

RESEARCH ARTICLE

The progressive deregulation of fishery management in the Venetian Lagoon after the fall of the Repubblica Serenissima: food for thought on sustainability

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Since the origins of the first human settlements in the Venetian Lagoon, the exploitation of biological resources has represented the most important source of food for local communities. The Repubblica Serenissima strictly managed and controlled fishing activities because they were essential to the Venetian economy. Consequently, the Serenissima survived for over 1000 years in its lagoon, thanks to the numerous policies and regulations that were promulgated to enhance environmental quality, preserve biological resources and prevent degradation. An effective tool for assuring the sustainable use of resources was the establishment of fishermen's corporations called *fraglie*, which had the exclusive use of specific fishing grounds, introducing a sort of "restricted access" in lagoon resource management. Conversely, the fall of the Serenissima was followed by a progressive deregulation of fishing activities that was probably a consequence of the political instability of the area and the widespread poverty that afflicted local inhabitants, the priority being to allow open access to biological resources for subsistence fisheries (abolishing, for instance, the *fraglie*) at a time when there were few alternatives to fishing. In this paper we examine, via a collection of archival documents, grey literature and scientific papers, how changes in legislation impaired the sustainability of fisheries in the Venetian Lagoon, considering the effectiveness of those measures and how they jeopardized fishery resources.

Keywords: Mediterranean; artisanal fishery; fishermen's corporation; deregulation; sustainability

Introduction

The Venetian Lagoon: a brief description

The Venetian Lagoon lies in the North-West Adriatic Sea (Figure 1) and it is the largest single lagoon of the Mediterranean basin, with a surface of around 550 km². It is a transition zone between the sea and the mainland, and it is separated from the Adriatic Sea by two sandbar islands (Lido and Pellestrina). Three main inlet-openings – Lido, Malamocco and Chioggia – connect the lagoon with the Adriatic Sea (Figure 2).

It is a temperate coastal lagoon characterized by a water salinity gradient ranging from low salinity in its most inner parts to high salinity towards the inlets, and a high biological productivity that, coupled with the presence of a wide variety of habitats (salt marshes, tidal mudflats, tidal canals), sustains a rich and diversified fish fauna (Franco, Franzoi, Malavasi, Riccato, &

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Figure 1. Map of the Mediterranean Sea showing the Venetian Lagoon (black rectangle).

Torricelli, 2006; Ravera, 2000). Moreover, due to its low depth (the average depth is roughly one metre), this ecosystem shows remarkable seasonal changes in water temperature, with winter temperatures ranging between zero and 5 degrees Celsius, as opposed to summer temperatures which generally range between 28 and 30 degrees Celsius.

The commercial importance of the fishery in the Venetian Lagoon in the past

Since the presence of ancient human settlements in this area, people have been accustomed to exploit the resources of the lagoon (Zolezzi, 1946). Fishing, together with hunting, was the main source of cheap food for local communities (Bevilacqua, 2000; Granzotto, Franzoi, Longo, Pranovi, & Torricelli, 2001; Sansovino, 1663). In the fifteenth century, fishing resources were so abundant as to be considered exchange currency according to an established agreement (Dal Borgo, 2009).

Approximately 41 different commercial species were targeted in the Venetian Lagoon (Nalato, 1906; Sormani Moretti, 1884). Fishing was practised throughout the year, even though during the winter months the intensity of fishing was reduced since most of the fish species migrated from the lagoon due to the low water temperatures (Zolezzi, 1946). Lagoon products were sold at the Rialto fish market in the city centre of Venice, as well as at the fish markets of the Chioggia and Burano islands. Although long-term landing statistics are not available for the period under review, some scattered data allows an estimate of the relative importance of lagoon fisheries compared to marine ones. Indeed, lagoon fishery (including fish farm production) yielded yearly about 700 tons of fish in the late nineteenth century (Ninni, 1880), a value close to that obtained by marine fisheries (Ministero di Agricoltura, Industria e Commercio, 1872).

