



**Book of
Abstracts**

International Conference on Marine Science

Towards a sustainable ocean

Colombia 2018

**NOVEMBER
19–23**

**UNIVERSIDAD
NACIONAL DE
COLOMBIA
SEDE MEDELLÍN**

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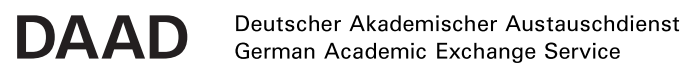
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Table of Contents

Aims and objectives	11
Ocean and society: The social dimension of ecosystem services	13
Innovations in the economic analysis and the evaluation of investments in coastal protection and ecosystem restoration in the Caribbean	14
Sustainability of fisheries and food security: An approximation from a Household Production model of fishermen in the Colombian Caribbean	14
Heritage preservation, transformations and environmental interactions in coastal cities: San Francisco de Campeche, Mexico.....	15
Governance and sustainability of the coastal and mangrove ecosystems of Cartagena de Indias	16
Tortuguero: an experience of conservation with the community.....	16
Results of fisheries restoration with Colombian social work	17
Social-ecological restoration in the Seaflower Biosphere Reserve - San Andrés, Providencia and Santa Catalina Archipelago, Colombian Caribbean...	17
Effect of salinity on genes associated with biogeochemical cycles of the mangrove swamp at the mouth of the Ranchería River, La Guajira.....	18
Marine environmental change: From species responses to environmental modeling	19
Exploring the role of water flow in the response of scleractinian corals to ocean acidification	20
<i>Symbiodiniaceae</i> community dynamics in the starlet coral (<i>Siderastrea siderea</i>) during two experimental bleaching and recovery events.....	20
Ocean acidification causes mortality in the medusa stage of the cubozoan <i>Carybdea xaymacana</i>	21
Applied hologenomics: Performance and Potential Applications in Coral Holobiont Research	22
Inhabiting the technosphere: the encroachment of anthropogenic marine litter in Neotropical mangrove forests and its use as habitat by macrobenthic biota	22
Microplastic: the Trojan horse of the ocean that might affect coral health.....	23
Reconstruction of the Origin of the Organic Matter Deposits in the Gulf of Urabá.....	24
Characterization of deep-sea chemosynthetic communities in the Southern Colombian Caribbean.....	24
3D scanning as novel method for measuring stress in corals.....	25

Hydropower dam implications and saltwater intrusion on a tropical estuary in the southern Gulf of Mexico	25
Spatio-temporal changes in the Mexican Caribbean coral reef communities over the last four decades.....	26
Ecologic integrity and biodiversity of reef ecosystems in oceanic islands of Colombia in the Caribbean: Serranilla Cay	27
Mangrove macroecology in Colombia: understanding geographical patterns to anticipate responses to climatic changes.....	27
Mediterranean aquaculture impact on subtidal macroalgae community: a case study from the Aegean Sea (Greece).....	28
Gorgonian corals ecology and threats: invasive species and disease outbreaks in the Tropical Eastern Pacific.....	29
Evaluation of octocoral ecophysiological response under ocean warming scenarios.....	29
The effect of sewage discharge on the microbial community of mangrove ecosystems	30
Advances in Ballast water treatment in a pilot scale.....	31
Benthic reef cyanobacteria from Serranilla Cay (Seaflower Biosphere Reserve): Distribution and potential impacts.....	32
Steady decline of corals and other benthic organisms in the Seaflower Biosphere Reserve (Roncador and Serrana banks): are we missing something beyond alarming?	32
Using polychaetes to track the effects of climate change in the Antarctic and the Colombian Caribbean Sea	33
Polychaetes and organic matter: the biogeographic gap knowledge in the East Coast of South America from 1980 to 2015.....	34
Phytoplanktonic communities in a climate season in the Uraba Gulf, Colombian Caribbean.....	34
Comparison of the structure and functional groups of Eunicidae (Eunicidae: Polychaeta: Annelida) between Isla Fuerte and Cayo Roncador, Colombian Caribbean	35
Phylogenetic reconstruction of the <i>Eunicea</i> Caribbean octocorals using secondary structures of Internal Transcribed Spacer 2 (ITS2)	36
Influence of salinity on the degradation of xenobiotic compounds from microbial communities in mangrove soils in La Guajira-Colombia	36
Blue carbon in seagrass meadows is affected by wave's intensity within a coral reef lagoon?	37
Marine resources: Sustainable use in a changing world.....	38

Combining scientific and local knowledge to estimate vulnerability of data-poor stocks.....	39
Gregarious behavior of the small pelagic fish in the Gulf of California using acoustic methods	39
Breeding, larval development, and growth of juveniles of edible echinoderms for aquaculture and repopulation in Ecuador	40
Insights for sustainable development through Salinity Gradients.....	41
Deep-water crustaceans captured with traps, like a potential alternative fishery in the Colombian Caribbean.....	41
Advances on salinity gradient energy in Latin America	42
Impacts of coastal development on the resilience of coral reefs: Twenty years of monitoring from the Dominican Republic.....	43
Acoustic telemetry as a tool for the design and evaluation of MPAs	43
Designing a Marine Protected Area in the Guatemalan Pacific.....	44
Prediction and seasonality of potential fishing areas for dorado (<i>Coryphaena hippurus</i>) and tuna (Scombridae) and their relationship with environmental changes in the Colombian Pacific and nearby areas.....	44
Community Structure of Gelatinous Zooplankton (Meduzosoa and Tunicata) of Tropical East Pacific and Antarctic Peninsula, Austral Summer 2014-2015.....	45
Multiannual analysis of the fishing impact of the white sea urchin <i>Lytechinus variegatus</i> (Lamarck, 1816) (Echinoidea: Toxopneustidae) in the south of Margarita island, Venezuela.....	46
Environmental education and its application in marine sciences.....	46
Mid to Late Holocene geochemical and diatom based environmental reconstruction of Colombian Coastal Lagoons	47
Relationship between fish catch and environmental variables reveals the importance of mangroves to small-scale fisheries in Urabá gulf, Colombian Caribbean.....	48
Building a network for the characterization of marine ecosystems in Colombia by using modern technologies.....	48
Carbon stocks in the Pacific Colombian mangroves	49
CEROCONFLICTO	50
Evaluation of the metabolic profile in the culture of a Colombian Caribbean sea reef benthic cyanobacteria consortium.....	51
Population structure of the blue land crab (<i>Cardisoma guanhumi</i>) in four coastal localities of Turbo municipality.....	52
Population growth of the calanoid copepod Paracalanidae <i>parvocalanus crassirostris</i> fed with different species of microalgae	52

Oceanography: Understanding the physical processes of atmosphere-ocean interactions	54
On the exchange of carbon dioxide between the ocean and atmosphere	55
Effect of small-scale transport processes on phytoplankton distribution in coastal seas	55
Sedimentary features and seasonal benthic metabolism in a tropical coastal area (Taganga bay, Colombian Caribbean) impacted by a sewage outfall	56
Methodological approximation to the assessment of biological production and destruction of calcium carbonate in coral reefs of the Colombian Pacific.....	57
Multitemporal coastal changes in the Colombian Pacific: Mangroves and intertidal sediments using satellite imagery and Unmanned Aerial Vehicles (UAV's).....	57
Submerged structure effects on oscillatory flows (Wave-seagrass interaction).....	58
Development and implementation of a stochastic dynamic model for search and rescue operations in the Colombian Caribbean Sea.....	59
Insights of ocean acidification processes in Colombia.....	60
Estimating the Potential of Deep Ocean Water in the Caribbean.....	60
Analysis of short-term processes interactions on coastline evolution	61
Sea surface temperature inter-annual variability in the northeastern tropical Pacific and its relationship with El Niño and La Niña conditions	61
Seasonal sea level variation in the San Andres, Providencia and Santa Catalina Archipelago, Caribbean Sea	62
Analysis of the 3D behavior of currents in the north coast of Colombia.....	62
Oceanography, fish larvae and artisanal fisheries, knowledge for the protection of a resource	63
Hydrodynamic connectivity in the Seaflower Biosphere Reserve system and its potential impact on biological connectivity	64
Sea level spatio-temporal variability on the Colombian Caribbean coast	64
Patterns of surface circulation between coastal systems of Punta de las Vacas and El Uno bay, Turbo, Colombia	65
Representation of the vertical water temperature profile in a tropical region through coupled and uncoupled ocean-atmosphere model integrations.....	66
Author Index.....	67

Aims and objectives

This book of abstracts summarizes the works presented at the Colombia 2018: International Conference on Marine Science - Towards a sustainable ocean, held at the Universidad Nacional de Colombia, Medellín, Colombia.

The conference brings together researchers, practitioners and educators to exchange and share their experiences in answering fundamental environmental and socio-economical questions related to marine ecosystems in Latin America. It provides an interdisciplinary forum for discussing environmental change and its impact on ecosystems and society, the sustainable use of marine and coastal ecosystems, as well as technological advances.

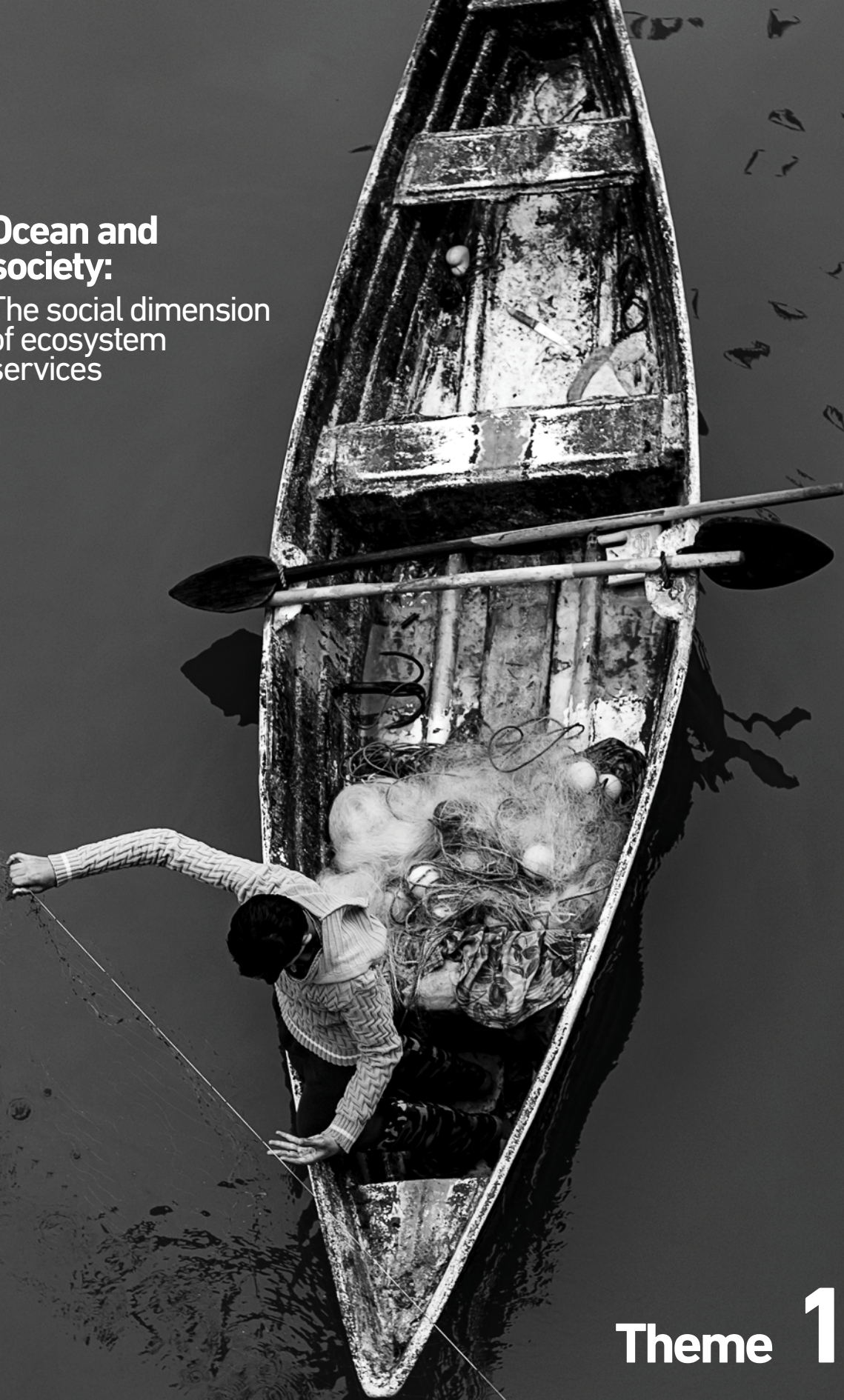
The conference, which is jointly organized by the CEMarin and DICM, focusses on five research themes:

1. Ocean and society: The social dimension of ecosystem services.
2. Marine environmental change: From species responses to environmental modeling.
3. Marine resources: Sustainable use in a changing world.
4. Oceanography: Understanding the physical processes of atmosphere-ocean interactions.
5. Water waves: How the ocean affects life.

Scientific Committe

Ocean and society:

The social dimension of ecosystem services



Theme **1**

Oral presentation 1-1

Innovations in the economic analysis and the evaluation of investments in coastal protection and ecosystem restoration in the Caribbean

Henao, J.P. & Maldonado, J.

Centro de Estudios sobre Desarrollo Económico – CEDE, Universidad de los Andes, Colombia

Abstract

Coastal zones and their communities are particularly vulnerable to the risks and impacts of Climate Change, thus their ability to adapt to the risks imposed by this phenomenon is highly important. Recently, the health of the ecosystems has been recognized as an important factor in the reduction of the vulnerability in coastal zones. In the framework of this discussion, the Integrated Coastal Zone Management (ICZM) arises to confront the degradation of the coastal ecosystems and develops a sustainable administration in the coasts, by incorporating risk management and climate change adaptation tools. In particular, the green infrastructure and the restoration of the ecosystem's projects, are part of the tools that allow the adaptation to climate change and at the same time, favors the provision of other ecosystem services. Although, and in general, there is a lack of knowledge in the economic benefits (both direct and indirect) that the coastal ecosystems provide. This study contributes with the development of a reference framework for the inclusion of the economic tools, such as the cost-benefit analysis, impact evaluations and the economic valuation of the non-market goods, to facilitate the process of identification and incorporation of the natural capital in the decision making of programs, policies and investment projects related to ICZM in the Caribbean region. In particular, emphasis is made on the economic valuation of the ecosystem services in the coastal protection interventions for flood prevention and erosion control.

Oral presentation 1-2

Sustainability of fisheries and food security: An approximation from a Household Production model of fishermen in the Colombian Caribbean

Vargas, M. & Moreno, R.

Centro de Estudios sobre Desarrollo Económico – CEDE, Universidad de los Andes, Colombia

Abstract

The artisanal fishing communities in the Colombian Caribbean are characterized for having high levels of poverty and vulnerability, as well as an important dependence to fishing resources for their subsistence. Understanding the relationship between the livelihoods of the households that are related to fisheries and the sustainability in the use of marine resources is essential to the design of policies for both the management of marine resources and the social development of these communities. Nevertheless, there does not exist sufficient information about these dynamics. In order to consider these dimensions, a household production model of fishermen is laid out, where the households make simultaneous decisions of consumption and

production, and where fishing plays a main role in those decisions, as a source of income and food security. Also, the development of a bioeconomic model is proposed, which allows us to identify the pressures over the fishing resources and the conditions of the main stocks of these resources. The theoretical model is validated with the fishery and socioeconomic information, that comes from permanent follow-ups that have been made to the households of fishermen in the Corregimiento de Barú (Bolivia, Colombia), in three-time spaces: March-December in 2015, February-December in 2016 and September 2018 to June 2019. The results will permit us to characterize the livelihoods of the fishing households in Barú, in order to propose policies that promote the sustainability of marine resources and enhance the life standards of the local communities as well.

