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Length-Weight Relationship of 33 Fish Species and Their Potential Overexploitation from the Hurghada Fish Market, Red Sea, Egypt

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ABSTRACT

Instead of sampling at the landing site to ensure a wide diversity of fish length ranges, this study examined the fisheries status, well-being, and exploitation characteristics of 33 fish species from the Red Sea, collected at the main fish market in Hurghada. A total of 2,182 fish specimens, representing 33 species, were measured for body weight (g) and total length (cm). The largest and heaviest species was *Variola louti*, with a maximum total length of 71cm and a weight of 2,700g. *Euthynnus affinis* recorded the greatest weight at 3,000g and a length of 68cm. Across all species, growth patterns varied between allometric and isometric. Positive allometric growth (b> 3) was observed in seven species, negative allometric growth (b< 3) in 24 species, and isometric growth (b= 3) in two species. The mean condition factor (Kc) ranged from 0.66 to 1.8, with values below 1.0 recorded for only four species. The lowest mean relative weight condition factor (Kn) values were found in *Atule mate* (0.97 ± 0.09), *Parupeneus forsskali* (0.98 ± 0.09), *Priacanthus hamrur* (0.97 ± 0.15), *Plectorhinchus gaterinus* (0.96 ± 0.11), and *Acanthopagrus bifasciatus* (0.99 ± 0.09), indicating relatively poor growth conditions for these species. In contrast, all other species exhibited Kn values above 1.0, suggesting favorable environmental conditions for growth. The highest calculated Kn values were recorded for *Lutjanus monostigma* (1.02 ± 0.09) and *Lutjanus fulviflamma* (1.02 ± 0.08). The allometric condition factor (Ka) was rarely applied, as it is only used when a fish species displays an allometric growth pattern or when sufficient data are available to estimate the b-value with a minimal margin of error.

INTRODUCTION

Over the past several decades, many fisheries have collapsed, demonstrating that overfishing remains a major threat to the world's seas **(Pauly *et al.*, 2002; Myers & Worm, 2003)**. This situation is exacerbated by the failure of regulatory frameworks to keep pace with declining fish stocks. While some attribute the crisis to technological advancements in fishing, the underlying cause is often the lack of effective control and supervision in many fishing areas worldwide. A key challenge in fisheries management is the absence of accurate, species-specific data—such as landing composition, fishing effort, and local economic impacts—particularly in less developed or more remote locations **(Watson *et al.*, 2004; Vasconcellos & Cochrane, 2005; Sethi *et al.*, 2010)**.

Globally, an estimated 260 million people are employed in marine fishing, with approximately 22 million operating on a small-scale basis **(Teh & Sumaila, 2013)**. Marine fisheries contribute around USD 100 billion annually to global trade, with small-scale fisheries accounting for half of global fish exports. These small-scale fisheries are highly dependent on and vulnerable to environmental stress **(Allison *et al.*, 2009; McClanahan *et al.*, 2015)**. The rapid expansion of commercial fishing in the 1950s has contributed to widespread declines in natural fish populations **(Pauly *et al.*, 2002)**.

The Red Sea supports extensive coral reef ecosystems that provide livelihoods for thousands of artisanal fishers. Egypt controls 387,050 square miles of the western Red Sea coastline, which averages 450km² in width and 1,002km² in length. Noncompliance with fishing regulations is a widespread issue in many tropical fisheries, including those of the Red Sea **(PERSGA, 2006; Bailey *et al.*, 2016; Katikiro & Mahenge, 2016)**.

In Egypt, coral reef fish stocks have been overfished since at least the early 1990s **(Jin *et al.*, 2012; Tesfamichael & Pauly, 2016)**, largely due to increased fishing pressure. In the Egyptian Red Sea, more than 76% of landings are obtained using handlines, with the remainder primarily harvested using gillnets and traps **(Jin *et al.*, 2012)**. However, the lack of species-specific catch statistics for this region poses a significant challenge. The dispersed nature of landing sites and the large number of small artisanal fishing vessels make it difficult to collect accurate landing and catch data, further complicating fisheries monitoring **(Chang, 2014)**.

