

Inventory of Chondrichthyes and Actinopterygii species collected in the central coast of São Paulo State, Brazil

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Abstract: This biodiversity inventory of the central coast of São Paulo State presents species of demersal and pelagic fishes of Santos Bay, Bertioga Channel, and adjacent continental shelf, between São Sebastião and Peruibe, from the coast till a depth of 100 m. Samples were taken during oceanographic campaigns using otter trawls, between November 2004 and February 2006. A total of 56,095 individuals were collected, belonging to the classes Chondrichthyes (three orders and fourteen species) and Actinopterygii (fifteen orders and 141 species). This list adds 27 species to those explicitly cited for the coast of São Paulo state, contributing to the knowledge of this group.

Keywords: Ichthyofauna, Santos Bay, Bertioga Channel, Continental Shelf, Southeastern Brazilian Coast.

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Resumo: Este inventário comentado da biodiversidade do litoral central do estado de São Paulo apresenta as espécies de peixes demersais e pelágicas da baía de Santos, do canal de Bertioga e da plataforma continental adjacente, entre Peruibe e São Sebastião, da costa até 100 m de profundidade. Os exemplares foram capturados durante campanhas oceanográficas, utilizando-se redes de arrasto de fundo com portas, entre novembro de 2004 e fevereiro de 2006. Foram capturados um total de 56.095 indivíduos pertencentes às Classes Chondrichthyes (três ordens e quatorze espécies) e Actinopterygii (quinze ordens e 141 espécies). Esta lista amplia em 27 espécies as explicitamente citadas para o litoral do estado de São Paulo, contribuindo para o conhecimento do grupo.

Palavras-chave: Ictiofauna, baía de Santos, canal de Bertioga, plataforma continental adjacente, costa sudeste brasileira.

Introduction

Species lists are important tools in biodiversity and fish community structure studies, not only to evaluate current and past ichthyofauna records and richness but also as a reference document to environmental agencies and consultancies. Considering these different purposes and the poor environmental quality of the coastal areas, fish have also been used to assess the ecological status of marine environments (Henriques et al. 2008).

Some ichthyofaunistic surveys have been conducted in the central coast of São Paulo state; among these surveys, we can highlight Vazzoler (1970), Paiva-Filho et al. (1987), Giannini & Paiva-Filho (1990), and Graça-Lopes et al. (1993) for the Santos Bay and Barbanti et al. (2013) for the Bertioga Channel. Although already investigated, little information has been published about the ichthyofauna inventory of the continental shelf ecosystem (Vazzoler et al. 1982, Fachinni, 1999). However, this lack of information is not restricted to

the coast of São Paulo. Most of ichthyofauna information is found in academic products (Dissertations and Theses). One of the major surveys was the “Program of Evaluation of the Sustainable Potential for Living Resources in the Exclusive Economic Zone (Programa de Avaliação do Potencial Sustentável de Recursos Vivos na Zona Econômica Exclusiva – REVIZEE)”, which was carried out between Cabo Frio (22°52’S) and Chuí (33° 41’S) and which resulted in a series of technical documents and available information; however, this campaigns occurred in deeper waters than those examined in the present study, between 100 and 1,000 meters.

Menezes (2011) published a checklist of marine fishes for the state of São Paulo, which was based on the Catalog of Marine Fish Species of Brasil that he and colleagues published in 2003.

The purpose of this article is to present an updated species list, based on the current knowledge of the biodiversity fish in the central coast of São Paulo state.

