PEOPLE'S DEMOCRATIC REPUBLIC OF ALGERIA

MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC RESEARCH

STATE ENGINEER TRAINING COURSES

In Ecosystem-Based Fisheries Management

Establishment	Faculty / Institut	Department
National School of Maritime Sciences and Coastal Management		**Living resources**

Field: Natural and Life Sciences (SNV)

Track**: Marine and inland hydrobiology (HBMC)**

Specialization: Ecosystem-Based Fisheries Management **(GEP)**

Academic year: 2023-2024

CONTENTS

I – Identity sheet

1. Training location :

National School of Maritime Sciences and Coastal Management
Department : Living resources

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2. Training partners *:

2.1. National partners

- Center National de Recherche et de Développement de la Pêche et de l'Aquaculture (CNRDPA).

- Laboratoire d'Etude Maritimes (LEM).
- Institut National Supérieur de la Pêche et de l'Aquaculture (INSPA).
- Institut de Technologies des Pêches et de l'Aquaculture (ITPA Collo).
- Institut de Technologies des Pêches et de l'Aquaculture (ITPA Cherchell).
- Institut de Technologies des Pêches et de l'Aquaculture (ITPA Ghazaouet).
- Ecole de Formation Technique de Pêche et d'Aquaculture de Beni-Saf (EFTPA).
- Direction de la Pêche et des Ressources Halieutiques de Ain Témouchent.
- Gouraya National Park.
- Association pour la Recherche, l'Information et la Formation Subaquatique (RECIF).
- KALYPSO scuba diving club.
- AQUAMAR scuba diving school.
- PARADIVE scuba diving club.

2.2. Higher education establishments

- Ecole Nationale Supérieure Vétérinaire d'Alger Rabie BOUCHAMA(ENSV),

- Ecole Supérieure des Sciences de l'Aliment et des Industries Agroalimentaires (ESSAIA),
- Ecole Nationale Supérieure des Forêts (ENSF),
- Ecole Supérieure en Sciences Biologiques d'Oran (ESSBO),
- Ecole Supérieure d'Agronomie de Mostaganem (ESA).
- Abou Bakr BELKAID University, Tlemcen.
- University of Science and Technology Houari BOUMEDIENE(USTHB)

2.3. Companies and other socio-economic partners :

Institution	Field of activity	Terms and conditions
CNRDPA (Bou-Ismaïl)	Fishing and aquacul-	Strategic cooperation framework agreement
PN Taza (Jijel)	ture Protected area	Scientific and technical collaboration agreement
PN Gouraya (Béjaïa)	Protected area	Scientific and technical collaboration agreement
PN Grands vents (Alger)	Protected area	Scientific collaboration agreement
CN Littoral (Alger)	Coastal protection	Scientific and technical collaboration agreement
CNRDB (Alger)	Biodiversity	Scientific and technical collaboration agreement
CEI HALFAOUI.	Environment	Scientific and technical collaboration agreement
NEPHROPS	Environmental engineering.	Scientific and technical collaboration agreement

2.4. International partners :

- Istanbul University (Turkey).
- University of Ankara (Turkey).
- Université Akdeniz (Antalya, Turquie).
- International University of the Sea (France).
- Université de Nouakchott Al Aasria (Mauritania).

3- Training context and objectives

A- Access conditions

- Diplomas required
    - ENSSMAL integrated preparatory classes
    - SNV preparatory classes
    - Licences in the SNV field - field of study: continental and marine hydrobiology
- Specific pedagogical prerequisites
    - Botany
    - Zoology
    - Microbiology
    - Ecology
    - Genetics
    - Biochemistry
- Competitive selection procedures

B- Training objectives

The aim is to train future marine scientists with a view to sustainable fishing and responsible management. Training as an engineer specializing in ecosystemic fisheries management is a multi-disciplinary, polytechnical course designed to provide the foundations needed to understand the dynamics of fisheries resources and the way fisheries operate in all marine environments.

Research is a major objective of this course, and a thesis is a natural extension. The aim is to train future marine scientists with a view to sustainable fishing and responsible management.

This training is geared towards both research and professional aspects. It is based on the life cycle and dynamics of aquatic living resources, in relation to the ecosystems in which they live, and their interactions with human activities. A large part of the course is devoted to learning quantitative analysis and modeling methods (statistical analysis, stock assessment, ecosystem models and indicators)

Students will also take courses on marine animal systematics (traditional and molecular genetic methods), biology (reproduction, diet, growth) and ecology. They will also participate in fishing campaigns deployed by sector, in particular by conducting surveys of vessel activity. This training is geared towards both research and professional careers. It is based on the life cycle and dynamics of living aquatic resources, in relation to the ecosystems in which they live, and on interactions with human activities. A large part of the training is devoted to learning quantitative analysis methods and related modeling (statistical analysis, stock assessment, ecosystem models and indicators).

C- Target profiles and skills

The range of potential outlets for future graduates of this program is highly diversified. In fact, it is a polytechnic course that trains future fisheries administration executives, as well as managers, project leaders and study managers for professional structures and structures supporting the fishing industry. It also prepares students to work in a wide range of sectors, and opens the way to a scientific career at university:

- Sea fishing

- Biotechnology

- Research & Development

Specific skills

The student takes into account a global context (socio-economic, physical, meteorological...). They are familiar with fish biology, but also with different fishing methods (using different types of nets), fisheries economics, maritime law and the environment. They also need to be computer literate to use specific software.

Graduates of this course should understand the basic assumptions, construction principles, potential and limitations of the main population dynamics models used worldwide. They will be able to analyze the uses and management methods of fisheries systems, both from a technical point of view and in terms of the strategic behavior of the various stakeholders. These students should be able to master the versatility of risk issues in different fields of practice, and to grasp the conceptual and methodological generalities and specificities.

Future graduates will be able to understand the behavior and dynamics of ecosystems, living aquatic resources and the people who exploit them, under certain conditions: they must be meticulous and have a strong taste for the field (having a "sea legs"), observation and interpretation of results; and above all, they must be able to work over the long term with real analytical and writing skills.

Cross-disciplinary skills

1. Communication: oral and written, in French and at least one foreign language, and in a style suitable for both specialist and non-specialist audiences.

2. Use digital reference tools and computer security rules to acquire, process, produce and distribute information, and collaborate internally and externally.
3. Carry out statistical calculations using single- and multi-dimensional models.
4. Master the analysis and interpretation tools used in marine ecology.
5. Know how to write: specifications, reports, summaries and assessments.
6. Read, draw up and interpret maps.
7. Know how to work with a multi-source georeferenced database.
8. Have the information needed to set up a business and the tools needed to organize organization and operation of a business.
9. Know how to carry out an ecosystem audit and an environmental impact assessment as defined by national legislation.
10. Design and manage a project.
11. Up-to-date knowledge of the field, in relation to the state of research and regulatory developments
12. Adapt to different national and international socio-professional and intercultural international contexts.
13. Elaborate climatic or environmental diagnoses by exploiting sources of information. theoretical and practical knowledge.

14. Implement innovative numerical and instrumental methodologies to answer emerging scientific or technical questions in the field of oceanography.
15. Respond to societal demands linked to climate change and variability, based on simulations and observations, and by developing decision-making tools.

D - Regional and national potential for diploma employability

The Ecosystemic Fisheries Management engineering program prepares professionals to work in all sectors: research - studies - development, administration and public sectors, production and professional organizations, environmental NGOs, enhancement and labeling of halio-food products, trade.

Graduates of ENSSMAL's Halieute program are widely recognized in national scientific, administrative and professional circles.

- Research engineer at the Research Centers
- Ministry of Fisheries
- Design engineer in the Fisheries and Aquaculture Departments
- Senior Fisheries Inspector
- Executive ecologist,
- Project manager for local authorities, consultancies, associations and marine parks,
- Aquaculture Production Manager,
- Environmental Manager,
- Company start-up (design office) …

There are also many international opportunities, particularly in European countries.

E - Gateways to other specialties

In relation to other national schools: no similar training. With regard to universities and university centers, the training is a continuation of the bachelor's degrees in natural and life sciences offered by the universities of Sidi Bel Abbès, Oran, Mostaganem, USTHB, Annaba and El Tarf. Bridges to the LMD system can easily be made.

F - Training follow-up indicators

A Pedagogical Coordination Committee will be set up for each semester and each training profile, to ensure that the modular system operates smoothly and is integrated. The Pedagogical Coordination Committee will monitor the schooling of a group of students enrolled during the semester.
It meets once a week for the first three weeks, and at least once every three weeks thereafter. At each meeting, minutes of decisions and proposals are drawn up and sent to the department and the school.
A calendar will be drawn up at the beginning of the semester or year to specify which meetings will take place in Sub-Committee and which in Committee. The running of a module will require contact between the module leader and the assistants in charge of tutorials and practical work as part of the module's teaching team.
At the end of the course, students present their final dissertation to a panel of judges, who evaluate the work and decide on its success.

G - Management capacity

24 students.

