

**BIOLOGICAL ASPECTS OF TWOBAR SEABREAM  
*ACANTHOPAGRUS BIFASCIATUS* (FORSSKÅL, 1775) IN  
WATER SURROUNDING SAMMALIAH ISLAND – ABU  
DHABI**

**Majid M. Taher**

*Department of Fisheries and Marine Resources, College of Agriculture  
University of Basrah*

**SUMMARY**

A total of 346 fish of *Acanthopagrus bifasciatus* were collected from water surrounding Sammaliah Island during September 2001 to May 2004. Lengths and weights for all fish were taken and relationship equation was obtained. Age of fishes were determined depend on scales reading and found 10 age groups from 0-group to 9+ group. Fish growth was represent by von Bertalanffy equation as follow ( $L_t = 535 [1 - e^{-0.1983(t+1.0828)}]$ ) and determine 535 mm as a maximum total length reached by this fish. Sex of 153 fish was determined and gonado somatic index was measured. It was found according to GSI and relative condition factor values that spawning period during January and February. Sex ratio was [females 93 (60.8%), males 12 (7.8%) and hermaphrodites 48 (31.4%)]. Food habits of 212 fish were studied. The main food for this fish is snails followed by crabs. It seems that feeding intensity and relative condition factor are higher during winter months than summer months.

**Introduction**

The Arabian Gulf is an extension of the Indian Ocean and has an area of about 24832 km<sup>2</sup>, while the volume of it's water is around 6000 km<sup>3</sup>, and it's average depth is 35 m (4). The Arabian Gulf waters are generally warm because of their geographical location and for their shallow depths and for the absence of cool circulating sea currents (13). The United Arab Emirates is a coastal country located on the southern side of Arabian Gulf having extensive coastlines on its west and east facing the Arabian Gulf and the Gulf of Oman respectively. The long of coastlines of UAE is 1400 km involved the coasts of islands. Al Sammaliah Island is located between 54 longitude and 24 latitude

and approximately 12 km for Abu Dhabi City (Figure, 1). The Island has an area of 13.448 km<sup>2</sup>.

*Acanthopagrus bifasciatus* belongs to Sparidae family (porgies) that occurs in tropical and temperate regions of Atlantic, Indian and Pacific Oceans. Fishes of this family are represented by 35 genera that involve 112 species (6). Ten species of this family are recorded in UAE waters (22; 5). Twobar seabream occurred in small groups and fished in UAE shallow coastal waters by gargours, seine nets and lines. It is common in UAE fish markets and has commercial importance (16).



Figure (1) Satellite picture of Al Sammaliah Island and Abu Dhabi City.

### Materials and Methods

Fish samples were collected from water surrounding Sammaliah Island during a period extended from September 2001 to May 2004 by cast and seine nets. A total of 346 fish were collected and examined. Measurements of total length (TL) and total weight (W), were taken for all fishes. Ages of 341 fish are also determined by reading their scales. The digestive canals of 212 fish were examined for feeding study. Sex determined for 153 fish and the gonads were weighted.

Linear equation  $Y = a + n \times X$  used to express relationships between total length and weight where X represented total length and Y represented other measurements, a and n are constants calculated from data (14).

The famous equation of von Bertalanffy used to represent the growth study, which has the general formula,  $L_t = L_\infty [ 1 - e^{-k(t - t_0)} ]$ , Where the time unit t represents the age of the fish measured in years from a starting time  $t_0$ ,

$L_t$  is the length of the fish at time  $t$ ,  $L_\infty$  is maximum length reached by this fish and  $k$  is the growth coefficient. The values of  $K$  and  $L_\infty$  are measured by using draft of (9) and (26), while the value of  $t_0$  be measured by the following equation that derived from von Bertalanffy equation:  $t_0 = \{ \ln (L_\infty - L_t) + K_t - \ln L_\infty \} / K$

Instantaneous growth rate ( $G$ ) was calculated using the following formula of (19),  $G = \ln (W_{t+1} / W_t)$ , Where  $W_t$  is the weight at time  $t$  and  $W_{t+1}$  is the weight at time ( $t+1$ ). Relative Condition factor ( $Kn$ ) was calculated according to the following Lecren formula (14):

$$Kn = W / \bar{W}$$

Where  $W$  is total observed weight in gram and  $\bar{W}$  is total calculated weight in gram. Sex was determined and gonado somatic index (GSI) was calculated according to following equation (25),  $GSI = (W_g / W) \times 100$ , Where  $W_g$  is gonad weight in gram and  $W$  is total fish weight in gram.

