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Editorial: Changing ecosystems: New findings in the Bay of Biscay

A B S T R A C T

This contribution summarizes the scope and results of a selection of the studies presented to the XV International Symposium of Oceanography of the Bay of Biscay (ISOBAY 15), that took place in Bilbao (Basque Country, Spain) from 22nd to 24th June 2016. Firstly, a brief introduction to the status of the Bay of Biscay, its presence in scientific literature over the last two decades, and the aims of the present edition of ISOBAY are presented. A second part shows the main findings of the works submitted for publication in this special issue. They represent new steps in the knowledge of oceanographic, geological and biogeochemical processes, biodiversity, ecosystems´ structure and functioning, and human impact in the Bay of Biscay. On the other hand, they also contribute to the overall knowledge of marine systems.

1. Introduction

Since the abundant and varied benefits of ecosystems to humans were recognized as services that may have assigned economic values (Daily, 1997; Daily et al., 2000), new concerns about ecosystems state and plausible changes driven by natural and/or anthropogenic factors have emerged. Currently, the human impact on the Bay of Biscay has been assessed ranging from low in the outer oceanic area to high or very high in coastal zones (Halpern et al., 2017). According to the health assessment of marine waters in exclusive economic zones (EEZs) by means of the Ocean Health Index (0-100 healthy), the Bay of Biscay ranges from 50-60 in the southwest part to 60-70 in the northeast part (Halpern et al., 2012). On the contrary, using the Nested Environmental status Assessment Tool (NEAT; Borja et al., 2016), other authors found that the area is in good status under the Marine Strategy Framework Directive (Uusitalo et al., 2016), being in agreement with previous assessments (Borja et al., 2011). So, the Bay of Biscay is not a homogenous region in health status and impact risk. Moreover, the Bay of Biscay constitutes a biogeographical and ecological boundary area in the North Atlantic Region. The ecogeographical classification of worldwide oceanic and shelf areas carried out by Longhurst (1998) includes oceanic waters of the Bay of Biscay in the southern limit of the North Atlantic Drift Province, and coastal waters in the southernmost part of the Northeast Atlantic Shelves Province, which expands northwards to the Celtic Sea, the English Channel and the North Sea. The marine ecoregions defined for shelf and coastal areas by Spalding et al., (2016), however, separate the Bay of Biscay, as a part of the Lusitanian province, from the above mentioned seas, as components of the Northern European Seas province. In this case, the Bay of Biscay is the northernmost region of the Lusitanian Province that reaches southwards the Saharan upwelling region. All this makes it a tempting object of study for oceanographers and marine ecologists, mostly in a world where man induced climate change is driving widespread changes in physical and biological properties of marine ecosystems and biogeographic boundaries

The Bay of Biscay as subject of scientific study, both in Agricultural and Biological sciences and in Earth and Planetary science areas, has experienced a remarkable increase over the last decade (Fig. 1). If a progressive increasing trend in the number of articles having “Bay of Biscay” in the Title, Abstract or Keywords is observed since the 1990s, a shift occurred during the first decade of the 21st century. This rise in the presence of the Bay of Biscay in science records is being undoubtedly assisted by the periodic celebration of the International Symposium of Oceanography of the Bay of Biscay (ISOBAY), which took first steps in 1988.

The Bay of Biscay was once again the focus of interest of a multidisciplinary team of scientist who attended the XV International Symposium of Oceanography of the Bay of Biscay (ISOBAY 15) organized in Bilbao, 22nd -24th June 2016, by the University of the Basque Country (www.ehu.eus/isobay15). The Symposium was open to contributions in all the fields of the Oceanography (Physical, Chemical, biological and Geological) and

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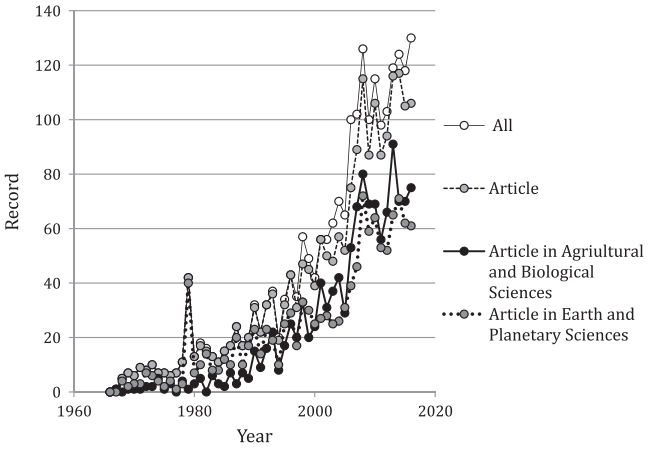

