Journal of the Indian Fisheries Association
19,1989, 19-24

SEASONAL VARIATION IN THE PROXIMATE COMPOSITION OF ROCK OYSTER *SACCOSTREA CUCULLATA* FROM BOMBAY COAST

L. KRISHNA KUMARI * AND VIJAYALAKSHMI R. NAIR
Regional Centre, National Institute of Oceanography, Versova, Bombay 400 061.

ABSTRACT

Changes in proximate composition of soft tissue of rock oyster *Saccostrea cucullata* inhabiting a polluted station at Bandra (stn. B) and a relatively clean area at Mudh Island (stn.M) were studied. An average protein content of 48.88 ± 3.73 and 53.68 ± 3.59% were recorded respectively for oysters from stns. M and B and the difference was significant ($P < 0.01$). Mean carbohydrate content in oysters from stn. M amounted to 14.69 ± 3.22 whereas at stn. B it was 8.79 ± 1.61 and the difference was found highly significant ($P < 0.001$). However, appreciable variation between stations was not observed in lipid and carbon content in oysters. Suitable period for harvesting of these organisms has been suggested.

INTRODUCTION

Inspite of heavy industrialization and increase in human population, dense oyster bed occurs at many locations along the coast of Bombay. The suitability of consumption of oysters depends upon a number of factors such as water content, proximate composition and level of contaminants like metals and hydrocarbons. Information on the biochemical constituents of rock oyster *Saccostrea cucullata* from Indian waters is limited (Rajagopal *et al.*, 1976; Nagabhushanam and Bidarkar, 1978). The present communication deals with changes in proximate composition of the soft tissue of *S. cucullata* collected from two different environments.

---

* Present address : National Institute of Oceanography, Dona Paula, Goa-403 004.

MATERIAL AND METHODS

Monthly collection of oysters from the intertidal rocky beaches of Bombay were made for a period of fifteen months from March 1981 to May 1982. An area of 0.25 m^2 was covered at two locations, a polluted area at Bandra (lat.19° 2' 14" N and long. 72° 49' 22" E) and a relatively clean environment at Mudh Island (lat. 19° 9'6" N and long. 72° 47'2" E). The stations at Bandra and Mudh islands were designated respectively as B and M. The specimens were kept overnight in filtered sea water to defaecate. After taking linear measurements, the soft parts were removed carefully, and dried at 70° C till constant weight. To evaluate sexwise difference, if any, on the proximte composition, they were sorted as male and female by microscopic examination of the gonad smear. The dry material was homogenised and a known quantity was used for the estimation of protein (Raymont *et al.*, 1964), carbohydrate (Dubois *et al.*, 1956), lipid (Folch *et al.*, 1957) and carbon (El Wakeel and Riley, 1957). Triplicate analyses were carried out for each component and the mean values are given in figure. Ash content was determined by igniting a weighed quantity of dry powder in a muffle furnace at 450° C for 3-4 hours. Caloric value was estimated as per Brody (1945).

RESULTS

Monthwise variations in the proximate composition of oyster (Fig.1, a-e) indicated a range of 42.20 to 55.12% at stn.M while fluctuation at stn.B was from 44.49 to 58.33%. On an average, protein content was high in oyster from stn.B (53.65 $\pm$ 3.59%) than stn.M (48.88 $\pm$ 3.73%) and the difference was significant ($P < 0.01$ d.f 1,28). Sexwise male indicated maximum (av.52.77 $\pm$ 5.31%) at stn.M and female at stn.B (av.56.26 $\pm$ 7.3%). The difference in protein content between male and female at stn.M was significant ($P < 0.01$ d.f 1,28), whereas in females between the stations the difference was highly significant ($P < 0.001$ d.f 1,28).

Regional difference was well marked in average carbohydrate content in the oysters. The percentage values were within the range of 9.05 to 20.79 at stn.M and 6.05 to 11.36 at stn.B. Mean carbohydrate content was comparatively high (14.69 $\pm$ 3.2%) in oysters from stn.M and the difference was significant ($P < 0.001$ d.f 1,28).

As far as the percentage of lipid is concerned excepting the slight increase in mean value at stn.B, no other difference was accounted. The values fluctuated

