

# Investigations on Microplastics in Lake Maggiore

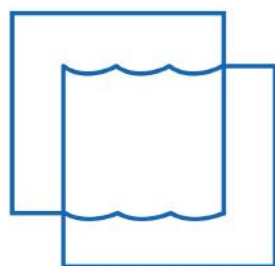
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**CIPAIS**

Commissione  
internazionale per la  
protezione delle acque  
italo-svizzere



## PROJECT OBJECTIVES:

1) Monthly monitoring of floating plastics along a cross-lake transect



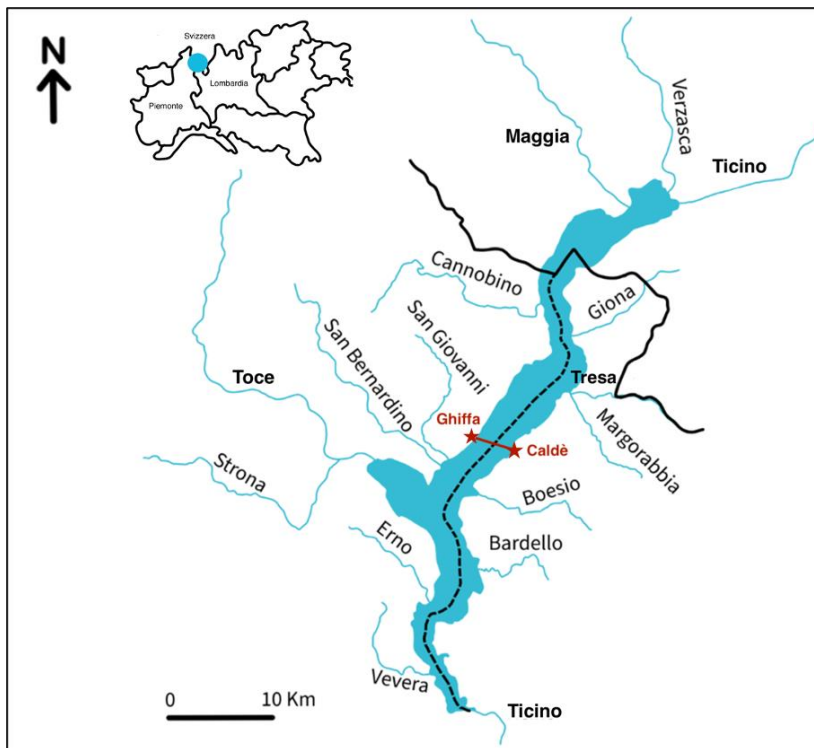
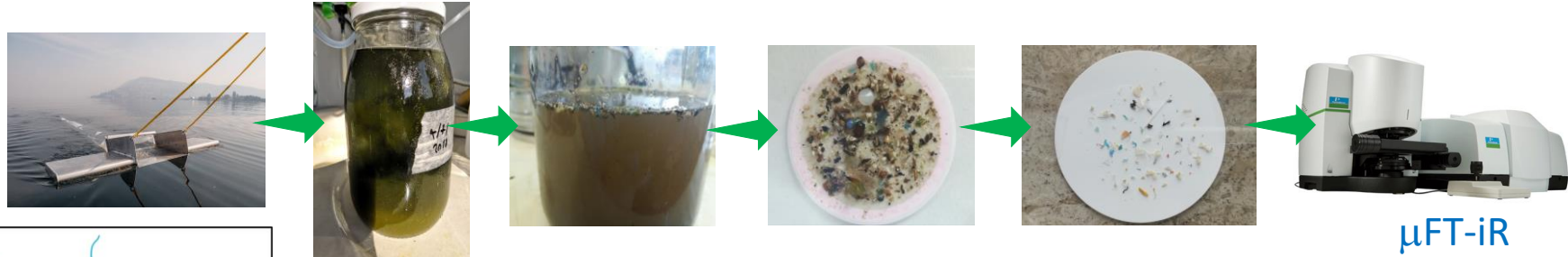
2) Monitoring of plastic particles along the water column (50 m)