Many coastal fisheries sell the majority of their catch directly through local fish markets, making these markets valuable sites for assessing catch composition, size structure, abundance, price, and seasonal trends **(Rhodes & Tupper, 2007; Rhodes *et al.*, 2008; Claro *et al.*, 2009; Sumaila *et al.*, 2011; Chang, 2014; Bos *et al.*, 2013)**. Such market surveys can provide essential baseline data to support local fisheries management.

To ensure the collection of fish from a variety of fishing gears and to capture a broad diversity of species and size ranges, the present study was conducted at the main fish market in Hurghada rather than at landing sites. The objective was to assess the fisheries status, condition, and exploitation patterns of 33 fish species from the Egyptian Red Sea.

MATERIALS AND METHODS

Materials

1- Study area

The study was conducted in Hurghada City, located on the northern Egyptian Red Sea coast (27°13′44.52″N, 33°50′32.31″E) (Fig. 1). Fish from all Red Sea landing sites are transported to the central “Sakkala” fish market in Hurghada, which serves as a major distribution hub for the region. Commercial landings at the Hurghada fishing harbor were sampled weekly during the 2022 fishing season.

The “Sakkala” market is one of the largest fish markets in the Egyptian Red Sea region, comprising approximately 20 fishmongers. According to interviews with market sellers, the market receives an estimated 40–50% of the total fish harvested along the Egyptian Red Sea coast. Compared to smaller coastal markets, the “Sakkala” market provides a more representative sample of locally caught fish species, their size ranges, and market prices, making it an ideal site for fisheries assessment.

Prior to market distribution, staff from the General Authority for Fish Resources Development (GAFRD) record the species composition, quantities, and presence or absence of prohibited species at the landing sites. The fish are then transported from these landing points to the Hurghada market for sale.

Fig. 1. Google earth map showing the main fishing landing sites and the study area of Hurghada fish market

2- Collected data

Data were gathered from the EL-Skkala fish market, which offers fish from all Red Sea landing sites and fishing areas for sale in Hurghada **(Mohammad *et al.*, 2021, 2022; El-Mahdy *et al.*, 2022; Mehanna *et al.*, 2022; Khaled *et al*., 2023; Osman & Samy-Kamal, 2023; Farrag *et al.*, 2024; Said *et al.*, 2024; Shafii *et al*., 2024)**. A total of 2,137 fish from 16 families and 33 fish species were weighed (gram) and measured to nearest cm for the fish total length; they were collected monthly from the commercial landing site in Hurghada fishing harbor during the 2022 fishing season.

Methods

Each fish's mass was determined by taking their recorded lengths and applying the formula: W= ax Lb. Where, W is the weight in grams, L is the total length in centimeters, and a and b are species-specific constants obtained from FishBase **(Friedlander & DeMartini, 2002; Froese & Pauly, 2022)**.

To determine whether the *b*-values obtained from the linear regressions differed significantly from the isometric value (b = 3), growth type was classified according to **Bagenal and Tesch (1978)** as follows: isometric growth ($b \approx 3$), negative allometric growth (b< 3), and positive allometric growth (b> 3). The significance of deviations from the isometric value was tested using Student's *t*-test **(Zar, 1984)**.

RESULTS AND DISCUSSIONS

Table (1) presents the length and weight characteristics of 33 commercial fish species from the Red Sea, including sample size, minimum and maximum lengths and weights, coefficients of determination (R^2), and 95% confidence intervals for the b values. Minimum total length was recorded for *Parupeneus cyclostomus* (11 cm), while the maximum length was observed for *Variola louti* (71 cm). Minimum body weight was also observed in *P. cyclostomus* (14.13 g), whereas the heaviest specimen was *Euthynnus affinis* (3000g). The sampled fishes belong to 16 families, with Serranidae represented by five species; Scaridae, Lethrinidae, Lutjanidae, Siganidae, and Carangidae by three species each; Gerreidae, Priacanthidae, and Mullidae by two species each; and seven families (Haemulidae, Sparidae, Terapontidae, Holocentridae, Scombridae, Acanthuridae, and Mugilidae) represented by a single species each. All species were bony fishes (Osteichthyes).

