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Growth Kinetics of *Etroplus suratensis* (Bloch, 1790) Reared Under Controlled Condition Using Four Different Feeds

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Abstract: *Etroplus suratensis* is considered as a delicacy in most part of south India and the important of the species has increased with its elevation to the state fish of Kerala in 2010. The demand for the species has considerably improved ever since its elevation to the status of state fish. However, the price of the fish has considerably improved in course of time and people have realized the potential of culturing it. Popularization of any aquaculture practices requires support of sound technology for seed production and a feed giving high growth rate. Data on growth kinetics of fishes is essential for decision making by policy planners to ensure returns for the fish farmers. The present study was conducted to analyze the effectiveness of the farm made feeds and the growth potential of the species fed with commercial shrimp feed using various growth models.

Keywords : *Etroplus suratensis*, growth kinetics, growth models, commercial feed, fish culture.

Introduction

Etroplus suratensis is a brackish water euryhaline fish included in the family Cichlidae inhabits in both brackish and fresh water ecosystem (Padmakumar et al, 2012). It can withstand wide range of temperature and salinity conditions as it has highly efficient cellular stress response mechanism and osmoregulatory mechanism (Chandrasekar et al, 2014). Ability to adapt wide salinity regimes increase the profitability of Etroplus suratensis in aquaculture (Arun et al, 2020). It is an omnivore and bottom feeder, feeding mostly on algae growing on substrates and the associated bacterial and zooplanktonic biomass (Keshava and Mohan, 1988). Periphyton growing on the additional substrate might have also been directly exploited by the fish resulting in high fish growth or yield. The demand for pearl spot is growing day by day and at the same time it is declining at an alarming rate due to over exploitation in their natural habitat and boon in brackish water tourism (Padmakumar et al, 2002).

The survival rate of pearl spot varies between 45 to 100% (Padmakumar et al, 2004). The present farming practices of *Etroplus suratensis* rely on several farm made feeds based on vegetable waste, kitchen waste and conventional food feed ingredients like rice bran and oil cake. Popularization of any aquaculture practices requires support of sound technology for seed production and a feed giving high growth rate. Data on growth kinetics of fishes is essential for decision making by policy planners to ensure returns for the fish farmers. The present study was conducted to analyze the effectiveness of

the farm made feeds and the growth potential of the species fed with commercial shrimp feed. Linear models and non linear models are used for such studies. Non linear models are widely used to generate reliable conclusions from short term lab based experiments in smaller fishes. Model fitted for growth gives indications on the different growth parameters including growth rate.

Figure 1: *Etroplus suratensis*

Material and Methods

Juveniles of pearl spot were collected from Neendakara, Kollam (figure.1). The fishes were acclimatized for three days in the laboratory condition before the study. Four different feeds were given to the fishes for studying the growth kinetics. Three feed combinations (chopped vegetables; rice bran and ground nut oil cake in 1:1 ratio and Maida flour and turmeric powder in 10:1 ratio) were adopted from the practices in farms with minor modifications, and commercial shrimp feed was used as control. Group of 10 fishes each were stocked in FRP tubs (25L water) and the experiment was conducted in triplicate for a period of 150 days. Continuous aeration was provided in the tank and 10%of water was exchanged on a daily basis. Growth was assessed from the weight of the fish measured with a weekly interval. The data generated was used for fitting growth models like Linear growth model, Von Bertalanffy growth function (Bertalanffy, 1938), Gompertz growth model (Gompertz, 1825), polynomial growth model, Logistic growth model (Verhulst, 1838) and the power growth model. The models obtained were compared for the best fit. The growth models also provide valuable information on the instantaneous growth rate of fishes fed on different diets.

Result and Discussion

Table 1: Parameters and index of fit(IF) for different models fitted for the growth of *Etroplus suratensis* fed with four different feeds.

