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# Reproductive Biology and Histology of Male Brushtooth Lizardfish *Saurida undosquamis* (Richardson), Family: Synodontidae, From The Mediterranean Coast of Egypt

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***Key words: Synodontidea, Saurida undosquamis, Brushtooth lizardfish, Reproductive biology, Histology, Testes, Reproduction.***

## ABSTRACT

The present study indicates that male *Saurida undosquamis* fish in the Egyptian Mediterranean Coast at Alexandria reached the first sexual maturity at a total length of 17 cm with a range of total length from 15 cm to 19 cm. The fish were divided into seven stages according to the maturity of the testes. Demonstration of the monthly distribution of these maturity stages indicated that this species has a long spawning season extending from late May to early March. The peak of the spawning activity extended from August to December. Monthly distribution of gonadosomatic index showed the highest value in May and June. Then decreased slightly in the following months. This slight decrease comes concomitant with the long spawning season and fractional spawning character.

## INTRODUCTION

The present study which deals with the reproductive biology and gonadal histology of male *Saurida undosquamis* in the Egyptian Mediterranean water off Alexandria is a second contribution in the study of the reproductive biology of this species. The first dealt with the female fish.

*S. undosquamis,* which belongs to family Synodontidae is one of many Lessepsian migrants that migrated to the Mediterranean sea from the Red Sea through the Suez Canal (Ben-Tuvia, 1953, 1966; Ben-Yami & Glaser, 1974; Shenouda, 1986; Faltas 1993; Saad, 1994; Backhoum, 2000).

The reproductive biology of *S. undosquamis* was studied by Shenouda, 1969 and Latif & Shenouda, 1973 in the Gulf of Suez. It was studied in the Egyptian Mediterranean waters by Faltas, 1993. This study demonstrated the reproductive biology of this species in comparison with another close species *Saurida saurus* in three different regions along the Egyptian Mediterranean waters. In the same year, Golani 1993, studied the biology of this species in the Mediterranean coast of Israel.

The present study aims at the investigation of the reproductive biology and gonadal histology of male *S. undosquamis* in Alexandria water.

## MATERIAL AND METHODS

Samples of *Saurida undosquamis* used in the present study were collected from the commercial catch at Anfoushy market, Alexandria, Egypt. The sampling was done three times a month throughout the period from January to December 2003.

Total Length ( to the nearest mm) and total weight (to the nearest gm) of the fish were recorded before its dissection. Then the gonads were examined to determine sex and maturity stage, removed and weighed (to the nearest mg). The gonadosomatic index was calculated as the percentage weight of the gonad to the gutted weight of the body. For histological examination, pieces of the testes were fixed in Bouin's fluid or 4% formol saline. Then washed with 70% ethyl alcohol prior to dehydration with an

ascending series of ethyl alcohol. They were then cleared in methyl benzoate and embedded in Paraffin wax (m.p. 58-62 $^{o}$C). Sections of 3-6µm thick were stained with Eosin-Haematoxylin and Triple Mallory stains for microscopic examination.

## RESULTS

**1. Maturity stages**

Maturity stages were detected through a morphological examination of the gonads by the naked eye. A scale of seven stages (Zaki *et al.* 1986) was adopted as follows:

**Stage I (thread sage)**

The testes are threadlike, transparent and occupy a very small proportion of the body cavity. They are colourless or having white colour.

**Stage II (immature stage)**

The testes are thin, flattened, semitransparent and occupy about one fourth of the body cavity.

**Stage III (maturation stage)**

The testes increased in size to occupy one third of the body cavity. They have a creamy white or dull grey colour.

**Stage IV (nearly ripe stage)**

Enlargement in the size of the testes was clear. They have a creamy white colour and occupy ¾ of the body cavity.

**Stage V (ripe stage)**

The testes are developed to their maximum size. They have white colour. The belly looks swollen and milt could be easily extruded upon exerting a slight pressure on the belly.

**Stage VI (spawning stage)**

The testes slightly decreased in size due to the discharge of milt during the spawning process. So, they become slightly flaccid and flabby. They have a white colour.