3) Monitoring of plastic particles in the stomachs of whitefish



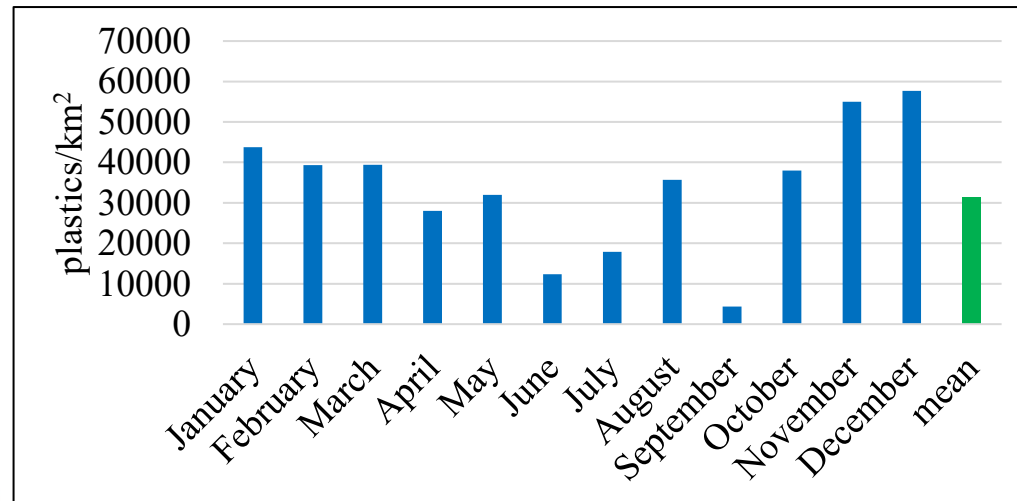
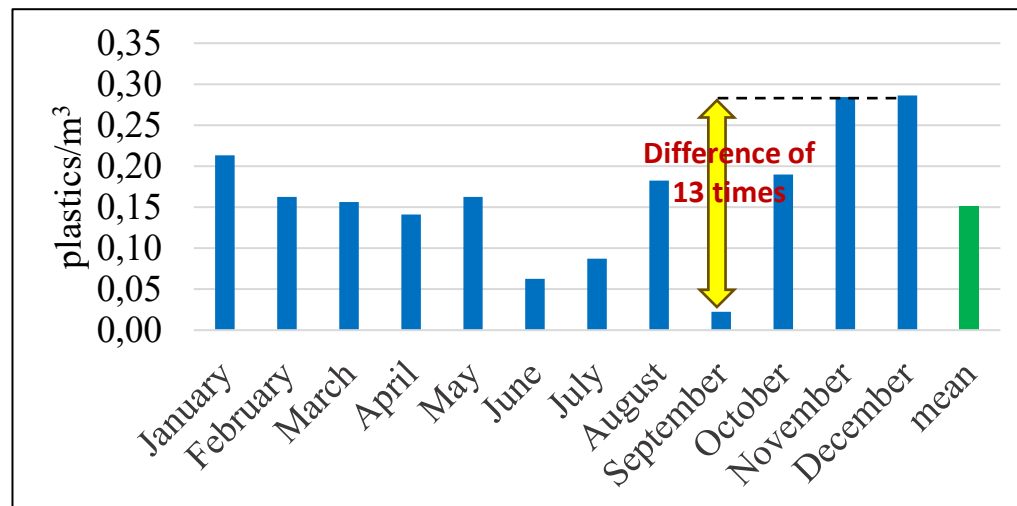
# MONTHLY MONITORING OF FLOATING PLASTICS



## SAMPLING CHARACTERISTICS

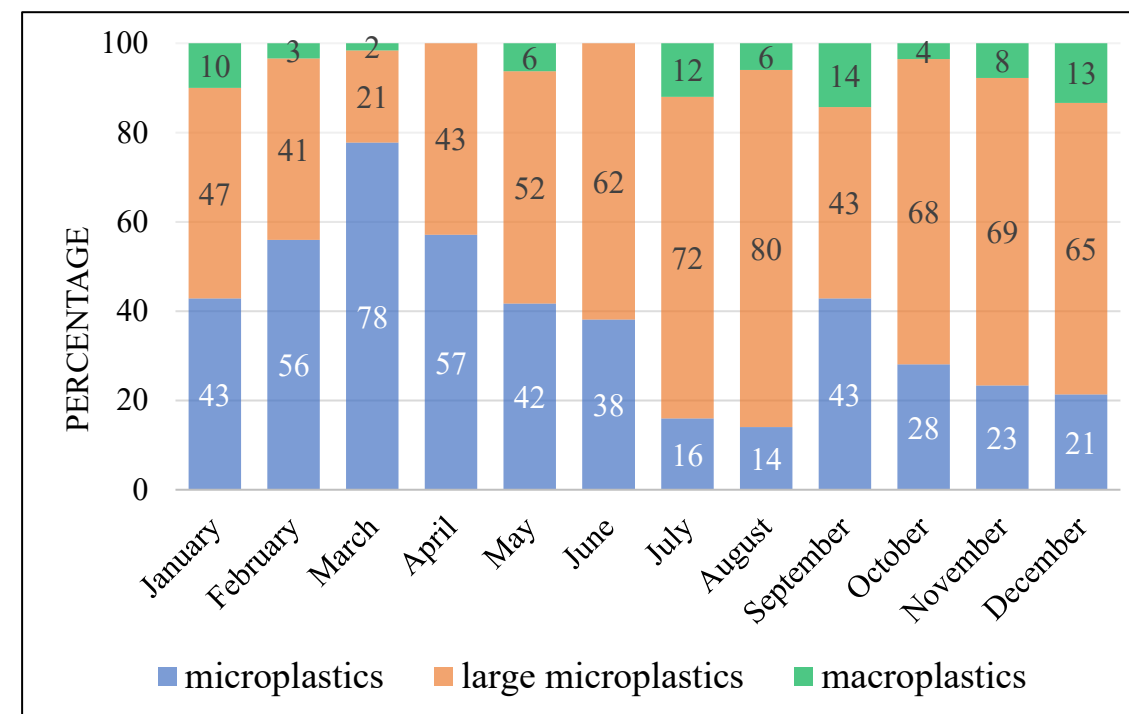
- 12 monthly transects from January to December 2022
- Sampling performed using a Manta Net with 100  $\mu\text{m}$  mesh size
- Average distance per transect: 2.8 km
- Average filtered surface: 1,500  $\text{m}^2$
- Average filtered water volume: 314  $\text{m}^3$

