M 2024

IX INTERNATIONAL SYMPOSIUM
ON MARINE SCIENCES
VALENCIA. JULY 10-12

SIQUIMAR

XXII SEMINARIO IBÉRICO DE **QUÍMICA MARINA**

XXII IBEARIAN SEMINAR ON MARINE CHEMISTRY

VALENCIA, JULY 10-12

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

Universidade Vigo

Organizing Committee:

Jesús Forja Pajares, Aridane González González, David González Santana, Rocío Ponce Alonso, Juan Santos Echeandía

Local Organizing Committee:

Ana Blázquez Morilla, María Jesús Domínguez, María del Carmen Fuentes, Tania García Sanz, Ana Hernández Martínez, Jorge Juan Vicedo, Candela Machuca Arellano, Carolina Padrón Sanz, Ana Eugenia Rodríguez-Pérez, Javier Torres Gavilá

Scientific Committee:

Julián Blasco Moreno, Alexandra Cravo, Jesús Forja Pajares, Melchor González Dávila, Víctor León León, Marta Martins, Teodora Ortega Díaz, Magdalena Santana Casiano

Editors:

Jesús Forja Pajares, Aridane González González, David González Santana, Rocío Ponce Alonso, Juan Santos Echeandía

Abstracts Volume XXII International Iberian Seminar on Marine Chemistre (SIQUIMAR)
held under umbrella of the IX International Symposium on Marine Sciences**,** July 2024

ISBN: 979-13-990198-3-4

Linckia

* Organized by oral or poster categories, by thematic areas, and within each thematic area, in alphabetical order by author.

INDEX

ORAL COMMUNICATIONS

POSTER COMMUNICATIONS

ARIDANE G. GONZÁLEZ	MULTI-COAST: MULTIPARAMETRIC STUDY OF THE CO_2 CHEMISTRY IN COASTAL WATERS	BIOGEOCHEMICAL PROCESSES	86
JAIRO SÁNCHEZ-RODRÍGUEZ	ENHANCED GREENHOUSE GAS PRODUCTION BY DISSOLVED ORGANIC MATTER IN THE GUADALQUIVIR ESTUARY	BIOGEOCHEMICAL PROCESSES	87
MARIA JEREMIAS	SIMULTANEOUS VOLTAMMETRIC ANALYSIS OF PALLADIUM AND NICKEL USING SIGNAL TRANSFORMATION	BIOGEOCHEMICAL PROCESSES	89
MARÍA DEL CARMEN FERNÁNDEZ PUGA	DISTRIBUTION, SOURCES AND FLUXES OF DISSOLVED ORGANIC MATTER IN SEDIMENTS OF THE GUADALQUIVIR ESTUARY (SW IBERIAN PENINSULA)	BIOGEOCHEMICAL PROCESSES	91
NOUR BOCQUET	COUPLING GLOBAL OCEAN DEOXYGENATION AND ACIDIFICATION TROUGH MACHINE LEARNING PRODUCTS	BIOGEOCHEMICAL PROCESSES	93
ROCÍO PONCE	DIAGENESIS OF ORGANIC MATTER IN THE ESTUARY OF THE GUADALQUIVIR RIVER	BIOGEOCHEMICAL PROCESSES	95
XOSÉ ANTONIO PADÍN	UPTAKE OF ATMOSPHERIC CO_2 DURING DEEP-WATER FORMATION IN THE NORTHWESTERN MEDITERRANEAN SEA	BIOGEOCHEMICAL PROCESSES	97
FLORENCIA BELÉN RIAL	BASELINE STUDY OF SULFUR LEVELS IN THE COASTAL ZONE OF THE BAHÍA BLANCA ESTUARY (ARGENTINA)	CHEMICAL OCEANOGRAPHY	100

SIQUIMAR
XXII SEMINARIO IBÉRICO DE **QUÍMICA MARINA**

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

XXII IBERIAN SEMINAR ON MARINE CHEMISTRY

~

ORAL COMMUNICATIONS

Universidad Católica de Valencia San Vicente Mártir
Universitat d'Alacant
Universidad de Alicante
Universitat de Barcelona
UCA Universidad de Cádiz
ULPGC Universidad de Las Palmas de Gran Canaria
Universida de Vigo

SIQUIMAR

XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024

VALENCIA
JULY 10-12

IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

ORAL COMMUNICATIONS

~

BIOGEOCHEMICAL PROCESSES

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

UniversidadeVigo

ENHANCING ALKALINITY IN RIA FORMOSA BY DEPLOYMENT OF ALKALINE SUBSTRACTES: VARIABILITY IN NUTRIENT CONCENTRATION AND FLUXES

A. Cravo*[1], C. Correia[1], J. Lübbers[1], J. Schonfeld[2], and I. Mendes[1]

[1] CIMA/UALG, FCT, University of Algarve, Faro, PORTUGAL.
acravo@ualg.pt, cfcorreia@ualg.pt, jaluebbers@ualg.pt, imendes@ualg.pt
[2] Helmholtz Centre for Ocean Research Kiel (GEOMAR), GERMANY.
jschoenfeld@geomar.de

Abstract: Reducing atmospheric CO_2 levels is crucial in combating global warming. Mineral weathering naturally maintains ocean alkalinity, removing CO_2 from the atmosphere over geological time scales. To accelerate this process, alkaline substrates can be introduced into coastal areas, but their effectiveness depends on factors such as substrate type, grain-size, temperature, pH, and salinity. In addition, the marine biota can be affected by the release of nutrients and trace elements. An *in situ* experiment in Ria Formosa productive coastal lagoon, Portugal, Europe's first, initiated in September 2022, examines the effects of olivine and basalt (coarse and fine) application on alkalinity, nutrient and metals. The experiment was installed in an undisturbed zone colonised by *Spartina maritima* with monthly measurements of temperature, salinity, oxygen concentration, pH and determination of total alkalinity, nutrients and trace metals in supernatant and porewater samples. The aim of the present work was to assess the variability of nutrient concentrations, during the first year. Nutrients were determined spectrophotometrically (Grasshoff et al., 1999), using the OSIL Marine Nutrient Kit as reference material. Following mineral application, there was a notable rise in nutrient levels, particularly in porewater (up to 15-fold higher than the supernatant). Sediments acted as a nutrient source, influenced by organic matter remineralization, bioturbation, and mineral dissolution. Nutrient concentrations in porewater relative to control were up 2-fold for silicate and phosphate and 50% higher for ammonium and nitrate. After 3-4 months, concentrations stabilized, resembling control levels and fluxes also decreased, except silicate and nitrate. Nutrients were higher in olivine treatments than in basalt despite no significant differences occurred between substrates. No significant differences were also found between grain-size. Data variability can also be due to seasonal effects including of biological activity, and heterogeneity in the composition of the sediments. Data show that substrates have potential to increase alkalinity, with manageable nutrient impacts, attributed to Ria Formosa's high-water renewal rate.

Key words: Alkalinity enhancement, nutrients, Ocean acidification, Ria Formosa lagoon.

Acknowledgments: We would like to acknowledge the funding provided by FCT to the projects: RECAP (PTDC/CTA-CLI/1065/2021), LA/P/0069/2020 awarded to the Associate Laboratory ARNET (https://doi.org/10.54499/UIDB/00350/2020) and UID/00350/2020 awarded to CIMA of the University of the Algarve (https://doi.org/10.54499/LA/P/0069/2020).
Cátia Correia is funded through CIMA PhD Research Scholarships program (ref. UI/BD/150771/2020) and I. Mendes by FCT contract CEECINST/00052/2021/CP2792/CT0012.

References:

Grasshoff, K., Erkhardt, M., Kremling, K. (1999). Methods of Seawater Analysis. Third, Completely Revised and Extended Edition. Wiley-VCH, New York, 598 pp.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

MICROBIAL PROCESSES IN A DEOXYGENATING OCEAN: COEXISTENCE AND DOMINANCE AT LOW O_2 LEVELS

Emilio Garcia-Robledo*[1], Irene Ramirez-Hernandez[1], Marika Mecca[1], Julio Bohórquez[1], Jose Calderón-Caro[1] and Julia Huggins[1]

[1] Microbial Ecology and Biogeochemistry Lab, Department of Biology, Universidad de Cádiz, Cádiz, SPAIN.
emilio.garcia@uca.es, irene.ramirez@uca.es, marika.mecca@uca.es, julio.bohorquez@uca.es, jose.calderon@uca.es, julia.a.huggins@gmail.com

Abstract: As a consequence of Global Warming and the eutrophication of coastal areas, the oxygen reservoir in the oceans is progressively decreasing. In permanent or seasonally stratified water masses, the respiration of the biological community decreases the dissolved oxygen, eventually leading to the formation of hypoxic and anoxic conditions. The progressive ocean deoxygenation is increasing the extension of these areas with unclear impacts on the global biogeochemical cycles. The microbial community inhabiting these marine areas respond to the changing redox conditions by altering the composition of the microbial community as well as modifying the main metabolic processes. Some components have metabolic plasticity, allowing physiological adaptations, such as increasing their affinity for oxygen to pursue with aerobic processes at trace O2 levels or eventually shifting to anaerobic metabolic pathways such as denitrification. The balance of these processes determines the role of the ecosystem in the regeneration or loss of nitrogen nutrients and the production of relevant greenhouse gases such as nitrous oxide. During a series of oceanographic cruises to a coastal anoxic fjord and the oceanic Oxygen Minimum Zones, we measured some of the most relevant aerobic processes such as aerobic respiration and nitrite oxidation, as well as other anaerobic processes such as denitrification and anammox. Our results show that the aerobic community consumes the oxygen at nanomolar levels and that nitrite oxidation rather than aerobic respiration may be the most efficient processes consuming oxygen at trace levels. The constant exposure of the microbial community to low oxygen levels induces the use of higher affinity enzymes, increasing the affinity for oxygen of these communities for oxygen. In addition, anaerobic processes such as denitrification and anammox remain active in the presence of low oxygen levels, challenging the tight coupling of these processes to the absolute absence of oxygen.

Key words: Microbial metabolism, Oxygen, Respiration, Microbial community

Acknowledgments: This work has been funded by the project PID2020-117340RA-I00 and the Ramon y Cajal grant (RYC2019-027675-I) to EGR. IRH and MM were funded by the PhD fellowship program of the Plan Propio de la Universidad de Cádiz.

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

INFLUENCE OF DISSOLVED ORGANIC MATTER ON THE QUANTIFICATION OF WATER-ATMOSPHERE CO2 FLUXES IN ESTUARINE SYSTEMS

J. Forja[1], J. Sánchez-Rodríguez[1], A. Sierra[1], B. Vallejo[1], R. Ponce[1] and T. Ortega[1]

[1] Dpto. Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, 11510 Puerto Real, Cádiz, Andalucía, SPAIN.
jesus.forja@uca.es, jairo.sanchez@uca.es, ana.sierra@uca.es, Beatriz.vallejojurado@uca.es, rocio.ponce@uca.es, teodora.ortega@uca.es

Abstract: Total alkalinity (TA) and pH are variables commonly used for characterizing the inorganic carbon system in coastal and estuarine systems. However, total alkalinity is not a specific method for measuring dissolved inorganic carbon (DIC), and the influence of different acid-base equilibria in water can be corrected based on its analytical concentrations and available thermodynamic information (e.g., silicate, phosphate, ammonium, or borate). In this study, a methodology is presented that allows estimating the influence of dissolved organic matter on total alkalinity (Aorg) and is applied to assess its impact on quantifying CO_2 fluxes with the atmosphere in the Guadalquivir estuary. The approach involves successive acid-base titrations on the same sample while maintaining an intense N_2 bubbling to remove produced CO_2.

The Guadalquivir estuary exhibits intense gradients of TA (2500 - 4000 µmol kg^{-1}) and dissolved organic carbon (DOC, 100 - 450 µmol kg^{-1}) with salinity. The results obtained indicate that organic alkalinity (Aorg) increases toward the interior of the estuary, contributing between 50 and 100 µmol kg^{-1} to TA. However, there is no linear relationship with DOC, and this dependence varies based on the nature of the organic matter. These variations are interpreted in terms of the relative abundance of humic and protein compounds characterized using spectrofluorometric techniques. The presence of dissolved organic matter in the Guadalquivir estuary causes an apparent increase in CO_2 partial pressure when AT is not corrected for this effect, reaching levels above 100 µatm in the inner part of the estuary. This methodology helps to avoid overestimation of CO_2 fluxes to the atmosphere in systems with high DOC concentrations.

Key words: Total alkalinity, dissolved organic matter, water-atmosphere CO_2 fluxes, estuaries

Acknowledgments: This work was supported by the Spanish CICYT (Spanish Program for Science and Technology) under contract RTI2018-100865-B-C21 and P20_00953 (Junta de Andalucía).

DISSOLVED REEs IN THE RIVER ULLA BASIN: SOURCES AND TRANSPORT TO THE RIA OF AROSA (NW IBERIAN PENINSULA)

R. Prego*[1], G. Farinango[1] and M.A. Álvarez-Vázquez[2]

[1] Instituto de Investigaciones Marinas (CSIC), Vigo, SPAIN.
**prego@iim.csic.es, gonzalo.farinango.vallejos@gmail.com*
[2] Área de Xeografía Física, Grupo GEAAT, Universidade de Vigo, Ourense, SPAIN.
mianalva@uvigo.gal

Abstract: The land-sea transport of Rare Earth Elements (REEs), recognized as emerging contaminants, is insufficiently studied. No research has focused on the eighteen Galician Rias, where to identify the geogenic and anthropogenic sources is a key issue. The Ulla-Arousa system is the biggest river-ria network in the northwest Iberian Peninsula, which is fed by tributaries like Lañas, Brandelos, Deza, and Sar, post-Portodemouros dam. Monthly water samples, including tributaries, the Ulla River and the dam outflow, were collected throughout October 2018 to September 2019. In situ measurements of temperature, conductivity, and pH were conducted. Fluvial water samples underwent processing in a clean laboratory, and dissolved lanthanides (Ln) and Y were determined in the "Analytical Service for the Determination of Metals in the Environment" of IIM-CSIC.

	Dam	Lañas	Brandelos	Deza	Ulla	Sar	Unit
Flow	23.7	1.5	3.1	13.5	51.5	8.4	$m^3 \cdot s^{-1}$
Ln	173	24,400	1750	118	383	198	$ng \cdot L^{-1}$
Y	56	8270	826	53	161	63	$ng \cdot L^{-1}$

The outflows from the Portomouros dam and the Deza tributary exhibited lower annual average concentrations of dissolved REEs, as shown in the table. Conversely, the Lañas and Brandelos tributaries, situated near the amphibolite massif of the Arinteiro unit, displayed the highest concentrations. At the head of the Ria of Arousa, during the hydrological year addressed, the Ulla River discharged 748 $kg\text{-}Ln \cdot yr^{-1}$ (47.8 $kg\text{-}Gd \cdot yr^{-1}$), with an additional 57 $kg\text{-}Ln \cdot yr^{-1}$ from the Sar River. This river, flowing alongside the city of Santiago de Compostela, exhibited a Gd anomaly, Gd/Gd* of 9.6, compared to 1.2 in the Ulla and other tributaries. This anomaly could be attributed to its use as an MRI contrast agent for cancer detection. In the Sar, the estimated anthropogenic input into the ria was 3.6 $kg\text{-}Gd \cdot yr^{-1}$, constituting 58% of the total output (6.2 $kg\text{-}Gd \cdot yr^{-1}$).

Key words: Lanthanoids, Yttrium, Gadolinium, concentration, fluxes, contamination.

Acknowledgments: M.Á.Á.V is supported by Xunta de Galicia, grant #ED481D-2023/006 and G.F. by the JAE-Intro grant JAEICU-20-IIM-01. This research was funded by the project AMBARULLA (CSIC code: 20181970).

GREENHOUSE GAS DYNAMICS (CO_2, CH_4 AND N_2O) IN COASTAL SYSTEMS OF SOUTHWEST SPAIN: RIO SAN PEDRO TIDAL CREEK AND BARBATE ESTUARY

T. Ortega[1], J. Sánchez-Rodríguez[1], V. Vizcaíno[1], A. Cuadros[1], A. Sierra[1], R. Ponce[1] and J. Forja[1]

[1] Dpto. Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, 11510 Puerto Real, Cádiz, Andalucía, SPAIN.
teodora.ortega@uca.es, jairo.sanchez@uca.es, virginia.vizcaino@alum.uca.es, ainoa.cuadrosalba@alum.uca.es, ana.sierra@uca.es, rocio.ponce@uca.es, jesus.forja@uca.es

Abstract: Coastal areas are experiencing significant anthropogenic pressure, leading to the influx of substantial amounts of organic matter and nutrients into these systems. A large portion of this organic matter reaches the sediments, where it is mineralized through various diagenetic processes, resulting in benthic fluxes of nutrients, carbon, and greenhouse gases (GHGs) into the water column. Consequently, the water column becomes supersaturated with greenhouse gases, causing coastal zones to act as GHG emitters. Concentrations of carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) in the water column and sediments have been analyzed in two coastal systems in the southwest of the Iberian Peninsula: Río San Pedro tidal Creek and Barbate Estuary. To examine seasonal variations, two samplings were conducted under winter and summer conditions in 2023. In the sediment, CO_2, CH_4 and N_2O concentrations generally increased with depth at almost all stations and exhibited seasonal variations associated with the intensification of mineralization processes with temperature. In the water column, GHG concentration increases towards the interior of both systems. These variations have been attributed to the high rates of organic matter mineralization both in the sediment and that entering the system through lateral inputs, mainly from the effluents of a fish farm in the San Pedro River and agricultural practices in the Barbate Estuary. Water-atmosphere fluxes increase towards the interior of both systems, generally being more intense during the summer. Both the Rio San Pedro and Barbate Estuary serve as sources of CO_2, CH_4, and N_2O to the atmosphere. Annual average emissions for Rio San Pedro were estimated at $5.4\ 10^6$ mol/year for CO_2, $1.6\ 10^4$ mol/year for CH_4, and $5.6\ 10^2$ mol/year for N_2O, while for the Barbate Estuary $1.7\ 10^7$ mol/year for CO_2, $3.5\ 10^4$ mol/year for CH_4, and $2.5\ 10^3$ mol/year for N_2O.

Key words: greenhouse gases, air-water fluxes, sediment profile, coastal systems

Acknowledgments: This work was supported by Junta de Andalucía under the contract P20_00953.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

DISTRIBUTION OF GREENHOUSE GASES (CH_4 AND N_2O) IN SOUTH AMERICAN ATLANTIC COASTAL LAGOONS (URUGUAY)

V. Amaral[1,2], T. Ortega[2], J. Sánchez-Rodríguez[2], A. Sierra[2], C. Lescano[1], L. Rodríguez-Gallego[1] and J. Forja[2]

[1]Departamento Interdisciplinario de Sistemas Costero Marinos, Centro Universitario Regional Este, Ruta nacional 9 y 15, Rocha, URUGUAY.
[2] Departamento de Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Cádiz, ESPAÑA.
vamaral@cure.edu.uy, teodora.ortega@uca.es, jairo.sanchez@gm.uca.es, ana.sierra@uca.es, carolilescano@gmail.com, dunachirca@gmail.com, jesus.forja@uca.es.

Abstract: Coastal regions receive inputs of organic matter and nutrients, leading to the production of greenhouse gases (GHG) such as methane (CH_4) and nitrous oxide (N_2O). While coastal ecosystems emit varying amount of CH_4, their role as a net source or sink of N_2O is uncertain, in particular in the southern hemisphere (Rosentreter et al., 2023). Here, we investigated the distribution of CH_4 and N_2O in three coastal lagoons located on the Atlantic coast of Uruguay (Laguna de Rocha, Laguna Garzón, Laguna José Ignacio). These lagoons integrate the UNESCO biosphere reserve "Reserva de Biosfera Bañados del Este", and are designated as protected landscapes under the National System of Protected Areas, as well as being part of the Ramsar Convention for wetlands. Samplings were conducted seasonally, during February, May, August, and November in 2021, 2022 and 2023. The concentration of CH_4 and N_2O were determined by gas chromatography. CH_4 concentrations ranged from 8.0 to 332.6 nM, with CH_4 saturation levels ranging from 285.9% to 11663.0%, indicating oversaturation of CH_4. On the other hand, N_2O concentrations ranged from 6.0 to 22.3 nM, with saturation levels between 70.3% and 781.0%. Overall, in the three lagoons water-atmosphere fluxes of CH_4 were positive throughout the study period (from 5.6 to 3319.0 μmol m^{-2} d^{-1}). In contrast, N_2O fluxes exhibited seasonal variability, with mean positive fluxes during February and May, and negative fluxes during August and November (from -77.3 to 1194.8 μmol m^{-2} d^{-1}). The study revealed that the Uruguayan coastal lagoons act as a source of CH_4 to the atmosphere consistently, as source of N_2O in summer and autumn, while acting as a sink of N_2O in winter and spring. This work is the first GHG characterization in these lagoons, and its results are expected to improve our understanding of regional variations from coastal systems.

Key words: greenhouse gases, atmospheric flux, coastal lagoons, South Hemisphere

Acknowledgments: This work was supported by the Agencia Nacional de Investigación e Innovación (ANII, Uruguay) under contract FCE_3_2022_1_172208 and Acuerdo de cooperación técnica y científica para el monitoreo de la calidad del agua de las lagunas costeras del Uruguay (Ministerio de Ambiente, Uruguay-Centro Universitario Regional Este, UdelaR).

References:

Rosentreter, J. A., Laruelle, G. G., Bange, H. W., Bianchi, T. S., Busecke, J. J., Cai, W. J., ... & Regnier, P. (2023). Coastal vegetation and estuaries are collectively a greenhouse gas sink. *Nature climate change*, *13*(6), 579-587.

SIQUIMAR

XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

ORAL COMMUNICATIONS

~

CHEMICAL OCEANOGRAPHY

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

Universitat de Barcelona

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

Universidade de Vigo

EVOLUTION OF THE FE(II) OXIDATION KINETIC CONSTANTS DURING THE 2021 LA PALMA ERUPTION

A. Bullón-Téllez*[1], J. M. Santana-Casiano[1], M. González-Dávila[1], A. G. González[1] and D. González-Santana[1]

[1] Instituto de Oceanografía y Cambio Global, IOCAG, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, SPAIN.
adrian.bullon101@alu.ulpgc.es; magdalena.santana@ulpgc.es; melchor.gonzalez@ulpgc.es; aridane.gonzalez@ulpgc.es; david.gonzalez@fpct.ulpgc.es

Abstract: The eruption of La Palma, Canary Islands, Spain, in September 2021 was the longest in the island's recorded history. During 85 days, lava entered the sea on the west coast of the island four times, forming two lava deltas. The oxidation kinetics of iron(II) in this environment are poorly constrained, particularly in relation to the dependence on physico-chemical parameters such as temperature (T), pH and the effect of organic matter. Seawater samples were collected at 10 time points in the proximities of the forming lava deltas from the time of the eruption until 2024. Iron(II) oxidation kinetic studies were performed to analyse the effects of seawater characteristics on Fe(II) oxidation rate constants and $t_{1/2}$ (half-life). The experimental methodology is based on the Flow Injection Analysis by Chemiluminescence (FIA-CL) method at fixed conditions of pH, temperature and oxygen saturation (pH=8, T=15ºC and Sat[O_2]=100%) resulting in t1/2 times ranging from 2 to 11 minutes. In the case of a sample in which a rapid complexation was observed with the lowest $t_{1/2}$, further analyses were performed. The analysis of the Fe(II) oxidation rate constants at several stations revealed that factors, apart from T and pH, controlled the oxidation process. In a biogeochemical context, nutrients were analysed in order to elucidate the observed deviations.

Key words: Fe(II) oxidation kinetics, volcanic eruption, lava, GEOTRACES.

Acknowledgments: This work was funded by the FeRIA project (PID2021-123997NB-I00) from the Ministerio de Ciencia e Innovación (Spain). A. Bullón-Téllez participation was funded by the PhD grant (ULPGC2023-2-01).

