CALORIC VALUES OF ESTUARINE AND MARINE ORGANISMS FROM GOA

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ABSTRACT

Caloric contents of 7 species of seaweeds and 64 species of animals representing molluscs, crustaceans and fishes were determined. Large differences in the caloric values between the species of the same group and between the groups were observed. The frequency distribution of the number of species against the energy values was found to be skewed towards higher ranges.

INTRODUCTION

In the energy flow studies, caloric content of the whole organism is an important parameter and is used for converting the biomass values to energy units. A survey of the literature shows that published data on caloric contents of the whole animal and marine plants are very few (Cummins and Wuycheck, 1970; Thayer *et al.*, 1973; Tyler, 1973 and Peiris and Grero, 1973). Some aspects of the caloric contents of a few fishes and prawns have been dealt with by Qasim and Jacob (1972) and Qasim *et al.*, (1973). The present study was undertaken to determine the caloric values of some animals and seaweeds found in the Goa region.

MATERIAL AND METHODS

Fresh samples of fishes and crustaceans were obtained from the fish landing centre at Panaji. Molluscan forms and seaweeds were collected from the estuaries and beaches. All organisms were washed with distilled water, wiped and treated promptly after collection. The shells of the molluscs and the exoskeleton of the crustaceans were removed and excluded from the analyses. Gut contents of all the organisms except the fishes were left intact and hence these have been included in the analyses. After overdrying for 24 hours at 70°C the samples were homogenised and stored in a desiccator till analysed. The method of Karzinkin and Tarkovaskaya (1964) was employed for the caloric determinations. The results give the average of 3 analyses of each sample.

RESULTS AND DISCUSSION

Table I gives the caloric values of 71 species. In seaweeds, the caloric

TABLE I.

Caloric Values of 71 Species Collected around Goa

Groups	Cal/g dry wt.	Groups	Cal/g dry wt.
I. SEAWEEDS		4. *Sardinella longiceps*	4194
1. *Ulva fasciata*	1904	5. *Sardinella albella*	4639
2. *Dictyota dumosa*	2783	6. *Ambassis sp.*	5092
3. *Padina tetrastomatica*	2231	7. *Kowala coval*	3414
4. *Sargassum tenerrimum*	3087	8. *Dussumieri sp.*	5567
5. *Gelidiella sp.*	2714	9. *Anadontostoma chacunda*	3457
6. *Hypnea musciformis*	3307	10. *Opisthopterus tardoore*	4259
7. *Gracilaria corticata*	4049	11. *Thrissocles malabaricus*	4287
Mean	2868	12. *Pellona ditchella*	3572
II. MOLLUSCA		13. *Chanos chanos*	3202
1. *Meretrix meretrix*	2569	14. *Saurida tumbil*	4822
2. *Meretrix casta*	3369	15. *Tachysurus sp.*	4028
3. *Donax incarnatus*	3313	16. *Tachysurus thalassinus*	3910
4. *Mytilus viridis*	3549	17. *Hemiramphus sp.*	3155
5. *Crassostrea cucullata*	3301	18. *Tylosurus strongylurus*	3054
6. *Paphia malabarica*	3768	19. *Mugil cephalus*	5300
7. *Solen kempi*	3744	20. *Leiognathus insidator*	4242
8. *Dosinea sp.*	3656	21. *Leiognathus splendens*	3803
9. *Mactra olorina*	3335	22. *Lactarius lactarius*	4028
10. *Villorita sp.*	3882	23. *Epinephelus malabaricus*	4034
11. *Loligo sp.*	3989	24. *Nemipterus japonicus*	4028
12. *Octopus sp.*	2863	25. *Pampus argenteus*	3768
Mean	3449	26. *Caranx digideba*	4074
III. CRUSTACEA		27. *Trypauchen vagina*	4124
1. *Isopod sp.*	2175	28. *Pseudopristipoma nigra*	5346
2. *Squilla sp.*	1375	29. *Scatophagus argus*	4327
3. *Metapenaeus affinis*	1544	30. *Etroplus suratensis*	4372
4. *Penaeus monodon*	1735	31. *Caranx kalla*	3741
5. *Penaeus mergueinsis*	1803	32. *Trichurus haumela*	4394
6. *Palaemon pacificus*	3394	33. *Scombromorus commersoni*	4777
7. *Penulirus homarus*	1690	34. *Sciaena miles*	3313
8. *Portunus pelagicus*	2163	35. *Johnius axillaris*	4665
9. *Portunus sanguinolentus*	2659	36. *Rastrelliger kanagurta*	4402
10. *Scylla serrata*	1452	37. *Sillago sihama*	4000
Mean	1999	38. *Gobid sp.*	3966
IV. FISHES		39. *Therapon jarbua*	3299
1. *Scoliodon sorrokowah*	5346	40. *Cynoglossus semifasciatus*	3866
2. *Sardinella gibbosa*	4738	41. *Synaptura commersoni*	4251
3. *Sardinella fimbriata*	4842	42. *Gerres filamentosus*	3651
		Mean	4175

values varied from 1904 to 4049 cal/g dry weight. The range in variations in the crustaceans, molluscs and fishes was 1452 to 3394, 2569 to 3989 and 3054 to 5567 cal/g dry weight respectively. Large difference in the energy contents between different groups were observed (Table II). The mean caloric values in the crustaceans in the present study was found to be lower than that of the molluscs. Thayer *et al* (1973) have shown that the caloric value shows a progressive increase from lower to higher forms of life. In the present study the energy content of the molluscs was greater than the crustaceans. This may be because that the molluscs collected were in advanced stages of sexual maturity. It is well known that the caloric values of the individual species increases significantly during the maturation phases.

