

Occurrence of the Speigleri's Mullet, *Osteomugil speigleri* (Bleeker, 1858) in the Iraqi Marine Waters, Northwest Arabian Gulf

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ABSTRACT---- *The occurrence of the Speigleri's mullet, Osteomugil (Valamugil) speigleri is reported for the first time from the Iraqi marine waters, northwest Arabian Gulf. Fish were captured by gill nets during December 2008-November 2009. 26 morphometric and 17 meristic measurements and SDS-PAGE analysis for muscle proteins were applied to describe the species. The results showed that the morphometric data and electrophoresis analysis of proteins were successful in identifying of O. speigleri from other mullets and confirm the presence of the species in Iraqi marine waters.*

Keywords---- Speigleri's mullet, morphometric and meristics characters, SDS-PAGE analysis, Iraq

1. INTRODUCTION

Mullets have worldwide distribution and inhabit coastal waters and estuaries of the tropical and subtropical zones of world seas; a few spend their lives in freshwater [1]. The family Mugilidae was previously placed in the order Perciformes but is now considered the sole representative of the order Mugiliformes [2]. According to the latest taxonomic revision made by Eschmeyer and Fong [3], this family includes a total of 74 valid species in the world.

The silver mullet, *Osteomugil (Valamugil) speigleri* (Bleeker, 1858), is a member of the family Mugilidae and is distributed throughout the Indo-West Pacific from Pakistan to the west coast of India and Sri Lanka, extending to the east coast of India, Indonesia and Australia [4]. The scientific name of the species, *Valamugil speigleri* has been revised recently to *Osteomugil speigleri* [5] and established by Xia, *et al.* [6].

Previous studies on the ichthyofauna in the Iraqi marine waters and the Arabian Gulf did not indicate the presence of *O. speigleri* in these waters [7-14], while it registered in the Indo-West Pacific region (Fishing Areas 51 and 57) include Pakistan waters [15, 4, 16]. Anonymous [17] reported that Rudolf Arndt, Dames & Moore Inc. got one specimen of *O. speigleri* from the north side of the Kuwait Bay, northern Arabian Gulf (E 48°: N 29° 58') on 6th of June 1982 and reserved in the Museum of Comparative Zoology at Harvard University, also another specimen of the same species (11.6 cm) was caught by J.E. Randall on 31st of August 1985 from the same area, reserved in the Bishop Museum in Hawaii, USA.

During the investigation of the Iraqi marine waters, northwest Arabian Gulf between December 2008-November 2009, several mullet's species were captured including *Planiliza subviridis* (Valenciennes, 1836), *P. klunzingeri* (Day, 1888) and *P. carinata* (Valenciennes, 1836) belonging to genus *Planiliza* and one species recorded for the first time, *O. speigleri* (Bleeker, 1858) belonging to genus *Osteomugil*. So, the purpose of this paper is to describe the morphometric and meristic characters, and electrophoresis analysis of muscle proteins of the Speigleri's mullet, *O. speigleri* for the first time in Iraqi marine waters. The specimens were deposited in the fish collection of the Department of Fisheries and Marine Resources, College of Agriculture, University of Basrah, Basrah, Iraq.

2. MATERIALS AND METHODS

The marine waters of Iraq occupy the most northwestern tip of the Arabian Gulf and represent the estuarine part of the Gulf which is considered its most productive part due to run off from the Shatt Al-Arab River, the confluent delta of

the Rivers Tigris and Euphrates [18]. A total of 125 fish species belonging to 60 families including 16 chondrichthyes and 109 osteichthyes species have been recorded in Iraqi marine waters [13].

Mullet fish were collected monthly from the Iraqi marine waters, northwest Arabian Gulf (Fig. 1), within the region ($48^{\circ} 38'$ to $48^{\circ} 42'$ E, $29^{\circ} 47'$ to $29^{\circ} 50'$ N) during December 2008 to November 2009 by drift gill nets (200-250m length with 25 x 25mm mesh sizes) and fixed gill nets (100-200m length with 25 x 25mm mesh sizes). Fishes were immediately preserved in ice box till arrive the Basrah University (about an hour).

