The inconvenient truth on the fish fauna of Italian lowland waters

Giuseppe Castaldelli, Marco Milardi, Mattia Lanzoni, Vasileios Aschonitis, Anna Gavioli, Elisa Anna Fano

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tudies I'm going to show you mainly concern the province of Ferrara, where the loss of
versity started with greater severity than other parts of the Po Valley and of center and
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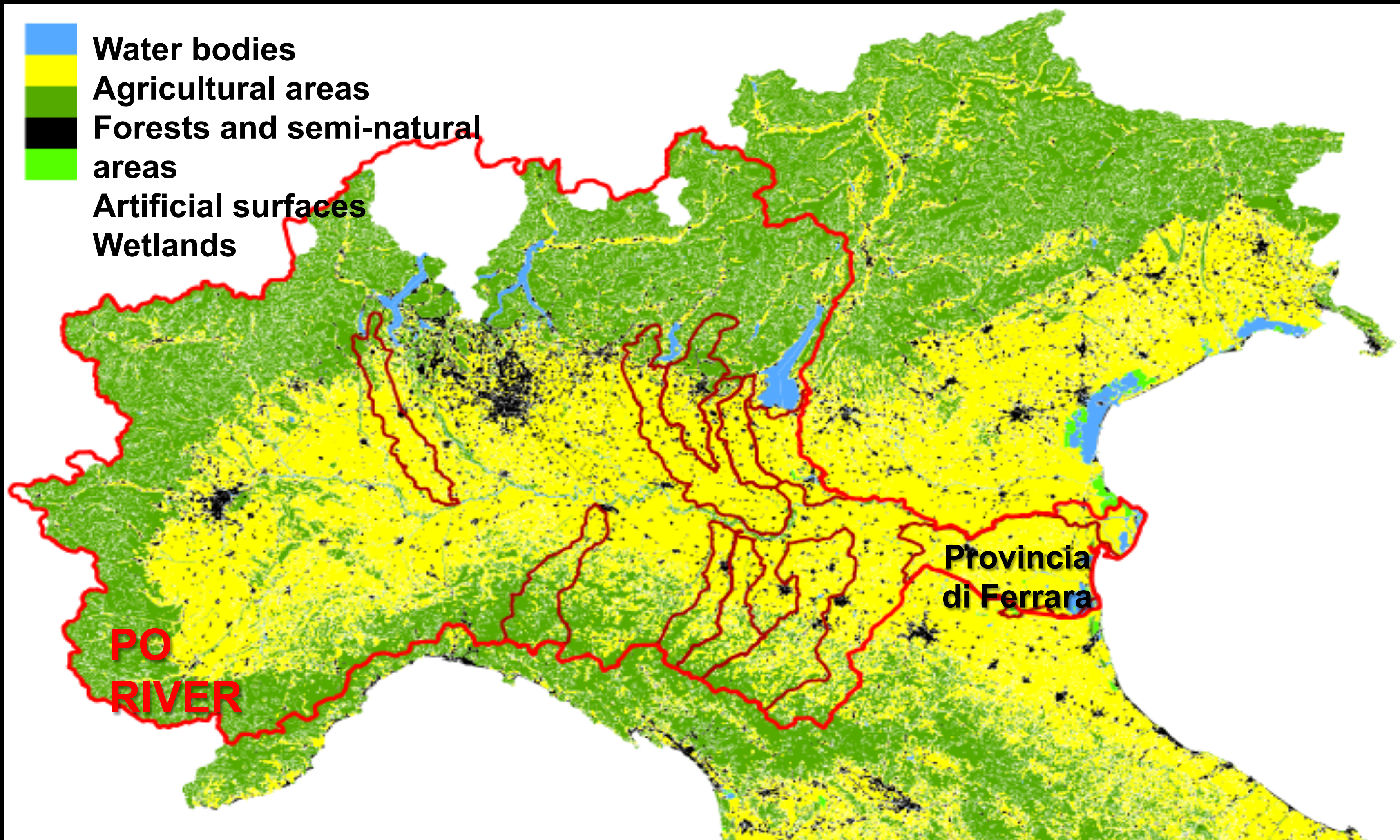

Land use of the 8 sub-basins of the Po River (CORINE Land Cover)

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rently, almost all ditches and canals of low plain are extremely simplified at all ecosyste
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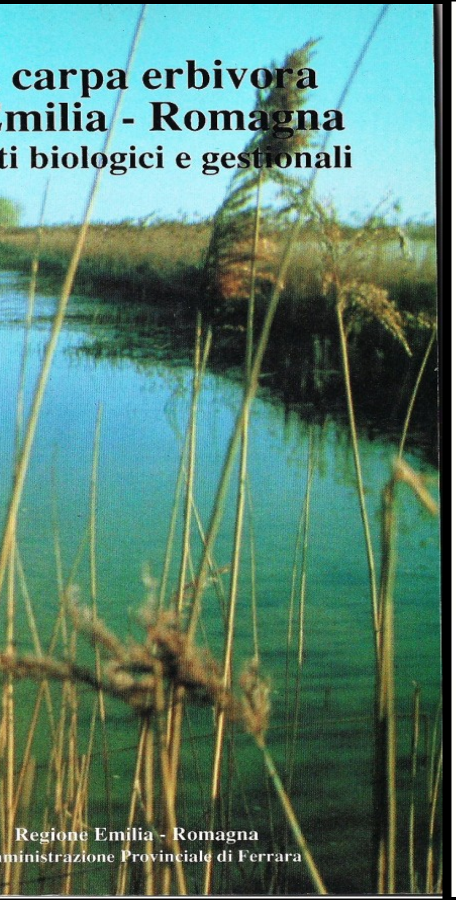
nd it was not a stochastic event.

emergence and/or worsening of further factors of disturbance, such as the expansion of
iana red swamp crayfish and coypu, in some areas have led to more and more severe
gement solutions.


