Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 24(3): 145 – 156 (2020)
www.ejabf.journals.ekb.eg

Species composition, length-weight relationships and condition factor of commercial species grasped by trammel nets and gill nets in the Gulf of Suez, Red Sea, Egypt

Mahmoud A. Saber, Amgad M. Shaaban, Azza A. El ganainy and Hanan M. Osman*
National Institute of Oceanography and Fisheries, Suez, Egypt
*Corresponding author: hanan_zxcv@yahoo.com

ARTICLE INFO

Article History:
Received: March 18, 2020
Accepted: April 29, 2020
Online: May 2020

Keywords:
Isometric growth,
Gill net,
Trammel net,
Gulf of Suez,
Condition factor

ABSTRACT

Three experimental fishing operations were conducted in the Gulf of Suez during October 2018, January 2019, and September 2019 to analyze the species composition of fishes caught by trammel nets and gill nets. Trammel nets and gill nets are important artisanal fishing gears in the Gulf of Suez. The main catch of the trammel net contained 16 species belonging to 11families, on the other hand, the catch of gill net was dominated by 4 species belonging to 4 families. Concerning the trammel net, three species constituted about 89.19 % of the total catch (*Gerres oyena* 33.87%, *Siganus rivulatus* 25.32%, and *Rhabdosargus haffara* 20.0%). While the catch of gill net composed of 4 species; *Siganus rivulatus* (51.69%), *Liza carinata* (32.17%), *Gerres oyena* (14.14%), and *Diplodus noct* (1.99%). The results of the length-weight relationships for 9 species revealed that 6 species have isometric growth, two species namely *Pomadasys stridens* and *Liza carinata* showed negative allometric growth whereas one species, *Siganus rivulatus* has positive allometric growth. The mean condition factor, *K* for 9 fish species in the Gulf of Suez ranged from 1.0 for *Liza carinata* to 1.6 for *Stephanolips diaspros*. The provided data can be used as a basis for proper management of the fisheries of these species in the Gulf of Suez.

INTRODUCTION

The Gulf of Suez is the north eastern part of the Red Sea. Suez Bay is the northern part of the Gulf of Suez and provides important nursery areas, feeding sites, spawning grounds and shelter for many fish species (Abd EL-Naby *et al*, 2018). The small-scale fisheries, Gulf of Suez depend mainly on gill nets and trammel nets with different mesh sizes. Small scale fisheries (SSF) are some of the major economic activities along the Gulf of Suez. There are 711 boats operating along the whole fishing ground of the Gulf of Suez using long lines, trammel nets and gillnets (GAFRD, 2016). Gillnets and trammel nets are widely used in small-scale fisheries because they require little investment in labor and equipment. Trammel nets are sometimes used as a sampling gear because there is less mortality associated with them than with gill nets. However, the time required to remove fish from trammel nets is often much more than the time needed to remove fish from gill nets (Hubert *et al.,* 2012).

There are many biological studies on the commercial species that caught by deffernt fishing gears in the Gulf of Suez (El- Ganainy &Sabrah, 2008, El-Etreby et *al*., 2013, Sabrah, 2015, El-Ganainy *et al*., 2018, Osman *et al.*, 2019, Saber & Gewida 2020). However, there is a little information about the species composition of fishes caught by trammel nets and gill nets in the Gulf of Suez. The Length-weight relationship has an important role in fishery resources management where it is useful for comparing life history, morphological aspects of populations inhabiting different regions, length and age structures and estimating condition factor (Goncalves *et al*., 1997 and Froese and Pauly, 2012).

Mathematically, length–weight relationship explains the correlation between fish length and fish weight. Hence, it is useful for converting length observations into weight estimates to provide some measure of biomass (Froese, 1998). The information about the length-weight relationships of fish species investigated in our study in the Gulf of Suez is very scarce and incomplete. Relationship between length and weight is required for setting up yield equation (Beverton & Hold, 1957; Ricker, 1968) and sometimes it may be useful as a character to differentiate "small taxonomic units" (Le Cren, 1951). Thus, the aim of this study is the characterization of trammel nets and gill nets used in the Gulf of Suez and determination of the length–weight relationship for the most common species collected by trammel net and gill net in the Gulf of Suez, Red Sea, Egypt.

