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First Occurrence Of The Tilapia *Oreochromis Niloticus Niloticus* (Linnaeus, 1758) In Lesina Lagoon (Eastern Italian Coast)

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Abstract

Individuals of the tilapia species Oreochromis niloticus niloticus (Linnaeus, 1758) were caught in Lesina Lagoon during experimental sampling for the shrimp Penaeus kerathurus using fyke net traps from December 1999 to September 2000. The species O. niloticus is not native in Italian coastal waters, although attempts of tilapia culture in land-based aquaculture farms were occasionally carried out in the past. The number of individuals captured in the samples suggests a colonization of the area of Lesina lagoon. The highest catches were observed during July. In July, the individuals caught represented the 22.3±4.1 % of the total catch weight. Such colonization of a marine environment by O. niloticus niloticus is the first case reported for Italy. The occurrence of the species in Lesina lagoon is attributed to fish which escaped from fish farms in the area and entered the lagoon through the numerous streams and irrigation-drainage channels that outflow along the south coastline.

Keywords: *Oreochromis niloticus niloticus*, Lesina Lagoon, First occurrence.

Introduction

The world production of cichlids (wild catches and aquaculture) is represented mainly by the species *Oreochromis niloticus niloticus, O. golden, O. mossambica, O. hornorum, O. rendalli and O. zillii*. The species *O. niloticus* niloticus is a euryhaline species characterized by fast growth and resistance to pathogens. The species has been introduced for aquaculture in several countries in the Mediterranean such as Israel, Egypt, Malta, France and Czechoslovakia (WELCOMME, 1988). The reproduction (both natural and artificial) of the species in captivity is not complicated and the market size (250-300 g) can be reached during a summer season in aquaculture (WANG *et al.*, 1998; RAKOCY & MCGINTY, 1989). The species *O. niloticus niloticus* is resistant to low temperatures (8°C; TREWAVAS, 1983), although it is native in

tropical regions. Tilapias are not native in Italian areas and have never been reported before in coastal lagoons (ARDIZZONE *et al.*, 1988). On the other hand, several attempts to introduce the species in pond aquaculture were carried out occasionally in the past in Italy.

The aim of this paper is to report the first occurrence and the establishment of a wild population of the species *Oreochromis niloticus niloticus* in Lesina Lagoon (central-east Italy) as well as discuss the possible reason for this colonization event.

Materials and Methods

Lesina lagoon is located in the southern Adriatic Sea on cape Gargano (Fig. 1). It exhibits an area of 5,100 ha with an average depth of 0.6 m. There are 2 canals connecting the lagoon with the open sea for water circulation. The large size of the lagoon in relation to the low depth, limits the beneficial effects of incoming sea water (FICCA, 1995; MAROLLA *et al.*, 1996). Lesina lagoon is a eutrophic lagoon with salinity variation between 22 and 33‰ in the main part. The principal fishing gear in these lagoons is the 'paranza' (a traditional system of leader and barrier nets) closing the lagoon from one shore to the other. The height of the leader net that connects the opposite shorelines is enough to cover the full depth of the lagoon (from surface to bottom). At 100 m intervals approximately, secondary nets are connected to the primary leader net forming a 'fish-spine' structure. At the end of each secondary leader net, 1-8 fyke net traps are placed in a cyclical pattern. The paranza systems are used between 1st of September and 31st of January.

Experimental fishery was carried out in Lesina lagoon using traditional fyke-net traps. The fishing system was composed of a 200-250 m of still net barriers (leaders) and 8-18 fyke net traps. The paranza technical description is: main leader net length, 200m; main leader net mesh, 10 mm; secondary leader net length, 30m; secondary leader net mesh size , 12 mm; wing net length, 4 m, wing net mesh size, 12 mm; fyke-net mesh size 6 mm. The sampling operations were conducted at two stations in Lesina Lagoon: L1 (41° 54' 17"N-15° 30'34"E) and L2 (41° 52' 43"N-15° 25' 21"E; Fig. 1)