**Stage VII (spent stage)**

The testes are highly reduced in size, completely shrunken and collapsed. They have a deep dull white colour.

**2. Length at first sexual maturity**

According to Pitt(1970), the length at which 50% of a fish population reaches sexual maturity ($L_{50}$) is considered to be the length at first sexual maturity. In the present study, fish of different length groups were classified to either immature or mature individuals. Fish of stages I & II (thread & immature) are considered to be immature. Fish of of stages III to IIV (mature to spent) gonads are designated as mature individuals. Figure (1) shows that all male *Saurida undosquamis* fish with total length less than 15 cm are immature , while those longer than 19 cm are mature. By adopting $L_{50}$ value, it was found that male *Saurida undosquamis* fish reach first sexual maturity at 19.5 cm.

**3. Monthly distribution of maturity stages**

The percentage distribution of different maturity stages of male *S. undosquamis* in Alexandria Mediterranean waters is given in Table (1). It is obvious that the immature and mature stages were recorded during the whole year with the highest percentage during March and April. Nearly ripe stage was recorded throughout the whole year with the highest percentage during the period from March to June and then decreased due to the ripening of the testes. The ripe stage was recorded throughout the whole year with the maximum during April and May. Spawning stage was recorded throughout most of the year with the peak form August to January. Spent stage appeared in June recorded the peak in February.

**4. Gonadosmatic Index**

Monthly distribution of GSI of males is shown in Table (2). It is obvious that the G.S.I increased from February to reach the peak in May and then slightly decreased to reach the minimum value in January.

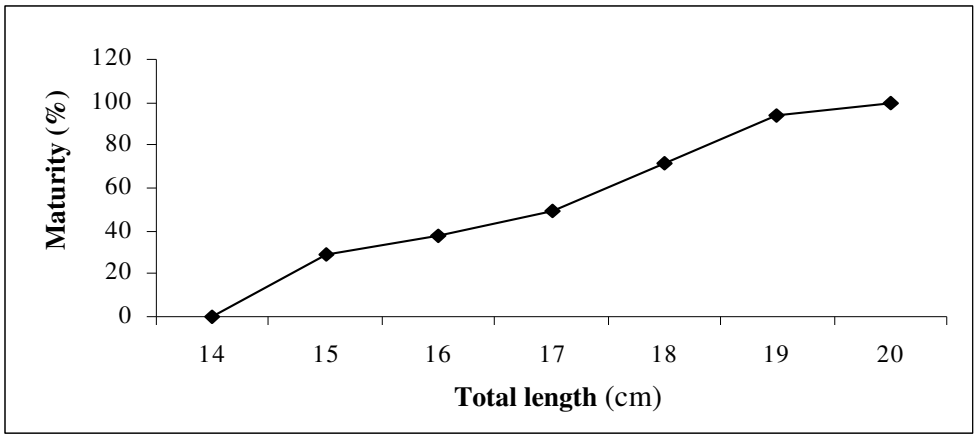


**Figure (1): The percentage distribution of mature *S. undosquamis* in Alexandria Mediterranean water.**

**Table (1): Monthly distribution of different maturity stages of male *S. undosquamis* in Alexandria Mediterranean water.**

