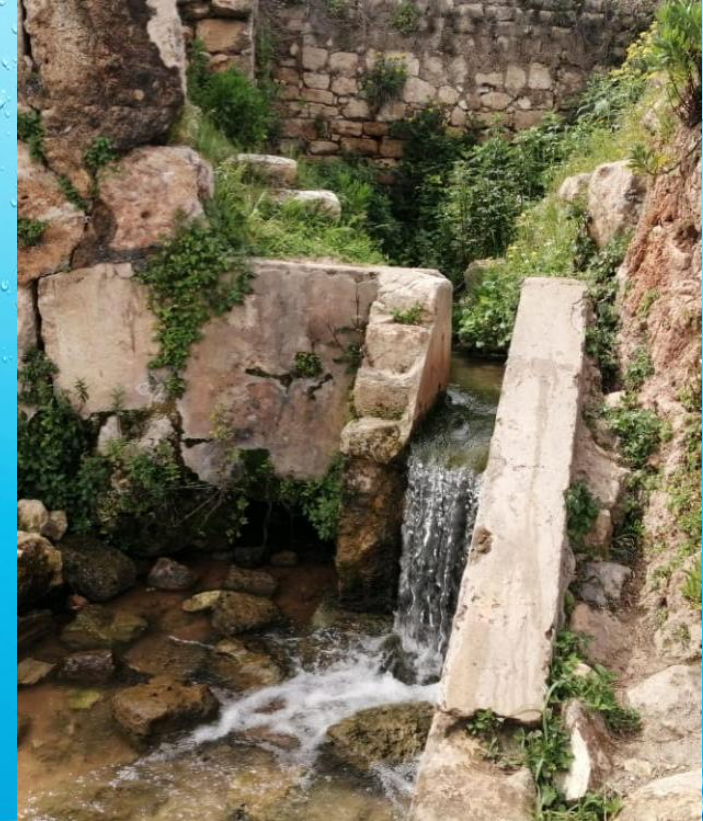
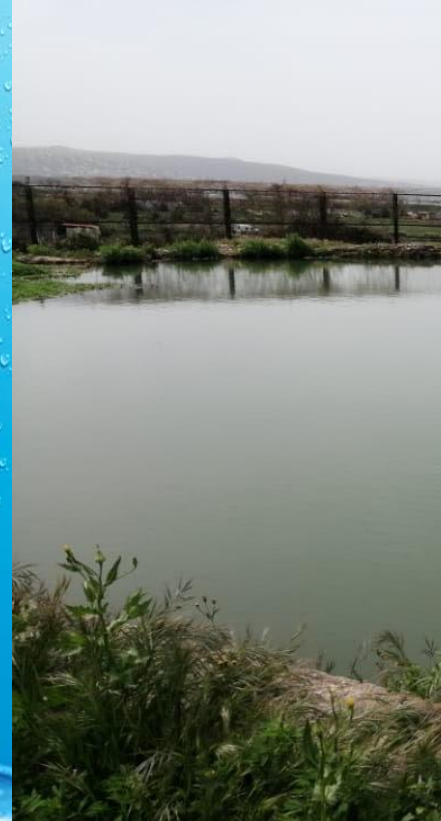


# 2022 The 5<sup>th</sup> International Symposium on Water Pollution and Treatment

 **ISWPT 2022**  
October 28-29, 2022 Bangkok



 **Physicochemical and  
microbiological  
characteristics of Ras El-  
Ain basin, Tyre, Lebanon**

Oct. 28-29, 2022 | Webinar



# Physicochemical and microbiological characteristics of Ras El-Ain basin, Tyre, Lebanon



**Dr. Milad Khatib**  
ISSEA-Cnam, Lebanon

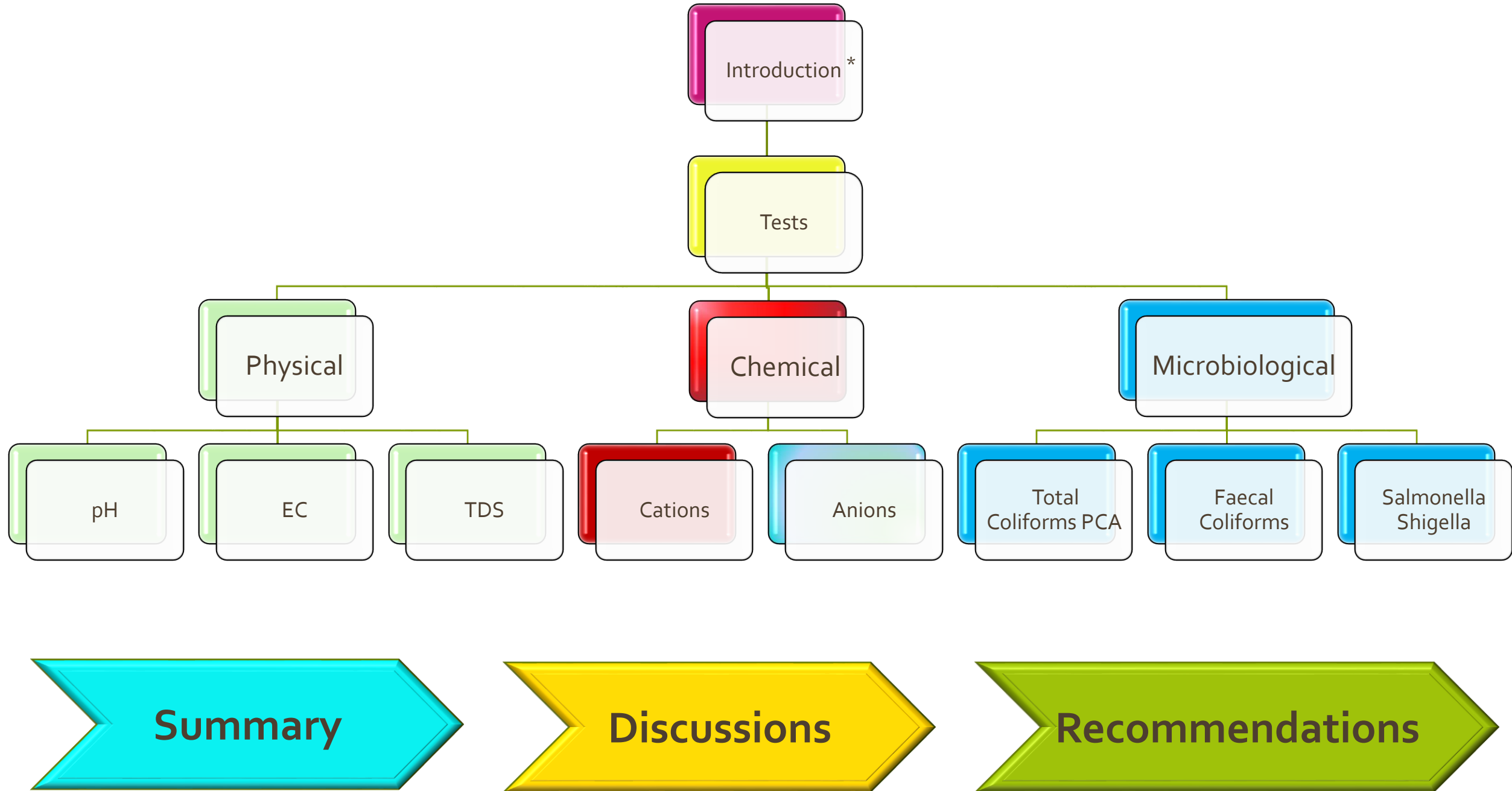
**Ass. Prof. Wahib Arairo**  
University of Balamand



**Mbio. Mohamad Daoud**  
Lebanese University

**Prof. Hussein Mortada**  
Lebanese University







Chamouni Reda..@AncienCity..Puits de Salomon Tyr sud Liban 1714  
برك رأس العين صور جنوب (لبنان)