Fossa Lavezzola


Scolo Principale



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ntroduction of exotic fish species and decline of native species in the lower Po basin, north-eastern Italy

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REMIGIO ROSSI[a] and ELISA ANNA FANO[a]

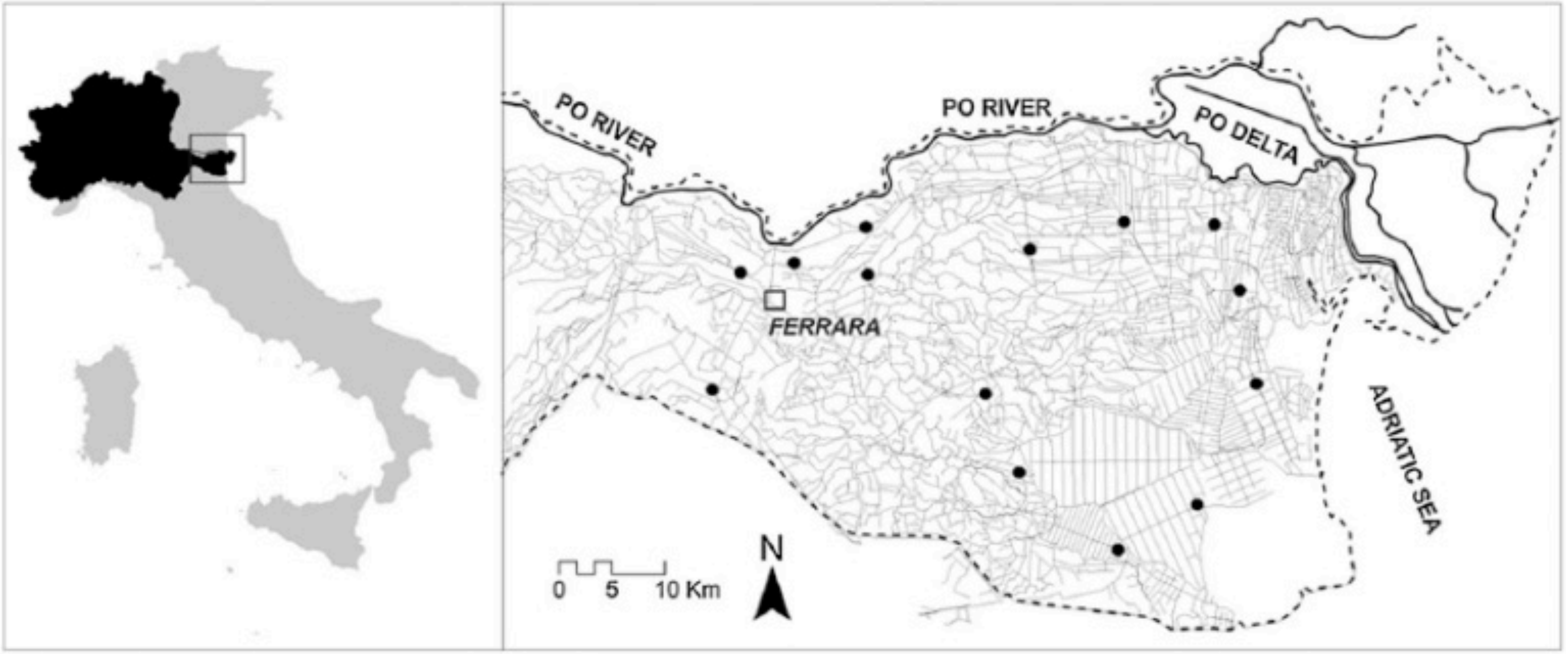

Figure 1. Map of the study area: lower Po River plain (Province of Ferrara, Italy). Black dots represent the location of canal stretches where the fauna was assessed.


COADIUVATORE
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Table 2. Taxa, status (N = native species; E = exotic species), mean fish abundance (number of individuals ha^{-1}), percentage of the total individuals (%) and biomass (g ha^{-1}) for fishes collected in 1991, 2003 and 2009 surveys, in 14 canals of the lower Po River plain

			1991			1997			2003			2009		
Family	Species	Status	Fish abundance	%	Biomass	Fish abundance	%	Biomass	Fish abundance	%	Biomass	Fish abundance	%	Bio
Anguillidae	*Anguilla anguilla* (Linnaeus, 1758)	N	36.1	2.9	6568.0	5.9	2.8	1055.7	1.5	0.5	270.0	0.6	0.2	
Clupeidae	*Alosa fallax* (Lacépède, 1803)	N	7.1	0.6	399.6	-	-	-	0.9	0.3	47.1	-	-	
Cyprinidae	*Rutilus pigus* (Lacépède, 1804)	N	2.1	0.2	333.2	-	-	-	-	-	-	-	-	
	Rutilus aula (Bonaparte, 1841)	N	55.7	4.4	1598.5	4.4	2.1	127.0	-	-	-	-	-	
	Squalius cephalus (Linnaeus, 1758)	N	10.1	0.8	1927.1	0.4	0.2	67.9	-	-	-	-	-	
	Tinca tinca (Linnaeus, 1758)	N	27.4	2.2	5371.1	2.5	1.2	501.1	-	-	-	-	-	
	Scardinius erythrophthalmus (Linnaeus, 1758)	N	172.9	13.7	23335.7	14.8	7.1	1996.1	5.0	1.8	1350.0	1.1	0.3	[illegible]
	Alburnus arborella (Bonaparte, 1841)	N	185.0	14.6	1387.5	25.4	12.2	190.2	41.9	14.7	313.9	25.9	7.7	
	Chondrostoma soetta (Bonaparte, 1840)	N	30.0	2.4	1650.0	-	-	-	-	-	-	-	-	
	Barbus plebejus (Bonaparte, 1839)	N	4.6	0.4	618.1	-	-	-	-	-	-	-	-	
	Carassius auratus (Linnaeus, 1758)	E	266.4	21.1	23978.6	40.5	19.5	3645.0	29.0	10.2	3915.0	25.8	7.6	4
	Cyprinus carpio (Linnaeus, 1758)	E	18.8	1.5	4132.9	9.1	4.4	2148.6	17.9	6.3	10714.3	36.6	10.8	52
	Abramis brama (Linnaeus, 1758)	E	-	-	-	-	-	-	11.4	4.0	1419.6	86.3	25.6	14
	Rhodeus sericeus (Pallas, 1776)	E	-	-	-	-	-	-	27.6	9.7	96.8	35.6	10.5	
	Pseudorasbora parva (Temminck and Schlegel, 1846)	E	-	-	-	4.0	1.9	30.0	44.6	15.7	334.3	36.1	10.7	[illegible]
	Ctenopharyngodon idellus (Valenciennes, 1844)	E	1.9	0.2	3471.4	0.8	0.4	1846.4	2.2	0.8	19817.9	6.8	2.0	60
	Hypophthalmichthys molitrix (Valenciennes, 1844)	E	-	-	-	-	-	-	-	-	-	1.6	0.5	13
	Aspius aspius (Linnaeus, 1758)	E	-	-	-	-	-	-	-	-	-	7.1	2.1	1
Cobitidae	*Sabanejewia larvata* (De Filippi, 1859)	N	15.7	1.2	149.3	-	-	-	-	-	-	-	-	
Siluridae	*Silurus glanis* (Linnaeus, 1758)	E	2.3	0.2	6514.3	28.6	13.7	120000.0	14.6	5.1	99085.7	26.1	7.7	208
Ictaluridae	*Ameiurus melas* (Rafinesque, 1820)	E	213.6	16.9	17085.7	31.3	15.0	2502.9	15.9	5.6	1110.0	20.7	6.1	1
	Ictalurus punctatus (Rafinesque, 1820)	E	-	-	-	0.5	0.2	72.5	0.6	0.2	82.9	1.6	0.5	[illegible]
Esocidae	*Esox lucius* (Linnaeus, 1758)	N	13.1	1.0	3006.4	0.8	0.4	180.7	-	-	-	0.1	0.0	
Poeciliidae	*Gambusia holbrooki* (Girard, 1859)	E	18.6	1.5	46.4	-	-	-	60.7	21.3	157.9	-	-	
Gasterosteidae	*Gasterosteus aculeatus* (Linnaeus, 1758)	N	2.9	0.2	15.7	-	-	-	-	-	-	-	-	
Centrarchidae	*Micropterus salmoides* (Lacépède, 1803)	E	29.6	2.3	3705.4	1.6	0.8	205.4	-	-	-	-	-	
	Lepomis gibbosus (Linnaeus, 1758)	E	16.2	1.3	154.0	28.9	13.9	2452.9	3.9	1.4	255.4	11.4	3.4	[illegible]
Percidae	*Perca fluviatilis* (Linnaeus, 1758)	N	135.0	10.7	22275.0	-	-	-	-	-	-	-	-	
	Sander lucioperca (Linnaeus, 1758)	E	-	-	-	8.4	4.0	1378.9	7.1	2.5	1071.4	14.0	4.2	2
Mugilidae	*Liza ramada* (Risso, 1827)	N	-	-	-	0.4	0.2	53.6	-	-	-	-	-	