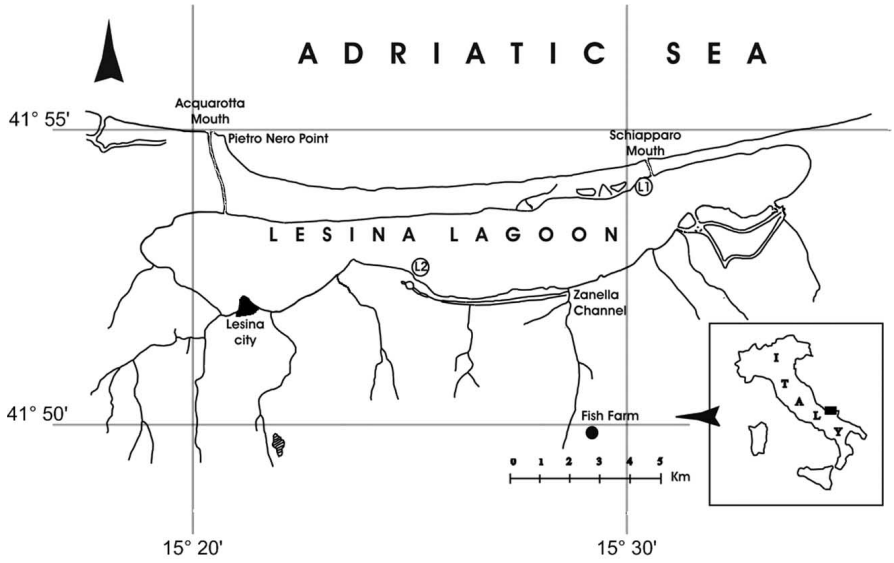

Fig. 1: Map of the area of Lesina lagoon (Central-East Italy) indicating the locations of the sampling stations and the freshwater fish farm.

during the period December 1999-September 2000. A total of 10 samplings were carried out at both stations in Lesina lagoon.

The measurements taken from each individual caught were the total length and the wet weight. Length was measured with using a digital calliper (0.05 mm accuracy) for the small individuals and a decimetre (1 mm accuracy) for the larger individuals. Weight was measured with a digital balance (0.001 g accuracy). Discussion of the findings is based on the length- and weight-frequency distribution of the collected individuals as well as catch per unit of effort (CPUE). CPUE was expressed as the weight of fish caught (in g) divided by the total number of each fyke net traps used:

$$CPUE = \frac{Weight\ of\ fish\ caught\ (in\ g)}{fyke\ net}$$

During the fishing operation, the main physical parameters of the water at the trap locations were measured on site using portable digital instruments. The parameters measured were temperature, salinity, conductivity, pH, dissolved oxygen and transparency using portable instruments.

Results and Discussion

Temperature varied between 13.5 to 28.7°C, salinity between 15.5 to 26.8 ‰, pH between 8.18 to 8.68, the dissolved oxygen between 2.8 to 5.5 mg/L and transparency between 0.5 to 1.1 m. The profiles of these parameters were similar at the two stations except for salinity, which differed during June (18.4 ‰ at L1 and 26.2 ‰ at L2).

Each collected individual was identified according to specific taxonomic characters (TREWAVAS, 1983; ECCLES, 1992). The main systematic classification characteristics of the species *Oreochromis niloticus niloticus* are: 16-18 dorsal spines, 12-13 dorsal soft rays, 3 anal spines and 9-11 anal soft rays; presence of regular vertical stripes throughout the depth of caudal fin; margin of dorsal fin grey or black and vertical bars in caudal fin 7-12.

The composition of the catch in the traps and fyke nets included 19 fish and 6 crustacean species. The list of species is summarised in Table 1. The overall species composition in the samples is in accordance with the known diversity of Lesina lagoon (LUMARE, 1988; LUMARE & VILLANI, 1989). However, the presence of the species *Gasterosteus aculeatus* and *Oreochromis niloticus niloticus* have not been reported in Lesina lagoon before. Species richness was similar at both stations: 23 species at L1 and 21 species at L2.

