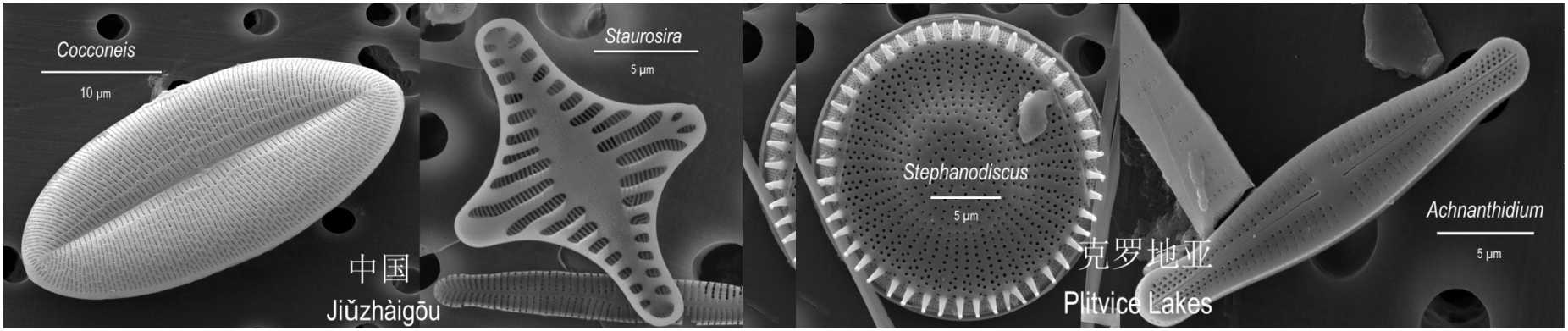

When nature gave us so much wealth
It is our duty to preserve it for future generations

CHENGDU INSTITUTE OF BIOLOGY, CHINESE ACADEMY OF SCIENCES

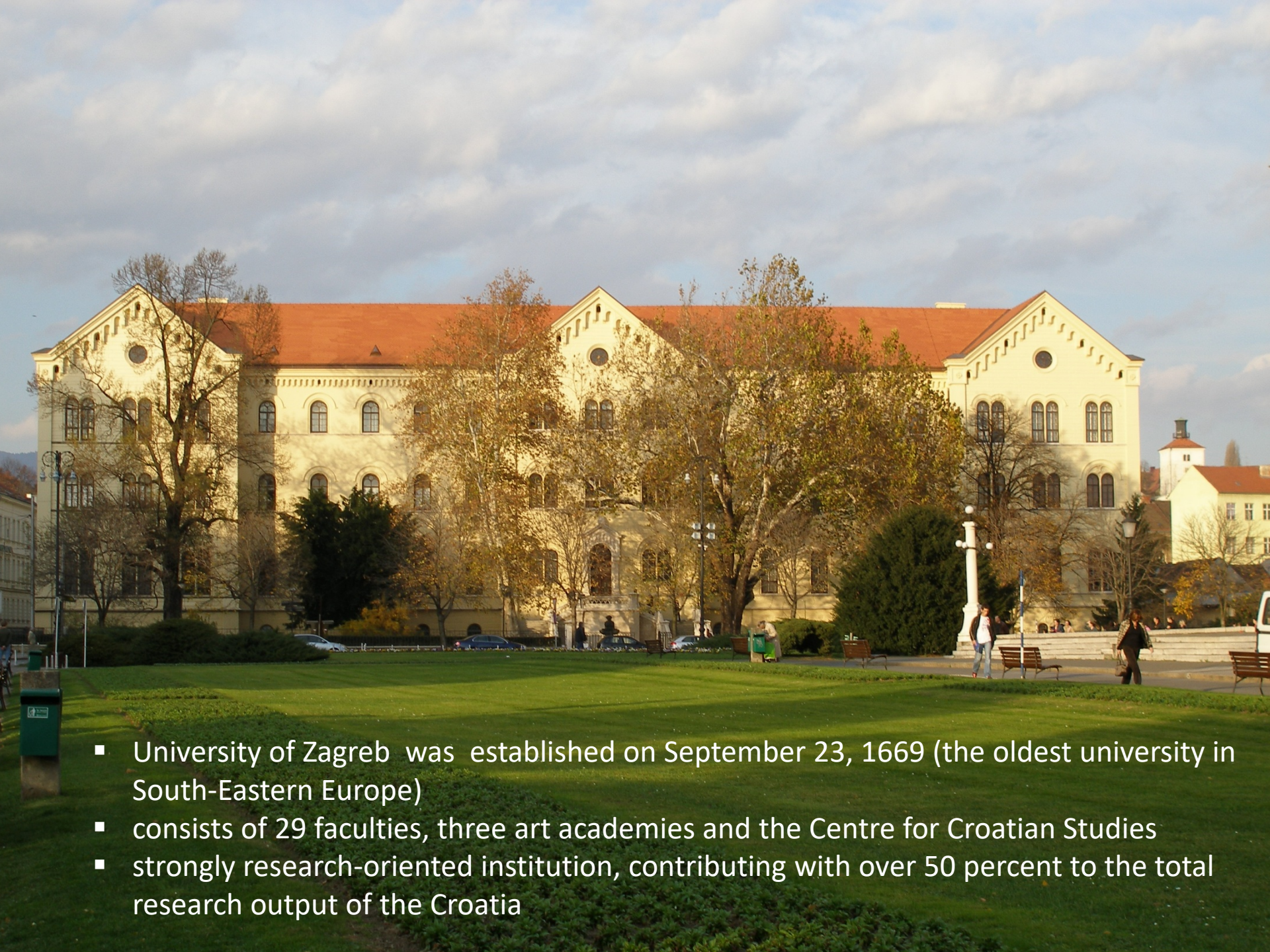
UNIVERSITY OF ZAGREB, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, CROATIA

Diatoms - ecological status indicators of Jiuzhaigou Valley



Chinese Team Coordinator
Prof. Sun Geng, PhD

Croatian Team Coordinator
Prof. Anđelka Plenković Moraj, PhD



- University of Zagreb was established on September 23, 1669 (the oldest university in South-Eastern Europe)
- consists of 29 faculties, three art academies and the Centre for Croatian Studies
- strongly research-oriented institution, contributing with over 50 percent to the total research output of the Croatia

FACULTY OF SCIENCE
University of Zagreb

URL: www.pmf.hr

- founded in 1946
- includes Biology, Geology, Physics, Chemistry, Geophysics, Mathematics and Geography
- 2 computer centers, the Seismological Service, 2 meteorological stations, the Croatian Time Service and the Botanical garden.

University of Zagreb
Faculty of Science
Department of Biology

Botany, Zoology, Animal Physiology, Molecular Biology and Microbiology

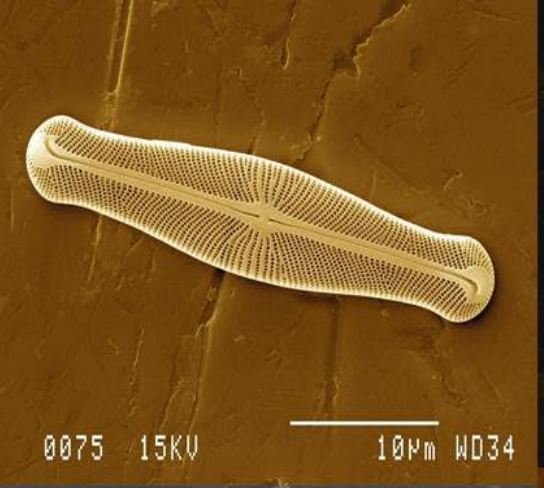
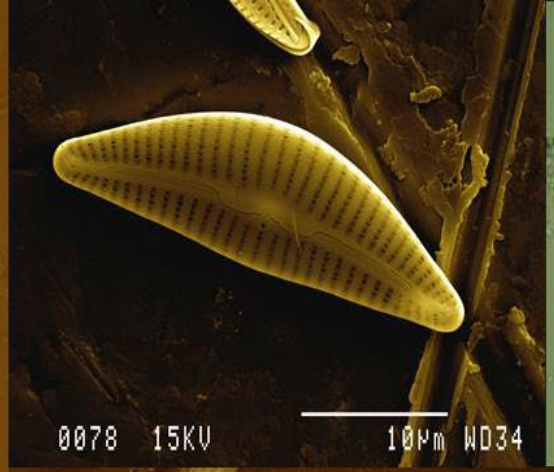
- 66 professors
- 45 research asisstants
- 10 professional co-worker
- 12 technicians
- 10 non-teaching staff
- 11 support staff
- 30 botanical garden staff

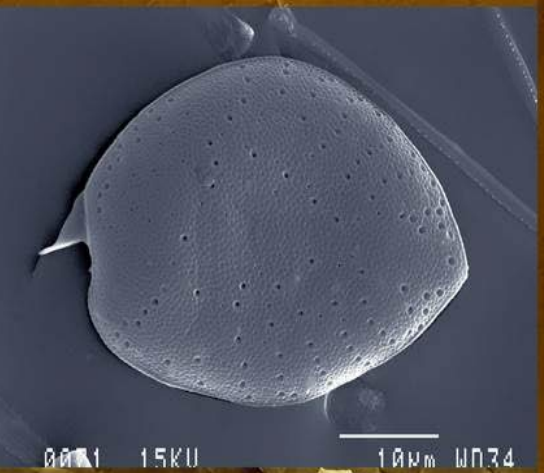
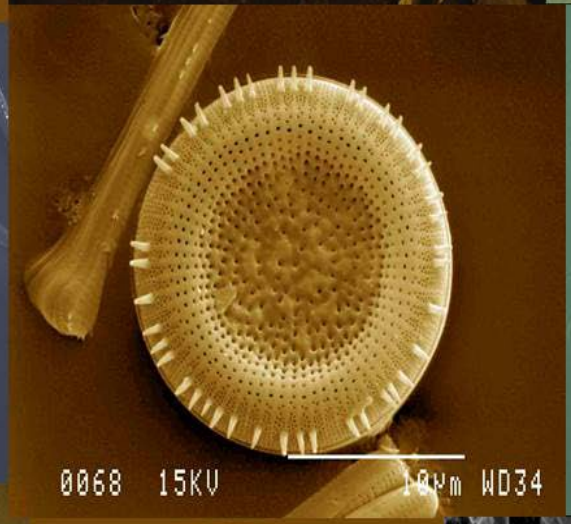
1200 STUDENTS

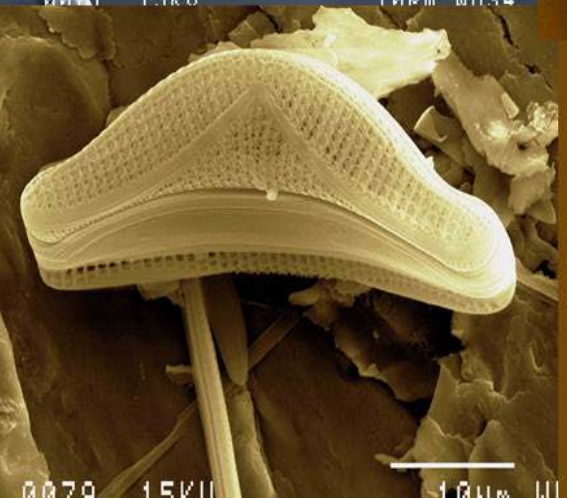
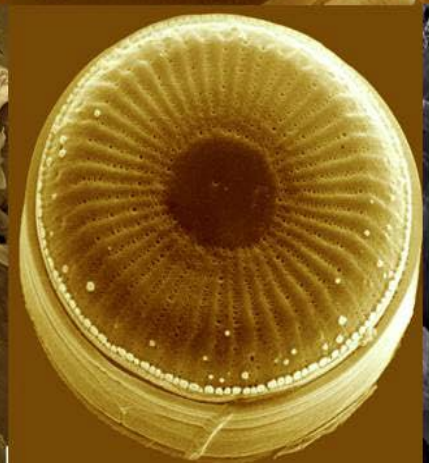
Apothecary garden and the renewed exhibition pavilion (1891)

Garden activities:
research
education
horticulture

Education and *ex situ* conservation in 122 years old Botanical Garden in Croatia


0075 15KV 10µm WD34

0078 15KV 10µm WD34



15KV 10µm WD34

0068 15KV 10µm WD34



15KV 10µm W


- The term ***algae*** represents a large group of different organisms from.

- Although they have historically been regarded as simple plant-like organisms that are usually photosynthetic and aquatic, and are generally classified in to kingdom ***Protista***, rather than Plantae because they do not have true roots, stems, leaves, vascular tissue and have simple reproductive structures.

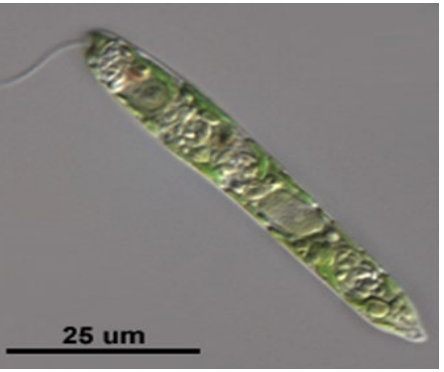
- Algae are simple organisms that can range from the microscopic (microalgae), to large seaweeds (macroalgae), such as giant kelp more than one hundred feet in length. Most microalgae grow through photosynthesis (converting sunlight, CO_2 and a few nutrients, including nitrogen and phosphorous, into material known as biomass). This is called “autotrophic” growth. Other algae can grow in the dark using sugar or starch (called “heterotrophic” growth), or even combine both growth modes (called “mixotrophic” growth).

The various types of algae play significant roles in ecology of each ecosystem. Microscopic forms that live suspended in the water column (called phytoplankton) or attached to different type of submerged substratum (called phytobenthos /periphyton) provide the food base for most aquatic food chains and they produce about 70 percent of all the air we breathe.

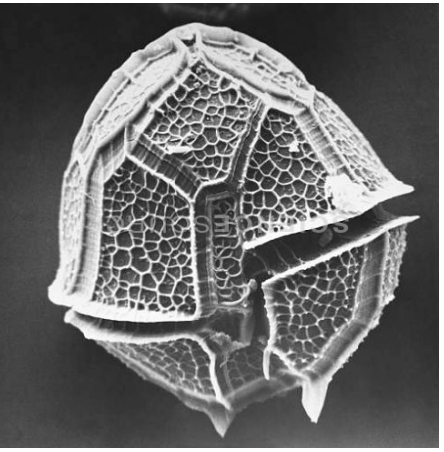
Algae can be found just about everywhere where there is light with which to photosynthesis and where water is available for reproduction. If life exists elsewhere in our solar system, an alga-like organism is among the most likely to be found.

Algae are regular used as indicators of water quality for several reasons: they are easy to collect by way of well-established sampling techniques, a significant number are ubiquitous, short generation time (one to several days) and nutrient uptake directly from the water column allow them to act as initial indicators of the impacts of changing nutrient conditions on freshwater ecosystems, etc.

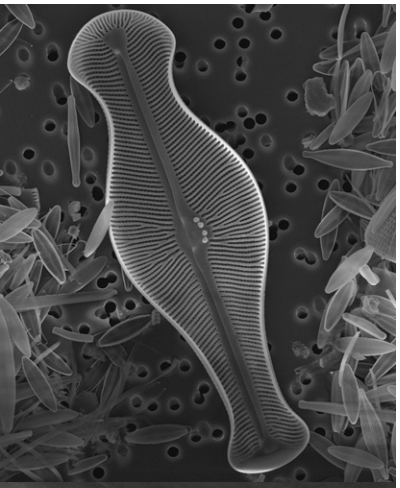
CYANOBACTERIA - one of the oldest groups of known organisms existed for about 3.5 billion years, from Pre-cambrian times, and played a significant role in oxygen accumulation in the Earth's early atmosphere making it fit for the survival of aerobic life-forms.

