International Journal of Multidisciplinary Trends

E-ISSN: 2709-9369
P-ISSN: 2709-9350
Impact Factor (RJIF): 6.32
www.multisubjectjournal.com
IJMT 2021; 3(2): 230-238
Received: 15-11-2021
Accepted: 28-12-2021

VM Chavda
College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India

PV Parmar
College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India

HV Parmar
College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India

VC Bajaniya
College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India

Corresponding Author:
VM Chavda
College of Fisheries Science, Junagadh Agricultural University, Veraval, Gujarat, India

Growth, mortality and stock assessment of *Osteogeneiosus militaris* (Linnaeus, 1758) from Veraval fishing harbour, Gir-Somnath District, Gujarat

VM Chavda, PV Parmar, HV Parmar and VC Bajaniya

DOI: https://www.doi.org/10.22271/multi.2021.v3.i2c.794

Abstract
The present study was undertaken to assess on aspects of growth, mortality and stock assessment of *Osteogeneiosus militaris* from Veraval fishing harbour. The species found carnivour feeding habit and principle food preference was crustaceans crustaceans, mollusc and small fishes. The estimated growth parameter for *Osteogeneiosus militaris* (Linnaeus, 1758) was 523 mm and 0.62 for L∞ & K respectively. The estimated mortality parameter for the species was 1.09, 3.67 and 2.58 for Natural mortality, total mortality and fishing mortality respectively. The fecundity found in the range of 23 to 75. Gestating males found incubating eggs in the range of 49 to 55. The pooled length-weight relationship is Log W = - 4.74567 + 2.825541 Log L.

Keywords: *Osteogeneiosus militaris*, Veraval fishing harbour, Gujarat

1. Introduction
Marine catfishes belonging to the family Ariidae are grouped under three genera Arius, Osteogeneiosus and Batrachocephalus in Indian waters. The Ariidae is the one of the important marine catfish resource of India. Gujarat is one of the major catfish producing state India. Almost 70 percent of catch is originated from west coast of India. Major fishing gears capturing catfish in Gujarat are trawl net, gill net and dol net. The dominant catfish species captured in T. Thalassinus, T. dussumieri, T. tenuispinis while Saurashtra shows landing of *Osteogeneiosus militaris*. *Osteogeneiosus militaris* (Linnaeus, 1758) is the monotypic species found in Indian coast. The contribution of marine catfish to the demersal landings has decreased from 24% to 8% from 1970 to 2005 due to expansion in mechanization from 1970 onwards (Vivekanandan et. al). After the introduction of mechanized crafts and the introduction of more efficient gears has brought in several new problems regarding the sustainability of stock of this monotypic species. The problem compound by several instances of mass destruction of incubating catfishes and thereby causing enormous destruction of the young ones.
The present study was carried on *Osteogeneiosus militaris* to find out its growth, mortality and stock assessment, off Veraval coast.

Material & methods
Monthly random samples from Veraval fishing harbour were collected during the period of year 2012 to 2015 for a period of three years. Total length of the fish was taken from the tip of the snout to the tip of the caudal fin in mm. length, weight, qualitative gut content analysis were carried out. During the period of study, 3181 specimens in the length range of 142 to 483 mm were measured. The growth was expressed using the von Betrtalanffy's formula given as: Lt = L∞ *(1-e-K(t-to). Growth and mortality parameters parameters were analyzed in FiSAT software.

Result & Discussion
The study aimed to estimate the growth, mortality parameters and to highlight the effect of fishing on the stock of Soldier catfish *Osteogeneiosus militaris* (Linnaeus, 1758) off Veraval coast with the FiSAT software. Based on the qualitative gut content analysis the species found carnivour feeding habit and principle food preference was crustaceans crustaceans, mollusc and small fishes The estimated growth parameter for *Osteogeneiosus militaris* (Linnaeus, 1758) was 523 mm and 0.62 for L∞ & K respectively. The estimated mortality parameter for the species was 1.09, 3.67 and 2.58 for Natural mortality, total mortality and

fishing mortality respectively. Therefore, it is recommended not to increase the fishing effort: such an increase would be particularly unwise for *Osteogeneiosus militaris* (Linnaeus, 1758). The present level of fishing on *Osteogeneiosus militaris* (Linnaeus, 1758) confirmed that the stock is overexploited.

A total of 3181 specimens of species *Ostegeneiosus militaris* (Linnaeus, 1758) were analyzed for the present study from Veraval fish landing center (Table 1) out of which 2842 specimens were recorded from trawl net and 339 specimens were recorded from gill net (Table 2). Graphical representation of length-frequency data of *Osteogeneiosus militaris* (Linnaeus, 1758) are presented in fig 1. The recorded morphometric measurement of *Osteogeneiosus militaris* (Linnaeus, 1758) has been given in Table 3. Measurement of minimum and maximum length and weight with estimated mean and standard deviation is given in table 4. Preliminary estimates of asymptotic length L∞ and growth co-efficient K estimated were 514 mm and 0.58 year-1 respectively, with Electronic length frequency analysis (Fig. 2 & 3). The asymptotic length (L∞) and growth coefficient (K) estimated using Gulland and Holt plot were 529 mm and 0.61 yr-1 respectively (Fig 4). The asymptotic length (L∞) estimated from Powell-Wetherall plot was 523 mm and Z/K value estimated was 4.001 (Fig 5). The values of growth parameters has been presented in table 5. The VBGF for this species can be written as:

Lt= 523.0[1-e-0.62{t-(-0.391)}]

The growth curve of the *Osteogeneiosus militaris* (Linnaeus, 1758) based on VBGF equation is presented in fig. 6.

