

Chapter 7

The Scientific Explorations for Deep-Sea Fishes in Brazil: The Known Knowns, the Known Unknowns, and the Unknown Unknowns



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Abstract The deep sea is the largest and one of the most extreme environments on Earth. It is estimated that 10–15% of all fish species are dwelling in the deep sea, most of which have unique morphological and physiological adaptations. Biological expeditions to sample the deep ocean off Brazil started with the British HMS Challenger Expedition (1872–1876), followed by a few fishery stations made by the German RV *Ernst Haeckel* (1966) and the North-American MIV *Oregon II* (1957–1975), the cruises of the French RVs *Marion Dufresne* (1987) and *Thalassa* (1999, 2000), the Brazilian RV *Atlântico Sul* (1996–1999), the FV *Diadorim* and FV *Soloncy Moura* (1996–2002), OSB *Astro Garoupa* (2003), and, more recently, the American RV *Luke Thomas* and *Seward Johnson* (2009, 2011), the French RV *Antea* (2015, 2017), and the Brazilian RV *Alpha Crucis*. A total of 712 species of deep-sea fishes were recorded, including five species of Myxini, six species of Holocephali, 81 species of Elasmobranchii, and 620 species of Actinopteri. As in other parts of the world, the Brazilian deep-sea ichthyofauna struggles under severe anthropogenic impacts caused by the commercial fishing, and the extraction of oil and gas. The deep ocean is a delicate environment and its recovery is considerably slower than an equivalent in shallow water habitat. Therefore, increasing the research efforts is needed to avoid that part of its diversity disappear without our accurate knowledge.

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7.1 Introduction

The oceans cover 70% of the Earth's surface, which represents 97% of the water available as fish habitats. The average depth of the oceans is 3800 m and more 50% of their volume below is 3000 m, and 95% is below 200 m, making the deep sea the largest environment available on Earth (Horn 1972; Angel 1997). Even though the oceans are continuous and interconnected, there are well-defined basins limited by the continents, water masses, currents, and a great variety of habitats that range from continental slopes and rises, abyssal plains, trenches, canyons, zones of oxygen depletion, and hydrothermal vents (Tyler 2003).

The deep sea is characterized by extreme conditions of pressure, temperature, and light penetration (Angel 1997; Thistle 2003) that influence fish assemblages. The pressure increases one atmosphere for every 10 m of water depth and can reach up to 1100 atmospheres in the deepest parts of the world's oceans. The sunlight intensity decreases exponentially with depths, while the long wavelengths of the light spectrum – red, yellow, and orange – only penetrate to approximately 15, 30, and 50 m, respectively, making photosynthesis impossible below depths greater than 250 m. However, the short wavelengths of the light spectrum – violet, blue and green – can penetrate in depths of up to 1000 m, creating the twilight zone. Below 1000 m depth, the sunlight is completely absent and the only light available is produced by bioluminescent organisms, such as cnidarians, fishes, cephalopods, and crustaceans. In the deepest regions, the water temperature is constant between 2 and 3 °C, but it is extremely variable from 200 to 400 m, with the formation of thermoclines. Gases such as oxygen and carbon dioxide have a higher solubility at greater pressure, making the levels of oxygen similar to the surface waters, with the exception of the zones with oxygen depletion (Brinton 1979; Rogers 2000; Tunnicliffe et al. 2003).

It is estimated that 10–15% of the known diversity of fishes and over 160 families occur in depths greater than 500 m (Weitzman 1997; Priede and Froese 2013). Among the hagfishes (Myxini), more than 50% of the species are from deep waters, 800 m on average. Two myxinid species, *Eptatretus deani* (Evermann and Goldsborough 1907) and *E. fritzi* Wisner and McMillan 1990, were reported at 2743 m (Fernholm 1998). More than 50% of chimaeras, sharks, and rays (Chondrichthyes) occur in depths greater than 500 m; however, they become extremely rare at depths over 3000 m. The deepest records for a chimaera belong to the chimaerid *Hydrolagus affinis* (De Brito Capello 1868) at 3000 m, for the sharks, to the dalatiid *Isistius brasiliensis* (Quoy and Gaimard 1824) and the somniosid *Centroscymnus coelolepis* Barbosa du Bocage and de Brito Capello, 1864 at 3700 m, and for a skate, to the rajid *Rajella bigelowi* (Stehmann 1978) at 4156 m (Priede et al. 2006, Musick and Cotton 2015). The bony fishes (Actinopterygii) comprise the majority of the biodiversity, and the deepest records belonging to the

liparid *Pseudoliparis amblystomopsis* (Andriashev 1955) at 7703 m, and the ophiidiid *Abyssobrotula galathea* Nielsen 1977, known as the deepest-living known vertebrate, living at 8370 m (Nielsen 1977; Smith Fujii et al. 2010). The two extant species of coelacanth (Sarcopterygii), the latimerids *Latimeria chalumnae* Smith 1939 and *Latimeria menadoensis* Pouyaud et al. 1999, are also from deep waters, occurring in depths from 150 to 700 m (Fricke et al. 1991; Pouyaud et al. 1999; Jewett 2001).

7.1.1 Early Discoveries of Deep-Sea Organisms

Historically, the first reports of deep-sea organisms collected with precise depths were the polychaete *Lumbriclymene cylindricauda* Sars 1872, and an ophiuroid, probably *Gorgonocephalus arcticus* Leach 1819. Both were brought to the surface from off the northeast coast of Canada on a sounding line deployed at 1095 m, by the British HMS *Isabella* under the command of Captain Sir John Ross RN (Ross 1819; Anderson and Rice 2006).

The first reports of deep-sea fishes were made even before their formal description by Linnaeus (1758) – for instance, the velvet belly lanternshark *Etmopterus spinax* (Linnaeus 1758) (Etmopteridae) appeared in Willughby (1686), Ray (1713), and Artedi (1738), however, without a precise depth record. By 1775, 26 species of deep-demersal fishes were known from the Atlantic (Haedrich 1996) and, in the early nineteenth century, Risso (1810, 1820a, b) compiled a primary summary of the bathymetric distributions of fishes in the Mediterranean, including myctophids [e.g., *Gasteropelecus humboldti* Risso 1810 (now valid as *Myctophum punctatum* Rafinesque, 1810) and *Lampanyctus crocodilus* (Risso 1810)] and alepocephalids [e.g., *Alepocephalus rostratus* Risso 1820)].

“The shape of these fish [*Alepocephalus rostratus* Risso 1820a, b], their extraordinarily large eyes, the dark hues, and little variations which cover them, reveal that they are from the deep abyssal pelagic, which make their home, and their habits and habitats will remain, for the naturalists, long buried in these profound regions.” [Translated from Risso 1820b].

Ignoring these data, Forbes (1844) reportedly proposed the azoic hypothesis, which predicted a decrease of abundance and diversity of marine animals with depth, which would cease to exist at a depth of 300 fathoms, about 550 m. Surprisingly, the azoic theory became widely accepted among the scientific community (Anderson and Rice 2006). A few years later, James Clark Ross (1847) and Michael Sars (1872, 1875) obtained several specimens of deep-sea invertebrates at depths of up to 700 m from the Antarctic, and between 360 and 500 m from deep areas off Norway, respectively. Nevertheless, it was only after the expeditions coordinated by the Scottish naturalist Charles W. Thomson onboard of the British HMS *Lightning* (1868) and HMS *Porcupine* (1869, 1870) that the azoic theory was finally dismissed (Thomson 1873; Levin and Gooday 2003; Anderson and Rice 2006).

Thomson used the results of those expeditions to convince the British Royal Navy to allow the use of the HMS *Challenger* in a worldwide expedition to explore

the deep sea. The Challenger Expedition took place between December 7th, 1872 and May 24th, 1876, traveling 68,890 nautical miles (=127,584 km) across the Atlantic, Pacific, and Indian Oceans. It was the first oceanographic expedition to obtain biological, chemical, and physical samples from around the world, collecting data from 362 stations, in depths of up to 8183 m – the majority between 1800 and 5400 m (Thomson 1880). The outcome of the Challenger Expedition was published in a series of reports between 1885 and 1895, that includes four volumes on botany, one volume on deep-sea deposits, and an introduction plus 83 volumes on zoology, with the descriptions of astonishing 715 genera and 4417 species of marine organisms, most of which are still valid nowadays (Murray 1895). The fishes were studied by the German ichthyologists Albert Günther (1877, 1878a, b, 1880, 1887), which recognized 385 species living below 180 m and 230 species below 550 m.

The western South Atlantic deep-sea ichthyofauna remained unstudied until the two passages of the *Challenger* Expedition off Northeastern Brazil (1873) and off Uruguay and Argentina (1976). In Brazil, the deep sea had not been further explored for almost a century, until the passages of the German RVs *Ernst Haeckel* (1966) between Southern Brazil and Argentina and the American MIV *Oregon II* (1957–1976) in northern South America. The first expedition focused exclusively on Brazilian waters was carried out much later, onboard the French RV *Marion Dufresne* (1987), and the most important contributions were made during the REVIZEE years (1996–2002), especially with the cruises of the French RV *Thalassa* (1999, 2000), the Brazilian RV *Atlântico Sul* (1996–1999), and the Brazilian FVs *Diadorim* and *Soloncy Moura* (1996–2002). The Brazilian oil company Petróleo Brasileiro S.A. – Petrobras hired the Brazilian OSB *Astro Garoupa* (2001, 2007) and the American RVs *Luke Thomas* and *Seward Johnson* (2009, 2011) to evaluate the deep-sea biodiversity on the oil basins. The most recent expeditions were made onboard the French RV *Antea* (2015, 2017) and the Brazilian RV *Alpha Crucis* (2019), as part of the ABRACOS (Acoustics along the BRAzilian COaSt) and the DEEP-OCEAN (Diversidade E Evolução de Peixes de Oceano Profundo) projects, respectively. In this chapter, we provide a historical overview about the discoveries of deep-sea fishes in the Brazilian Economic Exclusive Zone (EEZ), including a summary of the results obtained by either the major scientific expeditions or the additional fisheries exploratory surveys of interest (Table 7.1, Fig. 7.1).

The search for the taxonomic records was initially made in Catalog of Marine Fishes of Brazilian Coast (Menezes et al. 2003) and the Catálogo Taxonômico da Fauna do Brasil (Boeger et al. 2015) and restricted to those species that occur in depths greater than 200 m. To minimize the chance of error and update taxonomic status, each record was double-checked in the Eschmeyer's Catalogue of Fishes (Fricke et al. 2020), literature reviews, and the original descriptions, and only those records with a voucher specimen obtained in the Brazilian EEZ were considered. Reports of species that had been substantiated by material deposited in museums were confirmed or excluded from the account by accessing the online databases of the Museum of Comparative Zoology of Harvard University, the National Museum of Natural History of the Smithsonian Institution, and the Zoologisches Institut und Zoologisches Museum der Humboldt Universität, and also examining material in the Museu de Zoologia da Universidade de São Paulo, and the Museu Nacional da Universidade Federal do Rio de Janeiro.

Table 7.1 List of deep-sea expeditions in the Brazilian Economic Exclusive Zone that contributed to knowledge of the ichthyofauna

Year	Vessel	Country	Cruise	Gear	Depth (m)	Area explored
1873, 1976	HMS <i>Challenger</i>	British	Challenger Expedition	Dredge (4.15 m) and trawl nets (4 and 6 m)	32–2350	Pernambuco, Alagoas, Sergipe, and Bahia
1966	RV <i>Ernst Haeckel</i>	Germany		Bottom trawl (not specified)	54–500	Brazil and Argentina
1957–1976	MIV <i>Oregon II</i>	USA	# 47, 58, 66, 84	Shrimp trawl (12 m)	0–411	Amapá, Maranhão, and Pará, off mouth of Rio Amazonas
1987	RV <i>Marion Dufresne</i>	France	MD-55	Chalut à Pache beam trawl (4.5 m); Blake trawl (4 m); Sanders dredge	20–5092	Rio de Janeiro, Espírito Santo, and Victoria-Trindade seamount
1999	RV <i>Thalassa</i>	France	Bahia-1	Midwater net (56 × 25 m)	30–2000	Bahia to Rio de Janeiro
2000	RV <i>Thalassa</i>	France	Bahia-2	ARROW trawl (47.4 × 26.8 m); GOV trawl (36 × 47 m)	195–2137	Bahia to Rio de Janeiro
1996–1999	RV <i>Atlântico Sul</i>	Brazil	REVIZEE I–VI	Pelagic trawl (268 m circumference)	100–1500	Rio de Janeiro to Rio Grande do Sul
1996–2002	FV <i>Diadorim</i> and FV <i>Soloncy Moura</i>	Brazil		Longline and traps; Engel star balloon trawl (40.4 m)	100–1200	Rio de Janeiro to Rio Grande do Sul
2003	OSV Astro Garoupa	Brazil	OCEANPROF I, II	Semi-balloon otter trawl (5.5 m)	1059–1640	Rio de Janeiro
2009	RV <i>Luke Thomas</i>	USA		Semi-balloon otter trawl (8 m)	150–2000	Rio Grande do Norte
2011	RV <i>Seward Johnson</i>	USA		Semi-balloon otter trawl (15 m)	150–2068	Rio Grande do Norte
2012–present	MS <i>Teahupoo</i>	Brazil	TAMAR	Longline and fish traps	250–900	Bahia
2012–2014	FV <i>Transmar I</i>	Brazil		Longline and fish traps	170–700	Saint Peter and Saint Paul Archipelago
2015, 2017	RV <i>Antea</i>	France	ABRACOS I, II	Micronekton and mesopelagic nets	0–1113	Seamounts off Northeastern Brazil and Fernando de Noronha
2019–present	RV <i>Alpha Crucis</i>	Brazil	DEEP-OCEAN	Shrimp trawl (19 m)	400–1500	Southern Brazil

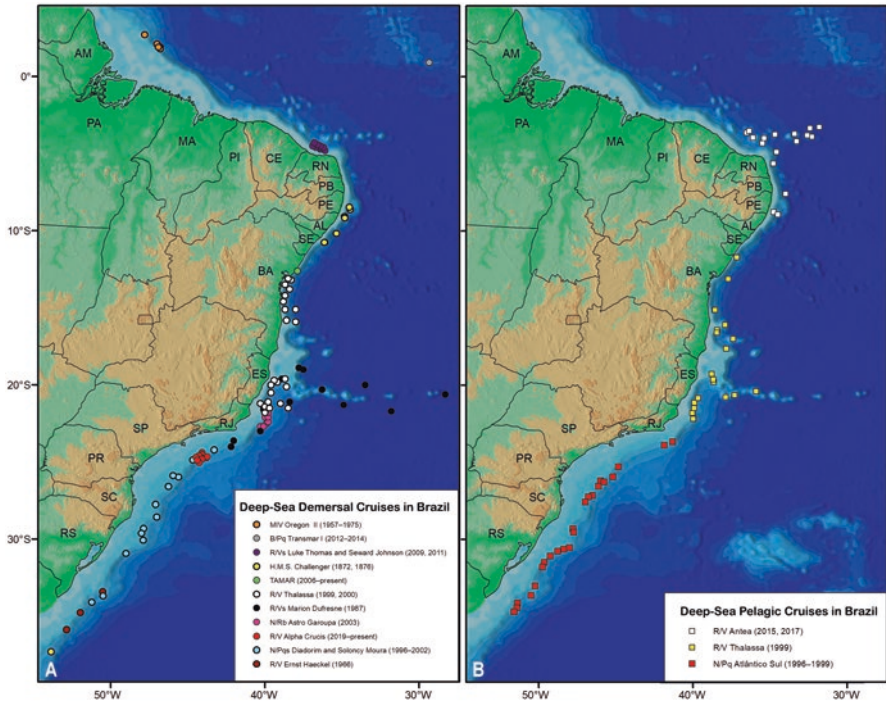


Fig. 7.1 Cruises to the Brazilian Economic Exclusive Zone that produced information about the deep-sea ichthyofauna using (a) demersal gear such as bottom trawl, longline, and fish traps (circles) or (b) pelagic net (square). To avoid excessive overlapping, each point may represent more than one station

The arrangement of Classes, Orders, and Families follows Fricke et al. (2020) for Myxini and Chondrichthyes, which are divided into the Classes Elasmobranchii and Holocephali; Betancur-R et al. (2017) was used for the ranks within the Class Actinopteri. Prefixes of vessels used along text are as follows: FV, fishery vessel; MV or MIV, motor vessel; RV research vessel; HMS, His/Her Majesty's Ship; OSV, offshore supply vessel.

