



Impact of water scarcity and flood on bathing waters in Emilia-Romagna Italy

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Strategic Roundtable on Increasing Resilience to Climate Change in the Water and Sanitation Sector

13 – 14 November 2023 | Geneva

Land uses & terrestrial ecosystems

Inland waters

Estuaries and deltas

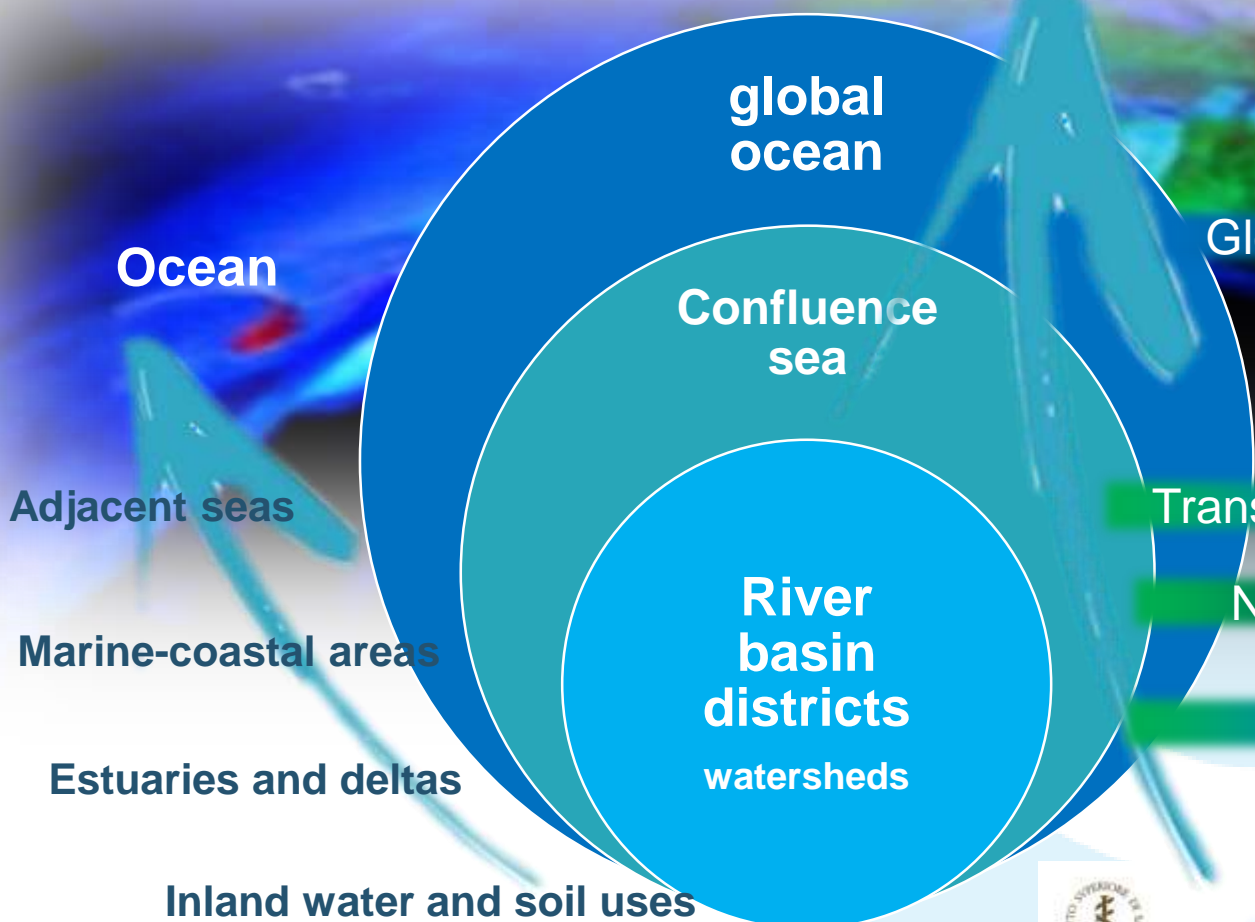
Marine-coastal areas

Adjacent seas

High Seas
Open ocean

water
biota
sediment
materials
pollutants





SOURCE-TO-SEA MANAGEMENT

14 - 16 DECEMBER 2022 | GENEVA & ONLINE

LINEE GUIDA PER L'ANALISI DELLE PRESSIONI AI SENSI DELLA DIRETTIVA 2000/60/CE

Delibera del Consiglio SNPA, Seduta del 22.02.2018. Doc. n. 26/18

Progettazione di reti e programmi di monitoraggio delle acque ai sensi del D.Lgs.152/2006 e relativi decreti attuativi

Delibera del Consiglio Federale delle Agenzie Ambientali. Seduta del 30 giugno 2014. DOC.n.42/14-CF

RAPPORTI ISTISAN 22|33

Linee guida nazionali per l'implementazione dei Piani di Sicurezza dell'Acqua

RAPPORTI ISTISAN 16|12

Elementi di analisi del rischio correlati all'utilizzo e riutilizzo di acque in produzione primaria e alimentare

STUDIO DELL'AREA DI INFLUENZA PER LA GESTIONE DELLE ACQUE DI BALNEAZIONE

PARTE 1: ANALISI DELLE PRESSIONI E STRUMENTI DI GESTIONE

Delibera del Consiglio SNPA, Seduta del 18.05.21. Doc. n. 115/21

LG-SNPA 31 2021

Rapporto Istisan 2023

Bozza finalizzata

Linee di indirizzo per l'elaborazione dei piani di sicurezza delle acque di balneazione e per la gestione della qualità delle acque a diversi usi ricreativi