Length–weight relationships (LWRs) varied between species, reflecting differences in body shape and condition, and can also vary within a species due to environmental and biological factors. LWR parameters are influenced by seasonal changes, food availability, and sampling conditions, and thus may differ throughout the year. The R^2 values ranged from 0.90 (*Siganus rivulatus*) to 0.99 (*P. cyclostomus*), with all regressions being statistically significant (P< 0.01). The b values ranged from 1.9707 (*Siganus stellatus*) to 3.392 (*Lutjanus fulviflamma*). Growth was classified as isometric when $b = 3$, positively allometric when $b > 3$, and negatively allometric when $b < 3$.

The observed LWRs were generally consistent with previous studies **(Mohammad, 2007, 2016; Osman, 2018; Farrag *et al*., 2024)**. Differences in b values compared to earlier reports may be attributed to factors such as fish physiology, developmental stage, sex, reproductive status, season, feeding intensity, habitat, and health condition **(Froese, 2006; Froese *et al*., 2011; Mondol *et al*., 2017; Osman & Samy-Kamal, 2023)**. While FishBase **(Froese & Pauly, 2022)** contains extensive LWR data, it does not cover all 33 species examined in this study.

This research therefore provides updated LWR estimates for several species and first-time estimates for numerous Red Sea taxa. These findings are of practical value to fisheries biologists and managers, particularly in the absence of gear-specific or size-specific fishing regulations in the region, as they can inform stock assessment models and management strategies for both sexes combined.

Table 1. Length–weight relationship (LWR) parameters for 33 fish species collected from the "Sakkala" fish market, Hurghada, Red Sea, Egypt. Parameters include the estimated LWR equation ($W = aL^b$), number of specimens (No), total length (TL, cm: minimum, maximum, mean ± SD), total weight (TW, g: minimum, maximum, mean ± SD), length–weight constants (*a*, *b*), coefficient of determination (R^2), and growth type classification

