

BOOK OF ABSTRACTS



72ND ANNUAL GULF & CARIBBEAN FISHERIES INSTITUTE

November 4 – 8, 2019
Punta Cana, Dominican Republic

SPONSORS & SCHEDULE

GCFI72 SPONSORS



OVERALL SCHEDULE

Monday 4 November	Tuesday 5 November		Wednesday 6 November	Thursday 7 November		Friday 8 November
Opening Ceremony	Spawning Aggregations		Effective Fisheries Management	BIOPAMA	Invertebrates	Sargassum
Keynote Address	Break		Break	Break		Break
Marine Litter	Marine Protected Areas		Effective Fisheries Management	BIOPAMA	Habitats & Ecosystems	Lionfish
Lunch / Cacú	Lunch		Lunch	Lunch		Coral Disease
Recreational Fisheries	Vemco	Socio Econ	Field Trips	Demersal Fisheries	Too Big To Ignore	Lunch
Break	Break			Break		Climate Change
Fishers Forum	Communication	Fishers Field Trip		Demersal Fisheries		Aquaculture
Free Time	Free Time	Free Time	Free Time	Free Time		Break
Informal Reception	Poster Session	CINEFISH	Banquet Reception	Albatross Film Screening		Student Awards
						Closing Ceremony

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BACKGROUND & PRE-MEETING ACTIVITIES

ABOUT GCFI

The Gulf and Caribbean Fisheries Institute (GCFI) was founded in 1947 to promote the exchange of information on the use and management of marine resources in the Gulf and Caribbean Region. From its beginning, GCFI has endeavored to involve scientific, governmental, and resource-use sectors in providing a broad perspective on relevant fisheries issues. The GCFI membership comprises over 40 nations and territories representing university faculty and students, governmental agencies, policy-makers, private sector, fishers, non-governmental organizations, and other stakeholders.



THE HOSTS

GCFI is partnering with the Dominican Council for Fisheries and Aquaculture (CODOPESCA – Spanish abbreviation), Fundación Grupo Punta Cana, and Reef Check Dominican Republic to host GCFI72



THE VENUE

The meeting venue will be at the the Now Larimar Convention Centre in Punta Cana, Dominican Republic with accommodation at the Secrets Royal Beach Punta Cana, located 25 minutes from the Punta Cana International Airport

THE MEETING

This annual meeting represents a platform for information exchange among various groups. There will be symposia, forums and workshops on topical issues to facilitate translation of knowledge into effective actions to inform the conservation, management, and restoration of fisheries and aquatic resources within the region.

Any presentation with a * indicates a student presenter

PRE - MEETING ACTIVITIES

Saturday 2nd November

9:00 - 17:00 Workshop: Improving the Monitoring and Abundance Estimation of Fish Spawning Aggregations (Day1)

Sunday 3rd November

09:00 - 17:00 Workshop: Improving the Monitoring and Abundance Estimation of Fish Spawning Aggregations (Day 2)

15:30 - 19:00 GCFI Board of Directors Meeting

16:00 Registration

19:30 Student-Board Social: for registered students & GCFI Board Members

MONDAY 4TH NOVEMBER

OPENING CEREMONY (8:30 - 9:10) (CHAIR: ALEJANDRO ACOSTA, GCFI)

Opening Remarks

Ing. Osmar Benitez / Lic. Milton Ginebra Morales

Rosa Magarita Bonetti de Santana

Jake Kheel

Martin Russell

Presidium

Ing. Osmar Benitez - Minister of Agriculture

Lic. Milton Ginebra Morales - Executive Director at CODOPESCA

Dr. Alejandro Acosta, Program Chair, GCFI

Ms. Rosa Magarita Bonetti de Santana - Vice-President, Propagas Board of Directors

Dr. Ruben Torres, Director of Reef Check, Dominican Republic

Mr. Martin Russell, Chair, GCFI

Mr. Jake Kheel, Vice President Grupo Puntacana Foundation

Ms. Jeannette Mateo, Director of Fisheries Resources at CODOPESCA

Ms. Nina Lysenko, Ministry of Environment and Natural Resources

Mr. Robert Glazer, Executive Director, GCFI

Ms. Gladys Rosado, Director of the Marine Biology Research Center (CIBIMA), of the Autonomous University of Santo Domingo (UASD)

KEYNOTE ADDRESS (9:10 - 9:50) DR SELINA HEPPEL

Professor and Head of Fisheries and Wildlife, Oregon State University.

"Conservation success scales with successful partnerships"

OPENING BELL (9:50) LEROY CRESWELL, GCFI EXECUTIVE SECRETARY

COFFEE BREAK (10:00 - 10:30)

SCIENCE, MANAGEMENT & SOLUTIONS TO ADDRESS MARINE LITTER IN THE CARIBBEAN & GULF OF MEXICO (Sponsored by GPML-Caribe: A partnership between GCFI & UNEP) Moderator: Bob Glazer

10:30 **Corbin, Christopher** Solid waste and marine litter management trends in the Wider Caribbean Region

10:45 **Ali, Fadilah** Introducing the Caribbean Node of the Global Partnership on MarineLitter (GPML-Caribe)

11:00 **Caporusso, Carolyn** Harmonizing marine litter monitoring in the Wider Caribbean Region: A hybrid approach

11:15 **Taylor, Michelle** Not Just Plastic! An update from Grenada, West Indies

11:30 **Ambrose, Kristal** Spatial trends and drivers of marine debris accumulation on shorelines in South Eleuthera, The Bahamas using citizen science

11:45 ***Jaggernaut, Adara** Impact of marine debris among different coastline types in Grenada, West Indies

12:00 **Siqueira Morais, Leonardo Mario** The sea anemone *Bunodosoma cangicum* as a potential sentinel species for microplastic pollution on the Amazonian coast

12:15 **Aldana Aranda, Dalila** Microplastics in the food chain using molluscs as indicators

MONDAY 4TH NOVEMBER

LUNCH (12:30 - 14:30)

SPECIAL FILM SCREENING: *Cacú: A Change for Life* (12:30 - 14:30)

What does it take to transform a sea turtle nest predator into a conservationist of endangered species? With electrifying images, *Cacú: A Change for Life* follows five fishermen from Manresa, a poor neighborhood to the West of Santo Domingo, as they learn from marine biologist Omar Shamir Reynoso's one-of-a-kind plan to protect nesting sea turtles. With the scientist's guidance and the community's collaboration, the fishermen become sea turtle advocates and custodians in this story of conservation success. *Cacú* is a hopeful environment story of success and inclusion.



RECREATIONAL & PELAGIC ECOSYSTEM FISHERIES (Sponsored by GCFI)

Moderator: Jeremy Higgs

- 14:30 ***Torres, Jashira** Analysis of management strategies for red snapper recreational fisheries in the Gulf of Mexico
- 14:45 ***Millender, Anna** A preliminary life history assessment of Swordfish, *Xiphias gladius*, landed in the northern Gulf of Mexico recreational fishery
- 15:00 **Villaseñor-Derbez, Juan Carlos** Documenting status and mapping suitability of Caribbean moored Fish Aggregating Device (MFAD) fisheries
- 15:15 **Pitt, Joanna** The reproductive biology of baitfish species in Bermuda
- 15:30 **Welch, Jirani** Examining the temporal and spatial distribution of baitfish species in Bermuda's coastal waters

COFFEE BREAK (15:45 - 16:00)

FISHERS FORUM – GLADDING MEMORIAL AWARD (GMA)

(Sponsored BY GCFI; NOAA and Shell) **Moderator: Don DeMaria**

- 16:00 **DeMaria, Don** Opening and introduction to the Fisher Forum
- 16:10 **Marquez, Cecil** Big fish from small boats - pelagic longline fishing
- 16:20 **DeMaria, Don** Florida marine life fishery
- 16:30 **Maldonado, Andres** A fisher's experience with scientific research
- 16:40 **Surrency, Ron** Powerhead and bandit fishing in Florida
- 16:50 **Mendez, Angelica** Cooperative fisheries management in Guatemala
- 17:00 **Hickman, Scott** Catch shares in the Gulf of Mexico
- 17:10 **Fisher Forum Question & Answer period**
- 17:50 **Russell, Martin** Presentation of the 2019 Gladding Memorial Award
- 18:00 **Closing remarks**

INFORMAL RECEPTION & WELCOME ADDRESS BY GCFI EXECUTIVE DIRECTOR: ROBERT GLAZER (19:30)

TUESDAY 5TH NOVEMBER

REEF FISHERIES & SPAWNING AGGREGATIONS (Sponsored by GCFI & SCRFA)

Moderator: Martin Russell

- 08:15 *Zayas-Santiago, Carlos M Red hind *Epinephelus guttatus* vocal repertoire characterization, behavior and temporal patterns
- 08:30 Morley, Danielle Reef fish spawning aggregation research in the Florida Keys: how technology has informed management
- 08:45 Rowell, Timothy J. Female abundance and spawning prospects drive sound production in a territorial male grouper: Implications for monitoring fish spawning aggregations
- 09:00 White, Allison A comparison of the practical and statistical sampling considerations between parallel line and star survey designs for hydroacoustically - derived abundance estimates of goliath grouper (*Epinephelus itajara*) spawning aggregations
- 09:15 Taylor, Chris Results of the workshop to improve monitoring and analysis of fish spawning aggregations

COFFEE BREAK (9:30 - 9:45)

MARINE PROTECTED AREAS (MPAS) SCIENCE & MANAGEMENT (Sponsored by BIOPAMA; CaMPAM and GCFI) Moderator: Hyacinth Armstrong-Vaughn

- 09:45 Young, Jayron Use of S.M.A.R.T. in the Turneffe Atoll Marine Reserve
- 10:00 Rios Sais, Gerardo Antonio Collective construction of the CAMPAM comprehensive database of marine protected areas necessary to improve the conservation of marine biodiversity in the Caribbean
- 10:15 Camejo Lamas, Jose Alberto National Park to evaluate its contribution to connectivity and to mitigate the effects of climate change
- 10:30 Torres, Ruben Hispaniola Reef Health Monitoring: Status and Trends of Dominican Republic and Haiti
- 10:45 Cruz-Motta, Juan Jose Inferring marine protected areas effectiveness out of temporal patterns alone: the case of two Marine Reserves of Puerto Rico
- 11:00 Eckrich, Caren Striving for a blue destination – finding common ground
- 11:15 Fulton, Stuart We're going to make a marine reserve, but who is going to pay for it?
- 11:30 Lysenko, Nina Decision Support System, based on a set of information, data and indicators, for integrated management of the coastal-marine environment. Final outcomes of the Caribbean EBM-DSS pilot project of Dominican Republic
- 11:45 Walcott, Julian The Caribbean Protected Areas Gateway – supporting better MPA management

LUNCH (12:00 - 14:00)

FISHERS FIELD TRIP: BOCA DE YUMA (SPONSORED BY CODOPESCA)

VEMCO ACOUSTIC TELEMETRY WORKSHOP (14:00 - 16:00)

TUESDAY 5TH NOVEMBER

SOCIO-ECONOMICS & GOVERNANCE (*Sponsored by GCFI*) **Moderators:** **Maria Pena & Manoj Shivlani (10 minute presentations, Students 15 min)**

- 14:00 ***Bowman, Chad** Managed access applied to the fisheries of Belize: stakeholder perceptions of the social and economic impacts
- 14:15 **Mateo, Jeannette** An overview of 20 years of fisheries management in the DR
- 14:25 **Zambrano, Someira** The National Strategic Framework for Fisheries in Dominican Republic: 2019 – 2024
- 14:35 **Olivares-Bañuelos, Nadia Citlali** The sum of the diagnoses: prioritizing actions adding all voices in fisheries management
- 14:45 **Karnauskas, Mandy** Identifying priorities for ecosystem-based management in the Gulf of Mexico through a participatory process
- 14:55 **Cabrera-Pichardo, Joandry** Participation of Dominican women in the fisheries sector
- 15:05 **Botto-Barrios, Darlin** State of fishery resources in the north of the Colombian Pacific facing the implementation of the exclusive zone of artisanal fishing in a socio-ecological context
- 15:15 **Margolis, Sarah** Modernizing fisheries information in the Gulf Of Mexico and Caribbean
- 15:25 **Hawk, Marin** Challenges and successes in small-scale fisheries in the Marine Stewardship Council's program
- 15:35 **Vallès, Henri** The impact of moored fish aggregating devices (FAD) on the artisanal marine fishery in Southeast Haiti

COFFEE BREAK (15:45 - 16:15)

MEETING OF THE GCFI MEMBERSHIP (16:15 - 17:00) Everyone is welcome

COMMUNICATION & POLICY (*Sponsored by GCFI*) **Moderator: Fadilah Ali** **(10 minute presentations, Students 15 min)**

- 17:00 ***Wade, Eric** A methodological approach to systematically assess stakeholder perspectives in fisheries management
- 17:15 **Poon Kong, Nakita** Establishing a coral restoration program on Mustique
- 17:25 **Montes de Soto, Nancy** A profile of the Gulf and Caribbean Fisheries Professional Development Program
- 17:35 **Altamar, Jairo** What size should we catch? A strategy for disclosure in a simple language
- 17:45 **Confair, Rachel** Update on the U.S. Marine Mammal Protection Act import provisions: Implementation process and analysis of marine mammal bycatch in commercial fisheries

POSTER SESSION WITH COCKTAILS & SNACKS (19:00) (Sponsored by GCFI) **Full list at end of Program**

WEDNESDAY 6TH NOVEMBER

EFFECTIVE FISHERIES MANAGEMENT: REDEFINING FISHERIES POLICIES IN THE GULF OF MEXICO & THE CARIBBEAN REGION

(Sponsored by Environmental Defense Fund & GCFI) Moderator: Valerie Miller

- 08:20 Miller, Valerie Overview - Effective fisheries management session
- 08:30 Alzugaray, Romina Cuba - Catch quotas for a finfish fishery in Cuba: Lane snapper (*Lutjanus synagris*)
- 08:40 Carrillo, José Luis & Medellín, Alfonso Mexico - Exploring management measures towards sustainability in the Mexican red grouper fishery
- 08:50 Rodriguez, Elmer Belize - Managed access committees
- 09:00 Mateo, Jeannette & Zambrano, Someira Dominican Republic - Analysis of the effectiveness of the parrotfish ban in Dominican Republic: lessons learned from 2 years
- 09:10 Belize, Cuba, D.R., Mexico & U.S. Multinational panel 1 - Effective fisheries management practices

COFFEE BREAK (10:10 -10:25)

- 10:25 Miller, Valerie Overview - Fisheries policies guided by effective management session
- 10:30 Puga, Rafael Cuba - Cuba's new Fisheries Law, a call for sustainability and adaptive management.
- 10:40 Aldana, Andrés Belize - Highlights of the new Fishing Bill in Belize
- 10:50 Santos, Josefina & Sánchez, Manuel Mexico - Participatory governance through advisory committees
- 11:00 Silleck, Elizabeth U.S. - Recreational Fisheries Reform in the Gulf of Mexico
- 11:10 Manjarrés Martínez, Luis The management of fishery resources in Colombia: an analysis of their relevance and appropriateness from a historical outlook
- 11:20 Acosta, Alejandro Developing a process for identifying fisheries research priorities
- 11:30 Belize, Cuba, D.R., Mexico & U.S. Multinational panel 2 - Policies guided by effective fisheries management
- 12:20 Whittle, Dan Closing remarks and conclusions

LUNCH BREAK (12:30 - 14:00)

FIELD TRIPS (14:00)

- a) Tour of the Grupo Puntacona Foundation projects (Beekeeping, worm composting, Center for Marine Innovation, and Indigenous Eyes Ecological Reserve. (Need reservation, limited to 40 people) Cost: \$12.00
- b) TBC

CINEFISH (19:30) (Sponsored by GCFI)

Moderator: Fadilah Ali

THURSDAY 7TH NOVEMBER

CONCURRENT SESSION (08:00 - 12:00) BIOPAMA: The Caribbean Protected Areas Gateway - supporting better MPA Management

REEFS & ASSOCIATED ECOSYSTEMS: LOBSTER, CONCH & OTHER INVERTEBRATES (Sponsored by GCFI) Moderator: LeRoy Creswell

- 08:00 *Issac, Laura E Preliminary findings: testing an egg farm as a method to increase reproduction of queen conch, *Lobatus gigas*, in The Bahamas
- 08:15 Joseph, Allena Overcoming the challenges facing spiny lobster mariculture in small island developing states (SIDS).
- 08:30 Santos-Valencia, Josefina del Carmen Reproductive cycle of *Lobatus gigas* in Chinchorro Bank, Mexico
- 08:45 Appeldoorn, Richard Maturation and fecundity in the queen conch: individual variability and the effects of density
- 09:00 Aldana Aranda, Dalila Steroid hormones in the Queen conch, *Lobatus gigas* and their association with the spawning
- 09:15 Kitson-Walters, Kimani Population genetics informs management of a commercially endangered species: first insights into Jamaica's queen conch fishery
- 09:30 Forbes-Pacheco, Trisha Experimental culture of *Cittarium pica* in the reef platform of Old Providence and Santa Catalina Island
- 09:45 Matthews, Thomas R. Value enhancement of spiny lobster (*Panulirus argus*) for the live-lobster export market

COFFEE BREAK (10:00 - 10:15)

HABITATS & ECOSYSTEMS (Sponsored by GCFI) Moderator: Mark Peterson

- 10:15 *Stoffers, Twan Spatial distribution, relative abundance and size composition of reef-associated sharks on St Eustatius, Saba and the Saba Bank (Caribbean Netherlands)
- 10:30 McPherson, Matthew Using oral histories and participatory mapping to understand the biological impacts and resilience of fishermen to red tides on the West Florida coast
- 10:45 Hiwat, Michael Engaging stakeholders in marine spatial planning in Suriname through participatory 3-D modelling of the coastal and marine area
- 11:00 Furman, Kelsi Spatial variation and social equity in shore-based recreational fisheries in Key West, Florida.
- 11:15 Charles, Kate Sea turtles in Grenada, West Indies: Celebrating 20 years of conservation
- 11:30 Cambronero-Solano, Sergio New reports of echinoderms on the Caribbean continental slope of Central America
- 11:45 Wongbusarakum, Supin Do scientists and managers think and feel the same about data? Insights from the Pacific island region
- 12:00 Abril-Howard, Omar Deep Sea Monitoring Using ROV Technologies in the San Andres, Providence and Santa Catalina Archipelago, Colombian Caribbean

THURSDAY 7TH NOVEMBER

LUNCH BREAK (12:15 - 14:00)

GCFI BOARD OF DIRECTORS MEETING (12:15 - 14:00)

REEF FISH ECOSYSTEMS: DEMERSAL FISHERIES (Sponsored by GCFI)

Moderator: Yvette DieiOuadi

- 14:00 ***Bolser, Derek** Environmental and structural drivers of fish distributions among petroleum platforms across the U.S. Gulf of Mexico
- 14:15 ***Escalante-Dominguez, Andy** Age and growth of gray snapper (*Lutjanus griseus*) in the Northern Coast of the Yucatan Peninsula
- 14:30 **Chamberlin, Derek** Examining aging error in northern Gulf of Mexico gray triggerfish (*Balistes capriscus*) via multiple hard part age estimates
- 14:45 **Paris, Morgan** Validation of annular increments and formation timing in otoliths of Red Snapper *Lutjanus campechanus*.
- 15:00 **Pineda-Muñoz, Alexandra** Multiannual changes in shallow coral reefs of Albuquerque Islands in the Seaflower Biosphere Reserve, Colombia
- 15:15 **Tzadik, Orian** Using opportunistic datasets to infer spatial management strategies of endemic fisheries in the U.S. Caribbean region
- 15:30 **Giro, Ana** Ecosystem health and management effectiveness in the Mesoamerican Reef

COFFEE BREAK (15:45 - 16:15)

- 16:15 **Santos-Martínez, Adriana** Dynamics of artisanal fisheries and proposals for sustainable management, zone Providencia and Santa Catalina, Colombian Caribbean Seaflower Biosphere Reserve
- 16:30 **Semmens, Brice** Long-term trends in Caribbean parrotfish abundance at local, regional and basin-wide scales: Implications for fisheries and ecosystem management
- 16:45 **Pattengill-Semmens, Christy** A Clearer Picture: how digital cameras have changed marine life surveys over the last three decades
- 17:00 **Johnson, Matthew** From habitat mapping to fish abundance: NOAA's coral reef monitoring program, methodologies, and usefulness as a Caribbean-wide tool for fishery-independent sampling
- 17:15 **Maskrey, Ben** Ciguatera poisoning in Antigua and Barbuda: working towards a risk management strategy

BANQUET RECEPTION (Sponsored by CODOPESCA)

FRIDAY 8TH NOVEMBER

CONCURRENT SESSION (08:00 - 17:00)

**Too Big to Ignore (TBTI): Training-of-the-Trainers Training Workshop:
Transdisciplinarity in Fisheries & Ocean Sustainability**

SARGASSUM IN THE GULF AND THE CARIBBEAN (*Sponsored by GCFI*)

Moderator: Emma Doyle

- 08:00 **Beltré Díaz, Maria J.** Monitoring evaluation of the arrival of the sargazo (Sargassum) to the Dominican coasts: its impact on fishery production
- 08:15 **Iporac, Lowell Andrew** Lessons and challenges in piloting a citizen science project to monitor pelagic Sargassum landings in South Florida
- 08:30 **Baldwin, Kimberly** A geospatial approach to quantifying stranded Sargassum seaweed using drones
- 08:45 **Johnson, Donald** Pelagic Sargassum blooms and dynamics of the north Tropical Atlantic
- 09:00 **Martinez-Daranas, Beatriz** Arrival of pelagic Sargassum to the Cuban coasts, 2012-2019
- 09:15 **Suarez, Ana M.** Ideas for the management of the unusual arrival of Sargassum to the Cuban coasts
- 09:30 **Collado-Vides, Ligia** Variability of nutrient and metals tissue content in pelagic Sargassum spp from South Florida compared with global data

COFFEE BREAK (09:45 - 10:00)

LIONFISH & OTHER INVASIVE SPECIES RESEARCH (*Sponsored by GCFI, FWC*) **Moderator: Joanna Pitt (10 minute presentations, Students 15 min)**

- 10:00 ***Harris, Holden** Substantial population declines in the northern Gulf of Mexico invasive lionfish following disease emergence
- 10:15 **Bolaños Cubillos, Nacor** First 11 years of the lionfish invasion in Colombia: achievements, difficulties and challenges of the different government institutions in the country
- 10:25 **Candelmo, Allison** A deep dive into lionfish
- 10:35 **Hutchinson, Emily** Development of a trap to catch the invasive lionfish
- 10:45 **Schärer-Umpierre, Michelle** The purr of the lionfish: Sound and behavioral context of wild lionfish in the Greater Caribbean
- 10:55 **Eddy, Corey** The Reef Sweeper: A remotely operated vehicle for harvesting invasive lionfish without bycatch at depths to 300 m
- 11:05 **Hunt, Christina** Invasive lionfish decrease shelter-use in the presence of native spiny lobster
- 11:15 **Kington, Kelly** A NEW alien fish species discovered in Trinidad, this is NOT another lionfish talk!

FRIDAY 8TH NOVEMBER

CORAL DISEASE (Sponsored by GCFI) Moderator: Scot Frew

- 11:30 **Gonzalez, Melina** Distribution, abundance and prevalence of coral diseases along the coast of the Dominican Republic
- 11:45 **Berkebile, Nate** Multi-species coral rescue in response to the Stony Coral Tissue Loss Disease on the Florida Reef Tract
- 12:00 **Doyle, Emma** Caribbean cooperation on response to Stony Coral Tissue Loss disease epidemic
- 12:15 **Bervoets, Tadzio** Capacity building efforts to address the emerging issue of Stony Coral Tissue Loss Disease in the Caribbean

LUNCH BREAK (12:30 - 14:00)

CLIMATE CHANGE (Sponsored by GCFI) Moderator: Sandrine Pivard

- 14:00 **Glazer, Robert** Applying a Climate-Smart approach to marine adaptation planning in Southwest Florida
- 14:15 **Eyzaguirre, Jimena** A Climate-Smart fisheries toolkit for the Caribbean: Part 1 - Results of a regional ecological and economic assessment of climate change impacts on Caribbean fisheries
- 14:30 **Tamburello, Natascia** A Climate-Smart fisheries toolkit for the Caribbean: Part 2 - A monitoring and management framework for guiding climate change adaptation in the fisheries sector
- 14:45 **Jiménez-Badillo, Lourdes** Strengthening capacities in fishing communities for adaptation to climate change
- 15:00 **Theophile, Derrick** Vulnerability and adaptive capacity of the fisheries sector in Dominica: Impacts from climate change and hurricanes
- 15:15 **Singh, Joth** Moving to implementation of Ecosystem based Adaptation (EbA) approaches to alleviate the effects of Climate Change in the Insular Caribbean: The CBF's EbA Facility and Partners.
- 15:30 **Felix, Marie-Louise** Strengthening fisher resilience to the impacts of climate change through the use of vulnerability and capacity assessment tools in 3 communities in Saint Lucia.

AQUACULTURE (Sponsored by GCFI) Moderator: Luis Orlando Duarte

- 15:45 **Enriquez Diaz, Martha** Educational programs on the Queen conch in the Caribbean
- 16:00 **Davis, Megan** Development of a fishermen operated pilot-scale queen conch (*Lobatus gigas*) hatchery and nursery facility for sustainable seafood supply and restoration of wild populations in Puerto Rico
- 16:15 **Prada, Martha** Improving mariculture development in the archipelago of San Andres, Providencia and Santa Catalina
- 16:30 **Sánchez-García, Camila** Small scale fish mariculture for artisanal fishers of the islands of Providencia and Santa Catalina, Colombia

COFFEE BREAK (16:45 - 17:00)

FRIDAY 8TH NOVEMBER

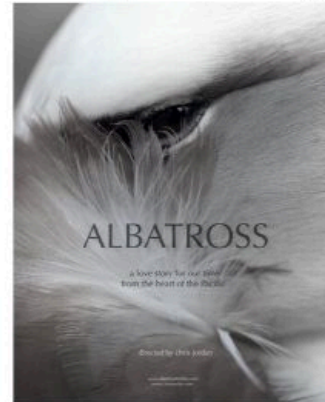
STUDENT AWARD PRESENTATIONS (17:00)

- Presentation of the Ron Schmied Scholarship
- Presentation of the GPML-Caribe Marine Litter Awards
- Presentation of the GCFI Outstanding Student Achievement Awards

CLOSING CEREMONY (17:15)

SPECIAL FILM SCREENING: ALBATROSS (19:30) (Sponsored by GPML-Caribe)

ALBATROSS is a powerful visual journey into the heart of an astonishingly symbolic environmental tragedy. On one of the remotest islands on our planet, tens of thousands of baby albatrosses lie dead on the ground, their bodies filled with plastic. The viewer will experience stunning juxtapositions of beauty and horror, destruction and renewal, grief and joy, birth and death, coming out the other side with their heart broken open and their worldview shifted. Stepping outside the stylistic templates of traditional environmental or documentary films, ALBATROSS delivers a profound message of reverence and love that is already reaching an audience of millions of people around the world.



POST-CONFERENCE ACTIVITIES

SATURDAY 9TH NOVEMBER

CONCURRENT SESSIONS:

- TooBig to Ignore (TBTI): Training-of-the-Trainers Training Workshop
"Transdisciplinarity in Fisheries & Ocean Sustainability (08:00- 12:30;
14:00- 17:00)
- Introduction to FishPath: Tools to Promote Sustainable Fisheries
Management in Data Limited Situations. (08:00- 12:30; 14:00- 17:00)

SUNDAY 10TH NOVEMBER

CONCURRENT SESSIONS:

- TooBig to Ignore (TBTI): Training-of-the-Trainers Training Workshop
"Transdisciplinarity in Fisheries & Ocean Sustainability (08:00- 12:30;
14:00- 17:00)
- Introduction to FishPath: Tools to Promote Sustainable Fisheries
Management in Data Limited Situations. (08:00- 12:30; 14:00- 17:00)

POSTER SESSION

Presenters should be at odd numbered posters from 19:00-20:00 and even numbered posters from 20:00 – 21:00

- 1 ***Alves, Catherine** Assessing fisher perceptions of the Territorial User Rights for Fishing (TURF) program: A Belizean case study
- 2 **Alzugaray, Romina** Bioeconomic modeling of multispecific fisheries in the southeast platform of Cuba
- 3 **Andrés, Navia** *Hypanus americanus* In San Andres Island, Colombian Caribbean, and their relationships with supplementary food as a touristic activity.
- 4 ***Appeldoorn Sanders, Eric** Comparing the diversity of the soundscapes at two fish spawning aggregation sites in western Puerto Rico
- 5 **Atis, Maxene** Sustaining Fisheries and Livelihoods in Haiti's, Three Bays Protected Area Community
- 6 **Azcarate, Ruben** Large scale reef restoration in the Seaflower Biosphere Reserve - San Andres, Providence and Santa Catalina Archipelago, Colombian Caribbean
- 7 **Azcarate, Ruben** Status of the queen conch (*Lobatus gigas*) (Linnaeus, 1758) populations in the Seaflower biosphere reserve and sustainable management implications.
- 8 **Bernus, Jeffrey** CARI'MAM (Caribbean Marine Mammal Preservation Network): Standardized monitoring protocols across the Caribbean
- 9 **Conruyt, Geraldine** Carib'Coast project (Caribbean coastal risks related to climate change: for a monitoring and prevention network); Management plans, human activities and marine mammals
- 10 **Helion, Mike** CariMam: The Caribbean Marine Mammals Preservation Network project
- 11 **Cambronero-Solano, Sergio** Hybrid solution? Building the case for Acroporid restoration in Costa Rica
- 12 **Castro Munoz, Laura M.** Community participation in the control and use of IAS in the International GEF / UNDP Project "Improving the Prevention, Control and Management of Invasive Exotic Species in Vulnerable Ecosystems in Cuba"
- 13 ***Cordero, Katelin** Spatial Analysis of Billfish Species Using Geographic Information Systems (GIS) and Implications for Future Management
- 14 **Cortes Gomez, Rodolfo Adrian** Integral Exploitation of Fishing in Yucatan
- 15 **Cortés-Useche, Camilo** Optimizing coral reef restoration across network of coral nurseries within the Dominican Coastal Restoration Consortium (CDRC)
- 16 **Croquer, Aldo** Grounding Coral Reef Restoration in an Experimental Ecology Framework: A Case Study in Bayahibe, Dominican Republic
- 17 **Duarte, Luis Orlando** Status of fishery resources exploited by small-scale fisheries in the Caribbean Sea of Colombia. Approach based on simple indicators
- 18 ***Esteves Dias, Ana Carolina** Mobilizing action towards social-ecological changes in coastal communities through co-creation of ideas and visual arts
- 19 **Fogg, Alexander** The Continental United States First Fish Aggregating Device Network: Opportunities for Tourism and Pelagic Fisheries Monitoring
- 20 **Furnish, Abigail** Data Gaps and Alternative Approaches: Applying National Standard 1 to Data Limited Stocks

POSTER SESSION

- 21 ***Garcia, Eduardo R.** Length-based growth parameters of *Xiphopenaeus kroyeri* in the Gulf of Salamanca, Caribbean Sea off Colombia
- 22 ***Garcia, Rebecca** The Effects of Water Quality and Sediment Grain Size on the Presence of *Emerita talpoida* at High (Clearwater Beach, FL) and Low (Indian Rocks Beach, FL) Human Impact Beaches.
- 23 **Higgs, Jeremy** Diet observations from tournament landed Swordfish, *Xiphias gladius*, in the north central Gulf of Mexico
- 24 **Andres, Michaels** Integrating parasites into the trophic ecology of the Swordfish, *Xiphias gladius*
- 25 **Kimak, Erin** Distribution & composition of fishaggregating devices as marine debris
- 26 ***Lo Verso Alonso, Gian Luca** Historical changes in catch and composition rates by species of batoids exploited by artisanal fisheries in the Colombian Caribbean Sea.
- 27 **Lohmann, Hilary** A Review of SocMon Caribbean: Challenges and opportunities for improving the visibility and relevance of social science in management and policy
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- 29 ***MacDonnell, Conor** A comparison of biogeochemical and fitness effects of fertilizers on subtropical seagrasses
- 30 **Mateo, Jeannette** Chronology of events of massive fish mortality in the Dominican Republic: possible causes and impacts on local fishing communities
- 31 **Matos-Caraballo, Daniel** Description of Puerto Rico's Queen Conch (*Lobatus gigas*) Fishery Trends After Two Years of the Impact of Hurricane María in Puerto Rico.
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- 39 **Olszak, Sammy** Using citizen science photographs and in situ sampling to measure abundance and biomass of Sargassum landings
- 40 **Pitt, Joanna** An evaluation of the baitfish fisheries in Bermuda
- 41 **Posada Riaño, Violeta** Culture of Macroscopic Marine Algae *Gracilaria* Spp. E *Hypnea Musciformis* In the Reef Platform of Old Providence and Santa Catalina Islands, Biosphere Reserve Seaflower
- 42 **Puga, Rafael** The lobster fishery in Cuba, a decade after the implementation of catch quotas
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POSTER SESSION

- 44 ***Ramos Luna, Luis Felipe** Historical Changes in the Capture Rates of an Artisanal Ancestral Fishery of Beach Seine in Taganga, Caribbean Sea of Colombia
- 45 **Richards, Travis** Food web structure of deep-pelagic micronekton assemblages in the Gulf of Mexico
- 46 **Rivera, Antonella** Socioeconomic landscape of a small-scale reef fishery transitioning to co-management
- 47 **Roa, Camilo** Taxonomical classification of reef fish based on a swimbladder BEM, broadband echosounder modeling; and Bayesian, SVM, and KNN estimators
- 48 **Rodriguez, Manuel** Trends on reef fish populations inside and outside no take zones after 10 years in Sosua Bay, Dominican Republic
- 49 **Rodriguez-Duarte, Joel** Characterization of the queen conch fishery (*Lobatus gigas*) in the Banco Chinchorro Biosphere Reserve in the Mexican Caribbean 2018
- 50 **Rosemond, Claire R.** Estimating Red Hind (*Epinephelus guttatus*) population structure, movement, and vital rates in the US Virgin Islands to inform stock assessment and fisheries management
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- 52 **Surmont, Emily** Variables Influencing Spat Recruitment of *Crassostrea virginica* and *Crassostrea rhizophorae* in an Estuarine Environment
- 53 **Sys, Kim** Bycatch of endangered, threatened and protected species in the coastal artisanal fishery in Suriname
- 54 **Theophille, Derrick** Expanded biological data collection of Dominica key commercial fish species in support of sustainable management
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- 56 **Torres-Pineda, Patricia** Getting to know the coastal-marine biodiversity of a promising area aided by citizen science
- 57 **Torres-Pineda, Patricia** Marine and estuarine fishes of the scientific collection of the National Museum of Natural History "Prof. Eugenio de Jesús Marcano" in Dominican Republic
- 58 **Vignaud, Lea** Use of fish fins as a non-destructive method for isotopic analysis
- 59 **Zambrano Romero, Someira** Dominican Reef Network, A Conservation Alliance in Dominican Republic
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GENDER IN FISHERIES POSTER SESSION

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- 62 **Fletcher, Pamela** Empowering women and girls in fisheries research and ecotourism: Case Study from Leon, Nicaragua
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Deep Sea Monitoring Using ROV Technologies in the San Andres, Providence and Santa Catalina Archipelago, Colombian Caribbean

Monitoreo de Aguas Profundas Utilizando Tecnologías ROV en el Archipiélago de San Andrés, Providencia y Santa Catalina, Caribe Colombiano

Surveillance en Haute Mer Utilisant les Technologies de ROV dans les Archipels de San Andres, Providence et Santa Catalina, dans les Caraïbes Colombiennes

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ABSTRACT

In the Seaflower Biosphere Reserve (RB) marine ecosystems at depths over than 40 meters have been little studied, this generates information gaps that affect the conservation processes and recognition of the population dynamics of marine species. The local company SEPIAROV SAS, developed an ROV-type technology focused on the reduction of the necessary logistics, enabling its application in research exercises, called SEPIA that solves the need to evaluate deep ecosystems, reducing efforts and increasing background time. More than 20 prototypes were developed, applying agile technology development methodologies in order to adapt the operational capabilities of the SEPIA ROV to monitoring. Currently, thanks to the inter-institutional work that integrates the state through the Departmental Government and the CORALINA Environmental Corporation, the academy with the National University of Colombia, the private company SEPIAROV SAS and the community. SEPIAROV is being implemented in projects such as the monitoring of coral reefs, distribution of shovel snail and lionfish, in the latter identifying individuals between 50 and 89 meters deep, developing methodologies that allow to optimize the dive time and the results obtained. The SEPIAROV initiative has worked hand in hand with Macondo lab innovation laboratories of the Simón Bolívar University, in order to boost technology innovation for the marine research community, with versatile tools that meet the needs of deep ecosystem research, key and invasive species in the islands of San Andrés, Providencia and Santa Catalina which have gained high importance in recent years.

KEYWORDS: ROV, deep sea monitoring, prototyping

Developing a Process for Identifying Fisheries Research Priorities

Desarrollando un Proceso para Identificar Prioridades de Investigación Pesquera

Identifier les Stratégies de Recherche sur les Pêches qui Comprennent le Fonctionnement du Processus

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ABSTRACT

Ecosystem-Based Fisheries Management (EBFM) has been promoted in the wider Caribbean as a sound approach for achieving the sustainable use of marine fishery resources. However, developing fisheries' strategies aimed to respond to multiple objectives is complex, especially when managing multi-species fisheries. With the support of the UNDP/GEF "Caribbean and North Brazil Shelf Large Marine Ecosystems" (CLME+) Project, research priorities were identified for four key CLME+ fisheries in the region: Caribbean spiny lobster, fourwing flyingfish, shrimp, and groundfish fisheries. The analysis of priority research needs focused on three Themes: biology /ecology, socio-economics, and governance. Priority needs, gaps, and challenges were identified within a workshop conducted during the 2017 GCFI annual meeting. The objective of this presentation is to outline the process undertaken to agree on research priorities for these complex, multi-species fisheries in order to improve management and achieve economic and social sustainability goals. The research priorities for these fisheries inevitably included some degree of overlap given the complex nature of transboundary marine resources in the Caribbean. Included among these complexities are biological and physical processes, as well as socio-economic, cultural, and governance interactions. Workshop participants recognized the need for accurate and timely scientific data as a foundation for EBFM called for urgent investment in new and improved data collection strategies which address existing data gaps. Ultimately, this will improve public confidence in the information, and facilitate the recovery of socially, economically and ecologically important fish stocks..

KEYWORDS: Ecosystem based fisheries management (EBFM), research strategy, spiny lobster

**Steroid Hormones in the Queen Conch, *Strombus gigas*,
and their Association with the Spawning**

**Hormonas Esteroideas en el Caracol Rosa *Strombus gigas*
y su Asociación con el Desove**

**Les Hormones Stéroïdes et leur Association
Avec le Frai de *Lobatus gigas***

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ABSTRACT

Better to know the reproductive biology of the queen conch *Strombus gigas* will improve the management and conservation of wild populations and develop the aquaculture of this species. The objective of the present work was to know the existence of steroid hormones in *Strombus gigas* and to see their correlation with spawning. A non-invasive stool collection technique was used to generate profiles of the sex hormones of estrogen, progesterone and testosterone. Simultaneously spawning was recorded in the natural environment for one year. The concentrations of the hormones estrogen, testosterone and progesterone were measured by high performance liquid chromatography and a UV detector. The three sex hormones were present in this species, and their concentrations increased during the reproductive period. Males and females showed the highest testosterone concentration in May (1.8 ± 0.3 and 2.1 ± 0.8 ng / ml, respectively). The maximum concentration of estrogen for both sexes was in May (1.2 ± 0.7 and 1.0 ± 0.3 ng / ml, respectively). Progesterone in the females remained constant from March to July. The Pearson correlation between spawning and estrogen was $r = 0.66$ ($p < 0.05$), spawning and testosterone ($r = 0.5216$, $p < 0.05$) and spawning with progesterone ($r = 0.437$, $p < 0.05$). This study shows that sex hormones control the reproductive events of this species.

KEYWORDS: Hormones, reproduction, queen conch

Microplastics in the Food Chain Using Molluscs as Indicators

Microplastics en a Cadena Trofica, Utilizando Moluscos como Indicadores

Microplastiques in Chain Trophique Utilisant les Mollusques Comment Indicateur

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ABSTRACT

The invention of plastic based on synthetic polymers changed our lives forever; it is one of the most versatile materials ever produced. However plastic pollution in our marine environment has reached a critical point, with 9.5 million tonnes of new plastic waste flowing into the ocean each year. Particularly, microplastics in the oceans is becoming an increasing concern. These particles from 300-5000 µm, are found in the sediments, the water column making it very easy for marine organisms to ingest them. This study was carried out in the Celestun lagoon, Yucatán Mexico (Biosphere reserve) on four types of molluscs (carnivorous, *Melongena corona bispinosa*; herbivores, *Nassarius vibex*; filter feeders *Ischadium recouvum* and detritivores) to know if microplastics are presented according to their eating habits. Five organisms from each of these four species were sampled. From each of them the stomach was dissected. Organic matter was eliminated with chlorine solution. Microplastics were extracted and analysed by stereomicroscopy, scanning electron microscopy and Raman spectroscopy. All molluscs analysed showed microplastics. Fibers were the most abundant (68%) regardless of their eating habits. Filter feeders and carnivorous mollusc were the most impacted by microplastics with 39% and 37 %, respectively. For carnivores could be explained as result of a biomagnification phenomenon. Filter feeders are more exposed to them by the currents, decreasing the sedimentation speed of microplastics, making them more available in the water column.

KEYWORDS: Microplastics, pollution, marine reserve

Introducing the Caribbean Node of the Global Partnership on Marine Litter (GPML-Caribe)

Presentamos el Nodo del Caribe de la Alianza Global sobre Basura Marina (GPML-Caribe)

Présentation des Caraïbes Noeud du Partenariat Mondial sur les Déchets Marins (GPML-Caribe)

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ABSTRACT

The Global Partnership on Marine Litter - Caribbean Node (GPML-Caribe) was formed in 2015 and represents a partnership among national and regional organisations, governments, research and technical agencies, and individuals, that work together to reduce the quantity and impact of marine litter in coastal zones of the Wider Caribbean Region (WCR). The Gulf and Caribbean Fisheries Institute (GCFI) and the Secretariat for the Cartagena Convention (UNEP-CEPful) are the co-hosts of the GPML-Caribe. GPML-Caribe is focused on supporting national and regional marine litter projects whilst also promoting national policy and legal reforms. Through the support and development of marine litter related projects, a dedicated webpage (www.gpml-caribe.org), social media platforms, factsheets, an email distribution list, and sharing of information on new grant opportunities, GPML-Caribe strives to be the coordinating force that unifies national and regional actions to achieve the overall goal of reducing and managing marine litter in the WCR. GPML-Caribe has enlisted marine litter experts to develop a marine litter-monitoring manual and to assist with the development of a Regional Marine Litter Management Strategy. This strategy will help to identify priority actions which could be used as the basis for developing new project proposals and assist in resource mobilisation efforts. It will further support the implementation of the Regional Action Plan for Marine Litter Management in the Wider Caribbean Region (RAPMaLi) and implementation of the Protocol on Land Based Sources of Pollution (LBS Protocol).

