

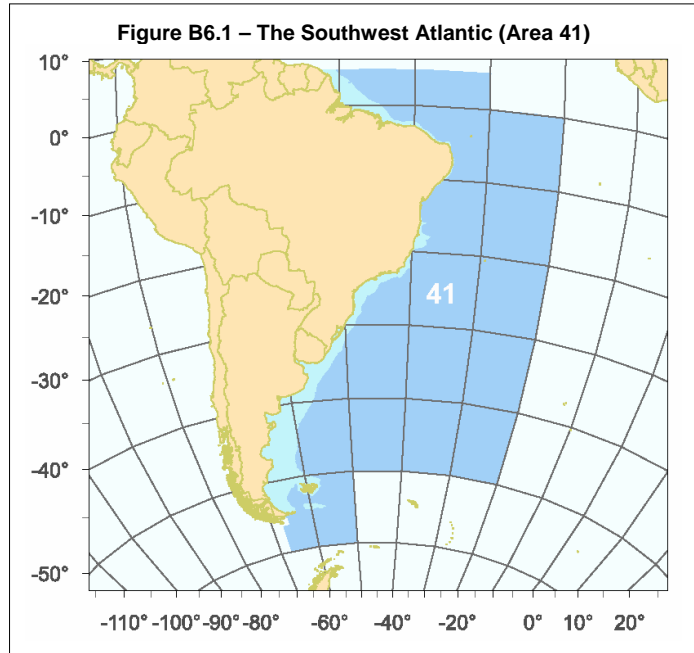
B6. SOUTHWEST ATLANTIC

FAO Statistical Area 41

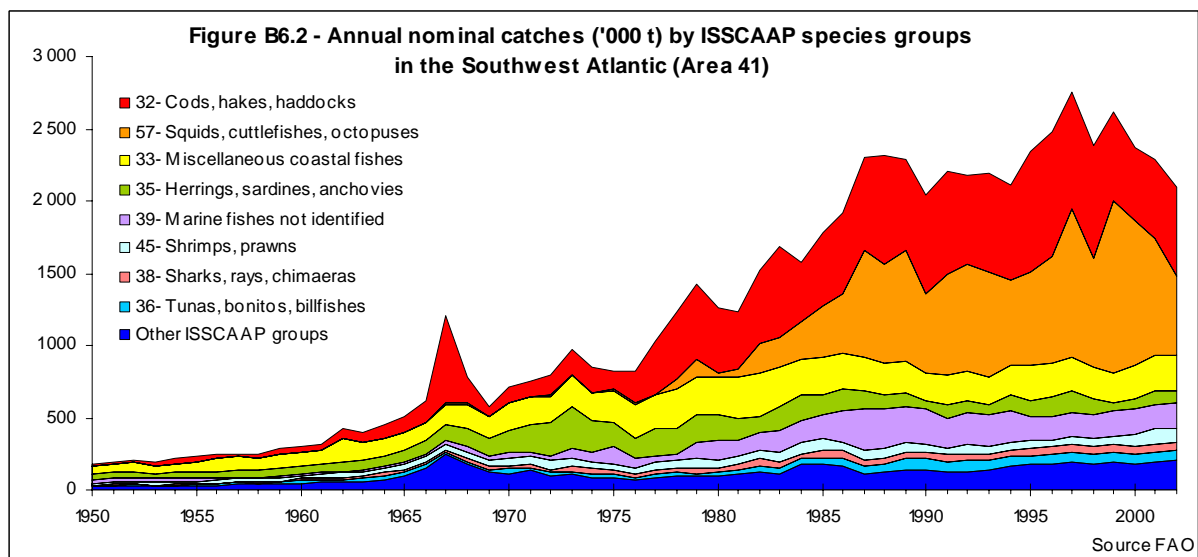
by Jorge Csirke *

INTRODUCTION

This Area covers a total surface of 17.65 million km² off the eastern South American coast, between latitudes 05°00'N off northern Brazil and 60°00'S off southern Argentina and includes a total shelf area of 1.96 million km² (Figure B6.1). In the north, in the Amazon River area the continental shelf may extend as far as 160 nm (320 km) offshore where the bottom is mostly river deposits and debris. As one moves south away from the influence of the Amazon River the shelf becomes narrow, coralline and mostly unsuitable for trawling. The shelf is also narrow and mostly rocky further south, off central and southern Brazil, becoming wider and more suitable for trawling only as higher latitudes are approached. The best and largest trawling areas are found in the River Plate area and over the Patagonian shelf and the Falkland-Malvinas area, where the shelf extends well beyond the 200 nm limit (more than 370 km) off the coastline, turning this into the largest shelf area in the southern hemisphere.



The variety and abundance of fishery resources and types of fisheries in this area are determined by the topography and other physical characteristics, including the environmental conditions that range from typically tropical in the north to sub-Antarctic in the south. Towards the northern part of this area, the marine environmental conditions are dominated by the South Equatorial Current that flows from the coast of Africa and encounters the South American coast branching into the North Brazil Current that flows along the north Brazilian coast



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and the Brazil Current that flows south, along the central and southern Brazilian coast. The northern part of the area is further influenced by the great flow of fresh water from the Amazon River. Further south, the marine environment is dominated by the warmer south-flowing Brazil Current and then by the colder northern-flowing Falkland-Malvinas current, which merge into an offshore flow of subtropical convergence just off the River Plate area where there is also a great flow of freshwater in to the coastal areas (Emilsson, 1959; Hempel, 1971; Dias Neto and Mesquita, 1988; Bakun and Parrish, 1991; Bakun, 1993; Castro and Miranda, 1998).

