

# First remarks on fish from the running waters of Vincheto di Celarda Nature Reserve

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## ABSTRACT

Fish assemblages of the running waters of Vincheto di Celarda Nature Reserve (Piave River, Torrente Caorame, Rio Caoramello and Rio Celarda) were investigated in order to assess the communities abundance and structure. Investigations on the eco-morphology and water quality of rivers and streams were conducted alongside fish surveys. We recorded the presence of six species of fish and one cyclostome. Four species were of particular interest, listed in the Annex II of the Habitats Directive 92/43/CEE (*Salmo [trutta] marmoratus*, *Cottus gobio*, *Barbus plebejus* and *Lampetra zanandrei*). We calculated the Index of Ecological Status of Fish Communities by following the I.S.E.C.I. methodology as modified in 2007.

**Key words:** Vincheto di Celarda Nature Reserve, Ecological Index, ISECI, *Salmo [trutta] marmoratus*, *Cottus gobio*, *Barbus plebejus*, *Lampetra zanandrei*.

## RIASSUNTO

I popolamenti ittici dei corsi d'acqua che scorrono nella Riserva Naturale Vincheto di Celarda (Fiume Piave, Torrente Caorame, Rio Caoramello e Rio Celarda) sono stati oggetto di uno studio teso a determinare le presenze, le abbondanze e le strutture delle popolazioni presenti. Contestualmente ai censimenti ittici sono state condotte una serie di indagini sull'ecomorfologia e lo stato di qualità delle acque. Le indagini hanno permesso di evidenziare la presenza certa di sei specie di pesci e di una di ciclostoma. Di queste ben quattro sono specie di interesse comunitario inseriti in Allegato II della Direttiva Habitat 92/43/CEE (*Salmo [trutta] marmoratus*, *Cottus gobio*, *Barbus plebejus* e *Lampetra zanandrei*). Si è infine proceduto al calcolo dell'indice dello stato ecologico delle comunità ittiche (I.S.E.C.I.) così come modificato nel 2007.

## INTRODUCTION

Vincheto di Celarda Nature Reserve is located in Feltrina (Belluno province) municipality. Despite its small area, it is characterized by a high environmental value and diverse natural and semi-natural habitats. The reserve extends along the Piave River banks downstream of the joining with the Torrente Caorame. The reserve is delimited entirely by water courses which are all tributaries of the Piave River: the Torrente Caorame to the North, Rio Caoramello to the West, and Rio Celarda to the South (fig. 1). Springs and ponds within the reserve originate from ancient oxbow lakes created by the Piave River. The information regarding the geographical setting, the distribution and ecology of fish species of Italy and Veneto region, together with the results of the assessment of the available running water habitats for fish, were used to identify the *expected fish community*, which was compared with the *observed community*. Such a comparison is essential to assess the *ecological status* of fish communities according to the Directive 2000/60/EC "Water Framework Directive", which in this work is accomplished by us-

ing the Index (I.S.E.C.I.) recently developed by Zernian (2004, 2007). The work was funded by the LIFE Project LIFE04NAT/IT/000190.

## STUDY AREA

The main water courses of the Vincheto di Celarda Nature Reserve run over wide alluvial plains at a mean elevation of 230 m a.s.l. Four different habitats corresponding to the four main rivers/streams can be distinguished. The Piave River is about 20 m wide, it is characterized by a rubble-gravel bottom, and water temperature reaching a maximum of 16-17° C. The river bed is covered by wide gravel deposits devoid of vegetation. These features are typical of the "upper salmonid zone" (Zanetti et al. 2000). The Torrente Caorame belongs to this category as well. The Rio Caoramello is a small creek, about 3 m wide, with constant discharge, which originates from a deviation of the Torrente Caorame. It runs over flat areas among pastures, water is often clear and high flows are short-lasting; the bed is mainly sand-clay alternating with

more recent gravel alluvium. Current speed is high, creating the typical features of the "lower salmonid zone". A different and particularly important stream typology is represented by the Rio Celarda, a krenal stream, about 6 m wide, with constant discharge, large wetted area, strong current alternating with lower current in deep areas, substrate represented by sand and clay with gravel banks. These features are typical of the "lithophilic spawning cyprinid zone". Due to such habitat diversification, water courses of the Vinchetto di Celarda Nature Reserve host quite rich and diverse fish communities, including taxa

endemic for the Padanian ichthyogeographic region (Zerunian 2002).