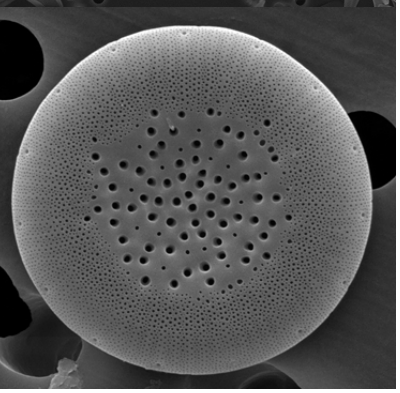


EUGLENOPHYTA - a small phylum consisting of mostly unicellular aquatic algae. Some contain chloroplasts with the photosynthetic pigments; others are heterotrophic and can ingest or absorb their food.

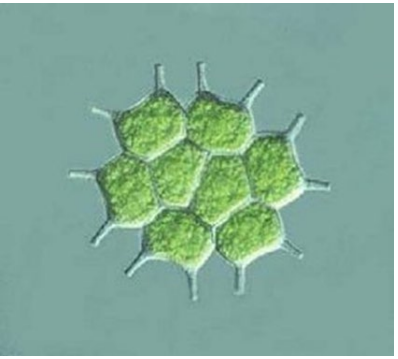


DINOFLAGELLATA - large group of flagellate protistis. They are important constituents of plankton, and as such are primary food sources in warmer oceans. Many forms are phosphorescent; they are largely responsible for the phosphorescence visible at night in tropical seas.





DIATOMS are unicellular organisms characterized by a silica shell of often intricate and beautiful sculpturing. When aquatic diatoms die they drop to the bottom and form the material known as diatomaceous earth. Diatoms can occur in a more compact form as a soft, chalky, lightweight rock, called diatomite. Diatomite is used as an insulating material against both heat and sound, in making dynamite and other explosives, and for filters, abrasives, and similar products. Diatoms have deposited most of the earth's limestone, and much petroleum is of diatom origin.



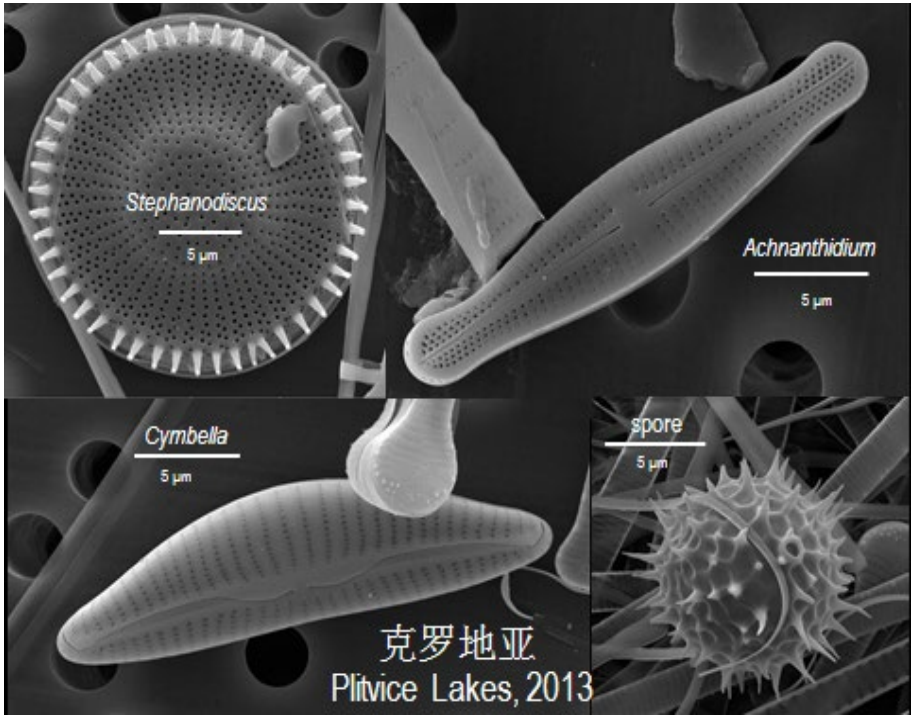
CHLOROPHYTA/CHAROPHYTA consisting of the photosyntetic organism commonly known as green algae. It is generally accepted that early chlorophytes gave rise to the plants.

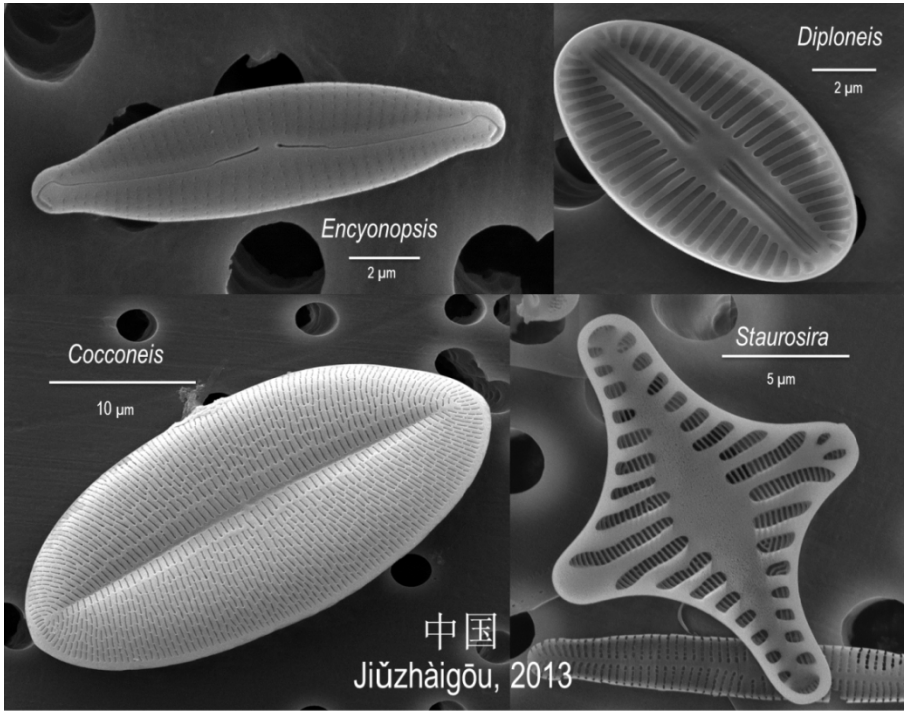
PHAEOPHYTA consisting of those organisms commonly called brown algae. With only a few exceptions, brown algae are marine, growing in the colder oceans of the world.

RHODOPHYTA consisting of the photosynthetic organisms commonly known as red algae. and are most common in warm-temperate and tropical climates, where they may occur at greater depths than any other photosynthetic organisms. Most of the coralline algae, which secrete calcium carbonate play a major role in building reefs, and they are a traditional part of oriental cuisine.

2009./2011."*Biodiversity and ecology of phytoplankton communities in Lake Jiuzhaigou Valley (China) and National Park Plitvice Lakes (Croatia)*"
2011./2013."*Application of phytobenthos in water quality assessment in karstic waters of Croatia and China*"

Why algae were the main focus of those projects?





Algal properties: small size, easy to collect, fast growth, etc. make them suitable model organisms for ecological topics in water quality, environmental protection and sustainable development.

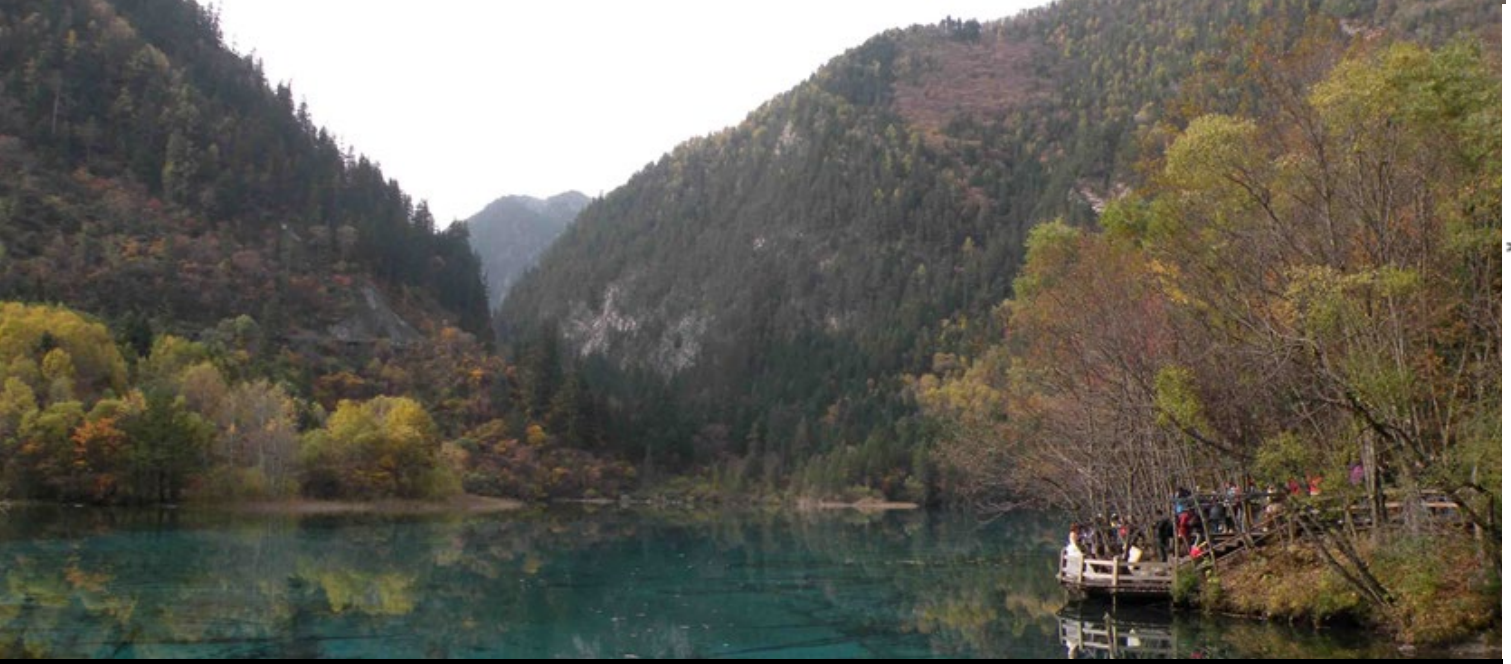
A one year climate cycle, during which land plants usually complete one life cycle, is sufficient for algae turnover in the order of 100 times.

Chengdu Institute of Biology
Chinese Academy of Sciences

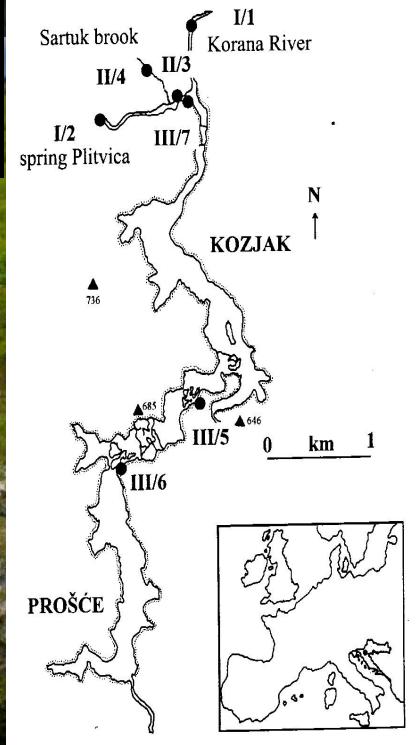
Jiuzhaigou Valley

University of Zagreb, Faculty of Science,
Department of Biology

Plitvice Lakes National Park



Each projects participant conduct the same type of investigation in their country according to national relevant methodology and place of investigation.



At the end of each project bilateral exchange was conduct

implementation and applicability of EU methodology and technology in fields related to nature conservation, ecosystem management and sustainable development of world natural heritage sites

MEMORANDUM OF UNDERSTANDING
BETWEEN
THE SCIENCE AND TECHNOLOGY DEPARTMENT OF
SICHUAN PROVINCE,
THE PEOPLE'S REPUBLIC OF CHINA
AND
THE UNIVERSITY OF ZAGREB, CROATIA

This memorandum records the intention of the Science and Technology Department of Sichuan Province and the University of Zagreb to strengthen ties between the two organizations which might lead in future to the establishment of one or more partnership agreements for science and technology exchange purposes and research program co-operation.

At present this agreement is made as a gesture of goodwill between the two organizations, which may see the development of links in the areas of:

a) Promotion and support of projects jointly carried out by the University of Zagreb and institutes from Sichuan Province to apply for the Bilateral Cooperation Program for Science and Technology between China and Croatia.

b) Collaboration in the areas including biotechnology, medicine and pharmaceutical technology, electronics information, agriculture, and environmental protection.

c) Exchange of information, documentation and research materials

d) Training and exchange of staff members in joint or collaborative programs

Cooperation under this general agreement shall be defined in separate prepared written agreements between the corresponding units and agreements must be approved and signed by authorized representatives of each party to this Memorandum.

This agreement is subject to revision, renewal or cancellation by mutual consent and becomes effective upon completion of signature for a period of 5 years.

Singed by:

Mr. Luo Zhiping,
Deputy-director General
Science and Technology Department
Of Sichuan Province
The People's Republic of China

Signed by:

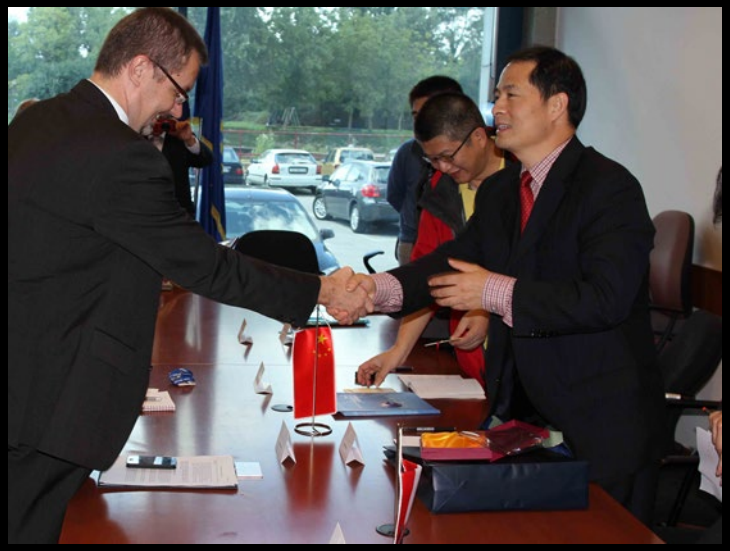
Prof. Aleksa Bjeliš,
Rector
University of Zagreb
Croatia

June, 2011

Mr Luo Zhiping, Deputy-director General, STDSP lead Sichuan delegation

As part of the mentioned events and China-Croatia exchange of experience in environmental protection and sustainable development, in September 2013, Sichuan delegation led by Mr Zhou Menglin Deputy Director-General STDSP visited Croatia and very successful and fruitful meetings with representatives of UNIZG, Croatian Ministry of Science, Education and Sports were held.