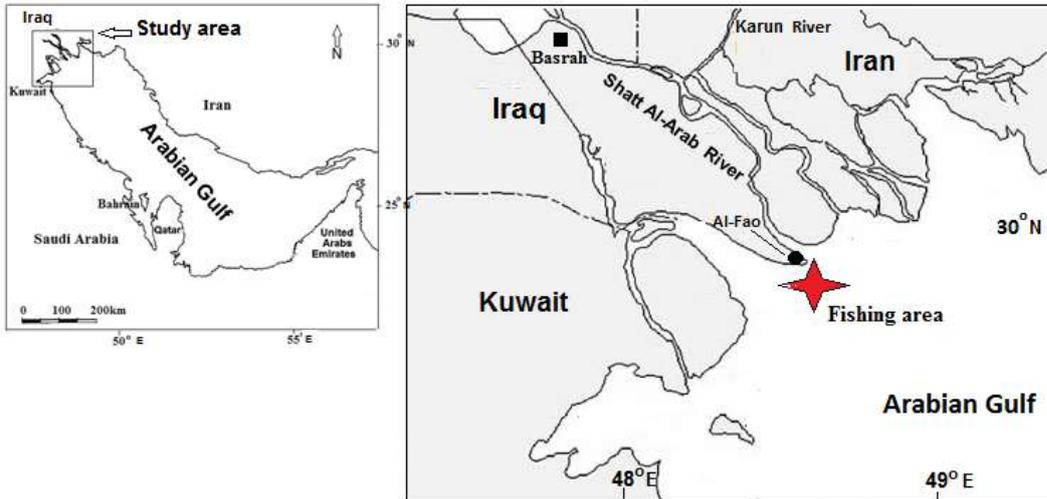


Figure 1: Map showing the collection site of the specimens of *O. speigleri*

In the laboratory, the individuals of *O. speigleri* (Bleeker, 1858) were distinguished from other species of mugilidae follows Thomson [4], Carpenter *et al.* [12], Coad [19], Durand, *et al.* [5] and Xia, *et al.* [6].

Morphometric and meristics measurements were followed Hubbs and Lagler [20] and Katselis *et al.* [21]. Total length, standard length and fork length of 125 specimens from *V. speigleri* were measured to the nearest 1.0 mm using a measuring board. The other morphometric variables were determined using digital caliper to the nearest 0.1mm. Names of morphometric variables are provided in Figure 2.

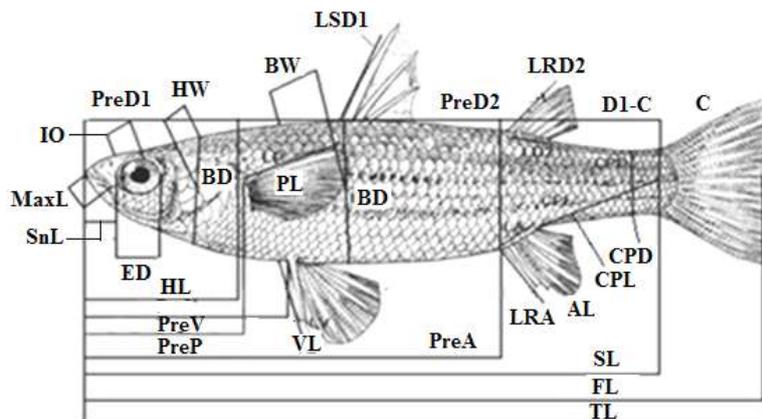


Figure 2: Morphometric characteristics of *O. speigleri*: total length (TL), standard length (SL), fork length (FL), body depth (BD), body width (BW), head length (HL), head depth (HD), head width (HW), snout length (SnL) eye diameter (ED), inter-orbital distance (IO), upper jaw length (MaxL), inter-orbital space (IO), pre-dorsal 1st length (PreD1), pre-dorsal 2nd length (PreD2), pre-anal length (PreA), pre-ventral length (PreV), pre-pectoral length (PreP), distance between 1st dorsal fin and caudal fin (D1-C), 1st dorsal fin spine length (LSD1), 2nd Dorsal fin length (LRD2), anal fin length (AL), pectoral fin length (PL), ventral fin length (VL), longest ray of anal fin (LRA), longest ray of 2nd dorsal fin (LRD2), caudal peduncle length (CPL) and caudal peduncle depth (CPD).