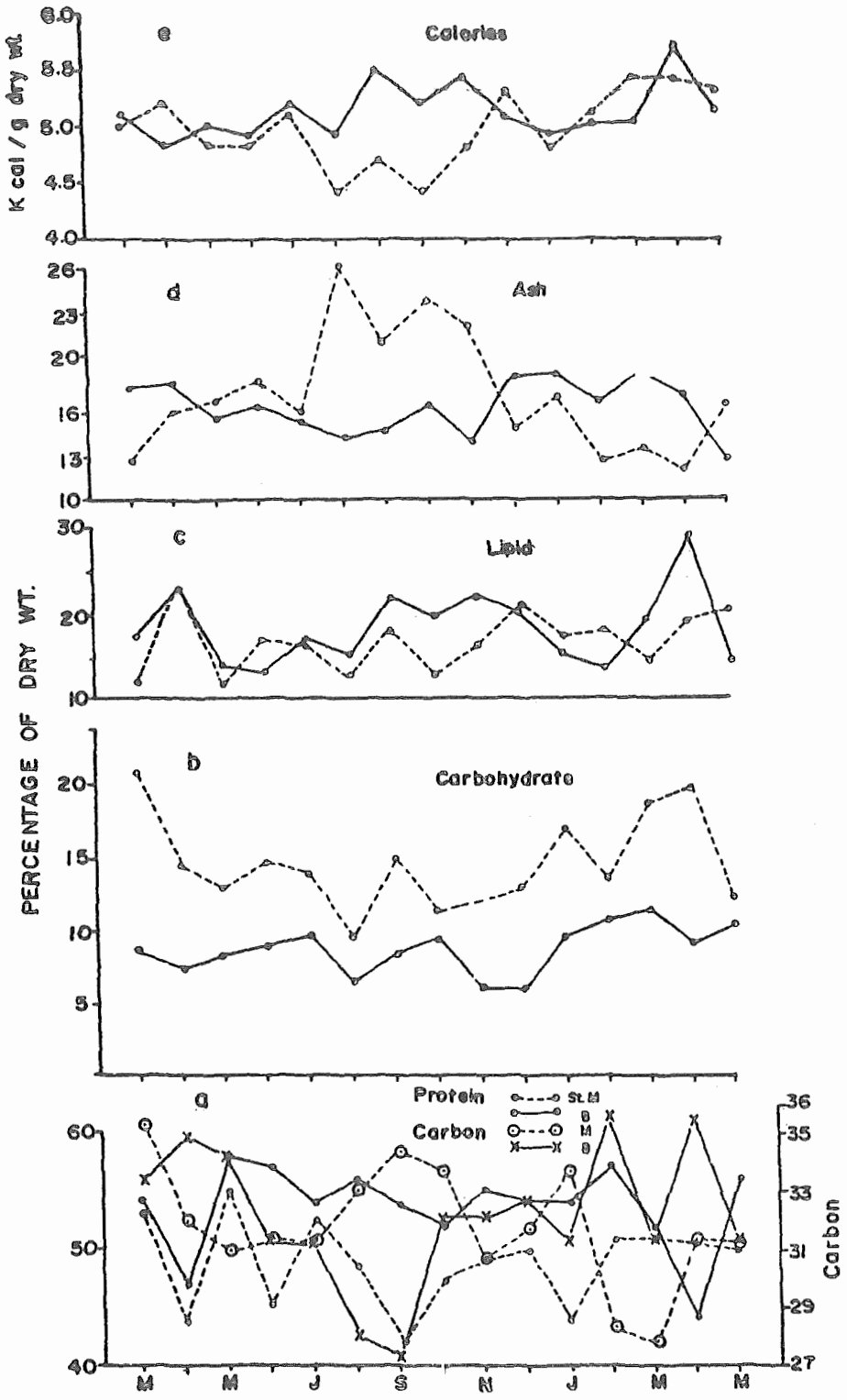

Fig. 1. Monthwise variations during 1981-82 in protein, carbohydrate, lipid, ash, calories, and carbon content in the soft tissue of oyster *S.cucullata* from stns., M and B.

from 11.83 to 22.9% (av. 16.83 ± 3.29) at stn.M and 13.66 to 29.23% (av.18.44 ± 4.41) at stn.B.

Stationwise difference was not noticed in the % of organic carbon content and it varied from 27.29 to 35.54 (stn.M) and 27.74 to 35.24 (stn.B). Seasonal difference in carbon content between monsoon and premonsoon was significant ($P < 0.01$ d.f 1,9).

Calorific value varied from 4.38 to 5.43 Kcal/g dry wt. (av.4.97 ± 0.34) at stn.M and 4.76 to 5.65 Kcal/g dry wt. (av.5.09 ± 0.25) at stn.B. Correlation between lipid and calories was significant $r = 0.59$ ($P < .02$) at stn.M and $r = 0.67$ ($P < 0.01$) at stn.B.

Ash content at stn.M fluctuated from 12.16 to 26.22 with a mean value of 17.33 ± 5.84 and 12.79 to 18.97 (av. 16.43 ± 1.86) at stn.B.

Percentage of water content ranged from 69.94 to 80.58 (stn.M) and 75 to 82.05 (stn.B).

DISCUSSION

Based on the energy available for gametogenesis, marine bivalves are grouped into opportunistic and conservative ones (Bayne, 1976). Importance of protein as stored energy in bivalves during energy imbalance (Navarro *et al.*, 1989) and its decrease in Chiton and Onchidium during spawning period has been reported (Deshpande and Nagabhushanam, 1983). A similar trend was noticed in the present study with lowest values during premonsoon in oysters from stn.B.

