Reconstruction of marine fisheries catches for Algeria, 1950-2010[1]

Dyhia Belhabib, Daniel Pauly, 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; d.pauly@fisheries.ubc.ca; s.harper@fisheries.ubc.ca; d.zeller@fisheries.ubc.ca

Abstract

Total marine fisheries catches by Algeria were estimated from 1950 to 2010, including commercial landings, subsistence and recreational catches, as well as illegal and unreported catches. Commercial landings were obtained from FAO fisheries statistics database and from other sources. Non-commercial catch estimates were obtained from field survey data converted to *per capita* rates and catch per unit of effort estimates using Algerian population and effort data. Illegal catches and discards were estimated using recent at-sea observer data, expanded to cover the 1950-2010 time period. Total reconstructed catches were estimated to be 7.14 million tonnes over the study period, which is almost twice as high as the official landings of 3.9 million tonnes supplied to the FAO. In addition, we noted that the strong decline in catch per unit of effort is probably exacerbated by government subsidies to the fisheries sector.

Introduction

Located in the south of the Western Mediterranean basin, Algeria claimed an Exclusive Fishing Zone (EFZ) of 95,000 km² in 1994 (Cacaud 2002a) (Figure 1). The narrow continental shelf is a constraint to the development of the Algerian fisheries (Maurin 1962; Chaussade and Corlay 1989); thus, in Algeria, fisheries are mainly coastal (Coppola 2001) and target mainly small pelagic fish (Oliver 1983; Zeghdoudi 2006; www.mpeche.gov.dz [2001]), but also large pelagic fish and other species depending on the season (Coppola 2001; Sahi and Bouaicha 2003). The rocky bottoms hinder large-scale bottom trawling, which is mainly performed with small boats (Ordines *et al.* 2009). This fleet targets mainly high value species, e.g., red shrimp (*Aristeus antennatus*) (Belhabib 2007). The fisheries on the eastern and western coasts are the most productive, because of the strength of the Atlantic current (Furnestin 1961; Gulland 1971; Millot 1985, 1987) in the West and a relatively large continental shelf in the East (Oliver 1983).

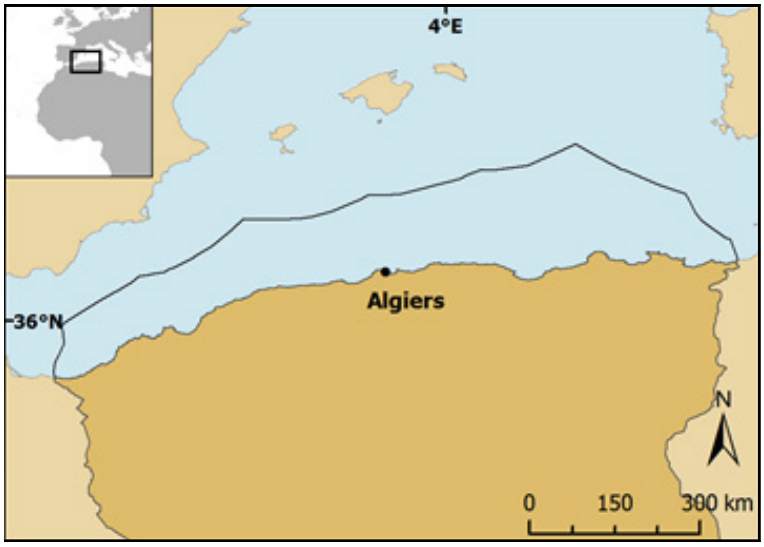

Figure 1. Map of the Exclusive Fishing Zone of Algeria.

From 1830 to 1962, Algeria was a French colony; the war for liberation started in 1954 and ended with independence in 1962, when many fishers left the country (Boude 1987). Afterwards, Algeria had a period of large investments in the agricultural and oil and gas sectors, and political stability during the 1970s and early 1980s (CIHEAM 2005). However, the fishing industry, privatized in the mid-1970s (Ministerial Decree of September 29, 1979) has been relatively neglected (FAO 2011).

These events have certainly impacted the fishing industry. From the late 1970s to the 2000s, unequal development and insecurity in rural areas accelerated the migration towards coastal cities, which led to an increasing demand for fish products. Yet, Algeria is still the country where the consumption of seafood is stated to be the lowest in the south-western Mediterranean (faostat.fao.org [2011]). Despite an overall increasing trend (71% increase in GDP since independence; www.worldbank.org [2011]), the fishing industry represents only around 1.3% of the GDP (Breuil 1997). Consequently, investment and financing programs targeting fisheries have been implemented in 1988, 1994, 2000-2003 and 2004-2007 (MPRH 2008), which led to increasing pressure on fish stocks (MATE 2006). Catch data reported to FAO often excludes important components such as by-catch, discards and recreational catches (Garibaldi 2012). Besides, fisheries lack a reliable landings data collection system to provide a better understanding

[1] Cite as: Belhabib, D., Pauly, D., Harper, S. and Zeller, D. (2013) Reconstruction of marine fisheries catches for Algeria, 1950-2010. pp 1-22. 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].

of the fisheries dynamics in the country, which is a requirement for effective fisheries policy (MATE 2006; F. Hemida, pers. comm., Université de la Technologie et des Sciences Houari Boumedienne (UTSHB), 2011). With a fishing fleet of nearly 5,000 boats, including newly introduced industrial purse-seiners, and more than thirty seaports and 34 other landing sites in 14 coastal *wilayas* (districts), fishing in Algeria is important. Therefore, the trends in Algerian fisheries catches must be studied and analyzed to provide a solid basis for fisheries management and development policies.

Methods

Electronic time series of landings data from 1950 to 2010 were available through the Food and Agriculture Organization (FAO) FishstatJ database and used in this paper. In addition, we used data available from scientific and socio-economic reports (Furnestin 1961; Simonnet 1961; Vidal Junemann 1976; Oliver 1983) and statistical bulletins covering the period 1990 to 2007 of the Ministry of Fisheries and Fish Resources of Algeria (www.mpeche.gouv.dz [2011]). Reported landings are distinguished by species or higher taxonomic grouping and `miscellaneous groups´. Since the main goal of this study is to estimate total catches per species or higher taxonomic group, we compared the data supplied by Algeria to FAO to the above-cited national reports and used them as a reported baseline, to which we added: (1) illegal, unreported, and unregulated catches; (2) discards; (3) recreational and subsistence fisheries; (4) commercial catch adjustment including underreported catches of commercialized species; and (5) foreign flag catches.

Table 1. Taxonomic composition of the artisanal fisheries in Algeria, based on MPRH (2011) and Griffiths *et al.* (2007).

Common name	Taxon[a]	Catch (%)
Surmullets	*Mullus* spp.	2.59
European hake	*Merluccius merluccius*	3.97
Common pandora	*Pagellus erythrinus*	6.12
Gilthead seabream	*Sparus aurata*	10.70
Sole	Soleidae	0.06
Groupers	Epinephelidae; Polyprionidae	7.39
Pargo breams	*Pagrus* spp.	6.44
Axillary seabream	*Pagellus acarne*	0.12
Blackspot seabream	*Pagellus bogaraveo*	0.66
Sparidae	Sparidae	0.12
Moronidae	Moronidae	0.10
Red gurnard	*Aspitrigla cuculus*	0.01
Salema	*Sarpa salpa*	1.66
Rockfishes	Sebastinae and Scorpaeninae	7.31
Electric rays	Torpedinidae	0.19
Rays	Rajidae	0.27
Miscellaneous demersal fish	-	0.39
Sardinellas	*Sardinella* spp.	0.08
European anchovy	*Engraulis encrasicholus*	0.01
European pilchard	*Sardina pilchardus*	27.60
Horse mackerel	*Trachurus* trachurus	3.71
Atlantic mackerel	*Scomber japonicus; S. scombrus*	0.43
Bogue	*Boops boops*	0.34
Greater amberjack	*Seriola dumerili*	0.02
Barracudas nei	*Sphyraena sphyraena; S. virdensis*	0.18
Grey mullets	Mugilidae *(Liza* spp.*)*	0.97
Miscellaneous small pelagic	-	0.41
Yellowfin tuna	*Thunnus* spp.	1.36
Little tunny	*Euthynus alleteratus*	10.39
Swordfish	*Xiphias gladius*	1.56
Skipjack tuna	*Katsuwonus pelamis* and *Sarda sarda*	2.75
Blue and red shrimp	*Aristeus antennatus*	0.01
Deep-water rose shrimp	*Parapenaeus longirostris*	0.01
Palinurid spiny lobsters	Palinurus	1.81
Palinuridae	Palinuridae	0.08
Scyllaridae	*Scyllarus* spp.	0.03
Smooth-hound	*Mustelus mustelus*	0.08
Gulper shark	*Centrophorus granulosus*	0.01
Nursehound	*Scyliorhinus* spp.	0.01
Common cuttlefish	*Sepia officinalis*	0.09
Common octopus	*Octopus vulgaris*	0.02
European squid	*Loligo vulgaris*	0.01

[a] Djabali *et al.* (1993)

Illegal, unreported and unregulated commercial catches

This category includes the unreported portion of the artisanal catches since these are not properly covered by the official statistics. Illegal unreported catches also reported to as marine living resource crime by the United Nations and INTERPOL (INTERPOL 2010; UNODC 2011) include mainly undersized fishes.

Artisanal commercial landings

This paper highlights the under-reported portion of catches, with a particular emphasis on grouper catches, due to their overexploited status in the Mediterranean (Kara and Derbal 1999). Artisanal fisheries catches in Algeria are underestimated (MPRH 2011)[2], with about 80% of the catches being unreported (MATE 2005b; 2006; F. Hemida, pers. comm., UTSHB). From the 1950s to the late 1960s, only a few authors mentioned the artisanal fishing effort (Furnestin 1961; Simonnet 1961; Oliver 1983). From 1970 to 1980, development programs targeted some of the artisanal fleets (Boukhalfa and Rambeau 1993). Since then, fisheries subsidies to increase fishing effort have been provided through successive government programs (www.mpeche.gov.dz [2011]). Consequently, the interest in recording the artisanal fishing effort increased, but without focusing on concomitant catch. Since no national artisanal catch datasets are

[2] This information was provided by sources in local branches of the Ministry of Fisheries and Fisheries Resources who indicated that the real catch data were not reported to the Ministry. The individual sources preferred to remain anonymous.

available, we used local catch and artisanal effort data from two local branches of the Ministry of Fisheries and Fisheries Resources (MPRH 2011). The total small-scale landings reported are 176 t·year^{-1} for the first district and 341 t·boat^{-1}·year^{-1} for the second (MPRH 2011), and a catch per unit of effort (CPUE) of 84 t·year^{-1} for a third district (Bouazouni 2004). We adjusted the landings by +70% instead of +80% to allow for a conservative estimate. We then divided the estimated catch by the fishing effort, where all active boats are reported to both local branches. We averaged these estimates and obtained a CPUE of 38.15 t·boat^{-1}·year^{-1} for the active fleet in 2010 and generalized it over the other districts. Then, we assumed the CPUE was 50% higher in 1980 and 70% higher in 1950 because of the over-exploitation pattern of the coastal resources (Simonnet 1961; Oliver 1983). Thereafter, we interpolated linearly to estimate the annual CPUE. Based on the survey of Sahi and Bouaicha (2003), 89% of the artisanal fleet is active. We applied this to the available total effort data (1957, 1958, 1969, 1970, 1971, 1987-2009). We then estimated total catches using the derived CPUE and active effort time series, under the assumption that the fleet efficiency as well as the fishing grounds remained largely unchanged (PNUE 1996). Then, we interpolated linearly to complete the estimates for the missing years. During the period 2003-2004, a decrease in active artisanal fishing boats and landings was observed (MATE 2006). We applied an arbitrary correction rate of -15% to the effort, as a conservative approach to better represent the trend of the data.

Table 2. Anchor points for annual total catches of serranids in Algeria and the corresponding effort.

Year[a]	Catches (t·year^{-1})	Effort (Boats)	Data source
1950	26.00	-	Assumed
1957	182.64	296	Simonnet (1961); Oliver (1983)
1958	168.39	269	Simonnet (1961); Oliver (1983)
1969	159.77	221	www.fao.org [2011][b]
1971	125.10	169	Oliver (1983)
1987	326.15	456	Griffiths (1991)

[a]) the catch estimate is divided by 2 in 1962 (Meuriot and Dremiere 1986; Boude 1987).
[b])www.fao.org/docrep/005/D8317F/D8317F03.htm (accessed on June 1, 2011).

Species disaggregation: Coppola (2001) described the species composition of artisanal catches in the western Mediterranean Sea including Algeria. Griffiths *et al.* (2007) described the the gear type, i.e., gillnets, trammel nets and longlines (80% of the artisanal gears). Based on these sources, we estimated the percentage of catches for each species (taxonomic group) and applied this breakdown to the total reconstructed artisanal catches (Table 1).

Artisanal grouper catches: When artisanal catches were reported, they generally excluded groupers which accounted for 7.4% of the landings (DPRH 2011). Therefore, we assumed that a simple breakdown of the reconstructed artisanal catches would not reflect the development of this fishery, and thus we estimated these separately. Three species of serranids are caught in Algeria: the dusky grouper (*Epinephelus marginatus*), the white grouper (*Epinephelus aeneus*) and the dogtooth grouper (*Epinephelus caninus*) (Ouyahia 2004), while the red grouper (*Epinephelus morio*) was caught along the Algerian coast up to the late 1970s (Brualé 1985). Data provided to FAO by Algeria covered the `grouper nei´ and `groupers and seabasses´ for the years 1999-2003 and 2006-2009, respectively, but from 1950 until 1998, no commercial catches for this group were reported to the FAO. Here, we derived the percentage of boats targeting serranids (62.7%) by dividing the number of boats targeting groupers (among other fish) by the total artisanal active effort from Sahi and Bouaicha (2003) to estimate total catch per year. We used a CPUE of 0.53 t·year^{-1}·boat^{-1} in 2010[3], then applied the same adjustments assumed for small-scale CPUE described above. Then, we interpolated linearly assuming the CPUE in 1950 was the same as in 2010. Effort data were available for the years 1957 to 1958, 1969 to 1971 and 1990 to 2009. We interpolated linearly to complete the effort time series. In 1988 and 1989, only a few dozens of the artisanal boats were really active (Griffiths 1991). Consequently, we reduced the active effort by 80% for the years 1988 and 1989 (Table 2). We multiplied the effort by the CPUE to estimate total grouper catches for the 1950 to 2010 time period. For 2003 and 2004, we applied the same adjustment as for the artisanal catch estimation, i.e., -15%. Here, to remain conservative, we averaged grouper catches estimated above with grouper catches obtained using a species breakdown of total artisanal catches assuming a percentage of 7.4% (MPRH 2011). This better represents catch variations and captures the impact of increasing technological efficiency in targeting.