Shrimps and lobsters, and to a lesser extent reef fishes and other tropical demersals tend to be of particular relevance towards the northern part of the area. Further south, in nutrient-rich coastal areas where water masses mix off central Brazil and off Uruguay-northern Argentina, the area sustains important populations of small pelagics, particularly in the River Plate area. Coastal demersals are particularly important off southern Brazil and in the River Plate area, while mid- and deepwater demersals tend to dominate over most of the River Plate, the Patagonian and Falklands-Malvinas shelf area, where there is also an important squid fishery. Large pelagics are mostly caught off central Brazil and the River Plate area.

PROFILE OF CATCHES

Total capture fish production from the southwest Atlantic area comes mostly from demersals, and more recently from squids mainly caught in the southern Patagonian shelf and slope area. This is one of the FAO Statistical Areas where capture fisheries have seen a rapid development in terms of total production, with a more or less sustained rate of increase until recent years. In 1950 the total catch for the whole area was only 172 000t, and by then most of the known fish stocks in the area were only lightly or moderately exploited with several important stocks still virtually unexploited. Several new fisheries have developed since and except for the burst in catches between 1966 and 1968, with a peak catch of 599 000t in 1967 caused by an intense pulse fishing of hake and probably other demersals by the ex-USSR fleet, total annual catches increased almost steadily at an average rate of 7.4 percent per year, to reach a maximum

of 2.4 million tonnes in 1987. This was followed by a decline, with some year-to-year fluctuations, to a low 2.0 million tonnes in 1990 and 2.1 million tonnes in 1994. A new maximum was reached in 1997 at 2.8 million tonnes. Catches have declined since, with approximately 2.0 million t landed in 2002 (Figure B6.2 and Table D6). Worth mentioning is that total marine aquaculture production has increased in this area at a rate of almost 42 percent per year over the last five years, from 8 000t in 1996 to 72 000t in 2002, but contributing only 3 percent of the total production in this area.

