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RESEARCH ARTICLE

CHANGES OF BIOCHEMICAL COMPOSITION IN THE MUSCLE TISSUES OF LUTJANUS JOHNII (BLOCH, 1792) AND LUTJANUS RUSSELLI (BLEEKER, 1849) FROM GOPALPUR COAST, EAST COAST OF INDIA.

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Abstract

The biochemical composition such as protein, carbohydrate, lipid, ash and moisture content in the muscle of *Lutjanus johnii* and Lutjanus *russelli* has been carried out during January to December 2017 to know the seasonal changes. They are excellent sources of high quality proteins and biochemical composition. The percentage composition of moisture, protein, carbohydrate, lipid and ash contents showed variations in their abundance in different seasons in both the species. The highest content of moisture was 79.13±1.9712%, protein 19.95±0.6894% in post-monsoon and carbohydrate was 2.31±0.1935% in pre-monsoon recorded in *L. johnii* and highest content of lipid was 4.29±0.2452%, and ash was 3.38±0.3503% in *L. russelli* in pre-monsoon.

Introduction:-

Fishes of the Lutjanidae are generally carnivorous, piscivores or plantivores and are found worldwide in tropical and subtropical regions of all oceans [1]. Among these species, the snapper *Lutjanus johnii* and *Lutjanus russellii* is considered as an esteemed food fish having great potential for export. These are rocky fish and abundantly occur throughout the Indian Coast [2]. The family Lutjanidae contains 17 genera and 109 species, which are mainly confined to tropical and subtropical seas [3], [4]. The sea food like fin fishes and shell fishes have high nutritional and the repented benefits in addition to important source of protein, essential minerals, vitamins and un saturated fatty acids [5]. The American heart association recommended eating fish at least twice per week in order to reach the daily intake of Omega-3 fatty acids [6]. These fishes are commercially known for their delicacy as food fish and have good quality of protein, lipid, carbohydrate and other nutrients. They are caught by various gears such as gill nets; trap hook and bottom trawl, using fishing vessels from small boats and wooden down in artisanal fisheries to large steel ships in industrial fisheries [7], [8]. Snappers are costly food fishes and achieve high market prices worldwide. It has a good market demand because of its delicious and good taste [9], the demand has increased to such extent that there is now interest in the development of culture methods for commercial production and stock enhancement of snappers [10]. For maximum growth, greater food intake, higher feed utilization, higher nutrient retention efficiency and for stable body conformation and composition in fish [11] a factor named the optimum ration level and feeding frequency play a vital role. Increase in growth becomes negligible when the feeding at levels higher than the optimum [12], whereas a sub-optimal ratio may result in reduced growth [13], [10]. Several snappers' species are commercially cultured in floating cages and coastal ponds [14]. Lutjanidae fishes are generally collected during the months of January, February, April, August and October using different types of nets in different places [15].

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Landings of snappers are of significant volume and economic value due to the excellent quality of the meat and high demand, making them some of the most appreciated species in the market today [16]. In south-east Odisha John's snapper *Lutjanus johnii* and *Lutjanus russelli* is an important commercial fish species, both in capture fisheries and in aquaculture.

Materials methods:-

Gopalpur coast is situated at about 16km from Berhampur city and 6 km from Berhampur University. It is located between 19^0 16'N latitude and $84^0$55'E longitude (Figure-1). It is a small fishing town and well known beach resort on the south Odisha coast. The sandy beach is dominated by sand particles. The climate in the region is tropical wet and dry. Varieties of fishes are available at Gopalpur coast. The present study is on biochemical composition of *Lutjanus johnii* and *Lutjanus russelli*. *Lutjanus johnii* and *Lutjanus russelli* is a commercial important fish otherwise known as golden snapper and finger mark respectively [2]. Golden snappers are hard fighting and highly prized table fish. Here in the territory it is most commonly called 'goldy', which is explained by its golden, bronze and occasionally silvery-green body coloration. These are occurring in large schools at depths of 80m. Russell's snapper is a marine fish native to the western Pacific Ocean.

