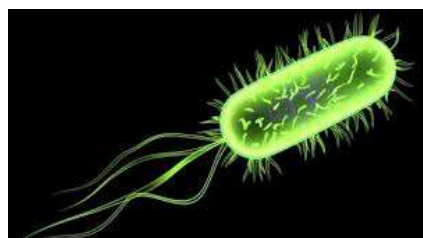
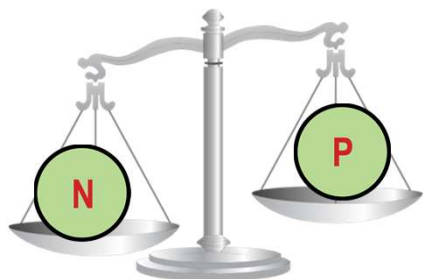


# WP3.1 Review of existing data

AdSWiM | several PPs | Celussi

GA and SC Meeting | Online | 14th of December 2021

# Activity 3.1: Critical review and analysis on existing chemical and microbiological data



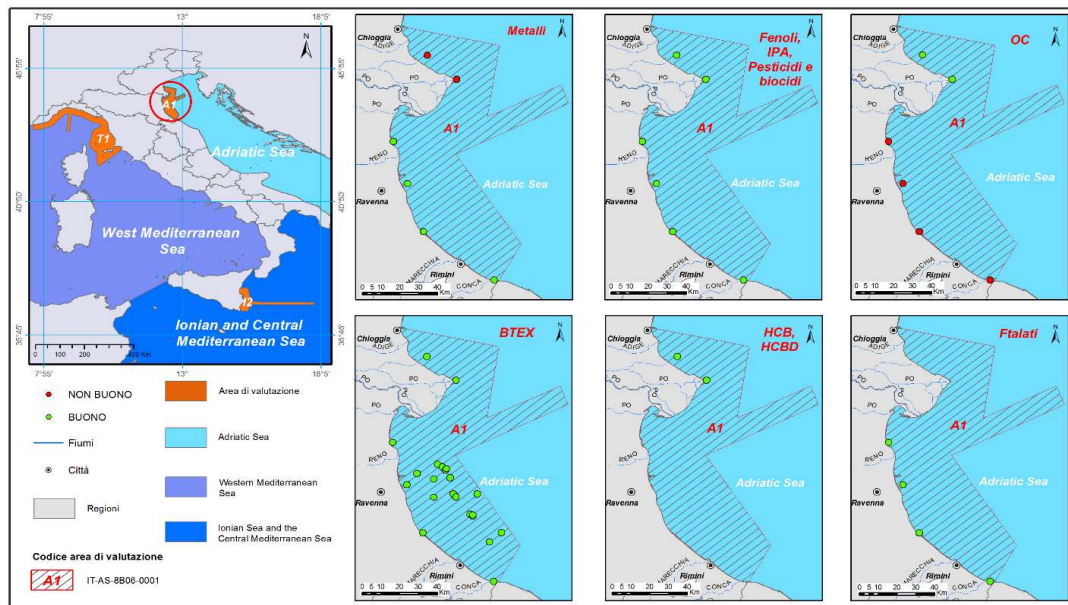
Nutrients, microelements and pollutants, microbiological indicators data are collected from EU reports, local and regional bodies and the scientific literature to lay down the current status of water quality in Adiratic areas involved in the projects.



# Deliverable 3.1.1: Report of trend survey of nutrients and other chemical parameters

...heavy metals pollution could represent an additional but very important indicator for the BW quality and for our seas in general as requested by Marine Strategy Directive...

...among these cadmium, lead and mercury are listed as Priority Substance to monitor in water column...



metal survey in Adriatic Sea, available just for 0.04% of valuation area (VA), by ISPRA

Area di valutazione A1= 16340 celle totali									
	Metalli	Fenoli	IPA	Pesticidi e biocidi	OC	BTEX	HCB	HCBd	Ftalati
% di celle buono	57	100	100	100	43	100	100	100	100
% di copertura dell'area di valutazione	0,04	0,04	0,04	0,04	0,04	0,14	0,02	0,02	0,02

Site	Dissolved and (total) concentrations (nmol L <sup>-1</sup> )			Reference
	Cd	Pb	Cu	
Po plume 2002	0.12 ± 0.04 (0.14 ± 0.05)	0.33 ± 0.21 (0.52 ± 0.35)	5.3 ± 2.5 (7.1 ± 4.6)	(Illuminati et al., 2019)
Northern Adriatic Sea, 1994	0.083		7.14	(Tankere and Statham, 1996)
Northern Adriatic Sea, 1996			5.4 ± 2.5	(Zago et al., 2002)
Northern Adriatic Sea, 1997			6.4 ± 2.8	(Zago et al., 2002)
Central Adriatic Sea, 2000–2004	0.14 ± 0.06	0.24 ± 0.14	7.1 ± 3.6	(Annibaldi et al., 2009)
Southern Adriatic Sea, 1994	0.076		2.95	(Tankere and Statham, 1996)

## Heavy metal data from the literature

Take home message: not enough data! Need for implementation!

