



Estudio de la biodiversidad de macroinvertebrados sésiles de la Reserva Marina El Pelado (REMAPE) para el biodescubrimiento y la conservación

Una oportunidad para el descubrimiento de la biodiversidad marina ecuatoriana



Centro Nacional de Acuicultura e Investigaciones Marinas CENAIM-ESPOL

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Valorización y uso de organismos marinos en salud, alimentación y conservación



Salud humana y animal

Biodiversidad (invertebrados) y biodescubrimiento
Biotecnología azul

Protocolos de domesticación para uso sostenible de nuevas especies marinas: consumo de alimentos y repoblación de bancos naturales

Métodos de control y prevención de enfermedades en especies acuáticas de uso comercial y uso potencial en maricultura o repoblación

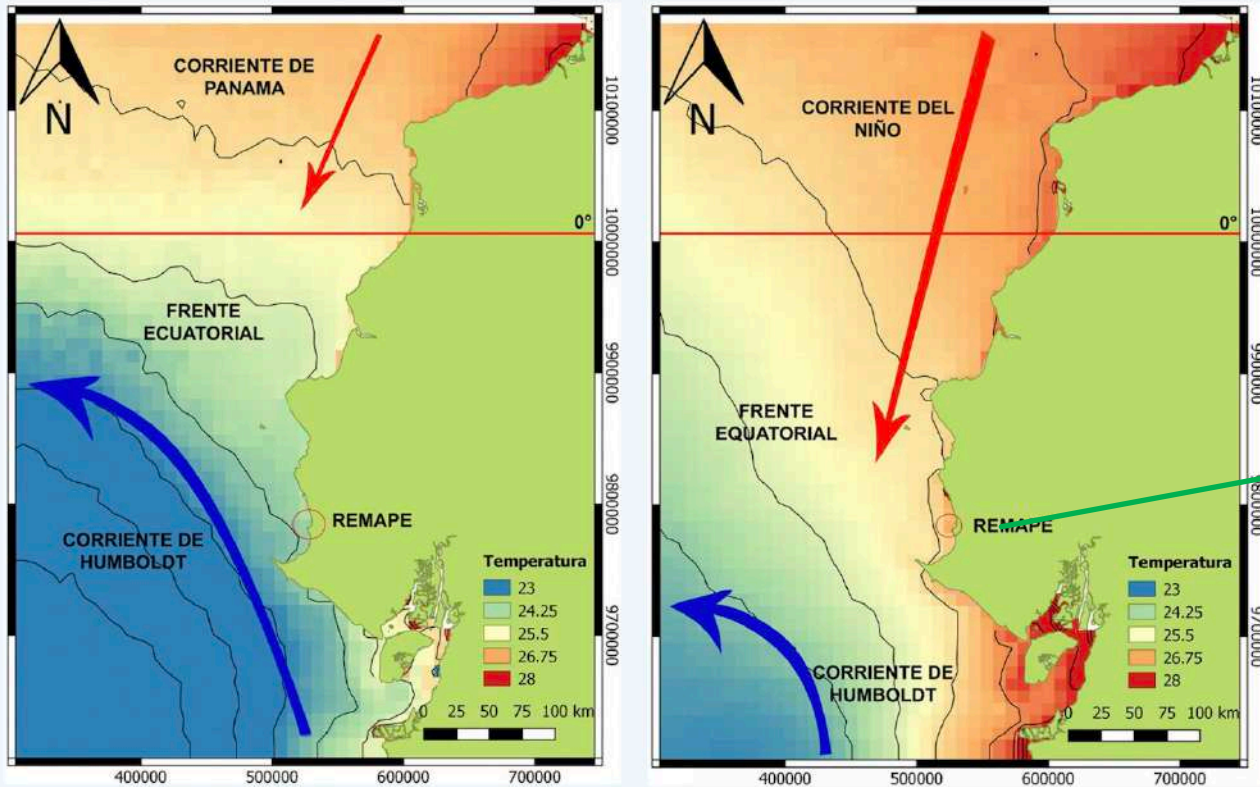
Alimentación y conservación

Salud animal
Alimentación y conservación



Ecuador: 2.859 Km costa continental

REMAPE



Condiciones oceanográficas del Frente Ecuatorial, ubicación en el TEP (A). Area de la Reserva Marina El Pelado (B). El frente ecuatorial en los meses de junio a noviembre (C). El frente ecuatorial en los meses de diciembre a mayo (D)

ENFOQUE DE LEVANTAMIENTO DE LA BIODIVERSIDAD DE LA REMAPE



Caracterización de Hábitats
**INVENTARIO DE
MACROINVERTEBRADOS
SÉSILES**

**Banco biológico
REPOSITORIO**

Grupos de Interés (Criterios: Abundancia,
Perfiles de Metabolitos)
**PORIFERA, CNIDARIA (ANTHOZOA),
CHORDATA**

Sistematización de la
información y
difusión
**BASE DE DATOS
WEBGIS
DOCUMENTOS
CIENTIFICOS**

**TAXONOMÍA INTEGRATIVA
METAGENÓMICA ESTRUCTURAL
METAGENÓMICA FUNCIONAL
BACTERIAS CULTIVABLES
METABOLOMICA
BIOACTIVIDAD**

