J.K.A.U.: Mar. Sci., **Vol. 2**, pp. 111-122 (1411 A.H./1991 A.D.)

Biochemical Composition of Gilthead Bream *Sparus aurata* L. from Lake Bardawil (Egypt)

ELHAM A. WASSEF and M.B. SHEHATA
National Institute of Oceanography and Fisheries, Alexandria, Egypt

ABSTRACT. Protein, lipids, moisture and ash contents of the edible muscles of gilthead bream *Sparus aurata* L. were estimated for fish of different sizes, and sexes, and in different months. On fresh weight basis, percentage crude protein ranged from 17.6-22.5%, lipids from 1.6-4.9%, moisture 71.2-78.8%, and ash from 1.1-1.6%.

Moisture and ash contents showed limited degree of variability, whereas lipids content showed the highest particularly for females. Both protein and lipid percents increased with the increase in fish size. Highest values of these two components, were obtained in summer (July to September) and lowest values in winter (October to December) which coincided with the spawning season. Male and female fish have almost the same composition.

Highly significant inverse relationship was established between moisture and lipids contents of the species. The regression equations representing this relation were arrived at. Estimates of percentage lipids could be deriven by using the easily obtainable moisture percent.

Introduction

Gilthead bream *Sparus aurata* has been the main economical resource of traditional lagoon fishing and extensive farming all around the Mediterranean. Interest in gilthead bream culture has recently developed in Egypt. The species is highly esteemed and brings a relatively high market price. Bardawil lagoon, Northern Sinai, constitutes a major fishery resource for sea breams, particularly in winter months (December to February) when the fish traped during migration to the sea for spawning. The yield was five times as much as that of the Egyptian Mediterranean waters (El Zarka and Koura 1965). Sea breams contributed to an average of 58% of total fish production of the lagoon (El Shereif 1988).

Studies on the nutritional value of sea bream would be highly desirable and are of paramount importance. The main objectives of the present work are to determined

the nutritive value of sea bream's muscles and to investigate the variability of each of the four main constituents namely: protein, lipids, moisture and ash. It is hoped that these information will be useful for biologists, dietecians and food technologists.

Previous reports on the subject have been given for the species, taken from the Egyptian Mediterranean waters of Alexandria, by El Saby 1934, Eisa and Zaki 1963, Wassef 1978 & 1985c and Khalil *et al.* 1986 and in other areas by Marias and Kissil 1979.

Material and Methods

1. Sampling

Gilthead bream were monthly collected from the commercial catch at Tulul center of Bardawil lagoon. Sampling extended for a whole year, from December 1985 to December 1986. Freshly caught fish were transported immediately, into iced boxes, to the laboratory. Investigation were carried out shortly after capture. Fish were measured (mm), weighed (g), and maturity stages were assigned adopting Wassef's scale (1985a). The fish were divided into sexually immature and mature groups, which were further subdivided to the following categories :

A. Juveniles or fingerlings (less than 10 cm), which were only obtainable in May.

B. Youngs or subadults (10-20 cm).

C. Adults or mature (over 20 cm) that can be differentiated to either male or female fish.

The last group was classified to two groups according to sex. From each category, ten samples were skinned, fillted and homogenized together for proximate composition analyses, using an Edmund-Buhner H04 homogenizer.

2. Analytical procedures

2.1 Moisture content

This was determined by oven drying the muscle samples at 105°C until constant weight (about 4 h).

2.2 Total lipids

Total lipids was assayed, on fresh mucles, by Smith *et al.*'s (1964) modification of the chloroform-methanol unheated extraction procedure of Bligh and Dyer (1959). This was found to extract quantitatively both polar and non-polar lipid fractions, unlike single solvent extraction procedures such as with ether (Stirling 1972).

The Floch *et al.*'s (1957) lipid extraction by heating, was also adopted on the same samples, using the same solvents, for the purpose of comparison. Both methods gave similar results which did not differ by more than 0.5%.

