



Reconstruction of Italy's marine fisheries removals and fishing capacity, 1950–2010



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ARTICLE INFO

Article history:

Received 21 March 2015

Received in revised form 26 May 2015

Accepted 16 June 2015

Keywords:

Catches
Recreational
Unreported
Discards
Industrial
Artisanal

ABSTRACT

Italy has the highest catches of all countries fishing in the Mediterranean Sea. Despite the availability of fisheries statistics at the national level, reported catch amounts account only for a portion of total fisheries removals. This study aims to provide an estimate of 1) catches for all marine fishing sectors; 2) fishing effort in the major Italian fishing fleets; and 3) catch per unit of effort from 1950 to 2010. Catches were estimated using a catch-reconstruction approach that looked at all types of fisheries removals: from reported and unreported landings (from both industrial and artisanal fisheries) to recreational landings and discards. The reconstructed total catch for the 1950–2010 time period was 2.6 times the amount reported by the FAO on behalf of Italy. Illegal, unreported and unregulated (IUU) landings constituted 53.9% of the reconstructed total catch, followed by reported catches (38.8%) and unreported discards (7.3%). Industrial fisheries were dominant, with 79.1% of the reconstructed total removals, followed by the artisanal catch (16.8%), with recreational (3.2%) and subsistence (0.9%) fisheries making very small contributions. Catch per unit of effort declined since the early 1950s. Our study is the first that estimated total Italian fisheries removals and fishing capacity using a holistic approach; such approach is particularly important in areas like the Mediterranean Sea, where the multi-species and multi-gear nature of fisheries make the assessment of single-species fisheries resources and their management difficult.

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1. Introduction

The Mediterranean Sea has been described as “under siege” due to the effects of multiple stressors such as fishing, habitat loss and degradation, pollution, eutrophication, and the incidental introduction of alien species (Coll et al., 2011). Fishing is one of the strongest pressures, and has caused changes in ecosystem structure, declines in major fish stocks and in overall biodiversity in many parts of the Mediterranean Sea (Colloca et al., 2011; Farrugio et al., 1993; Papaconstantinou and Farrugio, 2000; Vasilakopoulos et al., 2014). Although the exploitation of marine resources has a long history in the Mediterranean basin (Thompson, 1947), fisheries research and management has only developed post-World War II, particularly in the northwest of the basin (Farrugio et al., 1993). Italian fisheries are among the most important fisheries in the Mediterranean,

constituting, according to the Food and Agriculture Organization of the United Nations (FAO) statistics, roughly 30% of its all catches. In recent decades, the Italian fishing industry has faced declines, both in terms of catch, due to a decrease in the major fisheries resources (4th Multi-Annual Guidance Plans; MAGPs), and also in fishing effort, as a result of European Commission regulations, which attempt to adjust the fishing fleet to the available fishing resources (Iborra Martin, 2006). In contrast, since the late 1980s, there has been a steady increase in farmed fish production. The majority of mariculture production consists of Mediterranean mussels (*Mytilus galloprovincialis*) and Manila clams (*Tapes philippinarum*), followed by gilt-head seabream (*Sparus aurata*) and European seabass (*Dicentrarchus labrax*) (Cataudella and Spagnolo, 2011; OECD, 2010). The present reconstruction is solely concerned with marine capture fisheries of finfish and invertebrates (excluding sponges, turtles, jellyfish and marine mammals), and thus does not address aquaculture trends and associated issues.

Given the growing emphasis on ecosystem-based management issues in fisheries (Pikitch et al., 2004), a comprehensive understanding of total fisheries removals and fishing capacity is

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fundamental to understanding the ecosystem resources trends and thus contribute to policy on future resource use. This, however, becomes challenging in a Mediterranean country whose statistical reports of catch and effort are often unreliable, and where actual catches are often underestimated (European Commission, 2003; Garibaldi, 2012; Garibaldi and Kebe, 2005; Moutopoulos and Koutsikopoulos, 2014). Commercially valuable species often go directly to public markets and regional auctions, and these catches often are not included in the official records and hence go unreported (OECD, 1994). Also, there is limited monitoring and enforcement, especially with regard to illegal nets and mesh sizes, the landing and marketing of undersized fish, and compliance with restrictions on fishing season and areas (OECD, 1994). Available fisheries statistics exist at the national level, i.e., from the Italian National Statistical Institute (ISTAT) and the Institute for Economic Research in Fishery and Aquaculture (IREPA), and the data from these two organizations are sent to FAO. These reported catches account only for part of total fisheries removals and have never been harmonized and/or compared with estimates of total fisheries removals. This is particularly true for small-scale fisheries, whose catches are generally underestimated, and for recreational and subsistence fisheries, which are often not accounted for in countries' official statistics (Pauly, 2006; Pauly et al., 2014).

As part of an overall effort to reconstruct global fisheries catches (Zeller et al., 2007) by the *Sea Around Us* (www.seaaroundus.org; Pauly, 2007), which also includes Mediterranean countries (Coll et al., 2014; Pauly et al., 2014; Tsikliras et al., 2007; Ulman et al., 2013), this study aims to provide estimates of fishing capacity for the major Italian fishing fleets and catches for all marine fishing sectors from 1950 to 2010, using all available data sources and accounting for reported and unreported commercial landings, recreational and subsistence landings and discards. Reconstructed catches and effort presented here are for the whole of Italy. Results by sub-regional seas: 1) Ligurian; 2) Northern, Central and Southern Tyrrhenian; 3) Ionian; 4) Northern, Central and Southern Adriatic Sea; 5) Sicilian and 6) Sardinian waters can be found in Piroddi et al. (2014).