BIODESCUBRIMIENTO

Aplicaciones biotecnológicas en salud
humana y animal de metabolitos y
microorganismos biodescubiertos



INVENTARIO DE
MACROINVERTEBRA
DOS SÉSILES Y
MÓVILES
REPRESENTATIVOS



Muestras colección



Muestras
cuantitativas



HABITAT



Islote El Pelado



DIVERSIDAD Y DISTRIBUCION



Ecol Res
DOI 10.1007/s12244-018-0267-3



ORIGINAL ARTICLE

Sascha C. C. Steiner · Bernhard Riegl
Antonella Lavarato · Jenny Rodríguez

Community structure of shallow water Alcyonacea (Anthozoa: Octocorallia) from the southern Tropical Eastern Pacific

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Abstract Alcyonacea are sessile invertebrates, which can significantly shape the boundary layer in coral reefs and rocky habitats. Ecological aspects in this taxon have been well studied in the Caribbean, Mediterranean, and Indo-Pacific. With few recent exceptions, studies in the Eastern Pacific focused on taxonomy. We present a quantitative assessment of Alcyonacea communities from the southern Tropical Eastern Pacific, based on video transects in the Marine Reserve El Pelado. Seventeen species from the Plexauridae (8), Gorgoniidae (8), and Clavularidae (1) were identified, comprising 8963 colonies dominated by *Muricea* (86.7%), particularly *M. plantaginea* (48.0%). The overwhelming dominance of *M. plantaginea* was the most striking and previously unreported community trait, which contributed to a moderate Shannon entropy ($h' = 31$, H_2 mean 1.40, SD 0.22), equitability ($e = 31$, H_2 mean 0.16, SD 0.4), and species diversity expressed as effective number of species ($e = 31$, mean 4.16, SD 0.67). Two common species overprinted a more variable and subtle community pattern among rarer species, suggested in agglomerative hierarchical cluster analysis. Four species (*M. plantaginea*, *M. purpurata*, *M. frutescens* and *Leprosyrinx alba*) had the strongest influence on site groupings in the correspondence analysis between a principal component analysis of a Hellinger-transformed Alcyonacea species matrix and substrate categories, with filamentous turf algae and crustose coralline algae being the main determinants of site differentiation. *Muricea plantaginea*'s qualities of a keystone species, and

the eurytopic and stenosecious distribution traits among some species are discussed. The invasive *Carrija rita* was confirmed as biological threat to other Alcyonacea, and possible physiological distribution limitations are indicated.

Keywords Alcyonacea · Community structure · Eastern Pacific · Equatorial Front · Keystone species

Introduction

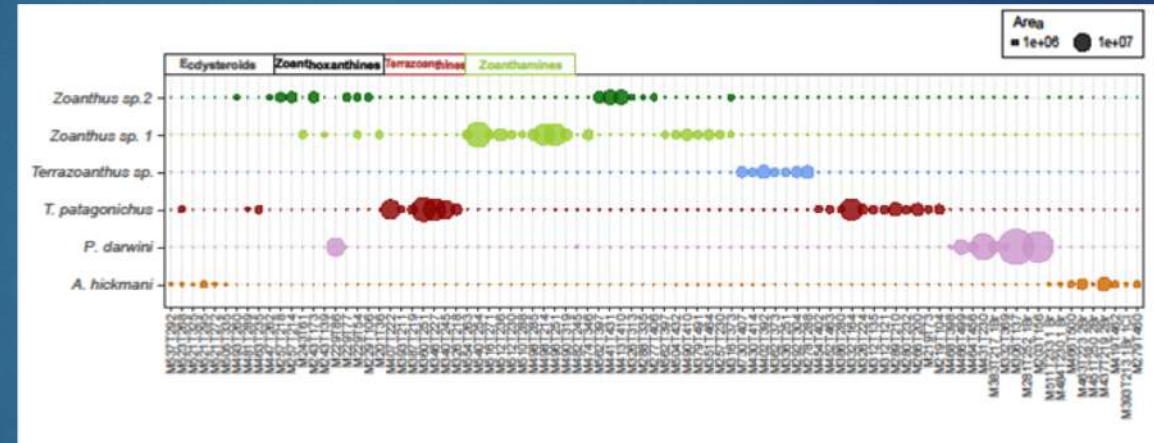
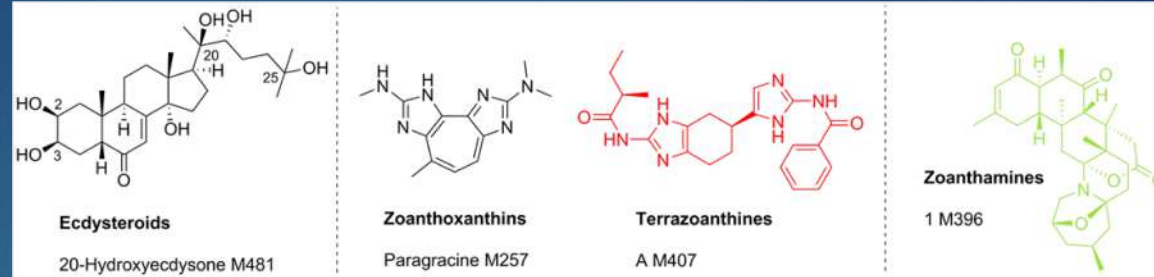
Tropical shallow water Alcyonacea (soft corals and sea fans) are among the characteristic sessile and colonial faunal components of rocky habitats and coral reefs. Erect growth forms compartmentalize the benthic boundary layer by creating structural heterogeneity in the form of micro habitats and nurseries for other invertebrates (Pattin 1972; Cantara et al. 1987; Vroeland and Lasker 1988; Naira et al. 1992; Ramos 1995; Mosler and Watling 2009) fishes (Lasker 1993; Elroyer and Wernbach 2007; Taylor et al. 2013). Where Alcyonacea form dense stands, they further create a complex mosaic of gradients in light penetration, which in turn influence the distribution of sessile photosynthetic organisms, and of hydrodynamic gradients (Wainwright et al. 1976) that affect water exchange and material cycles, analogous to dense stands of macrophytes (Prichard et al. 1989; Vogel 1994; Irlund 1996; Gonzalez-Ortiz et al. 2014). At least in Caribbean reef settings, population densities of Alcyonacea and therefore also the structural habitat heterogeneity which they offer, showed considerable persistence (Lonz et al. 2015; Tzouris and Edmonds 2017) during recent decades amidst a general flattening of reefs caused by the degradation of stony coral communities (Aburto-Philp et al. 2009). Alcyonacea are also a viable source of bioactive components (Côté 1992; Guitierrez et al. 2000; Rocha et al. 2011; Blent et al. 2014). The generally long-lived Alcyonacea (Fabricius and Alderslade 2001) are, nonetheless, negatively affected by pollution

