GCFI

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Book of Abstracts

70th Annual Gulf and Caribbean Fisheries Institute

Merida, Mexico

Hosted by:

INSTITUTO TECNOLOGICO MERIDA YUCATAN

CINVESTAV Unidad Mérida

UNIVERSIDAD AUTONOMA YUCATAN

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PROGRAM
70TH ANNUAL GULF AND CARIBBEAN FISHERIES INSTITUTE
Merida, Yucatan - Mexico
6-10 NOVEMBER 2017

PRE-MEETING ACTIVITIES

Friday, November 3

9:00 – 17:00	FAO/WECAFC workshop

Saturday, November 4

9:00 – 17:00	Acoustic Workshop Field Trip (Progreso)
9:00 – 14:00	FAO/WECAFC workshop
14:00-17:00	Caribbean Billfish Working Group Meeting

Sunday, November 5

9:00 – 17:00	Acoustic Workshop
9:00 – 17:00	MPA workshop
14:30	GCFI Board of Directors Meeting
16:00	Registration
19:30	Student-Board Social (for registered students and GCFI Board Members) Venue TBD

Monday, November 6

OPENING CEREMONY

Program Chair: Alejandro Acosta, GCFI

HONORARY GUESTS		**Opening Address**
8:00 8:10	Rafael Rivera Bustamente,	Director of CINVESTAV – Opening Remarks
8:10 8:20	José Castillo Ruz,	Comision de Pesca, y Acuacultura Sustentable – Opening Remarks
8:20 8:30	Juan José Canul Peréz,	Secretario de Desarrollo Rural – Opening Remarks
8:30 8:40	Raúl Godoy,	Secretario de Investigación e Innovación Gobierno Estado de Yucatán – Opening Remarks
8:40 8:50	Nancy Brown-Peterson	Chair, GCFI Board of Directors– Opening Remarks
8:50 9:00	Dalila Aldana-Aranda	CINVESTAV – Opening Remarks

PRESIDIUM:

1. José Castillo Ruz, Comision de Pesca, y Acuacultura Sustentable y/o Juan José Canul Peréz, Secretario de Desarrollo Rural
2. LeRoy Creswell, Executive Secretary GCFI
3. Alejandro Acosta, Scientific Program, Board Director
4. José de Jesús Williams, Rector UADY
5. Nancy Brown-Peterson, Chairperson GCFI
6. Raúl Godoy, Secretario de Investigación e Innovación Gobierno Estado de Yucatán
7. Dra. Josefina Santos Valencia, Directora INP
8. Rafael Rivera Bustamente, Director Unidad Mérida Cinvestav
9. Manuel Pérez Mendez, Director Cámara de Comercio de Pesca
10. José Luis, Presidente de la sociedad de Cooperativas de Pesca
11. Mirna Manzanilla, Directora Tecnológico de Mérida
12. Mario González, Director ECOSUR
13. Robert Glazer, Executive Director, GCFI
14. Dalila Aldana Aranda, Coordinadora 70 GCFI

	Keynote Speaker	
9:00-9:50	**Brian Luckhurst**	"The Oceans are Changing - Implications for Fisheries"
		Question and comment period
9:50- 10:00	LeRoy Creswell	GCFI Executive Secretary; Opening Bell
10:00	**Coffee break**	

TECHNICAL SESSIONS

The Grouper Fishery of the Gulf of Mexico or "Governance, livelihoods and organizations". *Moderator: Alejandro Acosta (Sponsored by by CINVESTAV, Instituto Technologico de Merida, UNAP and GCFI,)*

10:30-10:45		**Session Overview Presentation**
10:45-11:00	Vidal-Hernández, Laura	Evidence of Risk on Epinephelus morio By Recreational Fishing in the Cost of Yucatan and the Alacranes Reef (Mexico)
11:00-11:15	Monroy Garcia, Carmen	Impact of the Use of Different Hooks in the Grouper Fishery (Epinephelus morio), in the Coastal Zone of Yucatán: Through a Size-based Approach
11:15-11:30	Rodriguez Gil, Luis Alfonso	Monitoring of Fishery of the Grouper in the Port of San Felipe, Yucatán, Mexico
11:30-11:45	Renan, Xinema	Otolith Shape Analysis in Groupers from Different Southern Gulf of Mexico Habitats
11:45-12:00	Rincón-Sandoval, Luis A*	Effect of Hook Size and Bait Size on the size at Catch of the Red Grouper (Epinephelus morio) in Coastal Waters of the Yucatan Peninsula, Mexico
12:00-12:15	Galindo-Cortes, Gabriela	Variations in Recruitment Levels of Red Grouper (Epinephelus morio) at the Bank of Campeche during 1980-2016
12:15-12:30	Enriquez-Hernandez, Elsa I.	The Status of the Groupers Major Fishing Resources in the North of the Mexican Caribbean, Based Upon Simple Indicators
12:15-14:00	**Lunch**	

Lunch **BIOPAMA - From knowledge to action for a Protected Planet. The Biodiversity and Protected Areas Management (BIOPAMA)** Programme will be hosting a lunch session to share the programme's goals and objectives for the next 6 years. BIOPAMA is an initiative of the ACP Group of States and is funded by European Union under the 11th EDF.

CONCURRENT WORKSHOP

CLME+ Meeting (14:00- 17:00) Ecosystem Approach of Key Fisheries including flying fish, spiny lobster, shrimp, and groundfish in the CLME+ region. Hosted by: *the Project Coordination Unit of the UNDP/GEF CLME+ Project*

TECHNICAL SESSIONS

Socio-economic and Governance, *Moderator: Patrick McConney (Sponsored by GCFI)*

14:00-14:15	Botto-Barrios, Darlin	Towards Adaptive Co-management of Small-Scale Marine Fisheries in Colombia: Study Cases - Taganga and Tumaco
14:15-14:30	Coronado, Eva	Toward the Generation of a Governability Index for Small-scale Fisheries: The Case Study of Yucatan Peninsula, Mexico
14:30-14:45	Duarte, Luis Orlando	Towards the Management of the Artisanal Trawl Fishery in the Caribbean of Colombia: Local Ecological Knowledge and Participatory Learning
14:45-15:00	Wade, Eric*	Property Rights in Fisheries Management: The Case of Belize's Managed Access Program
15:00-15:15	Villanueva, Raúl	Distributional Performance of a Small-scale Lobster Fishery Managed Under a TURF Scheme
15:15-15:30	Vidal-Hernández, Laura	Network Analysis of the Fishing Product Trade: An Alternative Method for Governance of Rural Fisheries — The Yucatan Sea Cucumber Case (Mexico)
15:30-15:45	Garza-Lagler, Christina	The Analysis of Market Structures in the Fisheries Organizations of the Coast of Yucatan, Mexico
15:45-16:00	Cardenas, Sandra	Cross-Border Fishing in the Gulf of Honduras

16:00-16:15 **Coffee Break**

Socio-economic and Governance, *Moderator: TBD; (Sponsored by GCFI)*

16:15-16:30	Sidman, Charles	Opportunities to Strengthen Co-Management of Caribbean Offshore FAD Fisheries
16:30-16:45	Montes, Nancy	Perceived Impact of FAD Development Programs on the Livelihoods of Caribbean Offshore Fishers
16:45-17:00	Sadusky, Heather*	A Guide to Managing Fish Aggregation Devices (FADs) in the Caribbean
17:00-17:15	García-Moliner, Graciela	Participation of Women in GCFI
17:15-17:30	Aldana Aranda, Dalila	GCFI Space for the Leadership of Women Scientists?

Fishers forum — Gladden Memorial Award (GMA). *Moderator: Will Heyman (Sponsored: GCFI; NOAA and Shell)*

17:30-17:50	Heyman, Will	Introduction to Fisheries for Fishers (F4F) initiative, and the 2017 Gladden Memorial Award (GMA)
17:50-18:00	Lay, Mitchell	Closing

19:30 **Informal Reception & Welcome Address, Robert Glazer, Executive Director, GCFI**

Tuesday, November 7

TECHNICAL SESSIONS

GCFI-SEAC Symposium on Acoustic Technologies to Improve Reef Fish Ecosystem Surveys *Moderators: Bill Michaels and Chris Taylor. (Sponsored by: NOAA and GCFI)*

08:00-08:30	Michaels, William	Developing a Strategic Initiative to Transition Technologies into Operations for Improving Reef Fish Ecosystem Surveys
0815-08:30	Nealson, Pat	Hydroacoustic Tools for Monitoring Shrimp Distribution, Movement, and Behavior in Natural and Built Environments
08:30-08:45	Binder, Benjamin	An Integrated Approach to Develop in situ Target Strength – Length Relationships for Atlantic Goliath Grouper (Epinephelus itajara) on Coastal Reefs
08:45-09:00	Landero Montserrat *	Using Acoustic and Optical Methods in Fish Spatial Distribution Assessment

09:00-09:15	Lebourges-Dhaussy, Anne	Underwater Acoustics for Ecosystem Research: Current Advances and Perspectives in Northeast Brazil
09:15-09:30	Martinez Clavijo, Santiago	Acoustic Assessment of Bathymetry, Bottom Types and Characterization of Ichthyofaunal Community in Shallower Waters of Serrana Key Island, Biosphere Reserve Seaflower, Colombia
09:30-09:45	Rowell, Timothy*	Coupling Echosounder and Hydrophone Surveys at Spawning Aggregations: Relationships Between Levels of Fish Sound Production and Density
09:45-10:00	Schärer-Umpierre, Michelle	Coupling Passive Acoustic Techniques to Survey Fish Spawning Habitats in Puerto Rico
10:00-10:30	**Coffee Break**	
10:30-10:45	Cherubin, Laurent	Implementation of a Passive Acoustic Monitoring Systemon a SV3 Wave Glider and Applications
10:45-11:00	Silva, Lina Marcela	Acoustic Assessment of Zooplankton Biomass in the Coast of Magdalena, Colombian Caribbean
11:15-11:30	Pyc, Cynthia	Monitoring the Soundscape of Paradise Reef, Cozumel: A Tool for Assessment and Conservation Planning
11:30-11:45	Taylor, Chris	Overview of the GCFI-SEAC Acoustic Workshops for Building Scientific Capacity to Improve Reef Fish Ecosystem Surveys
11:45-12:30		Wrap up and group questions.
12:30-14:00	**Lunch**	
14:00		**Fishers field trip:** *(Sponsored by Fishing Cooperatives of Yucatan)*

TECHNICAL SESSIONS

Marine Protected Areas (MPAs) Science and Management. , (UNEP-CEP-SPAW/CaMPAM, GCFI). *Moderator:* Georgina Bustamante

14:00-14:15	Ramirez, Silia	Network of Recovery Areas in the Caribbean Guatemala as a Tool for Management and

		Conservation of Marine and Coastal Resources and Ecosystems
14:15-14:30	Fulton, Stuart	The Troika of Fishers, Government and Academia: Improving the Likelihood of Success in Fish Spawning Aggregation Conservation in the Mexican Mesoamerican Reef
14:30-14:45	Doyle, Emma	An Update on Marine Protected Area Management Capacity in the Caribbean, 2011-2017
14:45-15:00	Aguilar-Perera, Alfonso	Rapid Resilience Assessment Protocol Reveals Good Coral Reef Conditions in the Parque Nacional Arrecife Alacranes, off the Northern Yucatan Peninsula, Mexico
15:00-15:15	Appeldoorn, Richard	Incorporating Deep Mesophotic Coral Ecosystems into MPA Planning
15:15-15:30	Cobian Rojas, Dorka	Strategies and Regulations for a Sustainable Development of Tourism in the Marine-coastal Area of the Guanahacabibes National Park
15:30-15:45	Espinosa Andrade, Noemi*	Protecting Reefs with High Structural Complexity Benefits Fish Biomass in the Mexican Caribbean
15:45-16:00	Maldonado, Andres	Ambassadors Fishing with Science for Ecosystem Management
16:00-16:15	**Coffee Break**	

Marine Protected Areas (MPAs) Science and Management. (UNEP-CEP-SPAW/CaMPAM, GCFI). *Moderator:* Martha Prada

16:15-16:30	Newball, Casimiro	Guardians of Marine Protected Areas, an Effective Conservation Strategy
16:30-16:45	Baldeo, Roland	Minimizing Fisher Impact on the Coral Reef at the Moliniere Beausejour MPA Through Sustainable Livelihood Initiatives:Case Study from the ECMMAN Project, Grenada
16:45-17:00	Ramdeen, Robin	How Do We Adapt Stakeholder Engagement for Effective Ocean Planning in the Caribbean? A Case Study of the Waitt Institute's Stakeholder Engagement Toolkit

17:00-17:15	Prada, Martha	Evaluation of the CaMPAM Marine Protected Areas Database and its Relevance for Application of EBM Concepts and Tools
17:15-17:30	Flower, Jason	Data-limited Marine Spatial Planning: Generating Maps of Priority Conservation Areas in Montserrat

19:00-21:00 **POSTER SESSION with Cocktails and Snacks** *Hosted by GCFI* (Sponsored by GCFI) *Poster session Coordinators: (TBD)*

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

Poster Number	Author	Title
1	Aguilar-Perera, Alfonso	Marine Introduced Species in the Southern Gulf of Mexico and Mexican Caribbean: A Checklist
99	Anariba, Jorge	Fisheries Management Technology Tools - Lessons, Challenges and Opportunities
2	Arias-Aleman, Leonardo	Caribbean Marine Atlas: Technological Platform as Information Repository to Support Integrated Coastal Management and Ecosystem-based Management for the Region
85	Arkam, Salim	Characterization of Cultivable Bacteria Associated to the Coral Porites astreoides in Guadeloupe Island and Demonstration of the Metabolic Activity of Isolated Strains
86	Asencio, Claudeth	Determination of Location and Dimension of Escape Windows for Traps Used in the Fishery of Blue Crab (Callinectes sapidus) in the Ciénaga Grande de Santa Marta, Colombian Caribbean
70	Ávila Méndez, Emmanuel	Metazoan Parasites of Euthynnus alletteratus (Osteichthyes: Scombridae) in the Central Coast of the State of Veracruz, Mexico
87	Avendaño Álvarez, Otilio	Biomass Estimates of Common Octopus Octopus vulgaris in the Continental Shelf of Yucatan
39	Ávila Turriago, Laura Maria*	Satellite Telemetry of Sea Turtles from the Colombian Caribbean

100	Bonilla Anariba, Sara Esther	Fishing Styles in the Caribbean Sea of Honduras
4	Bouchon, Claude	Mapping of the State of Health of the Coral Communities of Martinique Island (Lesser Antilles)
78	Brito-Manzano, Nancy Patricia	Evaluation of the Content of Heavy Metals in Water, Sediment, and the Oyster Crassostrea virginia of Lagoon Mecoacán, Tabasco
79	Brito-Manzano, Nancy Patricia	Density Effects on the Survival of the Juvenile Conch “Tote” Pomacea flagellata Under Laboratory Conditions in Tabasco, Mexico
23	Bustamante, Georgina	Combining Grant Awarding with Technical Assistance and Training and to Build Capacity of Marine Protected Areas in the Caribbean: The Case of the CaMPAM-ECMMAN Small Grant Program
24	Bustamante, Georgina	A Transatlantic Initiative Supports Exchanges Among Regional Networks of Marine Protected Managers Around the World and CaMPAM is at the Forefront
46	Butkowski, Drew	Coordinating Lionfish Removal Efforts Using a Publicly Accessible Web Map
48	Caballero, José Adán	Risk Map of the Lion Fish Invasion in the Mexican Caribbean
3	Cannon, Abigail*	The Influence of Simulated Green Turtle Grazing, on Benthic Community Composition, Seagrass Productivity, and Stingray Foraging in a Highly Runoff-influenced Environment
101	Cervera-Pacheco, Regina	Fishermen Perspectives on the Fishery Ban of Red Grouper Epinephelus morio (Teleostei: Epinephelidae) in Sisal, Yucatan, Mexico
80	Chávez Villegas, Jose Francisco	Effect of Ocean Near-future Predictions During Larval Period of the Queen Conch (Strombus gigas)
30	Chavez, Ernesto A.	Towards a Sustainable Exploitation of the Caribbean Fisheries
81	Chong, Fabiola*	Hormone Cycle in Strombus (Lobatus) gigas (Linneo, 1758)

82	Chong, Fabiola*	Relation Between Hormonal Cycle and Gonadic Stages of Strombus pugilis (Linneo, 1758)
49	Cobián Rojas, Dorka	Diversity of Native Reef Fish Communities in Two Protected Areas in the Caribbean Sea and its Relationship to the Invasive Lionfish
102	Compton, Sanya	A Participatory Process for Formulating a Protocol on the Small-Scale Fisheries Guidelines
103	Compton, Sanya*	National Intersectoral Coordination Mechanisms (NICS): Marine Resources Management through Effective Integrative Governance
104	Cordero Romero, Salvador	Socioeconomic Factors and Risk Perception of Sea Cucumber Migrant Harvesters in the Yucatan, Mexico.
105	Coronado, Eva	Characterization of Small-scale Fisheries of the Yucatan Peninsula, Mexico: Complexity and Management Challenges
57	Cox, Amy M.	Does Unoccupied Microhabitat Patch Size Affect Early Post-Settlement Demographics in a Coral Reef Fish?
83	Cruz-Marrero, Wilmelie	Comparing Divers and Camera Sled Surveys for Assessing Queen Conch Abundance in Puerto Rico
58	Cuervo, Carlos*	Temporal Changes in the Functional and Taxonomic Diversity of the Colombian Caribbean Sea Demersal Fish Community
106	D'Cuire, Emilio	Governance of Marine Resources Through Integrated Fisheries Management
84	Delgado, Gabriel	Arrested Sexual Development in Queen Conch (Strombus gigas) Linked to Abnormalities in the Cerebral Ganglia
107	Dorantes González, Miguel Angel	Characterization of the Shark Market in the Southeast of Mexico
68	Dove, India	Evaluating the Recovery of a Nassau Grouper (Epinephelus striatus) Spawning Aggregation

		via Length-frequency Analysis from Underwater Laser Caliper Video
124	Dromard, Charlotte R	Ways of Transfer of an Organochlorine Pesticide Along Marine Tropical Food Webs
59	Ellis, Katherine	Comparative Diet and Trophic Ecology of Red Snapper (Lutjanus campechanus), Vermillion Snapper (Rhomboplites aurorubens), and Blackfin Snapper (Lutjanus buccanella) in the Northwestern Gulf of Mexico
5	Falcetta, Marcos Francesco	Promoting Ecosystem-based Management in the Caribbean: A Regional Pilot-template in the Dominican Republic
17	Fletcher, Pamela	Expanding the Collection and Use of Climate Data in the Caribbean
50	Fogg, Alexander	Lion King: Invasive Lionfish (Pterois sp.) Agonistic Behavior Observations
108	Francis, Calliste	Their Own Co-management of Offshore FAD Fisheries in Grenada
71	Franks, James	Fishes Collected in Association with Pelagic Sargassum in the Northcentral Gulf of Mexico During Surveys Conducted by the Gulf Coast Research Laboratory, 1999-2008; 2010-2011: A Checklist
31	Galindo-Cortes, Gabriela	First Estimations of Maximum Sustainable Yield of Main Finfish Fisheries Caught on the Coast of Veracruz: A Simple Catch-based Approach
40	Garcia Alvarado, Pedro Alberto	Evaluation of the Satellite Transmitters' Behavior Using ARGOS System Used for Tracking Marine Turtles
6	Garcia, Nepsis*	Monitoring of Herbivorous Fish in Coral Ecosystems of the Dominican Republic Using the Guidelines from the Global Coral Reef Monitoring Network (GCRMN), 2017
51	García-Rivas, María Del Carmen	Spatial and Temporal Differences Related to Age, Habitat and Predatory Strategies in Lionfish

52	Gittings, Stephen	Involving Fishing Professionals in Lionfish Trap Evaluation
19	Gomez-Rodriguez, Santiago	Trophies, Fecundity and Markets for Animal Parts: An Economic Case Study of Pristis spp. Extinction and Some Conservation Policy Solutions
36	González Pabón, María De Los Ángeles	Changes in the Abundance and Fishing Effort in the Gulf of Salamanca during Different Stages of Development of Coal Port Operations
88	Guarneros Narváez, Paulina Valerai	Spatio-temporal Distribution of Octopus maya by Age
37	Guéné, Mathilde	Contamination of Scleractinian Corals by Microplastics in Guadeloupe Island (Lesser Antilles)
60	Gutiérrez Estrada, Diana Leticia	First Results on the Study of the Bite Process of the American Mero Epinephelus morio Using a Biomechanical Model
7	Harvey, Michael	Identifying Key Biodiversity Areas for Marine Vertebrates in the Greater Caribbean
25	Hernández-Landa, Roberto Carlos	Composition of Parrotfish (Labridae: Scarinae) in the Parque Nacional Arrecife Alacranes, Southern Gulf of Mexico
42	Hoffmayer, Eric R.	Movement and Habitat Use of Whale Sharks (Rhincodon typus) Tagged in the Northern Gulf of Mexico
26	Horsford, Ian	Preliminary Results of a Fishery Independent Trap Survey of Marine Reserve and Fishing Areas on the South Coast of Antigua
109	Huchim Lara, Oswaldo	Risk Perception of Diving Among Small-scale Fishers: A Qualitative Risk Assessment
110	Ishida, Mitsuhiro	Fisheries Co-management Rules and Regulations: Toward Caribbean Fisheries Co-management Project
72	Jáuregui Romero, Guiomar Aminta	Genetic Variability Evaluation of the Caretta caretta and Chelonia mydas, from Mitochondrial DNA, Nororiental Sector Colombian Caribean