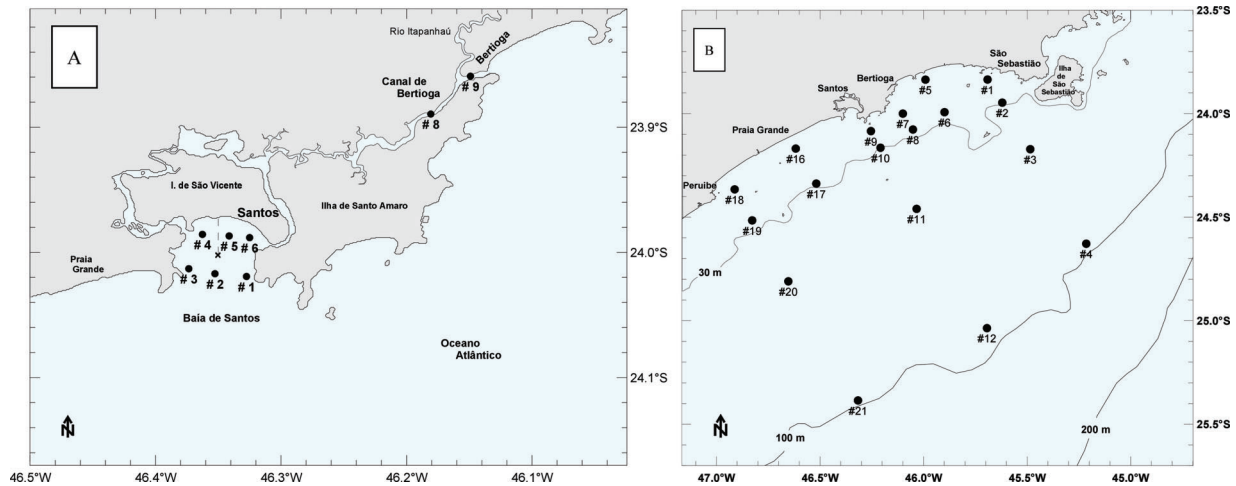


Figure 1. Maps of Santos Bay, Bertioga Channel (A) and adjacent Continental Shelf in the central coast of the state of São Paulo (B), with collection stations of the ichthyofauna.

Material and Methods

The sampled areas are part of the Santos-São Vicente estuarine system, including the adjacent continental shelf (Fig. 1). The Santos Bay (23.98° - 24.04° S; 46.4° - 46.3° W) is a semi-sheltered bay, with depths ranging from 5 to 15 m. It is bordered by beaches and two natural channels (Santos and São Vicente) to the north and by the Atlantic Ocean to the south. It has an outfall sewer. The sediment type from Santos Bay was classified as very fine sand at the western side and clay and silt in the central-eastern area.

The Bertioga Channel is located at the eastern end of the Santos region (23.85 - 23.60° S; 46.18 - 46.25° W) and is considered a secondary connection to the ocean of the estuarine system of Santos - São Vicente. The channel is 25 km long with an average depth between 3 and 6 m and width ranging from 200 to 700 m. The sediment types were classified as clay and medium silt along the channel and fine sand on both borders.

On the continental shelf adjacent to the estuarine system, the sampling area was concentrated between São Sebastião ($23^{\circ}45'$ S) and Peruíbe ($24^{\circ}19'$ S) at depths shallower than 100 m. In this region, the sediment types were classified as sand for all coastal areas up to 80 m, a transition from sandy silt to silt-clay type sediment occurred between 80 and 100 m.

In the Santos Bay, specimens were caught monthly at six oceanographic stations, between November 2004 and December 2005 (except for the month of December 2004), three along the entrance of the bay and three along the beaches (stations 1 to 6; Fig. 1A). In the internal stations, the local depth varied between 5.7 and 9.9 m, while it varied between 10 and 14.3 m in the external stations. In the Bertioga Channel, samples were collected monthly from September to December 2005 in two channel points (stations 8 and 9; Fig. 1A), one more internal (between the bar and Largo do Candinho) and another more external point close to channel north mouth. An otter-trawl was used to collect fish in these areas, with a mesh size of 40 mm in the arms and 30 mm in the bagger; the otter-trawl was 11 m long. The effort unit was a 10-min tow at a speed of two knots.

Two expeditions were made at the continental shelf, one in the winter of 2005 (August/September) and another in the

summer of 2006 (February), totaling 38 oceanographic stations at depths varying between 14 and 94 m (Fig. 1B). An otter-trawl with 17 m length, and a mesh size of 60 mm in the arms and 25 mm in the bagger was used. The effort unit was a 30-minute tow at an average speed of two knots.

The caught specimens were sacrificed by cooling, sorted and identified based on Figueiredo & Menezes (1978, 1980, 2000), Menezes & Figueiredo (1980, 1985) manuals; Marceniuk (2005) and Gomes et al. (2010) identification keys, and additional taxonomic information of Nelson (2006). Data of total length and standard length (in mm) were taken for each specimen. After identification and data recording on board, all Chondrichthyes specimens were immediately released to the sea while still alive.

The Menezes *et al.* (2003) catalog, the Websites Catalog of Fishes (CAS), FishBase, Advanced Search Report (ITIS), and World Register of Marine Species (WorMS); and Marceniuk & Menezes (2007) and Menezes et al. (2015) publications were utilized to update the nomenclature. The testimony specimens are frozen at ECORREP (Reproductive Ecology and Recruitment Laboratory - Oceanographic Institute-University of São Paulo) and will be added to the ColBIO (Coleções Biológicas Prof. Edmundo Ferraz Nonato-IOUSP).

Results

The collected species are presented in phylogenetic order according to Menezes et al. (2003), and the lists are separated per area. The minimal and maximal lengths per species are also shown. If the caudal fin was damaged or absent, the standard length of the species was provided.

1. Santos Bay

The Santos Bay was represented by 94 species of Actinopterygii and by only one species of Chondrichthyes (Rajiformes) (Table 1).

2. Bertioga Channel

The Bertioga Channel contained 50 species, all belonging to Actinopterygii (Table 2).

Ichthyofauna of the central coast of São Paulo

Table 1. List of species collected at Santos Bay between November 2004 and December 2005, with respective total maximum (TL max) and minimum (TL min) lengths in millimeters. In case of a single specimen, its length is shown at “TL max” column. SL = standard length.