KEYWORDS: Marine litter, partnership, pollution

**What Size Should We catch?
A Strategy for Disclosure in a Simple Language**

**¿Qué Tamaño Deberíamos Pescar?
Una Estrategia de Divulgación en un Lenguaje Sencillo**

**Quelle Taille Devrions-nous Pêcher?
Une Stratégie de Sensibilisation dans un Langage Simple**

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ABSTRACT

Catch rates of most of the resources that sustain artisanal fisheries Colombia Caribbean Sea are experiencing a drastic decline. As the region does not have specific information for most species and there are limitations for obtaining data; biological reference points based sizes are a good tool to monitor the status of fish stocks in relation to the exploitation that is exerted on them and for management purposes. This work gathering databases and reviewed biological-monitoring of artisanal fisheries landings (catch sizes, sex and maturity stages) from them biological reference points (size at first maturity, optimum size of capture and size at which most individuals are mature were calculated) and simple indicators of 17 major species landed. The current state of the resource was assessed by the percentage of mature and immature individuals caught by fishing gear and the interquartile range of the distribution of sizes of catch. The result was the publication of a handbook with high graphic content (in Spanish: ¿qué tamaños deberíamos pescar?), which aims simple and clear provide useful information to artisanal fishermen of the Colombian Caribbean to carry out a responsible management of fishery resources in the region. The question arises again: how do we capture those sizes?

KEYWORDS: Artisanal fisheries, biological reference points, simple indicators

**Communication and the Gender Approach as a Process of Change
for the Sustainable Fishing: A Community Look**

**La Comunicación y el Enfoque de Género como Proceso de Cambio
para la Pesca Sostenible. Una Mirada Comunitaria**

**La Communication et l'Approche Genre en Tant que Processus de Changement
pour le Pêche Durable Un Regard Communautaire**

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ABSTRACT

The cooperation project SOS Pesca Sustainability of fisheries and improvement of the quality of life of the Fishing Communities was developed in a key area of the Caribbean Basin, aimed to contribute to the regeneration of fish stocks and the sustainable use of the fishing resources of the marine-coastal ecosystems. The scope of this objective included, among other aspects, the improvement of the quality of life of the Playa Florida communities in Camagüey and Guayabal in Las Tunas in southern Cuba. They have approximately 2006 inhabitants, the fundamental economic activity is fishing and more than 90% of the women are housewives who did not have work opportunities that allowed them to improve the living conditions of their family. The sensitization and training aspects were of significant importance in this result, with topics that included identity, gender focus, use of resources and the environment to achieve sustainable fishing. The coordination of these activities allowed to strengthen the local identity and the identification of small-scale economic alternatives.

From a mainstreaming of the gender approach, it was perceived that the participating national institutions did not have an adequate level of preparation on the subject, however, at the end of the project, training was carried out that had high impact and assessment by the community as social aspects necessary to be treated.

KEYWORDS: Communities, cooperation, gender

**Assessing Fisher Perceptions of the Territorial User Rights for Fishing (TURF) program:
A Belizean Case Study**

**Évaluation des Perceptions des Pêcheurs à l'Égard du Programme Droits de l'Utilisateur
Territorial à la Pêche: Étude de Cas du Belize**

**Evaluación de las Percepciones de los Pescadores sobre el Programa de Derechos de los
Usuarios Territoriales para la Pesca: Un Estudio de Caso de Belice**

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ABSTRACT

A major challenge facing subsistence fisheries is gaining support for sustainable management, ensuring the longevity of coastal resources for livelihood and ecosystem benefits. Territorial User Rights for Fishing (TURFs) have emerged as a possible solution to overfishing by requiring fishers to report their catch, color-code their vessels, and fish in designated areas. Belize was the first country in the Caribbean to nationally implement TURFs, with two pilot sites opening in 2011 and seven sites added in 2017. This is the first study to evaluate how the livelihoods and perceptions of fishers in Belize's TURF program have changed from the program's inception in 2011 to present. We administered quantitative surveys to 123 fishers from ten communities, using four TURFs in southern Belize. We compared results to pre-implementation data from 2011 and 2014 to determine the effect of TURF participation on fishers' livelihoods and opinions. Preliminary data indicate fishers overall have positive perceptions about TURF participation, but are dissatisfied with illegal fishing by unlicensed transboundary fishers. Over 65% of respondents know the rules for obtaining and renewing their license, but only 43% see the benefits of catch reporting. 70% of respondents support the TURF program in the long run, but 62% report observing illegal fishing behavior. These data suggest a need to educate fishers about the benefits of accurate catch reporting, improve enforcement, and develop fisher empowerment programs. While the TURF program in Belize is fairly new, the lessons learned can be applied to other small-scale fisheries contexts. This study indicates the importance of evaluating fishers' perceptions of marine policies and provides science-based advice for sustaining fishers' livelihoods while preserving marine resources.

KEYWORDS: Coral reefs, livelihoods, fisheries management

Bioeconomic Modeling of Multispecific Fisheries in the Southeast Platform of Cuba

Modelación Bioeconómica de Pesquerías Multiespecíficas en la Plataforma Suroriental de Cuba

Modélisation Bioéconomique des Pêcheries Multispécifiques sur la Plate-forme Sud-est de Cuba

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RESUMEN

En Cuba, la ordenación pesquera de los peces y las restricciones sobre el comportamiento de sus pesquerías ha sido mínima. A pesar de que la sobrepesca sea uno de los factores que más influye en los bajos niveles de captura, no todos los cambios se pueden atribuir a este único factor; la degradación de hábitats, intensificado por crecientes tasas de turismo y desarrollo costero son factores que amenazan la salud de los ecosistemas y ponen en peligro el futuro económico y los medios de vida de comunidades costeras y la industria pesquera. La mayoría de la captura proviene de la zona suroriental del país, representando un 44% de los desembarques nacionales. A 34 stocks de peces de la zona se les aplicó un modelo dependiente solo de captura (COM), Catch-MSY, para evaluar el estado actual y posteriormente se utilizó un modelo bioeconómico dinámico para obtener estimaciones futuras de captura, ganancias y biomasa bajo diversas estrategias de manejo para lograr diferentes objetivos de producción y conservación. El modelo se adaptó al contexto cubano con información local, estimaciones específicas de precios y costos, así como estimaciones de mortalidad por pesca atribuida a la pesca ilegal. Las proyecciones a 50 años muestran potencial para aumentar biomasa y ganancias disminuyendo las capturas. Para cada especie individualmente se mostraron resultados más diversos, aunque para la mayoría parece posible mejorar la situación actual. Estas oportunidades de recuperación ayudarán a determinar una propuesta de manejo para las pesquerías multiespecíficas que contribuya al uso sostenible de los recursos pesqueros favoreciendo la conservación de la biodiversidad marina, mediante la implementación y el perfeccionamiento de medidas de protección a las especies con valor comercial y con significación especial para los ecosistemas.

PALABRAS CLAVES: Bioeconomía, manejo, peces

Spatial Trends and Drivers of Marine Debris Accumulation on Shorelines in South Eleuthera, The Bahamas Using Citizen Science

Tendencias Espaciales y Motores de la Acumulación de Escombros Marinos en las Costas del Sur de Eleuthera, Bahamas, Utilizando la Ciencia Ciudadana

Tendances Spatiales et Facteurs d'Accumulation de Débris Marins Sur les Rivages à South Eleuthera, aux Bahamas, à l'Aide de la Science Xitoyenne

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ABSTRACT

This study measured spatial distribution of marine debris stranded on beaches in South Eleuthera, The Bahamas. Citizen science, fetch modeling, relative exposure index and predictive mapping were used to determine marine debris source and abundance. Citizen scientists quantified debris type and abundance on 16 beaches within three coastal exposures (The Atlantic Ocean, Great Bahama Bank and The Exuma Sound) in South Eleuthera. Marine debris, (~2.5cm or larger) on each beach was monitored twice between March–May and September–November 2013 at the same locations using GPS. Approximately, 93% of all debris items were plastic with plastic fragments ($\leq 2.5\text{cm}$) being the most common. There were spatial differences ($p \leq 0.0001$) in plastic debris abundance between coastal exposures. Atlantic Ocean beaches had larger quantities of plastic debris by weight and by meter (m) of shoreline. Stranded plastic may be associated with Atlantic Ocean currents associated with leakage from the North Atlantic sub-tropical gyre.

KEYWORDS: Marine debris, plastic pollution monitoring, citizen science

Integrating Parasites into the Trophic Ecology of the Swordfish, *Xiphias gladius*

Integrando Parásitos en la Ecología Trófica del Pez Espada, *Xiphias gladius*

Intégration des Parasites dans l'Écologie Trophique de l'Espadon, *Xiphias gladius*

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ABSTRACT

Over the past decade the role parasites play in ecosystems has gained increased attention, but in terms of an isotopic approach to trophic ecology they still lag far behind their free-living counterparts. Swordfish offer the unique opportunity to study the trophic relationships within a host-parasite system because their parasites are relatively well known, they have varied feeding ecology, and there is a high incidence of multiple co-infections within the same organ (e.g., stomach). We opportunistically sampled the stomachs of 33 Swordfish landed at the Mississippi Gulf Coast Billfish Classic in 2017 and 2018. A total of nine species of parasite were found either in the stomach or attached exterior to the stomach; including 5 species of nematode (3 as adults), 2 species of larval cestode (one that occurred within the stomach and one associated with the body cavity), and one species each of a trematode and an acanthocephalan. The adult nematodes *Hysterothylacium incurvum* and *H. corrugatum* had the highest prevalence of infections at 81% (95%CI 63–92%) and 59% (95%CI 41–76%), respectively, the highest mean abundances (16.3 ± 3.4 and 11.4 ± 2.6 , respectively), and highest mean intensity of infections (20.0 ± 3.8 and 19.2 ± 3.5 , respectively) of all other parasite taxa. The congeners co-occurred in 56% of samples, but there were no differences in any of the parasite metrics based on host sex. We hypothesize that the trophic position of these co-occurring parasites will vary based on their different feeding strategies (feeding on host prey items, absorptive feeding on macronutrients, or feeding directly on the host) and their development stage (larval vs adult). This approach should provide additional insight into how two congeners can occupy the same habitat in a host and if any resource partitioning occurs.

KEYWORDS: Pelagic, stable isotopes

***Hypanus americanus* in San Andres Island, Colombian Caribbean,
and Their Relationships with Supplementary Food as a Touristic Activity**

***Hypanus americanus* en la Isla de San Andres, Caribe Colombiano, y
sus Relaciones con la Comida Suplementaria como Actividad Turística**

***Hypanus americanus* dans l'Île de San Andres, dans les Caraïbes Colombiennes,
et Leurs Relations avec l'Aliment Supplémentaire en Tant qu'Activité Touristique**

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RESUMEN

Hypanus americanus es una especie de interés turístico en la Isla de San Andrés, Caribe colombiano, específicamente en la zona conocida como “El Acuario”. Para el ordenamiento de esta actividad se han desarrollado estudios sobre el tamaño poblacional, residencia e indicadores fisiológicos de salud. Entre noviembre de 2014 y septiembre de 2018 se marcaron 115 individuos de *H. americanus* en El Acuario (89 hembras y 26 machos). Para los análisis poblacionales se aplicaron modelos Cormack-Jolly-Seber (CJS) y Jolly-Seber (JS). La población total estimada fue de 114 individuos, y en promedio, 41 ± 5.08 visitaron El Acuario por mes. Las hembras fueron más abundantes en todos los años (91 ± 1.28) que los machos (23 ± 0.05). La población total se estimó en 100.7 ± 3.1 para hembras y en 25.3 ± 1.1 para machos.

Las hembras (32-105 cm de ancho de disco (AD) fueron significativamente más grandes que los machos (34-65 cm AD). 79.7% de los individuos fueron juveniles y no se encontraron diferencias entre años en las tallas promedio (AD) ni para hembras ni para machos. Las hembras inmaduras fueron más abundantes que las maduras, mientras que en los machos los individuos maduros fueron más frecuentes.

En 2018 se obtuvieron muestras de sangre de 14 individuos, nueve hembras y cinco machos. Las hembras presentaron mayores valores de hematocrito, hemoglobina, CMCH y proteínas plasmáticas que los machos, así como valores mayores de glucosa, colesterol y triglicéridos. Este resultado aún no puede interpretarse como un reflejo de efectos negativos de la actividad turística en la salud de las rayas pues debería contrastarse con muestras de individuos no asociados a la actividad turística.

PALABRAS CLAVES: Stingrays, Myliobatiformes, tamaño poblacional

**Maturation and Fecundity in the Queen Conch:
Individual Variability and the Effects of Density**

**Maduración y Fecundidad en el Caracol Rosado:
Variabilidad Individual y Efectos de la Densidad**

**Maturation et Fécondité Chez le Lambi:
Variabilité Individuelle et Effets de la Densité**

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ABSTRACT

The queen conch, *Lobatus gigas*, resource is one of the most important in the Caribbean. While aspects of conch reproduction, such as size at maturity and spawning season have been studied, there is little information on other important aspects. Experimental caged conch populations held on a natural spawning ground off southwest Puerto Rico were monitored across the spawning season to evaluate fecundity, its variability across individuals and between density treatments. Daily monitoring allowed all egg masses to be allocated to specific females and to calculate the number of eggs. It was also possible to develop a relationship between % maturity and shell lip-thickness. Within each density treatment, individual fecundity varied by a factor of 6. Conch in the low-density treatment produced more and larger egg masses than those in the high-density treatment. The most productive female produced the most egg masses (25), the most eggs (22 million), the largest single egg mass (1.48 million eggs), and had the longest reproductive season, spawning both the first and the last egg masses during the season. In the low-density treatment there was a significant relationship between lip-thickness and fecundity. These results emphasize the importance of allowing conch to mature and further grow in lip-thickness to ensure sufficient spawning to sustain reproductive capacity. They also suggest that there exist super-spawners – individuals whose output may have a differentially greater contribution to future generations.

KEYWORDS: Queen conch, *Lobatus gigas*, reproduction

**Comparing the Diversity of the Soundscapes at
Two Fish Spawning Aggregation Sites in Western Puerto Rico**

**Comparando la Diversidad de los Paisajes Sonoros en
Dos Sitios de Agregación de Desove de Peces en el Oeste de Puerto Rico**

**Comparaison de la Diversité des Paysages Sonores sur
Deux Sites de Concentration de Poissons en Phase de Frai dans l'Ouest de Porto Rico**

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ABSTRACT

Marine soundscapes are complex and include a variety of sounds from sources that can be classified as geophony, biophony and anthrophony. The occurrence and intensity of these different sounds may reflect environmental conditions, biodiversity and human use of critical habitats, such as aggregation sites where multiple species of groupers spawn. Passive acoustic monitoring has been ongoing at two fish spawning aggregation (FSA) sites off the west coast of Puerto Rico, documenting the presence of soniferous species such as red hind (*Epinephelus guttatus*), a commercially important grouper. Sound files collected at both FSA sites, recorded from December to March during the morning time period (6:00 to 11:00 am) in both 2016 and 2017 were analyzed to determine fine scale temporal patterns in the soundscape. Fish and whale sounds were classified as biophony, wind waves and swell sounds were classified as geophony while diver and vessel sounds were classified as anthropophony. The temporal patterns of the classes of sounds within the three levels were cross correlated to reveal detailed temporal patterns of use of the acoustic environment. Results revealed positive correlations between daily patterns of vessel noise and red hind calling activity at each site during a single spawning season. This is a first step to be able to determine the applicability of passive acoustic monitoring to identify sources of sounds that could threaten the effectiveness of FSA sites where communication between spawning fishes is an important part of their reproductive behavior.

KEYWORDS: Fish spawning aggregations, soundscape, passive acoustic monitoring

**Sustaining Fisheries and Livelihoods in Haiti's,
Three Bays Protected Area Community**

**Sostener la Pesca y los Medios de Vida
en la Comunidad de la Area Protegida de las Tres Bahías en Haití**

**Soutenir les Pêches et les Moyens de Subsistance
dans la Communauté de l'Aire Protégée des Trois Baies en Haiti**

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ABSTRACT

The Caribbean Marine Biodiversity Program's Fishing Gear Swap Pilot, funded by the United States Agency for International Development (USAID), was designed to help reduce juvenile fishing in Haiti's Three Bays Protected Area, by promoting sustainable fishing practices among fisherfolk. The Nature Conservancy (TNC) together with fisheries experts and students from the Limonade Campus of Haiti's State University, worked with fishers from the Madras community to replace small mesh traps that capture juveniles (≤ 5 inches in total length), to larger mesh traps targeting mature fish. Fishers that committed to being involved in the pilot received an incentive package with supplies to help maintain quality of catch, larger mesh traps, and training in proper fishing methods. Additionally, a community-based breadfruit flour production enterprise (ATRALMA) was established for these fishers and their family members to provide supplemental income, alleviating the need to solely fish to support their household consequently reducing fishing pressure. Temporary economic shortfalls were expected during the initial phase of the pilot, thus these incentives, including the set-up of the flour production business, were offered to offset short-term losses.

During the pilot, fishers experienced a large increase in the number of mature fishes (> 7 inches) caught (e.g. grunts, jacks, snappers, and barracudas) compared to the catch composition of small mesh traps (many juvenile herbivores), leading to much higher profits with the shift in gear. There was also a 63% reduction in the number of parrotfishes caught which is a species critical to maintaining coral reef health. The breadfruit flour enterprise was also productive. The operationalization of ATRALMA led to flour production and sales throughout the Caracol-Madras district.

KEYWORDS: Fisheries, biodiversity, livelihoods

Status of the Queen Conch (*Lobatus gigas*) (Linnaeus, 1758) Populations in the Seaflower Biosphere Reserve and Sustainable Management Implications

Estado de las Poblaciones de Caracol Pala (*Lobatus gigas*) (Linnaeus, 1758) en la Reserva de Biosfera Seaflower e Implicaciones en el Manejo Sostenible

Situation des Populations de Lambis (*Lobatus gigas*) dans la Réserve de Biosphère de Seaflower et Implications pour la Gestion Durable

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ABSTRACT

The queen conch *Lobatus gigas* is an important fisheries resource in the Caribbean region. The Departmental Government of the Archipelago of San Andres, Providence and Santa Catalina and CORALINA have been monitoring this species populations for more than a decade. Between September and October 2017, populations of the queen conch were evaluated in the Serranilla bank (northern Seaflower MPA) and Courtown and Southwest Cays (southern area of Seaflower MPA). Abundance and density estimates were made from visual assessments and biometrics along transects in stations within the cays' reef shelf, randomly generated since 2007. In Serranilla the total average density (TAD) was 28.74 ind./ha (\pm 47.5), with a maximum of 208.33 ind./ha, mostly adults, the highest density recorded there during this decade. In Courtown and Southwest Cays the TAD was 124.26 ind./ha (\pm 840.69), and 39 ind./ha (\pm 236.36), respectively, most of them juveniles. In Serrana the TAD were 303 ind./ha (\pm 704.12) with a total biomass of the adult stock of 313 tons. We concluded that the populations of the queen conch in Serranilla and in the southern area of the MPA have densities similar to those of overexploited areas in the Caribbean and it's necessary to implement relevant measures that allow to recovery and sustainable use of this resource by the communities in the Seaflower biosphere reserve. Moreover, Serrana seems to maintain the queen conch fisheries in the archipelago due to geomorphological, weather and species ethology conditions, being the only place nowadays where fishing this resource is allowed.

KEYWORDS: Queen conch populations, Seaflower biosphere reserve, Caribbean fisheries

Large Scale Reef Restoration in the Seaflower Biosphere Reserve - San Andres, Providence and Santa Catalina Archipelago, Colombian Caribbean

Restauración a Gran Escala de los Arrecifes de Coral en la Reserva de Biosfera Seaflower - Archipiélago de San Andrés, Providencia y Santa Catalina, Caribe Colombiano

Restauration de Récifs à Grande Échelle dans la Réserve de Biosphère Seaflower - Archipel de San Andres, Providencia et Santa Catalina, Caraïbes Colombiennes

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ABSTRACT

October 2017 saw the start of Colombia's largest coral rehabilitation project via two-step concept of coral gardening. The project objective is to upscale coral reef restoration actions in the San Andres, Providence 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 underwater rope nurseries have been built with the capacity to grow at least 20.000 fragments of coral reef species. The initial stock was 5302 fragments of four hard corals, three soft corals and two sponges' species. Six months after stocking (final stock of 13.468 fragments), the average fragment survival ($89\% \pm 7$ SE) and the increase in ecological volume (EV) recorded ($365\% \pm 99$ SE of their initial size) are within the reference values for reef restoration projects in the Caribbean. Construction, installation, stocking and monitoring nurseries and corals was conducted by more than 70 people representing different relevant social actors, aimed at developing the local capacity in coral gardening and the monitoring of coral reefs in the archipelago. In three years, we expect to see that the joint protection of selected sites with the addition of ca. 1.000 nursery-grown coral colonies per hectare, lead to a 10% increase in the live coral cover, fish biomass, aesthetic value and structural complexity and overall health at intervened coral reefs within the Seaflower MPA.

KEYWORDS: Coral reef conservation, coral gardening, fisheries enhancement

A Geospatial Approach to Quantifying Stranded *Sargassum* Seaweed Using Drones

Un Enfoque Geoespacial para Cuantificar las Algas *Sargassum* de Algas Usando Drones

Une Approche Geospatiale pour la Quantification d'Eau de Mer en Eau de *Sargassum*, a l'Aide de Drones

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ABSTRACT

Mass strandings of pelagic *Sargassum* on beaches across the Caribbean have become the 'new normal' and efforts to manage the negative environmental, social and economic impacts now rank among the priority issues to be solved across the region. To better understand the ecological impacts, develop appropriate strategies to respond to inundations, and assess the viability of entrepreneurial businesses using *Sargassum*, requires standardized information on the locations and quantity of sargassum strandings across the region. To date there are no standard monitoring protocols in place for quantifying stranded *Sargassum* and limited resources available for sustaining time-consuming, conventional quantification methods using transects and quadrats on multiple beaches. In this study we test and compare the use of 'off-the-shelf' recreational drones together with photogrammetry mapping software to easily obtain and process high resolution aerial imagery. Remote sensing and standard geospatial techniques are then leveraged to map, classify and quantify the volume of stranded *Sargassum*. This research was conducted in Barbados during the summer of 2019, under different weather conditions, different beach morphologies and different drone flight parameters to determine the most suitable methods. We use these results to provide a first draft protocol for monitoring *Sargassum* strandings. The use of online collaboration tools could enable this geospatial framework to be rolled out as a standard protocol across the Caribbean with minimal training to obtain, process and share *Sargassum* information regionally in near real-time.

KEYWORDS: *Sargassum* monitoring, standardized protocol, drone

Monitoring Evaluation of the Arrival of the Sargazo (*Sargassum*) to the Dominican Coasts: Its Impact on Fishery Production

Monitoreo Evaluación de la Llegada del Sargazo (*Sargassum*) a las Costas de República Dominicana: Su Impacto en la Producción Pesquera

Suivi de l'Évaluation de l'Arrivée du Sargazo (*Sargassum*) sur les Côtes Dominicaines: Impact sur la Production de la Pêche

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ABSTRACT

The study evaluated the arrival of the *Sargassum* on the Dominican coast, against the real situation of the fisheries under the conditions created by this phenomenon. It was carried out through a survey of fishermen from the areas with the greatest presence of *Sargassum* during the year 2018, in the coastal sections Barahona-Pedernales, Boca de Yuma-Zona Este, San Cristóbal-Baní – Azua and Nagua-Cabrera-Río-San Juan and, the analysis of fishing records available in the Dominican Fisheries and Aquaculture Council for the same year. 129 fishermen were surveyed at 26 landing sites and 7,977 landing records were worked. The data were analyzed using SAS version. 12 and R Studio version 3.5.2. The results indicate that the arrival of the *Sargassum* begins between April-September in the eastern and southern parts of the country and in October to the North. Most fishermen perceive that there is a notable increase in the volumes and composition of their catches in the presence of *Sargassum*, which means an increase in their income; while the records report a production of 351, 347 kg, being the April-July period where the highest CPUE with 53 kg per vessel was found. These data allow us to conclude that *Sargassum* is present almost all year round, following a very varied arrival pattern and that it affects the behavior of fishing activity, the positive impacts being more remarkable than the negative ones. It is recommended to extend the study to the last 10 years, so that a more conclusive trend can be evidenced in relation to fish production versus months with *Sargassum* and months in the absence of it.

KEYWORDS: *Sargassum*, fishing, fishery production

**Multi-species Coral Rescue in Response to the
Stony Coral Tissue Loss Disease on the Florida Reef Tract**

**Rescate de Coral Multiespecie en Respuesta a la Enfermedad de
Pérdida de Tejido Coral Pedregoso en el Tracto de Arrecifes de Florida**

**Sauvetage de Corail Multi-espèces en Réponse à la Maladie de
Perte de Tissu Corallien de Stony sur le Secteur de Récif de la Floride**

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ABSTRACT

The Florida Reef Tract (FRT) is experiencing an unprecedented disease outbreak described as Stony Coral Tissue Loss Disease (SCTLD). First reported near Miami in 2014, SCTLD has since spread to the northernmost extent of the FRT in Martin County and southwestward through the lower Florida Keys resulting in the mortality of thousands of colonies from >20 coral species, including primary reef builders and species listed under the Endangered Species Act. Efforts to identify the pathogen(s) of SCTLD, determine the mode(s) of transmission, and develop potential intervention techniques are currently underway, but our limited understanding of SCTLD greatly impedes management efforts to control the spread of this virulent disease. A multi-agency, multi-disciplinary Coral Rescue Team (CRT) was developed to: 1) design and implement a reef-tract wide coral collection plan for SCTLD-susceptible species, 2) preserve representative portions of the remaining genetic diversity of FRT corals in captivity, and 3) plan for future propagation, restoration and reintroduction of such corals to the wild. The CRT has determined priority target species for rescue, initiated pilot coral collections, developed coral care plans, and started delivery of rescued corals to Florida-based non-governmental organizations and universities as well as long-term housing facilities from the Association of Zoos and Aquariums outside Florida.

KEYWORDS: Stony Coral Tissue Loss Disease

CARI'MAM (Caribbean Marine Mammal Preservation Network)

Red del Caribe para la Protección de los Mamíferos Marinos

CARI'MAM Réseau Caraïbéen pour la Protection des Mammifères Marins

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ABSTRACT

The Agoa Sanctuary (second largest French MPA) is leading an INTERREG Caraibes project called CARI'MAM (Caribbean Marine Mammal Preservation Network). This project aims to develop a network of MPAs dedicated to the conservation of marine mammals in the Caribbean, a veritable hot spot of biodiversity suspected to host up to 31 cetacean species.

Among the action led through the project, emphasis is put on capacity-building for managers and development of common management tools.

The technical objective is to standardize scientific protocols and develop common management tools. In an international context with strong inequalities and various levels of knowledge, it is a challenge to standardize methods that accord the needs and possibilities of all.

Several methods ranging from passive acoustic monitoring to photo-identification are adapted and used by several territories to study the diversity and seasonality of species in order to adapt the associated management measures (eg periods and locations of seismic campaigns). Given the high number of islands, the large influx of data and the need for constant analysis for comparisons, tools for assisting standardized data entry and artificial intelligence algorithms were favored by valuing as much as possible pre-existing tools.

KEYWORDS: Marine mammal, Caribbean, MPA

**Diel Variability in Estimates of Acoustic Biomass and Abundance on
Goliath Grouper (*Epinephelus itajara*) Spawning Aggregations**

**La Variabilidad de Diel en las Estimaciones de la Biomasa Acústica y la Abundancia
en las Agrupaciones de Desove del Goliath Grouper (*Epinephelus itajara*)**

**Variabilité de Diel dans les Estimations de la Biomasse Acoustique et de l'Abondance sur
les Agrégations de Géniteurs du Goliath Grouper (*Epinephelus itajara*)**

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ABSTRACT

Hydroacoustic surveys represent a rapid and non-invasive approach to identify spatiotemporal changes in fish abundance and biomass. This is particularly useful when monitoring fish spawning aggregations that are in recovery, and those known to exhibit high site fidelity across seasons. However, hydroacoustic surveys do possess inherent limitations, such as an inability to detect fish close to the benthos or outside the instruments limited field of view. Thus, proper survey design is a crucial first step to ensure that the data collected will provide an accurate representation of the study system and address the intended questions. Here we compare acoustically derived metrics of biomass and abundance from day and night surveys (n = 70) at consistently occurring Goliath Grouper (*Epinephelus itajara*) aggregations near Jupiter, Florida, over three consecutive spawning seasons during peak lunar periods (new/full moon). Considering that Goliath Grouper are known to be most active after dark during the new moon (while aggregating), and use shelter during the day, we hypothesize that biomass and abundance estimates from night surveys will be significantly greater. Additionally, we expect that differences between lunar periods will be negligible, and propose that the high energetic cost of migrating precludes aggregation dissolution between spawning events. With these data, improvements in abundance and biomass estimates can be used by resource managers to inform effective Goliath Grouper management strategies, but most importantly, this work highlights the importance of acoustic survey design and its effect on data quality and accuracy.

KEYWORDS: Hydroacoustics, goliath grouper, survey design

**Comparison of Age and Growth of Indo-Pacific Lionfish (*Pterois volitans/miles*)
in the Southern Caribbean and the Northern Gulf of Mexico**

**Comparación de la Edad y el Crecimiento del Pez León del Indo-Pacífico
(*Pterois volitans / miles*) en el Sur del Caribe y el Norte del Golfo de México**

**Comparaison de l'Âge et de la Croissance du Poisson Lion Indo-Pacifique
(*Pterois volitans / miles*) dans le Sud des Caraïbes et le Nord du Golfe du Mexique**

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ABSTRACT

Indo-Pacific lionfish (*Pterois volitans/miles* complex) were first introduced off the coast of Florida in the 1980s and have become one of the most severe marine fish invaders in the Atlantic Ocean, Gulf of Mexico, and Caribbean regions. Fisheries managers are concerned about the impacts this alien species may have on the environment such as competition with native species for food and habitat, direct predation of native reef fish, and alteration of community structure. Information about their life history parameters are required for use in models that can determine removal rates needed to effectively manage lionfish densities. This study validated annuli rings in sagittal otoliths to document age from lionfish collected in Aruba in 2014 (n = 63) and the Flower Garden Banks National Marine Sanctuary (FGBNMS) in 2018 (n = 120). Additionally, Fulton's condition factor (K) and asymptotic maximum lengths (Linfinity) were calculated for each of the populations. One-way analysis of variance (ANOVA) was used to determine if the mean age and growth of the two populations differed between locations. Results of the ANOVA suggested the populations were significantly different, with lionfish from Aruba exhibiting a greater L(infinity) and growth rate. However, lionfish from the northern Gulf of Mexico (FGBNMS) exhibited higher condition as compared to those from the southern Caribbean (Aruba). This may suggest that although lionfish may grow faster and larger in Aruba, lionfish in FGBNMS are in better condition.

KEYWORDS: Lionfish, Age & Growth, Aruba

**An Appetite for Lionfish:
Can Texas Support a Commercial Lionfish Fishery?**

**Un Apetito por el Pez León:
¿Puede Texas Apoyar una Pesquería Comercial de Pez León?**

**Un Appétit pour le Poisson-lion:
Le Texas Peut-il Soutenir une Pêche Commerciale au Poisson-lion?**

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ABSTRACT

Indo-Pacific lionfishes (*Pterois volitans* and *P. miles*) are the first marine invasive fish species to become established in the Atlantic, Gulf of Mexico, and Caribbean regions. Lionfish invaded the Gulf of Mexico in 2009 and their population has since grown exponentially. To-date, there are few systematic removal strategies employed to manage the population, although ad-hoc efforts occur intermittently. It is evident that a long-term, sustainable (i.e. ecologically and economically viable) tactic is necessary. We developed a conceptual, sustainable lionfish fishery model that aims to balance native ecosystem vitality and economic viability of local communities. We surveyed Texas Gulf Coast county residents to determine their awareness of lionfish as a threat, level of concern for lionfish in the environment, willingness to eat and pay for the fish, and level of support/confidence for management, as well as investigated lionfish observation reports and removal efficiency of divers. We found that 57% of Texas Gulf Coast residents were willing to consume lionfish. Additionally, 45% believe a commercial fishery would be good for the economy and environment and 66% have confidence that researchers, fishermen, and managers can successfully manage the invasion. We estimated that the present population of lionfish is likely 10-fold higher than current observations predict based on the structure available for colonization and limited area that has been surveyed to date. Divers that have removed lionfish from Texas waters have a removal efficiency of approximately 75%; however, this increases by 93% with experience level per diver. Our results conclude that a lionfish fishery is likely to be one of the few options available for future management in Texas.

KEYWORDS: Lionfish, fishery, Texas

First 11 Years of the Lionfish Invasion in Colombia: Achievements, Difficulties and Challenges of the Different Government Institutions in the Country

Primeros 11 Años de la Invasión del Pez León en Colombia: Logros, Dificultades y Retos de las Diferentes Instituciones Gubernamentales del País

Les 11 Premières Années de l'Invasion du Poisson-lion en Colombie: Réalisations, Difficultés et Défis des Différentes Institutions Gouvernementales du Pays

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ABSTRACT

The first record of the lionfish in Colombia was in 2008 and required the development of an inter-institutional work carried out by the Ministry of Environment and Sustainable Development, the INVEMAR research institute, the CORALINA environmental authority, the Local Government of the San Archipelago Andrés, National Parks of Colombia, and several Colombian universities and NGOs, which led to the development of various actions of education, control, research, monitoring, formulation of national policies, which has been strengthened with the international efforts of the regional strategies of several countries.

The most relevant results of Colombian efforts are: the official declaration of the lionfish as an invasive alien species in the country, the adoption and implementation of a National Plan for Management and Control and a Protocol for the capture, extraction and disposal of lionfish, the incentive of consumption as a control strategy, the obtaining of by-products, the linking of communities in hunting efforts, control, consumption and costume jewelery, the installation of monitoring stations for lionfish in different areas of the country, capturing different depths, the creation of an official web portal for exotic species in Colombia, among other actions.

In spite of the above, the difficulties to obtain economic resources for the development of actions of management, control and monitoring of the lionfish are increasing, with the aggravating fact that over time, the invasion of the lionfish and its effects on biology and Ecology of species and ecosystems seems to be losing interest and adherents, so it is proposed to resume discussions to strengthen and boost the process again at the regional level.

KEYWORDS: Lionfish, invader, regional strategy

**Environmental and Structural Drivers of Fish Distributions
Among Petroleum Platforms Across the U.S. Gulf of Mexico**

**Impulsores Ambientales y Estructurales de la Distribución de Pescado
entre las Plataformas Petroleras del Golfo de México de EE. UU.**

**Influences de l'Environnement et des Caractéristiques des Plate-Formes Pétrolières
sur la Distribution Spatiale des Poissons Autour des Plate-Formes Pétrolières
dans la Partie Américaine du Golfe du Mexique**

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ABSTRACT

Petroleum platforms in the U.S. Gulf of Mexico (U.S. GOM) are important habitat for fishes and support regional fisheries. However, drivers of the regional distribution of fishes associated with these artificial habitats are not fully understood. To address this, we conducted 114 submersible-rotating drop-camera and water quality sonde surveys at 54 platforms throughout the U.S. GOM. We then fit two sets of binomial generalized additive mixed models (GAMMs) integrating environmental and structural predictors to encounter/non-encounter data for 17 fish species, so as to understand their horizontal and vertical distribution patterns around platforms. Significant predictors for horizontal distribution included distance from shore (Bermuda Chub *Kyphosus sectatrix*, Greater Amberjack *Seriola dumerili*, Vermilion Snapper *Rhomboplites aurorubens*), salinity (Bermuda Chub, Red Snapper *Lutjanus campechanus*), the number of platforms within five kilometers (Blue Runner *Caranx crysos*, Crevalle Jack *Caranx hippos*), and dissolved oxygen concentration (Red Snapper). Significant predictors for vertical distribution included salinity (Atlantic Spadefish *Chaetodipterus faber*, Bermuda Chub, Greater Amberjack, Red Snapper, Vermilion Snapper), dissolved oxygen concentration (Greater Amberjack, Red Snapper), and seafloor depth (Red Snapper). However, the majority of the study species were not influenced by the predictors included in the horizontal (11/17 species) and vertical distribution (12/17 species) GAMMs. Thus, many U.S. GOM fishes were found to associate with platforms over a relatively wide range of environmental conditions and platform characteristics. This suggests that association with the physical habitat may be more important than the optimal environmental conditions and specific platform characteristics for these fishes.

KEYWORDS: Fish distribution, Gulf of Mexico, petroleum platforms

State of Fishery Resources in the North of the Colombian Pacific Facing the Implementation of the Exclusive Zone of Artisanal Fishing in a Socio-ecological Context

Estado de los Recursos Pesqueros en la Zona Norte del Pacífico Colombiano ante la Implementación de la Zona Exclusiva de Pesca Artesanal en un Contexto Socioecológico

L'état des Ressources Halieutiques au Nord Pacifique Colombien Face à la Mise en Place de la Zone Exclusive de Pêche Artisanale dans une Perspective Socio-écologique

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RESUMEN

A nivel global existe una crisis por el acelerado detrimento de los recursos pesqueros, en gran parte por una débil gobernanza, ausencia de manejo y la falta de conocimiento. En Colombia, se han implementado algunas herramientas de manejo para avanzar hacia la cogestión de los recursos pesqueros, destacándose la Zona Exclusiva de Pesca Artesanal (ZEPA) del Pacífico Colombiano. La presente investigación se propone aportar al conocimiento del estado de los recursos pesqueros y al análisis del manejo de la zona norte del Pacífico colombiano, ante la implementación de la ZEPA. Se recopilieron los datos pesqueros del área, registrados por instituciones gubernamentales y ONG's, para analizar la dinámica interanual y comparar los efectos de la implementación de la ZEPA, en particular con índices como la captura por unidad de esfuerzo. Así mismo, se obtuvo información cualitativa, a través de cuatro grupos focales, con la participación de 30 pescadores y 15 entrevistas semiestructuradas a investigadores, con el fin de evaluar el estado de los ocho principios propuestos por Ostrom para una exitosa cogestión de los recursos en la ZEPA. Los análisis holísticos realizados evidencian en un corto periodo (años 2011-2017), disminución del esfuerzo y mejora en las capturas. Además, se propone una cuota de captura a partir del RMS para cada una de las artes de pesca, siguiendo el enfoque precautorio propuesto por FAO. Con los resultados se construyó una visión del estado de los principios de Ostrom, evidenciando la urgencia de fortalecer el monitoreo de los recursos y de las reglas y consensuar sanciones para los infractores. Este estudio destaca las fortalezas de la ZEPA en Colombia y presenta los factores mínimos requeridos para fortalecerla.

KEYWORDS: Cogestión, pesca artesanal, sistema socioecológico

**Managed Access Applied to the Fisheries of Belize:
Stakeholder Perceptions of the Social and Economic Impacts**

**Acceso Gestionado Aplicado a las Pesquerías de Belice:
Percepciones de las Partes Interesadas sobre los Impactos Sociales y Económicos**

**Accès Géré Appliqué aux Pêcheries du Belize:
Perceptions des Parties Prenantes des Impacts Sociaux et Économiques**

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ABSTRACT

Controlling and monitoring fishing effort and understanding human perspectives on fisheries management strategies are paramount to the sustainability of Belize's fisheries. To address the challenges posed by open access fishing, Belize implemented a Rights-Based Fishery (RBF) management strategy in 2016, known as Managed Access (MA), issuing tenure rights to more than 3,000 traditional fishers in eight distinct fishing areas in its territorial waters. Although RBFs have been successfully applied elsewhere, usually in industrial/large-scale fisheries, their implementation in small-scale coastal fisheries in the Caribbean is under-studied and there is little practical guidance for managers. This study uses Q-Methodology to explore the perceptions of four key MA stakeholder groups on the early impacts of Belize's MA strategy, and to assess its contribution to the socio-economic value of Belize's fisheries. Participants were asked to sort 35 statements about the social, economic, biological, administrative, enforcement and compliance aspects of the MA system, using a Q-sort grid. Factor analysis of the Q-sorts provided five distinct perceptions. Perception 1 supports MA but believes some components need revision. Perception 2 has high confidence in the strategy and expects improvements with financial investments. Perception 3 does not believe in the strategy and expresses frustration with it not protecting fishers' rights. Perception 4 captured the biological concerns not addressed by the strategy, while Perception 5 focused on the strategy's inability to make the fisheries more profitable thus far. This study contributes to the scarce scientific information on the early stages of RBF implementation in a Caribbean SIDS and could provide valuable guidance to managers as they attempt to improve aspects of the MA.

KEYWORDS: Rights-based fisheries, small-scale coastal fisheries, sustainable fisheries

Migratory Species and Blueways Conservation: The Case of Cuba

Especies Migratorias y Conservacion de Blueways: El Caso de Cuba

Conservation des Espèces Migratrices et des Voies Bleues: Le Cas de Cuba

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ABSTRACT

The Nature Conservancy is studying migratory pathways to identify key habitats in the life cycles of marine species in the Gulf, the critical regions connecting them, and the threats migratory species encounter that can impede migration. Critical migratory pathways and threats to species migration are essential information for effective marine conservation planning and species survival, yet are poorly understood. By identifying these blueways and hotspots, marine conservation planners can aim to protect these locations and improve species survival. The Conservancy has gathered animal tracking data from over 100 researchers and institutions in the United States, Mexico, and Cuba to assess migratory pathways in the Gulf of Mexico, including Cuba. The goal of its Migratory Species Conservation framework is to enhance migratory biodiversity by conserving important pathways within the Gulf of Mexico and improving ecological connectivity. More specifically migratory connectivity refers to the links individual animals or species populations provide to their ecosystems based on their use of and fidelity to specific habitats or geographic areas. In this presentation we share the results of our recent migratory connectivity assessment for Cuba. This project aims at highlighting the geographic role Cuban marine environments in maintaining the regional migratory connectivity across the region. The results highlight the different levels of connectivity of marine megafauna in Cuban waters, and regionally within the North Atlantic. Examples are presented of migratory pathways of fish, sea turtles, marine mammals and birds, and their demographic and habitat connections across the region, with emphasis in the Gulf.

KEYWORDS: Migration, Gulf of Mexico, Cuba

Participation of Dominican Women in the Fisheries Sector

Participación de la Mujer Dominicana en el Sector Pesquero

Participation des Femmes Dominicaines au Secteur de la Pêche

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ABSTRACT

When talking about fishing and aquaculture, we usually think of men, however, the Food and Agriculture Organization of the United Nations, in 2016, defends that about 50% of this sector is made up of women who assume key roles such as extraction or resource cultivation, processing and commercialization. The objective of this analysis is to publicize the participation of women in the fisheries sector. The data was updated through the database of fishermen of the Consejo Dominicano de Pesca y Acuicultura with update of the first quarter of 2019. In the Dominican Republic there are officially registered 8567 people dedicated to fishing, of this total 8264 are men and 298 are women, which indicates that around 5% of the people engaged in this occupation are female, it is undoubtedly estimated that the greater participation of women in the fisheries sector lies in the processing, commercialization and administration of the resources obtained from fishing. The fishing art preferred by females was gillnet, followed by fishing rod. As a result of this situation, the National Fisheries Strategy has given priority to projects of which women are the owners and those administered by them, in addition to motivating greater participation by women in the fisheries sector.

KEYWORDS: Fisheries sector, women, participation

Hybrid Solution?
Building the Case for Acroporid Restoration in Costa Rica

Solución Híbrida?
Desarrollando las Bases para la Restauración de Acropóridos en Costa Rica

Solution Hybride?
Construire les Fondations pour la Restauration d'Acroporids au Costa Rica

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ABSTRACT

Coral reefs provide coastal protection, are centers of high biodiversity, and support a wide range of recreational and commercially important species of fish and invertebrates. Due to significant declines in living coral coverage worldwide, coral restoration efforts are increasing, especially in the Caribbean region. Among the most important reef building species, Acroporids play a major role in habitat complexity and because of their growth rates have been targeted for restoration projects. Three sympatric *Acropora* species occur in the Caribbean; in Costa Rica, *A. palmata* is the most common, *A. cervicornis* is very scarce and the hybrid *A. prolifera* has not been reported yet. Understanding ecological, physiological and evolutionary relationships is a key factor to conduct a successful restoration project. We report for the first time the presence of *A. prolifera* in Costa Rica, from a single colony located at Cahuita National Park. On site photographs and opportunity fragments were collected and compared to museum specimens of Museo de Zoología of Universidad de Costa Rica. Morphological evidence demonstrates hybrid intermediate morphology, with high similarity to the palmate morph reported on other Caribbean regions. We propose genetic, micro-structure and immunological analyses that will support the best management practices of *Acropora* spp. in Costa Rica, a country with high potential for ecological restoration. Lastly, we urge the need of stakeholders to increase support for coral reef research, monitoring and restoration projects in the South Western Caribbean region.

