Echinodermata from São Sebastião Channel (São Paulo, Brazil)

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Abstract: Faunal inventories are extremely important, especially when focused on neglected groups, such as echinoderms, and concentrated on areas under intense anthropic activity such as the São Sebastião Channel in Brazil (23°41' - 23°54' S and 45°19' - 45°30' W). Intertidal and upper sublittoral zone collections were performed at five sites of the Channel's continental margin from May to August 2001. The rocky substrate down to 19 m deep was surveyed by snorkeling and SCUBA diving from August 2002 to May 2004, on both margins of the Channel: continental (14 sites) and insular (10 sites). We report a total of 38 species of echinoderms (one Crinoidea, nine Asteroidea, 13 Ophiuroidea, nine Echinoidea and six Holothuroidea). Seven of those species have been recorded here for the first time for the Channel (four Asteroidea, two Ophiuroidea and one Echinoidea). Rev. Biol. Trop. 53(Suppl. 3): 207-218. Epub 2006 Jan 30.

Key words: Echinodermata, São Sebastião Channel, Brazil, Biodiversity, Benthic fauna.

Echinoderms are widespread all over the Brazilian coast. They can be found from the intertidal zone to the deepest regions and occupy all marine habitats (Hadel *et al.* 1999). While some species are epizootic, most of them live on the sea floor, either exposed or burrowing in the substrate as part of the infaunal community (Shimizu 1991, Pires-Vanin *et al.* 1997, Tiago 1998). They can be found among the organisms associated with algae (Boffi 1972), living inside other animals such as bryozoans (Boffi 1972, Morgado 1980), and sponges (Pearse 1950, Boffi 1972, Duarte and Nalesso 1996), or on polychaete colonies (Nalesso *et al.* 1995). Nevertheless, all echinoderms are free living or commensal animals (Hadel *et al.* 1999). They are in fact among the most abundant and ecologically important organisms of benthic communities (Fell and Pawson 1966). In spite of that, studies on echinoderm biology have been historically neglected in Brazil and data on the diversity of the group have been achieved only under general evaluation approaches (Hadel *et al.* 1999).

The first data on the echinoderm fauna of São Paulo State was a list published by Ihering (1897). Since then only a few data have appeared focusing on the species from this region. Among them are those of Luederwaldt and Fonseca (1923), Luederwaldt (1929a, b), Tommasi (1957, 1958a, 1964a, 1967, 1971, 1985), Camargo (1982), Shimizu and Rodrigues (1988), Rodrigues and Shimizu (1988), Duarte and Nalesso (1996), Pires-Vanin *et al.* (1997) and Heitor (2002), all of them on echinoderm species in general. However, Tommasi (1970a), Boffi (1972) and Monteiro (1987, 1990a, b, 1992) published data on the Ophiuroidea only, Tommasi (1958b, 1962, 1964b) and Giordano (1986) provided data on the Echinoidea, Ancona-Lopez (1962, 1963, 1964, 1965), Hadel (1997), Tiago (1998), Hadel *et al.* (1998) and Tiago and Ditadi (2001) studied the Holothuroidea and MacCord and Duarte

(2002) studied the sole species of Crinoidea recorded in shallow waters up to now.

In comparison with the number of echinoderm species recorded worldwide, it is remarkable that this phylum is so poorly represented in the Brazilian littoral. This probably reflects our lack of knowledge on echinoderm biodiversity and distribution rather than a poorly represented fauna.

Data from such surveys are imperative for conservation and environmental remediation programs in areas such as the São Sebastião Channel (23°41' - 23°54' S and 45°19' - 45°30' W), which are prone to severe environmental stresses. This is a tourist region under intense anthropic activity. It is also under constant risk of serious environmental hazards due to the presence of Brazil's largest oil terminal. Since echinoderms represent an important component of the Channel's benthic macro and megafauna (Pires-Vanin *et al.* 1997), zoological surveys on their diversity are urgent. Therefore, the aim of this study was to survey the echinoderm fauna of the SSC and verify the existing knowledge on echinoderms of this region.

