Guinean fisheries, past, present and...future?[1]

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Abstract

Guinea is known for the wealth of its fisheries resources, targeted by both the domestic as well as foreign legal and illegal fleets. Domestic fisheries catches along the Guinean coast between 1950 and 2010 were estimated at 8.3 million t, compared to 2 million t of landings as reported to FAO. Small-scale fisheries subsectors accounted for over 5.6 million t. Foreign fisheries, with an estimated 22.6 million t between 1950 and 2010, constituted the bulk of fisheries removals in Guinean waters, and threaten the sustainability of Guinea's already over-exploited fisheries. These fleets caught over 3 times the maximum potential catch estimated by the Guinean government. This poses serious concerns regarding the domestic food security of Guinea, as well as livelihood of fishers and the local economy, as thousands of jobs are lost to illegal foreign fishing.

Introduction

Guinea is located in the 'corner' of North West Africa, with Guinea Bissau to the North and Sierra Leone, Liberia and Côte d'Ivoire to the south (Figure 1). With an Exclusive Economic Zone of 59,400 km² (www.seaaroundus.org) and the largest continental shelf of North West Africa (second in all of West Africa), Guinea enjoys a productive marine environment induced by the Guinea Current upwelling system.

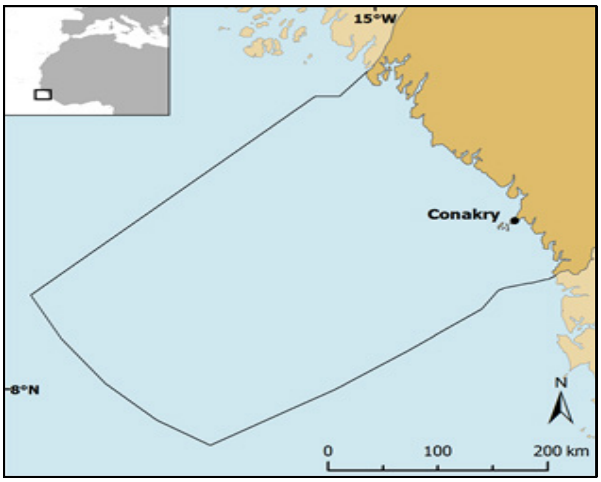

Figure 1. Map of Guinea showing the Guinean EEZ.

Historically, Guinea was one of the first countries of the West African French colonial empire to gain independence from France in 1958. After independence, Guinea suffered governance issues, a succession of political conflicts, poverty and food security crises, and the Guinean population has been under the risk of serious hunger for decades (Anon. 2004; von Grebmer *et al.* 2010; Anon. 2011b). With an annual per capita consumption spendings of US$ 175-452, half of the population lives under the poverty line and 13% in extreme poverty (Anon. 2004; www.worldbank.org [2012]).

More than 1.5 million people directly depend on fish for their livelihoods, with 60% of the protein intake of the Guinean population from fish (Goujet *et al.* 1992; Anon. 2003; N'Dia 2004; WFC 2005). The Guinean population suffers from malnutrition and animal protein deficits (Lopriore and Muehlhoff 2003; Touré 2006), which can be related to declining fish productivity (Figure 2) caused by over-exploitation (Gascuel *et al.* 2009). It is clear, however, that fisheries, if well managed, could provide more security in terms of food and income to local communities. Fisheries management initiatives should be supported by fisheries catch data for local and foreign sectors in the Guinean EEZ. This is far from being the case. Moreover, Guinea is known to be the country most strongly affected by illegal fishing in West Africa, which makes it one of the worst cases of illegal fishing in the world (Godoy 2010). It is important to better understand how much fish is taken from Guinean waters, before attempting to make any plan on how management incentives should be implemented. Not surprisingly, without proper knowledge of long-term

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fisheries removals in Guinean waters, many fisheries development initiatives since the 1950s have failed, since they prioritized the expansion of fishing as key to 'sustainable development' (Kaczynski and Fluharty 2002).

The available literature on fisheries in Guinea documents an artisanal sector comprised of traditional fishing with *pirogues* of less than 12 m since the 1950s, and advanced artisanal fishing (or semi-industrial fishing) with trawlers under 100 GRT, and to a lesser extent, an industrial demersal fishing sector (Chavance and Diallo 1996; Damiano 1999; Gascuel *et al.* 2009) alongside the foreign industrial sector which is prominent in Guinean waters (Lesnoff *et al.* 1999). Subsistence fishing is also important in Guinea and constitutes an important source of protein for the Guinean population (Chavance and Diallo 1996; Chauveau *et al.* 2000; Sidibe 2003). Guinea was handing out fishing licenses to foreign fleets in the early 1950s, even before the declaration of the Guinean EEZ in 1980, and the definition of artisanal fishing zones in 1985 (Lesnoff *et al.* 1999). Artisanal fishing zones are also subject to non-authorized exploitation by foreign vessels operating illegally (Gorez 2010). This paper analyses the fisheries in one of the poorest countries of the world and reconstructs historic fisheries catches (1950-2010) using the method described by Zeller *et al.* (2007) in an attempt to provide a more realistic estimate of Guinean fisheries removals including the prominent foreign catches.

Table 1. Artisanal effort anchor points and the corresponding CPUE. Interpolations are indicated by '-'.

Year	Number of boats	Source	CPUE ($t \cdot boat^{-1} \cdot year^{-1}$)
1950	1,000	Bouju (1993)	22.4[a]
1951-1982	-		-
1983	1,700	Pollnac (1985)	-
1984	1,700	Weber and Durand (1986)	-
1985-1988	-		-
1989	1,788	Gascuel *et al.* (2009)	29.8[b]
1990-1991	-		-
1992	2,306	Chavance and Diallo (1996)	-
1993-1994	-		-
1995	2,343	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
1996	2,358	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
1997	2,561	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
1998	2,361	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
1999	2,361	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
2000	2,564	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
2001	3,637	CNSHB 1995-2012, unpub. data	-
2002	3,636	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
2003	3,636	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
2004	3,636	CNSHB 1995-2004 in Gascuel *et al.* (2009)	-
2009	6,025	CNSHB 1995-2012, unpub. data	
2010	6,030	CNSHB 1995-2012, unpub. data[d]	26.8[a]

a) Assumption;
b) Chavance and Domalain (1999).

Methods

Reported fisheries landings time series were extracted from the Food and Agriculture Organisation database (FishstatJ) covering the 1950-2010 time-period, and used as a reporting baseline for this study. Effort time series including the number of artisanal and industrial vessels were available through the 'Centre national des sciences halieutiques de Boussoura' (CNSHB) and an extensive literature review that covered the period from 1950 to 2010. Effort estimates combined with catch per unit of effort estimates (CPUE) allowed estimating total catches for industrial (domestic and foreign) and artisanal sectors in the Guinean Exclusive Economic Zone (EEZ), from which subsistence fisheries and discards were inferred.

Artisanal fisheries

Artisanal fishing in Guinea is conducted by canoe-type boats of less than 12 m. This sector includes all motorized and unmotorized canoes as long as their activity is defined as artisanal for commercial purposes by the Guinean legislation. This sector operates in Guinea since 1950. This definition excludes the Senegalese *Yoli*-type *pirogues* that target sharks for their fins since the mid-1980s. Official artisanal fishing effort surveys in Guinea started in 1989 (Gascuel *et al.* 2009). These surveys included catches since the mid-1990s (Chavance 2002). The number of traditional artisanal *pirogues* was documented in the 1950s, 1980s, 1990s and 2000s (Table 1), from which we derived a complete series for the 1950-2010 time-period by linear interpolations. We estimated a catch per unit of effort (CPUE) of 29.8 $t \cdot boat^{-1} \cdot year^{-1}$ by dividing a catch of 53,300 $t \cdot year^{-1}$ in 1989 (Chavance and Domalain 1999) by the corresponding effort of 1,788 *pirogues* (Gascuel *et al.* 2009; Anon. 2011a). Given that most fishers (also farmers) were operating part-time (50%) in the agricultural sector in the early 1950s (Chavance and Domalain 1999), we divided the 1989 CPUE by two, which accounted for the time spent fishing, then again by two to account for the lower efficiency of the non-motorized *pirogues* used in the 1950s compared to the 1980s (Sidibe 2003), considering that increasing technology and modernization (motorization) lead to considerably higher catches (Mathew 2001). Therefore, the CPUE in 1950 was estimated at 75% of the CPUE in 1989, i.e., 22.4 $t \cdot boat^{-1} \cdot year^{-1}$. Discussions with local representatives or artisanal fisheries revealed that although Guinean waters are heavily over-exploited (Figure

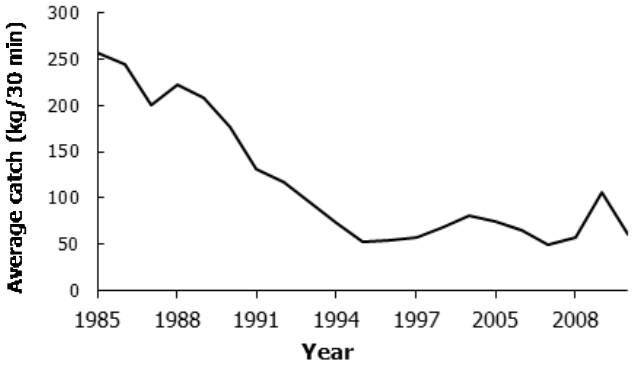

Figure 2. Relative abundance in the marine environment from 1985 to 1995, adapted from trawl surveys documented Domain *et al.* (1999), updated by the CNSHB.