KEYWORDS: *Acropora*, hybrid, restoration

New Reports of Echinoderms on the Caribbean Continental Slope of Central America

Nuevos Reportes de Equinodermos en el Margen Continental Caribe de America Central

Nouveaux Rapports d'Echinodermes sur le Versant Continental des Caraïbes de l'Amérique Centrale

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ABSTRACT

The Caribbean is considered a unique biogeographic region that represents an important hotspot of marine diversity in the Atlantic Ocean. The Caribbean Continental Slope of Central America (CCCA) is a largely unexplored area that exhibits a variety of habitats. We present the results from the first exploratory fishing survey campaign on the CCCA, done under the regional coordination of OSPESCA (Central America Fisheries and Aquaculture Organization) on board of the R/V Miguel Oliver in January 2011. Data was collected from a total of 96 trawls arranged in 25 transects that started in Panama and finished in Belize. A Lofoten bottom trawling net was dragged for 30 min between 0 to 1500m depth. The major component of the total invertebrate catch was Holothuroidea with a biomass of 593 kg (16.49% of the total) and represented by seven species. The following are new reports for the Caribbean: *Bathyploes natans* in Honduras and Guatemala, *Bentothuria funebris* in Panama, *Benthodytes sanguinolenta* in Panama, Costa Rica, Nicaragua and Belize; *Hansenothuria* sp. in Panama, Costa Rica and Honduras. *Paroriza pallens* extends its distribution to Panama, Costa Rica, Nicaragua and Honduras, and *Zygothuria lactea* its reported in Panama. We also present the first records of the crinoid *Neocomatella pulchella* in Honduras, the asteroid *Cheiraster* (*Cheiraster*) *planus* in Panama, and, for Costa Rica (Asteroidea: *Doraster constellatus* and Echinoidea: *Clypeaster euclastus*). Holothurians are the predominant invertebrate fauna in terms of biomass in the entire region of the CCCA. These findings suggest that CCCA presents a high echinoderm biodiversity and also supports the ecoregional variation theory. We report higher echinoderm biomass (75%) in the Southwestern Caribbean compared to Western Caribbean ecoregion.

KEYWORDS: Deep-Sea, echinoderms, Caribbean

Characterization of the Mangrove in the Guanahacabibes National Park to Evaluate its Contribution to Connectivity and to Mitigate the Effects of Climate Change

Caracterización del Manglar en el Parque Nacional Guanahacabibes para Evaluar su Contribución a la Conectividad y a la Mitigación de los Efectos del Cambio Climático

Caractérisation de la Mangrove dans le Parc National des Guanahacabibes pour Évaluer sa Contribution à la Connectivité et Atténuer les Effets du Changement Climatique

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ABSTRACT

The work presents the most up-to-date characterization of the coastal mangrove ecosystem in the Guanahacabibes National Park with the objective of evaluating its contribution to the connectivity of the processes that occur in the marine-coastal interface and to the mitigation of the effects of climate change in the region. For the characterization, forest plots were established in three locations with different intensities of effects due to disastrous natural events, according to the methodology established for the monitoring of mangroves in protected areas of Cuba. In each plot data on species composition, abundance, canopy coverage, formation height, basal area, substrate characteristics and interstitial salinity were taken. An evaluation of the variables analyzed in the three selected locations is presented and it is shown that the ecosystem in general has a good state of conservation, even when it is in different stages of succession after the impact of disastrous natural events that have affected the area, including six intense hurricanes in the last 16 years. The contribution of the mangrove to the protection of the forests located towards the interior of the area and to the marine pastures and coral reefs that make up the marine-coastal sector of the protected area is analyzed. An evaluation of the management activities program that is carried out with the participation of local communities for the conservation of the mangrove ecosystem is presented as a contribution to the connectivity of marine-coastal biological populations and to the mitigation of the effects of climate change.

KEYWORDS: Mangroves, mitigation, connectivity

A Deep Dive into Lionfish

Una Inmersión Profunda en el Pez León

Une Plongée Profonde dans le Poisson-lion

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ABSTRACT

Research and anecdotal evidence has shown reduced lionfish densities in heavily culled areas. However, there is still concern that densities of lionfish are high at deep sites outside recreational dive limits. Understanding lionfish densities and behavior in deep reef habitats is vital for management of these habitats. We conducted roving diver surveys of deeper reef and artificial habitats (35 - 45m) off the reef tract of Islamorada Florida and adjacent shallower surveys (20-30m) day and night. CPUE of lionfish varied in these systems spatially and temporally. Preliminary results revealed higher CPUE of lionfish on deep low reefs during the day compared to at dusk. Lionfish may be moving to hunt or spawn in the evening and therefore dispersing daytime aggregations. Day time may be more efficient to cull time-limited deep dive sites. This differs from shallower, higher relief sites where lionfish are less cryptic at dusk and easier to find. Additional factors which may influence CPUE at deep reef and artificial structures are; intensity of culling pressure in adjacent shallow sites, presence of larger predators and reef structure and complexity. In addition, a hydrophone was deployed at one deep site with high CPUE. Thirteen lionfish were surveyed within three meters of the hydrophone upon retrieval. Over three hundred distinct recordings of lionfish were isolated. Frequency of calls increased during dusk. Further recording is underway and will be compared with video to establish behavior associated with the calls and their utility as a lure for traps and removal at deep sites.

KEYWORDS: Lionfish, Deep habitat, acoustic

Community Participation in the Control and Use of IAS in the International GEF / UNDP Project “Improving the Prevention, Control and Management of Invasive Exotic Species in Vulnerable Ecosystems in Cuba”

Participación Comunitaria en el Control y Aprovechamiento de las EEI en el Proyecto Internacional GEF/PNUD “ Mejorando la Prevención, Control y Manejo de Especies Exóticas Invasoras en Ecosistemas Vulnerables en Cuba”

Participation de la Communauté au Contrôle et à l'Utilisation des EEE dans le Projet International FEM / PNUD «Améliorer la Prévention, le Contrôle et la Gestion des Espèces Exotiques Envahissantes dans les Écosystèmes Vulnérables à Cuba»

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ABSTRACT

The environmental problem, recognized by the different social instances, is determined among other processes by the specific forms of socioeconomic development, whose practice involves from the ways in which man conceives himself within nature to the specific instruments with which appropriates her; that is, the different knowledge and practices - not only economic - but social and cultural of humanity.

The need to address the environmental problem in our communities, requires a perspective that involves the criticism of these different knowledge and developments of human knowledge and the creation of alternatives or the search for a unit of their traditional knowledge on native and exotic species Invasive and the contributions that the International GEF / UNDP project “Improving the Prevention, Control and Management of IAS in vulnerable ecosystems in Cuba” generated from its work objectives. For this purpose, the objective has been to facilitate the integration of the surrounding human communities to the intervention sites of the project, in the knowledge, control and use of IAS, as well as to appreciate anomalous behaviors in the ecosystems and measure the effects of climatic variations in the dispersion of these invasive alien species.

KEYWORDS: Communities, invasive alien species, participation

**Examining Aging Error in Northern Gulf of Mexico Gray Triggerfish
(*Balistes capriscus*) via Multiple Hard Part Age Estimates**

**Examinando el Error de Envejecimiento en el Pejepuerco Blanco (*Balistes capriscus*) del
Norte del Golfo de México vía de Múltiples Estimaciones de Edad de Parte Duro**

**Examen des Erreurs de Vieillissement dans *Balistes Caprisques* (*Balistes capriscus*) aux
Nord du Golfe du Mexique à l'Aide de Multiples Estimations de l'Âge des Parties Dures**

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ABSTRACT

Ageing error can be propagated in stock assessments, which in turn can result in erroneous estimates of stock status and productivity and contribute to depleted stocks not recovering according to projected timelines. The Gulf of Mexico (GOM) gray triggerfish (*Balistes capriscus*) stock is one such stock that has failed to rebuild at projected rates. Dorsal spines have been the preferred ageing structure for gray triggerfish, but the lack of precision in age estimates derived from dorsal spines is well-documented and recent evidence exists that spines may produce biased age estimates as well. Unlike many marine fishes, gray triggerfish have not been routinely aged with otoliths due to their small size thus difficult extraction and preparation. We assessed ageing error (both imprecision and bias) in gray triggerfish by comparing age estimates between dorsal spine translucent zone counts and sagittal otolith opaque zone counts. Age estimates were validated by analyzing radiocarbon ($\Delta 14C$) from eye lens cores and fitting radiocarbon signatures to the regional coral bomb radiocarbon chronometer. Bias was assessed by fitting a linear regression to the regional coral data and computing the sum of squared residuals for ages $\pm 1-4$ years. Results indicate otoliths are the more accurate and precise ageing structure. Improved age estimates will allow for the more accurate modeling of current gray triggerfish stock dynamics and projections of future rebuilding scenarios.

KEYWORDS: Age validation, gray triggerfish, bomb radiocarbon chronometer

Sea Turtles in Grenada, West Indies: Celebrating 20 years of Conservation

Tortugas Marinas en Granada, Antillas: Celebrando 20 Años de Conservación

Tortues Marines à la Grenade, dans les Antilles: 20 Ans de Conservation

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ABSTRACT

Grenada provides nesting, foraging and developmental habitats for four species of sea turtle; Leatherback (*Dermochelys coriacea*), Hawksbill (*Eretmochelys imbricata*), Green (*Chelonia mydas*) and Loggerhead (*Caretta caretta*). Ocean Spirits, a local non-profit NGO, conducted their 20th consecutive year of nesting research in 2019 on Levera and Bathway beaches on the north eastern tip of the main island of Grenada. Annually a minimum of 2000 hours are spent collecting data. Grenada hosts a critical population of nesting leatherbacks, the third largest in the Caribbean. Over the past twenty years, an average of 640 ± 276 Leatherback nests have been laid at Levera beach annually and nesting females ranging in size from 113.6 cm to 173.6cm in Curved Carapace Length have been recorded. Each female nests between 3- 10 times within a season and lays 79.4 ± 56.5 eggs per nest. Leatherback turtles have been protected by national legislation since 2001. A legal fishery still exists for hard-shelled species between September 1st and March 31st.

We documented low nesting in 2019. 428 confirmed nests were laid by *D. coriacea* and only 120 individual Leatherback turtles were identified (compared to an 18-year average of 184.3 ± 65.6). During the 2019 season, 90% of nests on the south side of Levera beach were lost and destroyed through *Sargassum* inundation and erosion. Green and Hawksbill turtles were recorded on Levera Beach in small numbers in 2019.

Turtles from Canada and Trinidad visited Grenada this season and successfully nested. In previous seasons, turtles from Tobago, Venezuela, Costa Rica, Barbados, Puerto Rico and Panama have nested in Grenada.. Ocean Spirits work on a range of educational outreach activities to raise awareness of the importance and value alive of Grenada's marine resources reaching +250 students annually.

KEYWORDS: Sea turtle, Grenada, *Sargassum*

**Variability of Nutrient and Metals Tissue Content in Pelagic *Sargassum* spp.
from South Florida Compared with Global Data**

**Variabilidad de las Concentraciones de Nutrientes y Metales en Tejido de *Sargassum* spp.
Pelágico del sur de Florida en Relación con los Datos Globales**

**Variabilité de la Concentration de Nutriments et Métaux dans Tissus chez *Sargassum* spp.
Pélagique du Sud de la Floride par Rapport aux Données Mondiales**

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ABSTRACT

The pelagic *Sargassum* bloom might be responding to nutrient enrichment of ocean waters; and the massive amount of biomass might be an opportunity to commercialize this resource. Safe use need to be tested due to the metals' biosorption ability of *Sargassum*. Here we present nutrient and trace metal tissue content of pelagic *Sargassum* collected in south Florida. Samples of *S. fluitans*, and *S. natans* collected from three localities in the Biscayne area were cleaned, dried for 48 h at 68C, and ground. Analysis were conducted at analytical facilities at FIU. Mean N tissue content was 1.08 ± 0.23 and mean P was $0.0348 \pm .0122$. No deficit of nutrient content compared to global mean values for macrophytes were detected. The C:N ratio of 43.15 ± 7.43 , and the C:P ratio of $3175 \pm 1039:1$ show a high content of C relative to N and P. The N:P ratio of 66 ± 24.35 show a limitation of P content relative to N. The stoichiometric C:N:P ratio of $3175 \pm 1039: 66 \pm 24.35:1$ of the south Florida samples compared to the global average of $1,106:38:1$ demonstrate a large content of C and N. We suggest that an increase on C availability together with N should be explored as potential causes triggering this macroalgal mega bloom. A high variability in metal concentrations were found, it is noteworthy that Arsenic was found in high concentrations in all samples ranging from 73 up to 120 mg/kg. The characteristic presence of alginates in brown algae, particularly in *Sargassum*, increases the affinity of species of this genus for trace metals. Variability might reflect individual physiological conditions as well as metals' availability along the trajectory of these pelagic species along the Atlantic. We suggest requesting estimations of tissue metal concentrations before approving *Sargassum* for animal of human consumption.

KEYWORDS: *Sargassum*, nutrients, variability

Update on the U.S. Marine Mammal Protection Act Import Provisions: Implementation Process and Analysis of Marine Mammal Bycatch in Commercial Fisheries

Actualización sobre las Disposiciones de Importación de la Ley de Protección de Mamíferos Marinos de EE. UU.: Proceso de Implementación y Análisis de Captura Incidental de Mamíferos Marinos en Pesquerías Comerciales

Mise à Jour des Dispositions d'Importation de la Loi Américaine sur la Protection des Mammifères Marins: Processus de Mise en Œuvre et Analyse des Prises Accessoires de Mammifères Marins dans les Pêches Commerciales

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ABSTRACT

The U.S. Marine Mammal Protection Act states that the U.S. shall ban the importation of foreign commercial fish or fish products which have been caught with commercial fishing technology which results in the incidental kill or incidental serious injury of marine mammals in excess of U.S. standards or of any fish or fish product that was produced in a fishery that intentionally kills marine mammals in the course of those fishery operations. Previously, NOAA Fisheries, in consultation with foreign trading partners assembled a List of Foreign Fisheries, which contains global fisheries information for fisheries that export seafood products to the U.S., including the target catch, gear type, and data on incidents of marine mammal interaction in the course of fishing operations. Fishery and marine mammal interaction data was provided by nations and cross-checked with published information from regional fishery management organizations and Food and Agricultural Organization's national reports, scientific publications, and gray literature. NOAA Fisheries is in year three of the five-year exemption period and here to provide updates, including the introduction of a web-based portal for accessing fishery information and completing the 2019 Progress Report. The Progress Report asks fisheries managers to provide information on their nation's regulations relating to marine mammal bycatch and fisheries management with the goal to track the reduction of marine mammal interaction in commercial fisheries. We pose for the oral session to review each nation represented in Gulf and Caribbean Fisheries Institute their list of fisheries, as well as any priorities and possible mitigation measures. Nations are welcome to bring any questions about the Progress Report due September 13, 2019, and schedule technical consultations after the event.

KEYWORDS: Regulations, protected species mitigation, passive gears

Solid Waste and Marine Litter Management Trends in the Wider Caribbean Region

Tendencias en el Manejo de Desechos Sólidos y Desechos Marinos en la Región del Gran Caribe

Tendances en Matière de Gestion des Déchets Solides et des Déchets Marins dans la Région des Caraïbes

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ABSTRACT

The 2019 State of Convention Area (SOCAR) Report for the Wider Caribbean Region (WCR) on marine pollution published by the Secretariat to the Cartagena Convention estimated that in 2015, the resident population generated 79 million tons of solid waste. As a result of inadequate solid waste management practices, as much as 1.3 million tons of plastics were introduced to the Caribbean Sea. The WCR is among the world's regions with the highest floating microplastic and macroplastic concentrations. Microplastic adsorbs organic pollutants from the surrounding seawater and when ingested, can deliver harmful chemicals to marine fauna and humans. In Grenada, for example, in a recent study, microplastic particles were found in 41 of the 42 digestive tracts of seven species of commercially exploited marine fish analysed. While bans of single-use plastic bags and polystyrene foam products have swept across the region in the last year, solid waste management continues to be a major challenge. While addressing plastic pollution using a circular economy approach is gaining momentum, the by-products of plastic recycling can be just as, or even more harmful than the uncycled plastic itself. There is a growing recognition of the need to reduce the production of new plastic and to seek appropriate alternatives. The Protocol on Land-Based Sources of Marine Pollution, ratified by 15 Countries in the WCR, forms a valuable regional framework for continued efforts to control pollution from Marine Litter and Plastics, and to assist Governments in meeting Sustainable Development Goal 14.2 on reducing marine pollution.

KEYWORDS: Litter, Caribbean, plastic

Spatial Analysis of Billfish Species Using Geographic Information Systems (GIS) and Implications for Future Management

Análisis Espacial de Especies de Marlines Utilizando Sistemas de Información Geográfica e Implicaciones para el Manejo Futuro

Analyse Spatiale des Espèces de Marlins à l'Aide de Systèmes d'Information Géographique et Implications pour la Gestion Future

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ABSTRACT

Marine management areas are created with the idea to conserve various species from overharvest and/or preserve an important ecosystem. For highly migratory fish, like billfish, this can be difficult due to the fact that they do not stay in the same place for long periods of time typically, but a number of management areas have been created over the past several decades with varying success. Nearly two decades ago, the Florida East Coast Pelagic Longline Closed Zone (FECPLLCZ) was established due to overfishing of the stock and the region being identified as a nursery ground for swordfish. The spatial analysis of tag and release data of blue marlin, sailfish, and swordfish was conducted with Geographic information systems (GIS) software by looking at management areas off Florida and billfish data reported to The Billfish Foundation (TBF) in order to investigate any correlation between conservation zones and recreational effort. Answering this question would help pave way to future management strategies to help advance billfish conservation as well as the rights of recreational anglers. The use of TBF's data was most logical seeing as it is widely recognized and used by many in the sportfishing community since 1990. The analysis showed that the FECPLLCZ was particularly effective for swordfish and sailfish species, as shown by the statistics presented in the high low clustering reports. Furthermore, the information found supports the idea that using proper management techniques and implementing marine conservation zones that are able to, at the same time, protect the right of recreational anglers ensures that the links between sportfishing, marine conservation, and both our local and global economy remain strong.

KEYWORDS: Marine management area, billfish, spatial analysis

Integral Exploitation of Fishing in Yucatan

Aprovechamiento Integral de la Pesca en Yucatán

Exploitation Intégrale de la Pêche au Yucatán

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RESUMEN

En México se pescan 1.3 millones de t, ocupando el tercer lugar en Latinoamérica y el 16° nivel mundial. Yucatán captura 44 432 toneladas: 6 500 Mero, 2 600 Rubia, 2 000 Rubio y 1 000 Chac-chi. Anualmente de 70 millones t capturadas mundialmente, se generan 4 200 000 t de residuos (cabeza, vísceras, aleta y piel). De los cuales México produce 800 000 t anuales. Estos subproductos se transforman en harinas para ganadería. El objetivo de este estudio fue analizar la factibilidad de transformar subproductos de pescado en botanas. Se registraron las especies y cantidad comercializada por semana en tres pescaderías. Generan 58 kg de subproductos. Las aletas y pieles se prepararon y sazonaron para posteriormente ser freídas a: 100°C, 150°C y 175°C por 5, 10 y 15 minutos. Se realizó una evaluación sensorial a 30 personas para conocer la calidad de la botana obtenida, usando como indicadores: crujientes, contenido de grasa y masticabilidad. La menos aceptada fue 100°C/10min, por ser grasosa y nada crujiente. La mejor aceptada 175°C/5min, que resulto fácil de masticar y crujiente. Además, se determinó su valor nutricional: humedad 8%, cenizas 40%, proteínas 30%, grasas 22% y 3 400 Kcal/Kg. Este trabajo da como resultado final una botana, sana, rica en proteína y barata. Valor \$1 dólar, bolsa de 50g. Siendo una actividad alternativa a la economía de Yucatán, que puede destinarse a mujeres.

KEYWORDS: Subproductos, Yucatán, aletas

**Optimizing Coral Reef Restoration Across Network of Coral Nurseries
Within the Dominican Coastal Restoration Consortium (CDRC)**

**Optimización de la Restauración de Arrecifes de Coral a través de la Red de Viveros
de Coral Dentro del Consorcio de Restauración de la Costa Dominicana (CDRC)**

**Optimiser la Restauration des Récifs Coralliens à travers le Réseau de Pépinières de
Coraux au Sein du Consortium Dominicain de Restauration Côtière (CDRC)**

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ABSTRACT

Restoration is a tool widely known for assisting ecosystem recovery. To mitigate the effects of environmental change drivers, restoration techniques have diversified in the Caribbean region. Here, we describe the implementation of a network of coral nurseries within the Dominican Coastal Restoration Consortium (CDRC) as an alternative to optimize efforts in the Dominican Republic. We reviewed collaboration agreements between three local institutions, including the Fundación Grupo Puntacana (FGPC), the Fundación Dominicana para Estudios Marinos (FUNDEMAR) and Counterpart International (CPI) founders of the CDRC. We detail the CDRC's management tools to improve coral nursery management, facilitate information exchange, and standardize procedures and protocols in the Dominican Republic. In the country a total of 10 coral nurseries are monitored and operated by the CDRC; using the best available equipment and using parameters for the evaluation of each member nursery. These protocols and standards are shared through a digital platform for the collection of data, reports and information. This within a framework of partnership between local communities, government authorities, NGOs and industry, which have achieved an innovative ecological and economic strategy for the development of long-term programs and thus benefit the development of the region by providing ecosystem services.

KEYWORDS: Restoration, coral reefs, ecosystem services

Integrating Local and Scientific Knowledge for Climate Change Adaptation in the Eastern Caribbean Fisheries Sector

Integrando el Conocimiento Local y Científico para la Adaptación al Cambio Climático en el Sector Pesquero del Caribe Oriental

Intégration des Connaissances Locales et Scientifiques pour l'Adaptation au Changement Climatique dans le Secteur de la Pêche des Caraïbes Orientales

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ABSTRACT

The importance of local knowledge of fisherfolk regarding changes not normally observed or examined through science should not be overlooked by fisheries managers and policy makers, especially in the data poor environment typical of the fisheries sector in the Eastern Caribbean. In this circumstance, such knowledge may be the best available information for a precautionary approach. Fisherfolk knowledge gained through their daily observations and experiences at sea and ashore, particularly when combined with natural and social scientific information, can inform meaningful adaptation to climate change and variability and support efforts to manage climate risks in the sector. In this paper, we present preliminary findings from combining Eastern Caribbean fisherfolk observations, perceptions and behavioral changes with scientific information to better understand climate impacts and related environmental risks. This research forms part of the Climate Change Adaptation in the Eastern Caribbean Fisheries Sector (CC4FISH) Project of the Food and Agriculture Organization. Among the significant findings are observed changes in sea state (colour, current direction, roughness), winds (strength and seasonal patterns), and changes in behaviour and seasonal availability of key pelagic fish species. Fisherfolk coping strategies have included changes in the species and individual sizes targeted and processed for marketing. Mobilising this local knowledge for evidence-based policy-making is essential for more effective and sustainable implementation of climate change adaptation strategies.

KEYWORDS: Climate change adaptation, local knowledge, fisherfolk

**Grounding Coral Reef Restoration in an Experimental Ecology Framework:
A Case Study in Bayahibe, Dominican Republic**

**Afianzando la Restauracion de Arrecifes en el Marco de la Ecologia Experimental:
Un Caso de Estudio en Bayahibe, Republica Dominicana**

**Renforcement de la Restauration des Récifs dans le Contexte de l'Écologie Expérimentale:
Une Étude de Cas à Bayahibe, en République Dominicaine**

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ABSTRACT

Coral reefs are undergoing rapid changes because of a combination of local and global stressors. In the Caribbean, populations of reef-building corals are declining at unprecedented rates, underscoring the need for urgent action to preserve these ecosystems. Coral restoration has gained a great deal of attention as a strategy to help corals and coral reefs to withstand increasing disturbances. While coral reef restoration science has improved in past decades, strong experimental design and monitoring plans are key to assess success and upscale restoration efforts. Experimental ecology has played an important role in restoration programs in many terrestrial and marine ecosystems. Herein, we propose an experimental framework for coral reef restoration and discuss its advantages/disadvantages using a reef section located at Bayahibe as study case. A mixed experimental design which includes fixed and nested factors will be implemented in the Sombrero Reef, Bayahibe, the Dominican Republic. Fixed factors will include plots to be restored (i.e., a set of experimental units impacted and rehabilitated) using sexual and asexual recruits (i.e., micro fragmentation), control plots (i.e., a set of experimental units impacted) and reference plots (i.e., a set of experimental units less impacted where rehabilitation is not necessary). Plots will be monitored for 3 years after establishing a baseline (T0) prior to intervention. The experiment will also measure the potential effects of seasonality over the restoration outcome. The proposed experiment renders seven sources of variation allowing testing if restoration will be effective for a known reef section and whether the outcome varies in space and time. We hope our experience in the Sombrero Reef in Bayahibe will contribute to coral restoration experimental design in the Dominican.

KEYWORDS: Restoration, coral, experimental design

**Inferring Marine Protected Areas Effectiveness Out of Temporal Patterns Alone:
The Case of Two Marine Reserves of Puerto Rico**

**Inferencia sobre la Efectividad de Áreas Protegidas Basadas en Patrones Temporales:
El Caso de Dos Reservas Marinas de Puerto Rico**

**Inférence sur l'Efficacité des Zones Protégées sur la Base de Modèles Temporels:
Le Cas de Deux Réserves Marines à Porto Rico**

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ABSTRACT

Whenever assessing the effectiveness of marine reserves, it is important to have both outside reference areas (fished vs non-fished) and temporal comparisons for each (before vs after reserve declaration). This optimal situation is not commonly found, so inferences about effectiveness must be made from patterns of temporal variation alone. This is the case of Mona Island, a relatively isolated and unique no-take within the Mona and Monito Natural Reserve (MNR) located west of Puerto Rico. To infer effectiveness of the MNR, closed since 2010, temporal trends of the structure and composition of fish assemblages were assessed and compared to those of La Parguera Natural Reserve (LPNR), which is open to fishing. To achieve this, underwater visual censuses of fish (30 x 2 m belts of 10 min) were done at multiple sites (91 MNR to 140 LPNR), in different areas (3), during several times (5 MNR to 7 LPNR) between 2010 and 2018. Since assemblages in these two areas are known to be different, comparisons were based on temporal trends alone. It was hypothesized that: 1) effect sizes due to temporal variation would be greater than that of spatial variation, and 2) temporal variation in MNR would be greater than in LPNR. Multifactorial-multivariate linear models of total assemblage biomass showed that relative temporal components of variation (CVs) were greater in MNR (42%) than in LPNR (20%). Also, temporal CV in MNR was greater than any of the spatial CV, but this was not found for LPNR. Temporal trends in MNR were driven by 16 different species, 12 of which are commercially important. Out of those 12 species, 8 increased (snappers, groupers and parrotfishes) in biomass while the other four (all groupers) have decreased; indicating that MNR has been effective in protecting some of commercially important species in the region.

KEYWORDS: MPA, effectiveness, reef fishes

**Development of a Fishermen Operated Pilot-Scale Queen Conch (*Lobatus gigas*)
Hatchery and Nursery Facility for Sustainable Seafood Supply and Restoration
of Wild Populations in Puerto Rico**

**Desarrollo de un Criadero y Vivero Piloto de Carrucho (*Lobatus gigas*)
Operado por Pescadores, para la Producción Sostenible de Mariscos y Restauración
de Poblaciones Silvestres en Puerto Rico**

**Développement d'une Écloserie de Lambis (*Lobatus gigas*) et d'Une Aire D'alevinage
Expérimentale Diriger par des Pêcheurs pour l'Établissement d'une Production de
Produits de la Mer Durable et le Rétablissement des Populations de Lambis a Porto Rico**

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ABSTRACT

The queen conch *Lobatus gigas* is an important fisheries species in the Caribbean that has been overfished. In the U.S. Caribbean, The Queen Conch Resources Fishery Management Plan established a program to help rebuild conch populations in Puerto Rico and U.S. Virgin Islands. The majority of the conch “Carrucho” fished in Puerto Rico are consumed locally with little export. With the decline in conch populations in Puerto Rico’s state and federal waters, closed seasons, and disruption of conch habitats from hurricanes such as Maria, conch is a prime candidate to be cultured in a pilot-scale hatchery in Puerto Rico. The goal of the 2-yr project (S-K NOAA Award NA10NMF4270029) is to assist with restoration of queen conch fisheries in Puerto Rico by producing conch in a fishermen-operated conch aquaculture facility. The conch hatchery is being built at the Fishermen’s Association in Naguabo, PR. The first hatchery season will be the summer of 2020. Hatchery-reared juvenile conch will be released into the Luis Peña Channel Natural Reserve no take MPA near Isla de Culebra. The hatchery will be open to fishermen, community, students and visitors to learn about conch aquaculture, biology, conservation and fisheries. A live webcam will broadcast hatchery activities and a conch aquaculture Spanish training manual will be completed. This project will serve as a model, which can be transferred to other fishing communities in Puerto Rico and elsewhere. The project will aid sustainable fisheries practices through aquaculture by working with the fishermen, using the commercial Fishermen’s Association’s working waterfront, helping provide diversified incomes for the fishery communities, promoting aquaculture practices, and ensuring the conch population is available for future fishing and food security through aquaculture and restoration.

KEYWORDS: Queen conch, hatchery, fishermen

**Capacity Building Efforts to Address the Emerging Issue of
Stony Coral Tissue Loss Disease in the Caribbean**

**Los Esfuerzos de Capacitación para Enfrentar el Asunto Emergente de la
Enfermedad de la Pérdida de Tejido de Coral Duro en el Caribe**

**Efforts de Formation pour Traiter le Problème Émergent de la Maladie Corallienne
Liée à la Perte de Tissu sur les Coraux Durs dans les Caraïbes**

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ABSTRACT

Stony coral tissue loss disease (SCTLD), first reported in Florida in 2014, has been reported in 2018 and 2019 in the Wider Caribbean Region with cases in Jamaica, Mexico, Saint Maarten, the US Virgin Islands, the Dominican Republic, the Turks and Caicos Islands and Belize. To provide capacity-building support to countries currently affected by SCTLD and those susceptible to the disease, MPACConnect (an initiative of the Gulf and Caribbean Fisheries Institute, the NOAA Coral Reef Conservation Program and over 30 Caribbean coral reef marine protected areas) hosted a learning exchange for marine natural resource managers and partners from the Caribbean with their counterparts in Florida and with coral disease experts. The exchange focused on sharing information among participants about disease identification, monitoring, strategies for minimizing diver, fisher, and ship-borne dispersal of the presumed pathogen(s), treatment protocols, and effective outreach communication. We will summarize the distribution, chronology and known status of SCTLD in the Caribbean region through October 2019 using data submitted to our three organizations and displayed at the AGRRA web site, our efforts to help identify the pathogen(s) causing SCTLD and highlight the challenges it presents to managers. We explain the approach to collaborative sharing of information and ideas to help correctly identify, monitor and respond to cases of SCTLD in order to proactively address the unprecedented threat of this new disease.

KEYWORDS: Coral disease, management, monitoring

**Status of Fishery Resources Exploited by Small-scale Fisheries
in the Caribbean Sea of Colombia: Approach Based on Simple Indicators**

**Estado de Recursos Pesqueros Explotados por la Pesca Artesanal
en el Mar Caribe de Colombia: Aproximación Basada en Indicadores Simples**

**État des Ressources Halieutiques Exploitées par la Pêche Artisanale
de la Mer des Caraïbes, en Colombie: Approche Basée sur des Indicateurs Simples**

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RESUMEN

La política pesquera y ambiental de Colombia reconoce la necesidad de evaluar los recursos que sustentan las pesquerías artesanales, pero históricamente se cuenta con poca información para formular medidas de manejo con criterios de sostenibilidad social, económica y ecológica. En el país, se realiza el monitoreo de los desembarcos pesqueros y de los aspectos biológicos de las especies explotadas, desde el año 2012, mediante el Servicio Estadístico Pesquero Colombiano. Con base en la información registrada en el Caribe de Colombia, se calcularon indicadores simples basados en el tamaño de los animales capturados (L50 y Lóptima) y las tasas de captura para *Caranx crysos*, *Centropomus undecimalis*, *Lutjanus synagris* y *Mugil incilis*, especies de importancia social y económica en la región. Se contrastó la estructura de tamaños y el tamaño promedio de captura (Lc) del método de pesca predominante para cada especie, en cada año y estrato geográfico con L50 y Lóptima, con el fin de detectar la posible pérdida de sostenibilidad de la población debido a la erosión en su capacidad de renovación. En la mayoría de los casos, Lc resultó menor que L50. En *C. crysos* se observó una tendencia a la disminución en el tamaño promedio de captura entre 2013 y 2018, en *L. synagris* se detectó un patrón espacial de incremento de Lc de sur a norte, mientras que en *M. incilis* el patrón espacial resultó contrario. El establecimiento de tamaños mínimos legales, el control de la selectividad de los métodos de pesca y estrategias de manejo diferenciales en los estratos espaciales se requieren para contrarrestar los indicios de pérdida de sostenibilidad en las pesquerías artesanales.

PALABRAS CLAVES: Pesquerías de pequeña-escala, sistemas de información, puntos de referencia

**Spatial-temporal Movement Patterns of Lane Snappers (*Lutjanus synagris*)
in Brewers Bay, St. Thomas, US Virgin Islands**

**Patrones Espacial-temporales del Movimiento de las Biajaibas (*L. synagris*)
en la Bahía de Brewers, St. Thomas de las Islas Vírgenes de los EE.UU.**

**Schémas de Mouvements Spatio-temporels des Argentés (*L. synagris*)
dans la Baie Brewers, St. Thomas du les Îles Vierges Américaines**

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ABSTRACT

Lane snapper (*L. synagris*) is a medium sized reef-associated fish species of commercial importance in the Caribbean and Gulf of Mexico region. Little is known about the diurnal and seasonal movement patterns of individual *L. synagris* across Caribbean seascapes. This study aims to fulfill those gaps by using acoustic telemetry in Brewers Bay, St. Thomas, US Virgin Islands. Fifteen adult lane snapper ranging in size from 26.5-36.7 cm total length were passively tracked to identify their home ranges during diel, crepuscular and seasonal periods. From July 2015 to December 2017 only eleven lane snappers were present every day and showed greater than 90% residency time within Brewers Bay. Lane snappers showed high site fidelity in four areas of Brewers Bay: Black Point reef, Ratchford reef, shallow Brewers Bay and mid Brewers Bay throughout the year. The average home range size for all lane snappers was 0.0339 km², range [0.002 km², 0.129 km²]. Lane snappers residing in shallow and mid Brewers Bay had their day and night home ranges at separate locations; while lane snappers residing at Ratchford and Black Point reefs showed complete overlap in day and night home range location. The average home range size of lane snapper showed significant difference across diel and crepuscular periods (RM-ANOVA $p < 0.001$). Home range sized varied significantly across months ($R^2 = 0.0238$, $p = 0.034$) and primarily increased in size from April to September. Two lane snappers changed significantly their behavior and habitat utilization within Brewers Bay during the passing of two major hurricanes (Irma and Maria) in September of 2017. Our results provided baseline data to efficiently monitor and evaluate responses to changes in water and habitat quality for the management of this species.

KEYWORDS: Acoustic telemetry, home range, lane snapper

Striving for a Blue Destination – Finding Common Ground

Luchando por un Destino Azul: Encontrar un Terreno Común

Vise une Destination Bleue – Trouver un Terrain d’Entente

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ABSTRACT

Bonaire is a Dutch Caribbean island whose economy is driven by dive tourism. For 40 years, the Bonaire National Marine Park has actively managed its coral reefs and has developed strong partnerships with the dive industry: they are its eyes and ears on the water and are responsible for collecting the nature fees that finance the park. Strengthening this partnership are initiatives that have evolved in which coral reef conservation activities are only permitted via the dive industry, such as lionfish hunting and coral restoration specialties. Also, in a joint effort to salvage 1000s of sponges during a pier renovation project at a popular dive site, Salt Pier, STINAPA partnered with Cargill and Dive Friends to develop volunteer and guided dive programs to transplant sponges that would have perished. Furthermore, STINAPA is partnering with the dive industry to develop guided data collection dives to document coral disease and bleaching prevalence. As our island works towards defining and achieving the status of a Blue Destination, partnerships and close communications, especially between STINAPA and the local government, are necessary to ensure sustainable development. One such project in 2018 was the renovation of several commercial piers in Kralendijk: the government, contractors and stakeholders met frequently, a budget for nature conservation was approved, measures were taken to protect marine life, and the pier was renovated with as little impact to the marine environment as possible. STINAPA also partnered with fishermen in its BRUV shark monitoring project. Achieving Blue Destination status, going forward sustainably, means different things for different people. With fishermen, the government and private companies, STINAPA is finding common ground in which to bridge the gap and achieve sustainable solutions.

KEYWORDS: Blue Destination, Bonaire, partnerships

**The Reef Sweeper: A Remotely Operated Vehicle for Harvesting
Invasive Lionfish Without Bycatch at Depths to 300 m**

**The Reef Sweeper: Un Vehículo Operado de Forma Remota para la Captura de Pez León
Invasivo sin Captura Incidental a Profundidades de Hasta 300 m**

**Le Reef Sweeper: Un Véhicule Télécommandé pour la Capture de Poissons-lions
Envahissants sans Capture Accessoire à une Profondeur de 300 m**

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ABSTRACT

Lionfish in the western Atlantic Ocean pose a threat to marine ecosystems across their invaded range. To mitigate this threat, managers have focused on programs that encourage volunteer cullers to spear lionfish for consumption and, in some jurisdictions, speared lionfish may be sold. There have also been efforts to commercialize lionfish harvest, both in association with existing commercial trap fisheries and using dedicated traps designed to catch lionfish with minimal bycatch. However, these approaches are limited by the depths and/or habitats in which they can operate, and may not be allowed in Marine Protected Areas because of the bycatch risk. Atlantic Lionshare, a Bermuda-based company, has developed a Remotely Operated Vehicle (ROV) designed specifically to harvest lionfish. The custom-built Reef Sweeper ROV utilizes a retractable spear to capture individual lionfish and then contain them within a cage until it returns to the surface. Real-time camera feeds and lasers guide the operator firing the spear, and station-keeping software helps the vessel and ROV maintain position. The Reef Sweeper team removed more than 1,000 lionfish from deep Bermuda reefs over the past year. Operating at an average depth of 60 m with an average capture rate of 54%, capture success was correlated with the total number of lionfish initially present at a site, and averaged 71% when 20 or more lionfish were present. This ROV complements other lionfish removal efforts as it can operate for extended periods at depths down to 300 m, and makes harvesting lionfish on a commercial scale, with no by-catch, feasible. Now in Florida waters, collaborating with the Fish and Wildlife Commission, the Reef Sweeper is removing invasive lionfish from vulnerable deepwater habitats below 46 m, while supplying markets with quality fish for consumption.

KEYWORDS: Lionfish, mitigation, management

Educational Programs on the Queen Conch in the Caribbean

Programas Educativos sobre el Caracol Rosa en el Caribe

Programmes Éducatifs sur le Lambi dans la Caraïbe

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ABSTRACT

The Queen Conch, *Lobatus gigas*, is an emblematic gastropod of the Caribbean. The Conch populations have declined significantly, so various management initiatives have been directed towards their sustainable use. The purpose of this review was to locate educational material and outreach programs on this gastropod, and examine the measures taught to mitigate the problem of overfishing and resource conservation. A search of documents was carried out on the web, with the keywords: Queen Conch educational program and management measures. 80 digital documents with this information were located. It was observed that of 45 countries and overseas department (OD), 19 have generated educational material, with the Bahamas being the one with the highest number of educational material (21), followed by the USA and Colombia (8), Mexico (7), Belize and Turk and Caicos (6). 79% of the documents presented the Queen Conch as a species threatened with overfishing. The minimum size, body weight, lip thickness and closure season were the fishing management measures detected. Eight countries and OD, presented information of these measures, Bahamas touches four measures. The USA and Puerto Rico touch the measures of minimum size, lip thickness and closure season; while Belize, Cayman Islands, Mexico, Turk and Caicos and Virgin Islands only mention the closing season of the fishery. In the analysis it was observed that the main consuming and exporting countries, Bahamas and the USA have educational programs for the sustainable use of the Queen Conch, however, France and its OD being the second conch consumers, does not maintain an educational program. In general, only 2% of the educational material showed data on fishery management measures, presenting great variability due to each fishing situation, whether social, economic or biological.

KEYWORDS: Queen conch, educational programs, management measures

**Age and Growth of Gray Snapper (*Lutjanus griseus*)
in the Northern Coast of the Yucatan Peninsula**

**Edad y Crecimiento del Pargo Prieto (*Lutjanus griseus*)
en la Costa Norte de la Península de Yucatán**

**Age et Croissance du Vivaneau Sarde Grise (*Lutjanus griseus*)
le Long de la Côte Nord de la Péninsule du Yucatan**

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RESUMEN

En el sur del Golfo de México, los meros (Epinephelinae) han constituido el principal componente de la pesquería de escama del estado de Yucatán, México. Debido a que ésta entró en una fase de declive, el esfuerzo pesquero ha sido redirigido hacia los Lutjánidos como el pargo prieto *Lutjanus griseus* (Linnaeus, 1758). La información científica disponible sobre la biología de este pargo en Yucatán es escasa, lo cual impide un manejo sustentable del recurso.

Un total de 837 especímenes de pargo prieto (rango: 8.0 a 65.5 cm LT; 8 a 3,876 g PT) fueron colectados mensualmente a lo largo de la costa de Yucatán, de los cuales se seleccionó una sub-muestra de 357 individuos (12.3- 65.5 cm LT; 756- 3876 g PT) para el análisis de sus otolitos (sagittae). A partir de micro-cortes de estos otolitos se analizó los anillos de crecimiento presentes para determinar la edad después de realizar una validación por el incremento marginal (IM). El crecimiento de la especie fue descrito mediante el modelo de Von Bertalanffy.

El análisis del IM confirmó la formación de anuli en los otolitos analizados. La edad de los individuos fluctuó entre +0 y 10 años, siendo los de 4 (n = 76), 3 (n = 66) y 5 (n = 53) los más abundantes y los +0 (n = 3) y 10 años (n = 4) los más escasos. Los valores de los parámetros del modelo de crecimiento de Von Bertalanffy para el pargo prieto de Yucatán fueron: L_{∞} = 68.54; k = 0.16, t_0 = -0.2346 y ϕ = 2.876. Los resultados obtenidos en el presente estudio fueron comparados con los disponibles para las poblaciones de otras regiones de distribución de la especie.

KEYWORDS: *Lutjanus griseus*, edad, crecimiento

**Mobilizing Action Towards Social-ecological Changes in Coastal Communities
Through Cco-creation of Ideas and Visual Arts**

**Acción Hacia los Cambios Socio-ecológicos en Comunidades Costeras
a través de la Co-creación de Ideas y Artes Visuales**

**L'action Face aux Changements Sociaux et Écologiques dans les Communautés Côtières
à travers la Co-cr  ation d'Id  es et d'Arts Visuels**

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ABSTRACT

The purpose of this study is to critically analyze how communities and decision-makers can adapt to uncertainty and rapid change in social and ecological aspects of coastal and marine systems towards a more effective environmental governance at the regional level. We describe and analyze three participatory workshops as an arena of co-creation of ideas towards key social-ecological changes and their impacts on the wellbeing of coastal communities. The workshops were stimulated by visual arts and community participation in three fishing communities at the Southeast coast of Brazil. The workshop followed the World Caf   method due to its flexibility and potential to stimulate a co-creation process as participants build from information provided by others. Massive tourism, changes to water regime in the region, and reduced fish stocks were the key changes happening at the regional level driven by both local and external drivers. On one hand, such changes negatively impact local eating habits and social relations between community members. On the other hand, they provide new education and income opportunities. The graphics outcome and the discussions of the workshops were disseminated to local schools fostering children reflection and awareness of themselves as agents of change. They also contributed to community engagement at the regional level including an exchange of experiences between coastal communities and communication with regional protected area managers, including a marine protected area that is currently developing a zoning plan to regulate marine activities in the North Coast of S  o Paulo state and a no-take protected area that struggles to manage traditional communities living within its delimitation. Further outcomes include the development of a theoretical approach to tailor conservation measures.

