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Quantitative composition of fish biomass in Qandil River Estuary and the neighboring areas

Soher Salhab

ABSTRACT

This research was conducted from January to December 2014 to study the quantitative composition of the most important fish species available in the estuary area and its surroundings. Samples were collected from five sites (estuary, front, right, left and river). Monthly samples were carried out from the selected sites using trammel nets, with 16 mm mesh. Caught fish species were classified using the approved taxonomic keys, and some environmental parameters were determined (such as condition coefficient, biomass, and Jaccard similarity index). Research results showed the presence of 45 fish species belonging to 39 genera and 27 families, and the highest similarity value was between the estuary (ST1) and its left (ST2), and fish productivity in the study area is generally low.

Keywords: Qandil River, Degree of similarity, Estuary, Fish biomass, Condition factor.

1. INTRODUCTION

An estuary is the part of a river that is under tidal influence and is characterised by a continuous salinity gradient. Estuary area is divided into the freshwater area on the riverside, marine water area on the seaside, and the area where freshwater mixes with marine water (the estuary area). Carried nutrients (especially phosphates and nitrates) affect the characteristics of river water and its mouths and thus the growth of various animal and plant organisms, especially in the warm seasons. Estuaries have recently received significant attention, as they are considered incubating environments for a wide range of fish species, including marine species, moderately salinity-tolerant freshwater species, and other estuarine species.

Estuaries also constitute migration corridors for many types of fish to feed, such as some types of mullet or to cross to the upstream areas to reproduce, such as salmon, or to cross towards the sea, such as eels (Malavasi et al., 2004). Estuaries constitute an aquatic environment inhabited by a wide range of local and transient fish species due to their richness in the natural foodstuff, and the specific richness of fish changes according to the year's seasons and their age stage. Some fish living in freshwater can tolerate marine water salinity to varying degrees. Many research and studies were conducted in the Mediterranean countries, focusing on the spatial and

temporal distribution of fish species, their biological quantities, and their relationship to salinity, temperature, turbidity, dissolved oxygen, water flow, and depth (Akin et al., 2005).

Research importance

The study of fish fauna biodiversity in the marine waters of the Syrian coast in general and the estuary areas (such as the mouth of Qandil River) is of great importance environmentally and taxonomically, as it participates in developing the environmental distribution map of fish species. Study has scientific and applied importance as it contributes to the sustainable investment of marine living resources, especially fish.

Study the biomass of fish species in Qandil River Estuary and the neighboring areas.

Determine the temporal condition factor (by months) of fish species caught.

We are measuring the degree of similarity between the stations studied.

2. RESEARCH METHODS AND MATERIALS

Description of the research area

The Qandil River Basin is located in the northwestern region of the Syrian Arab Republic, defining the southern edge of the Al-Basit Mountains, upper sources begin about 3 km north of Al-Qantara, draining into the Wadi Qandil region, about 25 km from Latakia. Research was conducted at the Estuary of Qandil River from the shore of the tourist area of Wadi Qandil. Five sites were chosen (Figure 1) based on the salinity gradient from fresh water towards seawater, where field bag (model WTW multi 340 I) was used to determine the salinity of these sites.

Figure 1 Distribution of study sites (2016 Google Earth)

Description of the study sites

The estuary location (ST1): (35,719486N, 35,831787E), depth between 30 cm to 1 m, bottom nature is pebble sand.

Left of the estuary (ST2): Pure marine area (35.713848N, 35.827633E) extending into the sea with a length of ~10 m, depth of ~2 m characterized by a rocky bottom.

Right of the estuary (ST3): Purely marine area (35.730585N, 35.831284E) extending into the sea ~20 m long ~3 m deep characterized by a sandy rocky bottom.

The front of the estuary (ST4): A purely marine area (35.718466N, 35.828953E) extending from the end of the estuary area to about 50 m into the sea. Depth is about 10 m. Nature of the bottom is primarily sandy and interspersed with some rocky areas.

The upper part of the river mouth, i.e. the river (ST5): The depth varies between 50 cm to 2 m. Bottom nature is clay. Site ends at ~10 m (35.719240N, 35.832978E) before the point where the river meets the sea. Aquatic plants are distributed along its sides, including: Water reed (*Arundo donax*), typha (*Typha domingensis*).

