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RESEARCH ARTICLE

SPECIES COMPOSITION OF ORDER STOMATOPODA (CRUSTACEA) AND SOME BIOCHEMICAL ASPECTS OF TWO STOMATOPOD SPECIES AT VISAKHAPATNAM, EAST COAST OF INDIA

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ABSTRACT

The study recorded 26 stomatopod species belonging to 6 families and 11 genera in the trawl net by-catches at Visakhapatnam, east coast of India during February 2008 to January 2009. The family Squillidae (54.16%) was the dominant among the 6 families recorded. Species-wise composition showed that *Oratosquilla anomala* (34.34%) and *Harpiosquilla harpax* (29.80%) were the dominant species followed by *Harpiosquilla annandalei* (12.10%), *Oratosquilla nepa* (9.38%), *Lophosquilla costata* (4.83%) and remaining 21 species scarcely distributed in the trawl net by-catches. The mean values of biochemical constituents reported were protein (13.38%), lipid (3.58%), carbohydrate (0.28%) and ash (1.58%) in *H. Harpax*. The mean values of protein (13.78%), lipid (3.73%), carbohydrate (0.24%) and ash (1.35%) were reported in *O. anomala*.

INTRODUCTION

Stomatopods belonging to order stomatopoda, class crustacea are referred as 'mantis shrimp'. Stomatopod crustaceans are common members of benthic ecosystems in tropical and subtropical marine and brackish waters throughout the world. Few species are known from temperate seas. There are 412 species known to inhabit the world oceans (Hans-George Muller, 1994) and 54 species of stomatopods inhabiting in the seas around India (Manning 1968a and 1969b). In the fishery point of view stomatopods are important resources in global fishery especially in Asia (Lui *et al.,* 2007). In these communities, many species of mantis shrimps are commercially valuable species, such as *Oratosquilla oratoria* (Kodama *et al.,* 2004), *Squilla* species (Musa and Wei, 2008) and *Harpiosquilla raphidea* (Yusli Wardiantno and Mashar, 2011). As fisheries product, mantis shrimp can be found regularly in fish markets of several countries, such as Spain, Italy, Egypt and Morocco (Abello and Martin, 1993). In many Asian countries, mantis shrimps are considered a delicacy and commonly eaten by middle and upper class people. Basically, mantis shrimps are an important commercial species, especially in Hong Kong (Lai and Leung, 2003). In India, especially in Andhra Pradesh, stomatopods are non-target species incidentally or accidentally caught by benthic trawl operations. They are treated as by-catch and not used for human consumption. Ever-increasing population and day-by-day depletion of natural resources, it is high time to efficiently use all aquatic forms like stomatopod crustaceans along with other table fish and shrimps as this forms one of the alternative to meet the food demand. In order to assess the nutritional value of stomatopods, biochemical studies are very essential. Among 26 species of stomatopods represented in the trawl net by-catches at Visakhapatnam, *Oratosquilla anomala* and *Harpiosquilla harpax* were dominant in the catches, which can be exploited rationally for economic purpose. The present study focussed on species composition of stomatopods and biochemical composition of *H. harpax* and *O. anomala* represented in the trawl net by-catches at Visakhapatnam.

MATERIALS AND METHODS

Stomatopod samples were collected in fresh condition randomly at 10 days interval from trawl net by-catches at Visakhapatnam fishing harbour (Figure 1) during February 2008- January 2009. The collected samples were stored in crushed ice and immediately brought to the laboratory, where they were washed with tap water and sorted into species-wise. The three samples were pooled and treated as a single sample for that month. The members of stomatopods were identified up to species level using standard taxonomic keys (Manning, 1968a and 1969b; Dingle and Caldwell, 1975; Shanbhogue, 1975a, 1975b and 1985; Ahyong, 2001) and their percentage was calculated in relation to family, species and season (Summer: February – May; Monsoon: June – September; Post monsoon: October – January). For biochemical analysis, fresh muscle tissue was carefully removed from the animal and weighed immediately. This tissue was kept in hot air oven at 60-70^{0}C for about 2-3 days till the moisture was completed evaporated. The moisture content was calculated as the

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difference between the wet weight and dry weight of the tissue. The dry tissue was then ground in a mortar for further analysis. The finely powdered samples were used for the determination of protein, carbohydrate, lipid and ash by using standard methods. The protein, carbohydrate, lipid and ash in the dry muscle tissue was determined by Folin Ciocalteau method of Lowry *et al.,* (1951), Anthrone method of Carroll *et al.,* (1956), Bligh and Dyer (1959) and Hart and Fisher (1971) respectively. ANOVA (Microsoft excel) was carried out for density distribution of stomatopod species.

