

ECOLOGIA E BIOLOGIA DEI SALMONIDI

Francesco Nonnis Marzano

Dipartimento di Biologia Evolutiva
e Funzionale - Università di Parma



Timallidi



Salmonidi



Coregonidi



Ministero dell'Ambiente

Unione Zoologica Italiana

I PESCI DELLE ACQUE INTERNE ITALIANE

Gilberto GANDOLFI
Patrizia TORRICELLI

Sergio ZERUNIAN
Andrea MARCONATO

(disegni di Luigi CORSETTI)



ISTITUTO POLIGRAFICO E ZECCA DELLO STATO

CHIAVE PER IL RICONOSCIMENTO DEI GENERI

1. Denti ben sviluppati, robusti e acuti 2

- Denti rudimentali o assenti *Coregonus*

2. Prima pinna dorsale normalmente sviluppata, con 16 raggi al massimo 3

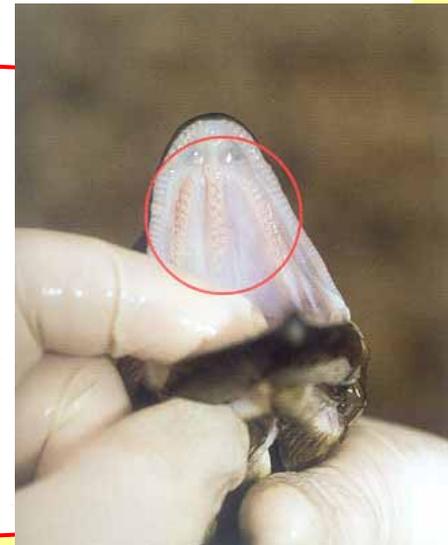
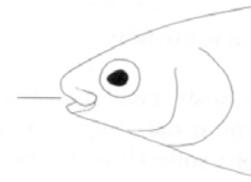
- Prima pinna dorsale grande, sia in altezza che in lunghezza, con 17 raggi o più *Thymallus*

3. Stelo del vomere privo di denti *Salvelinus*

- Stelo del vomere munito di denti 4

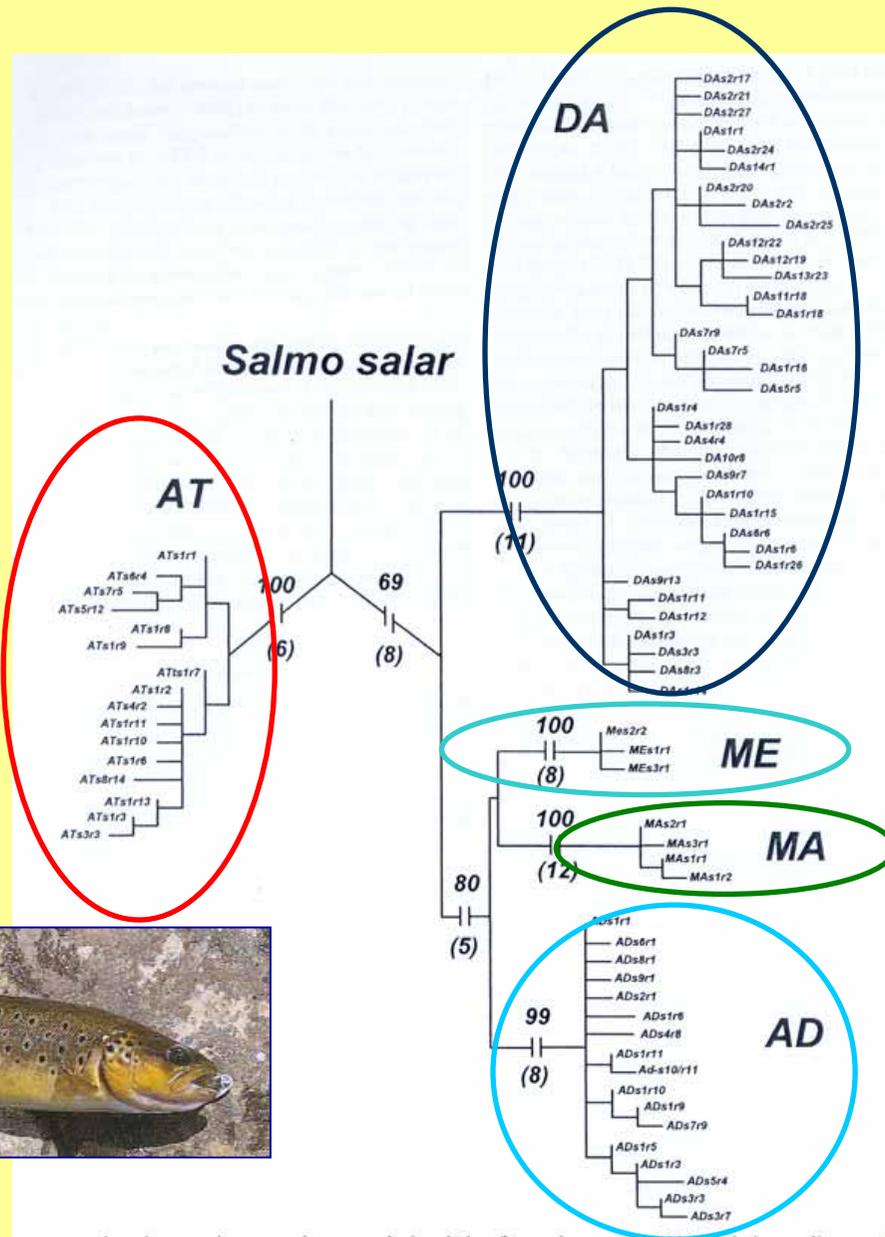
4. Pinna caudale con piccole macchie nere rotondeggianti *Oncorhynchus*