2), artisanal fishers increased the time spent at sea per day, and the distance to fishing grounds, as well as the total number of days per year. Therefore, we assumed the catch per year was 10% lower in 2010 compared to 1989 (i.e., 26.8 t·boat^{-1}·year^{-1}) to account for this increase in the intensity of fishing, which illustrates via increasing costs the over-exploitation of Guinean coastal fisheries resources (Domain 1999; Gascuel *et al.* 2009). Furthermore, during discussions within the CNSHB with local experts, fishers representatives noted that annual artisanal catch per boat was much higher than the official estimate of 16 t·boat^{-1}·year^{-1}. We believe this further illustrates the importance of the unreported component in the 2000s as shown previously in the study of Chavance and Domalain (1999). Thereafter, we performed a linear interpolation between CPUE anchor points (Table 1), and then multiplied the resulting rates by the estimated number of *pirogue*s. To derive a taxonomic breakdown, we applied the average species disaggregation provided by Gascuel *et al.* (2009), accounting for a multi-gear artisanal fishery from 1985 to 2004 (Table 2).

Table 2. Breakdown of artisanal species by Gascuel *et al.* (2009).

Taxon name	Scientific name	Percentage (%)
Bonga shad	*Ethmalosa fimbriata*	53
Bobo croaker	*Pseudotolithus elongatus*	8
Sardinellas	*Sardinella* spp.	7
Guinean sea catfish	*Arius* spp.	7
Croakers	*Pseudotolithus* spp.	6
Seabreams	*Sparus* spp.	6
Mullets	*Mugilidae*	3
Royal threadfin	*Pentanemus quinquarius*	2
Demersal fishes	-	2
Jacks	*Caranx* spp.	1
Grunt	*Pomadasys* spp.	1
Soles	*Solea* spp.	1
Giant African threadfin	*Polydactylus quadrifilis*	0.9
Rays	Elasmobranchii	0.5
Sharks	Elasmobranchii	0.5
Large pelagics	Scombroids	0.5
Barracudas	*Sphyraena* spp.	0.5
Lesser African threadfin	*Galeoides decadactylus*	0.1

Semi-industrial fisheries

Semi-industrial fishing is also commonly called advanced-artisanal fishing in some countries of West Africa[2]. This sector in Guinea is operated by trawlers of which the capacity is under 100 GRT. Although this sector started in 1981, it only expanded from 1985 onward (Chavance and Diallo 1996), with the first vessels delivered from Spain (Damiano 1999). Anchor points for the number of vessels (exclusively trawlers) were available from Damiano (1999), Bah *et al.* (2002) and Richard *et al.* (2006). We assumed effort from 2006 to 2010 was constant since the overall artisanal effort was constant over the same time period (Table 3). We then interpolated linearly to complete the time series. CPUE rates were estimated at 122 t·boat^{-1}·year^{-1} for 1981 and 111 t·boat^{-1}·year^{-1} for 2002 based on catch and effort estimates by Damiano (1999), Chavance and Diallo (1996) and Bah *et al.* (2002). We assumed a 10% lower CPUE for 2010, i.e., 100 t·boat^{-1}·year^{-1}. This rather low decreased in CPUE, despite strong over-exploitation of Guinean fisheries resources, is justified by the increasing fishing capacity (e.g., the number of fishing days per year per boat). We interpolated linearly between the CPUE rates and applied these to the estimated effort (Table 3). Thereafter, we disaggregated catches using the taxonomic breakdown provided by Damiano (1999, Table 4).

Table 3. Semi-industrial effort anchor points and the corresponding CPUE. '-' indicate Interpolations.

Year	Number of boats	Source	CPUE (t·boat^{-1}·year^{-1})
1950	0	Assumption[a]	0
1980	0	Assumption[a]	0
1981	1	Damiano (1999)	122[b]
1982	1	Damiano (1999)	-
1983	1	Damiano (1999)	-
1984	1	Damiano (1999)	-
1985	2	Damiano (1999)	-
1986	5	Damiano (1999)	-
1987	7	Damiano (1999)	-
1989	17	Damiano (1999)	122[c]
1990	11	Damiano (1999)	-
1991	9	Damiano (1999)	-
1992	11	Damiano (1999)	-
1993	16	Damiano (1999)	-
1995	10	CNSHB, unpub. data	
1996	11	CNSHB, unpub. data	-
1997	10	CNSHB, unpub. data	
1998	4	CNSHB, unpub. data	
1999-2000	0	CNSHB, unpub. data	
2001	-		-
2002	18	Bah *et al.* (2002)	111[d]
2003-2005	-		-
2006	14	Richard *et al.* (2006)	-
2007-2009	-		-
2010	14	Assumed constant	100[c]

a) Advanced artisanal fishing started in 1981 (Damiano 1999);
b) Derived from the available average catch per day of 0.9653 t·boat^{-1}·day^{-1} for 1989 and the number of fishing days for 1981 (126 days) (Damiano 1999);
c) Assumption;
d) Derived from a catch of 2000 tonnes and an effort of 18 vessels for 2002 (Bah *et al.* 2002).

Subsistence fisheries

Small-scale fishing before the 1980s was mainly for subsistence (Chavance 1999). Guineans, along with other migrant fisher groups from Ghana and Sierra Leone, were catching fish for personal consumption. Subsistence fishing in Guinea can be land-based or operated by dugout-canoe type boats propelled by paddle, sail and/or motor of less than 25 hp, mostly of 8 and 15 hp. The most important part of small-scale fishing was thus for subsistence in the 1950s and 1960s (Chauveau *et al.* 2000). Therefore, it is reasonable to assume that at least the equivalent of the commercial catch (i.e., the equivalent of 100% of artisanal catch) was caught for personal consumption, i.e., subsistence from 1950 to 1980 when the Guinean EEZ was declared. In the last decade (2000s), a portion of small-scale catches intended for commercialization were kept for personal consumption (N'Dia 2004). Consequently, we assumed that subsistence catches from 2000 to 2010 were equivalent to 10% and 5% of the artisanal catch respectively, which we interpolated. We interpolated from 100% in 1980 to 30% in 2000 to complete

[2] For the purposes of the *Sea Around Us* Project, the semi-industrial sector was treated as 'industrial'.

the time series, and then applied the resulting rates to the reconstructed artisanal catch from 1950 to 2010. Bonga shad (*Ethmalosa fimbriata*), sardinellas (*Sardinella* spp.) and other small pelagics (Clupeidae) are the main taxa kept for subsistence in Guinea (Goujet *et al.* 1992), and were assigned to the estimated subsistence catch equally (33% per taxon).

Table 4. Semi-industrial catches taxonomic breakdown.

