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# Fisheries and biology of Spinner shark *Carcharhinus brevipinna* in Ras-Lanuf shores, Libya - Spring and summer 2019

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## Abstract

Between March and August 2019, about 52 specimens of *Carcharhinus brevipinna* were collected from Ras-lanuf shores, Libya. In a size range (60.3-270.3 cm) and weights (1551.11-39510.22 gm), to study their biology: In length-weight relationship was isometric (B=2.5934); values of condition factors (Kf and Kc) plummeted by increasing size, from 0.42 and 0.28 in 77.6 cm size, to Kf = 0.17 in 145.8 cm and Kc = 0.13 in 178.6 cm. The presence of the middle group (178.6 cm) peaked by the quarter (26.9%), whereas the largest group had the lowest attendance by 7.6%. The variance of the H.S.I. started by 20.8% to drop in the middle (15.2%) raising to 25.7% in the largest specimens. G.S.I. averages of males and females indicated gradually from 1.20 and 1.00 in the small sizes, till 4.31 and 4.82, respectively. The sex ratio of males and females approached by 1.33: 1.00 respectively. Their stomachs contained pelagic teleosts (44.6%) then mollusks by 20.3 %, with the benthic fishes, cephalopods and juvenile cartilaginous fishes constituted by 17.6, 9.4 and 8.1% respectively. Pelagics peaked in 113.9 cm by 65.0% and dropped (30.4%) in 229.1 cm; in 77.6 cm, the bony benthics and cartilaginous fishes recorded 52.2 and 14.6% respectively, with 16.7 of mollusks, compare to 29.8% in 178.6 cm, cephalopods peaked to 20.0% in 145.8cm. This study is beneficial for studies the population dynamics of this species and others in the Libyan coast, to manage the fish stocks-assessment and to protect the immature individuals in coasts and nursery grounds from overfishing.

**Key words:** *Carcharhinus brevipinna* - Length-weight relationship - Condition factors - Hepto-somatic Index - Gonado-somatic Index, Ras-Lanuf - Libya.

## 1 Introduction

It is not hidden that the Libyan shores have abundant resources of fisheries, that is still not well-exploited; although their ability for more investments to increase production according to FAO, (2006). Before that, these fisheries must be indicated by a database of the important economic species, including sharks; the highly-diversified in the Mediterranean; and listed on the IUCN nowadays. Betts et al, (2019) recorded 36 rays and 49 sharks inhabiting the Mediterranean; twelve of them are Carcharhinids (Golani et al., 2006).

Sharks are caught as a target of fishing by long-lines in artisanal fisheries (Fahmi and Sumadhiharga, 2007 and Ben-Abdalla et al., 2012), or as by-catch in the trawling nets in Libya, although most caught are undersized (Buzaid et al., 2020), this leading sharks and rays to be more over-exploited than the other fishes (Camhi et al., 1998 and Stevens et al., 2000 A and B).

The Libyan coast is an important habitat for some elasmobranches as breeding grounds; such as the white shark *Carchardon carcharias*, copper shark *Carcharhinus*

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*brachyurus*, thornback ray *Raja clavata*, Common guitarfish *Rhinobatus rhinobatus* and Tope shark *Galeorhinus galeus* (Bradai, *et al*. 2012; Ben-Abdalla et al., 2012; Buzaid & El-Mor, 2015; Buzaid, 2017; Buzaid, 2019 and Buzaid et al., 2020).

Spinner shark, *Carcharhinus brevipinna* (Müller and Henle, 1938) has a wide distribution in the Atlantic, Mediterranean, Red Sea, Indian Ocean, and Western Atlantic (Garrick, 1982). Compagno (1984) and Golani et al., (2006) noted that *C. brevipinna* is a common coastal pelagic, warm temperate shark of the continental and insular shelves, common in shallow waters at a depth less than 30 m, but ranging down to at least 75 m depth, from the surface to the seafloors in all tropical and sub-tropical seas, also migrates to temperate areas during the warmer season, immigration in big flocks (Ben-Abdalla et al., 2012). The spinner shark is a schooling, active species, but more commonly leaps spinning out of the water. Active migratory sharks that inhabit benthic and pelagic habitats (Golani et al., 2006). Maximum reported size is 278 cm, females get matured in 170-200 cm, while males in 159-203 cm (Ben-Abdalla et al., 2012); birth-size is 60-75 cm (Compagno, 1984). This species is important economically, for liver oil (Ben-Abdalla et al., 2012). In the Mediterranean Sea, Tortonese (1939) reported the first record of C. *brevipinna* off Libya.

Compagno, (1984) listed the menu of the spinner sharks; that ingest principally on fishes; even stingrays and large invertebrates; especially cuttlefish, squid and octopi (Ben-Abdalla et al., 2012). Golani et al., (2006) mentioned the attack of this species on its prey from below while spinning its body and after leaping out of the water.

In general; Sharks are considered as top predators (Musick and Bonfil, 2005), and may have an important role in the regulation of marine ecosystems at lower trophic levels. Studying the feeding habits of sharks is essential to appreciate their biology and ecology and to understand the functional role of fish within the ecosystem, distribution and their position in food webs (Motivarash-Yagnesh et al., 2020). The food quality and quantity affect directly on growth, maturation and mortality of species. In addition, quantitatively describing the diet and foraging habitat and predator–prey interactions in a community are a key step in ecosystem approaches to fisheries management (Buzaid and El-Mor, 2015).

The study of the Hepato-Somatic Index (H. S. I.) is considered essential for fish biology (Buzaid, 2018), as it is closely related to the size of the fatty stock in the liver as a result of feeding, as well as the activity of the fish during the breeding and migration season (Htum-Han, 1978).

Spinner sharks are oviviparous species; females give birth to 6-14 embryos their sizes 50-70 cm, in spring and summer (Golani et al., 2006 and Ben-Abdalla et al., 2012), after a gestation period of 12 to 15 months (Compagno, 1984).

Pauly, (1983) and Tagliafico et al., (2014) stated that studying how the fish grow is essential for population and stock assessment objectives; for the growth of every single fish is precisely a source of information of each obtained catch in the fishery. In turn, this data is fundamental to study the fisheries' yield according to Wang et al., (2012).

About reproductive biology; Clark and von Schmidt (1965) reported that in this species in the northwest of Atlantic. Branstetter (1982) and (1987) described the identification of the key characters of this species, and its age, growth, and reproduction estimates; although they are lacking in the Mediterranean; although they are recorded in the northwest of Atlantic (Branstetter, 1987) and south of Indian Ocean (Allen and Cliff, 2000).

Capapé et al., (2003) mentioned that Data on the reproductive biology of C. brevipinna have been reported for specimens fr Brazil by Sadowsky, (1967), off South Africa by Bass et al., (1973), Senegal by Cadenat and Blache, (1981), the Gulf of Mexico by Branstetter, (1981), and in Australian waters by Stevens, (1984); Stevens and Mc Loughlin, (1991). On the other side, its reproductive biology from the Mediterranean Sea is studied sketchily. Capapé (1974) and Capapé et al., (2003) gave data on the breeding period and fecundity of specimens in the Tunisian shores.

Joung et al., (2005) stated that such life-history information is important for stock assessment and fisheries management of this species, especially size or age at maturity for age- and size-structured models, such as the spawner per recruit model and so on (Deriso et al. 1985, Quinn II et al. 1990 and Katsukawa et al. 1999).

To encourage regional concerns on conservation and management of elasmobranches, information about them should be collected in every country (Fahmi and Sumadhiharga, 2007). Unfortunately, studies on shark diversity and their biology in Libya are very few.

This work has an objective to provide information concerning aspects of the fisheries' biology, including morphometric, food and feeding, sex ratio and reproduction of the spinner shark in the Libyan waters. These biological input parameters could be useful for further evaluation of this species and its stocks in the Mediterranean south.

## 2. The Study Area

### 2.1. Locations

According to Abu-Madinah, (2008); gulf of Sirt, from Tukera in the east, till Ras-Albuj at the west, going to the south by two and have degrees of the latitude, with a shore long to 920 Km and entrance width as 450 Km.

Ras Lanuf (between Marsa-Bwairat and Zwaitina) has a sandy and wide beach and waved-shores getting higher gradually as far as from the beach, parallel to the sea-floor depth on shore-line 1-3 Km and 10 m depth; till more than 6 Km width and 20 m depth (Abu-Madinah, 2008) (Fig 1).

#### 2.1.1. RAS LANUF COMPOUND [30° 32' 06'' N - 18° 30' 24'' E] (MBRC, 2005):

About 7 km west from the entrance of Ras Lanuf port. A permanent landing site, with an artificial breakwater as shelter from north and west waves (Reynolds et al, 1995).

#### 2.1.2. MINA RAS LANUF [30° 30' 30'' N - 18° 34' 00'' E] (MBRC, 2005):

The entry is just west past the chemical complex, the entrance with a big tanker painted on the wall. This location is a permanent landing site as harbour with deep water suitable for trawlers (Reynolds et al, 1995).

