UTMA
UNIVERSITY OF TRADITIONAL MEDICINE OF ARMENIA

Title: **Citizen Science as a Tool to Monitor the Water Pollution. A Case Study of Lake Sevan, Armenia**

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Country: **Republic of Armenia**

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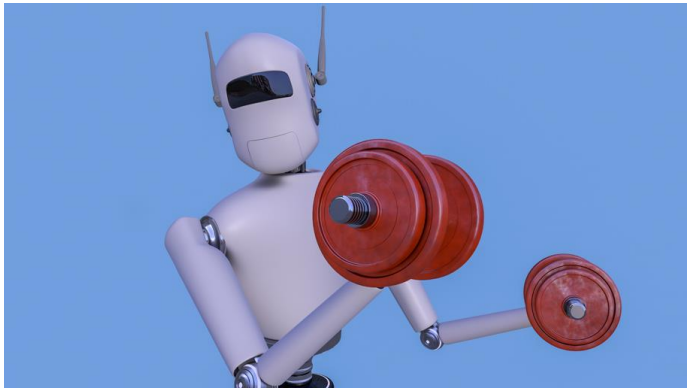
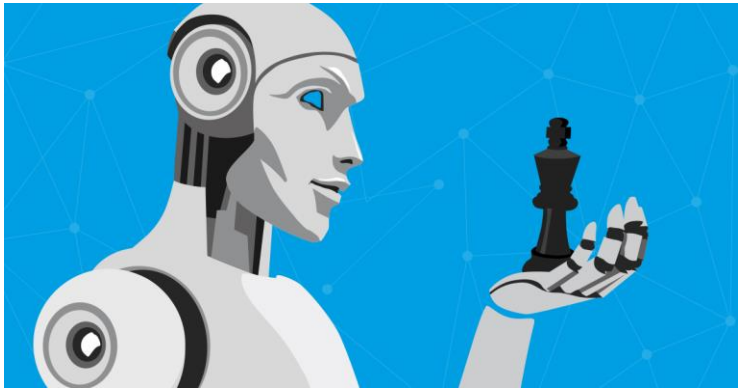
An ICTP - IAEA Meeting
Trieste, Italy

IAEA International Atomic Energy Agency
United Nations Educational, Scientific and Cultural Organization
EPS
APS physics
ICTP The Abdus Salam International Centre for Theoretical Physics www.ictp.it
IAEA

Mother Cathedral of Holy Etchmiadzin
https://www.stsarkis.org/holy-etchmiatzin.html



AI and Gyms
https://twobrainbusiness.com/ai-content-relationships/



The History of Chess AI
https://becominghuman.ai/the-history-of-chess-ai-f8b0dcb4d6d4

Pulpulak
https://i.pinimg.com/originals/50/65/ef/5065ef1130ef7828f553cb9dc7029ce0.jpg

Me before 2017

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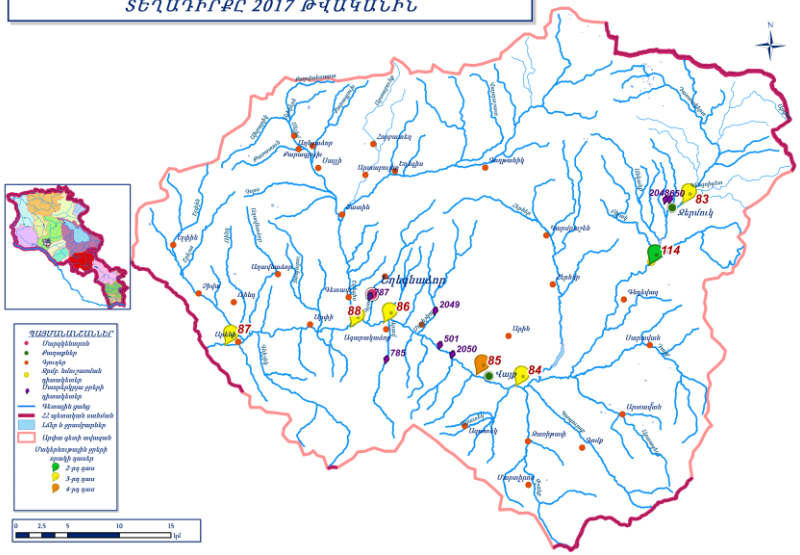


