COMPLIANCE OF MORPHOMETRIC CHARACTERS OF *SARDINELLA LONGICEPS* WITH LEGAL REGULATION

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ABSTRACT

Indian oil sardine is distributed on the complete west coast of India from Gujarat to Kerala, and also on Tamil Nadu, Pondichery, Andhra Pradesh, and Odisha in the Indian east coast, but the maximum abundance is discovered off Kerala and Karnataka coasts. Commercial portions of huge numbers of finfish and shellfish are gifts within the Kerala coastal waters. Gonadosomatic index which is an index of gonad length relative to fish length is a superb indicator of gonadal improvement in fish. The proportion of body weight of fish this is used for the production of eggs is determined by the gonadal-somatic index. Sex ratio research provides statistics on the representation of male and female fish present in a populace. The aim of this examine changed into to investigate whether the sardine gathered for having a look at are in the legally accredited length, to discover the level of maturity of gathered fishes and to calculate the gonadosomatic index and sex ratio, that are some factors of the reproductive biology of Sardinella longiceps of the Kerala coast, India.

Key phrases: Sardinella longiceps, Gonadosomatic index, felony length.

INTRODUCTION

Worldwide fish manufacturing peaked at about 171 million lots in 2016, with aquaculture representing forty-seven percent of the overall food uses (FAO, 2018). The full first sale cost of fisheries and aquaculture production in 2016 turned into expected at USD 362 billion, of which USD 232 billion turned into from aquaculture production. The consumption growth has been pushed now not simplest via elevated production, but also by way of other factors, which include decreased wastage. The share of mature fish at age or duration is one of the maximum vital populace attributes in assessing reproductive capability. This percentage is normally named the maturity ogive. The most crucial step in estimating this percentage offers with adulthood staging assessed with the aid of macroscopic or histology analysis.

The primary try to determine the spawning habits and the factors which control the migration of the oil sardine was made by using Hornell (1910) who made some trendy observations and at the same time confused the need for extensive investigations on the problems related with the food, existence-history and seasonal migration of the oil sardine for the proper improvement of its fisheries. Sardines are of high call for in India because of their excessive protein (18.1% on a wet weight basis) and lipid content (10.1%) (Bahurmiz et al., 2017). Sardines ought to have a 10-12 cm duration for prison seizing. During the cutting-edge fishing season, a widespread amount of juveniles of small pelagic has been captured alongside the Kerala coast in a focused way to meet the demand of fish meal plant

life. It changed into found that the gonads of the oil sardine typically do no longer showcase any apparent distinction in the maturing or mature eggs both inside the different areas of the equal ovary or within the two ovaries of the identical fish (Nair, 1959).

The purpose of this examination became to analyze whether the sardine amassed for taking a look at is inside the legally permitted size, to discover the level of maturity of accumulated fishes, and to calculate the gonadosomatic index and intercourse ratio, that are some factors of the reproductive biology of Sardinella longiceps of the Kerala coast, India.

MATERIALS AND METHOD

Raw Materials

Overall 34 specimens had been accrued at some stage in the length of December 2019 to February 2020 from Azhikode location, Thrissur, Kerala. The samples have been caught by using coastal gillnet and seashore seine catches. Patterns were brought to the aquaculture lab for evaluation. They were analyzed for the total duration; to the nearest mm; from the tip of the mouth to the longest caudal fin. The total weight and gonad weight are also recorded to the nearest 0.01g with the use of electronic stability. Similarly, the samples have been analyzed for sex and adulthood stages with the aid of visual observation.

Morphometry

The measurements taken from person fish blanketed their general duration (LT), well-known period, fork period, width, wet frame mass (in g), sex, gonad maturity stage, and gonad mass (Fig. Three.2).

Sex ratio

Every specimen become dissected and the gonads were removed. The sex of each specimen was diagnosed by using an exam of the gonads. The proportion of the 2 sexes relative to each other becomes used to calculate the sex ratio. Total 34 fishes were collected on a month-to-month basis for examining the improvement tiers of the gonad.

Gonado-somatic index

The GSI is a metric that represents the relative weight of the gonad to the fish weight. The gonado-somatic index was calculated consistent with Strum (1978) as follows:

$$GSI = [\text{Gonad weight} / \text{Total tissue weight}] \times 100$$

RESULT AND DISCUSSION

Morphometric evaluations have been done on samples amassed from Azhikode coast, Thrissur, Kerala, from December 2019 to February 2020. Further sampling became impossible because of the outbreak of the Covid 19 pandemic. The average length of sardine from the Azhikode coast is 16.2cm. The average weight of the January sample is 32.06g. The most duration attained by means of sardine is 35 cm. The accrued fishes were well in the criminal length consistent with the present-day observed from CMFRI citing the legal length of all pelagic and semi pelagic fishes. The permitted length for Indian oil sardine is 10cm. Kerala coast includes many unlawful sports, mainly undersized capture of fish. It ends in inventory evaluation troubles. It can be overcome by using an implementation of proper mesh length regulation. It is seen via-out this have a look that the fishermen are sticking to the prison guidelines imposed with the aid of the authorities.

