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## FISHERIES CATCH STATISTICS FOR URUGUAY

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## ABSTRACT

We present a compilation of reported commercial catch statistics from Uruguay, for the last six decades, extracted from statistical books published by agencies of the Uruguayan Government. We also provide new catch estimates for the country for discards and recreational catches based on information from unpublished sources. Statistics are reported based on local common names. We find that total reconstructed catches for 1950-2010 (over 5.1 million t) were 25% higher than the data reported by FAO on behalf of Uruguay (over 4.1 million t) suggest. The discrepancies were mainly due to substantially underreported artisanal catches and the absence of discards in the officially reported data.

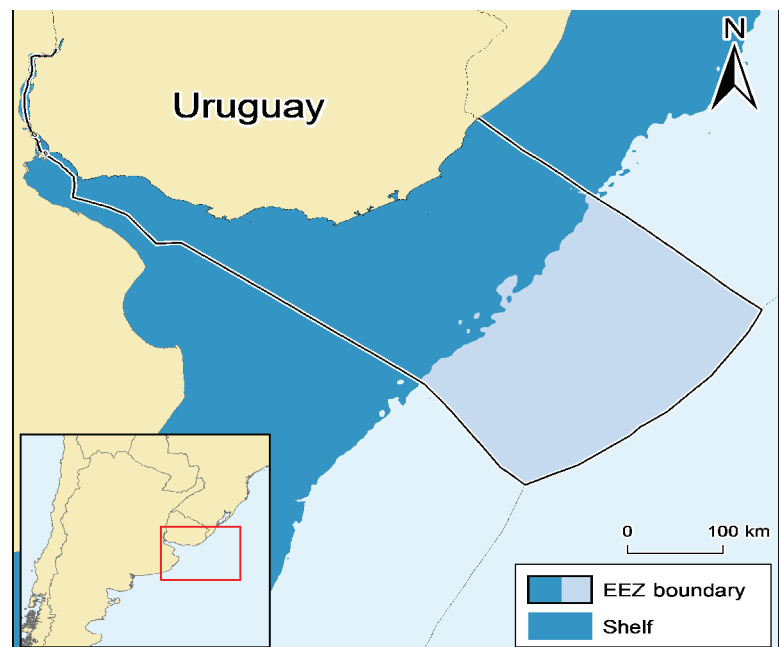
## INTRODUCTION

The Uruguayan 'Plan for Fisheries Development' began in the early 1970s. In 1973, the signature of the 'Tratado del Río de la Plata y su Frente Marítimo' with Argentina allowed the industrial fishing fleet of Uruguay to have access to shared resources in the Argentinean-Uruguayan Common Fishing Zone (AUCFZ) extended between 34° and 39°30' S (Figure 1). In 1975, a legal and institutional framework was established, which facilitated the development of the sector through a policy that privileges the promotion of exports through incentives and credits. This overemphasis on industrial fisheries also occurred in Uruguay, from the very beginning in the 1970s (Defeo *et al.* 2011).

## METHODS

*Uruguayan Catch Statistics*

The Uruguayan fishing industry can be divided into artisanal and industrial sectors. Historically, the official reported industrial fisheries data account for landings in the AUCFZ for the period 1960-2010 (Table 1). Data sources used in this study include official data and published and grey literature (e.g., unpublished reports), media sources and personal information based on communications from DINARA (formerly INAPE). The analysis of these various information sources identified 'missing' data, sectors, time periods, species and gears. Alternative information was gathered from literature searches and interviews with local experts.



**Figure 1.** The Uruguayan-Argentinean Common Fishing Zone (UACFZ), including the Uruguayan Exclusive Economic Zone (EEZ).

**Table 1.** Government sources of fisheries catch data for Uruguay.

Period	Source
1975-1979	Anuarios Boletín Estadístico Pesquero. INAPE, MGAYP. One per year.
1986	Boletín Estadístico Pesquero. INAPE, MGAYP. Estadísticas 1982-1986.
1990-1996	Boletín Comercial. Compendio Estadístico Pesquero. INAPE, MGAYP.
1998-1999	Informe Sectorial Pesquero. INAPE, MGAYP. One per year.
2000-2001	Informe Sectorial Pesquero. DINARA, MGAYP.
2002-2007	Boletín Estadístico Pesquero. DINARA, MGAYP.
2008-2010	Boletín Estadístico Pesquero. DINARA, MGAYP. One per year.