111	Jiménez Badillo, Ma. De Lourdes	Capacity Building in Fishing Communities of the Gulf of Mexico
73	Johnson, Donald	Some Effects of Hurricanes on Ichthyoplankton in the Upper Mixed Layer
8	Kimball, Justine	NOAA's National Coral Reef Monitoring Program: Integrated Ecosystem Monitoring and Reporting in U.S. Coral Reef Areas to Inform Conservation and Management
9	Labbouz, Lucie	Improving Long-term Coral Reef Monitoring in the Wider Caribbean region: GCRMN-Caribbean Accomplishments for 2016
124	Puga Millán, Rafael	A Multi-institutional Approach to Bio-economic Fishery Models in Cuba
10	Lapointe, Brian	Macroalgal Blooms in the Belize Barrier Reef Complex: Evidence of Long-Term Nutrient Enrichment
61	Lockhart, Kathy	Evaluation of the Local Trends in the Spatial and Temporal Variation of Hogfish – Lachnolaimus maximus, in South Caicos, Turks and Caicos Islands, BWIs
112	Lopéz Quiroga, Oscar Gustavo*	Rubia, Ocyrus chrysurus Capture by the Artisanal Fishery in Antón Lizardo, Veracruz, México
89	Lopez-Rocha, Jorge A.	Habitat Preference of Sea Cucumber Isostichopus badionotus (Selenka, 1867)
96	Macal-López, Karina	Food Habits of Hogfish Lachnolaimus maximus (Perciformes: Labridae) from the North Coast of Yucatan, Mexico.
18	Maharaj, Ravi*	Exploring Factors Determining the Sensitivity of Reef Fish Assemblages to Ocean Warming
21	Maldonado-Bandala, Rocío	Vulnerability of Critical Habitats of Green (C. mydas) and Hawksbill Turtles (E. imbricata) to Oil Activity in the Southern Gulf of Mexico
62	Margolis, Sarah	Historical Reconstruction of Red Snapper (Lutjanus campechanus) Size-at-Age
69	Martinez-Soto, Kayla	Egg Morphometrics and Fertilization Rates from Recovering and Unexploited Populations:

		Nassau grouper and Tiger grouper in the Cayman Islands
113	McConney, Patrick	Perils of Partnership
53	Meiners-Mandujano, Cesar	Diet Composition of Lionfish (Pterois volitans) in the Veracruz Reef System, Southwestern Gulf of Mexico
41	Mexicano-Cintora, Guadalupe	Technical Performance of Satellite Transmitters on Female Sea Turtles in the Gulf of Mexico and Caribbean Sea
27	Nava, Gabriela	Consolidation of a Coral Restoration Community Group in the National Park Reefs of Xcalak
22	Nava, Gabriela	Changes in Coral Cover, Coral Size Distribution, and Fish Density in Reef Restoration Sites of the Mexican Caribbean
11	Nuñez Vallecillo, Mayra	Biological Baseline for Fishing Replenishment Areas in the Honduran Caribbean
114	Ochoa, Mariela	Financial Sustainability of the Fishing Replenishment Zones of Guanaja, Bay Islands
63	Olaya-Nieto, Charle,W.	Reproductive Biology of Striped Mojarra Eugerres plumieri (Cuvier, 1830) in the Cordoba Caribbean Sea, Colombia
54	Olsen, David	A Note on Lionfish Removals in St. Thomas/St. John, U.S. Virgin Islands
28	Olson, Jack*	The Mona Island MPA 13 Years After No-take Designation: Testing the NEOLI Paradigm
12	Ortiz Oyola, Daniel Stiven	Structure and Functioning of the Trophic Web of Gulf of Salamanca, Colombian Caribbean
115	Ortiz-Rodriguez, Rafael	Towards a Participatory Management Model Through an Advisory Fishery Council: The Case of the Gulf Corvina in the Gulf of California
116	Oviedo-Romero, Vanessa	Fishing Operations Characterization of a Mixed Fleet: Case Study at Sisal, Yucatan, Mexico
43	Palafox-Juárez, E. Betzabeth	Density and Spatiotemporal Distribution of Sea Turtles on the Yucatan Shelf, Mexico

118	Paramo, Jorge	Contributions to the Diversification of Artisanal Fisheries in the Marine and Coastal Area of the Department of Magdalena, Colombian Caribbean
90	Peraza-González, Enrique E.	Evaluation of Energy Efficiency in the Process of the Brown Sea Cucumber in Yucatán
44	Peterson, Mark	The New Gulf and Caribbean Research-GCFI Partnership: A Peer-reviewed, Open Access Option for Publication of GCFI Manuscripts
91	Pharo, Devon	The Effects of Hard-bottom Habitat Degradation on the Ecology and Biology of the Florida Stone Crab Menippe mercenaria from the Florida Keys
45	Thigpen, Robert	Why Teach Fundamental Marine Conservation Concepts in Schools in Mayan Fishing Communities Using Maya (Yucateco) as the Language of Instruction?
92	Poot-Salazar, Alicia	Processing of Sea Cucumber on the Coast of Yucatan and Its Implications on the Fishery Management
123	Popa, Daniel	Healthy Fisheries Need Healthy Fishermen: An Overview of the Work-related Health Problems of the Artisanal Diving Fishermen of Yucatan, Mexico
64	Pozos Carré, Daniel Augusto*	Helminth Parasites of Lutjanus campechanus (Poey, 1860) in the Central Zone of the State of Veracruz, Mexico
74	Ramírez Gonzalez, Alma Rosa*	Metazoan Parasites of Sardinella aurita (Clupeiformes: Clupeidae) in the Central Coast of the State of Veracruz, Mexico
32	Ramirez, Argiro	Direct Assessment of Biomass, Spatial Distribution, and Current State of Southern Pink Shrimp Fishery (Farfantepenaeus notialis) in the Colombian Caribbean
14	Raynor, Chanel	Is Mangrove Restoration Worth the Effort?
33	Renan, Xinema	Sagittae Morphology of Economically Important Fishes from Southern Gulf of Mexico

75	Rios-Fuentes, Yunuen Gisell	Intestinal Parasitic Helminths of Some Sharks in the Central Coast of the State of Veracruz, Mexico
93	Rodriguez Gil, Luis Alfonso	Output and Conversion Factors Obtained from the Dehydration Process in Yucatan, Mexico Sea Cucumber
15	Rodriguez-Medina, Karla	Potential Distribution of Mangrove Communities in Mexico Using Correlative Niche Models
28	Romero, Eli	"Boat to Boat" a MPA management approach to increase stakeholder involvement from fishing communities in Northern Belize
47	Sabido Itza, Miguel Mateo	Density and Size of Lionfish and its Relationship with Environmental and Ecological Variables in Coral Reefs of Mexican Caribbean
119	Salas, Silvia	How Small-scale Fisheries in the Yucatan Peninsula Have Evolved? Expert Eye's Perceptions
76	Sanchez, Suleyma	First Contributions of the Oceanographic Aspects in the SAR, "El Blanquizal", Xcalak, Quintana Roo, Mexico, through in situ Observations
13	Santos Martinez, Adriana	Dinámica de la Pesca Artesanal Entre los Años 2004 a 2016 en el Área de Influencia de la Isla de San Andrés, Reserva de Biosfera Seaflower, Caribe Colombiano
94	Santos-Valencia, Josefina	Variations in Recruitment and Spawning Stock Biomass of the Red Octopus (Octopus maya) in the Yucatan Peninsula during Fishing Seasons 2007-2016
95	Shivlani, Manoj	Developing a Fishery Management Plan for the Bahamas Spiny Lobster Fishery
55	Sweeney Tookes, Jennifer	Commercial Fishermen's Willingness to Harvest Lionfish: A Multi-disciplinary Analysis of the Potential Supply in the US Virgin Islands

117	Smyrnios, Panos	Driving Market Demand Toward Sustainable Seafood Products
120	Tamura, Minoru	Overview of Caribbean Fisheries Co-management Project
97	Tello Cetina, Jorge	Use of Melanin from Octopus maya from Yucatan as Antibacterial Agent
65	Tobón Villatoro, Sergio	Diet Composition of Yellowtail Snapper, Ocyurus chrysurus (Bloch, 1971) Captured by the Artisanal Fishery of Antón Lizardo Veracruz, México
45a	Thigpen, Robert	Fundamental Marine Conservation Concepts Should be Taught in Fishing Communities Using Native Languages as the Language of Instruction
66	Towne, Ian	Evidence of Variable Growth Rates in Hogfish (Lachnolaimus maximus) Depending on Reef Tract
121	Uribe Cuevas, Mariana	Spatial Behavior and Profile of the Small-scale Fleet Catches in Yucatán, México
34	Vallès, Henri	A Preliminary Analysis of Marine Fishery Catches Along Southeast Haiti
56	Vanegas González, Maria Juliana	State of the Invasion of Lionfish Pterois volitansin the Continental Caribbean Colombian Coast, Nationwide Monitoring
67	Vargas Charris, Olga Cecilia*	Temporal Variability of Ecological Descriptors in the Demersal Fish Community of the Caribbean Sea of Colombia
38	Vargas-Facón, Perla	Determination of Cd, Pb, and Zn in the Oyster Crassostrea virginica from Carmen Lagoon, Tabasco, México
77	Velez, Sebastian*	Juvenile Population Dynamics of Families Lutjanidae and Serranidae in the Northern Gulf of Mexico, with Respect to the Loop Current and other Hydrographic Features
98	Villegas-Hernández, Harold	Selectivity, Abundance, and Density of Males and Females of Callinectes sapidus on the Coast of Yucatan

35	Wakida-Kusunoki, Armando T.	Shrimp Fishery Bycatch in the Bay of Campeche. Is it a Problem?
122	Weinstock, Stacey*	What are the Factors Affecting Trip Satisfaction for the For-hire Industry in South Carolina in relation to the Black Sea Bass bag limit?
16	Wims, Thomas	Innovative Technologies Used for Ocean Observing

2nd Gender in Fisheries Special Session

19:30 – 19:32	Martha Enriquez Díaz (Mistress of Ceremonies)	Welcome and opening remarks
19:32 – 19:35	Maria Pena (CERMES)	Introduction to the Gender in Fisheries Team (GIFT) initiative
19:35 – 19:55	Shelly-Ann Cox (CERMES)	GIFT theatrical presentation
19:55 – 20:00	Esther Alonzo (Director, Gender Commission, Yucatán Government)	Esther Alonzo (Director, Gender Commission, Yucatán Government) Gender agenda of the Yucatán government
20:00 – 20:05	Ruby Bentacourt (Former Head, Ministry of Fisheries)	Direction of fisheries policies in the Yucatán
20:05 – 20:10	Lilia Frías (President, Cooperative Society)	Opportunities and limitations of women in fisheries in the Yucatán
20:10 – 20:15	Dalila Aldana Aranda (Cinvestav)	12 Leading Ladies in Fisheries in the Yucatán 2018 calendar launch
20:15 – 20:30	All Leading Ladies	*All Leading Ladies Calendar signing and photo opportunity*

20:15-21:00	**Special POSTER SESSION: Gender in Fisheries [Sponsored by GCFI] (Moderators – Maria Pena and Dalila Aldana Aranda)**	
1	Boné Morón, Eduardo	Women's Contributions to Sustainable Fisheries in Mexico, Cuba and the World

2	Frangoudes, Katia	Why and How Do Fisherwomen Build Their Own Organization?
3	Gender in Fisheries Team (GIFT)	Developing Practical Solutions to Issues Faced by Working Women in the All-female Central Fish Processors Association (CFPA) in Barbados
4	Gavaldon, Ana	Gender and fisheries in a changing world: the coast of Yucatan in Mexico
5	Grant, Sandra	Women in Fisheries Forum (WIFF) in Belize: Promoting Gender Equality and Equity in Fisheries
6	Simmons, Bertha	Caribbean Small-Scale Fisherwoman Learning Exchange in Costa Rica: Women's Voices
7	Dalila Aldana Aranda	GCFI an Opportunity Institution for Women Scientists

Specially invited guests:

- Aicela Beatriza Rosado Martínez, Dirección de apoyo a la Mujer y grupos vulnerables
- Graciela Garcia-Moliner, Former Chairperson, GCFI
- Nancy Brown-Peterson, Chairperson, GCFI
- Esther Alonzo, Directora Comisión de Género Gob. Yucatán
- Ana Pech, Empresaria Pesca
- Lilia Frías, Presidenta Sociedad Cooperativa
- Ruby Bentacourt, Delegada de Pesca
- Aicela Beatriza Rosado Martínez, Dirección de apoyo a la Mujer y grupos vulnerables

Wednesday, November 8

TECHNICAL SESSIONS

Marine Animal Movement Ecology in the Wider-Caribbean ***(****Moderators: Dr. Sue Barbieri and Jorge Brenner****)*** *(Sponsored by TNC and GCFI)*

8:00-8:15	Barbieri, Sue and Jorge Brenner	Session Overview Presentation
8:15-8:30	Uribe-Martínez, Abigail	Spatial Features of Sea Turtle Post-nesting Migrations and Core Use Areas in the Southern Gulf of Mexico and Caribbean Sea
8:30-8:45	Gallego-Fernandez, Sandra. A.	Under the Sea Surface: Sea Turtles Diving Behavior

8:45-9:00	Moncada, Felix	North Coast of the Cuban Shelf: A Migratory Corridor for Sea Turtles in the Caribbean Sea Region
9:00-10:00	**MEETING OF THE GCFI MEMBERSHIP (Everyone is welcome - Learn about GCFI)**	
10:00-10:15	**Coffee break**	
	Marine Animal Movement Ecology in the Wider-Caribbean ***(****Moderators: Dr. Sue Barbieri ans Jorge Brenner****)*** *(Sponsored by TNC and GCFI)*	
10:15-10:30	Ortuno Crespo, Guillermo	Advancing Area-Based Planning and Network Approaches in Areas Beyond National Jurisdiction: A Global Review of Data on Connectivity for Migratory Marine Animals
10:30-10:45	Alvard, Michael	Identifying Patch Types Using Movement Data from Artisanal Fishers from the Commonwealth of Dominica
10:45-11:00	Cerutti-Pereyra, Florencia	Spotted Eagle Ray Aggregations in the Mexican Caribbean Using Citizen Science and Photo-identification – A Base Line Study
11:00-11:15	Cuevas, Eduardo	Review of Satellite Tracking Efforts of Two Sea Turtle Species from Southern Gulf of Mexico
11:15-11:30	Bassos-Hull, Kim	Movement Patterns of Spotted Eagle Rays (Aetobatus narinari) Along Southwest Florida and in the Gulf of Mexico
11:30-11:45	Heidmann, Sarah*	Migration of Mutton Snapper (Lutjanus analis) Between Home Range Areas and Spawning Aggregation Sites in the US Virgin Islands
11:45-12:00	Szedlmayer, Stephen	Mortality Estimates for Red Snapper, Lutjanus campechanus, Based on Acoustic Telemetry and Conventional Tagging in the Northern Gulf of Mexico
12:00-12:15	Stock, Brian*	Mapping Fine-scale Dispersal of Nassau Grouper (Epinephelus striatus) Eggs from a Spawning Aggregation with a Novel Plankton Imaging System

12:15-12:30	Biggs, Christopher*	Spatial Distribution, Habitat Associations, and Periodicity of Spotted Seatrout (Cynoscion nebulosus) Spawning in South Texas

12:30-14:00 **Lunch Break**

14:00 **Field trips:**

a) Dzibilchaltún is a great Maya city that is only 15 km. from Mérida. Cost $ 10.00/ person

b) A world-class museum celebrating Maya culture, the Gran Museo del Mundo Maya (Great Museum of the Mayan World). Cost $ 5.00/ person.

19:30-21:00 **CINEFISH** *Moderator:* ***Fadilah Ali and Luis Rodriguez-Gil*** *(Sponsored by GCFI)*

Thursday, November 9

CONCURRENT WORKSHOP:

Best practices for acoustic surveys in reef fish ecosystems (08:00- 17:00) *Hosted by:* ***Gulf and Caribbean Fisheries Institute (GCFI) and SouthEast Acoustic Consortium (SEAC), with sponsorship from the National Oceanic and Atmospheric Administration (NOAA), Kongsberg-Simrad, and Echoview***

TECHNICAL SESSIONS

Innovative technologies and tools to support implementation of Ecosystem-Based Management" (EBM) and the "Ecosystem Approach to Fisheries" (EAF) in the CLME+ region. *Chair: Moderator: Andrea Salinas. Sponsored by CLME+ and GCFI)*

8:00-8:15	Patrick Debels	Session Overview Presentation
8:15-8:30	Posada, Juan M.	Development and Use of Applications for the Promotion of Responsible Fishing and Consumption, and the Strengthening of Governmental Management for the

		Conservation of Coastal Marine Resources: The Experience of Fundación Marviva
8:30-8:45	Laurent, Yann	Innovative Approaches in Support to Fisheries Management and Stock Assessment Systems
8:45-9:00	Mallalieu, Kim	Marine Communications Range Analyzer and Data Observatory for Small-scale Fisheries
09:00-09:15		Group questions
09:15-09:25	Lopez, Jorge Alberto	Clima Pesca: Climatic Information at the Service of the Regional Fisheries and Aquaculture Sector
09:25-09:35	Wright, P.W.	Leveraging IT to Counter IUU Fishing and Improving SAR Operations
09:45-09:55	Pittman, Simon	Decision Support Tool for the Prioritization of Coral Reefs in the U.S. Virgin Islands
09:55-10:05	Manjarrés Martínez, Luis	Colombian Fisheries Statistical Service (SEPEC): A Computer Platform for the Integrated Management of Fishery Resources
10:05-10:15	McDonald, Will	Using Sunlight and Cell Networks to Bring New Management Tools to Small-scale Fisheries
10:15-10:30	Sfeir, Alfred	Innovative Electronic Monitoring Applications for Rural Small-scale Fishing Vessels in Caribbean
10:30-10:45		Wrap up and group questions.
10:45-11:00	**Coffee Break**	
	Lionfish Research *(Moderators: Joanna Pitt) (Sponsored by GCFI, FWC)*	
11:00-11:15	Hasenei, Aaron	Environmental Physiology of Lionfish (Pterois volitans and Pterois miles) Metabolic Systems: Are There Physiological Limits to Inshore Invasion?