Family	Species	No	Length (cm)			Weight (g)			LWR constants			
			MIN TL	MAX TL	Mean ± SD TL	MIN TW	MAX TW	Mean ± SD TW	a	b	R^2	GT
Serranidae	*Aethalopercus rogaa*	47	24.5	45	34.5±4.20	400	1420	704±216.25	0.3118	2.1889	0.93	NA
	Cephalopholis oligosticta	49	28	45	34±3.51	359	960	515±136.10	0.1751	2.2691	0.93	NA
	Epinephelus chlorostigma	47	13	42	30±6.12	73	710	371.2±151.51	0.2779	2.1005	0.95	NA
	Epinephelus summana	43	22.2	42.1	33±4.99	157.17	1002	492±219.21	0.0632	2.5752	0.93	NA
	Variola louti	43	35	71	43±8.70	430	2700	708±504.97	0.032	2.6553	0.97	NA
Carangidae	*Atule mate*	59	36	57.3	46.3±4.65	299	1350	642±239.91	0.0018	3.3479	0.93	PA
	Caranx sexfasciatus	37	25	37	32±3.50	202	541	379±115.43	0.0179	2.8787	0.93	NA
	Trachurus indicus	40	19	26	20.05±2.80	49	132	65.6±29.81	0.0119	2.8457	0.98	NA
Lethrinidae	*Gymnocranius grandoculis*	116	21	48.1	28±5.23	152.8	2030	401.3±313.32	0.0092	3.1916	0.99	PA
	Lethrinus lentjan	35	18.6	31.5	23.6±2.96	101	441	200±86.36	0.0148	3.0049	0.97	I
	Lethrinus nebulosus	122	16	30	21.8±2.14	63.4	350	155.8±48.99	0.0353	2.7314	0.91	NA
Lutjanidae	*Lutjanus fulviflamma*	60	18	31	21.5±2.66	80	452.25	123.5±79.35	0.0039	3.392	0.96	PA
	Lutjanus kasmira	26	19	28.5	21.9±2.40	106	391.7	166.6±69.99	0.0086	3.1843	0.96	PA
	Lutjanus monostigma	51	15.5	30	23.2±3.19	56.71	447.53	199.87±88.51	0.0108	3.1141	0.96	PA
Scaridae	*Chlorurus sordidus*	54	20.6	34	27±3.43	171	620	363±121.78	0.0556	2.6623	0.91	NA
	Hipposcarus harid	49	21.3	33	27±2.94	147.2	573	300.3±98.88	0.0233	2.8772	0.98	NA
	Scarus rubroviolaceus	67	18.5	47.2	29±6.07	140	996.2	326±202.51	0.1101	2.3591	0.95	NA
Siganidae	*Siganus luridus*	119	14.5	28.8	21±2.64	35	414	137±66.73	0.0065	3.2874	0.93	PA
	Siganus rivulatus	192	16	30	22.4±2.96	52	381.7	147.55±74.85	0.0044	3.3542	0.9	PA
	Siganus stellatus	74	27.8	35	32.1±2.03	333	525	424.5±54.27	0.459	1.9707	0.97	NA
Gerreidae	*Gerres longirostris*	51	18	33.1	22.1±4.04	70.4	456.7	146.2±97.86	0.0177	2.9088	0.98	NA
	Gerres oyena	137	18	29	21.4±2.35	71	275	119±42.10	0.0374	2.6346	0.94	NA
Mullidae	*Parupeneus cyclostomus*	53	11	37.5	14.2±8.77	14.13	508	30.16±152.88	0.0133	2.9136	0.99	NA
	Parupeneus forsskali	57	15.5	26.5	20±2.03	44	170	86.2±24.31	0.0613	2.4294	0.97	NA
Priacanthidae	*Priacanthus hamrur*	61	16.5	47	28±6.42	62.47	980	317±190.27	0.0401	2.6588	0.94	NA
	Priacanthus sagittarius	75	14.5	23.2	19.6±2.02	49	175	119±33.35	0.0196	2.9066	0.91	NA
Acanthuridae	*Naso hexacanthus*	39	38.8	61	51.8±4.64	952	2530	1910±325.01	0.3894	2.1399	0.94	NA
Haemulidae	*Plectorhinchus gaterinus*	35	21	51.5	40±9.22	143	1802	1030±499.60	0.0424	2.7126	0.96	NA
Holocentridae	*Sargocentron spiniferum*	124	17.7	45.8	29.8±4.80	101.5	1632	411.6±246.09	0.0203	2.9268	0.97	NA
Sparidae	*Acanthopagrus bifasciatus*	46	19	33	24±3.67	121	650	227±127.69	0.0287	2.8422	0.96	NA
Scombridae	*Euthynnus affinis*	55	44	68	49±6.61	1054	3000	1405±472.29	0.3675	2.1227	0.94	NA
Mugilidae	*Moolgarda crenilabis*	57	24	44.5	36±4.55	125	902	426±180.51	0.0069	3.0952	0.92	I
Terapontidae	*Terapon jarbua*	62	20	32	24±2.95	90	325	140±65.89	0.0165	2.8631	0.96	NA

*I, isometric growth; PA, positive allometric; NA, negative allometric

Condition factors

This study evaluated three different condition factors: Fulton's condition factor (kc), the allometric condition factor (ka), and the relative weight condition factor (kn). The results are presented in Table (2) and Figs. (1, 2, and 3).

Fulton's condition factor (kc)

Fulton's condition factor (kc) is considered the gold standard for assessing the well-being of fish species. It is a common tool for evaluating allometric growth where b= 3. As shown in Table (2) and Fig. (1), the lowest recorded kc value was 0.64 for *Moolgarda crenilabis* and 0.53 for *Atule mate*, while the highest recorded value was 3.41 for *Epinephelus summana* and 2.72 for *Aethalopercus rogaa*. The lowest maximum kc value recorded (<1) occurred in *Atule mate* and *Trachurus indicus*, whereas the largest maximum value (3.41) was observed in *Epinephelus summana* (Table 2 & Fig. 1).

According to **Ricker (1975)**, nutritional activities can cause kc values to vary among populations or even within the same species in the same region over successive years. The variation in body shape between species likely accounts for the observed differences in mean kc.

