

A study on spatial and seasonal variation of proximate composition in *Polynemus tetradactylus* along the three coastal regions of Andhra Pradesh

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Abstract: Studies on spatial and seasonal variation of proximate composition in *Polynemus tetradactylus* is the significant aspect in fish nutrition. Proximate composition varied in seasonal and spatial wise. More amount of moisture content accumulated in the areas of Yanam in all the three seasons, whereas the quantity of protein, fat and ash content was found more in the area of Amalapuram region in all the three seasons' viz., pre-monsoon, monsoon and post-monsoon. No significant ($p < 0.05$) values were observed in between the regions and, a significance was found in between the species ($p < 0.05$). This study shows that the investigated fish species is a good source of nutrients.

Keywords: *Polynemus tetradactylus*, proximate composition, seasonal variation, spatial variation.

Introduction

Polynemus tetradactylus belongs to the order Perciformes and family Polynemidae is one of the commercially important fish in India and contributes a significant portion to marine fish production in India. Its English name is 'Golden threadfin'. It is one of the important commercial fishes in South Asia and South East Asia and especially in India, Thailand, Vietnam and Bangladesh. It lives over sandy bottoms, regularly entering freshwaters during breeding season and feeds mainly on crustaceans (especially shrimps), small fishes and benthic organisms.

Proximate composition generally comprises the estimation of moisture, protein, fat and ash contents of the fish. The percentage composition of these constituents accounts for about 96-98% of the total tissue constituents in fish (Nowsad, 2007). The assessment of the proximate composition of the fish is not only important to know its nutritive value, but also for its preservation and better processing (Mridha *et al.*, 2005).

The nutritional composition of fish was found to differ between geographical localities (Zenebe *et al.*, 1998). When compared to chicken or beef, fishes have extensively low lipid contents (Nestel, 2000). The changing biological and environmental conditions are a useful tool to the ecologists as they require information on meat composition to help create or maintain dam water atmosphere conducive for rearing quality fish. So far there has been research on other effects and aspects on fish, but not much research has been done on the nutritional quality of the fish living in different ecosystems. The proximate composition of fish is significant since it influences the quality and technological distinctiveness (Huss, 1988). Measurement of proximate profiles such as protein, lipids, and moisture content is often necessary to ensure that they meet the requirements of food regulations and commercial specifications (Waterman, 2000). They also influence postharvest processing and the shelf-life of the fish (Clement and Lovell, 1994). The objective of the current study was to evaluate the proximate composition in the three selected areas of Andhra Pradesh.

Material and methods

Polynemus tetradactylus collected from the markets of Amalapuram, Pallamkurru and Yanam were placed in separate plastic bags, kept in ice box and were bought to the laboratory at regular intervals for two years from March 2015 to February 2017. The samples were washed in running water and the excess water was removed with blotting paper. The wet weight of each individual sample along with petri-dish was recorded carefully and the samples were placed in hot air oven for drying at 80°C for overnight. Moisture, fat, and ash content was determined according to the AOAC (Association of Official Analytical chemists) (2000) and protein by Micro-Kjeldahl method by Bonsdorff and Pearson (1999). All the samples were taken in triplicates and values are expressed as mean \pm Standard deviation.

Moisture content was determined by the standard AOAC method (AOAC, 2000) for which a known weight (10 ± 0.5 g) of sample was placed individually in a moisture dish and dried in a hot air oven set at 105°C until constant weights were obtained. The protein content of the fish was determined by Micro Kjeldahl method (AOAC, 2000). It involves the conversion of organic nitrogen to ammonium sulphate by digestion of flesh with concentrated sulphuric acid in a micro Kjeldahl flask. The digest was diluted, made alkaline with sodium hydroxide and distilled. The liberated ammonia was collected in a boric acid solution and total nitrogen was determined titrimetrically. For the estimation of fat content, the dried samples left after moisture determinations were finely grinded and the fat was extracted with chloroform and methanol mixture (AOAC, 2000).

Results

Proximate composition involves the chemical assessment of muscle constituents, so as to identify the moisture, protein, and fat and ash percentage. The mean values of proximate composition of *Polynemus tetradactylus* muscle during the year 2015 to 2017 from the given three areas, viz., Amalapuram, Pallamkurru and Yanam were represented in table 1 respectively. The overall mean values of proximate composition viz., moisture, protein, fat and ash in seasonal wise and spatial wise were represented in table 1; figure 1. More amount of moisture was found in the region of Yanam followed by Pallamkurru and Amalapuram which has represented in table 1 respectively.

The values of moisture content range in between 74.59 ± 0.39 and 79.45 ± 0.80 in the area of Amalapuram, whereas as the values found were in the range from 76.43 ± 0.46 to 81.62 ± 0.92 in the area of Pallamkurru and the moisture percentage was observed more (82.68 ± 0.35) in the month of November and less (78.92 ± 0.13) in the month of January from the area of Yanam (table 1). In seasonal and spatial wise variation, more amount of moisture content accumulated in the areas of Yanam in all the three seasons, whereas the quantity of protein, fat and ash content was found more in the area of Amalapuram region in all the three seasons viz., pre-monsoon, monsoon and post-monsoon seasons (table 2; figure 1). No significant ($p < 0.05$) values were observed in between the regions and, a significance was found in between the species ($p < 0.05$).

