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King Carlos of Portugal, a Pioneer in European Oceanography

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The great interest in studying the sea in its many aspects that arose in many European countries and in America in the second half of the 19th century, as manifested by scientific voyages and the creation of marine laboratories, also had its repercussions in Portugal.

It is not surprising that such interest had its roots in the industrially developed countries where culture was current—whether the aims were simply to advance knowledge (life at the depths?) or to help clarify great biological problems (the origin of life and of species), or were of more practical intent (cable-laying).

How is it, then, that such a small and poor country as Portugal, where the rate of illiteracy was so high, managed to be among those that contributed to this early stage of the oceanographic sciences?

The impetus came from one man, King Carlos de Bragança, who reigned from 1889 to 1908. Carlos I was a highly intelligent and sensitive person, much interested in humanism in all its aspects. Thus, we note in passing that he was a talented painter and that he published a lavishly illustrated catalog of the birds of Portugal. As he himself wrote, he had a “passion de la mer” from childhood, and with money and a yacht at his disposal, it was natural that one of his fields of interest was the sea and all that dwelled therein.

In 1897 Carlos began his paper on the main achievements of his first cruise on *Amélia* in 1896 as follows:

The numerous oceanographic researches that foreign countries have carried out in recent times with such auspicious results, the importance of these studies for the fisheries industry, one of the most important in our country, and the exceptional variety of bathymetric conditions of the sea along and

off our coasts, suggested to us last year the idea of the scientific exploration of our sea, and to make available, by regular work, not only a knowledge of the fauna of our continental shelf but also that of the abysses that are found in certain regions only a few miles off the coast, a situation almost unique in Europe.

These words indicate clearly what Carlos had in mind. They also reflect the strong influence of Prince Albert of Monaco and the results the latter had obtained in his earlier work off the Azores. Furthermore, the presence of deep canyons so near the Portuguese coast presented an intriguing opportunity for intensive work, for although Forbes' Azoic theory had been rejected several decades before, relatively little was known about life in these sites.

More importantly, perhaps, Carlos de Brangança shared Thoulet's view that it was advantageous to study a relatively small region of the ocean in detail rather than large areas from which it was possible to obtain only more general data. So it was that he wrote in 1902 that despite the fact that some stations had been occupied by such famous oceanographic vessels as *Challenger*, *Porcupine*, *Talisman*, and *Princesse Alice* near the Portuguese coast, a methodical study of these waters was a necessity in order to gain a full understanding of them.

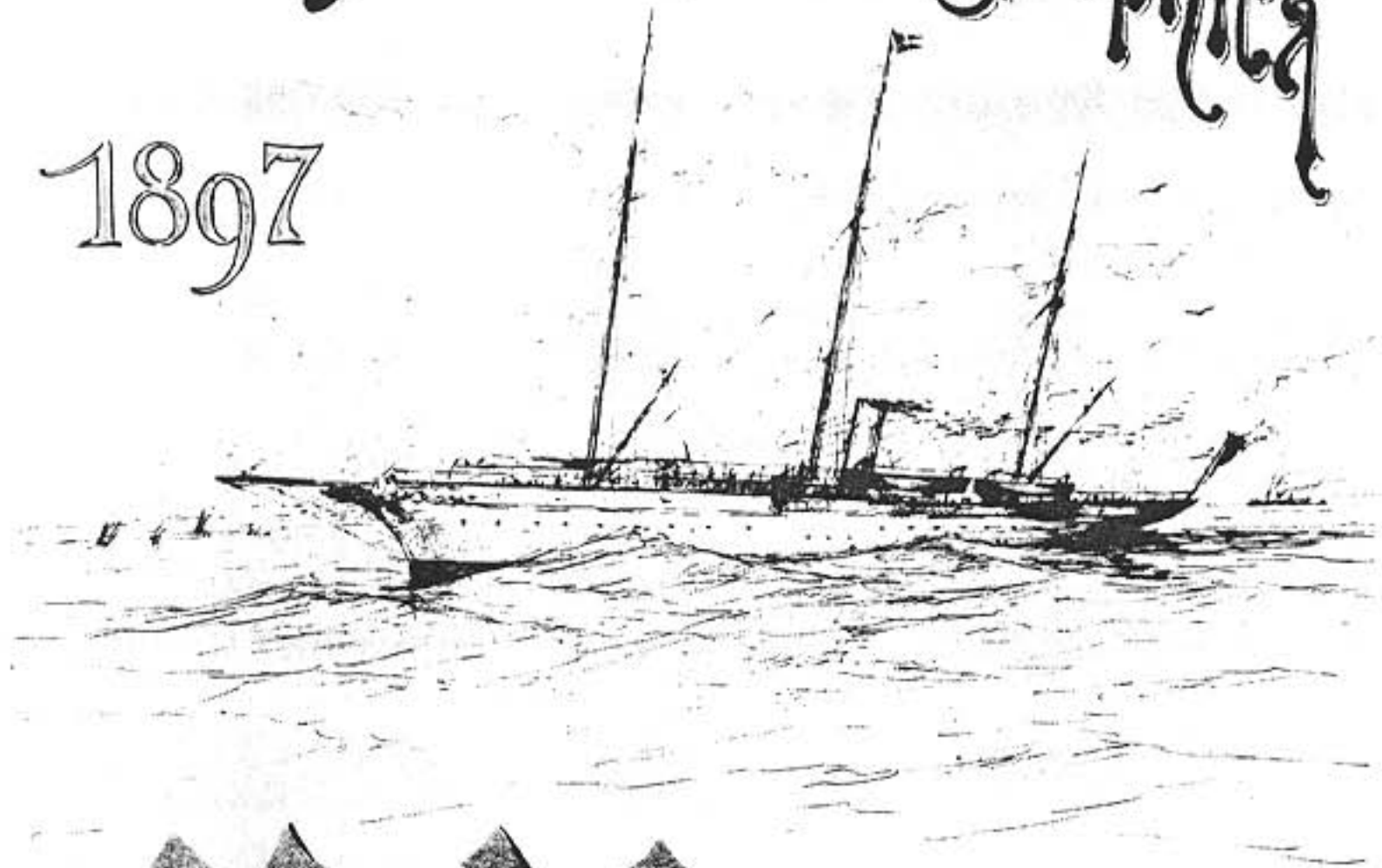
"On 1st September 1896 we had the pleasure of beginning the first national oceanographic cruise in the seas of Portugal." So wrote King Carlos in 1897 about the first service in the cause of science undertaken by *Amélia*, named in honor of his Queen.