- Pinna caudale priva di macchie nere rotondeggianti ... *Salmo*



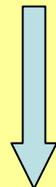
Bernatchez (2001) *Evolution*

Inquadramento evolutivo e zoogeografico

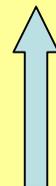


BIOLOGIA

Biologia riproduttiva



GESTIONE



ECOLOGIA

Sistematica

Distribuzione

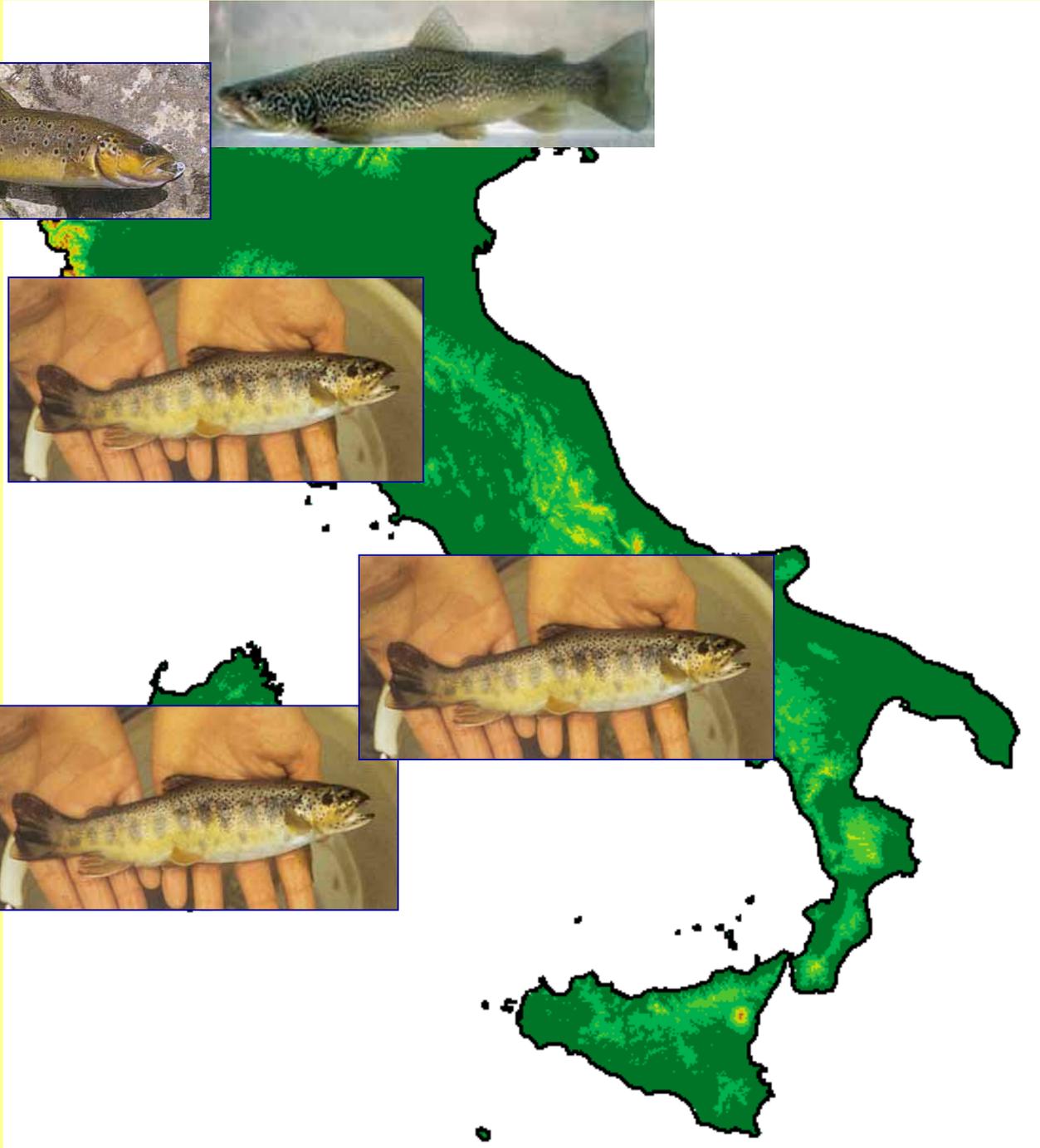
Attività trofica

Competizione intra e interspecifica









DISTRIBUZIONE

Acque correnti

900 m

Fario

700-500 m

Fario, Marmorata e loro Ibridi

Fondovalle

Marmorata, Temolo (Iridea)

DISTRIBUZIONE

Acque lacustri



**SIMPATRIA
E
BARRIERE RIPRODUTTIVE**





IBRIDAZIONE



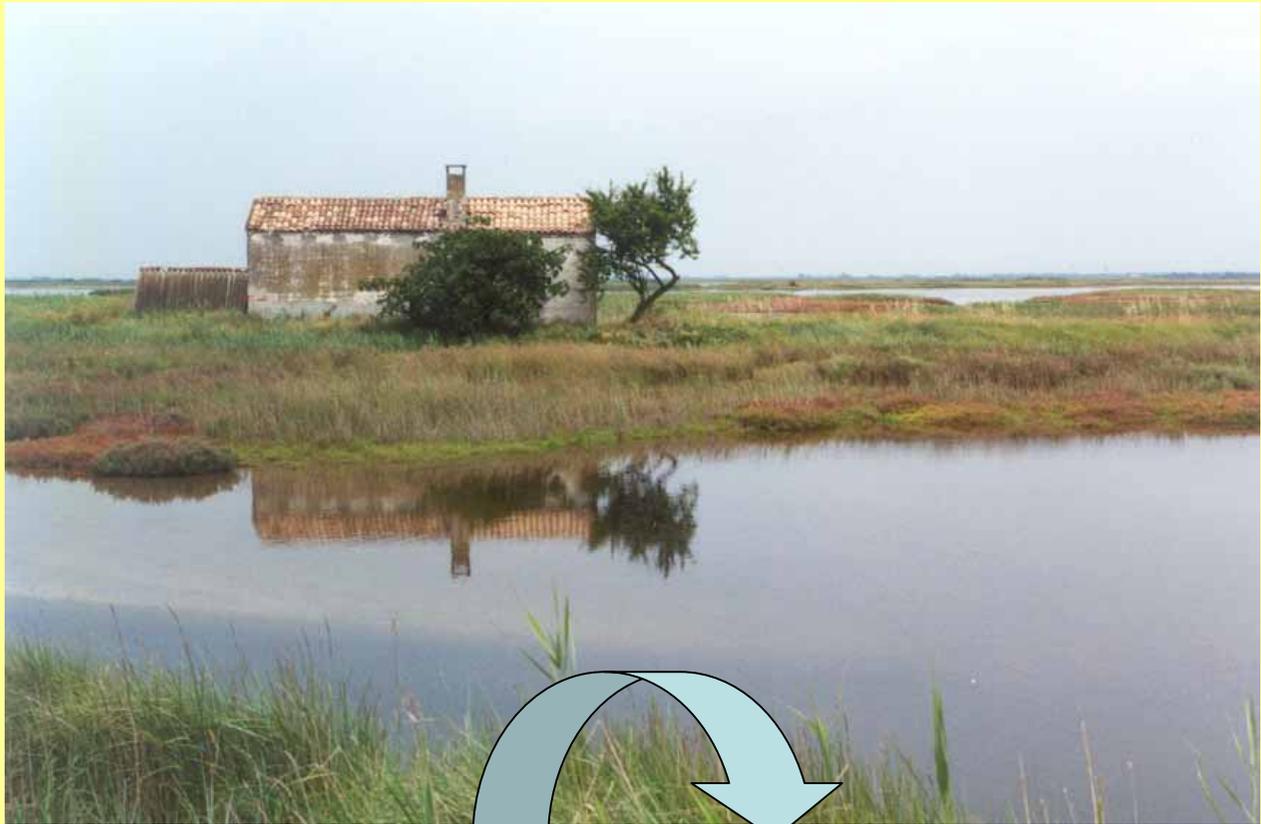
IBRIDAZIONE

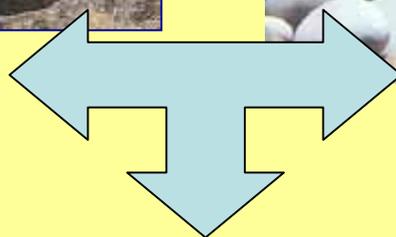
Accoppiamento di due individui appartenenti a taxa differenti

