

FISHERIES OF THE FALKLAND ISLANDS AND THE SOUTH GEORGIA, SOUTH SANDWICH AND SOUTH ORKNEY ISLANDS⁵

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Abstract

The history of the Falkland Islands, and the islands of South Georgia, South Sandwich and South Orkney Islands, is briefly reviewed, with emphasis on the exploitation of the living resources (marine mammals, fishes) surrounding these islands. This is then used as background for a ‘reconstruction’ of the catches of fishes and invertebrates, based on a variety of historic sources and catch statistics of the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) from the period from 1950 to 2010. These catches evolved from primarily subsistence and artisanal fisheries supplying the staff of whaling stations and (in the Falklands) the local inhabitants in the 1950s and 1960s, to licensed, well documented and managed industrial fisheries with annual average catches of more than 185,000 t in the Falkland Islands, about 96,000 t in South Georgia, 60 t in South Sandwich Islands, and about 79,000 t in South Orkney Islands. These fisheries are currently targeting mainly squids (*Illex argentinus* and *Doryteuthis gahi*) and various species of rockcod (*Patagonotothen* spp.) around the Falklands, krill (*Euphausia superba*) and various high-value demersal fishes (such as the mackerel icefish *Champsocephalus gunnari* and the Patagonian toothfish, *Dissostichus eleginoides*) around the South Georgia, South Sandwich and South Orkney Islands.

Introduction

This account presents a reconstruction of the marine fisheries catches of the Falkland Islands and South Georgia, South Sandwich and South Orkney Islands for the years 1950-2010. The results are tentative and the reconstruction is preliminary. It is mainly based on official statistics of the Falkland Islands Fisheries Department⁶ and data extracted from the Commission for the Conservation of Antarctic Marine Living Resource (CCAMLR) for South Georgia, South Sandwich and South Orkney Islands, complemented by historical data from the scientific and geographic literature.

The Falkland Islands (Figure 1), named after the Viscount of Falkland⁷, were first colonized by immigrants from San Malô in France at the end of the 17th Century, and hence the name *Iles Malouines* in

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⁶ The Falkland Islands are too far north to be covered by the Commission on the Conservation of Antarctic Marine Living Resources (CCAMLR; see Russ 2007).

⁷ Treasurer of the Navy (HMSO 1920) and one of the owners of the *Welfare* commanded by Captain John Strong in 1690, i.e., the first recorded landing in the Falklands, at Bold Cove, Port Howard (Boyson 1924).

French (Charton 1848). The islands were later referred to as *Las Islas Malvinas* in Spanish when the French relinquished the islands to the Spanish in 1767 (see Palomares et al. 2006). The British reclaimed the islands in the 1840s⁸, after which a succession of conflicts, notably between Spain and Britain and Argentina and Britain, over who should own these islands ensued, the last culminating in a brief war between Argentina and Britain in 1982⁹. The Falklands consist of 778 islands, of which two, the West and East Islands, are the major ones. Peopled by almost 3,000 inhabitants¹⁰, the Falkland Islands jointly cover 12,200 km² and are surrounded by an Exclusive Economic Zone of 551,000 km², which contains valuable marine resources within a 179,000 km² shelf area and a 44,000 km² inshore fishing area¹¹.

The Falkland Islands Dependencies, defined by the Letters Patent of 21 July 1908 and 28 March 1917, include all the islands and territories from 20°W and 50°W, south of 50°S and from 50°W to 80°W, south of 58°S (HMSO 1959a). This definition includes the islands of South Georgia¹² (35°50'–38°15'W; 54–55°S), South Sandwich (26–28°15'W; 59°18'–59°30'S), South Orkney (44–47°50'W; 60–61°S), South Shetlands (west of the South Orkneys), Graham Land including Palmer, Biscoe and other islands separated from the South Shetlands by the Barnsfield Strait (HMSO 1920). The international legal regime established as the Antarctic Treaty

in 1961 led to the establishment of the British Antarctic Territory in 1962 to include only South Georgia and South Sandwich Islands (inclusive of Shag and Clerke Rocks). In 1985, the territory became the British Overseas Territory of South Georgia and South Sandwich Islands (HMSO 1962a), with an EEZ¹³ of 1,449,532 km², a shelf area of 23,090 km² and an inshore fishing area of 14,940 km².

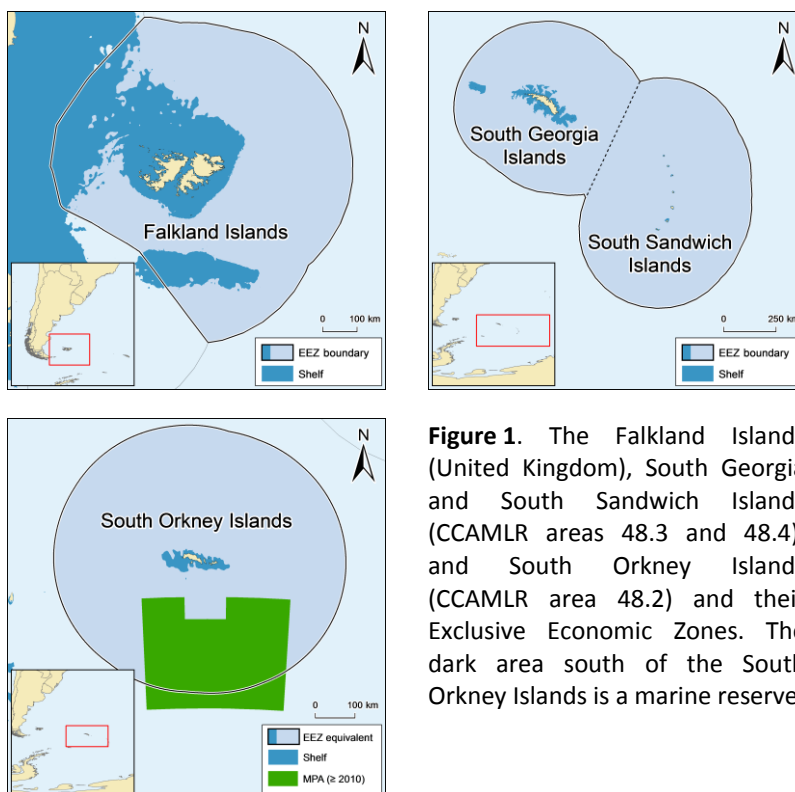


Figure 1. The Falkland Islands (United Kingdom), South Georgia and South Sandwich Islands (CCAMLR areas 48.3 and 48.4), and South Orkney Islands (CCAMLR area 48.2) and their Exclusive Economic Zones. The dark area south of the South Orkney Islands is a marine reserve.

⁸ Act of Parliament dated 11 April 1843 declared the Falkland Islands as Crown colony, with Port William (renamed Stanley Harbour after Lord Stanley, Secretary of State for the Colonies) and Lieutenant R.E. Moody as Governor (HMSO 1920).

⁹ See historical timeline at <https://falklandstimeline.wordpress.com/>.

¹⁰ Current population based on <http://www.falklands.gov.fk/our-people/>.

¹¹ EEZ, shelf and inshore fishing area (IFA) data from the *Sea Around Us* database (see

<http://www.seaaroundus.org/eez/238.aspx>; accessed 11/01/2015). The IFA is defined as the area within 50 km from the coast or 200 m depth, whichever comes first (Chuenpagdee et al. 2006).

¹² Captain Cook, onboard the *Resolution*, landed at Possession Bay on 17 January 1775, and named the islands after King George III (see Cook 1776).

¹³ Though also contested by Argentina.

While the South Georgia and the South Sandwich Islands have well defined EEZs (Figure 1), which include 20,000 km² of marine reserve (see South Georgia and South Sandwich Islands Government 2012), the South Orkney Islands and surrounding waters are of uncertain legal status, which may have helped to convert them into a marine reserve that is largely accepted internationally since it was declared in 2010¹⁴ (Figure 1). Given that these three island groups are part of the CCAMLR convention (Subareas 48.3, 48.4 and 48.2, respectively), which contain no other island groups, and given that these islands have a similar fauna and history of exploitation (see Kock 1992), we are presenting their catch reconstruction in the same contribution, which thus covers, (i) the Falkland Islands; and (ii) the Antarctic Islands of South Georgia, South Sandwich and South Orkney.

*"We go somewhere, use up a resource and move on to the next one"*¹⁵

For over one century, the main industry of the Falkland Islands and its Dependencies was sheep farming, which produces wool, meat, skins and tallow (i.e., fat). Regularly published 'blue books' reporting on the economic progress of the Colony as early as 1846 trace the growth of sheep farming from 1867 onwards, replacing the South American 'gaucho style' wild cattle¹⁶ ranching established by Louis-Antoine de Bougainville's French colony at Fort St. Louis¹⁷ (Pernetty 1773) and surreptitiously continued by the Spanish¹⁸ until the early 1800s (HMSO 1920; Strange 1987).

