International Journal of Zoology Studies
ISSN: 2455-7269
Impact Factor: RJIF 5.14
www.zoologyjournals.com
Volume 3; Issue 1; January 2018; Page No. 63-67

Comparative analysis of nutritive composition of wild and cultured seabass, *Lates calcarifer* from Krishna estuarine region

Krishna PV, Panchakshari V, K Prabhavathi, SK Saleem Basha
Department of Zoology & Aquaculture, Acharya Nagarjuna University. Nagarjuna Nagar, Guntur, Andhra Pradesh, India

Abstract
Fish is inseparable part of Indian economy its play vital role in human nutrition as an important source of protein. Asian seabass, *Lates calcarifer* is one of the ideal species for diversification of Indian brackish water aquaculture sector which as a good domestic market potential species in Andhra Pradesh. In this study biochemical observations cultured and wild *Lates calcarifer* were comparatively investigated. The biochemical composition such proteins, carbohydrates, lipids, total ash and moisture content were lower in both cage and pond cultured species when compare with wild *Lates calcarifer*. However, not much significant differences were found in moisture and ash content between wild and culture. It is an economically important food fish in the coastal districts of Andhra Pradesh and the fish is of uniform size and has a body shape amenable for easy portioning with minimum wastage.

Keywords: nutrition composition, wild & cultured both cage and pond, *Lates calcarifer*

Introduction
The increase in human population that led to shortage of animal protein sources all over the world has directed the attention to fish as rapid and healthy compensatory source of good quality animal protein. Fishes are quite different from the other animal food sources, because they provide calories with high quality proteins, which contain all essential amino acids in easily digestible form. Health benefits of fish meat has been studied extensively and there are reports which confirm its preventive effects against cardiovascular diseases and some types of cancer, including colon, breast and prostate cancer [1]. Fish mainly assimilates proteins in its muscles. Fish protein has relatively high digestibility and is considered to have high biological and growth promoting value [2]. In terms of nutrition, fish is considered as a rich source of protein, good quality fat and micronutrients [3]. Fish protein produces a good influence on the assimilation of magnesium, phosphorus, and iron. Fat in aquatic animals particularly fishes are associated with a variety of function reflecting special biochemical and environmental conditions, fats are the major metabolic reserve in most of the fishes [4].

Muscle tissue is the main edible portion of fish and responsible of their nutritional value. The culture of the fish may produce a wide range of numbers and diameters of muscle fibers in the flesh, which is related to the growth history of fish. Also, in wild fish the environmental and nutritional conditions may determine different muscle cellularities associated to their particular lifestyle. Flesh quality is a complex set of characters involving intrinsic factors such as texture, chemical composition, colour, fat content [5]. and is heavily influenced by extrinsic factors such as pre and post slaughter handling procedures [6]. The biochemical composition between wild and cultured fish observed by Boressen, [7], Netteleton and Exler, [8]. The chemical parameters of wild fish are strongly influenced by the environmental conditions, which determine the nutrients availability. In cultured fish feeding with artificial diets provides a wide range of nutrients and this fact, not only determines fish growth rate but flesh composition, in particular the lipid content, which may be quantitatively and qualitatively modified [9].

Biochemical studies of fish tissue are of considerable interest for their food values of the fish and for the evaluation of their physiological needs at different periods of life. It is also necessary to have the data on the composition of fish in order to make the best use of it as food. Generally changes in chemical composition of body have been known to reflect storage or depletion of energy reserves. The values of body composition in fishes vary considerably within and between species, with fish size, sexual condition, feeding, time of the year and activity [10]. Food composition, environment and genetic trait are also known to influence chemical composition of fish [11]. Health benefits of fish meat has been studied extensively and there are reports which confirm its preventive effects against cardiovascular diseases and some types of cancer, including colon, breast and prostate cancer. Wild and farmed fish vary in nutrients Nettleton and Exler, [8] are sensorial, chemical and physical properties Lindsay, [12]; Chanmugam *et al*., [13]; Haard, [14]; Orban *et al*. [15]; Cox and Karahadian, [16]; Grigorakis *et al*., [17]; Delwiche and Liggett, [18], with diet being one of the major factors that affects these properties (Lie, [19]; Kinsella, [20]; Cox and Karahadian, [16]; Alasalvar *et al*., [21].

