Progress in Oceanography xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Progress in Oceanography

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

The PELGAS survey: Ship-based integrated monitoring of the Bay of Biscay pelagic ecosystem

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ARTICLE INFO

Keywords:
Pelagic ecosystem
Integrated ecosystem monitoring survey
Marine Strategy Framework Directive
Ecosystem variability
Bay of Biscay
Fishing vessels

ABSTRACT

The Pélagiques Gascogne (PELGAS) integrated survey has been developed by a multidisciplinary team of Ifremer and La Rochelle University scientists since 2000, joined by commercial fishermen in 2007. Its initial focus was to assess the biomass and predict the recruitment success of anchovy in the Bay of Biscay in spring. Taking advantage of the space and versatility of R/V Thalassa II, sampling has been progressively extended to other ecosystem components. PELGAS therefore further developed the second objective of monitoring and studying the dynamic and diverse Biscay pelagic ecosystem in springtime. The PELGAS survey model has allowed for the establishment of a long-term time-series of spatially-explicit data of the Bay of Biscay pelagic ecosystem since the year 2000. Main sampled components of the targeted ecosystem are: hydrology, phytoplankton, mesozooplankton, fish and megafauna. The survey now provides two main ecosystem products: standard raster maps of ecosystem parameters, and a time series dataset of indicators of the Bay of Biscay pelagic ecosystem state. They are used to inform fish stock and ecosystem-based management, and support ecosystem research. The present paper introduces the PELGAS survey, as a practical example of an integrated, vessel-based, ecosystem survey. The evolution of the PELGAS scientific team and sampling protocols are presented and analysed, to outline factors crucial to the success of the survey. Data and results derived from PELGAS are reviewed, to exemplify scientific questions that can be tackled by integrated ecosystem survey data. Advantages and challenges of the survey are discussed and put into the context of marine ecosystem surveys in the European Marine Strategy Framework Directive and the Common Fisheries Policy.

1. Introduction

The Pélagiques Gascogne (PELGAS, Doray et al., 2000) survey monitors the Bay of Biscay pelagic ecosystem in springtime. The main goal of PELGAS is to provide information for a management plan in accordance with an ecosystem approach to fisheries (EAF; Garcia et al., 2003). As such, PELGAS also aims at studying the structure and dynamics of the pelagic ecosystem on the continental shelf. PELGAS has been conducted by the Institut français de recherche pour l'exploitation de la mer (Ifremer), in collaboration with La Rochelle University and the Centre national de la recherche scientifique (CNRS) since 2000. As for other long term, multidisciplinary, ecosystem surveys such as CalCofi (CalCOFI, 2011), Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) Ecosystem Monitoring Program (Agnew, 1997) or the Barents Sea ecosystem survey (Eriksen, 2014; Eriksen et al., this volume), the initial aim of PELGAS was the provision of scientific information for fisheries management. PELGAS initial objective was to provide springtime biomass estimates of the Bay of Biscay anchovy (*Engraulis encrasicolus*) population to the ICES stock assessment group WGHANSA in charge of this commercially important species.

The PELGAS survey takes place in a dynamic and biologically diverse pelagic ecosystem, located in a subtropical/boreal transition zone.

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http://dx.doi.org/10.1016/j.pocean.2017.09.015

