LENGTH FREQUENCY DISTRIBUTION, LENGTH-WEIGHT RELATIONSHIPS AND THE CONDITION FACTOR OF THE SPADENOSE SHARK *SCOLIODON LATICAUDUS* MULLER & HENLE, 1838 IN MON COASTAL WATER

Myo Min Tun[1]

Abstract

Population parameters of the spadenose shark *Scoliodon laticaudus* were estimated for a total of 180 specimens in each station from the fish landing sites were also studied periods. The estimated length-weight relationship of *S. laticaudus* showed a negative allometric growth pattern (b<3) in Zeephyuthaung and Setse and an isometric growth pattern (b=3) in Kyaikkhami. According to length frequency distribution, the juveniles of shark were observed throughout the study period and (10-12 cm) size group was recruited to the fishery from October to December in Setse. The value of K was the highest in February at Setse.

Keywords condition factor, length frequency distribution, length-weight relationships, Mon coastal water, *Scoliodon laticaudus*, spadenose shark,

Introduction

Establishment of a relationship between length and weight is necessary for the calculation of fish condition and biomass of a fish population. Length-weight relationships (LWRs) are also useful for life history and morphological comparisons of populations from different locations and these relationships allow conversion of a growth equation in length to a growth equation in weight. Basic biological data needed for stock assessment are lacking for many of these sharks and rays, including size values and size relationships/ conversions. These data are essential for understanding growth rate, age structure and other aspects of population dynamics. Size conversions have a practical value in fisheries.

The study of distribution of the species and the stocks from which the fishery is supported forms valuable information in assessing the fishery potential. In addition, it is also important to know the estimation of population parameters. The windows version of FiSAT II is a program package consisting of methodologies for use with computers, enabling users to formulate some management options for fisheries, especially in data-sparse, tropical contexts. It was developed mainly for the analysis of length-frequency data but also enables related analyses, size-at-age, catch-at-age, selection and others.

The objective of the present study is to estimate the length frequency distribution, length-weight relationships and the condition factor of the spadenose shark *Scoliodon laticaudus* along the Mon coastal areas including Ahlayt, Sebalar, Kyaikkhami, Setse and Zeephyuthaung.

Materials and Methods

The monthly data on the length frequency of specimens collected from the study areas during the study periods were examined. A total of 180 fish samples of shark from each station were arranged with the class interval of 2 cm. And then, the mean value, mode and standard deviation were computed by excel program. The total length (from the tip of the snout to the extended tip of the caudal fin) of each sample was measured to the nearest centimeter by measuring board and the fish body weight was measured to the nearest gram by Balance (1 Kg) and. LWRs were estimated by fitting an exponential curve, W= $a\mathrm{L}^{b}$ (Le Cren, 1951).

[1] Department of Marine Science, Sittway University

Parameters *a* and *b* of the exponential curve were estimated by linear regression analysis over log-transformed data log W = Log *a* + *b* LogL, where W is the total weight (g), L is the total length (cm), *a* is the intercept and *b* is the slope. The degree of association between the variables was computed by the determination coefficient, r^2. The condition factor (K) of fish was determined by using the following formula:

K= $100*W/L^3$ (Pauly 1983 as cited in Fafioye and Oluajo 2005)
Where, K = condition factor, W= weight of fish in gram and L= total length of fish in cm.