Good quality and adequate nutrition plays a very important role in the expression of mental, physical, and intellectual qualities in humans. They have the ability to reduce blood lipid level, particularly serum triglycerides [22] and have a good source for human nutrition due to their therapeutic role in reducing certain cardiovascular disorders [23]. The per capita availability of fish in India is now 9.5 kg with 56% of Indians

considered fish eaters. It is estimated that by 2010, India requirements for fish will be around 10 million tons [24]. The lower percentage of water, lipids, protein contents and higher energy density present in the fish [25]. An important contribution have been made on the study of the body composition and their significance of different freshwater fishes by following workers; Peyami *et al.,* [26]; Albrektsen *et al.,* [27]; Asdari *et al.,* [28]. In the present has taken for the biochemical observations of both cage & pond cultured and wild fish *L. calcarifer* as candidates species in the Nagayalanka Krishna district, Andhra Pradesh.

Materials and Methods

The fish *Lates calcarifer* were collected from Nagayalanka, Krishna district, Andhra Pradesh and were collected from private fish farm and cage cultured fish also collected from same area (Fig-1). And also wild fish was collected from Krishna estuarine region. The fresh fish were transported to the laboratory and cleaned immediately then dissect and separated meat for further analysis. The fish meat samples were then cleaned with tap water and the muscle tissues were collected from whole fish body. Bones were removed and the boneless muscles were thoroughly mixed to form a composite or representative sample of edible portion of the fish. The whole procedure was done on ice that took about 10 min. The tissue samples were packed in clean labelled ziploc polythene bags and stored at -25^{0}C for further analyses.

Moisture

One gram of meat samples were taken in a weighted Petri dish (W_1) and placed it in the oven at 60ºC for 12 hours or until dried. The dried samples were transferred to desiccators for 5 minutes and weighted. The samples were again kept in oven for one to two hours until constant weight (W_2) was obtained. The loss in weight was recorded as moisture.

$$\text{Moisture (\%)} = \frac{W_1 - W_2}{W_3}$$

Where, W_1 = weight of Petri dish + sample before drying;
W_2 = weight of Petri dish + sample after drying;
W_3 = weight of the sample;

Dry matter percentage was calculated by the following;
Dry matter (%) = 100 - moisture (%)

Proteins

Protein was estimated according to the method described by Lowery *et al*., (1951) [29]. One gram of muscle powder (both cultured and wild fish) was homogenized with double distilled water and the extract was centrifuged at 4000 rpm for 10 minutes. To 1ml of the supernatant, 4ml of Biuret reagent was added and incubated for 20 minutes. The optical density (OD) of the color developed was read at 540 nm using spectrophotometer and the protein was calculated by referring to the standard graph of Bovine serum Albumin. The result was expressed in percentage.

Carbohydrates

Carbohydrate was estimated according to the procedure of Dubois *et al*., (1956) [30]. Sample (25 mg) was homogenized with double distill water and centrifuged: 1ml of 5% phenol solution and 5ml of concentrated sulphuric acid were added and it was allowed to react for 30 minutes and then OD value was measured at 490 nm in spectrophotometer. The standard value was obtained by using glucose and the carbohydrate percentage was then calculated.

Lipids

For the estimation of lipid, chloroform: methanol method was followed (Folch *et al*., 1957) [31]. Sample (400 mg) was homogenized with 5ml of chloroform: methanol mixture (2:1) and filtered by a fat filtering unit. The filtered solution was poured into a previously weighed 10 ml beaker and kept in an oven at 70ºC for 24 hrs. The difference in weight between the empty beaker and the beaker containing fat was expressed as the amount of fat in the sample analyzed.

