Arquivos de Ciências do Mar

DIET COMPOSITION OF *Dasyatis marianae* (ELASMOBRANCHII: DASYATIDAE) OFF PARAÍBA STATE, BRAZIL

Composição da dieta de *Dasyatis marianae* (Elasmobranchii: Dasyatidae) da costa da Paraíba, Brasil

Akemi Shibuya[1], Ricardo de Souza Rosa[2]

ABSTRACT

Dasyatis marianae *is a costal stingray that lives associated with coral and sandstone reefs. This species has been captured in the artisanal fishery along Paraíba State's coast, Brazil. Its diet was studied through stomach contents analysis of individuals captured with hand line off Conde county. The prey items were identified to the lowest possible taxonomic level or category. The results indicated that the diet is dominated by crustaceans and revealed seven prey groups: Penaeidae, Caridea,* Callinectes exasperatus, Epialtus *sp.,* Acanthonyx *sp., Amphipoda and Isopoda. Annelida, Mollusca and Teleostei also occurred with minor participation. The Index of Relative Importance indicated that the shrimp group (67.75%) and crab group (29.16%) were the most important prey items. The stomach contents suggest that* D. marianae *is a selective feeder on the most abundant prey of its habitat.*

Key words**:** *Elasmobranchs,* Dasyatis*, stomach contents, benthic community.*

RESUMO

Dasyatis marianae *é uma raia costeira e vive associada a recifes coralinos e areníticos. A espécie tem sido capturada na pescaria artesanal na Paraíba. Sua alimentação foi estudada através da análise do conteúdo estomacal de indivíduos capturados pela pesca realizada com linha de mão, no município de Conde, Paraíba, Brasil. Os itens alimentares foram identificados até o menor nível taxonômico possível. Os resultados indicaram que sua dieta é dominada por crustáceos e revelaram sete grupos de presas: Penaeidae, Caridea,* Callinectes exasperatus, Epialtus *sp.,* Acanthonyx *sp., Amphipoda e Isopoda, além de Annelida, Mollusca e Teleostei, com menor participação. O Índice de Importância Relativa indicou que os grupos do camarão (67.75%) e dos caranguejos (29.16%) foram os mais importantes. Os itens alimentares encontrados mostram que* D. marianae *é uma espécie seletiva, alimentando-se das presas mais abundantes no seu hábitat.*

Palavras-chaves*: Elasmobrânquios,* Dasyatis*, dieta alimentar, comunidade bentônica.*

[1] Bolsista CNPq/PCI do Instituto Nacional de Pesquisas da Amazônia, Av. André Araújo, 2936. Aleixo, Manaus, AM 69083-000. E-mail: akemi_shibuya@yahoo.com.br.
[2] Professor do Departamento de Sistemática e Ecologia, CCEN, Universidade Federal da Paraíba, João Pessoa, PB 58059-900.

INTRODUCTION

Dasyatid stingrays are a coastal batoid group and important predators of benthic communities, as well as a potential prey for large fishes. Occasionally, these species have been found in stomach contents of sharks, such as the tiger shark *Galeocerdo cuvier* (Lowe *et al.,* 1996, Shibuya *et al.,* 2005*b*).

Dasyatis marianae Gomes, Rosa & Gadig, 2000 is distributed on the Brazilian continental shelf, from the Maranhão State to southern Bahia. This species lives associated to coral and sandstone reefs, and it has been caught mainly by bait and hook by artisanal fishery (Gomes *et al.,* 2000; Rosa *et al.,* 2000).

Studies on the diet of Dasyatid stingrays are still scarce, compared to the high number of species (38 valid species, according to Compagno, 2005). It has been carried out by Gilliam & Sullivan (1993), for *Dasyatis americana* in Bahamas; Carqueija *et al.* (1995) and Silva *et al.* (2001) in northeastern Brazil, for *D. guttata* and Ebert & Cowley (2003) in South African coast, for *D. chrysonota*. These studies showed dasyatid stingrays feed especially on crustaceans, mollusks, annelid and other small invertebrates.

The current study aims to describe the diet of *D. marianae* from the Paraíba State's coast captured by the artisanal fishery.

MATERIAL AND METHODS

The specimens were obtained at Praia do Amor, at Conde county, Paraiba, Brazil (07º16'24.4"S - 34º48'05.4"W), from March to November, 2003 by the artisanal fishery carried out with hand line. Specimens were sexed and measured for disc width (DW) and weight. Stomachs were removed, their contents fixed in 10% buffered formalin solution and preserved in 70% ethanol solution. Prey items were identified to the lowest possible taxonomic level or category.

Frequency of occurrence (%FO), weight (%W) and number (%N) were calculated and the Index of Relative Importance (IRI) (Pinkas *et al.,* 1971) was used to rank prey items: IRI = (%W + %N) x %FO. The IRI was converted to percentage (%IRI), as proposed by Cortés (1997).