Field works

The research was carried out between January and December 2014 at a rate of one trip per month for each site. Several fishing methods were used: Lined nets (16 mm holes, 1 m high, 200 m long), in addition to carrying out a field fishing operation in the estuary area by opening a channel extending from the riverbed towards the sea in a U-shaped form with one end closed, so that the river water can flow into it. Water stream was then closed with an amount of sand as soon as the fish entered the stream. Water leaks between the grains of sand caused the channel to dry out and the fish to remain on the bottom, then collected directly by hand.

Laboratory work

The caught fish species were classified according to the scientific taxonomic references Whitehead et al., (1986), Fisher et al., (1987), Golani et al., (2006), Beckman, (1962) and morphometric measurements were recorded according to (Kottelat and Freyhof, 2007; Pravdin, 1966).

Statistical study and environmental indicators used

All data were processed using Microsoft Excel, where mean values and standard deviation (Mean ± SD) were calculated

1. Biomass: The biomass (kg/m²) is calculated with the aim of estimating the fish stock, which generally expresses the amount of fish present in a specific area during a specific period, which can be estimated through the biomass, i.e. the total weight of individuals per unit area.

2. Jaccard similarity index: This index measures the degree of similarity between the stations studied. According to, the similarity index is calculated as follows:

$$C_j = \frac{j}{a + b - j}$$

Where j is the number of species shared between the two study stations, a is the number of species in the first station and b is the number of species in the second station.

3. Condition Factor: The condition factor is an essential indicator of the feeding density and growth level of fish (Dutta & Banerjee, 2016). Standard value of this coefficient is /1/, and it is given by the relationship according to Hile (1936):

$$C_f = \left(\frac{W}{L^3}\right) * 100$$

Where C_f: condition factor

W: Total weight of the fish (g)

L: Total length of the fish (cm).

3. RESULTS AND DISCUSSION

Degree of similarity in the number of species between stations

We notice from Table 1, and by comparing the similarity values between each two stations, that the highest similarity value was between the two stations: the estuary (ST1) and its left (ST2), reaching (0.43), followed by the value (0.33) between the estuary area and

its right. At the same time degree of similarity between the river and the rest of the stations was low and was highest between the river and the estuary area (0.15).

Table 1 Degree of similarity in the number of species between stations

	ST1	ST2	ST3	ST4	ST5
ST1	1	0,43	0,33	0,22	0,15
ST2	-	1	0,32	0,12	0,09
ST3	-	-	1	0,14	0,09
ST4	-	-	-	1	0
ST5	-	-	-	-	1

Statistical coefficients of the morphometric characteristics of the most important fish species available in the research area:

Changes in the condition factor for some species studied

This factor is studied to know the availability of food in the environment in which fish live and the effectiveness of nutrition in increasing their weight and length, which in turn is reflected in body compactness (muscle growth and fat deposition throughout the body) (Pravdin, 1966). Figures (2 through 11) show the monthly changes in the condition factor values for fish species (*Liza aurata*, *Diplodus sargus*, *Alburnus orontis*, *Boops boops*, *Sardinella aurita*, *Siganus luridus*, *Siganus rivulatus*, *Tcrachurus trachurus*, *Upeneus asymmetricus*, *Lithognathus mormyrus*).

We notice from the data in the following figures (2 to 11) that the highest values of the state coefficient were reached in different months during the year. In March, such as the *T. trachurus* (0.97), and others in April, such as the *D. sargus* (2.02), the *A. orontis* (1.21), and the *B. boops* (1.07), and others in August, such as the *U. asymmetricus* (1.11), and in September the *S. aurita* (0.75). for *L. aurata*, this value was highest in October (0.93) and *S. rivulatus* in November (1.55). In turn, indicates the availability of the natural food base in the environmental areas inhabited by these fish according to the months of the year, which is consistent with the data of (Costa and Araújo, 2003; Ali et al., 2016).