KEYWORDS: Governance, marine conservation, knowledge co-production

A Climate-Smart Fisheries Toolkit for the Caribbean: Part 1 - Results of a Regional Ecological and Economic Assessment of Climate Change Impacts of Caribbean Fisheries

Una Caja de Herramientas para la Pesca Climáticamente Inteligente en el Caribe: Parte 1 – Resultados de una Evaluación Regional de los Impactos Ecológicos y Económicos del Cambio Climático en Recursos Pesqueros del Caribe

Boîte à Outils des Pêches Intelligentes Face au Climat pour les Caraïbes: Partie 1 - Résultats d'une Évaluation des Impacts Écologiques et Économiques Régionale des Changements Climatiques sur les Pêcheries des Caraïbes

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ABSTRACT

Marine biodiversity, ecosystems, and fisheries provide sustenance and livelihoods critical to human well-being in island and coastal communities globally. This socio-ecological balance is under threat from many pressures, including climate change. Climate change adaptation planning is underway in the Caribbean, and accessing quantitative information on climate hazards and impacts can strategically enhance this process. The Caribbean track of the Pilot Program on Climate Resilience supported completion of new climate change impact assessments on Caribbean marine resources and the fisheries sector in 2018. This presentation provides key conclusions from the assessment of (1) climate risks and ecological impacts for Caribbean marine fish stocks, and (2) the economic consequences of ecosystem shifts and of increased tropical cyclone activity. Overall, multiple lines of evidence suggest large risk and impacts of climate change on Caribbean fish stocks and fisheries by the 2050s. Lower catches, in turn, have significant market impacts, including lower domestic demand, higher fish prices and reduced incomes. The research highlights a large pre-existing “adaptation deficit” in the sector: incremental economic impacts of climate change appear small relative to current loss and damages registered. The scale and speed of the changes pose substantial challenges for both ecological and human systems to adapt, demanding swift transformations across the fish value chain, as well as stronger and formal cooperation among public and private value chain stakeholders. Sufficient information exists to inform adaptation planning and targeted measures. Assessment results informed development of ‘climate-smart’ monitoring and management recommendations, which are the subject of a companion presentation at this conference.

KEYWORDS: Climate change, ecological impacts, economic impacts

**Strengthening Fisher Resilience to the Impacts of Climate Change Through the Use of
Vulnerability and Capacity Assessment Tools in 3 Communities in Saint Lucia**

**Fortalecimiento de la Resiliencia de los Pescadores a los Impactos del Cambio Climático
Mediante el Uso de Herramientas de Evaluación de Vulnerabilidad y Capacidad
en 3 Comunidades en Santa Lucía**

**Renforcer la Résilience des Pêcheurs aux Impacts du Changement Climatique
Grâce à l'Utilisation d'Outils d'Évaluation de la Vulnérabilité
et des Capacités dans 3 Communautés de Sainte-Lucie**

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ABSTRACT

Fishing communities in the Eastern Caribbean are prone to the influences of climate. In Saint Lucia, under the Climate Change Adaptation of the Eastern Caribbean Fisheries Sector (CC4FISH) Project, executed by the Food and Agriculture Organization, efforts are put in place to aid fisherfolk adapt and better cope with climate change. In so doing, there is a need to prioritize interventions to take into consideration fisher needs and resource constraints. A Vulnerability and Capacity Assessment mechanism to quantitatively and qualitatively assess climate change vulnerabilities of fishing communities has thus been developed. This mechanism enables communities most in need of assistance to be identified through the calculation of vulnerability indices (VI). The mechanism was field tested in July 2019 in 3 communities in Saint Lucia. CC vulnerability indicators were selected as a function of the IPCC (2007, 2014) recommendations of Exposure, Sensitivity and Adaptive Capacity. Climatic hazards assessed included extreme drought, rainfall variability, storms, hurricanes and invasive species. A minimum of 100 fisherfolk and residents were interviewed in each community. Responses were linked to indicators with assigned scores from 1 to 3. Vulnerability indices (VI) were calculated based on the overall score received per community. Selection and prioritization of CC interventions was also achieved using open ended questions and scoring guidelines. Validation of results occurred through community meetings. Vulnerability indices results ranged from 148 to 152 out of a possible range of 71 to 213. The higher the VI the more vulnerable the community. Notably, recommended interventions were similar but not identical per community. The VCA outcomes will be used under the CC4FISH project to provide needs-based interventions.

KEYWORDS: Climate, vulnerability, assessment

**Empowering Women and Girls in Fisheries Research and Ecotourism:
Case Study from Leon, Nicaragua**

**Empoderamiento de Mujeres y Niñas en la Investigación Pesquera y el Ecoturismo:
Estudio de Caso de León, Nicaragua**

**Renforcer le Pouvoir des Femmes et des Filles dans la Recherche
Halieutique et l'Écotourisme: Étude de Cas de Leon, Nicaragua**

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ABSTRACT

Gender empowerment in fisheries and tourism is the focus of current efforts to support natural resources management and to build capacity and opportunities for girls and women in Leon, Nicaragua. A collaborative effort to establish a female owned and operated ecotourism company that includes community members and local university students studying biology is underway. The project builds upon a partnership established in 2006. The first hands-on effort began in 2012 with service learning student volunteers from the United States. Students funded their service learning visit to the region to volunteer alongside Nicaraguan college students and youth, and the Sutiava indigenous community. Habitat restoration and monitoring was the initial focus that expanded to include building capacity for educational programming with students from Nicaragua and the United States working and learning side-by-side. As the concept gained popularity, a stronger focus on conservation outreach programming developed and formal education components added. A marine conservation outreach course was implemented and resulted in several student proposals relating to gender empowerment coupled with natural resources management. These concepts helped begin a dialogue with the local community to consider opportunities for women and girls. Currently, women from the community are receiving assistance and building capacity in designing a tour company and learning fisheries research protocols to pursue in their coursework at the local university. Goals of this program are 1) to foster environmental awareness and instill a conservation ethic in the local community and tourists, and 2) to gather information about fisheries and natural resources. Using NOAA's Project Design and Evaluation methodology, a logic model and clearly defined short-, medium-, and long-

KEYWORDS: Gender empowerment, gender in fisheries, Nicaragua

**The Continental United States First Fish Aggregating Device Network:
Opportunities for Tourism and Pelagic Fisheries Monitoring**

**La Primera Dispositivo de Red de Agregación de Peces de los Estados Unidos Continental:
Oportunidades para el Monitoreo del Turismo y la Pesca Pelágica**

**Premier Réseau de Dispositifs de Concentration de Poissons dans la Zone Continentale des
États-Unis: Opportunités pour le Tourisme et la Surveillance de la Pêche Pélagique**

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ABSTRACT

Human fishing behavior has included construction and use of fish aggregating devices (FADs) to attract fish in the open ocean for millennia. The pelagic environment is a relatively featureless region of water with little or no structure. Floating material will typically attract fish, and the longer that material remains, the more colonists (and prey items) will inhabit the floating material and the water column immediately adjacent to the structure. FADs are present around many Caribbean islands, however, very few FADs occur in American waters and none have been deployed (legally) around the continental USA, specifically in the Gulf of Mexico. The first FAD network consisting of eight buoys will be deployed in the northern Gulf of Mexico in 200 – 600 m of water and 95 – 130 km from shore. The purpose is to create habitat for pelagic game fishes as well as expand and enhance recreational and sport fishing opportunities across the region. The FAD network is estimated to provide an economic impact of \$56million to not only the fishing industry in the region but to regional tourism and will also provide a unique platform for pelagic research. Specifically, collaborations with universities, non-profits, and government agencies will result in utilizing the FAD network as a platform to conduct research in a relatively inaccessible environment. Passive monitoring equipment will be used to monitor oceanographic and biological conditions and to detect and track movements of specific species of interest. The purpose of this presentation is to quantify the anticipated tourism benefit and proposed monitoring methodologies.

KEYWORDS: Pelagic, fisheries, tourism

**Experimental Culture of *Cittarium pica* in the Arrecifal Platform
of Old Providence and Santa Catalina Isla, Seaflower Biosphere Reserve**

**Cultivo Experimental de *Cittarium pica* en la Plataforma Arrecifal
de Providencia y Santa Catalina Isla, Reserva de Biosfera Seaflower**

**Culture Expérimentale de *Cittarium pica* sur la Plate-Forme des Récifs Coralliens des Îles
de Providencia et Santa Catalina, Réserve de Biosphère Seaflower**

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ABSTRACT

Cittarium pica or whelks, is a species that represents for the artisanal fishermen and residents of the Caribbean region a source of food and economic income as artisanal material from the use of its shell. It is currently considered an overexploited species due to high levels of capture in much of the Caribbean, including Colombia. In order to seek alternatives for sustainable production of marine resources by artisanal fishermen, the biological and technological feasibility of whelks juvenile cultivation at sea is being evaluated. With wild juveniles between 10 and 20 mm, two experiments are being carried out testing 4 cultivation systems (tanks with continuous seawater flow, floating cages, static and intertidal) and 3 densities (100, 200 and 300 ind/m²). All treatments are being tested in triplicate, maintaining white PVC plates (20 x 15 cm) provided with a coverage greater than 50% of artificial or natural marine biofilm in a 1: 1 ratio. The animals are being maintained at a density of 100 ind/m² (equivalent between 21-62 snails, depending on the area of the tank, basket or confinement used in the system) in the culture systems experiment and in floating cage systems for the density experiment. Monthly, the growth (in length of the shell and in total weight), the rate of recovery of animals and the presence of predators in each replica. So far, the highest animal recovery rates have been found in the intertidal cage systems (94.3%) and using the lowest culture density (100 ind/m², equivalent to 32 snails). In terms of growth, the highest values have been recorded in the floating system (2.49 mm/month) and under low density conditions (100 ind/m², equivalent to 21 snails). These preliminary results suggest that the cultivation of whelks juveniles in the sea is biologically and technologically feasible.

KEYWORDS: Farming systems, mariculture, culture density

We're Going to Make a Marine Reserve, but Who is Going to Pay for It?

Vamos a Hacer una Reserva Marina y ¿Quién Pagará?

Nous Allons Créer une Réserve Marine, Mais qui va la Payer?

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ABSTRACT

International conservation and sustainability targets recommend increasing the marine area under protection and effective management to protect biodiversity and promote sustainable fisheries. Recently, national governments have gone big, creating very large marine protected areas, and questions have been raised about the effectiveness of management at such scale, the top-down approach and the low percentage closed to fishing. A bottom-up approach can result in socially-acceptable marine reserves, but scaling problems are common. From 15 years of experience in Mexico, we examine the biophysical monitoring costs of 25 no-take marine reserves, covering 186 km², through a fisher-led citizen science program. Biophysical monitoring is important and remains the most effective method of scientifically documenting recovery. In our study, the average annual monitoring period costs USD\$13,200 (including NGO participation), but would cost only USD\$8,000 if fishers were able to operate independently. At present, fishers only cover 16% of the annual monitoring budget, with the majority covered by philanthropy. Data obtained by Causa Natura through FOI acts help us contrast the total amounts required to effectively maintain the marine reserves versus the distribution of financial resources in CONAPESCA's (Mexico's fisheries agency) subsidies program. For example, CONAPESCA subsidises fisheries to the tune of USD\$123 million per year, but only 1.43% of the total amount between 2013-2018 (USD\$9.6 million) has been assigned to the marine reserves under the agencies jurisdiction. Of this, 73.7% goes to only one of said areas, the Golfo de Ulloa, which is not no take. Options for increasing co-investment from the fishers and diversifying funding to assure the long-term viability of the reserves are discussed.

KEYWORDS: MPA, marine reserve, finance

**Spatial Variation and Social Equity in Shore-based
Recreational Fisheries in Key West, Florida**

**Variación Espacial y Equidad Social en la Pesca
Recreativa en Tierra en Key West, Florida**

**Variation Spatiale et Équité Sociale dans les Pêcheries
Récréatives à Terre à Key West, en Floride**

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ABSTRACT

As fisheries management continually strives to define and actualize more holistic management strategies, an understanding of social outcomes and potential inequalities is essential. In shore-based fisheries, shoreline condition is of particular importance with implications for social equity, including social costs and benefits of fishing opportunities, outcomes, and management. While information on fishing behaviors is obtained through the Marine Recreational Information Program, little remains known about shore-based fisheries and the implications of shoreline condition. This research aims to examine the following questions: 1) does fishing effort and catch vary across shore typologies and socioeconomic status and 2) how do the social and ecological dynamics of shoreline fisheries intersect and are these dynamics socially equitable? To answer these questions, we collected 105 creel intercept surveys with recreational shore-fishers in Key West, Florida from June to August of 2019 to assess angler-specific fishing trip information and fishing behavior. Preliminary data analysis shows that tourists have higher satisfaction with access and catch for shore-fishing than residents, as locals talk of a decreased abundance of site access through time. Of all respondents, 48.57% listed a barrier that prevented or discouraged them from shore-fishing where they would like, and of those, 52.94% listed access regulations as a barrier. Further, satisfaction is much lower for those fishing for food or subsistence than those fishing for recreation. Advances in the literature have called for greater inclusion of social impact assessments as knowledge gaps have led to data uncertainties in stock assessment. This research addresses these gaps to gain a better understanding of spatial variation and social equity in shore-based fisheries.

KEYWORDS: Shore-based fisheries, creel surveys, fishing behaviors

**Data Gaps and Alternative Approaches:
Applying National Standard 1 to Data Limited Stocks**

**Enfoques Alternativos:
Aplicacion de Norma Nacional 1 en Poblaciones con Limitacion de Datos**

**Approches Alternatives:
Application de la Norme Nationale 1 aux Stocks de Données Limitées**

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ABSTRACT

U.S. Fisheries have some of the strongest science-based management systems in the world. National Standard 1 (NS1) of the Magnuson-Stevens Act requires that fishery management measures shall prevent overfishing while achieving optimum yield, and the NS 1 Guidelines establish a framework of reference points for evaluating stock status and identifying annual catch limits that achieve sustainability goals. In the most recent revisions to the NS1 guidelines (2016), allowance was made for flexibility in application of the guidelines in limited data-limited circumstances. NOAA Fisheries is currently developing technical guidance regarding this flexibility, and this presentation will present progress made on objectives to: identify best practices for adhering to the annual catch limit (ACL) framework with data-limited stocks; identify situations where the current ACL framework may not be appropriate due to data limitations; and provide examples of alternative methods. We focus on a few example case studies, evaluating the feasibility of managing data-limited fisheries under current catch-based management, primarily using the FishPath tool, and explore alternative options, including the use of rate-based or effort-based catch limits, as opposed to biomass based ACLs.

KEYWORDS: Data-limited, National Standard 1, FishPath

**Length-based Growth Parameters of *Xiphopenaeus kroyeri*
in the Gulf of Salamanca, Caribbean Sea Off Colombia**

**Parámetros de Crecimiento Basados en la Longitud de *Xiphopenaeus kroyeri*
en el Golfo de Salamanca, Mar Caribe de Colombia**

**Paramètres de Croissance Basés sur la Longueur de *Xiphopenaeus kroyeri*
dans le Golfe de Salamanque, Mer des Caraïbes en Colombie**

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RESUMEN

El camarón *Xiphopenaeus kroyeri* es un importante recurso pesquero en varias regiones del atlántico occidental. Se distribuye desde Carolina del Norte hasta Brasil. En el golfo de Salamanca (Caribe de Colombia), una pesquería de arrastre artesanal se sustenta en la captura de esta especie, no obstante, son escasos los estudios biológicos, particularmente del crecimiento somático, que brinden información necesaria para el análisis de la dinámica poblacional. Para atender este vacío de conocimiento, se midió la longitud total y la longitud del cefalotórax (mm) a individuos capturados por la pesquería, cada dos semanas, desde marzo de 2018 hasta julio de 2019. El sexo se determinó a cada individuo medido. Los parámetros de crecimiento se estimaron por separado para hembras y machos utilizando el método ELEFAN I, empleando FiSAT II. Funciones de crecimiento von Bertalanffy (FCVB) estándar y estacional fueron ajustadas numéricamente a las frecuencias de tallas observadas, empleando como criterio de selección el índice R_n . Una primera estimación de L_∞ se obtuvo mediante el método Powell-Wetherall. Las longitudes de 3253 machos y 2485 hembras fueron empleadas en el análisis. Empleando la longitud del cefalotórax, la FCVB resultante para hembras fue $L_t = 35,0(1 - \exp(-0,54t))$ con $R_n = 0,163$ y para machos fue $L_t = 30,9(1 - \exp(-0,25t))$ con $R_n = 0,171$. La FCVB estacional recalculada para hembras resultó ser $L_t = 35,4(1 - \exp(-0,55t) + St - Sto)$, donde $St = 0,35\text{sen}(6,28(t - 0,92))$ y $Sto = 0,35\text{sen}(6,28(-0,92))$ con $R_n = 0,178$. En los machos la FCVB estacional fue $L_t = 31,02(1 - \exp(-0,40t) + St - Sto)$, donde $St = 0,31\text{sen}(6,28(t - 0,87))$ y $Sto = 0,31\text{sen}(6,28(-0,87))$ con $R_n = 0,199$. Adicionalmente, se estimó la FCVB empleando la longitud total, de manera que los resultados fuesen comparables con estudios realizados en otras regiones. Financiado por la Universidad del Magdalena.

PALABRAS CLAVES: Pesca de arrastre artesanal, ELEFAN, von Bertalanffy

**The Effects of Water Quality and Sediment Grain Size on the Presence of
Emerita talpoida at High (Clearwater Beach, FL) and Low (Indian Rocks Beach, FL)
Human Impact Beaches**

**Los Efectos de la Calidad del Agua y el Tamaño del Grano de Sedimento
en la Presencia de *Emerita talpoida* en las Playas de Alto Impacto (Clearwater Beach, FL)
y Bajo (Indian Rocks Beach, FL) Impacto Humano**

**Effets de la Qualité de l'Eau et de la Taille des Grains de Sédiment sur la Présence
de *Emerita talpoida* sur les Plages à Impact Élevé (Clearwater Beach, FL)
et Faible (Indian Rocks Beach, FL)**

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ABSTRACT

This study focused on the interactions and connections between mole crabs in comparison to high vs. low human impact beaches along with water and sediment quality. Sediment cores were completed at Clearwater Beach (high impact) and Indian Rocks Beach (low impact) in order to observe the presence or absence of *Emerita talpoida*. At each site there were 5 sediment and 5 water samples collected at the mid-swash zone in order to assess sediment grain size and water quality. There were significant differences between turbidity, alkalinity, and temperature between sites; Clearwater Beach had higher levels of all three factors. However, there was no difference in sediment grain size based on site. While there was no *E. talpoida* found in any of the sediment cores, there was a presence of coquina clams which served as an indicator of *E. talpoida* occupation in the habitat. The higher levels of turbidity and alkalinity could have been the result of no *Donax variabilis* being found at Clearwater Beach in comparison to Indian Rocks Beach. This creates a great concern because *E. talpoida* populations are key indicators of overall beach health.

KEYWORDS: *Emerita talpoida*, *Donax variabilis*, clearwater beach florida

The National Strategic Framework for Fisheries in Dominican Republic: 2019 – 2024

El Marco Estratégico Nacional para la Pesca en República Dominicana: 2019 – 2024

Le Cadre Stratégique National pour la Pêche en République Dominicaine: 2019 – 2024

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ABSTRACT

Fisheries represent an important source of food for part of the world's population. It constitutes a livelihood that involves cultural and economic aspects for millions of people. However, the absence of unsustainable practices and overfishing regulations has caused negative effects on marine ecosystems in the Dominican Republic.

The National Fisheries Strategy (NFE) was developed in a discussion process conducted by The Nature Conservancy and Dominican Reef Network, following the Dominican Fisheries and Aquaculture Council guidelines. This document incorporates the opinion of the actors involved in the fishing activity nationwide.

The NFE groups the challenges for sustainable fisheries during the 2019-2024 period. It incorporates institutional cooperation, productivity and environmental protection, coherent to the current capacities of the Dominican State.

The NFE has four strategic objectives that involves: 1. institutional aspects, 2. fisheries information management, 3. effectiveness of law enforcement, and 4. strengthening of fishing communities and gender equality.

This document is a product of the Caribbean Marine Biodiversity Program, sponsored by the United States Agency for International Development (USAID).

KEYWORDS: Pesca sostenible, cooperación institucional, recurso pesquero

Ecosystem Health and Management Effectiveness in the Mesoamerican Reef

Salud del Ecosistema y Efectividad de Manejo en el Arrecife Mesoamericano

Santé des Écosystèmes et Efficacité de la Gestion dans le Récif Mésoaméricain

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ABSTRACT

Healthy Reefs for Healthy People Initiative (HRI) is an international collaborative program of over 73 research, management, and conservation organizations dedicated to safeguarding the Mesoamerican Reef (MAR). For over a decade HRI has used scientific data to produce and disseminate collaborative, appealing, politically influential Report Cards and Eco-Audits.

Improving scientific understanding of the functioning of the reef has promoted management interventions and the application of evaluation tools that regional leaders, local partners, and policymakers can use to protect and enhance the health of the MAR. Over the years, numerous additional MPAs, fully-protected replenishment zones, management plans and important species protection (parrotfish) have been achieved in the MAR region thanks to this effort.

The 2019 Report Card marks 12 years of data collection and reporting with 286 sites monitored throughout the Mesoamerican Reef. Overall, the reef condition in the MAR went down from being ‘fair’ (2.8) in 2018 to ‘poor’ (2.5) for 2019.

One of our reef health indicators is commercial fish biomass, this indicator graded as ‘poor’. Throughout the MAR we have seen how this indicator is decreasing in some areas due to bad fishing practices and lack of adequate enforcement.

Replenishment Zones (RZ) are one of the most effective approach to increasing fish biomass, when established on ecologically important areas, such as coral reefs or fish spawning aggregation sites. Fish biomass can double in these areas, however only 3% of the MAR is fully protected. Ecosystem based fisheries management is one of the HRI strategies, HRI's collaborative process to monitor and report on management effectiveness can accelerate and catalyze actions that make a positive contribution to improving ecosystem health.

KEYWORDS: Mesoamerican reef, ecosystem health, management

**Applying a Climate-Smart Approach to
Marine Adaptation Planning in Southwest Florida**

**Aplicación de un Enfoque Climáticamente Inteligente a la Planificación
para la Adaptación Marina en el Suroeste de Florida**

**Appliquer une Approche <<Climate Smart>> à la Planification
de l'Adaptation Marine dans le Sud-ouest de la Floride**

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ABSTRACT

Climate-smart conservation addresses changes to ecosystems, populations, and species by coupling anticipated climate impacts with adaptation actions. This process has become commonplace in the terrestrial environment; however, climate-smart adaptation is not frequently used in estuarine and marine environments. We highlight the use of climate-smart principles to examine the possible conservation approaches for the Charlotte Harbor and Tampa Bay estuarine and marine systems in southwest Florida under alternative future conditions characterized by increasing water temperatures and salinities. We also examine possible shoreline changes resulting from sea level rise and coastal development. The climate-smart approach we discuss includes step that 1) identify the issue to be addressed, 2) examine multiple scenarios thus accounting for uncertainty, 3) examine the climate impacts to suites of estuarine and marine species that share similar vulnerabilities, 4) develop possible adaptation options, 5) prioritize adaptation options, 6) identify trigger points for implementing the prioritized options, and 7) develop monitoring programs that indicate when trigger points have been reached. We further discuss barriers to implementing actions. Taken together, these steps provide a comprehensive planning methodology that offers a pro-active approach to species conservation.

KEYWORDS: Climate-smart, adaptation, climate change

**Distribution, Abundance and Prevalence of Coral Diseases
Along the Coast of the Dominican Republic**

**Distribucion, Abundancia y Prevalencia de las Enfermedades Coralinas
a lo Largo de la Costa de Republica Dominicana**

**Répartition, Abondance et Prévalence des Maladies des Coraux
sur la Côte de la République Dominicaine**

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ABSTRACT

The health of coral reefs is vital for maintaining the ecosystem services they produce. The Dominican Republic (DR) depends on coral reefs as an essential source of food, tourism opportunities and protection against tropical storms. However, their condition remains poor, being mostly attributed to overfishing, pollution and coastal development. Another rising threat for coral reefs is the emergence of new diseases. To date, no national-level studies have been carried out on which diseases are affecting corals in the DR, their distribution and prevalence.

In 2019, the assessment of coral diseases and species affected was included in the DR's National Reef Health Monitoring Program; part of a strategic alliance between Reef Check DR, Propagas Foundation and the University of Maine. The type, abundance, distribution and prevalence of the diseases were determined in 12 sites around the DR's coast, belonging to six marine protected areas. In each of the sites, four 10x1 m belt transects were established where all stony coral colonies were counted and visually assessed for disease signs. The national extent of the Stony Coral Tissue Loss Disease (SCTLD), first recorded for the DR in early 2019 and which is estimated to have caused the death of millions of corals across the Caribbean, was also evaluated.

KEYWORDS: Corals, coral diseases, SCTLD

**Combining Social Network Analysis and Ethnography to
Better Understand Stakeholder Organization and Promote
Sustainable Small-scale Fisheries in St. Croix, US Virgin Islands**

**Combinando Análisis de Redes Sociales y Etnografía para Comprender Mejor
la Organización de las Partes Interesadas y Promover la Pesca Sostenible
a Pequeña Escala en St. Croix, Islas Vírgenes de EE. UU.**

**Combinants et Méthodes de Communication Sociale et Organisationnelle
pour l'Organisation de Réunions Professionnelles et la Promotion de la Promotion
de la Paix et de la Sécurité à Sainte-Croix, Îles Vierges UU.**

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ABSTRACT

This manuscript synthesizes theoretical concepts and methodologies from social network analysis (SNA) with the political ecological analysis of natural resource management institutions, focusing on multi-level fisheries management structures and networks in St. Croix, USVI. Specifically, the research results presented focus on four concepts (collective action, flows of knowledge, social capital, and cross-scale interactions), analyzing how these concepts relate to networks of fisheries management stakeholders, and how power relations, class, ethnicity, gender, and other factors influence their structure. This examination contributes to our understanding of how social group differences and inequalities influence, and are influenced by, structural patterns of relations among natural resource stakeholders at multiple scales. Rather than simply using social networks to operationalize concepts, this study integrates SNA, ethnography, and other methods to develop a ground-truthed and comprehensive depiction of a small-scale fisheries multilevel management structure. The results suggest practical ways to improve stakeholder trust of, and participation in, management processes, and illuminates potential opportunities for applying a similar mixed methods approach to the management of other complex social-ecological systems.

KEYWORDS: Fisheries management, social network analysis, US Virgin Islands

**Substantial Population Declines in the Northern Gulf of Mexico
Invasive Lionfish Following Disease Emergence**

**Disminución de la Población en el Norte del Golfo de México
Pez León Invasor Después de la Aparición de la Enfermedad**

**Déclin Accéléré de la Population de Sébastes-lions Envahissants du Nord
du Golfe du Mexique à la Suite de l'Apparition de la Maladie**

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ABSTRACT

Invasive Indo-Pacific lionfish *Pterois volitans/miles* have established high population densities in many western Atlantic marine habitats and regions. However, high densities and low genetic diversity could make their populations susceptible to disease. We examined changes in northern Gulf of Mexico (nGOM) lionfish populations following the emergence of an ulcerative skin disease in summer 2017, when disease prevalence was as high as 40%. Sex-specific relative condition was 8.8% lower for ulcerated female lionfish versus non-ulcerated females. Analysis of lionfish size composition during 2014 – 2018 indicated the abundance of new recruits declined by >80% in spring and summer 2018, then returned to near pre-disease levels by that fall. Remotely operated vehicle surveys indicated mean lionfish density in 2018 declined 75 – 79% for high-density populations (>25 fish per 100 m²) on artificial reefs, 52 – 62% for low-density (<15 fish per 100 m²) artificial reefs, and 75% for populations on natural reefs. Regional commercial lionfish spearfishing landings and catch per unit effort (CPUE) also declined approximately 50% in 2018. Lionfish tournament mean CPUE declined 44% in 2018 and an additional 18% in 2019. Collectively, these results provide evidence for density-dependent epizootic population control, given the gross pathology of the disease, the effect in relative condition for ulcerated females, and that lionfish highest disease prevalence and strongest declines were on high density reefs.

KEYWORDS: *Pterois volitans*, invasion ecology, boom-bust population

**Challenges and Successes in Small-Scale Fisheries
in the Marine Stewardship Council's Program**

**Desafíos y Éxitos en la Pesca en Pequeña Escala
en el Programa del Marine Stewardship Council**

**Défis et Succès de la Pêche Artisanale dans le
Programme du Marine Stewardship Council**

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ABSTRACT

The Marine Stewardship Council (MSC) program is a market-based program which aims to reward sustainable fisheries in the marketplace. Several Caribbean small-scale fisheries have entered the MSC program with varying degrees of success over its 20 year history, including Sian Kaan spiny lobster and Bahamian spiny lobster. Small-scale fisheries specifically often have a more difficult time securing funding and support to become MSC certified. This presentation explores the various fisheries that have engaged in the program and why they were or were not successful. It will also explore the MSC Standard's engagement with small-scale fisheries and what that engagement is likely to look like in the future.

KEYWORDS: Sustainable, small-scale, ecolabel

**Fish Communities as Related to Lionfish Abundance on Mesophotic Reefs
Inside and Outside of Marine Protected Areas in the US Virgin Islands**

**Comunidades de Peces Relacionadas con la Abundancia de Pez León
en los Arrecifes Mesofóticos Dentro y Fuera de las Áreas Marinas Protegidas
en las Islas Vírgenes de los Estados Unidos**

**Communautés de Poissons Liées à l'Abondance du Poisson-lion
dans les Récifs Mésophotiques à l'Intérieur et à l'Extérieur
des Zones de Protection Marines des îles Vierges Américaines**

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ABSTRACT

The US Virgin Islands (USVI) is home to several marine protected areas (MPAs), some of which encompass mesophotic coral ecosystems (MCEs), such as the Hind Bank Marine Conservation District (MCD) and the Virgin Islands Coral Reef National Monument (VICRNM). These managed areas were established to protect native fish populations, especially commercially-important species, from the effects of overfishing. This study sought to use fishery-independent surveys to compare fish communities inside and outside these regionally-important protected areas, especially as related to the presence of the invasive lionfish, first observed in the USVI in 2008. Belt transects (25m x 2m, n = 119) were completed on SCUBA, balanced among inside and outside the MCD and VICRNM, counting all fish observed and sizing them into 10-cm bins. All large-bodied, commercially important piscivores were considered potential natural predators. Commercially-important piscivore abundance was higher around the VICRNM than the MCD, while there was no significant difference in abundance between inside and outside when combining the two MPAs. A total of 65 lionfish were observed across all sites, with 46% of these observed inside the MCD, and 15% inside the VICRNM. Lionfish abundance was higher around the MCD than the VICRNM, with no significant difference in abundance between inside and outside across the two MPAs. There has not been much demonstration of the impacts of MCE MPAs, and this study will help inform management of these emerging important ecosystems.

KEYWORDS: Lionfish, mesophotic reefs, US Virgin Islands

**Diet Observations from Tournament Landed Swordfish,
Xiphias gladius, in the North Central Gulf of Mexico**

**Observaciones de la Dieta del Pez Espada Desembarcado en el Torneo,
Xiphias gladius, en el Centro Norte del Golfo de México**

**Observations de l'Alimentation d'un Espadon du Tournoi Débarqué,
Xiphias gladius, dans le Centre-nord du Golfe du Mexique**

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ABSTRACT

Targeting Swordfish, *Xiphias gladius*, as a sportfish in the north central Gulf of Mexico (ncGOM) is drastically increasing in popularity providing a unique opportunity to investigate their life history and diet. We opportunistically collected 27 female and 6 male Swordfish, ranging in age from 3-11 years old, during the 2017 and 2018 Mississippi Gulf Coast Billfish Classic. Stomach contents were found in 87% of Swordfish (n = 29; 25 female, 4 male). Prey item identification was difficult due to highly degraded tissue but resulted in broad taxonomic identification with teleosts comprising (63%) of overall diet; followed by cephalopods (20%), vegetative matter (3%), crustaceans (2%), and unknown remains (12%). Further prey identification was conducted through DNA barcoding of unidentified teleosts and cephalopods (COI; n = 139, and 28, respectively). Molecular identifications were paired with associated hard structures (i.e., otoliths and squid beaks) to further resolve prey item identifications. This indicated Luminous Hake (45%O), *Steindachneria argentea*, and Blue Runner (45%O), *Caranx crysos*, as the most abundant identifiable prey. Ongoing molecular identification and subsequent hard structure comparison will better define ingested prey. Our results suggest that Swordfish in the ncGOM primarily feed on teleosts rather than squid, which is contrary to what has been reported for other Atlantic Ocean Swordfish populations.

KEYWORDS: Billfish

**Quantifying Illegal Fishing Activity in The Bahamas
and its Impact on Marine Conservation**

**Cuantificación de la Actividad de Pesca Ilegal en las Bahamas
y su Impacto en la Conservación Marina**

**Quantifier l'Activité de Pêche Illégale aux Bahamas
et son Impact sur la Conservation Marine**

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ABSTRACT

Illegal fishing by foreign entities is regarded as one of the most significant threats to fisheries resources of The Bahamas, including the only MSC certified lobster fishery in the Caribbean region. The lack of available data on this problem makes it difficult to properly assess the ecological, economic and social impact of illegal fishing on such fisheries. A newly created database of illegal fishing activity provides quantitative baseline information on illegal fishing effort, catch and economic value over the last decade. During this time, there has been an increase in the apprehension rate of illegal fishers and an increase in the number of violent altercations between poachers, local fishers and enforcement agencies. The reasons for these trends, their impact on the fishery and options for incorporating additional data sources are discussed. Further evidence shows that illegal fishing is undermining stakeholder engagement in broader marine conservation initiatives, not only threatening specific fisheries species, but the conservation of whole marine ecosystems.

KEYWORDS: IUU fishing, lobsters, enforcement

Invasive Lionfish Decrease Shelter-use in the Presence of Native Spiny Lobster

El Invasivo Pez León Disminuye el Uso de Refugios en Presencia de la Langosta Espinosa Nativa

L'Invasif Poisson Lion Diminue l'Utilisation de Refuges en Présence de la Native Langouste Épineuse

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ABSTRACT

Lionfish (*Pterois volitans* and *P. miles*) have become invasive throughout the tropical western Atlantic, with *P. volitans* widely distributed across the region. Most lionfish research has focused on their consumptive effects on reef fish and so little is known about their non-consumptive effects and their effects on invertebrates. Lionfish often shelter around biotic and abiotic structures on the reef, thus there is potential for competition between lionfish and other shelter using organisms.

I will summarise the results of research carried out in Tela bay, Honduras, from June – August 2019. The aim of this research was to test whether the presence of invasive lionfish alters shelter-use behaviour of native spiny lobster, or vice versa. Shelter use was assessed ex-situ in a large tank with a single shelter, using infrared cameras to film for 60 seconds every hour over a 24 hour period. A subsidiary aim was to investigate what factors influence individual sheltering behaviour.

Our preliminary results suggest that lionfish reduce their shelter use in the presence of lobster. Lionfish spent 421 ± 87 s (mean \pm standard error) in shelter when alone, compared to only 142 ± 53 s when lobster were present. However, the same trend was not seen in lobsters, which spent similar lengths of time in shelter when alone (182 ± 69 s) and when lionfish were present (169 ± 75 s). Lionfish and lobsters rarely shared the shelter.

Our results are positive for lobster populations because lionfish did not influence lobster shelter use. However, lionfish may impact lobster fisheries because once a lionfish entered a shelter, the lobster rarely co-habited the shelter. The exclusion of lionfish from their preferred habitat may reduce survival or feeding success, resulting in lionfish being less successful invaders on reefs with limited shelter.

KEYWORDS: Lionfish, lobster, competition

Development of a Trap to Catch the Invasive Lionfish

Desarrollo de una Trampa para Capturar al Pez León Invasor

Contribution au Développement d'un Piège pour Capturer le Poisson-lion Envahissant

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ABSTRACT

In the southeastern United States and Caribbean, lionfish are highly invasive and have detrimental impacts on native ecosystems due to their generalist feeding behavior, high consumption rates, high reproductive output and lack of predators. Recreational divers and snorkelers have been encouraged to harvest lionfish using spears and hand-held nets to manage their population. Lionfish removal has generally occurred in waters less than 30 m in depth, where they are easily accessible to divers. However, lionfish can be found in waters hundreds of meters deep. In Florida, spiny lobster (*Panulirus argus*) commercial fisherman have caught lionfish in both wood and wire traps, with most of that catch occurring in the latter. The goal of this project was to maximize lionfish catch while reducing bycatch through modifications of wire spiny lobster traps in deeper water ranging from 30-100 meters, where diver access is limited. Modifications of throat type, throat location, bait type and incorporation of escape gaps were evaluated throughout the duration of the study to achieve the previously stated goal. Bycatch reduction is a relevant consideration in trap design for Florida and other regions where fish traps are illegal or reef fish populations are fully exploited. Adding escape gaps significantly reduced bycatch of other fish species and using live lionfish as bait both lowered bycatch and significantly increased the catch of lionfish. The most effective trap designs will be tested by commercial fishermen to evaluate trap utility at a larger geographic scale and over a broader range of habitats and depths.

KEYWORDS: Lionfish, invasive, Florida

**Lessons and Challenges in Piloting a Citizen Science Project
to Monitor Pelagic *Sargassum* Landings in South Florida**

**Lecciones y Desafíos para Pilotar un Proyecto de Ciencia Ciudadana
para Monitorear los Desembarques de *Sargazo* Pelágico en el Sur de Florida**

**Enseignements et Défis Liés à la Mise à l'Essai d'un Projet de Science Citoyenne Visant à
Surveiller les Débarquements de Pélagiques de *Sargasses* dans le Sud de la Floride**

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ABSTRACT

Citizen's involvement monitoring large geographical areas over long periods of time is becoming an effective way to support scientific projects. The influx of pelagic *Sargassum* is a regional problem throughout the NW Tropical Atlantic. While satellite imagery can estimate *Sargassum* blooms on a regional level, it is difficult to have systematic in situ abundance observations. Additionally, the impacts of *Sargassum* in the Caribbean vary between geographical locations. Here we present a brief analysis of the citizen science project, "*Sargassum* Watch". We piloted the study using two apps, "CitSci" and "Epicollect5." Three categories of citizens send entries to the project: "target group (N = 24 members)" that have standardized daily observations associated with established monitoring programs; members of our lab (N= 9); and friends, family or general public (n = 10) that send opportunistic observations. Between March 2018 and July 2019, a total of 664 *Sargassum* landing events were reported by participants in South Florida. Most of the observations reported were daily observations from the target group (n = 560) compared to our lab members (n = 91) and the public (n = 13). These observations provide a first perspective of *Sargassum* landings at a large scale. Using the citizen science apps effectively requires in-person training and constant feedback between project managers and participants. We envision strong improvements by adding other target groups supplemented by opportunistic observations from the general public. As a complement, we are exploring a sister app platform simplified to increase general public observations as opposed complex training workshops. Regardless of the challenges, this citizen science program has potential to expand *Sargassum* monitoring efforts at both a local and regional level.

KEYWORDS: *Sargassum*, citizen science, monitoring

**Preliminary Findings: Testing an Egg Farm as a Method
to Increase Reproduction of Queen Conch, *Lobatus gigas*, in The Bahamas**

**Hallazgos Preliminares: Probando una Granja de Huevos Como Método
para Incrementar la Reproducción de Caracol (*Lobatus gigas*) en Las Bahamas**

**Résultats Préliminaires: Test d'une Ferme d'Œufs comme Méthode
pour Augmenter la Rreproduction de Queen Conch, *Lobatus gigas*, aux Bahamas**

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ABSTRACT

The queen conch, *Lobatus gigas*, is key to the Bahamian way of life. Recent studies suggest that commercial stocks will be depleted in The Bahamas in 10-15 yrs. To assist in restoration, a long-term Egg Farm was established (5/26/19) in a historic breeding ground in Moriah Harbour Cay National Park, Exuma, Bahamas. Previously used for aquaculture, the Egg Farm concept is being tested as a restoration approach. Conch from two populations with lip thicknesses, 2-28 mm, and shell lengths, 17-25 cm, were bought directly from the fishermen's boats in Georgetown, Great Exuma, Bahamas. Of these conch, 67% are adults with a lip thickness of > 15 mm. All 255 conch were tagged and stocked in a 0.14 ha circular enclosure at an equivalent of 1,821/ha. The Egg Farm is on a back reef in a depth of 2.5-4.5 m; it is exposed to ocean and bank water and consists of rubble, sand, and sparse to dense seagrass. Every 24-48 hrs the Egg Farm is visited to study conch movement, burial, predation, breeding, and egg mass laying. In the first month the conch acclimated to the Egg Farm while recovering from their long-distance transport and shell damage. During this time 90% of the conch were aggregated in the dense seagrass area. In the second month the conch were found throughout the enclosure. Conch are actively feeding during the day and evening hours. Mating has been observed; however, no egg masses have been observed yet. The Egg Farm benthos has been surveyed monthly inside and outside of the perimeter of the enclosure to characterize any habitat changes from the presence of conch and their grazing. It is anticipated that this partnership project will result in a path to test more Egg Farms and set an example of a low-tech, accessible tool that can be used by fishermen to increase egg mass production while protecting breeding populations.

KEYWORDS: Queen conch, marine protected area, The Bahamas

Impact of Marine Debris Among Different Coastline Types in Grenada, West Indies

Impacto de los Desechos Marinos entre Diferentes Tipos de Costa en Grenada, Antillas

Effets de Débris Marins entre Différents Types de Côtes en Grenade, Caraïbe Orientale

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ABSTRACT

Marine debris has become a prominent issue because of its impacts on environment, wildlife, and society. Small island nations, such as Grenada, are particularly vulnerable because of their lack of resources to properly manage waste. During a 10 month period between March 2018 and January 2019, we conducted a systematic debris collection on beaches that were used for recreational purposes (high human traffic frequented by tourists and locals), deposition sites (not readily accessible, or well-located, and not frequented by tourists or locals), and underwater sites. Data was collected using an amended Project AWARE citizen science data protocol, to better represent our study area. In 23,868 items collected, weighing 826.75 kg, we found that plastic was the most abundant material and that recreational sites had the greatest amount of debris in both number and weight. The specific discarded items that were the most abundant were metal bottle caps, plastic beverage bottles and plastic bags (over 1000 for each item). Understanding the sources of marine pollution, and the societal causes and behaviours that lead to this type of pollution, could specify better marine litter mitigation recommendations. While positive steps have already been taken by means of the Litter Abatement Act and the importation ban of polystyrene and plastic bags into Grenada, greater enforcement is needed. Cooperation between government, industry and the public is needed in order to tackle our ever increasing marine debris problem.

KEYWORDS: Marine debris, Grenada, plastic

Pelagic *Sargassum* Blooms and Dynamics of the North Tropical Atlantic

Pelagic *Sargassum* Florecimientos y Dinámica del Atlántico Tropical Norte

Pélagique *Sargassum* Florece y Din'mica del Atlàntico Tropical Norte

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ABSTRACT

Satellite identification and interpretation of new *Sargassum* bloom areas in the north Tropical Atlantic have led to considerable misunderstanding of available political and engineering solutions for local *Sargassum* events in the Caribbean. Cloud cover and satellite resolution have inhibited detection in much of the North Equatorial Recirculation Region (NERR), leading to the assumption that it is 'blooming' off Brazil in the North Brazil Current Retroflexion (NBCR). Ocean surface transport patterns and events off West Africa, however, suggest that it is a much larger problem, with bloom/growth/mortality and consolidation not easily confined to one relatively small region.