The biological quality of the water courses of the Vinchetto di Celarda Nature Reserve was assessed using the Extended Biotic Index (APAT-IRSA 2003) which resulted in a high quality class, with EBI values generally higher than 10 for the entire assessment period (2005-2007). Only in a few instances the EBI value was lower, with a minimum value of 9 recorded for the Rio Celarda in November 2005 (Turin 2007).

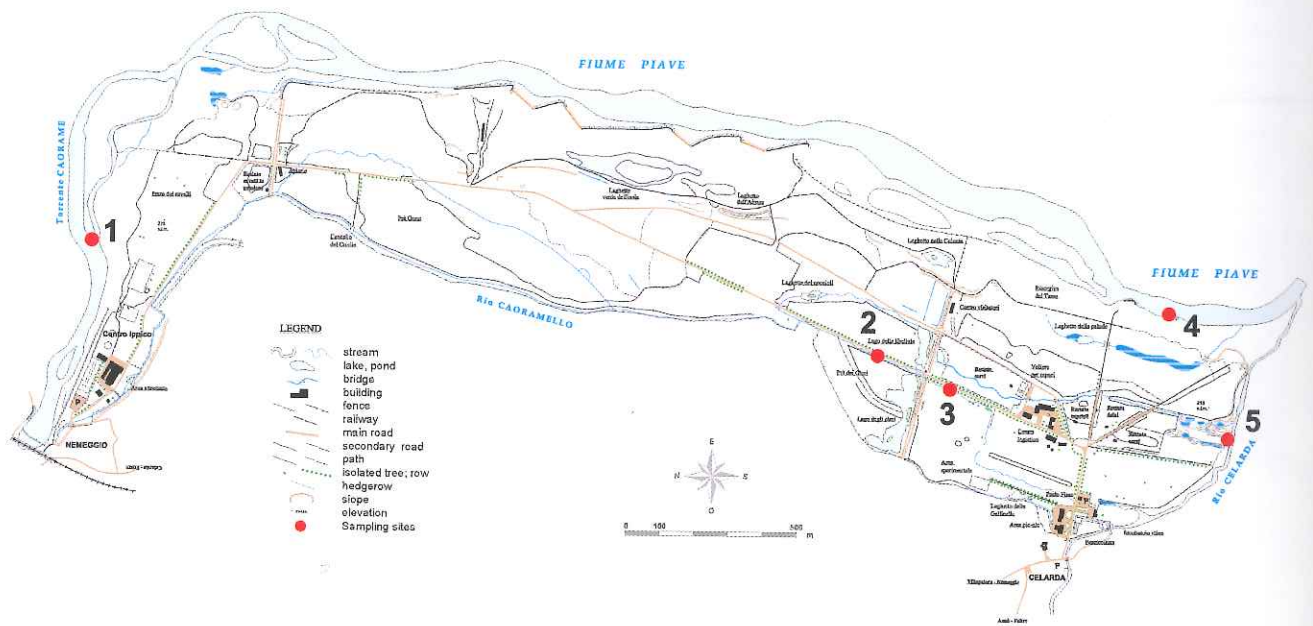


Fig. 1. Planimetry of the Vinchetto di Celarda Nature Reserve and location of the sampling sites.