## 3. Materials and Methods

### 3.1. Sampling

About 52 specimens of *Carcharhinus brevipinna* were collected irregularly, between the end of March and the beginning of August 2019, using the drifting long-line and bottom set long-line for sharks, locally named by Bringali Sayeb/Ayam and Bringali Kelb, according to Lambouf et al., (2000), in to shores of Ras lanuf.

### 3.2. Study Lab

#### 3.2.1. Identification of the Species:

Specimens of *Carcharhinus brevipinna* had been identified according to some reference collection (Compagno, 1984; Serena, 2005; Golani, 2006; Ben-Abdalla et al., 2012; Iglésias, 2013 and FAO, 2018) (Fig 1).

#### 3.2.2. Morphometrics:

#### 3.2.3.1. Length-weight relationship (LWR):

It was estimated by total length (cm) and total weight (g), according to the following equation:

**$W = aL^b$ (Hile, 1936; Beckman, 1948; Froese, 2006 and Khan *et al*., 2012):**

Where: W = Total weight (g), L = Total Length (cm), a = Constant value, b = Variable Value (2 – 4) according for fish species (Bagenal and Tesch, 1978).

#### 3.2.2.2. Condition factors:

It is known that the total weight of fish is variable during the year, Due to the change in diets, growth of the gonads and physiological status of fish, which is calculated as following:

**3.2.2.2.1. *Fulton's method:***

**$K_F = 100\ W_tL^{-3}$ (Fulton, 1902)** Where: $W_t$ = Total weight (g), L = Total Length (cm).

**2.2.2.2.2. *Clark's method:***

**$K_c = 100\ W_tL^{-3}$ (Clark, 1928)** Where: $W_g$ = Gutted weight (g), L = Total Length (cm).

#### 3.2.3. Food and feeding:

This includes feeding habits, annual, diet composition, variations of the diet with lengths. In this study, for each fish specimen total length was measured to the nearest 0.1 cm. Each fish was dissected and the alimentary tract removed and preserved in 10% formalin. Food items were identified to their groups. A list of general diet composition was made food analysis was made by the numerical method according to Pillay, (1952), Godfriaux, (1969) and Hyslop, (1980).

#### 3.2.4. Hepato-somatic Index (H.S.I.) (Htum-Han, 1978) :

H.S.I. = [weight of liver (g) / weight of body (g)] X 100.

#### 3.2.5. Gonado-Somatic Index (G.S.I.) (Buxton, 1989):

G.S.I. = [weight of gonad (g) / weight of body (g)] X 100.

**3.3. Statically studies:**

All static analysis was done by MS Excel 2010, SPSS V. 21; with Pearson correlation at the 0.01 significance level.

## 4. Results and Discussion

About 52 individuals of *Carcharhinus brevipinna* from Ras Lanuf shores, had a size range (60.3- 270.3 cm) and weighted between 1551.11 and 39510.22 gm. Their averages and standard divisions were analysed in the table (1).

**4.1. Length-Weight relationship (LWR)**

Table (1) shows an agreement was stated between the average observed and calculated weight for each length group. Froese (1998) mentioned that value (b) in this equation should be in the range 2.5-3.5 to be expected, as the following:

*W= 0.0181*L2.5934,* $R^2 = 0.9769$

Where the value of (b) was 2.5934 (Fig 2); showing an isometric growth (b<3). This variable value is slightly lower than that found by Sentosa et al., (2018) for male and female spinners, in the south of Nusa Teggara, and sharply down than Santos et al., (2017) for the same species on the continental shelf of southern brazil. Almost, this species has positive allometric-growth, with a greater gain in weight than in length (Casselman, 1990); especially the neonates increase by 25-33% of their length at birth in the first years and above that in the protected areas as nursery grounds (Branstetter, 1987). Stevens and Wiley, (1986), reported that the variations between length–weight relationships of males and females may be a result of different sample sizes, an unequal distribution of sizes within each data set of each sex, or even of non-pregnant females that may be lighter due to the inclusion of giving-birth, which have a lower condition factor (Motta et al., 2013). In this work, (b) value was isometric, according to Froese, (2006); this estimated parameter is acceptable.

Based on Pearson correlation coefficient, at the 0.01 significance level; a very positive statistical correlation (0.919) was found between the total length and the total weight of this species. The same test showed high values of correlation coefficient (R) , R square and adjusted R square, recorded as 0.995, 0.990 and 0.987, respectively; to elaborate the effect of these independent variables, that explained by about 99% of the variance in total size as a dependent variable, with total weight, sex, condition factors (KF & KC), hepato-somatic index (H.S.I.), gonado-somatic index (G.S.I.), and stomachs' fullness degree as well; all the aforementioned as independent variables in this work.

**4.2. Size composition**

Using the length frequently distribution in fig. (3) to describe the size composition in catch-stock of *C. brevipinna*; it was noticed that the young specimens of 77.6 and 113.9 cm. had an equal portion of the stock, meanwhile about half of the chunk was divided between the middle groups (145.8 and 178.6 cm) by the peaks of 23.1 and 26.9%

respectively, whereas the nadir value (7.6%) was counted to the largest individuals in the catch-stock of the study. These sizes are not as large as the peaks of Buzaid, (2017) for the specimens of *Galeurhinus galeus* in Susah shores, nor Fahmi and Sumadhiharga, (2007) for the Spinner sharks in western Indonesia as well. Walker, (2013) suggested that birth, mating, ovulation and mortality occur an influence on the presence of small sizes in the stocks. Taking the correlation between size and age in considering; as an example, to count the small sizes as an immature in the reproductive cycle of *C. brevipinna* had a little record in the North East Atlantic and Mediterranean for a long time, till Capapé et al. (2003) provided an approximate data in Gulf de Gabes. In this work, immatures have around 30.0% in the stock; compare Fahmi and Sumadhiharga, (2007) who contributed the immature size about 65% of the total species in Indonesian waters. Castro, (1993) and Carlson, (1999) mentioned that juveniles and sub-adult sharks tend to occur in the shores and shallow waters. Larger sharks are most abundant in the deeper waters or open seas while coastal and shallow waters are known as nursery grounds for juveniles of some shark species. This condition makes immature sharks can be caught easier than adults. The tendency of catching immature sharks by local fishers and divers was not only caused by lack of their knowledge; but also, it depends on the fishing gear type, size, and capability of the fishing boats and fishing areas (Fahmi and Sumadhiharga, 2007). Coleman, (1996); Camhi et al., (1998); Stevens et al., (2000) and Bonfil, (2002) indicated that the situation is not a good sign for the sustainability of shark resources, regarding the biological characteristics of these species, there will be a small opportunity for them to recover from their exploitation, if the existence of female sharks in nature is threatened. As well as, the exploitation of immature sharks makes them have no opportunity to get mature and reproduce, leading these species to be extinct in the next decades if there is no control and assessment for the shark in the Libyan fisheries in the south of the Mediterranean.

**4.3. Condition factors**

The body condition factors (Kf and Kc) of *C. brevipinna* in shores of Ras-Lanuf were calculated in size groups, and shown in table (1) and fig (4). As a general view, these values plummeted by increasing for length, from 0.42 and 0.28 in 77.6 cm size, to the lowest values in size-group of 145.8 cm (Kf = 0.17) and in 178.6 cm (Kc = 0.13); to recover slightly between 0.20 and 0.22 in the total weights, and less than 0.16 in gutted weights of the largest specimens (Fig.4). Looking to the given values of KF & KC, according to Pearson's correlation in this work; It was found a moderately strong inverse correlation, that approached - 0.549 and - 0.582, respectively. Whereas a very strong direct relationship appeared between these two factors, which amounted by 0.961, to indicate and clarify a very good "health" condition in this species in this work.

These Spinners have mainly close to results of relative condition factors of Sentosa et al., (2018) of the same species in Southern Nusa Tenggara Waters, they were not different in males and females; but in size groups. Rapi et al., (2020) reported the same range of relative condition factors in *C. amblyrhynchos* (Bleeker,1856) in Makassar

Strait, where these relative factors of females are smaller than males, indicating that the condition of males is better than females, from the sides of size and the annual duration. Generally, the difference in values of condition factors is influenced by age, population density, gonad maturity level, growth phase, season, degree of stomach fullness, gonad maturity, sex, size range, health, and general fish condition and preservation techniques (Niklosky, 1963; Tesch, 1971; Roo et al., 1999 and Effendie, 2002). However, in this work, these factors were not counted.

