

## Physiology of Aquaculture Species (I002880)

Due to Covid 19, the education and evaluation methods may vary from the information displayed in the schedules and course details. Any changes will be communicated on Ufora.

<b>Course size</b>	<i>(nominal values; actual values may depend on programme)</i>		
<b>Credits</b> 8.0	<b>Study time</b> 200 h	<b>Contact hrs</b>	50.0 h

### Course offerings in academic year 2022-2023

A (semester 1)	English	Gent
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### Lecturers in academic year 2022-2023

Navarro, Isabel	BARCELO1	lecturer-in-charge
Blasco, Josefina	BARCELO1	co-lecturer
Capilla, Encarnación	BARCELO1	co-lecturer
García de la Serrana, Daniel	BARCELO1	co-lecturer
García-Meilán, Irene	BARCELO1	co-lecturer
Gutiérrez Fruitos, Joaquim	BARCELO1	co-lecturer
Ibarz, Antoni	BARCELO1	co-lecturer
Martin-Pérez, Miguel	BARCELO1	co-lecturer

### Offered in the following programmes in 2022-2023

<a href="#">International Master of Science in Health Management in Aquaculture</a>	<b>crdts</b>	<b>offering</b>
	8	A

### Teaching languages

English

### Keywords

*Fish nutrition, energetics, metabolism, digestibility, dietary requirements, fish oil and fishmeal replacement, food intake control, aquaculture invertebrate reproduction, fish reproduction, hypothalamus- pituitary- gonad axis, spawning induction, sex control, environmental regulation, gamete quality, fish growth, larval development, endocrine regulation of growth, muscle growth and myogenesis, hyperplastic and hypertrophic growth, skeletal malformations, flesh organoleptic traits.*

### Position of the course

*This course aims at introducing into the physiology of fish and invertebrate species relevant for aquaculture, assessing the fundamentals of nutrition, reproduction, and growth, and how can be applied to a sustainable aquaculture development.*

### Contents

#### 1. Fish nutrition and health

- Food and nutrition. Metabolic rate. Energy balance and its components.
- Gastrointestinal tract: anatomy and physiology. Digestion and assimilation. Antinutritional factors.
- Effects of nutrition on fish health.
- Protein metabolism: synthesis and degradation. Dietary protein quality, digestibility and requirements.
- Carbohydrate metabolism: uptake, metabolization, and dietary protein-saving effect.
- Lipid metabolism: transport and deposition. Antioxidants and oxidative stress.
- Endocrine regulation of metabolism and control of food intake.
- Manufacture of compound feed in fish farming: bases of the formulation.

#### 2. Reproduction of aquatic invertebrates and fish

- Reproductive strategies. Gametogenesis: oogenesis and spermatogenesis.

- Reproduction in invertebrate species relevant for aquaculture.
- Endocrine regulation of fish reproduction: hypothalamic, pituitary and gonadal hormones.
- Hormonal manipulation of reproduction: spawning induction, sex control and sterility induction.
- Gamete quality: techniques to determine the quality and cryopreservation processes.
- Reproduction in fish, control by environmental factors and effects on health.

### **3.Fish growth and skeletal malformations**

- Stages of growth in fish. Embryonic and larval development: hatching and organogenesis. Larval growth.
- Endocrine regulation of somatic growth: Growth hormone and factors, thyroid hormones, and other hormones.
- Fish muscle and skeletal characteristics; development and growth. Hyperplastic and hypertrophic growth.
- Skeletal malformations.
- Musculoskeletal interactions for proper growth and environmental effects.
- Fish flesh quality. Main techniques, reference parameters and quality markers.