INTROGRESSIONE

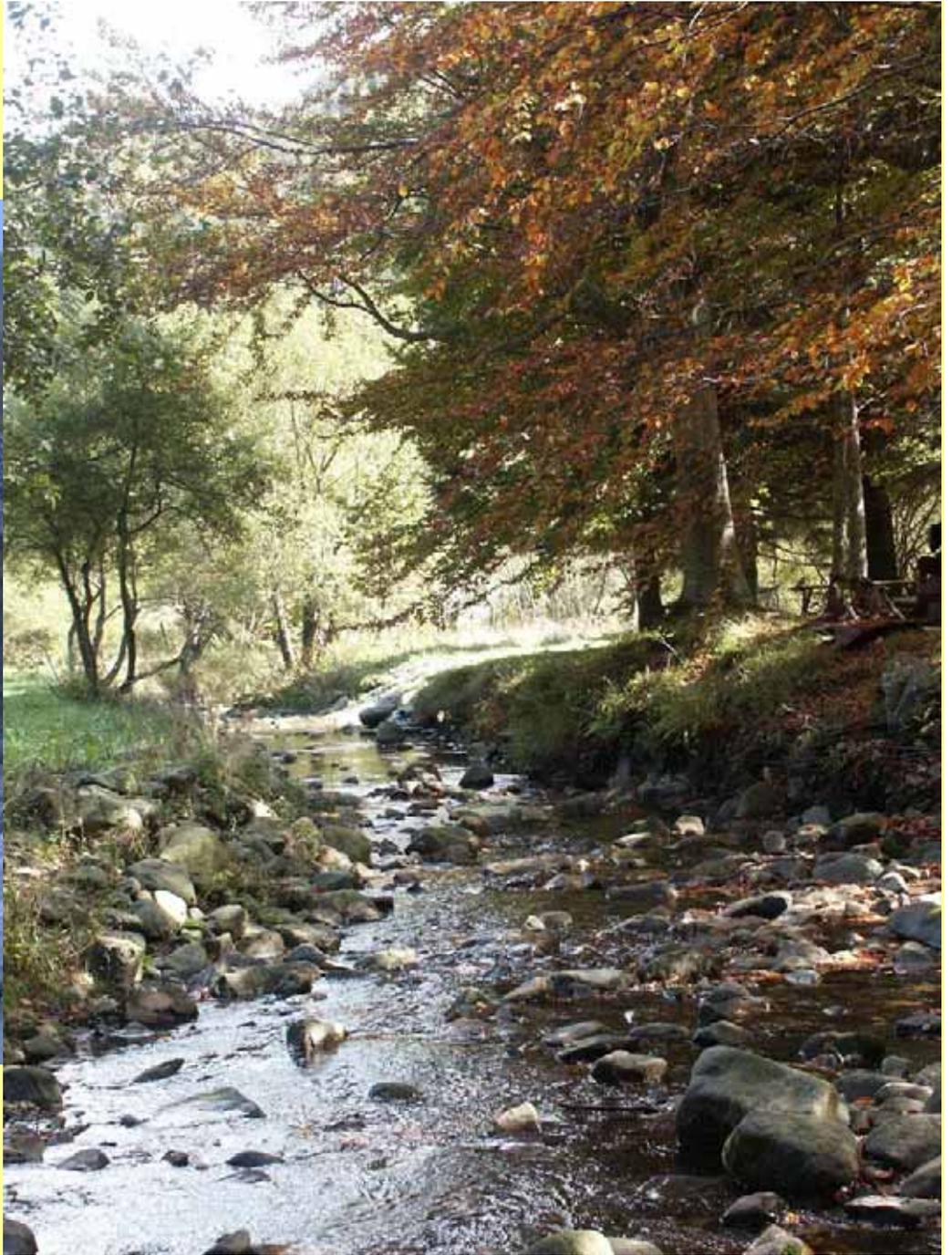
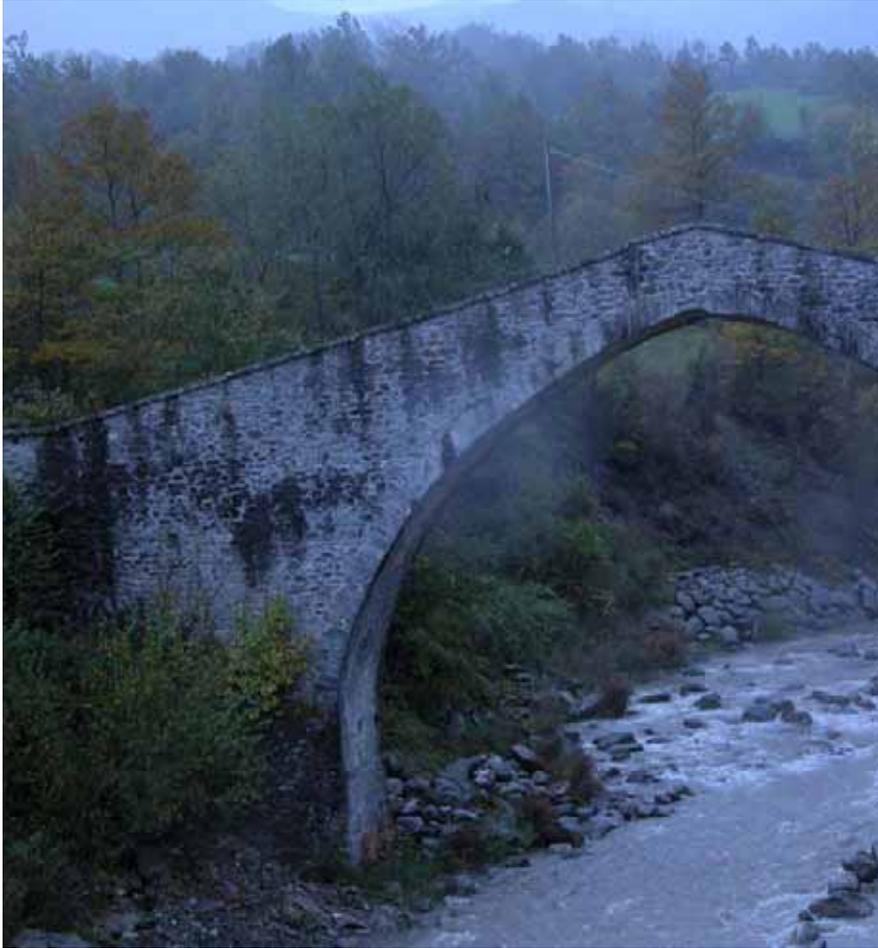
Trasferimento di geni da un taxon ad un altro