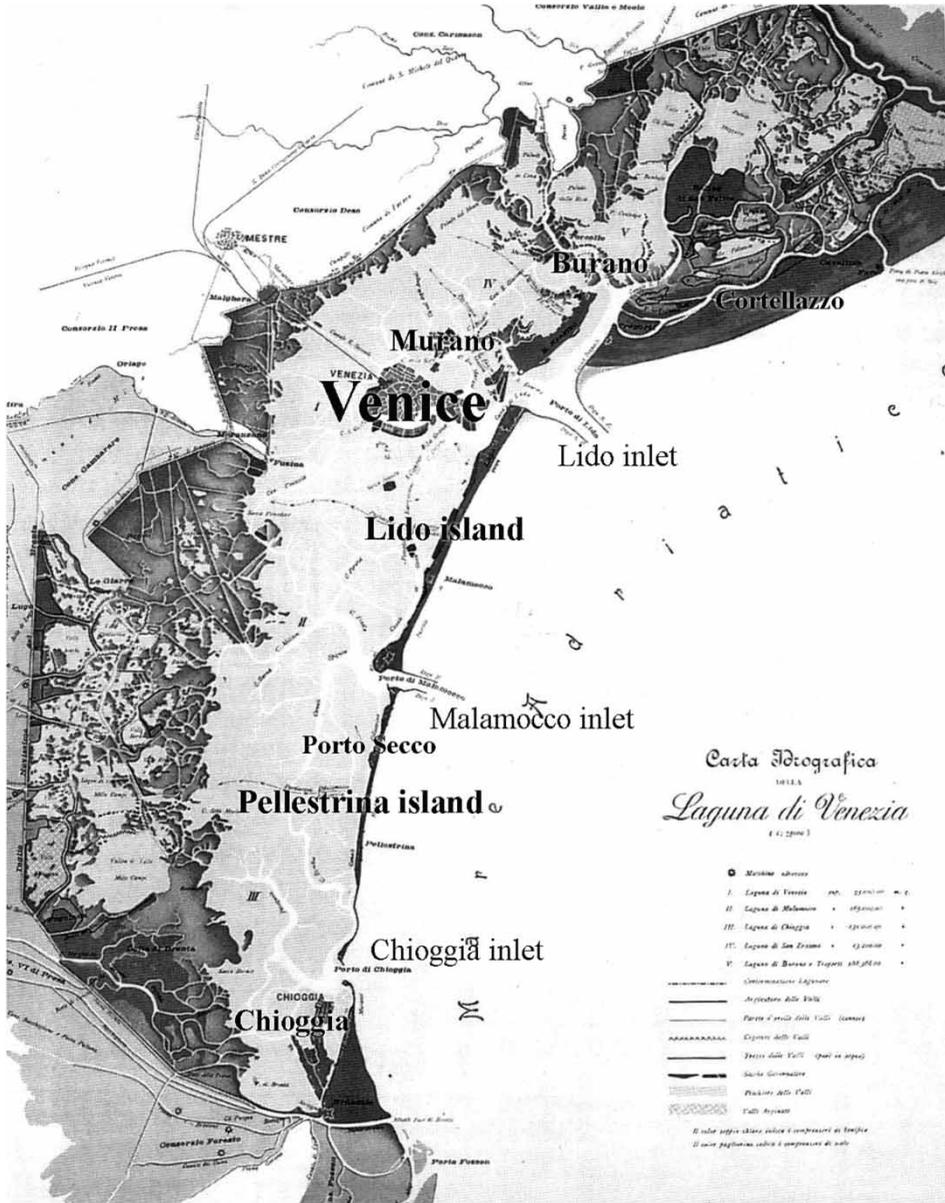


Figure 2. Map of the Venetian Lagoon in 1898.

Lagoon catches were more cost-effective than those from the sea and from fish farms, mainly because fishing in the lagoon was easier and thus required lower expenses in terms of boats and gear (Horden & Purcell, 2000). For instance, at the beginning of the twentieth century, lagoon fish cost on average 94 lire per quintal, while marine fish and farmed fish cost 108 lire and 119 lire per quintal, respectively (Levi-Morenos, 1919). For these reasons, lagoon fishery was of vital importance to local inhabitants.

Some remarks on fishery management during the Serenissima dominion

In the sixth century, the lagoon protected the mainland people who, despite health hazards and difficulties in establishing a cluster of villages, settled in the area to escape tribal invaders (D'Alpaos, 2010; Neil, 2002). Later it provided conditions for the growth of Venice, one of the largest cities in Europe from the thirteenth century, and the Republic of Venice (the so-called Repubblica Serenissima). The Repubblica Serenissima existed for over a millennium, from the late seventh century until 1797. While it is not possible here to describe in detail how fishery management worked throughout the entire Serenissima dominion, nevertheless we intend to discuss some aspects of fishery management (and its enforcement) which are important in understanding how regulations changed after the fall of the Serenissima, and in turn affected the sustainability of this activity.

Venice was a city state symbolically “wedded to the sea”, and the lagoon represented the most important source of food, as well as a defence against invasions (Dal Borgo, 2009; Scarpa, 1996). This was also the case for many other Mediterranean coastland cities, where “lagoon fisheries have formed a considerable part of the revenues and alimentation” (Horden & Purcell, 2000). A wide literature reports that the Repubblica Serenissima severely disciplined the lagoon management (e.g. Bevilacqua, 2000; Brunelli, Magrini, Miliani, & Orsi, 1940; Dal Borgo, 2009; Neil, 2002) to ensure a sustainable use of resources (Bevilacqua, 2000; Cecchetti, 1889; Granzotto et al., 2001; Mazier, 1893; Scarpa, 1996) as well as the long-term maintenance of its morphological features (Bevilacqua, 2000; Gatto & Carbognin, 1981; Ravera, 2000). Indeed, the Repubblica Serenissima survived for over 1000 years in its lagoon, thanks to the numerous policies and regulations that were promulgated to enhance environmental quality and prevent degradation (Neil, 2002). The successful environmental management of the Serenissima was based on the far-seeing and severe legislation implemented and enforced by the authority, which promoted the public interest instead of private ones, reaching an equilibrium between the economic freedom of citizens and the protection of collective resources (Bevilacqua, 2000).

Laws and restrictions on the fishery were established by the local authority, Magistrato alle Acque (Granzotto et al., 2001), while in 1261 an ad hoc commission, Giustizia Vecchia (literally translated Old Justice), was established (Scarpa, 1996). The first law on fishery was promulgated in 1173, regulating the use of seines in the lagoon. The fishery was probably the activity for which the highest number of laws was promulgated during the dominion of the Repubblica Serenissima (Scarpa, 1996). A review of the most important laws on fishery is reported in Sormani Moretti (1880) and in Dal Borgo (2009).