GIUSEPPE CASTALDELLI[a], ANGELA PLUCHINOTTA[a,*], MARCO MILARDI[b], MATTIA LANZONI[a], LUISA GIARI[a], REMIGIO ROSSI[a] and ELISA ANNA FANO[a]

lower Po basin, north-eastern Italy

Numero di individui per ettarc Biomassa per ettaro

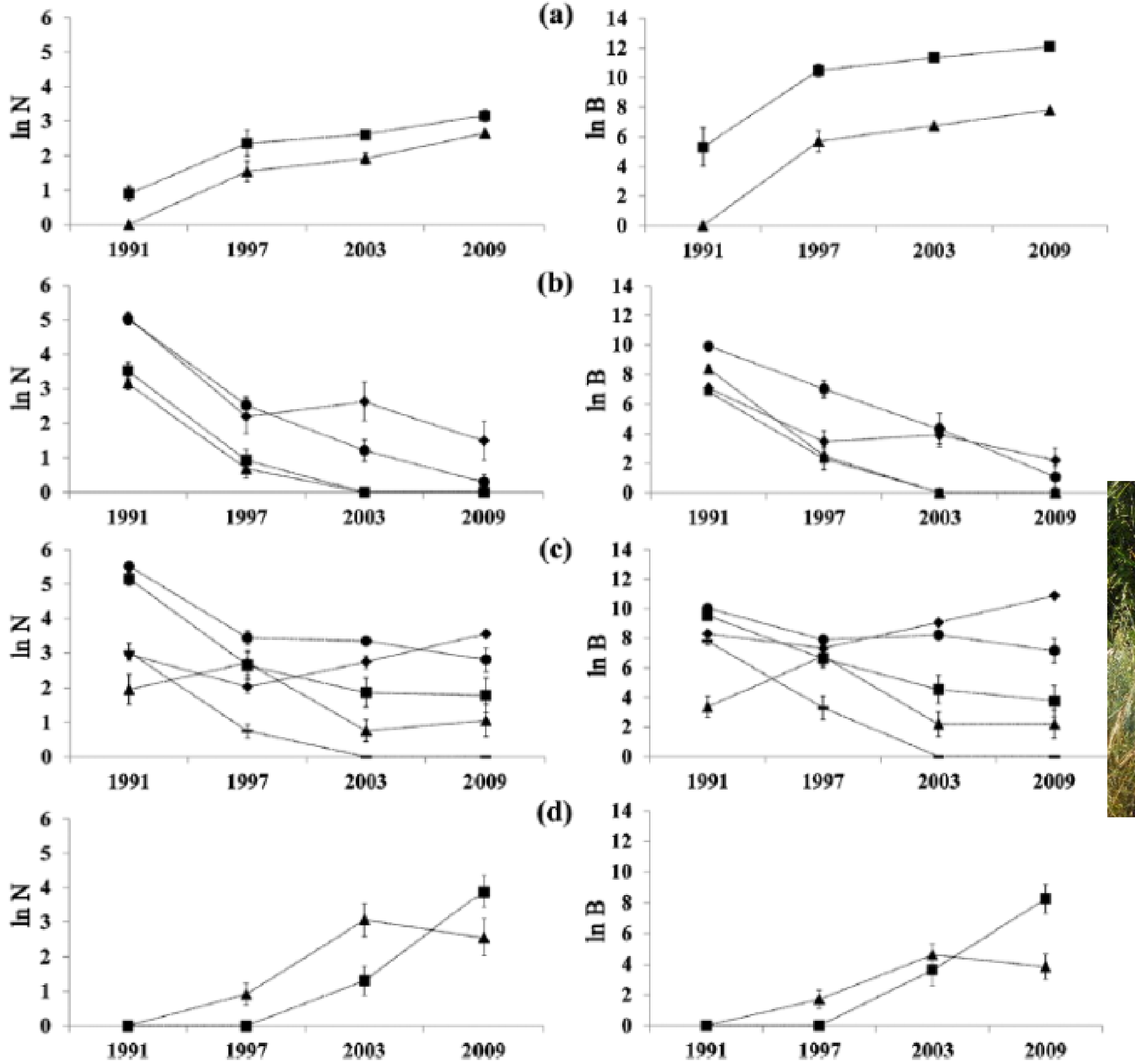

Figure 6. Temporal variation in fish abundance (ln number of individuals ha^{-1}, left) and biomass (ln g ha^{-1}, right) of the most re collected in the 14 canal stretches of the lower Po River plain. The graphs refer to (a) exotic predators of recent introduction, (b exotic species of ancient introduction, (d) exotic species of recent introduction.

