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The *valli* in Marano and Grado Lagoon: historical aspects and productive topics

RODOLFO BALLESTRAZZI*

Abstract. Valliculture in Friulian lagoons is a very ancient aquaculture system. Documents dating 1564 show the presence of brackish water farms close to Marano Lagunare. Ever since the '20s, land reclamation in the Friulian lowlands seriously reduced the number and the surface of *valli* in our Region. The main traits of Marano *valli* are: their modest size, the location close to the village and the shape, like a comb, with rectangular canals connected by a main canal to the sea sluice gate. The Grado *valli* are scattered throughout the lagoon area, are larger than those of Marano are, and show the typical structure of the *valli* in Veneto, with big basin and irregular shape. The current limits of these plants are to be found in the lack of expert *valli* men for their management, the low prices of the products, the lack of marketing politics by the owners, the presence of fish eating birds and low water exchange between the *valli* and the lagoon.

Key-words. *Valli*, valliculture, Marano and Grado Lagoon, marine water farming system, marine fish species.

1. Introduction. The *valli* are fish farms typical of the Northern Adriatic Sea. They were built in the past, delimiting some areas of the lagoon through embankments.

They must not be mistaken for pond farms, because in the *valli* marine water is used instead of freshwater and they have a completely different water management and farmed species. According to their size, they can be divided into two categories: *valli*, used only for farming fish (the small units) or plants, with a double use: fish production and wildfowling (the large ones).

They are a perfect example of the ability of the man, in the past, in using

* Department of Agricultural, Food, Environmental and Animal Sciences, University of Udine, Italy. E-mail: rodolfo.ballestrazzi@uniud.it

Table 1. Numbers and surfaces of the Friulian valli according to different census.

Year	*Marano*		*Grado*		*Autors*
	Number	*ha*		*ha*	
1937	2	20.35 * (6)	-	-	MLF-MAF, 1937
1952	-	-	47	1180	Dorigo 1965
1985	17	324.6	39	1409.8	Lanari, Ballestrazzi 1985
2002	18	187.2	-	-	Ballestrazzi, Pravisano 2002
2016	5	74.4	16	890	Ballestrazzi 2016

the "dead" areas of the lagoon, to avoid their becoming swamp.

In Friuli, the size of these plants can vary from 1-2 ha to 350 ha. Until 40 years ago, all these plants were polycultures: several different fish species were contemporarily farmed in the same basin. Nowadays, this farming system is still going on only in few plants, being most of them turned to monoculture: each species is farmed alone in a basin.

The fish species common in a *valli* are: European eel (Anguilla *anguilla*), 5 species of mullet: Flathead grey mullet (Mugil *chelo*), thicklip grey mullet (Chelon *labrosus*), golden grey mullet (Liza *aurata*), leaping mullet (Liza *saliens*), thinlip mullet (Liza *ramada*), the European sea bass (Dicentrarchus *labrax*, L.) and the gilthead seabream (Sparus *auratus*, L.) (Ravagnan 1992). Occasional species in the valli are the flat fish: common flounder (Platischis *flexus, flexus*) common sole (Solea *solea*), and the big-scale sand smelt (Atherina *boyeri*). Shrimp, crabs and cockles complete the list of aquatic species naturally present in the *valli*.

The origin of these *valli* is very old. They derive from the *Roman peschiere*, and the general, "biological", rules governing them were fixed by the Benedictine monks in the early middle ages. These plants were very common also along the estuaries and the lagoons of other Latin countries. In France, they were called *marais* and in Spain *esteros*. Also in these countries, these plants suffered for low productivity and in some cases changed productive destination, as in France, where some *marais* are now used for oyster farm.

The first document citing Friulian valli dates 1564 when the quartermaster general Battista Foscarini wrote a letter to the authorities of the Republic of Venice concerning the building of a new street from Marano to Muzzana, to avoid the customs of Carlino. Later, in the 18th century, it was cited valle Pantani for a bloody fight between some shepherds from Latisana and a "*valli* man" from Marano for the use of the poor meadows in the area.

