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RESEARCH ARTICLE

MORPHOMETRY, LENGTH-WEIGHT RELATIONSHIP, HABITAT AND FISHERY OF THE STRIPED SEABREAM *LITHOGNATHUS MORMYRUS* (LINNAEUS, 1758) FROM AL-HANEAH FISHING LANDING SITE, MEDITERRANEAN SEA, EASTERN LIBYA

*¹Sayed Mohamed Ali, Eyman Faraj Abd Alssalam, Ramadan A.S. Ali and Esam M.K. Rafi

Department of Zoology, Omar Al-Mukhtar University, Al Bayda, Libya

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ABSTRACT

Examination of monthly samples of *L. Mormyrus* (n = 224) obtained from Al Haneah fishing site, eastern Libya, Mediterranean Sea, showed that the fish was relatively small elongated, ovoid, compressed, with a narrow snout at the end of the head and 12 to 16 black transverse strips on its sides. The color was silvery grey. The Meristic formula was: D, X - XIII (mostly X) + 9 - 12 (mostly 11); A, II - III (mostly III) + 10 - 11 (mostly 10); P, 15-17; V, 1 + 5; LL, 59-65 (mostly 62 and 60); GR, 14-16 on lower branchial arch. The variations in numbers encountered in the meristic features were not related to fish length. The total length (L) of studied fish ranged between 11.5 cm and 23.4 cm., corresponding to observed weights (W) of 24.5 gm and 160.8 gm. The Length-Weight relationship was slightly positive allometric: $W = 0.008L^{3.2163}$, $R^2 = 0.9658$, n = 224. The fish was very common in the study site (Al-Haneah) where it inhabited sandy bottoms. The supra littoral zone of the site was rocky. The intertidal zone was sandy but rocky underneath, and littered with small tidal pools during low tide. Patches of *Posidonia oceanica* stands were present within the upper sub littoral. The area was relatively clear from pollutants and biodiversity was high, in particular of algae, sea weeds and benthic animals. From the observation that the tidal pools housed many larval fish and juveniles it was concluded that the area is a nursery and feeding ground for many marine animals. The mean monthly catch of *L. mormyrus* per fisher at Al-Haneah was 45.074 kg ± 39.2 (std). This amount constituted 28.696 % of the overall catch of all species which was estimated as 157.1 kg per month per fisher. The season of abundance of *L. mormyrus* in the catch was summer and that of scarcity was winter. The fishing gears in use were nets (gill and trammel), explosives and lines. Means of mobility during fishing were boats with engines, without boats (foot fishers) and boats without engines. *L. mormyrus* inhabited sandy bottoms. Sand dredging from coastal waters for construction purposes which had been practiced for many years had negatively affected abundance of this fish in the study site.

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INTRODUCTION

L. mormyrus (Family: Sparidae; Golani et al., 2006) is a medium size marine gregarious fish demersal on sandy shallow littoral waters (Guidetti, 2000). It feeds on worms, mollusks, small crustaceans and detritus. It is protandrous hermaphrodite and breeds in summer (Russell et al., 2014). *L. mormyrus* is a subtropical in the eastern Atlantic Ocean, the Mediterranean sea, the Red sea and the southwestern Indian Ocean. The IUCN conservation status of this fish is: Least concern. However, the negative impact of some fishing methods and the increased effort have reduced or eliminated this species in some parts of the Mediterranean (Russell et al. 2014). The reduction in catches of this species from the eastern coast of

Libya observed in recent years may be due to habitat destruction resulting from large scale dredging of coastal sand for construction purposes. The objectives of the present study were to:

- Study morphometry and length weight relationship of *L. mormyrus* collected from Al-Haneah fishing site, eastern Libya.
- Collect preliminary information on *L. mormyrus* habitat and fishery in Al-Haneah site.

The data obtained will be helpful in managing the fisheries of this fish.