Total ash

The total ash was determined by burning 2g of dried fish tissue in a pre-weighed China dish and then samples were placed in a muffle furnace for ignition at 550 - 600°C till residue was obtained after 4 - 5 hours. Then the samples residue were placed in desiccators to cool and then weight was recorded. Percentage of ash was obtained by using the following formula.

$$\text{\% of Ash content} = \frac{Wi - Wf}{Wf} \times 100$$

Where,
Wi = Initial weight of sample (before ashing)
Wf = Final weight of ash sample (after ashing)

Results & Discussion

The biochemical composition of *L. calcarifer* wild and cultured fish samples results was given (Table 1) The average percentage of total proteins, lipids, carbohydrates, ash and moisture was in wild *L. calcarifer* was 38.29, 11.5, 1.35, 4.4 and 73.6% respectively. In case of cage cultured fish percentage was 36.5, 10.6, 1.46, 3.9, and 75.3respectively. The pond reared percentage was 34.2, 9.2, 1.88, 3.8 and 74.8 % respectively.

Carbohydrates formed a minor percentage of the total composition of the muscle. The carbohydrate level varies species to species mainly due to the availability of food and feeding habitat of the species and seasonal distribution. In the other hand the carbohydrate percentage in trash fishes is very less in composition to the food fishes or commercially important fishes. Thus differences in biochemical composition among the species may be due to the organic content and composition of the tissues. Studies also show that the biochemical composition content of fish is in constant flux in response to tropic conditions. The amount of organic composition of the species was dependent on the amount to of food that they had received. In general more de growth, (i.e. decreases in cell numbers) may occur when food is scarce for longer period of time [32]. Thus it appears that fish exhibit considerable differences in these chemical compositions among species and they also can vary significantly response to tropic conditions.

Fishes proteins produce a good influence on the assimilation of magnesium, phosphorus and iron. Fat in aquatic organisms are associated with a variety of function reflecting biochemical and environmental conditions. Menendez *et al*.,[33] concluded that the lipids and fatty acids profiles of fish are influenced by nutrients and environmental factors and they are also reflected in biochemical the wild and cultured composition and sensorial quality of fish. Changes in body composition in relation to type of food ingested are a common phenomenon in all species of fish [34, 35]. The quantity and quality of supplementary feed have a pronounced effect in growth rate, feed conversion efficiency and proximate composition of fish [36]. The main constituent of muscle of the fish is moisture, which play an important role in their metabolism. The body moisture undergoes cyclic changes along with fattening of the body [37; 26]. In body composition of the fish are an important attribute which affected by pond ecosystems, fertilization [38], feed ingredients [39] and feeding rates [40]. The protein contributed from the supplementary feed and natural diet combination might be efficiently utilized by the fish for synthesis of tissue protein, leaving the scope for diversion to energy production through domination. Hassan [38] confirmed these results by reporting that meat quality is affected by natural and supplementary feed. Hassan *et al.*, [41] reported that significant difference in carcass composition of fish was observed between the treatments for various treatments. Lopamudra *et al.*, [42] reported that the dietary supplementation of fatty and amino acids may improve the quality of the fish. So, the generated on nutritional composition of different portions of the fish could be use of both consumers as well as processors in utilization different body parts of the fish appropriately. The results of the present study indicated that carbohydrates are little bit high in cultured fish. Among the cultured fish pond cultured goes to better values.