1. **2017 SMR2858 - Joint ICTP-IAEA Workshop on Environmental Mapping:Mobilising Trust in Measurements and Engaging Scientific Citizenry**

2. 2017 - 2022 CSC pilot projects in different sectors at the home country

- Author: “Water quality monitoring” guiding book for citizen scientists (2020)
- Co Author: “Mining monitoring toolkit” book for citizens (2022)

3. 2020

SAFECAST 10TH ANNIVERSARY ONLINE EVENT

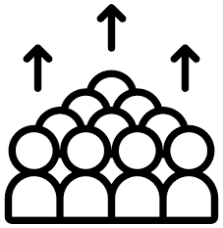
Iain_Darby Azby_Brown

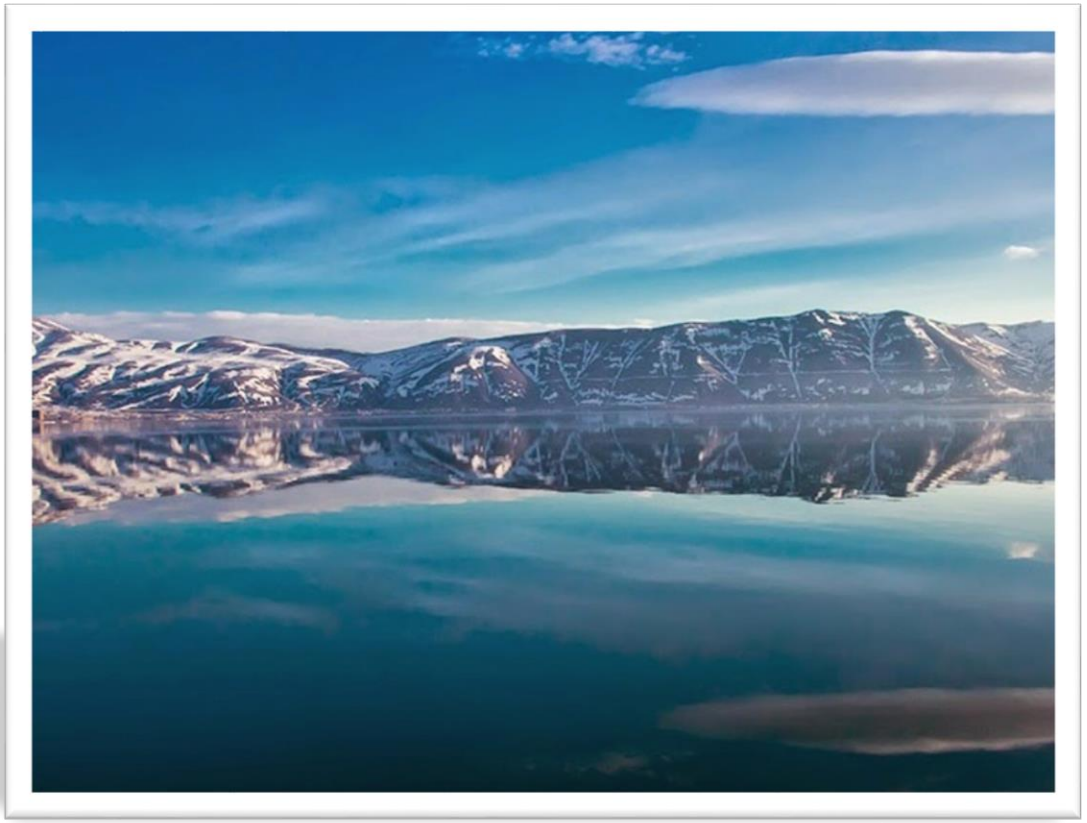
safecast bgeigie nano

4. 2022 Course in Dresden “Environmental Management for Developing Countries” (Final paper: CSc as a tool for Water quality assessment)

5. 2023

smr 3824: Useful information & Instructions 'Joint ICTP-IAEA Advanced School/Workshop on Machine Learning in Citizen Science'