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Zoantidos en la REMAPE



Frederic Sinniger

Karla Jaramillo
PhD Student



At least 7 species present in a small Marine Protected Area called El Pelado. Macrocnemina: *Antipathozoanthus*, *Parazoanthus*, *Terrazoanthus*. Brachycnemina: *Zoanthus*, *Palythoa*

OPEN

Assessing the Zoantharian Diversity of the Tropical Eastern Pacific through an Integrative Approach

Karla B. Jaramillo^{1,2}, Miriam Reverter³, Paul O. Guillen^{1,3}, Grace McCormack², Jenny Rodriguez¹, Frédéric Sinniger¹ & Olivier P. Thomas³

Zoantharians represent a group of marine invertebrates widely distributed from shallow waters to the deep sea. Despite a high diversity and abundance in the rocky reefs of the Pacific Ocean, very few studies have been reported on the diversity of this group in the Tropical Eastern Pacific coasts. While molecular techniques recently clarified some taxonomic relationships within the order, the taxonomy of zoantharians is still highly challenging due to a lack of clear morphological characters and confusing use of different data in previous studies. Our first insight into the zoantharian diversity at El Pelado Marine Protected Area - Ecuador led to the identification of six species: *Terrazoanthus patagonichus*; *Terrazoanthus* sp.; *Antipathozoanthus hickmani*; *Parazoanthus darwini*; *Zoanthus* cf. *pulchellus*; and *Zoanthus* cf. *sociatus*. A metabolomic approach using UHPLC-HRMS was proven to be very efficient as a complementary tool in the systematics of these species and specialized metabolites of the ecdysteroid and alkaloid families were identified as key biomarkers for interspecific discrimination. These results show good promise for an application of this integrative approach to other zoantharians.