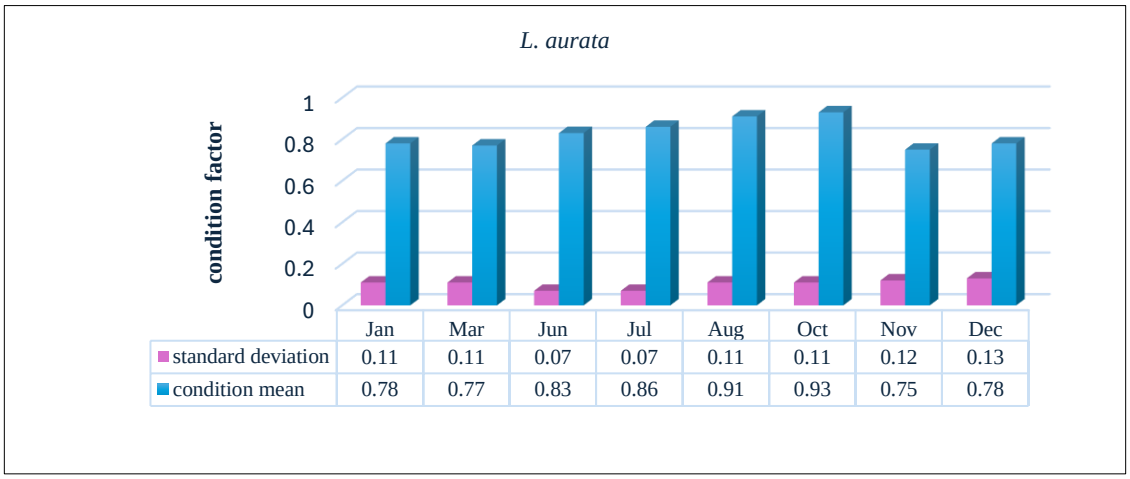

Figure 2 Changes in the condition factor of *L. aurata* during the research period

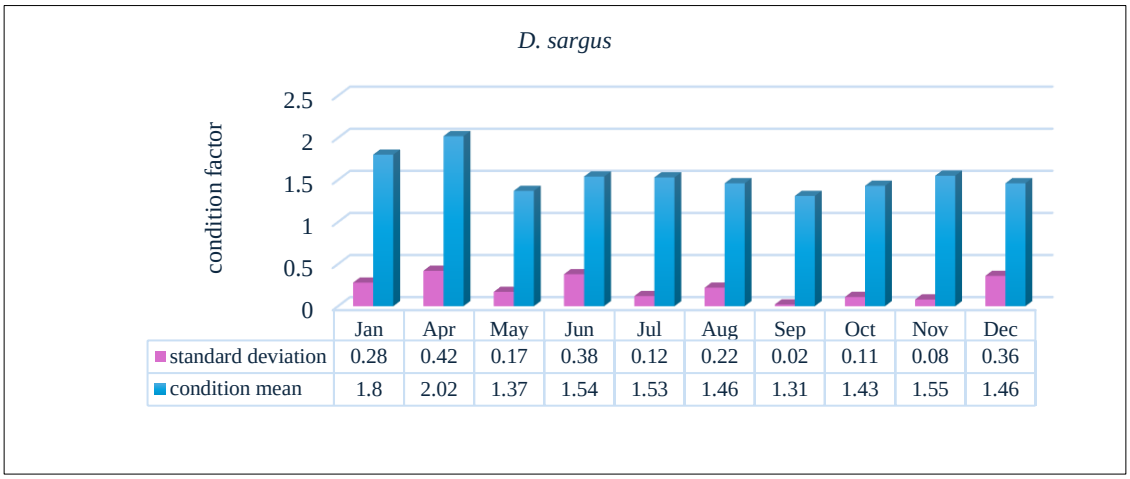

Figure 3 Changes in the condition factor of *D. sargus* during the research period