MATERIALS AND METHODS

Study Area: In winter Brazilian southern waters can be described as a narrow strip of cold and dense waters with low salinity values flowing from the Malvinas Current near the coast with the Brazilian Current to the east. In spring, due to northwestern wind action, the Brazilian Current prevails on the continental shelf with dense and warmer waters with higher salinity values. In autumn, the Brazilian Current is deflected once again away from the coast by the cold waters coming from the south and by the southwestern wind action (Palacio 1982).

The southeastern Brazilian continental shelf is limited to the north by Cabo Frio (23° S; Rio de Janeiro state) and to the south by Cape of Santa Marta Grande (28°40' S; Santa Catarina state) (Castro Filho 1990) and includes the coast of the state of São Paulo. Water masses flowing off the northern coast of this state find a barrier formed by São Sebastião Island and São Sebastião Channel (SSC) is the only passage to the littoral currents (Emílsson 1962, Kvinge 1967). It has high mountain ridges on both margins, continental to the west and insular to the east, which protects it from the direct action of the Atlantic Ocean waters. It has a length of 25 km and a maximum depth of 40 m at the central axis (Schaffer-Novelli 1990, Furtado 1995, Miranda and Castro Filho 1995, Hadel 1997).

Currents in this region are parallel to the coast and generated by wind force and tides (Emílsson 1959, 1961). Atmospheric pressure and currents have a four to five days' periodicity, but water may be still throughout the SSC for several hours (Emílsson 1962, Kvinge 1967). Tide waves reach the coast from east-southeast and reach both entrances of the Channel simultaneously. As a consequence low tide amplitudes are observed inside the SSC (Emílsson 1962). Currents are not strongly altered by tides, but are influenced by meteorological conditions, topography, and, most of all, by the winds (Emílsson 1962, Kvinge 1967). Winds coming from the south drive currents to northeast while winds from the north drive currents to the southwest (Emílsson 1962). Nevertheless, current direction inside the SSC can vary especially when winds are feeble (Castro Filho 1990).

The SSC is under the influence of the isotherm of 21°C, but water temperature may be as low as 17°C in summer due to the effects of the South Atlantic Central Water, which causes an upwelling to the north, at Cabo Frio (Matsuura 1986). This water mass fills the bottom of the SSC through its southern entrance, the natural inlet for this cold water. In autumn and winter, however, warmer Tropical Water prevails (Silva 2001). The Channel is also under the influence of the isohaline of 34‰ but salinity may vary from 33 to 35‰ on the coastal waters off the states of Paraná, São Paulo and Rio de Janeiro (Emílsson 1959, Palacio 1982, Matsuura 1986).

The sediment is rich in carbonates and between Cabo Frio and São Sebastião is

formed mainly by clay and sand (Palacio 1982). Due to its curved shape, sediment deposition is stronger on the continental margin. The great amount of sediments deposited on both entrances is a result of constant change in current direction inside the Channel. The sources of this material are sediments carried from adjacent regions, from the coastal ridges and from suspended sediments in the incoming waters (Furtado 1995).

Sampling methods: Snorkeling and SCUBA diving were chosen to sample the echinoderm fauna in order to reach habitats such as crevices and holes, generally neglected in superficial collecting. Samplings were qualitative and aimed to evaluate the richness of the echinoderm community at the SSC. Special attention was given to the rocky bottom areas due to the difficulty in sampling echinoderms that live on consolidated substrates by means of drag nets, dredges or other equipment usually employed on marine benthic studies.

The animals were collected by hand at low tides or by snorkeling from May to August 2001 from the continental margin of the SSC. From August 2002 through May 2004, SCUBA diving was employed to explore the rocky sublittoral substrate at both margins of the Channel down to 19 m. The collecting sites on both margins of the SSC are shown in Table 1.

When identifications of specimens *in situ* were possible, data were recorded and the animals released on site. Otherwise, specimens were captured alive and taken to the laboratory. Other organisms, such as sponges and algae, used as substrate by echinoderms, were also transported to the laboratory for detail study.

