

## The presence of southern fishes in the Argentinian continental shelf and adjacent areas

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**Abstract** A list of Southern Ocean fishes captured in the Argentinian continental shelf and adjacent areas is presented. The list comprises a total of 41 species. They represent 15% of the ichthyofauna registered in the Southern Ocean. The geographic position of the samples was considered in order to show the northward displacement of some Antarctic species toward southwestern Atlantic waters.

**Keywords** Fish distribution · Southern Ocean · Southwestern Atlantic

The tip of South America extends almost 20° farther south than any of the other continental masses reaching the circum-Antarctic region (Briggs 1974). Both continents were connected until the early Tertiary through the Scotia Arc (Balech and Ehrlich 2008). The Antarctic Convergence, characterized by great stability, is the northern boundary of the Antarctic area; the permanent occurrence of the convergence makes the Antarctic area one of the most isolated regions of the world. At the longitude of the American continent, the Antarctic Convergence sends two

branches that flow northward, one along the west coast of South America, the Humboldt Current, and the other along the east coast, the Malvinas Current. Moreover, near the American continent, at the latitude of Tierra del Fuego and Malvinas Islands, the Antarctic Convergence is more meandering, and those meanders facilitate the water mixture (Balech and Ehrlich 2008). Because of this, the cold-temperate area of South America is strongly influenced by the Southern Ocean.

The Southern Ocean fish fauna is well known through numerous papers based on research cruises carried out by several countries (Headland 1990). On the other hand, the relationship between the ichthyofaunas of the Antarctic region and the cold-temperate waters of South America is less well known.

The aim of this work is to show the presence of Southern Ocean fishes in the Argentinian continental shelf and adjacent areas, as a contribution to the knowledge of the relationship between the Southern Ocean and South American fish faunas from the ichthyological point of view.

The specimens collected came from the cruises indicated in Table 1, carried out between 1968 and 1998 with fishing boats and research vessels, mainly with the Argentine R/V “Capitán Oca Balda” and “Dr. Eduardo L. Holmberg”, both belonging to the Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP).

Species were identified on board or in the laboratory; we followed Eschmeyer (2010) for an updated taxonomy. The samples are preserved at the INIDEP Fish Collection (Copeia 1996). For each species, information was recorded as follows: catalog number; family; specific scientific name; author; year; number of specimens; size; locality (place name or latitude, longitude and depth); date; collector’s name. Size was recorded as total length and standard length.

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**Table 1** Cruises from which the species were obtained

| Vessel                            | Type | Cruise             | Date      |
|-----------------------------------|------|--------------------|-----------|
| “Martín Fierro” <sup>a</sup>      | RV   | Camaronera IV      | 1968      |
| “Profesor Siedlecki” <sup>b</sup> | RV   | Camp. Pesca Exp.   | 1973      |
| “Cruz del Sur”                    | RV   | Santa Cruz         | 1973–1974 |
| “Walther Herwig”                  | RV   | Tierra del Fuego   | 1974      |
| “Shinkai Maru”                    | RV   | No. 3              | 1978      |
| “Capitán Oca Balda”               | RV   | OB 05-87           | 1979      |
| “Evríka”                          | RV   | OB 02-91           | 1987      |
| “Kaiyo Maru”                      | RV   | No. 25             | 1988      |
| “Capitán Oca Balda”               | RV   | Evaluación Calamar | 1989      |
| “Dr. Eduardo L. Holmberg”         | RV   | OB 02-91           | 1991      |
| “Capitán Oca Balda”               | RV   | EH 01-92           | 1992      |
| “Dr. Eduardo L. Holmberg”         | RV   | OB 01-93           | 1993      |
| “Capitán Oca Balda”               | RV   | EH 15-94           | 1994      |
| “Capitán Oca Balda”               | RV   | OB 09-95           | 1995      |
| “Capitán Oca Balda”               | RV   | OB 10-95           | 1995      |
| “Capitán Oca Balda”               | RV   | OB 13-95           | 1995      |
| “Dr. Eduardo L. Holmberg”         | RV   | EH 08-97           | 1997      |
| “Aguchi Maru”                     | FV   | Marea 16-97        | 1997      |
| “El Navegante”                    | FV   | 80-0027            | 1997      |
| “Dr. Eduardo L. Holmberg”         | RV   | EH 02-98           | 1998      |

RV Research vessel, FV fishing vessel

<sup>a</sup> Fishing vessel rented

<sup>b</sup> Observation from land

The geographical location of the samples is shown in Fig. 1. In order to describe the distribution pattern, fish species were arranged according to two regions or categories. A: Argentine continental shelf and adjacent waters; B: mesopelagic species in the southwestern Atlantic.