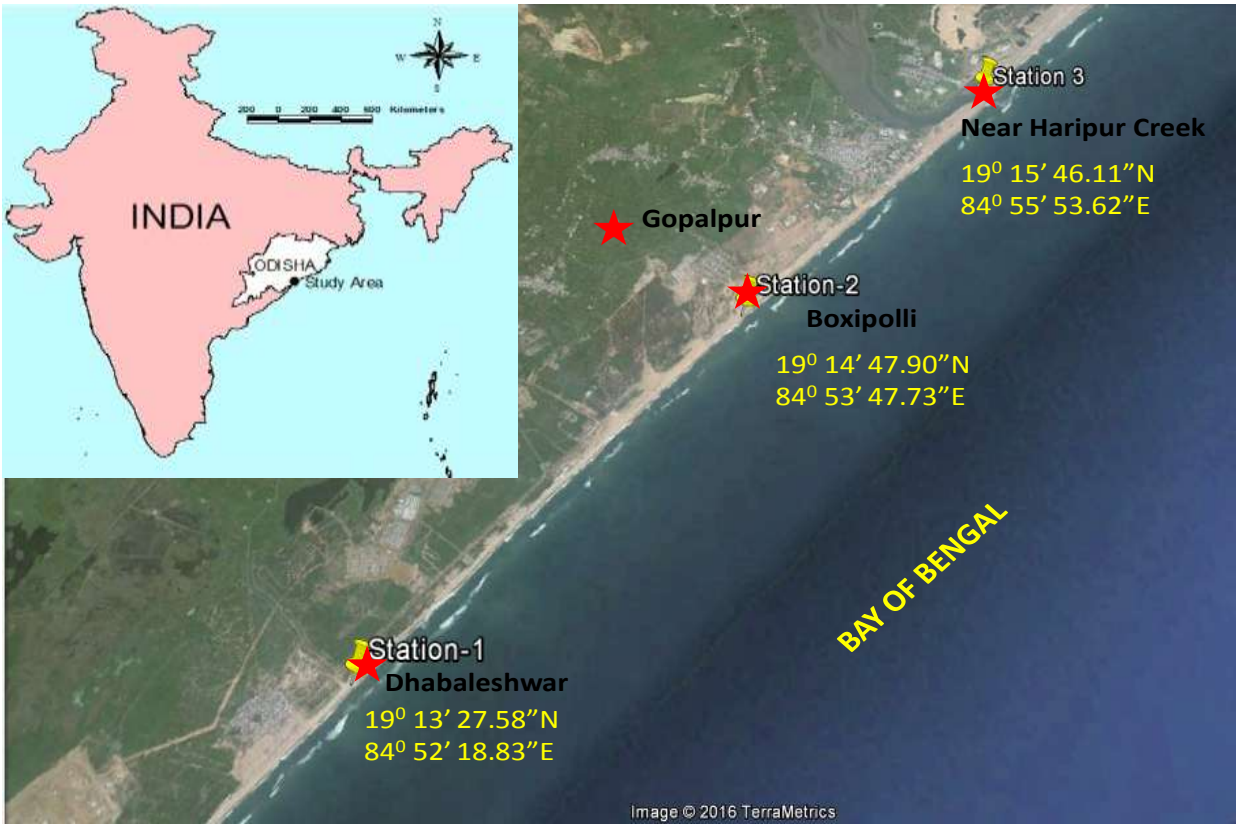

Figure-1:-Map of Gopalpur Coast showing study area.

They live in brackish water in rocky areas and coral reefs at depths of 20-50m. Specimens were collected regularly on monthly basis during January 2017 to December 2017 at Gopalpur Coast from tree landing station. The fishes were brought to the laboratory washed and identified using different literature like [17], [18], [19], [20], [21].

Moisture content:-

The moisture content of the fish was estimated by drying a knowing weight (1g) of fish tissue in a hot air oven at 105^0C for 24hrs. The differences in weight before and after drying are the amount of moisture present and the results are expressed in percentage of wet weight of the tissue [22].

Proteins:-

The protein content of the muscle tissue was estimated following Lowry's method [23].