Taxon name	Scientific name	Percentage (%)
Cassava croaker, longneck croaker and law croaker	*Pseudotolithus senegalensis, P. typus* and *P. brachygnathus*	30
Bobo croaker	*Pseudotolithus elongatus*	11
Cameroon croaker, Guinea croaker	*Pseudotolithus epipercus, P. moori*	7
Royal threadfin	*Pentanemus quinquarius*	6
African sicklefish	*Drepane africana*	2
Sompat grunt	*Pomadasys jubelini*	1
Lesser African threadfin	*Galeoides decadactylus*	17
Guinean sea catfish	*Arius* spp.	13
Rays	Rajiformes	7
Other demersal species	-	6

Industrial

Domestic

Guinean industrial fishing is mostly composed of trawlers operating under joint venture arrangements (Sidibe 2003). Joint ventures are second-generation fishing agreements which allow the transfer of part of a vessel ownership to a third party in the host country and commonly translate into reflagging vessels. In Guinea, it mainly consists of reflagging foreign vessels, but with highly variable or no real Guinean ownership. This fishery started in 1950 (Moal 1961 in Lesnoff *et al.* 1999). N'Dia (2004) provided effort data with 23 vessels in 1985, 13 in 2002, and 12 in 2004, which then represented 7% of the total industrial fleet including foreign vessels. We assumed that this rate remained constant until 2010, and calculated the number of vessels to be 13 trawlers. To reconstruct catches by these joint venture vessels, we first interpolated effort data of the number of trawlers per year from zero vessels in 1950 to 23 trawlers in 1985, and performed a series of linear interpolations to complete the time series. We multiplied this effort by the CPUE of 2,400 $t \cdot boat^{-1} \cdot year^{-1}$ (Kaczynski 1989) from 1950 to 2010, assuming the resulting decline in CPUE caused by over-exploitation (Gascuel *et al.* 2009) would be compensated for with increasing vessel capacity and the number of fishing trips.

Foreign

Herein, we first estimated total foreign catches by the legal fleets using an overall average CPUE, then we separately estimated catches by the Chinese fleet, as a subset, using a CPUE that is typical of the Chinese fleet. Catches by the EU fleet were also estimated as a subset of total foreign catches. The remaining foreign catch (after subtracting Chinese and EU catches) were disagregated per beneficial country of origin and per taxon.

Total foreign catches: Although Guinea declared its EEZ in 1980, the first formal industrial fishing licences were distributed in the early 1970s (Lesnoff *et al.* 1999; Sidibe 2003), and Moal (1961 in Lesnoff *et al.* 1999) already documented foreign industrial trawlers operating in Guinea's EEZ equivalent waters in the 1950s. Industrial fishing effort by gear type from 1950 to 2003 was reconstructed and interpolated for years when data were not available (Table 5), while the 2005 data point was fragmentary, the total effort was available for 2004 (177 vessels) and 2010 (169 vessels) including all gear types

Table 5. Anchor points for annual industrial fishing effort by foreign fleets.

Year	General bottom trawlers	Demersal fish trawlers	Cephalopod trawlers	Shrimp trawlers	Small pelagic seiners	Large pelagics (longline and purseiners)	Mixed
1950	12[a]	1[f]	1[f]	1[f]	0[f]	0[f]	0[a]
1961	12[a,b]	-	-	-	-	-	-
1966	10[c]	-	-	-	-	-	-
1971	-	4[g]	-	1[f]	-	-	-
1972	-	5[f]	-	0[f]	-	-	-
1973	-	9[f]	-	2[f]	-	-	-
1974	-	10[f]	-	3[f]	-	-	-
1975	-	6[f]	-	1[f]	-	-	43[h]
1976	10[c]	10[f]	-	6[f]	-	0[f]	-
1977	-	25[f]	-	4[f]	-	0[f]	-
1978	-	48[f]	-	5[f]	-	2[f]	-
1979	-	47[f]	5[f]	8[f]	-	8[f]	-
1980	-	58[f]	5[f]	10[f]	-	9[f]	-
1981	-	45[f]	7[f]	12[f]	-	11[f]	-
1982	-	46[f]	3[f]	12[f]	-	7[f]	-
1983	-	49[f]	9[f]	13[f]	-	11[f]	-
1984	14[d]	43[f]	10[f]	12[f]	-	21[f]	-
1985	-	23[f]	14[f]	11[f]	-	45[f]	-
1986	-	33[f]	24[f]	10[f]	-	28[f]	0g
1987	-	41[f]	24[f]	7[f]	-	47[f]	21g
1988	-	31[f]	18[f]	9[f]	-	40[f]	13[g]
1989	-	11[f]	19[f]	8[f]	-	51[f]	15[g]
1990	-	49[f]	31[f]	13[f]	0[f]	41[f]	11[g]
1991	-	49[f]	24[f]	3[f]	11[f]	23[f]	7[g]
1992	-	40[f]	15[f]	6[f]	9[f]	19[f]	0[g]
1993	-	36[f]	64[f]	8[f]	8[f]	23[f]	0[g]
1994	-	34[f]	-	5[f]	4[f]	24[g]	-
1995	-	42[g]	34[g]	6[h]	2[g]	26[g]	-
1996	-	37[g]	25[g]	16[g]	4[g]	37[g]	-
1997	-	72[g]	55[g]	24[g]	6[g]	38[g]	-
1998	-	76[g]	55[g]	11[g]	4[g]	49[g]	-
1999	-	54[g]	38[g]	17[g]	3[g]	50[g]	-
2000	-	75[g]	58[g]	45i	5[g]	43[g]	-
2001	-	67[g]	46[g]	43i	5[g]	47[g]	-
2002	-	55[g]	38[g]	58i	4[g]	39[g]	-
2003	-	61[g]	42[g]	18[g]	5[g]	43[g]	-

a) Assumption ; b) Moal (1961) in Lesnoff *et al.* (1999); c) Caverivière (1979) in Lesnoff *et al.* (1999); d) Weber and Durand (1986); e) Richard *et al.* (2006); f) Lesnoff *et al.* (1999); g) Sidibe (2003); h) Chavance and Diallo (1996); i) CNSHB (2004).

(N'Dia 2004; Fontana 1998, in Richard *et al.* 2006; Diop and Dossa 2011). We calculated the annual sum representing the total effort from 1950 to 2003, then interpolated linearly the total effort by year to 2004 and 2010 to complete the time series. The effort between 1950 and 2003 was documented on the basis of licences; we conservatively assumed each licence accounted for one vessel. Thereafter, we applied an average CPUE of 2,400 t·boat^{-1}·year^{-1} (Kaczynski 1989) to the total number of vessels. These estimates are considered conservative especially for the earlier time period when fishing licences and vessels were not all reported (Lesnoff *et al.* 1999). Total foreign catch by all authorized fishing under foreign flags in Guinea's waters includes catches by the European fleet under EU Fisheries Partnership Agreements (FPAs), China, Japan, Korea, African countries and other fleets notably those from Flag of Convenience countries (FoC).

Industrial catches under EU agreements: Guinea and Europe signed their first fishing access agreements in the early 1980s (N'Dia 2004), for shrimp trawlers from Spain, Portugal and Greece; demersal fish and cephalopod trawlers from Spain, Italy and Greece; tuna seiners and pole and line vessels from France and Spain; and tuna longliners from Portugal and Spain (EU 2004). The number of vessels were available from formal agreements between 1980 and 2010 from the EU agreements database (eur-lex.europa.eu[2012]) which corresponded to the number of EU vessels operating in Guinea (N'Dia 2004) (Table 6). We converted the effort expressed in GRT to the number of vessels using an average of 141 GRT·vessel^{-1}. We then multiplied the number of vessels by the average CPUE of 2,400 t·boat^{-1}·year^{-1} (Kaczynski 1989) to estimate total catches by the European countries under EU-Guinea agreements. Although European countries benefiting from these agreements are often not specified, based on the European Community – Guinea 2003 agreement (EU 2004), 59% of the effort was from Spain, 20% was from France, 9% was from Greece, 6% from Portugal and 6% from Italy. We assumed these rates were constant from 1980 to 2010, except for Portugal who started fishing in Guinea in 1981 and was no longer under EU agreements after 2007. We allocated 0% of EU catches to Portugal in 1980 and from 2007 to 2010; the remaining 6% (originally Portuguese) was distributed evenly to the remaining countries, i.e., Spain, France, Greece and Italy. Effort estimates under agreements are conservative, since they only include agreements between Guinea and the EU on behalf of EU countries, whereas other occasional government fishing agreements and joint ventures (for example with Spain and Greece) were documented for the 1970s and 1980s, but not accounted for in this estimation (Weber and Durand 1986).

Table 6. Number of vessels per gear type from the European Union under formal agreements (EU 2004; N'Dia 2004; EU 2009).