From the continental shelf and adjacent areas, 25 species of Southern Ocean fishes were recorded, belonging to 16 families, mainly notothenioids (families Nototheniidae, Harpagiferidae, Bathylagidae, Bathydraconidae and Channichthyidae) (Table 2). The most interesting case is *Paranotothenia magellanica*, captured at 38°S in temperate waters of the Argentinian Biogeographic Province, and far from its more usual area of occurrence, the Magellanic Province (Figueroa et al. 2005). Mesopelagic fishes are represented by species of the families Microstomatidae, Stomiidae, Notosudidae, Paralepididae, Myctophidae, Melamphaidae, Melanonidae and Gempylidae (Table 2). In a description of the mesopelagic fish distribution in the southwestern Atlantic related to water masses, those species were classified as subantarctic by Figueroa et al. (1998). The abovementioned species represent altogether 15% of the Southern Ocean ichthyofauna, according to Gon and Heemstra (1990).

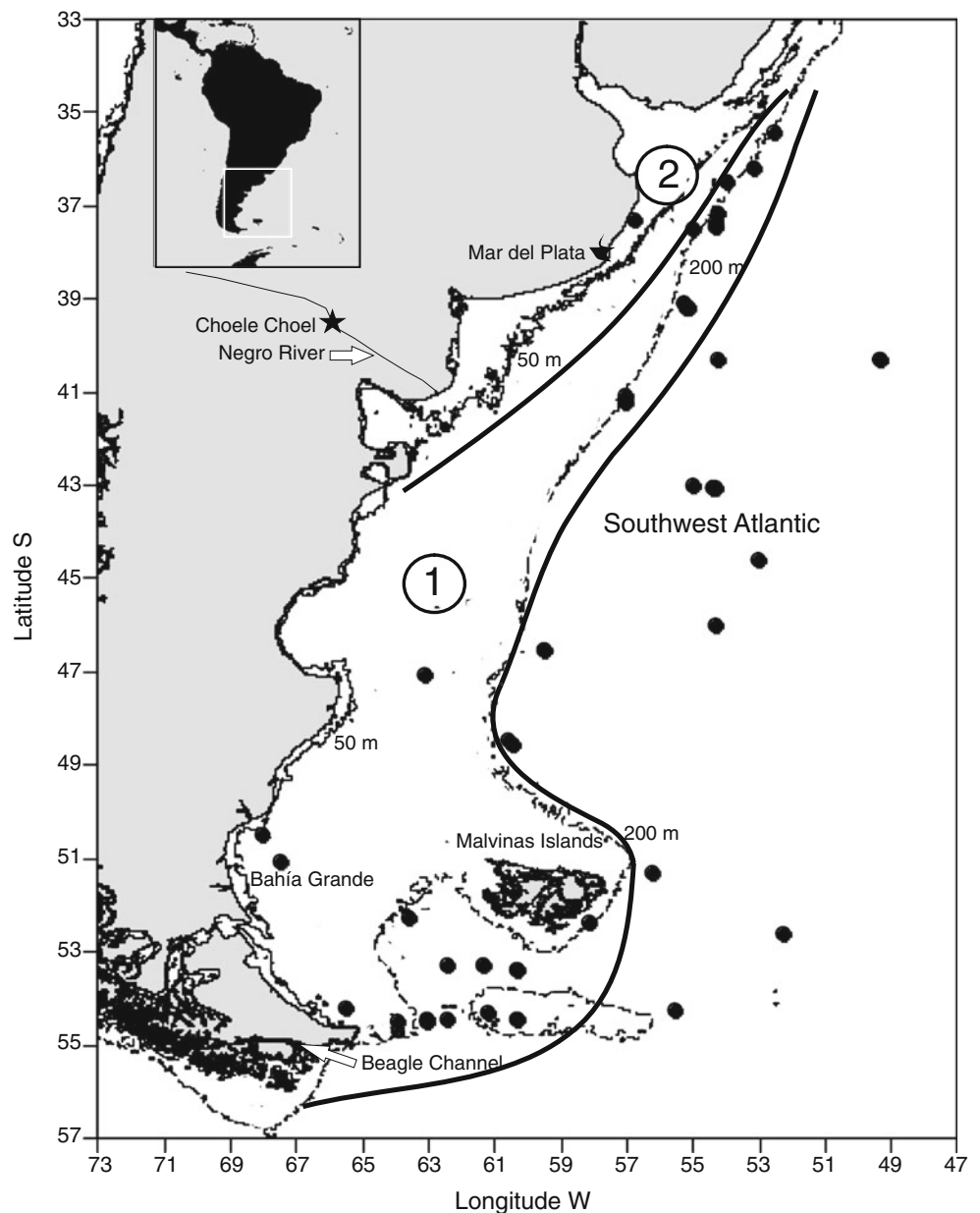
Balech and Ehrlich (2008) mentioned the close relationship between the ichthyofauna of the Magellanic

