ITALIAN VALLICULTURE

AND ITS FUTURE DEVELOPMENT

Febo LUMARE

Institute for the Biological Exploitation of Lagoons
National Research Council
71010 Lesina (Italy)

Even though fish-farming experiments in Italy date back to as early as the 1st century b.C., the most traditional form is certainly "valliculture" or extensive fish-farming in enclosures in the great lagoons of the northern Adriatic. This form of extensive fish farming makes use of lagoon currents and, wherever possible, also of fresh water in order to favour the ascent of the fry and the descent of the adult fish for capture. This system originated in the Venetian lagoon in about the 12th century, although the Comacchio valliculture lay claim to having invented the technique.

The most primitive form of valliculture had enclosures made of reeds. These have been replaced either partly ("semi-embanked valleys") or wholly ("embanked valleys") with banks made of earth, rubble or other resistant material.

The "embanked valley", i.e. the more highly developed type of extensive valliculture, is equipped with fry acclimatization areas ("seragio per il pesce novello") during their ascent, canals for wintering white fish ("peschiere di svernamento"), and a surrounding underwater trench. Above all, it is equipped with a specialized system for catching adult fish during genetic migration from the lagoon to the sea, known as "lavoriero".

The area given over to extensive valliculture in Italy has diminished considerably. De Angelis (1946) estimated that the Venetian valliculture ponds covered and area of 12,500 ha and those of Comacchio 33,000 ha. In 1960, the same author (De Angelis, 1960) gave the area of the ponds in the Venice lagoon as 6,661 ha. According to recent data (Giorgetti and Ceschia, 1978; Ravagnan, 1978; Zerbinato, 1981), the total surface of the Italian valliculture has since diminished further (see tab.1).

North Adriatic valliculture	Area	Extensive valliculture pond n°	Surface (ha)
	Grado and Marano Lagoons	55	1,537.6
	Caorle Lagoons	5	1,703
	Venice Lagoon	26	8,770
	Caleri and Polesini Vecchi valliculture ponds	16	7,960
	Comacchio valliculture ponds	4	10,800
Centre-South valliculture			
	Zapponeta valliculture pond	1	400
	Ittica Valdagri valliculture pond	1	400
		108	31,570.6

TAB. 1 - Present state of the Italian valliculture

The present area amounts to about 31,750 ha and comprises a total of 108 ponds.

Also the coastal pools and brackish lagoons of Centre-South Italy have adopted numerous valliculture techniques (e.g. underwater canals, "lavoriero") in order to increase production. However, in these environments it is impossible to use valliculture techniques fully owing to the

small difference in the level of the tides which are much greater than in the North Adriatic (often exceeding 100 cm), as well as to the lack of freshwater streams to create the necessary currents.

The species farmed in the extensive valliculture consist mainly of the grey mullets (Mugil cephalus; Liza ramada; L.aurata; L.saliens; Chelon labrosus), the eel (Anguilla anguilla) and the silversides (Atherina boyeri); there are also small quantities of sea-bass (Dicentrarchus labrax) and sea-bream (Sparus aurata) while also the sole (Solea vulgaris), the flounder (Pleuronectes flesus), the gudgeon (Gobius ophiocephalus), the common prawn (Crangon vulgaris). Also found in the brackish pools and lagoons of the South are red mullet (Mullus surmuletus), the puntazzo (Puntazzo puntazzo), the sargo (Diplodus annularis) and the giant prawn (Penaeus kerathurus).

In the past, the production in the valliculture was fairly high. Bullo (1955) reports that the average output from a well productive extensive valliculture is around 120 kg/hectare/year. Ravagnan (1978) reports that there was an appreciable drop in valliculture production after 1951. Especially in the case of the eel, this drop may be attributed to infestation by the branchiuran crustacean of the genus Argulus.

However, there were other factors acting at the same time, such as the gradual pollution of coastal and lagoon waters, the falling land level in the North Adriatic ponds and over-fishing. These phenomena caused the average yelds of the valliculture to drop to less than 45 kg/ha/year, and as low as 20 kg/ha/year in the case of the Comacchio valliculture. The brackish pools hardly fared better, with yields as low 18 kg/ha/year (Varano lagoon on the southeast coast of Italy), although there were occasional peaks of 300 kg/ha/year (Santa Giusta lagoon on the west coast of Sardinia; Regional Council of Sardinia, 1981). However, brackish pool yields fluctuate around 60-100 kg/ha/year.

Except for small enclaves, there is thus a disturbing decline in fish production in the Italian valliculture and lagoons.