2.3 Crude protein

Crude protein was obtained by measuring total nitrogen, adopting a modified micro Kjeldahl procedure (El-Aggan 1982), using silinate and copper sulphate as a catalyst for the digestion. The value for protein nitrogen was multiplied by a factor of 6.25, which assumes that the fish protein contains 16% nitrogen, to obtain the

amount of protein (Love 1970). Percentage protein was then converted to wet weight basis.

2.4 Ash content

Ash content was determined by ignition of dried samples into a muffle furnace at 600°C over night (about 17 h).

All subsequent results shown below are the mean of at least three determinations with further repeats if necessary. Total fish length was used throughout this study and sexes were kept separate.

3. Statistical analysis

Mean value ($\bar{X}$), standard deviation (s.d.), coefficient of variance (C.V.) and correlation coefficient (r) were all calculated according to Steel and Torrie (1980).

Results

As the four major constituents of fish muscles, namely: protein, lipids, moisture and ash are usually affected by various factors such as fish size, sex, stage of maturity and month of capture it is essential therefore to take these factors into account. In general, the edible flesh of gilthead bream contains 17.2-22.5% protein (Table 1), 1.6-4.9% lipids (Table 2), 71.2-78.8% moisture (Table 3) and 1.1-1.6% ash (Table 4).

1. Protein content

Average protein content slightly increased with further increase of fish size (Table 1). Percent protein of juveniles (18.1%) and youngs (19.1%) were slightly lower than that of adults (about 20.6%). Variations of protein content were tested to be insignificant among opposite sexes (20.8% for males and 20.4% for females).

TABLE 1. Monthly variations of mean percentage crude protein in body muscles of *Sparus aurata*, caught from Bardawil lagoon.

Month	% Crude protein*			
	Juveniles	Youngs	Adults T.L. (cm) > 20	
	T.L. (cm) < 10	T.L. (cm) 10-20	Males	Females
December, 1985		18.6 ± 0.06	18.9 ± 0.09	18.8 ± 0.1
April, 1986		19.3 ± 0.1	20.5 ± 0.1	20.8 ± 0.1
May	18.1 ± 0.12	18.8 ± 0.1	21.0 ± 0.2	20.9 ± 0.2
June		19.2 ± 0.2	20.9 ± 0.1	21.2 ± 0.1
July		20.7 ± 0.1	21.4 ± 0.1	21.9 ± 0.1
August		21.0 ± 0.1	22.0 ± 0.3	22.5 ± 0.2
September		18.8 ± 0.1	22.3 ± 0.2	22.2 ± 0.3
October		18.7 ± 0.3	22.1 ± 0.2	19.9 ± 0.2
November		18.7 ± 0.2	21.9 ± 0.1	20.6 ± 0.1
December		17.6 ± 0.2	18.2 ± 0.1	17.7 ± 0.1
Average	**18.1**	**19.1**	**20.8**	**20.4**

* on fresh weight basis. ± standard deviation. T.L. total length.

Monthly variations showed highest values of percent protein in July and August for youngs, in August for females (22.5%) and in September for males (22.3%). Whereas, the lowest values for the three size-classes were recorded always in December.

2. *Lipids content*

Likewise, lipids content was found to increase with fish size (about 2.0, 3.6 & 4.4% for the three size-classes respectively). Average percent lipids showed insignificant differences between male and female fish (about 3.0 & 3.1% respectively).

Marked monthly fluctuations in lipids content were noticed (Table 2) particularly for adults. Highest values were detected in May and June (3.6 & 3.8% respectively) for youngs and in May, June and July (4.2-4.9%) for adults. Whereas the lowest values were recorded in October, particularly for females (1.6%).

TABLE 2. Monthly variations of mean percentage crude lipids in body muscles of *Sparus aurata*, caught from Bardawil lagoon.