TAXONOMIA INTEGRATIVA

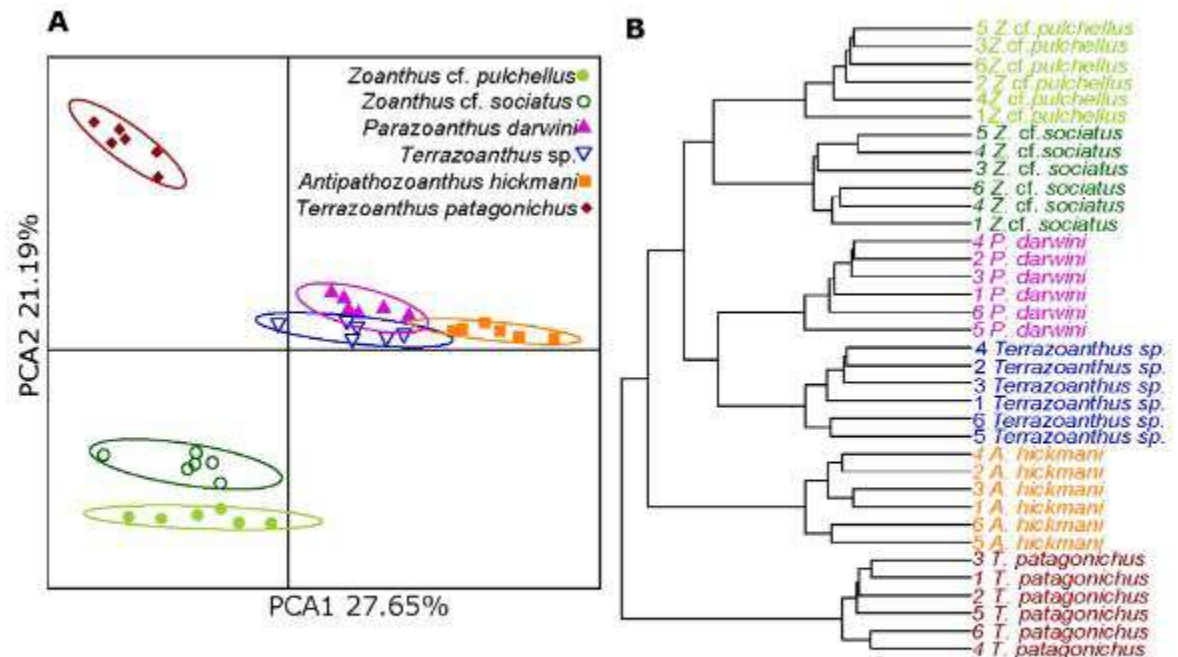
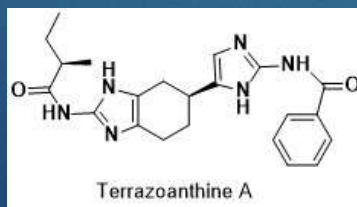
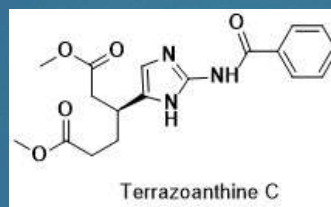
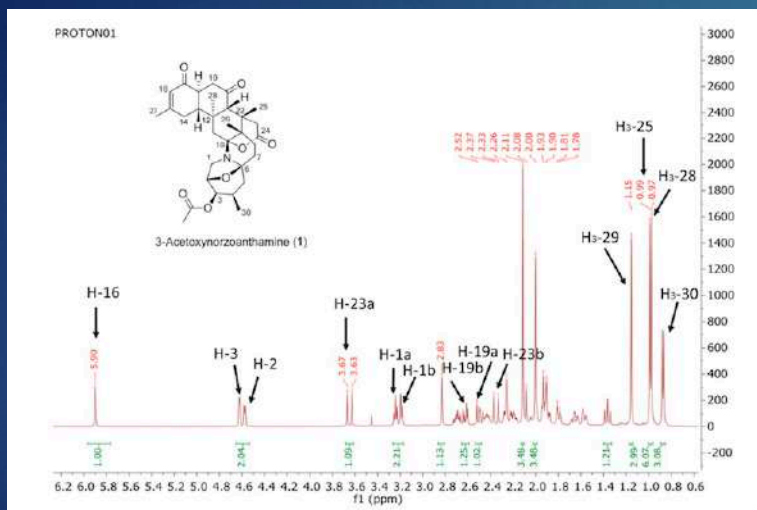
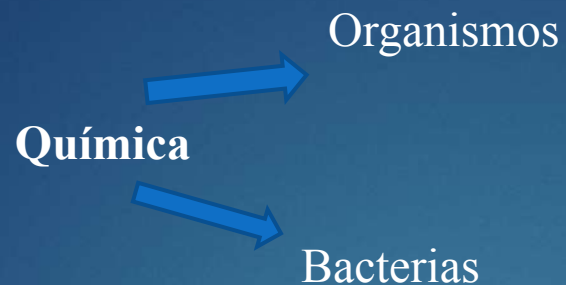


Figure 3. Untargeted Metabolomic Analysis of Zoantharians from this study. Score plots of metabolomic profiles of *Antipathozoanthus hickmani*, *Parazoanthus darwini*, *Terrazoanthus patagonichus*, *Terrazoanthus* sp., *Zoanthus* cf. *pulchellus*, and *Zoanthus* cf. *sociatus*. The explained variances are shown in brackets. (A) Principal Component Analysis. (B) Hierarchical Cluster Analysis.

BIODESCUBRIMIENTO

La biodiversidad marina es mayor a la terrestre (250,000 especies censadas en 2010) el 90 % de los organismos son microbios
Ambientes muy competitivos.
Donde se producen cocteles químicos de potente bioactividad

BIODESCUBRIMIENTO



Purificación y determinación de estructura molecular de metabolitos aislados

Terrazoanthines, 2-Aminoimidazole Alkaloids from the Tropical Eastern Pacific Zoantharian *Terrazoanthus onoi*

Paul O. Guillen^{††}, Karla B. Jaramillo^{††}, Gregory Genta-Jouve[§], Frederic Sinniger[‡], Jenny Rodriguez[†], and Olivier P. Thomas^{‡‡}

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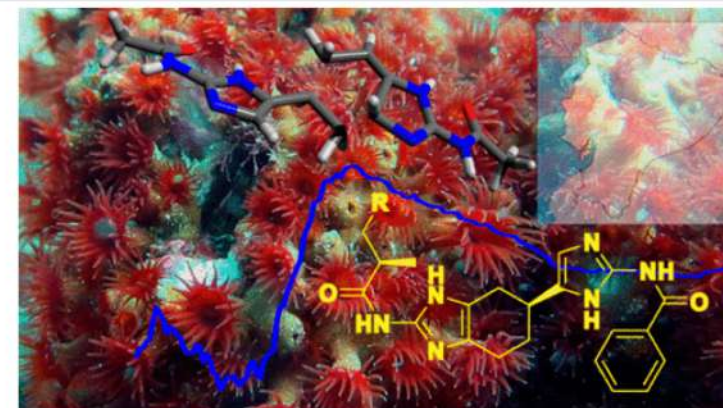
Publication Date (Web): March 23, 2017

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Abstract



The first chemical study of the common species *Terrazoanthus onoi*, present off the coast of Ecuador, led to the identification of a new family of 2-aminoimidazole alkaloids named terrazoanthines A–C (1–3). Homologues 1 and 2 feature an unprecedented 6-(imidazol-5-yl)benzo[*d*]imidazole. Acyl substitution pattern and complete configurational assignments were deduced from comparison between experimental and theoretical ¹³C NMR and ECD data, respectively. These compounds may represent key derivatives in the biosynthesis of zoanthoxanthins.