An attempt has been made to compare the caloric values obtained in this study with those of information given by other authors (Table III). It is evident that the mean caloric values for fishes in the present study closely agrees with the other recorded values. However, the values for molluscs and crustaceans show considerable variations from the values given by the other authors (Table III). Similar was the case with chlorophyta among the seaweeds. The differences in the values between those recorded elsewhere and in the present study may be due to the geographic variations or due to specific differences among those selected for estimation. The differences also could have resulted from the wet-oxidation method employed here as against the microbomb calorimetry employed by others.

TABLE II.

Analysis of variance of energy content in kilocalorie per gram dry weight for all the species examined excluding seaweeds.

Source of variation	Sum of squares	Degrees of freedom	Mean square	F Ratio
Among Groups	39.7974	2	19.8987	*124.5225
Residual	9.7494	61	0.1598	—
Total	49.5468	63	—	—

* Significant at the 0.01 level

TABLE III.

Showing the comparative values of caloric content of different species expressed as kilocalorie per gram dry weight

Reference	Cummins & Wuycheck (1970)	Thayer *et al* (1973)	Tyler (1973)	Qasim *et al* (1973)	Present authors
Groups					
Chlorophyta	3.850	—	—	—	1.904
Phaeophyta	3.056	—	—	—	2.700
Rhodophyta	3.170	—	—	—	3.357
Crustacea	4.726	4.163	4.180	2.774	1.999
Mollusca	3.120	4.929	4.213	—	3.449
Fishes	5.086	4.924	—	4.149	4.175

The frequency distribution of energy content in the present study is shown in Fig. 1. Slobodkin and Richman (1961), reported the model frequency to be on the lower side of the energy content values. Cummins and Wuycheck (1970) presented a frequency similar to that of Slobodkin and Richman (1961) and pointed out that the type of distribution obtained was due

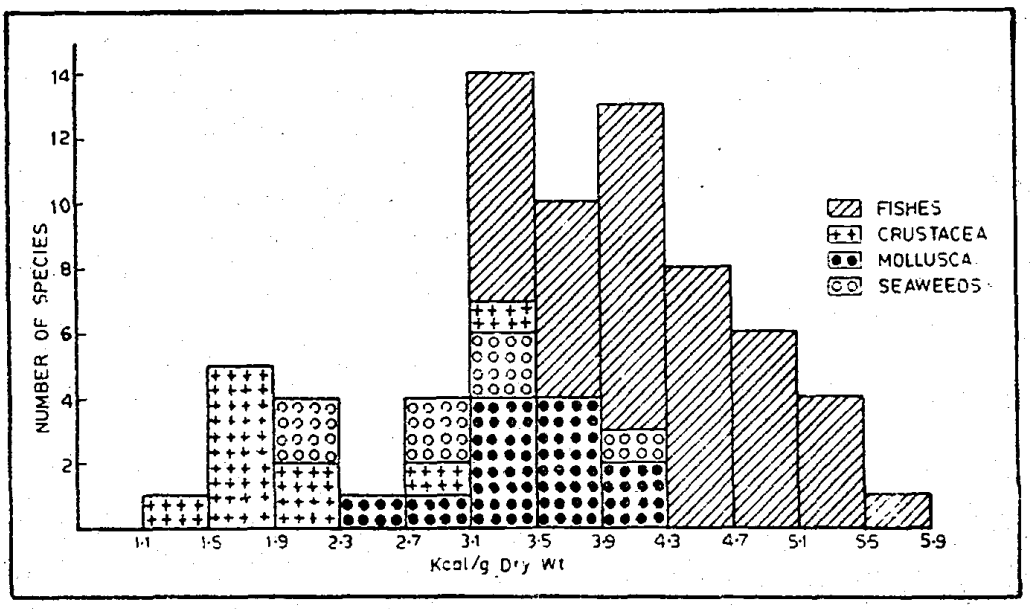

Fig. 1 Frequency distribution of energy content.

to the inclusion of a large number of plant species in the samples. Paine (1964) with his data for 17 species combined Slobodkin and Richman's (1961) data and obtained a symmetrical distribution. Thayer *et al* (1973) with 51 species values reported that the frequency of distribution skewed to the left due to the predominance of higher animal species in their samples. The frequency distribution of energy content in the present study was found to be similar to that reported by Thayer *et al* (1973) (Fig. 1). It is interesting to note that crustaceans and molluscs contribute to low caloric ranges i. e., 1.1 - 4.2 kcal/g dry weight and fishes contribute significantly to higher range i. e., 3.5 - 5.8 kcal/g dry weight and their share become exclusive in the range 4.3 - 5.8 kcal/g dry weight. It should be pointed out that our analysis is based on random samples obtained from different localities, and we have not taken into consideration the size, stage of maturity, sex and seasons. Perhaps if all these factors were to be taken into account while determining the energy content, a different picture could have resulted. Further studies are in progress.

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