

Echinoderms from Santa Catarina, southern Brazil: an update on biodiversity and distribution

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Abstract. We provide an update, based on literature records, on biodiversity and distribution of echinoderms along the state of Santa Catarina, Brazil. Sixty-one echinoderms taxa are reported, in 36 families. We present information on habitat distribution, taxonomy and possible threats to these species. The highest number of echinoderm records was between 25°19'S and 28°11'S latitudes, and sites of the Continental Shelf and the Reserva Biológica Marinha of Arvoredo area had the most species records (30 and 26 species, respectively). In addition, Santa Catarina is the southernmost record, in the Atlantic Ocean, for 40 echinoderm species; of these, 10 are on the regional list of endangered species. Eight species are endemic to Brazil and one ophiuroid species was reported herein for the first time at Santa Catarina: *Ophiacantha pentacrinus* Lütken, 1869.

Keywords. Echinodermata; Threatened species; Geographical distribution; Atlantic biodiversity; Faunistic survey.

INTRODUCTION

There are about 7,000 echinoderm species worldwide, of which 347 have been reported in Brazil (Ventura *et al.*, 2006, 2013). The group is represented by sea stars (Asterozoa), sea urchins (Echinozoa), sea cucumbers (Holothurozoa), sea lilies and feather stars (Crinozoa), and brittle stars (Ophiurozoa). Echinoderms, such as starfishes and sea urchins, are important predators and herders that play key roles in the functioning of shallow-water marine ecosystems (Paine, 1966; Lessios, 1988; Birkeland, 1989). Over the years, echinoderms became targets of anthropic action. Sea urchins and sea cucumbers, for instance, are commercially popular in several regions for human consumption and supposed medicinal properties (Pangestuti & Arifin, 2017). In Brazil, these organisms are also collected and sold as a decorative artifact, such as the starfish *Oreaster reticulatus* (Linnaeus, 1758) (Dias *et al.*, 2011; Martins *et al.*, 2012c; Alves *et al.*, 2018), currently in vulnerable status in the endangered species book (ICMBio, 2018).

The spatial arrangement of continents and oceans, combined with the influence of temperature and latitudinal gradients, local circula-

tion patterns, and the properties of water divide the oceans into a series of provinces or biogeographic regions with characteristic assemblages (Floeter & Soares-Gomes, 1999). The Brazilian biogeographic province extends from the Amazon River to Santa Catarina in southern Brazil (Floeter *et al.*, 2008; Briggs & Bowen, 2012). The state of Santa Catarina, from Itapoá (25°59'S) to Passo de Torres (29°19'S), represents the southern limit for the distribution of many shallow-water marine species, such as the starfish *Coscinasterias tenuispina* (Lamarck, 1816) (ICMBio, 2016), the marine sponge *Dragmaxia anomala* Carvalho & Hajdu, 2004 (Carraro, 2012), the mollusk *Tambja stegosauriformis* Pola, Cervera & Gosliner, 2005 (Padula *et al.*, 2011; Cunha *et al.*, 2016), zooxanthellate scleractinian corals (*e.g.*, Capel *et al.*, 2012; Lindner *et al.*, 2017) and numerous species of other invertebrate groups and tropical reef fish (*e.g.*, Anderson *et al.*, 2015).

The history of studies on echinoderms in Brazil goes back to the first report of echinoderms in 1648 (see Marcgrave, 1942; Ventura *et al.*, 2013). The following records were those of Verrill (1868), Rathbun (1879), Ludwig (1882), and those from the southern coast of Brazil by Müller (1898) (Tiago, 1998; Hadel *et al.*, 1999; Tiago & Ditadi,

2001; Ventura *et al.*, 2006), who recorded the crinoid *Antedon carinatus* (Lamarck, 1816) [currently *Tropiometra carinata* (Lamarck, 1816)] and the sand-dollar *Encope emarginata* (Leske, 1778) in the state of Santa Catarina.

In the twentieth century, researcher Luiz Roberto Tommasi, from Instituto Oceanográfico da Universidade de São Paulo, published a range of studies on echinoderms. Tommasi contributed to the description and new records of several species off Santa Catarina (Tommasi, 1964, 1965, 1966, 1970a, b, 1971, 1999). A conference abstract (Oliveira *et al.*, 1987; Oliveira, 1990) and an unpublished honor thesis on starfishes and ophiuroids (Oliveira, 1989) provided additional records of several other species of echinoderms for the state. Subsequently, Xavier (2010), based on a review of the literature, published the first checklist of echinoderms from Santa Catarina, with 34 species in 16 different sites. However, several species of echinoderms recorded by Oliveira *et al.* (1987) and Oliveira (1989) were not included (Xavier, 2010). More recently, additional records of echinoderms for Santa Catarina were reported by Labbé-Bellas *et al.* (2016) and Bueno *et al.* (2018). Based on these studies, herein we provide an updated checklist of echinoderms for Santa Catarina.

MATERIAL AND METHODS

Study area

The coast of the state of Santa Catarina (25°59' to 29°19'S) is 561.4 kilometers long, and comprises more than 500 beaches, 47 islands, mangroves, lagoons, bays and other ecosystems (Branco *et al.*, 2004; Rodrigues *et al.*, 2004; Anderson *et al.*, 2015). The central-northern coast of the state is under the influence of upwelling of the South Atlantic Central Water (SACW) (Carvalho *et al.*, 1998). It is a phenomenon of biological and ecological importance, being responsible for the increase of primary production, more pronounced in the spring and summer seasons (Gherardi *et al.*, 2008).

Data

An extensive literature survey on echinoderm records was performed with literature records available on the search sites Google Scholar, Capes platform, Scientific Electronic Library Online (SciELO), bibliographic database of the Federal University of Rio Grande do Sul (LUME), Library System from Federal University of Paraná (Portal UFPR). In addition, the search included conference proceedings, scientific manuscripts, undergraduate thesis, master thesis, PhD thesis, books, and book chapters, endangered species lists and technical reports. Data from species collected in Santa Catarina coast also were extracted and listed from national and foreigner museums database, Global Biodiversity Information Facility (GBIF) platforms, Ocean Biogeographic Information System (OBIS) and the collaborative network of museums SpeciesLink.

The search criteria used was "localities in Santa Catarina", and the keywords used in online searches, "Echinodermata", "Echinoderms", "Echinoderms from Santa Catarina", "Marine fauna of Santa Catarina", "Diversity of fauna in Santa Catarina", "Echinoderms de Santa Catarina", "Fauna marinha de Santa Catarina", "South Atlantic echinoderms".

We also included the following information about species:

Threatened species: The species in this study were classified in three IUCN (International Union for Conservation of Nature) categories, NE (Not Evaluated), VU (Vulnerable), CR (Critically Endangered) and one criterion, A (population reduction (past, present and/or projected for the future) IUCN, 2020). The data were obtained from Livro Vermelho da Fauna Brasileira Ameaçada de Extinção (ICMBio, 2018), Atlas da Fauna Brasileira Ameaçada de Extinção em Unidades de Conservação Federais (Nascimento & Campos, 2011) and Lista das Espécies da Fauna Ameaçada de Extinção em Santa Catarina (IMA, 2011).

Habitat distribution: Eight different habitat types are provided. The Soft bottom (SB) is the zone covered essentially by sandy and muddy sediments. Rocky bottom (RB) is the zone associated with the presence of rocky substrate such as rocky shores and isolated boulders. Biologic Bottom (BB) is composed essentially by sponge, coral, bryozoans, other echinoderms and polychaetes colonies. Calcareous Algae (CA). Seagrass bed (SeB). Shells bottom (ShB). Gravel bottom (GB). Not Informed (NI).

Geographic range: The data were obtained from GBIF (online database), WoRMS (online database), Oliveira *et al.* (2010), Alvarado & Solís-Marín (2013) and Bueno *et al.* (2018). Abbreviations are as follow SWA = Southwestern Atlantic Ocean; SEA = Southeastern Atlantic Ocean; GM = Gulf of Mexico; CS = Caribbean Sea; CAA = Central American Atlantic Coast; NWA = Northwestern Atlantic Ocean; NEA = Northeastern Atlantic Ocean; ARO = Arctic Ocean; NS = North Sea; MS = Mediterranean Sea; RS = Red Sea; SWI = Southwestern Indic Ocean; SEI = Southeastern Indic Ocean; NWI = Northwestern Indic Ocean; NEI = Northeastern Indic Ocean; IPO = Indo-Pacific Ocean; NEP = Northeastern Pacific Ocean; NWP = Northwestern Pacific Ocean; CP = Central Pacific Ocean; SWP = Southwestern Pacific Ocean; SEP = Southeastern Pacific Ocean; CG = Circumglobal; AO = Antarctic Ocean; DSt = Drake Strait; WS = Weddell Sea; BR = Brazil. In addition, those species whose southern limit of geographic distribution, in the Atlantic Ocean, is Santa Catarina coast were marked.

Record type: The following criteria were used herein: LIT = *in litteris* (record from the literature without illustration or photograph); PHO = Photographs (record from the literature with specimens illustrated by photographs); SIG = *In situ* observation by authors. The species reported in unpublished studies (Ph.D. thesis, M.Sc. thesis and undergraduate thesis) were only considered

herein if those could be identified on the basis of photographs or illustrations provided.

Acronyms: Scientific institutions (Echinodermata Collection (EQMN) of the Museu Nacional da Universidade Federal do Rio de Janeiro (MN/UFRJ); Zoological Collection of the Museum of Comparative Zoology from Harvard University (MCZ-IZ); Zoological Invertebrates of the Muséum National D'Histoire Naturelle, Paris (MNHN-FR); Ophiuroidea Collection of the Museu de Zoologia da Universidade de Campinas (ZUEC-OPH); Collection of Invertebrate Zoology of the California Academy of Science (CAS-IZ); Invertebrate Collection of the Museu de Zoologia da Universidade de São Paulo (MZUSP); Collection of Invertebrates of the Smithsonian Institution National Museum of Natural History (ISNMNH-IZ); Collection of the Laboratório de Praias Arenosas (LABMAR) of the Universidade Federal do Paraná (UFPR); Universidade do Vale do Itajaí (UNIVALI); Instituto do Meio Ambiente de Santa Catarina (IMA); Instituto Chico Mendes de Conservação e Biodiversidade (ICMBio) and Scientific databases online (World Marine Register Species (WoRMS); Ocean Biogeographic Information System (OBIS); Global Biodiversity Information Facility (GBIF)).

RESULTS

The echinoderm species search resulted in 444 records for the state of Santa Catarina. One hundred and fifty one records are in scientific manuscripts, 90 in master thesis, PhD thesis and undergraduate thesis, 45 in conference proceedings, 41 in endangered species lists, 27 in book chapters and 16 in technical reports (see Appendix 1). The scientific databases OBIS, GBIF and SpeciesLink resulted in 60 records and 14 in zoological collections from foreigner institutions (see Appendix 2).

In total, the search revealed 66 echinoderms taxa: 61 species, three subspecies and two genera (without specific classification). All of them were classified in five classes and 36 families (Table 1).

The largest number of recorded specimens belongs to the Class Ophiuroidea (33 species), followed by Asteroidea (12 species and three subspecies) and Echinoidea (12 species and two genera), Holothuroidea (two species) and Crinoidea (two species).

One echinoderm species not previously reported in the literature for the coast of Santa Catarina is reported herein: *Ophiacantha pentacrinus* Lütken, 1869.

Order Ophiacanthida, Family Ophiacanthidae

Ophiacantha pentacrinus Lütken, 1869. Three individuals were sampled by Onboard Fleet Observers Program (Programa de Observadores de Bordo na Frota Arrendada – PROA) executed by the fishing study group (Grupo de Estudos Pesqueiros – GEP) from University of Vale do Itajaí (Universidade do Vale do Itajaí – UNIVALI).

The specimens were identified by Dr. Michella Borges, specialist and curator of the Echinoderms Collection from the Museum of Zoology of the University of Campinas (Museu de Zoologia da Universidade Estadual de Campinas – ZUEC). The specimens were labeled as ZUEC-OPH 1868; ZUEC-OPH 1871 and ZUEC-OPH 1872 (see Appendix 2). The previous southernmost record was the state of Paraná (Borges *et al.*, 2015), in this study we extend it to the Santa Catarina coast.

Seventy-seven percent of Echinoderms species recorded occur on sandy substrate (SB) (Table 1). Some ophiuroids species, such as *Astrocyclus caecilian*, were observed on gorgonians. Regular equinoids and starfish species, such as *Narcissia tigonaria*, prefer rocky bottoms. However, irregular equinoids, such as *Clypeaster subdepressus* and the sea cucumber *Holothuria (Halodeima) grisea*, occur frequently on gravel and sandy substrates (Fig. 1).

Sixteen echinoderm species listed are present in the endangered species list of Santa Catarina (IMA, 2011), and seven of them are in the Brazilian Red List (ICMBio, 2018).

The species were recorded in 135 different sites off Santa Catarina (Fig. 2) and the highest number of echinoderm records was between 25°19'S and 28°11'S latitudes. Sites of the continental shelf and the Reserva Biológica Marinha of Arvoredo area had most of the records (30 and 26 species, respectively) (Tables 1 and 2). In addition, we observed that Santa Catarina is the southernmost record, in the Atlantic Ocean, for 40 echinoderm species listed herein (19 Ophiuroidea, 12 Echinoidea, five Asteroidea, two Crinoidea and two Holothuroidea) (Table 1). Eight species are endemic to the Brazilian coast: the ophiuroids *Amphiura deichmanni*, *Amphiura muelleri*, *Ophiothrix brasiliensis*, *Ophiothrix rathbuni*, *Ophiothrix tommasii*, *Ophiothrix troscheli*, *Ophiomisidium tommasii*, *Ophiomastus satellitae*.