# Nutrient data from the literature

Site (year)	Phosphorous		Nitrogen				Silicon/ Carbon	Reference	
Coastline of Pesaro (2000)	Tot P 0 - 30 (µg/l)			N-NO <sub>3</sub> 0 - 600 (µg/l)	N-NH <sub>4</sub> 0 - 50 (µg/l)			Penna et al., 2004	
Southern Adriatic Surface water (2007-2008)									
2007	TDP 0.08 ± 0.02 (µM)	SRP 0.03 ± 0.02 (µM)	TDN 4.7 ± 0.8 (µM)	DIN 0.17 ± 0.3 (µM)	DON 4.6 ± 0.9 (µM)		DOC 70 ± 7 (µM)	Santinelli et al., 2012	
2008	TDP 0.12 ± 0.04 (µM)	SRP 0.08 ± 0.04 (µM)	TDN 6.2 ± 1.5 (µM)	DIN 2.0 ± 1.2 (µM)	DON 4.1 ± 1.0 (µM)		DOC 53 ± 3 (µM)	Santinelli et al., 2012	
Gulf of Trieste (2006-2007)	P-PO <sub>4</sub> 0.02 - 0.12 (µM)						S-Si(OH) <sub>4</sub> 0.29 - 5.93 (µM)	Cibic et al., 2018 (1)	
Gulf of Trieste (2006-2007)	P-PO <sub>4</sub> 0 - 12.15 (µM)		N-NO <sub>3</sub> 0 - 0.75 (µM)	N-NO <sub>3</sub> 0 - 0.75 (µM)	N-NH <sub>4</sub> <0.13 - 3.41 (µM)		S-Si(OH) <sub>4</sub> 0 - 6.80 (µM)	Cibic et al., 2018 (2)	
North Adriatic (1972-1975)									
Western side	TP 0.27W (m.mol/m3)	PO <sub>4</sub> 0.06 (m.mol/m3)	NO <sub>3</sub> 0.30 (m.mol/m3)	NO <sub>3</sub> 1.08 (m.mol/m3)	NH <sub>4</sub> 0.75 (m.mol/m3)	TIN 2.08 (m.mol/m3)	DON 3.33 (m.mol/m3)	Si(OH) <sub>4</sub> 3.22 (m.mol/m3)	Degobbiet al., 1990
Eastern side	TP 0.13 (m.mol/m3)	PO <sub>4</sub> 0.02 (m.mol/m3)	NO <sub>3</sub> 0.13 (m.mol/m3)	NO <sub>3</sub> 0.41 (m.mol/m3)	NH <sub>4</sub> 0.58 (m.mol/m3)	TIN 1.08 (m.mol/m3)	DON 2.86 (m.mol/m3)	Si(OH) <sub>4</sub> 1.83 (m.mol/m3)	Degobbiet al., 1990
Central Adriatic (1990-1992)	P-PO <sub>4</sub> 0.02 - 0.20 (µM)		N-DIN 0.7 - 8.2 (µM)	N-NO <sub>3</sub> 0.3 - 22.5 (µM)				Si- SiO <sub>2</sub> 0.9 - 5.5 (µM)	Zoppi et al., 1995
North Adriatic (1993)	PO <sub>4</sub> 0.10 ± 0.19 (µM)		NO <sub>3</sub> 0.19 ± 0.21 (µM)	NO <sub>3</sub> 1.56 ± 1.91 (µM)	NH <sub>4</sub> 2.07 ± 1.35 (µM)	TIN 3.87 ± 2.83 (µM)			Kaltenböck et al., 1992
Jabuka PR (1993-1994)									
1993	PO <sub>4</sub> 0.090 - 0.147 (µmol/kg)			NO <sub>3</sub> 2.44 - 3.92 (µmol/kg)				SiO <sub>2</sub> 3.45 - 4.84 (µmol/kg)	Krakakopoulou et al., 2005
1994	PO <sub>4</sub> 0.216 - 0.481 (µmol/kg)			NO <sub>3</sub> 5.8 - 6.64 (µmol/kg)				SiO <sub>2</sub> 7.09 - 9.89 (µmol/kg)	Krakakopoulou et al., 2005
Adriatic sea historical data									
Shallow Northern Adriatic	PO <sub>4</sub> 0.05 - 0.12 (µM)			NO <sub>3</sub> 0.58 - 3.18 (µM)				SiO <sub>2</sub> 0.51 - 5.63 (µM)	Zavatrelli et al., 1998
Deep Northern Adriatic	PO <sub>4</sub> 0.02 - 0.07 (µM)			NO <sub>3</sub> 0.40 - 1.25 (µM)				SiO <sub>2</sub> 1.34 - 2.52 (µM)	Zavatrelli et al., 1998
Middle Adriatic	PO <sub>4</sub> 0.06 - 0.07 (µM)			NO <sub>3</sub> 0.63 - 0.84 (µM)				SiO <sub>2</sub> 4.03 - 4.76 (µM)	Zavatrelli et al., 1998
Southern Adriatic	PO <sub>4</sub> 0.04 - 0.06 (µM)			NO <sub>3</sub> 0.77 - 1.21 (µM)				SiO <sub>2</sub> 2.06 - 3.52 (µM)	Zavatrelli et al., 1998
Gulf of Trieste (1992-1993)	PO <sub>4</sub> 0.2 - 1.4 (µM)			NO <sub>3</sub> 0.5 - 1.5 (µM)	NH <sub>4</sub> 0.1 - 0.5 (µM)			SiO <sub>2</sub> 0.5 - 2.5 (µM)	Reisenhofer et al., 1996
Mjrt Island, Croatia (1997-1999)									
1997	PO <sub>4</sub> 0.02 - 0.15 (µmol/dm3)		NO <sub>3</sub> 0.02 - 0.33 (µmol/dm3)	NO <sub>3</sub> 0.1 - 3.42 (µmol/dm3)	NH <sub>4</sub> 0.07 - 0.33 (µmol/dm3)	Ntot 2.19 - 7.82 (µmol/dm3)		SiO <sub>2</sub> 0.61 - 37.99 (µmol/dm3)	Benovic et al., 2000
1998	PO <sub>4</sub> 0 - 0.36 (µmol/dm3)		NO <sub>3</sub> 0.02 - 0.42 (µmol/dm3)	NO <sub>3</sub> 0.02 - 4.44 (µmol/dm3)	NH <sub>4</sub> 0.21 - 1.2 (µmol/dm3)	Ntot 0.88 - 22.13 (µmol/dm3)		SiO <sub>2</sub> 0.14 - 28.71 (µmol/dm3)	Benovic et al., 2000
Northern Adriatic (1993-1994)	PO <sub>4</sub> 0.12 - 0.21 (µM)			NO <sub>3</sub> 1.03 - 3.33 (µM)	NH <sub>4</sub> 0.46 - 1.02 (µM)			SiO <sub>2</sub> 0.72 - 4.23 (µM)	Graneli et al., 1999
Ancona, central Adriatic (2009-2010)									
2009	PO <sub>4</sub> ~5 - ~20 (µM)		DIN ~5 - ~20 (µM)						Accoroni et al., 2012
2010	PO <sub>4</sub> ~5 - ~30 (µM)		DIN ~5 - ~30 (µM)						Accoroni et al., 2012