11:15-11:30	Bustos-Montes, Diana	Reproductive Aspects of the Invasive Lionfish in Taganga Bay, Colombian Continental Caribbean
11:30-11:45	Acero, Arturo	Feeding Habits of Pterois volitans: A Real Threat to Caribbean Coral Reef Biodiversity
11:45-12:00	Simnett, Skyler	Consumer Demand for Lionfish : A Multi-disciplinary Analysis of the Potential for a Lionfish Market in the US Virgin Islands
12:00-12:15	Sanjuan-Muñoz, Adolfo	Assessment of the Impact of Lionfish on Coral Reef Fish Community in the Colombian Caribbean
12:15-12:30	Candelmo, Allison	Vertical Movement and Site Fidelity of Lionfish (Pterois volitans) Along a Deep Reef Wall Using in situ Acoustic Telemetry
12:30-12:45	Cambronero-Solano, Sergio*	Taxonomic Positioning and Isotopic Niche Characterization of Lionfish Species Complex (Pterois volitans/miles) in the South Caribbean, Costa Rica

12:45-14:00 **LUNCH**

12:45–14:45 **GCFI BOARD OF DIRECTORS MEETING**

TECHNICAL SESSION

Reefs and Associated Ecosystems: Lobster and other Invertebrates. *Sponsored by GCFI; Moderator:*

14:00-14:15	Lockhart, Kathy	Evaluation of the Status of the Panulirus argus (Spiny Lobster)from 2004 through 2017 in the Turks and Caicos Islands
14:15-14:30	Hernández Millán, Martha Beatriz	Fisheries Assessment of the Spiny Lobster (Panulirus argus) in Xcalak Reefs National Park, Mexico
14:30-14:45	Ríos Lara, Gloria Verónica	Co-management in the Mitigating Impact of Sea Cucumber Fishery on the Lobster Fishery of Yucatan Coast, Mexico

14:45-15:00	Olsen, David	A Study of the Virgin Islands Spiny Lobster Fishery: Growth, Population Size and Mortality
15:00-15:15	Hutchinson, Emily	Catch of Postlarval Caribbean Spiny Lobster (Panulirus argus)Using Witham Collectors May Under Represent Peaks in Monthly Recruitment and Limit Assessment of Annual Trends
15:15-15:30	Tewfik, Alexander	Examining Caribbean Spiny Lobster Size at Maturity Using Yellowtail Snapper -related Structures in Belize
15:30-15:45	Behringer, Donald	What Toll does PaV1 Exact from the Caribbean Spiny Lobster Population?
15:45-16:00	**Coffee break**	

Reefs and Associated Ecosystems: Conch other Invertebrates. *Sponsored by GCFI; Moderator: LeRoy Creswell*

16:00-16:15	Medina-Quej, Alejandro	Current Situation of the Pink Snail (Lobatus gigas), Implications for its Fishery Management in the South of Mexican Caribbean
16:15-16:30	García-Rivas, Carmen	Queen Conch Restoration Program in the Biosphere Reserve Banco Chinchorro
16:30-16:45	Joseph, Allena	An Assessment of Conch Morphology on the Island of Saint Lucia and Possible Future Management Implications
16:45-17:00	Brito-Manzano, Nancy Patricia	Temporal Variations in the Development, Growth, and Survival of the Larvae of Queen Conch Strombus gigas Under Experimental Cultures
17:00-17:15	Andreze-Louison, Ruby	Influence of the Age of Female Strombus (Lobatus) gigas on Fertility and Larval Development Rates
17:15-17:30	Santana-Flores, Pablo*	Reproductive Strategies of Strombus (Lobatus) gigas

17:30-17:45	Feunteun, Ellen	Determine the Queen Conch Strombus (Lobatus) gigas Home-range During the Reproductive Period

Banquet Reception: Yucatecan Dinner at Hacienda Ya-axka, Merida Yucatan. Cost $20.00 per person

Friday, November 10

TECHNICAL SESSIONS

Reef fish ecosystem: Demersal fisheries. *Sponsored by GCFI Moderator:*

8:00-8:15	Stewart, Laura	Comprehensive approach in assessing release mortality of targeted and non-targeted reef fishes in the Gulf of Mexico
8:15-8:30	Antoni, Luca	A First Assessment of Genome Wide Genetic Variation and Population Structure in Queen Triggerfish, Balistes vetula
8:30-8:45	Noh Quiñones, Virginia*	Reproductive Cycle and Sizes of First Maturity and Sexual Inversion of Hogfish, Lachnolaimus maximus, from the southern Gulf of Mexico
8:45-9:00	Paramo, Jorge	Community Structure of a New Potential Deep-sea Resource of Commercial Importance in the Colombian Caribbean Sea
09:00-09:15	Keller, Elizabeth*	Relationships Between Habitat and Fish Assemblages on Louisiana-Texas Shelf-edge Banks
09:15-09:30	Galvez, Guillermo Antonio	Economic Valuation of Mangrove Fisheries and Their Current Status
09:30-09:45	Ferreira da Silveira, Mariana*	Temporal Changes in a Small-scale Artisanal Reef Fishery in Brazil: Management Efficiency and Technological Transformations
09:45-10:00	Mayorga Martínez, Melissa	Potential Distribution of Mesophotic Coral Ecosystems at the Veracruz Reef System National Park

10:00-10:15	Jiménez Sosa, Maria de Lourdes*	Spatial Variation in the Composition of Fish Species Caught with Bottom Longline in Coastal Waters of the Northern Peninsula of Yucatán, México
10:15-10:30	**Coffee break**	
10:30-10:45	Beyea, Taylor	A Remote Video Survey of the Coral Communities from Deep Water Mesophotic Reef Habitats in the Northern Gulf of Mexico
10:45-11:00	Giro Petersen, Ana	The 2017 Mesoamerican Reef Report Card Measures Increasing Fish Biomass and Reef Health over the Last Decade

Reef Fisheries and Spawning Aggregations. *Sponsored by GCFI; SCRFA*
Moderator: Martin Russell

11:00-11:15	Sadovy, Yvonne	Aggregations as a Proxy for Changes in Abundance in a Threatened Reef Fish, the Nassau Grouper
11:15-11:30	Erisman, Brad	Tradeoff Analysis of the Conservation and Fisheries Benefits of Temporal Closures in a Spawning Aggregation Fishery
11:30-11:45	Waterhouse, Lynn*	Comparing Management Actions and Assessing Trends in Populations of Reef Fish That Form Spawning Aggregations in the Caribbean
11:45-12:00	Pitt, Joanna	Managing Fish Spawning Aggregations in a Changing Climate: A Case Study of Red Hind (Epinephelus guttatus) in Bermuda
12:00-12:15	França, Aline*	Mutton and Dog Snappers (Lutjanus analis and Lutjanus jocu) Spawning Aggregations in the Brazilian Northeastern Continental Shelf: Identification and Validation
12:15-12:30	Zayas Santiago, Carlos M.*	Use of Open Accelerometer Tag to Detect Grouper Courtship Associated Sounds: A Pathway to Spawning-Stock Size Determination

CONCURRENT WORKSHOP: Too Big to Ignore (TBTI) Meeting (08:00- 12:30)

08:30-10:15	SESSION 1: The big questions about sustainability and viability of small-scale fisheries in Latin America and the Caribbean. **Session chair**: Maria Pena (CERMES, West Indies)	
10:30-12:30	SESSION 2: Implementing the Small-Scale Fisheries Guidelines in Latin America and the Caribbean: What will it take? **Session chair:** Silvia Salas (CINVESTAV, Mexico)	
12:30-14:00	**Lunch**	
	TECHNICAL SESSION	
	Pelagic and Recreational Ecosystem Fisheries. *Sponsored by GCFI; Moderator: James Franks*	
14:00-14:15	Keyes-Pulido, Shasta	A Multi-criteria Spatial Analysis to Determine Shark Species at Risk in the Gulf of Mexico
14:15-14:30	Sosa-Nishizaki, Oscar	The Use of Tagging Data and Ecological Niche Models to Establish the Baseline of Pelagic Fish Vulnerability to Deep Oil Spills in the Mexican Portion of the Gulf of Mexico: The Yellowfin Tuna Case
14:30-14:45	Altamar, Jairo	Optimal Mesh Size for the Capture of Serra Spanish mackerel (Scomberomorus brasiliensis) with Artisanal Gillnets in the Colombian Caribbean
14:45-15:00	Robinson, Kelly	Predictions of the Presence of Coastal Pelagic Fishes off Georgia, USA, from Local Oceanographic and Biological Conditions
15:00-15:15	Garza-Gisholt, Eduardo	Understanding Visual Ecology of Sharks and the Possible Use in Bycatch Reduction Devices
15:15-15:30	Moncrief, Trevor	Tails n' Scales: Use of an Innovative Reporting System for Red Snapper (Lutjanus campechanus) Management in Mississippi
15:30-15:45	Nembhard, Nadine	Mobile Applications for Fishermen: Catching ICT at Sea and On the Road

Concurrent Sessions:	**Too Big to Ignore (TBTI) Meeting (14:00- 16:00)**
14:00-15:45	SESSION 3: Is "transdiciplinarity" an answer to the wicked problem in small-scale fisheries governance? **Session chair:** Maria Jose Espinosa (COBI, Mexico)

15:45-16:00	**Coffee Break**	

TECHNICAL SESSION

Climate Change. *Sponsored by GCFI: TBD*

16:00-16:15	Monnereau, Iris	Vulnerability of the Caribbean Fisheries Sector and Identification of Appropriate Adaptation Pathways to Counter Climate Change Impacts in the Eastern Caribbean
16:15-16:30	Johns, Elizabeth	The Role of Surface Wind Forcing on the Movement and Distribution of Sargassum in the North Atlantic Ocean and Caribbean Sea
16:30-16:45	Johnson, Donald	Pelagic Sargassum in the North Tropical Atlantic: Mortality, Growth and Seasonal Prediction

STUDENT AWARD PRESENTATIONS

17:00-17:50		Presentation of the Ron Schmied Scholarship Presentation of the GCFI Outstanding Student Achievement Awards. Presentation of SCRFA Award
18:00	**CLOSING CEREMONY**	

ABSTRACTS

Feeding Habits of *Pterois volitans*: A Real Threat to Caribbean Coral Reef Biodiversity

Habitos Alimentarios de *Pterois volitans*: Una Verdadera Amenaza para la Biodiversidad de los Arrecifes Coralinos

Habitudes Alimentaires de *Pterois volitans*: Une Menace Réal a la Biodiversite des Recifs Coralliens au Caraibes

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ABSTRACT

Lionfish has been successfully established in Caribbean waters and many research efforts have focused in deepening our knowledge of its biology. The deleterious consequences on ecosystem balance, mainly at trophic levels, due to this invasion have been widely discussed in the last decade. With the aim of contributing to the goal of gathering information about its ecology, 3380 stomachs of lionfishes, fished in several Colombian Caribbean localities, were examined between 2011 and 2017. Stomach content examination revealed 92 different items included in 28 fish families, 20 crustacean families, and one mollusk family. Coinciding with what has been previously reported, main fish families used by lionfish as food are Pomacentridae, Labridae, and Haemulidae, while the main crustacean families are Penaeidae and Portunidae. Several cryptic species, hard to observe in visual censuses, have been found in stomach contents, such as the crustacean families Euganatonotidae and Majidae, as well as juveniles of the fish species Lutjanus synagris and Fistularia sp., as well as octopus (*Octopus* sp.). The important presence of the hovering goby Coryphopterus personatus is alarming, since it was just declared by the IUCN as a Vulnerable species due to lionfish predation.

KEYWORDS: Trophic ecology, Colombian, Caribbean, biological invasion

Marine Introduced Species in the Southern Gulf of Mexico and Mexican Caribbean: A Checklist

Especies Marinas Introducidas en el Sureste del Golfo de México y Mar Caribe Mexicano: Un Listado de Verificación

Les Espèces Marines Introduites dans le Sud du Golfe du Mexique et les Caraïbes Mexicaines: Un Liste de Contrôle

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ABSTRACT

The number of introduced species in the marine environment has increased due to, among other factors, high demand in fisheries, aquaculture, and aquarium trade. Introduced species become invasive when they reach a widespread distribution and pose an environmental risk. The World Register of Introduced Marine Species recognizes about 1,844 species as alien or non-indigenous, but it is difficult to determine how introduced species become invasive and which is the damage inflicted to the environment. Various terms are used interchangeable referring to invasive species, such as non-indigenous, alien, introduced, invasive etc., but these terms may not mean the same. In Mexico, research has been concentrated mainly on invasive species in terrestrial and freshwater environments, with less attention devoted to marine species. In this work, we reviewed scientific databases and scientific journals (indexed in JCR) for publications using terms such as introduced, invasive, alien, or non-indigenous, for marine species in the southern Gulf of Mexico (off Tamaulipas, Veracruz, Tabasco, Campeche and Yucatan) and the Mexican Caribbean (off Quintana Roo). We built a checklist of 23 marine species (algae, jellyfish, coral, amphipod, shrimp, and fish) with potential of being invasive and discussed possible or null effects of their introduction.

KEYWORDS: Invasive species, Yucatan, introduced species, Mexico, Mexican Caribbean

Rapid Resilience Assessment Protocol Reveals Good Coral Reef Conditions in the Parque Nacional Arrecife Alacranes, off the Northern Yucatan Peninsula, Mexico

El Protocolo de Evaluación de Resiliencia Rápida Revela Buenas Condiciones del Arrecife Coralino en el Parque Nacional Arrecife Alacranes, Norte de la Península de Yucatan, México

Un Protocole Rapide D'évaluation de la Résilience Révèle de Bonnes Conditions de Récifs Coralliens dans le Parque Nacional Arrecife Alacranes, au Large de la Péninsule Nord du Yucatan, au Mexique

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ABSTRACT

A rapid coral reef resilience assessment protocol was implemented in 2016 in the Parque Nacional Arrecife Alacranes (PNAA), off the northern Yucatan Peninsula, Mexico, in the southern Gulf of Mexico. Trained diver teams surveyed 18 reef sites in the PNAA, completing 72 surveys from September to October 2016. Coral reef conditions in surveyed sites were considered in good condition, with high live coral cover and low macroalgal levels. Coral bleaching was low in the PNAA at a time when regional forecasts indicated high likelihood of bleaching in the southern Gulf of Mexico. Grouper (Epinephelidae) abundance was low but that of snappers (Lutjanidae) was higher, although with variable fish size classes across the marine protected area. We recommend implementing management strategies in the PNAA to increase coastal resilience via enforcement planning with partners, targeted outreach/education to build compliance, coral bleaching response, monitoring of visitation, water quality monitoring and further bio-physical monitoring. The coral reef resilience protocol was successfully used for the first time in PNAA and proved efficient to rapidly describe coral reef condition and provide an initial assessment of resilience in a remote protected area where frequent and in-depth coral reef monitoring can otherwise be challenging.

KEYWORDS: Yucatan Peninsula, Alacranes Reef, coral reef, reef resilience, Mexico

¿GCFI — Espacio para el Liderazgo de Mujeres Científicas?

GCFI Space for the Leadership of Women Scientists?

¿GCFI — C'est une Space pour les Femmes Scientiques?

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RESUMEN

El GCFI es una institución creada en 1947 con el objetivo de promover el intercambio de información sobre el uso y manejo de los recursos marinos del Golfo y el Caribe, con la participación de más de 80 países de los sectores científico, gubernamental y comercial.

Desde 2015 esta institución ha creado una sección especial de Género, donde se analizó la participación de las mujeres en las pesquerías. En este trabajo, se analiza el papel de las mujeres científicas participantes en el GCFI, tomando como criterio de liderazgo que sea primer autor en los proceedings del GCFI. Se analizaron los volúmenes 23 al 43 (1970 a 1990 y los volúmenes 65 al 69 (2012 al 2016). Un cuarto de siglo después de la creación del GCFI (1973, vol. 26), es donde se registra por primera vez a una científica como primer autor en este Instituto. En 1981, se tiene la primera contribución de una académica Latinoamericana (Mexicana). De 2012 a 2016 se presentaron un total 1 158 trabajos; el 43 % corresponde a mujeres como primer autor. En 2015 se registró la mayor participación de académicas (45%) y en 2012 la menor (39 %). Académicas de 34 países han participado como primer autor, el país con mayor participación de mujeres es Estados Unidos (27 %), seguido de México (16%) y Colombia (12%). En los proceedings del GCFI, académicas de 85 instituciones han sido primer autor. Las instituciones con mayor participación de académicas: Universidad Nacional de Colombia (2012), la NOAA (2013), Lousiana State University (2014), Oregón University y CINVESTAV-IPN (2016). Las científicas trabajan principalmente con peces (65 %) y moluscos 11.76 %.

PALABRAS CLAVES: GCFI, science, women empower

Tamaño Óptimo de Malla para la Captura de Carite (*Scomberomorus brasiliensis*) con Redes de Enmalle Artesanales en el Caribe Colombiano

Optimal Mesh Size for the Capture of Serra Spanish mackerel (*Scomberomorus brasiliensis*) with Artisanal Gillnets in the Colombian Caribbean

Grandeur Optimal de L'ouverture des Maille pour la Capture de Thazard Tacheté du Sud (*Scomberomorus brasiliensis*) avec Filets Artisanale dans les Caraïbes Colombiennes

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RESUMEN

El carite es uno de los principales recursos pesqueros capturados con redes de enmalle artesanales en el Caribe colombiano. A pesar de su importancia pesquera y el elevado nivel de explotación, actualmente no existen medidas de manejo orientadas a la regulación de los artes de pesca que lo capturan. A partir de información biológico-pesquera colectada en los desembarcos procedentes de distintos artes de pesca, se determinaron las relaciones morfométricas entre la circunferencia máxima (Gmax) y circunferencia de captura (Gc) vs longitud total (Lt); estos parámetros fueron determinados considerando los puntos de referencia biológicos L50 y L90-100 los cuales corresponden a 50 y 62 cm, respectivamente. La estimación del tamaño óptimo de malla se calculó según el principio de similaridad geométrica de Baranov. La relación entre Gmax vs Lt y Gc vs Lt, fueron determinadas por medio de una regresión lineal que respondieron a las ecuaciones: Gmax = 0,3759 (Lt) + 0,0766 y Gc = 0,3379 (Lt) + 1,4687. El tamaño de malla óptimo estimado para L50 fue 7,5 cm que comercialmente equivale a 3 pulgadas y 9,4 cm para L90-100 que comercialmente equivale a 4 pulgadas. En la actualidad el 72,6 % de las redes utilizan tamaños de mallas menores a los estimados, obteniendo un 86 % de individuos inmaduros en las capturas. Las pesquerías artesanales con redes de enmalle en el Caribe colombiano son multiespecíficas, por lo tanto se requiere generar este tipo de insumos para las principales especies capturadas y mediante una estrategia de "sombrilla", es decir, que mediante el mayor tamaño de malla estimado se puedan formular medidas de manejo basadas en el control del arte de pesca que a su vez contribuyan a maximizar el aprovechamiento sostenible de los recursos pesqueros capturados con redes.

PALABRAS CLAVES: Relaciones morfométricas, red de enmalle, tamaño de malla, *Scomberomorus brasiliensis*

Identifying Patch Types Using Movement Data from Artisanal Fishers from the Commonwealth of Dominica

Identificación de Tipos de Parches Usando Datos de Movimiento de Pescadores Artesanales del Commonwealth de Dominica

Identification des Types de Patchs à Partir des Données de Mouvement des Pêcheurs Artisanaux du Commonwealth de Dominique

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ABSTRACT

We collected movement data from GPS devices placed on 44 fishing trips originating from the fishing village of San Sauveur, on the east coast of the Caribbean island nation of the Commonwealth Dominica. Behavioral observations of the trips were made simultaneously. Our larger goal is to understand how property rights are emerging after the introduction of fish aggregating device (FAD) technology in 1999. FADs are human-made structures anchored to the ocean floor and designed to float on or near the surface, attract fish, and facilitate their capture. We used the tracking data and a cumulative sum method to examine movement during the fishing trips to distinguish travel segments from segments of area-restricted search (ARS) when fishers are exploiting patches. ARS is generally defined by a decrease in speed and an increase in sinuosity of movement, in contrast to the faster, more directed movement associated with travel. We validated the method by ground truthing the GPS data with the behavioral observations confirming that the model can clearly discern travel from ARS at patches. We correctly identified as patches all the visits to FADs recognized by the on-board observers. In addition to the FADs, we also identified other non-FAD patch segments. We develop a machine learning model and use expert knowledge to teach a Classification and Regression Tree (CART) analysis how to discern FADs from these other patches. The analysis can correctly discern FAD patches from others in 97% of the cases.

KEYWORDS: Movement, fishing, FAD patches, methods

Fisheries Management Technology Tools - Lessons, Challenges and Opportunities

Herramientas Tecnológicas de Gestión Pesquera - Lecciones, Retos y Oportunidades

Outils Technologiques de Gestion des Pêches - Leçons,Ddéfis et Opportunités

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ABSTRACT

In 2013, DIGEPESCA stablished a collaboration agreement with the Centre of Marine Studies (CEM) with the purpose of facilitating the modernization of the registration systems meant for the control and inspection of the fishing sector of the country. Since then, CEM has developed an online system to take on the General Fisherman Registry (RGP according to its Spanish acronym), which has progressively grown since its piloting in 2014. From 2015 on, regular improvements on the RGP have enabled to suit national license demands, reflected in an increase of 1,169 registries in 2015 to 3,510 for 2016. Nowadays, the app "Ourfish", which links with the RGP via a QR code printed in the licenses it issues, created to monitor fisheries by means of a mobile device, is being rolled out to serve as an electronic logbook aimed for merchants of fishery products acquired from small-scale fishermen. At present, there are twenty users, among fishmongers and fish collection centers, registering their daily transactions for several months now.
Nevertheless, the development of these applications has been considerably challenging, as it was not taken into account the magnitude and reality of the country at the time of its design. This has resulted in setbacks in both its use as in the analysis of the resulting data, to which CEM is providing a solution through the renovation of its underlying structures and platforms. These improvements will allow in the short-term and along the coastal and insular Atlantic zone of the country the deployment of the Ourfish app in at least 50 small-scale seafood-marketing centers. Such endeavor will generate the inflow of thousands of data on fishery production to the system, which will be possible to visualize for fisherman as for national public authorities via an online dashboard.