The main objectives of the Serenissima fishery policy were to ban fishing gear and practices deemed harmful to the lagoon's ecosystem and to protect fish fry from over-exploitation (Bevilacqua, 2000; Brunelli et al., 1940; Dal Borgo, 2009; Sormani Moretti, 1880). Management aimed at ensuring a high productivity of fish in the long term by respecting the natural cycles of species (Bevilacqua, 2000; Dal Borgo, 2009). Regulations governed restrictions on fishing gear, fishing seasons, the number of fishermen, the commercial size of fish, their conservation and trade. For instance, the authority controlled fishing gear yearly, and assessed its conformity to law (i.e. shape, size, mesh size, etc.) by comparing it with a template (Bevilacqua, 2000; Granzotto et al., 2001). Dal Borgo (2009) provided archival evidences of the enhanced controls of fishing gear by the Serenissima. She reported that, for instance, in 1761 some illegal fishing gear (mainly beach seines with small-sized mesh, used for fry fishery) was confiscated from a fisherman – since it did not match the templates – and burnt at the Rialto fish market (Figure 3). This was a common practise during the Serenissima dominion. Punishment was severe, including the cutting of ears, imprisonment, and the impoundment of boats and fishing gear (“Senato Veneto” decree of 3 October 1760).

From the eleventh century, fishermen were organized in corporations called *fraglie*, which had the exclusive use of specific fishing grounds, introducing a sort of “restricted access” in lagoon

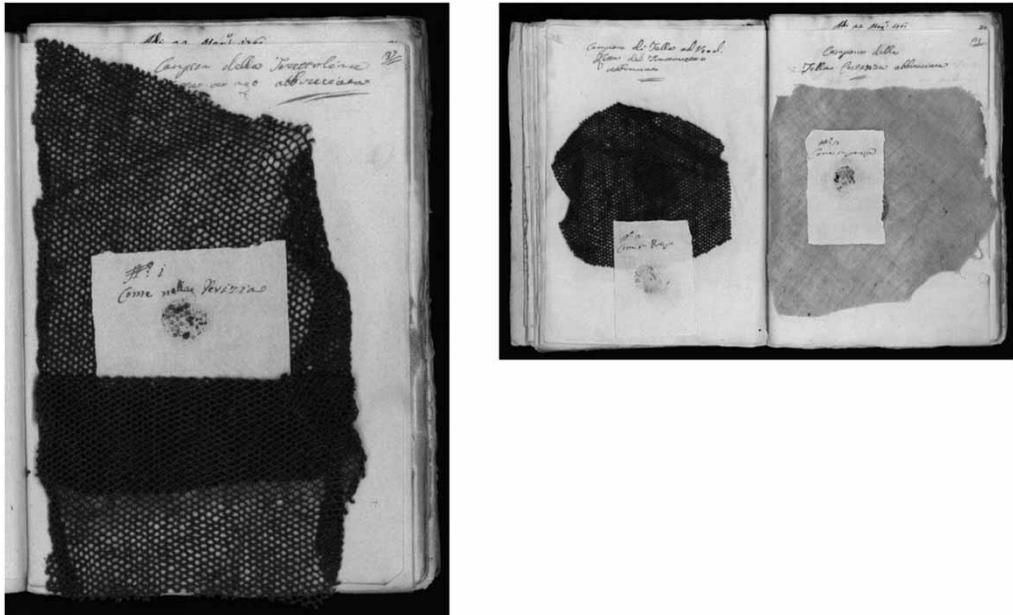


Figure 3. Samples of fishing nets confiscated from a fisherman in 1761 since the mesh-size was too small and thus illegal. (Credit: State Archive of Venice, *Giustizia Vecchia*, Folder 84)

resource management. Similar institutions for fishermen were present with similar competences also in France and Spain, called *prud'homies* and *cofradias*, respectively (Escobar & Alegret, 2008; Frangoudes, 2008). These institutions exercised control over all fishing activity in the lagoon and had the authority to seek abuse and report it to the Republic (Levi-Moreno, 1919). Hence, these corporations were directly involved in resource ownership and management, their own interests being to exploit resources in a sustainable way. To this purpose, every two years the *fraglie* elected two old and skilled fishermen, who were responsible for controlling fishing activities. Moreover, a decree of 1536 established that the authority had to consult the fishermen's representatives when implementing laws regarding fishery management, in order to take advantage of their experience and traditional knowledge (Scarpa, 1996). However, it is worth noting that the fishermen's points of view were presented alongside those of experts, since the authorities were aware that some fishermen believed resources to be inexhaustible and therefore requested complete freedom while fishing, whereas it was necessary to manage fishing activities to prevent over-exploitation (Scarpa, 1996).

Since lagoon fish were the most common source of cheap food for the poor inhabitants of the Serenissima, the authority also fixed a maximum price, so that an equilibrium between the interests of sellers and buyers was reached (Bevilacqua, 2000; Dal Borgo, 2009). The first law (*dendis et de ponderibus ac mensuris*) governing fish prices was promulgated in 1173 by the doge Sebastiano Ziani.

Historical fishing activities in the Venetian Lagoon

The exploitation of aquatic resources historically occurred through the employment of artisanal fishing gear and boats. A strong connection existed between fishermen and the environment, resulting from centuries of traditional practices rooted in the past (Granzotto, Pranovi, Libralato,

Torricelli, & Mainardi, 2004). Accordingly, the capability to yield high quantities of fish was mainly based on a knowledge of fish behaviour and ecology, and the development of efficient fishing gear (Zolezzi, 1946).