Demersal species in ISSCAAP Group 32 (cods, hakes, etc.) and molluscs in Group 57 (squids, etc.), are the major contributors to the catches from this area, followed by the coastal species in Group 33 (croakers, weak fishes, etc.), the small pelagics in Group 35 (herrings, sardines, anchovies, etc.), and other demersals in Group 34 (toothfish, cusk-eel, etc.) and Group 38 (sharks, rays, chimaeras, etc.). The dominant species in terms of volume are the Argentine hake (*Merluccius hubsii*), the Patagonian grenadier (*Macruronus magellanicus*), and the southern blue whiting (*Micromesistius australis*) in the demersals Group 32, the Argentine shortfin squid (*Illex argentinus*) in Group 57, and the Brazilian sardinella (*Sardinella brasiliensis*) in the small pelagics Group 35.

The Argentine hake sustains one of the most important fisheries in the River Plate area and over most of the Patagonian shelf. From 1950 total catches of this species, at first all taken by the coastal states, Argentina, Brazil and Uruguay, increased steadily to 102 000t in 1965. Following the exceptionally high catches of hake reported by the USSR in 1966 (56 000t), 1967 (513 000t) and 1968 (100 000t), catches by the same coastal states and then total catch for the area declined to 70 000t in 1969 to then increase steadily to 462 000t in 1979. Total catch of hake declined to a low 255 000t in 1984, and increased again to a record high of 682 000t in 1996. Since then, total catches of this species have steadily declined to a record low in the last 25 years of 243 000t in 2000, with an increase to slightly over 400 000t in 2002 (Figure B6.3).

The Argentine hake is now mostly exploited by Argentine and Uruguayan fleets. Both fleets increased in the 1980s to the early 1990s, and the fleet of Argentina continued to increase in the

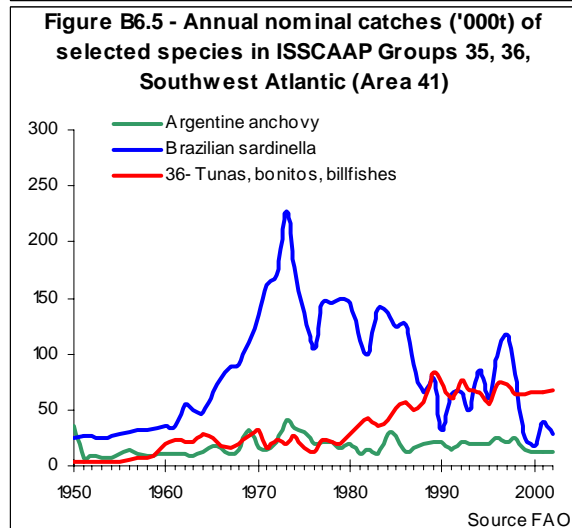
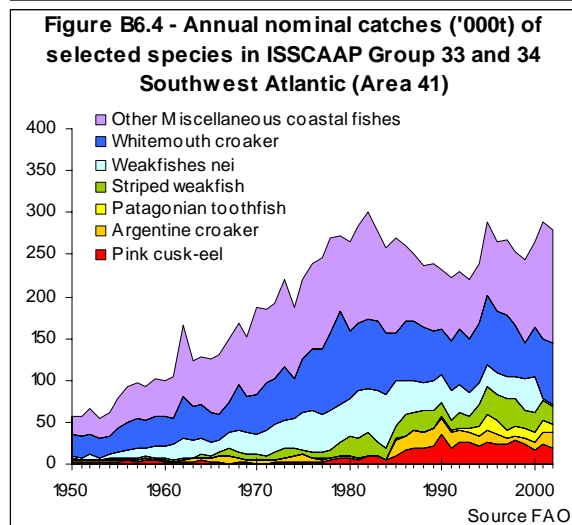
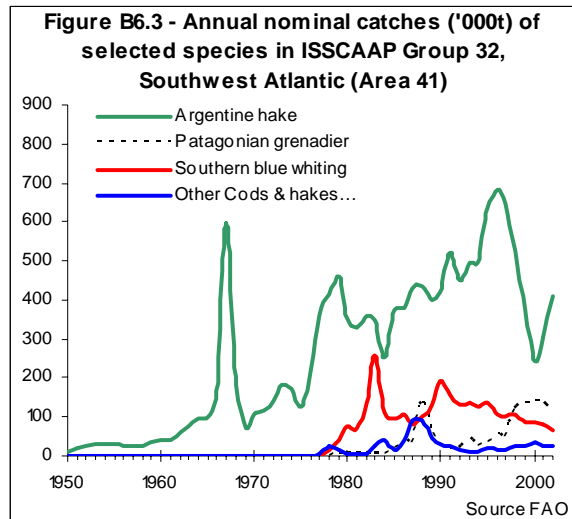
1990s. Other deepwater demersals in the Group 32 which make a significant contribution to the total fish production in the area are the Patagonian grenadier and the southern blue whiting (Figure B6.3) that produced 116 000t and 64 000t respectively in 2002. These are particularly abundant in the southern Patagonian shelf and slope area, where they are exploited by long-range fleets from the region as well as from distant areas.

