PC-EU TRAINING COURSES + CONFERENCE

Athens – Aegean, Greece, 05th April - 10th May 2019

I. ***"Staff Development Courses for the Participants of the Treasure-Water Project"***

II. ***"Scientific and Practical Conference on the Freshwater Resources and Management in the Aegean"***

Organizer: National and Kapodistrian University of Athens (NKUA)
Convener: Dr. Athena ECONOMOU-AMILLI, Professor Em.
Venue: Athens (Ilissos Hotel), Aegean (amphitheater on cruise)

MINUTES

ATTENDEES

1. Dr. ECONOMOU-AMILLI Athena, Professor Em., Department of Biology, Section of Ecology & Systematics, National & Kapodistrian University of Athens (NKUA), Greece – (Scientific Responsible of the Project in the National and Kapodistrian University of Athens-Greece (NKUA), and Convener of the Meeting)
   Official Opening - Greetings and Scope of the Meeting **Introductory Lecture**

Greek Scientists of the Athens University, involved at certain periods in the Project

2. CHANTZISTROUNTSIOU Xanthi, PhD Cand., Department of Biology, Section of Ecology & Systematics, National & Kapodistrian University of Athens (NKUA), Greece– **Key Lecture No. 03**
3. Dr. LOUVROU Ioanna, Department of Biology, Section of Ecology & Systematics, National & Kapodistrian University of Athens (NKUA), Greece– **Key Lecture No. 02**
4. Dr. PAPANTONIOU Georgia, Department of Biology, Section of Ecology & Systematics, National & Kapodistrian University of Athens (NKUA), Greece– **Key Lecture No. 01**
5. Dr. TZOVENIS Ioannis, Department of Biology, Section of Ecology & Systematics, National & Kapodistrian University of Athens (NKUA), Greece– **Key Lecture No. 04**

Greek Scientists, as Invited Speakers

6. Dr. GEORGANTIS Panagiotis, Natural History Museum of Crete, Herakleion **Presentation**
7. Dr. HATZILACOU Dionysia, Biologist-Ornithologist, Water expert– Athens **Key Lecture No. 05**
8. Dr. VOREADOU Catherine, Head of Hydrobiology Laboratory, Natural History Museum of Crete, University of Crete **Key Lecture No. 11**

British Scientists of the Wolverhampton University, involved in the Project

9. Dr. SHIPLEE Brian, Senior Lecturer, Faculty of Science and Engineering, School of Architecture and Build Environment, University of Wolverhampton, (UK)– **Key Lecture No. 16**
10. Dr. TOBIN Cathernine, Senior Lecturer, Faculty of Science and Engineering, School of Sciences, University of Wolverhampton, UK– **Key Lecture No. 15**
11. Dr. WILLIAMS Craig, Professor, Faculty of Science and Engineering, School of Sciences, University of Wolverhampton, UK– **Key Lecture No. 14**

Scientists from Kazakhstan (Eurasian National University), involved in the Project

12. Dr. ABILEV Madi, Head of the Research Organization Office, Ust-Kamenogorsk, Kazakhstan
13. Dr. BEISENOVA Raikhan, Head of the Environmental Management and Engineering, Department of L.N.Gumilyov Eurasian National University (ENU), Kazakhstan
14. RAKHYMZHAN Zhanar, PhD Cand., Environmental Management and Engineering Department of L.N.Gumilyov Eurasian National University, Kazakhstan
15. TULEGENOVA Symbat, PhD Cand., Environmental Management and Engineering Department of L.N.Gumilyov Eurasian National University, Kazakhstan
16. Dr. ZHAMANGARA Aizhan, Associate Professor, International Department of Management and Engineering in Environmental Protection, Faculty of Natural Sciences, L.N. Gumilyov Eurasian National University (ENU), Kazakhstan

Scientists from Russia (Altai, and Tomsk State Universities), involved in the Project

17. Dr. BARYSHNIKOV Gennady, Professor, Head of Natural Management and Geo-Ecology Department, Altai State University (ASU), Russia
18. Dr. BARISHNIKOVA Olga, Associate Professor, Faculty of Geography, Altai State University (ASU), Russia
19. Dr. VERSHININ Dmitry, Associate Professor, Hydrology Department, Tomsk State University (TSU), Russia
20. Dr. ZEMTSOV Valerii, Professor, Head of Hydrology Department, Tomsk State University (TSU), Russia **Key Lectures No. 12 & 13**

Accompanying persons

21. Dr. AGORASTOS Theodoros, Professor, Medical Department, Aristoteleion University of Thessaloniki, Greece
22. Dr. AGORASTOS Ioanna, Professor, Faculty of Literature, Aristoteleion University of Thessaloniki, Greece
23. Dr. AMILLIS Vasileios, Chemist, Aristoteleion University of Thessaloniki, Greece