MATERIALS AND METHODS

Fish samples were obtained from an experimental fishing operations conducted by using a small-scale fishing vessel (12 m length) in the Gulf of Suez (Figure 1). We used a gillnet with mesh size 36 mm and a trammel net with inner panel mesh size 34 mm. The general characteristics of the trammel net and gill net are shown in Table (1).

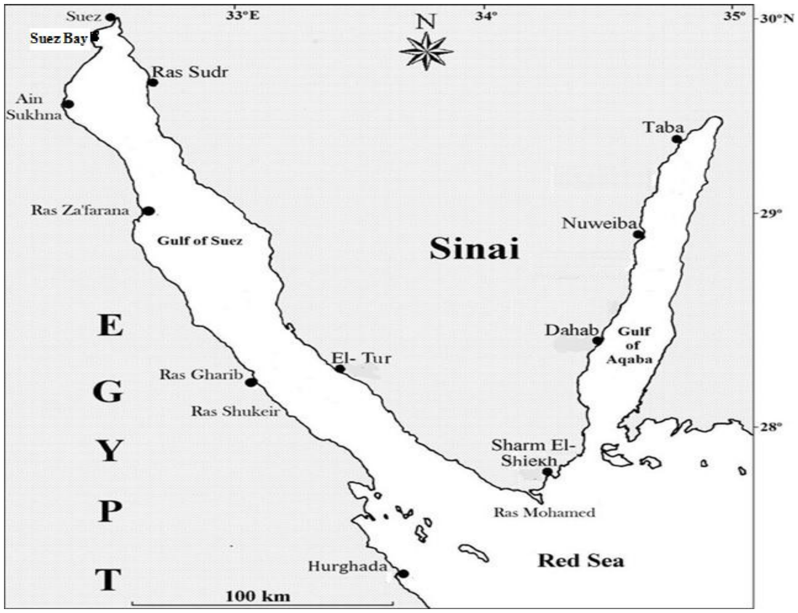

Fig. 1: A map of the study area (The Gulf of Suez).

Table (1): Specifications of the trammel net and gill net used in the Gulf of Suez.

Gear items	Trammel net	Gill net
Unit length (m)	35m	50m
Net depth (m)	0.95m	1.60m
Float line materials and diameter	Polyethylene, 5mm	Polyethylene, 5mm
Sinker line materials and diameter	Polyethylene, 6mm	Polyethylene, 6mm
Distance between two floats (cm)	65cm	115cm
Distance between two sinkers (cm)	20 cm	33 cm
Total weight of sinkers	4.5kg/unit	6 kg/unit
Mesh Size (mm)	Inner 34 mm Outer: 120 mm	36 mm
Twine materials	Polyamide monofilament	Polyamide monofilament

The total catch of the two nets was transported to lab and identified to the species level. The total weight (g) and total lengths (cm) were measured. The relationship between body weight and total length of samples was computed by the equation:

$$W = a\,L^{b}\ ,$$

The parameters a and b were obtained by the least-squares method based on logarithms: Log W = Log a + b Log L, where W is the total body weight (g), L is the total length (cm), *a* the intercept and b (the exponent) is the parameter describing growth pattern (Froese, 2006; Thorson & Reyes, 2013).

Fulton's condition factor (*K*) was estimated from the relationship $K=100W/L^3$ to assess the fish condition in Gulf of Suez where W is Total Weight in gram, L is Total length in cm and the factor 100 is used to bring K close to unity (Le Cren, 1951; Froese, 2006).