5- Specific equipment available

A- Teaching Laboratories and Equipment

Laboratory name : Marine Biology Laboratory 1 (MBL1)

N°	Designation (Alphabetical order)	Type	Quantity
1	Histological needle	Pointed	9
2	Histological needle	Arrow	8
3	Histological needle	60°	6
4	Bacs	Inox	6
5	Bacs	Plastic	4
6	Bras -Bistouris	inox	11
7	Scissors	10	12
8	Freezer	whirlpool	1
9	Freezer		1
10	Chariot	Inox	1
11	Slide blades		100
12	Ocular lens		31
13	graduated microscope lens		18
14	Blue lens		21
15	Blue/white lens		10
16	Binocular loupe	Motic	5
17	Binocular loupe	Motic(power)	5
18	Binocular loupe	Optech	2
19	cork		11
20	Laboratory scope		1
21	Camera microscope	Zeiss	1
22	Microscope	Zeiss	9
23	Microscope	Euromax	10
24	Inverter		2
25	Manual vernier calipers	Mutitoyo	4
26	Magnifier plate Black background	Plastique	27
27	Magnifier plate White background	Plastique	20
28	Transparent magnifying glass	verre	7
29	Pince		14
30	Scissor-type pliers		1
31	wash bottels	Plastique	11
32	Probe		4
33	Spatula		2
34	Watch glass		12

Laboratory name : Marine Biology Laboratory 2 (LBM2)

N°	Désignation	Type	Quantité
1	Histological needle	Straight lanceolate type	10
2	Histological needle	Straight type	8
3	Dissecting box		1
4	Scissors	Chirurgical	5
5	Scissors	inox	7
6	Freezer	whirpool infiniti	1
7	Freezer	Condor	1
8	Blades	Prepared	134
9	Blades	Slide blades	42
10	Binocular loupes	Motic	12
11	Safety goggles		1
12	Eye micrometer1	OPTIKA M-005	1
13	Eye micrometer2	OPTIKA M-005	1
14	Microscopes	Zeiss	4
15	Microscopes	Optika	5
16	Microscopes	Bioblue	4
17	Microscopes	Optech	1
18	Microscopes	hund h60	1
19	Manual calipers	MUTITOYO	4
20	Pinces	Pointed	18
21	Pinces	kocher	1
22	Tray	cork	14
23	Tray	inox	9
24	Tray	plastic	2
25	Overhead projector		
26	Scalpels and stainless steel		9
27	Sondes		3

Laboratory name : Marine Biology Laboratory 3 (MBL3)

N°	Designation	Type	Quantity
1	Dissecting needles	thin straight lines	11
2	Dissecting needles	lanceolate	10
3	Bacs	inox	6
4	Scissors	ordinary dissection	15
5	Pull-out freezer		1
6	Binocular magnifiers		20
7	Scalpel handles	/	17
8	Microscopes		20
9	Microscopes	Axio (without camera)	1
10	Vernier caliper	Manual	4
11	Pinces	kocher	3
12	Dissecting tweezers	Curve	5
13	Dissecting tweezers	flat	20
14	Dissecting tweezers	Pointed	13
15	wash bottels	/	5
16	Magnifier stages	Reversible black and white	2
17	Magnifier stages	Transparent	5
18	Sondes	Grooved	3
19	Dissecting kit	/	1
20	Watch glasses	/	6

B- Internships and on-the-job training :

Location	Number of students	Length of internship (day)
EFTP Cherchell	24	7
Kala	24	7
EFTP Oran	24	7
EFTP Ghazaouet	24	15
EFTP Béni Saf	24	15
EFTP Jijel	24	15
CNRDPA	24	15

II – Semester organization sheet

1- Semester 1

Teaching Unit	HVW	H.V weekly				Coeff	Credits	Evaluation mode	
	14-16 week.	C	TD	TP	others			Continuous control	Exam
UE fondamentales									
UEF1									
Material 1 : Systematics of marine plants	45 H 00	1H30	1H30			3	6	50%	50%
Material 2 : Physiology of marine organisms	45H00	1H30	1H30			2	4	50%	50%
Material 3 : Systematics of marine invertebrates	45H00	1H30		1H30		3	6	50%	50%
Material 4 : Fishing techniques and gear	67H30	1H30	1H30	1H30		3	6	50%	50%
UE methodology									
UEM1(O/P)									
Material 1 : Biostatistics	60H00	1H00	3H00			2	4	50%	50%
Material 2 : Technics of sampling and measures	45H00	1H30		0H42	0H48	2	2	50%	50%
UE transversal									
UET1(O/P)									
Material 1 : English for Specific Purposes 1 (ESP1)	45H00	1H30	1H30			1	1	50%	50%
Material 2 : Aquariology	22H30	1H30				1	1	50%	50%
Total Semester	**375H**	**150**	**157,5**	**45**		**17**	**30**		

2- Semester 2

Teaching Unit	HVW	H.V weekly				Coeff	Credits	Evaluation mode	
	14-16 week.	C	TD	TP	Other			Continuous control	Exam
UE fundamental									
UEF1									
Material 1 : Biology of fishery resources	67H30	1H30	1H30	1H30		3	5	50%	50%
Material 2 : Marine ecology	67H30	1H30	1H30	1H30		3	5	50%	50%
Material 3 : Systematics of marine vertebrates	45H00	1H30		1H30		3	5	50%	50%
UE methodology									
UEM1(O/P)									
Material 1 : Multidimensional data analysis	67H30	1H30	3H00			2	5	50%	50%
Material 2 : R programming	30H00	0H30	1H30			2	4	50%	50%
UE transversale									
UET1(O/P)								50%	
Matière 1 : English for Specific Purposes 2 (ESP2)	22H30	0H45	0H45			2	3	50%	
UE découverte									
UED1(O/P)									
Material 1 : Documentary research and communication	45H00	1H30	1H30			1	2	50%	50%
Material 2 : Internship 1	30H00				2H00	1	1	50%	50%
Total Semester 2	**375H**					**17**	**30**		

3- Semester 3

Teaching Unit	HVW	V.H weekly				Coeff	Credits	Evaluation mode	
	14-16 week	C	TD	TP	Other			Continuous control	Exam
UE fundamental									
UEF1									
Material 1 : Geomatics	67H30	1H30	3H00			3	5	50%	50%
Material 2 : Population dynamics	67H30	1H30	2,4H*	0,6H*		3	5	50%	50%
Material 3 : Taxonomy of fishery resources	67H30	1H30	1H30	1H30		3	5	50%	50%
UE methodology									
UEM1(O/P)									
Material 1 : Quality control of fish products	45H00	1H30		1H30		2	4	50%	50%
Material 2 : Python and AI programming	60H00	1H00	3H00			2	5	50%	50%
UE transversal									
UET1(O/P)									
Matière 1 : Meteorology and navigation	45H00	1H30	1H30			2	3	50%	50%
Matière 2 : English for Specific Purposes 3 (ESP3)	22H30	0H45	0H45			2	3	50%	50%
Total Semester 3	**375H**					**17**	**30**		

*** This represents 12 TD sessions and 3 TP sessions during the semester (3H00 per session).**

4- Semester 4

Teaching Unit	HVW	V.H weekly				Coeff	Credits	Evaluation mode	
	14-16 Week.	C	TD	TP	Other			Continuous control	Exam
UE fundamental									
UEF1									
Material 1 : Assessment and management of fish stocks	67H30	1H30	3H00			4	5	50%	50%
Material 2 : Marine biogeography	67H30	1H30	1H30	1H30		4	5	50%	50%
Material 3 : Molecular biology techniques and bio-informatics	67H30	1H30	1H30	1H30		3	5	50%	50%
UE methodology									
UEM1(O/P)									
Material 1 : Workshop 1	82H30				5H30	3	7	50%	50%
Material 2 : Internship 2	60H00				4H00	2	6	50%	50%
UE discovery									
UED1(O/P)									
Material 1 : Innovation	30H00	2H00				1	2	50%	50%
Total Semester	**375H**					**17**	**30**		

5- Semester 5

Teaching Unit	WHV	V.H weekly				Coeff	Credits	Evaluation mode	
	14-16 week.	C	TD	TP	Other			Continuous control	Examen
UE fundamental									
UEF1									
Material 1 : Ecosystem modeling of fishing resources	67H30	1H30	3H00			4	6.0	50%	50%
Material 2 : Fisheries ecology	67H30	1H30	3H00			3	6.0	50%	50%
Material 3 : Economics of fishery resources	67H30	1H30	1H30	1H30		3	6.0	50%	50%
UE methodology									
UEM1(O/P)									
Material 1 : Atelier 2	60H00				4H00	3	6.0	50%	50%
Material 2 : Project management	45H00	1H30	1H30			2	4.0	50%	50%
UE discovery									
UED1(O/P)									
Material 1 : Law of the sea and legislation	45H00	3H00				1	1	50%	50%
Material 2 : Sustainable development	22H30	1H30				1	1	50%	50%
Total Semester	**375H**					**17**	**30**		

6- Semester 6:

Domain : Natural and Life Sciences(SNV)
Program : Marine and Continental Hydrobiologye (HBMC)
Speciality : Ecosystem-Based Fisheries Management

An internship culminating in a dissertation and oral presentation.

	VHS	Coefficient	Credits
Personal work	500H	11	20
Internship	250H	6	10
Seminars	-	-	-
Other	-	-	-
Total Semester	750H	17	30

7- Overall training summary :

UE / VH	UEF	UEM	UET	UED	PFE	Total
Courses	360	127,5	90	120		697,5
TD	418,5	180	67,5	22,5		688,5
TP	211,5	33	0			244,5
Other	214,5	0	30	250	494,5	
Personal work	990	555	157,5	172,5	500	2375
Total	1980	1110	315	345	750	4500
Credits	85	47	11	7	30	180
% in credit for each UE	47,22	26,11	6,11	3,89	16,67	100%

III – Detailed program by subject

(1 detailed subject sheet)

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU title: Fondamentale

Subject title : Systematics of marine plants

Hourly volume: 45 H **Credits : 6** **Coefficient : 3**

Teaching objectives :

Acquire the knowledge needed to recognize and identify marine plants, particularly in the stromal contents of herbivorous fish.

Recommended prior knowledge:

- Biology
- Botany

Contents :

Courses	**Chapter 01 :** General introduction **1.** Definitions **2.** Origin and evolution of algae **3.** General classification of the major divisions of algae + marine angiosperms **4.** Distribution **5.** Rôles et importance des assemblages de végétaux marins **Chapter 02 :** presentation of some divisions **1.** Cyanophyta **2.** Rhodophyta **3.** Chlorophyta **4.** Ochrophyta, classe : Phaeophceae **Chapter 03 :** marine angiospermes
Tutorial	**TD 01 -** Methodology for studying algae **TD 02 -** Systematic study of some Cyanophyta + toxic algae
Practical work	**TP 01 -** Systematic study of some Rhodophyta **TP 02 -** Systematic study of some Phaeophyceae **TP 03 -** Systematic study of some Chlorophyta **TP 04 -** Systematic study of some marine angiosperms+ Field trip

Assessment method :

¾ End-of-semester exam

¾ Continuous controls : (tests in class sessions, practical work, oral tests, homework, presentations, internship reports)

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU title : Fundamental

Subject title : Systematics of marine invertebrates

Hourly volume : 45 H **Credits : 6** **Coefficients : 3**

Teaching objectives :

Acquire the knowledge needed to recognize and identify marine invertebrates.