Plate 1: Morphometric analysis of Sardinella longiceps

Plate 2: Gut length analysis of Sardinella longiceps

Morphometric Analysis

Morphometric characters of all the fish collected during the present investigation have been worked out and compared. The various body part measurements of the fish have been computed and are given in Tables 1 and 2. Characters with total length were analyzed to find out the degree of correlation. The comparative account of various relationships between different morphometric measurements has been indicated in Table 3.

Table 1: Morphometrics in January

NUMBER	TOTAL LENGTH(cm)	FORK LENGTH(cm)	STANDARD LENGTH(cm)	WIDTH (cm)	WEIGHT (g)
1	16.6	14.8	14.1	4.2	23.4
2	16.2	14.7	13.9	3.7	31.6
3	17.0	15.2	14.5	4.1	36.5
4	15.7	14.0	13.3	3.5	25.5
5	16.3	14.7	13.9	4.1	34.6
6	16.5	14.7	14.0	4.2	35.1
7	16.5	14.8	14.0	4.3	38.4
8	16.7	15.2	14.5	4.1	35.8
9	15.4	13.9	13.2	4.0	25.1
10	17.4	15.2	14.9	3.9	38.7
11	16.6	14.9	14.0	3.9	33.5
12	16.3	14.6	13.9	3.8	31.5
13	15.0	13.4	12.6	3.5	25.4
14	15.7	14	13.4	3.7	28.5
15	16.4	14.8	14.1	4.1	37.6
16	16.2	14.4	13.8	3.7	29.6
17	16.4	14.7	14.0	3.9	36.3
18	16.6	14.3	13.6	3.9	33.7
19	16.3	14.5	13.7	4.1	32.6
20	15.2	13.3	12.9	3.9	28
Mean	16.25	14.5	3.81	3.9	32.1
Std.Dev	0.59	0.54	0.54	0.2	4.7

Table 2: Morphometrics in February

NUMBER	TOTAL LENGTH(cm)	FORK LENGTH(cm)	STANDARD LENGTH(cm)	WIDTH(cm)
1	15.5	13.9	13.1	4.0
2	16.6	14.8	14.1	4.0
3	16.6	14.9	14.1	4.2
4	16.2	14.5	13.9	4.0
5	16.1	14.9	13.8	4.1
6	17.3	15.4	14.7	4.3
7	16.3	14.4	13.7	3.9
8	16.6	14.9	14.1	4.2
9	15.5	13.9	13.1	4.0
10	16.1	14.9	13.8	4.1
11	16.6	14.8	14.1	4.0
12	16.2	14.5	13.9	4.0
13	16.3	14.4	13.7	3.9
14	17.3	15.4	14.7	4.3
Mean	16.37	14.68	13.91	4.07
Std.Dev	0.51	0.43	0.44	0.12

Correlation between total length and weight = 0.76
Correlation between the width and weight = 0.66
Correlation between fish weight and weight of gonad 0 .=056
Correlation between the weight of gonad and GSI = 0.94

The length-weight relationship is the standard method that yields authentic biological information in fishery assessment. There were high positive correlations between the total length and weight of the fish (0.76). There is no considerable impact on gonad weight with an increase in the length of the population. The correlation coefficient between fish weight and gonad weight was weakly positively correlated by 0.056.

Table 3: Comparison of morphometric data

Parameter	January	February
Gonad development	Stage 1	Stage 2
Average length	16.25cm	16.37cm
Average weight	32.06gm	31.25gm
Average gonad weight	-	1.37gm
Average fork length	14.5cm	14.68cm
Average standard length	13.81cm	13.91cm
Average width	3.93cm	4.07cm
Sex ratio	1:2	0.75:1

Gonado-somatic index

The GSI is a metric that represents the relative weight of the gonad to the fish weight. GSI= (gonad weight /overall weight) X one hundred. The GSI fee in males for the duration of January – February were 3.31 to four.71, while in girls the excessive values all through January – February are four.29 to 5.06. This suggests that male and woman gonads begin maturing throughout February (desk four and 5). The best gonadosomatic index cost in men has been 4. Seventy-one (degree II). On this look, ranges of gonadal development have been located in male and female S. longiceps. These had been degree are Ovarian ranges stage I- (Immature virgin): Small, obvious, yellowish-white, a bit asymmetrical, extremely cylindrical, ova obvious and without yolk deposition, Oviduct lengthy and skinny. Fish measures 152-170 mm TL. Degree II- (growing virgin): Whitish, small, transparent, a piece asymmetrical, Oviduct a touch reduced. Fish degree 155-173 mm TL. The levels of gonads within the sample of February are generally 2d level and have reddish or orange in coloration. The samples gathered at some point in the first week of February is having the suggested weight of gonad as 1.37g. The mean weight of the accrued fishes in February is 31.25 g.