In this study winds and surface currents are analyzed over periods significantly longer than the '*Sargassum* era' which began off Brazil and West Africa in 2011. Archived near surface currents from a finite difference model (HYcom) and a diagnostic model (OCSAR) together with NCEP blended 10 m winds are analyzed by the empirical orthogonal function method to elicit patterns and determine temporal variations in the patterns. Recirculation in two regions is clearly defined: a small western recirculation region associated with the NBCR and a large eastern recirculation region. Although long term trends in the patterns are clear, there was no sudden change in 2010/2011 to suggest that the *Sargassum* bloom in the NERR was due to hydrography alone. Most likely it was a combination of retention in a warm nutrient rich area together with a seeding mass critical for bloom to occur.

KEYWORDS: *Sargassum*, circulation, NERR

**From Habitat Mapping to Fish Abundance: NOAA's Coral Reef
Monitoring Program, Methodologies, and Usefulness as a
Caribbean-wide Tool for Fishery-independent Sampling**

**Desde el Mapeo del Hábitat Hasta la Abundancia de Peces: El Programa de Monitoreo de
Aarrecifes de Coral, las Metodologías y la Utilidad de NOAA como una Herramienta en
Todo el Caribe para el Muestreo Independiente de la Pesca**

**De la Cartographie de l'Habitat à l'Abondance des Poissons: Le Programme de
Surveillance des Récifs Coralliens de la NOAA, ses Méthodologies et son Utilité en tant
qu'Outil à l'Échelle des Caraïbes pour un Échantillonnage Indépendant de la Pêche**

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ABSTRACT

Sampling of coral reef ecosystems in the Caribbean has been a challenge to resource managers for many reasons ranging from the lack of resources and communication, to unreported harvesting and jurisdictional boundaries. Because of these difficulties, the need exists to develop a program that does not rely on the infrastructure and public cooperation to estimate fish and habitat quality and abundance. Additionally, many of the reefs in the Gulf and Caribbean are ecologically and evolutionarily linked, requiring a quantitative, consistent sampling approach to make temporal and areal comparisons and provide understanding beyond the local level. Multiple fish and coral monitoring programs exist regionally, but all are limited in scope, scale, or not designed to answer the multi-scalar questions for basin-level problems. Over the past decade, NOAA Fisheries and National Ocean Service developed a suite of monitoring tools under the National Coral Reef Monitoring Program (NCRMP) to provide a simplified approach to long-term monitoring coral reefs at the ecosystem level to provide vital information on fish, coral, and habitats. Protocols exploit habitat-organism relationships that exist on coral reefs providing an iterative, stratified random sampling design that allows for optimal sample allocation with fewer samples. Among locations, organisms of interest may vary depending on the high-value species present or local interests, but functional groups remain similar, making cross-ecosystem comparisons possible. Here, we describe the history, methods, and future of the NCRMP as a tool to unify sampling across the Gulf and Caribbean to aid in ecosystem evaluation, fishery management, sanctuary efficacy, habitat conservation, and enhance uniformity of the Global Coral Reef Monitoring Network for reporting and product development.

KEYWORDS: Long-term monitoring, fishes, coral reef

**Identifying Priorities for Ecosystem-based Management
in the Gulf of Mexico Through a Participatory Process**

**Identificando Prioridades para la Gestión Basada en Ecosistema
en el Golfo de México a través de un Proceso Participativo**

**Identifier les Priorités pour la Gestion Écosystémique
dans le Golfe du Mexique à travers un Processus Participatif**

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ABSTRACT

In 2016 NOAA Fisheries released its National Ecosystem-Based Fishery Management (EBFM) Policy, affirming a commitment to support an ecosystem approach to management, applied at regional scales. As the agency endeavors to implement EBFM, there is an increasing need to engage resource managers and users in identifying relevant ecosystem drivers, risks, and trade-offs. To fulfill this need, the NOAA Southeast Fisheries Science Center initiated a series of participatory fisheries system modeling workshops with fishing communities along Florida's Gulf coast. A major finding from this initiative was that water quality issues, and in particular harmful algal blooms known as "red tides," are perceived to be major threats to sustainability of fisheries in the region. By leveraging resources and collaborating with state, federal, academic and private agencies, research has since been conducted to better understand the severe red tide events and their impacts on biological and human communities. The participatory modeling approach was effective for defining discrete EBFM issues that were highest priorities for additional research and management consideration. At the same time, the approach was effective for engaging both researchers and stakeholders, and building synergies such as public-private partnerships to work toward common objectives. We will discuss the strength of the participatory modeling approach for building partnerships and identifying information gaps, how the resulting response plan led to decision-relevant knowledge, and the prospects for improving upon this research effort in the future.

KEYWORDS: Ecosystem-based fisheries management, snapper-grouper complex, water quality

Distribution and Composition of Fish Aggregating Devices as Marine Debris

Distribución y Composición de Dispositivos de Concentración de Peces como Desechos Marinos

Distribution et Composition des Dispositifs de Concentration de Poisson en tant que Débris Marins

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ABSTRACT

Marine debris is increasingly seen as an environmental threat. However, little is known about the contribution of drifting Fish Aggregating Devices (dFADs), a gear accessory often used by commercial purse-seine fishers to increase efficiency and catches of target species, particularly tunas. dFADs are simply a surface or sub-surface platform with construction ranging from commercially manufactured plastic discs to home-made rafts. Many also have subsurface netting to increase prey attraction, as well as satellite-linked electronic buoys that allow remote monitoring of fish aggregations underneath. Particularly in pelagic waters, dFADs contribute to the growing problem of Abandoned, Lost, and Discarded Fishing Gear (ALDFG) identified by the FAO. To date, little has been done to quantify the dFADs abandoned and beached in the Greater Caribbean. Using primarily social media, reports and photographs of stranded dFADs in the western Atlantic (n=153) were compiled from 1999 to present, including details on construction and designs, with locations throughout the Greater Caribbean in the western Atlantic and eastward to Scotland and the Azores. Two general trends were observed: 1) FAD platforms initially consisted of hand-made bamboo rafts, but the manufactured plastic discs that were developed in 2016 were first reported in October 2017, 2) an increasing frequency of home-made dFAD platforms composed of multiple jugs wrapped in netting within PVC or metal frames since January 2018. As reports of adverse anthropogenic impacts on the oceans increase, a need for sustainable, less damaging fishing gear and better fisheries management practices has become apparent, especially for dFADs. Better dFAD monitoring and reporting is recommended at the international RFMO/RFAB level.

KEYWORDS: Fish Aggregating Device, distribution, Caribbean

**A NEW Alien Fish Species Discovered in Trinidad,
This is NOT Another Lionfish Talk!**

**Una NUEVA Especie de Pez Alienígena Descubierta en Trinidad,
¡Esto NO es Otra Charla Sobre el Pez León!**

**Une NOUVELLE Espèce de Poisson Exotique Découverte à Trinidad,
Ce n'est PAS une Autre Discussion sur le Poisson-papillon!**

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ABSTRACT

With increased globalization, the spread of alien species is expanding. One such species is the Regal Demoiselle, *Neopomacentrus cyanomos*; a small, planktivorous damselfish native to coral reefs in the Indo-West Pacific Ocean. In 2013, this species was discovered in the southwest corner of the Gulf of Mexico where it was already well established and is now known to occur throughout the western and northern Gulf of Mexico. This year we found *N. cyanomos* around the northwestern islands and peninsula of Trinidad, again already well established and inhabiting shallow, rocky outcrops and shipwrecks. Abundances on the nine sites we surveyed ranged from 3 - 100s. At several sites, we saw males courting females, spawning, and guarding egg clutches. We plan to perform genetic analysis to identify relationships between the Trinidad populations, native populations and those in the Gulf of Mexico. Additional future work will be to identify the age and sex structure of the population. We surmise that this species was likely introduced to Trinidad and the Gulf of Mexico via the transport of oil and gas rigs and their support vessels from the Indo-West Pacific. These two locations, the only western Atlantic sites where this species currently is known, are regions with extensive oil and gas industries. Given its spread throughout the Gulf of Mexico, where it lives on coral reefs, and its ability to colonize the estuarine environment of Trinidad, it is also likely that *N. cyanomos* will start to colonize the southern Caribbean Sea in the near future. The ecological implications of this introduced species are currently not well understood and require further study and observation.

KEYWORDS: *Neopomacentrus cyanomos*, invasive species, Trinidad and Tobago

**Population Genetics Informs Management of a Commercially Endangered Species:
First Insights Into Jamaica's Queen Conch Fishery**

**Genética de Poblaciones Informa a la Gerencia de una Especie en Peligro de Extinción
Comercial: Primeras Ideas Sobre la Pesquería de Caracol Rosado de Jamaica**

**La Génétique des Populations Informe la Ggestion d'une Espèce en Danger de Disparition
sur le Plan Commercial: Premières Informations sur la Pêche au Lambi en Jamaïque**

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ABSTRACT

Queen conch populations within Jamaica's Exclusive Economic Zone have been subject to immense exploitation over the last 3 decades, with Jamaican exports accounting for 46% of international trade during the mid to late 1990s. Government implemented regulations have since reduced harvest to within sustainable levels. However, the assessment of Jamaica's conch populations, in particular those on the Pedro Bank (the island's primary fishing ground), have been limited to abundance surveys, which are site specific and does not consider the genetic interactions between sites. Knowledge of the genetic connectivity is vital to the management of this commercially endangered species as this connectivity facilitates population replenishment and continuity via larval transport by ocean currents. Due to the lack of knowledge in this regard to Jamaican queen conch populations, the genetic connectivity of the species throughout the country's Exclusive Economic Zone was assessed. Four hundred and fifty-nine individuals collected across 12 sites encompassing nearshore and offshore were genotyped using nine microsatellite loci. We present the findings of this study and highlight critical implications, not only for local management but the role Jamaica's queen conch populations play in wider Caribbean.

KEYWORDS: Queen conch, Jamaica, genetics

**Analysis of Historical Aerial Photographs and Satellite Data Reveal
an Increase in Seagrass Cover in Caja de Muertos Island Nature Reserve, Puerto Rico**

**Análisis de Fotografías Aéreas Históricas y Datos Satelitales Revelan un Aumento en la
Cobertura de Hierbas Marinas en la Reserva Natural Isla Caja de Muertos, Puerto Rico**

**L'Analyse des Photographies Aériennes Historiques et des Données Satellitaires
a Révèle une Augmentation de la Couverture des Herbiers Marins
dans la Réserve Naturelle l'île de Caja de Muertos, Porto Rico**

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ABSTRACT

Under a climate change scenario and an increase of anthropogenic disturbances on seagrass ecosystems, establishing baseline references of cover, distribution, and dynamics of these ecosystems are needed for their better understanding and management. Long-term changes in seagrass distribution in the Caja de Muertos Island Nature Reserve (CMINR), Puerto Rico, were assessed using an analysis of historical aerial photographs and remote sensing techniques. A WorldView-2 image from 2014, historical aerial photographs from 1950 to 2010, and field data were used to compare spatial trends within four zones in the CMINR. Remote sensing data were analyzed using object-based image analysis. Overall seagrass extent increased 64%, which contrasted with worldwide declining trends in seagrass habitats. Such increase was mainly driven by the patchy seagrass cover category, which was also the most persistent cover for the 64-year period. Temporal and spatial differences observed were probably associated with natural factors. Resulting seagrass persistence map elaborated on this study can be useful for managers in determining the severity of either natural or anthropogenic impacts in the CMINR and in deciding if management is needed. Data of this study represent a baseline by which future seagrass changes can be analyzed, as well as a valuable information source for the conservation of seagrass beds in the CMINR.

KEYWORDS: Seagrass dynamics, WorldView-2, object-based image analysis

**Historical Changes in Catch and Composition Rates by Species of Batoids
Exploited by Artisanal Fisheries in the Colombian Caribbean Sea**

**Cambios Históricos en las Tasas de Captura y Composición por Especie de Batoideos
Explotados por las Pesquerías Artesanales del Mar Caribe Colombiano**

**Changements Historiques dans les Taux de Capture et de Composition par Espèces de
Batoïdes Exploités par la Pêche Artisanale dans la Mer des Caraïbes Colombienne**

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RESUMEN

En el mar Caribe colombiano las pesquerías artesanales juegan un rol significativo en el desarrollo socioeconómico, pues de ellas depende el sustento de un gran número de comunidades costeras. En el trópico los batoideos son esenciales en la estructura y dinámica de las poblaciones marinas, puesto que desempeñan un papel importante en el intercambio de energía. Estas especies se caracterizan por poseer una elevada longevidad y una baja tasa de reproducción, haciéndolos vulnerables a la sobrepesca. En las últimas décadas se ha incrementado la presión pesquera debido a una mayor demanda comercial, además de convertirse en un grupo relevante en la fauna acompañante de los desembarcos pesqueros artesanales. No obstante, han sido muy poco estudiados y existen muy pocos antecedentes que indiquen cambios en el estado del recurso. El objetivo del presente estudio fue evaluar los cambios históricos en las tasas de captura y la composición por especie de los batoideos explotados por las pesquerías artesanales que operan en el Caribe colombiano, utilizando bases de datos de desembarcos pesqueros del periodo 1994-2018 en los departamentos de La Guajira, Magdalena, Atlántico, Bolívar, Sucre y Córdoba registrados por el Servicio Estadístico Pesquero Colombiano (SEPEC). En general, se observó una tendencia ascendente en las tasas de captura registradas en la mayoría de departamentos. Así mismo, se evidencia que los artes de pesca más comunes en la captura de batoideos son red de arrastre, palangre, chinchorro y red de enmalle. Se destaca que al inicio de la serie de tiempo, hace 25 años, *Hypanus americanus* fue la principal especie desembarcada, mientras que actualmente lo es *Hypanus guttatus*.

PALABRAS CLAVES: Pesca artesanal, batoideos, rayas

A Review of SocMon Caribbean: Challenges and Opportunities for Improving the Visibility and Relevance of Social Science in Management and Policy

Una Revisión de SocMon Caribbean: Desafíos y Oportunidades para Mejorar la Visibilidad y Relevancia de las Ciencias Sociales en la Gestión y las Políticas

Examen de SocMon Caribbean: Défis et Opportunités pour Améliorer la Visibilité et la Pertinence des Sciences Sociales dans la Gestion et la Politique

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ABSTRACT

The Global Socioeconomic Monitoring Initiative for Coastal Management (SocMon) was developed to improve the understanding of the social and economic conditions, contexts and motivations associated with the use of coastal ecosystems relevant to coastal management. SocMon is a methodology to be incorporated into site monitoring frameworks and programs for improving adaptive management. Between 2005-2018, initial SocMon assessments were conducted at 26 sites in 12 Caribbean nations and territories. A 2018 review of SocMon Caribbean evaluated the impacts of the assessment activities and results to site and resource management by interviewing thirteen SocMon project leaders from eight nations and territories. Practitioners agreed that conducting participatory social science data collection improves trust and communication with stakeholders. Such results can greatly improve management effectiveness on the ground and provide a foundation of key learning for further investments in social science for more effective adaptive resource management. Commonly reported challenges regarding the influence of SocMon include lack of: economic valuation variables in SocMon, local leadership and ownership of SocMon, and post-SocMon support to further its impact. There is a gap between the introduction of social science tools to marine and coastal managers, and the uptake of those tools into management. The addition of more variables that describe economics, revenue and employment, and the addition of follow-up communication in the temporal and fiscal budgets for SocMon projects, could improve the use and impact of socioeconomic data on coastal and marine decisions. Adaptive marine and coastal resources management could improve if decision-makers increase investments (staff, programming, budgeting) to reduce stressors on natural resources.

KEYWORDS: SocMon, socioeconomic monitoring, coastal zone management

**Comparison of Herbivory Rates of *Scarus gaucamaia*, *Scarus coelestinus*, *Scarus coeruleus*,
and *Scarus vetula* Across the Caribbean Basin**

**Comparación de las Tasas de Herbivoría de *Scarus gaucamaia*, *Scarus coelestinus*,
Scarus coeruleus y *Scarus vetula* en la Cuenca del Caribe**

**Comparaison des Taux d'Herbivorie de *Scarus gaucamaia*, *Scarus coelestinus*,
Scarus coeruleus et *Scarus vetula* dans le Bassin des Caraïbes**

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ABSTRACT

Reef ecosystems are trending towards a more algae dominated system. Scientists and managers alike are trying to better comprehend the role that herbivores play in reducing the amount of algae on reefs and opening up space for coral recruitment. Large parrotfish are an important herbivore but the specifics of how *Scarus gaucamaia*, *Scarus coelestinus*, *Scarus coeruleus*, and *Scarus vetula* contribute to algae reduction is not fully understood. The purpose of this study is to investigate the differences of these four *Scarus* species across a latitudinal gradient. Field surveys were conducted in Bermuda, United States Virgin Islands, and Bonaire. Snorkel and SCUBA surveys were conducted towing a GPS to determine the area each parrotfish grazed, grazing rates, and the algae on which the parrotfish grazed. Herbivore and algal abundance data were also collected for each site. This data will allow a comparison of the herbivory rates of these four fish and the latitudinal effects their herbivory rates. This information will inform managers as they set fishing restrictions in the Caribbean and help protect coral reefs by keeping important herbivores on the reef.

KEYWORDS: *Scarus*, parrotfish, herbivory

Field Testing Assumptions and Model Predictions about Sex Change and Spatial Management in a Protogynous Grouper, Gag, *Mycteroperca microlepis*

Supuestos de Pruebas de Campo y Predicciones de Modelos sobre el Cambio de Sexo y el Manejo Espacial en un Mero Protoginoso, Gag, *Mycteroperca microlepis*

Hypothèses d'Essais sur le Terrain et Prévisions de Modèles Concernant le Changement de Sexe et la Gestion Spatiale chez un Mérrou Protogyne, Gag, *Mycteroperca microlepis*

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ABSTRACT

In protogynous species the assumption that reproductive potential is driven by female biomass or egg production is not accurate and we need a better understanding of: sex change mechanisms, male abundance and productivity, and how protogyny may impact the effectiveness of spatial management. In this study we integrate capture-based and video data from a three-year study sampling a spawning reserve (MPA), a seasonally-closed spawning area, and an unprotected area with similar habitat with survey and fishery dependent data (n = 1,666 Gag). We test common assumptions about Gag spatial ecology, sex change cues, and expected increased male sex ratios in the MPA. Density changes supported previous reports of female pre-spawning aggregations but evidence for spawning aggregations was weaker, with the maximum number of Gag observed on video being 13 fish during the spawning season in the MPA. However, low abundance may have impacted these results as catch rates were low, even in the MPA (CPUE of 1.7 +/- 2.8 fish/hour). Depth at capture differed significantly with female reproductive phase, with actively spawning females and males occurring only in waters deeper than ~50 m. Within the MPA, age at 50% male increased to 13.0 y (vs 10.9 y), but the percentage of males (~5%) remained significantly lower than models had predicted. The percentage of males was effectively 0% in the seasonally-closed and open areas. Transitionals occurred in shallow water pre-spawning aggregations, as well as at spawning sites, and were sampled from December through May. We hypothesize that the Gag sex-specific movement ecology and lek mating strategy play an important role in their sex change mechanism, with cues first occurring in female-only pre-spawning aggregations.

KEYWORDS: Gag grouper, MPAs, sex change

Decision Support System, Based on a Set of Information, Data and Indicators, for Integrated Management of the Coastal-Marine Environment. Final Outcomes of the Caribbean EBM-DSS Pilot Project of Dominican Republic

Sistema de Soporte a la Toma de Decisiones, Basado sobre un Conjunto de Informacion, Datos e Indicadores, para el Manejo Integrado del Ambiente Costero-Marino. Resultados Finales del Proyecto Piloto EBM-DSS del Caribe en la República Dominicana

Système d'Aide à la Décision, Basé sur un Ensemble d'Informations, de Données et d'Indicateurs, pour la Gestion Intégrée de l'Environnement Marin et Côtier. Résultats Finaux du Projet Pilote EBM-DSS dans les Caraïbes en la République dominicaine

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ABSTRACT

A pilot project based on the Ecosystem Based Management (EBM) concept was promoted and performed in the provinces of Montecristi and Puerto Plata, Dominican Republic, as part of the “Biodiversity for Sustainable Development in the Caribbean through EBM” project. The main outcome of first phase, implemented in 2016-2017, was the creation of an interinstitutional multidisciplinary working group and its training in the use of the Decision Support System (DSS) Software. These two essential results were achieved through the application of the PROGES EBM-DSS methodology in a stage of four specific workshops. A relevant difficulty of the first phase was related to the data availability, accessibility and format. In the second phase of the project (January-September 2019) the Ministry of Environment and Natural Resources (MARENA) has created synergies and actions between different projects and institutions in order (i) to improve and update the database of the DSS, tackling the data collection issue occurred in the first phase, (ii) to strengthen the sustainability of the DSS and (iii) to enhance the effectiveness of the institution in the coastal-marine area management. MARENA has established interinstitutional agreements with the key-actors in order to ensure a periodic and continuative update of the data to be entered in the EBM-DSS. The monitoring of the key parameters and the specific management actions have been developed by the interactions among experts and institutional stakeholders in the process of the ecosystem cause-effect analysis based on the DSS methodology. The results of the data collection task, the field monitoring practices, and the above mentioned management activities will be finalised within September 2019. The scientific, technical and the institutional final outcomes will be identified and described.

KEYWORDS: EBM-DSS, coastal marine PAs, sustainability

**A Comparison of Biogeochemical and Fitness Effects
of Fertilizers on Subtropical Seagrasses**

**Una Comparación de los Efectos Biogeoquímicos y de Aptitud Física
de los Fertilizantes en las Hierbas Marinas Subtropicales**

**Une Comparaison des Effets Biogéochimiques et de Remise
en Forme des Engrais sur les Herbiers Subtropicaux**

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ABSTRACT

Seagrasses are in decline worldwide, and restoration of these ecosystems are difficult to conduct. Fertilization, a popular restoration technique, can have variable results or pollute the surrounding ecosystem. The use of fertilizers with low dissolution rates may reduce nutrient pollution and improve restoration success, as the nutrient load is mostly intercepted by the seagrass rhizosphere rather than being leached out to the open water. Struvite, a slow release fertilizer sustainably harvested from wastewater treatment plants, was compared to Osmocote, a popular granular fertilizer, to assess their effects on seagrass fitness (measured via shoot counts) and the biogeochemistry of the sediment. Two experiments have compared the effectiveness of both fertilizers in a subtropical mesocosm experiment, with one current project applying the results in a seagrass scar restoration experiment off Crystal River, FL. The first study added a single 0.5 mg P per gram DW dose of Osmocote and struvite fertilizers to seagrass plots inside a subtropical 6 meter diameter mesocosm. Seagrass shoot counts were significantly higher in the struvite treatments than both the Osmocote and controls ($p < 0.02$). We also determined a significant difference between total phosphorus in the Osmocote treatment vs struvite and controls ($p < 0.0005$), suggesting a faster dissolution rate compared to struvite. This may pose problems if Osmocote is implemented in seagrass restoration efforts, especially in concentrated doses like those used in this experiment, leading to pollution and even seagrass stress (possibly observed in the roots). Results from a subsequent mesocosm experiment using lower doses of fertilizer, as well as preliminary data/drone imagery from the field experiment will also be presented.

KEYWORDS: Seagrass, restoration, fertilizer

How Will Climate Change Affect the Resilience of Caribbean Coral Reef Ecosystems?

¿Cómo Afectará el Cambio Climático la Resiliencia de los Ecosistemas de Arrecifes de Coral del Caribe?

Comment le Changement Climatique Affecte la Résilience des Écosystèmes de Récifs Coralliens des Caraïbes?

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ABSTRACT

Coral reef ecosystems provide important natural services to developing world societies, but are expected to show significant declines in species diversity, shifts in community composition and declines in productivity under climate change, increasing vulnerability of dependent societies to external shocks. Given current climate trajectories, adapting to these changes is an important goal for developing world societies and developing means of measuring changes in the functioning of coral reef ecosystems. Resilience is defined as the ability for an ecosystem to return to its original state of functioning following some external impact and can be represented by species diversity, particularly in ecosystems exposed to medium to high levels of disturbance, such as coral reefs, where high diversity plays an important role in maintaining ecosystem functioning. Here, we used species distribution models to produce projected changes in the species diversity of coral reef ecosystems in the ecologically distinct Caribbean large marine ecosystem, a socially and ecologically vulnerable region. The results of this study can provide a basis for the development of climate-proof policies for resource management and further explorations of resilience as a measure of ecosystem integrity.

KEYWORDS: Coral reef, climate, species diversity

**The Management of Fishery Resources in Colombia:
An Analysis of Their Relevance and Appropriateness from a Historical Outlook**

**La Gestión de los Recursos Pesqueros en Colombia:
Un Análisis de su Pertinencia y Oportunidad desde una Perspectiva Histórica**

**La Gestion des Ressources Halieutiques en Colombie:
Une Analyse de leur Pertinence et de leurs Opportunités d'un Point de Vue Historique**

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ABSTRACT

A characteristic inherent to the administration of Colombia's fishery resources has been institutional instability, derived from changes in the governmental entities that govern the national fishing activity and even in their hierarchical level in the context of the public administration of the country. In some cases this situation has determined a disconnect between the reality of the situation of the main fishing resources and the relevance or appropriateness of the management measures that are promulgated, although in many of these cases there is scientific information on support for the promulgation and implementation of such measures. This conclusion was reached after analyzing the historical trends in the amount and type of management measures promulgated by the government entities during the period 1978-2018 and contrasting them with the results of more than 1200 scientific studies conducted in the country on fishery biology, population dynamics or stock assessment. In total, 2383 regulations were analyzed, of which 27.7% corresponded to closures, 25.4% to fishing quotas, 20.6% to delimitation of species considered as fishery resources, 20.4% to minimum catch sizes and the remaining percentage to declarations of exclusive areas of artisanal fishing, bycatch reduction devices, aggregation devices, illegal fishing and control and surveillance measures. Another conclusion derived from the study is a significant gap in the regulations related to artisanal fishery resources exploited mainly by artisanal fisheries in the coastal areas of the Pacific and Caribbean coastlines. Indeed, despite the fact that the highest percentage of scientific research carried out in the last three decades corresponds to marine resources, the number of measures on inland water resources is greater than that of marine fishery resources.

KEYWORDS: Artisanal fishing, ordination, freshwater resources

Modernizing Fisheries Information in the Gulf of Mexico and Caribbean

Modernización de la Información Pesquera en el Golfo de México y el Caribe

Moderniser l'Information sur les Pêches dans le Golfe du Mexique et les Caraïbes

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ABSTRACT

Improving the accessibility and quality of data is integral when managing sustainable fishing practices. Modernized data governance and workflows enable more efficient information exchange among scientists, managers, and other stakeholders across the 42 geopolitical jurisdictions in the Gulf of Mexico and Caribbean. As many fish stocks share time and space across these boundaries, proper management is contingent upon timely and accessible data and collaboration. The modernization of a workflow should consider the end-to-end process from data collection and reporting to processing, distribution, and disposition. Each component of this system poses its own technical, logistical, policy, legal, and social modernization challenges. Two important steps in modernizing fisheries information management systems are to identify the components of that system and define the key actions required to modernize each component (i.e what resources will be required, a timeline for their completion, and metrics to measure their impact). The 2019 Fisheries Information Management Modernization Workshop organized by NOAA Fisheries will bring together expertise across different data types and roles within the data lifecycle to collectively identify priorities for modernization. These priorities will likely be useful and transferable to the Gulf of Mexico and Caribbean. The top priorities identified in this workshop will be linked to case studies in the Gulf of Mexico and Caribbean to highlight work already being done to modernize workflows such as the successful implementation of electronic technologies and projects focused on increasing data accessibility. Increasing efforts to improve data modernization will not only enhance the quality and timeliness of data products, it also allows for increased collaboration to manage shared stocks.

KEYWORDS: Modernization, accessibility, workflow

Arrival of Pelagic *Sargassum* to the Cuban Coasts, 2012-2019

Las Arribazones de *Sargassum* Pelágico a las Costas Cubanas, 2012-2019

Arrivée des *Sargassum* Pélagique sur la Côte Cubaine, 2012-2019

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RESUMEN

El archipiélago cubano no ha estado exento de las inusuales arribazones de *Sargassum*, fundamentalmente *S. fluitans* en la costa sur; en la costa norte se ha comportado de la forma históricamente natural de siempre. La costa sur de la isla grande está protegida por los archipiélagos de Jardines de la Reina, al sureste y Los Canarreos al suroeste. En ninguno de ellos hay comunidades costeras que sufran el impacto de estas arribazones, sólo un escaso desarrollo de actividades turísticas y no se han visto muy afectados; pero no ha sido así en otros tramos costeros sin la protección de archipiélagos. La primera noticia de arribazones inusuales fue en la zona surcentral, bahía de Cienfuegos, donde afectó un delfinario y costas de manglares, en mayo de 2012; también en ese año se reportó al sur de la provincia de Santiago de Cuba. En 2015, de nuevo se recibieron avisos, pero sólo de la zona suroccidental, en playas de anidación de tortugas de la península de Guanahacabibes. Las mayores arribazones han ocurrido durante 2018 y 2019 y de nuevo sólo en el sur. En estos casos se han observado impactos físicos en las costas, intentos de anidación fallidos, mortalidad de peces y acumulación de basura. Para la protección de las tortugas y sus nidos se han abierto corredores en las zonas de desove y desde los nidos. Se elabora un proyecto multidisciplinario del manejo integrado de las arribazones en las costas del sur de Cuba.

PALABRAS CLAVES: Invasive, costas, *Sargazo*

**Ciguatera Poisoning in Antigua and Barbuda:
Working Towards a Risk Management Strategy**

**Envenenamiento por Peces Ciguatera en Antigua y Barbuda:
Trabajando Hacia una Estrategia de Gestión de Riesgos**

**Intoxication par les Poissons de la Ciguatera à Antigua-et-Barbuda:
Vers une Stratégie de Gestion des Risques**

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ABSTRACT

Ciguatera Poisoning (CP) is a foodborne illness caused by consumption of fish contaminated with ciguatoxins and has been estimated to affect up to 500,000 people annually worldwide. Ciguatoxins are produced by tropical marine microalgae of the genus *Gambierdiscus* spp. which once ingested by herbivorous reef fish can become bioaccumulated through the food web, and impact upon important fishery species. Globally, CP is distributed across all subtropical and tropical oceans and within the Caribbean, two common isomers known as C-CTX-1 and -2 are the most commonly reported, with many other related toxins identified but yet to be elucidated.

Within the Caribbean CP is highly prevalent, having profound effects on fisheries with associated socio-economic burdens. It is known that CP occurrence can be highly localised in its prevalence, both geographically and within fish species and a more detailed understanding of CP distribution could potentially lead to a risk assessment type approach to fisheries management.

Due to the extremely low concentrations of toxins required to cause illness, analysis of ciguatoxins in fish is highly challenging. Current approaches typically assess overall toxicity via a cytotoxicity assay, with molecular confirmation obtained by mass spectrometry. We are currently working with the Antiguan Fisheries Board to assess occurrence and levels of ciguatoxins within fish from Antigua and Barbuda. A number of fish species from sites believed to be high, medium and low risk will be assessed for the presence of CTX and toxicity levels. Pilot data has shown for the first time the molecular confirmation of Caribbean CTXs in Antiguan fish. This partnership demonstrates how the scientific community can collaborate with local fishers and resource managers to improve evidence-based CP management strategies.

KEYWORDS: Ciguatera, ciguatoxin, management

An Overview of Twenty Years of Fisheries Management in the Dominican Republic

Una Visión General de Veinte Años de Ordenación Pesquera en la República Dominicana

Un Aperçu de Vingt Ans de Gestion de la Pêche en République dominicaine

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ABSTRACT

A general view of improvements and challenges of the fisheries management in the Dominican Republic is presented. The shift in organizational structure and movements among government ministries is analyzed and the threats and strengths defined. Modernization of fisheries law and regulations, adoption of regional integrated regulations and close seasons, increased participation of fisheries stakeholders in fisheries management and inclusion of fishers and their families in social security schemes has allowed the improvement of fishers quality of life. By another hand, limitations on monitoring, control and surveillance has posed a threat in fisheries long-term sustainability. We discussed that the up-to-date fisheries strategy and probable adoption of international treaties on Port States Measures provides a hope for sustainability of fisheries resources for the use and enjoyment of present and future generations.

KEYWORDS: Fisheries management, sustainability, social security

**Chronology of Events of Massive Fish Mortality in the Dominican Republic:
Possible Causes and Impacts on Local Fishing Communities**

**Cronología de Eventos de Mortalidad Masiva de Peces en la República Dominicana:
Posibles Causas e Impactos en las Comunidades Pesqueras Locales**

**Chronologie des Événements de Mortalité Massive de Poissons en République
Dominicaine: Causes Possibles et Impacts sur les Communautés de Pêcheurs Locales**

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ABSTRACT

Massive fish mortality events in both marine and freshwater ecosystems pose a threat to the conservation of the elements of aquatic biodiversity and negatively impact fisheries in the Dominican Republic with the consequent economic losses for fishers and their families. This study compiles and analyzes the data and information recorded in news from digital newspapers, videos, government technical reports and interviews with key informants in relation to news source, date and location where the mass mortality happened and perceptions about the possible causes of fish mass mortality. The analysis of 50 fish mass mortality events that took place from year 2005-2019 showed that the main marine groups and life cycle affected by mass mortality are juvenile stages of Gerreidae, Holocentridae, Haemulidae, Mugilidae, Tetraodontidae, Anguillidae and invertebrates such as marine crabs. Freshwater fishes including Cichlids (*Oreochromis* spp. and *Nandopsis haitiensis*); Cyprinidae (carps), Mugilidae (*Agonostomus monticola*) and Eleotridae (*Eleotris pisonis*) are integral parts of the death fish mass architecture as well as a few freshwater crabs, shrimps and turtles. Probable causes of mass fish death are related to poisoning by spillage into the water, spillage or fumigation with toxic chemicals, anoxia related to massive arrival of the sargassum seaweed or overheating of the waters, fishing with inappropriate nets, practice of "apaleo" or water beating and, in some cases, the causes are unknown. The real and potential effects of massive fish deaths on fishing activity and beach tourism are discussed.

KEYWORDS: Chronology, fish death, event

**Puerto Rico's Active Fishing Centers and Fishing Villages
after Two years of the Impact of Hurricane María**

**Centros Pesqueros y Villas Pesqueras Activas en Puerto rico
Dos Años Después de Huracán María**

**Les Centres de Pêche Active et les Villages de Pêche de Porto Rico
Après Deux Ans d'Impact de l'Ouragan María**

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ABSTRACT

The Fisheries Research Laboratory (FRL) of the Puerto Rico Department of Natural and Environmental Resources (DNER) monitors the commercial landings of fish and shellfish in Puerto Rico since 1967. The CFSP receive commercial fisheries landings reports, collect and process biostatistics data. The biostatistics data collection occurred at the fishing centers (places where fishers landings). Many fishing centers have “Villas Pesqueras”, they are buildings that Puerto Rico’s Agriculture Department or municipality provided to commercial fishers, where they have place to storage their fishing gear, vessels, fish house and some have ramps and/or dock. In September 20, 2017 Hurricane María impacted Puerto Rico. This was a catastrophic hurricane. The Puerto Rico population was impacted with category five winds of 175 – 200 MPH. Most of the 88 fishing centers active before the Hurricane María and Villas Pesqueras were seriously damaged. The CFSP make an inventory to know how many fishing centers and “Villas Pesqueras” still active after two years of the hurricane impact.

Two years after the impact of Hurricane María the CFSP personnel account for approximately 60 fishing centers and 38 “Villas Pesqueras” active. This paper will present the list and the status of every fishing center and “Villa Pesquera” and how is the fishing activity.

KEYWORDS: Commercial fishery, fishing centers, Villa Pesquera

**Description of Puerto Rico's Queen Conch (*Lobatus gigas*) Fishery Trends
After Two Years of the Impact of Hurricane María in Puerto Rico**

**Descripción de las Tendencias Pesqueras del Caracol Rosado en Puerto Rico
después de Dos Años del Impacto del Huracán María en Puerto Rico**

**Description des Tendances de la Pêche au Lambi de Porto Rico
après Deux Ans d'Impact de l'Ouragan María à Porto Rico**

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ABSTRACT

The Queen Conch (*Lobatus gigas*) has been a very important fishery in Puerto Rico since 1980s. Since the middle of 1980's the SCUBA divers fishers shown an increase in their number of active fishers and pounds landed. Currently queen conch fishers are one of the most significant components of the full time commercial fishers. The SCUBA divers primary target is the queen conch and lobsters, thus both species have been in the top five landed in Puerto Rico since 1988. The mentioned facts resulted in large fishing pressure on the queen conch. Hurricane María impacted Puerto Rico. This was a catastrophic hurricane. The Puerto Rico population was impacted with category five winds of 175 – 200 MPH. The hurricane was 300 miles wide. Queen Conch are found in shallow, clear water of oceanic or near-oceanic salinities at depths generally less than 75 meters and most often in water less than 30 meters deep. Queen conchs are likely limited to that depth range by limits in seagrass and algae cover. Unfortunately, it was reported by queen conch fishers that Hurricane María destroyed most of the queen conch banks. Thus the commercial fishers reduce their average catch per trip from 40 pounds per trip to approximately 12 pounds. The average cost of the queen conch was approximately \$6.00 per pound before the hurricane and two years after the hurricane the average increase to \$9.00. In the west coast most of the SCUBA commercial fishers that caught 20 to 30 queen conch pounds per trip had been fishing at 115-130 feet depth, resulting in 6 fishers have been in the hyperbaric chamber to receive bends treatments.

This paper will present describe the current queen conch fishery, the landings reported by coast and will present the opinions of the commercial fishers to improve this situation.

KEYWORDS: Puerto Rico, commercial landings, queen conch

**Value Enhancement of Spiny Lobster (*Panulirus argus*)
for the Live-lobster Export Market**

**Mejora del Valor de la Langosta Espinosa (*Panulirus argus*)
para el Mercado de Exportación de Langosta Viva**

Valorisation de la Langouste (*Panulirus argus*) pour le Marché d'Exportation du Homard

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ABSTRACT

Over the last decade, the increased value of and demand for Caribbean spiny lobster (*Panulirus argus*), particularly on the international live market, have spurred interest in the aquaculture of spiny lobster. The complex life history of spiny lobster has, for the time being, generally constrained such enterprises to collection and captive grow-out of small-wild lobsters to marketable size. An alternative aquaculture method, developed here, involves the grow-out or “rehabilitation” of small, but legal-size, and low-grade lobsters captured in the fishery. “Low-grade” refers to lobsters not suitable for the high-value international live market including lobsters with missing appendages and those that are too weak or unhealthy to survive shipment. Our public-private partnership is developing the regulatory mechanisms and practical methods to add value to these low-grade lobsters by holding and feeding them in culture to increase both their size and grade. An added benefit of holding lobsters in culture is the ability to market lobsters at times of high demand and peak price particularly when the fishing season is closed. The demand for and price of lobsters fluctuates because of both supply and economic factors affect this luxury food item. In Florida, ex-vessel value of lobsters has ranged from \$13.8 to \$57.5 million dollars (US) during each fishing season since 1999. Landings of lobsters have declined nearly 20% in Florida and 12.5% in the Caribbean region since landings peaked in 1999. However, over the last 5 years, the price differential between whole frozen and live lobsters in Florida indicates that a 30% to 50% increase in market value is possible if full exploitation of the live-lobster export market can be attained.

KEYWORDS: Aquaculture, spiny lobster, public–private partnership

Five Key Factors to Elevating *Sargassum* Mitigation Efforts

Cinco Factores clave para Elevar los Esfuerzos de Mitigación del *Sargazo*

Cinq Facteurs clés pour Faire Progresser les Efforts d'Atténuation des *Sargasses*

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ABSTRACT

In the face of climate change, coastal communities have been urged to advance their management practices in an effort to maintain resilient coastlines. One climate-induced factor that has proven especially relentless to the Caribbean and Gulf regions is *Sargassum*. *Sargassum* is a macro-alga that thrives on the surface waters of the North Atlantic Ocean and the Caribbean Sea as a result of warmer ocean temperatures and nutrient pollution. The following presents five prime factors that should be considered in all attempts to elevate current *Sargassum* mitigation efforts. These five factors include: 1. Innovative Collection Experimentation, 2. Post-Collection Refinement, 3. Public-Private Partnership Development, 4. Point-Source Management, and 5. Full-Cost Accounting. Factor 1, Innovative Collection Experimentation, tasks those affected to engage in and support experimental efforts such as pilot-studies that aim to pioneer *Sargassum* collection methods through trial and error. Factor 2, Post-Collection Refinement, encourages the realization of *Sargassum*'s prospective role in fields such as biomedical, agricultural, and biofuel. A positive return on investment (ROI) could transform the process of controlling this natural disaster into a profitable effort on both the local and on the global-scale. Factor 3, Public-Private Partnerships, directs those involved to combine the resources of public and private parties in an effort to unify results. Factor 4, Point-Source Management, aims to address the overarching factors contributing to *Sargassum* influxes (ie - greenhouse gas emissions, nutrient loading, deforestation, etc.). Lastly, factor 5, Full-Cost Accounting, supports the generation of exhaustive cost evaluations by incorporating both the direct and indirect costs of *Sargassum* landings.

KEYWORDS: *Sargassum*, climate change, innovative

Using Oral Histories and Participatory Mapping to Understand the Biological Impacts and Resilience of Fishermen to Red Tides on the West Florida Coast

Usando Historias Orales y Mapeo Participativo para Entender los Impactos Biologicos y Resiliencia de los Pescadores a las Mareas Rojas en la Ccosta Occidental de la Florida

Utilisation des Histoires Orales et de la Cartographie Participative pour Comprendre les Impacts Biologiques et la Résilience des Pêcheurs aux Marées Rouges sur la Côte Ouest de la Floride

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ABSTRACT

The effect of red tides on ecosystem services can generate additive and potentially synergistic effects that can have far-reaching impacts on commercial and recreational fishermen and coastal communities. A series of summer 2018 workshops led by the Southeast Fisheries Science Center with fisheries stakeholders on the southwest Florida coast highlighted serious concerns regarding the multifaceted impacts of red tide. In addition to the obvious fish kills and water quality issues, stakeholders have observed extensive habitat damage related to red tide, and have noted that recovery of fish populations has been increasingly delayed following recent and frequent red tides.

In response to these concerns, we developed an initiative to systematically explore local ecological knowledge (LEK) regarding red tides with fishermen using oral histories and participatory mapping. Goals of the LEK assessment were to: 1) document red tide locations, frequency and severity over time and space, 2) document impressions of how red tides/blooms develop and their impact on different fish populations and habitats, 3) identify possible ecological signals and stakeholder-driven hypotheses of red tide event occurrence and severity, and 4) document the adaptation strategies fishermen have employed in the face of red tide events. Some 60 interviews were conducted with fishermen along the west Florida coast. Relevant information was extracted from each of the oral histories and was quantified to compare the recent 2017-2018 event to previous events in terms of severity, recovery time, temporal extent and species killed. This presentation will focus in particular on the use of oral history information in the recent red grouper stock assessment and the adaptive strategies of fishermen in the face of red tide events.