University of Zagreb



Ministry of Science, Education and Sports

United Nations Educational, Scientific and Cultural Organization · World Heritage Convention

JIUZHAI VALLEY national park

Memorandum of Understanding on the Establishment of China-Croatia Joint International Research Center for Ecological Environment Protection

Between

Jiuzhaigou National Nature Reserve, China

University of Zagreb, Croatia

and

Chengdu Institute of Biology, Chinese Academy of Sciences

Plitvice Lakes National Park, Croatia

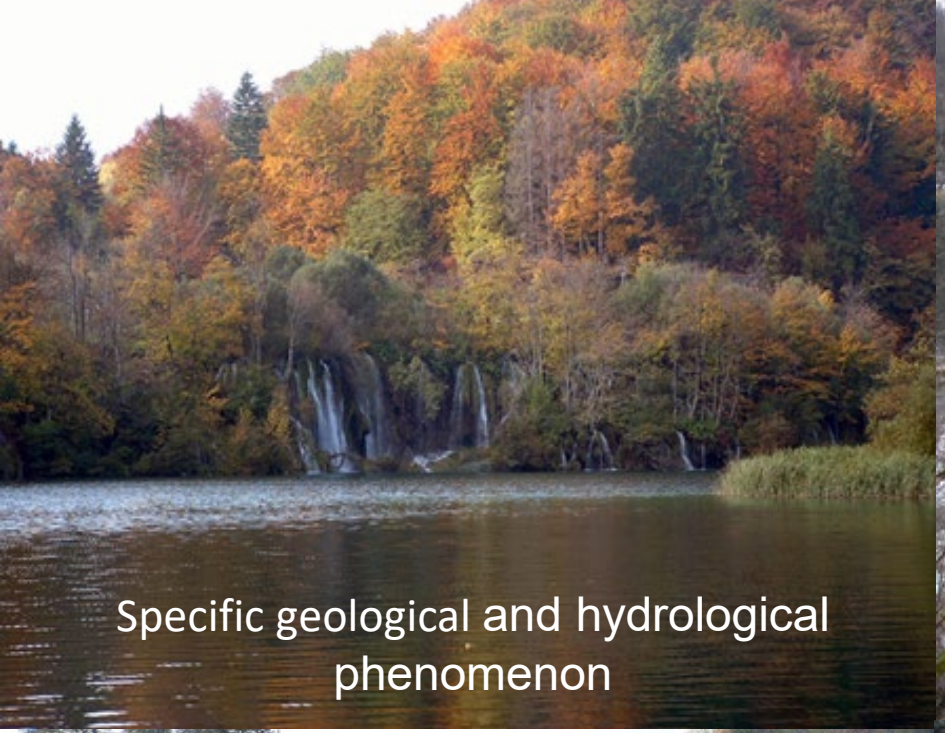
May 2014

on May 24, 2014 a high-level delegation by central government of the People's Republic of China led by vise premier h.e. Liu Yandong, visit Croatia and attend in the unveiling ceremony of establishing "China-Croatia Joint International Research Center for Ecological Environment Protection", which aims to bridge joint research staffs and organizations between our counties.

There are water, lakes, waterfalls and forest elsewhere,
but Jiuzhaigou and Plitvice Lakes are unique.
They simply must be seen!

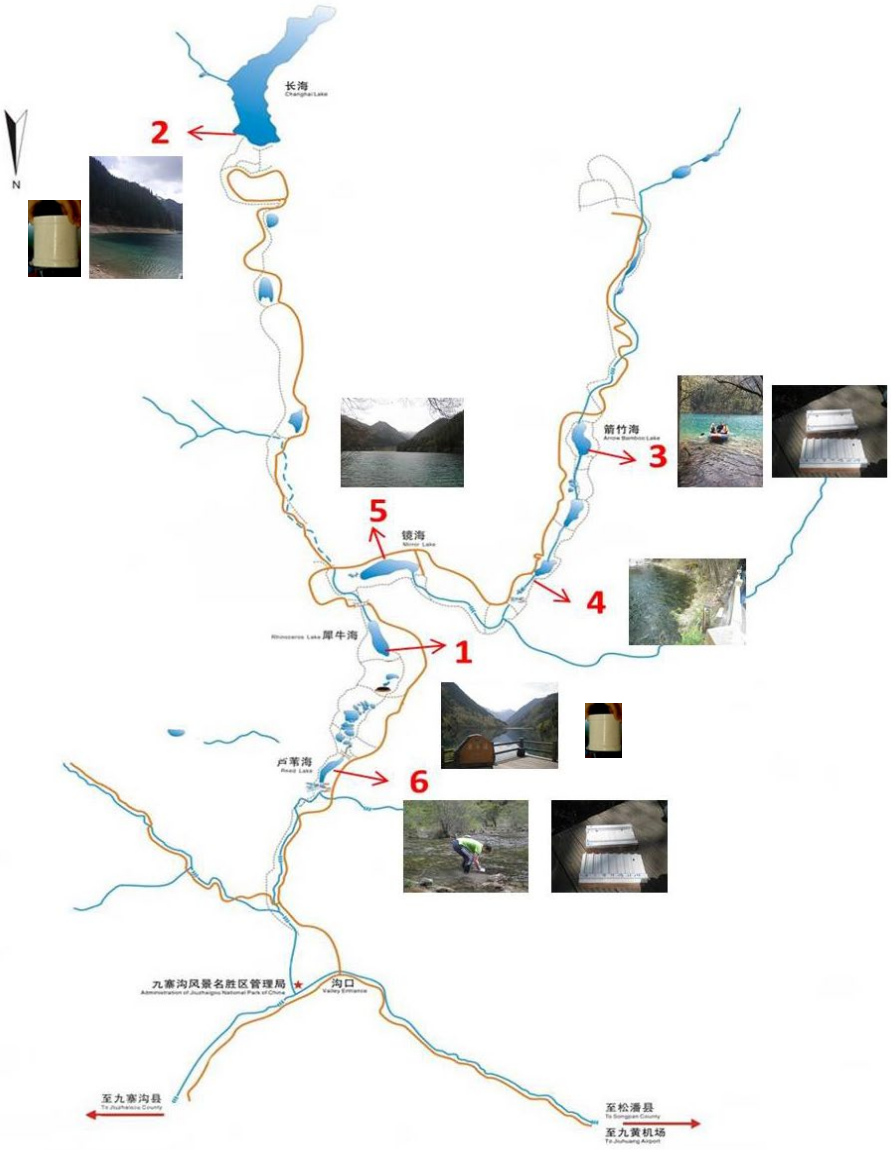

First Croatian site on
UNESCO World Heritage List
entered in 1979

established in 1949



Consists of 16 lakes, which gradually blend into one another in a long series of more than 5000 m

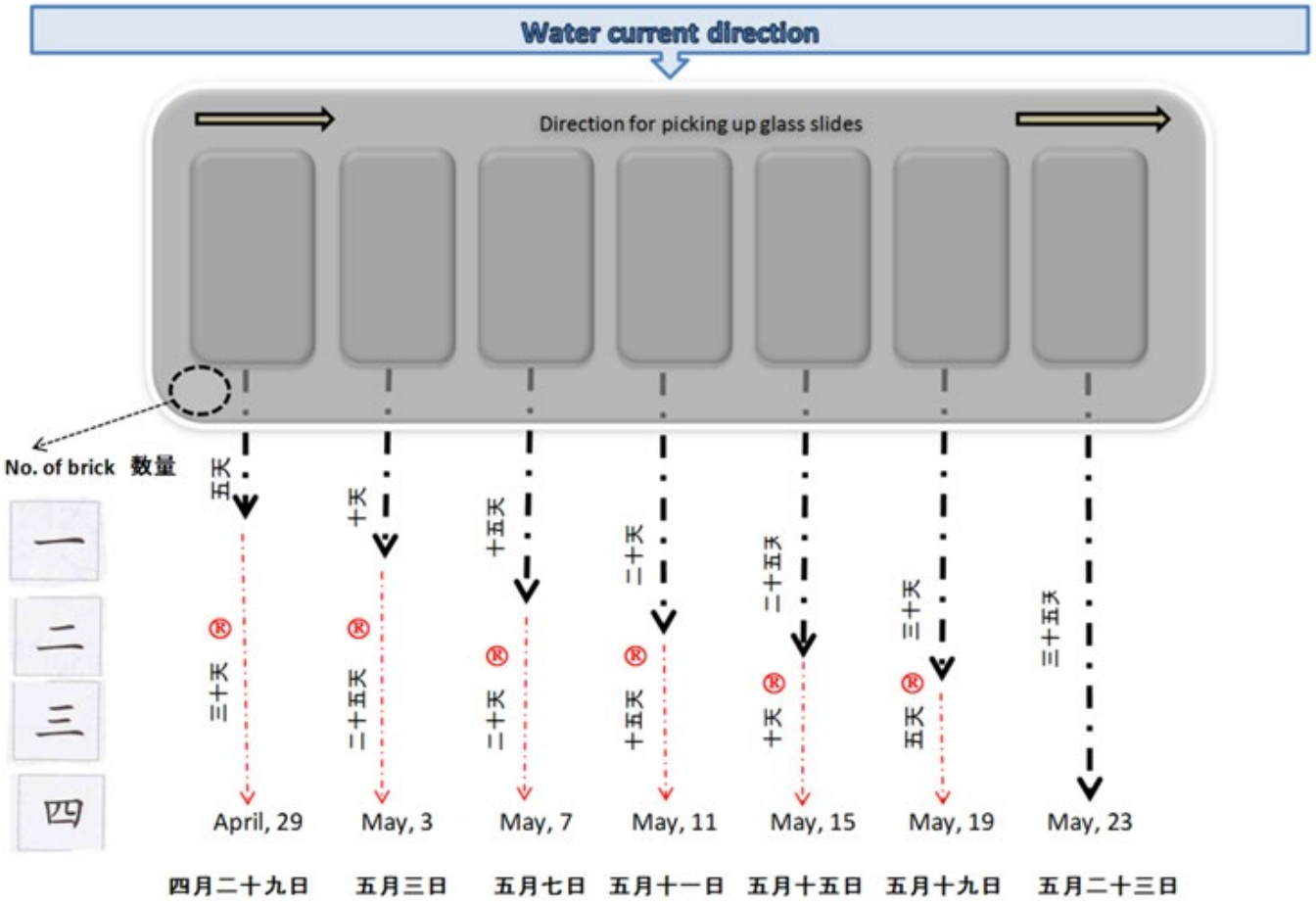


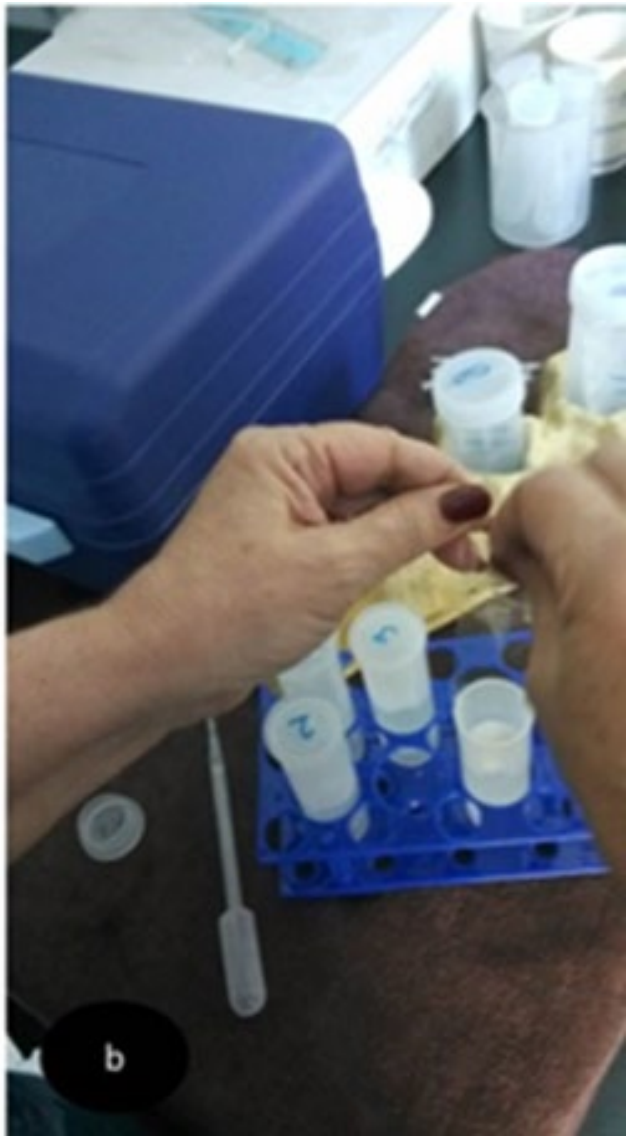
location of the sampling sites in the branch of NP Jiuzhaigou (1= Rhinoceros Lake, 2=Long Lake, 3= Arrow Bamboo Lake, 4= Mirror Lake, 5= The Peacock Riverbed, and 6= Reed Lake)


a


b



Scheme of experimental artificial plate with microscopic gasses during the sampling time



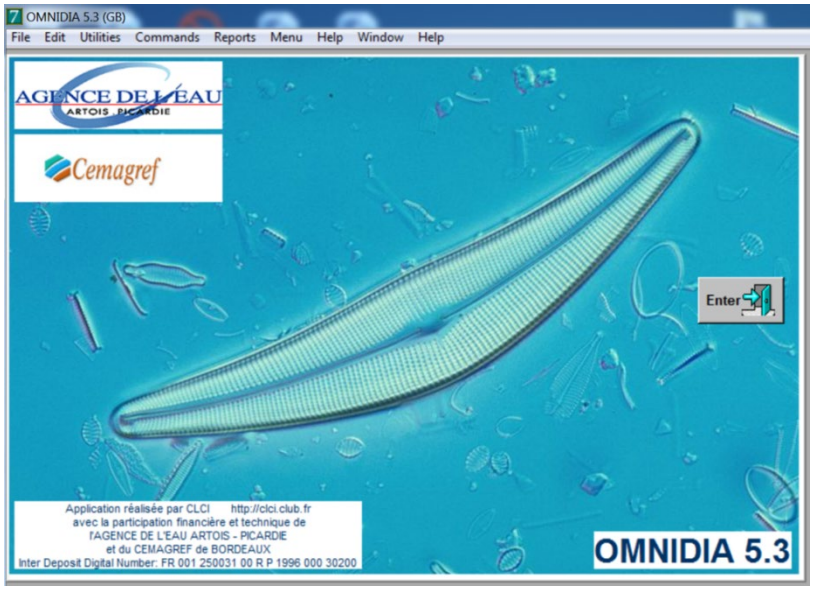
VID_20150509_114750.mp4

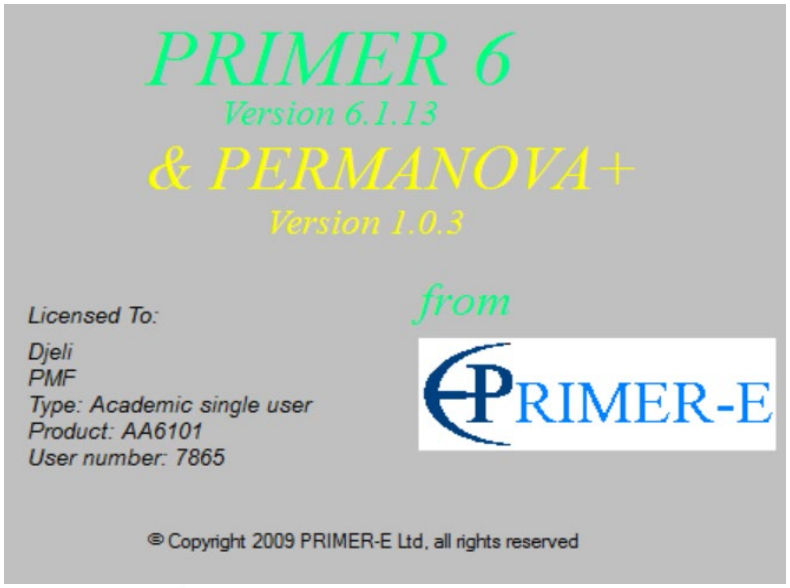
Status	Code	
High		"Reference condition" / Acceptable ecological condition
Good		
Moderate		Action needed for achieving acceptable ecological status
Poor		
Bad		