**4.4. Physiological indices**

**4.4.1. *Hepato-somatic index (H.S.I.)***

Looking to the table (1) and fig (5); to analyze the variance of the H.S.I. averages in the sampled *C. brevipinna*; which indicated a significantly between size groups. Starting from 20.8% in 77.6 cm; dropping till 15.4% in the next group (113.9 cm) as the nadir, followed by gradual raising as increase as the group sizes; till the zenith of 25.7% in the largest specimens (258.2 cm). A Pearson direct correlation showed mainly positive in the hepato-somatic index; correlated with an increase in size by 0.636; which may indicate its connection to the process of initiating the formation of glycogen clumps inside their livers, coinciding with the exit from a giving birth process, that might be occurred, before these specimens get captured. It is reasonable to suppose that higher H.S.I.'s are normally found in periods preceding events of high metabolic activity such as reproduction and or migration, which are considered in sharks; especially endemic or relatively small-distributed (Reis & Figueira, 2021). Davidson, B., & Cliff, G. (2002) showed a mass of liver reaches above 15% of bodies of *C. brevipinna* specimens off the east coast of South Africa, with rich fatty-acid profiles that would be most favorable in human nutrition, in that it showed levels of saturated (SFA) and high polyunsaturated fatty acid (PUFA) in their livers. Related particularly to their varied diets; teleosts, cartilaginous fishes, and squids; depending on the prey species; partially (Davidson & Cliff, 2002). Yigin & Ismen, (2013) recorded a significant increase in H.S.I. and G.S.I. in *Squalus acanthias* in the North Aegean Sea; with size in both males and females. While the ranges of H.S.I. reached the highest values in both juveniles and adult individuals, reflecting the liver's role in gonadal production. Although H.S.I. is related to G.S.I. because of vitellogenesis; which can increase both of them (Menn et al., 2007). Osman et al., (2011) reported that the relationship between gonads and liver is not always as strong and positive as it could be expected, since H.S.I. values varied according to feeding activity or reproductive behavior (Uka & Sikoki, 2012).

**4.4.2. *Gonado-somatic index (G.S.I.) for males***

Results of G.S.I. in males of *C. brevipinna* showed a significant interaction between gender and size (fig 5); from 1.20 as a low value in the young individuals (77.6), to expand slowly till the double (2.32) in the middle (178.6 cm), falling to 1.89, to a sharp soar of around the triple (4.31) in the largest speciemens in the population.

Allen, & Cliff, (2000) reported the same raising of these values in the mature males *C. brevipinna* off Kwazulu-Natal, South Africa. These obtained values showed that females had higher G.S.I. values than males; it might be occurred in all the six stages of gonad maturation (Shinkafi & Ipinjolu, 2012). There is evidence that the majority of species undergo the reproductive cycle and variation in the size of gonads is observed (Sadekarpawar, and P. Parikh, 2013; and De Vlaming et al., 1981). That found G.S.I. values might be independent of the size of fish, as the smaller individuals of the species here, it had developing gonads, and then already engaged in reproductive activity (Shinkafi & Ipinjolu, 2012). On the contrary, to calculate the weight of gonad as a percentage of the body weight, that has been used to estimate the reproductive maturity, and the responses to environmental dynamics as well.

**4.4.2. *Gonado-somatic index (G.S.I.) for females***

Fig. (5) elaborated the growing G.S.I. values in females of *C. brevipinna* in Ras lanuf shores; from 1.00 in 77.6 cm, going in plateau till the peaks in larger sizes of 229.1 and 258.2 cm by 2.80 then 4.82, respectively. Ba et al. (2013); mentioned that these peaks could appear to have an annual reproductive cycle, when mating takes place, hepatosomic index of pregnant females was highest at the onset of pregnancy and lowest at parturition (Allen & Cliff, 2000). In this work; a large number of females were not observed in pregnancy, and the fact that neonates were found in other locations at the beginning of the fall season, according to witness of local fishermen; this indicates that the parturition period is in the previous season. The fact that sperm was not observed in the oviducal glands of the females under study after the breeding season, indicates that fertilization may occur almost immediately after copulation (Ba et al., 2013). Talking about gonadal stages; based on G.S.I. records for *C. brevipinna*, indicate to a larger frequency of pregnant females at the beginning of the Mediterranean winter, and the presence of post-partum females in beginning of fall. Results of gonadal stage analysis for *C. brevipinna* are rather inconclusive due to the availability of female samples being restricted randomly to spring and summer. However, this high frequency of pregnant in this period, similar to the G.S.I. results of Reis & Figueira, (2021), suggests late southern-Mediterranean summer and early fall as the reproductive periods.

Wourms (1977) classified the reproductive cycles in spinner sharks as a pattern with a well-defined annual or biennial cycle; that it shows a distinct biennial cycle (Allen and Cliff 2000). Joung et al., (2005) noted that to assess maturity for spinner shark males were clasper morphology and hardness. Pratt (1979) and Joung and Chen (1995) indicated the utility of these characters to estimate the sexual maturity of males for other shark species. Ovarian eggs in C. brevipinna do not continue to ripen during gestation according to Joung and Chen (1995) and Tanaka et al. (1990). In *C. brevipinna*, developing embryos receive almost all of their nutrients via the placenta, as in other species of *Carcharhinus* sp. (Joung and Chen 1995). Joung et al., (2005) suggested that *C. brevipinna* has a resting stage for 1 yr of its 2 yr reproductive cycle. Although Allen and Cliff (2000) suggested a gestation period of 13-18 months for spinner sharks in

the south Indian Ocean, they concluded that a 2 yr reproductive cycle exists in females. Similar findings were also reported for spinner sharks in the northwestern Atlantic (Branstetter and Stiles, 1987). According to Capapé and Reynaud, (2011); shark species displaying an annual reproductive cycle assume concomitantly vitellogenesis and embryonic development (Capapé et al., 2006). Then; in uteri, embryos get developed, a the fully-yolked oocytes' crop get enlarged and received yolk in the ovary. After parturition by while, the female ovulated and conceived another period.
Galván-Magaña et al., (2019) considered sharks as K-selected species (Cailliet et al., 2005; Stevens et al., 2000). meaning they are relatively conservative life-history traits, compared to teleost fishes; especially the reproductive side, detailed by: gestation period, reproductive mode, egg hatching period, maternal investment, fecundity, offspring size, age at maturity, and longevity (Compagno, 1990; Cortes, 2000; Dulvy and Reynolds, 2002). As well as, most sharks display slow growth, late maturity, low fecundity and productivity, long gestation periods, and long-life cycles (Cailliet et al., 2005; Camhi et al., 1998; Cortes, 2000). In general; these biological characters result in low reproductive potential and low capacity to increase population size, after stressor make a perturbation with serious implications for elasmobranches' populations, limiting their capacity to sustain fisheries, and to recover from declines (Cailliet et al., 2005; Cavanagh and Gibson, 2007).
In males and females together; a law correlation between G.S.I. and total size was also indicated in a sharp inverse relationship (-0.801); to reflect a decrease in the reproductive capacity of this species as size as increase, while getting older.

**4.5. Sex Ratio**

The spinner sharks caught during the study periods consisted of 30 males and 22 females. Total distribution and sex ratio were obtained in size groups provided in the table (1). The sex ratio of male and female Spinner sharks obtained from Ras lanuf tends to approach the balanced condition of 1.33: 1.00 respectively. This is proven that the number of male and female do not have a significant difference in terms of the total number. Based on the number of catches, the male sharks were caught more than the female sharks. There was an idea of segregation between females and males that occurred at different area, as suggested by Heithaus (2001). Another possibility was adult females may occur at shallower waters to give birth (Simpfendorfer, 1992). On the contrary, Sumpton et al., (2010) found females of *C. brevipinna* in Queensland (from neonates to adults) outnumber males in the catch with the overall sex ratio being 1.4:1. In in the Gulf of Gabès; it was distributed for 1:1. Male neonates are significantly more numerous than female The relative abundance of pregnant females and neonates suggests that the Tunisian coasts could be considered a nursery area for the spinner shark (Capape et al., 2003)**.** Even in western Indonesia during the study was 1:1.05. This ratio indicated that there were about equal (Fahmi and Sumadhiharga, 2007). Springer (1960) noted that sexes are often segregated, except during mating. This kind of sexual segregation could explain the deviations in sex ratio during the course of the year. According to Muslih et, al., (2016) states that if a population has more female composition or is equal to the number of males, then the population is still in the ideal category (Rapi et al.., 2020). The sex ratio in the wild is not absolute but is influenced by the distribution patterns caused by food availability, population density, and food chain balance (Muslih et, al., 2016). Sex ratio is one of the important parameters to be studied to understand the reproductive biology of fish (Al-Jufaili, 2013).