The first appearance of *Oreochromis niloticus niloticus* in the samples from Lesina lagoon occurred in December, at station L1. In the following period, the species re-appeared in the samples in May at both stations. The absence of the species during the winter-spring period suggests that there occurs a local migration from the central part of the lagoon towards locations close to the coastline (Zannella Channel), where warm water of low salinity (temperature 21 °C and salinity 1.7 ‰) flows from hot springs. Migration towards the sea cannot be considered due to the high salinity and the fact that the seaward channels of the lagoon are occasionally blocked by fishermen. For the period between May and September, this species is always present in the samples (except in June at station L1). The amounts caught, reached a maximum in July at both stations and represented the 18.2 % and 26.4 % of the total catch from stations L1 and L2, respectively. After July, the rate of appearance of the species decreased gradually.

The weight-frequency distribution of the species from L1 and L2 stations is illustrated in Figure 2, while the length-frequency distribution in Figure 3. The maximum individual weight of 255.9 g (230 mm Total Length) was recorded at station L1 in July. The minimum individual weight of 0.488 g (5 mm Total Length) was recorded at the station L1 in August. In general, the smaller individuals were captured in station L2. The average

Table 1
List of the identified species collected in stations L1 and L2 of Lesina lagoon

	L1 station		L2 station	
FISH SPECIES	Number	%	Number	%
Anguilla anguilla	54	0.51	48	0.32
Aphanius fasciatus	5509	51.60	8792	58.36
Atherina boyeri	431	4.03	1641	10.89
Belone belone	44	0.41	99	0.66
Blennius sp.	56	0.52	206	1.37
Chelon labrosus	20	0.19	1	0.01
Dicentrarchus labrax	10	0.09		
Diplodus annularis	60	0.56	1	0.01
Engraulis encrasicholus	1645	15.41	89	0.59
Gasterosteus aculeatus	28	0.27	17	0.11
Gobius sp	51	0.48	87	0.58
Liza aurata	227	2.13	1301	8.63
Liza saliens	1	0.01		
Solea solea	200	1.87		
Sparus aurata	33	0.31		
Sygnathus sp.	219	2.06	240	1.59
Oreochromis niloticus niloticus	47	0.44	129	0.85
Zosterissor ophiocephalus	42	0.39	57	0.38
Sciena umbra	1	0.01		
CRUSTACEAN SPECIES				
Palaemon elegans	1441	13.49	1851	12.29
Palaemon serratus	2	0.02	6	0.04
Palemon adspersus	57	0.53	106	0.70
Penaeus kerathurus	90	0.84		
Carcinus mediterraneus	299	2.80	279	1.85
Crangon crangon	110	1.03	116	0.77
TOTALS	**10676**	**100.00**	**15065**	**100.00**

length was 84.9±11.17 mm and weight, 20.6±4.89 g.

The length-weight relationship of the species is the following:

$$Weight\ (g) = 0.00027 \cdot [Lenght,\ mm]^{2.506},$$
$$r^2 = 0.981,\ std.err = \pm 7.15gN=$$

The CPUE of *O. niloticus niloticus* is illustrated in Figure 4. CPUE was maximum in July (=1.2 g/fyke-net). The average weight of *O. niloticus niloticus* individuals in the catches did not increase with time during the summer period due to the reproduction and recruitment of juveniles. This fact also explains the decrease of CPUE from 0.32 g/fyke-net in May to 0.02 g/fyke-net in June at station L2 (Fig. 4).