Month	% Crude lipids*			
	Juveniles	Youngs	Adults T.L. (cm) > 20	
	T.L. (cm) < 10	T.L. (cm) 10-20	Males	Females
December, 1985		2.2 ± 0.05	2 ± 0.06	1.9 ± 0.04
April, 1986		2.9 ± 0.04	2.9 ± 0.08	3.8 ± 0.09
May	1.98 ± 0.08	3.6 ± 0.08	4.6 ± 0.1	4.2 ± 0.1
June		3.8 ± 0.1	4.7 ± 0.1	4.7 ± 0.2
July		2.9 ± 0.2	4.8 ± 0.09	4.9 ± 0.08
August		2.6 ± 0.08	2.9 ± 0.1	3.1 ± 0.1
September		2.5 ± 0.06	2.6 ± 0.05	2.9 ± 0.06
October		1.9 ± 0.1	1.8 ± 0.08	1.6 ± 0.08
November		2.0 ± 0.09	2.0 ± 0.1	1.8 ± 0.3
December		2.4 ± 0.05	2.1 ± 0.04	1.9 ± 0.1
Average	**1.98**	**2.68**	**3.04**	**3.08**

* on fresh weight basis, ± standard deviation, T.L. total length.

3. *Moisture content*

Percent moisture showed a tendency to decrease with further increase in fish size (78.8, 75.6 & 75.1% for the three size-classes respectively). Highest records were distinguished in December whereas the lowest were obtained in September for youngs, or July for adults (Table 3). Differences due to sex variations were tested to be insignificant (approximately 75% for both males and females).

TABLE 3. Monthly variations of mean percentage moisture in body muscles of *Sparus aurata*, caught from Bardawil lagoon.

Month	% Moisture			
	Juveniles	Youngs	Adults T.L. (cm) > 20	
	T.L. (cm) < 10	T.L. (cm) 10-20	Males	Females
December, 1985		77.6 ± 0.6	77.5 ± 0.1	77.9 ± 0.09
April, 1986		75.6 ± 0.4	75.9 ± 0.2	75.1 ± 0.1
May	78.8 ± 0.4	75.1 ± 0.3	74.2 ± 0.2	73.5 ± 0.2
June		75.9 ± 0.1	73.5 ± 0.3	72.2 ± 0.1
July		75.4 ± 0.1	72.7 ± 0.1	71.2 ± 0.3
August		75.0 ± 0.08	73.8 ± 0.2	73.9 ± 0.1
September		74.2 ± 0.06	75.2 ± 0.06	75 ± 0.05
October		75.4 ± 0.1	76.8 ± 0.2	76.9 ± 0.7
November		76.5 ± 0.09	76.2 ± 0.1	76.1 ± 0.7
December		77.9 ± 0.06	77.9 ± 0.4	78.2 ± 0.2
Average	**78.8**	**75.6**	**75.3**	**74.9**

± standard deviation, T.L. total length.

4. *Ash content*

Percentage ash was more or less a constant value (about 1.4%) for all sizes, sexes and months except for juveniles which showed the lowest value (1.1%) (Table 4).

TABLE 4. Monthly variations of mean percentage ash in body muscles of *Sparus aurata*, caught from Bardawil lagoon.

Month	% Ash*			
	Juveniles	Youngs	Adults T.L. (cm) > 20	
	T.L. (cm) < 10	T.L. (cm) 10-20	Males	Females
December, 1985		1.4 ± 0.02	1.5 ± 0.07	1.5 ± 0.1
April, 1986		1.4 ± 0.06	1.3 ± 0.07	1.3 ± 0.1
May	1.1 ± 0.08	1.4 ± 0.97	1.4 ± 0.05	1.4 ± 0.07
June		1.4 ± 0.04	1.4 ± 0.09	1.5 ± 0.04
July		1.4 ± 0.06	1.5 ± 0.09	1.5 ± 0.1
August		1.4 ± 0.05	1.4 ± 0.06	1.4 ± 0.08
September		1.5 ± 0.07	1.5 ± 0.08	1.5 ± 0.1
October		1.6 ± 0.08	1.5 ± 0.1	1.5 ± 0.09
November		1.3 ± 0.1	1.5 ± 0.1	1.6 ± 0.06
December		1.4 ± 0.07	1.5 ± 0.09	1.5 ± 0.1
Average		**1.4**	**1.45**	**1.47**

* on fresh weight basis, ± standard deviation, T.L. total length.