Order	Family	Species	TL min	TL max	
Rajiformes	Rhinobatidae	<i>Rhinobatos percellens</i> (Walbaum, 1792)	235	540	
Anguilliformes	Ophichthidae	<i>Ophichthus gomesii</i> (Castelnau, 1855)	503	600	
Clupeiformes	Engraulidae	<i>Anchoa filifera</i> (Fowler, 1915)	72	105	
		<i>Anchoa januaria</i> (Steindachner, 1879)	65	92	
		<i>Anchoa marinii</i> Hildebrand, 1943	64	95	
		<i>Anchoa spinifer</i> (Valenciennes, 1848)	60	180	
		<i>Anchoa tricolor</i> (Spix & Agassiz, 1829)		69	
		<i>Anchovia clupeoides</i> (Swainson, 1839)		66	
		<i>Anchoviella brevirostris</i> (Gunther, 1868)		49	
		<i>Anchoviella lepidentostole</i> (Fowler, 1911)	52	165	
		<i>Lycengraulis grossidens</i> (Agassiz, 1829)	60	135	
		<i>Chirocentrodon bleekermanus</i> , (Poey, 1867)	56	61	
		<i>Pellona harroweri</i> (Fowler, 1917)	24	142	
		Clupeidae	<i>Harengula clupeola</i> (Cuvier, 1829)	67	187
			<i>Opisthonema oglinum</i> (Lesueur, 1818)	80	95
			<i>Platanichthys platana</i> (Regan, 1917)		63
Siluriformes	Ariidae	<i>Aspistor luniscutis</i> (Valenciennes, 1840)	60	335	
		<i>Bagre bagre</i> (Linnaeus, 1766)	65	246	
		<i>Cathorops spixii</i> (Agassiz, 1829)	41	366	
		<i>Genidens barbatus</i> (Lacepède, 1803)	55	255	
		<i>Genidens genidens</i> (Cuvier, 1829)	171	313	
		<i>Notarius grandicassis</i> (Valenciennes, 1840)	70	139	
		<i>Synodus foetens</i> (Linnaeus, 1766)	45	203	
		<i>Urophycis brasiliensis</i> (Kaup, 1858)		131	
Batrachoidiformes	Batrachoididae	<i>Porichthys porosissimus</i> (Cuvier, 1829)	32	237	
Lophiiformes	Ogcocephalidae	<i>Ogcocephalus vespertilio</i> (Linnaeus, 1758)		67	
Scorpaeniformes	Scorpaenidae	<i>Scorpaena brasiliensis</i> Cuvier, 1829		206	
		Triglidae	<i>Bellator brachyichir</i> (Regan, 1914)		91
			<i>Prionotus punctatus</i> (Bloch, 1793)	35	160
Perciformes	Centropomidae	<i>Centropomus parallelus</i> Poey, 1860	243	540	
		Serranidae	<i>Diplectrum radiale</i> (Quoy & Gaimard, 1824)	107	218
			<i>Rypticus randalli</i> Courtenay, 1967	103	204
	Carangidae	<i>Rypticus sp.</i> Cuvier & Valenciennes, 1829		128	
		<i>Chloroscombrus chrysurus</i> (Linnaeus, 1766)	37	105	
		<i>Hemicaranx amblyrhynchus</i> (Cuvier, 1833)	77	115	
		<i>Oligoplites saliens</i> (Bloch, 1793)	119	167	
		<i>Selene setapinnis</i> (Mitchill, 1815)	3	235	
		<i>Selene vomer</i> (Linnaeus, 1758)	27	152	
		<i>Trachinotus carolinus</i> (Linnaeus, 1766)	51	201	
		Gerreidae	<i>Diapterus auratus</i> Ranzani, 1842	119	130
			<i>Diapterus rhombeus</i> (Cuvier, 1829)	100	198
			<i>Eucinostomus argenteus</i> Baird & Girard, 1855	100	141
			<i>Eucinostomus gula</i> (Quoy & Gaimard, 1824)	104	180
			<i>Eucinostomus melanopterus</i> (Bleeker, 1863)	122	194
	Haemulidae	<i>Conodon nobilis</i> (Linnaeus, 1758)	70	182	
		<i>Genyatremus luteus</i> (Bloch, 1790)	90	194	
		<i>Orthopristis ruber</i> (Cuvier, 1830)	140	302	
		<i>Pomadasy corvinaeformis</i> (Steindachner, 1868)	64	102	
	Polynemidae	<i>Polydactylus oligodon</i> (Gunther, 1860)	164	167	
		<i>Polydactylus virginicus</i> (Linnaeus, 1758)		156	
	Sciaenidae	<i>Bairdiella ronchus</i> (Cuvier, 1830)	61	261	
		<i>Ctenosciaena gracilicirrhus</i> (Metzelaar, 1919)	89	107	
		<i>Cynoscion jamaicensis</i> (Vaillant & Bocourt, 1883)	39	164	
		<i>Cynoscion leiarchus</i> (Cuvier, 1830)	40	68	
		<i>Cynoscion sp.</i> Gill, 1861	25	51	
		<i>Cynoscion virescens</i> (Cuvier, 1830)	66	331	

Continued on next page

Table 1. Continued.