| Month | No. of fish | Immature | | Mature | | Nearly Ripe | | Ripe | | Spawning | | Spent | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | No. | % | No. | % | No. | % | No. | % | No. | % | No. | % |
| **Jan.** | 25 | 2 | 8.0 | 3 | 12.0 | 1 | 4.0 | 4 | 16.0 | 9 | 36 | 6 | 24 |
| **Feb.** | 28 | 2 | 7.1 | 3 | 10.7 | 3 | 10.7 | 1 | 3.6 | 8 | 28.6 | 11 | 39.3 |
| **March** | 26 | 3 | 11.5 | 4 | 15.4 | 8 | 30.8 | 2 | 7.7 | 4 | 15.4 | 5 | 19.2 |
| **April** | 24 | 2 | 8.3 | 5 | 20.8 | 8 | 33.3 | 9 | 37.5 | - | - | - | - |
| **May** | 40 | 2 | 5.0 | 4 | 10.0 | 14 | 35.0 | 17 | 42.5 | 3 | 7.5 | - | - |
| **June** | 42 | 2 | 4.8 | 4 | 9.5 | 13 | 31.0 | 12 | 28.6 | 7 | 16.7 | 4 | 9.5 |
| **July** | 37 | 1 | 2.7 | 3 | 8.1 | 7 | 18.9 | 11 | 29.7 | 10 | 27 | 5 | 13.5 |
| **Aug.** | 49 | 1 | 2.0 | 2 | 4.1 | 7 | 14.3 | 8 | 16.3 | 23 | 46.9 | 8 | 16.3 |
| **Sept.** | 53 | 1 | 1.9 | 2 | 3.8 | 5 | 9.4 | 7 | 13.2 | 25 | 47.2 | 13 | 24.5 |
| **Oct.** | 37 | 1 | 2.7 | 1 | 2.7 | 3 | 8.1 | 3 | 8.1 | 18 | 48.7 | 11 | 29.7 |
| **Nov.** | 40 | 1 | 2.5 | 1 | 2.5 | 2 | 5.0 | 4 | 10.0 | 19 | 47.5 | 13 | 32.5 |
| **Dec.** | 45 | 3 | 6.7 | 2 | 4.4 | 2 | 4.4 | 4 | 8.9 | 18 | 40.0 | 16 | 35.6 |

**Table (2): Monthly distribution of GSI of male *S. undosquamis* in Alexandria Mediterranean water.**

| Month | No of fish | GSI | | |
|---|---|---|---|---|
| | | Minimum | Maximum | Mean ± SD |
| **Jan.** | 25 | 0.19 | 1.25 | 0.70±0.47 |
| **Feb.** | 28 | 0.25 | 2.25 | 1.07±0.55 |
| **March** | 26 | 0.26 | 2.50 | 1.50±0.84 |
| **April** | 24 | 0.35 | 3.08 | 1.83±0.79 |
| **May** | 40 | 0.79 | 3.42 | 2.09±0.86 |
| **June** | 42 | 0.62 | 3.52 | 1.80±0.74 |
| **July** | 37 | 0.73 | 2.91 | 1.66±0.78 |
| **Aug.** | 49 | 0.77 | 1.95 | 1.35±0.41 |
| **Sept.** | 53 | 0.60 | 1.89 | 1.31±0.39 |
| **Oct.** | 37 | 0.52 | 1.56 | 1.23±0.33 |
| **Nov.** | 40 | 0.33 | 1.45 | 1.18±0.28 |
| **Dec.** | 45 | 0.27 | 1.39 | 0.93±0.35 |

**Histological characteristics of the testes during spermatogenesis:**

Spermatogenesis in the testes of *S. undosquamis* was demonstrated in the present study through five stages of male germ cells according to Nagahama (1983). These stages are described as follows:

**1. Spermatogonia**

Spermatogonia stage is more frequent in the thread and immature testes. However, it could be rarely found in maturing and nearly ripe stages. Spermatogonia are the largest among male germ cells. Their diameter varied from 5 to 8µm. Spermatogonia have a large pale nucleus with a diameter varying from 3 to 5µm. The chromatin material could be found in the middle of the nucleus or near to the nuclear envelope.

Spermatogonia cells could be divided into two forms. Mother spermatogonia (A), which are the larger and more faint; and daughter spermatogonia (B), which are smaller and darker. The chromatin material in the nucleus of spermatogonia B looked lobular with irregular boundary (plates 1, 2 and 3).

**2. Primary spermatocytes**

Primary spermatocytes are produced by mitotic division of the spermatogonia. They have a smaller size than the spermatogonia. The diameter of a primary spermatocyte varied from 4 to 7µm. The nucleus is still distinct and large compared to the cell size. The chromatin material is condensed in one pole of the nucleus and became of a crescent shape (plates 2, 3 and 4).

**3. Secondary spermatocytes**

They are produced by a meiotic division of the primary spermatocytes. They are smaller and darker than the primary spermatocytes. Their diameter ranges from 3 to 5µm. Neither the cytoplasm nor the Nuclear envelope could be detected by ordinary microscope (plates 3 and 4).

