IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN:2278-3008, p-ISSN:2319-7676. Volume 13, Issue 3 Ver. V (May. – June. 2018), PP 01-06
www.iosrjournals.org

Morphological Differences and Their Relation to Diet of Epinephelus Aenuse and Siganus Luridus

Hanen. M. Ali Hamed [1,] Eman S. R. Mohamed [2] , Azza Salem[3]
[1]*A Zoology Department, Faculty of Science, Omar El-Mokhtar University, El -Beyda-Libya*
[2]*A Zoology Department, Faculty of Science, Omar El-Mokhtar University, El -Beyda-Libya*
[3]*A Zoology Department, Faculty of Science, Omar El-Mokhtar University, El -Beyda-Libya*
Corresponding Author: Hanen. M. Ali Hamed

Abstract: *The present study was deal with two species of teleost, which have different types of diet, Epinephelus aenuse (carnivores) and siganus luridus (herbivores). The samples were collected between November 2016 and January 2017 to study some morphological and structural aspect of heads, gill rakers and alimentary canal to determine their relation with different diets of E. aenus and S. luaridus. The study showed different measurement of head with (7.9 cm) in E. eanuse and (3.2 cm) in S. luridus , the length of four gill arches related to total length was estimated and were longer in E. aenuse with (22.0, 20.7, 19.1, 17.2%) respectively comparing with S. luridus (15.9, 15.8, 15.9, 15.2%) respectively . According to the study, the shape of first gill rakers was different, in E. aenuse was longer whereas it was smaller and had rounded shape in S. luridus. In term of shape and structure of alimentary canal of the studied fish were showed morphogical and structural differences in part of alimentary canal with different in length of digestive tract. It was longer in S. luridus with 63.9 cm to 19.7cm in E. aenuse . Beside the different in length the present study was represented that E. aenuse had pyloric coca, whereas this structure was absence in the alimentary canal of S. luridus. The results were discussed on the base of differences in nature of food habit to each fish*

Key wards: *carnivores fish, herbivores fish, morphological differences , digestive tract*

Date of Submission: 16-06-2018 Date of acceptance: 02-07-2018

I. Introduction

The Libyan coast has a varying topography with a wide range of habitats and environmental variables [1] This allows to many kinds of marine organisms to live, including fish such as *siganus luridus* and *Epinephelu aenuse* , both of them have high commercial value and this leads to be a suitable target by many research, for instance , The diet of *S. luridus* has been studied both in the Red Sea, which is it original habitat [2, 3] and in the eastern Mediterranean [4,5; 6 , 7, 8 ,9 , 10 , 11, 12]. Also as *E. aenuse* is an important species in the fisheries of this area, many studies show interested in diet and how to reach a significant improvement of reproduction and nutrition [13, 14, 15]. On the other hand , some research take a different aspects to display the relationship between diet and the shape of body. According to [16, 17, 18] morphological features linked to prey capture and intake evolved to maximize feeding performance and can be strongly correlated with diet. Also many studies have significantly related diet to several morphological characteristics of species [19, 20 , 16, 21, 17, 18, 22 , 23, 24]. For instance, in fishes, gut length clearly distinguish algivores, detritivores and herbivores from carnivores [25 ,26 ,27 , 28]. However, relationships between diet and morphology are equivocal since other studies found weak and indistinct results rather relating feeding and morphological variables to local environmental factors and resource availability [29 , 30, 31, 32, 33] Potential large regional changes can be a source of bias explaining these mixed results since feeding and morphological plasticity can be induced by environmental variability [34, 35,36]. Therefore, understanding the related between diet and the shape of fish body could be helpful not only to estimate the different between species but also among the same species of fish which live in different location

The aim of this research was to establish the morphology of *Epinephelus aenuse* and *siganus luridus* and to relate it to their diet

II. Materials and Methods

2.1. Collecting fish sampling:

30 fish samples were collected (15 samples for each species) between November 2016 and January 2017 from Susa 32°53'48" N21°57' 47" E Libya , they were transported immediately in an ice box to the Zoology Laboratory for analysis

2. 2. Morphometric measurements:

The morphology and morphometric measurements were taken according to [37 , 38]. They included Total length, head length, gill arches length, number of gill filaments, eye diameter and gut length. The collected data were statistically analyzed.