Discussion

The overall average values of moisture were found as 77.00 % in Amalapuram, 78.95 % in Pallamkurru and 80.67 % in Yanam region respectively. These results coincide with the findings of Nabi and Hossain (1989) in *Macrognathus aculeatus*, Salam *et al.*, (1995) in *Puntius gonionotus* and Mazumder *et al.*, (2008) in *Amblypharyngodon mola*. According to Stansby, (1954) and Salam *et al.*, (1995), variation in proximate composition of fish flesh may vary with species variation, season, age and feeding habit of the fish. Generally moisture content shows inverse relationship with lipid content. The inverse relationship has also been reported in our current study of the selected three regions which has been relatively comparable with the study of *Mugil cephalus* (Das, 1978), *Sarda sarda* (Zaboukas, 2006) and freshwater fishes *Mystus seenghala* (Jafri, 1968) and *Ophicephalus punctatus* (Jafri and Khawaja, 1968).

Jacquot, (1961) in his experiment observed that the fatty fish contained 68.6% moisture, semi fatty fish contained 77.2% and lean fish contained 81.8% moisture which showed the inverse relationship between fat and moisture content. In fishes change in protein content during spawning season may occur due to change in the endocrine system that monitors supply of nutrient to gonads from all parts of body including liver and muscles (Sinha and Pal, 1990; Jyotsna *et al.*, 1995). Norman and Cheung, (1980) reported that protein catabolism is reducing with onset of starvation in fishes like snakehead. An increase in protein volume during rainy season in snakehead was also reported by Gam *et al.*, (2006).

The protein percentage of *Polynemus tetradactylus* was found as 19.57 % in Amalapuram, 19.00 % in Pallamkurru and 17.67 % in Yanam region. The range of protein content in the area of Amalapuram was 18.24 to 21.06, whereas in the area of Pallamkurru, the range of protein values were 17.43 to 22.48 and in Yanam region, the protein percentage was found in between 15.34 to 19.83. The results of the present study agreed with previous studies which were reported by Tawfik, (2009) and Di Lena, *et al.*, (2016). According to Ackman, (1989), generally fish can be grouped into four categories according to their fat content: lean fish (< 2%), low fat (2–4%), medium fat (4–8%) and high fat (>8%). The fat content of the given species in all the three areas namely Amalapuram, Pallamkurru and Yanam were found to be slightly lower than the values obtained by Osman *et al.*, (2001), which also used the same fat extraction method by Bligh and Dyer (1959). A slight differences observed in these values could be due to various factors, such as fat content in fish vary according to seasons, species and geographical variations. Age variation and maturity in the same species may also contribute to the noteworthy differences in the total lipid percentage (Piggot and Tucker, 1990).

Conclusion

The study of the proximate composition of *Polynemus tetradactylus* fish from the area of Amalapuram, Pallamkurru and Yanam revealed that it is rich in protein and average in lipid content. The variations in the chemical compositions, particularly in relation to the protein and lipid are indeed noteworthy of study. This study also proves it is a good source of nutrients and can be recommended for human consumption.

Table 2. Seasonal and spatial variation of proximate composition in *Polynemus tetradactylus* during the years 2015 - 2017