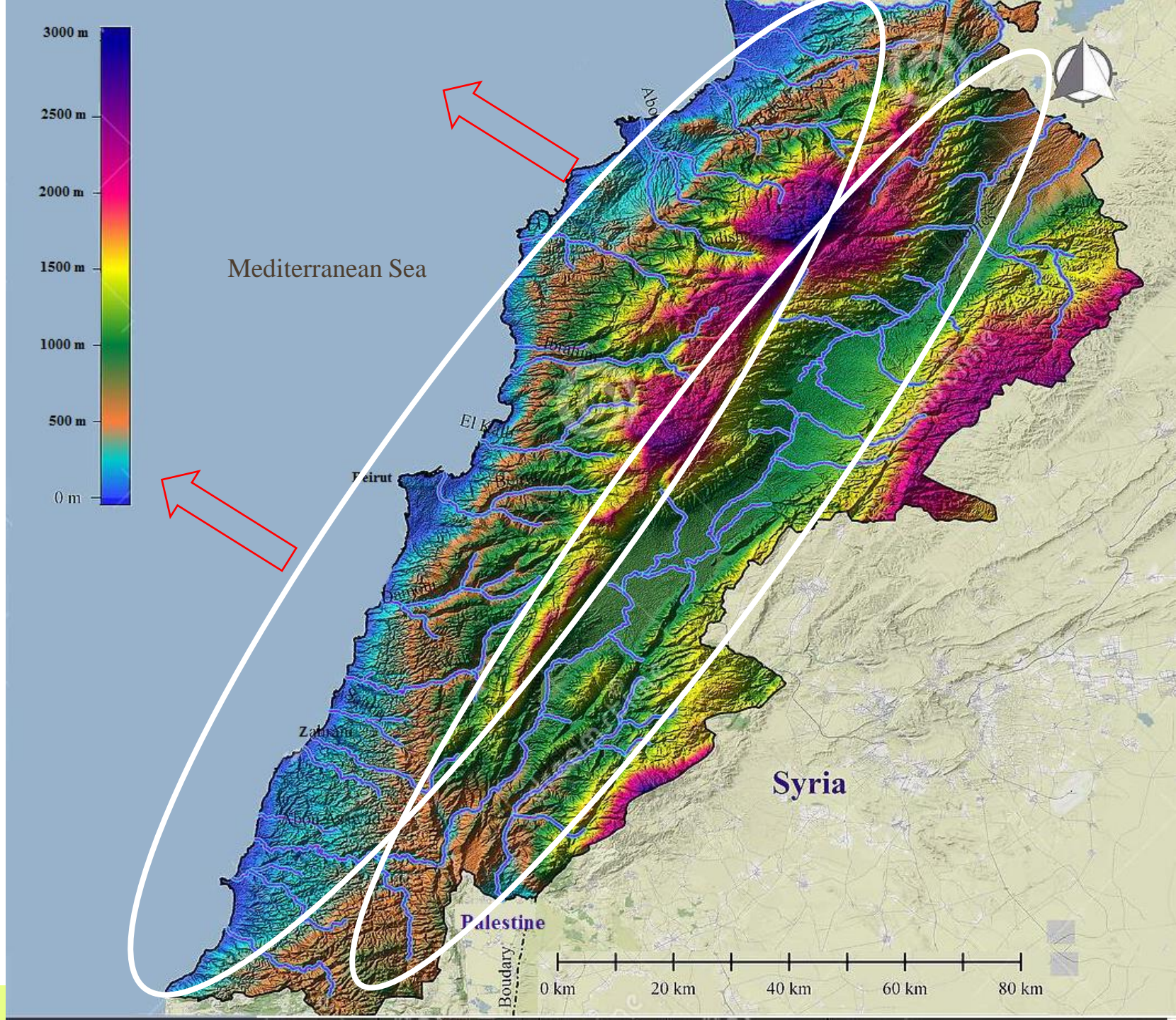


\*  
**Ras  
El-Ain  
Basin  
1714**



# Introduction

- All Lebanon rivers are non navigable.
- 28 begin on the western slope of the Lebanon range and flow via steep gorges into the Mediterranean Sea.
- Besides that, there are six rivers originate in the Beqaa Valley.



Abou Ali River

Ibrahim River

Lebanon's  
natural  
water  
resources  
are facing  
serious  
problems  
and  
approach  
from  
Exhaustion<sup>\*</sup>

Beirut River

Awali River





Lebanon's  
natural  
water  
resources  
are facing  
serious  
problems  
and  
approach  
from  
Exhaustion<sup>\*</sup>







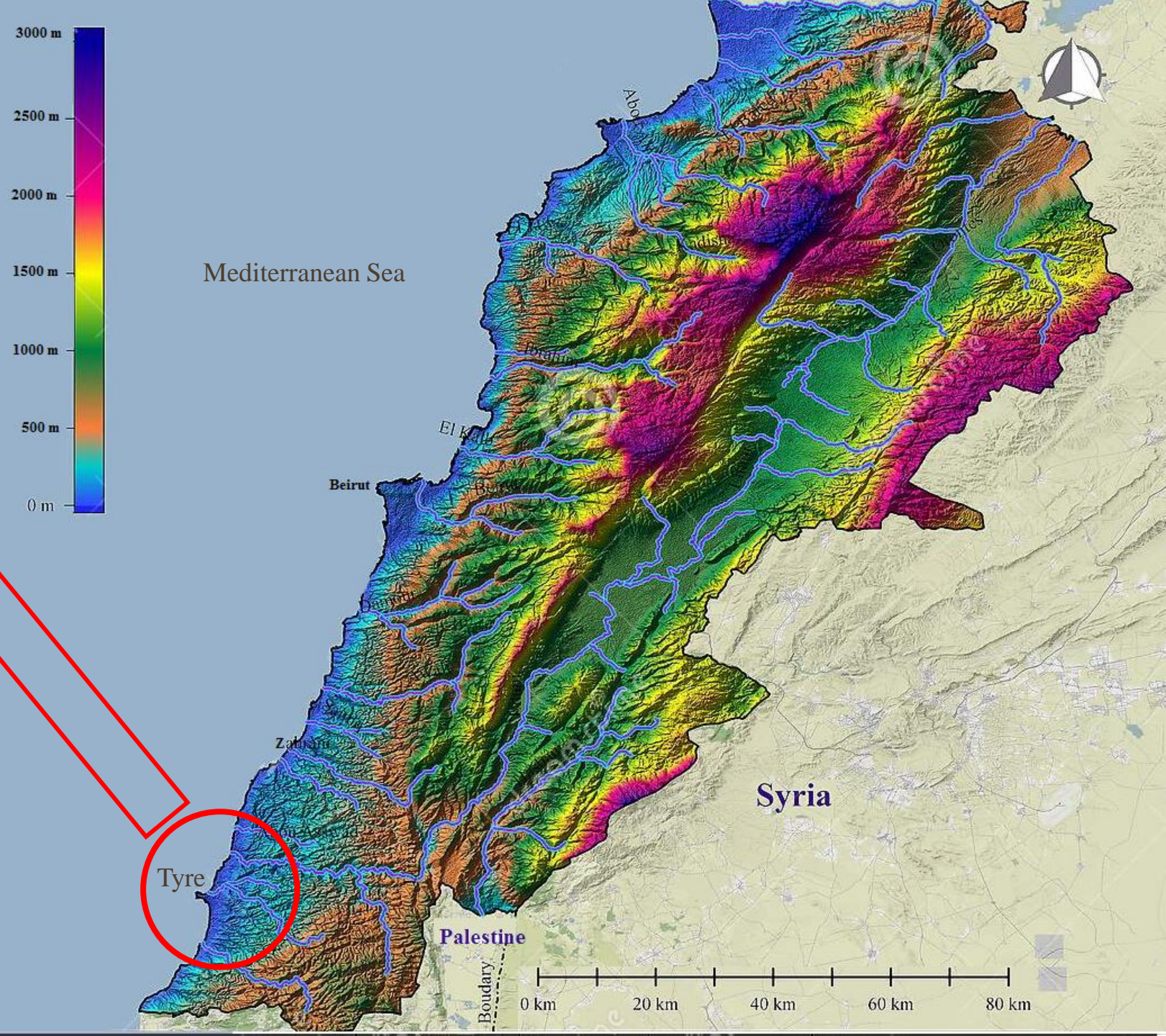
Lebanon's  
natural  
water  
resources  
are facing  
serious  
problems  
and  
approach  
from  
Exhaustion\*