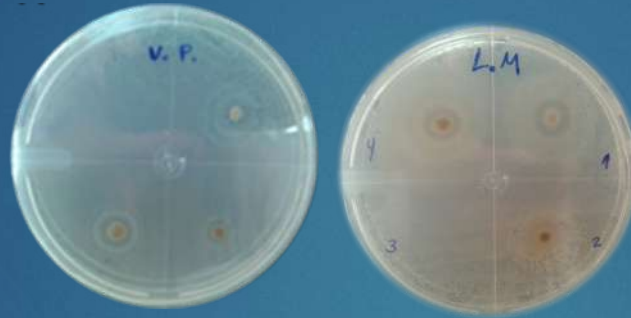
BIODESCUBRIMIENTO: Microbiomas

Bacterias cultivables

Aislamiento y caracterización mediante bioquímica, técnicas moleculares y bioactividad.

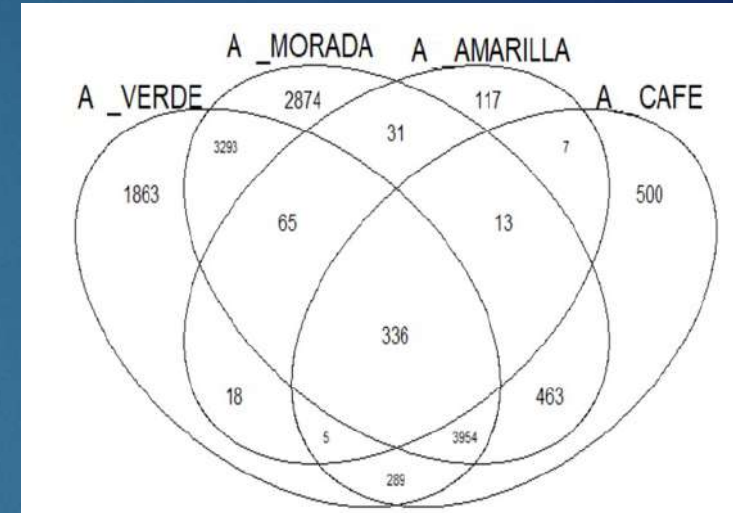


Purificación de colonias.



Biopactividad de *Pseudovibrios* frente a *Vibrio campbellii*

Metagenómica
Metabarcoding
Metagenómica funcional



	Bact. X1	Bact. X2	Control
Supervivencia	79,2 ± 5,2	66,3±6,8	63,0±6,7
Lbs/ha	1979±131	1658±170	1575±168
Peso	9,9±2,0	10,8±3,4	9,4±2,4

Aplicaciones Biotecnológicas: Metabolitos aplicados en Salud Humana

50 Moléculas puras 50, 48 fracciones de Zoanthidos, hexacorales, Octocorales, Poríferos, tunicados, 16 bacterias asociadas

- ▶ Antitumorales: Líneas de cáncer hígado, pulmón, colón, mama, sistema nervioso, páncreas, melanoma. Fundación Medina, CENAIM
- ▶ Antimicrobianos: *Escherichia coli*, *Pseudomona aeruginosa*, *Acinobacter baumani*, *Klebsiella pneumoniae*, *Staphylococcus aerus* resistente a la meticilina
- ▶ Antiparasitarios: Leishmania. UTPL, tripanosoma (Fundación Medina, Universidad Central).
- ▶ Anfungicos: *Aspergillus fumigatus*, *Candida albicans*. Fundación Medina



SISTEMATIZACION Y DIFUSION DE LA INFORMACIÓN: BASE DE DATOS Y WEBGIS

Link A EXCEL base de datos (estándar Darwin Core)

Bioconocimiento, gestión de recursos marinos y conservación
Permitirá compartir los registros en OBIS, y en WEBGIS divulgarlos con la comunidad científica, la academia y las entidades públicas involucradas en la gestión de recursos marinos.

WEBGIS Proyecto <http://200.10.147.233/drupal/?q=es/node/7>

Ocean Biogeographic Information System (OBIS)



282

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Articles

Database and WebGIS: tools for integration and access to biodiversity information of invertebrates of the marine reserve 'El Pelado' (REMAPE)

Gabriela Agurto , Elizabeth Andrade, Cecilia Tomalá, Cristóbal Domínguez , Paúl Guillén , Karla Jaramillo , ...show all

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ABSTRACT

The marine biodiversity program of CENAIM-ESPOL focuses on sessile invertebrates from the "El Pelado" marine reserve". The present study aims at understanding the different hierarchical levels of biodiversity found at the "El Pelado" and to guide biodiscovery initiatives. Generated biodiversity data were systematized in a database (Darwin Core standard) and integrated into a geographic information system that uses webGIS as a search engine. In this way, the information becomes available to the academy and entities involved in the management of coastal resources.