5. *Lipid-moisture relationship*

An inverse relationship between lipid and moisture contents of gilthead bream was evident (Table 5), *i.e.* an increase in the proportion of one leads to a decrease in the

other. The following regression equations were arrived at to represent this relationship :

$$\left.\begin{aligned} W &= 79.02 - 0.98\ F \\ F &= 75.40 - 0.95\ W \end{aligned}\right\} \text{for youngs}$$

$$\left.\begin{aligned} W &= 78.9 - 1.17\ F \\ F &= 67.4 - 0.85\ W \end{aligned}\right\} \text{for males}$$

$$\left.\begin{aligned} W &= 79.19 - 1.42\ F \\ F &= 55.62 - 0.70\ W \end{aligned}\right\} \text{for females}$$

where W & F are percentage water and fat respectively.

Furthermore, it was noticed that the sum of percentage of the two components made up nearly a constant value of about 78.9, 78.6 & 78.1 for youngs, males and females respectively, at all levels of fat accumulation (Table 5).

TABLE 5. Lipid (F) moisture (W) relationship in the muscles of *Sparus aurata*

Fish size	Mean percentage				
	Obs.		Calc.		Sum of
	(F)	(W)	(F)	(W)	(F + W)
Youngs	1.9	77.30	1.9	77.3	79.20
	2.45	76.05	2.7	76.1	78.50
	3.70	75.50	3.7	75.5	79.20
Means ± s.d.					78.9 ± 0.4
Males	1.80	76.80	1.80	76.80	78.80
	2.4	76.90	2.30	76.20	79.30
	4.70	73.30	4.70	73.40	78.00
Means ± s.d.					78.6 ± 0.65
Females	1.75	77.75	1.30	77.40	79.50
	2.90	74.80	2.90	74.80	77.70
	3.45	74.50	3.45	74.50	77.90
	4.80	72.40	4.83	72.30	77.20
Means ± s.d.					78.07 ± 0.99

s.d. = standard deviation.

6. *Interrelation between the Four Constituents*

6.1 *Coefficient of Variance (c.v.)*

For the purpose of comparison between the degree of variability of each component throughout the whole year, coefficient of variance (c.v.) was calculated (Table 6). Results have shown that lipids have the highest degree of variation (c.v. = 38), among other constituents. Moisture, on the other hand, showed the lowest c.v. value

(1.7). This pointed out that lipid content is the most subjected to monthly or seasonal variations. Protein and ash contents are less affected, and moisture content is the least component influenced by such variations.

TABLE 6. Coefficient of variance (c.v.) of mean percentage: protein, lipid, moisture and ash in body muscles of *Sparus aurata* caught from Bardawil lagoon.

Fish size		Crude protein			Lipids			Moisture			Ash		
		Range (%)	$\bar{X} \pm sd$	c.v.	Range (%)	$\bar{X} \pm sd$	c.v.	Range (%)	$\bar{X} \pm sd$	c.v.	Range (%)	$\bar{X} \pm sd$	c.v.
Youngs T.K. (cm) 10-20		18.6-21.0	19.1±1.0	5.2	1.9-3.7	3.0±0.5	18.5	73.9-77.9	75.7±1.3	1.7	1.3-1.6	1.4±0.07	6.3
Adults T.L. (cm) >20	Males	18.9-22.3	20.9±1.2	5.9	1.7-4.8	3.3±1.2	37.5	72.2-78.7	75.4±1.8	2.4	1.3-1.5	1.4±0.06	6.8
	Females	18.8-22.5	20.4±1.2	6.2	1.6-4.9	3.3±1.2	38.0	71.3-78.6	75.1±2.4	3.2	1.3-1.6	1.5±0.09	6.0

$\bar{X}$ = mean percentage, sd = standard deviation, T.L. = Total length.