Oral presentation 1-3

Heritage preservation, transformations and environmental interactions in coastal cities: San Francisco de Campeche, Mexico

Hernandez-Aviles, D.A. & Cejudo Collera, M.
Universidad Nacional Autónoma de México, México

Abstract

Restoration and conservation of heritage in historical coastal cities normally lacks of comprehensive studies under a multidisciplinary perspective. The methods for analysis applied to heritage conservation have focused on solving needs for specific temporal scales and usually do not account the historical context needed on development and conservation planning. From the analysis of the urban transformations of San Francisco de Campeche, Mexico, as a coastal walled city, implications for the conservation of built heritage in coastal urban are developed, taking into account: i) fundamental elements on a coastal regional scale; ii) the causes that promoted the main changes in the city, and iii) the link with the coastal environment. Results show the relationship of the coastal environment for the initial development of the city. The further development considered historical transformations from a territorial and commercial scope (terrestrial and maritime) as well as the implementation of policies that have affected not only the urban coastal development but the natural environment. Comparison with the development and origin of analogous cities in the Caribbean has given rise to the interpretation of the influence that the environment has on the transformation of cities, the needs that predominate in them over the centuries, heritage threaten, the unlinked development of urban areas, the loss of urban identities and social sense of belonging. This kind of studies will allow a better understanding of the urban development in coastal environments as well as the interactions between the coast, the heritage preservation, the environment and the society.

Oral presentation 1-4

Governance and sustainability of the coastal and mangrove ecosystems of Cartagena de Indias

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¹Universidad Nacional de Colombia, sede Medellín, Colombia

²Doctorado Interinstitucional en Ciencias del Mar

Abstract

Cartagena de Indias is an emblematic city for Colombia, for its historical importance since its founding due to the attributes of sheltered and strategic bay within the Caribbean Sea, historically entrance, in search of gold and the main slave port, which earned it the construction of forts and walls of protection against pirates, and that by its current state of conservation, exceeded the interest of a country, and is considered a world heritage site. However, this patrimonial character does not exempt it's from remaining at serious risk, not because of the filibusters of the seventeenth century, but because of the myopic vision of urban development at all costs and not towards the sustainable development of the 21st century. This model is leading to natural destruction, reaching inconceivable limits of social inequality; these two, dimensions required for sustainability. Given this reality, the author makes a historical tour of the city of three moments from its founding to the present, where it shows that the environmental has always been important, but ignored. For this reason, it proposes a model of governance, given the proven ungovernability of this dual city. The first results show that applying three lines of action: education as a basis, entrepreneurship, for economic sustainability and participatory planning, for social inclusion, under the TRIADA work model, three types of actors manage to reach common interests with results in six strategies, which must be articulated in the seventh strategy, with state policies from the global to the local.

Oral presentation 1-5

Tortuguero: an experience of conservation with the community

Dorantes Palacios, M.

Sea turtle conservancy, México

Abstract

In tortuguero since 1959 Sea Turtle Conservancy (STC) has recollect biometric data and nesting information. Nonetheless not only with the collection of these data the STC has achieved conservation for this species. The most important part has been the work with the community. Since the begging Dr. Archie Carr convinced the people in tortuguero to stop hunting sea turtles. In Tortuguero the most important ecosystem service for the people is the tourism. In 2004 with the help of STC, Tortuguero National Park and hotels in the area, the program of "rastreadores" (trackers) began and stayed until current days. This program has 15 people from the community of Tortuguero working each night (in nesting season) patrolling the beach looking for turtles ready to lay their eggs so tourist can watch them. This program has reduced the number of turtles returning to sea without laying cause

by disturbance of tourist and lights. Also, environmental education with the smaller ones has achieved to have young people working with us, the junior research assistant program allows young boys and girls to patrol with us on weekends. Another current project is a certification to hotels and restaurants that are ecofriendly and socially responsible, this has encouraged people in town to be actively involve in the protection of the environment and in the development of the town. The social dimension in Tortuguero is the most important part in the way of conservation of sea turtles.

Oral presentation 1-6

Results of fisheries restoration with Colombian social work

Galvis, N.

Foundation ICRI Colombia, Colombia

Abstract

Ten years of working with the community of fishermen now bring the results of an environmental empowered community that claims for Sustainable development. Industrial fisheries were replaced for exclusive artisanal fisheries and local protection under an international framework as New Hope Spot. Healthy coral colonies of 4 m² and abundant commercial important fishes and lobster populations and many other indicators of optimal integrity of the coral reef.

Oral presentation 1-7

Social-ecological restoration in the Seaflower Biosphere Reserve - San Andrés, Providencia and Santa Catalina Archipelago, Colombian Caribbean

Gnecco, M. & Montoya, P.

Corales de Paz, Colombia

Abstract

October 2017 saw the start of Colombia's largest coral reef rehabilitation project. The objective is to upscale coral reef restoration actions in the San Andres, Providencia and Santa Catalina Archipelago to accelerate the natural recovery of intervened reefs, promote adaptation to climate change, anticipate the direct effects of anthropogenic origin, and reach a great social impact. In its first phase, eight nurseries have been built with the capacity to grow at least 20,000 fragments of coral reef species. The current stock is 12,500 fragments of four species of hard corals. Periodic monitoring reveals fragment survival and growth above benchmark values for reef restoration projects in the Caribbean. Construction, installation, stocking and monitoring of nurseries and corals was conducted by more than 50 people representing different relevant social actors, aimed at developing the local capacity in coral gardening and the monitoring of coral reefs in the archipelago. We are also piloting the first payment for ecosystem services scheme for marine areas in Colombia which seeks to offer an alternative livelihood to artisanal fishermen committed to enforce reduce local coral reef threats and assist with the project's coral

rehabilitation activities within voluntary conservation agreements (VCA). In three years, we expect to see that the joint protection of selected sites with the addition of ca. 5,000 nursery-grown coral colonies per hectare of intervened reef, lead to a 10% increase in the live coral cover, fish biomass, structural complexity, aesthetic value, and overall reef health within the Seaflower MPA.

Poster presentation 1-1

Effect of salinity on genes associated with biogeochemical cycles of the mangrove swamp at the mouth of the Ranchería River, La Guajira

Rodelo Bernal, M.C.; Sandoval Figueredo, A.V.; Isaza, J.P.; Figueroa, I.P.; Polania Vorenberg, J.H.; Vanegas, J.

Universidad Colegio Mayor de Cundinamarca, Colombia

Abstract

Mangrove soils harbor a large variety of key microorganisms in the cycling of nutrients under seasonal and salinity variations. However, it is unknown how salinity influences the functionality of mangrove microorganisms. The objective was to determine the effect of salinity on genes associated with N, S and methane biogeochemical cycles in an altered mangrove swamp of Guajira by metagenomics. For this, three contrasting salinity points were sampled (H: 61.52 ppm, M: 14.61 ppm, L: 2.80 ppm), the total DNA was extracted, sequenced by illumina Hi-seq, scored with MEGAN 5 and the sequences were assigned with KEGG. The statistical analysis was with the Microbiome Analyst website. In low salinity (2.8 ppm of NaCl) the highest abundance of genes related to the cycles were found, with the methane cycle being the most abundant, followed by the S and N cycle. This tendency was maintained at the three salinity points. For the N cycle the majority of biomarker genes are for high salinity with genes associated with denitrification, for S these are for medium salinity with association to assimilation reduction of sulfate and SOX system, for methane they are for high salinity associated with methanogenesis and assimilation of formaldehyde. The biomarkers indicate that the high salinity favors the abundance of the nitrogen cycle and the sulfur cycle, the low salinity favors the pps of the methane cycle. The results reveal the influence of salinity on biogeochemical cycles and contribute to understand the functional dynamics of mangrove microorganisms.



**Marine
environmental
change:**
From species responses
to environmental modeling

Theme 2

Oral presentation 1-8

Exploring the role of water flow in the response of scleractinian corals to ocean acidification

Martins, C. & Wilke, T.

Justus Liebig University Giessen, Germany

Abstract

Coral reefs are widely regarded as one of the most vulnerable marine ecosystems to ocean acidification (OA). Particularly scleractinian corals, which produce an array of growth forms, are impacted by OA. Yet, the crossed effects of OA with other physical variables remain poorly understood. Water flow, for instance, has been shown to modulate coral metabolism and affect colony survival. This physical parameter may thus have the potential to increase the capacity of some corals to cope with environmental stress by modulating the photosynthesis of their photosymbionts. To elucidate the underlying mechanisms, the role of water flow in modulating the response of corals to OA stress is currently being investigated under laboratory conditions. We hypothesize that the adverse effect of OA on corals could be mitigated under elevated water flow conditions. To test this, the branching acroporid coral *Acropora muricata* is exposed to different water flow regimes and pCO₂ treatments in a fully-controlled microcosm experiment. Photosynthetic efficiency is measured in hospite using pulse amplitude modulated fluorometry to assess the response of the coral holobiont. Additionally, differences in coral form and rugosity between treatments are studied using 3D scanning. This study will further elucidate the role of water flow in modulating the photophysiology of corals and its potential to alleviate OA impacts on the health of coral holobionts. Understanding the role of hydrodynamics in coral reefs and its relationship to coral physiology will also enable us to better identify reef areas that may act as refuge under conditions of continuous climate change.

Oral presentation 1-9

Symbiodiniaceae community dynamics in the starlet coral (*Siderastrea siderea*) during two experimental bleaching and recovery events

Palacio-Castro, A.M.

University of Miami, United States of America

Abstract

Continued climate change is threatening the persistence of coral reefs. Prolonged temperature stress disrupts the nutritional mutualism between corals and micro-algae in the family *Symbiodiniaceae* (formerly genus *Symbiodinium*), causing coral bleaching and mortality. Although some corals can increase their bleaching thresholds by associating with more thermo-tolerant algae after stress events, the stability of these acquired communities was not established yet. To assess the persistence of thermo-tolerant algal species hosted by the starlet coral, *Siderastrea siderea*, we monitored the *Symbiodiniaceae* community composition in 24 replicate cores from each of 6 *S. siderea* colonies during three years. Using real-time PCR, we quanti-

fied the abundance of thermo-sensitive *Cladocopium* (formerly *Symbiodinium* clade C) and thermo-tolerant *Durusdinium trenchii* (formerly *Symbiodinium* D1a) during three periods at control temperature (7-12 months at 24-28°C) separated by two thermal challenges (4-5 weeks at ~32°C). Under control temperature, cores initially dominated by *D. trenchii*, but hosting 1-49% of *Cladocopium* became dominated by *Cladocopium* in 4-6 months. Contrary, cores containing <1% *Cladocopium* remained dominated by *D. trenchii* for >1 year and bleached less severely (evaluated as declines in symbiont abundance and performance [Fv/Fm]) during heat stress. Under both thermal challenges, cores with mixed communities increased *D. trenchii* dominance, and cores already dominated by *D. trenchii* became virtually exclusive on this symbiont, thereby increasing the long-term dominance of thermo-tolerant communities. These results suggest that the persistence of *D. trenchii* increases if competing symbionts are reduced below 1%, which could occur if sensitive symbionts are frequently eliminated during heat stress events.

Oral presentation 1-10

Ocean acidification causes mortality in the medusa stage of the cubozoan
Carybdea xaymacana

Chuard, P.; Johnson, M.D. & Guichard, F.
Department of Biology, McGill University, Canada

Abstract

The pH of the ocean is decreasing due to anthropogenic activities, and the negative consequences of this acidification on marine fauna and ecosystems are the subject of an increasing number of studies. Despite their abundance and ecological importance, some groups of organisms, such as jellyfish, have received little attention when it comes to ocean acidification (OA). To date there have been no studies on the effect of post-2050 OA projections on the medusa stage of jellyfish. As medusae represent the reproductive stage of cnidarians, negative impacts on adult jellyfish could severely impact the long-term survival of this group. Using a laboratory experiment, we investigated the effect of 2300 OA projections (i.e. pH of 7.5) on the mortality rate of the medusa-stage of the cubozoan species *Carybdea xaymacana*, compared to ambient seawater pH conditions (i.e. pH of 8.1). After a 12-h exposition to OA, *C. xaymacana* medusae suffered higher mortality rates compared to ambient conditions in which all individuals survived. This study represents the first evidence of the potential lethal effects of OA projections post-2050 on jellyfish, and more specifically on cubozoans. We discuss several hypotheses behind the apparent increase in mortality of this species under OA, and the potential repercussions that this higher mortality could have on ecosystems.

Oral presentation 1-11

Applied hologenomics: Performance and Potential Applications in Coral Holobiont Research

Celis, J.S.

Department of Animal Ecology and Systematics,
Justus Liebig University Giessen, Germany

Abstract

Animals and plants are no longer regarded as autonomous entities, but rather as holobionts, composed of the host plus its associated microbes. Reef-building corals are regarded as highly efficient holobionts due to the close symbiotic associations, including photosynthetic dinoflagellate of the genus *Symbiodinium*, and a highly diverse microbial community composed of bacteria, archaea, endolithic algae, and fungi. This taxonomical complexity hampers the generation of coral genomic datasets due to parallel sequencing of symbiont genomes. As a consequence, most of coral genomic research has been based on symbiont-free approaches aimed at reducing data complexity. However, this approach may not be applicable to the majority of coral species for ecological reasons. Here, we evaluate the performance of an alternative approach based on a NextGen hologenomic sequencing applied to the stress-tolerant stony coral *Porites rus*. Mitochondrial and nuclear genome assemblages, together with an assessment of horizontal gene transference using intron-encoded endonucleases, were used as criteria for evaluating the potential applications of the hologenomic approach. The results of the hologenomic approach demonstrated its capacity for facilitating the assembly of the *P. rus* mitochondrial (mt) and nuclear genomes without performing pre-processing DNA enrichment steps. In conclusion, a hologenomic approach represents an efficient alternative to bypass the main issues related with the high complexity generated by parallel sequencing of symbiont genomes. It provides a methodological framework not previously employed in coral genomics, with multiple potential applications that will help boost coral genomic data production in times of coral reef decline.

Oral presentation 1-12

Inhabiting the technosphere: the encroachment of anthropogenic marine litter in Neotropical mangrove forests and its use as habitat by macrobenthic biota

Riascos, J.M.¹; Valencia, N.1; Peña, E.J.² & Cantera, J.R.¹

¹Grupo de Investigación en Ecología de Estuarios y Manglares, Instituto de Ciencias del Mar y Limnología, Universidad del Valle, Cali, Colombia

²Grupo de Biología de Plantas y Microorganismos, Instituto de Ciencias del Mar y Limnología, Universidad del Valle, Cali, Colombia

Abstract

The fast rate of urbanization in the world coasts is leading to the accumulation of marine anthropogenic litter. Plastics, the most common and persistent component of marine litter can now be considered a planetary boundary threat and a challenge

in ocean governance. Understanding the marine litter distribution and habitat use by marine biota is important to predict how organisms will respond to future anthropogenic changes. We assessed the spatial abundance, distribution and composition of surface macro-litter (> 5mm) (SML) in four mangrove forests in Buenaventura Bay, Colombian Pacific, and analysed how the benthic biota use the microenvironments made available by its presence. SML density ranged from 2 to 314 g m⁻² (0.22 to 35.5 items m⁻²), implying that mangrove forests in Buenaventura Bay, particularly those surrounding urban areas are among the most polluted coastal areas in the World. The structure of biological assemblages colonising SML differed according to position on the forest (on-ground or aboveground) and litter type (flexible or hard). The encroachment of SML in mangrove forest enables a seemingly transient colonization of both, indigenous and non-indigenous (rocky shore and hard bottom) biota. The successful colonization of SML by a diverse biological assemblage poses questions regarding the potential for plastics or their associate chemical contaminants to transfer or leach into aquatic organisms through food webs and ultimately into humans.