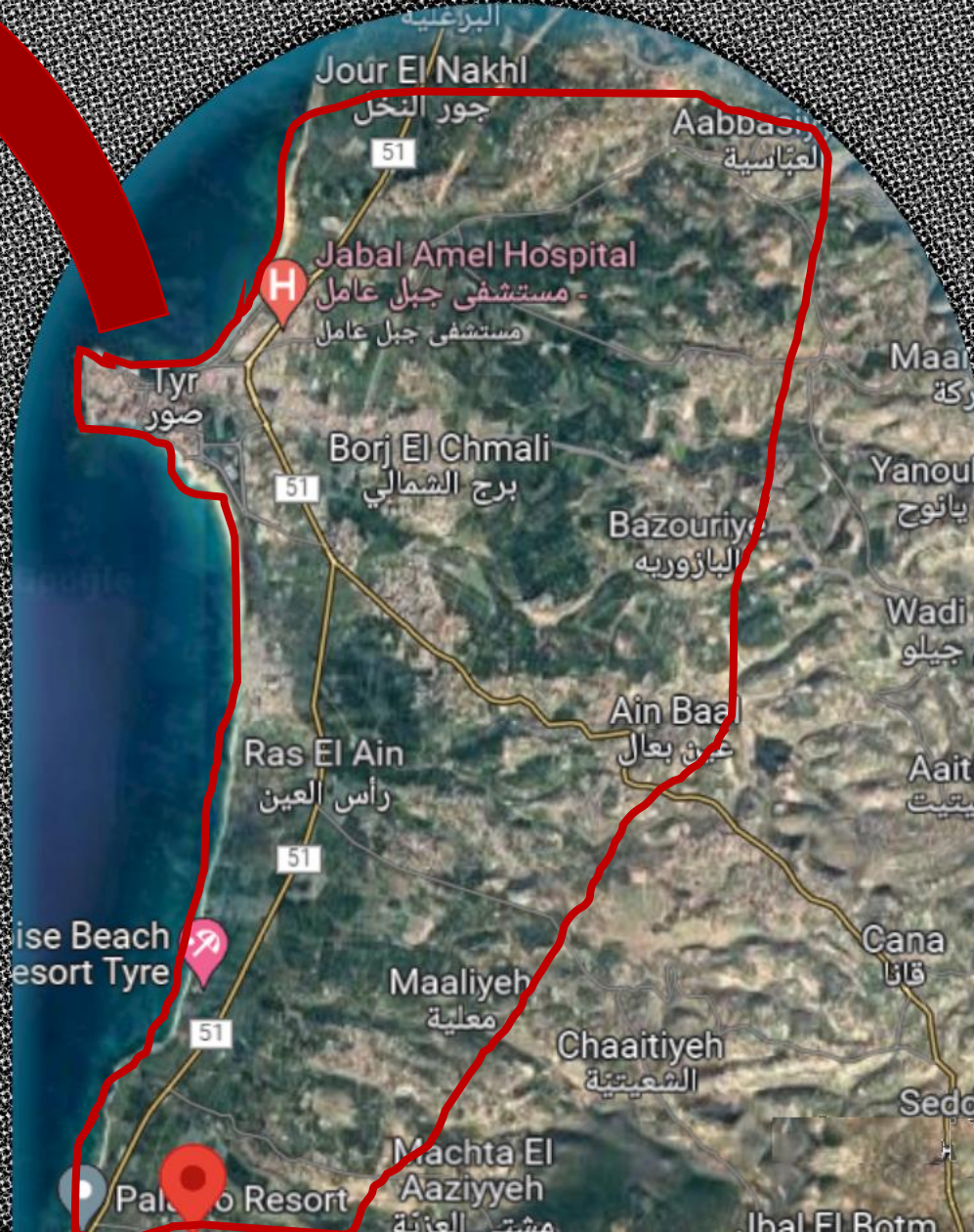


- \* The Ras El-Ain basin is 6 km far south of Tyre, Lebanon.





over  
30 km square.



The Lebanese  
state dedicated  
it, along with  
other reservoirs,  
to supply  
potable water  
for:

Tyr  
&  
Surrounding  
villages.



# Observations



These basins' water quality has deteriorated significantly.

Contamination can be seen through direct observations, odors, watercolor, and patterns.





## Ras El-Ain Basin Location



Different selected samples from each basin were tested.

Name	Designation
Al-Safsafa Stagnant	SF1
Al-Safsafa Tide	SF2
Al-Sayde	SD
Al-Asrawi	SA
Water Department	MS

To assess the level of pollution in the Ras El-Ain basin “physicochemical and microbiological”