The estimated growth of this species using VBGF was 251, 383, 461 and 503 mm at the end of 1, 2, 3 and 4 years respectively (table 6). Pantulu (1963) [11] reported growth of O. militaris from Hoogly estuary and reported L∞ & K value 540 and 0.65 per year respectively. The L∞ estimated by earlier workers (Pantulu, 1963; Gulati *et al*., 1996) [11, 6] and Chakraborty *et al*. (1994, 1997) [4] appears to be comparable**.** The size of fish at various probabilities was presented by the Fig. 7. The estimated sizes at 25, 50 and 75% probabilities of capture of *Osteogeneiosus militaris* (Linnaeus, 1758) were respectively 191.85, 261.91 and 331.97mm. The natural mortality was calculated 1.09 per year as per the Pauly's empirical equation (fig 8)

The size of fish at various probabilities was presented by the Fig. 7. The estimated sizes at 25, 50 and 75% probabilities of capture of *O. militaris* were respectively 191.85, 261.91 and 331.97mm.

The 'Z' of 3.67 per year obtained during the present study was also higher as compared to the value of 0.88 reported by Gulati *et al*. (1996) [6], but lower than the report of Chakraborty *et al*. (1997) [4] who estimated it as 5.0. The fishing mortality was found 2.58 per year (table 7). 'M' varies with age (Boiko, 1964) [1] and also with predator abundance (Pauly, 1980, 1982; Jones, 1982; Munro, 1982) and also with size, K and the mean ambient temperature of the ecosystem. Virtual population analysis performed of *O. militaris* indicated that the minimum and maximum fishing mortalities were recorded for the mid-lengths 170 and 370 mm, respectively (Fig. 9). Prediction of maximum length from extreme values was calculated 506.59 mm (fig. 10 & 11) Estimation of class weight and sample weight is given in Table 8a and 8b based on length weight co-efficients (fig 12). The exploitation rate (E) were estimated as 0.70 yr^{-1}. In the relative yield per recruit (Y/R) and biomass per recruit (B/R) prediction models the descending curves showed decrease in biomass/recruit (B/R) as exploitation ratio increased (Table 9). The exploitation rates of 0.70 are certainly more than the optimum of 0.5 suggested by Gulland (1971) [8]. The maximum exploitation rate (E_{max}), which gives maximum yield per recruit, was 0.375 (Fig 13). Thompson & Bell model (Fig. 14) indicated a decline in fish yield with an increase in exploitation rate (Table 10).

Table 1: Observations

Number of individuals recorded	3181
Number of individuals recorded from Trawl net	2842
Mesh size of trawl net	10 - 40 mm
Number of individuals recorded from Gill net	339
Mesh size of gill net	40 -150 mm
Type of fishing craft	Mechanized vessel
Length range of specimens	142-483mm
Weight range of specimens	30-970gms
Depth of fishing ground	30 - 120 meters

Table 2: Tabulationof length-frequency for O. militaris

Class Interval(Length) mm	No. of individuals from Trawl net	No. of individuals from Gill net	Total No. of individuals.
140-160	2	0	2
160-180	2	0	2
180-200	6	0	6
200-220	18	3	21
220-240	98	7	105
240- 260	298	24	322
260-280	356	28	384
280-300	417	48	465
300-320	362	38	400
320-340	324	64	388
340-360	248	33	281
360-380	384	28	412
380-400	136	24	160
400-420	109	18	127
420-440	42	13	55
440-460	22	7	29
460-480	17	4	21
480-500	1	0	1
500-510	0	0	0
Total	2842	339	3181

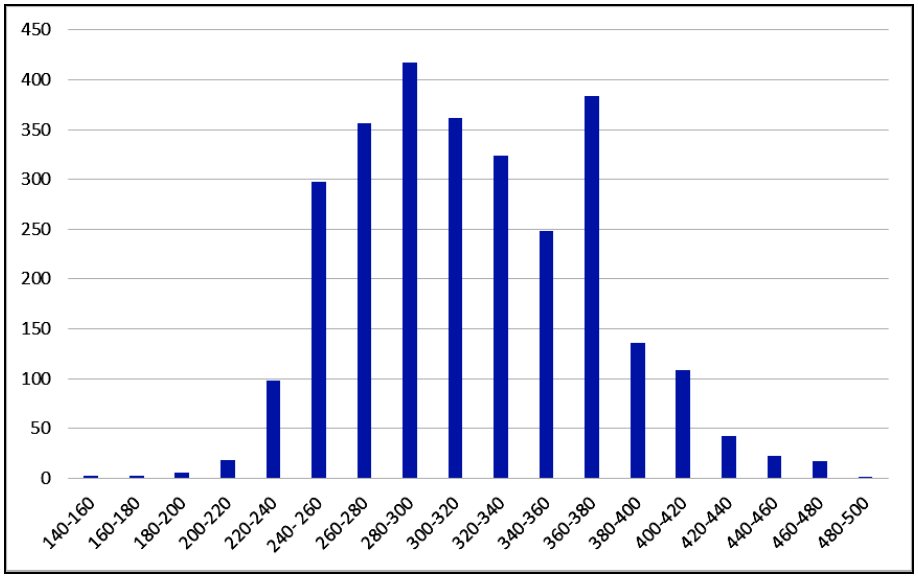

Fig 1: Length frequency diagram of O. militaris

Table 3: Morphometric measurements of representative sample of *Osteogeneiosus militaris*

