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Cetacean diversity and distribution in the coast of Gipuzkoa and adjacent waters, southeastern Bay of Biscay

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Abstract

Since 2003, cetacean populations have been continuously studied in adjacent Gipuzkoan waters, Bay of Biscay, following the Spanish Cetacean Society methodological protocols of shipboard visual surveys. Diversity, densities, spatial and temporal distribution of species where analysed. The scientific field survey results confirm the presence of twelve species in the area. The area has proved to be a notable zone for five cetacean species, particularly for bottlenose dolphin (*Tursiops truncatus*). Common dolphin (*Delphinus delphis*), long-finned pilot whale (*Globicephala melas*), striped dolphin (*Stenella coeruleoalba*) and Cuvier´s beaked whale (*Ziphius cavirostris*) are highly represented in the area. Home ranges for those principal cetacean species have been delimited, as a first step to create an appropriate frame to proceed with the creation of a Marine Protected Area in the area.

• **Key words:** Cetacean Populations; Diversity; Distribution; Densities; Home Range.; Guipuzkoan Coast; Marine Protected Areas.

Laburpena

2003 garren urtean hasita, Gipuzkoar kostaldeko zetazeoak ikertzeko helburuarekin itsasoan laginketak etengabeki gauzatu dira Espainiar Zetazeoen Elkarteko protokoloen arabera. Espezie hauen aniztasuna, dentsitatea, distribuzio espaziala eta tenporala aztertu da. Ondorioen arabera, 12 zetazeo espezieen presentzia baieztatu da eta ikertutako eremua bost espezierentzat garrantsitsua dela frogatu da, bereziki izurde haundiarentzat, (*Tursiops truncatus*). Izurde arrunta (*Delphinus delphis*), izurde pilotu hegaluzea (*Globicephala melas*), izurde marraduna (*Stenella coeruleoalba*) eta cuvier zifioak (*Ziphius cavirostris*) eremu itastar hontan adierasgarritasun haundia daukate. Espezie hauen banaketa eremu printzipalak mugatu dira, Itsastar Eremu Babestu bat sortzeko oinarrizko urratsak ematearren.

• **Gako-hitzak:** Zetazoen populazioak, Dibertsitatea, Banaketa, Dentsitateak, Bizi esparrua, Gipuzkoako kosta, Itsas Eremu Babestuak.

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Resumen

Desde el año 2003, se ha realizado un seguimiento continuo a las poblaciones de cetáceos de la costa guipuzcoana, siguiendo los protocolos de muestreo de cetáceos en mar de la Sociedad Española de Cetáceos. Se ha estudiado la diversidad, la densidad, la distribución espacial y temporal de estas especies. Los resultados indican la presencia de 12 especies de cetáceos en el área, y la importancia de la misma para cinco de ellas, especialmente para el delfín mular (*Tursiops truncatus*). El delfín común (*Delphinus delphis*), el calderon de aleta larga (*Globicephala melas*), el delfín listado (*Stenella coeruleoalba*) y el cifio de cuvier (*Ziphius cavirostris*) son especies altamente representadas en el área. Se han definido las principales áreas de distribución de estas especies con el fin de dar los primeros pasos para la creación de un Área Marina Protegida en el área.

• **Palabras clave:** Poblaciones de cetáceos, Diversidad, Distribución, Densidades, Espacio Vital, Costa de Gipuzkoa, Áreas Marinas protegidas.

Introduction

Shipboard visual surveys have been carried since 2003 in adjacent Gipuzkoan waters, the South eastern Bay of Biscay. From the results obtained, the area has proved to be a notable zone for several cetacean species, and other bird, shark and turtle endangered species, particularly bottlenose dolphin, present all year round in the whole area.

The Canyon of Cap Breton characterizes the area's morphology, as well as provides suitable ecological conditions for many fish species and their predators. Consequently, professional fisheries exploited the area intensively, despite the alarming decrease of fish captures in the last years.

