



## Description of the clay pot fishery in the Gulf of Cadiz (SW Spain) for *Octopus vulgaris*: Selectivity and exploitation pattern

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### ABSTRACT

Clay pot fishery exclusively dedicated to catching octopus (*Octopus vulgaris*) is carried out in the Gulf of Cadiz by 185 artisanal vessels. This fleet is largely composed of vessels of 5.3 tons of gross tonnage (GT) and 55 hp averaging. Its catch volume fluctuates yearly depending on the abundance and availability of this species with average values of 1000 tons per year.

In the area of study, octopus presents an annual lifecycle with recruitment in late autumn and early spring and the reproduction season between July and October. The sex ratio is 1:1 although males begin to dominate in specimens weighing more than 3.5 kg. Experiments were carried out with pots of four different sizes and two materials (clay or plastic) for the purpose of analyzing selectivity over a two-year period to analyzed fisheries yield. A clear relation between pot size and size range in octopus capture was observed. The estimation of pot selectivity was carried for octopus applying the SELECT method using in gillnet selectivity to the experimental data. Four different uni-modal and a bi-modal models were fitted. The best fittings were achieved to normal function (location and scale). The mean weight per type of pot used ranged from 820 to 1450 g. During the experiments, experimental pots were not used as a spawning ground. Pots remaining on the seabed for more than a month were not used for egg deposition.

Pots losses and breakages are estimated to be quite high up to 9000 pots per month. Therefore, the environmental impact could be dependent on the material of the pot used in the fishery.

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### 1. Introduction

The Spanish South Atlantic region (SSR), also known as the Gulf of Cadiz, stretches from the mouth of the Guadiana River in Ayamonte (Huelva) to Tarifa (Cadiz) (Fig. 1). This region forms part of the ICES Subdivision IXa-South for the purposes of Council Regulation (EEC) No. 3094/86. The Spanish artisanal fishery in the Gulf of Cadiz is of a marked multi-gear and multi-species nature, where a fleet composed of around 1000 vessels captures more than 50 commercial species (Sobrino et al., 1994).

The common octopus (*Octopus vulgaris*) is the most important demersal species in landings from the entire SSR. Octopus catches have fluctuated between 3010 tons in 1989 and 441 tons in 1997 in the historical series of landings in the last fifteen years representing a mean of approximately 13% of the total annual demersal landing (Silva et al., 2002).

*O. vulgaris* is broadly distributed throughout the coastal waters of the Gulf of Cadiz. Most of the population is concentrated on the continental shelf, down to 100 or 150 m depth (Mangold-Wirz,

1963; Guerra, 1981), occupying diverse habitats on various substrates (rocks, gravels, sand). Specimens of this species have been found at 317 m depth in the Gulf of Cadiz (Silva et al., 2002) though they are more abundant in shallower waters (Roper and Sweeney, 1981; Belcari et al., 2002; Belcari and Sartor, 1999).

Octopus life cycle lasts from 12 to 24 months (Mangold, 1983). Their embryonic development is indirect. Life begins with a paralarval phase, during which they are part of plankton. This phase lasts between 1 and 3 months depending on water temperature (Iglesia et al., 2004; Villanueva, 1995). The paralarval stage is followed by the benthic stage during which specimens seek refuge on the seabed to avoid predation and to spawn and protect eggs until they hatch in the case of the females. Such shelters can be natural (cracks in rocks, holes in the substrate or empty shells) or manmade (plastic bottles, buckets, barrels) (Katsanevakis and Verriopoulos, 2004a,b). The tendency of this species to seek shelter has led to the development of a type of artisanal fishery using pots which is the object of this study. This fishery uses species-specific fishing gear (Silva et al., 1998), such as clay-pots, locally called *alcatruces* or *cajirones*.

Pots are passive capture gears that not use bait as an attractant (Hubert, 1996). Its design and size is usually dependent on local custom, target species and available construction materials.

