

## The biology and management of Marble trout in the province of Padua (North-Eastern Italy)

### Biologia e gestione della Trota marmorata in provincia di Padova

### Biologija, nadzorin upravljanje soške postrvi v provinci Padova

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#### Key words

Padua (North-Eastern Italy) Marble trout (*Salmo trutta marmoratus*). Biology. Management.

#### Summary

The Province of Padua offers a wide variety of fluvial ecosystems that range from the trout waters of the Northern plains to the brackish waters of the "Valle Millecampi" lagoon, passing through a wide area laced with canals more suited to carp and bottom fish.

In this variegated context, the areas suited to the proliferation of marble trout are rare indeed and limited exclusively to the middle section of the Brenta River that runs for 15 kilometres in the northernmost part of the Province.

The presence of this species is rather reduced in terms of quantity and for this reason a series of specific measures has been taken to guarantee greater protection. This work aims to illustrate the principal aspects of the population's biology collected during the studies conducted for the drafting of the Fish Map, and the lines of management operation adopted in the attempt to ensure the optimum conservation of this highly-valuable local species of trout.

#### Riassunto

Il territorio provinciale padovano presenta una ampia varietà di ambienti fluviali che vanno dalle acque salmonicole dell'alta pianura sino alle acque salmastre della zona lagunare della "Valle Millecampi" passando attraverso ampia zona di canali a vocazione ciprinicola.

In questo variegato contesto idrologico le zone vocate a marmorata sono decisamente poche e si limitano alla sola area del medio Brenta.

La presenza di questa specie è abbastanza ridotta in termini contenuta i termini quantitativi ed in ragione di ciò sono state intraprese una serie di iniziative specifiche tesa a garantirne una maggiore tutela. In questo lavoro vengono illustrate i principali elementi della biologia di questa popolazione, raccolti nel corso degli studi propedeutici alla redazione della Carta Ittica, nonché le linee gestionali poste in essere per al fine di tentare di garantire una migliore conservazione di questo pregiato salmonide autoctono.

#### Povzetek

Območje Padove je bogato z rečnimi ekosistemi, od postrvjih vod na severu do somorničnih v laguni "Valle Millecampi", v vmesnem prostoru pa je območje s številnimi kanali, ki jih naseljujejo krapovci in vrste, ki živijo na dnu.

Območja, ki jih naseljuje soška postrv so redka, omejena izključno na osrednji tok reke Brenta, dolg približno 15 km, v severnem delu province.

To območje, s površino 350.000 m<sup>2</sup>, povprečnim padcem 2,1 % in sestavo dna v razmerju: skale 25%, prod 30%, kamni 35% in mivka 10%, lahko po Vernaux & Leynaud-u (1974) uvrstimo v biocenotip "5".

Ribjo populacijo (v oklepajih so podane vrednosti za pogostost po Moyle & Nichols, 1973,) sestavljajo *Oncorhynchus mykiss* (2), *Salmo (trutta) trutta* (1), *Thymallus thymallus* (1), *Cottus gobio* (3), *Phoxinus phoxinus* (2), *Leuciscus cephalus* (4) *Barbus plebejus* (3), *Chondrostoma genei* (1) *Gasterosteus aculeatus* (2), *Padogobius martensi* (2), *Orsinigobius punctatissimus* (2), *Anguilla anguilla* (1), *Esox lucius* (1), *Tinca tinca* (1), *Rutilus erythrophthalmus* (1) *Lethenteron zanandrei* (1).

## Introduction

The Province of Padua offers a wide variety of fluvial ecosystems that range from the trout waters of the Northern plains to the brackish waters of the "Valle Millecampi" lagoon, passing through a wide area laced with canals more suited to carp and bottom fish.

In this variegated context, the areas suited to the proliferation of marble trout are rare indeed and limited exclusively to the middle section of the Brenta River running for 15 kilometres in the northernmost part of the Province.

This area, which may be classified as biocenotype "5" according to Vernaux & Leynaud (1974), offers a water surface area of approximately 350,000 m<sup>2</sup>, an average gradient of 2.1%, and a riverbed substrata composed of rocks (25%), gravel (30%), stones (35%) and silt (10%).

The fish population (with the frequency provided by Moyle & Nichols, 1973, in parenthesis) is composed of *Onchorhynchus mykiss* (2), *Salmo (trutta) trutta* (1), *Thymallus thymallus* (1), *Cottus gobio* (3), *Phoxinus phoxinus* (2), *Leuciscus cephalus* (4), *Barbus plebejus* (3), *Chondrostoma genei* (1), *Gasterosteus aculeatus* (2), *Padogobius martensi* (2), *Orsinigobius punctatissimus* (2), *Anguilla anguilla* (1), *Esox lucius* (1), *Tinca tinca* (1), *Rutilus erythropthalmus* (1), *Lethenteron zanandrei* (1).

## Materials and methods

Investigations into environmental characteristics were performed on site.

Surveys on the fish population were conducted using direct census-taking methods through *electrofishing* performed repeatedly during the 1991-2000 period.