Order	Family	Species	TL min	TL max
		<i>Isopisthus parvipinnis</i> (Cuvier, 1830)	20	181
		<i>Larimus breviceps</i> Cuvier, 1830	47	222
		<i>Macrodon atricauda</i> (Gunther, 1880)	22	355
		<i>Menticirrhus americanus</i> (Linnaeus, 1758)	63	410
		<i>Menticirrhus littoralis</i> (Holbrook, 1847)	80	142
		<i>Micropogonias furnieri</i> (Desmarest, 1823)	40	478
		<i>Nebris microps</i> Cuvier, 1830	35	290
		<i>Ophioscion punctatissimus</i> Meek & Hildebrand, 1925	99	144
		<i>Paralonchurus brasiliensis</i> (Steindachner, 1875)	44	240
		<i>Stellifer brasiliensis</i> (Shultz, 1945)	36	222
		<i>Stellifer rastrifer</i> (Jordan, 1889)	32	220
		<i>Stellifer sp.</i> Oken, 1817	40	137
		<i>Stellifer stellifer</i> (Bloch, 1790)	42	201
		<i>Umbrina canosai</i> Berg, 1895	88	151
		<i>Umbrina coroides</i> Cuvier, 1830	125	151
	Ephippidae	<i>Chaetodipterus faber</i> (Broussonet, 1782)	52	233
	Stromateidae	<i>Peprilus paru</i> (Linnaeus, 1758)	29	125
Pleuronectiformes	Paralichthyidae	<i>Citharichthys dinoceros</i> Goode & Bean, 1886		139
		<i>Citharichthys macrops</i> Dresel, 1885		116
		<i>Citharichthys spilopterus</i> Gunther, 1862	83	130
		<i>Etropus crossotus</i> Jordan & Gilbert, 1882	63	118
		<i>Etropus longimanus</i> Norman, 1933		93
	Achiridae	<i>Achirus declivis</i> Chabanaud, 1940	81	143
		<i>Achirus lineatus</i> (Linnaeus, 1758)	64	139
		<i>Catathyridium garmani</i> (Jordan, 1889)		62
		<i>Trinectes paulistanus</i> (Miranda Ribeiro, 1915)	58	205
	Cynoglossidae	<i>Symphurus jenynsi</i> Evermann & Kendall, 1906		SL 120
		<i>Symphurus tessellatus</i> (Quoy & Gaimard, 1824)	61	177
		<i>Symphurus trewavasae</i> Chabanaud, 1948	123	147
Tetraodontiformes	Monacanthidae	<i>Monacanthus ciliatus</i> (Mitchill, 1818)		26
		<i>Stephanolepis hispidus</i> (Linnaeus, 1766)	24	25
	Tetraodontidae	<i>Lagocephalus laevigatus</i> (Linnaeus, 1766)	34	115
		<i>Sphoeroides greeleyi</i> Gilbert, 1900	35	177
		<i>Sphoeroides spengleri</i> (Bloch, 1785)		90
		<i>Sphoeroides testudineus</i> (Linnaeus, 1758)	43	260
	Diodontidae	<i>Chilomycterus spinosus</i> (Linnaeus, 1758)	56	162

3. Continental shelf

One hundred fifteen species occurred on the continental shelf, 14 of which belong to Chondrichthyes (Squaliformes, Squatiniformes, and Rajiformes Orders), and the remainder belong to Actinopterygii (Table 3).

Discussion

Menezes (2011) refers to 594 species of marine fish in the coast of São Paulo state based on the "Catalog of Marine Fish Species of Brazil". In the present study, 154 species were caught in the central coast, which represents approximately 26% of the total evaluated species. This number is expressive when considering that the investigated areas were restricted to soft bottoms and that a single fishing gear was utilized. In general, the restriction to depths lower than 100 m eliminates mesopelagic fish, such as Myctophidae, Stomiidae, and Sternoptychidae; the oceanic Xiphidae, Scombridae, Gempylidae, and Echeneidae; the larger Carangidae, and many

Elasmobranchii species. The species associated with rocky or coralline sea bottoms, such as Serranidae, Haemulidae, Labridae, Labrisomidae, Pomacanthidae, Pomacentridae, Scorpaenidae, and Scaridae; and those of very shallow areas, such as Gobiidae and Blenniidae, also were not caught. Moreover, the stations were widely spaced in the case of continental shelf, and only two sampling seasons were utilized.

Despite the above restrictions and considering the three sampled areas, this inventory adds 27 species to the checklist published by Menezes (2011), which reports the ichthyofauna of all coastal areas in São Paulo state (Tab. 4).

