Marine Policy 45 (2014) 69–75

Contents lists available at ScienceDirect

Marine Policy

journal homepage: www.elsevier.com/locate/marpol

Integration of fishery-dependent data sources in support of octopus spatial management

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ARTICLE INFO

Article history:
Received 18 October 2013
Received in revised form
20 November 2013
Accepted 20 November 2013
Available online 10 December 2013

Keywords:
Fishing intensity
Population structure
Octopus vulgaris
Portuguese Iberian Northeast Atlantic waters

ABSTRACT

Octopus vulgaris is the most important target species in Portuguese fisheries in terms of economic value, when all official and non-declared landings are considered. Around 10% of the landings in national waters come from the trawl fleet, which is both the least selective and the best documented *métier* in the fishery, allowing the simultaneous assessment of distribution and population structure. This study represents a first attempt to integrate different sources of information obtained at commercial trip-level, with the objective of providing a perspective of octopus population structure and relative distribution, together with information on the exploitation pattern in 2003. High-quality resolution of sequential geo-referenced data were obtained from the Portuguese Vessel Monitoring System for the fishing trips targeting octopus. Intensive fishing activity was observed inshore of two regions, one to the north of Peniche (from Cape Carvoeiro to Portuguese border) and the other between Cape St. Vicente (Sagres) and Cape St. Maria (Faro) in the South coast. Fishing trips undertaken between 39.5 and 42°N were used to provide information on volume and size distribution of landings. These show that smaller individuals (= < 12 cm ML) are mainly concentrated between 40.5 and 41.5°N, whereas larger individuals (> 12 cm ML) concentrate south of 41.5 and north of 40.5°N.

1. Introduction

The European Marine Strategy Framework Directive (MSFD) [1,2] established the need for reference points (benchmarking) of population characteristics, in order to assess the impact of exploitation pressures, species spatial distribution and structure, as well as the dynamic interactions between the several components of the ecosystem.

Cephalopods are regarded as key ecosystem components, as they are simultaneously important predators and prey, highly sensitive to ecosystem change, with short life cycles and high generation turnover, (e.g. [3]). Thus, they constitute potential community-level indicators to monitor and assess marine environmental status, including biodiversity. However, in order to be able to identify ecosystem change, it is necessary to first describe the ecosystem status at least at some point in a time-series.

The octopod cephalopod *Octopus vulgaris* (Cuvier, 1797) ranks as the second to fourth most important fisheries resource in Portugal in terms of the quantities landed in almost every year since records in weight began in 1927 (National Statistics Institute, databases, "Estatísticas da Pesca", available online at http://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&xlang=en for the most recent years, including [4]). Statistics indicate that there has been a general tendency for an increased volume of landings marked by three relatively stable periods (1927–1970, 1975–1986 and 1988–present) in-between which there were rapid rises (Fig. 1a).

Historically, landings (commercial catches) in Portugal were more significant in the south (Algarve), but they have been matched up by other regions since the early 1990s (Fig. 1b). Whatever the region, more than 90% of the landings result from the activities of the artisanal fishery using traps. Bottom-trawling for demersal communities accounts for the remainder, and while this is therefore not the most important source of fishing mortality, it is arguably both the least selective and the best documented of all of the fishing métiers employed in the fishery, allowing the simultaneous assessment of distribution and population structure.

Officially, the species is also the second most important target in Portuguese fisheries in value [4], and is estimated to rank first when all official and non-declared landings are considered (IPMA, unpublished data), which makes it a prime candidate for dedicated monitoring and control activities.

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http://dx.doi.org/10.1016/j.marpol.2013.11.016

