SHORT COMMUNICATION

The diet of *Ophionereis reticulata* (Echinodermata: Ophiuroidea) in southeastern Brazil

Leonardo Q. Yokoyama [1, 2] & Antonia C. Z. Amaral [1]

[1] *Departamento de Zoologia, Instituto de Biologia, Universidade Estadual de Campinas. Caixa Postal 6109, 13083-970 Campinas, São Paulo, Brasil.*
[2] *Corresponding author. E-mail: lqyokoyama@gmail.com*

ABSTRACT. The ophiuroid *Ophionereis reticulata* (Say, 1825) occurs in the sediment-rocky shore interface, under small stones. Its diet is analyzed in this short communication. Specimens were collected at the Praia Grande beach, located on the northern coast of the state of São Paulo, Brazil, in July, 2002 and January, 2003. The animals were fixed in 70% ethanol and dissected to obtain their stomach contents. Of the total (35), 77.1% (27) had ingested some kind of food and, among those, 81.4% (22) had more than one item. The mean number of food items per stomach was 1.9. *Ophionereis reticulata* is an omnivorous species, consuming sediment, green and red algae, and polychaetes.
KEY WORDS. Diet, omnivorous; ophiuroid.

RESUMO. O ofiuróide *Ophionereis reticulata* (Say, 1825) ocorre na interface sedimento rocha de costões rochosos, sob pequenas pedras. Alguns aspectos de sua dieta alimentar foram analisados nesta nota. A amostragem foi realizada na Praia Grande, localizada no litoral norte do estado de São Paulo, Brasil. Os indivíduos, coletados em julho de 2002 e janeiro de 2003, foram fixados em álcool 70% e dissecados para obtenção de seus conteúdos estomacais. Do total (35), 77,1% (27) tinham ingerido algum tipo de alimento, e destes, 81,4% (22) possuíam mais de um item. O número médio de itens alimentares por estômago foi 1,9. *Ophionereis reticulata* é uma espécie onívora, consumindo sedimento, algas verdes e vermelhas, e poliquetas.
PALAVRAS-CHAVE. Dieta alimentar; ofiuróide; onívoro.

Ophiuroids have a wide variety of feeding strategies, including predation, deposit-feeding, and suspension-feeding. However, the diets of different species also vary as a result of differences in feeding mechanisms and life styles (Pearson & Gage 1984). Amphiurid species burrow underneath the sediment surface and form a semi-permanent mucous shelter, extending their arms over the surface to maintain local water current. As a consequence, they obtain food from the sediment surface and its different layers and from the water column (Woodley 1975). Despite its importance, there are few studies to date on ophiuroid dietary analysis. Jones & Smaldon (1989), analyzing the stomach contents of *Amphipholis squamata* (Delle Chiaje, 1828), recorded the presence of algae, fragments of small crustaceans and arms of *Amphipholis* Ljungman, 1867. Pearson & Gage (1984) studied the diets of *Ophiacantha bidentata* (Rezius, 1805), *Ophiactis abyssicola* (M. Sars, 1861), *Ophiocten gracilis* (G.O. Sars, 1871), *Ophiura irrorata* (Mortensen, 1933), and *Ophiomusium lymani* (Wyville Thompson, 1873), and observed a wide variety of food items and many similarities among their diets. The diet of *Ophiospartes gigas* was also extremely diverse, with 15 different taxa being used as energy sources (Dearborn *et al*. 1996). The diet of the reticulated brittle star, *Ophionereis reticulata* (Say, 1825), is presently thought to be based solely on green algae and diatoms (Hendler *et al*. 1995). In this short communication, we present new information about the diet of *O. reticulata*.

Individuals of *O. reticulata* were collected in June, 2002 and January, 2003 on the Praia Grande beach (23°49'20"S, 45°25'05"W), located in the São Sebastião Channel on the northern coast of the state of São Paulo, Brazil. The rocky shore is exposed to wave action and is composed of small and medium boulders. This intertidal region extends for approximately 40 m perpendicularly to the water line. The zone of occurrence of *O. reticulata* is only exposed during low tide. The specimens were manually collected, fixed in 70% ethanol, and later dissected for analysis of stomach contents with the use of a stereoscopic microscope.

A total of 35 stomachs (15 in the summer and 20 in the winter) were examined. The disc diameters of the animals var-

ied between 5.2 and 9.5 mm, with a mean of 7.3 mm. Of all the stomachs analyzed, 77.1% (27) contained some kind of food and, of these, 81.4% (22) contained more than one food item. The mean number of food items per individual was 1.9 (Tab. I). There was a slightly higher frequency of individuals with some food in their stomachs in the winter (80%) than in the summer (73.3%). The most important identified food items were sediment, green and red algae, and polychaete fragments (Tab. II). The stomachs in the winter contained larger numbers and more diverse items than in the summer. In the summer, the individuals consumed more items of plant origin. The winter diet was more diverse, with the consumption of more animal food items; however, the frequency of sediment and algae remained high.

New items were observed for the diet of *O. reticulata*, showing that this ophiuroid is an omnivorous species. It feeds mainly on algae but being also capable of consuming animal prey such as crustaceans, polychaetes, and even ophiuroids. Similar dietary diversity is consistently observed in other species (Pearson & Gage 1984).

A single cannibalism event was observed during this study. Further, six ophiuroid species were observed in stomachs of *O. gigas*. Other, similar records exist for *Ophiacantha bidentata*, *Ophiactis abyssicola*, *Ophiocten gracilis*, *Ophiura irrorata,* and *Ophiomusium lymani* (Pearson & Gage 1984).