Comparing the current inventory, in which 95 species are recorded for the Santos Bay, with the list of species collected by the end of the 1980s in the same area (Ribeiro Neto, 1989) some important differences may be noticed. Some groups, such as Serranidae, Haemulidae, and top predators like rays, morays, barracudas, and common snooks, were not captured. Conversely, ten different species of soles and two species of puffers appear in this inventory and were not part of the fauna 25 years ago. Despite the differences and environmental degradation,

Ichthyofauna of the central coast of São Paulo

Table 2. List of species collected at Bertioga Channel between September and December 2005, with respective total maximum (TL max) and minimum (TL min) lengths in millimeters. In case of a single specimen, its length is shown at “TL max” column.

Order	Family	Species	TL min	TL max		
Clupeiformes	Engraulidae	<i>Anchoa januaria</i> (Steindachner, 1879)		77		
		<i>Anchoviella lepidentostole</i> (Fowler, 1911)	70	180		
		<i>Cetengraulis edentulus</i> (Cuvier, 1829)	137	182		
			<i>Lycengraulis grossidens</i> (Agassiz, 1829)	160	246	
		Pristigasteridae	<i>Pellona harroweri</i> (Fowler, 1917)	54	134	
		Clupeidae	<i>Harengula clupeola</i> (Cuvier, 1829)	56	187	
			<i>Opisthonema oglinum</i> (Lesueur, 1818)	77	102	
Siluriformes	Ariidae	<i>Aspistor luniscutis</i> (Valenciennes 1840)	109	370		
		<i>Cathorops spixii</i> (Agassiz, 1829)	80	240		
		<i>Genidens barbatus</i> (Lacepède, 1803)	113	289		
		<i>Genidens genidens</i> (Cuvier, 1829)	110	294		
Aulopiformes	Synodontidae	<i>Synodus foetens</i> (Linnaeus, 1766)		190		
Mugiliformes	Mugilidae	<i>Mugil curvidens</i> Valenciennes 1836		222		
Scorpaeniformes	Triglidae	<i>Prionotus punctatus</i> (Bloch, 1793)	43	141		
Perciformes	Centropomidae	<i>Centropomus parallelus</i> Poey, 1860	185	266		
		<i>Centropomus undecimalis</i> (Bloch, 1792)	810	1080		
		Serranidae	<i>Diplectrum radiale</i> (Quoy & Gaimard, 1824)	81	190	
			<i>Rypticus</i> sp. Cuvier & Valenciennes, 1829		132	
		Carangidae	<i>Chloroscombrus chrysurus</i> (Linnaeus, 1766)	49	100	
			<i>Selene vomer</i> (Linnaeus, 1758)	44	478	
		Gerreidae	<i>Diapterus auratus</i> Ranzani, 1842		231	
			<i>Diapterus rhombeus</i> (Cuvier, 1829)		198	
			<i>Eucinostomus gula</i> (Quoy & Gaimard, 1824)		133	
		Haemulidae	<i>Pomadasys corvinaeformis</i> (Steindachner, 1868)	90	159	
		Sciaenidae	<i>Bairdiella ronchus</i> (Cuvier, 1830)	138	216	
			<i>Isopisthus parvipinnis</i> (Cuvier, 1830)	120	195	
			<i>Larimus breviceps</i> (Cuvier, 1830)		152	
			<i>Menticirrhus americanus</i> (Linnaeus, 1758)	70	193	
			<i>Micropogonias furnieri</i> (Desmarest, 1823)	70	243	
			<i>Ophioscion punctatissimus</i> Meek & Hildebrand, 1925		142	
			<i>Paralonchurus brasiliensis</i> (Steindachner, 1875)		58	
			<i>Stellifer rastrifer</i> (Jordan, 1889)	68	133	
			<i>Stellifer stellifer</i> (Bloch, 1790)	76	143	
		Ephippidae	<i>Chaetodipterus faber</i> (Broussonet, 1782)	77	490	
		Trichiuridae	<i>Trichiurus lepturus</i> Linnaeus, 1758	116	577	
	Pleuronectiformes	Paralichthyidae	<i>Citharichthys spilopterus</i> Gunther, 1862	73	157	
			<i>Etropus crossotus</i> Jordan & Gilbert, 1882	70	121	
			Achiridae	<i>Achirus declivis</i> Chabanaud, 1940		92
				<i>Achirus lineatus</i> (Linnaeus, 1758)	68	135
				<i>Trinectes paulistanus</i> (Miranda Ribeiro, 1915)		80
		Cynoglossidae	<i>Symphurus tessellatus</i> (Quoy & Gaimard, 1824)	111	172	
Tetraodontiformes	Monacanthidae	<i>Stephanolepis hispidus</i> (Linnaeus, 1766)		50		
	Tetraodontidae	<i>Lagocephalus laevigatus</i> (Linnaeus, 1766)	38	112		
		<i>Lagocephalus lagocephalus</i> (Linnaeus, 1758)	49	121		
		<i>Sphoeroides greeleyi</i> Gilbert, 1900	58	114		
		<i>Sphoeroides spengleri</i> (Bloch, 1785)		111		
		<i>Sphoeroides testudineus</i> (Linnaeus, 1758)	193	210		
		<i>Sphoeroides tyleri</i> Shipp, 1972		106		
		<i>Chilomycterus spinosus</i> (Linnaeus, 1758)	105	164		

Schmidt & Dias (2012) assumed that at least the Sciaenid fish assemblage has been stable in the Santos Bay for more than 20 years.