The miscellaneous demersals in Group 34 (Figure B6.4) that mostly contribute to the total fish production in this area are the pink cusk eel (*Genypterus blacodes*) and Patagonian toothfish (*Dissostichus eleginoides*) with 20 000t and 11 000t respectively in 2002. These species are exploited by both coastal and long-range fleets from the region and from other areas. Coastal demersal species within Group 33 also produce significant catches within the area, particularly the Argentine croaker (*Umbrina canosai*), the striped weak fish (*Cynoscion striatus*), the whitemouth croaker (*Micropogonias furnieri*), and the weakfishes (*Cynoscion* spp.), which have reported relatively high and stable catches over the past few years, with a total of 113 000t for the four species group and 247 000t for the whole species group in 2002. These species are all exploited by coastal fleets.

The main small pelagic species within Group 35 are the Brazilian sardinella (*S. brasiliensis*) and the Argentine anchovy (*Engraulis anchoita*). After the record catches of 228 000t of Brazilian sardinella reported in 1973, total catches of this species have been declining, although with some marked year-to-year fluctuations, to hit a lowest level of 17 000t in the year 2000, with a slight increase to 35 000t in 2001 and catches of 28 000t in 2002 (Figure B6.5). Catches of Argentine anchovy have been between 10 000t and 25 000t per year in recent years. Catches of tunas and other large pelagics in Group 36 have been more or less stable at 50 000-60 000t per year, after reaching a maximum of 74 000t in 1996.

Another very important fishery in this area is that for squids (Group 57). The main dominant species is the Argentine shortfin squid (*Illex argentinus*) which represents 94 percent of the squid catches and 24 percent of total marine catches in this area in 2002. The overall abundance and actual catches of Argentine

shortfin squid have been very variable since the fisheries started in the late 1970s. After reaching 638 000t in 1993, total catches of this species declined to 506 000t in 1994, to increase again to a record high of 1.1 million tonnes in 1999 and decline to 930 000t in 2000 and to a further 511 000t in 2002 (Figure B6.6). Although less



abundant, total catches of Patagonian squid (*Loligo gahi*) have also been fluctuating between a maximum of 89 000t reached in 1989 and a low 22 000t in 1997. In 2002, the total catch of this species was 25 000t. Other squid species caught occasionally are the sevenstar flying squid (*Martialia hyadesi*), that except for a record high catch of 24 000t in 1995, followed by 3 800t and 8 300t in 1996 and 1997, respectively, had relatively low catches in other years, ranging from 0 and 1 000t per year. Catches of non-identified squids has declined sharply in recent years, suggesting great improvements in the identification at species level of squid catches from the area.