Illegal catches of small fish

Fish size regulations have been officially legislated since 1994 (Cacaud 2002b; Belala 2004). Since then, high value demersal species of sub-legal size, mainly surmulets (*Mullus barbatus* and *M. surmuletus)* and hake, (*Merluccius merluccius*) targeted by trawlers are often sold illegally in the market during October and November[4]. Local active effort data (381 trawlers), the quantity of illegal fish landed (0.2 t·day^{-1}·trawler^{-1}) for 60 days, and the species caught were available for 2010 (MPRH 2011). We first estimated the total illegal landings for the active segment of the Algerian trawling fleet for 2010 at 4,570 t·year^{-1}, and then assumed that in 1994 landings of small fish were reported, thus being 0% of the 2010 illegal catch, 80% in 2000 while in 2010 the catch estimated represented 30%.

[3] The source of this information preferred to remain anonymous.
[4] This information was passed on to us on condition of anonymity.

Commercial catch adjustment

Miscellaneous fish disaggregation

FAO data contains the category 'marine fishes nei'. To disaggregate the data taxonomically, we used detailed local catches by species or higher taxonomic level.

Small pelagic fish

Caddy *et al.* (1995) suggested that small pelagic fish catches were underreported in national data. To account for the unreported portion, we first combined the officially reported small pelagic catch with the amount of small pelagics estimated from the 'marine fishes nei' disaggregation. Thereafter, we adjusted the reported catch by a conservative rate of +10% per year from 1950 to 1962 during the French settlement, +20% from 1963 to 1994 after independence and during the black decade, when fishers failed to report their catches for security reasons, and +10% per year from 1994 to 2010, when new regulations were increasingly enforced.

Cephalopods

Six species of cephalopods are caught in Algerian waters: the horned octopus (*Eledone cirrhosa*), the musky octopus (*Eledone moschata*), the common octopus (*Octopus vulgaris*) (listed by FAO under `Octopuses´), the broadtail shortfin squid (*Illex coindetii*), the European squid (*Loligo vulgaris*) (listed under `Common squids´) and the common cuttlefish (*Sepia officinalis*) (Chavance 1987; MATE 2005b; Zeghdoudi 2006). FAO also reported miscellaneous cephalopod species under the category `Cephalopods nei´. Cephalopod catches have only been reported since 1989. In the 2000s, cephalopod catches represented 1% of the total landings (Zeghdoudi 2006). To adjust cephalopod catches, we first estimated the total cephalopod catch by applying the previous rate (1%) to the total reported landings to complete the time series from 1950 to 1988; then we used estimates from various sources (Table 3) as a proportion of the total cephalopod landings reported by FAO in order to disaggregate cephalopod catches.

Table 3. Composition of the cephalopod catches of Algeria (in %).

Reference	*Sepia* spp.	*Octopus* & *Eledone*	*Loligo vulgaris*
DPRH (2011)	55	43	5
DPRHA (2011)	18	18	63
MATE (2005b)	34	63	0
Chavance (1987)[a]	83	17	0
Mean	48	35	17

[a]) Estimated using the percentage of the cephalopod catches (3.88% of the demersal fishery catches) by the trawling fleet (20%) of the total catches.

Sharks and rays

Elasmobranch catches for Algeria are reported by the FAO under four categories: `Sharks, rays, skates, etc.´, `Rays, stingrays, mantas nei´, `Dogfish sharks nei´and`Catsharks, nursehounds nei´. The last two categories are reported only for the period 2007 to 2009. Shark and ray catches were reported as zero in 1963 and from 1986 to 1989. Shark catches were not reported from 1950 to 1953 due in part to species being confused as other pelagic fish (S. Hemida, pers. comm., UTSHB). We estimated rays to be 2.11% of the group 'sharks, rays and skates' (Hemida 2005) and thus disaggregated FAO data into two major categories: sharks and rays. To estimate shark catches for the period from

Table 4. Composition of the sharks and rays catches of Algeria for the period 1950-2010 (in %).

Ray species	Catches (%)	Source number	Shark species	Catches (%)	Source number
Dipturus batis	0.47	1	*Cetorhinus maximus*	84.89	1
Dipturus oxyrinchus	31.68	1	*Hexanchus griseus*	8.50	1
Leucoraja melitensis	0.15	1	*Heptranchias perlo*	0.20	1 ; 2
Raja africana	0.24	1	*Isurus oxyrhincus*	1.70	1
Raja asterias	13.32	1	*Alopias vulpinus*	1.70	1 ; 3 ; 4
Raja brachyura	12.49	1	*Carcharhinus brachyurus*	0.19	5 ; 6
Raja clavata	19.79	1	*Carcharhinus plumbeus*	0.16	5 ; 6
Raja miraletus	2.48	1	*Carcharhinus altimus*	0.39	5 ; 6
Raja montagui	6.58	1	*Carcharhinus obscurus*	0.10	5
Raja polystigma	0.59	1	*Carcharhinus brevipinna*	0.02	5
Raja radula	7.74	1	*Galeus melastomus*	0.01	1
Raja undulata	1.46	1	*Scyliorhinus canicula*	0.01	1
Rostroraja alba	0.02	1	*Scyliorhinus stellaris*	0.03	1
Leucoraja naevus	1.77	1	Triakidae[a]	0.30	1
Leucoraja circularis	1.11	1	Squalidae[b]	0.14	1
			Oxynotus centrina	0.01	1
			Echinorhinus brucus	1.70	1

1) Hemida (2005); 2) Canapé *et al.* (2003) ; 3) Fowler *et al.* (2005) ; 4) Pillans *et al.* (2008) ; 5) Hemida *et al.* (2002b) ; 6) Dieuzeide *et al.* (1953).
[a]) *Mustelus mediterraneus, M. mustelus ; Centrophorus granulosu ; C. uyato.*
[b]) *Dalatias licha, Etmopterus spinax, Squalus acanthias, S. blainvillei, Somniosus rostratus.*

1950 to 1953, we carried the catch trend from 1954 to 1957 using FAO landing data. For the periods from 1986 to 1989 and from 2003 to 2006, we performed simple linear interpolations based on FAO landings data and commercial catches (Hemida 1998). A literature review allowed for the estimation of shark and ray catches by species (Table 4). For the devil fish (*Mobula mobular*), Hemida *et al.* (2002a) reported a total catch of 3.3 tonnes for 1996, 1999 and 2001. We estimated an average catch of 1.1 $t \cdot year^{-1}$ for the years 1996 to 2009. This species was rare in 1953 (Dieuzeide *et al.* 1953; Notarbartolo-Di-Sciara 1987), but incurs high mortality from accidental catch in pelagic (Cavanagh and Guibson 2007) and drift-net fisheries (Cornax *et al.* 2006), which appeared in Algeria in 1989 (Abdelguerfi 2003). In this study, we assumed that catches started in 1976 (see Hemida *et al.* 2002a) and increased steadily until 1996, afterwhich catches remained stable.

FAO data for sharks and rays are considered to be underestimates (Kroese and Sauer 1998). We assumed that 37% of sharks were caught by the small-scale fishery (Canapé *et al.* 2003), with 40% of the catch being unreported (i.e., 37% x 40% =15%). Therefore, we applied this percentage (15%) to each of the shark and ray species caught by artisanal gears. For the remaining 63% of the reported shark and ray catch taken by trawlers, purse-seiners and drift-nets used largely in Algeria, we assumed 20% of the catch was unreported (i.e., 63% x 20%=12.6%) (Cornax *et al.* 2006; Cavanagh and Guibson 2007; EJF 2007). We applied the resulting rate (12.6%) to non-artisanal shark and ray catches from 1950 to 2010, excluding devil fish which has already been estimated separately (see above).

Crustaceans

The main crustacean species caught along the Algerian coast are the blue and red shrimp (*Aristeus antennatus*) and the deep water rose shrimp (*Parapenaeus longirostris*) (Maurin 1962; MATE 2005b; Zeghdoudi 2006). The `marine crustaceans nei´ group reported by FAO includes other crustacean species, mainly caught by the artisanal fleet: spider crab (*Maia squinado*), common spiny lobster (*Palinurus elephas*), pink spiny lobster (*Palinurus mauritanicus*), caramote prawn (*Penaeus kerathurus*), Mediterranean slipper lobster (*Scyllarides latus*) and small European locust lobster (*Scyllarus arctus*) (MATE 2005b). In Algeria, shrimp catches are also underreported due to trans-shipments to foreign vessels; thus, a portion of the real catch is not reported to the FAO (Boukhalfa and Rambeau 1993; Mediouni 1997). CPUEs based on at-sea observations are higher (Sardà 2000; Bouaicha 2011). Algeria supplied a catch of zero tonnes to FAO for the blue and red shrimp from 1950 to 1953; however, Anon. (1955) and Maurin (1962) reported large amounts of catch by the trawl fishery during the same period. Here, we first estimated the number of active trawlers (Table 5) based on the number of operating trawlers per year and the total number of registered trawlers, i.e., 75.8% in 2010, which we assumed constant (MPRH 2011). Then, we estimated the total effort as the total number of hours per year

Table 5. Active trawl fleet and number of hours.

Year	Number of trawlers	Active trawlers	Number of hours
1950	146	110	110,869
1951	136	102	103,275
1952	135	101	102,516
1953	138	104	104,794
1954	137	103	104,034
1955	146	110	110,869
1956	152	114	115,425
1957	147	110	111,628
1958	153	115	116,184
1959	152	114	115,425
1960	156	117	118,463
1961	158	119	119,981
1962	75	56	56,953
1963	75	56	56,953
1964	76	57	57,713
1965	76	57	57,713
1966	103	77	78,216
1967	100	75	75,938
1968	100	75	75,938
1969	99	74	75,178
1970	101	76	76,697
1971	110	83	83,531
1972	115	86	87,328
1973	130	98	98,719
1974	140	105	106,313
1975	149	112	113,242
1976	158	119	120,171
1977	167	126	127,100
1978	177	132	134,030
1979	186	139	140,959
1980	195	146	147,888
1981	204	153	154,818
1982	213	160	161,747
1983	222	167	168,676
1984	231	173	175,605
1985	240	180	182,535
1986	250	187	189,464
1987	259	194	196,393
1988	268	201	203,323
1989	277	208	210,252
1990	286	215	217,181
1991	285	214	216,422
1992	284	213	215,663
1993	285	214	216,422
1994	289	217	219,459
1995	293	220	222,497
1996	295	221	224,016
1997	294	221	223,256
1998	299	224	227,053
1999	305	229	231,609
2000	318	239	241,481
2001	338	254	256,669
2002	352	264	267,300
2003	354	266	268,819
2004	358	269	271,856
2005	403	302	306,028
2006	435	326	330,328
2007	476	357	361,463
2008	487	365	369,816
2009	494	371	375,131
2010	494	371	375,131

Table 6. Demersal and shrimp trawl catch per unit of effort.

Taxon name	English name	CPUE (kg·h^{-1})	Taxon name	English name	CPUE (kg·h^{-1})
Abralia veranyi	Eye-flash squid	4.959	*Parapenaeus longirostris*	Deep-water rose shrimp	11.252
Aristaeomorpha foliacea	Giant red shrimp	2.588	*Pasiphaea multidentata*	Pink glass shrimp	0.020
Aristeus antennatus	Blue and red shrimp	12.333	*Phycis blennoides*	Greater forkbeard	3.976
Arnoglossus laterna	Mediterranean scaldfish	0.072	*Phycis phycis*	Forkbeard	1.583
Arnoglossus rueppelli	Rüppell's scaldback	0.035	*Plesionika acanthonotus*	lesser striped shrimp	0.213
Chelidonichthys cuculus	Red gurnard	0.053	*Plesionika antigai*	Catalonian striped shrimp	0.057
Bathysolea profundicola	Deepwater sole	0.002	*Plesionika edwardsii*	Soldier striped shrimp	0.069
Boops boops	Bogue	1.374	*Plesionika giglioli*	Shrimp	1.004
Centrolophus niger	Rudderfish	0.462	*Plesionika heterocarpus*	Shrimp	1.095
Chlorotocus crassicornis	Green shrimp	0.313	*Plesionika martia*	Golden shrimp	0.128
Citharus linguatula	Spotted flounder	0.024	*Plesionika martia*	Golden shrimp	0.391
Conger conger	European conger	1.035	*Processa canaliculata*	Shrimp	1.621
Diplodus annularis	Annular seabream	0.308	*Pteroctopus tetracirrhus*	Fourhorn octopus	0.003
Echelus myrus	Painted eel	0.016	*Raja clavata*	Thornback ray	0.068
Eledone cirrhosa	Horned octopus	2.512	*Raja polystigma*	Speckled ray	0.058
Eledone moschata	Musky octopus	0.134	*Rondeletiola minor*	Lentil bobtail squid	0.096
Engraulis encrasicholus	European anchovy	0.892	*Sardina pilchardus*	European pilchard	0.246
Gadella maraldi	Gadella	0.242	*Scaergus unicirrhus*	Cephalopod	0.201
Galeorhinus galeus	Tope shark	0.648	*Scomber scombrus*	Atlantic mackerel	0.019
Galeus melastomus	Blackmouth catshark	3.864	*Scomberesox saurus*	Atlantic saury	0.227
Gnathophis mystax	Thinlip conger	0.078	*Scorpaena elongata*	Slender rockfish	0.245
Helicolenus dactylopterus	Blackbelly rosefish	1.505	*Scorpaena scrofa*	Red scorpionfish	0.010
Illex coindetii	Shortfin squid	0.905	*Scyliorhinus canicula*	Small-spotted catshark	0.454
Lepidorhombus boscii	Four-spot megrim	1.330	*Sepia elegans*	Elegant cuttlefish	1.156
Lepidotrigla cavillone	Large-scaled gurnard	0.452	*Sepia officinalis*	Common cuttlefish	0.078
Lepidotrigla dieuzeidei	Spiny gurnard	0.064	*Sepia orbignyana*	Pink cuttlefish	0.971
Loligo vulgaris	European squid	1.023	*Sepietta oweniana*	Common bobtail squid	1.574
Lophius budegassa	Blackbellied angler	0.680	*Sepiola* spp.	Bobtails	0.077
Lophius piscatorius	Angler	0.123	*Serranus cabrilla*	Comber	0.366
Merluccius merluccius	European hake	6.040	*Serranus hepatus*	Brown comber	0.522
Micromesistius poutassou	Blue whiting	2.913	*Solea solea*	Common sole	0.026
Molva dypterygia	Blue ling	0.236	*Spicara flexuosa*	Blotched picarel	0.600
Mullus barbatus	Red mullet	3.516	*Spicara smaris*	Picarel	1.506
Mullus surmuletus	Surmullet	0.862	*Symphurus nigrescens*	Tonguesole	0.345
Neorossia caroli	Carol bobtail	0.023	*Synodus saurus*	Atlantic lizardfish	0.041
Nephrops norvegicus	Norway lobster	2.380	*Todarodes sagittatus*	European flying squid	0.520
Octopus salutii	Long-armed octopus	0.344	*Todaropsis eblanae*	Lesser flying squid	1.137
Octopus vulgaris	Common octopus	0.385	*Torpedo marmorata*	Marbled electric ray	0.345
Oxynotus centrina	Angular roughshark	0.097	*Torpedo nobiliana*	Electric ray	0.050
Pagellus acarne	Axillary seabream	2.293	*Trachurus mediterraneus*	Mediterranean horse mackerel	0.073
Pagellus bogaraveo	Blackspot seabream	4.044	*Trachurus picturatus*	Blue jack mackerel	1.217
Pagellus erythrinus	Common pandora	1.906	*Trigla lucerna*	Tub gurnard	0.064
Pagurus excavatus	Hermit crab	0.284	*Trigla lyra*	Piper gurnard	0.160
Paralepis coregonoides	Sharpchin barracudina	0.037	*Zeus faber*	John dory	0.760

(1,017 hours per trawler), expressed in the total number of hour for the active trawl fleet based on the average operating time per day, i.e., 9 hours (Nouar 2007) and the number of days at sea, which were averaged between 32 and 193 days, i.e., 113 days at sea (FAO 1973; Nouar 2007), and then by the number of trawlers (Table 5) from 1950 to 2010 collected from Belouahem (2009), MPRH (2001), MPRH (2010) and Oliver (1983). Catches are then obtained by multiplying this effort by per species CPUEs based on at-sea observations for 2010 (Table 6) (Bouaicha 2011). We thus completed the estimate for the years when data were not reported to FAO, or reported as zero for the taxa mentioned above and we replaced the catch data provided to FAO whenever our approach provided higher estimates. We then completed the estimate with catch data for the species that were never reported (landed by-catch) to obtain a more complete estimate with a higher resolution.