The yacht had been constructed in England by Allsup & Sons in 1878. She was solid iron, three-masted, 111 feet in length, 147 tons and could make 9-10 knots. The proposed program for the first cruise was to carry out soundings to 1500 m and dredgings to 600 m, to fish with long-lines, to study the pelagic fauna, and to make observations on the "physics" of the sea. To this end he took on board some Negretti and Zambra reversing thermometers, two water samplers and several densitometers (Chabaud's model), two Blake beam trawls, four dredges of different sizes, a polyhedric trap (*Hirondelle* model), plankton and other nets and fishing gear. Except for its maneuverability, *Amélia* was ill-suited for oceanographic service. There was little deck-space for work, no place for a laboratory, and in fact no adequate room for storage of scientific equipment and gear; furthermore, the anchor winch was too weak for trawling.

For these reasons Carlos acquired a second *Amélia*, also built in England (at Leith), 148 feet long, 301 tons, 10-11 knots. The cruises of 1897 and 1898 were conducted on this vessel (Fig. 1); however, she also lacked laboratory space as well as adequate quarters for the larger crew required for work further offshore. The King therefore purchased a third English yacht, the *Yacona*, built by J. Scott & Co.; this third *Amélia* was 180 feet in length, 650 tons, 12-14 knots. She was also armed with several types of guns, including a harpoon-gun for cetacean work. Most important, there was good space and the smoking room was transformed into a laboratory with a zinc-covered table for wet work, facilities for the microscopist, racks for oceanographic instruments including

Campanha Oceanographica

1897



Yacht Amélia

Figure 1. The frontispiece of the diary of the cruise of 1897, depicting the second *Amélia*.

Buchanan's water samplers, and shelves and cabinets for chemicals, dissecting instruments, glassware, and reference books. Furthermore, the laboratory could easily be transformed into a dark room for photographic purposes and for the study of luminescence in fishes and invertebrates.

The published works of King Carlos deal mainly with the results obtained during the cruises of these three *Amélias* between 1896 and 1900.

Despite all the improvements for efficient scientific work at sea on *Amélia* III, the King was still not satisfied and in 1901 he obtained a fourth *Amélia*, the former *Banshee*, built by Ramage and Ferguson, 234 feet and 993 tons. The

letters from Carlos to Prince Albert in 1904-05 and the log of the yacht show that much more intensive work was carried out during her operations at sea, always with great enthusiasm. Unfortunately, however, the results were never published—presumably because of the political disruptions of the times and the premature death of the King in 1908. This fourth *Amélia* was later renamed *Aviso* (dispatch boat) *5 de Outubro* after the day of the Republican revolution in 1910; she carried on considerable hydrographic work for two decades.