INAPE: National Institute of Fisheries; MGAYP: Ministry of Cattle, Agriculture and Fisheries; DINARA: National Direction of Aquatic Resources (ex-INAPE)

## Artisanal fisheries

The artisanal sector is characterized by small-scale vessels (10 GRT) operating mainly in coastal waters that extend from the intertidal zone to about 7 nm of the coast, but they tend to concentrate at the mouth of rivers, lakes, coastal waters adjacent to rocky headlands and sandy beaches. Despite the low contribution of artisanal fisheries to the total catch (3%), the sector has great social importance, employing almost half of the fishers in the country (Defeo *et al.* 2011). Approximately 56% of fishers are concentrated in the area of influence of the Rio de la Plata and the Atlantic coast. The number of artisanal vessels increased linearly from 1975 to 1996 (269 to 905 vessels, respectively). In 1996, DINARA updated the information of the fleet to those with a GRT  $\geq 3$ , canceling permits of those vessels which did not perform fishing activities during the last years or for a variety of other reasons. After this categorization of the artisanal fleet, the number of vessels increased from 393 in 1997 to 752 in 2010 (Figure 2). However, it must be stressed that the actual number of vessels of the artisanal sector is still underestimated, according to recent figures provided by Puig *et al.* (2010).

Artisanal fisheries are typically multi-species, exploiting about 50 species of fish and invertebrates. The main species recorded in the coastal zone for this sector are whitemouth croaker (*Micropogonias furnieri*)<sup>1</sup>, striped weakfish (*Cynoscion guatucupa*), narrownose smooth-hound (*Mustelus schmitti*) and shad (*Prochilodus lineatus*). The most important artisanal shellfisheries include blue and brown mussels (*Mytilus edulis* and *Perna perna edulis*, respectively), the yellow clam (*Mesodesma mactroides*), brown shrimps (*Farfantepenaeus* spp., *Artemesia longinaris*, *Pleoticus muelleri*) and crabs (*Callinectes sapidus* and *Neohelice granulata*). Recorded landings registered between 1975 and 2010 averaged ca. 3,000 t·year<sup>-1</sup> and never exceeded 5,000 t·year<sup>-1</sup>.

Artisanal fisheries statistics were not gathered by the official agencies from 1960 to 1975. Thus, using data from both published and grey literature sources as anchor points, time series data were reconstructed using interpolation and extrapolation. Hard data used to form these anchor points included the proportional commercial catch breakdown (marine vs. freshwater) to estimate the proportion of artisanal catches. Data from 1975 to 2005 were multiplied by 5 according to information provided by official representatives. For the year 2005 onwards, total catch estimates for the artisanal sector were modified according to estimates provided by Puig *et al.* (2010). The authors conducted a national census of the artisanal fleet and found a gross underestimation in the number of vessels registered by DINARA and in the catches declared by the fishers, which are taken into account to build the official statistics. According to Puig *et al.* (2010), the amount of catches declared by the fishers represents approximately 8.7% of the actual catch, and thus the official statistics for the period 2005-2010 were multiplied by a factor of 11.5. Final estimates reconstructed in this paper are shown in Figure 3a. Although data were extracted from and/or estimated from 'official statistics' and used as the basis of the artisanal sector reconstruction, all artisanal catches are considered to be unreported, as the data reported by the FAO on behalf of Uruguay are taken to be representative of the industrial sector. We acknowledge that this may slightly overestimate the industrial catches.

Species composition of the artisanal fishery was available for the years 2000-2010.<sup>2</sup> The average species composition for the years 2000-2002 was used to disaggregate the artisanal catch from 1950-1999.

## Subsistence fisheries

Artisanal fishers are known to take home a portion of their catch for consumption by their family and friends. This take-home catch is considered subsistence, and does not include any potential true subsistence fishing. Although there are no data on this sector, it is known that the percentage of the catch that goes to subsistence has been decreasing over time. Therefore, an assumption was made that in 1950, 80% of an artisanal fisher's catch went to subsistence, 10% in 1980 and only 5% in 2010. Percentages were interpolated for intervening years. This percentage time series was applied to the artisanal catch calculated above in order to derive a catch time series for the subsistence sector.