**4.6. Food and feeding**

**4.6.1. *Diet Composition***

Fig (6). elaborated the menu of Spinner shark. Pelagic bony fishes made up of 44.6% as the bulk of this diet; which represented by sparids such as *Pagrus pagrus*, *Diplodus annularis*, *D. sargus*, *D. vulgaris*, scombrids like *Scomber scombrus* and barracuda *Sphyraena* spp as well. Mollusks; although they were crashed, they attended in the second position in the stomachs of Spinner sharks by 20.3 %; whereas the benthic teleosts (17.6%) included Solea vulgaris, *Mullus barbatus* and *Trigla lucerna*. Cephalopods (9.4%) such as *Sepia officinalis* and *Octobus vulgaris* were composed in this menu. Meanwhile cartilaginous fishes constituted by 8.1% as juveniles of rays such as *Raja* spp., *Dasyatis* spp. and guitarfishes *Rhinobatus* spp. (Fig. 6). From another areas; stomachs of spinner shark stomachs in Queensland were examined in over 80% of teleost as a major content, that had identifiable remains in these stomachs (Sumpton et al., 2010); with a slight differences in results of Van der Elst (1979) in South-African specimens of *C. brevipinna* feeding on the large schools of sardines *Sardinops sagax*, that are common in coasts of KwaZulu-Natal coastal waters during winter; Sumpton et al., (2010) stated that case as large pelagic predators.

**4.6.2. *Food variation in size groups***

In the 6 size groups of *C. brevipinna* population, (table 1 and fig 6). Pelagics peaked in the size groups of 113.9, 145.8 and 258.2 cm. by 65.0, 62.5 and 60.0% respectively, when it was found the least (30.4%) in the group of 229.1 cm; this group recorded the largest portion of benthic bony fishes (52.2%) and the smallest portion in their stomachs for the parts of cartilaginous fishes (8.7%); which found doubled (14.6%) in the youngest fishes (77.6 cm), these juveniles recorded presence of mollusks by 16.7%, and 29.8% for the same content in only another group (178.6 cm), that has the least level (8.5%) of cephalopods, compare to the middles (145 cm) by 20.0%, and 7.5% as the nadir of cartilage fishes in all size groups.

The pelagic and benthic bony fishes varied strongly as the size increased, while mollusk and cephalopods dimensioned as the fish get sized, at most; this result is almost close to records of Buzaid and El-Mor, (2015) on the Copper shark *Carcharhinus brachyurus* from Ain El-Ghazala lagoon, east of Libya. In general, the food extent demands and food acquisition ability as increase as the fish grows (Golani, 1996). In a study on the feeding habits of different species of sharks on the western Adriatic Sea in the Italian waters by Cugini and De Maddalena, (2003); it was concluded that the numbers and size of prey taxa increased with the size of the fish due to the ability of larger fishes to consume a wide range of prey sizes, compare to the smaller individuals of the same species (Golani et al., 2002). Pillay, (1952) indicated that the pelagic bony fishes increased as the size increased while benthic bony fishes and cephalopods decreased as the size increased in the elasmobranches. This variation is similar in the condition factors of fish are affected by the feeding activity, which may show their reflection on the body condition (Godfriaux, 1969).

## 5. Conclusion and Recommendation

The Spinner sharks *Carcharhinus brevipinna* is one of the known species in the Libyan coast. However, very few studies were done on this species, and more studies are required to create beneficial database for elasmobranches in this region.

As well as, it is recommended to work on extensive studies to develop strategies for optimum use of fisheries of these fishes. This study is a beneficial to facilitating studies of the population dynamic of this species and other cartilaginous fishes in the Libyan coast, to work on the assessment of fish stocks and to protect the juveniles from overfishing.

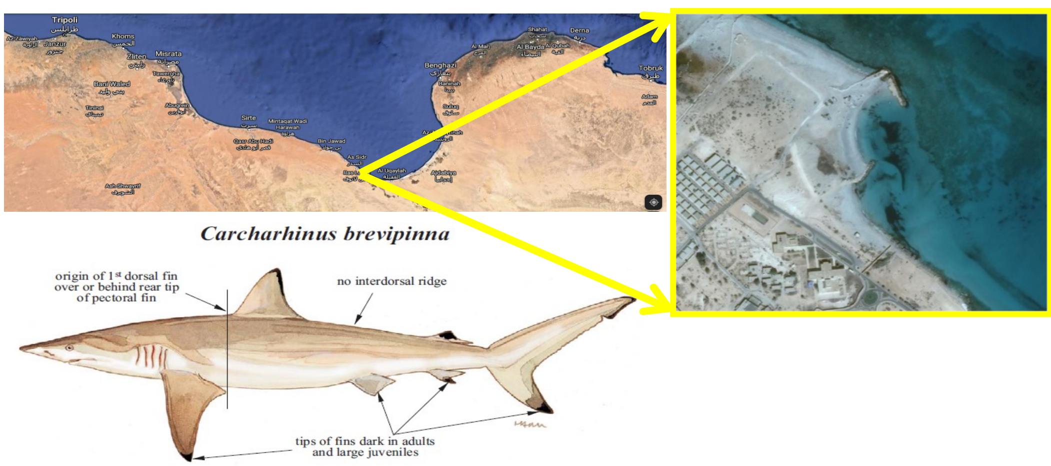


Fig (1) The Libyan coast and location of study area [above]; the satellite image of Ras Lanuf Mina and around [right] and illustrated image of *Carcharhinus brevipinna* [down] (Abdalla, 2007).

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**Table (1) Biological information collected from 52 specimens of Spinner shark *Carcharhinus brevipinna* according to size groups, Ras Lanuof, Libya, March to August 2019.**

| Group no. | | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|---|
| Count [Sum = 52] | | 8 | 8 | 12 | 14 | 6 | 4 |
| T. L. [Range] (cm) | | 60.3-95.3 | 95.4-130.3 | 130.4-165.3 | 165.4-200.3 | 200.4-235.3 | 235.4-270.3 |
| T. L. [Average] (cm) | | 77.6 | 113.9 | 145.8 | 178.6 | 229.1 | 258.2 |
| T. wt. [Mean ± S.D.] (gm) | | 1673.95 ± 151.28 | 4002.67 ± 711.08 | 5324.80 ± 705.01 | 11931.23 ± 3359.04 | 24945.16 ± 3084.64 | 38190.08 ± 1866.96 |
| Calculated wt. (gm) | | 1441.60 | 3900.02 | 7398.90 | 12522.99 | 23887.33 | 32572.11 |
| K (F) [Mean ± S.D.] | | 0.42 ± 0.22 | 0.27 ± 0.02 | 0.17 ± 0.02 | 0.20 ± 0.02 | 0.21 ± 0.01 | 0.22 ± 0.0 |
| G. wt. [Mean ± S.D.] (gm) | | 1091.16 ± 93.61 | 3122.79 ± 755.97 | 4574.85 ± 858.10 | 7623.37 ± 1784.45 | 17625.63 ± 2375.05 | 27560.19 ± 2757.75 |
| K (C) [Mean ± S.D.] | | 0.28 ± 0.15 | 0.21 ± 0.02 | 0.15 ± 0.01 | 0.13 ± 0.01 | 0.15 ± 0.01 | 0.16 ± 0.01 |
| H.S.I. [Mean ± S.D.] | | 20.79 ± 4.48 | 15.24 ± 3.80 | 20.42 ± 0.97 | 22.63 ± 1.81 | 24.40 ± 0.64 | 25.73 ± 2.32 |
| Males | Count [Sum = 30] | 4 | 4 | 8 | 8 | 4 | 2 |
| | % | 50 | 50 | 66.6 | 57.1 | 66.6 | 50 |
| Females | Count [Sum = 22] | 4 | 4 | 4 | 6 | 2 | 2 |
| | % | 50 | 50 | 33.4 | 42.9 | 33.4 | 50 |
| Sex ratio [M : F] = [1.90 : 1.00] | | 1.00 : 1.00 | 1.00 : 1.00 | 1.20 : 1.00 | 1.33 : 1.00 | 2.00 : 1.00 | 1.00 : 1.00 |
| G.S.I. males [Mean ± S.D.] | | 1.20 ± 0.29 | 1.35 ± 0.41 | 1.60 ± 0.41 | 2.32 ± 0.52 | 1.89 ± 1.10 | 4.31 ± 1.34 |
| G.S.I. females [Mean ± S.D.] | | 1.00 ± 0.42 | 0.90 ± 1.11 | 1.16 ± 0.27 | 1.13 ± 0.76 | 2.80 ± 1.18 | 4.82 ± 1.91 |
| Food items | Pelagic bony fishes | 39.6 | 65.0 | 62.5 | 34.0 | 30.4 | 60.0 |
| | Benthic bony fishes | 12.5 | 15.0 | 7.5 | 14.9 | 52.2 | 27.5 |
| | Cephalopods | 16.7 | 10.0 | 20.0 | 8.5 | 8.7 | |
| | Cartilaginous fishes | 14.6 | 10.0 | 10.0 | 12.8 | 8.7 | 12.5 |
| | Mollusca | 16.7 | - | - | 29.8 | - | - |

T. L. = Total length; T. wt. = Total weight; G. wt. = Gutted weight; H. S. I. = Hepato-Somatic Index; G. S. I. = Gonado-Somatic Index; S.D. = Standard deviation.