The aim of this work is to analyse the distribution and density of the principal cetacean species present in the area, in order to catalogue and identify their critical habitat.

Due to the lack of protection of this area, this work is direct to provide scientific information to competent authorities, as a first step to draft a Proposal for a Special Areas for Conservation (SAC) of cetaceans in the area.

Methodology

A total of 8451,6 kilometres have been sailed with correct effort conditions along Gipuzkoa´s coast, between April 2003 and October 2008, covering 1.524,45 Km^2. Data regarding effort of observation, as well as environmental and sighting data were recorded onboard, following the methodological protocols of the Spanish

Cetaceans Society (SEC 1999). The human activity in the area was simultaneously studied to detect possible threats for cetaceans (acoustic, traffic, fisheries, surface pollution and trash)

Only data recorded where the sea state was 3 or less in the Douglas scale, were taken into account for the data analysis.

To analyse the temporal distribution was used the parameter encounter rate (ER) that is the number of sightings of a given species per sailed kilometres and is defined as: ER=(Sigh/Eff)x100. The ranging patterns for the species are autumn (October to December)-winter (December to March), spring (April to June) and summer (July to September).

To analyse the sighting frequencies distribution for bottlenose dolphins, common dolphins and pilot whales, statistic program SPSS 11.was used, Chi^2 tests were applied for temporal distribution heterogeneity analysis, for that issue, expected frequencies for homogeneous distribution were calculated by Ni= Nt x Li / Lt where Ni are sighting frequencies on year season, Nt total sightings, Li is effort on year season and Lt is total effort.

The spatial distribution of the five most frequent species was analysed to define the home range for each species.

For that spatial modelling, the study area was divided in a grid with a cell resolution of 2 minutes latitude by 2 minutes longitude each (Figure 1). This scale was

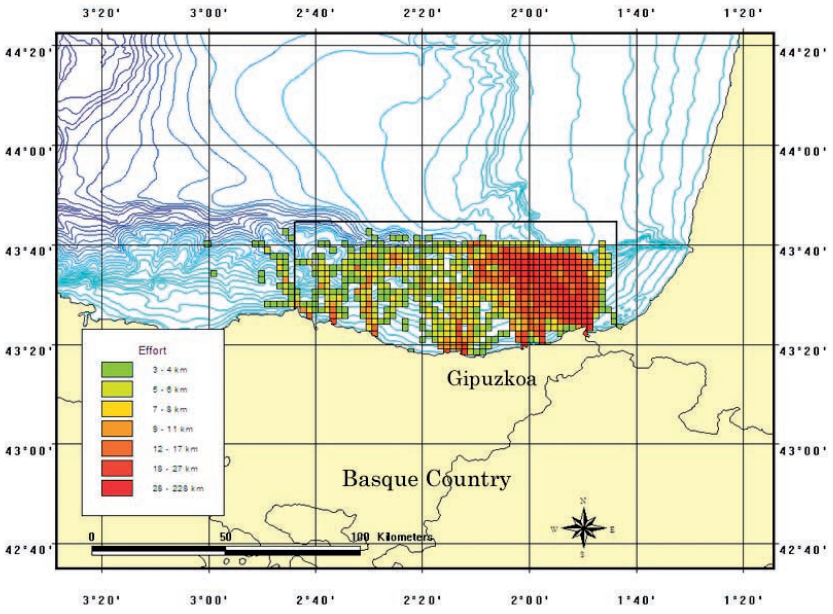

Figure 1.- Searching effort

used to be able to compare the results obtained during the scope of this study with results obtained by concurrent research programs carried out by members of the Spanish Cetacean Society. The distance in kilometres searched in each quadrate was then calculated using a Geographic Information System: Arc View 3.2 from ESRI and its extension Animal movement (Hooge and Eichenlaub 2000).Encounter rate for each cell was calculate (ER=Sigh/Eff), only sightings for which the contact was established were used for these analyses, as some animals could be seen several kilometres away from the survey vessel and conversely could not be located precisely. Only cells in which at least 3 km were covered on sighting effort were used for the analysis (Figure 1).