Allometric condition factor (ka)

The allometric condition factor (ka) is rarely used, except when the b-value can be calculated with sufficient data to minimize error or when a fish species shows a clear pattern of allometric growth **(Bagenal & Tesch, 1978)**. **Ighwela *et al.* (2011)**, **Omogoriola *et al.* (2011)**, **Fafioye and Ayodele (2018)** and **Ragheb (2023)** elucidated that ka is useful for assessing feeding activity and intensity in laboratory trials. According to **Ragheb (2023)**, ka may be preferable when fish exhibit allometric growth or an isometric growth pattern where $b \neq 3$.

For isometric growth patterns ($b = 3$), kc and ka values are generally similar. However, kc > ka when $b > 3$, and kc < ka when $b < 3$.

Table 2 and Fig. (2) show that 18 species—including *Aethalopercus rogaa* (31.55 ± 2.73) and *Epinephelus chlorostigma* (17.52 ± 1.28)—had ka values ≥ 2. Other notable species include *Epinephelus summana* (27.65 ± 3.11), *Cephalopholis oligosticta* (6.28 ± 0.78), *Variola louti* (3.25 ± 0.26), *Lethrinus nebulosus* (3.53 ± 0.29), *Chlorurus sordidus* (5.53 ± 0.63), *Hipposcarus harid* (2.35 ± 0.12), *Scarus rubroviolaceus* (11.06 ± 1.14), *Siganus stellatus* (45.51 ± 1.10), *Gerres oyena* (3.74 ± 0.32), *Parupeneus forsskali* (6.02 ± 0.55), *Priacanthus hamrur* (3.91 ± 0.60), *Naso hexacanthus* (52.28 ± 2.52), *Plectorhinchus gaterinus* (4.07 ± 0.46), *Sargocentron spiniferum* (2.05 ± 0.18), *Acanthopagrus bifasciatus* (2.82 ± 0.33), and *Euthynnus affinis* (36.87 ± 2.80).

In contrast, eight species—including *Caranx sexfasciatus* (1.81 ± 0.16), *Trachurus indicus* (1.19 ± 0.07), *Lethrinus lentjan* (1.47 ± 0.10), *Lutjanus monostigma*

(1.10 ± 0.10), *Gerres longirostris* (1.77 ± 0.14), *Parupeneus cyclostomus* (1.33 ± 0.10), *Priacanthus sagittarius* (1.94 ± 0.17), and *Terapon jarbua* (1.67 ± 0.14)—had lower ka values. Seven species had mean ka values < 1, including *Atule mate* (0.17 ± 0.02), *Gymnocranius grandoculis* (0.922 ± 0.06), *Lutjanus fulviflamma* (0.40 ± 0.03), *Lutjanus kasmira* (0.868 ± 0.06), *Siganus luridus* (0.65 ± 0.08), *Siganus rivulatus* (0.44 ± 0.06), and *Moolgarda crenilabis* (0.70 ± 0.08).

Higher ka values generally indicate better fish health. While kc may be more appropriate for comparing species across different regions or time periods, ka is particularly useful for assessing multiple fish species within the same location and time frame to determine environmental impacts on health.

Relative weight condition factor (kn)

The lowest mean kn values were observed in *Atule mate*, *Parupeneus forsskali*, *Priacanthus hamrur*, *Plectorhinchus gaterinus*, and *Acanthopagrus bifasciatus* (Table 2 & Fig. 3), indicating poor growth conditions. Most other species had kn values ≥ 0.99, which is close to the ideal value of 1, suggesting good growth conditions. The highest computed kn values were 1.02 ± 0.08 for *Lutjanus fulviflamma* and 1.02 ± 0.09 for *Lutjanus monostigma*.

According to **Muchlisin *et al.* (2010)**, kn < 1.0 suggests a lack of prey or high predator density, whereas kn > 1.0 indicates abundant prey or low predator density. **Muchlisin *et al.* (2017)** noted that kn = 1.0 reflects healthy waterways with balanced predator-prey dynamics, enabling fish to reach their growth potential. Furthermore, **Jisr *et al.* (2018)** found that kn ≥ 1 indicates that fish are receiving adequate food for optimal development. Typically, differences between kn and 1 reflect the influence of physicochemical characteristics on fish life cycles and food availability **(Le Cren, 1951)**.