MATERIALS AND METHODS

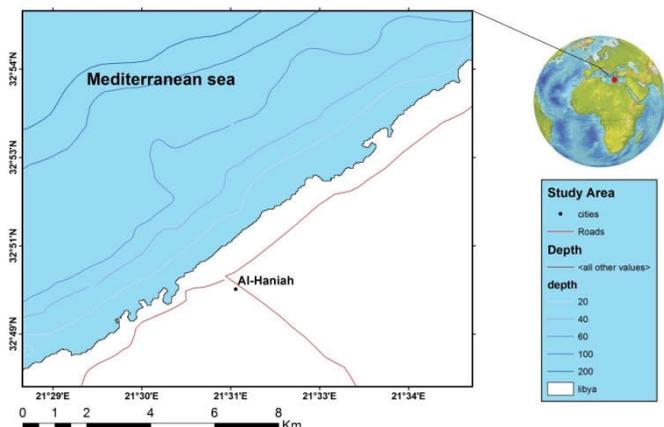
The study site

Al-Haneah coast is a principal fishing ground on eastern Libyan Mediterranean Sea (map 1). The area is important for

*Corresponding author: Sayed Mohamed Ali

Department of Zoology, Omar Al-Mukhtar University, Al Bayda, Libya

several commercial fishes such as those of the families Sparidae, Mugilidae, Serranidae and Carangidae (Ekwella, 2008).



The morphometry and the length-weight studies

Monthly samples totaling 224 *L. mormyrus* were collected from Al-Haneah artisanal catch during March 2015 to February 2016 for the morphometric and the length-weight studies. In the Marine Laboratory of the Zoology Department Of Omar Al-Mukhtar University the total length (mm) and the corresponding total weight (0.0 gm) were established for each fish. The transverse bands on the body, the gill rakers on the lower branchial arch of the first gill arch and spines and rays in each fin were counted. Scales on the lateral line were also counted. The length-weight-relationship was established according to the equation of Ricker, 1975, $W = aL^b$, (n= 224 fish).

W: the total fish weight (g), L: the total fish length (cm)
 “a”: the intercept, “b”: the slope

The habitat and fishery of *L. mormyrus* in Al-Haneah site

Data about the following subjects was collected by questionnaire distributed to 32 Al-Haneah fishers.

- Habitat of *L. mormyrus*.
- Effect of dredging sand from coastal waters for construction purposes on the availability of *L. mormyrus* in recent years.
- Quantity of *L. mormyrus* caught monthly, its percentage from total catch of all species and seasonality of its catch.
- Types of fishing gears (nets, lines, hooks, boats...etc.) in use.

RESULTS

Al-Haneah fishing site

Payed visits showed that Al-Haneah is a small inlet fish-landing site typical of those found scattered on Libya eastern Mediterranean coast. Its supralittoral zone was rocky. The intertidal zone was sandy but rocky underneath, and littered with small tidal pools. The sand cover was shallow. Patches of *Posidonia oceanica* stands were present within the upper sublittoral.

The area was relatively clear from pollutants and biodiversity was high, in particular of algae, sea weeds and benthic animals. From the observation that the tidal pools housed many larval fish and juvenile of many forms one could deduce that the area is a nursery and feeding ground for many marine animals.

Bottom substrate of *L. mormyrus* habitat

Ninety seven percent (97 %) of the questioned fishers said that *L. mormyrus* inhabits sandy bottoms, 3 % said it inhabits rocky bottoms.

Effect of sand dredging on *L. mormyrus* abundance

All fishers agreed that sand dredging had negatively impacted abundance of *L. mormyrus* and that the decrease in numbers of this fish in the artisanal catch observed in recent years occurred only after the commencement of the sand dredging operations.

Morphometric and meristic features of *L. mormyrus*

Number of transverse strips

The morphometric and meristic features of *L. mormyrus* established in the present study are shown in tables 1, 2, 3, and 4. Twelve to sixteen transverse strips were found on the sides of the fish (Table 1). 43.98 % of the examined fish had 14 strips. 25.65 % and 24.08% of fish had 12 and 16 strips in order. These variations were not related to fish length. The number of scales on the lateral line varied between 59 and 65 (Table 2). Most fish had either 62 or 60 scales (34.08% and 32.29% of examined fish in order).

There was no relation between number of scales and fish length. Number of spines (Table 3a) and soft rays (Table 3b) in dorsal fin of *L. mormyrus* ranged between 10 to 13 spine and 9 to 12 ray. Most fish (75.13 %) had 10 spines and 11 rays (87.77 %) in their dorsal fin. The frequency of spines and rays was not related to fish length. Most fish (97.88% of examined fish, Table 4a) had 3 spines and 10 rays (97.88%, Table 4b) in their anal fin. 14 to 16 gill raker were found on the lower branchial arch of the fish.

