

Marine Biology in the Adriatic Sea: An Historical Review

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“Aristotele, Ovidio, Giovenale, Plinio e Marziale parlano, benché di paesaggio, in lode a qualche adriatico prodotto, specialmente commestibile...” (Aristotle, Ovid, Juvenal, Pliny and Martial all speak not so much of environments, as in praise of the products of the Adriatic, especially edible ones...”). It is with these words that Giandomenico Nardo presents his “Bibliografia cronologica della fauna del Mare adriatico” (Chronological bibliography of the fauna of the Adriatic Sea, Nardo, 1877), listing in chronological order, from the 16th century to 1875, with concise descriptions of the contents, all the works having as their subject the Adriatic Sea and its lagoons. He reviews works of the 16th, 17th and 18th centuries in which are described species of fish, molluscs, crustaceans and “sea stones” in the Adriatic. Some of the authors he cites are little known; others belong to the more famous ranks of scholars of natural history of those centuries: Bonanni, Vallisneri, Zanichelli, Marsili, Janus Plancus, Vianelli, Grisellini, Vandelli, etc. Among the works of the early 18th century, there are those by Antonio Vallisneri senior (1661–1730) (Fig. 1) on the discovery of ovaries in a mature eel from the Lagoon of Comacchio (Vallisneri 1715), and Gian Girolamo Zanichelli (1662–1729), who reported the presence of a “sea calf” (monk seal) off Rovinj in 1720 (Zanichelli 1720). It was as early as 1725 that the Bolognese Luigi Ferdinando Marsili, founder of the Accademia delle Scienze di Bologna, published his “*Histoire physique de la mer*” (Marsili 1725), a work that was unanimously recognized as the foundation of all later oceanographic studies (Fig. 2).

There is, however, one volume, “*Della storia naturale marina dell’Adriatico*” (The natural history of the Adriatic Sea) by Vitaliano Donati (1750), that must be considered a milestone in the

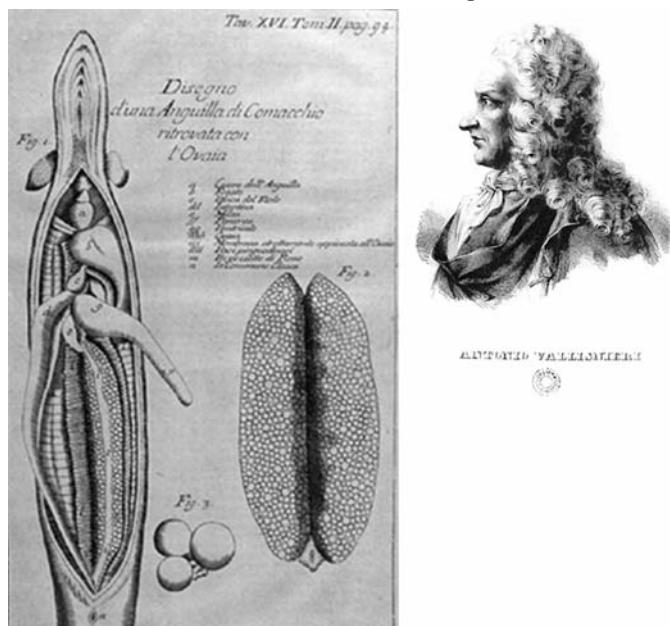


FIGURE 1. Antonio Vallisneri senior (1661–1730), the plate with the description of the ovary of an eel (from “*Opere Fisico-Mediche stampate e manoscritte del Kavalier Antonio Vallisneri raccolte da Antonio suo figliuolo*” Venezia, 1733).