Table 4: GSI of male sardines during February

WEIGHT(g)	WEIGHT OF GONAD	GSI
28.7	1.2	4.18
31.8	1.5	4.71
33.2	1.1	3.31
31.8	1.5	4.71
28.7	1.2	4.18
33.2	1.1	3.31

Table 5: GSI of female sardines during February

WEIGHT(g)	WEIGHT OF GONAD	GSI
30.7	1.5	4.88
32.5	1.4	4.3
31.6	1.6	5.06
30.3	1.3	4.29
31.6	1.6	5.06
30.7	1.5	4.88
32.5	1.4	4.3
30.3	1.3	4.29

Morphometric characters of all the fish collected all through present research were labored out and in comparison. The various frame part measurements of the fish were computed and are given in table 1 and a pair of. Characters with overall length have been analyzed to discover the diploma of correlation. The Sex composition of the random samples examined at some stage in each month has been represented in desk three. Girls were nearly always extra in range with an average ratio of one male: 1. five girls. The observations screen that women outnumbered males in the months with a maximum ratio within January (1:2).

The suggested GSI value in adult males in February is 4.06, at the same time as in girls the mean GSI value at some stage in February has been determined to be 4. Sixty-three. This shows that male and woman gonads are in their 2nd stage of

improvement at some point of January – February. The very best gonad somatic index fee in men has been four. Seventy-one and the lowest GSI cost three.31 had been recorded at some stage in degree II, whilst in women, the excessive value recorded for degree II changed into 5.06 and the lowest GSI cost has been 4.29 in this have a look at, degrees of gonadal development has been found in male and lady Sardinella longiceps. Those degrees are shown in Fig 1 and defined in table 6. Maturity ranges will be recognized with the help of shade and form of ovary according to Bal and Rao (1984).

Table 6: Ovarian stages

Ovarian stages	Morphological characters	Fish size
Stage 1(immature virgin)	Small, transparent, yellowish-white, a bit asymmetrical, somewhat cylindrical, ova transparent and devoid of yolk deposition, Oviduct long and thin.	99-180 mm TL.
Stage II(developing virgin)	Whitish, small, transparent, a bit asymmetrical, Oviduct a little reduced.	109-182mm TL.

DISCUSSION

The levels of gonadal development determined in both male and female oil sardine in this study have been quiescent and maturing stages. Different stages of gonadal improvement were no longer encountered inside the samples used for this have a look at them. This indicated that the samples used were quiescent and maturing fish. Since no immature gonads were encountered in the samples examined, it indicated that immature oil sardine can be smaller than thirteen.9cm (general period) and weigh much less than 26.8g. In oil sardine, all of the stages of gonadal traits had been observed in each male and girl fish besides the ripe strolling degree which becomes not encountered (Al-Nahdi et al., 2010). FehriBedoui and Gharbi (2008) determined immature, resting, maturation, mature, and spawning and spent levels of gonadal improvement in bastard grunt sardine. Eight levels of gonadal improvement were discovered in silver grunt oil sardine. These have been immature, resting, developing, mature, gravid, spawning, spent, and convalescing spent degrees (AbuHakima, 1984).

The levels of gonadal improvement discovered in both male and female oil sardine in this have a look at had been in keeping with Nikolsky as stage I- immature, stage II- developing, stage III- growing,

degree IV- Maturing, level V- mature, level VI- Ripe(walking) and degree VII- spent. In oil sardine, the simplest tiers (Quiescent, Maturing, and Mature stages) had been determined (Adebiyi, 2013). In keeping with Edwards and Shaher (1987), growth, size composition, condition component, and gonad index of the oil sardine, Sardinella longiceps Val., oscillated over an annual cycle in terms of upwelling.

CONCLUSION

Sardinella longiceps specimens have been gathered from the Azhikode coast inside the January and February 2020. The morphometric evaluation showed that fishes taken for the study had been of legally accredited size and additionally were sexually matured. The 20 samples had been taken in January for morphometric analysis. The average duration of sardine from the Azhikode coast is sixteen.2cm. The common weight of the January sample is 32.06gm. The accumulated samples had been sexually matured and had spawned at least as soon as. Most of the sampled fishes were girls. Within the month of February, the common length of sardine is 16.37 cm. The fishes did not display the widespread difference in length among the two months. The best distinction inside the fish samples of February is the development of gonads from stage I to level II and the visibility of intercourse organs. The samples collected at some stage in the primary week of February become having a mean gonad weight of one.37g. The implied weight of the amassed fishes in February was 31.25 g. the belief of the take a look at is that the fishes caught from the Azhikode coast have been adhering strictly to the guidelines and policies of fishing. The MSL of 10-12cm changed into maintained even throughout non-ban intervals. The discount in sardine fishery due to fishing beneath MSL can be overruled inside the have a look at the place.

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