TECHNOLOGICAL ASPECTS OF PRESERVATION AND PROCESSING OF EDIBLE SHELL FISHES

II. INFLUENCE OF SEASON ON THE CHEMICAL COMPOSITION OF CRAB *(SCYLLA SERRATA)*

CHINNAMMA GEORGE AND M. ARUL JAMES
Central Institute of Fisheries Technology, Ernakulam, Cochin-11

The purpose of this communication is to bring out the influence of season on the chemical composition of crab, covering a period of 2 years. Changes in moisture, protein, water extractable nitrogen, non-protein nitrogen, glycogen, lactic acid, fat and free amino acid composition of crab meat have been reported on a monthly basis

INTRODUCTION

Though not established itself as an export oriented industry, crab fishery has been gaining more and more importance in recent years. The fishery is seasonal. In Bombay they are collected throughout the year, the peak period being August-October. In Madras, the best season is March-May, though fairly good numbers are also marketed in June, September and December. In West Bengal they are caught during November-February. On the South-West Coast some species are caught from October-April and in Kerala they are caught throughout the year, but plenty during June-December (C S. I.R. 1963). However very little attempt has been made in conserving this valuable protein food by processing into useful preserved products, presumably due to lack of sufficient knowledge on the chemistry and preservation characteristics of the fresh crab. It has already been shown that during icing of fresh crab there is considerable loss of almost all nutrients to the extent of affecting the over-all flavour and nutritive value during further processing (Chinnamma et al, 1970) There is indication that fish and shell fish undergo changes in chemical chara. cteristics according to season (Venkataraman *et al*, 1968, Galtsoff, 1964, Fraga, 1956, Lagendre, 1938). The present paper deals with a study of the seasonal changes in the chemical characteristics of one of the important commercial species of crabs, *Scylla serrata*, caught in Indian waters.

Materials and Methods

To exclude the variations in composition due to the differences in size, sex, maturity, fishing grounds and the stage of *rigor mortis*, only fully grown live female crabs from the same fishing ground and of nearly identical size (length: 12±1 cm) were used. They were collected on newmoon and full moon days of every month, dissected according to Blackwood *et al* (1969), after taking the size-weight measurements. Meat was analysed for moisture, protein, water extractable nitrogen, non-protein nitrogen, glycogen, lactic acid, fat and free amino acids.

Moisture was determined by the method of Jacobs (1959) and protein by the A. O. A. C. (1960) method. Water extractable nitrogen and non-protein nitrogen estimations were carried out by microkjeldahl method. Total fat was estimated by extracting about 1 g of the dried sample with petroleum ether (60–80°C) for about 10–12 hours. Glycogen was estimated by the method of Van de Kleiy (1951) and lactic acid by the method of Barker and Summerson (1941). Free amino acids were extracted with ethyl alcohol and estimated by the standard microbiological assay method.

Results and Discussion

Results of analysis of samples studied during the years 1966-'68 are tabulated and graphically represented. In almost every month of the year egg was noticed and meat content depended upon the quantity of egg present (Table I).

Table-I

Length in cm.	Egg%	Meat%
9.5	Nil	21.78
9.5	32 53	14.45
10.1	Nil	29.57
10.1	20.00	18.40
11.5	Nil	25.25
11.5	12.30	21.94

The graph of meat weight against length shows a linear relationship and during new moon time meat content is more than that in full-moon (Fig I). Figure 2 represents the percentages of moisture and protein contents during full-moon time. Maximum moisture (83.1%) and minimum protein (14.0%) contents are recorded in the month of May and minimum moisture and maximum protein are recorded during October-April. Galtsoff (loc cit), while studying the seasonal variation of American Oyster, observed a decrease in protein content in May and an increase of solids from October-March corresponding to a fall in water content. Dambergs (1964) reported that the seasonal variations in water of cod fillets are opposite to those for protein.

