American Journal of Life Sciences
2014; 2(2): 57-62
Published online March 20, 2014 (http://www.sciencepublishinggroup.com/j/ajls)
doi: 10.11648/j.ajls.20140202.14

Comparative studies on specific growth rate and feed conversion efficiencies of Schizothorax Niger and Schizothorax esocinus

Aijaz Ahmad Bhat*, Ulfat Jan, G. Mustafa Shah

P. G. Department of Zoology, University of Kashmir J&K, India

Email address:
showkat80ahmad@gmail.com (A. A. Bhat)

To cite this article:
Aijaz Ahmad Bhat, Ulfat Jan, G. Mustafa Shah. Comparative Studies on Specific Growth Rate and Feed Conversion Efficiencies of Schizothorax Niger and Schizothorax Esocinus. *American Journal of Life Sciences.* Vol. 2, No. 2, 2014, pp. 57-62.
doi: 10.11648/j.ajls.20140202.14

Abstract: Schizothoracinae being a native fish species of Kashmir and its population is being declining day by day. Hence an attempt has been made to culture the fish on artificial diet and observe the effect of artificial diet on the growth and feed conversion efficiency. For this work three water bodies have been taken Beerwa spring, Akad river tributary and kokernag fish hatchery, in which two species of Schizothoracinae viz, Schizothorax esocinus and Schizothorax Niger were reared. The diet provided was made of different ingredients. The SGR results observed at three sites in case of S. Niger at control were 1.1 gms/day, 2gms/day and 1.93 gms/day and in culture were 2.3 gms/day, 2.63 gms/day and 1.93 gms/day respectively. S. esocinus under control at three sites has shown 0.93 gms/day, 1.66 gms/day and 0.93 gms/day and during the culture has shown3.86 gms/day, 3.63 gms/day,and 3.36 gms/day respectively. Feed conversion efficiency observed under controlled conditions in S.Niger at three sites were 0.27 gms/day, 0.5gms/day, and 0.48 gms / day and under culture were 0.57 gms/day, 0.65 gms / day, 3.03 gms / day respectively. Whereas FCR observed at three sites under controlled conditions in S. esocinus were 0.23 gms/day, 0.41 gms/day,0.23 gms/day and under culture were 0.96 gms/day,0.90 gms/day and 0.84 gms/day respectively.

Keywords: Schizothorax Niger, Schizothorax Esocinus, Diet, SGR, FCR

1. Introduction

Food is considered as an important ecological factor influencing the population dynamics of fishes. One of the essential prerequisites for the successful management of fish culture programmed is a comprehensive understanding of feeding. The increase in cost and demand of feed protein from conventional resources necessitates fish culturists of the developing countries to incorporate cheap and locally available ingredients in fish feeds. Recently the utilization of aquatic plants having high food value are used to supplement fish food has taken a new dimension for producing the much required animal protein at low cost. Fish requires diet relatively higher in protein than those of commercially cultured animals. As protein represents the most expensive component in a formulated diet. It is considerable practical importance to determine the optimum level that will support maximum growth and survival.

Growth is a bioenergetic process, and is defined as a change in its length and weight over a period of time. It indicates the health of the individual and of the population and has been extensively studied for various species of fishes. The growth and age of a fish are closely related to each other and depends on several factors like temperature, photoperiod, quality and quantity of food available, dissolved oxygen, ammonia, salinity, age and the state of maturity of the fish, interspecific and intraspecific competition among the individuals and crowding and disease etc. The rate of growth varies in different species, and in the same species living in different environmental conditions.

Nutrients essential to fish are the same as those required by most animals ,these include water proteins,(amino acids), lipids (fats, oils, fatty acids), carbohydrates (sugars, starch), vitamins and minerals .In addition pigments (carotenoids) are commonly added to the diet of salmonid and ornamental aquarium fishes to enhance their flesh and skin coloration respectively. In their natural environment fish have developed a wide variety of feeding specialization (behavioral, morphological, and physiological) to acquire

essential nutrients and utilize varied food sources. Based on their preference to diet fishes are classified as carnivorous (consuming largely as animal material) herbivorous (consuming primarily on both plant and animal material). However, regardless of their feeding classification in captivity fish can be taught to readily accept various prepared foods which contain the necessary nutrients which loves cold, well oxygenated and pollution free waters.