Recommended prior knowledge :

- Notions acquired in zoology (1 et 2) (2 e FPSM)

Contents :

Courses	**Chapter I :** Basic concepts and principles of zoological nomenclature **Chapter II :** Porifera 1. Calcarea 2. Demospongiae 3. Hexactinellida 4. Homoscleromorpha **Chapter III :** Cnidaria 1. Myxozoa 2. Anthozoa 3. Hydrozoa 4. Scyphozoa 5. Cubozoa 6. Staurozoa **Chapter IV :** Mollusca 1. Monoplacophora 2. Polyplacophora 3. Caudofoveata 4. Solenogastres 5. Cricoconarida 6. Rostroconchia 7. Scaphopoda 8. Gastropoda 9. Bivalvia 10. Cephalopoda **Chapter V :** Les vers 1. Nematomorpha (vers ronds) 2. Annelida 3. Plathelminthes (vers plats)

	4. Nemertea (vers rubans) **Chapitre VI :** Arthropoda 1. Chelicerata Merostomata 2. Crustacea **Chapitre VII :** Bryozoa 1. Gymnolaemata 2. Stenolaemata **Chapitre VIII :** Echinodermata 1. Asterozoa 2. Crinozoa 3. Echinozoa
Practical work	1. **n°01 :** Classification of sponges and bryozoans(3 H) 2. **n°02 :** Cnidarian classification(3 H) 3. **n°03 :** Mollusc classification (3 H) 4. **n°04 :** Crustacean classification (3 H) 5. **n°05 :** Classification of echinoderms (3 H) 6. **Field trip :** Discover, observe and collect invertebrates in a coastal environment (6 H)

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports).

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU title : Fundamental

Subject title : Physiology of marine organisms

Hourly volume : 45 H **Credits : 4** **Coefficients : 2**

Teaching objectives :

To provide basic training in animal anatomy and physiology for all students. The main aim is to study the characteristics of the various anatomical systems (respiratory system, circulatory system) of marine organisms and to understand how they function. The knowledge acquired in this course provides a good grasp of the concepts inherent in feeding, reproduction, development and animal behavior.

Recommended prior knowledge:

- Biology
- Chemistry

Contents :

Courses	Introduction 1. Vertebrate and invertebrate anatomy 2. Locomotion 2. Circulatory system 3. Immune system 4. Respiratory system 5. Osmoregulation and excretion 6. Thermoregulation 7. Digestive system 8. Reproductive system 9. Nervous and sensory systems 10. Endocrine system 11. Moulting phenomenon
Tutorial	Review of recent review articles on fish, crustacean and mollusc physiology.
Practical work	1. Internal and external anatomy of fish, decapod crustaceans and molluscs. 2. Observation of blood smear slides and fish heart anatomy 3. Macro and microscopic observation of gills (fish, decapod crustaceans, molluscs) 4. Observation of osmosis on potatoes and onions 5. Observation of different parts of the digestive tract 6. Micro- and macroscopic observation of the gonads 7. Observation of histological sections on fish kidneys 8. Observation of histological sections on the brain and sensory organs 9. Observation of histological sections on endocrine glands

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU title : Fundamental

Subject title : Fishing techniques and gear

Hourly volume: 67,5 H **Credits : 6** **Coefficients : 3**

Teaching objectives :

The descriptions and operating principles of passive and active fishing gear are studied to ensure responsible fishing. The engineer will learn about the design of fishing gear from a conceptual point of view, so as to be able to propose solutions to the problems of catching species or inventing new gear (nets or other) to enable responsible fishing.

Recommended prior knowledge:

- Mathematical concepts acquired during the first cycle

Contents :

Courses	**Chapter I. Introduction to fisheries technology** 1. Definitions 2. The role of fishing technology 3. Identifying the needs of the fishing industry 4. International Standard Statistical Classification of Fishing Gear (CSITEP) **Chapter II. Active devices** 1. Trawls 1.1. Parts assembly 2. Seines 2.1. Parts assembly 3. Other gear **Chapter III. Passive devices** 1. Nets 2. Longlines 3. Other gear
Tutorial	**1.** Solving thread-cutting problems **2.** Solving thread mounting problems **3.** Selectivity of trawls and gillnets **4.** Introduction to the use of Dynamit fishing gear design and simulation software.
Practical work	**1.** Sailor's knots **2.** Design of miniature fishing gear

Practical activity	**Outing 1. Field observation of fishing gear.** **Outing 2. A few beaming techniques**

Assessment method :

- End-of-semester exam
- Continuous testing: (tests in class sessions, practical work, oral tests, homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU Title : Methodology

Subject title: Biostatistics

Hourly volume : 60 H **Credits : 4** **Coefficients : 2**

Teaching objectives :

The subject aims to introduce the concepts of statistics and probability through descriptive statistics and random variables.

Recommended prior knowledge:

- A basic understanding of statistics and mathematics

Contents :

Courses

Chapter 01: General introduction and data collection

- Definitions and History
- Data collection
- Sampling
- The nature, recording and processing of data

Chapter 02 : A reminder of descriptive statistics

- Frequency distributions
- Graphic representations
- Position and dispersion parameters
- Calculating mean, variance and covariance
- Coefficient of correlation and determination
- Linear least-squares regression

Chapter 03 : Theoretical distributions

- Reminders on the notion of probability
- The notions of random variable and theoretical distribution -

✓ Binomial and polynomial distributions

✓ Normal and log-normal distributions

✓ Student's t distributions

✓ Pearson's $\chi 2$ distributions

✓ Fisher-Snedecor F distributions

Chapter 04 : The principles of statistical inference

- Sampling distributions
- Estimation problems
- Hypothesis testing
  - ✓ Comparison of two averages

	✓ Comparison of two percentages ✓ Slope compliance test ✓ Analysis of variance • Simple analysis of variance: One-way ANOVA • Analysis of multiple variance: two-factor ANOVA ✓ Model with repeated measurements ✓ Model without measurement repetition • Tests post hoc
Tutorial	**01-** Descriptive statistics in 1 and 2 dimensions (3 sessions) **02-** The main theoretical one-dimensional distributions (2 sessions) **03-** Confidence interval estimation (2 sessions) **04-** Comparison of two averages / percentages (1 session) **05-** Slope conformity test (1 session) **06-** Analysis of variance (4 sessions)

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management(GEP)

Semester : 1

EU title : Methodological

Subject title : Sampling and measurement techniques

Hourly volume : 45 H **Credits : 2** **Coefficients : 2**

Teaching objectives :

Know the sampling techniques and measurement methods used for different groups of marine animals.

Recommended prior knowledge :

- A basic understanding of statistics and mathematics

Contents :

Courses	**Chapter 1. Aquatic animal sampling** 1. Introduction 2. Types of sampling 2.1. Stratified sampling 2.2. Practical aspects of retail sampling 2.3. Sampling on board a ship 2.4. Sampling on board a research vessel 2.5. Sampling on board an industrial vessel 3. Number of individuals to be measured in case of sampling 4. Sample storage 5. Data storage and distribution **Chapter 2. Field surveys** 1. Concepts for estimating fishing effort 2. Surveys for basic fisheries data 3. Landings surveys 4. Business day surveys 5. Bioeconomic surveys 6. Data storage and distribution. **Chapter 2. Measuring and weighing fish species** 7. Introduction 8. Measuring instruments 9. Reference quantities 10. Number of individuals to be measured in case of sampling 11. Measuring fish 11.1. Select the length dimension to be measured 11.2. Surveying methods 11.3. Measuring damaged and treated fish 12. Measuring shellfish

	3.3 Forms for taking measurements 3.4 Measurement units and data grouping 3.5 Length composition data ratio 3.6 The various weighing operations
Practical work	**1.** Preparation of sample containers and preservation solutions (3 H) **2.** Processing a fish sample (3 H) **3.** Processing a sample of crustaceans, molluscs and other shellfish (3 H)
Other	Field trips (12 H)

Evaluation mode :

- End-of-semester exam
- Continuous controls : (tests in class sessions, practical work, oral tests, homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU title : transversal

Subject title: English for Specific Purposes 1 (ESP1)

Hourly volume : **Credits : 1** **Coefficients : 1**

Teaching objectives :

This program is designed for future engineers to enable them to acquire the basic knowledge needed to analyze a corpus containing key words, or scientific terminology..

Recommended prior knowledge:

FPSM English subjects (1st and 2nd year).

Courses	**Unit 1: Describing the dimensions of an object.** • Height, Width, Weight, depth, rate… • Exercises • Lexicon **Unit 2: Speaking about quantity** • Countable nouns: a/an, the, many, few, a few • Uncountable nouns: much, little, a little • Exercises: How much ….? How many…? How far…? • How to talk about measurements? • Lexicon **Unit 3: To say how often something does happen?** • Usually, often, rarely, sometimes, once, twice… • Review of Present Simple tense • Exercises • Lexicon **Unit 4: Asking questions in Present simple tense** • How does …? • Is it …? • Exercises • Lexicon **Unit 5: Comparison** • Comparative adjectives: …is bigger than… • Superlative Adjectives: The biggest, the best, … • Similarity: …as big as… • Exercises • Lexicon **Unit 6: Modification**

	• Premodification: Determiners, adjectives • Postmodification: Relative clauses introduced by Who, which, that… • Exercises • Lexicon **Unit 7: Scientific affixation (Prefixes and suffixes)** • Suffixes • Prefixes • Exercises • Lexicon **Unit 8: Figures, charts, graphs** • Reading figures • Explaining graphs and charts • Exercises • Lexicon

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 1

EU title : discovery

Subject title : Aquariology

Hourly volume : 22.5 **Credits : 1** **Coefficients : 1**

Teaching objectives :

Minimum knowledge of the principles of aquariology to maintain aquatic organisms in an ornamental tank or pond.

