

## **Syllabus Information**

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**Academic Year:** 2020/21

**Subject:** 25268 -

**Faculty / School:** 201 - Escuela Politécnica Superior

**Degree:** 571 - Degree in Environmental Sciences

**ECTS:** 6.0

**Year:** 3

**Semester:** Second Four-month period

**Subject Type:** Optional

**Module:** ---

## **1.General information**

### **1.1.Aims of the course**

### **1.2.Context and importance of this course in the degree**

### **1.3.Recommendations to take this course**

## **2.Learning goals**

### **2.1.Competences**

### **2.2.Learning goals**

### **2.3.Importance of learning goals**

## **3.Assessment (1st and 2nd call)**

### **3.1.Assessment tasks (description of tasks, marking system and assessment criteria)**

## **4.Methodology, learning tasks, syllabus and resources**

### **4.1.Methodological overview**

The learning process that has been designed for this assignment is based on the following:

- Theory sessions that will consist of participatory lectures.
- Practical sessions that will consist of field and lab work with material provided by the teacher.

This subject includes theory and practise sessions where the several targets of SDG 4, 6, 7, 14, 15 are approach.

### **4.2.Learning tasks**

The program offered to achieve the expected results include the next learning activities:

**Theory sessions:** Lectures introduce the main concepts and lines of the subject. In addition, most difficult issues will be reviewed thoroughly. Bibliography and auto-evaluation tools are provided. Readings and instructions for all practical exercises will be provided on the course website (moodle).

**Practical sessions:** Practical classes form part of the required activities for this course. If you miss a lecture or tutorial through illness or some other serious reason, it is your responsibility to attend an equivalent class from another stream. Some content and activities will not be available except by physically attending the classes, and missing material will disadvantage you in the course assessment.

### **4.3.Syllabus**

Theoretical Programme The theoretical programme is as follows:

1. Introduction. Limnology. World water cycle, primary and secondary production. Main aquatic ecosystems in Aragon.
2. Resources and factors; distribution, abundance and availability of basic elements for life. Factors, resources and sub-products relating to organism activity in ecosystems. Autoecological limitations relating to abundance; resources and other varying factors. Asymptotic yield of resources. Limiting resources. Significance of metabolic sub-products in ecosystems. Importance of the vertical axis in the organisation of material space. Gradients of redox in nature.
3. Fluvial systems and physical-chemical characteristics. The basin as a hydrological unit. Continental waters. Typology. The water cycle. Composition. Water flow. Substratum. Light and temperature. Dissolved gas. Inorganic carbon and pH regulation.
4. Fluvial systems and biological characteristics. The dynamics of nutrients. Phosphorous as a limiting nutrient. Use of dissolved and particulate organic matter. Fluvial biofilm. Microbial loop. Consumers; shredders, collectors, grazers, predators. Integration of different factors along the river. The "river continuum concept." Variation of food chain characteristics along a fluvial gradient. Mediterranean rivers. Eutrophication. Micro-contaminants.
5. Fluvial systems: Impacts. Invasive species. Eutrofication. Pollutants. Hydrological regime perturbation. Restoration of ecosystems.
6. Lake systems: Estructure and organization of abiotic factors. Dynamics. Depth profile. Stratification. Trophic state. Ligth extinction law.
7. Lake systems: Biotic factors. Organisms. Main biological traits.
8. Lake systems: Transition waters and lagoons. Dynamics. Depth profile. Stratification. Trophic state. Biotic factors. Organisms. Main biological traits.
9. Lake systems: Causes of degradation and eutrophication.
10. Reservoirs: dynamics and organisms. Impact. Taxonomical and functional diversity shift.
11. Oceanic ecosystem: littoral, benthic and pelagic zones.
12. Oceanic ecosystem: Food chain. Communities.
13. Oceanic ecosystem: Main impacts.
14. The EU Water Framework Directive. Waterbodies tipologies following the Real Decreto 817/2015. Ecological Status. Nueva Cultura del Agua Foundation.

#### Practical Programme

The practical programme is as follows:

- ? Practical case study: interpretation, summary and presentation of a scientific article
- ? Primary production and predation. The importance of "bottom-up" and "top-down" controls within the food chain.
- ? The quality of water ecosystems. Ecological status index; macroinvertebrates and chlorophyll. Field trip and practicals.
- ? Population census in nature. The effect of protection in natural aquatic ecosystems.
- ? Visits to a variety of aquatic ecosystems undergoing restoration projects.