Models		Commercial Shrimp Feed	GOC/RB	Vegetable Mixture	Maida/ Turmeric
Linear	a	2.212009	1.994989	2.0	2.093828
	b	0.01315	0.01398	0.01	0.013156
	IF	**0.986501**	**0.991456**	**0.95679**	**0.971886**
von Bertlanffy	winf	2.502999	2.300333	2.3	2.386
	k	2.168094	2.104824	1.9	2.098333
	IF	**0.454566**	**0.387453**	**0.44108**	**0.467378**
Gompertz	wo	2.193524	1.993659	2.1	2.061326
	k	0.383511	0.939276	-0.5	0.321394
	g	0.019939	0.007603	0.1	0.029459
	IF	**0.99074**	**0.948847**	**0.65512**	**0.987137**
Polynomial	a	2.19518	1.994506	1.95	2.060898
	b	0.016286	0.014081	0.023	0.019281
	c	-8.5E-05	-2.8E-06	0.000	-0.00017
	IF	**0.990752**	**0.991459**	**0.96831**	**0.987906**
Logistic	ALPHA	50.12727	49.22653	49.22	49.65993
	BETA	21.58293	23.56921	23.59	22.61654
	K	0.00561	0.006496	0.0073794	0.005862
	IF	**0.982502**	**0.990419**	**0.94835**	**0.964354**
Power	a	2.187802	1.998641	1.95	2.050244
	b	0.023161	0.012706	0.03	0.032915
	c	0.850338	1.025613	0.82	0.759931
	IF	**0.989996**	**0.99155**	**0.96242**	**0.982013**

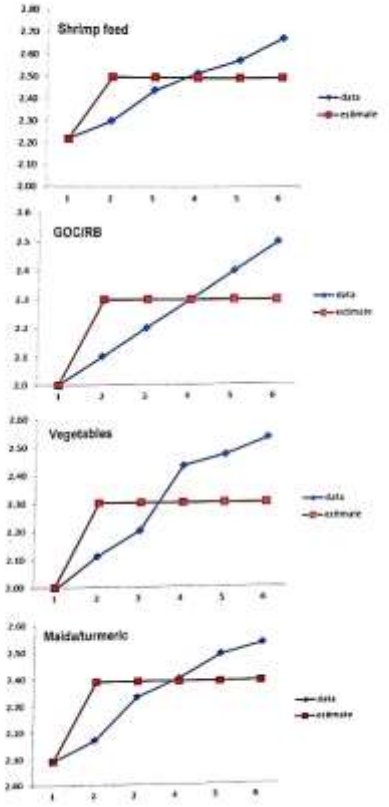

Figure 2. von Bertalanffy growth model fitted to *Etroplus suratensis* fed with four different feeds

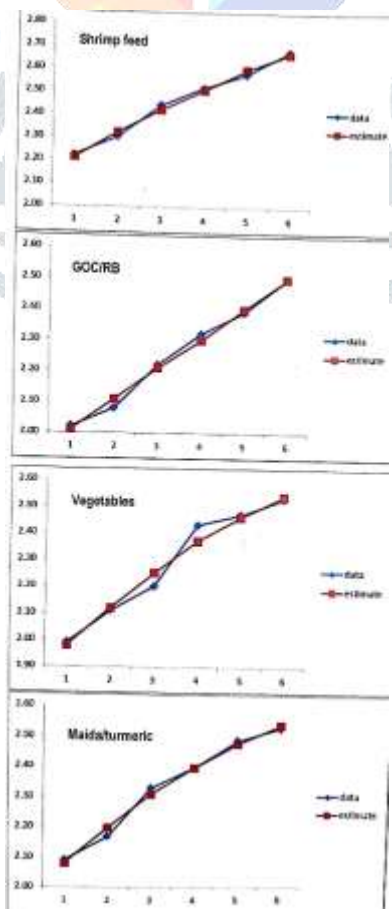

Figure 3: Polynomial growth model fitted to *Etroplus surtensis* fed with four different feeds.