Most of the lagoon's fishermen came from Burano, Venice and Pellestrina, although men and women also came from inshore areas to fish in the lagoon. In 1884, for instance, there were more than 600 fishing boats and 2500 fishermen in the Venetian Lagoon (Sormani Moretti, 1884). For Venetian fishermen most of their earnings came from lagoon fishery (Ministero di Agricoltura, Industria e Commercio, 1872), highlighting the importance of this activity for local inhabitants.

Two main kinds of fishing activities were practised in the Venetian Lagoon: capture-based aquaculture (locally named *vallicoltura*) and “open lagoon” fishery (locally named *pesca vagantiva*) (Zolezzi, 1946).

Capture-based aquaculture: the vallicoltura

The practice of *vallicoltura* represents an interface between capture fisheries and aquaculture, defined as the practice of collecting “seed” material – from early life stages to adults – from the wild, and subsequently growing them to marketable size in captivity, using aquaculture techniques.

This practice was based on the seasonal migration of juvenile marine fish (fry) from the Adriatic Sea to the lagoon. During late winter and the beginning of spring, the young fry of some marine migratory species, locally named *novellame*, enter the lagoon and concentrate mainly in its inner areas. The migration of young fish from the sea to the lagoon is called *montata*, and is followed by a period of fast growth due to the optimal conditions found on arrival (high availability of food, warm temperatures and absence of predators). During the autumn, when water temperatures in the lagoon become colder, fish move back to the open sea to reproduce and spawn, since winter seawater temperatures are warmer than those of the lagoon. The period of migration towards the lagoon depends on the species' biology and varies between winter and autumn.

This phenomenon has been known by fishermen since ancient times. Indeed, fishermen used to close some ponds in the lagoon where fry concentrated by means of removable fences made of hurdles (e.g. reed enclosures) and nets, preventing fish from escaping during the warmer season. At the beginning of the autumn, when the water became colder, fishermen caught fish while they were leaving the ponds and heading out to sea.

This practice developed over the centuries until the creation of fish ponds, called *valli da pesca* (from the Latin *vallum*, meaning fence), where the *vallicoltura* was (and still is) practised. The *valli da pesca* were shallow portions of the lagoon limited by banks, which separated the *valle* from the lagoon. There were several types of *valli*: some were open (*valle aperta*) or embanked with fences of hurdles (*valle semi-chiusa* or *valle a grisirole*), whereas others were completely embanked (*valle chiusa*), with some inlets permitting the water to flow between the *valle* and the lagoon (Ravera, 2000). In the nineteenth century, most fish farms consisted of semi-enclosed areas (*valle semi-chiusa*) in direct communication with the lagoon (through mobile barriers). In 1884 about 1000 workers were employed in the Venetian *valli da pesca* (Sormani Moretti, 1884). The total number of fish ponds in 1905 was 50 (Nalato, 1906), covering an area of approximately 138 km² (approximately 25% of the lagoon surface) (Amministrazione Provinciale di Venezia, 1979).

Fish farms gave a profitable yield all the year round. However, since most of them were able to sustain higher densities of fish than those that entered spontaneously, fingerlings of some species (e.g. grey mullet and other mullets, gilthead bream, bass and eel) were also fished outside these basins and then put inside with the aim of increasing their productivity (Faber, 1883).

Fishing was carried out using small fishing boats with a crew of two expert fishermen and a young boy. They used small-meshed seine nets called *tela da pesce novello* (Figure 4). Fishermen grouped in cooperatives to optimize the yield and to divide possible sanctions from illegal fishing, which after the fall of the Serenissima were widespread (see following paragraphs). Voltolina (1898) reported that

the highest is the number of the boats and fishermen in a company, the easiest is the fishing by night and in areas where it is prohibited by Regulation [...]. It is worth risking two or five lire to earn 100 lire in those places near the Port where nobody goes fishing. (Free translation by the authors)

In 1898 in Burano there were 49 companies with 210 boats, 20 boats of fishermen not involved in the companies, and 70 non-professional fishermen (people who during the remaining part of the year were employed in different activities). At the end of the nineteenth century, approximately 20–25 million fry per year were brought into the fish farms of the Venetian Lagoon.