Figure 1 Selected species the spadenose shark *Scoliodon laticaudus*
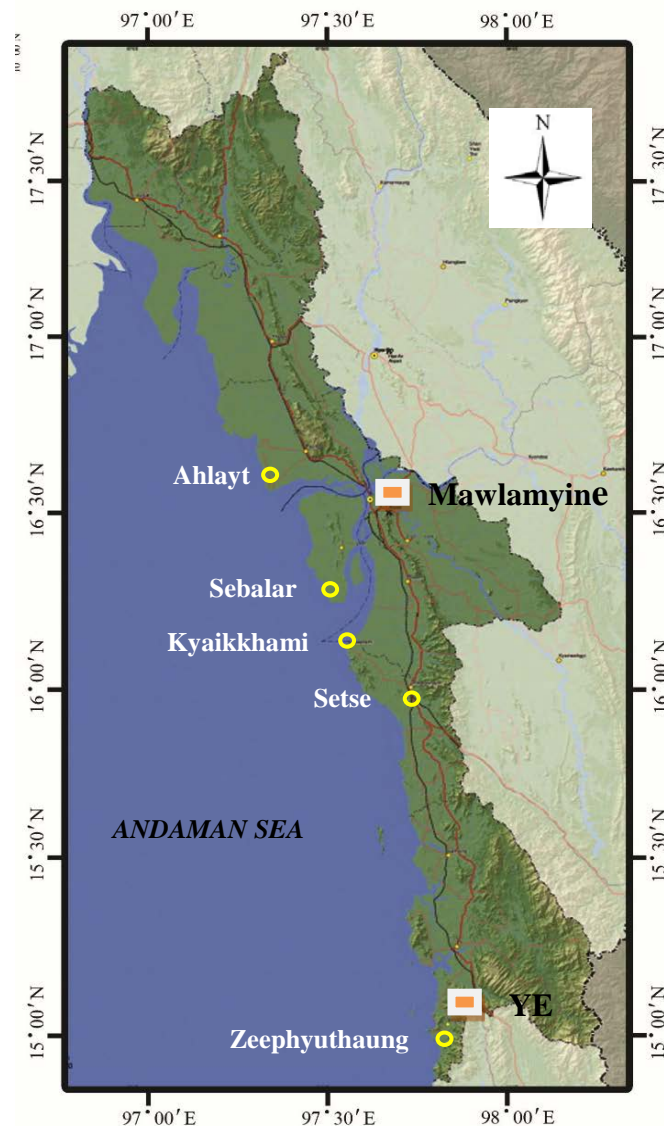
Figure 2 Map showing the sample collection sites of the study areas.

Results and Discussion

Length frequency distribution of the shark *Scoliodon laticaudus*

The length frequency data of *Scoliodon laticaudus* ranging from the size group of total length 10-12 cm to 48-50 cm were collected from October 2015 to September 2016 in Zeephyuthaung, Setse, Kyaikkhami, Sebalar and Ahlayt. In Zeephyuthaung, the size group of 30-32 cm was the most dominant in the catch in May. In October and November, the size groups of 36-38 cm and 38-40 cm occurred abundantly. In May, August and December, the size group of 32-34 cm occurred abundantly. The size group of 22-24 cm occurred the highest abundant in January. In February, May and July, the size group of 30-32 cm occurred abundantly. The size group of 26-28 cm occurred the higest abundant in March. A large number of 40-42 size groups were recorded in April and June. The size group of 34-36 cm was mostly dominant in the catch in Zeephyuthaung. The size group of 34-36 cm, 36-38 cm and 38-40 cm were the most abundant at Zeephyuthaung landing site.

In Setse, the size group of 16-18 cm was abundant in the catch in October. In November and December, the size group of 14-16 cm was dominant. The most abundant size group of 30-32 cm was observed in January, April, May and July. The size group of 12-14 cm was abundant in February. In March, the size group of 40-42 cm was abundant. In June and August, the size group of 38-40 cm was observed abundantly. The size group of 34-36 cm was abundant in September. The size groups of 30-32 cm, 32-34 cm and 34-36 cm were the most abundant at Setse landing site.

In the landing site of Kyaikkhami, the size group of 20-22 cm was found abundantly in March and May. The most abundant size group of 30-32 cm was observed from August to January. In April, the size group of 40-42 cm was abundantly observed. The size group of 34-36 cm was abundant in January and February. In June and September, the size group of 36-38 cm was abundant. In July the size group of 38-40 cm was abundant and 30-32 cm show as a peak in October. The size group of 30-32 cm, 32-34 cm and 34-36 cm were the most abundant at Kyaikkhami.