For estimating home ranges fixed kernels were used (Worton 1995, Seaman and Powell 1996, Seaman et al 1999, Powell 2000, Owen et al 2002).

Results and discussion

Twelve species of cetacean were encountered in a total of 198 sightings (Figure 2). The five most frequent species in the area are, common dolphin (*Delphinus delphis*) who's relative density is of one sighting each 148 kilometres (N=57), bottlenose dolphin (*Tursiops truncatus*) who was observed once each 154 kilometres (N=55), long-finned pilot whale (*Globicephala melas*) each 235 kilometres (N=36), striped dolphin (*Stenella coeruleoalba*) each 291 km (N=29) and Cuvier's beaked whale (*Ziphius cavirostris*) each 768 kilometres (N=11). Other cetacean species occasionally develop the area, as sperm whale (*Physeter macrocephalus*)

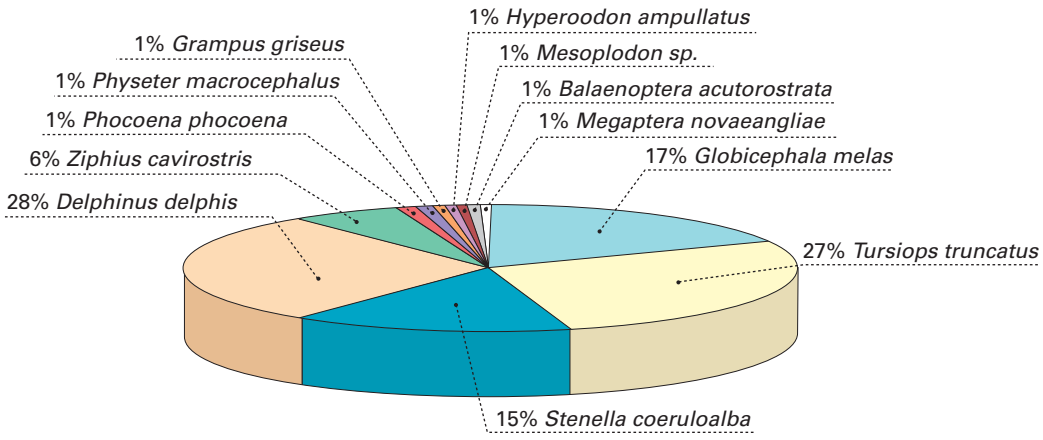

Figure 2.- Diversity of cetaceans in Gipuzkoa´s coast

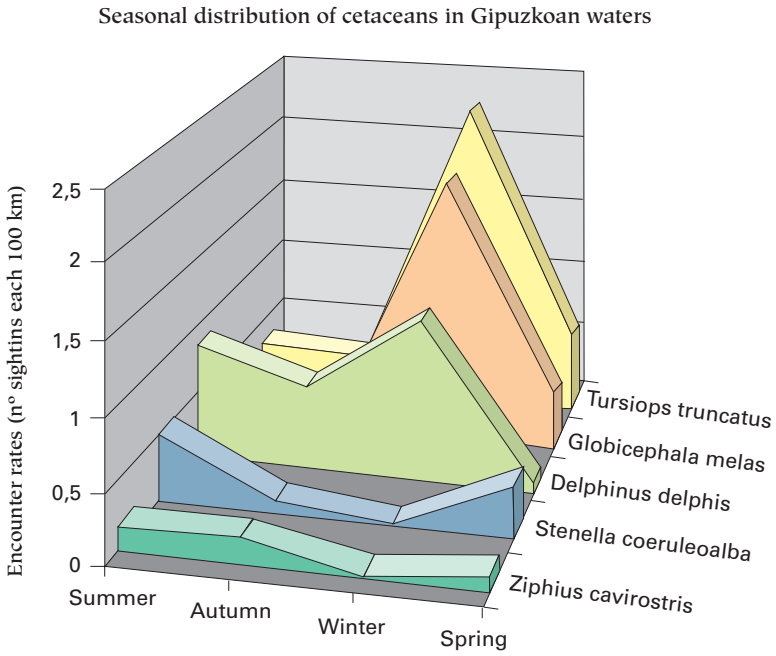

Figure 3.- Temporal distribution of cetaceans in Gipuzkoa´s coast