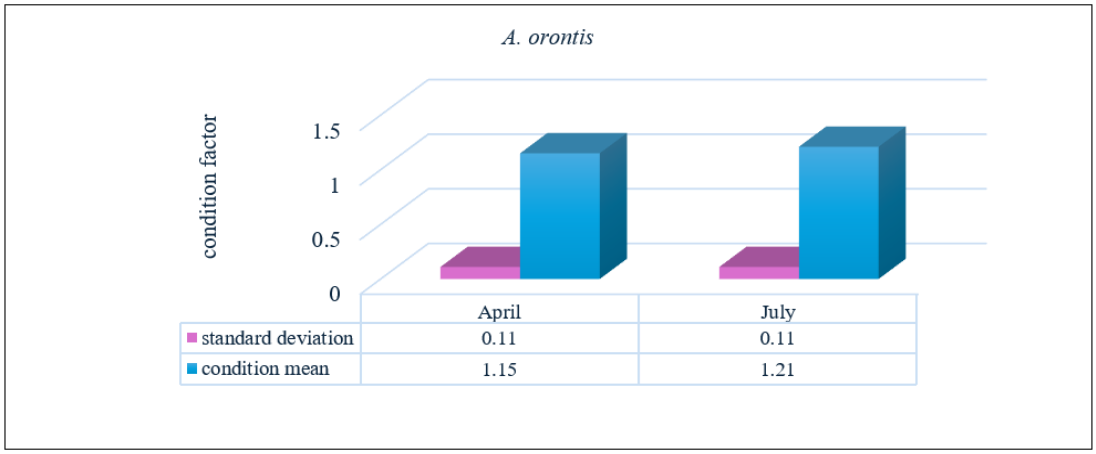

Figure 4 Changes in the condition factor of *A. orontis* during the research period

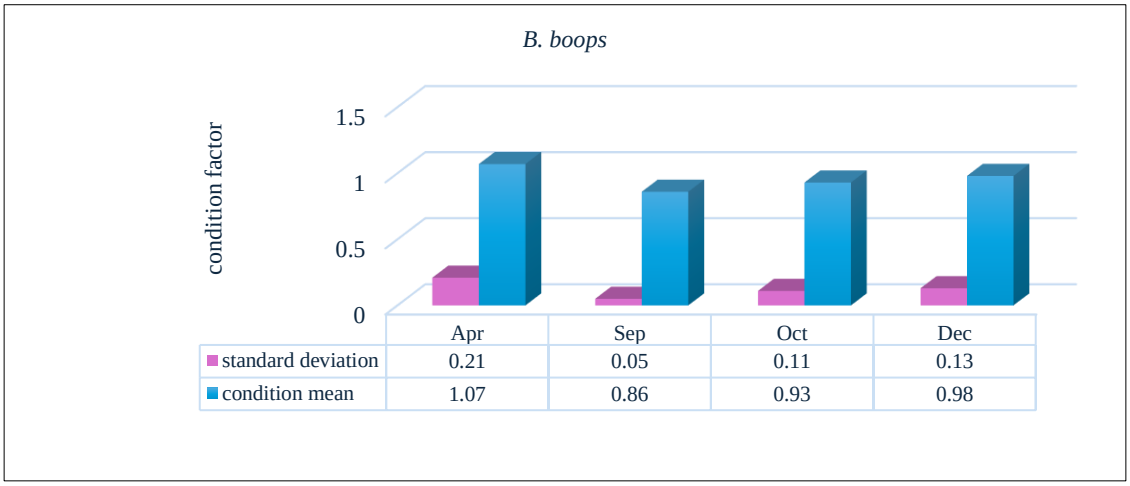

Figure 5 Changes in the condition factor of *B. boops* during the research period

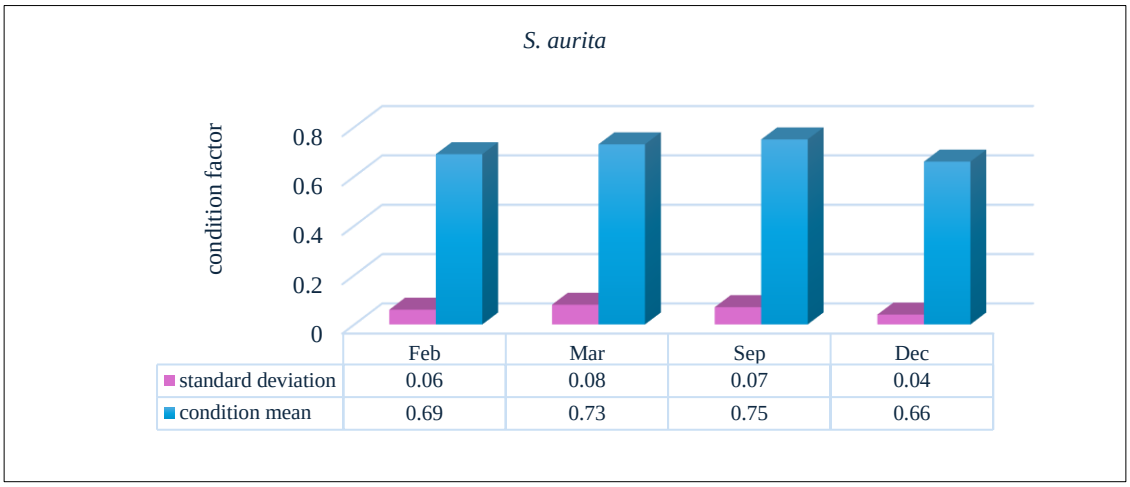

Figure 6 Changes in the condition factor of *S. aurita* during the research period