DISCUSSION

In this study, we updated the list of echinoderms reported for Santa Catarina, including information on taxonomy, habitat and possible threats. In Brazil, echinoderm diversity comprised 347 species, 5% of the world total (about 7,000 species) (Ventura *et al.*, 2013). For the state of Santa Catarina, Xavier (2010) published a checklist with 34 echinoderm species. Subsequently, Bueno *et al.* (2018) identified 42 echinoderms species at the northern part of Santa Catarina. In the present study, we assembled 67 species records (Table 1, Fig. 2), a result that reveals that the state of Santa Catarina comprises 19% of the total echinoderm diversity in Brazil. In São Paulo and Bahia, two other states for which checklists are available, 34.2% and 23.14% of the echinoderm diversity in Brazil is present, respectively (Hadel *et al.*, 1999; Alves & Cerqueira, 2000; Tiago & Ditadi, 2001; Netto *et al.*, 2005; Manso, 2004; Magalhães *et al.*, 2005; Borges, 2006; Martins *et al.*, 2012a, b, c; Miranda *et al.*, 2012; Queiroz *et al.*, 2013; Bueno *et al.*, 2018).

Table 1. Checklist of echinoderm species recorded at Santa Catarina State, Southern Brazil.

Order	Family	Species	ICUN	Habitat	Site code	Reference	Geographic Range	Rec. Type
Class Asteroidea de Blainville, 1830 Forcipulatida Perrier, 1884	Asteriidae Gray, 1840	<i>Coscinasterias tenuispina</i> (Lamarck, 1816)	VU (A3cd)	RB, SB	12h, 12k, 12m, 13a, 13d, 16h	Oliveira, 1989; IMA, 2011; Nascimento & Campos, 2011; Ventura et al., 2016; ICMBio, 2018	NS, NWA, GM, MS, SWA*	Pho/Sig
	Astropectinidae Gray, 1840	<i>Astropecten arcticulatus</i> (Say, 1825) <i>Astropecten brasiliensis</i> Müller & Troschel, 1842	NE VU (A1cd)	SB SB	1dd, 17a 1ee, 1ff, 1gg, 1hh, 1ii, 3a, 3e, 3i, 3j, 3f, 9, 12a, 12d, 12e, 12l, 13d, 15c, 15j, 15n, 16j, 16k, 17k, 18a, 18b	Klein et al., 2001; Moreira, 2011; Bueno, 2015; Bueno et al., 2018 Tommasi, 1964; Oliveira, 1989; Klein, 1998; Caregnato et al., 2009; Amaral et al., 2008; IMA, 2011; Klein et al., 2001; Xavier, 2010; Moreira, 2011; Nascimento & Campos, 2011; Gondim et al., 2014; Branco et al., 2015; Bueno, 2015; Barrilli, 2018; Bueno et al., 2018	NWA, GM, CS, CAA, SWA* NEP, CP, SWA, WS, NWA, CS	Pho/Lit Pho/Lit
Paxillosida Perrier, 1884	Luidiidae Sladen, 1889	<i>Astropecten cingulatus</i> Sladen, 1889	NE	SB	—	Amaral et al., 2008; Xavier, 2010; Gondim et al., 2014	NS, NWA, GM, CS, CAA, SWA, SEA, NEA	Pho/Lit
		<i>Astropecten marginatus</i> Gray, 1840	VU (A1cd)	SB	3h, 3i, 4, 7f, 7h, 9, 12a, 12d, 14, 15c, 15j, 15n, 16a, 17a, 18b	Tommasi, 1964; Oliveira et al., 1987; Oliveira, 1989; Branco et al., 1998; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Moreira, 2011; Gondim et al., 2014; Branco et al., 2015; Bueno, 2015; Ventura et al., 2016; ICMBio, 2018; Barrilli, 2018; Bueno et al., 2018	CS, CAA, SWA	Pho/Lit
		<i>Tethyaster vestitus</i> (Say, 1825)	NE	SB	1ii, 1jj	Klein, 1998; Bueno, 2015; Bueno et al., 2018	NWA, GM, CS, SWA	Pho/Lit
		<i>Luidia alternata alternata</i> (Say, 1825)	VU (A3cd)	SB	15g	Oliveira, 1989; Oliveira, 1990; IMA, 2011	NWA, GM, CS, SWA	Pho/Lit
		<i>Luidia clathrata</i> (Say, 1825)	NE	SB, GB	1ee, 1ii, 7f, 7h, 9, 13a, 15c	Tommasi, 1970b; Oliveira, 1989; Branco et al., 1998; Klein, 1998; Klein et al., 2001; Netto, 2006; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Gondim et al., 2014; Branco et al., 2015; Bueno, 2015	NWA, GM, CS, CAA, SWA, WS	Pho/Lit
		<i>Luidia ludwigi scotti</i> Bell, 1917	VU (A3cd)	SB	1ii, 1jj	Klein, 1998; Klein et al., 2001; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Gondim et al., 2014; Bueno, 2015; Bueno et al., 2018	NWA, GM, CS, CAA, SWA, NWI	Pho/Lit
		<i>Luidia senegalensis</i> (Lamarck, 1816)	VU (A1cd)	SB	1ee, 2a, 2b, 3e, 3i, 4, 7f, 7h, 9, 12a, 12d, 14, 15c, 15e, 15j, 15l, 16a, 17a, 18b	Tommasi, 1964; Tommasi, 1970b; Oliveira, 1989; Branco et al., 1998; Klein, 1998; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Moreira, 2011; Gondim et al., 2014; Branco et al., 2015; Bueno, 2015; Ventura et al., 2016; Barrilli, 2018; ICMBio, 2018	NWA, GM, CS, CAA, SWA*	Pho/Lit
		<i>Ctenodiscus australis</i> Loven in Lütken, 1871	NE	SB, GB	1d	Tommasi, 2004	NWA, SWA, WS	Lit
		<i>Echinaster (Ophilia) brasiliensis</i> Müller & Troschel, 1842	VU (A1de)	SB, RB, CA, BB	3a, 3f, 3i, 7e, 7f, 7h, 10, 11d, 12a, 12h, 12m, 13a, 13d, 13g, 13h, 15d, 15m, 15n, 16a, 16g, 16i, 16j, 16k, 17a, 17b, 17c, 17h, 17k, 18a, 18b	Tommasi, 1964; Oliveira, 1989; Marchiori et al., 1996; Branco et al., 1998; Metri, 2006; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Moreira, 2011; Nascimento & Campos, 2011; Gondim et al., 2014; Branco et al., 2015; Lopes et al., 2016; Ventura et al., 2016	NWA, GM, CS, CAA, SWA	Pho/Lit/Sig
		<i>Asterina stellifera</i> (Möbius, 1859)	VU (A3de)	SB, RB	2d, 3a, 7b, 7c, 7d, 7e, 7f, 7h, 10, 12a, 12h, 12k, 13a, 13d, 15a, 15f, 15g, 15i, 15j, 15m, 16a, 16b, 16e, 16i, 16j, 16k, 17c, 17e, 17j, 17k, 18a	Tommasi, 1964; Oliveira, 1989; Branco et al., 1998; Cim, 1999; Vidolin et al., 2002; Amaral et al., 2008; Calli et al., 2009; Xavier, 2010; IMA, 2011; Nascimento & Campos, 2011; Branco et al., 2015; Ventura et al., 2016	NEA, SEA, SWA	Pho/Lit

Legend: ICUN Status: CR = Critically Endangered; VU = Vulnerable; NE = Not Evaluated. **Habitat:** SB = Soft bottom; RB = Rocky bottom; BB = Biologic bottom; CA = Calcareous Algae; SeB = Seagrass Bed; SHB = Shells bottom; GB = Gravel bottom; NI = Not Informed. **Site Code:** see Table 2. **Geographic Range:** SWA = Southwestern Atlantic Ocean; SEA = Southeastern Atlantic Ocean; GM = Gulf of Mexico; CS = Caribbean Sea; CAA = Central American Atlantic Coast; NWA = Northwestern Atlantic Ocean; NEA = Northeastern Atlantic Ocean; ARO = Arctic Ocean; NS = North Sea; MS = Mediterranean Sea; HS = Red Sea; SWI = Southwestern Indian Ocean; SEI = Southeastern Indian Ocean; NWI = Northwestern Indian Ocean; NEI = Northeastern Indian Ocean; IPO = Indo-Pacific Ocean; NEP = Northeastern Pacific Ocean; NWP = Northwestern Pacific Ocean; CP = Central Pacific Ocean; SWP = Southwestern Pacific Ocean; SPP = Southeastern Pacific Ocean; CG = Circumglobal; AO = Antarctic Ocean; DST = Drake Strait; WS = Weddell Sea; RR = Brazil (species that only occur in Brazil). **Record Type:** LIT = in literis; PHO = Photograph; SIG = in situ observation by authors. For museums code see Acronyms. For more details about museum specimens see Appendix 2. * Echinoderms species whose southern limit of geographic distribution in the Atlantic Ocean is Santa Catarina.

Table 1. Continued.

Order	Family	Species	IUCN	Habitat	Site code	Reference	Geographic Range	Rec. Type
	Ophiasteridae Verrill, 1870	<i>Narcissia trigonaria</i> Sladen, 1889	VU (A3cd)	RB, BB	13b, 13d	Oliveira, 1989; Oliveira, 1990; IMA, 2011; Nascimento & Campos, 2011; Ventura et al., 2016	NWA, GM, CS, CAA, SWA*	Pho/Sig
	Oreasteridae Fisher, 1908	<i>Oreaster reticulatus</i> (Linnaeus, 1758)	CR (A2)	SB, RB, GB	13b, 13d	Oliveira, 1989; Oliveira, 1990; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Nascimento & Campos, 2011; Gondim et al., 2014; Ventura et al., 2016; ICMBio, 2018	NWA, GM, CS, CAA, SEP, SWA*	Pho/Lit
Class Crinoidea Miller, 1821								
	Rhizocrinidae Jaekel, 1894	<i>Democrinus canifer</i> (AH Clark, 1909)	NE	SB, GB	1d, 1e	Tommasi, 2004	NWA, GM, CS, CAA, MS, SWA*	Lit
	Triplometridae AH Clark, 1908	<i>Triplometra carinata</i> (Lamarck, 1816)	NE	RB, SB	3f, 7f, 11a, 12h	Müller, 1898; Tommasi, 1964; Netto, 2006; Xavier, 2010; Ventura et al., 2016	CS, RS, SWA*	Pho/Lit/Sig
Class Echinoidea Leske, 1778								
	Arbaciidae Gray, 1855	<i>Arbacia lixula</i> (Linnaeus, 1758)	NE	RB	6, 7d, 7e, 7f, 12c, 12f, 12h, 13d, 13f, 13g, 15a, 15b, 15h, 15i, 16c, 16e, 16f, 17f, 18d, 18e, 18f	Rathbun, 1879; Tommasi, 1964; Oliveira et al., 1987; Marchiori et al., 1996; Xavier, 2010; Branco et al., 2015; Fagundes, 2016; Labbé-Bellas et al., 2016; Riffel, 2016; Soares & Resgalla-Jr., 2016; Ventura et al., 2016; Castellano et al., 2017; Lindner et al., 2017	GM, SEA, MS, NEA, SWA*	Pho/Lit/Sig
	Echinometridae Gray, 1855	<i>Echinometra lucunter</i> (Linnaeus, 1758)	NE	RB	3b, 3j, 3l, 6, 7a, 7b, 7e, 11c, 12c, 12f, 12h, 12i, 12j, 13d, 13f, 13g, 15h, 16c, 16d, 16f, 17f, 17g, 18d, 18e, 18f	Rathbun, 1879; Tommasi, 1966; Marchiori et al., 1996; Calli et al., 2009; Xavier, 2010; Freire et al., 2011; Labbé-Bellas, 2013; Fagundes, 2016; Labbé-Bellas et al., 2016; Riffel, 2016; Soares & Resgalla-Jr., 2016; Ventura et al., 2016; Castellano et al., 2017; Lindner et al., 2017	NWA, GM, CS, CAA, SWA*	Pho/Lit/Sig
	Parechinidae Mortensen, 1903	<i>Paracentrotus gaimardi</i> (Blainville, 1825)	VU (A2e)	RB	12f, 13d, 13f, 13g, 16c, 17f, 17g, 18d, 18e, 18f	Rathbun, 1879; Tommasi, 1966; Marchiori et al., 1996; Netto, 2006; Labbé-Bellas, 2013; Fagundes, 2016; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Nascimento & Campos, 2011; Labbé-Bellas et al., 2016; Riffel, 2016; Ventura et al., 2016; Lindner et al., 2017	SEA, SWA*	Pho/Lit/Sig
	Toxopneustidae Troschel, 1872	<i>Lytechinus variegatus</i> (Lamarck, 1816)	VU (A3de)	RB	3c, 3l, 6, 7e, 7f, 12a, 12g, 12h, 12j, 13d, 13f, 13g, 15h, 16f, 17a, 17e, 17f, 18b	Tommasi, 1964; Oliveira et al., 1987; Marchiori et al., 1996; Metri, 2006; Xavier, 2010; Moreira, 2011; IMA, 2011; Labbé-Bellas, 2013; Branco et al., 2015; Fagundes, 2016; Labbé-Bellas et al., 2016; Soares & Resgalla-Jr., 2016; Ventura et al., 2016; Vieira et al., 2016; Castellano et al., 2017; Lindner et al., 2017; ICMBio, 2018	NWA, GM, CS, CAA, RS, SWA*	Pho/Lit/Sig
		<i>Pseudoboletia Troschel, 1869</i>	NE	RB, SB	13c	Lopes et al., 2017	NWA, GM, CAA, SWI, NWI, NEI, IPO, SEI, NEP, SEP, SWA*	Pho/Lit
		<i>Triplometra ventricosus</i> (Lamarck, 1816)	NE	RB, BB	13b	Labbé-Bellas, 2013; Labbé-Bellas et al., 2016	NWA, GM, CS, CAA, MS, IPO, SWA*	Pho/Lit
	Cidaridae Claus, 1880	<i>Eucidaris tribuloides</i> (Lamarck, 1816)	VU (A1de)	SB, SHB, CA	13d, 13f, 13g	Oliveira et al., 1987; Marchiori et al., 1996; Metri, 2006; Netto, 2006; Xavier, 2010; IMA, 2011; Nascimento & Campos, 2011; Labbé-Bellas, 2013; Labbé-Bellas et al., 2016; Ventura et al., 2016; Lindner et al., 2017	NWA, GM, CS, MS, NEA, SEA, NEP, SWA*	Pho/Lit/Sig
	Diadematoidea Duncan, 1889	<i>Astropygia Gray, 1825</i>	NE	SB, GB	13b, 13f	Oliveira et al., 1987; Tommasi, 1999	NWA, CAA, NEP, CP, GM, CS, SWI, NEI, IPO, SEI, NWP, SWP, SWA*	Pho/Lit/Sig