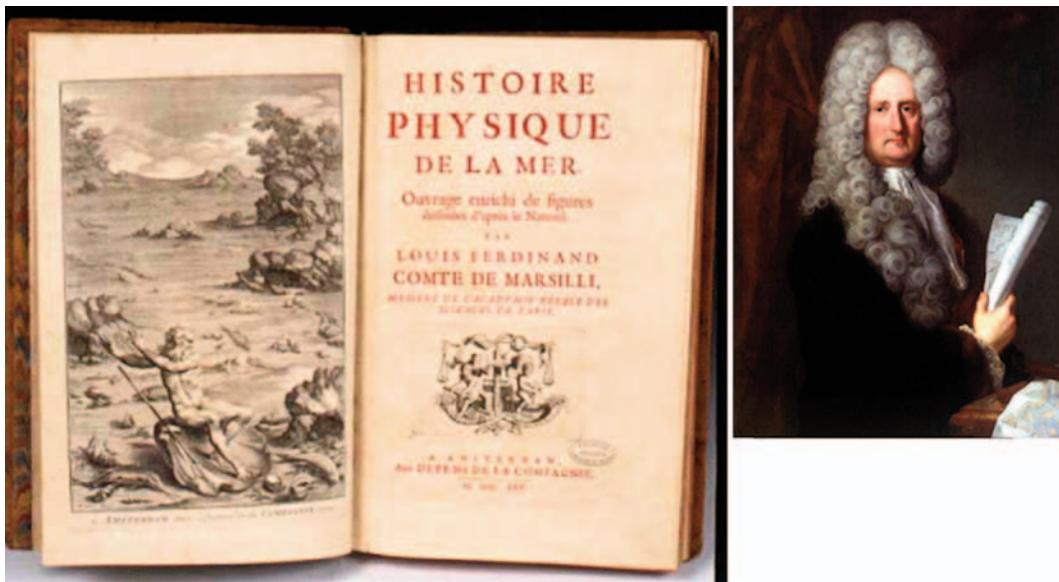


FIGURE 2. Luigi Ferdinando Marsili (1658–1730) the founder of the “Istituto delle Scienze” at Bologna. He wrote the first treatise on oceanography.

sector (Fig. 3). Donati, from Padova, took his degree in Philosophy and Medicine at the *Università degli Artisti*, as it was then called. Two of his teachers were Giovanni Poleni (1683–1761), a physicist and engineer, founder of “Experimental Philosophy” at the University of Padova, and Antonio Vallisneri junior (1708–1777), the only son of his famous father (Antonio Vallisneri senior), to whom the official histories have not devoted much attention. Relegated to the status of a background figure, Vallisneri Jr. is mainly remembered for having donated his father’s collections to the University of Padova, for editing his father’s posthumous works (“*Opere Fisioco-Mediche stampate e manoscritte del Kavalier Antonio Vallisneri raccolte da Antonio suo figliuolo*” Venezia, 1733), and for himself being the first professor of Natural History, from 1734 to 1777.

In 1742, Donati accompanied Poleni to Rome, where the latter had been asked to restore the dome of St. Peter’s. A meeting with the ecclesiastical physician Antonio Leprotti revealed the pos-



FIGURE 3. Vitaliano Donati (1717–1762). A recent (1999) anastatically reproduced copy of his work: “*Della storia naturale marina dell’Adriatico*”.

sibility of a natural history campaign in the Kingdom of the Two Sicilies. The plan was to collect fauna, flora and "petrifacts" in the area, in order to set up a natural history museum to be annexed to the chair of Natural History that Pope Benedetto XIV intended to institute at the University of Rome, a position to which Donati aspired (he was not granted it, but did obtain another at Turin, in 1750). However, Donati did not carry out the campaign, as an outbreak of the plague at Messina caused him to cancel all his plans. His research, therefore, moved to the area then called Illyria, between Dalmatia and Albania, in the eastern Adriatic, and his survey may be considered the very first natural history oceanographic campaign. The survey came to an end in 1745 and Donati prepared a report on it in the form of an essay (with 10 plates of drawings, dedicated to Leprotti), which was published in Venice in 1750. In this essay, which was extremely popular in Europe (one translation in French was published eight years later in Holland), Donati first provided a physico-geological picture of the bottom of the Adriatic Sea, within the framework of those studies, begun by Ferdinando Marsili, that maintained that the structure of the sea bed was like that of the surface of the earth. In the scientific ambit, Donati's work, which stimulated much more research in later years, covered many different subjects: he did in fact discover and describe in great detail new natural marine objects such as the "Virsoid" (*Fucus*) or "Cesalpino" (*Acetabularia*), algae that were abundant in several places in the Adriatic (Fig. 4). At the same time, his deep study and morpho-functional discussions led him to show the validity of some hypotheses which had given rise to lively debate among 18th-century scholars. Examples are the "animality" of coral and sponges. Observing polyps meticulously under the microscope, Donati revealed the similarities between these organisms, until then believed to be flowers or minerals, with other, already known, marine animals. He not only made great contributions to our knowledge of the rich marine heritage, but also anticipated results later confirmed by other scholars. At the same time, he represented nature according to the image of a "network"—an undoubtedly original idea with respect to that of the early 18th century, based as it was on the concept of a simple "chain of beings".

