International Journal of Innovative Studies in Aquatic Biology and Fisheries (IJISABF)
Volume 1, Issue 1, June 2015, PP 38-45
www.arcjournals.org

A Contribution to the Fishery Biology of an Immigrant New Species, *Sillago Suezensis* (Golani, Fricke & Tikochinski, 2014) (Family Sillaginidae), In the Egyptian Mediterranean Waters "Off Port Said"

El Sayed Haroun Khamis Akel, Samir Ibrahim Rizkalla

Fishery Biology Lab, National Institute of Oceanography and Fisheries
Kait-Bey, Alexandria, Egypt
akeldraly@yahoo.com, samirrizkalla@hotmail.com

Abstract: *Sillago suezensis (GOLANI; FRICKE and TIKOCHINSKI, 2014) samples were collected during September and November 2013 from bottom trawlers operated off Port Said (Egyptian Mediterranean waters). It was evident that 87 specimens recorded had lengths between 12.0cm and 19.0cm with an average of 14.2cm while three specimens (recruits) with average length 7.0cm were recorded during November. Length- weight relationship showed negative allometric growth and condition factor varied between 0.877 for smaller size (12.0cm) and 0.642 for large size fishes (19.0cm). Age composition of this species revealed the presence of two age groups during September: age group one with mean length 13.62cm and age group two with average length 17.01cm. The sex ratio of males to females was 0.85: 1 however; males dominated the catch at length ranged between 12.0cm and 16.0cm but females dominated the catch at larger sizes between 17.0cm and 19.0cm. The maturity stages of males and females showed that both sexes were ripe during September and the appearance of recruits in November declared that this species nearly spawn during summer. The potential impacts of the economic Erythrean species in the Egyptian Mediterranean fisheries exhibit desirable consequences.*

Keywords: *Sillago suezensis, morphometrics, biology, invasive species, Egyptian Mediterranean waters.*

1. INTRODUCTION

The biodiversity of the eastern part of the Mediterranean Sea has been altered since the opening of the Suez Canal in 1869. There were two barriers prevented the migration of Indo – Pacific species to the Mediterranean Sea. The first one was the high water salinity of Bitter Lakes (THOROSON, 1971). The second barrier was the Nile flood which was lowering the salinity of sea water in front of Port Said. By time the continuous dissolution of the salt bed in the Bitter Lakes due to deepening, widening and continuous ship movement in the Canal, in addition to the cessation of the Nile flood after the construction of the Aswan High Dam in 1965 – 1970 initiated favorable environmental conditions for the settlement and spreading of Erythrean fish and invertebrates in eastern Mediterranean basin (POR, 1978; MORCOS, 1990; POR, 1990; HALIM *et al.*, 1995 and HALIM, 2004).

BEN- TUVIA (1985) listed 41 species including the records of MOUNEIMNE (1977). However, GOLANI *et al.* (2002) reported 59 exotic species and later on GOLANI *et al*. (2011) recorded 65 Indo – Pacific species. GÜCÜ *et al.* (1994) recorded the occurrence of Red Sea fish (*Sillago suezensis*) at Turkish Mediterranean waters northern Cilician basin with maximum length 20.3 cm.

As regards to Egyptian waters, EL SAYED (1994) gave a check list of 31 Indo – Pacific fish out of a total 257 of Mediterranean fishes. RIZKALLA (1997), ALLAM *et al*. (1999), AKEL (2005) and GAMEE (2005) added new species to account 38. Recently HALIM and RIZKALLA (2011), TEMRAZ and BEN SOUISSI (2013) and RIZKALLA and AKEL (2015) recorded new species reaching to 45 Indo- Pacific species in the Egyptian Mediterranean waters.

TIKOCHINSKI *et al.* (2013) investigated genetic difference between *Sillago sihama* from Hong Kong which was also found in southern Red Sea and *Sillago suezensis* from eastern Mediterranean Sea and was also observed in the northern Red Sea. They declared that *Sillago suezensis* constitutes a distinct population inhabits both north Red Sea and the eastern Mediterranean. GOLANI *et al.* (2014)

studied and re-examined Sillaginid fishes in south and north Red Sea and differentiated between both populations. *Sillago suezensis* is characterized by having swim bladder divided posteriorly into two extensions sheltering under the vertebral column which consists of 34 vertebrae, and the absence of scales on the preopercle and the low position of nostril. INNAL *et al*. (2015) studied the length-weight relationship and morphometry of *Sillago suezensis* from Antalya Gulf (Mediterranean-Turkey). Erguden and Turan (2013) considered this fish, *S. suezensis,* as one of the Lessepsian species that has an economic importance.