No	Morphometric measurements	Length (mm)
1	Total Length	291
2	Snout to peduncle length	232
3	Length of barble	71
4	Distance from snout to dorsal fin	87
5	Distance from snout to pectoral fin	60
6	Distance from snout to pelvic fin	113
7	Distance from snout to anal fin	162
8	Distance from snout to adipose fin	175
9	Length of mouth	60
10	Length of dorsal fin	52
11	Length of adipose fin	27
12	Length of pectoral fin	41
13	Length of pelvic fin	34
14	Length of caudal fin	59

Table 4: Measurements of length & weight of *Osteogeneiosus militaris*

	Length (mm)	Weight (gm)
Minimum	142	30
Maximum	483	970
Mean	312	500
SD	54	152

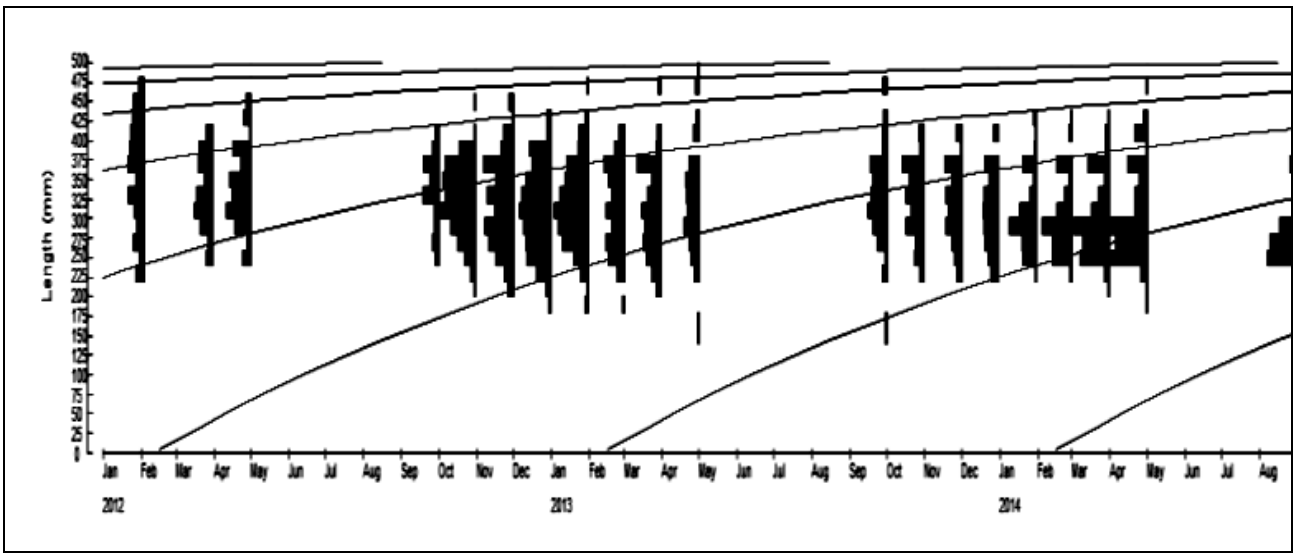

Fig 2: Von-Bertlanffy growth function & length freq. on O. militaris

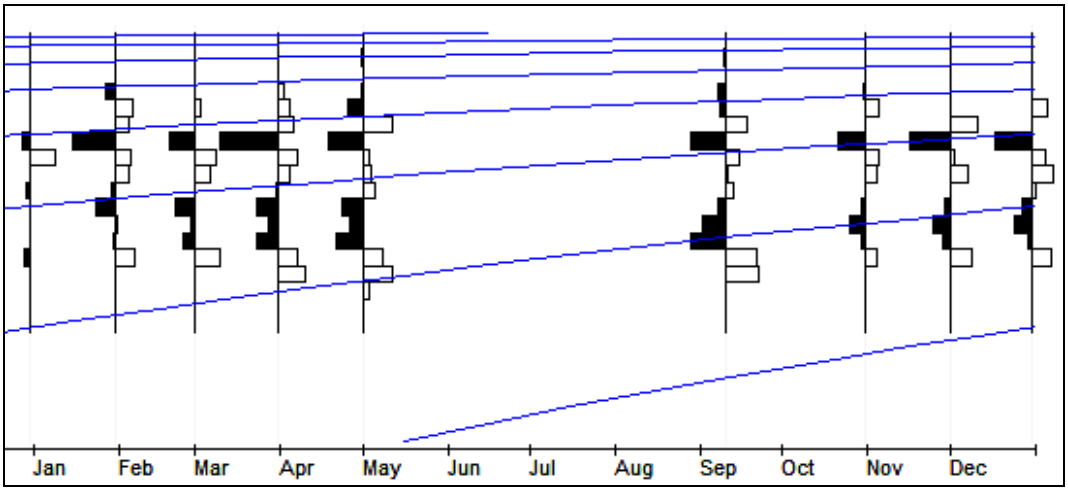

Fig 3: ELEFAN (restructured sample & growth curves): L_∞= 514mm K= 0.58 year^{-1}