III. Results

3. 1. Morphology of the digestive tract:

3. 1. 1. Gills

The study was demonstrated difference in shapes of gills morphological between *S. luridus* and *E. aenuse* (fig 1; 2). The first gill rakers of *E. aneuse* were longer and thin with tiny structures on them whereas smaller and rounded in *S.luridus* (fig 3).

3. 1. 2. Digestive canal

Stomachs were varied between *E. aenuse* and *S. luridus* , The stomach in *E. aenuse* was well-developed and had thick wall and the pyloric coca was present. In contrast, *S luridus* had stomach with thin wall and the pyloric coca was absent (fig 4; 5).

3. 2. Morphometric measurements:

The study was displayed difference in morphometric measurements, according to table (1) the length of gill arches of *E. aenuse* were longer than gills arches of *S. luridus*, with 4.9, 5.5 , 5.1 , 4.6 cm respectively in *E. aenuse* and 2.7,2.7,2.7,2.6 cm respectively in *S.luridus*. Furthermore, the head length of *E. aenuse* was 7.9cm while was 3.2cm in *S.luridus*. Canal digestive had the significant difference between two species with 63.9 cm in *S. luridus* and 19.7cm in *E. aenuse* . However the dimeter of eyes were similar in both fish by 1.1 cm horizontal , 1.3 cm vertical in *E.aenuse* and 0.8cm horizontal and 0.9 cm vertical in *S.luridus*

3. 3. Numerate measurements:

The table(2) showed difference in number of fourth arches filaments between *E.aenuse* and *S.luridus* , with 195.1 , 186.1 , 179 , 165 filament respectively in *E,aenuse* and 80.2 , 85.1 , 88.8 , 86.2 filament in *S.luridus*

3. 4. The relation of morphometric measurements to total length

According to fig(6) the percentage of gill arches related to total length was higher in *E. aenuse* than *S luridus*, with 22.0, 20.7, 19.1, 17.2 % respectively in *E. aenuse* and 15.9, 15.8, 15.9, 15. 2 % respectively in *S lurridus* . In addition, the related of head length to total length was greater in *E.aenuse* with 30.1.% compared to *S.luridus* with 18.3%. Digestive length of *S,luridus* was by far higher than *E,aenuse* with 371.1 % and 75.0 % respectively . A lthough the dimeter of eyes (Vertical and Horizontal) was not so different, when comparative between of them to total length was a slightly bigger in *S. luridus* than *E. aenuse* by 4.5 % horizontal and 5.1% vertical in *S.luridus* and 4.2 % horizontal , 4.5% vertical in *E.aenuse*

