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## Does Le Danois Bank (El Cachucho) influence albacore catches in the Cantabrian Sea?

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### ABSTRACT

This study explores the relationship between a seamount located in the Cantabrian Sea known as Le Danois Bank (El Cachucho fishing ground), the first offshore Marine Protected Area (MPA) in Spain, and the Spanish albacore (*Thunnus alalunga*) surface fishery that operates during the summer and autumn months. The geographical distribution of catch per unit effort (CPUEs), expressed by number, showed that August and September were the months with the highest catches in the El Cachucho area, however, annual variability existed. Nominal CPUE series obtained from both logbook data and fishing interviews revealed that higher CPUEs were achieved inside the MPA during some fishing seasons, but there was no consistency in the data, since spatial and temporal variability were shown. The spatial distribution of monthly CPUE data was characterized by means of geostatistical analysis. Albacore schools tended to aggregate in mesoscale patches of similar dimensions but the location of these aggregations was non-stationary both in space and time. This supports the hypothesis that albacore are not randomly spatially distributed, but that they concentrated in certain areas where they find suitable conditions of food availability.

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### 1. Introduction

The albacore surface fishery in the north of Spain is one of the most important economic activities of the Spanish artisanal surface fleet from the Galician and Cantabrian fishing ports during the summer and autumn (June–October). The marked seasonality of this fishery is due to the highly seasonal trophic migration of immature albacore (mainly ages 1–4) into the north-eastern Atlantic temperate surface waters (Aloncle and Delaporte, 1973; Bard, 1981; Ortiz de Zárate and Cort, 1998) due to the high productivity of the Bay of Biscay during the spring and summer. Two different types of gears, bait boat (BB) and troll (TR), target albacore. The number of boats involved varies between fishing seasons but there is an annual average of 550 vessels (80% troll and 20% bait boat).

The seamount of Le Danois Bank (Le Danois, 1948), also known as El Cachucho by local fishermen, is located in the Cantabrian Sea, north of Spain, 65 km from the coast of Asturias at 5°W longitude, and it has an elongated E-W shape, with depths on the plain ranging between 450 and 600 m (Sánchez et al., 2008).

Seamounts are known to have a strong influence on the behavior and distribution of tunas and other large, highly migratory, pelagic species (Morato et al., 2008; Silva and Pinho,

2007; Klimley et al., 2003) by means of enhancing food availability (Holland and Grubbs, 2007) and providing navigational aid “waypoints” in the larger movement patterns of these species (Klimley, 1993; Holland et al., 1999). In some fisheries, available catch data indicate that catch per unit effort (CPUE) is higher around seamounts than in adjacent areas of the ocean (Fonteneau, 1991; Campbell and Hobday, 2003). However, this effect can be difficult to detect as there are so many factors influencing the CPUE. For example, in Australia, analysis of swordfish catches indicated that certain seamounts in the region supported enhanced densities of swordfish (*Xiphias gladius*) that were subsequently depleted as the fishery persisted (Campbell and Hobday, 2003). Skipjack (*Katsuwonus pelamis*) and bigeye tuna (*Thunnus obesus*) were much more abundant in the proximity of some shallow-water seamount summits in the Azores (Morato et al., 2008). Fonteneau (1991) reported higher concentrations of smaller skipjack, bigeye and yellowfin tuna (*Thunnus albacares*) on some seamounts around Cap Vert Island. Likewise, in Hawaiian waters, the Cross seamount produced very high catch rates of bigeye tuna compared to adjacent waters and bigeye were more persistent and less vulnerable to the fishery than yellowfin (Itano and Holland, 2000; Holland and Grubbs, 2007).

Also, seamounts have higher secondary production compared with the surrounding open ocean, mainly due to bottom-up transfer of energy from locally enhanced primary production (Genin and Dower, 2007; Clark, 1999). In particular, it is known that Le Danois Bank produces important effects, such as a

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distortion of the isopycnals at the level of the waters of the thermocline, in the general circulation pattern of the water masses in the area (Ruiz-Villarreal et al., 2006) and it possesses high values of diversity and species richness (Sánchez et al., 2008; <http://www.ecomarg.net/>).

No previous studies have been carried out regarding the effects of this seamount, neither on pelagic nor on demersal Spanish fisheries in the surrounding area. Although some fishermen believe that seamounts are sites of great densities for tunas and other pelagic species, empirical data to support this argument are scarce. Albacore is characterized as an opportunistic species that feeds on pelagic or mesopelagic species such as anchovy, sardine, mackerel, horse mackerel and squids. However, it can also prey on demersal species like blue whiting (Ortiz de Zárate, 1987), crustaceans (Hassani et al., 1997) or mesopelagic species (Pusineri et al., 2005) due to its high capacity to make vertical migrations (Laurs et al., 1980; Bertrand et al., 2002). The high biomass levels for some of these species, such as blue whiting on the Le Danois Bank (Sánchez et al., 2008), as well as the high diversity and richness of zooplanktonic crustaceans and suprabenthic communities (Cartes et al., 2007; Frutos and Sorbe, 2008) could provide good forage conditions and attract these large pelagic species to this area.

