

Seasonal variation in the protein composition of *Rastrelliger kanagurta* (Cuvier) from within PFZ and outside PFZ at Sakhri-Natye fish landing centre on the coast of Ratnagiri district at Maharashtra state.

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Abstract

The protein content in the muscles, liver and gonad of *Rastrelliger kanagurta* from Sakhri-Natye fish landing centre at Ratnagiri district coast was studied from Within Potential Fishing Zone (PFZ) and Outside PFZ. The protein study analyzed that winter and summer season. The protein content was increased in male muscle than female muscle, gonad and liver respectively within PFZ than outside PFZ. The protein contents in the body muscle, liver and gonad of *Rastrelliger kanagurta* (Cuvier) were investigated. The compositions varied seasonally in relation to reproductive cycle of the fish. The study also showed that protein was high in the muscles and gonads and in liver from within PFZ than outside PFZ in female and male.

Keywords: Protein content, *Rastrelliger kanagurta*, within PFZ and outside PFZ, Sakhri-Natye fish landing centre.

INTRODUCTION

Satellite based Sea Surface Temperature (SST) images are being used as an input for locating potential fishing zone (PFZ) of productivity and hence fish availability for commercial fishing operations (Pillai, 2005). The PFZ advisories pertaining to these coastal States are being generated using the satellite data sets and the SST and chlorophyll-a were derived from NOAA AVHRR, IRS-P4 OCM and MODIS AQUA. Fish catch data pertaining to the PFZ advisories were collected from both the boats operating within and outside PFZ. Fishes are rich source of animal protein for the population. The nutritive value of fish is recognized all over the world. Fishes is very important for rich source. It is therefore obvious that an understanding of the chemical constitution and nutritional quality of fish is important in its use as food of human. Reconsideration of the literature shows that biochemical composition of different body parts of fish has not received adequate attention. Fish is a major source of food for human nutrition providing an important amount of dietary protein diet in many countries. Fish flesh is easily digestible because it contains long muscle fibres. Furthermore, it has been linked to health benefits, such as the prevention of cardiovascular diseases and some types of cancer, including colon, breast and prostate (Rose and Connoll, 1993; Marchioli, 2001, 2002; Sidhu, 2003).

Fish is a good source of many important nutrients such as proteins. Fish has long been a popular meal of people living around the Konkan coast and has been a major source of food for people living this region. The biochemical contents of fishes are subject to

marked seasonal Potential Fishing Zone and outside PFZ changes, which have been attributed to factors such as maturation, spawning, age, growth and feeding. The mackerel fish, *Rastrelliger kanagurta* is abundant in the Ratnagiri district coasts, at Maharashtra State and forms subsistent fishery. This fish is one of the favorite items of the diet of local people. The paper is an attempt to evaluate the variations in proteins in different body tissues like muscle, liver and gonad in relation to within PFZ and outside PFZ in winter and summer season from males & females fish.

MATERIALS AND METHODS

The PFZ advisories are generated by INCOIS thrice in a week (Monday, Wednesday and Friday), in non-monsoon and non-banned period and cloud free days, There were used by the fishermen along Ratnagiri district coasts. Depending on the location of Potential Fishing Zone (PFZ), i.e. the advisories provided by personal contacts, fax or telephone messages and on Digital Display Boards installed at major landing centres. The boats were selected for the within and outside PFZ region in the Sakhri-Natye fish landing centre at Ratnagiri districts. The PFZ boats and outside PFZ were returned to fishing at Sakhri-Natye FLC and collected the feedback from the users, fishing by the purse-seine and trawl. The pelagic fishes such as mackerel *R. kanagurta* caught by purse-seine within PFZ and outside PFZ region. The PFZ vessels using PFZ-Mission forecast and outside PFZ vessels not using the PFZ forecast. The mackerel samples of *R. Kanagurta* were collected from fishermen catches of within and outside PFZ region of Sakhri-Natye. After bringing them to the research laboratory the total length, body weight, sex and stage of maturity were determined based on findings (Nikolsky, 1963). The fishes washed thoroughly and the surface moisture was removed by blotting paper. The muscular, hepatic and gonadal tissues were dissected, weight to nearest 1 mg using digital electronic balance. The wet weight tissues were taken for further protein analysis. The optical density of the color developed for protein, glycogen and lipid was measured using spectrophotometer. The total protein estimation

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was made employing the method by (Lowry et al., 1951), Glycogen by De-zwaan and Zandee (1972) and Lipid estimation by Barnes and Black stock (1973). Results were expressed as mg/100mg wet weight tissues, biochemical constituents were correlated within and outside PFZ region. The standard deviations expressed were arithmetic means, S. D. and statistical analysis.