Shrimps, prawns, lobsters, crabs and other crustaceans in Groups 42, 43 and 45, also sustain important local fisheries in the area, from the tropical to the sub-Antarctic zone. Altogether these species groups have yielded total catches of over 100 000t since 2000 (Figure B6.7) which are important volumes considering their relatively

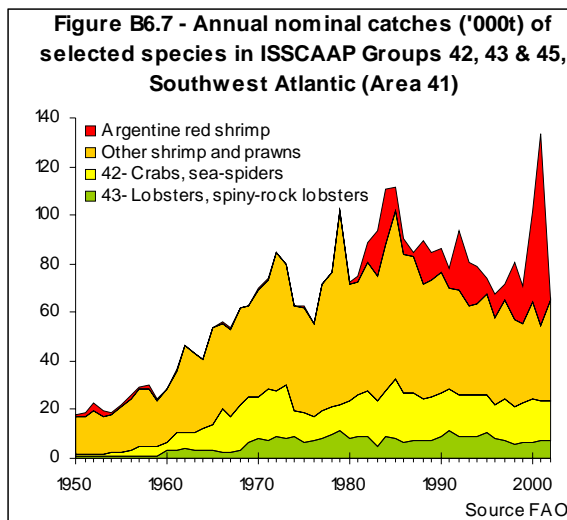
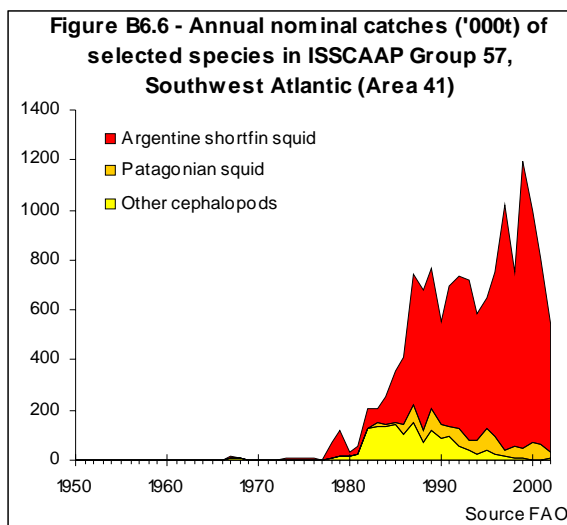
high market value. The single crustacean species yielding the highest catches is the Argentine red shrimp (*Pleoticus muelleri*), with highly variable catches ranging from 3 000 to almost 40 000t per year since the fishery started in the 1980s, with record high catches of 79 000t reported in 2001.

Around 8 percent of the total catches in this area (176 000t in 2002) are reported as not identified marine fishes in the official FAO statistics grouped under ISSCAAP Group 39 (marine fishes not identified). These mostly come from small-scale fisheries, particularly in Brazil, where the variety of species and landing sites makes the recording of catches by species a rather difficult task.

RESOURCES STATUS AND MANAGEMENT

Until the late 1970s and early 1980s, this area was amongst the few major fishing areas of the world still having a large potential for expansion and where abundant and potentially valuable fish resources were still reported as underexploited or lightly exploited (FAO, 1979, 1981, 1983; Otero *et al.*, 1982, 1983; Csirke, 1987; Dias Neto and Mesquita, 1988). Several coastal and mostly industrialized long-range fisheries have developed since and most of the fish stocks are now considered to be fully exploited, while some are, or have been, overexploited, even severely, in recent years (Bezzi, Akselman and Boschi, 2000; Dias Neto, Saccardo and Bernardino, 2001; FAO, 1997, 2002).

International fisheries research, stock assessment and fisheries management activities in the area are mostly dealt through bilateral arrangements. The Joint Technical Commission for the River Plate Maritime Front, based in Montevideo, Uruguay, was established in 1973. One of its main objectives is the promotion of bilateral cooperation between neighbouring Argentina and Uruguay regarding the assessment and management of shared stocks in the River Plate Maritime Front ("Frente Marítimo del Río de la Plata", <http://www.cofremar.org>), taking management action when required. In so doing, this Commission has been organizing or coordinating joint research surveys and other research activities in the area under its competence. It has also actively promoted scientific meetings and publications of regional and international



relevance, where various stock assessment and fisheries management issues of interest to the two member countries but also to other countries in Latin America and countries fishing in the area are or were addressed and discussed. While very active in the 1980s and 1990s, the activities of this regional Commission have decreased somehow, particularly with regards to their scientific activities having a wider regional or international coverage.