Both intestinal and stomach contents were examined to determine food materials. Point's method (12) was used, where points range from 0 (empty canals) to 25 (filled canals). In addition to points the frequency of kinds of food also used to give more information about food materials. Feeding intensity was calculated according to the following equation of (10):

$$\text{Feeding Intensity} = \text{Sum of feeding points} / \text{No. of feeding fish}$$

Feeding activity was calculated according to the following equation (7):

$$\text{Feeding Activity} = (\text{No. of feeding fish} / \text{No. of examined fish}) \times 100.$$

## Results and Discussion

### 1- Length distribution and length weight relationship

The distribution of total length frequency for all 346 fish was shown in figure (2). Table (1) illustrates that there are 28 length groups with dominant group of 280- 289 mm (12.7% of total fish), followed by group 270-279 mm (10.7% of total fish). Total length of fish range from 159 to 420 mm and weight from 73 to 1520 g. Length frequency study of twobar seabream in Gulf of Aden pointed that fork length range is 187-417 mm (8). The survey of (5) stated the smallest fish for twobar seabream and yellowfin seabream is 190 mm and for king soldierbreem is 160 mm. Figure (3) show the relationship between total length and weight, where slope value was 3.1339. Length-weight equation for twobar seabream in Kuwaiti waters was  $W = 0.0176 + 3.001 \times TL$  (20), while

(8) found that this relationship for the same species in Gulf of Aden is ( $W = 0.039 + 2.91 \times TL$ ).

## 2- Age and Growth

Table (2) shows the average measurements for 9 age groups (from 1+ group to 9+ group). Figure (4) show Ford and Walford draft that represented the relationship between lengths at time  $t$  and lengths at time  $t_{+1}$ , so growth of this species were represented by the following von Bertalanfy equation:

$$L_t = 535 [1 - e^{-0.1983(t+1.0828)}]$$

The value of  $L_\infty$  for *A. bifasciatus* was 535 mm, while the previous studies indicate different values. Maximum total length of 339 mm for this species in UAE waters mentioned by (5), while (21) mentioned maximum total length of 500 mm in Somalia waters. Maximum total length of 318 mm for *A. bifasciatus* in Gulf of Aden recorded by (8), while Pauly (18) recorded maximum total length of 481 mm in Gulf of Aden at depth 50 m, and (20) recorded 349 mm as maximum total length in Kuwaiti waters. Maximum total length recorded for relatives seabreams are 900 mm for *A. berda*, 800 mm for *Rhabdosargus sarba*, 700 mm for *Argyrops spinifer*, 500 mm for *A. datnia*, *A. latus*, *Sparidentex hasta* and 300 mm for *Crenidens crenidens* and *Diplodus sargus kotschyi* (11).

**Table (1): Relative condition factors of different length groups for twobar seabrea.**

Length Group	No. of Fish	Total Length (mm)	Observed Weight (g)	Calculated Weight (g)	Relative Condition Factor	Standard Deviation
150-159	1	159	73	77.08	0.9471	-
160-169	1	164	91	84.93	1.0714	-
170-179	3	175	104.7	104.16	1.0068	0.0595
180-189	3	183.7	120.7	121.29	0.9933	0.067
190-199	9	195.4	143.5	147.14	0.9757	0.0513
200-209	9	208.8	168.4	167.16	0.9783	0.042
210-219	14	213.6	196.4	193.87	1.0111	0.0484
220-229	13	224.3	222.2	226.72	0.9804	0.0552
230-239	21	233.8	262.05	258.14	1.0155	0.0735
240-249	23	245.8	301.3	302.12	0.9972	0.0729
250-259	28	253.5	328.5	332.69	0.9877	0.0579
260-269	24	264.6	386.8	380.37	1.0161	0.0691
270-279	37	274.1	431.5	424.82	1.0158	0.0624
280-289	44	284.4	480.2	476.9	1.0071	0.0578
290-299	18	293.9	530.9	528.62	1.0033	0.0696
300-309	15	303.7	594.7	585.75	1.0155	0.0667
310-319	21	313.6	654.5	647.75	1.0106	0.0533
320-329	13	324.4	720.6	720.32	1.001	0.0749
330-339	17	333.5	779.5	785.63	0.9912	0.0845
340-349	10	345.2	876.1	875.14	1.001	0.1042
350-359	3	354.3	940.3	949.97	0.989	0.0342
360-369	6	366	1028	1051.34	0.9776	0.0725
370-379	3	373.3	1130	1118.68	1.0103	0.0367
380-389	3	384	1263.7	1222.23	1.034	0.0374
390-399	3	392.3	1315.3	1307	1.0069	0.0916
400-409	2	404.5	1408.5	1438.74	0.9808	0.0734
410-419	1	416	1264	1570.21	0.804988	-
420-429	1	420	1520	1618.0132	0.9394	-