KEYWORDS: Society, marine, government, innovation, digital

Influencia de la Edad de Hembras de *Strombus* (*Lobatus*) *gigas* en la Tasa de Fecundidad y Desarrollo Larvario

Influence of the Age of Female *Strombus* (*Lobatus*) *gigas* on Fertility and Larval Development Rates

Influence de L'âge de la Femelle de *Strombus* (*Lobatus*) *gigas* dans le Taux de Fecondité et Developpement Larvaire

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RESUMEN

Le lambi, *Strombus gigas* c'est une espèce qui se trouve à la base des réseaux trophiques. Par conséquent, elle constitue une source d'alimentation pour de nombreuses espèces. Par ailleurs, elle joue un rôle important dans l'équilibre des herbiers (Tewfik 2014, Stoner 1989). Elle occupe une place importante dans l'économie de la pêche, étant donné qu'elle représente la seconde pêcherie d'importance économique de la Caraïbe. Les répercussions du changement climatique sur la reproduction et calcification de ces larves, c'et un facteur négative de plus qui vient s'ajouter au problem de recuperation de stock de ce especе sur exploitée. Ainsi face à la raréfaction de la ressource, il est important de mettre en place des plans de gestion adaptés et efficaces. Dans cette optique, il est nécessaire de comprendre la dynamique de la population, ce qui passe par une acquisition de connaissance sur la reproduction de l'espèce. A cet égard, un paramètre important à prendre en compte est la fécondité. Influencée par des facteurs environnementaux et les contraintes morphologiques de l'organisme, elle est directement liée au cycle de vie de l'espèce (Remiz-Llodora 2002, Chamber 1989). L'objectif de l'étude suivante est de comprendre l'influence de l'âge de la femelle sur la fécondité, la qualité des œufs et la qualité larvaire.

PALABRAS CLAVES: Reproduction, females, age, fertility, larval development

A First Assessment of Genome-wide Genetic Variation and Population Structure in Queen Triggerfish, *Balistes vetula*

Un Primer Balance de Genoma Amplio Variación y Población Estructura Genética en Reina Triggerfish, *Balistes vetula*

Une Première Évaluation de la Variation Génétique a L'échelle du Génome et de la Structure des Populations de Baliste Royal, *Balistes vetula*

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ABSTRACT

The queen triggerfish is an economically important Balistidae exploited commercially in the Caribbean region for local food markets and the ornamental trade. The species is reported to have declined in several parts of its range yet essential data for its management and conservation such as information on stock structure and demography are still lacking. In this work, the double-digest Restriction Site Associated DNA (RAD) sequencing method was applied in a survey of genetic variation among six geographic populations including offshore Southeast Florida, St Croix, St Thomas, the East and West coasts of Puerto Rico, and La Martinique Island in the Lesser Antilles. A total of 3,177 Single Nucleotide Polymorphism (SNP) loci were examined with sample size per locality averaging 71 individuals (range 48-85). An outlier analysis did not detect loci undergoing significant divergent selection. Allele frequencies were homogeneous among localities with a weak isolation-by-distance pattern. Estimates of the dispersal parameter sigma were over 657 km suggesting long distance dispersal is occurring consistent with the extended duration of the pelagic larval phase in this species. These findings suggest a strong contribution of non-local spawning stocks on recruitment through pelagic transport at early life stages leading to concerns over the sustainability of southern populations.

KEYWORDS: Queen Triggerfish, *Balistes vetula*, stock structure, genetics, RAD sequencing

Incorporating Deep Mesophotic Coral Ecosystems into MPA Planning

Incorporación de Ecosistemas de Coral Profundo Mesofóticos en la Planificación de AMP

Incorporer les Écosystèmes de Corail Mésophotiques Profonds dans la Planification de l'AMP

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ABSTRACT

Mesophotic coral ecosystems (MCEs) are those light-dependent benthic communities extending from 30m potentially to 150 m in clear waters. Increasingly, MCEs have been the focus of study as technology has improved and shallow coral ecosystems have degraded. Deep MCEs (DMCEs), defined here as 50m and deeper, are a less extensively studied component, typically located along the slopes of island platforms, banks and seamounts. Results of a multi-disciplinary, multi-year and multi-site study to characterize DMCEs suggest that spatial planning and MPA design should incorporate these areas to achieve management and conservation goals. DMCEs can be highly developed, but such areas are patchily distributed, with geomorphology and sedimentation being important controlling factors. These DMCEs are highly diverse but represent unique species assemblages relative to shallow reefs. They also serve as important habitat for threatened or overfished species, such as turtles, sharks and large groupers. For fishes, there is a high degree of critical connectivity between DMCEs and shallow reef habitats, including mangrove/seagrass nursery areas. Yet, despite their greater depth and distance from shore, DMCEs are still susceptible to anthropogenic threats such as land-based sources of pollution, deep ocean outfalls, cable access and overfishing. Strong vertical connectivity mandates that DMCE protected areas be linked to shallow reef MPAs. The patchy distribution of DMCEs offers a challenge to managers, as their greater depth makes their specific distribution unknown. A higher probability of capturing DMCEs can be obtained by incorporating knowledge of the local geomorphology, choosing areas of higher slope (but not vertical) and rugosity that are sheltered from prevailing waves and shelf-based sources of sediment.

KEYWORDS:Mesophotic, coral ecosystems, marine protected sreas, vertical connectivity, fish communities, benthic communities

Atlas Marino del Caribe: Plataforma Tecnológica como Repositorio de Información para Soporte al Manejo Integrado Costero y la Gestión Basada en Ecosistemas de la Región

Caribbean Marine Atlas: Technological Platform as Information Repository to Support Integrated Coastal Management and Ecosystem-based Management for the Region

Atlas Marine des Caraïbes: Plateforme Technologiques pour Soutenir la Gestion Intégrée des zones Côtières et la Gestion Écosystémique de la Région

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RESUMEN

El Atlas Marino del Caribe trabaja en la operacionalización sostenible de una plataforma tecnológica digital en línea para la publicación de información geoespacial relevante que soporte el manejo integrado costero con especial énfasis en eventos naturales, cambio climático, biodiversidad, hábitats, pesquerías, fuentes de contaminación terrestre y manejo basado en ecosistemas para los grandes ecosistemas del Caribe. La plataforma se estructura fundamentalmente en la herramienta tecnológica de código abierto GeoNode, que consume y publica webservices enlazándolos a otras herramientas para visualización dinámica y usable de indicadores seleccionados (al menos 5) para la Región. Está implementándose para 12 países piloto interesados en ofertar su propia información geoespacial para consulta regional y nacional. La arquitectura tecnológica ofrece herramientas en línea para el almacenamiento y consulta de capas, mapas estáticos e interactivos, documentos asociados al contenido geoespacial, enlaces a otras fuentes de información del Caribe, noticias, calendario e indicadores que apuntan a contribuir al reporte nacional o regional de estrategias globales (Metas AICHI u Objetivos de Desarrollo Sostenible). La gestión de información promueve que a través de un Punto Focal Nacional, los países auto-gestionen su información bajo implementación de estándares y protocolos (metadato) acordes con la política de información. Colombia, como coordinación del proyecto brinda soporte, capacitación y ejerce control de calidad. Adicionalmente, el Atlas también sirve de repositorio de información espacial al proyecto hermano Caribbean Large Marine Ecosystems - CLME+, y además se vale de sinergias estratégicas con otras iniciativas (IODE) como SPINCAM, ICAN u OTGA. Posicionar el atlas como repositorio de referencia en el Caribe, es el reto.

KEYWORDS: Atlas, integrated coastal zone management, large marine ecosystem, Caribe

Characterization of Cultivable Bacteria Associated to the Coral *Porites astreoides* in Guadeloupe Island and Demonstration of the Metabolic Activity of Isolated Strains

Caracterización de las Bacterias Cultivables Asociadas al Coral *Porites astreoides* en la Isla de Guadeloupe y Puesta en Evidencia de la Actividad Metabólica de las Cepas Isoladas

Caractérisation des Bactéries Cultivables Associées au Corail Porites Astreoides en Guadeloupe et Mise en Évidence de L'activité Métabolique des Souches Isolées

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ABSTRACT

Cultivable bacteria associated to the coral *Porites astreoides*, a dominant species in the Caribbean reefs, was studied in order to characterize beneficial bacteria for its health. A total of 224 bacterial strains were isolated by microbial culture. P. astreoides cultivated bacteria showed a predominance of Vibrionaceae (associated with coral tissue and mucus) and Bacillus (associated with sediment and seawater around coral colonies). Metabolic tests (antibiogram and antimicrobial tests) were applied to these bacterial strains. Twenty-four of them presented a high sensitivity to four tested antibiotics (oxytetracycline, penicillin, streptomycin and ampicillin). In parallel, pure clones of Photobacterium rosenbergii (C91 and C70 strains), *Pseudomonas plecoglossicida* (C89 strain), and *Vibrio vulnificus* (F11 strain) inhibited the growth of *V. splendidus*, a pathogen of the oyster *Crassostrea gigas*, suggesting a possible synthesis of antimicrobial metabolites by these bacteria. These results are consistent with the coral probiotic hypothesis established by Reshef et al. (2006), as well as the recent term « Beneficial Microorganisms for Coral » proposed by Peixoto et al. (2017).

KEYWORDS: Marine bacteria, holobiont, coral, *Porites astreoides*, antimicrobial activity, coral health

Determinación de la Ubicación y Dimensión de Ventanas de Escape para las Nasas Utilizadas en la Pesquería de Jaiba (*Callinectes sapidus*) en la Ciénaga Grande de Santa Marta, Caribe Colombiano

Determination of Location and Dimension of Escape Windows for Traps Used in the Fishery of Blue Crab (*Callinectes sapidus*) in the Ciénaga Grande de Santa Marta, Colombian Caribbean

Détermination de L'emplacement et de la Dimension des Fenêtres D'échappement pour les Nasses Utilisés dans la Êche de Crabe Bleu (*Callinectes sapidus*) dans le Ciénaga Grande de Santa Marta, Caraïbes Colombiennes

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RESUMEN

La pesquería de jaiba de la Ciénaga Grande de Santa Marta es esencial para las comunidades aledañas. Sin embargo, una fuerte presión de pesca ha conllevado a una sobrepesca por reclutamiento. Un amplio rango de tamaños de jaibas es capturado con nasas incluyendo un alto porcentaje de individuos inmaduros. Se determinó la dimensión y ubicación de ventanas de escape para que puedan salir los tamaños no deseados. A partir de videos grabados con una cámara sumergible se estudió el comportamiento y los sitios de preferencia de la jaiba dentro de la nasa, luego se diseñaron y ubicaron las ventanas. El tamaño de las ventanas se estimó utilizando las siguientes relaciones morfométricas: Altura de la Base de la Espina Lateral (ABEL) vs Altura del caparazón y ABEL vs altura del cuerpo. Para establecer diferencias estadísticas entre las distribuciones de tamaño capturadas y la CPUE de nasas con o sin ventanas de escape se utilizó la prueba no paramétrica W de Mann-Whitney (Wilcoxon) para comparar las medianas. Los resultados de las relaciones fueron explicados mejor mediante una relación lineal según las siguientes ecuaciones: Lca = 0.5938*ABEL + 0.3102 y Alt = 0.3094*ABEL + 0.2934. El ABEL correspondiente a la talla de madurez se estimó en 63.3 mm. Se instalaron 4 ventanas rectangulares (21 mm de alto y 40 mm de largo), que fueron ubicadas en las esquinas inferiores. La estructura de tamaños capturada evidenció diferencias estadísticas ($p < 0.05$) mostrando una reducción de la captura de individuos inmaduros. Sin embargo, en términos de eficiencia en la captura no se presentaron diferencias entre las CPUE evaluadas. El uso extensivo de ventanas de escape en la pesca de jaibas podría favorecer la disminución de las tasas de capturas de individuos inmaduros y en consecuencia contribuir a la sostenibilidad de esta pesquería.

PALABRAS CLAVES: Relaciones morfométricas, nasas ventanas de escape, *Callinectes sapidus*

Biomass Estimates of Common Octopus *Octopus vulgaris* in the Continental Shelf of Yucatan

Estimaciones de Biomasa de Pulpo Común *Octopus vulgaris* en la Plataforma Continental de Yucatán

Estimations de la Biomasse du Poulpe Commun *Octopus vulgaris* de la Plateforme Continentale du Yucatan

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ABSTRACT

Mexico occupies the third place for the world's highest catches of genus Octopus, whit increases in the past decade. Since the first records of 5,000 tons in 1949, the catch rate of *Octopus vulgaris* has peaked to 10,000 tons in 2014. However, the rate of exploitation and the status of the stocks across the different regions in Mexico, is less known. In this regard, the present study aims to estimate, for the first time, the common octopus' biomass, abundance and distribution on the continental shelf of Yucatan. Data was collected from four research cruises, two before (May and July) and two after (December and January) the fishing season. The biomass was calculated using three different numerical models (swept areas, stratified and geostatistical). The results show low variability in potential biomass between models, these can be explained by the difference in the statistical assumptions of the abundance's distribution (regionalized and homogeneous). Abundance estimations were higher during July and December (>20 org/km^2), which coincides with the end of the recruitment period. On the other hand, lower abundances were estimated during May and January, probably due to the higher natural mortality rates associated with the Octopus short life cycle.

KEYWORDS: Benthic, Campeche Bank, biomass, cephalopod, fishery

Parasitos Metazoos de *Euthynnus alletteratus* (Osteichthyes: Scombridae) en la Costa Central del Estado de Veracruz, México

Metazoan Parasites of *Euthynnus alletteratus* (Osteichthyes: Scombridae) in the Central Coast of the State of Veracruz, Mexico

Métazoaires Parasites de *Euthynnus alletteratus* (Osteichthyes: Scombridae) sur L' État de la Côte Centrale de Veracruz, un Mexique

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RESUMEN

Se examinaron las branquias y tracto digestivo de 29 ejemplares de bonito *Euthynnus alletteratus* capturados por la pesca artesanal de Chachalacas, Veracruz. Las muestras se fijaron en formaldehído al 10% para su revisión en el laboratorio. Para el procesamiento del material biológico se aplicó la técnica parasitológica acorde al grupo de parásito encontrado. Se realizó la identificación y descripción taxonómica de los parásitos y se calcularon los parámetros ecológicos de prevalencia, abundancia e intensidad promedio de infección. La parasitofauna de *E. alletteratus* incluye 15 especies: cuatro monogéneos, tres trematodos, un acantocéfalo, dos nematodos y cinco copépodos. Se colectaron 776 parásitos metazoarios, de los cuales, los trematodos representan el 74.7%, seguido por los acantocéfalos con 13.7%. Todos los hospederos estuvieron parasitados con al menos un individuo, excepto uno que no registró parásitos. El mayor número de parásitos registrados en un hospedero fue de 342 individuos. El mayor número de especies se registró en un hospedero con seis especies. Los valores de prevalencia alcanzados por las especies de parásitos en este hospedero, establecen al monogéneo *Hexostoma euthynni* (69%) como la especie más ampliamente distribuida en la población de hospederos, a la vez que el trematodo Brachyphallus parvus (65.5%) y el acantocéfalo *Rhadinorhynchus pristis* (62%) son las más abundantes y de las que se registran las infecciones más intensas (27.2 ± 70.9 y 5.9 ± 5.8, respectivamente), por lo que podría considerárseles como las especies más importantes para este hospedero. El presente estudio mostró que los bonitos *E. alletteratus* están infectados por una rica fauna de metazoarios parásitos que parecen ser una herramienta prometedora para inferir información sobre la biología y ecología del hospedero.

PALABRAS CLAVES: Helmintos, Acantocephala, monogenea, digenea, Golfo de México

Telemetría Satelital de Tortugas Marinas desde el Caribe Colombiano

Satellite Telemetry of Sea Turtles from the Colombian Caribbean

Satellite Telemetry Tortues Marines de Caraïbes Colombien

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RESUMEN

La telemetría satelital, es una herramienta ampliamente utilizada para generar información de la ecología espacial de las especies migratorias y de sus posibles riesgos a nivel mundial. Gracias a la interacción de sus rutas trazadas con los ecosistemas presentes en los recorridos, dinámica oceanográfica y presiones antrópicas identificadas, se pueden establecer patrones de conectividad, junto a sus potenciales peligros. Por lo anterior, el Programa de Conservación de Tortugas y Mamíferos Marinos –ProCTMM y sus aliados, desde el 2009 iniciaron la implementación de transmisores en ejemplares de tortugas marinas que circundan el Caribe colombiano, con el propósito de describir los recorridos demarcados desde el país. Centrando los seguimientos en dos de las especies catalogadas en amenaza para la región y, enfocándose en los estadios juveniles, al evidenciarse los mayores vacíos de conocimiento durante esta etapa. A la fecha, se han introducido 5 individuos de Eretmochelys imbricata (LCC 31–76 cm; 21 y 697 días de transmisiones) y 2 de Caretta caretta, (LCC 25-48 cm; 9 -78 días de transmisiones), portando dispositivos rectangulares SPOT 5 y 6 respectivamente con sensores de temperatura. Las careyes mostraron una tendencia donde los juveniles tempranos, tomaron rumbos al oeste/noroeste a Centro América, mientras que los pre-adultos este/noreste al Norte de Sur América. Las caguamas optaron por recorridos más oceánicos con dirección noroeste, hacia las Antillas Mayores. La delimitación de los tramos obtenidos, contribuyen a la identificación de corredores biológicos para ambas especies, conectado áreas marinas protegidas y generando una línea base para que las autoridades competentes, formulen estrategias de manejo regional, que permitan la interconexión entre zonas de desarrollo, forrajeo y anidación en el Gran Caribe.

PALABRAS CLAVES: Transmisores, seguimiento, satelital, Carey Caguama, tramos, recorridos

Minimizing Fisher Impact on the Coral Reef at the Moliniere Beausejour MPA Through Sustainable Livelihood Initiatives: Case Study from the ECMMAN Project, Grenada

Minimiser L'impact de Fisher sur le Récif Au MPA de Moliniere Beausejour Grâce à des Initiatives de Moyens de Subsistance Durables: Étude de Cas du Projet ECMMAN, Grenade

Minimizar el Impacto de Fisher en el Arrecife en el MPA de Moliniere Beausejour a través de Iniciativas de Medios de Vida Sostenibles: Estudio de Caso del Proyecto ECMMAN, Grenada

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ABSTRACT

The Moliniere Beausejour Marine Protected Area (MBMPA) was one of the first MPAs to be legally declared by Grenada in 2001. The primary purpose of MBMPA is to provide a management framework to reduce user conflicts, as well as protect coral reefs and associated resources. The livelihood of the fishers who historically utilized the area were disproportionally affected given their low adaptive capacity due primarily to the lack of diversity in their source of income. The fishers were ill-equipped to take advantage of the increase in tourism activities that resulted from the designation of the MBMPA. Consequently, some of the fishers covertly resumed their fishing practices, which threatened to erode all the gains that had been made in restoring fish populations within the MPA. The Eastern Caribbean Marine Managed Areas (ECMMAN) Project through a 'sustainable livelihood' component, provided the Grenada Marine Protected Areas Program with the opportunity to develop a pilot project to equip fishers displaced by the designation of the MBMPA. The project aimed to generate alternative livelihoods within the tourism sector that best fitted their existing skillsets. As a result of this initiative, the fishers and community members are now more supportive of management measures in the MBMPA. This paper examines the successes, shortcomings and lessons learnt from the implementation of the ECMMAN Sustainable Livelihoods Program for fishers within the Moliniere Beausejour MPA, Grenada.

KEYWORDS: Sustainable livelihoods, marine protected areas, fishers, coral reefs

Movement Patterns of Spotted Eagle Rays (*Aetobatus narinari*) Along Southwest Florida and in the Gulf of Mexico

Los Patrones de Movimiento de los Rayos de Águila Manchada (*Aetobatus narinari*) a lo Largo del Suroeste de la Florida y en el Golfo de México

Motifs de Mouvements des Rayons D'aigle Tachetés (*Aetobatus narinari*) le Long du Sud-ouest de la Floride et dans le Golfe du Mexique

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ABSTRACT

The spotted eagle ray, *Aetobatus narinari*, is a large, wide-ranging benthopelagic ray found in coastal and estuarine ecosystems in the Atlantic, including the Gulf of Mexico and Caribbean Sea. Although this species is protected in Florida waters, it is targeted in fisheries in Mexico, Cuba, and Venezuela, causing concern for its conservation status due to decreasing population trends. Understanding movement patterns is crucial to determining the mechanisms of population structure in spotted eagle rays. Preliminary satellite and conventional tagging data indicate these rays are capable of extensive migrations. As part of an ongoing tagging study, some individuals have been recaptured over weeks to years in Sarasota, Florida, suggesting the species exhibits a degree of fidelity to the region. We acoustically tagged spotted eagle rays to examine fine-scale movements in and out of coastal estuaries along the eastern Gulf of Mexico, while also monitoring longer distance movements via collaborative acoustic telemetry networks (i.e., iTAG). During spring 2016 (n = 15) and 2017 (n = 9), 24 spotted eagle rays were fitted with Vemco V16 acoustic transmitters and monitored with acoustic gates covering inlet passes in Sarasota Bay. Most detections of study animals ranged from weeks to months in three passes and several tagged individuals were detected in collaborative network arrays up to 100 km away. All rays tagged in spring 2016 left the Sarasota Bay area when a harmful algal bloom (i.e., *Karenia brevis*) appeared in September 2016, with 8 of 15 rays returning in spring 2017. Understanding these movement patterns in relation to environmental factors is important for management of this species in the U.S. and neighboring countries.