MORFOTIPI/ECOTIPI

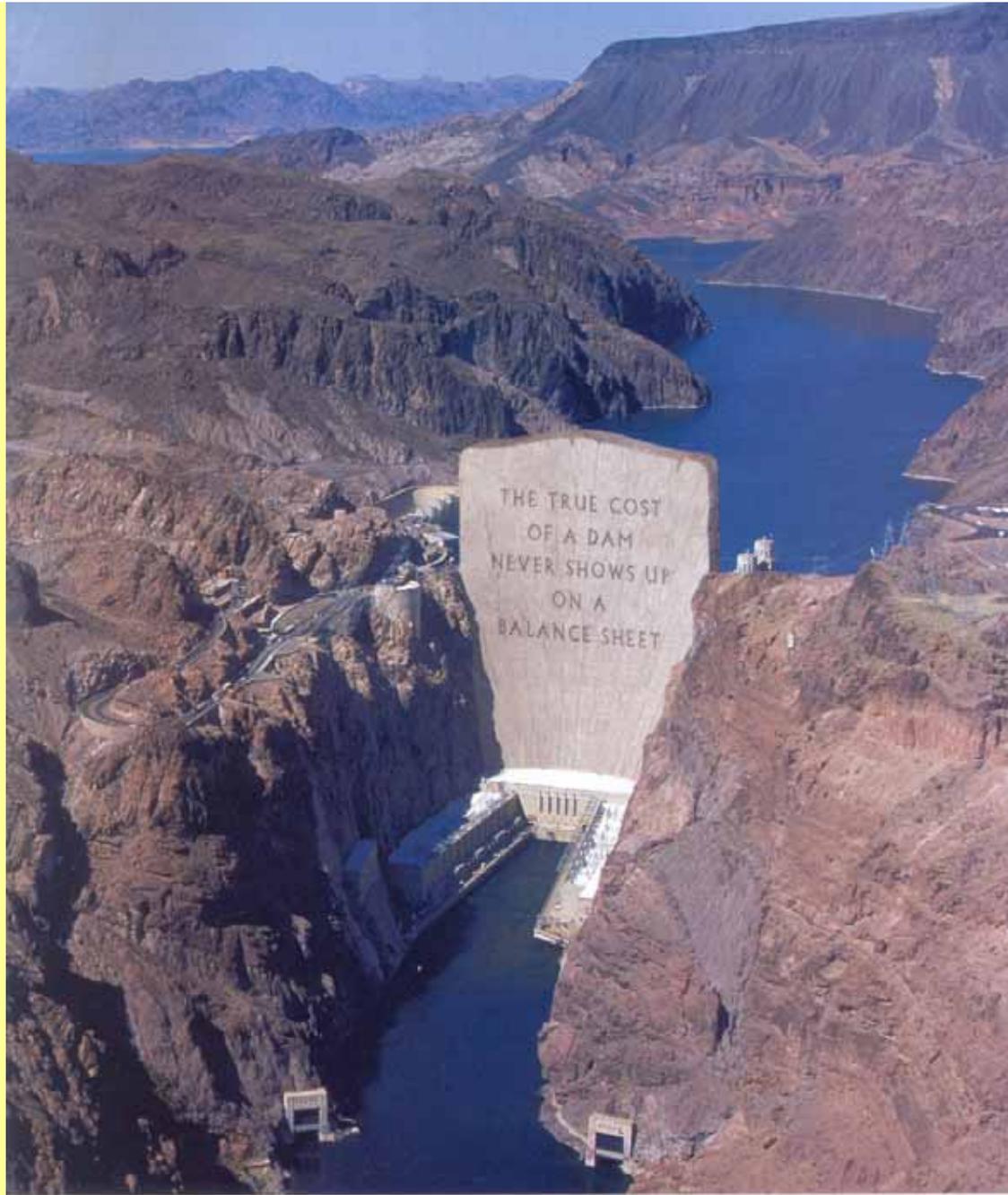


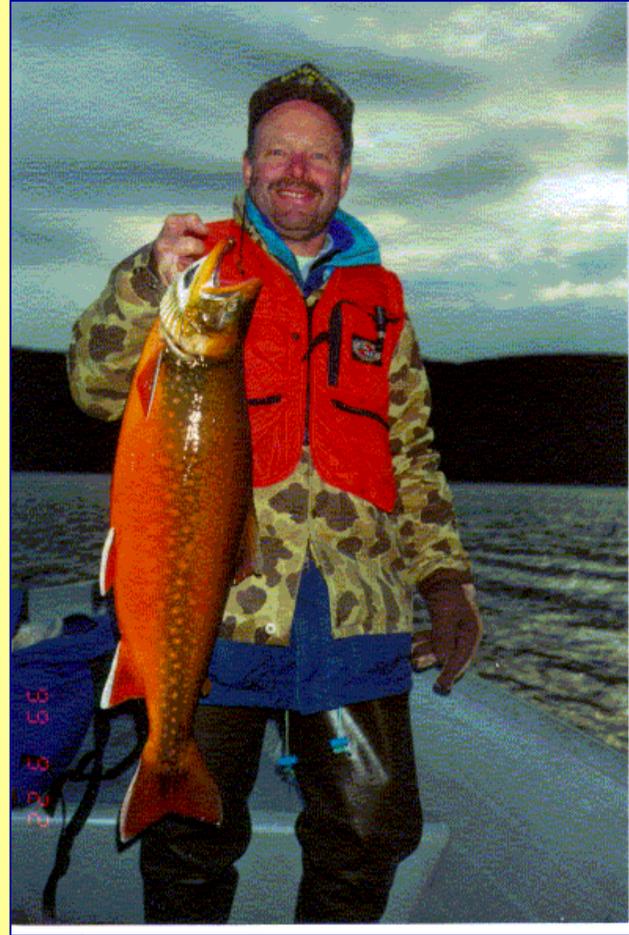


TROTA DI LAGO





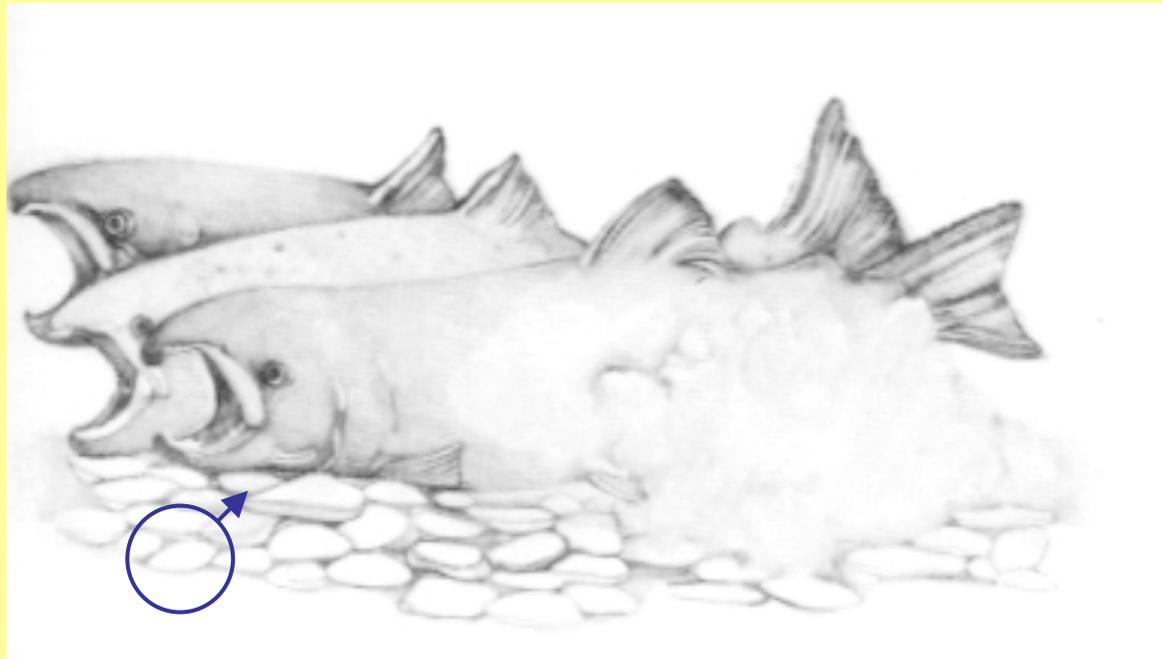
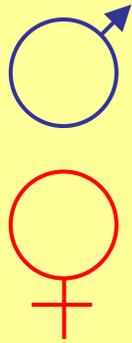






BIOLOGIA RIPROD





MASCHI
-DOMINANTI
-INCURSORI
-SATELLITI



SCHIUSA

350 Gradi/Giorno

35 giorni con acqua a 10 °C



MARMORATA
440 Gradi/Giorno

FARIO
420 Gradi/Giorno

TEMOLO
300 Gradi/Giorno

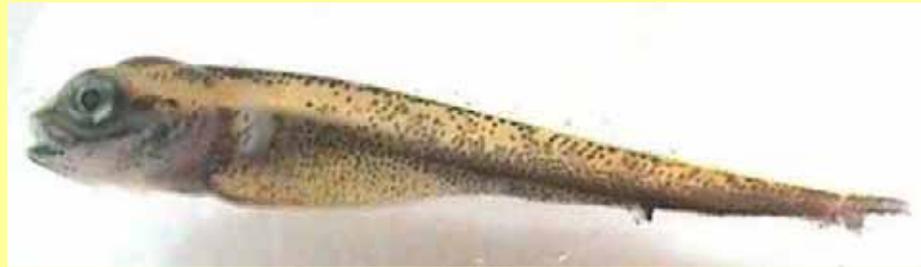
SALMERINO FONTE
450 Gradi/Giorno

IRIDEA
350 Gradi/Giorno

COREGONE
250 Gradi/Giorno

STRATEGIE TROFICHE (ALIMENTARI)