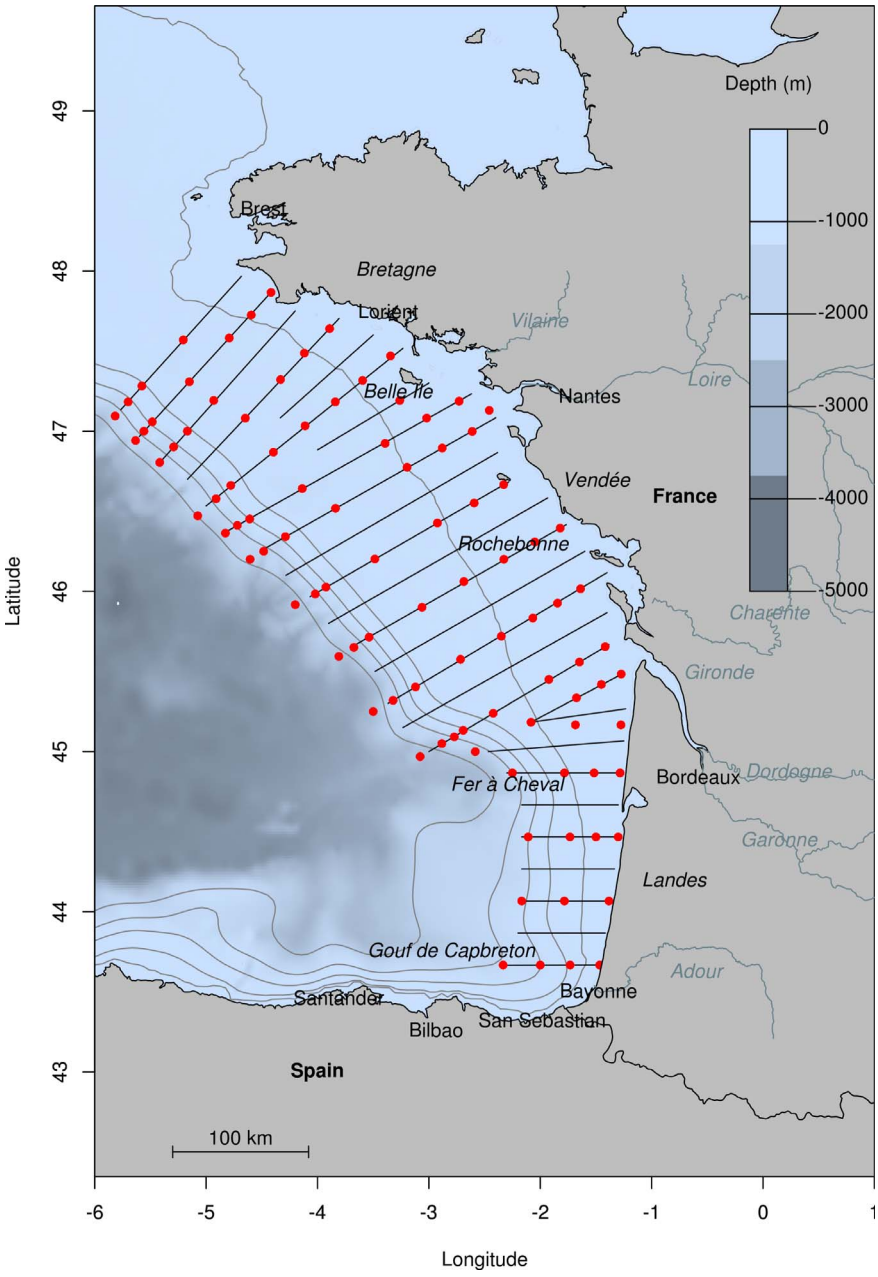

Fig. 1. PELGAS survey sampling scheme. Solid lines: systematic line transects, red dots: hydrobiology stations. Light grey lines: 100, 200, 300, 400, 500 m isobaths.

The Bay of Biscay is an open oceanic bay delimited by the west-east oriented Spanish coast in the southern part, and the north-south oriented French coast in the eastern part (Fig. 1). It is part of the subtropical/boreal transition subprovince of the biogeographic Lusitanian province (OSPAR Commission, 2000), where mixing between faunal groups of boreal and subtropical origin occurs. The seasonal southern or northern distribution limits of many fish species populations are contained within the Bay of Biscay (Poulard and Blanchard, 2005). Ambient environmental conditions are variable in springtime in Biscay, depending on the onset and magnitude of post-winter phytoplanktonic blooms, seasonal water warming and stratification setup, coastal upwellings, as well as cumulated intensity of winter river discharge and plume spreading over the shelf (Huret et al., this volume; Koutsikopoulos and Le Cann, 1996).

The diversity and dynamic nature of the Bay of Biscay pelagic ecosystem largely influences anchovy population dynamics (Koutsikopoulos and Le Cann, 1996; Planque et al., 2007). This illustrates well some of the earliest observations in fisheries science, acknowledging the “complex interactions of the (marine) living beings” (Lankester, 1884) and the importance of recruitment in small pelagic fish population dynamics (Hjort, 1914). Based on these findings, PELGAS was designed as an integrated ecosystem survey, requiring extensive sampling of several ecosystem components, working towards an improved understanding of target species population dynamics, in the context of EAF.

This paper introduces PELGAS, as a practical example of an integrated, vessel-based, ecosystem survey. The evolution of the PELGAS scientific team and sampling protocols are presented and analysed, to outline the factors critical to the success of the survey. Data and results derived from PELGAS are reviewed, to illustrate some scientific questions that can be tackled by integrated ecosystem survey data. We further discuss advantages and challenges of the survey. In conclusion, integrated ecosystem surveys are assessed in the context of the European Marine Strategy Framework Directive (MSFD, 2008/56/EC).