KEYWORDS: Participatory research, red tide, Florida

Exploring Management Measures Towards Sustainability in the Mexican Red Grouper Fishery

Exploración de Medidas de Manejo hacia la Sustentabilidad de la Pesquería Mexicana de Mero Rojo

Adaptation des Mesures de Gestion Vers la Durabilité de la Pêche Mexicaine du Mérou Rouge

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ABSTRACT

In Mexico, red grouper has a long harvest history. This resource is mainly caught in Yucatán state, and account for over 60% of finfish landings. At present, the fishing sector and management agencies are concerned about the future of this fishery. This study assesses different harvesting scenarios based on data from the last 19 years of the fishery along the Gulf of Mexico, focusing in stock recovering as well as minimizing social impacts. Red grouper stock biomass was estimated using steady state and non-equilibrium surplus production models; parameters were fitted through least squares and maximum likelihood profiles. B/BMSY and F/FMSY ratios were calculated to produce Kobe diagrams to observe stock trend and status. Scenarios considered 1) constant fishing mortality at 75, 50, 40, 30, 20 and 10% of the estimated MSY, and 2) random catch limits in ranges from 1,000 – 2,500 ton, 1,800 – 2,500 ton, and 1,800-3,800 ton. Scenarios were calculated using median CPUE for the time series (i.e., 0.06 ton vessel-1 effective fishing day-1), projected from 2019 to 2034. From Kobe diagram, overfishing occurred from 2000 to 2007, and stock remained overfished from 2008 to 2017. Stock status in 2018 falls within the limit of recovery due to low fishing mortality. Scenarios with catch levels below 50% of MSY yielded recovery of the stock; scenarios where catch was 75% or within 1,800 – 3,800 ton resulted in the depletion of the stock by 2034. Based on current results we suggest that maintaining current fishing effort and limiting catches within 1,000 – 2,500 ton threshold could result in a slow but steady recovery of the red grouper stock without aggravating the current status of the fishing fleets.

KEYWORDS: Red grouper, fisheries, kobe plot

Maritime Pollution by Microplastics in the Gulf of Nicoya of Costa Rica

Contaminación Marítima por Microplásticos en el Golfo de Nicoya de Costa Rica

Pollution Maritime par les Microplastiques dans le Golfe de Nicoya au Costa Rica

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ABSTRACT

The presence of fragments or pieces of large plastic or macro plastic in the marine environment have generated great concern worldwide given its persistence in the environment. Due to the degradation suffered by these materials, there is contamination by microplastics and problems in the marine ecosystem. Nowadays, the sources of income of these pollutants to water bodies and their global dissemination have been investigated. It is important to perform an analysis about the abundance of microplastics in marine sediments and surface waters in order to obtain a clearer understanding of the availability of microplastics in the marine environment and the risks they pose to the health of the aquatic ecosystem and affect the ecological processes. Given the lack of information on microplastic contamination in the Gulf of Nicoya, there is a need to conduct a study that defines a baseline and contributes to diagnose the current situation of this environmental problem, as a first step towards reducing pollution marine by plastic waste in the Costa Rican Pacific Sea. For this study, it is necessary to sample sediment and seawater; then proceed to perform the laboratory analysis by means of density techniques and electron microscopy in order to quantify and characterize microplastics at various points in the study area.

KEYWORDS: Microplastics, sediment, surfacewater

A Preliminary Life History Assessment of Swordfish, *Xiphias gladius*, Landed in the Northern Gulf of Mexico Recreational Fishery

Una Evaluación Preliminar de la Historia de Vida del Pez Espada, *Xiphias gladius*, Desembarcó en la Pesquería Recreativa del Norte del Golfo de México

Une Évaluation Préliminaire du Cycle de Vie de l'Espadon, *Xiphias gladius*, a Atterri dans la Pêche Récréative dans le Nord du Golfe du Mexique

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ABSTRACT

Swordfish, *Xiphias gladius*, is a highly migratory pelagic species found circumglobally in tropical, subtropical and temperate ocean waters. Historically, studies investigating age, growth and reproduction of swordfish have primarily been conducted on specimens collected from commercial fisheries in the Atlantic and Pacific Oceans and the Mediterranean Sea, with information lacking from the Gulf of Mexico (GOM). Increased recreational fishing for swordfish in the northern GOM dictates the need to collect regional life history data to inform future stock assessments in support of effective management of swordfish populations in the GOM. The current study collected biological samples and data from 51 swordfish (45 females and 6 males) ranging in size from 82.6 – 246.3 cm lower jaw fork length that were landed in the northern Gulf of Mexico recreational fishery during 2017, 2018, and 2019. Histological examination of gonadal tissue from an initial subset of 26 fish indicated that all had reached sexual maturity and all males were spawning capable. Sixty percent of female swordfish were in the early developing reproductive phase, while 10% were in the spawning capable phase. Additionally, females exhibited asynchronous oocyte development indicating batch spawning. The second anal spine of each specimen was prepared for age analysis. Independent readers provided annuli count with no prior knowledge of specimen size, sex, or previous counts. Age estimates ranged between 3 - 11 years. Back-calculations of age were conducted to model growth due to limited sample size and resulting values fitted to four growth models (two- and three-parameter von Bertalanffy, Gompertz, and logistic). To our knowledge this ongoing study is the first to investigate life history of recreationally landed swordfish in the GOM.

KEYWORDS: Swordfish, age, growth

**Generating High-resolution Seabed Habitat Maps
Around the Coast of Saint Lucia to Support Future Development**

**Apoyando el Desarrollo en las Costas de Santa Lucía:
Generación de Mapas de Hábitat de Alta Resolución**

**Génération de Cartes à Haute Résolution des Habitats Côtiers
du Fond Marin de Sainte-Lucie pour Soutenir le Développement Futur**

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ABSTRACT

As a small island with an extensive marine jurisdiction, the marine ecosystems and the species they support are integral to the economy of St Lucia. To support St Lucia's development ambitions and enhance coordination and management of marine resources, a detailed marine spatial plan is required for the island. This requires a thorough understanding of the ecological characteristics around St Lucia which can be achieved through baseline surveys and the development of seabed habitat maps. As part of the Commonwealth Marine Economies (CME) programme and in collaboration with the St Lucia Department of Fisheries, two seabed imagery surveys were undertaken around the west coast of St Lucia to determine the presence and extent of benthic habitats and their associated species. Over 200 drop camera video tows were conducted to survey the benthic habitats to a maximum depth of 80 m. The acquired data were analysed for percentage coverage and grouped into community assemblages based on the observed taxa. Assisted by bathymetry and backscatter data derived from a separate CME project led by the United Kingdom Hydrographic Office (UKHO), geomorphological and benthic habitat maps were generated for four key sections of the coastline. These four focal areas, identified through consultation with local stakeholders, were targeted based on their potential conservation importance, volume of vessel traffic and importance for tourism and fishing industries. The resulting habitat maps will be used to support the delineation of Marine Protected Areas, reduce stakeholder conflict and for supporting evidence-based decision-making for subsequent marine development projects.

KEYWORDS: Habitat mapping, multibeam echosounder, seabed imagery

**Characterization of the Fisheries of Marine Organisms
with Ornamental Purposes in the Dominican Republic**

**Caracterización de la Pesca de Organismos Marinos
con Fines Ornamentales en República Dominicana**

**Caracterisation de la Pêche d'Organismes Marins
à des Fins Ornamentales en République Dominicaine**

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ABSTRACT

Fishing for ornamental purposes begins in the Dominican Republic in the 80's. The country is consolidated as a medium-sized exporter of marine species destined for trading in recreational aquariums, exporting to 8 countries on three continents. The methodology and characteristics of this activity are described. The most important species and the export rates between 2008-2015 are listed. A total of 162 species distributed between invertebrates and fish are exported annually. Of this total, 43 families of fish are used, being Serranidae the one with the greatest number of species captured. Crustaceans are the most demanded group of invertebrates, with *Pagurites cadenati* at the head of exports. Finally, it is recommended to continue with the Order Resolution for the Fishing of Ornamental Marine Organisms to establish catch limits and conservation of the species captured.

KEYWORDS: República Dominicana, ornamental fishery, coral reef fish, trade, *Pagurites cadenati*

A Profile of the Gulf and Caribbean Fisheries Professional Development Program

Perfil del Programa de Desarrollo Profesional en la Gestión de la Pesca en el Golfo de México y la Región del Caribe

Profil de Programme de Perfectionnement Professionnel en Gestion des Pêches dans la Région du Golfe du Mexique et des Caraïbes

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ABSTRACT

The Gulf and Caribbean Fisheries Professional Development Program represents a partnership between the NOAA Sea Grant Program, the Gulf and Caribbean Fisheries Institute and the Caribbean Regional Fisheries Mechanism. The program was developed to enhance collaboration and knowledge sharing among organizations that manage and promote the sustainability of fisheries resources. This program provides an excellent opportunity to bridge knowledge for marine and fisheries professionals around the needs and capacity shortages present in participating countries. Due to its success in the Caribbean Region, the program has recently been expanded to the South Pacific through a partnership with Hawaii Sea Grant. The program offers a four-month training opportunity at the University of Florida. The successful candidate is matched with Florida Sea Grant-affiliated faculty that works alongside them to close an skill/knowledge gap in fisheries management and helps them to implement an ongoing or proposed project of their choosing that is related to a need identified by the awardee's organization. Since 2011, the program has received 42 applications and has awarded training grants to seven Caribbean-based fisheries management professionals who will be profiled in this presentation. Learning options will also be discussed, including specialized certificates and distance learning courses at the University of Florida.

KEYWORDS: Fisheries, management, professional development

Trouble in Paradise

Problemas en El Paraíso

Troubles au Paradis

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ABSTRACT

Steelpan music, turquoise waters, white sand beaches and dirty martinis are just a few of the sights, sounds and experiences associated with the portrayal of paradise the Caribbean seems to represent. However, this paradisiacal state of affairs is under threat by the dilemma of marine pollution. The photos released by Caroline Power in 2017 of the ‘trash island’ found off the island of Roatán in Honduras shed light on the deleterious effects of marine litter. Bearing in mind the importance of the Wider Caribbean Sea to its surrounding States, and the fact that land-based sources of pollution represent the lion’s share of pollution to the marine environment the question arises whether any measures exist for addressing pollution of the Wider Caribbean Sea. The Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region or Cartagena Convention, particularly its Protocol on Land-based Sources of Marine Pollution, addresses pollution in the Wider Caribbean Sea. However, the Convention entered into force in 1986, and the LBS Protocol entered into force in 2010 while the trash island was discovered in 2017. It seems therefore that there is ‘trouble in paradise,’ as the trash island is visual evidence of ineffectiveness of either the Convention, its LBS Protocol and/or the implementation of its provisions by States. As such the proposed presentation will employ recent data to analyse the state of affairs within the region. The presentation will be sub-divided into three components reflection, recognition and recommendations. The reflection component will outline the importance of the Wider Caribbean Sea. The recognition component will outline current developments to combat marine litter and their downfalls. The recommendations will highlight practical solutions that may be employed.

KEYWORDS: Cartagena Convention, land-based sources of pollution, Wider Caribbean

Reef Fish Spawning Aggregation Research in the Florida Keys: How Technology Has Informed Management

Investigación en las Agregaciones Reproductivas de Peces de aArrecife en los Cayos de Florida: Cómo la Ttecnología ha Informado a la Gestión

Recherche sur l'Agrégation deP poissons de Récif dans les Keys de Floride : Comment la Technologie a Informé la Gestion

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ABSTRACT

Technology for studying the marine environment has been rapidly diversifying over the past few decades. These technologies can be applied to a wide range of marine environments and are relevant to many of the contemporary challenges facing decision makers with managing commercial fisheries or ecosystems. The Florida Fish and Wildlife Conservation Commission has been studying reef fish spawning aggregations in the Florida Keys for over a decade using many different technologies; some with more success than others. Here we discuss lessons learned from many different partnerships using diverse approaches such as: split beam surveys, diver surveys, stereo cameras, ROVs, wave gliders, and acoustic telemetry. We explore what tools were more effective for informing management and ideas for introducing new technology in future research. This overview provides insight into the important role that technology plays in the research and management of marine fisheries with emphasis on snapper and grouper fisheries.

KEYWORDS: Fish spawning aggregation, technology, management

**Casting a Wider Net: Crowdsourcing Qualitative Stakeholder Observations
to Ground Truth Trends in Fisheries Stock Assessments**

**Ampliando la Red: Utilizando las Observaciones de los Pescadores
para Verificar el Estado y Tendencias de Recursos Pesqueros**

**Ratisser Plus Large: Utiliser les Données Qualitatives Collectées
par les Usagers Pour corroborer les Tendances des Évaluations de Stocks de Poisson**

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ABSTRACT

The Regional Fishery Management Councils (Councils) were formed in 1976 to encourage local-level authority over federal fisheries management in the United States. Stakeholders engage in fisheries management decision-making through the Council process. However, this process has not traditionally allowed for public input into the scientific aspects of resource management. Fishery stakeholders are an incredible source of on-the-water knowledge, capable of providing valuable information to the scientific understanding and assessment of fish stocks. Traditional cooperative research and citizen science opportunities that incorporate stakeholder perspectives typically require considerable individual involvement. Through its “Something’s Fishy” tool, the Gulf of Mexico Fishery Management Council (Gulf Council) gathers species-specific anecdotal data from its vast network of stakeholders who may not have the time, resources, or desire to dedicate towards cooperative research or citizen science. Thus far the Gulf Council has gathered information from its stakeholders on Red Grouper, Gray Triggerfish, and Yellowtail Snapper. The information has been analyzed manually and using qualitative sentiment analysis, and the results have been presented during the start of each relevant stock assessment. These data have served to ground-truth or explain trends and anomalies found in indices of abundance used in the assessments. This effort has proven itself to be a worthwhile enterprise and based on the preliminary results, the Gulf Council endeavors to continue using this tool.

KEYWORDS: Stakeholder, citizen science, assessment

**Sportfishing in Cuba:
A Sustainable, Conservation-based, Economic Opportunity**

**La Pesca Deportiva en Cuba:
Una Oportunidad Económica, Sostenible y Basada en la Conservación**

**La Pêche Sportive à Cuba:
Une Opportunité Économique Durable, Basée sur la Conservation**

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ABSTRACT

Cuba is a hotspot for sportfishing and the industry is likely to grow as tourism to the country continues to increase. This growth presents a valuable opportunity to promote a sustainable and conservation-based sportfishing industry in Cuba. In July 2019 University of Havana's Marine Research Center, the Cuban Fisheries Research Center, Hemingway International Yacht Club, Harte Research Institute for Gulf of Mexico Studies, and The Ocean Foundation organized a workshop Sportfishing in Cuba: A Sustainable, Conservation-based, Economic Opportunity to discuss conservation-based sportfishing models with Cuban officials and stakeholders such as fishers, industry members, and researchers. The event brought together Cuban fisheries experts and international experts to

- Present international and domestic models for sportfishing management in Cuba
- Identify the scientific basis needed for sportfishing management in Cuba
- Review models, identify gaps, and sketch a roadmap for future implementation

There was consensus on the potential to develop Cuban grown recreational fishing opportunities and policy. As a result, participants are creating Cuba's first-ever National Sportfishing Working Group. Its objective would be to lead and promote initiatives related to sportfishing in Cuba, such as research, capacity building, environmental education, and sportfishing development.

KEYWORDS: Sportfishing, Cuba, recreational fishing

**Reproductive Aspects of the Lionfish, *Pterois volitans*,
in the Parque Nacional Arrecife Alacranes, Southern Gulf of Mexico**

**Aspectos Reproductivos del Pez León, *Pterois volitans*,
en el Parque Nacional Arrecife Alacranes, Sureste del Golfo de México**

**Aspects de la Reproduction du Poisson-lion, *Pterois volitans*,
dans le Parque Nacional Arrecife Alacranes, Sud-est du Golfe du Mexique**

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ABSTRACT

In the Mexican Caribbean and southern Gulf of Mexico (GOM), the lionfish (*Pterois volitans*) was detected late in 2009 where now this fish is considered established. Its reproductive potential is among the most important factors driving its invasive success in the region; thus, understanding its ecology and biology, and in particular its reproductive aspects, are key in attempting counterbalancing its population increase in the region by culling. This work presents the reproductive aspects of lionfish in the Parque Nacional Arrecife Alacranes, a Mexican protected area in the southern GOM, off the northern Yucatan Peninsula. A total of 368 lionfish were obtained from lobster fishermen in 2012, and from 2014-2018. Based on gonad histological analyses, there were 18% females (N = 65) and 82% males (N = 303) (F:M = 0.21:1) where females showed a size range of 139 to 390 mm TL and males 183 to 440 mm TL. While sex proportion was skewed to males, the size class of 236 mm TL was not significantly different to a sex proportion close to equilibrium (F:M = 0.82:1). Active females were found in May and December, and there were spawning peaks from July to December. Maturation size for females and males were 160 mm and 207 mm TL, respectively. Size at which 50% females and males reach sexual maturity is 181 and 201 mm TL, respectively. These results are new contributions in describing the reproductive biology of lionfish in the southern GOM. These are compared with results found in the northern GOM.

KEYWORDS: Reproduction, *Pterois volitans*, Alacranes Reef

**The Sum of the Diagnoses:
Prioritizing Actions Adding All Voices in Fisheries Management**

**La Suma de Los Diagnósticos:
Priorizando Acciones de Manejo Pesquero con Todas las Voces**

**La Somme des Diagnostics:
Donner la Priorité aux Actions Associant Toutes les Voix de la Pêche**

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RESUMEN

La pesquería de mero rojo (*Epinephelus morio*) es de gran relevancia económica, social y cultural en las comunidades costeras del estado de Yucatán generando hasta 12,000 empleos directos, siendo una de las pesquerías más importantes de la entidad. Con base en una revisión de reportes y literatura científica se ratifica lo que se ha venido reportando por años, problemas de sobrecapacidad pesquera (embarcaciones y usuarios) y mayores demandas a nivel de mercado; esto genera incertidumbre en los usuarios directos e indirectos de este recurso. La pesquería cuenta con un Comité Consultivo de Manejo para el estado de Yucatán y una Red de Investigadores de mero, el primero integra al sector productivo, distintos órdenes de gobierno, académicos y organizaciones de la sociedad civil; mientras que el segundo esta integrado por 17 investigadores de 7 centros de educación superior y de investigación. Una iniciativa promovida por ambos grupo se orientó a analizar los distintos instrumentos de manejo y documentos oficiales asociados a la pesquería, así como de literatura relevante que posteriormente fueron discutidos en el marco de un taller participativos. En este trabajo se presentan los resultados del análisis de los documentos y del análisis del taller participativo. De los documentos analizados se obtuvieron un total de 325 acciones de manejo propuestas, que se integraron en cinco componentes temáticos. Así mismo se integraron las necesidades de investigación que también fueron discutidas y priorizadas. Del análisis resaltan las necesidades de un ordenamiento pesquero que incluya un, censos de embarcaciones, pescadores y comercializadores, seguidas de fortalecimiento de capacidades, incluyendo programas de educación ambiental, dinámica de poblaciones, entre otros.

PALABRAS CLAVES: Comité consultivo, red de Investigadores, mero rojo

**Using Citizen Science Photographs and *in situ* Sampling
to Measure Abundance and Biomass of *Sargassum* Landings**

**Estimación de la Abundancia de Biomasa de *Sargazo*
Utilizando Datos de Ciencia Ciudadana y Muestreo *in situ***

**Estimation de l'Abondance de la Biomasse de *Sargasse*
à l'Aide de Données Scientifiques Citoyennes et d'un Échantillonnage *in situ***

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ABSTRACT

The influx of pelagic *Sargassum* is a recurring problem in the Caribbean and South Florida region. The estimation of its abundance poses a challenge due to the large area affected. A useful approach to estimate abundance qualitatively is through photographs reported by citizens using apps, such as the citizen science project “Sargassum-Watch.” However, pictures cannot provide quantitative information of *Sargassum* biomass accumulating on the beaches. Here we test the possibility of developing a semi-quantitative method by combining *in situ* sampling of *Sargassum* biomass with citizen science data. The biomass of *Sargassum* species and morphotypes was quantified in Dania Beach, Florida using the transect-quadrat method on October 2018, February 2019, and April 2019. Pictures for the same dates and sites were classified using the qualitative approach used in the *Sargassum*-Watch citizen science project. Pictures showed that October 2018 and February 2019 had very low accumulation of *Sargassum* (level 1), while April 2019 had moderate accumulations (level 3). Biomass collected from events with level 1 accumulation had a range from 343.67 - 413.32 g/m² (Oct-18, Feb-19), while events with moderate accumulation classified as level 3 had 1545.68 g/m² (Apr-19). These results, while preliminary, show that developing an index with a range of accumulation in combination with citizen science observations would allow semi-quantitative estimations of biomass from the photos without having repeated *in situ* collections. A large amount of combined estimations will be needed to provide an accurate and context-dependent range of biomass for each category. This combination of methods will increase the value of both methods of abundance estimation, and also provide a powerful way to ground-proof observations from drones, planes, or satellites.

KEYWORDS: *Sargassum*, monitoring, macroalgae

**Validation of Annular Increments and Formation Timing
in Otoliths of Red Snapper (*Lutjanus campechanus*)**

**Validación de Incrementos Anulares y Tiempos de Formación
en Otolitos de Pargo Rojo (*Lutjanus campechanus*)**

**Validation des Incréments Annulaires et du Temps de Formation
dans les Otolithes du Vivaneau Rouge (*Lutjanus campechanus*)**

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ABSTRACT

Life history parameters such as age-and-growth estimates are necessary for stock assessments and management of commercially and recreationally important species such as Red Snapper *Lutjanus campechanus*. Perhaps the most widely accepted method to establish age in Red Snapper is by counting the number of opaque bands on otoliths (one increment consists of a translucent and an opaque band). However, when counting opaque bands it is critical that the increments are validated as annular. Mark-recapture of oxytetracycline (OTC) marked fish and marginal increment analysis (MIA) methods were used on Red Snapper to validate periodicity and timing of opaque band formation. Annual otolith increment formation rates were validated for recaptured Red Snapper (n = 65) at liberty for 0.8 to 11 years. However, the timing of opaque band formation varied from most previous studies, with most opaque bands formed from June through November with peak formation in September (dorsal axis = 68 %, ventral axis = 76% percent frequency). An annual formation rate and opaque band formation peaks during the summer from June to August were also supported by MIA for age-1 to age-16 fish (n = 595). This unusual summer-fall formation of opaque bands has important implications for Red Snapper aging studies, especially when attempting to link environmental disturbances to year-class abundance.

KEYWORDS: Aging, oxytetracycline, mark recapture

**A Clearer Picture:
How Digital Cameras have Changed Marine Life Surveys Over the Last Three Decades**

**Una Imagen Más Clara: Cómo las Cámaras Digitales han Cambiado
las Encuestas de Vida Marina en las Últimas Tres Décadas**

**Une Image Plus Claire: Comment les Caméras Numériques Ont Changé
les Enquêtes Sur la Vie Marine au Cours des Trois Dernières Décennies**

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ABSTRACT

The rapid evolution of digital underwater imaging technology has resulted in a broad expansion of underwater photography among scuba divers. Such photography, once the domain of technical specialists, has allowed citizen scientists to record, identify, and inventory species well after their dive gear is dry. Reef Environmental Education Foundation (REEF) has maintained a citizen science fish survey program for the last 26 years, an interval of time that encompasses the advent of digital camera commercial availability. I will discuss how underwater digital photography has changed the game for these diving citizen scientists, and how photo documentation, in concert with social media applications, has led to a vibrant, interactive community of amateur natural historians. I will also discuss how digital imaging by this community has altered our understanding of species-specific distributions, commonness, and habitat specialization. Finally, I will outline a series of best practices guidelines for integrating imaging technology with formal and informal diving-based citizen science programs.

KEYWORDS: Reef fish, species distribution, citizen science

**Occupying Similar Occupations in the Barbados Fisheries Value Chain:
What Differences Make a Difference for Women and Men?**

**Ocupando Ocupaciones Similares en la Cadena de Valor de la Pesca de Barbados:
¿qué Diferencias Hacen la Diferencia para Mujeres y Hombres?**

**Occuper des Professions Similaires dans la Chaîne de Valeur de la Pêche à la Barbade:
Quelles Différences Font la Différence pour les Femmes et les Hommes?**

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ABSTRACT

The Barbados fishing industry employs approximately 6,000 people full-time or part-time in the ancillary (support), harvesting, processing and distribution, marketing and sales, and consumer segments of the fisheries value chain. Women and men typically are engaged in different occupations along the value chain and have different assets, skills, experience, knowledge and decision-making roles. Such differences have often been attributed to varying access to resources, education, training, traditional and cultural norms that act to reinforce gendered roles, power disparities and other inequalities. This multi-part poster installation examines and compares the differences (and similarities) between pairs of women and men with similar roles in diverse occupations – e.g. fuel and ice supplier, fisheries officer, fisher, fish processor and fish fry operator – from “pre-hook to cook” for a better understanding of the gendered division of labour, differences that make a difference in Barbados fisheries and the fixes needed to remedy any differences in fisheries-related livelihoods that disadvantage either women or men. Sharing stories of women’s and men’s fisheries livelihoods is research done by the Gender in Fisheries Team (GIFT) to document and mainstream gender in Caribbean fisheries. This mainstreaming assists implementing the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines).

KEYWORDS: Gender, fisheries value chain, Barbados

**Multiannual Changes in Shallow Coral Reefs of Albuquerque Islands
in the Seaflower Biosphere Reserve, Colombian Caribbean**

**Cambios Multianuales en los Arrecifes Coralinos Someros de las Islas Cayos de
Albuquerque en la Reserva de Biosfera Seaflower, Caribe Colombiano**

**Changements Pluriannuels dans les Récifs Coralliens peu Profonds des Îles Albuquerque
dans la Réserve de la Biosphère de Seaflower, dans les Caraïbes Colombiennes**

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ABSTRACT

The UNESCO declared in 2000 the Archipelago of San Andres and Providence as the Seaflower Biosphere Reserve (BR) in order to promote conservation actions for its species and ecosystems, mainly marine. The Seaflower BR is located in the Colombian Caribbean, covering an area of 180.000km² which include the reef complex of Albuquerque Cays, situated some 35km to the southeast of San Andres island. This complex has a peripheral coral reef, that extends to the north, east and southeast, and forms a semi atoll in which holds inside a lagoon different types of reef patches. Previously, monitoring of coral reefs in 1996 allowed to identify the presence of various types of corals, allowing to obtain a detailed cartography of shallow coral formations. With the goal of updating the information about these coral reef complexes in Albuquerque, in 2018 the Seaflower Scientific Expedition obtain information of 30 monitoring stations distributed along the reef complex. In each station the species richness, substrate cover and coral reef health was registered, along with cyanobacteria samples. 30 species of corals were reported, many with low cover and frequency under 5%. Coral cover average was under 20%, with macroalgae and calcareous algae dominance where coral reefs dominated previously, as was inferred by the geoforms of the reef. Three coral diseases were identified with low incidence, and low cyanobacteria coral cover was registered. Monitoring the state of coral reefs in the Seaflower BR is crucial for the conservation of these important fishing areas, which by tradition have been exploited by artisanal fishers of San Andres. This information is highly important for the management, conservation and restoration in Seaflower.

KEYWORDS: Seaflower, coral reefs, multiannual

An Evaluation of the Baitfish Fisheries in Bermuda

Una Evaluación de las Pesquerías de Carnada en las Bermudas

Une Évaluation de la Pêche au Poisson-Appât aux Bermudes

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ABSTRACT

Small fishes are an important link in the food chain, but are exploited by commercial and recreational fishers for bait. In Bermuda, baitfish landings have declined, but it is unclear whether this indicates population declines or altered fishing practices. Current management restricts the size and type of nets used, and prohibits net fishing in 4 bays. We analysed landings data for seasonal and long-term trends, and found three modes of commercial bait fishing. We then surveyed commercial and recreational fishers to examine bait fishing and bait use practices, and attitudes to alternative baits. Interviews with specialist commercial bait fishers highlighted debris items hindering use of seine nets and seasonality of bait markets as driving where and when they fish. Shifts in the depth distribution of large bait species and in the peak abundance of Dwarf herring have made it difficult to serve markets in the spring. Young Redear herring are targeted to compensate. A mail survey of other commercial fishers received 15 responses (8%). Most catch some bait themselves but also purchase bait from other fishers or retailers. About 63% of commercial fishers utilise scraps for chum; of the remainder, half were interested in this for their own fishing or to sell. Other sources of chum are being explored. A roving shoreline survey and concurrent online survey of recreational fishers garnered 41 responses. Most recreational fishers (75%) catch at least some bait themselves, and 92% expressed interest in purchasing chum alternatives. Amongst recreational fishers, awareness of the bays closed to net fishing was poor, at 55%. The consensus is that the smaller baitfish species remain relatively abundant, but that the Round sardinella and Threadfin herring have declined. This information will inform future management of these species.

KEYWORDS: Baitfish, Bermuda, fisheries

The Reproductive Biology of Baitfish Species in Bermuda

La Biología Reproductiva de las Especies de Carnada en las Bermudas

Biologie de la Reproduction des Espèces de Poissons-appâts aux Bermudes

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ABSTRACT

Small bony fishes are ecologically important, providing food for larger fishes and waterbirds, but are also exploited by commercial and recreational fishers for bait. In Bermuda, baitfishes include five clupeoid species and one atherinid, but their life history characteristics are poorly understood. We report on the annual reproductive cycle for these species, as well as female size-at-maturity and fecundity. Female Bermuda anchovy from 48 mm total length (TL) were reproductively active from March through November. Active spawning individuals were found around the full moon, and occasionally around the new moon. Female Reef silversides from 48 mm TL were reproductively active from April through mid-August. Partial spawners, they appear to reproduce every two weeks around the new and full moon. Female Dwarf herring were mature from 37 mm TL and reproductively active fish were found year round. However, activity peaked between April and July, and fish produced fewer oocytes in the winter, with some reproductively inactive individuals found in December. Partial spawners, they appear to spawn every six weeks around the full or new moon. Female Redear herring from 111 mm TL spawn from April through August, with most juveniles recruiting in June and July. Threadfin herring and Round sardinella were less abundant than the other species. Juveniles were found in June and July, and data suggest that these species do not spawn in the winter months, although they are most abundant near shore at that time. Fecundity is limited by size in these small species, but spawning appears to occur more frequently or over a longer season to compensate. These data will inform the management of baitfish species in Bermuda, improving the sustainability of the fishery while ensuring that these species continue to fulfil their key ecological role.

KEYWORDS: Baitfish, Bermuda, Bermuda anchovy

Establishing a Coral Restoration Program on the Private Island of Mustique

Establecimiento de una Programa de Restauración de Coral en la Isla Privada de Mustique

Mise en Place d'un Programme de Restauration des Coraux sur l'Île Privée de Mustique

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ABSTRACT

Coral reefs around the world are disappearing due to climate change, pollution and poor water quality. Mustique is a private island in St. Vincent and the Grenadines and in 2015, the Mustique Company Limited established a coral restoration program through The Coral Restoration Foundation, to improve the health of their surrounding reefs in line with stewardship goals driven by their environment committee. They installed two coral nurseries and started growing three different species of coral- Elkhorn coral (*Acropora palmata*), Staghorn coral (*Acropora cervicornis*) and Fire coral (*Millepora*). To date, the company has out planted over 7,500 fragments of harvested coral around the North and West coast of the island and has collected data to include out plant locations, genotypes and survival rates. Sustainable Grenadines (SusGren) is a trans-boundary Non-Governmental Organization (NGO) committed to the conservation of the coastal and marine environment between Grenada and St. Vincent and the Grenadines. The Mustique Company Limited has worked alongside SusGren and governments from both countries to share best practices since the coral restoration program has been established. Through hosted knowledge exchanges where coral restoration practitioners visit the nurseries and out plant sites, they see where restoration has worked and where it needs to be improved. On a local level, the Environmental Manager as well as visiting restoration consultants engage guests and residents to increase education and participation through tours, maintenance of the nurseries and out planting. Having sustainable financing through The Mustique Company Limited allows for public private partnership between these stakeholders which further encourages restoration programs around the region.

KEYWORDS: Coral, reef, restoration

Culture of Macroscopic Marine Algae *Gracilaria* spp. and *Hypnea musciformis* in the Reef Platform of Old Providence and Santa Catalina Islands, Biosphere Reserve Seaflower

Cultivo de Macroalgas Marinas *Gracilaria* spp. y *Hypnea musciformis* en la Plataforma Arrecifal de las Islas Providencia y Santa Catalina, Reserva de Biosfera Seaflower

Culture de Macroalgues Marines *Gracilaria* spp. et *Hypnea musciformis* sur la Plate-forme de Old Providence et Santa Catalina Îles, Réserve de Biosphère Seaflower

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ABSTRACT

Marine macroalgae is an important ecological resource. It is a source of food and habitat for marine organisms. It is also used for human consumption and utilized in the cosmetic, nutraceutical and fertilizer industries. On the initiative of fishermen's cooperatives from Old Providence and Santa Catalina islands, and with the financial support of the Republic Government itself and the National Team which takes care of the administration of Risks from disasters, an algae culture assay was established in 2015 as a productive alternative to artisanal fishing. The second stage of this initiative took place in 2017, with an agreement between the Regional Autonomal Corporation CORALINA, the National Natural Park and the National University of Colombia-Caribbean location, this stage had a special focus on manufacturing algae derived products. In August 2018, four algae farms were built, each occupying a space of 225m and located in the reef platform of Old Providence and the Santa Catalina Islands. The farm's cultivation cycles, made it possible to estimate the production of *Gracilaria* spp. and *Hypnea musciformis*. Partial results, such the relative growth rates (RGR), for *Gracilaria* spp. the RGR is between 0,36 % day⁻¹ y 4,5% day⁻¹ on the first three months of culture, over that time losses of biomass and high epiphytism rates were observed, and for *Hypnea musciformis*, the RGR was between 0,48 % day⁻¹ and 4,98 % day⁻¹. The herbivory and epiphytism was a key factor that exerted influence on seaweed growth and the culture. At this moment, we are still in the process of standardizing the most appropriate culture techniques for the two species. With the seaweed from the farms, cosmetics byproducts are being manufactured, such as soaps, 'after sun gel' and body lotion.

KEYWORDS: Archipelago of San Andrés, Old Providence and Santa Catalina Islands, marine macroalgae culture, mariculture

**Improving Mariculture Development in
the Archipelago of San Andres, Providencia and Santa Catalina**

**Mejorando el Desarrollo de la Maricultura en
el Archipelago de San Andres, Providencia y Santa Catalina**

**Améliorer le Développement de la Mariculture Dans
l'Archipel de San Andres, Providencia et Santa Catalina**

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ABSTRACT

The development of mariculture in the Archipelago of San Andrés, Providencia and Santa Catalina remains incipient, but it is considered a good productive activity in the future. Since 2013 and up to now, the national government has financed two science, technology and innovation projects to promote the small scale culture of marine species as an innovative agenda for the artisanal fishermen community of the Providencia and Santa Catalina Islands. This work describes the achievements of the participatory planning process led by the Corporation CORALINA to guide the establishment of mariculture projects in the insular territory and in this way complementing other project results regarding rearing, and training of local staff.

The first international mariculture workshop (July 31 to August 2, 2018) was part of this process, and allowed get together more than 11 national and international experts and with an audience of 80 people, including local artisanal fishermen, entrepreneurs, local and national fisheries and environmental management authorities and academy representatives. Important contributions were also obtained from six consultation and analysis workshops, and the analysis of technical studies, the complex regulatory framework, and the GIS analysis with bio-ecological, oceanographic and socioeconomic information. The mariculture management plan presented 4 objectives, 15 promising species and proposed 47 actions framed in 5 lines of action: Sustainable growth, improved governance, training and research, development of communication channels between actors, and adaptive management development.

This is the initiative of the national and local governments along with the artisanal fishermen from Old Providence and Santa Catalina Islands.

KEYWORDS: Better governance, mariculture management plan, small scale mariculture

**The Lobster Fishery in Cuba:
A Decade After the Implementation of Catch Quotas**

**La Pesquería de Langosta en Cuba:
Una Década Después de la Implementación de Cuotas de Captura**

**La Pêche au Homard à Cuba:
Une Décennie Après la Mise en Place de Quotas de Capture**

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RESUMEN

Después de un incremento del esfuerzo de pesca entre 1993 y 1999, sin resultados en la captura de langosta, se produjo una reducción continuada del esfuerzo, se aplicaron nuevas medidas regulatorias y se perfeccionaron las existentes en esta pesquería. Entre 2002 y 2007, la talla mínima se incrementó de 69 a 76 mm largo cefalotórax y la temporada de veda de 3 a 4.5 meses. Se mantuvieron las restricciones en número de artes de pesca, la prohibición de desembarcar hembras con señales de actividad reproductiva, la veda en áreas de cría y los derechos territoriales de pesca (TURF), entre otras regulaciones. En 2008, como medida para evitar capturas excesivas ante posibles aumentos en la capturabilidad, se implementaron cuotas de captura permisibles (TAC), basadas en la estimación actualizada de F40%, o sea, la tasa de mortalidad por pesca asociada al 40% del potencial reproductivo en estado de no explotación. Para evaluar el estado de la pesquería y el efecto de diferentes escenarios de manejo, se utilizó un modelo bioeconómico dinámico (Costello et al., 2016) con datos históricos de captura y esfuerzo, incluyendo estimaciones de mortalidad por pesca atribuida a Pesca Ilegal, no Declarada y no Reglamentada (Alzugaray et al., 2018). Los resultados muestran que la biomasa se encuentra en niveles sostenibles y la pesquería se ha mantenido ligeramente por debajo del punto de referencia FMEY (rendimiento máximo económico) desde 2012. Garantizar a largo plazo este nivel de explotación (FMEY) minimizando la Pesca Ilegal, no Declarada y no Reglamentada, proporciona los mayores beneficios económicos con condiciones de sostenibilidad en esta pesquería.

PALABRAS CLAVES: Bioeconomía, *Panulirus argus*, pesca ilegal

**Distribution, Abundance, and Types of Plastic Debris
Along Beaches in Demerara Mahaica, Guyana**

**Distribución, Abundancia y Tipos de Residuos Plásticos
a lo Largo de las Playas en Demerara Mahaica, Guyana**

**Répartition, Abondance et Types de Débris de Plastique
le Long des Plages de Demerara Mahaica, Guyana**

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ABSTRACT

Pollution is evident on coasts around the world. Marine debris on beaches is as unsightly as is it harmful to marine organisms. This study assessed the types, abundance and distribution of plastic debris on two study sites located on the coast of Demerara Mahaica, Guyana. The study sites were Marriott beach and Bee-Hive beach and were sampled for macro-plastics and micro-plastics for a period of eight weeks. Selection of the beaches was based on the level of anthropogenic activity. At Marriott beach, surrounded by an urban area, plastic caps had the highest abundance while at Bee-Hive beach, surrounded by a rural community, plastic bottles dominated. Compared to Bee-Hive beach, Marriott beach had the highest abundance of debris with the exception of plastic bottles and unidentifiable plastics indicating that rivers draining from populous areas are the major source of debris to the study site. Overall, plastics accounted for 93.7% of the total marine debris collected. The most abundant types of plastics found were bottles (52.9%), plastic bottle caps (11.3%), and straws (9.8%). Micro-plastics were only present at Bee-Hive beach and were secondary in nature. The findings demonstrate there is a need for management actions to prevent further accumulation of marine debris and reduce the current debris on the coast by implementing better waste management strategies.

KEYWORDS: Marine debris, micro-plastic

Historical Changes in the Capture Rates of an Artisanal Ancestral Fishery of Beach Seine in Taganga, Caribbean Sea of Colombia

Cambios Históricos en las Tasas de Captura de una Pesquería Ancestral Artesanal de Redes de Tiro (Chinchorro Playero) en Taganga, Mar Caribe de Colombia

Changements Historiques dans les Taux de Capture d'Une Pecherie Artisanale Ancestrale de Senne de Plage a Taganga, dans la Mer des Caraïbes de Colombie

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RESUMEN

En Taganga la pesca artesanal es la principal actividad económica de una fracción importante de la comunidad, obteniendo de ella alimentos, ingresos y trabajo. El chinchorro velao es un arte de pesca que se opera desde la playa, compuesto de un paño con diferentes dimensiones y tamaños de malla, con dos alas y dos cuerdas para su halado. Los chinchorros que se operan en Taganga, se denominan chinchorros velaos, puesto que inicialmente actúan de manera pasiva, y ante la presencia del objetivo de captura y luego del aviso de un buzo o “caretero”, pasan a ser activos. Este trabajo realizó la comparación de la CPUE de las principales especies capturadas con chinchorros, entre ellas: cojinoa negra (*Caranx crysos*), bonito (*Euthynnus alletteratus*) y la cachorreta (*Auxis thazard thazard*), a partir de las bases de datos de diferentes proyectos: PICEP (1993-1998) Comanejo (2007-2008), Proyecto Pargos (2000-2001) y Servicio Estadístico Pesquero Colombiano (2013 y 2018), se realizó una comparación de la CPUE estimada con bootstrap e intervalo de sesgo corregido y acelerado (BCa). La especie *C. crysos* se evidenció una tendencia de disminución en las tasas de captura, la cual alcanzó el 57.8% al comparar el promedio anual la CPUE del inicio y el final de la serie de tiempo analizada. Sin embargo las especies *E. alletteratus* y *A. thazard thazard*, muestran una marcada estacionalidad, apareciendo en algunas épocas del año, pero presentando una amplia variabilidad interanual. Los resultados de la disminución de la CPUE en cojinoa, encienden las alarmas sobre el estado de sus poblaciones por lo que se requieren insumos para la implementación de medidas de manejo que contribuyan a la sostenibilidad de sus pesquerías.

PALABRAS CLAVES: Pesca artesanal, CPUE, chinchorro

**Ecological Drivers and Long-term Impacts of Parrotfish Predation
on Endangered *Orbicella annularis* Corals**

**Impulsores Ecológicos e Impactos a Largo Plazo de la Depredación del Pez Loro
en los Corales *Orbicella annularis* en Peligro de Extinción**

**Facteurs Écologiques et Impacts à Long Terme de la Prédation par les Poissons Perroquets
sur les Coraux d'*Orbicella annularis* en Danger d'Extinction**

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ABSTRACT

Parrotfishes (Scarinae) are dominant Caribbean herbivores that reduce coral-algae competition, but heavy fishing pressure can compromise their top-down control of algae overgrowth. Managing parrotfish harvest to increase coral cover is a priority for marine managers. Yet, some parrotfish species are also occasional corallivores. They prey upon multiple coral species, but heavily target *Orbicella annularis*— a major reef-building coral and endangered species. Researchers have suggested that parrotfish predation may contribute to long-term declines in *O. annularis*, particularly if parrotfish do not scale back predation as coral cover decreases. We compared the intensity of *O. annularis* predation in response to parrotfish biomass, coral and algae cover on St. Croix (where parrotfish are heavily fished) and Bonaire (where parrotfish harvest is banned). Additionally, we tracked bite scar healing rates on *O. annularis* colonies for one to three months and analyzed photos in ImageJ to quantify healing. Preliminary analyses indicate that scar healing rates decreased significantly as initial scar area and total colony tissue loss increased. Healing also decreased significantly over time. We found a scar healing threshold, where the scars larger than ~0.9 cm² failed to fully heal within a month. Initial results also support that relative intensity of predation on *O. annularis* increased in response to increased parrotfish biomass. These data suggest that parrotfish can adversely affect some coral species in particular ecological contexts, but the net impact of parrotfishes on corals are still unknown. More research is needed on how rates of parrotfish corallivory and herbivory shift in response to changes in parrotfish and benthic community composition, and how fisheries management may impact these processes.

