



Reconstructed catches and trends for mainland Portugal fisheries between 1938 and 2009: implications for sustainability, domestic fish supply and imports



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ABSTRACT

Illegal, Unreported and Unregulated catches (IUU) are an important topic in fisheries, both from an economic and environmental perspective. Here, we estimated the likely total Portuguese mainland catches between 1938 and 2009 by estimating unreported catches (i.e., missing from official statistics) using a fishery-by-fishery approach. Landings increased from 1938, peaking between 1964 and 1972 (period when landings reached highest values across the time series), and declined thereafter, reaching values below the mean after 1993. Higher misreporting (unreported values above the mean) were recorded between 1956 and 1988. Overall, we estimated that over 25,013,000 t were caught between 1938 and 2009, which is 36% (range 28.2–41.5%) higher than the 16,121,510 t officially reported for the same time period, based on annual catches of around 123,000 t·year⁻¹. Trawl fisheries accounted for the largest part of unreported catches, with 54% of total unreported catches, while accounting for 21% of total reported landings. The multi-gear fisheries accounted for the second largest percentage of estimated catches (25% of total unreported catches, 30% of reported landings). Purse seine fisheries accounted for 49% of total reported landings, but had the smallest proportion of unreported catches (19%). Unreported catches from the recreational/subsistence sector were lower, accounting for 1.5% of total unreported catches. Finfish accounted for 94% (115,000 t·year⁻¹) of unreported catches, followed by cephalopods (2,400 t year⁻¹) and crustaceans (1,800 t·year⁻¹).

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1. Introduction

There is evidence that marine species are under threat of local and global decline due to the direct and indirect effects of fishing (Pitcher and Pauly, 1998; Watson and Pauly, 2001). One of the main contributors to the general failure to manage the world's fisheries sustainably is incomplete knowledge of total fishery removals (Watson et al., 2011), generally referred to as 'Illegal, Unreported and Unregulated' (IUU) catches. The IUU issue is a crucial topic in fisheries, from economic, environmental and management points of view (Alverson and Hughes, 1996; FAO, 1994, 2005, 2010). IUU implies that official landing statistics only account for a portion of what is being extracted from the marine environment (Pauly, 2009; Zeller et al., 2008). In fact, in developing and many developed

countries, unreported catch can surpass official landing statistics (Kleiven et al., 2012; Zeller and Pauly, 2007).

Fishing is an integral part of the Portuguese social and cultural heritage, as one might expect in a country with a long maritime tradition and an Exclusive Economic Zone (EEZ) of 1.7 million km², amounting to almost 50% of the European Union (EU) EEZs. The country has long relied on fishing as a major means of subsistence, in particular for coastal communities that depend almost exclusively on fisheries and related activities. The exploitation of fisheries resources in Portuguese waters has always been strongly linked to small-scale coastal and estuarine fisheries. In fact, trawl fisheries were only introduced in 1880 (Alves, 1991).

The development of the mainland fisheries is well documented, with several historical syntheses, including those of Lobo (1812), Baldaque da Silva (1891) and Alves (1991). However, none of the historical documents published between 1800 and 1950 address by-catch and discards issues. Since the early 1980s, a number of studies have been published on the selectivity of fishing gear, by-catch and discards in Portuguese fisheries (Table 1), improving our

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Table 1
Commercial fisheries discard ratios used in the catch reconstruction per gear. * - percentage value refers to the recreational/subsistence average contribution to total yearly landings. The study area field refers to the location (North, Center and South Portuguese coast sub-divisions and Mainland, the latter when the study covers all the mainland coast) where the studies were conducted (see Fig. 1).