It is also noticed that fish-size variations greatly influenced lipid content (c.v. = about 18.5 for youngs & 38 for adults). Estimates of the corresponding values for protein, moisture or ash contents were much more smaller indicate a lesser degree effect of fish size on these components. Proximate composition of adult's muscles is more subjected to variations than that of youngs. It is obvious also that the effect of sex on either of the four constituents is almost negligible (Table 6).

6.2 Correlation Coefficient (r)

The relationship between the four components were tested by computing the correlation coefficient (r), (Table 7). The higher the value of (r) (the closer to unity) the stronger the relation is. The following observations were derived:

a. A strong relationship exists between lipid and moisture contents which was tested to be highly significant for females, significant for males and youngs.

b. A positive relationship exists between lipid and protein contents, which was detected to be significant for only females.

c. A negative relationship exists between protein and moisture contents, which was tested to be highly significant for females and significant for youngs.

d. Other relations such as: protein/ash, lipid/ash, and moisture/ash are mostly negative and proved to be all insignificant (Table 7).

Discussion

Gilthead bream live a benthic life (Wassef 1978) and are highly prized for their firm white flesh. According to Stansby's system of classification (1962), young sea breams are low lipid-high protein fish, while adults are low lipid-very high protein fish. Therefore, *Sparus aurata* has a high food value, being rich in protein and low in lipid.

TABLE 7. Interrelation between muscle's protein, lipids, moisture and ash contents for *Sparus aurata*, caught from Bardawil lagoon.

Fish size		Variables	(r)	$p \geq 0.01$	$p \geq 0.05$	significancy
1. Youngs T.L. (cm) 10-20		a) Moisture / lipid	- 0.318	–	–	IS
		b) Moisture / protein	- 0.714	–	*	–
		c) Moisture / ash	- 0.473	–	–	IS
		d) Protein / lipid	+ 0.238	–	–	IS
		e) Protein / ash	+ 0.021	–	–	IS
		f) Lipid / ash	- 0.121	–	–	IS
2. Adults T.L. (cm) > 20	Males	a) Moisture / lipid	- 0.701	–	*	–
		b) Moisture / protein	- 0.615	–	*	–
		c) Moisture / ash	- 0.313	–	–	IS
		d) Protein / lipid	+ 0.094	–	–	IS
		e) Protein / ash	+ 0.021	–	–	IS
		f) Lipid / ash	- 0.469	–	–	IS
	Females	a) Moisture / lipid	- 0.873	**	–	–
		b) Moisture / protein	- 0.844	**	–	–
		c) Moisture / ash	+ 0.249	–	–	IS
		d) Protein / lipid	+ 0.654	–	*	–
		e) Protein / ash	- 0.354	–	–	IS
		f) Lipid / ash	- 0.419	–	–	IS

$p \geq 0.01$ highly significant (**). $p \geq 0.05$ significant (*).
IS = insignificant, r = correlation coefficient (regression).

This conclusion is in agreement with previous work on the species (El Saby 1934, Eisa and Zaki 1963, Kamel 1978, Wassef 1978, Khalil *et al.* 1986). Moreover, *Sparus aurata* have an edible portion of about 40% of whole fresh weight (Eisa and Zaki 1963).