KEYWORDS: Parrotfish, corallivory, grazing scars

Food Web Structure of Deep-pelagic Micronekton Assemblages in the Gulf of Mexico

Estructura de la Red Alimentaria de Ensamblajes de Micronekton Pelágico Profundo en el Golfo de México

Structure du Réseau Trophique d'Assemblages de Micronekons Pélagiques profonds dans le Golfe du Mexique

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ABSTRACT

A major goal of ecological research is the ability to model food web dynamics so that predictions regarding changes in food web and ecosystem structure can be made. Before accurate models can be constructed, information pertaining to trophic relationships among functional groups, including estimates of trophic position using both stomach content analysis (SCA) and stable isotope analysis (SIA) are needed. Currently, several data sets utilizing SCA to describe trophic structure of micronekton (2-10 cm) in the deep-pelagic Gulf of Mexico (GoM) exist but studies using SIA are less common. Using a dataset including 58 species, we describe the trophic structure of deep-pelagic micronekton assemblages in the GoM using $\delta^{13}\text{C}$ and $\delta^{15}\text{N}$ using. Both vertically migrating, and non-migrating taxa representing a range of feeding modes, depth distributions, and putative trophic levels were selected to describe trophic variability within deep-pelagic assemblages. Additionally, samples of particulate organic matter (POM) from the epi-, meso-, and bathypelagic were used to delineate carbon source isotopic signatures. Isotopic signatures of POM samples were significantly different across depth zones displaying a pattern of enrichment in ^{15}N with increasing depth. The $\delta^{13}\text{C}$ values of micronekton varied among species, ranging from -22.73‰ to -16.35‰ suggesting consumers utilize POM throughout the water column. Micronekton $\delta^{15}\text{N}$ values ranged from 1.85‰ to 10.97‰ encompassing ~3 trophic levels. Elevated $\delta^{15}\text{N}$ values in many non-migratory taxa suggest an increased reliance on deep-suspended POM when compared to migratory taxa who receive the bulk of their carbon from epipelagic sources. This project provides data that can be used to inform ecosystem models and will provide insight into the structure of the GOM's deep-pelagic ecosystem.

KEYWORDS: Stable isotopes, food webs, mesopelagic

Collective Construction of the CAMPAM Comprehensive Database of Marine Protected Areas Necessary to Improve the Conservation of Marine Biodiversity in the Caribbean

Construcción Colectiva de la Base de Datos Integral de Áreas Marinas Protegidas de CAMPAM Necesaria para Mejorar la Conservación de la Biodiversidad Marina en el Caribe

Construction Collective de la Base de Données Complète sur les Aires Marines Protégées de la CAMPAM, Nécessaire pour Améliorer la Conservation de la Biodiversité Marine dans les Caraïbes

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ABSTRACT

The database of marine protected areas of CaMPAM has been updated and is now spatialized. With more than 40 variables, your information has increased from 570 to more than 1000 records. The update process used only open source GIS and data collection tools, which will facilitate its use and maintenance.

At present, there is a website that displays an interactive map generated with the QGIS program that allows specific searches and multiple formats to download the information. You also have a form to facilitate your collective update. This form is compatible with the KoBo Toolbox project, that is, it uses a tool developed in the collection of field data against different conditions, including catastrophic events.

With these advances, CaMPAM is expected to strengthen its purposes of supporting conservation and the application of tools for ecosystem management, such as the democratization of data and public access, the creation of learning networks between managers of protected areas and integration of information available in other databases with similar objectives. Therefore, when the process is completed, it is expected to connect with other tools that monitor the status and diseases of corals, sargassum outcrops, control of invasive species and pollution, among others, using common data collection frameworks and analysis approaches.

This work is carried out within the framework of the project “Biodiversity for sustainable development in the Caribbean through ecosystem-based management” funded by the Italian Agency for International Cooperation and the support of the Caribbean Environment Program of the United Nations Environment Program and multiple partners from the Greater Caribbean region.

KEYWORDS: Database, marine protected areas, Greater Caribbean

**Socioeconomic Landscape of a Small-scale Reef Fishery
Transitioning to Co-management**

**Paisaje Socioeconómico de una Pesquería de Arrecife a Pequeña Escala
en Transición Hacia el Co-manejo**

**Paysage Socio-économique d'une Pêcherie de Récif
à Petite Échelle en Transition Vers la Cogestion**

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ABSTRACT

The management of artisanal fisheries often sidelines the human dimension, which is key to understanding its impact. The Tela Bay (Honduras) is currently transitioning towards the co-management of fishing resources, with the local communities increasingly becoming stewards of their resources. To anticipate the impact of this transition, we assessed the socioeconomic landscape of fishing communities in Tela through open-ended interviews and surveys. Tela has a unique natural resource management entity known as the Environmental Committee that is comprised by actors from the public and private sector, including the National Fishing Authority, who work together in the management of the fishery. The Tela artisanal fishery displays a high level of diversity in harvesting patterns and gears among communities. Furthermore, fishing was reported as the main source of income and food security, it is the main livelihood for 65% of respondents and 90% of all landings remain within the fishers' local community. Despite fishing being viewed as a low-income profession, fishers report average monthly earnings up to 5 times the minimum wage. The disparity between reported incomes and poverty in the region indicates that management efforts should focus on promoting the equitable distribution of the resource and providing fishers the tools necessary to make the most out of their earnings. Co-management appears to be an advantageous alternative to fishery management in the Tela Bay since the area has a bridging organization between the National authorities and the local communities, it can aid in the development of strategies targeted to each group of users and it can promote the equitable distribution of the resource. Tela can be a useful learning platform for future scaling-up efforts throughout the region.

KEYWORDS: Co-management, socioeconomic, Honduras

**Exploring Trap Designs in Seek of a Commercial Fishing Plan
and Control of the Invasive Lionfish**

**Explorando Diseños de Trampas en Busca de un Plan de Pesca Comercial
y Control del Pez León Invasivo**

**Explorer les Conceptions de Pièges à la Recherche d'un Plan de Pêche Commerciale
et de Contrôle du Poisson-Lion Envahissant**

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ABSTRACT

The lionfish has proven to be an enormously invasive species, taking up an entire new geographical range, spreading from the Gulf of Mexico to the Caribbean and the Western Atlantic. They pose a threat to reef ecosystems, deep sea habitats and important nursery areas with their ferocious appetites and rapid reproduction. Spearfishing has been able to provide some population control, but only in shallow depths. Traps have been proposed as a potential solution to controlling lionfish populations to not only protect ecologically/economically valuable species, but also to produce a possible commercial fishery. While lionfish destructive invaders, demand for lionfish as a food product has risen, but divers and spearing techniques are unable to meet this demand.

This research aims to develop a plan for further steps that may improve the comparison and improvement of trap designs, improve ease of deployment, ideal depth range, ideal locations, attractants and soak times. This pilot project concludes depths over 50m as having significantly higher catches, funnel designs leading to lower bycatch and the comparison of soak times and seasonality in lionfish catches. Brief results from a small market report are included to establish demand and supply of lionfish as a food product. Here we explore the use of local trap designs on the Saba Bank to investigate a potential commercial lionfish fishery with potential benefits to the fishermen and the local eco-system.

KEYWORDS: Lionfish, Saba Bank, trapping

Taxonomical Classification of Reef Fish Based on a Swimbladder BEM, Broadband Echosounder Modeling, and Bayesian, SVM, and KNN Estimators

Clasificación Taxonómica de Peces Coralinos Basada en BEM, Modelamiento de Ecosonda de Banda Ancha y Estimadores Bayesianos, SVM y KNN

Classification Taxonomique dDe Poissons de Récif, Basée sur un Modèle BEM de Vessie Natatoire, Modélisation par Échosondeur à Large Bande et Estimateurs Bayésiens, SVM et KNN

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ABSTRACT

The recent development and commercial availability of broadband echosounders have the potential to classify acoustic targets based on their scattering responses, which are expected to be a function of their species-specific morphological and physiological properties. This is particularly important in complex environments with biologically diverse fish assemblages. Using theoretical acoustic scattering models, we examined the potential to taxonomically classify dominant reef fish based on the fine-scale gas-bearing swimbladder morphology quantified from three-dimensional computed-tomography models. Echoes of the swim bladder for an incident broadband sound source (30 – 200 kHz) and orientation angles with respect to the fish between +/- 45° from normal incidence were acoustically simulated using the boundary element method (BEM). They presented characteristics that were consistent within species and distinguishable among them. We used a Bayesian, Support Vector Machine and K-Nearest Neighbor estimators to classify the broadband echoes and compare them to a multi-frequency case. The classifiers had accuracies between 80% and 90%, performing better in the broadband case. The modeling and classification approach presented here indicates that a taxonomic distinction based on morphologically-dependent scattering responses is possible. Furthermore, it represents an important step toward improving marine ecosystem acoustics for managing and assessing reef fish communities.

KEYWORDS: Taxonomic classification, wideband echosounder, boundary element method

**Trends on Reef Fish Populations Inside and Outside No Take Zones
After 10 Years in Sosua Bay, Dominican Republic**

**Tendencia de las Poblaciones Icticas Dentro y Fuera de Areas de Exclusion Pesquera
Durante una Decada en la Bahia de Sosua, Republica Dominicana**

**Tendance des Populations de Poissons à l'Intérieur et à l'Extérieur
des Zones d'Exclusion de la Pêche en une Décennie
dans la Baie de Sosua, République Dominicaine**

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ABSTRACT

Caribbean reefs have been subjected to a wide array of consequences from human population overgrowth since last century, including the severe deterioration of the ecological processes that rule the delicate dynamics of coral reefs. Overfishing, water quality deterioration due to land-based and coastal pollution and climate change are among the causes. In the case of the Caribbean reefs, over-fishing has led to a tremendous reduction of fish biomass and diversity, which results in increased stressors over corals, including an increase of corallivory and disease sources, macroalgae biomass and eroding sponges, and the decrease of key elements for reef health such as the nutrients and beneficial bacteria coming from fish wastes normally present on healthy populated reef. In order to plan reef ecological restoration and fisheries management it is important to understand the trends and dynamics of keystone species in no-take areas previously impacted by over-fishing. During November 2009, October 2013, October 2016 and early November 2018, two 50 x 2.5m transects were placed on three protected reefs and three non protected reefs of Sosua Bay northern Dominican Republic, in order to study the relative abundance of adult and semi-adult individuals using ReefCheck indicator species as well as any other species larger than 10cm within protected and non protected areas. The total of the species observed around 2.5 meters from each side of the transect was recorded, specifically those individuals bigger than 10cm. This study highlights an important change over time in the species composition of Sosua reef fish community as well as a gradual increase in biomass inside strict non take zones, while no significant change was observed in open fishing zones. The results can contribute to the management of marine areas.

KEYWORDS: Coral restoration, restoration, fishery management

**Characterization of the Queen Conch Fishery (*Lobatus gigas*)
in the Banco Chinchorro Biosphere Reserve in the Mexican Caribbean 2018**

**Caracterización de la Pesquería de Caracol Rosado (*Lobatus gigas*)
en la Reserva de la Biosfera de Banco Chinchorro en el Caribe Mexicano 2018**

**Caractérisation de la Pêcherie de Lambis (*Lobatus gigas*)
dans la Réserve de Biosphère de Banco Chinchorro dans les Caraïbes Mexicaines 2018**

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ABSTRACT

The queen conch (*Lobatus gigas*), is a large gastropod mollusk known mostly for its economic importance in commercial and artisanal fishing, in addition to its representativeness in Caribbean culture and society. In Mexico, the pink snail is located around the Yucatan Peninsula, distributed along the coastal area of the state of Quintana Roo and on the sandbars near Isla Contoy, Isla Mujeres, Cozumel and Banco Chinchorro, and in the Yucatan state there is a population in Alacranes Reef. Currently, fishing for this mollusk is only allowed in the Biosphere Reserve of Banco Chinchorro. The National Institute of Fisheries and Aquaculture (INAPESCA), has carried out assessments of the snail population in this site since 1989 and due to the decline of the queen conch populations in 2012, a ban of almost 5 years was decreed for the recovery of the resource and it was not until March of 2017 that the fishery was opened again. Currently, fishing is carried out by approximately 100 fishermen in 30 vessels, belonging to three fishing cooperatives "Langosteros del Caribe", "Pescadores de Banco Chinchorro", and "Andrés Quintana Roo." The closed season in Mexico includes a period of 8 months, from May to November and February. However, a previous study is necessary to determine the fishing quota, in 2017 a quota of 9 tons of queen conch pulp or meat was granted, which was captured in 3 effective days of fishing. The dynamics of fishing in the Biosphere Reserve of Banco Chinchorro is very peculiar. This work describes the catch that was made in January 2018 and includes an analysis of catches by boat, cooperatives, fishing areas, yields and catch sizes (Siphonal length and lip thickness).

KEYWORDS: Caracol rosado, fisheries, México

Estimating Red Hind (*Epinephelus guttatus*) Population Structure, Movement, and Vital Rates in the US Virgin Islands to Inform Stock Assessment and Fisheries Management

Estimación de la Estructura de la Población, el Movimiento, y las Tasas Vitales de Mero Cabrilla (*Epinephelus guttatus*) en las Islas Vírgenes para Informar la Evaluación de la Población y la Gestión de la Pesca

Estimation de la Structure, des Déplacements, et de la Survie des Populations de Red Hind (*Epinephelus guttatus*) dans les Îles Vierges pour Éclairer l'Évaluation des Stocks et la Gestion de la Pêche

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ABSTRACT

Red Hind (*Epinephelus guttatus*) are fished commercially, recreationally, and for subsistence throughout much of the Caribbean. Red Hind are of particular management interest in the US Virgin Islands and Puerto Rico, as the species has historically comprised the majority of fin fish landings in these locations. Our study aims to provide fishery managers with current estimates of population structure, movement, and vital rates to inform stock assessment and fisheries management. We tagged fish during the winter spawning months in the Red Hind Conservation District south of St. Thomas, USVI. Each fish was tagged with a uniquely-numbered conventional streamer tag, measured for total length, blood sampled (to determine sex), and then released at the point of capture. Population movement and vital rates were estimated based on information from recovered and reported tags during normal annual harvest. Using historical and contemporary mark-recapture data and a Barker modeling framework, we are working to estimate population survival, harvest, and reporting rates. We are also estimating sex and length distribution and total movement to and from the spawning aggregation site. This study will provide valuable demographic information regarding the Red Hind population twenty years after the spawning aggregation site was closed to all fishing during spawning activity.

KEYWORDS: Mark-recapture, fish spawning aggregation, Barker model

Soundscape Monitoring in U.S. National Marine Sanctuaries

Monitoreo del Ambiente Acústico en Santuarios Marinos Nacionales de los Estados Unidos

Surveillance de l'Environnement Acoustique dans les Sanctuaires Maritimes Nationaux des États-Unis

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ABSTRACT

In 2018, the U.S. National Oceanographic and Atmospheric Administration (NOAA) and the U.S. Navy initiated a multi-year effort to monitor underwater sound using a standardized methodology within U.S. National Marine Sanctuaries (NMS). The agencies with numerous collaborators set out to study sound and its sources within seven NMS and one Marine National Monument, which includes waters off the east coast, west coast, and Pacific region of the U.S. The project was designed to provide information important for contextualizing contributions of sound by specific sources and their impacts on the soundscape, marine taxa, and habitats. Within the east coast region, sound is being recorded continuously at Stellwagen Bank, Gray's Reef, and Florida Keys NMS, and data collected in 2018-2019 were analyzed to produce comparable soundscape statistics and detections of regionally important sound producers, which include invertebrates, fishes, marine mammals, and vessels. Differences in ambient sound were observed among sites with major contributors of snapping shrimp, fish, whales, and vessels to the soundscape at varying spatio-temporal scales. Results of the study highlight the potential of acoustic monitoring to assess ecosystem health, populations and behaviors of protected (e.g. whales) and commercially important species (e.g. Atlantic cod, grouper-snapper complex), and usage by stakeholders (e.g. vessels) within protected areas. Data are publicly available through NOAA's National Center for Environmental Information (NCEI), and a web portal is under development to provide further public access and exploration of findings. This effort has and will continue to provide information about soundscapes and marine resources at national and regional scales and establishes a precedence for expansion to other priority areas for management.

KEYWORDS: Passive acoustics, marine protected areas, Florida Keys NMS

**Female Abundance and Spawning Prospects Drive Sound Production in a
Territorial Male Grouper: Implications for Monitoring Fish Spawning Aggregations**

**La Abundancia de Hembras y las Perspectivas de Desove Motivan la Producción de
Sonidos en Machos Territoriales de una Especie de Meros:
Implicaciones Para El Monitoreo De Las Agregaciones Reproductivas De Peces**

**L'Abondance des Femelles et les Perspectives de Frai Conduisent
à la Production de Sons Chez un Mérou Territorial Mâle:
Implications pour la Surveillance des Agrégations de Frai**

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ABSTRACT

The use of passive acoustics to monitor sound production at fish spawning aggregation (FSA) sites has facilitated an ability to crudely infer patterns of spawning and abundance in the absence of visual surveys. However, challenges in calibrating counts of detected fish sounds for time-varying, environmental effects on detectability (e.g. background noise) has limited the evaluation of relationships between sound production and levels of courtship behaviors, spawning, and abundance. Here, we used propagation modeling and detection theory to estimate rates of sound production from uncalibrated levels of detected sounds produced by territorial, male Gulf grouper (*Mycteroperca jordani*) during visual displays directed towards females as part of spawning bouts. Estimated rates of sound production were compared to diver observations of courtship, spawning, and numbers of females within male territories. Environmentally calibrated, estimated rates of sound production differed from raw levels of detected sounds, highlighting the importance of incorporating detection theory into acoustic monitoring efforts at FSAs prior to making inferences about patterns in courtship, spawning, and abundance. Rates of sound production were greatest prior to sunset and were correlated to observed rates of spawning and females encountered within male territories, indicating that female presence and increased opportunities to spawn largely drive sound production in some territorial male groupers during reproductive periods. This study found that once calibrated for environmental effects and detection capabilities, changes in rates of fish sound production can be used to estimate levels of spawning activity and the abundance of both sexes at FSAs, thereby supporting the continued use of passive acoustics to monitor FSAs of soniferous species.

KEYWORDS: Passive acoustics, *Mycteroperca jordani*, reproductive behavior

**Small Scale Fish Mariculture for Artisanal Fishers of the Islands
of Providencia And Santa Catalina, Colombia**

**Maricultura de Peces a Pequeña Escala para Pescadores Artesanales
de las Islas de Providencia y Santa Catalina, Colombia**

**Mariculture de Poissons sur une Petit Échelle Destinée aux Pêcheurs
des Îles de Providencia et Santa Catalina, Colombie**

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ABSTRACT

The decrease in fishing areas in the Archipelago of San Andrés, Providencia and Santa Catalina as a result of the ruling of the International Court of Justice (2012) has generated social problems that directly affect the fishing communities, who have lost traditional fishing areas and therefore reduced the products of their operations. As a result, and based on the agreement with fishermen's associations, mariculture projects have been generated for the benefit of the community. This is the case of fish mariculture, currently promoted for increasing production of the fishing resource.

As a result of this study, we expect to generate a model of small-scale fish mariculture and appropriate technology, which is replicable by fishermen on the islands. A promising herbivore species was studied (*Kyphosus* sp.) and caged specimens were fed daily with fresh macroalgae, periodically observing seaweed species preference. In addition, carnivorous fish (*Lutjanus* sp., *Mycteroperca* sp) were studied, and were fed exclusively with fishing leftover, byproducts and bycatch. Juvenile individuals were captured from the environment (11-20 cm). Likewise, the effectiveness of three designs of confinements in the open sea and in the coastal zone, with different volume, capacity, behavior, vulnerability, material and structure, as well as their durability were evaluated. The selection of the sites for cultivation is a key component of the project, so a general characterization of them was carried out and the interaction between the cages model, species and location is related.

As a final result, a protocol is being elaborated by which the factors to be considered in the methodology and implementation of the model are indicated, with the main objective of facilitating the replication and development of the same by artisan fishermen of the islands.

KEYWORDS: Artisanal fishing, *Kyphosus*, SeaFlower Biosphere Reserve

Overcoming the Challenges Facing Spiny Lobster Mariculture in Small Island Developing States (SIDS).

Superando los Obstáculos a los que se Enfrenta la Maricultura de la Langosta Espinosa en los Pequeños Estados Insulares en Desarrollo (SIDS)

Surmonter les Difficultés Liées à la Mariculture de la Langouste Blanche dans les Petits États Insulaires en Développement (PIED)

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ABSTRACT

Caribbean spiny lobster, *Panulirus argus*, supports economically important fisheries across the Caribbean. Over the last 20 years, increasing fishing pressure due to increasing demand has raised concerns that the fishery is over exploited and unsustainable. Within the same period, spiny lobster mariculture has expanded rapidly in South-East Asia. However, despite previous studies in the region, productive spiny lobster farming has not widely developed in the Caribbean. In partnership with stakeholders in St. Lucia, this project addresses the challenges facing the establishment of sustainable lobster mariculture in Small Island Developing States (SIDS). Based on the ranching methods used to culture spiny lobster in South East Asia this project looks to evaluate if similar approaches could be applied in Caribbean SIDS to support economic development and diversification in the fishing sector. An initial health screen of lobsters from the existing fishery in St. Lucia, using histological and molecular approaches, found no significant disease issues. The creation of up-to-date habitat maps has provided tools to assist stakeholders, regulators and potential farmers to identify appropriate mariculture sites. Trial deployments of larval collectors around the island have identified locations for collecting a supply of lobster seedstock. Sea-bed culture containers have been constructed and deployed at a test site and data on health, growth, survival and overall costs are being collected. Collectively these data are being used to inform an aqua-economic model developed in this project to assess viability and profitability of small-scale lobster mariculture in SIDS.

KEYWORDS: Spiny lobster, aquaculture

Dynamics of Artisanal Fisheries and Proposals for Sustainable Management, Zone Providencia and Santa Catalina, Colombian Caribbean Seaflower Biosphere Reserve

Dinámica de la Pesca Artesanal y Propuestas de Manejo Sustentable, Zona Providencia y Santa Catalina, Reserva de Biosfera Seaflower Caribe Colombiano

Dynamique de la Pêche Artisanale et Propositions de Gestion Durable, Providencia et Santa Catalina, Réserve Colombienne de la Biosphère du Seaflower des Caraïbes

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RESUMEN

En la región del Caribe se explotan recursos pesqueros marinos de los grupos peces, crustáceos y moluscos, pero en las últimas décadas las capturas han disminuido significativamente, al igual que en el Departamento Archipiélago de San Andrés, Providencia y Santa Catalina – Reserva de Biosfera Seaflower. Por ello la Secretaría de Agricultura y Pesca, ha implementado acciones de seguimiento y manejo, entre ellas el monitoreo de los desembarcos e investigaciones sobre la pesca artesanal. De manera conjunta con la Universidad Nacional de Colombia – Sede Caribe se logró evaluar la dinámica de la pesca para obtener medidas de manejo sustentables. En las islas de Providencia (PRO) y Santa Catalina, se caracterizaron a nivel interanual las Unidades Económicas de Pesca (UEPs) y se estimaron y analizaron las variables Captura, Esfuerzo y Captura por Unidad de Esfuerzo (CPUE) y el Rendimiento Máximo Sostenible RMS, con los modelos holísticos de producción excedente Schaefer y Fox. Los resultados muestran en la serie de siete años (2012 a 2018), al grupo de peces (cerca de 90 especies) con el 78 % de las capturas en promedio, 1,6% moluscos (caracol *Lobatus gigas*) y 0,5% crustáceos (langosta *Panulirus argus*). La captura estimada anualmente presentó variaciones grandes de 5,1 a 59 toneladas año, con mayor proporción de la captura con línea de mano (56%), que buceo. El modelo de RMS muestra una fase de plena explotación está cercana a la extracción de 40 toneladas año. Con los pescadores artesanales se está trabajando en generar políticas de pesca que promuevan la sustentabilidad natural, social, económica de forma interinstitucional e incluso transnacional.

PALABRAS CLAVES: Evaluación pesquera, manejo pesquero, captura pesca

Reproductive Cycle of *Lobatus Gigas* in Chinchorro Bank, Mexico

Ciclo Reproductivo de *Lobatus Gigas* en Banco Chinchorro, México

Cycle De Reproduction de *Lobatus Gigas* en Banc Chinchorro, Mexique

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RESUMEN

El caracol rosado *Lobatus gigas* es de gran importancia en Quintana Roo, México. La regulación por cuotas de pesca inició en 1976 y en 1983 se decretó la primera veda en la entidad. Actualmente la captura de caracol sólo se realiza en Banco Chinchorro con una cuota de captura anual y una veda temporal que abarca todo el mes de febrero y del 1° de mayo al 30 de noviembre de cada año. Para actualizar las medidas manejo se estudió el ciclo reproductivo de la especie. Se realizaron muestreos mensuales en Banco Chinchorro, de marzo de 2017 a mayo de 2018. Se tomaron muestras de gónadas a 503 organismos (57% hembras, 42% machos), asignando cinco estadios de madurez sexual: 1) Inmaduro, 2) Gametogénesis, 3) Madurez, 4) Emisión, 5) Post-emisión. La longitud sifonal varió entre 150-283 mm y el peso entre 640–2900 g. Organismos sexualmente activos se observaron durante casi todo el periodo de estudio, con menor actividad reproductiva de octubre a diciembre. El pico mayor de madurez y emisión de gametos fue en marzo y abril de 2017 y 2018. Los resultados permitirán mejorar las estrategias en el manejo actuales de la pesquería, como es la modificación del periodo de veda.

PALABRAS CLAVES: Caracol rosado, Banco Chinchorro, reproducción

**The Purr of the Lionfish:
Sound and Behavioral Context of Wild Lionfish in the Greater Caribbean**

**El Ronroneo del Pez León:
Sonido y Comportamiento de Pez León Salvaje en la Región del Gran Caribe**

**Le Ronronnement du Poisson-Lion:
Contexte Sonore et Comportemental du Poisson-Lion Sauvage dans la Grande Caraïbe**

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ABSTRACT

Passive acoustic technology has become a useful and cost-effective method to collect data with very high temporal resolution that can be used to detect the presence, distribution, and remotely monitor soniferous marine biodiversity. In order to maximize the potential of bioacoustic and soundscape research in the oceans, understanding the association between the different realms of sound sources, species-specific calls and behavioral context of sound production are fundamental. The ability to produce sounds in laboratory conditions has provided much knowledge regarding the association of particular sounds with species, however behaviors of coral reef fishes may be different in the wild. A previously unknown vocalization was associated with a behavioral display of lionfish (*Pterois* spp.) by recordings with synchronous audio and video at deep coral reefs in both Puerto Rico and the Florida Keys. A pulse train of variable total length that sounds like an intermittent purr was associated with a display between pairs of lionfish. This sound has a constant interval between short pulses at low frequency and low amplitude. This sound may be classified as courtship related since it was observed between two lionfish that appeared of dissimilar size (presumably male and female), engaged in following and circling displays. The sound occurred during afternoon hours, prior to sunset. This is the first reported sound produced by lionfish in association with a behavioral display in the wild. Low sound pressure levels suggest this is a quiet signal for communication between individuals in close proximity. With this description passive acoustic datasets collected on coral reefs can be verified for the presence of lionfish including areas deeper than the limits posed to divers or in the dark.

KEYWORDS: Acoustics, behavior, lionfish

**Fish Aggregation Devices (FADS) as Conservation Tools:
Understanding the Colonization and Succession of Species at a Pelagic Moored FAD**

**Dispositivos Agregadores de Peces (DAP) como Herramientas de Conservación:
Comprendiendo la Colonización y Sucesión de Especies en Daps Pelágicos y Amarrados**

**Dispositifs de Concentration des Poissons (DCPS) comme Outils de Conservation:
Comprendre la Colonisation et la Succession des Espèces dans un DCP Pélagique Amarré**

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ABSTRACT

The propensity of pelagic fishes to aggregate around floating structure has been exploited by fishers for centuries, and the rapid expansion of this commercial fishing technique over the past 30 years has made the need for more research in pelagic fisheries ecology obvious. Data collection in the open ocean poses numerous logistical challenges and this fact has resulted in a relatively poor understanding of the basic biology and ecology of many pelagic species. Furthermore, the behavior of these fishes when associated with floating structures (fish aggregation devices in particular) is not well understood, but is essential information for the development of effective management and stock conservation strategies. To address this need, two sub-surface moored fish aggregation devices (FADs) were installed in the pelagic zone off shore from Eleuthera, The Bahamas to serve as a platform to study the biodiversity and dynamics of fish assemblages around these structures. A combination of remote video, fisheries echosounder and light trap surveys are ongoing to begin to understand the community of organisms attracted to these FADs and to continue to move towards more effective FAD fisheries management.

KEYWORDS: FAD, fish aggregation device, pelagic

Long-term Trends in Caribbean Parrotfish Abundance at Local, Regional and Basin-wide Scales: Implications for Fisheries and Ecosystem Management

Tendencias a Largo Plazo en la Abundancia de Peces Loro del Caribe a Escala Local, Regional y en Toda la Cuenca: Implicaciones para la Pesca y el Manejo del Ecosistema

Tendencias a Largo Plazo en la Abundancia de Peces Loro del Caribe a Escala Local, Regional y en Toda La Cuenca: Implicaciones Para La Pesca Y El Manejo Del Ecosistema

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ABSTRACT

Parrotfish species in the Caribbean are widely considered an important component of coral reef resilience. However, in many locations throughout the Caribbean, fisheries routinely target parrotfish. Virtually nothing is known about stock status, either for individual species, or collectively. The Reef Environmental Education Foundation (REEF) Fish Survey Project, a citizen-science monitoring program, provides a 25-year time series of reef fish relative abundance based on diver observations throughout the tropical western Atlantic. Using these data, we explored temporal trends in abundance for the most common Caribbean parrotfish species across multiple spatial scales, from local dive sites, to regions (e.g. Cozumel, Bonaire, Florida, Cayman Islands), to the Caribbean basin. We found that, in general, parrotfish species exhibited similar abundance trends within dive sites and regions. On the other hand, we found little evidence for synchronous intra-specific trends across regions. Thus, regardless of species, parrotfish population dynamics appear driven by regional processes (e.g. recruitment dynamics, non-specific fishing methods). These findings suggest that fisheries management generically targeted at the parrotfish family will likely have common effects across species

KEYWORDS: Parrotfish, citizen science, reef fish trends

**Moving to Implementation of Ecosystem Based Adaptation (EbA) Approaches to Alleviate the Effects of Climate Change in the Insular Caribbean:
The CBF's EbA Facility and Partners**

**Hacia a la Implementación de Enfoques de Adaptación Basada en Ecosistemas (EbA) para Aliviar los Efectos del Cambio Climático en el Caribe Insular:
El Fondo EbA del CBF y sus Socios**

**Passage à la Mise en Œuvre d'Approches d'Adaptation Basées sur les Écosystèmes (EbA) Visant à Atténuer les Effets du Changement Climatique dans les Caraïbes Insulaires:
Le Mécanisme CBF EbA et ses Partenaires**

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ABSTRACT

The presentation highlights the partnerships, projects, and strategies that the Caribbean Biodiversity Fund (CBF) Ecosystem based Adaptation (EbA) Facility will engage to contribute to alleviating the effects of climate change in select insular Caribbean countries.

The Caribbean marine and coastal ecosystems and accompanied biodiversity are major contributors to the region's economies, food security and water supply. Local communities, the majority of whom live in the coastal areas, are direct beneficiaries both in terms of livelihoods and quality of life. However, the Caribbean's natural resources and people are under growing threat from climate change and unsustainable development.

The partnerships to be engaged will include a mix of government departments/agencies, non-governmental organizations, the private sector, and community based organizations. The overarching approach will emphasize collaborative action to assist affected communities to adapt to the effects of climate change through sustainably managing the Caribbean's marine and coastal natural resources of climate change adaptation significance. Focus will also be placed on the scale-up and replication of tested EbA approaches to expand the benefits realized through these approaches.

The CBF in partnership with the German government through KfW, established a US\$26.5 million EbA Facility as a sinking fund. This Facility will support eligible Caribbean island states, to help people to adapt to the adverse effects of climate change through the restoration and use of biodiversity and ecosystem services. Projects to be supported were selected from submissions made by a broad range of organizations in response to a public call for proposals released by the CBF at the end of October 2018.

KEYWORDS: Climate change, climate change adaptation, ecosystem based adaptation

**The Sea Anemone *Bunodosoma cangicum* as a Potential Sentinel Species
for Microplastic Pollution on the Amazonian Coast**

**La Anémona de Mar *Bunodosoma cangicum* como una Especie Potencial
de Centinela para la Contaminación por Microplásticos en la Costa Amazónica**

**L'Anémone de Mer *Bunodosoma cangicum* est une Espèce Sentinelle Potentielle
contre la Pollution Microplastique sur la Côte Amazonienne**

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ABSTRACT

Plastic pollution is a growing global concern. The ingestion of plastics debris has become one of the biggest threats to marine life. Here we report for the first time the ingestion of meso- (5.1–25 mm) and microplastic (<5 mm) particles by the sea anemone *Bunodosoma cangicum*, the most abundant species at the Amazon coast, wider Caribbean region (WCR). Ninety anemones (30 at each local) were randomly sampled, during October 2018, in three beachrocks of intertidal zones distributed on the Amazonian coast (state of Pará, Brazil). The individuals were measured (pedal disc diameter, mm) and the contents of the gastrovascular cavity were extracted and analyzed under stereoscope. The identified plastic particles were counted, classified, measured and photographed. Laboratory procedures were performed to prevent airborne fibers contamination. Polymer identification are in course and will be presented. Here, we present the results for a single location (Salinópolis municipality). Overall, 121 microplastics and 2 mesoplastics items were identified in 25 individuals (83.3%) among the 30 examined. On average, 4.1 ± 3.9 plastics per individual were found. Fibers comprised about 89% of the ingested plastics, followed by fragments (~7%) and films (~3%). The particles diameter ranged from 0.09 to 7.6 mm. Linear regression analysis indicated a positive correlation between pedal disc diameter and number of plastic particles ($F(1,22) = 6.342$; $p = 0.01957$; $r^2 = 0.2238$). No significant correlation ($F(1,121)$; $p = 0.2439$) was found between pedal disc diameter and plastics diameter. This study provides the first evidence of microplastic contamination of marine invertebrates from the Amazon coast. Abundant species like *B. cangicum* has the potential to monitor the levels of plastic contamination at the area, which is part of the WCR.

KEYWORDS: Marine litter, plastic debris, Brazil

Spatial Distribution, Relative Abundance, and Size Composition of Reef-associated Sharks on St Eustatius, Saba and the Saba Bank (Caribbean Netherlands)

Distribución Espacial, Abundancia Relativa y Composición por Tamaño de los Tiburones de Arrecife de Santa Eustaquio, Saba y de Saba Bank (Caribe Neerlandés)

Distribution Spatiale, Abondance Relative et Composition de Taille des Requins de Récif de Saint-Eustache, Saba et du Saba Bank (Pays-bas Caribéens)

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ABSTRACT

The aim of this study was to undertake a baseline-survey on the spatial distribution, relative abundance and size composition of reef-associated sharks in St Eustatius, Saba and the Saba Bank, windward islands of the Caribbean Netherlands. From 2012 to 2014 376 sites were surveyed with stereo Baited Remote Underwater Video (sBRUV) deployments. Videos were analysed for shark presence and individual sharks were measured using stereo-video, enabling accurate length measurements. A total of 153 sharks belonging to six species were recorded. Mean probability of observing at least one shark per recording is 0.29. In 4.3% of the video deployments two or more sharks were observed. Nurse shark was the most frequently observed species ($n = 78$) followed by Caribbean reef shark ($n = 62$), blacktip reef shark ($n = 6$), tiger shark ($n = 5$), great hammerhead shark ($n = 1$) and silky shark ($n = 1$). Significant spatial differences in geographic location were found for abundances of *G. cirratum* and *C. perezii*. Mean probability of observing these shark species on St Eustatius and the Saba Bank was found to be twice as high as compared to Saba. Habitat complexity and depth also had significant effects on total shark abundances. Mean probability of observing a reef-associated shark increased with habitat complexity and decreased with depth. The effect of management zone was not significant. Individuals of *G. cirratum* were significantly larger on the Saba Bank and in sites with low habitat complexity. Judging by total shark abundances, the shark populations of the Saba Bank, Saba and St Eustatius appear to be in reasonably healthy state compared to other areas in the Caribbean. The vast majority of observed sharks were juveniles, indicating that these shallow waters may be used as nursery areas.

KEYWORDS: Elasmobranchs, conservation, habitat preference

Ideas for the Management of the Unusual Arrival of *Sargassum* to the Cuban Coasts

Ideas para la Gestión de las Inusuales Arribazones de *Sargassum* a las Costas Cubanas

Idées pour la Gestion des Inusuels Arrivée de *Sargassum* aux Côtes Cubains

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RESUMEN

Los países del Gran Caribe ya nos encontramos en el noveno año (2011-2019) de estar recibiendo la entrada de grandes masas de *Sargassum* pelágico y son bien conocidas las zonas de mayor impacto ambiental, social y económico (fundamentalmente pesca y turismo). En Cuba existe una guía metodológica nacional para la organización del proceso de reducción de desastres con los procedimientos para evaluar el nivel de reducción de la vulnerabilidad y el riesgo en los organismos, entidades y territorios; pero está elaborada fundamentalmente para ciclones, huracanes, exceso de lluvias o sequías y movimientos sísmico y otros. Si se considera que estas arribazones inusuales puedan considerarse dentro de los desastres naturales, se pretende tomarlas en cuenta dentro de esta guía metodológica general. Pero la abundancia o florecimiento de algas no es sólo en Gran Caribe, ni sólo de *Sargassum* pelágico. Según parece hay un problema global que resolver, la eutrofización de los océanos y la utilización de sus aguas como depósito de basura. Pensamos que deben coordinarse los esfuerzos dentro de cada localidad afectada, dentro de cada país, dentro de cada región y globalmente como una estrategia semejante a cuando se elaboró la Agenda 21 en la Cumbre de Río. La participación de las comunidades costeras es indispensable, para lo cual deben elaborarse proyectos que los impliquen en la recogida de la biomasa, la búsqueda de lugares de depósito y en el aprovechamiento de la misma en la agricultura, alimentación de ganado menor, en la creación de dunas, en artesanía y en la obtención de productos, en lo cual participarían instituciones especializadas.

PALABRAS CLAVES: Invasive, beaches, management

**Variables Influencing Spat Recruitment of *Crassostrea virginica*
and *Crassostrea rhizophorae* in an Estuarine Environment**

**Variables que Influyen en el Reclutamiento de *Crassostrea virginica*
y *Crassostrea rhizophorae* en un Entorno Estuarino**

**Variables Influençant le Recrutement de naissains de *Crassostrea virginica*
et *Crassostrea rhizophorae* dans un Environnement Estuarien**

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ABSTRACT

Crassostrea virginica and *Crassostrea rhizophorae* are two important species that provide habitat and improve water quality within the Lake Worth Lagoon at John D. MacArthur Beach State Park, Florida, USA. Restoration plans exist to improve population health to restore ecosystem services these species provide. Spat recruitment arrays were deployed and analyzed to determine variables influential in spat recruitment. Spat recruitment arrays were built to provide hard substrate and interstitial space for spat settlement using ceramic tiles. Each spat recruitment array was made up of 6 tiles, arranged in pairs. Each pair was placed 12 cm apart with 3.75 cm of space within the pair. Each tile had one textured side and one smooth side. After 3 months, tiles were removed from the estuary to count and measure oyster spat present. Our analysis found spat recruitment is heavily influenced by texture. Compared to smooth-sided tile, textured tile recruits a higher level of spat. If textured substrate is not available, inward orientation becomes more influential. For the spat recruitment arrays used in this study, smaller spaces between tiles did not foster heightened spat recruitment. The research did not identify a difference in the number of large oyster spat on inward or outward oriented tiles. According to our data from MacArthur Beach, Oyster spat recruitment for *Crassostrea virginica* and *Crassostrea rhizophorae* is more heavily influenced by available texture than space between substrate. The research asserts the importance of texture in oyster spat recruitment. An emphasis on textured substrate could increase success of spat recruitment arrays, restoration sites, and commercial operations.

KEYWORDS: Spat recruitment, oyster reef restoration, textured surface

**Bycatch of Endangered, Threatened and Protected Species
in the Coastal Artisanal Fishery in Suriname**

**Captura Incidenta de Especies en Peligro, Amenazadas y Protegidas
en la Pesquería Artisanal Costera en Suriname**

**Prises Accessoires d'Espèces en Danger, Menacées et Protégées
dans la Pêche Artisanale Côtière au Suriname**

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ABSTRACT

Suriname, located on the northeast coast of South America, is under the influence of the nutrient-rich Amazon River effluents, making its coastal waters very productive, supporting a variety of fish stocks. Whilst fishermen target certain species of marketable fish, there is also substantial bycatch of unwanted species. WWF Guianas has been monitoring for bycatch of endangered, threatened and protected (ETP) species in the coastal artisanal fisheries in the Suriname since 2006. This paper presents the data analysis for the monitoring efforts in 2015-2016. Analysis of these data resulted in landing profiles of target species and bycatch data for a selection of shark, ray and sea turtle species. Extrapolation of these data to the entire coastal artisanal fleet of Suriname, resulted in an estimation of the annual ETP bycatch per fishing technique. Results are alarming; annually, more than 4,000 sea turtles, over 130,000 sharks and almost 130,000 rays are being entangled by the Surinamese coastal artisanal fleet. Moreover, we can assume that the extrapolated data is an underestimation of the real situation especially as there are regular instances of illegal, unreported and unregulated fishing in Surinamese coastal waters. Based on this study, we can state that various shark, ray and sea turtle species are indeed under pressure from the coastal artisanal fishery in Suriname. A reduction of bycatch of these species therefore is a priority. More continuous monitoring of bycatch in different fisheries and across seasons should be carried out in order to gain a better understanding of the occurrence, distribution and status of the different species caught as bycatch over time. Therefore, ETP species bycatch monitoring remains a priority focus for WWF Guianas and its partners.

KEYWORDS: Bycatch, sea turtles, ETP

A Climate-Smart Fisheries Toolkit for the Caribbean: Part 2 – A Monitoring and Management Framework for Guiding Climate Change Adaptation in the Fisheries Sector

Una Caja de Herramientas para la Pesca Climáticamente Inteligente en el Caribe: Parte 2 – Un Marco de Monitoreo y Gestión para Guiar la Adaptación al Cambio Climático en el Sector Pesquero

Boîte à Outils des Pêches Intelligentes Face au Climat pour les Caraïbes: Partie 2 - Cadre de Surveillance et de Gestion pour Guider l'Adaptation au Changement Climatique dans le Secteur de la Pêche

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ABSTRACT

Climate change adaptation planning is often constrained by a lack of information on vulnerabilities and impacts. The recent completion of detailed vulnerability and impact assessments for Caribbean fisheries as part of the Caribbean track of the Pilot Program on Climate Resilience now provides a stronger foundation for a more systematic and informed approach to climate change adaptation planning in the region's fisheries sector. This presentation summarizes key outcomes from work on a 'climate-smart' fisheries monitoring and management framework for the Caribbean region, including indicators for tracking climate change impacts on fisheries, a compilation of the most promising adaptation measures currently in use across the globe, and decision-making frameworks for selecting and implementing adaptation measures. This work stresses the importance of linking monitoring data to decisions on adaptation and highlights areas in which public-private stakeholder partnership and cooperation could play vital supporting roles. It thus emphasizes the need to leverage existing programs and partnerships to increase capacity for climate change monitoring and impact reduction in the face of limited adaptation resources. By adopting the monitoring guidance provided in the toolkit, regional stakeholders will be in a position to provide a "line of sight" between adaptation measures and vulnerability reduction, which is also important for accessing global climate finance. This work culminated in the delivery of a regional training workshop where fisheries management representatives from six pilot countries learned about frameworks and participated in exercises to apply these tools to their own fisheries management settings. The presentation will also include insights and lessons learned throughout the development and dissemination process.

KEYWORDS: Climate change, adaptation, fisheries

Not Just Plastic! An Update from Grenada, West Indies

No Solamente Plastico! Una Actualizcion desde Grenada, Indias Occidentales

Pas que du Plastique! Une Mise à Jour en Grenade, Caraïbe Orientale

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ABSTRACT

With support from the Global Partnership of Marine Litter (GPML), we have documented small foreign objects (<5 mm) in organisms (fish, lobsters, snails and sponges) and water samples (marine, river, tap and bottled) from Grenada.

