Deep–Sea Research Part II 141 (2017) 31–40

Contents lists available at ScienceDirect

Deep–Sea Research II

journal homepage: www.elsevier.com/locate/dsr2

Seasonal distribution and abundance of cetaceans within French waters- Part II: The Bay of Biscay and the English Channel

Sophie Laran[a,*], Matthieu Authier[a], Aurélie Blanck[b], Ghislain Dorémus[a], Hélène Falchetto[a], Pascal Monestiez[c], Emeline Pettex[a], Eric Stephan[d], Olivier Van Canneyt[a], Vincent Ridoux[a,c]

[a] Observatoire PELAGIS, UMS 3462 CNRS - Université de la Rochelle, 5 allées de l'océan, 17000 La Rochelle, France
[b] Agence des aires marines protégées, 16 quai de la douane, Cedex 2, 29229 Brest, France
[c] Centre d'Etude Biologique de Chizé, UMR 7273 - CNRS - Université de La Rochelle, 2 rue Olympe de Gouges, 17000 La Rochelle, France
[d] APECS (Association pour l'Etude et la Conservation des Sélaciens), 13 rue Jean-François Tartu, BP51151 - Cedex 1, 29200 Brest, France

ARTICLE INFO

Keywords:
Cetaceans
Bay of Biscay
English Channel
Harbour porpoise
Common dolphin
Bottlenose dolphin
Aerial survey

ABSTRACT

From the Habitat Directive to the recent Marine Strategy Framework Directive, the conservation status of cetaceans in European water has been of concern for over two decades. In this study, a seasonal comparison of the abundance and distribution of cetaceans was carried out in two contrasted regions of the Eastern North Atlantic, the Bay of Biscay and the English Channel. Estimates were obtained in the two sub-regions (375,000 km²) from large aerial surveys conducted in the winter (November 2011 to February 2012) and in the summer (May to August 2012). The most abundant species encountered in the Channel, the harbour porpoise, displayed strong seasonal variations in its distribution but a stable abundance (18,000 individuals, CV=30%). In the Bay of Biscay, abundance and distribution patterns of common / striped dolphins varied from 285,000 individuals (95% CI: 174,000–481,000) in the winter, preferentially distributed close to the shelf break, to 494,000 individuals (95% CI: 342,000–719,000) distributed beyond the shelf break in summer. Baleen whales also exhibited an increase of their density in summer. Seasonal abundances of bottlenose dolphins were quite stable, with a large number of 'pelagic' encounters offshore in winter. No significant seasonal difference was estimated for pilot whales and sperm whale. These surveys provided baseline estimates to inform policies to be developed, or for existing conservation instruments such as the Habitats Directive. In addition, our results supported the hypothesis of a shift in the summer distributions of some species such as harbour porpoise and minke whale in European waters.

1. Introduction

The conservation status of cetaceans has been of concern for many years in the North Sea and adjacent waters, but discussions have mainly been focused on the two species of cetaceans listed in Annex II of the Habitat Directive (HD), namely the harbour porpoise (*Phocoena phocoena*) and the common bottlenose dolphin (*Tursiops truncatus*), with all other cetaceans being listed in the Annex IV. While Annex II lists species that can justify the designation of Special Areas of Conservation, Annex IV lists all species under strict, albeit not site-based, protection. European Union Member States have to implement a surveillance programme for species listed under HD-Annexes II and IV, as well as to monitor man-induced causes of death for species under Annex IV. Since the beginning of the 1990s, several studies have documented the large impact of incidental catches of cetaceans in Eastern-North Atlantic (ENA) fisheries (Peltier et al., 2016; Rogan and Mackey, 2007), with a risk of entanglement in different types of nets (Tregenza et al., 1997). While driftnets have been restricted in the area, trawling, particularly pelagic pair-trawling, has become the main threat for delphinids (de Boer et al., 2012). In addition, the development of marine renewable energy facilities could potentially affect marine mammals (Madsen et al., 2006; Thomsen et al., 2015). Finally, global warming is also expected to have a substantial impact on cetacean communities (MacLeod et al., 2005).