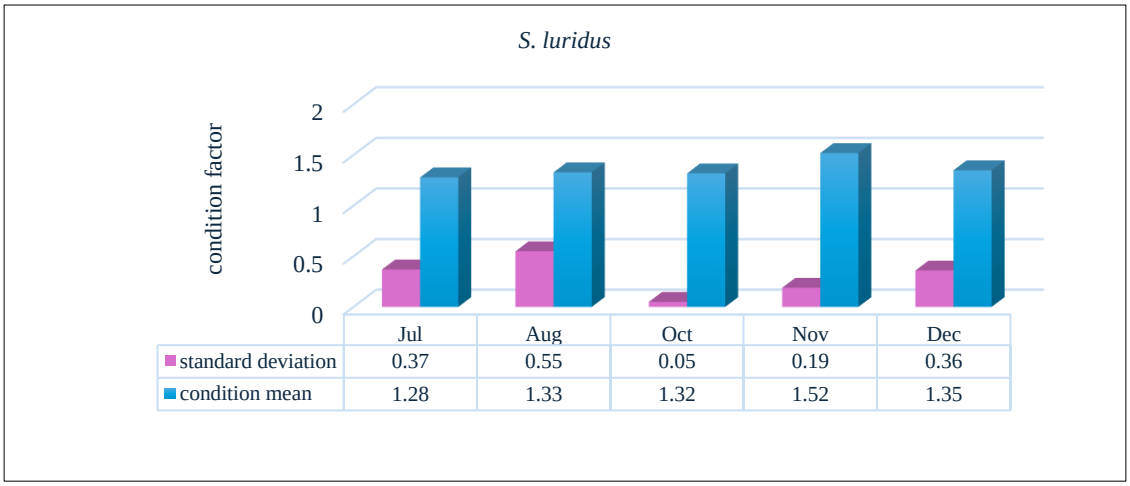

Figure 7 Changes in the condition factor of *S. luridus* during the research period

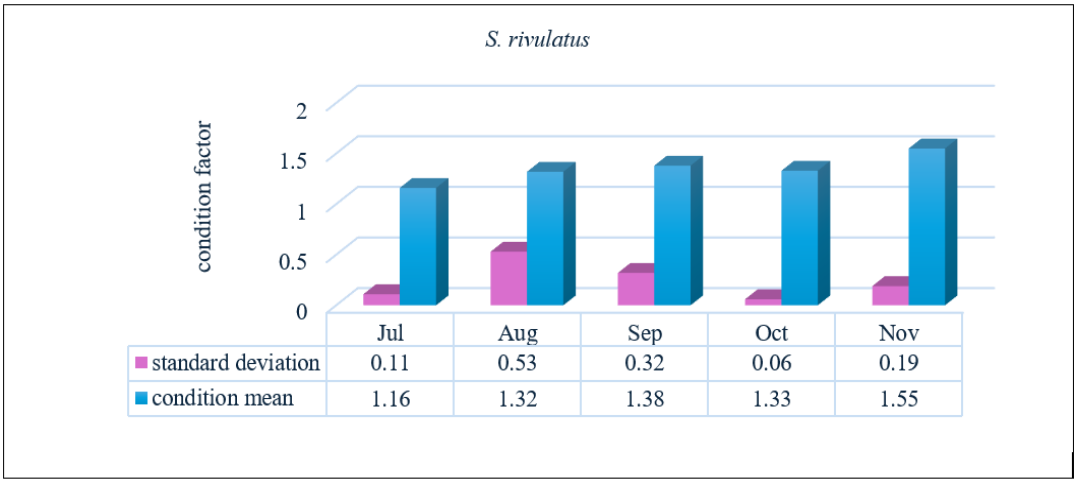

Figure 8 Changes in the condition factor of *S. rivulatus* during the research period