# CHARACTERISTICS OF CONTAMINATION



Number of potential plastic particles detected through visual sorting: 845

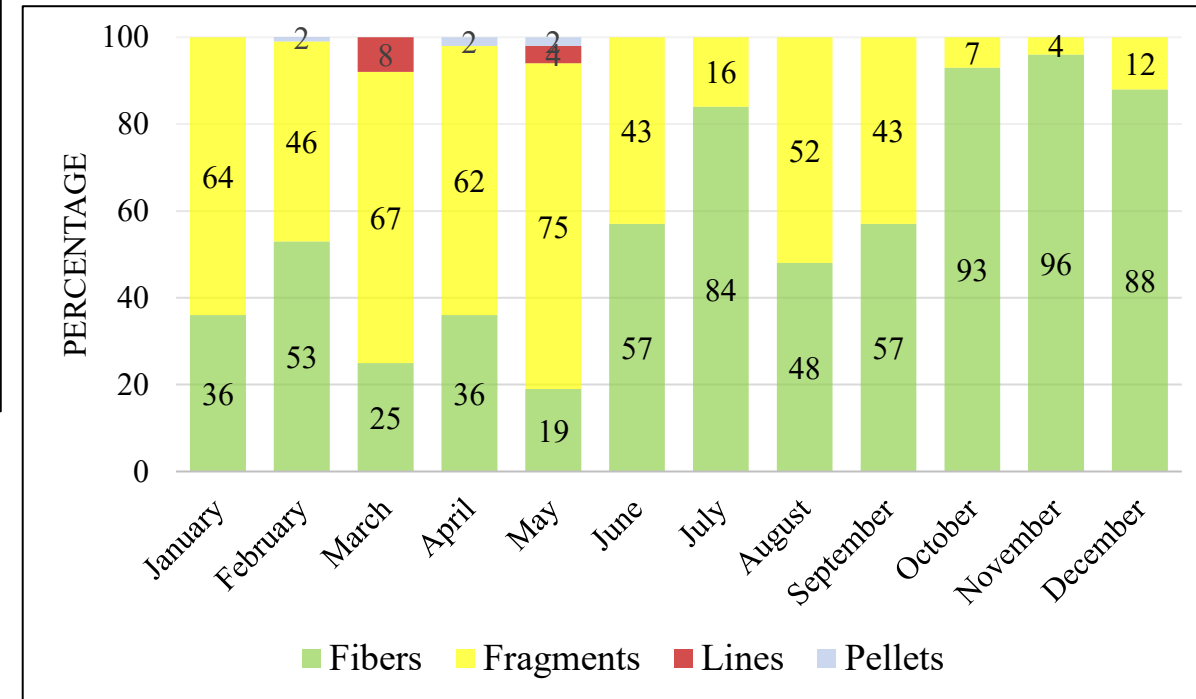
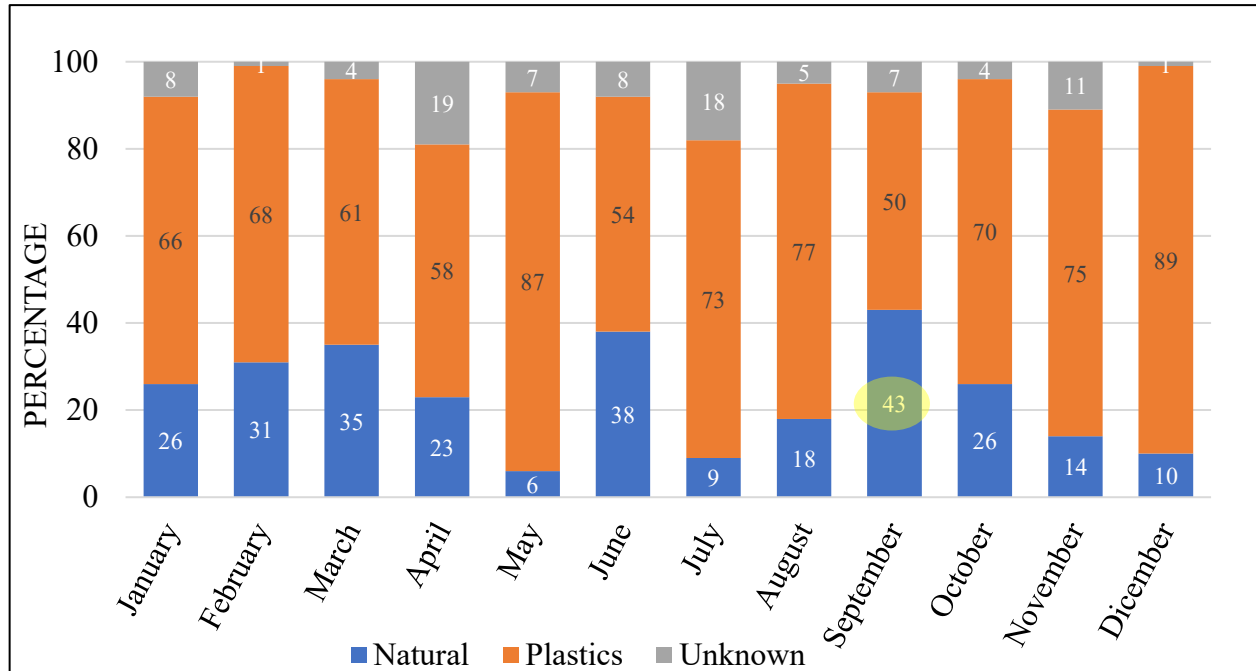
Number of polymer particles identified by  $\mu$ FT-IR: 328