Related articles

NOAA's Coral Reef Watch program from satellite observations

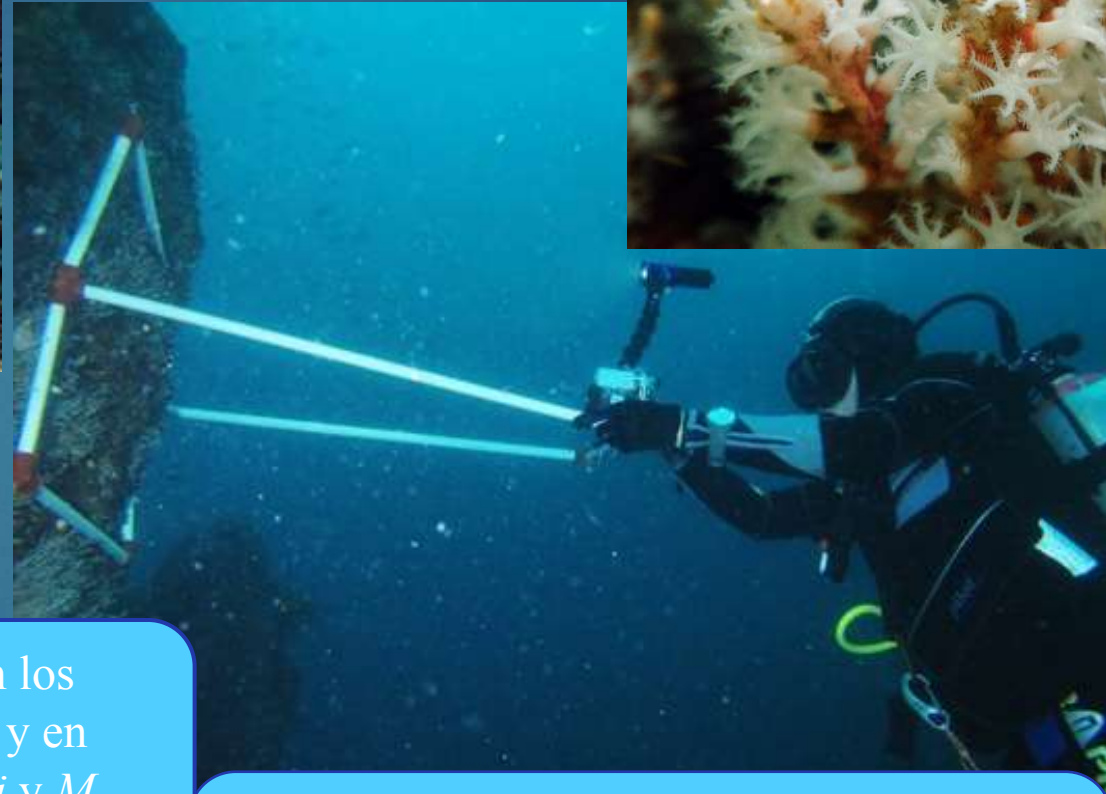
Alan E. Strong et al., *Annals of GIS*

Challenges for research on global change in mainland Ecuador

Veerle Vanacker et al., *Neotropical Biodiversity*

Energetic processes regulating the strength of MJO circulation over the Maritime Continent during two types of El Niño

CONSERVACION



Estudio de las interacciones del octocoral *Carijoa riisei*

Ensayos quimio-ecológicos en los arrecifes superficiales (in-situ) y en Acuarios (ex situ), entre *C.riisei* y *M. plantaginea* y sus metabolitos.

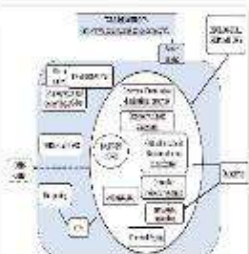
Aplicar herramientas de metabolómica para evaluar la variabilidad en la producción de metabolitos, objetivo para aplicaciones ecológicas y biológicas.

ACTIVIDADES

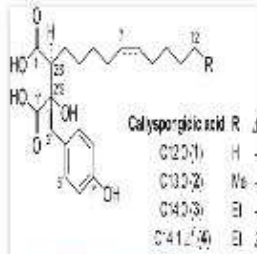
Productos

- ▶ **Base de datos (Darwin Core) y WebGIS**
(<http://200.10.147.233/drupal/?q=es/node/7>)
- ▶ **Siete artículos en revistas indexadas**
- ▶ **A manual on documenting benthic invertebrate communities from rocky environments in the Marine Reserve El Pelado, Santa Elena, Ecuador**
- ▶ **UN EQUIPO HUMANO MULTIDISCIPLINARIO: DOS TESIS DE DOCTORADO, DOS TESIS DE MAESTRÍA, 2 TESIS DE PREGRADO**
- ▶ **Laboratorios: Química de productos naturales, taxonomía, cultivo celular, bioactividad, pañol de buceo**