# Physical Tests

Microprocessor pH

To test the degree of acidity or alkalinity for the water

Tracer EC/TDS

To measure the water's capacity into carrying Electric Current

To measure the Total Dissolved matter in the water



# Physical Tests

## Microprocessor pH



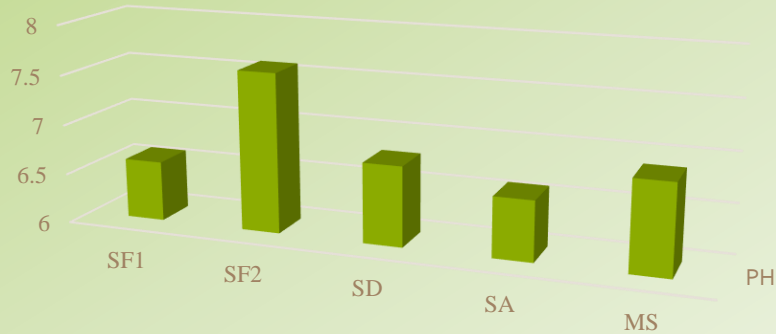
## Tracer EC/TDS



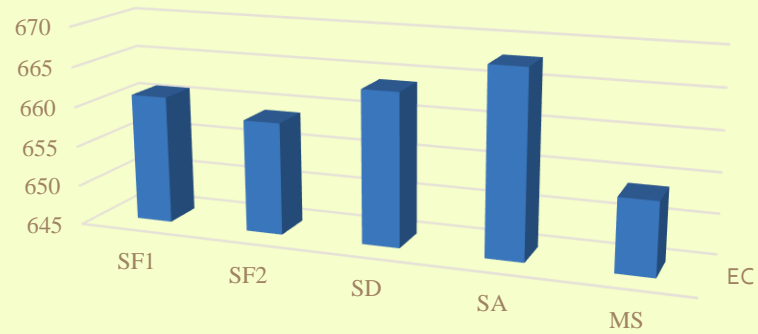


# Physical Tests

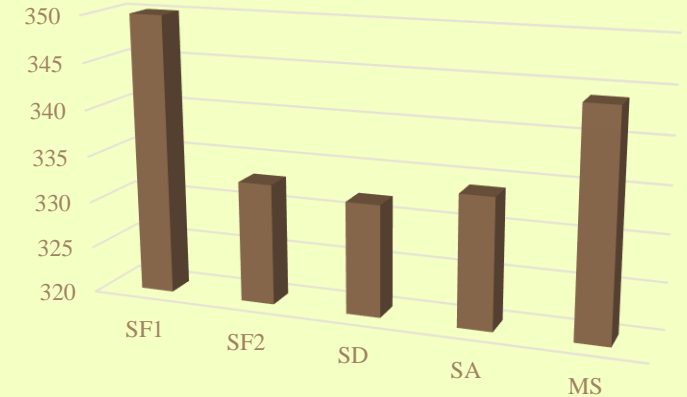
pH



EC



TDS



LIBNOR (Lebanese Standard Institution) specifications

$6.5 < \text{pH} < 8.5$

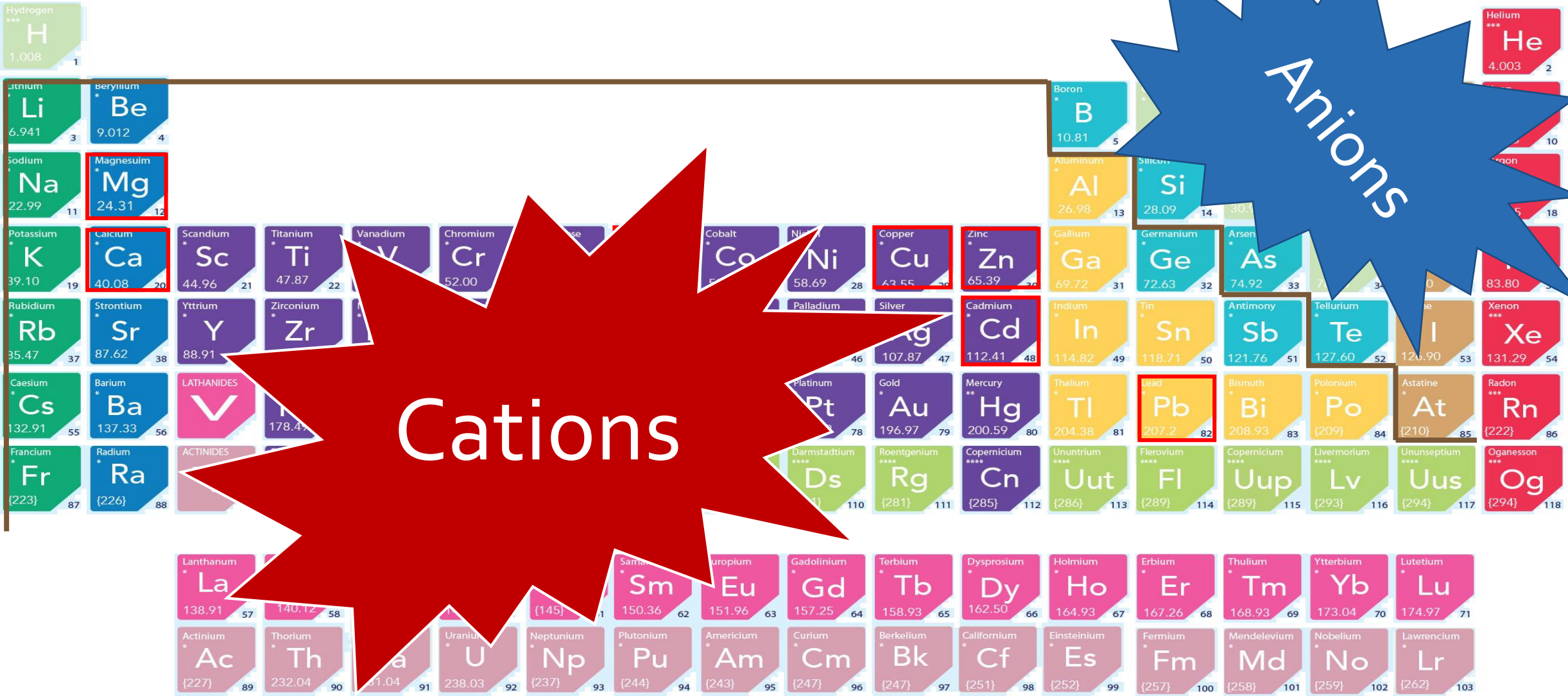
$\text{EC} < 1500 \mu\text{S}/\text{cm}$

$< 500 \text{mg}/\text{L}$



# Chemical Tests

Cations: Ca, Cd, Cu, Fe, Mg, Pb, and Zn





# Flame Atomic Absorption (FAAS)

Cadmium

Non Detected

$< 0.005\text{mg/L}$

Lead

Non Detected

$< 0.1\text{mg/L}$





## Flame Atomic Absorption (FAAS)

Cadmium

Non Detected

< 0.005mg/L

Lead

Non Detected

< 0.1mg/L

It is a popular method for identifying metals in natural materials. This principle is based on measuring the intensity of emitted light when metal is put into the flame. The wavelengths of the color indicate the element, and the color of the flame represents the amount of the contained item.