PLANCTOFAGIA



BENTOFAGIA



ENTOMOFAGIA



ITTIOFAGIA





PARCO DEI CENTO LAGHI

PARCO REGIONALE DI CRINALE ALTA VAL PARMA E CEDRA

NANISMO

PROBLEMATICATA ECOLOGICA MULTIFATTORIALE

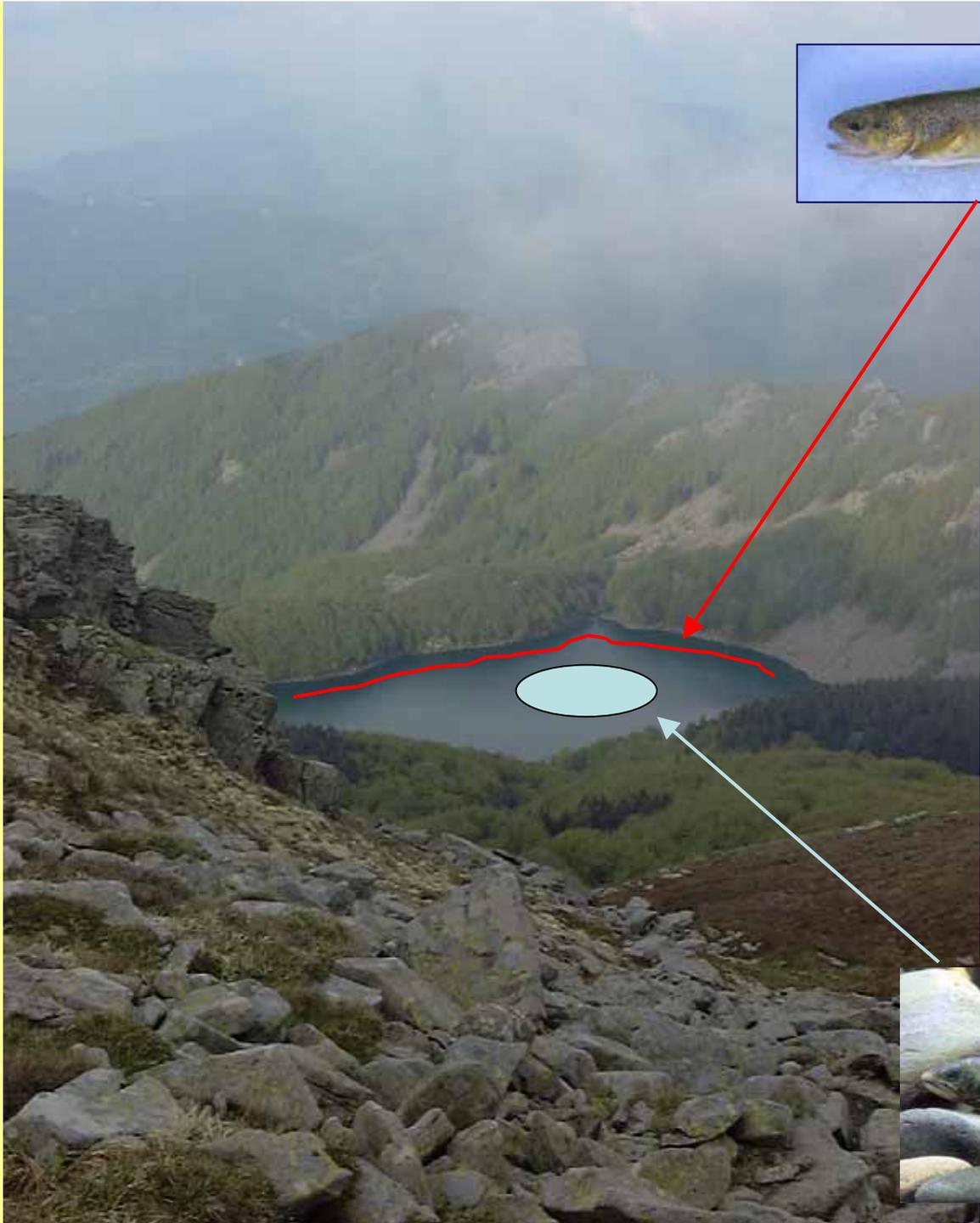
Competizione intraspecifica

Competizione interspecifica

Depressione da inincrocio

Pressione di pesca

Modificazione condizioni ambientali





**CORRETTA GESTIONE
ECOLOGICA DELLE POPOLAZIONI**

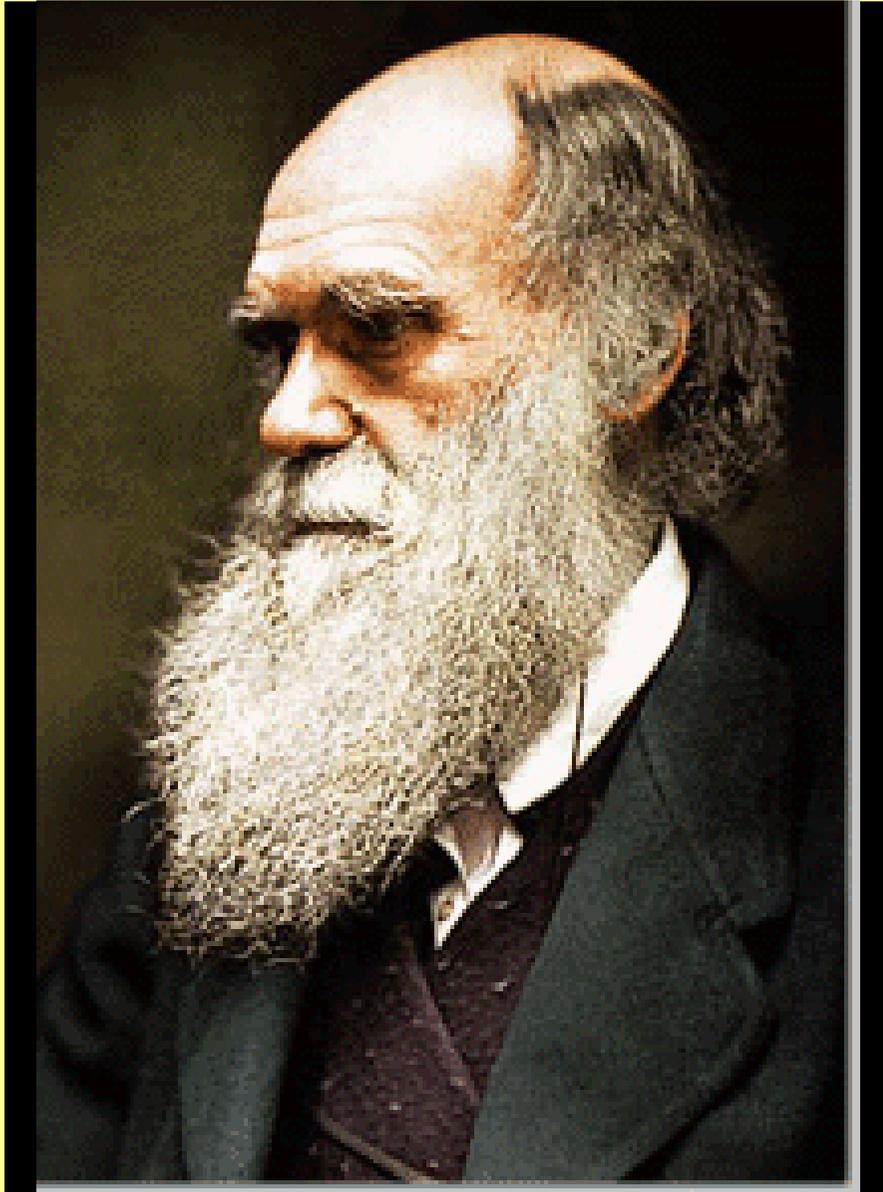
Policansky e Magnuson, 1998

SALVAGUARDIA DELLA BIODIVERSITA'