As in most fish, protein and ash contents were proved to be more or less stable components of sea bream's muscles. In contrast, lipid content undergoes wide seasonal variations, particularly for adults (Table 2). Love (1970 has mentioned that lipid is the most variable component in fish. The same phenomenon was previously reported for *Sparus aurata* in particular (Wassef 1978, and Khalil *et al.* 1986). The factors which influence the lipid and water contents do not cause much variation in protein and ash contents especially in the edible portion. However, it is almost impossible to distinguish surely between the effect of many factors which play apart in lipids seasonal fluctuations, but the principal ones are the stage of sexual development and feeding conditions.

The wider range of variation of lipids for mature fish than for immature (Juveniles and Subadults), noticed in the present study, is expected and may be attributed to the diversified feeding habits of the two groups of fish. Juveniles feed on plankton,

whereas Subadults include in their diet benthos collected on the bottom (Ferrari and Chieregato 1981).

These variations may also denote the effect of the annual reproductive cycle on muscle's composition.

The lower values of lipids or protein contents of adults in winter months, particularly December, which coincided with the peak of spawning (Wassef, 1985 a) probably due to the consumption of such materials for gonadal development.

Shabaan (1983) has noted that triglycerides content of *Sparus aurat's* muscle lipids was higher for adults than for young or immature fish. She attributed the seasonal variations in lipid content to physiological and feeding aspects.

However, El Sayed (1979) explained the rising of moisture in fish muscles during spawning period to be from endocrine source. Gonadotrophic hormones increase prespawning, therefore, it can be expected that consequent increase in water content may be brought about during this period.

On the other hand, the higher values of lipids during spring and summer months, for both young and adults, probably signifies higher feeding intensity of fish during this period (Wassef and Eisawy 1985).

The inverse relationship between fat and water contents of fish has been previously investigated, and *Sparus aurata* is not an exception (Wassef 1978, Marias and Kissil 1979, Khalil *et al.* 1986). This has resulted that the sum of these two indices is always nearly constant (about 78%, see Table 5).

Also, Marias and Kissil (1979) suggested that *Sparus aurata,* unlike many other fish, has a remarkably constant body composition at a specific age, irrespective of nutritional status. Careful examination of the studies on the species (Wassef 1978, Kamel 1978, Shabaan 1983 and Khalil *et al.* 1986) seems to confirm this observation.

Therefore, Table 8 was initiated to display the equations derived to represent fat or water relationship for gilthead bream in different habitats. The equations arrived at in the present study are considered more precisive, since they have taken into account size and sex of fish. They can be applicable, for lake Bardawil species, in estimating either fat or water content, with great accuracy, when only one parameter is known. Whereas, the other equations are also useful for each region specified within the specification noted.

Determinations of type and composition of fatty acids present in the muscle lipids of this species (Wassef 1985 b) and amino acids as well (Wassef 1990), add greatly to the value of proximate composition data, but have been neglected in the field of nutritive value These results may be also of great importance concerning the valuation of culture of gilthead breams.

Acknowledgement

The authors would like to express their deep gratitude and sincere thanks to Prof.

TABLE 8. Fat (F) / water (W) relationship for *Sparus aurata* in different localities.

*Equations	Specification	Locality	Fat level (% wet weight)	Authors & year of study
F = 79.23 – 1.01 W W = 78.30 – 0.97 F	For sexes combined, young and adults (T.L. = 13-15 cm)	Egyptian Medit. Waters (wild fish)	0.77-7.31	Khalil *et al.* 1976*
F = 92.60 – 1.20 W W = 77.29 – 0.81 F	For immature fish (T.L. < 20 cm)	Rattama ponds (Reared fish)	0.61-4.56	Khalil *et al.* 1976
F = 75.40 – 0.95 W W = 79.02 – 0.98 F	For youngs (T.L. = 10-20 cm)	Bardawil lagoon	1.90-3.80	Present work, 1986
F = 67.40 – 0.85 W W = 78.90 – 1.17 F	For males (T.L. = 20-30 cm)	Bardawil lagoon	1.80-4.80	Present work, 1986
F = 55.62 – 0.70 W W = 79.19 – 1.42 F	For females (T.L. = 20-30 cm)	Bardawil lagoon	1.60-4.90	Present work, 1986

* Published in 1986.

