An overview of fish removals from Morocco by Distant-Water  $Fleets^{\scriptscriptstyle 1}$ 

# Dyhia Belhabib, Sarah Harper and Dirk Zeller

## Sea Around Us Project, Fisheries Centre, University of British Columbia 2202 Main Mall, Vancouver, V6T 1Z4 Canada

d.belhabib@fisheries.ubc.ca; s.harper@fisheries.ubc.ca; d.zeller@fisheries.ubc.ca

## Abstract

Morocco has productive fishing grounds. As such, especially the Atlantic areas of Morocco are targeted by distantwater fleets from more than 19 countries, which together caught approximately 90.8 million tonnes between 1950 and 2010. These foreign countries reported 64 million tonnes to FAO during the same time period for the entire Eastern Central Atlantic area (FAO area 34), which suggests massive underreporting. Asian fleets were found to have the highest level of underreporting, followed by Western Europe, with 300% and 80% higher catches than reported landings, respectively. Foreign catches increased dramatically after Morocco extended its jurisdiction over the southern areas in the mid-1970s, after which foreign catches decreased despite increasing fishing effort, suggesting over-exploitation.

#### INTRODUCTION

Morocco is located on the boundary between the Mediterranean Sea and the Atlantic Ocean in North West Africa (Figure 1), and experiences high productivity due to the flow of nutrient-rich Atlantic waters into the Mediterranean. The Moroccan central and southern EEZs are 254,020 km<sup>2</sup> and 300,653 km<sup>2</sup>, respectively. Together, these areas encompass the Canary Current Large Marine Ecosystem within which high marine productivity supports some of the most valuable fishing operations in the world (Cruzado 1979; Pauly *et al.* 2008). The narrow shelf of the central areas of Morocco offers good opportunities for pelagic fishing fleets, while a larger continental shelf in the southern areas, along with coastal upwelling, result in significant demersal and cephalopod resources for foreign fleets to exploit (Cruzado 1979; Pauly *et al.* 2008).

In 1956, Morocco was the first French colony in West Africa to gain independence. The former Spanish Sahara (here referred to as southern areas) was under Spanish colonial rule from 1884 to 1975. Spain handed over the former Spanish Sahara to Morocco and Mauritania under the Madrid treaty in exchange for fishing and phosphate mining rights in this area, ending the Spanish occupation. Mauritania forfeited its claim and Morocco extended its jurisdiction (Buteau 2005). Morocco is the only North African country with undiscovered oil resources, making its rich fishing grounds a significant source of foreign currency. These fishing grounds are attractive to foreign fleets, mostly from Europe and Asia, with foreign exchange earnings of US \$ 1.4 billion (Anon. 2011b). While Norway and France started fishing in these waters at the beginning of the twentieth century (Baddyr and Guénette 2001), Spain, through the former Spanish Sahara, granted fishing rights to Italy, Portugal, South Africa, the former Soviet Union, Japan and South Korea from 1950 until 1975 (Martínez Milán 2006). Thereafter, these grounds remained freely accessible to foreign fleets (Alder and Sumaila 2004). After Morocco extended its jurisdiction over the southern areas, access agreements were offered by Morocco and expanded to include countries from Eastern Europe (Barreira et al. 1998; Martínez Milán 2006).



**Figure 1.** Map of Moroccan central (Top) and southern (Bottom) areas.

<sup>&</sup>lt;sup>1</sup> Cite as: Belhabib, D., Harper, S. and Zeller, D. (2012) An overview of fish removals from Morocco by Distant-Water Fleets, 1950-2010. pp 41-60. In: Belhabib, D., Zeller, D., Harper, S., and Pauly, D. (eds.), Marine fisheries catches in West Africa, 1950-2010, part I. Fisheries Centre Research Reports 20 (3). Fisheries Centre, University of British Columbia, Canada [ISSN 1198-6727].

These agreements were justified by their potential financial contribution to food security and fisheries export developments (Atmani 2003). Although operating under fishing access agreements, foreign fishing countries do not supply catch data by Exclusive Economic Zone (EEZ) to the FAO. Rather, catch data are provided for the entire Eastern Central Atlantic area, which corresponds to FAO area 34, covering the area from Morocco in the north to the Democratic Republic of the Congo in the South, including high seas waters half way to the Americas. This makes it difficult to trace the spatial origin of catches and assess the real impacts of fishing access agreements with Morocco, where only a fraction of the catch is landed and where the true beneficiaries of these agreements are under question (Anon. 2011a). Countries considered here are those for which presence has been historically documented, including Portugal, Spain, Italy, Norway, France, the Netherlands and Germany for Western Europe; Bulgaria, Romania and Poland for Eastern Europe; the former Soviet Union and its members; Japan, China and Korea for Asia; and South Africa. Given the significance of these fisheries, we herein analyse foreign catches in the waters of Morocco to provide more realistic estimates of these catches than what has been officially reported.

# Methods

In this study, we independently estimated catches by each foreign country operating in the central areas of Morocco corresponding to the northern Atlantic area and the southern areas of Morocco (i.e., the former Spanish Sahara), which allows higher spatial resolution to refflect the species distribution. An extensive literature review resulted in a number of fragmentary catch time series and anchor points for 19 countries. We used these data to complete foreign catch estimates by country, including unreported catches. Illegal catches were only estimated for the Russian Federation, which prominently fished for small pelagics in the southern areas. We then compare reconstructed catches to the data supplied to FAO for the entire FAO area 34, since no other EEZ specific baseline was available. However, this provides a general idea of underreporting tendencies by foreign countries fishing in the waters of Morocco (and the rest of West Africa).

# Moroccan central areas

Most of the foreign catches reported in waters under Morocco's jurisdiction were from the southern areas, and represented 70% of the total reported landings by foreign fleets (Belveze and Bravo de Laguna 1980; Kaczynski 1989). Similarly and more recently, Riché (2004) inferred that a large amount of catches off Morocco by the international fleets are actually from these same southern areas. Therefore, we assumed catches in central Morocco represented 30% of the total catch by foreign vessels during the 1950-2010 time period. This translates into catches from central Morocco being the equivalent of 42% of catches from the southern areas, i.e., foir every tonne taken from the southern areas, 0.42 tonnes is taken from the central areas. Here, we first estimated foreign catches in the southern areas, then applied the previously suggested rate to estimate foreign catches from the central areas.

# Moroccan southern areas (former Spanish Sahara)

## Spain

Data for Spanish catches from the southern areas were available from 1950 to 1998 (Guénette *et al.* 2001). To update these catches, we estimated a catch per unit of effort (CPUE) of 1,617 t· boat<sup>-1</sup>·year<sup>-1</sup> in 1997 based on a catch of 194,632 t·year<sup>-1</sup> (Guénette *et al.* 2001) and the number of Spanish vessels operating in these waters. We assumed that the number of vessels operating in the southern areas was proportional to the catch, i.e., off the 172 Spanish vessels fishing under agreements with Morocco, 70% were operating in the southern areas in 1997 (Belveze and Bravo de Laguna 1980; Milano 2006). Then we applied this CPUE to 70% of the reported 110 Spanish vessels in 2010 under the EU-Morocco Agreement (<u>eur-lex.europa.eu</u> [2012]), to estimate a catch of 83,835 t·year<sup>-1</sup> for 2010. We interpolated catches from 121,065 t·year<sup>-1</sup> in 1998 (Guénette *et al.* 2001) to 83,835 t·year<sup>-1</sup> in 2010. Using the catch composition from Guénette *et al.* (2001) for 1998, we disaggregated updated total catches from 1999 to 2010 into the 5 groups, i.e., 41% small pelagics, 45% demersal and deep water fish, 6% miscellaneous fish, 8% cephalopods and 2% other invertebrates. We disaggregated the cephalopod group reported by Guénette *et al.* (2001) into three taxa according to Ariz (1985): Octopus (67%), squid (22%) and cuttlefish (11%). Then, we completed the gaps, when no catches of cephalopods were reported using estimates presented in Balguerías *et al.* (2000), and when catches from Guénette *et al.* (2001) were considered comparatively low. Thereafter, we assigned 3.6% of the miscellaneous fish group to tunas and large pelagics and 96.4% to miscellaneous fish (Balguerias 1985).

## <u>Italy</u>

Italy started fishing in the southern areas through an agreement with the Spanish government in 1963 (Martínez Milán 2006), and continuously fished until 2011 under the EU-Morocco fishing partnership agreements. Barbier (2003) reported a catch of 450,000 t·year<sup>-1</sup> in 1969, which corresponds to a period when foreign fishing boat traffic was high (Martínez Milán 2006; Besenyő 2009). According to the FAO statistics, catches by Italian vessels in FAO area 34 decreased by 95% from 1969 to 2010. Therefore, we estimated that catches in 2010 would be 22,477 t·year<sup>-1</sup>,

An overview of fish removals from Morocco by DWFs-Belhabib et al.

95% lower than catches in 1969. We then interpolated linearly from zero in 1963 to 450,000 t·year<sup>-1</sup> in 1969 then to 22,477 t·year<sup>-1</sup> in 2010. We disaggregated Italian catches based on the targeted species composition from Martínez Milán (2006): octopus (20%), demersal fish (20%), crustaceans (20%), cephalopods (20%), sharks (5%), rays (5%) and others (10%).

## **Portugal**

Portuguese vessels started fishing in the southern areas in 1963 (Martínez Milán 2006) and caught 22,000 t·year<sup>-1</sup> in 1969 (Barbier 2003). Data from the FAO fisheries statistics database suggest that Portuguese reported landings decreased continuously from 1969 to 2010 by 68%. Using this rate, we estimated a total catch of 7,087 t·year<sup>-1</sup> in the southern areas of Morocco for 2010. We performed a series of linear interpolations from zero in 1963 to 22,000 t·year<sup>-1</sup> in 1969, then to 7,087 t·year<sup>-1</sup> in 2010. We disaggregated catches using the species composition in Guénette *et al.* (2001).

## Germany (former East Germany)

The former German Democratic Republic (GDR) mackerel catch data were available from 1967 to 1972 and from 1978 to 1983, and sardine catches were available from 1974 to 1980, which we carried onward assuming a constant figure (FAO 1985a). We performed a series of linear interpolations to complete sardine and mackerel catch estimates from zero in 1963 to 1,561 t·year<sup>-1</sup> in 1974 for sardine and from zero in 1963 to 569 t·year<sup>-1</sup> in 1978 for mackerel, assuming East Germany started fishing in this area along with other important European fleets (Martínez Milán 2006). We estimated total catches by applying the ratio (mackerel + sardine): (other species) of 1.8. Between 2006 and 2010, 6 boats per year were operating in Western Sahara, which when multiplying by a CPUE of 1,607 t·year<sup>-1</sup>·boat<sup>-1</sup> allows for a total catch of 9,642 t·year<sup>-1</sup> from 2006 to 2010. We interpolated linearly to complete the estimate from 1983 to 2006. Since the Democratic Republic of Germany ceased to exist and was incorporated into the Federal Republic of Germany in 1990, we simply considered catches as 'German' for the entire time period.

## <u>Norway</u>

Norway was fishing in the southern areas as far back as 1918 (Baddyr and Guénette 2001). Sardine catches from Morocco were reported for a group of countries all together including Norway, the former Soviet Union, Poland, Romania, Bulgaria and Bermuda<sup>2</sup> at 425,900 t year<sup>-1</sup> in 1974, while catches by the former Soviet Union, Poland, Romania, Bulgaria and Bermuda (i.e., excluding Norway) were estimated at 318,606 t-year<sup>-1</sup> for the same year (Belveze and Bravo de Laguna 1980; FAO 1985a; Anon. 2011a). Therefore, the subtraction allowed to estimate the Norwegian catch from Morocco. We assumed 70% of these catches were from the southern areas and 30% from the central areas (Belveze and Bravo de Laguna 1980; Kaczynski 1989; Riché 2004), and estimated Norwegian sardine catches of 75,106 t year in southern areas in 1974. Norway's sardine catch was the equivalent of 83% of Spanish small pelagic catches in 1974. Thus, assuming a constant figure over time, which is likely since Norway and Spain started fishing similarly targeting the same species under Spanish permits, we applied this rate (83%) to the Spanish small pelagic catch from 1950 to 1973 and 1975. After Spain left the former Spanish Sahara in 1975, agreements were no longer offered by Spain, therefore, we used a different approach to estimate Norwegian catches off these areas. Catch data reported by Norway to FAO from FAO area 34 in 1998 were 15% of the reported catch of 1975. Thus, we prorated Norway's 1998 sardine catch to 15% of the estimated Norwegian sardine catch of 1975 (94,712 t-year<sup>-1</sup>), i.e., 14,207 t year in 1998. We assumed catches were zero in 2010 when Norway stopped fishing in the southern areas under agreements with Morocco (Anon. 2010). We performed a series of linear interpolations to complete the estimated sardine catch by Norway. Mackerels (Scomber spp.) catches represented the equivalent of 11% of the estimated sardine catches between 1971 and 1975 (FAO 1985a). By applying this to the reconstructed sardine catch, we estimated mackerel catches from 1950 to 2010. Then, we applied a ratio (mackerel + sardine): (other species) of 1.8 (FAO 1985a; Goffinet 1992) to estimate catches of other species and then disaggregated catches using the same method as for Spain.

## <u>France</u>

France has also been fishing in Morocco since 1918 (Baddyr and Guénette 2001). France's sardine catches were documented from 1965 to 1975 only from Moroccan central areas (FAO 1985a). Therefore, we carried the 1965 catch estimate backwards, assuming a constant figure from 1950 to 1965. Then, we applied a CPUE estimate of 1,617 t·boat<sup>-1</sup>·year<sup>-1</sup> to the number of French vessels authorized to fish in the waters under Moroccan jurisdiction, i.e., 9 boats in 2010. A large portion of the small pelagic stocks including sardine lies in the southern areas. Therefore, we conservatively assumed France's sardine catches were the equivalent of 30% of the catch reported from Moroccan central areas. To complete the estimate for other small pelagic species, we assumed these represented 20% of the total catch based on the average ratio between sardine catches and small pelagic catches by Norway and Spain. Then, we smoothed the estimated catch data time series.