Oral presentation 2-1

Microplastic: the Trojan horse of the ocean that might affect coral health

Franco, A.; Reichert, J.; Hardt, M.; Schubert, P.; Wilke, T. & Glaeser, S.P.
Institute of Applied Microbiology, Justus Liebig University, Germany

Abstract

Aquatic ecosystems are threatened by increasing concentrations of microplastics (MP), which are colonized by specific bacterial communities (BC). Interactions between MP and animals occur mainly after MP ingestion. Recent reports showed that MP uptake negatively affect corals (bleaching or necrosis), but the question whether MP per se or MP-colonizing bacteria impair coral health remains unclear. In a marine microcosm we studied the bacterial colonization of sterile MP after 12 weeks of incubation and compared their BCs to those associated with sterile sediments, detritus, and particle-containing (>5 µm) and particle-free (0.22-5 µm) water fractions. Scanning electron microscopy indicated particle-specific colonization of MP by complex eukaryotic and prokaryotic communities. DGGE fingerprinting and Illumina MiSeq sequencing of 16S rRNA gene amplicons revealed exclusive BCs on MP. High abundances of *Jejudonia*, *Roseivivax*, *Marinobacter*, and *Erythrobacter* were found solely on MP. Abundant bacteria were isolated and identified by partial 16S rRNA gene sequencing and differentiated at strain level by genomic fingerprinting. A high diversity of phylogenetically different *Vibrio* spp. were cultured from the system (n=53), among those, only two MP-specific phylotypes were isolated, including strains exclusively detected on MP, which were next related to the coral pathogen *Vibrio corallilyticus* (99.4% 16S rRNA gene sequence similar) and to *Vibrio fortis* (99.9%). This study illustrates specific colonization of MP, comprising potential coral pathogens, which might be transferred into coral tissues and the cause of disease events, likely triggered by the disturbance of the holobiont's native microbiota. The isolated bacteria now can be used to test this hypothesis.

Oral presentation 2-2

Reconstruction of the Origin of the Organic Matter Deposits in the Gulf of Urabá

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Abstract

Carbon stable isotopes analysis serve reconstruction of the origin of organic matter (OM) deposited onto sediments. They also allow tracing vegetation change at different time scales. This study weighs the contribution of both marine and terrestrial sources to sedimentary organic carbon (OC) from a southwestern Caribbean Gulf partly surrounded by large *Musa acuminata* (banana) croplands. The $\delta^{13}C$ values in three sediment cores from the gulf have slightly decreased over 1000 yrs BP, indicating enhanced terrestrial input of detrital carbon owing to river discharge. A two-end mixing model fed with these $\delta^{13}C$ values showed that averaged terrestrial contribution of OC to sediment was 52.0% at prodelta, 76.4% at delta front, and 64.2% at Colombia Bay. This agrees well with sediment dynamics. The main source of sedimentary OC within the gulf was terrestrial instead of marine. In fact, a distorted trend in $\delta^{13}C$ values for one of the coring sites could be the result of banana crop expansion through the 20th century.

Oral presentation 2-3

Characterization of deep-sea chemosynthetic communities in the Southern Colombian Caribbean

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Abstract

Chemosynthetic communities are found in patchy areas where methane or other hydrocarbons leak through the seafloor (cold seeps). Although common in the deep-ocean continental margins, chemosynthetic communities in the Caribbean region are poorly known. Their existence in Colombian waters was first suggested given the occurrence of carbonates and biological specimens obtained through trawling nets. Predictive models incorporating bathymetry and backscatter data indicate the presence of hard ground areas (authigenic carbonates formed due to chemosynthetic activity), which were consistent with water column plume anomalies. The presence of chemosynthetic communities at these predicted sites was validated through systematic piston core sampling and towed camera imaging. We utilized these samples and image data to generate a first description of biodiversity and community structure found at chemosynthetic communities in the Southern Colombian Caribbean. The results demonstrate that the habitat predictive model is accurate; however, the size of the habitats predicted by the model overestimate the areas observed. Chemosynthetic communities at these sites resemble those ones found off Trinidad and Tobago and the Gulf of Mexico. Dominant species in-

clude tubeworms (*Lamellabranhia* sp. and *Escarpia* sp.), mussels (*Bathymodiolus* sp.), shrimp (*Alvinocaris* sp.), and squat lobsters (*Munidopsis* sp.), among others. These results represent foundational knowledge of Colombian deep-sea ecosystems. This research also represents the starting point for the understanding of the patterns and processes that have shaped biodiversity in the deep waters of the Southern Caribbean.

Oral presentation 2-4

3D scanning as novel method for measuring stress in corals

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Abstract

Growth and shape are fundamental biological traits of scleractinian corals that can be used to assess the effects of global change stressors, which increasingly affect coral reef ecosystems worldwide. However, traditional methods to determine these parameters are often invasive or inaccurate, and quantitative analyses of the irregular growing organisms are often too complicated to apply to large datasets on a regular experimental basis. Therefore, we explored the use of 3D scanning and analyses as novel method to study the effects of anthropogenic stressors on corals. We could show that 3D scanning constitutes a highly precise, reproducible, and minimally invasive method for documenting and analyzing growth and shape of scleractinian corals. Further, we established a baseline workflow for following 3D analyses, especially addressing growth and shape quantifications of corals. The developed 3D methods were successfully applied to study the effects of different stressors in laboratory setups. We give insights into how the method can be combined with traditional approaches from coral ecology and how we used it to unravel the impact of the emerging stressor microplastics on major reef-building coral species. These novel 3D methods can set new standards for future research assessing the effects of anthropogenic stressors on scleractinian corals.

Oral presentation 2-5

Hydropower dam implications and saltwater intrusion on a tropical estuary in the southern Gulf of Mexico

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Abstract

Estuaries are highly productive ecosystems that form a transition between riverine and maritime environments. Salt-freshwater exchanges are influenced by tides, waves and freshwater discharge. In Tropical estuaries, periodic advances and retreats of the influx of saline water are dependent on seasonality as well as on episodic and intense river flows. Modifications upriver due to dam systems are among the

stressors that might alter the hydrological regime in the river inducing changes in the estuarine environments and the adjacent coastal areas. In this regard, monthly field measurements for characterization of the seasonal behavior of the salt-water intrusion, temperature and water discharge in the upper-estuary of the Grijalva River in the southern Gulf of Mexico were conducted. Results of the analysis of a 4 dam-system are also presented in relation to the historical induced changes that could have influenced the estuarine environment: i) changes on mean annual water discharges, ii) general loss of seasonality and iii) threatening to the hydrologic regime related to the dam-system development. Management plans and policies associated to the modification of the hydrological regime and possible consequences to the estuarine environment are discussed. Implications on the changes on the current upper-estuary condition measured will be drawn, which aim to contribute to the better understanding of estuarine systems due to long-term anthropic perturbations motivated by hydropower developments.

Oral presentation 2-6

Spatio-temporal changes in the Mexican Caribbean coral reef communities over the last four decades

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Abstract

Increasing global and local stressor influences on coral reefs have led to widespread coral mortality. Although analyses in the wider Caribbean have revealed a decline in coral cover since the late 1970s on a regional scale, the current literature lacks specific information on coral and macroalgae cover developments for the Mexican Caribbean. In order to fill existing knowledge gaps, this study explored distribution and change patterns of benthic key reef organisms using a meta-analysis. Time series of 111 reef sites with coral and macroalgae cover estimates were collated from monitoring programs, and existing literature. Results revealed a decrease in coral cover and recovery following the 2005 mass bleaching event and hurricane impacts, though with high spatial variability among sub-regions. Over the study period, overall hard coral cover declined by 12% from 1978 to 2004, but increased again by 10% between 2005 and 2016. Our results also identified reef sites in the Southern sub-region that experienced a loss in coral cover. Some sites in the Northern sub-region, still exhibit more coral than macroalgae coverage. This indicates high localized resilience to stressors that is likely acquired through either functional attributes of important reef building coral genera such as *Acropora* and *Orbicella* and/or physical characteristics of these reefs. Although this study reports a recovery after a mass bleaching, it is also notorious that most MC coral reefs are now no longer dominated by reef-building organisms. Therefore, in order to prevent further reef degradation, it is imperative to explore viable and reliable conservation alternatives.

Oral presentation 2-7

Ecologic integrity and biodiversity of reef ecosystems in oceanic islands of Colombia in the Caribbean: Serranilla Cay

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Abstract

The Seaflower Biosphere Reserve (SBR) has the most important coral reef areas in the Colombian Caribbean. Since 2014, yearly scientific expeditions to remote areas of the SBR have been done, including 2017's expedition to Serranilla Cays. On 2017, the ecologic integrity of the cay was evaluated by: A) evaluating shallow coral reefs' condition, B) evaluating historic growth conditions of a species of massive coral in order to infer changes through the last century, and C) evaluating bird colonies in the cays. Six monitoring stations were evaluated for coral reef health, complemented with an additional 20 rapid check stations, identifying a very low coral (<10%) and high macroalgae coverage in all monitored stations. Low coral disease was identified, though a constant presence of benthic cyanobacteria consortiums was registered in all reef areas. These cyanobacteria consortiums were collected to further identify dominant species in the lab, corresponding to *Phormidium corium* y *P. morile* (Order: *Oscillatoriales*). Five coral cores were extracted from colonies of *Orbicella faveolata*. An exhaustive inventory of birds was done, identifying 70 bird species, most of which are migratory, though no nesting colonies were observed. Additionally, the Gecko *Aristelliger georgeensis* was identified, making this the first registry for the species in Serranilla.

Oral presentation 2-8

Mangrove macroecology in Colombia: understanding geographical patterns to anticipate responses to climatic changes

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Abstract

Mangroves are intertidal ecosystems dominated by vascular plants, tolerant to flooding with saline or brackish waters. They are broadly distributed along both coasts in Colombia, however, little is known about quantitative patterns at national and regional spatial scales. At global and continental scales strong correlations have been found between forest attributes from species-level to ecosystem-level with climatic variables, particularly mean annual precipitation and minimum annual temperature. Identification of macroecological patterns along climatic transitions has been the foundation for modelling the effects of climate changes beyond sea-level rise. Here, I used a dataset from a past national inventory covering nearly 100 sites in Colombia's mainland to explore macroecological patterns of species presence,

species richness, Importance Value Index (IVI) of the dominant species, and estimated above-ground carbon relative to latitudinal and longitudinal gradients extending from superhumid to arid climates. Further correlations were explored with WorldClim 2 grided data. Although species presence and species richness randomly varied along the geographic gradients, significant linear and non-linear correlations were observed between IVI of the dominant species and both latitude and longitude, and ultimately with mean annual rainfall. Correlation of ecosystem-level carbon storage with rainfall reflected the contribution of *Rhizophora* as the foundation species. These results allow stating predictions about the potential effects of reduced rainfall on mangrove ecosystems in both coasts of Colombia and the consequences on carbon storage over the next century.

Oral presentation 2-9

Mediterranean aquaculture impact on subtidal macroalgae community:
a case study from the Aegean Sea (Greece)

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Abstract

The marine fish aquaculture keeps growing in the Mediterranean Sea, and its expansion is related to increasing loads of nutrients been released to the environment. That has been often associated with deteriorating environmental conditions of the surrounding habitats. However, the studies addressing this have been usually directed to the benthonic habitats in the close vicinity of the fish farms, neglecting other sensitive habitats. In the framework of the European project TAPAS, the effect of nutrient loading from fish farm facilities on the subtidal macroalgae community was evaluated for the first time in the Mediterranean. Two stations at increasing distance from a fish cage facility in the Aegean (Greece), where sampled in winter and summer. In each the subtidal macroalgae cover was assessed, the macrobenthos collected and identified, and the sea urchin collected and measured. The macrobenthos assemblage structure did not change in relation to the impact of aquaculture. The assemblage structure of the macroalgae changed near the farm, being dominated by turf-forming algae and lacking canopy-forming macroalgae. The invasive species *Styopodium schimperi* covered a larger area in the impact area than in the control. The sea urchin *Paracentrus lividus* population had a higher condition index in the impact station independent of the season variability. Whereas, the structure of the macrobenthos assemblages had no significant variation in the influence of aquaculture. The results give evidence of the impact of aquaculture in the enhancement of grazing pressure, the change of macroalgae assemblage structure and in the establishment of invasive species.

Oral presentation 2-10

Gorgonian corals ecology and threats: invasive species and disease outbreaks in the Tropical Eastern Pacific

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Abstract

Gorgonian corals, which play key ecological roles in benthic communities, are among the most vulnerable reef organisms. Particularly, declines in *Pacifigorgia* spp., have been registered in the Tropical Eastern Pacific (TEP) over the last years due to the interaction with the octocoral *Carijoa riisei* and disease outbreaks. In order to understand the impact that abiotic factors such as local and global thermal conditions and biotic factors such as disease outbreaks and invasive species may represent to these gorgonian populations, we used *Pacifigorgia cairnsi* as a model species, which is the most abundant invertebrate in a remote marine area little affected by anthropogenic pressures (Malpelo Island, Colombian TEP). By conducting approaches such as phylogeography, metabarcoding, microbial ecology and demography, our results suggest that (1) *C. riisei* might have been introduced from the Atlantic into the Colombian TEP and it constitutes a fully invasive species in this region. Additionally, we found that (2) the bacterial microbiome associated with the 'Necrotic Patch Disease (NPD)' behaves opportunistically and is likely in a state of microbial dysbiosis. Moreover, the confinement of the disease-related consortium to symptomatic tissues may facilitate colony recovery. Finally, (3) *P. cairnsi* showed high densities, population size structures driven by local hydrodynamics, growth rates negatively affected by ENSO events and low NPD prevalence, while most of colonies recovered. Overall, we conclude that *P. cairnsi* develop mature and healthy populations at Malpelo Island but some threats such as invasive species and ENSO events may represent a long-term impact to these key benthic organisms.

Oral presentation 2-11

Evaluation of octocoral ecophysiological response under ocean warming scenarios

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Abstract

Octocorals are common components of coral reef communities around the globe. Several studies have reported that octocorals in the context of phase shifts may replace scleractinian corals so that octocorals likely become even more common benthic organisms in the future. However, very few studies have evaluated how octocorals respond to climate change induced environmental changes. Our study thus aims to evaluate in a comprehensive way the ecophysiological responses of an ex-

emplary octocoral to global warming scenarios simulated in aquaria laboratory facilities under controlled and manipulated conditions. During this study, we measured key physiological response parameters of the octocoral *Xenia umbellata* including photosynthesis, respiration, pigmentation, organic matter fluxes, and growth as well as pump rates (a particular trait of this species). Three temperature treatments were tested: 26, 29, and 32 °C over a total experimental duration of 6 weeks with a high temporal resolution in measurements (N=120 colonies). In order to evaluate respiration and photosynthetic rates we performed 2h light and dark incubation experiments with additional measurement of TOC as means to calculate fixed organic carbon. Our preliminary findings suggest a complex biological response that do not present simple correlations as observed for many of the current landscapes in coral reefs. The results of our study offers an insight to the present and future context of coral reef ecosystems.