ASSESSMENT OF THE MAIN DRIVERS CONTRIBUTING TO PCO2 AND PH GRADIENT FORMATION ALONG THE GALICIAN RIAS BAIXAS (NW PENINSULA)

A. Castro-Olivares*[1,2], M. Clerencia[2], P. Alcaraz-Rocha[2], A. Fuentes-Lema[2], M. Des.[1] and C. Sobrino[2]

[1] Centro de Investigación Mariña, Universidade de Vigo, Environmental Physics Laboratory (EPhysLab), Campus As Lagoas s/n, Ourense, 32004, SPAIN.
[2] Centro de Investigación Mariña, Universidade de Vigo, Grupo de Oceanografía Biolóxica, Facultade de Ciencias do Mar, 36310, Vigo, SPAIN.
adrian.castro@uvigo.gal, mar.clerencia.izquierdo@uvigo.gal, lalcaraz@uvigo.gal, antonio.fuentes@uvigo.gal, mdes@uvigo.gal, sobrinoc@uvigo.gal

Abstract: The Rías Baixas (NW Spain) are four coastal embayments lied within the Iberian Upwelling System that support important socioeconomically activities as aquaculture and small-scale fisheries (Fraga, 1981). In coastal upwelling regions the seasonal variation in wind direction results in an upwelling-downwelling regime that modulates CO2, nutrient concentration, water temperature and primary production. This, together with the interaction with freshwater sources, such as river discharge, can result in CO2 and pH gradients that can affect the response of plankton microbial community and calcifying bivalve production, among others (Álvarez et al. 1999; Nogueira and Figueiras, 2005). However, assessing the relationship of the main drivers on the CO2 and pH gradients remains challenging (Duarte et al. 2013). In the framework of the ACID project, monthly sampling was carried out at the Ría de Vigo from April 2023 to April 2024 with the objective of addressing this uncertainty. Hydrographic profiles and samples for the determination of pH, dissolved inorganic carbon (DIC) and pCO2, as well as samples for the assessment of the biological response, were collected throughout a longitudinal transect early morning during low tide. 2023-2024 results were also compared to preliminary data from October 2019 to February 2020. Results from both datasets showed that pCO2 and pH along the Ria were regulated by wind-driven circulation and the intrusion of freshwater. 2019-2020 data revealed more pronounced pCO2 gradients compared to 2023-2024 ACID findings. The inner stations exhibited higher pCO2 concentrations (~5400 ppmv in January 2020), gradually decreasing towards outter stations (~430 ppmv in October 2019). In contrast, pH showed an opposite pattern to pCO2, with similar values observed in both datasets and ranging from 8.29 to 6.61. DIC concentrations remained relatively uniform throughout the longitudinal transect, although slightly lower in 2023-2024 ACID findings. Hydrographic properties also showed consistently lower salinity conditions during 2023-2024 ACID samplings due to regular precipitation events and higher river freshwater discharge than in 2019-2020 period. The latter seems to explain the main differences observed between both periods regarding the occurrence of pCO2 and pH gradients and arise as important drivers of coastal acidification in Rías Baixas.

Key words: pCO2, coastal acidification, upwelling region, gradients, Rías Baixas.

Acknowledgments: M.D. is supported by the Xunta de Galicia through a postdoctoral grant (ED481B-2021-103). M.C. is supported by the Spanish Ministry of Science, Innovation and Universities through a predoctoral fellowship, FPI (Ref: PRE2022-105066). This research has been co-funded by the Spanish Ministry of Science, Innovation and Universities (Oriented Research Projects grant number, PID2021-127092OB-I00) and the European Structural Funds (FSE and FEDER), and partially supported by Xunta de Galicia, Consellería de Cultura, Educación e Universidade, under project ED431C 2021/44 “Programa de Consolidación e Estructuración de Unidades de Investigación Competitivas”.

References:

Àlvarez, M., Fernández, E. and Pérez, F.F., (1999). Air—sea CO2 fluxes in a coastal embayment affected by upwelling: physical versus biological control. Oceanologica acta, 22(5), pp.499-515.

Duarte, C.M., Hendriks, I.E., Moore, T.S., Olsen, Y.S., Steckbauer, A., Ramajo, L., ... & McCulloch, M., (2013). Is ocean acidification an open-ocean syndrome? Understanding anthropogenic impacts on seawater pH. Estuaries and Coasts, 36, pp.221-236.

Fraga, F., (1981). Upwelling off the Galician coast, northwest Spain. Coastal upwelling, 1, pp.176-182.

Nogueira, E. and Figueiras, F.G., (2005). The microplankton succession in the Ría de Vigo revisited: species assemblages and the role of weather-induced, hydrodynamic variability. Journal of Marine Systems, 54(1-4), pp.139-155.

REACTIVITY AND FLUXES OF INORGANIC NUTRIENTS FROM AN AGRICULTURALLY AFFECTED ESTUARY (GUADALQUIVIR ESTUARY)

A. Sierra[1], J. Sánchez-Rodríguez[1], S. Sirviente[2], J.J. Gomiz-Pascual[2], M. Bolado-Penagos[2], M. Bruno[2], J. Forja[1] and T. Ortega[1]

[1] Dpto. Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, 11510 Puerto Real, Cádiz, Andalucía, SPAIN.
ana.sierra@uca.es, jairo.sanchez@uca.es, jesus.forja@uca.es, teodora.ortega@uca.es
[2] Dtpto. Física Aplicada, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, 11510 Puerto Real, Cádiz, Andalucía, SPAIN.
sara.sirviente@uca.es, juanjesus.gomiz@gm.uca.es, marina.bolado@uca.es, miguel.bruno@gm.uca.es

Abstract: The Guadalquivir Estuary receives significant inputs of nutrients from agricultural fields and from different urban centres, which causes a disturbance of the natural biogeochemical cycles of the system. For this reason, this study has been carried out to determine the longitudinal, tidal and seasonal influence on dissolved inorganic nitrogen (DIN), silicates (SiO_2) and phosphates (PO_4^{-3}), as well as their transport to the Gulf of Cadiz. The study consists of a total of 12 samplings carried out between 2017 and 2022, ensuring different hydrodynamic and environmental conditions. The concentration of the nutrients increases inwards, reaching maximums in the innermost zone for DIN (416.2 μmol L^{-1}) and SiO_2 (156.3 μmol L^{-1}), while PO_4^{-3} has maximums in the intermediate zone (4.0 μmol L^{-1}), at the turbidity maximum zone (TMZ). Both DIN and SiO_2 show maximums associated with growing seasons and higher river flows. However, PO_4^{-3} shows its maximums in summer, suggesting a production favoured in the system by higher temperatures. The calculated maximum net transport shows clear dependence on the discharge regime, showing the maximum transport in the sampling where extreme rainfall occurred. Tidal height is the second variable that influences transport, which influences the inundation area, and therefore the greater transport of inorganic nutrients compared to other samplings with similar river flows. The range for the net transport is $1.7 \cdot 10^5 – 6.3 \cdot 10^6$ mol d^{-1} for DIN, $1.4 \cdot 10^5 – 3.6 \cdot 10^6$ mol d^{-1} for SiO_2 and $3.6 \cdot 10^3 – 3.0 \cdot 10^4$ mol d^{-1} for PO_4^{-3}. The results obtained indicate the Guadalquivir Estuary acts as a source of inorganic nutrients to the Gulf of Cadiz.

Key words: Guadalquivir Estuary, inorganic nutrients, net transport.

Acknowledgments: A. Sierra was financed by the Spanish Ministry of universities and

European Union - Next Generation EU, under contract Margarita Salas, and J. Sánchez-Rodríguez was financed by the Spanish Ministry of Education with FPI fellowship (PRE2019-087387). We thank the crews of the R/V UCadiz for their assistance during field works. This work was supported by the Spanish CICYT (Spanish Program for Science and Technology) under contract RTI2018-100865-B-C21 and P20_00953 (Junta de Andalucía).

RECENT ADVANCES IN THE BIOGEOCHEMISTRY OF PLATINUM-GROUP ELEMENTS IN IBERIAN ECOSYSTEMS

Carlos E. Monteiro*[1], Melina Abdou[2], Clara Almécija[3], Miguel Caetano[2,4], Miguel Santos[2], Margarida M. Correia dos Santos[1] and Antonio Cobelo-García[3]

[1] Centro de Química Estrutural, Institute of Molecular Sciences, Department of Chemical Engineering, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, PORTUGAL.
carlos.e.monteiro@tecnico.ulisboa.pt
[2] Interdisciplinary Centre of Marine and Environmental Research (CIIMAR), University of Porto, Matosinhos, PORTUGAL.
[3] Bioxeoquímica Mariña, Instituto de Investigacións Mariñas IIM-CSIC, Vigo, SPAIN.
[4] Instituto Português do Mar e da Atmosfera (IPMA), Algés, PORTUGAL.

Abstract: Over the past decade, studies on Platinum-Group Elements (PGEs) in the coastal ecosystems of the Iberian Peninsula have fulfilled significant knowledge gaps using various analytical strategies. Voltammetry has played a crucial role in understanding PGEs' biogeochemistry, particularly for platinum (Pt) and rhodium (Rh). The introduction of signal transformation using the second derivative improved voltammetric measurements, revealing new insights on their occurrence in aquatic media. Combining voltammetry with inductively coupled plasma mass spectrometry (ICP-MS) enhanced the understanding of Pt and Rh speciation analysis. In filtered samples (<0.45 µm) of road dust leachates and riverine waters, truly dissolved species determined by voltammetry comprised a significant portion of total dissolved species. Additionally, wetland vegetation's seasonal activity controls Pt geochemistry in sediments, influencing its solid/dissolved chemical species. Comparison of Pt and Rh concentrations in biota from urbanized coastal systems support their export to adjoining coastal areas. Therefore, further research on PGEs' biogeochemistry should encompass voltammetry due to its ability to provide additional information on the species and to cope with some analytical limitations that other techniques face during PGE analysis.

Key words: Platinum-Group Elements, Analytical advances, Environmental biogeochemistry

Acknowledgments: The authors acknowledge Fundação para a Ciência e Tecnologia (FCT) for funding the project SPECS (2022.06832.PTDC) and CQE projects 2020-2023 UIDB/00100/2020 and UIDP/00100/2020.

ARE RARE EARTH ELEMENTS CLIMBING THE FOOD CHAIN? A CLOSER LOOK AT THE RÍA DE VIGO

C. Mendoza-Segura*[1], A. Cobelo-García [1] and M. Planas[2]

[1] Department of Oceanography, Marine Research Institute, Vigo, SPAIN.
cmendoza@iim.csic.es, acobelo@iim.csic.es
[2] Department of Marine Ecology & Resources, Marine Research Institute, Vigo, SPAIN.
mplanas@iim.csic.es

Abstract: Rare earth elements (REEs) are the subject of current economic and political attention due to their essential role in many essential industries and day-to-day technologies. These elements share very similar physico-chemical characteristics, show consistent behaviour in the environment and differ from each other due to the natural fractionation they undergo from their lithogenic origin to natural waters. The growing interest for this group, the issues related to their exploitation and the consequent increase in their presence in the aquatic environment highlight their potential role as new pollutants. This, together with the limited studies available on their effects and environmental problems that may affect several species, many of which are of important commercial value, indicates the need for further studies. The present work focuses on the determination of REEs (Y, La, Ce, Pr, Nd, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu) concentrations in the species studied along two trophic chains in the Ria de Vigo (NW Spain). The trophic levels of the collected species were established by stable isotope analysis (SIA) and trace elements concentrations, mainly in muscle tissues, were measured using ICP-MS. The results reflect intraspecific variability with different patterns of accumulation within the same group. The observed REEs variabilities are consistent with previous studies, showing higher concentrations in benthic or detritivorous species than in filter-feeding or pelagic species. Similarly, no pattern of biomagnification was observed in the trophic chains studied, as reported in reviews on this subject. The new data presented here on REEs concentrations in a wide range of marine species present in NW Spain can be used as a reference for future studies.

Key words: REEs, Stable isotopes, biomagnification, bioaccumulation

Acknowledgments: This study was developed as part of the thesis project of Clara Mendoza-Segura funded by the FPU grant (FPU21/01226) of the Spanish Ministry of Science, Innovation and Universities.

References:

Pereto, C., Baudrimont, M., and Coynel, A. (2024). Global natural concentrations of Rare Earth Elements in aquatic organisms: Progress and lessons from fifty years of studies. The Science of The Total Environment 922, 171241.

Santos, A., Souza, L., Araujo, T., de Rezende, C. E. and Hatje, V. (2023). Fate and Trophic Transfer of Rare Earth Elements in a Tropical Estuarine Food Web. Environmental Science & Technology 57 (6), 2404-2414.

Filgueira, R. and Castro, B.G. (2012). Study of the trophic web of San Simón Bay (Ría de Vigo) by using stable isotopes. Continental Shelf Research 31(5), 476-487.

UNVEILING THE COMPLEXATION DYNAMICS OF PLATINUM WITH DISSOLVED ORGANIC MATTER IN ESTUARINE ENVIRONMENTS

C. Mendoza-Segura*[1] and A. Cobelo-García[1]

[1] Group of Biogeochemistry, Instituto de Investigaciones Marinas (IIM-CSIC), Vigo, SPAIN.
cmendoza@iim.csic.es , *acobelo@iim.csic.es*

Abstract: In the last decade, research on the behaviour of Platinum in aquatic systems has become a growing trend due to its increasing anthropogenic demand, especially linked to its use in catalytic converters in cars (Rauch and Peucker-Ehrenbrink, 2015). However, several aspects of the biogeochemical behaviour of Pt remain largely unknown; in particular, studies of the interaction with dissolved organic matter (DOM), a key factor in determining the speciation and reactivity of trace elements, are scarce for this metal. In order to assess the potential organically-bound fraction of Pt, we studied the concentration of dissolved organic carbon (DOC), dissolved Pt and other trace metals in the longitudinal axis of the Vigo Ria (NW Spain), from freshwater to the seawater end-member at different seasonal conditions. Concentrations of total dissolved and solid-phase extractable (SPE) DOC and trace metals of interest (Pt, Cu, U, Zn, Ni, Co, Fe, V, Mn, Cd, Pb) were determined in filtered (0.2 μm) water samples. SPE procedure used a styrene-divinylbenzene polymer sorbent (Bond Elut PPL). Results obtained in the extraction efficiencies for DOM (67.6 ± 6.4 %) and some of the 'common' trace metals (i.e. Cu (8-15%), Co (5-10%)), as well as the order of binding strength of these elements (Cu>U>Co>Ni>Fe>V>Cd) are consistent with previous studies (Dittmar et al., 2008; Waska et al., 2015; Ksionzek et al., 2018). On the other hand, extraction efficiency for Pt ranged from 10 to 30% (Pt). Thus, considering the differences existing between the metal-DOM complexation in water and extraction efficiencies reported in the literature (i.e. Cu >90% and 10-20% respectively), we can expect similar behaviour for Pt with comparable or higher extraction efficiencies in their association with DOM (Prego and Cobelo-García, 2003). Overall, our study provides new evidences on the effective complexation of Pt with DOM in natural waters that will allow a better assessment and understanding of its biogeochemical behaviour in estuarine systems.

Key words: Pt, trace elements, DOM, complexation, estuarine mixing

Acknowledgments: This study was developed as part of the thesis project of Clara Mendoza-Segura funded by the FPU grant (FPU21/01226) of the Spanish Ministry of

Science, Innovation and Universities.

References:

Dittmar, T., Koch, B., Hertkorn, N. and Kattner, G. (2008). A simple and efficient method for the solid-phase extraction ofdissolved organic matter (SPE-DOM) from seawater. Limnology and Oceanography: Methods, 6, 230-235.

Ksionzek, K.B., Zhang, J., Ludwichowski, K.U., Wilhelms-Dick, D., Trimborn, S., et al. (2018). Stoichiometry, polarity, and organometallics in solid-phase extracted dissolved organic matter of the Elbe-Weser estuary. PLOS ONE 13(9): e0203260.

Prego, R. and Cobelo-García, A. (2003). Twentieth century overview of heavy metals in the Galician Rias (NW Iberian Peninsula). Environmental Pollution, 121, 425-452.

Rauch, S. and Peucker-Ehrenbrink, B. (2015). Sources of Platinum Group Elements in the Environment. In: Zereini, F., Wiseman, C. (eds) Platinum Metals in the Environment. Environmental Science and Engineering(). Springer, Berlin, Heidelberg, pp. 3-17.

Waska, H., Koschinsky, A., Ruiz Chancho, M.J. and Dittmar, T. (2015). Investigating the potential of solid-phase extraction and Fourier-transform ion cyclotron resonance mass spectrometry (FT-ICR-MS) for the isolation and identification of dissolved metal–organic complexes from natural waters. Marine Chemistry 173, 78–92.

EVOLUTION OF IRON SIZE FRACTIONATION IN SURFACE WATERS DURING AN AERIAL VOLCANIC ERUPTION

D. González-Santana[1], M. González-Dávila[1], A. G. González and J. M. Santana-Casiano[1]

[1] Instituto de Oceanografía y Cambio Global, IOCAG, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, SPAIN.
david.gonzalez@fpct.ulpgc.es; melchor.gonzalez@ulpgc.es;
aridane.gonzalez@ulpgc.es;magdalena.santana@ulpgc.es

Abstract: Life on land and at sea drastically changed on La Palma, Canary Islands, Spain in September 2021. For 85 days, the longest eruption in its recorded history took place. The aerial eruption produced tons of tephra which covered the whole island. This tephra reached the ocean liberating moles of iron. Concurrently, the lava flow reached the ocean, further liberating more iron. These two iron sources combined with the continuous iron sources found in these coastal areas such as sediment resuspension and underground water discharge.

Pre-lava-arrival and post-eruptive samples showed the lowest concentrations (averaging 77±33 nM). The highest concentrations were observed 5 m from the lava-sea interface, when incandescent lava was observed to be forming laze plumes (2008±75 nM on October 1, 2114±41 nM on November 12 during LPV6 and 2008±49 nM on November 14 during LPV7). Similar increases were observed in the dFe size fraction. Soluble Fe (<0.02µm) did not present the same behaviour. The measured results confirm the importance of these two iron sources, where lava arrival produces a strong input, while ash deposition acts as a more continuous but lower iron source.

Key words: Iron size fractionation, volcanic eruption, lava, GEOTRACES

Acknowledgments: This work was funded by the FeRIA project (PID2021-123997NB-I00) from the Ministerio de Ciencia e Innovación (Spain).

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

ISOTOPIC CHARACTERIZATION OF DISSOLVED INORGANIC CARBON IN ESTUARY WATERS

E. Capilla*[1], A. Sierra[1], B. Vallejo[1], T. Ortega[1] and J. Forja[1]

[1] Department of Chemistry-Physics, Faculty of Enviromental and Marine Science, Marine Research Institute, INMAR University of Cádiz, Puerto Real (Cádiz), SPAIN.
eva.capillagarcia@alum.uca.es, ana.sierra@uca.es, beavallejojurado@gmail.com ,
Teodora.ortega@uca.es , jesus.forja@uca.es.

Abstract: Dissolved inorganic carbon (DIC) is the primary carbon reservoir in natural waters, and its quantification is essential for studying the global carbon cycle. Measurement of the stable isotope of DIC ($\delta\ ^{13}$C-DIC) is a valuable tool for determining sources and sink of DIC providing a better understanding of the biogeochemical processes affecting the carbon cycle in aquatic ecosystem. This study aims to develop a methodology for the precise characterization of $\delta\ ^{13}$C-DIC in estuarine waters from coastal marine zones to fluvial waters. The study was carried out in several coastal systems of the southwestern of the Iberian Peninsula, taking Guadalquivir estuary as an example, which show an increase in DIC concentration from 2400 µmol kg^{-1} at the mouth to 4300 µmol kg^{-1} in the inner region. Measurements of $\delta\ ^{13}$C-DIC were conducted using a water-gas equilibration system coupled to an Isotope Ratio Mass Spectrometer (IRMS). Helium flow was optimized (100 mL min^{-1}) to purge air from the samples, and phosphoric acid was added to maintain a pH below 2. It was determined that 1 mL of sample acidified with 30 µL of 2 M H_3PO_4 in 10 mL vials, with 24-hour equilibration, was optimal for the determinations. Ten consecutive measurements were taken to enhance precision in of $\delta\ ^{13}$C-DIC measurements. Applying the developed methodology to Guadalquivir estuary revealed a significant $\delta\ ^{13}$C-DIC decrease along the salinity gradient. Values were -0.12 at the mouth and dropped to -5.95 ‰ in the inner zone. These variations in $\delta\ ^{13}$C-DIC along the estuarine salinity gradient, with more negative values in the inner region, are attributed to mixing processes and the intensity of mineralization processes within the estuary. This study underscores the importance of accurate $\delta\ ^{13}$C-DIC characterization for understanding carbon cycling in estuarine ecosystems and highlights the utility of the developed methodology for future research in similar environments.

Key words: estuarine waters, DIC, carbon isotope, southwestern Iberian Peninsula.

Acknowledgments: E. Capilla has been funded by the Faculty of Marine and Environmental Sciences of the University of Cádiz and by Marine Research Institute (INMAR). This work was supported by Junta de Andalucía under contract P20_0095.

References:

Deng, X., Li, Q., Su, J., Liu, C. Y., Atekwana, E., & Cai, W. J. (2022). Performance evaluations and applications of a δ13C-DIC analyzer in seawater and estuarine waters. Science of The Total Environment, 833, 155013.

He, S., & Xu, Y. J. (2017). Assessing dissolved carbon transport and transformation along an estuarine river with stable isotope analyses. Estuarine, Coastal and Shelf Science, 197, 93-106.

Salata, G. G., Roelke, L. A., & Cifuentes, L. A. (2000). A rapid and precise method for measuring stable carbon isotope ratios of dissolved inorganic carbon. Marine Chemistry, 69(1-2), 153-161.

VARIABILITY AND VERTICAL FLUXES OF CARBON DIOXIDE IN THE GUADALQUIVIR ESTUARY

J. Sánchez-Rodríguez[1], A. Sierra[1], J. Forja[1] and T. Ortega[1]

[1] Dpto. Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, 11510 Puerto Real, Cádiz, Andalucía, SPAIN.
jairo.sanchez@uca.es, ana.sierra@uca.es, jesus.forja@uca.es, teodora.ortega@uca.es

Abstract: Spatiotemporal variability of carbon dioxide (CO_2) in the Guadalquivir Estuary has been studied considering the influence of temperature, salinity, water-atmosphere fluxes, benthic fluxes and lateral inputs. The data correspond to tidal and longitudinal samplings carried out in September 2021, February 2022 and July 2022. The pCO_2 always increases inland, with values of 490 µatm at the mouth, and 2790 µatm in the inner zone. The influence of temperature in the variability of pCO_2 ranges between -3.1 and 4.3 µatm km^{-1}, contributing positively or negatively to CO_2 variability depending on the sampling. The effect of salinity always contributes negatively to pCO_2 variability, varying between -33.1 and -3.6 µatm km^{-1}. The system acts as a source of CO_2 to the atmosphere, with water-atmosphere fluxes of CO_2 increasing inland and ranging between 2.8 and 122.1 µatm m^{-2} d^{-1}. The sediments of the Guadalquivir Estuary are a source of CO_2 to the water column, with benthic fluxes of CO_2 ranging between 0.3 and 7.2 mmol m-2 d-1. Based on the information obtained, it seems that lateral inputs would be the main factor controlling CO_2 variability, above thermodynamic effects and sediment-water-atmosphere fluxes. However, the uncertainty associated with the quantification of these processes does not allow a precise assessment of the influence of lateral inputs, despite their great importance in the Guadalquivir Estuary.

Key words: Carbon dioxide, water-atmosphere fluxes, benthic fluxes, lateral inputs, Guadalquivir Estuary

Acknowledgments: J. Sánchez-Rodríguez was financed by the Spanish Ministry of Education with FPI fellowship (PRE2019-087387), A. Sierra was financed by the Spanish Ministry of universities and European Union - Next Generation EU, under contract Margarita Salas. We thank the crews of the R/V UCadiz for their assistance during field works. This work was supported by the Spanish CICYT (Spanish Program for Science and Technology) under contract RTI2018- 100865-B-C21 and P20_00953 (Junta de Andalucía).

DISSOLVED IRON CYCLING IN THE MAR MENOR (SE SPAIN) UNDER DIFFERENT SINGULAR ENVIRONMENTAL EVENTS: LEVELS AND ORGANIC SPECIATION

Juan Santos-Echeandía*[1], Maria Pilar Ponce Roa[1], Aridane G. González[2], Geraldine Sarthou[3] and Paula Sánchez-Marín[1]

[1] Centro Oceanográfico de Vigo, IEO-CSIC, Vigo, SPAIN.
juan.santos@ieo.csic.es, paula.sanchez@ieo.csic.es
[2] Instituto de Oceanografía y Cambio Global, IOCAG, Universidad de Las Palmas de Gran Canaria, ULPGC, Las Palmas de Gran Canaria, SPAIN.
aridane.gonzalez@ulpgc.es
[3] University Brest, CNRS, IRD, Ifremer, LEMAR, Plouzane, FRANCE.
geraldine.sarthou@univ-brest.fr

Abstract: The Mar Menor is a shallow coastal lagoon with high salinity located in the southeast of the Iberian Peninsula. This area is highly affected by various impacts generated by human activity, especially of agricultural and mining origin, leading to the introduction of metals, organic matter, nutrients and contaminants into the lagoon. However, total metal concentrations are not precise indicators of their biological availability, so it is crucial to consider the chemical speciation of these metals, as is the case with iron (Fe), which also plays a crucial role in phytoplankton growth. The presence of elevated levels of dissolved organic matter (DOM), which may be due to eutrophication or associated to precipitation events, leads to the formation of organic complexes with Fe. In order to understand the Fe cycle in the lagoon, multiple stations were measured during 2021 including physico-chemical parameters (temperature, salinity, dissolved oxygen, pH and turbidity) as well as the dissolved Fe concentration (dFe) and Fe-binding ligands (LFe) that were characterized by the conditional stability constant (KcondFe3+L). Fe concentration and speciation was measured by using Competitive Ligand Exchange-Adsorptive Stripping Voltammetry (CLE-AdCSV), employing TAC (2-(2-thiazolylazo)-p-cresol) as a synthetic competitive ligand (Croot et al., 2000). Total dissolved iron and speciation results show variations among different environmental events. The concentration of dissolved iron ranged from 12.99 nM to 72.38 nM. It is observed that the concentration of dFe is directly influenced by the presence of organic compounds. The conditional stability constant ranged from 21.57 to 19.68, and the concentrations of the complexing capacity (LFe) ranged from 13.60 nM to 58.50 nM. Both variables correlated with optical properties of organic matter such as fluorescence (humic substances) and absorbance at different wavelengths. This study highlights the importance of both the quantity and quality of dissolved organic matter in the biogeochemical cycling of a micronutrient element such as iron.