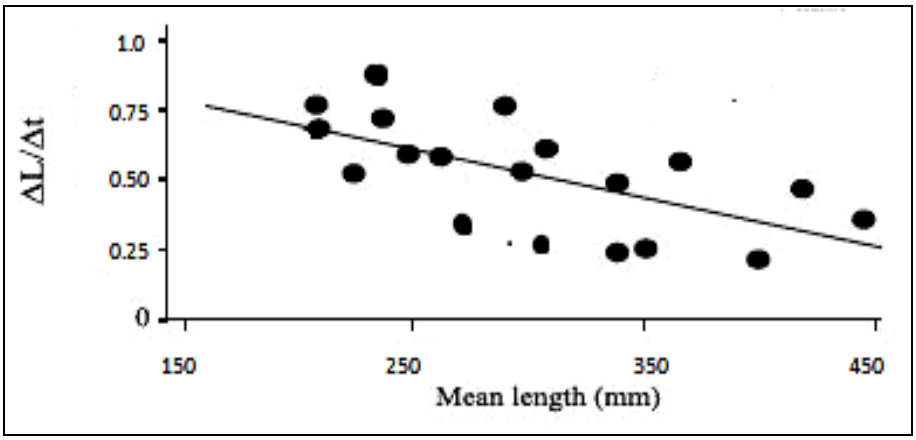

Fig 4: Gulland & Holt plot: L_∞= 529mm K= 0.61 year^{-1}

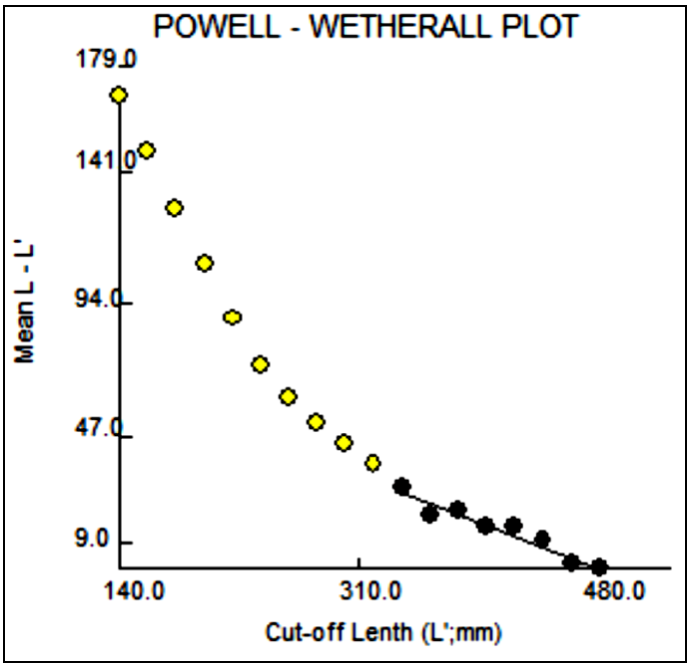

Fig 5: Powell-Wetherall plot: L_∞= 523 mm Z/K= 4.001

Table 5: Growth Parameters

	Growth parameters	Calculated value
1.	L_∞	523 mm
2.	K	0.62 Year $^{-1}$
3.	t_0	-0.391 year

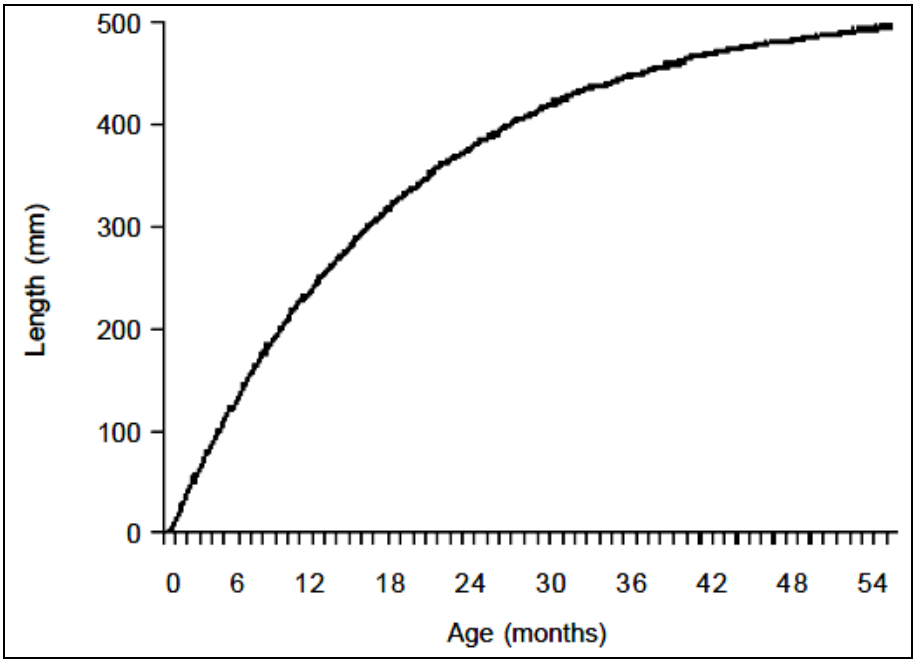

Fig 6: Growth curve of *Osteogeneiousus militaris* based on VBGF equation:

Table 6: Length attained by *Osteogeneiosus militaris* at different ages.