The species composition of the take-home catch was derived from the artisanal breakdown. The average species composition of the artisanal catch (2000-2010), excluding sharks, rays, and crustaceans, was used as an assumed breakdown for the subsistence catches (Table 2).

## Industrial fisheries

The industrial fleet targets mainly Argentine hake (*Merluccius hubbsi*), whitemouth croaker (*Micropogonias furnieri*) and striped weakfish (*Cynoscion guatucupa*), and consists of nearly 100 vessels that, by law, restrict their fishing operations to waters beyond 7 nm offshore (Horta and Defeo 2012). In addition, Uruguay has an industrial fleet operating in international waters (high seas), mainly targeting tuna, Patagonian toothfish (*Dissostichus eleginoides*), krill and other crustaceans. Landings of the Uruguayan industrial fishing fleet represented 95% of the total catch and directly employ almost 2,000 people. The industrial fleet linearly increased from 1975 to 2004 (46 to 124 vessels), decreasing thereafter to 81 vessels in 2010 (Figure 2).

<sup>1</sup> Taxonomic nomenclature of marine and freshwater taxa caught in the AUCFZ followed Nion (1998). Names of the taxa caught are local names, which were conserved throughout the process.

<sup>2</sup> Unpublished data from the fisheries department.

**Table 2.** Species composition applied to the subsistence catch (derived from the artisanal species breakdown).

Species	%
<i>Anchoa maringhi</i>	0.75
<i>Brevoortia aurea</i>	4.27
<i>Conger orbignianus</i>	0.13
<i>Cynoscion guatucupa</i>	10.35
<i>Cyprinus carpio carpio</i>	1.10
<i>Genidens barbatus</i>	1.02
<i>Macrodon ancylodon</i>	1.11
<i>Menticirrhus americanus</i>	0.15
<i>Micropogonias furnieri</i>	60.85
<i>Mugil platanus</i>	0.95
<i>Mytilus edulis</i>	5.33
<i>Odontesthes</i> spp.	0.21
<i>Pagrus pagrus</i>	0.03
<i>Paralichthys</i> spp.	0.17
<i>Parona signata</i>	2.10
<i>Pogonias cromis</i>	0.43
<i>Trachurus lathami</i>	0.00
<i>Umbrina canosai</i>	1.77
<i>Urophycis brasiliensis</i>	9.28

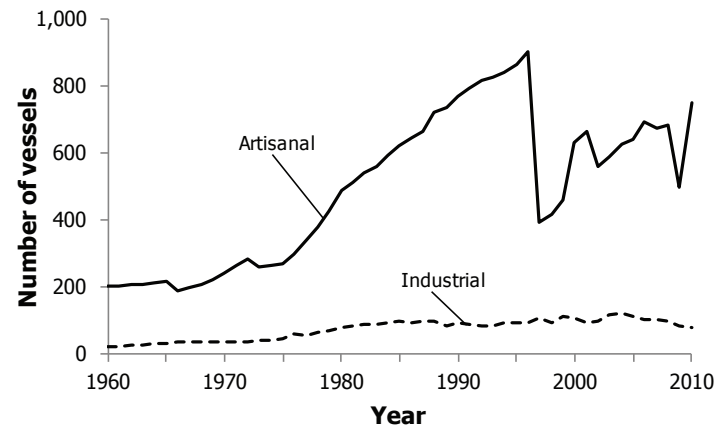
According to Defeo *et al.* (2011), the industrial fishing sector underwent three phases that depict long-term landing patterns: development, expansion and overexploitation-diversification. 1) The development phase ran approximately from the late 1960s to the second half of the 1970s. It was characterized by relatively low and constant landings. Fisheries tended to operate under open access regimes and the products were mostly channeled to domestic markets. 2) The expansion phase occurred during the second half of the 1970s and early 1980s, as a result of the 'Fishery Development Plan' carried out by Uruguay, which included the development of the industrial fishing fleet, port infrastructure and the concomitant increase of the processing sector. Uruguayan landings increased six fold between 1975 (26,000 t) and 1981 (147,000 t: historical maximum), as a result of increasing demand from foreign markets (e.g., Asia, USA) and the steady increase in the unit prices of fishery products. Landings were mainly based on three demersal fishes exploited by the industrial fleet: the Argentine hake (*Merluccius hubbsi*), the whitemouth croaker (*Micropogonias furnieri*) and the stripped weakfish (*Cynoscion guatucupa*). Improvements in fishery technology and government credits stimulated fishery activities. 3) The overexploitation-diversification phase began in the second half of the 1980s, but gained intensity during the 1990s. Two concurrent phenomena occurred during this phase: (a) the three demersal fishes mentioned above displayed a decreasing trend in catches and fishing yield, and showed signs of overexploitation in the case of the Argentine hake; and (b) new fisheries were developed on the basis of virgin or underexploited stocks of high unit value and international demand. Other fisheries developed, based on incidental or by-catch species. Landings of non-traditional fisheries represented more than 45% of total landings during the late 1990s (Milessi *et al.* 2005; Defeo *et al.* 2011). Consequently, total catches fluctuated around 110,000-130,000 t, similar to amounts seen in the early 1980s, but the increased pressure on non-traditional resources compensated for the depletion of traditional species, hiding the issue of fully exploited and overexploited stocks of formerly abundant species.