Year	Tuna seiners	Small pelagic seiners	Longliners (tuna)	Trawlers
1950 to 1979	0	0	0	0
1980	25	25	0	12
1981	25	25	0	12
1982	25	25	0	12
1983	25	25	0	12
1984	25	25	0	12
1985	45	25	6	12
1986	45	25	6	12
1987	45	25	6	12
1988	45	25	6	12
1989	45	25	10	12
1990	45	25	10	12
1991	24	8	5	12
1992	24	10	5	17
1993	24	10	5	17
1994	28	7	7	20
1995	28	7	7	20
1996	33	13	28	20
1997	33	13	28	20
1998	36	14	22	18
1999	38	14	16	16
2000	38	14	16	16
2001	38	14	16	16
2002	38	14	16	16
2003	38	14	16	16
2004	34	12	16	70
2005	31	10	15	60
2006	28	8	15	50
2007	24	6	15	41
2008	21	4	15	31
2009	17	2	14	21
2010	14	0	14	12

Table 7. Anchor points for annual fishing effort in capacity converted to number of Chinese vessels operating in the Guinea EEZ.

Year	GRT trawlers	GRT Cephalopod Trawlers	Number of vessels	Source
1950	0	0	0	assumption
1996	1,500	2,048	26	N'Dia (2004)
1997	1,500	2,048	26	N'Dia (2004)
2000	1,000	2,200	22	N'Dia (2004)
2001	1,000	2,200	22	N'Dia (2004)
2003	800	1,500	16	N'Dia (2004)
2004	800	1,500	16	N'Dia (2004)
2010	NA	NA	30	Anon. (2012)

The Chinese distant water fleet: The Chinese distant water fishing fleet was operating in Guinea between the 1950s and 2010 (Lesnoff *et al.* 1999), until the 2000s with formal fishing access agreements mainly for cephalopod and demersal resources (Lesnoff *et al.* 1999; Sidibe 2003; Anon. 2012). To estimate the number of Chinese vessels operating under licence in Guinea, we divided the reported total GRT (N'Dia 2004) by an average GRT of 250 GRT·vessel^{-1} (Anon. 2003) (Table 7) of which 55% were targeting cephalopods and 45% demersal fish and crustaceans (N'Dia 2004). We performed a series of linear interpolations to complete the effort time series between 1950 and 2010 (Table 7). We then multiplied the derived effort time-series by a CPUE of 221 t·boat^{-1}·year^{-1} for cephalopod vessels

and 1,252 t·boat^{-1}·year^{-1} for trawlers (Pauly *et al.* 2012). Assuming a constant CPUE overtime for the Chinese fleet particularly highlights the compensation due to first increasing fishing capacity per boat, but also refflects upon the increasing unregulated practices of the Chinese fleet fishing in the artisanal and near-shore zones of Guinea, on contrast to fleets of other origin. These vessels were operating under licence with Guinea. Although we assumed all catches were exclusively from the Guinean EEZ, these estimates remain conservative since they do not account for the occasional and seasonal Chinese fleets operating in Guinea. Catches of the demersal and cephalopod fleets consist to 50% of scianids (*Pseudotolithus senegalensis, P. typus, P. elongatus, Cynoglossus canariensis, C. monody, C. senegalensis, Arius heudeloti, A. istiscutatus, A. parkii, Galeoides decadactylus, Pomadasys incisus, P. jubelini*), 44% of cephalopods (*Sepia* spp. and other cephalopods), 2.4% of sparids (*Pagellus bellottii* and *Sparus caeruleostictus*) and 3.6% of crustaceans (*Penaeus notialis, P. kerathurus and Perapenaeopsis atlantica*) (Lesnoff *et al.* 1999). We used these rates to disaggregate Chinese catches from Guinean waters.

Table 8. Countries operating in the Guinean EEZ under agreements.

Country	Period	Source
Russia	1950-2000s	Lesnoff *et al.* (1999); Sidibe (2003)
Ukraine	1950-2000s	Lesnoff *et al.* (1999); Sidibe (2003)
Korea	1958-2010	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Gorez (2010)
Poland	1958-2010	Lesnoff *et al.* (1999)
Japan	1966-mid 2000s	Weber and Durand (1986); OECD (2010)
Yugoslavia	1966-1984	Weber and Durand (1986)
Malta[a]	1971-2000	Sidibe (2003)
Germany	1958-1984	Lesnoff *et al.* (1999)
Liberia[a, b]	1966-1986	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Dobo (2009)
Ghana[a, b]	1966-1986	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Dobo (2009)
Côte d'ivoire	1966-2010	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Dobo (2009)
USA	1966-2010	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Dobo (2009)
Senegal	1971-2010	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Dobo (2009)
Sierra Leone	1971-2010	Weber and Durand (1986); Lesnoff *et al.* (1999); Sidibe (2003); Dobo (2009)

a) Korean vessels reflagged.
b) Operating under joint ventures with Guinea.

Other fleets: The difference between the total estimated catch and the sum of European (Greece, Italy, Portugal, Spain and France) and Chinese catches was allocated to other flags operating under licences in the Guinean EEZ (Table 8). We determined the presence or absence of a foreign fishing country per year based on a literature review, i.e., when a country is mentioned as fishing in Guinea's waters, then that country was present during that year. We assumed the absence of literature documenting a country fishing in Guinea meant the absence of that country during that period/year, and the first time this country was mentioned would correspond to the first year it started fishing in Guinea. According to the presence or absence of a country in the Guinean EEZ, we first assumed an even distribution by country depending on the number of countries operating and the start and end of fishing operations by country. For example, the former USSR (Russia and Ukraine) were the only fleet fishing in Guinea from 1950 to 1957, therefore, we allocated 100% of catches to these former Soviet republics from 1950 to 1957. In 1958, Korea, Poland and Germany started fishing in the Guinean EEZ, we allocated 0% of the catch to these countries in 1957, and then interpolated from these rates to 20% for each country (USSR, Korea, Poland, Germany) in 1965 assuming approximately the same catch per country. In 1966, USA, Japan, Liberia, Ghana Ivory Coast and Senegal started industrial fishing operations in Guinea; therefore they were allocated 0% in 1965 increasing linearly to 10% for each country in 1970, right before Malta (mostly Korean reflagged vessels), Sierra Leone and Senegal started fishing in Guinea etc. This rationale assumes an even distribution of catches where countries which started fishing earlier get a higher percentage of unallocated catches in the earliest time-periods, decreasing thereafter when other countries start fishing.

Illegal fishing

There are three main types of illegal fishing in Guinea: fishing without a licence (42% of the cases), industrial fishing in artisanal zones (21%, i.e., the equivalent of 50% of illegal unlicensed vessels), and fishing using illegal gear (31%) (EJF 2006; Gorez 2010). In this study, we only estimated catches by non-licenced or non-authorized foreign vessels as a conservative approach to avoid double counting, since legal vessels may have been using illegal mesh size or operating in artisanal zones. Foreign fleets operate increasingly in Guinea without authorizations (Godoy 2010). In 2006, illegal fishing by foreign fleets represented the equivalent of 63% of legal landings, when 22 boats of an observed total of 104 boats were illegal (EJF 2006). Chinese vessels (including under flags from Belize and Panama) represented 50% to 60% of illegal fishing vessels (Dobo 2009; EJF 2009; Mallory 2012). The remaining countries include South Korea (with flags from Korea, and FoC countries like Malta, Panama and Belize), vessels reflagged to Guinea and to Senegal and others (Anon. 2006; EJF 2009). We estimated that illegal vessels represented the equivalent of 13% of the legal fleet in 2006, i.e., 22 vessels (EJF 2006) divided by the total legal fleet in 2006 (176 vessels). We then applied this percentage to the total legal fleet from 1950 to 2010. Catches taken before the declaration of the EEZ are considered legal but unregulated in this study. Thereafter, we distributed catches by flag, where China represented 60% of catches, and the remaining catch was allocated evenly between Korea, Guinea, Senegal and others.

Although industrial catches in artisanal areas are already accounted for here, since the catch reconstruction disregards the zone of the catch, it is important to establish an estimated amount taken from reserved artisanal fishing zones in Guinea. The equivalent of 50% of illegal catches are caught within artisanal zones (Gorez 2010).

Therefore, we applied the latter rate to the estimated illegal catch from 1950 to 2010, to retrace illegal catches in artisanal areas.