Legend: IUCN Status: CR = Critically Endangered; VU = Vulnerable; NE = Not Evaluated. **Habitat:** SB = Soft bottom; RB = Rocky bottom; BB = Biologic bottom; CA = Calcareous Algae; SeB = Seagrass Bed; SHB = Shells bottom; GB = Gravel bottom; NI = Not Informed. **Site Code:** see Table 2. **Geographic Range:** SWA = Southwestern Atlantic Ocean; SEA = Southeastern Atlantic Ocean; GM = Gulf of Mexico; CS = Caribbean Sea; CAA = Central American Atlantic Coast; NWA = Northwestern Atlantic Ocean; NEA = Northeastern Atlantic Ocean; ARO = Arctic Ocean; NS = North Sea; MS = Mediterranean Sea; RS = Red Sea; SWI = Southwestern Indian Ocean; SEI = Southeastern Indian Ocean; NWI = Northwestern Indian Ocean; NEI = Northeastern Indian Ocean; IPO = Indo-Pacific Ocean; NEP = Northeastern Pacific Ocean; NWP = Northwestern Pacific Ocean; CP = Central Pacific Ocean; SWP = Southwestern Pacific Ocean; SEP = Southeastern Pacific Ocean; CG = Circumglobal; AO = Antarctic; DS = Drake Strait; WS = Weddell Sea; BR = Brazil (species that only occur in Brazil). **Record Type:** LIT = in litteris; PHO = Photograph; SIG = in situ observation by authors. For museums code see Acronyms. For more details about museum specimens see Appendix 2. * Echinoderms species whose southern limit of geographic distribution in the Atlantic Ocean is Santa Catarina.

Table 1. Continued.

Order	Family	Species	IUCN	Habitat	Site code	Reference	Geographic Range	Rec. Type
Clypeasteroidea A. Agassiz, 1872	Clypeasteridae L. Agassiz, 1835	<i>Clypeaster subdepressus</i> (Gray, 1825)	NE	SB	12h, 13d, 13g	Oliveira et al., 1987; Marchiori et al., 1996; Meiri, 2006; Xavier, 2010; Ventura et al., 2016; Lindner et al., 2017	NWA, GM, CS, CAA, SWA*	Pho/Sig
	Fibularidae Gray, 1855	<i>Echinocyamus grandiporus</i> Mortensen, 1907	NE	SB, GB	1a, 1f, 1g	Tommasi, 2004; Bueno, 2015	NWA, GM, CAA, SWA*	Lit
	Mellitidae Stefanini, 1912	<i>Encope emarginata</i> (Leske, 1778)	NE	SB	1ee, 1ff, 1gg, 3d, 3e, 3f, 3i, 12b, 12d, 12h, 15k, 17a, 18c	Rathbun, 1879; Tommasi, 1964; Reichholf, 1981; Klein, 1998; Klein et al., 2001; Moreira, 2011; Bueno, 2015; Soares & Resgalla-Jr., 2016; Ventura et al., 2016	NWA, GM, CS, CAA, SWA	Pho/Sig
		<i>Mellita quinquesperforata</i> (Leske, 1778)	NE	SB	2b, 2c, 11b, 12a, 12k, 18b	Oliveira et al., 1987; Xavier, 2010; Branco et al., 2015	NWA, GM, CS, SWA, CAA	Pho/Sig
Spatangoida L. Agassiz, 1840	Brissidae Gray, 1855	<i>Brissopsis atlantica</i> Mortensen, 1907	NE	SB, GB	1g	Tommasi, 2004; Bueno, 2015	NWA, GM, CS, CAA, SWA*	Lit
		<i>Plagiobrissus grandis</i> (Gmelin, 1788)	VU (A1de)	SB	17b	Oliveira et al., 1987; Netto, 2006; IMA, 2011	NWA, GM, CS, SWA*	Lit/Sig
Class Holothuroidea de Blainville, 1834								
Holothuriida Miller, Kerr, Paulay, Reich, Wilson, Carvajal & Rouse, 2017	Holothuriidae Burmeister, 1837	<i>Holothuria (Halodeima) grisea</i> (Selenka, 1867)	NE	SB, RB	2d, 7c, 7e, 7g, 7i,	Yoshimura, 1997; Vidolin et al., 2002; Mendes et al., 2006; Netto, 2006; Castellano, 2009; Xavier, 2010; Ventura et al., 2016	NWA, GM, CS, CAA, SWA*	Pho/Lit/Sig
		<i>Isostichopus badionotus</i> (Selenka, 1867)	VU (A1de)	SB, SBb, CA	13g	Netto, 2006; Amaral et al., 2008; Xavier, 2010; IMA, 2011; Nascimento & Campos, 2011; Ventura et al., 2016; Lindner et al., 2017	NWA, GM, CS, CAA, NEA, SWA*	Pho/Sig
		<i>Amphilitina mirabilis</i> (H.L. Clark, 1941)	NE	GB, SB	1g	Borges et al., 2002; Borges et al., 2004; Xavier, 2010; Bueno, 2015; Bueno et al., 2018	CS, FS, SWA*	Pho/Lit
		<i>Amphilitina olivacea</i> (Lyman, 1869)	NE	SB	1c, 1w	Borges et al., 2002; Borges et al., 2004; Xavier, 2010; Bueno, 2015; Bueno et al., 2018	NWA, GM, CS, SWA, SEA	Pho/Lit
Amphiuroida O'Hara, Huggall, Thuy, Stöhr & Martynov, 2018	Amphiuroidae Ljungman, 1867	<i>Amphiplus lucyae</i> Tommasi, 1971	NE	SB	17d	Oliveira, 1989; Oliveira, 1990; Bueno, 2015; Bueno et al., 2018	SWA, DSt	Pho/Lit
		<i>Amphipholis squamata</i> (Delle Chiaje, 1828)	NE	SB, RB, SBb, BB, Seb	16g	Oliveira, 1989; Oliveira, 1990; Bueno et al., 2018	CG	Pho/Lit
		<i>Amphiura complanata</i> Ljungman, 1867	NE	SB, GB	1c, 1d, 1o	Borges et al., 2002; Borges et al., 2004; Xavier, 2010; Bueno, 2015; Bueno et al., 2018	SWA, SWI	Pho/Lit
		<i>Amphiura deichmanni</i> Tommasi, 1965	NE	NI	8, 10	Tommasi, 1965; Tommasi, 1970a; Xavier, 2010	BR*	Lit
Ophiactidea Matsumoto, 1915	Ophiactidae	<i>Amphiura flexuosa</i> Ljungman, 1867	NE	SB, GB	1a, 1d, 1o, 1r, 1t	Borges et al., 2002; Borges et al., 2004; Xavier, 2010; Bueno, 2015; Bueno et al., 2018	NWA, SWA	Pho/Lit
		<i>Amphiura muelleri</i> Marktanner-Turneretsche, 1887	NE	SB	1q, 1u, 1v	Borges et al., 2002; Borges et al., 2004; Xavier, 2010; Bueno, 2015; Bueno et al., 2018	BR*	Pho/Lit
		<i>Microphiphalis atra</i> (Stimpson, 1852)	NE	SB, RB	3b, 3d, 3e, 3h, 4, 5, 7f, 7h, 15e, 15m, 18b	Tommasi, 1964; Tommasi, 1970a; Oliveira, 1990; Netto, 2006; Martins & Almeida, 2014; Branco et al., 2015; Bueno, 2015; Bueno et al., 2018	NWA, GM, CS, SWA*	Pho/Lit
		<i>Ophioprogamus luetkeni</i> (Ljungman, 1872)	NE	SB	1kk	Bueno, 2015; Bueno et al., 2018	CS, SWA*	Pho
		<i>Hemiphalis elongata</i> (Say, 1825)	NE	SB, BB	3e, 3f, 3h, 3i, 4, 5, 7f, 7h, 11d, 17d, 18b	Tommasi, 1964; Tommasi, 1970a; Oliveira, 1989; Oliveira, 1990; Netto, 2006; Martins & Almeida, 2014; Branco et al., 2015	NWA, GM, NEP, CP, CS	Pho/Lit
		<i>Ophiactis lymani</i> Ljungman, 1872	NE	SB, BB	12m, 13a, 13d, 15c, 16b	Oliveira, 1989; Bueno, 2015; Bueno et al., 2018	GM, SEA, SWA*	Pho

Legend: IUCN Status: CR = Critically Endangered; VU = Vulnerable; NE = Not Evaluated. **Habitat:** SB = Soft bottom; RB = Rocky bottom; BB = Biologic bottom; CA = Calcareous Algae; Seb = Seagrass Bed; SBb = Shells bottom; GB = Gravel bottom; NI = Not Informed. **Site Code:** see Table 2. **Geographic Range:** SWA = Southwestern Atlantic Ocean; GM = Gulf of Mexico; CS = Caribbean Sea; CAA = Central American Atlantic Coast; NWA = Northwestern Atlantic Ocean; NEA = Northeastern Atlantic Ocean; ARO = Arctic Ocean; NS = North Sea; MS = Mediterranean Sea; HS = Red Sea; SWI = Southwestern Indian Ocean; NWI = Northwestern Indian Ocean; NEI = Northeastern Indian Ocean; IPO = Indo-Pacific Ocean; NWP = Northwestern Pacific Ocean; CP = Central Pacific Ocean; SWP = Southwestern Pacific Ocean; SEP = Southeastern Pacific Ocean; CG = Circumglobal; AO = Antarctic Ocean; DSt = Drake Strait; WS = Weddell Sea; BR = Brazil (species that only occur in Brazil). **Record Type:** Lit = in literis; PHO = Photograph; Sig = in situ observation by authors. For museums code see Acronyms. For more details about museum specimens see Appendix 2. * Echinoderms species whose southern limit of geographic distribution in the Atlantic Ocean is Santa Catarina.

Table 1. Continued.

Order	Family	Species	IUCN	Habitat	Site code	Reference	Geographic Range	Rec. Type	
Euryalida	Ophiuridae	<i>Ophiactis savignyi</i> (Müller & Troschel, 1842)	NE	BB, GB	7h, 12h, 12m, 13a, 13d, 15m, 16g, 17c, 17d, 17h	Oliveira, 1989; Bueno, 2015; Bueno et al., 2018	CG	Pho/Lit	
		<i>Ophioneis reticulata</i> (Say, 1825)	NE	SB, GB, RB, BB	7h, 12h, 13d, 17b, 17d, 18a	Oliveira, 1989; Netto, 2006; Bueno, 2015; Bueno et al., 2018	NWA, GM, CS, CAA, SWA*	Pho/Lit	
		<i>Ophiolithrix angulata</i> (Say, 1825)	NE	SB, RB, BB, GB, SHB	3f, 7e, 7h, 10, 12h, 13a, 13d, 15c, 16f, 16h, 17h, 17i, 18a, 18g	Tommasi, 1964; Tommasi, 1970a; Oliveira, 1989; Monteiro, 1998; Xavier, 2010; Bueno, 2015; Bueno et al., 2018	NWA, GM, CS, CAA, SWA	Pho/Lit	
		<i>Ophiolithrix brasiliensis</i> Santana, Manso, Almeida & Alves, 2020	NE	NI	16g	Santana et al., 2020		BR	Pho/Lit
		<i>Ophiolithrix rathbunii</i> Ludwig, 1882	NE	SB, RB	3f	Tommasi, 1970a; Santana et al., 2020		BR	Pho/Lit
		<i>Ophiolithrix tommasii</i> Santana, Manso, Almeida & Alves, 2020	NE	NI	13e, 18h	Santana et al., 2020		BR*	Pho/Lit
		<i>Ophiolithrix troscheli</i> Santana, Manso, Almeida & Alves, 2020	NE	NI	18h	Santana et al., 2020		BR*	Pho/Lit
		<i>Ophiolithrix mirabilis</i> Verrill, 1867	NE	BB	3g, 3k	Lawley et al., 2018		NEP, CP, CAA, SWA*	Pho/Lit
		<i>Ophiomisdium tommasii</i> Borges, Monteiro & Amaral, 2006	NE	SB, GB	1b, 1d, 1e, 1i, 1j, 1k, 1l, 1m, 1n, 1p	Borges, 2006; Borges et al., 2006; Bueno, 2015; Bueno et al., 2018		BR*	Pho/Lit
		<i>Ophiomastus sareitalae</i> Tommasi & Abreu, 1974	NE	SB, GB	1d, 1n	Borges et al., 2002; Borges et al., 2004; Xavier, 2010; Bueno, 2015		BR*	Pho/Lit
		<i>Ophiura clemens</i> (Koehler, 1904)	NE	SB, GB	1d, 1n	Borges, 2006; Borges & Amaral, 2007; Xavier, 2010; Bueno, 2015; Bueno et al., 2018		IPO, SWA*	Pho/Lit
		<i>Ophiura Jungmani</i> (Lyman, 1878)	NE	SB, GB	1d	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NWA, GM, CS, CAA, SWA, NS, NEA, SEA	Pho/Lit
		<i>Ophiomusium eburneum</i> Lyman, 1869	NE	SB, GB	1d, 1j, 1n	Borges, 2006; Borges & Amaral, 2007; Xavier, 2010; Bueno, 2015; Bueno et al., 2018		NWA, GM, CS, CAA, SWA, SEA	Pho/Lit
<i>Ophiomusa aculeata</i> (Lyman, 1875)	NE	SB	1a	Borges et al., 2002; Borges, 2006		GM, CS, CAA, SWA*	Pho/Lit		
Euryalida	Gorgonocephalidae	<i>Gorgonocephalus chilensis</i> (Phillippi, 1858)	NE	BB	13e	Barboza et al., 2010	SWA, SEA, DS, SWP, DST, AO	Pho/Lit	
		<i>Astrocyclus caecilia</i> (Lütken, 1856)	NE	BB	13d, 16h	Oliveira et al., 1987; Oliveira, 1989; Ventura et al., 2016	NWA, GM, CS, CAA, SWA*	Pho/Lit	
		<i>Ophiacantha cosmica</i> Lyman, 1878	NE	SB, GB	1d, 1n, 1s, 1z	Borges et al., 2002; Xavier, 2010	NWA, CAA, SWA, NEP, SEP, CP, NEA, SEA, NEI, SEI, NWP, AO	Pho/Lit	
		<i>Ophiacantha pentacarinus</i> Lütken, 1869	NE	NI	1v, 1x	ZUEC-OPH1871; ZUEC-OPH1872		NWA, GM, CS, CAA, NEP, SWA*	Lit
		<i>Ophiomastix wendtii</i> (Müller & Troschel, 1842)	NE	SB, RB, GB	13d	Oliveira, 1989; Oliveira, 1990		NWA, GM, CS, CAA, SWA*	Pho/Lit
		<i>Ophiomyces frutescens</i> Lyman, 1869	NE	SB, GB	1a	Borges et al., 2002; Borges et al., 2004		NWA, GM, CS, CAA, NS, SWA*	Pho
		<i>Ophiostriatus striatus</i> (Mortensen, 1933)	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit
		<i>Ophiocleidia</i> sp.	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit
		<i>Ophiocleidia</i> sp.	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit
		<i>Ophiocleidia</i> sp.	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit
		<i>Ophiocleidia</i> sp.	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit
		<i>Ophiocleidia</i> sp.	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit
		<i>Ophiocleidia</i> sp.	NE	SB, GB	1d, 1e	Borges et al., 2002; Borges et al., 2004; Xavier, 2010		NS, ARO, SWA*	Pho/Lit