The European Zoological Journal

A regional fish inventory of inland waters in Northern Italy reveals the presence of fully exotic fish communities

M. Lanzoni, M. Milardi, V. Aschonitis, E. A. Fano & G. Castaldelli

ble II. Exotic species present in the nine positions belonging to
e xenodiversity hotspots where native species were absent
igure 2).

	Lowland region							Upland region		
Site	1	2	3	4	5	6	7	8	9	Total
ucian carp	x		x	x		x				4
ommon carp	x	x	x	x		x	x			6
hite bream					x					
ommon bream	x									
terling	x									
one moroko	x	x	x			x				
ass carp					x					
els catfish	x	x		x	x		x			
ack bullhead	x			x						2
stern mosquitofish		x								1
mpkinseed	x	x	x							3
ke-perch	x		x							2
ffe							x			1
inbow trout								x	x	2
otal number of exotic species	9	5	5	4	3	3	3	1	1	

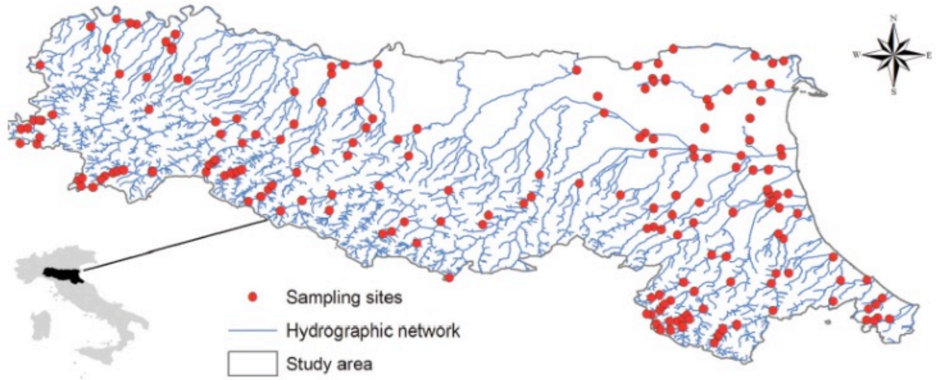

Figure 1. Study area (data source: http://gadm.org), hydrographic network of main rivers and streams (data source: http://www eu/data-and-maps/data/european-river-catchments-1) and location of sampling sites.

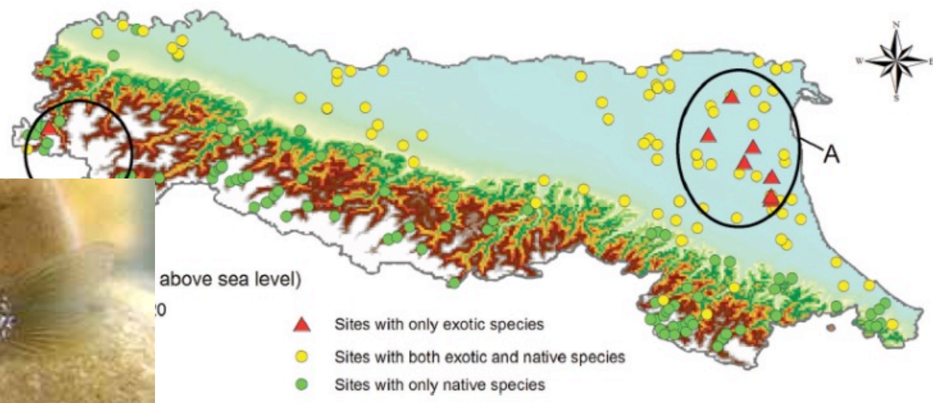

Figure 2. Altitude (data source: https://lta.cr.usgs.gov/GTOPO30) and separation of sampling sites based on the presence/abser and exotic species.

Journal of Limnology
CNR - Istituto per lo studio degli Ecosistemi - Verbania Pallanza - Italy

Exotic fish invasion progresses regardless of hydrology

Long-term fish monitoring underlines a rising tide of temperature tolerant, rheophilic, benthivore and generalist exotics, irrespective of hydrological conditions

Marco MILARDI,* Mattia LANZONI, Anna GAVIOLI, Elisa Anna FANO, Giuseppe CASTALDELLI

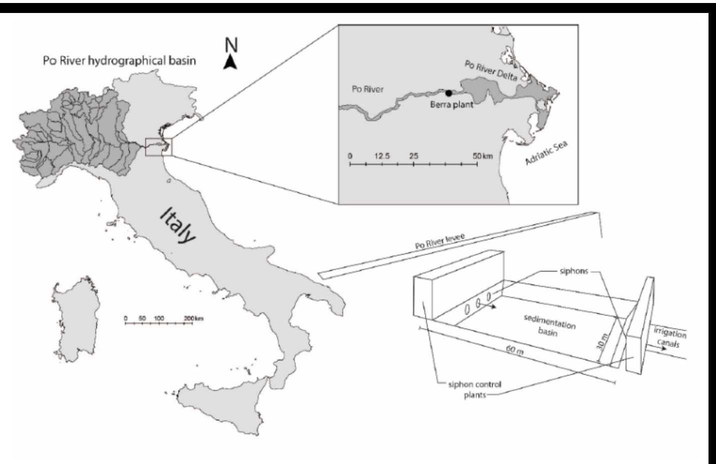

Fig. 1. Map of the study area: sampling location in the upstream section of the Po Delta (Province of Ferrara, Italy), in the Berra plant.