Oral presentation 2-12

The effect of sewage discharge on the microbial community of mangrove ecosystems

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Abstract

Diversity and microbial activity are important for the stability and maintenance of mangroves. The anthropogenic pressure caused by the discharge of sewage and oil spills could be detected by changes in bacterial groups. This research shows a robust description of the microbiota from two mangroves in La Guajira, one pristine (conserved) and another contaminated by urban sewage discharge (altered). We assessed the structure of the bacterial community by sequencing 16S rRNA gene on the Illumina system. Raw sequences were filtered and annotated using Mothur software. Alpha and Beta diversities were calculated to identify the diversity within and between the samples respectively. The soil samples were also subjected to physicochemical analyzes. 2,767 OTUs with a similarity of 97% were identified. 14 phyla, 15 classes, 29 orders, 55 families and 106 genera were enriched in some of the two mangroves. The genera *Marinobacterium*, *Marinobacter*, *Clostridium* and *Alcanivorax* showed significant abundances in the altered mangrove and have been postulated as indicators of contamination in mangroves. On the other hand, some bacterial genera involved in the nitrogen and sulfur cycle were significantly enriched in the altered mangrove. Phosphorus was the most important physicochemical parameter among mangroves. Our results clearly show changes in the structure and proportion of the bacteria community between mangroves. In addition, some bacterial groups are postulated and confirmed as bioindicators of urban wastewater pollution in mangroves. This study will permit the identification of microbial markers as a strategy for conservation and monitoring of pollution.

Oral presentation 2-13

Advances in Ballast water treatment in a pilot scale

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Abstract

Ballast water is a dead weight used by ships to provide stability in their journeys. These water masses may pose serious health, economic and ecological problems due to the transportation of alien species and pathogens from one country to another. Colombia is a country that has plenty of biodiversity, which can be affected by the loss of the native species or have health problems due to pathogens transported. Since September 2017 onwards, it will be mandatory by the International Maritime Organization (IMO) to manage the Ballast Water. Consequently, the present work aims to compare different Ballast Water treatments in order to determine the one that most effectively eliminates hazardous organisms. Treatments include TiO₂, H₂O₂ and UV which have shown better results in Ballast Water treatment in previous studies by increasing the hydroxyl radicals. Several advanced oxidation processes (AOPs) were used taking into consideration: UV/H₂O₂, UV/TiO₂, UV/TiO₂/H₂O₂, UV/TiO₂/H₂O₂, and were compared with natural Solar Radiation (SRAD), UV alone and the disinfectant H₂O₂. In the pilot-scale study, the disinfection capacity was measured in natural sea water pumped from a beach nearby a port zone of Colombia (Santa Marta). More importantly, the test was carried out by examining the abundance of viable organisms whose size was bigger than 50 µm, organisms between 10 and 50 µm and the pathogens: *E. coli*, *Enterococcus* and *Vibrio* sp. Mortality populations were measured. The AOPs showed differences in its effectiveness according to the tested organisms. Species bigger than 50 µm were the most resistant. As for the microorganisms, they were evaluated in different bacterial decay models and compared, finding that the models log lineal and log lineal tail were adjusted for most of AOPs in *E. coli*. For *Vibrio*, the models were Log-Lineal tail and biphasic and for *Enterococcus* was only the biphasic model common for two AOPs. Some of the AOPs reached up to 99.99-100 % of disinfection for *Enterococcus* and *Vibrio*, and for *E. coli* the levels required by the IMO were reached. In general, the natural sea water taken from Santa Marta can be used for test of microorganism because of the high abundance of *E. coli* and *Vibrio*, but for the organism greater than 10 µm the populations must be increased. After some AOPs treatments the parameter of the IMO (D₂) were reached except by the organisms greater than 50 µm, therefore the latter must be removed first by a previous stage like physic filter, hydrocyclone or cavitation.

Poster presentation 2-1

Benthic reef cyanobacteria from Serranilla Cay (Seaflower Biosphere Reserve): Distribution and potential impacts

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Abstract

In the Caribbean, many studies have demonstrated a generalized decrease of live coral cover, reduced coral recruitment and an increased algal biomass. Experimental and field data suggest that these trends are a consequence of intense herbivore reduction and greater nutrient input. Although algal cover is monitored in reef evaluations, benthic cyanobacteria are still ignored and reported as a subcategory of algae. Yet cyanobacteria are strong indicators of decreased water quality in reef ecosystems. In the framework of the Program of Ecological Integrity and Biodiversity of oceanic reef and island coral complexes of Colombia, reef surveys were performed in Serranilla Cay to determine the presence of cyanobacteria in this area, as well as their distribution and abundance. Despite the special status and management initiatives of the Seaflower Biosphere Reserve, cyanobacteria are abundant growing on corals, rubble and sea grasses, as well as forming large mats over sandy bottoms. As one of the results of the Seaflower 2017 Expedition to Serranilla Cay, herein we report the presence of *Phormidium corium* (Cyanophyceae: Oscillatoriales) at various reef sites in the zone. The wide distribution and abundance of benthic cyanobacteria in the region demonstrate that it is necessary to establish a database on cyanobacteria found in the Colombian Caribbean, their abundance and impact on corals and other benthic organisms to design and implement long-term management plans.

Poster presentation 2-2

Steady decline of corals and other benthic organisms in the Seaflower Biosphere Reserve (Roncador and Serrana banks): are we missing something beyond alarming?

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Abstract

The SeaFlower Biosphere Reserve includes some of the most remote oceanic coral reefs in the southwest Caribbean, which provide natural experiments against the global degradation of the entire coral reef basin. In this study, we compared the coverage of corals and other substrates, and the densities of populations of key sea urchins species in the same sites in the lagoons of two atolls in the Serrana and Roncador banks, during 1995, 2003 and 2015/2016. We also quantified benthic foraminifera (FI) as an indicator of water quality for coral growth in the last period.

Although remote reefs represent an exemplary case to assess the health of the reef, due to its isolation from direct human disturbances, our results evidenced an evident decline in algae, coral cover, and urchin populations. Although both banks followed a loss in coral coverage, topographic complexity (roughness) and resilience (FI index), the Roncador bank faces a worrying descent. These unexpected reef findings, disappearing in recent decades, lead us to consider the alarming scenario, where these atolls begin to erode while providing the ideal conditions for the growth of octocorals. The fate of these and many coral reefs in the Caribbean is more than critical, and conservation programs are critical to their long-term maintenance.

Poster presentation 2-3

Using polychaetes to track the effects of climate change in the Antarctic and the Colombian Caribbean Sea

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Abstract

In marine ecosystems, the increase of CO₂ and climate change are associated with raises in temperature and stressful thermal environments. Temperature affects directly the rates of enzymatic reactions and fundamental biological processes, modeling the distribution of the species. Marine species are vulnerable to ocean warming due to physiological intolerance to new environments, given the relative thermal stability of their habitats and their limitations in phenotypic plasticity. Since the ability to express protective metabolic mechanisms such as heat shock proteins and antioxidant enzymes can counteract the damage generated by thermal and oxidative stress to which these species are subjected, we are comparing patterns of expression of some detoxifying enzymes between polychaetes from West Antarctic Peninsula and Colombian Caribbean Sea, through a biochemical approach and sequencing of the latest generation. Benthic and coastal polychaetes are susceptible to changes in temperature and conditions of water and sediment, becoming an adequate biological model to study the increase in ocean temperature. Antarctic preliminary results showed that spionids were the most abundant family in the sediments, represented by *Microspio moorei* (Gravier, 1911). Since the species was described as new only with a single specimen, the holotype, and since paratypes do not exist, the abundant material revised herein is helping to the species description giving morphological variations and running biochemical experiments. To date, *M. moorei* subjected to acute thermal stress showed a greater activity of Catalase and Superoxide Dismutase, compared to worms maintained under normal temperature conditions; the enzymatic activity found was related to both time and exposure temperature. These results suggest a potential capacity of acclimating in this species. Tropical experiments and transcriptomic analyses will contribute to elucidate the physiological mechanisms that underline this potential adaptation.

Poster presentation 2-4

Polychaetes and organic matter: the biogeographic gap knowledge in the East Coast of South America from 1980 to 2015

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Abstract

Polychaetes are in permanent contact with sediments, which result in a close relationship with the organic matter therein. In this study, we assessed the trends in polychaetes and organic matter research in the East Coast of South America through a biographic overview. We explored 81 articles published between 1980 and 2015 that analyzed the effect of organic matter on any aspect of polychaetes assemblage by using the Web of Science and Scielo databases. An Activity Index analysis showed that publications rates were not homogeneous within the biogeographic provinces. Tropical Southwestern Atlantic (TrSA) and Warm Temperate Southwestern Atlantic (WTSA) have the most populated coastal cities such as Buenos Aires, Montevideo and Rio de Janeiro that reflects the increased presence of polychaetes researchers in these areas and their high contribution. Brazil has a disproportional influence on the publication rates in polychaetes and organic matter in the region. We identified 53 polychaetes families recorded, but the tolerant families such as Spinionidae, Capitellidae and Nereididae were dominant in all provinces. Species from these families, many estuarine, are commonly used as biological indicators of pollution or natural organic matter fluctuations. We observed significant differences in the composition of polychaetes studied in the five biogeographic provinces (PERMANOVA; $F_{4,86} = 1.522$, $p = 0.023$), specially between TrSA and WTSA. We suggest an increase in studies that explores the effect of organic matter variations from upwelling and fishing industry to understand the consistency of polychaetes responses and in poor-known provinces such as North Brazilian Shelf, Tropical Northwestern Atlantic and Magellonic.

Poster presentation 2-5

Phytoplanktonic communities in a climate season in the Uraba Gulf, Colombian Caribbean

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Abstract

Permanent study of the phytoplanktonic communities at a regional level is fundamental due to the importance to understand several ecological processes in ecosystems such as eutrophication, harmful algae and invasive species presence, and coastal and marine zones management, also it provides tools to the monitoring of primary production. The aim of this study is to describe the structure of the phy-

toplanktonic community in the Gulf of Uraba, Caribbean Colombian, to do this, different samples in the wet season were taken using a phytoplankton net (20/40 μm porosity) in stations with fluvial, estuarine and oceanic water column conditions of the gulf inshore and offshore (4.5 km away from coast in average). For each station, richness and abundance of phytoplankton has been made, then they were correlated with temperature, salinity, turbidity, dissolved oxygen, and phosphate and nitrate concentrations in the estuary. Results show that in the fluvial and estuarine zones cyanobacteria from *Anabaena*, and in the oceanic zone *Oscillatoria* predominates, exhibiting also a higher richness of diatoms in the offshore stations and dinoflagellates at inshore stations. *Coscinodiscus* and *Chaetoceros* were the genera with a distribution along of the gulf, also there is a presence of harmful algae species from the genus *Pseudo-nitzschia* and *Dinophysis*. Finally, the phytoplankton communities in the gulf of Uraba presents different organisms that can produce toxins, although they have an abundance that is not harmful (less than 1 cell/mL) the community needs to be monitored due to the potential risk that these species represent in an estuary.

Poster presentation 2-6

Comparison of the structure and functional groups of Eunicidae
(Eunicidae: Polychaeta: Annelida) between Isla Fuerte and Cayo Roncador,
Colombian Caribbean

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Abstract

Studies on marine fauna, especially aquatic benthic invertebrates that been conducted in the Colombian Caribbean, have helped to understand the functioning of different ecosystems, and the relationship existing between organisms. However, information on taxonomy, biodiversity and functional diversity of different marine invertebrate groups, especially on the polychaetes, is bare. Polychaetes are aquatic invertebrates, mainly benthic, belonging to the class Polychaeta, phylum Annelida. These organisms stand out for the ecological functions they perform, the recycling of nutrients, the exchange of organic matter and the role as indicators of environmental quality; also, they have economic importance in the pharmaceutical and fishing industry. The following report covers a taxonomic analysis of the 18 species belonging to the family *Eunicidae* found in the two sampled sites (Isla Fuerte and Cayo Roncador). A comparative study between Isla Fuerte as continental island, and Cayo Roncador as oceanic island, in the Colombian Caribbean, shows that in spite of the geographical difference, and the presence of environmental and anthropic tensions between the two islands, it was possible to determine non-significant differences in biodiversity. Likewise, similarities were found at a taxonomic level, suggesting the capacity of adaptation of these organisms is very high. Additionally, an approximation of four functional groups was seen in the morphological features at the genus level, which may be useful as guide for future works on functional diversity of polychaetes.

Poster presentation 2-7

Phylogenetic reconstruction of the *Eunicea* Caribbean octocorals using secondary structures of Internal Transcribed Spacer 2 (ITS2)

Sarmiento, A. & Sánchez, J.A.
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Abstract

In Caribbean reefs the diversity and abundance of octocorals can be greater than those of scleractinian corals. Octocorals are an important component of benthic communities, providing tri-dimensional structure and habitat for associated species. The most abundant and diverse group in Caribbean reefs is the genus *Eunicea*, with 15 described species and more than 30 described. Studying the genetic and morphological diversity of current species along with all cryptic morphotypes may result in the discovery of new species. Here, we reviewed the diversity and phylogenetic relationships of the genus based on the ribosomal DNA of the Internal Transcribed Spacer 2 (ITS2). In addition to the phylogenetic analysis of the sequences, we used derived 28 molecular morphometric characters from the ITS secondary structure and 17 discrete morphological characters to evaluate three kinds of possible data to reconstruct phylogenetic hypotheses and to establish phylogenetic relationships among species. Finally we present five different topologies of phylogenetic hypotheses for all species based on ITS2 corrected alignment, molecular morphometrics, morphological characters and combined data. Our results support at least one new species in this group.

Poster presentation 2-8

Influence of salinity on the degradation of xenobiotic compounds from microbial communities in mangrove soils in La Guajira-Colombia

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Abstract

Mangroves are highly productive tropical ecosystems influenced by seasonal and daily salinity changes and frequently exposed to pollution with sewage, oil spills, heavy metals, among others. Mangrove microorganisms have the ability to degrade xenobiotic compounds. However, the influence of salinity on the capacity of microorganisms to degrade xenobiotic compounds is limited. This study determined the influence of salinity in degradation of xenobiotic compounds in mangrove soils of La Guajira. Soil samples were taken at three points with contrasting salinity (23.2%, 14.61% and 2.8% of NaCl). Total DNA was extracted and shotgun sequencing by Illumina HiSeq technology. The sequences were analyzed with the DIAMOND software. The annotation was made with MEGAN 5 software. MetagenomeSeq was used to identify OTUs with differential abundance among salinities. 507,343 readings were associated with degradation of xenobiotics. The average counts reads per sample were 24,130 in categories of processes of degradation and metabolism

of xenobiotics. We detected 21 pathways associated with degradation and metabolism of xenobiotics. The most abundant of sequences in all the samples was the degradation of Benzoate, followed by drug metabolism and degradation of chloroalkane and chloroalkene. The highest abundances of KO occurred at the point of lowest salinity. The most abundant KO were the acetyl-CoA C-acetyltransferase (10% of the total KO), catalase-peroxidase (9%), GMP synthase (glutamine-hydrolysing) (6%). The results indicated potential degradation of xenobiotics in mangrove soils in low salinities. The degradation of xenobiotic compounds could be used as a strategy of conservation and implementation of bioremediation of mangroves before contamination agents.

Poster presentation 2-9

Blue carbon in seagrass meadows is affected by wave's intensity within a coral reef lagoon?


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Abstract

I assessed differences in seagrass living biomass (SLB) in meadows exposed to two wave's intensity levels within a coral reef lagoon in the small and oceanic island of San Andrés (N12°32' and W81°43', southwestern Caribbean). Two exposed sites and two sheltered sites were assessed. I used the cylindrical core method (10.2cm diameter and 30cm length) to collect SLB. Then, I classified the material by seagrass species and their living organs (modules). I found the 78% of SLB was *Thalassia testudinum*, the dominant seagrass in the study area, despite *Syringodium filiforme* and *H. wrightii* SLB. I used SLB to estimate de organic carbon (Corg) stock in these meadows, and also I used the loss on ignition (LOI) method (450°C/6h) to determine organic matter (OM-LOI) in SLB. Also, I determine $40.2 \pm 0.7\%$ (CI 95%, n=39) of Corg in *T. testudinum* green leaf samples. Besides, I linked granulometric attributes in sediments to wave's intensity levels within the reef lagoon, and these variables explained significant differences in SLB means among sheltered and exposed sites. Sheltered sites presented higher SLB than exposed sites, and I found a simple linear relationship among MO-LOI in sediments and belowground living biomass (BLB) in seagrass. Sheltered sites are using organic matter in sediments as a source of nutrients in these oligotrophic seawaters. Finally, I found BLB determines a mean 1.68 ± 0.28 Mg Corg/ha (n=36) in the study area, 3.4 times higher than Corg stock in Green leaves. Economic valuation and ecosystem services in these meadows are required.