RESULTS

Species composition and catch

As shown in Table (2), the most dominant species caught by trammel net was *Gerres oyena* (33.87%) followed by *Siganus rivulatus* (25.32%), *Rhabdosargus haffara* (20.00%), *Pomadasys stridens (6.29%), Liza carinata (4.63%), Parupeneus forsskali* (4.09%), *Stephanolepis diaspro* (1.95 %), *Aluterus Monoceros* (1.02%) and other seven species less than 1% (*Diplodus noct*, *Scarus harid, Terapon puta*, *Saurida undosquamis, Synodus variegatus, Mulloides flavolineatu and Upeneus japonicus, Lagocephalus sceleratus*) (Fig. 2). While the catch of gill net composed of four species *Siganus rivulatus* (51.69%), *Liza carinata* (32.17%), *Gerres oyena* (14.14%) *and Diplodus noct* (1.99%) (Fig. 3).

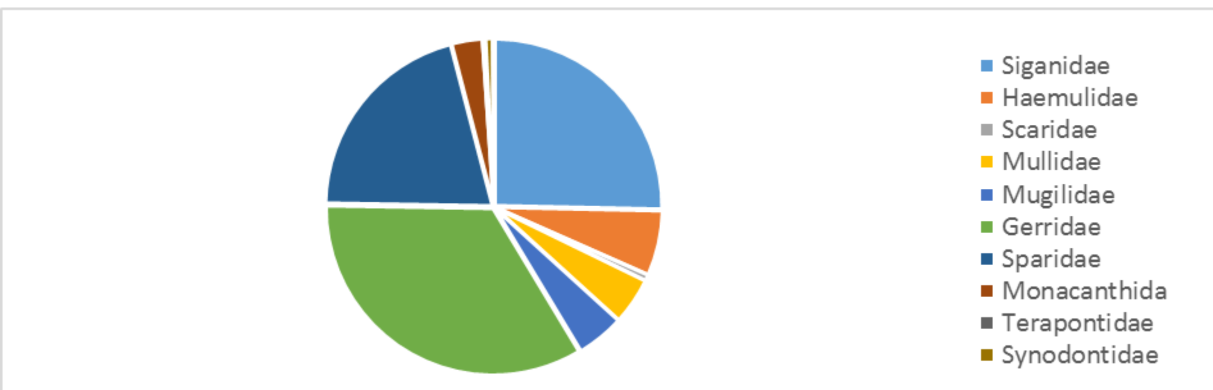

Fig. 2: Catch composition of trammel net

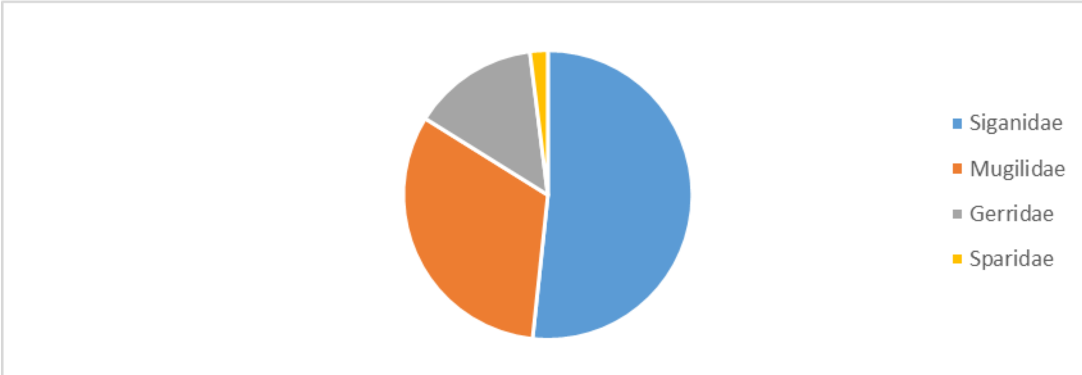

Fig. 3: Catch composition of gill net.

Table (2): Species composition and relative abundance of commercial species caught by trammel nets and gill nets in the Gulf of Suez.