harbour porpoises (*Phocoena phocoena*), northern bottlenose whale (*Hyperoodon ampullatus*), mesoplodon backed whales, risso´s dolphin (*Grampus griseus*), minke whale (*Balaenoptera acutorostrata*) and humpback whales (*Megaptera novaeangliae*).

The distribution of the five most frequent species in the area is heterogeneous all year round (X^2 = 67.8, df 3, p ≤0.000).

Delphinus delphis are heterogeneously distributed both spatial and temporally (X^2 = 124.11, df 3, p ≤0.000) Common dolphins are widely distributed around all the area, his presence increases in zones between 200 and 1200 metres depth (Figure 4). During all round the year the density of common dolphins is higher in winter, decreasing significantly in spring (Figure 3).

Tursiops truncatus. is the most widely distributed specie in the area, with preference for areas between 200 and 1200 meters depth and often seen close to land, 20 meter deep waters (Figure 5). This specie is regularly observed all round the year, having the highest relative density during winter (X^2 = 54.19, df 3, p ≤0.000) (Figure 3).

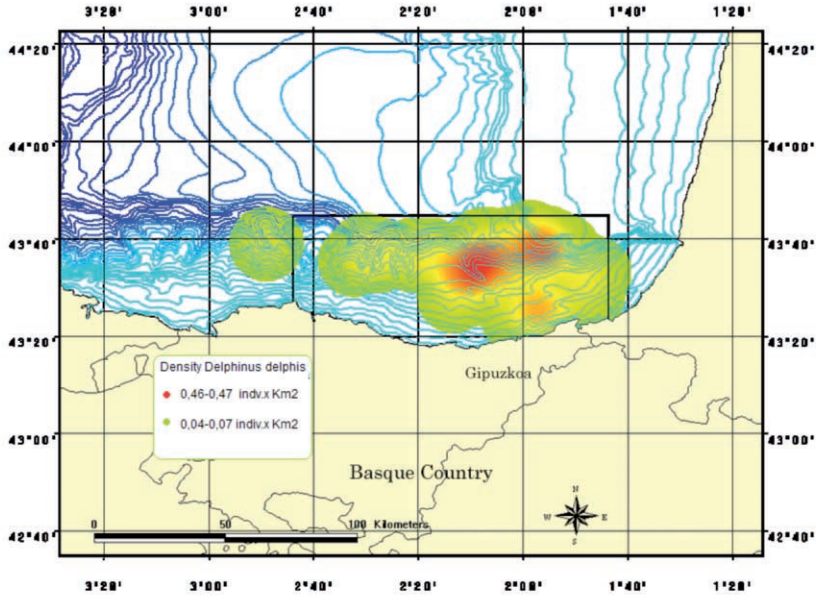

Figure 4.- Distribution of common dolphin (*Delphinus delphis*)