 $<sup>\</sup>frac{1}{2}$  According to the reflagging history of vessels from Bermuda, these are suspected to be Spanish vessels (www.grosstonnage.com [Accessed on 02/08/2012]).

# The Netherlands

We assumed the Netherlands started fishing off Morocco in 1963 (Martínez Milán 2006). From 1972 to 1974, 20 Dutch vessels were operating in the southern areas (Barreira *et al.* 1998), and from 2006 to 2010, 6 vessels, i.e, a third of the total of 18 vessels allowed for Lithuania, Germany and the Netherlands (<u>eur-lex.europa.eu</u> [2012]). We performed a series of linear interpolations from zero vessels in 1963 to 20 in 1972, and from 20 in 1974 to 6 vessels in 2010 to complete the effort time series. Then, we applied a CPUE of 1,607 t·boat<sup>-1</sup>·year<sup>-1</sup> to the interpolated effort to estimate the total catch by the Netherlands.

## <u>Japan</u>

Barbier (2003) documented catches by Japan from 1964 to 1985. These catches were concordant with the decrease observed by Kaczynski (1989) of 25% from 1976 to 1985. Barbier (2003) reported no catches from 1950 to 1963; however, Barreira *et al.* (1998) reported that Japan, along with Spain, was already fishing in the southern area waters since 1950, targeting cephalopods. Therefore, given a similar fishing effort, we assumed that Japan caught the same quantity as Spain in 1950, and then interpolated linearly to 20,196 t-year<sup>-1</sup> in 1964 (Barbier 2003). Morocco signed several agreements with Japan to develop Moroccan fisheries, with the last agreement signed in 2009. To estimate Japanese catches, we calculated the rate of change from 1985 to 2010 from Japanese catch data in area 34, i.e., a decrease of 14%, which we applied to the catch in 1985, i.e., 225,000 t-year<sup>-1</sup> (Barbier 2003). Thereafter, we interpolated linearly to complete the time series.

# The Republic of Korea (South Korea)

South Korea started fishing in the southern areas in 1963 (Martínez Milán 2006), and caught around 50,000 t-year<sup>-1</sup> in 1969 (Barbier 2003). According to the FAO statistics database, reported catches by the Republic of Korea in FAO Area 34 increased 2.89 times from 1969 to 1981 and then decreased by 75% from 1981 to 2010. We applied these rates to the catch in 1969 and estimated the Korean catch in the southern areas to be 94,674 t-year<sup>-1</sup> in 1981 and 23,101 t-year<sup>-1</sup> in 2010. We performed a series of linear interpolations to complete the Korean catch time series from southern areas. To disaggregate catches, we assumed the Korean fleet targeted the same species as other fleets (Barbier 2003) and used the species breakdown in Guénette *et al.* (2001).

# <u>China</u>

China signed the first fishing agreement with Morocco in 1985, and has been fishing there ever since. China operated 63 to 70 Chinese vessels under joint ventures off Morocco in 2003 and 2010<sup>3</sup>. Therefore, we assumed the number of boats was zero in 1985, and we interpolated linearly to an average of 63 boats in 2003 and then to 70 boats in 2010. We multiplied the number of boats by an average CPUE of 2,283 t-year<sup>-1</sup>-boat<sup>-1</sup> (based on data in Pauly *et al.* 2012) to estimate total catches from 1985 to 2010.

# Former Union of Soviet Socialist Republics (USSR) members

According to the FAO statistics database, the former USSR and its members started reporting catches in 1988. However, Belveze and Bravo de Laguna (1980) documented catches by the USSR off Morocco as early as 1964. Barbier (2003) and FAO (1985a) estimated sardine and mackerel catches by USSR as well as Romania which started fishing in these waters in 1967. We first interpolated catches from zero in 1964 to the reported catch of sardine in 1970 (80,100 t·year<sup>-1</sup>) and the reported catch of mackerel in 1973 (111,765 t·year<sup>-1</sup>). Goffinet (1992) reported total catches of 200,000 t·year<sup>-1</sup> for 1970, therefore, using the ratio (mackerel + sardine): (other species) of 1.8, we estimated other taxa caught by the USSR fleets from 1964 to 1970. We then interpolated all catches from 200,000 t·year<sup>-1</sup> in 1970 to zero in 1991 (Garibaldi and Grainer 2002) when the Soviet Union ceased to exist.

Illegal catches by the USSR were estimated by Goffinet (1992) to be around 250,000 t·year<sup>-1</sup> in the 1970s and the 1980s. We assumed these catches started in 1965 along with legal fishing activities, increased linearly to 250,000 t·year<sup>-1</sup> in 1971, remained constant until 1987, then decreased linearly to be zero in 1991.

<u>Russian Federation</u>: the Russian Federation (Russia) renewed fishing agreements with Morocco up until 2011 (Eyckmans 2011). Under these agreements, the Russian Federation was mainly operating in the southern areas, catching around 100,000 t·year<sup>-1</sup> (Eyckmans 2011). We reconstructed Russian catches from 1950 to 1991 as part of the former USSR catch, and independently as the Russian Federation after the collapse of the Soviet Union. Assuming the same Soviet Union catch allocation as for Mauritania (IMROP, unpub. data), Russian catches represented 22% of the total Soviet Union catch from 1950 to the late 1980s. Russian catches were then around 100,000 t·year<sup>-1</sup> from 2000 to 2010, when Russia was mostly fishing off the southern areas (Eyckmans 2011). Thereafter, we performed a linear interpolation to complete the estimate and disaggregated catches taxonomically using the same method applied to Spain.

<sup>3</sup> <u>http://wuxizazhi.cnki.net/Search/ZYJJ200402001.html</u>, <u>http://www.leconomiste.com/article/la-peche-hauturiere-en-crise-grave</u> and <u>http://www.aujourdhui.</u> <u>ma/economie-details35916.html</u> [Accessed August 13<sup>th</sup>, 2011]. An overview of fish removals from Morocco by DWFs-Belhabib et al.

Lithuania: Lithuanian vessels took 22% of total catches by the Soviet Union (IMORP, unpub. data) from 1950 to 1990. We applied this rate to catches by the USSR from 1950 to 1990. The agreement between Morocco and the EU in 2006 allowed Lithuania, Germany and the Netherlands to operate 18 industrial fishing vessels in Morocco for a quota of 50,000 t·year<sup>-1</sup>. We assumed the effort was distributed evenly between Lithuania, Germany and the Netherlands and allocated 1/3, i.e., 6 vessels per year to each of the above mentioned countries from 2006 to 2010. We used a CPUE of 1,607 t· boat<sup>-1</sup>·year<sup>-1</sup>, i.e., the same as for Spain, to estimate total catches by Lithuania from 2006 to 2010. We then performed a linear interpolation from 1990 to 2010.

Latvia and Ukraine: Latvia and the Ukraine represented 33% and 22% respectively of former Soviet Union catches (IMROP, unpub. data). Therefore, we applied these rates to the Soviet Union reconstructed catch to allocate the catches to country assuming a constant figure over time. No catches were recorded after 1991, since the Ukraine resumed agreements with Morocco only in 2012 (Danine 2012), while Latvia resumed fishing with one vessel in the southern areas in 2011 (Catzeflis 2011).

Other former Soviet republics, such as Georgia and Estonia were not reported historically as having significant catches from the waters of Morocco, thus they were not considered in the present study.

### <u>Romania</u>

Romania started fishing in the southern areas of Morocco in 1967 (FAO 1985a). Landings by the Romanian fleet from these areas were documented by FAO (1985a) from 1971 to 1983 for mackerel, and from 1974 to 1981 for sardine. We assumed Romania stopped fishing in the southern areas (at least legally) in 1993 when catches for FAO area 34 were no longer reported to FAO. We then interpolated linearly to complete the time series. Thereafter, we applied the same approach as for the USSR to determine the portion of other species caught along with sardines and mackerels. We disaggregated catches using the species composition presented in Guénette *et al.* (2001).

### **Bulgaria**

Catches of mackerel and sardine by Bulgaria were estimated by FAO (1985a), since 1968 and 1973, respectively. We assumed Bulgaria started fishing in the southern areas when Bulgaria started reporting catches from area 34 to the FAO, i.e., 1964 and ended its fishing activities in the area in 2000. We interpolated linearly each estimate from zero in 1964 to the first anchor point for both species, then from 1983 and 1982 respectively for mackerel and sardine to 0 zero in 2000. We then applied the ratio (mackerel + sardine): (other species) of 1.8 to estimate catches of other species.

## <u>Poland</u>

Poland reported catches in FAO area 34 between 1957 and 2010, and caught 19,000 t-year<sup>-1</sup> from the southern areas in 1969 (Barbier 2003). FAO (1985a) reported sardine catches from 1970 to 1977, then in 1979, and mackerel catches from 1967 to 1977 and for 1980 and 1981. Here we considered that Poland started fishing in the southern areas in 1963 (FAO 1985b). To estimate the catch in 2010, we used the rate of change of the Polish landings in area 34 as reported to FAO from 1981 to 2010, when reported landings increased by a factor of 24. We estimated a catch of mackerel of 2,137 t-year<sup>-1</sup> and a catch of sardine of 38,759 t-year<sup>-1</sup> in 2010 from the southern areas. We performed a series of interpolations to complete the time series for sardine and mackerel. Thereafter, we estimated catches of other taxa using the ratio (sardine and mackerel): (other species) as 0.41 (Barbier 2003), then disaggregated catches using the catch composition in Guénette *et al.* (2001).

#### South Africa

South Africa did not report any catches from the Eastern Central Atlantic (FAO area 34). However, South Africa is fairly active in the area, and started fishing off Morocco as early as 1963 (Martínez Milán 2006), catching an estimated 100,000 t·year<sup>-1</sup> in 1969 (Barbier 2003), and was still operating there in 2008 (Anon. 2008). Although South Africa has diplomatic relationships with the unofficial government of 'Western Sahara' (here Morocco southern areas), which would infer prohibiting fishing activities in these waters under Moroccan licensing, South African companies were operating under private Moroccan licenses in 2008 (Anon. 2008). Therefore, we assumed catches in 2010 by South Africa in the southern areas were 1% of the 1969 catch as a conservative approach, since catches decreased substantially with improved diplomatic relations between the unofficial government and South Africa. We then interpolated linearly to complete the time series, and applied the species breakdown provided in Guénette *et al.* (2001).

To allow for comparison and assess underreporting, FAO landings by each country were extracted from FAO FishstatJ covering the entire FAO statistical area 34 from Morocco in the North to the Democratic Republic of the Congo in the South. These were then compared to reconstructed catches, as estimated here, to assess the levels of reporting by each country.

## Results

### Total reconstructed catches

Total foreign catches in the waters of Morocco were estimated to be 90.8 million tonnes between 1950 and 2010, compared to 56.9 million tonnes reported to FAO from the complete FAO area 34, which suggests strong underreporting at least by 30%. This assumes all catches in area 34 outside Morocco were properly reported. Catches increased from on average 175,000 t·year<sup>-1</sup> in the 1950s to a peak of 4.3 million t·year<sup>-1</sup> in 1978, after Morocco took over the former Spanish Sahara, and then decreased to one million t·year<sup>-1</sup> in 2010 (Figure 2a).

Total foreign catches in the southern areas were estimated at 65.8 million tonnes from 1950 to 2010, 13% higher than catches supplied by these countries to FAO for the entire FAO area 34, i.e. 56.9 million tonnes (Figure 2a). Catches followed the same pattern as the data supplied to FAO, increasing from 110,000 t·year<sup>-1</sup> in 1950 to a peak of 3 million t·year<sup>-1</sup> in 1978, after Morocco extended their jurisdiction over the former Spanish Sahara (Figure 2a). Catches decreased thereafter to around 753,000 t·year<sup>-1</sup> in 2010 compared to 623,000 t·year<sup>-1</sup> supplied to the FAO for the entire FAO area 34 (Figure 2a). Overall, catches from the southern areas were 14% higher than landings supplied to FAO from FAO area 34 in the 1950s, 30% to 100% higher in the 1980s, and up to 55% higher in the 2000s.

Total foreign catches in central waters were estimated at 25 million tonnes between 1950 and 2010, the equivalent of 40% of the foreign catch from the waters off Western Sahara. Foreign catches from Morocco's central areas (50 million tonnes) represented half of landings data supplied to FAO for the FAO area 34 between 1950 and 2010 (Figure 2a).

Overall, catches include 40% of clupeids (sardines and sardinellas), 23% of demersal fish species (Sparidae and Mercuccidae), 21% of cephalopods including squids, octopus and cuttlefish, 6% of large pelagic species, and 10% of other miscellaneous marine species (Figure 2b).

### Southern areas

#### <u>Spain</u>

Spanish catches from the waters of the southern areas, were reconstructed to be 12 million tonnes for the time period considered in this study, which was almost as high as total catches declared by Spain from the entire FAO area 34 (13.6 million tonnes). Between 1950 and 2010, Spanish reconstructed catches were 20% higher than the reported catch by Spain covering the entire FAO area 34 (Figure 3). Spanish catches from the southern areas increased from 52,000 t-year<sup>-1</sup> in the 1950s to 378,000 t-year<sup>-1</sup> on average in the late 1970s corresponding to the highest catch, when these areas were a free fishing access zone. Catches decreased thereafter to less than 125,000 t-year<sup>-1</sup> in 2010.