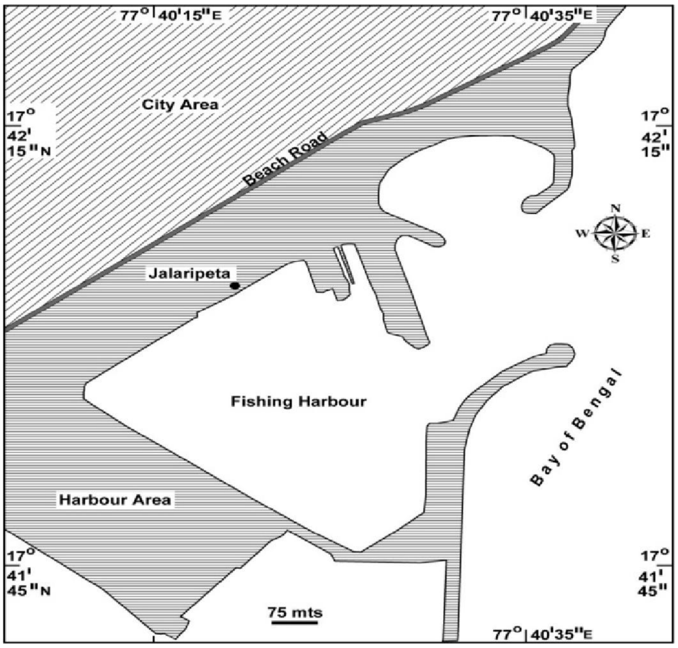

Fig. 1. Map of the study area: Visakhapatnam Fishing Harbor, Bay of Bengal

RESULTS

Family-wise stomatopod composition

The study recorded 6 families namely Gonodactylidae, Odontodactylidae, Lysiosquillidae, Nannosquillidae, Harpiosquillidae and Squillidae. The family-wise stomatopod composition showed that the families Squillidae (54.16%) and Harpiosquillidae (44.41%) were most dominant in the by-catches. Miscellaneous (1.43%) includes Gonodactylidae, Lysiosquillidae, Nannosquillidae scarcely distributed in the by-catches (Figure 2). Seasonally Squillidae was the dominant family during summer season (72.51%) and monsoon (67.35%). Family Harpiosquillidae was dominated in the catches during post-monsoon (62.07%). The families Gonodactylidae (summer and monsoon), Lysiosquillidae (summer), Nannosquillidae (monsoon) and Odontodactylidae (monsoon) were scarcely represented in the by-catches (Figure 3). Analysis of variance showed statistically significant ($p<0.05$) in distribution of stomatopod families.

Species-wise stomatopod composition

The study recorded 26 stomatopod species belonging to 6 families and 11 genera. Among 26 species, *O. anomala* (34.40%) was the dominant species. *H. harpax* (29.80%) was the second dominant species followed by *H. annandalei* (12.10%), *O. nepa* (9.38%) and *L. costata* (4.83%). Remaining 21 species were scarcely distributed in the by-catches (Table 1). Analysis of variance showed statistically significant ($p<0.05$) in distribution of stomatopod species.

Table 1. Species-wise stomatopod composition at Visakhapatnam

S. No.	Species name	Percentage
1	*O. anomala*	34.34
2	*O. nepa*	9.38
3	*O. interrupta*	0.80
4	*O. holoschista*	3.49
5	*O. pentadactyla*	0.09
6	*O. perpensa*	0.27
7	*O. woodmasoni*	0.27
8	*O. gonypetes*	0.09
9	*O. inornata*	0.09
10	*A. fasciata*	0.18
11	*L. gilesi*	0.09
12	*L. costata*	4.83
13	*S. leptosquilla*	0.09
14	*S. scorpio*	0.09
15	*H. harpax*	29.80
16	*H. annandalei*	12.10
17	*H. raphidea*	0.54
18	*H. indica*	0.09
19	*H. melanoura*	1.88
20	*G. demanii*	0.09
21	*G. falcatus*	0.71
22	*L. tredecimdentata*	0.27
23	*L. sulcirostris*	0.09
24	*A. multifasciata*	0.09
25	*A. acanthocarpus*	0.09
26	*H. pulchella*	0.09