Although a single type of gear was used in the Bertioga Channel, this study adds 15 species to the ichthyofauna inventory of Barbanti et al. (2013), whose

captures utilized ten different fishing gears over a longer sampling period.

Examples, such as those of the Santos Bay and Bertioga Channel, suggest that the respective sampling sufficiency was not achieved for both areas, as the ichthyofauna has not been adequately sampled.

Table 3. List of species collected at Continental Shelf, in the 2005 winter and 2006 summer, with respective total maximum (TL max) and minimum (TL min) lengths in millimeters. In case of a single specimen, its length is shown at "TL max" column.

Order	Family	Species	TL min	TL max
Squaliformes	Squalidae	<i>Squalus</i> group <i>megalops/cubensis</i> *	458	477
Squatiniiformes	Squatinaidae	<i>Squatina argentina</i> (Marini, 1930)	267	557
Rajiformes	Narcinidae	<i>Narcine brasiliensis</i> (Olfers, 1831)		237
	Rhinobatidae	<i>Rhinobatos horkelii</i> , Muller & Henle 1841	250	756
		<i>Rhinobatos percellens</i> (Walbaum, 1792)	204	286
	Rhinobatidae	<i>Zapteryx brevirostris</i> (Muller & Henle, 1841)	123	493
	Rajidae	<i>Atlantoraja castelnaui</i> (Miranda Ribeiro, 1907)	256	852
		<i>Atlantoraja cyclophora</i> (Regan, 1903)	122	591
		<i>Atlantoraja</i> sp. Menni, 1972		454
		<i>Psammobatis extenta</i> (Garman, 1913)	87	276
		<i>Psammobatis rutrum</i> Jordan, 1891	77	283
		<i>Rioraja agassizii</i> (Muller & Henle, 1841)	175	560
	Dasyatidae	<i>Dasyatis hypostigma</i> (Santos & Carvalho, 2004)		449
	Myliobatidae	<i>Myliobatis freminvillei</i> Lesueur, 1824		?
Anguilliformes	Muraenidae	<i>Gymnothorax ocellatus</i> (Agassiz, 1831)	279	580
	Congridae	<i>Ariosoma opisthophthalmus</i> (Ranzini, 1839)		293
		<i>Conger orbignianus</i> Valenciennes, 1837		286
Clupeiformes	Engraulidae	<i>Anchoa januaria</i> Hildebrand, 1943	83	168
		<i>Anchoa spinifer</i> (Valenciennes, 1848)	128	148
		<i>Anchoviella lepidentostole</i> (Fowler, 1941)	61	129
		<i>Centegraulis edentulus</i> (Cuvier, 1829)	87	90
		<i>Engraulis anchoita</i> Hubbs & Marini, 1935	86	104
		<i>Lycengraulis grossidens</i> (Agassiz, 1829)		200
	Pristigasteridae	<i>Chirocentron bleekermanus</i> (Poey, 1867)	60	113
		<i>Pellona harroweri</i> (Fowler, 1919)	34	152
	Clupeidae	<i>Harengula clupeola</i> (Cuvier, 1829)	91	186
		<i>Sardinella brasiliensis</i> (Steindachner, 1879)	70	98
Siluriformes	Ariidae	<i>Bagre bagre</i> (Linnaeus, 1766)		271
		<i>Genidens genidens</i> (Cuvier, 1829)		285
Aulopiformes	Synodontidae	<i>Saurida brasiliensis</i> Norman, 1935	48	140
		<i>Synodus foetens</i> (Linnaeus, 1766)	85	538
Ophidiiformes	Ophidiidae	<i>Raneya brasiliensis</i> (Kaup, 1856)	194	215
Gadiformes	Phycidae	<i>Urophycis brasiliensis</i> (Kaup, 1858)	85	395
	Merlucciidae	<i>Merluccius hubbsi</i> Marini, 1933	82	340
Batrachoidiformes	Batrachoididae	<i>Porichthys porosissimus</i> (Cuvier, 1829)	61	332
Lophiiformes	Lophiidae	<i>Lophius gastrophysus</i> Miranda Ribeiro, 1915	83	436
	Ogcocephalidae	<i>Ogcocephalus vespertilio</i> (Linnaeus, 1758)	54	142
Zeiformes	Zeidae	<i>Zenopsis conchifer</i> (Lowe, 1852)		132
Gasterosteiformes	Fistulariidae	<i>Fistularia petimba</i> Lacepède, 1803	295	970
Scorpaeniformes	Dactylopteridae	<i>Dactylopterus volitans</i> (Linnaeus, 1758)	63	310
	Scorpaenidae	<i>Scorpaena brasiliensis</i> Cuvier, 1829		134
	Triglidae	<i>Bellator brachychir</i> (Regan, 1914)	51	71
		<i>Prionotus nudigula</i> Ginsburg, 1950	40	212
		<i>Prionotus punctatus</i> (Bloch, 1793)	45	380
Perciformes	Acropomatidae	<i>Synagrops spinosus</i> Schultz, 1940	60	95
	Serranidae	<i>Diplectrum formosum</i> (Linnaeus, 1766)	90	237
		<i>Diplectrum radiale</i> (Quoy & Gaimard, 1824)	82	240
		<i>Dules auriga</i> Cuvier, 1829	59	163
	Priacanthidae	<i>Priacanthus arenatus</i> Cuvier, 1829	66	264
	Pomatomidae	<i>Pomatomus saltatrix</i> (Linnaeus, 1766)		343
	Carangidae	<i>Caranx crysos</i> (Mitchill, 1815)		255
		<i>Chloroscombrus chrysurus</i> (Linnaeus, 1766)	41	206
		<i>Decapterus punctatus</i> (Cuvier, 1829)		97
		<i>Oligoplites saliens</i> (Bloch, 1793)	110	478
		<i>Selene setapinnis</i> (Mitchill, 1815)	36	263
		<i>Selene vomer</i> (Linnaeus, 1758)	50	236
		<i>Trachinotus carolinus</i> (Linnaeus, 1766)	275	286
		<i>Trachurus lathamii</i> Nichols, 1920	46	158