2000 uova/kg

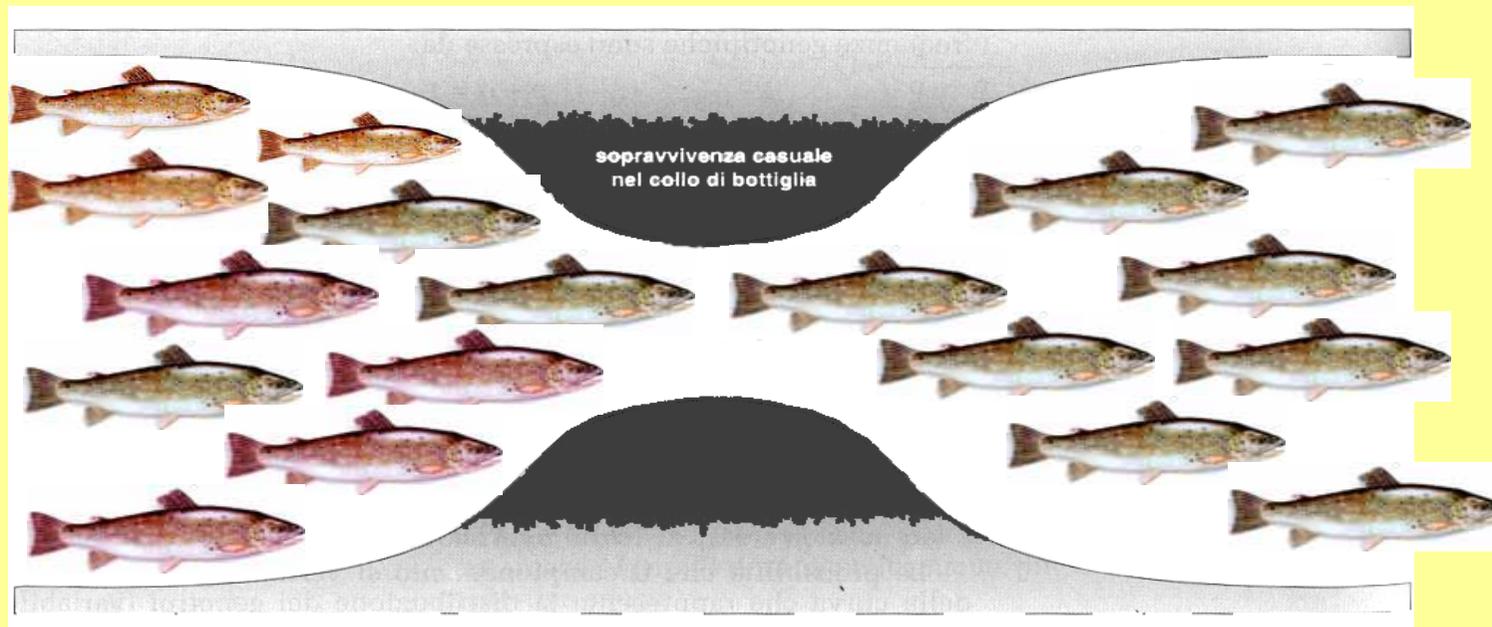
BIOLOGIA DELLA CONSERVAZIONE



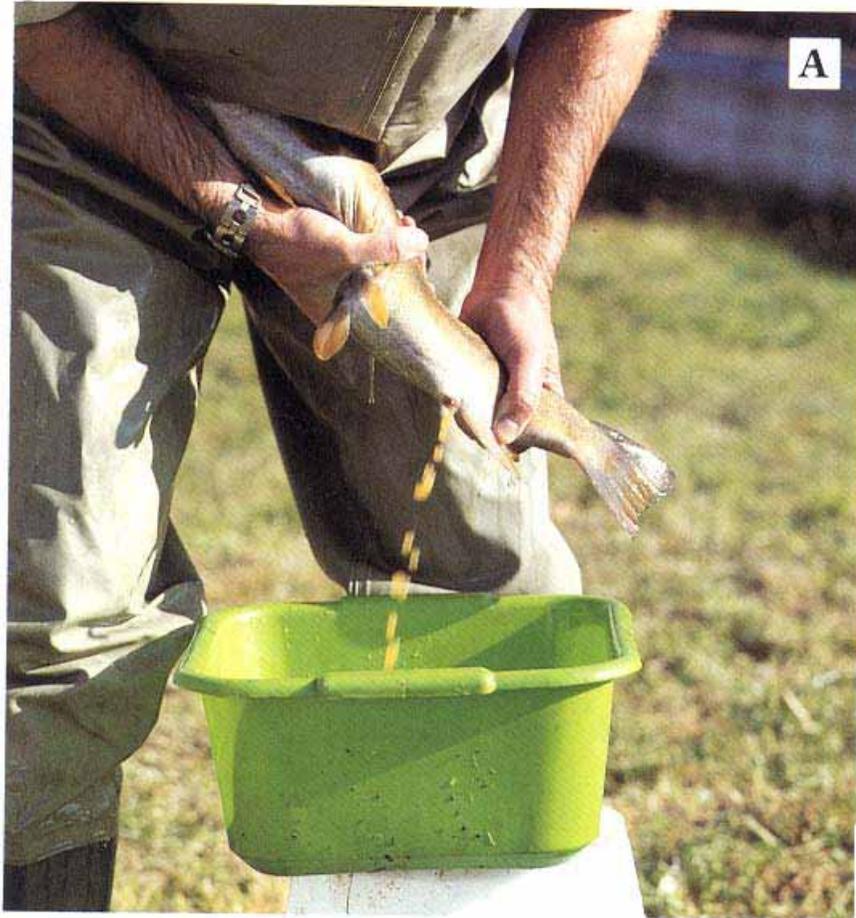
Charles Darwin (1859)
*On the origin of species by
means of **artificial selection***

EFFETTO COLLO DI BOTTIGLIA

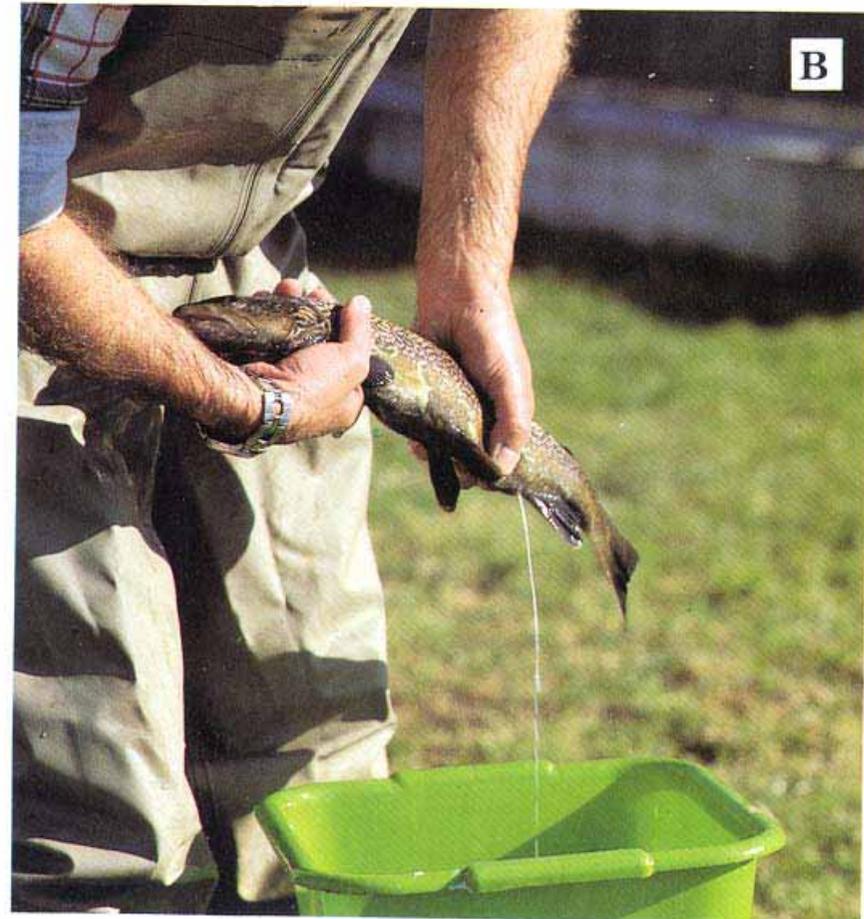
Perdita diversità genetica in una popolazione
conseguente a forte riduzione numero degli esemplari



PRATICHE ITTIOGENICHE



...fa seguito la “spremitura” della femmina (A) e del



maschio (B), previa anestesia per evitare inutili traumatismi.

INBREEDING DEPRESSION

DEPRESSIONE DA ININCROCIO

Dimensioni ridotte



Predisposizione a patologie



Minor potenziale riproduttivo



Maggior rischio di estinzione

Frankham 1995. Inbreeding and extinction: a threshold effect. *Conserv. Biol.*
Keller & Waller 2002. Inbreeding effects in wild populations. *TEE*

Maggio



Oociti estremamente eterogenei (<1 diametro >2 mm)

Luglio



Gonadi in regressione con oociti in riassorbimento

Allegato II della DIRETTIVA HABITAT
(Unione Europea)

Red list IUCN

International Union for the Conservation of Nature
Conservazione degli habitat e delle specie