Fig. 1. Records of the place name "Bay of Biscay" in the Title, Abstract or Keywords of all publications and articles, and articles assigned to Agricultural and Biological Sciences and Earth and Planetary Sciences.
(Source: Scopus)

related issues of Marine Ecology involving human interference in marine ecosystem (marine resources exploitation, pollution and management). Around 150 researchers participate in the presentation of 52 oral communications and 77 posters. "Changing Ecosystems: Natural versus Anthropogenic Effects" was the introducing topic in the present edition, and Changes in the Bay of Biscay was the main scope, this covering both spatial and temporal scales of variability in physicochemical and biological processes as well as in community/ecosystems structure and functioning of pelagic and benthic environments. In this special issue are published 21 out of the 129 contributions presented to ISOBAY 15. All of them are valuable contributions to improve our knowledge on the Bay of Biscay and, by extension, on marine ecosystems.

2. New contributions to the knowledge of the Bay of Biscay

This section summarizes the main findings of the contributions published in the present special issue. They are grouped according to the topics dealt with in the symposium: (1) Physical Oceanography, (2) Biogeochemical cycles, (3) Geology; erosion transport and sedimentation, (4) Biodiversity; ecosystem structure and functioning, (5) Fisheries and Aquaculture, and (6) Anthropogenic effects; quality assessment ad ecosystem management.

2.1. Physical Oceanography

Two papers have been published in this section. Costoya et al. (this issue) analyzed then main drivers affecting Loire and Gironde plumes by means of MODIS imagery and computational models. River discharge was found to be the main driver, followed by wind, which can modulate the turbid plume under high river discharge. In addition, teleconnection indices East Atlantic pattern (EA) and North Atlantic Oscillation (NAO), which are the most representative patterns of atmospheric variation in the Northern Hemisphere (Barnston and Livezey 1987), were also found to affect the dynamics of plumes: positive values of both indices favoured a greater extension of the plume. Finally, the rivers maintain winter stratification inside the turbid plume, which results in a different warming ratio when compared with the adjacent ocean, in good agreement with previous research (Costoya et al., 2016). In Rodríguez-Díaz and Gómez-Gesteira (this issue), the authors use a Lagrangian model to analyze the duration of migration of the European eel than can be found at the Bay of Biscay after a long migration across the Atlantic. The duration of this larval migration is a controversial matter (Bonhommeau et al., 2010), ranging from 7 months to > 4 years. The authors show that the minimum migration duration estimated from a Lagrangian model is similar to the duration obtained from the microstructure of eel otoliths, which is typically on the order of 7–9 months (Arai et al., 2000).

2.2. Biogeochemical cycles

About this topic, Buquet et al. (this issue) analyzed the effect of lakes on the flux of nutrients into the Bay of Biscay. In particular, they sampled Lacanau and Carcans-Hourtin, which belongs to the catchment area of Arcachon Bay (the largest coastal lagoon of the Bay of Biscay French coast). Samples were compared with values obtained from Leyre river, which is the main source of freshwater and nutrients for the lagoon. The authors conclude that lakes eliminate a large proportion of nutrients supplied by surface waters, trapping between 50 and 80% of dissolved nutrients, which are sequestered in autochthonous sediments. Both lakes behave in a similar manner although with some differences in nutrient retention probably due to different water residence times (Seitzinger et al., 2002). Lakes can be considered nutrient filters, lowering the level of eutrophication of adjacent coastal zones, although at the risk of suffering eutrophication themselves.

2.3. Geology; erosion transport and sedimentation

Papers of this section describe studies that bring new knowledge on the geology of the Bay of Biscay. This collection of four papers treat of geology with different time and geographic scales, including recording of plate tectonics during the formation of the Bay of Biscay by ammoniods, recording of paleo-oceanographic conditions during the last 140 ky by fossilized microfauna, and identification of suspended particulate matter