The introduction of grazing animals (pigs, rabbits and goats, in addition to cattle and sheep) into an ecosystem which had evolved in the absence of such animals (Russ 2007) led to overgrazing of the grass that grew on an acidic and infertile soil. This must have contributed to Charles Darwin's view of the islands as 'desolate', on his first visit aboard the *HMS Beagle* in 1833¹⁹ (see Armstrong 2004). Sheep farming reached a record total production in 1896, and slowly dwindled, presumably because the carrying capacity of the terrestrial grass ecosystem was exceeded. However, at least in the Falkland Islands (South Georgia was by then already an important sealing and whaling station; see Rankin 1951), sheep farming remained profitable given the high value of wool, frozen meat and the low rent of tenured land (HMSO 1920). To this day, sheep farming remains as the major land-based industry in the Falkland Islands, though it has been replaced by fisheries as a major source of income²⁰.

The exploitation of the marine resources in and around these islands can be traced back to the 1760s, associated with de Bougainville's colony (Headland 1984). By 1775, seals were being extracted for export, e.g., as cargo of seal fur and associated products to Canton (now Guangzhou), China in 1784, with

¹⁴ <http://www.mpatlas.org/mpa/sites/5283/>

¹⁵ MacArthur (2010), on the 'linear' progression of the Falkland Islands' economy.

¹⁶ No record remains of the wild cattle breed introduced by de Bougainville, whose traits include "*large spreading horns, long hair, broad fore limbs and small hind quarters*" (Strange 1987).

¹⁷ Named after the *St. Louis*, commanded by Jacques Gouin de Beauchêne, which landed there in 1698 (Taillemite 1997).

¹⁸ Spain reclaimed Port Louis in 1766. However, in 1764, the British established a station in Port Egmont, unbeknownst to the Spanish. The discovery of each other's stations in 1769 sparked the first colonial battle for the Falklands between Spain and Britain, which resulted in the dismantling of both camps (HMSO 1920).

¹⁹ Charles Darwin, who visited the Falklands during his voyage with *HMS Beagle*, wrote in his diary on 3 March 1833 in Port Luis: "*Took a long walk; this side of the island is very dreary: the land is low & undulating with stony peaks & bare ridges: it is universally covered by a brown wiry grass, which grows on the peat. In this tract very few plants are found, & excepting snipes & rabbits, scarcely any animals. The whole landscape from the uniformity of the brown color has an air of extreme desolation.*" (Armstrong 2000, p. 24-25; see also Pauly 2004).

²⁰ See <http://www.falklands.gov.fk/self-sufficiency/commercial-sectors/agriculture/>.

an average load of 2,000-4,000 seals·ship⁻¹·voyage⁻¹ (Hofman and Bonner 1985), or an average of 300,000 seals caught by over 100 sealing vessels per season (Palomares et al. 2006). Seal populations quickly succumbed to this overexploitation. Entire populations were annihilated due to indiscriminate removals (see de Saint-Martin 1845), i.e., young, old, male, female seals were taken, mostly due to an ensuing competition for better exports between ‘sealer gangs’ (Russ 2007). In South Georgia, where sealing and whaling was practiced year round in the 1860s, an estimate of 1.2M seals ‘*were slaughtered*’ in 1865, while a fishing fleet of 5 vessels caught only 600 in 1875 (Rankin 1951). This ‘*criminal attack*’, as referred to by Rankin (1951, p. 34), led to the local extirpation of elephant seals in the Falklands by 1871 (Armstrong 1994) and of fur seals in Beauchêne Island by 1919 (Strange 1976). From the late 1920s to the early 1950s, sea lions were being culled at the annual rate of 7% (Rodriguez and Bastida 1998).

As the seal population declined, whaling was taken up.²¹ Technological improvements increased the efficiency of whaling activities, e.g., the explosive harpoon gun invented by Svend Foyn in 1866 (see Tønnessen and Johnsen 1982), and the establishment of permanent coastal whaling stations in South Georgia with inshore floating processing stations²² in the early 1900s (Stevenson 1915). By the 1920s, the fishery consisted of more than 600 vessels deployed by 21 companies, with six coastal and two floating stations processing an annual average of 9,000 whales (Palomares et al. 2006) and exporting 430,000 barrels of whale oil (Stevenson 1915). This increased the production of whale oil to 10 times the value of sheep wool (Jones 1924). Offshore floating stations were established by 1925 (Gambell 1993), which permitted whaling in open and deep seas. By the early 1930s, there were 41 floating stations and 232 whalers in the open seas (Jahn 1937). In the 1950s, the ‘bluebooks’ published by the Colonial Office (HMSO, 1954 to 1959) report sealing and whaling as the only industry in the Falklands and its Dependencies, and producing an average of 160,000 barrels of whale oil (from data for the period 1951-1957; HMSO 1959b, p. 53) and 12,000 barrels of seal oil (from data for the period 1953-1957; HMSO 1959b, p. 54). The ‘bluebook’ for 1958-1959 (HMSO 1960) and those of the years following, however, did not include an entry for whale or seal oil production, presumably because the fishery had ceased²³. In March 1962, Strange (1987, p. 150) recounts an encounter with a Russian fleet illegally whaling in Falkland waters²⁴. He was aboard a small ex-motor fishing vessel (with 6 crew members including the customs officer) observing the Russian ship, which after a while caught *one* whale – the last that he saw alive in those waters.

The probability of developing a finfish fishery was considered as early as the 1920s, because the whale fishery’s growth was by then already limited. Jones (1924) writes: *"The fact that the waters off the Falkland Islands and southern South America support quantities of seals and penguins [...] presupposes the existence here of at least a fairly large number of fish. Moreover, direct observation has shown the presence of edible species, while shoals of fish resembling small herring are reported from Port Stanley.*

²¹ The Republic of Buenos Aires established a settlement in Port Louis in 1820, taking advantage of the void left by the Spanish and British camps. Its then governor, Louis Vernet, quickly claimed exclusive rights to the seal fishery and thus prevented American and British ships from operating in the islands. Louis Vernet’s moratorium on ‘foreign’ vessels was voided when the settlement was destroyed by an American warship, the *Lexington* in 1831 (HMSO 1920), which enabled the continuation of indiscriminate sealing/whaling operations.

²² ‘Bay whaling’ (Russ 2007; see also Salvesen 1914 and Headland 1984)

²³ Note that the International Convention for the Regulation of Whaling was signed in Washington DC on December 2, 1946 (see <http://iwc.int/history-and-purpose>).

²⁴ Implying that whaling was still in operation, albeit illegally, in those waters.

Whether these fisheries will be developed from the Falkland Islands as a base or from Chile, Argentina, and Uruguay will depend on the countries engaged in the fishing operations and on the market regions. Recently these latter countries have taken initial steps for such development. [...] If the fisheries are worked by these countries, little profit will accrue to the Falkland Islands from them. The Falkland Islands have an excellent location for operations on the bank but lack a population with a natural aptitude for the industry. The young men accustomed to life in the sheep stations, rather than change their occupation migrate to Chile or Patagonia. In all probability, therefore, the Falkland Islands will take at best a minor part in the development of these fisheries and will derive little advantage from their exploitation by other countries."

As commercial finfish fishing was not yet developed, sealers (mostly Norwegian and some British; see Tritton 2011), seeking to complement the food ration (mutton was the staple, though beef was consumed in winter; see HMSO reports) supplied by their employers, caught fish for subsistence²⁵ (Strange 1987). Fanning (1833) described a fishing method using a dam employed at the river mouth, i.e., ‘fish wall’ (Strange 1987), to trap large quantities of ‘mullet’²⁶ which enter the river at high tide. A report of such subsistence fishing was also found in the 1954 bluebook (HMSO 1956), stating that in the Falkland Islands, “occasional catches of mullet and smelt²⁷ by net hauling were sold for local consumption” (i.e., as artisanal fishing). This information was provided for the Falkland Islands until 1963 (HMSO 1965), but was not found in any of the text reporting the production of the Dependencies. Strange (1987) alludes to the “occasional catch being advertised by the appearance of gulls”, implying that in the 1980s, subsistence fishing was still being practiced in the Falkland Islands. Similar observations were made on the considerable finfish populations around South Georgia and South Sandwich Islands (in spite of several attempts to establish shore-based commercial finfish fisheries), and where ‘fjord’ and ‘sea’ fishes²⁸ remained unexploited even after almost a “century of their discovery” (by Fanning 1833) and only “lightly fished (hand lining)” by residents of the whaling stations (Kock 1992; Wild 1923).

Commercial trawling experiments were conducted in the 1960s by Japanese whaling companies based in Grytviken and Leith in the waters around South Georgia (see Hirabayashi 1963; see also Inoue and Kido 1964) and by the Russian Atlantic Research Institute of Marine Fisheries and Oceanography (AtlantNIRO; based in Kaliningrad) in the waters around South Orkney Islands (Kock 1992; Dickinson 1985). The annual catch of krill and nototheniids in 1965 was recorded at 1,800 t, which increased more than 200 fold to 407,900 t in 1970 (Everson 1981). Meanwhile, the establishment of the Fishery Conservation Zone in 1987 paved the way for commercial fishing operations in the Falkland Islands (see Dingwall 1992).¹³ Note, that at the start of the 1980s, Strange (1987) observed 14 trawlers going back and forth from the Falkland Islands, jigging for squids (though we have not found reports of this fishery in the current literature). The Falkland Islands Government reports recent catches of squid to make up 75%

²⁵ Sealers supplemented their rations with wildlife, e.g., eggs and birds (i.e., seabirds), and thus had an immense impact on the marine ecosystem (Russ 2007; Strange 1987; Jones 1924).