Dr. M.A. Eisawy, President of National institute of Oceanography, Fisheries, and to Prof. Dr. E.G. Zied, Chemistry Department, Faculty of Sciences, Mounfia University for their help and support.

References

Bligh, G. and **Dyer, J.** (1959) A rapid method of total lipid extraction and purification. *Can. J. Bioch. Physiol.* **37:** 911-917.

Eisa, E. and **Zaki, M.** (1963) Comparative study on the biochemical constitution of the main Egyptian fresh and salt water fish. *Ein Shams Sci. Bull.* **7:** 157-163.

El-Aggan, W.H. (1982) *A Comparative Study of the Growth and Nitrogenous Activity of Five Azolla Species*, Ph.D. Thesis, Fac. Sci., Cairo University.

El-Saby, M.K. (1934) Dietetic value of certain Egyptian food fishes. *Rapp. et Proc. Verb.* **8:** 127-143.

El-Sayed, A.F. (1979) *Seasonal Biochemical Changes in Pylamis Spp. from the Egyptian Mediterranean Water*, M.Sc. Thesis, Fac. Sci. Alex. Univ.

El-shereif, R. (1988) *Report on "Shanshoula": A Fishing Gear Operating in Lake Bardawil.* Presented to Authority for Aquatic Resources Development, Egypt.

El-zarka, S. and **Koura, R.** (1965) Seasonal fluctuations in the production of the important food fishes of the U.A.R. waters of the Mediterranean sea. *Bull. Inst. Oceanogr. Fish. U.A.R. Notes and Memoirs* **74:** 1-69.

Ferrari, I. and **Chieregato, A.R.** (1981) Feeding habits of Juvenile stages of *Sparus auratus*, *Dicentrarchus labrax* and Mugilidae in a brackish embayment of the PO River Delta, Italy, *Aquaculture* **25**(2-3): 243-258.

Floch, J. Sloane, G. and **Stanley, H.** (1957) A simple method for the isolation and purification of total lipids from animal tissues. *J. Biol. Chem.* **226** (3): 497-509.

Kamel, S. (1978) *Lipids and Free Amino Acids Patterns of Different Sexes of Some Species of Family Sparidae. Inr. M. Sc. Thesis, Fac. Sci. Alex. Univ., 213 p.*

Khalil, M.S., Hilmy, A., Badawi, H. and **Wassef, E.** (1986) Proximate composition of wild and reared gilthead bream, *Chrysophrys auratus* (Forster). *Bull. Fac. Sci. Cairo Univ.* **54:** 1-30.

Love, R.M. (1970) *The Chemical Biology of Fishes*, Academic Press, London. pp. 255-262.

Marias, J. and **Kissil, G.** (1979) The influence of energy level on the feed intake, growth, food conversion and body composition of *Sparus aurata*, *Acquaculture* **17:** 203-219.

Shabaan, F. (1983) *Comparative Study on Lipids Content of Fresh Water Fish (Tilapia nilotica) and Saltwater Fish (Sparus aurata)*, M.Sc. Thesis, Biochem. Dept., Fac. Sci. Alex. Univ. 124 p.

Smith, P., Embrose, M. and **Knoble, C.** (1964) Improved rapid method for determining total lipids in fish meal, *Comm. Fish. Rev.* **26**(7): 1-15.

Stansby, M. (1962) Proximate composition of fish. *In.* **Heen, E.** and **Kreuzer, R. (ed.)** *Fish in Nutrition*. Fishing News Ltd. London, pp. 55-60.

Steel, R.G. and **Torrie, J.H.** (1980) *Principles and Procedures of Statistics*, McGraw-Hill Publ, New York, USA, pp. 255-262.