Strong variability due to: hydrographyc conditions, connections with land and seabed, biological activities (consumption vs. remineralization processes)



## Deliverable 3.1.2: Report of trend survey of biological indicators

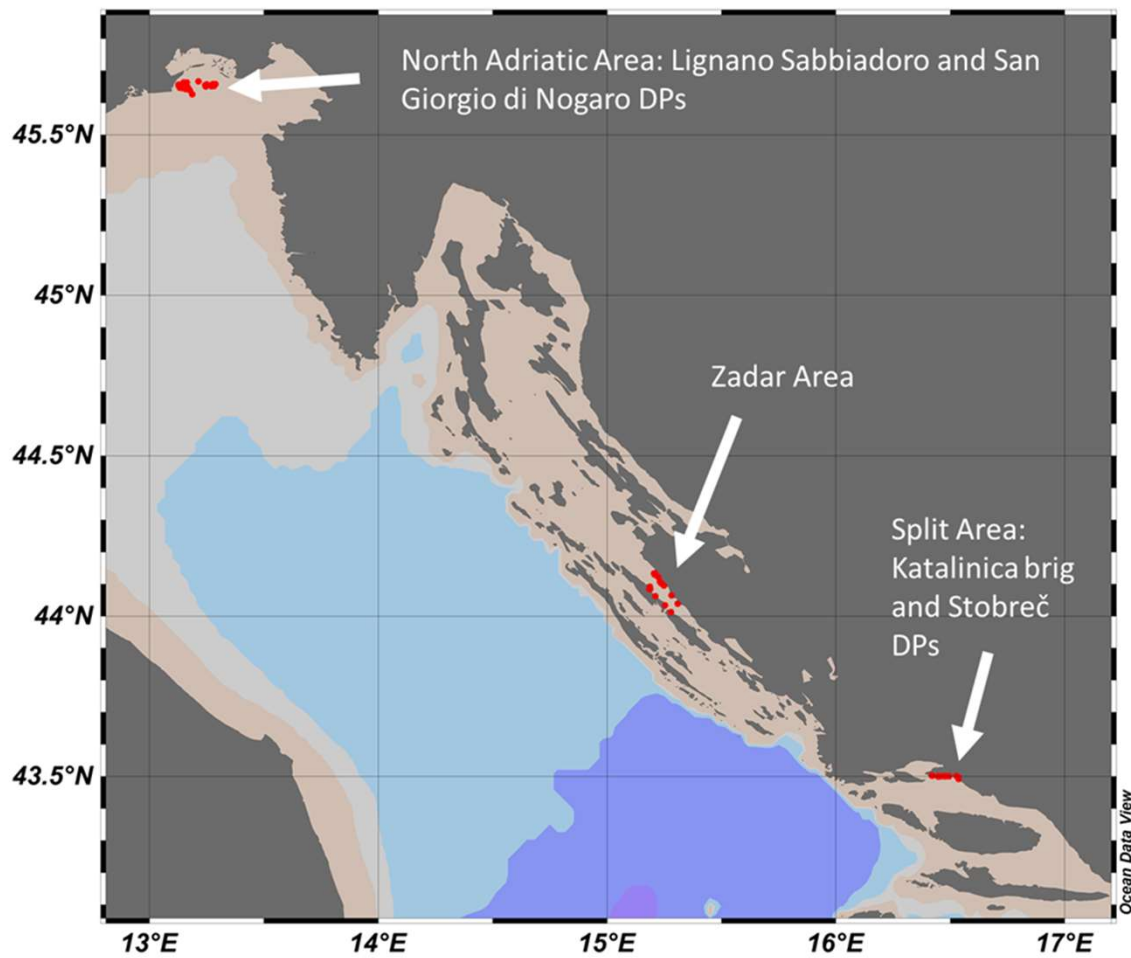
Mauro Celussi [OGS, ]Roko Andričević,  
Petra Šimundić, Toni Kekez, Marija Kvesić  
[UNIST-FGAG], Jadranka Sangulin, Anita  
Vucic [PHI], Anna Annibaldi [UNIVPM],  
Sabina Susmel [UNIUD]