Family	Species	Number of specimens	Total Length range (cm)	Total weight range (g)	Relative abundance (%)
Trammel net					
Siganidae	*Siganus rivulatus*	519	10.4-24.3	9.5-203	25.3294
Haemulidae	*Pomadasys stridens*	129	6.3-15.1	3.8-51.6	6.2958
Scaridae	*Scarus harid*	12	17.1-25.2	98.4-349.5	0.5857
Mullidae	*Mulloides flavolineatu*	6	9.5-15.6	8.9-46.2	0.2928
	Parupeneus forsskali	84	8.9-26.4	8.3-202.3	4.0996
	Upeneus japonicas	3	9.6-15	14.2-35.0	0.1464
Mugilidae	*Liza carinata*	95	7.8-18.5	11.2-63.8	4.6364
Gerridae	*Gerres oyena*	694	10.3-24.6	14.3-160	33.8702
Sparidae	*Diplodus noct*	14	11.0-16.0	18.6-66.6	0.6833
	Rhabdosargus haffara	410	8.7-25.4	8.4-251.5	20.0098
Monacanthida	*Stephanolepis diaspro*	40	11.2-21.1	17.1-166.4	1.9522
	Aluterus monoceros	21	11.4-21.1	22.4-168.9	1.0249
Terapontidae	*Terapon puta*	6	5.6-12.6	3.9-23.5	0.2928
Synodontidae	*Saurida undosquamis*	12	15.5-22.7	85.2-559.2	0.5857
	Synodus variegatus	2	14.4-27.1	36.3-134.5	0.0976
Tetraodontidae	*Lagocephalus sceleratus*	2	19-29.6	117.5-355.9	0.0976
Gill net					
Siganidae	*Siganus rivulatus*	519	10.4-24.3	9.5-203	51.693
Mugilidae	*Liza carinata*	323	10.9-17.5	14.0-51.0	32.171
Gerridae	*Gerres oyena*	142	11.3-16.8	19.6-61.8	14.143
Sparidae	*Diplodus noct*	20	10.8-17.8	17.1-74.3	1.992

The length-weight relationship:

The length-weight relationship was estimated for the most abundant and important fish species caught with trammel nets and gill net in the Gulf of Suez. The parameters of length-weight relationships (a and b), standard error (SE), and the coefficient of determination (r^2) are presented in Table (3). The *b* values of LWR for 6 species were close to 3, indicating isometric growth and representing the ideal shape of fish. Two species namely *Pomadasys stridens* and *Liza carinata* showed a negative allometric growth of b<3.0 whereas one species *Siganus rivulatus* had positive allometric growth with *b*>3.0 (Table 4).

Table (3): Parameters of length-weight relationships (LWRs) of investigated fish species collected from the Gulf of Suez (b=slope, a= intercept, r^2= regression coefficients and CI= confidence interval.

Family	Species	Regression parameter				
		b	a	95%CI (slope)	95% CI (intercept)	r^2
Trammel net						
Siganidae	*Siganus rivulatus*	3.25	0.006	3.19-3.32	0.005-0.007	0.97
Haemulidae	*Pomadasys stridens*	2.81	0.020	2.71-2.91	0.016-0.026	0.95
Sparidae	*Rhabdosargus haffara*	3.07	0.011	3.02-3.12	0.010-0.013	0.96
Gerreidae	*Gerres oyena*	2.94	0.014	2.87-3.00	0.012-0.016	0.91
Monacanthidae	*Stephanolepis diaspros*	3.06	0.013	2.84-3.28	0.007-0.024	0.95
Mullidae	*parupeneus forsskali*	2.98	0.012	2.86-3.09	0.008-0.017	0.96
Gill net						
Siganidae	*Siganus rivulatus*	2.99	0.013	2.89-3.08	0.010-0.017	0.97
Mugilidae	*Liza carinata*	2.55	0.034	2.44-2.67	0.025-0.047	0.85
Gerreidae	*Gerres oyena*	3.08	0.010	2.93-3.23	0.006-0.014	0.92

Table 4: The estimated values of the length-weight relationship parameters a = intercept and b = slope and the growth pattern of nine species in the Gulf of Suez. NA= Negative Allometric (*b*<3), IS= Isometric (b=3), PA= Positive Allometric (*b* >3).