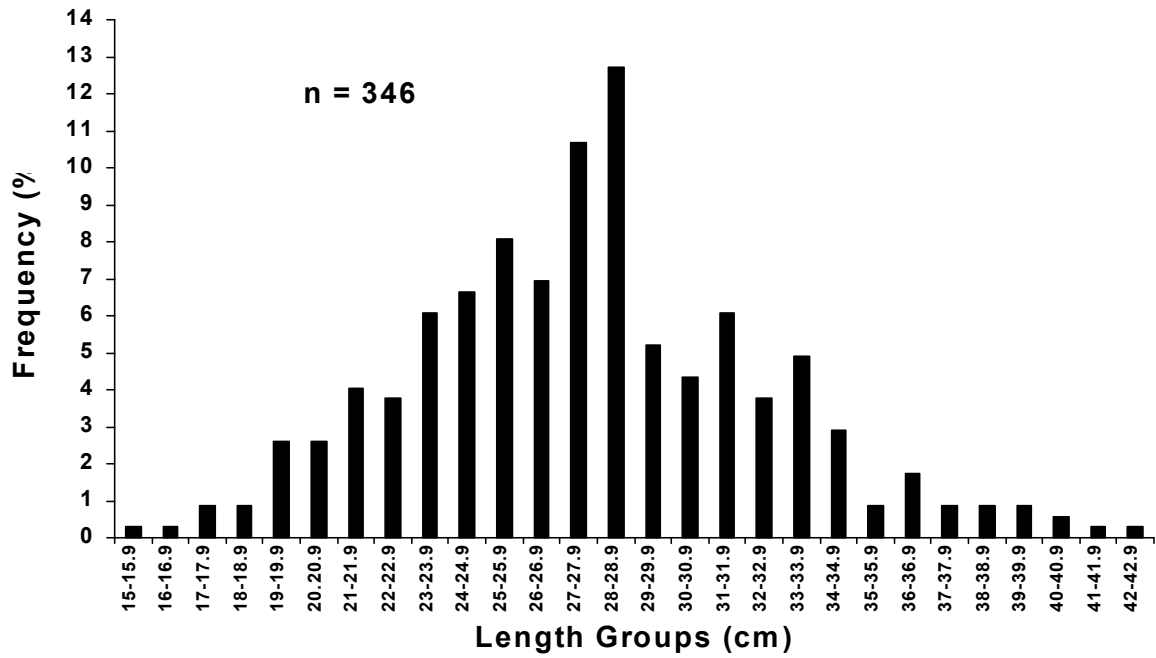


Figure (2): Frequencies of total length groups for two-bar seabream.