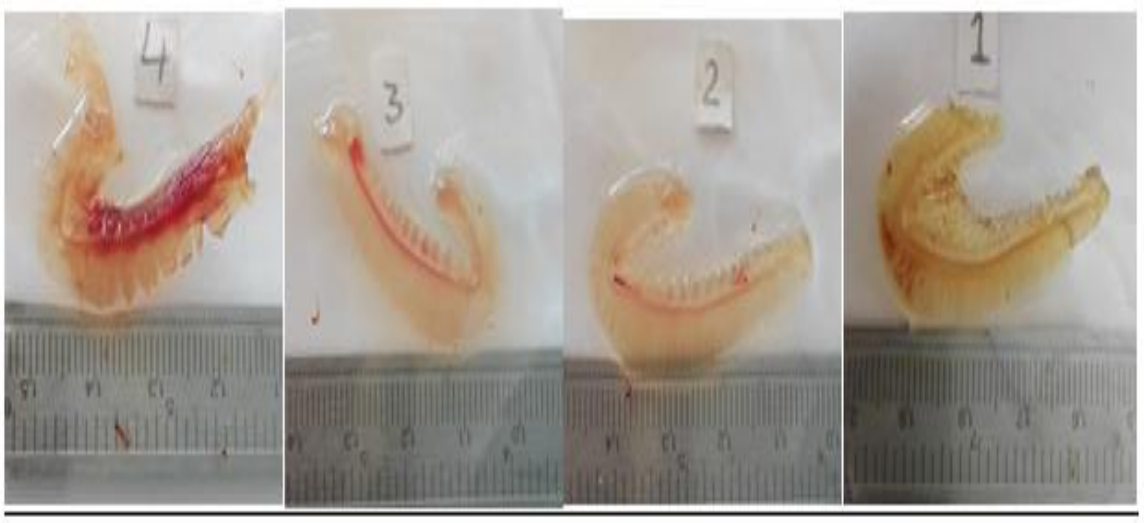
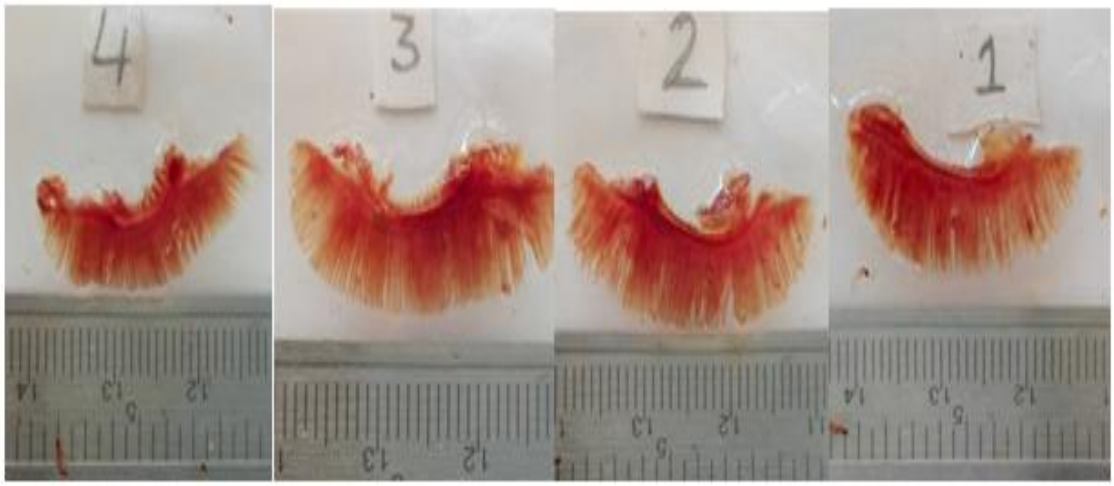
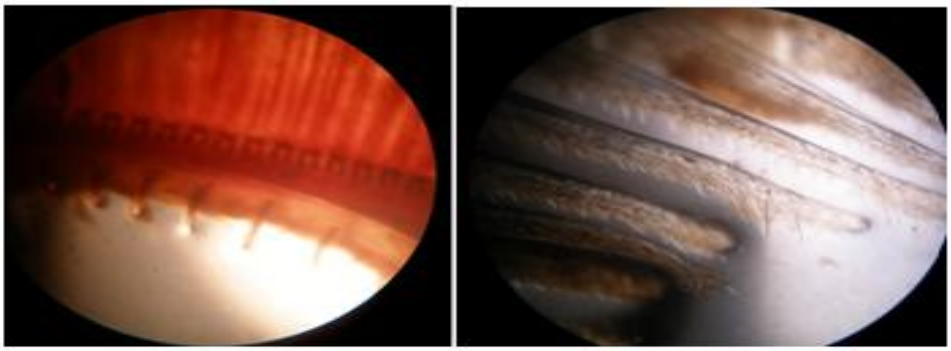


Figure1: gills of *E. aenuse*



Figur2: gills of *Siganus luridus*



(a) (b)

Figur3: first Gill rakers of *S.luridus* (a) and *E. aenuse*(b)