The sand whiting Sillago species has a worldwide distribution in Indo-Pacific, eastern Africa through the Indian Ocean to Korea, northern Australia, to Solomon Islands (Mckay, 1992). *Sillago suezensis* was misidentified first as *Sillago sihama* from Red Sea and was first recorded in Lebanon (MOUNEIMNE, 1977); successively recorded in Israel (BEN-TUVIA, 1985); Turkey (GÜCÜ *et al.*, 1994) and Egypt (ELSAYED, 1994).Recently, *Sillago suezensis* was established and identified as a new immigrant population from north Red Sea to the eastern Mediterranean Sea by GOLANI *et* al.(2014).

The objective of the present work is to cover the paucity of information on the fishery biology of an invasive Erythrean species *Sillago suezensis* (family Sillaginidae) in the Egyptian Mediterranean waters.

2. MATERIALS AND METHODS

Random samples were collected from the trash catch of the bottom trawlers operated off Port Said (Egypt) during September and November 2013 (Fig.1). It is worth to mention that this species did not appear yet in other areas along the coast line of Egypt. The diagnostic features and meristic characters of the species were investigated. For each individual fish total length and weight were obtained to the nearest centimeter and gram, respectively. The length weight relationship ($W = a L^b$), where L is the total length in cm and W is the weight in gram, and a & b are constants estimated by the least square method. The condition factor (K) was calculated from the equation: $K= 100 W / L^3$, where W= total weight (g); L= total length (cm). Sex was determined to evaluate the sex ratio of the species. Age composition was estimated by using the length frequency distribution (LFD) according to Bhattacharya method (1943).

Figure1. *A map showing Port Said, Suez Canal and Gulf of Suez (Egypt)*

3. RESULTS

3.1. Diagnostic Features: (Fig.2)

Body Shape: The body is elongated with terminal mouth and the dorsal head profile is more or less straight. The first dorsal fin is strengthened with 11 spines but the second dorsal one with 21 rays however the anal fin with 2 spines and 19 fin rays. The body back is light brown but belly is silver. The caudal fin is forked; edge of its upper and lower lobes is black. Pectoral, ventral and anal fins have yellow tint.

Morphometric Measurements for one Specimen: Total length: 19.0cm; Fork length: 16.5cm; Head length: 4.5cm; Eye diameter 0.7cm; Pre first dorsal length 5.5cm; Pre second length: 9.0cm; Pre pectoral length 4.7cm ; Pre ventral length: 5.0cm ; Pre anal length : 9.0cm and Body depth : 3.0cm.

Figure2. *Sillago suezensis caught from Egyptian Mediterranean waters, off Port Said, during 2013*

3.2. Size Composition: (Table1)

The total number of *Sillago suezensis* species under investigation was 87. Their length ranged between 12.0cm and 19.0cm with mean of 14.3cm and weight ranged between 15.5 and 44.0g with mean of 21.4g.

The dominant lengths for combined sexes were 13.0cm, 14.0 and 15.0cm representing 31.03 %, 41.38 % and 11.49 % respectively.

3.3. Length – Weight Relationship: (Fig. 3)

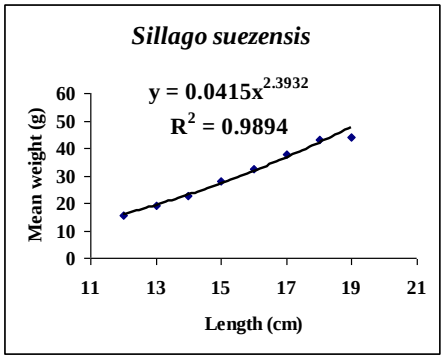

Figure3. *Length- weight relationship of Sillago suezensis from Egyptian Mediterranean waters,(off Port Said), during 2013.*

The equation representing the length- weight relation was found to be as follows:

$Y = 0.0415\ X^{2.3932}$

where a = 0.0415, b = 2.3932 and $R^2 = 0.9894$.