Age (years)	Size (mm)
0.5	146
1.0	251
1.5	326
2.0	383
2.5	428
3.0	461
3.5	483
4.0	503
4.5	514

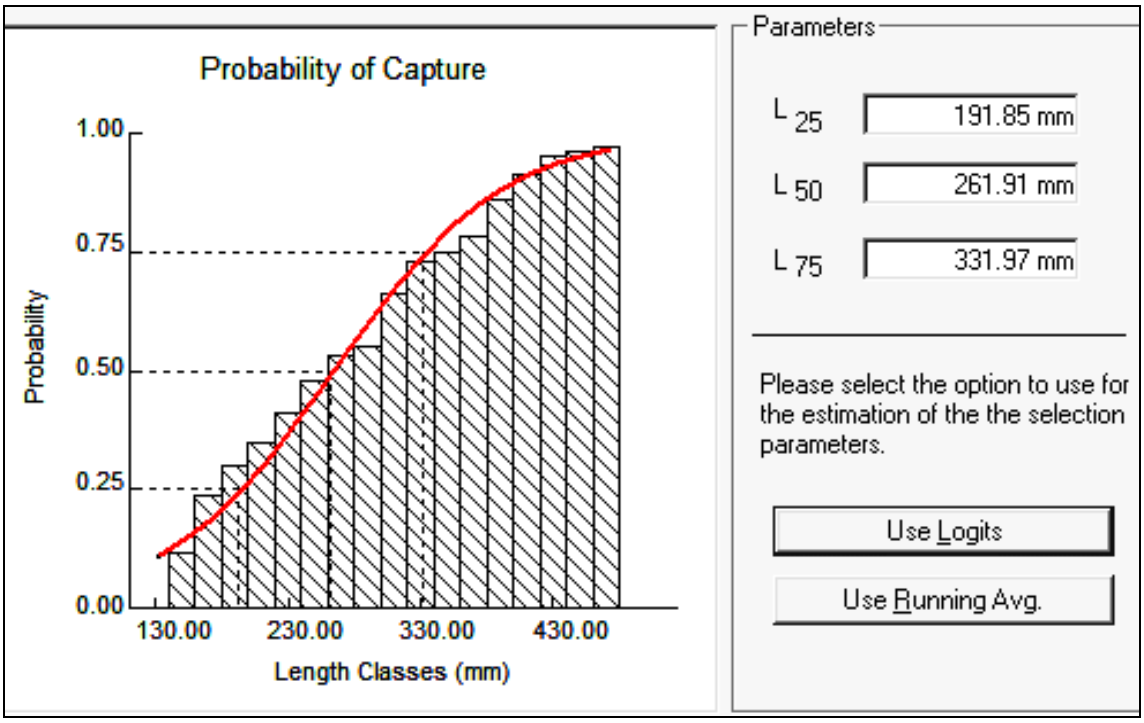

Fig 7: Probability of capture

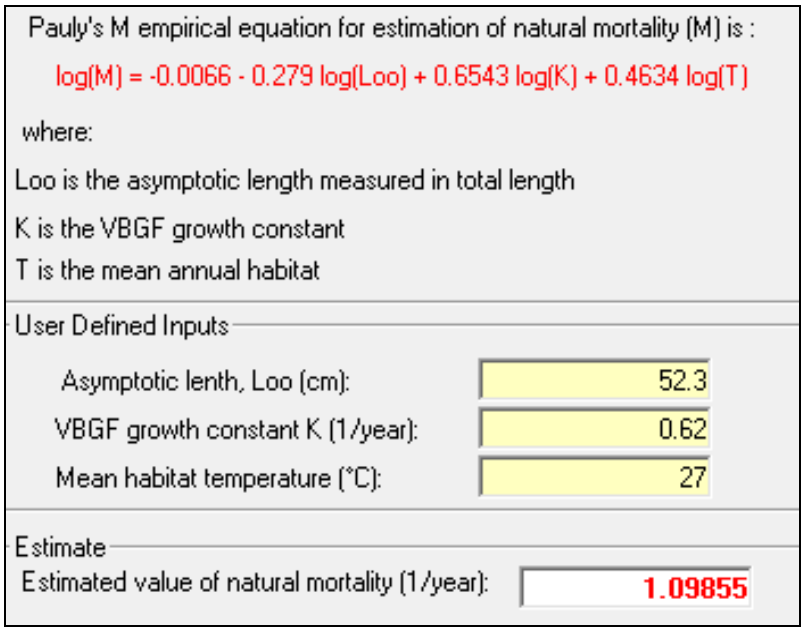

Fig 8: Estimation of Natural Mortality.

Table 7: Estimation of fishing mortality.