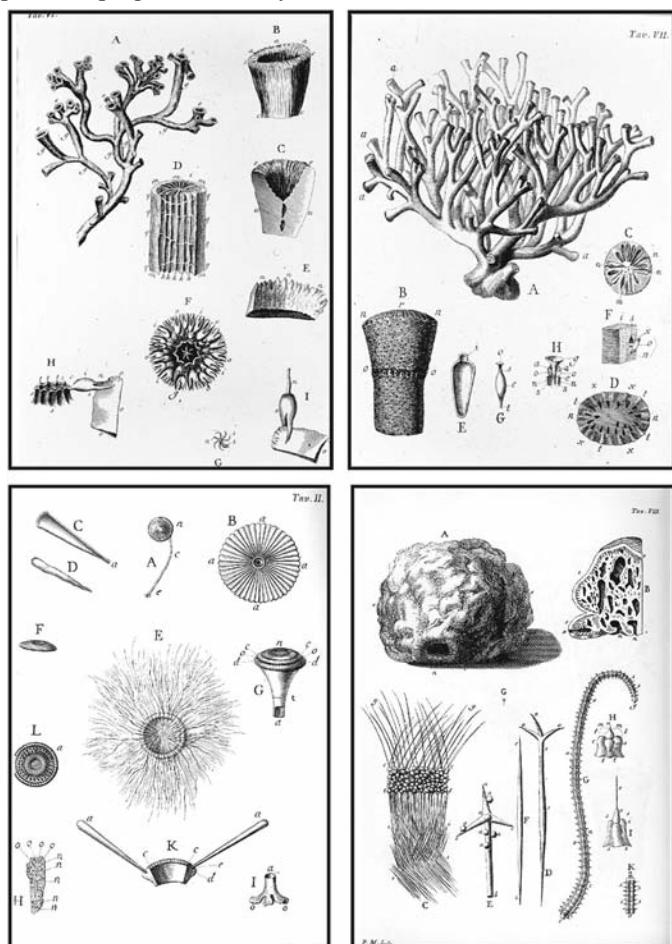


FIGURE 4. Some drawings of V. Donati from "Della storia naturale marina dell'Adriatico".

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During the last 25 years of the 18th century and up to about 1850, a true centre for scholars of Natural Sciences, devoted in particular to marine biology, developed at Chioggia. The entire Chioggia school, from its founder, Giuseppe Valentino Vianelli (1720–1805), to Giuseppe Olivi (1769–1795), from Stefano Chiereghin (1745–1820) to Giandomenico Nardo (1802–1877), assistant to Stefano Andrea Renier (1759–1830), professor of Natural History at Padova (Fig. 5) and discoverer, in 1793 (Renier 1793), of a new type of *Botryllus* (which Lamarck had called *Polyclitus renieri* in his honour), and Fortunato Luigi Naccari (1793–1860), who as early as 1837 attempted, unsuccessfully, to found a Museum of Natural Sciences at the Episcopal Seminary at Chioggia (Nardo 1867). Giuseppe Olivi is the best-known of these. His most important publication, "Zoologia Adriatica" (Fig. 6), appeared in 1792. This volume was composed in epistolary form, following the custom of the time, addressed to Alberto Fortis (1741–1803), another Paduan, an ecclesiastic by career but a naturalist by vocation, devoted to studies on marine zoology, in the tradition of Donati. Olivi's work was published at the end of the century (Fig. 7) and is certainly the most important result of that movement of exploration of all the lagoonal and marine waters that developed in the second half of the 18th century, notably in the Veneto. Olivi provided the first example of the application of mathematical criteria to the study of the shape of living forms (Fig. 8), at the same time indicating a quantitative type of approach to marine zoology. He also discussed the importance of defining study areas properly, and remarked on the need to relate living beings to the characteristics of the environment in which they lived and to understand the relationships between organisms of the same species and of different species. He anticipated ecological and zoogeographic concepts,



FIGURE 5. Some scholars of the "Chioggia group of marine naturalists of '700-'800".

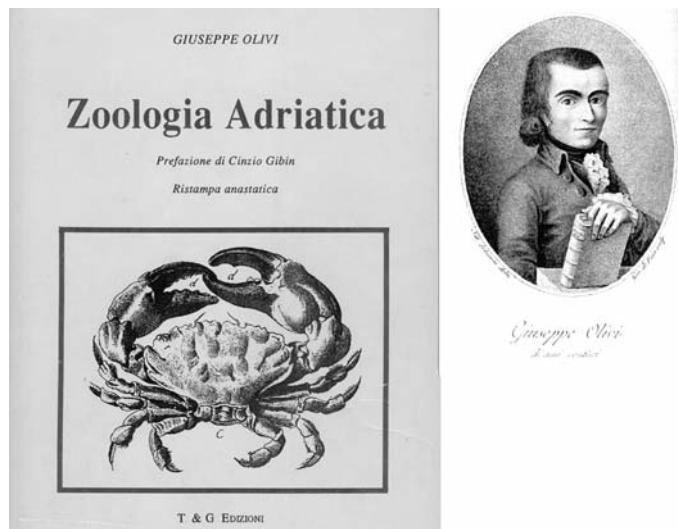


FIGURE 6. Giuseppe Olivi (1769–1795) and the anastatically reproduced (1995) copy of his work: "Zoologia Adriatica".

