BOOK REVIEW

Borja, A. and M. Collins (eds.). 2004. – *Oceanography and Marine Environment of the Basque Country*. Hardcover. Elsevier Oceanographic Series. Amsterdam, 616 pp.

The aim of this book is to establish the present level of understanding of Basque coastal research, including the estuaries and the adjacent continental shelf. As the authors already note in the Preface (Borja and Collins), the main source of information is the Spanish side of the Basque country, with very little reference to the French Basque coast. The Spanish Basque coast is around 150 km long, and is exposed to the prevailing N and NW winds. It is very steep, dominated by rocky substrate, with vertical cliffs and abrasion platforms intercalated with sandy beaches. There are 12 small estuaries, which are river valleys that were drowned 500 million years ago, when the sea level rose by around 100 m. The area is highly inhabited and industrialised. Population density is the highest among the catchment areas draining into the Bay of Biscay. This high demographic pressure on the coastal area has led to the deterioration of some estuarine systems and particular sections of the coastal zone. Contamination, although diminishing, is a serious problem that is addressed in several chapters. The book presents the main results obtained mostly during the last 25 years, the most productive period of marine research in the Basque Country.

Rallo and Borja (Chapter 1) introduce the historical perspective of marine research in the Basque country with a paragraph entitled “the heroic times”, a period that lasted until the end of the dictatorship regime of General Franco (1975). Only from then on was an integrated approach to the study of the environment undertaken. However, this late start did not prevent some Basque researchers/naturalists from having an understanding of the mechanisms of marine production and reasons for concern. In fact, in 1913 Lizasoain published in the journal of the Oceanographic Society of Gipuzkoa that “...fisheries, like all the products of Nature, are at risk of disappearing because of exhaustion, depletion...” and gave some guidelines that are basically mainstream in modern fisheries management and sustainability. This chapter represents an enormous effort, gathering

information from many different sources. I strongly recommend anybody interested in the marine environment of the Basque Country to read it.

In Chapter 2, Cearreta *et al.* provide the framework of past human activities that have led to the present situation: “The Basque coastal zone represents 12% of the total surface of the Basque Country but supports 60% of the total population and 33 of the industrial activities. [*Fishing activities represent 1% of the Basque GNP.*] This great human pressure on the coastal area has produced dramatic changes in the original physical, chemical and biological features during the last two centuries. However, nowadays, there is concern about the environmental importance of coastal areas and increasing efforts are being devoted by local authorities to their conservation and restoration”. The idea of a scientific effort with an environmental goal is a key element throughout the book.

Chapter 3 (Pascual *et al.*) summarises the geological features of the coast, including the paleoceanographic evolution of the Bay of Biscay and the natural resources (gas, oil) on the continental shelf. The meteorological characteristics, some special atmospheric events, and the interaction between ocean and meteorology are described in Chapter 4 (Usabiaga *et al.*). On the coast, temperatures range between 10 and 16 °C and rainfall is around 1500 mm per year, which classifies the climate as marine, west-coast and mild. A finer description of the coast starts in Chapter 5 (Uriarte *et al.*) with the explanation of the dynamics of sediment supply and distribution. The role of 12 rivers with torrential characteristics as sediment suppliers and the estuarine and shelf transport of sediments result in a synthetic conceptual model of sediment transport on the Basque coast. The reconstruction of the late evolution of the coast explains its current sedimentological characteristics.

Wave climate and water level fluctuation and currents on the continental shelf, littoral zone and estuaries of the Basque country are presented in Chapter 6 (González *et al.*). This information is then used for practical purposes to model pollutant dispersion (floating debris, oil spills) at two heavily populated sites. Chapter 7 (Valencia *et al.*) and 8 (Valencia and Franco) deal with the hydrography