Recommended prior knowledge:

Biology, microbiology, elemental cycles and physical chemistry of water, zoology, botany

Contents :

Courses	**Chapter I: Definitions and basic concepts** 1. Aquariology 2. Aquaristics 3. Breeding tank or aquarium 4. Pond 5. Aquascaping 6. Different types of rearing tanks 7. Nitrogen cycle and toxicity of related products 8. Other concepts **Chapter II: Aquarium equipment** 1. Fresh water tank equipment 2. Equipment for aquarium ponds 3. Seawater tank equipment 4. Aquascaping equipment **Chapter III: Species used in aquaria** 1. Freshwater species 2. Seawater species **Chapter IV: Pathology and disease prevention** 1. Common aquarium diseases, causes and treatment 2. Prophylaxis and water treatment for aquarists

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

References

- Breitenstein, Alain, 1999. *Aquariophilie : l'aquarium d'eau douce.* Paris : Proxima. 144 p.
- Gereg, Allain et al., 2009. *Larousse des poissons et aquariums : tout sur les aquariums d'eau douce et d'eau de mer.* Paris : Larousse. 384 p.
- Hiscock, Peter, 2007. *L'encyclopédie des plantes d'aquarium.* Paris : De Vecchi. 205 p.
- Mills, Dick et al., 2006. *Créer un aquarium marin : sélection des poissons, aménagement, entretien.* France : Marabout informatique. 208 p.
- Royer, Philippe et Stéphane Fournier, 2008. *Le traitement de l'eau des aquariums : eau douce, eau de mer, récifal.* France : Animalia. 80 p.
- Vast, Claude, 2007. *ABC de l'aquarium pour tous.* Paris : De Vecchi S. A. 96 p.

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : fundamental

Subject title : Biology of fishery resources

Hourly volume : 67.5 **Credits : 5** **Coefficients : 3**

Teaching objectives :

Fishery resources represent significant economic potential. The study of species reproduction, diet and behavior is a preliminary step in assessing how the stocks in question should be managed.

Recommended prior knowledge:

- Biology

Contents :

Cours	**Chapter I. Reproduction of harvested species** I.1. Sexuality patterns of harvested species I.1.1. Gonochorism I.1.2. Hermaphroditism I.2. Sexual cycle I.2.1. Spermatogenesis and ovogenesis I.2.2. Study methods: review of histological techniques I.2.3. Macroscopic scales of sexual maturity I.2.4. Microscopic scales I.3 Gonado-somatic ratio / Hepato-somatic ratio I.4. condition factors I.5. Sex ratio I.5.1. Study methods I.5.2. Variations in sex ratio I.6. Size at sexual maturity I.7. Fertility and reproductive capacity I.7.1. Absolute fertility I.7.2. Relative fertility I.7.3. Total fertility (reproductive capacity) I.8. Ichthyoplankton (eggs, larval development) **Chapter II. Diet of harvested species** II.1 Stomach content analysis methods II.2. Variation in diet: the notion of overlapping diets II.3. Morphological and physiological adaptations to diets II.4. Prey-predator relationships II.5. Trophic levels and indices
TD	1. Study of sex ratio, RGS and condition factors

	2. Estimated size at sexual maturity 5. Estimating fecundity in bony fishes 3. Estimation of reproductive capacity 6. Ichtyoplankton: observation of fish eggs and larvae 7. Diet study 4. Calculation of food indices and food overlap tests
TP	1. Sex recognition in different zoological groups (Crustaceans, Molluscs, Fish) 2. Spermatogenesis and ovogenesis: macroscopic stages of sexual maturity 3. Spermatogenesis and ovogenesis: microscopic stages of sexual maturity (reading histological slides) 4. Study of a few cases of hermaphroditism: macroscopic and microscopic observations.

Assessment method :

- End-of-semester exam
- Continuous testing: (tests in class sessions, practical work, oral exams, homework, presentations, internship reports)

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : fundamental

Subject title : Marine ecology

Hourly volume: 67H30 **Credits : 5** **Coefficients : 3**

Teaching objectives :

The aim of this course is to provide students with a set of concepts and approaches enabling them to understand the basic structure and organization of marine ecosystems, based on a description of the biological compartments of marine ecosystems and their organization in pelagic and benthic ecosystems.

Recommended prior knowledge :

Basic knowledge of general ecology, zoology, botany and systematics of aquatic organisms.

Contents :

Courses	**Chapter I: Marine ecology foundations and basic concepts** 1. Subdivisions and floors 1.1. Pelagic zone 1.2. Benthic domain 2. Ecological factors 2.1. Abiotic factors 2.1.1. Hydrological factors 2.1.2. Edaphic factors 2.2. Biotic factors 2.3 Human factors 2.4. Other factors **Chapter II: Pelagic zone** 1. General knowledge 2. Adaptations to pelagic life 2.1. Size and coloring 2.2. Suspension, buoyancy, mobility and morphological adaptations 3. Plankton composition 3.1. Phytoplankton 3.2. Zooplankton 4. Colored waters 5. Necton 5.1. Definition 5.2. Composition 5.3. Mobility and morphological adaptations 5.4. Gregarious behavior 5.5. Migration

	6. Sampling methods **Chapter III: Benthic environment** 1. Definition 2. Adaptations to benthic life 3. Substrate as a structuring factor 3.1. Substrate varieties 3.2. Hard-bottom populations 3.3. Soft-bottom populations 4. Requirements and eating habits 5. Reproductive aspects and strategies 6. Sampling methods **Chapter IV: Production** 1. Primary production 2. Secondary production and trophic cycles in the marine environment **Chapter V: Populations, remarkable habitats and protected and invasive species in the Mediterranean** 1. Remarkable Mediterranean populations and habitats 2. Protected species and regulations 3. Invasive species
TD	1. Data analysis of a nectonic settlement (6 H) 2. Benthic bionomics: analytical characteristics of populations (3 H) 3. Benthic bionomics: general characteristics (3H) 4. Benthic bionomics: ecological groups and benthic indices (3H) 5. Study and numerical analysis of posidonia (6H)
TP	1. Practical work: Brief identification of plankton samples collected (3 H) 2. Practical work: Brief identification of benthos samples collected (3 H)
Practical activities	1. Field trip: Ecological discovery of the marine environment and sampling of the plankton (6 H) 2. Field trip: Sampling methods for the flora and fauna of the medio- and upper supralittoral (6 H) 3. Field trip: Visit to a remarkable site: vermetid sidewalks and reefs reefs (3 H)

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports).

References

- Albin, Michel, 1999. *Dictionnaire de l'écologie. Paris : Ecyclopédie universitaire.* 1399 p.
- Bayer, E. et al., 2009. *Guide de la flore méditerranéenne : caractéristiques, habitat, distribution et particularités de 536 espèces.* Paris : Délachaux et Niestlé. 287 p.
- Bellan-Santini, D. et al., 1994. *Les biocénoces marine et littorales de Méditerranée : synthése, menaces et perspectives.* Paris : Muséum national d'histoire naturelle. 246 p.
- Collignon, Jean, 1991. *Ecologie et biologie marines : introduction à l'halieutique.* Paris : Dunod. 298 p.

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : fundamental

Subject title : Systematics of marine vertebrates

Hourly volume: 67H30 **Credits : 5** **Coefficients : 3**

Teaching objectives :

Know the different groups belonging to the vertebrate sub-branches.

Recommended prior knowledge :

- Biology
- Embryology
- Zoology

Contents :

Courses	**Chapter I: Definitions and basic concepts** 1. Systematics 2. Taxonomy 3. Phylogeny 4. Phenetics 5. Cladistics 6. Morphology 7. Anatomy 8. Physiology 9. Ethology 10. Basic rules of zoological nomenclature according to ICZN **Chapter II: Current vertebrate classification** 1. Reference documentation 2. Current summary classification **Chapter III : Agnatha** 1. Myxini 2. Petromyzonti **Chapter IV : Chondrichthyes** 1. Elasmobranchii 2. Holocephali **Chapter V : Osteichthyes** 1. Actinopterygii 2. Sarcopterygii **Chapter VI : Tetrapoda** 1. Mammalia 2. Testudines 3. Aves
TP	1. Field trip: Discovery, observation and collection of marine vertebrates in the coastal environment (6 H) 2. Practical work: Agnathans and Chondrichthyes (3 H) 3. Practical work: Osteichthyes (9 H) 4. Practical work: Tetrapoda (3 H)

Assessment method :

- End-of-semester exam

➢ Continuous testing: (tests in class sessions, practical work, oral exams, homework, presentations, internship reports)

References

- Baer, Jean G., 1965. *Cours d'anatomie comparée des vertébrés.* Paris : Griffon. 206 p.
- Devillers, Charles et P. Clairambault, 1976. *Précis de zoologie vertébrés : anatomie comparée (tome 1).* Paris : Dunod. 468 p.
- Grassé, Pierre-P. et Charles Devillers, 1965. *Zoologie : vertébrés (tome 2).* Paris : Dunod. 1129 p.
- Grassé, Pierre-Paul et al., 2000. *Zoologie vertébrés.* Paris : Masson. 198 p.
- Picaud, Jean-Louis et al., 2004. *Biologie animale : vertébrés.* Paris : Masson. 298 p.
- https://www.iczn.org/the-code/the-international-code-of-zoological-nomenclature/

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : Methodology

Subject title : Multidimensional data analysis

Hourly volume : 67H30 **Credits : 5** **Coefficients : 2**

Teaching objectives :

Improve students' knowledge and practice of multidimensional data analysis

Recommended prior knowledge:

- Mathematics
- Biostatistics

Contents :

Cours	**Chapter 01: Correlations and multiple regression** **1.** The double regression model **2.** Stepwise regression **Chapter 02: Reminders on matrices and matrix functions** **Chapter 03: Factor analysis** 1. Principal Component Analysis (PCA) 2. Correspondence Factorial Analysis (CFA) 3. Discriminant Factor Analysis (DFA) 4. Multiple Correspondence Analysis (MCA) **Chapter 04: Classification methods** 1. Hierarchical Ascending Classification (HAC) method 2. K-means 3. Joint Classification
TD	01- Double multiple correlations and regression 02- Stepwise regression 03- Principal Component Analysis 04- Correspondence factor analysis (CFA) 05- Discriminant Factor Analysis (DFA) 06- Multiple Correspondence Analysis (MCA) 07- Hierarchical Ascending Classification (HAC) TD 08- K-Averages 09- Joint Classification

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

References

- **Dagnelie P., 2013.** Statistique théorique et appliquée. Tome 1. Statistique descriptive et bases de l'inférence statistique. *Bruxelles, De Boeck*, 517 p.
- **Tukey J. W.1953.** "The Problem of Multiple Comparisons," Mimeographed Monograph, *Princeton University.*
- **Scheffé, H. 1953.** A method for judging all contrasts in the analysis of variance, *Biometrika*, 40: 87 – 104.
- **Wayne, W. D. et Chad L.C., C. L. 2018**. Biostatistics: a foundation for analysis in the health sciences. *Wiley*.

