Aquatic resources play an important role in the economic, social, nutritional and aesthetic development of a nation. The uses of these resources, especially fish, for human consumption has increased over the years as a result of the continuous increase in human population. More than half of the world’s population depends on fish as their main source of animal protein (FAO, 2010). It is a valuable and nutritious food and an essential source of high quality and cheap animal protein crucial to the diets of man (United Nations, 2004). However, despite the social, economic, nutritional and ecological significance of fish, the state of stocks worldwide is declining at an alarming rate due to a combination of environmental degradation as a result of human activities and poor management of fisheries resources (Jamu and Ayinla, 2003; Akpaniteaku et al., 2005).

According to Clark (2006), the non-implementation of the required management policies has led to over-exploitation and eventual collapse of most aquatic ecosystems. A collapse of an aquatic ecosystem can cause several alterations and also contribute a negative effect to the economy of a nation (Dudgeon et al., 2006). This ecosystem collapse might inexorably lead to increased poverty...
and lack of opportunities for fisher folk to make a decent livelihood. This calls for an ecological assessment of aquatic resources in order to understand the relationship between different aquatic organisms (Karr et al., 2006), and how the population of one affects the others.

*Trichiurus lepturus*, popularly known as “Ribbonfish” but locally called “Doje”, represents an important species of food fish in the coastal communities in Nigeria (Odulate, 2010). This species is confined to a shallow depth zone below 70 m (Ghosh et al., 2014). Females of *T. lepturus* spawn more than once in a reproductive season. The females are more abundant, especially among older cohorts (Al-Nahdi et al., 2009). They are apex predators, which feed actively on fishes, crustaceans and cephalopods (Ojelade et al., 2016).

Hence, trophodynamic interactions (predation and competition), stock structure and reproductive biology of *T. lepturus* will give insight into the composition, distribution, spawning season and food habits of the species before applying appropriate management measures.

At the present time, there is no available information on reproductive biology, food items and feeding habits, nor the stock structure of *T. lepturus* from Ogun marine waters, which represents an important and unique commercial fishing community on the Bight of Benin. This area is also the only zone where coastal marine species can be caught in Ogun State, Nigeria. Hence, the objective of this study was to determine some aspects of the reproductive biology, trophodynamics and stock structure of ribbonfish (*Trichiurus lepturus*) in tropical marine waters of the Bight of Benin.

**MATERIALS AND METHODS**

*Description of the study area*

The geographical location chosen for this study is the coastal marine waters of Ogun State, Nigeria. It covers an area of about 6,032 km² with a 15-km (Olopade, 2001) coastline off Nigeria along the Bight of Benin (Figure 1). The study area is bounded to the west by Ijebu-East Local Government Area and Lekki Lagoon, to the north and east by Ondo State and to the south by Lagos State and the Bight of Benin. It is predominantly a rural settlement and the indigenes are mainly the southwestern habitants of Nigeria (Odulate et al., 2012). The area comprises over 50 towns and villages and the Headquarters is at Abigi, at 6°29’N 4°24’E/6.483°N 4.4°E with a population of 72,935 (NPC, 2006). Ogun coastal area is situated in the rainforest belt of Nigeria with an annual rainfall of 125-150 cm as reported by Oluwalana (1997). It is characterised by two distinct seasons. The rainy season lasts for eight months (March-October) while the dry season lasts for four months, between November and February. The relative humidity is high year-round, usually above 80% during the wet season and ranges between 60% and 80% during the dry season (Ayansanwo, 2003).

*Catch assessment survey*

The study was carried out between February 2015 and January 2017. The data were pooled as annual data by estimating their means. Each site was visited monthly for data collection. A graded monofilament gillnet of varying mesh sizes (18, 22, 26, 30, 40, 45, 50, 65, 70, 75, 80 and 90 mm, knot-to-knot) was used to acquire the fish population sample. Three fishing nets were set at a distance of 300 m from the shore in late afternoon (6 PM and 8 PM) and retrieved the following morning (6:00 AM and 8:00 AM). Specimens of *T. lepturus* were sorted out and subjected to further analysis.

*Reproductive biology of collected fish specimens*

Sex identification of the specimens was determined by dissecting to reveal the genitals as described by Ama-Abasi (2002); the sex ratios of the sampled fish species were recorded on a monthly basis.