**4. Spermatids**

Spermatids are produced by mitotic division of the secondary spermatocytes. They are smaller and more condensed than the secondary spermatoytes. The diameter of the spermatids ranges from 2 to 4µm (plate 4).

Spermatids undergo a spermiogenesis process to produce the sperms. This process includes nuclear condensation, tail formation and casting of the residual body.

**5. Spermatozoa**

The spermatozoa are the smallest among male germ cells. They are formed by the differentiation of the spermatids. They have a spherical or oval head with a diameter ranged from 1 to 3µm (plats 5, 6 and 7). A group of spermatozoa originating from one lobule may be oriented as a parachute shape as shown in plate 6.

The testes of *S. undosquamis* were classified morphologically in the present study according to Zaki *et. al*. 1986 into seven stages of maturity. Histologically, the spermatogenesis process was demonstrated through five stages of male germ cells according to Nagahama (1983). Stages I &II (thread & immature stages) are mainly characterized by the presence of spermatogonia A & B. The primary and secondary spermatocytes are also available in a high frequency, but the primary are more frequent than the secondary spermatocytes. During the beginning of maturation, the primary spermatocytes frequency increases. Also, the secondary spermatocytes increases but in a lower frequency. It is available in case of stage III (maturation stage). During stage IV (nearly ripe stage), all stages of male germ cells are available. The spermatogonia and the primary spermatocytes constitute a lower frequency than that of the previous stages. Secondary spermatocytes still appear in a high amount. Spermatids and spermatozoa stages appear in a considerable amount during the nearly ripe stage. During stage V (ripe stage), the testes are congested mainly by spermatozoa. Spermatids are also present, but in a lower frequency. Some spermatozoa, which are originating from the same seminal lobule are oriented as a parachute shape. During stage VI (spawning stage), the testes also contain mainly spermatozoa, but they are less congested than the ripe stage, depending on the time passed from the onset of the spawning process. During stage VII (spent stage), the testes contain a few amount of the spermatozoa, which remained in the testes and failed to be spawned. Thus, the testes looked flaccid and flabby.

## DISCUSSION

Important reproductive parameters of male *S. undosquamis* fish from Egyptian Mediterranean water at Alexandria coast were investigated in the present study to clarify the annual changes that the fish undergo during the annual reproductive cycle. These parameters are: maturity stages, length at first sexual maturity, monthly distribution of the maturity stages, gonadosomatic index and gonadal histology.

Seven maturity stages for the testes of *S. undosquamis* were determined morphologically by the naked eyes in the present study. These maturity stages are: stage I (thread); stage II (immature); stage III (maturation); stage IV (nearly ripe); stage V (ripe); stage VI (spawning); and stage VII (spent). The same scheme was used by Zaki *et al.* (1986) for *Clarias lazera*; Assem (1995) for solea species; El-Greisy (2000) for *Diplodus sargus*.

Knowledge of the length at first sexual maturity is important for fishery management. In the present study, the range of length at first sexual maturity for male *S. undosquamis* was 15-20 cm total length. However, Faltas (1993) recorded 15-19 cm in Alexandria and Damietta; Budnichenko & Dimitrova (1979) recorded 12-13cm in the Arabian Sea; Latif and Shenouda (1973) recorded 16cm in the Gulf of Suez; Sanders and Kedidi (1984) recroded 17cm in the Gulf of Suez.

Difference in the length at first sexual maturity from one region to another could be attributed to the difference in environmental conditions.

Demonstration of the monthly distribution of the maturity stages of *S. undosquamis* revealed that this species exhibits nearly a year round spawning season extending from late May to January with the maximum activity from August to December. It showed that the immature and maturing stages were recorded during the whole year with a peak during March and April. Maturation of the testes increased to record the maximum percentage of ripe testes during May, after which spawning stage starts to appear and increase to record the maximum in October. Spent stage starts to appear in June and extends until March being highest in November, December, January and February.

The length of the spawning season and the breeding activity could be demonstrated through the monthly distribution of the GSI values. These values started to increase from February to reach the maximum in May. After that, it decreased slightly due to the spawning process to reach the minimum in January. This slight decrease in GSI values indicated that this species has a long spawning season.