Numbers of meristic characters commonly used to describe mullets; first and second dorsal fin rays, ventral fin rays, anal fin rays, pectoral fin rays, gill rakers and pyloric caeca were examined under a binocular microscope. Additional data, such as vertebrae and preorbital teeth were also recorded.

Linear regression relationship and coefficient of correlation were calculated to determine the strength of relationship between standard length (SL) and all morphometric characters, and between head length and certain dimensions in the head. The various statistical values, correlation coefficients and regression analysis were made using Microsoft Office Excel 2007 version.

After morphometric and meristics measurements, sample of lateral muscle tissue was taken quickly and stored at -20°C till SDS-PAGE analysis. SDS-PAGE (Sodium Dodecyl Sulfate Poly Acrylamide Gel Electrophoresis) analysis was performed according to the Wong *et al.* [22] method using a running gel containing 12.5% Poly Acrylamide gel to proteins separate in vertical electrophoresis device (Cleaver Scientific Ltd, UK). The examination of the gel and protein bands density and weight were done according to gel documentation system and UVI band advanced software [23].

3. RESULTS

3.1 Description

O. speigleri is characterized by the following features. Body moderately robust; head wide, flattened above (Fig. 3). Colour of body green-gray dorsally, silvery on sides and belly. No longitudinal streaks on sides. Lips are thin, fine ciliiform teeth on both lips, but more sparse on upper. Maxilla bone slim looks like a straight, not hooked at tip (Fig. 4A), and hidden when mouth closed. The back of the fatty (adipose) tissue well developed and covers most of the iris (Fig. 4B). Preorbital filling the space between the upper lip and eye, its dorsal part soft, semi-straight, short and little notched. Scale cycloid and moderate-sized (Fig. 4C). First dorsal fin originates nearer to snout tip than to



Figure 3: *O. speigleri* captured from Iraqi marine waters, 150 mm total length

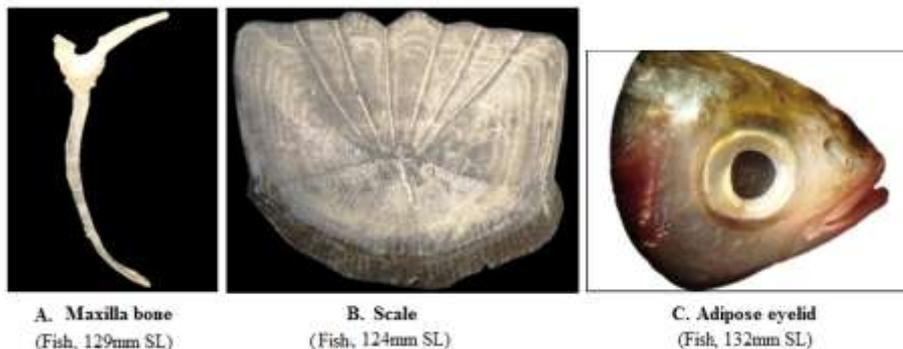


Figure 4: Maxilla bone, scale and adipose eyelid in *O. speigleri*

caudal fin base with four slender spines and black margin. Second dorsal fin originates at the end of anterior quarter of anal fin base, green to yellowish with black spots and axillary scale. Anal fin with 3 spines and 9 soft rays. Pectoral fin

reaches somewhat beyond vertical from first dorsal fin origin, with axillary scale 1/3 the length of fin. Second dorsal and anal fins densely scaled. The caudal fin forked, orange to yellowish with black margin.