A cura del gruppo di lavoro sui Piani di sicurezza della balneazione

Some impacts of climate change in Emilia-Romagna

- ✓ higher frequency of extreme events
- ✓ drought and water scarcity
- ✓ temperature increase in average 1.1 C (1961-1990)



FIGURA 14
Anomalia delle precipitazioni totali (mm) dell'anno 2022 rispetto al clima 1991-2020

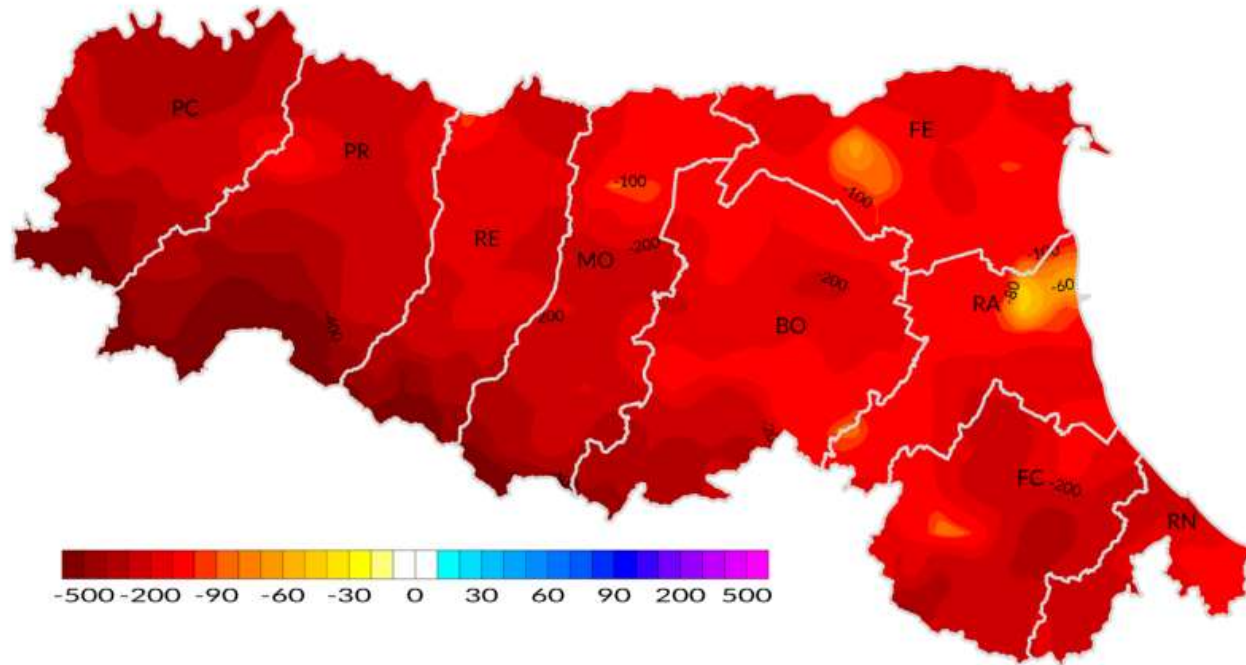


FIGURA 15
Andamento temporale della media regionale delle precipitazioni annue (1961-2022)



2022

- ✓ unprecedented long period of drought
- ✓ decisive effect on the flow of many rivers
- ✓ impact on the volumes of water flowing out of their mouths.

July exceptional conditions: what causes?



Classe di qualità	2019	2020	2021	2022
Eccellente	89	90	91	81
Buona	5	5	6	12
Sufficiente	2	1	0	4
Scarsa	1	0	0	0
In attesa di classificazione	0	1	0	1
Totale	97	97	97	98



- ✓ Bathing season 2022: exceptionally high E.coli values
- ✓ 26th, 2022, routine samples from **28 areas** along the coast: very high E.coli concentrations (2 to 4 times E.coli value for a sufficient status = 500 units/ml) causing bathing water prohibition. 26 in the Province of Rimini
- ✓ No WWTP malfunctions;
- ✓ All WWTP in normal range
- ✓ No rain - No sewers overflow

