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Original Article

Biological stations and the study of marine life: Umberto D'Ancona and the Hydrobiological Station of Chioggia (1940 – 1964)

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Marine zoological stations played an important role in the history of biology and the study of marine life. From the 1870s onward, a large number of biological stations were founded across Europe from Naples to Bergen. In the light of the new theory of evolution and the emerging discipline of ecology, it becomes increasingly necessary for biologists to study nature in the field. Beginning in the second half of the 19th century, much of the research on aquatic organisms was conducted at such stations. The aquatic environment appeared to be particularly suitable for research on the theory of evolution, on embryology, physiology, anatomy, and organism – environment interactions. Marine stations also served as sites for the study of fishery management and fish farming and aquaculture. The hydrobiological station located in the town of Chioggia on the Venetian Lagoon represents one of the less well-known examples of such research centres. It was set up in 1940 by the Italian zoologist Umberto D'Ancona of the University of Padua (1896 – 1964), who modelled it on already existing zoology, hydrobiology, and fish farming stations in Italy and abroad. Their research was conducted on the ecosystems of the Venetian Lagoon and the northern part of the Adriatic Sea, the natural stocks of valuable commercial fish species, and the reproductive biology of various teleosts. This essay will review the history of the Hydrobiological Station in Chioggia during the period 1940 – 1964 when it was directed by D'Ancona, its work in the fields of marine biology and fishery, and its ties with other marine stations in Italy and abroad.

Keywords: Adriatic Sea, fishery, marine biology, marine zoological stations, Umberto D'Ancona, Venetian Lagoon.

Introduction

From the second half of the 19th century onwards, marine zoological stations played an important role in the history of marine biology, the history of fisheries, and the history of marine zoology. Following the pioneering work of Margaret Deacon (1971) and others, the recent literature testifies the growing scholarly interest in the history of oceonography. We may cite the work of Helen M. Rozwadowski, who edited a focus section entitled *Knowing the Ocean: A Role for the History of Science* for one of the most prominent journals in the field (Rozwadowski, 2014) and the book of Raf De Bont (2015), who reviewed the history of marine zoological stations in Europe 13 years after the important study by Robert E. Kohler on "labscapes" in biology (2002). The latter topic is particularly important to our understanding of the history of marine and ecological studies, and marine resource management policies over the past century.

In their comprehensive volume on the role of field stations in the United States, the editors Mary Price and Ian Billick show how the establishment of site-focused research facilities have been central to the emergence of ecology as a formal discipline. In their preface, "a third approach" to ecological studies is proposed—an "ecology of place" based on the study of "a single system in depth, often over many years" (2010, p. xi). As the historian of science Sharon E. Kingsland persuasively argues in her chapter, "The Role of Place in the History of Ecology", it must be emphasized to understand "what role certain landscapes have had in the development

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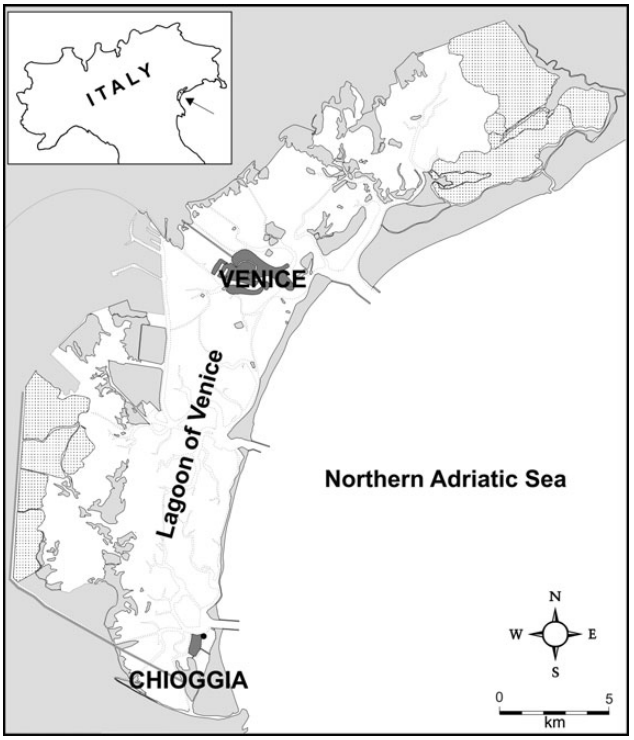

Figure 1. Map showing the location of the Hydrobiological Station of Chioggia on the Venetian lagoon.

or testing of theory" (p. 15). These "landscapes" include the stations founded in Europe and the United States by some of the greatest biologists and zoologists of the time.

Marine stations differed in terms of their institutional status (university, state, local, or private) and purpose, which could range from biological research to education and studies relating to fisheries management, fish farming, and aquaculture. Most of them had to perform a difficult balancing act between pure and applied research.

One of the less well-known examples of such institutions is the Hydrobiological Station of Chioggia. Located on the Venetian Lagoon (Figure 1), it was founded in 1940 by the Italian zoologist Umberto D'Ancona of the University of Padua (1896–1964). Like many of these marine stations, Chioggia is still active today. Its history and the central role played by D'Ancona in the study of the Venetian Lagoon and the upper Adriatic Sea shed useful light on the relationship between biological research and the fisheries industry (Fortibuoni *et al.*, 2014). Identifying the contribution of these institutions could help us to reconstruct past European marine biology and fishery policies and to understand the role that the study of specific ecosystems may have played in the history of biology (Dolan, 2007; Wyman *et al.*, 2009).