A photograph of a sunset over a body of water. The sky is filled with dark, heavy clouds, with a bright orange and yellow glow from the setting sun breaking through near the horizon. In the foreground, several boats are silhouetted against the water. The water reflects the colors of the sunset. On the right side, a dark cliffside with some vegetation is visible. The overall mood is serene and contemplative.

Marine resources:
Sustainable use in a
changing world

Theme 3

Oral presentation 2-14

Combining scientific and local knowledge to estimate vulnerability of data-poor stocks

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Abstract

Developing countries are often limited in their capacity to assess small-scale fisheries, and it is unlikely these fisheries will ever have the resources to develop complete stock assessments. Researchers have developed a number of models that require fewer data and that utilize the information available. However, for data-poor fisheries, even those models can require an excessive amount of information. We introduce a modified Productivity and Susceptibility Analysis (PSA) that integrates scientific knowledge with information from local fishermen to overcome the lack of data. We assessed the vulnerability to overfishing of 15 local stocks in the southern Colombian Pacific and used participatory surveys to elicit local fishermen knowledge in 12 communities. We found a general lack of life history information for the species, necessary to assess the productivity of the stocks. We increased the number of susceptibility parameters to reflect the local conditions of the study area and scored those through the knowledge provided by the fishermen. All the species assessed got high susceptibility values and we prioritized *Ambulú* (*Hyporthodus acanthistius*), Alguacil (*Bagre pinnimaculatus*) and Cubo (*Caulolatilus affinis*) as vulnerable to overfishing. Our modified approach to the PSA, allowed us to tailor the PSA to local conditions, integrate local fishermen knowledge, apply it to the specific conditions of the study area, and prioritize vulnerable species in a previously unassessed fishery.

Oral presentation 2-15

Gregarious behavior of the small pelagic fish in the Gulf of California using acoustic methods

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Abstract

In the Gulf of California (GC), small pelagic fish (sardines, anchovies and mackerels) have a high ecological and economic value. A distinctive feature of these species is their ability to form schools, which can be defined by their size, density, position and location in the water column. The objective of the present work is characterize its aggregative and dynamic behavior in the water column by analyzing the acoustic information and its relationship with the prevailing environmental variables in the GC. A total of 1100 schools were recognized, which were more abundant during 2012 when the net primary productivity values in the area were highest. The importance that the Midriff island zone (lowest sea surface temperature and highest productiv-

ity) represents for the distribution of many species was corroborated, especially for the small pelagic schools, obtaining in this zone the highest number of detections per nautical mile prospected. The significant number of schools detected during the twilights and the night suggest that within the GC the typical dispersal behavior of the small pelagic schools during the night is not fulfilled. This could have favored traditional fishing methods in this area. The moon elevation and the phases, appear to have an influence in the schooling behavior of the small pelagic species, reflected in a greater depth at the time of the moon's appearance and a greater proximity to the surface during full moon nights; this behavior could be motivated by a high presence of zooplankton prey in shallow layers during full moon nights.

Oral presentation 2-16

Breeding, larval development, and growth of juveniles of edible echinoderms for aquaculture and repopulation in Ecuador

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Abstract

Echinoderms have ecological and commercial interest. Sea cucumber and sea urchin fisheries have gradually expanded in different countries and territories around the world, including South America. *Isostichopus fuscus*, *Holothuria theeli* (sea cucumbers) and *Tripneustes depressus* (sea urchin) are three feasible candidates for aquaculture and re-stocking natural populations in Ecuador. The aim of this study was to prepare a biotechnical protocol for rearing larvae and production of those juveniles, and explore asexual fission in adults of sea cucumbers. Large animals were collected at monthly intervals at a subtidal rocky coast off Santa Elena, from January 2013 to July 2018. Spawning was explored. Embryo and larval stages were completed in 48 h and 31 days, respectively, at 26.5 ± 0.5 °C. Larvae were fed a mixed diet of phytoplankton at different concentrations as they increased in size. Larval rudiment in sea urchins and hyaline granules around the larval body of sea cucumbers are important for the timing of their competence. Asexual body parts of adult sea cucumbers are functionally completed in 90 days with zero mortality. Cultured sea cucumbers reach 3 cm in size around 200 days after metamorphosis. Sea urchins can reproduce after six months of life (fast-growth), when it reach approximately 4.2 cm diameter. We produced perfectible protocols for three commercial echinoderms for aquaculturing and restocking in Ecuador. However, we have made recommendation for consideration that include increasing survivorship and supplying post-larvae for juvenile production. Our results are in context to the Blue Carbon Biotechnology Initiative.

Oral presentation 2-17

Insights for sustainable development through Salinity Gradients
Energy-based technology in small coastal communities

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⁶Doctorado Interinstitucional en Ciencias del Mar

Abstract

Energy in form of heat is liberated on the irreversible mixing of two water bodies with difference in salinity. In nature, this happens continuously on several systems such as river mouths and coastal lagoons, that is why the salinity gradient energy (SGE) is considered a renewable source of energy. Electrical energy can be obtained from salinity gradients through membrane-based technology (e.g. Pressure Retarded Osmosis – PRO and Reverse Electrodialysis - RED) in non-CO₂ emitting processes. So far, the technological development is on pilot-plant stage, having progress in materials development and performance when artificial feed waters are used, however, net power output is decreased when real feed waters are used. Regarding the applications of SGE technology, it might be used for harnessing gradients in nature and these resulting from anthropogenic activities (e.g. desalination). So far, the efforts in SGE development have been focused on the technological development to make it competitive with other renewables; however, there is not a concrete route map of how to harness the potential of SGE. This work assesses general insights of using SGE in small communities by including technical potential, technological development, environmental constraints and sociological analysis. This approach considers SGE as a sustainable alternative not only in terms of electrical energy supply for domestic uses, but in other areas such as coupled desalination-SGE systems for useful water obtention at low energy consumption, reducing brine environmental impacts and providing add-value to the effluent.

Oral presentation 3-1

Deep-water crustaceans captured with traps, like a potential alternative
fishery in the Colombian Caribbean

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Abstract

In the Colombian Caribbean, have been reported high abundance and distribution of deepwater species with potential commercial value. However, the most common

worldwide fisheries method using is trawling with a great impact within the marine ecosystems. Therefore, the objective of the present study was to determine the composition and distribution of deep-sea crustaceans, captured with a low-impact passive fishing gear (traps) in the marine area of the department of Magdalena, Colombia. Four samplings were conducted between October and November 2016, between 200 and 500 meters deep, in an artisanal fishing boat using experimental folding traps for the collection of crustaceans. Differences between the fishing areas abundance were determined and the heterogeneity of the species were evaluated with the main ecological indices (diversity, richness, dominance and equity). 131 individuals were captured, grouped in 12 families and 20 species, of which six are commercial resources in other countries. The most abundant species were *Achelous spinicarpus*, *Plesionika longipes* and *Heterocarpus ensifer*, and the biggest *Eunephrops bairdii* and the shrimp *Aristaeomorpha foliacea*. Greater abundance and diversity was found in the northern areas. The wide distribution and abundance of *P. longipes* reported in this study and previous studies allow the species to be considered as a potential fishery resource for the Colombian Caribbean.

Oral presentation 3-2

Advances on salinity gradient energy in Latin America

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Abstract

Salinity gradient energy (SGE) can be generated from the controlled mixing of two water masses with different salinity, due to the increase in Gibbs free energy resulting from this mixing. River mouths, coastal lagoons and desalination plants are potential exploitation sites. We estimate that 134 TWh/y of SGE are extractable in Latin America only from the river mouths. This amount of renewable energy is greater than the electricity consumption of most countries in the region. The river mouths of Orinoco, Paraná, Magdalena and Uruguay rivers are in the top 10 of the systems with highest SGE potential worldwide; Brazil is the country with the largest number of river mouths with extractable SGE potential and the Gulf of Mexico - Caribbean Sea region show one of the highest energy densities (potential per cubic meter) worldwide. Despite the extraordinary potential, the commercial exploitation of SGE is still limited by several challenges related with: technology development, water pretreatment, possible environmental side effects and possible collateral benefits of this energy generation. An interdisciplinary team of Latin American scientists are joining efforts to overcome these challenges and is expected to have the first field pilot of the continent in the next five years. In this talk we will discuss the main challenges, the recent advances and the prospection for the next decade.

Oral presentation 3-3

Impacts of coastal development on the resilience of coral reefs: Twenty years of monitoring from the Dominican Republic

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Abstract

Coral reef health data collected from 1995 to 2017 was gathered from three reefs along the southeast portion of the Dominican Republic to assess how coastal development, or the lack of it, has affected these ecosystems over the past two decades. The data was compared for live coral cover, macroalgae cover and herbivore fish densities over time between highly developed tourism areas and existing MPAs. The three areas selected vary greatly in both management approaches and socio-economic backgrounds. Results showed marked differences in reef health trends over time and between locations. Reef resilience proved to be a key factor in how reefs recovered after major impacts such as hurricanes and bleaching events. These results provide the first long-term evidence on how coastal development can negatively impact the health of coral reefs and their ability to recover in the face of damaging events. Such evidence can be highly beneficial for the sustainable use of these resources and the environmental services they offer to tropical islands.

Oral presentation 3-4

Acoustic telemetry as a tool for the design and evaluation of MPAs

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Abstract

Acoustic telemetry is a tool that provides information on the movements of a wide range of marine species. In addition to increasing knowledge on the spatial ecology of species, this information can be used for a variety of purposes, including the design and assessment of protected marine areas. The Arrábida Marine Park and the movements of three species (white seabream, cuttlefish and sole) were used as a case study. The information obtained through acoustic telemetry was used to 1) determine areas of use, 2) determine residence periods, and 3) generate models of species distribution in the study area. Subsequently, Marxan software was used to test different protection scenarios. Vulnerability to fishing was estimated for each species along the MPA. The results suggest that the current design of the Arrábida Marine Park offers adequate protection for the white seabream and sole but is not efficient in order to protect the cuttlefish. The framework presented here can be applied to any MPA during the design or evaluation phase providing relevant information to stakeholders.

Oral presentation 3-5

Designing a Marine Protected Area in the Guatemalan Pacific

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Abstract

"Las Lisas", a coastal wetland with its associated marine influence zone located in the eastern part of the Guatemalan Pacific Coast was included as a prioritized site to establish a MPA in that region as part of the GEF funded project "Conservation and Sustainable Use of Biodiversity in Coastal and Marine Protected Areas". In order to design a MPA aiming to conserve and utilize the coastal marine resources of such area in a sustainable way, an intense research and consultation process following the Marine Spatial Planning methodology and principles was conducted during 2016-2018. Technical information regarding 43 biological, social, legal and administrative criteria was obtained to conceptualize and design the MPA. Based on the current, potential and possible future uses of the area, a zoning scheme identifying 11 different zones (with their own objectives, permitted and non-permitted uses), including a marine no-take zone, was proposed. Parallel to the design process, an intense consultation and joint construction process took place with the seven local communities' part of the proposed MPA and with local, regional, national authorities and actors with influence and interest in the area, which led to a MPA acceptance of 94%. The proposed MPA encompasses 104,059.49 hectares (1,040.59 square kilometers), from which 101,847.61 hectares are marine and 2,211.88 are terrestrial. If declared, "Las Lisas" would establish a conservation scheme on the 0.79% of the Guatemalan Exclusive Economic Zone, a promising start for the management and sustainable use of the marine coastal ecosystems in the region.

Oral presentation 3-6

Prediction and seasonality of potential fishing areas for dorado (*Coryphaena hippurus*) and tuna (Scombridae) and their relationship with environmental changes in the Colombian Pacific and nearby areas

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Abstract

The hypothesis of this project suggests that, in the Colombian Pacific and nearby areas, the habitat suitability index (HSI) for dolphinfish and tuna are explained by changes in temperature, salinity, sea level height, and circulation patterns. The objective of this research is to analyze the effects of environmental variables on the distribution of tuna and dolphinfish potential habitats in the Colombian Pacific, by selecting the distribution model that best explains the behavior of the presence as a function of the physical oceanographic information and generate the respective potential distribution maps. Finally, global climate models with different climate change scenarios projected to the year 2100 are used to evaluate modifications

in projected potential habitats and their respective suitability indices. The climate change indicator was the increase in sea surface temperature. The fish presence data were obtained from the Colombian on-board Fishing Observer Program (2009 to 2015), and the environmental data were downloaded from the Copernicus Marine Environment Monitoring System. To date, the time series of tuna and dolphin-fish presence data for the Colombian Pacific has been reconstructed, in addition to estimating a mathematical formula to standardize the fishing effort of the smaller purse-seine vessels for this area. Finally, the fish aggregating devices used as a complement to the fishing gear are described. The results of the study update the information on the status, location and quantity of the fishing resource that can be exploited in the country.

Oral presentation 3-7

Community Structure of Gelatinous Zooplankton (Meduzosoa and Tunicata) of Tropical East Pacific and Antarctic Peninsula, Austral Summer 2014-2015

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Abstract

Although the research conducted on Gelatinous communities has increased in last years, for the East Tropical Pacific (POT) and Antarctic Peninsula (PA) provinces, composition and structure of these communities is still poorly known. Gelatinous zooplankton was sampled during the First Colombian Expedition to the Antarctic "Expedición Caldas" (2014-2015), to describe their richness and abundance in POT (Colombia, Ecuador and Northern Perú), and PA (Gerlache Strait) stations. Samples were collected using 200 and 300 microns nets, in six horizontal trawls at depths between 30 and 50 meters. Physical and chemical data (temperature, salinity, dissolved oxygen, water density and turbidity) were measured to determine their relationship with the community structure. Richness ($p < 0.05$) and abundance ($P < 0.05$) were different between the provinces. Higher richness was found in POT than in PA. Dominant species were *Doliolum nationalis*, *Liriope tratrophylla*, *Aglaura hemistoma* and others in POT and *Salpa gerlachei* in PA during the seasons sampled. Some species like *A. hemistoma* and *L. tratrophylla* were found in all the POT sampled zones while others were restricted to only one sampled zone (*Fritillaria pellucida omani*, *Chelophyes appendiculata*) suggesting that is important to analyze the biogeography of these organisms in order to understand their distribution and ecological dynamics. Site was the main determinant of community structure and within sites, temperature and salinity for POT, and dissolved oxygen and water density for PA. These communities presented a latitudinal gradient of distribution, and it is possible that differences between provinces will be due to local variables.

Oral presentation 3-8

Multiannual analysis of the fishing impact of the white sea urchin *Lytechinus variegatus* (Lamarck, 1816) (Echinoidea: Toxopneustidae) in the south of Margarita island, Venezuela

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Abstract

To assess the impact of sea urchin fishing and its closure effect, abundance and size data were collected from sea urchins in extraction areas (impact zones) and without extraction (control zones) between 2012-2015, as well as the variables associated with *Thalassia testudinum* patches. The aim of this study was to test 1) if there is an impact of sea urchin fishery with 1997-98 reference data, 2) the effect of the seasonal closure on the recovery of populations, 3) a possible expansion of the area of fishing, from 2014 fishing season. The results show a decrease in densities due to their extraction over the years, without detection of populations recovery during the seasonal closure, which is also constant throughout the study period. Seagrasses presented better conditions in control zones than in the impact zones. The normal distributions of sea urchin sizes suggest a continuous recruitment and there was no difference between impact and control zones. The decrease of densities from 2014 fishing period observed in a locality, initially considered as a control zone, is attributed to a possible expansion of the fishing zone. Given the low densities observed in the usual fishing areas, it is likely that local populations of *L. variegatus* will collapse under current exploitation levels. The evaluations show that the impact of the extraction is severe, persistent over time and without evidence of recovery. It is recommended to exercise greater regulation on the activity and execute management measures that allow to recover the populations.