Bluefin tuna catches of Algeria

FAO bluefin tuna (Thunnus thynnus) landings have been increasing since the 1950s. However, a dramatic increase in catches was reported after Algeria became a member of ICCAT in 2000 (ICCAT 2003). From the early 1990s,

when Algeria signed its first agreement for foreign longliners, to 2002, a large portion of Algerian bluefin tuna catch was attributed to foreign-flagged vessels (Abdelguerfi 2002; WWF 2006, 2008b). From 1991 to 1994, we believe Algeria over-reported its bluefin tuna catch, where the over-reported portion is allocated to foreign vessels operating under or without agreement. Thus, we assumed Algerian domestic bluefin tuna catch is the difference between the estimated foreign catch (see foreign flag catch section) and bluefin tuna catches reported by Algeria to FAO. From 1995 to 1997, we accepted bluefin tuna catches as reported by Algeria since there was no evidence to suggest over-reporting. It is only in 2004 that Algeria acquired its first purse-seiner, and evidence suggests that Algeria over-reported its bluefin tuna catch to maintain a high quota with ICCAT as a high portion of the reported catch was being allocated to foreign vessels for the period from 1998 to 2006. Consequently, from 1998 to 2003, we adjusted bluefin tuna landings by applying a CPUE estimate obtained from local catch data of aggregated tuna species (i.e., 0.5 t·year^{-1}·boat^{-1}) to the small-scale fleet (MPRH 2010, 2011). Thereafter, we added the estimated catch for the purse seine fleet of 600 t·year^{-1} from 2004 to 2006 and 1740 t·year^{-1} from 2006 to 2010 (WWF 2008a). Although considerable uncertainty exists in our catch estimate due the use of aggregated tuna CPUE, Abdelguerfi (2002) suggested that Bluefin tuna catches were underestimates, therefore our estimates are likely conservative.

Subsistence and recreational fisheries

Subsistence fisheries

Local estimates for subsistence catches per species, gear type and the number of fishers in Bouzadjar, Western Algeria were available for 1960[5], one of the 5 main maritime areas identified by the French administration (Oliver 1983) leading to a local catch of 68 t·year^{-1} for 1960. We assumed an equivalent catch over the 4 other maritime areas and estimated a total catch of 340 t·year^{-1} in 1960 (based on 68 t·year^{-1} x 5=340 t·year^{-1}). Given a local population of 1,020,000 in 1960 (www.populstat.com [2011]), this translates to an annual per capita catch of 0.33 kg·person^{-1}·year^{-1}. We applied this catch rate to the population data available for the years 1954, 1958, 1960, 1963, 1966, 1970, assuming that the consumption rate was constant (which is likely to underestimate catches). After 1970, development plans targeting fisheries (CIHEAM 2005) were issued and the first fisheries regulations were promulgated and gradually enforced (Belala 2004), thus reducing subsistence fishing. Consequently, we assumed that by 2000, subsistence catches were 1% of subsistence catch of 1970 and remained stable thereafter, and completed the time series by applying a series of linear interpolations for the missing years. We used the local estimate in 1960 to disaggregate the catches to the species/taxon level.

Table 7. Catch per recreational fisher (kg·fisher^{-1}) the corresponding catch composition of recreational fishing.

		1998					2002			
Taxon name	**English name**	**Weight (kg)**	**Frequency**	**Catch/ trip**	**Catch/ year**	**%**	**Frequency**	**Catch/trip**	**catch/ year**	**%**
Epinephelus marginatus	Dusky grouper	7.0	1.00	7.0	266.0	17.9	0.20	1.4	53.2	4.4
Epinephelus caninus	Dogtooth grouper	2.5	0.50	1.3	47.5	3.2	0.20	0.5	19.0	1.6
Epinephelus fasciatus	Blacktip grouper	2.5	0.50	1.3	47.5	3.2	0.20	0.5	19.0	1.6
Sphyraena sphyraena	European barracuda	4.0	0.33	1.3	50.7	3.4	0.33	1.3	50.7	4.2
Lichia Amia	Leerfish	18.8	1.00	18.8	714.8	48.0	1.00	18.8	714.8	58.8
Seriola Dumerili	Greater amberjack	3.0	0.10	0.3	11.4	0.8	0.10	0.3	11.4	0.9
Conger conger	European conger	5.0	0.10	0.5	19.0	1.3	0.10	0.5	19.0	1.6
Muraena helena	Mediterranean moray	5.0	0.10	0.5	19.0	1.3	0.10	0.5	19.0	1.6
Sphyraena spp.	Barracudas	1.0	0.67	0.7	25.3	1.7	0.67	0.7	25.3	2.1
Octopus vulgaris	Common octopus	1.0	0.07	0.1	2.5	0.2	0.07	0.1	2.5	0.2
Sepia spp.	Cuttlefish	0.5	0.07	0.0	1.3	0.1	0.07	0.0	1.3	0.1
Sciaena umbra	Brown meagre	0.5	0.33	0.2	6.3	0.4	0.10	0.1	1.9	0.2
Spondyliosoma cantharus	Black seabream	1.5	0.67	1.0	38.0	2.6	0.67	1.0	38.0	3.1
Diplodus puntazzo	Sharpsnout seabream	1.0	0.33	0.3	12.7	0.9	0.33	0.3	12.7	1.0
Dentex dentex	Common dentex	5.0	0.33	1.7	63.3	4.3	0.33	1.7	63.3	5.2
Sarpa salpa	Salema	1.0	0.33	0.3	12.7	0.9	0.33	0.3	12.7	1.0
Sparus aurata	Gilthead seabream	2.5	0.33	0.8	31.7	2.1	0.33	0.8	31.7	2.6
Diplodus sargus sargus	White seabream	1.5	0.25	0.4	14.3	0.9	0.25	0.4	14.3	1.2
Pagellus erythrinus	Common pandora	1.0	0.25	0.3	9.5	0.6	0.25	0.3	9.5	0.8
Pagrus auriga	Redbanded seabream	1.0	1.00	1.0	38.0	2.6	1.00	1.0	38.0	3.1
Balistes capriscus	Grey triggerfish	2.0	0.25	0.5	19.0	1.3	0.25	0.5	19.0	1.6
Umbrina cirrosa	Shi drum	2.3	0.33	0.8	29.1	1.9	0.33	0.8	29.1	2.4
Palinurus elephas	Common spiny lobster	2.5	0.10	0.3	9.5	0.6	0.10	0.3	9.5	0.8
Total CPUE		-	-	-	1.49	-	-	-	1.2	-

[5] G. Padilla, a subsistence fisher now living in France (pers. comm.).

Recreational fisheries

Recreational fishing in Algeria includes mainly boat-based line fishing (longline fishing, 80%), handline fishing, and spearfishing using boats of 5 to 7 meters (Boukhalfa and Rambeau 1993).

Spearfishing: Spearfishing was rarely practiced until the 1980s[6] and started increasing thereafter. We relied on a field survey targeting spearfishers, electronic qualitative data[7] and literature review (see MATE 2005b; Grau *et al.* 2009) to estimate catches by this gear type. We assumed an average number of 381 spearfishers (from 2002 to 2010) based on 28 scuba diving clubs (www.corbusmilchasse.com [2011]), the estimated number of divers practicing spearfishing per club (14) and a nominal effort of 38 days per year (M. Kharfellah, pers. comm., *Institut des Sciences de la Mer et de l'Aménagement du Littoral*, 2011). We assembled a catch frequency per species per day expressed as a probability of catch ranked from 0 to 1 from the field survey and www.corbusmilchasse.com [2011] (Table 7), we multiplied each frequency by the average weight of each species and the number of fishing days per spearfisher (38), then estimated the total catch per year for 1998 (567.32 t·year^{-1}) when the total recreational catch per fisher is the product of the number of fishing days by the sum of each species catch per day (1.49 t·year^{-1}·fisher^{-1}). We obtained the percentage of each species by dividing the weight of each species by the annual recreational catch per fisher for 1998 (Table 7). We reduced the catch frequency (given for 1998) by 80% for groupers (*Epinephelus marginatus, E. caninus* and *E. fasciatus)* and 25% for brown meagre (*Sciaena umbra*) for the last decade, beginning from 2002, to represent their decreasing trend (Kara and Derbal 1999; Grau *et al.* 2009), which led to a total catch of 462.84

Table 8. Species composition of recreational boat-based catch.

Scientific name	Common name	Mean weight (kg)	Source	Catches (%)
Boats using hooks				
Xiphias gladius	Swordfish	26.7	Chalabi *et al.* (1995)	56.5
Thunnus spp.	Tunas	142.0	ICCAT (2007) ; Bachet *et al.* (2007); estimated[a]	0.8
Prionace glauca	Blue shark	41.3	Hemida (2005)	14.6
Isurus oxyrinchus	Shortfin mako	63.0	OCEANA (2010); Megalofonou *et al.* (2005)	4.1
Galeorhinus galeus	Tope shark	19.1	OCEANA (2010)	0.1
Coryphaena hippurus	Common dolphinfish	3.31	Djabali *et al.* (1993); Bas Peired (2006); estimated[a]	0.6
Dasyatis pastinaca	Common stingray	44.0	Serena *et al.* (2003)[b]; www.fishbase.org [2011]	21.4
Alopias vulpinus	Thresher shark	104.9	Hemida (2005)	1.9
Other boat-based[c]				
Mullus spp.	Goatfish			29.0
Helicolenus dactylopterus; Scorpena porcus; S. scrofa; S. notate; S. elongata	Scorpionfishes			8.8
Sepia sp.	Common cuttlefish			2.9
Pagrus pagrus	Red porgy			5.9
Pagellus bogaraveo; P. erythrinus	Seabreams			14.7
Phycis spp.	Forkbeard			2.9
Sparidae	Porgies			5.9
Solea solea	Common sole			2.9
Merluccius merluccius	European hake			2.8
Raja spp.	Rays			2.9
Mustelus mustelus	Smooth-hound			2.9
Pagellus acarne	Axillary seabream			8.8
Epinephelus spp.	Groupers			2.9

[a]) Derived from length-weight relationship.
[b]) www.iucnredlist.org/apps/redlist/details/161453/0 (accessed on June 1, 2011).
[c]) Sahi and Bouaicha (2003) and Anon. (2005).

t·year^{-1} for 2002. From 2003 onwards, we assumed a decreasing rate of recreational catches of 10% per year, then applied it year by year until 2010 to represent the decreasing trend of catches (i.e., recreational catch (2003) = recreational catch 2002 x (100%-10%)). Here, we assumed recreational spearfishing begun in 1970 (10 years after the independence), thus interpolated linearly from zero in 1970 to 567.32 t·year^{-1} in 1998, to 462.84 t·year^{-1} in 2002, and then completed the time series with a 10% decrease of recreational catches per year.

Boat-based fishing: In Algeria, recreational fishing boats are about 5 to 7 meters of length, using hook and line (80%) or other gears. Here, we assumed boat-based recreational fishing started in 1970 , corresponding to the implementation of the first fisheries development program (CIHEAM 2005). Until 2002, recreational fishers had no legal restrictions (Abdelguerfi 2002).

Based on local effort and catch data (MPRH 2011; www.Algeria.com [2011]) we estimated a catch of 0.5 t·boat^{-1}·year^{-1} for a total of 1,680 recreational fishing boats per year over the period 2002-2010, resulting in a total

[6] www.bainsromains.com (accessed on June 13th, 2011).
[7] www.corbusmilchasse.com/corbusmil1/poisson%20miniature.htm (accessed on June 13th, 2011).

catch of 840 t·year^{-1} for 2010. To estimate recreational boat-based line catches and allow for species disaggregation, we combined data on the number of fishes per hook per fishing trip (Báez *et al.* 2009) with weight data per species (obtained from literature or derived from length-weight relationships (Table 8). We adjusted the estimated catch per species per hook by -50%, to account for the difference in boat efficiency since Báez *et al.* (2009) described these

Table 9. Demersal and shrimp trawl discard per effort.