Trota macrostigma (trota fario di ceppo mediterraneo)
Trota marmorata

Salmo trutta species complex



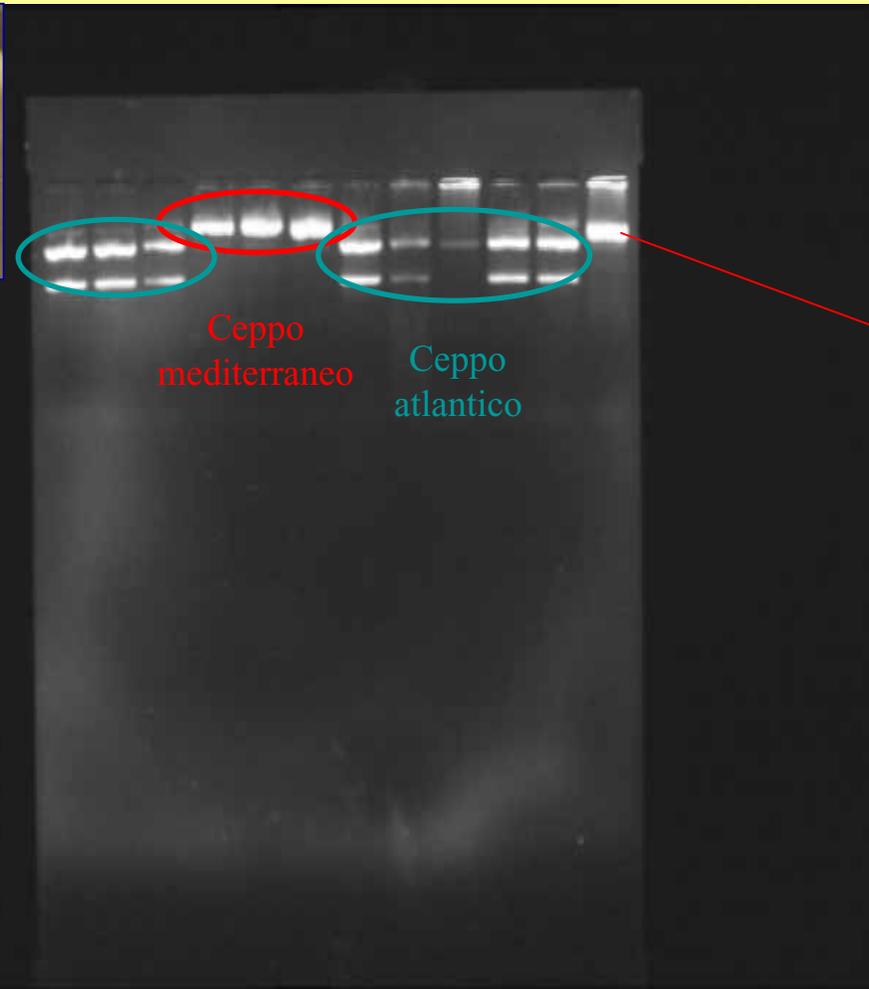
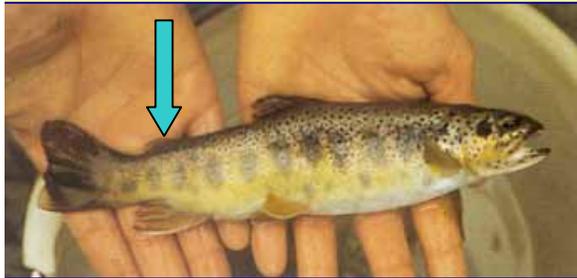


PCR



Sequenziatore automatico di acidi nucleici

RFLP gene mitocondriale 16S rDNA



Ceppo
mediterraneo

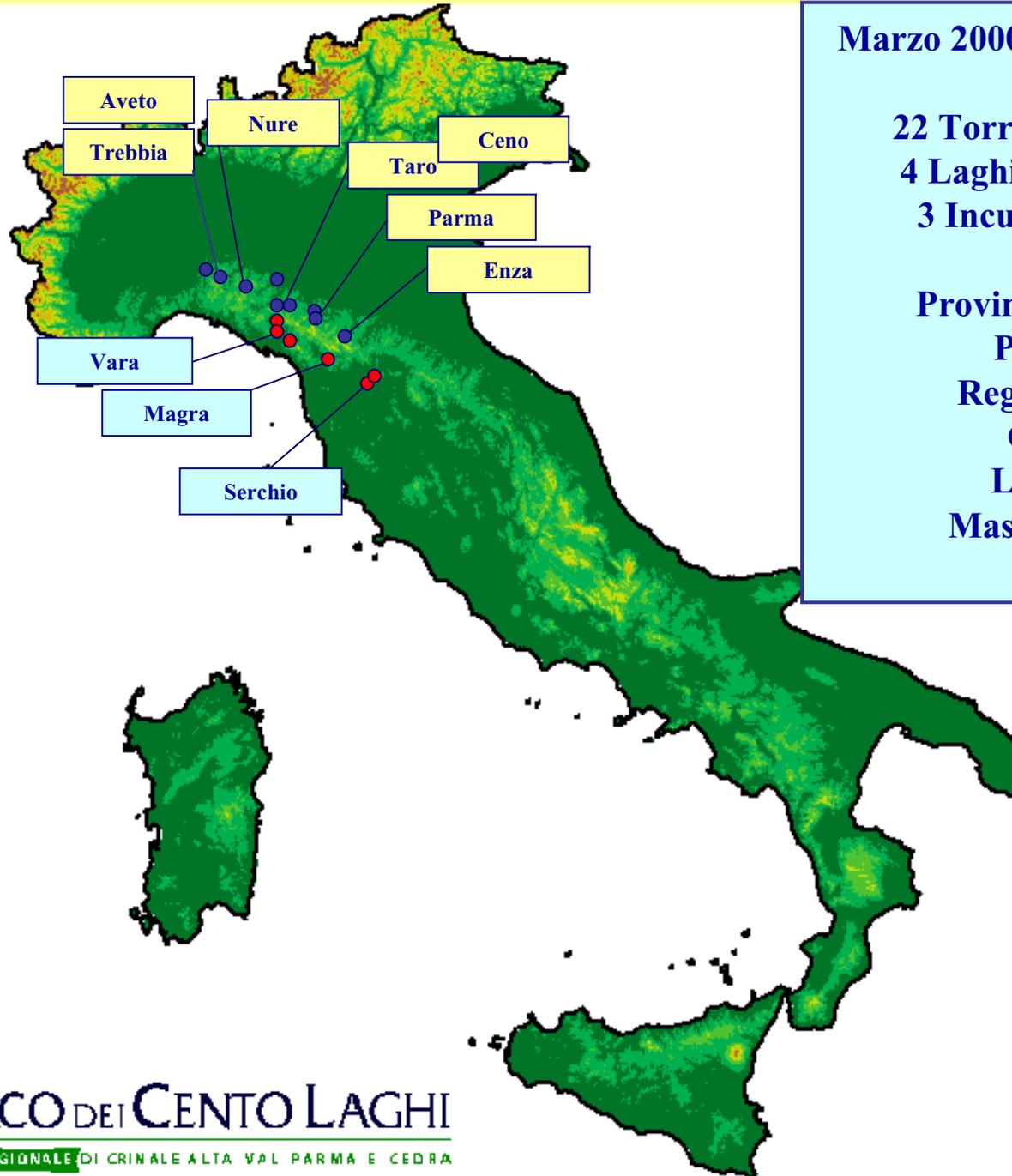
Ceppo
atlantico

Trota sarda
(controllo)