*Gonadosomastic Index*

Gonadosomatic index (GSI) of the dissected fish specimens was determined by morphometric analysis using the method of Afonso-Dias et al. (2005), and was expressed as a percentage of gonad
weight (GW) to total body weight (BW) of the specimen, by the following equation:

\[ GSI = \left( \frac{GW}{BW} \right) \times 100 \]

**Fecundity**

The sub-sample method was applied to estimate the fecundity of females of *T. lepturus*. Female specimens were dissected and both ovaries were removed and weighed to the nearest 0.01 g using a Hannna sensitive scale (Model 1106). Three different sections were sampled from the weighed ovaries; 1 g of tissue was taken from the anterior, middle and posterior regions of the ovary, respectively, and examined to determine the average number of eggs per 1 g of ovary after Yelden and Avsar (2000) and Ama-Abasi (2002). Mean of the obtained result was multiplied by the total weight of the gonads to get the absolute fecundity for each fish.

The **Relative Fecundity (RF)** was determined to express the relationship between the fecundity of each fish specimen in relation to its body weight. This was calculated using the following formula as described by Bagenal (1978):

\[ RF = \frac{F}{BW} \]

---

Figure 1. Map of the study area.
\[ RF = \frac{\text{Fecundity}}{\text{Total Weight}} \times 100 \]

Proportion of ripe gravid females of *T. lepturus* (which was determined by applying slight pressure to the abdomen to reveal presence of eggs) and the estimation of oocyte developmental stages were used to determine the spawning season of the population.

**Food and feeding habits of Trichiurus lepturus**

Stomachs of all fish specimens without an empty stomach were ventrally dissected to reveal the gut contents, which was preserved by immersing in 4% formaldehyde. The contents of each of the dissected specimens was poured into a Petri dish. The preserved gut contents of *T. lepturus* were analysed using frequency of occurrence, numerical and volumetric methods as described by Hyslop and Ugwumba (Hyslop, 1980; Ugwumba and Ugwumba, 2007).

The feeding intensity of the specimens was assessed based on the volume of food contained in the stomach, and classified as full, \( \frac{3}{4} \) full, \( \frac{1}{2} \) full, \( \frac{1}{4} \) full, or empty stomach. Relative importance of various food components in the stomach was calculated by the index of relative importance (IRI) as described in Nunoo *et al.* (2013). This was estimated by incorporating the frequency of occurrence, number, and volume of each food item for effective grading of the individual items. The IRI was computed as given below:

\[ \text{IRI} = (\%N + \%V) \times \%F \]

where \( N \) = number, \( V \) = volume and \( F \) = frequency of occurrence of prey items in the sampled *T. lepturus*.

The % IRI was estimated according to the methods described in Paul *et al.* (2018), as:

\[ \%\text{IRI} = \frac{\text{IRI}}{\Sigma \text{IRI}} \times 100 \]

The samples used for stomach analysis were further categorized into three sizes (\( S1 = \leq 42.9 \) cm, \( S2 = 43.0-52.9 \) cm and \( S3 = \geq 53.0 \) cm) as juvenile, post-juvenile and adult using their total length (TL).

**Morphometric data for population parameters**

Morphometric parameters such as total length (TL, distance from the snout with the mouth closed to tip of the caudal fin) and standard length (SL, distance from the snout to the caudal peduncle) were measured with a measuring board to the nearest 0.1 cm for each of the specimens, while the ungutted body weight (BW) was measured with a Mettler weighing balance (Model 1106) to the nearest 0.01 g.

To study population structure, size frequency was analyzed at a class interval of 2 cm using a histogram to determine the distribution that characterized the fish population.

**Length-weight relationship (LWR) of the selected fish species**

The length-weight relationship (LWR) of the selected fish species was calculated using the equation: \( W = a L^b \); where \( a \) is the intercept and \( b \) is the allometry coefficient, while \( W \) (g) and \( L \) (cm SL) represent the weight and length of the fish specimens. Parameters \( a \) and \( b \) were determined via least–squares linear regression (Zar, 1999). In order to check if the value of \( b \) was significantly different from 3, the method as described by Sparre and Venema (1992) was used. The value of \( b \) gives information on the growth pattern of fish: growth is isometric if \( b = 3 \), and the growth is allometric if \( b \neq 3 \) (negatively allometric if \( b < 3 \) and positively allometric if \( b > 3 \)).