Dietary habits were studied through analysis of the stomach content of fish caught by anglers.

Data on fishing pressure were collected through analysis of the fishing licenses and records of the "La Sorgente" fishing sports company that has been assigned the rights to use for the section of the Brenta River in question.

## Results

### Dimensions and characteristics of the stock

In terms of quantity, the dimensions of the population were decidedly modest throughout the period of observation, with biomass values in the range of 1 - 4 gr/m<sup>2</sup> and density values of usually less than 0.01 gr/m<sup>2</sup>.

Although previous data for purposes of significant comparison are unavailable, it appears clear that the current population is much lower than the biogenic potential offered by the local river system.

In terms of quality, the most serious problem to be faced involves the phenomenon of hybridism with *Salmo (trutta) trutta*. At the start of the study (1991), more than 60% of the population was found to be composed of hybrids, at least in terms of phenotype; the percentage of individuals with phenotypical characteristics is currently (1999) clearly lower (< 30%), and may be considered the most significant result of the prohibition against the stocking of fertile brown trout *Salmo (trutta) trutta* in the Padua Province section of the Brenta River.

### Growth rates

The growth of marble trout in the Paduan Brenta has been remarkably rapid (Fig. 1), especially when compared with the other Veneto Region river systems (Zanetti *et al.*, 1990); marble trout reaches the current minimum catch size (40 cm) after slightly, less than four years of age, and continues growing steadily even afterwards.

The age/length ratio is sufficiently described by VBGE, at least in regard to the first 7 years of life: the characteristic parameters of the equation calculated are as follows:

$$L_{inf} = 1030; K = 0,13; t_0 = -0,18 \text{ (Fig. 1).}$$

It is, however, possible that the growth rate in future years may not follow the model illustrated, and the asymptote will come to be reached in much shorter times than those hypothesised, as demonstrated in other works on the species in the Brenta River (Marconato *et al.*, 1990). The weight/length ratio is exponential, and a logarithmic transformation of the values measured permits description using the following linear equation:

$$\text{LogBW} = 2,91\text{logLT} - 4,77 \text{ (} r = 0.991; p < 0.01 \text{)}$$

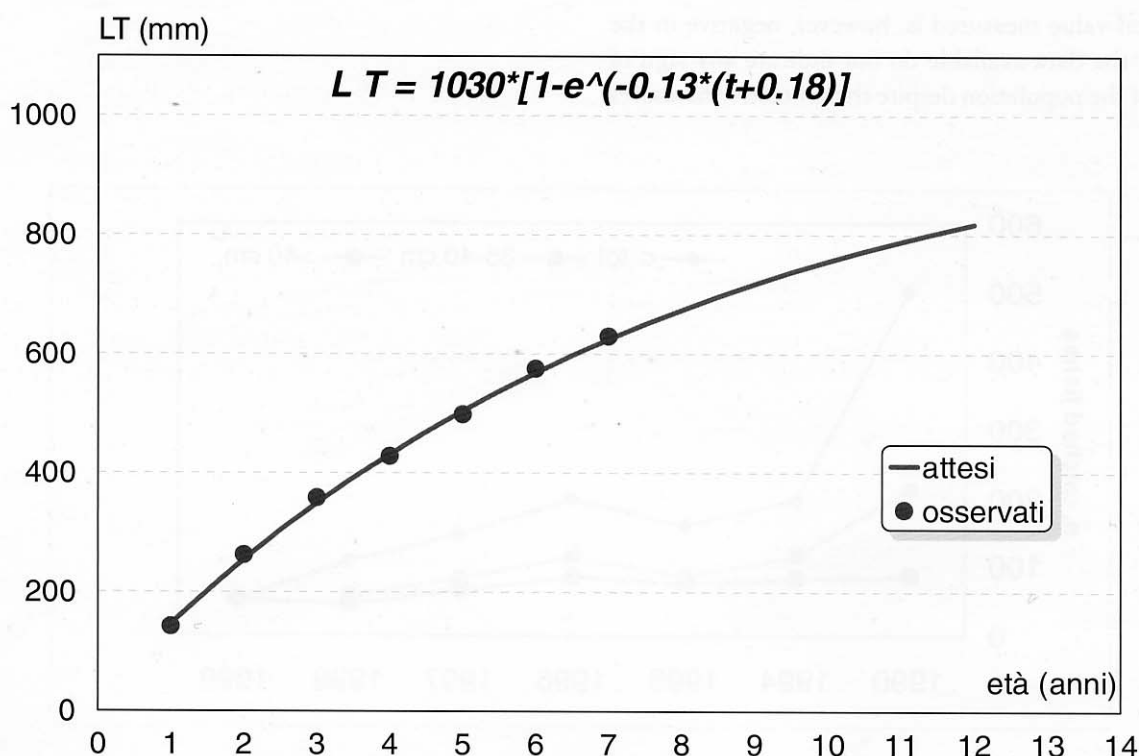


Fig. 1 - Marble trout in the Paduan Brenta – VBGE Growth curve

### Reproduction and fertility

The reproductive period is extremely limited and concentrated in the roughly one-month period from the end of November to the third week of December.