In Sebalar, the size group of 30-32 cm was abundant in October, January, February and May. In November, December and March, the size of 32-34 cm was abundantly found. The size group of 32-34 cm, 38-40 cm and 40-42 cm were abundant in March. In April, the size group of 40-42 cm and 42-44 cm were abundant. The size group of 36-38 cm was dominant in June, July and August. In September, the size group os 28-30 cm occurred abundantly. The size group of 30-32 cm, 36-38 cm and 32-34 cm were the most abundant at Sebalar and 30-32 cm shows a peak in October.
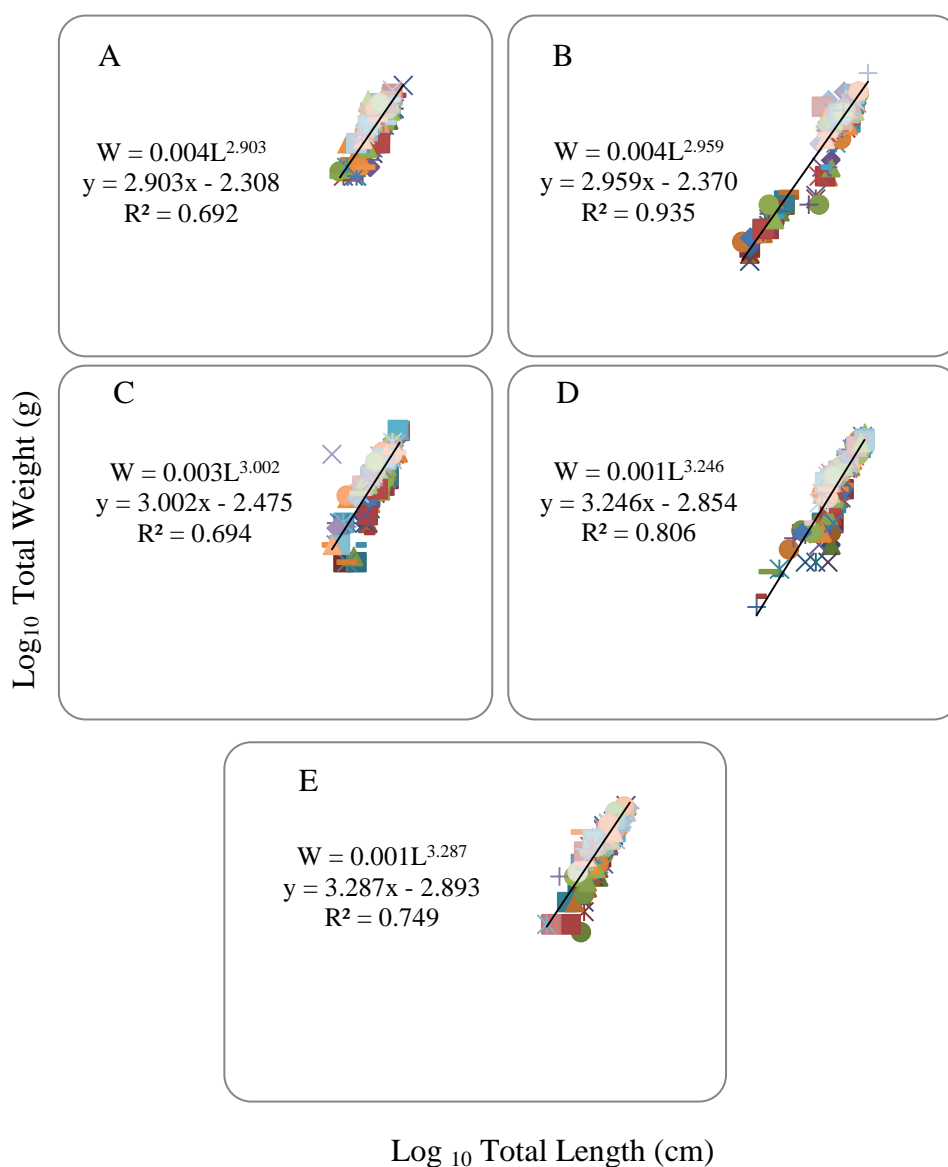
In Ahlayt fish landing site, the size group of 30-32 cm was mostly found in September, October, December and May. In March, August, September and November the size group of 32-34 cm occurred abundantly. The large group of 34-36 cm was observed abundantly in August, November and January. In February, the size group of 38-40 cm and 40-42 cm were abundant. In February and April, the size group of 38-40 cm was dominant. The size of 36-38 cm was dominant in June and November. In July, the size group of 46-48 cm was abundant. The size groups of 30-32 cm, 32-34 cm, 36-38 cm, 34-36 cm and 38-40 cm were the most abundant at Ahlayt landing site and 32-34 cm shows a peak in March. The highest mean lengths are B 36.57 ± 5.560 cm in Ahlayt and the lowest mean length, 29.03 ± 9.678 cm in Setse.