The first biological stations

Umberto D'Ancona was well aware of the activities of the zoology, hydrobiology, and fish farming stations of the time in Italy and abroad when he founded the station in Chioggia (Figure 2). He was in close contact with colleagues and institutions around the world, from the United States to Japan, and from Eastern Europe to South America. As shown by his copious correspondence, today preserved in the archives of the Biblioteca Civica and the

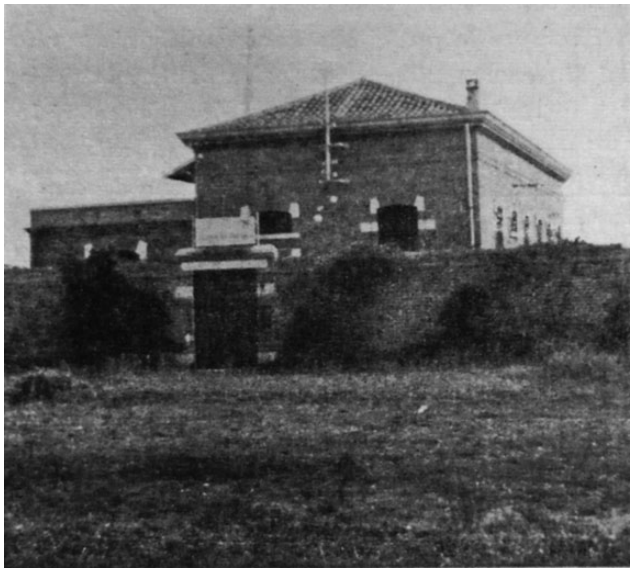

Figure 2. The Hydrobiological Station in Chioggia in 1942. From *La Pesca Italiana,* 1942, 8.

Accademia Galileiana in Padua, among his correspondents were laboratory directors, zoologists, biologists, and ecologists such as Kaj Berg of the Ferskvands-biologiske Laboratorium Hilleröd; Leonard Schultz, curator of the Division of Fishes at the Smithsonian Institution; Charles Elton of the Department of Zoology and Comparative Anatomy at the University Museum, Oxford; and Joel W. Hedgpeth of the Scripps Institution of Oceanography in La Jolla, CA.

D'Ancona's profound knowledge of ecology and marine biology was based on his own field experience (1920–1925) as a member of the Royal Italian Thalassographic Committee. Founded in 1910, in part as a response to the ongoing debate on fishery regulations, the mission of the committee was to support research in theoretical and applied biology, and to transmit pertinent results to the fishing industry (Linguerri, 2005). During this period, D'Ancona published important studies in the area of complex ecological interactions, focusing on variations and fluctuations in the fish stocks of the upper Adriatic Sea and on their impact on the markets of Trieste, Fiume, and Venice, which were a consequence of the forced moratorium on fishing during World War I (D'Ancona, 1926). On this subject D'Ancona worked together with his father-in-law Vito Volterra, a noted mathematician with whom in 1935 he published a monograph, *Les associations biologiques étudiées au point du vue mathématique* (Israel and Gasca, 2002; Gatto, 2009).

D'Ancona was familiar with the debate that, beginning in the second half of the 19th century, had accompanied the foundation of the earliest zoological stations. He was also aware of the gap between Italy and other countries, such as France and Germany, which could rely on government committees and scientific societies for support, as well as on already existing stations on the coast or near inland basins dedicated to marine biology, oceanography, limnology, and fish farming. To rectify this situation, the Italian ichthyologist, Decio Vinciguerra, was instructed by the Italian Thalassographic Committee in 1912 to conduct a survey of the principal European stations, including those in Kiev, Rovinj, Boulogne-sur-Mer, Wimereux, and Plymouth (Vinciguerra, 1912). In the same period journals, such as *Neptunia* and *L'Acquicoltura lombarda*, began publishing articles on the work being done outside of Italy, while newly founded societies for

the promotion of fishing and aquaculture in Venice (created in 1893) and elsewhere sought to raise awareness of the importance of sustainable fishing and to encourage effective policies.

To understand the rise of the biological station and the important role it played in advances in biology over the past two centuries, it is useful to review its history. The first marine biology laboratory was opened in 1843 in Ostend, Belgium by the zoologist Pierre Joseph van Beneden, professor at the University of Leuven. Beginning in the 1860s, France invested substantially in such institutions. In 1859, the embryologist, Victor Coste, founded the marine biology laboratory of the Collège de France in Concarneau on the southern coast of Brittany. A laboratory-aquarium was established in Arcachon in 1866 on the occasion of the International Fisheries and Aquaculture Exhibition and remained in service for research purposes even after the closing of the exhibition. In 1871, the zoologist, Henri de Lacaze-Duthiers, founded a large laboratory of experimental zoology in Roscoff. Two years later, his student Alfred Giard set up the marine laboratory of Wimereux, and in 1881, another facility was opened in Banyuls-sur-Mer. The Millport Station in Scotland came into operation in 1897, while in 1888 a marine laboratory was established in Plymouth, England.