Table 1. Number of transverse strips on body of *L. mormyrus* (n= 191) of different lengths. Numbers of fish are shown between two brackets

Fish length interval	Number of transverse strips per fish				
	12 strips	13 strips	14 strips	15 strips	16 strips
12-12.9 cm	(5)	(2)	(2)		(3)
13-13.9 cm	(15)		(26)		(8)
14-14.9 cm	(6)		(3)		
15-15.9 cm	(4)		(6)		(3)
16-16.9 cm	(2)	(3)	(2)		(4)
17-17.9 cm	(6)		(5)		(9)
18-18.9 cm	(3)		(18)		(4)
19-19.9 cm		(2)	(10)		(8)
20-20.9 cm	(8)	(5)	(12)		(7)
Total of strips	49	12	84	0	46
% from total	25.65%	6.28%	43.98%	0%	24.08%

Number of scales on lateral line

Table 2. Number of scales on lateral line of *L. mormyrus* of different lengths. Numbers of fish are shown between two brackets

Fish length interval	Number of scales on lateral line						
	59 scales	60 scales	61 scales	62 scales	63 scales	64 scales	65 scales
12-12.9 cm	(15)						
13-13.9 cm		(13)	(11)	(26)			
14-14.9 cm	(3)	(30)					
15-15.9 cm		(18)			(14)		
16-16.9 cm		(3)		(10)	(5)		
17-17.9 cm				(13)		(6)	
18-18.9 cm		(3)		(14)		(5)	
19-19.9 cm				(4)		(8)	(3)
20-20.9 cm	(2)	(5)				(3)	
Total of strips	20	72	11	76	19	22	3
% from total	8.96%	32.29%	4.93%	34.08%	8.52%	9.87%	1.35%

Dorsal fin

Table 3. Number of spines (Table a) and number of soft rays (Table b) in dorsal fin of *L. mormyrus*

a- Number of spines: 10 – 13, mostly 10. (n= 189 fish).

Number of spines	10 spines	11 spines	12 spines	13 spines
Number of fish	(142)	(27)	(13)	(7)
% from total	75.13%	14.29%	6.88%	3.70%

b- Number of soft rays: 9 to 12, mostly 11. (n= 189 fish).

Number of spines	9 rays	10 rays	11 rays	12 rays
Number of fish	(1)	(2)	(165)	(20)
% from total	0.53%	1.06	87.77%	10.64%

Anal fin

Table 4. Number of spines (Table a) and number of soft rays (Table b) in anal fin of *L. mormyrus*

a- Number of spines: 2 – 3, mostly 3 (n= 189 fish)

Number of spines	1 spines	2 spines	3 spines	4 spines
Number of fish	0	4	185	0
% from total	0%	2.12%	97.88%	0%

b- Number of soft rays: 10 – 11, mostly 10.(n= 189 fish).

Number of soft rays	9 rays	10 rays	11 rays	12 rays
Number of fish	0	178	11	0
% from total	0%	97.88%	5.82%	0%

Number of gill rakers

14 to 16 on lower branchial arch. The above morphometric and meristic features were summarized in the following table (Table 5).

Meristic formula of *L. mormyrus* according to the present study

D, X - XIII (mostly X) + 9 – 12 (mostly 11); A,II – III (mostly III) + 10 - 11 (mostly 10); P, 15-17; V, I + 5; LL, 59-65 (mostly 62 and 60); GR, 14-16on lower branchial arch.