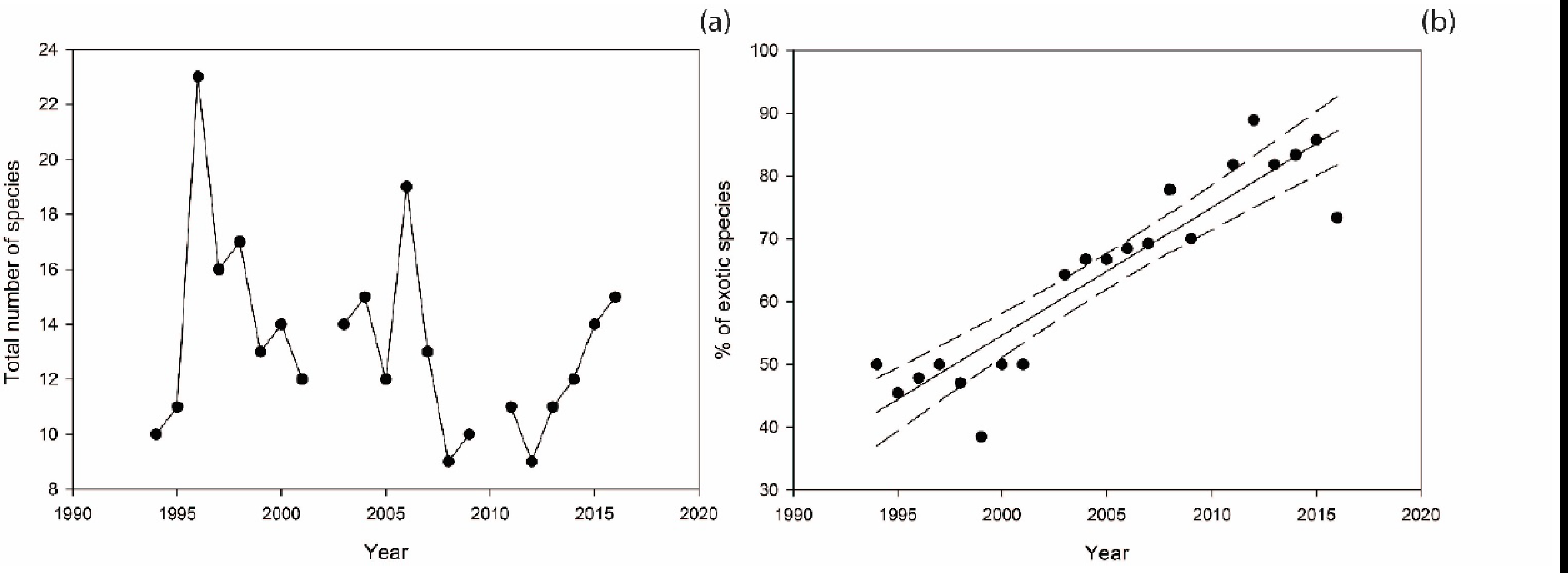

Fig. 4. Long-term trends in the total number of detected species (a) and the share of exotic species in the total (b). The solid line in (b) represents a significant linear regression while the dashed lines represent 95% confidence intervals.

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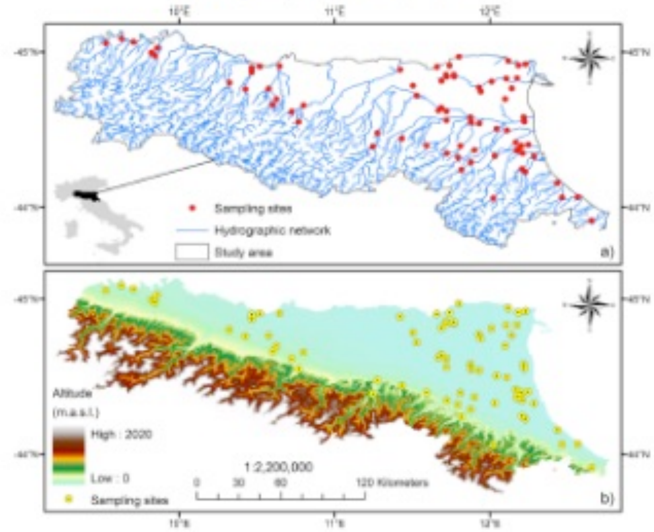
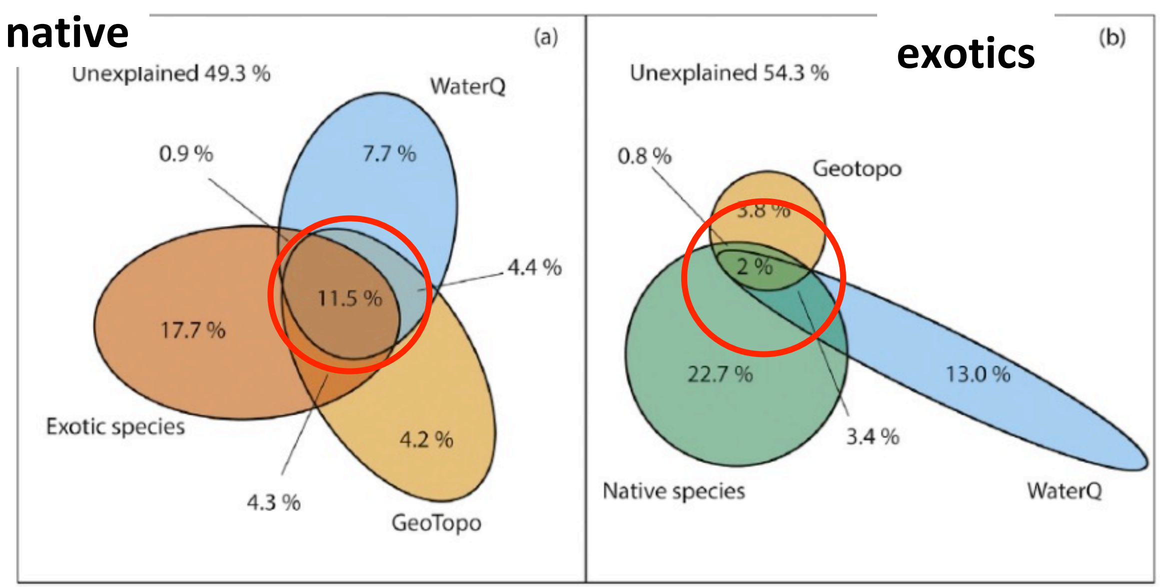
o the hills: exotic fish invasions and water quality degradation drive
e fish to higher altitudes

Milardi *, Vassilis Aschonitis, Anna Gavioli, Mattia Lanzoni, Elisa Anna Fano, Giuseppe Castaldelli





Venn diagram of unique and joint effects of geographical (GeoTopo), water quality (WaterQ) and exotic species on native species distribution and abundance (a) and the resentation of the same effects for exotic species, using native species as explanatory variables (b). The numbers indicated the variance explained by each component.