Key words: Mar Menor, iron, stability constant, metal speciation, dissolved organic matter.

Acknowledgments: This research has been funded by the Spanish Ministry of Science and Innovation through project SEE-ME (PID2019-109355RA-I00) and COMETA (PID2022-139975OB-I00).

References:

Croot, P.L., Johansson, M. (2020). Determination of iron speciation by cathodic stripping voltammetry in seawater using the competing ligand 2-(2-thiazolylazo)-p-cresol (TAC). Electroanalysis, 12(8), 565–576.

FE(III) REDUCED TO FE(II) BY TRIPTOPHAN IN SEAWATER

L. Suárez-Betancor*, D. González-Santana, A.G. González, M. González-Dávila, J. M. Santana-Casiano

Departamento de Química, Facultad de Ciencias del Mar, Universidad de Las Palmas de Gran Canaria, Campus de Tafira, 35017, Las Palmas, SPAIN.
laura.suarezbetancor@ulpgc.es

Abstract: Iron (Fe) is an essential micronutrient for marine productivity and can be found as Fe(III) and Fe(II), being the first one the most abundant but Fe(II) is easily used by microorganisms. In this sense, natural organic ligands play an important role in the Fe chemistry and can reduced Fe(III) to Fe(II) making it available for longer. Among all the ligands, tryptophan (Trp), an amino acid, is found in seawater and can form complexes with metal ions via chelation involving the α-amino ($-NH_2$) and α-carboxylate ($-CO_2^-$) groups. Then, the Fe(III) reduction by Trp has been studied as a function of pH (7.0 – 8.0), temperature (10ºC – 25ºC) and Trp concentrations (50 – 500 nM). In addition, a comparison with 0.7 M NaCl 2 mM $NaHCO_3$ solutions has been carried out for the same pH range. The Fe(III) reduction rate ($\log k'_{Fe(III)-red}$) in seawater was from -4.36 to -4.71 at pH 7.0 and 7.8, respectively, while at pH 8.0 the Fe(II) was not detectable. While in NaCl-HCO_3 solutions it was from -4.19 to -4.59. In the case of temperature, the Fe(III) reduction was studied at two pH values. The $\log k'_{Fe(III)-red}$ followed an inverse dependence when the temperature change from 10ºC to 25ºC and ranged from -5.06 to -4.36 and from -5.22 to -4.71 at pH 7.0 and 7.8, respectively. The concentration of Trp also affected the Fe(III) reduction in seawater. At pH 7.0, 10.12% and 18.64% of Fe(III) were reduced to Fe(II) when added Trp increased from 50 to 500 nM, respectively, while at pH 7.8, this Fe(III) was reduced between 5.06% and 16.67%.

According to the current results, in a situation of global warming and ocean acidification, changes in the physico-chemical conditions promote impacts on the Fe(III) reduction by organic ligands, such as amino acids, and influence the Fe marine biogeochemical cycles promoting the formation of bioavailable Fe(II) in seawater.

Key words: Iron, Amino acid, Kinetics, Seawater, Fe(II) regeneration

Acknowledgments: This work has been funded by FeRIA (PID2021-123997NB-I00) project given by the Ministerio de Ciencia e Inovación from Spain. LSB participated was funded by the PhD grant (PRE 2022-101456).

INTERANNUAL AIR-SEA CO$_2$ FLUXES IN THE NW IBERIAN UPWELLING SYSTEM

Marcos Fontela*[1] and Xosé Antonio Padín[1]

[1] Instituto de Investigacións Mariñas (IIM-CSIC), Vigo, SPAIN.
mfontela@iim.csic.es, padin@iim.csic.es

Abstract: Assessment of air-sea carbon dioxide (CO$_2$) fluxes are a requisite to evaluate carbon budgets and to inform policy and decision-making. In the coastal area the spatio-temporal heterogeneity of surface pCO$_2$ is larger in zones with seasonal variability, episodes of intense primary production, land-coastal fluxes and upwelling events. All these processes exist and usually co-occur in the upwelling region off NW-Iberian, but their long-term response to climate change is still uncertain. Here, a new assembled database of in-situ and remote observations collected from 1991 to 2022 has been curated and analysed for the South of Galicia coastal zone (43-42ºN, 10-8ºW). We produce an ensemble average of new development machine-learning models of variate complexity and adjusted for each Ría. The average uncertainty of this new pCO$_2$GalicIA ensemble, establishes a root mean square error of ~5-10 µatm when checked with independent datasets. The higher variability in the inner Rías, combined with a lower amount of observations for these zones, results in a lower confidence in the predictions compared with the offshore area. The interannual air-sea CO$_2$ exchange variability observed in Galicia was mostly related with the seasonal cycle, positive temperature anomalies, salinity, and chlorophyll. Although air-sea CO$_2$ exchanges are highly variable, surface waters off NW Iberian Upwelling System are net sinks for atmospheric CO$_2$ all year-round. This is an ongoing effort to characterize air-sea CO$_2$ fluxes at high resolution scale in the upwelling system of the NW Iberian Peninsula, a first step to characterize long-term responses in a highly productive marine ecosystem within the framework of anthropogenic climate change. This challenge will be even more relevant as it is an upwelling region that seems to be at a tipping point about its future evolution as climate projections suggest future wind intensification[1] while in situ observations still show contradictory results[2-4].

Key words: air-sea CO$_2$ fluxes, upwelling system, machine learning

Acknowledgments: MF was funded by PTA2022-021307-I, MCIN/AEI/10.13039/501100011033 and by FSE+. CAPTA project (0062_CAPTA_1_E) is co-financed by the European Union through the Interreg Spain-Portugal Cross-Border Cooperation Programme (POCTEP) 2021-2027 and by the REDEIRA project (Proyecto

Estratégico Orientado a la Transición Ecológica y a la Transición Digital; Ref: TED2021-132188B-I00).

References:

Álvarez, I., Lorenzo, M.N., deCastro, M., Gomez-Gesteira, M., 2017. Coastal upwelling trends under future warming scenarios from the CORDEX project along the Galician coast (NW Iberian Peninsula). Int. J. Climatol. 37, 3427–3438. https://doi.org/10.1002/joc.4927

Barton, E.D., Field, D., Roy, C., 2013. Canary Current upwelling: More or less? Prog. Oceanogr. 116, 167–178. https://doi.org/10.1016/j.pocean.2013.07.007

Otero, P., Cabrero, Á., Alonso-Pérez, F., Gago, J., Nogueira, E., 2023. Temperature and salinity trends in the northern limit of the Canary Current Upwelling System. Sci. Total Environ. 901, 165791. https://doi.org/10.1016/j.scitotenv.2023.165791

Pérez, F.F., Padín, X.A., Pazos, Y., Gilcoto, M., Cabanas, M., Pardo, P.C., Doval, M.D., Farina-Busto, L., 2010. Plankton response to weakening of the Iberian coastal upwelling. Glob. Change Biol. 16, 1258–1267. https://doi.org/10.1111/j.1365-2486.2009.02125.x

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

COMPARISON OF VOLTAMMETRIC METHODS TO DETERMINE THE CHEMICAL SPECIATION OF DISSOLVED COPPER IN SEAWATER

Maria Sol Hernández-Conesa[1], Xosé Antón Álvarez-Salgado [2], Mar Nieto-Cid [3], Juan Santos-Echeandía [*1], Paula Sánchez-Marín [1]

[1] Centro Oceanográfico de Vigo, IEO-CSIC, Vigo, SPAIN.
marisol.hernandez@ieo.csic.es, paula.sanchez@ieo.csic.es, juan.santos@ieo.csic.es
[2] Instituto de Investigacións Mariñas, IIM-CSIC, Vigo, SPAIN.
xsalgado@iim.csic.es
[3] Centro Oceanográfico de A Coruña, IEO-CSIC, A Coruña, SPAIN.
mar.nietocid@ieo.csic.es

Abstract: The total metal concentrations are not suitable predictors of their bioavailability, therefore, the chemical speciation of metals should be considered. Speciation of dissolved Cu in seawater is mainly dominated by organic ligands, such as dissolved organic matter (DOM) (Sánchez-Marín et al., 2020). The present study aims at studying the chemical speciation of Cu in a coastal lagoon, affected by mining and eutrophication, and presenting high Cu and high DOC levels (Santos-Echeandía et al., 2023). The chemical speciation of dissolved copper (Cu) was studied using two different voltammetric methods known as cathodic stripping voltammetry (CLE-ACSV), using salicylaldoxime (SA) as competing ligand, and anodic stripping voltammetry (ASV). For this purpose, 36 water samples were taken in different locations of the Mar Menor lagoon at different events in 2021 and 2022. The Cu speciation parameters (complexation capacity and conditional stability constant) were calculated using ProMCC software, and the obtained values for the different samples were related with physicochemical variables (pH, salinity) and with different variables related with DOM such as DOC, fluorescence and absorbance of the DOM, by means of correlation and multiple regression analysis. The results of Cu complexation capacity (L_{Cu}) ranged from 15.89 to 90.82 nM for the CLE-ACSV method and from 40.37 to 205.50 nM for the ASV method. Additionally, the values of conditional stability constant (Log $K_{Cu^{2+}}$) varied between 11.36 and 12.92 for the CLE-ACSV and 8.19 and 10.09 for the ASV method. The parameters derived from both methods did not correlate between them, suggesting that these techniques might detect different ligand classes having different sources and behaviors. Clear relationships were observed between complexation parameters obtained by CSV and DOC and fluorescence peaks related with humic matter. The application of a unified multiwindow approach to these data is hampered by the important difference in Cu speciation obtained in both analysis methods.

Key words: Mar Menor, copper, complexation capacity, voltammetry, dissolved organic matter.

Acknowledgments: This research has been funded by the Spanish Ministry of Science and Innovation through project SEE-ME (PID2019-109355RA-I00) and COMETA (PID2022-139975OB-I00).

References:

Sánchez-Marín, P. (2020). A review of chemical speciation techniques used for predicting dissolved copper bioavailability in seawater. Journal Environmental Chemistry**,** 17 (7), 469-478.

Santos-Echeandía, J., Bernárdez, P., and Sánchez-Marín, P. (2023). Trace metal level variation under strong wind conditions and sediment resuspension in the waters of a coastal lagoon highly impacted by mining activities. Journal Sci, 20 (905),167806.

SPONTANEITY OF THE DISSOLUTION REACTION OF BTEX COMPOUNDS IN A DEEP SPILL

Rubén Andrés Rodríguez Pineda

[1] Universitat de Barcelona
rrodripi69@alumnes.ub.edu

Abstract: The use of dispersants in deep hydrocarbon spills can have unfavorable consequences regarding pollution by BTEX compounds. In this context, it is important to be able to combine the effects of dispersants and their coupling with oceanographic dynamics to generate knowledge in the development of possible alternatives for the treatment of this type of contaminant in deep hydrocarbon spills. Based on the aforementioned, in a deep spill, the Gibbs potential of the benzene dissolution reaction in the water column, ΔG, will be a function of the hydrocarbon composition of the spill and the behavior of the plume(s), which, in turn, depends on the physical characteristics of the environment, such as bathymetry, stratification, depth, and absolute salinity SA. Currently, there is no coupling of thermodynamic aspects in mesoscale models, and, in that sense, the incorporation of thermodynamic variables into a hydrodynamic model becomes a research challenge. The dynamics and spatial distribution of the thermodynamic potential of Gibbs, ΔG, will provide information about the spontaneity of the dissolution reaction of BTEX compounds in seawater, which may vary during the ascent and evolution of the plume.

IRON BINDING LIGANDS IN THE SOUTHERN OCEAN, WINTER, AND SPRING (SCALE CRUISE 2019)

V. Coussy*[1], J. M. Santana-Casiano[1], M. González-Dávila[1], D. González-Santana[1], T. Mtshali[2], T. Ryan-Keogh[3], A. González González[1]

[1] Instituto de Oceanografía y Cambio Global, IOCAG, Universidad de Las Palmas de Gran Canaria, ULPGC, Las Palmas de Gran Canaria, SPAIN.
victor.coussy@ulpgc.es, magdalena.santana@ulpgc.es, melchor.gonzalez@ulpgc.es, david.gonzalez@fpct.ulpgc.es, aridane.gonzalez@ulpgc.es
[2] Department of Environment, Forestry and Fisheries, Oceans and Coast, Cape Town, SOUTH AFRICA.
tmtshali@csir.co.za
[3] Southern Ocean Carbon-Climate Observatory, CSIR, Cape Town, SOUTH AFRICA.
tryankeogh@csir.co.za

Abstract: The Southern Ocean acts as a motor for the global oceanic circulation with the downwelling of water masses and its influence on the climate. This ocean is known to be a High Nutrient Low Chlorophyll region with iron (Fe) limitation. Fe-organic speciation and distribution knowledge is necessary to understand the Fe biogeochemical cycle. This work presents the first study of Fe-organic speciation in the Atlantic sector of the Southern Ocean in winter and spring (SCALE cruises 2019), measuring the Fe-binding ligand concentration (L_{Fe}) and their characteristics via conditional stability constant ($K^{cond}_{Fe'L}$) in the water column. The L_{Fe} were measured by competitive ligand exchange-adsorptive cathodic stripping voltammetry (CLE-ACSV) method, using TAC as a competitive ligand. Different detection windows (5 and 10 µM TAC) were used to determine the optimal experimental conditions for winter and spring samples, being 5 µM TAC the most convenient for comparing all the samples. The L_{Fe} concentrations ranged from 0.74-2.42 nM in winter and 0.57-2.03 nM in spring, and log $K^{cond}_{Fe'L}$ varied between 9.44 and 11.38 in the same period. According to the log $K^{cond}_{Fe'L}$ most of the L_{Fe} are L_2 (weak ligands) in the entire region. The L_{Fe} maxima were found in the lower intermediate waters and were higher in winter compared to spring. The maximum L_{Fe} concentration was found across the Antarctic Circumpolar Current (ACC), near Bouvet Island. The enrichment in L_{Fe} during the transport of the water masses can be linked to important remineralization processes, sediment leaching, sea ice melting, the proximity to the Antarctica shelf or the island effect.

Key words: Iron, Fe-binding ligands, Complexation, Southern Ocean.

Acknowledgments: We would like to thank the South African National Antarctic Programme (SANAP), captain and the crew of the S.A. Agulhas II, and Trace Metal sampling teams during the SCALE cruises. This work was supported by National Research Foundation (NRF) SANAP grant SANAP200511521175 (grant # 129230).

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

ORAL COMMUNICATIONS

~

ECOTOXICOLOGY AN MARINE POLLUTION

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

UniversidadeVigo

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

COMPARATIVE STUDY PB, CD AND CU CONCENTRATIONS IN *SCYLIORHINUS CANICULA* (LINNAEUS, 1758) AND *MERLUCCIUS MERLUCCIUS* (LINNAEUS, 1758) FROM THE WESTERN MEDITERRANEAN FOR FUTURE XENOBIOTIC MONITORING

Alejandro J. Molera[1], Ana M. Hernández Martínez[2], Jose Rafael García March[3] and Jose Tena Medialdea[4]

[1, 2, 3, 4] Research Institute in Environment and Marine Sciences (IMEDMAR-UCV), Universidad Católica de ValenciaMártir Calp, Alicante, SPAIN.
aj.molera@ucv.es, am.hernandez@ucv.es, jr.garcia@ucv.es, imedmar@ucv.es
[1] Doctoral School. Universidad Católica de Valencia, Valencia, SPAIN.
aj.molera@ucv.es

Abstract: The small-spotted catshark, *Scyliorhinus canicula* is a demersal Scyliorhinid shark species commonly found in the Mediterranean and Northeastern Atlantic waters. The philopatric and sedentary nature of adult female individuals, along with its high abundance among bottom trawl bycatch, stock exploitation resilience, and widespread distribution, could support the species xenobiotic biomonitoring potential. Previous research concluded that *S. canicula* muscle tissue is capable of reflecting space-time persistent Pb, Cd, and Cu hotspots. To further explore its biomonitor potential, interspecific monitoring has been conducted between *S. canicula* and the commercially valued species *Merluccius merluccius,* both of which can be found coexisting within the same habitat. A total of 50 individuals of each species were collected, and data correlation was performed among the individuals captured within the same trawl. High significant interspecific correlation values were observed in Cd and Pb concentrations between both species (Spearman r = 0.817 and 0.833 respectively) as well as moderate positive correlation for Cu (r = 0.633). Higher Cd and Cu concentrations were generally observed in *S. canicula* however, Pb concentrations were higher in *M. merluccius*. Such differences were attributed to trophic and physiological inter-specific differences. High correlation values between both species supports their utilization for interspecific monitoring, which could pose a significant advancement towards xenobiotic biomonitoring in marine foodstuffs.

Key words: Biomonitor, GFAAS, Heavy metals, Marine pollution, *Scyliorhinus canicula, Merluccius merluccius*

Acknowledgments: This study is part of the OCECOSVAL project (GVA-THINKINAZUL/2021/033) within the ThinkInAzul program and was supported by MCIN with funding from the European Union NextGenerationEU (PRTR-C17.I1) and Generalitat Valenciana. This study was also supported by the Catholic University of Valencia through an EDUCV PRE-2019 grant for in-training predoctoral research personnel as well as the 2021-159-001 and 2022-170-006 research aids. This study was further supported by the IMEDMAR-UCV Internal Donation Fund. Special thanks go to Carles Úbeda for their help and support.

PHYSIOLOGICAL RESPONSE OF *P. ELEGANS* TO ANTHROPOGENIC STRESSORS: SYNERGISTIC IMPACTS OF HEATWAVES AND UV FILTERS FROM SUNSCREENS

A. Autiero[1,2], I. Martínez[1], S. Montesdeoca Esponda[3], M. Gómez[1], E. Iñeguez[4,5,6], M. Gouazé[7], V. Vinagre[2], A. Herrera[1]

[1] Marine Ecophysiology Group (EOMAR). IU-ECOAQUA, Universidad de Las Palmas de Gran Canaria, Canary Islands, SPAIN.
[2] CCMAR – Centre of Marine Sciences, University of Algarve, Faro, PORTUGAL.
a56765@ualg.pt, cmvinagre@ualg.pt
[3] Instituto de Estudios Ambientales y Recursos Naturales, Universidad de Las Palmas de Gran Canaria, 35017 Las Palmas de Gran Canaria, SPAIN.
[4] MARE – Marine and Environmental Siences Centre /ARNET Acquatic Research Network, Agência Regional para o Desenvolvimento da Investigação Tecnologia e Inovação (ARDITI), Madeira University, Funchal, Madeira, PORTUGAL.
[5] Faculty of Life Sciences and LB3, Faculty of Exact Science and Engineering, University of Madeira, PORTUGAL.
[6] CIIMAR – Interdisciplinary Center of Marine and Environmental Research, University of Porto, PORTUGAL.
[7] University of Toulon, FRANCE.

Abstract: Heatwaves are prolonged periods of unusually high temperatures which have emerged as a significant environmental threat to marine organisms. Their intensification has raised concerns about the impacts on aquatic organisms and ecosystem dynamics. On the other hand, the rapid escalation of tourism particularly in tropical and subtropical regions and the greater awareness of photoaging and photodamage caused by solar UV radiation increased the use of sunscreens. However, UV filters found in sunscreen have recently been identified as emerging pollutants in coastal waters due to their accumulation in the marine environment. Exposure to these components has been proven toxic to many aquatic species, both invertebrates and vertebrates. UV filters are a cause of substantial levels of reactive oxygen species (ROS) and the liberation of inorganic micronutrients, interacting with coastal habitats.

This study analyses the effects of extreme weather temperatures with two different sunscreens. Two temperatures (20, and 32°C) and two different sunscreens (one labelled as eco-friendly and the other not) were tested in a full factorial experiment for 12 hours. Shrimps were sampled at 0, 6 and 12 hours of exposure. The combined effect of temperatures and sunscreens was tested at each sampling time on shrimps' muscle and hepatopancreas. Cellular stress biomarkers associated with oxidative stress (CCO – Cytocromo-C oxidasa,

ETS – Electron transport system, GST – Glutathione-S-Transferase, SOD – Superoxide Dismutase and LPO – Lipid) were used as indicators of the shrimp's physiological response to the stressors. Incorporation and bioaccumulation of the UV filters along the exposure period will also be investigated using high-performance liquid chromatography, clarifying if such a short time is sufficient to observe significant effects on the organisms.
By elucidating these mechanisms, this study will clarify these organisms' physiological resilience and vulnerabilities, which are fundamental for understanding the impact of environmental changes on marine ecosystems.

Key words: Heatwaves, oxidative stress, UV sunscreens filters, biomarkers, environmental stressors, *P.elegans*

Acknowledgments: This study was supported by the Portuguese Foundation for Science and Technology (FCT) and the Marine Ecophysiology Group (EOMAR) IU-ECOAQUA, Universidad de Las Palmas de Gran Canaria, through ERASMUS+ MOBILITY OF INDIVIDUALS – Traineeship Mobility.

THE UNPREDICTABLE RESPONSE OF *IN VIVO* AND *IN VITRO* BIOLOGICAL MODELS TO MIXTURES OF POLYCYCLIC AROMATIC HYDROCARBONS

B. Matos*[1], M. Diniz[2], V. Branco[3] and M. Martins[1]

[1] Marine and Environmental Sciences Centre (MARE) & ARNET, Aquatic Research Network Associated Laboratory, NOVA School of Science and Technology (FCT NOVA), 2829-516 Caparica, PORTUGAL.
bi.matos@campus.fct.unl.pt, marta.martins@fct.unl.pt
2 UCIBIO—Applied Molecular Biosciences Unit, NOVA School of Science and Technology (FCT NOVA), 2829-516 Caparica, PORTUGAL.
mesd@fct.unl.pt
[3] Research Institute for Medicines (iMed.ULisboa), Faculty of Pharmacy, Universidade de Lisboa, 1649-003 Lisboa, PORTUGAL.
vasco.branco@ff.ulisboa.pt

Abstract: Polycyclic aromatic hydrocarbons (PAHs) are complex compounds commonly encountered in the environment, formed through the fusion of aromatic rings. Their limited solubility in water leads to environmental persistence, accumulation within organisms, and induction of adverse effects such as oxidative stress, inflammation, genotoxicity and cellular damage. The complexity inherent to their toxicology arises from their existence in environmental matrices as complex mixtures, presenting challenges for risk assessment.

This study aims to understand the mode of action (MoA) of environmentally relevant PAH mixtures using several biological models including fish primary hepatocytes, zebrafish immortalized hepatocytes (ZFL), immortalized human hepatocytes (HepG2), and juvenile fish.

In vitro experiments involved exposing cells to three PAHs (Benzo[a]pyrene - B[a]P, Phenanthrene - Phe, and Benzo[b]fluoranthene - B[b]F) individually and in mixtures (1:1, 1:2, 2:1). Toxicological responses, encompassing metabolism-related genes expression and activity, as well as DNA damage, were evaluated after 24h and 48h at concentrations ranging from 5 to 100 μM.

For the *in vivo* bioassay, *Sparus aurata* juveniles were exposed for 42 days to Phe and B[a]P individually and in mixtures (1:2, 2:1), followed by biochemical analyses related to oxidative stress and PAH detoxification pathways.

In vitro assays revealed that B[a]P upregulated CYP1A1, enhancing its activity and inducing genotoxic DNA damage. Mixtures of Phe and B[a]P showed elevated CYP1A1 mRNA levels and DNA damage. In the in vivo bioassay, it was observed that PAH mixtures exerted diverse effects on antioxidant enzymes and CYP1A1 expression compared to individual compounds in adult *S. aurata*. Nonetheless, no significant increase in DNA damage or lipid peroxidation was noted.