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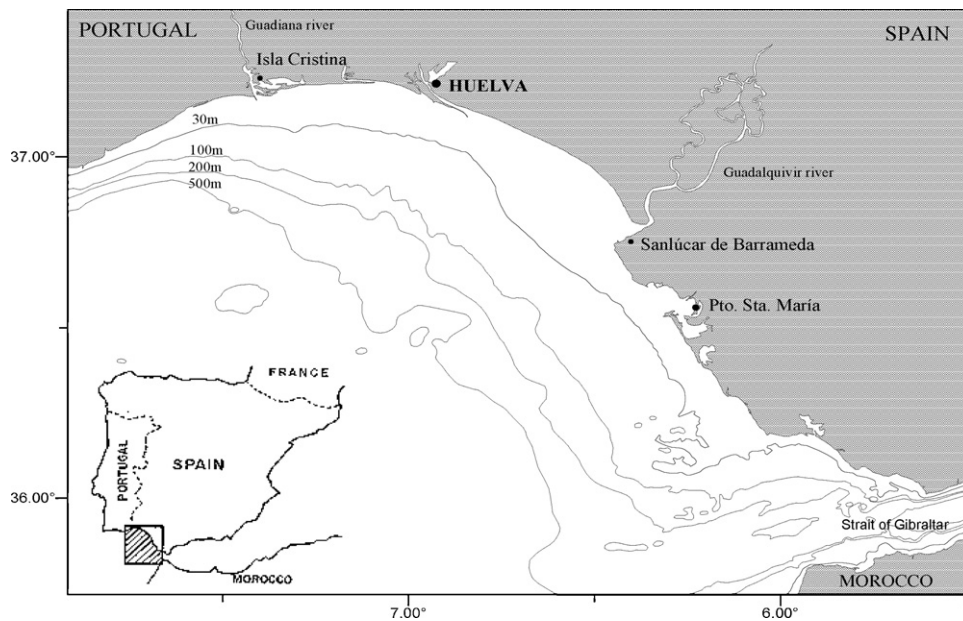


Fig. 1. Study area: Gulf of Cadiz.

The fishing gear known as *alcatruz* (octopus pot) is an entrapment device used specifically for the common octopus fishery. Is based on a close knowledge of octopus behaviour: very territorial, “hermit-like” and constantly seeking shelter for a “home/nest” and octopus can go in or out in whatever moment. This type of fishing gear is a very simple, consisting of a vase-like clay pot without net to retain the octopus. The clay pots are rigged to long lines containing 50–70 clay pots. The maximum number of pots per vessel is limited to 1000 units in accordance with the aforementioned regulation (Royal Decree 1428/1997, of September 15). Lines are checked every 2–5 days depending on the abundance of octopus.

Work undertaken in the area of study includes a description of the reproductive biology of *O. vulgaris* in the Gulf of Cadiz by Silva et al. (2002) and Tirado et al. (2003). However, literature about fishing with pots and their effect on the spawning of *O. vulgaris* is scant (Sánchez and Obarti, 1993). Some studies have been carried out on the selectivity of octopus fishing using trawl gear (Quetglas et al., 1998) or traps (Barry et al., 2009; Stewart and Ferrell, 2003; Treble et al., 1998) but none have analyzed clay pot selectivity on the population of *O. vulgaris*.

The aim of this study – innovative in this field – is to improve knowledge about clay pot fishery for octopus in the Gulf of Cadiz and about its selectivity on this fishery. Also we analyze the exploitation patterns, incidence of pot fishery on spawning and losses of pots.

## 2. Materials and methods

### 2.1. Fisheries data

Statistical fisheries data were gathered from sales sheets at various ports and from lists of licences issued by the Spanish General Secretariat of Maritime Fisheries which led to information about landings per vessel and per day. Information about composition in catch size was obtained from a sampling scheme of on board observers. Thirty-six commercial fishing trips with clay pots were made from April 2005 to March 2007. On board information covered fishery data: location, number of clay pots checked and catch in weight (g) and size (mm) of the specimens caught. Table 1 outlines the trips made.

### 2.2. Experimental pots and sampling design

The four kinds of pots used in this study were made of clay or plastic and came in different shapes and volume (Fig. 2). Following is a description of the pots used: level plastic pot (PL) of 6.3 l volume with a flat and cement-filled bottom which stabilizes the pot on the seabed, plastic pot (PIN) of 6.5 l volume with a tilting and cement-filled bottom, tubular clay pot (BL) of 3.7 l volume and clay flowerpot (BR) of 4.4 l volume.

For a period of 24 months, 2 experimental lines of pots were set and checked every 2 weeks with the aid of a professional vessel from Isla Cristina port. The pots were located at depths of 10–30 m. Each experimental line was composed of 25 pots of each kind (a

Table 1  
On board observers on commercial trips.

Month	POTS		
	Number of sea days	Number of lines	Number of pots checked
April-05	1	7	700
May-05	3	18	2900
June-05	3	19	2400
July-05	2	10	2000
August-05	2	9	1520
September-05	1	6	600
October-05	Biological rest		
November-05	2	17	1700
December-05	3	22	2200
January-06	2	16	1600
February-06	2	16	1600
March-06	1	4	400
April-06	3	10	1000
May-06	Biological rest		
June-06	Biological rest		
July-06			
August-06	1	3	300
September-06	Biological rest		
October-06	Biological rest		
November-06	3	5	500
December-06	3	4	400
January-07	1	1	100
February-07	1	1	200
March-07	2	2	100

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