The animals were anesthetized with an isotonic solution of magnesium chloride (73 g of $MgCl_2 \cdot 6H_2O$ in 1 l of distilled water) and preserved in a 70-80% ethanol solution (Ditadi 1987, Hendler *et al.* 1995). Whenever observations of anatomical details in living animals were necessary for identification, such animals were kept alive in tanks supplied with running seawater.

All the preserved specimens were deposited in the Echinoderm Reference Collection of the Centro de Biologia Marinha da Universidade de São Paulo (CEBIMar - USP). The identifications of the specimens collected in this study were based mainly on the works of Brito (1968), Tommasi (1965, 1966, 1969a, b, 1970b, c, 1999), Clark and Downey (1992), Fell (1960), Hendler *et al.* (1995), Borges *et al.* (2002), Albuquerque *et al.* (2001) and Smith (2003) or by matching specimens with those in the Echinoderm Reference Collection of the CEBIMar - USP.

Data Analysis: Similarity measures between collecting sites were calculated taking into account the absence-presence of the species found in each site. The Sørensen Binary Similarity Coefficient (Valentin 2000) was employed using the following expression: $S=2a/(2a+b+c)$ where:

a = the number of species present on both sites,
b = the number of species present only in one of the sites, and
c = the number of species present only on the other site of the pair considered.

This coefficient puts more weight on joint occurrences than on mismatches and varies from zero to one.

RESULTS

Altogether 38 echinoderm species were collected: 13 Ophiuroidea, nine Asteroidea, nine Echinoidea, six Holothuroidea and a single Crinoidea. Similarity data between collecting sites are shown in Table 2.

TABLE 1
Collecting sites of Echinoderms in the São Sebastião Channel

CUADRO 1
Sitios de recolecta de los equinodermos en el canal de São Sebastião

Collecting site	Geographical coordinates	Hydrodynamics	Substrate
Arpoar Point (ApP)	23°44'30" S; 45°23'48" W	low to medium	rocks, fine sand and mud
Figueira Beach (FgB)	23°44'56" S; 45°24'34" W	low	coarse sand, boulders and mud
Araçá Beach (ArB)	23°49'00" S; 45°24'18" W	low	mud
Preta Point (PrP)	23°49'17" S; 45°24'37" W	low	rocks, boulders and sand
Moleques Islet (MoI)	23°49'39" S; 45°24'36" W	medium to high	rocks, boulders and coarse sand
Jarobá Point (JaP)	23°49'30" S; 45°25'18" W	low	rocks, boulders and sand
Baleeiro Point (BaP)	23°49'44" S; 45°25'24" W	medium to high	rocks, coarse and fine sand
Barequeçaba Point (BqP)	23°49'56" S; 45°25'53" W	medium	rocks, boulders and sand
Barequeçaba Beach (BqB)	23°49'55" S; 45°26'20" W	medium to high	coarse and fine sand
Itaçucê Islet (ItI)	23°49'55" S; 45°26'40" W	medium to high	rocks, coarse and fine sand
Guaecá Point (GuP)	23°49'50" S; 45°26'57" W	medium	rocks, boulders and sand
Guaecá Beach (GuB)	23°49'15" S; 45°27'40" W	medium to high	sand
Tapuá Beach (TaB)	23°49'20" S; 45°28'15" W	medium to high	rocks, boulders and sand
Brava Point (BvP)	23°50'10" S; 45°29'35" W	medium to high	rocks, boulders and sand
Canas Point (CaP)	23°43'42" S; 45°20'30" W	low	rocks, medium and fine sand
Sino Beach (SiB)	23°44'48" S; 45°20'54" W	low	medium sand
Siriuba Point (SrP)	23°45'06" S; 45°21'00" W	low	medium sand
Barreiro Beach (BrB)	23°46'06" S; 45°21'12" W	low	rocks and fine sand
Cabras Island (CaI)	23°49'42" S; 45°23'30" W	medium to high	rocks, boulders, medium sand
Portinho Beach (PoB)	23°50'45" S; 45°24'45" W	medium	rocks, boulders, medium sand
Praia Grande Islet (PgI)	23°51'10" S; 45°25'08" W	medium to high	rocks, boulders, coarse and medium sand
Ribeirão Point (RrP)	23°51'47" S; 45°25'55" W	medium to high	rocks, boulders, coarse and medium sand
Figueira Point (FiP)	23°53'03" S; 45°27'25" W	medium to high	rocks, boulders, coarse and medium sand
Sela Point (SeP)	23°53'55" S; 45°27'45" W	medium to high	rocks, boulders, coarse and medium sand