Data gathering for the industrial fleet was easier than in the artisanal sector because catch reporting is a formal requirement by the governmental agency (DINARA). Also, the relatively low number of vessels and companies makes monitoring, control and surveillance (e.g., VMS) much easier to perform. In addition, industrial operators have their own records as raw material. The annual series of catches started in 1975, when DINARA began systematic data collection of catch and effort statistics. Official data for the period 1960–1975 were based on pooled information (i.e., landings were not disaggregated by species, gear or fleet type). From 1975 onwards, data were discriminated by species and sub-sector (artisanal and industrial). Between 1975 and 1980, the annual value for each species was calculated as the sum of the catches recorded in each month. Statistical coverage for 1981, 1982, 1988 and 1989 were not performed by DINARA. Therefore, estimates for these years were obtained by a moving average procedure for a period of 5 years. Data from the DINARA and the FAO were reconciled, as the FAO data had a richer taxonomic composition.

Industrial catch statistics underestimated total catch, because vessels reported almost exclusively target species or species groups. Discards are entirely absent from the reported data series. To estimate total discards information from multiple sources on the various fleet types was amalgamated (Rey *et al.* 2000; Kelleher 2005). Also considered were the changes in fishing regulations enacted by DINARA (1997). Therefore, for the period 1960–2000, a discard rate of 14% was applied to the landings, whereas this rate was set to 9% for 2001–2010. Information on the species composition of discards from the two sources (Rey *et al.* 2000; Kelleher 2005) was also used to create a proportional taxonomic breakdown (Table 3).

### Recreational fisheries

A small recreational fishery exists in Uruguay. In a study on global recreational marine fishing participation, Cisneros-Montemayor and Sumaila (2010) approximated the recreational marine fishing participation rate in Uruguay as 0.78% of the population. This translates to 26,000 people in 2003. If we conservatively assume that each person fishes once per month for six months of the year, and catches 1 kg per trip, this would equate to 156 t·year<sup>-1</sup>. We set this as our 2010 anchor point and assume that recreational fishing began in the early 1950s. We interpolate the tonnage from zero tonnes in 1950 to 156 tonnes in 2010 to estimate a time series of recreational catch. It is known that *Micropogonias furnieri*, *Pogonias cromis*, *Brevoortia aurea*, *Mugil platanus*, *Menticirrhus americanus*, and *Macrodon ancylodon* are the main targets of recreational fishing. The relative proportions of these species within the artisanal species breakdown is used as a proxy breakdown for the recreational fishery (Table 4).