The habitat definition adopted herein is adapted from Briggs (1960) and Gaither et al. (2016): (A) shallow benthopelagic, species that live on or near to the bottom and are typically found on the continental shelf in shallower waters and mesophotic reefs, which were also reported in depths greater than 200 m (e.g., muraenids, seranids); (B) epipelagic, species that generally inhabit the upper 200 m of the water column, but also visit deeper waters (e.g., lamnids and scombrids); (C) deep benthopelagic, species that live on or near to the bottom at depths greater than 200 m (e.g., chimaerids and synphobranchid eels); (D) mesopelagic, species that are encountered in the water column at depths between 200 and 1000 m (e.g., etmopterids, myctophiforms, and stomiiformes), and (E) bathypelagic, species that occur in the water column in depths great than 1000 m (e.g., dalatiids, ceratioids, and

eurypharyngids). All the records were organized considering the cruise and presented along with the existing information on habitat occupation.

7.2 Records of Deep-Sea Fishes in Brazilian EEZ

7.2.1 *HMS Challenger Expedition (1872–1876)*

In Brazil, the Challenger Expedition passed through the Saint Paul Rocks (August 28–29th, 1873) and the Fernando de Noronha Archipelago (September 1^s–8th, 1873), but only obtained biological collections between Pernambuco and Bahia States (September 9–14th, 1873) (Thomson 1880). Those specimens were used by Günther (1877, 1878a, b, 1880, 1887) for the descriptions of the first Brazilian deep-sea fishes, including the grenadier *Coryphaenoides leptolepis* Günther 1877 (Macrouridae), the tripod fish *Bathypterois quadrifilis* Günther 1878, the grideye *Ipnops murrayi* Günther 1878 (Ipnopidae), the serranid *Bathyanthias roseus* Günther 1880 (Serranidae), the flatfish *Citharichthys cornutus* (Günther 1880) (Paralichthyidae), the armored-searobin *Peristedion truncatum* (Günther 1880) (Peristediidae), the viviparous brotula *Diplacanthopoma brachysoma* Günther 1887 (Bythitidae), the clusk eel *Neobythites ocellatus* Günther 1887 (Ophidiidae), and the bigscale *Poromitra crassiceps* (Günther 1878a, b) (Melamphaidae).

The Challenger Expedition also visited other parts of South America, obtaining samples from Punta Arenas, Chile to the Falkland Islands (January 20th–February 3rd, 1976), from the Falkland Islands to off the Rio de la Plata mouth, at the border between Argentina and Uruguay (February 8–26th, 1876), and from the Rio de la Plata mouth to the Tristan da Cunha Islands (February 28th–March 14th, 1876) (Thomson 1880). Those stations in adjacent waters resulted in the descriptions of additional five species that also occur in the Brazilian EEZ: the gadiforms *Coryphaenoides affinis* Günther, 1878, *Laemonema longifilis* Günther 1880 [valid as *Urophycis brasiliensis* (Kaup 1858) (Lemes et al. 2016)] (Phycidae), and *Antimora rostrata*; the tripodfish *Bathypterois longipes* Günther 1878 (Ipnopidae); and the viviparous brotula *Cataetx messieri* (Bythitidae).

7.2.2 *Fishery Surveys in the Nineteenth Century (1950–1970)*

In 1966, the western German RV *Ernst Haeckel* made a cruise to the southern part of South America between Brazil and Argentina (32°–51° S), resulting in records of 85 species of Actinopterygii, nine from deeper waters, and the description of the flathead *Cottunculus granulatus* Karrer 1968 (Psychrolutidae) (Krefft 1968a, Lima and Mincarone 2004).

Between 1957 and 1975, the United States National Oceanic and Atmospheric Administration MIV *Oregon II* conducted several expeditions to Northern Brazil, off the mouth of the Rio Amazonas. Most part of the samples was taken from up to 80 m, on the continental shelf; however, a few stations were made on the continental slope, in depths of up to 411 m (Cohen 1958, Collette and Rützler 1977). Those stations resulted in the discovery of a deep-reef of sponges and rhodoliths, and the descriptions of the slender catshark *Schroederichthys tenuis* Springer 1966 (Scyliorhinidae), the shortspine boarfish *Antigonia combatia* Berry and Rathjein 1958, a slope dragonet *Centrodraco oregonus* (Briggs and Berry 1959) (Draconettidae), the Atlantic green eye *Chlorophthalmus brasiliensis* Mead 1958 (Chlorophthalmidae), a grenadier *Malacocephalus okamurai* Iwamoto and Arai 1987 (Macrouridae), an argentine *Glossanodon pygmaeus* Cohen 1958 (Argentinidae), a clusk eel *Neobythites brasiliensis* Nielsen 1999 (Ophidiidae), the anguilliforms *Bathycongrus bullisi* (Smith and Kanazawa 1977) (Congridae) and *Chlorophthalmus brasiliensis* Mead 1958 (Chlorophthalmidae), and the western luminous roughy *Aulotrachichthys argyrophanus* (Woods 1961) (Trachichthyidae) (Mead 1958; Briggs and Berry 1959; Woods 1961; Springer 1965; Smith and Kanazawa 1977; Iwamoto and Arai 1987; Gadig et al. 1996; Nielsen 1999).

7.2.3 *RV Marion Dufresne (1987)*

In 1987, the expedition MD-55 was conducted onboard of the French RV *Marion Dufresne*, as part of a collaboration between the Universidade Santa Úrsula, Brazil, and the Muséum National d'Histoire Naturelle, France (Guille and Ramos 1988; Tavares 1999). A total of 33 stations using bottom trawls were made on the continental shelf and slope between northern Rio de Janeiro and Espírito Santo States, and on the Vitória-Trindade Seamount Chain (23°36'40"–18°49'00" S and 42°10'–28°20' W), in depths of 200 to 5092 m. The MD-55 expedition produced 500 specimens, comprising 81 species and 39 families of Osteichthyes and four Elasmobranchii (Séret and Andreata 1992). The specimens were split between the two leading institutions, but more recently the fish specimens deposited at the Universidade Santa Úrsula were transferred to the Museu Nacional/UFRJ.

7.2.4 *The REVIZEE Years (1994–2004)*

In 1994, the Brazilian Government launched the Program Evaluation of the Sustainable Potential of Living Resources in the Exclusive Economic Zone (REVIZEE), a 10 years long project which objective was to evaluate the marine resources in the Brazilian Exclusive Economic Zone. The Brazilian EEZ was divided into four scores, according to their oceanographic and biological

characteristics, and dominant seabed type: North, Northeast, Central, and Southeast-South (Ministério do Meio Ambiente 2006; Serafim 2007).

During the REVIZEE program, the French RV *Thalassa* of the Institut Français de Recherche pour l'Exploitation de la Mer (IFREMER) was hired to explore the continental slope. Two cruises were conducted in 1999 and 2000, between Bahia and Rio de Janeiro States (11°–22° S and 34°40'–40°30' W), formerly named as Bahia-1 and Bahia-2, respectively. The goal of the Bahia-1 cruise was to explore the epipelagic (0–200 m) and mesopelagic (200–1000 m) resources. The samples were obtained from 51 stations, from depths between 14 and 910 m and resulted in the capture of 96 species of Osteichthyes from 38 families (Madureira et al. 2004, Braga et al. 2007). During the Bahia-2 cruise, focused on the demersal and benthopelagic organisms, samples were obtained from 58 stations between 195 and 2137 m and resulted in the capture of 208 species from 61 families of Actinopteri, and 14 species sharks from eight families (Costa et al. 2000, 2007; Nunan et al. 2007). The collections made by the RV *Thalassa* served as base for descriptions of nine new species: the angelshark *Squatina varii* Vaz and Carvalho 2018 (Squatinaidae); the catsharks *Scyliorhinus cabofriensis* Soares et al. 2016 and *S. ugoi* Soares et al. 2015 (Scyliorhinidae); the dogsharks *Squalus bahiensis* Viana et al. 2016 and *S. albicaudus* Viana et al. 2016 (Squalidae); the skates *Dipturus mennii* Gomes and Paragó 2001 and *Malacoraja obscura* Carvalho et al. 2005 (Rajidae); the swallower *Kali colubrina* Melo 2008 (Chiasmodontidae); the clusk eel *Neobythites monocellatus* Nielsen 1999 (Ophidiidae); the eelpout *Pachycara alepidotum* Anderson and Mincarone 2006 (Zoarcidae); and, in part, the bald cutthroat eel *Synaphobranchus calvus* Melo 2007 (Synaphobranchidae) (Anderson and Mincarone 2006; Carvalho et al. 2005; Melo 2007, 2008; Melo et al. 2009; Nielsen et al. 2009; Soares et al. 2015, 2016; Soares and Carvalho 2016; Viana et al. 2016; Vaz and Carvalho 2018).

For the Southeast-South score, three cruises were made onboard of the RV *Atlântico Sul* from the Fundação Universidade Rio Grande, between Rio de Janeiro and Rio Grande do Sul States (22°–34° S and 40°–53° W), formerly named as REVIZEE I, II, and III. Most samples were obtained using pelagic nets mainly from 100 to 500 m, but a single station at 675 m during the cruise REVIZEE I, eight stations from 500 to 1480 m during REVIZEE II, and 12 stations from 500 to 1457 m, during REVIZEE III. Those materials collected during those cruises resulted in records of 171 species from 71 families of Actinopterygii and the description of the chimaera *Hydrolagus matallanasi* Soto and Vooren 2004 (Chimaeridae) (De Figueiredo et al. 2002; Soto and Vooren 2004; Bernardes et al. 2007 and Rossi-Wongtschowski 2007).

For the demersal fauna, the samples were obtained onboard of the Brazilian FVs *Diadorim* and *Soloncy Moura*, both from the Centro de Pesquisa e Extensão Pesqueira das Regiões Sudeste e Sul (CEPSUL/IBAMA). Different types of fishing gear were used, including fish traps launched to depths of up to 500 m, long lines to depths between 100 and 1200 m, and bottom trawls made between 100 and 600 m. From these samplings, two species of Myxini, 37 species of Elasmobranchii, and 184 species of Actinopteri were collected (Bernardes et al. 2005a, b; Haimovici et al. 2008). The hagfish *Eptatretus menezes* Mincarone 2000 (Myxinidae) and the

catshark *Schroederichthys saurissqualus* Soto 2001 (Scyliorhinidae) were described based on specimens collected by the RV *Diadorim* (Mincarone 2000; Soto 2001).

7.2.5 *The Petrobras Expeditions (2000–2011)*

Since 2000, the Brazilian oil company Petróleo Brasileiro S.A. – Petrobras started to invest in projects to increase the knowledge of the deep-water fauna (Morais 2013). During the projects OCEANPROF – Oceano Profundo (2001–2007) and HABITATS – Heterogeneidade Ambiental da Bacia de Campos (2008–2015), two expeditions were conducted onboard the Brazilian OSV *Astro Garoupa* to the continental slope off northern Rio de Janeiro State. Using a bottom trawl, the OSV *Astro Garoupa* obtained samples from 40 stations on the continental slope, between 1059 and 1640 m. Two species of Elasmobranchii and 80 species of Actinopteri were reported; including part of the specimens used in the description of the cut-throat eel *Synaphobranchus calvus* (Synaphobranchidae) (Melo 2008; Lavrado and Brasil 2010).

During the Projeto de Monitoramento Ambiental Marinho da Bacia Potiguar (2009–2011), two expeditions were made onboard of the North American RVs *Luke Thomas* and *Seward Johnson* off the Rio Grande do Norte State. The samples were obtained using bottom trawl, from depths between 150 and 2000 m, and resulted in the capture of five species of Elasmobranchii and one Holocephali and 159 species of Actinopteri (Oliveira et al. 2015), and was used for the description of *Barathronus linsi* (Nielsen et al. 2015).

7.2.6 *FRV Antea (2015, 2017)*

The Acoustics along the BRAZILIAN COaSt (ABRACOS) is an integrated program between the French Institut de Recherche pour le Développement and the Brazilian institutions Universidade Federal do Rio de Janeiro, Universidade Federal de Pernambuco, and Universidade Federal Rural de Pernambuco, with the goal to monitor the tropical marine ecosystems between oceanic islands and the continental margin in Northeastern Brazil. Two cruises were carried out onboard the French RV *Antea* (2015, 2017) using micronekton and mesopelagic nets for deep-pelagic organisms in depths of up to 1113 m (Bertrand 2015, 2017; Eduardo et al. 2018a, b). A bottom trawl was also used in 2017, but focused on the continental shelf, therefore not included in this account (Melo et al. 2020). So far, the results of the two expeditions resulted in new records in the Brazilian EEZ of a trichiurid, two howelliids and four caristiids, and regional accounts for 11 mesopelagic species (Eduardo et al. 2018a, c, 2019, Mincarone et al. 2019).

7.2.7 *RV Alpha Crucis (2019–Present)*

The Projeto Diversidade E Evolução de Peixes de Oceano Profundo – DEEP-OCEAN, hosted at the Instituto Oceanográfico da Universidade de São Paulo, has the goal to study the diversity and evolution of deep-sea fishes in the western South Atlantic. The first cruise to the Brazilian EEZ was conducted onboard the Brazilian RV *Alpha Crucis* in September 2019 using a bottom trawl between 400 and 1500 m. Preliminary, unpublished data indicates the capture of 88 species of Elasmobranchii (11), Holocephali (1), and Actinopteri (76). Two additional cruises are planned for 2020/2021.

7.2.8 *Additional Contributions*

Since 2006, the Projeto TAMAR systematically carry out deep-sea fishing off Praia do Forte, Bahia, using the MV *Teahupoo* adapted to deploy longline and traps. The specimens collected are regularly destined to scientific collections and served for the new records of nine species of Actinopterygii in the Brazilian EEZ (Carvalho-Filho et al. 2009, 2010a, b, 2011a, 2011b, 2012, 2020).

Several projects developed at the Universidade Federal Rural de Pernambuco obtained samples from the Saint Peter and Saint Paul Archipelago (ASPSP) and the continental slope off Pernambuco. According to Nunes (2016), the fishing boat FV *Transmar I* was used between 2012 and 2014 to deploy longlines and fish traps at depths from 200 to 700 m in the ASPSP, resulting on records of 11 species of Actinopterygii, one of which was recently described by Pires et al. (2019) as *Physiculus cirm* Carvalho-Filho and Pires 2019 (Moridae).