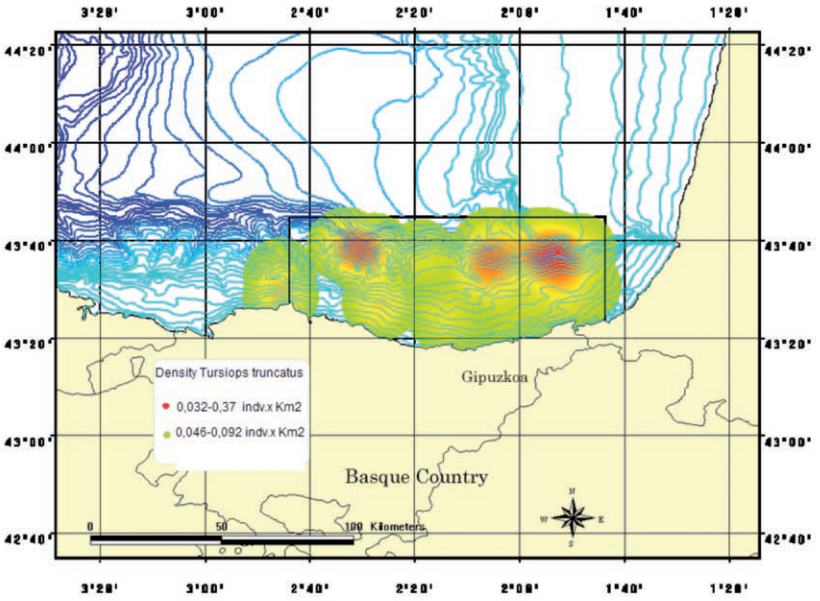

Figure 5.- Distribution of botllenose dolphin (*Tursiops truncatus*)

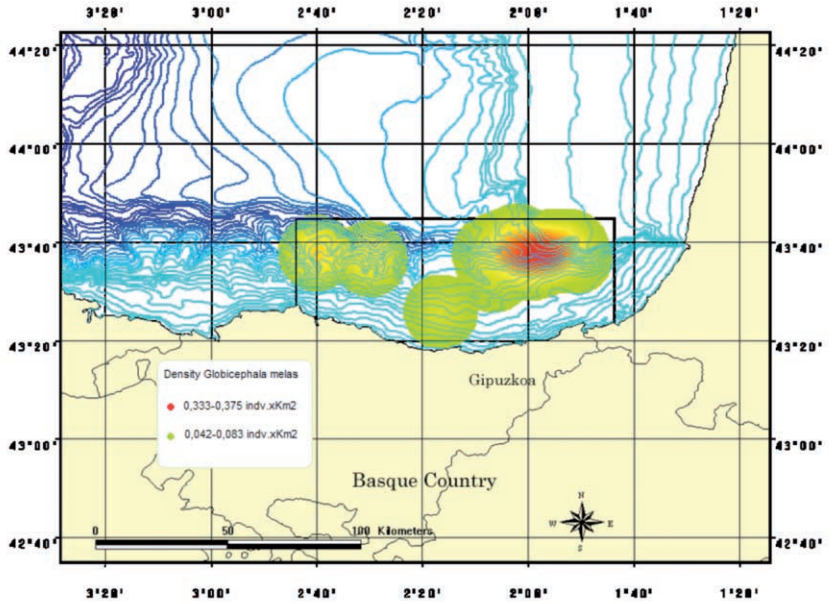

Figure 6.- Distribution of long fined pilot whale (*Globicephala melas*)

Globicephala melas long finned pilot whales were distributed mostly in deep waters, up to 200 meters, mainly in areas between 800 and 1200 meters deep (Figure 6). His presence is significantly higher in winter, during the rest of the year is relatively low (X^2 = 75.05, df 3, p ≤0.000) (Figure 3).

Stenella coeruleoalba striped dolphins are present in pelagic waters from 200 to 2000 meters deep, most frequently in areas between 600 and 1200 meters deep. (Figure 7) The highest density of this specie is showed between spring and summer, during autumn and winter his density decreases considerably. (Figure 3).

Ziphius cavirostris Cuvier's beaked whales are distributed in the deep areas of the zone, up to 800 meters deep, mainly in the deepest area of the Canyon, more than 1200 metres depth (Figure 8). This specie is been observed between spring and autumn, most frequently in summer. (Figure 3).

Conclusion

- The area is exploited all round the year by several cetacean species, in winter the density of cetaceans increases considerably, concentrated mainly in areas from 200 and 1200 metres, in the head of the canyon of Cap Breton.