## MATERIALS AND METHODS

Fish sampling was conducted in May 2006 in five different sites: one in Torrente Caorame, one in Piave River, two in Rio Caoramello, and one in Rio Celarda. Fish populations were investigated by electrofishing, using a backpack electroshocker with continuous pulsating current and adjustable voltage; (3.8-7 A, 300-500 V, 1500 W). An abundance value was assigned to each species, and a stability index to each population. We used the Moyle & Nichols (1973) abundance index, modified according to Turin et al. (1999), which allows estimating the relative abundance of each species according to the criteria listed in tab. 1.

The stability of each population was quantified by

Tab. 1. Moyle & Nichols abundance index (modified).

Abundance index	Number of individuals recorded in a straight 50 m long stream reach
1	1 - 2
2	3 - 10
3	11 - 20
4	21 - 50
5	> 50

using a simple index which takes into account the population structure as assessed in the field (Turin et al. 1999). This index indicates if the individuals of a sampled population are regularly distributed in the various age classes (tab. 2).

Tab. 2. Population structure index.

Population structure index	Population structure level
1	Structured population
2	Non structured population – young individuals dominant
3	Non structured population – adult individuals dominant

## RESULTS

The results of the analysis of the fish assemblages collected in the Piave River, Torrente Caorame, Rio Caoramello and Rio Celarda are listed in tabs. 3, 4, 5, 6, 7, respectively. For each sampling site we list the collected species, and their values of the Moyle & Nichols and population structure indices.

A total of seven species were recorded, belonging to three teleost, and one cyclostom families. Salmonidae were represented by brown trout (*Salmo [trutta] trutta*), marble trout (*Salmo [trutta] marmoratus*) and hybrids of the two taxa; Ciprinidae were represented by common barbel (*Barbus plebejus*), chub (*Leuciscus cephalus*) and minnow (*Phoxinus phoxinus*); Cottidae by bullhead (*Cottus gobio*), and Petromizontidae by the Po brook lamprey (*Lampetra zanandrei*). The latter was not directly collected by electrofishing, but its presence (already recorded for the area) had been visually assessed in a previous survey. Four of the recorded species are listed in the Annex II of the Habitats Directive 92/43/CEE: *Salmo [trutta] marmoratus*, *Cottus gobio*, *Barbus plebejus*, and *Lampetra zanandrei*. All recorded species are autochthonous but most of the specimen of *Brown trout* seems to be hybridized with allochthonous stocks.

Tab. 3. Fish assemblages of the Piave River - sampling site 4.

Species present	Scientific name	Moyle & Nichols index	Population structure index
Common barbel	<i>Barbus plebejus</i>	2	1
Chub	<i>Leuciscus cephalus</i>	2	1
Minnow	<i>Phoxinus phoxinus</i>	5	1
Brown trout	<i>Salmo [trutta] trutta</i>	3	2
Marble trout (and hybrids Bt x Mt)	<i>Salmo [trutta] marmoratus</i>	2	2
Bullhead	<i>Cottus gobio</i>	3	1

Tab. 4. Fish assemblages of the Torrente Caorame - sampling site 1.

Species present	Scientific name	Moyle & Nichols index	Population structure index
Brown trout	<i>Salmo [trutta] trutta</i>	4	1
Marble trout (and hybrids Bt x Mt)	<i>Salmo [trutta] marmoratus</i>	2	2
Bullhead	<i>Cottus gobio</i>	2	1

Tab. 5. Fish assemblages of the Rio Caoramello - sampling site 2.

Species present	Scientific name	Moyle & Nichols index	Population structure index
Brown trout	<i>Salmo [trutta] trutta</i>	4	1

Tab. 6. Fish assemblages of the Rio Caoramello - sampling site 3.

Species present	Scientific name	Moyle & Nichols index	Population structure index
Brown trout	<i>Salmo [trutta] trutta</i>	2	1
Minnow	<i>Phoxinus phoxinus</i>	3	1

Tab. 7. Fish assemblages of the Rio Celarda - sampling site 5.

Species present	Scientific name	Moyle & Nichols index	Population structure index
Common barbel	<i>Barbus plebejus</i>	1	3
Chub	<i>Leuciscus cephalus</i>	2	1
Bullhead	<i>Cottus gobio</i>	5	1
Brown trout	<i>Salmo [trutta] trutta</i>	5	1
Po brook lamprey	<i>Lampetra zanandrei</i>	n.d.	n.d.