Oral presentation 3-9

Environmental education and its application in marine sciences

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Abstract

Although Colombia has great biodiversity in its seas, the poor management and the pressure that coastal zone users place on its resources, has affected in the drastic reduction of some of its strategic populations such as turtles and marine mammals, taking them to be categorized in the different red lists of conservation, in both national and international. In recent years, it has become evident that in addition to the scientific knowledge generated about the species, Environmental Education (EE) programs must be consolidated around these, in order to contribute and guarantee their protection. Faced with this need, the Conservation Program of Marine Turtles and Mammals - ProCTMM of the Jorge Tadeo Lozano-Mundo Marino University, search through this work to consolidate EA strategies that have been devel-

oped with different social actors: fishermen's associations, educational institutions, tourists and visitors, evaluating in particular the degree of receptivity of participants in formal education: preschool, primary and secondary; For this purpose, pedagogical instruments and tools were structured, designed and put to the test, such as: feedback booklets (35), specialized training workshops (5), illustrative talks (17), recreational activities (12), instructional practices (11) and commemoration of environmental allusions (6), in accordance with the levels of schooling contemplated. Based on the results obtained, a very high degree of receptivity (80-95%) was recorded in the three groups considered, contributing to the awareness and awareness of the sustainability and perpetuation of these species and their associated marine ecosystems.

Oral presentation 3-10

Mid to Late Holocene geochemical and diatom based environmental reconstruction of Colombian Coastal Lagoons

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Abstract

Modern tropical coastal lagoons are semi-closed shallow water bodies generated by sea level changes, floodplains stabilization, and/or climate fluctuations occurred since the Pleistocene-Holocene transition. They have low to very low flushing regimens, and their trophic state is oscillatory in nature. These characteristics make them excellent localities for nutrient cycling and as such are some of the most productive environments on earth. However, in the last few decades, eutrophication and water quality impoverishment are putting these ecosystems at risk, and thus socio-ecological services such as fishing, shelter, climate regulation, and aesthetics are in danger of being lost. Governmental and scientific efforts are being made to detect threshold conditions that provoke major ecological shifts in these ecosystems. Nonetheless, it's success is very modest due to the non-linearity inherent in any ecological change, and the multiplicity of spatial and temporal scales at which drivers might operate. This study present a Mid to Late Holocene paleo-ecological reconstruction of two tropical semi-closed coastal lagoons. From multi-proxy analysis, we assess the importance of paleo-nutrients content in the sediment as the key response variables, and climate change as the major ecological driver. Anthropogenic settlements are detected in the littoral since 6000 yr BP. The role of humans as receivers or producers of ecological change is under study.

Oral presentation 3-11

Relationship between fish catch and environmental variables reveals the importance of mangroves to small-scale fisheries in Urabá gulf, Colombian Caribbean

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Abstract

Mangroves provide a range of valuable ecosystem services for instance: fish production, coastal protection, carbon storage, and sediment trapping. We study linkages between environmental variables and capture per unit of effort (CPUE) of key fish species in Urabá Gulf (ecodistrit). We include mangrove parameter (area, perimeter and carbon accumulation in aerial biomass) and pelagic environment (Salinity, Total Dissolved Solid) and productivity (Chlorophyll a, Seston and Zooplankton Biovolumen) variables. Finer-scale analyzes were done using experimental fishing data and high-resolution image photos. Spearman correlations and Stepwise Multiple Regression analyses were used to know which environmental variables explained and predicted CPUE species-specific. Positive correlations (Spearman) showed that mangrove variables (area and perimeter) explained the CPUEs of four key species: *Ariopsis canteri*, *Mugil incilis*, *Oligoplites saurus*, *Cetengraulis edentulous*. Step way multiple linear regressions showed that mangrove rather than pelagic characteristics were important to predict CPUE of three key species: *A. canteri* ($r^2 = 0.49$), suggesting that it is a mangrove-associated species with a strong mangrove dependency; *M. incilis* ($r^2 = 0.40$), suggesting that it is a mangrove-associated species and *Scombromorus brasiliensis* ($r^2: -0.52$) suggesting that is a marine straggler species; no dependence on mangroves. While pelagic environmental and productivity variables predicted the capture of seven species: *Centropomus pectinatus*, *Oligoplites saliens* y *Cetengraulis edentulous* by TDS; *Oligoplites sauros* by salinity; *Bagre marinus*, *Caranx hippos*, *Bagre bagre* by Chla a. Results of this study can be useful for the management of fishery resources and the conservation of the mangrove ecosystems of the Gulf of Urabá

Oral presentation 3-12

Building a network for the characterization of marine ecosystems in Colombia by using modern technologies

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Abstract

This work addresses the construction of a specialized network to promote the de-

velopment, use, and appropriation of modern technologies for the characterization of marine ecosystems in Colombia. The efforts have been led by the Universidad Pontificia Bolivariana - UPB, the Universidad Nacional de Colombia Sede Medellín - UNALMED, and the General Maritime Directorate (DIMAR) and its Caribbean Center for Oceanographic and Hydrographic Research CIOH. Other institutions, such as Parques Nacionales Naturales de Colombia - PNN, Geomares SAS (a marine surveying company), Ecopetrol, and Instituto Geográfico Agustín Codazzi have joined the network through different projects. Such projects have been executed by members of the network, and are related to the development and use of tools and methods for the characterization of marine ecosystems by using satellite images, remotely piloted aircraft systems, high resolution multi-beam bathymetry data, oceanographic measurements, remotely operated vehicles, gliders, advanced underwater video/image acquisition systems, geo-referenced diving, and specialized software among others. The use of such technologies can help producing cartographical data that will help making informed management decisions. Thus, the ongoing and new projects are being designed with an inherent emphasis on modern methods that can be useful for the management of marine ecosystem services and for addressing challenges related to marine spatial planning processes, such as lack of mechanisms for stakeholders involvement and enforcement, inadequate technical information, and limited capacity. Because these modern technologies have not been consistently used for the integrated characterization of Colombian marine environments, this inter-institutional effort constitutes one of the first approaches towards the use of robotics and remote sensing technologies in order to enhance the capacity to document, understand, manage and protect marine habitats in the country. Using such technologies to characterize ecosystems (coastal, shallow-water and deep-water) can help strengthening decision making processes and implement biodiversity conservation policy to ensure appropriate and sustainable management towards the achievement of the Sustainable Development Goals in 2030.

Oral presentation 3-13

Carbon stocks in the Pacific Colombian mangroves

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Abstract

Mangroves are well known for their high rate of carbon accumulation. However, they are threatened by deforestation and degradation which, in turn, generate high greenhouse gas emissions. Since mangroves are ecologically diverse within the same climatic zone, coastal geomorphology and hydrological processes influence the chemical and physical conditions of their soils, as well as the structural development of their vegetation and, consequently, on the carbon storage capacity of their different compartments. Therefore, it is essential to quantify the ecosystems carbon stocks. This study estimated the carbon stocks of Málaga bay (Colombian Pacific). Carbon stocks were calculated in 45 plots of 500 m² (20 x 25 m), as well

as their relationship with the soil physicochemical characteristics. The total carbon stocks was 226.4 ± 126.9 Mg C ha⁻¹. The soil was the main compartment, representing 62,8% of the carbon stock, followed by aboveground biomass (31,8%), necromass (2,8%) and roots (2,7%). The highest carbon stock in soil was associated with higher values in the C/N ratio. Additionally, we found greater allocation to the root biomass at the expense of the aboveground compartment when soil nutrients were less available. These results reaffirm that the protection of mangroves is one of the key in climate change mitigation strategies, however, carbon stock estimates should take into account the great variability of these forests.

Poster presentation 3-1

CEROCONFLICTO

Romanovna Zhdanovskaya, A.

Performance Art in the Environmental Department, Dominican Republic

Abstract

Growing up in Punta Cana, Dominican Republic for more than 14 years: has made my eyes a living proof of how Google Images of our Caribbean Coastline passed from being just a shot of its amazingness in real life, to a sweet memory of how wonderful everything used to be. For a completely dependent country of tourism, doing nothing to save our island, but rather blaming nature for the chaos is a total heartbreak. The lack of education in Caribbean Third-World countries is something that has to change. My goal apart from creating consciousness is working with what we already have. So the idea is creating two different motors, with the help of my grandfather Victor Gurin (who is a scientific engineer). He has already worked in the past changing motors of big machines to more ecologically sustainable ones. I would like to promote the switch of toxic waste coming from party boats and infinite excursions on our coast, to a more environmentally friendly deal. Apart from this, we will design and construct a semi-permanent machine that cleans what we already have in the present day. Its is an idea in development, any help and feedback is much appreciated.

Poster presentation 3-2

Evaluation of the metabolic profile in the culture of a Colombian Caribbean see reef benthic cyanobacteria consortium

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Abstract

As a product of a long evolutionary history and the lack of physical defenses, marine benthic cyanobacteria become a promising source of bioactive compounds. Considering the diversity of these organisms in Colombia and its biotechnological potential, the culture of 19 Colombian Caribbean See cyanobacteria consortia were established. A modification in the SWBG-11 culture medium increased the iron bioavailability in the growth medium and promote the consortia consolidation under lab conditions. From those, only five survive to the large volume resuspension process and therefore, their raw extracts were prepared. The biological tests, showed that CB-09 consortium had the lowest ecotoxicity against *Artemia salina* and the highest activity against *A. aegypti*. This consortium was exposed to variations in the phosphorous, iron and nitrogen concentrations, where it was observed that nutrients limitation and depletion conditions, promote the production and/ or biosynthesis of some compounds, possibly related with an increase in the insecticide activity of the extracts. For its chemical study, a large-scale culture of the selected consortium where performed and crude extracellular and intracellular extracts were prepared using different polarity solvents. Each of the extracts were analyzed and treated using different separation and spectroscopic techniques, revealing that they are complex mixtures of salts and metabolites, where fatty acids were one of their main components. From these results, we proposed the structures of a cyclic peptide analogous to dolastatin D and an amide, and we began the construction of molecular networks that reveal the metabolic complexity of the obtained extracts. The biological activity test of the scale culture extracts revealed that they possess growth inhibitory activity against *A. aegypti* larvae.

Poster presentation 3-3

Population structure of the blue land crab (*Cardisoma guanhumí*) in four coastal localities of Turbo municipality

Zapata Hinestroza, J.A.; Quiceno Cuartas, P.A. & Velasquez Aristizabal, J.A.
Ciencias del Mar, Universidad de Antioquia

Abstract

Cardisoma guanhumí is an important fishing resource for the coastal populations that inhabit the region of Urabá, this fact has led to a high capture of this crustacean, causing the decline of their populations. The reason for their indiscriminate capture is mainly that the meat is very popular with local people and is offered as an exotic snack for tourists. Therefore, this species is classified as vulnerable (VU) in the Red Book of Marine Invertebrates of Colombia. The main threats that *C. guanhumí* faces globally, is the loss of its natural habitat and the indiscriminate artisanal capture. According to the above, this project aims to find out what is the actual population structure of the blue crab in four coastal localities of Turbo and aims to see if there is some differences among the sites, and what is the principal cause of their threat. We suppose that is due to the Holy Week, week where local people are used to eat crabs as an exotic snack or just for the "time." This project has found that there is a threat on blue crabs in their habitat. Up to the time, there is less habitat for them, and they are obligated to migrate toward banana crops where local producers kill them because they eat the banana plants causing them the dead. The results of this project will serve as a base to local management and care of this species, having in account that this is badge species for this municipality.

Poster presentation 3-4

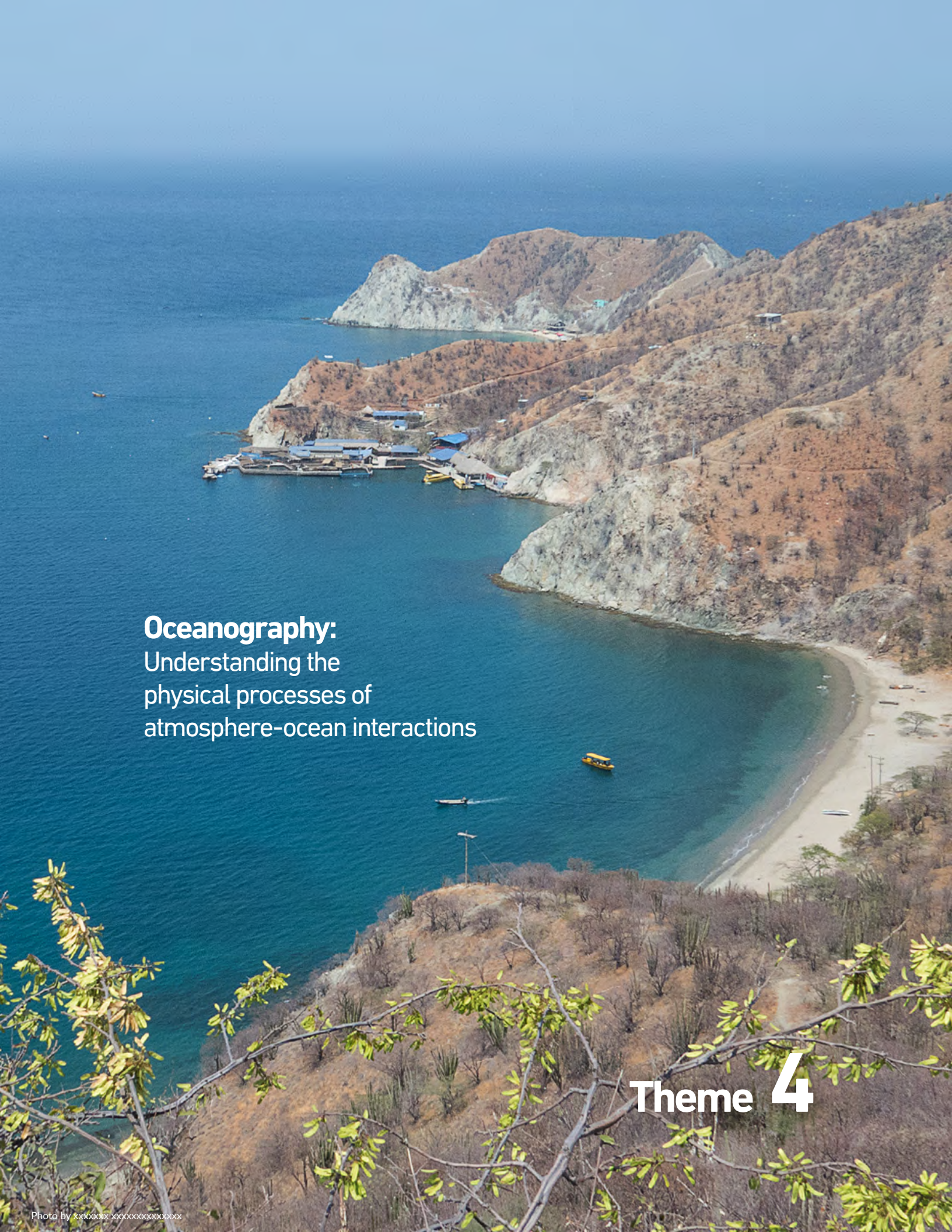
Population growth of the calanoid copepod *Paracalanidae parvocalanus crassirostris* fed with different species of microalgae

Ochoa Tovar, M. & Fuentes Montes, M.A.
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Abstract

A morphometric description was made of the different stages of the copepod *P. crassirostris* in 142 individuals and two experimental phases of its culture under a triplicate randomized design, the first with three diets treatments with different microalgae combined from the *Isochrysis galbana* species (I), *Chaetoceros* sp. (C) and Swedish Tetraselmis (T), 50:50 ratio as follows: T1 (I + C), T2 (T + I), T3 (C + T); later in phase II, the best treatment of phase I (T1) was tested in different proportions T1 as follows: T1 (70:30), T2 (50:50), T3 (30:70). The treatments of both phases were corresponding to 8 µg.mL⁻¹ of dry biomass, initial density of 2 copepods / mL, with aeration, photoperiod 10-14 hours. Water quality was recorded, density and population composition were evaluated every two days. The population parameters were determined: time duplication; instant growth rate; dairy produce. The nauplii recorded total length of 117.4 ± 7.1 µm and body width 55.8 ± 2.5 µm. The combi-

nation of (I + C) proportion (70:30) recorded the highest density of nauplii (6.44 ± 0.29 Org.mL⁻¹) with K values = 0.9 ± 0.1 days⁻¹; PD = 2.7 ± 0.1 org.ml⁻¹.day⁻¹; TD = 0.8 ± 0.1 days⁻¹ after 4 days, with significant differences ($p > 0.05$) with respect to the other treatments. The microalgae diet (I) + (C) allows greater productive efficiency of the copepod. The small size of the nauplii makes it viable for use as live prey from the first feeding on fish larvae with small mouth opening (<150 μ m).