Histologically, the course of male germ cells was divided into five stages. These stages started by the spermatgonia and ended by the spermatozoa according to Nagahama (1983). As spermatogenesis and spermiogenesis proceed, the cyst expands and eventually ruptures, liberating sperms into the lobular lumen, which are continuous with the sperm duct.

The histological features of the testes of *S. undosquamis* throughout the spawning season showed that the discharge of the spermatozoa from the seminiferous lobules proceeds gradually and slowly . Thus, the spawning season is very long and expands nearly a year round.

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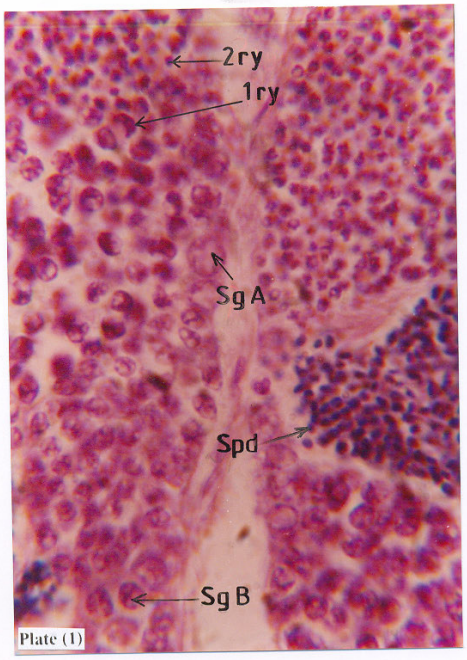
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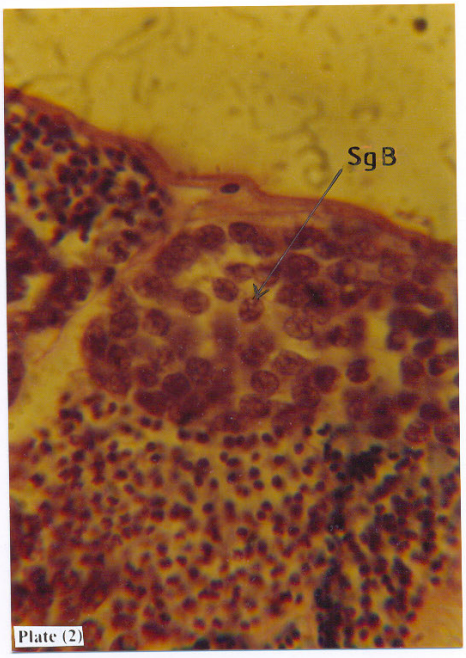
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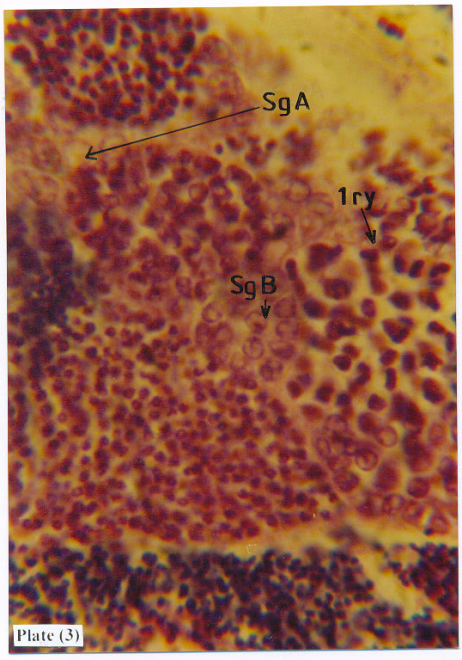
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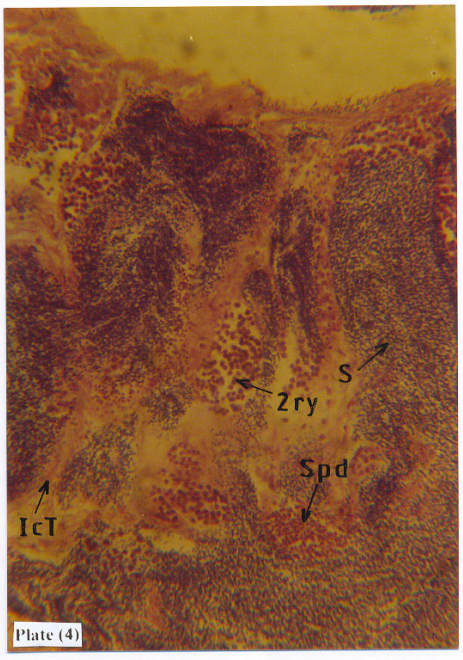
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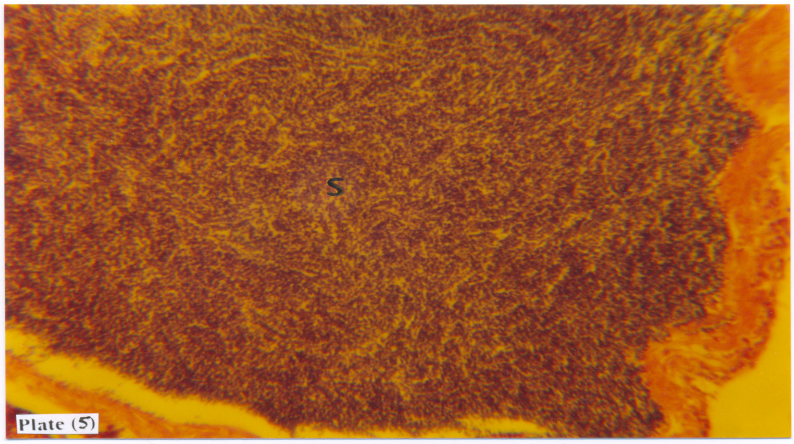