Figur4: Digestive canal of *E. aenuse*

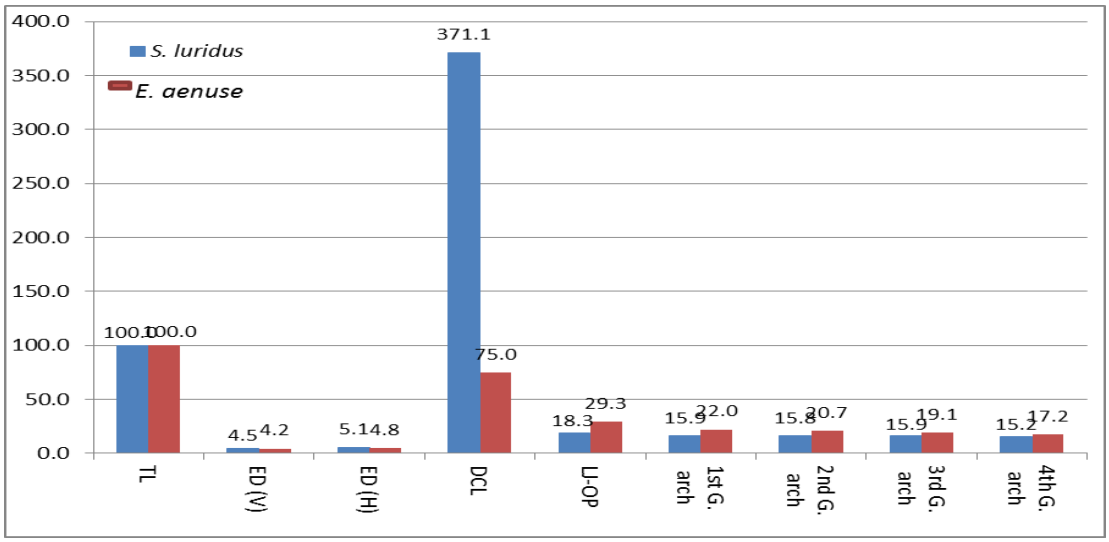
Figur5: Digestive canal of *S.luridus*

Table 1 : morphometric measurements of *E.aenuse* and *S. luridus*

	E.aenuse	%	*S. luridus*	%
Total length	20.0 - 29	100	15.4 - 19.1	100
Horizontal dimeter eye	1.1 ± 0.2	4.2%	0.8 ± 0.2	4.5%
Vertical dimeter eye	1.3 ± 0.2	4.8%	0.9± 0.2	5.1%
Head length	7.9 ±1.0	30.1%	3.2 ± 0.2	18.3%
Digestive canal length	19.7 ± 3.2	75.0%	63.9 ± 8.7	371.1%
First arches length	4.9 ± 1.2	22.0%	2.7 ± 0.2	15.9%
Second arches length	5.5 ± 1.0	20.7%	2.7 ± 0.2	15.8%
Third arches length	5.1± 0.9	19.1%	2.7 ± 0.2	15.9%
Fourth gills arches length	4.6± 0.8	17.2%	2.6 ± 0.2	15.2%

Table 2: Numerate measurements

	E.aenuse	%	*S. luridus*	%
The number filaments of 1st arch	195.1 ± 15.1	742.1%	80.2 ± 2.5	476.0%
The filaments number of 2nd arch	186.1 ±12.9	709.3%	85.1 ± 5.2	494.8%
The filaments number of 3rd arch	179 ± 15.2	676.8%	88.8 ± 6.4	516.5%
The filaments number of 4th arch	165.8 ± 16.9	631.5%	86.2 ± 5.9	501.9%



Figur 6: The relation of morphometric measurments to total length

TL: Total length ,
ED(V): Vertical dimeter eye
ED(H): Horizontal dimeter eye
DCL: Digestive canal length
LI-OP: Head length

IV. Discussion

Morphology of the head and digestive tract both constrains and facilitates food acquisition since these structures determine the manner in which fish take in and process food [31, 39,21].