²⁶ *Eleginops maclovinus* (Eleginopsidae, Perciformes), also known as ‘Patagonian blennie’ (FAO-FIES 2014; see www.fishbase.org for other common names), is a euryhaline species, endemic to coastal South American temperate and sub-Antarctic waters (Ceballos et al 2012). This fish is abundant in Falkland waters, with adults migrating from rivers and estuaries into marine coastal waters in spring and reach a maximum age of 11 years (see Brickley et al 2005a).

²⁷ *Galaxias maculatus* (Galaxiidae, Osmeriformes), also known as Inanga (FAO-FIES 2014) is a catadromous species, important in white bait fisheries (Allen et al 2002).

²⁸ *Notothenia rossii* (Nototheniidae, Perciformes), occurring in the Southern Ocean (Hureau 1985). The juveniles occur in fjords (‘fjord fishes’), and the adult (‘sea fishes’) occur further away from the coast (Kock 1992).

amounting to about 200,000 t exported to Europe and the Far East²⁹. Modern ‘bluebooks’ published by the CCAMLR and the Falkland Islands Government Fisheries Department record the progress of the finfish fisheries in this region since the 1970s for South Georgia, South Sandwich and South Orkney Islands and since the late 1980s for the Falkland Islands, respectively.

Data sources

Industrial fisheries

Although the Falklands is not defined in any of the CCAMLR conventions (Russ 2007), it was the seat of government, which controlled the “Dependencies” (South Georgia, South Sandwich, South Orkney Islands; see HMSO, 1920). Colonial Office reports (HMSO 1954-1965) summarized the catches of the Falkland Islands and the Dependencies from 1952 to 1967. The earliest catch records by the Falkland Islands Government Fisheries Department (FIG) are from 1987 onwards (FIG 1998, 2000, 2005, 2014). Additional data on hake (1979-1982), southern blue whiting (1970-1985) and squid (1970-1985) fisheries in the Falkland Islands were reported in Csirke (1987). FIG reporting evolved between 1998 and 2014. Earlier FIG reports had aggregated statistics, e.g., categories such as ‘Hakes’, ‘Skates’ and ‘Others’. Assuming that the same fleets would have targeted the same species (and that the same gears would have the same bycatch), earlier catches were disaggregated based on the catch composition from recent reports.

Table 1. Catches (t) of hake (*Merluccius* spp.) in the Southwest Atlantic; adapted from Csirke (1987, Figure 12). Others here include Germany, Japan and the former Soviet Union. Catch for the Falkland Islands assumed to be 5% of the total removals of hake in the region.

Year	Argentina	Uruguay	Others	Total	Falklands
1970	80,000	3,600	–	83,600	4,180
1971	87,000	3,600	–	90,600	4,530
1972	100,000	7,300	–	107,300	5,365
1973	145,000	3,600	–	148,600	7,430
1974	160,000	3,600	–	163,600	8,180
1975	100,000	7,300	–	107,300	5,365
1976	175,000	7,300	–	182,300	9,115
1977	270,000	22,000	22,000	314,000	15,700
1978	340,000	44,000	14,600	398,600	19,930
1979	365,000	58,000	22,000	445,000	22,250
1980	280,000	58,000	14,600	352,600	17,630
1981	230,000	95,000	7,300	332,300	16,615
1982	280,000	67,000	7,300	354,300	17,715
1983	270,000	80,000	7,300	357,300	17,865
1984	182,000	58,000	7,300	247,300	12,365
1985	263,000	102,000	7,300	372,300	18,615

Reported catches of ‘Hakes’ (*Merluccius* spp.) were separated, throughout the time series, into *Merluccius hubbsi* (dominant species in catch; assumed at 80%) and *M. australis* (experimental licensing in 2012 established that it made up 20% of the catch; FIG 2013). An earlier catch time series reported for the Southwest Atlantic in Csirke (1987; see Table 1) indicated that Argentina expanded its Rio del Plata fishery using factory vessels in 1979-1982 stationed around the Falkland Islands, and which caught 5,000-10,000 t of hake. Malaret et al. (1986) indicated that 90% of the Southwest Atlantic hake biomass is concentrated off the Falkland Islands, and presumably also where Argentinian and Uruguayan offshore fleets were likely to go, with or without the factory vessels. Thus, we assumed that a certain percentage of the total hake catch reconstructed from Csirke (1987; see Table 1) would have been caught in Falkland waters. Given the estimate for the catch of factory vessels and MRAG (1986a, 1986b) estimates of 20,000-40,000 t in 1984-1985, we are able to discern that catch of hakes in the Falkland Islands may have

²⁹ See <http://www.falklands.gov.fk/self-sufficiency/commercial-sectors/fisheries/>.

represented 2-9% (average of 5%) of the total Southwest Atlantic hake removals. Assuming that the 80%:20% assumption also holds for this earlier catch time series, we reconstructed the catches of the two species of hakes from the estimates of hake removals from the Falkland Islands in Table 1. Catches for 1986-1988 were then interpolated from the reconstructed 1985 catches and the disaggregated 1989 catches.

Table 2. Disaggregation of catches (t) for the group 'Skates' based on average % contribution of skate species in the catch by gear targeting skates or by gear which catches skates as bycatch and the total removals as reported in Falkland Islands Government Fisheries Statistics (FIG 2005-2014).

Species	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<i>Amblyraja georgiana</i>	–	–	–	–	–	–	–	417	606	9
<i>Bathyraja albomaculata</i>	515	570	468	566	385	564	766	834	592	1,187
<i>B. brachyurops</i>	1,803	1,994	1,638	1,982	1,349	1,955	1,278	2,155	1,101	1,781
<i>B. cousseauae</i>	–	–	–	–	–	–	–	–	–	10
<i>B. griseocauda</i>	927	1,026	842	1,019	694	1,039	1,284	904	–	651
<i>B. macloviana</i>	–	–	–	–	–	–	–	–	838	–
<i>B. meridionalis</i>	–	–	–	–	–	–	–	–	10	–
<i>B. papilionifera</i>	–	–	–	–	–	–	–	–	7	–
<i>B. scaphiops</i>	–	–	–	–	–	311	–	–	542	457
<i>Zearaja chilensis</i>	–	–	936	1,133	771	1,122	1,261	1,043	740	1,096
<i>Raja flavirostris</i>	1,030	1,140	–	–	–	–	–	–	–	–
Rajidae ^a	876	969	795	963	655	881	1,302	1,599	2,219	732
Total	5,151	5,698	4,679	5,663	3,853	5,872	5,891	6,953	6,655	5,923

^a Other skates, mostly caught as bycatch and, which cannot be further disaggregated.

Catches of 'Skates' were disaggregated based on the reported % catch composition of gears during the period 2004-2013 which target³⁰ as well as catch these species as bycatch³¹ (Table 2).

Catches reported as 'Others' (miscellaneous Osteichthyes/Chondrichthyes), were disaggregated based on the percent composition of the catch for the period 2006-2013 (Table 3). These percent compositions were applied to the catch of the fishing fleets to obtain estimated catches of the 30 species lumped under 'Others' by fishing fleet. With the exception of the Falkland mullet (*Eleginops maclovinus*; see below), which was reported as part of 'Others' in the 2006 and 2009 reports, all of these catch statistics are reported as industrial catch.

The squid fishery was unregulated until the establishment of the Falkland Islands Fishery Conservation Zone (Arkhipkin et al. 2007), and catch reports for this fishery by the Falkland Islands Government started only in 1989. However, Csirke (1987) reported that a small-scale *Illex argentinus* fishery started in the early 1970s, developing to large-scale offshore operations in 1978. Note that although the fishery is considered small-scale prior to 1978, for *Sea Around Us* purposes this catch is considered industrial as it is foreign catch within the EEZ. His assessment made use of data from Argentina, Japan and Poland and surveillance data from MRAG (see Table 4), estimating that 80% of the total catch from the Southwest Atlantic were from around the Falkland Islands (see also Basson et al. 1996).

Csirke (1987) also presented catch data for the southern blue whiting, *Micromesistius australis* in the Southwest Atlantic. This fishery apparently started in the region in 1977 with Polish distant water fleets

³⁰ Gears categorized as 'skate target trawls' in FIG reports.

³¹ Gears categorized as 'finfish target trawls', '*Doryteuthis gahi* (Patagonia longfin squid) target trawls', and longline sets.