Table 5. A comparison between morphometric and meristic features of *L. mormyrus* established in the present study and those reported in previous Literature

Parameters	Description from the present study	*From previous literature
The body form	elongate, ovoid, and well compressed; the head gently slopes into an elongated, pointed snout. The eye is rather small	elongate, ovoid, and well compressed; the head gently slopes into an elongated, pointed snout. The eye is rather small.
Color	silvery grey base coloration, inter ocular space and snout dark.	silvery grey base coloration, inter ocular space and snout dark.
Number of transverse strips	12 to 16	14-16 (but up to 17)
Total fish length	11.5 to 23.4 cm	usually up to 25 cmbut up to 55 cm
Gill rakers	14 to 16 on lower branchial arch.	14-17 lower, 9-11 upperbranchial arch.
Scales	On cheek and opercle; Pre opercle broad, scale less	On cheek and opercle; Pre opercle broad, scale less
Lateral line scales (to caudal base)	59-65, mostly 62 and 60	59-65
Dorsal fin	X - XIII, mostly X, 9 - 12, mostly 11	XI- XIII + 11-12
Anal fin	II to III, mostly III + 10 - 11, mostly 10	II - III + 10-11
Pectoral	15 - 17	15 - 17
Ventral	I + 5	I + 5

• Assembled from Archipelagos, 2009; UNESCO, 1984/1986 and Palma and Andrade, 2002; Golani, 2006.

The biological studies

The length – weight relationship

The relationship between total weight (W gm) and total length (L cm) was:

$W = 0.008L^{3.2163}$. It was slightly positive allometric (Fig.1).

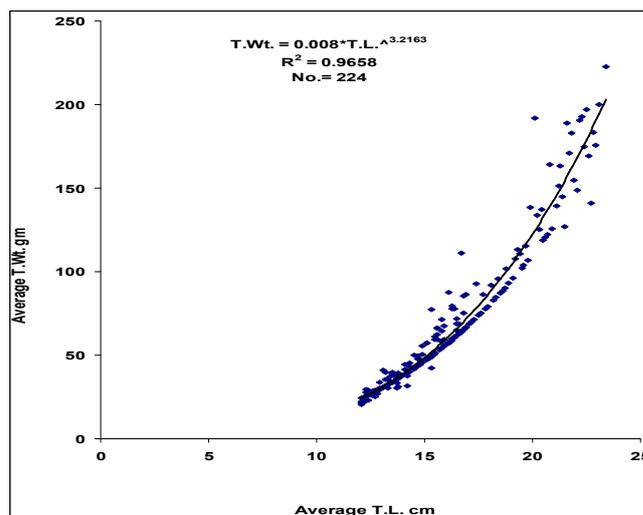


Figure 1. The relationship between length and weight for *L. mormyrus* (n= 224) from Al-Haneah coast

***L. mormyrus* fisheries in Al-Haneah coast**

Analysis of the questionnaires distributed to Al-Haneah fishers (32 fisher) showed that mean monthly catch of *L. mormyrus*

per fisher was 45.074 kg ± 39.2359 (std), (Table 6 and Figure 2). Mean percentage of monthly catch of *L. mormyrus*/fisher from total fish catch (of all species) per fisher was 28.696 % ±19.201 (Table 6 and Figure 3).The total fish catch per month per fisher was calculated as 157.074 kg, the daily total catch was 5.61 kg and that of *L. mormyrus* was 1.02 kg. In Fig. 2, 37 % of the fishers said they catch 25 kg or less of *L. mormyrus* per month.

Types of fishing gears used in artisanal fishery in Al Haneah

Fifty six point nine percent (56.9 %) of the questionaired fishers said that they use nets (trammel and gill), 31.3 % said they use explosives in addition and 11.8 % said they use lines (Fig. 4a).

Table 6. Monthly catch of *L. mormyrus* (kg)/fisher and its percentage from total fish catch per fisher from Al-Haneah fishing site

	Minimum(kg)	Maximum(kg)	Mean (kg)	Std. Deviation	No. of fishers
Monthly catch of <i>L. mormyrus</i> /fisher (kg)	6.0	175.0	45.074	39.2359	27
Percentage of monthly catch of <i>L. mormyrus</i> /fisher from total fish catch per fisher	5.0%	75.0%	28.696%	19.201	23