RESULTS

The study showed that the analysis of protein constituent from muscle, liver and gonad in the within and outside PFZ during winter and summer season. The mean values for each area were calculated and the results were expressed in mg of protein/100mg of wet wt. tissues

Table 1. Protein (mg/100mg wet wt.) content in male *R. kanagurta* from Sakhri-Natyae.

| Landing centre | Season | Fishing zone | Tissue | | |
|----------------|---------------|--------------|--------------|--------------|----------------------------------|
| | | | Muscle | Liver | Gonad |
| Sakhri-Natyae | Winter season | Within PFZ | 21.03 ± 0.40 | 13.50 ± 1.01 | 21.80 ± 1.23 * °° |
| | | Outside PFZ | 20.08 ± 0.93 | 13.20 ± 1.01 | 21.50 ± 1.20 * °° |
| | Summer season | Within PFZ | 20.84 ± 0.80 | 12.90 ± 0.61 | 21.43 ± 1.21 *** *** °° |
| | | Outside PFZ | 19.90 ± 0.61 | 12.61 ± 0.84 | 21.30 ± 0.61 °° |

•=P<0.001, ••= P<0.01, •••=P<0.05 comparison were made muscle to liver
* =P<0.001, **= P<0.01, ***=P<0.05 comparison were made liver to gonad
° =P<0.001, °°= P<0.01, °°° =P<0.05 comparison were made muscle to gonad

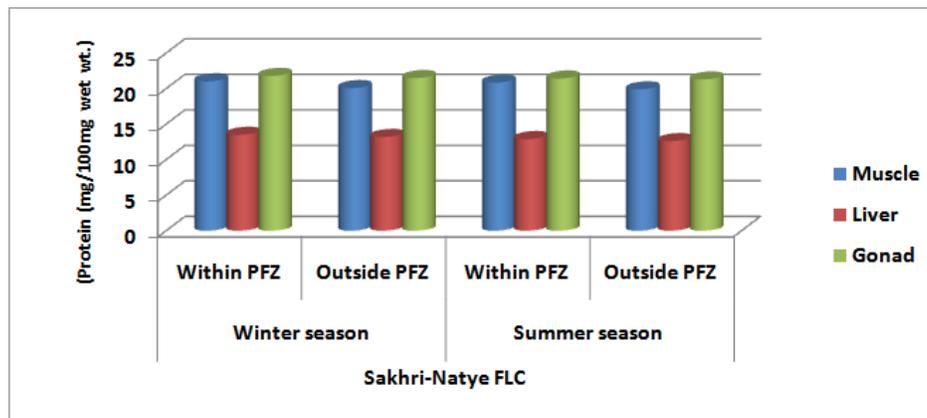


Fig 1. Protein content in male *R. kanagurta*.

Protein Sakhri-Natyae Fish landing centre in males:

In Table. 1. & Fig. 1. Shows that males protein content from muscle was 21.03 ± 0.40 and liver 13.50 ± 1.01 while, in testis it was higher 21.80 ± 1.23 from within PFZ and in outside PFZ males muscle protein content was 20.08 ± 0.93 and in liver 13.20 ± 1.01 while in testis it was protein content was 21.50 ± 1.20 during winter season. The protein content in males muscle was 20.84 ± 0.80 and in liver was 12.90 ± 0.61 while in testis 21.43 ± 1.21 within PFZ and in male muscle 19.90 ± 0.61 and liver protein content was 12.61 ± 0.84 while in testis protein content was 21.30 ± 0.61 outside PFZ during summer season from Sakhri-Natyae fish landing centre.

The comparisons were made liver and gonad significant (P<0.001) and muscle to gonad (P<0.01) where as the no significant value was occurred in muscle to liver within PFZ. In outside PFZ liver to gonad value was significant (P<0.001) and muscle to gonad value was similar (P<0.01) during winter season. The comparisons was made muscle to liver highly significant (P<0.05) and liver to gonad (P<0.05) and muscle to gonad significant (P<0.01) within PFZ, where as to muscle to gonad comparisons were made (P<0.01) and muscle to liver and liver to gonad value was significant in outside PFZ during summer season. Overall result showed that the protein content from winter season significantly high value than summer season, where as the value was highly significant within PFZ than outside PFZ. Therefore the result showed that the protein content was increased within PFZ and decreased outside PFZ during winter and summer season.