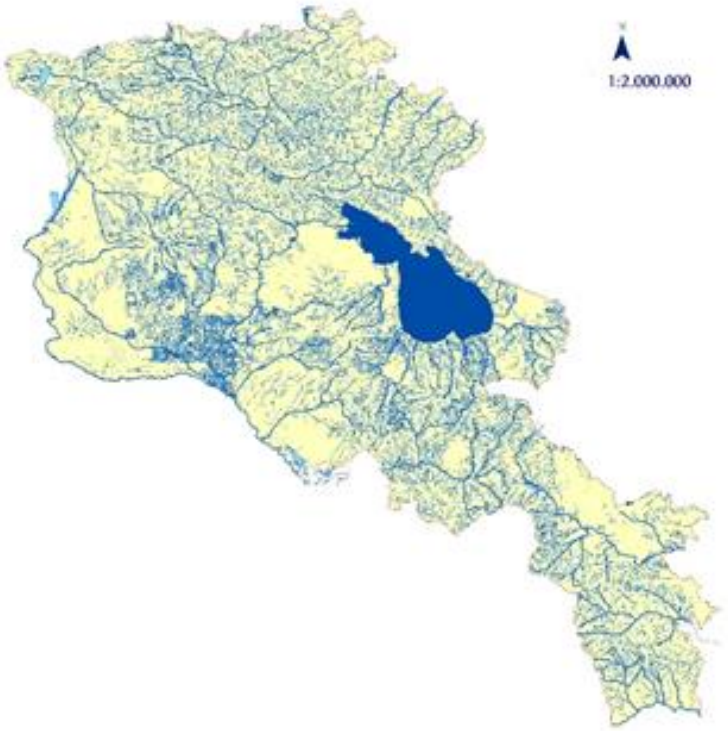


Decreasing water quality

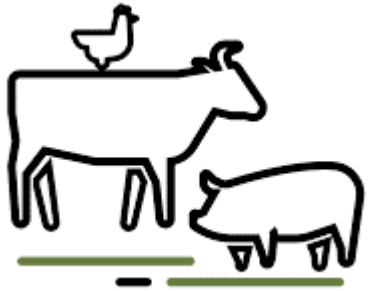
Freshwater

Increasing demand

Surface Water Network in Armenia



Water quality impacted by



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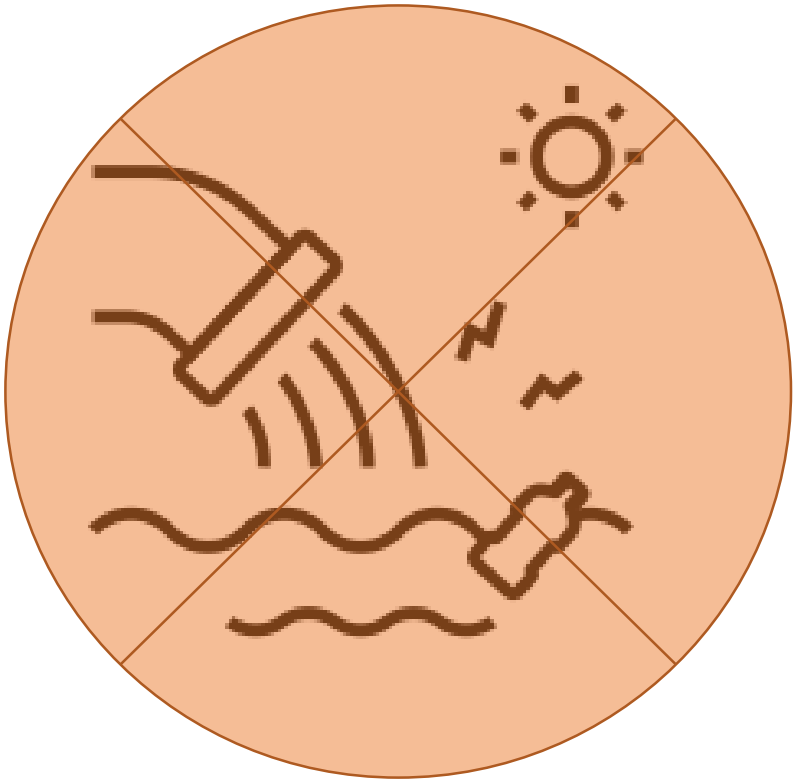
To protect water resources …



CITIZEN SCIENCE ?