Integrating the three condition factors

From a structural standpoint, it is best to examine kc, ka, and kn together. Although kc > 1 can suggest improved fish condition, this is not a strict rule. Table (2) and Figs. (1–3) show that several species—*Acanthopagrus bifasciatus*, *Priacanthus hamrur*, *Priacanthus sagittarius*, *Parupeneus forsskali*, *Cephalopholis oligosticta*, *Chlorurus sordidus*, *Siganus stellatus*, *Plectorhinchus gaterinus*, and *Epinephelus summana*—had kc > 1 but kn < 1, indicating suboptimal growth due to factors such as temperature and life history traits. Four species—*Moolgarda crenilabis*, *Variola louti*, *Atule mate*, and *Trachurus indicus*—had kc < 1, suggesting stunted development.

Because kc ranges are influenced by *b*-value, growth pattern, and body shape, each fish family will have unique baseline values. Therefore, using multiple condition factors provides a more complete understanding of fish well-being and environmental conditions.

In conclusion, this research expands knowledge on the habits of certain fish species in the Egyptian Red Sea and updates information on others. The results reflect changes in physiological, environmental, and biological variables, including deviations from earlier studies. These findings are expected to contribute to more accurate stock assessments of fish species.

Table 2. Length–weight relationships (LWR) and growth types (GT) for 33 fish species from the "Sakkala" fish market in Hurghada, Red Sea, Egypt. Analysis includes Fulton's condition factor (kc), allometric condition factor (ka), and relative weight condition factor (kn)