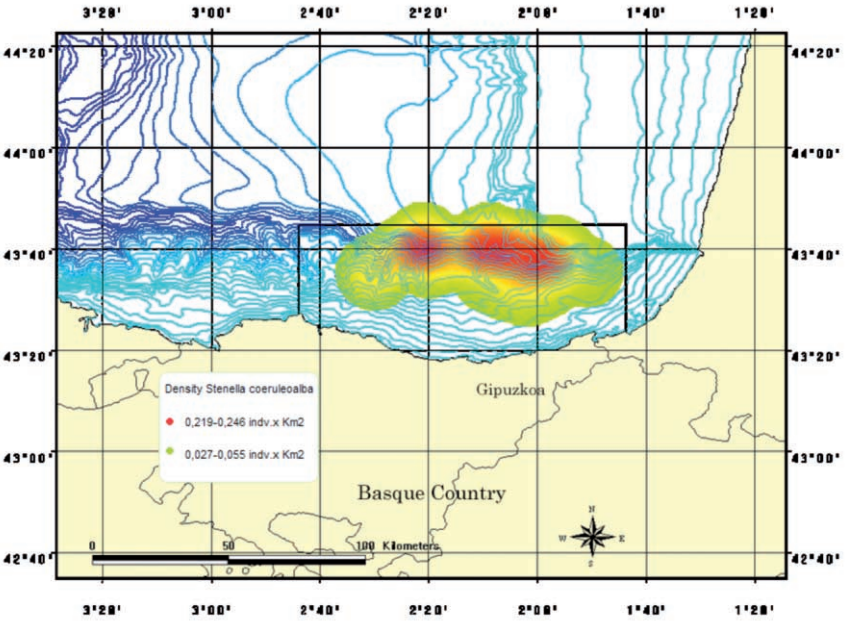

Figure 7.- Distribution of striped dolphin (*Stenella coeruleoalba*)

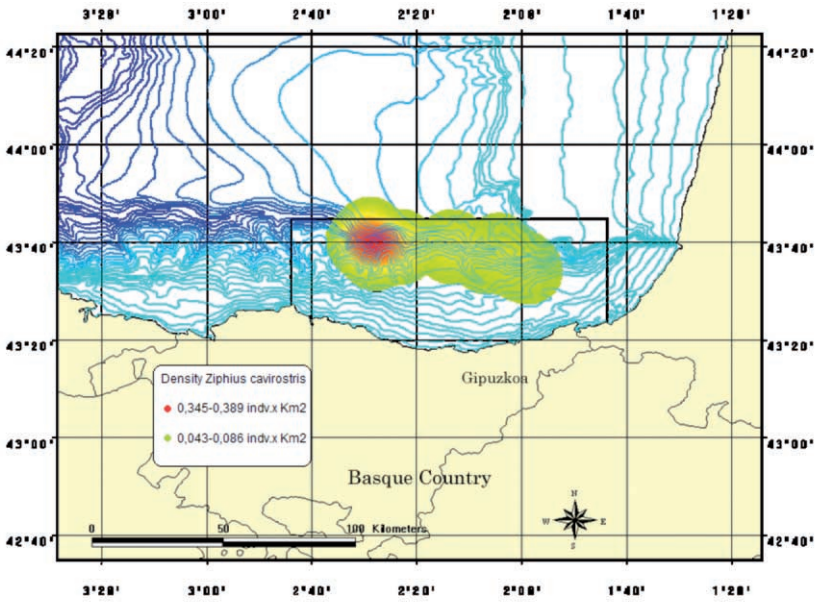

Figure 8.- Distribution of cuvier´s beaked whales (*Ziphius cavirostris*)

- The area has proved to be an important area for several cetacean species, consequently, the area should be proposed to be included in the Special Areas for Conservation net Natura 2000, due to is importance for bottlenose dolphin and based in his home range, with the aim of ensure the protection of this specie listed on the annex II of European Habitats Directive, who requires the establishment of Marine Protected areas.

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