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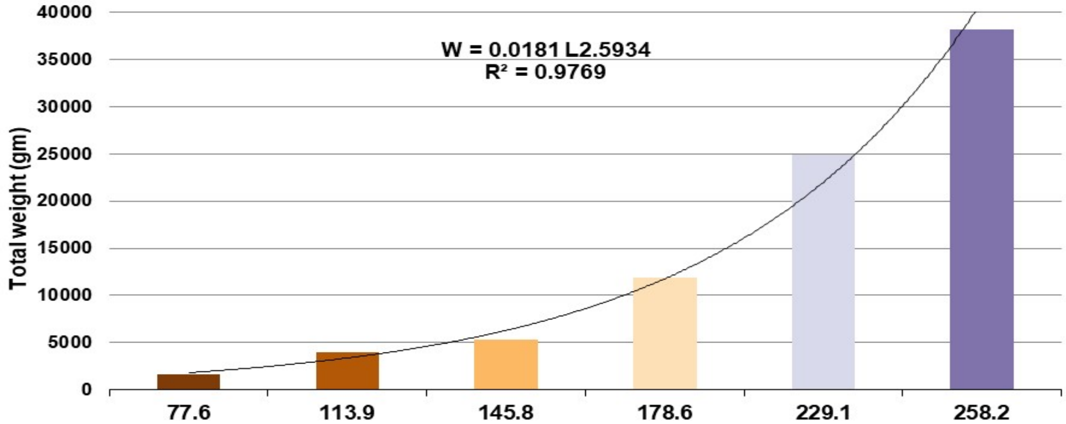


**Fig (2) Length-weight relationship in size groups of Spinner shark *Carcharhinus brevipinna* from Ras Lanuof, Libya, March to August 2019.**

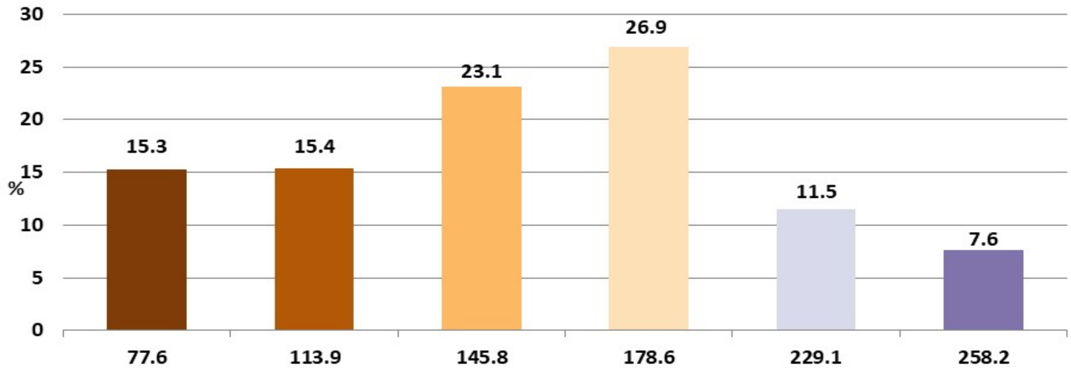


**Fig (3) Length frequency distribution per size groups of Spinner shark *Carcharhinus brevipinna* from Ras Lanuof, Libya, March to August 2019.**

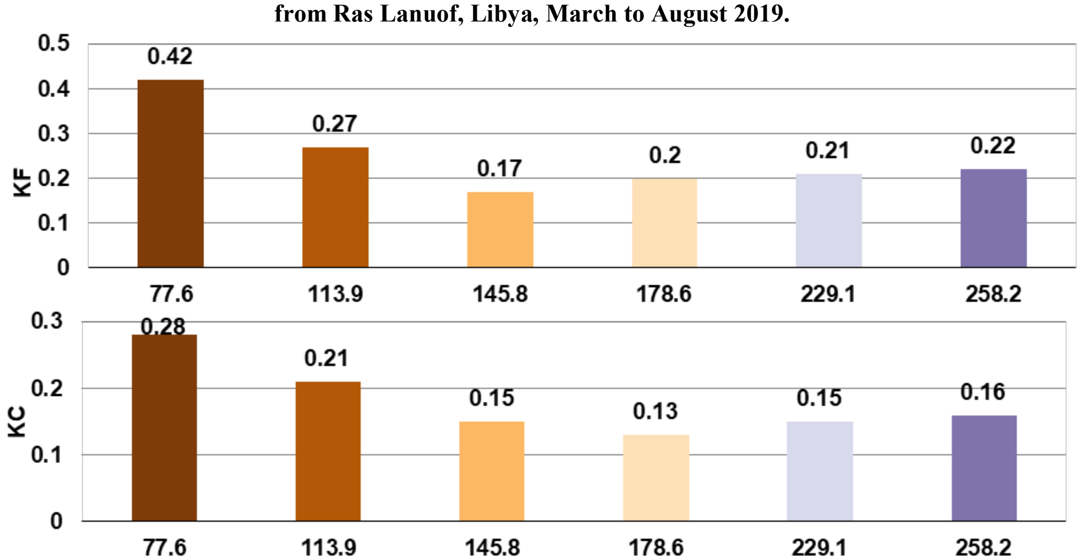


**Fig (4) Condition factors of Fulton (KF) [above], and Clark [below] in size groups of Spinner shark *Carcharhinus brevipinna*, Ras Lanuof, Libya, March to August 2019**.

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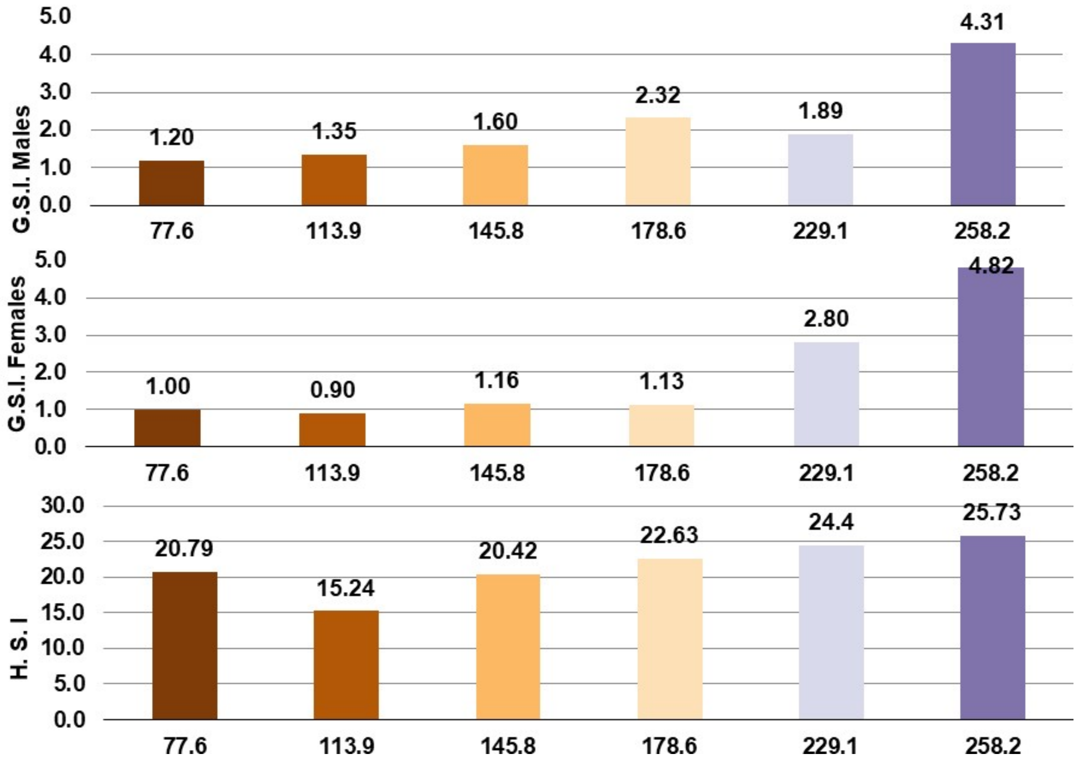


**Fig (5) Gonado-somatic indexes (G.S.I.) of males [above], and females [middle] andHepato-somatic index (H.S.I.) [below] in size groups of Spinner shark *Carcharhinus brevipinna*, Ras Lanuof, Libya, March to August 2019.**