(getting 70-95% of the catch) and later on joined by fleets of the ex-Soviet Union, Argentina, Bulgaria and Japan. These fleets predominantly fished in the Patagonian shelf, notably the area around the Falkland Islands. Thus, we assumed that 90% of the catches presented in Table 5 were obtained from the Falkland Islands.

Table 3. Disaggregation of the catches (t) of the group 'Others' as reported in Falkland Islands Government Fisheries Statistics (FIG 2005-2014).

Species	2006	2007	2008	2009	2010	2011	2012	2013
<i>Allothenus fallai</i>	0.25	–	0.25	–	–	–	–	0.05
<i>Antimora rostrata</i>	14	16	15	11	12	22	18	16
<i>Brama dussumieri</i>	3	0.25	–	–	–	–	–	–
<i>Champscephalus esox</i>	23	2	90	0.25	6	0.25	0.25	0.05
<i>Congiopus peruvianus</i>	–	–	–	–	–	–	–	0.10
<i>Cottoperca gobio</i>	5	30	25	16	11	43	26	18
<i>Cottunculus granulosus</i>	–	–	–	0.25	–	–	–	–
<i>Eleginops maclovinus</i>	1	–	–	0.25	–	–	–	–
<i>Icichthys australis</i>	0.25	–	–	–	–	–	–	–
<i>Iluocetes fimbriatus</i>	–	–	–	0.25	0.25	2	0.25	–
<i>Lamna nasus</i>	1	2	2	3	2	3	1	1
<i>Lampris immaculatus</i>	1	1	1	1	1	1	0.25	–
Lithodidae	27	25	0.25	10	1	1	0.25	0.30
Macrouridae	671	622	932	958	450	2,058	225	3
<i>Mancopsetta</i> spp.	–	–	–	0.25	1	–	–	541
Medusae ^a	–	–	–	–	–	–	–	329
<i>Moroteuthis</i> spp.	–	–	–	–	36	33	4	12
<i>Moroteuthis ingens</i>	22	71	29	87	–	–	–	–
<i>Munida</i> spp.	4	348	0.25	0.25	6	1	0.25	–
Others ^b	1,001	483	499	10	96	71	87	436
<i>Patagonotothen</i> spp.	20,210	30,157	60,209	58,149	76,411	55,648	63,510	–
<i>Patagonotothen tessellata</i>	–	–	–	–	–	–	–	1
<i>Pseudocyttus maculatus</i>	–	–	–	0.25	–	–	–	–
<i>Psychrolutes marmoratus</i>	–	–	1	0.25	–	–	–	–
<i>Schroederichthys bivius</i>	–	–	–	–	–	–	–	1
<i>Sebastes oculatus</i>	19	24	6	31	46	104	30	18
<i>Somniosus microcephalus</i>	–	–	–	–	–	–	–	3
<i>Sprattus fuegensis</i>	–	9	–	0.25	1	4	50	12
<i>Squalus acanthias</i>	11	9	5	0.25	1	50	65	72
<i>Stromateus brasiliensis</i>	1	6	102	75	2	12	19	8
<i>Thysmops birsteini</i>	0.25	11	–	–	–	–	–	–
<i>Zygochlamys patagonica</i>	–	14	6	13	3	11	0.25	–
Totals	22,015	31,830	61,923	59,367	77,086	58,064	64,037	1,471

^a More information will have to be gathered on this catch, which appears to be non-targeted (i.e., bycatch; Lucas Brotz, Fisheries Centre, UBC, pers. comm.).

^b Can no longer be disaggregated and here treated as 'miscellaneous demersal fishes'.

Industrial catch records for South Georgia, South Sandwich and South Orkney Islands published by CCAMLR (2014) provide data for South Georgia for the period 1970-2013, for South Sandwich for 1973-2013 and South Orkney Islands for 1977-2013, which were re-expressed from 'fishing season' to calendar years³².

³² CCAMLR's reporting season is for December of Year N to November of Year N+1; this was here extracted from the CCAMLR database by calendar year (i.e., January-December of Year N).

Table 4. Catches of shortfin squid, *Illex argentinus*, in the Southwest Atlantic; adapted from Csirke (1987, Figure 26). Catches in the Falkland Islands were assumed to be 80% of these (Csirke 1987). Others here include Bulgaria, Germany, Cuba and South Korea.

Year	Total catch	Argentina	Poland	Japan	Others
1970	1,000	1,000	–	–	–
1971	1,000	1,000	–	–	–
1972	1,000	1,000	–	–	–
1973	2,000	2,000	–	–	–
1974	2,000	2,000	–	–	–
1975	2,000	2,000	–	–	–
1976	5,000	5,000	–	–	–
1977	1,000	1,000	–	–	–
1978	73,000	58,500	3,900	3,900	6,700
1979	128,000	89,700	15,600	11,700	11,000
1980	24,000	11,700	7,800	3,900	600
1981	50,000	7,800	19,500	15,600	7,100
1982	190,000	39,000	109,200	35,100	6,700
1983	160,000	23,400	120,900	15,600	100
1984	220,000	27,300	117,000	62,400	13,300
1985	234,000	19,500	97,500	81,900	35,100

Table 5. Catch (t) of southern blue whiting, *Micromesistius australis*; adapted from Csirke (1987; Figure 13). Others here include Bulgaria and Japan. Catch in Falkland Island waters assumed to be 90% of the total catch in the region.

Year	Poland	Soviet Union ^a	Others	Total catch	Falklands
1977	2,000	–	–	2,000	1,800
1978	12,188	4,063	1,750	18,000	16,200
1979	32,500	4,063	3,438	40,000	36,000
1980	52,813	20,313	6,875	80,000	72,000
1981	44,688	16,250	9,063	70,000	63,000
1982	121,875	4,063	12,063	138,000	124,200
1983	223,438	20,313	16,250	260,000	234,000
1984	97,500	8,125	8,375	114,000	102,600
1985	73,125	16,250	7,625	97,000	87,300

^a Note that Soviet Union was reassigned to Russian Federation in the reconstructions, see text below.

Artisanal, subsistence and recreational fisheries

Although meat (cattle and sheep) is the staple food, fish figures in the diet of these islanders; at least in the Falklands, “*fish is the base for various light main courses*”³³. Thus, we assume that subsistence fishing in the 1950s to the end of the 1960s would be practiced at least by staff of the whaling stations. We assembled demographic estimates in the Falkland and South Georgia Islands, noting the number of workers based at the whaling stations (see Table 6), i.e., potential subsistence fishers of ‘mullet’, ‘smelt’ and ‘fjord’ and ‘sea fishes’. Per capita fish and shellfish consumption for human food by Falkland Islanders for the period 2007-2009 was estimated at 35.2 kg·year⁻¹ (FUS 2011³⁴). Given that subsistence catch is seasonal (i.e., occasional), we assumed that 5% of the per capita fish consumption can be

³³ See http://recipes.wikia.com/wiki/Falkland_Islander_Cuisine.

³⁴ “The FAO calculation for apparent consumption is based on a disappearance model. The three year average considers, on a round weight equivalent basis, a country’s landings, imports, and exports” (FUS 2011).

obtained through subsistence fishing. Thus, 1.76 kg was multiplied with the number of whaling station inhabitants to obtain the annual subsistence catch for the period 1952-1963. This estimate of subsistence catch was then projected backward to 1950 and forward to 2005, and was disaggregated into 3 groups: Falkland mullet (70%), smelt (20%) and mixed marine species (10%). Note that the catch of smelt, is categorized as artisanal catch from 1950 onwards because of the indication that it is sold for local consumption. The catch of the Falkland mullet was categorized as subsistence before 2000 and artisanal thereafter³⁵.

A similar procedure was followed for South Georgia Island, for the period 1952-1963. The number of workers residing in the whaling stations (Table 6) was multiplied by 1.76 kg (see above; NOAA_NMFS 2012). This catch was applied to *N. rossii* and categorized as artisanal, assuming that it is sold for consumption by the station staff (see Kock 1992)³⁶. Artisanal catch of *N. rossii* was backward extrapolated to 1950 and forward extrapolated to 1969. Note that the earliest catch record of *N. rossii* reported by South Georgia to the CCAMLR is in 1970 as part of the industrial fishery fleet of the former USSR. Neither subsistence nor artisanal fishing was estimated for the South Sandwich and South Orkney Islands as these are uninhabited islands. Unreported catches were estimated using data from Agnew (2000, Table 1, p363) and the CCAMLR-Working Group on Stock Assessment of *D. eleginoides* (CCAMLR-WGFS 2011, Appendix G, Table 1, p.2).