As *E. aenuse* considered as carnivores and and *S. luridus* as herbivores our study showed a massive Varity between the morphological shape of them depending on diet . According to our study gill rakers were different and this agree with [40] who found the gill rakers reflect the type of diet, Long and numerous gill rakers are generally associated with a filtering feeding behavior and as a consequence with small prey and this agree with our result to first gill rakers of *E.aenuse* which were longer and had small structures and this could help to catch a small pray such as zoobenthos the part of feeding chin of *E. aenuse* [41]

The Morphometric measurements results support the strong relationship between morphology and diet. The gill arches of *E. aenuse* related to the total length were longer than *S.luridus* gill arches and this could because the length of head of *E.aenuse* was longer than *S.luridu*s. However, the different in length of gill arches between *E. aenuse* and *S.luridus* followed by difference in the gill filaments number to be higher in *E. aenuse* comparing to *S. luridus* for all gill arch filaments and this agree with [42] who suggested the gills lengths reflect the filtering efficiency of fish . eyes were studied by some research because of their important to explain the relationship between morphogical and diet [18] , despite our result showed a slight different in dimeter of eyes between *E.aenuse* and *S. luridus* could be explain by using *E. aenuse* to other sense like smell or lateral line rather than eyes to catch prey comparing to *S. luridus* which may use its eyes to find its feeding to be more effective in size and may structure.

The variation of digestive system shape was documented and this agree with many research [43, 44, 45, 46´] who determined that Intestine length is related directly to diet and food digestibility . In addition, the result displayed the percentage of digestive system of *S. luridus* (omnivorous) related to total length was higher than *E. aenuse* (carnivorous) this interpreted as reflecting the resistance of different foods to digestion[47] . The intestine is generally more developed in species with less developed stomachs [48] this was the case of *S. luridus* which had the highest average intestine length and no distinct stomach *E. aenuse* had the lowest average intestine length and the best developed stomach.

Reference

[1]. E. Shakman, H. Winkler, R. Oeberst and R.Kinzelbach, Morphometry, age and growth of Siganus luridus Ruppell, 1828 and Siganjus rivulatus forsskal, (Siganidae) in the central Mediterranean(Libyan coast), Revista de Biologia Marina y Oceanografia 43(3), 2008, 521-529.

[2]. B. Lundberg and Y. Lipkin , Natural food of the herbivorous rabbitfish (Siganus spp.) in Northern Red Sea. Botanica marina, 22,1979, 173-181.

[3]. B. Lundberg, A preliminary study of the algae food selectivity by the rabbitfish Siganus rivulatus in the gulf of Elat and at the Mediterranean coast of Israel. In: Shoval H, ed. Developments in arid zone ecology and environmental quality. Balaban ISS, Philadelphia, PA: 1981, 157-166.

[4]. B. Lundberg, Selectivity of food algae by herbivorous fish Siganus rivulatus in the marine vegetation at Mikhmoret (the Mediterranean coast of Israel). Ph.D. Thesis, University of Jerusalem, 1980.

[5]. K. L. Stergiou, Feeding habits of the Lessepsian migrant Siganus luridus in the eastern Mediterranean, its new environment. Journal of fish biology, 33, 1988, 531-543.

[6]. B. Lundberg and D. Golani,. Algal diet of Siganus luridus, a Lessepsian migrant, as adapted to algal resources at the Mediterranean coast of Israel. A preliminary study. Israel journal of zoology, 1993, 39: 69.

[7]. B. Lundberg and Y. Lipkin, Seasonal grazing site and fish size effects on patterns of algal consumption by the herbivorous fish, Siganus rivulatus, at Mikhmorte (Mediterranean Israel). Natural science and technology, 27, 1993, 413-419.

[8]. B. Lundberg and D. Golani, Diet adaptation of Lessepsian migrant rabbitfishes, Siganus luridus and S. rivulatus, to the algal resources of the Mediterranean coast of Israel. Marine ecology P.S.Z.N.I, 16, 1995, 73-89.

[9]. B. Lundberg, R. Ogorek, B.S. Galil and M. Goren, Algal food of Siganid fishes in Shiqmona, Israel. Israel journal of zoology, 1999a, 45: 314.