The condition factor, which represents the state of the general well-being of the fish sampled was analysed in relation to size, and this was estimated using Fulton’s equation (Le Cren, 1951):

\[ K = 100 \frac{W}{L^3} \]

To estimate growth and mortality parameters, the obtained LW results were subjected to length-frequency analysis in FiSAT II (Version 2.2) to obtain the parameters for the Von Bertalanffy (1938) equation:

\[ L_t = L_\infty \left[ – \exp \left( – K (t-t_0) \right) \right] \]
The estimates of $L_\infty$ and $K$ were used to compute the growth performance index $\phi'$ (in terms of length) of the species (Munro and Pauly, 1983; Pauly and Munro, 1984) by the following equation:

$$\phi' = \log_{10}(K) + 2\log_{10}(L_\infty).$$

The fitting of the best growth curve was based on ELEFAN I (Pauly and David, 1981), which allows the fitted curve through the maximum number of peaks of the length–frequency distribution as described by Abdul et al. (2015). The annual instantaneous rate of total mortality, $Z$, was estimated by linearized length-converted catch curves. Instantaneous natural mortality rates, $M$, were computed using the empirical equation described in Pauly (1980), and a mean annual surface temperature ($T$) of 28.6 ºC, as described below:

$$\log_{10}(M) = -0.0066 - 0.279 \log_{10}(L_\infty) + 0.6543 \log_{10}(K) = 0.463 \log_{10}(T).$$

The instantaneous fishing mortality rate, $F$, was calculated as $Z - M$ (Sparre and Venema, 1992). The exploitation rate ($E$) was $E = F/Z$.

### Statistical analysis

The overall sex ratio was tested against 1:1 using chi-square test.

### RESULTS

#### Sex ratio

Females (n=921) dominated the specimens with an overall sex ratio of 1:1.33 male: female. The sex ratio of the sampled *T. lepturus* varied across the sampling months though, and the obtained mean value was significantly different from 1:1 ($x^2=32.144; p=0.0007$) (Table 1).

#### Spawning season

Gravid females were recorded in all months, with peaks in December-February and June to August (Figure 2). Gonadosomatic Index (GSI) analysis indicated that the gonads of both sexes were available year-round and the spawning season of *T. lepturus* in the study area is not confined to a specific period of the year. GSI varied within

<table>
<thead>
<tr>
<th>Months</th>
<th>Male</th>
<th>Female</th>
<th>Male: Female Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>February</td>
<td>51</td>
<td>104</td>
<td>0.3:1</td>
</tr>
<tr>
<td>March</td>
<td>80</td>
<td>73</td>
<td>1:0.5</td>
</tr>
<tr>
<td>April</td>
<td>55</td>
<td>93</td>
<td>0.4:1</td>
</tr>
<tr>
<td>May</td>
<td>56</td>
<td>86</td>
<td>0.4:1</td>
</tr>
<tr>
<td>June</td>
<td>67</td>
<td>91</td>
<td>0.4:1</td>
</tr>
<tr>
<td>July</td>
<td>71</td>
<td>97</td>
<td>0.4:1</td>
</tr>
<tr>
<td>August</td>
<td>65</td>
<td>62</td>
<td>1:0.5</td>
</tr>
<tr>
<td>September</td>
<td>47</td>
<td>53</td>
<td>0.4:1</td>
</tr>
<tr>
<td>October</td>
<td>48</td>
<td>64</td>
<td>0.6:1</td>
</tr>
<tr>
<td>November</td>
<td>75</td>
<td>59</td>
<td>1:0.7</td>
</tr>
<tr>
<td>December</td>
<td>43</td>
<td>81</td>
<td>0.5:1</td>
</tr>
<tr>
<td>January</td>
<td>37</td>
<td>58</td>
<td>0.4:1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>695</strong></td>
<td><strong>921</strong></td>
<td><strong>0.4:1</strong></td>
</tr>
</tbody>
</table>

($x^2=32.144; p=0.0007$)
the months of study, with the highest recorded values in July (2.72±0.75%) and December (2.51±0.63%), while the smallest value (0.91±0.23%) was recorded in March, as presented in Figure 3.