Lipids:-
The total lipids were extracted from the dry tissues, by following the method of Folsch *et al* [24].

Carbohydrates:-
Anthrone in sulphuric acid can be used for colorimetric determination of sugars, methylated sugars and polysaccharides by Dubois *et al*., [25].

Ash:-
The ash content was estimated by burning oven-dried sample in a muffle furnace at 550^0C [22].

Result:-

Biochemical composition of *Lutjanus johnii*:-
Monthly variation of moisture, protein, lipid, carbohydrate and ash were observed and reported in Table-1. The water, protein, lipid, carbohydrate and ash showed wide variations during the study period. The high percentage of water (79.13±1.9712%) in December, protein in (19.95±0.6894%) in October, lipid (4.14±0.1645%) in July, carbohydrate (2.31±0.1935%) in May and ash (3.3±0.3679%) in January have been observed in *Lutjanus johnii* during January 2017 to December 2017 and lowest percentage of water (67.09±1.8763%) in March, Protein (12.25±0.3294%) in July, carbohydrate (0.92±0.0435%) in December, lipid (2.5±0.1397%) in October and ash (0.89±0.0665%) in October have reported in *Lutjanus johnii* during January 2017 to December 2017.

Biochemical composition of *Lutjanus russelli*:-
Monthly variation of moisture, protein, lipid, carbohydrate and ash were observed and represented in Table-2. The water, protein, lipid, carbohydrate and ash showed wide variations in biochemical composition of muscle tissue. The high percentage of water(77.28±1.8405%) in October, protein (19.23±0.7289%) in February, lipid (4.29±0.2452%) in June, carbohydrate (1.98±0.1746%) in August and ash (3.38±0.3503%) in June have reported in *Lutjanus russelli* during January 2017 to December 2017 and lowest percentage of water (63.21±1.8879%) in February, protein (16.68±0.5262%) in April, lipid (1.46±0.1764%) in October, carbohydrate (0.71±0.0423%) in October, ash (0.44±0.0241%) in October have reported in *Lutjanus russelli* during January 2017 to December 2017.

Table-1:- Percentage composition of the biochemical constituents of *Lutjanus johnii* during Jan 2017-Dec 2017 from Gopalpur Coast.

Month	Moisture	Protein	Lipid	Carbohydrate	Ash
Jan	73.47 ± 1.4383	15.08 ± 0.7327	3.72 ± 0.2132	1.41 ± 0.1119	3.3 ± 0.3679
Feb	75.55 ± 1.8954	16.09 ± 0.8227	3.95 ± 0.187	2.25 ± 0.1801	2.21 ± 0.3066
Mar	67.09 ± 1.8763	16.73 ± 0.9228	3.68 ± 0.2687	2.24 ± 0.1823	2.01 ± 0.2757
Apr	69.67 ± 1.9967	15.77 ± 0.8418	2.94 ± 0.1958	1.66 ± 0.1513	1.96 ± 0.2781
May	76.25 ± 1.9964	16.07 ± 0.9023	3.57 ± 0.2473	2.31 ± 0.1935	2.01 ± 0.2757
Jun	71.56 ± 1.9657	15.79 ± 0.931	3.03 ± 0.2013	1.93 ± 0.1445	1.8 ± 0.2806
Jul	67.5 ± 1.9918	12.25 ± 0.3294	4.14 ± 0.1645	1.65 ± 0.1911	2.05 ± 0.2674
Aug	70.16 ±	13.87 ±	5.21 ±	1.94 ±	1.3 ±

	1.6243	0.4782	0.2144	0.1723	0.1732
Sep	73.37 ± 1.8646	15.5 ± 0.6304	4.78 ± 0.199	1.73 ± 0.1726	2.7 ± 0.9875
Oct	78.14 ± 1.9281	19.95 ± 0.6894	2.5 ± 0.1397	1.22 ± 0.1091	0.89 ± 0.0665
Nov	74.57 ± 1.9829	18.98 ± 0.5059	2.79 ± 0.0345	1.4 ± 0.1046	1.45 ± 0.1636
Dec	79.13 ± 1.9712	16.29 ± 0.351	2.67 ± 0.1726	0.92 ± 0.0435	1.66 ± 0.0915

Table-2:-Percentage composition of the biochemical constituents of *Lutjanus russelli* during Jan 2017-Dec 2017 from Gopalpur Coast.