Partnership with commercial fishing boats also are a good source of scientific material, serving the base for new records of nine species of Actinopterygii in Northeastern Brazil and the description of a new genus and species, *Leucogrammolycus brychios* Anderson and Mincarone 2008 (Zoarcidae) (Anderson and Mincarone 2008; Caires et al. 2008; de Paiva et al. 2011).

7.3 Important Expeditions to Other Parts of the Western South Atlantic

After the scientific achievements of the Challenger Expedition, there was a considerable increase in oceanographic expeditions across the world to obtain physical, chemical, and biological samples (Wust 1964; Hopper 1995). Several fisheries expeditions were conducted off South America that improved the taxonomic knowledge of the deep-sea ichthyofauna in the western South Atlantic, thus providing additional records for several species that occur in the Brazilian EEZ.

Beginning in the 1960s, the German Institute of Sea Fisheries (Institut für Seefischerei, Hamburg, Germany) conducted several expeditions across the Atlantic Ocean, and off Argentina and Uruguay, using the FRV *Walther Herwig* (1960–1971) and FRV *Walther Herwig II* (1973–1985). The results included descriptions of several deep-sea species and extensive taxonomic reviews (Krefft 1968a, b, 1974, 1976; Stehmann and Hulley 1994; Stein 2010).

From the 1970s to the early 2000s, the Japanese Marine Fisheries Research and Development Center (JAMARC) and the Japan Deep-Sea Trawlers Association (JDSTA) performed several fisheries surveys in South America to evaluate the fishery stocks along the coasts of Patagonia (1976–1979), French Guiana and Suriname (1979–1983), and Peru (Uyeno et al. 1983; Nakamura et al. 1986; Nakaya et al. 2009). Off French Guiana and Suriname, bottom trawling was conducted onboard by the whaler MV *Nisshin-Maru No. 201* to explore the resources on the continental shelf and slope, between 90 and 1000 m. A total of 453 species were recorded, including two species of Myxini, 45 Chondrichthyes and 406 Actinopteri (Uyeno et al. 1983). Off Patagonia, the Japanese expeditions were conducted by the MVs *Akebono Maru No. 72* and *Shinkai Maru* focused on the continental shelf and slope off Argentina and the Atlantic Chilean coast, between 20 and 1200 m. The results include a single species of Chondrichthyes and 130 species of Actinopteri (Nakamura et al. 1986).

Between 1970s and 1980s, the Ministry of Fishing Industry of the then Soviet Union promoted an expansion of the deep-sea fisheries in the Southern Atlantic, as a part of a global program. Scientific and commercial explorations were conducted on the Victoria-Trindade Seamount Chain (1982) and on the Rio Grande Rise (1982–1984, 2000) using several fisheries vessels equipped with different types of gear. Those expeditions resulted in reports and species descriptions of about 70 species of fish, including the rare goblin shark *Mitsukurina owstoni* Jordan 1898 (Parin et al. 1995; Shcherbachev 1995; Clark et al. 2007; Prokofiev and Kukuev 2009).

7.4 The Diversity of Deep-Sea Fishes in the Brazilian EEZ

Hitherto, 712 species from 145 families and 37 orders of deep-sea fishes had been recorded in the Brazilian EEZ (Table 7.2). Those records include five species from a single family of Myxiniformes (Table 7.3), six species from three families of Holocephali, 81 species from 23 families and eight orders of Elasmobranchii, and (Table 7.4), and 620 species from 118 families and 27 orders of Actinopteri (Table 7.5). Additionally, 51 species previously mentioned in the area did not have their occurrence confirmed and, therefore, were excluded from this account (Table 7.6).

Among the Brazilian deep-sea ichthyofauna, 40.4% are deep-benthopelagic (e.g., *Bathydroconger vicinus*, *Coelorinchus caribbaeus*, and *Bathyraja schroederi*), 20.2% are mesopelagic (e.g., *Isistius brasiliensis*, *Argyropelecus aculeatus*, and *Diaphus adenomus*), and 21.6% are bathypelagic (e.g., *Barbourisia rufa*,

Table 7.2 Summary of the deep-sea fishes occurring in the Brazilian Economic Exclusive Zone

Class	Order	#Families	#Species	Habitat	
Myxini	Myxiniiformes	1	5	DB	
Holocephali	Chimaeriformes	3	6	SB, DB	
Elasmobranchii	Carcharhiniiformes	3	16	SB, DB	
	Hexanchiformes	1	3	SB, DB	
	Lamniiformes	7	9	EP, BP, SB	
	Myliobatiformes	1	1	EP	
	Rajiformes	2	23	SB, DB	
	Squaliformes	6	23	MP, BP, SB, DB	
	Squatiniiformes	1	3	SB, DB	
	Torpediniiformes	2	3	SB, DB	
	Actinopteri	Acanthuriformes	1	1	EP
Alepocephaliformes		2	21	DB	
Anguilliformes		15	59	BP, SB, DB	
Argentiniiformes		4	11	BP	
Ateleopodiformes		1	1	DB	
Aulopiformes		10	53	BP, DB, SB	
Beryciformes		9	20	BP, DB, SB	
Caproiformes		1	2	DB	
Gadiformes		6	52	MP, DB, SB	
Malacanthidae		2	3	SB	
Opistognathidae		1	1	SB	
Istiophoriformes		1	1	EP	
Lampridiformes		4	8	BP	
Lophiiformes		11	27	BP, SB, DB	
Lutjaniformes		1	2	SB	
Myctophiformes		2	79	MP	
Notacanthiformes		2	10	DB	
Ophidiiformes		4	39	SB, DB	
Pempheriformes		4	15	BP, SB, DB	
Perciformes		9	46	BP, SB, DB	
Pleuronectiformes		4	16	SB, DB	
Polymixiiformes		1	2	DB	
Scobriformes		10	59	EP, MP, BP, DB	
Stomiiformes		4	77	MP, BP	
Syngnathiformes		3	6	DB	
Tetraodontiformes		2	4	EP, DB	
Zeiformes		4	5	BP, DB	
Total		37	145	712	

Abbreviations: *DB* deep benthopelagic, *BP* bathypelagic, *EP* epipelagic, *MP* mesopelagic, and *SB* shallow benthopelagic

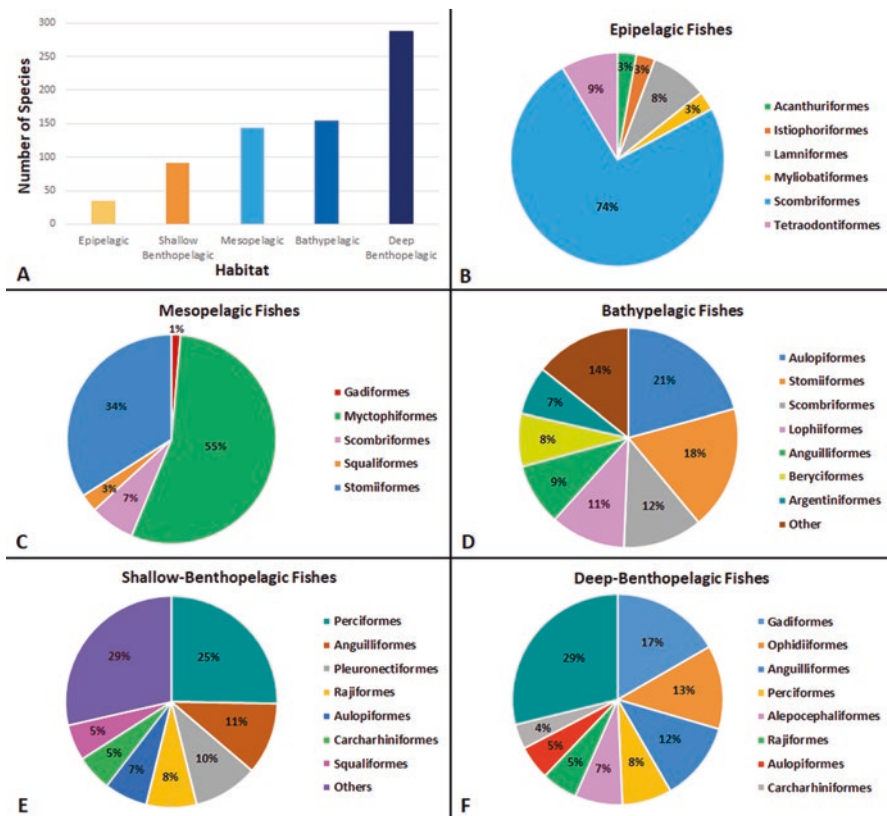


Fig. 7.2 In (a), the composition of the deep-sea fishes in the Brazilian Economic Exclusive Zone per habitat. The proportions of the most diversified groups in each habitat are as follows: (b) epipelagic; (c) shallow benthopelagic; (d) mesopelagic; (e) bathypelagic; and (f) deep-benthopelagic fishes

Gigantactis verhoeffeni, and *Kali indica*) (Fig. 7.2). Noteworthy, several species classified herein as bathypelagic are not restricted to greater depths and frequently occur in the mesopelagic zone (Rofen 1966; Melo 2008; Pietsch 2009).

The shallow benthopelagic species represent 12.8% (e.g., *Callorhynchus callosyrinchus*, *Merluccius hubbsi*, and *Polyprion americanus*), and only 4.9% are epipelagic (e.g., *Characarodon carcharias*, *Mola mola*, and *Xiphias gladius*).

The deep-benthopelagic fishes are the most diversified, including 288 species (Fig. 7.3). All five species of hagfishes (Myxinidae) are benthopelagic. The Elasmobranchii are represented by 41 species from 11 families and six orders: Rajiformes, with 16 species from the families Rajidae (15) and Arhynchobatidae (1); Carcharhiniformes, with 11 species from the families Pseudotriakidae (1) and Scyliorhinidae (11); Squaliformes, with ten species from the families Somniosidae (4), Centrophoridae (2), Dalatiidae (2), Echinorhinidae (1), and Squalidae (1); Hexanchiformes, with two species from the family Hexanchidae (2);

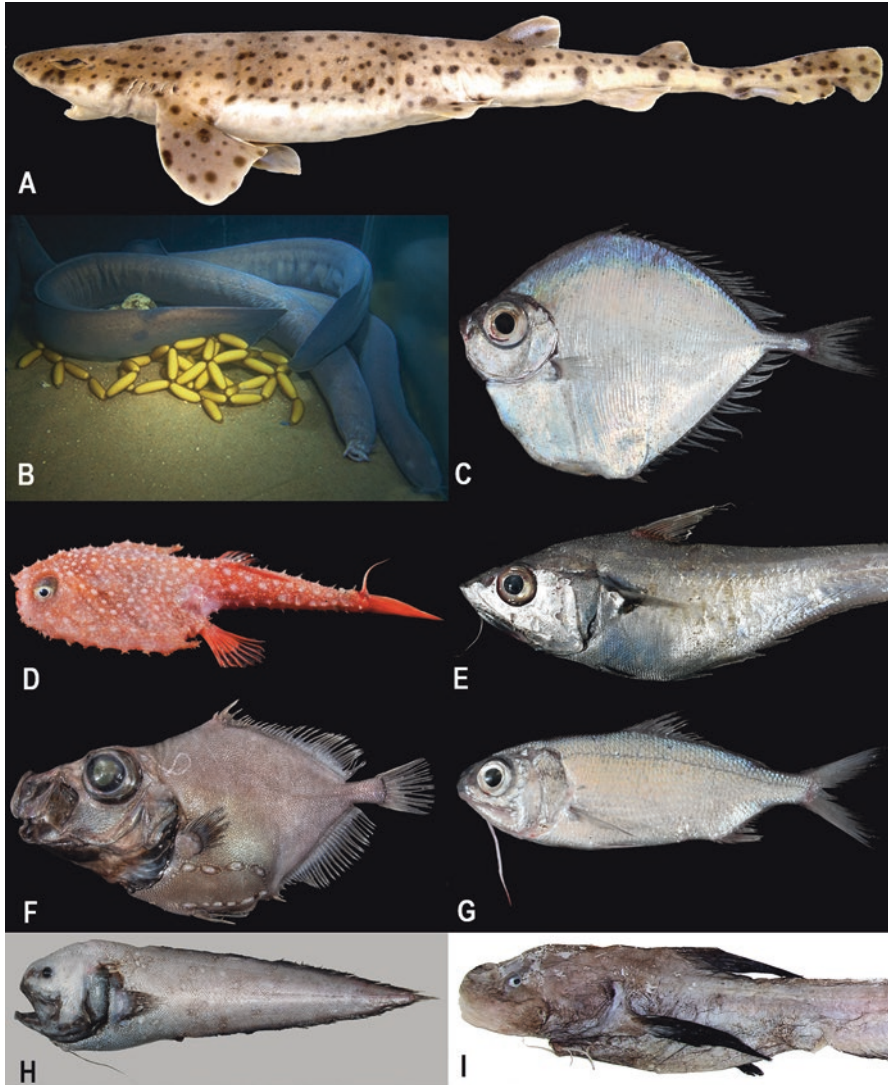


Fig. 7.3 Diversity of the Brazilian deep-benthopelagic fishes: (a) freckled catshark *Scyliorhinus haeckelii*; (b) hagfish *Eptatretus multidens* (Myxinidae); (c) spotted tinseltfish *Xenolepidichthys dalgleishi* (Grammicolepididae); (d) Atlantic batfish *Dibranchius atlanticus* (Ogcocephalidae); (e) western softhead grenadier *Malacocephalus occidentalis*; (f) warty oreo *Allocyttus verrucosus* (Oreosomatidae), (g) beardfish *Polymixia lowei* (Polymixiidae), (h) cargoyle cusk *Xyelacyba myersi*, and (i) Lope's tadpole fish *Ijimaia cf. loppei* (Ateleopodidae)

Squatiniiformes, with a single species in the family Squatinidae; and Torpediniiformes, with a single species in the family Narcinidae. The Holocephali is represented by three species from the two families of Chimaeriformes, Chimaeridae (2) and Rhinochimaeridae (1).

Most deep-benthopelagic fishes are actinopterygians, with 237 species from 51 families from 18 orders. Gadiformes is the most diversified order, with 48 species from the families Macrouridae (32), Moridae (12), Merlucciidae (2), Gadidae (1), and Melanonidae (1); followed by Ophidiiformes, with 37 species from the families Ophidiidae (26), Bythitidae (4), Carapidae (4), and Aphyonidae (3); Anguilliformes, with 35 species from the families Congridae (15), Synphobranchidae (14), Nettastomatidae (5), and Colocongridae (1); Perciformes, with 22 species from the families Bembropidae (5), Scorpaenidae (6), Zoarcidae (4), Serranidae (3), Peristediidae (2), Psychrolutidae (1), and Setarchidae (1); and Alepocephaliformes, with 21 species from the families Alepocephalidae (18) and Platytrociidae (3).

Other deep-benthopelagic fishes includes the Aulopiformes (15), Notacanthiformes (10), Pempheriformes (10), Lophiiformes (7), Pleuronectiformes (7), Syngnathiformes (6), Beryciformes (6), Scombriformes (5), Caproiformes (2), Polymixiiformes (2), Zeiformes (2), Atelepodiformes (1), and Tetraodontiformes (1).

The 144 species of mesopelagic fishes are included in only a single order of Elasmobranchii and four orders of Actinopteri (Fig. 7.4). The elasmobranchs are represented by four species of Squaliformes from the families Etmopteridae (3) and Dalatiidae (1). The actinopterygians are represented by 79 species of Myctophiiformes from the families Myctophidae (77) and Neoscopelidae (2), followed by 49 species of Stomiiformes from the families Gonostomatidae (16), Sternoptychidae (14), Stomiidae (10), and Phosichthyidae (9). Other mesopelagic fishes are the scombriform families Chiasmodontidae (6) and Caristiidae (4), and the gadiform family Bregmacerotidae (2).