3.4. Condition Factor (K): (Table1)

It was found that this factor varied between 0.877 for smaller size (12.0cm) and decreased gradually reaching 0.642 for large size fishes (19.0cm) with an average of 0.796.

Table1. *Size composition, number , percentage, total weight, mean weight and condition factor for combined sexes for Sillago suezensis caught from the Egyptian Mediterranean waters off Port Said, during 2013.*

Length (cm)	Number	%	Combined Sexes		K
			Total weight (g)	Mean weight (g)	
12.0	2	2.3	31	15.50	0.877
13.0	27	31.03	514	19.00	0.865
14.0	36	41.38	820	22.80	0.831
15.0	10	11.49	279	27.90	0.827
16.0	2	2.30	65	32.50	0.793
17.0	6	6.90	2225	38.00	0.773
18.0	2	2.30	86	43.00	0.727
19.0	2	2.30	88	44.00	0.642
Total number	87				
Mean weight(g)				21.4	
Length range(cm)	12- 19				
Mean length(cm)	14.20				
Average K					0.796

3.5. Age Composition: (Fig.4)

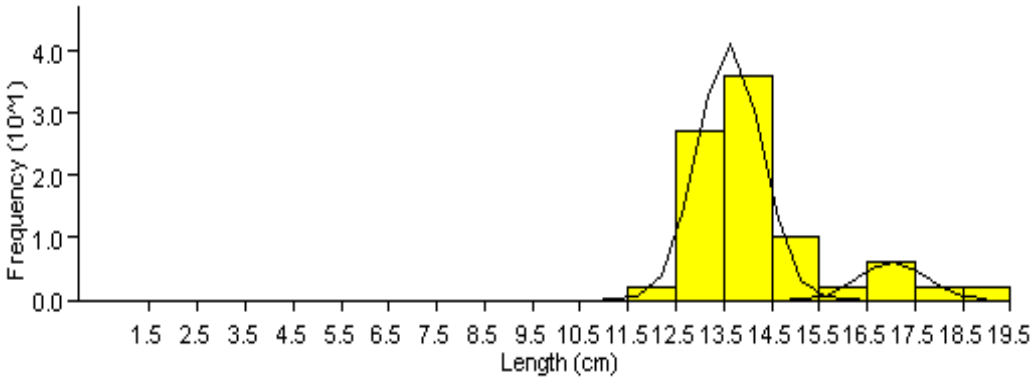

Figure4. *Length- Frequency distribution of Sillago suezensis from Egyptian Mediterranean waters, (off Port Said), during 2013*

By applying Bhattacharya method of length frequency, *Sillago suezensis* had two age groups: age group I with mean length 13.62cm and age group II with mean length 17.02cm. Age group I dominated the population during September forming 87% of the total examined fishes.

3.6. Sex Ratio: (Table2)

Table2. *Sex variation of Sillago suezensis caught from the Egyptian Mediterranean waters, off Por Said, during 2013.*

Length (cm)	Number	Male		Female	
		No.	%	No.	%
12.0	2	1	50.00	1	50
13.0	27	17	63.00	10	37.00
14.0	36	11	30.60	25	69.40
15.0	10	7	70.00	3	30.00
16.0	2	2	100.00	-	-
17.0	6	1	16.70	5	83.30
18.0	2	-	-	2	100.00
19.0	2	1	50.00	1	50.00
Total number	87				
Sex ratio	0.85: 1				

The total number of males was 40 individual out of total 87 and dominated length groups were between 13.0 cm and 16 .0 cm but females dominated the length groups 17.0 cm and 18.0cm. The sex ratio between males and females was 0.85:1.

4. RECRUITS

On 23 of November 2013 three individuals of *Sillago suezensis* of small lengths (6.0cm and 7.0cm) appeared in the catch of the bottom trawler operated in front of Port Said. These were considered the first recruits of this species after the spawning period having age group less than one year.