Table 2. Protein (mg/100mg wet wt.) content in female *R. kanagurta* from Sakhri-Natye.

| Landing Centre | Season | Fishing zone | Tissue | | |
|----------------|---------------|--------------|--------------|--------------|----------------------------------|
| | | | Muscle | Liver | Gonad |
| Sakhri-Natye | Winter season | Within PFZ | 22.24 ± 0.40 | 14.55 ± 1.45 | 20.41 ± 0.70 °°° |
| | | Outside PFZ | 21.60 ± 1.82 | 12.53 ± 0.80 | 20.22 ± 1.21 ••• ** °°° |
| | Summer season | Within PFZ | 21.55 ± 1.23 | 12.80 ± 0.84 | 20.70 ± 1.40 ° |
| | | Outside PFZ | 19.95 ± 0.61 | 12.53 ± 0.70 | 20.40 ± 0.23 *** °°° |

•=P<0.001, **= P<0.01, ***=P<0.05 comparison were made muscle to liver
 * =P<0.001, **= P<0.01, ***=P<0.05 comparison were made liver to gonad
 ° =P<0.001, °°= P<0.01, °°° =P<0.05 comparison were made muscle to gonad

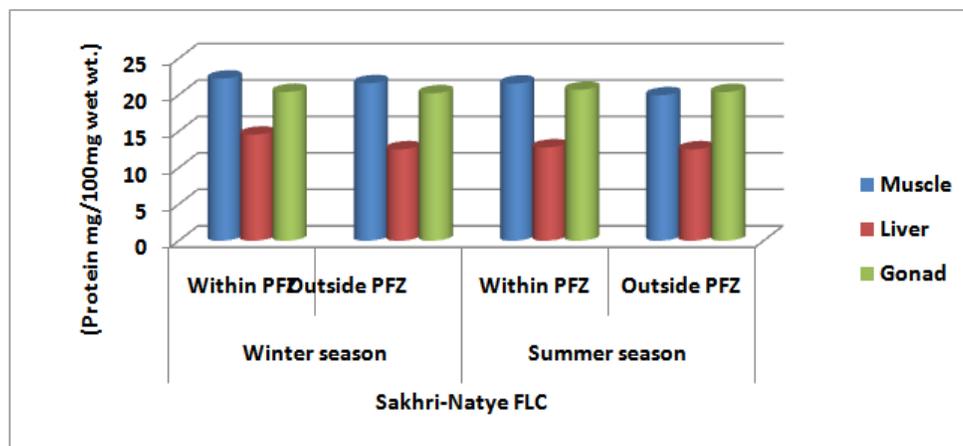


Fig 2. Protein content in male *R. kanagurta*.

Protein Sakhri-Natye Fish landing centre in female

In Table. 2. & Fig. 2. Shows that in female muscle protein content was 22.24 ± 0.40 and in liver 14.55 ± 1.45 while in ovary it was 20.41 ± 0.70 within PFZ. In muscle protein content was 21.60 ± 1.82 and in liver lower to 12.53 ± 0.80 in ovary it was 20.22 ± 1.21 in outside PFZ during winter season. In muscle protein content was 21.55 ± 1.23 and in liver protein content was 12.80 ± 0.84 and in ovary it was 20.70 ± 1.40 within PFZ. From outside PFZ in muscle protein content was 19.95 ± 0.61 and in liver 12.53 ± 0.70 while in ovary it was high 20.40 ± 0.23 during summer season in Sakhri-Natye fish landing centre.

The comparisons were made muscle and gonad highly significant (P<0.05) and muscle to liver and liver to gonad Non significant in within PFZ. In muscle to liver highly significant value (P<0.05) and liver to gonad significant (P<0.01), while muscle to gonad value was high significant (P<0.05) in outside PFZ during winter season. In summer season value was made muscle to gonad

increased high in muscle (P<0.001) highly significant and liver to gonad and muscle to liver Non significant value was observed in within PFZ. In outside PFZ value was made liver to gonad increased high in muscle (P<0.05) highly significant and liver to gonad (P<0.05) muscle to liver Non significant value was observed in outside PFZ.

The overall result showed that the muscle tissue of protein content was increased and p value was significantly high within PFZ than outside PFZ in winter season than summer season, therefore the result showed that the protein content was increased within PFZ and decreased outside PFZ during winter and summer season.