Students

24. APOSTOLOPOULOS Efstathios, Department of Biology, National and Kapodistrian University of Athens (NKUA), MSc Program “Biodiversity”, Greece
25. BECBOSSYNOVA Samal, PhD Cand., L. Gumilev Eurasian National University, Kazakhstan
26. KASSARI Nefeli, Undergraduate Student, Department of Biology, National & Kapodistrian University of Athens (NKUA), Greece
27. MAGDALINOU Eleni, MSc Student, Faculty of Agriculture, Athens, Greece
28. PAPADOPOULOU Sofia, Undergraduate Student, Department of Biology, National & Kapodistrian University of Athens (NKUA), Greece
29. SOULIOTI Nikoleta, Postgraduate Student, Department of Biology, National & Kapodistrian University of Athens (NKUA), MSc Program “Biodiversity”, Greece

PURPOSE OF THE ATHENS - AEGEAN CONFERENCE

The general aims of the International Scientific and Practical Conference held in Athens and the Aegean (5^{6h} to 10th May 2019), as stated in the Introductory Lecture, were:

PART I The enhancement of the teaching and knowledge potential in order to develop successful partnerships between Universities of EU and those of PC, an aim covered under the general title '*Staff development courses for the Treasure-Water project's participants*'. To this direction teaching examples of hydrobiology were delivered - diversified into three levels of education (under-and post-graduate, professionals) - by introducing new courses with supporting teaching material based on the ECTs introduced in professional training of specialists (Key Lectures No. 01-04). In this way, the strategic mission of universities is fostered, and a closer connection between education, research and innovation aspects is provided.

PART II Moreover, in comparison with relevant courses on the Greek mainland offered during the first meeting in Athens (May 2018), a second perspective was defined towards the general title '*Freshwater resources and management in inhabited areas of the Aegean*'. The geological and biogeographical interest of the Greek islands (active geotectonic regime; also environmental heterogeneity, complex paleogeography, high diversity and endemism) is widely recognized; therefore, the present selection can further *encompass the goals of the whole Erasmus+ project to include diversified water resources*. Moreover, since human influence is extremely intense also on the Aegean island ecosystems, priority in water conservation strategies should be given in education and sensitization of local population to environmental issues and particularly to the special value of Aegean islands as places that house unique components of global biodiversity.

Herein, we tried to combine the previous knowledge benefits of the first Athens meeting (May 2018), extending them from issues related with water resources and management on the Greek mainland
(e.g. biological estimation of the quality of inland waters *using various biotic indices and score systems evolved through a series of refinements and adaptations and based on algae and mainly diatoms, macroinvertebrates and fishes*; water management *using the results of these techniques which now are influencing policy decisions concerning surface water management in Europe, where community assessment is being used as a planning tool for managing water uses, for ambient monitoring, and for evaluating the effectiveness of pollution control measures*)
to similar issues related with water resources from isolated Greek areas, i.e. island areas of the Aegean.

Five (5) Greek islands of the Aegean were selected as case-studies, and information about the water resources and management was provided: 1. Mykonos – a small island of the Cyclades highly affected by tourism with few artificial wetlands and seasonal marshes (Key Lecture No. 06), 2. Patmos – a middle-sized island with religious visits and few natural salt marshes covering its needs with very recent two desalination units (Key Lecture No. 08). 3. Rhodes – a middle-sized island with long knights' occupation with natural and artificial wetland areas, covering the water supply needs with the dam of Gadouras, desalination units and bore holes (Key Lecture No. 09). 4. Crete – a large island with an extended surface water system, similar to that of the Greek mainland (Key Lecture No. 11). 5. Santorini – the well-known volcanic touristic island with no running water supplies, covering its Water Supply Needs by desalination units (Key Lecture No. 10).
Apart from the islands, Ephesus, an ancient urban Hellenic settlement located south of the river Küçük Menderes now in Turkey (Ancient Cayster or Kaystros), was selected as case-study, helping us understand how the Greek cultural heritage could be related to our topic (e.g. how the ancient Greeks tackled water management issues with the use of an extended aqueduct water and sewage system, running throughout the ancient city and drawing water from more or less distant natural springs).

These goals were further enriched by

a. Background lectures with information on the Greek State Policy and the related running financed programs in Greece (Key Lectures No. 05, and 11)
b. Information on Hydrology, Pollution remediation, Engineering & Management Solutions in freshwaters of some areas of the United Kingdom (Key Lecture No. 14, and 15), Russia (West Siberia) (Key Lectures No. 12, and 13), and USA (Key Lecture No. 16)

During the meeting the participants had the possibility to summarize the acquired information on the above topics in relation to the goals of the meeting, and to give suggestions for Sustainable Management of Transboundary Water Resources and future actions.