5. DISCUSSION

The coastal ecosystem of the eastern Mediterranean Sea had been subjected to the establishment of non- indigenous species (NIS) of Indo- Pacific origin. EDELIST *et al*. (2012) declared that the rate of fish migration has increased in recent decades. GOREN and GALIL (2005) mentioned that nearly half of the catches along the Israeli coast is composed of Erythrean species. The process of increasing sea temperature has been accelerated in recent years with increasing records of newly discovered Erythrean species and expansion towards other areas of eastern Mediterranean basin (GALIL and ZENETOS, 2002) and western Mediterranean (HARMLIN -VIVEN *et al*., 2005). GOLANI *et al*. (2011) declared that 65 Lessepsian fish species have been recorded from the Mediterranean. ZENETOS *et al*. (2012) found that the total alien species of fishes in the Mediterranean increased by six species per year.

The comparison of morphometric characters in the present work and those given by INNAL *et al*. (2015) in Turkey for *Sillago suezensis* and *Sillago sihama* was given in table (3). It is clear that pre

first dorsal, pre pelvic, pre pectoral and head lengths, body depth length have the same proportions in both species. However, a tangible difference was observed for pre anal length and caudal fin of *Sillago suezensis* which is markedly forked while that of *Sillago sihama* is truncate. The second dorsal fin is situated on the same vertical line with anal fin.

Table3. *Comparison of percentages of different morphometric measurements of Sillago suezensis from Egyptian Mediterranean waters and those from Antalya Gulf-Turkey and Sillago sihama given by www.fishbase (Family: Sillaginidae)*

Measurement	Percentage		
	Sillago sihama Www. fish base	*Sillago suezensis* INNAL *et al*. 2015	*Sillago suezensis* Present work
Total length	-	14.3 cm	19.00 cm
Standard length	89.20 % T.L.	83.66% T.L	-
Fork length	99.10 % T.L.	93.78% T.L	86.80 % T.L
Pre first dorsal length	29.30 % T.L.	27.81% T.L	28.90 % T.L.
Pre second dorsal length	-	46.15% T.L	47.40 % T.L.
Pre pelvic length	25.60 % T.L.	26.46% T.L	26.30% T.L.
Pre pectoral length	24.00 % T.L.	24.84% T.L	24.70 % T.L.
Pre anal length	50.89 % T.L.	46.8% T.L	47.40 % T.L.
Body depth	17.50 % T.L.	14.53% T.L	15.80 % T.L.
Head length	23.54 % T.L.	22.21% T.L	23.74 % T.L.

Comparing the results of length – weight relationship (LWR), in the present work with those given by TASKAVAK and BILECENOGLU (2001) and INNAL *et al*. (2015) in Turkey (Table 4), it is evident that the recently migrated *Sillago suezensis* to the Egyptian Mediterranean water showed negative allometric growth (b< 3) when compared with those in Turkey which have positive allometric growth. Lower value of "b" in the present work from cube law may be attributed to poor number of samples examined and also the prevailing environmental conditions. It is well known that there is a number of factors affect length- weight relationship such as growth phase, season effect, size range, fish condition and the used gear selectivity. The condition factor in the present work revealed that the value is higher in smaller size and lower in larger size. SHAMSAN and ANSARI (2010) in India, mentioned that in *Sillago sihama* as in most tropical fishes which have protected breeding season, the entire growth is confined to the prematurely phase and has little growth after they become sexually mature.

Table4. *A comparison between the parameters of length weight relation of Sillago suezensis (present work) from Port Said, Egyptian Mediterranean waters, and those from Turkey (2001 and 2015)*

Country	Length (cm)	a	b	R^2	Author
Turkey	9.4 – 20. 30	0.00317	3.355	0.931	TASKAVAK &BILECENOGLU 2001
Turkey	12.2 - 17.6	0.0066	3.0478	0.9339	INNAL *et al*., 2015
Egypt	12 – 19	0.0415	2.392	0.9894	Present Work

Considering the size composition of *Sillago suezensis*, in the present work, varied between 12.0cm and 19.0cm with mean length 14.2cm and mean weight 21.4g. TASKAVAK and BILECENOGLU (2001) in Turkey found that the size of *Sillago suezensis* ranged between 9.4cm and 20.3cm. Later on, INNAL *et al*. (2015) in Turkey recorded that this species measured between 12.2 and 17.6cm with mean length 14.03cm and mean weight 21.03g.