Length-weight relationships of the shark *Scoliodon laticaudus*

A total of 180 fishes were measured in each station throughout the study period. In Zeephyuthaung, the size group from 22 cm to 48 cm (TL) with mean length of 34.95 ± 4.828 cm of *Scoliodon laticaudus* were used to estimate their length-weight relationships and the mean

weight of 161.61 ± 69.797 g were observed in this study. In Setse fish landing site, the size group of this species from 10 cm to 48 cm (TL) with mean length of 29.03 ± 9.678 cm were used to estimate their length-weight relationships and the mean weight of 124.12 ± 93.116 g was found.

The size group of *S. laticaudus* from 18 cm to 46 cm (TL) with mean length of 33.62 ± 5.961 cm were studied to estimate their length-weight relationships and the mean weight of 148.73 ± 86.708 g was observed in the fish landing site of Kyaikkhami. In Sebalar, the fish ranging in size from 12 cm to 46 cm (TL) with mean length of 33.8 ± 6.436 cm were used to estimate their length-weight relationships and the mean weight of 153.75 ± 94.841g was studied. In the fish landing site of Ahlayt, the size group of this species from 20 cm to 50 cm (TL) with mean length of 36.57 ± 5.560 cm were used to estimate their length-weight relationships and the mean weight of 196.38 ± 99.158 g was observed in this study. The relationship was obtained by using the formula Log W = Log a + b Log L for males and females separately. The values of parameters "a" and "b" are expected from the linear regression equation of logarithmic conversion values of length and weight. The linear regression equation: Y = a+bX.

A

$W = 0.004L^{2.903}$
$y = 2.903x - 2.308$
$R^2 = 0.692$

B

$W = 0.004L^{2.959}$
$y = 2.959x - 2.370$
$R^2 = 0.935$

C

$W = 0.003L^{3.002}$
$y = 3.002x - 2.475$
$R^2 = 0.694$

D

$W = 0.001L^{3.246}$
$y = 3.246x - 2.854$
$R^2 = 0.806$

E

$W = 0.001L^{3.287}$
$y = 3.287x - 2.893$
$R^2 = 0.749$

Log_{10} Total Weight (g)

Log_{10} Total Length (cm)

Figure 3 Length-weight relationship of *Scoliodon laticaudus* in (A. Zeephyuthaung, B. Setse, C. Kyaikkhami, D. Sebalar, E. Ahlayt) from October 2015 to September 2016.

The value of "a" need to transform antilogarithm value to express, $W = \alpha L^b$ where "α" is the antilogarithm value of "a". The exponent (b) value of *S. laticaudus* was 2.903 in Zeephyuthaung, 2.959 in Setse, 3.002 in Kyaikkhami, 3.246 in Sebalar and 3.287 in Ahlayt respectively. Their length-weight relationships were $W = 0.004L^{2.903}$, r = 0.8318 in Zeephyuthaung, $W = 0.004L^{2.959}$, r = 0.9669 in Setse, $W = 0.003L^{3.002}$, r = 0.8331 in Kyaikkhami, $W = 0.001L^{3.246}$, r = 0.8978 in Sebalar and $W = 0.001L^{3.287}$, r = 0.8654 in Ahlayt stations respectively. (Fig 3. A-E)