Stirling, H.P. (1972) The proximate composition of the European bass, *Dicentrarchus labrax* (L.), from the Bay of Naples, *J. Cons. Int. Explor. Mer.* **34:** 357-364.

Wassef, E.A. (1978) Biological and Physiological studies on marine and acclimatized fish *Sparus aurata* L., Ph.D. Thesis, Fac. Sci. Cairo Univ. 225 p.

Wassef, E.A. (1985a) Reproduction of gilthead bream *Sparus aurata* L. (Sparidae) in the Egyptian Mediterranean waters off Alexandria, *J. Egypt Vet. Med. Ass.* **45**(1): 25-39.

Wassef, E.A. (1985 b) Comparative study on the biochemical composition of six Egyptian marine fishes, *Comm. Sci. Develop. Res. Alex.* **9** (85): 138-153.

Wassef, E.A., and **Eisawy, M.A.** (1985) Food and feeding habits of will wild and reared gilthead bream *Sparus aurata* L., *Cybium* **9** (3): 233-242.

Wassef, E.A. (1991) Development of diets for *Sparus aurata* cultured in Egypt, *JKAU: Mar. Sci.* **2:**. 103-111.

التركيب البيوكيميائي لأسماك الدنيس القاطنة بحيرة البردويل (مصر)

إلهام واصف* و محمد بسيوني شحاتة

المعهد القومي لعلوم البحار والمصايد ، الإسكندرية - مصر

المستخلص . يتركز الاهتمام حديثا في تربية بعض الأسماك البحرية أو استزراعها في مصر خاصة أسماك الدنيس لأهميتها من الناحية الغذائية والتسويقية . وقد تم اختيار بحيرة البردويل كإحدى المناطق المناسبة لهذا الغرض . ويهدف البحث إلى دراسة القيمة الغذائية لأسماك الدنيس القاطنة بحيرة البردويل بتحليل العضلات (الجزء الذي يؤكل) وتقدير نسبة كل من : المواد البروتينية ، المواد اللبيدية ، الرطوبة ، والرماد ، وذلك تبعا للأطوال المختلفة والجنس ووقت الصيد .

وقد تبين من هذه التحاليل أن المحتوى المائي يمثل أعلى نسبة ، يليه المحتوى البروتيني ثم اللبيدي وأخيراً الرماد .

وأثبتت النتائج أن كلاً من الإناث والذكور لها نفس التركيب البيوكيميائي .

وقد وجد أن متوسط المحتوى البروتيني يتراوح بين ١٧,٦ - ٢٢,٥٪ (على أساس الوزن الرطب) وكان أقل عرضة للتغيرات الشهرية أو الموسمية من باقي المكونات الأخرى .

أما بالنسبة للمحتوى اللبيدي فإن المتوسط له يتراوح مابين ١,٦ و ٤,٩٪ (على أساس الوزن الرطب) وقد وجد أن المحتوى اللبيدي كان أكثر عرضة للتغيرات الشهرية أو الفصلية وكانت أعلى نسبة له في فصل الصيف وأقلها في الشتاء متزامنة مع موسم التكاثر .

وقد وجد أن المحتوى المائي يتراوح مابين ٧١,٢ - ٧٨,٨٪ ويقل متوسط هذا المحتوى بزيادة الطول (العمر) .

ويتراوح المحتوى الخاص بنسبة الرماد في العضلات مابين ١,١ - ١,٦٪ (على أساس الوزن الرطب) ولا يتأثر كثيرا بالتغيرات الشهرية .

وأثبتت النتائج أيضًا علاقة عكسية (معنوية) بين المحتوى المائي والمحتوى اللبيدي ومنها تم حساب معادلات رياضية يمكن بها تقدير قيمة المحتوى اللبيدي بمعرفة قيمة المستوى المائي أو العكس .

* العنوان الحالي : كلية التربية للبنات بجدة ، الرئاسة العامة لتعليم البنات ، المملكة العربية السعودية .