Species	Intercept (a)	Slob (b)	Growth pattern
Trammel nets			
Siganus rivulatus	0.006	3.25	PA
Pomadasys stridens	0.020	2.81	NA
Rhabdosargus haffara	0.011	3.07	IS
Gerres oyena	0.014	2.94	IS
Stephanolepis diaspros	0.013	3.06	IS
parupeneus forsskali	0.012	2.98	IS
Gill nets			
Siganus rivulatus	0.013	2.99	IS
Liza carinata	0.034	2.55	NA
Gerres oyena	0.010	3.08	IS

Condition factor:

The condition factor, *K* for 9 fish species from the Gulf of Suez is presented in Table 5. Concerning trammel net catch, the mean condition factor ranged from 1.1 for *Parupeneus forskali* to 1.6 for *Stephanolips diaspros*. While in the gill net, the mean condition factor ranged from 1.0 for *Liza carinata* to 1.3 for *Siganus rivulatus*.

Table 5: Condition factor for the most abundant species in trammel and gill net from the Gulf of Suez.

Trammel Net			
Species	Min. K	Max. K	Average. K
Siganus rivulatus	0.7	1.7	1.3
Pomadasys stridens	1.0	1.6	1.3
Rhabdosargus haffara	1.1	1.8	1.4
Gerres oyena	1.0	1.5	1.2
Stephanolips diaspros	1.2	1.8	1.6
Parupeneus forskali	0.9	1.2	1.1
Gill Net			
Siganus rivulatus	1.1	1.7	1.3
Liza carinata	0.8	1.4	1.0
Gerres oyena	1.1	1.6	1.2

DISCUSSION

Marine fish communities in tropical regions characteristically have a large number of species and complex interactions as compared to those of the communities in temperate regions. In the present study, the species composition of trammel net was dominated by eleven families (16 species) while the catch of gill net was dominated by four families (4 species).

There were clear differences in fish assemblage composition between the catch of trammel net and gill net. Several species very common in the trammel net catch were absent or very scarce in the gill net catch, thus may be attributed to the trammel net is less selective than the gill net (Erzini *et al.*, 2006).. The present results agree with Martins *et al.* (1992) and Erzini *et al.* (2003) who conclude that the greater diversity of trammel net catches compared to other static gear.

Variability in length-weight relationship among species depends on many factors. It may depend on the fishing gear as a mesh size determine the size selectivity. It also may affected by the environmental condition (Forese, 2006). The specimens in this study were collected by trammel and gill net. The value of b normally should lie between 2.5 and 3.5, our results confirmed this and it also agreed with the other studies on the same species as shown in (Table 6).

An extensive investigation has been made on length-weight relationship of many commercial and economically important species from tropical waters in the world. However, very limited information is available on the length-weight relationship of commercial species in the Gulf of Suez. Furthermore, the results of this work provide useful inputs for fisheries scientists; also it helps in stock assessment models and also spatial- temporal comparisons in the future.

The condition factor is studied for knowing the wellbeing state of fish during its life span (Osman, 2016). The values of condition factor (K) estimated for 9 species ranged from 0.7 to 1.8. The highest mean value of K was 1.6 and recorded for *Stephanolips diaspros* and the lowest value was 1.0 which recorded for *Liza carinata*. Barnham and Baxter (1998) proposed that if the *K* value is 1.00, the condition of the fish is poor, long and thin. A 1.20 value of *K* indicates that the fish is of moderate condition and acceptable to many anglers. A good and well-proportioned fish would have a *K* value that is approximately 1.40. Based on this criterion, the sampled fishes in the Gulf of Suez revealed that two species namely *Rhabdosargus haffara* and *Stephanolepis diaspros* are in good condition. Three species are in moderate condition namely *Siganus rivulatus*, *Pomadasys stridens* and *Gerres oyena* .Two species are in poor condition which are *Parupeneus forskali* and *Liza carinata.* The variation of K value may be correlated with sex, maturity stage or state of feeding intensity (Gayanilo & Pauly 1997; Abowei *et al*. 2009; Isa *et al*, 2012).