PART III *Furthermore, participation to cultural events and also to educational field excursions (e.g. guided visit to Gadouras dam in Rhodos, and desalination centers in Santorini) and exhibitions (e.g. guided visit to the Natural History Museum and presentation in Herakleion, Crete) would facilitate the system of continuing education in the PC according to the European Qualifications Framework, and contribute to new curricula for professional re-training.*

PART – I
THE KEY-LECTURES DELIVERED – (summaries)

✓ Key Lectures

PAPANTONIOU, G. Key Lecture No. 1

Title: "*Food Webs in Freshwater Ecosystems: an Ecosystem Approach*"

Freshwater ecosystems and species are under intense anthropogenic threats. These threats directly affect services such as sustainable fisheries, drinking water or ecosystem resilience. To adequately respond to these 21st century challenges and conserve these goods and services, a fundamental understanding of the biodiversity and ecosystem processes is needed, as without knowledge there can be no application or effective management. Food webs are networks that not only represent ecological community structure but also depict energy flows between species and provide the opportunity for more holistic assessment of energy flows and potential trophic cascades. Ecological networks represent a cornerstone of ecology: they describe and evaluate the links between form and function in multispecies systems, such as food-web structure and dynamics, and they connect different scales and levels of biological organization. Ecosystem approach to freshwater ecosystems is the integrated management of human activities, based on knowledge of ecosystem dynamics, to achieve sustainable use of ecosystem goods and services, and maintenance of ecosystem integrity.

Both undergraduate and postgraduate programs concerning freshwater ecology should be designed to equip the students with the interdisciplinary practical skills and theoretical understanding in order to provide a good understanding of applying scientific understanding to science policy. Through undergraduate courses students should acquire a detailed knowledge of the food web structure of aquatic environments and the ecology of particular groups of organisms, taxonomic skills in order to identify an array of aquatic organisms, participation in field and laboratory work to develop techniques in data collection and analysis, a range of skills in team work, report writing, communication, presentation and IT skills. In postgraduate courses students should learn how to reconstruct the past of freshwater ecosystems, understand the contemporary via monitoring, and predict the future via modelling. Emphasis should be placed on practical skills and field experience. Postgraduate students should acquire advanced knowledge of the structure and function of aquatic food webs and current management issues, advanced taxonomic skills, participation in sophisticated field and laboratory work and experiments in order to develop techniques in experimental design for monitoring and modelling aquatic environments. Finally in an holistic perspective of managing freshwater resources and anthropogenic activities, the ecosystem approach via modelling food web interactions has the potential to increase realism in order to describe the ecosystem resources and their interactions, disaggregate the impacts imposed by anthropogenic activities (e.g. fishing, nutrient loads from land use), investigate the ecosystems' functional responses to environmental and human pressures (e.g. introduction of invasive species, climate change) and explore management policy options incorporating economic, social and ecological considerations.

LOUVROU, I. & ECONOMOU-AMILLI, A. Key Lecture No. 02

Title: "*Algal Diversity in Inland Waters: An Educational Approach"*

Teaching outline in Algal Diversity of Inland Waters should include study of the drainage basin and the resulting Inland Waters abiotic factors, the heterogeneous group of organisms that correspond to the 'Algae', the algal diversity at all 3 levels i.e. genetic, species and ecosystem level, as well as the relation between algal biota and the environment. Different aspects of Algal Diversity in Inland Waters should be incorporated in several general or specific courses at an undergraduate and postgraduate level. For instance in undergraduate general courses, basic elements should be included in the course outline (i.e. algal ecology and function relative to the ecosystem in 'Ecology'; taxonomy, systematic and ecology of the main algal groups in 'Botany'). In specific courses the knowledge should be wide, deep and advanced with up-to-date research data and applications (i.e. in 'Limnology' the ecological role and function of the different groups of algae should be analysed, as well as the use of algae in biomonitoring as ecological guilds, biomarkers and bioindices; in 'Phycology' algal taxonomy, systematic and ecology should be analysed). Basic principles related to microalgae should be presented in 'Microbiology', elements related to algal exploitation in 'Biotechnology' and applied notions related to Algal Diversity in Inland Waters should be given in courses related to water resources management and water quality assessment. In Postgraduate studies advanced knowledge on algal diversity should be incorporated at the 3 levels in the Phycology course (Genetic: Basic principles, Evolutionary paths, Details; Species: Examples of a vast variety of the different groups of algae; and Ecosystem: Diversity and complexity of algal communities and their role in the whole ecosystem). Also in the 'Limnology' course basic knowledge of the algal diversity at the genetic and species level (Basic principles, Life forms, Ecological guilds, Indices) should be given together with an emphasis to the algal diversity at the ecosystem level (microhabitat and micro niches, management as well as presentation of different case studies of inland water ecosystems with either effective or not management). Different questions can be addressed at a PhD level (i.e. on yet unknown aspects related to the genetic, species or ecosystem level of a precise taxonomic group of algae, on the ecology and /or systematics of certain algal communities, or on distinct inland water ecosystems and on determination of effective management).

CHANTZISTROUNTSIOU, X. Key Lecture No 3

Title: "*Biodiversity and Ecology of Transitional Waters: an Educational Approach*"

Transitional waters are aquatic ecosystems located in the interface between the land and the sea and show the transition from freshwater to marine conditions. They are characterised by an increased intrinsic heterogeneity, intense gradients and biocommunities that present a remarkable tolerance in the fluctuation of physical and chemical parameters. In order to study and communicate the knowledge on transitional ecosystems it is imperative that we focus on the key aspects of those systems and thoroughly understand their most important feature, the salinity gradient that defines them and is the main drive force for all their physical, chemical and biological processes. In order to investigate those aspects more efficiently, they can be categorised in: abiotic factors (salinity, temperature, geomorphology etc.), biotic components (quantitative and qualitative properties of populations and biocommunities), human activities in the catchment area and the wetland itself (agriculture, aquaculture, tourism etc.), goods and services (conservation, protection, production of goods etc.) and challenges and management (threats and managing prospects).