Taxon name	CPUE (kg·trawl^{-1}·h^{-1})	Taxon name	CPUE (kg·trawl^{-1}·h^{-1})	Taxon name	CPUE (kg·trawl^{-1}·h^{-1})
Abralia veranyi	31.2	*Hoplostethus mediterraneus*	55.3	*Plesionika antigai*	14.0
Acanthocardia echinata	45.4	*Illex coindetii*	70.0	*Plesionika edwardsii*	4.1
Alpheus glaber	27.3	*Lampanyctus crocodilus*	39.7	*Plesionika giglioli*	64.7
Antonogadus megalokynodon	40.7	*Lepidopus caudatus*	70.4	*Plesionika heterocarpus*	71.0
Argentina sphyraena	62.8	*Lepidorhombus boscii*	81.8	*Plesionika martia*	23.4
Argyropelecus hemigymnus	12.2	*Lepidotrigla cavillone*	27.2	*Plesionika* spp.	14.7
Aristaeomorpha foliacea	118.1	*Lepidotrigla dieuzeidei*	8.3	*Policheles typhlops*	24.5
Aristeus antennatus	290.7	*Lesueurigobius friesii*	34.4	*Pontophilus spinosus*	28.8
Arnoglossus laterna	5.6	*Lesueurigobius spp.*	5.1	*Processa canaliculata*	31.0
Arnoglossus rueppelli	1.9	*Liocarcinus depurator*	18.7	*Pteroctopus tetracirrhus*	0.9
Chelidonichthys cuculus	8.7	*Loligo vulgaris*	56.4	*Raja clavata*	3.4
Bathysolea profundicola	0.6	*Lophius budegassa*	32.6	*Raja polystigma*	3.4
Benthocometes robustus	4.4	*Lophius piscatorius*	9.7	*Rondeletiola minor*	7.9
Benthosema glaciale	3.3	*Macropipus tuberculatus*	30.4	*Rossia macrosoma*	6.8
Blennius ocellaris	2.4	*Macropodia longipes*	0.2	*Sardina pilchardus*	28.9
Boops boops	88.5	*Macropodia* spp.	0.0	*Sardinella aurita*	0.4
Callionymus maculatus	8.1	*Macroramphosus scolopax*	76.3	*Scaergus unicirrhus*	12.7
Capros aper	24.1	*Maurolicus muelleri*	4.5	*Scaphander lignarius*	5.8
Centrolophus niger	12.9	*Merluccius merluccius*	263.5	*Scomber scombrus*	1.6
Centrophorus granulosus	27.7	*Micromesistius poutassou*	159.7	*Scomberesox saurus*	15.0
Cepola rubescens	13.9	*Molva dypterygia*	23.5	*Scorpaena elongata*	15.4
Ceratoscopelus maderensis	4.9	*Monodaeus couchi*	5.2	*Scorpaena notata*	4.8
Chimaera monstrosa	10.8	*Mullus barbatus*	154.6	*Scorpaena porcus*	0.5
Chlorophthalmus agassizi	56.1	*Mullus surmuletus*	22.8	*Scorpaena scrofa*	0.9
Chlorotocus crassicornis	23.7	*Munida iris*	0.1	*Scyliorhinus canicula*	26.4
Citharus linguatula	2.6	*Munida perarmata*	25.0	*Sepia elegans*	45.9
Coelorinchus caelorhincus	60.0	*Munida rugosa*	14.9	*Sepia officinalis*	3.5
Conger conger	36.0	*Myctophum punctatum*	10.6	*Sepia orbignyana*	37.9
Dalatias licha	39.3	*Nemichthys scolopaceus*	0.2	*Sepietta oweniana*	98.3
Dalophis imberbis	1.3	*Neorossia caroli*	3.4	*Sepiola* spp.	4.4
Dardanus arrosor	3.7	*Nephrops norvegicus*	131.7	*Sergestes arcticus*	4.0
Diplodus annularis	14.0	*Nettastoma melanurum*	3.6	*Sergia robusta*	12.7
Echelus myrus	0.2	*Nezumia aequalis*	50.4	*Serranus cabrilla*	11.6
Eledone cirrhosa	91.7	*Nezumia sclerorhynchus*	33.7	*Serranus hepatus*	18.6
Eledone moschata	3.4	*Notacanthus bonapartei*	8.3	*Solea solea*	3.7
Engraulis encrasicholus	48.6	*Octopus salutii*	26.8	*Solenocera membranacea*	61.0
Epigonus constanciae	0.8	*Octopus vulgaris*	11.9	*Spicara flexuosa*	19.0
Epigonus denticulatus	25.2	*Oxynotus centrina*	18.0	*Spicara smaris*	34.6
Epigonus telescopus	2.7	*Pagellus acarne*	85.4	*Sequilla mantis*	2.3
Etmopterus spinax	164.2	*Pagellus bogaraveo*	168.8	*Stomias boa*	15.7
Gadella maraldi	6.1	*Pagellus erythrinus*	83.0	*Symphurus nigrescens*	46.7
Gadiculus argenteus	57.2	*Pagurus excavatus*	11.4	*Synchiropus phaeton*	15.0
Galeorhinus galeus	51.0	*Paralepis coregonoides*	12.0	*Synodus saurus*	7.2
Galeus melastomus	164.5	*Parapenaeus longirostris*	528.0	*Todarodes sagittatus*	26.0
Geryon longipes	10.9	*Paromola cuvieri*	17.9	*Todaropsis eblanae*	63.2
Glossanodon leioglossus	35.9	*Parthenope macrochelos*	6.0	*Torpedo marmorata*	14.4
Gnathophis mystax	3.5	*Pasiphaea multidentata*	25.2	*Torpedo nobiliana*	3.2
Goneplax rhomboides	54.2	*Pasiphaea sivado*	11.6	*Trachurus mediterraneus*	2.2
Helicolenus dactylopterus	69.3	*Peristedion cataphractum*	20.5	*Trachurus picturatus*	59.4
Heteroteuthis dispar	7.0	*Phycis blennoides*	249.0	*Trigla lucerna*	2.5
Histioteuthis bonnellii	8.1	*Phycis phycis*	70.6	*Trigla lyra*	9.1
Histioteuthis reversa	24.3	*Plesionika acanthonotus*	17.9	*Zeus faber*	41.9
Homola barbata	4.2	-	-	-	-

catches for recreational boats ranging from 5 meters to 12.5 meters of length. By multiplying the sum of recreational catches per species (8.49 t·hook^{-1}·year^{-1}) by the total number of hooks, we obtained a total catch of 481.31 t·year^{-1} for 2010 which we assumed to be constant from 2002 to 2010 (M. Kharfellah, pers. comm., *Institut des Sciences de la Mer et de l'Aménagement du Littoral*, 2011) then we interpolated backwards to zero in 1970. The difference in total recreational catches (i.e., 840 t·year^{-1}–481.31 t·year^{-1} =358.68 t·year^{-1}) represents recreational catches by other boat based gear types in 2010 which we interpolated backwards to zero in 1970.

Discards

Discards include non-commercial species, damaged fish and illegal-size fish (GFCM 2011). Discards in the Western Mediterranean are not negligible (Carbonell *et al.* 1998; Kelleher 2005), and among all fishing gears, trawls have been recognized as the most problematic gear (Lleonart *et al.* 1999), besides the use of dynamite, which while not considered here, generates high rates of underwater gear mortality (Tudela and Sacchi 2003). We consider two types of discards: from the pelagic trawl fishery and the shrimp trawl fishery.

Pelagic trawl discards

Multi-purpose boats (trawler - seiner) introduced in the 1970s (Oliver 1983) started to generate increasing discards. Pelagic trawl fishery discards thus were about 20% of the pelagic trawl landings in 2010 (MPRH 2011). We first estimated the portion of pelagic fish landed by pelagic trawlers using catch per gear data (23% of the small pelagic fish landings), then applied the 20% discard rate to the reported landings from 1971 to 2010.

Shrimp fishery discards

Shrimp fishery discards in Algeria were as high as 49% of the total retained catches (FAO 1973; Carbonell *et al.* 1998; Bouaicha 2011). Here, we used a survey based on at-sea observations of discards, by-catch and targeted species catches for a commercial trawler of 368 kW and a length of 20 m (Bouaicha 2011). We multiplied the discard per hour per species (expressed in kg·h^{-1}) Bouaicha (2011) (Table 9) by the number of operating hours per trawler per year (1,017 hours) to estimate the discard per boat per hour, i.e., 48 kg·h^{-1}. Then, we applied this discard estimate to the total number of operating shrimp trawl hours (Table 5). Prior to 1994, when Algeria began regulating size limits (Belala 2004), we assumed that fishers were discarding commercially valuable catch only based on storage capacity constraints. Thus, we adjusted discards as a function of the storage capacity. Storage capacity expressed in GRT in the 1950s was 43% of what it is today (Simonnet 1961; Oliver 1983; Zeghdoudi 2006; Belhabib 2007). From the 1970s to late 1980s, it was 61% of the 2010 level (Belhabib 2007). Consequently, we adjusted the total discard, where from 1950 to 1960, 43% of the high value species discard where size restriction apply were retained, and from 1970 to 1994, 61% of the same discards were retained. As for the period from 1994 to 2010, no adjustment is applied, since discarding of valuable species was due to size limits.

Foreign flag catches

Many authors have described foreign fleets operating in Algerian waters since 1950 (Furnestin 1961; Simonnet 1961; Oliver 1983; Tudela and Sacchi 2003; Varela and Ojeda 2010). Here, we focused on bluefin tuna catches and other pelagic fish species.

Table 10. Anchor points for the foreign bluefin tuna catches in Algeria.

Year	Catches (t·year^{-1})	Reference
1950	0	assumed
2004	960	WWF (2006)
2005	666	WWF (2006); Anon. (2004)
2006	1,682	Bregazzi (2007); www.illegal-fishing.com [2011]
2008	2,260	WWF (2008a); www.illegal-fishing.info [2011]

Foreign bluefin tuna catches

Since the 1950s, Italian and Spanish fishing vessels, 20 times more efficient than Algerian vessels (Simonnet 1961), were known to target large pelagic species along the Algerian coast (Tudela and Sacchi 2003). However, no data were recorded. In 1992, the first foreign access fishing agreement for longliners was signed by Algeria (Abdelguerfi 2002). From 2000 to 2009, several cases of illegal bluefin tuna fishing have been recorded (Anon. 2004; WWF 2006; Bregazzi 2007; WWF 2008a), which allowed us to identify bluefin tuna catch anchor points (Table 10). Assuming that catches were zero in 1950, we interpolated linearly to the first anchor point in 2004. Also, we assumed catches remained unchanged in 2009 and 2010, which provides a conservative estimate, since illegal catches were likely increasing (WWF 2008b).

Foreign flag large pelagic fishery by-catch

Two important species are reported as by-catch in the purse-seine and longline fisheries: bluntnose sixgill shark (*Hexanchus criseus)* and blue shark (*Prionace glauca)* from 1996 to 2002 (Canapé *et al.* 2003; Hemida 2005). To estimate the bluntnose sixgill shark by-catch, we used the weight-frequency data in Canapé *et al.* (2003). A total of 15.86 tonnes was calculated over the period 2000-2002 for a total unreported catch of bluefin tuna of 2,728 tonnes. Based on this estimate, a percentage of 0.58% was calculated and applied to the unreported bluefin tuna catch from 1950 to 2010. We used the same method for the blue shark using data from Hemida (2005). We only considered the non-reported catch of bluefin tuna assuming that the by-catch of the declared bluefin tuna was reported to the FAO. To estimate by-catch of other species, we used at-sea observer data provided by Burgess *et al.* (2010) for longliners from Malta and applied it to the blufin tuna reconstructed catch.

Foreign flag catches (excluding bluefin tuna)

In the 1950s, 50% of the fishers operating in Algerian territorial waters (i.e., inshore) were Italian and Spanish targeting pelagic fish (Furnestin 1961; Simonnet 1961). This number does not include fishers in the Algerian waters equivalent to the subsequent FEZ. In 1976, all foreign fishing in Algerian territorial waters was prohibited (Ordinance N° 76-84, 1976, act. 6). As a conservative approach, we estimated the foreign-flag catches as being 20% of the Algerian reported landings of small pelagic species in the FEZ equivalent waters in 1950. Then, we interpolated to zero in 1994 when Algeria declared its FEZ, assuming the catches were zero afterwards. To disaggregate catches, we identified two gear-types or vessel types: pelagic driftneters and pelagic seiners. We used data from Di Natale *et al.* (1995) to disaggregate the catches to species or higher taxonomic level.

Results

Algerian catches by sector

The investigation of local names and scientific names revealed some confusions in species catch classifications (e.g., dogfishes are sometimes not considered to be sharks). Herein, in many cases different local names refer to the same species (Table 11).

Artisanal catches

Small-scale commercial catches, mainly of European pilchard (*Sardina pilchardus*), gilthead seabream (*Sparus aurata*) and little tunny (*Euthynus alleteratus*), increased from 26,819 t·year^{-1} in 1950 to 96,973 t·year^{-1} in 2010. However, a slower rate of increase was observed since 2005. The artisanal portion of the catch data supplied to FAO represented only 30% of the artisanal commercial reconstructed catch (Figure 2a). Reconstructed artisanal grouper catches, as estimated separately, increased steadily from about 807 t·year^{-1} in 1950 to 3,316 t·year^{-1} in 2007 and have declined since. Swordfish (*Xiphias gladius*) represented 1% of artisanal catches and followed a similar trend as total artisanal catches, with peak of 1,158 t·year^{-1} in 2007 compared to a total catch of 602 t·year^{-1} supplied to FAO (including all the other vessels, i.e., trawlers and seiners) (Figure 2b).

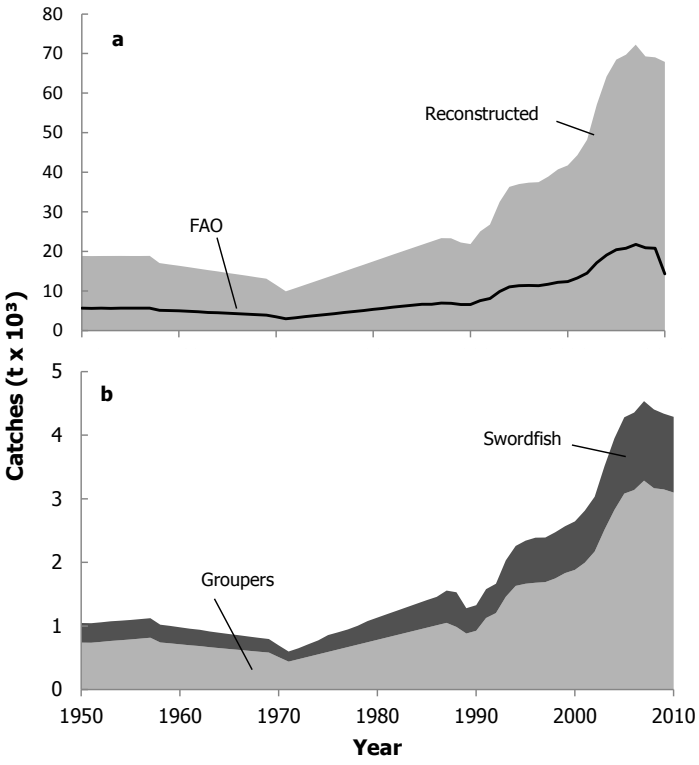

Figure 2. a) Estimated total artisanal marine fisheries catches by Algeria as compared to the artisanal portion of the data supplied to the FAO; and b) Estimated grouper catches (*Epinephelus* spp.) and swordfish catches (*Xiphias gladius*), 1950-2010.

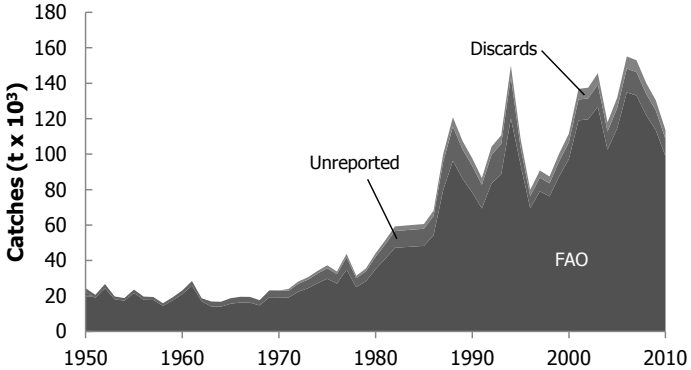

Figure 3. Total estimated small pelagic fishery removals by Algeria, 1950-2010.