Table 6: length- weight relationship parameters for some species in different areas.

Family	Species	Authors	Study area	a	b
Siganidae	*Siganus rivulatus*	Present study	Gulf of Suez	0.006	3.25
		Belhassan *et al*, 2017	Mediterranean sea, Libya	0.019	2.66
	..	Taskavak&Bilcenoglu,2001	Mediterranean sea, Turkey	0.0004	3.20
Mugilidae	*Liza carinata*	Present study	Gulf of Suez	0.034	2.55
		Belhassan *et al*, 2017	Mediterranean Sea, Libya	0.005	2.87
		Taskavak&Bilcenoglu,2001	Mediterranean Sea, Turkey	0.002	2.86
		El-Ganainy *et al*, 2014	Suez bay	0.005	2.86
		Hakimelahi *et el*, 2010	Persian Gulf	0.02	2.82
		Hussain *et al*, 2010	Arabian sea	0.088	2.20
Haemulidae	*Pomadasys stredinse*	Present study	Gulf of Suez	0.02	2.81
		Edelist D. 2014	Mediterranean Sea, Israel	0.0112	3.07
		Osman *et al* 2019	Gulf of Suez	0.0074	3.02
Sparidae	*R.haffara*	Present study	Gulf of Suez	0.011	3.07
		Mehanna *et al*, 2001	Suez bay	0.017	2.94
		El darwany, 2015	Lake Timsah	0.017	3.10
Gerreidae	*Gerres oyena*	Present study	Gulf of Suez	0.014	2.94
		El agamy, 1986	Arabian Gulf	0.008	3.10
		Kanak *et al*, 2006	Okinawa island Japan	0.003	2.87
		Isa *et al*, 2012	kedah, Malaysia	0.008	3.29
Monacanthidae	*S. diaspors*	present study	Gulf of Suez	0.013	3.06
		El ganainy &Sabrah, 2008	Gulf of Suez	0.026	2.83
Mullidae	*p. forsskali*	Present study	Gulf of Suez	0.012	2.98
		Mehanna *et al*, 2018	Red Sea	0.007	3.16
		Sabrah, 2015	Red Sea	0.021	2.80

Aknowledgement

The authors wish to express their gratitude to fishermen who helped them to collect the fish samples, and they would also like to acknowledge the NIOF for the funding provided for this work.

REFERENCES

Abd EL-Naby, A. S.; El-Ganainy, A. A; Mohamed,M. A. and El-Mor, M. (2018). Species composition and size structure of experimental beach sein by-catch in eion moussa, north Gulf of Suez, Egypt. Al Azhar Bulletin of Science 29(2): 39-47.

Abowei, A.F.N.; Davies, O.A. and Eli, A. A. (2009). Study of the length-weight relationship and condition factor of five fish species from Nkoro River, Niger Delta, Nigeria. *Jou. of Biolo.Scie.* 1(3): 94-95.

Barnham, C. and Baxter, A. 1998. Condition Factor, K, for Salmonid Fish. Fisheries Notes, pp. 1-3.

Belhassan, A. M. A.; Ali, R. A. S.; Ali, S. M., and Elmor, M. (2017). Species Composition, Relative Abundance and Length-Weight Relationship of Ten Exotic Fishes from Eastern Libya Mediterranean Sea Coast. Journal of Global Scientific Research 2, 13-23.