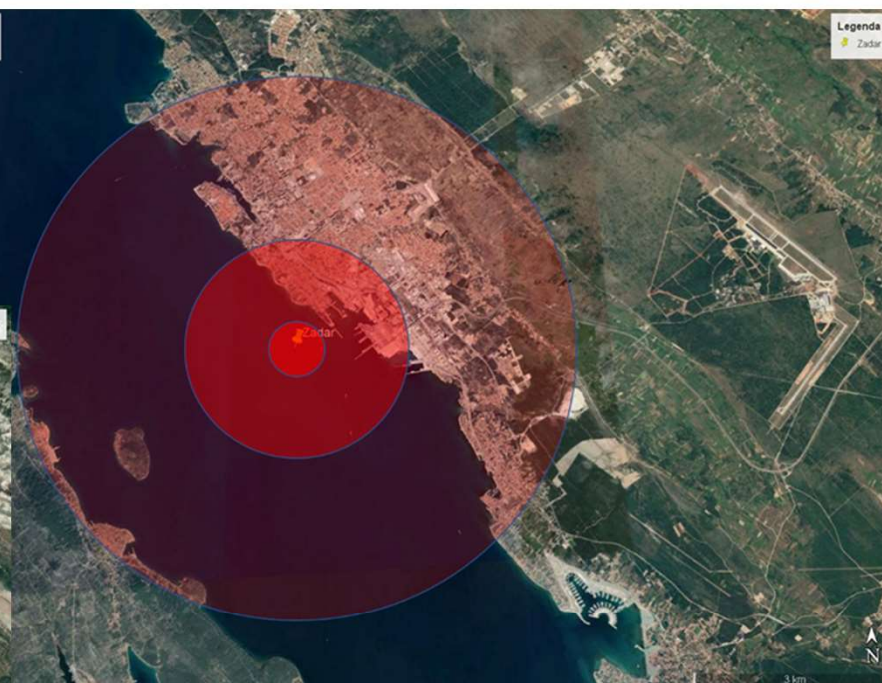
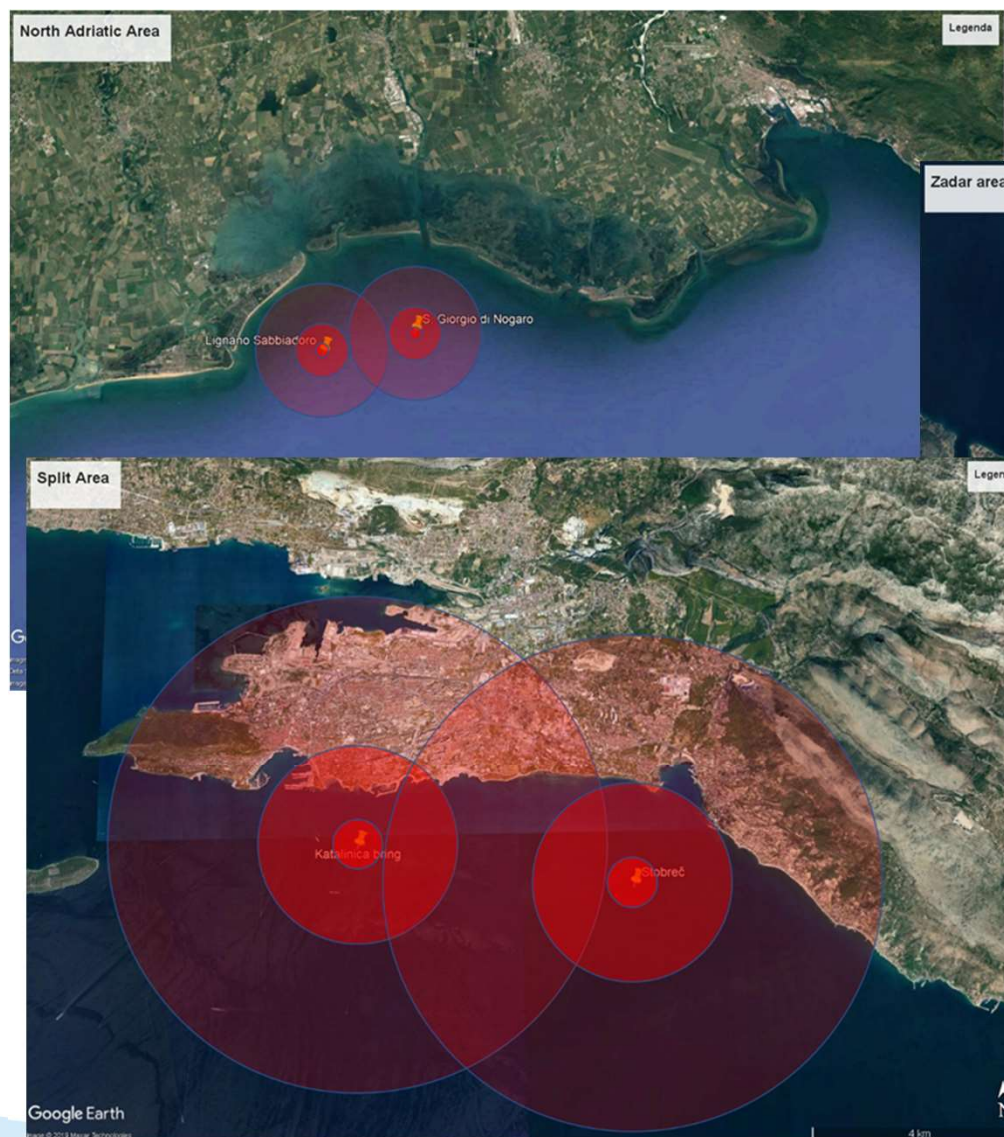
### Focus on *Escherichia coli* and Enterococci