In 1891, the Berlin Aquarium opened an experimental station in Rovinj overlooking the Adriatic Sea, which was expanded and became the Institute of Marine Biology: at the end of World War I, the city fell under Italian rule and the station's name was changed to the Istituto Italo-Tedesco di Biologia Marina of Rovinj. In another consequence of the war, the entire contents (equipment, zoological specimens, and library) of the zoological station founded in 1875 in Trieste by the University of Vienna were transferred to Rovinj in 1915. In Germany, the research station of Helgoland on the North Sea was founded in 1892; even before its creation, the island itself was considered an important site where zoologists, such as Johannes Müller, Carl Gegenbaur, and Ernst Haeckel, carried out field studies. In 1891, Otto Zacharias opened an important limnological station dedicated to the biology of inland waters in Plön, while the laboratory of Bergen, in Norway, was established in 1892. In 1910, the important Musée Océanographique of Monaco was founded.

During this period, the scientific community on the other side of the Atlantic as well was beginning to take an interest in marine biology and hydrobiology. One of the first stations to be established in the United States was the Anderson School of Natural History, founded by the Swiss zoologist Louis Agassiz in 1873 (shortly before his death) on Penikese Island, just off the coast of Massachusetts. In 1877, his son Alexander Agassiz established a marine laboratory in Newport, Rhode Island, which closed in 1910. In 1878, the Johns Hopkins University started the Chesapeake Zoological Laboratory. In 1888, the Marine Biological Laboratory of Woods Hole was established and became a major research centre where during the course of the 20th century many eminent biologists, including D'Ancona, came to do research. In 1892, Stanford University founded the Hopkins Seaside Laboratory on the coast of California (Kofoid, 1910; Vaughan *et al.*, 1937; Jack, 1945; Egerton, 2014).

The Italian scenario

Compared with the thriving international scene, what was the situation in Italy? Despite its long coastline and wealth of inland freshwater basins, despite the efforts made by the scientific community and the government, Italy failed to create a strong network of state, academic, civic, and private stations until the first decades of the 20th century. Even then, usually the institutions were forced to work on limited budgets and many failed to survive. Such was the case of the Limnological Station of Lake Bolsena founded in 1901 and directed by Luigi Palazzo of the Italian Bureau of Meteorology and Geodynamics. Other examples include the Laboratory of Quarto dei Mille in Genoa, created in 1911 by the marine zoologist Raffaele Issel, and the modest marine station established not far from Genoa, in Rapallo, in 1889 by a professor of the University of Turin. Even the landlocked city of Milan opened a Civic Station of Biology and Applied Hydrobiology in 1908, but had to close its doors just 20 years later.

In the area of applied research, in 1895, the Ministry for Agriculture, Industry, and Commerce established a fish cultivating station in Rome with equipment from the defunct Aquarium of Rome. A similar station was set up in Brescia in 1887, with different branches around the region specializing in applied research. The operation of restocking the major lakes and rivers of northern Italy was run from the main station in Brescia. In 1888, a fish farming station was opened by the local authorities in the province of Belluno with the support of the Italian government.

One of the most important marine biology institutes in Italy was founded in 1872 by the German zoologist Anton Dohrn. The Zoological Station of Naples would serve as a model for many other research centres, including the renowned Woods Hole Oceanographic Institution. During the course of the 20th century, other institutions were established in Italy, such as the Biological Station of the University of Cagliari set-up in 1909 on the island of Sardinia, which was directed by Ermanno Giglio-Tos and later became the Marine Biology Station of the Tyrrhenian Sea. Research continued even during the First World War, when the Central Institute of Marine Biology of Messina (1916) and the Marine Biological Laboratory of Taranto (1914–1918) were created.

The 1930s and 1940s were a particularly fertile period and important hydrobiology stations sprang up in different parts of Italy: the Central Laboratory of Hydrobiology in Rome (1921), the Marco De Marchi Institute of Hydrobiology in Pallanza (1938), the Observatory for Marine Fisheries of Venice, and the Marine Biology Laboratory in Fano (1939). In 1941, the Experimental Thalassographic Institute of Trieste (originally founded in 1840 as the Imperial Royal Meteorological Observatory) replaced the Geophysical Institute of Trieste. At the end of War World II, in 1947, the Thalassographic Research Center of the Consiglio Nazionale per la Ricerca (CNR, or National Research Council) began its activities in Venice.

When D'Ancona set up the Station of Chioggia in 1940 the picture was mixed, with some institutions being forced to close, others successfully continuing their activities (e.g. in Naples and Messina), and new stations being created (Kofoid, 1910, 7–34; Jack, 1940; FAO, 1957; Hiatt, 1963, 99–105; Linguerri, 2010).

Beginning in the second half of the 19th century therefore, much of the biological research in Italy was already being conducted on aquatic organisms and ecosystems in zoological stations. The aquatic environment was particularly suited to research on the evolution, embryology, anatomy, and physiology of marine life forms, and on the interactions between these organisms and the environment. During the second half of the 20th century, alongside the Zoological Station of Naples, a prominent role was played by the Italian Institute of Hydrobiology in Pallanza (now the CNR Institute for the Study of Ecosystems), which was inaugurated on 29 September 1940. Located on the shores of Lake Maggiore, this was the first institute in Italy dedicated to the study of natural population genetics and evolutionary synthesis. From its founding, Umberto D'Ancona actively collaborated with colleagues at the

institute in Pallanza. For example, he helped to organize an international symposium on ecological and genetic factors in the speciation of animals, which was held from 29 July to 2 August, 1948 and attended by internationally renowned geneticists and biologists such as John B.S. Haldane, Theodosius G. Dobzhansky, and Adriano Buzzati-Traverso.