Temperature exceeds 20 °C in May and can be as high as 28 °C in June, which is a favourable thermal range for the reproduction of tilapia (PHILIPPART & RUWET, 1982; TREWAVAS, 1983). In addition to that, there exist numerous underwater freshwater springs (temperature 21°C, salinity 1.7-4‰; LUMARE, 1988) at the eastern part which combined with the sea temperature create a favourable environment both in terms of temperature and salinity, for the reproduction

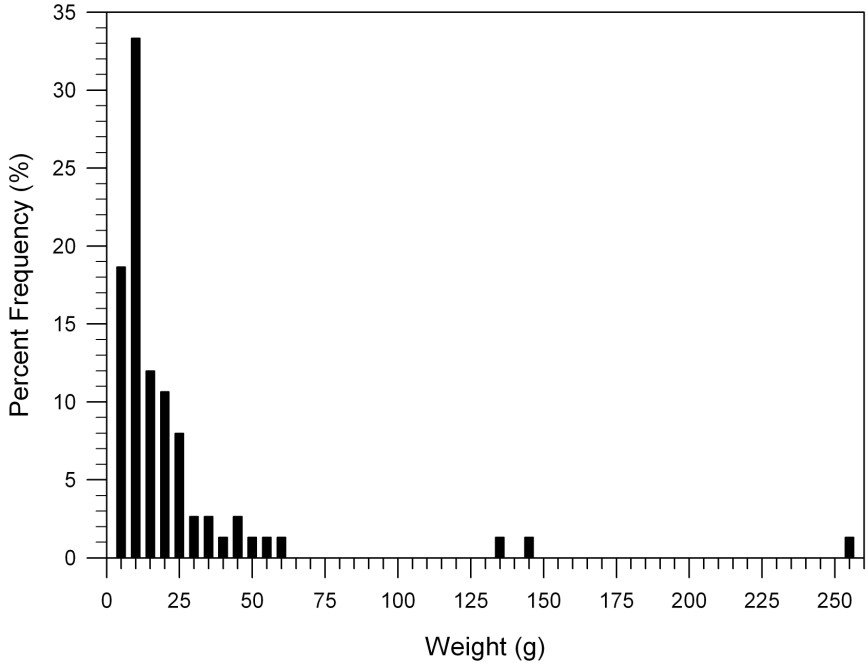

Fig. 2: Weight-frequency distribution (%) of the Oreochromis niloticus niloticus individuals caught in Lesina lagoon.

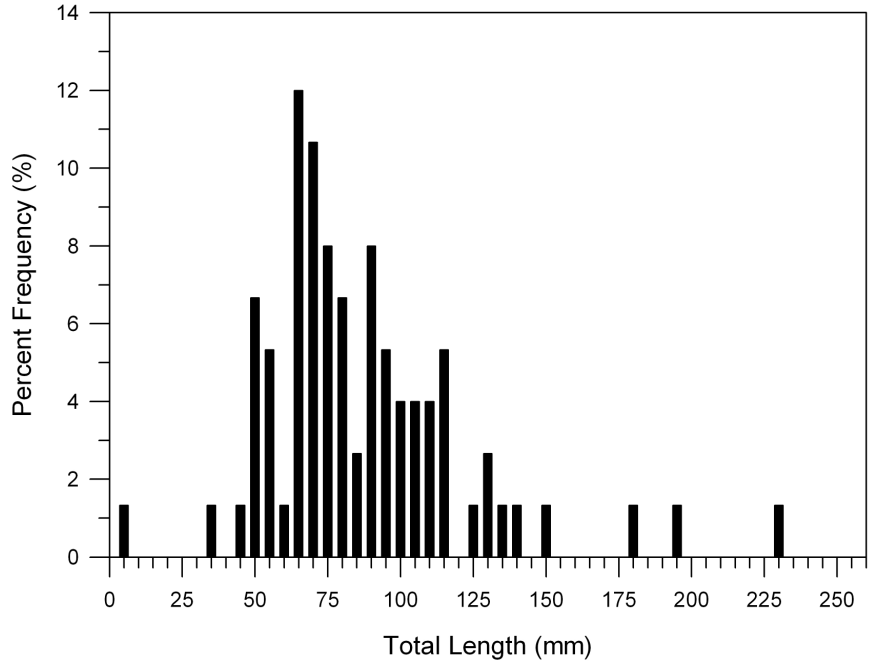

Fig. 3: Length-frequency distribution (%) of the Oreochromis niloticus niloticus individuals caught in Lesina lagoon.