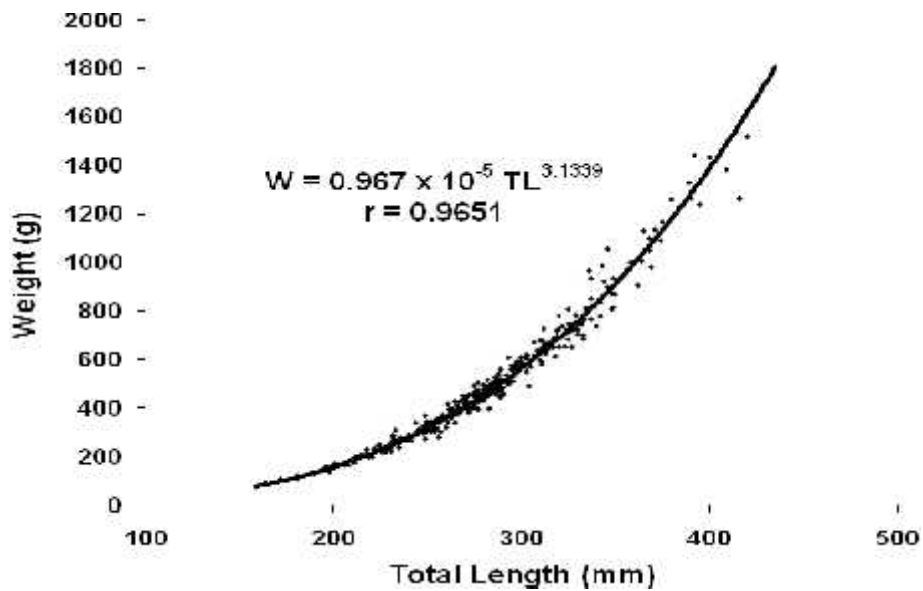
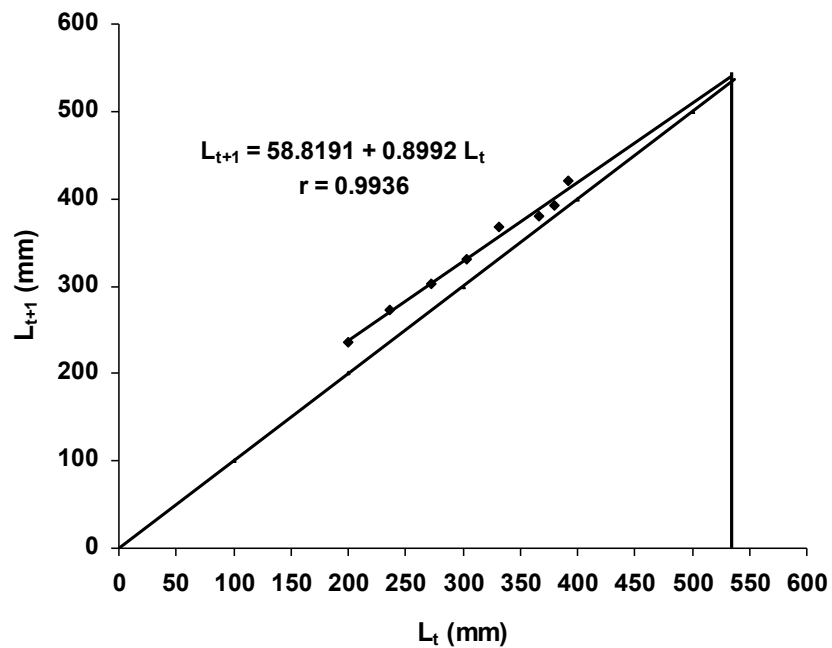


Figure (3): Relationship between total length and weight of two-bar seabream.

**Table (2): Instantaneous growth rate of different age groups for twobar seabream.**

Age Group	Fish No.	Observed T.L. (mm)	Calculated T.L. (mm)	Observed Weight (g)	Calculated Weight (g)	I.G.R. (G)
1+	76	235.9	181	270.6	115.7	
2+	120	272.3	244.7	428.4	297.7	0.9451
3+	73	303.3	296.9	604.4	545.6	0.6058
4+	30	331.3	339.7	765.8	832.1	0.4221
5+	5	367	374.9	1037	1133.4	0.3090
6+	6	379.3	403.7	1191.3	1429.3	0.2319
7+	6	391.5	427.3	1251.7	1707.8	0.1780
8+	1	420	446.7	1520	1962.8	0.1392
9+	1	400	462.6	1434	2190.1	0.1096



**Figure (4): Ford and Walford draft for the relationship between lengths at time t and  $t_{+1}$  of twobar seabream.**

The value of calculated lengths from above growth equation and related value of calculated weights from length-weight logarithmic equation are shown in table (3). Maximum value for instantaneous growth rate (0.9451) was recorded between age 1+ and age 2+, then the values decreased with age reaching to the minimum (0.1096) between age 8+ and age 9+ (table, 3). It is well known that most organisms have rapid growth rate during early stages of life, which became slowly or stopped at all during progress stages of life. Figure (5) shows the differences in the values of relative condition factor for different length groups of *A. bifasciatus*. These values range from (0.8050-1.0340), with an average of 0.9917. Generally there aren't differences between relative condition factors with the size of fish.