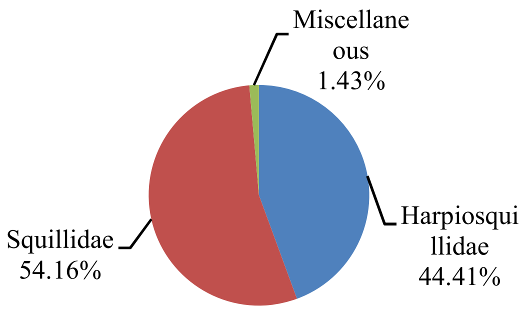

Fig. 2. Family-wise stomatopod composition at Visakhapatnam

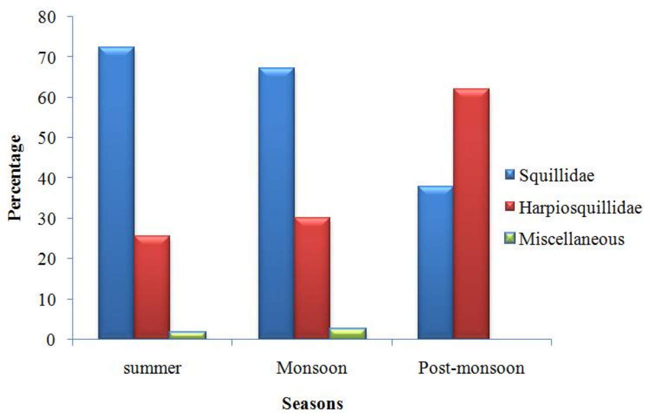

Fig. 3. Season-wise stomatopod composition at Visakhapatnam

Biochemical composition of *H. harpax*

The mean values of water (81.18% ± 0.9178), protein (13.38% ± 0.6648), lipid (3.58% ± 0.3067), carbohydrate (0.28% ± 0.0432) and ash (1.58% ± 0.0619) were reported in Figure 4.

Seasonally highest percentage of water (82.68%) was noticed in summer season, protein (14.03%) in post-monsoon season, lipid (3.96%) in monsoon, carbohydrate (0.38%) in summer season and ash (1.66%) in monsoon season (Figure 5).

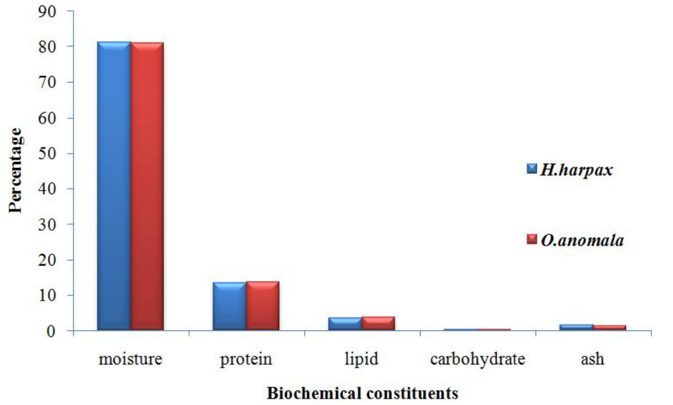

Fig.4. Percentage composition of biochemical constituents in *H. harpax* and *O. anomala*

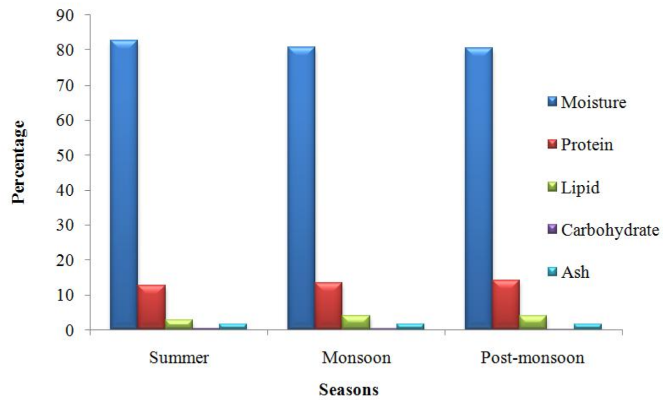

Fig. 5. Season-wise composition of biochemical constituents in *H. harpax*

Biochemical composition of *O. anomala*

The mean values of water (80.90% ± 0.6990), protein (13.78% ± 0.4665), lipid (3.73% ± 0.2903), carbohydrate (0.24% ± 0.0363) and ash (1.35% ± 0.0767) were reported in Figure 4. Seasonally highest percentage of water (82.59%) was reported in summer season, protein (14.34%) in post-monsoon season, lipid (3.99%) in post- monsoon, carbohydrate (0.30%) in summer season and ash (1.42%) in post-monsoon season (Figure 6).