**Figure 2.** Number of vessels for the industrial and artisanal fleets in Uruguay, 1960–2010.

**Table 3.** Species composition of industrial discards (derived from Rey *et al.* 2000; Kelleher 2005)

Species	%
<i>Cynoscion guatucupa</i>	13.94
<i>Merluccius hubbsi</i>	59.81
<i>Micropogonias furnieri</i>	17.51
<i>Mustelus schmitti</i>	0.05
<i>Nemadactylus bergi</i>	0.90
Rajidae	7.37
<i>Squatina guggenheim</i>	0.02
<i>Umbrina canosai</i>	0.40

**Table 4.** Assumed species composition of the recreational catch (derived from the artisanal species breakdown).

Species	%
<i>Brevoortia aurea</i>	6.30
<i>Macrodon ancylodon</i>	1.64
<i>Menticirrhus americanus</i>	0.22
<i>Micropogonias furnieri</i>	89.80
<i>Mugil platanus</i>	1.41
<i>Pogonias cromis</i>	0.63



## RESULTS AND DISCUSSION

Our final estimates resulting from the reconstruction procedure of artisanal, industrial and recreational fisheries in Uruguay were compared to those of the Uruguayan government and FAO statistics (Figure 3a).

The database compiled here indicates that total reconstructed catches by Uruguay in its EEZ increased from just over 5,000 t·year<sup>-1</sup> in 1950 to a maximum of just over 171,000 t·year<sup>-1</sup> in 1981 (Figure 3a). Subsequently, catches declined to around 114,000 t·year<sup>-1</sup> by 2010. The total reconstructed catch for Uruguay was estimated to be slightly over 5.18 million t over the 1950–2010 time period. This was 25% higher than the catch reported by the FAO on behalf of Uruguay (4.13 million t; Figure 3a). Thus, the estimates provided in this paper show that catches made by the country are actually higher than previously thought, and that this is due to a combination of factors: 1) a gross underestimation of the artisanal catch; and 2) the amount of discard observed for the industrial fleet. Unreported recreational catches seem a minor contributor to total national catches.

The reported data does not fully account for the small-scale fisheries, which include the artisanal, subsistence and recreational sectors. Discards are also absent from the reported data. It was estimated that discards equate to approximately 10% of the total catch. Although industrial fisheries account for 90% of the total catch (including discards), artisanal and subsistence fisheries (8% and 2%, respectively; Figure 3a) are important for the economic stability and food security of the artisanal fishers.

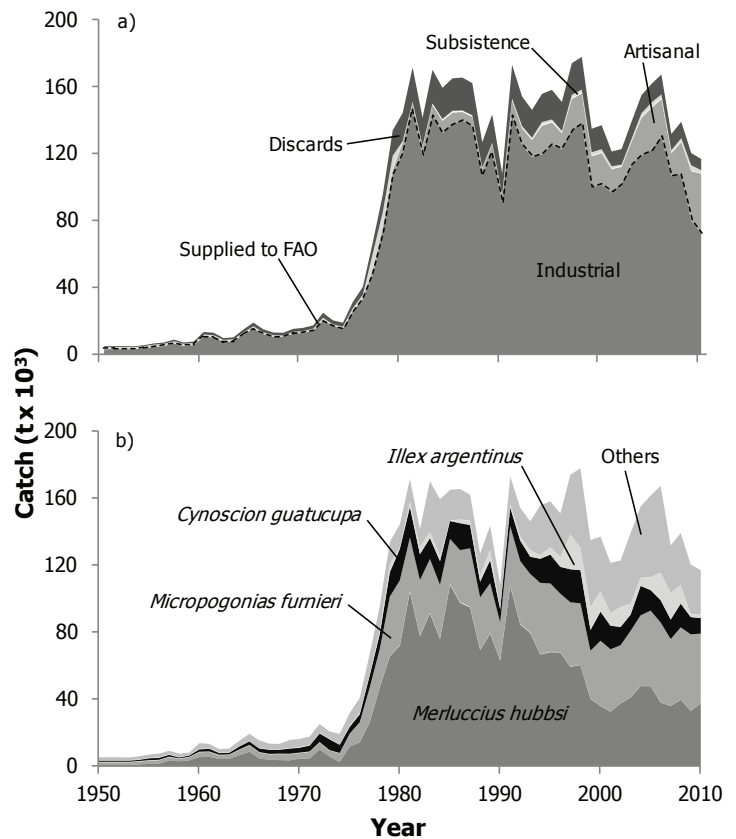
The total reconstructed catch was dominated by Argentine hake (*Merluccius hubbsi*), accounting for 43% of the catch (Figure 3b). Other important taxa included whitemouth croaker (*Micropogonias furnieri*; 25%), striped weakfish (*Cynoscion guatucupa*; 10%) and Argentine shortfin squid (*Illex argentinus*; 4%).