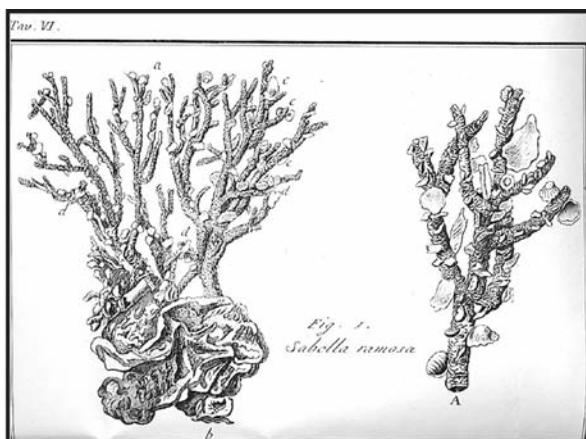
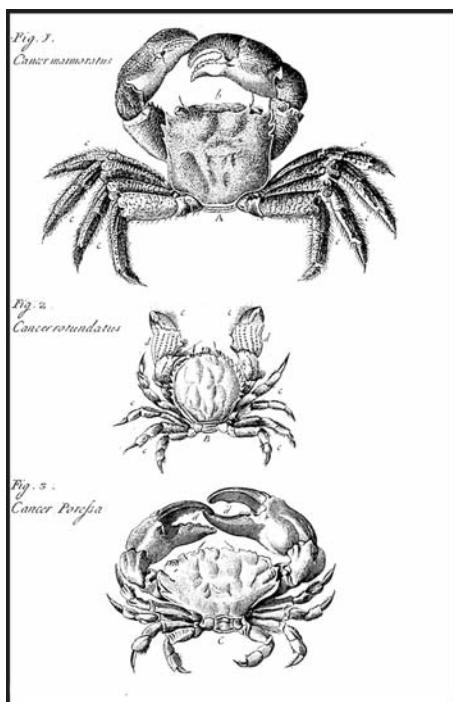


FIGURE 7. Some drawings of G. Olivi from "Zoologia Adriatica".

which were to receive precise definitions only in the following century.

Historical reviews become even more interesting when unpublished material comes to light. One recent praiseworthy restitution to the scientific community was the printing of a precious manuscript, now conserved in the Biblioteca Marciana of Venice: "Descrizione dè Pesci, dè Crostacei e dè Testacei che abitano le lagune e il Golfo Veneto" ("A Description of the Fishes, Crustaceans and Molluscs Inhabiting the Lagoons and the Gulf of Venice"), which represents almost a whole lifetime's work of the naturalist Stefano Chiereghin (1745–1820) (Fig. 9), a fervent scholar of marine biology, in the same Venice-Chioggia environment. The volume gathers together material resulting from 40 years of work in the Lagoon of Venice and its Gulf, from 1778 to 1818: precise drawings and detailed descriptions of 744 species of crustaceans, molluscs, echino-

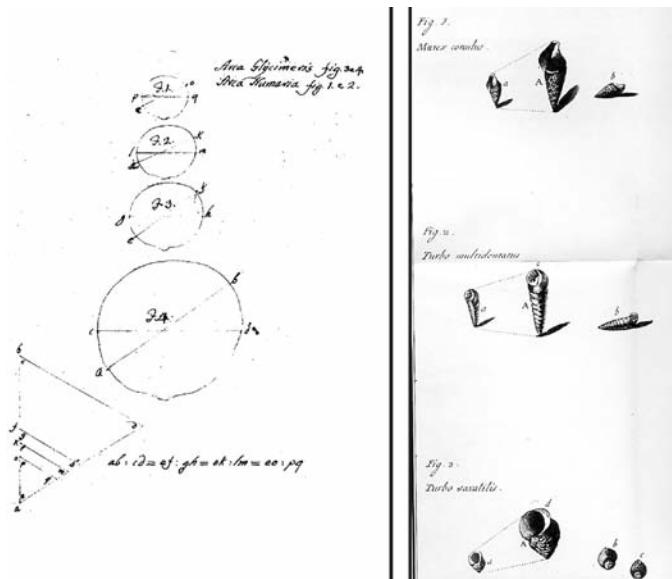


FIGURE 8. Examples of application of mathematical criteria to the study of the shape of the marine organisms, from "Zoologia Adriatica".

derms and fishes, of which 455 are described for the first time, collected in 12 manuscript volumes.

When Chiereghin was still alive, some attempts at publishing his “paper museum” were made, including those of a famous French academic, Louis Augustin-Guillaume-Bosc. Chiereghin was asked to prepare his collection and present it as well as he could, because it was then to be housed in the prestigious Museum of Natural History in Paris, and his most beautiful drawings (Fig. 10) were to be reproduced by capable French engravers and their publication edited by the Augustin academician. Nothing came of this grand scheme; the collection and the drawings remained at Chioggia. The *Imperial Regio Governo* purchased the work and the collection in 1819 and took it to the *Liceo-Convitto* of St. Catherine in Venice where it was displayed to the public. The author had planned on publishing it later, but he died in 1820 before he was able to do so. Shortly afterwards, the drawings passed to the Biblioteca Marciana (the collection was dispersed), although it remained the property of the School of St. Catherine. Twenty years later, thanks to the intervention of Francesco Zantedeschi (1797–1873), professor of Physics in the *Liceo* (he was later to become professor of Physics at the University of Padova), the task of publishing an inventory of the species described by Chiereghin was given to Giandomenico Nardo, for the 9th Congress of Italian Scientists, held in Venice itself. On that occasion, Nardo inserted an updated list of the taxonomic nomenclature of most of the species.