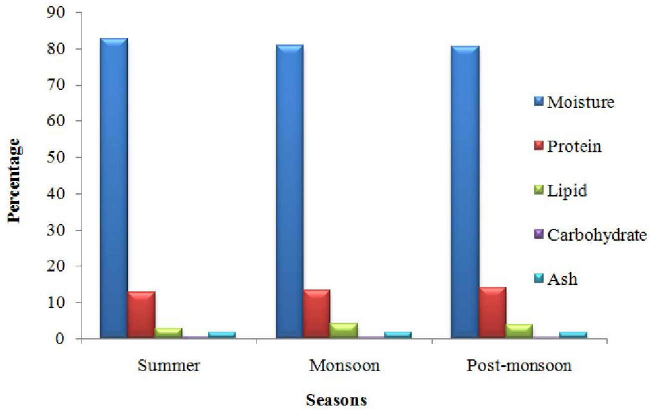

Fig. 6. Season-wise composition of biochemical constituents in *O. anomala*

DISCUSSION

The present study recorded 26 species of stomatopods belonging to 6 families and 11 genera in the trawl by-catches at Visakhapatnam. Gayathri Rao (1987) reported 17 species belonging to 4 families of stomatopods in the by-catches at Visakhapatnam. Devika Nutakki (1990) reported about 21 species belonging to 5 families of stomatopods in the by-catches at Visakhapatnam. This variation may be due to improvement in the mechanization of commercial shrimp trawling. Analysis of percentage composition of the stomatopod families indicated that the Squillidae and Harpiosquillidae were the dominant in the trawl net by-catches at Visakhapatnam. Which may be reflected their abundance in shallow coastal waters. The remaining families (Gonodactylidae, Lysiosquillidae, Nannosquillidae and Odontodactylidae) are sporadically represented in the catches depending on their favorable time period. Season-wise percentage composition of stomatopods indicated that family Squillidae was dominated during summer and monsoon. The family Harpiosquillidae was dominated during post-monsoon. The families Gonodactylidae (summer and monsoon), Lysiosquillidae (summer), Nannosquillidae (monsoon) and Odontodactylidae (monsoon) were scarcely distributed during their respective seasons. Season-wise variation of stomatopods may be attributed to the variation of the fishing effort of the fishing vessels and burrowing activity of the stomatopods. This behavior makes the species less vulnerable to the fishing in areas where fishing is for bidden at night (Froglia and Giannini, 1989). Additionally, weather and sea conditions represent an important influence on the catch-ability of this species. Giovanardi and Piccinctti-Manfrin (1984) and Froglia (1996) also reported that females of mantis shrimp rarely exist their burrow when they are incubating their egg mass. Species-wise percentage composition indicated that the *O. anomala, H. harpax, O. nepa* and *L. costata* were the dominant species in the trawl net by-catches at Visakhapatnam during study period. The sporadic occurrence and dominance of the stomatopod species in the catches reflect their abundance in the coastal waters. Lui King–Yung Karen (2005) reported that family Squillidae was dominated in the crustacean assemblage, accounting to 37% of total number and 48% of the total biomass in the waters of Hong Kong. The present study also reported that the family Squillidae (54.16%) was the dominant family followed by Harpiosquillidae (44.41%) in the trawl net by-catches at Visakhapatnam. Sukumaran (1987) reported that *O. nepa* was the most common species from south Kanara coast, India. In the present study *O. anomala* and *H. harpax* were most abundant and available throughout the year.