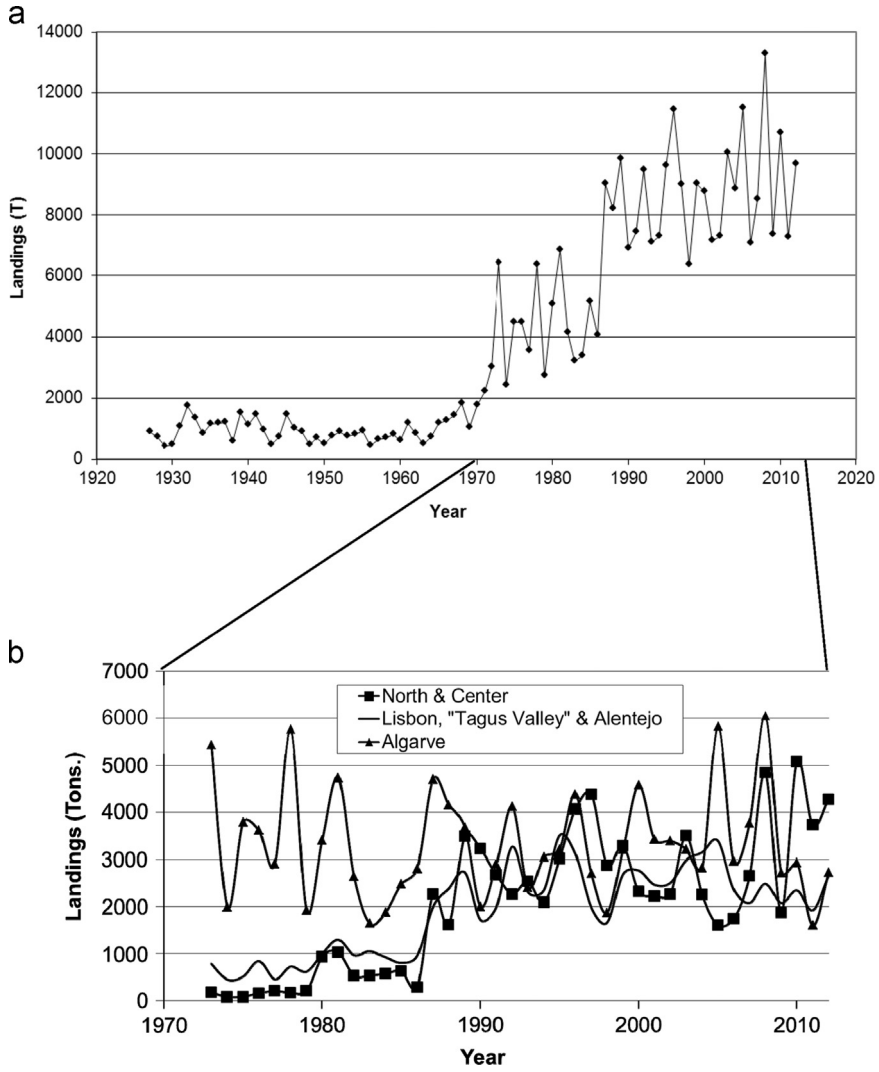

Fig. 1. Landing statistics of octopus caught and landed in Portugal, nationally between 1927 and 2011 (a), and by the geographic region 1970–2010 (b). Data from INE.

Research surveys conducted by the Portuguese public research laboratory (IPMA) between 1989 and the present (IPMA, unpublished data), indicate that the species is widespread throughout the coast, presenting concentration hotspots especially in the northwest coast (near Aveiro) and in the Algarve (south coast). These areas roughly coincide with hotspots for pre-recruits in the same seasons [5], indicating that most of the population biomass is based on newly recruited individuals, as a consequence of the one-year life cycle.

Cephalopod assessments in European waters generally assume that there is no directed fishing effort [6]. However, previous studies on trawl fleet segmentation [7] identified the existence of landing profiles (fishing trip types) where cephalopods are target species. In a latter study [8] spatial and temporal patterns of cephalopods landings in this fleet were identified, with a number of larger vessels, operating on the west coast and targeting horse mackerel during the winter, and shifting target species in the Spring/Summer and Autumn to take advantage of the higher abundance of octopus and squid respectively, depending on the yearly recruitment of these species.

Portuguese bottom trawling fisheries spatial activities have been monitored by a dedicated Vessel Monitoring System (VMS) created in 1987 (the first to be implemented in Europe). Until 2004, information was collected every 10 min, but since then, according to European Union (EU) regulations, the frequency of data transmission has been decreased to once every 2 h [9,10].

Spatial patterns of fishing activity were mapped for this fleet using VMS data from 2002 to 2004, with landings mainly in the ports of Aveiro (central west Portuguese coast) [8]. Further analysis on the evolution of fishery dynamics for Portuguese finfish trawlers, using daily landings for the period 1995–2007 [11], has shown results that are consistent with the former.

Taking advantage of statistical multivariate techniques, developed for the determination of target species of specific fleet components, trawl fishery-dependent data from 2003 were analysed [7,11]. The choice of the reference year (2003) is due to an advantageous combination of high-resolution spatial data and a distance in the past that may allow comparisons with the present situation. In addition, landing patterns and volumes have also been shown to be similar to those in a wider time-series (1995–2007—[11]).

This study aims to: (i) integrate different sources of information obtained at the commercial trip-level, (ii) provide a perspective of octopus population structure and relative distribution, and (iii) provide information on the effective fishing pressure and specific exploitation pattern. The analysis of these fishery-dependent data may thus inform a decision support system and therefore contribute to the design of an ecosystem-based management.