The data were delivered by CAFC (self monitoring activities), PHI (bathing water monitoring) and, to a lesser extent, OGS (AdSWiM)

Number of data:

- Lignano Sabbiadoro: 309
- San Giorgio di Nogaro: 205
- Zadar: 311
- Katalinica brig: 364
- Stobreč: 96

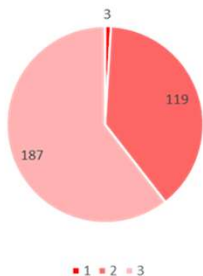




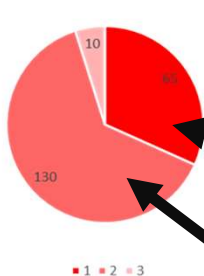
(1) < 500 m, (2) > 500 m and < 2000 m  
and (3) >2000 m and < 5000 m



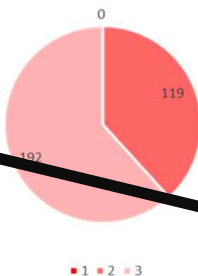
Lignano Sabbiadoro



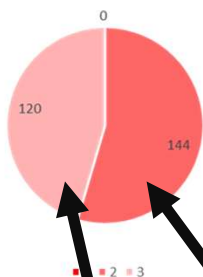
San Giorgio di Nogaro



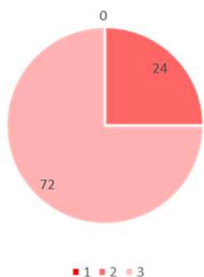
Zadar



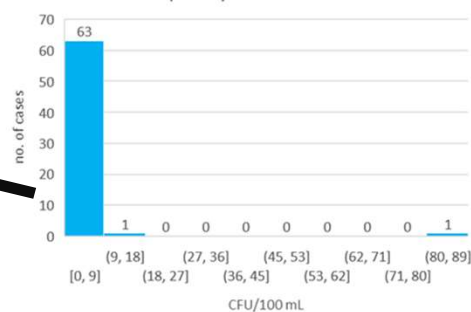
Katalinica brig



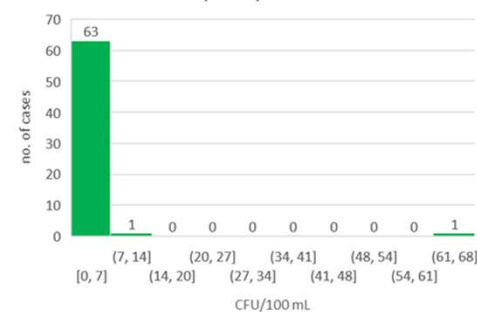
Stobreč



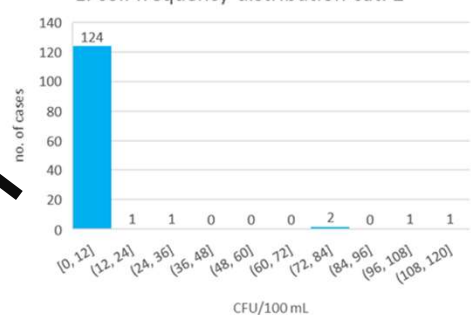
E. coli frequency distribution cat. 1



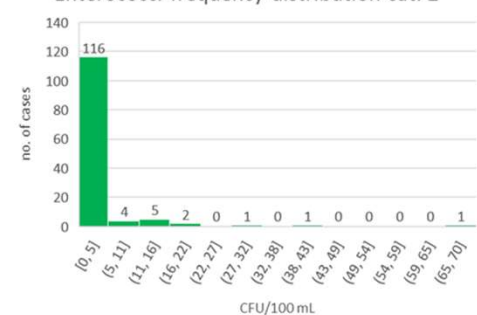
Enterococchi frequency distribution cat. 1



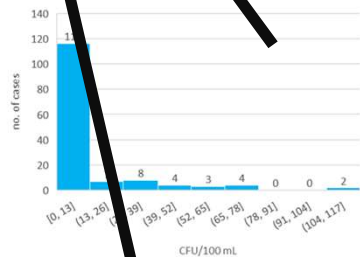
E. coli frequency distribution cat. 2



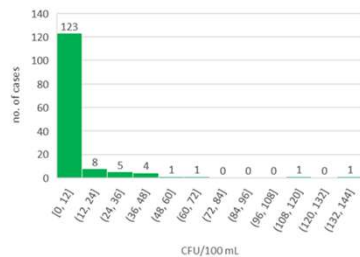
Enterococchi frequency distribution cat. 2