Legend: IUCN Status: CR = Critically Endangered; VU = Vulnerable; NE = Not Evaluated. Habitat: SB = Soft bottom; RB = Rocky bottom; BB = Biologic bottom; CA = Calcareous Bed; SHB = Shells bottom; GB = Gravel bottom; NI = Not Informed. Site Code: see Table 2. Geographic Range: SWA = Southwestern Atlantic Ocean; SEA = Southeastern Atlantic Ocean; GM = Gulf of Mexico; CS = Caribbean Sea; CAA = Central American Atlantic Coast; NWA = Northwestern Atlantic Ocean; NEA = Northeastern Atlantic Ocean; ARO = Arctic Ocean; NS = North Sea; MS = Mediterranean Sea; RS = Red Sea; SWI = Southwestern Indian Ocean; NWI = Northwestern Indian Ocean; NEI = Northeastern Indian Ocean; IPO = Indo-Pacific Ocean; NEP = Northeastern Pacific Ocean; NWP = Northwestern Pacific Ocean; CP = Central Pacific Ocean; SWP = Southwestern Pacific Ocean; SEP = Southeastern Pacific Ocean; CG = Circumglobal; AO = Antarctic Ocean; DST = Drake Strait; WS = Weddell Sea; BR = Brazil (species that only occur in Brazil). Record Type: LIT = in litteris; PHO = Photograph; SIG = in situ observation by authors. For museums code see Acronyms. For more details about museum specimens see Appendix 2. * Echinoderms species whose southern limit of geographic distribution in the Atlantic Ocean is Santa Catarina.

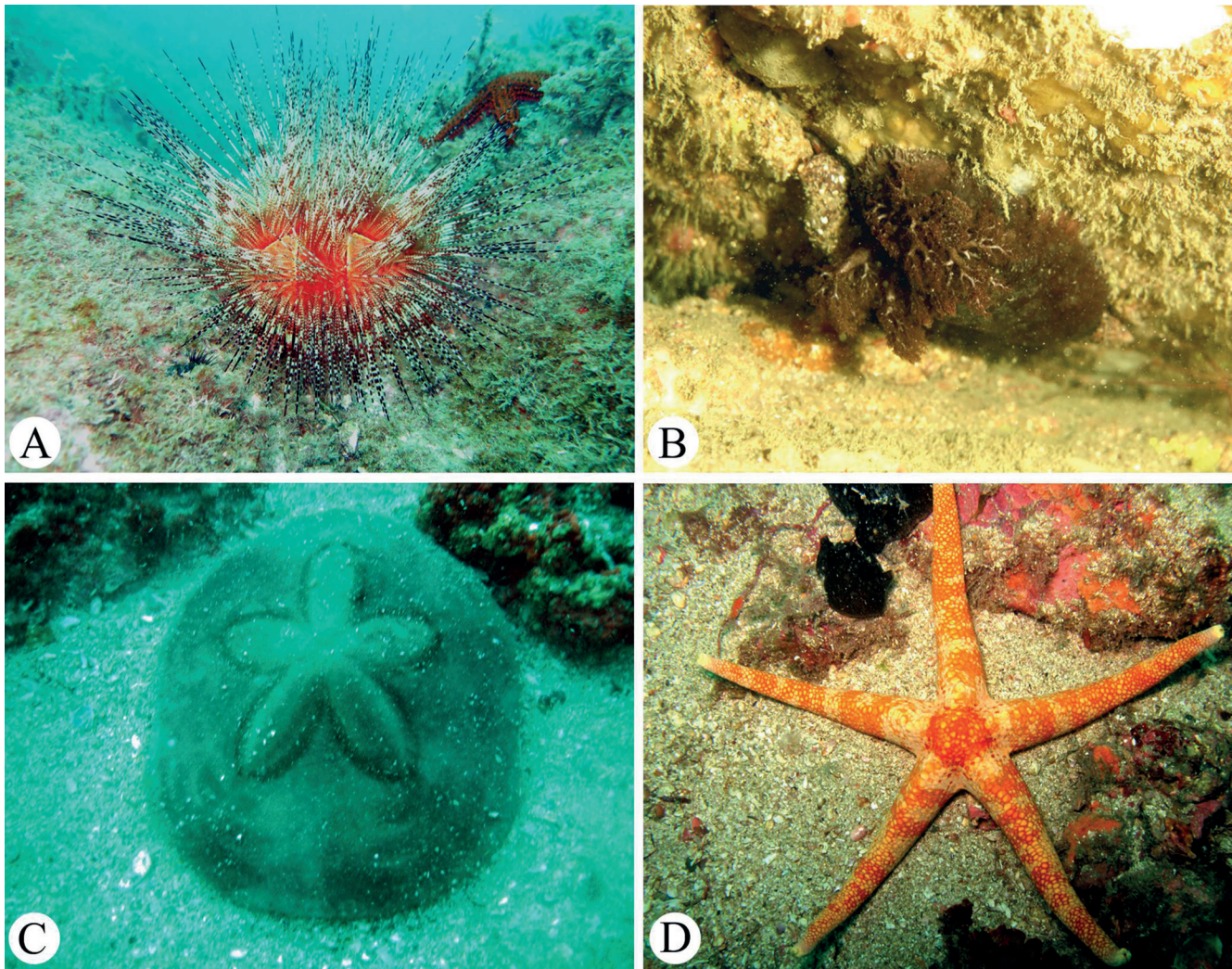


Figure 1. Some echinoderm species from Santa Catarina. (A) *Astropyga* sp. (Arvoredo Island; Photo: Jéssica Link), (B) *Holothuria* (*Halodeima*) *grisea* (Arvoredo Island; Photo: Thiago Fiuza), (C) *Clypeaster subdepressus* (Xavier Island; Photo: Nataly Slivak), (D) *Narcissia trigonaria* (Xavier Island; Photo: João Luís Carraro).

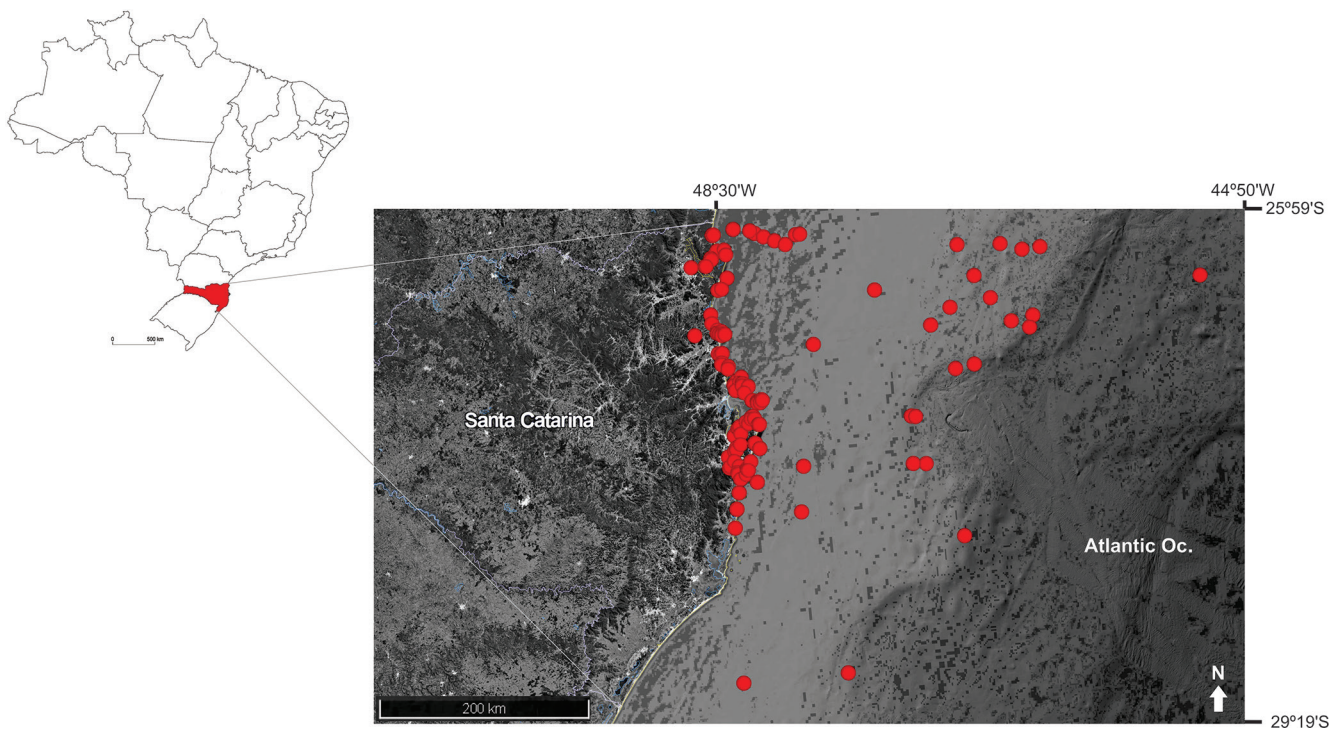


Figure 2. Map of Santa Catarina State, Brazil, showing the record sites of echinoderm species (red circles).

Table 2. Sites of echinoderm species records in Santa Catarina, Brazil.