2. Materials and methods

2.1. Study area

Italy is located in southern Europe and covers an area of approximately 301,270 km². It includes the Italian peninsula, Sicily and Sardinia (the two largest Mediterranean islands), and 71 other smaller islands. The country consists of 21 regions, 15 of which are coastal (Fig. 1). The territorial waters extend to 12 nautical miles from the coast and have a surface area of 7210 km² and the continental shelf has a surface area of 201310 km² (Iborra Martin, 2006). The Italian Exclusive Economic Zone (EEZ), as delineated by Claus et al. (2014) (see also www.vliz.be), covers nearly 538,000 km². Due to its central Mediterranean Sea location, four of the seven Mediterranean Sea subdivisions surround the peninsula: the Tyrrhenian and Ligurian Sea in the west, the Ionian Sea in the south and the Adriatic Sea in the east. This geographic positioning leads to important biophysical differences of the waters around Italy. For example, the distribution of the continental shelf is very uneven; it is very broad and shallow in the Adriatic Sea, but changes to very narrow shelves with steep slopes in the other seas (Cataudella and Spagnolo, 2011; Francalanci, 1993). Also, the waters range from being highly eutrophic in the northern Adriatic Sea to oligotrophic in most other areas. The diversity of these biophysical conditions also leads to a high biodiversity: Italian waters host important commercial species such as the Atlantic bluefin tuna (*Thunnus thynnus*), charismatic megafauna such as the endangered Mediterranean

monk seal (*Monachus monachus*) and habitat-forming species, such as seagrass (*Posidonia oceanica*) (Giakoumi et al., 2013; MacKenzie et al., 2009; Reijnders et al., 1997).

Italy has a population of 61 million people (ISTAT, 2012), over half of which reside in coastal regions (Cori, 1999; ISTAT, 2012). Fishing occurs along the entire coastline and catches are landed at over 800 sites (Cataudella and Spagnolo, 2011; Iborra Martin, 2006; OECD, 2010). Despite their marginal contribution to the national economy, both in terms of income and employment opportunities, fisheries play a fundamental role in certain regions (e.g., in Sicily). The Italian fishing industry is characterized by the predominance of small and older vessels, a diversity of fishing gear, and consequently a diverse array of multi-species catches (Cataudella and Spagnolo, 2011; FAO, 2010; OECD, 2010). The commercial fisheries are represented by the following types of fleets: bottom trawlers, mid-water trawlers, purse seiners, longliners, dredges, multi-purpose vessels and an artisanal fishery.

2.2. Italian fisheries management

A comprehensive fisheries management scheme was initiated in 1982 with the Law 41/1982; prior to that, only certain restrictions such as minimum mesh size, minimum legal landing size, and closed areas were mandated by national authorities. With the introduction of Law 41/1982, national triennial plans were established. In particular, all professional fishing vessels had to possess a license managed by the Directorate General for Fishery and Aquaculture of the Ministry of Agriculture Policy. The license includes characteristics of the vessel (e.g., the name of the vessel, the EU number, GT), limitations of fishing areas, gear use and spatial licensing (e.g., over-seas and ocean-going fishing, Mediterranean fishing, and in-shore coastal fishing; OECD, 2010). Currently, the licensing scheme limits fishing effort mainly in the form of temporal restrictions which are set each year in relation to spawning seasons. In addition, the closure is compulsory for the eastern fishing grounds and voluntary in the western grounds. Starting in 1996 and re-enforced in 2000, a seasonal closure was also initiated for tuna. In addition, in 1992, the European Union (EU) put a 2.5 km limit on the length of driftnets; in 1998, the EU fully banned the use of driftnets in the Mediterranean Sea and the northeast Atlantic Ocean, which became fully effective on January 1, 2002. Additionally, in 1994, the EU established a set of restrictions for the main gear-types (EU Rule 1626/94) to preserve fisheries resources in the Mediterranean Sea. For instance, the operation of trawls and seines was prohibited within three nautical miles (nm) from the coast except for "special fisheries" for which derogation by the national legislation was put in place. For example, the "Bianchetto" (juvenile of *Sardina pilchardus*), "Rossetto" (*Aphia minuta mediterranea*) and "Cicerello" (juvenile of *Gymnammodytes cicerelus*) fisheries operate only in winter (January 15–March 15 as a rule) for a period of 60 days. These fisheries have a long history at the local level and are one of the most important small-scale activities with large socio-economic impacts. Since 2010, the EU has banned these fisheries (small trawling boats using mesh size <40 mm) throughout the Mediterranean for their unsustainability, stating that only vessels of other gear types with a proper management plan would be allowed to fish (Reg. (CE) n. 1967/2006).

In Italy, to date, no quotas or TACs (total allowable catch) have been established, except for sedentary species such as clams or highly migratory species such as Atlantic bluefin tuna, due to the multi-species nature of the fisheries, which does not allow fishers to easily shift their target species from one to the other (Cataudella and Spagnolo, 2011; Iborra Martin, 2006; OECD, 2010).

Also, few fisher consortia exist in the country, such as for the management of molluscs (CO.GE.MO) and of small-scale fisheries (CO.GE.PA.), introduced by the Italian Ministry, to empower fishers

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