This study underscores the unpredictable nature of PAH mixtures and highlights the underestimation of the associated risks. Thus, there is a pressing need to enhance environmental guidelines, as the potential synergistic or antagonistic effects of various PAH mixtures may be miscalculated.

Key words: PAHs, Mixtures, Metabolism, CYP1A, Biological Models

Acknowledgments: The authors thank to Fundação para a Ciência e a Tecnologia (FCT; www.fct.pt) funded the present work by the Project PAHMIX (PTDC/CTA-AMB/29173/2017)) and by the project Nanoplastox Project – Nanoplastic Toxicity: from gut inflammation to systemic effects (2022.04884.PTDC), the strategic project UIDB/ 04292/2020 granted to MARE and the project LA/P/0069/2020 granted to the Associate Laboratory ARNET, as well as iMed, ULisboa's Strategic Project (UIDB/04138/2020; UIDP/04138/ 2020). Beatriz Matos is financed by FCT via PhD grant 2020.09005. BD.

References:

Mojiri, A., Zhou, J. L., Ohashi, A., Ozaki, N. & Kindaichi, T. 2019 Comprehensive review of polycyclic aromatic hydrocarbons in water sources, their effects and treatments. Sci. Total Environ. 696, 133971 .

Branco. V., Matos. B., Mourato. C., Diniz M., Carvalho. C., & Martins. M. 2021 Synthesis of glutathione as a central aspect of PAH toxicity in liver cells: A comparison between phenanthrene, Benzo[b]Fluoranthene and their mixtures. Ecotoxicol. Environ. Saf. 208, 111637 .

Bramatti, I., Matos. B., Figueiredo. N., Pousão-Ferreira. P., Branco. V. & Martins. M. 2023 Interaction of Polycyclic Aromatic Hydrocarbon Compounds in Fish Primary Hepatocytes: From Molecular Mechanisms to Genotoxic Effects. Sci. Total Environ. 855, 158783 .

EFFECTS OF UV-C EXPOSURE ON LARVAL PERFORMANCE: IMPLICATIONS FOR BALLAST WATER TREATMENTS AND INVASIVE SPECIES MANAGEMENT

Ángela Rodríguez-Ruiz*[1,2], E. González-Ortegón[2], G.F. de Carvalho-Souza[2], J. Moreno-Andrés[3] and L. Romero-Martínez[3]

[1] Department of Biology, Institute of Marine Sciences of University of Cádiz (INMAR – UCA), Puerto Real (Cádiz), SPAIN.
angela.rodriguez@uca.es
[2] Department of Ecology and Coastal Management, Andalusian Institute of Marine Sciences (ICMAN – CSIC), Puerto Real (Cádiz), SPAIN.
[3] Department of Environmental Technologies (INMAR – UCA), Puerto Real (Cádiz), SPAIN.

Abstract: Bioinvasions are the second major threat to world biodiversity, after habitat destruction [**1**]. On marine environment, ballast water (BW) from ships stands out as the most significant introduction vector of allocthonous species into other biogeographic regions [**2**]. Although not all these introductions are successful, some could cause important ecological, socio-economic and health impacts [**3**]. In this sense, the International Maritime Organization (IMO) established the International Convention for the Control and Management of BW and Sediments to restrict the spread of organisms via BW [**4;5**]. According to these regulations, ships must install BW Treatment Systems to comply with the D-2 standard, which sets limits on the concentration of viable organisms in BW.

Ultraviolet irradiation is the most common method used on vessels and most studies focus on bacteria or phytoplankton rather than zooplankton species [**6;7**], while recent reports indicate that various BW treatments are ineffective for organisms larger than $\geq$50µm. Thereby, studies on larval ecology are crucial since larval survival is a critical factor for the successful establishment of exotic species [**8**], acting as a bottleneck for the overall adult population [**9**].

This study aims to test the effect of different UV-C exposure treatments (1, 3 and 5 minutes) on physiological traits of *Carcinus maenas* larvae, a native species in the Gulf of Cadiz. Longer UV-C time exposure resulted in a decrease of larval survival, movement and oxygen consumption, suggesting UV irradiation as an efficient BW treatment for larger organisms ($\geq$50 µm fraction). This analysis aimed to compare these traits with larvae from other crustacean species, especially the invasive ones (generally more tolerant) [**10**], p.e. the American blue crab *Callinectes sapidus*. This outcome could make positive contributions to blue economy, ensuring an environmentally safe shipping trade reducing biological invasions, according to sustainability objectives and the EU Biodiversity Strategy for 2030.

Key words: invasive species, ballast water, larval ecology, management, UV-LED.

Acknowledgments: The authors are grateful to the FPU-UCA predoctoral contract (A. Rodríguez), INMAR and Faculty of Marine and Environmental Science (University of Cádiz) for their funding and ICMAN – CSIC for the scientific-technical support. This work is a contribution of the InvBlue project (PID2019-105978RA-I00) MINECO, Plan Nacional I+D, and LASTRELED project, Plan Propio UCA (PR2023-015).

References:

[1] Simberloff, D., Martin, J.L., Genovesi, P. *et al.* Impacts of biological invasions: what's what and the way forward. Trends in Ecology & Evolution, 28(2013):58-66

[2] Zhang, N., Hu, K., Shan, B. A review of developments in ballast water management. Chemical Engineering Journal, 243(2014):7-13

[3] David, M., Perkovic, M. Ballast water sampling as a critical component of biological invasions risk management. Marine Pollution Bulletin, 49(2004): 313–318

[4] Jefatura del Estado, Convenio Internacional para el control y la gestión del agua de lastre y los sedimentos de los buques, 2004, 2016. http://www.boe.es.

[5] International Maritime Organization, BWM Technologies, 1 2021.

[6] Gerhard, W.A., Lundgreen, K., Drillet, G. *et al.* Installation and use of ballast water treatment systems – Implications for compliance and enforcement. Ocean Coastal Management 181(2019)104907

[7] Díaz-Domínguez, E., Romero-Martínez, L., Ibáñez-López, M.E. *et al.* Evaluation of ozone treatment for bacterial disinfection of ballast water. Journal of Environmental Chemical Engineering, 12(2024): 111656

[8] Costlow, J.D. The effect of salinity and temperature on survival and metamorphosis of megalops of the blue crab *Callinectes sapidus*. Helgoland Marine Research, 15(1967):84-97

[9] Sandifer, P.A. The role of pelagic larvae in recruitment to populations of adult decapod crustaceans in the York River estuary and adjacent lower Chesapeake Bay, Virginia. Estuarine Coastal and Shelf Science, 3(1975):269-79

[10] González-Ortegón, E., Moreno-Andrés, J. Anthropogenic Modifications to Estuaries Facilitate the Invasion of Non-Native Species. Processes, 9(2021):740

OPTIMIZING (PHOTO)-FENTON FOR EFFLUENT DECONTAMINATION: SALINITY, pH & PHENOLIC LIGANDS

J. Moreno-Andrés*[1], I. Vallés[2], I. Sciscenko[2], E. Nebot[1] and A. Arques[2]

[1] Department of Environmental Technologies, INMAR, University of Cadiz, SPAIN.
javier.moreno@uca.es; enrique.nebot@uca.es
[2] Grupo de Procesos de Oxidación Avanzada, Departamento de Ingeniería Textil y Papelera, Universitat Politècnica de València, Campus de Alcoy, SPAIN.
ivvalfer@epsa.upv.es; ivsci@txp.upv.es; aarques@txp.upv.es

Abstract: Fenton-based processes have shown remarkable effectiveness in decontaminating various waste effluents worldwide, including high salinity effluents from aquaculture or maritime industries. However, maintaining active iron during the process poses a significant challenge. This study focuses on six different Contaminants of Emerging Concern selected as a model mixture. Phenolic compounds that mimic those found in phytoplankton exudates, have been investigated as iron chelates to assist (photo)-Fenton processes (González et al. 2019). The presence of phenolics, especially those with -OH groups in the ortho-position, enhances ligand efficiency, correlating with their ability to reduce Fe(III) to Fe(II). Catechol proves effective in suppressing chloride interference, preventing the formation of $FeCl_2^+$ and improving treatment outcomes even in saline conditions (Vallés et al. 2023). Moreover, the complex composition of the effluent matrix, including anions and organic pollutants, significantly influences iron speciation. These insights underscore the importance of phenolic compounds in (photo)-Fenton processes for marine pollution remediation, highlighting their role in overcoming challenges posed by high salinity and enhancing treatment efficiency for sustainable marine environmental protection.

Key words: Marine pollution, Contaminants of Emerging Concern, Fenton, Phenolics

Acknowledgments: Project MOBILED (PCM_00015) funded by "Junta de Andalucía" and by the European Union NextGenerationEU/PRTR, National Complementary Plan for Marine Sciences. Project ECOTRANSEAS (TED2021-130994B-C31) funded by MICIU/AEI/10.13039/501100011033 and by European Union NextGenerationEU/PRTR.

References:

González, A.G., Cadena-Aizaga, M.I., Sarthou, G., González-Dávila, M., Santana-Casiano, J.M. (2019). Iron complexation by phenolic ligands in seawater. Chem. Geol. 511, 380–388. https://doi.org/10.1016/J.CHEMGEO.2018.10.017.

Vallés, I., Sciscenko, I., … Moreno-Andrés, J., Arques, A., (2023). On the relevant role of iron complexation for the performance of photo-Fenton process at mild pH: Role of ring substitution in phenolic ligand and interaction with halides. Appl. Catal. B Environ. 331, 122708. https://doi.org/10.1016/J.APCATB.2023.122708.

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

STABLE ISOTOPE DETECTION OF THE INFLUENCE OF MARINE AQUACULTURE ON SUBMERGED NATURAL HERITAGE: THE CASE OF THE BOU-FERRER ROMAN SHIPWRECK OFF THE COAST OF LA VILA JOIOSA (ALICANTE, SPAIN)

L. Roda-Lluch[1], J. Moya-Montoya[2], A. Carratalá-Giménez[3], P. Sánchez-Jerez[4]

[1] Student of Marine Sciences, University of Alicante, Alicante, SPAIN.
lrl44@alu.ua.es
[2] Institute for Research in Archaeology and Historical Heritage, of Alicante, Alicante, SPAIN.
ja.moya@ua.es
[3] Department of Chemical Engineering, University of Alicante, Alicante, SPAIN.
a.carratala@ua.es
[4] Department of Marine Science and Applied Biology, University of Alicante, Alicante, SPAIN.
psanchez@ua.es

Abstract: The impact of aquaculture on the marine environment has been extensively studied. However, there are fewer studies that analyse the impact on cultural heritage. The Bou Ferrer is a Roman wreck from the 1st century AD, discovered in 1999 off the coast of La Vila Joiosa at a depth of 24 m (Alicante, Spain). This site has been legally protected by Spanish law as an Asset of Cultural Interest since 2014, and in 2017 UNESCO included it in its International Register of Good Practices in Underwater Archaeology. In 2023, the Directorate General for Culture and Heritage of the Generalitat Valenciana commissioned the University of Alicante to carry out a study on the Evaluation and analysis of the impact of the aquaculture facility in La Vila Joiosa on the archaeological site of the Bou Ferrer Wreck (Code C.P.I 23-CECE19-03-195-UT-O). The present study was carried out to determine the influence of the aquaculture activity of a facility located 800 meters from the site, based on the isotopic signal of Carbon ($\delta^{13}C$) and Nitrogen ($\delta^{15}N$), comparing different sampling methods on the 24 m isobath. Four sampling localities were determined: Bou Ferrer, a locality close to the facility (< 500 m) and two controls (> 1 km), to the north and south of the facility. Niskin bottles (particulate matter near the bottom), sedimentation traps (water and sediment matter near the bottom) and cores (bottom sediment) were used for sampling. The influence of aquaculture was detected mainly by changes in $\delta^{13}C$ in the sediment obtained with the sedimentation traps and in the sediment itself. Fish-farming aquaculture may have a significant impact on this Roman wreck.

Key words: fish farm, stable isotopes, impact, cultural heritage, Vila Joiosa.

POTENTIAL HAZARDS OF OCTINOXATE (ETHYLHEXYL METHOXYCINNAMATE) EXPOSURE IN THE SEAGRASS *POSIDONIA OCEANICA* (L.) DELILE: EXPERIMENTAL EVIDENCE

Manuela Gertrudis García-Márquez*[1], Daniel García-Veira[1] and Nona S.R. Agawin[1]

[1] Marine Ecology and Systematics (MarES), Department of Biology, University of the Balearic Islands, Palma de Mallorca, SPAIN.
manuelag.garciam@uib.es, daniel.garcia-veira@uib.es, nona.agawin@uib.es

Abstract: Interest has risen in recent years to assess the fate and impacts of organic ultraviolet (UV) filters in aquatic environments, after being recognized as contaminants of emerging concern. Octinoxate, also known as ethylhexyl methoxycinnamate (EHMC), is among the widely used UV filters in sunscreen formulations, and its potential toxicological effects in aquatic biota has led to precautionary actions in some jurisdictions, such as restricting and even banning its presence in commercial sunscreens. However, research data is lacking for effective regulation of sunscreen ingredients in Mediterranean countries. Our study evaluated the response of the seagrass *Posidonia oceanica* to EHMC under a short-term experimental setup, recreating summer conditions in aquaria subjected to different environmentally relevant concentrations for the Mediterranean Sea (minimum: 31 ng L^{-1}, intermediate: 710 ng L^{-1} and maximum: 1420 ng L^{-1}) and a control (no addition). Negative responses were evidenced in the physiology of *P. oceanica* due to EHMC exposure, with decreased gross primary production rates, loss of leaf chlorophyll content and inhibition of the overall nitrogen fixation associated with the seagrass tissues. Elevated oxidative stress biomarkers in *P. oceanica* under EHMC addition (*i.e.*, catalase activity, polyphenols concentrations and alkaline phosphatase activity in leaves) reflect the activation of antioxidant defenses to counteract oxidative damages possibly induced in cellular components by the presence of the contaminant. Our results may conservatively imply the high ecological risk imposed to *P. oceanica* by maximum concentrations of EHMC in Mediterranean coastal waters. Moreover, they contribute as experimental evidence of the potentially detrimental effects of sunscreen pollution in a keystone species, such as *P. oceanica*, which is the main structural component of a priority habitat for conservation in the Mediterranean Sea, currently affected by multiple stress factors leading to its recession in recent years.

Key words: organic ultraviolet filters, contaminants, octinoxate, sunscreen pollution, seagrass.

Acknowledgments: M.G.G.-M. is recipient of the CAIB (2021) predoctoral grant (BOIB No. 103) funded by the Govern de les Illes Balears - Conselleria de Fons Europeus, Universitat i Cultura. This work has been partially sponsored and promoted by the Comunitat Autonoma de les Illes Balears through the Servei de Recerca i Desenvolupament and the Conselleria de Fons Europeus, Universitat i Cultura and by the European Union-Next Generation EU (BIO/001). Nevertheless, the views and opinions expressed are solely those of the authors, and do not necessarily reflect those of the European Union or the European Commission. Neither the European Union nor the European Commission are to be held responsible." We acknowledge the collaboration of José Carlos Rodríguez-Castañeda in the chlorophyll and oxidative stress analyses. We also thank the Scientific Technical Service of the University of the Balearic Islands for their support in the gas chromatography (Maria Trinidad Garcia Barceló) and spectrofluorimetric (Biel Martorell Crespí) analyses.

References:

Caloni, S., Durazzano, T., Franci, G., Marsili, L. (2021). Sunscreens' UV Filters Risk for Coastal Marine Environment Biodiversity: A Review. Diversity, 13, 374.

Carve, M., Nugegoda, D., Allinson, G. and Shimeta, J. (2021). A systematic review and ecological risk assessment for organic ultraviolet filters in aquatic environments. Environmental Pollution, 268 (B), 115894.

García-Márquez, M.G., Rodríguez-Castañeda, J.C. and Agawin, N.R.S. (2024). Effects of the sunscreen ultraviolet filter oxybenzone (benzophenone-3) on the seagrass Posidonia oceanica (L.) Delile and its associated N2 fixers. Science of The Total Environment, 918, 170751.

Da Silva, A.C., Santos, B.A.M.C., Castro, H.C., Rodrigues, C.R. (2022). Ethylhexyl methoxycinnamate and butyl methoxydibenzoylmethane: Toxicological effects on marine biota and human concerns. Journal of Applied Toxicology, 42 (1), 1-167.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

EVALUATION OF TBT CONTAMINATION BY PASSIVE SAMPLERS IN THE BIDASOA ESTUARY (BAY OF BISCAY - NORTHEAST SPAIN) IN THE CONTEXT OF THE WATER FRAMEWORK DIRECTIVE

M.J. Belzunce Segarra*[1], N. Montero[1], J. Franco[1]

[1] Marine Research, AZTI Foundation, 20110 Pasaia, SPAIN.
jbelzunce@azti.es, nmontero@azti.es, jfranco@azti.es

Abstract: Tributyltin (TBT) and its degradation products are persistent substances that at very low concentrations (ng·L^{-1}) can produce toxic effects in a wide spectrum of organisms (Beyer et al. al., 2022), being considered one of the most toxic xenobiotics that have ever been introduced into the environment (Goldberg, 1986). In the European Union, its use in the coating of ships was prohibited two decades ago. However, despite this, and due to its persistence in the environment, some water bodies still fail to meet the good chemical status for TBT.

Since 2014, in the Bidasoa estuary, the Basque Water Agency (URA), in collaboration with AZTI, has carried out quarterly monitoring of TBT following the conventional method of spot sampling, using an oceanographic bottle, and subsequent analysis to evaluate the degree of compliance with environmental quality standards (EQS). However, on many occasions, TBT concentrations are lower than the quantification limits of the analytical techniques used, which represents a limitation for evaluating the chemical status of the water body. Due to these difficulties, the use of passive samplers, recognized by Directive 2013/39/EU as novel and complementary techniques for the evaluation of chemical status, was proposed as an alternative.

In this study, the chemcatcher passive sampler was selected to determine contamination by TBT and DBT in the Bidasoa estuarine waters. For this purpose, in 5 stations, passive sampling (chemcatchers) and spot sampling (using bottles) were simultaneously carried out, in the dry season (May-June 2022) and in the rainy season (November 2022). The results obtained through spot sampling show great variability, both spatially and seasonally, with TBT and DBT concentrations from values below the limit of quantification to values higher than the EQS-Annual Average (0.2 ng·L^{-1}), which makes it difficult to assess the chemical status. On the contrary, with chemcatchers, in all stations and periods it was possible to quantify and determine time-integrated concentrations of TBT and DBT, making it possible to estimate the chemical status and determine a pattern of contamination by TBT and DBT in the estuary, showing the advantages of these techniques over the conventional ones.

Key words: Tributyltin (TBT), Chemcatchers, Spot sampling, WFD

Acknowledgments: Authors wish to acknowledge URA - Basque Water Agency for promoting and funding this study.

References:

Beyer, J., Song, Y., Knut Erik Tollefsen, John Arthur Berge, J.A., Tveiten, L., Helland, A., Øxnevad, S. Schøyen., M. (2022). The ecotoxicology of marine tributyltin (TBT) hotspots: A review. Marine Environmental research, 179, 105689.

Goldberg, E.D. (1986). TBT: An environmental dilemma. Environment: Science and Policy for Sustainable Development 28, 17-44.

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

ALTERATIONS IN THE MICROBIOME OF THE CLAM DIGESTIVE GLAND AFTER EXPOSURE TO DRUGS

Marina Barbudo-Lunar[1], Chiara Trombini[2], Julián Blasco[2,3], José Alhama[1] and Carmen Michán[1]

[1] Department of Biochemistry and Molecular Biology, ceiA3, Campus Rabanales, Universidad de Córdoba, 14071-Córdoba, SPAIN.
b62balum@uco.es, bb2midoc@uco.es, bb2alcaj@uco.es
[2] Institute of Marine Sciences of Andalusia (CSIC). Department of Ecology and Coastal Management. Puerto Real, Cádiz, SPAIN.
chiara.trombini@icman.csic.es, julian.blasco@csic.es
[3] Blue Growth associated unit ICMAN-IFAPA El Toruño. Puerto Real / Puerto de Santa María, Cádiz, SPAIN.
julian.blasco@csic.es

Abstract: Aquatic ecosystems cover more than two-thirds of our planet and are the ultimate sinks for pollutants. The consumption of pharmaceuticals compounds in the last years has increased notably, and, consequently, the occurrence of these compounds in the aquatic environment. Their presence may be of concern, because although lethal concentrations are not usually approached, sublethal effects have been reported at cellular and molecular levels, even affecting physiological functions. In this work, we have investigated the effect of two different pharmaceuticals which have been described as compounds of environmental concern: carbamazepine (CBZ) and sulfamethoxazole (SMZ). To do so, multispecies/microcosm aquatic experimental set-ups were used to expose to 1 μg/L of the chemicals, individually or mixed, for 10 days. Using *Scrobicularia plana* clams as bioindicator organism, the microbiome associated to their digestive gland was identified and analysed by 16S rRNA metagenomics. At the highest taxonomic level, the phyla with the highest number of identifications were Proteobacteria, Tenericutes and Bacteroidetes. The *Mycoplasmataceae*, *Ectothiorhodospiraceae* and *Flavobacteriaceae* families were substantially abundant in every condition. Exposure to SMZ resulted in a significant decrease in the families *Pseudonocardiaceae*, *Thioalkalispiraceae* and *Xanthomonadaceae* when compared to the control. Exposure to the mixture of drugs resulted in an increase of the *Clostridiaceae* and *Pseudonocardiaceae* families when compared to SMZ exposure. The alpha diversity was calculated using the Shannon-Wiener index, but no significant change was observed after exposure to any drug/mixture. The potential biological functions of the microbiome were analysed with the FAPROTAX algorithm. "Chemoheterotrophy", "Aerobic chemoheterotrophy" and "Phototrophy" functions were highly represented in each condition. However, no significant changes were observed in the functional pattern after any of the exposures. Our final goal is to assess changes in the structure and functionality of the microbiome upon pharmaceuticals exposure to use them as biomarkers of pollution

Key words: Bacteria, Carbamazepine, Metagenomics, Pharmaceuticals, *Scrobicularia plana*, Sulfamethoxazole

Acknowledgments: This research has been funded by the Projects "ENVIROMICROB" (PID2019-110049RB-I00) and "E-WASTERISK", (PID2022-139807OB-I00), financed by the Spanish Ministry of Science and Innovation. M. Barbudo-Lunar is recipient of a predoctoral contract of the University of Cordoba ("Plan Propio").

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

IMPACT OF NATURAL UV RADIATION ON THE TOXICITY OF PLASTIC LEACHATES TO MARINE ZOOPLANKTON

Mina Vassvik, Olalla Alonso and Rodrigo Almeda

EOMAR, ECOAQUA, University of Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, SPAIN.
mina.vassvik101@alu.ulpgc.es, olalla.alonso@ulpgc.es, rodrigo.almeda@ulpgc.es

Abstract: The presence of plastic waste in marine environments poses significant ecological threats. Leachates from plastic materials can contribute to the chemical stress experienced by marine organisms (Gunaalan et al. 2020, Almeda et al. 2023). This study investigates the influence of natural ultraviolet (UV) radiation on the toxicity of leachates from various plastic materials to marine zooplankton, using the nauplius larvae of the copepod *Acartia tonsa* as a model species.

Leachates of different plastic materials (beach-collected plastics, bioplastics, and tire wearparticles) were exposed to natural sunlight for two or five days. Post-exposure leachates were then tested on *A. tonsa* larvae for 48 hours and the number of surviving nauplii was recorded at the end of the exposure period. Results revealed a notable decrease in toxicity in leachates subjected to UV exposure compared to those kept in dark conditions. The decrease in leachate toxicity after UV exposure varied depending on the plastic material. Nauplii survival increased, and Lowest Observed Effect Concentration (LOEC) and No Observed Effect Concentration (NOEC) consistently decreased across all tested plastic types after five days of exposure. However, after only two days of exposure, no significant difference was observed between UV-exposed leachates and those kept in dark conditions.

The reduction in toxicity is hypothesized to result from photodegradation processes facilitated by UV radiation, which alters the chemical properties of the leachates, reducing their harmful effects. Further chemical characterization is being conducted to understand the specific transformations occurring in the leachates.

This study highlights the importance of UV radiation in reducing the ecological risks of plastic pollution. By revealing a natural factor that reduces plastic toxicity, these findings contribute to a better understanding of marine pollution dynamics. This knowledge is crucial for predicting the environmental risks associated with plastic debris and for developing effective strategies to manage and remediate plastic pollution in marine environments.

Key words: Plastic Pollution, Leachates, Photodegradation, Zooplankton, Copepods

Acknowledgments: This work was supported by the Spanish Ministry of Science and

Innovation and Spanish National Agency of Research through a “Ramón y Cajal” grant (RYC 2018-025770-I) and the MICROPLEACH project (Agencia Estatal de Investigación, PID2020-120479 GA-I00/AEI/10.13039/501100011033)..