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : Methodology

Subject title : Programmation R

Hourly volume : 30H00 **Credits : 4** **Coefficients : 2**

Teaching objectives :

Use of the R language and software in statistical calculations, fisheries modeling, image analysis of calcified parts in systematic studies and stock recognition, etc.

Recommended prior knowledge:

- Basic computing

Contents :

Courses/ tutorial	**Chapter 01- Introduction to the R language** 1. Download and install the R program 2. Create and manipulate the main R objects (vector, matrix, etc.),data.frame, list) 3. Import/export a data file 4. Installing and using packages 5. Data visualization and description in R **Chapter 02-** Graphics with R **Chapter 03-** Descriptive statistics in R **Chapter 04-** Comparison of fish stocks **Chapter 05-** Designing R packages

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : transversal

Subject title : English for Specific Purposes 2 (ESP2)

Hourly volume: 45H00 **Credits : 3** **Coefficients : 2**

Teaching objectives :

The program is designed to reinforce the ability to describe different shapes. Similarly, future engineers will be called upon to apply different procedures, such as function and capacity, the relationship between cause and effect, the logical sequence of sequences, and the method that differs from one process to another.

Recommended prior knowledge :

- ESP 1

Contents :

Courses	**Unit 1: Shapes** • One dimensional shapes • Two dimensional shapes • Three dimensional shapes • Exercises • Lexicon **Unit 2: Process 1 - Functions and ability** • Function of devices • Instruments • Ability and capacity • Exercises • Lexicon **Unit 3: Process 2 - Cause and effect** • Actions and results • Changes of state • Causing, allowing and preventing • Exercises • Lexicon **Unit 4: Process 3 - Purpose and Method** • How things should be done • How things may be done • Describing experiments • Exercises • Lexicon

Evaluation mode :

- End-of-semester exam

➢ Continuous testing: (tests in class sessions, practical work, oral exams, homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Managements (GEP)

Semester : 2

EU title : discovery

Subject title : Documentary research and communication

Hourly volume : 22H30 **Credits :2** **Coefficients : 1**

Teaching objectives :

The various learning units that make up the course will enable students to acquire knowledge of research, exploitation and synthesis of scientific documents, as well as the production of written and oral scientific communications.

Recommended prior knowledge:

- Preparatory training

Contents :

Courses	**Chapter I : Research and use of scientific documents** 1. The benefits of scientific research 2. Definitions 3. Stages of scientific research 3.1.1. Defining the subject 3.1.2. Defining the search strategy 3.1.3. Search for information / Find sources 3.1.4. Evaluate and use information 3.1.5. Cite sources 4. Plagiarism **Chapter II : Synthesis of scientific documents** 1. Interest and methodology for synthesizing scientific documents 2. Writing a reading sheet **Chapter III : Scientific communication** 1. IMRAD structure 2. Scientific publications 3. Making an oral presentation 4. Producing a scientific poster 5. Writing a research paper
Tutorial	1. Use of bibliographic resource management software (6 H) 2. Exercise in creating reading records (3 H) 3. Researching information on a scientific subject and writing a scientific scientific passage (6 H) 4. Creation of an oral presentation (3H) 5. Creating an outline for a research paper and scientific poster (3 H)

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

References

- American Psychological Association, 2010. *Publication manual of the American Psychological Association (6ème éd.).* Washington, DC : Auteur.
- Provost, M. A. et al., 2010. *Normes de présentation d'un travail de recherche (4ème éd.)*. Trois Rivières, QC : SMG.
- https://bib.umontreal.ca/citer/styles-bibliographiques/apa
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- https://www.mendeley.com/
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Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 2

EU title : discovery

Subject title : Stage 1

Hourly volume : 30H00 **Credits :1** **Coefficients : 1**

Teaching objectives :

Acquire the investigative skills needed to make reasoned judgments and master theories by familiarizing students with the marine world through the concrete description of ecosys-tems: illustrate the diversity of fauna composition in different geographical areas through surveys and observations of different marine domains, teaching learners to perceive or construct the spatial and temporal components of distributions.

Recommended prior knowledge:

- Botany
- Zoology
- Ecology
- Geography
- Geology

Contents :

Practical activity	• Ranges of distribution, endemism, dispersal, invasions, migration concepts of biocenoses, distributions and communities: survey of island and rocky lagoon ecosystems. • Communities and ecosystems ; • Surveying and observing species in all accessible biotopes and at the points of sale • Fauna and flora trends by stage ; • Analysis of landings in fishing ports and shelters

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, pre-sentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 3

EU title : fundamental

Subject title: Geomatics

Hourly volume : 67H30 **Credits : 3** **Coefficients : 5**

Teaching objectives :

Geomatics is the set of tools and methods for integrating, processing and analyzing geospatial data to produce value-added data. The focus is on :

- definition of geospatial data (DG), its different sources, types and characteristics, etc;
- data integration, structuring and analysis techniques geospatial data.

Design and production of different types of cards.

Recommended prior knowledge:

In order to take this course, students must have completed the Geology IV course in semester 4 of the 1st cycle of the Marine Science Preparatory Courses.

Contents :

Cours	**Course 1: Geomatics** (1h30) – Definitions - Software - Geomatics fields of application (use) **Courses 2 :** Geospatial data (DG) (1h30) • Definition • Where to find DG? (Sources) • Spatial models (Raster, Vector) • Components of geospatial data (graphical, non-graphical and metadata) • Notions of quality and properties **Course 3 :** Spatial reference systems (1h30) • Definition • Cartesian geocentric system • Geographic coordinate systems (concepts of ellipsoids) • Plane coordinate systems (notions about projections) • Local and global reference systems • Algeria's current reference systems

Transformations between systems
Notions on vertical reference systems (orthometric and vertical heights) ellipsoidal heights) and measurement techniques (notions of the geoid)

Cours 4 : Satellite images/data(2*1h30)

- Definition
- Types
- Acquisition diagrams
- Electromagnetic radiation (EMR) and its properties
- The electromagnetic spectrum
- EOM wave energy and measured physical quantities
- Radiation/atmosphere interaction
- Atmospheric windows for remote sensing
- Interaction between radiation and matter
- Signature spectrale
- Features (all 4 resolutions)
- Acquisition techniques
- Levels (L1, L2, L3, L4)

Course 5 : Techniques for integrating DG (2 * 1h30)

- Techniques for integrating the graphics component
- Attribute data integration techniques (direct input, by mask calculation, etc.)

Course 6 : Editing DG (1h30)

- Definition
- Sources of error
- Tools for correcting editing errors

Course 7 : Vector" data analysis (1h30)

- Definition
- Spatial queries
- Geoprocessing

Course 8 : Raster data analysis (1h30)

- Definition
- Local operations (arithmetic, statistical, relational or comparison, mathematical, logical and conditional)
- Neighborhood operations (filters, Mathematical morphology)
- Global operations
- Reclassement

Course 9 : Satellite data pre-processing/processing. (3*1h30)

- Geometric corrections
- Atmospheric corrections
- Classification
- Filtrages
- Area statistics

	Course 10: Cartography**(2*1h30)** **- Introduction and background** • Definition • Card types (widely distributed) or thematic (presentation of results or a study area) • Card components (frame, title, etc.) by type • Shaping the skin • Symbolic expression on a real/virtual vector (point, polygon, polyline) and a raster (color ramp) • Visual variables (shape, size, orientation, color, value, dynamics and structures) • Properties of visual variables
TD	**1:** Access to online open data databases (3h) **2:** Introduction to software (ArcGis, QGIS, SeaDAS, SNAP, etc.) (3h**)** **3:** Integration techniques (3h) **4:** Vector data editing (3h) **5:** Spatial queries (3 hrs) **6 :** Geoprocessing (3h) **7:** Spatial analysis on rasters (Mapalgebra) (3 hrs) **8 :** Map design (3h) **9 :** Introduction to satellite image manipulation I (3h) **10 :** Atmospheric corrections (3h) **11 :** Classification (3h) **12 :** Filtrage (3h) **13 :** Application 1: Ocean color data analysis (3h) **14 :** Application 2: OHS data analysis (3h)

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title: Ecosystem-Based Fisheries Managements (GEP)

Semester: 3

EU title : fundamental

Subject title : Population dynamics

Hourly volume : 67H30 **Credits : 5** **Coefficients : 3**

Teaching objectives :

Mastery of the scientific bases of fisheries management. It is based on a presentation of the concepts and models used in population dynamics. In order to be able to tackle all the major sectors of marine fisheries and, more generally, the management of exploited ecosystems.