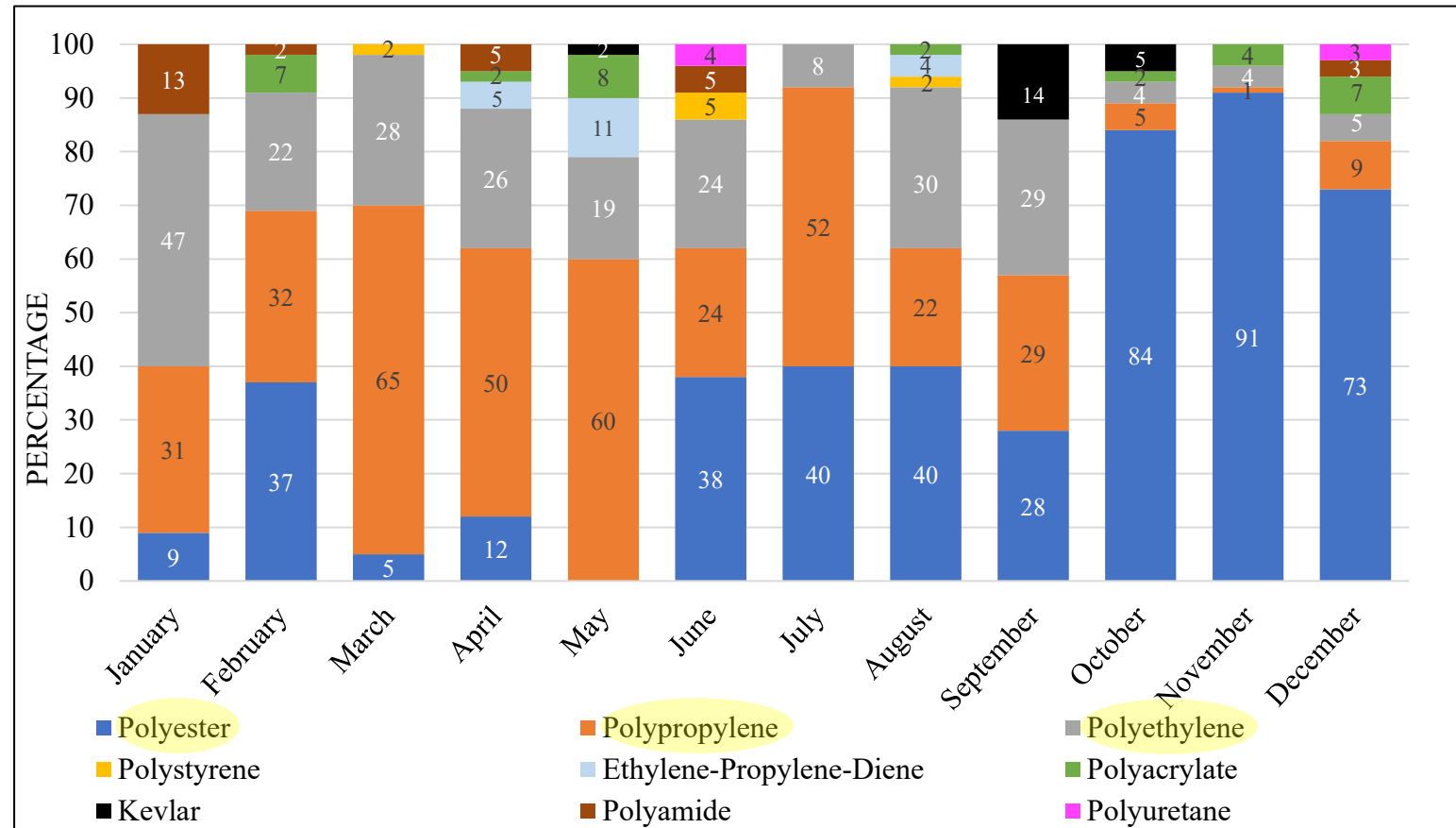
	LARGER SIZE		
Macro	Large	Micro	Nano
> 5 mm	1 ≤ 5 mm	1 $\mu$ m ≤ 1 mm	100 nm < 1 $\mu$ m