Previous attempts to deal with this situation consisted of introducing fry caught wild into the ponds and pools. This technique has become more difficult nowadays as the demand for fry (mainly eels, mullet sea-bream and sea-bass) rose considerably after numerous intensive farming installations came into operation. It has been estimated that for white fish alone, fry demand has now reached some 50 million units/year, while no more than 10-15 million are actually caught. To make up the shortfall attempts have been made to improve techniques of capture transport and sowing of fry with a view to reducing losses of even more than 95% due to stress and predation. Integrated valliculture system, based on integration between the intensive and extensive systems (Ravagnan, 1981) tend towards the controlled raising of fry immediately

after capture in order to increase survival rate and thus final yield. In the case of eels it has been observed that survival until commercial size is reached (i.e. 5–7 years after sowing as elvers; final body weight 250 g) is achieved in 12–14% of the cases. If elvers are farmed intensively until a body weight of 40–50 g is reached, and then released for extensive farming, a survival rate of 50–70% can be achieved after just over two years, with a final mean body weight of 350 g (Ravagnan, 1978).

This criterion has begun to be applied also to grey mullet, particularly Mugil cephalus, and sea-bream by applying intensive-extensive farming techniques at different culture stages.

However, these techniques are not enough by themselves to overcome the problem of the shortage of fry. This is why studies were begun about a decade ago on the artificial production of certain aquatic organisms of commercial interest. For some years now there has been a regular artificial production of sea-bass fry (2,250,000 in 1981/82; Lumare, 1982) and 9 commercial and experimental hatcheries have already been set up in Italy. In some cases, three-month old bass fry have been introduced into ponds and brackish lagoons in order to increase productivity. Generally speaking, however, they are raised under intensive conditions in concrete tanks. This particular species has been found to be comparatively unsuited to restocking in natural environments owing to high fry production costs, unfavourable climatic conditions (the temperature of the North Adriatic valliculture ponds is usually too low for fry in February–March) and to the high degree of predation suffered by the seeded fry.

Another species that is artificially reproduced and used to increase productivity in pools and valliculture is the decapod penaeid Penaeus japonicus (750,000 P_{22} post-larvae produced in 1982). The results obtained using this species are very interesting. A preliminary experiment involving post-larva seeding (Lumare and Hiramatsu, 1982) carried out in the Lesina lagoon in 1981 afforded 23.6% recovery of the initial population and a final average body weight of 38.7 g after 5 months' cultivation. In 1982 some 400,000 P_{22} post-larvae were sown in the Lesina lagoon. About 25% of this population was subsequently recovered, i.e. a production of about 3 tonnes. In the extensive valliculture in the Grado lagoon (North Adriatic sea) prawn yields of 85 kg/ha were obtained after 4 months (final body weight = about 22 g). With these results and the highly advances technology used in Italy (Lumare, 1981), this Penaeid will probably be used on a large scale to increase productivity in pools, valliculture and also in the sea.

References

BULLO, A., 1955. La vallicoltura che si esercita in zone lagunari lungo il litorale dell'Alto Adriatico. Agricoltura delle Venezie n° 10, ott. 1955: 13-25.

CONSIGLIO REGIONALE DELLE SARDEGNA, 1981. Le Lagune in Sardegna: una risorsa. 1-105.

DE ANGELIS, R., 1946. Valli da pesca. Ed. REDA Roma: 1-99.

DE ANGELIS, R., 1960. Exploitation et description des lagunes saumâtres de la Mediterranee. FAO Etudes et Revues 12: 1-69.

GIORGETTI, G., G. CESCHIA, 1978. Studio ricerca sui principali motivi di mortalità della fauna ittica allevata nelle acque esterne e programma di assistenza sanitaria. Reg. Aut. Friuli-Venezia Giulia - Assessorato Industria e Commercio - Trieste 1-25.

LUMARE, F., 1981. Artificial reproduction of Penaeus japonicus Bate as a basis for the mass production of eggs and larvae. World Mariculture Society Journal (in press).

_____, 1982. State of italian aquaculture in the production and research sectors. FAO General Fisheries Council for the Mediterranean (GFCM) XVI Session 27th September - 1st October 1982 - Rome: 1-6.

LUMARE, F. e K.HIRAMATSU, 1982. Prova preliminare di semina di novellame di Penaeus japonicus Bate (Decapoda, Natantia) nella Laguna di Lesina (costa sud-est italiana). Atti XVI Congresso Soc. Ital. Biol. Marina 20-24 settembre, Massa Lubrense (Napoli) (in press).

RAVAGNAN, G., 1978. Vallicoltura moderna - Ed. Edagricola 1-283.

RAVAGNAN, G., 1981. Productive development of lagoonal zones: available technologies and operational strategy. In "Menagement of living resources in the mediterranean coastal area". Stud.Rev. GFCM (58): 173-239.

ZERBINATO, M., 1981. L'acquicoltura in Italia: indagine conoscitiva. ED. A.N.G.A.: 1-127.