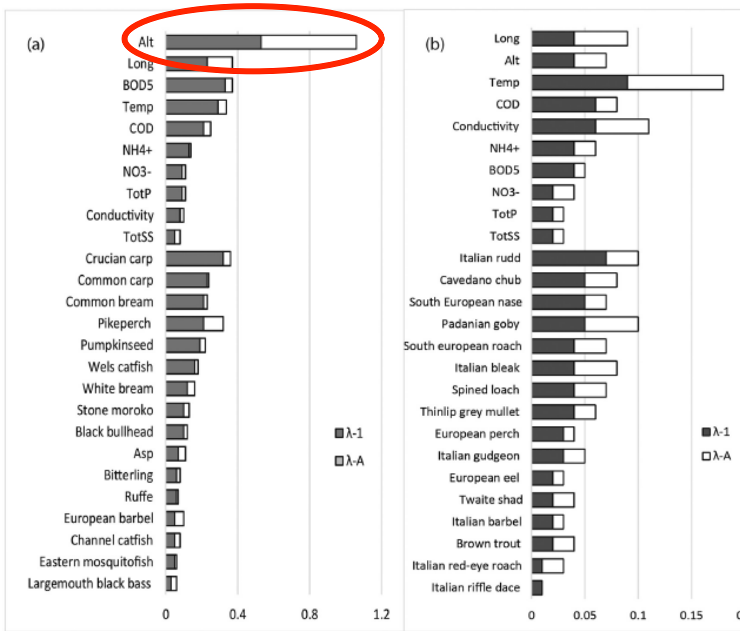


Fig. 3. Marginal (λ-1) and conditional (λ-A) effects of variables within variable groups that affect native (a) and exotic (b) species distribution and abundance. Bars a
to a decreasing order of magnitude of marginal effects, by variable group (GeoTopo, WaterQ and exotic or native species).

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Article

recruitment contributes to high densities of grass carp *ryngodon idella* (Valenciennes, 1844) in Western Europe

rdi[1]*, Mattia Lanzoni[2], Mikko Kiljunen[3], Jyrki Torniainen[3,4] and Giuseppe Castaldelli[2]

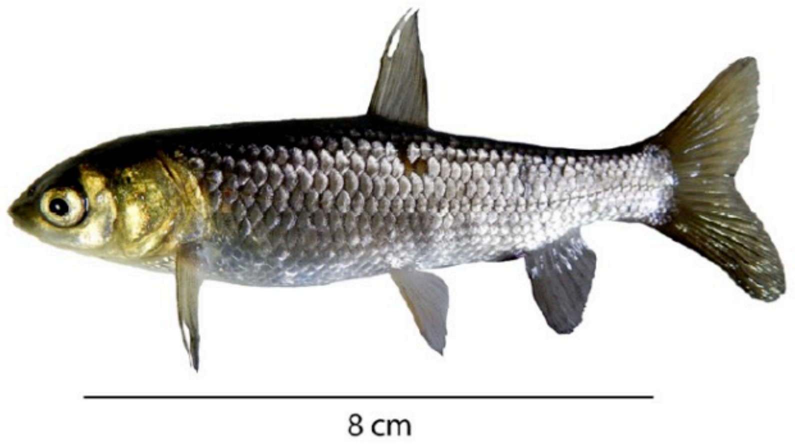


Figure 3. One of the young-of-the-year specimens of grass carp, captured in 2013. Photograph by Mattia Lanzoni.