Catches by the former USSR 1970-1991 were redistributed to Ukraine and the Russian Federation using the reported CCAMLR landings for the South Georgia Islands for the period 1992-2004, i.e., 15% Russian Federation and 85% Ukraine, following the logic presented in Zeller and Rizzo (2007). Note that the reported landings for the Falkland, South Sandwich and South Orkney Islands did not follow the pattern of reporting for South Georgia Islands. In the Falklands, catches from 1978-1988 were reported under the USSR, no catches were reported between 1988 and 1994, and from 2001 onwards catches were reported only under the Russian Federation. We thus assumed that earlier landings were of the Russian Federation. A similar reporting pattern was observed for the South Orkneys, except that catches made by Ukraine were reported consistently from 1992-2008 and catches by the Russian Federation were reported only for 1992 and 2009-2010. We thus assumed that earlier catches reported under the USSR were taken by Ukrainian vessels. In the South Sandwich Islands, only one catch record was recorded for the Russian Federation in 1992, and we

Table 6. Number of inhabitants in the Falkland and South Georgia Islands and number of whaling station staff reported in Colonial Office 'bluebooks' (HMSO 1954-1965). The number of Falkland Islanders apparently fluctuated depending on the number of migrant whalers, which was not regularly reported. South Georgia, on the other hand, was populated mostly by whalers.

Year	Island	Inhabitants	Whaling station workers
1952	Falklands	2,230	500
1953	Falklands	2,220	500
1954	Falklands	2,212	500
1955	Falklands	2,249	500
1956	Falklands	2,294	500
1957	Falklands	2,253	500
1958	Falklands	2,238	500
1959	Falklands	2,173	500
1962	Falklands	1,252	500
1963	Falklands	1,252	500
1952	South Georgia	1,477	1,469
1953	South Georgia	1,449	1,441
1955	South Georgia	1,329	1,329
1957	South Georgia	1,098	1,098
1959	South Georgia	1,252	1,252
1961	South Georgia	1,252	521
1963	South Georgia	1,252	421

³⁵ The mullet catch of the small beach seine fishery (established in 2000; see Brickley et al. 2005b) in 2006 was 0.25 t (FIG 2008) and was 1.0 t in 2009 (FIG 2011).

³⁶ Falklands is assigned as the fishing entity for this catch, as at the time South Georgia was a dependency of the Falklands. Therefore, for *Sea Around Us* purposes this catch is considered industrial.

assumed that the former USSR did not fish in these islands. Note that the longest reported catch time series in the South Sandwich Islands are for New Zealand and the UK, and covering the period 2005-2010.

Recent sporting news and an angling club web sites indicate the existence of a touristic sport fishery (mostly in freshwater), which is probably catching small amounts of demersal species. However, catch records are not found in any of the government reports. We thus exclude this sector from our analyses.

Results and Discussion

The annual average catches for the Falkland, South Georgia, South Sandwich and South Orkney Islands summarized in Table 7 suggest that the Falkland Islands has the highest annual average catch with over 80% of the annual catch consisting of 5 species (of 48 taxa caught). However, the evolution of the catch over 20-year periods shows that the highest annual catches were taken in the 1970-1989 period, with annual catch per vessel estimates of 19,000 t, 47,000 t and 38,500 t by fleets operating in the Falkland, South Georgia and South Orkney Islands, respectively. The annual average number of fleets operating in the islands shows a 2-3-fold increase in the last 20 years, with annual catch per vessel estimates decreasing 125 times in the Falklands and 2 times in South Georgia Island, but increasing by an enormous amount in the South Sandwich Islands. Though these islands are found in the same region, the main target species differs, with squid in the Falklands, krill in South Georgia and South Orkney and Patagonian toothfish in the South Sandwich Islands (see Aquarone and Adams 2008; Clers et al. 1996; Ashford et al. 1994).

The reconstructed catches for the Falkland and South Georgia Islands, extend coverage of the historical catches to 1950 (reported catches started only in the late 1980s for the Falklands and in the 1970s for South Georgia), with data on subsistence and artisanal fishing practiced by inhabitants of the whaling stations (Figure 2). We estimated an annual average subsistence catch (mostly *E. maclovinus*) at about 0.6 t·year⁻¹ and artisanal fisheries catch (of *E. maclovinus*, *G. maculatus* and *I. argentinus*) at 197 t, in the Falklands for 1950-2010. The average annual artisanal catch (the majority being *N. rossii*) for the period 1950-1969 in South Georgia was estimated at 2.1 t·year⁻¹. The reconstructed industrial catches of the Falklands ranges from about 4,200 t in 1950 to 355,000 t in 2010, which includes an annual average of over 30,000 t of unreported catches (over the 1950-2010 time period), the highest reaching over 270,000 t in 1983. The South Georgia Islands industrial fisheries ranges from 400,000 in 1970 to 11,400 t in 2010 with an annual average unreported catch (notably krill fisheries bycatch of juvenile fishes; see data in Pakhomov and Pankratov 1994) of about 2,800 t·year⁻¹, the highest being in 1989 at 20,000 t (available for 1973-2004).

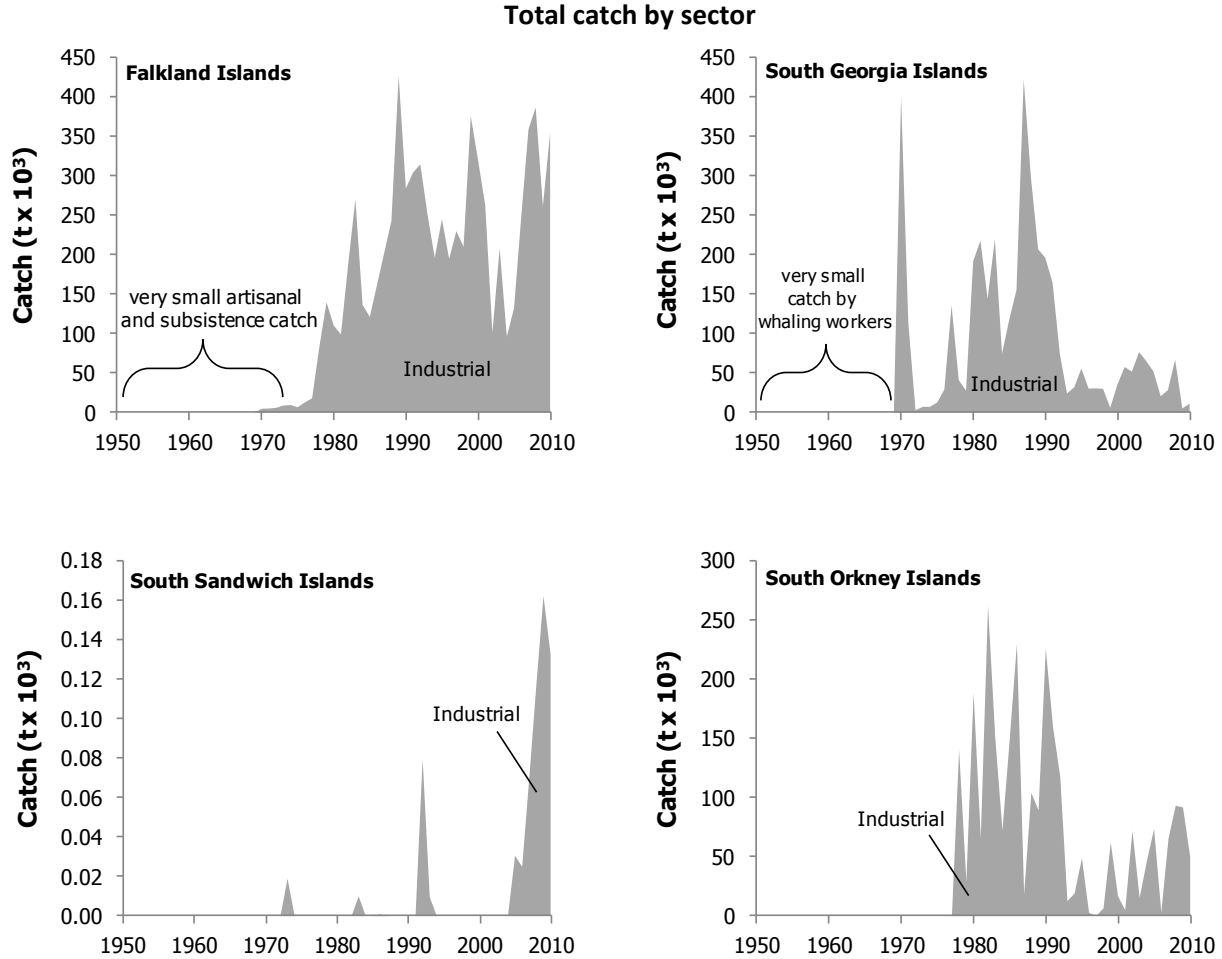


Figure 2A. Catches from 1950-2010 for the Falkland Islands and the Antarctic Islands of South Georgia, South Sandwich and South Orkney by fisheries sector. Note that subsistence and artisanal catches reconstructed for the Falkland are too small to be visible. Artisanal catches by whaling workers in South Georgia were relabelled as industrial as per *Sea Around Us* guidelines. Catches for South Sandwich (1973-2010) and South Orkney Islands (1977-2010) were obtained from the CCAMLR report (2014), are expressed in calendar years and show only industrial catches.