Schizothoracids, contribute 15-25% in total fish catches in Kashmir. The introduction of the exotic species for commercial gains has resulted in the loss of diversity. The introduction, in 1956, of the exotic common carp, Cyprinus carpio L. caused a sharp decline in the population and almost exterminated the schizothoracine fishes in Kashmir valley Dehadria and Poniah, 1977; Zutshi and Gopal, 2000. Three varieties of Cyprinus carpio L. viz., scale carp, mirror carp and leather carp introduced in the valley led to the predominance of the exotic species over the indigenous fish population (Foteder and Qadri, 1974). The major reasons put forth for the predominance of common carp over the more prized endemic fish fauna are (i) Food competition due to more or less identical food spectra, (ii)Higher fecundity, (iii) Spawning facilities prevailing in the lake, (iv) Shorter incubation period, (v) Better fertilization and (vi) Better growth rate. Similar conditions were also reported by Nikolsky (1960) in Russian lakes.

2. Material and Methods

Fingerlings of S.Niger and S.esocinus were collected from government fish seed hatchery Srinagar. They were transferred to operational sites in oxygen bags. During early period the fingerlings were fed on a commercial diet to acclimatize. After acclimatization for 60 days they were transferred to the hapas at the rate of six fishes in each. Four hapas were set up at each station viz Beerwa (spring), Akad (pahalgam) and Kokernag.

In the laboratory fishes were wiped dry and then weighed. Different morphometric measurements were recorded separately. Total length of the fish from the tip of the snout upto the posterior most extremity of the caudal fin was taken as the total length. Standard length was measured from the tip of the snout upto the caudal peduncle. Maximum depth was measured from the anterior base of the dorsal fin upto the ventral buldging surface of the body. Minimum depth was measured at the base of the caudal peduncle.

All measurements were taken in cms and weighings in grams.

Diet formulation: Diet was prepared through the square method. The diet is mad up of mustard cake, Soya meal, rice bran, wheat bran and fish meal.

Diet Ingredients: The ingredients were dried and grinded to powder form. The proximate composition of three ingredients is shown in table below. After acclimatization six fingerlings were randomly transferred to each aquarium. The average initial body weight of fingerlings was 60g. The feed was applied at the rate of 4% of body weight of the fingerlings throughout the experiment of two years.

Feed ingredients

Group	Fish meal	Soya meal	Mustard cake	Wheat bran	Rice bran
Group 1	50%	23%	11%	9%	7%
Group 2	40%	23%	7%	9%	11%
Group 3	30%	43%	9%	7%	11%
Control	*	*	*	*	*

Particulars	BEERWA control	Culture	AKAD control	Culture	KOKERNAG control	Culture
	S.Niger	S. Niger	S.Niger	S.Niger	S.Niger	S.Niger
Total initial wt.	362	372	445	441	428	441
Total final wt	395	441	505	520	486	532
Feed given	120gms	120gms	120gms	120gms	120gms	120gms
SGR	1.1 gms/day	2.3 gms/day	2gms/day	2.63 gms/day	1.93 gms/day	3.03 gms/day
FCR	0.27	0.57	0.5	0.65	0.48	3.03

Table 1. *Showing SGR and FCR of SNiger at various sites.*

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Weight	Equal variances assumed	.234	.654	-2.971	4	.041
	Equal variances not assumed			-2.971	3.723	.045

Table 2. *Showing SGR and FCR of S. esocinus.*

Particulars	BEERWA control	Culture	AKAD control	Culture	KOKERNAG control	Culture
	S.esocinus	S.esocinus	S.esocinus	S.esocinus	S.esocinus	S.esocinus
Total initial wt.	382	375	435	431	448	461
Total final wt	410	491	485	540	476	562