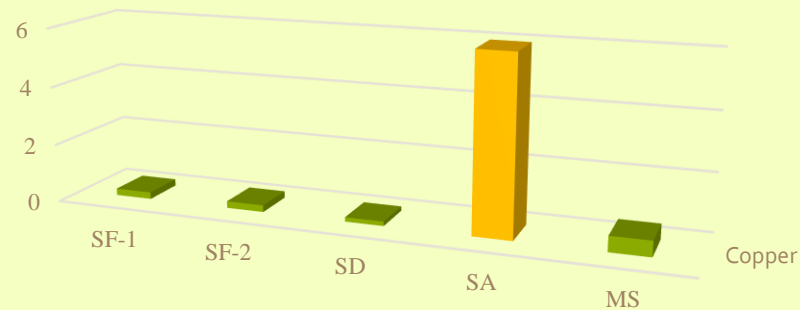


## Calcium



< 200mg/L

## Copper



< 1mg/L

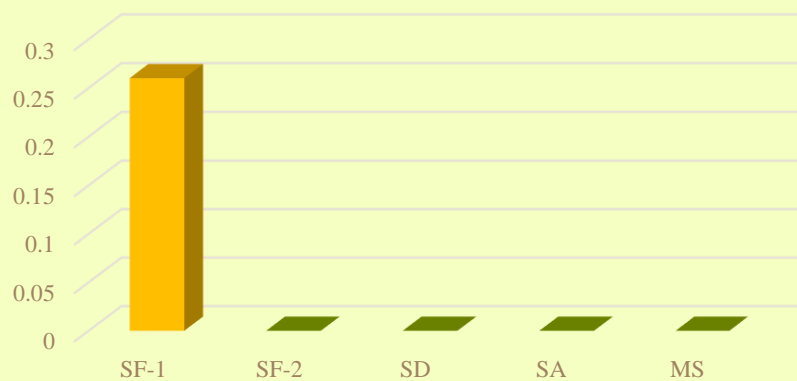
\*

## Iron



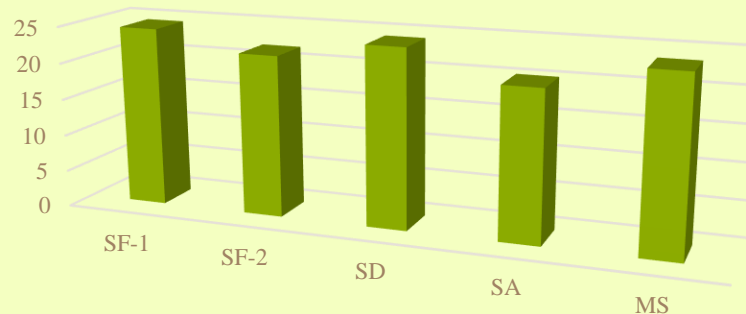
< 0.3mg/L

## Lead



< 0.1mg/L

## Magnesium



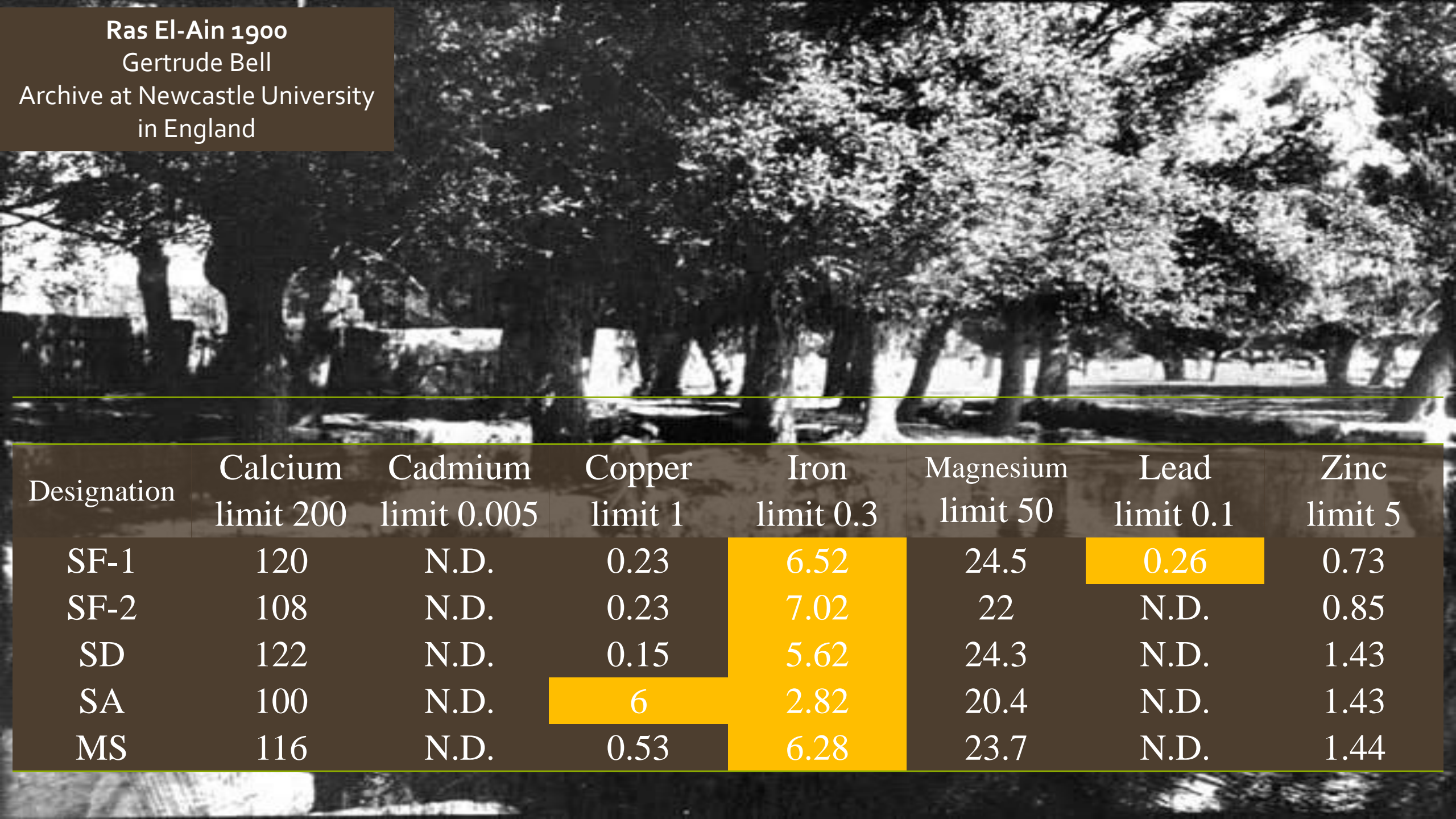
< 50mg/L

## Zinc



< 5mg/L





Ras El-Ain 1900  
Gertrude Bell  
Archive at Newcastle University  
in England

Designation	Calcium limit 200	Cadmium limit 0.005	Copper limit 1	Iron limit 0.3	Magnesium limit 50	Lead limit 0.1	Zinc limit 5
SF-1	120	N.D.	0.23	6.52	24.5	0.26	0.73
SF-2	108	N.D.	0.23	7.02	22	N.D.	0.85
SD	122	N.D.	0.15	5.62	24.3	N.D.	1.43
SA	100	N.D.	6	2.82	20.4	N.D.	1.43
MS	116	N.D.	0.53	6.28	23.7	N.D.	1.44



# Chemical Tests \*

Anions: Br, Cl, F, NO<sub>2</sub>, NO<sub>3</sub>, PO<sub>4</sub>, and SO<sub>4</sub>

Hydrogen *** H 1.008 1																	Helium *** He 4.003 2												
Lithium * Li 6.941 3	Beryllium * Be 9.012 4											Boron * B 10.81 5	Carbon * C 12.01 6	Nitrogen *** N 14.01 7	Oxygen *** O 16.00 8	Flourine *** F 18.998 9	Neon *** Ne 20.18 10												
Sodium * Na 22.99 11	Magnesium * Mg 24.31 12											Aluminum * Al 26.98 13	Silicon * Si 28.09 14	Phosphorus * P 30.97 15	Sulphur * S 32.07 16	Chlorine *** Cl 35.45 17	Argon *** Ar 39.95 18												
Potassium * K 39.10 19	Calcium * Ca 40.08 20	Scandium * Sc 44.96 21	Titanium * Ti 47.87 22	Vanadium * V 50.94 23	Chromium * Cr 52.00 24	Maganese * Mn 54.94 25	Iron * Fe 55.84 26	Cobalt * Co 58.93 27	Nickel * Ni 58.69 28	Copper * Cu 63.55 29	Zinc * Zn 65.39 30	Gallium * Ga 69.72 31	Germanium * Ge 72.63 32	Arsenic * As 74.92 33	Selenium * Se 78.96 34	Bromine ** Br 79.90 35	Krypton *** Kr 83.80 36												
Rubidium * Rb 85.47 37	Strontium * Sr 87.62 38	Yttrium * Y 88.91 39	Zirconium * Zr 91.22 40	Niobium * Nb 92.91 41	Molybdenum * Mo 95.94 42	Technetium * Tc {98} 43	Ruthenium * Ru 101.07 44	Rhodium * Rh 102.91 45	Palladium * Pd 106.42 46	Silver * Ag 107.87 47	Cadmium * Cd 112.41 48	Indium * In 114.82 49	Tin * Sn 118.71 50	Antimony * Sb 121.76 51	Tellurium * Te 127.60 52	Iodine * I 126.90 53	Xenon *** Xe 131.29 54												
Caesium * Cs 132.91 55	Barium * Ba 137.33 56	LATHANIDES * V 57-71	Hafnium * Hf 178.49 72	Tantalum * Ta 180.95 73	Tungsten * W 183.84 74	Rhenium * Re 186.21 75	Osmium * Os 190.23 76	Iridium * Ir 192.22 77	Platinum * Pt 195.08 78	Gold * Au 196.97 79	Mercury ** Hg 200.59 80	Thallium * Tl 204.38 81	Lead * Pb 207.2 82	Bismuth * Bi 208.93 83	Polonium * Po {209} 84	Astatine * At {210} 85	Radon *** Rn {222} 86												
Francium * Fr {223} 87	Radium * Ra {226} 88	ACTINIDES * V 89-103	Rutherfordium **** Rf {267} 104	Dubnium *** Db {268} 105	Seaborgium **** Sg {269} 106	Bohrium **** Bh {270} 107	Hassium **** Hs {269} 108	Mtnerium **** Mt {278} 109	Darmstadtium **** Ds {281} 110	Roentgenium **** Rg {281} 111	Copernicium *** Cn {285} 112	Ununtrium **** Uut {286} 113	Flerovium **** Fl {289} 114	Copernicium **** Uup {289} 115	Livermorium **** Lv {293} 116	Ununseptium **** Uus {294} 117	Oganesson *** Og {294} 118												
Lanthanum * La 138.91 57		Cerium * Ce 140.12 58		Prasodymium * Pr 140.91 59		Neodymium * Nd 144.24 60		Promethium * Pm {145} 61		Samarium * Sm 150.36 62		Europium * Eu 151.96 63		Gadolinium * Gd 157.25 64		Terbium * Tb 158.93 65		Dysprosium * Dy 162.50 66		Holmium * Ho 164.93 67		Erbium * Er 167.26 68		Thulium * Tm 168.93 69		Ytterbium * Yb 173.04 70		Lutetium * Lu 174.97 71	
Actinium * Ac {227} 89		Thorium * Th 232.04 90		Protactinium * Pa 231.04 91		Uranium * U 238.03 92		Neptunium * Np {237} 93		Plutonium * Pu {244} 94		Americium * Am {243} 95		Curium * Cm {247} 96		Berkelium * Bk {247} 97		Californium * Cf {251} 98		Einsteinium * Es {252} 99		Fermium * Fm {257} 100		Mendelevium * Md {258} 101		Nobelium * No {259} 102		Lawrencium * Lr {262} 103	



# Ionic Chromatography (IC)



Retention in ionic chromatography is based on attract of solute ions (from the water sample) to charge sites bound for stationary phase.