References:

Gunaalan, K., Fabbri, E., Capolupo, M., 2020. The hidden threat of plastic leachates: A critical review on their impacts on aquatic organisms. Water Res. 184, 116170. https://doi.org/10.1016/j.watres.2020.116170

Almeda, R., Gunaalan, K., Alonso-López, O., Vilas, A., Clérandeau, C., Loisel, T., Nielsen, T.G., Cachot, J., Beiras, R., 2023. A protocol for lixiviation of micronized plastics for aquatic toxicity testing. Chemosphere 333, 138894. https://doi.org/10.1016/j.chemosphere.2023.138894

VERTICAL DISTRIBUTION OF ORGANIC MICROPOLLUTANTS IN SEDIMENTS FROM EUROPEAN BAYS AND ESTUARIES

Rubén Rios-Quintero*[1], Daniel González-Fernández[2], Pablo Lara-Martín[1] and Marina G. Pintado-Herrera[1]

[1] Physical Chemistry Department, Faculty of Marine and Environmental Sciences, International Campus of Excellence of the Sea, University of Cadiz, Cadiz 11510, SPAIN.
ruben.rios@uca.es, pablo.lara@uca.es,
marina.pintado@gm.uca.es
[2] Biology Department, Faculty of Marine and Environmental Sciences, International Campus of Excellence of the Sea, University of Cadiz, Cadiz 11510, SPAIN.
daniel.gonzalez@uca.es

Abstract: Contamination of marine ecosystems by organic micropollutants may lead to a significant risk for inhabitant species. In order to assess such contamination, we have monitored several European estuaries and bays during the oceanographic campaign carried out within the SEA-EU in 2022 on board R/V OCEANOGRAF. Such research was conducted in 9 sampling sites along the Baltic Sea, North Sea and the Atlantic Ocean. Sediment cores were collected, divided in 1 cm sections and analysed by gas chromatography – tandem mass spectrometry (GC-MS/MS) using a multiresidue method that covers > 100 target contaminants: polycyclic aromatic hydrocarbons (PAHs), UV filters, fragrances, organophosphorus flame retardants (OPFRs), polybrominated diphenyl ethers (PBDEs), phthalates, pyrethroids, among others. The most prevalent target contaminants were PAHs (anthracene or phenanthrene), followed by traces of UV-filters (4-MBC or octocrylene) and fragrances (tonalide or galaxolide), revealing different contamination sources in our study area. Vertical profiles for contaminants differed depending on the sampling site and target compound, with surficial or sub-surficial concentration maxima in most cases. Our study covers a very wide area and shows new data on the occurrence and distribution of a very high number organic contaminants, some of them of emerging concern (e.g., fragrances and UV-filters), for which available information is still scarce.

Key words: PAHs, micropollutants, marine environments, gas-chromatography.

Acknowledgments: This work has been carried out by the support of two research pro-jects: European University of the Seas – SEA-EU (no 612468-EPP-1-2019-1-ES- EPPKA2-EUR-UNIV) - and BIOCEMAS, (RTI2018-096211-B-100), Spanish Ministry of Science and

Innovation.

References:

Pintado-Herrera, M.G., Gonzalez-Mazo, E., Lara-Martín, P.A., 2016. In-cell clean-up pressurized liquid extraction and gas chromatography–tandem mass spectrometry determination of hydrophobic persistent and emerging organic pollutants in coastal sediments. J. Chromatogr. A 1429, 107–118.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

FROM NECROPSIES TO CONSERVATION: INVESTIGATING MASS MORTALITY EVENTS IN ALCID SEABIRDS

Yada Trapletti Lanti*[1], Mónica Expósito Granados[2], Sergio López Martínez[3], Miguel Torres[2] and Marga L. Rivas[2]

[1, 2] Biology Department, University of Cadiz, Cadiz, SPAIN.
yada.trapletti@uca.es; *monica.exposito@uca.es; miguel.torres@uca.es; mlrivas@uca.es*
[3] Biology and Geology Department, University of Almeria, Almeria, SPAIN.
sergilm@ual.es

Abstract: The migration patterns of seabirds, including those in the Alcidae family, are influenced by climatic phenomena and resource availability. These factors can have a significant impact on their survival and breeding success [2]. Our study was conducted along the southern coast of Spain to investigate mass mortality events of Atlantic Puffins (*Fratercula arctica*) and Razorbills (*Alca torda*) during the winter of 2022-23. Stranded seabirds were necropsied, and samples of muscle and liver tissue were collected to assess their body and metabolic state. A total of 95 specimens were collected, with Razorbills being the most abundant species and with a higher percentage of juveniles (74.5 %), as has been observed in other seabird stranding events [1]. The results revealed no significant differences in body condition between the two species, but metabolic analysis on both species indicated low carbohydrate levels and elevated lactate in muscle tissues, suggesting potential exhaustion or hypoglycaemia [3]. In this study, we also proposed a standardised body condition index based on biometric measurements and tissue analysis, offering a comprehensive approach to understanding the body condition at death of these unique species. Comparison with global data has highlighted similar mortality events in other regions, emphasizing the need for standardized protocols to assess possible causes of death through seabird necropsies. These findings underscore the importance of understanding the factors affecting to seabird mortality to contribute on the implementation of conservation measures to protect these vulnerable species.

Key words: Seabird mortality, Mass stranding events, Physiological assessment

Acknowledgments: We appreciate the help and participation of volunteers, technicians and staff of CREAS (Andalusian Care centers) and personnel from SeoBirdlife and Tragsatec. This work was partially funded by the UE project 2020 LIFE Environmental Governance and Information (LIFE Seabil - Saving seabirds from marine Litter-) LIFE20 GIE/FR/000114.

References:

[1] Costa, R. A., Pereira, A. T., Costa, E., Henriques, A. C., Miodonski, J., Ferreira, M., ... & Eira, C. (2019). Razorbill Alca torda mortality in the Portuguese west coast. European Journal of Wildlife Research, 65, 1-7.

[2] Fayet, A. L., Freeman, R., Shoji, A., Boyle, D., Kirk, H. L., Dean, B. J., ... & Guilford, T. (2016). Drivers and fitness consequences of dispersive migration in a pelagic seabird. Behavioral Ecology, 27(4), 1061-1072.

[3] Wynkoop, M. R., Cooper-Mullin, C. M., & Jimenez, A. G. (2022). Plasma lactate dehydrogenase and pyruvate kinase activity changes with body mass and age across birds and mammals. Animal Biology, 72(4), 447-463.

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

ORAL COMMUNICATIONS

~

GLOBAL CHANGE

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

UniversidadeVigo

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

pH AND CO_2 COASTAL MONITORING IN THE CANARY ISLANDS

A.G. González*[,1], A. Aldrich-Rodríguez[1], D. González-Santana[1], M. González-Dávila[1], J.M. Santana-Casiano[1]

[1] Instituto de Oceanografía y Cambio Global (IOCAG). Universidad de Las Palmas de Gran Canaria (ULPGC). Telde, SPAIN.
aridane.gonzalez@ulpgc.es, ariadna.aldrich@uabc.edu.mx, david.gonzalez@fpct.ulpgc.es, melchor.gonzalez@ulpgc.es, magdalena.santana@ulpgc.es

Abstract: Carbon dioxide (CO_2) transferred from the atmosphere to the ocean is causing the ocean acidification. This monitoring initiative, in the Gando Bay, focuses on multiple variables within the CO_2 system, such as CO_2 fugacity (fCO_2), pH (in total scale, pH_T), total inorganic carbon (C_T), and other hydrographic variables including sea surface salinity (SSS), sea surface temperature (SST), wind intensity and direction. In addition, the CO_2 flux (FCO_2) between the surface waters and the atmosphere was computed. The lowest SST values were recorded in March, with a range of 18.8-19.3°C, while the highest SST were observed in September and October (24.5-24.8°C). SST exhibited an annual increase with a rate of 0.007°C yr^{-1}. Warmer months increased SSS, while colder periods, influenced by extreme events like tropical storms, led to lower salinity (SSS=34.02). The predominant Trade Winds facilitated the arrival of deeper water, replenishing seawater. Atmospheric fCO_2 averaged 415±4 µatm (2020-2023) while surface water fCO_{2sw} presented variability, with the highest values recorded in September and October, peaking at 437 µatm in September 2021. The lowest values for fCO_{2sw} were found in February 2021 (368 µatm). From 2020 to 2023, surface water fCO_{2sw} values displayed an increasing rate of 1.9 µatm yr^{-1} in the study area. The assessment of fCO_{2sw} decomposition into thermal and non-thermal processes revealed the importance of SST on the fCO_{2sw}. Our findings highlight the influence of physical factors such as tides, and wind effect to horizontal mixing in these areas. The C_T showed a mean concentration of 2113±8 µmol kg^{-1} and pH at *in-situ* temperature ($pH_{T,IS}$) has a mean value of 8.05±0.02. The mean FCO_2 from 2020 to 2023 was 0.34±0.04 mmol m^{-2} d^{-1} (126±13 mmol m^{-2} yr^{-1}) acting as a slight CO_2 source. Extrapolating to the 6 km^2 of Gando Bay, the region sourced 33±4 Tons of CO_2 yr^{-1}.

Key words: CO_2 observations, coastal waters, times-series, Canary Islands, acidification

Acknowledgments: This study was supported by the Government of the Canary Islands the Loro Parque Foundation through the CanBIO project, CanOA subproject (2019-2023) and the CARBOCAN agreement (Consejería de Transición Ecológica, Lucha contra el Cambio Climático y Planificación Territorial, Gobierno de Canarias). Discrete sampling and maintenance were also supported by the FeRIA project (PID2021-123997NB-100), the Spanish Ministerio de Ciencia e Innovación. Special thanks go to the Mando Aéreo de Canarias (MACAN), its officers and all the members of the Base Aérea de Gando, and to all the marine supporting members for providing support (personnel and boats), assistance and surveillance.

SEASONAL VARIABILITY OF GREENHOUSE GASES (CO_2, CH_4 AND N_2O) AT THE EDGES OF RIA FORMOSA COSTAL LAGOON, SOUTH PORTUGAL

C. Correia*[1], A. Sierra[2], T. Ortega[2], J. Forja[2] and A. Cravo[1]

[1] CIMA (Centro de Investigação Marinha e Ambiental), Universidade do Algarve, Faro, PORTUGAL.
cfcorreia@ualg.pt, acravo@ualg.pt
[2] Dpto. Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, Puerto Real, Cádiz, ESPANHA.
ana.sierra@uca.es, teodora.ortega@uaca.es, jesus.forja@uca.es

Abstract: Coastal lagoons are highly productive ecosystems affected by anthropogenic pressures and climate change. The coastal lagoon Ria Formosa (southern Portugal) has been studied in terms of greenhouse gases (pCO_2, N_2O and CH_4), particularly at its western and eastern edges, where water quality has been found to be more variable. These parameters help to understand the environmental dynamics and the response of this ecosystem as a source or sink of greenhouse gases. The seasonal variability of partial pressure of CO_2 (pCO_2) and concentrations of dissolved methane (CH_4) and nitrous oxide (N_2O) were assessed over complete tidal cycles with 24 h sampling at the two edges of Ria Formosa (Site 1 and Site 2). pCO_2 was calculated from total alkalinity (TA) and pH, while N_2O and CH_4 were measured by gas chromatography. Site 1 had the highest values of both pCO_2 and N_2O, while site 2 had the highest concentrations of CH_4. However, globally, the variability of greenhouse gases was higher at site 2 than at site 1. Daily variations were observed to be in antiphase with the tidal cycles at both stations, with highest concentrations during ebb to low tide, suggesting that the coastal lagoon exports CO_2, CH_4 and N_2O to the adjacent coastal ocean. Changes in greenhouse gas concentrations were influenced by various environmental factors (e.g. salinity, temperature, gas reactivity, exchanges with the atmosphere) as well as biological processes (photosynthesis and respiration), which apparently are different at the two sites. Positive fluxes of pCO_2 and CH_4 indicate that the study areas acted as a source of these gases to the atmosphere. However, the fluxes of N_2O were negative, except during the summer campaign, indicating that the water was a sink for this greenhouse gas.

Key words: Greenhouse Gases, Coastal Lagoon, Ria Formosa

Acknowledgments: We would like to acknowledge the funding provided by FCT to the projects LA/P/0069/2020 awarded to the Associate Laboratory ARNET https://doi.org/10.54499/UIDB/00350/2020 and UID/00350/2020 awarded to CIMA of the

University of the Algarve https://doi.org/10.54499/LA/P/0069/2020. Cátia Correia was supported by the grant UI/BD/150771/2020, funded by FCT.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

IMPACT OF OCEAN WARMING AND ACIDIFICATION ON THE STATOLITHS OF THE MEDITERRANEAN JELLYFISH *RHIZOSTOMA PULMO*

M. J. León-Cobo*[1], Angélica Enrique-Navarro[2], A. Bartual[3] and L. Prieto[4]

[1, 2, 4] Instituto de Ciencias Marinas de Andalucía (ICMAN - CSIC), Cádiz, SPAIN.
manueljesus.leon@csic.es, angelica.enrique@csic.es, laura.prieto@csic.es
[3] University of Cádiz, Cádiz, SPAIN.

Abstract: Ocean acidification, along with rising water temperature, are both processes whose occurrence has increased alarmingly in recent decades, threatening the biogeochemistry of marine ecosystems (Flecha *et al*., 2019). The gradual diminution of pH in the water column due to ocean acidification results on a lower stability of certain solid structures, affecting both directly and indirectly organisms that make use of them (Doney *et al*., 2009; Billé *et al*., 2013). Here we analyze the effects of both individual and combined increases of acidification and temperature on the statoliths of newly released ephyrae of the Mediterranean Jellyfish *Rhizostoma pulmo* Macri (1778). These structures, composed of calcium sulfate hemihydrate ($\mathrm{CaSO4\cdot 0.5H_2O}$), are used for equilibrium and are essential for the correct development and adaptation of the organisms to the marine environment, so their malformation could mean a decrease in their survival capacity and also could end up impacting negatively the planktonic food webs. In this work, six combinations of temperature and pCO_2 (18ºC, 24ºC and 30ºC with a pCO_2 of 500 ppm and 1000 ppm each), according to the projections of the SSP5-8.5 (IPCC, 2021) scenario for the year 2100, were applied during 32 days to different groups of polyps. Statoliths of the ephyrae released during this period were counted and measured by inverted optical microscopy and SEM, as composition analyses were performed via EDX. Our results suggest the variation of both variables influence on the size of the structures but not their composition, where the increment of temperature causes the synthesis of bigger statoliths, while the increment of pCO_2 is responsible for the production of smaller structures. The way in which the development of different sized statoliths under warming and acidification conditions affect the equilibrioception and adaptation capacity of *R. pulmo*, as well as how it may impact the ecosystem of a warmer and more acidic Mediterranean is currently under study.

Key words: Jellyfish, Ephyra, Statolith, Acidification, Ocean warming

Acknowledgments: This research was funded by the CSIC (grant number 202330E57 "Estudio de los efectos de motores de impacto del cambio climático sobre las dinámicas poblacionales de medusas mediterráneas”), as well as by a Ph.D. fellowship (FPU22/03487) from the Spanish Ministry of Science, Innovation and Universities.

References:

Billé, R., Kelly, R., Biastoch, A., Harrould-Kolieb, E., Herr, D., Joos, F., Kroeker, K., Laffoley, D., Oschlies, A., & Gattuso, J. P. (2013). Taking action against ocean acidification: A review of management and policy options. Environmental Management, 761–779.

Doney, S. C., Fabry, V. J., Feely, R. A., & Kleypas, J. A. (2009). Ocean Acidification: The Other CO2 Problem. Annual Review of Marine Science, 1(1), 169–192.

Flecha, S., Pérez, F. F., Murata, A., Makaoui, A., & Huertas, I. E. (2019). Decadal acidification in Atlantic and Mediterranean water masses exchanging at the Strait of Gibraltar. Scientific Reports, 9.

IPCC, 2021: Summary for Policymakers. In: *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 3−32.

Winans, A. K., & Purcell, J. E. (2010). Effects of pH on asexual reproduction and statolith formation of the scyphozoan, Aurelia labiata. Hydrobiologia, 645(1), 39–52.

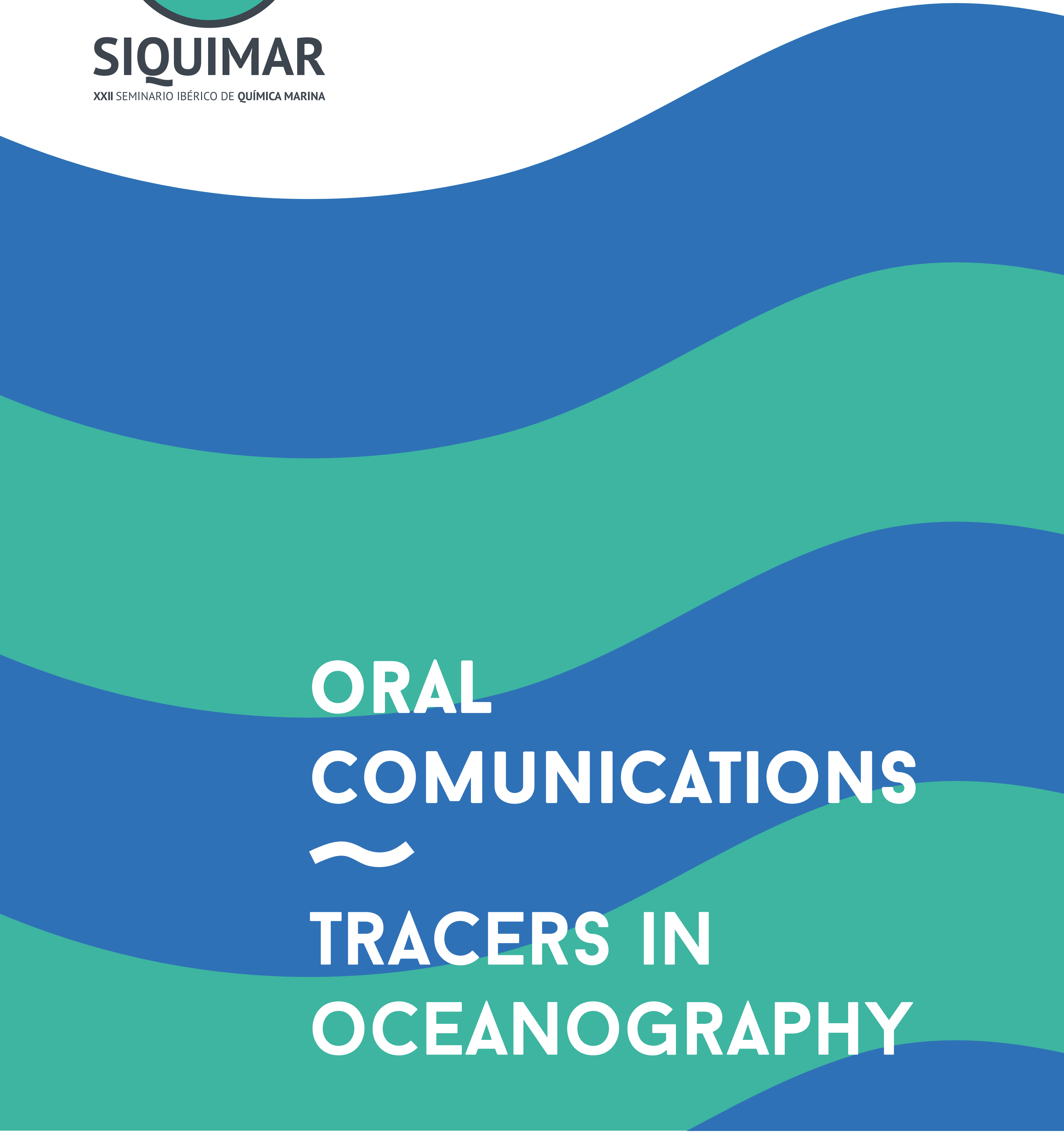
SIQUIMAR

XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024

VALENCIA
JULY 10-12

IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES



ORAL COMUNICATIONS

~

TRACERS IN OCEANOGRAPHY

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

Universitat de Barcelona

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

UniversidadeVigo

GEOCHEMICAL TRACERS OF MEDITERRANEAN OUTFLOW WATERS: ND ISOTOPES, CARBON CYCLE AND NEW EXPORT CONSTRAINTS

L.D. Pena*[1], S. Campderrós[1], E. Garcia-Solsona[1], E. Paredes-Paredes[1], J. Frigola[1], C.N. Rodríguez-Díaz[1,2], A. Lucas[2], S. Espinosa[1], J. Torner[1], E. Calvo[2], C. Pelejero[2,3], I. Cacho[1]

[1] GRC-Geociències Marines, Departament de Dinámica de la Terra i l'Oceà, Universitat de Barcelona, Barcelona, SPAIN.
lpena@ub.edu
[2] Institut de Ciències del Mar, Consejo Superior de Investigaciones Científicas, Barcelona, SPAIN.
[3] Institució Catalana de Recerca i Estudis Avançats (ICREA), Barcelona, SPAIN.

Abstract: The North Atlantic Ocean plays a critical role in the global circulation system, regulating the penetration of surface waters into the deep ocean, but also in key ocean biochemical cycles (e.g. carbon, oxygen, nutrients). Meridional heat and salt transport (i.e. buoyancy) drive the formation of different water masses and their circulation pathways. A relatively unknown but important element controlling the net meridional export of heat, salt and other chemical species into the North Atlantic is the Mediterranean Outflow Water (MOW): the salt injector. In this work, we present the first high resolution systematic study of traditional (T, S, Nutrients) and novel (Nd isotopes, alkalinity, pH) geochemical parameters of MOW waters from its source area at the Strait of Gibraltar up to the northern Iberian margin (Cantabric Sea). During the TRANSMOW cruise in 2021, over 500 seawater samples were collected along the main MOW pathway following its northward flow. A comprehensive suite of geochemical parameters including ε_{Nd}, alkalinity, pH and preformed nutrients were analyzed for these samples. We show that MOW can be 'traced' unequivocally using εNd as a conservative tracer, a feature that opens a new set of possibilities to better estimate the contribution of MOW export to higher latitudes in the North Atlantic Ocean. Other parameters directly linked to the carbon cycle (alkalinity, pH) are also controlling the distinctive chemical properties of the MOW. One of the key advantages of these geochemical tracers is that they allow to better quantify export and mixing rates of MOW with North Atlantic waters. Using statistical tools such as a newly developed Monte Carlo Optimum Multi-Parameter Analysis (MC-OMPA) on an array of conservative tracers we have quantified mixing rates and exports between different water masses. These results will be fundamental to better constrain paleoreconstructions in the sedimentary record.

Key words: MOW, Nd isotopes, Carbon Cycle, geochemical tracers, OMPA

Acknowledgments: Financial support is acknowledged to the Spanish Ministry of Science and Innovation through research projects TRANSMOW (PID2019-105523RB-I00) and MORIA (PID2022-138010OB-I00), and to European Research Council through research project TIMED (683237). S.E. acknowledges an FPI PhD contract funded by the Spanish AEI. I.C. acknowledges an ICREA-Academia award. This is a contribution from the Geociències Marines research group (Grant 2021SGR01195) from Generalitat de Catalunya.

THE IMPRINT OF ANTHROPOGENIC CLIMATE CHANGE IN THE SW IBERIAN UPWELLING SYSTEM: A WARMER, MORE ACIDIC AND LESS OXYGENATED OCEAN

M. Fontela[1,2], A. Voelker[2,3], M. J. Álvarez-Fernández[1], C. G. Castro[1], D. Curbelo[4], A. Mega[2], S. Nieto, P. Relvas[2,5], D. Rios-Yunes, A. Velo[1], F. Abrantes[2,3]

[1] Instituto de Investigacións Mariñas (IIM), Vigo, SPAIN.
mfontela@iim.csic.es, mjalvarez@iim.csic.es, cgcastro@iim.csic.es, avelo@iim.csic.es
[2] CCMAR - Centro de Ciências do Mar, Campus de Gambelas; 8005-139 Faro, PORTUGAL.
alinemega20@gmail.com
[3] IPMA - Instituto Português do Mar e da Atmosfera; Divisão de Geologia e Georecursos Marinhos; Av. Doutor Alfredo Magalhães Ramalho 6; 1495-165 Alges; PORTUGAL.
antje.voelker@ipma.pt, fatima.abrantes@ipma.pt
[4] Instituto de Oceanografía y Cambio Global (IOCAG), Universidad de Las Palmas de Gran Canaria (ULPGC), Las Palmas, SPAIN.
david.curbelo@ulpgc.es
[5] UAlg - University of Algarve, Estr. da Penha 8005-139 Faro, PORTUGAL.
prelvas@ualg.pt

Abstract: The imprint of anthropogenic climate change on the ocean is unequivocal. Warming, ocean acidification, and deoxygenation stand out as the main biogeochemical stressors at global scale. At regional scale, Eastern Boundary Upwelling Systems are hotspots of climate change, threatening their valuable ecosystem services. Currently, predictions of how and when anthropogenic changes will emerge in coastal upwelling systems in response to biogeochemical stressors are uncertain. Furthermore, the potential widespread of biogeochemical compound events, that is, several extreme events co-occurring simultaneously (Gruber et al., 2021) is still unknow.

