SEASONAL CHANGES IN THE ENERGY CONTENT OF FEMALES OF THE FIDDLER CRAB, UCA LACTEA, ESPECIALLY DURING THE REPRODUCTIVE PERIOD

BY

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ABSTRACT

Adult females of Uca lactea were dissected and the dry weight of their hepatopancreas, ovary, and other portions of the body was measured separately. Hepatopancreas and ovary indices (H. I. and O. I., respectively) were defined as the percentage of their dry weight against that of the whole body. From the relationship equation, the dry weight of a 13 mm CW female was calculated. A large seasonal change in weight was recognized. It was high in June and low during August and October. H. I. was highest in May and lowest in August. O. I. was inversely related to H. I. and was highest by the end of June and early July. The calorific value of the body was obtained by totalling the calorific contents of hepatopancreas, ovary, and other parts of the body. The value was highest in May and lowest in August or October. The calorific value of the body of ovigerous females in August was only 52-57% of the maximum calorific content of females in May. The ovigerous females in August had a H. I. of only 2.0-3.6 and had consumed almost all the nutrients deposited in their body after the production of two clutches of eggs. They had not enough nutrients left to produce a third clutch. The calorific content of a 14 mm CW male was obtained by a similar procedure. The value was highest in May and June but no large decrease as a result of reproductive activities was found.

RÉSUMÉ

Des femelles adultes de Uca lactea ont été disséquées et le poids sec de leur hépatopancréas, de leurs ovaires et d’autres parties du corps a été mesuré séparément. Les indices ovariens et hépatopancrétique (respectivement, H. I. et O. I.) ont été définis comme le pourcentage de leurs poids sec par rapport au corps entier. A partir de l’équation de ce rapport, le poids sec d’une femelle de CW 13 mm a été calculé. Une grande variation du poids en fonction des saisons a été reconnue. Il était élevé en juin et faible en août et en octobre. H. I. était maximum en mai et minimum en août. O. I. était dans le rapport inverse de H. I. et était le plus élevé à la fin de juin et au début de juillet. La valeur calorique du corps a été obtenue en totalisant le contenu calorique de l’hépatopancreas, de l’ovaire, et des autres parties du corps. Cette valeur était la plus élevée en mai et la plus basse en août ou en octobre. La valeur calorique du corps des femelles ovigères en août était seulement de 52 à 57% de la valeur calorique maximale des femelles en mai. Les femelles ovigères en août avaient un H. I. de seulement 2.0 à 3.6 et avaient consommé presque tous les nutriments absorbés après la production de deux pontes. Elles n’avaient pas assez de nutriments pour produire une troisième ponte. La valeur calorique d’un mâle de CW 14 mm a été obtenue par un procédé analogue. La
INTRODUCTION

The most characteristic feature of the fiddler crabs of the genus *Uca* is the presence of an enormously developed large cheliped in males. To develop the large cheliped, males undoubtedly consume a large quantity of nutrients. However, in most species, males are larger than females (Crane, 1975; Yamaguchi, 1994). I studied the feeding activities of *Uca lactea* (De Haan, 1835) and confirmed that there is no large sexual differences in food uptake (Yamaguchi, 2000). Total dry weight of sand pellets produced in a year was estimated to be 765 g and 698 g in males and females with a carapace width of 14 mm, respectively. These values are 1,011 g in both males and females of 16 mm CW. Therefore, the difference in food uptake is not large enough to explain the size difference between the sexes. The sexual size difference in fiddler crabs seems to be the result of the use of energy output for oviposition. It is expected that females lose a larger amount of energy in the form of egg masses than the energy males use to form and maintain their large cheliped. To verify this assumption, it was necessary to determine how much energy is accumulated in the ovaries and how much is extruded as egg masses.

MATERIALS AND METHODS

Collection of crabs. — Females and males of *Uca lactea* were collected on the tidal flat at Nagaura Island, Amakusa, Japan, in 1973, 1974, 1976, 1977, 1982, 1983, and 1984. The flat is located at 4 km distance from the Aitsu Marine Biological Station. *U. lactea* occupied 13,000 square meters of the flat, which has a total area of 30,000 m². Collections were carried out at ten to fifteen sites in this habitat. At each spot, all adult females or males that were found in circa two square meters were caught. Not only the active crabs, but also those hidden in their closed burrows were collected. Most crabs were feeding at the time of collection, therefore they contained undigested substances in their intestines. They were kept individually in a beaker with a volume of 300, 500, or 1,000 ml, containing seawater, for several hours until they had finished the extrusion of faeces. After the measurement of maximum carapace width (CW) with hand callipers to the nearest 0.05 mm, they were dissected under a stereomicroscope. The hepatopancreas, ovary, and other portions of the body were weighed separately after drying at 70°C for 12 hours. From egg-bearing females, the egg masses were carefully removed and also weighed after drying. From males, the hepatopancreas was taken out.