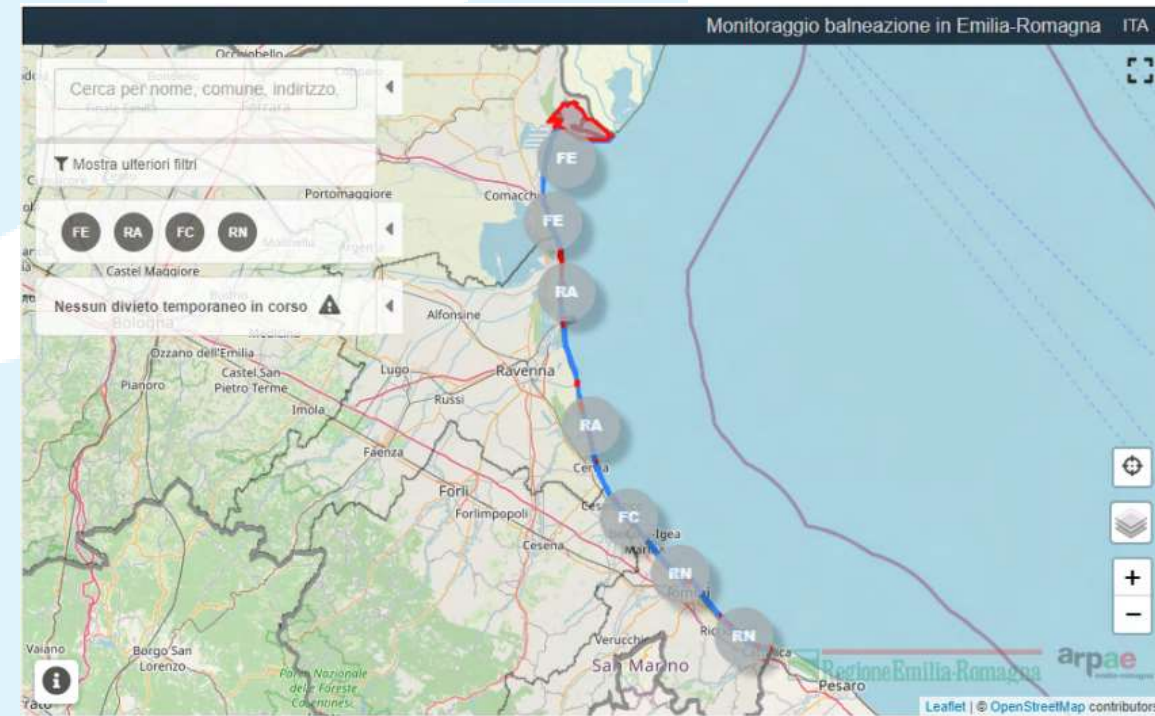
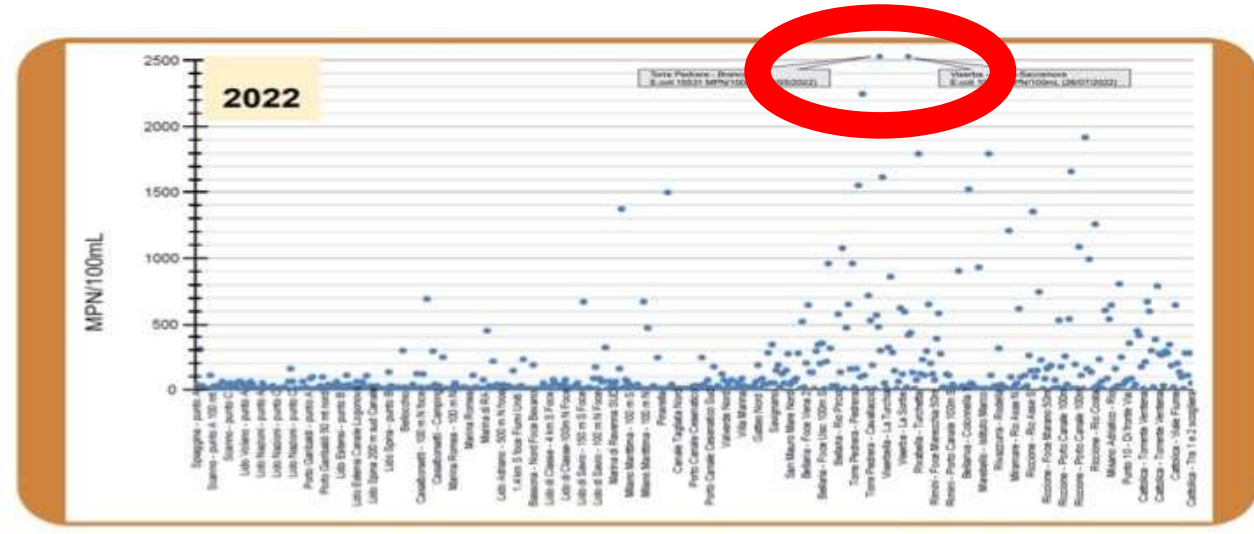
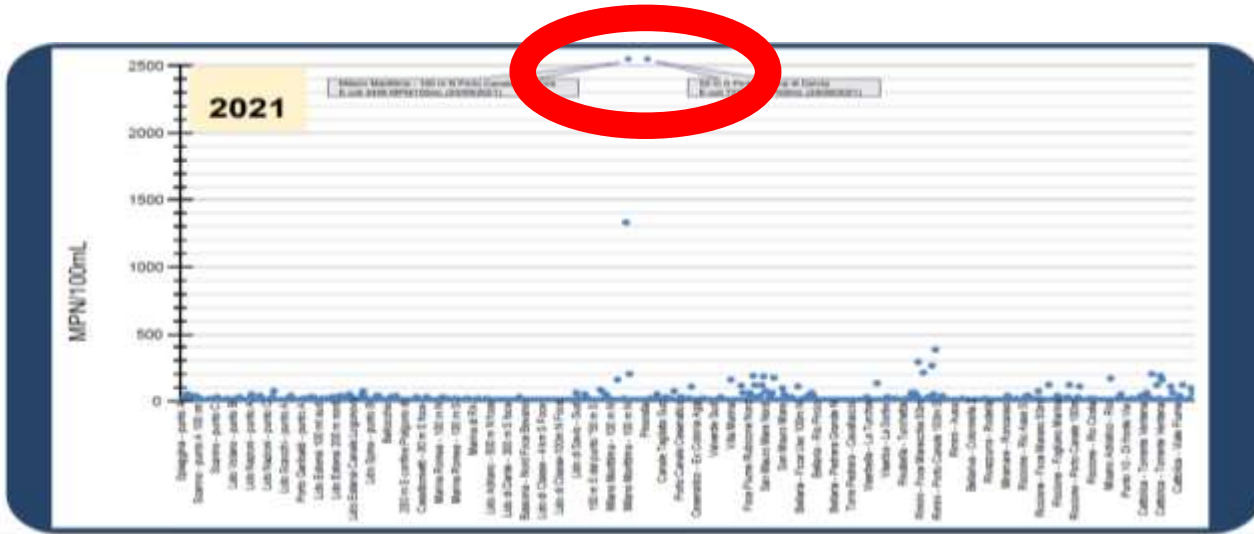