Z (Total Mortality) = M (Natural Mortality) + F (Fishing Mortality)	
F (Fishing Mortality)	2.58

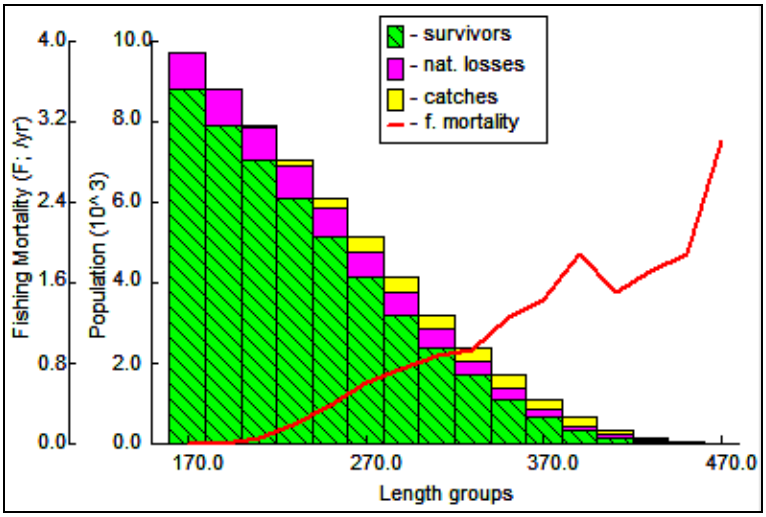

Fig 9: Length structured Virtual Population Analysis: Highest mortalities was found in the Min size: 170 mm & Max size 370 mm.

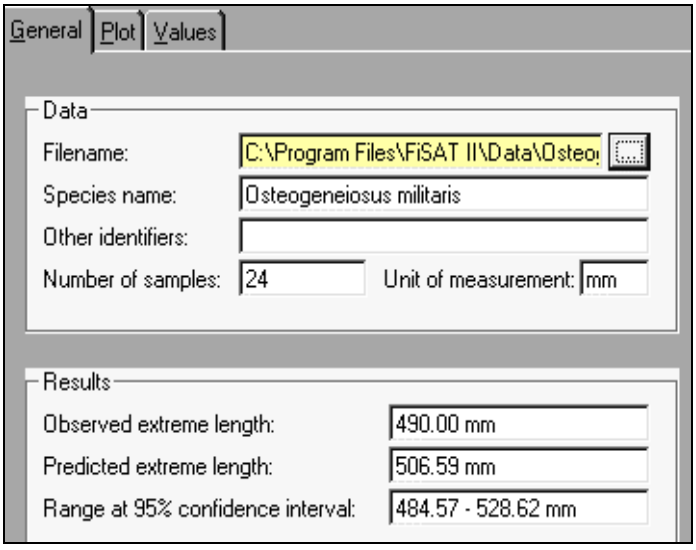

Fig 10: Prediction of the maximum length from extreme values

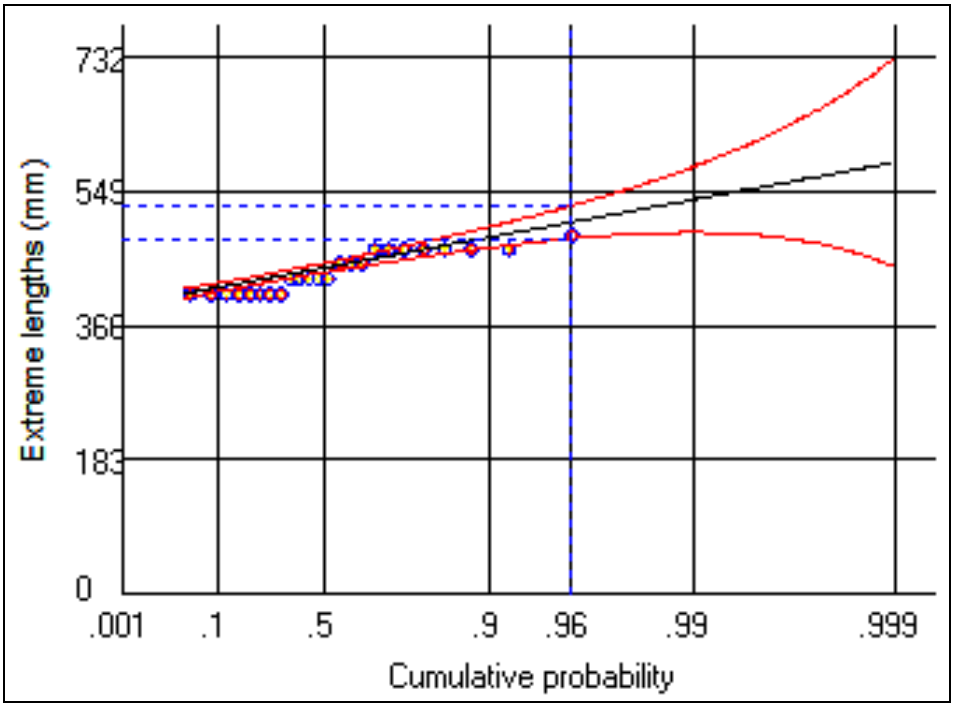

Fig 11: Graphical representation of prediction of maximum length.