Beverton, R.J.H. and Holt, S.J. (1957). on the dynamics of exploited fish populations. Fish. Invest. Ser. 2 Mar. Fish. G.B. Minist. Agric. Fish. Food No.19, 533.

Edelist, D. (2014). New length–weight relationships and Lmax values for fishes from the Southeastern Mediterranean Sea. J. Appl. Ichthyol. 30 : 521–526.

El agamy, A.E. (1986). The fecundity of *gerres oyena* forskal 1775, (fam. gerreidae) in the qatari waters of the Arabian Gulf. Qatar Univ. Sci. Bull. (1986), 6: 371-388.

El darwany, M.A. (2015). Age, growth and mortality of *Rhabdosargus haffara* in Lake Timsah, (Suez Canal, Egypt): international J. of Fish. and Aqu. Stu. 3(1): 239-243.

El-Ganainy, A. A. and Sabrah, M. M. (2008). Age, Growth, Mortality and Yield per Recruit of the Filefish *Stephanolepis diaspros* (Fraser-Brunner, 1940) (Pisces: Monacanthidae), in the Gulf of Suez, Egypt. J. Fish. Aqu. Sci., 3 (4): 252-260.

El-Ganainy, A.A. ; Abd El-Rahman F.A.A. ; Rizkalla, W. ; El-Shabaka, H.A. and Abo-Mesalem, M.A. (2014). Age, growth and reproductive biology of the keeled mullet *Liza carinata* from theSuez Bay, Red Sea, Egypt. Egypt. J. Aquat. Biol. & Fish., Vol. 18, No. 4: 1 – 8.

El Ganainy, A. A. ; Khalil, M. T. ; El Azab, E. B. ; Saber, M. A. and Abd El-Rahman F. A. (2018). Assessment of three nemipterid stocks based on trawl surveys in the Gulf of Suez, Red Sea. Egyptian Journal of Aquatic Research. 44(1):45-49.

El-Etreby S. G.; El Ganainy A. A.; Saber M. A.; El Elwany M. A and El Bokhty, A. E.
(2013). Age, growth and reproduction of the lizard fish *Saurida undosquamis* from the Gulf of Suez, Red Sea, Egypt. Egypt. J. Aquat. Biol. & Fish., Vol. 17 No. 3, 25-34.

Erzini, K.; Gonc¸alves, J.M.S.; Bentes, L. ; Lino, P.G.; Ribeiro, J.; Stergiou, K.I., (2003). Quantifying the roles of competing static gears: comparative selectivity of longlines and monofilament gill nets in a multi-species fishery of the Algarve (southern Portugal). Sci. Mar. 67, 341–352.

Erzini, K. ; Gonc¸alves, J.M.S. ; Bentes, L. ; Moutopoulos, D.K. ; Casal, J.A.H.C. ; Soriguer, M.C. ; Puente, E. ; Errazkin, L.A. ; Stergiou, K. I. (2006). Size selectivity of trammel nets in southern European small-scale fisheries. Fish. Res. 79 (1–2), 183–201.

Froese, R. (1998). Length-weight relationships for 18 lessstudied fish species. J. Appl. Ichthyol. 14: 117-118.

Froese, R. (2006). Cube law, condition factor and weight–length relationships: History, meta-analysis and recommendations. Journal of Applied Ichthyology, 22, 241–253.

Froese, R. and Pauly, D. (2012). FishBase World Wide Web electronic publication http://www.fishbase.org.

Froese, R.; Thorson, S.J. J. and Reyes, R.B. (2013). A Bayesian approach for estimating length-weight relationships in fishes. J. Appl. Ichthyol. : 1-7.

GAFRD (2016). General Authority for Fish Resources Development) of Ministry of Agriculture. Fishery statistics

Gayanilo, F.C. and Pauly, D. (1997). FAO ICLARM stock assessment tools (FISAT), References Manual, FAO Computerized Information Series (Fisheries) **8**, 262.