Oceanography:
Understanding the
physical processes of
atmosphere-ocean interactions

Theme **4**

Oral presentation 3-14

On the exchange of carbon dioxide between the ocean and atmosphere

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Abstract

The ocean-atmosphere exchange of greenhouse gases is a key process in establishing our planet's climate and its changes. The main physical factors affecting this exchange are to be discussed in this work, while the focus of this research is to approach the problem of determining the relative importance of those physical factors through detailed measurements and analysis. It is important to bear in mind the needs of better parametrisation of the exchange processes, in order to improve our ability to predict the climate. The study of the carbon dioxide exchange in terms of a transfer velocity and also of an exchange coefficient is dealt with in this work and the analogy with the exchange of other physical variables and chemical compounds is addressed. In particular, the exchange coefficient as a function of wind speed is explained, and the effect of other phenomena besides the wind is discussed. A detailed analysis of the most relevant challenges we are facing is also given, upon the basis of recent efforts to carry out ocean field campaigns to measure the most relevant physical variables involved in the exchange process.

Oral presentation 3-15

Effect of small-scale transport processes on phytoplankton distribution in coastal seas

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Abstract

Coastal ocean ecosystems are major contributors to the global biogeochemical cycles and biological productivity. Physical factors induced by the turbulent flow play a crucial role in regulating marine ecosystems. However, while large-scale open-ocean dynamics is well described by geostrophy, the role of multiscale transport processes in coastal regions is still poorly understood due to the lack of continuous high-resolution observations. Here, the influence of small-scale dynamics (O(3.5–25) km, i.e. spanning upper submesoscale and mesoscale processes) on surface phytoplankton derived from satellite chlorophyll-*a* (Chl-*a*) is studied using Lagrangian metrics computed from High-Frequency Radar currents. The combination of complementary Lagrangian diagnostics, including the Lagrangian divergence along fluid trajectories, provides an improved description of the 3D flow geometry which facilitates the interpretation of two non-exclusive physical mechanisms affecting phytoplankton dynamics and patchiness. Attracting small-scale fronts, unveiled by backwards Lagrangian Coherent Structures, are associated to negative divergence where particles and Chl-*a* standing stocks cluster. Filaments of positive divergence,

representing large accumulated upward vertical velocities and suggesting accrued injection of subsurface nutrients, match areas with large Chl-*a* concentrations. Our findings demonstrate that an accurate characterization of small-scale transport processes is necessary to comprehend bio-physical interactions in coastal seas.

Oral presentation 3-16

Sedimentary features and seasonal benthic metabolism in a tropical coastal area (Taganga bay, Colombian Caribbean) impacted by a sewage outfall

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Abstract

Sedimentary features (organic matter quantity, C, N and P pools and $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$) and benthic metabolism (aerobic respiration, denitrification, and nutrient regeneration) was measured along a gradient of impact generated by a submarine outfall in Taganga Bay, Colombia. Two samplings were performed in November 2017 (no-upwelling period) and in January 2018 (during upwelling) at 4 stations (in the proximity and at 100 m, 750 m and 1800 m far from the outfall, respectively). From each site, plexiglass liners were collected by diving for sediment characterization ($n=4$) and metabolic measurements ($n=8$). Sedimentary pools were analyzed along the upper, more reactive 0-3 cm horizon, by extruding and slicing the intact cores. Fluxes (O_2 , N_2 , CH_4 , Fe^{2+} , Mn^{2+} , NH_4^+ , NO_2^- , NO_3^- , PO_4^{3-} and SiO_2) were measured in the laboratory via short-term (maximum 6 hours), dark, start end incubations under constant stirring and at in situ temperature. Sequentially to fluxes we measured denitrification and dissimilative nitrate reduction to ammonium rates via the r-IPT, adding increasing amounts of 15NO_3^- to the core water phase ($n=12$). Results suggest measurable impacts of the outfall, as evidenced by marked differences in $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ values among stations and supporting large organic matter input from terrestrial sources. The influence of the outfall was clearly detectable 750 and 1800 m away from the point pollution source outfall (~ 40 and ~20 % contribution of terrigenous organic carbon, respectively). Flux data, in particular those of O_2 , suggest also significantly higher respiration rates in the proximity of the outfall, only partially coupled to nutrient regeneration. Denitrification was low, due to low NO_3^- concentration in the water column and limited nitrification. However, it allowed to trace differences among sites and seasons.

Oral presentation 3-17

Methodological approximation to the assessment of biological production and destruction of calcium carbonate in coral reefs of the Colombian Pacific

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Abstract

Although Colombian Pacific coral reefs are considered well developed reefs in the south range of the ETP, they grow under marginal conditions. Hence, their structure and development are relatively simple and modest, compared to coral reefs elsewhere (e.g. Caribbean and IndoPacific). The largest Colombian Pacific coral reefs are located in Gorgona National Natural Park; these reefs are formed mainly by branching corals of the genus *Pocillopora*. These ecosystems endure continuous and stressful conditions, at both local (e.g. aerial exposures, directly (rain) and indirectly (run-off) freshwater input) and large (e.g. ENSO) scales. Regardless these disadvantageous conditions, these reefs seem to thrive, so constructive processes must surpass destructive ones. In order to evaluate the balance between constructive and destructive processes, different approaches were used to measure the contribution of corals and crustose coralline algae to coral framework construction and the contribution of fishes and invertebrates to coral framework destruction. Here, the main methods used to respond to these questions are shown and partial results obtained with this methodology reported. The proper way to analyze these results is also shown. In general, highly complex processes like this are difficult to measure in full; however, good approximations are possible when experimental designs are planned carefully.

Oral presentation 4-1

Multitemporal coastal changes in the Colombian Pacific: Mangroves and intertidal sediments using satellite imagery and Unmanned Aerial Vehicles (UAV's)

Mejía-Rentería, J.C.^{1,2,7}; Cantera-Kintz, J.R.¹; Castellanos-Galindo, G.A.^{1,3,4}; Ricaurte, C.⁵; Rovere, A.³; Casella, E.³ & Hamilton, S.E.⁶

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Abstract

Environmental conservation, management, and policy rely on accurate scientific information and interpretation. Dramatic numbers related to the decline of a natural resource often get the attention of the media, and even the scientific community, and propagate through to wider society. Such headline-generating reporting of dramatic environmental loss scenarios can confuse and may result in poor decision making related to the application of funding priorities and policies driven by concerned scientists, environmental groups, and the public. Here we analyze the historical and current estimations of mangrove cover of a relatively pristine mangrove area of the Neotropics along the Colombian Pacific coast. Our comparison reveals highly differing estimates of mangrove coverage based on the methods used since the 1960's. As opposed to what is commonly claimed by some studies, and the media, mangrove cover in this region has likely remained relatively stable, at least over the last 15-years. Estimates constructed between 1966 and 1992 likely overestimate mangrove area due to the lack of high-resolution delineation methods, such as satellite imagery, and a lack of robust defined methodologies. Mangroves along the Pacific coast of Colombia, despite localized losses, likely remain one of the most well-preserved tidal forests of the Neotropics. Future analyses of mangrove in this region need to treat with caution earlier estimates of mangrove cover that are likely overestimates based on dated technologies and undefined methodologies. Here we also present our recent work, which consists in short-term analysis of beach topographic changes in response to natural processes as waves, wind, tides, currents and storms, using accurate 3D data collected from drones. The resulting digital elevation model (DEM) has a very high resolution (few centimeters) and the dense point cloud contains around 100 times more georeferenced points than the conventional 2D profiles. The aim of this work is to show the potential of the UAV and Structure from Motion (SfM) methodology to study these topographical changes. Understanding volume beach dynamic is critical for local coastal communities, environmental agencies and the decisions makers in the Colombian Pacific Coast.

Oral presentation 4-2

Submerged structure effects on oscillatory flows
(Wave-seagrass interaction)

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³Doctorado Interinstitucional en Ciencias del Mar

Abstract

In the present work, a numerical and experimental works were performed. With the numerical model, a dynamic mesh and RANS model (k-w sst) were used to generate waves and to solve a complex vortex formation by the adverse pressure gradient produced by a submerged slender column with similar dimensions to a seagrass stem. In the experimental work, a set of wave-random seagrass canopy distribution experiments were performed in order to analyses the effect of the shear layer at the top of the canopy. In the numerical simulation, the vortex produced by the adverse

pressure gradient is in charge of induced a backward wave breaking process due to strong transport of mass at the upper zone of the vortex. This turbulent structure is the dominant process even when the wave breaking occurs. With the experimental work, a steady current was found, it is not induced by a wave decay nor by a background current but it is released by the shear layer nearby the canopy top. So three main mechanisms of steady currents in seagrass-canopy environments can be identified: 1) background current coming from the open sea (or outside the seagrass canopy system), 2) a current because of the wave decay at the wavelength scale and 3) the steady current produced by a shear layer at the top of the canopy at the particle excursion scale.

Oral presentation 4-3

Development and implementation of a stochastic dynamic model for search and rescue operations in the Colombian Caribbean Sea

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Abstract

Development and implementation of a stochastic dynamic model for search and rescue operations in the Colombian Caribbean Sea, which takes into account the different factors to which a drifting person is exposed, such as currents, the action of waves and the leeway. This model will employ the Langevin equations at different levels, and will be validated and calibrated with data from drifters that simulate the behavior of a drifting person. This model coupled with an operational system with information on wind, waves and currents, using data from drifters in the study area, will allow an error reduction in the predicted position of a drifting person or drifting object in the Colombian Caribbean Sea, during a period of 48 hours. Likewise, there must be greater dispersion in the non-homogeneous hydrodynamic fields and greater complexity of the trajectory, attempting the highest degree of certainty in the prediction results of the model. In the scientific aspect, a new proposal is presented in the development of the Langevin equations, in different level orders to describe the dynamics of the particles, in inhomogeneous hydrodynamic fields, as well as for the assimilation of data obtained from drifters. This work will have a social impact, by strengthening the security of human life at sea. In the economic aspect, it will reduce the operating costs of the units required in the search and rescue of the person at sea.

Oral presentation 4-4

Insights of ocean acidification processes in Colombia

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Abstract

One of the main concerns related to marine ecosystems, especially coral reefs, is the pH decrease in seawater due to the increase of atmospheric CO₂ -process known as ocean acidification-, with effects that can change differentially at various locations worldwide. Declared by the UNESCO in 2000, the Seaflower International Biosphere Reserve is one of the widest marine reserves in the world and is part of the system of marine protected areas in Colombia (AMPs). This research evaluated changes of seawater pH in Seaflower over the last century. Sampling was performed at the NW of San Andrés Island, in June 2015, with a sediment corer (designed in the framework of this project) and at depths between 15.2 and 16.9 meters. Results of $\delta^{11}\text{B}$ and $\delta^{13}\text{C}$ measurements, applied on the benthic foraminifera *Amphistegina lessonii*, show a suspected increase in the anthropogenic CO₂ input to seawater for the last century. The current work, pioneer in Colombia, suggests further research about the resilience mechanisms at the country's Caribbean basin, as the phenomena is likely to cause loss of calcareous tissue in marine calcifiers.

Oral presentation 4-5

Estimating the Potential of Deep Ocean Water in the Caribbean

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Abstract

Deep ocean water (DOW) is a renewable alternative to the many sustainability challenges that the Caribbean faces today. DOW can be used to provide seawater air conditioning (SWAC) for buildings and greenhouses, electricity through an ocean thermal energy conversion plant (OTEC), and nutrients for aquaculture and cosmetic industries. Despite the many benefits, today the implementation of DOW technologies in the Caribbean is inexistent, and the studies about DOW potential are scarce. The estimation of the practical potential remains limited to only three cities: San Andres, Montego Bay, and Puerto Plata. Thus, in this study, we aim to develop a methodology to estimate the maximum practical potential of a city using the available information on bathymetry, ocean currents, temperatures and salinity, and considering several environmental restrictions. We use the proposed methodology to estimate the potential in Willemstad, Bridgetown, San Andres, Montego Bay and Puerto Plata. We found that the DOW potential in each city is big enough to supply 100% of the air conditioning demand and to install OTEC electricity plants with ca-

capacities between 10 – 35 MW per city. We also calculated a plant capacity factor that indicates the average monthly availability of the DOW resource. These estimations constitute an input to future feasibility and design studies of DOW technologies in the Caribbean. Finally, given the vast potential found, we recommend to include DOW technologies in the sustainability and energy policy in the Caribbean.

Oral presentation 4-6

Analysis of short-term processes interactions on coastline evolution

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²Doctorado Interinstitucional en Ciencias del Mar

Abstract

The main goal of this study was to analyze the evolution of the coastline on a sandy beach under the presence of short processes like storms. The study zone chosen has accurate profile measurements since 1981 to present; also there are a collection of data buoys since 1980 to present and information of 490 storms occurred in the study area since 1980. The methodology consisted to identify the profiles which have field measurements and wave data before and after a storm in order to get erosion/sedimentation maps and analyze the relationship of the maps with the behavior and characteristics of the storms like wave height, period, direction and duration. The results could help to understand the behavior of the beach and response to short processes.

Oral presentation 4-7

Sea surface temperature inter-annual variability in the northeastern tropical Pacific and its relationship with El Niño and La Niña conditions

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Abstract

The analysis, monitoring and prediction of the extreme phases of inter-annual variability of the tropical Pacific have been focused in the equatorial channel, in the Niño 1+2, Niño 3, Niño 3.4 and Niño 4 sectors. However, some situations with remarkable anomalies have been observed south and north of this channel in the tropical eastern Pacific, that have induced climate anomalies in several regions of South and Central America. In fact, southern of this channel, in front of the coast of Perú, it was detected special situation, which called El Niño-costero. As observed in the second half of 2014, it is possible that similar situations have been observed in the north-eastern tropical Pacific, which may be the cause of climatic anomalies in Central America and northern South America that are not attributable to the phenomena of El Niño and La Niña recognized until now. To corroborate this hypothesis, the behavior of anomalies in the sector between 5°N-15°N and 80°W-120°W was analyzed. This paper summarizes the results of this exploration.