In this study, we assessed the changes in biogeochemical stressors in the Southwest Iberian coastal upwelling system in the last three decades with recent high-quality observations (1989-2022) from the interior ocean. Here, we show with two independent methodologies, a biogeochemical back-calculation anthropogenic carbon method (ϕCT°) and an analysis of carbon isotope values for the dissolved inorganic carbon ($\delta^{13}C$-DIC), that the surface-intensified anthropogenic imprint already reached two-thousand meters depth. Warming, acidification, and deoxygenation align closely with this burden of anthropogenic imprint, pushing ocean tracers out of their preindustrial local variability. These new observations confirm that in September 2022 there was a biogeochemical extreme and compound event in the surface waters of the Southwest Iberian coastal upwelling system: a marine heatwave,

an ocean acidity extreme and a low-oxygen extreme occurring together. Furthermore, at intermediate depths, the layer of Eastern North Atlantic Central Water (around 100-500 m depth) shows a significant decrease in pH (~-2x10^3 pH units yr^{-1}) and dissolved oxygen (~-0.3 µmol $kg^{-1}yr^{-1}$) even when is actually colder and fresher than it was in 1989.

Key words: ocean acidification, ocean deoxygenation, coastal upwelling system, biogeochemical extreme events

Acknowledgments: MF was funded by Juan de La Cierva Formación (FJC2019-038970-I, Ministerio de Ciencia e Innovación, Spanish Government) and Personal Técnico de Apoyo (PTA2022-021307-I). AM, FA, PR, AV received Portuguese national funds from FCT - Foundation for Science and Technology through projects UIDB/04326/2020 (DOI:10.54499/UIDB/04326/2020), UIDP/04326/2020 (DOI:10.54499/UIDP/04326/2020) and LA/P/0101/2020 (DOI:10.54499/LA/P/0101/2020). DCH was funded by the PhD grant PIFULPGC-2020-2 ARTHUM-2. This project has received funding from the EU H2020 research and innovation programme under Grant Agreement No 824077. CAPTA project (0062_CAPTA_1_E) is co-financed by the European Union through the Interreg Spain-Portugal Cross-Border Cooperation Programme (POCTEP) 2021-2027.

References:

Gruber, N., Boyd, P.W., Frölicher, T.L. et al. Biogeochemical extremes and compound events in the ocean. Nature 600, 395–407 (2021). https://doi.org/10.1038/s41586-021-03981-7

SIQUIMAR

XXII SEMINARIO IBÉRICO DE **QUÍMICA MARINA**

ISMS 2024

VALENCIA
JULY 10-12

IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

XXII IBERIAN SEMINAR ON MARINE CHEMISTRY

~

POSTER COMMUNICATIONS

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

Universida de Vigo

SIQUIMAR

XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

POSTER COMMUNICATIONS

~

BIOGEOCHEMICAL PROCESSES

Universidad Católica de Valencia San Vicente Mártir
Universitat d'Alacant
Universidad de Alicante
Universitat de Barcelona
UCA Universidad de Cádiz
ULPGC Universidad de Las Palmas de Gran Canaria
Universidade de Vigo

MULTI-COAST: MULTIPARAMETRIC STUDY OF THE CO_2 CHEMISTRY IN COASTAL WATERS

A.G. González*[1], J.M. Santana-Casiano[1], M. González-Dávila[1], D. González-Santana[1], A. Bullón-Téllez[1], V. Coussy[1], L. Suárez-Betancor[1], A. Castro-Álamo[1], D. Curbelo-Hernández[1], N. Pérez-Almeida[1], M.A. Suárez de Tangil[1]

[1] Instituto de Oceanografía y Cambio Global (IOCAG). Universidad de Las Palmas de Gran Canaria (ULPGC). Telde, SPAIN.
aridane.gonzalez@ulpgc.es, magdalena.santana@ulpgc.es, melchor.gonzalez@ulpgc.es, david.gonzalez@fpct.ulpgc.es, adrian.bullon@ulpgc.es, victor.coussy@ulpgc.es, laura.suarezbetancor@ulpgc.es, adrian.castro@fpct.ulpgc.es, david.curbelo@ulpgc.es, norma.perez@ulpgc.es, miguel.suarezdetangil@ulpgc.es

Abstract: Coastal systems host a large amount of biodiversity, play a fundamental role in socio-economic development, and are highly affected by human activities. In addition, coastal zones connect terrestrial and oceanic systems being the interface where many chemical reactions and processes occur and are directly related to the carbon cycle. However, the coastal environment is very complicated to study due to the number of processes involved. In fact, the coastal contribution to the global carbon budget has been historically neglected even in such important reports such as the Intergovernmental Panel on Climate Change (IPCC). Accordingly, the Multi-Coast project is focused, for the first time, on a multidisciplinary analysis that involves the quantification of CO_2 transfer from coastal surface waters to sediments in three different areas: seagrass beds, algal covers and sandy zones. This work presents the overview of the preliminary results in terms of monthly measurements of sea surface temperature (SST), sea surface salinity (SSS), partial pressure of CO_2 (pCO_2), pH, total alkalinity (A_T), total inorganic carbon (C_T) and dissolved oxygen (DO). In addition, the % of CHN, metals in sediments, total dissolved metals in seawater and Fe-binding ligands have also been measured.

Accordingly, the results of this project try to identify a multiparametric relationship between CO_2 observations, hydrographic measurements and metal concentrations to be able to quantify the inventory of carbon sinks in coastal waters. The results of this project will be a decision-making tool for regional and national agencies to conserve those ecosystems where there is greater CO_2 capture.

Keywords: CO_2 observations, coastal waters, blue carbon, Canary Islands, trace metals

Acknowledgements: Multi-COast Project (TED2021-130892B-I00) has been funded by MCIN/AEI/10.13039/501100011033 and the Europe Union "NextGenerationEU"/PRTR.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

ENHANCED GREENHOUSE GAS PRODUCTION BY DISSOLVED ORGANIC MATTER IN THE GUADALQUIVIR ESTUARY

J. Sánchez-Rodríguez[1], A. Sierra[1], V. Amaral[2], J. Forja[1] and T. Ortega[1]

[1] Dpto. Química-Física, INMAR, Facultad de Ciencias del Mar y Ambientales, Universidad de Cádiz, Campus Universitario Río San Pedro, 11510 Puerto Real, Cádiz, Andalucía, SPAIN.
jairo.sanchez@uca.es, ana.sierra@uca.es, jesus.forja@uca.es, teodora.ortega@uca.es
[2] Ecología Funcional de Sistemas Acuáticos, Centro Universitario Regional Este, Universidad de la República, Rocha, URUGUAY.
vale8372@gmail.com

Abstract: Estuarine systems are characterized by receiving large amounts of organic matter, which can enhance the production of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). Therefore, a study is conducted to relate the composition of dissolved organic matter (DOM) to these GHG based on various samplings carried out between 2018 and 2022 in the Guadalquivir Estuary. Excess values of CO_2 (ΔCO_2), CH_4 (ΔCH_4), and N_2O (ΔN_2O) are calculated as the differences between the dissolved gas concentration and the expected equilibrium concentration in the water column. This approach removes the effects of temperature and salinity on the GHG distribution. In all cases, there is an increase towards the interior, with values ranging from 1.6 to 101.5 μmol L^{-1} for ΔCO2, -2.5 to 368.7 nmol L^{-1} for ΔCH4, and -3.0 to 91.4 nmol L^{-1} for ΔN_2O. Of the six PARAFAC components identified in this study, four are humic-like components of terrestrial or microbial origin and two are protein-like components, corresponding to tryptophan and tyrosine. The humic-like components account for 85.8 ± 5.8% of the FDOM, while the protein-like components account for 14.2 ± 5.9%. Using multiple linear models, significant links are found between the GHG and the DOM composition. The ΔCO_2 is related to humic compounds and aromaticity, indicating that CO_2 is influenced by terrestrial inputs. ΔCH_4 shows relationships with the humic fraction associated with photodegradation and the protein-like fraction. Finally, ΔN_2O appears to be explained only by the humic components and the Apparent Oxygen Utilization (AOU), suggesting that lateral inputs of DOM and high nitrate concentrations promote N_2O production in the Guadalquivir Estuary.

Key words: Carbon dioxide, Methane, Nitrous oxide, Dissolved organic matter.

Acknowledgments: J. Sánchez-Rodríguez was financed by the Spanish Ministry of Education with FPI fellowship (PRE2019-087387), A. Sierra was financed by the Spanish Ministry of universities and European Union - Next Generation EU, under contract

Margarita Salas. We thank the crews of the R/V UCadiz for their assistance during field works. This work was supported by the Spanish CICYT (Spanish Program for Science and Technology) under contract RTI2018- 100865-B-C21 and P20_00953 (Junta de Andalucía).

SIMULTANEOUS VOLTAMMETRIC ANALYSIS OF PALLADIUM AND NICKEL USING SIGNAL TRANSFORMATION

Maria Jeremias*[1], Margarida M. Correia dos Santos[1], Antonio Cobelo-García[2] and Carlos E. Monteiro*[1]

[1] Centro de Química Estrutural, Institute of Molecular Sciences, Department of Chemical Engineering, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, PORTUGAL.
maria.j.sardinheiro@tecnico.ulisboa.pt, mcsantos@tecnico.ulisboa.pt, carlos.e.monteiro@tecnico.ulisboa.pt
[2] Bioxeoquímica Mariña, Instituto de Investigacións Mariñas IIM-CSIC, Vigo, Pontevedra, SPAIN.
acobelo@iim.csic.es

Abstract: Palladium (Pd) is a technology-critical element that even used at trace levels raises environmental concern. In aquatic media, its concentrations can range from 0.04 ng/L to 3.2 μg/L, with wastewaters containing the highest concentrations. Nickel (Ni) is a priority pollutant with concentrations reaching up to 16 μg/L in wastewaters. Also, Ni is the main interferent in Pd determination using voltammetry, a cost-effective technique for metal analysis.

In this work, we investigated the determination of Pd while monitoring Ni simultaneously by cathodic stripping voltammetry, which can be achieved in an optimal pH, taking advantage of the formation of complexes with dimethylglyoxime (DMG) by modulating its concentration. To improve the sensitivity of the determination, square wave voltammetry with the second derivative signal transformation was used. The experimental conditions were optimized in terms of electrolyte composition, frequency (Hz), deposition time (t_d) and deposition potential (E_d). After setting Pd and Ni concentrations at 1.5 and 10 μg/L, respectively, a decrease of pH (in the range 5.0 − 3.4) resulted in a lower Ni signal without affecting Pd signal, while an increase in DMG concentration improved Ni sensitivity without affecting Pd signal. Thus, it was possible to control Ni interference on Pd signal by modulating the DMG concentration. Additionally, the best separation of Pd and Ni voltammetric signals was attained with a frequency of 30 Hz keeping the E_d at -0.2V. A linear increase in both signals with the td was noted. For t_d = 180 s, and in the working range up to 0.25 and 1.5 μg/L for Pd and Ni, respectively, the limit of detection for Pd was 0.02 μg/L and for Ni was 0.20 μg/L. The improved method was tested for interferences from other metal ions, and applied to different environmental matrices.

Key words: Palladium, Nickel, Square Wave Voltammetry, Second Derivative

Acknowledgments: The authors acknowledge Fundação para a Ciência e Tecnologia (FCT) for funding the project SPECS (2022.06832.PTDC) and CQE projects 2020-2023 UIDB/00100/2020 and UIDP/00100/2020.

DISTRIBUTION, SOURCES AND FLUXES OF DISSOLVED ORGANIC MATTER IN SEDIMENTS OF THE GUADALQUIVIR ESTUARY (SW IBERIAN PENINSULA)

M.C. Fernández-Puga*[1], V. Amaral[2], J. Sánchez-Rodriguez[3], A. Sierra[3], T. Ortega[3], R. Ponce[3], J. Forja[3]

[1] Dpto. CC de la Tierra, INMAR, Universidad de Cádiz. Facultad de CC del Mar y Ambientales.
Campus Universitario Puerto Real, 11510, Puerto Real, Cádiz. SPAIN.
mcarmen.fernandez@uca.es
[2] Ecología Funcional de Sistemas Acuáticos, Centro Universitario Regional Este, Universidad de la República, Rocha, URUGUAY.
vamaral@cure.edu.uy
[3] Dpto. Química-Física, INMAR, Universidad de Cádiz, Campus Río San Pedro, s/n, Puerto Real (Cádiz), SPAIN.
jairo.sanchez@uca.es, ana.sierra@uca.es, teodora.ortega@uca.es,
rocio.ponce@uca.es, jesus.forja@uca.es

Abstract: The Guadalquivir Estuary, is located in the SW of the Iberian Peninsula. In this estuary there is an exchange between the Atlantic and fluvial water masses. This region is characterized by a high anthropogenic pressure.

Sediment samples up to 30 cm depth taken with meso-boxcorer during 3 oceanographic cruise onboard R/V UCADIZ. Sediment samples were collected at 5 stations along the estuary. The objective of this research, is the characterisation of DOM by studying of its optical properties and its different fractions as well as an estimation of the diffusive flux of dissolved organic carbon (DOC) in the estuary.

To obtain quantitative and qualitative information about DOM their optical properties (absorbance and fluorescence) were characterised. PARAFAC analysis validated six fluorescent components, four humic-like or allochthonous (C1, C2, C4 and C5) and two protein-like or autochthonous (C3 and C6) The composition of DOM in the estuary is predominantly allochthonous, with humic components accounting for 64 ± 17 % of the fluorescent DOM (FDOM), while protein components, associated with autochthonous processes, account for 36 ± 17 % of the FDOM. Two indexes were further derived from the EEMs (Excitation-Emission matrixes): the humification index (HIX), with homogeneous high values average of 0.82±0.06, and the index of recent autochthonous contribution (BIX), with average values of 0.60±0.03. Calculated diffusive fluxes of DOC indicate positive values towards the water column with a wide range from 2.1 to 23.5 (mmol/ m^2d) along the estuary.

Key words: dissolved organic carbon, sediment, estuary, optical propierties.

Acknowledgments: This work was supported by the P20_00953 (Junta de Andalucia).

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

COUPLING GLOBAL OCEAN DEOXYGENATION AND ACIDIFICATION TROUGH MACHINE LEARNING PRODUCTS

N. Bocquet[1] and M. Fontela*[2]

[1] Biology Department, University of Ghent, Ghent, BELGIUM.
nour.bocquet@imbrsea.eu
[2] Instituto de Investigacións Mariñas (IIM), Vigo, SPAIN.
mfontela@iim.csic.es

Abstract: Climate change is altering ocean chemistry, posing serious threats to marine ecosystems through warming, ocean deoxygenation and acidification. These alterations, driven by heat uptake, changing ocean dynamics and anthropogenic carbon dioxide uptake, require sustained, long-term monitoring efforts for proper detection and attribution, that sometimes are not available. Machine learning spatio-temporal resolved fields are a promising alternative.

Here, we analysed the GOBAI-O2 dataset, a 0-2000 m water depth monthly time series (2004 - 2022) of temperature, salinity and dissolved oxygen (DO) in the global ocean (Sharp et al., 2022). From that, we estimated inorganic carbon and nutrients with CANYON-B (Bittig et al., 2018) and, for the Atlantic Ocean, the anthropogenic carbon content with the biogeochemical back-calculation ϕCT° method (Vázquez-Rodríguez et al., 2009). Following best practices for assessing trends of ocean acidification time series, we removed seasonal variability and fitted a linear model over the detrended data (Sutton et al., 2022) to investigate deoxygenation and acidification trends.

Our analysis indicates a statistically significant decline in dissolved oxygen content in the subtropical North Atlantic (-0.6 μmol.kg^{-1}.year^{-1}) and Northeast Pacific (-1.0 μmol.kg^{-1}.year^{-1}) between 100m and 500m depth. In the North Atlantic, comparisons between our inorganic carbon trends with trends based exclusively on observations validated our approach. In the subtropical North Atlantic there are some of the largest total carbon rates of increase. We also analysed the relationship between DO and total carbon trends in the Eastern North Atlantic Central Water layer, revealing differences in carbon dynamics relative to oxygen consumption between high and low latitudes.

Our case study presents a systematic procedure for detecting deoxygenation and acidification patterns in areas with limited time series, and analyse the relationship between total carbon and oxygen content change, offering valuable insights for understanding the full scope of the ocean's biogeochemical state trough machine learning products.

Key words: ocean deoxygenation, ocean acidification, machine learning, ocean chemistry, carbon

cycle

Acknowledgments: MF was funded by PTA2022-021307-I, MCIN/AEI/10.13039/501100011033 and by FSE+ . CAPTA project (0062_CAPTA_1_E) is co-financed by the European Union through the Interreg Spain-Portugal Cross-Border Cooperation Programme (POCTEP) 2021-2027 and by the REDEIRA project (Proyecto Estratégico Orientado a la Transición Ecológica y a la Transición Digital; Ref: TED2021-132188B-I00).

References:

Bittig, H. C., Steinhoff, T., Claustre, H., Fiedler, B., Williams, N. L., Sauzède, R., Körtzinger, A., & Gattuso, J.-P. (2018). An Alternative to Static Climatologies: Robust Estimation of Open Ocean CO2 Variables and Nutrient Concentrations From T, S, and O2 Data Using Bayesian Neural Networks. *Frontiers in Marine Science*, *5*. https://doi.org/10.3389/fmars.2018.00328

Sharp, J. D. Fassbender, A. J. Carter, B. R., Johnson, G. C., Schultz, C., Dunne, J. P. (2022). GOBAI-O2: A Global Gridded Monthly Dataset of Ocean Interior Dissolved Oxygen Concentrations Based on Shipboard and Autonomous Observations (NCEI Accession 0259304). v1.0. NOAA National Centers for Environmental Information. Dataset. https://doi.org/10.25921/z72m-yz67.

Sutton, A. J., Battisti, R., Carter, B., Evans, W., Newton, J., Alin, S., Bates, N. R., Cai, W.-J., Currie, K., Feely, R. A., Sabine, C., Tanhua, T., Tilbrook, B., & Wanninkhof, R. (2022). Advancing best practices for assessing trends of ocean acidification time series. *Frontiers in Marine Science*, *9*. https://doi.org/10.3389/fmars.2022.1045667

Vázquez-Rodríguez, M., Touratier, F., Lo Monaco, C., Waugh, D. W., Padin, X. A., Bellerby, R. G. J., Goyet, C., Metzl, N., Ríos, A. F., & Pérez, F. F. (2009). Anthropogenic carbon distributions in the Atlantic Ocean: data-based estimates from the Arctic to the Antarctic. *Biogeosciences*, *6*(3), 439–451. https://doi.org/10.5194/bg-6-439-2009

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

DIAGENESIS OF ORGANIC MATTER IN THE ESTUARY OF THE GUADALQUIVIR RIVER

R. Ponce*, J. Sánchez-Rodríguez, T. Ortega, J. Forja, A. Sierra and T. Fernández-Ponce

Department of Physical Chemistry, Faculty of Marine and Environmental Sciences, University of Cádiz, Cádiz, SPAIN.
rocio.ponce@gm.uca.es, jairo.sanchez@uca.es, teodora.ortega@uca.es, jesus.forja@uca.es, ana.sierra@uca.es, teresafernandez.ponce@gm.uca.es

Abstract: Three campaigns were conducted in the Guadalquivir River estuary (September 2021, February, and June 2022), collecting sediment cores at 3/5 stations to study the diagenesis of organic matter and its effect on the diffusive fluxes at the sediment-water interface.

The sediment is fundamentally anoxic, with only the stations near the estuary mouth showing positive Eh values at the surface. The organic carbon content is high at the internal stations (up to 90% of total carbon), decreasing towards the marine stations. The concentrations of dissolved organic carbon and nitrogen in pore water are high (DOC>6000 µM; DON>400 µM), often surpassing those of dissolved inorganic carbon and nitrogen.

The diffusive fluxes of DIC (0.25-6.51 mmol·m-2d-1) are highest at the innermost station, decreasing towards the mouth. For NH4+, the fluxes range between 0.13 and 1.17 mmol·m-2d-1, with no clear longitudinal or seasonal variations. High NO3- concentrations in the water column result in negative diffusive fluxes (-0.975 to 0 mmol·m-2d-1), indicating the importance of denitrification in organic matter diagenesis, more intense at the inner stations. The diffusive fluxes of Si (0.014-0.187 mmol·$m^{-2}d^{-1}$) and HPO_4^{-2} (0.00021-0.00543 mmol·$m^{-2}d^{-1}$) show higher at the more internal stations and during summer samplings compared to winter.

The low concentrations of sulfate and sulfide in the pore water suggest that aerobic oxidation, denitrification, and methanogenesis are the main mechanisms of organic matter diagenesis in the Guadalquivir estuary sediment. Generally, no clear seasonal variation is observed. The amount and type of organic matter received by the sediment and the characteristics of the water column seem to be the variables most influencing the estimated diffusive fluxes in this system.

Key words: organic matter diagenesis, Guadalquivir estuary

Acknowledgments: This work was supported by the Spanish CICYT (Spanish Program for

Science and Technology) under contract RTI2018-100865-B-C21 and P20_00953 (Junta de Andalucía).

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

UPTAKE OF ATMOSPHERIC CO_2 DURING DEEP-WATER FORMATION IN THE NORTHWESTERN MEDITERRANEAN SEA

X.A. Padin*[1], M. Riera-Lorente[2], M. Fontela[1], M. Emelianov[4], A.J. Ramos[5], J. Coca[5], J. Flos[3] and M. Vidal[3]

[1] Instituto de Investigacións Mariñas (CSIC), Vigo, SPAIN.
padin@iim.csic.es, mfontela@iim.csic.es, fiz.perez@iim.csic.es
[2] CFA La Verneda, Barcelona, SPAIN.
maxgalind@gmail.com
[3] Departament de Biologia Evolutiva, Ecologia i Ciències Ambientals, Universitat de Barcelona, Barcelona, SPAIN.
montsevidal@ub.edu, jflos@ub.edu,
[4] Institut de Ciències del Mar (CSIC), Barcelona, SPAIN.
mikhail@icm.csic.es
[5] Division of Robotic and Computational Oceanography-SIANI, Universidad de las Palmas de Gran Canaria, SPAIN.
1ntonio.ramos@ulpgc.es, jcoca@pesca.gi.ulpgc.es

Abstract: The ocean's absorption of carbon dioxide (CO_2) from the atmosphere takes up around 25% of anthropogenic CO_2 emissions. In particular, regions where open ocean deep convection takes place provide large sequestration of anthropogenic CO_2 in the deep ocean. However, the Gulf of Lion in the Mediterranean Sea, where the winter formation of the Western Mediterranean Deep Water (WMDW) takes place, has been insufficiently evaluated due to the scarce measurements taken of its carbonate system. The FAMOSO project (FAte of the northwestern Mediterranean Open sea Spring blOom) gathered biogeochemical information from underway pCO_2 measurements, vertical profiles and satellite observations in the Northwestern Mediterranean Sea from the ending of a deep-convection event (8th March 2009) to a restratification phase (23rd March 2009). The surface waters in the inner Gulf of Lion reached mean CO_2 undersaturation values of 54±10 μatm. The mean CO_2 uptake of the shelf and ocean waters during this period was -3 ± 3 mmol m^{-2} d^{-1} and -10 ± 5 mmol m^{-2} d^{-1}, respectively. In the first half of March 2009 a large extension of homogeneous dense waters recently ventilated filled the water column of the Gulf of Lion from surface to bottom. The intense penetration of atmospheric CO2 during these ventilation events is coincident with winter deep convection events that could foster ongoing ocean acidification.

Key words: air-sea CO2 flux, winter deep convection, Western Mediterranean Deep Water

Acknowledgments: We thank the late Prof. Aida Fernández Ríos for her decisive contribution to make possible the collaboration between the Instituto de Investigacións Mariñas (CSIC) and the Universitat de Barcelona within the FAMOSO project. We would like to extend our gratitude to the Captains and crew of RV Sarmiento de Gamboa for their hospitality and essential help, and to the UTM (Unidad de Tecnología Marina) team for their technical and logistic support throughout the FAMOSO cruises. MF was funded by PTA2022-021307-I, MCIN/AEI/10.13039/501100011033 and by FSE+. CAPTA project (0062_CAPTA_1_E) is co-financed by the European Union through the Interreg Spain-Portugal Cross-Border Cooperation Programme (POCTEP) 2021-2027 and by the REDEIRA project (Proyecto Estratégico Orientado a la Transición Ecológica y a la Transición Digital; Ref: TED2021-132188B-I00).