#### 4.4. Course planning and calendar

Task / week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
<b>Activities</b>																		
Theory session	2	2	2	2	2	2	2		2	2	2	2	2	2	2	2		
Lab session	2		2		2		2		2		2		2				1	
Field work		7		5		3												
Assessment																2		
<b>Autonomous work and study</b>																		
Individual work	2		4	1	4	3	4	5	4	4	4	4	4	4	4	4	4	8
Group work		1,5		1,5		1,5		1,5		1,5		1,5						
TOTAL	6	10,5	8	9,5	8	9,5	8	6,5	8	7,5	8	7,5	8	6	6	9	8	

#### 4.5. Bibliography and recommended resources

**BB** Dodds, Walter K. Freshwater ecology : concepts and environmental applications of limnology / Walter K.

Dodds and Matt R. Whiles. 2nd ed. Burlington (Massachusetts) : Academic Press, cop. 2010

- BB** Lampert, Winfried. Limnoecology / Winfried Lampert, Ulrich Sommer. 2nd ed. Oxford [etc.] : Oxford University Press, 2010 (reimp. 2007)
- BB** Margalef, Ramón. Limnología / Ramón Margalef . [1a ed.] reimp. Barcelona : Omega, D.L. 1983 (reimp.2011)
- BB** Sevilla H., M.L., Guadarrama, R. Elementos de ecología marina. Madrid : Instituto Politécnico Nacional, 2005 [Comentario del profesor: libro electrónico]
- BB** Wetzel, R.G. (2001). Limnology: lake and river ecosystems. San Diego: Academic Press, 3rd. ed.
- BC** Allan, J. David. Stream ecology : structure and function of running waters / J. David Allan, María M. Castillo . 2nd ed. Dordrecht (Países Bajos) : Springer, cop. 2007
- BC** Conceptos y técnicas en ecología fluvial / edición a cargo de Arturo Elosegui, Sergi Sabater . Bilbao : Fundación BBVA, 2009
- BC** Goldman, Charles R. Limnology / Charles R. Goldman, Alexander J. Horne. New York [etc.] : McGraw-Hill Book Company, 1983
- BC** Invertébrés d'eau douce : systématique, biologie, écologie / Henri Tachet ... [et al.]. 2 ed. revue et augmentée. Paris : CNRS Éditions, D.L. 2010
- BC** Margalef, Ramón. Ecología / Ramón Margalef . 10a reimp. Barcelona : Omega, cop. 2005
- BC** Oscoz, J., Galicia D., Miranda R. (2011): Identification guide of freshwater macroinvertebrates of Spain. Springer
- BC** Tait, R.V.. Elementos de ecología marina : curso preparatorio / R.V. Tait . 2ª ed. Zaragoza : Acribia, D.L. 1986
- BC** Thomas, C.R. (1997). Identifying marine phytoplakton. Florida: Academic Press

#### LISTADO DE URLs:

Alba, J., et al.: Caracterización del estado ecológico de ríos mediterráneos ibéricos mediante el índice IBMWP (antes BMWI) (2002), pp. 175-185

[<https://www.limnetica.com/documentos/limnetica/limnetica-21-2-p-175.pdf>]

American Rivers (2002). The ecology of dam removal. A summary of benefits and impacts. Washington: American Rivers

[[https://www.michigan.gov/documents/dnr/ecodamrmv1\\_513770\\_7.pdf](https://www.michigan.gov/documents/dnr/ecodamrmv1_513770_7.pdf)]

Bangqi Hu, Z.Y., et al.: Sedimentation in the Three Gorges Dam and the future trend of Changjiang (Yangtze River) sediments. Hydrol. Earth Syst. Sci. 13 (2009), pp. 2253-2264

[<https://pdfs.semanticscholar.org/790d/6b8aecab63ba658f52534abfaa470cae322b.pdf>]

Dodds, W.K.: Trophic state, eutrophication and nutrient criteria in streams. En: Trends Ecol. Evol. 22, 12 (2009), pp. 669-678

[<https://www.sciencedirect.com/science/article/pii/S0169534707002765>]

Reynolds, C.S. (1984). The ecology of freshwater phytoplankton. Cambridge University Press

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[https://www.waterboards.ca.gov/waterrights/water\\_issues/programs/bay\\_delta/california\\_waterfix/exhibits/docs/petitioners\\_comments\\_2009\\_07\\_01.pdf](https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/california_waterfix/exhibits/docs/petitioners_comments_2009_07_01.pdf)  
]

Sabater, S., Elosegui, A. (2009). Conceptos y técnicas en ecología fluvial. Barcelona: Fundación BBVA

[[http://www.fbbva.es/TLFU/microsites/ecologia\\_fluvial/index.htm](http://www.fbbva.es/TLFU/microsites/ecologia_fluvial/index.htm)]

Sabater, S., Elosegui, A. (2013). River Conservation: Challenges and Opportunities. Bilbao: Fundación BBVA

[[http://www.fbbva.es/TLFU/microsites/river/river\\_conservation.html](http://www.fbbva.es/TLFU/microsites/river/river_conservation.html)]

Streble, H., Krauter, D. (1987). Atlas de los microorganismos de agua dulce: la vida en una gota de agua: libro de clasificación e ilustraciones. Barcelona: Omega

[<https://es.slideshare.net/TheLoICore/atlas-de-los-microorganismos-de-agua-dulce>]

The update recommended bibliography can be consulted in:

<http://psfunizar10.unizar.es/br13/egAsignaturas.php?codigo=25268>