KEYWORDS: *Aetobatus narinari*, spotted eagle ray, movement, tagging

What Toll does PaV1 Exact from the Caribbean Spiny Lobster Population?

¿Cuál es el Peaje de PaV1 de la Población de Langostas del Caribe?

Quelle Quantité PaV1 est-il Exact de la Population de Homards Espagnols?

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ABSTRACT

By their very nature, pathogens take a toll on their hosts. Of course, scientists and managers strive to know how much of a host population is lost to a pathogen, but that information can be elusive. Hence, mortality from pathogens is typically lumped together with other sources of natural mortality in population models. For pathogens without a measurable impact on their host or those that impact inaccessible life stages, there is little recourse, but for those that cause direct and measurable host mortality the situation may be different. With the Caribbean spiny lobster, we have a tractable system where we can access all life stages from pueruli to adults, all of which are susceptible to the pathogenic virus PaV1. We quantified the impact of PaV1 on the metamorphosis and survival of pueruli, and the survival of benthic juveniles of incremental size classes. We also determined the proportion of the juvenile population with subclinical infections (via qPCR) that eventually develop clinical and lethal infections, relative to those that remain subclinical indefinitely. Ultimately, these results will be tested in the Florida stock assessment model for the P. argus fishery to evaluate the effect of PaV1 on the stock assessment results.

KEYWORDS: Disease virus, *Panulirus argus*, fishery, spiny lobster

A Remote Video Survey of the Coral Communities from Deep Water Mesophotic Reef Habitats in the Northern Gulf of Mexico

Un Sondeo de Video-Remoto de las Comunidades de Corales en Aguas Profundas Mesofoticas de Habitats Arrecifales al Norte del Golfo de Mexico

Une Enquête Vidéo à Distance des Communautés de Coraux des Habitats Récifaux d'eau Profonde Mésophotique dans le Nord du Golfe du Mexique

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ABSTRACT

The Pinnacle reefs are deep water (60–110 m) natural rock reefs that project up to 20 m from the seafloor on the edge of the continental slope in the northern Gulf of Mexico. These mesophotic reef habitats are home to a diverse invertebrate and fish community. From September to October 2014, a stratified random ROV video survey was used to count and identify benthic invertebrate species from 3 reef types: low (0-3m), medium (4-10m) and high (>10m) vertical relief, and from 2 reef habitats: reef top and reef slope. Still photos taken from video transects were analyzed to obtain percent cover and density per m^2 of invertebrate species. The ahermatypic, heterotrophic benthic community is dominated by gorgonians, antipatharians, scleractinian corals, comatulid crinoids, and sponges. Mean total benthic percent coverage was 28.0%, with a maximum of 60.3% coverage. Primary taxa include Rhizopsammia manuelensis (mean: 4.9%), Antipathes atlantica (1.9%), Bebryce sp. (1.2%), Swiftia exserta (1.1%), and Nicella sp. (1.1%). Benthic community composition differed among reef relief types (PERMANOVA, Pseudo-F = 2.66, p = 0.002) with high relief reefs supporting greater abundances than low relief reefs (Z = -4.49, p < 0.0001). Benthic communities also differed between reef top and slope habitats (PERMANOVA, Pseudo-F = 8.87, p = 0.001). Environmental factors of depth, sedimentation, and geographical location also contributed to variance in community composition (RELATE, Rho = 0.36, p = 0.001). Total benthic percent cover was correlated with total fish abundance (r = 0.37, n = 140, p < 0.0001).

KEYWORDS: Mesophotic reef, coral community, ROV

Spatial Distribution, Habitat Associations, and Periodicity of Spotted Seatrout (*Cynoscion nebulosus*) Spawning in South Texas

Distribución Espacial, Asociaciones de Hábitat y Periodicidad del Desove de Seatrout Manchado (*Cynoscion nebulosus*) en el Sur de Texas

Répartition Spatiale, Associations D'habitats et Périodicité de la Multiplication du Truite de Mer à Pois (*Cynoscion nebulosus*) dans le Sud du Texas

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ABSTRACT

Spotted seatrout (*Cynoscion nebulosus*) are among the most sought-after fish by recreational anglers throughout the Gulf of Mexico. While information exists on the spawning season and reproductive biology for seatrout, little is known about the distribution of spawning sites in Texas. We lack knowledge about how spawning activity or fish abundances coincide with specific habitats (e.g. seagrass beds, oyster reefs, structures, navigation channels) or how they vary with changes in environmental conditions (e.g. salinity, temperature, depth). Male Seatrout produce unique sounds during spawning, which can be used to identify and monitor spawning sites. We used a combination of mobile and fixed hydrophones to monitor seatrout spawning within the Mission-Aransas National Estuarine Research Reserve and Corpus Christi Bay, Texas. In 2016, we observed large spawning aggregations at 176 of the 378 stations sampled. The distribution of spawning sites among habitat types (seagrass, mud/sand, channel, reef/structure) was proportional to those sampled ($\chi 2 = 2.91$, df = 3, $p = 0.41$). Salinity was greater at large aggregation sites than non-spawning sites ($W = 3071$, $p < 0.01$), but temperature was not significantly different. We are currently monitoring spawning activity and periodicity at 16 sites among 4 habitat types throughout the estuary. Preliminary results from the monitoring sites indicates daily spawning. This information will assist in the successful management of the fishery and can help to preserve or restore essential fish habitat within the estuary.

KEYWORDS: Reproduction, spawning aggregation estuarine hydrophone

An Integrated Approach to Develop *in situ* Target Strength – Length Relationships for Atlantic Goliath Grouper (*Epinephelus itajara*) on Coastal Reefs

Un Enfoque Integrado para Estimar la Fuerza del Objetivo *in situ* – Relaciones de Longitud para el Mero Guasa del Atlantico (*Epinephelus itajara*) en Arrecifes Costeros

Une Approche Intégrée Pour Développer Des Relations Ciblées *in situ* Sur La Force Et La Longueur Pour Le Atlantic Goliath Grouper (*Epinephelus itajara*) Sur Les Récifs Côtiers

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ABSTRACT

Hydroacoustic surveys represent a rapid non-invasive alternative to labor-intensive population assessments using traditional fisheries dependent and independent survey methods. While hydroacoustic surveys provide a wealth of information that can simultaneously address management and ecological questions at enhanced spatiotemporal scales, there are certain limitations that have made studying reef associated and diverse fish assemblages exceptionally challenging. Specifically, the taxonomic discrimination of a species using acoustic approaches requires a comprehensive understanding of their frequency-dependent scattering properties that can be logistically difficult to measure. Here we provide data related to this effort, and present an approach to derive *in situ* target strength-length relationships for Atlantic Goliath Grouper statistically derived from the comparison between laser-calibrated photogrammetry estimated length distributions and coincident in situ target strength distributions collected from spawning aggregations in Jupiter, Florida. With these data, improvements in estimates of abundance, density, and biomass can be used to augment information needed by resource managers and policy makers to inform management decisions. Additionally, these data provide a framework for the development of similar population assessment efforts related to data poor species that exhibit conspicuous aggregating behavior, similar to goliath grouper spawning. Lastly, considering the advances in available acoustic technologies and the logistical challenges associated with acoustically surveying complex habitats, it is imperative that we consider strategic survey designs that maximize data quality and scope.

KEYWORDS: Atlantic Goliath Grouper, *Epinephelus itajara*, hydroacoustics, length distribution

Contribuciones de las Mujeres para la Pesca Dustentable en México, Cuba y el Mundo

Women's Contributions to Sustainable Fisheries in Mexico, Cuba and the World

Contributions des Femmes pour la Pêche Durable au Mexique, à Cuba et dans le Monde

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RESUMEN

Las mujeres representan cerca del 50 por ciento de la fuerza laboral en las pesquerías globales (FAO, 2014). Miles de mujeres pescan, procesan, distribuyen, preparan y venden productos pesqueros en todo el mundo. Sin embargo, hay pocos datos a nivel regional y nacional sobre estas contribuciones. Frecuentemente, la participación de las mujeres en tomas de decisiones en manejo pesquero es limitada. Estos factores dificultan asegurar que las mujeres tengan acceso al recurso y cadena productiva pesqueros como medios para sustentar sus economías. El programa de Océanos de Environmental Defense Fund (EDF) trabaja en catorce países aplicando sistemas de diseño y manejo pesquero participativos llamados Manejo Basado en Derechos para lograr pesquerías sustentables y socialmente equitativas donde las mujeres juegan un papel primordial. Parte de este trabajo incluye documentar el papel de las mujeres en la pesca sustentable. En México, la campaña de EDF #YoSoyPesca documentó 43 historias de mujeres del sector pesquero, científico, político, académico, empresarial y gastronómico. Estas historias se hicieron llegar por varios medios de comunicación a un público de más de 200,000 personas. También se realizó el Foro Regional "El papel de la mujer en la pesca sustentable", con más de 110 mujeres de varios estados pesqueros. En Cuba, el proyecto SOS-Pesca debió parte de su éxito al componente de equidad de género que logró extender los beneficios al seno de las familias en dos comunidades pesqueras. Los logros incluyeron alternativas económicas como el desarrollo de cultivos artesanales de ostión de mangle, un taller de textiles y la exploración de una nueva pesquería de cangrejo. Con estos y otros ejemplos, EDF continuará fomentando pesquerías sustentables y equitativas en los países donde trabaja y resto del mundo.

PALABRAS CLAVES: Equidad género, mujer, pesca sustentable, Cuba, México

Fishing Styles in the Caribbean Sea of Honduras

Estilos de Pesca en el Mar Caribe de Honduras

Styles de Pêche dans la Mer des Caraïbes du Honduras

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ABSTRACT

The ongoing process of transition in the small scale fishery sector of Honduras, where social relations are changing in a complex process of commoditization, has given rise to new modes of fishing livelihood strategies. The "traditional" artisanal fishing household, which relies on family labor and is partially integrated into markets, is only one of the different modes of fishing livelihood strategy that exists today in the coastal zone of northern Honduras. For a general description of the various fishing livelihood strategies in Honduras, we distinguishes three ideal types of fishing styles: capitalist, entrepreneurial and artisanal fishing. The capitalist mode mainly involves large corporate/industrial fishing linked to the export model. Entrepreneurial farming is of smaller size, but has also a distinct market focus and a logic of financial and industrial capital integration. Artisanal fishing is primarily characterized by family labor and family-owned boats and means of fishing. However, in Honduras there is a large group of fishermen without their own means of fishing, who work as laborers on other boats and/or lease space on boats for subsistence fishing. This group of fishermen will be added to the list of ideal types. Because they are ideal types, in reality the difference between them is blurred, and we can expect overlapping spaces and interactions among the four livelihood strategies. The different livelihood strategies are a result of how fisher households experience the broader transition process, their strategy for adapting to the institutional context and their effectiveness at negotiating with other actors. It's common to find all the livelihood strategies coexisting within the same geographic area.

KEYWORDS: Fishing styles, livelihood strategies, artisanal fishing

Hacia la Cogestión Adaptativa de la Pesca Artesanal Marino-Costera en Colombia: Casos Estudio - Taganga y Tumaco

Towards Adaptive Co-management of Small-Scale Marine Fisheries in Colombia: Study Cases - Taganga and Tumaco

Vers la Cogestion Adaptative de la Peche Artisanal Marin et Côtière Colombie: Étude de Cas – Taganga et Tumaco

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RESUMEN

La teoría de los bienes comunes ha establecido la relevancia de los principios de éxito (PE) diseñados por Ostrom para las acciones colectivas. En el contexto colombiano, los PE surgen como herramientas para guiar la implementación del Co-manejo Pesquero Participativo (CPP), al facilitar la cogestión de los recursos pesqueros. Este estudio evaluó con pescadores artesanales el estado de los PE, con el fin de establecer los factores requeridos para implementar el CPP. Se tomaron como casos de estudio las comunidades de Taganga (costa Caribe) y Tumaco (Pacífica), reconocidas como pueblos dependientes de la pesca, que actualmente enfrentan una crisis socioecológica en un marco administrativo centralizado con tendencia a la implementación de políticas participativas. Se realizaron 16 grupos focales, uno para cada método de pesca principal, con la participación de 115 pescadores (Taganga: 28 y Tumaco: 87). Con los resultados se logró construir una visión comunitaria del estado de los 12 PE en cada comunidad, priorizando aquellos que los pescadores consideran se requiere trabajar inmediatamente. En ambas comunidades, se destaca la urgencia de: establecer límites biofísicos claros entre los usuarios del recurso (PE-1A), la participación de todos los actores (PE-3), e instituciones anidadas (PE-8). En particular, la comunidad de Tumaco considera prioritario trabajar en el monitoreo de los recursos (PE-4A) y de las normas (PE-4A). Además, se vislumbran oportunidades y conflictos futuros para la implementación del CPP en las comunidades. Este estudio permite evidenciar que las comunidades de Taganga y Tumaco no están preparadas para la implementación del CPP. No obstante muestran conocimiento y voluntad para superar las barreras que les impiden avanzar en el manejo de sus recursos pesqueros y enfrentar la tragedia de los comunes.

PALABRAS CLAVES: Co-manejo pesquero participativo pesca artesanal sistemas socio-ecológicos conocimiento ecológico local

Mapping of the State of Health of the Coral Communities of Martinique Island (Lesser Antilles)

Mapa del Estado de Salud de las Comunidades de Corales de la isla de Martinica (Antillas Menores)

Cartographie de L'état de Santé des Communautés Coralliennes de la Martinique (Petites Antilles)

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ABSTRACT

During the "Madibenthos" scientific mission organized by the National Museum of Natural History of Paris in Martinique, a mapping of the state of health of the coral communities of the island was carried out. That was done by a rapid estimation method of health status of coral communities which takes into account both the coral-algal phase shift and high sedimentation rate on the reefs. These two phenomena represent the main causes of degradation of the coral communities in the Lesser Antilles. Health status of benthic coral communities was divided in four classes (class 1: pristine reefs; class 2: still healthy reefs; class 3: damaged reefs; class 4: relictual coral assemblages. The work was carried out using direct observation by the authors, as well as by the examination of 8.980 photographs and 223 videos taken around the island by all the participants of the field trip. Data were consistent enough to establish the state of health for 268 sites around the island. Among them, 19 % were attributed to class 1, 17 % to class 2, 41 % to class 3 and 23 % to class 4. Depth did not present any significant influence. On the contrary, the reef communities situated on the windward coasts of the island were much more degraded than those located on the leeward coasts. This study has highlighted the urgency to improve the quality of the coastal waters around Martinique Island.

KEYWORDS: Caribbean coral communities, mapping, state of health, rapid assessment

Temporal Variations in the Development, Growth, and Survival of the Larvae of Queen Conch *Strombus gigas* Under Experimental Cultures

Variación Temporal en el Desarrollo, Crecimiento y Sobrevivencia de las Larvas del Caracol Rosado *Strombus gigas* Provenientes de Cultivos Experimentales

Variations Temporelles du Développement, de la Croissance et de la Survie des Larves de *Strombus gigas* dans des Cultures Expérimentales

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ABSTRACT

Larvae of *Strombus gigas* of egg masses from natural ovoposition were reared under laboratory conditions in one year during the reproductive season (from March to September) in Chinchorro Bank. Same types of rearing containers and techniques were employed. Egg masses are incubated for 3-5 days in 25-l containers, and cultured in 4-l containers. Larvae were fed with Tetraselmis suecica at a concentration of 1000 algal cells by millilitre, density of 200 larvae by litre, temperature of 29º ± 1º C and natural photoperiod. At hatching, the larvae from March, April, May and September cultures, presented 2 velar lobes, 1.5 shell whorls and right tentacle (1-3 days), whilst the June, July and August, developed 4 velar lobes, 2.0 shell whorls and right tentacle (1-3 days). The mean shell length at hatching was 300 ± 1.52 µm for all culture months. The development of proboscis, begin between 11 to 16 days, for June to August cultures and in 19-21 days for March, April, May and September cultures. Settlement was first observed at 27 days in larvae from June to August cultures (42%), for March, April, May and September cultures it was in 29 days in 29% of larvae. The maximum shell lengths have been obtained in August and September (908 µm both), whilst the minor was registered for April with 867 µm. The growth rate varied from 22.33 µm/day to 30.00 µm/day. With regard to survival, the percentages obtained in June and July (38%) were highest in relation to September values (20%). For the other months, survival was 22% for March culture, 34% in April, 37% for May, and 28% in August culture. The results obtained in this work, demonstrate that the development, growth and survival of the larvae from the intermediate months (June to August) from reproductive season was much better ($F = 4.01$, $p < 0.05$, Tukey < 0.01), that it in early and

KEYWORDS: *Strombus gigas*, larvae, development, growth, survival

Evaluation of the Content of Heavy Metals in Water, Sediment, and the Oyster *Crassostrea virginica* of Lagoon Mecoacán, Tabasco

Evaluación del Contenido de Metales Pesados en Agua, Sedimento y el Ostión *Crassostrea virginica* de la Laguna Mecoacán, Tabasco

Évaluation du Contenu des Métaux Lours dans L'eau, Sediment et le Ostron *Crassostrea virginica* de Lagoon Mecoacán, Tabasco

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ABSTRACT

Water, sediments and oysters (*Crassostrea virginica*) from the Mecoacán Lagoon were analysed in order to determine concentrations of cadmium, copper, zinc and lead. Lead was found in concentrations above permisible limits in water (8 times) and in high concentrations in sediment and oyster, such concentrations are considered a potential risk to living organisms in the channel as well as to humans. Accumulation factors decreased in the following order: Zn > Cu > Cd > Pb, and a high correlation between metal concentration in oyster and sediment was observed. Metal concentrations in water and sediments increased with decreasing distance from the coast of Sánchez Magallanes, Tabasco. This observation was not posible to realize in oysters, probably because some factors, such as age, size, sex and reproductive cycle were not taken into account.

KEYWORDS: Oyster, heavy metas, lagoon, Tabasco, bioacumulation

Density Effects on the Survival of the Juvenile Conch "Tote" *Pomacea flagellata* Under Laboratory Conditions in Tabasco, Mexico

Efecto de la Densidad en la Sobrevivencia de Juveniles del Caracol "Tote" *Pomacea flagellata* a Bajo Condiciones de Laboratorio en Tabasco, México

Effets de Densité dans la Survie du Conch "Tote" Juvenile *Pomacea flagellata* Sous Conditions de Laboratoire à Tabasco, Mexique

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ABSTRACT

Effects of density of organisms on survival percentage was determinate in juvenile of the conch "tote" Pomacea flagellata, egg masses were collected in the pond of aquaculture laboratory and incubated under laboratory conditions, at temperature (29 ± 1°C) to the hatching of the conchs. At hatching, the organisms were distributed in aquariums of 40 liter and fed with chaya (Cnidoscolus aconitifolius) at libitum during all experimental period of 30 days. Six different densities were evaluated (50, 100, 150, 200, 250 and 300 organism/aquarium), each one with two replicates. The highest survival percentage (88%) was obtained at the densities of 50 and 150 org/aquarium), whilst at density of 200 org/aquarium was registered the lower percentage of survival with the 71% of the live organisms at the end of the four week of the study.