SIQUIMAR
XXII SEMINARIO IBÉRICO DE **QUÍMICA MARINA**

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

POSTER COMMUNICATIONS

~

CHEMICAL OCEANOGRAPHY

Universidad Católica de Valencia San Vicente Mártir
Universitat d'Alacant Universidad de Alicante
Universitat de Barcelona
UCA Universidad de Cádiz
ULPGC Universidad de Las Palmas de Gran Canaria
Universidade de Vigo

BASELINE STUDY OF SULFUR LEVELS IN THE COASTAL ZONE OF THE BAHÍA BLANCA ESTUARY (ARGENTINA)

F. B. Rial*[1,2], E. M. Fernández[1,2], B. Abasto[1,2], A. M. Martinez[2,3], N. S. Buzzi[1,4] and C. V. Spetter[1,2]

[1] Instituto Argentino de Oceanografía, CONICET/UNS, Bahía Blanca, ARGENTINA.
rial.florenciabel@gmail.com, eleonora.m.fernandez@gmail.com, babasto@iado-conicet.gob.ar, nbuzzi@criba.edu.ar, cspetter@iado-conicet.gob.ar
[2] Departamento de Química, Universidad Nacional del Sur, Bahía Blanca, ARGENTINA.
anamartinez.quimica@gmail.com
[3] Instituto de Química del Sur, CONICET/UNS, Bahía Blanca, ARGENTINA.
[4] Departamento de Biología Bioquímica y Farmacia, Universidad Nacional del Sur, Bahía Blanca, ARGENTINA.

Abstract: Estuaries are among the world's most productive zones. The sulfur cycle is crucial in the ocean, serving as an important reservoir of SO_4^{2-} and minerals such as pyrite (FeS_2). Under oxygenated conditions, SO_4^{2-} is the most stable form, while anoxic conditions lead to high concentrations of inorganic sulfur forms in sediments and bottom waters, affecting to entire water column. The aim of this study was to evaluate the inorganic sulfur levels and its relationship with the physical-chemical parameters in the seawater from the Bahía Blanca estuary, Argentina. Surface water samples were collected at the end of winter and early spring (August-November) during 2022 and 2023 in five sampling sites along the estuary: Brown (B), Ingeniero White (IW), Villa del Mar (VM), Puerto Rosales (PR) and Punta Ancla (PA). The concentration of sulfides (S^{2-}), sulfates (SO_4^{2-}), dissolved oxygen (DO), chlorophyll *a* (Chl*a*), phaeopigments (Phaeo), turbidity, pH, and temperature were determined. Results showed significant differences between months for SO_4^{2-} ($p < 0.01$) and DO ($p < 0.001$), between years for DO, Chl*a* and Phaeo, and between sites for S^{2-} (all with $p < 0.001$). In both years, positive correlations between temperature and SO_4^{2-}, turbidity and S^{2-}, and negative correlations between DO and temperature were detected. Chl*a* levels (7.29 ± 5.84 and 1.35 ± 1.09, μgL^{-1}), pH (8.44 ± 0.67 and 8.03 ± 0.18), and DO (9.65 ± 1.17 and 8.30 ± 0.84, mgL^{-1}) were significantly higher in 2022 than 2023. SO_4^{2-} monthly variations were registered, peaking during warmer months (3029.95 ± 294.09 mgL^{-1}, November). S^{2} mean concentration was 2.83 ± 4.48 μM and 2.35 ± 3.77 μM for 2022 and 2023, respectively. The positive correlation between turbidity and S^{2-} could indicate that the suspended particulate matter contributes this species to the water column. A decreasing trend in DO levels was detected.

Key words: sulfide, sulfate, seawater, dissolved oxygen, Bahía Blanca estuary

Acknowledgments: We acknowledge the Universidad Nacional del Sur (PGI 24/Q109 Spetter y 24/B299 Buzzi) and Consejo Nacional de Investigaciones Científcas y Técnicas (PIP 1698, Buzzi) for their financial support, both from Argentina. Also, we thank IADO' staff (J. Arlenghi, V. Bustos, R. Uibrig and A. Gonzalez) for their help in the field.

PRIORITY METAL CONCENTRATIONS IN TRANSITIONAL AND COASTAL WATERS BY CONCURRENT SPOT WATER SAMPLING AND PASSIVE SAMPLERS (DGT)

Margarida M. Correia dos Santos*[1], Miguel Caetano[2], Carlos E. Monteiro*[1] et al

[1] Centro de Química Estrutural, Institute of Molecular Sciences, Department of Chemical Engineering, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, PORTUGAL.
mcsantos@tecnico.ulisboa.pt, carlos.e.monteiro@tecnico.ulisboa.pt
[2] Instituto Português do Mar e da Atmosfera (IPMA), Algés, PORTUGAL.
mcaetano@ipma.pt

Abstract: The MONITOOL project was conceived to provide a robust database for total dissolved and labile metal concentrations in transitional and coastal waters supported on concurrent spot water sampling and Diffusive Gradients in Thin films (DGT) deployments. Thus the chemical forms of the priority metals Ni, Cd and Pb, regulated by Environmental Quality Standards (EQS) under the Water Framework Directive (WFD), were determined by different methodologies across a broad geographical area. In total, 712 spot water samples were collected, and 238 DGT devices concurrently deployed and retrieved. Then, were analyzed the relationships between metal concentrations in DGT (*i.e.*, DGT-labile concentration) and i) Pb and Cd conditional labile fractions determined in discrete water samples by Anodic Stripping Voltammetry (ASV); ii) total dissolved Ni in discrete water samples by Inductively Coupled Plasma Mass Spectrometry (ICP-MS) and also measured by Cathodic Stripping Voltammetry (CSV). As to the labile fractions, ASV and DGT were well suited for the simultaneous determination of Cd and Pb dynamic speciation in the marine environment. Similar labilities were measured for Cd, while for Pb, the ASV labile fraction was lower than the one determined by DGT. As to Ni, results confirmed that both ICP-MS and CSV are suitable for determining Ni dissolved concentrations through proper control of precision and accuracy of the analytical procedures. Despite the high variability, priority metal dissolved concentrations across locations remained below the EQS values.

Key words: Priority metals, Passive and spot sampling, DGT, Voltammetry, ICP-MS

Acknowledgments: This work was supported by Interreg MONITOOL project (EAPA 565/2016; https://www.monitoolproject.eu).

References:

Caetano et al (2022). Metals concentrations in transitional and coastal waters by ICPMS and voltammetry analysis of spot samples and passive samplers (DGT), Mar. Pollut. Bull., 179, 113715.

Rodríguez et al (2021). Assessing variability in the ratio of metal concentrations measured by DGT-type passive samplers and spot sampling in European seawaters, Sci. Total Environ., 783, 147001.

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

AIR SEA CO_2 EXCHANGE IN THE ALGARVE SHELF IS UNDERESTIMATED IN CURRENT COASTAL CO_2 FLUX ASSESMENTS

María Paz*[1], X.A. Padin[2], Melchor González-Dávila[3], F. Abrantes[4,5] and Marcos Fontela[2,4]

[1] Universidad de las Palmas de Gran Canaria, Las Palmas de Gran Canaria, SPAIN.
maria16ccm@gmail.com
[2] Departamento de Oceanografía, Instituto de Investigaciones Marinas (IIM), Vigo, SPAIN.
padin@iim.csic.es, mfontela@iim.csic.es
[3] Instituto de Oceanografía y Cambio Global (IOCAG), Universidad de Las Palmas de Gran Canaria (ULPGC), Las Palmas de Gran Canaria, SPAIN.
melchor.gonzalez@ulpgc.es
[4] Oceanography and climate change group, Centro de Ciencias do Mar (CCMAR), Faro, PORTUGAL.
[5] IPMA – Instituto Português do Mar e da Atmosfera, Divisão de Geología e Georecursos Marinhos, Alges, PORTUGAL.
fatima.abrantes@ipma.pt

Abstract: The ocean can be a source or a sink for carbon dioxide (CO_2). Whether it acts as a source or sink depends on a variety of hydrographic variables: from water temperature and salinity (which vary CO_2 solubility) to biological uptake of CO_2 or mixing of water masses. Robust assessment of air-sea CO_2 fluxes in space and time is a key knowledge for global and regional carbon budgets. This is relevant as inform-based decisions to mitigate climate change require well constrained carbon budgets.

The air-sea flux of CO_2 (FCO_2) from the west coast of the Iberian Peninsula (42.5-37.3ºN, 12.5-7.5ºW) was quantified using the partial pressure of carbon dioxide in surface seawater (pCO_2^{sw}), which was obtained during the EUROFLEETS+ SINES cruise (9th-21st September 2022). The data have been compared with previous data from the Surface Ocean CO_2 Atlas (SOCAT, Bakker et al., 2023) and the latest global coastal ocean pCO_2 product (Roobaert et al., 2023). In general, the ocean acted as a moderate source of CO_2 during the study days, with the exception of the Algarve shelf region (36.7-37.3ºN, 9.0-7.5ºW), where conditions of low temperatures (<19ºC) and salinities (<36) where concurrent with large wind speeds and a strong CO_2 uptake. The occurrence of short-lived event of high wind speed in the area, in conjunction with a low pCO_2 in surface seawater, led to an increase in the sink intensity, resulting in mean FCO_2 values of -3.97 molC m^{-2} yr^{-1}.

These findings were unseen in the previous measurements available in SOCAT and in the monthly climatology for coastal sea surface pCO_2 conditions likely due to sparse spatial and temporal observations. The September sink of CO_2 could be higher than previously thought. This serves to highlight the necessity for further data to be collected on the area in question, as well as for in situ samples to be analysed.

Key words: air-sea CO_2 fluxes, Algarve shelf region, partial pressure of CO_2 in sea surface.

Acknowledgments: MF was funded by Juan de La Cierva Formación (FJC2019-038970-I, Ministerio de Ciencia e Innovación, Spanish Government) and Personal Técnico de Apoyo (PTA2022-021307-I). CAPTA project (0062_CAPTA_1_E) is co-financed by the European Union through the Interreg Spain-Portugal Cross-Border Cooperation Programme (POCTEP) 2021-2027.

References:

Bakker, D. C. E., Alin, S.R., Bates, N., Becker, M., Feely, R.A., Gkritzalis, T., Jones, S.D., Kozyr, A., Lauvset, S.K., Metzl, N., …, Velo, A., Voynova, Y.G., Weller, R.A., Whitehead, C., Wimart-Rousseau, C.(2023). Surface Ocean CO2 Atlas Database Version 2023 (SOCATv2023) (NCEI Accession 0278913). NOAA National Centers for Environmental Information. Dataset. https://doi.org/10.25921/r7xa-bt92. Accessed [01/03/2024].

Fontela, M., Padín, X.A. (2023). Partial pressure (or fugacity) of carbon dioxide, water temperature, salinity and other variables collected from surface underway observations during the R/V Sarmiento De Gamboa EUROFLEETS+ SINES cruise in the Atlantic Ocean in 2022 (NCEI Accession 0276511). NOAA National Centers for Environmental Information. Dataset. https://doi.org/10.25921/fxv3-g751. Accessed [10/02/2024].

Roobaert, A., Regnier, P., Landschützer, P., Laruelle, G. G. (2023). A novel sea surface partial pressure of carbon dioxide (pCO2) data product for the global coastal ocean resolving trends over the 1982-2020 period (NCEI Accession 0279118). NOAA National Centers for Environmental Information. Dataset. https://doi.org/10.25921/4sde-p068. Accessed [05/04/2024].

CONTRIBUTION OF ORGANIC MATTER TO TOTAL ALKALINITY IN THE ESTUARY OF THE BARBATE RIVER AND IN THE RÍO SAN PEDRO CREEK (SW SPAIN)

R. Conesa*[1], T. Ortega[1], J. Forja[1]

[1] Department of Chemistry-Physics, Faculty of Environmental and Marine Science, Marine Research Institute, INMAR University of Cádiz, Puerto Real (Cádiz), SPAIN.
rosana.conesalopez@alum.uca.es , teodora.ortega@uca.es , jesus.forja@uca.es

Abstract: This work addresses the influence of organic matter on the inorganic carbon cycle when it is established on the basis of total alkalinity (TA) and pH measurements. The work has been carried out in two coastal systems in the south of the Iberian Peninsula, the Barbate estuary and the Río San Pedro tidal channel in winter and late spring situations. To quantify the contribution of organic matter to TA (Aorg), two consecutive potentiometric titrations were performed on the same sample. The first one allows the calculation of AT by means of Gran functions, and once finished, it is bubbled intensely with N_2 to eliminate the CO_2 produced. Subsequently, the pH is increased by addition of a NaOH solution to the initial values of the sample, and then titrated again with HCl to see the contribution to TA of all the acid-base equilibria present (phosphate, ammonium, silicate, borate, fluoride, sulfate and organic bases) once the dissolved inorganic carbon has been eliminated.

In general, TA values and concentrations of dissolved inorganic carbon (DIC) and dissolved organic carbon (DOC) increase towards the interior of both systems. However, the results obtained show a clear difference between winter and spring sampling. In this respect, the contribution of organic bases remains relatively constant, with mean values of 65.8 ± 6.1 µmol/kg in the Barbate River and 65.1 ± 1.9 µmol/kg in the San Pedro River. In summer, a considerable increase in DOC is observed, as well as a greater contribution of organic matter to TA values, which can reach maximum values of up to 800 µmol/kg in Barbate river and 450 µmol/kg in Río San Pedro.

The correction of TA values considering the contribution of organic compounds (Aorg) is important to avoid an overestimation of CO_2 fluxes through the atmosphere - ocean interface.

Key words: Organic alkalinity, DOC, estuarine system, SW Iberian Peninsula.

References:

Kerr, D. E., Brown, P. J., Grey, A., & Kelleher, B. P. (2021). The influence of organic alkalinity on the carbonate system in coastal waters. *Marine Chemistry*, *237*, 104050.

Martín Hernández-Ayon, J., Zirino, A., Dickson, A. G., Camiro-Vargas, T., & Valenzuela-Espinoza, E. (2007). Estimating the contribution of organic bases from microalgae to the titration alkalinity in coastal seawaters. *Limnology and Oceanography: Methods*, *5*(7), 225-232.

Sharp, J. D., & Byrne, R. H. (2020). Interpreting measurements of total alkalinity in marine and estuarine waters in the presence of proton-binding organic matter. *Deep Sea Research Part I: Oceanographic Research Papers*, *165*, 103338.

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

POSTER COMMUNICATIONS

~

ECOTOXICOLOGY AN MARINE POLLUTION

Universidad Católica de Valencia San Vicente Mártir
Universitat d'Alacant Universidad de Alicante
UNIVERSITAT DE BARCELONA
UCA Universidad de Cádiz
ULPGC Universidad de Las Palmas de Gran Canaria
UniversidadeVigo

IMPACTS OF AGRICULTURAL PLASTIC WASTE IN PORTUGAL - CONTRIBUTION TO THE AGRI-PLAST PROJECT

A. Alves[1,2], G. Martinho[1,2], M. Martins[1,2], P. Santos[1,2], J. Pequeno[1,2], G. Brito[1], P. Caetano[1]

[1] NOVA School of Science and Technology (NOVA FCT)
[2] MARE – MARE - Marine and Environmental Sciences Centre, ARNET - Aquatic Research Network Associate Laboratory, NOVA School of Science and Technology, NOVA University Lisbon, Caparica, PORTUGAL.

Abstract: Plastics are one of the environmental problems (OECD, 2022), and a recent FAO report (2021) points out that the amount of plastic waste in soil is higher than in the sea, with implications for the entire food chain, and recommends urgent implementation of measures for its reduction and better management. Since the 1970s, the use of plastics in agriculture has increased.

The massive use of agricultural plastic waste (APW) and its mismanagement is causing environmental impacts; large amounts of APW are lost to the soil, which eventually fragments, producing micro- and nanoplastics that persist for long periods in the environment, contaminating soil, water and plants, and affecting agricultural yields (Boots et al. 2019, Gao et al., 2019).

Portugal lacks an integrated solution for managing APW and has limited knowledge about the actual extent of the agricultural plastics value chain, its impacts, and potential management solutions. Mulch film waste stands out as a significant type of agricultural plastic by weight. A growing concern revolves around the generation and fate of microplastics from agricultural plastic materials, which can infiltrate various trophic levels, potentially endangering human health (FAO, 2021).

The Agri-Plast Project involves a consortium of 14 entities, which aims to develop organizational and economic solutions tailored to the different sectors that extensively use plastic films in their farming practices, and comprises five tasks: diagnosing the APW issue, capacity building and stakeholder engagement, experimentation for innovation and demonstration, organizational models for APW management, and post-project governance and policies. The first task has already initiated with the sampling campaign and the macro and microplastics analyses in the soil samples of the six partner entities with cultivated fields, which will contribute to the knowledge of the magnitude of the pollution associated with APW.

Key words: Agricultural plastic waste, Macro and Microplastic in soil, Production organization,

Innovation.

Acknowledgments: The Agri-Plast Project: Production Organization and Innovation for the Reduction of Agricultural Plastics is funded by the Portuguese Recovery and Resilience Plan (PRR), NextGenerationEU Funds (reference PRR ref.14/C05- i03/2021), within the scope of the excellence in the organisation of production. This work was funded by Fundação para a Ciência e a Tecnologia (FCT, Portugal), through the strategic projects UIDB/04292/2020 (https://doi.org/10.54499/UIDB/04292/2020) and UIDP/04292/2020 (https://doi.org/10.54499/UIDP/04292/2020) granted to MARE - Marine and Environmental Sciences Centre, and the project LA/P/0069/2020 (https://doi.org/10.54499/LA/P/0069/2020) granted to the Associate Laboratory ARNET - Aquatic Research Network.

References:

Boots, B., Russell, C.W. & Green, D.S. (2019). Effects of microplastics in soil ecosystems: Above and below ground. Environmental Science and Technology, 53(19): 11496–11506.

FAO. (2021). Assessment of agricultural plastics and their sustainability. A call for action. Rome. https://doi.org/10.4060/cb7856en

Gao, H., Yan, C., Liu, Q., Ding, W., Chen, B. & Li, Z. (2019). Effects of plastic mulching and plastic residue on agricultural production: A meta-analysis. Science of The Total Environment, 651: 484–492. https://doi.org/10.1016/j.scitotenv.2018.09.105.

OECD. (2022) Global Plastics Outlook - Economic Drivers, Environmental Impacts and Policy Options. https://doi.org/10.1787/de747aef-en

TOXICITY OF THIRTEEN ELEMENTS PRESENT IN TECHNOLOGICAL WASTE RESIDUES ON THREE MARINE MICROALGAE SPECIES

Ignacio Moreno-Garrido [*1,2], Chiara Trombini[1], Carmen Michán[3], Almudena Benítez[4], José Alhama[3] and Julián Blasco[1,2]

[1] Institute of Marine Sciences of Andalusia (ICMAN-CSIC). Department of Ecology and Coastal Management. Campus Río San Pedro 11510, Puerto Real, Cádiz, SPAIN.
ignacio.moreno@icman.csic.es[*], *chiara.trombini@icman.csic.es, julian.blasco@csic.es*
[2] Blue Growth associated unit ICMAN-IFAPA El Toruño. Puerto Real / Puerto de Santa María, Cádiz, SPAIN.
ignacio.moreno@icman.csic.es, julian.blasco@csic.es
[3] Department of Biochemistry and Molecular Biology, ceiA3, Campus Rabanales, University of Córdoba, 14071 Córdoba, SPAIN.
bb2midoc@uco.es, bb2alcaj@uco.es
[4] Department of Inorganic Chemistry and Chemical Enginery. Chemistry Institute for Energy and Environment (IQUEMA), University of Córdoba, 14071 Córdoba, SPAIN.
q62betoa@uco.es

Abstract: The occurrence and levels of elements from technological wastes have increased in aquatic media, as a consequence of the rapid evolution of those technologies (Pibul et al., 2023). Although hazard and risk associated to some of those elements (such as Cu, Cd or Zn) have been studied for years and are well-established, the consequences of increased concentrations of other components (such as Lanthanum, Neodymium or Gadolinium) in aquatic environments are not well understand yet (Bergsten-Torralba et al., 2020). In this work, wide-range toxicity of thirteen elements (Li, Al, Mn, Ni, Co, Zn, Cu, Cd, La, Ce, Nd, Gd and Pb), common in residues from technological products, have been tested on three marine microalgae: *Phaeodactylum tricornutum* (Bacillariophyceae), a standard species in microalgae bioassays (ISO, 1975); *Nannochloropsis gaditana* (Eustigmatophyceae), representative of the microplankton; and *Pleurochrysis roscoffensis* (Haptophyceae), a coccolithophorid. Results from those experiments reveal that, among the species assayed, *P. tricornutum* was the most sensitive species to the elements tested, while *P. roscoffensis* was the least sensitive. Cu proved to be the most toxic element assayed, although Zn, Cd, La, Nd, Gd and Pb also demonstrated toxicity to some of the assayed microalgal species at the concentrations assayed (up to 1 $mg \cdot L^{-1}$). A short-range toxicity test was then carried out for *P. tricornutum* and three rare earths (La, Nd and Gd), revealing that other endpoints measured by flow cytometry, apart from cellular density, (*e.g.*, chlorophyll fluorescence,

forward or side scatter) can also generated useful responses in toxicity studies involving microalgae.

Key words: Technological residues, Phytoplankton, Toxicity tests, Rare earths, Flow cytometry

Acknowledgments: This research has been funded by the Project E-wasterisk (PID2022-139807OB-I00), financed by the Spanish Ministry of Science and Innovation.

References:

Bergsten-Torralba, L.R.; Magalhães, D.P.; Giese, E.C.; Nascimento, C.R.S.; Pinho, J.V.A and Buss, D.F. 2020. Toxicity of three rare earth elements, and their combinations to algae, microcrustaceans and fungi. Ecotoxicology and Environmental Safety, 201, 110795. https://doi.org/10.1016/j.ecoenv.2020.110795

ISO. 1995. ISO 10253:1995(E). Water quality - Marine algal growth inhibition test with *Skeletonema costatum* and *Phaeodactylum tricornutum*. Pp 1-8.

Pibul, P.; Jawjit, S. and Yimthiang, S. 2023. Soil heavy metal pollution from waste electrical and electronic equipment of repair and junk shops in southern Thailand and their ecological risk. Heliyon 9, e20438. https://doi.org/10.1016/j.heliyon.2023.e20438

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

HOME-MADE AFFORDABLE UV-DIGESTOR FOR THE ELIMINATION OF ORGANIC MATTER IN WATER SAMPLES PRIOR TO VOLTAMMETRIC HEAVY METAL DETERMINATION

Leire Kortazar*[1,2], Ainara Gredilla*[1], Uxue Uribe-Martinez[1,2], Thomas Maupas[1,2,3], Alberto de Diego[1,2] and Luis Angel Fernandez[1,2]

[1] Department of Analytical Chemistry, University of the Basque Country (UPV-EHU), 48940 Leioa-Bizkaia, Basque Country, SPAIN.
[2] Plentzia Marine Station, University of the Basque Country (PiE-UPV/EHU), 48620 Plentzia-Bizkaia, Basque Country, SPAIN.
[3] Universite de Pau et des Pays de l'Adour, E2S UPPA, CNRS, IPREM, 2AV du Président Pierre Angot, 64000, Pau, FRANCE.
**leire.kortazar@ehu.eus, ainara.gredilla@ehu.eus*

Abstract: The presence of heavy metals in marine environments is a universal concern since they tend to accumulate in aquatic organisms. Amongst these, Pb and Cd are of special interest because of their toxicity. Voltammetry is a suitable technique for both qualitative and quantitative analysis of heavy metals with very low limits of detection. However, the organic matter (OM) present in these samples can compromise the trueness of the results since it can form stable complexes with the metals and, thus, underestimate their total concentration. Therefore, OM must be eliminated, and this is usually done by UV digestion. Few UV- digestion systems are commercially available, but they are expensive and have small capacities. For that reason, we developed an in-house UV-digestor to simultaneously digest 12 60 mL samples consisting of 6 commercial UVC (Hg vapor discharge, 250 nm Λ_{max}) lamps of 90W nominal power (20W/100 h radiated power) surrounding a rack holding 12 quartz tubes. Its performance was tested using tannic and humic acids as OM. Different carbon concentrations, radiation times and the need of H_2O_2 to improve the digestion were evaluated. Finally, the performance of the UV-digestor was tested with both synthetic samples spiked with Pb and Cd, and real river and estuarine samples. Results showed that the addition of small amounts of H_2O_2 fastened the digestion of the organic matter and 2h were enough to eliminate 10 mg/L C. Pb and Cd concentrations decreased in the presence of organic matter and after the digestion, their full concentrations were recovered.