Table 11. Arabic names of some species caught in Algeria. Assembled from Djabali *et al.* (1993) and Hemida (2005).

English name	Taxon name	Arabic name
African ray	*Raja africana*	Raya
Atlantic mackerel	*Scomber japonicus; S. scombrus*	Bacoreta; cavaya; kaballa; kaval
Axillary seabream	*Pagellus acarne*	Bazougue; boumchita; bizigo; chpigarel; mafroune
Barracudas nei	*Sphyraena sphyraena and S. virdensis*	Sirèn; la-alaz
Basking shark	*Cetorhinus maximus*	Chkara
Bignose shark	*Carcharhinus altimus*	Boudmaghe
Blackspot seabream	*Pagellus bogaraveo*	Mafroum; patchano
Blackspotted smooth-hound	*Mustelus mediterraneus*	Paloum; msola
Blonde ray	*Raja brachyura*	Raya
Blue shark	*Prionace glauca*	Zrika
Bluntnose sixgill shark	*Hexanchus griseus*	Chkara
Bluntnose sixgill shark	*Alopias vulpinus*	Zerdi; taous
Bogue	*Boops boops*	Bouga; vope; vopa
Brown ray	*Raja miraletus*	Raya
Common pandora	*Pagellus erythrinus*	El bejjij
Copper shark	*Carcharhinus brachyurus*	Boudmaghe
Dusky shark	*Carcharhinus obscurus*	Boudmaghe
European anchovy	*Engraulis encrasicholus*	Antchouva; bocorone; mentchouba
European hake	*Merluccius merluccius / Micromesistius poutassou*	Mernouze; pacalow
European pilchard	*Sardina pilchardus*	Sardine
Gilthead seabream	*Sparus aurata*	Quadjoudj
Greater amberjack	*Seriola dumerili*	Lichola; linchola, pech-limon
Groupers	Epinephelidae / Polyprionidae	Badecha; bayajo; merot; al- mara
Gulper shark	*Centrophorus granulosus*	Gagould; zaarour; gagaoul
Horse mackerel	*Trachurus* spp.	Saorel-lezreg; Saourine; Tcherel; Tonino
Little gulper shark	*Centrophorus uyato*	Zaarour; gagaoul
Longnose spurdog	*Squalus blainvillei*	Bouchouka
Longnosed skate	*Dipturus oxyrinchus*	Raya kahla
Mediterranean starry ray	*Raja asterias*	Raya
Moronidae	*Moronidae*	Gonfar; gonfran; kaross; liobarro
Grey mullets	Mugilidae *(Liza* and *Mugil* spp.*)*	Bouri; bousefra; bouri- mdehheb
Nursehound	*Scyliorhinus* spp.	Gat
Pargo breams	Sparidae *(Pagrus pagrus; P. auriga)*	El bedhar; pagri; pray
Red gurnard	*Aspitrigla cuculus*	Borraco
Rough ray	*Raja radula*	Raya
Salema	*Sarpa salpa*	Chelba; techelbine; tchelba
Sandbar shark	*Carcharhinus plumbeus*	Boudmaghe
Sardinellas	*Sardinella* spp.	Bouir; latcha; latchoum; salaga; sarakin
Rockfishes	Sebastinae and Scorpaeninae	Scorpa
Skipjack tuna	*Katsuwonus pelamis / Sarda sarda*	Bonite
Smooth-hound	*Mustelus mustelus*	Paloum; msola
Sole	Soleidae / Bothidae / Symphurinae	Pivola; sola; palaya
Sparidae	Sparidae	Sar
Speckled ray	*Raja polystigma*	Raya
Spinner shark	*Carcharhinus brevipinna*	Boudmaghe
Spotted ray	*Raja montagui*	Raya
Sharks	Squalidae	Bouchouka
Surmullets	*Mullus surmuletus / M. barbatus*	Rougi
Swordfish	*Xiphias gladius*	Boussif et-ouil; boussif; space; spadon
Thornback ray	*Raja clavata*	Raya
Tope shark	*Galeorhinus galeus*	Faux-paloum
Triakidae	Triakidae	Paloum; msola
Undulate ray	*Raja undulata*	Raya
Velvet belly	*Etmopterus spinax*	Far

Illegal small fish catch

Illegal small fish catch totaled about 118,043 tonnes over the period from 1950 to 2010. The illegal small fish catch trend followed governmental regulations and law enforcement incentives, increasing from zero in 1994 to a maximum of 12,200 t·year^{-1} in 2000. Illegal catches decreased thereafter to a plateau of around 4,600 t·year^{-1} from 2007 to 2010.

Small pelagic fisheries

Small pelagic species catches were about 3.6 million tonnes for the period 1950 to 2010 compared to 3.16 million tonnes reported to FAO. Catches were on average 11,600 – 17,000 t·year^{-1} from 1950 to 1968. After injection of subsidies, small pelagic catches increased dramatically to around 139,000 t·year^{-1} in 1994, then decreased by 71% in the late 1990s. Afterwards, catches increased to a maximum of 147,000 t·year^{-1} in 2006, and decreased thereafter (Figure 3).

Cephalopod catches

Reconstructed cephalopod (targeted) catches were approximately twice (40,500 tonnes) the catches reported the FAO (23,000 tonnes) over the period 1950 to 2010. Overall, the catches remained low from 1950 to the mid-1970s at approximately 250 t·year^{-1}, and increased thereafter, reaching a maximum of 2,300 t·year^{-1} in 2007. Since then, total reconstructed catches of cephalopods have been decreasing (Figure 4).

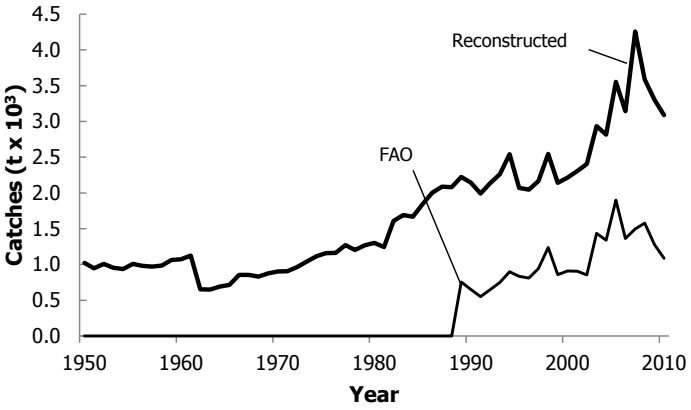

Figure 4. Total domestic cephalopod catch in Algeria, 1950-2010.

Shark and ray fisheries

Shark and ray catches were estimated to be about 46,900 tonnes for the period 1950 to 2010, of which slightly over 29,600 tonnes were sharks (63%), compared to a total of 28,719 tonnes reported to the FAO. Overall, the catches were decreasing from around 920 t·year^{-1} in 1950 to a minimum of 260 t·year^{-1} in 1976. Thereafter, catches increased to 1,700 t·year^{-1} in 1994, and then gradually decreased to around 640 t·year^{-1} in 2010 (Figure 5).

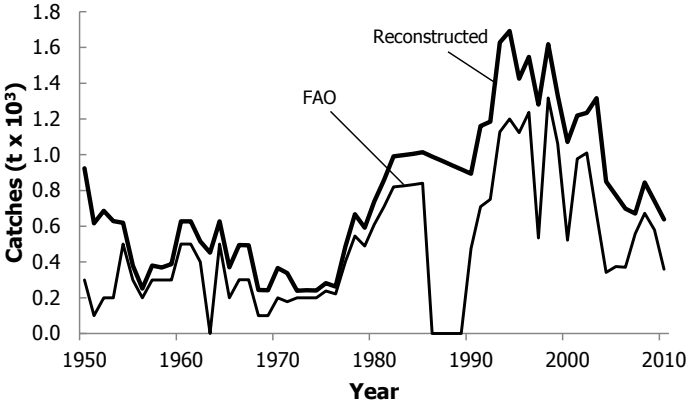

Figure 5. Total reconstructed sharks and rays catches compared to the total shark and ray catch data supplied to the FAO by Algeria, 1950-2010.

Crustacean/shrimp fisheries

Reconstructed crustacean catches in Algeria totalled over 382,900 tonnes for the period 1950 to 2010, compared to 129,077 tonnes reported to the FAO. Shrimp catches (mainly blue and red shrimp, and deep water rose shrimp) were estimated to be 271,000 tonnes for the same period. The unreported component includes 1,700 tonnes of trans-shipped catches over the 1994-2010 time period. Reconstructed shrimp catches increased three fold (11,000 t·year^{-1} in 2010) since the 1950s (3,600 t·year^{-1} compared to 1,700 t·year^{-1} reported to the FAO). Shrimp catches were smallest (1,800 t·year^{-1}) in 1962 due to the departure of many fishers to France when Algeria gained its independence. Thereafter, catches increased to a maximum of 10,900 t·year^{-1} in 2009 compared to 1,200 t·year^{-1} reported to FAO (Figure 6).

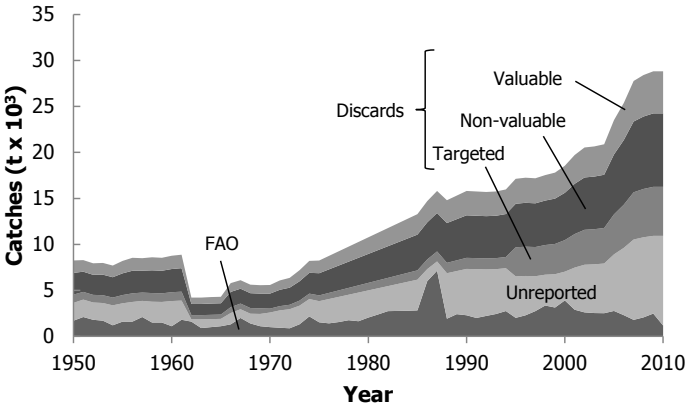

Figure 6. Reconstructed shrimp catches and discarded by-catch, 1950-2010.

Algerian bluefin tuna catches

Algerian bluefin tuna catches increased from 100 t·year^{-1} in 1950 to over 2,372 t·year^{-1} in 2010. Reconstructed commercial bluefin tuna catches were similar to those reported to the FAO for the 1950-1992 time period, when the first foreign longline fishing agreement was signed by Algeria. From 1992 to 1994, Algeria over-reported its bluefin tuna catches by over 2,300 tonnes. Thereafter, catches were similar to those reported to FAO until 1998 just before Algeria joined ICCAT. From 1998 to 2004, 73% (9,000 tonnes of a total of around 12,400 tonnes) of bluefin catches reported to FAO were considered to be from foreign vessels. Thereafter, Algerian catches increased to reach a total of 8,200 tonnes over the period 2005-2009, when Algeria started investing in industrial purse-seiners, compared to 4,000 tonnes reported to the FAO. Here, we assumed the 2009 catch to be the same for 2010 (Figure 7).

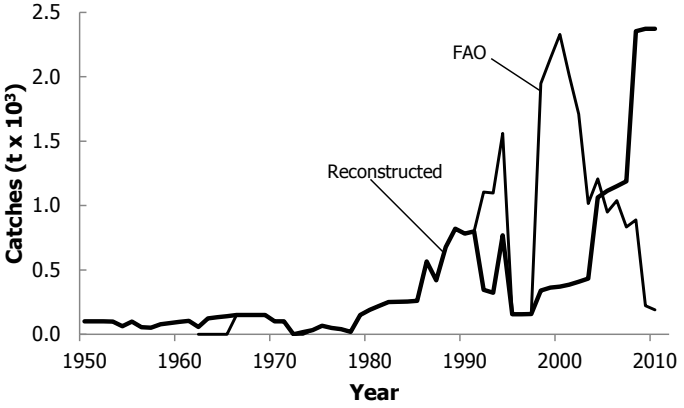

Figure 7. Reconstructed commercial Algerian bluefin tuna catches compared to the bluefin tuna catch data supplied to FAO, 1950-2010.

Subsistence fisheries

Catch data submitted to FAO by Algeria do not account for subsistence sector catches. Total reconstructed subsistence catches, consisting of swordfish (dominant in weight and caught using small-scale boats), seabreams (sparids), sharks, octopuses, groupers and tuna species, were estimated to be 65,340 tonnes from 1950 to 2010. Catches increased from around 1,300 t·year^{-1} in 1950 to reach their maximum of over 1,900 t·year^{-1} in 1970. During this period, subsistence fisheries catches were the equivalent of 20% of small-scale commercial fisheries catches. Since then, catches have been decreasing, estimated at about 200 t·year^{-1} in 2010 (Figure 8).

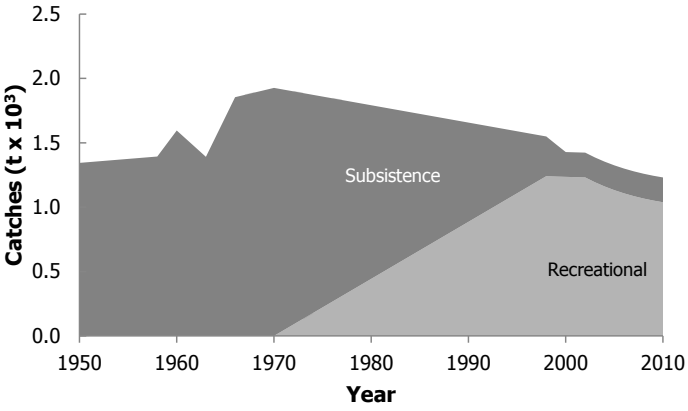

Figure 8. Estimated subsistence and recreational catches (spear, land-based handline, boat-based) for Algeria, 1950-2010.

Recreational fisheries

Recreational catches totalled approximately 31,750 tonnes for the period from 1970 (when recreational fishing began) to 2010. Recreational catches peaked at 1,200 t·year^{-1} in 2002, declining thereafter to about 1,000 t·year^{-1} in 2010 (Figure 8). Reconstructed recreational catches included leerfish (*Lichia amia*) which represented 25% of the catch, and which increased from zero in 1970 to 320 t·year^{-1} in the late 1990s, and decreased dramatically afterwards. Swordfish catches (18% of the reconstructed recreational catches) totalled 4,800 tonnes over the period 1970 to 2010, steadily increasing at first until a plateau was reached at about 300 t·year^{-1} during the 2000s. Stingrays and blue sharks (7% and 5% of the catches, respectively) amounted to 3,000 tonnes and were caught as by-catch by the swordfish fishery during the period 1970 to 2010, following the same trend as the swordfish fishery.