Undigested penaeid shrimps found in the mouth and stomachs (presenting different digestion degree of other items) were not considered as stomach contents, as they are used as bait by the fishermen.

RESULTS AND DISCUSSION

Seventeen specimens of *D. marianae* (3 females; 14 males), ranging DW 23.2 to 29.8 cm and 480 to 981 g in weight were obtained. Three individuals presented empty stomachs, two containing only amorphous substance (stomach contents in advanced digestion degree, precluding identification), one presented only sediments and the remaining presented some prey item. Evidences of regurgitation and gastric eversion were not observed.

Ten prey groups were identified, distributed in four higher taxonomic categories: Annelida, Mollusca, Crustacea and Teleostei (TABLE I). Crustaceans were dominant and the most important were: caridean shrimps (38.2%) and penaeid shrimps (26.1%), portunid crabs (*Callinectes exasperates,* 20.8%) and majid crabs (*Epialtus* sp., 7.8% and also *Acanthonyx* sp., 0.5%), lysianassid amphipods (0.78%) and isopods (0.17%). Unidentified teleosts, cephalopods and polychaets had a secondary importance on the diet and represented 0.68%, 0.15% and 1.31% of the IRI, respectively.

Table I - Prey groups composition on the diet of *Dasyatis marianae*, off Paraíba Stat e, Brazil, in percentages of number (%N), weight (%W), occurrence (%FO) and Index of Relative Importance (%IRI).

Items	%N	%W	%FO	%IRI
ANNELIDA				
Unidentified polychaet	**4.35**	**0.58**	**18.2**	**0.76**
MOLLUSCA				
Unidentified squid	**1.09**	**0.03**	**9.10**	**0.09**
CRUSTACEA				
Shrimps	**67.39**	**63.94**	**63.64**	**70.57**
Unidentified shrimp	1.09	25.06	9.10	3.46
Penaeidae	8.7	24.16	54.50	26.07
Caridea	57.60	14.72	36.30	38.22
Crabs	**19.56**	**30.87**	**63.64**	**27.10**
Portunidae				
Callinectes exasperatus	7.61	24.36	45.40	20.83
Majidae				
Epialtus sp.	9.78	5.08	36.30	7.85
Acanthonyx sp.	2.17	1.43	9.10	0.48
Other crustaceans	**6.52**	**0.58**	**18.18**	**1.09**
Amphipoda				
Lysianassidae	5.43	0.48	9.10	0.78
Unidentified Isopoda	1.09	0.10	9.10	0.17
TELEOSTEI				
Unidentified	**1.09**	**4.00**	**9.10**	**0.39**

The number of prey groups varied from one to five per stomach and the maximum of 38 prey items were found in one stingray specimen.

Table II presents a comparison among studies on the diet of Dasyatid species, with only three analyses (including the current study) having used the Index of Relative Importance. The results showed the dominance of decapods (crustaceans) in all

Table II - Comparisons on the diet and feeding habits from the early studies of dasyatid species. 1st item = first dominant item; 2nd = second item; 3rd = third item; Method = method of data analysis; %FO = frequency of occurrence; %IRI = Index of Relative Importance.

Species	1st item	2nd item	3rd item	Methods	References
D. sayi	Crustacea	Molluska	Teleostei	%FO	Hess, 1961
D. centroura	Crustacea	Molluska	Teleostei	%FO	Hess, 1961
D. americana	Crustacea	Teleostei	Molluska	%IRI	Gilliam & Sullivan, 1993
D. guttata	Crustacea	Teleostei	Molluska	%FO	Silva *et al*., 2001
D. chrysonota	Anellida	Crustacea	Molluska	%IRI	Ebert & Cowley, 2003
D. marianae	Crustacea	Anellida	Teleostei	%IRI	Current study

species, except in *Dasyatis chrysonota*, which presents dominance of polychaets (annelids). Silva *et al.* (2001) showed the category "others" was the second more important prey item for *D. guttata*, but it was excluded of the table for comprising six other prey groups. Ebert & Cowley (2003) reported a shift on the diet of *D. chrysonota*, when they separated the samples in three size classes. Due to the low number of individuals, the diet composition by size classes cannot be made. Moreover, the standardization of stomach-content methods can provide exact results of prey importance. Teleost fishes and mollusks (bivalves and squids) were less important or rare on the diet of dasyatid rays.

The southern guitarfish, *Rhinobatos percellens*, occurs at the same sampling area and its diet was analyzed by Shibuya *et al*. (2005a). Crustaceans were the dominant item in its feeding diet, suggesting that both species occupy the same food niche and have overlapping habitats.

Feeding behavior patterns have been found for dasyatid species, like prey location through electroreception in *D. sabina* (Blonder & Alevizon 1988) and the foraging described by Ebert & Cowley (2003) in *D. chrysonota*, whose body assumes a convex shape over its prey, and the suction movements were used to the prey's capture. This behavior also was observed for *Rhinobatos lentiginosus* (Wilga & Motta, 1998). The stomach contents of *D. marianae* suggest the use of similar foraging behavior due to the presence of many prey items from the same group in a stomach, presenting a similar digestion degree and the occurrence of sediments.