Key words: home-made UV digestor, voltammetry, trace analysis, heavy metals

Acknowledgments: This work is funded by PLASTEMER (PID2020-118685RB-I00) project from MCIN, FEDER and Consolidated Group 2022-2025 (IT1446-22) project from the Basque Government (BG). U. U-M. thanks the Consolidated Group (IT1446-22) from the BG for her predoctoral contract. T. M. acknowledges his predoctoral grant contract from University of the Basque Country (UPV/EHU).

IN SITU EXPERIMENTAL EVIDENCE OF THE EFFECTS OF COMMERCIAL SUNSCREENS AND THEIR ULTRAVIOLET FILTERS ON POSIDONIA OCEANICA IN A MEDITERRANEAN ISLAND (FORMENTERA) DURING SUMMER

Manuela Gertrudis García-Márquez*[1], Federico Abad Guillén[1] and Nona S.R. Agawin[1]

[1] Marine Ecology and Systematics (MarES), Department of Biology, University of the Balearic Islands, Palma de Mallorca, SPAIN.
manuelag.garciam@uib.es, federico.abad.guillen@gmail.com, nona.agawin@uib.es

Abstract: Sunscreen products usually contain a wide range of substances, including inorganic and organic ultraviolet (UV) filters, which belong to the main groups of contaminants of emerging concern for marine ecosystems. Research on the effects of sunscreen pollution in the Mediterranean marine biota is scarce, limiting the information necessary to promote a sustainable coastal tourism through environmental policies that protect priority species for conservation against potentially harmful substances. The impacts of sunscreen components on the primary productivity of *Posidonia oceanica* was assessed through short-term (48 h) in situ field experiments, using bell jar chambers during July of 2023 in Formentera, Balearic Islands, Spain. Environmentally relevant concentrations of a mixture of commercial sunscreens (6.080 mg L^{-1}), benzophenone-3 (BP-3; 246.990 and 1115.000 ng L^{-1}) and titanium dioxide (TiO_2; 0.042 and 37.600 µg L^{-1}) were tested against a control (without addition of contaminants). Both UV filters promoted greater respiration rates in *P. oceanica* than in the controls, resulting in a negative net carbon gain for the seagrass. Although the whole sunscreen mixture also induced respiration in the plants, the net primary productivity was higher under sunscreen addition, possibly enhanced by the nutrients released from the mix. These results provide pioneering evidence on the potential hazards of UV filters for *P. oceanica*.

Key words: Sunscreen, UV filters, Mediterranean, pollution, seagrass.

Acknowledgments: M.G.G.-M. is recipient of the CAIB (2021) predoctoral grant (BOIB No. 103) funded by the Govern de les Illes Balears - Conselleria de Fons Europeus, Universitat i Cultura. This work is part of the project RGENT-2020-19281, ImPeFora (Impactos de contaminantes emergentes en Posidonia de Formentera) funded by Consell de Formentera.

References:

Agawin, N. S. R., Sunyer-Caldú, A., Díaz-Cruz, M. S., Frank-Comas, A., García-Márquez, M. G. and Tovar-Sánchez A. (2022). Mediterranean seagrass *Posidonia oceanica* accumulates sunscreen UV filters. Marine Pollution Bulletin, 176, 113417.

García-Márquez, M.G., Rodríguez-Castañeda, J.C. and Agawin, N.R.S. (2024). Effects of the sunscreen ultraviolet filter oxybenzone (benzophenone-3) on the seagrass *Posidonia oceanica* (L.) Delile and its associated N2 fixers. Science of The Total Environment, 918, 170751.

García-Márquez, M.G., Rodríguez-Castañeda, J.C. and Agawin, N.R.S. (2023). Sunscreen exposure interferes with physiological processes while inducing oxidative stress in seagrass *Posidonia oceanica* (L.) Delile. Marine Pollution Bulletin, 187, 114507.

Mylona, Z., Panteris, E., Kevrekidis, T. and Malea, P. (2020). Physiological and structural responses of the seagrass *Cymodocea nodosa* to titanium dioxide nanoparticle exposure. Science of The Total Environment, 719, 137378.

BIOCHEMICAL AND PHYSIOLOGICAL BIOMARKERS IN SPECIMENS OF *CASSIOPEA XAMACHANA* (BIGELOW, 1892) AND *AURELIA AURITA* (LINNAEUS, 1758) FROM L'OCEANOGRÀFIC

Mar Llorca*[1], Pedro Jiménez[2], José del Ramo[2], Mario Roche[3], Montserrat Solé[4] and Amparo Torreblanca[2]

[1] Instituto de Acuicultura Torre de la Sal (IATS, CSIC), Ribera de Cabanes, Castellón, 12595, ESPAÑA.
mar.llorca@csic.es
[2] Departament de Biologia Cel·lular, Biologia Funcional i Antropologia Física,
Facultat de Ciències Biològiques, Universitat de València, València, 46100, ESPAÑA.
amparo.torreblanca@uv.es
[3] Fundació Oceanogràfic de la Comunitat Valenciana, Gran Vía Marqués del Turia 19, Valencia, 46005, ESPAÑA.
mroche@oceanografic.org
[4] Institut de Ciències del Mar, CSIC, Pg. Marítim de la Barceloneta 37-49, Barcelona, 08003, ESPAÑA.
msole@icm.csic.es

Abstract: There is a need to develop efficient tools to prevent damage to marine ecosystems due to pollution. The use of scyphozoans as biomonitors is proposed using biomarkers as sensitive early warning tools for the detection of contaminants. The common jellyfish (*Aurelia aurita*) and inverted jellyfish (*Cassiopea xamachana*) are species widely distributed in their natural habitats and are reproduced and exhibited in aquariums worldwide. *Cassiopea spp*. are epibenthic and incorporate the photosynthetic zooxanthella *Symbiodinium* within their mesoglea during the polyp stage.

The objectives of this study were a) to establish the practical procedures and the basal levels of a battery of biochemical and physiological biomarkers of *C. xamachana* and *A. aurita* and b) to characterize the carboxylesterase enzymes using different substrates and to quantify the degree of inhibition in the presence of model inhibitors.

Biomarkers related to the biotransformation of xenobiotics (enzymatic activity of CbE and GST), oxidative stress (LPO levels and enzymatic activity of CAT and GR), secondary metabolites (glucose, lactate and ammonia levels) and density of zooxanthellae in tissues of the umbrella and oral arms were studied. For the basal values of the studied biomarkers, ranges varied between 0.83 and 3.18 nmol g^{-1} of wet weight for LPO, 3.30 and 8.36 nmol min^{-1} mg^{-1} of protein for GR, 0.78 and 3.17 µmol mg^{-1} of protein for glucose, 0.36 and 1.14

μmol mg^{-1} protein for lactate, 0.029 and 0.073 μmol mg^{-1} protein for ammonia, 14.55 and 195.02 nmol min^{-1} mg^{-1} protein for CbE, 5.8 and 83 nmol min^{-1} mg^{-1} of protein for GST and 18.07 and 22.2 μmol min^{-1} mg^{-1} of protein for CAT. These results were compared with those of species of scyphozoans, other cnidarians and marine invertebrates, showing inter and intraspecific variability.

Key words: Jellyfish, lipid peroxidation, antioxidant enzymes, metabolites, biotransformation enzymes.

Acknowledgments: This project has been carried out thanks to the UV-INV-AE19-12104761210476 grant from the University of Valencia. The authors want to acknowledge the Oceanogràfic Foundation which has provided all the jellyfish specimens for this study and Dra. Belén Frigols Garrido from Universidad Católica de Valencia.

SEASONAL MICROBIAL CHANGES IN THE SEDIMENTS ALONG THE HUELVA COAST (SW SPAIN)

Marina Barbudo-Lunar[1], Chiara Trombini[2], Julián Blasco[2,3], Carmen Michán[1] and José Alhama[1]

[1] Department of Biochemistry and Molecular Biology, ceiA3, Campus Rabanales, Universidad de Córdoba, 14071-Córdoba, SPAIN.
b62balum@uco.es, bb2midoc@uco.es, bb2alcaj@uco.es
[2] Institute of Marine Sciences of Andalusia (CSIC). Department of Ecology and Coastal Management. Puerto Real, Cádiz, SPAIN.
chiara.trombini@icman.csic.es, julian.blasco@csic.es
[3] Blue Growth associated unit ICMAN-IFAPA El Toruño. Puerto Real / Puerto de Santa María, Cádiz, SPAIN.
julian.blasco@csic.es

Abstract: The ocean and coastal areas are subjected to many drivers of environmental changes, mostly associated with human activities. Some coastal areas are particularly stressed due to the nearby presence of impacting human activities, such as: mining, industry, or agriculture. Microorganisms have been proposed as good indicators of response to environmental pollution. In this regard, the wide distribution and rapid adaptation of the microbiome in response to environmental stressors lead to changes in their structure, diversity, and functionality. In this work, we have studied aquatic sediments from three different locations along the Huelva coast (Andalusia, Southwest Spain): “Isla Cristina” salt marsh (H1), “Carreras” river (H2) and “El Terrón” port (H3) in two different seasons: spring and autumn. The 16S rDNA gene was sequenced for the identification of bacteria. Statistical analyses were carried out to compare the number of bacterial identifications between the two seasons in each location. The phyla of bacteria with the highest number of identifications were Proteobacteria and Bacteroidetes in both seasons. In H1, the Planctomycetes phylum significantly decreased in autumn when compared to spring. In the case of H2, the Chlamydiae and Planctomycetes phyla significantly decreased in autumn. With respect to H3, the Cyanobacteria and Planctomycetes phyla significantly decreased in autumn, whereas the Firmicutes phylum increased in this season when compared to the spring sampling. A total of 96 bacterial families were identified considering the two seasons. In H1, 4 bacterial families showed significant changes; in H2, 12 families; and 16 families showed significant changes in H3. The Shannon-Wiener index was calculated to evaluate the alpha diversity, but no significant changes were observed in any of the three locations. Metagenomics allows us to assess the changes in the microbiome structure, which can be related with the sampling seasons and chemical characteristics of the sites in field studies.

Key words: Bacteria; Environmental samples; Metagenomics; Seasonal variations

Acknowledgments: This research has been funded by the Projects "ENVIROMICROB" (PID2019-110049RB-I00) and "E-WASTERISK", (PID2022-139807OB-I00), financed by the Spanish Ministry of Science and Innovation. M. Barbudo-Lunar is recipient of a predoctoral contract of the University of Cordoba ("Plan Propio").

USE OF OYSTER (*MAGALLANA GIGAS*) AS AN INDICATOR ORGANISM FOR PAHS CONTAMINATION ON THE SPANISH ATLANTIC COAST

M. Calviño*[1,2], E. Vazquez[1], B. Perez-Fernández[2], R. Ruiz[2], J. Bargiela[2], L.Viñas[2]

[1] CIM - Centro de Investigación Mariña, Universidade de Vigo, EcoCost, Departamento de Ecoloxía e Bioloxía Animal, Facultade de Ciencias do Mar, 36310 Vigo, SPAIN.
melissa.cristina.calvino@alumnos.uvigo.es, eotero@uvigo.es
[2] Instituto Español de Oceanografía (IEO-CSIC), Centro Oceanográfico de Vigo, Vigo, SPAIN.
lucia.vinas@ieo.csic.es

Abstract: Mussel *Mytilus galloprovincialis* have been used as a key species for assessing marine pollution in the Spanish coast during the last decades. However, the increasing scarcity of this species in some parts of the coastline is pushing the search for other species that can be used as sentinel organisms for pollution. Thus, the aim of this study is to examine the suitability of the introduced oyster *Magallana gigas* as sentinel for PAHs. We compare concentrations of PAHs in *M. galloprovincialis* and *M. gigas* (at six sampling sites along the Atlantic Spanish coast Additionally, we compared PAHs concentrations between two oyster size, 4,5-9cm and 9-12cm, and between two control groups, each one made of 25 randomly selected individuals. Both species displayed consistent pollutant concentration patterns, facilitating site pollution identification. In general, oyster concentrations showed similar assimilation and accumulation patterns than mussels. Also, we found similar assimilation and accumulation patterns across different sizes and control groups. In conclusion, oyster *M. gigas* seems to be suitable for effective pollution assessment and merits further consideration in environmental monitoring strategies, particularly for continuing historical monitoring records.

Key words: Polycyclic aromatic hydrocarbons (PAHs), oyster, indicator organism.

Acknowledgments: We thank the IEO-CSIC and UVigo for the opportunity to collaborate. We also acknowledge the support of the 3-ESMARES2C5A1 Project (Commissioned by MITECO-IEO), in the framework of which this joint work has been developed.

SIQUIMAR
XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

EFFECT OF MUSSEL BODY SIZE ON BIOLOGICAL RESPONSES TO FLUORANTHENE EXPOSURE

S. Sánchez-Segarra*[1], S. Hernandis[1,2], J.A. Campillo[1], L. Viñas[3], C. González-Fernández[4], J. Bellas[3] and M. Albentosa[1]

[1] Centro Oceanográfico de Murcia, Instituto Español de Oceanografía (IEO-CSIC), Murcia, SPAIN.
silvia.sanchez.segarra@ieo.csic.es, sebastian.hernandis@ieo.csic.es, juan.campillo@ieo.csic.es, marina.albentosa@ieo.csic.es
[2] Instituto de Investigación en Medio Ambiente y Ciencia Marina (IMEDMAR-UCV), Universidad Católica de Valencia SVM, Valencia, SPAIN.
[3] Centro Oceanográfico de Vigo, Instituto Español de Oceanografía (IEO-CSIC), Vigo, SPAIN.
lucia.vinas@ieo.csic.es, juan.bellas@ieo.csic.es
[4] L´Institut national de recherche pour l´agriculture, l´alimentation et l´environnement, INRAE, Villeurbanne, FRANCE.
carmen.gonzalez-fernandez@inrae.fr

Abstract: Environmental monitoring programs use wild mussel as bioindicator to assess the levels of chemical pollutants and the biological responses related to pollution. In IEO monitoring programs (González-Fernández, et al., 2015), organisms from a specific size range are used to reduce the influence of size on bioaccumulation and effects responses of the pollutants (30-50 mm). Nevertheless, differences in mussel size could be related to age, since mussels are animals with unlimited growth. Therefore, mussel size might act as a "confounding factor" affecting biological responses to pollutants (Zhong et al., 2013).
The aim of this study was to evaluate the effect of mussel size on biochemical responses to the polycyclic aromatic hydrocarbon (PAH) fluoranthene (FLU). For that purpose, mussels of different body sizes (S, small 30 mm; M, medium 40 mm; L, large 50 mm) were exposed to 30µg L^{-1} of FLU. After 21 days of exposure, the following biochemical biomarkers were measured: catalase (CAT), superoxide dismutase (SOD), glutathione reductase (GR), glutathione peroxidase (GPx), glutathione-S-transferase (GST) and lipid peroxidation (LPO). FLU bioaccumulation was quantified together with biological variables such as anatomical indices, gonadal development, and body reserves. Biochemical biomarkers were affected by the mussel size and also the effect of toxicant exposure was size-dependent. In general, small mussels were more sensitive to the oxidative stress of FLU. These results highlight the significance of endogenous factors, such as animal size, in the biological responses to pollutants and in assessing the biomarkers used in biomonitoring programs.

Key words: marine pollution, biomarkers, monitoring programs

Acknowledgments: This study has been funded by the projects BIOCOM (CTM2012-30737) and MITOYSTER (PID2022-139616OB-C31) from the Spanish State Research Agency (AEI, MCIN/ AEI/10.13039/501100011033/).

References:

González-Fernández, C., Albentosa, M., Campillo, J.A., Viñas, L., Fumega, J., Franco, A., Besada, V., González-Quijano, A., Bellas, J. (2015). Influence of mussel biological variability on pollution biomarkers. Environmental Research 137: 14-31.

Zhong, H., Kraemer, L., Evans, D. (2013). Influence of body size on Cu bioaccumulation in zabra mussels Dreissena polymorpha exposed to different sources of particle-associated Cu. Journal of Hazardous Materials, 261, 746-752.

SIQUIMAR

XXII SEMINARIO IBÉRICO DE **QUÍMICA MARINA**

ISMS 2024
VALENCIA
JULY 10-12
IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

POSTER COMMUNICATIONS

~

GLOBAL CHANGE

Universidad Católica de Valencia San Vicente Mártir
Universitat d'Alacant Universidad de Alicante
Universitat de Barcelona
UCA Universidad de Cádiz
ULPGC Universidad de Las Palmas de Gran Canaria
Universida de Vigo

OCEAN ACIDIFICATION FORCING DRIVERS IN THE IBERIAN BASIN OVER THE LAST 25 YEARS

X.A. Padin*[1], M. Fontela[1], A. Velo[1], M. López-Mozos[1], P. Lherminier[2], L.I. Carracedo[2], F.F. Pérez[2]

[1] Instituto de Investigacións Mariñas (CSIC). Vigo, SPAIN.
padin@iim.csic.es, mfontela@iim.csic.es, avelo@iim.csic.es, mlopezm@iim.csic.es, fiz.perez@iim.csic.es
[2] University of Brest, CNRS, Ifremer, IRD, Laboratoire d'Océanographie Physique et Spatiale (LOPS), Plouzané, FRANCE.
Lidia.Carracedo@ifremer.fr, pascale.lherminier@ifremer.fr

Abstract: High-quality measurements of CO_2 chemistry collected during 12 cruises along the GO-SHIP section A25-OVIDE between 1997 and 2023 have been utilized to assess long-term ocean acidification in the Iberian Basin. The section was divided into five layers based on thermohaline criteria: North Atlantic Central Water (NACW) as the surface layer, Mediterranean Water (MW) and Labrador Sea Water (LSW) as intermediate layers and upper and lower North Atlantic Deep Water (uNADW and lNADW) as the deepest layers. Results showed a pH decline across the water masses, with more pronounced acidification trends at the surface. The acidification rates in the three upper water masses were -0.0021±0.0002 yr^{-1} (NACW), -0.0013±0.001 yr^{-1} (MW), and -0.0008±0.0001 yr^{-1} (LSW). The trends observed in NACW and MW were nearly double the published trends for the Eastern North Atlantic (1981-2008) by Vázquez-Rodríguez et al. (2012). The pH decrease in the two deepest layers of the North Atlantic Deep Water was not significant, showing near steady-state values of 7.958±0.003 (uNADW) and 7.916±0.002 (lNADW) over the past 25 years. The main drivers of these pH trends were quantified using a decomposition approach based on temperature, salinity, total alkalinity, and total dissolved inorganic carbon (DIC) changes. DIC was split into natural and anthropogenic components using the φC_T^0 method (Pérez et al., 2008). The sum of all percentages of these forcings, positive and negative, was practically 100% considering methodological uncertainties. The increase in the anthropogenic DIC fraction was identified as the primary driver, representing 84±3% of the net pH decline in NACW, 73±7% in MW, and 78±8% in LSW. Significant decreases in total alkalinity, around -0.2 µmol kg^{-1} yr^{-1} in MW and LSW, reinforced ocean acidification by 43±19% and 73±17%, respectively. In contrast, cooling mitigated acidification in the intermediate layers, with a higher impact of -21±7% on the pH trend in MW.

Key words: ocean acidification, North Atlantic Ocean, GO-SHIP section A25

Acknowledgments: This research has been financially supported by BOCATS2 project (Biennial Observation of Carbon, Acidification, Transport and Sedimentation in the North Atlantic; Ref: PID2019-104279GB-C21/AEI/10.13039/501100011033) funded by Plan Estatal de Investigación Científica y Técnica y de Innovación 2017-2020. Cruises were co-funded by CNRS and Ifremer in France. MF was funded by PTA2022-021307-I, MCIN/AEI/10.13039/501100011033 and by FSE+. CAPTA project (0062_CAPTA_1_E) is co-financed by the European Union through the Interreg Spain-Portugal Cross-Border Cooperation Programme (POCTEP) 2021-2027 and by the REDEIRA project (Proyecto Estratégico Orientado a la Transición Ecológica y a la Transición Digital; Ref: TED2021-132188B-I00).

References:

Pérez, F. F., Vázquez-Rodríguez, M., Louarn, E., Padín, X. A., Mercier, H., & Ríos, A. F. (2008). Temporal variability of the anthropogenic CO2storage in the Irminger Sea. Biogeosciences, 5 (6), 1669–1679. https://doi.org/10.5194/bg-5-1669-2008

Vázquez-Rodríguez, M., Pérez, F. F., Velo, A., Ríos, A. F., & Mercier, H. (2012). Observed acidification trends in North Atlantic water masses. Biogeosciences, 9(12), 5217-5230.

SIQUIMAR

XXII SEMINARIO IBÉRICO DE QUÍMICA MARINA

ISMS 2024

VALENCIA
JULY 10-12

IX INTERNATIONAL SYMPOSIUM ON MARINE SCIENCES

POSTER COMUNICATIONS

* * *

TRACERS IN OCEANOGRAPHY

Universidad Católica de Valencia San Vicente Mártir

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

Universidade de Vigo

Seminario Ibérico de Química Marina (SIQUIMAR)
Valencia (Spain), 10-12th July 2024

CONSTRAINING DENMARK STRAIT OVERFLOW WATER EXPORT USING ND ISOTOPES

S. Espinosa-Paz*[1], I. Regada[1], S. Campderrós[1], E. Garcia-Solsona[1], E. Paredes-Paredes[1], M. Arjona-Camas[1,2], J. Frigola[1], M. Cerdà-Domènech[1], G. Lastras[1], A. Sanchez-Vidal[1], D. Amblàs[1] and L.D. Pena[1]

[1] GRC-Geociències Marines, Departament de Dinàmica de la Terra i l'Oceà, Universitat de Barcelona, Barcelona, SPAIN.
sara.espinosa@ub.edu
[2] CEFREM, CNRS-Université de Perpignan, Perpignan, FRANCE.

Abstract: The Denmark Strait is a gateway region between the Arctic and Atlantic oceans that plays a crucial role in the Atlantic Meridional Overturning Circulation (AMOC) and global climate dynamics. The Denmark Strait Overflow Water (DSOW) forms as a result of the admixture of Atlantic, Greenland Sea and Icelandic Sea sourced waters transported southward by the East Greenland Current (EGC) and by the North Icelandic Jet (NIJ). Once DSOW crosses the Denmark Strait, it becomes a precursor of the densest component of North Atlantic Deep Waters (NADW). Among the various geochemical tracers used to investigate ocean circulation, neodymium isotopes (εNd) have emerged as powerful tools due to their ability to serve as tracers for water mass origins, circulation patterns and mixing processes in the ocean. This study focuses on the characterization of DSOW export and mixing between the different water masses present in the Denmark Strait using neodymium isotopes and traditional tracers such as salinity and temperature. During the FAR-DWO cruise in 2023, approximately 250 seawater samples were collected for neodymium isotopes and rare earth elements analysis, aiming to characterize the water masses in the area, their mixing processes and tracing their circulation patterns. Initial results from εNd analysis reveal a very distinctive isotopic signature between DSOW (εNd ~ -10.9) and adjacent water masses (εNd ~ -14.0) thus enabling to track the path of this deep water formation and the mixing processes occurring along its export pathway. Using statistical tools such as a newly developed Monte Carlo Optimum Multi-Parameter Analysis (MC-OMPA) we will identify the relative abundances of the different water masses described in the Denmark Strait.

Key words: Nd isotopes, Denmark Strait, DSOW

Acknowledgments: Financial support is acknowledged to the Spanish Ministry of Science and Innovation through research projects FAR-DWO (PID2020-114322RB-I00) and MORIA (PID2022-138010OB-I00). S.E. acknowledges an FPI PhD contract funded by the

Spanish AEI. This is a contribution from the GRC-GM (Grant 2021SGR01195) from Generalitat de Catalunya.

M 2024

IX INTERNATIONAL SYMPOSIUM
ON MARINE SCIENCES
VALENCIA. JULY 10-12

SIQUIMAR

XXII SEMINARIO IBÉRICO DE **QUÍMICA MARINA**

XXII IBERIAN SEMINAR ON MARINE CHEMISTRY

ISMS.VALENCIA.ES/SIQUIMAR

Organizers

Universidad Católica de Valencia San Vicente Mártir

Collaborate

AJUNTAMENT DE VALÈNCIA

Centre Museístic La Beneficència

VALÈNCIA Capital Verda Europea

valenciaport Autoridad Portuaria de Valencia

Coorganizes

Universitat d'Alacant
Universidad de Alicante

UNIVERSITAT DE BARCELONA

UCA Universidad de Cádiz

ULPGC Universidad de Las Palmas de Gran Canaria

Universidade de Vigo

Sponsors

AxFlow

CIM Centro de Investigación Mariña Universidade de Vigo

ocean net sl DEEP KNOWLEDGE · QUALITY INSTRUMENTS

València Innovation Capital

GENERALITAT VALENCIANA Conselleria de Cultura, Educación, Universidades y Empleo