Continued on next page

Table 3. Continued.

Order	Family	Species	TL min	TL max
	Gerreidae	<i>Diapterus rhombeus</i> (Cuvier, 1829)	115	207
		<i>Eucinostomus argenteus</i> Baird & Girard, 1855	125	212
		<i>Eucinostomus gula</i> (Quoy & Gaimard, 1824)		108
		<i>Eucinostomus melanopterus</i> (Bleeker, 1863)	138	204
	Haemulidae	<i>Conodon nobilis</i> (Linnaeus, 1758)	69	236
		<i>Orthopristis ruber</i> (Cuvier, 1830)	138	296
		<i>Pomadasys corvinaeformis</i> (Steindachner, 1868)	77	214
	Sparidae	<i>Pagrus pagrus</i> (Linnaeus, 1758)	40	218
	Sciaenidae	<i>Ctenosciaena gracilicirrus</i> (Metzelaar, 1919)	51	180
		<i>Cynoscion acoupa</i> (Lacepède, 1801)		196
		<i>Cynoscion jamaicensis</i> (Vaillant & Bocourt, 1883)	70	382
		<i>Cynoscion leiarchus</i> (Cuvier, 1830)		242
		<i>Cynoscion virescens</i> (Cuvier, 1830)	70	435
		<i>Isopisthus parvipinnis</i> (Cuvier, 1830)	40	160
		<i>Larimus breviceps</i> (Cuvier, 1830)	49	215
		<i>Macrodon atricauda</i> (Gunther, 1880)	50	311
		<i>Menticirrhus americanus</i> (Linnaeus, 1758)	56	292
		<i>Micropogonias furnieri</i> (Desmarest, 1823)	189	523
		<i>Nebris microps</i> Cuvier, 1830	101	169
		<i>Paralonchurus brasiliensis</i> (Steindachner, 1875)	50	227
		<i>Stellifer brasiliensis</i> (Shultz, 1945)	50	153
		<i>Umbrina canosai</i> Berg, 1895	115	156
		<i>Umbrina coroides</i> Cuvier, 1830	191	269
	Mullidae	<i>Mullus argentinae</i> Hubbs & Marini, 1933	62	225
		<i>Upeneus parvus</i> Poey, 1852	54	232
	Labridae	<i>Halichoeres sazimai</i> Luiz, Ferreira & Rocha, 2009		43
	Pinguipedidae	<i>Pseudoperca semifasciata</i> (Cuvier, 1829)		280
	Percophidae	<i>Bembrops heterurus</i> (Miranda Ribeiro, 1903)	88	182
		<i>Percophis brasiliensis</i> Quoy & Gaimard, 1825	143	193
	Ephippidae	<i>Chaetodipterus faber</i> (Broussonet, 1782)	266	362
	Sphyraenidae	<i>Sphyraena guachancho</i> Cuvier, 1829	98	228
		<i>Sphyraena</i> sp Klein, 1778	163	180
		<i>Sphyraena tome</i> Fowler, 1903		186
	Trichiuridae	<i>Trichiurus lepturus</i> Linnaeus, 1758	168	922
	Stromateidae	<i>Peprilus paru</i> (Linnaeus, 1758)	34	160
Pleuronectiformes	Paralichthyidae	<i>Citharichthys dinoceros</i> Goode & Bean, 1886		170
		<i>Citharichthys macrops</i> Dresel, 1885	74	177
		<i>Citharichthys</i> sp. Bleeker, 1872	86	190
		<i>Citharichthys spilopterus</i> Gunther, 1862		128
		<i>Cyclopsetta chittendeni</i> Bean, 1895		250
		<i>Etropus crossotus</i> Jordan & Gilbert, 1882	97	164
		<i>Etropus longimanus</i> Norman, 1933	58	126
		<i>Paralichthys isosceles</i> Jordan, 1891	88	345
		<i>Paralichthys patagonicus</i> Jordan, 1889	186	264
		<i>Paralichthys</i> sp. Girard, 1858	60	295
		<i>Syacium micrurum</i> Ranzani, 1842	135	196
		<i>Syacium papillosum</i> (Linnaeus, 1758)	70	246
		<i>Syacium</i> sp. Ranzani, 1842	75	298
		<i>Verecundum rasile</i> Jordan, 1891	80	265
	Cynoglossidae	<i>Symphurus tessellatus</i> (Quoy & Gaimard, 1824)	115	200
Tetraodontiformes	Balistidae	<i>Balistes caprisacus</i> Gmelin, 1789	186	247
	Monacanthidae	<i>Ahuterus monocerus</i> (Linnaeus, 1758)	298	377
		<i>Stephanolepis hispidus</i> (Linnaeus, 1766)	40	226
	Tetraodontidae	<i>Lagocephalus laevigatus</i> (Linnaeus, 1766)	39	168
		<i>Sphoeroides spengleri</i> (Bloch, 1785)		91
	Diodontidae	<i>Chilomycterus spinosus</i> (Linnaeus, 1758)	35	221
		<i>Diodon hystrix</i> (Linnaeus, 1758)		31