When approaching the study of transitional ecosystem from an educational point of view, it is important to distinguish between undergraduate and postgraduate level as well as selecting the proper focus points depending on each project. Undergraduate studies require an investigation of the general processes taking place in those environments, under the light of wider subjects such as Ecology, Limnology and Oceanography; while postgraduate studies call for a more specific approach, concerning both the key aspects to be addressed, as well as the depth and detail required in order to cover the subject at hand depending on the programme. Additionally, in the matter of post-graduate studies, laboratory and field work are as important as theoretical knowledge.

Communicating Biodiversity and Ecology of Transitional Waters several subjects can be proven challenging due to, not only the limited knowledge and research concerning the systems in questions, but also due to their extreme variability and biotic community dynamics; however, inclusion of transitional systems in curricula concerning aquatic ecology, biodiversity and management of water resources is essential. Therefore, the biggest challenges concerning the education on these systems, are not only the deeper understanding of their functionality on a scientific and practical level, but also the raising of awareness and interest of the public on the management and conservation issues of these extremely important environments. Both education and dissemination of the knowledge acquired through well-organised and efficiently focused programs can be the key to communicating the subjects of biodiversity and ecology of transitional ecosystems, not only directly to the students but also to the public.

TZOVENIS, I. & ECONOMOU-AMILLI, A. Key Lecture No. 4

Title: "*Applied Phycology an Emerging Industry*"

The "aquatic" is the new frontier for human expansion and resources exploitation. In this context it is elementary to domesticate the aquatic photosynthesis, the basis of organic mass production in the aquatic carried out mostly by algae. Algae are a very diverse group of organisms performing oxygenic photosynthesis comprising cyanobacteria, and also eukaryotic micro- and macro-algae. Since ancient times there are records of near-shore seaweed consumption as well as of lake microalgae such as *Arthrospira* (ex *Spirulina*). In the early 20th century several applications were introduced by seaweeds like iodine and potassa production as well as cosmetic/spa uses. Microalgae were later on suggested for fat/oil production for food or energy, and as single cell protein producer along with their direct or indirect use as aquaculture feeds. Nowadays, applied phycology makes great leaps forward with niche market products like carotenoids (b-carotene, astaxanthin), phycocyanine and LC-PUFA along with established role for *Spirulina* and *Chlorella* as food supplements and several marine phytoplankters for marine hatchery nutrition. Great expectations for the future represent the full exploitation of waste streams (waste water nutrients, metals, flue gases), bulk production of organic matter in desert or ocean farming, bioactive compounds for functional foods and medicines, life support systems for space applications (oxygen generation, nutrient recycling), as well as modern applications for agriculture (N-fixation, natural pesticides, fertilisers, growth and bench life enhancing). Markets are so far exploiting in great volumes and value seaweeds while microalgae may establish a greater market impact in the near future.

PART – II
THE PRESENTATIONS DELIVERED – (summaries)

HATZILACOU, D. Key Lecture No. 5

Title: '*Water Policy in Greece - Administration, Management and the Insularity Issue"*

Greece has relatively ample surface and ground water resources in comparison to other Mediterranean countries; however, the spatio-temporal distribution of precipitation and the natural relief, which both determine the geographical distribution of water reserves, combined with water abstraction by various users (agriculture, municipal water supply, industry) are the main factors influencing the availability of freshwater resources (regarding its quantity and quality), in the different parts of the country. Roughly, the Pindos mountain range divides the country in two: the western, richest in water resources areas, and the eastern poorest one. The main institutional framework for the implementation of water policy in Greece consists of: a) the Water Framework Directive (WFD) 2000/60/EC, b) Directive 2007/60/EC on the Assessment and Management of Flood Risks (which is supplementary to the WFD) and c) the Marine Strategy Framework Directive (2008/56/EC). The first one adopted by Greece in 2003, set new objectives to protect and restore aquatic ecosystems as a basis for ensuring the long term sustainable use of water for people, business and nature. Hence, the country has been divided into 14 River Basin Districts, a specific administrative structure was set up (involving central government, decentralized, regional and local/municipal bodies), and water management is carried out through the implementation of 14 strategic planning documents, the River Basin Management Plans, while monitoring of quality and quantity parameters of the resource is carried out via the National Monitoring Network (2008 sampling stations nationwide). For the implementation of the second Directive, 14 Flood Risk Management Plans have been approved (2018) and cover flood risk evaluation, management and mitigation of their impacts. For the implementation of the 3rd Directive, marine strategies are developed for the assessment of the state of marine waters, the establishment of environmental targets and monitoring programs. The main factors contributing to water scarcity in one of the most water-shortage prone River Basin District of Greece, that of the Aegean, were described. Three projects financed by European Economic Area Financial Mechanism 2009-2014 and four projects funded by the Non-Conventional Water Resources (NCWR) Program in the Mediterranean (Greece, Cyprus, Malta), which have contributed to the mitigation of water scarci