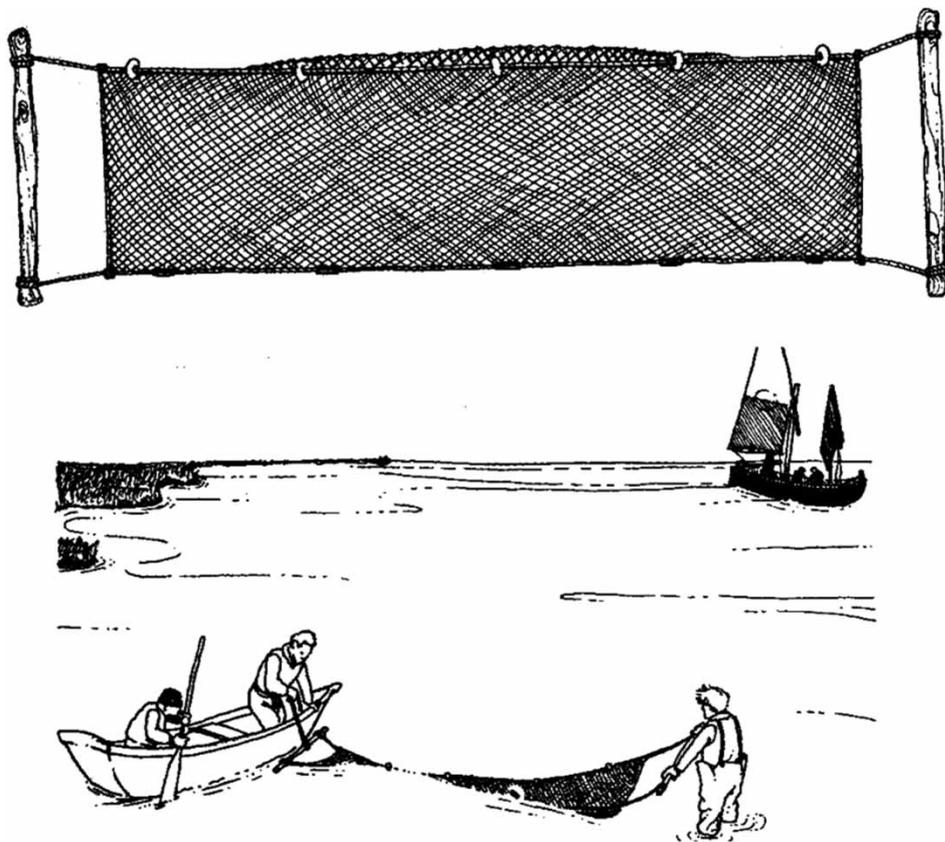


Figure 4. The *tela da pesce novello* was a linen small-meshed net used for catching fish fry, in particular grey mullets, gilthead breams, basses; the net was hung vertically in the water by means of weights positioned along the bottom edge, and floats located along the top. Four kinds of *tela da pesce novello* of different sizes were used, according to the target species and the habitat where they were employed. *Telon doppio*: length eight metres, height two metres; *telon semplice*: length five metres, height two metres; *teletta*: length three metres, height one metre; *volegon*: length two metres, height one metre.

“Open lagoon” fishery

Due to its long fishery tradition and the heterogeneity of its habitats, the Venetian Lagoon, from an historical and ethnographical point of view, can be considered the most important reference area for the fishing gears and techniques adopted in the estuarine areas of the Northern Adriatic Sea. In fact, its earlier inhabitants developed typical and specialized techniques for the exploitation of almost all edible resources, resulting in highly diversified exploitation activities. Accordingly, the large variety of habitats and targeted species were reflected in the number and assortment of fishing boats and gear adopted, which included a large part of the techniques that were in use in all the lagoons located in the north-western side of the Adriatic Sea (Rallo, 1999).

Levi-Morenos (1919) reported that in 1906 about 43 different types of fishing gear were in use in the Venetian Lagoon, both active (towed) and static, witnessing the high specialization of fishing in this area. Fishery in the Venetian Lagoon, when carried out in the open lagoon, was called *pescavagantiva*. The type of fishing gear and strategy employed was based on the empirical knowledge of the biology of a species, including its spawning period, preferred habitat, seasonal migrations and diurnal movements in relation to tides and lunar phases. For these reasons, fishermen had to be really skilled and the “art of fishing” was handed down from one generation to another.

Nets were handmade by fishermen and their relatives from hemp and linen produced on the mainland. The fishing gear used in the lagoon was similar to that employed at sea: *lampara* nets, trawling nets, trammel nets, surrounding nets, long-lines etc. (Figures 5a and 5b), with the exception of the drift nets, the use of which was not compatible with the shallow waters of the lagoon (Zolezzi, 1946).

With regard to fishing boats, the earliest inhabitants of the Venetian Lagoon since their settlement developed boats suitable for use in the peculiar habitats (Figures 6a and 6b), such as shallow-water ponds and narrow canals (Ministero di Industria, Agricoltura e Commercio, 1872; Rallo, 1999). For instance, small flat-bottomed boats were usually adopted for fishing, and in particular little draft boats when fishing in the more sheltered areas. In the period under review, fishing boats were not equipped with engines, so that movement towards the fishing grounds and the fish markets was achieved by sailing and rowing.

The progressive deregulation of fishery management after the fall of the Serenissima

The fall of the Repubblica Serenissima was followed by a progressive deregulation of fishing activities (Levi-Morenos, 1919) that was probably a consequence of the political instability of the area and of the widespread poverty that afflicted local inhabitants. As concluded by Neil (2002), “any semblance of coherent environmental policy and management appears to have collapsed with the instability and economic decline which followed the capitulation in 1797”. We hereby report some examples of how fishery management deregulation affected the sustainability of fishery in the Venetian Lagoon.

Formally, during the occupying French “Provisional Government of the Municipality of Venice” (1805–1814) and later during the first decades of the Austrian government, many of the laws and regulations concerning fishery were maintained, as reported by a document of the Prefect of the Adriatic (Ministero di Industria, Agricoltura e Commercio, 1872). This document establishes that there were three kinds of punishment if fishery laws were violated: a sanction, seizure of the boat, and the burning of fishing gear (Ministero di Industria, Agricoltura e Commercio, 1872).