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TABLE 2
Sørensen Binary Similarity Coefficient values between pairs of collecting sites

CUADRO 2
Valores del coeficiente binario de similitud de Sørensen entre pares de los sitios de recolecta

	SeP	FiP	RrP	PgI	PoB	CaI	BrB	SrP	SiB	CaP	BvP	TaB	GuB	GuP	ItI	BqB	BqP	BaP	JaP	MoI	PrP	ArB	FgB
ApP	0.35	0.33	0.36	0.44	0.00	0.40	0.22	0.18	0.00	0.43	0.48	0.17	0.00	0.57	0.67	0.00	0.47	0.38	0.38	0.53	0.55	0.00	0.00
FgB	0.00	0.11	0.09	0.22	0.00	0.30	0.22	0.18	0.00	0.29	0.38	0.33	0.00	0.29	0.22	0.00	0.24	0.23	0.38	0.13	0.18	0.00	
ArB	0.13	0.24	0.00	0.15	0.31	0.00	0.00	0.00	0.44	0.00	0.00	0.00	0.29	0.00	0.00	0.25	0.00	0.32	0.20	0.00	0.00		
PrP	0.37	0.57	0.69	0.81	0.33	0.80	0.32	0.48	0.20	0.58	0.71	0.45	0.00	0.77	0.86	0.21	0.67	0.67	0.58	0.64			
MoI	0.50	0.48	0.56	0.60	0.12	0.70	0.33	0.29	0.00	0.59	0.67	0.53	0.00	0.58	0.67	0.00	0.70	0.62	0.58				
JaP	0.38	0.59	0.45	0.67	0.26	0.69	0.33	0.30	0.11	0.61	0.67	0.38	0.12	0.67	0.67	0.22	0.77	0.69					
BaP	0.39	0.56	0.61	0.78	0.36	0.76	0.26	0.32	0.25	0.50	0.69	0.46	0.09	0.69	0.69	0.26	0.58						
BqP	0.45	0.61	0.59	0.56	0.21	0.72	0.43	0.38	0.00	0.74	0.62	0.47	0.00	0.69	0.78	0.14							
BqB	0.00	0.13	0.11	0.25	0.36	0.24	0.00	0.25	0.29	0.18	0.11	0.00	0.40	0.22	0.27								
ItI	0.35	0.58	0.57	0.73	0.30	0.77	0.40	0.47	0.13	0.70	0.74	0.44	0.00	0.89									
GuP	0.38	0.52	0.65	0.78	0.26	0.76	0.33	0.40	0.11	0.61	0.80	0.48	0.00										
GuB	0.00	0.00	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00											
TaB	0.35	0.33	0.45	0.44	0.00	0.60	0.44	0.36	0.00	0.57	0.48												
BvP	0.54	0.52	0.58	0.67	0.17	0.76	0.33	0.40	0.11	0.61													
CaP	0.53	0.50	0.50	0.48	0.13	0.64	0.36	0.31	0.00														
SiB	0.13	0.38	0.10	0.24	0.50	0.22	0.00	0.44															
SrP	0.13	0.59	0.38	0.38	0.46	0.53	0.75																
BrB	0.14	0.40	0.32	0.25	0.18	0.35																	
CaI	0.40	0.62	0.67	0.74	0.36																		
PoB	0.11	0.60	0.33	0.41																			
PgI	0.38	0.55	0.76																				
RrP	0.52	0.50																					
FiP	0.43																						

The following checklist includes all species collected in this survey, as well as those recorded by other authors. The checklist hence includes 58 species: one Crinoidea, nine Asteroidea, 29 Ophiuroidea, nine Echinoidea and ten Holothuroidea. The species marked with a (*) are those recorded only by previous authors while those marked with a (+) are new records for the region under consideration.