The seasonal variations of biochemical constituents in the muscle of *H. harpax* and *O. anomala* observed in the present study may be the results of stage of maturity, availability of food and temperature. Waters (1983) stated that the seasonal variations in biochemical composition are due to an alternate accumulation and expenditure of fat and protein. He also mentioned that shrimps have a minimum fat content after spawning and a maximum at the end of the feeding season. Devika Nutakki (1990) reported the value of water content in *H. harpax* little lesser than the present values. The protein is dominant constituent among biochemical components except water in *H. harpax* and *O. anomala* in the present study. The mean protein content in the present study indicated that similar values were observed in both *H. harpax* and *O. anomala*. Seasonally highest protein content was observed during post-monsoon in both the species. Devika Nutakki (1990) also found similar results in *H. harpax*. The mean lipid content in the present study indicated that similar values were observed in both the species. According to Devika Nutakki (1990), seasonally highest lipid content was observed in monsoon in *H. harpax*. Similar findings were also observed in the present study. Protein cycle and lipid cycle in the muscle of *H. harpax* and *O. anomala* were more or less inversely related in the present study. The inverse relation between lipid and protein was earlier reported by George and Patel (1956), Nair and Prabhu (1990) and Ravichandran (2000). Pillai and Nair (1973) marked an inverse relationship between lipids and moisture content. Similar findings were also observed in the present study. Carbohydrates constitute a meager percentage of total biochemical make up in *H. harpax* and *O. anomala* muscle tissue. Low value of carbohydrate recorded in the present study could be because glycogen in marine animals doesnot contribute much to the reserves in the body. Similar findings were also recorded in shrimps (Nair and Prabhu, 1990; Reddy and Shanbhouge, 1994; Shambu and Jayaprakash, 1994 and Ravichandran, 2000). The ash content gives a measure of the total minerals in the tissue (Viswanathan Nair and Suseela Mathew, 2000). The present study indicated that almost similar values of ash content were recorded in both *H. harpax* and *O. anomala*. According to results obtained in the present study, two species of mantis shrimps are nutritionally equal to any other food fish and they could be used for food.

REFERENCES

Abello, P. and Martin, P. 1993. Fishery dynamics of the mantis shrimp *Squilla mantis* (Crustacea:Stomatopoda) population off the Ebro delta (North Western Mediterranean). *Fisheries Research* 16:131–145.

Ahyong, S.T. 2001. Revision of the Australian Stomatopod Crustaceans. Records of the Australian Museum. 26: 1-326.

Bligh, E.C. and Dyer, W.J. 1959. A rapid method of total lipid extraction and purification. *Can.J. Biochem. Physiol*. 37, 911.

Carroll, N.V, Longley, R.W. and Roe, J.H. 1956. Determination of glycogen in the liver and muscle by use of Anthrone reagent. *J. Biological. Chemistry*, 220: 583.

Devika Nutakki, N. 1990. Stomatopod crustaceans of Visakhapatnam coast with special references to the biology of *Harpiosquilla harpax* (De Hann, 1844). Ph.D. Thesis, Andhra University, Waltair.

Dingle, H. and Roy L. Caldwell. 1975. Distribution, abundance and interspecific agonistic behaviour of two mudflat stomatopods, Oecologia (Berl.), Volume 20: 167-178.

Froglia C, and Giannini S. 1989. Field observations on diel rhythms in catchability and feeding of *Squilla mantis* (L.) 9crustacea, Stomatopoda) in the Adriatic Sea. In: Ferrero E.A. (ed.), Biology of stomatopods. Mucchi, Modena, pp. 221-228.

Froglia, C. 1996. Growth and behavior of *Squilla mantis* (mantis shrimp) in the Adriatic Sea. (*EU Study DG XIV/MED93*/016, Final Report).

Gayathri Rao, T. V. 1987. Systematic and some aspects of ecology of stomatopod crustaceans of Visakhapatnam coast. *Ph.D Thesis*, Andhra University, Waltair.

George, J.C. and Patel, B.S. 1956. The seasonal variation in the fat content of the liver and gonads in a marine and freshwater decapod. *J. Anim. Morph. Physiol.,* 3: 49-55.

Giovanardi, O. and Piccinctti-Manfrin, P. 1984. Summary of biological parameters of *Squilla mantis L.* in the Adriatic Sea. FAO, Fisheries and Aquaculture Reports,290:131-134.

Hans-George Muller, 1994. World catalogue and bibliography of the recent stomatopoda compiled and distributed, Wissenschaftler Verlag, Laboratory for Tropical Ecosystems, Research & Information Service P.O. Box 2268, D-35532. Wetzlar, Germany.

Hart, F.L. and Fisher, H.J. 1971. Modern food analysis. Springer Verlag, Berlin, 230 pp.