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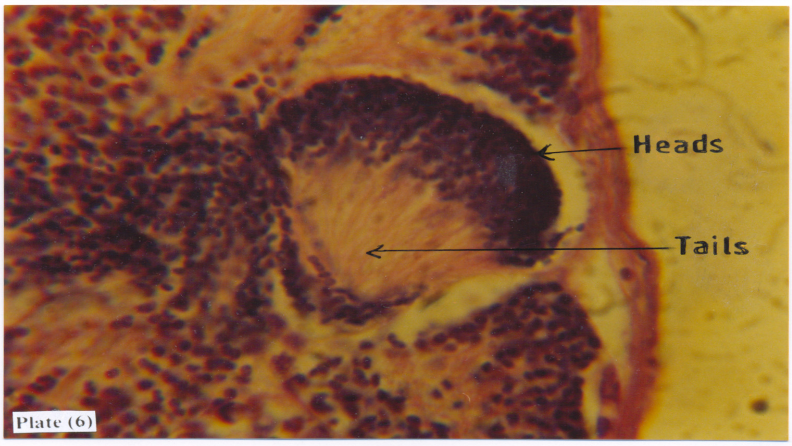


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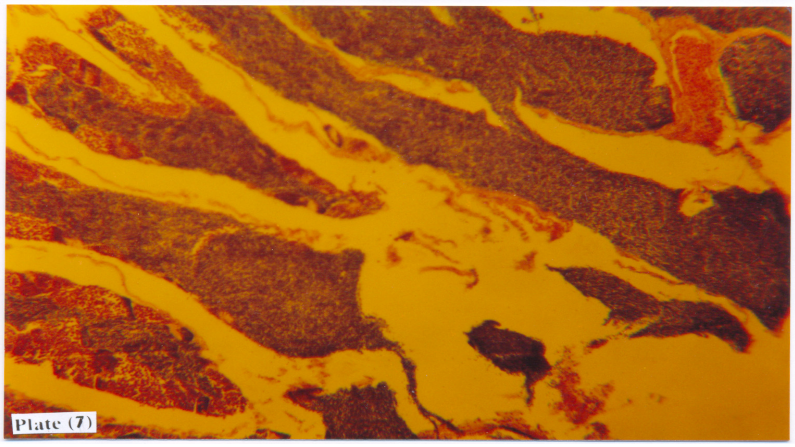

Plate (7)

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