The general structure and the management of these *valli* did not change up to the end of the First World War. With the advent of fascism in Italy, the state made a strategic investment in land reclamation. Many of the inner *valli* disappeared

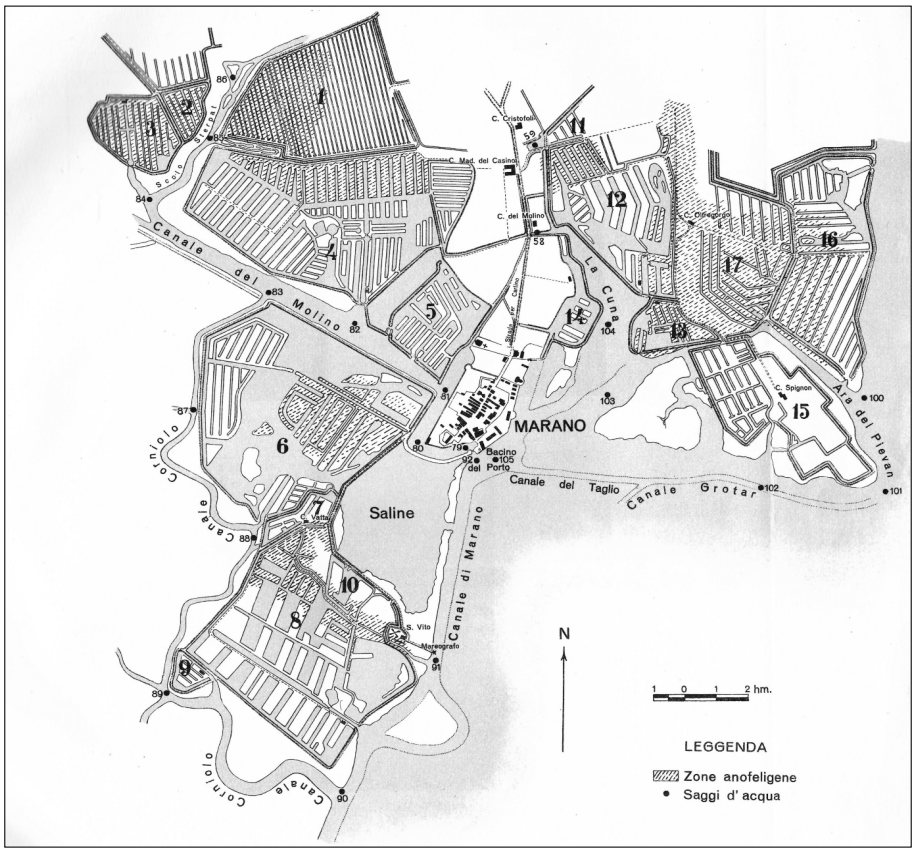

Figure 1. The distribution of the *valli* around Marano Lagunare in the '30ies (MLP-MAF, 1937).

(Valle Hierscel, Valle Lodra, Valle Marcotti, Valle del Seminario) or had a huge reduction (Valle Pantani). It was estimated that in those years in Friuli more than 1000 ha of valli disappeared.

In 1937 there was a first partial census of the *valli* in Marano lagoon (see Table 1). The census counted twenty-four plants with a little surface (20.35 ha, for 6 of them).

After the Second World War, it started a significant change in the materials used in the *valli*: concrete, metals and plastic substituted vegetal fibers, giant cane and wood.

In the '50s, a census of Grado lagoon reported a number of 47 active plants, with larger surfaces (Dorigo 1965). Since that moment, the number of valli in Friuli progressively decreased.

In 2016, the last count showed 21 active *valli* in the whole Region: 5 in Marano lagoon and 16 in Grado lagoon (Ballestrazzi 2016).