Grouper catches represented 10% of the reconstructed recreational catch, with a total of 2,500 tonnes for the period 1970 to 2010, and included three species: dusky grouper (7%),

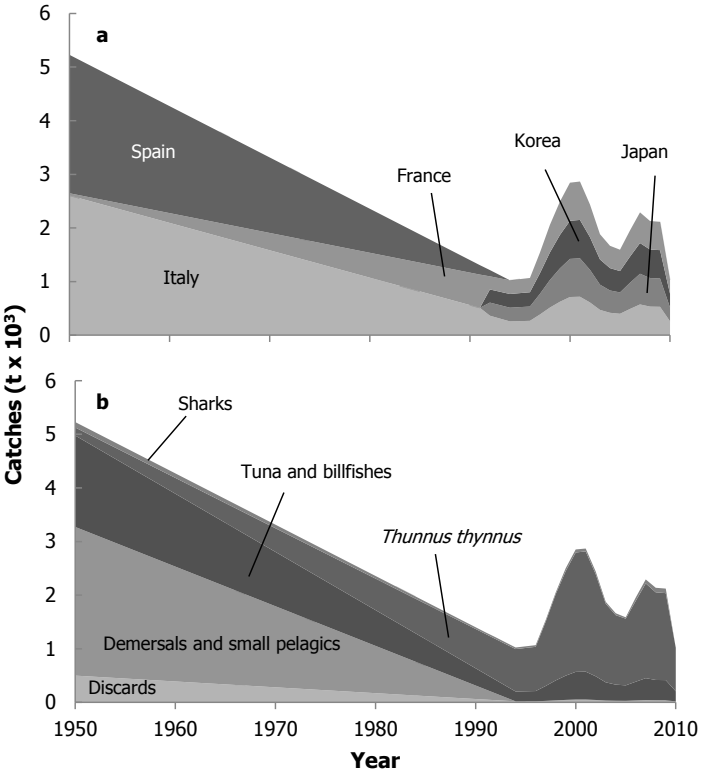

Figure 9. Estimated foreign flag catches for the 1950-2010 time period, a) by country; and b) by taxon. Discards include rays and other species.

dogtooth grouper and goldblotch grouper with together 3% of the total recreational catch. Grouper catches were increasing overall from zero in 1970 to a maximum of 150 t·year^{-1} in the mid-1990s, and then decreased to 26 t·year^{-1} by 2010.

Pelagic trawl discards

Pelagic trawl discards started in 1971 with the introduction of the multi-purpose trawls and have been increasing since, following the same trend as the small pelagic catches. Total pelagic trawl discards are estimated to be around 149,200 tonnes for the period 1950 to 2010 (Figure 3).

Shrimp fishery discards

Shrimp fishery discards (Figure 6) were estimated to be 24% higher than the total shrimp catch from 1950 to the early 1970, with an average discard of 4,555 t·year^{-1}, then decreased to 3,379 t·year^{-1} on average due to the increasing storage capacity of vessels after Algeria launched the first investment plans in the fisheries sector in the early 1970s. With the introduction in 1994 of new regulations on fish size limits, shrimp discards increased dramatically to 18,000 t·year^{-1} in 2010 (Figure 6), which included 5,300 t·year^{-1} of high value, targeted species (30%), 8,000 t·year^{-1} of other commercial species (45%) and 4,700 t·year^{-1} of non-marketable species (25%). Observer's presence on board could have resulted in overestimating targeted species discards as they are often kept and sold at the market illegally (F. Hemida, pers. comm., 2011).

Foreign flag catches

Foreign flag catches decreased from around 5,000 t·year^{-1} in 1950 to 1,300 t·year^{-1} in 2010, dominated by Italian catches (Figure 9a). Tuna and billfishes catches (60% of foreign fleet catches) followed the same trend, decreasing from around 1,850 t·year^{-1} in 1950 to a minimum of 1,030 t·year^{-1} in 1991 (Figure 9b). With the introduction of fishing agreements, catches started increasing and reached 3,160 t·year^{-1} in 2001 (Figure 9b). Thereafter, foreign flag catches of tuna and billfishes have been steadily decreasing (Figure 9b). By-catch of sharks and rays remained low from 1950 to 2010 (Figure 9b). Catches totalled 6,600 tonnes, of which 4,000 tonnes were discarded. However, in the 1950s, by-catch was much greater (200 t·year^{-1}) than in the recent period (70 t·year^{-1} in 2000s).

Total catches

Total reconstructed domestic catches for Algeria were more than 7.1 million tonnes for the period 1950 to 2010, almost twice as high as the data submitted by the government of Algeria to FAO (3.9 million tonnes, Figure 10). Although the unreported component appears to decrease over time from 131% in the 1950s to 89% in the 2000s, the minimum average recorded was at around 70% in the 1980s, which actually shows increasing

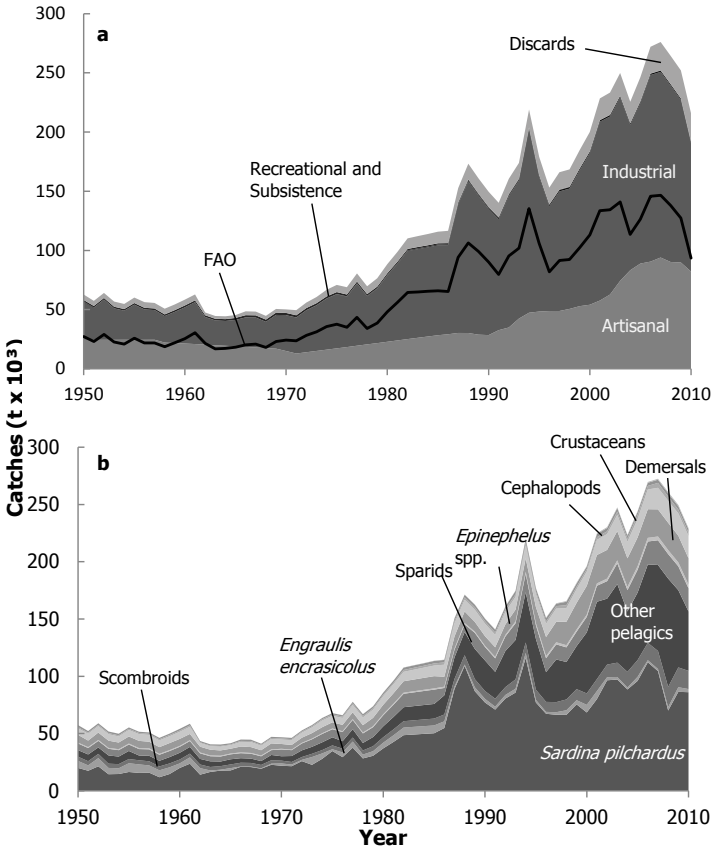

Figure 10. Reconstructed total marine fisheries catches by Algeria by a) fishing sector plus discards with data supplied to the FAO overlaid as line graph; and b) Major taxa caught by the domestic fisheries of Algeria, 1950-2010.

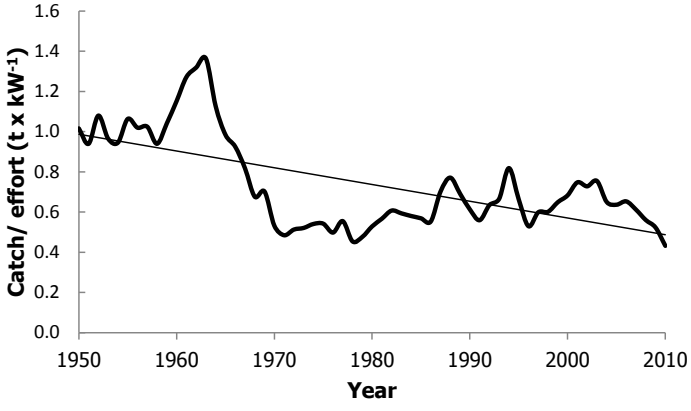

Figure 11. Estimated catch per unit of effort expressed in t·kW^{-1}.

unreported catches. Overall, total domestic catches increased steadily from around 57,500 $t \cdot year^{-1}$ in 1950 to 215,480 $t \cdot year^{-1}$ in 2010 (Figure 10). However, the most dramatic increase was observed from the late 1980s to the mid-1990s, after which the rate of increase was lower. Additionally, the CPUE has decreased overall from 1.02 $t \cdot KW^{-1}$ in 1950 to 0.44 $t \cdot KW^{-1}$ in 2010 (Figure 11).

Overall, the bulk of catches in Algeria were taken by the artisanal and industrial sectors. catches included mostly small-pelagics, particularly sardines, and demersal species at a lesser extent (Figure 10b).

Discussion

Here, we reconstructed Algeria's marine fisheries catches by accounting for all fisheries sectors and components, including unreported artisanal fisheries, inshore recreational and subsistence fisheries (Figure 10a). We also considered by-catch, which has been neither represented in FAO data nor documented in detail in the literature. Algerian catches increased dramatically over the 1950-2010 study period, though at a lower rate during the recent decades. More recently, catches seem to have experienced a decline. In contrast, CPUE has been decreasing continuously since the early 2000s.

Total marine fisheries catches by Algeria (excluding foreign flag catches) were almost twice the amount supplied to the FAO. Although some Algerian landings were presented in FAO fisheries statistics between 1950 and 2010[8], these data under-estimated actual catches. Demersal fisheries resources are not readily accessible because the narrowness of the continental shelf (Maurin 1962), which is likely why the pelagic fishery sector is the most developed, representing 35% of the total reconstructed catches and defining the general trend of Algerian catches. The small-scale fishery sector is also important and represented 14% of the total catches, a high portion of which is not accounted for in the official reports. This highlights the importance of domestic small-scale catches to food security. The decreasing catch trends and increasing prices are negatively affecting local fish consumption rates (Rahmouni 2010); as a result, per capita fish consumption in Algeria is one of the lowest in North Africa (Bouyacoub 2011). In contrast, increasing subsidized effort will lead to higher pressure on an already over-exploited coastal resource (Simonnet 1961; Maurin 1962; Kara and Derbal 1999; Ainouche and Nouar 2010). The narrow continental shelf along the Algerian coast (Leclaire 1972) and the nature of the effort subsidies programs offered, has increased fisher's debts and encouraged the use of illegal fishing methods (Cacaud 2002b; Chalabi *et al.* 2002).

Consequently, fish habitat loss (Chalabi *et al.* 2002) and high rates of by-catch and discards (Bouaicha 2011) have reduced the availability of fish in Algerian coastal waters (PNUE 1996)[9]. Moreover, demersal stock abundance has been declining since the early 1950s (Simonnet 1961; Oliver 1983; Laouar Stahi and Samar 1990; Belkessam and Issolah 1991; Nait Saidi and Taghanemt 1991; Kennouche 2003; Belhabib 2007). Small pelagic species and grouper abundance has also decreased due to a high exploitation rate (Kara and Derbal 1999; Bennoui *et al.* 2010; Bouaziz *et al.* 2010). Following this pattern, catches are likely to decrease substantially within the next 20-25 years. Nevertheless, the Algerian government, experiencing political and social turmoil related to unemployment and social crisis (Rarrbo 2009) has responded to concerns over decreasing catches (i.e., after 2006) by increasing fishing effort through financing programs (MPRH 2001; Zerrouki and Taftichte 2010; MPRH 2001), thus creating more pressure and conflicts among artisanal and other subsidized fishers (Boukhalfa and Rambeau 1993). Both of these factors are increasing the pressure on the ecosystem with a direct impact on fish stocks. This has serious implications for the national economy and domestic food security.

Furthermore, large pelagic fisheries, being heavily targeted both by illegal foreign fleets (WWF 2008a) and foreign fleets operating under fishing access agreements, account for more than 80% of estimated Algerian large pelagic catches. Without enhancing enforcement and monitoring, it is likely that illegal fishing by foreign countries will increase over time, as international markets (particularly fuelled by demand in Asia) become even more lucrative (WWF 2006). Algerian large pelagic catches also increased along with the unreported by-catch of sharks and rays, which include internationally protected species. This is mainly due to the increase in fishing capacity, the introduction of non-selective gears and increasing large pelagic fish prices (Chalabi *et al.* 1995).

A question which may be asked is whether there are persons in Algeria who benefit from the overall increase in illegal foreign fisheries. This situation raises serious issues regarding the Algerian policy of financial support for declining fisheries on one hand, and a poor to non-existent monitoring, a lack of fisheries data which leads to unreliable statistics (Chakour *et al.* 2010) and inefficient enforcement of fishing agreements (Bregazzi 2007) on the other hand. Indeed, monitoring and enforcement systems in Algeria rely on officially designated land-based observers, mostly non-qualified (in 50% of the areas) for coastal fisheries and a few at-sea observers on a few licensed foreign vessels operating under fishing agreements. Here, the importance of at sea-observations versus a system that hardly produces reliable data (MATE 2005a; Chakour *et al.* 2010) is highlighted by the difference between estimated catches based on direct observations and data supplied to the FAO. Fisheries data collection in Algeria seriously lacks necessary human resources with landing sites coverage of less than 2% (Anon. pers. comm.)[10].

In Algeria, fisheries catches have increased dramatically over the last six decades. However, past and present political

[8] We assumed catches in 2010 were 85% the amount in 2009 following a decreasing pattern since 2006.

[9] Programme des nations unis pour l'environnement.

[10] The person who submitted this information preferred to remain anonymous.

and social events have resulted in an increase in investments in this sector and poor monitoring of national fisheries. The continuous increase in capacity does not take into account the sustainable use of these resources. This study has shown that important components of Algerian fisheries are not accounted for in the official data and that catches of economically important taxa show signs of decline, including the small pelagic fishery which is of great importance for food security. This study also suggests that the lack of transparency, especially concerning the management of foreign fisheries may be jeopardizing domestic fisheries. This suggests that proper monitoring and statistical reporting must be prioritized and regulations more aggressively enforced.

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. We would like to thank Dr. Farid Hemida and others for the information and knowledge they shared and regret we are unable to name them.

References

Abdelguerfi A (2002) La bio-invasion, la pollution et l'érosion génétique.ALG97/G31, MATE, Alger. 100 p.

Abdelguerfi A (2003) Plan d'action et stratégie nationale sur la biodiversité. Tome VIII : Évaluation des besoins en matière de renforcement des capacités nécessaires à l'évaluation et la réduction des risques menaçant les éléments de la diversité biologique en Algérie. Annexes. Ministère de l'aménagement du territoire et de l'environnement, Alger. 70 p.

Anon. (1955) 15ème Congrès national des pêches et industries maritimes. Alger du 21 au 27 Juin 1954. Comité permanent des congrès des pêches et industries maritimes, Alger. 347 p.

Anon. (2004) Tuna ranching intelligence unit. 32, ATRT, Madrid. 41 p.

Anon. (2005) Programme d'aménagement côtier (PAC). Zone côtière algéroise. Activité: Protection des sites sensibles naturels marins du secteur Cap Djinet au Mont Chenoua. Actions pilotes, plan d'action et recommendations. Ministère de l'aménagement du territoire et de l'environement, Alger. 51 p.