Particulars	BEERWA control S.esocinus	Culture S.esocinus	AKAD control S.esocinus	Culture S.esocinus	KOKERNAG control S.esocinus	Culture S.esocinus
Feed given	120gms	120gms	120gms	120gms	120gms	120gms
SGR	0.93	3.86	1.66	3.63	0.93	3.36
FCR	0.23	0.96	0.41	0.90	0.23	0.84

Table 3. *Showing SGR and FCR of S. esocinus at various sites.*

Independent Samples Test		Levene's Test for Equality of Variances				
		F	Sig.	t	df	Sig. (2-tailed)
Weight	Equal variances assumed	1.785	.252	-8.648	4	.001
	Equal variances not assumed			-8.648	3.279	.002

Feeding: All ingredients were hand blended and extruded through a commercial food grinder (0.48 cm diameter) without added heat. Diets were dried in a forced air oven (90+15) mechanically crumbled and hand sieved to sizes that could be taken by fish easily without waste. Diets were stored at 20c. Portions were transferred to a refrigerator weakly as needed for feeding.

Feed was rationed at levels high enough to allow fish on all diets to feed to satiation. The feed was applied at the rate of 4% body weight of the fingerlings throughout the experimental period of two years. The diet was fed twice daily (morning and evening) in two equal portions.

Growth and Age Determination: Age and growth studies were performed with hard parts viz, vertebrae and otoliths. The vertebrae were cleared of their adhesive tissues by keeping in hot water for about 15-20 minutes and saparating each vertebrae to be examined with the help of a scalpel or a sharp knife. Subsequently they were immersed in xylol for 3-5 minutes which rendered the rings clearly readable under a compound microscope.

The otoliths removed from each fish were ground on a glass slide in a thick paste of corbrandum powder with water to decrease the thickness. The ground otoliths were washed in water with the help of a small brush and dried. Ultimately, they were kept in xylol for 5-10 minutes to read the rings under microscope. The measurements of distances of all the intermediate rings and the marginal rings from the centrum (vertebrae) and nuclear region (otoliths) were taken with the help of an ocular micrometer.

$$\text{Specific growth rate (SGR)} = \frac{\text{in last weight (g)} - \text{in first weight(g)}}{\text{Cultivation period (day)}}$$

3. Results

3.1. Growth Observations S.Niger

The Specific growth rate observed at three control sites were 1.1gms/day, 2gms /day,1.93gms/day respectively. Where as after rearing the fishes at various sites, specific growth rate increased viz, 2.3gms/day, 2.63 gms/day, 0.03 gms /day. The FCR observed at four control sites were 0.27, 0.5, and 0.48 respectively. Where as the results observed at various rearing sites after culturing the fishes on artificial diet were 0.57, 0.65, and 3.03 respectively.

3.2. Growth Observations S.esocinus

The Specific growth rate observed on S.esocinus at three control sites were 0.93gms/day, 1.66gms /day,and 0.93gms/day respectively. Where as after rearing the fishes at various sites, specific growth rate increased viz, 3.86gms/day, 3.63 gms/day, 3.36 gms/day. The FCR observed at four control sites were 0.23 gms/day, 0.41 gms/day,and 0.23 gms/day respectively. Where as the results observed at various rearing sites after culturing the fishes on artificial diet were 0.57 gms/day,0.65 gms /day, and 3.03 gms /day respectively.

4. Discussion

The State of Jammu and Kashmir is rich in streams, lakes and water reservoirs. The Himalayas are the main watersheds in the Indo-Gangetic Region, having numerous rivers, lakes and reservoirs. Most fish species inhabiting the Himalayan region are of small size. Their distribution depends on the environmental conditions such as water current velocity, nature of substratum, and the availability of food. Schizothoracinae the cyprinids (also called snow trout's) are believed to have migrated into lakes and streams of Kashmir from central Asian watersheds (Sehgall, 1999), bordered by inner and southern slopes of Hindukush, korakoram and inner ends of North Western Himalayas and Suleiman Ranges. These fishes got isolated in the Kashmir region by land upheavals and evolved into a large number of species now regarded as endemic in valley. (Raina and Peter,1999).In most water bodies of Kashmir like Dal lake, River Jhelum, Manasbal, etc Schizothoracinae are declining due to various reasons like pollution, habitat degradation, introduction of carp ,removal of sand and gravel etc.