Figura 1: Sito web regionale "Acque di Balneazione in Emilia-Romagna" (www.arpae.it/it/temi-ambientali/balneazione)

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Climate anomaly: a widespread phenomenon



Comparison of the datasets for the years 2021 and 2022:
exceedances are anomalous events along the entire coast of the Emilia-Romagna Region

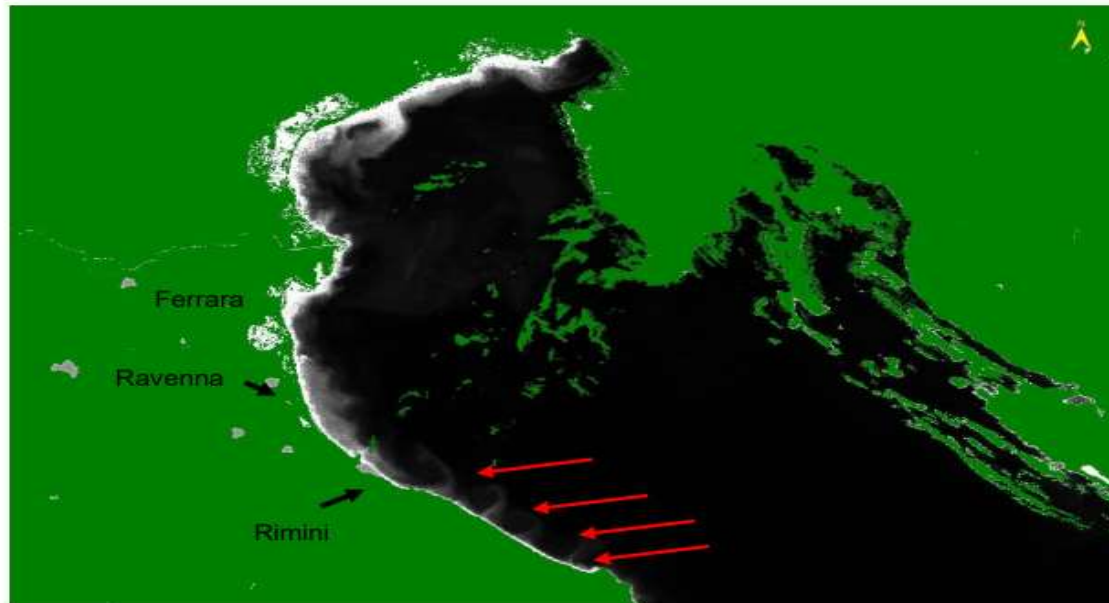
Satellite Monitoring



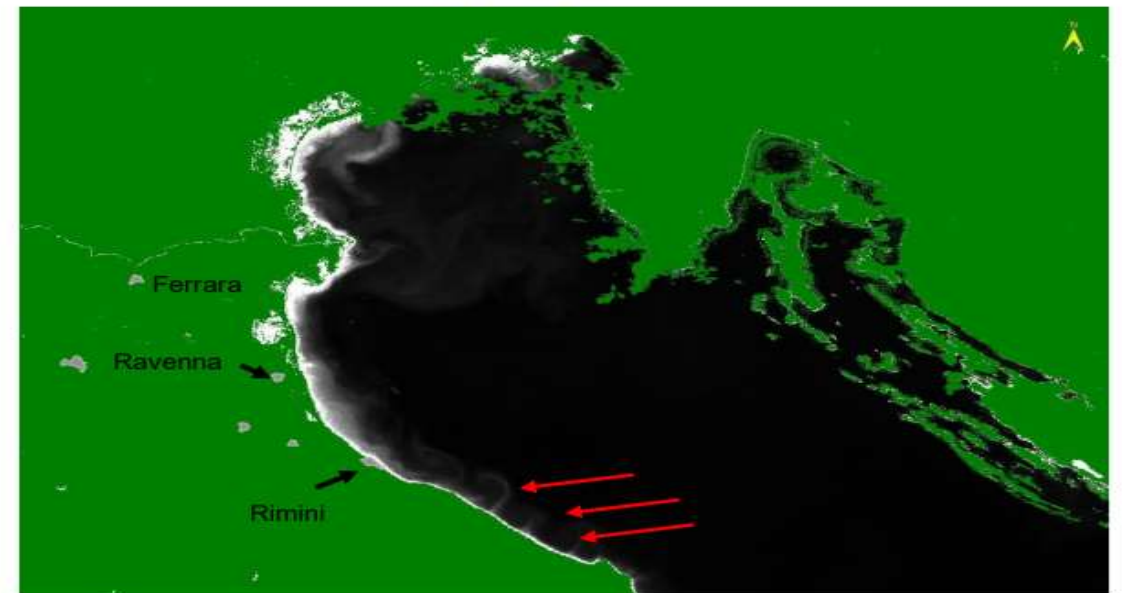
Exceptional weather and sea conditions

Sea currents observed by Satellite Sentinel-3 (concentration Chl-a)