**Figure 2.** Total reconstructed foreign catches by a) the two areas of Moroccan waters conscribed; and b) by taxon, compared to total reported catches by the same foreign countries from FAO area 34, 1950-2010.



**Figure 3.** Reconstructed Spanish catch from Morocco central and southern areas, compared to the reported catch by Spain from FAO area 34, 1950-2010.



**Figure 4.** Reconstructed catches by Italy from Morocco central and southern areas, compared to the reported catch by Italy from FAO area 34, 1950-2010.

<u>Italy</u>

Italian catches were estimated at 11.6 million tonnes between 1950 and 2010, i.e., 8 times higher than what Italy submitted to FAO for the entire FAO area 34 (1.5 million tonnes), which suggests substantial underreporting. Italian catches from the southern areas increased from zero in 1963, when Italy started fishing in the area, to 562,500 t-year<sup>-1</sup> in 1968, compared to 62,000 t-year<sup>-1</sup> supplied to the FAO for FAO area 34 (Figure 4).

#### **Portugal**

Portuguese catches were estimated at 665,000 tonnes for the period 1950 to 2010, which represented 50% of the catch data supplied by Portugal to FAO for FAO area 34, i.e., 1.4 million tonnes (Figure 5). During the 1960s and the early 1970s, Portuguese reconstructed catches in the southern areas were as high as the Portuguese data supplied to FAO for the entire area 34 (Figure 5). Reconstructed catches were around 10% higher than the reported catch in FAO area 34 in 1980, i.e., 17,800 t-year<sup>-1</sup> compared to 16,030 t-year<sup>-1</sup> (Figure 5).

#### **Germany**

German catches were estimated at 567,000 tonnes between 1950 and 2010. Catches varied substantially over the study period, however, there was an increasing trend from 3,200 t·year<sup>-1</sup> in 1964 to a peak of 31,500 t·year<sup>-1</sup> in 1970 and then a decreasing pattern to a plateau of 9,600 t·year<sup>-1</sup> in the 2000s (Figure 6).

#### <u>France</u>

French catches from the southern areas totalled 124,000 tonnes between 1950 and 2010. French catches increased from 2,100 t·year<sup>-1</sup> in 1950 to a peak of 4,300 t·year<sup>-1</sup> in 1969 (Figure 7). Catches decreased thereafter, and were estimated at 1,600 t·year<sup>-1</sup> in 2010 (Figure 7).

#### <u>Norway</u>

Norwegian catches were estimated at over 2.9 million tonnes for the 1950-2010 time period. Catches increased from 4,000 t·year<sup>-1</sup> in 1950 to a peak of 163,000 t·year<sup>-1</sup> in 1975 (Figure 8). Norwegian catches decreased rapidly



Figure 9. Reconstructed catches by the Netherlands from Figure 8. Reconstructed catches by the Netherlands from FAO area 34, 1950-2010. catch by Norway



Figure 5. Reconstructed catches by Portugal from areas, Morocco Atlantic compared to reported catch by Portugal from FAO area 1950-2010. 34,



Figure 6. Reconstructed catches by Germany areas, compared from the southern to reported FAO catches by Germany from area 1950-2010. 34,



**Figure 7.** Reconstructed catches by France from Morocco central and southern areas, compared to reported catches by France from FAO area 34, 1950-2010.



Figure 8. Reconstructed catches by Norway from Morocco Atlantic areas, compared to reported catch by Norway from FAO area 34, 1950-2010.

to zero in 2010 when Norway gave up fishing operations in the southern areas (Figure 8).

#### The Netherlands

Catches by the Netherlands increased from 5,000 t·year<sup>-1</sup> in 1964 to a peak of 33,700 t·year<sup>-1</sup> in the mid-1970s, then decreased gradually to 9,900 t·year<sup>-1</sup> on average in the late 2000s (Figure 9). The Netherlands reported catches from the FAO area 34 only since the mid-1990s, therefore, all reconstructed catches prior to the mid-1990s were not reported (Figure 9). After 1995, Netherlands' reconstructed catches represented 17% of the catch reported to FAO in FAO area 34 on average.

#### <u>Japan</u>

The Japanese fleet, which operated from 1950 to 2010 in the southern areas, caught over 11.1 million tonnes during this time period. Japanese catches were almost 3 times higher than data supplied by Japan to FAO for the entire FAO area 34 (3.1 million tonnes), which suggests substantial underreporting by Japan (Figure 10). Although underreporting by Japan was already high in the late 1960s, the underreported component further increased after Morocco extended their jurisdiction over the former Spanish Sahara in the mid-1970s (Figure 10). The underreported component was at its maximum in 2002, when Japan caught 203,600 t-year<sup>-1</sup> in the southern areas compared to 8,440 t-year<sup>-1</sup> for the whole FAO area 34 supplied to the FAO, i.e., 23 times higher. The peak of Japanese catches off the southern areas corresponds to the maximum Japanese catch of the entire FAO area 34 in the late 1960s. Thereafter catches decreased but at a slower rate than reported Japanese catches in the entire FAO area 34 (Figure 10).

#### South Korea

South Korean catches were estimated to be 276,000 tonnes for the period between 1950 and 1964, during which Korea supplied no catch data for FAO area 34 to FAO (Figure 11). Thereafter, catches were about 50% higher than the data supplied by Korea to FAO, i.e., 2.8 million tonnes compared to 1.8 million tonnes reported to FAO. Korean catches increased gradually to a peak of 95,120 t·year<sup>-1</sup> in 1981 and decreased thereafter to 23,200 t·year<sup>-1</sup> in 2010, almost as high as the catch



**Figure 14.** Reconstructed catches by Lithuania from Morocco central and southern areas, compared to reported catches by Lithuania from FAO area 34, 1950-2010.



**Figure 10.** Reconstructed Japanese catches from Morocco central and southern areas, compared to the reported catch by Japan from FAO area 34, 1950-2010.



**Figure 11.** Reconstructed catches by South Korea from Morocco central and southern areas, compared to reported catch by South Korea from FAO area 34, 1950-2010.



catches Figure Reconstructed by China from 12. compared and southern Morocco central areas, to catches by China from FAO area 34, 1950-2010. reported



**Figure 13.** Catches by Russia from Morocco central and southern areas, compared to reported catches by the Russian Federation from FAO area 34, 1950-2010.

supplied by Korea to FAO for the entire FAO area 34, i.e., 23,700 t·year<sup>-1</sup> (Figure 11).

## China

Chinese catches were estimated at 1.7 million tonnes between 1950 and 2010, compared to a reported catch of 360,012 tonnes in FAO area 34, which suggests substantial underreporting (Figure 12). Chinese catches increased from 5,200 t-year-1 in 1986 to 110,269 t-year-1 in 2010, showing an increasing presence of Chinese fishing fleets in the southern areas (Figure 12).

#### Former Soviet Union

<u>Russian Federation:</u> Russian catches from the southern areas were estimated at 4.4 million tonnes between 1950 and 2010, which is 30% of the catch by the former Soviet republics. Catches started at 16,700 t-year<sup>-1</sup> in 1966, increasing to a peak of 263,130 t·year<sup>-1</sup> in 1978. Catches decreased thereafter to 27,600 t-year<sup>1</sup> in 1991 with the collapse of the Soviet Union and then increased to around of 100,000 t-year-1 from 2001 onwards (Figure 13).

Lithuania: Similarly, Lithuanian catches increased from 16,700 t year in 1966 to a peak of 263,000 t-year-1 in 1978. Catches decreased rapidly to 27,600 t-year-1 in 1991 and then to 9,700 t vear by 2010. Overall, catches by Lithuania were estimated at 3.1 million tonnes between 1950 and 2010, accounting for 21% of catches by all former Soviet republics considered here (Figure 14).

Latvia: Catches by Latvia from the southern areas totalled 4.1 million tonnes, most of which were caught within the 1970-1990 time period, with a peak of 263,000 t year in 1978. Latvian catches represented over 29% of the total catch by former Soviet republics (Figure 15).

Ukraine: Ukrainian catches followed the same trend as other former Soviet Union members. Catches were estimated at 2.8 million tonnes between 1950 and 2010, which is 19% of the total catch by republics of the former Soviet Union. Catches increased from 16,700 t-year<sup>-1</sup> in 1966 to a peak of 263,000 t-year<sup>-1</sup> in 1978, then decreased rapidly to zero from 1991 onwards (Figure 16).



Figure 19. Reconstructed catches by Poland from Morocco Figure 18. Reconstructed catches by Bulgaria from Morocco Poland fromFAO area 34, 1950-2010.



Figure 15. Reconstructed catches by Latvia from Morocco central and southern areas, compared to reported catches by Latvia from FAO area 34, 1950-2010.



Figure 16. Reconstructed catches by Ukraine from Morocco central and southern areas, compared to catches supplied by Ukraine from FAO area 34, 1950-2010.



Figure 17. Reconstructed catches by Romania from Morocco Altantic areas, compared to the reported catch by Romania from FAO area 34, 1950-2010.



central and southern areas, compared to the reported catch by central and southern areas, compared to the reported catch by Bulgaria from FAO area 34, 1950-2010.

# <u>Romania</u>

The reconstructed Romanian catch was estimated to be over 261,700 tonnes for the 1950-2010 time period. Catches reached a maximum of 68,200 t-year<sup>-1</sup> in 1976, and then decreased to zero since 1984 (Figure 17). In the mid-1970s, reconstructed catches surpassed reported catches by Romania from the entire FAO area 34 (Figure 17).

# <u>Bulgaria</u>

Bulgarian catches in the southern areas increased from zero in 1963 to a peak of 49,500 t·year<sup>-1</sup> in 1979, when Bulgarian data as supplied to FAO were zero for FAO area 34 (Figure 18). Overall, reconstructed Bulgarian



**Figure 20.** Reconstructed catches by South Africa from Morocco central and southern areas, no catches were reported to FAO from FAO area 34, 1950-2010.

catches were slightly higher than reported catches, which indicates underreporting by Bulgaria (Figure 18).

# <u>Poland</u>

Polish catches were estimated at 3.5 million tonnes over the period from 1950 to 2010, twice higher than the catch supplied by Poland to FAO for the entire FAO area 34, i.e., 1.2 million tonnes (Figure 19). Catches increased drastically in the mid-1970s to 470,000 t·year<sup>-1</sup>, and then decreased to less than 6,000 t·year<sup>-1</sup> in the early 1980s. Thereafter, catches increased by a factor of 24 from 1985 to 2010, when Polish catches were estimated at 141,000 t·year<sup>-1</sup> (Figure 19).

# South Africa

Although South Africa did not supply catch data from FAO area 34 to FAO, a total catch of 2.5 million tonnes was estimated, increasing from 11,000 t·year<sup>-1</sup> in 1961 to a peak of 100,000 t·year<sup>-1</sup> in 1969, and then decreasing to 1,000 t·year<sup>-1</sup> by 2010 (Figure 20).

# Central areas

# <u>Spain</u>

Spanish catches in Moroccan central areas were estimated at 5.1 million tonnes for the 1950-2010 time period, i.e., 38% of the data supplied by Spain to FAO (13.6 million tonnes). Catches were relatively constant at 23,700 t-year<sup>-1</sup> in the 1950s, increasing gradually to a peak of 209,000 t-year<sup>-1</sup> in 1979, and were variable thereafter, with a decreasing trend (Figure 3).

# <u>Italy</u>

Italy caught around 5 million tonnes from the mid-1960s, when the Italian fleet started fishing in Morocco's central areas to 2010. These catches are 2.3 times higher than landing data supplied by Italy to FAO for FAO area 34 (1.5 million tonnes) (Figure 4). This underreporting tendency increased over time, with average catches being twice as high as Italian reported landings for FAO area 34, i.e., 58,300 t·year<sup>-1</sup> on average reported to FAO compared to a reconstructed catch of 153,200 t·year<sup>-1</sup> in the 1960s (Figure 4). Between 1970 and 1999, reconstructed catches were three times higher than landings supplied to FAO, i.e., 31,100 t·year<sup>-1</sup> supplied to FAO compared to 32,000 t·year<sup>-1</sup> on average, and 6 times higher in the 2000s with 5,200 t·year<sup>-1</sup> supplied to FAO compared to 32,000 t·year<sup>-1</sup> on average (Figure 4).

# <u>Portugal</u>

Catches by Portugal totalled 286,000 tonnes from 1950 to 2010, which represented 21% of landings supplied by Portugal to FAO, i.e., 1.3 million tonnes (Figure 5). Catches by Portugal increased from 1,600 t·year<sup>-1</sup> in 1964 to a peak of 9,460 t·year<sup>-1</sup> in 1969, and decreased since then to around 3,000 t·year<sup>-1</sup> in 2010 (Figure 5).

## **France**

France catches in the Moroccan central areas were estimated at over 413,000 tonnes during the 1950-2010 timeperiod. Catches by France increased from 6,900 t·year<sup>-1</sup> on average in the 1950s to over 14,000 t·year<sup>-1</sup> in the late 1960s, and then decreased to around 5,500 t·year<sup>-1</sup> in 2010 (Figure 7).

## <u>Norway</u>

As in the southern areas, Norwegian catches increased considerably until 1975, when the issue around the Moroccan borders started, and reached 70,300 t·year<sup>-1</sup> in 1975. Catches decreased thereafter to zero in 2010 (Figure 8). Norwegian catches in the Moroccan central areas were estimated at 1.3 million tonnes between 1950 and 2010, which is 60% higher than landings supplied by Norway to FAO for FAO area 34 (780,000 tonnes).

### <u>Japan</u>

Japanese catches from Moroccan central areas were 57% higher (4.8 million tonnes) than the catch data supplied by Japan to FAO (3.05 million tonnes) covering the entire FAO area 34 (Figure 10). Japanese catches off the Moroccan central areas were as high as the catches supplied to FAO for the FAO area 34 for the 1950s, 30% of the catch supplied to FAO for the 1960s, twice higher in the 1970s, and 5 to 6 times higher since the 1980s (Figure 10).