## DISCUSSION

The fish community of the Vinchetto di Celarda Nature Reserve is characterized by some interesting elements such as Italian endemic taxa (marble trout, common barbel and Po brook lamprey). In general, fish populations are quite well structured and abundant, even if some disturbance elements were recorded. In particular, salmonid populations showed the occurrence of hybridization and/or the presence of some allochthonous stocks, particularly for the brown trout. It is important to mention the lack of records for the eel, a catadromous species once com-

mon in the reserve and today at risk of extinction, due to the presence of the numerous impoundments on the Piave River (e.g. dams, weirs, sluices), which hinder the upstream movement of the juveniles from the Adriatic Sea (Zerunian 2002).

In order to provide a synthetic evaluation of the status of the fish communities of Vinchetto di Celarda, we applied the Fish Community Ecological Status Index (ISECI). The focal point of the index is represented by the attribution of a numeric value to the community, using the double-entry table below (tab. 8), which is then converted in ecological status levels by following a reference grid (tab. 9).

Tab. 8. Table for the calculation of the Index of Ecological Status of Fish Communities (Zerunian 2004, 2007).

Community composition (first entry in the table, horizontal)		Biological status of autochthonous populations (second entry, vertical)			
Native species	Alien species	A	B	C	D
All expected species are present	Absent or with non-naturalized populations	16	15	14	13
	One or two naturalized species are present; Wels catfish <sup>1</sup> absent	15	14	13	12
	More than two naturalized species or Wels catfish <sup>1</sup> present	14	13	12	11
Most of expected species are present (more than 50%); only taxa non-endemic for Italy are absent	Absent or with non-naturalized populations	13	12	11	10
	One or two naturalized species are present; Wels catfish <sup>1</sup> absent	12	11	10	9
	More than two naturalized species or Wels catfish <sup>1</sup> present	11	10	9	8
Most of expected species are present (more than 50%); only taxa endemic for Italy <sup>2</sup> are absent	Absent or with non-naturalized populations	10	9	8	7
	One or two naturalized species are present; Wels catfish <sup>1</sup> absent	9	8	7	6
	More than two naturalized species or Wels catfish <sup>1</sup> present	8	7	6	5
50% or less than the expected species are present	Absent or with non-naturalized populations	7	6	5	4
	One or two naturalized species are present; Wels catfish <sup>1</sup> absent	6	5	4	3
	More than two naturalized species or Wels catfish <sup>1</sup> present	5	4	3	2

## Legend:

1. *Silurus glanis*.
  2. *Lampetra zanandreae*, *Acipenser naccarii*, *Rutilus rubilio*, *R. erythrophthalmus*, *Leuciscus souffia muticellus*, *Alburnus alburnus alborella*, *A. albidus*, *Chondrostoma soetta*, *Ch. genei*, *Barbus plebejus*, *B. meridionalis caninus*, *Cobitis taenia bilineata*, *Sabanejewia larvata*, *Salmo [trutta] marmoratus*, *S. [trutta] macrostigma*, *S. fibreni*, *S. carpio*, *Pomatoschistus canestrini*, *Knipowitschia panizzae*, *K. punctatissima*, *Padogobius martensii*, *Gobius nigricans*.
- A) All populations well-structured in age classes, and with sufficient or good abundances (present, frequent, abundant or dominant). Populations of species of the genera *Salmo*, *Thymallus*, *Esox*, *Barbus* and *Rutilus* non hybridizing with allochthonous populations.
- B) All populations well-structured in age classes, and with sufficient or good abundances. One or more populations of species of the genera *Salmo*, *Thymallus*, *Esox*, *Barbus* and *Rutilus* hybridizing with allochthonous populations.
- C) Most of the populations (more than 50%) well-structured in age classes, and with sufficient or good abundances.
- D) Less than 50% of the populations well-structured in age classes, and with sufficient or good abundances.