Fish farming has registered a world wide rapid expansion in the recent years, showing the Asian sea bass *Lates calcarifer* production a great increased. Cultured fish food have little bit advantage over wild caught fishery products since they are produced and harvested under controlled conditions and for this reason the hazards associated with fish consumption might reduced. But, fish consuming only natural food have minimal fat and maximum protein accumulation in their body. Information regarding different fish contents such as protein, fats, carbohydrates and other nutrients and how they vary in different fish species used is very important for the consumers. This information helps them to select the most suitable fish species because of having elevated protein contents. It is also facilitates the consumer to select fish of optimum size and suitable for consumption. Further, Important differences were found in some of the quality properties of both wild and farmed *L. calcarifer* that could have been influenced by several factors. However, nutrition, feeding regimes and living conditions seem to have influenced the physicochemical properties the most. In the present study, an overall difference in biochemical parameters found between wild and farmed fish while little differences were found in various parameters. Aquaculturists possess an advantage over fishermen since farmers can control and manipulate different stages of the rearing, feeding and processing steps to deliver to consumers a designer *Lates calcarifer* with preferred quality and nutritional compositions. Hence information about food fish especially their nutritional significance will be needed for their effective utilization to compensate the future needs.

Fig 1: Cage culture at Nagayalanka

Table 1: Biochemical observations of wild and cultured *L. calcarifer*.

S. No.	Biochemical Composition%	Wild	Cultured	
			Cage	Pond
1	Total Proteins	38.29 ± 3.6	36.5±2.9	34.26±2.5
2	Lipids	11.5±1.8	10.6±1.7	9.2±1.6
3	Carbohydrates	1.35±0.11	1.46±0.12	1.88±0.10
4	Ash	4.4±0.5	3.9±0.6	3.8±0.6
5	Moisture	73.6±5.2	75.3±5.6	74.8±5.9

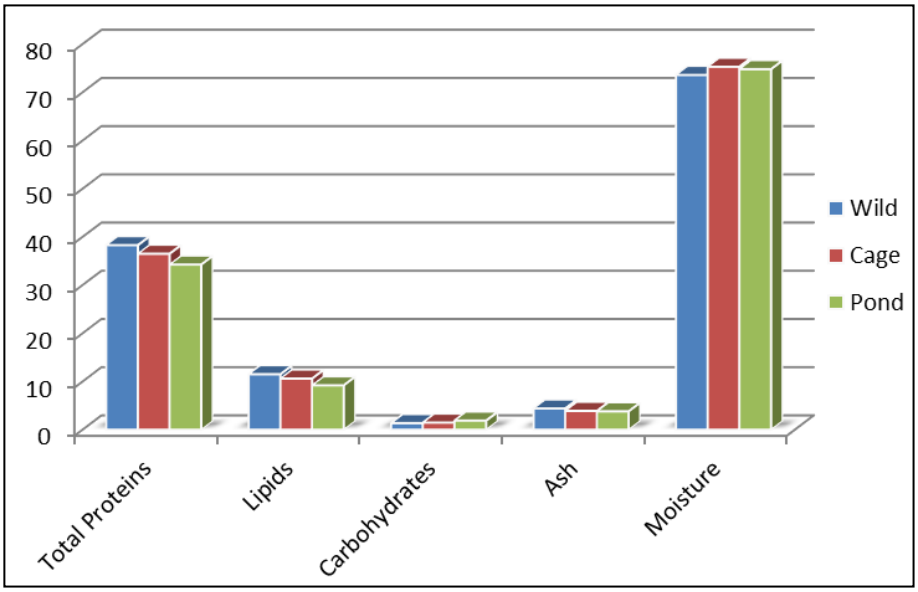

Fig 2: Biochemical observations of wild and cultured *L. calcarifer*.