Bachet F, Benhaj S, Bernard F, Delauge J, Harmelin J, Mante A, Pascal M, Tillmann M, Vela E and Vidal P (2007) Reserve des îles Habibas. Notes naturalistes. Petites îles de Méditerranée. Conservatoire de l'espace littoral et des rivages lacustres. 107 p.

Báez JC, Real R, Camiñas JA, Torreblanca D and Garcia-Soto C (2009) Analysis of swordfish catches and by-catches in artisanal longline fisheries in the Alboran Sea (western Mediterranean Sea) during the summer season. Marine Biodiversity Records 2(10): 1-4.

Bas Peired C (2006) The Mediterranean Sea: Living resources and exploitation. CIHEAM–FAO. 400 p.

Belala A (2004) Les lignes directrices de la loi sur la pêche et l'aquaculture à la lumière de la reglementation algérienne. Institut national d'agronomie, Alger. 34 p.

Belhabib D (2007) Aspects bioéconomiques et dynamiques de la pêcherie chalutière crevettière au port de Bejaia. Ingénieur d'état en sciences de la mer et de l'aménagement du littoral thesis, Ecole nationale supérieure des sciences de la mer et de l'aménagement du littoral, Alger. 67 p.

Belkessam D and Issolah F (1991) La pêche chalutière au port de Bou-Haroun : Etude statistique des débarquements et aperçu sur quelques paramètres biologiques et dynamiques d'éspèces cibles. . Ingénieur d'état en sciences de la mer et de l'aménagement du littoral thesis, Ecole nationale supérieure des sciences de la mer et de l'aménagement du littoral, Alger. 96 p.

Belouahem S (2009) An ecosystemic approach to fisheries. The Algerian case. University of Montpellier II, Montpellier. 96 p.

Bennoui A, Setti M, Bensmail S, Ferhani K and Bouaicha M (2010) Estimation de la biomasse exploitable de la sardine (*Sardina pilchardus*) & la sardinelle (*Sardinella aurita*) de la côte algérienne. Gestion systèmique des ressources halieutiques, ENSSMAL, Alger. 1 p.

Bouaicha M (2011) Étude de suivi des rejets de la pêcherie crevettière dans la baie de Bou-Ismail. Centre national d'étude de la pêche et de l'aquaculture, Bou-Ismail. 37 p.

Bouaziz A, Saiah Djebour O and Benina R (2010) Estimation de la biomasse exploitable et du point de référence biologique, F0.1, de la bogue de la région d'Alger. Gestion systèmique des ressources halieutiques, ENSSMAL, Alger. 1 p.

Bouazouni O (2004) Projet régional pour le développement d'aires marines et côtières protégées dans la région de la méditerranée (MedMPA). Parc national d'El Kala: Etude socio-économique du PNEK. United nations Environment Programme. 52 p.

Boude J-P (1987) Les pêches méditerranéennes. Études internationales 18(1): 83-105.

Boukhalfa M and Rambeau M (1993) Algérie : La pêche artisanale quitte la cale sèche. Syfia Info 1991: 3.

Bouyacoub A (2011) Le paradoxe de la consommation inégalitaire en Algérie Alger. 7 p.

Bregazzi RM (2007) The plunder of bluefin tuna in the Mediterranean and East Atlantic during 2006 and 2007 ATRT, Madrid. 92 p.

Breuil C (1997) Les pêches en Méditerranée: Élements d'information sur le contexte halieutique et les enjeux économique de leur aménagement. FAO, Rome. Available at: http://www.fao.org/docrep/w6526f/W6526f00.htm [Accessed: 04/06/2011].

Brualé J (1985) Exposé synoptique des données biologiques sur les mérous: *Epinephelus aeneus* (Geoffroy Saint-Hilaire, 1809) et *Epinephelus guaza* (Linnaeus, 1758) de l'Océan Atlantique et de la Méditerranée. FAO, Rome. 64 p.

Burgess E, Dimech M, Caruana R, Darmanin M, Raine H, Harrison A and Schembri PJ (2010) Non target by-catch in the Maltese bluefin tuna (*Thunnus thynnus*) longline fishery (Central Mediterranean).65, ICCAT. 8 p.

Cacaud P (2002a) Etude comparative sur la réglementation en matière de pêche maritime dans les pays de la Méditerranée occidentale participant au projet COPEMED. FAO, Rome. 34 p.

Cacaud P (2002b) Revue de la réglementation relative à la pêche maritime et aux aires protégées dans les pays participant au projet COPEMED.CGP/REM/057/SPA, FAO, Rome. 84 p.

Caddy JF, Refik R and Do-Chi T (1995) Productivity estimates for the Mediterranean: Evidence of accelerating ecological change. Ocean & Coastal Management 26(1): 18.

Canapé C, Guélorget O, Barrul J, Mate I, Hemida F, Seridji R and J B (2003) Records of the buttlenose six-gill shark, *Hexanchus griseus* (Bonnaterre, 1788) (Condrichtyes: Hexanchidae) in the Mediterranean sea: A historical survey. Annal for Istrian and Mediterranean studies: 9.

Carbonell A, De Rainieri S and Martín P (1998) Discards of the Western Mediterranean trawl fleet.94/027, Instituto Español de Oceanografía, Spain.

Cavanagh RD and Guibson C (2007) Aperçu du statut de conservation des poissons cartilagineux (Chondrichtyens) en mer Méditerrannée. IUCN, Malaga. 48 p.

Chakour SC, Bouzidi R and Dahout T (2010) Sustainable management of marine resources in Algeria: The contribution of an empirical approach. Gestion systèmique des ressources halieutiques, ENSSMAL. 1 p.

Chalabi A, Cherrak I, Hamida S and Sail M (1995) La croissance de l'espadon pêché près des côtes Algériennes. Colllective Volume of Scientifics Papers 44(1): 3.

Chalabi A, Semroud R and Grimes S (2002) Plan d'Action Stratégique pour la Conservation de la Diversité Biologique en Région Méditerranéenne CAR/ASP PAS BIO Algérie. Ministère de l'Aménagement du Territoire et de l'Environnement, Alger. 153 p.

Chaussade J and Corlay J-P (1989) Atlas des pêches et cultures marines en France. Cahiers de géographie du Québec 33(88): 118-120.

Chavance P (1987) Composition moyenne specifique des débarquements. 170 p.

CIHEAM (2005) Agriculture, pêche, alimentation et développement rural durable dans la région méditerranéenne. Centre International de Hautes Etudes Agronomiques Méditerranéennes Paris. 311 p.

Coppola SR (2001) Inventory of Artisanal Fishery Communities in the Western-Central Mediterranean. FAO, Rome. 64 p.

Cornax MJ, Pastor X and Aguilar R (2006) Italian Driftneters: The Oceana report. Oceana, Madrid. 36 p.

Di Natale A, Mangano A, Maurizi A, Montaldo I, Navarra E, Pinca S, Schimmenti G, Torchia G and Valastro M (1995) A review of driftnet catches by the Italian fleet: Species composition, observers data and distribution along the net.44, ICCAT, Messina. 9 p.

Dieuzeide R, Novella M and Rolland J (1953) Catalogue des poissons des côtes algériennes.4, Station d'aquiculture et de la pêche de Castiglione, Castiglione. 135 p.

Djabali F, Brahmi B and Mammasse M (1993) Pelagos: Poissons des côtes algériennes.Numero Special, Institut des sciences de la mer et de l'aménagement du littoral, Alger. 215 p.

DPRH (2011) Statistiques locales de pêche pour l'année 2010., Direction des pêches et des ressources halieutiques. 4 p.

EJF (2007) Illegal driftnetting in the Mediterranean. Environmental Justice Foundation, London. 24 p.

FAO (1973) Rapport au Gouvernement de l'Algérie sur le développement des pêches basé sur le travail de L.L. Vasconcelos.3181, FAO, Rome. 51 p.

FAO (2011) Fishery Country Profile: Algeria. Available at: http://www.fao.org/fishery/countrysector/FI-CP_DZ/en [Accessed: 04/06/2011].

Fowler SL, Cavanagh RD, Camhi M, Burgess GH, Fordham SV, Simpfenclorter CA and Musick JA (2005) Sharks, rays and chimeras: The status of the Chondrichtyan fishes. Status Survey. Information press Oxford. 461 p.

Furnestin J (1961) La pêche maritime algérienne et ses possibilités (Rapport de mission). Rcu. Trav. Inst. Pêches marit. 25: 21-32.

Garibaldi L (2012) The FAO global capture production database: A six-decade effort to catch the trend. Marine Policy 36(2012): 8.

GFCM (2011) Report on the transversal workshop on selectivity improvement, by-catch reduction and alternative gears. General fisheries commission for the Mediterranean, Marseille. 16 p.

Grau A, Linde M and Grau MA (2009) Reproductive biology of the vulnerable species *Sciaena umbra* Linnaeus, 1758 (Pisces: Sciaenidae). Scientia Marina 73(1): 14.

Griffiths RC (1991) Rapport de la sixième consultation technique du conseil général des pêches pour la méditerranée sur l'évaluation des stocks dans les divisions statistiques baléares et golfe du lion.47, FAO, Rome. 328 p.

Griffiths RC, Robles R, Coppola SR and Camiñas JA (2007) Is there a future for artisanal fisheries in the western Mediterranean. FAO, Rome. 106 p.

Gulland J-A (1971) The fish resources of the ocean. Fishing News (Books) Ltd., Surrey. 284 p.

Hemida F (1998) The Shark and Skate Fishery in the Algerian Basin: Biological and Technological Aspects. Shark news 12.

Hemida F (2005) Les sélaciens de la côte algérienne: Biosystèmatique des requins et des raies; écologie, reproduction et exploitation de quelques populations capturées. Doctorat d'état thesis, Université des sciences et de la technologie Houari Boumedienne, Alger. 233 p.

Hemida F, Mehezen S and Canapé C (2002a) Captures of the Giant Devil Ray, *Mobula mobular* Bonnaterre, 1788 (Chondrichthyes: Mobulidae) off the Algerian coast (Southern Mediterranean). Acta Adriatica 43(2): 13.

Hemida F, Seridji R, Labidi N, Bensaci J and Canapé C (2002b) Records of *Carcharhinus* spp. (Chondrichtyes: Carcharinidae) from off the Algerian coast (Southern Mediterranean). Acta Adriatica 43(2): 9.

ICCAT (2003) Rapport de la période biennale 2002-03 Ie partie (2002).1, ICCAT, Madrid. 180 p.

ICCAT (2007) Report for the biennial period, 2006-07 part II.3, ICCAT, Madrid. 211 p.

INTERPOL (2010) Resolution: Sustainable Environmental Crime Programme. INTERPOL General Assembly 79th Session, Resolution AG-2010-RES-03. INTERPOL, Doha, Qatar. 1 p.

Kara MH and Derbal F (1999) Données biologiques sur le mérou *Epinephelus marginatus* (Lowe, 1834) des côtes algériennes. Marine Life 9(2): 21-27.

Kelleher K (2005) Discards in the world's marine fisheries. An update.470, FAO, Rome. 131 p.

Kennouche H (2003) Recherche des facteurs influençant les débarquements de la crevette rouge *Aristeus antennatus* (Risso, 1816) dans le port de Bou-Haroun (Baie de Bou-Ismail) : Etude du régime alimentaire et de l'exploitation, Ecole nationale supérieure des sciences de la mer et de l'aménagement du littoral, Alger. 99 p.

Kroese M and Sauer WHH (1998) Elasmobranch exploitation in Africa. Marine and Freshwater Research 49(7): 573-577.

Laouar Stahi S and Samar L (1990) La pêcherie chalutière de la région d'Annaba : Analyse statistique des mises à quai et appréciation du niveau d'exploitation d'espèces cibles. Ingénieur d'état en sciences de la mer et de l'aménagement du littoral thesis, Ecole nationale supérieure des sciences de la mer et de l'aménagement du littoral, Alger. 99 p.

Leclaire L (1972) la sédimentation halocène sur le versant méridional du bassin Algéro-Baléares (Précontinent Algérien). Tome XXIV. Musée national d'histoire naturelle. 234 p.

MATE (2005a) Programe d'aménagement côtier (PAC): Zone côtière algéroise. Activité: Protection des sites sensibles naturels marins du secteur Cap Djinet au Mont Chenoua. Actions pilotes, plan d'action et recommandations Ministere de l'aménagement du littoral et de l'environement, Alger. 51 p.

MATE (2005b) Programme d'aménagement côtier (PAC). Zone côtière algéroise. Activité: Protection des sites sensibles naturels marins du secteur Cap Djinet au Mont Chenoua. Impact des activités anthropiques. Ministère de l'aménagement du territoire et de l'environement, Algerie. 94 p.

MATE (2006) Programe d'aménagement côtier (PAC): Zone côtière algéroise. Rapport Final Intégré. Ministère de l'aménagement du territoire et de l'environement, Alger. 202 p.

Maurin C (1962) Etude des fonds chalutables de la Méditerranée occidentale (écologie et pêche): Résultats des compagnes des navires océanographiques «Président-Théodore-Tissier» 1957 à 1960 et « Thalassa » 1960 et 1961.26, ISTPM. 218 p.

Mediouni C (1997) Élaboration d'un bilan d'une stratégie nationale de développement durable de la diversité biologique. Tome IX: Synthèse de la stratégie algérienne d'utilisation durable de la diversité biologique. Projet ALG/97/G31. Ministère de l'aménagement du territoire et de l'environement, Alger. 69 p.

Megalofonou P, Damalas D and Yannopoulos C (2005) Composition and abundance of pelagic shark by-catch in the eastern Mediterranean Sea. Cybium 29(2): 5.

Meuriot E and Dremiere P-Y (1986) Les systèmes de licences de pêche : le cas de la Mediterranée française. IFREMER. 100 p.

Millot C (1985) Some features of the Algerian current. Journal of Geophysical Research 90(64): 10.

Millot C (1987) The circulation of the levantine intermediate water in the Algerian basin. Journal of Geophysical Research 92(C8): 12.

MPRH (2001) Le secteur de la pêche et de l'aquaculture en Algérie. Capacités et perspectives. Ministère de la pêche et des ressources halieutiques, Alger. 21 p.

MPRH (2008) Schéma directeur de développement des activités de la pêche et de l'aquaculture. Horizon 2025 Ministère de la pêche et des ressources halieutiques, Alger. 135 p.

MPRH (2010) Principaux indicateurs statistiques de pêche, année 2009 Ministère des pêches et des ressources halieutiques, Alger. 6 p.

MPRH (2011) Canevas des statistiques locales mensuelles. Ministère des pêches et des ressources halieutiques. 34 p.

Nait Saidi N and Taghanemt A (1991) La pêche au chalut et à la senne au port de Bejaia : Etude statistiques des mises à quai et estimation du niveau d'exploitation de quelques espèces cibles. Ingénieur d'état en sciences de la mer et de l'aménagement du littoral thesis, Ecole nationale supérieure des sciences de la mer et de l'aménagement du littoral, Alger. 83 p.