Argentina and the United Kingdom are also cooperating in the assessment of fish stocks and management of fisheries in the Falklands-Malvinas area. In November 1990 the Governments of Argentina and the United Kingdom signed a joint statement on the conservation of fisheries that established a South Atlantic Fisheries Commission, composed of delegations from both States (<http://www.oceanlaw.net/docs/ficz4.htm>, last visited 26/10/03). The South Atlantic Fisheries Commission meets regularly and provides a forum for the exchange of information on marine living resources and the discussion and implementation of measures to improve the conservation of commercially important fish stocks and the management of fisheries exploiting them in the southwest Atlantic with particular reference to the Falklands-Malvinas area.

Brazil has some ten informal permanent working groups (Grupos Permanentes do Estudos, GPE), which over the years have had variable degrees of activity and in certain circumstances have been instrumental in coordinating research work and in providing technical advice on the assessment and management of important fisheries in Brazil, such as tunas, shrimps, lobsters, sardines and coastal demersals. Through some of these working groups covering the northernmost part of Area 41, there is an active cooperation with the Western Central Atlantic Fisheries Commission (WECAFC) covering Area 31 regarding the study and assessment of fish stocks in the Guyana-Brazil area.

Most of the reported expansion in production in Area 41 over the last two decades is due to the increased catches of hake and more recently of other demersals as well as squids, particularly in the Patagonian shelf and slope area. There are two well known species of hake in this area, the Argentine hake (*Merluccius hubbsii*) and the

Patagonian or southern hake (*M. australis*) and a third one (*M. patagonicus*, sp. nov, Lloris and Matalallanas, 2003), has recently been described. But by far the Argentine hake is the most conspicuous and abundant, while its area of distribution and fishing grounds tend to overlap in the outer Patagonian shelf and slope with that of the southern hake and the new described one, from which it can hardly be distinguished from simple observation. Given the higher abundance and relative importance of the Argentine hake, it is likely that at least some proportion of the actual catches of southern hake are reported as Argentine hake. Reported catches of southern hake have been well under the 10 000t per year in recent years, while those of Argentine hake have been in the range of 243 000 to 682 000t per year.

There seem to be at least two stock units of Argentine hake (*M. hubbsii*), with some authors proposing the existence of three-four and up to five stock units (Otero and Kawai, 1981; Bezzi and Perrotta, 1983; Otero, Giangiobbe and Renzi, 1986; Perrotta and Sanchez, 1992; Bezzi, Verazay and Dato, 1995). However, this possible distinction into two or more stock units are not taken into account in the official annual catch statistics and are not always taken into account in the assessment and management of the hake fishery within the common Argentine-Uruguayan fishing zone and in the remaining Patagonian shelf area.

The assessments available indicate that until the 1980s and early 1990s the stocks of Argentine hake were fully exploited, but this soon developed into a state of overexploitation by the mid-1990s and stock depletion later on (FAO, 1983; Csirke, 1987; Bezzi, Verazay and Dato, 1995; Consejo Federal Pesquero, 1998; Aubone *et al.*, 1998; Bezzi, Aubone and Irusta, 1999; Aubone, 2000; Bezzi, 2000; Bezzi, Akselman and Boschi, 2000; INIDEP, 2001; Tringali and Bezzi, 2001; Arena and Rey, 2003). At first the overexploitation of the hake stocks was mainly caused by growth overfishing, soon evolving into recruitment overfishing with a serious depletion of the spawning stock biomass. This resulted in the hake resource to be declared in a state of emergency and called for severe restrictive measures by both main fishing countries, Argentina and Uruguay, since 1998. The restrictive measures are still in force and include reduced Total Allowable Catch quotas (TACs)

and extensive seasonal and zonal closures to protect juveniles and spawners. While some signs of increased recruitment are being reported, the restrictive measures adopted so far do not seem to have caused the drastic reduction in fishing pressure which would have allowed a more rapid long-lasting recovery of the Argentine hake stocks in the area.