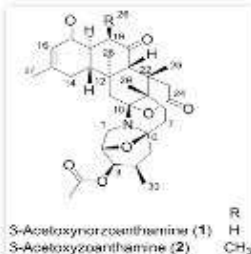
PRODUCTOS



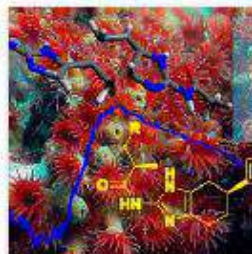
NEOTROPICAL BIODIVERSITY
Database and WebGIS: tools for integration and access to biodiversity information of invertebrates of the marine reserve 'El Pelado' (REMAPE)
Agurto G. et al 2016



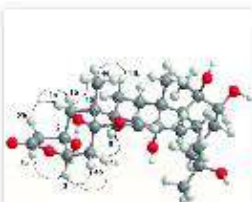
JOURNAL OF NATURAL PRODUCTS
Callyspongic Acids: Amphiphilic Diacids from the Tropical Eastern Pacific Sponge *Callyspongia cf. californica*
Calabro K. et al 2018



MARINE DRUGS
Zaoanthamine Alkaloids from the Zoantharian *Zoanthus cf. pulchellus* and Their Effects in Neuroinflammation
Guillen P. et al 2016



ORGANIC LETTERS
Terrazoanthines, 2-Aminoimidazole Alkaloids from the Tropical Eastern Pacific Zoantharian *Terrazoanthus onoi*
Guillen P. et al 2017



MARINE DRUGS
Ecdysonelactones, Ecdysteroids from the Tropical Eastern Pacific Zoantharian *Antipathozoanthus hickmani*
Guillen P. et al 2018



SPRINGER LINK
Community structure of shallow water Alcyonacea (Anthozoa: Octocorallia) from the southern Tropical Eastern Pacific
Steiner S. et al 2018



SCIENTIFIC REPORTS
Assessing the Zoantharian Diversity of the Tropical Eastern Pacific through an Integrative Approach
Jaramillo K. et al 2018

EVENTOS CIENTÍFICOS

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http://www.cenam.espol.edu.ec/biodiversidad_REMAPE_publicaciones



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 Cecilia Tomalá
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 Esther Mero
 Javier Soriano

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 Frederic Sinniger (University of the Ryukyus-Japan),
 Eduardo Hajdu (Universidad Federal de Río de Janeiro-Brasil),
 Federico Brown (Universidad de Sao Paulo-Brasil),
 Thierry Perez (IMBE-France)



COLABORADORES EXTERNOS



RETOS Y OPORTUNIDADES

- Crear una masa crítica de investigadores
- Simplificar procesos
- Apropiación de la biodiversidad