Class Crinoidea Müller, 1821

Suborder Comatulina A. H. Clark, 1908

Family Tropiometridae A. H. Clark, 1908

Tropiometra carinata (Lamarck, 1816)

Class Asteroidea de Blainville, 1830

Order Paxillosida E. Perrier, 1884

Family Astropectinidae Gray, 1840

Astropecten brasiliensis Müller & Troschel, 1842

Astropecten marginatus Gray, 1840

Family Luidiidae Sladen, 1889

Luidia alternata (Say, 1825) +

Luidia clathrata (Say, 1825)

Luidia senegalensis (Lamarck, 1816)

Order Spinulosida E. Perrier, 1884

Family Echinasteridae Verrill, 1870

Echinaster brasiliensis Müller & Troschel, 1842

Order Forcipulatida E. Perrier, 1893

Family Asteriidae Gray, 1840

Coscinasterias tenuispina (Lamarck, 1816) +

Order Valvatida E. Perrier, 1884

Family Oreasteridae Fisher, 1911

Oreaster reticulatus (Linnaeus, 1758) +

Family Asterinidae Gray, 1840

Asterina stellifera (Möbius, 1859) +

Class Ophiuroidea Gray, 1840

Order Ophiurida Müller & Troschel, 1840

Family Amphiuridae Ljungman, 1867

Amphiodia planispina (Von Martens, 1867) *

Amphiodia pulchella (Lyman, 1869) *

Amphiodia atra (Stimpson, 1852) *

Amphiodia riisei Lütken, 1860 *

Amphioplus lucyae Tommasi, 1970 *

Amphiura flexuosa Ljungman, 1867 *

Amphiura joubini Koehler, 1912 *

Amphiura kinbergiensis Koehler, 1914 *

Amphiura stimpsonii Lütken, 1859 *

Amphipholis januarii Ljungman, 1867

Amphipholis squamata (Delle Chiaje, 1828)

Amphipholis subtilis (Ljungman, 1867) *

Nudamphiura carvalhoi Tommasi, 1965 *

Ophiocnida scabriuscula (Lütken, 1859)

Ophiophragmus lutkeni (Ljungman, 1871) *
Ophiophragmus pulcher H. L. Clark, 1918 *
Ophiophragmus wurdemani (Lyman, 1860) *
Family Ophiactidae Matsumoto, 1915
Hemipholis elongata (Say, 1825)
Ophiactis brasiliensis Manso, 1987
Ophiactis lymani Ljungman, 1871
Ophiactis savigny (Müller & Troschel, 1842)
Family Ophiodermatidae Ljungman, 1867
Ophioderma apressum (Say, 1825) +
Ophioderma cinereum Müller & Troschel, 1842 +
Ophioderma januarii Lütken, 1856
Family Ophionereidae Ljungman, 1867
Ophionereis reticulata (Say, 1825)
Family Ophiuridae Lyman, 1865
Ophioplocus januarii (Lütken, 1856)
Ophiolepis elegans Lütken, 1859 *
Family Ophiothricidae Ljungman, 1866
Ophiothrix angulata (Say, 1825)
Ophiothrix rathbuni Ludwig, 1882 *

Class Holothuroidea de Blainville, 1834
Order Apodida Brandt, 1835
Family Chiridotidae Oestergren, 1898
Chiridota rotifera (Pourtalès, 1851)
Family Synaptidae Burmeister, 1837
Protankyra benedeni (Ludwig, 1881) *
Synaptula hydriformis (Lesueur, 1823)
Synaptula secreta Lopez, 1957 *
Order Dendrochirotida Grube, 1840
Family Cucumariidae Ludwig, 1894
Duasmodactyla seguroensis (Deichmann, 1930)
Ocnus surinamensis (Semper, 1868)
Family Phylophoridae Oestergren, 1907
Thyone pawsoni Tommasi, 1972 *
Order Aspidochirotida Grube, 1840
Family Stichopodidae Haeckel, 1896
Isostichopus badionotus (Selenka, 1867)
Family Holothuriidae Ludwig, 1894
Holothuria grisea Selenka, 1867
Holothuria surinamensis Ludwig, 1875 *