Citizen Science is the term that is used to describe a wide range of activities, in which people from all walks of life participate in a scientific project in a meaningful way

Content

- Introduction
- Conceptual framework
- Methods
- Results
    - a) Water quality situation
    - b) Designing monitoring plan
- Feedback from the expert
- Water Quality Monitoring Plan for Lake Sevan
- Discussion and Conclusions

Introduction

Location of Lake Sevan. Source: Gor Gevorgyan et al., 2020

Problem

Misunderstanding, that the small land area (29,743 sq. km) in Eurasia's South Caucasus region of Armenia does not need to implement additional water monitoring observation.

Because of a non-proper design and continuous war in the region, there is still no successfully accomplished citizen science project for water quality monitoring in The Republic of Armenia (RA).

The urgency of water quality data for Lake Sevan. The lake has been blooming since 2018 and the cause still not found.

There is still a few existing academic literature of CSc in the water area in the RA.

Introduction

Objectives

- to fill the data gap about the water quality of Lake Sevan

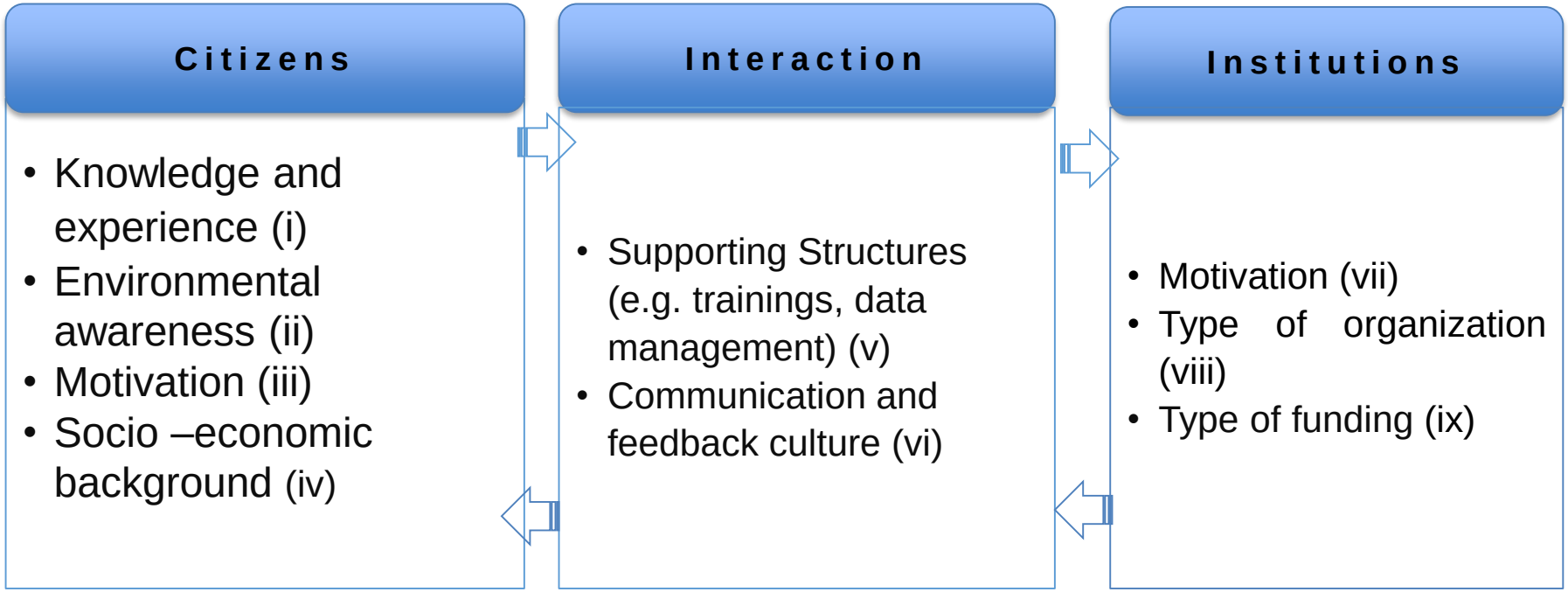
- to identify the success factors of CSc in water quality monitoring for Lake Sevan

Introduction

Research Question

- what is the level of the pollution of the lake in the last three years,
- what appropriate monitoring plan should be used for CSc project implementation.