Goncalves, J. M. S. ; Bentes, L. ; Lino, P. G. ; Ribeiro, J. ; Canario, A. V. M., and Erzini, K. (1997). Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and southwest coast of Portugal. Fisheries Research, Vol. 30, 253-256.

Hakimelahi, M.; Kamrani, E.; Taghavi Motlagh, S. A.; Ghodrati Shojaei, M. and Vahabnezhad, A. (2010). Growth parameters and mortality rates of Liza klunzingeri in the Iranian waters of the Persian Gulf and Oman Sea, using length frequency data. J. Fish. Sci., 9(1): 87-96.

Hubert, W. A.; Pope, K. L.; and Dettmers, J. M. (2012). "Passive Capture Techniques". Nebraska Cooperative Fish & Wildlife Research Unit -- Staff Publications. 111.https://digitalcommons.unl.edu/ncfwrustaff/111

Hussain, S. M.; Paperno, R. and Khatoon, Z. (2010). Length–weight relationships of fishes collected from the Korangi-Phitti Creek area (Indus delta, northern Arabian Sea). J. Appl. Ichthyol., 26: 477–480.

Isa, M. M.; Abdul Basri, M. N.; Zawawi, M. Z. M.; Yahya. K. and Nor, S.A. (2012). Length-weight Relationships of Some Important Estuarine Fish Species from Merbok Estuary, Kedah. *Jou. of Nat. Scie. Rese*. 2(2): 2224-3186.

Kanak, M.K. and Tachihara, K. (2006). Age and growth of *Gerres oyena* (Forsska˚ l, 1775) on Okinawa Island, Japan. J. Appl. Ichthyol. 22; 310–313.

Le Cren, C. D. (1951). The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (Perca fluviatilis). J. Anim. Ecol., 20: 201-219.

Martins, R.; Santos, M.N.; Monteiro, C.C. and Paes da Franca, M. D. L. (1992). Contribuic¸ ˜ao para o estudo da selectividade das redes de emalhar de um pano fundeadas na costa Portuguesa no bi´enio 1990–1991. INIP, Relat. T´ec. Cient., 1–26.

Mehanna S. F. (2001). Growth, mortality and yield per recruit of *Rhabdosargus haffara* (Sparidae) from the Suez Bay. Egypt J Aquat. Biol. & Fish.; 5(3):31-46.

Mehanna, S.F.; Osman, A.G.; Farrag M. M. and Osman, Y.A.A. (2018). Age and growth of three common species of goatfish exploited by artisanal fishery in Hurghada fishing area, Egypt. j. appl. ichthyol.34; 917–921.

Osman, H. M. (2016). Biological and Fisheries Studies on Barracuda Fish (Family: Sphyraenidae) in the Gulf of Suez. Ph.D. Thesis, Fac. Sci. Suez Canal, Uni. Ismailia, Egypt.

Osman, H. M.; Saber, M. A. and El Ganainy, A. A. (2019) Population structure of the striped piggy *Pomadasys stridens* in the Gulf of Suez. Egyptian Journal of Aquatic Research 45 (2019) 53–58.

Ricker, W. E. (1968). Methods for assessment of fish production in fresh waters. IBP Handbook No. 3. F. A. Davis, Philadelphia, Pennsylvania. 328 p.

Saber, M.A. and Gewida, A.G.A. (2020) The influence of trammel net fishing on the Rabbit fish (*Siganus rivulatus*) stocks in Suez Gulf, Red Sea, Egypt. Egypt. J Aquat. Biol. *&* Fish. Vol. 24(2): 135 – 145.

Sabrah, M. M. (2015). Fisheries biology of the Red Sea goatfish *Parupeneus forsskali* (Fourmanoir & Gue´ze´, 1976) from the northern Red Sea, Hurghada, Egypt. Egyptian Journal of Aquatic Research. 41, 111–117

Taskavak, E. and Bilcenoglu, 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. 81.; 895-896