23 luglio



24 luglio



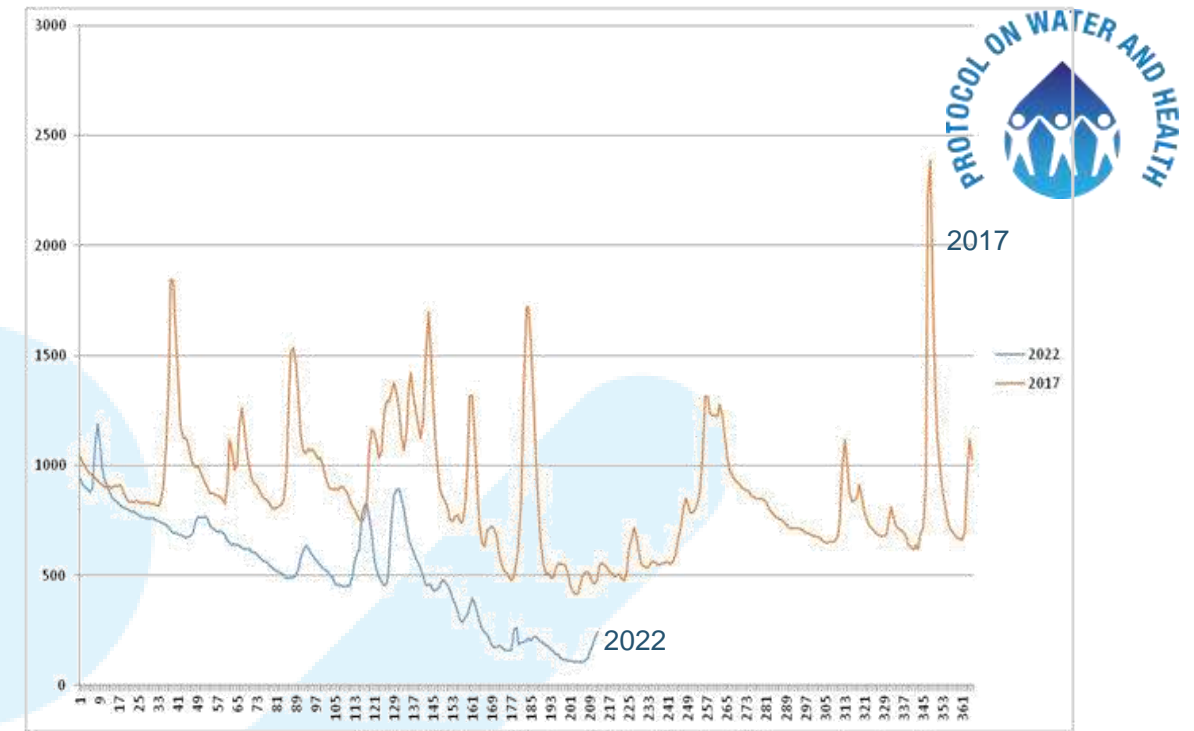
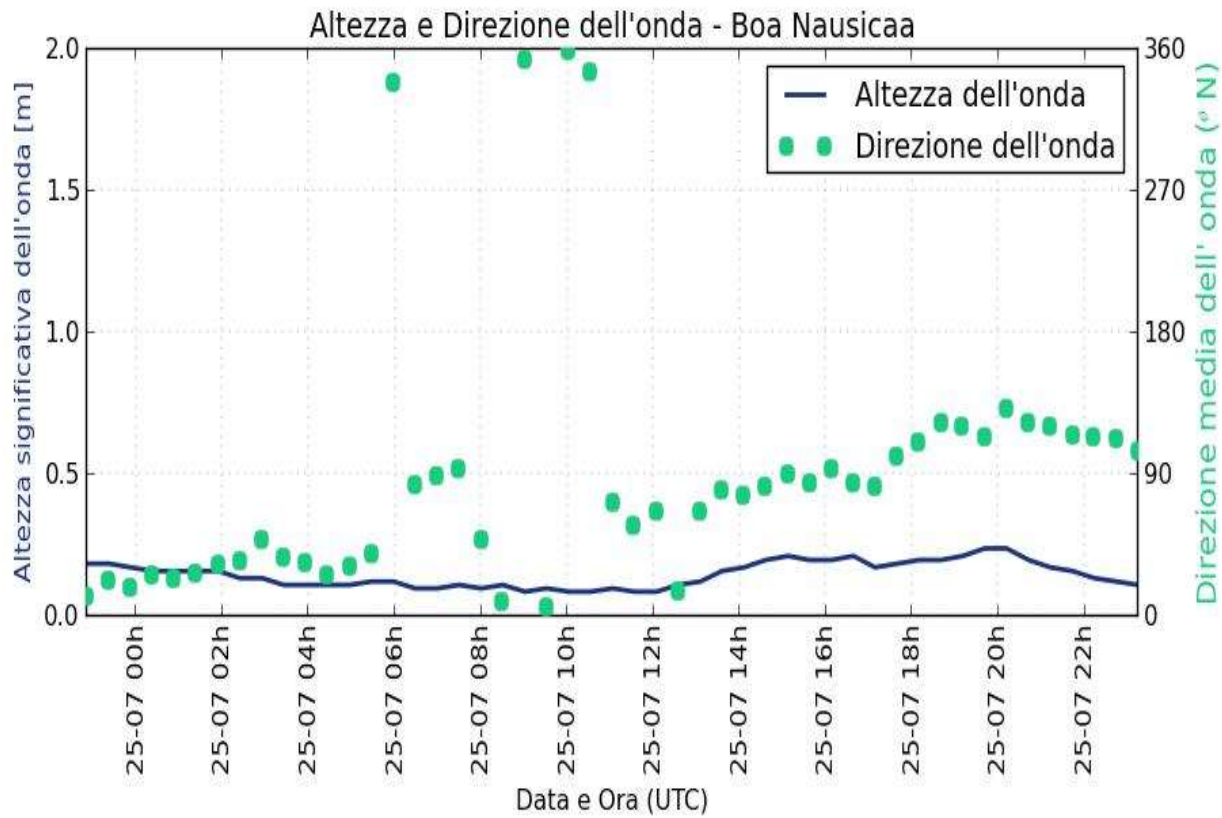