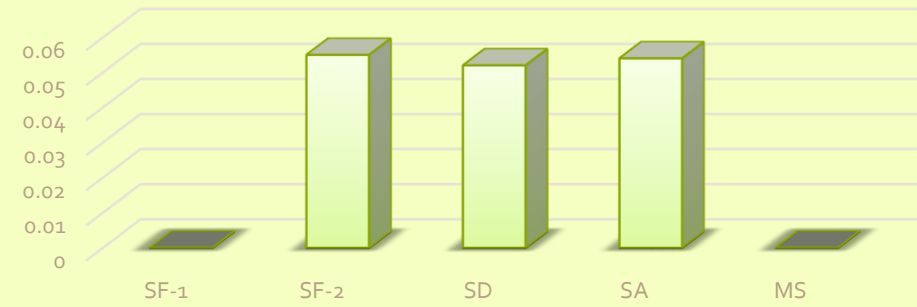
Dihydrogen Phosphate

Non Detected

< 0.005mg/L



Br<sup>-</sup>



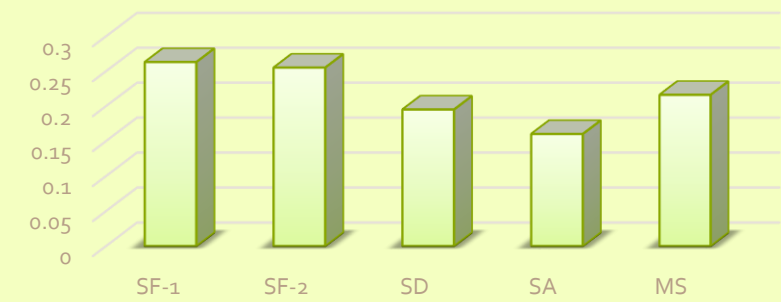
< 0.2mg/L

Cl<sup>-</sup>



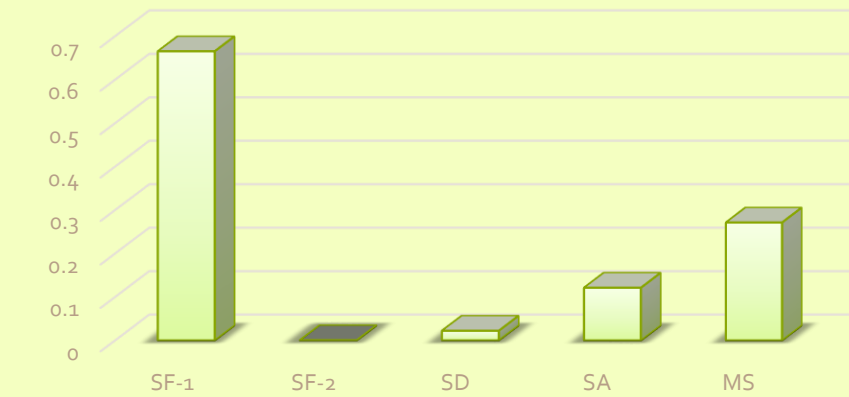
< 200mg/L

F<sup>-</sup>



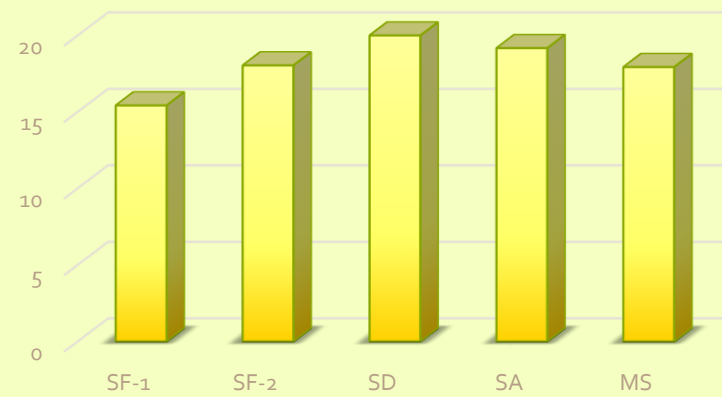
< 1mg/L

NO<sub>2</sub><sup>-</sup>



< 1mg/L

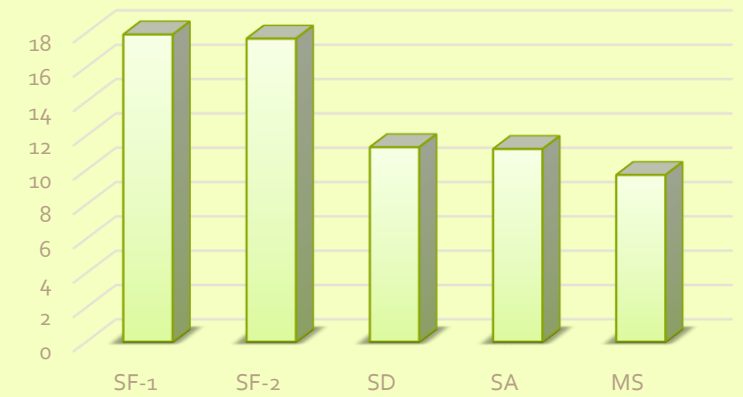
NO<sub>3</sub><sup>-</sup>



< 10mg/L

\*

SO<sub>4</sub><sup>-</sup>



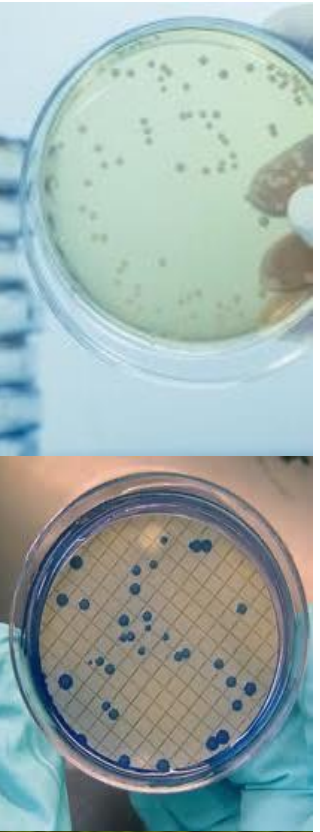
< 250mg/L



Designation	Br <sup>-</sup> limit 0.2	Cl <sup>-</sup> limit 200	F <sup>-</sup> limit 1	NO <sub>2</sub> <sup>-</sup> limit 1	NO <sub>3</sub> <sup>-</sup> limit 10	H <sub>2</sub> PO <sub>4</sub> <sup>-</sup> limit 1	SO <sub>4</sub> <sup>-</sup> limit 250
SF-1	N.D.	12.124	0.263	0.665	15.42	N.D.	17.901
SF-2	0.055	13.122	0.255	N.D.	18.039	N.D.	17.66
SD	0.052	15.917	0.195	0.022	19.998	N.D.	11.334
SA	0.054	13.673	0.16	0.121	19.17	N.D.	11.231
MS	N.D.	12.669	0.216	0.271	17.931	N.D.	9.717