Recommended prior knowledge:

Mathematics

Biology

Contents :

Courses	**Chapitre 01 : Structure démographique des populations** 1. Fish age estimation 1.1 Classical sclerochronology methods 1.2. Validation of direct age estimation 1.3. Back-calculation 1.4. Statistical methods for age estimation 1.5. New sclerochronology methods 2. Growth modeling 2.1. Linear growth 2.1.1. Notions and different growth models 2.1.2. Estimation of the parameters of von Bertalanffy's model (1938) 2.2. Study of biometry 2.2.1. Biometric relationships 2.2.2. Height-weight relationship 2.3 Weight growth **Chapter 02- Cohort dynamics** 1. Exponential decay model 2. Estimation of total mortality rate (Z) 2.1. Linearized catch curve 2.2. Beverton and Holt mortality equation 3. Estimation of natural mortality (M) 3.1 Natural mortality and longevity 3.2 Empirical formulas 4. Estimating fishing mortality (F)

	Chapter 03- Introduction to inventory valuation 1. The concept of a fish stock 2. Nominal fishing effort
Tutorial	1. Age-length key (direct method and back-calculation) 2. Petersen, Gheno-Leguen and Harding methods 3. Bhattacharya method (Excel and Fisat) 4. Growth parameters from age data analysis: Ford Walford, Gulland and Holt and Tomlinson and Abramson 5. Growth parameters from height data analysis: Powell Wetherall 6. Biometric relationships, height-weight relationship and weight growth 7. Estimation of total mortality (Z): Methods of Jones and van Zalinge, Pauly and Beverton and Holt methods 8. Estimation of natural mortality (M) and fishing mortality (F)
Practical work	1. Collecting and preserving calcified parts: otoliths and scales 2. Direct reading of otoliths: observation with a magnifying glass 3. Direct reading of scales: observation with a magnifying glass

Assessment method :

- End-of-semester exam

➢ Continuous testing: (tests in class sessions, practical work, oral exams, homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 3

EU title: fundamental

Subject title: Taxonomy of fishery resources

Hourly volume : 67H30 **Credits :5** **Coefficients : 3**

Teaching objectives :

Taxonomy is involved in the classification and naming of organisms, so it's a basic activity that involves describing and circumscribing living organisms in terms of species, and organizing them into hierarchical categories.

Recommended prior knowledge:

- Biology
- Zoology
- Ecology

Contents :

Courses	1. What is a fishery resource? ? 2. The different types of fishery resources 3. The fundamental concepts of taxonomy 4. Study and taxonomy of the main categories of fishery resources 4.1. The ichthyological resource 4.2. Crustaceans 4.3. Molluscs 5. Taxonomy of harvested plants 6. Taxonomy of potentially exploitable species 7. The state of world, Mediterranean and Algerian fishery resources 8. Measures to conserve fishery resources?
Tutorial	1. The laws and principles of classification, systematics and taxonomy of living organisms .
practical work	1. Osteichthyan representative study: marine fish versus freshwater fish 2. Recognition and identification of bony fish observed in the field 1. 3. Recognition and identification of bony fish observed in the field 2. 4. Study of Crustacean representatives: squid *versus* crab. 5. Recognition and identification of crustaceans observed in the field. 6. Recognition and identification of crustaceans observed in the field. 7. Study of Mollusc representatives: sepia versus gastropod/bivalve. 8. Recognition and identification of Molluscs observed in the field. 9. Recognition and identification of Molluscs observed in the field. 10. Recognition and identification of plants and potentially exploitable species.

Assessment method :

- End-of-semester exam
- Continuous testing: (tests in class sessions, practical work, oral tests, homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 3

EU title : methodology

Subject title : Quality control of fish products

Hourly volume : 45H00 **Credits : 4** **Coefficients : 2**

Teaching objectives :

Investigate the health and nutritional aspects of consuming these products of aquatic origin, in order to draw up an inventory of feeding practices for fish, shellfish and crustaceans.

Recommended prior knowledge :

- Biology
- Biochemistry
- Chemistry

Contents :

Courses	1. Reminder of the main aquaculture products (fish, mollusks, crustaceans) PMC 1.1. Biological aspects 1.2. Anatomy and physiology 2. Nutritional benefits of PMC before preservation and processing and impact of PMC feeding 2.1. PMC composition 2.2. Main variation factors and nutritional benefits 3. Post-mortem changes in fish 3.1 Organoleptic changes 3.2. Autolytic alteration 3.3 Bacteriological changes 4. Changes in quality and shelf life of refrigerated fish 4.1 Effect of temperature 4.2 Hygiene during handling 4.3 Effect of CO2 and anaerobic conditions 4.4 Effect of fishing methods and seasons on the quality of fish products 4.5. Effect of evisceration 4.6. Rancidity 5. HEALTH ASPECTS (CHEMICAL AND BIOLOGICAL) 5.1 Assessment of chemical risks associated with PMC consumption 5.2 Assessment of toxin-related risks 5.3 Assessment of biological risks associated with PMC consumption 6. Packaging and storage of PMC 7. Fish quality assessment 7.1. Sensory methods

	7.2. Biochemical and chemical methods 7.3. Physical methods 7.4. Microbial methods 7.5. PMC quality assurance
TD/ TP	1. Overall biochemical composition of fish and shellfish 1.1. Protein determination 1.2 Determination of total lipids 1.3. Determination of ash 2. Alteration factors 1.1. Determination of total volatile basic nitrogen (TVBN) 1.2 Trimethylamine (TMA) determination 1.3. Determination of histamine 1.4. Determination of indole 1.5 Peroxide index 3. Microbiological analysis 1.1 Stability (pH) 1.2. Presence of flora 1.3. Total germ count 4. Sensory evaluation of fresh PMC quality (French and European ratings)

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 3

EU title : methodology

Subject title : Python and AI programming

Hourly volume : 60H00 **Credits : 5** **Coefficients : 2**

Teaching objectives:

The aim of the course is to analyze data in order to derive answers to problems in the field. Machine learning (ML) is a form of artificial intelligence (AI) that focuses on creating systems that learn, or improve their performance, based on the data they process.

Recommended prior knowledge :

- Statistics
- Mathematics
- Informatics

Contents :

Courses	**1- Identifying the possibilities of Machine Learning** - Discover the field of Data Science - Identify the different modeling stages - Identify the different types of machine learning **1- Introduction to the Python language** - Numpy - MathPlotlib - Pandas **2- Identify Machine Learning techniques and tools** - Transforming business needs into Machine Learning problems **3- Data cleaning** - Data Cleaning with Excel. - Data Cleaning with Python. **4- Data Analysis** - Mean. - Variance. - Histogramms. **5- Classification** - Logistic Regression. - Validation. - Support Vectror Machine - Artificial Neural Network **6- Training the first Machine Learning algorithm** - Building a statistical model

	- Programmer la régression linéaire - Validation. - Regression Polynomiale. - Decision Trees.
TD	**1-** Identify the different modeling stages **2-** Identify the different types of machine learning **3-** Algorithm with python **4-** Transforming business needs into Machine Learning problems **5-** Data Cleaning with Excel. **6**-Data Cleaning with Python. **7-** Data analysis **8-** Classification with machine learning **9**- Programmation

Evaluation mode :

- End-of-semester examination

➢ Continuous testing: (tests in class sessions, practical work, oral exams, homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 3

EU title : transversal

Subject title : Meteorology and navigation

Hourly volume : 45H00 **Credits : 3** **Coefficients : 2**

Teaching objectives :

Assimilate the general knowledge that will enable students to understand the main atmospheric phenomena, analyze and interpret information from meteorological services, and acquire basic notions of navigation.

Recommended prior knowledge :

- Oceanography

Contents :

Courses	**Part I : General meteorology** **Chapter 1** : Planet Earth and its atmosphere – Planet Earth (shape, dimensions, geoid, parallels and meridians). – Earth's atmosphere (composition and structure). – Atmospheric variables (temperature, atmospheric pressure and humidity). – Standard atmosphere. – General traffic. **Chapter 2 :** Air masses and fronts – Action centers (depressions, anticyclones, ridges, barometric marshes, etc.). – Disturbances and fronts. **Chapter 3** : The winds – Synoptic and thermal winds. – Wind types. – Beaufort scale. – State of the sea (Douglas scale). **Chapter 4 :** The clouds – Formation. – Typologies. **Part I : Navigation** **Chapter 5 :** Introduction to marine navigation and charts – Definition and types of navigation. – Reference systems. – Definition of nautical mile and knot. **Chapter 6 :** Routes, headlands, landmarks and bearings. **Chapter 7:** Navigation and prospecting instrumentation (Global Positioning System (GPS), echosounder and sonar, etc.) **Chapter 8 :** Marine terminology

Tutorial	**1 :** Meteorological instrumentation and forecasting models **2 :** Introduction to reading weather maps (isobaric maps, altitude maps and temperature maps). **3 :** Calculating wind speed from an isobaric map. **4 :** Positioning formats (decimal degrees, decimal minutes, DMS and UTM). **5 :** Use of nautical charts (positioning, bathymetry and nature of the seabed, calculating distances, etc.). **6 :** Using the Cras rule. **7 :** Scientific work at sea (preparation of an outing on paper and electronic charts)).

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 3

EU title : transversal

Subject title : English for Specific Purposes 3 (ESP3)

Hourly volume : 22H30 **Credits : 3** **Coefficients : 2**

Teaching objectives :

This course will enable students to prepare for the world of work, which requires the application of their English language skills.