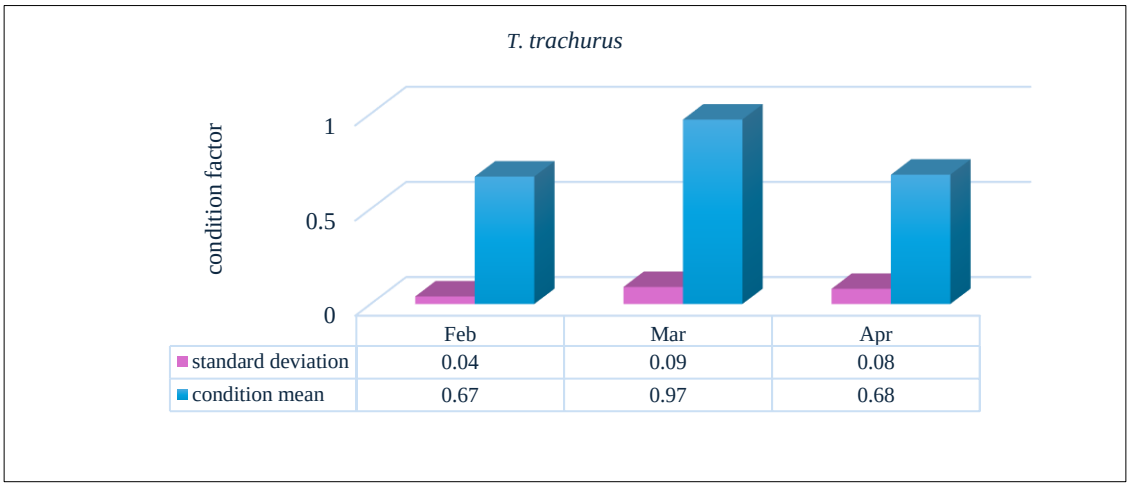

Figure 9 Changes in the condition factor of *T. trachurus* during the research period

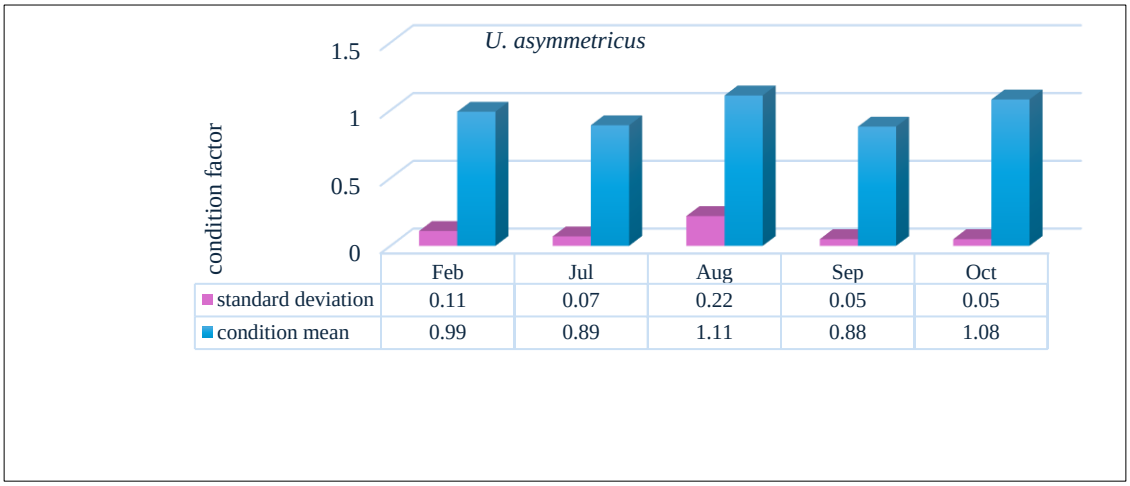

Figure 10 Changes in the condition factor of *U. asymmetricus* during the research period