The bathypelagic fishes include 147 species (Fig. 7.4). The Elasmobranchii are represented by only seven species of deep-sea sharks from the orders Laminiformes, families Cetorhinidae (1), Megachasmidae (1) and Mitsukurinidae (1), and Squaliformes, families Dalatiidae (2) and Etmopteridae (2). Among the Actinopteri, the most diversified groups are the Aulopiformes, with 32 species from the families Paralepididae (14), Scopelarchidae (6), Notosudidae (5), Evermannellidae (4), and Alepisauridae (3); followed by Stomiiformes, with 28 species from the family Stomiidae, Scombriformes, with 18 species from the families Chiasmodontidae (6), Trichiuridae (5), Gempylidae (4), Caristiidae (1), Centrolophidae (1), and Nomeidae (1); Lophiiformes with 17 species from the families Oneirodidae (4), Ceratiidae (3), Himantolophidae (3), Gigantactinidae (2), Melanocetidae (2), Chaunacidae (1), Diceratiidae (1), and Neoceratiidae (1); and Anguilliformes, with 14 species from the families Nemichthyidae (5), Serrivomeridae (3), Nettastomatidae (2), Cyematidae (1), Derichthyidae (1), Eurypharyngidae (1), and Saccopharyngidae (1). Other bathypelagic fishes belong to the orders Beryciformes (12), Argentiniiformes (11), Lampridiformes (8), Pempheriformes (3), Zeiformes (3), and Perciformes (1).

Within the two groups of shallow water fishes that can be occasionally be found in the deep sea, the epipelagic fishes are represented by two species of the lamniform sharks families Lamnidae (2) and Alopidae (1); and 31 species of the orders Scombriformes families Bramidae (10), Scombridae (6), Nomeidae (4),

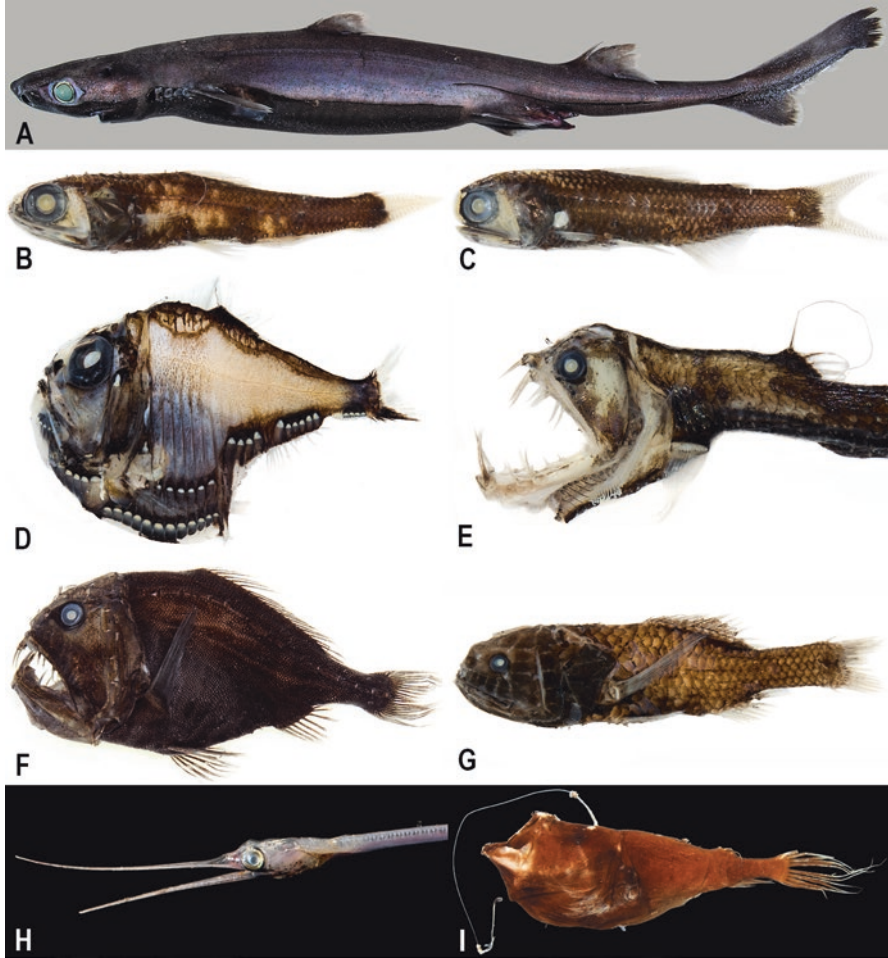


Fig. 7.4 Diversity of the Brazilian mesopelagic (a–d) and bathypelagic fishes (e–i): (a) blackbelly lanternshark *Etmopterus lucifer* (Etmopteridae), (b) Madeira lanternfish *Ceratoscopelus maderensis* (Myctophidae), (c) Soft lanternfish *Diaphus* cf. *mollis*, (d) silver hatchetfish *Argyropelecus aculeatus* (Sternoptychidae), (e) Sloane's viperfish *Chauliodus sloani* (Stomiidae) (f) ogresfish *Anoplogaster cornuta*, (g) ridge head *Poromitra* sp. (Melamphaidae), (h) slender snipe eel *Nemichthys scolopaceus* (Nemichthyidae), (i) Kroyer's deep-sea anglerfish *Ceratiis holboelli* (Ceratiidae)

Ariommatidae (2), Gempylidae (2), Centrolophidae (1), and Trichiuridae (1), followed by the orders Tetraodontiformes (3), Acanthuriformes (1), and Istiophoriformes (1).

The shallow benthopelagic fishes are composed by 91 species from 36 families. Holocephali is represented by a single species of Callorhynchidae, and the Elasmobranchii by 25 species, including seven species of Rajiformes from the families Arhynchobatidae (4) and Rajidae (3); five species of Carcharhiniformes,

families Triakidae (4) and Scyliorhinidae (1); and five species of Squaliformes, family Squalidae (5). The additional species belong to the orders Lamniformes (3), Squatiniformes (2), Torpediniformes (2), and Hexanchiformes (1).

Among the Actinopteri, Perciformes is the most diverse group, with 23 species from the families Serranidae (12), Peristediidae (4), Priacanthidae (3), Triglidae (3), and Scorpaenidae (1), followed by the Anguilliformes, with ten species from families Muraenidae (3), Ophichthidae (3), Chlopsidae (2), Congridae (1), and Muraenesocidae (1); Pleuronectiformes, with nine species from the families Cynoglossidae (4), Bothidae (3), and Paralichthyidae (1); and Aulopiformes, with six species from the families Synodontidae (5) and Aulopidae (1). Other shallow benthopelagic fish groups include the Lutjaniformes (2), Beryciformes (2), Gadiformes (2), Pempheriformes (2), Lophiiformes (3), the families Malacanthidae (2) and Emmelichthyidae (1), which are *incertae sedis* in Eupercaria, and Oipistognathidae (1), *incertae sedis* in Ovolentaria.

7.5 Anthropogenic Impacts and Major Treats

Recent accounts of the Brazilian fauna at risk of extinction include 16 species of deep-sea fishes (ICMBIO/MMA 2018a, b). Five species were categorized as vulnerable, including the Soto's hagfish (*Myxine sotoi*), the great white shark (*Carcharodon carcharias*), the argentine torpedo (*Tetronarce puelcha*), the snowy grouper (*Hyporthodus niveatus*), and the tile fish (*Lopholatilus villarii*). Three species are categorized as endangered, the dusky smooth-hound (*Mustelus canis*), the spotback skate (*Atlantoraja castelnaui*), and the warsaw grouper (*Hyporthodus nigrinus*). Seven species are categorized as critically endangered, the picked dogfish (*Squalus acanthias*), two angelsharks (*Squatina argentina* and *S. occulta*), two houndsharks (*Galeorhinus galeus* and *Mustelus fasciatus*), the broadnose-sevengill shark (*Notorynchus cepedianus*), and the Atlantic wreckfish (*Polyprion americanus*). Major treats for those species are related to overfishing causing considerable populational decline in the past 20 years.

Fishing operations targeting deep-sea species on the Brazilian EEZ have been conducted by international vessels since the late 1990s, focusing on both fishes and crustaceans from the continental slopes off Northern and Southern Brazil, the Ceará Plateau, and the Fernando de Noronha Chain (Athiê and Rossi-Wongtschowski 2005; Alvarez Perez et al. 2009; Kitahara 2009). Targeted stocks of several deep-sea species such as the blackfin goosefish (*Lophius gastrophysus*), Argentine hake (*Merluccius hubbsi*), and Atlantic wreckfish (*Polyprion americanus*) are currently depleted (Perez and Haimovici 1998; Perez and Wahrlich 2005; Pezzuto et al. 2006). The ecological impacts of deep-sea fisheries are similar to the impacts in shallow systems and may result on the removal of habitat-formers, decline in diversity, changes in abundance and biomass, reduction in distribution, and changes in the community structure; however, the rates of recovery are much slower and difficult to estimate (Clark et al. 2016).

Additionally, the deep-sea species have been consistently affected by human activities as disposal of litter and waste in sea beds, residuals from sewage, discards from fishing activities and transport of livestock, chemical contamination such as oil spills and pharmaceuticals, mining, ocean acidification, and fisheries (Koslow et al. 2000; van den Hove and Moreau 2007; Ramirez-Llodra et al. 2011; White et al. 2012).

The exploration oil and gas obtained from deep waters in Brazil started back in 1979, and, nowadays, Brazil is one of the world leaders in the exploration of oil and gas in deep (500–1500 m) and ultra-deep (>1500 m) waters. Major fields of explorations include the pre-salt layers of the Bacia de Campos and Bacia de Santos, which extends for about 800 km from the Espírito Santo and Santa Catarina States, and the Bacia Potiguar, located off the Rio Grande do Norte and Ceará States (Trindade et al. 1992; van den Hove and Moreau 2007; Morais 2013). There are substantial risks associated with this kind of activity, including light and acoustic disturbance, disposal of wastes produced during the drilling process, produced water, mechanical impacts caused by anchors, control cables, pipelines and risers, change of habitats by seabed infrastructures, mass hydrocarbon release caused by oil and gas spill, and mass dispersant and chemical amplificant release applied to oil spills (White et al. 2012; Cordes et al. 2016).

7.6 Challenges and Perspectives

The Brazilian deep-sea known unknowns include large areas of the continental slope in Northern and Northeastern Brazil and, in South and Southern Brazil, depths below 500 m, specially from the southern part of Rio de Janeiro to Rio Grande do Sul.

Besides the continental slope, key areas for further exploration are seamounts and oceanic islands, such as the North Brazilian ridge, the Fernando de Noronha ridge, including the oceanic islands of the Fernando de Noronha Archipelago and Atol das Rocas, the Victoria-Trindade Seamount Chain with the Trindade and Martin Vaz archipelago, and the isolated Saint Peter and Saint Paul archipelago, and Rio Grande Rise. Those remote areas are particularly challenging to sample, because of the difficult access and adverse oceanographic conditions of the strong currents, the steep and rocky bottom, and frequent inclement weather in the Rio Grande rise area.

The many efforts to obtain samples from greater marine depths since the beginning of the twenty-first century are contributing to cover such gaps and boosting significant gains to better understand the biodiversity of deep-sea fishes in the western South Atlantic. In the past years, a number of scientific contributions were published focusing on the deep-sea fish fauna, including general inventories and books

(De Figueiredo et al. 2002; Madureira et al. 2004; Bernardes et al. 2005b; Costa et al. 2007; Lavrado and Brasil 2010; Oliveira et al. 2015), ecological data on distribution and abundance (Bernardes and Rossi-Wongtschowski 2007; Braga et al. 2014), comprehensive taxonomic reviews (Mincarone et al. 2008; Santos and Figueiredo 2008; Melo 2009, 2010; Lima et al. 2011), and descriptions of sixteen new taxa (see above).

Indeed, only with the development of long-term projects to sample the deep ocean, the deposit of specimens in well-established natural history collections, and extensive public outreach will ensure fantastic discoveries, the appropriate monitoring of anthropogenic impacts on deep-sea communities, and inspire new generations of scientists.

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Appendix (Tables 7.3, 7.4, 7.5 and 7.6)

Table 7.3 Checklist of the deep-sea species of Myxini recorded in the Brazilian Economic Exclusive Zone

Class	Order	Family	Species	Habitat
Myxini	Myxiniformes	Myxinidae	<i>Eptatretus menezesi</i> Mincarone, 2000	DB
			<i>Eptatretus multidentis</i> Fernholm & Hubbs, 1981	DB
			<i>Myxine australis</i> Jenyns, 1842	DB
			<i>Myxine sotoi</i> Mincarone, 2001	DB
			<i>Nemamyxine krefftii</i> McMillan & Wisner 1982	DB

Abbreviations: *DB* deep benthopelagic, *BP* bathypelagic, *EP* epipelagic, *MP* mesopelagic, and *SB* shallow benthopelagic

Table 7.4 Checklist of the deep-sea species of Chondrichthyes (Holocephali and Elasmobranchii) recorded in the Brazilian Economic Exclusive Zone

Class	Order	Family	Species	Habitat		
Holocephali	Chimaeriformes	Callorhynchidae	<i>Callorhynchus callorynchus</i> Linnaeus, 1758	SB		
		Chimaeridae	<i>Hydrolagus affinis</i> de Brito Capello, 1868	DB		
			<i>Hydrolagus alberti</i> Bigelow & Schroeder, 1951	DB		
			<i>Hydrolagus matallanasi</i> Soto & Vooren, 2004	DB		
		Rhinochimaeridae	<i>Harriotta raleighana</i> Goode & Bean, 1895	DB		
			<i>Rhinochimaera atlantica</i> Holt & Byrne, 1909	DB		
		Elasmobranchii	Carcharhiniformes	Pseudotriakidae	<i>Pseudotriakis microdon</i> de Brito Capello, 1868	DB
				Scyliorhinidae	<i>Apristurus parvipinnis</i> Springer & Heemstra, 1979	DB
					<i>Apristurus profundorum</i> Goode & Bean, 1896	DB
					<i>Galeus mincaronei</i> Soto, 2001	DB
					<i>Parmaturus angelae</i> Soares, Carvalho, Schwingel & Gadig, 2019	DB
					<i>Schroederichthys bivius</i> Müller & Henle, 1838	SB
<i>Schroederichthys saurisqualus</i> Soto, 2001	DB					
<i>Schroederichthys tenuis</i> Springer, 1966	DB					
<i>Scyliorhinus boa</i> Goode & Bean, 1896	DB					
<i>Scyliorhinus cabofriensis</i> Soares, Gomes & Carvalho, 2016	DB					
<i>Scyliorhinus haeckelii</i> Miranda-Ribeiro, 1907	DB					
<i>Scyliorhinus ugoi</i> Soares Gadig & Gomes, 2015	DB					
Triakidae	<i>Galeorhinus galeus</i> Linnaeus, 1758				SB	
<i>Mustelus canis</i> Mitchell, 1815	SB					

(continued)

Table 7.4 (continued)