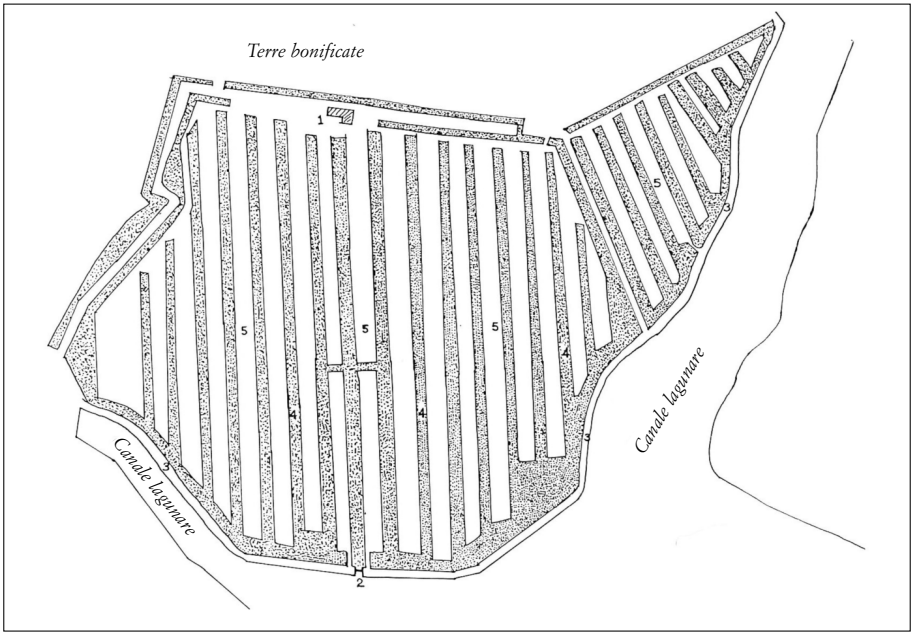

Figure 2. A typical *valli* in Marano: 1) "Casone" (typical house and depot of the *valli*); 2) main sluice-gate; 3) embankments; 4) canals; 5) land for cultivation.

Contemporarily these remaining plants underwent a big evolution in structure and productivity, becoming specialized intensive or semi-intensive marine farms.

2. The *valli* in Marano lagoon. These plants are all private properties. They are close to the village and their size is small. Generally, their shape is like a comb: basins connected to the sluice gate through a central or a lateral canal (Figure 2).

The ratio between water surface and land surface of the property is 50% - 50%. In the past, the land was a big lack for Marano, so all the small areas over the sea level were cultivated. That is why between the basins there were lucerne grass, corn, vegetables or grape trees (for wine production).

The decrease in the number of active *valli* was rather persistent in the last 15 years: from 21 to 5. The remaining plants had heavy investments in structure and productivity and they are managed rather well. All of them turned from extensive farming to intensive one, with daily feeding, forecast buying and selling.

3. The *valli* in Grado lagoon. In Grado lagoon, there are both private valli and "municipal-valli"; the last ones are rented to private operators for their management.

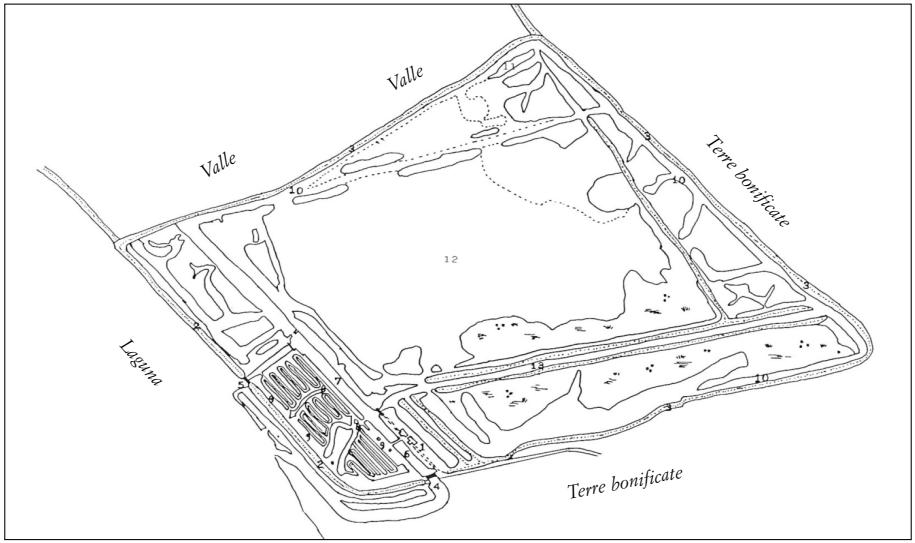

Figure 3. A typical valli in Grado lagoon.

They are scattered in the entire lagoon, from Porto Buso to Primero Canal. Their size is larger than Marano valli and their shape is traditional, with large, irregular basins and surrounding canals connected to the sluice gates.

The ratio between water surface and land surface is: 80%-20%.

Two are the main constraints of these plants: most of them can be reached only by boat and do not have electricity.

Also in this district, there was a big decrease of the plant number; the largest and more structured overcame the crisis. Extensive farming system was abandoned for a semi-intensive one.

4. Actual problems of Friulian *valli*. Nowadays, there are several problems for these plants that can be summarized as follows:

1) general management;
2) water management;
3) farming techniques;
4) product characterization and marketing.