Gear (Sector)	Study area	% bycatch(±SD)	Study year	Scientific Source
Trawl Crustacean	Mainland	55	2009	Pérez et al., 2009
	South	70	1997	Borges et al., 2001
	South	62	1999-2001	Costa et al., 2008
	Crustacean average	62 (7.5)		
Trawl Fish	Mainland	34	2009	Pérez et al., 2009
	South	62	1997	Borges et al., 2001
	South	72,45	1999-2001	Costa et al., 2008
	Fish average	56 (20)		
Trawl average Purse Seine	Pelagic Purse Seine Algarve	59 (13.86)	1997-2009	
	Pelagic Purse Seine Center and North	27	1997	Borges et al., 2001
	Purse Seine average	8,46	2003	Wise et al., 2005
Multispecies	Demersal Purse Seine Algarve	17.7 (13.1)		
	Demersal Purse Seine Center	20	1997	Borges et al., 2001
	Demersal Purse Seine average	96,61	2003	Wise et al., 2005
	Bivalves (dredges) ^{bycatch based}	58.3 (54.2)		
	Octopus Algarve	16,7	2006	Leitão et al., 2009
	Silver Scabbardfish center	7,02	2001	Saldanha, 2001
	Black scabbardfish center	2	2000-2004	Machado and Figueiredo, 2009
	Hake South (Hook)	2	2000-2004	Machado and Figueiredo, 2009
	Hake South (Hook)	27,8	1997-1998	Erzini et al., 2001
	Hake South (Gill net)	0,4	1998	Santos et al., 2002
	Hake South (Hook)	0,1	1998	Santos et al., 2002
	Hake average	9.43 (15.91)		
	Multispecies Center (trammel)	21,9	2004-2005	Baptista et al., 2009
Multispecies South (trammel)	13	1997	Borges et al., 2001	
Multispecies South (trammel)	49,4	1999-2000	Gonçalves et al., 2007	
Multispecies average	28.1 (19)	1997-2005		
Recreational/subsistence	Saltwater Shore angling*	0.8*	2006-2007	Veiga et al., 2010

* Percentage contribution for total yearly landing

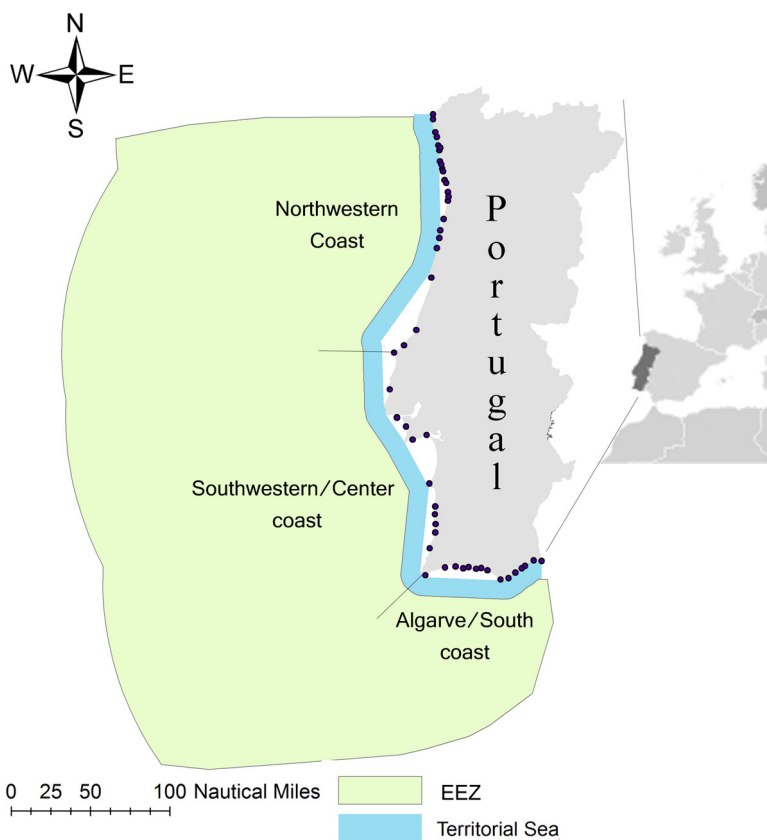


Figure 1. Map of the Portuguese mainland coastal area with the Exclusive Economic Zone (EEZ - 200 nautical miles), territorial sea (12 nautical miles) and the fishing harbors (dots).

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