Table (3) shows the values of total length, observed weight, calculated weight and relative condition factor for different months. It seems that the value of relative condition factors is higher in winter months than in summer months (Figure, 13). This result may be related to very high temperature (36 °C) for more than two months during summer, which retard feeding process and growth. It is necessary also to mention here that this very high temperature is very close to lethal temperatures for most fishes around the world. Too much mortalities occur during summer months for twobar seabream and other UAE fishes reared in floating cages at the same area of fish sampling (Personal Observations). It is concluded from average value (1.0004) of relative condition factor of different months that this fish are well being in the water surrounding Sammaliah Island. Relative condition factor also related to reproduction cycle where it is increased at maturation period and decreased after spawning. Values of relative condition factor begin to increase from October and reach maximum value (1.0565) at December, and then begin to decrease after spawning till reaching the minimum value (0.9416) at September. It is supposed from these results that spawning of twobar seabream may be beginning at January.

### **3- Food Habits**

Table (4) shows monthly differences in feeding activity and feeding intensity (Points/fish) of twobar seabream. Feeding activity values for most months are 100%, except for May, July and September where the values decreased to (94.6, 95 and 85.7) % respectively. Maximum value (11.4) of feeding intensity occurs during November and December, while the minimum (7.1) occurs during September, with an average of 9.6. It seem that feeding intensity are high during winter months (November-February) and low during summer

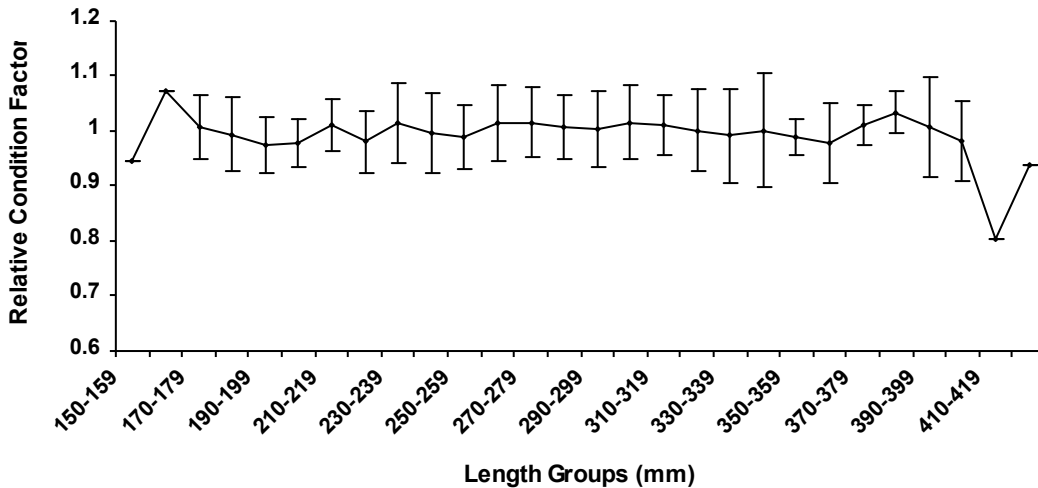


**Table (3): Values of total length, observed weight, calculated weight and relative condition factor for different months of twobar seabream.**

Month	Fish No.	T.L. (mm)	T.W. (g)	Observed T.W. (g)	R.C.F	S.D.
January	24	310	648.7	643.8	1.0138	0.0707
February	19	300.4	548.7	575.4	1.0142	0.061
March	20	296.1	575.8	564.2	1.0388	0.0937
April	12	327.2	761.4	765.7	1.0003	0.06
May	25	321.7	718.8	731.7	0.9888	0.0604
July	8	287	489.1	494.1	0.9868	0.0556
August	1	279	427	449	0.951	0
September	8	313.1	633.6	694.5	0.9416	0.0805
October	7	313.9	695	695.3	1.0033	0.0612
November	7	332.3	788.7	783.2	1.0094	0.0324
December	21	322.8	805.6	768.4	1.0565	0.0846