Dasyatis marianae from the Paraíba coast presented a selective feeding habit, consuming especially shrimps and crabs, as found for other dasyatid species. Most of species from this batoid group live associated with sand substrates, as well as their prey items.

Studies on the biological aspects and life history of *D. marianae* are essential to understand the role of this species in the marine ecosystems. Moreover, there is a necessity to verify movement patterns, feeding activities, and occurrence of overlap of activity area (observed by Cartamil *et al*., 2003, for *D. lata* and *Sphyrna lewini*), due to the presence of *Rhinobatos percellens* at the same environment.

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REFERENCES

Blonder, B.I. & Alevizon, W.S. Prey discrimination and Electroreception in the Stingray *Dasyatis sabina*. *Copeia*, v.1, p.33-36, 1988.

Carqueija, C.R.G., Souza-Filho, J.J., Gouvêa, E.P. & Queiroz, E.L. Decápodos (Crustacea) utilizados na alimentação de *Dasyatis guttata* (Bloch & Schneider) (Elasmobranchii, Dasyatididae) na área de influência da Estação Ecológica Ilha do Medo, Baía de Todos os Santos, Bahia, Brasil. *Rev. Bras. Zool.*,v.12, n.4, p.833-838, 1995.

Cartamil, D.P., Vaudo, A.J.J., Lowe, C.G., Wetherbee, B.M. & Holland, A.K.N. Diel movement patterns of the Hawaiian stingray, *Dasyatis lata*: implications for ecological interactions between sympatric elasmobranch species. *Mar. Biol.*, v.142, p.841-847, 2003.

Compagno, L.J.V. Checklist of living Chondrichthyes, p. 503-548, *in* Hamlett, W.C. (ed.), *Reproductive biology and phylogeny of Chondrichthyes: sharks, batoids and chimaeras*. Science Publishers, Enfield. 2005.

Cortés, E. A critical review of methods of studying fish feeding based on analysis of stomach contents: application to elasmobranch fishes. *Can. J. Fish. Aquat. Sci.*, v.54, p.726-738, 1997.

Ebert, D.A. & Cowley, P.D. Diet, feeding behaviour and habitat utilization of the blue stingray *Dasyatis*

chrysonota (Smith, 1828) in South African waters. *Mar. Freshw. Res.*, v.4, p.957-965, 2003.

Gilliam, D. & Sullivan, K.M. Diet and feeding habits of the southern stingray, *Dasyatis americana* in the central Bahamas. *Bull. Mar. Sci.*, v.52, n.3, p.1007-1013, 1993.

Gomes, U.L., Rosa, R.S. & Gadig, O.B.F. *Dasyatis macrophthalma* sp. n.: a new species of stingray (Chondrichthyes: Dasyatidae) from the southwestern Atlantic. *Copeia*, v.2, p.510-515, 2000.

Lowe, C.G., Wetherbee, B.M., Crow, G.L. & Tester, A.L. Ontogenetic dietary shifts and feeding behavior of the tiger shark, *Galeocerdo cuvier*, in Hawaiian waters. *Environ. Biol. Fishes*, v.47, p.203-211, 1996.

Pinkas, L.M., Oliphant, S. & Iverson, I.L.K. Food habits of albacore, bluefin, tuna and bonito in California waters. *Calif. Fish and Game*, v.152, p.1-105, 1971.

Rosa, R.S., Gadig, O.B.F. & Gomes, U.L.. *Dasyatis marianae*: The correct name for a recently described stingray (Chondrichthyes: Dasyatidae) from the southwestern Atlantic. *Copeia*, v.3, p.889-890, 2000.

Shibuya, A., Rosa, R.S. & Soares, M.S. Note on the diet of the guitarfish *Rhinobatos percellens* (Walbaun, 1792) (Elasmobranchii: Rhinobatidae) from the coast of Paraíba, Brazil. *Acta Biol. Leopoldensia*, v.27, n.1, p.63-64, 2005a.

Shibuya, A., Rosa, R.S. & Gadig, O.B.F. Stomach contents of *Galeocerdo cuvier* and *Carcharhinus plumbeus* (Elasmobranchii: Carcharhinidae) caught off Paraíba State,Brazil. *Arq. Ciên. Mar.*, v.38, p.105-107, 2005b.

Silva, G.B., Viana, M.S.V. & Furtado-Neto, M.A.A. Morfologia e alimentação da raia *Dasyatis guttata* (Chondrichthyes: Dasyatidae) na enseada do Mucuripe, Fortaleza, Ceará. *Arq. Ciên. Mar.*, v.34, p.67-75, 2001.

Wilga, C.D. & Motta, P.J. Feeding mechanism of the Atlantic guitarfish *Rhinobatos lentiginosus*: modulation of kinematics and motor activity. *J. Exper. Biol.*, v.2001, p.3167-3184, 1998.