Code	Site	Geographical Coordinates	References	№ of species
1 Continental Shelf of Santa Catarina				
1a	St. 6672-RevizEE/Score Sul-Bentos	26°27.75'S/44°35.11'W	Borges et al., 2002; Borges et al., 2004; Tommasi, 2004; ZUEC-OPH637	4
1b	St. 6689-RevizEE/Score Sul-Bentos	27°08.90'S/46°37.70'W	Borges et al., 2004; Borges et al., 2006	1
1c	St. 6692-RevizEE/Score Sul-Bentos	26°50.900'S/46°56.843'W	Borges et al., 2002; Borges et al., 2004	2
1d	St. 6693-RevizEE/Score Sul-Bentos	26°41.273'S/46°27.500'W	Borges et al., 2002; Borges et al., 2004; Tommasi, 2004; Borges et al., 2006; Borges & Amaral, 2007; Bueno, 2015; Bueno et al., 2018	11
1e	St. 6694-RevizEE/Score Sul-Bentos	26°31.269'S/46°34.377'W	Borges et al., 2002; Borges et al., 2004; Tommasi, 2004; Borges et al., 2006; ZUEC-OPH768; ZUEC-OPH774	3
1f	St. 6695-RevizEE/Score Sul-Bentos	26°17.51'S/46°41.23'W	Tommasi, 2004; Bueno, 2015	1
1g	St. 6698-RevizEE/Score Sul-Bentos	26°10.87'S/46°20.01'W	Borges et al., 2002; Borges et al., 2004; Tommasi, 2004; Bueno, 2015	3
1i	St. 6702-RevizEE/Score Sul-Bentos	26°01.50'S/45°59.00'W	Borges et al., 2006	1
1j	St. 6705-RevizEE/Score Sul-Bentos	25°59.73'S/45°37.32'W	Borges et al., 2006; Borges & Amaral, 2007	2
1k	St. 6777-RevizEE/Score Sul-Bentos	26°51.76'S/46°18.47'W	Borges et al., 2006; Bueno, 2015	1
1l	St. 6782-RevizEE/Score Sul-Bentos	27°10.18'S/46°46.80'W	Borges et al., 2006; Bueno, 2015	1
1m	St. 6785-RevizEE/Score Sul-Bentos	27°29.05'S/47°07.68'W	Borges et al., 2006	1
1n	St. 6786-RevizEE/Score Sul-Bentos	27°28.700'S/47°09.660'W	Borges et al., 2002; Borges et al., 2004; Borges et al., 2006; Borges & Amaral, 2007; Bueno, 2015	5
1o	St. 6789-RevizEE/Score Sul-Bentos	28°05'S/48°06'W	Borges et al., 2002; Borges et al., 2004; ZUEC-OPH796	2
1p	St. 6790-RevizEE/Score Sul-Bentos	27°49.29'S/47°04.49'W	Borges et al., 2006; Bueno, 2015	1
1q	St. 6791-RevizEE/Score Sul-Bentos	27°48.78'S/47°10.63'W	Borges et al., 2002; Borges et al., 2004; ZUEC-OPH799	1
1r	St. 6794-RevizEE/Score Sul-Bentos	27°45.85'S/48°03'W	Borges et al., 2002; Borges et al., 2004	1
1s	St. 6811-RevizEE/Score Sul-Bentos	29°14.672'S/47°50.669'W	Borges et al., 2002	1
1t	St. 6814-RevizEE/Score Sul-Bentos	29°15'S/48°41.80'W	Borges et al., 2002; Borges et al., 2004	1
1u	St. Of-06	26°55'0.001"S/46°10'0.001"W	ZUEC-OPH1855	1
1v	St. Of-17/08	28°21'S/46°49'W	ZUEC-OPH1856; ZUEC-OPH1871	2
1x	St. Of-24	26°16'S/46°10'W	ZUEC-OPH1872	1
1z	St. Of-35	26°50'S/46°8'W	ZUEC-OPH1859	1
1w	CCI45	26°34'0.0048"S/47°21'59.994"W	MNHN-IE2016-211	1
1dd	XI.1995	26°2'51"S/47°54'38.160"W	Bueno, 2015; Bueno et al., 2018; LABMAR-FAFIPAR	1
1ee	St. #5 NIPq Diadorim (CEPSULIBAMA)	26°18.76"S/48°26.024"W	Klein, 1998; Bueno, 2015; Bueno et al., 2018	4
1ff	St. #6 NIPq Diadorim (CEPSULIBAMA)	26°3'48.60"S/48°18'34.20"W	Klein, 1998; Bueno, 2015; Bueno et al., 2018	2
1gg	St. #7 NIPq Diadorim (CEPSULIBAMA)	26°6'56.16"S/48°12'25.20"W	Klein, 1998; Bueno, 2015; Bueno et al., 2018	2
1hh	St. #8 NIPq Diadorim (CEPSULIBAMA)	26°9'5.04"S/48°7'21.00"W	Klein, 1998; Bueno, 2015; Bueno et al., 2018	1
1ii	St. #9 NIPq Diadorim (CEPSULIBAMA)	26°11'6.72"S/48°2'22.56"W	Klein, 1998; Bueno, 2015; Bueno et al., 2018	4
1jj	St. #13 NIPq Diadorim (CEPSULIBAMA)	26°2'17.16"S/47°56'4.92"W	Klein, 1998; Bueno, 2015; Bueno et al., 2018	2
1kk	St. 6636/VIII.1982	26°3'0.00"S/48°15'59.76"W	Bueno, 2015; Bueno et al., 2018	1
2 Itapoá				
2a	Terceira Pedra	26°4'3.176"S/48°36'30.316"W	GBIF-ID2294663082	1
2b	next to Terceira Pedra	26°4'0.610"S/48°36'32.400"W	GBIF-ID2294662594; GBIF-ID2294661493	2

Table 2. Continued.

Code	Site	Geographical Coordinates	References	№ of species
2c	Segunda Pedra	26°41'11.892"S/48°36'23.544"W	GBIF-ID2269285137	1
2d	Itapema do Norte beach	26°04'S/48°36'W	Yoshimura, 1997; Cim, 1999	2
3	Babitonga			
3a	Itaguaçu-São Francisco do Sul Island	26°10'56.12"S/48°31'37.35"W	Oliveira, 1989	3
3b	next to the Ferry Boat Laranjeiras	26°17'6.40"S/48°40'47.67"W	Tommasi, 1964; Xavier, 2010	2
3c	Rabo Azedo-São Francisco do Sul Island	26°13'50.38"S/48°38'6.93"W	Tommasi, 1964	1
3d	Front of Pontal and Conoa	26°11'S/48°35'W	Tommasi, 1964	2
3e	Ubatuba Bay-São Francisco do Sul Island	26°13'S/48°31'W	Tommasi, 1964	5
3f	next to the São Francisco do Sul Seaport	26°14'30'S/48°38'W	Tommasi, 1964; Tommasi, 1970a	6
3g	next to the São Francisco do Sul Seaport	26°14'0.24"S/48°38'15.36"W	Lawley <i>et al.</i> , 2018	1
3h	Between Remédio and Arara Island	26°27'32.64"S/48°34'26.69"W	Tommasi, 1964	3
3i	Barra do Sul Beach	26°27'50.97"S/48°36'10.30"W	Branco <i>et al.</i> , 2015; Barrilli, 2018	4
3j	Paz Island	26°17'S/48°48'W	Riffel, 2016	1
3k	Tamboretes Archipelago	26°23'1.68"S/48°31'21.72"W	Lawley <i>et al.</i> , 2018	1
3l	São Francisco do Sul Island	Not informed	Klein <i>et al.</i> , 2001; USNM-E4684; USNM-E4685; USNM-E4686; USNM-E4689; USNM-E4703; USNM-E58380	5
4	Barra Velha	26°38'2.03"S/48°40'40.55"W	Tommasi, 1964	4
5	Grant/Canas Island	26°41'41.63"S/48°40'31.12"W	Tommasi, 1964	2
6	Feia Island	26°44'41.09"S/48°38'13.62"W	Soares & Resgalia-Jr., 2016	3
7	Itapocoroy Bay/Penha			
7a	Trápiche beach	26°47'11"S/48°36'20.22"W	Freire <i>et al.</i> , 2011	1
7b	Quilombo beach	26°46'2.24"S/48°38'24.21"W	Freire <i>et al.</i> , 2011; Xavier, 2010	2
7c	rocky shore at Quilombo Beach	26°46'1.36"S/48°38'25.03"W	Vidolin <i>et al.</i> , 2002; Calil <i>et al.</i> , 2009	2
7d	in front of Quilombo beach	26°46'S/48°38'W	Tommasi, 1964	1
7e	Paciência Beach	26°46'27.06"S/48°36'0.86"W	Monteiro, 1998; Castellano, 2009; Xavier, 2010; Castellano <i>et al.</i> , 2017	7
7f	Ponta da Vigia	26°46'53.73"S/48°34'49.66"W	Branco <i>et al.</i> , 2015; Müller, 1898	11
7g	Penha Bay	Not informed	MZUSP-00552; MZUSP-00714	1
7h	in front of Armação de Itapocoroy	26°46'-26°47'S/48°36'-48°37'W	Oliveira, 1989; Branco <i>et al.</i> , 1998; Lunardon-Branco <i>et al.</i> , 2006; Martins & Almeida, 2014; Barrilli, 2018	10
7i	Canto do Poá	26°46'10"S/48°49'10"W	Mendes <i>et al.</i> , 2006	1
8	Cabeçadas Beach	26°55'36.99"S/48°37'53.94"W	Tommasi, 1965; Tommasi, 1970a	1
9	Itajaí-açu River mouth	26°54'52.45"S/48°36'56.09"W	Branco <i>et al.</i> , 2015	4
10	Itajaí	Not informed	USNM-E534; USNM-E538; Tommasi, 1970a	4
11	Balneário Camboriú			
11a	next to the Parcel – Camboriu Bay	26°58'46.495"S/48°37'26.263"W	EQMN551	1
11b	Central Beach	26°59'38.620"S/48°37'37.967"W	GBIF-IDID2574244872	1
11c	Taquaras Beach	27°0'39.72"S/48°34'34.89"W	Riffel, 2016	1
11d	Estaleiro Beach	27°1'41.69"S/48°34'50.20"W	Oliveira, 1989	2

Table 2. Continued.

Code	Site	Geographical Coordinates	References	Nº of species
12 Porto Belo				
12a	Not informed	27°5'45.77"S/48°28'53.86"W	Branco <i>et al.</i> , 2015	7
12b	Caixa D'Aço Beach	27°7'35.69"S/48°31'34.60"W	Soares & Resgalla-Jr., 2016	1
12c	Estaleiro beach – Porto Belo Bay	27°7'12.62"S/48°31'6.82"W	Riffel, 2016	2
12d	Porto Belo Bay	27°9'1.00"S/48°32'32.46"W	Reichholf, 1981; Barrilli, 2018	4
12e	Bombas Bay	27°8'1.77"S/48°29'59.75"W	Caregnato <i>et al.</i> , 2009	1
12f	Sepultura beach	27°08'26.60"S/48°28'45.67"W	Fagundes, 2016	3
12g	Sepultura beach	27°08'28"S/48°28'42"W	Castellano <i>et al.</i> , 2017	1
12h	Sepultura beach	27°08'29.288"S/48°28'43.097"W	EOMN1148; EOMN1149; EOMN1150; EOMN1152; EOMN1153; EOMN1154; EOMN1155; EOMN1156; EOMN1157; EOMN1158; EOMN1160; EOMN1161; EOMN1162; EOMN1202	12
12i	Sepultura beach	27°8'29.72"S/48°28'40.77"W	Riffel, 2016	1
12j	Porto Belo (João da Cunha) Island	27°8'36.14"S/48°32'39.71"W	Xavier, 2010; Vieira <i>et al.</i> , 2016	2
12k	Quatro Ilhas Beach	27°9'26.820"S/48°28'51.132"W	EOMN1177; EOMN1178; EOMN1179	3
12l	Zimbros Bay	27°11'6.74"S/48°32'6.14"W	Caregnato <i>et al.</i> , 2009	1
12m	Amendoim (Macacos) Island	27°12'25.17"S/48°28'8.68"W	Oliveira, 1989	4
13 Reserva Biológica Marinha do Arvoredo (REBIO do Arvoredo)				
13a	Galé Island	27°9'57.08"S/48°25'58.67"W	Oliveira, 1989	7
13b	Deserta Island	27°16'23"S/48°19'53"W	Oliveira <i>et al.</i> , 1987; Oliveira, 1989; Labbé-Bellas, 2013	4
13c	Deserta Island	27°16'6.28"S/48°20'9.67"W	Lopes <i>et al.</i> , 2017	1
13d	Arvoredo Island	Not informed	Oliveira <i>et al.</i> , 1987; Oliveira, 1989; Marchiori <i>et al.</i> , 1996; Xavier, 2010	1
13e	Arvoredo Island-southeast	27°17'16"S/48°20'56"W	Barboza <i>et al.</i> , 2010	2
13f	Arvoredo Island-southwest	27°17'20.27"S/48°22'13.12"W	Labbé-Bellas, 2013; Labbé-Bellas <i>et al.</i> , 2016; iNaturalist-61249405	6
13g	Arvoredo Island-Rancho Norte	27°16'39.51"S/48°22'32.47"W	Metri, 2006; Lindner <i>et al.</i> , 2017	8
13h	Arvoredo Island-central west	27°17'10.572"S/48°22'14.833"W	EOMN4058; EOMN3895; EOMN3897	1
14	Tijucas	27°16'0.68"S/48°24'45.27"W	Branco <i>et al.</i> , 2015	2
15 north of Florianópolis Island				
15a	Ponta do Rapa	27°22'46.304"S/48°25'0.181"W	EOMN1185; EOMN1184	2
15b	Ponta da Laje	27°23'13.06"S/48°25'54.40"W	GBIF-ID1990466364	1
15c	Ponta das Canas Beach	27°23'54.89"S/48°25'58.12"W	Oliveira, 1989	6
15d	Francés Island	27°24'58.07"S/48°28'34.73"W	Oliveira, 1989	1
15e	Canasvieiras Beach	27°25'37.53"S/48°27'28.06"W	Tommasi, 1970a; Oliveira, 1989	2
15f	Brava beach	27°23'50.230"S/48°24'24.955"W	EOMN1183	1
15g	Inglêses Beach	Not informed	Oliveira, 1989	2
15h	Inglêses Beach-south bay	27°26'25.43"S/48°22'16.96"W	Fagundes, 2016	2
15i	Inglêses Beach-south bay	27°26'24.238"S/48°22'22.134"W	EOMN1186; EOMN1188	2
15j	Daniela Beach	Not informed	Oliveira, 1989	4
15k	Pontal Beach	27°27'18.16"S/48°32'24.35"W	Soares & Resgalla-Jr., 2016	1

Table 2. Continued.