Class	Order	Family	Species	Habitat
			<i>Mustelus fasciatus</i> Garman, 1913	SB
			<i>Mustelus higmani</i> Springer & Lowe, 1963	SB
	Hexanchiformes	Hexanchidae	<i>Hepranchias perlo</i> Bonnaterre, 1788	DB
			<i>Hexanchus griseus</i> Bonnaterre, 1788	DB
			<i>Notorynchus cepedianus</i> Péron, 1807	SB
	Lamniformes	Lamnidae	<i>Lamna nasus</i> Bonnaterre, 1788	EP
			<i>Carcharodon carcharias</i> Linnaeus, 1758	EP
		Alopiidae	<i>Alopias superciliosus</i> Lowe 1841	EP
		Megachasmidae	<i>Megachasma pelagios</i> Taylor, Compagno & Struhsaker, 1983	BP
		Cetorhinidae	<i>Cetorhinus maximus</i> Gunnerus, 1765	BP
		Mitsukurinidae	<i>Mitsukurina owstoni</i> Jordan, 1898	BP
		Odontaspidae	<i>Odontaspis ferox</i> Risso, 1810	SB
			<i>Odontaspis noronhai</i> Maul, 1955	SB
		Pseudocarchariidae	<i>Pseudocarcharias</i> <i>kamoharai</i> Matsubara, 1936	SB
	Myliobatiformes	Dasyatidae	<i>Pteroplatytrygon</i> <i>violacea</i> Bonaparte, 1832	EP
	Rajiformes	Arhynchobatidae	<i>Atlantoraja castelnaui</i> Miranda-Ribeiro, 1907	SB
			<i>Atlantoraja cyclophora</i> Regan, 1903	SB
			<i>Atlantoraja platana</i> Günther, 1880	SB
			<i>Bathyraja brachyurops</i> Fowler, 1910	SB
			<i>Bathyraja schroederi</i> Krefft, 1968	DB
		Rajidae	<i>Amblyraja frerichsi</i> Krefft, 1968	DB
			<i>Breviraja nigriventralis</i> McEachran & Matheson, 1985	DB

(continued)

Table 7.4 (continued)

Class	Order	Family	Species	Habitat
			<i>Breviraja spinosa</i> Bigelow & Schroeder, 1950	DB
			<i>Cruriraja rugosa</i> Bigelow & Schroeder, 1958	DB
			<i>Dactylobatus clarkii</i> Bigelow & Schroeder, 1958	DB
			<i>Dipturus chilensis</i> Guichenot, 1848	SB
			<i>Dipturus garricki</i> Bigelow & Schroeder, 1958	SB
			<i>Dipturus leptocaudus</i> Krefft & Stehmann, 1975	DB
			<i>Dipturus mennii</i> Gomes & Paragó, 2001	SB
			<i>Dipturus teevani</i> Bigelow & Schroeder, 1951	DB
			<i>Gurgesiella atlantica</i> Bigelow & Schroeder, 1962	DB
			<i>Gurgesiella dorsalis</i> McEachran & Compagno, 1980	DB
			<i>Malacoraja obscura</i> Carvalho, Gomes & Gadig, 2005	DB
			<i>Malacoraja</i> <i>spinacidervis</i> Barnard, 1923	DB
			<i>Rajella bigelowi</i> Stehmann, 1978	DB
			<i>Rajella fuliginea</i> Bigelow & Schroeder, 1954	DB
			<i>Rajella purpuriventralis</i> Bigelow & Schroeder, 1962	DB
			<i>Rajella sadowskii</i> Krefft & Stehmann, 1974	DB
	Squaliformes	Centrophoridae	<i>Centrophorus</i> <i>granulosus</i> Bloch & Schneider, 1801	DB
		Centrophoridae	<i>Deania profundorum</i> Smith & Radcliffe, 1912	DB

(continued)

Table 7.4 (continued)

Class	Order	Family	Species	Habitat
		Dalatiidae	<i>Dalatias licha</i> Bonnaterre, 1788	DB
			<i>Euprotomicroides zantedeschia</i> Hulley & Penrith, 1966	DB
			<i>Isistius brasiliensis</i> Quoy & Gaimard, 1824	BP
			<i>Isistius plutodus</i> Garrick & Springer, 1964	BP
			<i>Squaliolus laticaudus</i> Smith & Radcliffe, 1912	MP
		Echinorhinidae	<i>Echinorhinus brucus</i> Bonnaterre, 1788	DB
		Etmopteridae	<i>Etmopterus bigelowi</i> Shirai & Tachikawa, 1993	MP
			<i>Etmopterus gracilispinis</i> Krefft, 1968	BP
			<i>Etmopterus granulosus</i> Günther, 1880	MP
			<i>Etmopterus hillianus</i> Poey, 1861	MP
			<i>Etmopterus lucifer</i> Jordan & Snyder, 1902	BP
		Somniosidae	<i>Centroscymnus coelolepis</i> Barbosa du Bocage & de Brito Capello, 1864	DB
			<i>Centroscymnus owstonii</i> Garman, 1906	DB
			<i>Somniosus antarcticus</i> Whitley, 1939	DB
			<i>Zameus squamulosus</i> Günther, 1877	DB
		Squalidae	<i>Cirrhigaleus asper</i> Merrett, 1973	DB
			<i>Squalus acanthias</i> Linnaeus, 1758	SB
			<i>Squalus albicaudus</i> Viana, Carvalho & Gomes, 2016	SB
			<i>Squalus bahiensis</i> Viana, Carvalho & Gomes, 2016	SB
			<i>Squalus lobularis</i> Viana, Carvalho & Gomes, 2016	SB
			<i>Squalus quasimodo</i> Viana, Carvalho & Gomes, 2016	SB

(continued)

Table 7.4 (continued)

Class	Order	Family	Species	Habitat
	Squatiniformes	Squatinaidae	<i>Squatina argentina</i> Marini, 1930	SB
			<i>Squatina varii</i> Vaz & Carvalho, 2018	DB
			<i>Squatina occulta</i> Vooren & Silva, 1991	SB
	Torpediniformes	Narcinidae	<i>Benthobatis krefftii</i> Rincón, Stehmann & Vooren, 2001	DB
			<i>Tetronarce nobiliana</i> Bonaparte, 1835	SB
			<i>Tetronarce puelcha</i> Lahille, 1928	SB

Abbreviations: *DB* deep benthopelagic, *BP* bathypelagic, *EP* epipelagic, *MP* mesopelagic, and *SB* shallow benthopelagic

Table 7.5 Checklist of the deep-sea species of Actinopterygii recorded in the Brazilian Economic Exclusive Zone

Class	Order	Family	Species	Habitat
Actinopteri	Acanthuriformes	Luvaridae	<i>Luvarus imperialis</i> Rafinesque, 1810	EP
	Alepocephaliformes	Alepocephalidae	<i>Alepocephalus australis</i> Barnard, 1923	DB
			<i>Asquamiceps caeruleus</i> Markle, 1980	DB
			<i>Bajacalifornia calcarata</i> Weber, 1913	DB
			<i>Bathytroctes michaelisarsis</i> Koefoed, 1927	DB
			<i>Bathytroctes microlepis</i> Günther, 1878	DB
			<i>Bathytroctes oligolepis</i> Krefft, 1970	DB
			<i>Bathytroctes squamosus</i> Alcock, 1890	DB
			<i>Conocara macropterum</i> Vaillant, 1888	DB
			<i>Conocara microlepis</i> Lloyd, 1909	DB
			<i>Conocara murrayi</i> Koefoed, 1927	DB
			<i>Einara macrolepis</i> Koefoed, 1927	DB
			<i>Leptoderma macrops</i> Vaillant, 1886	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Mirognathus normani</i> Parr, 1951	DB
			<i>Narcetes erimelas</i> Alcock, 1890	DB
			<i>Narcetes stomias</i> Gilbert, 1890	DB
			<i>Rouleina attrita</i> Vaillant, 1888	DB
			<i>Talismania homoptera</i> Vaillant, 1888	DB
			<i>Xenodermichthys copei</i> Gill, 1884	DB
		Platyroctidae	<i>Maulisia microlepis</i> Sazonov & Golovan, 1976	DB
			<i>Mentodus rostratus</i> Günther, 1878	DB
			<i>Normichthys yahganorum</i> Levenberg, 1965	DB
	Anguilliformes	Chlopsidae	<i>Chlopsis bicolor</i> Rafinesque, 1810	SB
			<i>Chlopsis dentatus</i> Seale, 1917	SB
		Colocongridae	<i>Coloconger meadi</i> Kanazawa, 1957	DB
		Congridae	<i>Acromycter atlanticus</i> Smith, 1989	DB
			<i>Acromycter perturbator</i> Parr, 1932	DB
			<i>Ariosoma balearicum</i> Delaroche, 1809	DB
			<i>Ariosoma</i> <i>opisththalmus</i> Ranzani, 1839	DB
			<i>Ariosoma selenops</i> Reid, 1934	DB
			<i>Bassanago albescens</i> Barnard, 1923	DB
			<i>Bathycongrus bullisi</i> Smith & Kanazawa, 1977	DB
			<i>Bathycongrus dubius</i> Breder, 1927	DB
			<i>Bathycongrus vicinalis</i> Garman, 1899	DB
			<i>Bathyuroconger vicinus</i> Vaillant, 1888	DB
			<i>Conger esculentus</i> Poey, 1861	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Conger orbignyanus</i> Valenciennes, 1837	SB
			<i>Pseudophichthys splendens</i> Leleup, 1913	DB
			<i>Rhynchoconger flavus</i> Goode & Bean, 1896	DB
			<i>Xenomystax congroides</i> Smith & Kanazawa, 1989	DB
		Cyematidae	<i>Cyema atrum</i> Günther, 1878	BP
		Derichthyidae	<i>Derichthys serpentinus</i> Gill, 1884	BP
		Eurypharyngidae	<i>Eurypharynx pelecanooides</i> Vaillant, 1882	BP
		Muraenesocidae	<i>Cynoponticus savanna</i> Bancroft, 1831	SB
		Muraenidae	<i>Gymnothorax conspersus</i> Poey, 1867	SB
			<i>Gymnothorax ocellatus</i> Agassiz, 1831	SB
			<i>Gymnothorax polygonius</i> Poey, 1875	SB
		Myrocongridae	<i>Myroconger compressus</i> Günther, 1870	DB
		Nemichthyidae	<i>Avocettina acuticeps</i> Regan, 1916	BP
			<i>Avocettina infans</i> Günther, 1878	BP
			<i>Labichthys carinatus</i> Gill & Ryder, 1883	BP
			<i>Nemichthys curvirostris</i> Strömman, 1896	BP
			<i>Nemichthys scolopaceus</i> Richardson, 1848	BP
		Nettastomatidae	<i>Hoplunnis macrura</i> Ginsburg, 1951	DB
			<i>Hoplunnis similis</i> Smith, 1989	DB
			<i>Hoplunnis tenuis</i> Ginsburg, 1951	DB
			<i>Nettastoma melanura</i> Rafinesque, 1810	BP
			<i>Saurenhelys cancrivora</i> Peters, 1865	DB
			<i>Saurenhelys stylura</i> Leleup, 1913	DB
			<i>Venefica procera</i> Goode & Bean, 1883	BP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Ophichthidae	<i>Echiophis intertinctus</i> Richardson, 1848	SB
			<i>Myrophis punctatus</i> Lütken, 1852	SB
			<i>Pseudomyrophis frio</i> Jordan & Davis, 1891	SB
		Saccopharyngidae	<i>Saccopharynx harrisoni</i> Beebe, 1932	BP
		Serrivomeridae	<i>Serrivomer</i> <i>lanceolatooides</i> Schmidt, 1916	BP
			<i>Serrivomer schmidtii</i> Bauchot-Boutin, 1953	BP
			<i>Stemonidium hypomelas</i> Gilbert, 1905	BP
		Synaphobranchidae	<i>Atractodenchelys phrix</i> Robins & Robins, 1970	DB
			<i>Diastobranthus capensis</i> Barnard, 1923	DB
			<i>Dysommia rugosa</i> Ginsburg, 1951	DB
			<i>Haptenchelys texis</i> Robins & Martin, 1976	DB
			<i>Histiobranthus australis</i> Regan, 1913	DB
			<i>Histiobranthus bathybius</i> Günther, 1887	DB
			<i>Ilyophis blachei</i> Saldanha & Merrett, 1982	DB
			<i>Ilyophis brunneus</i> Gilbert, 1892	DB
			<i>Meadia abyssalis</i> Kamorrara, 1938	DB
			<i>Simenchelys parasitica</i> Gill, 1879	DB
			<i>Synaphobranchus affinis</i> Günther, 1877	DB
			<i>Synaphobranchus</i> <i>brevadorsalis</i> Günther, 1887	DB
			<i>Synaphobranchus calvus</i> Melo, 2007	DB
			<i>Synaphobranchus oregoni</i> Castle, 1960	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat	
	Argentiniformes	Argentinidae	<i>Argentina brasiliensis</i> Kobyliansky, 2004	BP	
			<i>Argentina georgei</i> Cohen & Atsuides, 1969	BP	
			<i>Glossanodon pygmaeus</i> Cohen, 1958	BP	
		Bathylagidae	<i>Dolicholagus longirostris</i> Maul, 1948	BP	
			<i>Melanolagus bericoides</i> Borodin, 1929	BP	
		Microstomatidae	<i>Nansenia atlantica</i> Blache & Rossignol, 1962	BP	
			Opisthoproctidae	<i>Dolichopteryx</i> <i>binocularis</i> Beebe, 1932	BP
		<i>Dolichopteryx longipes</i> Vaillant, 1888		BP	
		<i>Monacoa grimaldii</i> Zugmayer, 1911		BP	
		<i>Opisthoproctus soleatus</i> Vaillant, 1888		BP	
		<i>Winteria telescopa</i> Brauer, 1901		BP	
		Ateleopodiformes	Ateleopodidae	<i>Ijimaia loppei</i> Roule, 1922	DB
		Aulopiformes	Alepisauridae	<i>Alepisaurus brevirostris</i> Gibbs, 1960	BP
				<i>Alepisaurus ferox</i> Lowe, 1833	BP
				<i>Anotopterus pharao</i> Zugmayer, 1911	BP
	Aulopidae		<i>Aulopus filamentosus</i> Bloch, 1792	SB	
	Bathysauridae		<i>Bathysaurus ferox</i> Günther, 1878	DB	
	Bathysauridae		<i>Bathysaurus mollis</i> Günther, 1878	DB	
	Chlorophthalmidae		<i>Chlorophthalmus agassizi</i> Bonaparte, 1840	DB	
			<i>Chlorophthalmus</i> <i>brasiliensis</i> Mead, 1958	DB	
			<i>Parasudis truculenta</i> Goode & Bean, 1896	DB	