Diet and Feeding Process in natural conditions: The results of the present study on feeding habits of Schizothorax Niger and Schizothorax esocinus in nature revealed that both are omnivorous fishes .Gut analysis showed that Schizothorax Niger contains more vegetable matter than animal matter, where as gut content of Schizothorax esocinus contains slightly higher quantity of

animal matter than plant matter. Perhaps this is because of environmental adaptation, availability of food and size of the fish. Imevebore and Bakare (1970) reported grasses, seeds, and decaying plant matter in the diet of cirrhinus citharus. Jan and Das (1970) observed Kashmir fishes prefer phytoplankton's (diatoms, green and blue green algae followed by detritus and sand). The fishes categorized as herbivorous, phytotoxic feeder, feeding by scrapping the food from the rocks and stones, leaching of essential nutrients from larval diets has long been considered a serious problem with water soluble vitamins being the most susceptible (Meyers,1979). Maynard (1979) worked out that excess dietary energy is known to be stored as fat increasing weight without corresponding increase in length. Protein values were less regular, fat decreased with increasing protein to energy ratio with levels ranging from 11.9% of wet weight.

The assessment of biological parameters can be considered as a diagnostic tool to determine the nutritive value of the fish, available information in the feeding plant diet by omnivorous fish revealed that the individuals are incapable of consuming enough plant diet to exhibit growth to support maintenance and even resulted in the loss of body tissue. This may be due to the presence of higher amount of carbohydrate present in the plant diet. Diet of schizothorax richardsonii comprises 75% plant matter and 25% of animal matter (Mir 1986). Khan (1996) observed that the omnivorous fishes do not show marked seasonal variation in feeding activity due to availability of one kind of fish or the other throughout the year. Okeoyo (2007) worked out that species feed predominantly on animal and plant materials. They used seeds, roots, and plant material formed a very reasonable component of its food items (39.40%). Species feed predominantly on animal and plant materials, seeds, roots, and plant materials formed a very reasonable component of its food items (39.40%) (Okeoyo-2007,Wu et al, 1997). Arthur (1976) observed that the composition of the diet of the majority of marine fish larvae which consume copepod nauplii at different frequencies because of their great abundance in the environment as well as their appropriate size as food for fish larvae

Age and Growth: Studies related to age and growth of fish species are of great significance for knowing the changes in the fish population and their subsequent relation to fishing pressure. In nature fishes collected had shown diverse alteration in the age. The age was determined by the help of operculum and otolith studies revealed that fishes collected from nature were of diverse age group. The growth observations revealed that growth depends on food availability, predation and anthropogenic pressures, and other physiochemical parameters. Maynard, (1979) worked out that excess dietary energy is known to be stored as fat increasing weight without corresponding increase in length. Protein values were less regular, fat decreased with increasing protein to energy ratio with levels ranging from 11.9% of wet weight. Better growth performance in carps fed on a diet containing brewery waste has been attributed to the availability of good quality protein as the waste contains essential amino acids like lysine, arginine, and methionine. Social interaction and dominance hierarchy formation can lead to suppression of food intake and growth in subordinate individuals. On a relative basis the demand for protein for somatic growth is known to be greater for smaller than larger fish and conversely the demand for energy is greater for larger than smaller fish. Appelbaum (2002) an increase of feeding level lead to increase of food conversion ratio but with rather the slight increase of specific growth rate. While dry diets promoted higher growth rate than live artemia nauplii alone a combination of the two resulted in the fastest growth. Jena (2006) observed higher growth in terms of live weight gain and specific growth rate in milk fish chanos fry fed at 40% protein level. Appelbaum (2002) reported that an increase of feeding level lead to increase of food conversion ratio but with rather the slight increase of specific growth rate, while dry diets promoted higher growth rate than live Artemia nauplii alone a combination of the two resulted in the fastest growth. Huslop et al, (1978) worked out that haddock Melanogrammus aeglifinus feed a lab ration exhibited poor growth in terms of body length and weight. In India major carp percentage, weight gain of fry increased with an increase in the dietary protein levels up to 45% and therefore the growth increment was insignificant (Singh et al, 1987). Significant higher growth in terms of live weight gain and specific growth rate in milk fish chanos chanos fry feed at 40% protein level (Jena, 2006).