Conceptual framework



The design sets in the water quality monitoring. Source: Capdevila et al. (2020)

Methods

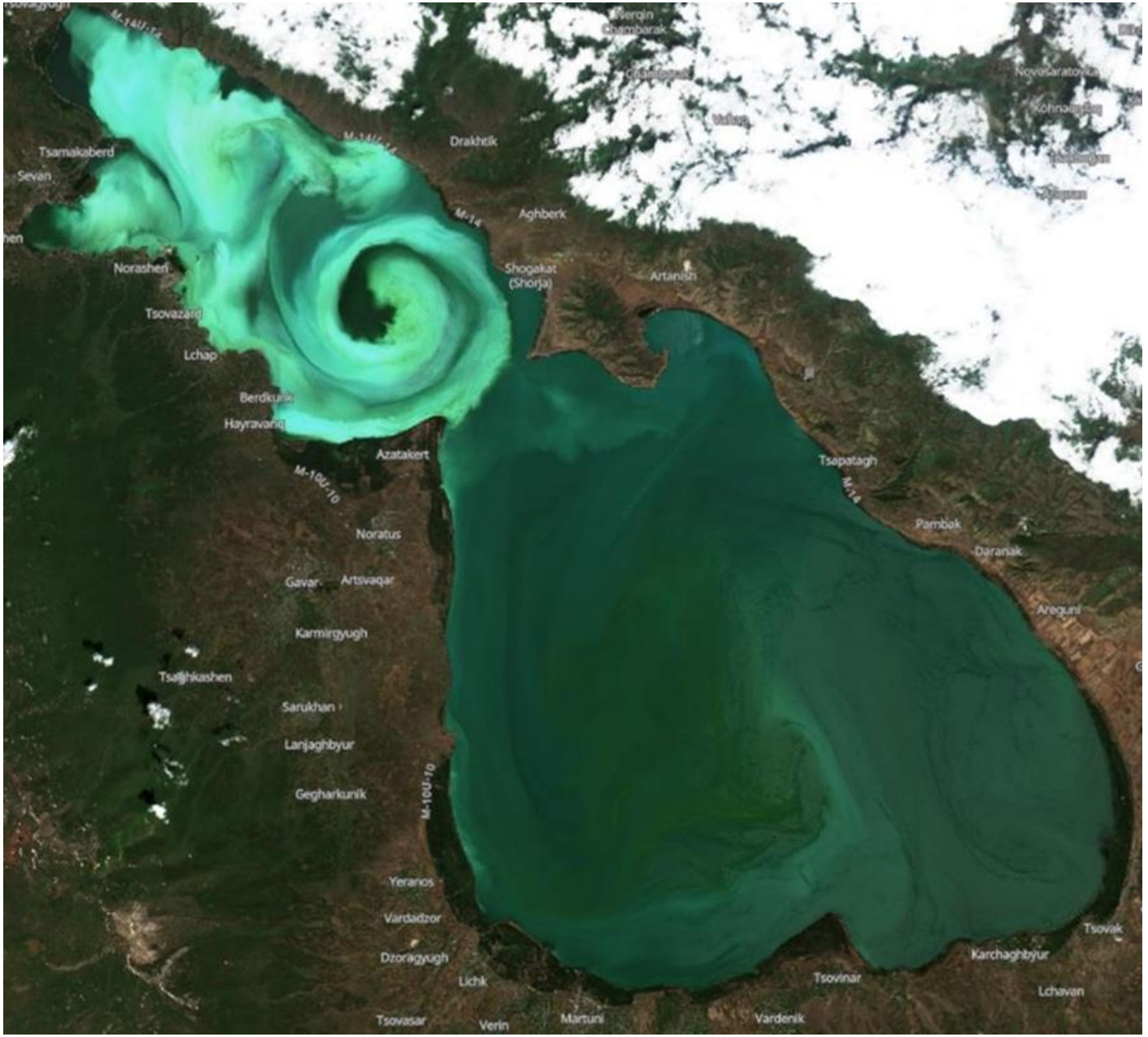
Understanding the case	Determining Lake Sevan basin spot	Designing the monitoring plan	Feedbacks from experts
the data from • Ministry of the Environment • Statistical Committee • Website of “Hydrometeorology and Monitoring Center” SNCO • the existing data published at EarthEcho International’s	See the figures on next slides	• The literature review approach to include a qualitative analysis and the synthesis of information. • The electronic resources such as Web of Science, Taylor & Francis Online, EBSCO and Wiley Online Library were used to identify relevant publications. ○ Inclusion criteria for publications were: ○ explore the CSc project (i), ○ present cases of CSc project in water quality monitoring (ii), open access (iii), ○ available in English (iv), ○ peer review article, review article or book (v).	international independent experts have been interviewed about the water quality monitoring program.