Discards

Discards in the industrial fisheries of Guinea (domestic and foreign) are important and range between 40% and 67% of demersal fish catches (discarding mainly cephalopods), 78% to 150% of shrimp catches and 82% of cephalopod catches from 1986 to 1998 (Weber and Durand 1986; Sidibe 2003). Artisanal fisheries discards ranged between 10% and 15% of the artisanal catches (Weber and Durand 1986) and here were assumed to be constant. Therefore, to estimate discards by sector, we assumed discard rates were constant from 1950 to 1986 for industrial fisheries, and during the 1950-1986 and 1998- 2010 time periods for artisanal fisheries. Comparative results by Sidibe (2003) show a 6% decrease in the catch kept onboard industrial vessels since 1998, i.e., here increase in discards by 6% from 1998 to 2010. We interpolated linearly the above mentioned discard rates by sector from 1986 to 1998 for artisanal fisheries, and from 1986 to 1998, then from 1998 to 2010 for industrial fisheries. We applied these discard rates to the reconstructed demersal fish, shrimp and cephalopod catch for the domestic and foreign sectors along with artisanal domestic reconstructed catches. We performed a species breakdown for large-scale shrimp and cephalopod sector discards using the estimated discard rates per species by Sidibé *et al.* (2003), i.e., 71% of lesser African threadfin catches, 53% of bobo croaker catches, 35% of longneck croaker catches and 28% of the Cassava croaker catch by calculating corresponding species rates and assuming 20% is unknown fish species, we disaggregated the remaining 80% to include the four species listed above.

Results

Total reconstructed catches in Guinea

Total catches (domestic and foreign) taken in Guinea's waters between 1950 and 2010 accounted for 31.8 million t (Figure 3a). Guinean domestic catches were estimated at 8.4 million t between 1950 and 2010 compared to 2 million t of landings as reported by FAO, i.e., 4.2 times as high (Figure 3b). Domestic catches in the Guinean EEZ increased from 47,800 t·year^{-1} in 1950 to a first peak of around 178,000 t·year^{-1} in 1985, decreasing in the late 1990s, and then increased again and reach their maximum of 231,000 t·year^{-1} in 2009, i.e., over twice as high as the data supplied to FAO (81,000 t·year^{-1}) (Figure 3b). Over a total of 8.4 million t, 130,000 were caught by industrial vessels of foreign beneficial ownership reflagged to Guinea.

Guinean domestic catches were almost as high as foreign industrial catches including illegal removals between 1950 and the early-1970s, with a total domestic catch of 2.3 million t compared to a foreign catch of 2.3 million t between 1950 and 1973 (Figure 3a). This trend has changed since the early 1980s, after Guinea declared its EEZ, when foreign catches (19.2 million t) were over three times the reconstructed

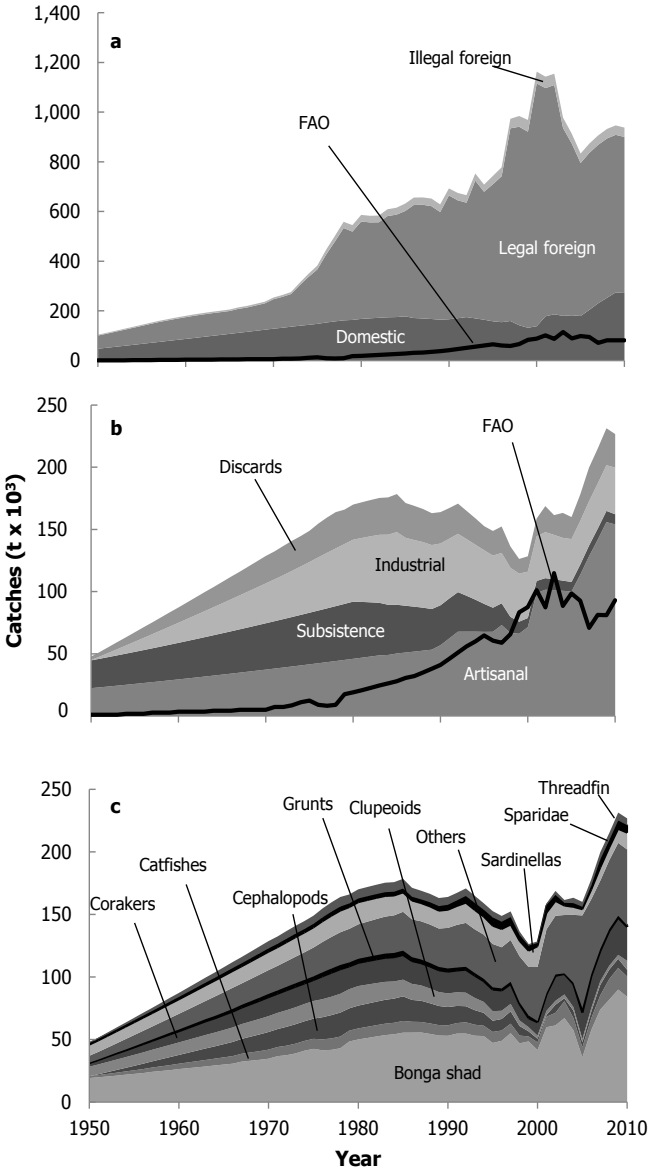

Figure 3. Estimated catch from the Guinea EEZ by a) the domestic and foreign sectores, b) the domestic sector compared to catches supplied to FAO, and c) taxon, 1950-2010.

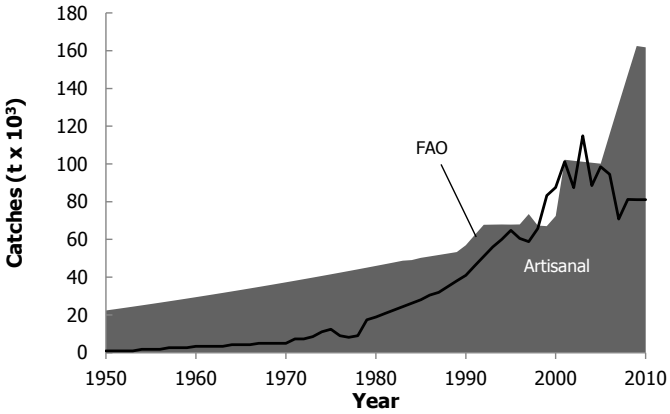

Figure 4. Total reconstructed artisanal catches by Guinea compared to data supplied to the FAO, 1950-2010.

domestic catch (5.1 million t) between 1980 and 2010 (Figure 3a).

Domestic catch breakdown is dominated by Bonga shad, other small pelagics including sardinella, and cephalopods (Figure 3c).

Reconstructed catches by sector

Artisanal

Artisanal landed catches (i.e., excluding discards) were estimated at 3.4 million t for the period between 1950 and 2010, increasing from around 22,000 t·year^{-1} in 1950, to a plateau of 101,000 t·year^{-1} in the eary 2000s (Figure 4). Thereafter, catches increased, driven by the increase in the fishing effort to a maximum of 156,000 t·year^{-1} in 2009 (Figure 4). Artisanal catches were constituted mainly of Bonga shad, sardinellas and croakers.

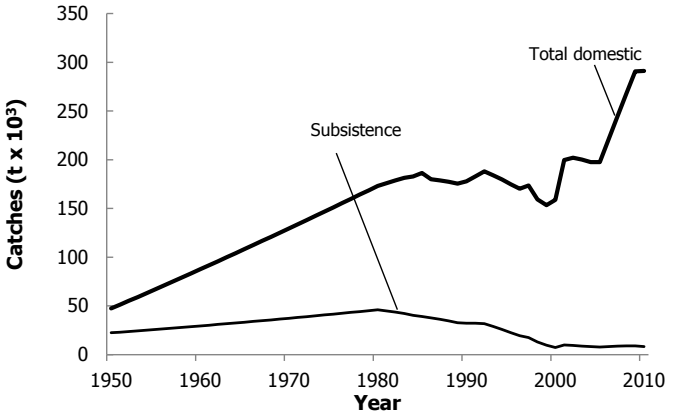

Figure 5. Reconstructed subsistence compared to total domestic catches in Guinea, 1950-2010.

Semi-industrial fisheries

Semi-industrial catches were estimated at around 40,000 t between 1950 and 2010, which is less than 1% of the total reconstructed catch (Figure 3b). Catches increased from 0 t·year^{-1} in 1950 to a peak of around 1,900 t·year^{-1} in 2001 then decreased steadily thereafter. Semi-industrial catches were dominated by croakers (Scianidae).

Subsistence

Subsistence catches increased from 22,400 t·year^{-1} in 1950 to about 46,000 t·year^{-1} in 1980 then decreased to 8,200 t·year^{-1} in 2010 (Figure 5). Subsistence catches totalled around 1.7 million t from 1950 to 2010 which represents 20% of the total reconstructed catch in Guinea since 1950 (Figure 5). This included small pelagic species, mostly sardinella and bonga shad, which accounted for 66% of total subsistence catches.