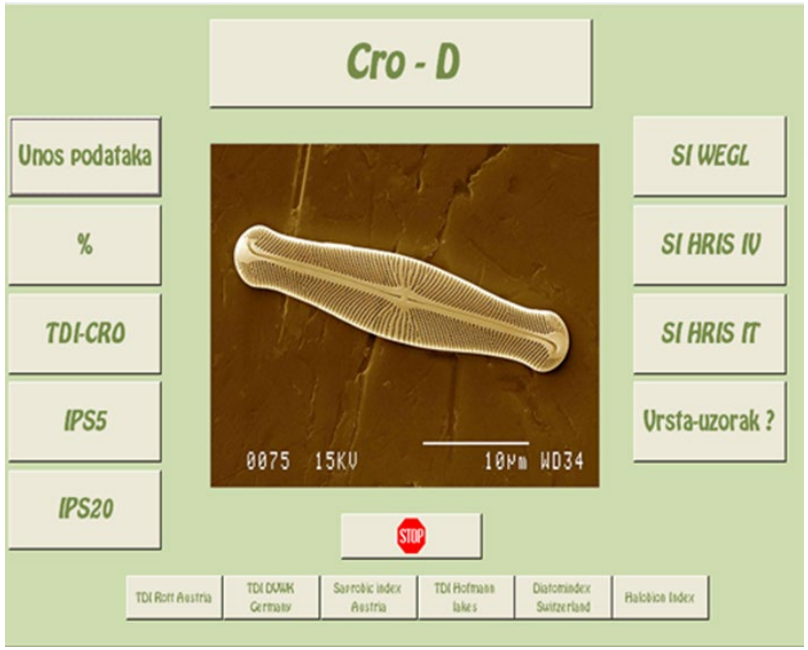
- The WFD is the most important legislation for water management in the EU. It aims is to develop a broadly applicable strategy for managing ground and surface water bodies in terms of their protection and sustainable development.
- Classification of the ecological status of water resources is carried out on the basis of biological, hydromorphological and physico-chemical elements. Biological quality elements (BQEs) used to assess the ecological status of water bodies are: phytoplankton, phytobenthos, macrophytes, macrozoobenthos and fish.

indicator value **TOLERANCE**	indicator weight **SENSITIVITY**
decimal numbers	integer numbers
1-5	1-5
1 = good indicator, tolerates low concentrations of nutrients	1= wide sensitivity range, weak indicator
5= bad indicator, tolerates high concentrations of nutrients	5= narrow sensitivity range, very good indicator

Most of diatom species indices used in the calculation/equation is assigned two values: the first value reflects the tolerance or affinity of the diatom to a certain water quality (good or bad) while the second value indicates how strong (or weak) the relationship is.



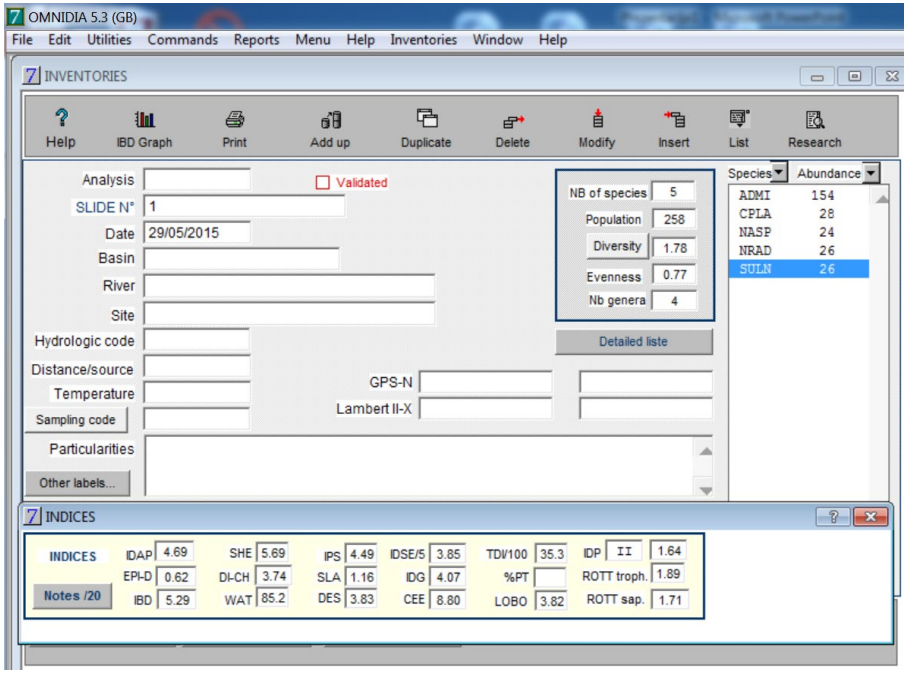


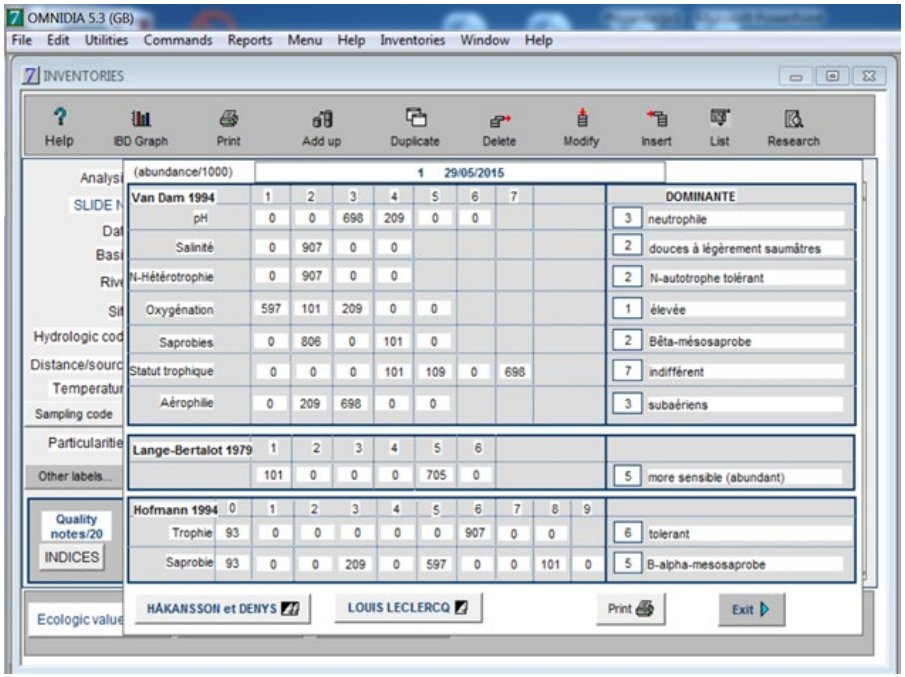


The identification of diatom species was performed with a light microscope Leicka DMLB at CIB,CAS

The diatoms were identified to at the lowest taxonomical level according to the relevant literature

METODOLOGY





QUALITY NOTES / 20

IPS	SLA	DESCY	IDSE/5	GENRE	CEE	SHE	WAT	IDAP	TDI	IBD	DI-C	EPI-D
17.6	14.5	14.5	3.85	15.6	17.7	15.9	17.2	18.5	35.3	16.6	12.6	17.1

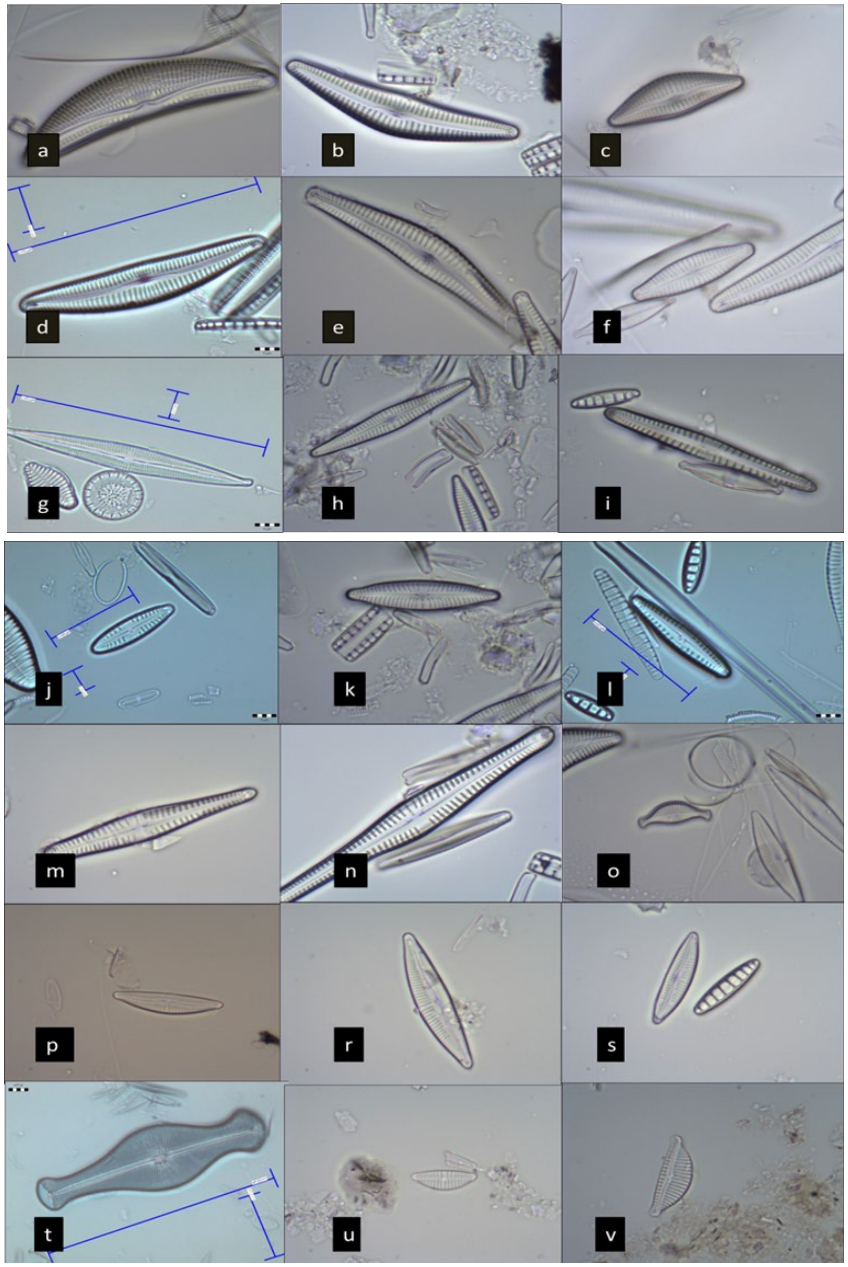
100.00 258	80.00 234	80.00 234	80.00 234	100.00 258	80.00 234	80.00 234	40.00 182	80.00 234	80.00 234	80.00 234	80.00 234	100.00 258