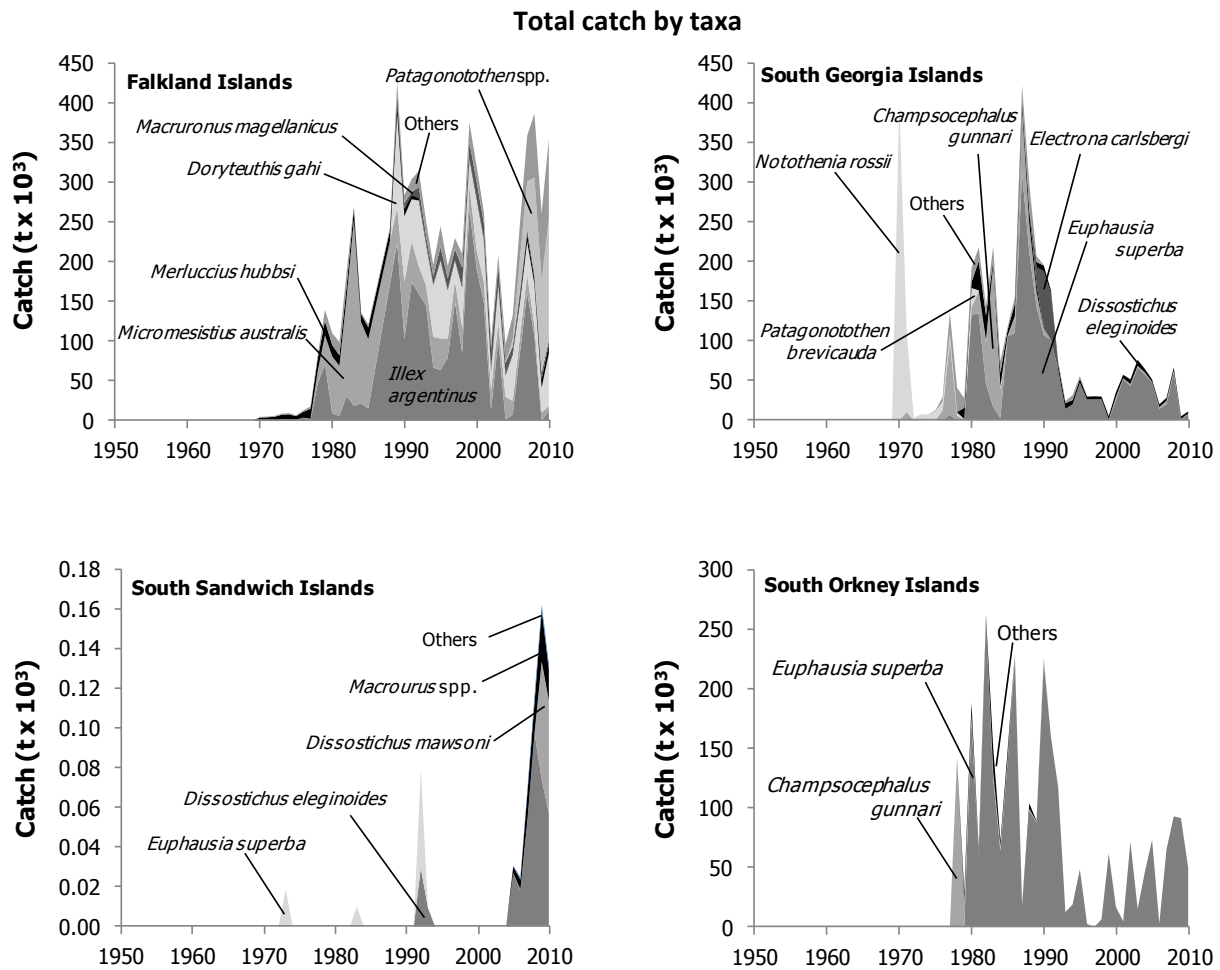


Figure 2B. Catches from 1950-2010 for the Falkland Islands and the Antarctic Islands of South Georgia, South Sandwich and South Orkney by taxa. Note that subsistence (*Eleginops maclovinus*) and artisanal (*Galaxias maculatus*) catches reconstructed for the Falkland Islands and whaling worker catches (*Notothenia rossii*) for South Georgia Islands do not show because of their small amounts as compared to the much larger industrial catch.

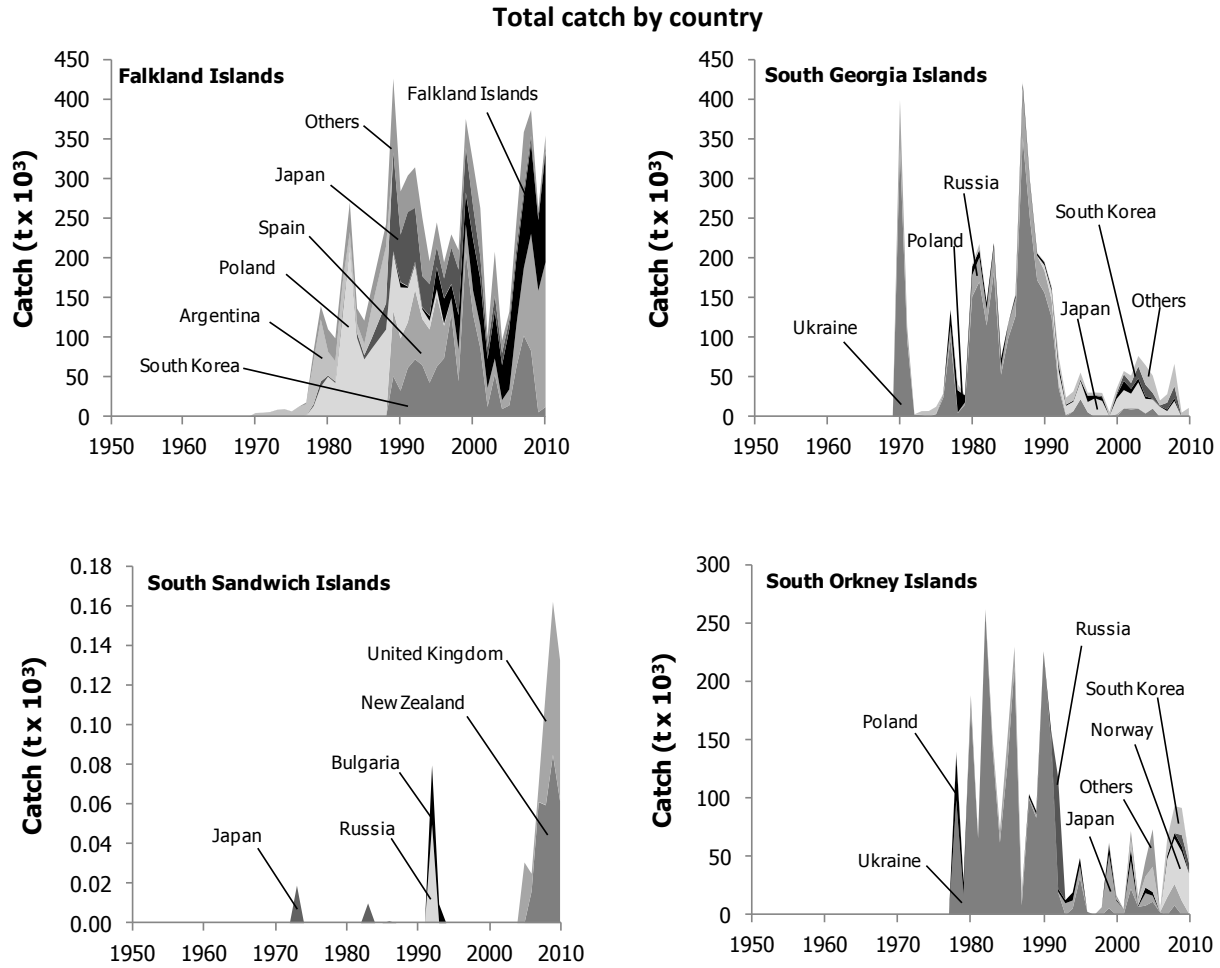


Figure 2C. Catches from 1950-2010 for the Falkland Islands and the Antarctic Islands of South Georgia, South Sandwich and South Orkney by country fishing, i.e., with legal licenses or access agreements. Note that reconstructed subsistence and artisanal catches were assigned to country fishing as Falklands and South Georgia Islands (as opposed to the United Kingdom). Catches by the former USSR in the: a) Falkland Islands were assigned to the Russian Federation; b) South Orkneys were assigned to Ukraine; and c) South Georgia Islands were split (15:85%) between the Russian Federation and Ukraine (see sources of data for more details).

Table 7. Summary of reconstructed data for the Falkland and South Georgia Islands and of the CCAMLR data (expressed in calendar years) for the South Sandwich and South Orkney Islands.