With regard to the obvious improvements in collecting gear and instrumentation that took place with the acquisition of the successive *Amélias*, among them the use of steel cables (after Beloc and Lord Kelvin) and the Luca's apparatus employed by transatlantic cable-laying vessels, it is interesting to note the close communication between Carlos de Bragança and the Prince of Monaco. Albert I not only offered Carlos much encouragement but went into great detail about operational methods and the utilization of special gear. Thus his letters include drawings to show the precise location of weights on the cable when trawling, instructions as to the length of cable required to dredge or trawl at different depths, the details of handling trawl nets, how to construct a "faubert" (hempen mop or tangles attached to the dredge for the capture of echinoderms, sponges, corals, etc.), and many other pertinent observations. It is interesting also that in a letter in 1899 the Prince proposed to the King that he present the results of his investigations to the French Academy of Sciences.

Bragança's main interest lay in the fishes, but extensive collections of all kinds of marine animals were preserved. These collections, somewhat decimated over the years, are now housed at the Aquarium Vasco de Gama in Lisbon. They were studied not only by the King himself but also later by others such as Vilela (1936) on the stomatopod and decapod crustacea and Gonçalves (1942) on fishes. And to this day the collections are available for use by modern workers.

Bragança (1904) himself published a detailed work on the sharks obtained on the cruises between 1896 and 1903. In the introduction he repeats his conviction that a more thorough knowledge of the ichthyofauna would be beneficial to the commercial fisheries. He goes on to suggest that a catalogue of the Portuguese species with accounts of their distribution, reproductive periods, seasons of availability of migratory species off the Portuguese coast, and the best methods of capture would be of interest. With reference to distribution, he notes in passing that well before the refutation of Forbes' theory that 300 fathoms was the limit of animal life, the Portuguese fishermen long-lined for "abyssal" sharks and incidentally brought up large sponges (*Hyalonema* and *Asconema*). In his detailed description of long-lining for sharks he includes a curious detail, namely the rubbing of certain parts of the line with the liver of a macrourid fish, *Macrocephalus laevis*, "... whose extraordinary qualities of phosphorescence have the property of attracting fishes." He notes also that the examination of the stomach contents of sharks is an important tool for deep-sea biologists in their search for rare specimens in good condition "... that sharks swallow whole due to their extreme voracity."

In this work on sharks Carlos attempts a brief classification of sharks on the basis of distribution: coastal and abyssal, the former divided into sedentary and pelagic. He gives definitions of these categories, but points out that the distinc-

tion between coastal sedentary and abyssal is not always clear. With reference to the distribution of the abyssal forms, he believes that temperature and pressure are important factors.

The main bulk of the King's work on sharks is an account of the different Portuguese species with synonymies, appropriate references, common names, listings of specimens collected on each cruise, and in many cases measurements and notes on morphology and distribution. There are dichotomous keys for species identification, colored illustrations of some, and tables of bathymetric distribution. One long-nosed shark is described as a new species (*Odontaspis nasutus* Bragança 1904), later recognized as a synonym of *Mitsukurina owstoni* Jordan, 1898.

As indicated earlier, Carlos de Bragança was much concerned with the problems of the commercial fisheries. His work on "The Tuna Fishery at Algarve in 1898" (1899) states that while he was working in the area with deep canyons off the coast at Sesimbra he decided to undertake annual well-organized cruises to the south off the province of Algarve where the capture of migrating tuna by trap nets was the most important fishery. His plan was to make systematic observations from *Amélia* on the temperature and transparency of the water and on the prevailing currents. He also distributed cards to the owners of the tuna fisheries for recording daily catch by species and other information—surely one of the earliest methodical attempts to record catch statistics. By this method he hoped to provide substantial information on the occurrence and abundance of the tunas in the Algarve fishery. However, the work was carried out for only one year. Carlos' account of the results (1899) includes keys for the different species of tunas off the Portuguese coast, with fine illustrations of their particular characteristics, notes on their food, reproduction, distribution and migrations, making reference to the work carried out at other laboratories such as that at the Marine Station of Endoume in Marseille. The occurrence, behavior and abundance of the Algarve tuna for the year 1898 is also carefully documented with accompanying graphs, tables and charts.

Nor was the King's interest in the commercial fisheries confined to the above-mentioned. At the turn into the 20th century the Portuguese fishermen became much concerned about the introduction of steam trawlers, fearing the depletion of resources by engine-powered vessels, as opposed to the conventional methods used by boats under sail. To test the efficiency of the new procedure he hired the steam-driven *Machado*, which then fished off Sesimbra at different depths with the catches (several tons) being counted by species and measured.