Code	Site	Geographical Coordinates	References	Nº of species
15l	Pontal da Daniela	27°27'32.033"S/48°32'46.108"W	GBIF-ID2518107442	1
15m	Sambaqui Beach	27°29'41.52"S/48°31'35.89"W	Oliveira, 1989	4
15n	North bay	Not informed	Moreira, 2011	4
16 central region of Florianópolis Island				
16a	next to the Estreito	27°35'18.66"S/48°34'13.91"W	MCZ species	4
16b	Barra da Lagoa	Not informed	Oliveira, 1989	2
16c	Barra da Lagoa	27°34'16.31"S/48°25'22.23"W	Fagundes, 2016	3
16d	Barra da Lagoa	27°34'20.24"S/48°25'26.00"W	Riffel, 2016	1
16e	Praiaha do Leste	27°34'24.218"S/48°25'11.460"W	EQMMN1189; EQMMN1197	2
16f	Praiaha do Leste	27°34'23.329"S/48°25'13.858"W	EQMMN1190; EQMMN1191; EQMMN1193; EQMMN1194; EQMMN1195; EQMMN1196	4
16g	Ponta do Coral	27°34'10.99"S/48°32'14.57"W	Oliveira, 1989	4
16h	Xavier Island	Not informed	Oliveira, 1989; Oliveira <i>et al.</i> , 1987	3
16i	Xavier Island-west side	27°36'32.83"S/48°23'10.88"W	GBIF-ID1913660323	2
16j	Saudade (Coqueiros) Beach	27°36'24.14"S/48°34'21.72"W	Oliveira, 1989	3
16k	Itaguaçu Beach	27°37'2.32"S/48°35'21.28"W	Oliveira, 1989	3
17 south of Florianópolis Island				
17a	South bay	Not informed	Moreira, 2011	6
17b	Campeche Island	Not informed	Oliveira <i>et al.</i> , 1987; Oliveira, 1989	3
17c	Ribeirão da Ilha Beach	27°43'17.35"S/48°33'54.43"W	Oliveira, 1989	3
17d	Armação Beach	Not informed	Oliveira, 1989	4
17e	Armação Beach-next to the Ponta das Campanhas	27°44'51.248"S/48°30'2.221"W	EQMMN1180; EQMMN1182	2
17f	Matadeiro beach	27°45'21.09"S/48°29'36.19"W	Fagundes, 2016	4
17g	Matadeiro beach	27°45'19.63"S/48°29'43.53"W	Riffel, 2016	2
17h	Ponta do Caiacanguçu	27°45'46.49"S/48°34'53.10"W	Oliveira, 1989	3
17i	Pombas Island	Not informed	Oliveira, 1989	1
17j	Pântano do Sul Bay	Not informed	Oliveira, 1989	1
17k	Caieira da Barra Sul	Not informed	Oliveira, 1989	3
18 south of Santa Catarina coast				
18a	Moleques do Sul Island	Not informed	Oliveira, 1989	5
18b	Palhoça	Not informed	Branco <i>et al.</i> , 2015	8
18c	Guarda do Embaú	27°54'27.022"S/48°35'0.499"W	EQMMN1554	1
18d	Vigia	28°11'16.64"S/48°36'49.73"W	Fagundes, 2016	3
18e	Vigia	28°11'21.14"S/48°36'52.11"W	Riffel, 2016	3
18f	Batuta Island	28°9'11.00"S/48°38'31.45"W	Riffel, 2016	3
18g	Praia de Fora-Palhoça	27°43'39.45"S/48°38'29.01"W	Tommasi, 1970a	1
18h	Pontal	27°43'0.04"S/48°37'59.98"W	Santana <i>et al.</i> , 2020	2

Echinoderm distribution along Santa Catarina coast

Of the 134 sites where echinoderm species were recorded (Fig. 2), the shallow continental shelf and the Arvoredo area concentrated the highest number of species. The continental shelf of Santa Catarina was mainly explored by the ReviZEE program (Living Resources in the Exclusive Economic Zone). The program provided the discovery of new marine species for Brazil, especially those inconspicuous and difficult to be sampled, such as ophiuroids (Borges *et al.*, 2002, 2006). In this study, we observed that most of the ophiuroids registered for Santa Catarina came from the ReviZEE program (45%). Due to mobility, diversity of eating habits and small size, ophiuroids are able to explore habitats often unattainable by other echinoderms (Hyman, 1955; Bueno *et al.*, 2018).

Part of Arvoredo Island is within the Arvoredo Marine Biological Reserve, a conservation unit that also includes Galé and Deserta Island, and Calhau de São Pedro (Segal *et al.*, 2017). The echinoderm records reported herein are mainly from the north and center-north coast of Santa Catarina (26 species), where the Arvoredo Marine Reserve is located. Rocky shores and coastal islands characterize this coastal region, environments suitable for several echinoderm species. In addition, most marine research institutions are located in the center-north region of Santa Catarina, and thus may contribute to the largest sample effort in this area. In contrast, the results revealed a lower number of echinoderm records in the southern region of Santa Catarina. Sandy beaches and dunes characterize the southern coast of Santa Catarina, where marine and wind processes predominate. The echinoderm species reported in the literature for the southern coastal region were the epibenthic sea biscuits, *Encope emarginata* and *Melitta quinquesperforata* (Tavares, 1996; Brustolin, 2013).

These animals live under sandy and/or muddy substrate and require different sampling techniques, such as fishing nets and trawls. The lower number of echinoderms recorded between 27°50'S and 29°20'S latitudes can indicate that the echinoderm diversity presented in this study may be underestimated due to the absence of further studies and/or appropriate sampling methods.

Ophiuroidea was the most representative class, with 33 species recorded (50%). Some authors also observed similar results for the northeast region of Brazil, such as 50% ophiuroid records in Bahia state (Alves & Cerqueira, 2000; Magalhães *et al.*, 2005), 40% in Paraíba (Gondim *et al.*, 2008) and 42% in Pernambuco (Lima & Fernandes, 2009). In Paraná state, southern Brazil, ophiuroid diversity (34 species) was similar to this study, comprising 55% of the echinoderm fauna (Bueno *et al.*, 2018). Ophiuroidea representativeness is a pattern on the Brazilian coast, comprising 153 extant species (43.7% of 347 species of echinoderms) (Ventura *et al.*, 2013). Asteroidea and Echinoidea were the second and third most representative classes at Santa Catarina (22.7% each) followed by Holothuroidea and Crinoidea (2.6% each). The starfish *Asterina stellifera* and *Echinaster (Othilia) brasiliensis* occurred in at least 29 coastal sites, and the sea urchin *Echinometra lucunter* and *Arbacia lixula*, in 25 and 21,

respectively (Table 1). Our results also reveal that Santa Catarina is the southernmost record for 40 species, that is, about 60% of the species recorded (Table 1; see Geographic Range column). In addition, 12 of the recorded species listed in this study (17%) are endemic to the Brazilian coast, such as two ophiuroid species recently described, *Ophiothrix tommasii* Santana, Manso, Almeida & Alves, 2020 and *Ophiothrix troscheli* Santana, Manso, Almeida & Alves, 2020. New species recorded recently (Santana *et al.*, 2020) and new occurrences (Labbé-Bellas *et al.*, 2016; Lopes *et al.*, 2017) show that there is still much to learn about the echinoderm fauna of Santa Catarina.

Taxonomic information

In this study, we provided the updated species names for some ophiuroids, such as *Ophiomusa acufera* (before named *Ophiomusium acuferum*) and *Ophiomastix wendtii* (before named *Ophiocoma wendtii* Müller & Trsochel, 1842 and *Ophiocoma riisei* Lütken, 1856) (O'Hara *et al.*, 2018a, b). As presented above, in Brazil ophiuroids are one of the most abundant and studied groups of the Echinodermata macrofauna (Ventura *et al.*, 2013). Consequently, the systematics of ophiuroids is currently in flux (Albuquerque *et al.*, 2001; Borges *et al.*, 2002, Borges & Campos, 2011; Borges & Amaral, 2007; Gondim *et al.*, 2010, 2014, 2015; Manso *et al.*, 2014; Alitto *et al.*, 2020; Santana *et al.*, 2020), and with the increase in molecular data, more species can be expected to be discovered.

In Santa Catarina, the starfish *Echinaster (Othilia) brasiliensis* was identified in 29 sites, recorded by 14 scientific references (Table 1). In Brazil, three *Othilia* species have been recorded, *Othilia brasiliensis* (Tommasi, 1970b; Hopkins *et al.*, 2003; Netto *et al.*, 2005; Lima & Fernandes, 2009; Gondim *et al.*, 2011, 2020; Miranda *et al.*, 2012; Ventura *et al.*, 2013; Alitto *et al.*, 2016), *Othilia guyanensis* (Hopkins *et al.*, 2003; Mariante *et al.*, 2010; Ventura *et al.*, 2013) and *Othilia echinophorus* (Tommasi, 1970b; Alves & Cerqueira, 2000; Hopkins *et al.*, 2003; Gondim *et al.*, 2008, 2011, 2020; Lima & Fernandes, 2009; Miranda *et al.*, 2012; Ventura *et al.*, 2013). However, according to the phylogenetic study by Lopes *et al.* (2016), *O. brasiliensis* and *O. guyanensis* should be synonymized, and the status of *O. echinophorus* should be reviewed; the authors emphasize the large morphological variability and phenotypic plasticity of the genus *Echinaster*, and support the raise of the genus *Othilia*, previously demoted to subgenus (Clark & Tortonese, 1986). Morphological (Fontanella & Hopkins, 2003) and molecular data (Lopes *et al.*, 2016) have shown that *Othilia* is a monophyletic group and that the genus *Echinaster* is closer and more related to *Henricia* Gray 1840 than to *Othilia*.

Two echinoderm genera, in the present study, are not identified at the species level, the equinoids *Astropyga* and *Pseudoboletia*. The genus *Astropyga* is recorded for Brazil as *Astropyga nuptialis*, described for the state of São Paulo (Tommasi, 1958), and as *Astropyga magnifica* A.H. Clark, 1934 for Santa Catarina and Pernambuco

(Oliveira et al., 1987; Lima & Fernandes, 2009). Oliveira et al. (1987) recorded *A. magnifica* for Deserta Island (Arvoredo Marine Reserve) at 12 m depth. Recently, echinoderm researcher Cesar Cordeiro identified this genus at Arvoredo Island (ReBio Arvoredo) (Photo: iNaturalist – 61249405). However, as we did not have access to this material, we chose to keep it at genus level, and we suggest a taxonomic study to identify which of the two *Astropyga* species occur in Santa Catarina.

Lopes et al. (2017) recorded the genus *Pseudoboletia* sp. at Deserta Island, Santa Catarina and Cabo Frio Island, Rio de Janeiro. The molecular results differentiated three species of this genus, two from the Indo-Pacific (*P. indiana* and *P. maculata*) and one from the Atlantic (*Pseudoboletia* sp. from São Tome and Brazil). Martins et al. (2018) referred the specimens from the Trindade Island, as *P. maculata*, whose morphological characteristics are the same as those of *P. maculata* from the Indo-Pacific, but different from those recorded by Lopes et al. (2017) in Rio de Janeiro and Santa Catarina.

In this study, we adopted a method of taxonomic reliability (see “Record Type” in Table 1). Direct access to the documented literature material is not always possible, but it is important to validate this information. Although we included data from unpublished studies, these species records were included herein when also presenting photographs of the reported species. Most studies are specific publications on echinoderms (about 90%), carried out by experts in the group. We emphasize the importance of this literature for this checklist and for future studies on local biodiversity and ecology.

During this work, one ophiuroid species was reported for the first time in Santa Catarina, *Ophiacantha pentacrinus*. This specimen was identified by Dr. Michela Borges, ophiuroids specialist, and deposited in the Museu de Zoologia da UNICAMP (Coleção de Ophiuroidea) (UNICAMP Museum of Zoology (Collection of Ophiuroidea)), but was not previously reported in the literature. The species *Ophiacantha cosmica* and *Ophiacantha pentacrinus* have long been confused, taxonomically. Species identified as *O. cosmica* may actually be of this species or an *O. pentacrinus* (Tommasi, 1999). Even today, echinoderm specialists work with these two species in order to guarantee the correct identification. In addition to being a new record of this species in Brazil, Santa Catarina is the southernmost location for the distribution of *O. pentacrinus*.

Habitat distribution

Echinoderms inhabit all types of marine substrate (Ventura et al., 2016). Most species of ophiuroids are bottom dwellers on the sea floor, buried in mud or hidden in crevices and holes in rock or coral (Stöhr et al., 2008, 2012). In Santa Catarina, we observed that some ophiuroid species are epizoic, such as *Ophiactis savi-gnyi*, which colonizes other ophiuroids species, and *Astrocyclus caecilia*, which was observed on *Ellisella elongata* (Pallas, 1766), a gorgonian species (Oliveira, 1989;

Stöhr et al., 2012). Starfishes occur in unconsolidated (sandy, muddy) and consolidated (rocks) substrates. All starfish species recorded in this work occur in soft bottom. The species of the families Astropectinidae and Luidiidae are infaunal, that is, they spend most of their time under the substrate, such as *Astropecten brasiliensis* and *Luidia senegalensis* (Clark & Downey, 1992). However, *Echinaster (Othilia) brasiliensis*, for example, lives on rocks, rhodolites and shells, as they are mainly sponge-eating animals (Ferguson, 1969).

Echinoids, such as *Arbacia lixula*, *Echinometra lucunter* and *Tripneustes ventricosus*, typically inhabit rocky coast, rocky bottoms and seagrass beds (Mah & Blake, 2012; Tavares & Borzone, 2015), the same substrate pattern is observed for these species at Santa Catarina coast. In Northern Brazil, these animals also occur in tidal pools, biogenic reefs, crevices and dead coral substrate (Santos et al., 2002; Lima et al., 2009; Labbé-Bellas et al., 2016).

Crinoids occur in all oceans and ranging from coastal to abyssal depths, such as *Tropiometra carinata*, a common species on the Brazilian coast (MacCord & Duarte, 2002; Souto & Martins, 2017). This species was usually observed by the first and second authors as attached to the lateral surface of rocks, such as illustrated by Ventura et al. (2016). *Democrinus conifer* was collected on the outer continental shelf, in Santa Catarina, through the Living Resources Program in the Exclusive Economic Zone (ReviZEE), Score Sul/Bentos (Tommasi, 2004). This species has been recorded for Rio de Janeiro, São Paulo and Paraná (Bueno et al., 2018), however little information about this species in Brazilian waters is available.