Fig. 5 Portate Po – confronto anno 2017 con anno 2022 (gennaio-luglio)

- ✓ Average sea water temperature (July 2022): 28.05°C (highest value from 2001 to today)
- ✓ Average salinity in all coastal stations: 36.9‰, (highest value from 2001 to today)
- ✓ Flow rates of Po River (region's main river (J2022): historical lowest value causing 50 km seawater intrusion
- ✓ No / Very low sea waves

Possible hypotheses to explain the causes are represented by synergies of:

- ✓ exceptional meteorological, hydrological, and marine conditions acting on bacteria re-growth.
- ✓ non-compliance of site-specific bathing water sites not associated with conventional causes

Floods in Emilia-Romagna, May 2023

- 2-3 May 2023
- 16-17 May 2023

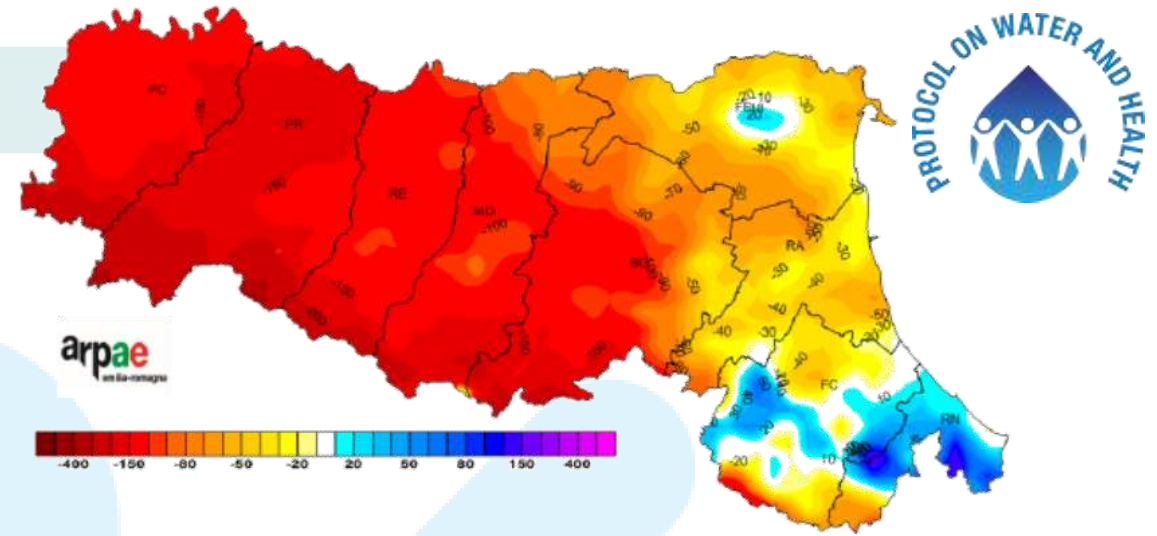
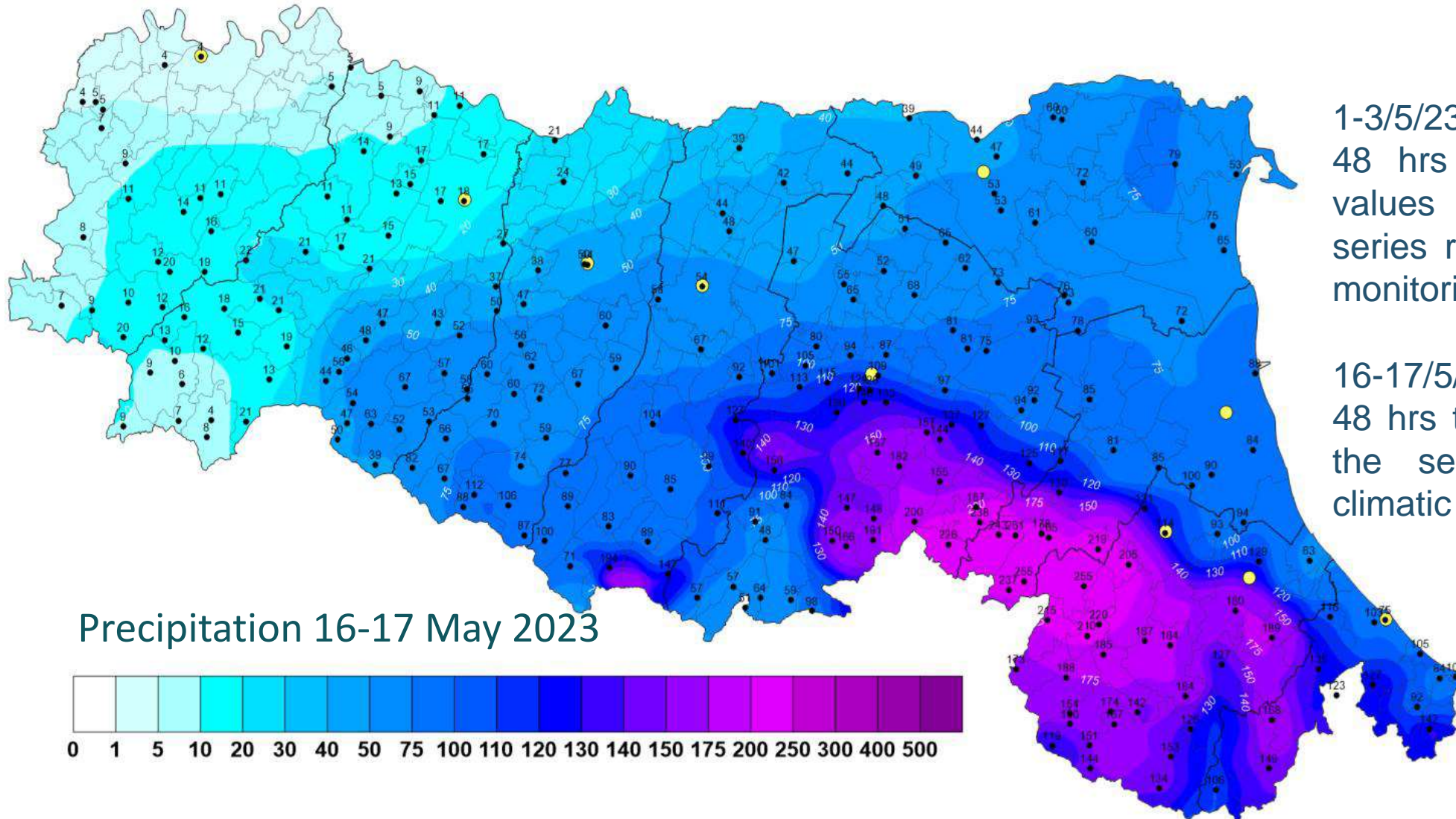