In comparison to the Argentine hake, the southern hake (*M. australis*) stock is much smaller and is distributed further south in the southern region of the Patagonian shelf and slope with possible connection with a larger stock of the same species in Area 87, off the southern coast of Chile (Tingley *et al.*, 1995). The stock of southern hake is considered to be fully exploited and current catches are within the recommended TAC for this species. However, as suggested by Bezzi and Dato (1995), the situation could easily deteriorate if only a small fraction of the large fleet fishing for Argentine hake switches its effort to southern hake.

The Patagonian grenadier (*Macruronus magellanicus*) is usually found in deeper waters in the southern Patagonian Shelf and according to recent estimates is considered to be moderately exploited, with current catches being well under the estimated TACs. The other main fish stock in Group 32 is the southern blue whiting (*Micromesistius australis*), that is also found in deeper waters in the southern Patagonian Shelf and slope, particularly around the Falkland Islands (Malvinas). While this stock was considered to be moderately to fully exploited until the mid-1990s, more recent studies suggest that at current catches the stock of southern blue whiting is being overexploited (Bezzi, Akselman and Boschi, 2000; Cordo and Wöhler 2000; Wöhler, 2000; Consejo Federal Pesquero, 2002).

Other demersal fish stocks in Group 34, such as the Patagonian toothfish (*Dissostichus eleginoides*) and the pink cusk eel (*Genypterus blacodes*) are considered as moderately to most likely fully exploited in this area, although there is the general perception that at least the Patagonian toothfish is in a much critical situation due to high non reported catches in international waters. There are several stocks of coastal demersal species of Group 33 throughout the region. The main species in this ISSCAAP Group are the Atlantic croaker (*Umbrina canosai*), striped whitefish (*C. striatus*), various

species of weakfishes (*Cynoscion* spp.) and the whitemouth croaker (*Micropogonias furnieri*). Most of these stocks are fully exploited, while some local stocks are still being moderately exploited and others are giving clear signs of overexploitation (Otero and Ibañez, 1986; Haimovici, 1988; Arena, 1990; Dias Neto and Dornelles, 1996; Arena and Rey, 1999; Bezzi, 2000; Bezzi, Akselman and Boschi, 2000).

The Brazilian sardinella (*Sardinella brasiliensis*) is one of the main small pelagics in ISSCAAP Group 35 being exploited in this area. It is found over the shallower continental shelf off Central Brazil between 22° and 29°S. After the record high catches of 228 000t obtained in 1973, catches of this species dropped to then fluctuate in the range of 100 000t and 250 000t until 1986, when another period of decline occurred. The total biomass of Brazilian sardinella declined from an estimated 350 000t in 1977 to 80 000t in 1997, and since then there have been no signs of stock recovery (Saccardo and Rossi-Wongtschowski, 1991; Rossi-Wongtschowski, Saccardo and Cergole, 1995, 1996; Matsuura, 1998; Vasconcellos, 2001). The causes of the severe decline and lack of recovery of this sardine stock is a source of great interest and active debate among fisheries scientists and administrators (Saccardo 1983; Saccardo and Rossi-Wongtschowski, 1991; Rossi-Wongtschowski, Saccardo and Cergole, 1996; Dias Neto, Saccardo and Bernardino, 2001; Vasconcellos, 2003). All seems to indicate that as with other stocks of sardines in other parts of the world, the Brazilian sardine is also exposed to decadal cycles of favourable and unfavourable environmental conditions that could drive the population size up and down more or less independently of fishing pressure. This comes in addition to the effects of heavy fishing, which seems to have maintained this sardine stock under a state of overexploitation almost continuously since its first recorded outburst more than three decades ago. In this respect, it has already been suggested that excessive fishing pressure could contribute to making declining biomass abundance trends steeper and delay or compromise possible natural increasing trends.