Academia puede ser el escenario

Articular procesos normativos

Confluencia de actores

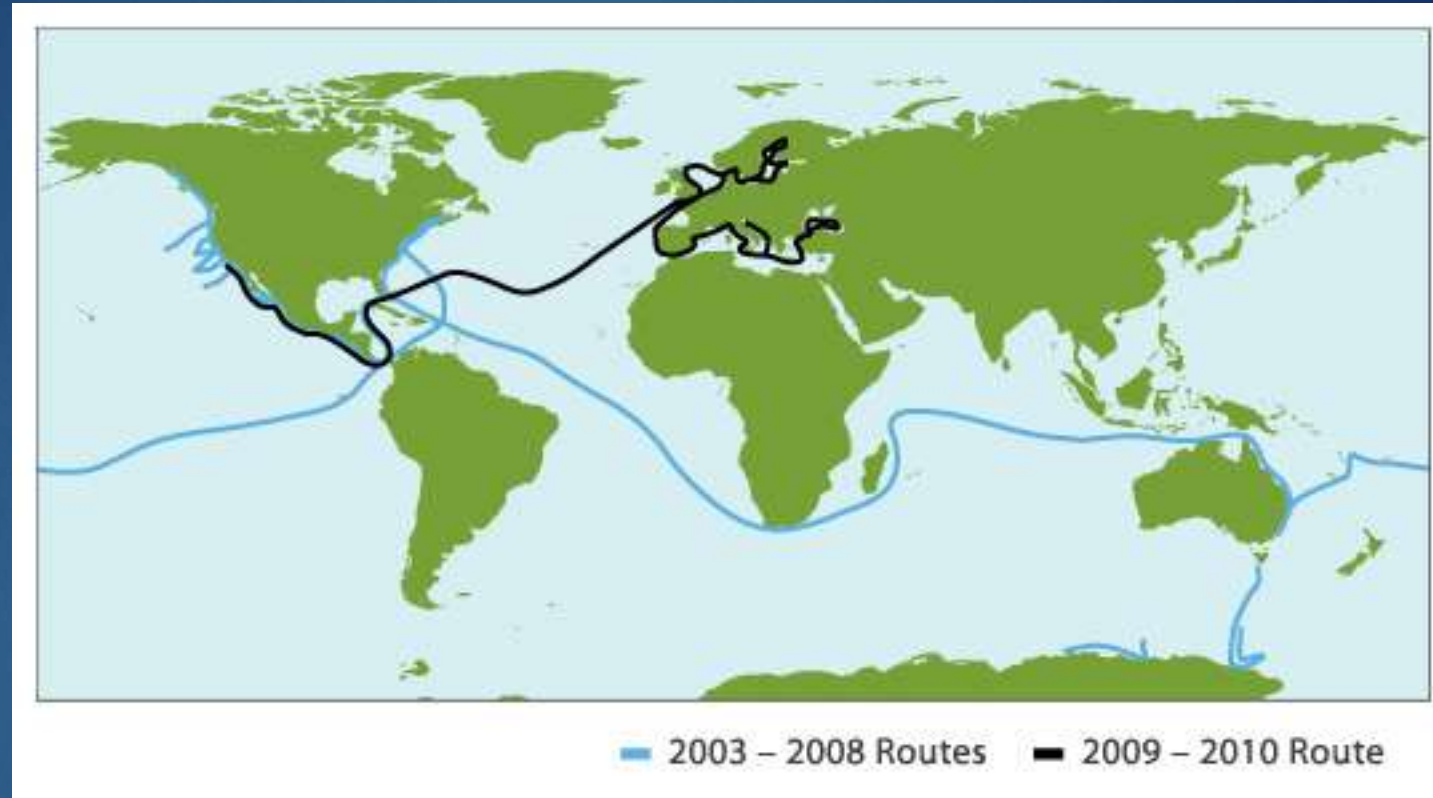




Global Ocean Sampling Expedition

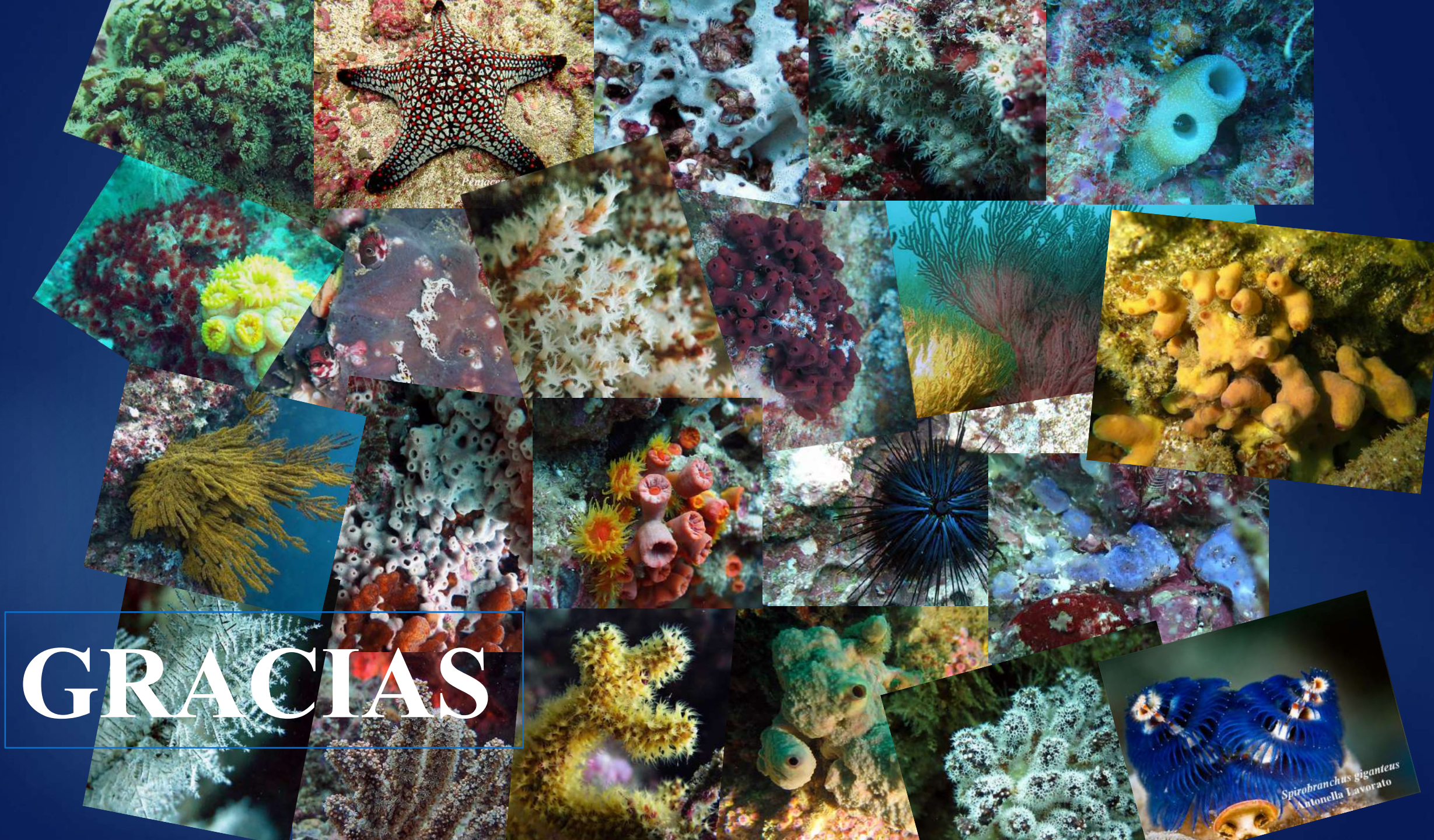
Viaje de biodescubrimiento microbiano

El que no los hace los ve hacer



No se cuida lo que no se ama y no se ama lo que no se conoce

GRACIAS



Spirobranchus giganteus
Antonella Lavorato