a) 2019

b) 2020

c) 2021

The distribution of water monitoring observation points for Lake Sevan approved by the Government of RA Source: armmonitoring.am



The settlement locations near the bloomed lake used to be in water sampling.
Source Image: Sentinel-2A, AUA GIS & Remote Sensing Lab

Results

Water quality situation

№ MOP / Date	MU	115	118	119	124	126	127	130	131
July, 2019	mg/l	0.0805	–	0.1016	0.0844	0.0811	0.0801	0.0895	0.0823
July, 2020	mg/l	0.034	0.0452	0.0558	0.0578	0.039	0.0459	0.0516	0.0544
June, 2021	mg/l	0.0808	0.0818	0.0733	0.0915	0.0892	0.0824	0.0598	0.07
October, 2021	mg/l	0.0649	0.0564	0.0629	0.0846	0.0548	0.0894	0.0839	0.0606
MAC	mg/l	0.1							

Concentration of total phosphorus of surface water of Lake Sevan (MAC (t-P) =0.1mg/l)

Results

Water quality measurements for Lake Sevan by citizens

Date	Turbidity	pH	Temperature	Oxygen	Oxygen Saturation	Nitrite	Nitrate
November, 2012	0 JTU	6.5	14 °C	4 mg/l	-	-	-
November, 2012	0 JTU	9	10 °C	4 mg/l	-	-	-
October, 2010	40 JTU	6.5	14 °C	7 mg/l	-	-	-
September, 2010	0 JTU	6.5	12 °C	4 mg/l	-	-	-
September, 2010	40 JTU	7.5	14 °C	6 mg/l	-	-	-
August, 2010		7.5	18 °C	8 mg/l	-	-	-
July, 2019	0 JTU	7.5	16 °C	4 ppm	84%	40 mg/l	7.5 mg/l
July, 2019	0 JTU	9	16 °C	4 ppm	41%	-	-

The data taken from “EarthEcho International” website for Lake Sevan, which have been added by citizens (https://www.monitorwater.org/).

Success Factors for Generating Monitoring Plan

Attribute of citizen	Knowledge and experience in the data collection	Implicit knowledge
	Citizens' interest	more intrinsic value in designing the monitoring plan because 1. The Lake Sevan is already contributing economically for surrounding, so by joining this CSc, 2. it will indirectly give financial incentives since the possible participants of this project come from places surrounding Lake Sevan that their business of tourism is possibly affected 3. There will be additional values that relates to resilience if we concern on Lake Sevan conservation
Attribute of institution		This project will involve university, schools, and local authorities. There are no particular criteria in the involved institution Second, the training they get from this project is beneficial to their capacity building. Lastly, the involvement of the educational institution is more targeted since they are in the educational institution
Attribute of process	Supporting structures	• To train the teachers from natural science subject. • The teachers will be responsible to disseminate the skill and knowledge gained from the training to their students. • The kit will be provided by the committee of this CSc project to make the students more interested in joining the research.
	Communication and feedback culture	• The feedback culture will be done manually using WhatsApp or email. • There is possibility to create an application for the data management and feedback in the further development of the project