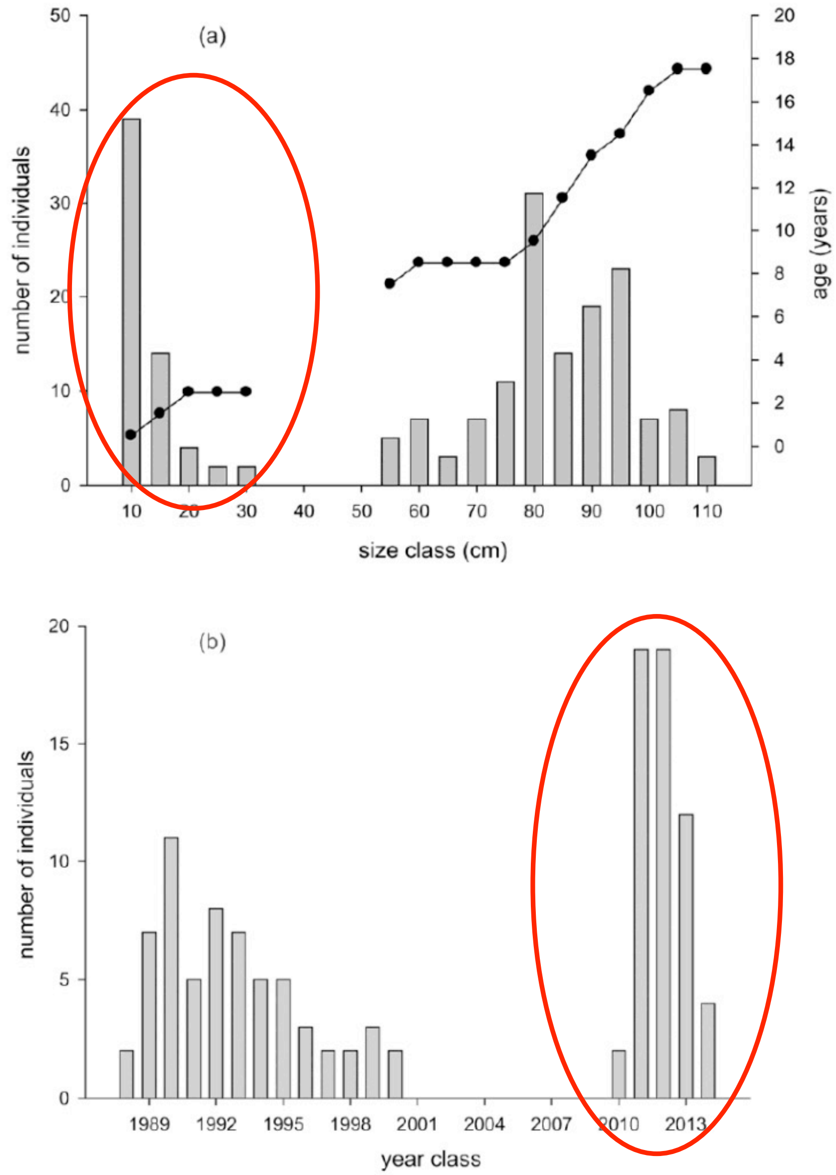
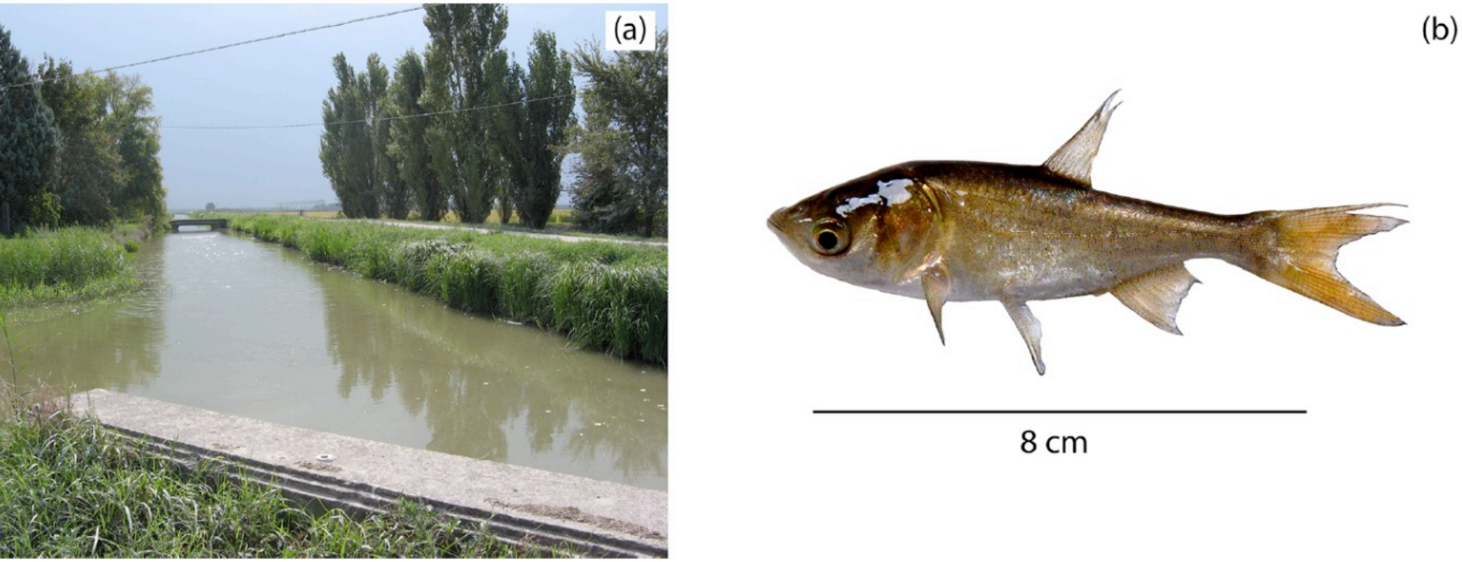


Figure 2. Size and average age distribution (a) and year class distribution (b) of all the grass carp specimens sampled and aged in this study. Grey bars represent size- and year-class frequencies and are scaled on the left vertical axis, while black line and dots represent average age distributions and are scaled on the right vertical axis.

RESEARCH ARTICLE

First evidence of bighead carp wild recruitment in Western Europe, and its relation to hydrology and temperature

Marco Milardi[1¤]*, Duane Chapman[2], Mattia Lanzoni[3], James M. Long[4], Giuseppe Castaldelli[3]



(a) the sampling location where all juvenile individuals were found and (b) one of the YOY bighead carp sampled during this study.

oi.org/10.1371/journal.pone.0189517.g002

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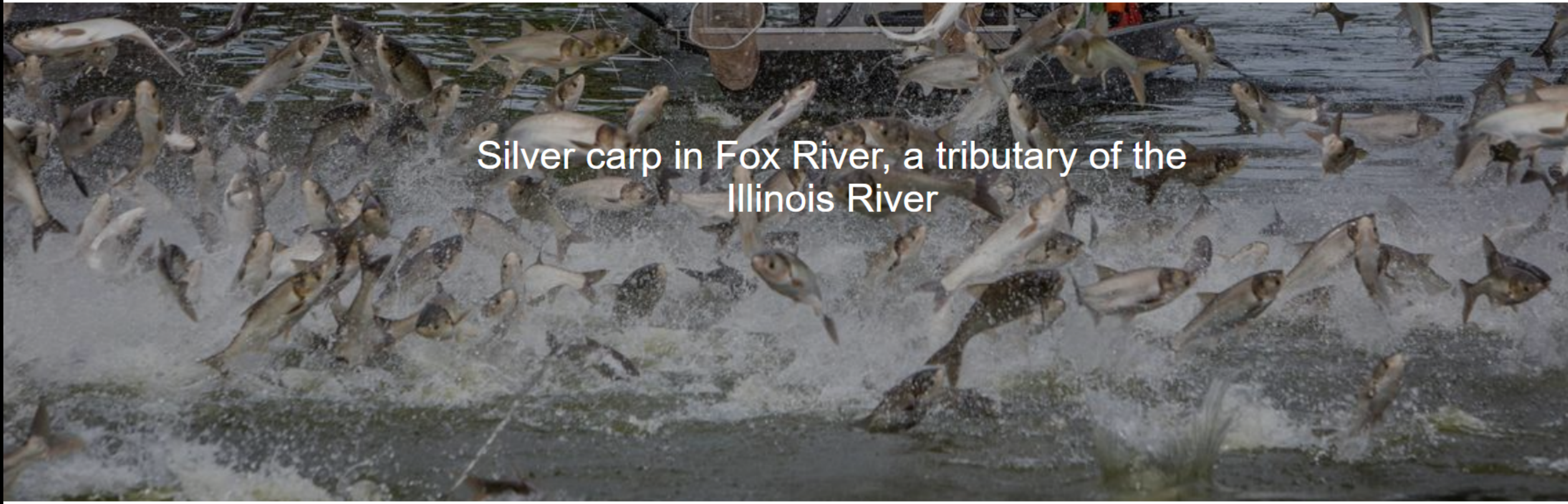