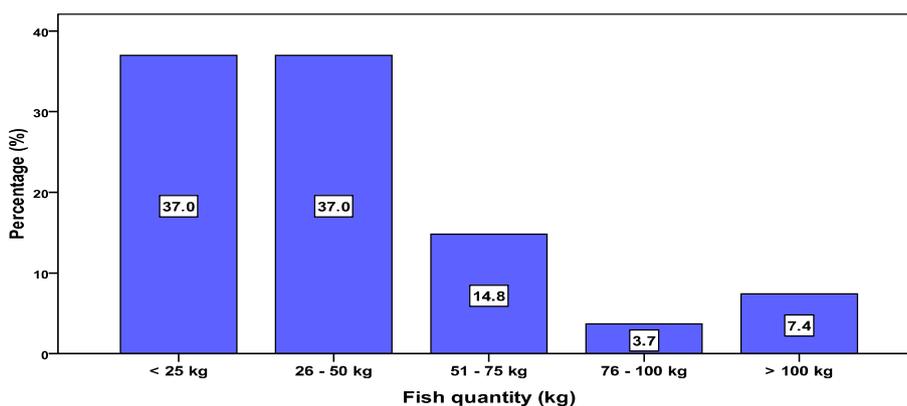


Fig. 2. *L. mormyrus* quantities caught monthly by individual fishers from Al-Haneah site (shown as percentage range). The mean was 45.074 kg

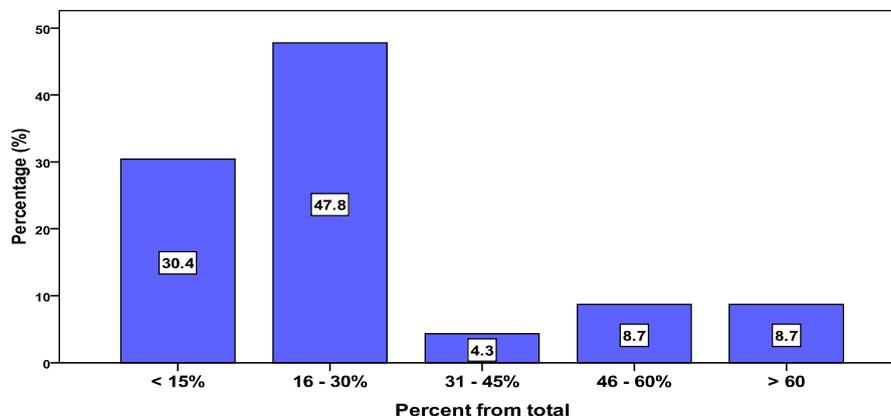


Fig. 3. *L. mormyrus* caught per month per fisher from overall total fish catch per month per fisher from Al-Haneah fishing site (shown as percentage range). The mean was 28.696%

Another 37 % said that they catch between 26 and 50 kg. The rest (26 %) said that they catch more than 50 kg. Figure 3 shows percentage of *L. mormyrus* caught per month per fisher from overall catch per month per fisher. 47 % of the fishers said that the quantity of *L. mormyrus* they catch was 16 to 30 % of the total catch. 30.4 % said the ratio was less than 15 %. Twenty one point eight percent (21.8 %) said that it was more than 30 %.

Seasonal abundance and scarcity of *L. mormyrus*

All question naired fishers agreed unanimously that the season of abundance of *L. mormyrus* in the catch is summer and that of scarcity is winter.

The dominant means of mobility during fishing (Fig. 4b) is small boats with engines (56.1 % of the fishers) followed by foot fishers (without boats, 26.8 %) and then boats without engines (17.1 %).

DISCUSSION

Results of morphometric and meristic features of *L. mormyrus* established in the present study agree to a large extent with those reported in previous studies (Archeopalagos, 2009; UNESCO, 1984/1986 and Palma and Andrade, 2002; FishBase; Wikipedia). The meristic formula of *L. Mormyrus* according to the present study was:

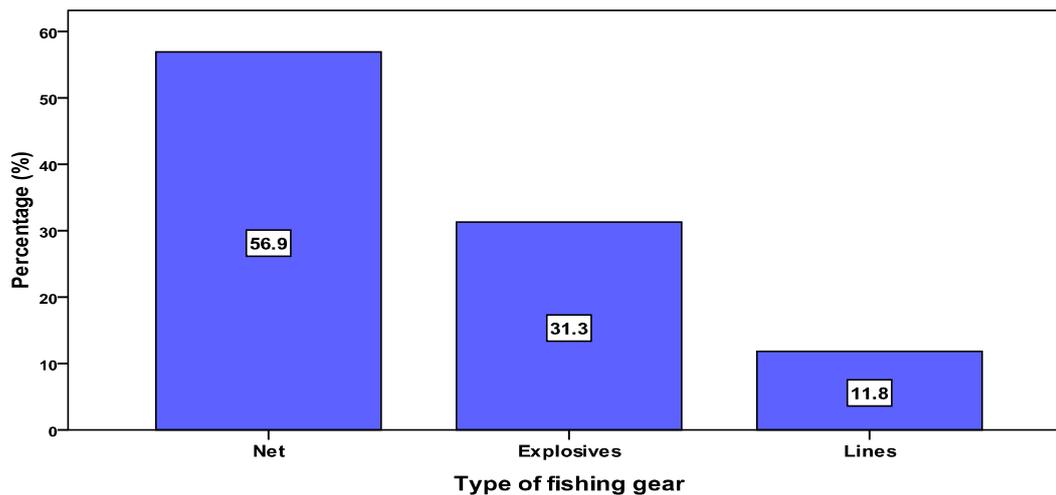


Fig. 4(a). Percentage of types of fishing gears used in artisanal fishery in Al Haneah

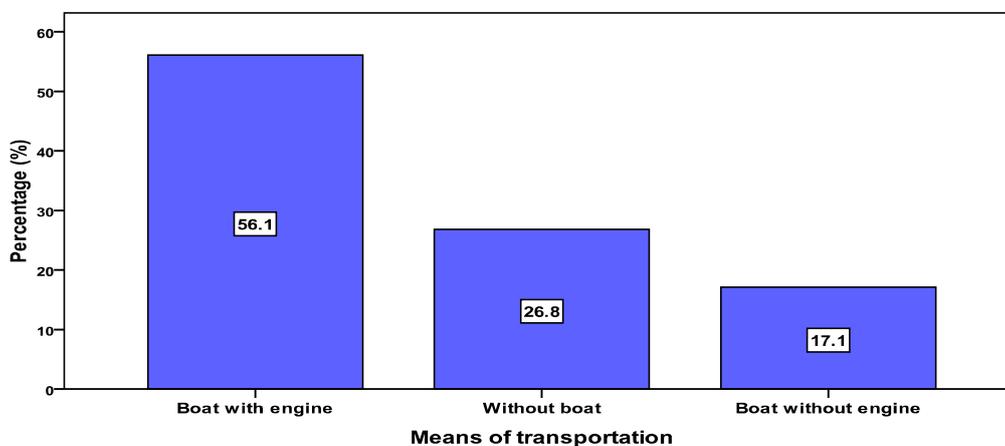


Fig. 4(b). Percentage of means of mobility used during fishing by Al Haneah fishers

D, X - XIII (mostly X) + 9 – 12 (mostly 11); A,II – III (mostly III) + 10 - 11 (mostly 10); P, 15-17; V, I + 5; LL, 59-65 (mostly 62 and 60); GR, 14-16on lower branchial arch. That according to Golani 2006 was:

D, XI-XII + 11-12; A, II + 10-11; P, 15-16; V, I + 5; LL, 59-65.

In the present study lengths of *L. mormyrus* ranged between 11.5 cm and 23.4 cm., corresponding to the observed weights 24.5gm and 160.8gm. Previous studies pointed that *L. mormyrus* can grow to a maximum length of about 55 cm, with a weight of around 1 kg, but a more common size is 20 - 30 cm total length (Fischer *et al.*, 1987; Bauchot and Hureau, 1990; Bizsel *et al.*, 2011; Malawi home page, internet). The length weight relationship obtained for *L. mormyrus* in the present study was almost isometric $W = 0.008L^{3.2163}$, ($R^2 = 0.9658$). This is in agreement with the general consensus that growth of *L. mormyrus* is either isometric or slightly positive allometric: Suau, 1970, in eastern Spain ($b = 3.43$); Kraljevic *et al.*, 1995 in Mirna Bay in the northern Adriatic ($b = 3.05$) and in Kasutela Bay in the middle Adriatic ($b = 2.69$); Kraljevic *et al.*, 1996, in the northern Adriatic for males ($b = 3.02$) and females ($b = 3.06$); Lorenzo *et al.*, 2002, off in the Canary Islands ($b = 2.91$); Santos *et al.*, 2002, in the Algarve coast ($b = 3.020$); Turkmen and Akyurt, 2003, in Üskenderun