ISO/TR 21960; 2020

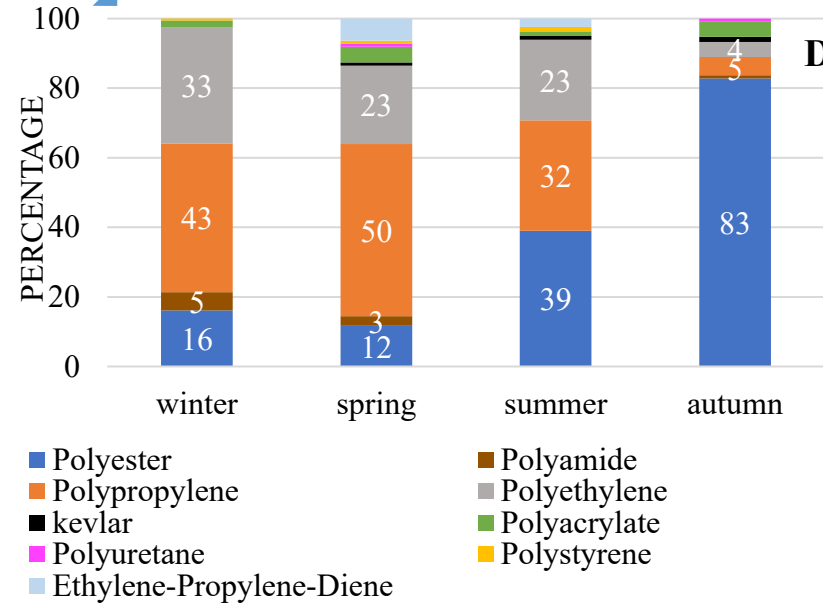
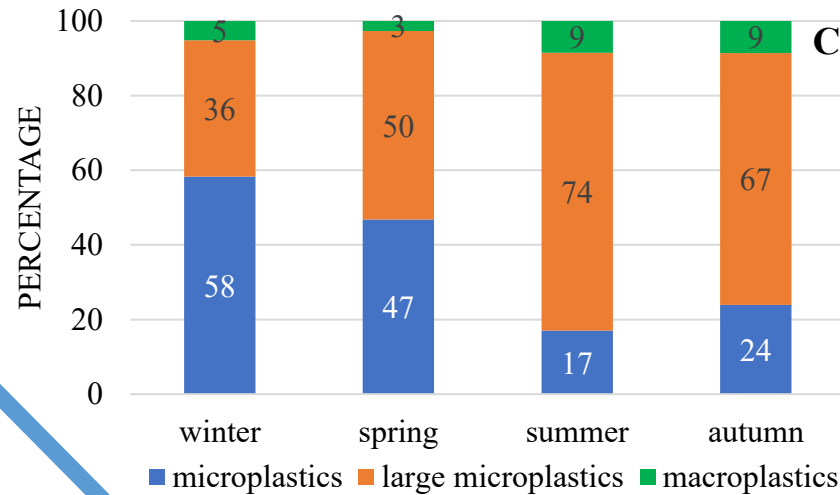
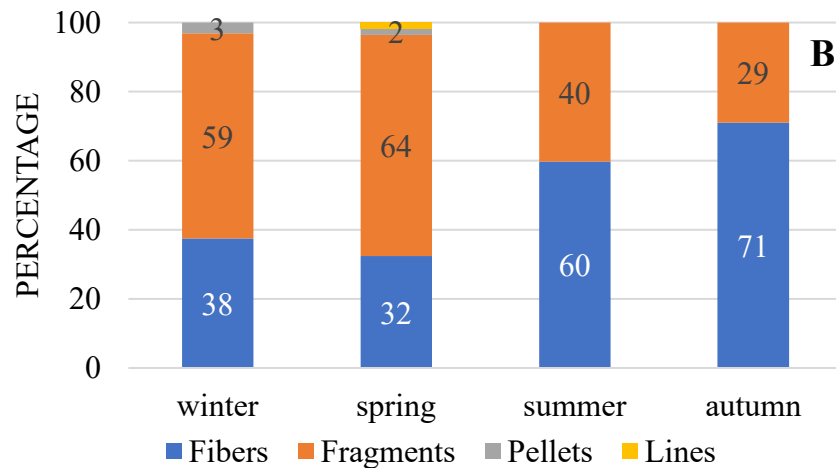
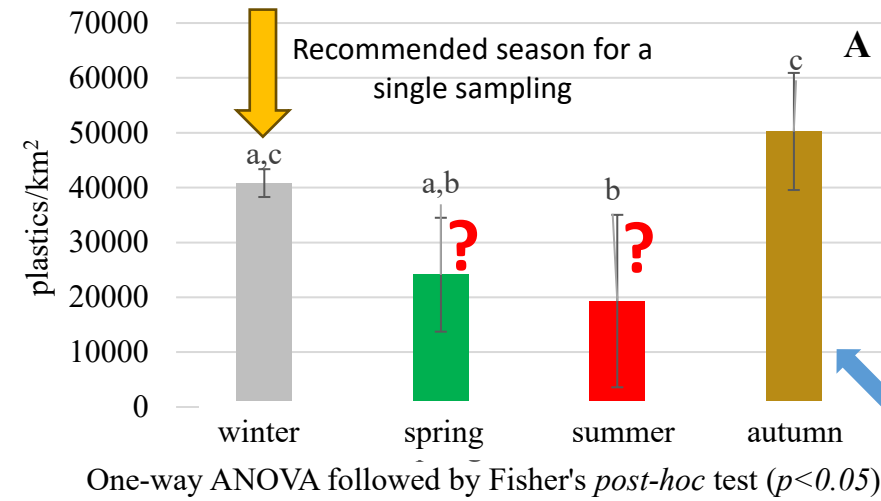
## CHARACTERISTICS OF CONTAMINATION