## ACKNOWLEDGEMENT

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**Figure 3.** Reconstructed total catch of Uruguay, 1950–2010, a) by sector (recreational not visible on graph). Note that FAO reported landings are superimposed as line graph (dotted line); and b) by species ('others' consists of 88 minor taxonomic groups).

**Appendix Table A1.** FAO landings vs. reconstructed total catch (in tonnes), and catch by sector with discards shown separately, for Uruguay, 1950-2010.

Year	FAO landings	Reconstructed total catch	Industrial	Artisanal	Subsistence	Recreational	Discards
1950	3,500	5,100	3,500	222	890	-	490
1951	3,500	5,110	3,500	224	888	3	490
1952	3,500	5,110	3,500	226	886	5	490
1953	3,400	5,000	3,400	228	884	8	476
1954	4,000	5,680	4,000	230	883	10	560
1955	4,900	6,710	4,900	232	881	13	686
1956	5,400	7,280	5,400	234	879	16	756
1957	6,900	9,000	6,900	235	877	18	966
1958	5,400	7,290	5,400	237	875	21	756
1959	5,900	7,860	5,900	239	873	23	826
1960	10,900	13,560	10,900	241	871	26	1,526
1961	10,500	13,110	10,500	243	870	29	1,470
1962	7,700	9,920	7,700	245	868	31	1,078
1963	8,100	10,380	8,100	247	866	34	1,134
1964	12,201	15,060	12,200	248	864	36	1,708
1965	15,800	19,160	15,800	250	862	39	2,212
1966	12,500	15,170	12,500	199	681	42	1,750
1967	10,900	13,240	10,900	175	592	44	1,526
1968	11,000	13,090	11,000	115	385	47	1,540
1969	12,700	15,420	12,700	207	687	49	1,778
1970	13,202	16,030	13,200	217	713	52	1,848
1971	14,402	17,490	14,400	238	776	55	2,016
1972	20,602	24,990	20,600	343	1,107	57	2,884
1973	17,502	20,510	17,500	119	381	60	2,450
1974	15,702	19,090	15,700	270	856	62	2,198
1975	26,004	31,550	26,000	446	1,399	65	3,641
1976	33,426	40,540	33,430	576	1,790	68	4,680
1977	47,954	67,230	47,950	3,060	9,430	70	6,714
1978	73,752	95,540	73,750	2,809	8,579	73	10,325
1979	107,556	134,000	107,560	2,808	8,498	75	15,058
1980	120,088	144,390	120,090	6,667	741	78	16,812
1981	146,598	171,610	146,600	3,971	441	81	20,524
1982	118,803	141,530	118,800	5,413	601	83	16,632
1983	143,360	170,180	143,360	6,002	667	86	20,070
1984	132,534	159,440	132,530	7,437	826	88	18,555
1985	137,754	165,040	137,750	7,119	791	91	19,286
1986	140,003	165,570	140,000	5,282	587	94	19,600
1987	136,686	162,190	136,690	5,648	628	96	19,136
1988	107,143	126,840	107,140	4,138	460	99	15,000
1989	121,452	143,590	121,450	4,534	504	101	17,003
1990	90,612	108,270	90,610	4,381	487	104	12,686
1991	143,227	173,100	143,230	8,747	972	107	20,052
1992	125,430	154,250	125,430	10,032	1,115	109	17,560
1993	118,195	146,240	118,200	10,245	1,138	112	16,547
1994	119,768	155,810	119,770	17,246	1,916	114	16,767
1995	125,599	158,200	125,600	13,410	1,490	117	17,584
1996	122,733	150,950	122,730	9,827	1,092	120	17,183
1997	134,739	174,130	134,740	18,365	2,041	122	18,863
1998	138,515	177,870	138,520	17,854	1,984	125	19,392
1999	100,070	134,980	100,070	18,700	2,078	127	14,010
2000	101,638	137,080	101,640	18,971	2,108	130	14,229
2001	97,081	121,400	97,080	13,906	1,545	133	8,737
2002	102,343	122,820	102,340	10,019	1,113	135	9,211
2003	113,133	139,160	113,130	14,141	1,571	138	10,182
2004	119,059	155,060	119,060	22,628	2,514	140	10,715
2005	122,463	161,710	122,460	25,275	2,808	143	11,022
2006	130,871	167,350	130,870	22,097	2,455	146	11,778
2007	106,802	131,850	106,800	13,755	1,528	148	9,612
2008	107,704	139,140	107,700	19,437	2,160	151	9,693
2009	80,245	120,430	80,240	29,529	3,281	153	7,222
2010	72,958	116,930	72,960	35,385	1,862	156	6,566