Feeding and Growth in captivity: Studies on feeding and growth revealed feeding has a profound effect on the growth of fishes. When S.Niger and S.esocinus were fed on artificial diet, having different compositions of rice, mustard cake, soya meal, wheat bran and rice bran and cultured at different sites, they showed variation in growth . The Specific growth rate observed at three control sites were 1.1gms/day ,2gms /day,1.93gms/day respectively. Where as after rearing the fishes at various sites , specific growth rate increased viz, 2.3gms/day, 2.63 gms/day, 0.03 gms/day. Fishes particularly at akad has shown better results of growth because the food provided to them they used that properly . Food rich in nutrients has shown better growth results. Similar findings have been observed by various workers. Singh et. al., (1987) observed percentage weight gain of fry increased with an increase in dietary protein levels up to 45% and then after the growth increment was insignificant. Dabrowskii (1977) reported that protein requirement of 45.6% has been recorded in case of grass carp fry, Chiropterans and nematodes as parts of the components found in the stomach of the species. Shabir et al., (2003) reported that weight gained by hybrids on wheat bran (1.60+-0.14g) was higher than the cirrhinus mrigila which gained 0.19+-0.2g weight on wheat bran. William (1995) observed maximum weight gain in fish fed on a diet containing 35% corn DGS. However, the maximum protein efficiency ratio was recorded in fish fed on a diet containing 49% DGS with synthetic lysine and tryptophan. Oreochromus niloticus fry feed on a practical diet containing

40% protein shows significant growth (Alhafedh, 1999). Diets containing excessive protein will generally be less cost effective and produce excessive nitrogenous wastes. Xic et. al, (2001) worked out that digestible energy content for smaller, rapidly growing fish, large mullaray is consumed relatively more lower energy diet (compared with HE diet), than small fish presumably to meet a greater demand for metabolic energy. However, the greater overall relative feed intake demonstrated by large mullaray was likely compensatory as indicated by the initial body composition. Najia (2003) worked out that crude protein contents in wheat bran used in the present study was comparatively higher (14.52%) than the wheat bran (13.81%) used for Cirrhinus mrigale. Shabir et. Al., (2003) reported that weight gained by hybrids on wheat bran (1.60+-0.14g) was higher than Cirrhinus mrigale which gained 0.19+-0.2g weight on wheat bran. Labeo rohita gained 2.63+-0.45g body weight on sunflower meal which is higher than the weight gained by hybrids (1.62+-0.05) (Ali and Salim, 2004). Diets with excessive lipid content with increase lipid deposition to the visceral cavity liver and muscle tissue of fish. (Nanton 2007)