Since that far-off year of 1847, too much time has passed, and too few people later remembered the enormous amount of work that Chiereghin had accomplished. Today, the work provides us with an irreplaceable “data-bank” with which to reconstruct the lagoonal and marine fauna of the 18th century. It is an immense pleasure to read the meticulous descriptions of the morphology and reproductive and alimentary habits of so many species, perfectly located in their various habitats. The classification is that of Linnaeus, although for many animals it is flanked by Nardo’s revised version (in the plates).

Lazzaro Spallanzani (1729–1799) also spent various periods of time at Chioggia between 1782 and 1795, 1784 was the most important year for his researches in the Lagoon of Venice and the northern Adriatic. Spallanzani was often accompanied by Chiereghin, who prepared drawings for him, to illustrate the ponderous *opus* that Spallanzani intended to publish on the natural history of the sea. These drawings, now conserved in the municipal library of Reggio Emilia, have recently been published in a volume edited by Gibin (1997). At Chioggia, Spallanzani studied how sponges feed, establishing once and for all the “animality” of these organisms that had several times been stated but never until then demonstrated. It should be recalled that, throughout the 18th century, scholars continued to speak of “zoophytes” and “plantanimals”. In the company of specialists on marine flora and fauna who used to meet at the house of the doctor Bartolomeo Bottari



FIGURE 9. Stefano Chiereghin (1745–1820) and the cover of the recent publication of his large manuscript: “*Descrizione de’ Pesci, de’ Crostacei e de’ Testacei che abitano le lagune e il Golfo Veneto*”.

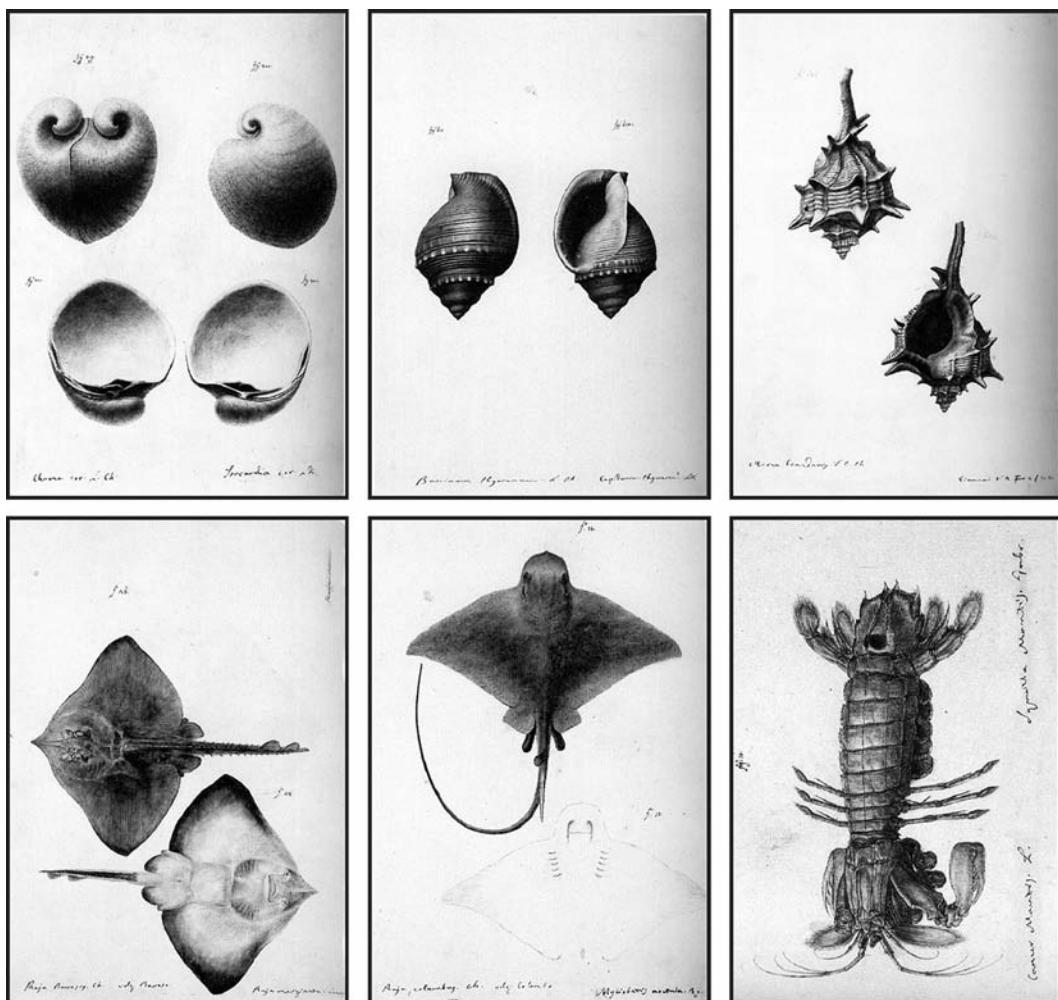


FIGURE 10. Some drawings of S. Chiereghin.