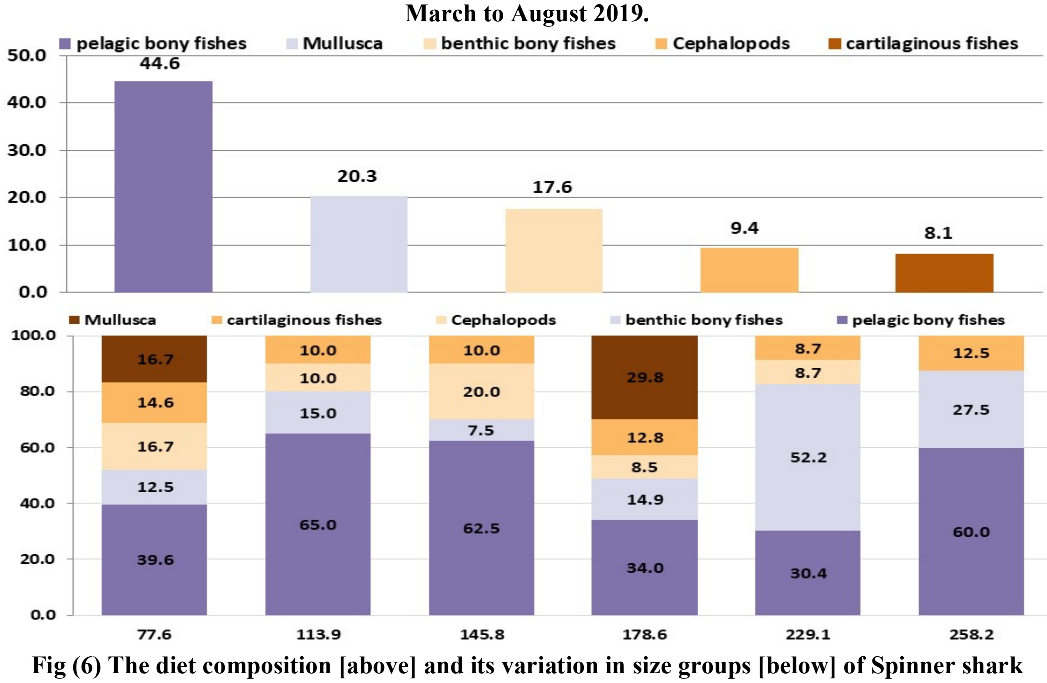


**Fig (6) The diet composition [above] and its variation in size groups [below] of Spinner shark *Carcharhinus brevipinna*, Ras Lanuof, Libya, March to August 2019.**

## References

Abdallah, A. (2007). Sharks and Rays of the Red Sea and the Gulf of Aden. FAO species Identification Cards. FAO, Rome. 110 pp.

Abu-Madinah, H.M. (2008). The Libyan harbours - A study in the Economic geography, The international house of books, Benghazi, Libya, 2nd ed., 368 pp.

Al-Jufaili S.M. 2013 Sex Ratio Variation of the Omani Indian Oil Sardine *Sardinella longiceps* (Valenciennes, 1847) Int. J. Mar. Sci., 3, 4-7.

Allen, B.R. & Cliff. G. (2000). Sharks caught in the protective gill nets off Kwazulu-Natal, South Africa. 9. The spinner shark *Carcharhinus brevipinna* (Mueller and Henle, 1839). South African Journal of Marine Science, 22, 199-215.

Ba, A.; Ba, C.T.; Diouf, K.; Ndiaye, P.I. & Panfili, J. (2013). Reproductive biology of the milk shark *Rhizoprionodon acutus* (Carcharhinidae) off the coast of Senegal. African Journal of Marine Science, 35(2), 223-232.

Bass, A.J.; D'Aubrey, J.D. and Kistnasamy, N. (1973). Sharks of the east coast of southern Africa. III. The genus *Carcharhinus* (Carcharhinidae). Oceanogr. Res, Inst. (Durban) Investigational Report N° 33, 168.

Beckman, W.C. (1948). The weight-length relationship factors of conversion between standard and total lengths and coefficient of condition for seven Michigan fishes. Trans. Amer. Fish. Soc.75, 237-256.

Ben-Abdalla, A.R.; Al-Gmati, H.; Kasim, A.A.; Al-Turkie, A.A. & Ben-Moussa, M.N. (2012). Guide to cartilaginous fishes in Libyan waters, Marine biology Research Center (MBRC) - Tajoura'a, Libya.

Betts, J., Young, R.P.; Hilton-Taylor, C.; Hoffmann, M.; Rodríguez, J.P.; Stuart, S.N. & Milner-Gulland, E.J. (2019). A framework for evaluating the impact of the IUCN Red List of threatened species. Biol. Conserv., 1-27.

Bradai M.N.; Saidi, B. & Enajjar S. (2012). Elasmobranchs of the Mediterranean and Black Sea: status, ecology and biology. Bibliographic analysis. Studies and Reviews. General Fisheries Commission for the Mediterranean. No. 91. FAO, Rome. 103.

Branstetter, S. (1981). Biological notes on the sharks of the North Central Gulf of Mexico. Contributions in Marine Science, 24, 13-34.

Branstetter S. (1982). Problems associated with the identification and separation of the spinner shark, *Carcharhinus brevipinna*, and the blacktip shark, *Carcharhinus limbatus*. Copeia, 461-465.

Branstetter S. (1987). Age and growth estimates for blacktip, *Carcharhinus limbatus*, and spinner, *Carcharhinus brevipinna*, sharks from the northwestern Gulf of Mexico. Copeia, 964-974.

Branstetter, S. & Stiles, R. (1987). Age and growth estimates of the bull shark, *Carcharhinus leucas*, from the northern Gulf of Mexico. Environ. Biol. Fish., 20, 169-181.

Buxton, C.D. (1989). [Protogynous hermaphroditism in *Chrsoblephuslaticeps*. (Curvier) and *C. cristiceps* (Curvier) (Teleosti; Sparidae)], S. Afr. J. zool., 24, 212-216.

Buzaid, E.M.K. and El-Mor, M.E.E. (2015). Feeding Habits of the Copper Shark, *Carcharhinus brachyurus* (Günther, 1870) from Ain El-Ghazala Lagoon, Eastern Libya during the Period from February till June 2013, Journal of Life Sciences, David Publishing, 9, 347-355.

Buzaid, E.M.K. (2017). Some morphological aspects of Tope shark *Galeorhinus galeus* in Susah, Libya, from June to December 2016, Journal of Global Scientific Research (JGSR), 2, 35-43.

Buzaid, E.M.K. (2018). Feeding Habits, Liver and Reproduction Study of Some Species of *Serranus* spp. in Benghazi Coasts in Winter 2018, Journal of Marine Sciences & Environmental Technologies, 4 (1), A 36 - A 52. [in Arabic].

Buzaid, E.M.K. (2019). Biometric study of Common Guitarfish *Rhiniobatus rhinobatus* in Dernah coast, Libya (June – December 2016), International Journal of Pharmacy & Life sciences (Int. J. of Pharm. Life Sci.), 10 (11-12), 6388-6396.

Buzaid, E.M.K.; Ali, S.M. and S.M. & Ali, S.M. (2020). Morphological aspects of Common Torpedo (*Torpedo torpedo*) in by-catch in Sidi Sha'ab Harbour, Tripoli, Libya, Central Asian Journal of Environmental Science and Technology Innovation (Cent. Asian J. Environ. Sci. Technol. Innov.), 2, 77-84.

Cadenat, J. and Blache, J. (1981). Requins de Méditerranée et d'Atlantique (plus particulièrement de la côte occidentale d'Afrique). Faune trop. ORSTOM, 21, 1-330.

Cailliet, G.M., Musick, J.A., Simpfendorfer, C.A., Stevens, J.D., (2005). Ecology and life history characteristics of chondrichthyan fish. In: Fowler, S.L., Cavanagh, R.D., Camhi, M., Burgess, G.H., Fordham, S.V., Simpfendorfer, C.A., Musick, J.A. (Eds.), Sharks, Rays and Chimaeras: The Status of the Chondrichthyan Fishes. IUCN, Gland, Switzerland, pp. 12–18.

Camhi, M.; Fowler, S.; Musick, J.; Bräutigam, A. and Fordham, S. (1998). The IUCN Species Survival Commission - Sharks and their Relatives, Ecology and Conservation, Occasional Paper of the IUCN Species Survival Commission No. 20. 63 pp.

Capapé, C. (1974). Observations sur la sexualité, la reproduction et la fécondité de 8 Sélaciens vivipares placentaires des côtes tunisiennes. Arch. Inst. Pasteur, Tunis, 51, 329-344.

Capapé, C. and J. Mellinger (1988). Nouvelles données sur la biologie de la reproduction du milandre, *Galeorhinus galeus* (Linné, 1778), (Pisces, Triakidae) des cotes tunisiennes. Cahiers Biologie Marine, 29, 135–146.

Capapé, C., F. Hemida, A.A. Seck, Y. Diatta, O. Guelorget and J. Zaouali. (2003). Distribution and reproductive biology of the spinner shark, *Carcharhinus brevipinna* (Mueller and Henle, 1841) (Chondrichthyes: Carcharhinidae). Israel Journal of Zoology, 49, 269-286.

Capapé, C.; Diatta, Y.; Diop, M.; Guélorget, O.; Vergne, Y. & Quignard J.P. (2006). Reproduction in the milk shark, *Rhizoprionodon acutus* (Rüppel, 1837) (Chondrichthyes: Carcharhinidae) from the coast of Senegal (eastern tropical Atlantic). Acta Adriática, 47, 111–126.