Province, corresponding to southern South America, and that of the Antarctic continent, characterized by a high endemism at the generic level and also at senior taxonomic categories.

From the comparison of the species listed in Table 2 with those mentioned by Fischer and Hureau (1985) in the FAO species identification sheets for fishery purposes, relating to the Southern Ocean, the results are as follows. Among Agnatha, two species are mentioned, *Myxine australis* and *Geotria australis*, as inhabitants of the Argentinian continental shelf. Seven species of chondrichthyans are mentioned, two of them common to both areas. The bony fishes amount to a total of 48 species in the work of Fischer and Hureau (1985), 17 of them (35.4 %) having been captured on the Argentinian continental shelf.

Gon and Heemstra (1990) edited a more detailed list of fishes of the Southern Ocean, with a total of 49 families and 273 species described. The Agnatha are the same as mentioned above; one of the four shark species and three of the seven species of skates are also mentioned for the Argentinian continental shelf and adjacent waters according to the list of Cousseau et al. (2010). Of 44 families of bony fishes mentioned in the work of Gon and Heemstra (1990), 35 (79.54%) are represented on the Argentinian continental shelf and adjacent waters (Cousseau et al. 2010). Of a total of 260 bony fish species of the Southern Ocean, as

**Fig. 1** Map showing the locations where Southern Ocean fishes were collected in the Argentinian continental shelf and adjacent areas. 1 Magellanic Province; 2 Argentine Province



mentioned by Gon and Heemstra (1990), 64 (24.61%), are represented on the Argentinian continental shelf and in adjacent waters (Cousseau et al. 2010).

It is interesting to remark that 9 of the families of bony fishes mentioned by Gon and Heemstra (1990), (Notacanthidae, Gonostomatidae, Sternoptychidae, Ophidiidae, Oneirodidae, Lampridae, Congiopodidae, Bovichtidae and Scombridae) are present on the Argentinian continental shelf and in adjacent waters, even though they have no species common to the Southern Ocean and the Argentinian continental shelf and adjacent waters (Menni et al. 1984).

The presence of *Somniosus antarcticus* on the Argentinian continental shelf and adjacent waters is detailed by Díaz de Astarloa et al. (1999).

The most interesting case of dispersion is that of the nototheniids. Eastmann (1991) considered Nototheniidae the most speciose family among the notothenioids, and pointed out that its great diversification allows recognition of species of several ecological niches: pelagic, cryopelagic, benthopelagic and benthic. Figueroa et al. (2003) think that, between the Antarctic fishes, the Family Nototheniidae “could be considered as a family in expansion, exceeding all the geographic barriers that