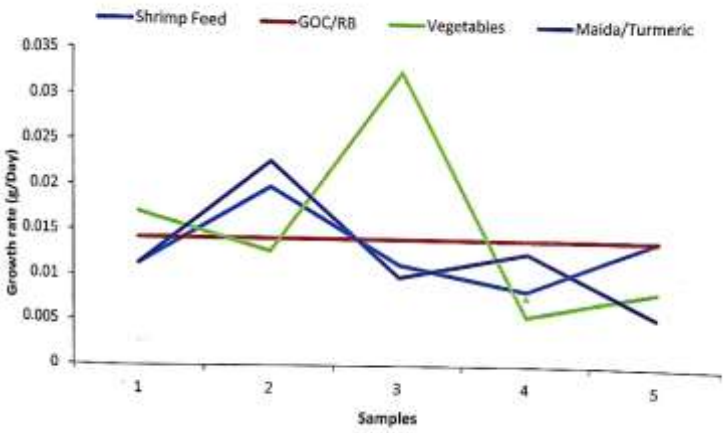

Figure 4: Growth rate estimated for *Etroplus suratensis* fed with four different feeds

Different growth models were fitted to understand the growth kinetics of the species under controlled rearing conditions. The lack of universal agreement in the best fitting growth model suggests applying a single parameterization is not necessarily the best method of fitting growth curves to data (Lee et al, 2020). Among all the models fitted for *Etroplus suratensis* fed with four different feeds, the best fit was observed for polynomial function (figure 3) and least fit was for Von Bertalanffy growth model (figure 2). Growth rates (gram/day) calculated for *Etroplus suratensis* fed with four different feeds are presented in figure 4. The result indicates a higher growth rate of 0.0154g/day for fishes fed with chopped vegetables and 0.014 g/day for fishes fed with rice bran and ground nut oil cake in 1:1 ratio. Parameters and index of fit (IF) for different models fitted for the growth of *Etroplus suratensis* fed with four different feeds were shown in table 1.

Extensive and successful use of the von Bertalanffy occurs for numerous fish species to aid the understanding of growth in relation to reproduction (Lester et al, 2004) fishing mortality (Taylor et al, 2005) and environmental temperature (Pauly, 1980). This clearly confirms the finding of Lester et al. (2004) showing that the model works extremely well when analyzing fish populations at the annual level, and not within the year. The polynomial growth model had more than 95% fit in all treatments. Polynomial growth models have been used to estimate growth of juveniles and fry of fishes. All the linear model could estimate the initial weight approximately and slope is very similar to the instantaneous growth of the organism. The Gompertz model gave a better fit in all treatment expect for vegetables fed *Etroplus suratensis*. This model has been applied with success to young fish (Monteiro, 1989 and Andrade, 1992). The variation in *Etroplus suratensis* may be due to the decrease in weight of the larger fishes resulting in reduction of the average weight of the organism during the intermittent time period.

For many animals the growth rate decrease more rapidly than in the case of the parabolic type of growth and tends to zero as the definitive size and eight is approached (Winberg, 1971). Logistic model could effectively estimate the average growth rate in all treatment and always had more than 90% fit in all treatments. Krebs (1994) considered that the logistic curve is an adequate description for the laboratory growth of organisms with simple life cycle but not for the description of population growth in organisms with complex life histories. The power growth model has been used randomly for comparing growth of fishes and shellfishes. This model is capable of smoothing the irregularities in the estimation. The differences among the various growth models are slight when compared with the variability of field data. For the description of young fish growth the parabolic or the Gompertz models seem to be the most appropriate. The von Bertalanffy equation or some modified form adjusted to seasonal growth is preferable for long lived fish. The results of the present study however contradicts the general belief that a nutritionally complete, formulated diet like commercial shrimp feed had a relatively lower growth rate of 0.013g/dy. The result indicates that the young fishes preferred their natural diet like vegetable matter and periphyton than the pelleted feeds. The farmers were also of the opinion that the vegetable mixture chopped and soaked in water for a couple of days showed good acceptance.

Conclusion

The growth rate was found to be high in fishes fed with vegetables followed by rice bran and ground nut oil cake. The best index of fit was for the polynomial function and it is an ideal model for small fishes reared for short duration under controlled conditions. Von Bertalanffy model gave the least index of fit value indicating that the model is suitable only for long term studies and not for juvenile fishes. Both linear and non-linear models gave good index of fit values for the model fitted.

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