Industrial

Domestic: Domestic industrial landed catches (i.e., excluding discards) were estimated at 2.1 million t between 1950 and 2010, accounting for 25% of the total domestic catch (Figure 6), and equivalent to over half of the Guinean artisanal catch. Around 130,000 t of these domestic industrial catches were taken by foreign vessels reflagged to Guinea. Industrial catches in the Guinean EEZ increased from 325 in 1950, when the fishery started, to a peak of 58,500 t·year^{-1} in 1985, then decreased to around 36,000 t·year^{-1} in 2001 (Figure 6). Guinean industrial catches remained relatively constant during the last decade at about 36,000 t·year^{-1} (Figure 6).

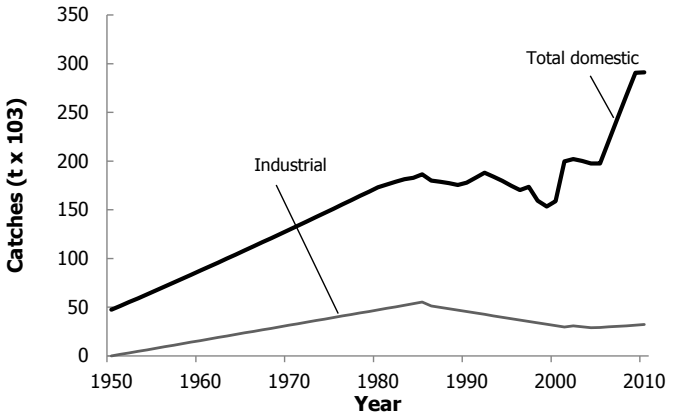

Figure 6. Domestic industrial catches in Guinean EEZ compared to total reconstructed catches, 1950-2010. Semi-industrial catches, also called advanced-artisanal, are not included in the industrial catch shown in this figure.

Foreign: Foreign legal catches (excluding discards)in the Guinean EEZ were estimated at nearly 15 million t over the period from 1950 to 2010. Industrial foreign catches increased from 36,400 t·year^{-1} in 1950 to their first peak of 351,600 t·year^{-1} in 1988, i.e, twice as high as total domestic catches (166,400 t·year^{-1}), then decreased to 338,000 t·year^{-1} in 1993 after the first attempt to limit foreign industrial fishing by Guinea (Figure 7). Thereafter, foreign industrial catches increased drastically to reach a peak of 551,000 t·year^{-1} in 2000, over 3 times higher than the reconstructed domestic catch in Guinean EEZ (Figure 7), then decreased again to 424,000 t·year^{-1} in 2010. Overall,

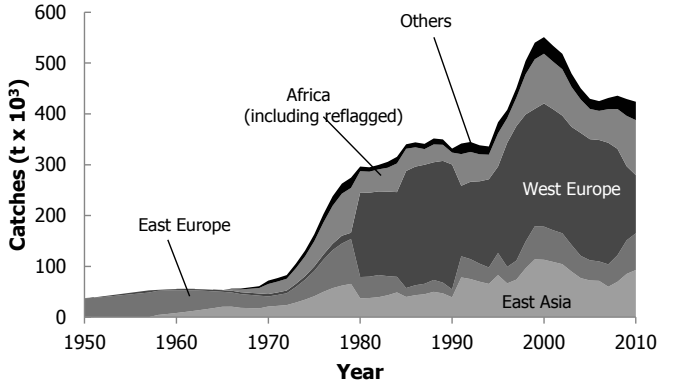

Figure 7. Foreign catches by legal fleets in Guinea, 1950-2010.

industrial foreign catches (15 million t) were almost twice as high as the domestic catch (8.4 million t) during the 1950-2010 time-period. Countries from Eastern Europe (Russia, Ukraine, Yugoslavia and Poland) and East Asia (Korea, Japan and China) accounted for the bulk of foreign industrial catches in the Guinean EEZ between 1950 and 1980, with 68% of the total foreign catch (Figure 7). After 1980, when Guinea declared its EEZ, foreign industrial catches were dominated by Western European countries accounting for 50% of the industrial reconstructed catch and East Asian countries with 20% of the total foreign industrial catch from 1981 to 2010 (Figure 7). More recently, western European industrial catches decreased to account for 43% of industrial catches in Guinean EEZ between 2005 to 2010, whereas African vessel (mostly non-African reflagged) catches increased from being 14% of the total foreign catch in Guinea waters from 2005 to about 20% in 2010 (Figure 7).

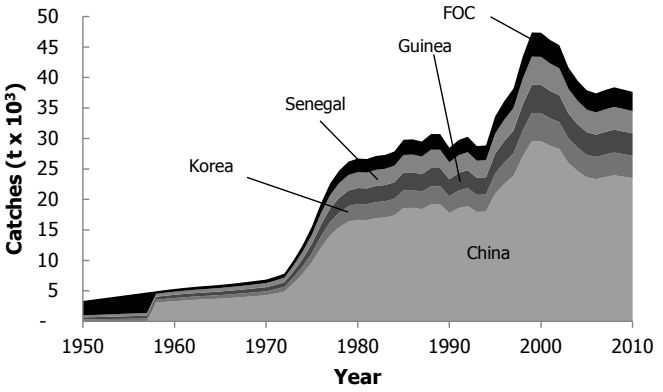

Figure 8. Illegal catches in the Guinean EEZ by country of origin, 1950-2010.

Illegal

Illegal foreign catches totalled around 1.3 million t from 1950 to 2010 (Figure 8). Illegal catches increased from around 3,300 t·year^{-1} in 1950 to around 26,700 t in 1980, when Guinea declared its EEZ. Catches prior to the EEZ declaration were considered unregulated rather than illegal. Illegal catches remained relatively constant from 1980 to 1993 at around 27,000 t·year^{-1}. Thereafter, illegal catches increased, after Guinea reduced the number of foreign fishing licences, to a peak of at least 47,400 t·year^{-1} in the late 1990s, then decreased to remain at a relatively constant catch of around 37,000 t·year^{-1} in the 2000s (Figure 8). Overall, China was responsible for the bulk of illegal catches in Guinea, with over 60% of the illegal catches between 1950 to 2010 (approximately 800,000 t), whereas vessels reflagged to Guinea and Senegal were responsible for 20% of the total illegal catch in the Guinean EEZ, followed by Korea with 10% (approximately 130,000 t, Figure 8).

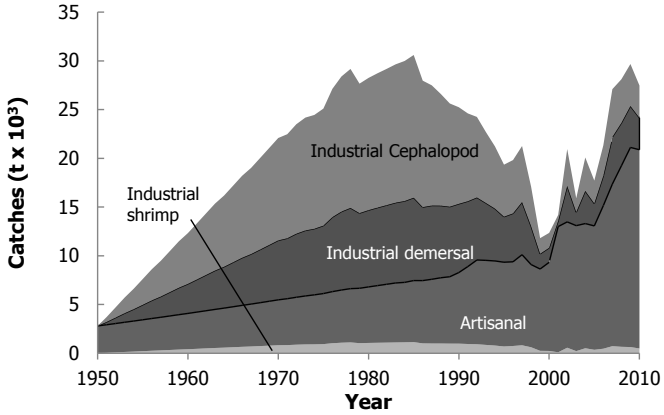

Figure 9. Discards by the domestic sectors in Guinea, 1950-2010.

Discards

Domestic discards were estimated at 1.2 million t between 1950 and 2010 (Figure 9), which is 14% of the total reconstructed domestic catch (Figure 2b). Discards increased from 2,800 t·year^{-1} in 1950 to a peak of 31,000 t·year^{-1} in the mid-1980s, before declining substantially in the late 1990s. By 2010, discards had increased again to around 27,000 t·year^{-1} (Figure 9). Industrial fisheries were responsible for the bulk of discards with 64% (782.171 million t) of the total discards by the Guinean fleet from 1950 to 2010, of which 40% was by the demersal sector. Artisanal discards were estimated at 436,000 t·year^{-1} between 1950 and 2010, i.e., 36% of the total discard by the Guinean fleets (Figure 9).