(1732–1780), Spallanzani gained useful field knowledge for his projects, which involved studies on marine biology along other Italian coasts, from Portovenere (in the Ligurian Sea, where he founded a biological station) to Messina and Rovinj. Giuseppe Olivi was part of this group, and the two naturalists certainly knew each other and exchanged views. But when he learnt that Olivi was about to publish his *Zoologia Adriatica*, Spallanzani was annoyed because he saw that the chance of being the first person to publish research on the Adriatic would elude him. He even refused to make the official presentation of the volume. Spallanzani was in fact known for such behaviour; he had already ferociously criticised Antonio Vallisneri junior, previously his master and advisor, and then publicly denigrated him as an Aristotelian: “*intriso di pece peripatetica*” (“soaked in peripatetic pitch”) (Contardi 1994). The reasons for this behaviour lay not only in profound differences of opinion in the scientific field, but also on a more personal level because Vallisneri had not come up to his expectations of aid and protection.

After the fall of the Republic of Venice in 1797, the “Republic of Veneto Naturalists” was inevitably influenced by the climate of decay that afflicted all the territories formerly governed by

the *Serenissima*. The alternating French and Austro-Hungarian regimes changed the cultural life and the politics and economy of the Lombardo-Veneto region, with inevitable repercussions on scientific research. In the 19th century, Chioggia and the Veneto environment gave way to the city of Trieste.

In the mid-19th century, Trieste was the only sea port of the Hapsburg monarchy. After the fall of Venice, Trieste inherited its hegemonic role in the Adriatic and also, with the opening of the Suez Canal, throughout the Mediterranean. Spending more or less extended periods in Trieste, studying the marine flora and fauna of its sea, had become a pleasant habit for naturalists and scholars, who came not only from Austria and Germany, but from as far afield as Czechoslovakia, Poland and Russia. Among these was Karl Ernst Von Baer (1792–1876) (Fig. 11), the discoverer of the human egg cell. After his arrival in Trieste in 1845, he promoted a whole series of initiatives favouring the development of marine biology in Trieste. At this time, von Baer frequented a group of enthusiasts and keen naturalists, including Enrico Koch, a Swiss merchant, who was interested in malacofauna, and Muzio de Tommasini, a botanist and future *podestà* (mayor) of the city. Together, supported and financed by authoritative institutions, they made plans for founding a museum for Adriatic fauna: the “*Museo Zoologico e Zootomico*”, which passed under the aegis of the city in 1852 under the name “*Museo Civico di Storia Naturale Ferdinando Massimiliano*”. This name was opportune, since Ferdinand Maximilian (1832–1867), the unfortunate Prince of Mexico, (Fig. 12) was not only the brother of the Emperor Franz Joseph, but also a passionate naturalist, who had collected and brought to Trieste many findings from his journeys round the world. The first director of this museum was Koch, followed by the Slovene zoologist Enrico Freyer, the Venetian Enrico F. Trois, and, lastly, Simeone Adamo de Syrski (1829–1882), a doctor and naturalist of Polish origin. He had come to Trieste in 1866. He was an experienced researcher (to him goes the merit of having discovered the male gonads in the eel) who spent his time in Trieste studying the reproductive cycles



FIGURE 11. K. Ernst von Baer (1792–1876).



FIGURE 12. Ferdinand Maximilian von Habsburg (1832–1867).

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of many marine animals, preceding the work of Eduard Graeffe (1833–1916). De Syrski also examined the “glutinous masses” of the high Adriatic, which we now call mucilage, or algal blooms. From his 1868 cruise on the corvette “Erzherzog Friedrich” in the Adriatic to areas as far-off as China, he collected an enormous quantity of material that enriched the collections for which he was responsible. The Museum was visited by other well-known scholars, including Johannes Müller (1801–1858), a famous embryologist, Adolph Eduard Grube (1812–1880), who classified its annelid collection, and Alexander O. Kovalevsky (1840–1901), who discovered sexual dimorphism in *Bonellia viridis*, and many others.

During these years, de Syrski had worked on a plan for a marine biology station directly on the sea, at Barcola, near Trieste (Stenta 1922), and although it was a goal he never achieved, nonetheless a station was in time completed by Carl Claus of Vienna and F.E. Schulze of Graz. Thus, the *Imperial Regia Stazione Didattica e di Osservazione Zoologica di Trieste* came into being, as a separate department of the University of Vienna. The Trieste station was visited by so many authoritative scientists that it would take too long to list them here, although brief mention must be made of Eli I. Metchnikoff (1845–1916), father of immunology, who studied phagocytosis in invertebrates, and Hans Driesch (1867–1941) who carried out fundamental research on the embryological development of the sea urchin in 1891.