**Table 2** Species preserved at the INIDEP Fish Collection, arranged by families and regions

| Cat.   | Taxonomic categories  | Area                                  | Depth         | Col. no. |
|--|---|---------------------------------------|---------------|----------|
| A  | Family Myxinidae  |                                       |               |          |
|  | <i>Myxine australis</i> Jenyns, 1842                          | 37°14'S, 54°28'W                      | 230 m         | 54       |
|  |   | Bahía Grande (Prov. Santa Cruz)       | 0 m           | 251      |
|  | Family Petromyzontidae  |                                       |               |          |
|  | <i>Geotria australis</i> Gray, 1851                           | Mar del Plata (38°S)                  | No data       | 60       |
|  | Larva <i>Ammocoetes</i>                                       | Negro river (38°57'S)                 | Freshwater    | 543      |
|  | <i>Macrophthalmia</i>   | Choele Choel Island (Prov. Río Negro) | Freshwater    | 649      |
|  | Family Dalatiidae   |                                       |               |          |
|  | <i>Somniosus antarcticus</i> Whitley, 1939                    | 54°45'S, 62°48'W                      | 913–1,278 m   | 578      |
|  | Family Muraenolepididae                                       |                                       |               |          |
|  | <i>Muraenolepis orangiensis</i> Vaillant, 1888                | 36°48'S, 54°00'W                      | 330 m         | 469      |
|  |   | 54°30'S, 61°24'W                      | 140 m         | 712      |
|  | <i>Muraenolepis marmoratus</i> Günther, 1880                  | 54°42'S, 60°35'W                      | 330 m         | 211      |
|  | Family Moridae  |                                       |               |          |
|  | <i>Antimora rostrata</i> (Günther, 1878)                      | 46°53'S, 59°54'W                      | 860 m         | 430      |
|  | <i>Lepidion ensiferus</i> (Günther, 1887)                     | 46°53'S, 59°54'W                      | 800 m         | 431      |
|  | <i>Halargyreus johnsonii</i> Günther, 1862                    | 54°49'S, 63°07'W                      | 1,350–1,500 m | 561      |
|  | Family Gadidae  |                                       |               |          |
|  | <i>Micromesistius australis</i> Norman, 1937                  | 48°45'S, 60°58'W                      | 206 m         | 207      |
|  |   | 54°24'S, 55°56'W                      | 400 m         | 219      |
|  |   | 54°42'S, 68°20'W                      | 330 m         | 264      |
|  | Family Macrouridae  |                                       |               |          |
|  | <i>Coelorinchus fasciatus</i> (Günther, 1878)                 | Beagle Channel                        | 22 m          | 359      |
|  |   | 52°36'S, 58°13'W                      | 385 m         | 427      |
|  | <i>Coelorinchus marinii</i> Hubbs, 1934                       | 35°42'S, 52°57'W                      | 138 m         | 433      |
|  | Family Carapidae  |                                       |               |          |
|  | <i>Echiodon criomargarites</i> Markle, Williams & Olney, 1983 | 51°29'S, 56°25'W                      | 658 m         | 500      |
|  |   | 37°43'S, 54°34'W                      | 800 m         | 648      |
|  | Family Ceratiidae   |                                       |               |          |
|  | <i>Cerantias tentaculatus</i> (Norman, 1930)                  | 39°10'S, 55°28'W                      | 524 m.        | 377      |
|  |   | 39°19'S, 55°18'W                      | 780 m         | 388      |
|  |   | 47°05'S, 63°15'W                      | 105 m         | 594      |
|  |   | 54°49'S, 63°07'W                      | 1,350–1,500 m | 595      |
|  | Family Oreosomatidae  |                                       |               |          |
|  | <i>Pseudocyttus maculatus</i> Gilchrist, 1906                 | 37°50'S, 55°01'W                      | 600 m         | 372      |
|  |   | 41°22'S, 57°09'W                      | 712 m         | 379      |
|  |   | 36°18'S, 53°19'W                      | 700 m         | 428      |
|  |   | 37°43'S, 54°34'W                      | 800 m         | 605      |
|  | Family Nototheniidae  |                                       |               |          |
|  | <i>Dissostichus eleginoides</i> Smitt, 1898                   | 48°56'S, 60°45'W                      | 230 m         | 208      |
|  |   | 54°42'S, 60°35'W                      | 330 m         | 214      |
|  |   | 50°46'S, 68°06'W                      | 83 m          | 231      |
|  | <i>Paranotothenia magellanica</i> (Forster, 1801)             | Off Mar del Plata (38°S)              | 15 m          | 519      |
|  |   | 37°30'S, 56°80'W                      | 1.30 m        | 540      |
|  |   | 52°24'S, 63°58'W                      | No data       | 609      |
|  | <i>Patagonotothen guntheri</i> (Norman, 1937)                 | 54°18'S, 65°55'W                      | 70 m          | 533      |
|  | Family Harpagiferidae   |                                       |               |          |
| <i>Harpagifer bispinis</i> (Schneider, 1801)     | Beagle Channel  | No data                               | 759           |          |
| <i>Harpagifer palliolatus</i> (Richardson, 1845) | Beagle Channel  |                                       | 818           |          |

