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POPULATION BIOLOGY OF SPARID FISHES IN QATARI WATERS : 4. GROWTH AND MORTALITY OF LONGSPINE SEA BREAM *(ARGYROPS SPINIFER)*

BY

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بيولوجية التجمع لأسماك عائلة سباريدي في المياه القطرية
٤ - معدلات النمو والوفاه في أسماك الكوفر

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تمت دراسة معدلات النمو والوفاة في أسماك الكوفر في المياه القطرية خلال الفترة من نوفمبر ١٩٩٢ حتى أكتوبر ١٩٩٣ . وقد أوضحت نتائج هذه الدراسة أن أقصى عمر يمكن أن تصل إليه هذه الأسماك هو ١٨ عاماً .

وأظهرت الدراسة أيضاً أن معدلات النمو كانت أعلى ما يمكن عند نهاية السنة الأولى من العمر ثم أخذت تتناقص تدريجياً مع التقدم في العمر . من ناحية أخرى كانت قيم معدلات الوفاه اللحظية والوفاة الطبيعية والوفاة الناتجة عن الصيد على التوالي هي ٤٣ , ، ٢٩ , ، ١٤ , في حين بلغ معدل الإعاشة ٦٥ , .

Key words : Sea bream, Sparidae, *Argyrops spinifer*, Age, growth, mortaliity, Arabian Gulf, Qatar.

ABSTRACT

Age, growth and mortality of longspine seabream, *Argyrops spinifer* in the Arabian Gulf waters off Qatar were investigated. The study was conducted on 664 fish obtained from Qatar National Fishing Company. The results revealed that the maximum age of studied fish was 18 years. The length / scale relationship was L (cm) = - 7.1478 + 0.232TS (r=0.925). The relationship between total length (cm) and total weight (g) was best fit by a curvilinear equation : W = $0.0398TL^{2.7376}$. The Von Bertalenffy growth equation obtained from back - calculated data was :

$$L_t = 81\ [\ 1 - e^{-0.094\ (t\ +\ 1.08)}\ ].$$

Estimated instantaneous total mortality estimate (Z), natural mortality (M) and fishing mortality (F) were 0.43, 0.29 and 0.14/ year , respectively.

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INTRODUCTION

Fishes of family *Sparidae* are among the most important fishes in the world. They are highly esteemed in the Arabian Gulf region [1 - 3]. 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.

Despite the vital ecenomic importance of sparid fishes in the Gulf region, little is known on their biology, feeding habits, reproduction patterns, abundance and population dynamics. The present study throws some light on the age, growth and mortality of longspine seabream, *Argyrops spinifer* in the Arabian Gulf waters off Qatar.

MATERIALS AND METHODS

The present study was conducted on 664 fish (combined sexes) collected from November 1993 through October 1994. Monthly random samples representing *A. spinifer* population in Qatari waters obtained from Qatar National Fishing company. A wide range of size (14 - 74.5 cm total length) were sampled. For each fish, the total length (cm), total weight (g) and sex were recorded.

The fish ages were determined using the scales reading methods. 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, integment and dirt and washed in tap water. 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 eye micrometer. Scales were read from the nucleus along the anterior radius. Several examined scales have shown various degrees of resorption, and in turn, were not used for age determination.

It should be mentioned that the ages were not validated. In addition, fish over 70 cm in length were not aged because it was extremely difficult to read their scales. Therefore, ages may have been underestimated.

The length / scale (L/S) relationship was derived by plotting the total scale length (S) on total fish length (L). The intercept value (a) of the regression equation was used to back-calculate the fish length at the end of each year of life [4].

The length / weight (L/W) relationship was determined by fitting a least squares logarithmic regression to the date using the following equation : $W = aL^b$, where, W = total weight (g), L = total length (cm), a and b = constants.

Growth parameters were obtained from back-calculated data and were used to calculate the Von Bertalanffy [5] growth equation (VBGE) :

$$L_t = L_\infty [1 - e^{-k(t - to)}] \text{, where :}$$

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. The Bertalanffy curve was fitted using Beverton's method [6].

A simple catch curve 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. The slope of the line equals the instantaneous rate of mortality (Z), while the survival rate (S) = e^{-Z}. Since no information is available on natural mortality (M) of these fish, an indirect method was adopted to predict its value using Alverson and Carney [7] equation :

$$t_{max} \times 0.38 = (1 / K) \text{Ln} [(M + 3K) / M],$$

where : t_{max} = maximum fish age and K = growth coefficient.

RESULTS

Growth

The relationship between total fish lengths and weights was best fit by the following curvilinear equation :

$$W = 0.0398\ TL^{2.7376}$$

$$\log W = -1.3999 + 2.7376 \log L,\ r = 0.999.$$

while a linear relationship was found between scale radius and total fish length (L = - 7. 1478 + 0.232 TS, r = 0. 925). The value of the intercept (- 7. 1478) was used to back-calculate fish length and growth increment at the end of each year of life. The back-calculated lengths and weights are given in Table 1.

Table 1 . Back - calculated total lengths (L , cm) , weights (W, g) and increment (%) of *A. spinifer* in Qatari waters.