References

1. Panchakshari V, Krishna PVK, Prabhavathi K, Bhanu Prakash K. Effect of feed and fertilizers on the growth and body composition of air breathing fishes Channa striata and pangasius hypophthalmus fry. International Journal of Advanced Research. 2016; 4(7):1732-1739.
2. Shekhar C, Rao AP, Abidi AB. Changes in muscle biochemical composition of Labio rohita Ham. in relation to season. Indian J Fish. 2004, 51(3):319-323.
3. Stansby ME. Proximate composition of fish. Fish in Nutrition. Ed by Erik Heen and Rudolf erenzer, Fishing News Books Ltd., Ludgate, 110 Fleet Styreet, London, E.C 4, England, 1962.
4. Lovell T. Nutrition and feeding of fish Van Nostrand Reinhold Publishers. New York. USA. 1989.
5. Fauconneau B, Alami-Durante H, Laroche M, Marcel J, Vallot D. Growth and meat quality relations in carp. Aquaculture, 1995; 129:265-297.
6. Gjerdrem T. Flesh quality improvement in fish through breeding. Aquac. Int. 1997; 5:197-206.
7. Borresen T. Quality aspects of wild and reared fish. In: Huss, H.H., Jacobsen, M., Liston, J Eds., Quality Assurance in the Food Industry. Elsevier Ltd., Amsterdam, 1992.
8. Nettleton JA, Exler J. Nutrients in wild and farmed fish and shellfish. Journal of Food Science, 1992; 57(2):257-260.
9. Izquierdo MS, Obach A, Arantzamendi L, Montero D, Robaina L, Rosenlund G. Dietary lipid sources for sea bream and sea bass: growth performance, tissue composition and flesh quality. Aquac. Nutr. 2003; 9:397-407.
10. Weatherley AH, Gill HS. The biology of fish growth. Academic Press, London, UK, 1987.
11. Oni SK, Olayemi JY, Adegboye JD. The comparative physiology of three ecologically Rupel. Synodonts schall. Block and Schneider and Tilapia zilli Gervais. J Fish. Biol, 1983; 22:105-109.
12. Krishna PV, Gopi G, Hemanth Kumar V, Bhanu Prakash K. Comparative study of meat composition of Catla catla, Labeo rohita, Cirrhinus mrigala and Pangasius hypophthalmus under different treatments, International Journal of Advanced Research. 2015; 3(10):480-485.
13. Lindsay RC. Comparative sensory analysis of aquacultured and wild yellow perch Perca flavescens fillets. Journal of Food Quality, 1980; 3:283-289.
14. Chanmugam P, Boudreau M, Hwang DH. Differences in the w3 fatty acids contents in pond-reared and wild fish and shellfish. Journal of Food Science. 1986; 51(6):1556-1557.
15. Haard NF. Control of chemical composition and food quality attributes of cultured fish. Food Research International, 1992; 25:289-307.
16. Cox DH, Karahadian C. Evaluation of microbial counts, nucleotide degradation, and sensory attributes of cultured and wild yellow perch Perca flavescens during refrigerated storage. Journal of Aquatic and Food Production Technology. 1998; 7(1):5-26.
17. Grigorakis K, Taylor KDA, Alexis MN. Organoleptic and volatile aroma compounds comparison of wild and cultured gilthead sea bream Sparus aurata: sensory differences and possible chemical basis. Aquaculture. 2003; 225:109-119.
18. Delwiche JF, Liggett RE. Sensory Preference and discrimination of wild-caught and cultured yellow perch Perca flavescens. Journal of Food Science. 2004; 69(4):144-147.
19. Lie Ø. Flesh quality – the role of nutrition. Aquaculture Research. 2001; 2006:32(1):341-348.
20. Kinsella JE. Fish and sea foods: nutritional implications and quality issues. Food Technnol. 1988; 42(5):146-150,160.
21. Alasalvar C, Taylor KDA, Zubcov E, Shahidi F, Alexis M. Differentiation of cultured and wild sea bass Dicentrarchus labrax: total lipid content, fatty acid and trace mineral composition. Food Chemistry, 2002;