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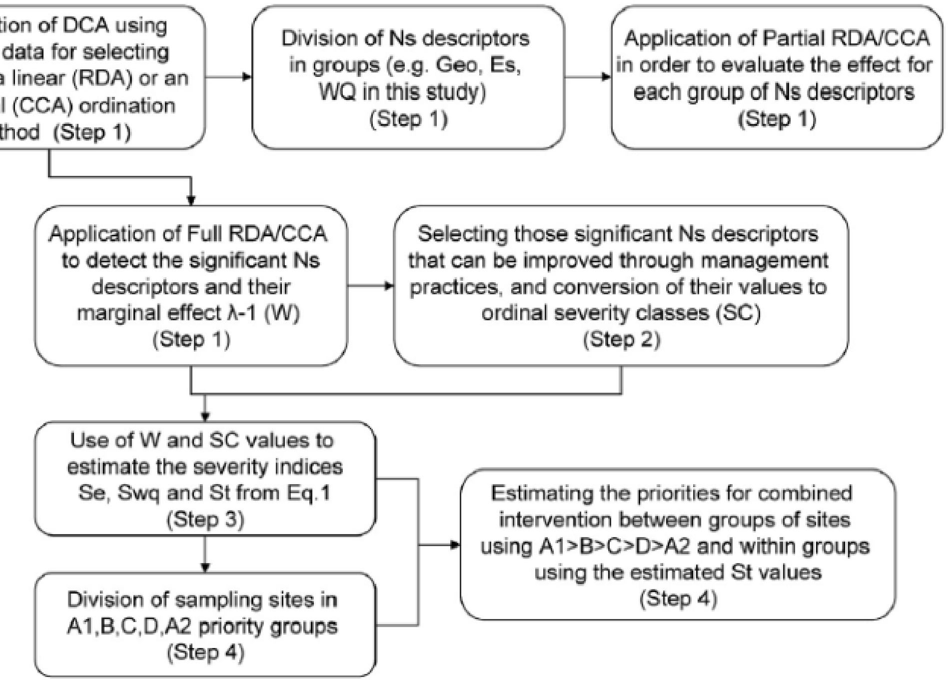
itis [a,*], A. Gavioli [a], M. Lanzoni [a], E.A. Fano [a], C. Feld [b], G. Castaldelli [a]



eneral diagram of the methodological steps for assessing priorities for combined intervention.

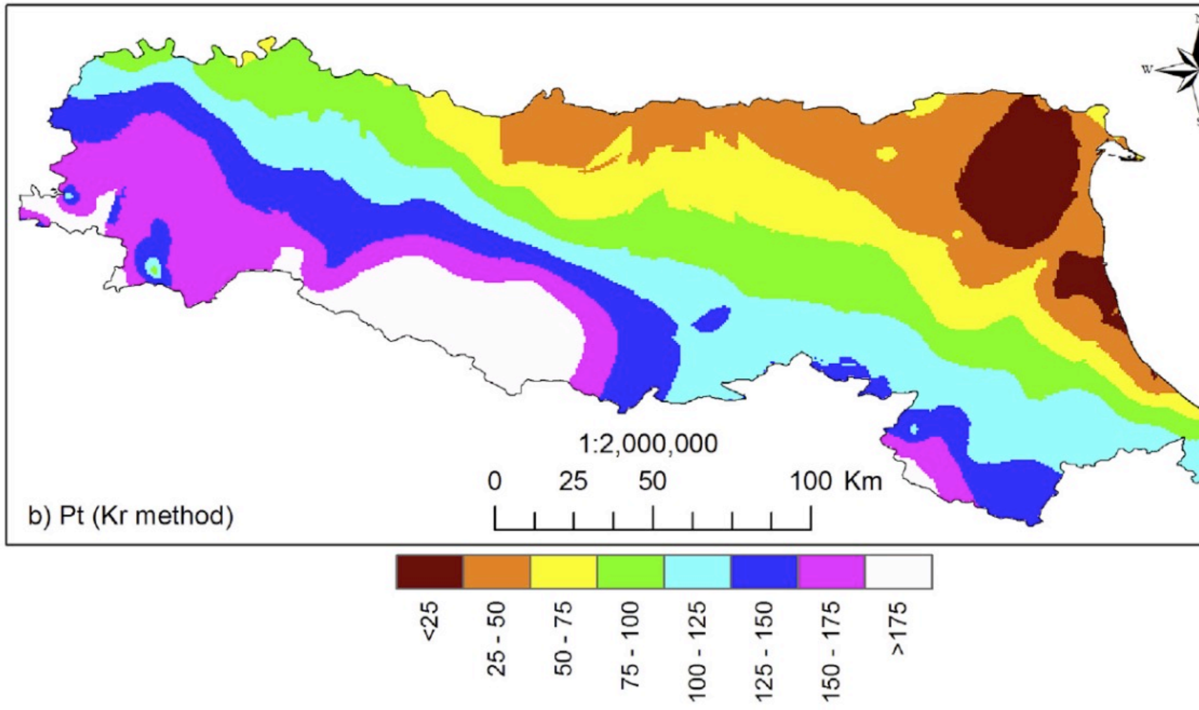


Fig. 5. Spatial interpolation of a) *Pt* using IDW technique, b) *Pt* using Kr technique.

all the above and to conclude:

fish communities examined, representative of the Italian plain waters, are dominatec
ic species.

dual populations of native species are present mostly in fluvial stretches of the foothi
, reserves of native biodiversity.

permanence of eutrophication and environmental simplification are such that they w
r also in the future the invasiveness of the exotic species, which are now dominant.

containment actions undertaken have proved so far completely ineffective.

effects of physical disturbance (e.g. nutrient and sediment resuspension), given by th
vity of herbivorous, benthivorous and planktophagous exotic fish species are such as t
the waters of the plan in a poor quality state, preventing the achievement of the WI
ctives.