Though lipid forms the major component of reproductive material in bivalves (Davis and Wilson, 1983) remarkable seasonal difference was not noticed in the present study. However, possibility of an increase in lipid content in bivalves during phytoplanktom bloom has been reported (Wenne and Jurewiez, 1987).

Variations in environmental conditions in particular temporal or geographic, food availability etc. may alter the relationship between storage and spawning cycle (Hawkin *et al.*,1985). Decrease in carbohydrate content during gonad development has been cited (Navarrao *et al.*, 1989). Significant correlation between carbon and calories ($P < 0.05$) was observed only in oysters from stn. M. However, the values recorded for various biochemical components in the present

study was higher than the report of Rajagopal *et al*..(1976) and lower (except lipid) than that observed by Nagabhushanam and Bidarkar (1978). Though stn.B was polluted due to industrial and domestic sewage (Krishnakumari and Nair, 1984-85) absence of significant difference, except in low value of carbohydrate in proximate composition of oysters as compared to those from stn.M reveals that the oysters can tolerate pollution to a certain extent, the limit need to be ascertained. As the present observation indicated only marginal seasonal fluctuations in the proximate composition, further support the possibility of harvesting these oysters at any time during the year. However, it is necessary to undertake periodic monitoring studies pertaining to the pollution effect on these oysters especially those inhabiting the polluted areas along the coast of Bombay.

ACKNOWLEDGEMENT

The authors are grateful to Director, National Institute of Oceanography and Scient-in-Charge, Regional Centre, NIO, Bombay for facilities.

REFERENCES

Bayne, B.L. 1976. Aspects of reproduction in bivalve molluscs. In Wiley, M (Ed.) Estuarine process. Vol. I Uses, stresses and adaptation to the estuary. Academic press. London. 432-448.

Brody, S.1945. Bioenergetics and growth, Hafner Publishing Company, New York. 30pp.

Davis, J.P. and Wilson, J.G. 1983. Seasonal changes in the tissue weight and biochemical composition of the bivalve *Nucula turgida* in Dublin Bay with reference to gametogenesis. *Neth. J. Sea. Res.* 17:84-95.

Deshpande, V.D. and Nagabhushanam R. 1983. Seasonal changes in the biochemical composition of *Chiton Chiton iatricus* (Polyplacophora: mollusca) and the marine pulmonate *Onchidium verruculatum* (Gastropoda: Mollusca) in relation to their reproductive cycle. *Mar.Biol.* 72:227-234.

Dubois, M., Gilles, K.A. Hamilton, J.K., Rebers, P.A. and Smith, F. 1956. Calorimetric method for the determination of sugars and related substances. *Anal. Chem.* **28**: 350-356.

El Wakeel, S.K. and Riley, J.P. 1957. Determination of organic carbon in marine muds. *J. Cons. Perm. Int. Explor Mar.***22**; 180-183.

Folch, J., Lees, M. and Stanley H.S. 1956. A simple method for isolation and purification of total lipid from animal tissue. *J.Biol. Chem.* **226**: 497-590.

Hawkin, A.J.S., Salked, P.N., Bayne B.L., Gnaiger, E and Lowe, D.M. 1985. Feeding and resource allocation in the mussel *Mytilus viridis*: evidence for time averaged optimization. *Mar. Ecol. Prog. Ser.***20**: 273-287.

Krishnakumari, L. and Nair, V.R. 1984-85. On the water quality of selected environments along Bombay coast. *Indian Fish. Asso.* **14&15**: (1985) 49-57

Nagabhushanam, R. and Bidarkar D.S. 1978. Studies on seasonal changes in the biochemical constituents of the oyster *Crassostrea cucullata. Indian J. Fish.* **25**: 156-164.

Navarro, E., Iglesias, J.I.P. and Larranaga A. 1989. Interannual variation in the reproductive cycle and biochemical composition of cockle *Cerastoderma edule* from Mundaca Estuary (Biscay, North Spain) *Mar.Biol.***101**: 503-512.

Rajagopal, M.D., Sumitra-Vijayaraghavan and Krishnakumari, L. 1976. Nutritive value of the rock oyster *Crassostrea cucullata. Mahasagar. Bull, Natn. Inst. Oceanogr.***8**: 203-205.

Raymont, J.E.G, Austin, J., and Linford, B. 1964. Biochemical studies in marine zooplankton. The biochemical composition of *Neomysis integr. J. Cons. Perm. Int. Explor. Mer.28:354-365* **5**.

Wenne, R. and Jurewiez, E.S. 1987. Gross biochemical composition of the bivalve *Macoma baltica* from the Gulf of Gdans'k (Southern Baltic) *Mar.Biol.* **96**: 73-78.