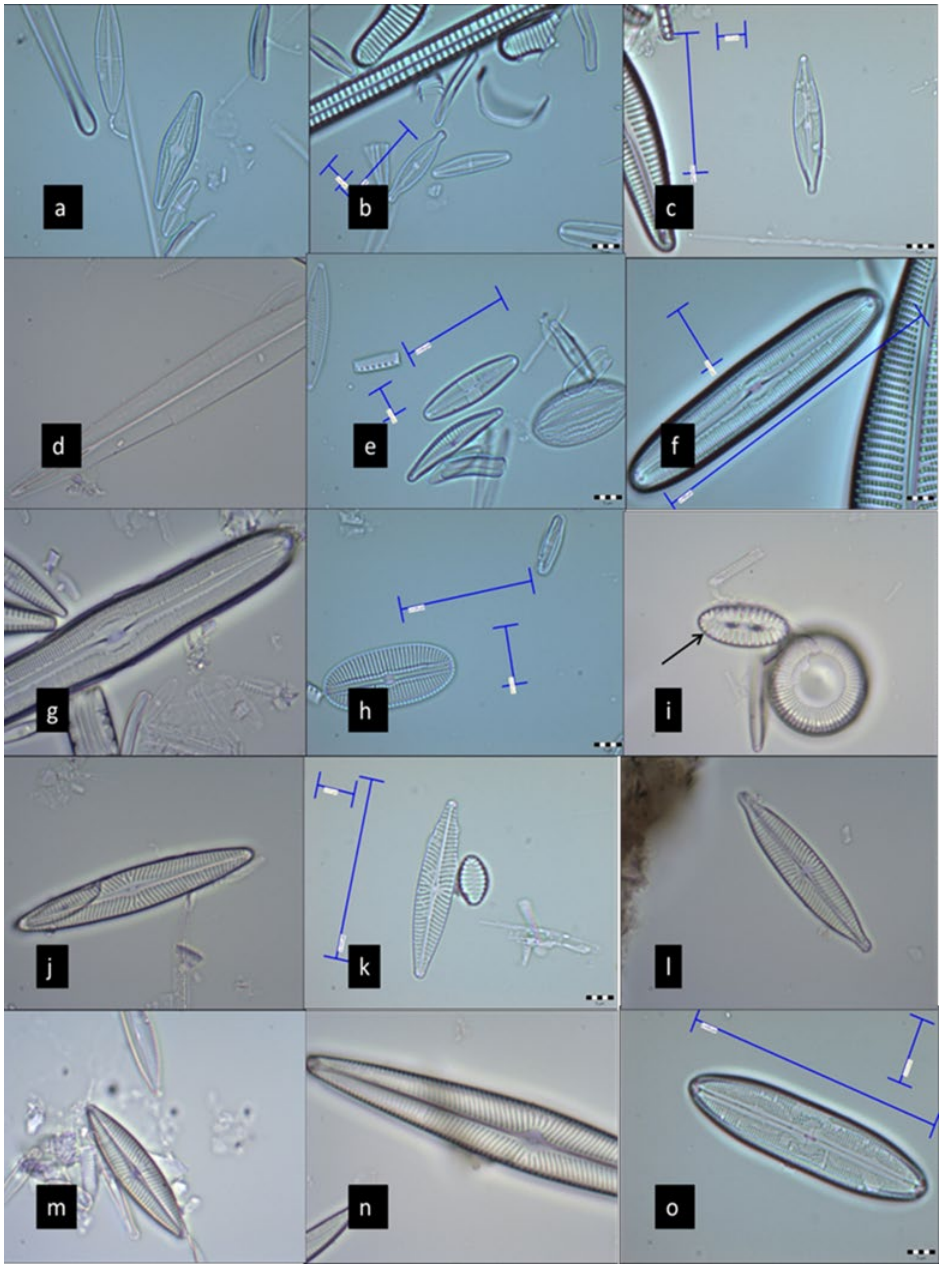
Number of species 5

Population 258

Diversity 1.78
Evenness 0.77

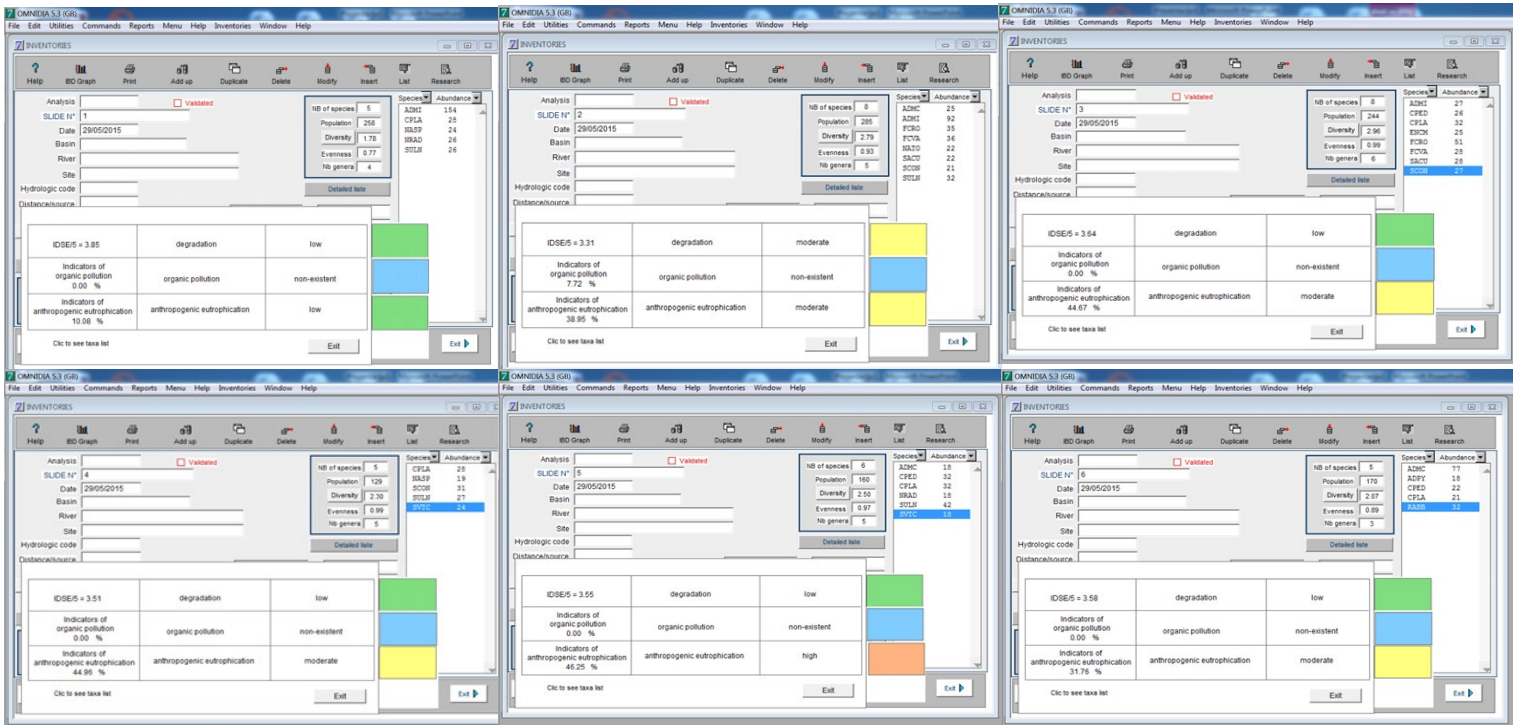
	IDP	LOBO	SID	TID
	12.2	18.9	15.2	11.6
% Tot	40.00 54	80.00 234	80.00 234	80.00 234





107 diatoms (Cymbella/Encyonema, Fragilaria)

RESULTS



1 *Achnanthidium microcephalum* Kützing
2 *Achnanthidium minutissimum* (Kützing) Czarnecki
3 *Achnanthidium pyrenaicum* (Hustedt) H.Kobayasi
4 *Cocconeis pediculus* Ehrenberg
5 *Cocconeis placentula* Ehrenberg
6 *Encyonopsis microcephala* (Grunow) Krammer
7 *Fragilaria capucina* var. *vaucheriae* (Kützing) Lange-Bertalot
8 *Fragilaria crotonensis* Kitton
9 *Navicula radiosa* Kützing
10 *Navicula* sp.
11 *Planothidium* sp.
12 *Rhoicosphenia abbreviata* (C.Agardh) Lange-Bertalot
13 *Sellaphora* sp.
14 *Staurosira sp.*
15 *Synedra acus* Kützing
16 *Synedra ulna* (Nitzsch) Ehrenberg

abundance ≥ 5%

RESULTS

OMNIDIA 5.3 (GB)

File Edit Utilities Commands Reports Menu Help Inventories Window Help

INVENTORIES

Help | IBD Graph | Print | Add up | Duplicate | Delete | Modify | Insert | List | Research

Analysis
SLIDE N° 232
Date 29/05/2015
Basin JUIZHAIGO
River
Site
Hydrologic code
Distance/source

Validated

NB of species	16
Population	1064
Diversity	3.78
Evenness	0.95
Nb genera	9

Detailed liste

Species	Abundance
ADMC	120
ADMI	119
ADPY	18
CPED	80
CPLA	113
ENCM	25
FCRO	86
FCVA	64
NASP	43
NATO	22
NRAD	44
RABB	

IDSE/5 = 3.51	degradation	low
Indicators of organic pollution 2.07 %	organic pollution	non-existent
Indicators of anthropogenic eutrophication 40.60 %	anthropogenic eutrophication	moderate

Clic to see taxa list

Exit

Exit

TAXA	ROTT Trophy		ROTT Saprobity	
	T	S	T	S
SACU	1.8	2		
SCON	2.3	2	1.4	3
SULN	3.5	4	3.2	1
SVTC	0.5	3		

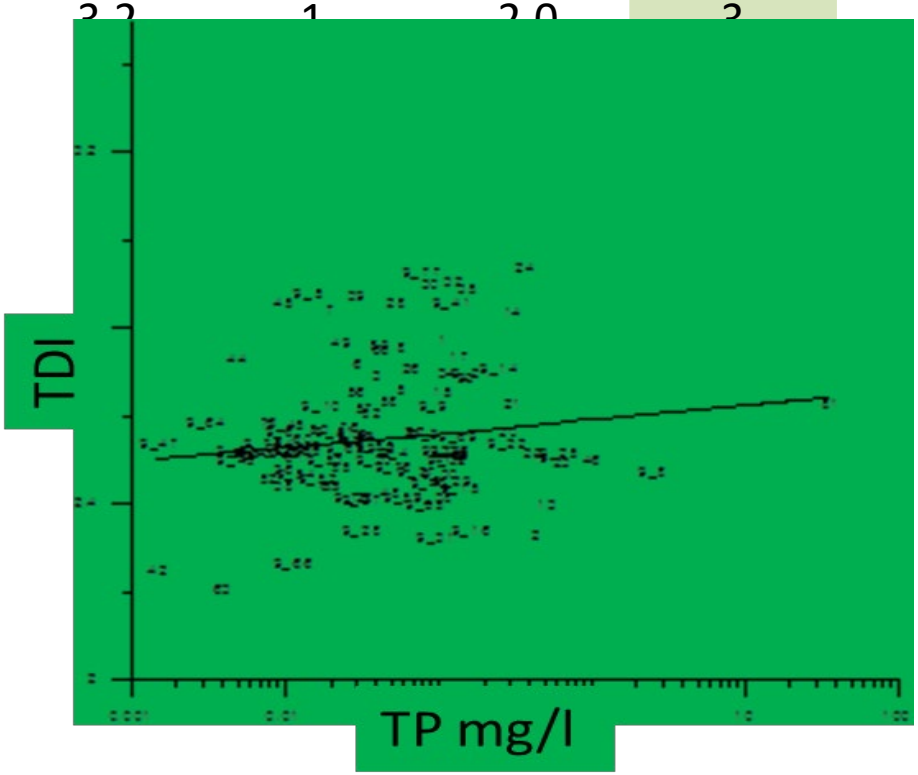
indicator value **TOLERANCE**	indicator weight **SENSITIVITY**
decimal numbers	integer numbers
1-5	1-5
1 = good indicator, tolerates low concentrations of nutrients	1= wide sensitivity range, weak indicator
5= bad indicator, tolerates high concentrations of nutrients	5= narrow sensitivity range, very good indicator

T = 13%

S = 25%

TAXA	ROTT Trophy		ROTT Saprobity		TID_{CRO}		SI_{CRO}	
	T	S	T	S	T	S	T	S
ADMI	1.2	1	1.7	1	2.5	2	2.2	1
ADPY	1.3	1	1.4	3	1.0	1	1.3	2
CPED	2.6	2					1.8	2
CPLA	2.6	2					1.8	2
ENCM	1.2	1					1.8	3
FCRO							2.0	3
FCVA	1.8	1					2.0	2
NASP							2.0	1
NATO	2.8	3					2.1	2
NRAD	0.6	3					2.1	2
RABB	2.9	2					2.1	2
SACU	1.8	2			2.1	2	2.2	2
SCON	2.3	2	1.4	3	2.0	1	1.7	2
SULN	3.5	4	3.2	1	2.1	2	2.2	2
SVTC	0.5	3			2.6	1	2.2	2

TAXA	ROTT Trophy		ROTT Saprobity		TID_{CRO}		SI_{CRO}	
	T	S	T	S	T	S	T	S
ADMI	1.2	1	1.7	1	2.5	2	2.2	1
ADPY	1.3	1	1.4	3	1.0	1	1.3	2
CPED	2.6	2	2.0	3	2.5	1	1.8	2
CPLA	2.6	2	1.8	2	2.5	2	1.8	2
ENCM	1.2	1	1.2	4	2.2	1	1.8	3
FCRO			1.4	3				
FCVA	1.8	1	2.5	2				
NASP								
NATO	2.8	3	3.4	2				
NRAD	0.6	3	1.3	4				
RABB	2.9	2	2.1	4				
SACU	1.8	2						
SCON	2.3	2	1.4	3				
SULN	3.5	4	3.2	1				
SVTC	0.5	3						



The Trophic Status Module assesses nutrient and The Saprobic Status Module assesses organic load.

ecological status	TID_{RH}
Very good	≤2,3
Good	≤2,6
Moderate	≤3,1
Bad	≤3,3
Very bad	>3,3

ecological status	SI_{HRIS}
Very good	≤1,5
Good	≤2,0
Moderate	≤2,5
Bad	≤3,0
Very bad	≤3,5

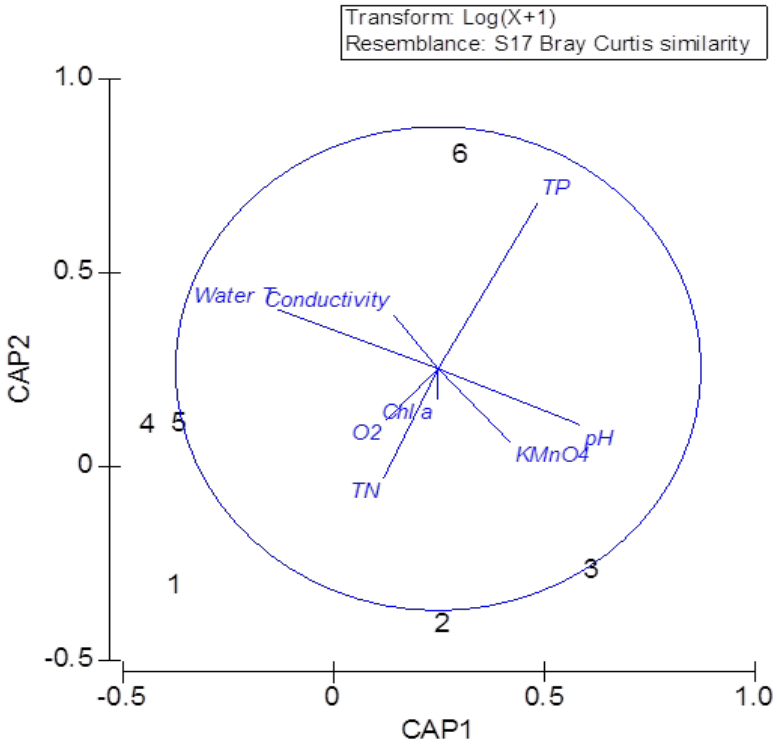
$$SI = \frac{\sum_{i=1}^{n} s_i \cdot h_i}{\sum_{i=1}^{n} h_i}$$

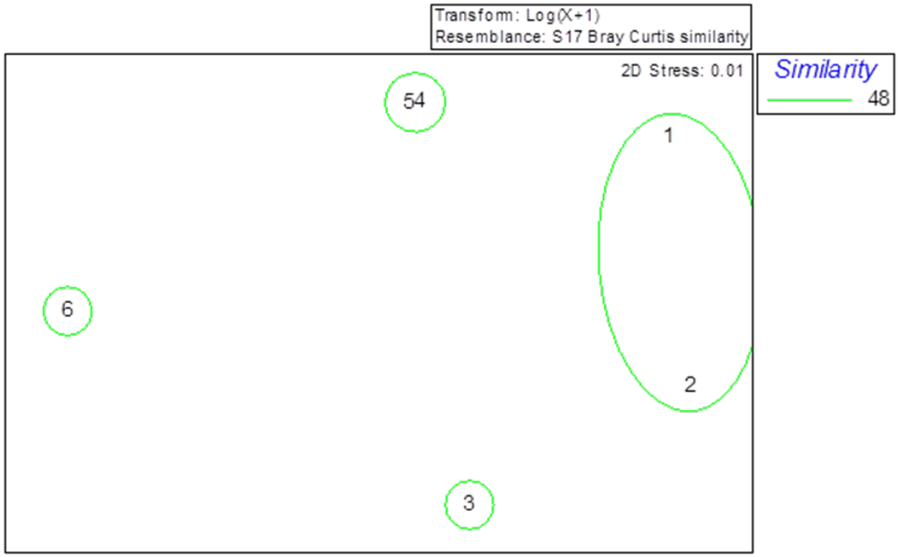
si - value for each indicator species
hi - abundance of occurrence for each species
n - number of species

TID_{CRO}	ROTT Trophy
1.0	**2.7**

SI_{CRO}	ROTT Saprobity
1.9	**2.6**

RESULTS





1= Rhinoceros Lake, 2=Long Lake, 3= Arrow Bamboo Lake, 4= Mirror Lake, 5= The Peacock Riverbed, 6= Reed Lake

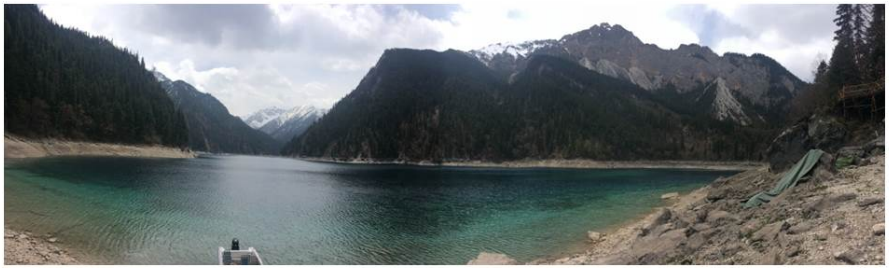
Using PRIMER 6 software for CAP analysis that allocates physical and chemical parameters and Non metric multidimensional scaling based of species abundance shows a difference affiliations of establish diatom communities on each location to measured parameters and grouping samples in 4 distinct groups which points out to the uniqueness of investigated area.