Age composition analysis using Bhattacharya method (LFD) suggested that this species has two age groups (age group I with mean length at 13.62 cm and age group II with mean length 17.02cm). The majority of the samples belonged to age group I. This result was found to be in agreement with those given on *Sillago sihama* in India by SHAMSAN and ANSARI (2010) who found that age group I was with mean length 13.09cm and age group II was with mean length 16.83cm.

As regards to sex ratio of the sample taken in September, females were found dominating the sample forming 54.1% of the total. RADHAKRISHNAN (1957) in India found that the sex composition, of the samples examined in *Sillago sihama* during 1953 and 1954, was 55.6% males and 44.4% females. The present results demonstrated that spawning occurred in September and the recruits (6.0cm and 7.0cm) appeared in late autumn (November). COULSON *et al*. (2005) reported that water temperature plays a crucial role in stimulating spawning activity in sillaginids.

A relevant information; the important economic Erythrean species in Egyptian Mediterranean waters are: *Scomberomorus commerson; Siganus rivulatus,; Siganus luridus; Dussumieria elepsoides, Etrumeus teres; Herklotsichthys punctatus; Saurida undosquamis; Upeneus moluccensis, Upeneus pori; Sphyraena chrysotaenia; Sphyraena flavicuda; Alepes djedaba; Nemipterus japonicus; Crenidens crenidens; Liza carinata; Fistularia commersonii*; *Pempheris vanicolensis*, variety of shrimps and two crabs.

It must be taken in consideration, that the spread and establishment of new exotic fish species to new habitats has always been a natural and continuous process over the ages. The Mediterranean Sea in particular has seen successive waves of introductions. Its fauna and flora consist of a mosaic of formerly alien species. The rate of fish invasion has continued unabated. AKEL (2005) declared that *Siganus spp*. and *Alepes djedaba* were represented by 24 % and 1.32 % by weight in the catch of the day time purse seine in Abu Kir Bay. FARRAG (2010) showed that *Etrumeus teres* formed 10.4 % of the total catch obtained by purse seine using light. AKEL and PHILIPS (2014) recorded that economic immigrant species weighed 17.4 % from the total catch of the beach seine operated in the eastern harbor (Alexandria). The potential impacts of the economic Erythrean species in the Egyptian Mediterranean fisheries may exhibit desirable consequences.

The present article focused on the fishery biology of *Sillago suezensis* in the Egyptian Mediterranean waters as it became a distinct population expecting to establish as economic immigrant species in the future.

ACKNOWLEDGEMENT

The authors wish to thank Dr.Ragia Moussa for providing the authors with samples under studies and her communication with ARCA (Alexandria research center for adaptation to climate change, Egypt) that funded a project “Pattern of diversity and climate change in Mediterranean transitional zone” held at NIOF (National Institute of Oceanography and Fisheries, Egypt).

REFERENCES

[1]. AKEL, E.H.KH., 2005. A comparative study on the catch characteristics of purse – seine during the day time in Abu Qir and El – Mex Bays, Alexandria, (Egypt). Egyptian Journal of Aquatic Research, 31(2): 357- 372.

[2]. AKEL, E.H.KH. and PHILIPS, A. E., 2014. Fisheries and biodiversity of the beach seine catch from the Eastern Harbor, Alexandria, Egypt. Egyptian Journal of Aquatic Research. 40 : 79-91.

[3]. ALLAM, S. M.; FALTAS, S.N. and RAGHEB, E., 1999. Food and feeding habits of barracuda in the Egyptian Mediterranean waters off Alexandria. Bulletin of the National Institute of Oceanography & Fisheries, 25: 395 – 410.

[4]. BEN – TUVIA, A., 1985. The impact of Lessepsian (Suez Canal) fish migration on the Eastern Mediterranean Marine Ecosystems. M. Moraitou- Apostlopoulou & V. Kiortsis (Eds). Plenum Press, New York.

[5]. BHATTACHARYA, A. (1943). "On a measure of divergence between two statistical populations defined by their probability distributions". – Bulletin of the Calcutta Mathematical Society. 35: 99- 109.