CHANTZISTROUNTSIOU, X., LOUVROU, I. & ECONOMOU-AMILLI, A. Key Lecture No. 6

Title: *Hydrobiological Overview of Inhabited Islands of the Aegean – Case Study-1 Mykonos*

Mykonos is a Greek island, part of the Cyclades, situated 150 km east of Athens in the Aegean Sea, representing a worldwide recognized touristic attraction.

The island features no rivers, but numerous seasonal streams two of which have been converted into reservoirs. It produces 4,500 m^3 of water daily, by reverse osmosis of sea water in order to help meet the needs of its population and visitors.The island is composed mostly of granite and the terrain is very rocky with many areas eroded by the strong winds (thus it is called "Island of the Winds". Mykonos is highly affected by tourism thanks to its numerous attractions including the traditional windmills, Little Venice and Peter the Pelican.

The island's freshwater resources include 6 wetlands located on the island of Mykonos (2 reservoirs/dam lakes, 1 estuary, 2 small seasonal ponds, and 1 marsh) as well as seasonal marshes in nearby islands (Delos, and Rineia). The water supply needs of the population and tourists, are covered by the two reservoirs and a reverse osmosis unit located in Korfos. The main dangers that the island's water resources are facing are extended construction in the drainage area, urban and water pollution, while all of them are protected by a Presidential Decree for the Small Island Wetlands as well as other national and international protection policies.

CHANTZISTROUNTSIOU, X., LOUVROU, I. & ECONOMOU-AMILLI, A. Key Lecture No. 7

Title: *Hydrobiological Overview of Inhabited Islands of the Aegean – Case Study -2 'Ephessos'*

Ephessos has been an ancient Greek city on the coast of Ionia, representing a great example of an ancient urban settlement and its relevant water management system. The city was located south of the river Küçük Menderes (Ancient Cayster or Kaystros), 3 km southwest of present-day Selçuk in Kuşadası, İzmir Province, Turkey, and was covering its requirements with the use of an extended aqueduct water and sewage system. The river was running throughout the ancient city and drawn water from more or less distant natural springs. The city was famed for the nearby Temple of Artemis, one of the Seven Wonders of the Ancient World. The fertility of the land as well as the position of the city at the contact point of the natural connection path of the Aegean sea and the mainland of Asia Minor played an important role on the prosperity of the city in the Roman Times.

Ephesus is a great example of the usage of an aqueduct system that covered the water supplies of a large urban settlement in ancient times. This system was an extended water and sewage system, with a secondary water distribution system dominated by terra cotta pipes, running throughout the ancient city and drawing water from more or less distant natural springs.

The up to seven aqueducts built during the existence of the Ephesus port, carried substantial volumes of water into the harbor. It is notable that water in the harbor was replaced by the aqueducts in merely six days and the Romans went to great length to protect the harbor from river floods.

CHANTZISTROUNTSIOU, X., LOUVROU, I. & ECONOMOU-AMILLI, A. Key Lecture No. 8

Title: *Hydrobiological Overview of Inhabited Islands of the Aegean – Case Study -3 'Patmos'*

Patmos is a middle-sized Greek island in the Aegean Sea and the northernmost island of the Dodecanese complex, situated 40 km west of Turkey in the Aegean Sea. The municipality of Patmos also includes the offshore islands of Arkoi, Marathos and several uninhabited islets and is part of the Kalymnos regional unit. Patmos is most famous for being the location of the vision given to the disciple John in the Book of Relevation in the New Testament, and where the book was written. As a result the island became a site of religious pilgrimage in the centuries that followed and several monasteries and theological schools were founded there.

The island is composed mostly of volcanic rocks and the terrain is generally dry and non-fertile. It features no rivers but a few small lakes and marshes as well as an artificial wetland (Livadi dam). Since 2017, two desalination units, producing a total of 12000 m^3 of water per day, covering the drinking water needs of the island and thus making the island autonomous concerning water supply. Additionally, the restoration of the water supply network of Skala is ongoing. In total, the island's freshwater resources include 5 natural wetlands (1 salt lake, 2 seasonal salt ponds, 1 natural salt marsh and 1 small lagoon)

covering a total of 12-18 acres, and 1 artificial dam lake, most of which are protected by a Presidential Decree for the Small Island Wetlands and are partially within a Special Conservation Zone, while the whole island is a Landscape of Exceptional Natural Beauty site.

