.

The present study is one of a series of studies being conducted on the biology and fisheries of fishes of family sparidae in Qatari waters. It throws the light on the age, growth and mortality of the black-banded sea bream (or porgy). This species is also called *Acanthopagrus bifasciatus* (Kronuma and Abe, 1972), and locally known as faskar.

MATERIALS AND METHOD

The present study was conducted on 314 fish (combined sexes) collected from January 1992 to May, 1993. Monthly random samples, representing faskar population in Qatari waters were obtained from the trawl catch of Qatar National Fishing Company (QNFC). A wide range of sizes (14-45.6 cm total length) was sampled. For each fish, the total length (TL) to the nearest 0.1 cm and total weight (TW) to the nearest g, were recorded.

The fish age was determined using the scales technique. Scales were taken from the left side of the fish, beneath the tip of the pectoral fin. The scales were soaked in 10% ammonia solution for 12 hrs, rubbed between fingers to remove chromatophores, integuments and dirts and washed in tap waters. After drying with filter papers, 3-5 scales from each fish were mounted between two clean glass slides. The clearest scale was used for age determination using a stereomicroscope equipped with an ocular micrometer.

Several examined scales have shown various degrees of resorption, and were, in turn, not used for age determination. Scales were read from the nucleus along the anterior radius. The length/scale (L/S) relationship was derived by plotting the total scale length (TS) on total fish length (TL). The intercept value of the regression equation was used to back-calculate the fish length at the end of each year of life according to the following equation (Lee, 1920):

$$L_n = \frac{S_n}{S_t}(L_t - a) + a, \qquad where,$$

L_n = fish length at age n, S_n = scales radius at age n, S_t = total scales radius (at capture), L_t = total fish length (at capture), and a = the intercept of the regression of total scale length Vs total fish length.

The length/weight (L/W) relationship was determined by fitting a least squares logarithmic regression to the data using the following equation:

$TW = aTL^b$, where,

TW = total weight (g), TL = total length (cm), a and b = constants. Growth parameters were obtained from back-calculated data and used to calculate the Von Bertalenffy (1938) growth equation (VBGE):

$L_t = L_\infty (1-e^{-K(t-t_0)})$, where:

L_t = total fish length at age t, L_∞ = maximum attainable length, K = growth coefficient and t_0 = hypothetical age at which the fish length is zero.

A simple catch curve method was used for estimating fish mortality. The $\log_e$ of numbers of catch at each age were plotted, and a least squares regression was fitted to the descending right limb, with a slope equals to the instantaneous rate of mortality, Z, while the survival rate S equals e^{-Z}.

RESULTS

GROWTH

The relationship between total fish length and weight is represented in Fig. 1. This relationship was best fit by the following curvilinear equation:

$TW = 0.01727TL^{3.01621}$

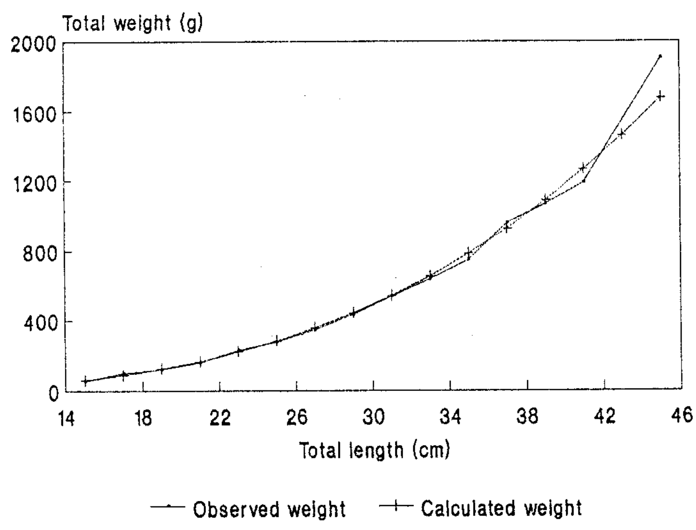

Fig 1: Length/weight relationship of faskar in Qatari waters.

The relationship between total scale radius and total fish length was best fit by the following first degree equation:

TL = 3.596 + 0.1465 TS, r = 0.997

The value of the intercept (3.596) was used to back-calculate fish length and growth increment at the end of each year of life. The average back-calculated lengths and weights are given in Table 1. The growth in length was slow and steady over the course of the fish life. The annual length increment was highest at the end of the first year (23%) and gradually decreased over time reaching about 3% at the end of the 13th year (Fig. 2). Growth in weight, on the other hand, showed an irregular pattern (Fig. 3).