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Evermannellidae	<i>Coccorella atlantica</i> Parr, 1928	BP
			<i>Evermannella balbo</i> Risso, 1820	BP
			<i>Evermannella melanoderma</i> Parr, 1928	BP
			<i>Odontostomops normalops</i> Parr, 1928	BP
		Ipnopidae	<i>Bathypterois bigelowi</i> Mead, 1958	DB
			<i>Bathypterois grallator</i> Goode & Bean, 1886	DB
			<i>Bathypterois longipes</i> Günther, 1878	DB
			<i>Bathypterois perceptor</i> Sulak, 1977	DB
			<i>Bathypterois phenax</i> Parr, 1928	DB
			<i>Bathypterois quadrifilis</i> Günther, 1878	DB
			<i>Bathypterois viridensis</i> Roule, 1919	DB
			<i>Bathytyphlops marionae</i> Mead, 1958	DB
			<i>Bathytyphlops sewelli</i> Norman, 1939	DB
			<i>Ipnows murrayi</i> Günther, 1878	DB
		Notosudidae	<i>Ahliesaurus berryi</i> Bertelsen, Krefft & Marshall, 1976	BP
			<i>Luciosudis normani</i> Fraser-Brunner, 1931	BP
			<i>Scopelosaurus argenteus</i> Maul, 1954	BP
			<i>Scopelosaurus herwigi</i> Bertelsen, Krefft & Marshall, 1976	BP
			<i>Scopelosaurus smithii</i> Bean, 1925	BP
		Paralepididae	<i>Dolichosudis fuliginosa</i> Post, 1969	BP
			<i>Lestidiops affinis</i> Ege, 1930	BP
			<i>Lestidiops jayakari</i> Boulenger, 1889	BP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Lestidiops mirabilis</i> Ege, 1933	BP
			<i>Lestidium atlanticum</i> Borodin, 1928	BP
			<i>Lestrolepis intermedia</i> Poey, 1868	BP
			<i>Macroparalepis affinis</i> Ege, 1933	BP
			<i>Macroparalepis brevis</i> Ege, 1933	BP
			<i>Magnisudis atlantica</i> Krøyer, 1868	BP
			<i>Stemonosudis intermedia</i> Ege, 1933	BP
			<i>Stemonosudis siliquiventer</i> Post, 1970	BP
			<i>Sudis atrox</i> Rofen, 1963	BP
			<i>Sudis hyalina</i> Rafinesque, 1810	BP
			<i>Uncisudis advena</i> Rofen, 1963	BP
		Scopelarchidae	<i>Benthalbella infans</i> Zugmayer, 1911	BP
			<i>Rosenblattichthys hubbsi</i> Johnson, 1974	BP
			<i>Scopelarchoides danae</i> Johnson, 1974	BP
			<i>Scopelarchus analis</i> Brauer, 1902	BP
			<i>Scopelarchus guentheri</i> Alcock, 1896	BP
			<i>Scopelarchus michaelsarsi</i> Koefoed, 1955	BP
		Synodontidae	<i>Saurida brasiliensis</i> Norman, 1935	SB
			<i>Saurida caribbaea</i> Breder, 1927	SB
			<i>Saurida normani</i> Longley, 1935	SB
			<i>Synodus intermedius</i> Spix & Agassiz, 1829	SB
			<i>Trachinocephalus myops</i> Forster, 1801	SB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
	Beryciformes	Anoplogasteridae	<i>Anoplogaster cornuta</i> Valenciennes, 1833	BP
		Barbourisiidae	<i>Barbourisia rufa</i> Parr, 1945	BP
		Berycidae	<i>Beryx decadactylus</i> Cuvier, 1829	DB
			<i>Beryx splendens</i> Lowe, 1834	DB
		Diretmidae	<i>Diretmichthys parini</i> Post & Quéro, 1989	DB
		Gibberichthyidae	<i>Gibberichthys pumilus</i> Parr, 1933	BP
		Melamphaidae	<i>Melamphaes polylepis</i> Ebeling, 1962	BP
			<i>Melamphaes typhlops</i> Lowe, 1843	BP
			<i>Poromitra crassiceps</i> Günther, 1878	BP
			<i>Scopeloberyx robustus</i> Günther, 1887	BP
			<i>Scopelogadus mizolepis</i> Günther, 1878	BP
			Rondeletiidae	<i>Rondeletia bicolor</i> Goode & Bean, 1895
			<i>Rondeletia loricata</i> Abe & Hotta, 1963	BP
		Stephanoberycidae	<i>Acanthochaenus luetkenii</i> Gill, 1884	BP
			<i>Stephanoberyx monae</i> Gill, 1883	BP
		Trachichthyidae	<i>Aulotrachichthys</i> <i>atlanticus</i> Menezes, 1971	SB
			<i>Aulotrachichthys</i> <i>argyrophanus</i> Woods, 1961	SB
			<i>Gephyroberyx darwinii</i> Johnson, 1866	DB
			<i>Hoplostethus</i> <i>mediterraneus</i> Cuvier, 1829	DB
	<i>Hoplostethus occidentalis</i> Woods, 1973		DB	
	Caproiformes		Caproidae	<i>Antigonia capros</i> Lowe, 1843
	<i>Antigonia combatia</i> Berry & Rathjein, 1959	DB		

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
	Gadiformes	Bregmacerotidae	<i>Bregmaceros atlanticus</i> Goode & Bean, 1886	MP
			<i>Bregmaceros cantori</i> Milliken & Houde, 1984	MP
		Macrouridae	<i>Cetonurus globiceps</i> Vaillant, 1884	DB
			<i>Coelorinchus caribbaeus</i> Goode & Bean, 1885	DB
			<i>Coelorinchus carminatus</i> Goode, 1880	DB
			<i>Coelorinchus marinii</i> Hubbs, 1934	DB
			<i>Coelorinchus occa</i> Goode & Bean, 1885	DB
			<i>Coryphaenoides affinis</i> Günther, 1878	DB
			<i>Coryphaenoides asper</i> Günther, 1877	DB
			<i>Coryphaenoides leptolepis</i> Günther, 1877	DB
			<i>Coryphaenoides mediterraneus</i> Giglioli, 1893	DB
			<i>Coryphaenoides rudis</i> Günther, 1878	DB
			<i>Coryphaenoides thelestomus</i> Maul, 1951	DB
			<i>Gadomus arcuatus</i> Goode & Bean, 1886	DB
			<i>Gadomus capensis</i> Gilchrist & von Bonde, 1924	DB
			<i>Haplomacrourus nudirostris</i> Trunov, 1980	DB
			<i>Hymenocephalus aterrimus</i> Gilbert, 1905	DB
			<i>Hymenocephalus billsam</i> Marshall & Iwamoto, 1973	DB
			<i>Hymenocephalus gracilis</i> Gilbert & Hubbs, 1920	DB
			<i>Hymenocephalus italicus</i> Giglioli, 1884	DB
			<i>Lucigadus ori</i> Smith, 1968	DB
			<i>Macrosmia phalacra</i> Merrett, Sazonov & Shcherbachev, 1983	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Macrouroides inflaticeps</i> Smith & Radcliffe, 1912	DB
			<i>Macrourus holotrachys</i> Günther, 1878	DB
			<i>Malacocephalus laevis</i> Lowe, 1843	DB
			<i>Malacocephalus</i> <i>occidentalis</i> Goode & Bean, 1885	DB
			<i>Malacocephalus</i> <i>okamurai</i> Iwamoto & Arai, 1987	DB
			<i>Nezumia atlantica</i> Parr, 1946	DB
			<i>Nezumia suilla</i> Marshall & Iwamoto, 1973	DB
			<i>Sphagemacrurus</i> <i>grenadae</i> Parr, 1946	DB
			<i>Squalogadus modificatus</i> Gilbert & Hubbs, 1916	DB
			<i>Trachonurus sulcatus</i> Goode & Bean, 1885	DB
			<i>Ventrifossa macropogon</i> Marshall, 1973	DB
			<i>Ventrifossa mucocephalus</i> Marshall, 1973	DB
		Melanonidae	<i>Melanonus zugmayeri</i> Norman, 1930	DB
		Merlucciidae	<i>Macruronus</i> <i>magellanicus</i> Lönnberg, 1907	DB
			<i>Merluccius hubbsi</i> Marini, 1933	SB
			<i>Steindachneria argentea</i> Goode & Bean, 1896	DB
		Moridae	<i>Antimora rostrata</i> Günther, 1878	DB
			<i>Gadella imberbis</i> Vaillant, 1888	DB
			<i>Halargyreus johnsonii</i> Günther, 1862	DB
			<i>Laemonema barbatulum</i> Goode & Bean, 1883	DB
			<i>Laemonema</i> <i>goodebeanorum</i> Meléndez & Markle, 1997	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Laemonema robustum</i> Johnson, 1862	DB
			<i>Notophycis marginata</i> Günther, 1878	DB
			<i>Physiculus fulvus</i> Bean, 1884	DB
			<i>Physiculus karrerae</i> Paulin, 1989	DB
			<i>Physiculus kaupi</i> Poey, 1865	DB
			<i>Physiculus cirm</i> Carvalho-Filho & Pires, 2019	DB
			<i>Tripterophycis gilchristi</i> Boulenger, 1902	DB
		Gadidae	<i>Urophycis brasiliensis</i> Kaup, 1858	SB
			<i>Urophycis cirrata</i> Goode & Bean, 1896	DB
	Istiophoriformes	Xiphiidae	<i>Xiphias gladius</i> Linnaeus, 1758	EP
	Lampridiformes	Lamprididae	<i>Lampris guttatus</i> Brünnich, 1788	BP
		Lophotidae	<i>Eumecichthys fiski</i> Günther, 1890	BP
			<i>Lophotus lacepede</i> Giorna, 1809	BP
			<i>Lophotus machadoi</i> Miranda Ribeiro, 1927	BP
		Regalecidae	<i>Regalecus glesne</i> Ascanius, 1772	BP
		Trachipteridae	<i>Desmodema polystictum</i> Ogilby, 1897	BP
			<i>Trachipterus jacksonensis</i> Ramsay, 1881	BP
			<i>Zu cristatus</i> Bonelli, 1819	BP
	Lophiiformes	Ceratiidae	<i>Ceratias holboelli</i> Krøyer, 1845	BP
			<i>Ceratias uranoscopus</i> Murray, 1877	BP
			<i>Cryptopsaras couesii</i> Gill, 1883	BP
		Chaunacidae	<i>Chaunax suttkusi</i> Caruso, 1989	BP
		Diceratiidae	<i>Bufoceratias wedli</i> Pietschmann, 1926	BP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Gigantactinidae	<i>Gigantactis longicirra</i> Waterman, 1939	BP
			<i>Gigantactis verhoeffeni</i> Brauer, 1902	BP
		Himantolophidae	<i>Himantolophus groenlandicus</i> Reinhardt, 1837	BP
			<i>Himantolophus macroceras</i> Bertelsen & Krefft, 1988	BP
			<i>Himantolophus paucifilosus</i> Bertelsen & Krefft, 1988	BP
		Lophiidae	<i>Lophiodes beroe</i> Caruso, 1981	DB
			<i>Lophius gastrophysus</i> Miranda-Ribeiro, 1915	DB
			<i>Sladenia shaeferi</i> Caruso & Bullis, 1976	DB
		Melanocetidae	<i>Melanocetus johnsonii</i> Günther, 1864	BP
			<i>Melanocetus murrayi</i> Günther, 1887	BP
		Neoceratiidae	<i>Neoceratias spinifer</i> Pappenheim, 1914	BP
		Ogcocephalidae	<i>Dibranchus atlanticus</i> Peters, 1876	DB
			<i>Dibranchus tremendus</i> Bradbury, 1999	DB
			<i>Halieutichthys aculeatus</i> Mitchill, 1818	DB
			<i>Ogcocephalus declivirostris</i> Bradbury, 1980	SB
			<i>Ogcocephalus nasutus</i> Cuvier, 1829	SB
			<i>Ogcocephalus vespertilio</i> Linnaeus, 1758	SB
		Oneirodidae	<i>Chaenophryne draco</i> Beebe, 1932	BP
			<i>Microlophichthys microlophus</i> Regan, 1925	BP
			<i>Oneirodes notius</i> Pietsch, 1974	BP
			<i>Pentherichthys atratus</i> Regan & Trewavas, 1932	BP
		Thaumatichthyidae	<i>Thaumatichthys binghami</i> Parr, 1927	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
	Myctophiformes	Myctophidae	<i>Benthoosema suborbitale</i> Gilbert, 1913	MP
			<i>Bolinichthys distofax</i> Johnson, 1975	MP
			<i>Bolinichthys indicus</i> Nafpaktitis & Nafpaktitis, 1969	MP
			<i>Bolinichthys photothorax</i> Parr, 1928	MP
			<i>Bolinichthys supralateralis</i> Parr, 1928	MP
			<i>Centrobranchus nigroocellatus</i> Günther, 1873	MP
			<i>Ceratoscopelus warmingii</i> Lütken, 1892	MP
			<i>Dasyscopelus asperum</i> Richardson, 1845	MP
			<i>Diaphus adenomus</i> Gilbert, 1905	MP
			<i>Diaphus anderseni</i> Tåning, 1932	MP
			<i>Diaphus bertelseni</i> Nafpaktitis, 1966	MP
			<i>Diaphus brachycephalus</i> Tåning, 1928	MP
			<i>Diaphus dumerilii</i> Bleeker, 1856	MP
			<i>Diaphus effulgens</i> Goode & Bean, 1896	MP
			<i>Diaphus fragilis</i> Tåning, 1928	MP
			<i>Diaphus garmani</i> Gilbert, 1906	MP
			<i>Diaphus hudsoni</i> Zurbrigg & Scott, 1976	MP
			<i>Diaphus lucidus</i> Goode & Bean, 1896	MP
			<i>Diaphus luetkeni</i> Brauer, 1904	MP
			<i>Diaphus meadi</i> Nafpaktitis, 1978	MP
			<i>Diaphus metopoclampus</i> Cocco, 1829	MP
			<i>Diaphus mollis</i> Tåning, 1928	MP
			<i>Diaphus ostenfeldi</i> Tåning, 1932	MP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Diaphus perspicillatus</i> Ogilby, 1898	MP
			<i>Diaphus problematicus</i> Parr, 1928	MP
			<i>Diaphus splendidus</i> Brauer, 1904	MP
			<i>Diaphus subtilis</i> Nafpaktitis, 1968	MP
			<i>Diogenichthys atlanticus</i> Tåning, 1928	MP
			<i>Electrona risso</i> Cocco, 1829	MP
			<i>Electrona paucirastra</i> Bolin, 1962	MP
			<i>Gonichthys barnesi</i> Whitley, 1943	MP
			<i>Gonichthys cocco</i> Cocco, 1829	MP
			<i>Gymnoscopelus bolini</i> Andriashev, 1962	MP
			<i>Gymnoscopelus braueri</i> Lönnberg, 1905	MP
			<i>Gymnoscopelus nicholsi</i> Gilbert, 1911	MP
			<i>Gymnoscopelus piabilis</i> Whitley, 1931	MP
			<i>Hygophum hanseni</i> Tåning, 1932	MP
			<i>Hygophum hygomii</i> Lütken, 1892	MP
			<i>Hygophum macrochir</i> Günther, 1864	MP
			<i>Hygophum reinhardtii</i> Lütken, 1892	MP
			<i>Hygophum taaningi</i> Bekker, 1965	MP
			<i>Lampadena anomala</i> Parr, 1928	MP
			<i>Lampadena chavesi</i> Collett, 1905	MP
			<i>Lampadena luminosa</i> Garman, 1899	MP
			<i>Lampadena notialis</i> Nafpaktitis & Paxton, 1968	MP
			<i>Lampanyctus alatus</i> Goode & Bean, 1896	MP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Lampanyctus ater</i> Tåning, 1928	MP
			<i>Lampanyctus australis</i> Tåning, 1932	MP
			<i>Lampanyctus cuprarium</i> Tåning, 1928	MP
			<i>Lampanyctus festivus</i> Tåning, 1928	MP
			<i>Lampanyctus lepidolychnus</i> Bekker, 1967	MP
			<i>Lampanyctus isaacsi</i> Wisner, 1974	MP
			<i>Lampanyctodes lineatus</i> Tåning, 1928	MP
			<i>Lampanyctus nobilis</i> Tåning, 1928	MP
			<i>Lampanyctus photonotos</i> Parr, 1928	MP
			<i>Lampanyctus pusillus</i> Johnson, 1890	MP
			<i>Lampanyctus tenuiformis</i> Brauer, 1906	MP
			<i>Lampanyctus vadulus</i> Hulley, 1981	MP
			<i>Lampichthys procerus</i> Brauer, 1904	MP
			<i>Lepidophanes gaussi</i> Brauer, 1906	MP
			<i>Lepidophanes guentheri</i> Goode & Bean, 1896	MP
			<i>Lobianchia dofleini</i> Zugmayer, 1911	MP
			<i>Lobianchia gemellarii</i> Cocco, 1838	MP
			<i>Loweina rara</i> Lütken, 1892	MP
			<i>Myctophum affine</i> Lütken, 1892	MP
			<i>Myctophum nitidulum</i> Garman, 1899	MP
			<i>Myctophum obtusirostre</i> Tåning, 1928	MP
			<i>Myctophum phengodes</i> Lütken, 1892	MP
			<i>Myctophum selenops</i> Tåning, 1928	MP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Notolychnus valdiviae</i> Brauer, 1904	MP
			<i>Notoscopelus</i> <i>caudispinosus</i> Johnson, 1863	MP
			<i>Notoscopelus resplendens</i> Richardson, 1845	MP
			<i>Scopelopsis</i> <i>multipunctatus</i> Brauer, 1906	MP
			<i>Symbolophorus barnardi</i> Tåning, 1932	MP
			<i>Symbolophorus rufinus</i> Tåning, 1928	MP
			<i>Taaningichthys</i> <i>bathyphilus</i> Tåning, 1928	MP
			<i>Taaningichthys minimus</i> Tåning, 1928	MP
		Neoscopelidae	<i>Neoscopelus</i> <i>macrolepidotus</i> Johnson, 1863	MP
			<i>Neoscopelus microchir</i> Matsubara, 1943	MP
	Notacanthiformes	Halosauridae	<i>Aldrovandia affinis</i> Günther, 1877	DB
			<i>Aldrovandia gracilis</i> Goode & Bean, 1886	DB
			<i>Aldrovandia oleosa</i> Sulak, 1977	DB
			<i>Aldrovandia phalacra</i> Vaillant, 1888	DB
			<i>Halosauropsis macrochir</i> Günther, 1878	DB
			<i>Halosaurus attenuatus</i> Garman, 1899	DB
			<i>Halosaurus guentheri</i> Goode & Bean, 1896	DB
		Notacanthidae	<i>Lipogenys gillii</i> Goode & Bean, 1895	DB
			<i>Notacanthus sexspinis</i> Richardson, 1846	DB
			<i>Polyacanthonotus</i> <i>africanus</i> MacGilchrist & Von Bonde, 1924	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
	Ophidiiformes	Aphyonidae	<i>Aphyonus gelatinosus</i> Günther, 1878	DB
			<i>Barathronus bicolor</i> Goode & Bean, 1886	DB
			<i>Barathronus linsi</i> Nielsen, Mincarone & Di Dario, 2015	DB
		Bythitidae	<i>Cataetyx messieri</i> Günther, 1878	DB
			<i>Diplacanthopoma brachysoma</i> Günther, 1887	DB
			<i>Saccogaster parva</i> Cohen & Nielsen, 1972	DB
			<i>Saccogaster staigeri</i> Cohen & Nielsen, 1972	DB
			<i>Stygnobrotula latebricola</i> Böhlke, 1957	SB
			Carapidae	<i>Echiodon cryomargarites</i> Markle, Williams & Olney, 1983
	<i>Echiodon dawsoni</i> Williams & Shipp, 1982	DB		
	<i>Echiodon drummondi</i> Thompson, 1873	DB		
	<i>Snyderidia canina</i> Gilbert, 1905	DB		
	Ophidiidae	<i>Acanthonus armatus</i> Günther, 1878		DB
		<i>Barathrites parri</i> Nybelin, 1957	DB	
		<i>Barathrodemus manatinus</i> Goode & Bean, 1883	DB	
		<i>Bassogigas gillii</i> Goode & Bean, 1896	DB	
		<i>Bassozetus compressus</i> Günther, 1878	DB	
		<i>Bassozetus normalis</i> Gill, 1883	DB	
		<i>Bassozetus robustus</i> Smith & Radcliffe, 1913	DB	
		<i>Bathyonus laticeps</i> Günther, 1878	DB	
		<i>Benthocometes robustus</i> Goode & Bean, 1886	DB	
		<i>Brotula barbata</i> Bloch & Schneider, 1801	DB	