Class Echinoidea Leske, 1778
Order Phymosomatoida Mortensen, 1904
Family Arbaciidae Gray, 1855
Arbacia lixula (Linnaeus, 1758)
Order Cidaroida Claus, 1880
Family Cidaridae Gray, 1825
Eucidaris tribuloides (Lamarck, 1816)

Order Echinoida Claus, 1876
Family Echinometridae Gray, 1825
Echinometra lucunter (Linnaeus, 1758)
Family Toxopneustidae Troschel, 1872
Lytechinus variegatus (Lamarck, 1816)
Family Echinidae Gray, 1825
Paracentrotus gaimardi (Blainville, 1825)
Order Clypeasteroida L. Agassiz, 1835
Family Clypeasteridae L. Agassiz, 1835
Clypeaster subdepressus (Gray, 1825)
Family Mellitidae Stefanini, 1911
Encope emarginata (Leske, 1778)
Mellita quinquiesperforata (Leske, 1778)
Family Brissidae Gray, 1855
Plagiobrissus grandis (Gmelin, 1788) +

DISCUSSION

According to Palacio's zoogeographical review of the southeastern Atlantic (1982), the east coast of South America can be divided into five provinces: (1) Tropical (from the Caribbean to the isotherm of 23°C off the coast of Espírito Santo and Rio de Janeiro states, Brazil); (2) Paulista (from the isotherm of 23°C to the isocryme of 23°C off the coast on the borders of Rio Grande do Sul state, Brazil and Uruguay); (3) Northern Patagonian (from the coast of Uruguay and Argentina to the Valdés Peninsula - 43°S); (4) Southern Patagonian (from the Valdés Peninsula to Bahía Grande - 52°S); and (5) Malvina (to the south of Bahía Grande). Of the 58 species recorded in this study, 40 (68.97%) are widely distributed and occur in both Tropical and Paulista Provinces. Nine species, 15.52% from all species recorded (*Astropecten brasiliensis*, *Luidia alternata*, *Amphiodia planispina*, *Amphiodia pulchella*, *Ophioplocus januarii*, *Ophiotrix angulata*, *Arbacia lixula*, *Encope emarginata* and *Mellita quinquiesperforata*) are distributed from the Tropical to the Northern Patagonian Provinces. Seven species (12.07%) are endemic to the Paulista Province, a transition zone between the tropical/subtropical and the Patagonian faunas (*Amphioplus lucyae*, *Amphiura kinbergiensis*, *Nudamphiura carvalhoi*, *Ophiophragmus wurdemani*, *Ophiactis brasiliensis*, *Synaptula secreta* and *Paracentrotus gaimardi*). It is within this zone that our study area is located. Only one species (1.72%), *Asterina stellifera*, occurs from the Paulista to the Northern Patagonian Province. Likewise, only one species (1.72%), *Amphiura joubini*, occurs from the Paulista to the Malvina Province. Thus, it can be concluded that the echinoderm fauna of the SSC has predominance of species from the Tropical rather than Patagonian fauna.

From the above stated, it seems that many echinoderm species of the Southeast Atlantic Ocean include SSC in their geographical distribution. Seven species (12.07%), the majority typical from consolidated sediments, have been recorded here for the first time for the SSC: *Luidia alternata*, *Coscinasterias tenuispina*, *Oreaster reticulatus*, *Asterina stellifera*, *Ophioderma apressum*, *Ophioderma cinereum* and *Plagiobrissus grandis*. This could be attributed to the different collecting methods employed in other surveys. For instance, the absence of *Luidia alternata* in previous surveys is worth noting, since this species is described as an inhabitant of non-consolidated bottoms. Actually, *Luidia alternata* was observed during daylight moving not only on hard substrates, but also on sandy and muddy substrates, probably seeking food or shelter. This observation was made at Sela Point were the substrate is a mosaic of sand pools, rocks and boulders.

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The Sørensen Binary Similarity Coefficient shows that the higher values, between 0.89 and 0.70, cluster sites characterized by rocky substrates such as points and islets. Similarity coefficients between 0.69 and 0.40 also group sites with consolidated substrate. Absence of similarity or the lowest values for the Similarity Coefficient, between zero and 0.39, were found when sites with sandy or muddy substrates were compared to each other and to those with rocky substrates.