**Appendix Table A2.** Reconstructed total catch (in tonnes) by major taxa for Uruguay, 1950-2010. 'Others' contain 88 additional taxonomic categories.

Year	<i>Merluccius hubbsi</i>	<i>Micropogonias furnieri</i>	<i>Cynoscion guatucupa</i>	<i>Illex argentinus</i>	Others
1950	1,090	1,550	681	-	1,780
1951	1,090	1,550	681	-	1,780
1952	1,090	1,550	681	-	1,780
1953	1,080	1,550	679	-	1,680
1954	1,330	1,770	691	-	1,890
1955	1,710	1,890	1,108	-	2,000
1956	1,750	2,110	1,118	100	2,210
1957	3,580	2,150	1,047	100	2,130
1958	3,250	1,410	518	-	2,110
1959	3,790	1,830	728	100	1,410
1960	5,710	2,950	1,325	100	3,480
1961	5,880	2,940	1,618	-	2,670
1962	4,640	2,180	963	-	2,140
1963	4,680	2,390	971	-	2,340
1964	6,820	3,190	1,751	-	3,290
1965	8,920	3,780	2,121	-	4,340
1966	4,750	3,660	2,133	-	4,630
1967	4,210	3,160	2,390	100	3,370
1968	3,920	3,610	2,265	100	3,190
1969	3,760	3,680	3,038	100	4,840
1970	4,810	3,320	2,852	100	4,950
1971	4,910	3,900	3,483	100	5,100
1972	10,230	4,210	5,049	200	5,310
1973	5,970	3,580	6,492	200	4,280
1974	2,810	5,110	4,820	100	6,250
1975	12,020	7,380	4,088	520	7,540
1976	14,470	11,710	4,782	773	8,800
1977	26,530	20,540	7,274	362	12,530
1978	47,500	22,580	9,077	2,182	14,200
1979	66,060	35,210	14,658	4,668	13,400
1980	72,360	38,660	18,916	715	13,730
1981	104,540	31,980	18,435	3,085	13,570
1982	77,980	33,190	15,499	4,106	10,760
1983	91,700	32,060	12,552	3,609	30,270
1984	76,150	32,070	14,304	2,743	34,180
1985	108,690	27,080	10,756	333	18,180
1986	97,940	31,100	16,179	2,061	18,290
1987	95,140	35,020	13,962	2,603	15,470
1988	69,710	31,130	9,372	3,652	12,980
1989	79,500	29,800	13,807	6,071	14,420
1990	63,340	22,450	7,892	623	13,970
1991	107,880	35,400	11,287	2,065	16,470
1992	85,010	37,500	12,285	2,390	17,050
1993	79,810	34,990	10,342	3,806	17,290
1994	67,010	42,470	14,468	2,022	29,840
1995	68,390	40,800	17,274	4,182	27,560
1996	68,210	34,800	16,079	5,669	26,190
1997	59,650	38,250	19,741	20,857	35,630
1998	60,710	36,540	19,861	13,175	47,580
1999	40,420	28,510	12,395	13,679	39,970
2000	36,220	38,700	17,365	12,144	32,640
2001	32,840	36,970	14,098	7,373	30,110
2002	37,740	34,480	10,934	11,811	27,860
2003	41,340	39,420	9,760	6,363	42,280
2004	48,110	41,980	17,611	4,728	42,620
2005	48,070	44,840	12,289	7,743	48,770
2006	38,280	47,500	13,409	16,277	51,890
2007	36,330	39,570	11,699	15,900	28,350
2008	39,890	43,000	14,236	10,897	31,110
2009	33,340	45,380	10,330	1,586	29,790
2010	37,810	41,390	9,256	2,375	26,100