### South Korea

South Korean reconstructed catches in Moroccan central areas were estimated at 103,000 tonnes over the period from 1950 to 1963, where no catches from FAO area 34 were supplied by South Korea to FAO. Between 1964 and 1968, reconstructed catches (18,100 t·year<sup>-1</sup> on average) were three times as high as landings supplied by South Korea to FAO with 6,400 t·year<sup>-1</sup> on average (Figure 11). Reconstructed catches represented the equivalent of 56% of the catch supplied by South Korea to FAO from 1969 to 1987 with 33,000 t·year<sup>-1</sup> compared to 67,000 t·year<sup>-1</sup> on average supplied to FAO (Figure 11). Between 1988 and 1998, reconstructed catches were 51% higher than landings supplied by South Korea to FAO with a reconstructed catch of 27,900 t·year<sup>-1</sup> on average compared to 19,300 t·year<sup>-1</sup> supplied to FAO (Figure 11). The underreporting tendency was then reversed in the 1990s and 2000s, when reconstructed catches represented 63% of landings supplied by South Korea to FAO for the FAO area 34 (Figure 11). This denotes inconsistencies in catch reporting by South Korea to FAO.

## <u>China</u>

Chinese catches off the Moroccan central areas were estimated in the present study at 725,000 tonnes from 1950 to 2010. Catches by China increased continuously from 2,200 t-year<sup>-1</sup> in 1986 to over 47,300 t-year<sup>-1</sup> in 2010, over 20 times in less than 25 years (Figure 12).

### Former Soviet Union

Catches by former Soviet republics represented 20% of landings supplied to the FAO for FAO area 34, with a total of 3.2 million tonnes for the period between 1950 and 2010 compared to 17.9 million tonnes of catch data supplied to the FAO. Catches increased from 17,200 t-year<sup>-1</sup> in 1966, when the Soviet Union started fishing in Morocco, to a maximum of 407,000 t-year<sup>-1</sup> in 1978, then decreased gradually to zero in the early 1990s.

<u>Russia</u> : Russian catches off Moroccan central areas increased from around 3,700 t·year<sup>-1</sup> in the mid-1960s to a peak of over 88,100 t·year<sup>-1</sup> in the mid-1970s (Figure 13). Reconstructed catches decreased thereafter to 26,000 t·year<sup>-1</sup> on average in the 1980s and zero in the 1990s and 2000s when Russian fleets moved south towards the former Spanish Sahara waters (Figure 13).

<u>Lithuania</u>: Lithuanian catches from the Moroccan central areas were estimated at around 703,600 tonnes between 1950 and 2010. The bulk of this was caught in the mid-1970s with 51,000 t·year<sup>-1</sup> on average (Figure 14). Catches declined in the 1980s and were zero in the 1990s, at the collapse of the Soviet Union. Lithuania followed the same pattern as Russia in the 2000s, moving southwards.

Latvia: Latvia was the most prominent Soviet republic in terms of catches totalling over one million tonnes between the mid-1960s and the early 1990s, when the Soviet Union collapsed. Latvian catches increased from 5,700 t·year<sup>-1</sup> in 1966 to a peak of 134,000 t·year<sup>-1</sup> in 1978 and decreased thereafter to zero in 2010 (Figure 15).

<u>Ukraine</u>: Ukrainian catches in the Moroccan central areas increased from 3,700 t·year<sup>-1</sup> in 1966 to a peak of 89,400 t·year<sup>-1</sup> in 1978, and then decreased gradually to zero in the early 1990s, when the Soviet Union collapsed (Figure 16).

## <u>Romania</u>

Romanian catches were estimated at 112,500 tonnes, i.e., 7% of landings data supplied by Romania to FAO from the FAO area 34, i.e., 1.5 million tonnes between 1950 and 2010 (Figure 17). Catches by Romania in Morocco's central areas increased from 240 t-year<sup>-1</sup> in the late 1960s to a peak of 29,300 t-year<sup>-1</sup> in 1976, when Morocco took over Western Sahara. Catches decreased thereafter to 1,850 t-year<sup>-1</sup> in 1983, after which Romania was reportedly no longer fishing in Morocco (Figure 14).

## <u>Bulgaria</u>

Catches by Bulgaria in Morocco's central areas were estimated at 191,000 tonnes for the period from 1950 to 2010, which represented 45% of the catches supplied by Bulgaria to FAO for FAO area 34 (424,000 tonnes). Although Bulgaria did not report any catches from FAO area 34 for the years 1979, from 1984 to 1989, 1993 to 1997, and 1999, catches were reconstructed here for Morocco and estimated at 21,200 t-year<sup>-1</sup> in 1979, 5,000 t-year<sup>-1</sup> on average between 1984 and 1989, and 1,700 t-year<sup>-1</sup> in the 1990s (Figure 18).

## **Poland**

Polish catches in the Moroccan central areas were 30% higher than data supplied by Poland to FAO for FAO area 34, with a total of 1.5 million tonnes over the study time period compared to 1.2 million tonnes supplied to FAO. Catches increased from 1,800 t·year<sup>-1</sup> in 1964 to a peak of 202,000 t·year<sup>-1</sup> in the late 1970s, then decreased to about 60,500 t·year<sup>-1</sup> in 2010 (Figure 19).

### South Africa

South African catches in the Moroccan central areas were estimated at around 1.1 million tonnes for the 1950-2010 time period, whereas this country did not supply any data to FAO from the entire FAO area 34. Catches increased from 4,800 t-year<sup>-1</sup> in 1961 to a peak of 43,000 t-year<sup>-1</sup> in 1969, and have been decreasing since then to a minimum of 430 t-year<sup>-1</sup> in 2010 (Figure 20).

## DISCUSSION

Overall total catches by foreign fleets in the waters of Morocco were conservatively estimated at 90.8 million tonnes between 1950 and 2010. Here, we treat the waters of Morocco as the EEZ equivalent waters for time periods prior to actual declaration of the EEZ. Catches reached their maximum in the mid-1970s when Morocco extended their jurisdiction over the southern areas, and when these EEZ equivalent waters were freely accessible to foreign fleets. Although reconstructed catches within EEZs cannot be directly compared to catches supplied to FAO for the entire FAO area 34, by analyzing the trends we can begin to assess the underreporting trends. Since the late 1980s, reconstructed catches within Morocco's EEZ and waters under Moroccan jurisdiction alone were 37% higher on average than catch data supplied to FAO from the entire FAO area 34, showing no significant improvements in reporting. Underreporting may in fact be higher since here we compare catch data from Morocco to landings supplied to FAO for the entire FAO area 34.

Furthermore, our estimate of total catches from Morocco is likely conservative since it does not include illegal catches, nor the catch of flag of convenience countries such as Belize (used by the United Kingdom, Sweden, Germany), Bermuda (used by Spain), Panama (used by Russia), Comoros (used by Sweden) and vessels reflagged to Morocco (Spanish origin) which land catches elsewhere (Catzeflis 2011) [information collected from different vessel databases www.vesselfinder.com, www.shipspotting.com, and www.marinetraffic.com)].

Western Europe was responsible for over half of the total foreign catch from Morocco as estimated here, and thus caught almost twice as much as Western Europe reports for the entire FAO area 34. Eastern Europe, including former Soviet republics, caught 32% of the total foreign catch, mainly from Morocco southern area, compared to 29% of the total foreign catch by Asian countries. Eastern European and Asian catches were 7% higher than the total catch reported to FAO for FAO area 34. When analyzed individually, some countries performed even more poorly in terms of reporting. China, for example, caught almost 7 times what was reported by FAO as Chinese catch in FAO area 34, indicating high underreporting and poor spatial accounting, as described in Pauly *et al.* (2012).

When Morocco extended its jurisdiction over the southern areas, the Moroccan government assumed exploitation rights and signed bilateral agreements offering access to the country's resources. This allowed foreign fleets to extract from the waters of the southern areas two to three times as much as they were catching in the central areas.

Historical events in Morocco directly impacted fisheries by foreign fleets. For example, the unreported component by Western Europe was lower in the 1950s when Spain was the colonial power ruling the former Spanish Sahara.

52

The underreporting component increased drastically in the 1980s after Morocco extended their jurisdiction over the southern areas, especially during the armed conflict, before the cease-fire agreement was reached (UN 2011). The underreporting component decreased again in later years. However it still remains high.

After the 1995 EU-Morocco fishing access agreement dispute, Morocco and the EU agreed to reduce the fishing quota by 40%, to protect Moroccan resources and fishing industry, which at the time represented 11% of the GDP. However, as shown here, for the same period, actual catches by EU members increased by 5%, which further questions the validity of these agreements in terms of sustainability and the ability of Morocco to monitor foreign fleets in its waters and the waters under its control. This also points to a failure of EU flag-state control over its fishing fleets. At the time of this study, the international community questioned the real contribution of the EU-Morocco fishing access agreements to food security in Morocco's southern areas. This further illustrates how these agreements were of limited benefits to poor populations for years.

In this study, we illustrated that foreign countries which accessed the waters of Morocco, increased their catches, but reported less over time. European Union members, for which access agreement information is freely available in the EU law database (<u>eur-lex.europa.eu</u>), underreported their catches substantially. These countries act under the 1982 UN Convention of the Law of the Sea (UNCLOS), where in cases where a country cannot utilise the full perceived surplus, this country shall give other nations access to the surplus (Anon. 1982). However, the host country must also prioritize local population interests and livelihoods and enforce fisheries rules and legislations. Non-transparency and non-effectiveness of West African management issues have been well documented for decades (Virdin 2005; Standing 2008, 2011), yet countries such as those in the European Union fail to adhere to the latter when applying their fishing rights under UNCLOS. Furthermore, results of this study, where Western European catches in Morocco were higher than the catch data supplied to FAO covering the area from Morocco to the Democratic Republic of the Congo, suggest these countries are an integral part of a failing fisheries management system in West Africa. Furthermore, the pattern of underreporting shows an increase after the independence of these countries from Europe (Spain and France), highlighting how their development path followed the colonial pattern of exporting primary natural resources.

This high level of underreporting suggests that Moroccan fishing access agreement partners do not comply with the obligation of comprehensive reports, or landing a large part of the catch at Moroccan landing sites, contrary to what is stated by official sources and reported to FAO (Atmani 2003). Thus, these agreements did not help reshape food security, especially in southern areas which still suffer from a lack of animal protein (FAO 2003). Furthermore, out of 11 exploited stocks included in fishing access agreements with the EU, 9 are overfished and 2 are unassessed. This challenges the Moroccan logic of offering access agreements to foreign fleets, while at the same time in 1999, this country cancelled the fishing access agreement with the EU to preserve fisheries resources for local populations. Additionally, these agreements have little to no economic value for the local populations.

## Acknowledgements

We acknowledge the support of the *Sea Around Us Project*, a scientific collaboration between the University of British Columbia and The Pew Charitable Trusts.

## References

- Alder J and Sumaila UR (2004) Western Africa: A Fish Basket of Europe Past and Present. The Journal of Environment 13(2): 156-178.
- Anon. (1982) United Nations Convention on the Law of the Sea. United Nations. 208 p.
- Anon. (2008) Namibian-South African fishing company setting up in occupied WS. Norwegian Support Committee for Western Sahara. 4 p.
- Anon. (2010) Un géant arrête ses achats au Maroc et Sahara Occidental. Fish Elswhere. 1 p.
- Anon. (2011a) Commission defends EU-Morocco fisheries agreement. European Parliement, Brussels, Belgium. 2 p.
- Anon. (2011b) Value chain report: Morocco. INFOSAMAK. 29 p.
- Ariz J (1985) Descripción de la actividad de la flota española que explota la pesquería de Cefalódos de África NO. p. 5 *In* Bas C, Margalef R and Rubies P (eds.), Simposio internacional sobre las areas de afloramiento mas importantes del Oeste Africano (Cabo Blanco y Benguela). 2 Barcelona.
- Atmani H (2003) Expert consultation on international fish trade and food security. Moroccan fisheries a supply overview.708, FAO, Casablanca, Morocco. 23 p.
- Baddyr M and Guénette S (2001) The fisheries off the Atlantic coast of Morocco 1950-1997. p. 15 *In* Zeller D, Watson R and Pauly D (eds.), Fisheries Impacts on North Atlantic Ecosystems: Catch, Effort and National/Regional Data Sets. Fisheries Centre Research Report 9 (3).
- Balguerias E (1985) Actividades de la flota artesanal Canaria que faenó en la costa africana de 1975 a 1982. Investigaciones Pesqueras 5(2): 851-857.
- Balguerías E, Quintero ME and Hernández-González CL (2000) The origin of the Saharan Bank cephalopod fishery. ICES Journal of Marine Science 57(1): 8.
- Barbier M (2003) Le conflit du Sahara occidental: Réédition d'un livre paru en 1982. L'Harmattan. 420 p.

- Barreira A, Fabra A, Martínez AR and Tudela T (1998) From concept to design: Creating an international environmental ombudsperson. Local communities and fishing disputes in Saharan and Moroccan waters: opportunities for new dispute resoluction mechanisms. The Nautilus Institute for Security and Sustainable Development, San José. 47 p.
- Belveze H and Bravo de Laguna J (1980) Les ressources halieutiques de l'Atlantique centre-est. Deuxième partie : Les ressources de la côte Ouest-Africaine entre 24°N et le détroit de Gibraltar.182, FAO. 81 p.

Besenyő J (2009) Western Sahara. IDResearch Ltd./Publikon Publishers, Budapest, Hungary. 197 p.