The aim of this study was to analyze the influence of this seamount, recently declared by the OSPAR Commission as the first offshore Marine Protected Area (MPA) in Iberian waters (Heredia et al., 2008), on the Spanish albacore surface fishery by means of comparing CPUE series inside and outside the El Cachucho area, and by analysis of CPUE spatial distributions.

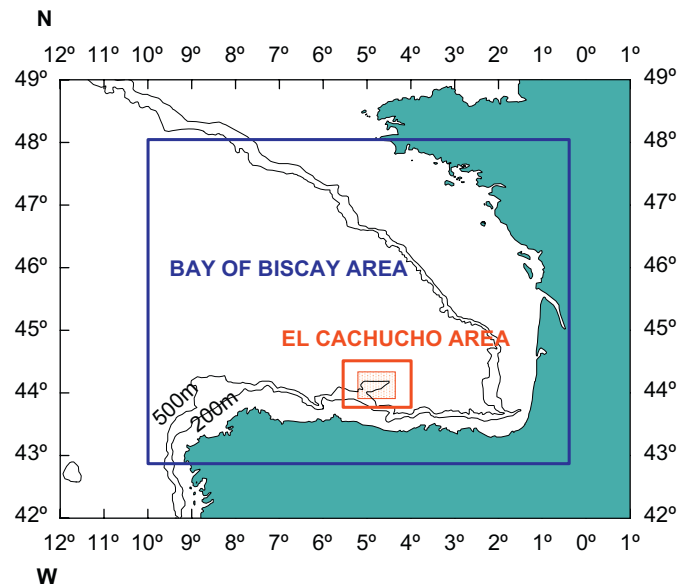
## 2. Material and methods

Different sources of information have been used: (a) data from logbooks and, (b) data from fishing interviews. As a first step, data from logbooks, collected from 1992 to 2001, were used (Table 1a). Daily position of catches, number and size of fish and fishing days were recorded. Fishing days with zero catches were also recorded by some vessels and included in the analysis. Secondly, data were collected through interviews on landings and fishing effort following fishing trips at the main fishing ports located along north and western coasts of the Cantabrian Sea for each fleet during the period (1997–2006). This data set was used for monitoring this surface fishery. It provided a high coverage of the fishery area but, in most cases, however, only the mean position of the catch during each trip was recorded (Table 1b). From each trip sampled the following information was recorded:

date of landing, gear, number of fishing days, number of skippers, number of lines, fishing area (latitude and longitude), catch in number, catch in weight (kg) and, in some cases, fish length.

An exploratory analysis of the fleet distribution revealed that troll vessels operated in a larger area, from the coastal waters of the Bay of Biscay to more western (25°W) and northern waters (52°N), while bait boats remained mainly in Bay of Biscay waters. In broad terms, this pattern was similar in each fishing season (Ortiz de Zárate and Rodríguez-Cabello, 2001) and, in order to avoid the background noise produced by such an extended fishing area and for comparative purposes, only data from the bait boat fleet fishing interviews were considered in this analysis.

Two areas were defined for comparative analysis: the El Cachucho area, which comprised the limits of the MPA, as defined by the following coordinates: 43°53'N–44°12'N and 4°26'W–5°16'W, covering approximately 2330 km<sup>2</sup>; and nearby adjacent waters in the Bay of Biscay area, constrained by 43°N–48°N latitude and 0°W–10°W longitude (Fig. 1). The MPA boundaries were slightly extended considering that, in broad terms, the



**Fig. 1.** The study area showing the Le Danois Bank (El Cachucho) seamount location and the Bay of Biscay area considered in this study (blue box). The dotted square shows the actual limits of the MPA and the red box the limits used in this study.

**Table 1**  
Summary of the database used in the analysis.

(a) Logbook data				(b) Fishery interviews data					
Year	Number of vessels			Number of data	Year	Number of vessels			Number of interviews
	Total	BB	TR			Total	BB	TR	
1992	13	11	2	1043	1997	366	98	268	1296
1993	8	8	0	928	1998	354	98	261	1100
1994	7	6	1	288	1999	375	72	273	1120
1995	5	4	1	268	2000	296	58	238	1018
1996	14	10	4	773	2001	272	69	203	882
1997	10	8	2	593	2002	287	69	218	926
1998	9	7	2	457	2003	277	69	208	968
1999	–	–	–	–	2004	270	57	213	1102
2000	4	3	1	309	2005	264	55	209	1207
2001	3	2	1	147	2006	259	55	204	1235

BB corresponds to bait boat vessels while TR refers to troll vessels. Number of data and interviews annually recorded.

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