DISCUSSIONS

The protein cycle appears to be having a strong correlation with feeding and spawning reported in a number of fish species. Maximum protein values recorded in male and female during winter season and summers season coincided with a period of intense feeding & maturing stage of this fish. This intense feeding perhaps is more in the seasons, i.e., immediately after spawning as the fish

while spawning incurs energy expenditure along with the loss of gonadal elements and recoups to compensate the expenditure through vigorous feeding activity. According to Standby, (1954) also found similar observations in the trout fish. The present study showed that protein value was high within PFZ than outside PFZ among winter season than summer season.

The study was observed that the seasonal variation of protein of mackerel the proportions of the components muscle tissue varied with the change of season. The seasonal variation found in females greater than the males. Biochemical composition of any organisms are known to vary with season, size of animal, stages of maturity and availability of food, temperature etc. (Soundarapandian and Ananthan, 2008). Meanwhile, for protein contents, no significant differences were found in the *R. kanagurta* species of pelagic fish. The fish were observed to contain with mean value shows Table.1. & Fig. 1. of value 12.90 to 21.80 from within PFZ while, outside PFZ value 12.61 to 21.50. In Table. 2. & Fig. 2. shows the value 12.80 to 22.24 within PFZ while in outside PFZ 12.53 to 21.60. However, the protein content could be considered as insignificant instead, as the values were derived and estimated from the difference of PFZ and outside PFZ. (Payne et al., 1999; Anthony et al., 2000).

CONCLUSIONS

The protein values calculated for different tissues based on the content of within PFZ and outside PFZ during winter and summer season from male and female. It was observed that among different tissues, protein content was maximum in the muscle of females and gonads of females, while it was minimum in the liver of both the sexes from within PFZ than outside PFZ. The present study was also revealed that within PFZ protein content was higher in males and females than the outside PFZ. The overall results showed that the protein content were increased within PFZ than outside PFZ in both sexes during winter and summer season. In conclusion, all marine fish species could be considered as a good source of protein composition and represent a very valuable essential nutrient choice for the maintenance of a healthy body of the people.

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REFERENCES

- [1] Pillai, V. N., 2005. Satellite remote sensing applications for the benefit of coastal fisher folk – a case study. Innovations and technologies in oceanography for sustainable development. *University of Malaya Maritime Research Centre*, pp.83-84.
- [2] Rose D.P., J.M., Connoll. 1993. Effects of dietary omega-3 fatty acids on human breast cancer growth and metastases in nude mice. *J. Natl. Cancer Inst.* 85, 1743-1747.
- [3] Marchioli R., 2001. Efficacy of n-3 polyunsaturated fatty acids after myocardial infarction: Results of gissi-prevenzione Trial. *Lipids*, 36, 119-126.
- [4] Marchioli R., 2002. Early protection against sudden death by n-3 polyunsaturated fatty acids after myocardial infarction: Timecourse analysis of the results of GISSI-prevenzione. *Circ.* 105, 1897-1903.
- [5] Sidhu K.S. 2003. Health benefits and potential risks related to consumption of fish or fish oil. *Regul. Toxicol. Pharm.* 38, 336-344.
- [6] Nikolsky C. V. 1963. The ecology of fishes. Academic Press, New York and London.
- [7] Lowry O H, H. J , Rosenbrough, A. L. Farr and R. J. Randall, 1951. Protein measurement with the folin phenol reagent. *J. Biol. Chem.* 193, 265-275.
- [8] De Zwaan A. and D. I. Zandee 1972. Body distribution and seasonal changes in the glycogen content of the common mussel, *Mytilus edulis*. *Comp. Biochem. Physiol.*, 43A, 53-58.
- [9] Barnes, H. and J. Blackstock, 1973. Estimation of lipids in marine animals and tissues. Detailed investigation of the sulphophovanillin method for total lipids. *J. Expt. Mar. Biol. Ecol.* 12 (1) : 103-118.
- [10] Stansby, M. E., 1954. Composition of certain species of freshwater fish. *Food Res.*, 16, 231-234.
- [11] Soundarapandian, P. and G. Ananthan, 2008. Effect of unilateral eyestalk ablation on the biochemical composition of commercially important juveniles of *Macrobrachium malcolmsonii*. *Int. J. Zool. Res.*, 4(2):106-112.
- [12] Payne, S. A., B. A., Johnson and R. S. Otto, 1999. Proximate composition of some north-eastern Pacific forage fish species. *Fish Oceanography*, 8(3), 159-177.
- [13] Anthony, J.A., D.D., Roby and K.R. Turco, 2000. Lipid content and energy density of forage fishes from the Northern Gulf of Alaska. *Journal of Experimental Marine Biology and Ecology*, 248: 53-78.