Marine stations: combining basic and applied research

The history of many of these marine stations was marked by a tension between the interests of commercial fisheries and those of basic research. In Italy as elsewhere, particularly in the smaller, local institutions, biological research was carried out with a view to its applications in the fields of fishing, lagoon fish breeding, aquaculture, and fish farming. Hydrobiological studies, in fact, had potentially important economic and social repercussions in terms of the better use of resources by the food industry and the recognition of fish as an excellent, low-cost source of protein. A thorough knowledge of the physiology, reproductive system, diseases, and natural environment of fish was a necessary precondition for the development of fisheries and aquaculture and for the rational exploitation of marine resources.

In some countries, especially in Italy where funding was scarce, competition between basic and applied research for government support resulted in few new stations being built and many of those already in existence being forced to close. This situation generated considerable debate between those who defended the need for research institutes such as the Zoological Station of Naples, and those who placed priority on the practical and economic applications of research, as Margaret Deacon has shown was the case in Great Britain (1993).

To understand the scientific reasons for the establishment of marine biology stations during the second half of the 19th century, the comments of Anton Dohrn are enlightening. His station quickly became one of the most important centres for experimental research in the fields of marine biology, embryology, and physiology (Groeben, 2002). In Dohrn's view, marine stations had a key role to play in the renewal of the life sciences in this period. Laboratories and aquariums allowed zoologists to conduct their work, which could sometimes be extremely complex, with a surplus of material, as on the Mediterranean coast. The stations not only allowed naturalists to carry out studies in the field, but also provided the *facilities* necessary to survey animals in their natural environment and to programme biological research in the light of Darwin's theory of natural selection and the emerging field of ecological studies pioneered by zoologists such as Karl Möbius. Dohrn laid out these notions in a heartfelt letter sent to Darwin from Stettin on 30 December 1869. At that time, 10 years after the publication of the *Origin of Species*, Dohrn's plan to open a marine station was slowly taking shape in his mind:

> Having stayed now several times on the seashore for zoological studies, I have found how difficult it is to study Embriology without an Aquarium. This want has suggested me the idea of founding not only Aquariums, but Zoological Stations or Laboratories on different points of our European coast. Such a Station should consist of a little house of perhaps four rooms, an Aquarium connected with the sea and the house, – the Aquarium of perhaps 60 feet in Cubus, where one might have streaming water, – a boat for dredging work, dredges, nets, ropes, – in short, all that is necessary for a marine Zoologist. Besides glasses larger tumblers, bottles; Acids and other chemical objects, and lastly a library. [...] If such a Station is ready, every Zoologist might go there, have all instruments at hands, even more, than he would ever have afforded by his own means [in Groeben (1982, 25–26)].

Underlying the creation of new zoological stations was therefore the desire felt by the entire community of biologists to share their facilities, knowledge, and experience. Dohrn closed his letter with expressions of hope that he might obtain the support of the English naturalist for his project: "I think this plan has nothing fantastical or utopian round it,—so I may not risk Your displeasure in communicating it to you; in the contrary I hope to meet Your consent, which is the chief thing I could now strive at" [in Groeben (1982, 27)].

Some years later, another marine biologist, the American Charles A. Kofoid (Dolan, 2007), was commissioned by the Bureau of Education of the Department of the Interior (Washington, DC) to prepare a report on the biological and hydrobiological stations in Europe. Kofoid underlined the importance of conducting research in the natural habitat of the organisms under study rather than on preserved specimens. In the opening lines of his report he noted: "A decade after the publication of *The Origin of Species* the fructifying influence of the new idea had not only brought new zest to classroom instruction and made the biological laboratory an inseparable part of the equipment of a university, but it also sent the investigator forth from the museum and laboratory to that greatest of the arenas of organic evolution, the seashore" (1910, 1). Seeking a balance between basic research and practical objectives, he observed that "[...] such stations should be free from the domination of economic interests, though it might be to the great advantage of both if the fisheries interests and the research stations should stand in an advisory and cooperative relation to one another" (1910, 3).

The Hydrobiological Station of Chioggia: an outpost in the Venetian lagoon

Aquatic life would form the primary focus of Umberto D'Ancona's research beginning with his first appointment as a graduate student by the Italian Thalassographic Committee in the early 1920s, where he worked under the supervision of Giovanni Battista Grassi, a physician and professor of zoology at the University of Rome. During his career, D'Ancona (Figure 3) would be invited to join international committees such as the Commission for the Scientific Exploration of the Mediterranean Sea, the UNESCO Commission for Oceanography, and the FAO's General Fisheries Council for the Mediterranean, of which he also served as president for a time. He held many prestigious positions in Italy, becoming a member in 1947 of the Governing Council of the Institute of Adriatic Sea Studies (founded in Venice in 1933) and in 1953 director of the CNR's Thalassographic Center in Venice which in 1955 became a national institution (Canadelli, 2015, 13–45).