Another small pelagic fish stock particularly abundant in the Southwest Atlantic is the Argentine anchovy (*Engraulis anchoita*) that usually is found off southern Brazil, Uruguay and northern Argentina, although in some years it has

been reported as far north as Central Brazil, in areas usually inhabited by Brazilian sardine (Lima and Castello, 1994). This is one of the few cases of highly abundant, well-known commercial fish stocks of the world that still remains underexploited. Total catches are in the lower tens of thousands tonnes per year, while the potential for the whole distribution area is more in the order of one or more hundred thousand tonnes. The total estimated biomass of Argentine anchovy, while highly variable, has mostly been well over one million tonnes, with maximum estimates close to 10 million tonnes in some years (Ciechomski and Sánchez, 1988; Hansen and Madirolas, 1999). This is a stock that clearly could support a much higher fishing pressure. However, it is clear that, as the species is close to the base of the food web of the northern Patagonian and River Plate system, any significant increase in the fishing pressure on this stock could have negative impacts on other fish stocks feeding on it.

Catches of tunas and other large pelagics have been more or less stable in recent years and most stocks seem to be fully exploited although some room for limited expansion exists in some cases. Total catches of sharks, rays and chimaeras have remained more or less stable or increased slightly over the last decade or so, with 57 000t reported for this species group in 2002. Although some stocks are not subject to direct fishing, they might still be moderately or fully exploited as by-catch in other more intensive demersal fisheries in the area. Due to their low fecundity and other life history characteristic there is some concern that through this indirect fishing individual populations of sharks, rays and chimaeras be exposed to undesirably high fishing mortality, become overexploited and in extreme cases depleted, even if not targeted by any particular direct fishery. More studies are needed in this respect, particularly in the context of the IPOA on sharks.

Amongst the crustaceans, the most abundant single species producing the highest yield is the Argentine red shrimp (*Pleoticus muelieri*) in the central Patagonian Shelf area (Boschi, 1989; Bezzi, Akselman and Boschi, 2000). This stock is considered to be fully exploited.

Another main stock is the Argentine shortfin squid (*Illex argentinus*), which is distributed along the shelf and slope from 22° to 54°S and is

exploited by long range fleets from the area as well as from distant areas. Several studies have been conducted on the shortfin squid stock in the Patagonian Shelf and slope area (Koronkiewicz, 1980, 1986; Brunetti, 1981; Otero *et al.*, 1982; Hatanaka, 1986, 1988; Csirke, 1987; Haimovici and Perez, 1990; Haimovici *et al.*, 1998; Bakun and Csirke, 1998). Some work has been done to distinguish possible population groups or stocks units in the area by analysing differences in reproductive seasonality and distribution of early and older life stages. At least three main spawning stocks are described, the summer-spawning stock, the south Patagonic stock and a Bonaerensis-north Patagonic stock, with a possible fourth one, the southern Brazil stock, that could well be an extension of the Bonaerensis-north Patagonic stock.

During the first years of rapid development of this fishery there was great uncertainty and concern regarding the state of this stock and the risk of overexploitation. However, the various research and management efforts made and in particular the joint or coordinated actions by Argentina and the United Kingdom in the context of the South Atlantic Fisheries Commission have contributed to improve the assessment, monitoring and control of fishing operations of local and particularly of long-range fleets. Regardless of the high year to year variability in abundance and resulting catches, the Argentine shortfin squid as well as the Patagonian squid are considered fully exploited.

Most of these fisheries are under some kind of management scheme with specific management measures varying from one country to another and from one fishery to another. Enforcement, however, is not always as effective as desirable. Only a few fisheries are under an open access regime and these are mostly coastal small-scale fisheries. In most cases there is a limited access scheme for which a fishing licence is required, which is usually combined with other nominal fishing effort and total catch limitations to keep fishing mortality under control. Also size at first capture regulations and seasonal and area closures are used to protect juveniles and spawners. In particular, Argentina and Uruguay and their sub-regional organization, the Frente Marítimo, have been compelled to adopt more severe restrictive regulations, combining TAC limits, size at first capture limits and seasonal and

area closures to face the critical situation of the Argentine hake stock.

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