Figures 3 and 4 depict the seasonal variations in percentage composition of water extractable nitrogen (WEN) and non-protein nitrogen (NPN) of crab meat. WEN is maximum during October-January and minimum during May and June in both full-moon and new-moon times. NPN during full-moon time is minimum in August and maximum during November-March; and during new-moon time the maximum is during January to March and minimum during May-October. Figure 5 represents the glycogen reserve of the muscle. It shows wide variation over 12 month period. Analysis during new-moon time shows maximum in February (2.05%) and minimum in October (0.45%), and during full-moon time maximum is in January (2.9%) and minimum in June (0.20%). Figure 6 shows the lactic acid changes due to season. During new-moon time lactic acid increases steadily from 90 mg% in May to 520 mg% in August, then starts declining to 200 mg% in January and again shows steady increase to the maximum value of 535 mg% in March. During full-noon time a distinct pattern or trend is not

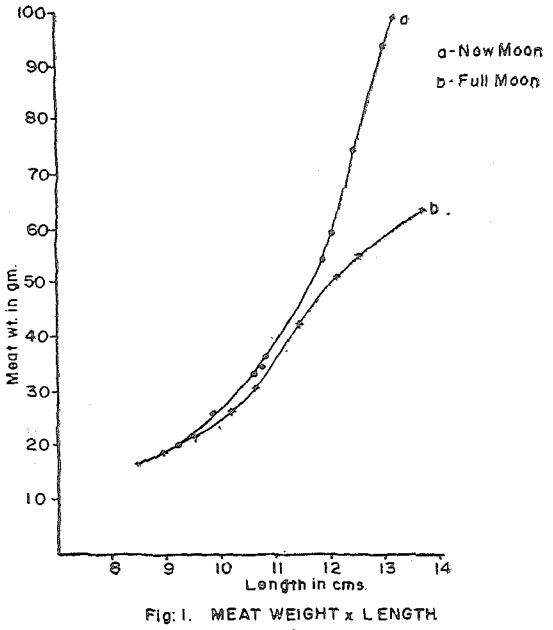

Fig: 1. MEAT WEIGHT x LENGTH

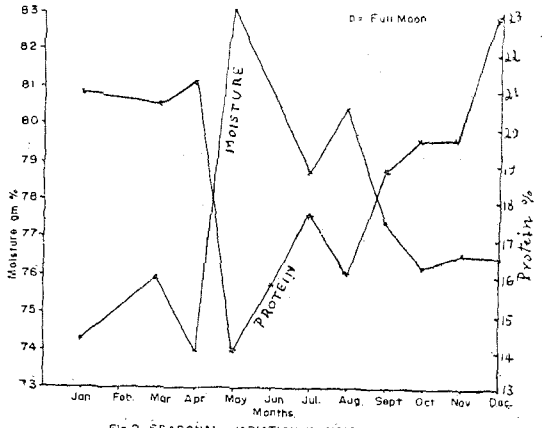

Fig 2 SEASONAL VARIATION IN MOISTURE & PROTEIN

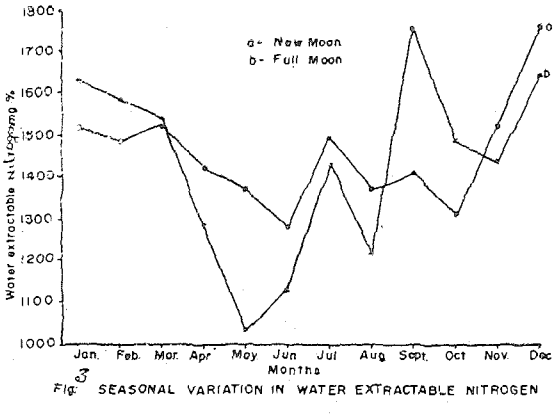

Fig. 3 SEASONAL VARIATION IN WATER EXTRACTABLE NITROGEN

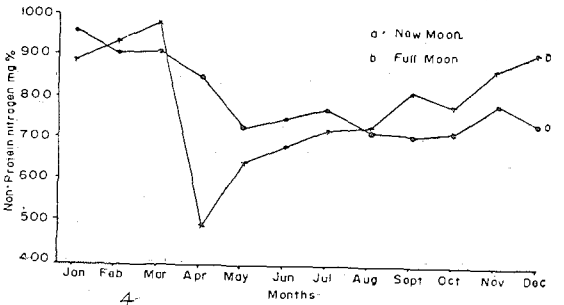

Fig 4 SEASONAL VARIATION IN NON-PROTEIN NITROGEN

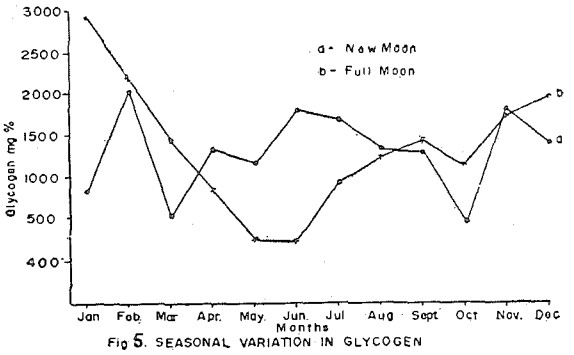

Fig 5. SEASONAL VARIATION IN GLYCOGEN