Islands	CCAMLR area	Period of coverage	Catch _{min} (and year)	Catch _{max} (and year)	Annual catch average	Main Fishing fleets	Number of fishing fleets	Main Target species	Number taxa caught
Falklands		1950-2010	0.6 (1962)	426,820 (1989)	124,651	Korea (19%),	35	<i>Illex argentinus</i> (39%),	48
		1950-1969			0.8	Spain (19%),	1	<i>Micromesistius australis</i> (21%),	
		1970-1989			112,927	Poland (16%)	6	<i>Dorytheuthis gahi</i> (16%),	
		1990-2010			254,531		13	<i>Merluccius hubbsi</i> (4%), <i>Macruronus magellanicus</i> (4%)	
South Georgia	483	1950-2010	1 (1969)	421,413 (1987)	63,973	Ukraine (68%)	23	<i>Euphausia superba</i> (52%)	83
		1950-1969			2	Russian Fed. (12%),	1	<i>Champscephalus gunnari</i> (16%)	
		1970-1989			141,200		3	<i>Notothenia rossii</i> (15%)	
		1990-2010			53,207	Japan (8%)	10		
South Sandwich ^a	484	1973-2010	1 (1986)	163 (2009)	60	New Zealand (43%)	5	<i>Dissostichus eleginoides</i> (56%)	15
		1950-1969			0	United Kingdom (39%)	0	<i>D. mawsoni</i> (18%)	
		1970-1989			10	Russian Fed. (8%)	1	<i>E. superba</i> (12%)	
		1990-2010			79		2	<i>Macrourus</i> spp. (12%)	
South Orkney ^b	482	1977-2010	26 (1977)	262,270 (1982)	77,463	Ukraine (69%),	15	<i>E. superba</i> (91%);	24
		1950-1969			0	Japan (10%)	0	<i>C. gunnari</i> (7%)	
		1970-1989			115,389	Norway (6%)	3		
		1990-2010			56,653		4		

^a The reconstruction of South Sandwich only includes data for the years 1973, 1983, 1986, 1992, 1993, and 2005-2010. Averages shown are over those years only.

^b The reconstruction of South Orkney only includes data for the years 1977-2010. Averages shown are over those years only.

Disaggregation of the hake, skates and miscellaneous species components of the Falkland Islands fisheries highlighted the species caught as bycatch of the various trawl fisheries. What is interesting is the high catches of *Patagonotothen* spp. (annual average of 49,000 t; 2006-2010 period), lumped with “Others”, but practically making up 90% of that category. Recent FIG catch data (2004-2013) also include *Patagonotothen ramsayi*, with annual average catches of almost 40,000 t. These species are members of the cod icefish (Nototheniidae) family, usually benthopelagic to depths of 500 m. Other species of the family known to occur in the area (and mostly restricted to the Patagonia Shelf) are *P. brevicauda*, *P. comucola*, *P. guntheri*, *P. sima*, *P. tessellata* and *P. wiltoni* (see www.fishbase.org). Not much is known of this group of fishes, which grow on average to more than 20 cm, the biggest of which is *P. ramsayi*, growing to more than 44 cm (Erzini 1991), which might explain why it is reported as a separate category. The trend of the time series of catches as shown in Figure 2 gives an impression of ‘boom and bust’ fisheries behavior, i.e., large spikes interspersed with low catches. However, an increase in the catch during the 1970-1990 period is evident; thereafter, catches fell to less than 100,000 t in the early 2000s. The ‘boom and bust’ fishing also involves the targeting of new species, and an ongoing expansion into new deeper fishing grounds, as can be assessed by a detailed analysis of taxonomically disaggregated and spatialized catches (see Ainley and Pauly 2013; Aquarone and Adams 2008). This strategy, imported from the far North, where the expansion of industrial fisheries began, is not sustainable (see data in Jones et al. 2000), and it is hoped that CCAMLR and its member countries will succeed in transiting to a different model, in which smaller fisheries operating sustainably over long time periods can generate what will actually turn to be large catches.

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References

- Agnew DJ (2000) The illegal and unregulated fishery for toothfish in the Southern Ocean, and the CCAMLR catch documentation scheme. *Marine Policy* 24: 361-374.
- Ainley D and Pauly D (2013) Fishing down the food web of the Antarctic continental shelf and slope. *Polar Record*, 50(1): 92-107
- Allen G.R., Midgley SH and Allen M (2002) Field guide to the freshwater fishes of Australia. Western Australian Museum, Perth, Western Australia. 394 p.
- Aquarone MC and Adams S (2008) Antarctic: LME #61, p. 765-773 In: K. Sherman and G. Hempel (eds.) The UNEP Large Marine Ecosystem Report: a Perspective on Changing Conditions in LMEs of the World’s Regional Seas. UNEP Regional Seas Reports and Studies No. 182. (See also www.lme.noaa.gov/lmeweb/lme_report/lme_61.pdf)
- Arkhipkin AI, Middleton DA, Barton J (2007) Management and conservation of a short-lived fishery resource: *Loligo gahi* around the Falkland Islands. American Fisheries Society Symposium.
- Armstrong PH (1994) Human impact on the Falkland Islands environment. *The Environmentalist* 14:215-231.
- Armstrong P (2000) Darwin’s Desolate Islands: A Naturalist in the Falklands, 1833 and 1834. In: Keynes RD (ed.), Darwin’s Zoology Notes & Specimen Lists from H.M.S. *Beagle*, p. 147. Cambridge University Press.

- Ashford JR, Croxall JP, Rubilar PS and Moreno CA (1994) Seabird interactions with longlining operations for *Dissostichus eleginoides* at the South Sandwich Islands and South Georgia. CCAMLR Science. Hobart, 1, 143-153.
- Basson M, Beddington JR, Crombie JA, Holden SJ, Purchase LV and Tingley GA (1996) Assessment and management techniques for migratory annual squid stocks: the *Illex argentinus* fishery in the Southwest Atlantic as an example. Fisheries Research, 28(1), 3-27.
- Brickle P, Arkhipkin AK and Shcherbich ZN (2005a). Age and growth in a temperate euryhaline notothenioid, *Eleginops maclovinus* from the Falkland Islands. J. Marine Biological Association UK 85: 1217-1221.
- Brickle P, Laptikhovskiy V and Arkhipkin A (2005b) Reproductive strategy of a primitive temperate notothenioid *Eleginops maclovinus*. Journal of Fish Biology 66:1044-1059.
- Boyson VF (1924) The Falkland Islands: With Notes on the Natural History by Rupert Vallentin. Oxford University Press. Oxford.
- CCAMLR (2014) Statistical Bulletin, Vol. 26. [www.ccamlr.org].
- CCAMLR/WGFSA (2011) Annex 7. Report of the working group on fish stock assessment. Hobart, Australia, 10-21 October 2011. 402 p.
- Ceballos SG, Lessa EP, Victorio MF and Fernández DA (2012) Phylogeography of the sub-Antarctic notothenioid fish *Eleginops maclovinus*: evidence of population expansion. Marine Biology 159: 499-505.
- Charton MÉ (1848) Iles Malouines ou Falklands. Le Magasin Pittoresque 16: 266-267.
- Chuenpagdee R, Liguori L, Palomares MLD and Pauly D (2006) Bottom-Up, Global Estimates of Small-Scale Marine Fisheries Catches. Fisheries Centre Research Report 14(8), 112 p.
- Clers S, Nolan CP, Baranowski R and Pompert J (1996) Preliminary stock assessment of the Patagonian toothfish longline fishery around the Falkland Islands. Journal of Fish Biology, 49(sA), 145-156.
- Cook, J (1776) A second voyage round the world, in the years MDCCLXXII, LXXIII, LXXIV, LXXV. By James Cook, Esq. commander of His Majesty's bark the *Resolution* ... Drawn up from authentic papers. Printed for the editor: sold by J. Almon; and Fletcher & Hodson, Cambridge, London. 102 p.
- Csirke J (1987) The Patagonian fishery resources and the offshore fisheries in the Southwest Atlantic. FAO Fisheries Technical Report (286). FAO, Rome. 75 p.
- de Saint-Martin MV (1845) Notice sur le progrès des découvertes géographiques pendant l'année 1844: Les îles Falklands. Nouvelles annales des voyages et des sciences géographiques. Paris.
- Dickinson AB (1985) South Georgia Fisheries: Some Early Records. Polar Record 22:434-437. doi:10.1017/S0032247400005726.
- Dingwall PR (Editor) 1992 Progress in conservation of the Subantarctic Islands. Proceedings of the SCAR/IUCN Workshop on Protection, Research and Management of Subantarctic Islands, 27-29 April 1992. Paimpont, France.
- Erzini K (1991) A compilation of data on variability in length-age in marine fishes. Fisheries Stock Assessment, Title XII, Collaborative Research Support Program, University of Rhode Island. Working paper 77, 36p.
- Everson I (1981) Fish. In: El-Sayed SZ (ed.), Biological Investigations of Marine Antarctic Systems and Stocks (BIOMASS), II: Selected contributions to the Woods Hole conference on living resources of the Southern Ocean 1976. Cambridge, SCAR and SCOR.
- Fanning E (1833) Voyages Round the World. Voyages and Discoveries in the South Seas 1792-1832. Collins & Hannah, New York. 512 p.
- FAO-FIES (2014) Aquatic Sciences and Fisheries Information System (ASFIS) species list. Retrieved from <http://www.fao.org/fishery/collection/asfis/en>, April 2014.
- FIG (1998) Fishery statistics Volume 2 (1989-1997). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 75 p.
- FIG (2000) Fishery statistics Volume 4 (1990-1999). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 71 p.