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Dicrolene introniger</i> Goode & Bean, 1883	DB
			<i>Dicrolene kanazawai</i> Grey, 1958	DB
			<i>Eremichthys pinnatus</i> Garman, 1899	DB
			<i>Genypterus brasiliensis</i> Regan, 1903	SB
			<i>Holcomycteronus squamosus</i> Roule, 1916	DB
			<i>Lamprogrammus brunswigi</i> Brauer, 1906	DB
			<i>Leucicorus atlanticus</i> Nielsen, 1975	DB
			<i>Luciobrotula brasiliensis</i> Nielsen, 2009	DB
			<i>Monomitopus agassizii</i> Goode & Bean, 1896	DB
			<i>Monomitopus americanus</i> Nielsen, 1971	DB
			<i>Neobythites brasiliensis</i> Nielsen, 1999	DB
			<i>Neobythites monocellatus</i> Nielsen, 1999	DB
			<i>Neobythites ocellatus</i> Günther, 1887	DB
			<i>Penopus microphthalmus</i> Vaillant, 1888	DB
			<i>Porogadus catena</i> Goode & Bean, 1885	DB
			<i>Porogadus miles</i> Goode & Bean, 1885	DB
			<i>Xyelacyba myersi</i> Cohen, 1961	DB
	Pempheriformes	Acropomatidae	<i>Parascombrops spinosus</i> Schultz, 1940	DB
			<i>Synagrops bellus</i> Goode & Bean, 1896	DB
			<i>Synagrops pseudomicrolepis</i> Schultz, 1940	DB
			<i>Synagrops trispinosus</i> Mochizuki & Sano, 1984	DB
			<i>Verilus costai</i> Schwarzjans et al., 2020	DB
			<i>Verilus sordidus</i> Poey, 1860	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Epigonidae	<i>Epigonus occidentalis</i> Goode & Bean, 1896	DB
			<i>Epigonus oligolepis</i> Mayer, 1974	DB
			<i>Epigonus robustus</i> Barnard, 1927	DB
			<i>Epigonus telescopus</i> Risso, 1810	DB
		Howellidae	<i>Bathysphyaenops simplex</i> Parr, 1933	BP
			<i>Howella atlantica</i> Post & Quéro, 1991	BP
			<i>Howella sherborni</i> Norman, 1930	BP
		Polyprionidae	<i>Polyprion americanus</i> Bloch & Schneider, 1801	SB
			<i>Polyprion oxygeneios</i> Schneider & Forster, 1801	SB
	Perciformes	Bembropidae	<i>Bembrops anatirostris</i> Ginsburg, 1955	DB
			<i>Bembrops gobioides</i> Goode, 1880	DB
			<i>Bembrops greyi</i> Poll, 1959	DB
			<i>Bembrops heterurus</i> Miranda-Ribeiro, 1903	DB
			<i>Bembrops ocellatus</i> Thompson & Suttkus, 1998	DB
		Peristediidae	<i>Peristedion altipinne</i> Regan, 1903	SB
			<i>Peristedion antillarum</i> Regan, 1914	DB
			<i>Peristedion ecuadorensis</i> Teague, 1961	DB
			<i>Peristedion gracile</i> Goode & Bean, 1896	SB
			<i>Peristedion thompsoni</i> Fowler, 1952	SB
			<i>Peristedion truncatum</i> Günther, 1880	SB
		Priacanthidae	<i>Cookeolus japonicus</i> Cuvier, 1829	SB
			<i>Heteropriacanthus cruentatus</i> Lacepède, 1801	SB
			<i>Pristigenys alta</i> Gill, 1862	SB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Psychrolutidae	<i>Cottunculus granulatus</i> Karrer, 1968	DB
		Scorpaenidae	<i>Helicolenus lahillei</i> Norman, 1937	SB
			<i>Idiastion kyphos</i> Eschmeyer, 1964	DB
			<i>Phenacoscorpius nebris</i> Eschmeyer, 1965	DB
			<i>Pontinus corallinus</i> Miranda-Ribeiro, 1903	DB
			<i>Pontinus longispinis</i> Goode & Bean, 1897	DB
			<i>Pontinus</i> <i>nematophthalmus</i> Günther, 1860	DB
			<i>Pontinus nigropunctatus</i> Günther, 1868	DB
		Serranidae	<i>Anthias asperilinguis</i> Günther, 1859	SB
			<i>Anthias menezesi</i> Anderson & Heemstra, 1980	DB
			<i>Anthias nicholsi</i> Firth, 1933	SB
			<i>Baldwinella vivanus</i> Jordan & Swain, 1885	DB
			<i>Bathyanthias roseus</i> Günther 1880	DB
			<i>Epinephelus morio</i> Valenciennes, 1828	SB
			<i>Epinephelus nigritus</i> Holbrook, 1855	SB
			<i>Gonioplectrus hispanus</i> Cuvier, 1828	SB
			<i>Hemanthias vivanus</i> Jordan & Swain, 1885	SB
			<i>Hyporthodus</i> <i>flavolimbatus</i> Poey, 1865	SB
			<i>Hyporthodus nigritus</i> Holbrook, 1855	SB
			<i>Hyporthodus niveatus</i> Valenciennes, 1828	SB
			<i>Plectranthias garrupellus</i> Robins & Starck, 1960	SB
			<i>Pronotogrammus</i> <i>martinicensis</i> Guichenot, 1864	SB
			<i>Serranus atrobranchus</i> Cuvier, 1829	SB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Setarchidae	<i>Ectreposebastes imus</i> Garman, 1899	BP
			<i>Setarches guentheri</i> Johnson, 1862	DB
		Triglidae	<i>Bellator brachychir</i> Regan, 1914	SB
			<i>Bellator egretta</i> Goode & Bean, 1896	SB
			<i>Prionotus nudigula</i> Ginsburg, 1950	SB
		Zoarcidae	<i>Iluocoetes fimbriatus</i> Jenyns, 1842	DB
			<i>Leucogrammolycus</i> <i>brychios</i> Mincarone & Anderson, 2008	DB
			<i>Notolycodes schmidti</i> Gosztanyi, 1977	DB
			<i>Pachycara alepidotum</i> Anderson & Mincarone, 2006	DB
		Bothidae	<i>Ancylopsetta kumperae</i> Tyler, 1959	SB
			<i>Chascanopsetta danae</i> Bruun, 1937	DB
			<i>Monolene antillarum</i> Norman, 1933	SB
			<i>Monolene atrimana</i> Goode & Bean, 1886	DB
			<i>Monolene megalepis</i> Woods, 1961	DB
			<i>Monolene sessilicauda</i> Goode, 1880	DB
			<i>Trichopsetta caribbaea</i> Anderson & Gutherz, 1967	SB
		Cynoglossidae	<i>Symphurus ginsburgi</i> Menezes & Benvegnú, 1976	SB
			<i>Symphurus marginatus</i> Goode & Bean, 1886	SB
			<i>Symphurus plagiusa</i> Linnaeus, 1766	SB
			<i>Symphurus plagusia</i> Bloch & Schneider, 1801	SB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
		Paralichthyidae	<i>Citharichthys cornutus</i> Günther, 1880	DB
			<i>Citharichthys dinoceros</i> Goode & Bean, 1886	DB
			<i>Syacium papillosum</i> Linnaeus, 1758	SB
			<i>Paralichthys brasiliensis</i> Ranzani, 1842	SB
		Pleuronectidae	<i>Poecilopsetta inermis</i> Breder, 1927	DB
	Polymixiiformes	Polymixiidae	<i>Polymixia lowei</i> Günther, 1859	DB
			<i>Polymixia nobilis</i> Lowe, 1838	DB
	Scombriformes	Ariommatidae	<i>Ariomma bondi</i> Fowler, 1930	EP
			<i>Ariomma melanum</i> Ginsburg, 1954	EP
	Scombriformes	Bramidae	<i>Brama brama</i> Bonnaterre, 1788	EP
		Bramidae	<i>Brama caribbea</i> Mead, 1972	EP
			<i>Brama dussumieri</i> Cuvier, 1831	EP
			<i>Eumegistus brevorti</i> Poey, 1860	EP
			<i>Pteraclis aesticola</i> Jordan & Snyder, 1901	EP
			<i>Pteraclis carolinus</i> Valenciennes, 1833	EP
			<i>Pterycombus brama</i> Fries, 1837	EP
			<i>Pterycombus petersii</i> Hilgendorf, 1878	EP
			<i>Taractes rubescens</i> Jordan & Evermann, 1887	EP
			<i>Taractichthys longipinnis</i> Lowe, 1842	EP
		Caristiidae	<i>Caristius macropus</i> Bellotti, 1903	BP
			<i>Paracaristius nudarcus</i> Stevenson & Kenaley, 2011	MP
			<i>Platyberyx andriashevi</i> Kukuev, Parin & Trunov, 2012	MP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Platyberyx paucus</i> Stevenson & Kenaley, 2013	MP
			<i>Platyberyx pietschi</i> Stevenson & Kenaley, 2013	MP
		Centrolophidae	<i>Centrolophus niger</i> Gmelin, 1789	BP
		Centrolophidae	<i>Hyperoglyphe macrophthalmia</i> Miranda-Ribeiro, 1915	EP
		Chiasmodontidae	<i>Chiasmodon microcephalus</i> Norman, 1929	MP
			<i>Dysalotus alcocki</i> MacGilchrist, 1905	BP
			<i>Kali colubrina</i> Melo, 2008	BP
			<i>Kali indica</i> Lloyd, 1909	BP
			<i>Kali kerberti</i> Weber, 1913	BP
			<i>Kali normani</i> Parr, 1931	BP
			<i>Kali parri</i> Johnson & Cohen, 1974	BP
			<i>Pseudoscopelus altipinnis</i> Parr, 1933	MP
			<i>Pseudoscopelus australis</i> Prokofiev & Kukuev, 2006	MP
			<i>Pseudoscopelus pierbartus</i> Spitz, Quéro & Vayna, 2007	MP
			<i>Pseudoscopelus scriptus</i> Lütken, 1892	MP
			<i>Pseudoscopelus scutatus</i> Krefft, 1971	MP
		Gempylidae	<i>Diplospinus multistriatus</i> Maul, 1948	BP
			<i>Gempylus serpens</i> Cuvier, 1829	EP
			<i>Lepidocybium flavobrunneum</i> Smith, 1843	BP
			<i>Nealotus tripes</i> Johnson, 1865	BP
			<i>Neopinnula americana</i> Grey, 1953	DB
			<i>Nesiarchus nasutus</i> Johnson, 1862	BP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Promethichthys prometheus</i> Cuvier, 1832	DB
			<i>Ruvettus pretiosus</i> Cocco, 1833	DB
			<i>Thyrstitops lepidopoides</i> Cuvier, 1832	EP
		Nomeidae	<i>Cubiceps caeruleus</i> Regan, 1914	EP
			<i>Cubiceps capensis</i> Smith, 1845	EP
			<i>Cubiceps pauciradiatus</i> Günther, 1872	BP
			<i>Psenes arafurensis</i> Günther, 1889	EP
			<i>Psenes cyanophrys</i> Valenciennes, 1833	EP
		Scombridae	<i>Auxis rochei</i> Risso, 1810	EP
			<i>Auxis thazard</i> Lacepede, 1800	EP
			<i>Euthynnus alletteratus</i> Rafinesque, 1810	EP
			<i>Thunnus albacares</i> Bonnaterre, 1788	EP
			<i>Sarda sarda</i> Bloch, 1793	EP
			<i>Scomber japonicus</i> Houttuyn, 1782	EP
		Scombrolabracidae	<i>Scombrolabrax heterolepis</i> Roule, 1921	DB
		Trichiuridae	<i>Aphanopus intermedius</i> Parin, 1983	DB
			<i>Assurger anzac</i> Alexander, 1917	BP
			<i>Benthodesmus elongatus</i> Clarke, 1879	BP
			<i>Benthodesmus tenuis</i> Günther, 1877	BP
			<i>Evoxymetopon taeniatus</i> Gill, 1863	BP
			<i>Lepidopus altifrons</i> Parin & Collette, 1993	BP
			<i>Trichiurus lepturus</i> Linnaeus, 1758	EP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
	Stomiiformes	Gonostomatidae	<i>Bonapartia pedaliota</i> Goode & Bean, 1896	MP
			<i>Cyclothone acclinidens</i> Garman, 1899	MP
			<i>Cyclothone alba</i> Brauer, 1906	MP
			<i>Cyclothone braueri</i> Jespersen & Tåning, 1926	MP
			<i>Cyclothone microdon</i> Günther, 1878	MP
			<i>Cyclothone pallida</i> Brauer, 1902	MP
			<i>Cyclothone pseudopallida</i> Mukhacheva, 1964	MP
			<i>Cyclothone parapallida</i> Badcock, 1982	MP
			<i>Cyclothone signata</i> Garman, 1899	MP
			<i>Diplophos australis</i> Ozawa, Oda & Ida, 1990	MP
			<i>Diplophos taenia</i> Matsubara, 1940	MP
			<i>Gonostoma atlanticum</i> Norman, 1930	MP
			<i>Gonostoma elongatum</i> Günther, 1878	MP
			<i>Manducus maderensis</i> Johnson, 1890	MP
			<i>Margrethia obtusirostra</i> Jespersen & Tåning, 1919	MP
			<i>Sigmops bathyphilus</i> Vaillant, 1884	MP
		Phosichthyidae	<i>Ichthyococcus australis</i> Mukhacheva, 1980	MP
			<i>Ichthyococcus ovatus</i> Cocco, 1838	MP
			<i>Ichthyococcus polli</i> Blache, 1964	MP
			<i>Phosichthys argenteus</i> Hutton, 1872	MP
			<i>Pollichthys maui</i> Poll, 1953	MP
			<i>Polymetme corythaeola</i> Alcock, 1898	MP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Polymetme thaeocoryla</i> Parin & Borodulina, 1990	MP
			<i>Vinciguerria nimbaria</i> Jordan & Williams, 1896	MP
			<i>Vinciguerria poweriae</i> Cocco, 1838	MP
		Sternoptychidae	<i>Argyripnus atlanticus</i> Maul, 1952	MP
			<i>Argyropelecus aculeatus</i> Valenciennes, 1850	MP
			<i>Argyropelecus affinis</i> Garman, 1899	MP
			<i>Argyropelecus gigas</i> Norman, 1930	MP
			<i>Argyropelecus hemigymnus</i> Cocco, 1829	MP
			<i>Argyropelecus sladeni</i> Regan, 1908	MP
			<i>Maurolicus muelleri</i> Gmelin, 1788	MP
			<i>Maurolicus stehmanni</i> Parin & Kobylansky, 1993	MP
			<i>Polyipnus clarus</i> Harold, 1994	MP
			<i>Polyipnus laternatus</i> Garman, 1899	MP
			<i>Sternoptyx diaphana</i> Hermann, 1781	MP
			<i>Sternoptyx pseudobscura</i> Baird, 1971	MP
			<i>Sternoptyx pseudodiaphana</i> Borodulina, 1977	MP
			<i>Valenciennellus tripunctulatus</i> Esmark, 1871	MP
		Stomiidae	<i>Astronesthes barbatus</i> Kner, 1860	BP
			<i>Astronesthes gemmifer</i> Goode & Bean, 1896	BP
			<i>Astronesthes haplophos</i> Parin & Borodulina, 2002	BP
			<i>Astronesthes macropogon</i> Goodyear & Gibbs, 1970	BP
			<i>Astronesthes similus</i> Parr, 1927	BP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Chauliodus danae</i> Regan & Trewavas, 1930	BP
			<i>Chauliodus minimus</i> Parin & Novikova, 1974	BP
			<i>Chauliodus sloani</i> Bloch & Schneider, 1801	BP
			<i>Echiostoma barbatum</i> Lowe, 1843	BP
			<i>Eustomias arborifer</i> Parr, 1927	BP
			<i>Eustomias braueri</i> Zugmayer, 1911	BP
			<i>Eustomias brevibarbus</i> Parr, 1927	BP
			<i>Eustomias curtifilis</i> Clarke, 2000	BP
			<i>Eustomias filifer</i> Gilchrist, 1906	BP
			<i>Eustomias ignotus</i> Gomon & Lubbock, 1985	BP
			<i>Eustomias krefftii</i> Gibbs, Clarke & Gomon, 1983	MP
			<i>Eustomias longibarba</i> Parr, 1927	BP
			<i>Eustomias posti</i> Gibbs, Clarke & Gomon, 1983	MP
			<i>Eustomias schmidti</i> Regan & Trewavas, 1930	MP
			<i>Eustomias spherulifer</i> Gibbs, Clarke & Gomon, 1983	BP
			<i>Eustomias tetranema</i> Zugmayer, 1913	BP
			<i>Flagellostomias boureei</i> Zugmayer, 1913	BP
			<i>Grammatostomias dentatus</i> Goode & Bean, 1896	BP
			<i>Idiacanthus atlanticus</i> Brauer, 1906	BP
			<i>Leptostomias longibarba</i> Regan & Trewavas, 1930	BP
			<i>Malacosteus niger</i> Ayres, 1848	BP
			<i>Melanostomias bartonbeani</i> Parr, 1927	BP