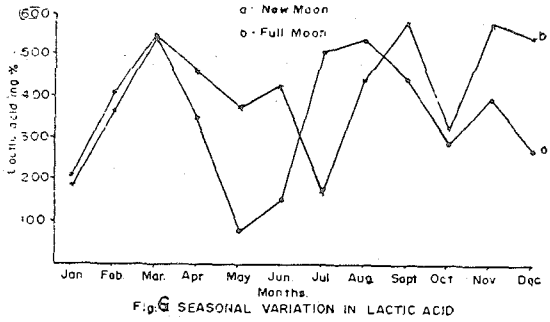

Fig. 6 SEASONAL VARIATION IN LACTIC ACID

found, but shows minimum values in January and July and maximum in September and November. Depletion of muscle glycogen during exercise in fish muscle has been studied by Miller *et al* (1959) and Stevens and Black (1966). Amano *et al* (1953) found different levels of glycogen content between different portions of the muscle and in all fish examined, the glycogen content decreased and lactate increased very markedly depending on the method and rapidity of

killing after capture. Environmental factors such as lack of food also could have played a part in the decrease of muscle glycogen. Figure 7, represents the fat content during full-moon and new-moon times. Compared to other shell fishes fat content is very low in crab muscle. It is maximum during full-moon time in September and minimum during January to February, and during new-moon time the maximnm value is in March and minimum in January. Venkataraman *et al* (1968), while studying the variation of fat due to season in black pomfret, reported that the rise in fat content coincided with the onset of summer. Kordyl (1953) and Lovern *et al* (1959) could not detect any definite seasonal trend in the muscular fat of fish muscle. Maximum values of protein, WEN, NPN & Glycogen are found duriug October–April, when the moisture content of the muscle is at a lower level. No such correlation could be assigned to fat content.