- FIG (2005) Fishery statistics Volume 9 (1995-2004). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 70 p.
- FIG (2006) Fishery statistics Volume 10 (1996-2005). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 70 p.
- FIG (2007) Fishery statistics Volume 11 (1997-2006). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 70 p.
- FIG (2008) Fishery statistics Volume 12 (1998-2007). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 70 p.
- FIG (2009) Fishery statistics Volume 13 (1999-2008). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 72 p.
- FIG (2010) Fishery statistics Volume 14 (2000-2009). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 72 p.
- FIG (2011) Fishery statistics Volume 15 (2001-2010). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 72 p.
- FIG (2012) Fishery statistics Volume 16 (2002-2011). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 72 p.
- FIG (2013) Fishery statistics Volume 17 (2003-2012). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 72 p.
- FIG (2014) Fishery statistics Volume 18 (2004-2013). Falkland Islands Government Fisheries Department. Stanley, Falkland Islands. 100 p.
- Gambell R (1993) International management of whales and whaling: an historical review of the regulation of commercial and aboriginal subsistence whaling. *Arctic* 46(2):97-107.
- Headland R (1984) *The island of South Georgia*. Cambridge University Press, Cambridge. 293 p.
- Hirabayashi S (1963) Letter to the Administrative Officer, South Georgia, 10 October 1963. SPRI MS 1228/10.
- HMSO (1920) *Falkland Islands Kerguelen*. Handbook No. 138. Historical Section of the Foreign Office. Her Majesty's Stationery Office, London. 43 p.
- HMSO (1954) *Report on the Falkland Islands and Dependencies for the years 1952 & 1953*. Reports of the Colonial Office. Her Majesty's Stationery Office, London. 52 p.
- HMSO (1956) *Falkland Islands and Dependencies. Report for the years 1954 and 1955*. Reports of the Colonial Office. Her Majesty's Stationery Office, London. 70 p.
- HMSO (1959a) *Gazetteer of the Falkland Islands Dependencies (Second Edition)*. Research Department Foreign Office. Her Majesty's Stationery Office, London. 28 p.
- HMSO (1959b) *Falkland Islands and Dependencies. Report for the years 1956 and 1957*. Reports of the Colonial Office. Her Majesty's Stationery Office, London. 81 p.
- HMSO (1960) *Falkland Islands and Dependencies. Report for the years 1958 and 1959*. Reports of the Colonial Office. Her Majesty's Stationery Office, London. 87 p.
- HMSO (1962a) *The British Antarctic Territory Order in Council, 1962*. Statutory Instrument 1962 No. 400.
- HMSO (1962b) *Falkland Islands and Dependencies. Report for the years 1960 and 1961*. Reports of the Colonial Office. Her Majesty's Stationery Office, London. 73 p.
- HMSO (1965) *Falkland Islands and Dependencies. Report for the years 1962 and 1963*. Reports of the Colonial Office. Her Majesty's Stationery Office, London. 76 p.
- Hofman RJ and Bonner WN (1985) Conservation and protection of marine mammals: past, present and future. *Marine Mammal Science* 1:109-127.
- Hureau J.-C. (1985) Family Notothenidae - Antarctic rock cods. p. 323-385. In W. Fischer and J.C. Hureau (eds.) *FAO species identification sheets for fishery purposes. Southern Ocean (Fishing areas 48, 58 and 88) (CCAMLR Convention Area)*. Rome, FAO. Vol. 2
- Inoue M and Kido T (1964) Experimental fishing on South Georgia Bank. *Transactions of the Tokyo University of Fisheries* 7(2):109-114.
- Jahn G (1937) Whaling in the Antarctic 1935-36. *International Whaling Statistics* VIII:3-16.

- Jones CF (1924) The economic activities of the Falkland Islands. *Geographical Review* 14(3): 394-403.
- Jones CD, Kock K-H and Balguerias E (2000) Changes in biomass of eight species of finfish around the South Orkney Islands (Subarea 48.2) from three bottom trawl surveys. *CCAMLR Science* 7: 53-74.
- Kock K-H (1992) *Antarctic Fish and Fisheries*. Studies in Polar Research, Cambridge University Press, Cambridge and New York. 359 p.
- MacArthur E (2010) Towns in transition: from Grytviken to Detroit. [<http://www.ellenmacarthurfoundation.org/circular-economy/explore-more/think-differently/towns-in-transition-from-grytviken-to-detroit.pdf>].
- Malaret AE (Editor) (1986) Impacto ecológico y económico de las capturas alrededor de las Malvinas después de 1982. Informe preparado en el Instituto Nacional de Investigación y Desarrollo Pesquero. Instituto Nacional de Investigación y Desarrollo Pesquero (INIDEP), Mar del Plata, Argentina. 115 p.
- MRAG (1986a) Fisheries around the Falklands: Interim report 2 (March 1986). Marine Resources Assessment Group, Imperial College, London. 26 p. (mimeo).
- MRAG (1986b) Fisheries around the Falklands: Interim report 3 (August 1986). Marine Resources Assessment Group, Imperial College, London. 42 p. +tables and figures (mimeo).
- NOAA-NMFS (2012) Fisheries of the United States. Current Fisheries Statistics No. 2011. US Department of Commerce. National Oceanic and Atmospheric Administration. National Marine Fisheries Service, Office of Science and Technology, Fisheries Statistics Division. Silver Spring, MD. 125 p.
- Pakhomov EA and Pankratov SA (1994) By-catch, growth and feeding of Antarctic juvenile fish taken in Krill (*Euphausia superba* Dana) fisheries in the South Georgia area, in 1992. *CCAMLR Science* 1:129-142.
- Palomares, M.L.D. and D. Pauly. 2011. A brief history of fishing in the Kerguelen Island, France p. 15-20 In: S. Harper and D. Zeller (eds.) Fisheries catch reconstruction: Islands, Part II. Fisheries Centre Research Reports 19(4).
- Palomares ML, Mohammed E and Pauly D (2006) European expeditions as a source of historic abundance data on marine organisms: a case study of the Falkland Islands. *Environmental History*. 11 (October): 835-847.
- Pauly D (2004) *Darwin's Fishes: an encyclopedia of ichthyology, ecology and evolution*. Cambridge University Press, Cambridge, xxv + 340 p.
- Pernetty AJ (1773) *The History of a Voyage to the Malouine (or Falkland) Islands Made in 1763 and 1764 under the Command of M. de Bougainville, in Order to Form a Settlement There: and of Two Voyages to the Streights of Magellan, with an Account of the Patagonians* (trans. from Dom Pernetty's historical journal written in French). W. Goldsmith and D. Steel, London.
- Rankin N (1951) *Antarctic Isle. Wild Life in South Georgia*. Collins, St. James's Place, London. 383 p.
- Rodriguez D and Bastida R (1998) Four hundred years in the history of pinniped colonies around Mar del Plata, Argentina. *Aquatic Conservation: Marine and Freshwater Ecosystems* 8: 721-735.
- Russ R. 2007. History, exploitation, settlement and past use of the sub-Antarctic. *Papers and Proceedings of the Royal Society of Tasmania* 141(1):169-172.
- Salvesen TE (1914) *The whale fisheries of the Falkland Islands and Dependencies*. Edinburgh.
- South Georgia and South Sandwich Islands Government (2012) *Subsidiary legislation. Wildlife and protected areas. Marine Protected Areas Order 2012*. South Georgia and South Sandwich Islands Gazette No. 1 (29February 2012). Attorney General's Chambers, Stanley, Falkland Islands. 12 p.
- Stevenson A (1915) Les pêcheries de baleines des îles Falkland et de leurs dépendences. *Revue générales des Sciences pures et appliquées* 26 : 181-186.

- Strange IJ (1987) *The Falkland Islands and their Natural History*. David and Charles Publishers, NY, USA. 160 p.
- Taillemite É (1997) *Sur des Mers Inconnues. Bougainville, Cook, Lapérouse. Découvertes*, Gallimard, Paris.
- Tritton PM (2011) Inspection of the disused shore-based whaling stations for the Government of South Georgia and the South Sandwich Islands. [<http://www.sgisland.gs/download/Gazetteer/Main%20Report%20July%202011.pdf>]. 93 p.
- Tønnessen JN and Johnsen AO (1982) *The history of modern whaling (a shortened translation of Den Moderne Hvalfangsts Historie; Opprinnelse og Utvikling, Vols I-IV, 1959-70)*. C. Hurst and Co., London. 798 p.
- Wild F (1923) *Shackleton's Last Voyage: the Story of the 'Quest'*. London, Cassell.
- Zeller D and Rizzo Y (2007) Country disaggregation of catches of the former Soviet Union (USSR). p. 157-163 In: Zeller D and Pauly D (eds.) *Reconstruction of Marine Fisheries Catches by Countries and Regions (1950-2005)*. Fisheries Centre Research Reports 15(2).