**Table (4): Monthly differences in summation and average food points with feeding intensity and activity of twobar seabream.**

Month	Examined Fishes	Feeding Fish	Non Feeding Fish	Sum of points	Feeding Intensity (points/ fish)	Feeding Activity
January	26	26	0	260	10	100
February	14	14	0	145	10.4	100
March	19	19	0	175	9.2	100
April	16	16	0	150	9.4	100
May	37	35	2	330	8.9	94.6
June	4	4	0	30	7.5	100
July	20	19	1	150	7.5	95
August	13	13	0	115	8.8	100
September	7	6	1	50	7.1	85.7
October	28	28	0	280	10	100
November	7	7	0	80	11.4	100
December	21	21	0	240	11.4	100
$\Sigma$	212	208	4	2045	-	-



**Figure (5) Relative condition factor for different length groups of twobar seabream.**

months (May-September), with moderate values of 9.2 and 9.4 during March and April respectively. This result may be related also (as we mentioned about relative condition factor) to very high temperature (above 30 °C) at summer months, which retard feeding process and reduced feeding intensity. This result can be supported also by twobar seabream fish behavior at obvious shallow waters in Sammaliah Island during very hot summer months, where they didn't bite live crabs in the hooks (Personal Observations).

Table (5) illustrates monthly differences in feeding ratio and frequency of twobar seabream. Main food of twobar seabream is snails that comprise 39.5% of food materials, followed by crabs that comprise 18.7%, with low importance starfish that comprise only 4.4% of food materials. This result may be related to the indigestible calcareous shells of snails that accumulated in fish stomachs. The main foods of juveniles and adults twobar seabream are zoobenthos, benthic crustaceans, mollusks and worms (17). Mollusks are recorded as the first main food in king soldierbream and goldlined seabream, and also as important food in black seabream, yellowfin seabream and natal pandora (11). It seems that the ratio of crabs in fish stomachs are high during hot summer 44.2, 33.8 and 31.1 for July, August and October respectively, except for September 5.9, while it is low during winter months from November 17.8 to April 6.1 (Table, 5). At the same time it is noticed that frequency of crabs in fish stomachs are higher during summer months than winter months. These results may be related to high abundance of crabs in

**Table (5): Monthly differences in ratio and frequency of different food materials found in twobar seabream stomachs.**

Month	Crabs		Snails		Starfish		Unidentified Matters	
	Ratio%	Freq.%	Ratio%	Freq.%	Ratio%	Freq.%	Ratio%	Freq.%
January	10.8	26.9	37.5	61.5	1.7	11.5	49.6	69.2
February	25	42.8	24.3	50	0.7	7.1	50	57.1
March	8.4	26.3	43.1	57.9	0	0	48.7	52.6
April	6.1	18.8	52.8	87.5	0	0	41.8	81.2
May	18	34.3	52.4	80	0	0	29.6	77.1
June	7.5	25	27.5	75	0	0	65	100
July	44.2	78.9	30.8	94.7	0	0	25	63.1
August	33.8	84.6	39.2	100	2.3	7.7	24.6	61.5
September	5.9	50	27	100	1.3	16.7	64.2	100
October	31.1	60.7	27.1	50	0	0	41.8	78.6
November	17.8	57.1	52.8	83.3	0	0	29.3	83.3
December	16.4	42.8	60	95.2	1.7	9.5	21.9	42.9
Average	18.75	45.6833	39.5417	77.925	0.6417	4.375	40.9583	72.2167

**Figure (6): Gonad pictures for different sexes of twobar seabream.**



**Table (6): Monthly differences in gonado somatic index of twobar seabream.**

Month	Females			Males			Hermaphrodites		
	Fish No.	GSI	SD	Fish No.	GSI	SD	Fish No.	GSI	SD
January	8	0.748	0.430	7	0.525	0.184	9	0.509	0.153
February	1	0.16	-	-	-	-	11	0.464	0.217
March	7	0.309	0.246	-	-	-	11	0.206	0.093
April	3	0.408	0.123	-	-	-	9	0.351	0.175
May	11	0.334	0.137	2	0.538	0.167	7	0.266	0.085
June	-	-	-	-	-	-	-	-	-
July	8	0.213	0.134	-	-	-	-	-	-
August	1	0.445	-	-	-	-	-	-	-
September	3	0.337	0.081	-	-	-	-	-	-
October	3	0.392	0.345	-	-	-	-	-	-
November	7	0.377	0.243	-	-	-	-	-	-
December	7	1.626	1.561	4	1.345	1.872	3	0.433	0.135