The males are already mature halfway through November. The females rarely deposit their eggs before the start of December; most eggs are deposited during the first two weeks of December, and only in few cases in the third.

The females reach sexual maturity after 3 years of life on the average. The males are more precocious, and are often already sexually active during the 2<sup>nd</sup> year of life.

We observed the number of eggs produced to be 1807 (d.s. ± 407) per Kg/female, which is less than the numbers reported by others (Jelli, 1989).

The eggs open in hatchery in approximately 450 °C/day.

### Dietary habits

Data obtained from an analysis of stomach content demonstrates that the marbled trout's diet varies depending on size. During the first 3-4 years of life, the diet is based on benthic macro-invertebrates composed primarily of Ephemeroptera (Mayflies) (78%) and Plecoptera (Stoneflies) 10%), which alone account for nearly 90% of the material contained in the stomachs analysed. The diet is completed by Tricoptera (Caddis flies) (3%) and worms (6%).

It is interesting to note that the Gammaride crustaceans that constitute one of the most significant groups in terms of macrobenthic biomass in this part of the river, accounting for nearly 60% of the total amount of benthic invertebrates present, are almost entirely absent from the diet of the marble trout.

These dietary habits change clearly with increased size, and the tendency to eat other fish is most evident in subjects over 40 cm long in which the remains of other fish eaten account for approximately 57% of the stomach's content, followed by Ephemeroptera (41%).

### The pressure on the stock posed by fishing

During almost ten years of monitoring, the number of marble trout caught has decreased significantly (Fig. 2), from the 500 catches/year recorded in 1990 to little more than 50 catches/year in 1999.

This decrease in catch approaching 90% is primarily due to the progressive increase in the mandatory minimum catch size from 30 cm in 199, to 35 cm in 1994 and to 40 cm in 1999.

Through the extrapolation of the data regarding catches of over 40 cm only, the catch values have remained substantially constant, and varied during the period of observation from a maximum of 85 catches (1990, 1996) to a minimum of 47 (1998).

The total value measured is, however, negative in the sense that the data available do not indicate any sign of recovery of the population despite the protective measures adopted.

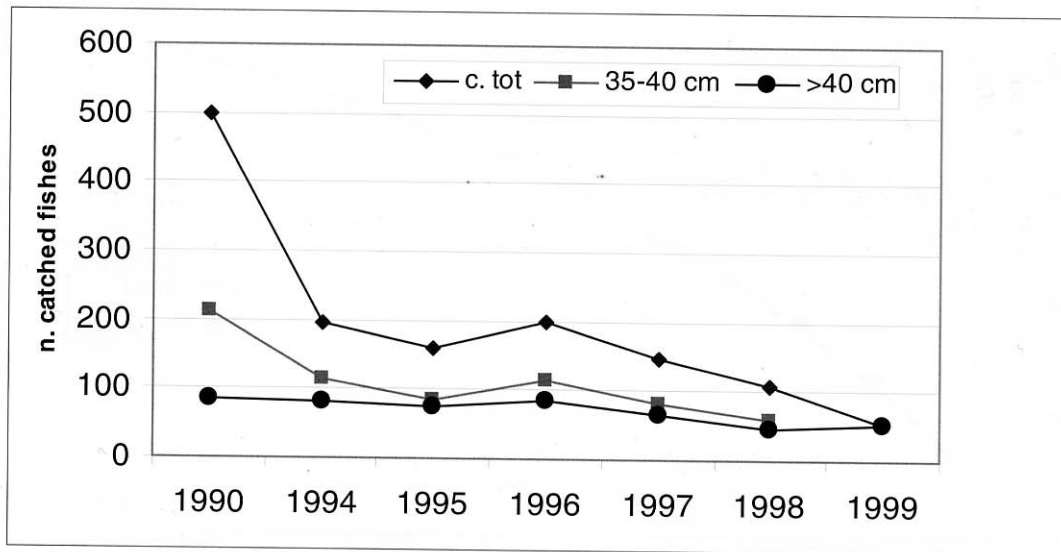


Fig. 2 - Catches of marble trout in the Paduan Brenta: 1990-1999

**Management operations**

The management of the population in question is based on the following three main elements:

- a) increased minimum catch size;
- b) prohibition against re-stocking with brown trout to prevent hybridism complemented by re-stocking with rainbow trout for sports fishing purposes;
- c) re-population through stocking with yearlings produced locally in special hatcheries.

The results achieved thus far are, on the whole, rather modest in terms of quantity, while the reduction in the hybridism rate is more encouraging and indicates a net reduction in the pronounced genetic introgression process that has been in progress since the start of the '90s.

**Conclusions**

An analysis of the data above clearly indicates the precarious situation of the marble trout population in the Paduan Brenta, which despite the protective measures adopted does not yet show signs of the increase that might have been expected.

This can only mean that much more remains to be done and more studies must be performed to ensure the complete recovery so amply deserved by this highly-valuable species of local trout.

**Acknowledgements**

The author would like to thank Craig Allen of Padua (Italy) for the revision and translation of the text into English.

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