- Buteau G (2005) Le Maroc au Sahara Occidental, 1975-2005: Trente ans d'une quête pour la souveraineté. Institut d'Etudes Politiques Lyon, France. 95 p.
- Catzeflis F (2011) Pêches abusives en Afrique de l'Ouest : un pillage organisé. L'UE paye le Maroc pour pouvoir pêcher au Sahara Occidental occupé. Greenpeace. 6 p.
- Cruzado A (1979) Coastal upwelling off Western Sahara. Investigacion Pesquera 43(1): 149-160.
- Danine O (2012) Pêche, vers un accord Maroc-Ukraine. Quotidien Les Echos 17 Août 2012: 1.
- Eyckmans S (2011) La flotte russe doit quitter le Sahara Occidental occupé. Western Sahara Resource Watch. 1 p.
- FAO (1985a) Rapport de la troisième reunion du Groupe de travail ad hoc sur la sardine *Sardina pilchardus* (Walb.) 85, COPACE FAO, Casablanca, Maroc. 157 p.
- FAO (1985b) Report of the First ad hoc working group on seabream (sparidae) stocks in the northern CECAF zone. CECAF, Rome, Italy. Available at: <u>http://www.fao.org/docrep/003/X6835E/X6835E00.htm#TOC</u> [Accessed: 04/02/2012].
- Garibaldi L and Grainger R (2002) Chroniques des captures des pêches maritimes dans l'Atlantique Centre-Est de 1950 à 2000 Pêcheries maritimes, écosystèmes et sociétés en Afrique de l'Ouest : un demi-siècle de changement (1). IRD, Bruxelles, Belgique. 100-112 p. *In*: P. Chavance, M. Ba, D. Gascuel, M. Vakily et D. Pauly (eds.) Pêcheries maritimes, écosystèmes et sociétés en Afrique de l'Ouest : un demi-siècle de changement. Collection des rapports de recherche halieutique ACP-UE 15.
- Goffinet T (1992) Development and fisheries management: The case of northwest Africa. Ocean & Coastal Management 17(2): 105-136.
- Guénette S, Balguerías E and Santamaría MTG (2001) Spanish fishing activities along the Saharan and Moroccan coast. pp. 206-213 *In* Fisheries Impacts on North Atlantic Ecosystems: Catch, Effort and National/Regional Data Sets. 3. Fisheries Centre, University of British Columbia.
- Kaczynski VM (1989) Foreign fishing fleets in the subSaharan West African EEZ. The coastal state perspective. Marine Policy 13(1): 2-15.
- Martínez Milán JM (2006) Integrating Western Saharan Coastal Fisheries into the International Economy, 1885-1975. XIV International Economic History Congress, Helsinki. 14 p.
- Milano E (2006) The new Fisheries Partnership Agreement between the European Community and the Kingdom of Morocco: fishing too south. Amsterdam Centre for International Law, Amsterdam. 33 p.
- Pauly D, Alder J, Booth S, Cheung WWL, Christensen V, Close C, Sumaila UR, Swartz W, Tavakolie A, Watson R, Wood L and Zeller D (2008) Fisheries in Large Marine Ecosystems: Descriptions and diagnoses. pp. 23-40 *In* Sherman K and Hempel G (eds.), The UNEP Large Marine Ecosystem Report: A perspective on changing conditions in LMEs of the world's regional seas182. UNEP Regional Seas Reports and Studies.
- Pauly D, Belhabib B, Cheung W, Cisneros-Montemayor A, Harper S, Lam V, Mai YY, Le Manach F, Mok KM, van der Meer L, Shon S, Swartz W, Sumaila UR, Watson R, Zhai Y and Zeller D (2012) Catches [of the Chinese distantwater fleet]. pp. 21-29 & 81-85 *In* Blomeyer R, Goulding I, Pauly D, Sanz A and Stobberup K (eds.), The role of China in World Fisheries. European Parliament, Directorate General for Internal Policies, Policy Department B: Structural and Cohesion Policies–Fisheries, Brussels.
- Riché P (2004) Les ressources naturelles du Sahara occidental. 4 p.
- Standing A (2008) Corruption and industrial fishing in Africa.2008, Insitute for security studies. 29 p.
- Standing A (2011) Making transparency work in Africa's marine fisheries.11, Chr. Michelsen Institute Anti-Corruption Resource Centre. 31 p.
- UN (2011) MINURSO: Mission des Nations Unies pour l'organisation d'un référendum au Sahara occidental United Nations. 2p. p.
- Virdin J (2005) West Africa Regional Fisheries Program. Lessons for reducing IUU fishing. The World Bank. 9 p.