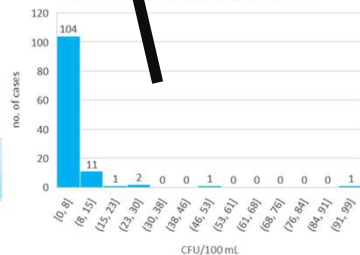
E. coli frequency distribution cat. 2



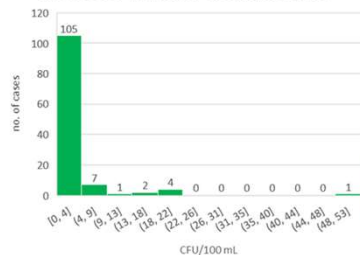
Enterococchi frequency distribution cat. 2



E. coli frequency distribution cat. 3



Enterococchi frequency distribution cat. 3



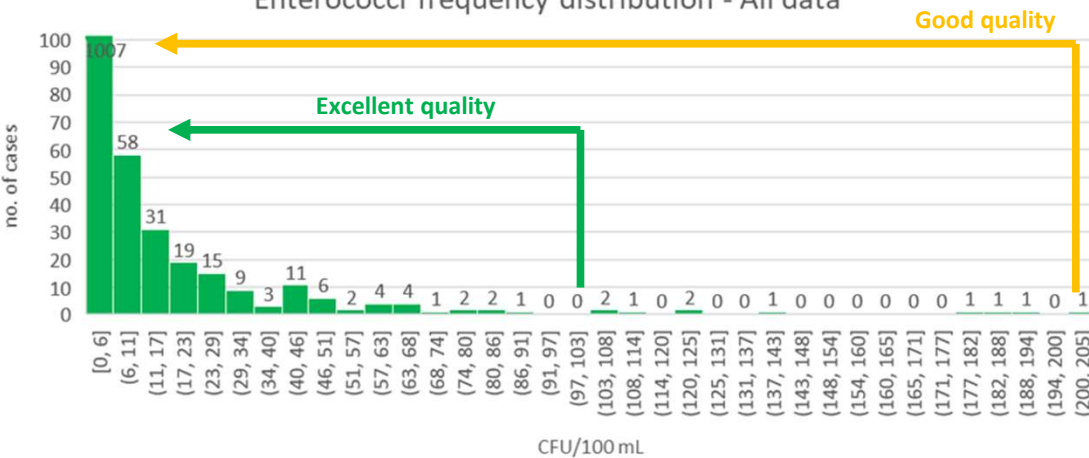
No difference among categories except in the Split area BUT the two DPs show contrasting results!



E.coli frequency distribution - All data



Enterococci frequency distribution - All data



## Take home messages:

- All data as good quality
- >99% of data excellent quality
- No evident influence of DPs on the distribution of fecal indicators
- Need for dedicated sampling activities; in Croatia the data come from BW quality assessment -> very close to the coast (weathering) and not to DP discharges

# WP3.2 Modelling and mapping of the project areas

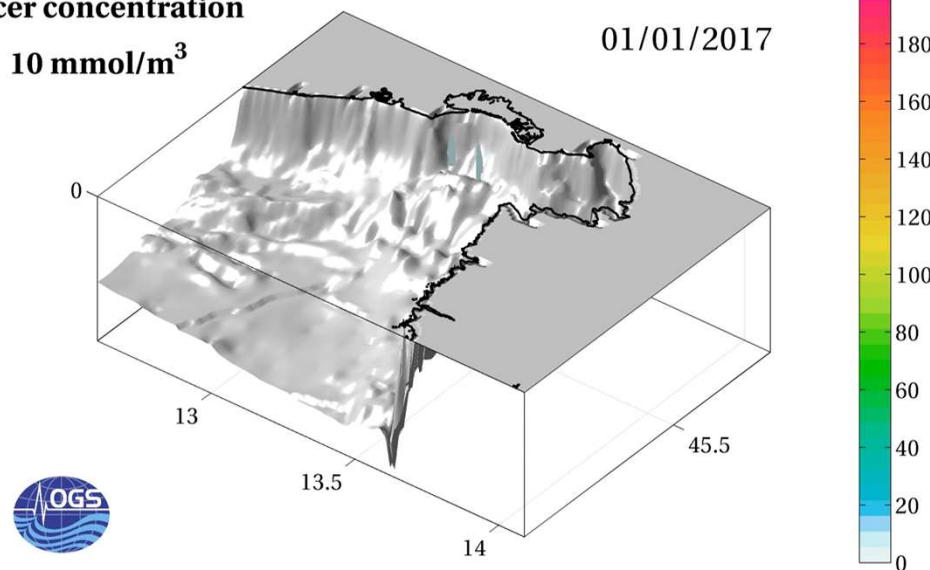
AdSWiM | OGS/UNIST-FGAG | Querin/Andričević