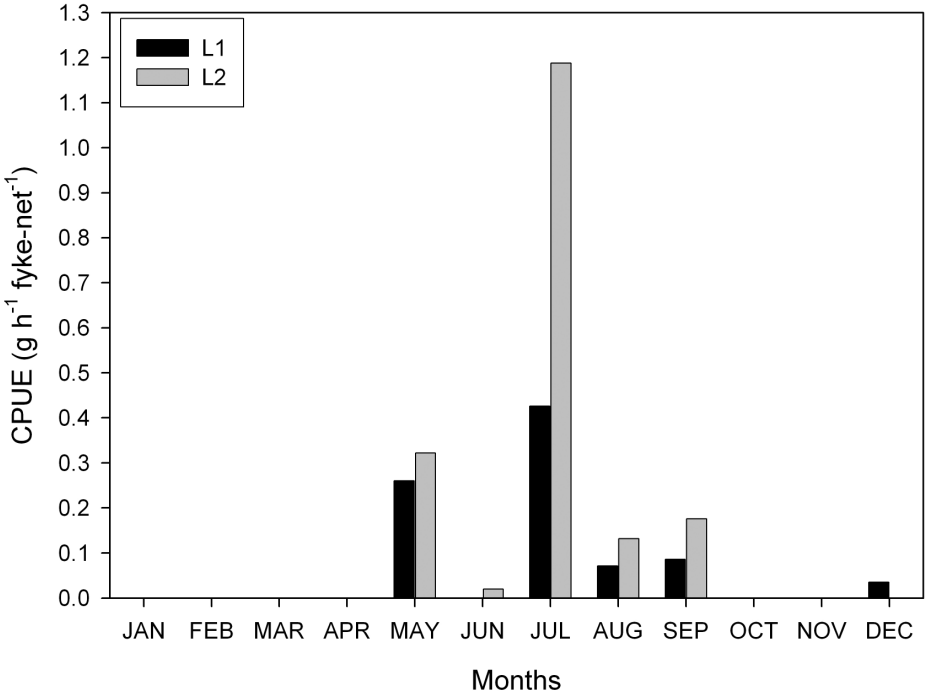

Fig 4: Catch per unit of effort (CPUE) of Oreochromis niloticus niloticus caught in fyke-net traps in Lesina lagoon.

of the species but only in a few areas within the lagoon.

The presence of *Oreochromis niloticus niloticus* in the Lesina Lagoon should be attributed to escapes of individuals from local fish farms. Tilapia fry originating from tropical countries were introduced in the area for ornamental and commercial fish culture in the region of Lesina lagoon. The fact that those farms never succeeded producing tilapia and the constant change of cultured species increases the possibility that individuals of the species either escaped or were released in the streams and irrigation-drainage channels that outflow in the south coastline of Lesina lagoon. The results from the presence of the species in the samples and the size range recorded indicate that the fish have established a local population in Lesina lagoon and that the environmental quality seems to be favourable for the completion of the species life-cycle. According to the known historical information on Lesina lagoon water quality and ecological characteristics (PALMEGIANO & DEOLO, 1983; PALMEGIANO *et al.*, 1985; FICCA, 1995; MAROLLA *et al.*, 1996), the physical and biological (blue-green algae and plants in the brackish areas) parameters clearly support the feeding (HICKLEY & BAILEY, 1987), the reproduction (PHILLIPART & RUWET, 1982) and larval requirements (HOUDE & ZASTROW, 1993) and this is the main reason for the successful colonization of the Lesina lagoon by the species. However, the use of illegal fishing methods (paranze) in Lesina lagoon, the use of non-selective gears (very small mesh sizes; unregulated) and the fishing of undersized fish will reduce the effectiveness of further population studies for *O. niloticus niloticus* in the region while the maximum reported sizes (60 cm standard length and up 4 kg of weight; TREWAVAS, 1983) may not be recovered.

Acknowledgements

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