CONCLUSIONS

The aim of project was to provide a firm foundation for subsequent more detailed assessment of wider usage in ecological valorization of water resources, education of personnel in concordance to long-term strategy for development of investigations and environmental protection.

Results presents a global overview of freshwater algae biodiversity in NP Jiuzhaigou Valley and only preliminary ecological status of water quality assessment according to diatoms, with aim to strengthen ecological valorization of Jiuzhaigou Valley water quality management.

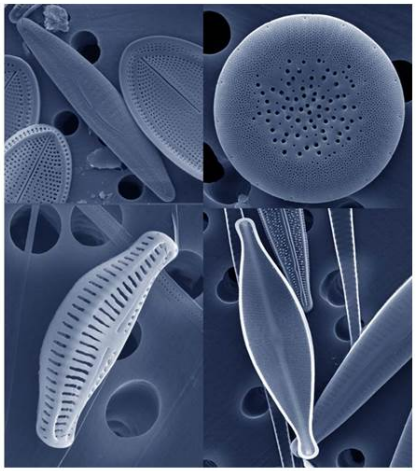
Plan for the future - to develop a stronger framework of co-operation between China and Croatia and to be more effective in the future investigations of monitoring techniques based on the ecosystem services, modernizing applicable methods in ecological valorization of water resources and landscape design in order to generate indices of their importance in concordance to long-term strategy for development of investigations and environmental protection .



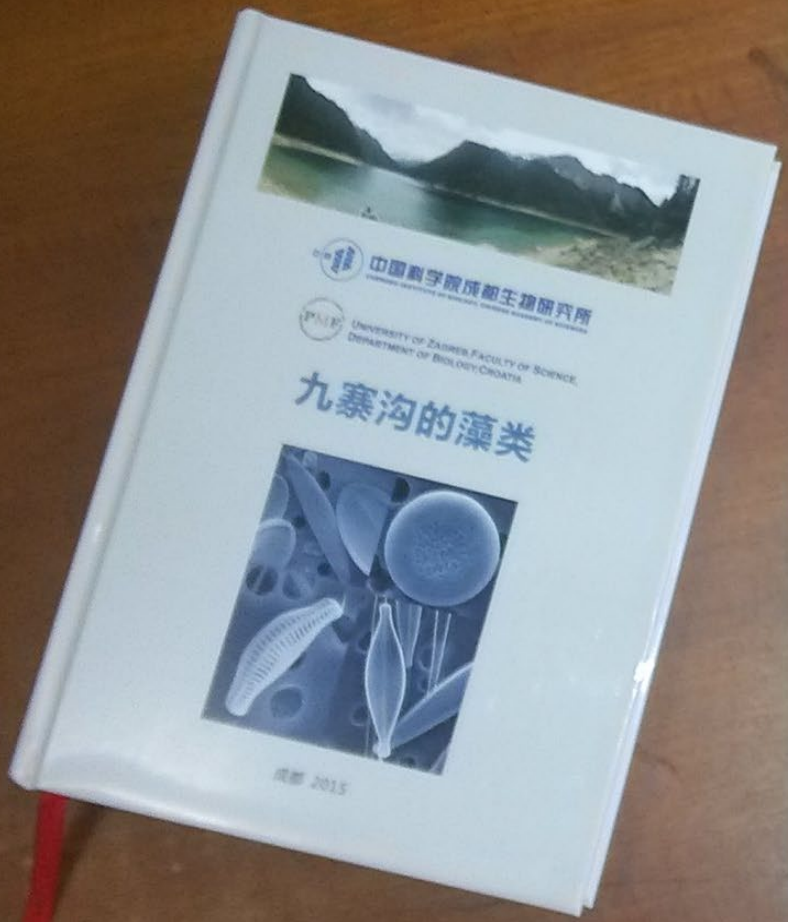
中国科学院成都生物研究所
CHENGDU INSTITUTE OF BIOLOGY, CHINESE ACADEMY OF SCIENCES

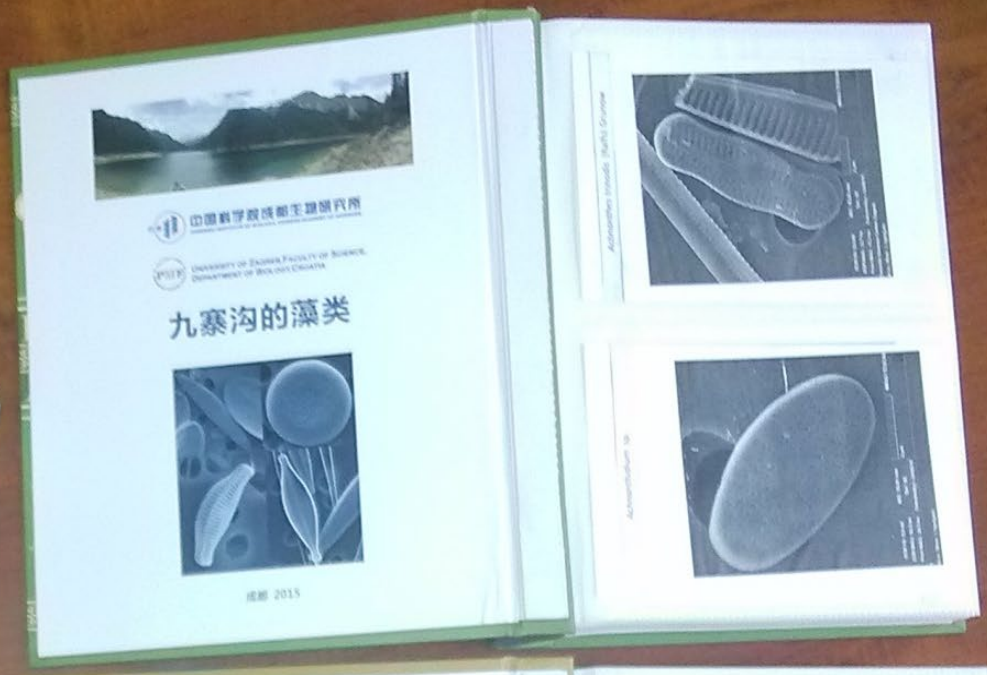
PMF UNIVERSITY OF ZAGREB, FACULTY OF SCIENCE, DEPARTMENT OF BIOLOGY, CROATIA

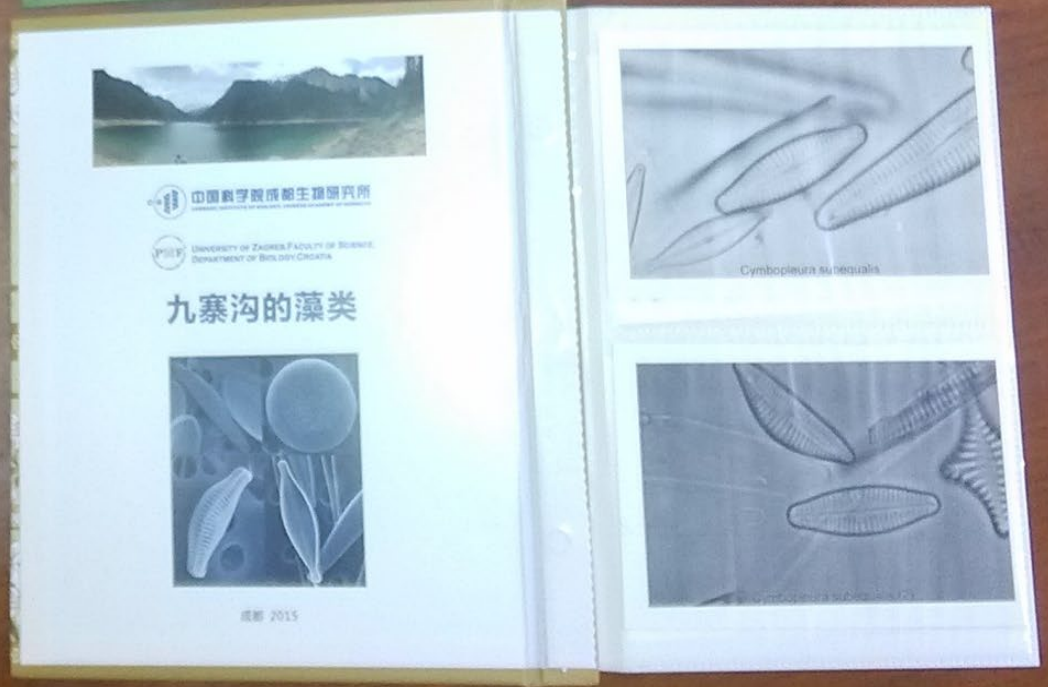
九寨沟的硅藻



成都,2015


中国科学院成都生物研究所
University of Zagreb,Faculty of Science,
Department of Biology,Croatia
九寨沟的藻类
成都 2015


中国科学院成都生物研究所
University of Zagreb,Faculty of Science,
Department of Biology,Croatia
九寨沟的藻类
成都 2015


中国科学院成都生物研究所
University of Zagreb,Faculty of Science,
Department of Biology,Croatia
九寨沟的藻类
成都 2015
Cymbopleura subequalis

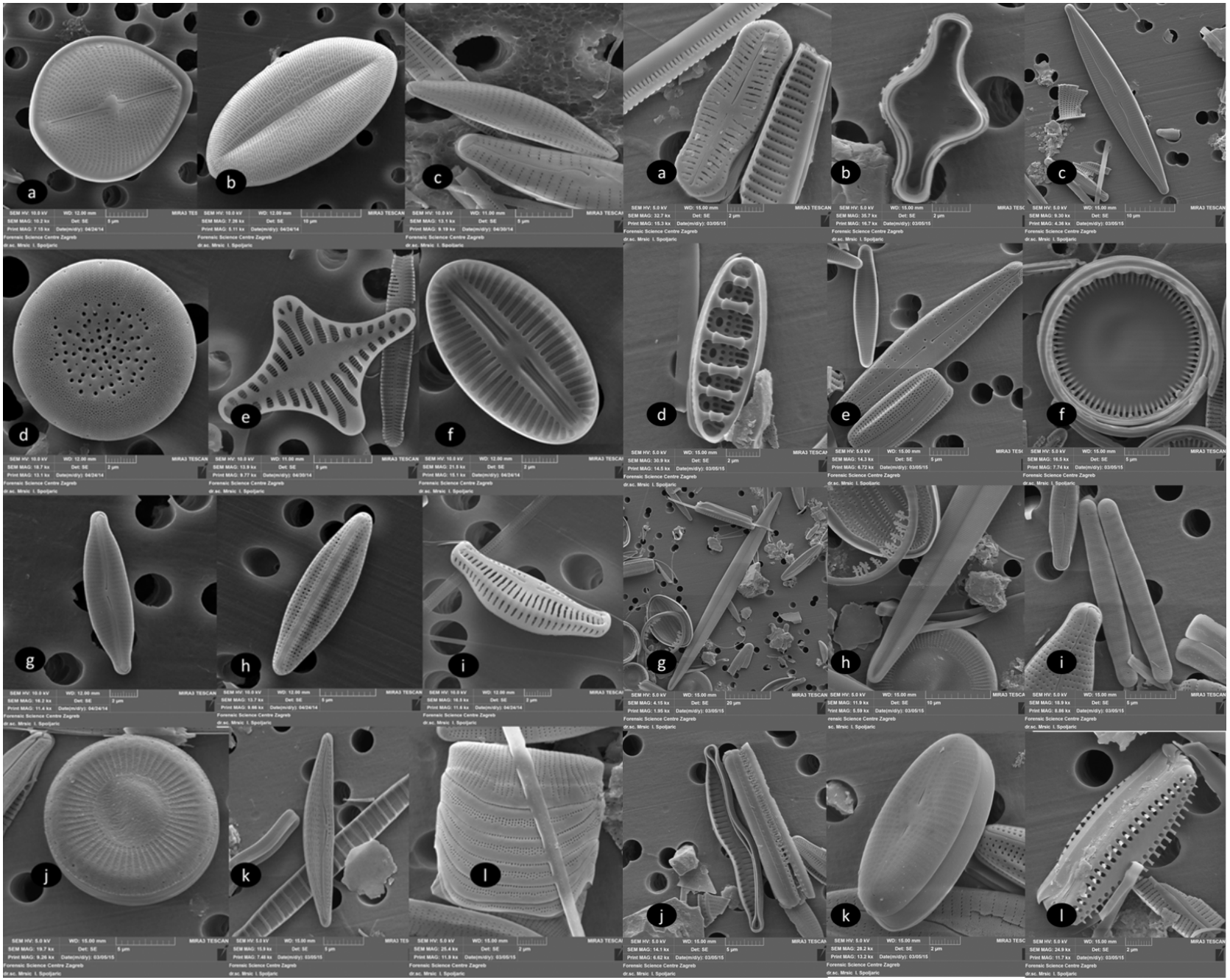


Photo albums

CONTENT

CHAPTER 1.

ALGAE

CHAPTER 2.

DIATOM SPECIES - Identification key

Chengdu Institute of Biology, Chinese Academy of Science, China

University of Zagreb, Faculty of Science, Department of Biology, Croatia

CAS President´ s International Fellowship Initiative (PIFI)

2015

Prof. Anđelka Plenković-Moraj, PhD

Given Check list of algal species from Jiuzhaigou Valley consists of several data sets: data given by authority of National park, published at the web page of National Park (418 species include), of two previous bilateral China-Croatia projects, and as result of project *Diatoms - ecological status indicators of Jiuzhaigou Valley*, financed by CAS President's International Fellowship Initiative (PIFI) for 2015.Up today, integrated list from available data sets consist of 649 algal species recorded for Jiuzhaigou Valley. All species Latin names were checked and revised according to AlgaeBASE, the main algology database obligatory used in EU. Recording algal species belongs to next Phyla: Cyanobacteria (or green-blue algae - 128 species), Dinophyta (7 species), Euglenophyta (2 species), Rhodophyta (3 species), Ochrophyta (classes *Chrysophyceae*-5 species; *Bacillariophyceae*- 299 species, *Coscinodiscophyceae*- 16 species, and *Fragilariophyceae*- 72 species); Chlorophyta (48 species), and Charophyta (69 species). According to the number of species in Jiuzhaigou National Park, predominant are diatoms, and subdominant are blue-green, and green algae. Beside the Check list of algal species, a photo album with more than 200 microphotographs of diatoms from Jiuzhaigou National Park and an Algae DataBase (Excel file) for Jiuzhaigou Valley was established too. Algae DataBase consist of detail taxonomic categories for each of 649 algal species recorded for National Park (including current status of the name), 168 pictures hyperlinked to corresponding species, and 141 hyperlinked references (books and articles) where the certain species was published.

Check list of algal species and AlgaeDataBase - Jiuzhai Valley

CHAPTER 1.