In the last decade, there was a heavy decrease of *valli* men, with no substitution by young workers. This fact concurred to the end of activity in several plants. This situation is generating a dangerous lack of transmission of know-how in the sector: with the risk of disappearance of a very interesting work profile. This type of job is rather demanding, both for time and body strength, but on the other side it is very various and needs a high technical preparation.

The bottom level of Friulian valli is at the same level of the lagoon.

Table 2. Ratio of the different fish species farmed and sold in Marano *valli*.

Species	*Marano Lagunare*
Sea bream	48
Gilthead sea bream	34
Mullets	
Flathead grey mullet	4
Thicklip grey mullet	2
Common eel	1
Striped bass	1

Source: Ballestrazzi 2016.

That is why the water exchanges can be made through sluice-gates (pumping devices are not necessary). Nevertheless, some plants have an insufficient number of gates and too little. Furthermore, there is the problem of the external lagoon canals are progressively becoming more and more plugged, which reduces a lot the water load exchange to the valli.

The Friulian *valli* are "cold" plants, because they are the northernmost plants of the Mediterranean Sea, but also because in winter time they suffer the direct effect of the "Bora", a very cold wind that decreases a lot the water temperature. This caused the development of a "wintering" technique based on inverse thermic stratification of the waters in wintering ponds to safe the fish by lethal temperatures. Some plants invested money to introduce heat exchangers, to warm the water and to eliminate this problem, but most of the *valli* are still wintering fish only through the old technique.

Fish eating birds are another big problem of the *valli*. Gulls, cormorants, herons and little egrets cause high mortality in fish stocks. For small ponds they can be used the nets, also on the wintering basins, to reduce fish mortality, but for larger ponds there is no solution, because bird-hunting is forbidden. In particular, the number of cormorants is becoming uncontrolled, in addition, they are very aggressive, above all in wintertime, when fish stocks are wintering.

The ratio of fish species farmed in the *valli* changed at the beginning of the '80s. Before the '80s, the fish restocking was natural, based only on wild fry and the main species were eels, mullets and few sea bass and sea bream. After the advent of artificial reproduction the last ones became the first farmed fish species in the Friulian *valli*, being highly priced. This situation is still going on (Table 3).

Some *valli* prefer to sell large fish (> 1 kg; 7%), while > 50% of the sold fish is portion size (350 g). Large size means longer farming cycle and more investment on diets. Not all the plants have the financial strength to sustain these farming periods.

The marketing is still based on wholesalers (70%), even though there is a percentage of direct sell to

the restaurants (15%). The fish market of Marano or Grado (10%) and the direct retail (5%) are secondary tools for selling fish.

5. Improvement of the Friulian valli. After the examination of the limiting factors for these plants, it is relatively clear what are the actions needed to recover productivity and professionalism of these plants.

First, a general renewal of the "*valli* men", teaching the practice to young people interested to this peculiar job, is quite urgent.

A farm association should be organized to gather periodically the interests of the *valli* men.

The plants should be improved in the water exchange with the lagoon: both renewing the sluice-gates (larger, with automatic control of opening and closing) and cleaning depth and width of the external canals in the lagoon.

In Marano lagunare there is also the necessity to build a by-pass beyond "La Cuna", to supply clean waters, in sufficient amounts to a series of *valli*, suffering low water exchange.

The exploitation of warm well water should be supported to avoid problems with wintering of fish stocks.

There should be a diversification of the farmed species, reducing the impact of sea bass and sea bream. In the *valli* can be farmed many other fish species: sea trout, sturgeon, shrimp, flatfish (Lanari et al. 1988, 1989). It would not be a bad idea to turn again to eel and mullets rearing: particularly flathead grey mullet and golden grey mullet.

Nowadays, the fish wholesalers know very well that fish produced by *valli* have better quality and they pay something more the local stock than imported Greek or Turkish sea bass and sea bream. However, this is not enough. It is necessary to characterize the valli products. There are some bio-technological ideas, but they involve costs of analysis and time.

Another strategic tool could be the introduction of the Geographical Protected Indication. All the valli might easily adopt the Code for production of Friulian Valli (PVF), elaborated some years ago by Udine University and then perhaps left in some drawer in some office of the local Regional Agriculture Authority (Ballestrazzi 2008).

Lastly, it is possible, with sufficient available amounts of niche product (i.e.: flathead grey mullet), to process the fish. In this sense, the Grado Fishermen Association has started a pioneering work producing highly price smoked mullet fillets.

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