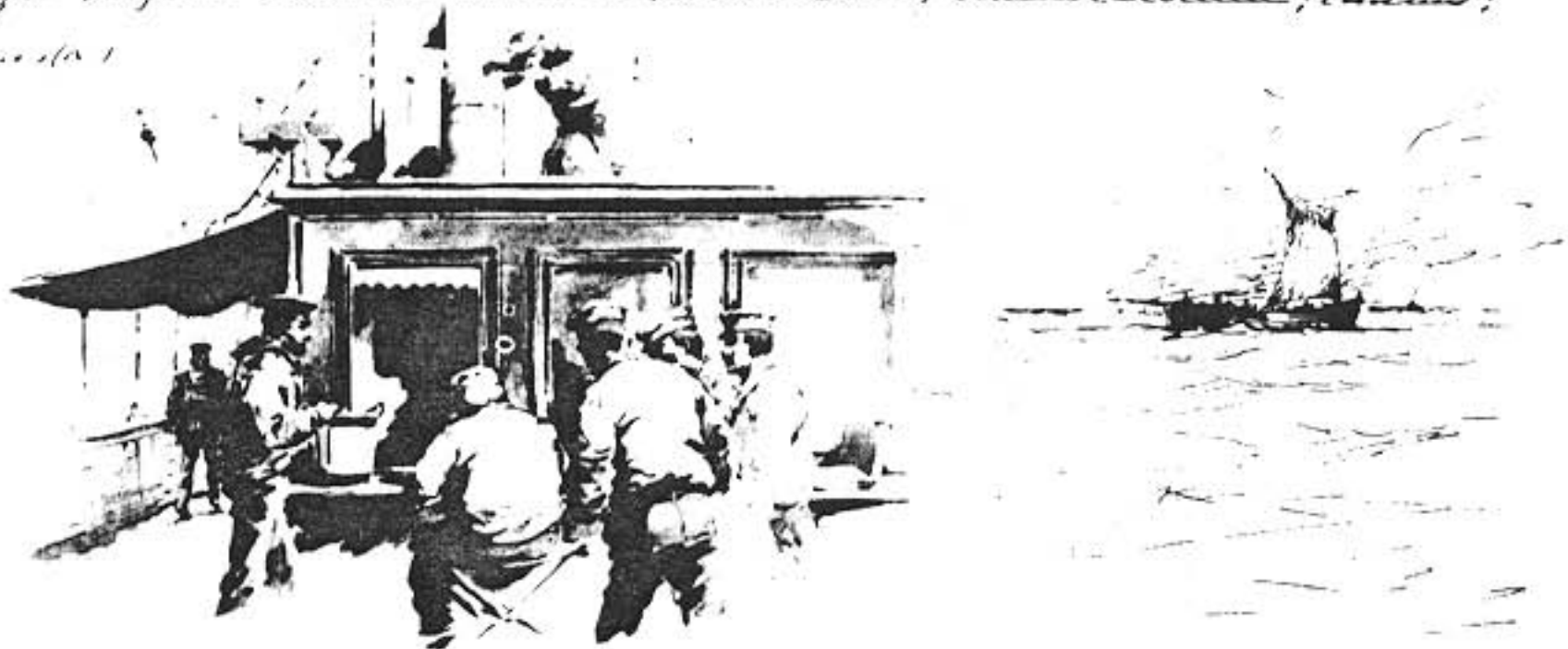
Bragança's broad interest in oceanography is evident from the wide variety of his studies. Thus he released floats in particular areas to gain a knowledge of local currents and made the observation that there was a surface coastal movement of water flowing to the north between Cape Espichel ($38^{\circ}26'$) and Aveiro ($40^{\circ}35'$) at the end of November and the beginning of December 1896. The King's notes also reveal his interest in the topography of canyons and their bottom sediments, and in this connection he undertook the construction of a bathymetric chart of Portuguese waters in a scale of 1/100,000. Neither did the inter-

Dia 28 de Maio 1897

Largamos de Teia

às 7.28 am - As 8 am saímos a barra

Chuvos com vento W. fraco às 9.30 largamos a arrasto com 72 (Palmeira 19.82 - Espi-
chete 62.84) levantou-se às 10.45 am (Palmeira 16.82 - Espi-chete 62.84) Traçando = Gobius,
Serranus, Scorpaena, Blennius, Merluccius, Galathea, Ophiura, Echinus, Spongia, etc.;
Vermes e cónchas - Esta dragagem foi feita com banco de Aviculas - As 11.30 am
arrasto, 1.ª linha de custo 58.82 - C.ª 2.ª de custo 11.84 suspendeu-se a, 0.ª - (Cabo 2.ª de custo 5.5.84 -
Palmeira 15.82) 45.ª de fundo = Banco Aviculas = traçando = Gobius, Serranus, Scorpaena,
Merluccius, Galathea, Ophiura (na), Pennatulidae, Meridae - As 12.45 pm arrasto
(Palmeira 11.82 - Espi-chete 65.84) 110.ª linha - levantou-se às 1.15 (Palmeira 8.82 - Espi-chete
66.84) = traçando = Vermes, Dentalium, Pectinodontus, Ichthyocardium, Echinus,
Serranus etc.