ALGAE

General characteristics, taxonomy and ecology of algae

oceans to fresh water to bare rock to soil. Some cyanobacterial species are highly toxic and others non-toxic. All blue-green algae however, contain lipopolysaccharides, which act as contact irritants. Blue-green algal blooms are natural phenomena and while it is not exactly clear what triggers a bloom, excess human sources of nutrients such as fertilizers and sewage certainly can increase the intensity of blooms (i.e. greater number of algae).

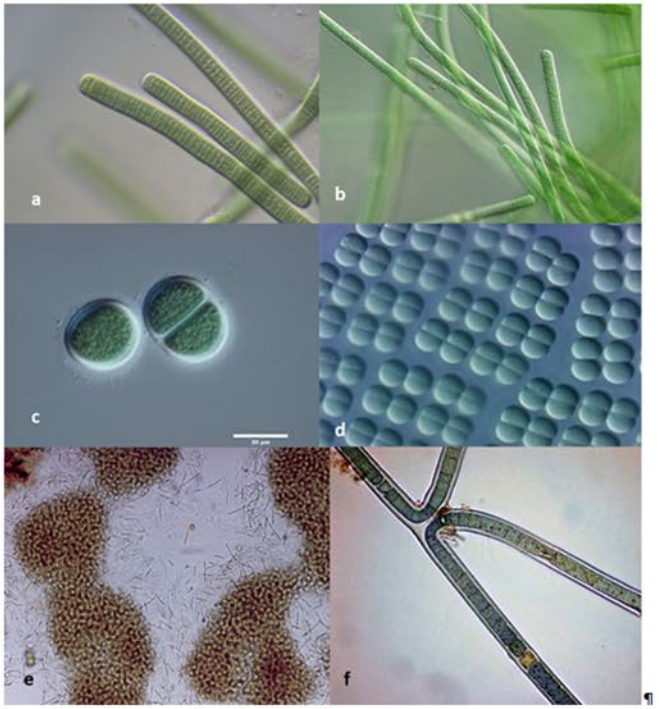


Figure 1. Cyanobacteria: a) *Oscillatoria tenius*, b) *Phormidum* sp., c) *Chroococcus turgidus*, d) *Merismopedia punctata*, e) *Microcystis aeruginosa*, f) *Scytonema* sp.

• **EUGLENOPHYTA** (Fig.2): small phylum consisting of mostly unicellular aquatic algae. Some euglenoids contain chloroplasts with the photosynthetic pigments; others are heterotrophic and can ingest or absorb their food. Reproduction occurs by longitudinal cell division. Most live in freshwater. The most characteristic genus is Euglena, common in ponds and pools, especially when the water has been polluted by runoff from fields or lawns on which fertilizers have been used. There are approximately 1000 species of euglenoids.

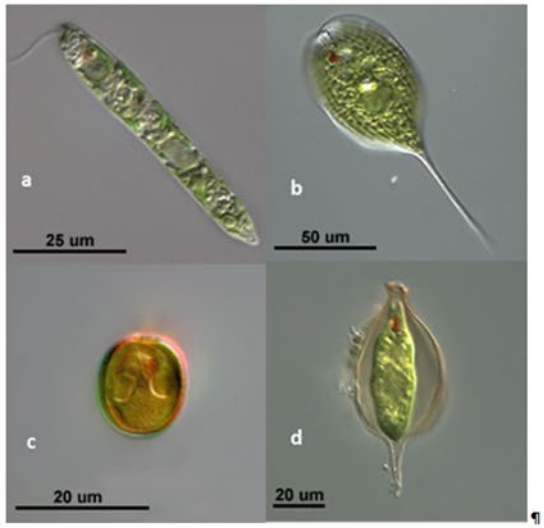


Figure 2. Euglenophyta: a) *Euglena gracilis*, b) *Phacus longicauda*, c) *Trachelomonas volvocina*, d) *Strombomonas* sp.

• **DINOFLAGELLATA** (Fig. 3) large group of flagellate protistis. Some species are heterotrophic, but many are photosynthetic organisms containing chlorophyll. Various other pigments may mask the green of these chlorophylls. Other species are

Check list of algal species - Jiuzhai Valley

able 1: Check list of algal species - NP Jiuzhaigou Valley

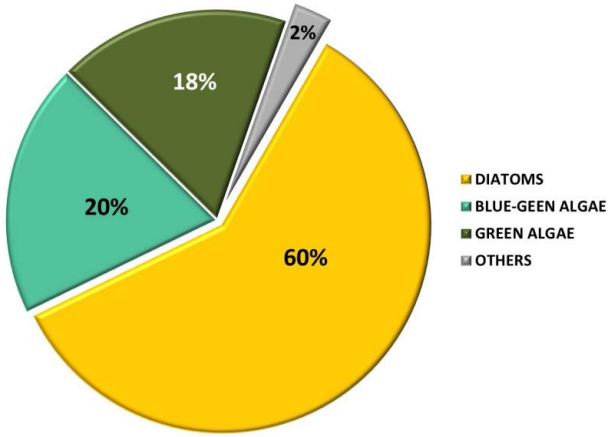
T A X A	Current status of name
mpire: PROKARYOTA	
ingdom: MONERA	
hylum: Cyanobacteria	
lass: Cyanophyceae	
Subclass: Nostocophycideae	
Order: Nostocales	
Family: Microchaetaceae	
Genus: Tolypothrix	
Tolypothrix byssoidea Kirchner	√
Tolypothrix lanata Wartmann	√
Tolypothrix sp.	√
Family: Nostocaceae	
Genus: Nostoc	
Nostoc linckia Bornet	√
Nostoc minutum Desmazières	*Nostoc commune* Vaucher
Nostoc muscorum C.Agardh	√
Nostoc punctiforme Hariot	√
Family: Rivulariaceae	
Genus: Calothrix	
Calothrix epiphytica West & G.S.West	√
Calothrix fusca Bornet & Flahault	√
Calothrix gracilis Wolly	√
Genus: Dichothrix	
Dichothrix gypsophila Bornet & Flahault	√
Dichothrix handelii Skuja	√
Dichothrix sacconemoides C.-C.Jao & Y.-Y.Li	√
Genus: Gloeotrichia	
Gloeotrichia natans Rabenhorst	√
Genus: Microchaete	
Microchaete uberrima N.Carte	*Microchaete grisea* Thuret
Genus: Rivularia	
Rivularia beccariana Bornet & Flahault	√
Rivularia jaoi H.-J.Chu	√
Family: Scytonemataceae	
Genus: Petalonema	
Petalonema alatum (Borzì) Correns	√
Petalonema crustaceum Kirchner	√
Genus: Scytonema	
Scytonema crispum Bornet	√
Scytonema hofmannii C.Agardh	√
Scytonema myochrous C.Agardh	√
Subclass: Oscillatoriophycideae	
Order: Chroococcales	
Family: Chroococcaceae	
Genus: Asterocapsa	
Asterocapsa changbaishanensis Wang	√

consists of several data sets:

- data given by authority of National park, published at the web page of National Park
- of two previous bilateral China-Croatia projects
- as result of project Diatoms - ecological status indicators of Jiuzhaigou Valley

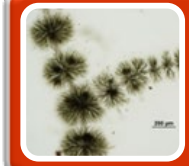
Up today, integrated list, from available data sets, consist of 649 algal species recorded for Jiuzhaigou Valley.

All species Latin names were checked and revised according to AlgaeBASE (main algology database for terrestrial, marine and freshwater organisms, obligatory used in EU).



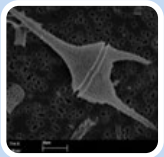
CYANOBACTERIA - 128 species

- No. of genus =35
- ***Chroococus*** **-** 20 species



RHODOPHYTA - 3 species

- No. of genus = 2
- 3 species



DINOPHYTA - 7 species

- No. of genus = 4
- 3 species

CHRYSOPHYCEAE - 5 species

- No. of genus = 2
- 5 species

EUGLENOPHYTA - 2 species

- No. of genus = 2
- 2 species

BACILARIOPHYCEAE - 387 species

- No. of genus = 76
- ***Cymbella*** **-** 46 species

CHLOROPHYTA - 48 species

- No. of genus = 24
- ***Scenedesmus- 7*** species

CHAROPHYTA - 69 species

- No. of genus = 16
- ***Cosmarium*****- 20 species**

CONTENT

Chapter 2

Chengdu Institute of Biology, Chinese Academy of Science, China

University of Zagreb, Faculty of Science, Department of Biology, Croatia

CAS President's International Fellowship Initiative (PIFI)

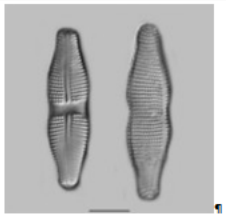
2015

Prof. Anđelka Plenković-Moraj, PhD

Composition and abundance of diatom species are well known to reflect the biotic conditions of freshwater ecosystems. Together with aquatic invertebrates or "bugs" and fish, diatoms are an indispensable component for environmental monitoring and assessment programs, especially in Water Quality Assessments. Diatoms are sensitive to human impacts on watersheds and the condition of diatom populations reflects the aquatic ecosystem response to environmental stress. This identification key to the genera of diatoms is provided, along with guides to the identification of the most common species within the larger genera, and users should find here sufficient information. This book is compilation of several free on-line identification keys (e.g. Diatom Ecological Database M. Kelly 2000: Field Studies, 9).

DIATOM SPECIES Identification key

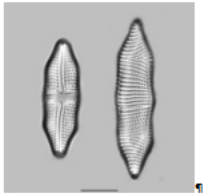
Morphology, ecology, physiology, habitats, adaptation, classification



Achnanthes coarctata

1. Valve margin biundulate
2. Raphe valve with central fascia
3. Areolae distinct
4. Rapheless valve with eccentric axial area

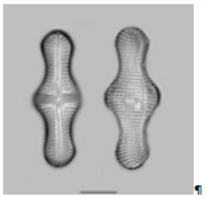
Monoraphid – Valves have biundulate margins, with a central constriction. The raphe valve face has a broad, central fascia. The fascia maybe asymmetric. The rapheless valve has a narrow, eccentric axial area. Striae are uniseriate and distinctly punctate.



Achnanthes felinophila

1. Valves triundulate
2. Ends cuneate
3. Proximal raphe ends deflected slightly
4. Rapheless valve with eccentric axial area

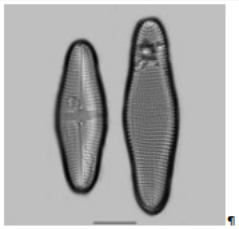
Monoraphid – Valves are distinctly triundulate in large specimens, becoming less triundulate and more lanceolate in smaller valves. The valve ends are narrow and cuneate. The raphe valve has a narrow axial area and a rectangular central area, extending to the valve margin. The proximal raphe ends are slightly unilaterally deflected slightly. The rapheless valve has an eccentric axial area. Striae are punctate and radiate throughout the raphe valve. Striae on the rapheless valve are parallel in the center, becoming radiate and curved at the ends. ..... Prijelom stranice .....



Achnanthes inflata

1. Valve margin triundulate
2. Raphe valve with central fascia
3. Areolae distinct
4. Rapheless valve with eccentric axial area

Monoraphid – Valves are broad, with triundulate margins. The raphe valve face has a broad, central fascia. The rapheless valve has a narrow, eccentric axial area that crosses one side of the central undulation. Areolae are uniseriate and distinctly punctate.



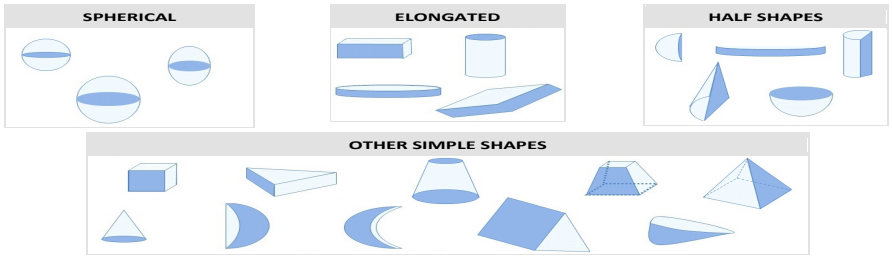
Achnanthes longboardia

1. Valves lanceolate
2. Raphe valve with laterally expanded central area
3. Rapheless valve with eccentric axial area
4. Ends broadly rounded

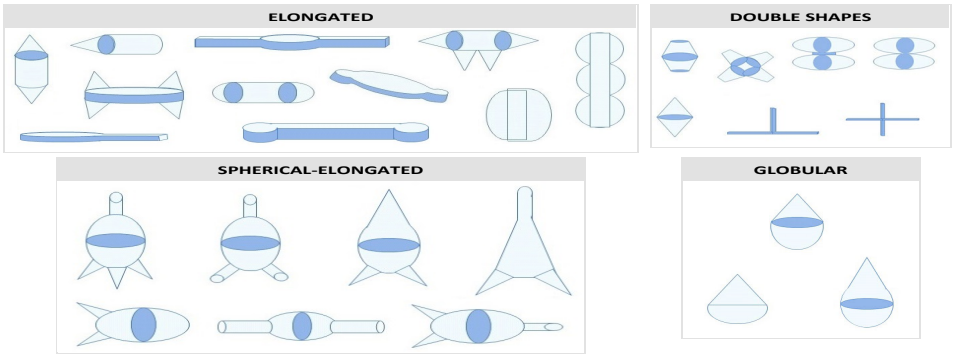
Monoraphid – Valves lanceolate, slightly swollen near the center, with broadly rounded ends. The raphe valve with a narrow axial area and wide central area, expanded laterally to the valve margins. The proximal raphe ends are slightly deflected in the same direction. The rapheless valve with an axial area positioned near the valve margin.

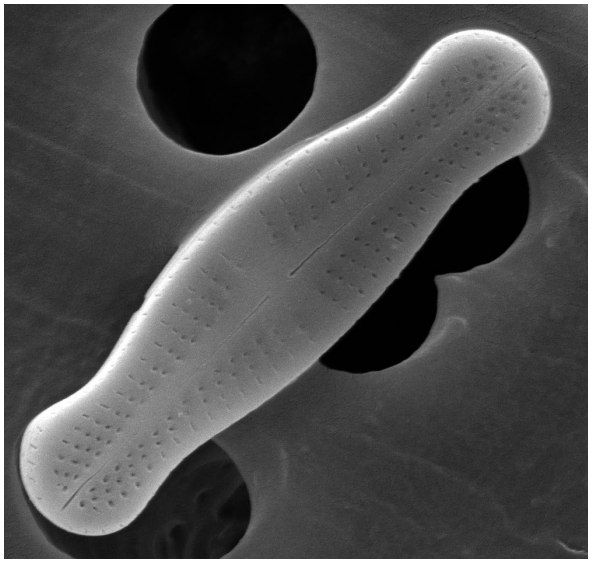
..... Prijelom stranice .....