Age	Number	L	Incr. (%)	W	Incr. (%)
1	33	14.39	-	59	-
2	171	20.36	41	152	128
3	148	25.81	27	292	92
4	81	30.76	19	472	62
5	49	35.26	15	685	45
6	33	39.40	12	929	36
7	27	43.11	09	1187	28
8	12	46.50	08	1462	23
9	09	49.60	07	1744	19
10	05	52.40	05	2028	16
11	04	55.00	05	2314	14
12	03	57.31	04	2590	11
13	02	59.44	04	2862	11
14	01	61.17	03	3096	08
15	01	63.13	03	3375	09
16	01	64.74	03	3616	07
17	01	66.16	02	3838	06
18	01	67.52	02	4057	06

The VBGE representing the estimates of growth parameters, obtained from scales readings were :

$$L_t = 81\ [\ 1 - e^{-0.094\ (t + 1.08)}\ ]$$

Mortality

A. spinifer are fully recruited, and in turn, fully vulnerable to fishing at age 3. Mortality estimates were determined from the catch curve (Fig. 1). Because only few fish older than 14 years of age were caught, mortality rate (Z) was calculated based on fish aged 3 to 14 years. The estimate of total instantaneous rate of mortality was 0.43 / year (Y = 5. 61 - 0.431X, r = - 0.996). The survival rate (S) was 0.65 ($S = e^{-0.44}$). This value indicates that 64% of the fish survive per year after the third year of fish life. Natural mortality (M) was 0.29 / year. Fishing mortality was then 0.43 - 0.29 = 0.14). The annual mortality was 1 - S = 0.35.

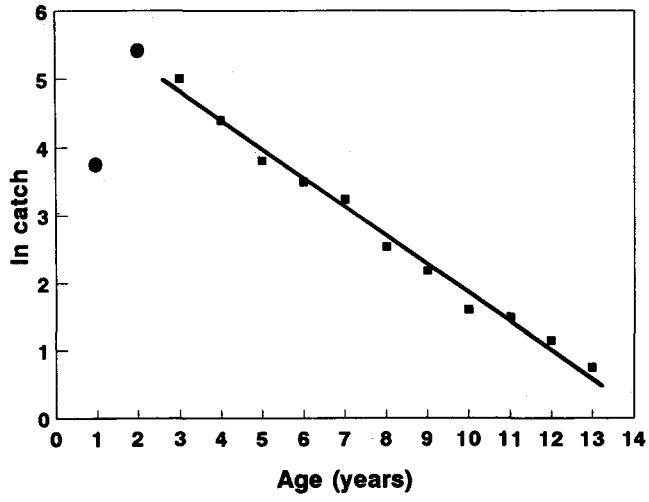

Fig. 1. Catch curve of kover in Qatari waters.

DISCUSSION

Age

Sparid fishes, in general, are long lived, displaying a steady and slow rate of growth [1, 2, 8, 9]. In the present study, the maximum age of A. **spinifer** was 18 years. This age, however, is probably an underestimate, since ages were not validated and fish 70 cm in length were excluded. Therefore, it would be safe to assume that this fish can live up to 20 years or more. Individuals of the same species have been living in Qatar Marine Aquarium for about 19 years (I. Foad, personal communication).

Growth

The value of the slope (b) of the length / weight regression of *A. spinifer* in the present study compares favorably with the values reported on *Pagrus sedecim* [10], *P. pagrus* [8] and *A. latus* [2]. It would appear therefore, that *A. spinifer* grow at a rate similar to that of these fishes. The values of b reported on other sparids (Table 2) were slightly higher, indicating a slightly better growth of these fishes than *A. spinifer*. The asymptotic length ($L \infty = 81$ cm) appears realistic, since a 75 cm fish was caught in May, 1993. In addition, a number of *A. spinifer* measuring about 75 cm are currently kept alive in Qatar Marine Aquariun (I. Foad, personal communication). Specimens measuring 79 cm were also recorded in the Gulf of Oman [11]. Generally, the maximum length of sparid fishes in the Arabian Gulf ranges from about 35 to 82 cm (Table 3).

Table 2 . Estimates of length / weight relationships of some sparid fishes (based on total lengths and total weights).

Species	a	b	Reference
P. sedecim	0.0000697	2.7385	[10].
P. pagrus	0.0000252	2.8939	[8].
P. erythrinus	0.0000270	2.9302	[12].
A. cuvieri	0.01165	3.03737	[2].
A. latus	0.02874	2.79198	[2].
A. berds	0.01713	3.01578	[2].
A. bifasciatus	0.01763	3.00075	[2].
M. bifasciatus	0.01727	3.01621	[9].
A. spinifer	0.03980	2.73761	This study.
Boops boops	0.01112	2.9166	[13].
B. salpa	0.01079	3.0560	[13].

Table 3 . Growth and mortality estimates of some sparid fishes

Species	TL	K / year	t_o	Z / year	S	t^1_{max}	Reference
P. pagrus	76.3	0.096	- 1.88	0.44	0.64	15	[8].
A. latus	43.0	0.20	-	0.97	0.38	-	[1].
A. latus	40.5	0.26	- 0.97	0.60	0.55	14	[2].
A. berda	37.4	0.33	- 0.35	0.39	0.68	14	[2].
A. cuvieri	81.9	0.28	- 0.55	0.36	0.70	11	[2].
A. bifasciatus	34.9	0.19	- 2.24	0.037	0.96	21	[2].
M. bifasciatus	47.1	0.14	- 1.70	0.40	0.67	14	[9].
A. spinifer	81.0	0.094	- 1.08	0.43	0.65	18	This study.

$^1t_{max}$ = maximum reported age.

Mortality

The rates of instantaneous mortality and survival of *A. spinifer* in the present study are comparable to that of *P. pagrus* [8], *A. cuvieri* and *A. latus* [2] and *M. bifasciatus* [9], as shown in Table 4. However, this rate was much lower than reported with *A. latus* [1] and much higher than that of *A. bifasciatus* [2].

It is clear from the present study that fishing mortality F is very low compared to natural mortality M. This may imply that the current landings of these fish are lower than what the fishery could sustain [3].

As stated earlier, mortality estimates were based on fish aging 3 - 14 years. Fish older than 14 years were excluded from the catch curve analysis. Since very old fish, sometimes, have higher mortality rates than middle age ones, our estimate of Z may be an underestimate.

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