To address and mitigate these threats, the European Union issued the Marine Strategy Framework Directive (hereafter MSFD) to restore the European marine ecosystem. The MSFD (Directive 2008/56/EC) capitalises on former conservation instrument such as the HD, but addresses their shortcomings (e.g. a bias toward terrestrial habitats and species, a focus on administrative boundaries instead of ecosystem ones, etc...). The MSFD sets deadlines and requires Member States to achieve or maintain 'Good Environmental Status' of their waters by 2020.

* Corresponding author.
E-mail address: sophie.laran@univ-lr.fr (S. Laran).

http://dx.doi.org/10.1016/j.dsr2.2016.12.012

Available online 22 December 2016

Because of the high mobility of cetacean species, their protection can only effectively be achieved by means of international cooperation, which the MSFD encourages through existing conservation bodies such as the Regional Sea Conventions. For example, the Agreement on the Conservation of Small Cetaceans of the Baltic and North Seas (ASCOBANS) promotes close cooperation between countries to achieve and maintain favourable conservation status for small cetaceans in the area. A prerequisite for effective conservation is information on important parameters such as abundance and distribution. If past large scale surveys such as SCANS and CODA (Hammond et al., 2013; MacLeod et al., 2009) have provided estimates for some species of community interest (*e.g.* harbour porpoises) or large whales. Some knowledge gaps, however, remain. Here, we report the results from two large scale aerial surveys designed to provide baseline estimates for the initial assessment of several cetacean species and their seasonal changes in abundance and distribution patterns in two contrasting areas of the Eastern North Atlantic Ocean (ENA): the English Channel and the Bay of Biscay. Among the detected species, two are considered in European waters as *Vulnerable* according to the IUCN Red List Criteria, the harbour porpoise and the sperm whale (*Physeter macrocephalus*), and one is *Near Threatened,* the fin whale (*Balaenoptera physalus*). In addition, these surveys allowed us to provide estimates for six currently *Data Deficient* species: common (*Delphinus delphis*) and striped dolphins (*Stenella coeruleoalba*), pooled together as small-sized delphinids; common bottlenose dolphin, Risso's dolphin (*Grampus griseus*), long-finned pilot whale (*Globicephala melas*) and Cuvier's beaked whale (*Ziphius cavirostris*), pooled in the beaked whales group. Finally, they provided estimates for the common minke whale (*Balaenoptera acutorostrata*), which is considered as *Least Concern*.

2. Materials and methods

2.1. Study area and survey design

Two contrasted sub-regions of the Eastern-North Atlantic were covered during this study. (1) The English Channel (EC), characterised by strong tides and freshwater inputs, which create well-mixed and turbid waters, joins the North Sea on its eastern partwith shallow depths, while its western end joins the Celtic Sea. Seasonal stratification along the English coast permits extensive blooms during the summer, while offshore southern Celtic Sea waters remained well mixed. (2) In the Bay of Biscay (BoB), the continental shelf is broader in the north, off France, while relatively narrow along the Iberian coast finishing with a wide complex of submarine canyons (Fig. 1). Blooms first occur in early summer, followed by shelf summer blooms along the Ushant front and coastal blooms on the shelf, related to river outflow or salinity fronts (Pingree and Garcia-Soto, 2014). The Ushant front (west of Brittany coasts) represents a transitional zone between cooler, tidally well mixed Channel water and the warmer stratified water of the Atlantic (Pingree and Garcia-Soto, 2014).

The study area was focused on the French EEZ, but for the sake of ecological consistency it also included Spanish waters in the south of the Bay of Biscay characterised by a complex topography due to numerous canyons and English Channel waters in the north to cover the whole epicontinental Channel. The study area spanned 375,000 km² including the English Channel (92,900 km²) and the Bay of Biscay (282,100 km²). These two sub-regions were stratified in four bathymetric strata (Fig. 1): two continental shelf strata less than 200 m deep (EC and BoB_Shelf); one continental slope stratum within the 200 m and 2000 m isobaths (BoB_Slope); and the oceanic stratum (BoB_Oceanic) with depth > 2000 m.