*According to Gomes et al., 2010.

Table 4. Species added to the fish fauna of the coastal area of São Paulo state, presented in Menezes (2011).

Order	Family	Species
Squaliformes	Squalidae	<i>Squalus</i> group <i>megalops/cubensis</i> *
Clupeiformes	Engraulidae	<i>Anchoa filifera</i> (Fowler 1915) <i>Anchoa spinifer</i> (Valenciennes 1848) <i>Anchoa tricolor</i> (Spix & Agassiz 1829) <i>Anchovia chupeoides</i> (Swainson 1839) <i>Anchoviella brevirostris</i> (Gunther 1868) <i>Chirocentrodon bleekermanus</i> (Poey 1867) <i>Aspistor luniscutis</i> (Valenciennes 1840) <i>Cathorops spixii</i> (Agassiz 1829) <i>Genidens barbatus</i> (Lacepède 1803) <i>Notarius grandicassis</i> (Valenciennes 1840) <i>Potamarius grandoculis</i> (Steindachner 1877)
Siluriformes	Pristigasteridae Ariidae	<i>Mugil curvidens</i> Valenciennes 1836 <i>Fistularia tabacaria</i> Linnaeus 1758 <i>Porichthys porosissimus</i> (Cuvier 1829) <i>Synagrops spinosus</i> Schultz 1940 <i>Pomadasys corvinaeformis</i> (Steindachner 1868) <i>Cynoscion leiarchus</i> (Cuvier 1830) <i>Cynoscion virescens</i> (Cuvier 1830) <i>Nebris microps</i> Cuvier 1830 <i>Stellifer stellifer</i> (Bloch 1790)
Mugiliformes	Mugilidae	
Gasterosteiformes	Fistulariidae	
Batrachoidiformes	Batrachoididae	
Perciformes	Acropomatidae Haemulidae Sciaenidae	
Pleuronectiformes	Labridae Paralichthyidae	<i>Halichoeres sazimai</i> Luiz, Ferreira & Rocha 2009 <i>Citharichthys dinoceros</i> Goode & Bean 1886 <i>Cyclopsetta chittendeni</i> Bean 1895 <i>Paralichthys isosceles</i> Jordan 1891 <i>Syacium micrurum</i> Ranzani 1842 <i>Lagocephalus lagocephalus</i> (Linnaeus 1758)
Tetraodontiformes	Tetraodontidae	

*According to Gomes et al., 2010.

The results obtained show that part of the region of the Santos-São Vicente estuarine system and adjacent continental shelf present high richness, despite suffering intense pressure from pollution, significant *habitat* alteration and loss, overfishing, and an important capture of juveniles as bycatch of shrimp fishing. In addition, this study expands the previously reported knowledge of the ichthyofauna in the central coast of São Paulo state.

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