CHANTZISTROUNTSIOU, X., LOUVROU, I. & ECONOMOU-AMILLI, A. Key Lecture No. 9

Title: *Hydrobiological Overview of Inhabited Islands of the Aegean – Case Study -4 'Rhodes'*

Rhodes is the largest of the Dodecanese islands and is also the island group's historical capital. It is located NW of Crete, SW of Athens and just off the Anatolian coast of Turkey. The interior of the island is mountainous, sparsely inhabited and covered with forests of pine and cypress. The island is habitat to important flora and fauna: The Rhodian population of fallow deer was found to be genetically distinct in 2005, and to be of urgent conservation concern and in Petaloudes Valley (Greek for "Valley of the Butterflies"), large numbers of tiger moths gather during the summer months.

Historically, Rhodes was famous worldwide for the Colossus of Rhodes, one of the Seven Wonders of the Ancient World. The Byzantine era of the island's history came to an end when the island was occupied by the Knights Hospitaller. Under the rule of the newly named "Knights of Rhodes", the city was rebuilt into a model of the European medieval ideal. In 1947, Rhodes, together with the other islands of the Dodecanese, was united with Greece. The Medieval Old Town of the City of Rhodes has been declared a UNESCO World Heritage Site and today, it is one of the most popular tourist destinations in Europe.

The island's freshwater resources include 28 natural wetland areas (5 Lakes, 4 Marshes, 6 Rivers, 13 Estuaries covering ~ 2300 acres during the wet period, but with no large permanent surface water areas), 1 semi-natural and 7 artificial wetlands. The water supply needs are covered by the island natural water sources, the dam of Gadouras, desalination units and bore holes.

CHANTZISTROUNTSIOU, X., LOUVROU, I. & ECONOMOU-AMILLI, A. Key Lecture No. 10

Title: *Hydrobiological Overview of Inhabited Islands of the Aegean – Case Study -5 'Santorini'*

Santorini, classically Thera, and officially Thira, is an island in the southern Aegean Sea, about 200 km southeast of Greece's mainland. It is the largest island of a small, circular archipelago, of the same name and is the remnant of a volcanic caldera. It forms the southernmost member of the Cyclades group of islands which includes the inhabited islands of Santorini and Therasia and the uninhabited islands of Nea Kameni, Palaia Kameni, Aspronisi, and Christiana. It was the site of one of the largest volcanic eruptions in recorded history: the Minoan eruption, which occurred about 3,600 years ago at the height of the Minoan civilization. The eruption left a large Caldera surrounded by volcanic ash deposits hundreds of metres deep. The Minoan town of Akrotiri is one of the most important ancient sites on Santorini. It is located on the southern side of the island and the town was found almost intact, covered with layers of ashes.

There is no running water on the island, as it is part of a metamorphic volcanic sediments formation and the sea water surrounding the island is rich in volcanic minerals, such as iron. The water supply of the island is covered solely by the desalination plant located in Oia.

The main hydrological interest lies in the small seasonal wetlands (ponds and marshes) located in the small islands of Thirasia and Palaea Kammen and the hot springs that appear during the summer months

in the latter. Both islets are protected by a Presidential Decree for the small island wetlands of Greece and the volcanic islands Palaea and Nea Kameni are both part of the Natura 2000 protection network.

VOREADOU, C. Key Lecture No. 11

Hydrobiological Overview of Inhabited Islands of the Aegean – Case Study -5 'Crete'

Title: '*Status of Freshwater Ecosystems in Crete*'

The island of Crete is characterized by its mountainous landscape (2400 m altitude), its elongate shape and the existence of various geological types. The isolation of Crete results in high endemism as well as increased human needs in water supply. Freshwater resources in Crete include a number of (such as Agia and Kournas), rivers and streams of several types and water reserves (such as Gergeris, Amourgiela etc).

According to the Water Framework Directive (WDF 60/2000) typology of Cretan rivers and streams, out of the 120 water bodies in Crete, the majority (85) belong to the category RM-5/RM5a of "Intermittent streams" and a considerable number (29) belong to the category RM1/RM1a of "Small Mediterranean streams". Accordingly for the determination of the lakes, the surface size criterion was taken into account according to the "A" system of the WFD typology. All natural lakes of Crete with an area of over 0.5 km^2 were examined (Lake Kournas – Type L1).

In order to determine the ecological status of Cretan streams according to WDF 60/2000 the element a total of 137.567 individuals of macroinvertebrates were examined with the cooperation between the Natural History Museum of Crete and the Hellenic Centre for Marine Research (HCMR). The metric system implemented is The Hellenic Evaluation System (Ε.Συ.Α.) HES *(Artemiadou & Lazaridou, 2005*). A number of reference sites throughout Crete were selected and the results showed a "Good" ecological status for 43% of the water bodies evaluated and a "High" status for 20% of them while "Moderate" status accounted for 34% and "Poor" for only 3%, with the lower quality water bodies located mainly within the prefecture of Heraklion.

Additionally to scientific research, the Natural History Museum organizes training and educational activities on the "Natural Environment of Greece". These activities include teachers' training, field trips with schools, as well as field trips with families.