and the chemical and optical characteristics of the main water masses. These chapters are probably the most oceanographic chapters of the book. However, estuaries constitute a significant contribution, again indicating the importance of coastal management in Basque marine science. This concern becomes especially evident in the chapters devoted to contamination (9, 10, 12, 13 and 14), and there are reasons for this. It is quite shocking to learn that until the 1980s almost all the wastewater was dumped into rivers and estuaries without treatment. Chapter 12 (Contaminants in sediments, Belzunce *et al.*) presents the scenario of the main contaminant problems affecting the Basque coast. At the present time the heritage of the heavy industries and mining that discharged their wastewater during the 19th and 20th centuries is responsible for the high levels of contaminants in rivers and estuaries affected by these industries. The chapter deals with bioavailability and toxicity of heavy metals and organic contaminants. The authors point out that Zn, Cu, Pb and Mn in sediments are still a potential risk to the marine environment in some estuaries and that most organic contaminants are above the Effect Range Level, which is a cause for concern. There is a continuous leaching of contaminants from the sediment to the water column and groundwater. The concentration of heavy metals (Chapter 9, Belzunce *et al.*) and microbiological indicators of sewage (Chapters 10, Bald *et al.*) indicate that water quality in most estuaries remains poor in general. Improvement is expected with the continuous implantation of new water treatment plants and more demanding treatments following European policies. The biological effect of this contamination should be more evident in biological indicators such as mussels (Chapter 13, Borja *et al.*) and specific contaminant targets within the organisms (Chapter 14, Marigómez *et al.*). Gorostiaga *et al.* (Chapter 22) use the recovery and manipulation of benthic communities to detect pollution effects. Strategies for effective biomonitoring are discussed in this chapter.

The youth of marine research and the great importance of coastal management is probably best reflected in the lack of information on bacterioplankton, phytoplankton and zooplankton (Chapters 15 and 16, Orive *et al.* and Villate *et al.* respectively), subjects considered traditionally as “basic research”. It is most surprising that studies of natural bacterioplankton are almost absent, whereas bacteria are known to be the main natural force in recycling marine contaminants, besides most biogenic

elements. Bacteria composition and concentration are used in biomonitoring networks as indicators of sewage in bathing and shellfish waters (Chapter 10, Bald *et al.*). Studies of bacterioplankton and phytoplankton have been restricted mostly to temporal and geographical succession in two estuaries and almost no data are provided for shelf and oceanic areas. This evident lack of basic information is acknowledged in the final chapter of Conclusions by Collins and Borja. Despite the shortage of zooplankton studies I read the chapter by Villate *et al.* with pleasure. Again, most information is supplied in the context of biomonitoring programmes in two estuaries. Microzooplankton information is available on the coast but absent on the shelf, while mesozooplankton coverage is slightly more complete. The spatial and temporal patterns of shelf and estuarine communities are described. Aspects of zooplankton feeding, reproduction and biochemistry are also addressed.

The chapter on ichthyoplankton (Chapter 17, Motos *et al.*) shows again a better knowledge of this component because of its closeness to fisheries. In fact, ichthyoplankton studies should identify events occurring during early life history in fish which dictate the annual recruitment. The understanding of recruitment appears to be one of the most important needs in the management of fish stocks. This chapter describes ichthyoplankton assemblages throughout the year, with special emphasis on anchovy. The dynamics of eggs and larvae of sardine, mackerel, horse mackerel, hake and blue whiting—species with commercial value in the Basque country—are also described.

Chapter 18 (Borja *et al.*) presents the main trait of the Basque coast in terms of phytobenthos, zoobenthos and coastal fish species: the fact that it is more meridional than the neighbouring regions. The most striking features of this coast are the lack of fucoids and the clear dominance of red algae over brown algae. This coast is also a refuge of some Mediterranean species and forms the northern boundary of some warm-water species. In fact, the Basque coast is located between Morocco and NW Spain in terms of flora and temperature. The meridionalisation is also observed in the physiology of species common to neighbour coasts. The authors, however, lead to the conclusion that it is probably better to use the term “septentrionalisation” for the coast of NW Spain because of intense upwelling and cooling during summer. The summer thermal pocket of the Basque coast (> 21°C) contrasts sharply with

the upwelled waters in Galicia (17-19 °C) during the same period. The authors complete the chapter with the description of benthic communities in mudflats, salt marshes, soft-bottom tidal (7 main communities), hard-bottom tidal (4 main communities) and subtidal (3 main communities). The low exploitation of benthic communities crustaceans and molluscs is addressed, as well as that of the red algae *Gelidium*. None of the resources seems to be overexploited.