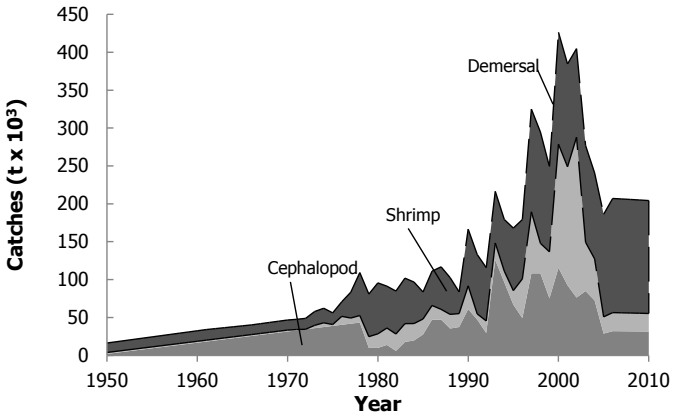

Figure 10. Discards by the foreign fleet by taxonomic group from the waters of Guinea, 1950-2010.

Foreign discards were estimated at 7.2 million t between 1950 and 2010, 48% of which were by demersal trawlers, 20% by shrimpers, and 32% by cephalopod trawlers (Figure 10). Foreign discards increased from 16,300 t·year^{-1} in 1950 to a peak of 426,000 t·year^{-1} in 2000 then decreased to be 205,000 t·year^{-1} by 2010 (Figure 10).

Discussion

This study is the first attempt to reconstruct the recent history of Guinean fisheries catches, including all the sectors that have been identified from 1950 to 2010. Although results were based on a number of assumptions, they were supported by well documented facts, evidence and external expertise. Thus, while uncertainty around these estimates exists, they are probably more accurate than the data provided to the FAO on behalf of Guinea and the distant water

fleet countries that exploit its EEZ. Furthermore, while this study uses CPUEs documented in published literature, in-country discussions with representatives of the artisanal fishing community revealed that the CPUE could be 40% higher than the one used here on average. However, the decreasing CPUE shown in the literature was validated (Aboubacar Kaba, ROPPA, pers. comm.). Along with the over-exploitation of formerly important species such as the giant African threadfin, ray species and snappers; a major decrease in fish size was also reported (Abdullaye Soumah, Artisanal Fishers Association, pers. comm.), which is another sign of over-exploitation.

Foreign fleets can significantly reduce catch opportunities for artisanal fishers, which have been declining over the last decades (EJF 2009). Indeed, the obvious spatial conflict between artisanal and foreign industrial sectors has further reduced the ability of artisanal fishers to improve their livelihoods. The poorly regulated and little monitored or enforced distant water fleets are clearly not helping here, but rather handicapping domestic fisheries and socio-economic development in Guinea. Therefore, the validity of fishing access agreements (let alone the substantial illegal fishery) offered to capture a 'surplus' in the Guinea EEZ is highly questionable, as the benefits to the Guinean population should be seriously considered. Repetitive evidence of illegal fishing, which is considered an international trans-boundary crime (INTERPOL 2010), by European and Asian fleets was available for decades (Anon. 2006). This, along with an obvious lack of monitoring and enforcement of Guinean fisheries (direct exports, trans-shipment, subsistence fisheries, industrial discards, processed fish[3]) (Solie 2004), raises serious concerns about the long term sustainability of Guinean fisheries. Furthermore, catches by foreign fleets are substantially higher than the potential catch of 200,000 t·year^{-1} estimated by the Guinean government (Anon. 2003). Moreover, in the mid-1990s, stocks of targeted and non-targeted species were already over-exploited, and abundance decreased (Figure 2). Therefore, the very recent 60% decrease in IUU catches (Aboubacar Kaba, ROPPA, pers. comm.) is related to the decrease in fishing opportunities for the illegal fleet in terms of ressource availability and surveillance capacity. While decreasing industrial presence is believed to have decreased the conflicts between artisanal and industrial sectors, the increasing presence of Senegalese pirogues fishing in Guinea but landing in Senegal, creates a new type of conflict with the Guinean artisanal fishers (Abdullaye Soumah, Artisanal Fishers Association, pers. comm.).

Another aspect of Guinean fisheries which most likely contributed to the decrease in catches inspite of an increasing capacity, is the high level of corruption involving European fleets (mostly Spanish tuna vessels) and members of the Guinean government, resulting in foraged licenses[4]. These fleets, along with other Asian fleets, were fishing in Guinean waters but exporting catches relabelled as Senegalese, Mauritanian or under the name of any West African country obeying the EU hygiene and health standards (Aboubacar Kaba, ROPPA, pers. comm.), which is now the new fashion in West Africa.

Economically, in the 1980s Guinea received compensation 5 times lower than the ex-vessel value of landings by foreign fleets fishing under Guinean access agreements (Kaczynski 1989), and this has further increased in recent years. As the amount of fish taken from Guinean waters by foreign fleets increased, the compensation decreased from 20% in the 1980s to 3% of the landed value of catches in 2010. While this mirrors a pattern seen elsewhere in West and East Africa (Iheduru 1995; Kaczynski and Fluharty 2002; Le Manach *et al.* in press), the repercussions in Guinea are extensively perceived, since fishing agreements had almost no benefit on local fishing communities, now facing the expansion of their own (over-exploited) fisheries at higher fishing costs. This study highlights the importance of fisheries resources in Guinea; both as protein source and an avenue of livelihood for coastal populations. Fish is more accessible to a large part of the population than any other animal protein sources. With increasing frequency of droughts caused by climate change, this dependency on fish is likely to increase (Allison *et al.* 2009), and therefore the present challenges persist, the economic future of Guinean fisheries is highly uncertain.

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Appendix Table A1. Annual catches by Guinea.

Year	Data reported to FAO	Artisanal	Industrial	Subsistence	Discards	Reconstructed catches
1950	900	22,357	0	22,357	2,795	47,509
1951	900	23,013	1,445	23,013	3,709	51,180
1952	900	23,690	3,022	23,690	4,708	55,111
1953	900	24,376	4,599	24,376	5,713	59,064
1954	1,800	25,069	6,176	25,069	6,616	62,931
1955	1,800	25,771	7,753	25,771	7,611	66,906
1956	1,800	26,481	9,330	26,481	8,612	70,904
1957	2,600	27,199	10,907	27,199	9,480	74,785
1958	2,600	27,925	12,484	27,925	10,479	78,813
1959	2,600	28,659	14,061	28,659	11,483	82,862
1960	3,400	29,401	15,638	29,401	12,325	86,766
1961	3,400	30,152	17,215	30,152	13,329	90,848
1962	3,400	30,910	18,792	30,910	14,338	94,950
1963	3,400	31,677	20,369	31,677	15,350	99,073
1964	4,200	32,451	21,946	32,451	16,173	103,022
1965	4,200	33,234	23,523	33,234	17,187	107,178
1966	4,200	34,025	25,100	34,025	18,204	111,354
1967	5,000	34,824	26,677	34,824	19,016	115,342
1968	5,000	35,631	28,254	35,631	20,035	119,552
1969	5,000	36,446	29,831	36,446	21,057	123,781
1970	5,000	37,270	31,408	37,270	22,082	128,030
1971	7,300	38,101	32,985	38,101	22,471	131,658
1972	7,300	38,941	34,562	38,941	23,493	135,936
1973	8,500	39,788	36,139	39,788	24,175	139,891
1974	11,100	40,644	37,716	40,644	24,450	143,454
1975	12,370	41,508	39,293	41,508	25,099	147,408
1976	8,920	42,380	40,870	42,380	27,130	152,760
1977	8,120	43,260	42,447	43,260	28,398	157,365
1978	9,000	44,148	44,024	44,148	29,170	161,490
1979	17,453	45,044	45,601	45,044	27,661	163,351
1980	18,900	45,949	47,219	45,989	28,250	167,406
1981	20,700	46,861	48,837	44,830	28,729	169,256
1982	22,600	47,782	50,454	43,592	29,174	171,002
1983	24,400	48,728	52,031	42,255	29,643	172,656
1984	26,200	49,053	53,649	40,356	29,989	173,047
1985	28,000	50,229	55,524	39,179	30,601	175,532
1986	30,500	50,988	51,733	37,636	27,967	168,324
1987	32,000	51,753	50,698	36,117	27,489	166,058
1988	35,000	52,524	49,745	34,549	26,602	163,420
1989	38,000	53,300	48,465	32,677	25,624	160,065
1990	41,000	56,899	46,898	32,115	25,239	161,152
1991	46,000	62,355	45,206	32,115	24,603	164,279
1992	51,000	67,755	43,955	31,824	24,245	167,779
1993	56,000	67,798	42,727	28,807	22,685	162,017
1994	60,000	67,787	41,380	25,695	21,218	156,080
1995	64,760	67,623	39,879	22,480	19,345	149,327
1996	60,580	67,683	38,377	19,360	19,819	145,238
1997	58,841	73,088	36,806	17,482	21,256	148,633
1998	65,764	66,782	35,307	12,900	17,086	132,075
1999	83,314	66,055	34,038	9,741	11,802	121,637
2000	87,513	71,498	32,665	7,276	12,343	123,782
2001	101,227	98,735	31,464	9,806	14,189	154,193
2002	87,358	101,511	32,575	9,296	20,947	164,329
2003	114,845	101,154	31,638	8,757	15,890	157,439
2004	88,550	100,637	30,534	8,190	20,082	159,443
2005	98,566	100,121	30,793	7,629	17,712	156,255
2006	94,489	113,524	31,367	8,224	21,331	174,445
2007	70,823	128,280	31,895	8,651	27,095	195,922
2008	81,240	141,722	32,511	8,915	28,108	211,256
2009	81,000	155,868	33,083	9,015	29,676	227,642
2010	93,000	154,045	33,810	8,159	27,010	223,024