à 1.30 arrasto = 110.ª linha (Palmeira 6.82 - Espi-chete 66.84) mettem-se
dentro à 2.ª - traçando = Scorpaena, Lepidogaster, Amphiprion, Vermes, e
molluscos etc.; em seguida navegamos para a Barra de Setúbal
e fomos fundados em Teia às 4.15 de tarde



Figure 2. A watercolored page of the diary of the cruise of 1897. The king depicts himself seated and working, watched by the members of his crew.

tidal zone in marine birds escape his attention. Furthermore, he organized several exhibitions in Lisbon and Oporto to show the public his collections and to demonstrate the results of his investigations. As an extension of his activities aboard the first *Amélia*, he also created a small marine laboratory at the fortress of Cascais, one of his summer residences; this was the forerunner of such laboratories in Portugal.

Despite the obvious fact that the King had no problem in financing his various projects in the marine sciences (and had no obligation to write reports!), he needed assistance to accomplish all he did. He had several people helping him on cruises, but his most important collaborator was A. Girard. Prince Albert wrote to Carlos in 1896 about Girard that "... je ne crois pas possible d'avoir un compagnon de travail plus intelligent, plus zélé ni plus agréable," and Carlos himself makes gracious acknowledgment (1899) to him and attributes much of the success of the early cruises to Girard's zoological knowledge and exceptional qualities. It would be interesting to know more about his precise role in the King's oceanographic endeavors, but clearly his assistance in no way detracts from the monarch's achievements.

Carlos, as he signed his paintings, was an accomplished artist in his own right. His works include studies of Portuguese rural life, landscapes, and, quite naturally, ships. His papers include drawings of his yachts, and the diary of the 1897 cruise (Fig. 1) is lavishly illustrated with his own watercolors (Fig. 2).

In conclusion, and without overlooking the work of such predecessors as Bocage and Capello, it is clear that Carlos de Bragança was a pioneer in the marine sciences in Portugal and that by his contributions to the knowledge of its coastal waters he provided a strong impetus to the development of oceanography. He was assassinated by political opponents in the streets of Lisbon on February 1, 1908, in his 45th year—a tragic loss to the field of endeavor he loved so much.

References

- Bragança, C. de. 1897. *Yacht Amélia*. Campanha oceanográfica de 1896. Imprensa Nacional, Lisboa. 20 pp.
- Bragança, C. de. 1899. *Pescas marítimas, I - A pesca do atum no Algarve em 1898*. Result invest. scient. *Yacht Amélia*, 104 pp., 3 plates, 8 graphics and maps.
- Bragança, C. de. 1902. *Rapport préliminaire sur les Campagnes de 1896 à 1900*. 1 - Introduction, Campagne de 1896. Bull. Camp. scient. *Yacht Amélia*, 1, 112 pp., 1 map, several illustrations.
- Bragança, C. de. 1904. *Ichthyologia. II - Esqualos obtidos nas costas de Portugal durante as campanhas de 1896 a 1903*. Result. invest. scient. *Yacht Amélia*, 115 pp., 2 color plates.
- Bragança, C. de. not published. *Yacht Amélia*. Diário da campanha de 1897. Existing in the Aquarium Vasco de Gama, Lisbon (a fac. simile was published in 1979 by the Portuguese Navy and includes the paper by Ruivo, 1957, and another on the artistic activity of the King).
- Diário náutico do iate real D. *Amélia*. Existing in the Arquivo Geral de Marinha, Lisbon.

Gonçalves, B. D. 1942. Peixes. Colecção Oceanográfica de D. Carlos I, Trav. St. Biol. mar. Lisbonne, 46, 108.

Ruivo, M. 1957. D. Carlos de Bragança Naturalista e Oceanógrafo. Conferência, ed. Fundação da Casa de Bragança, 43 pp., 1 fac. simile, 7 plates (2 in color).

Vilela, H. 1936. Crustáceos Decápodes. Estomatópodes. Colecção Oceanográfica D. Carlos I. Trav. St. Biol. mar. Lisbonne, 40, 215-242.