

Course Title: Shellfish aquaculture in the carbon circular economy

Modality: CFT- Transversal Training Course

Orientation:

- Ocean Observation and Global Change
- Sustainable use of Marine Resources
- Integral Management of the Sea
- Technological progress. Engineering and Business Management

Dates: 5, 6 and 7 May, 2021

Timetable: 9 to 14 h (CET)

Duration: 1 ECTS

Location: University of Vigo

Language: Spanish (English if necessary)

Academic coordinators:

Name	Institution	e-mail
Álvarez Salgado, Xosé Antón	CSIC	xsalgado@iim.csic.es
Taboada Antelo, Luis	CSIC	ltaboada@iim.csic.es

Lecturers:

Name	Institution	e-mail
Álvarez Salgado, Xosé Antón	CSIC	xsalgado@iim.csic.es
Taboada Antelo, Luis	CSIC	ltaboada@iim.csic.es

General description: Shellfish aquaculture is a low carbon footprint (CF) food production system. However, the major by-product of this activity, shell calcium carbonate (CaCO₃), which amounts about 13.6 million metric tons per year worldwide, has not been traditionally considered in the CF estimates of shellfish aquaculture. Therefore, methodologies to estimate the CO₂ sequestration budget of shellfish aquaculture have not been properly developed yet. In this regard, shellfish CaCO₃ could contribute to sequester anthropogenic CO₂ during shell formation, allowing the potential integration of shellfish aquaculture in the carbon emissions market. To achieve this goal, shell CaCO₃ should be used in activities that sequester their CO₂ for prolonged time periods. In this course, we will i) present global and regional shell CaCO₃ production from marine aquaculture; ii) propose a methodology to integrate shell CaCO₃ in the CO₂ sequestration budget of these food production activities; iii) analyse the effect of bivalve consume habits on the availability of shells; and iv) explore their possible agricultural, industrial, and environmental engineering applications. Furthermore, global, continental and regional demands of CaCO₃ will be matched with their respective mussel aquaculture productions.

Contents: The following four topics will be covered by the course:

Topic 1: Bivalve aquaculture. The case of Galician mussel aquaculture.

Topic 2: Towards a consensus CO₂ budget for shellfish aquaculture. Carbon footprint and carbon sequestration.

Topic 3: Shellfish calcium carbonate value chain.

Topic 4: Shellfish aquaculture in the carbon market

Teaching methodologies: Power point presentations by the lecturers and active dialogue and discussion with the students.

Evaluation system: Resolution of a practical case study

Brief CV of the lecturers:

Dr. **Luis T. Antelo** received a BSc in Chemical Engineering at University of Santiago de Compostela (USC) in 2001 and a PhD degree in Chemical Engineering by the University of Vigo (2008). Then, he got 3-years postdoctoral contract of the Program “Ánxeles Alvariño” (Xunta de Galicia) focusing his research on the definition of optimal control profiles/policies to new scenarios/cases through the definition of a hierarchy multi-layer approach for optimal control of processes. After being a "Ramón y Cajal" researcher (2016-2017), he got a permanent position as Tenure Scientist in the GEPRO Group of the IIM-CSIC in March 2017. His expertise offers a great potential to assist in the design and optimal control of new bio-processes and plants in the food industry or in the optimal selection of existing processing routes integrating both criterion (economic and environmental) to give response to the variety/volume of generated fishing by-products and previously discarded biomass while improving the final quality of the desired products (maximizing and preserving its quality and safety bioactive properties) under the novel concept he defined of Marine Biorefinery, eco-design and circular economy as well. He has published 36 papers in international scientific journals, 13 peer-reviewed book chapters and 2 articles in non-indexed scientific magazines, being the first/second and/or corresponding author in all of them. Up to 90% of the papers are in scientific journals within 25% of highest impact factor (Q1) of their topic area. He has participated in 16 research projects (half of them European), 2 as Technical Coordinator and 3 as Project Coordinator.

Prof. **X. Antón Álvarez Salgado** received an MSc in Physical Chemistry (1990) and a PhD in Ocean Chemistry (1993) at the University of Santiago de Compostela. He was a Marie Curie post-doc fellow at the Plymouth Marine Laboratory (1995–1996) and then returned to the Department of Oceanography, CSIC Institute of Marine Research, where he got a permanent position in 1999, being promoted to Research Scientist in 2006, and to Research Professor in 2018. Simultaneously, he has taught in MSc and PhD programmes of the Universities of Vigo, Las Palmas de Gran Canaria and Menéndez Pelayo. His work focuses on the study of carbon and nutrient cycles in coastal, shelf and ocean waters, with special emphasis on the Galician coastal upwelling system, both from the viewpoint of the exploitation of marine living resources, particularly cultured mussels, and of global change. He has participated in more than 40 research projects funded by the European Union, the Spanish Government and the Xunta de Galicia, being the principal investigator for half of them. He is the author of more than 150 research papers published in WoS-indexed journals, more than 80% of them in top-25% journals. He has received more than 5,000 citations (h index, 45) and has supervised 10 PhD Thesis.

Relevant references:

Alonso, A.A., Alvarez-Salgado, X.A., Antelo L.T., 2021. Assessing the impact of shellfish aquaculture on the carbon trading economy. *Journal of Cleaner Production* 279, 123873.

Filgueira, R., Strohmeier, T., Strand, Ø., 2019. Regulating Services of Bivalve Molluscs in the Context of the Carbon Cycle and Implications for Ecosystem Valuation. In: Smaal A., Ferreira J., Grant J., Petersen J., Strand Ø. (eds) *Goods and Services of Marine Bivalves*. Springer, Cham

Labarta, U., Fernández-Reiriz, M.J., 2019. The Galician mussel industry: Innovation and changes in the last forty years. *Ocean and Coastal Management* 167, 208-218.

Morris, J.P., Backeljau, T., Chapelle G., 2019. Shells from aquaculture: a valuable biomaterial, not a nuisance waste product. *Reviews in Aquaculture* 11, 42-57.