79:145-150.
22. Boberg M. Clinical effects of fish oil. Narings one word forsking, 1990; 34:133-134.
23. Stickney RR, Hardy RW. Lipid requirement of some warm water species. Aquaculture, 1989; 79:145-156.
24. Gopakumar K. Indian Aquaculture. Jour. Of Aquaculture, 2003; 13(1/2):1-10.
25. Dempson IB, Schwarz CJ, Shears M, Furey G. Comparative proximate body composition of Atlantic salmon with emphasis on parr from fluvial and lacustrine habitats. J Fish Biol, 2004; 64:1257-1271.
26. Peyami FY, Afser MR, Nisar SK, Anis AB, Choudhary. Body composition and caloric value of a teleostean fish, Etropiichthys Vacha Ham. Aquculture. 7(1):111-116.
27. Albrektsen S, Mudheim H, Aksnes A. Growth, feed efficiency, digestibility and nutrient distribution on Atlantic cad Gadus morhuo fed two different fish meal qualities as three dietary levels of vegetable protein sources. Aquaculture, 2006; 261:626-640.
28. Asdari R, Aliyu-Paiko M, Hashim R, Ramachandran S. Effects of different dietary lipid sources in the diet for Pangasius hypophthalmus Sauvage, 1878 juvenile on growth performance, nutrient utilization, body indices and muscle and liver fatty acid composition. Aquacult. Nutr, 2011; 17:44-53.
29. Lowery OH, Rosenberg NJ, Fare AL, Randall RJ. Protein measurement with the Follin-Phenol reagent. J Bio. Chem., 1951; 193:265-275.
30. Dubois M, Gills KA, Hamilton JK, Roder PA, Smith F. Colorimetric method for determination of sugars and related substances. Anal. Chem., 1956; 28:350.
31. Folch JM, Lees M, Sloane-Stanley GH. A simple method for they isolation and purification of total lipids from animal tissues. J Biol. Chem., 1957; 226:497-509.
32. Krishna PV, Gopi G, Panchakshari V, Prabhavathi K. Effects of probiotics on the survival and growth of Catla catla, Labeo rohita, Cirrhinus mrigala and Pangasius hypophthalmus under polyculture system. International Journal of Advanced Research. 2015; 3(10):625-632.
33. Menendez JA, Vellon L, Colomer R, Lupu R. Oleic acid, the main monounsaturated fatty acid of olive oil, suppresses Her-2/neu erb B-2 expression and synergistically enhances the growth inhibitory effects of trastuzumab Herceptin in breast cancer cells with Her-2/neu oncogene amplication. Ann Oncol, 2005; 16:359-371.
34. Papoutsoglou SE, Papaparaskeva-papoutsoglou EG. Comparative studies on body composition of rainbow trout Salmo gairdneri, R in relation to type of diet and growth. Aquculture, 1978; 13:235-243.
35. Jena JK, Ayyappan S, Aravindakshan PK, Dash B, Singh SK, Muduli HK. Comparative evaluation of growth and survival of Indian major carps rearing fingerlings. J Aquqcult. Trop. 1998; 13(2):143-149.
36. Afser MR. Observation on caloric value and moisture content of some freshwater fishes. Indian Journal of fisheries. 1992; 4(2):108-110.
37. Hassan M. Influence of pond fertilization with broiler droppings on the growth performance and meat quality of major carps. PhD. Thesis. Deptt. Zool. Fish., Univ. Agri., Faiasalabad, 1996, 195.
38. Krishna PV, Rama Rao N, AVVS Swami, Sharma SV. Probiotics use in biological systems- A Review. J Pharm. Tech and Res. 2009; 1(1):1-16.
39. Hasan MR, Macintosh DJ. Effect of environmental temperature and feeding rate on the growth, feed utilization and body composition of common carp Cyprinus carpio L fry. In Fish nutrition in practice: 4th International symposium on Fish Nutrition and Feeding, 1993, 767-778.
40. Hassan M, Javed M, Mahmood G. Response of different levels of nitrogen from broiler droppings towards planktonic biota of major carps rearing ponds. Pakistan J Biol. Sci. 2000; 3(10):1712-1715.
41. Lopamudra B, Keshari RS, Kumar TR, Kumar DB, Debamita J. Impact of Sewage on Certain Biochemical Profiles of Indian Major Carp, Labeo rohita Hamilton. 2015; 4(8):33-39.