Bay for males ($b = 3.042$) and females ($b = 3.069$); Morey *et al.*, 2003, off Balearic Islands and in the Iberian coast ($b = 3.0327$); Kallianiotis *et al.*, 2005, in the coastal waters of the Thracian Sea for immature individuals ($b = 3.242$) and for mature males, females and intersexual ($b = 2.960$); Mariani, 2006, in Fagliano Lagoon ($b = 2.85$); Gokce *et al.*, 2007, in the Northern Eagean ($b = 3.10$); Matić-Skoko *et al.*, 2007, in eastern Adriatic Sea ($b = 3.141$); and Emre *et al.*, 2010, in the Beymelek Lagoon (Turkey) for both males and females ($b = 3.1599$ and 3.2187 respectively). Of particular interest was the “b” value obtained by Verdiell-Cubedo *et al.*, 2006, in western Mediterranean Sea ($b = 3.285$) which was very close to our value ($b = 3.2163$). In the present study it was concluded that Al-Haneah is an important nursery and feeding ground for fishes and other marine animals. A similar statement was presented by Ekwella, 2008, for fishes of the families Sparidae, Mugilidae, Serranidae and Carangidae. It was also concluded that *L. mormyrus* dwells sandy bottoms and occasionally rocky bottom. This is in agreement with UNESCO, 1984/1986, who said that *L. mormyrus* is demersal on rocky and sandy muddy bottoms and the seagrass beds in littoral waters. We concluded that dredging of sands from Al-Haneah coastal waters had negatively impacted *L. Mormyrus* abundance as it destroyed its habitat. Vitale *et al.*, 2011, mentioned that the increased effort and the negative physical impact of some fishing practices like trawling on seagrasses,

and especially *Posidonia oceanica* beds, have been confirmed to reduce or eliminate *L. mormyrus* in some parts of the Mediterranean (Tudela, 2003). Catches of *L. mormyrus* have been declining in the Canary Islands during the past few years (Pajuelo *et al.*, 2002). In the preset study analysis of the questionnaire distributed to Al-Haneah fishermen showed that *L. mormyrus* was common in the artisanal catch. The average quantity of *L. mormyrus* caught per fisher per month was 45.074kg ± 39.2359. This quantity resembled 28.696 % of the total fish catch / month / fisher which corresponds to 157.074 kg. Khamis, 2008, analyzed the trawl by-catch from Benghazi coast, eastern Libya. Sparidae, including *L. mormyrus*, constituted most of the by-catch, *L. mormyrus* constituted 2.3% by number of the trawl fishery by-catch. Al-Hassan and El-Silini, 1999, recorded 14 species, including *L. mormyrus*, in the Libyan coast. All questionaired fishers agreed that the season of abundance of *L. mormyrus* was summer, and that of scarcity was winter. Summer (and spring) is the breeding season of *L. mormyrus* (UNESCO. 1984/1986; Lorenzo *et al.*, 2002; Ramos, 2002; Turkmen and Akyurt, 2003; Kallianiotis, 2005; and Emere *et al.*, 2010). It may be that these fishes come in shallow water in summer to breed, and therefore become more accessible to fishing, and return to deep water in winter. 56.9 % of Al-Haneah fishers said that they fish by nets (trammel, gill and tangle nets). 31.3 % use explosives, an illegal mean of fishing. 11.8 % use lines. Shakman, 1969, studied the coastal fisheries of Libya. He concluded that the most important fishing gear in the area is trammel nets. Kallianiotis, 2005, and Vital *et al.*, 2011, reported that *L. mormyrus* in the Mediterranean Sea is mainly caught using both trammel and gill nets throughout the year, but fishing methods vary according to areas and sea so n. Pajuelo *et al.*, 2002, said the fish is captured all year round, mainly with traps, with seasonal differences in landings. Kallianiotis, 2005, and Bizsel *et al.*, 2011, reported rhea this fish is caught by trammel net, gill nets, beach seines, fyke nets, traps and lines. The use of explosives for fishing, though very common, is illegal in Libya. Mobility during fishing is either by boats with engines (56 %), without boats (26.8 %) or boats without engines (17.1 %).

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