[6]. COULSON, P. G.; HESP, S. A.; POTTER, I. C. and HALL, N. G., 2005. Comparisons between the biology of two co- occurring species of whiting (Sillaginidae) in large marine embayment. Environ. Biol. Fish., 73: 125- 139.

[7]. EDELIST, O.; RILOV, G.; GOLANI, D.; CARLTON, J.T. and SPRNIER, E., 2012. Restructuring the Sea: Profound shifts in the world ’s most invaded marine ecosystem. Diversity and Distributions, 1- 9.

[8]. EL – SAYED, R. S. 1994. Check – list of Egyptian Mediterranean fishes. Bulletin of the National Institute of Oceanography & Fisheries, 1 – 77.

[9]. ERGUDEN D, TURAN C. Recent Developments in Alien Fish Fauna of the Gulf of Iskenderun and Mersin. Research Journal of Biological Sciences 2013; 6(1):17-22.

[10]. FARRAG, M. M., 2010. Fishery biology of Red Sea immigrant Etrumeus teres. M.Sc. Thesis, Al-Azhar Univ., Assiut, Egypt. 180 pp.

[11]. GAMEE, F. M., 2005. Taxonomical and biological studies on some representatives of Family Labridae in the Egyptian Mediterranean waters off Alexandria, Ph D., Thesis, Fac. Science, Alex. Univ., 235 pp.

[12]. GALIL, B. S. & ZENETOS, A., 2002. A sea of change: exotics in eastern Mediterranean Sea. In LEPPÄKOSKI, E., GOLLASCH, S.; OLENIN, S. (Eds). Invasive aquatic species of Europe: Distribution, Impact and Management. Kluwer Acad. Pub. Dordrecht. The Nederland: 325 – 236.

[13]. GOREN, M. & GALIL, B. S., 2005. Changes in fish assemblages of Levantine inland and marine ecosystem. Journal of Applied Ichthyology, 21,364 – 370.

[14]. GOLANI, D., ORSI-RELINI, L., MASSUTI, E. & QUIGNARD, J.-P., 2002. CIESM Atlas of Exotic species in the Mediterranean. Vol.1. Fishes. F. Briand (Ed).Monaco, 254 pp.

[15]. GOLANI, D.; ORSI- RELINT, L.; MASSUTI, E.; QUINGARD, J. P.; DULCIC, J. and AZZURRO, E.,2011. CIEZM Atlas of Exotic Fishes in the Mediterranean Sea. http // www. Ciezm org / atlas appendix land, 2, html.

[16]. GOLANI, D.; FRICKE, R. and TIKOCHINSKI, Y., 2014. Sillago suezensis, a new whiting from the northern Red Sea, and the status of Sillago erythraea Cuvier (Teleostei: Sillaginidae). J. Nat. Hist.48 (7-8): 413-428.

[17]. GÜCÜ, A.C., F. BINGLE, D. AVSAR and N. UYSAL, 1994. Distribution and occurrence of Red Sea fish at the Turkish Mediterranean Coast-Northern Cilician basin. Acta Adriatica 34(1/2):103-113.

[18]. HALIM, Y.; MORCOS, S. A. ; RIZKALLA, S. I. and El – SAYED, M. KH., 1995. The impact of the Nile and the Suez Canal on the living resources of the Egyptian Mediterranean waters (1958 – 1986). p. 19 – 57. In: Effects of riverine impacts on coastal ecosystems and fisheries resources, FAO Fisheries Technical Paper, No. 349, FAO, Rome.

[19]. HALIM, Y.; MORCOS, S. A. ; RIZKALLA, S. I. and El – SAYED, M. KH., 1995. The impact of the Nile and the Suez Canal on the living resources of the Egyptian Mediterranean waters (1958 – 1986).

[20]. p. 19 – 57. In: Effects of riverine impacts on coastal ecosystems and fisheries resources, FAO Fisheries Technical Paper, No. 349, FAO, Rome.

[21]. HALIM, Y., 2004. The Nile and Levantine Pump. P. 73 – 82. In: Proceedings" Isotopes in Environmental Studies. Aquatic Forum". LAEA Monaco, 25 – 29, October 2004.