GA and SC Meeting | Online | 14 th of December 2021

# Northern Adriatic Area

tracer concentration  
 $10 \text{ mmol/m}^3$

01/01/2017



## Split Area

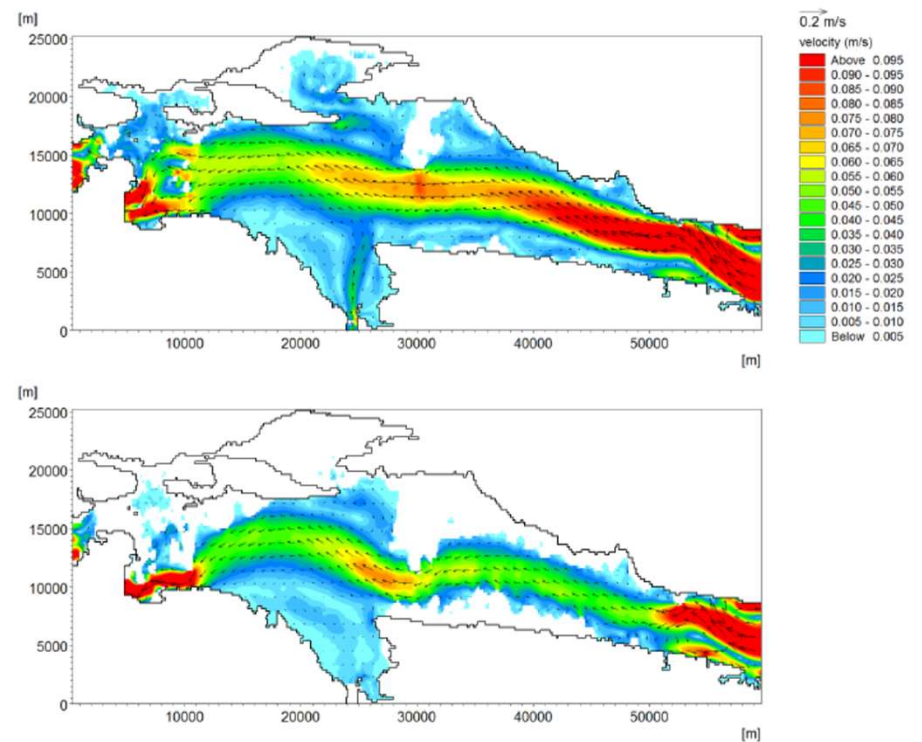


Figure 12 Averaged model current field for period 10.5.-1.7.2008. at a depth of -2m (above), -20m (middle) and -40m (below)