Recommended prior knowledge:

- ESP2

Contents :

Courses	**Unit 1:** Writing reports. **Unit 2:** Application Forms **Unit 3**: Preparing a CV **Unit 4:** Oral Interviews and Tips Questions and answers: Speaking about your skills. • Play role activities for students

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 4

EU title : fundamental

Subject title : Assessment and management of fish stocks

Hourly volume: 67H30 **Credits : 5** **Coefficients : 4**

Teaching objectives :

Stock assessments provide the information needed to make evidence-based decisions. Stock assessments are also useful for evaluating the expected biological impacts and benefits of proposed fisheries management measures

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Recommended prior knowledge:

- Population dynamics
- Mathematics

Contents :

Courses	**Chapter 1. Fish stock assessment models** 1.1. Characteristics of an operating stock 1.2. Building a model 1.3. The different types of models used in the fisheries sector 1.4. Choosing a model 1.5. Notions of maximum sustainable yield and balanced biomass **Chapter 2. Analytical (or structural) models** 2.1. Production per recruit by Beverton and Holt (1957) 2.2 Relative production per recruit by Beverton and Holt (1966) 2.3 Fry's virtual population analysis 2.4 Age-based cohort analysis (Pope method, 1972) 2.5 Length-based cohort analysis (Jones ,1983) 2.6 Thompson and Bell model (1934) **Chapter 3. Holistic (or global) models** 3.1 Basic concepts 3.2 Linear Schaeffer model 3.3 Exponential fox model 3.4 Cadima formula 3.5. Assessment of migratory stocks 3.6. Stock-release relationship **Chapter 4. Direct stock valuation: swept area method**
Tutorial	1. Characteristics of a working stock 2. Beverton and Holt's production per recruit (1957) 3. Relative production per recruit by Beverton and Holt (1966) 4. Fry's virtual population analysis 5. Age-based cohort analysis (Pope method, 1972) 6. Length-based cohort analysis (Jones ,1983) 7. Thompson and Bell model (1934) - Mono-specific approach 8. Holistic (or global) models

	9. Swept area method 10. Stock-recruitment models

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 4

EU title : fundamental

Subject title : Biogéographie marine

Hourly volume : 67H30 **Credits :5** **Coefficients : 4**

Teaching objectives :

Study the ancient and current causes of the geographical distribution of living beings and their groupings, as well as the dynamism of this distribution, using a global approach to define the various remarkable geographical systems of the marine space and its interface with the land: identifications, classification, speciation, evolution, etc..

Recommended prior knowledge:

- Biology-Ecology-Zoology

Contents :

Courses	1. Fundamental concepts of biogeography. 2. Elements of oceanography. 3. Different approaches to marine biogeography studies (database, zoosystematics, digital ecology, biocenology, zoocenology, modeling, multidimensional analysis, mapping). 4. History of the earth and living organisms (continental drift, plate tectonics, major geological and biological events). 5. History of the Mediterranean and biodiversity (formation, crises, biogeographical origins, biodiversity of the Algerian coast). 6. Allochthonous species and environmental modification (speciation, vicariance, acidification, meridionalization, Lessepsian/Herculean migrations, anthropization, etc.). 7. Fisheries and aquaculture production (worldwide, Mediterranean and Algerian).
Tutorial	1. Ocean circulation and primary production. 2. Communities and ecosystems 1: Horizontal distributions. 3. Communities and ecosystems 1: Vertical distributions. 5. Communities and ecosystems 2: Specific diversity and patterns of stand structure. 6. Communities and ecosystems 3: Associated fauna using the classical method. 7. Mapping: distribution of species observed on outings (by region and sector). 8. Cartography: distribution of species observed on outings (by region and sector).
practical work	1. Stock study: identification and sampling of meristic characters. 2. Geographical distribution of a biological trait: meristic traits and the concept of stock.
Practical activity	**Field trips: 15 H (plan trips to the Algiers fishery and to different areas of the Algiers region or the Algerian coast).**

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 4

EU title : fundamental

Subject title : Molecular biology and bioinformatics techniques

Volume horaire : 67H30 Crédits : 5 Coefficients : 3

Teaching objectives :

Introduce the concepts needed to master molecular biology techniques for manipulating and studying nucleic acids, as well as bioinformatics approaches that enable autonomous analysis of these data (e.g. taxonomy, phylogeny, DNA or protein sequences).

Recommended prior knowledge :

- Biology-Genetics

Contents :

Courses	**1- Genetic material** 1-1- Structure of nucleic acids 1-2- Physicochemical properties of nucleic acids 2- Molecular biology techniques 2-1- Nucleic acid extraction and purification 2-2-Hybridization of nucleic acids 2-3-PCR chain reaction techniques 2-4- Sequencing 2-5- Cloning **3-Introduction to bioinformatics** 3-1-History 3-2- Biological databases 3-3- Sequence alignment 3-4-comparison of "BLAST" sequences 3-5- Alignment of two sequences 3-6- Multiple sequence alignment 3-7- Phylogeny 3-7-1-Sparsimony methods 3-7-2-Likelihood method 3-7-3-Distance methodss
Tutorial	1. Comparison of nucleic acid sequences in a database 2. Nucleic sequence alignment 3. Study of examples of phylogenetic tree construction
Practical	1. DNA extraction and electrophoresis 2. DNA assay

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 4

EU title : methodology

Subject title : Atelier 1

Hourly volume: 82H30 **Credits : 7** **Coefficients : 3**

Teaching objectives :

The various practical activities are designed to complete the training.

Recommended prior knowledge:

- IT

Contents :

Practical activity	• Scuba diving (30 h) • Digital imaging (22.5 h) • Advanced Office Training (30 h)

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 4

EU title : methodology

Titre du sujet : Stage 2

Hourly volume : 60H00 **Credits : 6** **Coefficients : 2**

Teaching objectives :

The learner will have to immerse himself in companies such as the country's various natural parks (El Kala, Gouraya, Taza) and in research centers or companies. He or she will also have to embark on fishing boats and take part in activities that will provide a realistic perception of the environment being exploited.

In addition to theoretical knowledge, this involvement will lead the student to a research career or professional autonomy capable of transforming an idea or invention into a successful innovation.

Recommended prior knowledge:

Concepts studied in the basic unit subjects

Contents :

Activity practice	Content varies according to the host structure

Assessment method :

- End of semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 4

EU title : discovery

Subject title : Innovation

Hourly volume : 30H00 **Credits : 2** **Coefficients : 1**

Teaching objectives :

Introduce students to innovative methods and techniques related to the fishing industry..

Recommended prior knowledge:

Fisheries concepts covered in previous semesters' teaching units

Contents :

Courses	I. Innovations in sclerochronology I.1. The use of digital imaging I.2 Introducing TNPC (Digital Treatment of Calcified Parts) II. Some examples of innovative research projects II.1. The AWA campaign on the Thalassa II.2. The Charm3 Program II.3. Assessment of fishery resources through visual observation II.4. The European Fadio program III. Innovative techniques for sustainable fishing III.1. Innovations for fishing ? III.2. A few examples IV. Fish marking techniques V. High-definition video to study underwater biodiversity VI. The Fisheries Information System (SIH) VII. Fish aggregating devices (FADs): tools for sustainable fishing VIII. Using acoustics to capture aquatic animals

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 5

EU title : fundamental

Subject title : Ecosystem modeling of fishery resources

Hourly volume : 67H30 Credits : 6 Coefficients : 4

Teaching objectives :

Train future scientists in the maritime sector with a view to responsible fishing and ecosystem-based management of marine and coastal resources and environments.

Recommended prior knowledge:

- Population dynamics
- Mathematics

Contents :

Courses	**Chapter 1. Introduction to ecosystem-based fisheries modeling** 1. History 2. Fields of application of ecosystem models 3. Examples of the use of management advice 4. Fields of application of ecosystem models 5. Robustness and the precautionary approach : 6. The question of uncertainties in management **Chapter 2. Multispecies/multiflot models** 1. Obtain input data 2. Multispecies approach 3. Multifleet approach 4. Combined approach 5. Simulation techniques **Chapter 2. Le modèle Ecopath avec Ecosim (EWE)** 1. Definition and estimation of input parameters 1.1 Assessing relative food consumption (Q/B) 1.2 Estimating biomass 1.3 Identifying and defining trophic groups 1.4 Estimating the diet matrix 1.5. Estimation of production/biomass 1.6 Estimation of ecotrophic efficiency (EE) 1.7 Estimation of trophic level (TL) **Chapter 4. Self-centered modelIBM** **Chapter 5. Examples of research projects on the ecosystem approach to fisheries**

Tutorial	**1.** Review of population dynamics methods **2.** Multispecies approach **3.** Multifleet approach **4.** 77-combine approach **5.** Simulation techniques **6.** Applications of the Ecopath with Ecosim (EWE) model **7.** IBM model applications

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams),homework, presentations, internship reports)

Engineering title : Gestion de la pêche fondée sur les écosystèmes (GEP)

Semester: 5

EU title : fundamental

Subject title : Fisheries ecology

Hourly volume : 67H30 **Credits : 6** **Coefficients : 3**

Teaching objectives:

- Acquire advanced knowledge of the functioning of essential fishing habitats (spawning grounds, nurseries, migration routes, etc.), knowledge of the spatio-temporal dynamics of exploited marine resources, grasp and understand the factors responsible for their variability at different scales, and master the techniques for acquiring the bio-ecological information needed to analyze and manage populations.

Recommended prior knowledge :

- Programmation R

Contents :

Courses

Chapter 01. Food web dynamics

1. Introduction
2. Trophic relationships, food web structure and function
3. Trophic interactions
   3.1 Trophic control theory
   3.2 Methods for studying trophic interactions

3.2.1. Stomach content analysis

3.2.2. Trophic markers

- Stable isotopes
- Organic contaminants
- Fatty acids

Chapter 02. Bioenergetic models

1. Introduction
2. Model presentation and description DEB
3. Effect of environmental parameters on organism growth and reproduction

Chapter 03. Conservation and restoration

1. Definition, history and objectives of conservation and restoration
2. Objectives and structure of conservation and restoration strategies
3. Example of restoration
4. Nature reserves
5. Marine Protected Areas

	Chapter 04. Resource-climate and resource-fisheries interactions 1. Temporal population dynamics (species alternation, recruitment) 2. Effects of climate on the spatial distribution of populations. 3. The role of marine protected areas in resource management.
Tutorial	01- Estimation of trophic level TL 02- Trophic markers: case studies 03- Similarity/dissimilarity and distance indices with R 04- The Ecopath - Ecosim model: Case studies 05- Factor analysis in R and its application to ecology 06- Application of the DEB model

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Managements (GEP)

Semester : 5

EU title : fundamental

Subject title : Economics of fishery resources

Hourly volume: 67H30 **Credits : 6** **Coefficients : 3**

Teaching objectives :

Mastery of project management techniques and application of these tools in concrete projects for the restoration of ecosystems and populations by companies and engineering firms.