3.2. Morphometric characters

A total of 125 specimens of *O. speigleri* with length range of 115 to 182 mm in standard length (SL) were collected in the present study. 26 morphometric characters were calculated as numerical ratio to standard length and presented in the Table 1. The indices characters varied from 5.4 % of snout length to 127.6 % of total length. However, the ratio of body depth (26.3%) was greater than the ratio of body width (14.4%). The indices characters of head depth, head width, snout length, eye diameter, interorbital width and upper jaw length with head length ranged from 21.4% of snout length to 75.6% of head depth (Table 1).

Table 1: Morphometric characters (%) of *O. speigleri* from Iraqi marine waters (*SD*, standard deviation; *a*, *b*, parameters of regression equation; *r*, correlation coefficient)

| Morphometric Charaters | Range | % (\pm <i>SD</i>) | Regression constants | | |
|--|-----------|-----------------------|----------------------|----------|----------|
| | | | <i>a</i> | <i>b</i> | <i>r</i> |
| As % of standard length | | | | | |
| Total length | 1.26-1.29 | 127.6 (0.29) | 2.070 | 1.258 | 0.998 |
| Fork length | 1.18-1.21 | 118.9 (0.33) | -1.795 | 1.204 | 0.997 |
| Body depth | 0.25-0.27 | 26.3 (0.20) | 1.266 | 0.252 | 0.979 |
| Body width | 0.14-0.15 | 14.4 (0.16) | -2.759 | 0.168 | 0.989 |
| Head length | 0.25-0.27 | 25.4 (0.27) | 3.789 | 0.221 | 0.985 |
| Head depth | 0.18-0.20 | 19.2 (0.21) | 2.591 | 0.169 | 0.979 |
| Head width | 0.16-0.16 | 16.1 (0.08) | -0.145 | 0.163 | 0.994 |
| Snout length | 0.05-0.06 | 5.4 (0.12) | -1.623 | 0.068 | 0.951 |
| Eye diameter | 0.06-0.07 | 6.4 (0.10) | 1.869 | 0.047 | 0.978 |
| Interorbital distance | 0.09-0.10 | 9.8 (0.18) | -3.344 | 0.127 | 0.992 |
| Upper jaw length | 0.05-0.06 | 5.8 (0.16) | -0.630 | 0.063 | 0.833 |
| Predorsal 1 st fin length | 0.46-0.49 | 47.7 (0.30) | 3.654 | 0.445 | 0.990 |
| Predorsal 2 nd fin length | 0.69-0.73 | 71.2 (0.56) | 2.109 | 0.693 | 0.980 |
| Distance between 1 st dorsal fin original and caudal fin base | 0.48-0.54 | 51.4 (0.65) | -10.19 | 0.603 | 0.981 |
| Preanal fin length | 0.65-0.70 | 67.9 (0.67) | 1.095 | 0.669 | 0.967 |
| Preventral fin length | 0.35-0.39 | 37.0 (0.38) | 5.687 | 0.321 | 0.983 |
| Prepectoral fin length | 0.26-0.28 | 26.5 (0.30) | 4.910 | 0.222 | 0.989 |
| 1 st dorsal fin spine length | 0.11-0.14 | 12.9 (0.34) | 6.567 | 0.898 | 0.797 |
| 2 nd Dorsal fin length | 0.11-0.14 | 12.4 (0.36) | 2.314 | 0.104 | 0.768 |
| Anal fin length | 0.14-0.18 | 15.5 (0.45) | 3.952 | 0.094 | 0.763 |
| Pelvic fin length | 0.15-0.17 | 16.2 (0.30) | 5.512 | 0.114 | 0.973 |
| Pectoral fin length | 0.23-0.24 | 23.3 (0.17) | -0.674 | 0.239 | 0.986 |
| Caudal peduncle length | 0.17-0.19 | 18.5 (0.19) | -2.215 | 0.205 | 0.982 |
| Caudal peduncle depth | 0.11-0.12 | 11.0 (0.11) | 1.901 | 0.094 | 0.993 |
| Longest ray of anal fin | 0.14-0.16 | 14.5 (0.17) | 1.924 | 0.128 | 0.979 |
| Longest ray of 2 nd dorsal fin | 0.14-0.16 | 14.4 (0.24) | -2.19 | 0.163 | 0.921 |
| As % of head length | | | | | |
| Head depth | 0.77-0.75 | 75.6 (0.26) | -0.33 | 0.767 | 0.995 |
| Head width | 0.61-0.65 | 63.6 (0.55) | -2.799 | 0.732 | 0.996 |
| Snout length | 0.18-0.24 | 21.4 (0.64) | -2.575 | 0.302 | 0.919 |
| Eye diameter | 0.24-0.26 | 25.1 (0.26) | 1.136 | 0.212 | 0.967 |
| Interorbital width | 0.34-0.41 | 38.7 (0.98) | -5.39 | 0.572 | 0.989 |
| Upper jaw length | 0.21-0.26 | 22.7 (0.56) | -1.909 | 0.293 | 0.884 |
| No. of fish | 125 | | | | |