KEYWORDS: Pomacea, density, survival, laboratory, caracol

Combining Grant Awarding with Technical Assistance and Training and to Build Capacity of Marine Protected Areas in the Caribbean: The Case of the CaMPAM-ECMMAN Small Grant Program

Apoyo Financiero con Asistencia Técnica y Adiestramiento para Mejorar la Capacidad de las Áreas Marinas Protegidas en el Caribe: el Caso del Programa de Pequeñas Donaciones CaMPAM-ECMMAN

Une Combinaison de Soutien Financier avec L'assistance Technique et la Formation afin D'améliorer la Capacité des Aires Marines Protégées dans les Caraïbes: Le Cas du Programme-ECMMAN CaMPAM Petites Subventions

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ABSTRACT

In 2013 The Nature Conservancy requested the UN Environment Programme in the Caribbean to coordinate a small grant program specific for the OECS countries as part of the Eastern Caribbean Marine Managed Areas project funded by the German government to increase the capacity to manage marine managed areas in the 6 countries of the Eastern Caribbean: Antigua and Barbuda, Dominica, Grenada, Saint Kitts and Nevis, Saint Lucia, and Saint Vincent and the Grenadines. After a process of consultation with all actors involved (including each country focal points from relevant government agencies and the local NGOs that would eventually manage the projects), the program started in early 2014 with the establishment of the project procedure and the development of project proposals. Until March 2017, around $220,000 were awarded to each country with numerous benefits, namely: area management staff, fishers and other stakeholders trained and assisted by regional experts, environmental policy drafted, facilities built and equipped, biological and socioeconomic surveys implemented and monitoring programs established, local communities better educated of the importance of managing coastal resources sustainably, local and international governmental and non-governmental environmental agencies closer collaborators. This paper examines the successes, shortcomings and lessons learnt from the implementation of the CaMPAM-ECMMAN SMG, the largest implemented by CaMPAM.

KEYWORDS: Eastern Caribbean, marine managed area, capacity building, grant program, coordination

A Transatlantic Initiative Supports Exchanges Among Regional Networks of Marine Protected Managers Around the World and CaMPAM is at the Forefront

Una Iniciativa Trasatlántica Apoya Intercambios entre Redes Regionales de Gestores de Áreas Marinas Protegidas del Mundo y CaMPAM está a la Vanguardia

Une Initiative Transatlantique Soutient les Echanges entre les Réseaux Régionaux de Gestionnaires des Aires Marines Protégées du Monde et CaMPAM est à L'avant-garde

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ABSTRACT

After a first contact with MedPAN in 2010, CaMPAM continues to collaborate with this and other regional networks of MPA managers. Joint sessions with MedPAN, RAMPAO, NAMPAN and other regional networks were held at IMPAC3 in 2013 (a joint paper on the Mediterranean and Caribbean MPAs was published, click *here*), and at the Word Conservation Congress in 2016. What started with exchanges of coordinators to highlight the importance of regional networks to build MPA capacity has extended recently to site managers exchanges of the Caribbean, North and South America, Africa and Europe. This was possible thanks to the "Cooperation with Northern and Southern Transatlantic Dimension" project, supported by the European Union and aiming to establishing “transatlantic partnerships of marine protected areas’’. Site and networks managers have discussed the protection of species populations straddling the Atlantic Ocean, and management tools to increase resilience of coastal areas with intense tourism development and fishing. MPA managers from the Dominican Republic, The Bahamas, the Dutch Caribbean and Mexico (all members of CaMPAM Expert Team) shared their experience on participatory MPA management and coral reef research and monitoring, and discussed priorities and opportunities for a second phase to implement twinning projects designed to share good MPA management practices.

This initiative is based on the recognition that “There is enormous value in exchanging experiences beyond a single region: the identification of commonalities and differences in various biophysical and cultural scenarios is known to stimulate solutions to our own problems” and the managers claim that “You shall not manage alone”. CaMPAM encourages all actors to support transatlantic exchanges to enhance managers’ capacity.

KEYWORDS: Marine protected areas, regional networks of MPA managers, transatlantic, collaboration

Reproductive Aspects of the Invasive Lionfish in Taganga Bay, Colombian Continental Caribbean

Aspectos Reproductivos del Invasor Pez León en la Bahía de Taganga, Caribe Colombiano

Aspects Reproductifs du Envahissant Lionfish dans la Baie de Taganga, Caraïbe Continentale Colombienne

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ABSTRACT

The lionfish invasion in the western Atlantic has been the fastest one of a marine fish and has caused irreversible alterations in shelf Caribbean communities. Little is known about its reproductive cycle, although it is a key aspect to understand the success of its dispersion. In this work, we describe some reproductive aspects of *Pterois volitans* in Taganga Bay (Colombian Caribbean) during 2016. Specimens were captured on a monthly basis and sex, maturity stage, total length (TL), as well as total weight of fish, liver, and gonads were determined. A total of 130 organisms with a size range between 9.1 and 42.0 cm of TL and total weights between 7.2 and 926 g were examined. Mature individuals were found from 19.5 cm TL and one female may produce more than 86000 vitellogenic oocytes. Although reproductive activity intensifies during July and October, lionfish has the capacity to reproduce throughout the year. It is suggested that control programs of the invasive lionfish in Colombian waters should invest a greater effort in catching fishes before maturity, meaning sizes smaller than 19.5 cm TL.

KEYWORDS: *Pterois volitans*, histology, fecundity, control mechanisms

Coordinating Lionfish Removal Efforts Using a Publicly Accessible Web Map

Coordinación de los Esfuerzos de Remoción de Pez León Utilizando un Mapa Web Accesible Públicamente

Coordonner les Efforts de Déménagement du Lion en Utilisant une Carte Web Accessible au Public

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ABSTRACT

Indo-Pacific lionfish have established themselves in the western Atlantic Ocean, Gulf of Mexico, and Caribbean Sea, and have the potential to severely damage regional marine ecosystems. Since 2012, local scientists, dive operators, and volunteers have conducted weekly lionfish culls on the reefs around Little Cayman, Cayman Islands. Data recorded from these culls include dive site(s) culled, number of lionfish caught, number of lionfish missed, number of divers culling, and the maximum depth and dive time of all divers. Total length, weight, and sex of each lionfish captured is also recorded. Overall, the efforts on Little Cayman have been productive, with over 200 community culls scheduled over the past 6 years and over 18,000 lionfish removed from the reefs. Analysis of the data taken from this community culling effort shows that these targeted removals can decrease lionfish density as well as their size distribution. Targeted removals have been shown to be effective on a local scale, and therefore focus should be shifted to determining how to coordinate the limited resources available to provide the greatest positive impact. To this end, we are creating a publicly accessible, interactive web map of the community culling efforts using ArcGIS software. A total of 64 dive sites are included in the map, and each site is assigned to one of 31 culling zones based on proximity and reef topography. Pop-up labels for individual dive sites as well as site groups are populated with information including date of last cull, the number of fish caught on the most recent cull, mean CPUE, recommended culling frequency, and any other pertinent site details. Updated regularly, this map will provide a guide for stakeholders seeking to increase the sustainability and efficiency of Little Cayman's community lionfish culling program.

KEYWORDS: Lionfish. Culling. Little Cayman. ArcGIS. CPUE

Risk Map of the Lion Fish Invasion in the Mexican Caribbean

Mapa de Riesgo sobre la Invasión del Pez León en el Caribe Mexicano

Carte de Risque de L'invasion du Lionfish dans la Caraibe Mexicaine

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ABSTRACT

The lionfish (*Pterois volitans* / *miles* complex) is an invasive species that, since its first registration in the Caribbean, has changes the integrity and biodiversity of ecosystems. The lionfish has become a decade, in one of the most successful invasive species, affecting inconsistently and even undervalued, the coral reef ecosystems of the Mexican Caribbean. The objective of the research is to generate maps of distribution and risk on the invasion of lionfish in the study sites of the northern, central and southern sites in the Mexican Caribbean. Data generation is performed using systematic and autonomous diving methodology, using harpoon type Hawaiian for capture. The average fish population density per hectare is heterogeneous in the region, fish abundance does not vary significantly between sites, but is significant in a vertical depth profile to the coastline. The number of organisms per hectare in the NPA of Chinchorro, a southern zone (with high conservation level), is similar to that reported in Playa del Carmen, central zone (without conservation status), presenting in both sites the largest sizes and abundances . In Isla Contoy and Punta Nizuc (average level of conservation), north zone, the abundance is smaller with respect to the center and south zone. There are no correlations between the density of the invasive species, the complexity of the background or the biodiversity between zones. The results of the analysis reflect that unimportant invasive species control efforts are applied in each zone. It is recommended to intensify the efforts of control of the species and its consumption while working towards a unique integrated management strategy with an ecosystem approach, where the conservation of local species, magnify control.

KEYWORDS: Lion fish, invasive species, NPA, biodiversity, Caribbean

Taxonomic Positioning and Isotopic Niche Characterization of Lionfish Species Complex (*Pterois volitans/miles*) in the South Caribbean, Costa Rica

Posicionamiento Taxonómico y Caracterización del Nicho Isotópico del Complejo de Especies del Pez León (*Pterois volitans/miles*) en el Caribe Sur, Costa Rica

Positionnement Taxonomique et Caractérisation de Niche Isotopique du Complexe D'espèces de Poisson-Lion (*Pterois volitans/miles*) dans le Caraïbe Sud du Costa Rica

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ABSTRACT

Biological invasions are one of the main drivers of biodiversity loss. Human trade introduced lionfish in the Atlantic Ocean about 30 years ago, and is currently considered as the most significant marine invasion in tropical ecosystems. The invasion process has been well documented in most parts of the invaded range, however dispersion pathways, connectivity and trophic impacts have not been assessed yet in the Southwestern Caribbean. In order to bridge this information gap, we conducted genetic and stable isotope analyses of lionfish population in the Caribbean coast of Costa Rica. We evaluated the sequences of two mitochondrial genes (16S rRNA and cytochrome b) in order to determine which species of the *Pterois volitans/miles* complex is present in the region. Plus, stomach content analysis and mixing models by ratio isotopes (δ13C/δ15N) composition were used to infer the isotopic niche of lionfish individuals collected down to 150 meters of depth. Our results show that only P. volitans is present at the moment in the Caribbean coast of Costa Rica. Additionally, maximum likelihood analyses of the sequences show a differentiation of the Costa Rican population from the others in the invaded range, giving an insight of a possible genetic structure in the Southwestern Caribbean. Stable isotopes results indicate an intra-population variation of lionfish isotopic niche, based on sex and sizes. Also, we demonstrate that lionfish occupies a high trophic level in the region, with a niche width and range that could overlap those of other commercially and ecological important species.

KEYWORDS: Lionfish, genetics, stable isotopes, southwestern Caribbean, trophic ecology

Vertical Movement and Site Fidelity of Lionfish (*Pterois volitans*) Along a Deep Reef Wall Using *in situ* Acoustic Telemetry

Movimiento Vertical y Fidelidad del Sitio de Pez León (*Pterois volitans*) a lo Largo de una Pared de Arrecife Profunda Usando Telemetría Acústica *in situ*

Le Mouvement Vertical et la Fidélité du Ste du Lionfish (*Pterois volitans*) le Long d'un mur de Récif Profond Utilisant la Télémétrie Acoustique *in situ*

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ABSTRACT

Lionfish, (*Pterois volitans*) have been reported at deep depths, below recreational SCUBA diving limits in various locations including Little Cayman. Lionfish density surveys conducted two hours before dusk and repeated one hour later along permanent transects in six sites reveal vertical movement from deep to shallow during crespuscular periods. Acoustic telemetry was employed to further assess horizontal and vertical movement (daily, monthly, seasonal) of lionfish for the first time along a reef wall system. In order to achieve consistent detection of tagged fish, taking into account range test results, a 2000 m gate of 10 receivers was deployed along the northeast reef wall of Little Cayman to passively detect tagged lionfish for 12 months. Thirty adult lionfish (13 female and 17 male) were internally tagged at dusk, between May 22th to July 31st 2017, with Vemco V9P transmitters along the array at depths of 21 to 33 m. In situ tagging was elected to avoid barotrauma stress, which resulted in a number of logistical challenges; low light, current, depth, and sharks. Based on initial receiver downloads and visual surveys, the majority of tag deployments were deemed successful and the lionfish are behaving normally (feeding, swimming, resting with other conspecifics). Irregular movement patterns indicate that some lionfish were preyed upon the night of tagging by a nurse shark, Ginglymostoma cirratum. Preliminary data analysis reveals high tagging site fidelity with individuals remaining within a 300 m range. Daily vertical movement is as high as 30 m in some fish, although variable between individuals. Multiple fish have been recorded as deep as 60 m and one individual as deep as 115 m. A more comprehensive understanding of lionfish movement patterns may allow for targeted removals to be scheduled more effectively.

KEYWORDS: Lionfish, acoustic tagging, reef wall, telemetry, Little Cayman

The Influence of Simulated Green Turtle Grazing, on Benthic Community Composition, Seagrass Productivity, and Stingray Foraging in a Highly Runoff-influenced Environment

La Influencia de Pastoreo por la Tortugas Verdes Simulado en la Composición de las Comunidaded Bentónicas, la Productividad de los Pastos Marinos, y la Busqueda de Comida por las Rayas en un Ambientes Altamente Influido por la Escorrentía

L'influence du Broutage Simulé de Tortues Vertes sur la Composition de la Communauté Benthique, la Productivité des Herbiers Marins et la Recherche de Nourriture des Raies Pastenagues dans un Environnement Soumis à un Fort Ruissellement

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ABSTRACT

Green turtle (*Chelonia mydas*) abundance in the Caribbean is estimated to only be 0.33% of what it was in pre-Colombian times (McClenachan et al. 2006). The severe reduction of this formerly abundant herbivore has likely dramatically altered the ecology of the seagrass beds where *C. mydas* feeds, but the conclusions of past studies of the effect of sea turtle grazing in the Caribbean have varied by location.

We conducted our experiment in Bahía Almirante, in Bocas del Toro, Panamá. This experimental site receives notably more rainfall than the site of any other published grazing experiment in the Caribbean. To simulate grazing, we clipped turtle grass (*Thalassia testudinum*) with scissors in a way that imitated grazing by *C. mydas*. Highly grazed plots were clipped every two weeks, lightly grazed plots were clipped every four weeks, and ungrazed plots were never clipped. Seagrass production was assessed in each plot opportunistically. Plots were also photographed monthly to quantify ecological succession.

Grazing had the effect of generally reducing seagrass production per unit area and seagrass percent cover. No other species of seagrass or rhizophytic algae colonized the resulting empty space. Stingray foraging increased in both highly and lightly grazed plots compared to ungrazed ones, but did not differ between highly grazed and lightly grazed plots. Analysis of seagrass tissue suggests that seagrasses in this study were not nutrient limited, suggesting that the main limiting factor for seagrass growth at this site is low ambient light due to low water clarity. This has not been observed in other grazing studies in the Caribbean, but may be explained by this site's elevated levels of runoff due to high rainfall.

KEYWORDS::Seagrass, turtle, stingray, runoff, Panama

Cross-border Fishing in the Gulf of Honduras

Pesca Transfronteriza en el Golfo de Honduras

La pêche dans le golfe Transfrontalier du Honduras

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ABSTRACT

Cross-border fishing is the activity that is carried out by a fisherman using boundary shared waters between two or more countries and therefore does not recognize boundaries. In the eastern Caribbean of Honduras, cross-border fishing is carried out in the Gulf of Honduras, which it shares with Guatemala and Belize. In this region there are three marine protected areas (MPAs): PN Punta Manabique in Guatemala, Port Honduras Marine Reserve in Belize and PN Omoa- Cuyamel in Honduras, all of them that have biological connectivity and share fishery resources between the three countries. This type of fishing has great social and economic importance for many fishing communities in the countries involved. A large proportion of cross-border resources are now subject to over-exploitation. Usually there are no records of the fishermen who frequent these areas, most of them have great skills at sea therefore they know very well the fishing grounds. However, in most cases the fishermen who do fishing work for other fishermen and sell product to intermediaries who buy them at low prices with no inspection, there is no control over the species caught nor control of the fishing gear or catch sizes often reporting infractions and generating illegal, unregulated and unreported fishing (IUU). Between October and November of each year, the migration of tuna and snappers species is notorious in the Gulf of Honduras, increasing infractions reports for cross- border fishing amongst Honduras, Guatemala and Belizean waters. It is important to create a cross-border campaign amongst those three countries to promote the rational use of fishery resources, including training on respect for closures and fishing regulations of each country. More control and surveillance should be implemented by the authorities of the three countries before facing cross border.

KEYWORDS: Fishery, Honduras, governance, IUU

Programa de Restauración de la Población de Caracol Rosado en la Reserva de la Biosfera Banco Chinchorro

Queen Conch Restoration Program in the Biosphere Reserve Banco Chinchorro

Programme de Restuartion du Lambi dans la Reserva de la Biosfera Banco Chinchorro.

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RESUMEN

El caracol rosado *Lobatus gigas* es una especie comercial distribuida en todo el caribe mexicano la cual se encuentra en disminución. Su mayor abundancia la encontramos en la Reserva de la Biosfera Banco Chinchorro siendo éste el único sitio en donde se permite actualmente la pesca comercial.. Una de las principales amenazas para ésta población es la pesca furtiva. Para evitar que la población de caracol rosado se colapsará en la Reserva los pescadores y manejadores iniciaron en el 2007 una estrategia de conservación y restauración de caracol rosado con seis líneas principales de acción: 1. Monitoreos anuales para conocer el estado de la población 2. Translocación de 1000 individuos en un sitio de mayor vigilancia 3. Se reforzó la vigilancia con la presencia de un oficial de CONAPESCA y se aumentó el tiempo y calidad de vigilancia de la Reserva. 4. Gestiones para ampliar el tiempo de veda y se propuso una veda de temporal por cinco años. 5: Campaña de difusión de protección al caracol dirigida a toda la población. 6. Integrar actividades económicas alternativas para los pescadores. Para cumplir el programa se formaron alianzas entre los pecadores, las autoridades de vigilancia, los manejadores, los comercializadores y organizaciones de la sociedad civil. Los resultados mostraron un ligero aumento de la población de caracol y concientización de las personas relacionadas con el programa. Se concluye que los esfuerzos permitieron la estabilidad de la población del caracol rosado en la Reserva se recomienda mantener las acciones de manera continua y a largo plazo para tener un mayor éxito.

PALABRAS CLAVES: Alianzas vigilancia, veda pescadores, conservación

Spotted Eagle Ray Aggregations in the Mexican Caribbean Using Citizen Science and Photo-identification – A Base Line Study

Primer Estudio de Línea Base sobre las Agregaciones de la Raya Águila en el Caribe Mexicano a través de la Implementación de Ciencia Ciudadana y Foto-identificación

La Première Étude de Référence sur les Concentrations de la Raie Aigle dans les Caraïbes du Mexique avec la Science et Cité et Photo-identification

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ABSTRACT

The spotted eagle ray *Aetobatus narinari* is an iconic species for the scuba diving industry in the Mexican Caribbean although it is heavily fished in nearby waters of Cuba and the Gulf of Mexico. This species is listed on the IUCN Red List as Near Threatened with a decreasing population trend. Few studies have described the populations and migrations of spotted eagle rays (SER's) in the Atlantic and Caribbean Sea, and no regulations exist for its fishery or tourism in Mexico yet. Since these rays are charismatic and conspicuous for SCUBA divers, and aggregate in large numbers across the Mexican Caribbean, it was possible to enlist citizen scientists (SCUBA divers) to collect and report valuable data on their occurrence and abundance. Taking advantage of a large diving community, a Citizen Science and Outreach Program (CSOP) was launched to raise awareness, educate, and build the first library of photo-ID to study population and migration of SER`s in the Mexican Caribbean. In less than a year, with the CSOP and targeted field work, the research team created a regional library with over 1500 pictures across 9 sites within the Mexican Caribbean of which 545 pictures were analyzed using I3S photo identification software. In total, 266 individuals were identified through these photographs between 2003 and 2016. Furthermore, 14% of identified individuals were subsequently identified at least once at the same site. This study is the first report on SER populations in the Mexican Caribbean and highlights the value of photo-ID and citizen science for monitoring populations of marine mega-fauna. As previously mentioned, due to their importance in fisheries and tourism, there is an increasing need for better management and monitoring efforts to prevent overexploitation and work towards sustainable fisheries and tourism.

KEYWORDS: Spotted eagle rays migration photo ID citizen science, base line

Fishermen Perspectives on the Fishery Ban of Red Grouper *Epinephelus morio* (Teleostei: Epinephelidae) in Sisal, Yucatan, Mexico

Perspectivas de Pescadores sobre la Veda de Mero *Epinephelus morio* (Teleostei: Epinephelidae) en Sisal, Yucatán, México

Perspectives des Pêcheurs sur L'interdiction du Mérou Rouge *Epinephelus morio* (Teleostei: Epinephelidae) dans Sisal, Yucatan, Mexique

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ABSTRACT

The Red grouper, *Epinephelus morio*, is the most commercially important grouper in the northern Yucatan Peninsula, Mexico, but its fishery is overexploited despite the establishment of a seasonal ban (15 February to 15 March) since 2005. In 2017, the ban was extended to two months (1 February to 31 March). Despite declining conditions of the grouper fishery, the fishermen perspective, about the ban effectiveness and associated problems to the Red grouper fishery, has never been explored. In this study, semi-structured interviews were applied to 65 fishermen from Sisal, Yucatan, from September to November 2016. Results indicated 60% of fishermen accept the fishery ban; however, 92% agreed the ban is not enough for the Red grouper conservation. About 74% would be willing to have a ban extension but these latter fishermen have major concerns that the extension may negatively affect their earnings. We propose job alternatives, such as the eco-tourism, in order to compensate possible fishermen income loss.