Oral presentation 4-8

Seasonal sea level variation in the San Andres, Providencia and Santa Catalina Archipelago, Caribbean Sea

Torres Parra, R.R.^{1,2}; Otero Díaz, L.^{1,2}; & Mejía Trejo, A.¹

¹Universidad del Norte, Colombia

²Doctorado Interinstitucional en Ciencias del Mar

Abstract

The sea level seasonal cycle was assessed in the San Andrés, Providencia and Santa Catalina Archipelago in the Caribbean Sea using 22 years of absolute dynamic topography. Large spatial variability was found in the sea level seasonal spectrum in the 9 most important geographical features that constitute the archipelago, depending on their meridional position and as consequence of different forcings for this cycle present in the Colombian Basin. The sea level annual variation has a minimal range of 2.7 cm in Quitasueño and a maximum range of 9.5 cm in Roncador. The seasonal cycle is maximum in July-August and minimum in January-March toward the north of the archipelago; on the contrary, the seasonal cycle is maximum in February-March and minimum in August-September toward the south of the archipelago. The seasonal cycle explains between the 3 and 23% of the monthly sea level variation in the archipelago and it is not steady in time; changes up to 3.6 cm were found in the amplitude and 83° in the phase lag when the annual cycle was assessed fractionating the time series in 5-year segments. The seasonal cycle contribution must be included in the archipelago's risk assessment associated to sea level extreme values.

Oral presentation 4-9

Analysis of the 3D behavior of currents in the north coast of Colombia

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¹Universidad del Norte, Colombia

²Doctorado Interinstitucional en Ciencias del Mar

Abstract

The objective of this work is the study about the 3D behavior of the currents in the north coast of Colombia, in order to analyze its seasonal variation. For it, we obtain data of the eastward and northward speeds from Hybrid Coordinate Ocean Model (HYCOM) since January from 1993 to December from 2016. To analyze the 3D behavior was chosen a transect parallel of the coast of 684 km long, with an initial point of geographic coordinates (-76.00°W, 10.52°N) and a final point of coordinates (-70.30°W, 13.14°N). For this transect, matrices were constructed with velocity data for 33 depth levels from 0 to 900 m. The results of the analysis, present that the points at the initial outermost of the transect (from 0 to around 100 km) show a similar to the seasonal behavior of the Panama-Colombia Giro. In the same way, the points located at the end of the transect (from 584 to 684 km approximately) show a seasonal behavior similar to the behavior of the Caribbean Current. Between these two extremes, the data show the seasonal behavior of the Caribbean Current Contra. This middle segment of the chosen transect passes through the zone where the

upwelling of the Guajira occurs and possibly the behavior in depth of the currents can give an explanation of the lack of nutrient productivity of this upwelling.

Oral presentation 4-10

Oceanography, fish larvae and artisanal fisheries, knowledge for the protection of a resource

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²Doctorado Interinstitucional en Ciencias del Mar

Abstract

The early stages of development of fish (ichthyoplankton) and their interaction with physical and biological environmental forcings are studied in the Gulf of Tortugas, Valle del Cauca, Central zone of fishing of the Colombian Pacific, to: 1. describing the spatial and temporal variation of the abundance of fish larvae in this locality, with particular emphasis on species of interest for the artisanal fishery, 2. establishing the physical and biological factors that they would be modulating the variation of the structure and composition of fish larval assemblages in this region and 3. identify areas of importance for the availability of fish larvae in the Tortugas gulf region as an input to strengthen integrated management initiatives local fishing resource. As a working hypothesis it is stated that. The main physical and biological processes that modulate the availability and pattern of spatial and temporal distribution of fish larvae in the Gulf of Tortugas will be the pattern of surface circulation, the variability in vertical stratification and the productivity of the system, conditions that as a whole would be delimiting the environmental characteristics necessary for the development of the larvae. From systematic oceanographic sampling in the Gulf of Tortugas considering the intra-annual climatic variability, zooplankton fishing is done to count and identify fish larvae, establish the composition of the zooplanktonic community, in addition to registering oceanographic physical-chemical bathymetry, temperature, salinity, density, transparency, particulate matter (inorganic and organic), intensity and direction of the current to define the local fields of surface circulation and chlorophyll- a. Univariate community descriptors are used to establish the assembly structure of fish larvae and multivariate techniques are used to identify the spatial and temporal variation of the composition and their relationship with the registered oceanographic variables. Finally, a hydrodynamic model of the study area will be implemented through the ROMS tool that will serve as the basis to consolidate a physical-biological model coupled with the ICHTHYOP tool. The results of this research may be incorporated by environmental authorities and social organizations associated with artisanal fisheries to implement adequate measures for the conservation and sustainable use of the fishing resource. It allows us to understand the ecological factors present in this type of coastal systems at a small scale, in addition to their temporal dynamics”

Oral presentation 4-11

Hydrodynamic connectivity in the Seaflower Biosphere Reserve system and its potential impact on biological connectivity

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Abstract

The influence of the ocean currents over marine population's connectivity is a fundamental key in the territory planning and as consequence in the design of marine protected areas (MPA's). In addition, it is important for the understanding of their genetic configuration. To identify particle transport patterns associated to surface currents in the Archipiélago of San Andres, Providencia and Santa Catalina, declared as Biosphere Reserve in 2000, the advection of buoyant particles for different spawning events during 2008 and 2009 was simulated. Larval dispersal patterns were obtained through the offline coupling of: a high spatiotemporal resolution hydrodynamic field and a biophysical lagrangian model for particle dispersion. The ocean currents were generated through a regional ocean modeling system (ROMS) adequately configured for the domain. We determined oceanographic conditions that facilitate the connectivity in the Reserve and we identified the preference pathways for coral larvae.

Poster presentation 4-1

Sea level spatio-temporal variability on the Colombian Caribbean coast

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Abstract

There were analyzed monthly information of the mean level of the sea of the database AVISO (Archiving, Validation and Interpretation of Satellite Oceanographic) for the period 1993-2016 on the Colombian Caribbean Coast. These data have a spatial resolution of 0.25° (≈25.75 km). There were realized diagrams of Hovmöller and the calculation of orthogonal empirical functions (FEOs). The study site was divided into 5 zones: zone 1: Gulf of Urabá, zone 2: Cartagena de Indias, zone 3: Santa Marta, zone 4: Riohacha and zone 5: Uribía. The diagram of Hovmöller, realized along the Colombian coast, showed an increase in the mean sea level in the last 5 years, being the area of the Gulf of Urabá, the highest increase in the Colombian Caribbean. A possible reason for the increase is the high flow of the tributaries that flow into the Gulf. This surface water of low density, could reduce vertical mixing, limit the absorption of solar radiation, concentrate more heat and promote thermal expansion.

The first modes of the analysis of FEOs, spatial and temporal, explain 90% of the variability and the second modes account for 5% of said variabilities. According to the analyzes carried out, the first modes (spatial and temporal) can be associated to the variability of the surface temperature of the ocean. The behavior of the temporary mode can be associated with the increase of this temperature. While, the first spatial mode shows how, in general, the rise in sea level responds almost uniformly throughout the Colombian Caribbean. The second modes, spatial and temporal, can be associated to the ENSO phenomenon, mainly to the periods of the Niño. Specifically, for the period 2011-2015, the spatial mode shows how the Gulf of Urabá is the zone with the greatest increase in sea level, with an increase rate of ~ 19.4 mm / year, preceded by the zone of Santa Marta with an increase of ~ 12.55 mm / year. In general, the rise of the sea level can be associated mainly with the global warming, which produces the melting of the glaciers and the thermal expansion of the surface water of the sea, making this occupies a greater volume. The results suggest that phenomena such as global warming and the ENSO will allow sea level to continue rising rapidly.

Poster presentation 4-2

Patterns of surface circulation between coastal systems of Punta de las Vacas and El Uno bay, Turbo, Colombia

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Abstract

This work aims to analyze the superficial circulation patterns between Punta de Las Vacas and El Uno bay, located in the municipality of Turbo, gulf of Urabá, Colombia, employing two lagragian drifter as measuring instruments in dry and wet season. In addition, a comparison is made between wind data obtained from atmospheric Era-Interim reanalysis and currents from the Copernicus marine monitoring system. The data obtained allowed to analyze the direction and speed of currents at different forcings like the tide and wind. During the measurement campaigns, it was possible to identify how the meteorological conditions coincided with the characteristic conditions for each climate season, and how the entry and exit of the currents in the coastal bays is not very related to the tidal cycle. Additionally, the results show a circulation pattern closely related to the weather conditions of each season; for the campaigns of November (wet season) the drifter current marked trajectories towards the north while for those of January (dry season) the trajectories were to the south of the study area, with very similar celerities in all the campaigns. On the other hand in the trajectories compared with the tidal curve for each campaign, is possible an evidence of a delay of a few more than one hour in the tidal gauge from Sapzurro (where is reported the tidal height in real time by the national maritime direction) to Turbo. This is the first step for a new investigation about the tidal hydrodynamic in the gulf of Urabá.

Representation of the vertical water temperature profile in a tropical region through coupled and uncoupled ocean-atmosphere model integrations

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Abstract

Numerical modelling is currently one of the most important tools for the study of coastal and oceanic dynamics, as well as its interaction with other components such as the atmosphere, biological and chemical processes, among others. One of the most studied processes at present is the interaction between the ocean and the atmosphere and its involvement in climate. And although the use of coupled models can be a useful tool for the study of interaction mechanics, its high complexity and the high computational cost associated with its use make it an impractical tool to analyze long-term processes. Given the above, it is natural then to ask about the complexity that a model must have in order to allow the understanding and adequate representation of the coupled system, while optimizing both time and computational resources. In this work the ability of two ocean models, each with different complexity, is evaluated in the simulation of the temperature in the ocean water column in a tropical zone. The first one, the GOTM model is a 1D model that does not take advection into account; the second is the model ROMS (Regional Ocean Modeling System) that solves the equations of movement in the three directions and includes the advective terms. In addition, an evaluation of the coupled model ROMS-WRF is carried out in order to identify if a better estimate of the ocean dynamics is obtained, with respect to the two previous models, by including the feedback between the ocean model and the atmospheric model.

Author index

A

Abecasis, D.	43
Abril, S.	51
Acevedo, S.	46
Afonso, P.	43
Alcerreca-Huerta, J.C.	25
Alvarado, A.	44
Álvarez-León, R.	27
Álvarez-Silva, O.	41, 42
Apostolaki, E.T.	28
Arango Jiménez, Y.U.	66
Arango-Aramburo, S.	60
Arias-Gaviria, J.	60
Ariza, A.	48
Arroyave Gómez, D.M.	56
Atehortua, L.	34

B

Becerra L.	51
Blanco-Libreros, J.	27
Bolívar, J.	49
Bolaños-Cubillos, N.	27
Bracho, C.	46

C

Cáceres-Euse, A.	58
Callejas Jiménez, M.	25
Cantera, J.R.	22
Cantera-Kintz, J.R.	57
Cardona Orozco, Y.	57
Carrillo Bibriezca, L.	25
Casella, E.	57
Castellanos L.	51
Castellanos-Galindo, G.A.	57
Castillo Uzcanga, M.M.	25
Cejudo Collera, M.	15
Celis, J.S.	22
Chatzigeorgiou, G.	28
Chuard, P.	21
Córdoba Mena, N.I.	34
Córdoba Rojas, D.F.	63

D

Dávila, V.	44
Dorantes Palacios, M.	16
Dueñas, L.F.	24
Duque, F.	32

E

Enriquez Ortiz, C.	41
Erzini, K.	43
Escobar Sierra, C.	28
Estela, F.	27

F

Figueroa, I.	30
Figueroa, I.P.	18
Florez Leiva, L.	34
Fonseca-González, I.	33
Franco, A.	23
Franco-Herrera, A.	31
Fuentes Montes, M.A.	52

G

Galvis, N.	17
García-Garay, J.	31
García-Nava, H.	55
Giraldo López, A.	63
Glaeser, S.P.	23
Gnecco, M.	17,32
Gómez Corrales, M.	32
Gómez Maduro, M.C.	46
Gonzalez, F.	32
Guerra Vargas, L.A.	37
Gutiérrez Acosta, L.F.	66
Gutierrez-Cala, L.	32

H

Hamilton, S.E.	57
Hardt, M.	23
Hasler-Sheetal, H.	28
Henao, J.P.	14
Heppell, S.	39
Hernández Carrasco, I.	55
Hernández, D.P.	65
Hernández-Ávila, I.G.	46
Hernandez-Aviles, D.A.	15
Herrera Vázquez, C. F.	55
Holmer, M.	28

I

Irazabal, I.	43
Isaza, J.P.	18
Isaza-Toro, E.	44

Ixquiac, M.44

J

Jara, A.39

Jaramillo Vélez, A.65

L

León, H.48

Lizette I.45

Londoño Mesa, M.H. 33, 45

Londoño, G.S.64

Londoño-Cruz, E.57

Londoño-Mesa, M.H.35

Lonin, S.59

Lopera, L.64

Lopez-Victoria, M.27

M

Machuca Martinez, F.31

Maldonado, J.14

Mancera, E.60

Martinez Lacharme, L.34

Martins, C.20

Mejía Trejo, A.62

Mejía-Rentería, J.C.57

Monsalve, A.49

Montoya, P.17

Moreno Rincón, J.L.61

Moreno, R.14

Muñoz García, A.30

Muñoz, A.36

Murillo, E.M.64

O

Obando Montoya, E.J.34

Ocampo-Torres, F. J.55

Ochoa Tovar, M.52

Ojeda Caicedo, V.V.62

Orfila Forster, A.55

Osorio, A.F. 41, 48, 58, 60

Osuna, P.55

Otero Díaz, L.62

P

Paiba García, L.C.60

Palacio-Castro, A.M.20

Panchana-Orrala, M.40

Pelegrí Llopart, J.L.65

Peña, E.J.22

Pérez Ferro, D.G.41

Pineda-Muñoz, A. 27, 32

Pizarro, V. 27

Polania Vorenberg, J.H.18

Polanía, J. 30, 49

Puello Alcázar, A.C.61

Puyana M.51

Q

Quiceno Cuartas, P.A.52

Quintanilla, E.29

R

Ramos F.51

Rasclé, N.55

Reichert, J. 23, 25

Restrepo Avendaño, L.F.45

Riascos, J.M.22

Ricaurte, C.57

Roa, P.A.32

Rodelo Bernal, M.C.18

Roldan Carvajal, M.41

Romaña Torres, Y.65

Romanovna Zhdanovskaya, A.50

Romero Balcucho, C.A.59

Rovere, A.57

Rúa Cardona, A.F.27

S

Sánchez Rubio, L.16

Sánchez Sáenz, C.41

Sánchez, J.A.29, 32, 36

Sandoval Figueredo, A.V.18

Sandoval Londoño, A.48

Sarmiento Lezcano, A.N.39

Sarmiento Segura, A.32

Sarmiento, A.36

Schubert, P.23

Serna, Y.....	47
Sierra, P.....	49
Simancas Giraldo, S.M.	29
Sonnenholzner Varas, J.I.	40
Sonnenholzner, S.A.	40

T

Toro Botero, F.M.	58
Toro, V.M.	64
Torres Parra, R.R.	62
Torres, G.	30
Tsapakis, M.	28

V

Valencia, N.	22
Valle-Levinson, A.	64
Vanegas, J.	18, 30
Vargas, M.	14
Variano, E.	58
Vásquez, R.E.	48
Velasquez Aristizabal, J.A.	52
Velasquez Jofre, P.M.	44
Vergara, D.C.	32

W

Wilke, T.....	20, 23, 25, 29
---------------	----------------

Y

Young, Q.	45
----------------	----

Z

Zapata Hinestroza, J.A.	52
Zapata, L.A.	39
Zapata-Ramírez, P.	48, 64
Zuluaga, C.C.	36



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