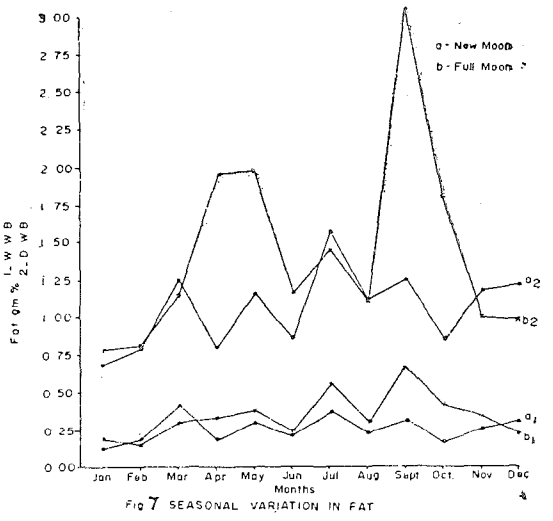

Fig 7 SEASONAL VARIATION IN FAT

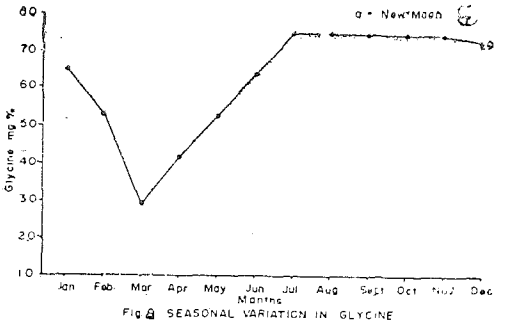

Fig 8 SEASONAL VARIATION IN GLYCINE

FREE AMINO ACIDS

Crab muscle contains all essential amino acids, the most abundant being glycine and this may be responsible for the sweet flavour of the meat. It follows a distinct pattern related to changes in season (Fig 8). It shows a steady decrease from 65 mg% in January to 29 mg% in March, then increases steadily to a maximum value of 75 mg% in July, this level being maintained till December. Apart from glycine, arginine, proline, glutamic acid, serine, tyrosine, leucine and phenyl alanine are present in appreciable quantities and methionine, lysine, threonine, iso-leucine and valine in small quantities and cystine, tryptophan, and histidine in traces (Table II).

Serine shows a distinct pattern related to season, from September it starts increasing to a maximum value in December and from January it starts decreasing to a minimum in April, then till September its level remains constant. Tyrosine and methionine show higher values during November–March and lower values during April to October, so also Arginine shows higher values during December to March and lower values during April to November. Jones (1955) observed marked seasonal variations in the values of glycine, glutamic acid, taurine etc in lemon sole muscle while Hughes (1959) failed to discover any correlation between stage of sexual maturity, sex and age of fish and total or individual amino acid content in herring. Dachateau and Florkin (1955) reported that definite changes were produced in the free amino acid pools of crab (*Eriochir Sinensis*) by altering the temperature and very large changes by altering the salinity.

TABLE–II FREE AMINO ACIDS – mg/100 gm.

	Pro-line	Serine	Glutamic acid	Methio-nine	Ly-sine	Threo-nine	Cystine	Leucine	Isoleu-cine	Tyro-sine	Trypto-phan	Phenyl-alanine	Valine	Arg-inine	Histi-dine
Jan.	15.26	12.61	12.63	1.33	0.942	—	traces	3.123	1.021	3.125	traces	7.043	0.942	24.820	traces
Feb.	10.39	7.21	10.42	1.34	1.192	traces	traces	4.513	1.941	3.331	0.057	2.167	0.981	18.430	,,
Mar.	11.44	10.84	7.24	2.51	1.243	—	traces	1.087	0.793	3.451	0.048	2.432	1.143	39.310	,,
Apr.	9.74	0.31	5.46	0.15	1.792	0.232	0.406	3.575	1.492	0.913	0.108	1.217	0.468	4.536	,,
May.	20.64	0.54	8.43	0.07	0.248	2.033	0.073	3.461	0.632	4.832	0.875	2.030	6.321	5.731	,,
June	23.45	0.63	10.62	0.11	2.186	2.015	0,832	3.042	0.731	1.889	0.753	3.420	4.366	9.564	,,
July	46.82	0.69	8.33	0.86	0.832	4.435	0.082	3.163	0.936	0.893	0.653	4.890	0.484	3.740	,,
Aug.	6.43	1.36	5.66	0.85	0.743	0.467	0.072	4.481	1.024	1.843	0.099	0.642	0.725	1.366	,,
Sept.	36.84	1.04	5.11	0.74	0.421	1.446	0.746	4.226	1.842	1.735	0.662	0.403	0.873	3.722	,,
Oct.	32.61	1.68	4.94	0.91	0.843	2.014	0.064	1.992	0.937	0.823	0.142	0.386	5.884	3.745	,,
Nov.	32.22	3.03	10.42	0.84	0.325	7.493	0.067	9.320	1.345	3.840	0.316	2.387	8.432	2.536	,,
Dec.	12.06	16.12	11.43	4.85	1.732	0.014	0.020	4.516	1,943	7.212	0.612	4.112	1.532	39.460	,,

SUMMARY

The influence of season on the nutritive value and chemical constituents of the edible crab *Scylla serrata*, available in the West Coast of India is the subject matter of this communication. Crabs of uniform size and sex caught under identical conditions were used for the study. The nutritive value is found to be maximum during the months of October to March. High yields of meat of the order of 30 to 35% were obtained during September to December compared to 15 o 30% during other seasons. There is also indication that new-moon periods favour the yield of the meat in the variety of crab studied.

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