1950     2,074     0     0     4,010     0     54,193       1951     2,074     0     0     0     4,003     0     64,524       1953     2,074     0     0     0     5,038     0     54,191       1954     2,074     0     0     0     5,039     0     54,212       1955     2,074     0     0     0     5,039     0     4,152       1957     2,074     0     0     0     6,891     0     4,155       1958     2,074     0     0     0     4,155     0     87,129       1961     2,074     0     0     0     5,141     0     82,334       1962     2,074     0     0     0     5,141     0     82,334       1963     2,074     4,350     22,500     6,605     12,852     6,887     5,7285       1964     2,074     4,512     35,705     10,606     14,733     10,399	Year	France	Germany	Italy	Netherlands	Norway	Portugal	Spain
1951     2,074     0     0     4,017     0     54,193       1952     2,074     0     0     0     5,088     0     54,124       1954     2,074     0     0     0     5,039     0     54,122       1955     2,074     0     0     0     5,039     0     74,662       1957     2,074     0     0     0     6,983     0     8,941       1958     2,074     0     0     0     4,140     0     6,831       1961     2,074     0     0     0     5,125     0     9,1373       1962     2,074     0     0     0     7,066     0     5,333       1964     2,074     3,159     112,500     4,944     9,9467     3,508     5,0635       1965     2,074     4,340     22,5000     15,641     2,0200     10,011       1970     3,16     4,50,800     12,927     6,358     13,334     9,306 <td>1950</td> <td>2,074</td> <td>0</td> <td>0</td> <td>0</td> <td>4,010</td> <td>0</td> <td>52,003</td>	1950	2,074	0	0	0	4,010	0	52,003
1952     2,074     0     0     0     4,043     0     6,524       1953     2,074     0     0     0     5,038     0     54,124       1954     2,074     0     0     0     5,051     0     47,682       1957     2,074     0     0     0     6,981     0     47,682       1958     2,074     0     0     0     4,140     0     68,315       1960     2,074     0     0     0     4,140     0     82,315       1962     2,074     0     0     0     5,125     0     93,335       1963     2,074     0,300     10,066     12,852     6,887     57,285       1964     2,074     4,350     225,000     6,060     12,852     6,887     57,285       1965     2,074     4,350     225,000     10,066     14,993     10,309     58,337       1966     4,344     4,694     450,000     12,457     3,	1951	2,074	0	0	0	4,017	0	54,193
1954     2,074     0     0     5,008     0     5,412       1955     2,074     0     0     0     5,033     0     5,1297       1955     2,074     0     0     0     5,051     0     4,0621       1957     2,074     0     0     0     6,989     0     58,491       1958     2,074     0     0     0     4,140     0     68,315       1961     2,074     0     0     0     5,141     0     82,334       1963     2,074     0     0     0     70,965     0     59,335       1964     2,074     4,350     225,000     6,606     14,793     10,399     58,337       1965     2,074     4,628     33,550     10,688     14,739     10,399     58,337       1966     1,651     5435,573     2,466     38,739     2,142     106,411       1970     3,146     4,698     450,000     12,127     3,888	1952	2,074	0	0	0	4,043	0	64,524
1954     2,074     0     0     5,038     0     5,4912       1955     2,074     0     0     0     5,051     0     47,682       1957     2,074     0     0     0     6,981     0     47,682       1958     2,074     0     0     0     6,981     0     87,129       1950     2,074     0     0     0     4,140     0     82,315       1960     2,074     0     0     0     5,125     0     93,335       1964     2,074     0     0     0     7,096     0     59,335       1965     2,074     4,350     12,500     6,666     12,852     6,887     57,285       1966     2,074     4,350     12,500     17,682     26,336     18,334     93,306       1967     2,074     6,468     450,000     12,481     14,327     98,919       1976     1,202     13,150     33,7500     11,682     43,9573	1953	2,074	0	0	0	5,008	0	51,814
1955     2,074     0     0     5,039     0     5,1297       1957     2,074     0     0     0     6,681     0     4,104       1958     2,074     0     0     0     6,681     0     4,140       1959     2,074     0     0     0     4,140     0     68,115       1960     2,074     0     0     0     5,125     0     9,373       1962     2,074     0     0     0     7,066     0     59,335       1964     2,074     3,159     112,500     4,914     9,967     3,508     50,635       1965     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1966     1,650     1,915     562,500     1,7642     2,634     49,200     30,001       1970     3,16     31,500     24,2145     2,2000     100611     1917     3,832     30,594     429,145     2,72,15     54,611     20,437	1954	2,074	0	0	0	5,038	0	54,912
1955     2,074     0     0     0     5,051     0     47,622       1957     2,074     0     0     0     6,989     0     58,491       1958     2,074     0     0     0     4,140     0     68,315       1960     2,074     0     0     0     4,155     0     87,129       1961     2,074     0     0     0     5,125     0     9,333       1962     2,074     0     0     0     7,096     0     5,3335       1964     2,074     4,350     225,000     6,606     12,852     6,887     57,285       1966     2,074     4,350     225,000     17,682     6,38,393     21,422     10,201       1970     3,116     31,505     439,573     24,666     38,793     21,422     10,201       1971     3,822     30,594     429,145     27,917     3,888     2,000     12,214       1972     4,238     49,923     3	1955	2,074	0	0	0	5,039	0	51,297
1957     2,074     0     0     6,981     0     49,104       1958     2,074     0     0     0     4,140     0     68,315       1960     2,074     0     0     0     4,155     0     97,129       1961     2,074     0     0     0     5,141     0     82,934       1963     2,074     0     0     0     7,066     0     53,335       1964     2,074     4,519     122,500     6,606     12,852     6,887     57,285       1965     2,074     4,628     337,500     10,068     14,793     10,399     58,337       1966     1,650     1,915     562,500     17,682     26,364     18,344     97,306       1970     31,16     31,500     10,068     14,793     10,399     58,337       1971     3,882     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,283     4,932     418,718 <t< td=""><td>1956</td><td>2,074</td><td>0</td><td>0</td><td>0</td><td>5,051</td><td>0</td><td>47,682</td></t<>	1956	2,074	0	0	0	5,051	0	47,682
1958     2,074     0     0     6,889     0     58,491       1959     2,074     0     0     0     4,140     0     68,315       1960     2,074     0     0     0     5,125     0     91,373       1961     2,074     0     0     0     7,096     0     5,335       1965     2,074     4,350     225,000     6,606     12,852     6,887     57,285       1966     2,074     9,946     450,000     15,431     2,6,314     14,327     98,919       1968     1,505     1,915     562,500     17,682     26,336     18,334     97,306       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,823     0,594     429,145     27,215     54,611     20,407     129,174       1972     4,28     4,932     418,718     32,089     71,123     20,874     129,174       1977     1,612	1957	2,074	0	0	0	6,981	0	49,104
1959     2,074     0     0     4,140     0     683,15       1960     2,074     0     0     0     5,125     0     97,129       1963     2,074     0     0     0     5,125     0     93,333       1964     2,074     0     0     0     7,066     0     82,934       1965     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1966     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1966     4,366     4,698     450,000     21,297     36,898     22,000     100,011       1970     3,165     439,573     24,666     38,793     21,422     106,411       1971     3,823     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,238     4,932     418,718     32,089     71,123     20,873     151,445     142,039     22,653       1975	1958	2,074	0	0	0	6,989	0	58,491
1960     2,074     0     0     4,155     0     87,129       1961     2,074     0     0     0     5,1241     0     82,934       1963     2,074     0     0     0     7,096     0     53,335       1964     2,074     4,350     225,000     6,606     12,852     6,887     57,285       1966     2,074     4,350     225,000     15,411     0,41,427     98,919       1968     1,650     1,915     562,500     17,682     26,336     18,334     97,306       1969     4,346     4,684     450,000     12,427     106,411     107,011       1971     3,155     4,39,573     24,666     38,793     21,422     106,411       1974     1,914     472,976     37,863     13,800     29,001     20,744     139,255       1973     1,714     4,791     406,220     33,780     67,839     21,594     220,441       1974     1,919     357,25     237,413	1959	2,074	0	0	0	4,140	0	68,315
1961     2,074     0     0     5,125     0     91,373       1962     2,074     0     0     0     5,141     0     82,934       1964     2,074     3,159     112,500     4,914     9,967     3,508     50,635       1965     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1966     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1966     4,346     4,698     450,000     21,297     36,898     22,000     102,001       1970     31,16     31,505     439,573     24,666     38,792     21,421     106,611       1971     3,882     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,238     4,932     418,718     32,089     71,123     20,078     20,018     279,976       1977     1,682     4,919     37,374     53,312     21,514     32,6253     133,142	1960	2,074	0	0	0	4,155	0	87,129
1962     2.074     0     0     0     5,141     0     82,934       1963     2.074     3,159     112,500     4,914     9,967     3,508     50,635       1965     2,074     4,350     225,000     6,606     12,852     6,887     57,285       1966     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1967     2,074     9,946     450,000     11,431     26,336     18,334     97,306       1969     4,346     4,698     450,000     21,297     36,888     22,000     102,011       1971     3,156     31,505     439,573     24,666     38,793     21,422     106,411       1974     4,288     4,932     418,718     32,089     71,123     20,847     175,225       1973     1,716     4,919     33,780     67,839     21,594     220,641       1974     1,921     45,727     39,7463     31,880     12,980     20,018     279,976	1961	2,074	0	0	0	5,125	0	91,373
1963     2.074     0     0     7.096     0     59.335       1964     2.074     3.159     112.500     4.914     9.967     3.508     50.635       1965     2.074     4.350     225.000     6.606     12.852     6.887     57.285       1966     2.074     6.628     337.500     10.668     14.793     10.399     58.337       1967     2.074     6.946     450.000     17.682     26.336     18.334     97.306       1970     3.116     31.505     439.573     24.666     38.783     21.422     10.64.11       1971     3.882     30.594     429.145     27.215     54.611     20.437     129.174       1972     4.238     4.932     418.718     32.089     71.123     20.876     175.225       1973     1.716     4.791     408.290     33.780     67.839     21.594     22.6431       1974     1.919     4.572     397.653     31.820     12.980     1.934     22.653	1962	2,074	0	0	0	5,141	0	82,934
1964     2.074     3,159     112,500     4,914     9,967     3,508     50,635       1965     2,074     6,628     337,500     10,068     11,473     10,399     58,337       1967     2,074     9,946     450,000     15,431     26,334     14,327     98,919       1968     1,650     1,915     562,500     17,682     26,336     18,334     97,306       1969     4,346     4,698     450,000     21,297     36,898     22,000     102,001       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,828     30,594     429,145     27,215     54,611     20,0437     129,174       1974     1,991     4,572     397,863     31,880     129,800     20,118     279,076       1975     1,682     4,919     387,7576     29,413     139,522     18,659     46,915       1976     1,207     15,817     25,827     127,488     16,529     32	1963	2,074	0	0	0	7,096	0	59,335
1965     2.074     4.350     225,000     6,606     12,852     6,887     57,285       1966     2.074     6,628     337,500     10,068     14,793     10,399     58,337       1967     2.074     6,628     337,500     15,631     14,327     98,919       1968     4,364     4,698     450,000     12,621     66,888     22,000     102,001       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,882     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,238     49,923     418,178     32,089     71,123     20,876     175,225       1973     1,622     4,919     367,436     33,725     163,412     21,039     32,653       1976     2,022     13,112     377,008     30,919     157,274     19,345     279,028       1977     1,637     355,299     27,943     13,160     17,91     33,142	1964	2,074	3,159	112,500	4,914	9,967	3,508	50,635
1966     2,074     6,628     337,500     10,068     14,793     10,399     58,337       1967     2,074     9,946     450,000     15,431     26,314     14,327     98,919       1968     1,650     1,915     562,500     17,682     26,336     18,334     97,306       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,882     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,238     4,932     418,718     32,089     71,123     20,876     175,225       1973     1,716     4,771     408,290     33,780     67,839     21,594     220,411       1974     1,991     4,572     397,863     31,880     129,800     20,018     279,028       1976     2,021     31,12     377,008     30,219     157,274     19,345     279,028       1977     2,011     21,671     365,153     28,371     145,180 <t< td=""><td>1965</td><td>2,074</td><td>4,350</td><td>225,000</td><td>6,606</td><td>12,852</td><td>6,887</td><td>57,285</td></t<>	1965	2,074	4,350	225,000	6,606	12,852	6,887	57,285
1967     2,074     9,946     450,000     15,431     26,314     14,327     98,919       1968     1,650     1,915     562,500     17,682     26,336     18,334     97,306       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,882     30,594     429,145     27,215     54,611     20,876     175,225       1973     1,716     4,791     408,290     33,780     67,839     21,594     220,0441       1974     1,991     4,572     397,863     31,880     129,800     20,018     279,976       1975     1,682     4,919     387,436     33,725     163,412     21,039     32,653       1976     2,002     1,188     356,153     28,371     145,180     17,912     346,972       1979     1,984     15,254     345,726     29,413     133,502     17,713     333,160     17,919     32,46,93       1980     1,977     16,637     35,299	1966	2,074	6,628	337,500	10,068	14,793	10,399	58,337
1968     1,650     1,915     562,500     17,682     26,336     18,334     97,306       1969     4,346     4,698     450,000     21,277     36,898     22,000     102,001       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,882     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,238     4,932     418,718     32,089     71,123     20,876     175,225       1973     1,716     4,791     408,290     33,780     67,839     21,1039     322,653       1975     1,682     4,919     387,436     33,725     163,412     21,039     322,653       1976     2,022     13,112     377,008     30,919     157,274     19,345     279,028       1977     2,011     21,671     365,153     28,371     145,180     17,912     346,912       1979     1,988     15,254     345,726     29,413     139,522	1967	2,074	9,946	450,000	15,431	26,314	14,327	98,919
1969     4,346     4,698     450,000     21,297     36,898     22,000     102,001       1970     3,116     31,505     439,573     24,666     38,793     21,422     106,411       1971     3,882     30,594     429,145     27,215     54,611     20,437     129,174       1972     4,238     4,932     418,718     32,089     71,123     20,876     175,225       1973     1,716     4,791     408,290     33,780     67,839     21,594     220,441       1974     1,991     4,572     397,863     33,725     163,412     21,039     322,653       1976     2,022     13,112     377,008     30,919     157,274     19,345     279,028       1977     1,6637     335,299     27,443     13,514     145,180     17,912     346,972       1980     1,977     16,637     335,299     27,443     13,266     14,721     309,094       1981     1,964     17,539     314,444     26,719     121,546	1968	1,650	1,915	562,500	17,682	26,336	18,334	97,306
1970   3,116   31,505   439,573   24,666   38,793   21,422   106,411     1971   3,882   30,594   429,145   27,215   54,611   20,437   129,174     1972   4,283   4,992   418,718   32,089   71,123   20,876   175,525     1973   1,716   4,791   408,290   33,780   67,839   21,594   220,441     1974   1,991   4,572   397,863   31,880   129,800   20,018   279,976     1975   1,682   4,919   387,436   33,725   163,412   21,039   322,663     1976   2,022   13,112   377,008   30,919   157,274   19,345   279,028     1977   2,011   21,671   366,581   28,837   151,184   18,751   345,382     1980   1,977   16,637   335,299   27,943   133,160   17,791   351,42     1981   1,966   16,631   324,871   25,872   12,748   16,529   302,018     1982   1,954   17,539   314,444	1969	4,346	4,698	450,000	21,297	36,898	22,000	102,001
1971   3,882   30,594   429,145   27,215   54,611   20,437   129,174     1972   4,238   4,932   418,718   32,089   71,123   20,876   175,225     1973   1,716   4,791   408,290   33,780   67,839   21,594   220,041     1974   1,991   4,572   397,863   31,880   129,800   20,018   279,976     1975   1,682   4,919   387,436   33,725   163,412   21,039   322,653     1976   2,022   13,112   377,008   30,919   157,724   19,345   279,028     1977   2,010   1,188   356,153   28,371   145,180   17,912   346,972     1980   1,977   1,6637   335,299   27,943   133,160   17,791   335,142     1981   1,966   16,831   324,871   25,827   127,488   16,529   320,218     1982   1,954   17,539   314,444   26,719   125,464   16,727   387,156     1984   1,932   16,241   293,589 <td>1970</td> <td>3,116</td> <td>31,505</td> <td>439,573</td> <td>24,666</td> <td>38,793</td> <td>21,422</td> <td>106,411</td>	1970	3,116	31,505	439,573	24,666	38,793	21,422	106,411
1972     4,238     4,932     418,718     32,089     7,123     20,876     175,225       1973     1,716     4,791     408,290     33,780     67,839     21,594     220,441       1974     1,991     4,572     397,863     33,725     163,412     21,039     322,653       1976     2,022     13,112     377,008     30,919     157,274     19,345     279,028       1977     2,011     21,671     366,581     29,837     151,184     18,751     345,382       1978     2,000     1,188     356,153     28,371     145,180     17,912     346,972       1980     1,977     16,637     335,299     27,943     133,160     17,791     335,142       1981     1,966     16,831     324,871     25,827     127,488     16,529     320,218       1982     1,954     17,539     314,444     26,719     121,546     17,219     309,094       1983     1,943     16,541     30,017     25,845     115,364	1971	3,882	30,594	429,145	27,215	54,611	20,437	129,174
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1972	4.238	4.932	418.718	32.089	71.123	20.876	175.225
1974   1,991   4,572   397,863   31,880   129,800   20,018   279,976     1975   1,682   4,919   387,436   33,725   163,412   21,039   322,653     1976   2,022   13,112   377,008   30,919   157,274   19,345   279,028     1977   2,011   21,671   366,581   29,837   151,184   18,751   345,382     1978   2,000   1,188   356,153   28,371   145,180   17,912   346,972     1980   1,977   16,637   335,299   27,941   133,160   17,791   355,142     1981   1,966   16,631   324,871   25,827   127,488   16,529   320,218     1983   1,943   16,541   304,017   25,845   115,364   16,727   387,156     1984   1,932   16,541   293,589   25,144   109,281   16,348   422,866     1985   1,920   15,917   283,162   25,075   102,961   16,404   425,571     1986   1,909   15,637   272,7	1973	1.716	4.791	408.290	33.780	67.839	21.594	220.441
19751,6824,919387,43633,725163,41221,039322,65319762,02213,112377,00830,919157,27419,345279,02819772,01121,671366,58129,837151,18418,751345,38219782,0001,188356,15328,371145,18017,912346,97219791,98815,254345,72629,413139,52218,659446,91519801,97716,637335,29927,943133,16017,791335,14219821,95417,539314,44426,719121,54617,219309,09419831,94316,541304,01725,845115,36416,727387,15619841,93216,241293,58925,184109,28116,398422,86619851,92015,917283,16225,075102,96116,404425,57119861,90915,637272,73424,02896,93715,619281,03819871,89815,355262,30723,55391,09315,619281,03819881,85614,906251,88022,38184,85815,141403,21119901,86414,906231,02521,27472,96614,388405,76019911,85214,62220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816 <td< td=""><td>1974</td><td>1.991</td><td>4.572</td><td>397.863</td><td>31.880</td><td>129.800</td><td>20.018</td><td>279.976</td></td<>	1974	1.991	4.572	397.863	31.880	129.800	20.018	279.976
19762,02213,112377,00830,919157,27419,345279,02819772,01121,671366,58129,837151,18418,751345,38219782,0001,188356,15328,371145,18017,912346,97219791,98815,254345,72629,413139,52218,659486,91519801,97716,637335,29927,943133,16017,791335,14219811,96616,83124,87125,827127,48816,529320,21819821,95417,539314,44426,719121,54617,219309,09419831,94316,541304,01725,845115,36416,727387,15619841,93216,241293,58925,184109,28116,398422,86619851,90915,63727,27,3424,02896,93715,797419,61319861,90915,63727,27,3424,02896,93715,797419,61319871,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,16220,59719,59966,82513,396341,40319921,84113,675210,17020,06960,76013,816 <td< td=""><td>1975</td><td>1.682</td><td>4.919</td><td>387.436</td><td>33.725</td><td>163.412</td><td>21.039</td><td>322.653</td></td<>	1975	1.682	4.919	387.436	33.725	163.412	21.039	322.653
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	1976	2.022	13.112	377.008	30.919	157.274	19.345	279.028
1978     2,000     1,188     356,153     28,371     145,180     17,912     346,972       1979     1,988     15,254     345,726     29,413     139,522     18,659     486,915       1980     1,977     16,637     332,427     25,827     127,488     16,529     320,218       1981     1,966     16,831     324,871     25,827     127,488     16,529     320,218       1982     1,954     17,539     314,444     26,719     121,546     17,219     309,094       1983     1,932     16,241     293,589     25,184     109,281     16,398     422,866       1984     1,932     16,241     293,589     25,184     109,281     16,404     425,571       1986     1,909     15,637     272,734     24,028     96,937     15,797     419,613       1987     1,888     15,3470     241,452     21,637     78,917     14,541     403,221       1989     1,875     14,700     21,637     78,917     14,541 <td>1977</td> <td>2.011</td> <td>21.671</td> <td>366.581</td> <td>29.837</td> <td>151.184</td> <td>18.751</td> <td>345.382</td>	1977	2.011	21.671	366.581	29.837	151.184	18.751	345.382
19791,98815,254345,72629,413139,52218,659486,61519801,97716,637335,29927,943133,16017,791335,14219811,96616,831324,87125,827127,48816,529320,21819821,95417,539314,44426,719121,54617,219309,09419831,94316,541304,01725,845115,36416,727387,15619841,93216,241293,58925,184109,28116,398422,86619851,90915,637272,73424,02896,93715,619281,03819861,90915,637272,73424,02896,93715,619281,03819881,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,544403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,76112,681168,46016,54336,59711,8319	1978	2.000	1,188	356,153	28.371	145,180	17.912	346.972
1980     1,977     16,637     335,299     27,943     133,160     17,791     335,142       1981     1,966     16,831     324,871     25,827     127,488     16,529     320,218       1982     1,954     17,539     314,444     26,719     121,546     17,219     309,094       1983     1,943     16,541     304,017     25,845     115,364     16,727     387,156       1984     1,932     16,241     293,589     25,184     109,281     16,398     422,866       1985     1,909     15,637     272,734     24,028     96,937     15,797     419,613       1987     1,898     15,355     262,307     23,553     91,093     15,619     281,038       1988     1,886     14,906     251,880     22,381     84,858     15,141     403,211       1990     1,864     14,496     231,025     21,274     72,966     14,388     405,760       1991     1,852     14,162     20,597     19,599     66,825	1979	1.988	15.254	345.726	29.413	139.522	18.659	486.915
1981     1.966     16,831     324,871     25,827     127,488     16,529     320,218       1982     1.954     17,539     314,444     26,719     121,546     17,219     309,094       1983     1.943     16,541     304,017     25,845     115,364     16,727     387,156       1984     1.932     16,241     293,589     25,184     109,281     16,398     422,866       1985     1.909     15,637     272,734     24,028     96,937     15,797     419,613       1986     1.909     15,637     272,734     24,028     96,937     15,797     419,613       1987     1.898     15,355     262,307     23,553     91,093     15,619     281,038       1988     1,866     14,906     231,025     21,274     72,966     14,388     405,760       1991     1,852     14,162     220,597     19,599     66,825     13,396     341,403       1992     1,841     13,875     210,170     20,069     60,760	1980	1.977	16.637	335.299	27.943	133.160	17.791	335.142
1982     1954     17,53     17,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     13,13     1	1981	1,966	16.831	324.871	25.827	127,488	16.529	320.218
19831,94316,54120,17725,845115,36416,727387,15619841,93216,241293,58925,184109,28116,398422,86619851,92015,917283,16225,075102,96116,404425,57119861,90915,637272,73424,02896,93715,797419,61319871,89815,355262,30723,55391,09315,619281,03819881,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,57711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06	1982	1 954	17 539	314 444	26 719	121 546	17 219	309 094
19841,93216,241293,58925,184109,28116,398422,86619851,92015,917283,16225,075102,96116,404425,57119861,90915,637272,73424,02896,93715,797419,61319871,89815,355262,30723,55391,09315,619281,03819881,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,31415,61520001,75011,413126,75114,18720,45610,97115,039<	1983	1,943	16.541	304.017	25.845	115.364	16.727	387,156
19851,92015,917283,16225,075102,96116,024425,57119861,90915,637272,73424,02896,93715,797419,61319871,88815,355262,30723,55391,09315,619281,03819881,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681166,46016,54336,59711,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,102116,32413,46818,81010,599148,2	1984	1.932	16,241	293,589	25,184	109,281	16.398	422,866
19861,90915,637127,73424,03296,93715,797419,61319861,90915,63727,73424,02896,93715,797419,61319871,89815,355262,30723,55391,09315,619281,03819881,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,283 </td <td>1985</td> <td>1 920</td> <td>15 917</td> <td>283 162</td> <td>25 075</td> <td>102 961</td> <td>16 404</td> <td>425 571</td>	1985	1 920	15 917	283 162	25 075	102 961	16 404	425 571
19871,89815,355262,30723,55391,09315,619281,03819881,88614,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,617<	1986	1,909	15,637	272,734	24,028	96,937	15,797	419.613
19881,86314,906251,88022,38184,85815,141304,89219891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,950 <td>1987</td> <td>1,898</td> <td>15,355</td> <td>262.307</td> <td>23,553</td> <td>91.093</td> <td>15.619</td> <td>281.038</td>	1987	1,898	15,355	262.307	23,553	91.093	15.619	281.038
19891,87514,760241,45221,63778,91714,541403,21119901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,529148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,284	1988	1.886	14,906	251.880	22,381	84.858	15,141	304,892
10001,0131,01410,01410,01410,01419901,86414,496231,02521,27472,96614,388405,76019911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,693<	1989	1 875	14 760	241 452	21 637	78 917	14 541	403 211
19911,85214,162220,59719,59966,82513,396341,40319921,84113,875210,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,367132,286 <tr< td=""><td>1990</td><td>1,864</td><td>14,496</td><td>231.025</td><td>21,007</td><td>72,966</td><td>14,388</td><td>405.760</td></tr<>	1990	1,864	14,496	231.025	21,007	72,966	14,388	405.760
19921,8011,8021,80313,87510,17020,06960,76013,816327,33319931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995	1991	1.852	14,162	220,597	19,599	66.825	13.396	341,403
19931,83013,603199,74318,75054,76113,007288,48919941,81813,279189,31518,73048,74313,186316,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681166,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,9532009 <td>1992</td> <td>1.841</td> <td>13.875</td> <td>210,170</td> <td>20.069</td> <td>60.760</td> <td>13,816</td> <td>327,333</td>	1992	1.841	13.875	210,170	20.069	60.760	13,816	327,333
19941,81813,279189,31518,73048,74313,18616,28519951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,953	1993	1 830	13 603	199 743	18 750	54 761	13 007	288 489
19951,80712,994178,88818,22042,63212,913241,18119961,79612,681168,46016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,95320091,6489,64932,9049,8642,0457,623126,95320091,	1994	1,818	13,279	189.315	18,730	48,743	13,186	316,285
19951,79612,681166,86016,54336,59711,89190,94519971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,95320091,6489,64932,9049,8642,0457,623126,953	1995	1 807	12 994	178 888	18 220	42 632	12 913	241 181
19971,78412,407158,03315,98930,57511,613338,75219981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,95320091,6489,64932,9049,8642,0457,623126,953	1996	1.796	12,681	168,460	16,543	36,597	11.891	90.945
13571,76412,407135,65515,56515,56516,51515,61519981,77312,117147,60615,94624,54911,742296,06419991,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,95320091,6489,64932,9049,8642,0457,623126,953	1997	1 784	12,001	158 033	15 989	30 575	11 613	338 752
19901,76111,707137,17814,90722,50111,344153,61520001,75011,413126,75114,18720,45610,971150,94920011,73911,120116,32413,46818,41010,599148,28320021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,953	1998	1 773	12,107	147 606	15 946	24 549	11 742	296.064
1000100110	1999	1 761	11 707	137 178	14 907	22 501	11 344	153 615
2001 $1,739$ $11,120$ $116,324$ $13,468$ $18,410$ $10,599$ $148,283$ $2002$ $1,727$ $10,826$ $105,896$ $12,749$ $16,364$ $10,227$ $145,617$ $2003$ $1,716$ $10,533$ $95,469$ $12,030$ $14,319$ $9,855$ $142,950$ $2004$ $1,705$ $10,239$ $85,041$ $11,311$ $12,273$ $9,483$ $140,284$ $2005$ $1,693$ $9,946$ $74,614$ $10,591$ $10,228$ $9,111$ $137,618$ $2006$ $1,682$ $9,649$ $64,187$ $9,864$ $8,182$ $8,739$ $134,952$ $2007$ $1,671$ $9,649$ $53,759$ $9,864$ $6,136$ $8,367$ $132,286$ $2008$ $1,659$ $9,649$ $43,332$ $9,864$ $4,091$ $7,995$ $129,620$ $2009$ $1,648$ $9,649$ $32,904$ $9,864$ $2,045$ $7,623$ $126,953$ $2010$ $1,672$ $0,649$ $32,904$ $9,864$ $2,045$ $7,623$ $126,953$	2000	1,750	11,413	126 751	14 187	20 456	10,971	150 949
20021,72710,826105,89612,74916,36410,227145,61720031,71610,53395,46912,03014,3199,855142,95020041,70510,23985,04111,31112,2739,483140,28420051,6939,94674,61410,59110,2289,111137,61820061,6829,64964,1879,8648,1828,739134,95220071,6719,64953,7599,8646,1368,367132,28620081,6599,64943,3329,8644,0917,995129,62020091,6489,64932,9049,8642,0457,623126,953	2001	1,739	11,120	116 374	13 468	18 410	10,599	148 283
2003   1,716   10,523   95,469   12,030   14,319   9,855   142,950     2004   1,705   10,239   85,041   11,311   12,273   9,483   140,284     2005   1,693   9,946   74,614   10,591   10,228   9,111   137,618     2006   1,682   9,649   64,187   9,864   8,182   8,739   134,952     2007   1,671   9,649   53,759   9,864   6,136   8,367   132,286     2008   1,659   9,649   43,332   9,864   4,091   7,995   129,620     2009   1,648   9,649   32,904   9,864   2,045   7,623   126,953	2002	1 727	10 826	105 896	12 749	16 364	10 227	145 617
2004   1,705   10,239   85,041   11,311   12,273   9,483   140,284     2005   1,693   9,946   74,614   10,591   10,228   9,111   137,618     2006   1,682   9,649   64,187   9,864   8,182   8,739   134,952     2007   1,671   9,649   53,759   9,864   6,136   8,367   132,286     2008   1,659   9,649   43,332   9,864   4,091   7,995   129,620     2009   1,648   9,649   32,904   9,864   2,045   7,623   126,953	2002	1 716	10,520	95 469	12,749	14 210	9 822	1 <u>4</u> 7 QCN
2004   1,705   10,255   65,041   11,511   12,275   5,465   140,264     2005   1,693   9,946   74,614   10,591   10,228   9,111   137,618     2006   1,682   9,649   64,187   9,864   8,182   8,739   134,952     2007   1,671   9,649   53,759   9,864   6,136   8,367   132,286     2008   1,659   9,649   43,332   9,864   4,091   7,995   129,620     2009   1,648   9,649   32,904   9,864   2,045   7,623   126,953     2010   1,637   0,640   23,477   0,864   2,045   7,623   126,953	2003	1 705	10 220	85 0/1	11 211	12 272	9/183	1/10 28/
2005   1,055   9,540   7,014   10,551   10,226   5,111   157,018     2006   1,682   9,649   64,187   9,864   8,182   8,739   134,952     2007   1,671   9,649   53,759   9,864   6,136   8,367   132,286     2008   1,659   9,649   43,332   9,864   4,091   7,995   129,620     2009   1,648   9,649   32,904   9,864   2,045   7,623   126,953     2010   1,637   0,640   23,477   0,864   2,045   7,623   124,236	2004	1 602	0 0/A	7/ 61/	10 501	10 228	9,403 Q 111	127 612
2000   1,002   5,043   5,044   6,162   6,759   134,952     2007   1,671   9,649   53,759   9,864   6,136   8,367   132,286     2008   1,659   9,649   43,332   9,864   4,091   7,995   129,620     2009   1,648   9,649   32,904   9,864   2,045   7,623   126,953     2010   1,637   0,640   23,477   0,864   2,045   7,623   124,236	2005	1 690	0 6 A D	6/ 107	10,331	10,220 Q 107	9,111 8 720	137,010
2007     1,071     5,043     53,755     5,804     6,150     8,507     132,286       2008     1,659     9,649     43,332     9,864     4,091     7,995     129,620       2009     1,648     9,649     32,904     9,864     2,045     7,623     126,953       2010     1,637     0,640     23,477     0,864     2,045     7,623     124,236	2000	1 671	9,049 0 610	52 750	9,004 0 861	6 1 2 6	0,733 8 267	127 706
2003   1,035   5,045   43,332   5,804   4,091   7,995   129,020     2009   1,648   9,649   32,904   9,864   2,045   7,623   126,953     2010   1,637   0,640   22,477   0,864   2,045   7,520   124,220	2007	1,071	9,049	22,122	9,004 0 961	0,130 A 001	7 005	120,200
2003 1,040 3,043 32,304 3,004 2,043 7,025 120,935 2010 1,027 0,040 22,477 0,004 0,7250 424,200	2008	1 6/9	9,049 0 6/0	43,332 27 QNA	5,004 0 861	4,091 2 ∩4⊑	7 672	176 053
	2009	1 627	9,049	32,304 33 177	9,004 Q Q6/	∠,045 ∩	7,023	120,333