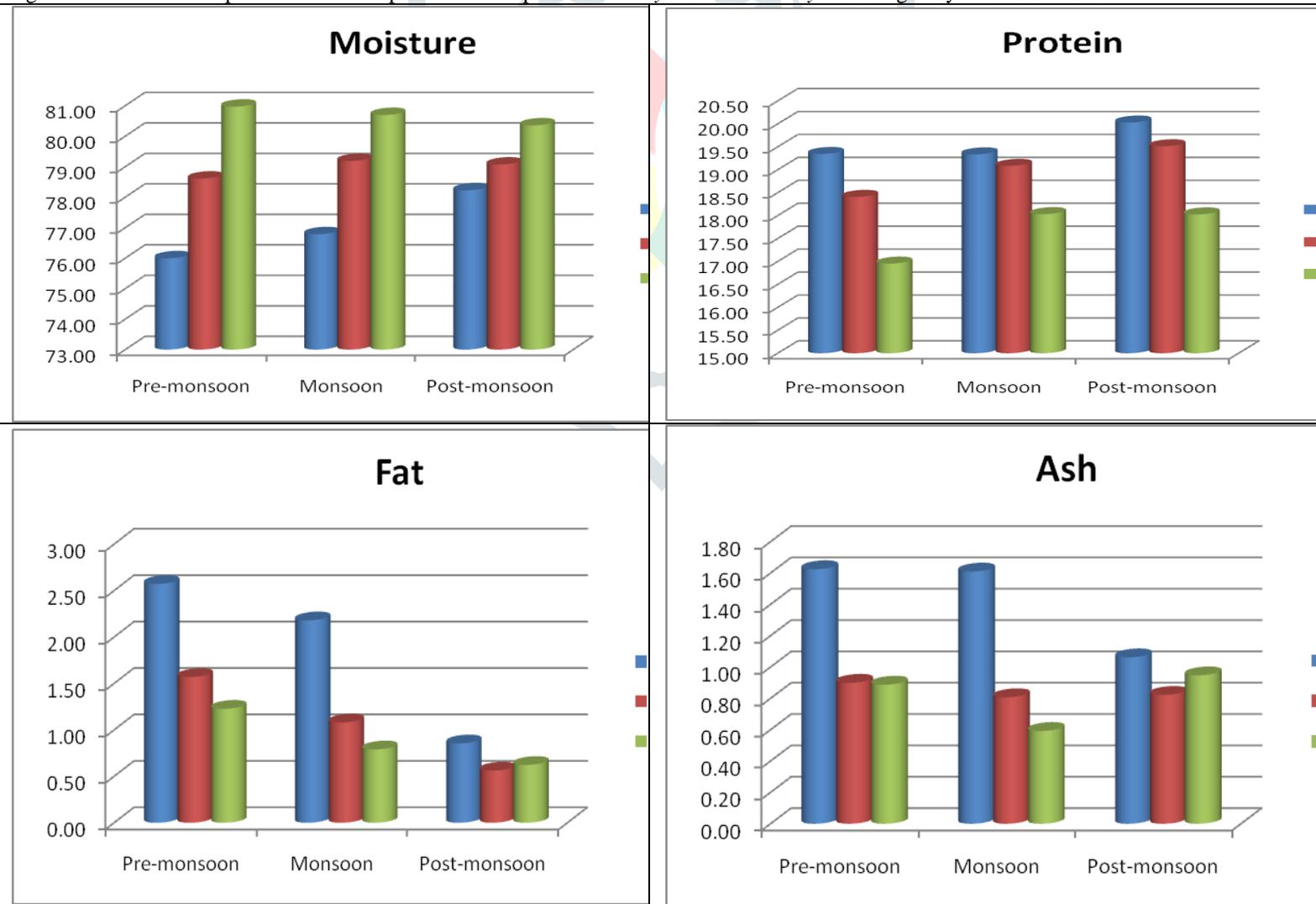
Proximate composition	Area	Pre-monsoon	Monsoon	Post-monsoon
Moisture	Amalapuram	76.00	76.78	78.23
	Pallamkurru	78.61	79.19	79.07
	Yanam	80.97	80.69	80.35
Protein	Amalapuram	19.35	19.34	20.03
	Pallamkurru	18.41	19.09	19.51
	Yanam	16.96	18.03	18.03
Fat	Amalapuram	2.57	2.18	0.86
	Pallamkurru	1.57	1.08	0.56
	Yanam	1.23	0.79	0.62
Ash	Amalapuram	1.63	1.61	1.06
	Pallamkurru	0.90	0.81	0.82
	Yanam	0.89	0.59	0.95

Table 1. Month wise analysis of proximate composition in *Polynemus tetradactylus* during the years 2015 - 2017

Season	Moisture			Protein			Fat			Ash		
	Amala	Pallam	Yanam	Amala	Pallam	Yanam	Amala	Pallam	Yanam	Amala	Pallam	Yanam
Pre-Monsoon	76.34	79.34	81.32	19.82	17.63	16.89	2.56	1.52	1.13	1.32	0.83	0.51
	76.83	78.46	80.46	18.96	18.42	17.61	2.32	1.64	1.25	1.67	0.87	0.86
	75.49	77.35	79.63	19.12	19.31	17.98	2.63	1.78	1.39	1.83	0.92	1.01
	75.32	79.28	82.46	19.48	18.28	15.34	2.78	1.34	1.14	1.68	0.98	1.17
Monsoon	74.86	78.14	81.98	20.12	19.64	16.49	2.86	1.19	1.21	1.93	0.86	0.53
	74.59	80.16	80.64	20.43	17.95	18.32	2.94	0.96	0.68	1.87	0.98	0.39
	78.34	81.62	80.98	18.56	17.43	17.59	1.53	0.83	0.59	1.68	0.68	0.69
	79.34	76.83	79.17	18.24	21.32	19.73	1.39	1.34	0.68	0.96	0.71	0.76
Post-monsoon	78.32	79.37	82.68	19.64	19.47	15.82	1.08	0.83	0.49	0.84	0.53	0.92
	79.45	76.43	80.56	19.33	22.48	18.05	0.96	0.35	0.55	0.68	0.83	0.48
	76.98	79.68	78.92	21.06	18.12	19.83	0.82	0.59	0.62	1.68	0.97	0.84
	78.15	80.79	79.25	20.09	17.98	18.41	0.56	0.48	0.83	1.05	0.96	1.55

Note: Amala: Amalapuram; Pallam: Pallamkurru

Figure 1: Seasonal and spatial variation of proximate composition in *Polynemus tetradactylus* during the years 2015 - 2017



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