Figura 16: Anomalia percentuale della precipitazione (%) dall'1 gennaio al 30 aprile 2023



Floods in Emilia-Romagna, May 2023



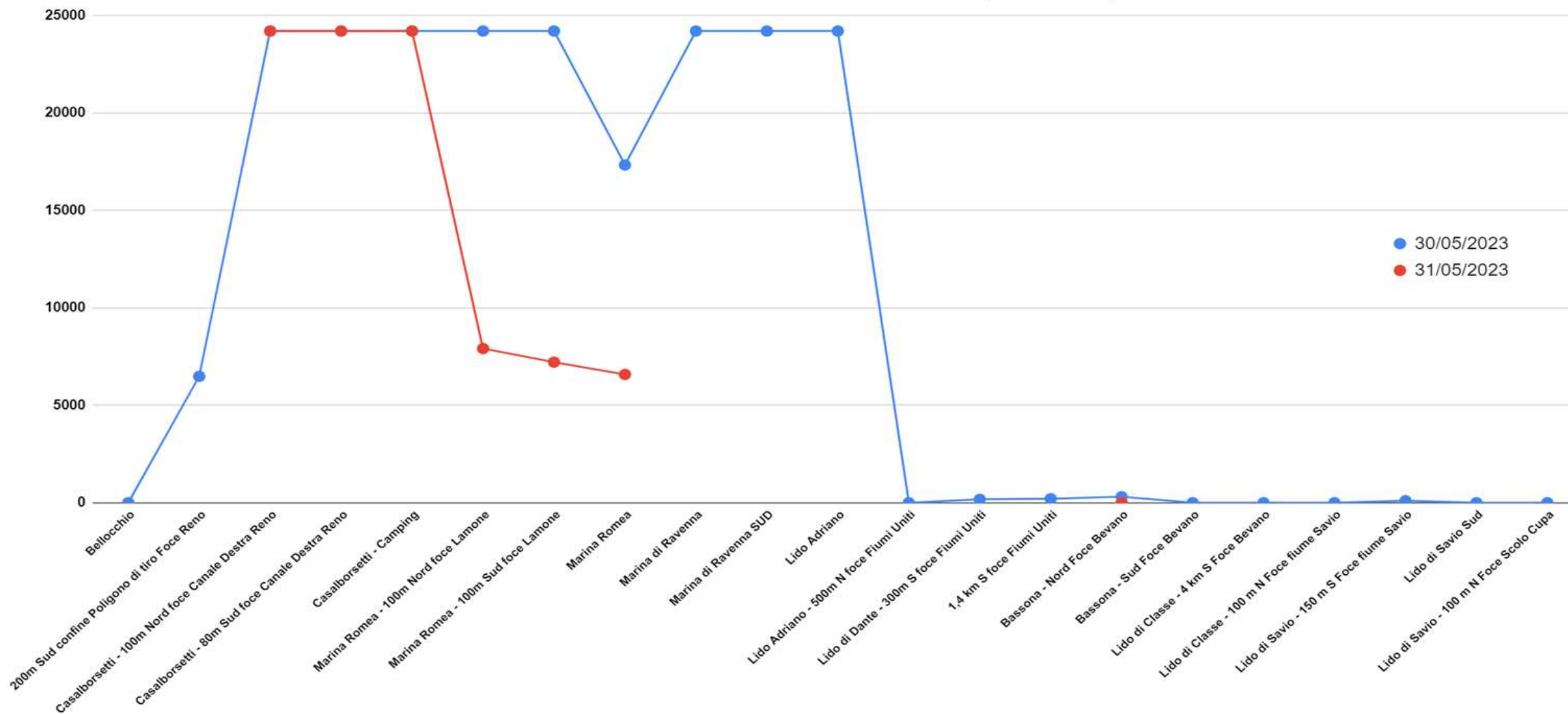
1-3/5/23

48 hrs total rain maximum values on 100 year climatic series recorded in 27 rainfall monitoring stations

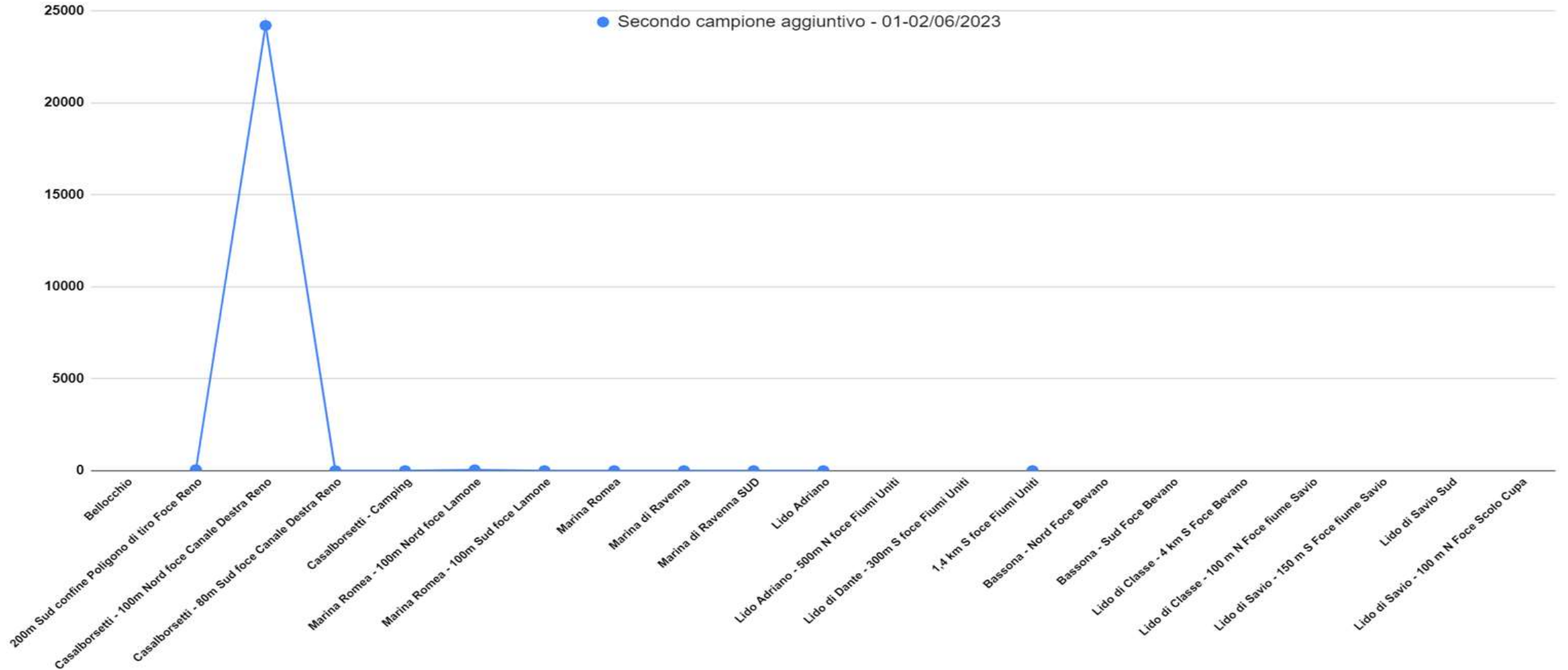
16-17/5/23

48 hrs total rainfall has been the second of the same climatic series

Municipality of Ravenna - Values of intestinal Enterococci in bathing water [MPN/100mL]



Municipality of Ravenna - Values of intestinal Enterococci in bathing water [MPN/100mL]



Conclusions

- Climate change impact bathing water with unprecedented and not yet elucidated effects
- Risk management strategies should be approached by integrated approach (Bathing Recreational water safety plans)
- Integrated early warning systems
- Further research on bacteria population dynamics in changing environmental conditions
- Guidelines needed particularly on management of exceedances and control measures in routine monitoring

Thank you!

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