Appendix Table A1. Reconstructed catches by W. European countries from Morocco's southern areas.

**Appendix Table A2**. Reconstructed catches by former Soviet republics and East European countries from Morocco's southern areas.

Year	Bulgaria	Latvia	Lithuania	Romania	Russia	Poland	Ukraine
1950	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0
1964	0	0	0	0	0	4 239	0
1965	895	0	0	0	0	8 468	0
1966	1 792	25 004	16 669	0	16 669	12 720	16 669
1967	2 689	49 861	33 345	0	33 345	16 967	33 241
1968	3 586	75 036	50 024	567	50 024	21 217	50 024
1969	1 182	100 0/9	66 699	1 1 2 2	66 699	26 18/	66 699
1970	5 361	12/ 996	82 221	1 698	83 331	18 966	83 331
1071	15 / 10	150 171	100 114	2,050	100 114	6 010	100 114
1072	20 722	172 678	115 105	6 1 7 8	115 105	0,019	115 110
1072	0 810	107 2/1	121 205	0,178	121 205	17 271	121 560
107/	6 812	171 071	11/ 126	9,095	11/ 126	5/ 862	111 618
1075	1 0512	212 005	1/5 1/0	10 910	114,120	70 210	1/5 227
1076	9,951	126 201	01 0/1	40,819 68 170	01 041	242 255	00 961
1970	0,400	260 490	91,041 170.027	20 722	91,041	242,555	170,601
1977	33,029 31 1E1	209,409	262 807	50,725	262 807	347,490	250 805
1970	40.460	209,700	104.070	20,777	202,807	409,949	259,605
1979	49,409	270,230	100,072	20,199	184,079	12,015	109,996
1980	30,082	103,329	112,072	3,283	109,072	9,502	112 645
1981	40,441	108,907	113,420	8,138 2.010	113,420	7,205	112,045
1982	44,130	210,083	144,189	3,919	144,189	5,015 10,422	144,055
1905	12 701	220,254	147,000	4,500	147,000	10,455	140,050
1984	13,781	210,004	140,027	0	140,027	10,254	140,003
1985	12,000	207,823	138,314	0	138,314	19,978	138,549
1980	12,028	166,008	124,420	0	124,420	24,785	124,405
1987	10,192	100,200	110,050	0	110,050	29,713	110,837
1988	10,309	124,442	82,898	0	82,898	34,387	82,961
1989	9,401	82,875	33,293	0	55,295	39,283	35,250
1990	8,612	41,502	27,659	0	27,659	44,208	27,668
1991	7,740	0	26,474	0	35,790	48,903	0
1992	6,877	0	25,428	0	42,426	53,077	0
1993	6,022 F 1CF	0	24,382	0	49,062	58,574	0
1994	5,105	0	23,151	0	56,869	63,460	0
1995	4,297	0	22,100	0	53,114	08,083	0
1996	3,438	0	20,996	0	70,531	72,911	0
1997	2,580	0	19,950	0	//,166	//,809	0
1998	1,721	0	18,842	0	84,193	82,747	0
1999	860	0	16 222	U	93,830	87,557	U
2000	U	0	10,233	U	100,000	92,379	U
2001	0	0	15,145	0	100,000	97,200	U
2002	0	0	14,056	0	100,000	102,021	U
2003	0	0	12,967	0	100,000	106,843	0
2004	0	0	11,8/8	0	100,000	111,664	0
2005	0	0	10,789	0	100,000	116,485	0
2006	0	0	9,699	0	100,000	121,307	0
2007	0	0	9,699	0	100,000	126,128	0
2008	0	0	9,699	0	100,000	130,949	0
2009	0	0	9,699	0	100,000	135,771	0
2010	0	0	9,699	0	100,000	140,591	0