Months	Moisture	Protein	Lipid	Carbohydrate	Ash
Jan	73.02 ± 1.2745	18.07 ± 0.7005	3.74 ± 0.2170	1.45 ± 0.1118	2.77 ± 0.3038
Feb	63.21 ± 1.8879	19.23 ± 0.7289	2.26 ± 0.1515	1.08 ± 0.1183	1.15 ± 0.1225
Mar	71.63 ± 1.8856	18.16 ± 0.5086	3.69 ± 0.2120	1.39 ± 0.1108	3.24 ± 0.3623
Apr	70.06 ± 1.6996	16.68 ± 0.5262	2.54 ± 0.1508	2.04 ± 0.3602	1.63 ± 0.1384
May	76.22 ± 1.9141	18.1 ± 0.6985	3.6 ± 0.2011	1.32 ± 0.1034	3.26 ± 0.3608
Jun	67.26 ± 1.8579	16.97 ± 0.6633	4.29 ± 0.2452	1.49 ± 0.1241	3.38 ± 0.3503
Jul	75.81 ± 1.8914	17.04 ± 0.6281	3.78 ± 0 .1812	1.7 ± 0.15703	2.38 ± 0.3062
Aug	71.2 ± 1.8669	17.24 ± 0.6767	3.46 ± 0.14506	1.98 ± 0.1746	3.23 ± 0.3632
Sep	76.76 ± 1.7827	17.8 ± 0.7659	3.93 ± 0.2095	1.31 ± 0.0976	3.38 ± 0.36301
Oct	77.28 ± 1.8405	18.63 ± 0.83209	1.46 ± 0.1764	0.71 ± 0.0423	0.44 ± 0.0241
Nov	67.42 ± 1.6322	17.28 ± 0.5888	2.92 ± 0.1628	0.92 ± 0.0912	2.54 ± 0.2953
Dec	66.03 ± 1.4389	17.57 ± 0.6911	3.27 ± 0.1814	1.57 ± 0.1375	2.52 ± 0.3081

Discussion:-

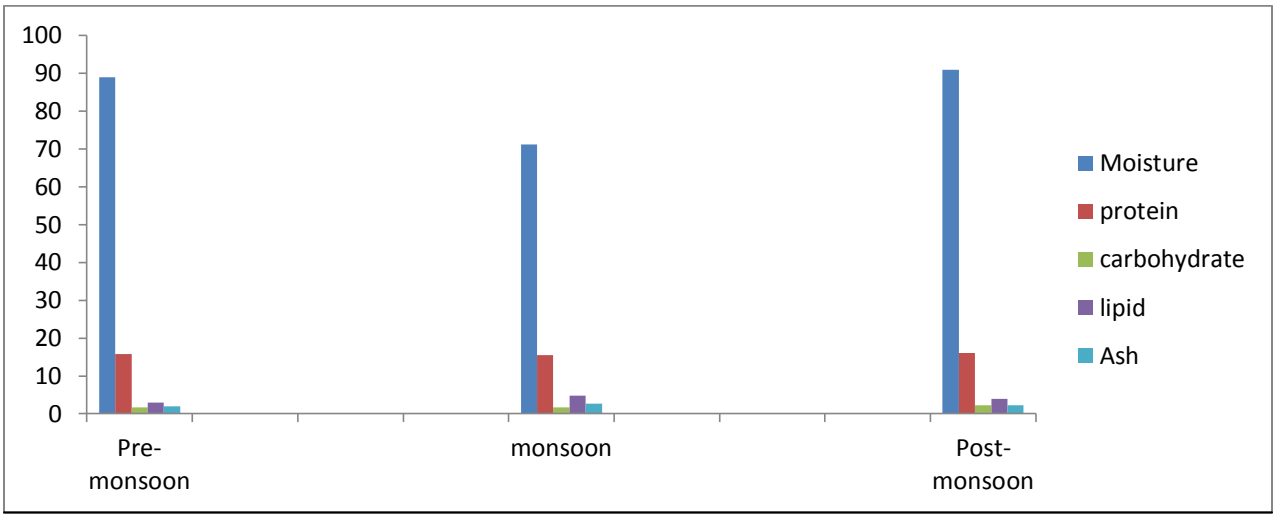

Figure 2:-Percentage composition of the biochemical constituents in *Lutjanus johnii* during in different seasons during January 2017 from Gopalpur Coast.