The actual importance of the sediment and the flocculent material present in the stomachs of *O. reticulata* is yet unknown. Bacteria and organic detrital particles are carbon sources for many benthic invertebrates (Warner 1982, Dearborn *et al*. 1996). Therefore, and as stated by Dearborn *et al*. (1996), we cannot discard the possibility that the sediment may act as an energy resource or even have a mechanical function during the digestive process.

Pearson & Gage (1984) observed a reduction in the number of stomachs with food coinciding with an increase in mean gonad size for *O. gracilis*. According to that authors, the species must feed during spring to accumulate enough energy in order to reproduce and maintain somatic growth. For *O. reticulata*, there was a pronounced decrease in the frequency of stomachs with food during summer; moreover, the highest quantity and diversity of items were found in winter. Analysis of the gonadal maturation of the species revealed a low gametogenic activity during the colder months. Although no empirical measures were made, stomachs in this season were visually smaller than those in the reproductive period (summer). Individuals must use other resources with a higher energy content to accumulate reserves for the next reproductive season. Higher temperatures in the summer may favor the elevation of the metabolic and growth rates in some macroalgae. However, the growth of many tropical species is not limited by temperature. Perhaps the seasonal tem-

Table I. Variation and mean size of *Ophionereis reticulata* individuals analyzed and frequency of stomachs with food.

Variable	Total	Summer	Winter
Individuals analyzed	35	15	20
Disc diameter variation (mm)	5.2-9.5	5.2-9.5	5.7-9.2
Mean disc diameter (mm)	7.3	7.3	7.5
Frequency (%) of stomachs with at least one food item	77.1	73.3	80
Frequency (%) of stomachs with more that one food item	62.8	66.7	60
Mean number of items per individual	1.9	1.7	1.8

Table II. Food items in the stomach of *Ophionereis reticulata*.

Item	Total (35 inds)		Summer (15 inds)		Winter (20 inds)	
	N	%	N	%	N	%
Green algae fragments	22	62.9	10	66.7	12	60
Red algae fragments	20	57.1	8	53.3	12	60
Polychaeta fragments	3	8.6	1	6.7	2	10
Polychaeta: Sabellidae	1	2.9	0	0	1	5
Crustacea: Amphipoda	1	2.9	0	0	1	5
Crustacea: Decapoda	1	2.9	0	0	1	5
Crustacea fragments	1	2.9	0	0	1	5
O. reticulata fragments	2	5.7	1	6.7	1	5

perature variation may indirectly influence other factors, such as inorganic nutrient reposition (Stimson *et al.* 1996) or even reduce the growth of algae, especially in winter, leaving a small quantity of resources available and refuges for other organisms, becoming more exposed to predation. Stimson *et al.* (1996) also stated that wave action during colder periods may remove the algae from the intertidal region, but this do not seem to be a main factor for the present sampled region, given that it has a well protected area against wave action.

Some ophiuroid species prey on small organisms; however, most spend large amounts of time feeding on detritus and any organic material they find (Fell 1966). The probability that *O. reticulata* acts as an active predator is low, even though it consumes items such as polychaetes and crustaceans. It is obvious that the sediment may function as an energy source, since it was present in all the analyzed stomachs. However, as mentioned before, the sediment may have some mechanical action during digestion.

In conclusion, *O. reticulata* can be considered an omnivorous species that constantly consumes food of plant origin. It is not possible to discard the possibility that it is a deposit feeder, because the state of the food prior to its ingestion is unknown. A longer, monthly study of stomach contents is necessary to fully understand the diet of this species.

ACKNOWLEDGMENTS

We would like to thank two anonymous reviewers that revised this short communication. This study was funded by the CNPq and FAEPEX/UNICAMP. Secondary address for L.Q. Yokoyama is Pós-graduação em Zoologia, Instituto de Biociências, USP, São Paulo, SP, Brasil.

Submitted: 21.VII.2008; Accepted: 11.IX.2008.
Editorial responsibility: Walter A.P. Boeger

LITERATURE CITED

Dearborn, J.H.; G. Hendler & K.C. Edwards. 1996. The diet of *Ophiosparte gigas* (Echinodermata: Ophiuroidea) along the Antarctic Peninsula, with comments on its taxonomic status. **Polar Biology 16** (5): 309-320.

Fell, H.B. 1966. The ecology of ophiuroids, p. 129-143. *In*: R.A. Boolootian (Ed.). **Physiology of Echinodermata.** New York, Interscience, 822p.

Hendler, G.; J.E Miller; D.L. Pawson & P.M. Kier. 1995. **Sea Stars, Sea Urchins, and Allies: Echinoderms of Florida and the Caribbean.** Washington, Smithsonian Institution Press, 390p.

Jones, M.B. & G. Smaldon. 1989. Aspects of the biology of a population of the cosmopolitan brittlestar *Amphipholis squamata* (Echinodermata) from the Firth of Forth, Scotland. **Journal of Natural History 23** (3): 613-625.

Pearson, M. & J.D. Gage. 1984. Diets of some deep-sea brittle stars in the Rockall Trough. **Marine Biology 82** (3): 247-258.

Stimson, J.; S. Learned & K. McDermid. 1996. Seasonal growth of the coral reef macroalga *Dictyosphaeria cavernosa* (Forskål) Børgesen and the effects of nutrient availability, temperature and herbivory on growth rate. **Journal of Experimental Marine Biology and Ecology 196** (1-2): 53-77.

Warner, G. 1982. Food and feeding mechanisms: Ophiuroidea, p. 161-181. *In*: M. Jangoux & J.M. Lawrence (Eds). **Echinoderm nutrition.** Rotterdam, Balkema, 654p.

Woodley, J.D. 1975. The behaviour of some amphiurid brittlestars. **Journal of Experimental Marine Biology and Ecology 18** (1): 29-46.