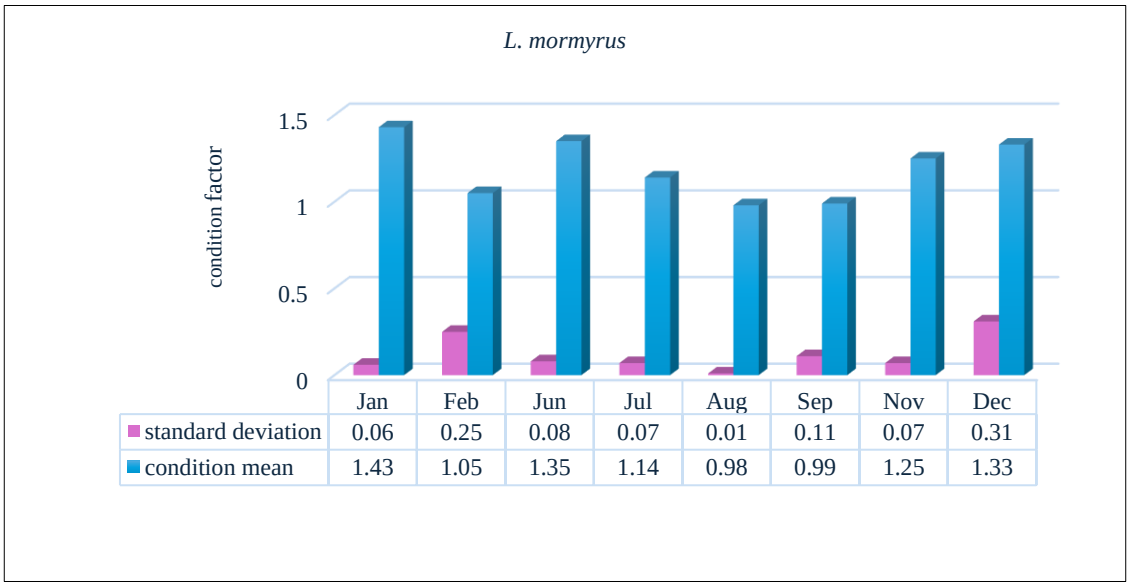

Figure 11 Changes in the condition factor of *L. mormyrus* during the research period

Quantitative composition of the catch (living mass) in the Qandil River estuary

Table 2 shows the results of the biomass study of the total catch in the Qandil River estuary area during the research period. Biomass of the caught fish species varied according to the months of the year; its highest values in December for each of the species: *S. rivulatus* (2.08) kg/m², *Sphyraena viridensis* (1.08) kg/m², *B. boops* (3.44) kg/m², *D. sargus* (4.31) kg/m², and *L. aurata* (2.53) kg/m², in October *Dicentrachus labrax* (8.43) kg/m², in November *U. canariensi* (24.04) kg/m² and the rest of the species had relatively small biomass. Highest productivity of the total catch in the study area was (2.26) kg/m² during December, while the lowest was during August (0.08) kg/m².

These values indicate that fish biomass is generally low, and fish productivity in the study area is also low, due to biotic factors (availability of the natural food base, food competition, etc.) and abiotic factors (pollution, overfishing). Estuaries are aquatic environments that are more sensitive and fragile than most other marine ecosystems, where estuaries are exposed to damage from invasive alien species, soil erosion resulting from deforestation, overgrazing, and poor agricultural practices (excessive use of nutrients resulting from Fertilizers), sewage, and outputs of industries, human activities, and tourism (Crossland et al., 2005).

Table 2 Biomass of the total catch in the study area during the research period (kg/m2)