A research partnership between St. George's University and Northumbria University enabled FTIR analysis of a subset of foreign objects from our biological and environmental samples. Cotton and polyester objects were identified from marine water, fish and sponge samples. In addition, fish samples contained HDPE, PVC and polypropylene objects. Planned work includes FTIR analysis of lobster, tap, bottled and river water samples.

Plastic in the environment is of concern in relation to organism health and public health. Economically Caribbean Fishing and Tourism Industries are vulnerable. To our knowledge, textile fibres have not previously been documented in marine organisms nor water samples in Grenada. Textile fibres can contain synthetic dyes and may pose a threat to marine organisms and humans. Investigations into the possible threat from textile fibres appears to have been overlooked to date but warrants further investigation.

Reports on marine litter in the Caribbean and microplastics in fisheries and aquaculture have been produced by the World Bank and FAO respectively. Caribbean specific challenges include limited wastewater management strategies. Furthermore, the implications of solid and liquid wastes in the environment and in organisms are inadequately appreciated. GPML produced eye-catching educational posters on Caribbean marine litter and microplastics. These posters are currently being used for educational outreach in Grenada (and we hope in many other places!) to raise awareness of the problems of litter and plastics. Much remains to be investigated, discovered, and understood.

KEYWORDS: Microplastic, textile fibre, Grenada

**Expanded Biological Data Collection of Dominica Key
Commercial Fish Species in Support of Sustainable Management**

**Expansión de la Recopilación de Datos Biológicos de Especies de Peces Comerciales
en Dominica en Apoyo de la Gestión Sustentable**

**Expansion de la Collecte de Données Biologiques sur les Espèces
de Poisson Commerciales de la Dominique à l'Appui d'une Gestion Durable**

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ABSTRACT

In Dominica, fisheries – which are generally small-scale and artisanal in nature, with almost all catches sold and consumed locally – face a number of challenges. Not only has Dominica recently been hit repeatedly by storms and hurricanes, notably Hurricane Maria in 2017 causing country-wide damage including to the fisheries sector; but also, some coastal or reef fisheries have faced declining catch rates. This has been partly offset by an offshore displacement of fishing effort, towards large, migratory pelagic species, caught with the aid of Fish Aggregating Devices (FADs). In order to build resilience to climate change and long-term prosperity in the fisheries sector, healthy, well-managed fish stocks are key, therefore requiring comprehensive data collection. We initiated a biological sampling programme of fish species caught by Dominican fishermen, and sampled at major and minor landing sites around the island. We measured the lengths of 3007 fishery species, representing 90 species, with weight measurements for the majority of samples. The resulting dataset is the first to provide a picture of size distributions for commercial fish species in Dominica. Preliminary analyses highlight that for Dominica's commercially most important species, dolphinfish (*Coryphaena hippurus*), most individuals measured (99%) were above length-at-maturity, and medium to large individuals of other pelagic species generally prevailed. For some reef species, however, many small individuals were caught and landed (e.g., 71% below size-at-maturity in sampled blackfin snapper (*Lutjanus buccanella*)). The preliminary findings are supportive of the recent change in emphasis of Dominica fisheries away from fishing in coastal, inshore reef waters towards either fishing further offshore for large pelagics, or for small coastal pelagics.

KEYWORDS: Artisanal fisheries, climate change, dolphinfish

**Vulnerability and Adaptive Capacity of the Fisheries Sector in Dominica:
Impacts from Climate Change and Hurricanes**

**Vulnerabilidad y Capacidad Adaptativa de las Pesquerías en Dominica:
Impactos de Cambio Climático y Huracanes**

**Vulnérabilité et Capacité d'Adaptation des Pêcheries en Dominique:
Des Impacts de Changement Climatique et Ouragans**

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ABSTRACT

Small island states in the Caribbean are at the forefront of climate change: not only subject to warming, but also facing a climate-driven increase in storminess including hurricanes. The Commonwealth of Dominica has been subject to a particularly broad range of natural hazards over the past century, most recently on 18–19 September 2017 Hurricane Maria with devastating impacts. In Dominica, fisheries are largely artisanal, the catch mostly sold locally on the island; they include reef and demersal fisheries, and at somewhat larger scale, pelagic fisheries that are largely dependent on Fish Aggregating Devices. Small-scale fishing communities may be especially vulnerable to climate change. Here we present a Climate Vulnerability Assessment (CVA) of the fisheries sector in Dominica, evaluating potential impacts over a broad range of fish species, and also socio-ecological systems. The CVA framework assesses the ‘exposure’ to a stressor (climate change and/or hurricane events), the ‘sensitivity’ to that stressor, and the ‘adaptive capacity’ within fishing communities faced with potential threats; these three components are then combined to estimate overall ‘vulnerability’. We make use of fisheries catch data from landing ports around Dominica to assess how each of Dominica’s ten parishes differ in terms of climate vulnerability. We examine information on species’ temperature preferences and life-history traits as well as data on social vulnerability. We then compare our predictions with observed damage following Hurricane Maria, using the 2017 Post-disaster Needs Assessment. In the aftermath of Hurricane Maria – with over 27% of all fishing vessels destroyed within one night, and extensive damage to reefs – fisheries vulnerability has become a very immediate issue in Dominica.

KEYWORDS: Artisanal fisheries, climate change, hurricane

**The Need to Check the Connectivity of Tarpon (*Megalops atlanticus*)
in Central America Due to Inconsistencies in Their Fishing Regulations**

**La Necesidad de Comprobar la Conectividad de los Sábalo (*Megalops atlanticus*)
en Centroamérica Debido a las Inconsistencias en la Regulación de su Pesca**

**La Nécessité de Vérifier la Connectivité des Tarpon (*Megalops atlanticus*)
en Amérique Centrale en Raison d'Incohérences dans Leurs Règles de Pêche**

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ABSTRACT

Tarpon is a worldwide known species for its ecological and economic importance. This species native to the Atlantic is a key species for tourism in many areas of Central America, generating employment in areas where there are not many economic possibilities. In this work we carry out a literature review of the management that is currently given to Tarpon in different areas of Costa Rica, Panama and Nicaragua. We find that, despite its importance, the legislation for its conservation in Central America is contradictory, there are areas where its fishing is fully regulated, even establishing strict guidelines on fishing and release techniques, and conversely there are places where they are hunted to market their meat. In addition, due to the Panama Channel, they have crossed into the Pacific, becoming an introduced species in this area, so there are conflicting positions about whether they should be extracted or conserved and even used as a sport fishing species in the Pacific. That is why it is of the utmost importance to establish what the connectivity of the populations is or to clarify if it is a single population, since this would justify major changes in the management that is currently being given to this species in Central America. We propose a genetic and ecological approach to address these facts that remain unclear in the absence of proper data and management.

KEYWORDS: Tarpon, *Megalops*, Central America

**Analysis of Management Strategies for Red Snapper
Recreational Fisheries in the Gulf of Mexico**

**Análisis de Estrategias de Manejo para la Pesca Recreativa
del Pargo Rojo en el Golfo de México**

**Analyse des Strategies de Gestion de la Pêche Sportive
au Vivaneau Rouge dans le Golfe du Mexique**

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ABSTRACT

Red snapper, *Lutjanus campechanus* is a fish species that has been harvested from the Gulf of Mexico (GOM) since the mid-1800s. This fish supports one of the top recreational and commercial offshore fisheries in the area. Their population has been affected by overfishing for many years. Because of that, the federal government has been implementing Gulf-wide basis regulations (including the establishment of quotas, bag limits and season shortenings) to rebuild the stock. The establishment of these management measures unleashed one of the biggest controversies in the fisheries sector in the United States. States accuse the Federal administration of over-regulating these activities affecting the economics and the safety of the fishermen. For this study, secondary data from scientific papers and agencies reports are analyzed for describing the background and the management system for the recreational red snapper fisheries in the GOM. Additionally, data is compared with other top recreational fish species in each Gulf state (Florida, Alabama, Mississippi, Louisiana, and, Texas). The purpose of this research is to analyze if the recreational red snapper fisheries in the GOM has been overregulated and to make policy recommendations for future management strategies.

KEYWORDS: Red snapper, recreational fisheries, Gulf of Mexico

**Hispaniola Reef Health Monitoring:
Status of Haiti Coral Reefs 2015-2019**

**Monitoreo de la Salud Arrecifal de la Hispaniola:
Estado de los Arrecifes de Coral en Haiti 2015-2019**

**Surveillance de la Santé de Hispaniola Reef:
Situation des Récifs de Coraux Haïtiens 2015-2019**

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ABSTRACT

Coral reefs are one of the most productive ecosystems on the planet. Pollution and accelerated human development have resulted in overfishing, sedimentation overgrowth of algae in coral reefs, and also Climate Change, which has lead to a drastic decline in reef health, and thus a decrease in productivity and the environmental services they offer. Coral Reefs are a source of environmental balance in our oceans, also a resource and employment opportunities for island countries, thus it is necessary to implement monitoring programs to document status and trends that help drive management actions necessary to improve the conditions of these ecosystems, mitigate the effects of climate change and reduce the effects of human actions. Since 2014, after the publication of the regional report Status and Trends of Caribbean Coral Reefs 1972-2012 by Jeremy Jackson, a group of reef monitoring specialists joined forces to determine the minimum recommended guidelines to determine the health of the reef and facilitate its comparability in time and space, as an initial measure of providing resource managers with a knowledge base on these important ecosystems.

To document the status of coral reefs in Haiti, with support from the United Nations Environmental Program and the Biological Corridor Project, a nation-wide monitoring of reef health was carried out according to the guidelines of the Global Coral Reef Monitoring Network (GCRMN) in six reef areas around the haiti. This new monitoring effort is also carried out in a complementary monitoring in the neighboring country of Dominican Republic, as a way, to complete the first report for the Hispaniola of reef health using the same methodology, which will serve for the global report of the GCRMN to be published in 2020.

KEYWORDS: Marine protected areas, monitoring, GCRMN

**Hispaniola Reef Health Monitoring:
Status and Trends of Dominican Republic Coral Reefs 2015-2019**

**Monitoreo de la Salud Arrecifal de la Hispaniola:
Estado y Tendencias de los Arrecifes de Coral de la República Dominicana 2015-2019**

**Surveillance de la Santé du Récif Hispaniola:
Situation et Tendances des Récifs de Coraux République Dominicaine 2015-2019**

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ABSTRACT

In May 2019 a team of 11 surveyors to study 12 coral reef sites distributed among 6 regions along coast of the Dominican Republic. Our goal was to monitor trends of important characteristics of coral reef health at these sites as we have been doing every other year since 2015.

To document the status and trends of coral reefs in the Dominican Republic, the monitoring of reef health was carried out according to the guidelines of the Global Coral Reef Monitoring Network (GCRMN) in six marine protected areas around the Dominican Republic, in a strategic alliance of Reef Check RD, the Propagas Foundation, and the University of Maine. This new monitoring effort is also carried out in a complementary monitoring in the neighboring country of Haiti, to complete the first report for the Hispaniola of reef health using the same methodology, which will serve for the global report of the GCRMN to be published in 2020.

The Dominican Republic coral reef monitoring program was designed to explore the strength and trends of interactions critical to the health of coral reefs. Specifically, we examined the relationship between herbivorous parrotfish and harmful macroalgae and the relationships between macroalgae and juvenile and adult corals. While live coral cover and seaweed (macroalgae) and juvenile corals were about the same as we have recorded since 2015, some patterns of abundance have shifted. Specifically, corals in the northern sites of the Montecristi region have declined but those around the La Caleta region have increased. Parrotfish and carnivorous fish such (snappers and groupers) have declined likely due to fishing pressure. The parrotfish decline is noteworthy because it occurred during a period when the harvest of parrotfish was banned throughout the Dominican Republic.

KEYWORDS: Marine protected areas, monitoring, GCRMN

**HISPANIOLA REEF HEALTH MONITORING: STATUS AND TRENDS OF DOMINICAN REPUBLIC
CORAL REEFS 2015-2019**

**MONITOREO DE LA SALUD ARRECIFAL DE LA HISPANIOLA: ESTADO Y TENDENCIAS DE LOS
ARRECIFES DE CORAL DE LA REPÚBLICA DOMINICANA 2015-2019**

**SURVEILLANCE DE LA SANTÉ DU RÉCIP HISPANIOLA: SITUATION ET TENDANCES DES RÉCIFS
DE CORAUX RÉPUBLIQUE DOMINICAINE 2015-2019**

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ABSTRACT

Coral reefs are one of the most productive ecosystems on the planet. Pollution and accelerated development have resulted in overfishing, sedimentation and overgrowth of algae in coral reefs, and also Climate Change, which has lead to a drastic decline in reef health, and thus a decrease in productivity and the environmental services they offer. Coral Reefs are a source of environmental balance in our oceans, also a resource and employment opportunities for island countries, it is necessary to implement monitoring programs to document status and trends that help drive management actions necessary to improve the conditions of these ecosystems, mitigate the effects of climate change and reduce the effects of human actions. Since 2014, after the publication of the regional report Status and Trends of Caribbean Coral Reefs 1972-2012 by Jeremy Jackson, a group of reef monitoring specialists joined forces to determine the minimum recommended guidelines to determine the health of the reef and facilitate its comparability in time and space, as an initial measure of providing resource managers with a knowledge base on these important ecosystems.

To continue the documentation of the status of coral reefs in the Dominican Republic, for the third time, the monitoring of reef health was carried out according to the guidelines of the Global Coral Reef Monitoring Network (GCRMN) in six marine protected areas around the Dominican Republic, in a strategic alliance of Reef Check RD, the Propagas Foundation, and the University of Maine. This new monitoring effort is also carried out in a complementary monitoring in the neighboring country of Haiti, to complete the first report for the Hispaniola of reef health using the same methodology, which will serve for the global report of the GCRMN to be published in 2020.

KEYWORDS: Marine protected areas, monitoring, GCRMN

Student Award Competition: No

Getting to Know the Coastal-Marine Biodiversity of a Promising Area Aided by Citizen Science

Conociendo la Biodiversidad Costera-marina de un Área Prometedora con la Ayuda de la Ciencia Ciudadana

Connaître la Biodiversité Marine et Côtière d'une Région Prometteuse Grâce à la Science Citoyenne

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ABSTRACT

The citizen science project held in the platform iNaturalist, called “Biodiversidad de Playa El Derrumbao y Zonas Aledañas” (Biodiversity of El Derrumbao beach and nearby places) gathers an extensive photographic catalog of various species presented in the area of Las Salinas and Las Calderas Bay in Peravia province in the Dominican Republic, with a focus on its marine and coastal fauna. In these late years, this area has taken preponderance as a birdwatching scene and more recently as a diving and snorkeling spot thanks to its proximity to the city and the variety of habitats that can be found, such as mangroves, dunes, coral reefs, coastal lagoons, and salt pans. Despite the importance of these sites, its marine fauna and coastal resources have not been exhaustively studied. This project was created in mid-2017 and has to date more than 300 observations of 141 different species of terrestrial and aquatic fauna and flora. More than 80% of the observations are marine or coastal fauna, including marine reptiles, fish, stony and soft corals, mollusks, crustaceans, echinoderms and more. Other marine-coastal biodiversity is comprised of plants such as mangroves, macroalgae and seagrasses. More than 75% of the observations are research grade. We have recorded 19 species of stony corals, several of them threatened, such as the ones of the genus *Acropora* and at least seven species of soft corals, zoanthids and hydrocorals. The fish diversity is rich, we have observed more than 40 species of fish including sharks, rays and reef fishes. This project has had the participation of people not directly related to science and also presents evidence on the fishing practices in the area. We think this can be a promising ecotouristic destination and the location of future scientific research.

KEYWORDS: Biodiversity, citizen science, marine biodiversity

**Marine and Estuarine Fishes of the Scientific Collection of the National Museum
of Natural History “Prof. Eugenio de Jesús Marcano” in Dominican Republic**

**Peces Marinos y Estuarinos de la Colección Científica de Referencia del Museo Nacional
de Historia Natural “Prof. Eugenio de Jesús Marcano” En República Dominicana**

**Poissons Marins Et Estuariens De La Collection Scientifique Du Muséum National
d’Histoire Naturelle “Prof. Eugenio de Jesús Marcano” en République Dominicaine**

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ABSTRACT

The National Museum of Natural History "Prof. Eugenio de Jesús Marcano" (MNHNSD), conserves the most extensive and important scientific collections of Hispaniola island. The ichthyological collection is the second most numerous and diverse of the Museum, with more than 30,000 specimens of 326 species of marine, estuarine, lacustrine and freshwater fishes. This being surpassed only by the entomological collection. The fishes are preserved in 70% ethanol and gather whole specimens as well as body parts; a small fraction of the collection corresponds to clarified and dyed specimens stored in glycerin. Most of the collection effort has taken place in the Dominican Republic, but there are several specimens from Haiti, Cuba, Navassa isle, Colombia, Mexico and the United States. The MNHNSD marine and estuarine fish collection is comprised of 886 cataloged lots with 5,415 specimens, represented by 291 species and 101 families of 29 orders. The class Actinopterygii represents the majority of the records, with 99.1% and the remaining 0.9% are of the class Chondrichthyes. Despite the relatively low number of registers, this collection comprises a good representation of the Caribbean Chondrichthyes fauna with 48 specimens of 18 species. The marine collections began in 1974. Although the research and collection activities ceased during the early 2000s, since 2009 these activities have not only been reactivated but intensified, carrying out an updating process and growth of the collection, positioning it as an important repository of the biodiversity of marine, estuarine and internal waters of the Caribbean. Summary tables of the records to date of the collection and a map with the most important collection sites are shown.

KEYWORDS: Scientific collection, fishes, Hispaniola

Using Opportunistic Datasets to Infer Spatial Management Strategies of Endemic Fisheries in the U.S. Caribbean Region

Usando Datos Oportunistas para Inferir Estrategias de Gestión Espacial de Pesquerías Endémicas en la Región del Caribe de los Estados Unidos

Utilisation d'Ensembles de Données Opportunistes pour Dédire des Stratégies de Gestion Spatiale de Pêcheries Endémiques dans la Région des Caraïbes Américaines

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ABSTRACT

As an initial step towards the implementation of an ecosystem-based approach to management, the Caribbean Fishery Management Council (CFMC) has recently ratified three island-based fishery management plans (IBFMP) that upon secretarial approval, will supplant the existing regional fishery management plans. The newly formed IBFMPs account for nuances among the individual island platforms in the U.S. Caribbean (i.e., Puerto Rico, St. Thomas/St. John, and St. Croix) including ecological, cultural, and social considerations. The island-based approach represents the first such management strategy among the eight fishery management councils in the United States and therefore remains an untested technique in the context of fishery management in the United States. This study evaluated the decision to separate fishery management among the island platforms by comparing fish assemblages through time in the region. Specifically, the study quantified spatial and temporal differences in fish community structure and function using three open source datasets that were collected via fishery-independent methods. All three datasets were sponsored by NOAA and quantified diurnal fish communities among photic-zone coral reefs (i.e., < 30 m). The results suggest that the structure and function of fish communities is spatially driven, with little temporal influence. In addition, these spatial differences can be quantified via the characteristics of particular fish populations, or indicator species. Combined with the ecological, cultural, and social differences among the islands, the spatial nature of the fish community data support the decision of the CFMC to transition to island-based management plans. As NMFS aims to implement ecosystem-based approaches to management across the nation, the CFMC has taken the initial steps towards that goal.

KEYWORDS: Ecosystem based fisheries management, indicator species, coral reef fishery

**The Impact of Moored Fish Aggregating Devices (FAD)
on the Artisanal Marine Fishery in Southeast Haiti**

**El Impacto de la Pesca Sobre Dispositivo de Concentracion de Peces (DCP)
Anclado Sobre la Pesca Artisanal en el Sureste de Haiti**

**L'impact de la Pêche au Dispositif de Concentration de Poisson (DCP)
Ancré sur la Pêche Artisanale dans le Sud-Est d'Haiti**

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ABSTRACT

The use of moored Fish Aggregating Devices (FAD) by artisanal fishers has rapidly increased since the 1990s in the Caribbean. Here, we provide (for the first time) quantitative data on the incipient moored FAD fishery in Haiti. Between 2007 and 2014, field surveyors regularly monitored fishing trips by artisanal fishers - who benefited from a government project aimed at developing the FAD fishery - at twelve landing sites spanning 150 km of coastline in Southeast Haiti. Monitoring allowed distinguishing between FAD fishing versus traditional coastal fishing. Data on >1,000 FAD and >3,200 coastal fishing trips were collected. FAD fishing relied almost exclusively on donated fiberglass boats with outboard engines at all landing sites, whereas concurrent coastal fishing involved mainly privately-owned unmotorized wooden boats at most sites. Catches on FADs yielded unprecedented proportions of oceanic pelagic fishes such as large tunas and dolphinfish across all landing sites. Overall, landings and profits per trip were approximately three- and two-fold higher for FAD fishing than coastal fishing, respectively. However, this overall pattern masked considerable variability among landing sites with FAD fishing being less profitable than coastal fishing at some landing sites, due partly to high fuel consumption to get to the FADs. Overall, this study shows that, on a fishing trip basis, FAD fishing can be more profitable than traditional coastal fishing in Southeast Haiti by facilitating access to a relatively unexploited pelagic resource locally. However, the long-term profitability and sustainability of this fishery will require careful planning and monitoring.

KEYWORDS: FAD, fisheries, Haiti

**Engaging Stakeholders in Marine Spatial Planning in Suriname
Through Participatory 3-Dimensional Modeling of the Coastal and Marine Area**

**Involucrar los Depositarios en la Planificación Espacial Marina en Surinam a Través
del Modelado Participativo Tridimensional de la Zona Costera y Marina**

**La Participation des Partenaires à la Planification Spatiale Marine au Suriname en
Utilisant la Modélisation Tridimensionnelle Participative de la Zone Côtière et Marine**

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ABSTRACT

About 85% of the population of Suriname lives near the coast and a growing number of economic activities are taking place here such as agriculture, fisheries, shipping, oil and gas exploration and tourism. In an effort to manage these activities, and at the same time protect coastal and marine resources, a comprehensive and inclusive Marine Spatial Plan (MSP) is being developed. Numerous examples from around the world have shown that involving stakeholders in the MSP process from the start is a key factor for success. Stakeholders can also serve as a great source of information, especially in areas where there is little to no data available about coastal and marine habitats, resources and human uses. In fact local knowledge can serve as a valuable addition to existing scientific information. In this case a Participatory 3-Dimensional Model (P3DM) of the coastal and marine area of Suriname was developed to serve as basis for informed decision-making. P3DM is a stakeholder-based method, which integrates local spatial knowledge with topographic and bathymetric data to produce a physical 3-D model. The P3DM approach also increases the opportunity to bring together unlikely parties (e.g. fishermen and an oil and gas company) allowing them to exchange information and discuss possible conflicts of interest. A series of dialogs were held during 2018-2019 with major coastal communities and other ocean stakeholders to construct, fill in and validate the legend and the model. The 3-D model (5.0 by 2.3 m) represents the coastal and marine area of Suriname from 20 km inland to ca. 150 km offshore, with water depths ranging from 0 to 200 m.b.s.l and contains 53 layers of information including broad categories of natural features, fisheries and fishing grounds, critical habitats, wildlife encounters, zones of environmental or social

KEYWORDS: Inclusive marine spatial planning, participatory 3-Dimensional modelling, stakeholder engagement

Use of Fish Fins as a Non-destructive Method for Isotopic Analysis

Uso se Aletas se Pescado como Método no Destructivo para el Análisis Isotópico

Utilisation des Nageoires de Poissons comme Méthode Non-destructive pour les Analyses Isotopiques

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ABSTRACT

Stable isotope analyses, especially carbon (^{12}C : ^{13}C) and nitrogen (^{14}N : ^{15}N) ratios, are widely used in ecology to study habitat use, trophic niches, structure of food-webs, or migrations. Muscles are commonly used for these analyses because this tissue is homogeneous and presents a moderate turn-over time (around three months for fish), that allow the study of ecological parameters in a relatively short period. However, the use of muscle generally requires the sacrifice of individuals. In the present study, the use of fins to perform stable isotope analyses was tested. Two herbivorous fish species were studied (*Sparisoma viride* and *Acanthurus bahianus*) on a reef site located the West coast of Guadeloupe. These two species were chosen due to their major ecological role on coral reef, in regulating algal biomass, and due to the scientific interest they represent in ecology.

For each individual, three samples were collected: white dorsal muscle, pieces of pectoral and dorsal fins. Measurements of carbon and nitrogen signatures were conducted on each sample. Statistical correlations were done between isotopic signatures of muscle and those of fins. Results showed significant positive correlations between muscle and fins isotopic ratios, for both carbon and nitrogen isotopic ratios. The respective equations of correlation were calculated, as well as the Spearman's coefficient of correlation. For both fish species, coefficients of correlation were higher when comparing isotopic signature of muscle and those of pectoral fins. Correlations with dorsal fins appeared to be less efficient.

These results suggest that fins, especially pectoral fins, could be used for stable isotope analyses instead of muscle. This practice could allow collaboration between scientists and fishers, as the removal of a piece of fin is not visible on

KEYWORDS: Herbivorous fishes, conservation, carbon

**A Methodological Approach to Systematically Assess
Stakeholder Perspectives in Fisheries Management**

**Un Enfoque Metodológico para Evaluar Sistemáticamente
las Perspectivas de los Interesados en la Ordenación Pesquera**

**Une Approche Méthodologique pour Évaluer Systématiquement
les Perspectives des Parties Prenantes dans la Gestion des Pêches**

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ABSTRACT

Management of natural resources ultimately requires managing the people who influence the resources. Fisheries management has primarily focused on the ecological and economic components of management without full consideration of the social dimensions. Indeed, there have been repeated calls for the greater inclusion of the human dimensions to natural resource management. While there is an abundance of literature detailing the importance of understanding the drivers of human behavior in coastal resource management methods, few agencies have been able to systematically measure these drivers. We introduce a tool, cognitive mapping, that through frequent administration we have found to be particularly effective in bridging the worlds of surveys and open-ended interviews. This method is able to capture substantial data, is easy to administer, puts less cognitive load on respondents and researchers, and requires minimal data analysis skills in order for it to be useful for decision makers and disseminated to stakeholders. Mental models are a key determinant in understanding a person's behavior and motivations. There exist many approaches to cognitive mapping ranging from simple to complex and have been applied to diverse topics in natural resource management. We discuss four of these approaches and outline their application to understanding natural resource issues in varying contexts. We conclude by discussing how this approach can be incorporated into coastal resource management in the Caribbean.

KEYWORDS: Cognitive mapping, coastal resource management, mental models

The Caribbean Protected Areas Gateway – Supporting Better MPA Management

The Caribbean Protected Areas Gateway - Apoyando una Mejor Gestión de AMP

Passerelle des Zones Protégées des Caraïbes - Soutenir une Meilleure Gestion des AMP

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ABSTRACT

Marine ecosystems and the biodiversity they contain are extremely important for sustaining livelihoods, maintaining food security, providing crucial ecosystem services and contributing to overall human wellbeing. MPAs, throughout our region, are distinct only by name or geographic boundaries, but can be highly connected due to the nature of the marine environment and the highly mobile and shared resources they house. Effective MPA management therefore requires a number of key components which include: an easy-to-use platform for the bringing together and dissemination of data and information; analysis of trends at local, national and regional levels; a robust communication network; the continual enhancement of capacities at local, national and regional levels and; grant facilities/funding mechanisms inter alia. The Caribbean Protected Areas Gateway (Caribbean Gateway), hosted by the University of the West Indies (UWI) and jointly implemented with the International Union for the Conservation of Nature (IUCN) and the European Commission-Joint Research Centre (EC-JRC), seeks to address the above-mentioned components of effective MPA management with an overall goal of improving decision making, PA management and the conservation of biodiversity. The Caribbean Gateway is based on open-source, free and secure technologies and consists of four main components: user friendly platform, data management system, communications platform and a grant facility. It engages primarily with national and regional level agencies, PA practitioners and key stakeholders to provide key tools, analyses and services. For example, the Caribbean Gateway is currently working on a State of Protected Areas report for the Caribbean region to elucidate trends, threats, data/information gaps, challenges, recommendations and the way forward inter alia.

KEYWORDS: Marine protected areas, effective management, Caribbean Protected Areas Gateway

Examining the Temporal and Spatial Distribution of Baitfish Species in Bermuda's Coastal Waters

La Distribución Temporal y Espacial de las Especies de Carnada en las Aguas Costeras de Bermudas

Le Répartition Temporelle et Spatiale des Espèces de Poissons-Appâts dans les Eaux Côtières des Bermudes

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ABSTRACT

Small fishes play a vital role in coastal food webs, but are also exploited by commercial and recreational fishers for bait. Yet the life cycles of these species are poorly understood. In Bermuda, baitfish landings have declined, but it is unclear whether this indicates population declines or altered fishing practices. Current management restricts the size and type of nets used, and prohibits net fishing in four bays. Here, we describe the annual cycles in abundance and the distribution of baitfishes in Bermuda's coastal waters to inform the management of these important species. Visual surveys of baitfish presence and school composition were conducted approximately weekly for one year at 6 bays, including two bays closed to net fishing, with additional opportunistic surveys. Observations revealed variability between the annual cycles of the 6 key inshore baitfish species, informing a broadscale survey, conducted in the fall of 2018, to capture the peak abundance of the most species. Using a drone and vessel-based visual observations, we surveyed 95 km of shoreline, covering long distances per day to get an overview of baitfish presence/absence, school sizes and species composition, while avoiding confounding by movements between surveys. Species composition was validated with net samples and snorkel surveys. Dense schools of Bermuda anchovy were present in sheltered bays around the island. Reef silversides were present in loose shoals along most lee shores. Redear herring, found in deeper areas of sheltered bays, was the most abundant of the larger species. Dwarf herring were under-represented as their abundance peaks earlier in the year. Threadfin herring and Round sardinella were the least abundant species in all surveys. Understanding the abundance and distribution of baitfishes opens up various management options.

KEYWORDS: Baitfish, Bermuda, distribution

A Comparison of the Practical and Statistical Sampling Considerations Between Parallel Line and Star Survey Designs for Hydroacoustically-derived Abundance Estimates of Goliath Grouper (*Epinephelus itajara*) Spawning Aggregations

Una Comparación de las Consideraciones de Muestreo Prácticas Yy Estadísticas Entre los Diseños de Encuestas Paralelas y en Estrella para Estimar la Abundancia Derivada Hidroacústicamente de la Agrupación de Desove de *Epinephelus itajara*

Comparaison des Considérations Pratiques et Statistiques Relatives à l'Échantillonnage Entre les Conceptions à Lignes Parallèles et en Étoile pour Les Estimations d'Abondance Dérivées d'Enquêtes Hydroacoustiques des Agrégations de Ponte de Mérou Goliath (*Epinephelus itajara*)

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ABSTRACT

"Star" survey designs have become an increasingly popular alternative to parallel line designs in hydroacoustic sampling of areas with isolated fish aggregations such as artificial reefs and spawning aggregation sites. While traditional parallel line surveys offer better coverage of the area surrounding a fish aggregation and less spatial autocorrelation between transect nodes, they often require a greater number of transects and present several practical difficulties in maneuvering tight turns. Star surveys involve fewer transects which are arranged in alternating directions and which all cross at the center of the aggregation site. Star designs may be easier to maneuver and provide a higher sampling of the targeted aggregation, but they have an inherently large spatial autocorrelation between transect nodes which can result in biased estimates of fish abundance. In this study, we sampled goliath grouper (*Epinephelus itajara*) spawning aggregations at three artificial reefs off of Jupiter, Florida using both star and parallel hydroacoustic survey designs. Additionally, we compared common model-based approaches to incorporate the statistical sampling considerations in abundance estimates from both designs. Grouper abundance estimates derived from geostatistical and general additive models (GAM) were computed for both survey designs, as well as cluster model-based estimates for parallel line surveys and a concentric interval approach for star surveys. Both design- and model-based approaches heavily influence estimates of fish abundance and should be carefully considered for each individual practical application in sampling fish aggregations.

KEYWORDS: Fish aggregations, hydroacoustics, ecosystem survey design

**Documenting Status and Mapping Suitability of Caribbean
Moored Fish Aggregating Device (MFAD) Fisheries**

**Documentando el Estado y Mapeando las Oportunidades
de las Pesquerías DAP en el Caribe**

**Documentation sur le Statut et Cartographie Opportunités
de le Pêche DCP dans le Caraïbes**

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ABSTRACT

The use of moored fish aggregating devices (MFADs) in the Caribbean has increased dramatically over the past several decades. MFAD fisheries have the potential to enhance fisher incomes, improve food security, and provide an alternative to less sustainable forms of fishing. However, concerns have arisen regarding insufficient management, environmental impacts, and conflict among fishers. This study addresses significant gaps in our understanding of the extent of MFAD proliferation and status of MFAD management throughout the Caribbean, as well as how social and ecological factors interact to drive the success of a given MFAD fishery. First, we report preliminary results of an island-level survey of estimated FAD numbers as well as FAD legislation and enforcement. These initial results show substantial variation across islands in terms of total FAD numbers and the use of public vs. private MFADs. While some islands have instituted regulations regarding the deployment and use of MFADs, enforcement remains a challenge across the region. In the second component of this study, we integrate social, ecological, and oceanographic datasets to generate a spatial suitability analysis to show areas where FAD deployment would be environmentally feasible, socially beneficial in terms of local livelihoods and nutrition, and responsibly managed. Our spatial model helps identify areas of both promise and concern and provides guidance as to how social and environmental factors can be optimized to improve existing and emerging MFAD fisheries.

KEYWORDS: FAD fisheries, management, pelagic

**Do Scientists and Managers Think and Feel the Same About Data?
Insights from the Pacific Island Region**

**¿Los Científicos y los Administradores Piensan y Sienten lo Mismo
Acerca de los Datos? Perspectivas Desde la Región Insular del Pacífico**

**Les Scientifiques et les Gestionnaires Pensent-ils et Sont-ils due Même
avis à Propos des Données? Les Réflexions du Pacifique Insulaire**

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ABSTRACT

Successful coastal management requires understandings of biophysical and social systems and how these are being affected by and implicated in resource governance. In the Pacific island region, there have been multiple long-term biophysical monitoring efforts implemented at site and island scales. In the last decade, socioeconomic monitoring has also been strengthening. At the same time, there is a recognized and growing need to integrate biophysical and social monitoring to comprehensively inform an ecosystem approach to fisheries, marine and coastal resource management, and to safeguard the ecological and social systems of coastal communities.

This oral presentation will share key results of a study that examines awareness of socioeconomic and biophysical data types that are available, perceptions regarding their relative importance, needs for additional data types considered useful for management, and potentials for better integrating biophysical and socioeconomic monitoring. The 112 survey respondents and 55 participants from 4 focus groups included coastal fisheries and marine resource managers, as well as biophysical and social scientists who are involved in the design and implementation of the long-term monitoring in the Pacific island region. The talk concludes with a set of recommendations for scientists and managers on how to better understand social-ecological systems through integrated monitoring that employs both natural and social sciences. It discusses findings regarding the similarities and differences of data considered important and useful, as well as data gaps identified by coastal managers, biophysical scientists, social and scientists. It also summarizes lessons on processes of collaboration.

KEYWORDS: Integrated monitoring, Pacific islands, biophysical monitoring

**Caribbean Cooperation on Response to
Stony Coral Tissue Loss Disease Epidemic**

**Cooperación del Caribe en Respuesta a la Epidemia
de Enfermedad por Pérdida de Tejido de Coral Pedregoso**

**Coopération des Caraïbes sur la Réponse à l'Épidémie
de Perte de Tissu Corallien Stony**

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ABSTRACT

Stony Coral Tissue Loss Disease, or SCTLD, affects approximately half of all known stony coral species in the Caribbean region. The SCTLD epidemic started in 2014 in Florida and this aggressive disease has now spread to at least seven Caribbean countries and territories including: Mexico, Jamaica, Sint Maarten, the Dominican Republic, the U.S. Virgin Islands, the Turks and Caicos Islands, and Belize. SCTLD poses a particularly significant threat to Caribbean reefs because of its large geographic range, extended duration, high rates of mortality, and large number of coral species affected. Florida's SCTLD Response Structure includes a Caribbean Cooperation Team that works to review new disease reports from the region and to disseminate information on SCTLD prevention, identification and response and assist Caribbean jurisdictions in their efforts to understand and address this disease.

KEYWORDS: Disease, SCTLD, Coral

Use of S.M.A.R.T. in the Turneffe Atoll Marine Reserve

Uso de S.M.A.R.T. en la Reserva Marina del Atolón de Turneffe

Utilisation de S.M.A.R.T. dans la Réserve Marine de Turneffe Atoll

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ABSTRACT

The use of S.M.A.R.T. was tested in late 2016, re-tested in late 2017 and then fully implemented in 2018 for the Turneffe Atoll Marine Reserve (TAMR). During the years of 2016 to 2017, the software development was still at its early stages and was experiencing glitches which prevented the full establishment during those years. With the release of a new version, most of the glitches were ironed out which resulted in a software that was able in capturing and managing the enforcement data. Recognizing the potential of the software, the Turneffe Atoll Sustainability Association (TASA) prompted a full implementation of the use of S.M.A.R.T. within TAMR. S.M.A.R.T. provided TASA with the capacity to effectively and efficiently track vessel movements, users of the reserve, fuel usage, marine reserve infractions and to some extent monitor the fishing pressure within the atoll. In addition to this, the data is collected to one centralized data base which is housed in online servers which provided much needed data security. Another benefit is that allowed us to contribute to a much larger pool of enforcement and surveillance data base which is used worldwide by other enforcement agencies. As a NGO, it provides us with the accountability and transparency of the resources being used for the day to day management of the marine reserve. This is an important management tool for TASA, for adaptive management and accountability for our donor organizations. S.M.A.R.T. allows for easy generation of reports for TASA Operations Program. S.M.A.R.T has paved the road to efficient management of the Turneffe Atoll and has allowed TASA to make effective policy decisions when it comes to the management of the marine reserve. TASA has proven to be one of Belize's leading organization in the adoption and use of S.M.A.R.T for adaptive management.

KEYWORDS: S.M.A.R.T., Turneffe Atoll, adaptive management

**Dominican Reef Network:
A Conservation Alliance in Dominican Republic**

**Red Arrecifal Dominicana: Una Alianza por la Conservación
de Corales en la República Dominicana**

**Réseau de Récifs Dominicains: Une Alliance pour la Conservation
es Coraux en République Dominicaine**

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ABSTRACT

Red Arrecifal Dominicana (RAD), is a conservation alliance, founded by Propagas Foundation, The Nature Conservancy, Reef Check Dominican Republic, Grupo Puntacana Foundation, CODOPESCA and FUNDEMAR. RAD was launched in 2016, after publishing the report "Situation of the Coral Reefs in the Dominican Republic". This report revealed the level of degradation of coral reefs in the country and the need to act in collaboration to ensure the future of this ecosystem for generations to come.

Currently, RAD and its more than 20 members are an example to other countries in the Caribbean, regarding national cooperation for coral reef conservation, management, restoration and monitoring. RAD ensures active participation of the Government, Private Sector, Academia and Local Communities to define actions for achieving sustainable management of coral reef ecosystems.

RAD works in four strategic lines: conservation, management, restoration and education. Our vision is to strengthen a partnership among key institutions and to establish a nationwide action plan which defines attention priorities with regards to coral reef management and, with the cooperation of all, to achieve most efficient results in the least possible time. The main objectives of RAD are:

- Designing and promoting strategies for coral reef ecosystem.
- To facilitate responsiveness given the threats faced by coral reefs.
- To be an open forum for information exchange.
- To promote the sustainable management and rehabilitation of fisheries.
- To identify research areas and institutional strengthen for applying the regulations.
- To disseminate coral reef values.

KEYWORDS: Ecosistema arrecifal, alianza, conservación

**Red Hind *Epinephelus guttatus* Vocal Repertoire Characterization,
Behavior, and Temporal Patterns**

**Comportamiento, Patrones Temporales y Caracterización
del Repertorio Vocal del Mero Cabrilla, *Epinephelus guttatus***

**Comportement, Modèles Temporels et Caractérisation
du Répertoire Vocal du Mérou Cabrilla, *Epinephelus guttatus***

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ABSTRACT

Passive acoustic monitoring is used to study groupers that produce courtship associated sounds (CAS) when they aggregate to spawn. This technique has revealed patterns of sound production during red hind (*Epinephelus guttatus*) spawning aggregations with extremely high temporal resolution. Investigations have shown that groupers can have a varied vocal repertoire, however, detailed studies of the number, types and periodicity of CAS are lacking. This study characterized in detail the CAS and other vocalizations in *E. guttatus* and their respective behavioral context, using a combination of field and laboratory studies. During the 2017 spawning season *E. guttatus* were held in a 57,000-liter tank equipped with a low frequency acoustic recorder and video cameras. Acoustic recordings from a simultaneous fish spawning aggregation (FSA) at a known *E. guttatus* spawning site were used to quantitatively characterize and compare the sound types recorded in captivity. Five sound types were characterized: four recorded in captivity and an additional one only recorded in the wild labeled ‘chorus’. These sounds consisted of variations and combinations of low frequency (50-450Hz) pulses, grunts and tones. Some types exhibited diel and lunar oscillations, which both field and captivity recordings peaked daily at 1800 AST and at 8 days after the full moon. Call-specific behavior included male-male and male-female interactions, with changes in position in the water column, coloration, body orientation, swimming speed and erect dorsal fins. Standardizing characterizations of CAS types will facilitate understanding of fish communication, pre-spawning behavior and automating CAS detections useful for research and monitoring of FSA’s. Quantifying CAS production and behavior can lead to hypotheses on fitness and mate choice.

KEYWORDS: Bioacoustics, courtship associated sounds, *Epinephelus guttatus*

Comparative Evaluation of the CPUE Before and After the Installation of Artificial Reefs in the Pozos Colorados Sector, Caribbean Sea of Colombia

Evaluación Comparativa de la CPUE Antes y Después de la Instalación de Arrecifes Artificiales en el Sector de Pozos Colorados, Mar Caribe de Colombia

Évaluation Comparative de la CPUE Avant et Après l'Installation de Récifs Artificiels dans le Secteur de Pozos Colorados, dans la Mer des Caraïbes, en Colombie

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RESUMEN

La bahía frente a Pozos Colorados y su zona costera en el Caribe de Colombia, ha sido una región con gran diversidad y presencia de ecosistemas para la actividad pesquera. No obstante, las actividades de desarrollo costero y la implementación de zonas restringidas para el cargue de carbón y líneas submarinas para el transporte de hidrocarburos, se han convertido en una amenaza para la sostenibilidad del ambiente marino, evidenciado tanto en los ecosistemas acuáticos como en las poblaciones de especies explotadas por las pesquerías artesanales. En consecuencia, de lo anterior, los principales afectados por esta problemática han sido las comunidades de pescadores artesanales que han visto la necesidad de desplazar espacialmente su esfuerzo pesquero. En aras de preservar la biodiversidad e impulsar el ecoturismo, la Empresa Ecopetrol S.A. instaló doce arrecifes artificiales (AAs). El objetivo de este trabajo consistió en evaluar la variación de la CPUE de los principales artes de pesca, comparando la información histórica de los desembarcos de la pesca artesanal, antes de la instalación de los AAs, con el estado actual, para lo cual se utilizó la metodología del monitoreo de sus desembarcos haciendo uso de encuestas semi-estructuradas dirigidas a las Unidades Económicas de Pesca (UEP), registrando datos correspondientes a la abundancia relativa (Captura por Unidad de Esfuerzo - CPUE) de cada UEP, expresada en kg.faena-1. Mediante la prueba no paramétrica de Mood se compararon las medianas de la CPUE antes y después de los AAs. Los principales resultados indicaron diferencias estadísticas entre los periodos evaluados, estas diferencias se expresaron a nivel de las artes de pesca comparadas (línea de mano, chinchorro y red de enmalle), siendo mayores antes de la instalación de los AAs. además se **evidenciaron cambios en la c**

PALABRAS CLAVES: Pesca artesanal, arrecifes artificiales