**Table 2** (continued)

| Cat. | Taxonomic categories                                | Area                 | Depth         | Col. no. |
|------|---|----------------------|---------------|----------|
|      | Family Bathydraconidae                              |                      |               |          |
|      | <i>Bathydraco marri</i> Norman, 1938                | 54°45'S, 63°07'W     | 1,350–1,500 m | 566      |
|      | Family Channichthyidae                              |                      |               |          |
|      | <i>Chionodraco hamatus</i> (Lönnberg, 1905)         | Off Malvinas Islands | No data       | 443      |
|      | Family Centrolophidae                               |                      |               |          |
|      | <i>Pseudoicichthys australis</i> (Haedrich, 1966)   | 53°30'S, 61°38'W     | 423–472 m     | 525      |
|      |   | 51°06'S, 67°51'W     | No data       | 530      |
|      | Family Achiropsettidae                              |                      |               |          |
|      | <i>Achiropsetta tricholepis</i> Norman, 1930        | 46°01'S, 54°30'W     | 58–0 m        | 419      |
|      | <i>Mancopsetta maculata</i> (Günther, 1880)         | 54°42'S, 60°35'W     | 330 m         | 213      |
|      |   | 41°07'S, 57°04'W     | 343 m         | 248      |
|      | <i>Neoachirosetta milfordi</i> (Penrith, 1965)      | 39°10'S, 55°28'W     | 524 m         | 371      |
| B    | Family Microstomatidae                              |                      |               |          |
|      | <i>Nansenia antarctica</i> Kamaguchi & Butler, 1984 | 39°18'S, 55°20'W     | 682–702 m     | 524      |
|      | Family Bathylagidae                                 |                      |               |          |
|      | <i>Bathylagus antarcticus</i> Günther, 1878         | 40°31'S, 45°50'W     | 80–140 m      | 413      |
|      |   | 43°05'S, 54°34'W     | 1,000 m       | 515      |
|      | <i>Bathylagus tenuis</i> Kobylansky, 1986           | 37°43'S, 54°34'W     | 800 m         | 603      |
|      | Family Stomiidae                                    |                      |               |          |
|      | <i>Borostomias antarcticus</i> Lönnberg, 1905       | 43°05'S, 54°39'W     | 1,000 m       | 573      |
|      |   | 53°37'S, 60°34'W     | 740 m         | 586      |
|      | <i>Stomias gracilis</i> Garman, 1899                | 43°05'S, 54°39'W     | 1,000 m       | 507      |
|      | Family Notosudidae                                  |                      |               |          |
|      | <i>Scopelosaurus hamiltoni</i> (Waite, 1916)        | 54°49'S, 63°07'W     | 1,350–1,500 m | 559      |
|      |   | 43°28'S, 52°59'W     | 133–75 m      | 417      |
|      |   | 43°01'S, 55°01'W     | 30 m          | 778      |
|      | Family Paralepididae                                |                      |               |          |
|      | <i>Magnisudis prionosa</i> Rofen, 1963              | 53°37'S, 60°34'W     | 740 m         | 580      |
|      | Family Myctophidae                                  |                      |               |          |
|      | <i>Electrona carlsbergi</i> (Tåning, 1932)          | 53°27'S, 62°46'W     | 470 m         | 607      |
|      | <i>Gymnoscopelu bolini</i> Andriashev, 1962         | 46°53'S, 59°54'W     | 800 m         | 584      |
|      | <i>Gymnoscopelus nicholsi</i> (Gilbert, 1911)       | 40°29'S, 54°26'W     | 125–75 m      | 412      |
|      |   | 53°30'S, 61°38'W     | 636 m         | 621      |
|      | <i>Gymnoscopelus piabilis</i> (Whitley, 1931)       | 44°57'S, 53°01'W     | 350–450 m     | 396      |
|      |   | 40°29'S, 49°33'W     | 135–60 m      | 407      |
|      | <i>Metelectrona ventralis</i> (Bekker, 1963)        | 43°05'S, 54°39'W     | 1,000 m       | 514      |
|      | <i>Protomyctophum tenisoni</i> (Norman, 1930)       | 40°29'S, 49°33'W     | 135–60 m      | 400      |
|      |   | 53°37'S, 60°34'W     | 740 m         | 572      |
|      | Family Melamphaidae                                 |                      |               |          |
|      | <i>Sio nordenskjoldii</i> (Lönnberg, 1905)          | 43°05'S, 54°39'W     | 1,000 m       | 516      |
|      | Family Melanonidae                                  |                      |               |          |
|      | <i>Melanonus gracilis</i> Günther, 1878             | 43°05'S, 54°39'W     | 1,000 m       | 440      |
|      | Family Gempylidae                                   |                      |               |          |
|      | <i>Paradiplospinus gracilis</i> (Brauer, 1906)      | 43°05'S, 54°39'W     | 1,000 m       | 571      |
|      |   | 53°37'S, 60°34'W     | 740 m         | 579      |

*A* Argentine continental shelf and adjacent waters. *B* Mesopelagic species in the southwestern Atlantic

*Col no.* Collection number

confined its Antarctic ancestral habitat, it has settled in the Patagonian shelf and slope, competing with new fish groups and searching new habitats.”

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