Family	Scientific name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
bBalitoridae	*Nemacheilus galilaeus*	-	-	-	0.01	-	-	-	-	-	-	-	-
Belonidae	*Belone belone*	-	-	-	-	-	-	-	-	-	5.48	1.71	-
Bothidae	*Bothus podas*	-	-	-	-	0.18	-	-	-	-	-	-	-
Blenniidae	*Parablennius anguinolentus*	-	0.06	-	-	-	-	-	-	-	-	-	-
Carangidae	*Caranx crysos*	-	-	-	0.07	-	-	-	0.05	-	-	-	-
	Trachinotus ovatus	-	-	-	0.07	-	-	-	-	-	0.05	0.17	-
	Trachurus trachurus	-	0.23	0.61	0.27	-	-	-	-	-	-	0.61	-
Clupeidae	*Sardinella maderensis*	-	-	-	-	-	-	-	-	-	0.06	-	-
	Sardinella aurita	-	0.33	0.49	-	-	-	-	0.04	1.51	-	-	0.19
Cyprinidae	*Alburnus orontis*	-	-	-	0.21	-	0.41	-	-	-	-	-	-
	Barbus longiceps	-	-	-	-	-	-	0.12	0.01	-	-	-	-
Fistulariidae	*Fistularia commersonii*	-	-	-	-	-	-	-	-	-	-	-	4.13
Haemulidae	*Pomadasys stridens*	-	-	-	-	-	-	-	-	-	-	0.78	-
	Pomadasys incisu	0.01	-	-	-	-	-	-	-	-	-	-	-
Hemiramphidae	*Hemiramphus far*	-	-	-	-	-	-	-	0.01	-	-	-	-
Labridae	*Symphodus roissali*	-	-	-	-	-	-	0.12	-	-	0.08	-	-
	Xyrichthys novacula	-	-	-	-	-	-	-	-	0.67	-	-	-
	Talassoma pav	-	-	-	-	-	-	-	-	0.006	-	-	-
	Coris julis	-	-	-	-	-	-	-	-	0.21	-	-	-
	Symphodus tinca	-	-	-	-	-	-	-	-	-	0.16	-	-
Moronidae	*Dicentrachus labrax*	-	-	-	-	-	-	-	-	-	1.75	8.43	-
Mugilidae	*Chelon labrosus*	-	-	-	-	-	0.85	2.57	-	-	3.79	3.22	1.79
	Liza aurata	5.01	-	0.31	-	0.03	0.92	0.98	0.25	0.63	1.99	5.47	2.53
Mullidae	*Mullus barbatus*	-	-	-	-	-	-	-	0.07	-	-	-	-
	Upeneus asymmetricus	-	0.32	-	-	-	-	0.01	0.07	0.46	-	0.41	-
Scaridae	*Sparisoma cretense*	-	-	-	-	-	-	1.76	-	-	-	-	-
Sciaenidae	*Umbrina canariensis*	-	-	-	-	-	-	-	-	-	24.04	-	-
Scorpaenidae	*Scorpaena porcus*	-	-	-	-	-	-	0.02	-	-	-	-	-
Serranidae	*Epinephelus costae*	-	-	-	-	-	-	0.15	-	-	-	-	-
	Epinephelus guaza	-	-	-	-	-	-	-	-	-	-	0.11	-

Siganidae	*Siganus rivulatus*	-	-	-	-	-	-	0.01	0.01	1.38	0.02	0.06	2.08
	Siganus luridus	-	-	-	-	-	-	0.03	0.02	-	0.27	0.09	0.43
Silaginidae	*Sillago sihama*	-	-	-	-	-	-	-	0.13	-	-	-	-
Sparidae	*Boops boops*	-	-	-	0.33	-	-	-	-	0.12	-	0.06	3.44
	Pagellus acarne	-	-	-	-	0.06	-	-	-	-	0.07	-	-
	Lithognathus mormyrus	0.09	0.05	-	-	-	0.25	0.17	-	0.03	0.11	0.09	0.51
	Sarpa salpa	-	-	-	-	0.51	-	-	-	-	0.15	-	-
	Diplodus sargus	0.22	0.05		0.49	0.02	3.57	0.21	0.21	0.03	0.04	0.58	4.31
	Sparus aurata	-	-	-	-	-	-	-	-	-	0.47	-	-
	Oblada melanura	-	-	-	-	0.01	-	0.03	-	0.14	-	-	-
Sphyraenidae	*Sphyraena viridensis*	-	-	-	-	-	-	0.29	-	-	-	-	1.18
Synodontidae	*Synodus saurus*	-	-	-	-	-	-	-	-	-	-	-	0.006
Trachinidae	*Echiichthys vipera*	-	-	-	-	-	-	-	-	-	0.04	-	-
Tetraodontidae	*Lagocephalus sceleratus*	-	-	-	-	-	-	-	0.11	-	-	-	-
Rhinobatidae	*Rhinobatos cemiculus*	-	-	-	-	-	-	-	-	-	-	0.40	-
Average	1.33	0.17	0.47	0.21	0.14	1.20	0.46	0.08	0.47	2.27	1.48	1.87	-

4. CONCLUSIONS AND RECOMMENDATIONS

The Qandil River estuary is inhabited by several fish species and frequented by several others. Study indicated that the river has a role in the distribution of fish species, as some species (*Dicentrachus labrax*) go to the estuary during the reproductive period.

The highest similarity value was between the two stations: estuary (ST1) and its left (ST2).

Fish productivity in the study area is low in general.

The highest condition factor values occurred at different months of the year, depending on the availability of the nutritional base.

Conflicts of interests:

The authors declare that there are no conflicts of interests.

Funding:

The study has not received any external funding.

Ethical approval

The Animal ethical guidelines are followed in the study for species observation & identification.

Data and materials availability

All data associated with this study are present in the paper.

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