Condition Factor (K) of the shark *Scoliodon laticaudus*

The monthly condition factor (k) of *Scoliodon laticaudus* in dominant group (ranging from 10 to 50 cm total length) was calculated during the study period. The condition factor was estimated for different months as shown in Table 6.1. The mean values of condition factor (k) in Zeephyuthaung varied from 0.278096 to 0.491526 and the maximum condition factor values occurred in July while the minimum value was in November. The condition factor indicated increasing variation in February. In Setse, the condition factor varied from 0.223334 to 0.627087 and the highest k values was recorded in February and the lowest k values were in January. In Kyaikkhami, the k values ranged from 0.242627 to 0.463537. May was the highest k values and the lowest was in December. The condition factor at the station Sebalar varied from 0.206446 to 0.438170. The maximum condition factor values occurred in May while the minimum value was in October. In Ahlayt, the k values ranged from 0.229543 to 0.466968 and the May has the highest which is compared with the other months during the study period. The highest k values of May were found in Kyaikkhami, Sebalar and Ahlayt stations. The lowest condition factor occurred in the months of October to January. During the study period, the highest k value (0.627087) was found in May at the station Kyaikkhami. The lowest condition factor (0.206446) occurred in October at the station Sebalar. The condition factor of *S. laticaudus* for different study areas is represented in Figure 4.

Population parameters of the shark *Scoliodon laticaudus* were estimated by using the length frequency data collected from October 2015 to September 2016. The length-weight relationships of these species were estimated by using the formula '$W = aL^b$'. The resultant 'b' value can determine the growth of fish. Fish can attain isometric or allometric growth. When the 'b' value equals 3, growth of fish is isometric which means that no change of body shape as a fish grows. If the 'b' value is larger or smaller than 3, growth of fish is allometric: positive allometric if b> 3 (fish becomes relatively stouter or deeper-bodied as it increases in weight) or negative allometric if b< 3 (fish becomes more slender as it increases in weight). Hile (1936) and Martin (1949) proposed that the value of exponent (b) in fish usually ranges between 2.5 and 4.0 (Chakravarty *et al*. 2012)
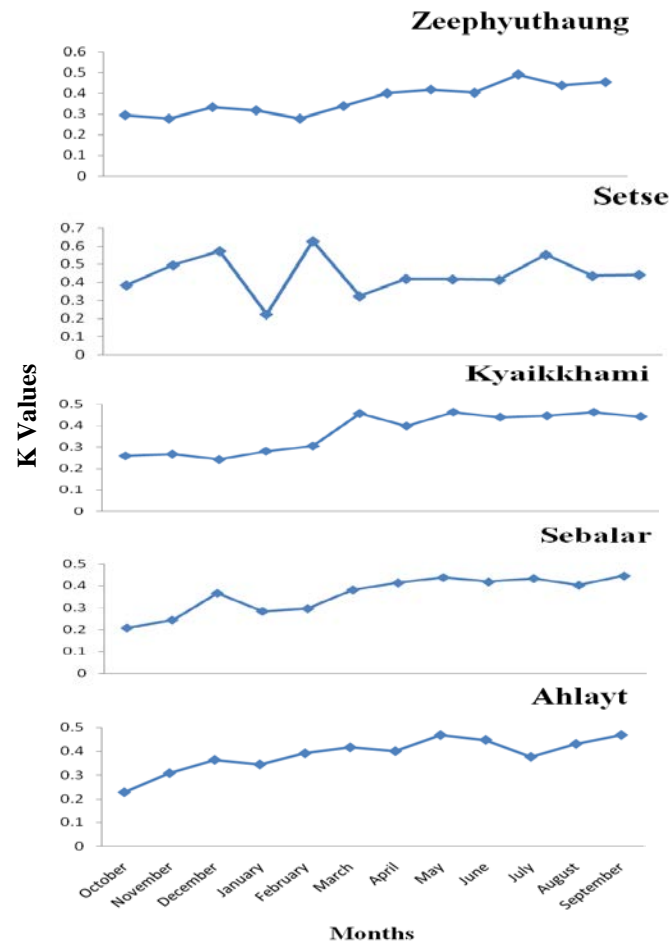
Figure 4 Monthly condition factor of the shark *Scoliodon latcaudus* in different studied areas
from October 2015 to September 2016.