However, the real novelty introduced by the Austrian government was the abolition of all of the corporations, called *arti* (arts) during the Repubblica Serenissima, including the fishermen’s corporations (*fraglie*). By abolishing the *fraglie*, an efficient tool for the management of lagoon resources was suddenly removed (Levi-Morenos, 1919). The direct involvement of fishermen’s

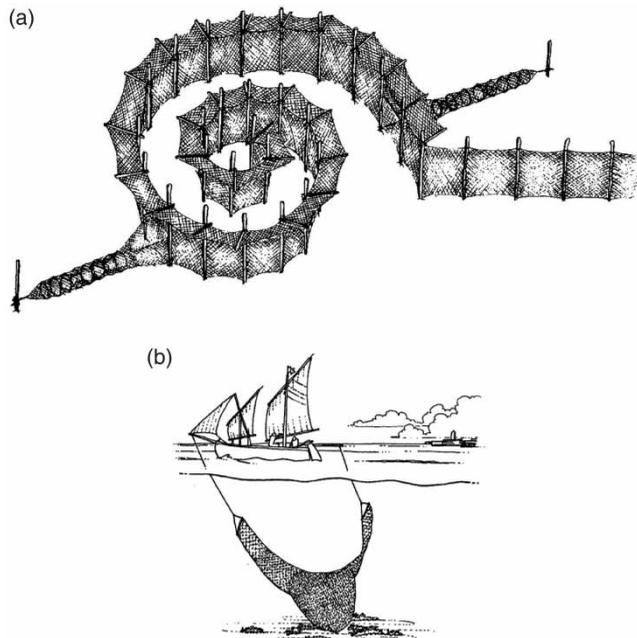


Figure 5. Two typical fishing gears employed in the Venetian Lagoon, one static and one towed. (a) The *saltarello* was a combination of a simple ground-net, hanging perpendicular in the water, together with a trammel-net, which was made to float on the surface of the water outside the ground-net but attached to it and entirely surrounding it. This fishing gear was conceived to take advantage of the behavioural response of these species (in particular grey mullets and basses) known to jump in order to escape from the nets. When caught in the ground-net, fish were induced to jump out of the water, and once they fell on the trammel net they were entangled. (b) The *bragagna* was a seine net combined with a *cogòlo* (a hempen net made in the shape of a long conical bag, narrowing by degrees to the tail end and held open by successive hoops) placed in its central part, towed by a boat usually with a crew of two fishermen. It was twelve metres long, half a metre high at the extremities, and two metres high in the middle. The *bragagna* was weighted at the footrope to keep it close to the bottom, and the drag-rope ends were attached to the bows and the stern; the boat sailed broadside and the net grazed the ground. It was used on vegetated areas mainly targeting grass gobies, eels, flounders, shrimps, Boyer's sand smelts, marbled gobies, Mediterranean green crabs and red mullets. Credit: Pellizzato (2011).

corporations in fishery management (in a sort of early co-management scheme), in fact, ensured the effectiveness of adopted legislation (Levi-Morenos, 1919) and avoided the so-called “tragedy of the commons” (Hardin, 1968). Indeed, it was in the fishermen’s own interest to preserve lagoon resources in the long term. Levi-Morenos (1919) stated that

Legislation of the Repubblica Serenissima based the repression of illegal fishing on a very important issue, namely the organization of fishermen in corporations or school of fishermen called *fraglie*. These corporations had an exclusive control over some fishing grounds, where only fishermen affiliated to the corporation were allowed to fish. Moreover, corporations had the power to repress abuses, control and punish fishermen who did not respect regulations, and denounce them to the Repubblica Serenissima. (Free translation by the authors)

As a result, towards the end of the Austrian domination the control of fishing activities was less rigorous while private interests (e.g. illegal fry fishery) began to predominate (Levi-Morenos, 1919). In a letter of 20 April 1864, two years before the liberation from the Austrian

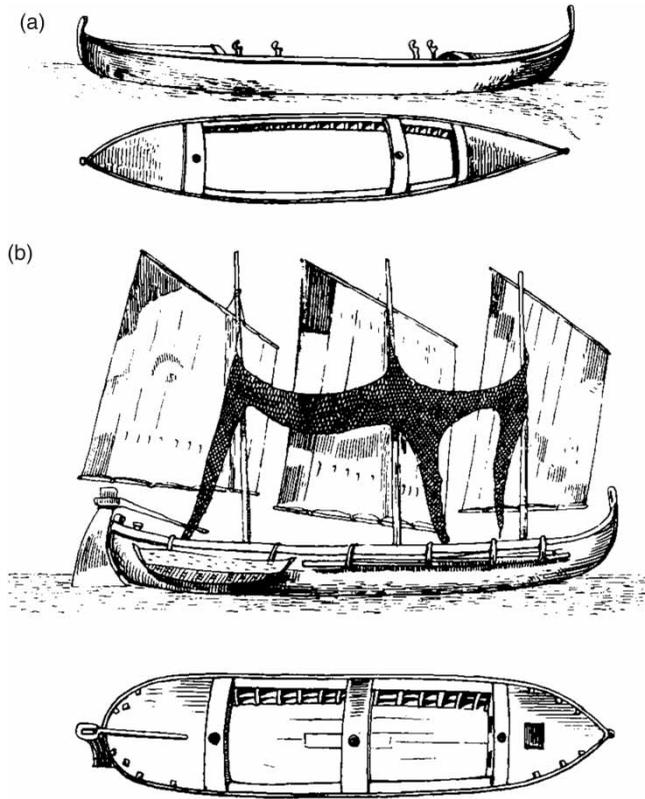


Figure 6. Two typical boats used in the Venetian Lagoon. (a) The *caorlina* (9–11 metres, 1–2 tons) was a flat-bottomed boat used mainly by Burano fishermen in the lagoon and on the seashore, and may be considered one of the most ancient lagoon boats. Its stern and bow were very similar and there were various types depending on the boat's use and place of origin. The crew was composed of between two and eight fishermen. (b) The *bragagna* (9–11 metres, 1–2 tons) was a deep un-decked boat, with three masts and two spars. It was mainly used in the lagoon with the homonymous trawling net, fishing athwart. The crew was composed of between two and four fishermen. Credit: Provincia di Venezia (1985).

dominion, the Municipal Congregation of Venice deplored the proliferation of abuses and recalled the need to enforce the Serenissima regulations to avoid the impoverishment of lagoon aquatic resources.