Notarbartolo-Di-Sciara G (1987) A revisionary study of the genus *Mobula* Rafinesque, 1810 (Condrichtyes: Mobulidae) with the description of a new species. Zoological Journal of the Linnean Society 1987(91): 91.

Nouar A (2007) Exploitation d'une espèce de crevettes profondes *Aristeus antennatus* (Risso, 1816)et *Parapenaeus longirostris* (Lucas, 1846) de la région algéroise.38, Commission internationale de la mer mediterranéene, Alger. 1 p.

OCEANA (2010) Les requins grand-migrateurs, les laissés-pour-compte de l'ICCAT. Oceana. 4 p.

Oliver P (1983) Les ressources halieutiques de la Méditerranée. Première partie: Méditerranée occidentale. FAO, Rome. 135 p.

Ouyahia A (2004) Décret exécutif n° 2004-86 du 26 Moharram 1425 correspondant au 18 mars 2004 fixant les tailles minimales marchandes des ressources biologiques. Gouvernement d'Algérie, Alger. 8 p.

Pillans R, Amorim A, Mancini P, Gonzalez M and Anderson C (2008) Carcharhinus altimus. In: IUCN 2010. IUCN Red List of Threatened Species. Version 2010. . IUCN. 6 p. Available at: http://www.iucnredlist.org/apps/redlist/details/161564/0 [Accessed: 04/06/2011].

PNUE (1996) Etat du milieu marin et littoral de la région méditerranéenne. PAM–PNUE, Athènes. 148 p.

Rahmouni A (2010) La sardine à 300 dinars le kilo. La voix de l'Oranie 3338: 1.

Rarrbo K (2009) Programe Euromed Jeunesse III. Etude sur les politiques jeunesse des pays mediterranéens: Algérie. Institut national de la jeunesse et de l'éducation populaire, Marly le Roi. 42 p.

Sahi MA and Bouaicha M (2003) La pêche artisanale en Algérie. Centre national d'études et de documentation pour la pêche et l'aquaculture, FAO Copemed, Alger. 23 p.

Sardà F (2000) Analysis of the Mediterranean (including North Africa) deep-sea shrimp fishery: catches, effort and economics. Institut de Ciències del mar, Barcelona. 24 p.

Simonnet R (1961) Essai sur l'économie des pêches maritimes en Algérie. Rev. Trav. Inst. Pêches marit.. 25(1): 34-124.

Tudela S and Sacchi J (2003) Impacts des pratiques de pêche en Mediterranée: Impacts sur les espèces et les habitats sensibles, solutions techniques et recommandations. Centre d'activités régionales pour les aires spécialement protegées, Barcelone 133 p.

UNODC (2011) Transnational organized crime in the fishing industry: Trafficking in persones, smuggling of migrants, illicit drugs trafficking. United Nations Office on Drugs and Crime, Vienna. 140 p.

Varela M and Ojeda C (2010) La pesca en España: una lección no aprendida: Estudio de las pesquerías y recomendaciones ante la reforma de la Política Pesquera Común. Greenpeace, Madrid. 42 p.

Vidal Junemann J (1976) Premier essai d'évaluation des ressources démersales et pelagiques au large des côtes Algériennes. FAO, Rome. 34 p.

WWF (2006) The plunder of bluefin tuna in the mediterranean and East Atlantic in 2004 and 2005. Uncovering the real story. WWF, Rome. 101 p.

WWF (2008a) Lifting the lid on Italy's bluefin tuna fishery. Assessment of compliance of Italy's fishing fleet and farms with management rules during the 2008 bluefin tuna fishing season in the mediterranean. WWF, Rome. 140 p.

WWF (2008b) Race to the last bluefin: Capacity of the purse-seine fleet targeting bluefin tuna in the Mediterranean Sea and estimation capacity reduction needs. WWF. 124 p.

Zeghdoudi E (2006) Modélisation bioéconomique des pêcheries méditerraneénnes: Application aux petits pélagiques de la baie de Bouismail (Algérie) Master of Science thesis, Universitat de Barcelona, Barcelona. 71 p.

Zerrouki R and Taftichte S (2010) Evolution de la production halieutique dans la wilaya d'Alger. Gestion systémique des ressources halieutiques, ENSSMAL, Alger. 1 p.

Appendix Table A1. Reported and reconstructed annual catches by Algeria.

Year	FAO	Artisanal	Industrial	Recreational	Subsistence	Discards	Total reconstructed
1950	27,201	24,523	32,243	0	1,344	4,612	62,722
1951	23,001	24,443	27,308	0	1,350	4,296	57,397
1952	29,101	24,498	33,982	0	1,356	4,264	64,101
1953	22,699	24,492	26,610	0	1,363	4,359	56,823
1954	20,962	24,542	24,555	0	1,369	4,327	54,794
1955	25,898	24,520	29,674	0	1,375	4,612	60,180
1956	21,956	24,505	25,642	0	1,381	4,801	56,329
1957	21,953	24,550	25,059	0	1,387	4,643	55,639
1958	18,578	22,180	22,385	0	1,394	4,833	50,792
1959	22,100	21,752	26,341	0	1,495	4,801	54,389
1960	25,500	21,363	30,589	0	1,596	4,928	58,475
1961	30,400	20,916	35,385	0	1,528	4,991	62,819
1962	21,500	20,390	23,378	0	1,459	2,369	47,597
1963	16,901	19,856	21,010	0	1,391	2,369	44,626
1964	17,300	19,469	20,962	0	1,546	2,401	44,378
1965	18,302	18,945	22,356	0	1,700	2,401	45,401
1966	20,351	18,485	24,972	0	1,854	3,253	48,565
1967	20,951	18,025	25,279	0	1,873	3,159	48,336
1968	18,051	17,490	22,192	0	1,891	3,159	44,731
1969	23,151	17,039	28,507	0	1,909	3,127	50,582
1970	24,235	15,017	30,250	0	1,927	2,994	50,188
1971	23,716	12,917	30,405	44	1,869	4,317	49,552
1972	28,314	14,011	35,438	89	1,811	4,647	55,995
1973	31,244	15,097	38,458	133	1,753	5,199	60,641
1974	35,708	16,181	43,083	177	1,696	5,653	66,790
1975	37,693	17,278	45,675	222	1,638	6,061	70,874
1976	35,122	18,355	42,560	266	1,580	6,178	68,939
1977	43,475	19,521	52,332	310	1,522	6,887	80,572
1978	34,143	20,649	40,649	355	1,464	6,612	69,730
1979	38,678	21,701	45,935	399	1,407	7,065	76,507
1980	48,000	22,845	56,123	443	1,349	7,711	88,470
1981	56,000	23,978	64,770	487	1,291	8,305	98,832
1982	64,500	25,117	74,392	532	1,233	8,919	110,193
1983	65,000	26,202	74,922	576	1,175	9,210	112,085
1984	65,500	27,286	75,345	620	1,118	9,501	113,870
1985	66,000	28,371	75,948	665	1,060	9,790	115,834
1986	65,261	29,192	75,266	709	1,002	10,391	116,560
1987	94,092	30,301	108,594	753	944	12,071	152,663
1988	106,434	30,246	128,070	798	886	13,250	173,250
1989	99,184	28,853	117,466	842	829	12,932	160,922
1990	90,192	28,475	106,727	886	771	12,776	149,634
1991	79,690	32,657	93,688	931	713	12,253	140,242
1992	95,266	34,907	110,979	975	655	13,003	160,519
1993	101,894	42,424	116,541	1,019	597	13,313	173,894
1994	135,402	47,382	154,855	1,064	540	15,165	219,005
1995	105,872	48,369	113,684	1,108	482	15,402	179,045
1996	81,989	48,808	88,473	1,152	424	14,199	153,056
1997	91,580	48,844	101,010	1,197	366	14,643	166,060
1998	92,332	50,600	101,622	1,241	308	14,676	168,448
1999	102,396	52,928	114,834	1,238	251	15,464	184,714
2000	113,158	54,110	128,062	1,236	193	16,426	200,027
2001	133,623	57,667	151,074	1,233	193	18,262	228,429
2002	134,320	62,747	150,377	1,231	193	18,799	233,346
2003	140,957	74,270	155,002	1,194	193	19,231	249,889
2004	113,462	83,291	122,777	1,161	193	18,156	225,577
2005	126,259	88,902	135,711	1,132	193	20,397	246,334
2006	145,762	90,550	157,594	1,107	193	22,581	272,025
2007	146,627	94,007	156,801	1,086	193	23,971	276,057
2008	137,895	90,198	148,982	1,067	193	23,807	264,247
2009	127,439	89,830	137,368	1,051	193	23,630	252,072
2010	93,607	82,208	108,595	1,038	193	23,986	216,020

Appendix Table A2. Reconstructed annual marine fisheries catches by Algeria by taxon.

Year	Sardine	Anchovy	Groupers	Scombroids	Sparids	Sharks and Rays	Cephalopods	Crustacea	Miscellaneous pelagics	Miscellaneous
1950	20,004	6,078	807	2,526	5,256	2,408	942	4,635	3,348	11,497
1951	17,534	4,675	795	2,361	5,126	1,926	873	5,008	3,882	10,092
1952	21,395	7,144	816	2,905	5,193	2,013	933	4,685	2,975	11,012
1953	14,486	5,503	830	2,262	5,211	1,969	877	4,653	5,177	10,921
1954	14,674	5,005	835	2,108	5,129	1,951	862	4,393	4,783	10,216
1955	16,436	7,648	848	2,256	5,145	1,729	926	4,687	5,091	10,670
1956	15,647	7,421	860	2,089	5,145	1,623	898	4,883	2,298	10,818
1957	15,843	6,325	874	1,988	5,144	1,634	888	5,058	3,059	10,274
1958	11,864	6,035	804	1,978	4,758	1,721	900	4,914	3,049	10,312
1959	14,656	5,859	800	2,080	4,730	1,735	978	4,981	3,481	10,728
1960	19,967	3,985	788	2,190	4,643	2,111	986	5,112	3,733	10,694
1961	23,672	5,523	771	2,153	4,552	2,098	1,037	5,177	3,687	9,979
1962	14,095	5,718	755	1,946	4,308	1,649	611	2,428	3,265	8,748
1963	16,484	1,294	719	4,002	4,038	1,337	608	2,463	1,547	8,155
1964	17,632	802	709	1,942	3,939	1,646	648	2,596	2,829	7,752
1965	17,817	2,005	700	2,672	3,857	1,306	672	2,526	2,730	7,328
1966	20,978	237	694	2,128	3,852	1,547	799	3,378	2,667	8,592
1967	20,733	467	680	1,990	3,746	1,528	798	3,766	2,541	8,488
1968	19,289	338	665	1,854	3,646	1,271	776	3,279	2,178	7,934
1969	22,726	995	659	2,070	3,628	1,266	819	3,246	3,086	8,681
1970	21,887	1,996	574	1,693	3,080	1,350	848	3,311	2,744	9,397
1971	21,487	1,483	508	1,702	2,709	1,331	845	3,594	2,920	9,756
1972	25,929	1,127	548	1,821	2,918	1,274	901	3,764	3,396	11,197
1973	22,697	6,817	592	1,922	3,178	1,365	969	4,243	3,611	12,223
1974	27,939	4,714	632	2,513	3,395	1,401	1,038	5,156	3,529	13,544
1975	34,723	1,595	673	2,970	3,621	1,509	1,079	4,873	3,452	13,546
1976	29,406	4,062	714	2,566	3,844	1,606	1,075	5,115	3,337	14,475
1977	37,681	5,317	756	2,525	4,072	1,840	1,180	5,455	3,787	15,318
1978	28,287	3,344	797	2,576	4,300	2,055	1,108	5,789	3,480	15,449
1979	30,595	4,010	838	3,518	4,522	2,065	1,169	6,118	4,403	16,819
1980	37,055	4,962	880	4,066	4,750	2,285	1,199	6,422	5,286	19,211
1981	42,649	5,781	921	4,520	4,977	2,473	1,136	6,731	6,061	21,323
1982	48,571	6,650	963	5,005	5,205	2,684	1,497	7,031	6,887	23,537
1983	49,144	6,703	1,004	5,082	5,432	2,744	1,573	7,331	6,977	24,026
1984	49,717	6,756	1,045	5,158	5,659	2,804	1,545	7,631	7,068	24,515
1985	50,253	6,814	1,087	5,240	5,885	2,873	1,716	7,938	7,155	24,996
1986	54,808	5,853	1,127	4,160	6,102	2,974	1,870	8,939	11,711	17,236
1987	88,841	2,163	1,168	6,261	6,328	2,993	1,949	9,841	10,807	20,625
1988	109,039	1,219	1,108	6,314	6,357	3,039	1,937	8,576	12,755	21,316
1989	86,958	3,439	1,023	6,105	13,557	2,903	2,078	9,329	14,525	19,509
1990	77,095	3,167	1,063	5,683	11,334	2,888	1,989	9,530	16,693	18,792
1991	70,884	2,574	1,268	4,795	11,413	3,210	1,842	9,402	14,330	19,220
1992	80,518	3,144	1,346	4,400	12,305	3,285	1,988	9,360	21,508	20,948
1993	85,754	3,386	1,605	5,082	14,218	3,873	2,113	9,393	23,820	23,027
1994	116,026	4,373	1,783	5,909	15,701	4,060	2,390	9,614	30,936	26,687
1995	77,117	2,303	1,824	6,155	10,341	3,804	1,916	9,614	35,221	29,214
1996	67,253	1,665	1,843	5,263	10,111	3,932	1,891	9,692	18,889	30,971
1997	66,406	2,238	1,855	5,567	10,140	3,024	2,012	9,705	29,530	33,575
1998	66,314	4,021	1,911	6,449	10,975	4,108	2,388	10,057	24,839	34,872
1999	75,475	3,645	1,901	6,339	11,140	3,811	1,981	10,073	28,931	38,484
2000	68,401	6,651	1,969	6,946	11,548	3,226	2,047	10,688	43,210	42,065
2001	80,107	6,966	2,069	7,563	12,204	3,881	2,129	11,303	55,916	43,007
2002	96,476	2,697	2,245	7,426	13,351	4,091	2,220	11,841	46,034	44,120
2003	97,165	2,223	2,592	11,607	15,519	4,489	2,748	11,623	52,829	46,816
2004	88,497	1,625	2,869	9,697	17,058	4,091	2,629	11,808	40,806	44,449
2005	95,991	3,558	3,123	9,178	18,188	4,275	3,341	13,214	47,428	46,073
2006	112,214	1,833	3,177	9,321	18,570	4,314	2,913	14,280	56,058	47,035
2007	104,493	1,849	3,515	9,959	20,063	4,526	4,007	15,657	61,468	47,890
2008	70,082	2,990	3,478	14,767	19,690	4,729	3,330	16,061	78,504	48,162
2009	86,413	4,033	3,394	11,382	19,456	4,657	3,042	16,256	54,446	46,567
2010	62,138	2,756	3,325	11,353	18,825	4,515	2,864	16,289	46,308	46,303