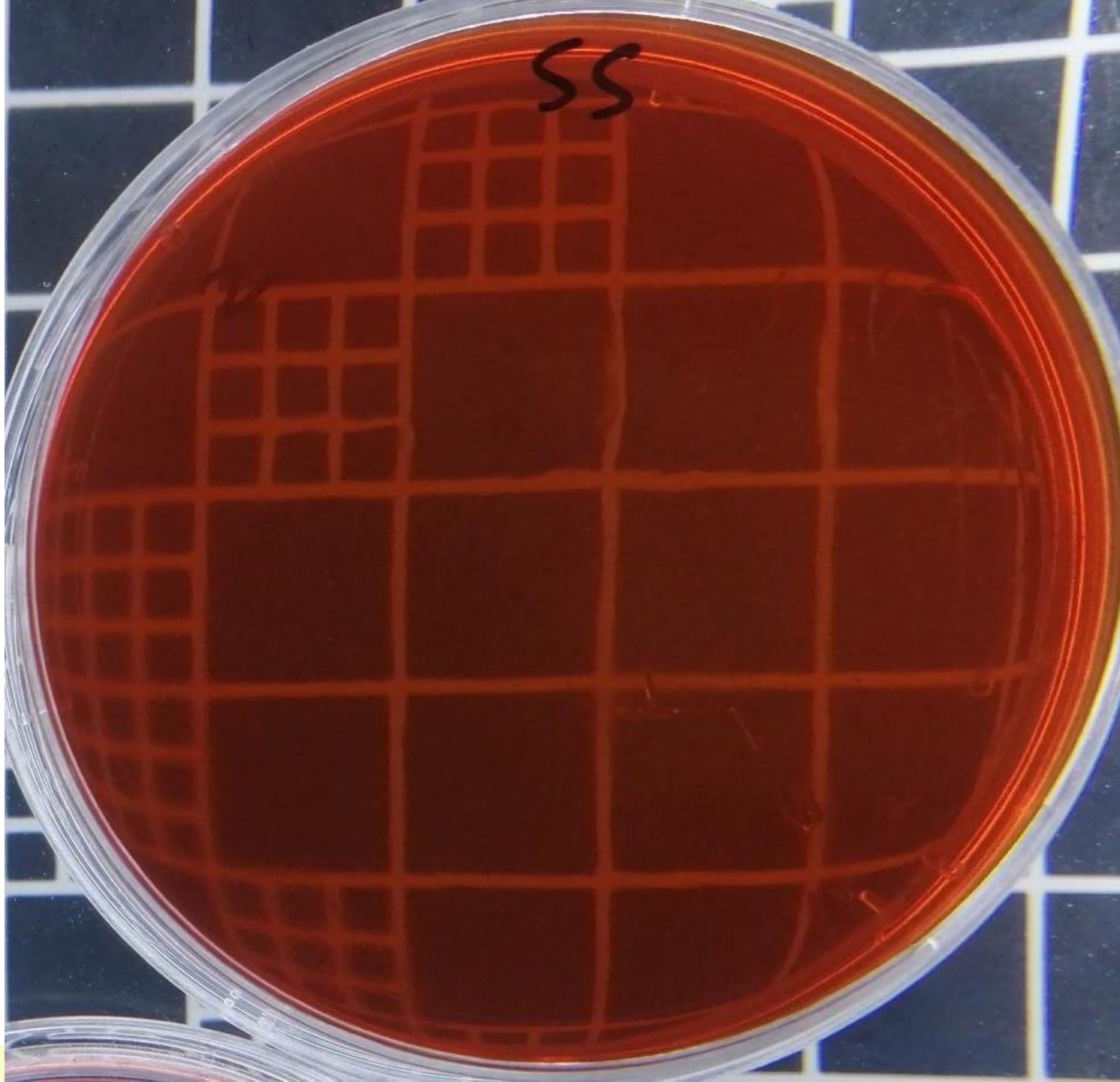




# Microbiological Tests







Salmonella  
Shigella agar (SS)  
at 37°

Non Detected \*

0

Salmonella  
Shigella agar (SS)  
at 44°

Non Detected

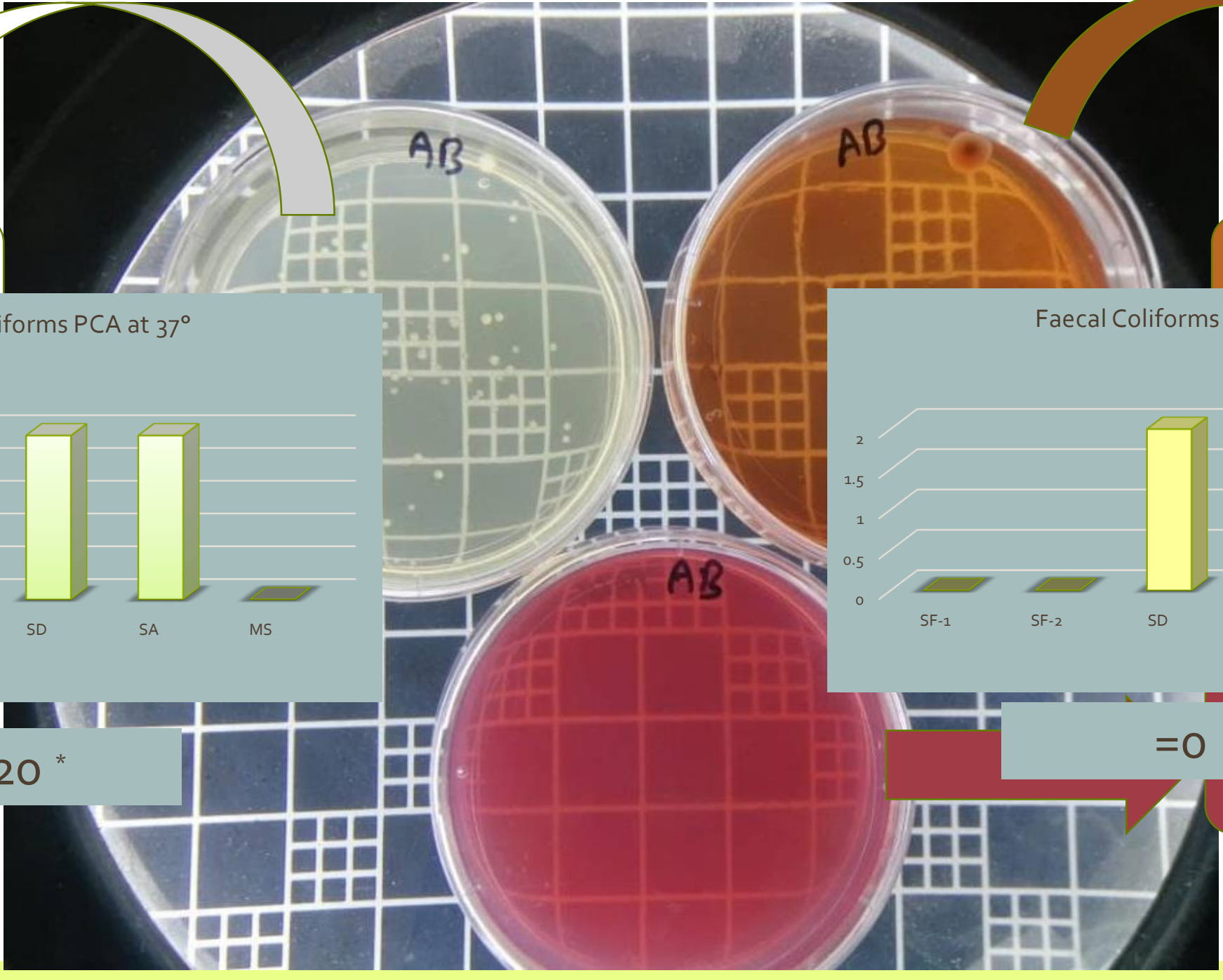
0

Total Coliforms  
PCA

Salmonella  
Shigella

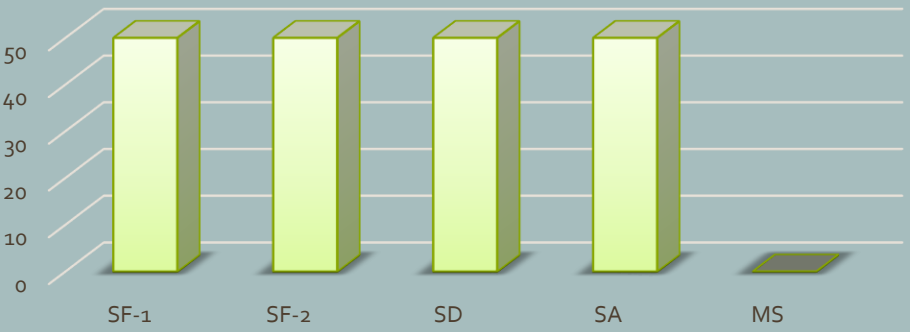
Faecal Coliforms





Total Coliforms

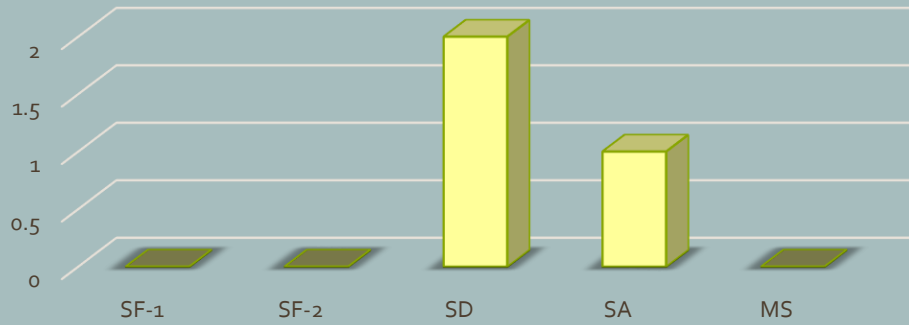
Total Coliforms PCA at 37°



>20 \*

Salmonella

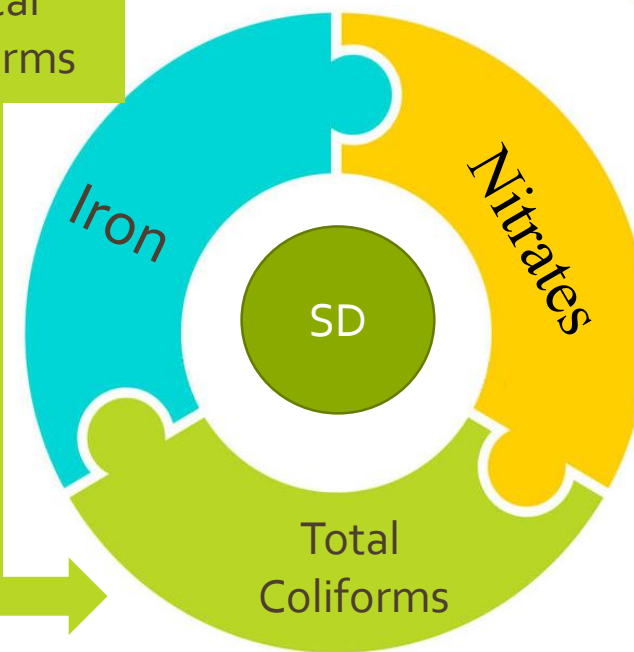
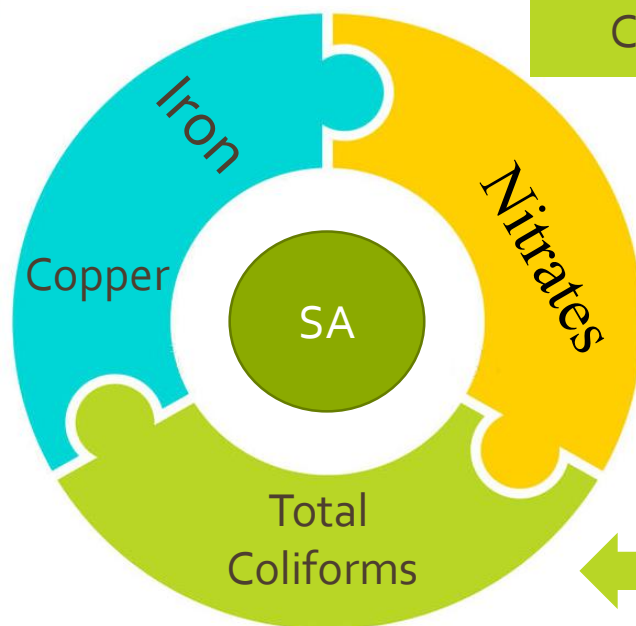
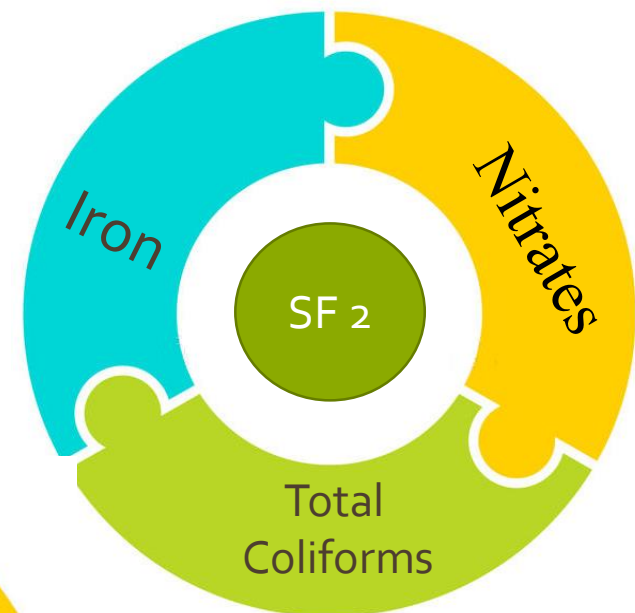
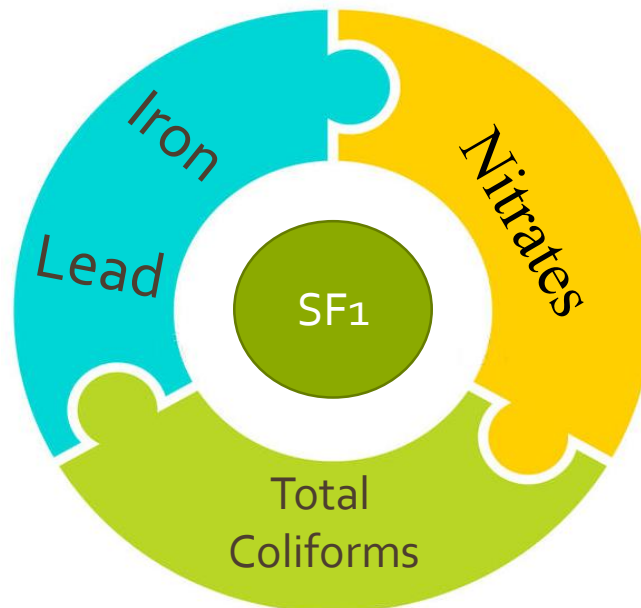
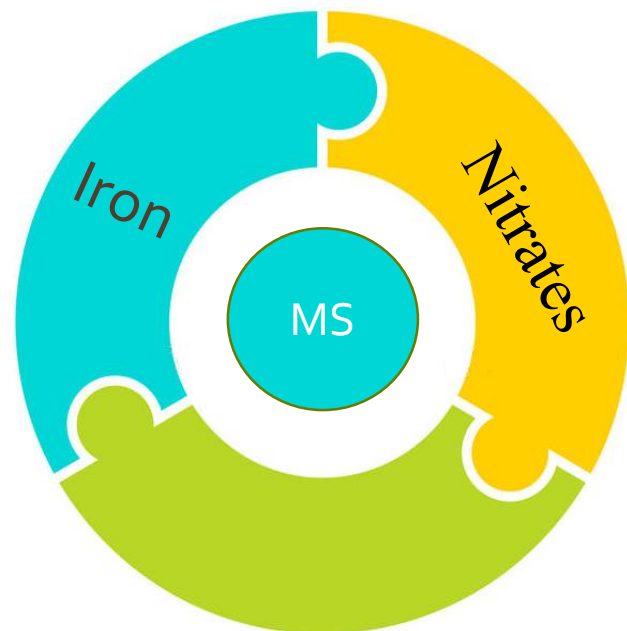
Faecal Coliforms at 44°



=0

Coliforms

# Summary \*



Faecal Coliforms

Cations

Anions

Microbiological



## Discussions

- ❑ The presence of iron in natural water supplies (five sources) is due to rock and mineral decomposition, acidic mine drainage, uncontrolled landfill leaching, sewage effluents, and release from iron processing industrial sectors.
- ❑ The corrosion process in the plumbing systems of old houses or water networks near SF1 increased the dissolution of lead into the water.
- ❑ It was seen that agricultural activities were developed all around the site SA thus hindering the uncontrolled use, and the application of fungicides and algicides leads to the increase in the copper concentrations.

## Discussions

- ❑ The high values of nitrates (five sources) are due to the excessive use of domestic waste, and uncontrolled domestic waste spilled near the reservoirs and most importantly the untreated sewage disposed in the area.
- ❑ Due to the existence of Total Coliforms and E. Coli (Faecal Coliforms), the natural water derived from such sources is not suitable for drinking. In addition treatment method should be considered, because they are contaminated and polluted by this bacteria.