#### **Initial competences**

General biology, general physiology, zoology

#### **Final competences**

- 1 Choose the appropriate nutritional and feeding parameters and optimal diets to maintain fish health and to obtain a high quality product in a sustainable way
- 2 Identify the reproductive strategies in fish and aquaculture invertebrates, and know the role of the environment on reproduction and its endocrine regulation, to assess an effective manipulation of the reproductive cycles in those species
- 3 Know how to apply the physiological bases of the development and growth of fish to obtain an optimal growth and good quality of the flesh, maintaining animal welfare

#### **Conditions for credit contract**

This course unit cannot be taken via a credit contract

#### **Conditions for exam contract**

This course unit cannot be taken via an exam contract

#### **Teaching methods**

Guided self-study, demonstration, group work, lecture, practicum, project, seminar, seminar: coached exercises, seminar: practical PC room classes

#### **Learning materials and price**

syllabus

#### **References**

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- Devlin, R.H., Nagahama, Y. (2002). Sex determination and sex differentiation in fish: an overview of genetic, physiological, and environmental influences Review article. *Aquaculture* 208, 191–364.
- Devlin, R.H., Sakhrani, D., Tymchuk, W.E., Rise, M.L., and Goh, B. (2009). Domestication and growth hormone transgenesis cause similar changes in gene expression in coho salmon (*Oncorhynchus kisutch*). *PNAS* 106: 3047–3052.
- serrana, D.,  
[Estevez, A.](#)

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[Johnston, I.A. \(2012\). Fast skeletal muscle transcriptome of the Gilthead sea bream \(\*Sparus aurata\*\) determined by next generation sequencing. \*BMC Genomics\* 13\(1\):181.](#)  
 -Grosell, M., Farrell, A.P., Brauener, C.J. (2011). *The multifunctional gut of fish. Fish Physiology* 30: 1-448  
 -González-Kother, P., Oliva, M.E., Tanguy, A., Moraga, D. (2020). A review of the potential genes implicated in follicular atresia in teleost fish. *Mar Genomics* 50: 100704.  
 -Herrera, M., Mancera, J.M., Costas, B. (2019). The use of dietary additives in fish stress mitigation: comparative endocrine and physiological response. *Frontiers in endocrinology* 10: 1-22  
 -Johnston, I. *Fish Physiology, XVIII. Muscle Development and Growth*. Ed. Ian Johnston, William Hoar, Anthony Farrell, Academic Press 2001.  
 -Kamalam, B.S., Medale, F., Panserat, S. (2016). Utilisation of dietary carbohydrates in farmed fishes: New insights on influencing factors, biological limitations and future strategies. *Aquaculture* 467: 3-27.  
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 -Peter, R.E., and Yu, K.L. (1997). *Neuroendocrine regulation of ovulation in fishes: basic and applied aspects Reviews in Fish Biology and Fisheries* 7, 173–197.  
 -Shadwinck, R.E. and Lauder, G.V. *Fish Physiology, XXIII. Fish Biomechanics. Academic Press, 2006*  
 -Turchini, G.M. Ng, W.-K., Tocher, D.(editors). (2011). *Fish oil replacement and alternative lipid sources in aquaculture feeds, CRC Press.*  
 -Vélez, E.J., Lutfi, E., Azizi, Sh., Perelló, M., Salmerón, C., Riera-Codina, M., Ibarz, A., J Fernández-Borràs, J., Blasco, J., Capilla, E., Navarro, I., Gutiérrez, J. (2017). *Understanding fish muscle growth regulation to optimize aquaculture production. Aquaculture, 467, 28-40.*  
 -Zohar, Y., Muñoz-Cueto, J.A., Elizur, A., Kah, O. (2010). *Neuroendocrinology of reproduction in teleost fish. Gen Comp Endocrinol. 165:438-55.*

#### **Course content-related study coaching**

Teacher available for student counselling

#### **Evaluation methods**

end-of-term evaluation and continuous assessment

#### **Examination methods in case of periodic evaluation during the first examination period**

Written examination with open questions, written examination with multiple choice questions, written examination, oral examination

#### **Examination methods in case of periodic evaluation during the second examination period**

Written examination, oral examination, report

#### **Examination methods in case of permanent evaluation**

Written examination with open questions, written examination with multiple choice questions, written examination, portfolio, participation, simulation, report

#### **Possibilities of retake in case of permanent evaluation**

examination during the second examination period is possible in modified form

#### **Calculation of the examination mark**

*Exam 30%; Case report and portfolio 20%; Oral presentation 50%*  
*Students who eschew period aligned and/or non-period aligned evaluations for this course unit may be failed by the examiner.*