The results of the relationship between all morphometric characters against standard length of *O. speigleri* are given in Table 1. The analysis of the relation revealed that the highest value of slope (*b*) with total length (*b*= 1.258) and lowest value with eye diameter (*b*= 0.047). However, the relation with total length, fork length, predorsal 2nd fin length, distance between 1st dorsal fin original and caudal fin base, preanal fin length and 1st dorsal fin spine length showed high growth rate, while snout length, upper jaw length, anal fin length and caudal peduncle depth indicated very slow growth rate. The values of correlation coefficient obtained were found to be highly significant (when *r* > 0.90) with most

morphometric characters of *O. speigleri*, and significant correlation (when $r < 0.90$) was observed for upper jaw length, first dorsal fin spine length, second dorsal fin length and anal fin length.

Again, the values of *b* for the relation between head length and certain dimensions in the head varied from 0.212 for eye diameter to 0.767 for head depth. The relation with head depth, head width and interorbital width showed high growth rate, while snout length, eye diameter and upper jaw length indicated slow growth rate. The analysis of relation between head length and other head characters revealed the correlation values ranged from 0.884 for upper jaw length to 0.996 for head width (Table 1).

3.3. Meristic characters

The meristic characters data of *O. speigleri* with length range of 115 to 182 mm in standard length were presented in Table 2. Seventeen meristic characters were counted and the results were pyloric caeca 4-6 (Fig. 5A), branchiostegals 6, gill rakers on upper row 23-38 and on lower row 35-45 (Fig. 5B), preorbital teeth 6-20 (Fig. 5C), vertebrae 24-26 (Fig. 5D), lateral series scales 37-40, dorsal fin rays 4, 8, pectoral fin rays 1, 1, pelvic-fin rays 1, 5, anal fin rays 3, 9 and caudal fin rays 14.

Table 2: Meristic characteristic of *O. speigleri* from Iraqi marine waters

| Meristic character | No. of Fish | Range | Mean (\pm SD) |
|-----------------------------------|-------------|-------|------------------|
| Pyloric caeca | 75 | 4-6 | 5.0 (0.02) |
| Branchiostegal rays | 50 | 6 | 6 (0) |
| Gill rakers on upper row | 50 | 23-38 | 38.9 (0.29) |
| Gill rakers on lower row | 50 | 35-45 | 41.5 (0.46) |
| Preorbital teeth | 25 | 6-20 | 12.6 (0.45) |
| Vertebrae | 75 | 24-25 | 24.8 (0.05) |
| Lateral series Scales | 75 | 37-40 | 37.9 (0.08) |
| Branched rays of dorsal fin | 75 | 8 | 8 (0) |
| unbranched rays of pectoral fin | 75 | 1 | 1 (0) |
| Branched rays of pectoral fin | 75 | 14-16 | 14.9 (0.04) |
| Branched rays of pelvic fin | 75 | 5 | 5 (0) |
| Branched rays of anal fin | 75 | 9-10 | 9.0 (0.01) |
| Caudal fin rays | 75 | 14 | 14 (0) |
| 1 st Dorsal fin spines | 75 | 4 | 4 (0) |
| Pectoral fin spines | 75 | 1 | 1 (0) |
| Pelvic fin spines | 75 | 1 | 1 (0) |
| Anal fin spines | 75 | 3 | 3 (0) |