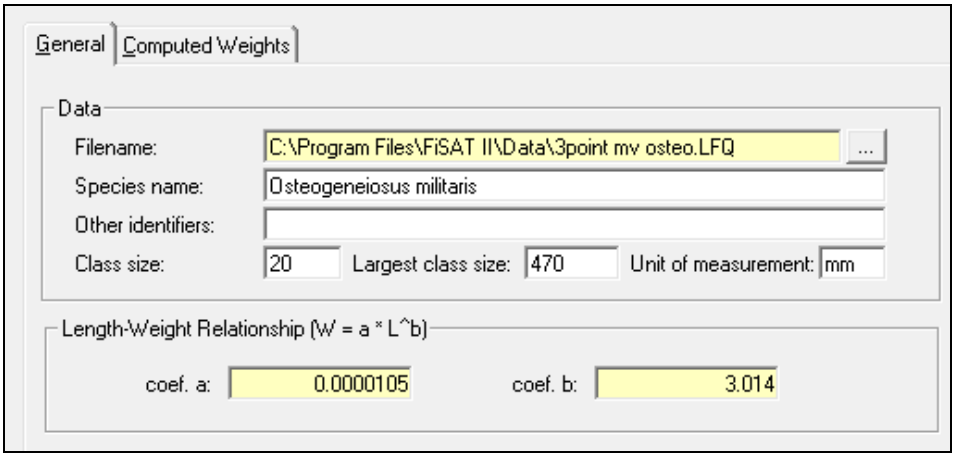

Fig 12: Sample weight estimation

Table: 8A Estimation of class weights

Estimation of Class weights	
Length	**Mean weight**
170.00	55.63
190.00	77.73
210.00	105.04
230.00	138.12
250.00	177.53
270.00	223.83
290.00	277.57
310.00	339.32
330.00	409.63
350.00	489.07
370.00	578.19
390.00	677.56
410.00	787.74
430.00	909.29
450.00	1042.77
470.00	1188.75

Table: 8B Sample weight estimation

Sample weight estimation			
Sample No.	**Sum F**	**Weight of sample**	**Mean weight**
1	65.00	40784.21	627.45
2	93.00	48823.70	524.99
3	90.00	40565.09	450.72
4	118.00	56461.71	478.49
5	60.00	27826.20	463.77
6	183.00	75008.55	409.88
7	186.00	76017.71	408.70
8	200.00	75793.07	378.97
9	191.00	74687.51	391.03
10	118.00	45672.26	387.05
11	120.00	44995.51	374.96
12	86.00	34969.20	406.62
13	96.00	42823.20	446.08
14	99.00	40436.20	408.45
15	89.00	35600.92	400.01
16	90.00	32407.75	360.09
17	93.00	33126.57	356.20
18	108.00	35482.03	328.54
19	141.00	46524.24	329.96
20	164.00	57154.75	348.50
21	168.00	58248.55	346.72
22	109.00	38568.15	353.84
23	86.00	31121.86	361.88
24	74.00	26757.17	361.58

Table 9: y/R & B/R analysis

E	Y/R	B/R	E	Y/R	B/R
0.01	0.010	0.775	0.60	0.016	0.088
0.20	0.017	0.577	0.70	0.011	0.038
0.30	0.021	0.410	0.80	0.005	0.011
0.40	0.022	0.272	0.90	0.002	0.001
0.50	0.020	0.165	0.99	0.000	0.000

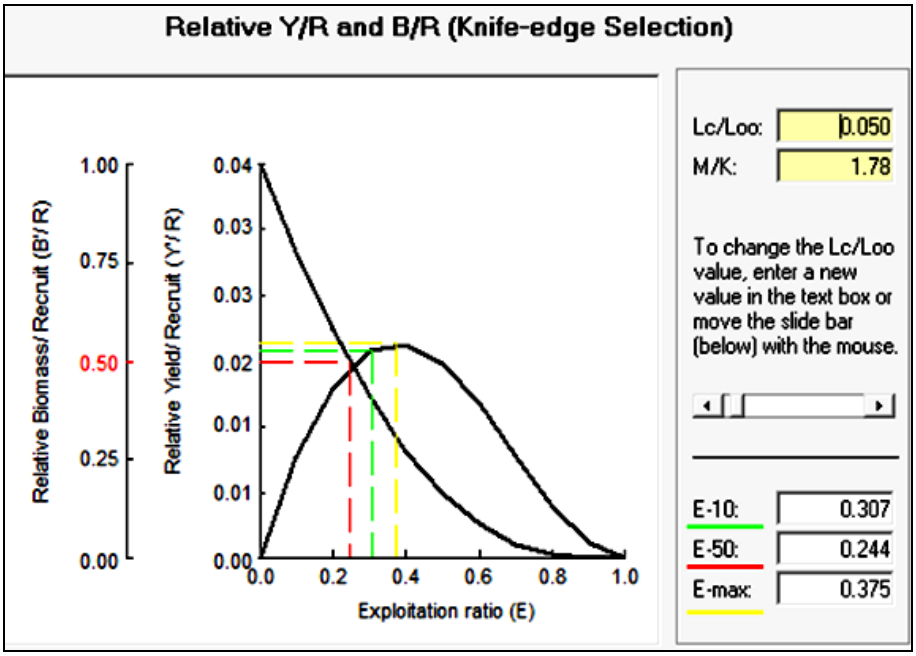

Fig 13: Relative Y/R and B/R (Knife edge selection)