It is worth noting that controlling fishing activities in the Venetian Lagoon was not an easy task since the restrictions governing fishing gear and fishing seasons differed according to the species. And to distinguish the species of small-sized fry, for instance, was no easy process; therefore the people charged with the monitoring activities had to be very skilled experts in fish species.

Another example of how fishery management changed after the fall of the Serenissima concerns fish market organization. During the Serenissima dominion it was mandatory to sell all fish only at the fish market and not directly to consumers, as recalled by a law of 5 April 1797 (*Proclama dei Provveditori sopra la giustizia vecchia, ed inquisitori ai viveri del 5 aprile 1797*; Superintendents' edict on the Old Justice and on rations of the 5 April 1797). Fishermen did not sell their fish directly to fishmongers, but there was an intermediary called the *persenevole*. The auction was secret: buyers stated their offer in the ear of the *persenevole* in a way that nobody

could hear. This practice allowed control over the quantities sold, the quality of fish and its price, and thus management of the resource. Moreover, during the Serenissima dominion, fishmongers were grouped in the corporation called *Compravendi di pesce* (Fish traders), in an activity regulated by a strict code of conduct called *Capitulare de piscaribus* (Chapter on fishery), enacted by the Giustizia Vecchia in 1227. Conversely, after the fall of the Serenissima it was common for fishermen to sell their fish directly to consumers (Levi-Morenos, 1919), preventing the authorities from controlling whether regulations regarding, for instance, minimum landing size were upheld.

In 1872, six years after Venice's annexation to the Kingdom of Italy, decreases in yields were for the first time publicly denounced by the Ministero di Industria, Agricoltura e Commercio, 1872 (Ministry of Agriculture, Industry and Trade). The widespread use of prohibited gear and the general lack of controls by the authorities were considered the main causes of the decline in the abundance of fish. A report compiled by the Ministero di Industria, Agricoltura e Commercio (1872) stated that

when the Austrian government asked naturalists to express themselves on the state of fishery in the Venetian Lagoon, in order to improve fishery productivity and management, their answers were meaningful. Naturalists concluded that the abundance of fish had severely decreased, and the main cause was the widespread use of prohibited, harmful gear, and the lack of controls by the authorities. The severity of the fishery legislation of the Repubblica Serenissima, aimed at preserving the richness of fish in the lagoon, was well known. Decisions were taken by highly skilled magistrates, and fishing activities were controlled by fishermen's corporations which, every two years, nominated two old and skilled fishermen who were obliged to intervene if laws and regulations were not upheld. These laws were subsequently abandoned, and abuses have been tolerated up until the present time. (Free translation by the authors)

After being invoked for a long time by almost 10,000 people of the Province of Venice, who at the time lived off activities connected to the fishery (Sormani Moretti, 1884), on 1 July 1880 the first Fishery Legislation for the Kingdom of Italy became effective. The new regulation regarding the Venetian Lagoon was more permissive than the previous one since its first aim, for economic reasons, was to guarantee open access to fishing activities (Sormani Moretti, 1884). Poverty afflicted many people, who found in fishery their main source of subsistence. For instance, limitations on the mesh size of fishing gear used in the lagoon were abolished, because they were considered an obstacle for the fishing industry and because surveillance was too onerous. Fry fishery in the lagoon was allowed (although only by day), while the use of dynamite for fishing was banned.

Even in the "Regulation for Maritime Fishery in the Kingdom of Italy" (13 November 1882) special dispositions on fishery in the Venetian Lagoon were included, which followed some of the guidelines of the Serenissima legislation. However, in the framework of these new regulations, support for the enforcement of the planned monitoring of fishing activities was not adequate (Levi-Morenos, 1919) and, consequently, abuses were widespread. For example, Art. 68 of the Regulation, and the Regal Decree No. 562 of the 9 November 1896, banned the use of nets longer than 3 metres and higher than 0.8 metres for fry fishery. However, Mazier (1896) reported that at the end of the nineteenth century four nets were in use for fry fishery (Figure 4). All these nets were illegal (see the above mentioned Art. 68 of the "Regulation for Maritime Fishery", 1882), but they were commonly used, demonstrating the discrepancy between the laws and their application as a result of the lack of controls by the local authorities.

The surveillance of fishery was delegated to officials and special agents nominated and paid by local administrations, which could not afford the expense of an adequate number of agents. The consequence being that in the Province of Venice only two agents were present, both in the Municipality of Venice. Considering the vast extent of the Venetian Lagoon, coupled with

the fact that fishery was practised mainly at night and far from the city centre, their ability to effectively supervise and preserve the living resources of the lagoon was questionable. Moreover, violations were often condoned or punished with ridiculous fines (Levi-Morenos, 1919). Conversely, during the Serenissima dominion many agents were devoted to fishery control. For instance, a decree of 1781 established that apposite agents had to supervise the whole area of the lagoon's fry fishery, "in order to find and punish illegal fishermen who practice activities that are extremely detrimental to the lagoon's resources and ecosystem" (citation from a collection of laws of the Venetian Magistrate, State Archive of Venice; free translation by the authors).