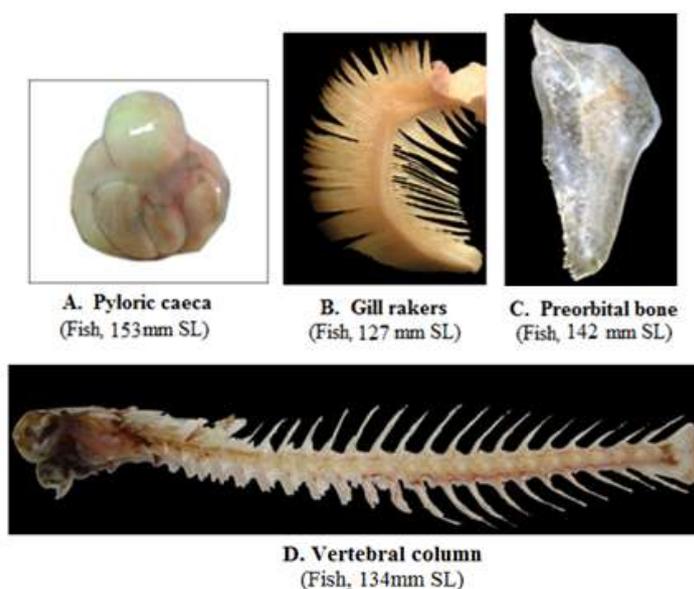


Figure 5: Pyloric caeca, gill rakers, pre-orbital and vertebral column bone in *O. speigleri*

3.4. Proteins Electrophoresis

The result of electrophoresis analysis of lateral muscle proteins of *O. speigleri* population in the study region is shown in Figure 6. There are six protein bands in muscles of this species and their molecular weights varied from 6.04 μ g to 20.44 μ g. The fifth band was the biggest in size (20.77%) and the third smallest one (6.14%).

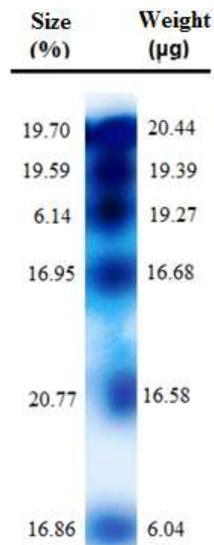


Figure 6: SDS PAGE electrophoresis of muscle proteins of *O. speigleri*

4. DISCUSSION

O. speigleri was previously recorded in the north side of the Kuwait Bay, northern Arabian Gulf [17]. Thus, from a mere geographical point of view, its presence was to be expected in the Iraqi waters. The capture during this study should not be regarded as accidental, as 125 individuals were collected, indicating the presence of a self-sustaining population of this species in Iraqi marine waters. Although several captures have been reported from temperate waters [24, 15, 4, 16, 25-28], the capture of *O. speigleri* reported herein is the first for Iraqi marine waters and the second for the Arabian Gulf.

The size of the specimens obtained in the present study (147.2-233.0 mm total length) seems to be compare favorably with other region. Zubia, *et al.* [29] reported a range of 131-194 mm total length for specimens of *O. speigleri* obtained from Karachi Coast of Pakistan.