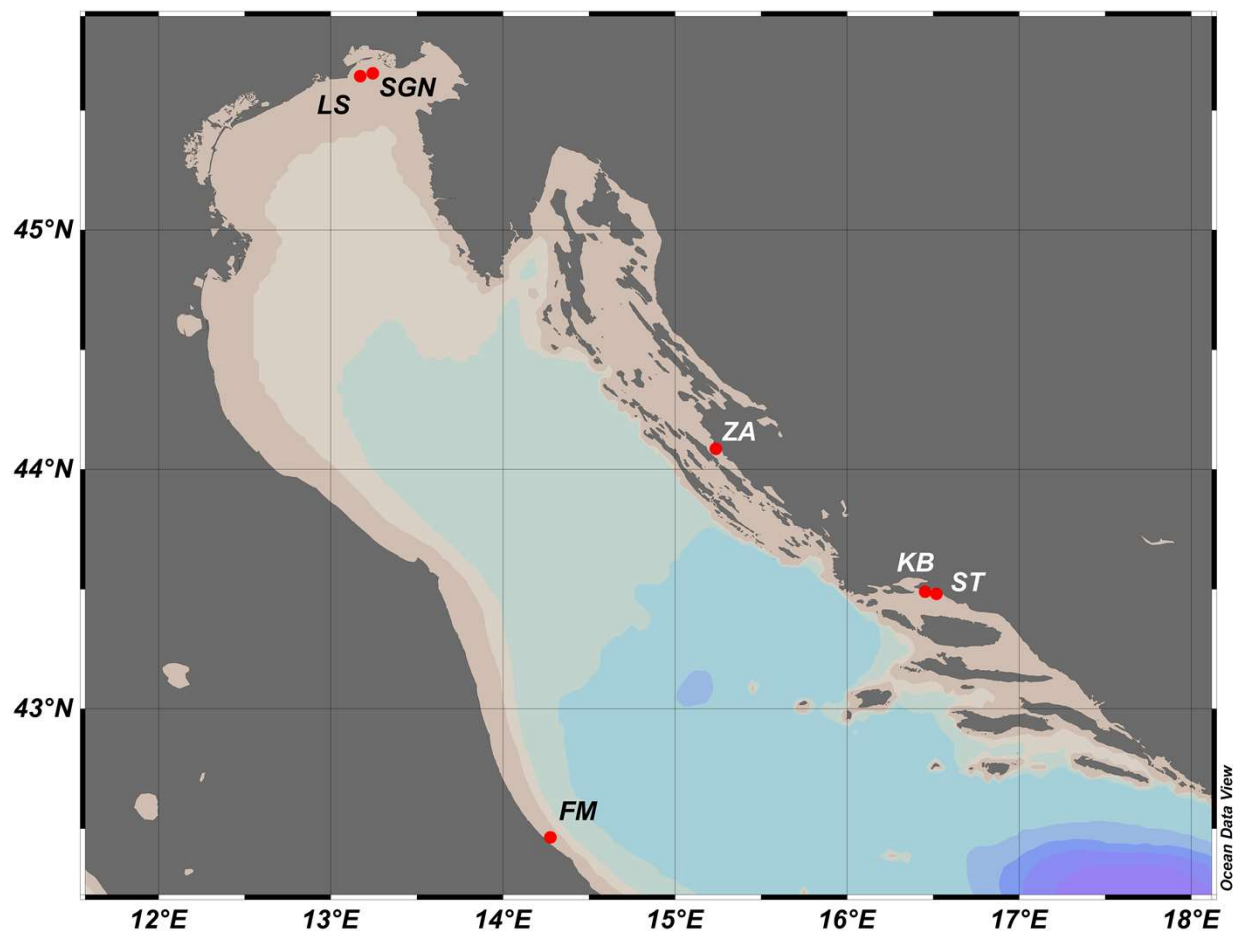


# WP3.3 Selection of sampling points/analysis with plan of experimental activities

AdSWiM | All PPs | Celussi-Annibaldi

GA and SC Meeting | Online | 14 th of December 2021

## Deliverable 3.3.1: Map with the sampling and/or monitoring points



# Deliverable 3.3.1: Plan of experimental activities

	Parameters to be analyzed	PP involved in sampling and analysis
San Giorgio di Nogaro	Nutrient concentration	<u>sampling</u> : CAFC, <u>analyses</u> : UnivPM, UNIUD
	Heavy metals' concentration	<u>sampling</u> : CAFC, <u>analyses</u> : UnivPM
	<i>Escherichia coli</i> abundance	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
	Enterococci abundance	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
	<i>Pseudomonas</i> abundance	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
	Bacterial community structure (Emerging pathogens)	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
Lignano Sabbiadoro	Nutrient concentration	<u>sampling</u> : CAFC, <u>analyses</u> : UnivPM, UNIUD
	Heavy metals' concentration	<u>sampling</u> : CAFC, <u>analyses</u> : UnivPM
	<i>Escherichia coli</i> abundance	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
	Enterococci abundance	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
	<i>Pseudomonas</i> abundance	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
	Bacterial community structure (Emerging pathogens)	<u>sampling</u> : CAFC, <u>analyses</u> : OGS
Francavilla al mare	Nutrient concentration	<u>sampling</u> : Pescara Mun, <u>analyses</u> : Pescara Mun
	Heavy metals' concentration	<u>sampling</u> : Pescara Mun, <u>analyses</u> : Pescara Mun
	<i>Escherichia coli</i> abundance	<u>sampling</u> : Pescara Mun, <u>analyses</u> : Pescara Mun
	Enterococci abundance	<u>sampling</u> : Pescara Mun, <u>analyses</u> : Pescara Mun
	<i>Pseudomonas</i> abundance	<u>sampling</u> : Pescara Mun, <u>analyses</u> : Pescara Mun
	Bacterial community structure (Emerging pathogens)	<u>sampling</u> : Pescara Mun, <u>analyses</u> : OGS

# Deliverable 3.3.1: Plan of experimental activities

	Parameters to be analysed	PP involved in sampling and analysis
Zadar	Nutrient concentration	<u>sampling</u> : PHI, <u>analyses</u> : PHI
	Heavy metals' concentration	<u>sampling</u> : PHI, <u>analyses</u> : UnivPM
	<i>Escherichia coli</i> abundance	<u>sampling</u> : PHI, <u>analyses</u> : PHI
	Enterococci abundance	<u>sampling</u> : PHI, <u>analyses</u> : PHI
	<i>Pseudomonas</i> abundance	<u>sampling</u> : PHI, <u>analyses</u> : PHI
	Bacterial community structure (Emerging pathogens)	<u>sampling</u> : PHI, <u>analyses</u> : OGS
Katalinica brig	Nutrient concentration	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	Heavy metals' concentration	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI-UNIVPM (SW), VIK-UNIVPM (DP)
	<i>Escherichia coli</i> abundance	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	Enterococci abundance	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	<i>Pseudomonas</i> abundance	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	Bacterial community structure (Emerging pathogens)	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI-OGS (SW), VIK-OGS (DP)
Stobreč	Nutrient concentration	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	Heavy metals' concentration	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI-UNIVPM (SW), VIK-UNIVPM (DP)
	<i>Escherichia coli</i> abundance	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	Enterococci abundance	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	<i>Pseudomonas</i> abundance	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI (SW), VIK (DP)
	Bacterial community structure (Emerging pathogens)	<u>sampling</u> : FGAG (SW), VIK (DP); <u>analyses</u> : PHI-OGS (SW), VIK-OGS (DP)



# WP3: HARMONIZATION OF THE KNOWLEDGES, PROJECT AREA MODELLING AND MAPPING, ACTIVITIES PLANNING

✓ Deliverable 3.1.1: Report of trend survey of nutrients and other chemical parameters

✓ Deliverable 3.1.2: Report of trend survey of biological indicators

✓ Deliverable 3.2.1: Hydrodynamic models and fluid dynamics simulations

✓ Deliverable 3.2.2: Map of highest risk of coastal pollution


✓ Deliverable 3.3.1: Map with the sampling and/or monitoring points

✓ Deliverable 3.3.1: Plan of experimental activities


# THANK YOU FOR YOUR ATTENTION!

National Institute of Oceanography and Applied Geophysics - OGS

Mauro Celussi

 Borgo Grotta Gigante 42/C - 34010 - Sgonico ( TS ) - Italy

 mcelussi@inogs.it

 +39 0402140732

 [www.italy-croatia.eu/adswim](http://www.italy-croatia.eu/adswim)