# POLYMER CHARACTERIZATION



# Suggestions for proper environmental management



## No correlation with environmental factors

- Plastic concentration and rainfall  
( $r = 0,355$ ;  $p = 0,258$ )



- Concentration of plastics and density of phytoplankton  
( $r = 0,5168$ ;  $p = 0,086$ )



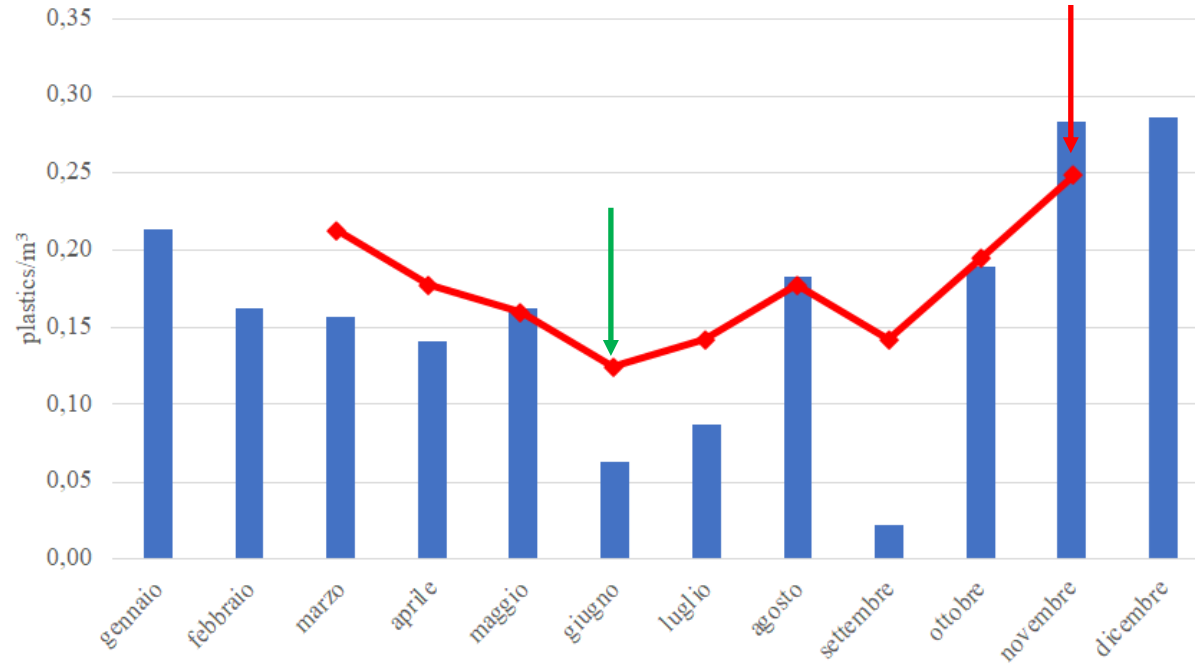
How high is the plastic contamination detected in L. Maggiore?