Morphometric and meristic characteristics of *O. speigleri* in Iraqi marine waters were compared with data obtained from the taxonomy references (Table 4). The results showed that morphometric and meristic features of *O. speigleri* are similar to the description of this species given by Fisher and Whitehaed [15], Thomson and Luther [30], Carpenter and Niem [31] and Froese and Pauly [32], when they showed that *V. speigleri* could be characterized by 35 to 45 gill rakers on lower limb of first gill arch, maxilla and anterior edge of preorbital almost straight, scales in lateral series 37 to 40. The only exceptions were slight differences in the total and fork lengths (expressed as a percentage of standard length) with the description of Froese and Pauly [32].

In the present study, all the body parameters show higher values of linear correlation with standard length or with head length. This indicates that the growth of fish in one area of the body is correlated to growth in another area of the body. Zubia, *et al.* [28] stated that the relationships between the whole body growth and various morphometric characters of *O. speigleri* from the Karachi coast of Pakistan were found to be strong ($r > 0.70$; $p < 0.05$). Similar linear relationship was also reported by Pandey, *et al.* [33], Jaiswar *et al.* [34] and Saroniya, *et al.* [35] in various fish species.

Table 3: Morphometric and meristic characteristics of *O. speigleri* in Iraqi marine waters compared with taxonomy references.

| Morphometric ratios | Present study | Fisher & Whitehaed [15] | Thomson & Luther[30] | Carpenter & Niem [31] | Froese & Pauly [32] |
|--|----------------------|--|--|----------------------------------|--------------------------------|
| Total length | 126-129% | | | | 122% |
| Fork length | 118-121% | | | | 115% |
| Body depth | 25-27% | | | | 26% |
| Head depth | 25-27% | | 24 -23% | | 25% |
| Predorsal 1 st fin length | 46-49% | Nearer to tip of snout | Nearer to tip of snout | | 46% |
| Distance between 1 st dorsal fin original and caudal fin base | 48-54% | > Predorsal 1 st fin length | > Predorsal 1 st fin length | | |
| Preanal fin length | 65-70% | | | | 65% |
| Preventral fin length | 35-39% | | | | 34% |
| Prepectoral fin length | 26-28% | | | | 30% |
| Pectoral fin length | 23-24% | < Head length | | 24-20% | NA |
| Snout length % HL | 18–24% | | | 17-22% | 19% |
| Eye diameter %HL | 24- 26% | | | NA | 25% |
| Meristic Characters | | | | | <u>Ahmed [25]</u> |
| Pyloric caeca | 4-6 | | | 4 | 4 |
| Gill rakers on lower raw | 35-45 | | | 35-45 | |
| Branched dorsal fin rays | 8 | | | 9-10 | 8 |
| Branched anal fin rays | 9-10 | | 9 | | 9 |
| Branched pectoral fin rays | 14-16 | | | 14-16 | 17 |
| 1 st Dorsal fin spines | 4 | | | | 4 |
| 2 nd Dorsal fin spines | 1 | | | | 1 |
| Pelvic fin spines | 1 | | | 1 | |
| Anal fin spines | 3-3 | | 3 | 2-3 | 3 |
| Lateral series scales | 37-40 | 37-40 | 37-40 | 37-41 | 37-40 |

Aboud [36] studied the systematic of four mullet species (*P. subviridis*, *P. klunzingeri*, *P. carinata* and *O. speigleri*) in Iraqi marine waters by SDS-PAGE analysis. He found that the lateral muscle protein band numbers of these species were 4, 5, 6 and 6, respectively. *O. speigleri* can be discriminated from *P. carinata* by differences in molecular weights (genetic loci), the intensity strength and distribute bands of protein during the electrolysis migration process. He concluded that the electrophoretic analysis of muscle proteins revealed that SDS-PAGE can be considered a good taxonomic criterion to differentiate among mullet species in Iraqi marine waters.

5. CONCLUSION

In conclusion, the morphological and meristic characters and electrophoresis analysis of muscle proteins discussed in this study have been very successful in identifying of *O. speigleri* from other mullets and confirm the presence of the species in Iraqi marine waters.

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