In his work, D'Ancona managed to achieve a goal that was pursued with less success by many other Italian scientists before and after him—to combine scientific research and practical applications in a fruitful symbiosis. He pursued his research in the areas of hydrobiology, oceanography, and marine biology while keeping in mind the problems of fisheries management and the conservation of fish stocks, which remain as relevant today as they were in his time. As a young researcher, D'Ancona published papers on fishing and marine and freshwater fauna, and over the years the

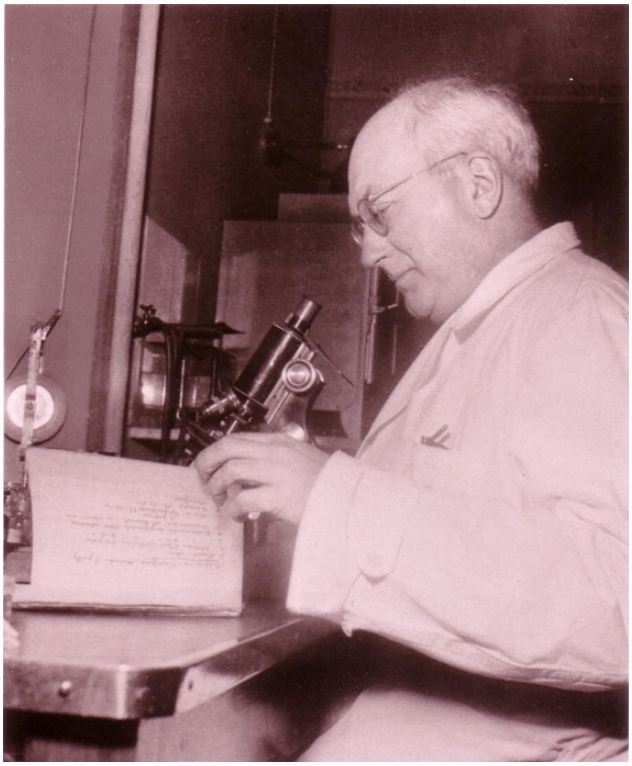

Figure 3. Umberto D'Ancona at work in his laboratory. From Battaglia, 1966.

number of his publications on these topics increased, many of them produced in collaboration with the FAO [for a complete list of D'Ancona's publications, see Battaglia (1966) and Stefanelli (1966)]. He wrote papers on the biology of eels, on the determination of the sex of fish, on speciation in salmonids, and on fish stocks in the Mediterranean Sea. He also studied the dynamics of fish populations in ecosystems such as lakes, the Venetian lagoon, and the upper Adriatic Sea. The aquatic environment allowed him to investigate the interdependence between biological, ecological, genetic, and environmental phenomena *in situ*, and to shed light on important practical issues relating to the management of fisheries and fish stocks in the Mediterranean Sea, and more particularly the upper Adriatic Sea (D'Ancona, 1926, 1949–1950).

D'Ancona was aware of the important role that could be played in research by hydrobiological stations. For this reason, he made it a priority to set up a station in nearby Chioggia when he took up his post as a professor of zoology and comparative anatomy at the University of Padua in 1937. He intended this station to serve as a crucial outpost for the study of the lagoon and its fauna. D'Ancona was already familiar with this ecosystem, having conducted research during the 1920s and 1930s on the fauna of the Upper Adriatic and on the sexual differentiation of the eels of the Venetian lagoon. In his view, the activities being carried out by other research entities in the area, such as the Venetian Institute of Sciences, Letters and Arts, the Magistrate of the Waters, the Civic Museum of Natural History of Venice, and the Observatory for Fishing in Venice, were insufficient. D'Ancona was convinced that it was "necessary to move to a more detailed investigation and to address specific issues with continuous observations and experimental means" and that this work could best be done at a hydrobiological station (1941: 128).

Installed on the Island of San Domenico in a former health station located close to the open sea, the laboratory went into operation in 1941. Chioggia is a busy port town overlooking the lagoon and continues to host one of the largest fish markets in Europe. It was therefore the ideal site for an institution whose original mission was biological research, but whose scope included the applications of research to fisheries and valliculture. Chioggia was chosen by D'Ancona for a number of reasons: it could be easily reached from Padua and the university; its waters were much less polluted than those of Venice; and it had a long history as a site for fishing activities and for studies on marine fauna beginning in the 18th century with naturalists such as Lazzaro Spallanzani, Giuseppe Olivi, and Stefano Andrea Renier. Chioggia was, in fact, uniquely situated in proximity to the lagoon, the Adriatic Sea (this being one of three Venetian canal-ports opening onto the Adriatic Sea, through which tidal currents flow in and out), the Po River Delta, and many *valli*—bodies of brackish water provided with weirs to separate them from the sea, which have been used in Italy to cultivate fish during their seasonal migrations. As D'Ancona explained, the Venetian Lagoon was a basin of ~58 600 hectares created by the flooding of the Brenta, the Piave, and other smaller rivers. Down through the centuries, this unique environment has been strongly influenced by the political, military, and economic requirements of the city of Venice. The first human impact on the area's environment resulted from: (i) the diversion of rivers which were made to flow into the sea from points outside the lagoon; (ii) the regulation of traffic to the open seas, access to which could be gained only through the three canal-ports of Lido, Malamocco-Alberoni, and Chioggia; and (iii) the separation of the seawaters from the lagoon waters by the construction of dikes (D'Ancona *et al.*, 1954: 14–15).