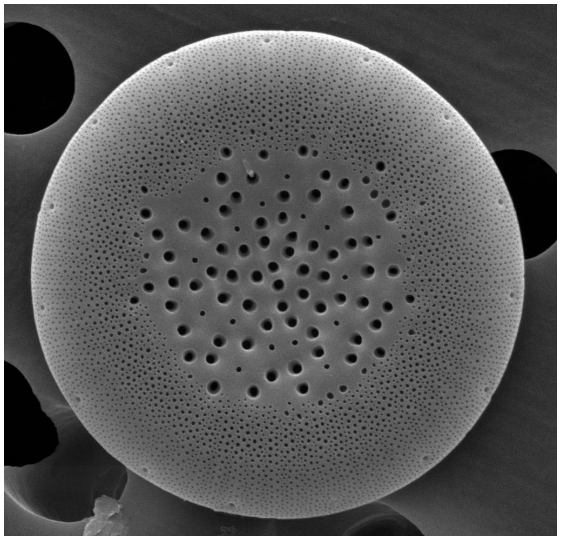
SHAPES



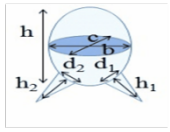
COMPLEX SHAPES







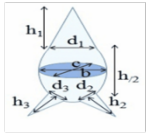
30 Ellipsoid + 2 Cones



$$A = \frac{\pi}{4}(b+c)\left[\left(\frac{b+c}{2}\right) + \frac{2h^2}{\sqrt{4h^2-(b+c)^2}}\sin^{-1}\frac{\sqrt{4h^2-(b+c)^2}}{2h}\right] + \\ + \frac{\pi}{4}d_1\left(\sqrt{d_1^2+4h_1^2}-d_1\right) + \frac{\pi}{4}d_2\left(\sqrt{d_2^2+4h_2^2}-d_2\right)$$

$$V = \frac{\pi}{6}bch + \frac{\pi}{12}d_1^2h_1 + \frac{\pi}{12}d_2^2h_2$$

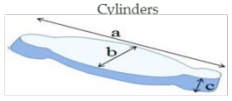
31 Half ellipsoid + 3 Cones



$$A = \frac{1}{2}\left\{\frac{\pi}{4}(b+c)\left[\left(\frac{b+c}{2}\right) + \frac{2h^2}{\sqrt{4h^2-(b+c)^2}}\sin^{-1}\frac{\sqrt{4h^2-(b+c)^2}}{2h}\right]\right\} + \\ + \frac{\pi}{4}d_1\left(\sqrt{d_1^2+4h_1^2}-d_1\right) + \frac{\pi}{4}d_2\left(\sqrt{d_2^2+4h_2^2}-d_2\right) + \frac{\pi}{4}d_3\left(\sqrt{d_3^2+4h_3^2}-d_3\right)$$

$$V = \left(\frac{\pi}{12}bch\right) + \left(\frac{\pi}{12}d_1^2h_1\right) + \left(\frac{\pi}{12}d_2^2h_2\right) + \left(\frac{\pi}{12}d_3^2h_3\right)$$

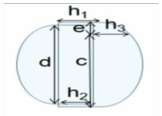
32 Prism on elliptical base + 2 Cylinders



$$A \approx \frac{\pi}{2}[(a\,b) + (b\,c) + (a\,c)]$$

$$V \approx \frac{\pi}{4}abc$$

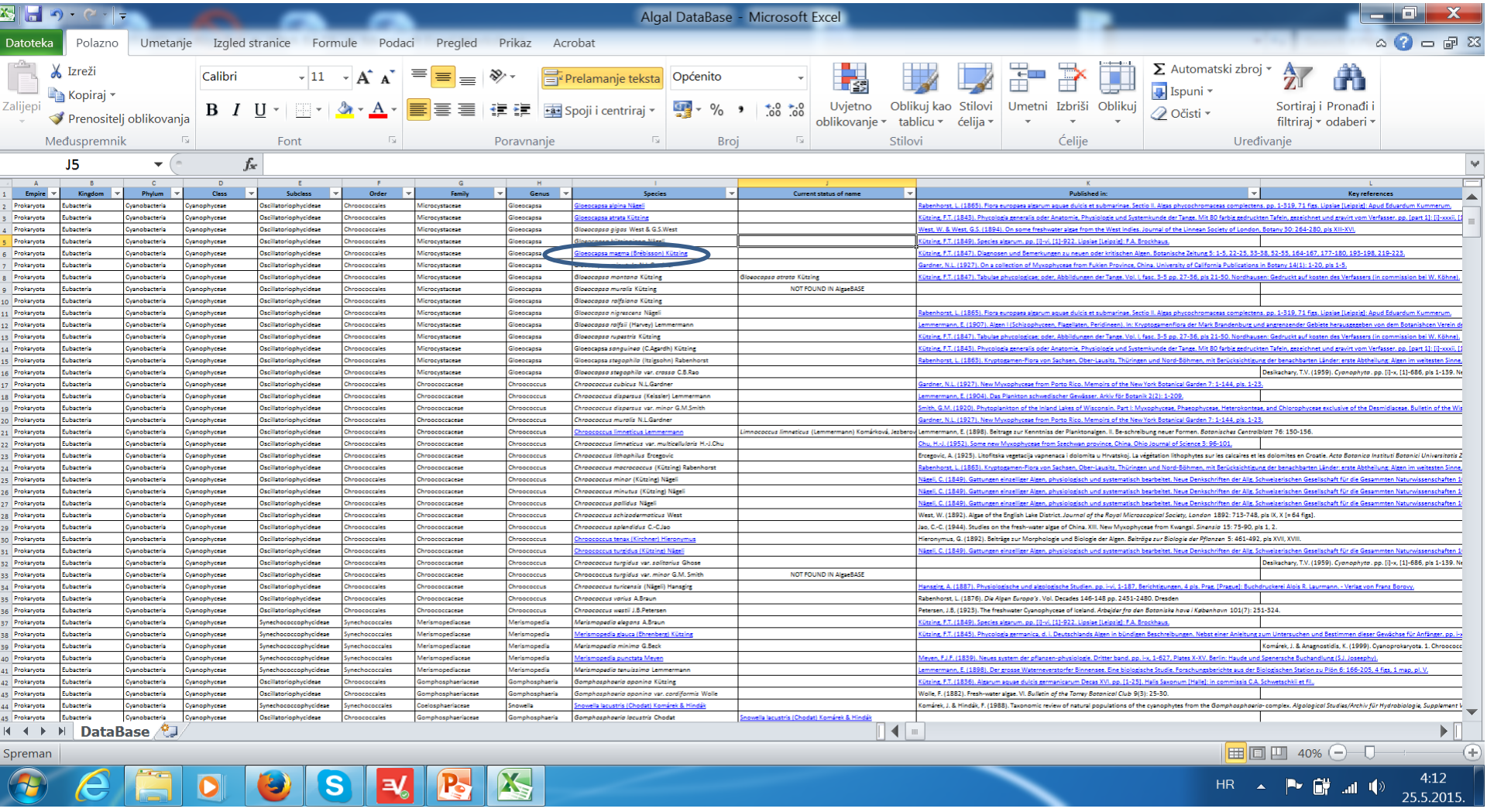
33 Cylinder with asymmetric bulging sides

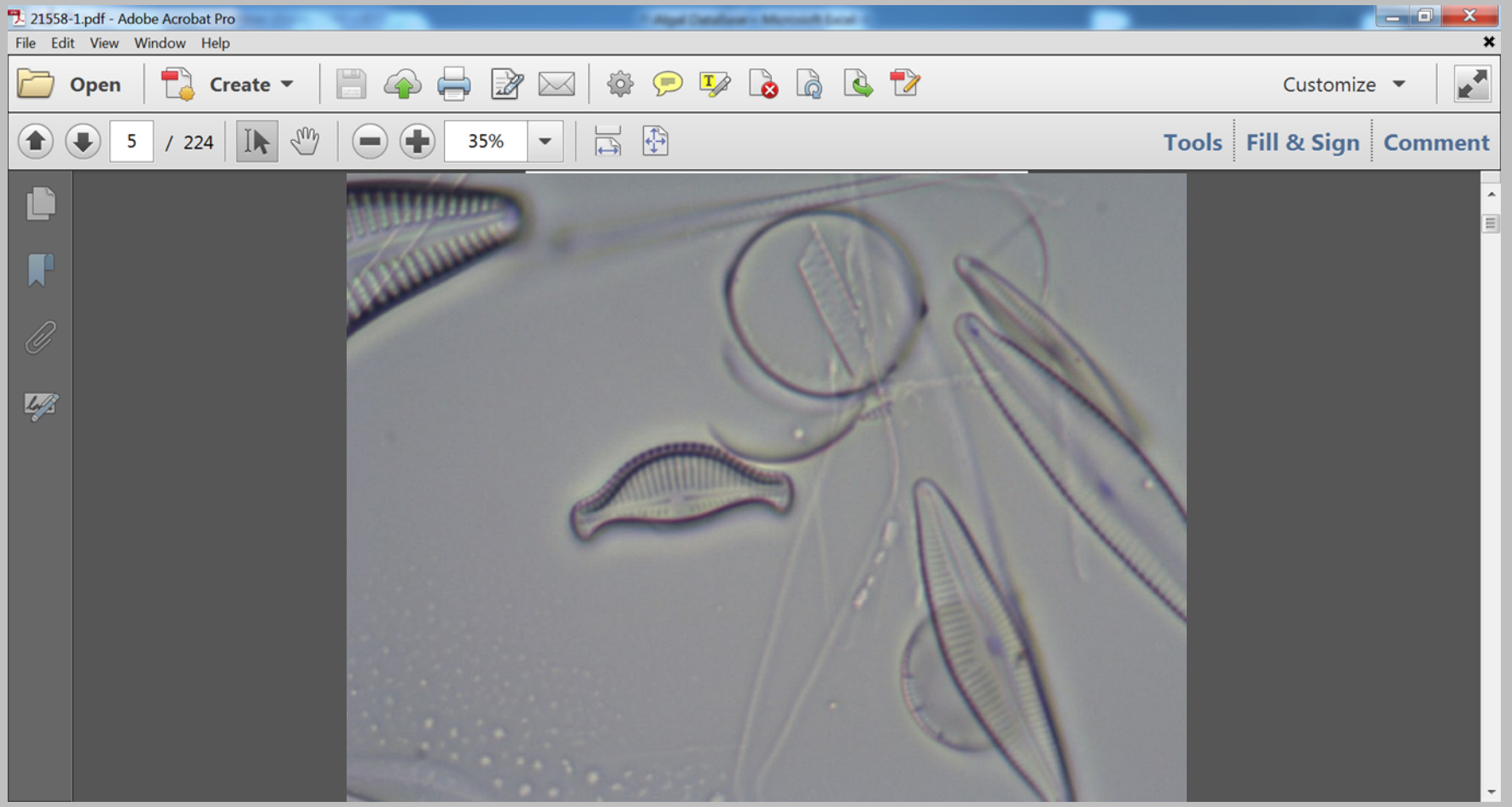


$$A = \text{under construction}$$

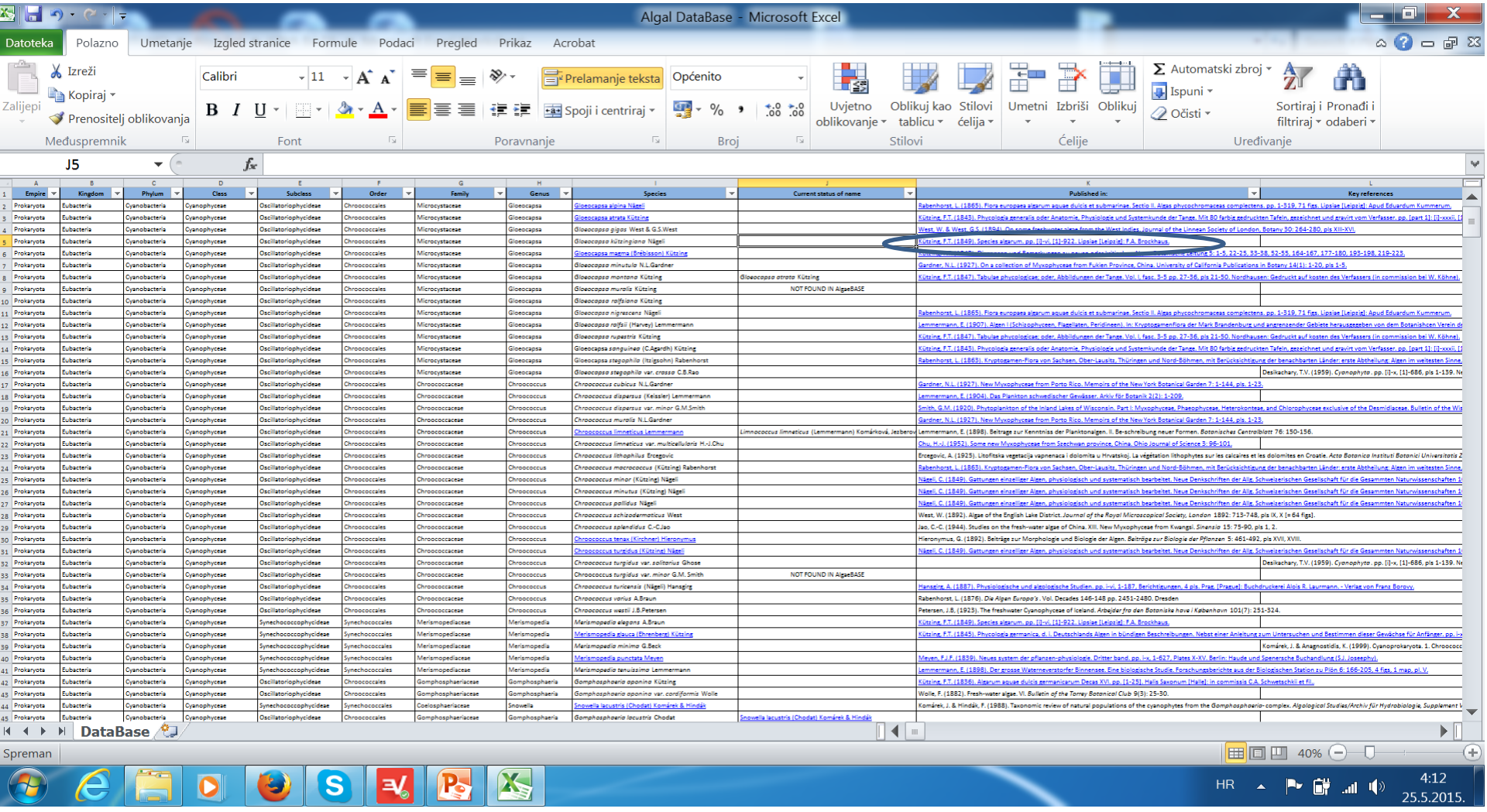
$$V = \frac{\pi}{8}d^2(h_1+h_2) + \pi h_3\sqrt{c\,e}\left(\frac{2}{3}e + \frac{1}{3}c\right)$$

- an e-version of Algae DataBase for Jiuzhaigou Valley is under construction
- it consists of detail taxonomic categories for each of 649 algal species recorded for National Park (including current status of the name), 168 pictures hyperlinked to corresponding species, and 141 hyperlinked references (books and articles) where the certain species was published




21558-1.pdf - Adobe Acrobat Pro
File Edit View Window Help
Open
Create
Customize
5 / 224
35%
Tools
Fill & Sign
Comment

- an e-version of Algae DataBase for Jiuzhaigou Valley was established
- it consists of detail taxonomic categories for each of 649 algal species recorded for National Park (including current status of the name), 168 pictures hyperlinked to corresponding species, and 141 hyperlinked references (books and articles) where the certain species was published



Die kieselschaligen

Bacillarien oder Diatomeen.

Bearbeitet

von

Dr. Friedrich Traugott Kützing,

Professor bei der Realschule zu Nordhausen.

(Mit 30 vom Verfasser gravirten Tafeln.)

NORDHAUSEN, 1844.

Zu finden bei W. Köhne.


Xièxiè nín de guānzhù