Feedback from the expert

Liana Margaryan 	… “In nowadays the citizen science water monitoring plan could be the fastest problem solving solution. The active youth of the communities located near the lake, are interested to take part in training to get knowledge about the conditions of the water quality of the lake. She mentioned the key factor to implement the CSc project is exist, it is the “motivation” of the youth who want to live in a better environment, By knowing their rights, the youth could demand from local authorities to take an urgent actions to stop the blooming of the lake. The community members realize the importance of the lake in their daily life activities”.
Masoom Hamdard 	… “Water quality monitoring is an important tool in water quality monitoring. CSc is the way to enlarge the network of water quality monitoring observation points. For creating the database for decision making the citizens should be trained to take water samples in the field and be experienced in field and have a knowledge about the water quality measurement methods. About concentration of the parameters the MAC should double checked then reported to the government of RA. The simple water sampling and quality measurement guideline with the step-by-step descriptions, should be provided to citizens for having reliable database”. He believes that with the growing technology, sooner will be find the easier and cheaper type of the data collection, transformation and maintenance.
Arevik Hovsepyan 	.. “The Sevan basin is not considered a drinking water source. However, it can also be dangerous for people who come to relax in the lake. She stressed that if anyone is testing the water, in the event of a significant deviation, the relevant government agencies should be informed. During the awareness raising trainings teachers and pupils were provided with the equipment to check the water quality. The devices allowing to make fast measurements and to understand the level of the pollution of the water body with the guiding notes of the toolkit. One of the group of the students found out that the tap water did not meet the drinking water standards and submitted an application to the municipality.
Nasr Hamid 	… “CS connects top sensitive environmental and development issues, such as the environmental justice and equal access to basic services such as clean water, food, education and healthcare. CS can contribute to the evidence base for monitoring and progress towards the SDGs. Data collection practices by using the CS projects have the potential to democratize the country. CS is a key driver for democratizing science and promoting the goal of universal and equitable access to scientific data and information. The professional scientists should be should evaluate citizen science' data products from the perspective of its utility”.

Water Quality Monitoring Plan for Lake Sevan

Structure in the Monitoring Plan	**Planning and Designing**
Project description	Scoping
Project location	Scoping
Responsible parties	Scoping Resources Community management
Water quality standard	1. Project design/protocol 2. Community management 3. Tools and methods 4. Data
Water sample	1. Project design/protocol 2. Community management 3. Tools and methods 4. Data
Inspection	Project design/protocol Data Resources
Reporting	Project design/protocol Data Resources

Discussion and Conclusions

It should become urgency to conserve the Lake Sevan since it has many impacts to the surroundings. The grade that shows in the 4th class has proven that the water quality is already in a critical condition

Combining the framework of success factors and steps of planning is expectedly beneficial to design an effective water quality monitoring plan.

A citizen science on water quality monitoring may serve as an alternative effort to conserve the Lake Sevan through participatory research that involves citizens

Expert's opinion as points that indirectly contribute to steps in the monitoring plan.

The success factor is used in designing the monitoring plan. From nine success factors, there will be seven factors that will be considered directly in designing the monitoring plan.

The first step before involving the citizens in this project is to connect with governmental agency that will connect to educational institution (universities or schools).

This CSc project in water quality monitoring will increase the awareness and sense of belonging of the people.

Post-Training Action Plan

Action	YOUR role	Stakeholders	Support and resources needed	Expected results of each step/objective	Obstacles, risks	How to manage (or mitigate) risks and obstacles	Indicator for success (in a 1-3 year perspective) – entire plan
Training course on water quality monitoring	Organize	Active Youth of the 3 river pollution affected communities	Training materials	Trained 30 active youth become community change agents who has critical thinking to save the environment	Funds	Engage Community members and local officials in planning and implementation to validate and authorize the meetings	Increased knowledge and skills on water quality monitoring
Data collection	Facilitate	local authorities	Training Modules		Covid 19	Print guide-book for future reading	People will start to think about the EcoThinking
Data analyses	Report writing	independent experts	Equipment's		Requiring to candidates to show rapid test result, bring sanitizers and wearing FFP2 masks	find other sponsors (from UNDP, NGO)	
Data maintenance	Link and coordinate with other stakeholder	representatives of the governmental institutions	Meals and Refreshments				
Meeting with the Government representatives		NGO	Community Halls				
			Media coverage				
			Financial resources				

Thank You For Your Attention