Umberto D'Ancona's goal was to make the hydrobiology station of the University of Padua an important centre for basic and applied oceanographic research. D'Ancona was not the first to attempt to establish a zoological station on the lagoon, but he succeeded where his predecessors had failed. Before him the Darwinian zoologist and professor at the University of Padua from 1869 to 1900, Giovanni Canestrini, was commissioned in 1884 by the Italian government—acting on the advice of the Fishery Advisory Commission—to draw up plans for a zoological and fish farming station to be built in the lagoon between the provinces of Ferrara, Rovigo, and Venice. The stated objective of this station was to promote the development of valliculture and lagoon and marine fishing. If realized, it would indeed have been of great benefit to the fishing industry and related activities, contributing to the drafting of more up-to-date legislation on fisheries. After years of discussion and a succession of proposals, the project was finally abandoned in 1896 (Bullo, 1890; Gibin, 2003). Among the reasons for this was the difficulty of reaching a compromise between those who wanted to place the emphasis on scientific research and those who were more interested in the commercial and practical side of the station's activities. In fact, the idea of creating a station of hydrobiology and fish farming in the lagoon area was not new, having been contemplated by local and government administrators, zoologists, and fish farmers since the middle of the 19th century.

Between 1920 and 1921, the director of the Royal Bacological Station of the University of Padua, Luciano Pigorini, and the ichthyologist Emilio Ninni made a second attempt to establish a marine biology laboratory, emphasizing the need for such a station close to Venice and referring explicitly to the project by Canestrini. In their comprehensive report addressed to Giovanni Magrini, director of the Hydrographic Office of the Magistrate of the Waters of

Venice, the two scholars put forward reasons similar to those presented by Anton Dohrn half a century earlier (Pigorini and Ninni, 1921). In their view, biological stations were indispensable facilities for research in the life sciences, and their laboratories could provide important information to both biologists and fishers, who needed to have a profound knowledge of the environment in which they were working. However, Pigorini and Ninni's initiative proved to be no more successful than the others.

Finally, thanks to Umberto D'Ancona's determined efforts, in 1940, a modest research station was set up in Chioggia. In 1942, it consisted of two rooms which were used as aquariums, three workrooms, a preparation room, a small pump room, and some utility and storage rooms. All the aquariums used water drawn directly from the lagoon, with an average salinity of 34.5 parts per 1000. The water was pumped into two tanks before passing into the aquariums; to ensure a constant degree of salinity, freshwater was added when necessary. The main purpose of the station was to study the biology of the lagoon, in particular marine life in waters with different salt concentrations. D'Ancona immediately began to keep a daily log of the density and temperature of the lagoon waters. To study the hydrobiology of the lagoon, D'Ancona set up a project in 1947 that involved monitoring the waters flowing in and out of the canal-port of Chioggia (a site that was relatively sheltered from boat traffic, and located to a convenient distance from the Hydrobiological Station) and their biological charge. His research group carried out regular tests, drawing water and plankton samples from both the outgoing and incoming tides. In addition to basic research, the station conducted studies on practical issues such as the biology of commercial fish species. As D'Ancona noted, with the establishment of this institution, Italy finally had "another center for the study of hydrobiological issues. The network of stations and observatories that is being completed around our coasts will give us the possibility of an ever deeper understanding of life in our coastal waters" (1942, 7).

With the end of World War II, the station began to operate at full capacity. D'Ancona concentrated his attention primarily on how to increase the productivity of the fishing industry, a problem of pressing interest for the country's economic recovery. Between 1946 and 1947, the facilities of the station were completed with the addition of a chemistry laboratory, a darkroom, a meeting room, and a common room. In 1953–1954, a boathouse was built, and between 1955 and 1960 the station constructed an annex to house the many scholars who came to Chioggia to conduct research. Between 1962 and 1963, a new caretaker's house was erected next to the main building. In 1950–1951, the station acquired the *Velella*, a lagoon boat with an outboard motor that could carry biological samples from the lagoon. Despite regular requests for more funding and staff (attested to in documents conserved in the historical archives of the University of Padua, *Archivio del Novecento*, *Atti Rettorato*), during D'Ancona's tenure the staff at the station remained relatively small, consisting of a director (D'Ancona himself), aided beginning in 1946 by an assistant who was appointed annually (Armando Faganelli 1946–1953 and Carlo Mozzi 1954–1964), and from 1956 one or two volunteer research assistants, such as Agostino Parise, Anna Maria Varagnolo, and Anna Maria Duò, and a caretaker (see *Annuario dell'Università degli Studi di Padova*, from 1946–1947 to 1963–1964).

Together with an outstanding team of collaborators (Faganelli, Mozzi, Parise, Varagnolo, Duò, and assistants connected with the Institute of Zoology of Padua, such as Bruno Battaglia, Armando Sabbadin, and Simonetta Merlo), D'Ancona moved on several fronts in synergy with the city of Chioggia, the University of Padua, CNR's National Thalassographic Center in Venice (which also provided financial support for the station), the Valliculture Cooperative of Chioggia, and Venice's Observatory for Fishing. Within a few years, the station earned a reputation as a reliable source of information for those engaged in fishing, valliculture, and related activities. D'Ancona managed to establish a respected position for the station of Chioggia within a network of partnerships with the local community and sister institutions in Italy and abroad.