Length-weight relationships have a most important role in fisheries studies. In the present study, the least value of "b" for *Scoliodon laticaudus* is 2.903 in Zeephyuthaung landing site and the most value of "b" is 3.287 in Ahlayt site. Due to the fact, the length of fish used for estimation ranged from 34-40 cm in Zeephyuthaung, 30-36 cm in Setse and Kyaikkhami, 30-38 cm in Sebalar and 30-40 cm in Ahlayt landing sites. The combined relationships of males and females with indeterminate in five study areas are 2.903, 2.959, 3.002, 3.246 and 3.287, indicating that the rate of increase in body length is nearly proportional to the rate of increase in the body weight. Among them, the higher "b" value for the combined population of *S. laticaudus* from Ahlayt (3.287) was observed. The growth of *S. laticaudus* is isometric because the "b" value is almost equal to 3. The mean value was 3.002 in Kyaikkhami and *S. laticaudus* showed isometric (b= 3) growth pattern in the present study. The present estimation on 'b' value of *S. laticaudus* also shows seasonal variation. This variation is possibly due to factors related to ecosystem and biological phenomena like maturity stages, feeding behavior, competition for food, etc (Gosh *et al.,* 2009).

The value of coefficient of correlation (r) determined whether the relationship between length and weight was significant or not. Its value lies between -1 and + 1. The monthly 'r' values of the shark *S. laticaudus* in the present study were higher than 0.5. So the relation between the length and weight of the shark *S.laticaudus* was positively correlated and highly significant. When the results from 5 stations were compared in the present study, Zeephyuthaung and Setse show a negative allometric growth pattern (b<3) which mean that a fish becomes more

selender as it increases in length. The shark *S. laticaudus* in Kyaikkhami show an isometric growth pattern (b=3) which indicated that fish length increases in equal proportion with body weight and body forming maintain a constant proportion to length.

The spadenose shark (*Scoliodon laticaudus*) was available throughout the study period but the peak month slightly varied from month to month. The smallest size of *S. laticaudus* occurred in the catch in Setse and Sebalar during the study period. The largest size of this species was found abundantly in Ahlayt landing site. The length frequency distribution showed that the young ones (10-12 cm) are recruited to the fishery from October to December in Setse.

The catching rate of fish was slightly varied monthly in the study areas. The highest catch rate occurred in the premonsoon season in March to August in Zeephyuthaung; in June to November in Setse; in April, June and September in Kyaikkhami; in March and April in Sebalar and in April, July and September in Ahlayt. Among them, April has the highest catching rate month in throughout the study areas. The size group of spadenose shark (30-38 cm) was observed in all months.

The condition factor (K) of the shark *S. laticaudus* in five study areas indicated slight variation in different months. The K values in Sebalar gradually increase from January to May and showed a decline in June. The peak value occurred in September from Sebalar and Ahlayt and indicated a rapid decline in October. The condition factor was the same in almost all stations except Setse. In Setse, the k value increase from March to July and decline in August. The highest condition factor (K) (0.627087) was found in February from Setse and the lowest K value (0.206446) occurred in October from Sebalar. Condition factor have been used as an index of growth and feeding intensity. Condition factor decrease in length and also influences the reproductive cycle in fish (Abowei, 2009). Other authors showed that the values of the condition factor vary according to the season and are influenced by environmental conditions. The K value depends on physiological factors like maturity and spawning as well as food availability.

Conclusion

The length-weight relationships of the shark, *Scoliodon laticaudus* showed that the growth was isometric and there were no significant and significant variations between male and female. All allometric coefficients (b) of *S. laticaudus* estimated in these study areas varied between 2.903 and 3.287. From the estimation of length frequency distribution, *S. laticaudus* breeds throughout the study period. Each female found in study period has brood of 15 larvae in average. The length-weight relationships data can be used in fishery or biomass assessment and trophic studies in this study area of Mon coastal waters.