Sammaliah Island during summer months comparing with winter months (Personal Observations). The result of low feeding ratio in September may be related to small number of examined fish and also to maximum ratio of unidentified food materials (64.2)% and maximum frequency (100). Generally the ratios of snails are high during winter months and low during summer months. This may be a result of low ratio of crabs during winter months because of low abundance in water. It seemed that starfish have low importance in food of twobar seabream comparing with snails and crabs.

#### **4-Sex Ratio and GSI**

Sex was determined for 153 fish, from these 93 (60.8%) are females, 12 (7.8%) are males and 48 (31.4%) are hermaphrodites. From 354 of sobaity seabream studied in Kuwaiti waters there are 83 (23.4%) females, 252 (71.2%) males and 19 (5.4%) hermaphrodites (1). There are too many differences in sex structure between twobar seabream in this study and it's relative sobaity seabream in Kuwaiti waters. It has been stated that picnic seabream was a protandrous hermaphrodite fish (3). Figure (6) shows gonad pictures of female, male and hermaphrodite of twobar seabream.

Table (6) shows monthly differences in gonado somatic index (GSI) for different sexes of twobar seabream. There is a decreased in GSI of females from 1.6264 at December to 0.7476 in January, followed by suddenly decreased to 0.16

at February. Also there is a suddenly decreased in GSI of males from 1.3435 at December to 0.5253 at January. It may be concluded from these differences in GSI of females and males that spawning of twobar seabream occurs during January and February. This fact supported by previous conclusion of relative condition factor values, that spawning begins at January. It has been stated that major spawning period for sobaity seabream in Kuwaiti waters extending from January to March, while GSI values increased dramatically in January, reaches its peak value in February, remains at the high levels in March and then decreases in April (1), while (15) stated that spawning of sobaity seabream in Kuwaiti waters occurs during February to March. Major spawning period for *Pomadasyus argenteus* in Kuwaiti waters extending from February to April (2). The spawning period for picnic seabream in Australia extending from June to September (23), while spawning periods in South Africa for picnic seabream extending from May to August, and for goldlined seabream from July to November (25).

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**الصفات الحياتية لأسماك الفسك (Acanthopagrus bifasciatus (Forsskål, في المياه المحيطة بجزيرة السماوية، أبوظبي 1775)**

ماجد مكي ظاهر

قسم الاسماك، كلية الزراعة، جامعة البصرة، العراق

**الملخص**

اصطيدت 346 سمكة من المياه المحيطة بجزيرة السماوية في أبوظبي خلال الفترة من سبتمبر 2001 إلى آيار 2004، وأخذت قياسات الأطوال والأوزان، كما حددت المعادلة التي تمثل العلاقة بين هذه القياسات. تمت قراءة الحراشف وحددت عشرة مجاميع عمرية من عمر أقل من سنة إلى عمر تسع سنوات وتمت دراسة عمر ونمو هذه الاسماك حيث وجد أن معادلة فون برتلانفي هي  $(L_t = 535 [1 - e^{-0.1983(t+1.0828)}])$  من قيم دالة المناسل وقيم معامل الحالة النسبي وجد أن عمليات التكاثر ووضع البيض تحدث خلال شهري كانون الثاني وشباط، كما وجد إن عدد الإناث في هذه الاسماك 93 وبنسبة (60.8%) وعدد الذكور 12 وبنسبة (7.8%) وعدد الأسماك الخنثية 48 وبنسبة (31.4%). تم فحص القناة الهضمية للتعرف على طبيعة الغذاء، حيث وجد إن الغذاء الرئيسي لهذه الاسماك هو المحار ومن ثم سرطان البحر. وجد إن شدة التغذية ومعامل الحالة النسبي يكونان أعلى خلال أشهر الشتاء من أشهر الصيف الحارة.