Panagiotis GEORGANTIS Guided visit and presentation

Title: '*On the various activities and the current Research and Development Projects of the Natural History Museum of Crete*'

In this presentation a quick glimpse through the topics and exhibits of the Natural History Museum of Crete, located in Herakleion, is given. At the beginning there were presented data related to the earthquake events occurred in Greece during the last years and about the precautionary measures applied in the country. Then a "trip" around eastern Mediterranean was presented by getting to know the different ecosystems one can explore in the region. Interesting information was presented about the most peculiar animals that inhabit those ecosystems. Finally the visitors travelled back in time meeting the most impressive prehistoric animals of Crete.

PART – II

LECTURES DELIVERED – (summaries)

ZEMTSOV, V. Key Lecture No. 12

Title: "*Hydrology and Hydrochemistry of West Siberia - Trans-Boundary Context*"

Hydrology deals with the occurrence, distribution, circulation and properties of water on Earth, while Hydrochemistry is a part of hydrology that deals with the chemical characteristics of water bodies. Herein, the water cycle and terrestrial water bodies (e.g. rivers, lakes, reservoirs etc.) were studied in West Siberia in relation to climate change, water regime changes and modification and water quality and pollution. The mean annual discharge of the largest rivers entering the Arctic Ocean reaches up to 630 km^3/y for Yenisey, while Ob's discharge is around 404 km^3/y.

The Basin of the large Ob and Irtysh Rivers covers a total area of around $3 \cdot 10^6$ km^2 and their tributaries have vast areas of floodplain. The mean annual temperature in the area is -5.2 ^oC, while the mean annual precipitation depth is 524 mm. The climate ranges from moderate to strong continental climate conditions and the geographic zonation includes the zones of steppe, forest steppe, boreal forests (taiga), forest tundra, tundra, arctic zone in the West Siberian plain and elevation zonation in mountains (the Urals, Altai).

Current changes in climate in the region are manifested in the increase of near-ground air temperature, changes in the rates and regime of atmospheric precipitation and increase in the frequency of abnormal (often extreme) hydro-meteorological events.

Relief and seasonality of climate determine the hydrologic regime in the study area**.** Hydrologic seasons in lowlands include 1) the snowmelt driven high flow season in spring and/or early to mid-summer, 2) the low flow period interrupted by rain-induced floods in summer and autumn, and 3) 5-6-months period of very low flow in winter when rivers are ice-covered and solely fed by groundwater. Rivers of the Altai Mountains with glaciers in their basins have high flow season in summer due to glacier ice melting.

Concerning the chemical composition, there is a zonation as we move from the North to the South of WSL, expressed by an increase in suspended solids and a decrease in organic matter. There are no standards (of good quality) for natural water–ecosystem approach; however, the role of the permafrost degradation is considered; the studied area is mostly covered by low resilience landscape including numerous oil polluted areas. The quality of surface waters characterizes ecological conditions for both a water body and its hydrographical basin as a whole. Physiographic settings along with typical historically developed land-use patterns define background patterns of water quality in local water bodies and eco-regions represent areas within which ecosystems are generally similar. An 'eco-regional concept' is useful for describing spatial water–quality patterns and for water quality management.

KIRPOTIN, S.N., ZEMTSOV, V. & CAZZOLLA GATTI, R. Key Lecture No. 13

Title: "*Western Siberia as a Natural Research Mega-Facility in Response to Global Challenges"*

TSSW ("The Trans-Siberian Scientific Way") is a world-class level response to global challenges. The main activity of TSSW is focused on creating scientific, educational, intellectual (analytical), infrastructural innovation and media products.

The concept of "mega-science" is usually applied in the field of physics. However, it is too expensive for just one country to install or even work on. Therefore, different countries and leading scientific centers unite their resources for the development of mega-science to form scientific consortiums.

Western Siberia is a unique wetland area, which due to its position, coastline, size, chemical and physical characteristics, is a huge expanse for research, is very attractive to the international scientific community and fosters the formation of network projects and research consortia. The new Mega-facility in Western Siberia developed by Tomsk State University, a member of INTERACT (an infrastructure project consisting of currently 76 terrestrial field, which seeks to build capacity for research and monitoring in the European Arctic and beyond) is unparalleled anywhere in the World, with an advanced cluster of field stations for conducting surveys, monitoring, sampling, live experiments etc.

The center is currently participating in international projects such as "JPI-Climate Project" aiming to improve the knowledge of the role of high latitude inland waters in emitting C to atmosphere and in exporting C to downstream coastal regions and how this varies between different climate regimes.

The Siberian Environmental Change Network (SecNET) established in 2016 is an open community of educational institutions, research organizations, scientific groups and individual scientists united by the common goal of promoting sustainable development of the northern and polar regions through identifying, modeling and forecasting the climate-caused changes in the Siberian environmental state. The approaches used to characterise environmental change in the units identified involve Identifying *past* change, characterising *current* status and predicting *future* change, while the identification of drivers of change include biotic, abiotic and anthropogenic approaches.

CRAIG, W. Key Lecture No. 14

Title: "*Pollution remediation using Zeolites"*

Zeolites are a mineral species formed in both igneous basalts and metamorphic deposits and are composed of silica and alumina tetrahedra joined by oxygen bridges and they are widely used both industrially and domestically in a variety of processes including catalysis, desiccation/gas separation, ion exchange and pollution remediation.

