



The ecosystem of the estuary of the river and the eutrophication

Modules:

**Impacts of human intervention
on river ecosystem**

River management

Total duration: 7 hours

Field work: Yes

List of materials:

Chemistry Kit for chemical
analysis (for field work)

Microprocessor

Conductivity/TDS Meter

pH Meter

Multiparameter Ion specific
Meter

Microscopes

Worksheets: 2

Students' age: 15-18

Use of apps/software: GIS

Brief disciplinary introduction

Chemical testing using water samples from the stream and study of earth samples too. Special reference to micro-organisms found in the water, to those originating from waste water, to the dangers they pose to humans as well as to other organisms in the ecosystem. Samples should be taken from different parts of the "Megalo Rema Rafinas".

Investigation of the effect of disposal of urban sewage in the Megalo Rema Rafinas and how that leads to eutrophication. We study the increase of green algae (seaweed) and other plants.



Objective of the learning unit

To learn about:

- ✓ Relationship between chemical nutrients (nitrates and phosphates) in algal development
- ✓ Chemical analysis and species identification
- ✓ Eutrophication and its impact
- ✓ Environmental impact of various pollutants

To be able to:

- ✓ Carry out a sampling of river water

Introduction (orientation)

Time estimated: 45 minutes

Where the activity takes place: outdoor, by the river

Method (how the students have to work): class brainstorming

Instructions for the teacher:

1) Introduction to the topic

We are in the estuary of Megalo Rema Rafinas.
Some questions for the students:

(Experiential Learning, biomatic Learning)

“What is a river estuary?”

“How are estuaries formed?”

“What is unique about an estuarine system?”

“What organisms live in estuaries?”

“What plants live in estuaries?”



Conceptualization

Time estimated: 15 minutes

Where the activity takes place: outdoor, by the river

Method (how the students have to work): group-work

Instructions for the teacher:

Ask the students if they notice something strange in the ecosystem; if there is something that is not so “natural”.

There are some very “very green areas” in front of us.

“What is that?”

“Is it normal?”

“From what it comprises?”

“What are the algae?”

“What is eutrophication?”

“What are the possible causes of eutrophication?”



The observation at the microscope can follow in the school laboratory.

Investigation

Time estimated: 5 hours

Where the activity takes place: outdoor, by the river and in the classroom

Method (how the students have to work): group-work

Instructions for the teacher:

In the classroom, the students are divided in groups.

1) Planning

Teachers and students plan the investigation of river biology (focus on algae) and chemistry profile. Investigation of the effect of disposal of urban sewage, and other pollutants in the river and how that leads to eutrophication and other diseases.

Teacher can also ask students if there might be a correlation between the disposal of various pollutants in the river with well-being (Human Health).

We want especially investigate the role of PCBs and PAHs in Human Health.

In the case of the Megalo Rema Rafinas, the investigation answered the question:

“Is there a correlation between death caused by cancer and the pollutants of the Athens International Airport “Eleftherios Venizelos” and the Port of Rafina?”

We study the increase of green algae (seaweed) and other plants.

Choose the sites where to take samples of geological rocks and water samples of for chemical analysis and for measuring the quantity of certain micro-organisms (Escherichia coli).

We investigate the causes of eutrophication. Possible cause of eutrophication might be:

- Discharge of Sewage (waste water)
- Fertilizer runoff
- Runoff water of Attiki Odos (great closed motorway)
- Runoff water of Athens International Airport “Eleftherios Venizelos”

Samples should be taken from certain parts of the river, and especially on the pipes.

From each site, it is good to take samples for:

- algae identification
- quantity of Escherichia coli.

Chemical analysis of:

- -NO₃ (nitrates)
- -PO₄ (phosphates)
- Temperature of the water
- pH
- Dissolved Oxygen
- Conductivity, Salinity
- TDS (% or ppm)
- Quantity of Escherichia coli
- Copper, Chromium
- PCBs, PAHs



2) Performing

Phase 1

Collection of water samples along the river on certain points.

Time needed: 1 hour and 15 minutes

Phase 2

Use of microscopes and scientific books for algae identification

Focus on green algae (Chlorophyta) that are pollution indicators.

The students fill the Worksheet 1 (biology data)

The students make the chemical analysis of the samples taken of the river.

Then they fill the Worksheet 2 (chemistry data)

In this example, we have measured the heavy metals in order to investigate the impact of Attiki Odos (Runoff water of Attiki Odos) and the impact of Athens International Airport "Eleftherios Venizelos" (Runoff water of Athens International Airport "Eleftherios Venizelos"). We have done this in collaboration with the Department of Maritime Studies of the University of Piraeus (Greece) and a local geologist.

Time needed: 3 hours and 45 minutes (2 or 3 different days)

3) Concluding

The different groups report their conclusions.

Students compare the results and they conclude if there is correlation between sewage and eutrophication.

Conclusion

Time estimated: 15 minutes

Where the activity takes place: in the laboratory

Method (how the students have to work): group-work

Instructions for the teacher:

Each group writes a note about their research and explain the result using images projected in the class.

Discussion

Time estimated: 45 minutes

Where the activity takes place: in the laboratory

Method (how the students have to work): group-work

Instructions for the teacher:

The different groups take part in a discussion about the main cause of eutrophication in the river.