Family	Species	No	Fulton's condition factor (k_c)		Allometric condition factor (k_a)		Relative weight condition factor (k_n)	
			Range	Mean K_C ± SD	Range	Mean Ka ± SD	Range	Mean Kn ± SD
Serranidae	*Aethalopercus rogaa*	47	1.38-2.72	1.74±0.25	24.72-36.42	31.55±2.73	0.79-1.17	1.01±0.09
	Cephalopholis oligosticta	49	1.05-1.74	1.33±0.14	15.05-20.42	17.52±1.28	0.86-1.17	1.001±0.07
	Epinephelus chlorostigma	47	0.96-3.41	1.35±0.46	21.81-34.57	27.65±3.11	0.78-1.24	0.99±0.11
	Epinephelus summana	43	1.15-2.54	1.40±0.22	5.36-9.52	6.28±0.78	0.85-1.51	0.99±0.12
	Variola louti	43	0.72-1.07	0.86±0.09	2.76-3.96	3.25±0.26	0.86-1.24	1.02±0.08
Carangidae	*Atule mate*	59	0.53-0.80	0.66±0.07	0.14-0.21	0.17±0.02	0.79-1.15	0.97±0.09
	Caranx sexfasciatus	37	0.92-1.34	1.19±0.10	1.38-2.02	1.81±0.16	0.77-1.13	1.01±0.09
	Trachurus indicus	40	0.67-0.85	0.73±0.04	1.07-1.35	1.19±0.07	0.90-1.13	1.00±0.06
Lethrinidae	*Gymnocranius grandoculis*	116	1.33-2.05	1.76±0.13	0.732-1.11	0.92±0.06	0.795-1.21	1.003±0.07
	Lethrinus lentjan	35	1.33-1.84	1.50±0.10	1.31-1.81	1.47±0.10	0.89-1.23	1.00±0.07
	Lethrinus nebulosus	122	1.12-2.09	1.54±0.14	2.58-4.62	3.53±0.29	0.73-1.31	1.001±0.08
Lutjanidae	*Lutjanus fulviflamma*	60	1.15-1.65	1.32±0.12	0.34-0.45	0.40±0.03	0.87-1.16	1.02±0.08
	Lutjanus kasmira	26	1.32-1.73	1.55±0.11	0.74-0.99	0.87±0.06	0.86-1.15	1.009±0.07
	Lutjanus monostigma	51	1.19-1.81	1.56±0.14	0.83-1.25	1.10±0.10	0.77-1.16	1.02±0.09
Scaridae	*Chlorurus sordidus*	54	1.47-2.46	1.80±0.23	4.27-7.21	5.53±0.63	0.77-1.30	0.99±0.11
	Hipposcarus harid	49	1.36-1.72	1.56±0.08	2.08-2.55	2.35±0.12	0.89-1.09	1.01±0.05
	Scarus rubroviolaceus	67	0.91-2.21	1.28±0.21	8.41-15.95	11.06±1.14	0.76-1.45	1.00±0.10
Siganidae	*Siganus luridus*	119	1.15-2.18	1.51±0.20	0.51-0.92	0.65±0.08	0.78-1.41	1.00±0.12
	Siganus rivulatus	192	0.80-1.94	1.34±0.20	0.28-0.70	0.44±0.06	0.63-1.58	1.00±0.15
	Siganus stellatus	74	1.21-1.55	1.28±0.10	44.18-48.36	45.51±1.10	0.96-1.05	0.99±0.02
Gerreidae	*Gerres longirostris*	51	1.10-1.57	1.33±0.11	1.47-2.11	1.77±0.14	0.83-1.19	1.00±0.08
	Gerres oyena	137	0.96-1.63	1.20±0.12	2.99-4.68	3.74±0.32	0.80-1.25	1.00±0.09
Mullidae	*Parupeneus cyclostomus*	53	0.78-1.28	1.05±0.09	1.06-1.60	1.33±0.10	0.80-1.20	1.00±0.08
	Parupeneus forsskali	57	0.87-1.44	1.09±0.12	4.97-7.36	6.02±0.55	0.81-1.20	0.98±0.09
Priacanthidae	*Priacanthus hamrur*	61	0.94-2.16	1.27±0.22	3.43-6.57	3.91±0.60	0.85-1.64	0.97±0.15
	Priacanthus sagittarius	75	1.25-1.85	1.48±0.13	1.64-2.45	1.94±0.17	0.84-1.25	0.99±0.08
Acanthuridae	*Naso hexacanthus*	39	1.1-1.64	1.37±0.14	47.77-55.92	52.28±2.52	0.92-1.08	1.01±0.05
Haemulidae	*Plectorhinchus gaterinus*	35	1.14-2.00	1.52±0.20	3.51-5.21	4.07±0.46	0.83-1.23	0.96±0.11
Holocentridae	*Sargocentron spiniferum*	124	1.17-1.98	1.60±0.14	1.50-2.57	2.05±0.18	0.74-1.26	1.01±0.09
Sparidae	*Acanthopagrus bifasciatus*	46	1.4-2.64	1.69±0.21	2.29-4.23	2.82±0.33	0.80-1.47	0.98±0.12
Scombridae	*Euthynnus affinis*	55	0.86-1.50	1.20±0.15	30.54-43.67	36.87±2.80	0.83-1.19	1.00±0.08
Mugilidae	*Moolgarda crenilabis*	57	0.64-1.25	0.98±0.11	0.46-0.89	0.70±0.08	0.66-1.29	1.01±0.12
Terapontidae	*Terapon jarbua*	62	0.89-1.23	1.08±0.09	1.38-1.88	1.67±0.14	0.84-1.14	1.01±0.09

*I, isometric growth; PA, positive allometric; NA, negative allometric.

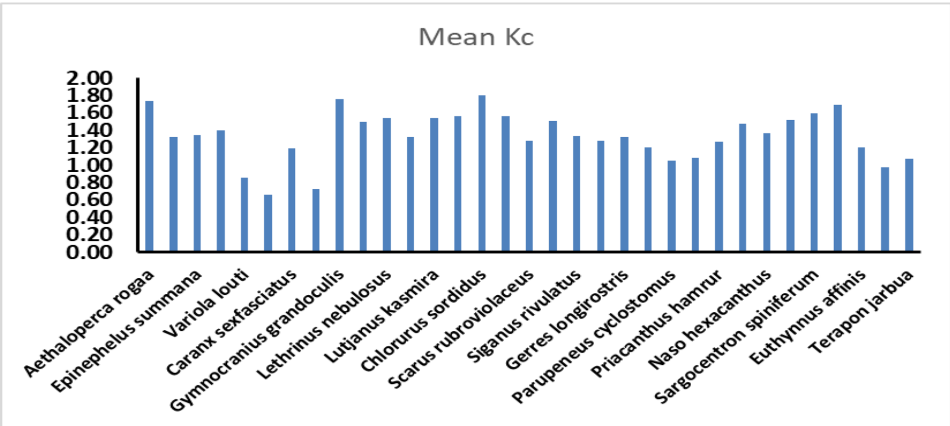

Fig. 1. Fulton's condition factor (kc) for 33 fish species from the Red Sea, Egypt