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
			<i>Melanostomias niger</i> Gilchrist & von Bonde, 1924	BP
			<i>Melanostomias</i> <i>tentaculatus</i> Regan & Trewavas, 1930	MP
			<i>Melanostomias valdiviae</i> Brauer, 1902	MP
			<i>Photonectes mirabilis</i> Parr, 1927	BP
			<i>Photostomias atrox</i> Alcock, 1890	MP
			<i>Photostomias goodyeari</i> Kenaley & Hartel, 2005	BP
			<i>Photostomias guernei</i> Collett, 1889	BP
			<i>Stomias affinis</i> Günther, 1887	MP
			<i>Stomias boa</i> Risso, 1810	MP
			<i>Stomias colubrinus</i> Garman, 1889	MP
			<i>Stomias danae</i> Ege, 1933	MP
	Syngnathiformes	Callionymidae	<i>Foetorepus agassizii</i> Goode & Bean, 1888	DB
			<i>Foetorepus dagmarae</i> Fricke, 1985	DB
		Centriscidae	<i>Centriscops humerosus</i> Richardson, 1846	DB
			<i>Macroramphosus</i> <i>scolopax</i> Linnaeus, 1758	DB
			<i>Notopogon</i> <i>fernandezianus</i> Delfin, 1899	DB
		Draconettidae	<i>Centrodraco oregonus</i> Briggs & Berry, 1959	DB
	Tetraodontiformes	Molidae	<i>Masturus lanceolatus</i> Liénard, 1840	EP
			<i>Mola mola</i> Linnaeus, 1758	EP
			<i>Ranzania laevis</i> Pennant, 1776	EP
		Triacanthodidae	<i>Hollardia hollardi</i> Poey, 1861	DB

(continued)

Table 7.5 (continued)

Class	Order	Family	Species	Habitat
	Zeiformes	Grammicolepididae	<i>Grammicolepis brachiusculus</i> Poey, 1873	BP
			<i>Xenolepidichthys dalgleishi</i> Gilchrist, 1922	BP
		Oreosomatidae	<i>Allocyttus verrucosus</i> Gilchrist, 1906	BP
		Zeidae	<i>Zenopsis conchifer</i> Lowe, 1852	DB
		Zeniontidae	<i>Zenion hololepis</i> Goode & Bean, 1896	DB
	Lutjaniformes	Lutjanidae	<i>Pristipomoides aquilonaris</i> Goode & Bean, 1896	SB
	Lutjaniformes		<i>Pristipomoides freemani</i> Anderson, 1966	SB
	<i>incertae sedis</i> in Eupercaria	Emmelichthyidae	<i>Erythrocles monodi</i> Poll & Cadenat, 1954	SB
		Malacanthidae	<i>Caulolatilus chrysops</i> Valenciennes, 1833	SB
			<i>Lopholatilus villarii</i> Ribeiro, 1915	SB
	<i>incertae sedis</i> in Ovolentaria	Opisthognathidae	<i>Lonchopisthus meadi</i> Menezes & Figueiredo, 1971	SB

Abbreviations: *DB* deep benthopelagic, *BP* bathypelagic, *EP* epipelagic, *MP* mesopelagic, and *SB* shallow benthopelagic

Table 7.6 List of species previously reported from the Brazilian Economic Exclusive Zone, excluded from the current account

Class	Order	Family	Species	Reason
Elasmobranchii	Carcharhiniformes	Scyliorhinidae	<i>Scyliorhinus hesperius</i> Springer, 1966	Occurrence not confirmed
			<i>Apristurus manis</i> Springer, 1979	Occurrence not confirmed
			<i>Parmaturus</i> cf. <i>campechiensis</i> Springer, 1979	Occurrence not confirmed
	Rajiformes	Arhynchobatidae	<i>Bathyraja multispinis</i> Norman, 1937	Occurrence not confirmed
			<i>Bathyraja scaphiops</i> Norman, 1937	Occurrence not confirmed
		Rajidae	<i>Dipturus bullisi</i> Bigelow & Schroeder, 1962	Occurrence not confirmed

(continued)

Table 7.6 (continued)

Class	Order	Family	Species	Reason
	Squaliformes	Dalatiidae	<i>Euprotomicroides zantedeschia</i> Hulley & Penrith, 1966	Occurrence not confirmed
			<i>Euprotomicrus bispinatus</i> Quoy & Garman, 1824	Occurrence not confirmed
	Squaliformes	Etmopteridae	<i>Etmopterus pusillus</i> Lowe, 1839	Occurrence not confirmed
		Somniosidae	<i>Centroscymnus cryptacanthus</i> Regan, 1906	Confirmed as <i>Centroscymnus owstonii</i> Garman, 1906
			<i>Somniosus pacificus</i> Bigelow & Schroeder, 1944	Occurrence not confirmed
		Squalidae	<i>Squalus cubensis</i> Howell Rivero, 1936	Current status: <i>Squalus bahiensis</i> Viana, Carvalho & Gomes, 2016
			<i>Squalus megalops</i> Macleay, 1881	Current status: <i>Squalus albicaudus</i> Viana, Carvalho & Gomes, 2016
			<i>Squalus mitsukurii</i> Jordan & Snyder, 1903	Current status: <i>Squalus lobularis</i> Viana, Carvalho & Gomes, 2016 or <i>Squalus quasimodo</i> Viana, Carvalho & Gomes, 2016
Actinopteri	Alepocephaliformes	Alepocephalidae	<i>Talismania antillarum</i> Goode & Bean, 1896	Occurrence not confirmed
			<i>Talismania homoptera</i> Vaillant, 1888	Occurrence not confirmed

(continued)

Table 7.6 (continued)

Class	Order	Family	Species	Reason
	Anguilliformes	Congridae	<i>Parabathymyrus oregoni</i> Smith & Kanazawa, 1977	Occurrence not confirmed
			<i>Rhynchoconger guppyi</i> Norman, 1925	Occurrence not confirmed
	Argentiniformes	Argentinidae	<i>Argentina striata</i> Goode & Bean, 1896	Occurrence not confirmed
		Opisthoproctidae	<i>Dolichopteryx anascopa</i> Brauer, 1901	Occurrence not confirmed
	Aulopiformes	Evermannellidae	<i>Evermannella indica</i> Brauer, 1906	Occurrence not confirmed
		Paralepididae	<i>Arctozenus risso</i> Bonaparte, 1840	Occurrence not confirmed
			<i>Paralepis elongata</i> Brauer, 1906	Occurrence not confirmed
			<i>Uncisudis advena</i> Rofen, 1963	Occurrence not confirmed
			<i>Uncisudis quadrimaculata</i> Post, 1969	Occurrence not confirmed
	Gadiformes	Bregmacerotidae	<i>Bregmaceros mclellandi</i> Thompson, 1840	Occurrence not confirmed
		Macrouridae	<i>Bathygadus melanobranchus</i> Vaillant, 1888	Occurrence not confirmed
			<i>Nezumia aequalis</i> Günther, 1978	Occurrence not confirmed
			<i>Odontomacrus murrayi</i> Norman, 1939	Occurrence not confirmed
			Merlucciidae	<i>Macruronus magellanicus</i> Lonnberg, 1907
		Moridae	<i>Salilota australis</i> Günther, 1878	Occurrence not confirmed
		Lophiiformes	Oneirodidae	<i>Oneirodes notius</i> Pietsch, 1974

(continued)

Table 7.6 (continued)

Class	Order	Family	Species	Reason
	Myctophiformes	Myctophidae	<i>Ceratoscopelus maderensis</i> Lowe, 1839	Occurrence not confirmed
			<i>Lampadena speculigera</i> Goode & Bean, 1896	Occurrence not confirmed
			<i>Loweina rara</i> Lütken, 1892	Occurrence not confirmed
			<i>Symbolophorus veranyi</i> Moreau, 1888	Occurrence not confirmed
	Notacanthiformes	Halosauridae	<i>Aldrovandia gracilis</i> Goode & Bean, 1896	Occurrence not confirmed
	Pempheriformes	Howellidae	<i>Howella brodiei</i> Ogilby, 1899	Confirmed as <i>Howella atlantica</i> Post & Quéro, 1991
	Scombriformes	Nomeidae	<i>Psenes maculatus</i> Lütken, 1880	Occurrence not confirmed
	Stomiiformes	Astronesthidae	<i>Astronesthes leucopogon</i> Regan & Trewavas, 1929	Occurrence not confirmed
			<i>Astronesthes niger</i> Richardson 1845	Occurrence not confirmed
		Phosichthyidae	<i>Vinciguerria attenuata</i> Cocco, 1838	Occurrence not confirmed
		Stomiidae	<i>Eustomias braueri</i> Zugmayer, 1911	Occurrence not confirmed
			<i>Eustomias krefftii</i> Gibbs, Clarke & Gomon, 1983	Occurrence not confirmed
			<i>Grammatostomias circularis</i> Morrow, 1959	Occurrence not confirmed
			<i>Leptostomias gladiator</i> Zugmayer, 1911	Occurrence not confirmed
			<i>Melanostomias macrophotus</i> Regan & Trewavas, 1930	Occurrence not confirmed
			<i>Melanostomias melanops</i> Brauer, 1902	Occurrence not confirmed

(continued)

Table 7.6 (continued)

Class	Order	Family	Species	Reason
			<i>Photonectes braueri</i> Zugmayer, 1913	Occurrence not confirmed
			<i>Stomias brevibarbatu</i> s Ege, 1918	Occurrence not confirmed
			<i>Stomias longibarbatu</i> s Brauer, 1902	Occurrence not confirmed

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