In the first years of the 20th century, the *Stazione Zoologica di S. Andrea* was enlarged, had its own resident personnel, and was directed by Professor Karl Cori of the German university at Prague, with his assistant Adolf Steuer, a well-known expert on plankton. Between 1904 and 1910, many oceanographic cruises were organised all along the Adriatic in the *Argo* and *Adria* ships. They were not the only ships to sail the Adriatic for purposes of scientific research in those years: also the *Stazione Zoologica di Rovigno*, established in 1891, stemming from the Berlin Aquarium (Fig. 13), promoted several cruises in the research vessel *Rudolph Virchow*. After the First World War, the Station passed to the *Regio Comitato Talassografico Italiano* and was renamed the *Istituto Italo-Germanico di Biologia Marina*.

In 1899, the first *Congresso Italiano di Pesca* (Vinciguerra 1899) took place in Venice, followed in 1910 by a conference of the delegates of the Institute for Adriatic Studies, again in Venice. The aim was to create an interna-

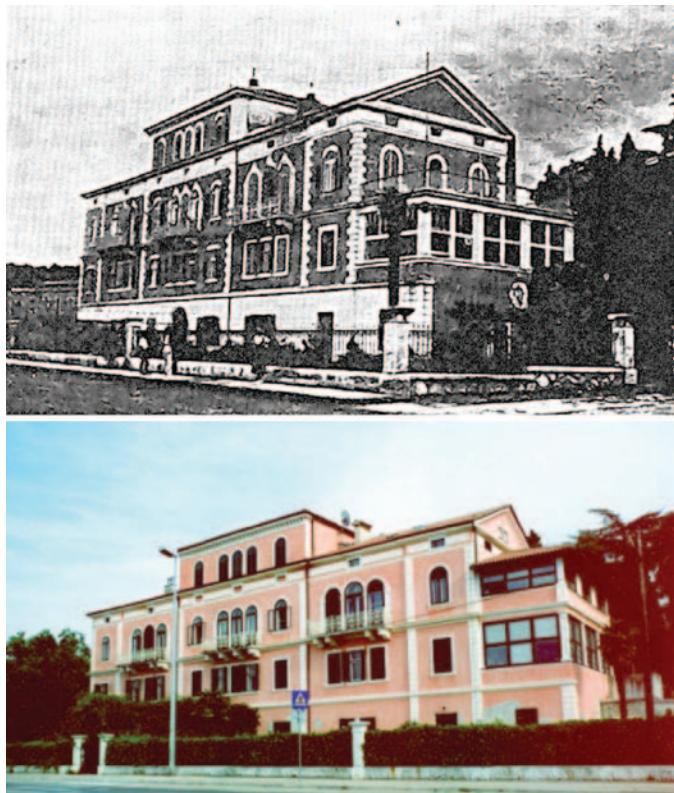


FIGURE 13. Above: Zoological Station in Rovinj at the beginning of 1900. Below: today the Center for Marine Research, at Rovinj is a Department of the Ruder Bošković Institute of Zagabria.

tional organisation under the aegis of which common research programs could be carried out. Austria and Italy were the first members, followed later by Turkey and Montenegro. There thus arose the *Commissione Internazionale per lo studio dell'Adriatico* that, between 1910 and 1914, organised five large-scale cruises in which the researchers from the Trieste station took part. But war loomed and, when hostilities broke out, the researchers were called to fight for their countries, their work-benches remained deserted, and the Station was obliged to close. The aquaria were emptied and the animals they had housed were thrown back into the sea. Part of the very rich library was sent to Vienna, from whence it never returned, not even after the Treaty of St. Germain, according to which Austria was obliged to return all scientific and bibliographic materials taken from conquered territories, and part remained in Trieste, until it was taken to the Italo-German Station at Rovinj in 1919. The botanical and zoological collections were also taken there, where they remained until 1943, when by good fortune they were taken to Venice and housed first in the basement of the Institute for Adriatic Studies and then at the Museum of Natural History, where they were also displayed to the public for a short time. It was only in 1968 that they finally reached the *Stazione Idrobiologica di Chioggia*.

The history of this institution is recent, but may be set against the background of the unquestioned disciplinary tradition of past centuries. It was established by Umberto D'Ancona (1896–1964) (Fig. 14), who had arrived in Padova from Pisa in 1937 to occupy the Chair of Zoology and Comparative Anatomy, which had been left vacant when its previous incumbent, Pasquale Pasquini (1901–1977), moved to Bologna. When he arrived in Padova, D'Ancona was only 41 years of age, but was already an important figure in the scientific community of the time. His inaugural lecture at the first course of Zoology, read in the Aula Magna of the University of Padova on December 9, had as its title "Chromosomes and sexual hormones", but his scientific experience had already covered the most disparate fields: biology, experimental embryology, hydrobiology, ichthyology and fisheries. In particular, he had been involved in fisheries studies ever since he had been an assistant at the *Comitato Talassografico Italiano*. Carefully analysing data on fishing in the high Adriatic between 1905 and 1923, with particular reference to the reduced pressure of fishing during the First World War, he had observed that, contrary to expectations, fish species that fed on plankton had not increased in numbers. Instead, only some species of predatory fish, at the top of the food chain, such as selachians (sharks, skates, rays, etc.), had increased. Correctly, D'Ancona interpreted these data as indicating a return to a state of natural equilibrium, favoured by the cessation of human interference. A proper explanation from a statistical and mathematical viewpoint came from Vito Volterra, (Volterra 1926) his father-in-law and an illustrious mathematician of international fame. Indeed, his son-in-law's research later inspired Volterra to formulate laws of biological fluctuations and prey-predator interactions (Lotka-Volterra models). Shortly after his arrival in Padova, D'Ancona worked on a project that reveals his ever intense interest in marine