The use of zeolites (alumina-silicate minerals) for pollution remediation is examined herein. Zeolites have been used in ion separation (e.g. the use of a surfactant-modified zeolite to selectively remove the perchlorate anion from contaminated waters containing other anions such as hydroxide, carbonate, chloride, and sulphate), arsenic removal (both As^{3+} and As^{5+}) from both contaminated wastewaters and ground waters and removal of lindane and aldrin from aqueous solutions (clinoptilolite, Sprynskyy *et al*., 2008) among other, while the zeolite HZSM-5 has been shown to be a very efficient adsorbent for paraquat and looks like a promising primary treatment for acute paraquat poisoning (Walcarius & Mouchotte, 2004).

Furthermore, several studies have looked at the possibility of using zeolites for desulphurisation and they have also been shown to remove nitrogen compounds from transportation fuels. Clinoptilolite has shown to remove copper, iron, and zinc from industrial wastewaters with a 100% efficiency (Kocasoy & Sahin, 2007).

Zeolites, in particular, clinoptilolite and mordenite, can selectively remove picograms of Cs^{+} and Sr^{2+} from solutions containing 100 mgL^{-1} Na^{+}, 1.5 mgL^{-1} Ca^{2+}, and 0.7 mgL^{-1} Mg^{2+} (nuclear clean-up) and they have also found use as adsorbents for organic molecules including phenols, aniline, and nicotine (organic clean-up). Zeolites can be found in NW Scotland, Skye.

TOBIN, C. Key Lecture No. 15

Title: "*Remediation of eutrophic lakes*"

Two large lakes subject to enrichment are examined.
The first is Lough Neagh, a large shallow lake in Northern Ireland, where intensive farming is the main source of nutrients.
The second is Windermere, a large lake in the English Lake District, which is visited by 18 million visitors a year, so that visitor pressure is a major challenge, along with warming water temperatures.
Lake management actions to reduce Phosphorus are described. The impact on native fish species and the role of introduced species are discussed.

SHIPLEE, B. Key Lecture No. 16

Title: "*Bioregional management of agricultural non-point source pollution in the Connecticut River watershed, USA*"

Agricultural nonpoint source pollution is the major cause of surface water pollution in the U.S. However, owing to the difficulty of regulating private land use, the predominant strategy by which to deal with this problem, is to rely upon farmers voluntarily adopting such best management practices as riparian buffers. Despite the obvious advantages of applying this through a whole watershed approach, this has been associated with difficulties of integrating the various organisations involved.
In theory the advantages of the watershed approach and riparian buffers can be utilised without requiring radical institutional change or the diminishment of organisation's influence. The term 'bioregional management' can be used to describe such an approach.
The Connecticut River basin was chosen in order to test this proposition, since the potential for agricultural nonpoint source pollution is very high owing to this region possessing some of the most fertile agricultural land in the U.S. and the catchment transcends a range of regional, State and local boundaries.
Various surrogate indicators from current programs and documents were used in order to test whether bioregional management was occurring.
Agricultural nonpoint source pollution continues to be a problem in the Connecticut River basin despite the development of bioregional management. This is due to the failure of programs (both State and federal) to provide suitable incentives for farmers to install riparian buffers and other related actions. Furthermore, despite the widespread adoption of the watershed approach across all levels and in all four states, differences persist.

PART – III

CULTURAL FIELD TRIPS/ EVENTS

- ✓ MYKONOS – *the archetypal image of the Cyclades, and a cosmopolitan island with immaculate whitewashed houses, windmills and winding alleys, and legendary nightlife (!)*
- ✓ KUŞADASI – *a Turkish resort town famous for its colorful bazaar but principally because of its proximity to the Hellenistic ruins of Ephessos*
- ✓ EPHESSOS – *the ancient Greek city with the Hellenistic, Roman and early Christian ruins famed for the Temple of Artemis, one of the Seven Wonders of the Ancient World*
- ✓ PATMOS – *the location where the exiled Saint John the Evangelist wrote the Book of Revelation; optional religious visits to the hilltop Monastery founded in his honor (declared World Heritage Site by Unesco) and the Cave of the Apocalypse*
- ✓ RHODES – *Medieval tour in the city of Rhodes*
  Excursion to the Acropolis of Lindos with the graceful Temple of Athena (300 B.C.)

GUIDED VISIT TO GADURAS DAM IN RHODES

- ✓ HERAKLEION – *the busy capital of Crete, a former Venetian harbor with a history dating back to the time of the Minoans*
- ✓

GUIDED VISIT TO THE NATURAL HISTORY MUSEUM IN HERAKLEION

- ✓ SANTORINI – *the cosmopolitan volcanic island*
  Visit to Oia Village – a spectacular city of Santorini with black volcanic cliffs, perched on the very edge of the caldera along the black volcanic clifftop, famous for its fiery sunset (!)

GUIDED VISIT TO DESALINATION CENTRES IN SANTORINI