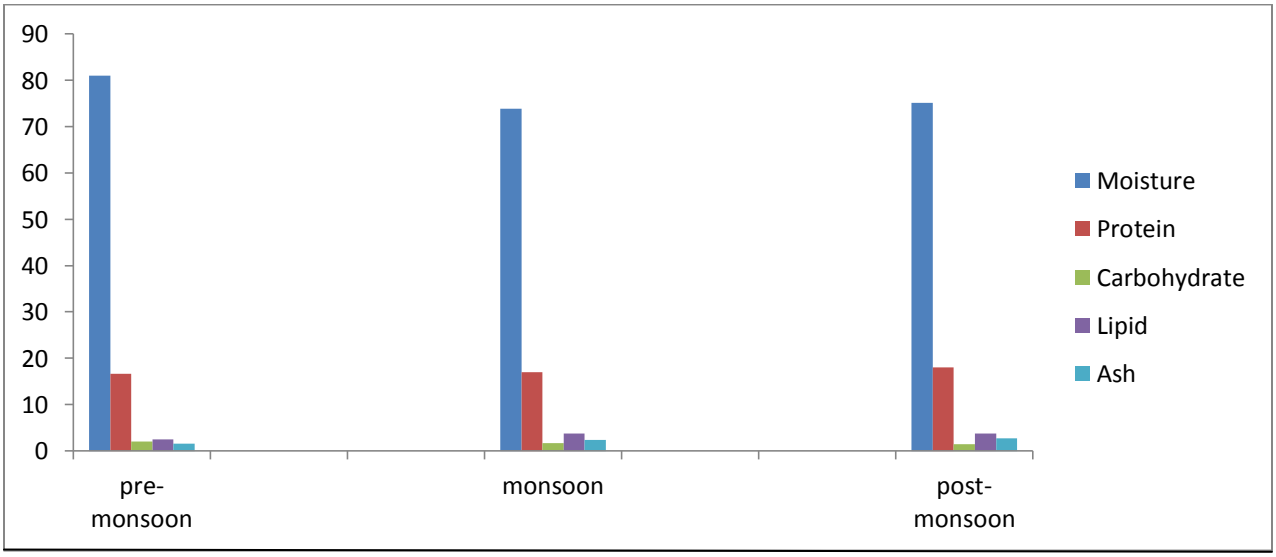

Figure 3:-Percentage composition of the biochemical constituents in *Lutjanus russelli* during in different seasons during January 2017 from Gopalpur Coast.

The chemical composition of the different fish species showed variation depending on seasonal variation, migratory behavior, sexual maturation, feeding cycles etc; these factors are observed in wild, free-living fishes in the open Sea and inland waters [26]. Fish of various species do not provide the same nutrient profiles to their consumers [27] and the nutritive value of a fish varies with season [28]. The protein content of the cell is considered as an important tool for evaluation of the physiological standards [29].

Moisture Content:-

The water content of *Lutjanus johnii* in the present study was higher than *Lutjanus russelli*. There exists an inverse relationship between water and fat content. Low water content was observed during monsoon season in both the species indicating that the water content decreases as fishes advance towards maturity. Low water content is usually associated with relatively high fat content and vice-versa [30], [8], [31], [32], [33] and [34]. [32], [35] and [36] noticed high value of protein and low value of lipid in marine fishes. In the present study *L. johnii* and *L. russelli* moisture content was highest being 79.13±1.9712% and 77.28±1.8405. Similarly also recorded a higher value of

body moisture content was 79.15±4.58% and 78.24±3.58% [37]. Similar result has been reported in juveniles of *P. monodon*, [38]. [39] Observed comparatively lower moisture values of 69.54 to 74.46% in *P. vigil*. In the present study *L. johnii* and *L. russelli* showed lowest moisture content being 67.09±1.8763% and 63.21±1.8879% which is partially in agreement with the result of [38].