Table 1
Average back-calculated total-lengths and weights of faskar at the end of each year of life

age	1	2	3	4	5	6	7	8	9	10	11	12	13
number	11	39	74	64	45	21	26	14	8	5	3	2	2
Total length (cm)	17.0	22.0	24.6	27.2	29.2	31.4	33.0	34.6	35.9	38.0	40.0	41.3	42.4
% increment		23	12	11	7	8	5	5	4	6	5	3	3
Total weight (g)	89	193	271	367	454	566	657	758	847	1006	1173	1292	1398
% increment		105	77	96	87	112	91	101	89	159	167	119	106

The VBGE representing the estimates of growth parameters was:

$$L_t = 47.12(1- e^{-0.14(t+1.69)}).$$

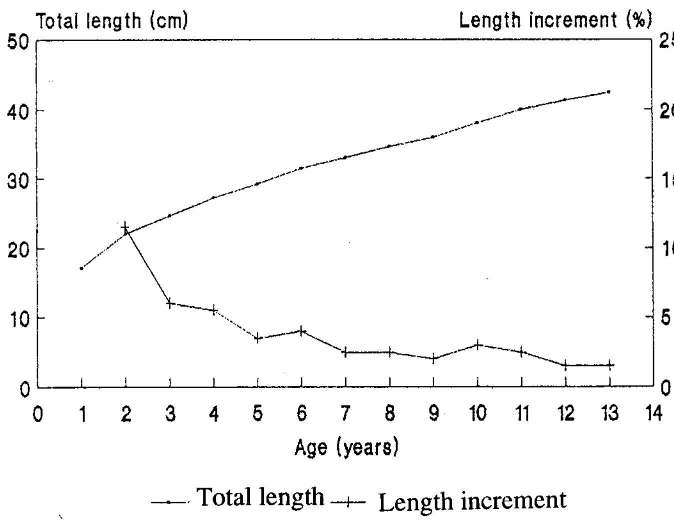

Fig 2: Growth in length and length increment of faskar in Qatari waters.

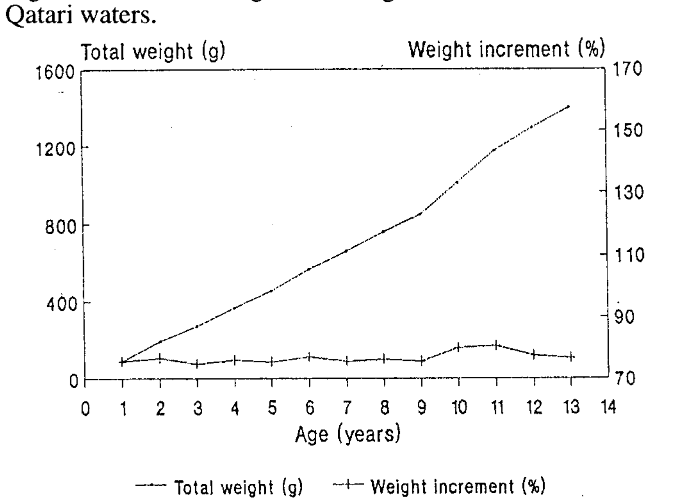

Fig 3: Growth in weight and weight increment of faskar in Qatari waters.

MORTALITY

Faskar are fully recruited, and in turn, fully vulnerable to fishing at age 3. Mortality estimates, determined from the catch curve (Fig. 4),were, therefore, based on fish aged 3 years and older (3-13 years) .Fish older than 13 years were excluded from the study, since only one fish aging 14 years was caught .The estimate of total instantaneous rate of mortality was 0.398 (Y=5.698-0.398X, r=-0.996).

The survival rate (S) of faskar was 0.67 ($S=e^{-0.398}=0.67$). This value indicates that 67% of faskar survive per year after the third year of life. The annual mortality was 1-S=0.33.

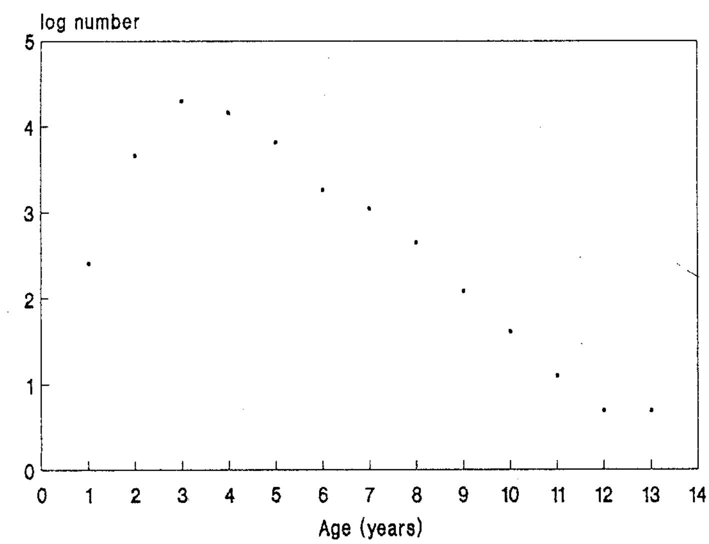

Fig 4: Catch curve of faskar in Qatari waters.

DISCUSSION

AGE

Sparid fishes, in general, and *M. bifasciatus*, in particular, are rather long lived and display a steady and slow rate of growth (Manooch and Huntsman, 1977; Morgan, 1985; Samuel and Mathews, 1987). In the present study, one fish aging 14 years was caught in May, 1992. Individuals of the same species have been living in Qatar National Marine Aquarium for about 16 years (personal communication). Moreover, a maximum age of 21 years has been reported for faskar in Kuwaiti waters (Samuel and Mathews, 1987).