[10]. B. Lundberg, G. Payiatas and M. Argyrou, Notes on the diet of the Lessepsian migrant herbivorous fishes, Siganus luridus and S. rivulatus in Cyprus. Israel journal of zoology, 45, 1999b, 127-134.

[11]. A. K. Hamza, N.I. Mohamed and El-Serafy, Food and feeding habits of Siganus rivulatus and Siganus luridus from the coastal Mediterranean water of Alexandria. Polish archives of hydrobiology, 47, 2000, 205-212.

[12]. B. Lundberg, R. Ogorek, B.S. Galil and M. Goren, Dietary choices of Siganid fish at Shiqmona reef. Israel journal of zoology, 50, 2004, 39-53.

[13]. S. Hassin, D. de Monbrison, Y. Hanin, A. Elizur, Y. Zohar and D.M. Popper, Domestication of the white grouper, Epinephelus aeneus. 1. Growth and reproduction, Aquaculture, 156, 1997, 305-316.

[14]. I. Lupatsch and G.W. Kissil, Feed formulations based on energy and protein demands in white grouper (Epinephelus aeneus), Aquaculture, 248, 2005, 83-95.

[15]. S. Gorshkov, Long-term plan for domestication of the white grouper (Epinephelus aeneus) in Israel. Israel Journal Aquaculture . - Bamidgeh, 62, 2010, 215-224.

[16]. E. D. Wikramanayake, Eco morphology and biogeography of a tropical stream fish assemblage: Evolution of assemblage structure. Ecology 71, 1990, 1756-1764.

[17]. G. Piet, Eco morphology of asize-structured tropical freshwater fish community. Environmental biology Fishes, 51, 1998, 67-86.

[18]. B. Hugueny and M. Pouilly, Morphological correlates of diet in an assemblage of West African freshwater fishes. Journal of fish biology, 54, 1999, 1310-1325.

[19]. A. J. Gatz, Ecological morphology of freshwater stream fishes. Tulane studies in zoology and botany, 21, 1979, 91-124.