Two holothurians species are present in this study, *Holothuria (Halodeima) grisea* and *Isostichopus badionotus*. Mendes et al. (2006) reported *Holothuria (Halodeima) grisea* in Armação do Itapocoroy Bay with a clumped distribution on rocky bottoms, however in sandy bottom areas, there was a high frequency of isolated specimens (not clumped). This seems to be a pattern along the Brazilian coast (Alves & Cerqueira, 2000; Miranda et al., 2012; Alitto et al., 2016; Leite-Castro et al., 2016). *Isostichopus badionotus* is an epibenthic holothurian widely distributed on shallow muddy, sandy and seagrass bed, but can also be found in coral reefs (Zacarias-Soto et al., 2013). In Santa Catarina, this species was observed in Arvoredo Island on sandy substrate, with different color patterns. There is little information about this species in Brazilian waters.

Threatened species

In this study, 16 threatened species were recorded (21% of total) (IMA, 2011). Of the 16 starfish species recorded, six are on the endangered national fauna list (ICMBio, 2018). According to Ventura et al. (2013), accidental capture by shrimp trawlers is one of the main threats to echinoderms, especially for asteroids that live in sandy and muddy bottoms, such as *Astropecten brasiliensis*, *Astropecten cingulatus*, *Luidia clathrata* and *Luidia senegalensis*. In Santa Catarina, Branco et al. (2015)

recorded 11 echinoderms species as bycatch in artisanal fishing for the seabob shrimp *Xiphopenaeus kroyeri* (Heller, 1862), that is, 68.75% of the total threatened echinoderm species in the Santa Catarina coast. In this context, knowledge about factors that affect the structure of communities in the areas in which trawling fisheries operate can be an important tool for the correct and sustainable management of fisheries (Barrilli, 2018).

Other potential threats to echinoderms in Santa Catarina are aquarium trade and commercial fishing for souvenirs and decorative items that affect starfishes such as *Oreaster reticulatus* and *Asterina stellifera*, which are captured and marketed to tourists (Ventura *et al.*, 2013; Branco *et al.*, 2015; Souto & Martins, 2017). In addition, although the echinoderm exploration for food purpose in Brazil is still small, the echinoid *Echinometra lucunter*

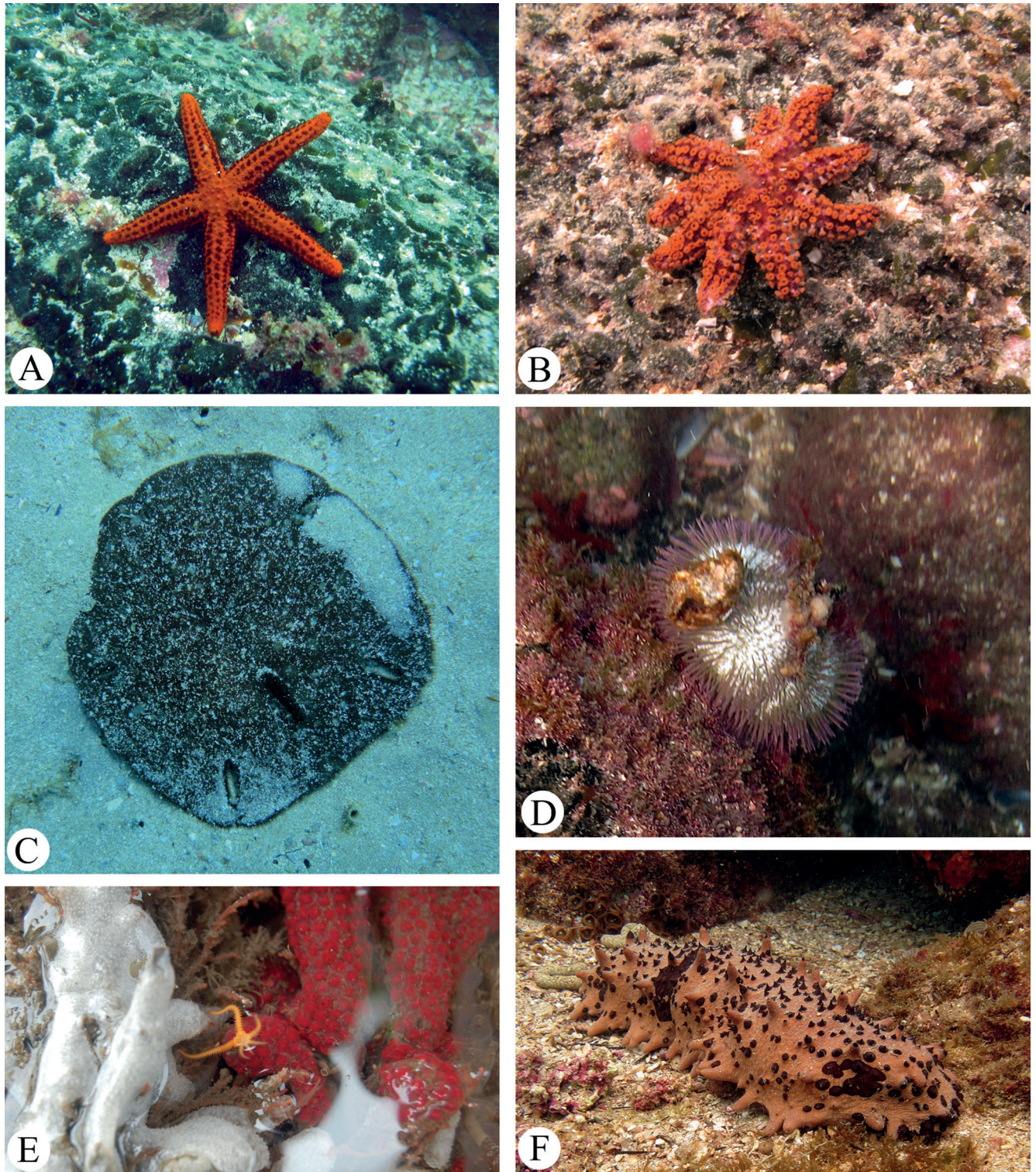


Figure 3. Some echinoderms species from Santa Catarina. (A) *Echinaster (Othilia) brasiliensis* (Xavier Island; Photo: Nataly Slivak), (B) *Coscinasterias tenuispina* (Xavier Island; Photo: Nataly Slivak), (C) *Mellita quinquiesperforata* (Saco do Capim – Arvoredo Island; Photo: Jonathan Lawley), (D) *Lytechinus variegatus* (Xavier Island; Photo: Nataly Slivak), (E) *Ophiothela mirabilis* (Photo: Jonathan Lawley), (F) *Isosticopus badionotus* (Rancho Norte-Arvoredo Island; Photo: Nataly Slivak).

is already marketed as a delicacy and there is evidence of illegal exploitation of the holothuroids *Isostichopus badiionotus* and *Holothuria (H.) grisea* in Brazil (Souto & Martins, 2017). Besides that, echinoderms, such as those recorded in the North and South Bays of Santa Catarina directly associated with the bottom, can be susceptible to contaminants stored in marine sediment caused by the progressive occupation and environmental degradation in favor of urban expansion (Moreira, 2011).

Therefore, studies on reproductive biology, population dynamics and genetics are needed. To achieve this knowledge, it is essential to protect these species. Currently, the Institute of the Environment of Santa Catarina (Instituto do Meio Ambiente de Santa Catarina, IMA), works with environmental protection programs in Hydrographic Basins and Federal Marine-Coastal Conservation Units, such as the Arvoredo Biological Marine Reserve (Reserva Biológica Marinha do Arvoredo), which shelter most echinoderm species listed in this study (IMA, 2011).

CONCLUSION

Considering the great length of the Brazilian's coastline, information on the occurrence and distribution of extant echinoderms species seems to be insufficient. Regional biodiversity inventories are the first step in understanding coastal ecological processes even at ocean scales. The remarkable number of new records, in recent years, of Echinodermata fauna listed in this study for Santa Catarina, reveals the lack of taxonomic studies. Updated checklists, as presented herein, may help monitor anthropic impacts, foster conservation strategies and generate subsidies for future studies of taxonomy, ecology and related fields.

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APPENDICES

Appendix 1: Scientific bibliographic references used to compile the distribution data of echinoderm species on the coast of Santa Catarina. In the middle column, the type of material found and if it is available online.

References	Type	Availability	Species number
Lindner <i>et al.</i> , 2017	book chapter	printed	7
Ventura <i>et al.</i> , 2016	book chapter	online	18
Marchiori <i>et al.</i> , 1996	conference proceedings	printed	7
Monteiro, 1998	conference proceedings	printed	1
Oliveira <i>et al.</i> , 1987	conference proceedings	printed	16
Oliveira, 1990	conference proceedings	printed	21
Amaral <i>et al.</i> , 2008	endangered species lists	online	9
ICMBio, 2018	endangered species lists	online	6
IMA, 2011	endangered species lists	online	16
Nascimento & Campos, 2011	endangered species lists	online	10
Bueno, 2015	master thesis	printed	25
Labbé-Bellas, 2013	master thesis	online	6
Moreira, 2011	master thesis	online	7
Netto, 2006	master thesis	online	10
Riffel, 2016	master thesis	online	3
Barrilli, 2018	PhD thesis	online	3
Borges, 2006	PhD thesis	online	4
Metri, 2006	PhD thesis	online	8
Borges <i>et al.</i> , 2004	technical report	online	12
Tommasi, 2004	technical report	online	4
Barboza <i>et al.</i> , 2010	scientific manuscripts	online	1
Borges & Amaral, 2007	scientific manuscripts	online	2
Borges <i>et al.</i> , 2002	scientific manuscripts	online	11
Borges <i>et al.</i> , 2006	scientific manuscripts	online	1
Branco <i>et al.</i> , 1998	scientific manuscripts	online	5
Branco <i>et al.</i> , 2015	scientific manuscripts	online	11
Bueno <i>et al.</i> , 2018	scientific manuscripts	online	20
Calil <i>et al.</i> , 2009	scientific manuscripts	online	1
Caregnato <i>et al.</i> , 2009	scientific manuscripts	online	1
Castellano <i>et al.</i> , 2017	scientific manuscripts	online	3
Freire <i>et al.</i> , 2011	scientific manuscripts	online	1
Gondim <i>et al.</i> , 2014	scientific manuscripts	online	8
Labbé-Bellas <i>et al.</i> , 2016	scientific manuscripts	online	8
Lawley <i>et al.</i> , 2018	scientific manuscripts	online	1
Lopes <i>et al.</i> , 2016	scientific manuscripts	online	1
Lopes <i>et al.</i> , 2017	scientific manuscripts	online	1
Lunardon-Branco <i>et al.</i> , 2006	scientific manuscripts	online	2
Martins & Almeida, 2014	scientific manuscripts	online	2
Mendes <i>et al.</i> , 2006	scientific manuscripts	online	1
Müller, 1898	scientific manuscripts	online	1
Rathbun, 1879	scientific manuscripts	online	4
Reichholf, 1981	scientific manuscripts	online	1
Santana <i>et al.</i> , 2020	scientific manuscripts	online	3
Soares & Resgalla-Jr., 2016	scientific manuscripts	online	4
Tommasi, 1964	scientific manuscripts	printed	11
Tommasi, 1965	scientific manuscripts	printed	1
Tommasi, 1966	scientific manuscripts	printed	2
Tommasi, 1970a	scientific manuscripts	printed	5
Tommasi, 1970b	scientific manuscripts	printed	2
Vidolin <i>et al.</i> , 2002	scientific manuscripts	online	2
Vieira <i>et al.</i> , 2016	scientific manuscripts	online	1
Xavier, 2010	scientific manuscripts	online	33
Castellano, 2009	undergraduate thesis	online	3
Cim, 1999	undergraduate thesis	online	1
Fagundes, 2016	undergraduate thesis	printed	4
Klein, 1998	undergraduate thesis	online	3
Oliveira, 1989	undergraduate thesis	printed	12
Yoshimura, 1997	undergraduate thesis	online	1

Appendix 2: Santa Catarina echinoderms record in online scientific databases, photographic database, and Museum Collections. **N. indiv.** = number of individuals. For abbreviations, see list of Acronyms.