An emblematic case of how fishery shifted from the sustainable to the unsustainable exploitation of biological resources after the Serenissima fall regards specifically fry fishery. This fishery must be strictly managed since juveniles guarantee the stability of fish populations. Therefore, the excessive exploitation of this life stage may result in the collapse of wild stocks. During the Serenissima dominion, to avoid any conflict between fishermen and fish farmers, and to preserve juvenile fish entering the lagoon, fry fishery inside the lagoon was banned all year long. However, because of increasing grievances, in 1780 the government, as an experiment, allowed this fishery while introducing severe restrictions regarding the time and space for this activity (Ministero di Industria, Agricoltura e Commercio, 1872). These restrictions were amended in 1863 by the Austrian government, which allowed fry fishery inside the Venetian Lagoon between 1 April (revised to 15 March in 1865) and 31 December, with some exceptions depending on the seasonality of species. Only a limited number of authorizations were granted but, despite these regulations, illegal fry fishery was widespread in the lagoon, mostly due to the lack of control by the authorities (Levi-Morenos, 1919). Subsequently, the Italian government applied rules similar to those enforced by the Austrian legislation, allowing fry fishery inside the lagoon for capture-based aquaculture purposes.

Consequently, it is not surprising that at the beginning of the twentieth century the scientist Levi-Morenos (1919) lamented the decrease in yields due to an unsustainable use of lagoon resources. He denounced in particular the following: (i) the unmanaged fry fishery, which every year destroys millions of individuals; (ii) grass goby fishery, mainly conducted during the spawning season; (iii) the widespread use of dynamite which, as mentioned above, should have been prohibited; (iv) the use of nets with an excessively small mesh size. Levi-Morenos attributed the cause of these abuses to the inefficiencies of Italian legislation and enforcement, which allow the private interests of fishers and fish farmers to prevail over public ones.

The same author identified another cause of fishery resource depletion to the fact that fishing was no longer restricted to professional fishermen, since after the fall of the Serenissima it was no longer necessary to hold a licence for fishing (Levi-Morenos, 1919). The Italian fishery legislation was in fact inspired by the communist water regime, "*Flumina autem omnia et portus publica sunt ideoque jus piscandi omnium commune est in portu fluminibusque*" (Rivers and ports are public; hence the right of fishing in a port, or in rivers are in common) (Justinian, *Institutiones*, De rerum divisione). While the need for a licence was removed to allow poorer people access to fishery resources at least on a subsistence level (Levi-Morenos, 1919), this deregulation increased the number of people who exploited Venetian Lagoon resources, thus increasing the impact on wild stocks. Moreover, these fishing practices were not conducted in a sustainable manner (or in accordance with the law), since these "newcomers" were only interested in the short-term benefits of fisheries and not in long-term sustainability. This situation led professional fishermen, frightened by the competition from non-professional fishermen, to increase fishing efforts and the practice of illegal fisheries too (Levi-Morenos, 1919). Consequently, Levi-Morenos (1919) proposed that fishing licences should be re-established and granted only to professional fishermen, in return for taxes which could be used for enforcing the control of fishing activities in the lagoon.

Conclusions

In this paper we have shown that after the fall of the Serenissima a common pattern was the relaxation of regulations, allowing the establishment of a destructive trend in natural resources. While the aim of the Serenissima policy was to preserve over the long term a common resource for the public welfare, after the fall of the Repubblica Serenissima the laws became increasingly permissive because the priority was to allow open access to biological resources for subsistence fisheries in a period when poverty was widespread and there were few alternatives. A growing amount of literature on poverty and fisheries has shown that there is a close interaction between the decline of fisheries and poverty, where decline may be both the cause and effect of poverty (McCay & Rudel, 2012).

However, the most prominent problem in the management of lagoon resources after the Serenissima fall was, most likely, the lack of control and monitoring, two basic requirements to ensure the sustainability of socio-ecological systems (Ostrom, 2009). Policy is largely irrelevant without implementation and enforcement (Neil, 2002).

It is worth noting that the abolition of the *fraglie* resulted in a shift from restricted (controlled) access to open access to fishery. As remarked by Hardin (1968) in her famous paper “The Tragedy of the Commons”, resources whose use is not controlled or restricted are more likely to be over-exploited and collapse. Stock depletion often occurs when fish stocks are un-owned and jointly exploited (Leal, 2002). In an open-access regime, fishers have no incentive to “save” fish for the future (i.e. avoid excessive catches), because if they restrict their harvest to leave enough fish for the following season, someone else may catch more fish to maximize their own short-term benefits. Moreover, each fisher captures all the benefits of catching more fish while facing only a fraction of the cost of stock depletion, because the cost is shared among all fishers. This disparity between the full benefits received and the fractional costs incurred encourages too many fishers (both professional and subsistence) to enter the fishery causing too many fish to be taken. In an open-access regime, each fisher is motivated to be the first to capture fish (Leal, 2002), whereas when fishers are actively involved in fishery management it is in their own interest to exploit the sustainably of resources.

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