Tab. 9. Conversion table of the ISECI values into levels of the Index of Ecological Status of Fish Communities (Zerunian 2007).

Ecological status level	ISECI value	Synthetic judgement	Thematic colour
I	≥ 14	high	blue
II	11 - 13	good	green
III	8 - 10	sufficient	yellow
IV	5 - 7	poor	orange
V	2-4	bad	red

The application of the ISECI requires defining the expected (potential) fish community for each of the sampling sites, i.e. the community expected if disturbance did not occur in the sampled water course.

The potential communities, assessed with regard to the ichthyogeographic region and the eco-morphological characteristics of each water course, are listed in tab. 10.

Tab. 10. Expected fish communities for the water courses of the Vincheto di Celarda Nature Reserve.

Water course	Expected fish communities
Piave River	marble trout, grayling, bullhead, common barbel, chub, minnow, eel, Po brook lamprey
Torrente Caorame	marble trout, grayling, bullhead, common barbel, minnow
Rio Caoramello	brown trout, minnow, bullhead
Rio Celarda	marble trout, brown trout, bullhead, chub, common barbel, minnow, stroemling, Po brook lamprey, eel

The values of the ISECI Index calculated for the observed fish communities of the water courses are listed in tab. 11. The observed fish community is the

first entry in the table, whereas the biological status of the examined populations is the second entry.

Tab. 11. ISECI values of the fish communities of the Vincheto di Celarda Nature Reserve water courses.

Water course	ISECI value	Synthetic judgement
Piave River	9	sufficient
Torrente Caorame	9	sufficient
Rio Celarda	9	sufficient
Rio Caoramello - site 2	6	poor
Rio Caoramello - site 3	10	sufficient

## CONCLUSIONS

Data collected in this study allowed a satisfactory description of the status of the fish communities at Vincheto di Celarda Nature Reserve. Fish populations are generally in good conditions but there are evident signs of ecological stress, which prevents reaching the optimal condition for the reserve (which should be the condition expected for a natural reserve).

In conclusion, the calculation of the Index of Ecological Status of Fish Communities resulted in the following evaluation:

1. the calculated ISECI of the Piave River (=9) indi-

cates a sufficient ecological status for the fish communities. The evaluated status is influenced by differences between the observed and the expected community composition and species abundances, such as the lack of the endemic Po brook lamprey (*Lampetra zanandreai*), already rare in this section of the Piave River and currently affected by channelization, which eliminates the habitats near the banks which are typically used by the species. The calculated status is also affected by i) the lack of eel (*Anguilla anguilla*), once frequent in the Piave but whose migration upstream is today hindered by several transversal barriers present in the river;

- ii) the hybridization rate of the autochthonous salmonids; iii) the poor structured composition in age class of the salmonids. The lack of adults in the salmonid populations are linked to the channelization and regulation of the riverbanks which eliminates pools that are the most suitable habitats for the adults.
2. the calculated ISECI of the Torrente Caorame (=9) indicates a sufficient ecological status for the fish communities. Also in this case, the evaluation is influenced by differences between the observed and the expected community composition and species abundances. The common barbel (*Barbus plebejus*), an Italian endemism, is not present. The autochthonous salmonids hybridize with allochthonous stocks.
  3. the calculated ISECI of the Rio Celarda (=9) indicates a sufficient ecological status for the fish communities. Differences in the observed community composition and species abundances compared to the expected ones are represented by the absence of marble trout (*Salmo [trutta] marmoratus*) and eel (*Anguilla anguilla*), and the presence of individuals of brown trout (*Salmo [trutta] trutta*) from allochthonous stocks.
  4. the calculated ISECI for the Rio Caoramello (=6) is poor for the upstream site, and sufficient (=10) for the downstream site. Variations in the observed community composition and species abundances compared to the ones expected are present; they are stronger for the upstream site where a monospecific population of allochthonous brown trout is present.

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