2010 110,269

193,260

23,195

1,002

Vear	China	lanan	South Koroo	South Africa
1050	Clilla	Japan	South Korea	South Africa
1950	0	52,128	0	0
1951	0	49,529	2,620	U
1952	0	47,603	5,276	U
1953	0	45,092	7,871	0
1954	0	43,159	10,573	0
1955	0	54,273	13,161	0
1956	0	40,806	15,827	0
1957	0	38,448	18,419	0
1958	0	36,063	20,977	0
1959	0	33,927	23,679	0
1960	0	31,650	26,294	0
1961	0	29,327	28,859	11,077
1962	0	27,068	31,473	22,147
1963	0	22,774	34,410	33,528
1964	0	20.164	36,784	44.374
1965	0	40.262	39.346	55.376
1966	0	60 518	42 057	66 590
1967	0	287 143	44 713	77 737
1968	0	288 574	47,715	88 889
1060	0	200,574	50,000	100,000
1070	0	200,418	50,000	07,212
1970	0	299,105	55,575	97,515
1971	0	301,018	57,040	95,494
1972	0	300,047	61,178	92,771
1973	0	300,000	64,891	90,342
1974	0	300,756	68,786	88,148
1975	0	299,362	/2,182	85,330
1976	0	291,367	75,764	82,776
1977	0	283,610	79,392	80,290
1978	0	276,302	83,144	77,931
1979	0	270,874	87,509	76,099
1980	0	261,637	90,650	73,198
1981	0	256,204	95,119	71,360
1982	0	249,309	92,880	69,111
1983	0	241,037	90,127	66,481
1984	0	233,328	87,584	64,008
1985	0	224,161	84,491	61,137
1986	5,188	222,954	82,060	58,750
1987	11,048	222,990	80,074	56,678
1988	18,790	220,352	77,129	53,927
1989	21,842	219,810	74,924	51,695
1990	27,085	219,298	72,714	49,455
1991	32,945	217,191	69,976	46,856
1992	38,188	215,683	67,440	44,396
1993	43,431	214,856	65,116	42,074
1994	49,599	213,896	62,744	39,719
1995	54,534	211,737	60,025	37,146
1996	60.394	210,536	57.586	34,749
1997	65.637	209.591	55.212	32,391
1998	71,188	208.744	52.857	30.039
1999	78 803	207 417	50 376	27 614
2000	84 258	206 131	47 904	25 195
2001	89 714	200,101	45 433	22,133
2001	95 160	204,044	43, <del>4</del> 33 <u>4</u> 2 962	20,256
2002	100 680	203,337	42,302 20 101	17 927
2003	100,000	202,270	20 020	15 510
2004 2005	102,004	200,983	30,UZU 25 540	12,000
2005	103,424	100 100	33,349 22 070	10 670
2000	106 164	107 102	33,U/8 20.607	TO'01A
2007	107 522	105.020	50,007	8,20U
2008	100,000	192,830	28,130	5,841
2009	108,903	194,549	20,005	3,421

**Appendix Table A3.** Reconstructed catches by East Asian countries and South Africa from Morocco's southern areas.

Year	France	Italy	Norway	Portugal	Spain
1950	6,914	0	1,724	0	22,288
1951	6,914	0	1,727	0	23,227
1952	6,914	0	1,738	0	27,655
1953	6,914	0	2,154	0	22,208
1954	6,914	0	2,166	0	23,535
1955	6,914	0	2,167	0	21,986
1956	6,914	0	2,172	0	20,436
1957	6,914	0	3,002	0	21,046
1958	6,914	0	3,005	0	25,069
1959	6,914	0	1,780	0	29,280
1960	6,914	0	1,786	0	37,344
1961	6,914	0	2,204	0	39,162
1962	6,914	0	2,211	0	35,545
1963	6,914	0	3,051	0	25,431
1964	6,914	48,375	4,286	1,508	21,702
1965	6,914	96,750	5,526	2,962	24,552
1966	6,914	145,125	6,361	4,471	25,003
1967	6,914	193,500	11,315	6,161	42,397
1968	5,500	241,875	11,324	7,884	41,705
1969	14,486	193,500	15,866	9,460	43,718
1970	10,388	189,016	16,681	9,212	45,608
1971	12,940	184,532	23,483	8,788	55,364
1972	14,125	180,049	30,583	8,977	75,101
1973	5,719	175,565	29,171	9,285	94,481
1974	6,638	171,081	55,814	8,608	119,998
1975	5,608	166,597	70,267	9,047	138,289
1976	6,741	162,114	67,628	8,319	119,592
1977	6,703	157,630	65,009	8,063	148,031
1978	6,666	153,146	62,427	7,702	148,712
1979	6,628	148,662	59,994	8,023	208,692
1980	6,590	144,178	57,259	7,650	143,642
1981	6,552	139,695	54,820	7,108	137,245
1982	6,514	135,211	52,265	7,404	132,478
1983	6,477	130,727	49,606	7,193	165,935
1984	6,439	126,243	46,991	7,051	181,240
1985	6,401	121,760	44,273	7,054	182,400
1986	6,363	117,276	41,683	6,793	179,846
1987	6,325	112,792	39,170	6,716	120,453
1988	6,288	108,308	36,489	6,511	130,677
1989	6,250	103,824	33,934	6,253	172,816
1990	6,212	99,341	31,375	6,187	173,909
1991	6,174	94,857	28,735	5,760	146,325
1992	6,136	90,373	26,127	5,941	140,295
1993	6,098	85,889	23,547	5,593	123,646
1994	6,061	81,406	20,959	5,670	135,560
1995	6,023	76,922	18,332	5,552	103,370
1996	5,985	72,438	15,737	5,113	38,979
1997	5,947	67,954	13,147	4,994	145,189
1998	5,909	63,470	10,556	5,049	126,943
1999	5,872	58,987	9,675	4,878	64,679
2000	5,834	54,503	8,796	4,718	63,556
2001	5,796	50,019	7,916	4,558	62,434
2002	5,758	45,535	7,037	4,398	61,311
2003	5,720	41,052	6,157	4,238	60,189
2004	5,683	36,568	5,277	4,078	59,066
2005	5,645	32,084	4,398	3,918	57,944
2006	5,607	27,600	3,518	3,758	56,821
2007	5,569	23,116	2,639	3,598	55,698
2008	5,531	18,633	1,759	3,438	54,576
2009	5,494	14,149	879	3,278	53,453
2010	5,456	9,665	0	3,118	52,330

Year	Bulgaria	Latvia	Lithuania	Romania	Russia	Poland	Ukraine
1950	0	0	0	0	0	0	0
1951	0	0	0	0	0	0	0
1952	0	0	0	0	0	0	0
1953	0	0	0	0	0	0	0
1954	0	0	0	0	0	0	0
1955	0	0	0	0	0	0	0
1956	0	0	0	0	0	0	0
1957	0	0	0	0	0	0	0
1958	0	0	0	0	0	0	0
1959	0	0	0	0	0	0	0
1960	0	0	0	0	0	0	0
1961	0	0	0	0	0	0	0
1962	0	0	0	0	0	0	0
1963	0	0	0	0	0	0	0
1964	0	0	0	0	0	1,823	0
1965	385	0	0	0	0	3,641	0
1966	771	5,684	3,717	0	3,717	5,470	3,790
1967	1,156	11,372	7,520	0	7,520	7,296	7,582
1968	1,542	17,062	11,375	244	, 11,375	9,123	, 11,375
1969	1.927	22.750	15.167	487	15.167	11.259	15.167
1970	2.305	28.410	18.892	728	18.892	8.155	18.940
1971	6.630	34,167	22,431	961	22.431	2,588	22.778
1972	8,915	38,768	25.829	2.655	25.829	3,951	25.845
1973	4 222	49 210	33 405	4 245	33 405	7 470	32 807
1974	2 929	38 136	25 328	4 193	25 328	23 591	25 424
1975	2 129	58 146	39 647	17 952	39 647	30 233	38 764
1976	3 6/9	23 246	15 / 88	29 299	15 / 88	10/ 212	15/198
1977	15 /06	23,240	53 / 71	13 150	13,400 53 //71	1/19/1212	53 719
1978	9 095	13/ 036	88 104	21 528	88 10 <i>1</i>	202 078	89 357
1979	21 272	83 256	55 759	8 725	55 759	5 166	55 504
1020	15 772	34 877	22 182	1 /08	22 182	/ 112	22 251
1001	17 200	27 695	23,102	2 /15	23,102	2 009	25,251
1007	10 070	57,005	24,319	1 670	24,319	2,090	20,120
1002	10,970 5 970	50,527	20 251	1,079	20 251	2,414	20 562
1004	5,672	53,544	35,331	1,642	35,331	4,400	35,303
1904	5,920	54,042 E2 720	36,400	0	36,400	0,559	30,30Z
1985	5,541	23,738	30,050	0	30,050	8,590 10.659	30,820 20,852
1980	5,172	44,780 25 000	29,870	0	29,870	10,000	29,800
1907	4,015	22,020	24,002	0	17.054	14 706	23,932 17.000
1988	4,433	20,803	17,954	0	17,954	14,780	11,909
1989	4,068	17,928	11,899	0	11,899	16,892	11,952
1990	3,703	8,971	5,978	0	5,978	19,009	5,981
1991	3,328	0	0	0	0	21,028	0
1992	2,957	0	0	0	0	23,081	0
1993	2,590	0	0	0	0	25,187	0
1994	2,221	0	0	0	0	27,288	0
1995	1,848	0	0	0	0	29,276	0
1996	1,478	0	0	0	0	31,352	0
1997	1,109	0	0	0	0	33,458	0
1998	740	0	0	0	0	35,581	0
1999	370	0	0	0	0	37,650	0
2000	0	0	0	0	0	39,723	0
2001	0	0	0	0	0	41,796	0
2002	0	0	0	0	0	43,869	0
2003	0	0	0	0	0	45,942	0
2004	0	0	0	0	0	48,016	0
2005	0	0	0	0	0	50,089	0
2006	0	0	0	0	0	52,162	0
2007	0	0	0	0	0	54,235	0
2008	0	0	0	0	0	56,308	0
2009	0	0	0	0	0	58,381	0
2010	0	0	0	0	0	60,454	0

**Appendix Table A5.** Reconstructed catches by former Soviet republics and East European countries from Morocco's central areas.

Year	China	Japan	South Korea	South Africa
1950	0	22,415	0	0
1951	0	21,297	1,127	0
1952	0	20,469	2,269	0
1953	0	19,390	3,385	0
1954	0	18,558	4,546	0
1955	0	23,338	5,659	0
1956	0	17,547	6,805	0
1957	0	16,533	7,920	0
1958	0	15,507	9,020	0
1959	0	14,589	10,182	0
1960	0	13,609	11,306	0
1961	0	12,611	12,409	4,763
1962	0	11,639	13,533	9,277
1963	0	9,793	14,796	13,989
1964	0	8,671	15,817	19,081
1965	0	17,313	16,919	23,178
1966	0	26,023	18,084	27,097
1967	0	123,471	19,227	33,223
1968	0	124,087	20,368	38,222
1969	0	129,180	21,500	43,000
1970	0	128,640	23,036	41,546
1971	0	129,438	24,785	39,315
1972	0	129,020	26,333	39,752
1973	0	129,000	28,221	39,935
1974	0	129,325	30,316	35,603
1975	0	128,726	31,899	37,795
1976	0	125,288	32,277	36,353
1977	0	121,952	34,139	34,284
1978	0	118,810	35,779	33,524
1979	0	116,476	37,836	32,900
1980	0	112,504	39,230	31,631
1981	0	110,168	41,239	29,517
1982	0	107,203	40,192	29,348
1983	0	103,646	38,690	28,355
1984	0	100,331	37,442	27,365
1985	0	96,389	36,568	26,372
1986	2,224	95,870	35,460	25,213
1987	4,735	95,886	34,652	24,193
1988	8,053	94,751	33,273	23,177
1989	9,361	94,518	32,376	21,946
1990	11,608	94,298	31,456	21,065
1991	14,119	93,392	29,417	20,170
1992	16,366	92,744	29,202	19,358
1993	18,613	92,388	27,424	18,045
1994	21,257	91,975	27,172	17,132
1995	23,372	91,047	26,097	16,059
1996	25,883	90,530	23,437	15,215
1997	28,130	90,124	23,617	13,955
1998	30,509	89,760	22,939	12,947
1999	33,773	89,190	21,880	11,941
2000	36,111	88,636	20,807	10,895
2001	38,449	88,083	19,/34	9,849
2002	40,/8/	87,529	18,001	8,803
2003	43,149	86,976	1/,58/	/,/5/
2004	43,/3/	86,423	16,514	6,/10
2005	44,325	85,869	15,441	5,664
2006	44,912	85,316	14,30/	4,618
2007	45,499	84,763	13,294	3,572
2008	40,080	84,209 83.656	12,221	2,520
2009	40,0/3	03,050 02 102	11,148	1,480
2010	47,258	83,102	10,074	433

Appendix Table A6. Reconstructed catches by Asia and South Africa from Morocco's central areas.