The station was attached to the University of Padua and published its results under the auspices of the Institute of Zoology, but its facilities were open to all Italian and foreign scholars engaged in lagoon research. Based on the visitors' register of the station, which was started in 1953, and the official logbook of the Institute of Zoology (maintained by its directors since the middle of the 19th century, see Cenni storici risguardanti il Gabinetto di Storia Naturale dell'Imp. R. Università di Padova, 1735–1966–67), we know that scholars from many countries came to do research at the station, including the engineer Dinko Morovich of the Oceanographic Institute in Split (1951–1952, 1952–1953, and 1963), Helmuth Gams, a botanist at the University of Innsbruck (1952 and 1953), and Luis Lozano Rey, a zoologist at the University of Madrid (1951). In the register, we also find the signatures of many Italian biologists, hydrobiologists, and geneticists, such as Livia Pirocchi Tonolli and Vittorio Tonolli, from the Institute of Hydrobiology of Pallanza and Adriano Buzzati-Traverso from the University of Pavia. Representatives of illustrious research institutes around the world also passed through Chioggia, such as M.J. Girard, secretary of the FAO's General Fisheries Council for the Mediterranean; A.R. El Bolock of the Alexandria Institute of Hydrobiology in Egypt, who visited the station in 1956; and the Japanese biologist Yoshimi Morita from the Tokyo University of Fisheries, who came in 1960. Fisheries historians visited the station in search of data as well (see Università di Padova, Stazione idrobiologica di Chioggia, 1953–1997) (Figure 4).

D'Ancona and his collaborators participated in many international conferences and themselves spent periods abroad doing research in the most important scientific institutions of the time, such as the Marine Biological Laboratory at Woods Hole, the Musée Océanographique of Monaco, the Gothenburg Oceanographic Institute, the Plymouth Marine Laboratory, and the Zoological Station in Naples.

Following the example of biologists such as Charles Kofoid, education and training were another priority for D'Ancona. Therefore, academic and research training courses were organized at the station for the students of Padua. Thanks to the *Annuari*, we know that the number of students who presented research theses on topics relating to the Venetian Lagoon during D'Ancona's tenure ranged from one in 1952–1953 to four in 1956–1957. Some of these students later became assistants at the station. Under D'Ancona's direction, new courses were created in subjects such as hydrobiology and fish farming; just a few weeks after his death, in September 1964, the station inaugurated its first course in marine biology, which constituted an important legacy of D'Ancona's scientific work in Padua.

The station received an annual budget of 220 000 lire from the University of Padua, with extra funds allocated year by year for special projects. Engaged on four fronts—academic teaching, lectures for the general public or for fishers and others engaged in the fishing industry, scientific research, and applied research relating to the economics of fishing and the management of *valli*—the station managed to obtain supplemental funding from the municipality of Chioggia and the Valliculture Cooperative of Polesine (in order, for example,