Protein:-

Protein is essential for the sustenance of life and accordingly exists in the largest quantity of all nutrients as a component of the human body [40]. The protein value in *P. vigil* was 15.75 to 20.16 %. The protein content of *P.pelagicus* and *P. sanguinolentus* was 0.47 to 15.91 % and 12.81 to 13.6 % respectively [39]. The present result is in partial agreement with the result of [29] and [41]. [42] Has reported that protein content was more in fishes during early summer and winter months corresponding to their maturity stages. In the present study percentage of maximum value *L. Johnii* and *L. russelli* of protein in muscle tissue is 19.95±0.6894% and 19.23±0.7289% and the lowest protein in muscle tissue is 12.25±0.3294% and 16.68±0.5262% during the month of October 2017. This may be due to similar environmental condition in both the study areas.

Lipid:-

During monsoon season in both the species, seasonally high lipid content was observed. During the spawning season the lipid content has been recorded in Bregmaceros mclellandi [43], Mugil cephalus [30] and Ambassis commersoni [44], [45] has observed depleted lipid in the muscle of diacanthus. Partially similar in the present study highest value *L. Johnii* and *L. russelli* is lipid in muscle tissue (4.14±0.1645%) and (4.29±0.2452%) and the lowest values is (2.5±0.1397%) and (1.46±0.1764%) which is partially in agreement with the result of [45].

Carbohydrate:-

Carbohydrates are a group of organic compounds including sugars, starches and fiber, which is a major source of energy for animals. Carbohydrates in fishery products contain no dietary fiber but only glucides, the majority of which consist of glycogen. They also contain traces of glucose, fructose, sucrose and other mono and disaccharides [40]. The carbohydrate in the muscle varied from 0.3 to 0.63% in *P. vigil*, [39], 2.4 to 3.4% in *C. smithii* [46], 0.17% in body meat, 0.24% in claw meat of *S. serrata* [41]. In the present study percentage of highest value in *L. Johnii* and *L. russelli* of carbohydrate (2.31±0.1935%) and (0.92±0.0435%), and the lowest protein in muscle tissue is (1.98±0.1746%) and 0.71±0.0423%). The difference in the carbohydrate in fishes may be due to climatic conditions in different places.

Ash:-

Two fishes are nutritionally equal to one other food fish and they are used for food and for preparing various fish by products [47]. In human nutrition minerals are important, they are essential for body maintenance and some are a part of enzymes [48]. In the present study ash content of *L. johnii* and *L. russelli* was highest being (3.3±0.3679%) and (0.89±0.0665%) and the lowest value was (3.38±0.3503%) and (0.44±0.0241%). The present result is in partially agreement with the result of [49]. Depending on the environment feeding habit and migration mineral content that contribute to the total ash content of the fishes may be change from place to place and region to season [50].

Conclusion:-

The biochemical composition of *Lutjanus johnii* and *Lutjanus russelli* was studied for Moisture content, Protein, Lipid, Carbohydrates and Ash in the muscles tissues from Gopalpur Coast. The moisture content was highest in *Lutjanus johnii* and lowest moisture content value *Lutjanus russelli* was observed to be post-monsoon season. The protein value was highest and lowest observed to be monsoon season in *Lutjanus johnii*. The lipid value was highest and lowest observed to be pre-monsoon and monsoon in *Lutjanus russelli*. The carbohydrate was highest being pre-monsoon season in *Lutjanus johnii*. The lowest carbohydrate value was observed to be monsoon in *Lutjanus russelli*. The ash value was highest and lowest observed to be pre-monsoon and monsoon in *Lutjanus russelli*. One year study for biochemical composition of the fish is not sufficient. Therefore a long term study is required to reach in a better conclusion.

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