Acknowledgements

References

Cengiz, O., (2013) "Length-weight relationships of 22 fish species from the Gallipoli Peninsula and Dardanelles (northeastern Mediterranean, Turkey)." *Turkish Journal of Zoology*, vol. 37, pp. 419-422.

Clarke, S.C, M.K Mcallister, and C.G.J. Michielsens., (2005) "Estimates of shark species composition and numbers associated with the shark fin trade based on Hong Kong auction data." *Journal of Northern Atlantic Fishery Science,* vol. 35, pp. 453-465.

Devadoss, P., (1989) "Observations on the length-weight relationship and food and feeding habits of spade nose shark, *Scoliondon laticaudus* Muller and Henle." *Indian Journal of Fishery,* vol. 36 (2), pp. 169-174.

Eronat, E.G.T and Ozaydi, O., (2014) "Length-weight relationship of cartilaginous fish species from Central Aegean Sea (Ismir Bay and Sigacik Bay)." *Ege Journal Fisheries and Aquatic Sciences,* vol. 31(3), pp. 119-125.

Fernandez, I.D.L, Baez, J.C, Garcia-Barcelona, S, Caminas, J.A, Urbina, J.M.O.D and Macias, D., (2017) "Length-weight relationships of kitefin shark dalatis licha and little sleeper shark *Somniosus rostratus* from the western Mediterranean Sea and long snouted lancetfish *Alepisaurus ferox* from the eastern north Atlantic Ocean." *Turkish Journal of Fisheries and Aquatic Sciences,* vol. 17, pp. 1073-1076.

Filiz, H and Mater, S., (2002) "A preliemary study on length-weight relationships for seven elasmobranch species from north Aegean Sea, Turkey." *E.U Journal of Fisheries & Aquatic Science,* vol. 19, Say1/Issue (3-4), pp. 401-409.

Gayanilo, F.C., Sparre, P. and Pauly, D., (2005) *FAO-ICLARM stock assessment tools II, user's guide.* Worldfish Center, Food and Agricultural Organization of the United Nations, Rome. 168 pp.

Joseph, M.C. and Devarai, M., (1997) "The biology and population dynamics of the spadenose shark *Scoliodon laticudus* in the coastal waters of Maharashtra State, India." *Indian Journal of Fisheries*, vol. 44 (1), pp. 11-27.

Kohler, N.E, Casey, J.G and Turner, P.A., (1996) *Length-length and length-weight relationships for 13 shark species from the western north Atlantic*. NOAA Technical Memorandum NMFS-NE-110. 22 pp.

Le Cren, E.D., (1951)" The length-weight relationship and seasonal cycle in gonad weight and condition in the perch (*Perca fluviatilis*)." *Journal of Animal Ecology,* vol. 20, pp. 201-219.

Mathew, C.J., (1992) *Biology, population dynamics, stock assessment and fishery of Scoliodon latcaudus in the coastal waters of Maharashtra.* PhD Thesis, Central Institute of Fisheries education, Indian Council of Agricultural Reserch, Versova, Bombay, India. (Unpublished)

Mathew, C, Joseph and M. Devaraj. (1997) "Thye biology and population dynamics of the spadenose shark *Scoliodon laticaudus* in the coastal waters of Maharashtra State, India." *Indian Journal of Fisheries*, vol. 44(1), pp. 11-27.

Mahendra D, F, Mangalsinh, Z and M. Koya. (2013) "Observations on selected biological aspects of the spadenose shark (*Scoliodon laticaudus* Muller & Henle, 1838), landed along saurashtra coast." *Indian Journal of Fisheries,*vol. 60(1), pp. 51-54.

Pauly, D., (1983) "Some sample methods for the assessment of tropical fish stocks." *FAO Fisheries Technical Paper*, vol. 243, 52 pp.

Raje, S.G., (2000) "Length-weight relationship of five species of rays from Mumbai, Maharashtra." *Indian Journal of Fisheries*, vol. 47(2), pp. 159-161.

Singh, M and Serajuddin, M., (2017) "Length-weight, length-length relationship and condition factor of *Channa punctatus* collected from three different rivers of India." *Journal of Entomology and Zoology Studies*; vol. 5(1), pp. 191-197.