The concentrations detected are among the lowest measured in the world

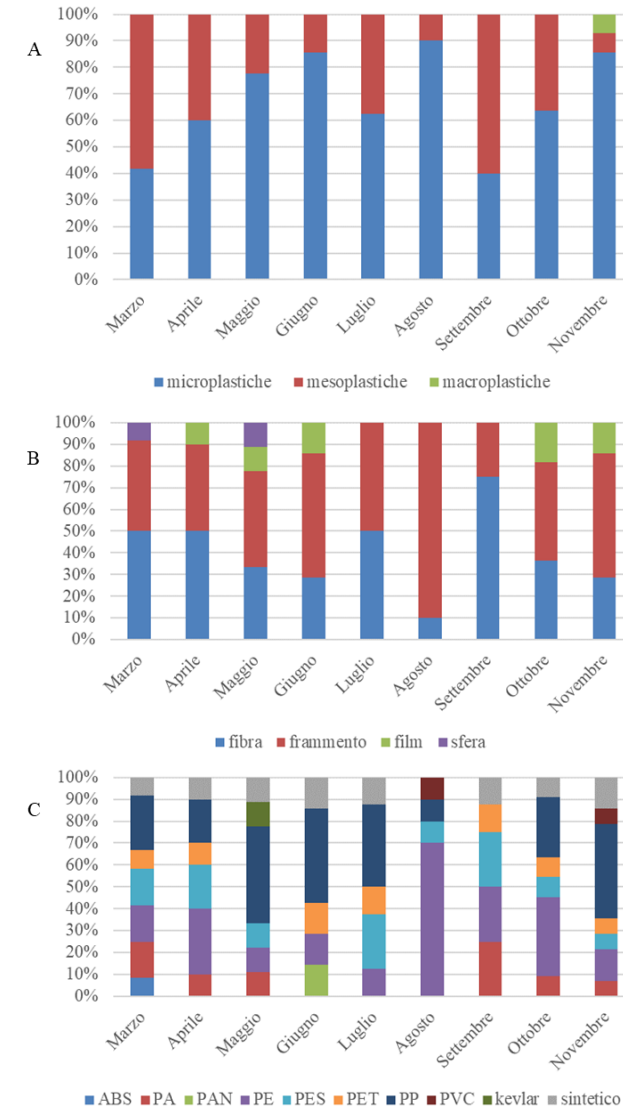
Lake	Country	Sampling type	Sampling method	Mesh (mm)	Plastic concentration	Characterization method	References
<b>AMERICAS</b>							
La Salada	Argentina	one point	net	38	143.3±40.4 plastics/m <sup>3</sup>	Visual	Alfonso et al., 2020a
Vintter	Argentina	trawl	net	38	1.9 plastics/m <sup>3</sup>	Raman (15% of particles)	Alfonso et al., 2020b
Erie	Canada	trawl	manta-net	355	45000 plastics/km <sup>2</sup> (mean)	FTIR	Mason et al., 2020
Ontario	Canada	trawl	manta-net	355	230000 plastics/km <sup>2</sup> (mean)	FTIR	Mason et al., 2020
Flathead	USA	trawl (n=12)	manta-net	330	189000 plastics/km <sup>2</sup> (mean)	Raman (12.5% of particles)	Xiong et al., 2022
<b>ASIA</b>							
Hong	China	one point	net	74	1800 plastics/m <sup>3</sup>	Raman (total particles)	Li et al., 2019
Poyang	China	some points	sieve	50	5000-34000 plastics/m <sup>3</sup>	Raman (100 particles)	Yuan et al., 2019
Hovsgol	Mongolia	trawl (n=9)	manta-net	333	20264 plastics/km <sup>2</sup> (mean)	optical microscope	Free et al., 2014
Rawal	Pakistan	trawl (n=3)	net	100	from 6.4 ± 0.5 to 8.8 ± 0.5 plastics/m <sup>3</sup>	FTIR (total particles)	Bashir and Hashmi, 2022
Baikal	Russia	7 points	pump+net	20	291 ± 252 plastics/m <sup>3</sup> (mean)	μFTIR (~30% filter area)	Moore et al., 2022
<b>AFRICA</b>							
Victoria	Tanzania	trawl (n=8)	manta-net	300	0.73 plastics/m <sup>3</sup> (mean) 120588 plastics/km <sup>2</sup> (mean)	FTIR (~20% of particles)	Egessa et al., 2020
<b>EUROPE</b>							
Kallavesi	Finland	trawl	manta-net	333	0.27±0.18 plastics/m <sup>3</sup>	FTIR (total particles)	Uurasjärvi et al., 2020
Lugano	Switzerland	trawl (3 replicates)	manta-net	300	11.50 plastics/m <sup>3</sup>	Raman (~25% of particles)	Nava et al., 2023
Tisza	Hungary	one point	pump	100	23.12 plastics/m <sup>3</sup>	FTIR (total particles)	Bordos et al., 2019
Tollense	Germany	one point	pump/filtration	20	1812 plastics/m <sup>3</sup>	Nile Red/μRaman (~2% of particles)	Tamminga et al., 2022
<b>ITALY</b>							
Garda	Italy	trawl (n=3)	manta-net	300	from 4000±2700 plastics/km <sup>2</sup> to 55000±29000 plastics/km <sup>2</sup>	FTIR (total particles)	Sighicelli et al., 2018
Iseo	Italy	trawl (n=3)	manta-net	300	from 15000±11000 plastics/km <sup>2</sup> to 57000±36000 plastics/km <sup>2</sup>	FTIR (total particles)	Sighicelli et al., 2018
Maggiore	Italy	trawl (n=3)	manta-net	300	from 29000±17000 plastics/km <sup>2</sup> to 45000±13000 plastics/km <sup>2</sup>	FTIR (total particles)	Sighicelli et al., 2018
Garda	Italy	trawl (n=7)	manta-net	300	36000±28000 plastics/km <sup>2</sup> (mean)	FTIR (total particles)	Galafassi et al., 2021
Orta	Italy	trawl (n=n.a.)	manta-net	300	63000±25000 plastics/km <sup>2</sup> (mean)	FTIR (total particles)	Galafassi et al., 2021
Como	Italy	trawl (n=5)	manta-net	300	29000±14000 plastics/km <sup>2</sup> (mean)	FTIR (total particles)	Galafassi et al., 2021
Maggiore	Italy	Trawl (n=6)	manta-net	300	100000±35000 plastics/km <sup>2</sup> (mean)	FTIR (total particles)	Galafassi et al., 2021
Maggiore	Italy	trawl (3 replicates)	net	200	8.24 plastics/m <sup>3</sup>	Raman (~25% of particles)	Nava et al., 2023
Maggiore	Italy	trawl	manta-net	100	from 0.02 to 0.29 plastics/m <sup>3</sup> from 4375 to 57692 plastics/km <sup>2</sup>	μFTIR (total particles)	Present study