Kodama Keita, Shimuzu, T., Yamakawa, T. and Aoki, I. 2004. Reproductive biology of the female Japanese mantis shrimp *Oratosquilla oratoria* (Stomatopoda) in relation to changes in the seasonal pattern of larval occurrence in Tokyo Bay, Japan. *Fisheries Science* 17: 734-745.

Lai, W.C. and Leung, K. 2003. Mantis shrimp found in Hong Kong Waters- A brief look at the Stomatopoda. Invertebrate. 3 - 4.

Lowry, O.H., Rosebrough, N.J., Farr, A.L. and Randall, R.J. 1951. Estimation of protein measurements with Folin-phenol reagent. *J. Biol. Chem,* 193-265.

Lui King-Yung Karen, 2005. Ecology of commercial important stomatopods in Hong Kong, M. Phil, at the University of Hong Kong.

Lui, K.K.Y, Ng, J.S.S. and Leung, K.M.Y. 2007. Spatio-temporal variations in the diversity and abundance of commercially important decopoda and stomatopoda in sub-tropical Hong Kong waters. Estuarine, Coastal and Shelf Science, 72: 635-647.

Manning, R.B. 1968a. Three new stomatopod crustaceans from the Indo-Malagan area. Pro. *Biol. Soc. Wash.* 81: 241-250.

Manning, R.B. 1969b. Note on some stomatopod crustacea from South Africa. Smithsonian Contributions to Zoology, No.1, Ist Edition.

Musa, N. and Wei, L.S.2008. Outbreak of vibriosis in mantis shrimp (*Squilla sp.*). *World Journal of Agricultural Science*, 4 (2): 137-139.

Nair, A.L. and Prabhu, P.V. 1990. Protein concentrates from tiny prawns. *J. Mar. Bio. Ass. India*, 32(1-2): 198-200.

Pillay. K.K. and Nair, N.B. 1973. Observation on the biochemical change in the gonad and other organs of *Uca annulipes, portunus pelagicus* and *Metapenaeus affinis* (Decapoda:Crustacea) during the reproductive cycle. *Mar. Biol*. 18: 167-198.

Ravichandran, R. 2000. Biodiversity, litter processing, leaf preference and growth, biochemical and microbial aspects in crabs of Pichavaram mangroves. Ph. D. Thesis, Annamalai University.

Reddy, H.R.V. and Shanbhogue, S.L. 1994. Biochemical changes in different tissues of the mantis shrimp, *Oratosquilla nepa* (Stomatopoda) during reproductive cycle. *Indian J. Mar. Sci.,* 23: 247-249.

Sambhu, C. and Jayaprakash. 1994. Effect of hormones on growth. Food convertion and proximate composition of the white prawn, *Penaeus indicus* (Milne Edward). *Indian. J. Mar. Sci.,* 23: 232-235.

Shanbhogue, S.L. 1975a. Description of stomatopod larvae from the Arabian Sea with a list of stomatopod larvae and adults from the Indian Ocean and a key for their identification. Part I. *J. mar. bio. Ass.* India, 1975, 17 (2): 196-238.

Shanbhogue, S.L. 1975b. Description of stomatopod larvae from the Arabian Sea with a list of stomatopod larvae and adults from the Indian Ocean and a key for their identification. Part II. *J. Mar. Bio. Asso.* India, 1975, 17 (3): 522-544.

Shanbhogue, S.L.1985. Studies on stomatpoda crustacean from the seas around India. *Recent Advances in Marine Biology*. Pages: 515-565, Editor P.S.B.R. James.

Sukumaran, K.K. 1987. Stomatopod resources of the South Kanara Coast during 1983-86. Marine fisheries information service, Technical and Extension Series, Central Marine Fisheries Research Institute, Cochin, India. No: 83.

Vishwanadhan Nair, P.G. and Suseela Mathew. 2000. Biochemical composition of fish and shellfish Cift. Technology Advisory Series, Central Institute of Fisheries Technology, Cochin, pp 14.

Waters, M.E. 1983. Chemical composition and froze storage stability of spot, *Leiostomus xanthurus. Mar. Fish. Rev*. 44 (11):14-22.

Yusli Wardiatno and Ali Mashar. 2011. Population dynamics of the Indonesian mantis shrimp, *Harpiosquilla raphidea* (Fabricius 1798) (Crustacea: Stomatopoda) collected from a Mud Flat in Kuala Tungkal, Jambi Province, Sumatera Island. *ILMU KELAUTAN*, *Indonesian Journal of Marine Sciences*, Vol. 16 (2) 111-118.

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