The hydrodynamics of currents and tides inside the SSC influence the kind of substrate found in each collecting site and those two abiotic factors seem to determine the echinoderm fauna present in each one. Therefore, *Mellita quinquesperforata* was found only at Guaecá Beach, along with *Luidia senegalensis*. This beach has a medium to high hydrodynamic force and a sandy substrate.

The low hydrodynamics and the muddy substrate render Figueira and Araçá Beaches dissimilar of all other collecting sites. Figueira Beach, for instance, is the only site where *Ocnus surinamensis* and *Duasmodactyla seguroensis* could be found.

On some places, however, local geomorphological aspects favor the occurrence of certain species. *Chiridota rotifera*, for instance, is a small holothuroid found only on the isthmus that connects Baleeiro Point to a beach nearby.

The most common species sampled in this study was *Echinometra lucunter*. It appeared in 75% of the collecting sites. The second most common (66.7% of the sites) was *Holothuria grisea*, followed by *Tropiometra carinata*, *Echinaster brasiliensis*, *Arbacia lixula* and *Lytechinus variegatus*, all of them present in 62.5% of the collecting sites. The predominance of species that inhabit consolidated or mixed substrates is understandable considering that the SSC has small sandy or muddy beaches with rocky coasts on either side. *Isostichopus badionotus* and *Encope emarginata,* which inhabit sandy sediments, appeared only on 50% of the collecting sites. These data show that the SSC have an echinoderm fauna formed mostly by species of consolidated substrates rather than non-consolidated ones.

Oreaster reticulatus was found mostly at Ribeirão Point, although it sporadically also occurs at other sites in the Channel. Unpublished data (J.A. Petersen, unpublished) point out that this species was quite common in the SSC forty years ago. Due to its beauty and familiarity to the laymen, this species has been extensively exploited for the curio trade. This is just one example of an echinoderm species that is under considerable environmental impact due to uncontrolled human activities resulting in a decrease in its population density.

The periodical dredging that PETROBRAS, the Brazilian oil company, carries out in the SSC, which enables oil tankers to negotiate the Channel all the way to the oil terminal, is also an important anthropogenic factor to take into consideration when assessing decline of echinoderm populations. Camargo (1982) demonstrated such effects in regions of the municipality of Santos, southern littoral of the state of São Paulo, one of the largest Brazilian ports accommodating an oil terminal.

The presence of shipwrecks at Ribeirão Point and Sela Point probably increased habitat complexity at these sites and, as a consequence, increased the number of species able to colonize them. *Eucidaris tribuloides*, for instance, although not common in the SSC, can be easily found on these two shipwrecks. These are habitats of difficult access, reached only by SCUBA diving. This may explain why the beautiful *Eucidaris tribuloides* and *Oreaster reticulatus*, although coveted by tourists and collectors, are so abundant here but scarce in more accessible places.

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RESUMEN

Los inventarios faunísticos son sumamente importantes, sobretodo cuando se concentran en grupos tradicionalmente poco estudiados, como los equinodermos, y cuando se realizan en áreas con intensa actividad antrópica, como el Canal de São Sebastião (23°41' - 23°54' S y 45°19' - 45°30' W). En el presente estudio se realizaron recolectas en las zonas intermareales y sub-litorales superiores de cinco sitios de la orilla continental del Canal, de mayo hacia agosto del 2001. El substrato rocoso, a una profundidad de 19 m, fue contemplado desde agosto del 2002 hacia mayo del 2004, en las dos orillas del canal mediante buceo. Se encontraran un total de 38 especies de equinodermos (un crinoideo, nueve asteroideos, 13 ofiuroideos, nueve equinoideos y seis holoturoideos). Seven de esas especies son informadas aquí por primera vez para el Canal (cuatro asteroideos, dos ofiuroideos y un equinoideo).

Palabras claves: Echinodermata, Canal de São Sebastião, Brasil, biodiversidad, fauna bentónica.

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