Species	Catalog code	Institution	Collection	Expedition	Coordinates	Event date mm/dd/yyyy	Database access	N. indiv.
<i>Amphitima olivacea</i> (Lyman, 1869)	MNHN-JE-2016-211	MNHN-FR	IE	Calypso 1961-62/CC145	26°34'0.0048"S 47°21'59.994"W	12/15/1961	MNHN Database	57
<i>Astropecten marginatus</i> Gray, 1840	MCZ:IZ:AST-180	MCZ-IZ	IZ	Fritz Müller	27°35'18.66"S 48°34'13.91"W	1861	MCZbase (The Database of the Zoological Collections)	1
<i>Luidia senegalensis</i> (Lamarck, 1816)	MCZ:IZ:AST-392	MCZ-IZ	IZ	Fritz Müller	27°35'18.66"S 48°34'13.91"W	1861	MCZbase (The Database of the Zoological Collections)	1
<i>Asterina stellifera</i> (Möbius, 1859)	MCZ:IZ:AST-683	MCZ-IZ	IZ	Fritz Müller	27°35'18.66"S 48°34'13.91"W	1861	MCZbase (The Database of the Zoological Collections)	1
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	MCZ:IZ:AST-1087	MCZ-IZ	IZ	Fritz Müller	27°35'18.66"S 48°34'13.91"W	1861	MCZbase (The Database of the Zoological Collections)	1
<i>Ophiactis savignyi</i> (Müller & Troschel, 1842)	MCZ:IZ:OPH-1220	MCZ-IZ	IZ	Fritz Müller	27°35'18.66"S 48°34'13.91"W	1861	MCZbase (The Database of the Zoological Collections)	1
<i>Arbacia lixula</i> (Linnaeus, 1758)	EQMN1158	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	1
<i>Arbacia lixula</i> (Linnaeus, 1758)	EQMN1185	MN/UFRJ	EQMN	snorkeling	27°22'46.304"S 48°25'0.181"W	02/01/1990	GBIF	3
<i>Arbacia lixula</i> (Linnaeus, 1758)	EQMN1186	MN/UFRJ	EQMN	snorkeling	27°26'24.238"S 48°22'22.134"W	02/01/1990	GBIF	2
<i>Arbacia lixula</i> (Linnaeus, 1758)	EQMN1196	MN/UFRJ	EQMN	snorkeling	27°34'23.329"S 48°25'13.858"W	02/01/1990	GBIF	1
<i>Arbacia lixula</i> (Linnaeus, 1758)	EQMN1197	MN/UFRJ	EQMN	snorkeling	27°34'24.218"S 48°25'11.460"W	02/01/1990	GBIF	1
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1154	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	3
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1179	MN/UFRJ	EQMN	snorkeling	27°9'26.820"S 48°28'51.132"W	02/01/1990	GBIF	1
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1180	MN/UFRJ	EQMN	snorkeling	27°44'51.248"S 48°30'2.221"W	02/01/1990	GBIF	2
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1183	MN/UFRJ	EQMN	snorkeling	27°23'50.230"S 48°24'24.955"W	02/01/1990	GBIF	1
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1184	MN/UFRJ	EQMN	snorkeling	27°22'46.304"S 48°25'0.181"W	02/01/1990	GBIF	2
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1188	MN/UFRJ	EQMN	snorkeling	27°26'24.238"S 48°22'22.134"W	02/01/1990	GBIF	2
<i>Asterina stellifera</i> (Möbius, 1859)	EQMN1189	MN/UFRJ	EQMN	snorkeling	27°34'24.218"S 48°25'11.460"W	02/01/1990	GBIF	3
<i>Clypeaster subdepressus</i> (Gray, 1825)	EQMN1162	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	2
<i>Coscinasterias tenuispina</i> (Lamarck, 1816)	EQMN1155	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	6
<i>Coscinasterias tenuispina</i> (Lamarck, 1816)	EQMN1178	MN/UFRJ	EQMN	snorkeling	27°9'26.820"S 48°28'51.132"W	02/01/1990	GBIF	1
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	EQMN1153	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	3
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	EQMN3895	MN/UFRJ	EQMN	snorkeling	27°17'10.572"S 48°22'14.833"W	12/05/2012	GBIF	1
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	EQMN3897	MN/UFRJ	EQMN	snorkeling	27°17'10.572"S 48°22'14.833"W	12/05/2012	GBIF	1
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	EQMN4058	MN/UFRJ	EQMN	snorkeling	27°17'10.572"S 48°22'14.833"W	12/05/2012	GBIF	1
<i>Echinometra lucunter</i> (Linnaeus, 1758)	EQMN1156	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	1
<i>Echinometra lucunter</i> (Linnaeus, 1758)	EQMN1195	MN/UFRJ	EQMN	snorkeling	27°34'23.329"S 48°25'13.858"W	02/01/1990	GBIF	1
<i>Enopla emarginata</i> (Leske, 1778)	EQMN1161	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S 48°28'43.097"W	02/01/1990	GBIF	1

Appendix 2: Continued.

Species	Catalog code	Institution	Collection	Expedition	Coordinates	Event date mm/dd/yyyy	Database access	N. indiv.
<i>Erope emarginata</i> (Leske, 1778)	EQMN1554	MN/UFRJ	EQMN	snorkeling	27°54'27.022"S/48°35'0.499"W	02/01/1990	GBIF	10
<i>Lytechinus variegatus</i> (Lamarck, 1816)	EQMN1157	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	1
<i>Lytechinus variegatus</i> (Lamarck, 1816)	EQMN1159	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	1
<i>Lytechinus variegatus</i> (Lamarck, 1816)	EQMN1160	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	1
<i>Lytechinus variegatus</i> (Lamarck, 1816)	EQMN1182	MN/UFRJ	EQMN	snorkeling	27°44'51.248"S/48°30'2.221"W	02/01/1990	GBIF	2
<i>Lytechinus variegatus</i> (Lamarck, 1816)	EQMN1193	MN/UFRJ	EQMN	snorkeling	27°34'23.329"S/48°25'13.858"W	02/01/1990	GBIF	3
<i>Lytechinus variegatus</i> (Lamarck, 1816)	EQMN1194	MN/UFRJ	EQMN	snorkeling	27°34'23.329"S/48°25'13.858"W	02/01/1990	GBIF	1
<i>Mellita quinquesperforata</i> (Leske, 1778) (Clark, 1911)	EQMN1177	MN/UFRJ	EQMN	snorkeling	27°09'26.820"S/48°28'51.132"W	02/01/1990	GBIF	4
<i>Ophiactis savignyi</i> (Müller & Troschel, 1842)	EQMN1148	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	3
<i>Ophioneis reticulata</i> (Say, 1825)	EQMN1149	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	1
<i>Ophioplacus januarii</i> (Lütken, 1856)	EQMN1190	MN/UFRJ	EQMN	snorkeling	27°34'23.329"S/48°25'13.858"W	02/01/1990	GBIF	5
<i>Ophiothrix (Ophiothrix) angulata</i> (Say, 1825)	EQMN1150	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	8
<i>Ophiothrix (Ophiothrix) angulata</i> (Say, 1825)	EQMN1191	MN/UFRJ	EQMN	snorkeling	27°34'23.329"S/48°25'13.858"W	02/01/1990	GBIF	2
<i>Ophiothrix (Ophiothrix) angulata</i> (Say, 1825)	EQMN1202	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	10
<i>Tropiometra carinata carinata</i> (Lamarck, 1816)	EQMN1152	MN/UFRJ	EQMN	snorkeling	27°08'29.288"S/48°28'43.097"W	02/01/1990	GBIF	2
<i>Tropiometra carinata carinata</i> (Lamarck, 1816)	EQMN551	MN/UFRJ	EQMN	snorkeling	26°58'46.495"S/48°37'26.263"W	02/05/1969	GBIF	4
<i>Asterina stellifera</i> (Möbius, 1859)	USNME534	NMNH-SI	IZ	manual	not informed	07/1919	NMNH-SI	1
<i>Astropecten brasiliensis</i> Müller & Troschel, 1842	USNME4684	NMNH-SI	IZ	manual	not informed	04/20/1935	NMNH-SI	2
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	USNME538	NMNH-SI	IZ	manual	not informed	07/1919	NMNH-SI	2
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	USNME38380	NMNH-SI	IZ	manual	not informed	04/20/1935	NMNH-SI	2
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	USNME4686	NMNH-SI	IZ	manual	not informed	04/20/1935	NMNH-SI	24
<i>Echinometra lucunter</i> (Linnaeus, 1758)	USNME4703	NMNH-SI	IZ	manual	not informed	04/20/1935	NMNH-SI	1
<i>Erope emarginata</i> (Leske, 1778)	USNME4685	NMNH-SI	IZ	manual	not informed	04/20/1935	NMNH-SI	1
<i>Lytechinus variegatus</i> (Lamarck, 1816)	USNME4689	NMNH-SI	IZ	manual	not informed	05/1935	NMNH-SI	7
<i>Ophiomusa acafera</i> (Lynan, 1875)	ZUEC-OPH 637	UNICAMP	ZUEC-OPH	S16772-RevIZEE-Score Sul/Bentos	26°28'0.120"S/44°30'0.00"W	01/11/1998	OBSIS	not informed
<i>Amphipura flexuosa</i> Ljungman, 1867	ZUEC-OPH 796	UNICAMP	ZUEC-OPH	S16789-RevIZEE-Score Sul/Bentos	27°45'0.00"S/48°3'0.00"W	03/15/1998	OBSIS, GBIF and Specieslink	1
<i>Amphipura muelleri</i> Marktkanner-Tumeretsche, 1887	ZUEC-OPH 799	UNICAMP	ZUEC-OPH	S16791-RevIZEE-Score Sul/Bentos	27°49'0.120"S/47°10'59.880"W	03/16/1998	OBSIS, GBIF and Specieslink	1
<i>Amphipura muelleri</i> Marktkanner-Tumeretsche, 1887	ZUEC-OPH 1855	UNICAMP	ZUEC-OPH	St-06 Embarcação Mar Salada (Programa de Observadores de Bordo na Frota Arrendada – UNIVALI)	26°55'0.001"S/46°10'0.001"W	07/13/2002	GBIF and Specieslink	1

Appendix 2: Continued.

Species	Catalog code	Institution	Collection	Expedition	Coordinates	Event date mm/dd/yyyy	Database access	N. indiv.
<i>Amphiuva muelleri</i> Markkammer-Turneretsche, 1887	ZUEC-OPH 1856	UNICAMP	ZUEC-OPH	St-17 Embarcação Mar Salada (Programa de Observadores de Bordo na Frota Arrendada – UNIVALI)	28°21'5"46"49"0.120"W	08/29/2002	GBIF and Specieslink	1
<i>Ophiacantha cosmica</i> Lyman, 1878	ZUEC-OPH 1859	UNICAMP	ZUEC-OPH	St-35 Embarcação Mar Salada (Programa de Observadores de Bordo na Frota Arrendada – UNIVALI)	26°50'5"46"8"W	07/19/2002	GBIF and Specieslink	1
<i>Ophiacantha pentacrinus</i> Lütken, 1869	ZUEC-OPH 1868	UNICAMP	ZUEC-OPH	St-05 Embarcação Mar Salada (Programa de Observadores de Bordo na Frota Arrendada – UNIVALI)	26°55'0.120"S/46°10'0.120"W	07/13/2002	GBIF and Specieslink	1
<i>Ophiacantha pentacrinus</i> Lütken, 1869	ZUEC-OPH 1871	UNICAMP	ZUEC-OPH	St-08 Embarcação Mar Salada (Programa de Observadores de Bordo na Frota Arrendada – UNIVALI)	28°21'5"46"49"0.120"W	08/29/2002	GBIF and Specieslink	1
<i>Ophiacantha pentacrinus</i> Lütken, 1869	ZUEC-OPH 1872	UNICAMP	ZUEC-OPH	St-24 Embarcação Siebech (Programa de Observadores de Bordo na Frota Arrendada – UNIVALI)	26°16'0.001"S/46°10'0.001"W	04/15/2002	GBIF and Specieslink	1
<i>Ophiomiscidium tommasii</i> Borges, Monteiro & Amaral, 2006	ZUEC-OPH 672	UNICAMP	ZUEC-OPH	St6782-RevizEE-Score Sul/Bentos	27°10'0.120"S/46°46'59.880"W	03/14/1998	OBIS, GBIF and Specieslink	1
<i>Ophiomyces frutescens</i> Lyman, 1869	ZUEC-OPH 768	UNICAMP	ZUEC-OPH	St6694-RevizEE-Score Sul/Bentos	26°28'0.120"S/44°30'0.00"W	01/11/1998	OBIS	not informed
<i>Ophiostriatus striatus</i> (Mortensen, 1933)	ZUEC-OPH 774	UNICAMP	ZUEC-OPH	St6694-RevizEE-Score Sul/Bentos	26°31'0.120"S/46°34'0.120"W	01/19/1998	OBIS, GBIF	4
<i>Astropecten articulatus</i> (Say, 1825)	LABMAR-FAFIPAR	UFPR	LABMAR	N/Pq Diadorim (CEPSUL/IBAMA)	26°2'51"S/47°54'38.160"W	12/1995	personal contact	2
<i>Arbacia lixula</i> (Linnaeus, 1758)	GBIF-ID1990466364	iNaturalist dataset	Scott Camazine	human observation	27°23'13.06"S/48°25'54.40"W	01/02/2019	https://www.inaturalist.org/observations/19400569	not informed
<i>Astrapygia</i> Gray, 1825	iNaturalist-61249405	iNaturalist dataset	Cesar Cordeiro	human observation	27°17'56.994"S/48°21'22.561"W	05/01/2018	https://www.inaturalist.org/observations/61249405	1
<i>Echinaster (Othilia) brasiliensis</i> Müller & Troschel, 1842	GBIF-ID1913660323	iNaturalist dataset	Nataly Slivak	human observation	27°36'32.83"S/48°23'10.88"W	05/29/2012	https://www.inaturalist.org/observations/154530	126
<i>Luidia senegalensis</i> (Lamarck, 1816)	GBIF-ID2294663082	iNaturalist dataset	Adolf Carl Kruger	human observation	26°4'3.176"S/48°36'30.316"W	07/24/2019	https://www.inaturalist.org/observations/29449502	1
<i>Luidia senegalensis</i> (Lamarck, 1816)	GBIF-ID2294662594	iNaturalist dataset	Adolf Carl Kruger	human observation	26°4'0.610"S/48°36'32.400"W	07/24/2019	https://www.inaturalist.org/observations/29449563	1
<i>Luidia senegalensis</i> (Lamarck, 1816)	GBIF-ID2518107442	iNaturalist dataset	Kahio Mazon	human observation	27°27'32.033"S/48°32'46.108"W	12/11/2019	https://www.inaturalist.org/observations/56254865	1
<i>Mellita quiniquesperforata</i> (Leske, 1778)	GBIF-ID2294661493	iNaturalist dataset	Adolf Carl Kruger	human observation	26°4'0.610"S/48°36'32.400"W	07/24/2019	https://www.inaturalist.org/observations/29449374	2
<i>Mellita quiniquesperforata</i> (Leske, 1778)	GBIF-ID2269285137	iNaturalist dataset	Adolf Carl Kruger	human observation	26°4'11.892"S/48°36'23.544"W	06/13/2019	https://www.inaturalist.org/observations/27168413	1
<i>Mellita quiniquesperforata</i> (Leske, 1778)	GBIF-ID2574244872	iNaturalist dataset	G. Fischer	human observation	26°59'38.620"S/48°37'37.967"W	01/09/2019	https://www.inaturalist.org/observations/58226501	1