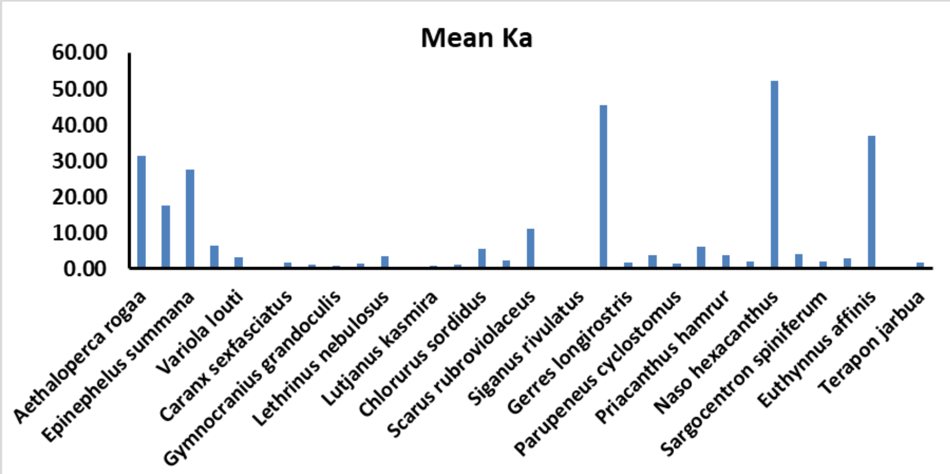

Fig. 2. Allometric condition factor (ka) for 33 fish species from the Red Sea, Egypt

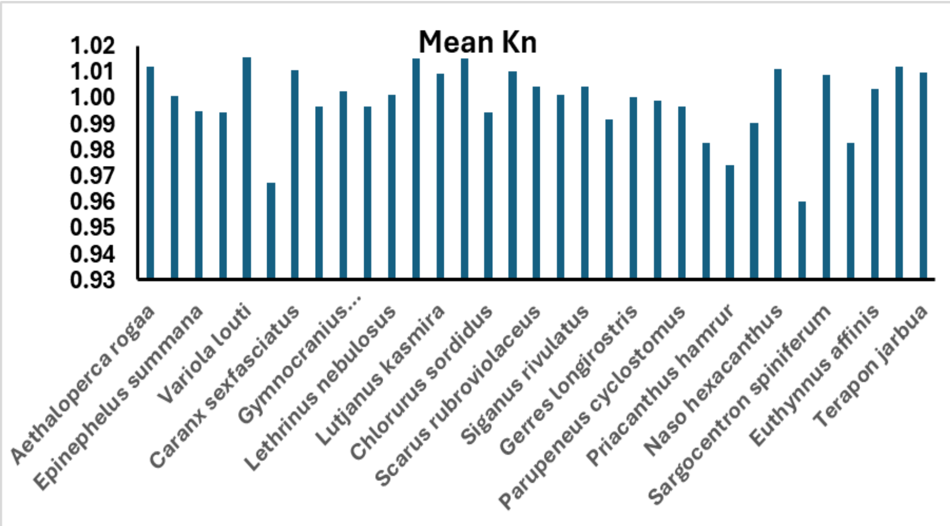

Fig. 3. Relative weight condition factor (kn) for 33 fish species from the Red Sea, Egypt

AUTHOR CONTRIBUTION

The research concept and study design were jointly developed by all authors. **Ashraf S. Mohammad, Alaa G.M. Osman, Mahmoud M.S. Farrag,** and **Aref F.A. Gad El-Karemm** were responsible for material preparation, data collection, and analysis. The first draft of the manuscript was written by **Alaa G.M. Osman, Ashraf S. Mohammad, Aref F.A. Gad El-Karemm,** and **Mahmoud M.S. Farrag**, and subsequently reviewed and revised by the same authors. All authors read and approved the final manuscript.

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