[20]. K. Kotrschal, Trophic Eco morphology in eastern Pacific blennioid fishes: character transformation of oral jaws and associated change of their biological roles. Environmental biology Fishes, 24, 1989, 199-218.
[21]. K. O. Winemiller , L. C. Kelso-Winemiller and A. L. Brenkert, Ecomorphological diversification and convergence in fluvial cichlid fishes. Environmental biology Fishes 44, 1995, 235-261.
[22]. S. Xie, Y. Cut and Z. Li, Dietary-morphological relationships of fishes in Liangzi Lake, China. Journal of Fish Biology, 58, 2001, 1714-1729.
[23]. J. P. Elliott and D. R. Bellwood, Alimentary tract morphology and diet in three coral reef fish families, Journal of Fish Biology, 63, 2003, 1598-1609.
[24]. M. Pouilly, F. Lino, G. Bretenoux and C. Rosales, Dietary-morphological relationships in a fish assemblage of the Bolivian Amazonian floodplain, Journal of Fish Biology, 62, 2003, 1137-1158.
[25]. D. Paugy, Ecologie des poissons tropicaux d' un cours d' eau temporaire (Baoulé, haut bassin du Sénégal au Mali): Adaptation au milieu et plasticité du régime alimentaire. Revista De biologia Tropical, 27, 1994, 157-172.
[26]. D. Kramer and M. Bryant, Intestine length in the fishes of atropical stream: 2. relationship to diet-the long and- short of a convoluted issue, Environmental biology of fishes,42, 1995, 129-141.
[27]. R. Delariva and A. Agostinho, Relationship between morphology and diets of six neotropical loricariids. Journal of fish biology, 58, 2001, 832-84.
[28]. B. M. S. Ward-Campbell, F.W.H. Beamish and C, Kongchaiya, Morphological characteristics in relation to diet in five coexisting Thai fish species, journal of fish biology, 67, 2005, 1266-1279.
[29]. G. D. Grossman, Food resource partitioning in a rocky intertidal fish assemblage, Journal of zoology . 1, 1986, 317– 355.
[30]. P. J. Motta, Functional morphology of the feeding apparatus of ten species of Pacific butterflyfishes Perciformes, (Chaetodontidae): An ecomorphological approach. Environmental biology of fishes 22,1988, 39-67.
[31]. M. E. Douglas and W. J. Matthews, Does morphology predict ecology? Hypothesis testing within a freshwater stream fish assemblage. Oikos Journal, 65, 1992, 213– 224.
[32]. K. O. Winemiller and A. Adite, Convergent evolution of weakly electric fishes from floodplain habitats in Africa and South America. Environmental biology of fishes, 49, 1997, 175-186.
[33]. D. R. Bellwood., P. Wainwright., C.J. Fulton and A. S. Hoey, Functional versatility supports coral reef biodiversity. Proc. R. Soc. B. 273, 2006, 101-107.
[34]. P. C. Wainwright, C. W. Osemberg and G. G. Mittelbach, Trophic polymorphism in the pumpkinseed sunfish (Lepomis gibbosus Linnaeus): effects of environment on ontogeny, Functional Ecology – journals, 5, 1991, 40-55.
[35]. P. H. Wimberger, Plasticity of fish body shape. The effects of diet, development, family and age in two species of Geophagus (Pisces, Cichlidae), Biological journal of the linnean society, 45, 1992, 197-218.
[36]. S. Hegrenes, Diet-induced phenotypic plasticity of feeding morphology in the orange spotted sunfish, Lepomis humilis, Ecology of Freshwater Fish, 10, 2001, 35-42.
[37]. H. J. Meng and M. Stocker, An evolution of morphmetrics and mertistics for stock separation of pacific herring (Clupea harengus pallasi), Canadian journal of fisheries and aquatic science, 41, 1984, :414-422.
[38]. T. Hurlbut and D. Clay, Morphometric and meristic differences between shallow-and deep-water populations of white hake (Urophycis tenuis)in the southern Gulf of St. Lawrence, Canadian journal of fisheries and aquatic science,55, 1998, 2274-2282.
[39]. T. A. Podoskina, Morphology of supporting elements in jaw-pharyngeal apparatus of some Pleuronectiform fishes in relation to feeding specializations. Journal of Ichthyology, 33, 1993, 122– 127.
[40]. E. V. Kliewer, Gill raker variation and diet in lake white fish Coregonus clupeaformis in nothern Manitoba. In: Lindsey C.C., Woods C.S. (eds.) Biology of Coregonides fishes. (Winnipeg, Univ. Manitoba Press, 1970) 147– 165.
[41]. http://www.fishbase.org
[42]. P. Budy and T. Haddix, Zooplankton Size Selection Relative to Gill Raker Spacing in Rainbow Trout . Transactions of the American Fisheries Society, 134, 2005, 1228– 1235.
[43]. B. G. Kapoor, H. Smith and I.A. Verigina, The alimentary canal and digestion in teleosts. Advances in Marine Biology 13, 1975, 109– 239.
[44]. S. H. Bowen, (1983). Detrivory in neotropical fish communities, Environmental Biology of Fishes, 9, 1983, 137– 144.
[45]. C. Sturmbauer, W. Mark and R. Dallinge, Ecophysiology of aufwuchs-eating cichlids in Lake Tanganyika: niche separation by trophic specialization. Environmental Biology of Fishes 35, 1992, 283– 290.
[46]. J. Lobo´n-Cervia and P. A. Rinco´n, Trophic ecology of red roach (Rutilus arcasii) in a seasonal stream; an example of detritivory as a feeding tactic. Freshwater Biology 32, 1994, 123– 132.
[47]. F. Herder and J. Freyhof , Resource partitioning in a tropical stream fish assemblage. Journal of fish biology . 69, 2006, 571-589.
[48]. I. A. Verigina, Basic adaptations of the digestive system in bony fishes as a function of diet. Journal of Ichthyology 30, 1990, 897– 907.

Hanen. M. Ali Hamed "Morphological Differences and Their Relation to Diet of Epinephelus Aenuse and Siganus Luridus." IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS) 13.3 (2018): 01-06.