Feed Conversion Efficiency: Growth of the fishes depends upon the food supplied to them or present in the natural environment. During the present study fishes had shown good good results of feed conversion efficiency to the diet provided to them. The FCR observed at four control sites were 0.23 gms/day, 0.41 gms/day,and 0.23 gms/day respectively. Where as the results observed at various rearing sites after culturing the fishes on artificial diet were 0.57 gms/day,0.65 gms/day,and 3.03 gms/day respectively This might be because of the fact that the food was rich in nutrients and fishes utilised them properly particularly at akad. Takeda (1975) reported that fat decreased with increasing protein to energy ratio. Chou and bureau (1977) observed that management of fish feeding in aquaculture can result in significant improvements in the feed. Maynard (1979) worked out that excess dietary energy is known to be stored as fat increasing weight without a corresponding increase in length. Feed conversion efficiency increased with increasing protein level up to 40% and then decreased for the diet containing 50% protein in Nile tilapia (siddiqui, 1988) spinelli (1985) observed that musca domestica (domestic fly) larvae meal in rainbow trout retain instead of fish meal found the feed conversion ratio value as 1.55 and there was statistically no significant difference in the comparison with control groups. Fish regulate feed intake to satisfy their energy requirements (Cho and Kaushik, 1990).Middendrop reported (1995) that good results of feed conversion ratio and when brewery waste along with cotton seed meal was used in the feed. Feed conversion ratio value 2.40-2.78 for the brood rainbow trout fed on cattle liver as wet feed. (Aras, 1993) high feeding rate and frequent feeding lead to the performance (Stickney, 1994) Awaiss et. al., (1998) observed that the highest growth rate and protein efficiency ratio can be obtained by feeding the larvae rotifers in association with a dry diet. Goddard (1996) reported that feed conversion improves increasing feeding frequency. Xie et al, (2001) studied that digestible energy content for smaller, rapidly growing fish, large mallaway in the study consumed relatively more energy diet (compared with the HE diet) than small fish presumably to meet a greater demand for metabolic energy, Seema et al, (2002) studied difference in body weight of hybrids and Cirrhinus mrigala may possibly be due to difference in crude protein contents of rice broken. Appelbaum (2002) reported that an increase of feeding level lead to increase of feed conversion ratio but with rather the slight increase of specific growth rate, while dry diets promoted higher growth rate than live Artemia nauplii alone a combination of the two resulted in the fastest growth. Shabbir et al, (2003) observed that weight gained by hybrids on wheat bran (1.60+-0.14%g) was higher than the Cirrhinus mrigala which gained 0.19+-0.2%g weight on wheat bran. Najia (2003) observed that crude protein contents in wheat bran used in the present study was comparatively higher (14.52%) than the wheat bran (13.81%) used for cirrhinus mrigala. However, body weight gained by Labeo rohita (3.39+_0.0001g) was higher than the value recorded for hybrids Labeo rohita gained 2.63+0.45g body weight on sunflower meal which is higher than the weight gained by hybrids (1.62+_0.05) (Ali and Salim,2004) . Jabeen et al, (2004) reported cirrhinus mrigala gained body weight of 1.17g on cotton seed meal. The body weights gained by hybrids and cirrhinus mrigala were highly on cotton seed meal as compared to other ingredients in both studies. Gul et. al, (2007) worked out protein level in the diet can affect its apparent digestibility coefficient. Species feed predominantly on animal and plant materials, seeds, roots, and plant materials formed a very reasonable component of its food items (39.40%) (Okeoyo- 2007).

References

[1] Zutshi, D. P. and Ticku, A. (1990).Impact of mechanical deweeding on Dal lake ecosystem. Hydrobiology. 200/201: 419-426.

[2] Fotedar, D. N. and Qadri, M. Y. (1974). Fish and fisheries and the impact of Cyprinus Carpio L. on endemic fish. J. Sci. univ. Kash. 2 (1-2): 79-90.

[3] Raina, H.S. et al., 1985 Prospects and problems of snow trout culture in Kashmir. zoological orientalis :24-30

[4] Jan N.A and Das, S.M. (1970) Quantitative and qualitative studies on the food of eight fishes of Kashmir valley ichthyologic.10: 21-27.

[5] Meyers .E.P (1979) Formulation of water stable diets for larval fish's pp.13-20.In; J.E.Halver and K.Tiewas 2.Heenemann, Berlin, Germany.

[6] Maynard, L.A, Loosli, J.K, Hintz, H.F and Warner, R.G (1979). Animal nutrition, 7th ed. McGraw hill, New York.

[7] Wu, Y.V; Rosati, R.R, Brown, P.B., (1997). Use of corn derived ethanol co products and synthetic lysine and tryptophan for growth of Tilapia (oreochromis niloticus) fry. Journal of agriculture and food chemistry .45: 2174-2177.

[8] Arthur D.K.(1976)Food feeding larvae of three fisher occurring in the California Current; Sardinops Sagare Engraulise mordax and Trachurus Symmnetricus Fishery Bulletin.U.S.A.,74:517-702.