# Recommendations



Improve the knowledge, and the orientation on the problem of water by integrate the essential aspects of the pollution for water and its sources.

Educate residents about the installation of treatment filters to purify water by suggest materials to dispose of solid, and microbiological pollutants.

---



Develop monitoring systems to periodically record water quality.

Prevent excessive application of fertilizers to agricultural land.

Dedicate well-defined landfill sites.

Monitor and apply environmental impact studies to preserve the quality of water resources.

Application of the polluter-pays principle to all users.

---



Legislation and environmental laws should be enforced with a focus on pollution and water consumption.

Government control should be applied over water resource areas, including rivers, springs, and lakes.

Put in place laws regulating the Physiochemical quality of domestic and industrial discharges..

# At the End....

- ❑ The discussion of major healthy problems that threaten Lebanon is open....
- ❑ Nowadays, we record the appearance of Cholera.... The Ministry of Public Health announced in a recent published report “220 cases and 6 deaths”.
- ❑ **THANKS' to the organizers of this conference (ISWPT 2022)** that give us the opportunity to participate and highlight on our problem, hope that we can get over this soon.



THANK

YOU



RESERVOIRS OF RÂS EL 'AIN AND PART OF THE ROMAN AQUEDUCT.

Close to this spot stood Palæotyrus, of which no vestige now remains, the materials having been carried away by Alexander (332 B.C.) to construct the mole or causeway which unites insular Tyre to the mainland.