It should be mentioned that various degrees of resorption of scales have been noticed during scale readings. Resorbed scales should not, therefore, be used for age determination.

The phenomena of scale resorption, regeneration and false annuli have been reported with the sparids *Crysophrys auratus* (Paul, 1968), and red porgy *Pagrus pagrus* (Manooch and Huntsman, 1977).

GROWTH

The value of the constants (a and b) of the length/weight regression of faskar in the present study are almost identical to the values reported by Samuel and Mathews (1987) on the same species in Kuwaiti waters (see Table 2). The results also compare favourably well with those reported on *A. berda* and *A. cuvieri* (Samuel and Mathews, 1987). It would appear therefore, that the rate of growth in length of faskar in the present study is similar to that of these fishes. Slight differences, however, have been found with other sparids (Dias et al. 1972; Manooch and Huntsman, 1977; Vassilopoulou et al., 1986; Samuel and Mathews, 1987), as shown in Table 2.

The growth of faskar as described by the VBGE predicts a maximum total length, L_∞, of 47 cm. This value appears rather realistic, since a 45.6 cm TL faskar was captured in July, 1992. In addition, a number of faskar of about 50 cm TL are currently living in Qatar National Marine Aquarium (Personal communication). However, L_∞ in the present study is much higher than that reported by Samuel and Mathews (1987), who found that L_∞ of faskar in Kuwaiti waters is only 34.89. That result may be questionable, since the authors conducted their study on 21 fish only. Obviously, a much larger sample should have been used in order to come up with a solid conclusion. The maximum attainable length of other sparid fishes in the Arabian Gulf ranged from 35 to 82 cm (Samuel and Mathews, 1987).

Table 2
Length / weight relationship of sparid fishes

Species	a	b	Reference
P. sedecim	0.0000697	2.7385	Dias et al. (1972)
P. Pagrus	0.0000252	2.8939	Manooch & Huntsman (1977)
P. erythrinus	0.0000270	2.9302	Vassilopoulou et al. (1986).
A. cuvieri	0.01165	3.03737	Samuel & Mathews (1987)
A. latus	0.02874	2.79198	Samuel & Mathews (1987)
A. berda	0.01713	3.01578	Samuel & Mathews (1987)
A. bifasciatus	0.01763	3.00075	Samuel & Mathews (1987)
M. bifasciatus	0.01727	3.01621	Present study
A. spinifer	0.03980	2.73761	(El-Sayed & Abdel-Bary), unpublished data).

It is known that the growth coefficient (K) is related to fish growth rates. Lower K means higher L_∞, and in turn faster growth rate (Ricker, 1975). The value of K (0.14) in the present study is lower than that reported with, *Acanthopagrus bifasciatus, A. latus, A. berda.* and *A. cuvieri* in the Arabian Guff (Morgan, 1985; Samuel and Mathews, 1987) (Table 3). This findings suggests a faster growth rate in faskar than in these sparids. On the other hand, the red porgy *P. pagrus* (Manooch and huntsman, 1977) have much higher growth than faskar, as their K value were much lower (Table 3).

MORTALITY

The rate of instantaneous mortality Z in the present study is somewhat comparable to that of *P. pagrus* (Manooch and Huntsman, 1977) and *A. cuvieri*, (Samuel and Mathews, 1987) as shown in Table 3. However, this rate was much lower than reported with *A. latus* (Morgan, 1985) and much higher than that of *A. bifasciatus* (Samuel and Mathews, 1987). These discrepancies may have resulted from sampling problems and /or sample sizes. For example, Morgan (1985) conducded his study on *A. latus* ranging from 19 to 30 cm only. This segment

Table 3
Growth and mortality estimates of sparid fishes

Species	L_∞	K	t_0	Z	S	t_{max}	Reference
P. Pagrus	76.30	0.096	-1.88	0.44	0.64	15	Manooch & Huntsman an (1977)
A. latus	43.00	0.20	--	0.97	0.38	--	Morgan (1985)
A. latus	40.48	0.26	-0.97	0.60	0.55	14	Samuel & Mathews (1987)
A. berda	37.35	0.33	-0.35	0.39	0.68	14	Samuel & Mathews (1987)
A. cuvieri	81.86	0.28	-0.55	0.36	0.70	11	Samuel & Mathews (1987)
A. bifasciatus	34.90	0.19	-2.24	0.037	0.96	21	Samuel & Mathews (1987)
M. bifasciatus	47.12	0.14	-1.69	0.40	0.67	14	Present study

of the population represented three to six-year old fish only. On the other hand, Samuel and Mathews (1987) estimated the rate of mortality of *A. bifasciatus* on only 21 fish sample. Again, the result is not reliable. An adequate number of fishes representing all age groups is, therefore, needed for reliable estimates of growth and mortality rates.

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