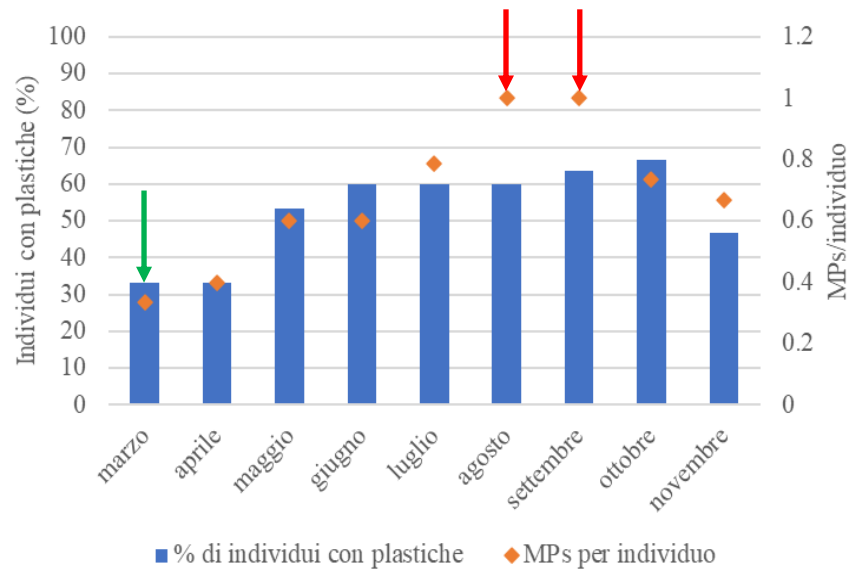
# Presence of plastic particles in the water column



Concentrations between 0.12 plastics/m³ in June up to a maximum of 0.25 plastics/m³ in November



# Ingestion by whitefish



53% of the fish had 1 to 3 plastics in their stomachs. The lowest ingestions were found in March (0.3 plastics/ind.) and highest in August and September with 1 plastic/ind.