Main fisheries in the Basque country are described in Chapter 19 by Arregi *et al.* This chapter divides fisheries into coastal and pelagic. The mean dimensions of the coastal small-scale fleet are boats of 12.4 m and 20.5 t, occupied by 3.5 men per vessel. Three quarters of the captures are mackerel, although albacore constitutes half of the fish value with only 10% of the captures. Hake is also a valuable fishery. The pelagic fisheries fleet is obviously larger (24 m and 107 t on average), with 14.5 men per vessel. Here, anchovy is an important resource (28% of total value), but again albacore represents 67% in economic terms. The authors point out that satellite imagery is a tool for fishing surface-inhabiting species, above all tuna, but that it should also be used to study the ethology in relation to the environment in order to properly manage the stocks. Only the captures of bluefin tuna are not sustainable, according to the authors. The chapter includes short notes on the biology of the anchovy, sardine, and mackerel in a kind of spring succession in spawning. Bluefin and albacore do not inhabit the Bay of Biscay, they only migrate.

The description of the seabird population by Franco *et al.* (Chapter 20) indicates that seabird nesting is very poor in terms of abundance and diversity. Only four species are regular breeders and three of them are classified as rare: the storm petrel, the European shag and the lesser black-backed gull. The authors suggest that limited prey availability close to nesting areas and few good nesting places are the reasons for this scarcity. Only the yellow-legged gull population has shown a sharp increase over the last two decades because of a rise in food availability derived from human activity. The inclusion of the Basque country in the migratory routes and as a wintering zone increases the list of species with northern gannets, auks, gulls (the most common), and above all great cormorants. Again, the chapter shows the lack of information even for the few nesting species.

The conservation of wildlife and natural habitats is addressed in Chapter 21 (Castro *et al.*). The

authors do a good job of synthesis, summarizing in clear tables the current legislative framework. Management of natural habitats follows two guidelines: avoiding negative actions on the environment (rational exploitation) and obtaining a suitable quality of life for all citizens.

A useful and interesting list of areas of natural interest is presented. The authors note that the list of protected species offered is insufficient and has been updated by now by the Basque Government. There is a small description of main threats to species of interest, from the less known invertebrates that include Gorgoniaceae that divers tear down for ornamental purposes, to the most familiar sea mammals and turtles endangered by fishing activities. Many web addresses are given throughout the text.

The overall assessment of the human impact and ecological quality of the marine environment is presented by Franco *et al.* in Chapter 23. In fact, it constitutes a summary and a good synthesis of the information provided throughout the book. As such, it shows that coastal management has been the backbone of Basque marine science. Together with an additional chapter devoted to a research agenda for the region (Collins and Borja), a strong case is built on the future direction of marine science in the Basque country.

My first impression after reading the book is that I found something different from what I expected from the title. Perhaps the title of Chapter 23, "Overall assessment: Human impacts and quality status (of the Basque marine environment)" would better reveal the tone of the book. The book presents the state of the art of the marine science carried out so far in the Basque Country but also reveals its weak points. For example, oceanographic studies, when present, are reduced mostly to the shelf; and data needed to provide basic information on ecosystem functioning is lacking except for two well-studied estuaries. These and other shortcomings are properly acknowledged in Chapter 24 (Collins and Borja), and a future expansion in those fields should be expected. In some of the chapters I missed a wider framework to relate the results presented. Sometimes the reader cannot grasp the meaning of the information provided in a broader context. Overall, I found the quality of the book to be high. The authors made an effort to summarise and focus the main results of existing research with the aid of tables and figures. The chapters include abundant literature and disclose to the broad public information contained in many technical reports, which is

always difficult to find. Although I would say this is not a book for the general public, it is quite interesting to any person interested in specific questions of the marine environment of the Basque Country. Undoubtedly it will become the reference book and

a cornerstone in the study of the marine environment in the Basque Country.

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