**Fecundity**

Absolute fecundity of *T. lepturus* (Table 2) varied with individual fish. The fish with the highest fecundity of 12,456 eggs was collected in June with a total length of 60.6 cm, while the fish with the lowest fecundity was collected in November, with a fecundity of 7,051±482 eggs and a TL of 37.9 cm. Relative fecundity ranged between 1,841±83 and 2,106±192 eggs g⁻¹.

**Food and feeding habits of Trichiurus lepturus**

The food items in the stomachs of *T. lepturus* were made up of finfishes of various sizes as well as shellfish (Figure 4). Juvenile ribbonfish dominated the finfishes in the gut contents, with an IRI value of 42.6%, while Penaeids occurred most frequently in the shrimp group, with an IRI value of 17.3%, as depicted in Figure 5.

**Feeding intensity and relative importance**

Analysis of food items in relation to body size, as presented in Table 3, depicted that over 40% of the juveniles and post juveniles fed mostly

### Table 2. Total length (TL) and some reproductive parameters (RP) of *T. lepturus* sampled from Ogun coastal waters.

<table>
<thead>
<tr>
<th>TL/RP</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total length (cm)</td>
<td></td>
<td></td>
<td>62.71±0.52</td>
</tr>
<tr>
<td>Gonad weight (g)</td>
<td>Minimum</td>
<td>Maximum</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>10.4</td>
<td>17.51</td>
<td>13.36±0.34</td>
</tr>
<tr>
<td>Fecundity (eggs)</td>
<td>Minimum</td>
<td>Maximum</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>7,051</td>
<td>12,456</td>
<td>11,156±997</td>
</tr>
<tr>
<td>Relative fecundity (eggs)</td>
<td>Minimum</td>
<td>Maximum</td>
<td>Mean</td>
</tr>
<tr>
<td></td>
<td>1841±83</td>
<td>2,106±192</td>
<td>1985±253</td>
</tr>
</tbody>
</table>

### Table 3. Dietary items of *T. lepturus* at different body sizes.

<table>
<thead>
<tr>
<th>Food item</th>
<th>≤42.9 cm</th>
<th>43.0-52.9 cm</th>
<th>≥53.0 cm</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
</tr>
<tr>
<td>Finfish</td>
<td>295</td>
<td>36.41</td>
<td>468</td>
</tr>
<tr>
<td>Shellfish</td>
<td>329</td>
<td>40.67</td>
<td>493</td>
</tr>
<tr>
<td>Undigested Food Materials</td>
<td>187</td>
<td>23.0</td>
<td>65</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>811</strong></td>
<td><strong>100</strong></td>
<td><strong>1026</strong></td>
</tr>
</tbody>
</table>
Figure 2. Month-wise percentage occurrence (mean±SD) of mature females of *T. lepturus* in Ogun marine waters.

Figure 3. Gonadosomatic index (mean±SD) of females of *T. lepturus* sampled along the Ogun coastline.

Figure 4. Percentage occurrence of food items in gut contents of *T. lepturus* sampled along the Ogun coastline.
on shrimps, while most (82.5%) of the adults preferred finfishes. Month-wise intensity of feeding was found to vary throughout the sampling period, with the highest proportion of fish possessing empty stomachs in July, December and January (Figure 6).

Length-distribution of Trichiurus lepturus

A total of 1,616 *T. lepturus* individuals with length range of 33.4-67.9 cm TL were used for the length-weight relationship analysis. Length frequency distribution of this population for the 24-month sampling period is shown in Figure 7. A bimodal distribution was observed with modal classes of 35.0-36.9 and 45.0-46.9 cm.

Estimates of length-weight relationships (LWR) showed that a strong positive correlation existed between the weight and total length ($r^2=0.946$) of the *T. lepturus* population in Ogun marine waters. The b-value was 3.08, which was not significantly (p>0.05) different from 3, with a corresponding a-value of 0.0101 as shown in Table 4. This result showed that this species increased in weight with a corresponding increase in length. The length frequency distribution with the superimposed growth curve for the sampling months is presented for *T. lepturus* in Figure 8.