FIGURE 14. Umberto D'Ancona (1896–1964).

biology. Born at Fiume (now called Rijeka, in Istria) in 1896, D'Ancona had the sea in his blood, and the Lagoon of Venice is only a short distance from Padova. He was able to arrange for the University of Padova to use a small public building on the island of San Domenico a Chioggia as a centre for marine and lagoonal research. Writing in 1939 in the original manuscript volume of the directors of the *Gabinetto di Zoologia* (with its *imprimatur* by Antonio Tomaso Catullo (1782–1869) of 1735), he stated: "work has begun for the establishment at Chioggia of a small laboratory for lagoonal research...." The *Stazione Idrobiologica di Chioggia* was opened in 1941, although activities were considerably hampered in the following years by the war. In 1946, with the nomination of the first true assistant, Armando Faganelli, a series of hydrographic and biological researches began, coordinated by Aristocle Vatova (1897–1992) (Fig. 15). Also Istrian by birth, Vatova had been nominated in 1924 by the *Regio Comitato Talassografico Italiano* as a temporary assistant and responsible for the provisional management of the Institute of Marine Biology at Rovinj (Fig. 13). He became its executive director in 1929. From 1931 to 1943, under his directorship the Institute published two reviews: *Thalassia* and *Note dell'Istituto di Biologia di Rovigno*. He had carried out much research in the intervening years and had published the "*Compendium of flora and fauna of the Adriatic Sea near Rovinj*" (Vatova 1928). In particular, since 1928 he had begun to study benthic fauna, which was to remain one of his ongoing research themes until the last years of his life. Between 1937 and 1938, he directed a daring scientific expedition in East Africa. In 1943, the war had obliged him to leave Rovinj. At Venice, where he moved with his family, he was able to reconstruct a centre for marine biological research at the *Osservatorio per la Pesca Marittima*, in a building belonging to the Italian *Regio Comitato Talassografico*, that later gave rise to the present *Istituto di Biologia del Mare* (later directed by D'Ancona). In 1955, Vatova left Venice, and moved first to the University of Camerino and then to that of Taranto. He returned to Venice only after he had retired, in the early 1970s. Many of us are well acquainted with the quality of his scientific output. Indeed, his works on the benthic fauna of the Adriatic coasts and the Lagoon of Venice are still points of reference for useful comparisons on the evolution of benthic biotopes, more than 50 years after he wrote them. His publications reveal great competence in highly varied sectors of marine biology, from the chemistry and physics of water, to the phenology of marine algae, and the effects of flooding on the fauna of the brackish *valli* of the Polesine area, near the mouth of the Po. Further testimonies of the collections made during the many oceanographic cruises in which he took part are the enormous numbers of preparations of marine animals, still conserved at the *Stazione Idrobiologica di Chioggia*, where the original nucleus of the collections in the *Stazione Zoologica di Trieste* can still be identified.

Recently, thanks to renewed interest in museum collections, which led to a new institution of the University of Padova, the *Centro d'Ateneo Museale*, restoration and recataloging of these preparations have begun, although the disastrous effects of decades of complete neglect are, unfortunately, too obvious.

This historical review must stop here, faced with the multiplicity of so many researches in the field of marine biology and the national and international initiatives that have covered and still cover the most recent researches on the Adriatic Sea. Today, check-lists of its fauna and flora are updated in real time. But this very particular environment must cope with pollution, eutrophication, the rise in water temperature due to the greenhouse effect, and invasion by allochthonous species from subtropical and tropical seas. The monk seal has long since disappeared; *Acetabularia* is no



FIGURE 15. Aristocle Vatova (1897–1992).

longer as abundant as in Donati's times; and mucilage and episodes of anoxia are much more frequent than in the past. And yet, the Adriatic still manages to surprise us. Those of us who, in the last few decades, have been able to study one very peculiar environment of this sea — the so-called *tegnue*, rocky outcrops found at depths of between 18 and 40 metres, off the north Adriatic coast from Grado to Ravenna — are aware of this. *Tegnue* are similar to coralligenous environments, true oases of biodiversity (Fig. 16), on the flat, homogeneous sea bed typical of this part of the Adriatic. We must not forget that it was Olivi himself, at the end of the 18th century, who signalled their presence, on the basis of fishermen's tales. Neglected for centuries, they were "rediscovered" in 1966: not even Olivi himself would have ever been able to imagine the richness of the fauna!



FIGURE. 16 The faunal benthic community of an Adriatic rocky outcrop at 23 m depth.

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