KEYWORDS: *Epinephelus morio*, TEK, Yucatan, Fishermen perspective, Mexico

Towards a Sustainable Exploitation of the Caribbean Fisheries

Hacia una Explotación Sostenible de la Pesca en el Caribe

Vers une Exploitation Durable des Pêches des Caraïbes

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ABSTRACT

Climate variability rather than the effects of fishing intensity rule catch trends in the long-term. This is particularly true in case of neritic stocks with short lives like sardines. In species with longer life span, is easier to detect the effects of fishing intensity, because their dependence on climate variability is less evident. In most cases, stock assessment usually is limited to the biological aspect, whilst the economic and social components are often neglected. Under this framework, the Caribbean fisheries are involved in a fuzzy cloud of socio-economic crisis leading to regulations based on good intentions rather than informed management decisions. In just a few cases, stock assessments have been applied to the most important fisheries like queen conch and spiny lobster. However, more than 60 species are exploited in the Caribbean and the Gulf of Mexico, with a biomass of 5.3 Million mt and an estimated Maximum Sustainable Yield of 2.65 Million mt; unfortunately, current yield and stock biomass suggest a 30% reduction respecting to values recorded a few years ago. A review of the status of some fisheries of the region, allows providing information for their management. Recommendations provided are addressed to improve stock assessments leading to attain sustainable exploitation.

KEYWORDS: Fisheries management, Caribbean Coral reef fisheries, spiny lobster, queen conch

Effect of Ocean Near-future Predictions During Larval Period of the Queen Conch (*Strombus gigas)*

Efecto del Cambio Climático Durante la Vida Larvaria de (*Strombus gigas)*

Effet du Changement Climatique au Cours de la Vie Larvaire du Lambi *(Strombus gigas)*

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ABSTRACT

The increase in CO_2 emissions produces heating and reduced pH in the oceans, which can have negatives effects on many marine organisms, in particular those with calcified structures (i.e. mollusk), affecting mainly their larval stages. We studded Strombus gigas, an important gastropod in the Caribbean sea, to known the influence of near-future predictions (ocean warming and acidification) over larval growth, their survival and calcification ratios. Larval culture was realized maintain constant temperature and pH (supplying CO_2 continuously). We employing three treatments (Control = 28°C-pH 8.1, T1 = 28°C-pH 7.6, T2 = 31°C-pH 7.6) in triplicate. Growth (n = 30 larvae per age/treatment) and survival were evaluated in larvae of 0, 10, 20 and 30 days old. Calcification was evaluated in S. gigas larval shell from 0, 3, 10, 20 and 30* days old (*settlement) by EDX and RAMAN analysis. One-Way ANOVA (p(α0.05)) was realized to larval growth, survival and shell calcification. Treatment 2 showed higher values in growth rate over time (from 31.55 ± 18.84 to 23.73 ± 16.18µm; p (α0.05) < 0.0001). We observed a difference of 14.17% in survival rate between control and treatment 2 (p (α0.05) = 0.0148). Average calcium proportion was major in the control 35.10 ± 9.48% wt, without diferences among treatments (p (α0.05) = 0.0875), moreover, the shell composition (aragonite and calcite) showed differences among treatments, where aragonite intensity (206 cm) was greater 858.07 ± 610.59a.u. at the control, and calcite (282 cm) was recorded only in the T2 with an average intensity of 457.63 ± 298.32a.u. Our results suggest that this specie could be adapted to warmer conditions, but the combination with an acidified environment could produce several issues in his composition and larval availability in future scenarios.

KEYWORDS: *Strombus gigas*, acidification, temperature, survival, calcification

Implementation of a Passive Acoustic Monitoring System on a SV3 Wave Glider and Applications

Implementación de un Sistema de Vigilancia Acústica Pasiva en un Wave Glider SV3 y Aplicaciones

Mise en Oeuvre d'un Système de Surveillance Acoustique Passive sur un Wave Glider SV3 et Applications

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ABSTRACT

Fisheries independent research strives for new technology that can help remotely and unobtrusively quantify fish biomass. Some large fish species, such as groupers vocalize during mating. Fish sounds provide an innovative approach to assess fish presence and numbers. However, large datasets make the detection process by a human ear very tedious and lengthy. We have developed an algorithm based on machine learning and voice recognition methods to identify and classify fish sounds. This algorithm currently operates on a SV3 Liquid Robotics wave glider, which has been fitted to accommodate a passive listening device. Fish sounds detection and classification results, and location, along with environmental data are transmitted in real-time to the science crew who can ground truth the detection with divers. This passive acoustic monitoring system has been deployed in the US Virgin Islands, Puerto-Rico, the Florida Keys and on the East Florida shelf. We will provide an overview of the findings made with this autonomous monitoring system.

KEYWORDS: Passive acoustic, fish vocalization, wave glider, monitoring, machine learning

Hormone Cycle in *Strombus* (*Lobatus) gigas* (Linneo, 1758)

Ciclo Hormonal en *Strombus* (*Lobatus) gigas* (Linneo, 1758)

Cycle Hormonal *Strombus* (*Lobatus) gigas* (Linneo, 1758)

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ABSTRACT

Sex steroids are presented in invertebrates which participated in homeostasis, growth and reproduction. Hormone cycle is very similar between vertebrates and invertebrates organisms. *Strombus (Lobatus) gigas*, is a commercial and endangered species, being the reproduction knowledge a key for sustainable management. The present study was carried out with the purpose of evaluate the concentration and temporal variation of the sex steroids (Testosterone, estradiol and progesterone) in *S. gigas*. In addition, this research was carried out using a noninvasive technique. Every two months for a year, the feces of ten organisms were collected in Quintana Roo, Mexico. Steroid extraction was carried out with 80% ethanol and the samples were analyzed using High Performance Liquid Chromatography technique. The results showed variation of sex steroids concentration during the study period with similar patterns of increase throughout the reproductive season until decrease from November to January. The maximum value of testosterone concentration was during May 1.96 ± 0.6 ng / mL and July for estrogen and progesterone (1.12 ± 0.78 ng / mL and 1.23 ± 0.50 ng / mL, respectively). No differences were observed of hormone concentration in youngest conch than oldest females (lip thickness > 20 mm). These results suggested a hormonal cycle related with reproductive season of S. gigas and the importance to protected old females during the reproductive season.

KEYWORDS: *Strombus*, reproduction, hormone, conservation, aquaculture

Relation Between Hormonal Cycle and Gonadic Stages of *Strombus pugilis* (Linneo, 1758)

Relación Entre el Ciclo Hormonal y Estadios Gonádicos de *Strombus pugilis* (Linneo, 1758)

Relation Entre le Cycle Hormonal et Étapes Gonadiques de *Strombus pugilis* (Linneo, 1758)

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ABSTRACT

Reproduction in mollusks, has been observed that could be determined by steroid hormones. Knowing their functions in the reproductive process improve aquaculture without wild egg masses collected. The purpose of this study was to quantify testosterone, estradiol and progesterone concentration and its temporal variation in contrast with their gonadic cycle of Strombus pugilis. Thirty organisms were collected in September, November and February. The gonad-digestive gland complex was dissected and divided; one gram of tissues was mixed with ethanol 80% to extract the steroids and analyzed with Enzimoinmunoassay. Other part was fixed in alcoholic Bouin, and processed with histological techniques. Sections were embedded in Paraplast wax and sections of 6 µm thick were stained with a trichrome stain. Steroid gonadic cycle showed the highest percentage of mature organisms was observed in September and November. The highest concentration of testosterone and estrogen were present during spawning stage. Progesterone remained constant at different reproductive stages. The knowledge generated in this study expands the basic knowledge of reproduction of this specie and could be used for the aquaculture development.

KEYWORDS: *Strombus*, hormone. Aquaculture, reproduction, steroid

Diversity of Native Reef Fish Communities in Two Protected Areas in the Caribbean Sea and its Relationship to the Invasive Lionfish

Diversidad de las Comunidades de Peces en Dos Áreas Marinas Protegidas del Caribe y su Relación con el Pez León

La Diversité des Communautés de Poissons dans Deux Aires Marines Protégées dans les Caraïbes et Ses Relations avec le Lionfish

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ABSTRACT

Lionfish (*Pterois volitans*) invaded the Caribbean region with the potential to alter the composition and structure of native coral reef fish communities. The objective of this study was to analyze the diversity indices of these fish communities potentially affected by lionfish predation and to compare with pre-invasion data. The study was undertaken in two Caribbean marine protected areas (MPAs): Guanahacabibes National Park (PNG) in W Cuba and Xcalak Reefs National Park (PNAX) in South Quintana Roo. We carried out visual censuses of fish species in reef habitats during the dry and rainy seasons of the period 2013-2015. For this, nine sites were defined and evaluated using stationary counts. Our results showed higher species richness (43.47 ± 5.14) and mean abundance (0.76 ± 1.25) in PNG than in PNAX (40.22 ± 4.96, 0.19 ± 0.46, respectively). Diversity decreased after the arrival of lionfish in a single site of PNG and in two sites of the PNAX, but apparently, these results are more related to the fishing activity effect than to the lionfish presence. Based on the results and assuming that changes in the native fish communities by lionfish may not yet be detected, we recommend to continue the monitoring community descriptions in order to detect future changes in native fish communities.

KEYWORDS: Diversity, invasive species, marine fishes, coral reef, predator effects

Strategies and Regulations for a Sustainable Development of Tourism in the Marine-coastal Area of the Guanahacabibes National Park

Estrategias y Regulaciones para un Desarrollo Sustentable del Turismo en el Área Marina-costera del Parque Nacional Guanahacabibes

Stratégies de Marine du Littoral et Reglements pour le Développement durable du Tourisme dans le Domaine du Parc National Guanahacabibes

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ABSTRACT

The work presents a group of strategies and regulations established in the Management Plan of the Guanahacabibes National Park (PNG), focused on the nature tourism that takes place in the area. These tools have been drawn from the results achieved in international and national projects focused on scientific research and monitoring of marine-coastal biodiversity. Current reports analyzing impacts on coral reefs by vessels have been taken into account. In addition to considering the evolution of tourism in the area (increase in the number of visitors and increase of activities of diving and hiking) in recent years). The functional zoning of the marine protected area of PNG is exposed; The environmental license of the diving points located within the limits of PNG; The strategy to evaluate the impacts of stranding, anchoring and dumping of pollutants; The regulations for the stay of cruises and boats of medium and small size in the marine area; For the sinking of boats, and for the observation of sea turtles in the area of public use of the park. All these actions allow a better management and management of marine resources and ecosystems of PNG.

KEYWORDS: Marine protected areas, nature, tourism, coral reefs

A Participatory Process for Formulating a Protocol on the Small-scale Fisheries Guidelines

Un Proceso Participativo para la Formulación de un Protocolo sobre las Directrices de Pesca a Pequeña Escala

Un Processus Participatif pour la Formulation d'un Protocole sur les Lignes Directrices sur les Pêches à Petite Échelle

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ABSTRACT

The Caribbean Network of Fisherfolk Organisations, in partnership with University of the West Indies - Centre for Resource Management and Environmental Studies, Caribbean Natural Resources Institute and the Caribbean Regional Fisheries Mechanism (CRFM) Secretariat, is spearheading a participatory process to incorporate the international Voluntary Guidelines for Securing Sustainable Small-scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines) into the Caribbean Community Common Fisheries Policy (CCCFP). The aim is to craft a policy protocol that not only incorporates the global instrument into the regional instruments, but also highlights what fisheries stakeholders consider to be priorities for attention. The Guidelines support responsible fisheries and sustainable social and economic development for current and future generations, while the CCCFP promotes the sustainable utilisation of the fisheries resources for the well-being of all Caribbean people. Having a protocol should move these Guidelines from global policy into regional practice. Since the acceptance of the recommendation to develop the protocol, using a participatory approach, by the March 2017 CRFM 15th Caribbean Fisheries Forum, and its subsequent endorsement by the May 2017 Ministerial Council, the project partnership has been creating awareness and engaging fisherfolk, fisheries officers and other key stakeholders in identifying and prioritizing fisheries issues for inclusion in the protocol. This is being done through the development of communication products, other events, and a survey of priorities. We examine here the processes involved in developing the SSF Guidelines protocol for Caribbean Community fisheries. The successes as well as challenges are discussed and suggestions for good practices are presented.

KEYWORDS: Small-scale, fisheries, guidelines, protocol, processes

National Intersectoral Coordination Mechanisms (NICS): Marine Resources Management through Effective Integrative Governance

Mecanismos de Coordinación Intersectorial Nacional (NICS): Gestión de los Recursos Marinos a través de una Gobernanza Integrativa Eficaz

Mécanismes Nationaux de Coordination Intersectorielle (NICS): Gestion des Ressources Marines grâce à une Gouvernance Intégrative Efficace

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ABSTRACT

The project on Catalysing Implementation of the Strategic Action Programme (SAP) for the Sustainable Management of shared Living Marine Resources in the Caribbean and North Brazil Shelf Large Marine Ecosystems (CLME+ Project, 2015-2020) is focused on 'Integrative governance arrangements for sustainable fisheries and for the protection of the marine environment'. National intersectoral coordination mechanisms (NICs) can serve as important links between regional and national levels of policy processes. Given the nature of the marine governance issues in the CLME+ region, addressing them will require having nationally well-coordinated, and regionally linked, intersectoral mechanisms. Having NICs in place is important not only for projects such as CLME+, but also for broader aims such as achieving the sustainable development goals (SDGs). However, establishing and sustaining adaptive NICs has proven challenging worldwide. Considering the region's diversity, it is unlikely that a single solution would apply to all types of NICs and governance arrangements. In this paper I examine how properly functioning NICs may carry out mandates within policy cycles while demonstrating good governance. The features and functions of NICs are highlighted and the findings on the scope and structure of successful NICs are presented. The information provided can be used to better inform integrative governance strategies geared towards implementing ecosystem-based approaches.

KEYWORDS: Integrative governance, intersectoral coordination, mechanisms

Socioeconomic Factors and Risk Perception of Sea Cucumber Migrant Harvesters in the Yucatan, Mexico

Factores Socioeconómicos y Percepción de Riesgo en Pescadores Migrantes de Pepino de Mar en Yucatán, México

Facteurs Socioéconomiques et Perception du Risque des Moissonneurs Migrateurs de Concombres de Mer au Yucatan, au Mexique

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ABSTRACT

Many people participating in the Yucatan, Mexico sea cucumber (Isostichopus badionotus) fishery come from inland communities and from other states, staying on the coast during fishing seasons. Hookah diving (HD) as a fishing method is a source of decompression sickness (DCS), carbon monoxide poisoning (COP), disabilities and death. Considering the HD risks, the aim of the study was to identify the socioeconomic cost and the risk perception of I. badionotus fishers.

The study was undertaken in two ports of the Yucatan northeastern coast during the 2017 fishing season. Yucatan inland and foreign (other states) fishers were surveyed about the fishery (catch per trip, catch value and fishing variable costs), stay expenses, diving accidents and HD risk perception.

Participants mean age was 33(±12) and range between 16 and 55 years-old, 76% were foreign fishers and the remaining from Yucatan inland communities. Per fishing trip, the mean catch was 130(±47) kg and the revenue was US$79(±37), five times the incomes with scale species at their homeland. The main expenses were gasoline (36%), bedroom rent (13%), round trip ticket (8%), DCS insurance (2%), ice (10%) and meals (30%). Fishers agreeing that DCS is the main cause of accidents with a possible likelihood of occurrence also agree that COP is a source of risk but considered as an unlikely likelihood of occurrence. Comparing risk perception of chronic diseases and its relation with diving-related accidents, the Yucatan inland fishers' perception was higher than the perception of foreign fishers. Regarding the labor issues, contract and life insurance are null, only a few employers sell DCS treatment insurance (US$50).

Economic incentives of the sea cucumber fishery drive the migration to the coastal area besides the risk of diving and the lack of formal labor contracts.

KEYWORDS: Sea cucumber, diving, small-scale fishers, decompression sickness. CO poisoning

Toward the Generation of a Governability Index for Small-scale Fisheries: The Case Study of Yucatan Peninsula, Mexico

Hacia la Generación de un Índice de Gobernabilidad para la Pesca Artesanal: El Caso de Estudio de la Península de Yucatán, México

Vers la Génération d'un Indice de Gouvernabilité pour des Pêches Artisanales: Le Cas D'étude de la Péninsule du Yucatan, au Mexique

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ABSTRACT

Over the last decade, several indicators for fisheries governance have emerged in response to the global call for sustainable development. Careful considerations are required to determine suitable indicators that could capture the diversity of small-scale fisheries, yet practical enough to be useful for governance. Using coastal fisheries (CF) in Yucatan Peninsula, Mexico, as illustrations, we draw from interactive governance theory and the governability assessment framework in proposing a set of 17 indicators linked to three governance systems: the fisheries and the social systems to be governed (10), the governing system (4), and the governing interactions (3). Analyzed data come from official records associated with CF from 23 fishing communities, published papers, gray literature, and web-based resources. For each indicator, we determine the appropriate data and the range of values that best represent what the indicator aims to capture; the score was evaluated through quintiles (q=k(n+1)/100). We allocate a score from 1 to 5 for each indicator, where 1 refers to features that make the system difficult to govern (low governability) while 5 refers to those contributing to high governability. We categorize the 23 communities into three groups by aggregating the scores across all indicators: on the high governability index (4), on medium (14), and on the low (5). Our analysis reveals that communities with high governability are those with a small number of species landed, low fishing pressure, lower changes in population growth rate in the communities, and a few types of licenses. Based on this initial development of the governability index, we contend that local-scale indicators can unveil important features about the fishing communities that can lead to improve fisheries governance.

KEYWORDS: Small-scale fisheries, interactive governance, governability index, indicators sustainability

Characterization of Small-scale Fisheries of the Yucatan Peninsula, Mexico: Complexity and Management Challenges

Caracterización de las Pesquerías de Pequeña Escala de la Península de Yucatán, México: Complejidad y Retos para el Manejo

Caractérisation de la Pêche Artisanale à la Péninsule du Yucatan, Mexique: Complexité de et Défis de Gestion

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ABSTRACT

Despite the significant contribution to food security, jobs, and foreign exchange, small-scale fisheries (SSF) receive less attention than industrial fisheries. SSF capture multiple species, use a diversity of gears, and land their catch all along the coasts. Under these conditions, the collection of information, monitoring, and management are difficult. This study illustrates how to characterize such complexity, using a case of small-scale fisheries of the Yucatan Peninsula, Mexico, and discusses the importance of such characterization for management. This is in order to generate a baseline that can support management decisions in the region. Analyzed data came from monthly official records of landings that cover 23 fishing communities of the area from 2006 to 2014. The frameworks used for the analysis define three subsystems: natural, human, and management. Therefore compiled data included landings of target species, catch value, fishing gears, the number of fishers, among other. These variables were contrasted between states and communities. Results show that the small-scale fishing fleet captures 18 target species groups, around 150 species, using 12 fishing gears. A total 25,917 fishers hold 3,758 permits, associated with 14,060 boats, however, the permits hold by fishers or organizations are unbalanced among stakeholders and communities. For instance, Yucatan and Campeche hold a higher number of permits, but more species are targeted in Campeche. Significant differences were observed among communities regarding target groups, total catch, and catch value. The results of this study show that the current management plans based on a single species approach do not account for the complexity of these fisheries and hence its viability is limited.

KEYWORDS: Small-scale fisheries, characterization, management implication, Yucatan Peninsula, complexity

Does Unoccupied Microhabitat Patch Size Affect Early Post-settlement Demographics in a Coral Reef Fish?

Influye el Tamaño de los Fragmentos de Hábitat Desocupados en la Demografía de un Pez de Arrecife Coralino que Acaba de Asentarse en el Arrecife?

La Taille des Fragments D'habitat Inoccupés Influence-T-Elle la Démographie d'un Poisson de Récif Corallien qui Vient de Recruter au Récif?

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ABSTRACT

Increases in frequency and intensity of physical disturbances under climate change will result in increases in microhabitat fragmentation and episodic mortality of resident fish populations, freeing previously occupied space. It is important to understand how the fragmentation of unoccupied habitat will affect the replenishment of fish populations, particularly soon after settlement, when fishes are most vulnerable. This study looks at the effect of microhabitat patch size on the abundance, survivorship and growth of newly settled bicolour damselfish *Stegastes partitus* in the absence of older resident fishes. We used standardized microhabitat settlement units arranged in two different patch size configurations, i.e. small (1 unit) and large (2x3 units), to monitor the abundance of bicolour recruits onto replicate size patches during a large natural settlement pulse. We expected that smaller patches would exhibit lower recruit abundance but higher density than larger patches because of their higher perimeter-to-area ratio. Consequently, we also expected stronger intra-cohort density-dependent effects on recruit growth and early-post settlement mortality in the small patches.