Capapé, C. & Reynaud, C. (2011). Maturity, reproductive cycle and fecundity of the spiny dogfish *Squalus acanthias* (Chondrichthyes: Squalidae) off the Languedocian coast (southern France, northern Mediterranean). Journal of the Marine Biological Association of the United Kingdom.

Casselman, J. M. (1990). Growth and relative size of calcified structures of fish. T. Am. Fish. Soc., 119(4), 673-688.

Cavanagh, R.D. & Gibson, C. (2007). Overview of the Conservation Status of Cartilaginous Fishes (Chondrichthyans) in the Mediterranean Sea. IUCN, Gland, Switzerland and Ma´laga.

Clark, F.N. (1928). The weight length relationship of the California Sardine (*Sardinacoerulea*) at San-Pedro, Fish. Bull., 12, 34-39.

Clark, E.K. & von Schmidt. (1965). Sharks of central Gulf Coast of Florida. Bull. Mar. Sci., 15, 13-83.

Compagno, L.J.V. (1984). FAO species catalogue. Vol. 4. Sharks of the world. An annotated and illustrated catalogue of shark species known to date. Part 2. Carcharhiniformes. FAO Fish. Synop. (125), 4(2), 251-655.

Compagno, L.J.V. (1990). Alternative life history styles of cartilaginous fishes in the time and space. Environ. Biol. Fishes 28, 33–75.

Cortes, E. (2000). Life history patterns and correlations in sharks. Rev. Fish. Sci. 8, 299–344.

Cugini, G. and De Maddalena, A. (2003). Sharks captured off Pescara (Italy, western Adriatic Sea). Annales Series historia naturalis, 13, 201-208.

Davidson, B., & Cliff, G. (2002). The liver lipid fatty acid profiles of seven Indian Ocean shark species. Fish Physiology and Biochemistry, 26(2), 171-175.

De Vlaming, V.L.; Grossman, G. & Chapman, F. (1981). On the use of gonadosomatic index, Comparative Biochemistry and Physiology, 73A, 31-39.

Deriso, R.B.; Quinn II, T.J. & Neal, P.R. (1985). Catch-age analysis with auxiliary information. Can. J. Fish. Aquat. Sci., 42, 815-824.

Dulvy, N.K. & Reynolds, J.D. (2002). Predicting extinction vulnerability in skates. Conserv. Biol. 16, 440–450.

Effendie, M. I. (2002). Biologi Perikanan (Fisheries Biology). Yogyakarta, Indonesia: Yayasan Pustaka Nusatama.

Elst, Van der R.P. (1979). A proliferation of small sharks in the shore based Natal sport fishery. Environmental Biology of Fishes, 4, 349-362.

ISSN 2708-8588

Fahmi L. & Sumadhiharga, K. (2007). Size, sex and length at maturity of four common sharks caught from western Indonesia, Mar. Res. Indonesia, 32(1), 7-19.

FAO, (2006). Fisheries Department, Fishery information data and statistics unit. Version 2-3. Food Agriculture Organization, Rome, Italy.

FAO, (2018). Species Photographic Plates. Mediterranean Sharks, by Monica Barone, Fabrizio Serena and Mark Dimech. Rome, Italy.

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

Fulton, F. (1902). Rate of growth of Sea fishes, Scient. Invest. Fish Div., scot. Rep., 20, 123-145.

Galván-Magaña, F.; Castillo-Geniz, J.L.; Hoyos-Padilla, M.; Ketchum, J.; Klimley, A.P.; Ramírez-Amaro, S.; Torres-Rojasg, Y.E. & Tovar-Ávila, J. (2019). Shark ecology, the role of the apex predator and current conservation status. Advances in marine biology, 83, 61-114.

Garrick, J.A.F. (1982). Sharks ofthe genus *Carcharhinus*. NOAA Tech. Rep., NMFS Circular N° 34.

Godfriaux, B.L. (1969). Food of Predatory Demersal Fish in Hauraki Gulf. Food and Feeding Habits of Snapper, *Shrysophyrs auratus*. N. Z. Mar. Fresh w. Res., 25, 281-92.

Golani, D. (1996). The Marine Ichthyofauna of the Eastern Levant—History, Inventory and Characterization. Israel Journal of Zoology, 42, 15-55.

Golani, D. & Pisanty, S. (2000). Biological Aspects of the Gulper Shark, *Centrophorus granulosus* (Bloch and Schneider, 1801), from the Mediterranean Coast of Israel. Acta Adriatica, 41, 71-8.

Golani, D.; Orsi-Relini, L.; Massutí, E. & Quignard, J.P. (2002). CIESM Atlas of Exotic Species in the Mediterranean: Fishes. CIESM (Monaco).

Golani, D. Öztürk, B. and Basusta B. (2006). Fishes of the Eastern Mediterranean, Turkish Marine Research Foundation.

Hile, R. (1936). Age and growth of the ciscoe, *Leveichthyes artedi* (lesueur), in the lakes of the northern high lands, Wiscosin. Bull.Mar. fish, U.S., 48(19), 211-317.

Htum-Han, M. (1978). The reproductive biology of the dab, *Limandd Limande* (L.) in the North Sea: gonado somatic index, hepato somatic index and condition factor. J. fish. Biol., 13, 369-378.

Hyslop, E.J. (1980). Stomach Content Analysis. Review of Methods and Their Application. J. Fish. Biol., 17, 411-429.

Iglésias, S.P. (2013). Chondrichthyans from the North-eastern Atlantic and the Mediterranean - A natural classification based on collection specimens - plates & text, V. 2. (In French).

Joung, S.J., & Chen, C.T. (1995). Reproduction in the Sandbar Shark, *Carcharhinus plumbeus*, in the Waters off Northeastern Taiwan. Copeia, 3, 659-665.

Joung, S.J.; Liao, Y.Y.; Liu, K.M.; Chen, C.T. & Leu, L.C. (2005). Age, growth, and reproduction of the spinner shark, *Carcharhinus brevipinna*, in the northeastern waters of Taiwan. Zoological Studies, 44(1), 102-110.

Katsukawa, T.; Lee, Y. & Matsumiya, Y. (1999). Spawning per recruit analysis for female snow crab *Chionoecetes opilio* in the sea off Kyoto Prefecture. Nippon Suisan Gakk, 65, 288-293.

Khan, M.A.; Khan, S. & Miyan, K. (2012). Studies on Length-weight and Length-length Relationships of Four Freshwater Fishes Collected from River Ganga. Journal of Fisheries and Aquatic Science, 7, 481-484.

Lamboeuf, M.; Abdallah, A.B.; Coppola, R.; Germoni, A. & Spinelli, M. (2000). Artisanal Fisheries in Libya: Census of Fishing Vessels and Inventory of Artisanal Fishery Métiers.FAO-COPEMED-MBRC, 42.

MBRC, (2005). Atlas of the Mediterranean Sea, Marine Biology Research Center (MBRC), Tajura'a, Tripoli, Libya.

Menn, F.L.; Cerda, J. & Babin, P.J. (2007). Ultrastructure Aspects of The Ontogeny and Differentiation of Ray Finned Fish Ovarian Follicles. (IN): Babin, P.J.; J. Cerda; E. Lubzens (Eds.). The Fish Oocyte: From Basic Studies to Biotechnological Applications. Springer. New York, 1-37.

Motivarash-Yagnesh, B.; Fofandi-Durga, C.; Dabhi-Raj, M.; Makrani-Rehanavaz, A. & Tanna-Poojaben, D. (2020). Importance of sharks in ocean ecosystem, Journal of Entomology and Zoology Studies, 8(1), 611-613.

Motta, F.S., Caltabellotta, F.P., Namora, R.C., & Gadig, O.B.F. (2013). Length-weight relationships of sharks caught by artisanal fisheries from southeastern Brazil. Journal of Applied Ichthyology, 30(1), 239-240.

Musick, J.A. & Bonfil, R. (2005). Management techniques for elasmobranch fisheries, FAO Fisheries Technical Paper. No. 474. Rome, FAO, 251.

Muslih, M.A.; Syakti, A.D.; Hidayati N.; Riyanti, V. & Yuneni, R.R. (2016). Several parameters of the population of hammerhead shark (*Sphyrna lewini*) in the waters of the Java and Borneo. Prosiding Simposium Hiu Dan Pari di Indonesia.

Niklosky, G.V. (1963). The Ecology of Fishes, (translated from Russian, L. Brikett), Academic Press London, New York.

Osman, A.G.; Akel, E.S.H.; Farrag, M. & Moustafa, M.A. (2011). Reproductive biology of round herring *Etrumeus teres* (Dekay, 1842) from the Egyptian Mediterranean water at Alexandria. International Scholarly Research Notices.

Pauly D. (1983). Algunos métodos simple’s para la evaluación de recursos pesqueros tropicales. FAO Doc. Tec. Pesca, No. 234.