Marzo 2000 - Settembre 2003

**22 Torrenti (9 Bacini)
4 Laghi di alta quota
3 Incubatoi di valle**

**Province di Parma
Piacenza
Reggio Emilia
Genova
La Spezia
Massa Carrara
Lucca**



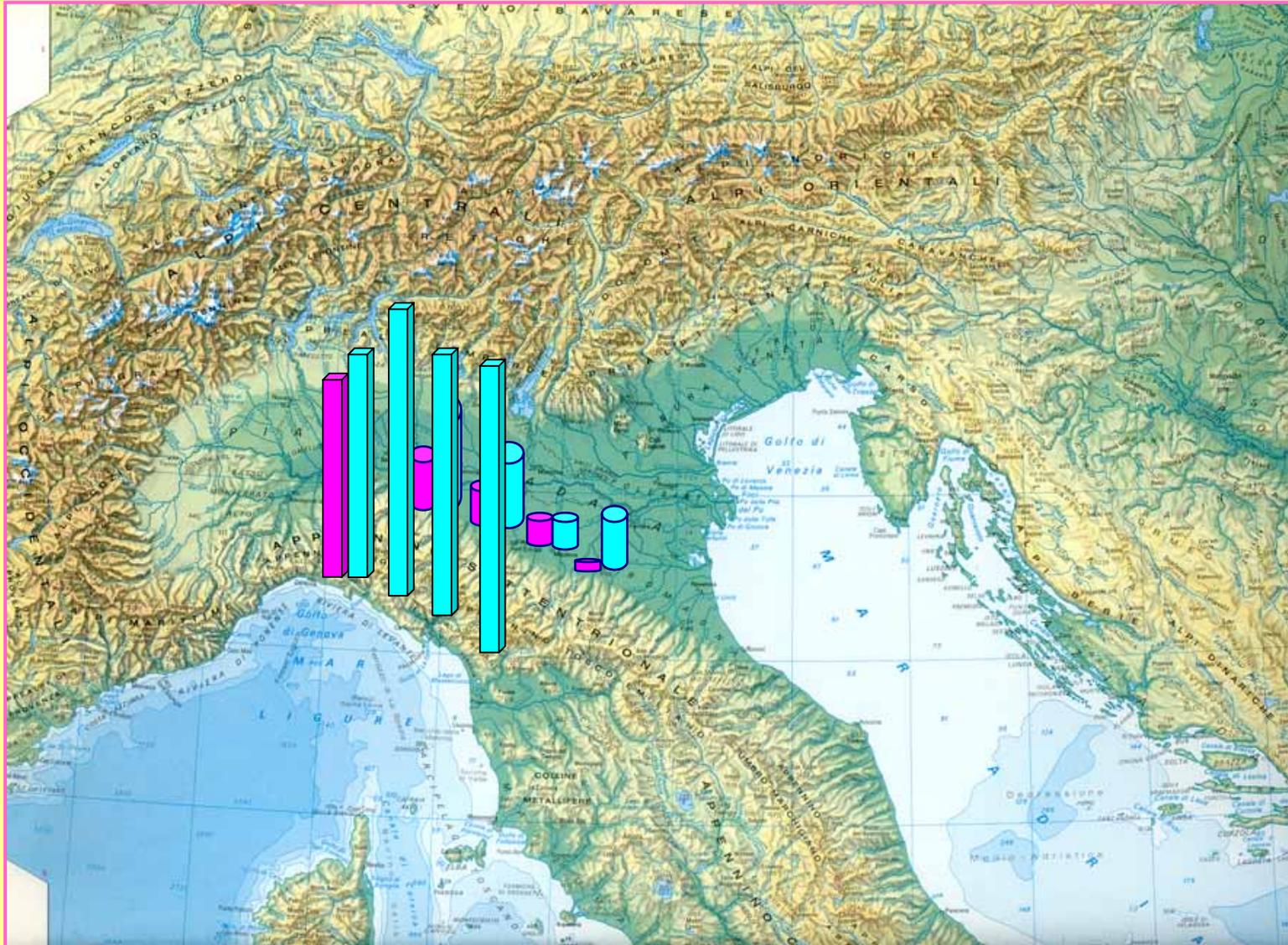
PARCO DEI CENTO LAGHI
PARCO REGIONALE DI CRINALE ALTA VAL PARMA E CEDRA

ANALISI DELLE FREQUENZE ALLELICHE

Gene: Fumarasi

	p	q
Torrente Bratica	0,714	0,250
“ Canalaccio	0,750	0,250
“ Parma di Badignana	0,700	0,300
“ Parma del Lago Santo	0,780	0,220
“ Cedra	0,717	0,283
Incubatoio Alta Valcedra	0,700	0,300

Frequenze di genotipi e aplotipi mediterranei





×



Aplotipo mediterraneo

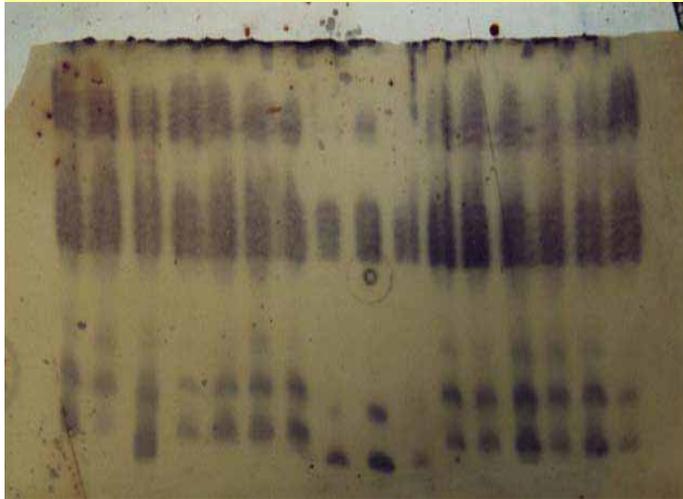
SONO IBRIDI



×



Aplotipo atlantico



Molecular Ecology (2001) 10, 29–34

Partial nucleotide sequences, and routine typing by polymerase chain reaction–restriction fragment length polymorphism, of the brown trout (*Salmo trutta*) lactate dehydrogenase, LDH-C1*90 and *100 alleles

O. M. McMEEL,* E. M. HOEY and A. FERGUSON

School of Biology and Biochemistry, The Queen's University of Belfast, Medical Biology Centre, 97 Lisburn Road, Belfast BT9 7BL, UK

Abstract

The cDNA nucleotide sequences of the lactate dehydrogenase alleles *LDH-C1*90* and **100* of brown trout (*Salmo trutta*) were found to differ at position 308 where an A is present in the **100* allele but a G is present in the **90* allele. This base substitution results in an amino acid change from aspartic acid at position 82 in the LDH-C1 100 allozyme to a glycine in the 90 allozyme. Since aspartic acid has a net negative charge whilst glycine is uncharged, this is consistent with the electrophoretic observation that the LDH-C1 100 allozyme has a more anodal mobility relative to the LDH-C1 90 allozyme. Based on alignment of the cDNA sequence with the mouse genomic sequence, a local primer set was designed, incorporating the variable position, and was found to give very good amplification with brown trout genomic DNA. Sequencing of this fragment confirmed the difference in both homozygous and heterozygous individuals. Digestion of the polymerase chain reaction products with *BsiI*, a restriction enzyme specific for the site difference, gave one, two and three fragments for the two homozygotes and the heterozygote, respectively, following electrophoretic separation. This provides a DNA-based means of routine screening of the highly informative *LDH-C1** polymorphism in brown trout population genetic studies. Primer sets presented could be used to sequence cDNA of other *LDH** genes of brown trout and other species.

Keywords: allele nucleotide substitution, brown trout, lactate dehydrogenase, LDH polymorphism, PCR–RFLP, salmonid

Received 3 February 2000; revision received 25 June 2000; accepted 26 August 2000

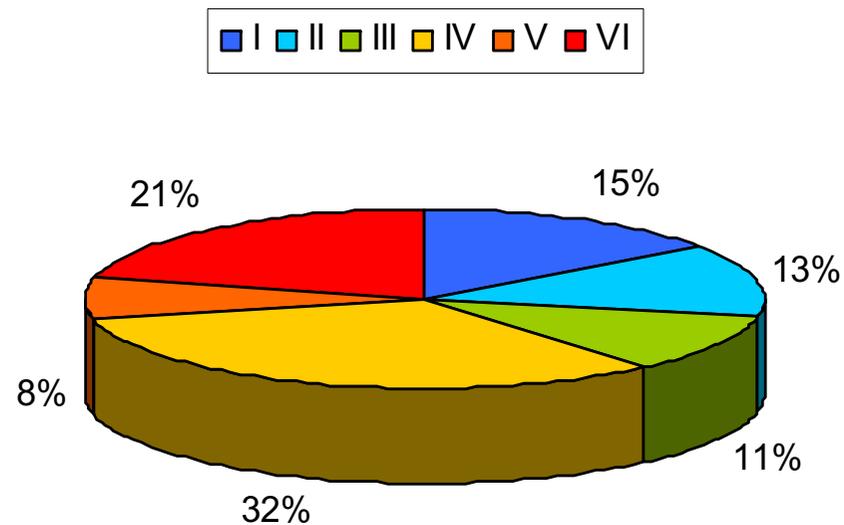
Combinazione n°	16S rDNA	LDH-C1*	Indice
I	A	*90/*90	massimo
II	M	*90/*90	elevato
III	A	*90/*100	alto
IV	M	*90/*100	medio alto
V	A	*100/*100	basso
VI	M	*100/*100	nullo

⇒ 15 % linea pura atlantica

⇒ 64 % ibridi con diverso grado di ibridazione

⇒ 21 % linea pura mediterranea

frequenze delle combinazioni tra il gene 16S rDNA
e il gene LDH-C1*





S. alpinus



S. fontinalis