[9] Appelbaum,S. and J.C. McGee(2007)Effect of diet and light regime on growth and survival of African Catfish (Clarius gariepinus) larvae and early juveniles .Aquaculture Nutrition 4(3);157-164.

[10] Jena S.N., S.K.Greg and U.K. Barman, (2006).Effects of dietary protein levels on growth and production of Chanos chanos (Fosskol) in inland saline ground water laboratory and field studies Aquac.Int, 14; 479-498.

[11] Singh, H. and Das, S.M 1969 Seasonal changes in the morphology of the ovaries of Crossochilus lateus punjabenisis (Heckel) Cypriniformes. Kashmir Science Vol. VI, Nos.1-2 :131-136

[12] Goddard S., (1996).Feed management in intensive Aquaculture Chapman and Hall. New York, 194pp.

[13] Seema, R., M. Salim and M.Rashid 2002. Performance of major carp (cirrhinus mrigala) fingerlings fed on rice polish, maize oil cake and rice broken int. j. Agri. Biol.4(1): 195-196.

[14] Najia, A., (2003) .studies on food conversion ratio of labeo rohita fingerlings fed on rice broken. Wheat bran and maize gluten 30% M.Sc thesis.Univ. Agri. Faisalabad, Pakistan.

[15] Singh.B.N., V.R.P.Sinha and K.Kumar (1987).Protein requirement of an Indian major carp Cirrhinus mrigala (ham) Int.j.Acad.Ichthyol. 8; 71-75.

[16] Okeoyo D.O. (2007) Updating names, destruction and ecology of revirine fish of Kenya in the Athi Galana Sabaki Rive Drainage system.NAGA IC LARM Quarterly : 44-53.

[17] Dabrowski, K, (1977).Protein requirement of grass carp (Ctenopharyngeodon idella).Aquaculture 12; 63-73.

[18] William, H.H, (1955). Cornell agricultural experiment station Memorandum number 337.

[19] Alhafedh Y.S., (1999).Effects of dietary protein in growth and body composition of Nile tilapia, Oreochromis noiloticus L.Aquac. 30:385-393.

[20] Ali.Tand M Salim (2004).Studies on the growth response and feed conversion ratio (FCR)F Labeo rohita fingerlings fed on rice polish ,fish meal and sunflower meal .Int.J.Agri.Biol.6(5),914-917.

[21] Nanton D.A,Vegusdal.A.,Rora,A.M.B.,Recyter.B.,B Bae verfjord,G. and Torstensen,B.E. (2007) Muscle lipid storage pattern. Composition and adipocyte distribution in different parts of Atlantic salmon (salmo salar) fed fish oil and vegetable oil. Aquaculture 265:230-245.

[22] Takeda M, Shimeno S. Hosokawa, H Hedetoshi, K. and Kaisyo, T. (1975). The effect of dietary calorie to protein ratio on the growth feed conversion and body composition of young yellowtail. Bull. Jpn. Soc. Sci. fish. 41:443-447.

[23] Siddiquio, AQ., M.S.Hawaldar and A.A. Adam ,(1988). Effect of dietary protein levels on growth feed conversion and protein utilization in fry and young Nile Tilapia Oreochromis nioticus Aquaculture.70;63-73.

[24] Spinelli J. (985)Unconditional feed ingredients for fish food in Fish feed technology, Pillay T.V.R., (ED)FAO ,Rome Italy ,pp;187-214.

[25] Middendrop A.J, (1995). Pond farming of Nile tilapia oreochromis niloticus in northern Cameron. Aquaculture Research .26: 715-722.

[26] Aras ,N.M.(1993).The effect of juvenile trout (Onchorhynchus mykiss)feeding periodically with cattle spleen on meat quality and yield determining of daily optimum amount of cattle spleen consumptio0n .PhD. thesis Ataturk Univ ,Institute of basic sciences Erzurum.

[27] Stickney, RR. (1994).Principles of aquaculture .John wiley and sons, New York 502pp.