2.2. Data collection

Data were collected during two large dedicated aerial surveys, named SAMM (*Suivi Aérien de la Megafaune Marine;* aerial survey for marine megafauna) over three geographic sub-regions: the EC, the BoB (within ENA) and North-Western Mediterranean Sea. Target species were the main taxa of marine megafauna, *i.e.* marine mammals, sea turtles, large fish as elasmobranchs collected in line transect mode, while seabirds in strip transect. This study only presents results obtained for cetaceans within the two ENA sub-regions. Detailed methodology and results for the North-Western Mediterranean Sea are presented in a companion paper (Laran et al., 2017).

Transect were drawn manually but in order to approximate an equal coverage probability within each strata. A systematic zig-zag sampling design (Buckland et al., 2001; Strindberg and Buckland,

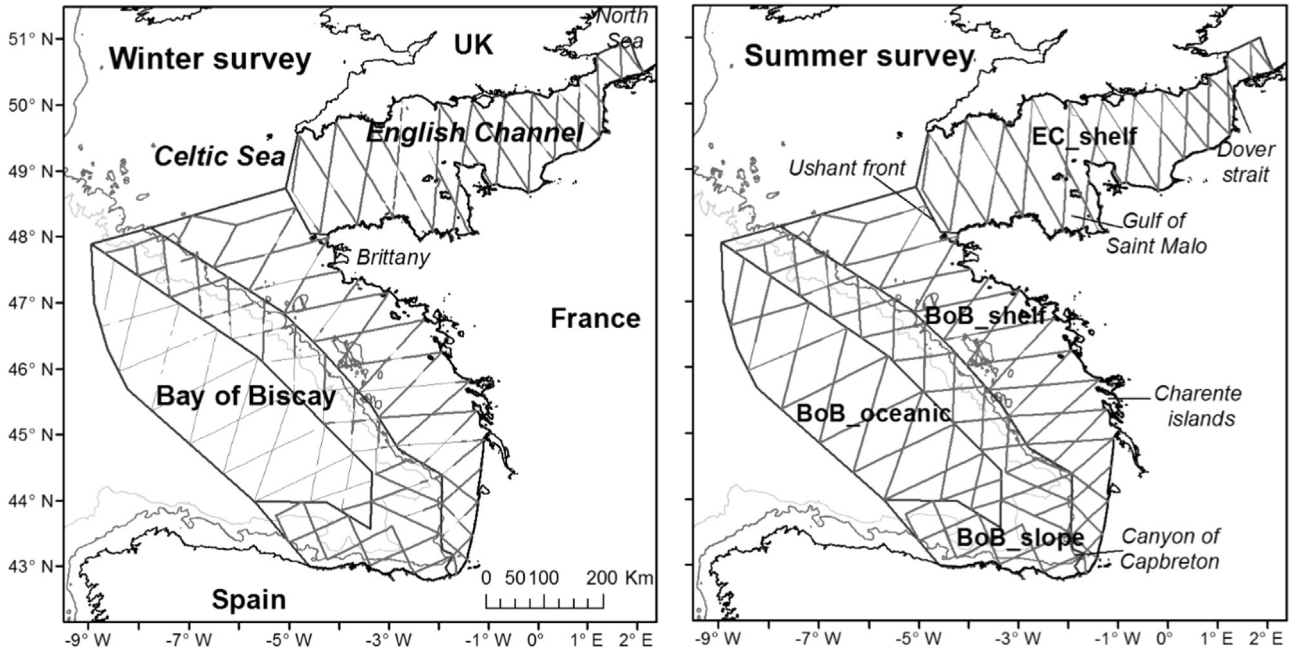

Fig. 1. Survey blocks with bathymetric strata and effort conducted during the winter survey (left) and summer (right) in good condition (selected for analyses: with sea state ≤3 Beaufort and subjective condition greater than *medium*). In bold transect done with a replicate.