Table 4. Length-weight relationship, mortality and population parameters of *T. lepturus* in Ogun marine waters.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>1,616</td>
</tr>
<tr>
<td>Intercept, a</td>
<td>0.0101</td>
</tr>
<tr>
<td>Allometry co-efficient, b</td>
<td>3.08±0.011</td>
</tr>
<tr>
<td>Regression constant, $r^2$</td>
<td>0.946</td>
</tr>
<tr>
<td>Condition factor, K</td>
<td>1.169286</td>
</tr>
<tr>
<td>Linear equation</td>
<td>$LogW=3.08L–Log1.62$</td>
</tr>
<tr>
<td>Curvilinear equation</td>
<td>$W = 0.0101L^{3.08}$</td>
</tr>
<tr>
<td>Asymptotic length, $L_{\infty}$</td>
<td>69.3</td>
</tr>
<tr>
<td>Growth curvature, k</td>
<td>0.60</td>
</tr>
<tr>
<td>Total mortality, $Z$ (yr$^{-1}$)</td>
<td>3.82</td>
</tr>
<tr>
<td>Natural mortality, $M$ (yr$^{-1}$)</td>
<td>1.02</td>
</tr>
<tr>
<td>Fishing mortality, $F$ (yr$^{-1}$)</td>
<td>2.80</td>
</tr>
<tr>
<td>Exploitation rate, $E$ (yr$^{-1}$)</td>
<td>0.73</td>
</tr>
<tr>
<td>Growth Performance Index, $\phi$</td>
<td>3.46</td>
</tr>
</tbody>
</table>
Figure 6. Month-wise feeding intensity of *T. lepturus* in Ogun marine waters.

Figure 7. Size structure of *T. lepturus* in Ogun marine waters.

Figure 8. Length frequency distribution output from FiSAT with superimposed growth curves for *T. lepturus* in Ogun marine waters.
Growth and mortality parameters (M, F and Z) of *Trichiurus lepturus*

The linearized length-converted catch curves for the selected species is presented in Figure 9. The curves enabled the estimation of the total mortality (Z) of 2.53; annual instantaneous fishing mortality rate (F) of 2.52; exploitation rate of 0.73, which reflected an over-exploitation of the fish stock in the study area; and a condition factor (k) of 1.169, as detailed in Table 4. This table further shows the fishing mortality and exploitation rate of 2.80 yr\(^{-1}\) and 0.73 yr\(^{-1}\), respectively.

![Length-Converted Catch Curve](image)

Figure 9. Length-converted catch curve of *T. lepturus* in Ogun marine waters, where N is the number of fish in each length class, dt is the time needed for the fish to grow through.

**DISCUSSION**

Most of the *T. lepturus* specimens used for the research were females (60%). The observed domination of females of *T. lepturus* in this study at most times during the sampling period is a pattern consistent with that reported by Udo *et al.* (2014), off Qua Iboe Estuary in Nigeria, where the sex proportion favors females. The recorded dominance by females in most months as observed in this study has similarly been observed in ribbonfish by several other authors (Abdussamad *et al.*, 2006; Bittar and Di-Beneditto, 2009; Ghosh *et al.*, 2014), which could be a mechanism for adapting to ecological changes, habitat preference or population control. The breeding season of *T. lepturus* is variable (Yan *et al.*, 2012), and breeding can be seasonal (Chiou *et al.*, 2006) or occur throughout the year (Martins and Haimovici, 2000; Al-Nahdi *et al.*, 2009).

The spawning season peaked in the wet months, while a prolonged spawning season spanning throughout the year was observed in the study area, which corroborates the findings of Al-Nahdi *et al.* (2009) and Ghosh *et al.* (2014). Peak spawning periods indicated by the GSI in July and December is in general conformity with the percentage occurrence of maturity stages in different months. This recorded peak period could be attributed to a high water volume coupled with enhancement in food abundance during the wet season of the sampling period (Olukolajo and Oluwaseun, 2008).

The fecundity and relative fecundity observed in this study is lower compared to the values reported by Abdussamad *et al.* (2006) for the east coast of India. Differences between this study and the earlier one might be due to the different sampling periods and environmental differences.
However, Ekanem et al. (2004) pointed out that high fecundity was a compensation mechanism for coastal fish species, as they did not show adequate parental care for their young. Thus, it allowed for eggs and fry that might be lost due to high mortality arising from environmental perturbation and predation (Offem et al., 2008).