Appendix Table A2. Total reconstructed catches by taxon caught by the domestic fisheries of Guinea, 1950-2010.

Year	*Pseudotolithus* spp.	Threadfins	*Arius* spp.	*Ethmalosa fimbriata*	Clupeoids	*Pomadasys* spp.	*Cynoglossus* spp.	Cephalopods	Scombroids	Sparidae	Others[a]
1950	3,062	356	1,464	19,225	16,432	127	0	0	347	1,238	5,258
1951	3,659	590	1,746	19,831	16,920	239	161	675	359	1,312	5,690
1952	4,308	846	2,052	20,453	17,423	360	337	1,415	371	1,391	6,156
1953	4,959	1,103	2,360	21,075	17,931	483	514	2,160	382	1,470	6,627
1954	5,446	1,321	2,589	21,870	18,396	588	672	2,821	382	1,503	7,342
1955	6,096	1,576	2,896	22,523	18,918	709	847	3,556	395	1,583	7,809
1956	6,748	1,832	3,204	23,176	19,445	831	1,022	4,295	407	1,664	8,280
1957	7,240	2,043	3,435	24,166	19,939	932	1,173	4,926	410	1,706	8,815
1958	7,893	2,298	3,744	24,836	20,479	1,054	1,348	5,662	423	1,788	9,290
1959	8,549	2,554	4,053	25,507	21,024	1,175	1,524	6,401	436	1,870	9,769
1960	9,034	2,759	4,282	26,397	21,539	1,273	1,668	7,008	440	1,915	10,451
1961	9,691	3,015	4,592	27,086	22,097	1,395	1,844	7,745	453	1,998	10,931
1962	10,351	3,272	4,904	27,777	22,660	1,518	2,020	8,486	466	2,081	11,416
1963	11,013	3,530	5,216	28,471	23,228	1,640	2,197	9,228	479	2,165	11,904
1964	11,494	3,730	5,443	29,277	23,770	1,735	2,337	9,816	485	2,214	12,721
1965	12,158	3,988	5,757	29,988	24,351	1,858	2,513	10,558	498	2,298	13,211
1966	12,824	4,247	6,071	30,703	24,937	1,981	2,690	11,302	512	2,383	13,704
1967	13,304	4,443	6,297	32,339	25,498	2,075	2,828	11,879	518	2,434	13,725
1968	13,972	4,702	6,613	33,063	26,097	2,198	3,005	12,623	532	2,520	14,227
1969	14,643	4,962	6,929	33,792	26,701	2,322	3,182	13,369	546	2,606	14,731
1970	15,315	5,222	7,247	34,665	27,310	2,445	3,360	14,115	559	2,693	15,098
1971	15,432	5,292	7,302	36,704	27,843	2,480	3,415	14,346	554	2,683	15,609
1972	16,104	5,551	7,619	37,456	28,465	2,603	3,592	15,089	568	2,771	16,119
1973	16,485	5,709	7,799	38,875	29,051	2,678	3,703	15,556	572	2,809	16,654
1974	16,521	5,747	7,815	41,071	29,594	2,697	3,735	15,692	565	2,790	17,227
1975	16,882	5,896	7,985	42,559	30,191	2,768	3,840	16,130	569	2,827	17,762
1976	18,411	6,453	8,708	41,407	30,957	3,031	4,210	17,688	613	3,059	18,223
1977	19,289	6,784	9,123	41,738	31,636	3,188	4,434	18,625	634	3,182	18,732
1978	19,752	6,968	9,341	43,023	32,263	3,276	4,561	19,161	642	3,236	19,267
1979	18,319	6,481	8,663	48,410	32,642	3,048	4,249	17,848	589	2,982	20,119
1980	18,651	6,617	8,817	50,050	33,293	3,111	4,339	18,229	593	3,016	20,691
1981	18,894	6,719	8,929	51,198	32,523	3,158	4,409	18,520	595	3,036	21,276
1982	19,112	6,812	9,028	52,403	31,698	3,200	4,471	18,784	596	3,053	21,845
1983	19,340	6,908	9,136	53,517	30,811	3,246	4,539	19,068	598	3,075	22,420
1984	19,477	6,986	9,198	54,181	29,513	3,283	4,597	19,312	592	3,064	22,845
1985	19,853	7,131	9,364	55,477	28,750	3,343	4,683	19,671	598	3,105	23,557
1986	18,380	6,413	8,678	55,508	27,813	2,984	4,151	17,436	580	3,082	23,299
1987	17,854	6,181	8,397	55,622	26,778	2,848	3,945	16,977	576	3,024	23,854
1988	17,760	5,894	8,376	54,476	26,167	2,658	3,665	16,143	559	3,355	24,367
1989	17,542	5,557	8,331	53,179	25,335	2,466	3,387	15,266	541	3,691	24,771
1990	17,490	5,290	8,350	52,979	25,378	2,326	3,170	14,611	557	4,005	26,995
1991	17,495	4,945	8,424	54,721	25,987	2,141	2,881	13,680	581	4,479	28,946
1992	18,469	4,734	9,005	54,762	26,879	1,989	2,643	12,858	599	5,406	30,434
1993	17,875	4,292	8,809	53,036	25,225	1,758	2,326	11,618	544	5,671	30,862
1994	16,705	3,838	8,272	52,758	23,060	1,550	2,041	10,272	828	5,541	31,215
1995	17,383	3,496	8,807	47,271	22,198	1,307	1,708	8,936	896	6,645	30,682
1996	16,307	3,604	8,237	48,957	21,096	1,349	1,750	9,204	2,834	5,897	26,004
1997	15,983	3,606	7,561	55,084	18,237	1,435	1,838	9,894	1,998	6,032	26,963
1998	13,152	2,372	6,220	46,931	16,621	1,013	1,296	7,653	1,652	4,725	30,439
1999	7,352	1,042	3,965	48,496	16,270	413	510	4,078	500	4,083	34,928
2000	10,796	1,047	6,150	41,596	19,003	396	483	2,873	427	2,654	38,356
2001	13,419	835	8,391	59,830	16,429	290	190	1,378	1,481	6,162	45,789
2002	20,036	2,484	10,023	61,268	14,942	1,005	1,180	6,510	1,159	4,866	40,857
2003	16,484	1,985	13,446	67,130	10,471	378	440	2,435	225	2,254	42,191
2004	18,568	3,655	9,823	57,452	9,112	905	1,056	5,876	533	3,052	49,412
2005	21,186	3,373	7,946	35,800	7,480	637	720	4,021	3,306	2,027	69,760
2006	25,597	4,233	9,406	57,665	10,376	898	951	5,337	1,257	3,240	55,484
2007	24,136	4,340	11,331	73,962	13,406	1,449	1,488	8,380	1,224	6,456	49,748
2008	27,864	4,313	16,440	81,826	13,076	1,385	1,348	7,624	1,757	5,875	49,749
2009	29,827	4,488	17,336	89,873	14,184	1,439	1,292	7,332	1,993	6,742	53,136
2010	27,175	3,767	16,173	84,100	20,521	1,173	987	5,417	4,289	6,081	53,339

a) include Elasmobranchii, Carangidae, Mugilidae, Sparidae, *Drepane africana*, *P. notialis*, *Penaeus kerathurus*, and various fishes.