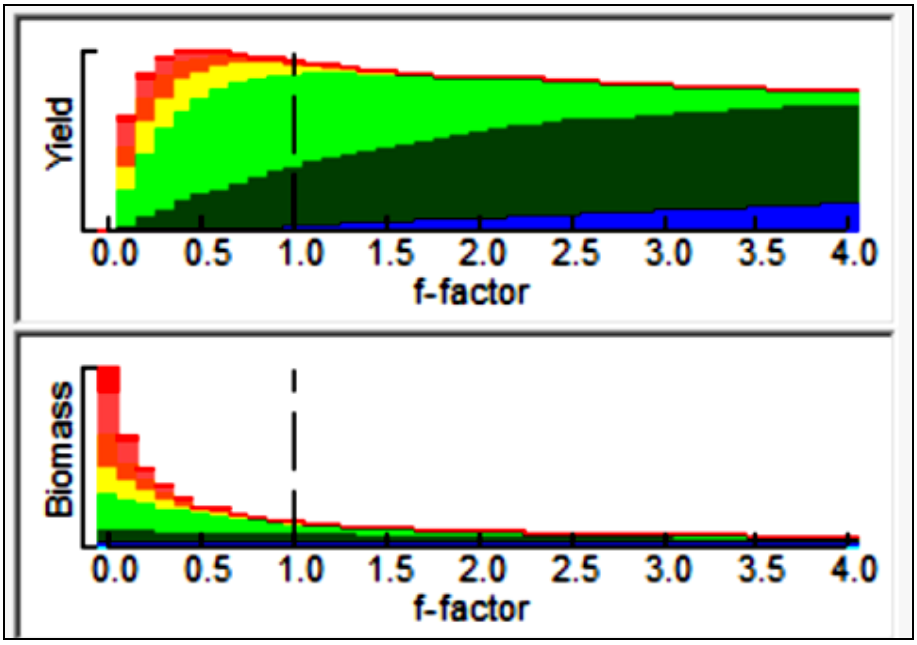

Fig 14: Thompson & Bell Model

Table 10: Thompson & Bell model

	F- factor	Yield	Biomass
1	0.1	536.93	152.281
2	0.2	724.468	108.361
3	0.3	794.707	83.795
4	0.4	819.083	68.542
5	0.5	823.844	58.333
6	0.6	819.848	51.102
7	0.7	811.953	45.75
8	0.8	802.473	41.649
9	0.9	792.535	38.413
10	1	782.691	35.8
11	1.1	773.207	33.646
12	1.2	764.201	31.841
13	1.3	755.713	30.307
14	1.4	747.741	28.984
15	1.5	740.265	27.833
16	1.6	733.253	26.821

Conclusion

The study aimed to estimate the growth, mortality parameters and to highlight the effect of fishing on the stock of Soldier catfish *Osteogeneiosus militaris* (Linnaeus, 1758) off Veraval coast with the FiSAT software. The estimated growth parameter for *Osteogeneiosus militaris* (Linnaeus, 1758) was 523 mm and 0.62 for L∞ & K respectively. The estimated mortality parameter for the species was 1.09, 3.67 and 2.58 for Natural mortality, total mortality and fishing mortality respectively. Therefore, it is recommended not to increase the fishing effort: such an increase would be particularly unwise for *Osteogeneiosus militaris* (Linnaeus, 1758). The present level of fishing on *Osteogeneiosus militaris* (Linnaeus, 1758) confirmed that the stock is overexploited.

References

1. Boiko EG. Prediction of reserves and catches of *Azovlueiperca*. Trudy VNIRO. 1964;50:1-20.
2. Bertalanffy L von. A quantitative theory of organic growth. Hum Biol. 1938;10:181-213.
3. Beverton RJH, Holt SJ. A review of life span and mortality rates of fish in nature and their relationship to growth and other physiological characteristics. CIBA Foundation Colloquia on Age. 1959;5:142-80.
4. Chakraborty SK, Deshmukh VD, Khan MZ, Vidyasagar K, Raje SG. Estimates of growth, mortality, recruitment pattern and MSY of important resources from Maharashtra coast. J Indian Fish. 1994;24:1-39.
5. Chakraborty SK, Deshmukh VD, Khan MZ, Vidyasagar K, Raje SG. Estimates of growth, mortality, recruitment pattern and maximum sustainable yield of important fishery resources of Maharashtra coast. Indian J Mar Sci. 1997;26:53-6.
6. Gulati D, Devaraj M, Palaniswamy R. Stock assessment of soldier catfish *Osteogeneiosus militaris* along the north-west coast of India. J Indian Fish Assoc. 1996;26:1-8.
7. Gulland JA. The fish resources of the ocean. West Byfleet (Surrey): Fishing News (Books) Ltd. for FAO; 1971. 255 p.
8. Gulland JA, Holt SJ. Estimation of growth parameters for data at unequal time intervals. J Cons CIEM. 1959;25(1):47-9.
9. Jones R. Ecosystems, food chains and yields. In: Pauly D, Murphy GI, editors. Theory and management of tropical fisheries. ICLARM Conference Proceedings. 1982;9:195-239.
10. Munro JL. Estimation of the parameters of the von Bertalanffy growth equation from recapture data at variable time intervals. J Cons CIEM. 1982;40:199-200.
11. Pantulu VR. Studies on age and growth, fecundity and spawning of *Osteogeneiosus militaris* (Linn.). J Cons Int Explor Mer. 1963;28(2):295-315.
12. Pauly D. On the interrelationship between natural mortality, growth parameters and mean environmental temperature in 175 fish stocks. J Cons CIEM. 1980;39(2):175-92.
13. Pauly D. Studying single species dynamics in a multispecies context. In: Pauly D, Murphy GI, editors. Theory and management of tropical fisheries. ICLARM Conference Proceedings. Manila (Philippines): ICLARM and CSIRO; 1982. 9:360 p.
14. Pauly D. Length converted catch curve: a powerful tool in fisheries research in tropics. Part I. ICLARM Fishbyte. 1984;1(2):9-13.