Recommended prior knowledge :

- Mathematics
- Statistics

Contents :

Chapter I : Introduction to General Economics

Courses	The purpose of economics 1.1.1. Evolution of economic thought 1.1.2. Economic functions and agents 1.1.3. Models of economic organization 1.2. Branches of the economy 1.2.1. Microeconomics 1.2.2 Macroeconomics **Chapter II: Fishing systems and fisheries economics** 2.1. Fishing system 2.2. Phases in the social evolution of a fishery 2.3 Fisheries resource issues and externalities 2.2 Economics of fishery resources 2.2.1. Economic analysis 2.2.2. Management of fishery resources 2.2.2.1. Fisheries management objectives 2.2.2.2. Fisheries management systems : 2.3 Fisheries bioeconomic modeling 2.3.1. Bioeconomic modeling fisheries management framework- **Chapter III : Blue Economy and Social Solidarity Economy** **Concepts and applications**
Turorial	• Exercises, • Presentations, • Field trips.

Evaluation mode :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 5

EU title : methodology

Subject title : Workshop

Hourly volume : 60H00 **Credits : 6** **Coefficients : 3**

Teaching objectives :

Complement training with conferences and apprenticeships in new and innovative techniques

Recommended prior knowledge:

- R programming
- Documentary research and communication

Contents :

Courses	• Halieutics themed conferences**Activités**
practices	– Geomorphometry - Writing the final dissertation

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Gestion Ecosystémique des Pêches (GEP)

Semester : 5

EU title : méthodologie

Subject title: Project management

Hourly volume: 45H00 **Credits : 4** **Coefficients :2**

Teaching objectives :

Mastery of project management techniques and application of these tools in concrete projects for the restoration of ecosystems and populations by companies and design offices.

Recommended prior knowledge:

- None

Contents :

Courses	**Chapter I : Project formalization** - Definitions and Typology - The seven facets of project management - Project life cycle **Chapter II: General approach to project management** - Project organization - Project scope - Teams - Tasks and responsibilities - Project stakeholders - SWOT matrix - Project planning - GANTT chart, PERT - Financial management - Risk and opportunity management - Project management - Resource tracking - Steering indicators - Quality management - Project communication - Means of communication - Communication plan **Chapter III: Project technical and economic studies** - Case studies
Tutorial	• Exercises, • Presentations ...

Méthode d'évaluation :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

References

- DUFORT G. et GOUAULT A., 1982. Economie générale. Fouchet, Paris.
- MONACO A. et PROUZET P., 2000. Valoristion et économie des ressources marines.ISTE éditions.
- DESAIGUES B. et POINT P., 1993. Economie du patrimoine naturel ; économie AParis. CILLY B., 1989. Les modèles bioéconomiques en halieutique.
- GORDON H.S., 1954. The economy theory in common propertiy ressource.

Engineering title: Ecosystem-Based Fisheries Management (GEP)

Semester : 5

EU title : découverte

Subject title : Droit de la mer et législation

Hourly volume : 45H00 **Credits : 1** **Coefficients: 1**

Teaching objectives :

General knowledge of the Law of the Sea and legislation governing the fishing industry.

Recommended prior knowledge:

- No prerequisites

Contents :

Courses	**Chapter I: General and basic concepts** 1. Right 2. International law 3. Public international law 4. Private international law 5. International law tools : 5.1. Treaty 5.2. Convention 5.3. Declaration 5.4. Agreement 5.5. Customs 5.6. Other tools 6. Public maritime domain 7. Legislation **Chapter II: Law of the Sea** 1. History of the Law of the Sea 1.1 Geneva Convention (1958) 1.2 United Nations Convention on the Law of the Sea (1982) 2. Maritime spaces 2.1. Baselines 2.2. Inland waters 2.3. Territorial sea 2.4. Contiguous zone 2.5. The exclusive economic zone 2.6. The continental shelf 2.7. High seas 2.8. Islands 2.9. Straits 2.10. Semi-enclosed seas

	2.11. The straits 2.12. Archipelago states **Chapter III : National legislation** 1. Maritime spaces in Algeria 1.1. Base line: decree no. 84-181 of August 4, 1984 1.2. Territorial sea: decree no. 63-403 of October 12, 1963 1.3. Contiguous zone: Presidential Decree No. 04-344 of November 6, 2004 1.4. EEZ: Presidential Decree No. 18-96 of March 20, 2018 1.5. Algeria's EEZ overlaps with other maritime areas maritime spaces 1.6. New legislation on maritime areas in Algeriae (if applicable) 2. Organization of fishing activities 2.1. Executive decree no. 20-266 of September 22, 2020 setting minimum sizes of biological resources 2.2. Order of April 29, 2020 setting limits on the use of trawls pelagic, semi-pelagic and bottom trawls in time and space 2.3. Order of December 31, 2020 instituting bluefin tuna fishing quotas for vessels flying the national flag and operating in waters under national jurisdiction, and setting the terms and conditions for their allocation and implementation 2.4. Arrêté du 4 avril 2021 instituant des quotas de pêche au thon rouge pour les navires battant pavillon national exerçant dans les eaux sous juridiction nationale et fixant les modalités de leur répartition et de leur mise en œuvre 2.5. Law n°15-08 of April 2, 2015 on fishing and aquaculture 2.6. New and other texts relating to fishing activities in Algeria (if applicable) where applicable) **Chapter III : International fisheries legislation** 1. Overview of European regulations 2. Overview of regulations in the United States American 3. Overview of regulations in Japan and other fishing-intensive countries **Chapter IV : Conventions internationales** 1. The Ramsar Convention on Wetlands of February 2, 1971 of International Importance especially as Waterfowl Habitat 2. The Rio de Janeiro Convention on Biological Diversity of June 5, 1992 3. The Barcelona Convention of June 10, 1995 of the Protocol on the conservation and sustainable use of natural resources in the Mediterranean.and Biological Diversity in the Mediterranean 4. Other agreements (if any)

Assessment method :

- End-of-semester exam
- Continuous assessment: (in-class tests, practical work, oral exams), homework, presentations, internship reports)

Engineering title : Ecosystem-Based Fisheries Management (GEP)

Semester : 5

EU title : découverte

Subject title : Développement durable

Hourly volume : 22H30 **Credits : 1** **Coefficients : 1**

Teaching objectives :

The aim of this course is to enable students to gain a global vision of the different social, economic, environmental and cultural dimensions of development, and to grasp their complexity. Students will acquire knowledge of the concept of sustainable development and its implementation at different scales. Analysis and monitoring tools will also be covered.

Recommended prior knowledge:

- No

Contents :

Courses	**I. Introduction** - The current development model and its limits. **II. History and definitions** - The birth and evolution of the concept of sustainable development - Definitions of sustainable development **III. Foundations and principles** - The three pillars of sustainable development - Introduction to the principles of sustainable development **IV. Evolution of the concept of sustainable development** - Key dates and conferences **V. Sustainable development players and tools** **VI. Sustainable Development Goals (ODD)** - Background and characteristics - The 17 SDGs - The contributions of the SDGs - SDG actors and their contribution - State of implementation **VII. Measuring sustainable development** - Indicators - Ecological footprint - Green GDP - Human Development Index(IDH)

	VIII. Fishing and sustainable development - History - The challenges and priorities of sustainable development in the fishing industry - Implementing sustainable development in fisheries **IX. Resilience** - Definitions - The importance of resilience - Sustainable development and resilience
TD	- Presentation of the 17 SDGs: consistency, targets, indicators, current status, examples of implementation initiatives. - Sustainable development in Algeria: evolution, achievements and status of implementation - Implementation of a sustainable development plan for a fishery

Assessment method :

- End-of-semester examination
- Continuous testing: (tests in class sessions, practical work, oral exams, homework, presentations, internship reports)

IV– National and International Cooperation Agreements

1- At national level :

– Agreement to set up the National Network of Engineering Schools

Natural and Life Sciences:

- ENSSMAL
- Ecole Nationale Supérieure Vétérinaire d'Alger Rabie BOUCHAMA (ENSV),
- Ecole Nationale Supérieure Agronomique d'Alger Kasdi MERBAH (ENSA),
- Ecole Supérieure des Sciences de l'Aliment et des Industries Agroalimentaires (ESSAIA),
- Ecole Nationale Supérieure de Biotechnologie Taoufik KHAZNADAR (ENSB),
- Ecole Nationale Supérieure des Forêts (ENSF),
- Ecole Supérieure en Sciences Biologiques d'Oran (ESSBO),
- Ecole Supérieure d'Agronomie de Mostaganem (ESA).

–Agreement with Abou Bakr BELKAID University in Tlemcen.

- Agreement with Université des Sciences et Technologies Houari BOUMEDIENE (USTHB) (to be signed).

- Center de Recherche en Sciences Pharmaceutiques (CRSP).

- Center National de Recherche et de Développement de la Pêche et de l'Aquaculture (CNRDPA). - Groupement Algerian Corporate Universities (GACU).

- Algiers Nuclear Research Center (CRNA).

- Laboratoire d'Etude Maritimes (LEM).

- Groupe GITRAMA (Groupe d'Infrastructures de Travaux Maritimes).

- Société des Eaux et de l'Assainissement d'Alger (SEAAL) (currently being signed).

- Plateau Technique de l'USTHB.

- Agence Nationale des Déchets (AND).

- DP World.

- CEI HALFAOUI.

- SPA CCS Industry.

- NEPHROPS Ingénierie Environnementale.
- Institut National Supérieur de la Pêche et de l'Aquaculture (INSPA).
- Institut de Technologies des Pêches et de l'Aquaculture (ITPA Collo).
- Ecole de Formation Technique de pêche et d'Aquaculture de Beni-Saf (EFTPA).
- Direction de la Pêche et des Ressources Halieutiques de Ain Témouchent.
- Spa Cultures Marines – CULTMARE.
- Parc National du Gouraya.
- Association pour la Recherche, l'Information et la Formation Subaquatique (RECIF).
- Club de plongée sous-marine KALYPSO.
- Ecole de plongée subaquatique AQUAMAR (en cours de signature).
- Club de plongée sous-marine PARADIVE.

2- Internationally :

- Istanbul University (Turkey).

- Ankara University (Turkey).

- Akdeniz University (Antalya, Turkey).

- Université Internationale de la Mer (France).

- University of Nouakchot Al Aasria (Mauritania).