The relatively low proportion of empty stomachs of *T. lepturus* observed in this study could be attributed to a high level of food abundance in the coastal environment where the study was carried out, coupled with the variation in the time of capture of the sampled species (Abdussamad et al., 2006). This observed trend of feeding intensity is similar to the findings of Udo et al. (2014) who also recorded a low level of empty stomachs for the same species in Qua Iboe, Nigeria. This study shows that *T. lepturus* is a voracious carnivore. The observed trend of prey items in this study is similar to the feeding pattern reported by Al-Nahdi et al. (2009) in their study on *Trichiurus margitrates*. Feeding intensity varied within the sampling months, probably due to differences in productivity and trophic enrichment caused by fluctuations in coastal waves. This observed trend corroborates the findings of Odulate (2010), who stated that the coastal tides of Ogun marine waters fluctuated with respect to environmental influence and season. Food item analysis with respect to body size depicted that juveniles fed mostly on prawns while adults preferred finfishes. This observed size-wise variation in food item is in line with the assertion of Udo et al. (2014) and Brewton et al. (2016). Ontogenetic switches in feeding habits are a general phenomenon among fish and it results from increase in body and mouth size, which permits the fish to capture a broader range of prey sizes and types (Bittar and Di-Beneditto, 2009). Feeding intensity varied between juveniles, post-juveniles and adult-sized *T. lepturus*; this could be attributed to the fact that as fish grows in size and age, several morphological changes occur in the form of increase in mouth size and improvement in locomotion ability, which alters their prey catching efficiency (Ghosh et al., 2014).

Monthly catch of *T. lepturus* varied throughout the sampling period, with a total of 1,616 individuals. This high catch within 24 months corroborates the report of Odulate, (2010) who also recorded a relatively high proportion of ribbonfish in the same study area. However, Abdussamad et al. (2006) reported the availability of this species in water at depths of between 25 and 75 m, with an abundance of 917 individuals. The mean length obtained in this study was significantly higher compared to the report of Morato et al. (2001). Abundance of food resulting from seasonal coastal waves, coupled with the graded gillnet used, could be the reason for the varying class length observed during the sampling (Ojelade et al., 2016). The length- weight relationship indicated that *T. lepturus* exhibited positive allometric growth in Ogun marine waters of the Bight of Benin; a similar pattern of allometric growth was also recorded by Ghosh et al. (2014) in his study on *Trichiurus margitrates*. However, the findings of this study are contrary to the report of Udo et al. (2014) who recorded an isometric growth pattern for the same species in the coastal waters of Qua-Iboe. The condition factor obtained shows that *T. lepturus* individuals are in a good physiological state.

The asymptotic length and growth performance indices of *T. lepturus* as observed in this study indicate a proportional increase in the length and corresponding weight of this species; this corroborates the reports of Al-Nahdi et al. (2009), who reported similar trends of growth parameters for *T. lepturus* from the Arabian sea coast, but differs from the report of Abdul et al. (2015), who recorded lower values of growth parameters for *Ellops lacerta* in the Ogun River. However, this variation in growth parameters could be due to factors related to ecosystem and biological phenomena such as maturity stages, feeding behaviour, and competition for food (Morato et al., 2001; Ekanem et al., 2004; Al-Nahdi, 2009).

The exploitation rate of 0.72 in this study, which is higher than the 0.50 sustainable exploitation margin, is an indication of an over-exploitation of the stock of ribbonfish in the study area, and shows that the population of *T. lepturus* is under threat of over-exploitation.
CONCLUSION

Some aspects of reproductive biology and stock structure of *Trichiurus lepturus* in the tropical marine waters of the Bight of Benin were studied. Females of *T. lepturus* dominated the population structure with a high fecundity rate, and peaks of spawning were in December and July. *T. lepturus* is a voracious carnivore with a positive allometric growth and asymptotic length of 69.5 cm. Condition factor of *T. lepturus* showed that individuals in this population were in good physiological condition. However, the exploitation rate of the species in Ogun coastal waters shows that it is almost over-exploited. Immediate management actions such as size-limit regulation, time-limit regulation, and protection of breeding or nursery areas are considered necessary for sustainable exploitation and conservation of this important fish species.

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LITERATURE CITED