[22]. HALIM, Y. and RIZKALLA, S.I., 2011. Aliens in Egyptian Mediterranean waters. A check – list of Erythrean fish with new records. Mediterranean Marine Science, 12 / 2: 479 – 490.

[23]. HARMELIN- VIVIEN, M. L.; BITAR, G.; HARMELIN, J. G.; and MONESTIEZ, P., 2005. The littoral fish community of the Lebanon rocky coast (eastern Mediterranean Sea) with emphasis on Red Sea immigrant, Biological Invasions, 7: 625 – 637.

[24]. MCKAY, R. I., 1992. FAO species catalogue, Sillaginid Fishes of the world (Family: Sillaginidae). An annotated and illustrated catalogue, smelt or Indo – Pacific whiting species known to date.

[25]. FAO Fish Synopsis, 125(14): 87 pp, Rome: FAO.

[26]. MORCOS, S.A. 1990. Physical and chemical oceanography. In: Red Sea, Gulf of Aden and Suez Canal.

[27]. A Bibliography on Oceanographic and Marine Environmental Research, (Morcos, S.A. & Varley, A. eds), pp. xvi-xxii.

[28]. MOUNEIMNE, N., 1977. Liste de poisons de la côte Liban (Méditerranée orintale) Cybium, 1: 37 – 66.

[29]. INNAL, D.; KISIN, B. and Akdoganbulut, D. (2015). Length-weight Relationships and Morphometry of *Sillago suezensis* from Antalya Gulf-Turkey. International Journal of Fisheries and Aquatic Studies; 2(4): 107-112.

[30]. POR, F. D., 1978.Lessepsian Migration. Ecological Studies. Vol. 23. Springer- Verlag, Berlin, 228 pp.

[31]. POR,F.D.,1990.Lessepsian Migration. An appraisal and new data. Bull. de l' institute Oceanographique. Monaco, 7: 1 -10.

[32]. RADHAKRISHNAN, N. 1957. Contribution to the Biology of Indian Sand whiting *Sillago sihama* (Forskål); Indian J. Fish., 4(2): 254-283.

[33]. RIZKALLA, S. I., 1997. New records of Lessepsian Fishes found in the Egyptian Mediterranean waters, p.464 – 470. In: Proceedings of the 7 th International Conference on "Environmental Protection is a must", Alexandria, Egypt.

[34]. RIZKALLA, S. I. and Akel, E. H. KH., 2015. New records of Indo- Pacific and Atlantic species in the Egyptian Mediterranean waters. Mediterranean Marine Science. Collective article. April 2015.

[35]. SHAMSAN, E.F. and ANSARI, Z. A., 2010. Study of age and growth of Indian sand whiting, *Sillago sihama*, (Forskål) from Zuari estuary. Goa.

[36]. TASKAVAK, E. and BILECENOGLU, M., 2001. Length-weight relationships for 18 Lessepsian (Red Sea) immigrant fish species from the eastern Mediterranean coast of Turkey. J. Mar. Biol. Ass. U.K. 81(5):895-896.

[37]. TEMRAZ, T. and BEN SOUISSI, J., 2013. First record of striped eel cat fish *plotosus lineatus* (THUNBERG, 1787) from Egyptian waters of the Mediterranean. Rapp. Comm. int. Mer Médit., 40.

[38]. THORSON, G., 1971. Animal migrations through the Suez Canal in the past, recent years and the future (A preliminary report). Troisiem Symposium European de Biologie Marine: Supplement No. 22: 841- 846.

[39]. TIKOCHINSKI, Y.; SHAININ, I.; HYAMS, Y.; MOTRO, U. and GOLANI, D., 2013. Genetic evidence for an undescribed species previously considered as *Sillago sihama* from the northern Red Sea. Marine Biology Research Volume 9, Issue 3, pages 309-31. www.Fishbase.com (Family: Sillaginidae).

[40]. ZENETOS, A.; GOFAS, S.; MORRI, C.; ROSSO, D.; VIOLANTI, D. et al., 2012. Alien species in the Mediterranean Sea by 2012. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part 2. Introduction trends and pathways. Mediterranean Marine Science, 13 (2), 328-352.