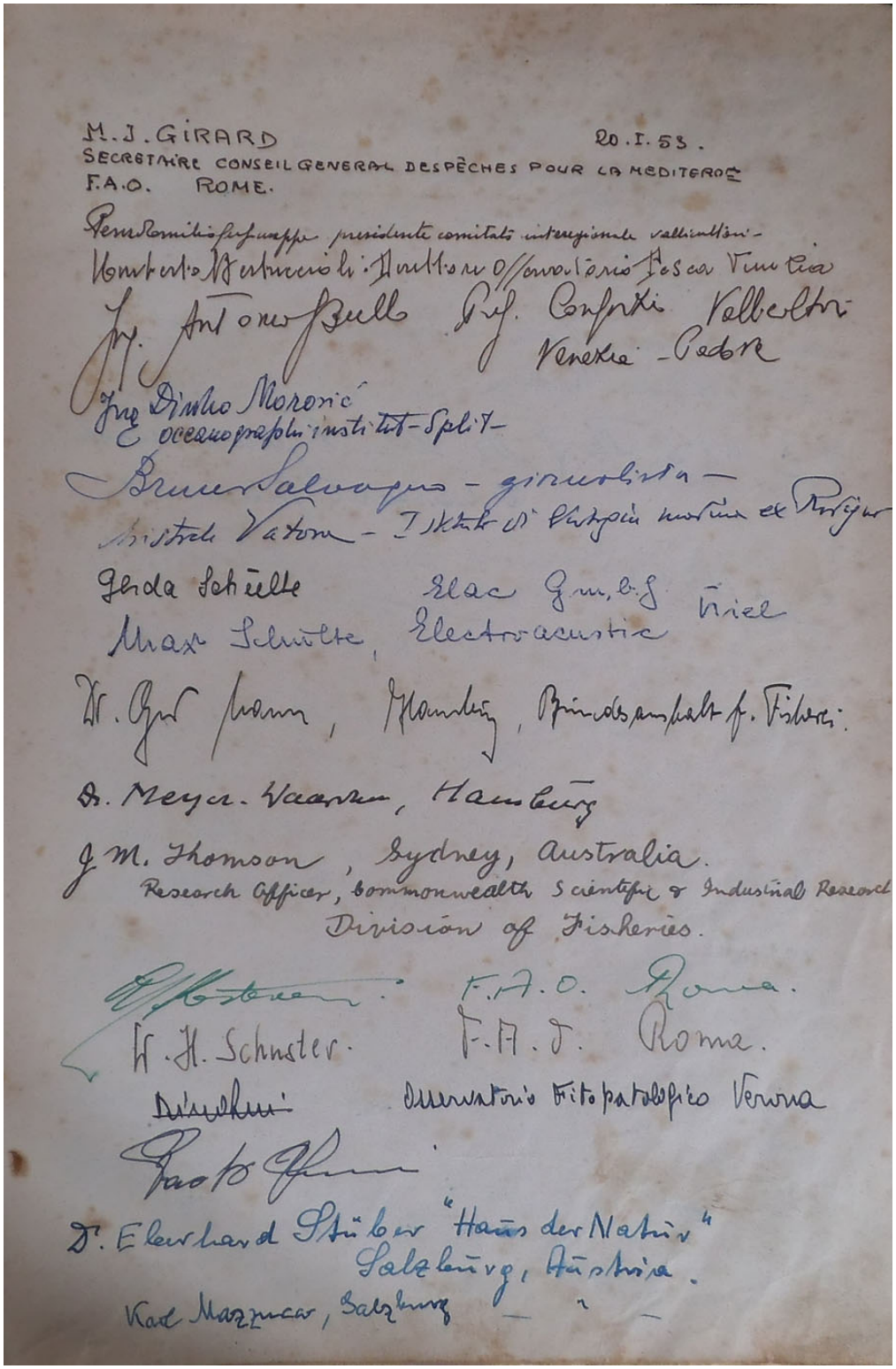

Figure 4. The first page of 1953 of the visitors' register of the Hydrobiological Station in Chioggia.

to finance the construction of outdoor fish farming pools). Grants came primarily from the CNR National Thalassographic Center in Venice, while the office of the Magistrate of the Waters allowed the station to use its facilities to conduct research in the northern part of the lagoon.

Some of the most important work carried out during D'Ancona's tenure from 1940 to his death in 1964 consisted of studies of the ecosystems of the lagoon and the *valli*, the dynamics of the interchange between marine and lagoon waters, and detailed analyses of the composition and physical characteristics of the lagoon's waters

(temperature, salinity, physical, and chemical characteristics, etc.). Much of this work was done by D'Ancona's assistant, Armando Faganelli, in collaboration with the Thalassographic Institute of Trieste and the National Thalassographic Center in Venice.

As a part of its activities during the International Geophysical Year (1957–1958), the station launched a project to study the distribution of marine plankton in the Northern Adriatic Sea, as well as a series of limnological analyses of Lake Garda (conducted by Simonetta Merlo). A significant part of the station's research focused on the reproductive biology of many teleost species, on fish stocks (especially those of commercial interest), and on the biology of edible fish (in particular eels, sea bream, mullet, gobies, and sardines). For example, Carlo Mozzi studied the Northern Adriatic sardine, including analyses of the sales statistics furnished by the markets of the Adriatic, while Bruno Battaglia investigated the selective pressure of the lagoon environment on benthic copepods and Armando Sabbadin studied the biological cycle of the ascidians in the Venetian lagoon. D'Ancona continued his work on the hermaphrodite gonads of the sea bream and the sexual differentiation and distribution of eels. He also worked on fishing and fish culture in brackish-water lagoons and the Adriatic Sea. In August–September 1955, he participated, together with his assistants Faganelli and Mozzi, in an oceanographic expedition to study the Adriatic Sea organized by the CNR's National Thalassographic Center in Venice in collaboration with the Thalassographic Institute of Trieste.

The studies conducted at the Hydrobiological Station and the Institute of Zoology of Padua appeared gathered together and reprinted in *Pubblicazioni dell'Istituto di zoologia e anatomia comparata e della Stazione idrobiologica (Chioggia) dell'Università di Padova* (see Appendix). D'Ancona and his collaborators published articles in Italian journals such as *Atti dell'Istituto Veneto di Scienze Lettere ed Arti*, *Archivio di oceanografia e limnologia*, and *Bollettino di zoologia*, and presented papers at international meetings organized by institutions such as the FAO's General Fisheries Council for the Mediterranean or the Commission for the Scientific Exploration of the Mediterranean Sea. These publications demonstrate that in the space of 20 years, D'Ancona succeeded promoting both basic and applied research on problems relating to the Venetian lagoon, as proved, for example, by the 1954 study on the lagoon's plankton published in the journal *Archivio di oceanografia e limnologia*.

Conclusions

Hydrobiological stations have historically and will continue to play a key role in marine research. The case of the station set up by Umberto D'Ancona at Chioggia is exemplary, showing the contribution that such institutions can make to our understanding of the complex ecosystems of specific areas, where environmental and economic issues intertwine with topics of strictly scientific interest.

Although founded some decades after the "golden age" of the first great hydrobiological stations established during the second half of the 19th century, the history of the station at Chioggia, which was dedicated to research on a unique lagoon environment, sheds interesting light on the history of marine biology and fishery biology in Italy and Europe. D'Ancona succeeded where many zoologists failed, placing his "little laboratory" at the disposition of an international network of marine scientists and conducting research that was of benefit not only to scholarship, but also to the local fishing community and the fishing industry.

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Appendix: List of the publications produced by the Hydrobiology Station at Chioggia

Between 1941 and 1964, the articles published by the staff of the marine station at Chioggia or based on research promoted by this station appeared gathered together and reprinted in the periodical *Pubblicazioni dell'Istituto di zoologia e anatomia comparata e della Stazione idrobiologica (Chioggia) dell'Università di Padova* together with other contributions from the staff of the Institute of Zoology of Padua. I reviewed the *Pubblicazioni* and included below are all the articles published by staff members at the station and by researchers at the Institute of Padua who occasionally worked in Chioggia:

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