Pillay, T.V.R. (1952). Acritique of the Methods of Study of Food of Fishes. J. Zool. Soc. India, 4, 181-99.

Pratt, H.L.JR. (1979). Reproduction in the blue shark, *Prionace glauca*. Fish. Bull. NOAA Tech. NMFS, 77, 445-470.

Quinn II, T.J; Fagen, R. & Zheng, J. (1990). Threshold management policies for exploited populations. Can. J. Fish. Aquat. Sci. 47, 2016-2029.

Rapi, N.L.; Mallawa, A.; Tresnati, J. and Amir, F. 2020. Growth pattern, condition factor and sex ratio of Grey Reef Shark *Carcharhinus* amblyrhynchos (Bleeker,1856) in Makassar Strait, IOP Conf. Series: Earth and Environmental Science, 564.

Reis, M., & Figueira, W.F. (2021). Age, growth and reproductive biology of two endemic demersal bycatch elasmobranchs: Trygonorrhina fasciata and *Dentiraja australis* (Chondrichthyes: Rhinopristiformes, Rajiformes) from Eastern Australia. Zoologia (Curitiba), 37.

Reynolds, J.E.; Abukhader, A. Ben Abdallah, A. (1995). The marine wealth sector of Libya: a development planning overview, Food and Agriculture Organization (FAO), Division of Fishery and Aquaculture Economics and Policy Division, Tripoli/Rome.

Roo, F.J.; Scorro, M.S.; Izquierdo, M.J.; Caballero, C.M.; Hernandez-Cruz, F. and Palaccios, H.F. (1999). Development of red porgy *Pagrus pagrus* visual system in the digestive tranct and larval feeding habits. Aquaculture, 179, 499-512.

Sadekarpawar, S. & Parikh, P. (2013). Gonadosomatic and Hepatosomatic indices of freshwater fish world. Journal of Zoology, 8(1), 110-118.

Sadowsky, V. (1967). Selachier aus dem litoral von Sao Paulo, Brasilien. Beit. Noetrop. Fauna, 5, 71-88.

Sentosa, A.A.; Fahmi, F. & Chodrijah, U. (2018). Growth Pattern and Condition Factor of Spinner Shark *Carcharhinus brevipinna* in Southern Nusa Tenggara Waters, Oseanologi dan Limnologi di Indonesia, 3(3), 209-218.

Serena, F. (2005) Field identification guide to the sharks and rays of the Mediterranean and Black Sea. FAO Species Identification Guide for Fishery Purposes. FAO, Rome, Italy.

Shinkafi, B.A., & Ipinjolu, J.K. (2012). Gonadosomatic index, fecundity and egg size of *Auchenoglanis occidentalis* (Cuvier and Valenciennes) in river Rima, North-western Nigeria. Nigerian Journal of Basic and Applied Sciences, 20(3), 217-224.

Stevens, J.D. (1984). Biological observations on sharks caught by sport fishermen off New South Wales. Australian Journal of Marine and Freshwater Research 35, 573-590.

Stevens, J.D.; Wiley, P.D., 1986: Biology of two commercially important Carcharhinidae sharks from northern Australia. Aust. J. Mar. Fresh. Res., 37, 671-688.

Stevens, J.D. & McLoughlin, K.J. (1991). Distribution, size and sex composition, reproductive biology and diet of sharks from northern Australia. Australian Journal of Marine and Freshwater Research, 42, 151-199.

Stevens, J.D.; West, G.J. and McLoughglin, K.J. (2000 A). Movements, recapture patterns and factors affecting the return rate of carcharhinid and other sharks tagged off northern Australia. Marine and Freshwater Research, 50,127-141.

Stevens, J.D.; Bonfil, R.; Dulvy, N. K. and Walker, P. A. (2000 B). The effects of fishing on sharks, rays and chimaeras (chondrichthyans), and the implications for marine ecosystem. ICES Journal of Marine Science, 57, 476-494.

Sumpton, W.; Lane, B. & Ham, T. (2010). Characteristics of the Biology and Distribution of the Spinner Shark (*Carcharhinus brevipinna)* in Queensland, Australia Based on Data Collected from the Shark Control Program, Asian Fisheries Science 23(3), 340-354.

Tagliafico, A.; Rago, N. & Rangel, M.S. (2014). Length-Weight Relationships of 21 species of Elasmobranchii from Margarita Island, Venezuela Journal of Research in Biology, 4(7), 1458-1464.

Tanaka, S.; Shiobara, Y.; Hioki, S.; Abe, H.; Nishi, G.; Yano, K. & Suzuki, K. (1990). The reproductive biology of the frilled shark, *Chlamydoselachus anguineus*, from Suruga Bay, Japan. Jap. J. Ichthyol., 37, 273-291.

Tesch, F.W. (1971). Age and Growth. In: Methods for Assessment of Fish Production in Fresh Waters. Ricker. W.E. (Ed.). Blackwell Scientific Publications, Oxford, UK, 98-103.

Tortonese, E. (1939). Appunti di ittiologia libica: Pesci di Tripoli. Ann. Mus. Libico Stor. Nat., 1, 359-379.

Uka, A., & Sikoki, F. D. (2012). Influence of indices of reproduction on condition factor and some morphometric features of *Tilapia guineensis*, 370-373.

Wang, T.H.S.; Wang, G.W.; Sun, D. & Huang, J.H. (2012). Length–weight and length–length relationships for some Yangtze River fishes in Tian-e-zhou Oxbow, China. *J. Appl. Ichthyol.*, 28(4), 660-662.

Wourms, J. P. (1977). Reproduction and development in chondrichthyan fishes. Am. Zool., 21,473-515.

Yigin, C.C., & Ismen, A. (2013). Reproductive biology of spiny dogfish *Squalus acanthias*, in the North Aegean Sea. Turkish Journal of Fisheries and Aquatic Sciences, 13(1), 169-177.

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# مصائد وبيولوجية كلب بحر بوريشة *Carcharhinus brevipinna* في ساحل راس لانوف ليبيا – ربيع وصيف 2019

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## الملخص

في الفترة بين مارس وأغسطس لسنة 2019 ، تم جمع حوالي 52 عينة من كلاب البحر بوريشة *Carcharhinus brevipinna* من شواطئ راس لانوف في ليبيا ، بأطوال بين 60.3 – 270.3 سم ، وأوزان (1551.11 – 39510.22 جم) ، لدراسة حالتهم البيولوجية : من ناحية علاقة الطول والوزن كانت النمو منتظم isometric (B = 2.5934) . وقد انخفضت قيم عوامل الحالة (Kf و Kc) بزيادة الحجم ، من 0.42 و 0.28 في حجم 77.6 سم ، إلى Kf = 0.17 في 145.8 سم و Kc = 0.13 في 178.6 سم . كما بلغ حضور المجموعة الحجمية الوسطى (178.6 سم) ذروته بمعدل ربع المجموعة (26.9٪) ، بينما سجلت المجموعة الأكبر نسبة 7.6٪ كأقل حضور . بدأت قيم المعامل الكبدي H.S.I. بنسبة 20.8٪ ، مع انخفاض في احدى المجموعات الطولية الوسطى (15.2٪) لترتفع إلى 25.7٪ في أكبر العينات. أيضاً ، أشارت معدلات المعامل المنسلي للذكور والإناث ارتفاعاً تدريجياً من 1.20 و 1.00 في الأحجام الصغيرة حتى 4.31 و 4.82 على التوالي . وكانت نسبة الذكور إلى الإناث 1.33 :1.00 على التوالي . كما تضمنت القائمة الغذائية لبطون هذه الاسماك الأسماك العظمية السطحية (44.6٪) تلتها الرخويات بنسبة 20.3٪ ، أما الأسماك القاعية العظمية ورأسيات الأرجل وصغار الأسماك الغضروفية فقد تواجدت بنسب 17.6 و 9.4 و 8.1٪ على التوالي . وقد بلغت الأسماك العظمية السطحية ذروتها في 113.9 سم ما نسبته 65.0٪ وانخفضت حتى 30.4٪ في 229.1 سم ، بينما سجلت الأسماك القاعية والغضروفية في أصغر مجموعة طولية (77.6 سم) ما نسبته 52.2 و 14.6٪ على التوالي ، مع 16.7٪ من الرخويات ، تقابله اعلى نسبة رخويات حتى 29.8٪ في مجموعة طولية 178.6 سم ، وبلغت اعلى نسبة لرأسيات الأرجل 20.0٪ في 145.8 سم . هذه الدراسة مفيدة لدراسات ديناميكية العشائر السمكية من هذا النوع وغيره في الساحل الليبي ، لإدارة تقييم المخزون السمكي وحماية الصغار منها في السواحل والمرابي من الصيد الجائر.

**الكلمات المفتاحية:** كلب بحر بوريشة – علاقة الطول بالوزن – معاملات الحالة – دليل المعامل الكبدي والجنسي – راس لانوف، ليبيا.