Over a three-week period, we recorded a total 225 bicolour recruits onto the experimental patches. As predicted, we found that the smaller patches had higher densities than larger patches, resulting in higher intra-cohort aggression in the smaller patches. However, we found no difference in recruit growth or mortality between patch sizes, indicating no measurable aggression effects on these demographic rates. Overall, our results indicate that bicolours readily tolerate high crowding soon after settlement and so this species might be little affected by fragmentation of unoccupied habitat when it is most vulnerable to mortality.

KEYWORDS: Reef fish, microhabitat, settlement, patch size

Comparing Divers and Camera Sled Surveys for Assessing Queen Conch Abundance in Puerto Rico

Comparción de Censos de Buceo y Cámara en Trineo para Evaluar la Abundancia de Carruchos (Caracol rosado) en Puerto Rico

Comparaison des Recensements de Plongée et de Traîneau pour Evaluer L'abondance de Carruchos (Escargot Rose) a Porto Rico

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ABSTRACT

Queen conch *Lobatus (Strombus) gigas* is one the most important fisheries species in the Caribbean with annual landings worth > US$30 million. Landings have declined in Puerto Rico since the 1980's due to overfishing. Currently queen conch harvest is prohibited in the Exclusive Economic Zone (EEZ) in Puerto Rico. Abundance estimates in Puerto Rico are conducted by scuba divers at intervals of 3 years, but limited availability of trained divers for conducting surveys has been an obstacle to complete coverage. Diver surveys are also limited by depth and time, whereas camera surveys are not, and provide a permanent photo record of observations. Preliminary results of a study in Puerto Rico showed that surveys conducted with a digital camera sled produced higher estimates of density (#/ha) than diver survey methods, and that measurements obtained using paired lasers were both more accurate and smaller from diver estimates. These results may lead to further applications or development of sled survey techniques, and improved data collection and analysis. Our research could improve the quality of information that can be used for management of queen conch in the Caribbean.

KEYWORDS: Queen conch, abundance, sampling techniques

Cambios Temporales de la Diversidad Funcional y Taxonómica de la Comunidad de Peces Demersales del Mar Caribe de Colombia

Temporal Changes in the Functional and Taxonomic Diversity of the Colombian Caribbean Sea Demersal Fish Community

Les Changements Temporaires dans la Diversité Fonctionnelle et Taxonomique de la Communauté de Poissons Démersaux de la Mer des Caraïbes Colombie

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RESUMEN

El funcionamiento de los ecosistemas está condicionado por el papel que juegan las especies para el mantenimiento de los procesos biológicos y ecológicos. Las propiedades funcionales están ligadas a la diversidad, la abundancia, distribución espacial y el cambio temporal de las comunidades. Las variaciones en su estructura y dinámica son una respuesta a los cambios a los que están sometidas estás comunidades. En el Caribe de Colombia solo se ha evaluado los cambios temporales de la diversidad funcional y taxonómica en un área determinada y durante un periodo establecido. A la fecha no se han descrito estos descriptores comunitarios a nivel del Caribe y en un periodo de tiempo largo. El objeto de este trabajo fue evaluar estos descriptores de la diversidad de la comunidad de peces demersales con la información de los cruceros científicos efectuados entre 1970 y 2001, almacenados en el Sistema de Información Evaluación y Ecología Pesquera. El área de estudio se dividió en tres áreas: Sur, desde la frontera con Panamá hasta la desembocadura del río Magdalena, golfo de Salamanca, entre la desembocadura del río Magdalena y el cabo de la Aguja y Norte, entre el cabo de la Aguja y la frontera con Venezuela. Los análisis mostraron una variabilidad en los indicadores evolutivos: diversidad taxonómica (Δ), distinción taxonómica promedio Δ+ y variación de la distinción taxonómica promedio (Λ+) observando diferencias significativas ($p < 0.05$) entre algunos periodos. En el análisis de diversidad funcional, los valores de la distinción funcional promedio (X+) fueron altos indicando la dominancia de especies redundantes. Los resultados evidencia la capacidad de la comunidad íctica de resistir posibles impactos (naturales y antropológicos) y su capacidad de resiliencia en el tiempo.

PALABRAS CLAVES: Funcionalidad, peces demersales, diversidad, funcional diversidad, taxonómica, Mar Caribe, Colombiano

Review of Satellite Tracking Efforts of Two Sea Turtle Species from Southern Gulf of Mexico

Revisión de los Esfuerzos de Rastreo Satelital de dos Especies de Tortugas Marinas en el Sur del Golfo de México

Revue des Efforts de Suivi par Satellite de Deux Espèces de Tortues Marines dans le Sud du Golfe du Mexique

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ABSTRACT

The advances of technology in the last decades has made more accessible the study of marine megavertebrates using satellite telemetry, hence having a substantial increase in the number of projects of this type, and the number of tracked individuals. After almost two decades of tracking post-nesting marine turtles in southern Gulf of Mexico (GoM), it becomes strategic to know the advances in this research line and how the information has been used to help recover and conserve these endangered species. The objective was to evaluate the advances in knowledge of sea turtle distribution using satellite telemetry and characterize beach origins and foraging grounds linkages for tracked individuals. We analyzed 90 tracks of two distinct species of sea turtles: hawksbills (*Eretmochelys imbricata* (Ei), n = 43) and greens (*Chelonia mydas* (Cm), n = 47). More than 20 distinct foraging grounds were identified inside the GoM and West Caribbean Sea for individuals coming from 22 distinct beaches. Bahia Ascension, Florida Keys, Nicaragua, Petenes and Veracruz Reef System were the foraging grounds that received individuals of both species. Petenes and Eastern Isla Mujeres had highest number of beach origins for the individuals they harbor. The nesting beaches with the highest number of foraging grounds linkages were Lechuguillas, Alacranes Reef, Celestun, Chencan, Holbox, Las Coloradas and Veracruz Reef System. We discuss an asymptotic trend of tracking efforts for these species in terms of the number of feeding grounds discovered per surveyed nesting beach, the connectivity between ocean watersheds, and suggest knowledge gaps and next steps for this region. Finally, we present some applications of this information for their conservation and recovery in southern Gulf of Mexico.

KEYWORDS: Hawksbill turtle, green turtle, telemetry, migration

Gobernanza de los Recursos Marinos Mediante la Gestión Integrada de la Pesca

Governance of Marine Resources through Integrated Fisheries Management

Gouvernance de Ressources Marines à travers de la Gestion Integrée de la Pêche

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RESUMEN

Según el Informe de Riesgo Climático, para el año 2017 Honduras ocupa el primer lugar como país vulnerable a los eventos climáticos extremos, situación que en buena medida es el resultado de la poca gestión integrada de los recursos por parte de las autoridades centrales por los vacíos legales y deficiente comunicación.

El Centro de Estudios Marinos, mediante la implementación de herramientas tecnológicas, la investigación social y científica encaminada a ampliar las áreas marinas protegidas y al desarrollo de las comunidades que dependen de los recursos marinos, ha generado información sobre el estado de estos recursos y de sus beneficiarios, datos que han descubierto la necesidad de que las autoridades centrales converjan, analicen e identifiquen soluciones en espacios formales para una adecuada toma de decisiones.

Como antecedente a esta coordinación interinstitucional se dio el reciente acuerdo establecido entra las autoridades de pesca y de áreas protegidas, quienes determinaron que próximas declaratorias de zonas de recuperación pesquera se realizarán con el visto bueno de ambas partes, sustituyendo de esta manera los acuerdos que venía realizando de manera unilateral el ente de pesca.

Ante la necesidad de formalizar el intercambio de información y definir protocolos para la toma de decisiones, en febrero de 2017 se reúnen seis instituciones relacionadas al tema de la gestión de los recursos marinos en lo que se conoce como Junta de Directores del Proyecto para el Manejo Sostenible de las Pesquerías Artesanales y la Protección de los Océanos.

En la Junta de Directores se mantendrá el debate en varios temas, especialmente la participación de las comunidades pesqueras, la gestión de las áreas marinas protegidas y el espacio marino en general, para lograr una buena gobernanza de los recursos marinos.

PALABRAS CLAVES: Gobierno, sociedad industria, artesanal, integral

Arrested Sexual Development in Queen Conch (*Strombus gigas*) Linked to Abnormalities in the Cerebral Ganglia

Desarrollo Sexual Retardada en el Cobo (*Strombus gigas*) Ligado a Anomalías en el Ganglio Cerebral

Retardé le Développement Sexuel dans la Lambi (*Strombus gigas*) Liés à des Anomalies dans le Ganglion Cérébral

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ABSTRACT

In the Florida Keys, queen conch (*Strombus gigas*) occur in two spatially distinct regions: nearshore in habitats immediately adjacent to the shoreline and offshore in habitats along the reef tract. Our previous research has demonstrated that nearshore queen conch are not reproductively active, showing deficiencies in their gonadal condition compared to their offshore counterparts. Since, sexual development in gastropods is controlled by hormones secreted by the cerebral ganglia, we hypothesized that the reproductive deficiencies found in nearshore queen conch may involve the cerebral ganglia. We collected nearshore and offshore conch and made histological comparisons of their gonads and cerebral ganglia. Our results confirmed that nearshore conch exhibited delayed gonadal maturity and reduced gametogenic output compared to offshore animals. These gonadal deficiencies were significantly correlated with abnormal cerebral ganglia histology (e.g., reduced number of ganglia cells, hypertrophy). In addition, we observed that nearshore conch had significantly lighter shells. This finding is particularly consequential since shell formation in gastropods is also mediated by hormones secreted by the cerebral ganglia. Given these results, it is apparent that the unidentified causative factor(s) behind the developmental and morphological anomalies in nearshore queen conch is targeting the cerebral ganglia and the effects cascade through the neuroendocrine system to gonad development and shell formation.

KEYWORDS: Florida Keys, gonads, reproduction, shell

Caracterización del Mercado de Tiburón en el Sureste de México

Characterization of the Shark Market in the Southeast of Mexico

Caractérisation du Marché de Requin dans le Sud-est du Mexqiue

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RESUMEN

Los tiburones son considerados reguladores poblacionales y predadores tope en la cadena trófica marina y han sido utilizados como fuente de alimento, empleo e ingresos para muchas comunidades costeras. Debido a la alta demanda del mercado por derivados de tiburón, principalmente aletas y cartílago, estos recursos se han visto amenazados por la creciente presión pesquera. A pesar de su importancia en el mercado nacional, la información existente sobre las fuentes, destinos y patrones de pesca, así como la red de valor de estos productos, es escasa, limitando acciones de manejo y conservación. El presente estudio se enfocó en el análisis de estos componentes. Para esto se utilizaron datos de registros oficiales de mercados, datos de capturas en cinco estados (2006-2014) y se aplicaron entrevistas a permisionarios y cooperativas en dos estados. Se realizaron análisis comparativos entre años y estados, y se mapeó el origen y destino de productos derivados de tiburón. Se identificaron 15 géneros de tiburón y un grupo de cazón. Los mayores volúmenes de captura comprenden al género Carcharhinus. Las redes de valor por las que se comercializa el tiburón en el Sureste de México varía entre estados ligeramente, siendo Veracruz el de mayor ingreso económico derivado de la pesca de tiburón y Quintana Roo el de menor ingreso. Campeche vende sus productos localmente, mientras que Veracruz presenta una amplia gama de destinos. Los entrevistados en Yucatán y Veracruz indicaron que el producto se vende local, nacional e internacionalmente, exportando las aletas al mercado asiático. La principal presentación en la que se comercializa el tiburón en el Sureste de México es el filete y los precios muestran tendencias crecientes en los últimos años.

PALABRAS CLAVES: Sureste de México, mercados, tiburones, tendencias pesqueras, pesquerías

Evaluating the Recovery of a Nassau Grouper (*Epinephelus striatus*) Spawning Aggregation via Length-frequency Analysis from Underwater Laser Caliper Video

Evaluación de la Recuperación de una Agregación de Desove de Mero de Nassau (*Epinephelus striatus*) a través del Análisis de Frecuencia de Talla de un Video con Pinzas Láser Subacuático

Évaluation de la Récupération d'une Agrégation de Fraise de Nassau Grouper (*Epinephelus striatus*) par Analyse de Fréquence de Longueur à Partir d'une Vidéo D'étanchéité Laser Sous-marins In the Cayman Islands

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ABSTRACT

Nassau Grouper (*Epinephelus striatus*) have been historically exploited on fish spawning aggregations (FSAs) until protections were enforced in 2003 to inhibit take on both historical and active spawning sites. Since then a long-term monitoring project has been underway to assess the stock status of Nassau Grouper, an endangered species, on the remaining FSA off of Little Cayman Island and on historical sites in the sister islands of Grand Cayman and Cayman Brac. Here we conducted a length-frequency analysis of a Nassau Grouper spawning aggregation; to do so we used underwater caliper laser video captured in February of 2017. The intent of the research is to understand the size structure of the Nassau Grouper spawning stock to see if the species is recovering, in the form of new recruitment. 2017 length measurements were compiled and analyzed in combination with length data previously compiled during the years 2004-2015. Cumulative frequency distribution results of the first quartile of fish lengths for all years indicate an increase in the proportion of smaller fish in 2017 compared to 2004- a baseline year of recruitment reference as used in Heppell et al. (2012). Furthermore, 2017 calculated values of mean length and size diversity were comparable to previous years of recruitment in 2007-10 as highlighted in Heppell et al., 2012. Therefore, 2017 may constitute a year of small adult Nassau Grouper recruitment.

KEYWORDS: Nassau Grouper, Cayman Islands, spawning aggregation, length-frequency, analysis, recruitment

An Update on Marine Protected Area Management Capacity in the Caribbean, 2011-2017

Actualizando el Conocimiento de la Capacidad de Gestión de Áreas Marinas Protegidas en el Caribe, 2011-2017

Mise à Jour de la Connaissance de la Capacité de Gestion des Aires Marines Protégées dans les Caraïbes, 2011-2017

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ABSTRACT

In 2010-2011, GCFI and CaMPAM with NOAA's Coral Reef Conservation Program undertook an assessment of management capacity among priority coral reef marine protected areas (MPAs) in the Caribbean region. A specialized tool was developed for facilitated self-evaluation of management capacity by MPA managers, addressing some 20 distinct elements of effective MPA management programs. The findings highlighted regional capacity building needs associated with sustainable financing, enforcement, strategic management planning and implementation, outreach and communications, and both socio-economic and biophysical monitoring. Now six years later, and following initiatives to build MPA management capacity by many partners, the assessment has been repeated and the findings updated. In this presentation we provide an update on the status of management capacity at 30 Caribbean MPAs in 10 countries and territories, we explore change and we present findings about the current top-priority needs of Caribbean MPA managers for capacity building.

KEYWORDS: MPA, management, capacity building

Ways of Transfer of an Organochlorine Pesticide Along Marine Tropical Food Webs

Voies de Transfert d'un Pesticide Organochloré le Long des Réseaux Trophiques Marins Tropicaux

Vías de Transferencia de un Pesticida Organoclorado a lo Largo de las Redes Tróficas

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ABSTRACT

Chlordecone is a persistent organochlorine pesticide used in the banana fields of the French West Indies, from 1972 to 1993. Three marine habitats (mangroves, seagrass beds and coral reefs) of two study sites located downstream contaminated rivers were chosen to evaluate the level of contamination of marine food webs. Each food chain studied included suspended organic matter, primary producers (macroalgae, algal turf, seagrass), zooplankton, symbiotic organisms (corals, sea anemones), primary consumers (herbivores, suspension feeders, biofilm feeders), omnivores and detritivores (lobsters, fish), secondary consumers (carnivores 1: invertebrate feeders, planktivores) and tertiary consumers (carnivores 2: invertebrate and fish feeders) and piscivores.

Log-linear regressions of the concentrations of chlordecone *versus* nitrogen isotopic ratios ($\delta^{15}N$) were used to assess the bioaccumulation of chlordecone along trophic food webs. On each site, both phenomena (bioconcentration and biomagnification) were active on the transfer of chlordecone in marine organisms. In mangroves (*i.e.* close to the source of pollution), lower trophic magnification factors (TMF) indicated that bioconcentration prevailed on bioamplification phenomenon. In seagrass beds and coral reefs, the opposite phenomenon appeared: bioconcentration processes were less important and bioamplification pathway became dominant. Far from the source of pollution, molecules of chlordecone seemed to be transferred to organisms mostly *via* trophic interactions rather than water contact.

KEYWORDS: Chlordecone, $\delta^{15}N$, bioaccumulation, biomagnification, bioconcentration

Hacía el Manejo de la Pesquería de Arrastre Artesanal en el Caribe de Colombia: Conocimiento Ecológico Local y Aprendizaje Participativo

Towards the Management of the Artisanal Trawl Fishery in the Caribbean of Colombia: Local Ecological Knowledge and Participatory Learning

Vers la Gestion de la Pêche Artisanale de Chalutage dans les Caraïbes de Colombie: Connaissance Écologique Locale et Apprentissage Participatif

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RESUMEN

Una pesquería de arrastre de fondo artesanal opera desde hace 15 años en el golfo de Salamanca (Caribe de Colombia), dirigiendo su esfuerzo hacía la captura de camarones, pero con una proporción importante de especies no objetivo en sus capturas. El conocimiento sobre el impacto ecológico, económico y social de la actividad es limitado en la región. Aemás, los pescadores no se han involucrado en el proceso de manejo pesquero. Con el propósito de documentar el conocimiento ecológico local de los pescadores sobre la composición de las capturas (incidental y descartes) y sobre las especies que consideran en riesgo, se realizaron entrevistas individuales a pescadores expertos. Luego, una estrategia de aprendizaje participativo y colectivo fue empleada para identificar las medidas de manejo pesquero recomendadas en las directrices internacionales para la reducción de pesca acompañante que tuviesen mayor aceptación por parte de los pescadores. Según el conocimiento de los pescadores, una elevada cantidad de especies no objetivo es capturada y un número creciente de esas especies está siendo comercializada para el consumo humano o como alimento de criaderos de peces. Los animales de tamaño muy pequeño son descartados, reconociendo el impacto que significa la pesca de arrastre sobre los juveniles. La percepción de los pescadores corrobora la disminución en la abundancia de especies de pargos, bagres y rayas documentada en estudios científicos. Los incentivos económicos para reducir el esfuerzo pesquero, las vedas y el uso de dispositivos reductores de fauna acompañante fueron las medidas de manejo con mayor votación por parte de los pescadores (77,6%, 65,5% y 53,4 respectivamente). Los resultados significan un insumo para la formulación de un proceso de manejo participativo en la pesquería artesanal de la región.

PALABRAS CLAVES: Co-manejo, pesca artesanal, Descartes, conocimiento ecológico local, camarón

Comparative Diet and Trophic Ecology of Red Snapper (*Lutjanus campechanus*), Vermillion Snapper (*Rhomboplites aurorubens*), and Blackfin Snapper (*Lutjanus buccanella*) in the Northwestern Gulf of Mexico

La Dieta Comparada y la Ecología Trófica del Pargo (*Lutjanus campechanus*), del Pargo Bermejo (*Rhomboplites aurorubens*) y del Pargo (*Lutjanus buccanella*) en el Noroeste del Golfo de México

Le Régime Alimentaire Comparé et L'écologie Trophique du Vivaneau Rouge (*Lutjanus campechanus*), le Vermillon des Vivaneaux (*Rhomboplites aurorubens*) et le Vivaneau (*Lutjanus buccanella*) dans le Nord-ouest du Golfe du Mexique

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ABSTRACT

Descriptions of the diet composition, trophic positions, and diet overlap among co-occuring species can provide a framework for management of these species and important habitat resources, particularly for ecosystem-based fisheries management. Collected from the shelf-edge banks of the northwestern Gulf of Mexico from 2015 through 2017, the diets and trophic ecology of 3 Lutanidae species, red snapper (*Lutjanus camprechanus*), blackfin snapper (*Lutjanus buccanella*), and vermilion snapper (*Rhomboplites aurorubens*), were examined. Stomach contents were identified to determine the diet composition and diet overlap among species. Stable isotopes were used to identify the isotopic niche and overlap among species as a correspondent to define trophic niches. Analysis has yet to be complete, however, some general trends have been noted. Stomach content results have shown a higher contribution of small crustaceans in vermilion snapper compared to red snapper and blackfin snapper. Red snapper and blackfin snapper showed higher contributions of fish and crabs. Stable isotopes results indicate that vermilion snapper feed on a different carbon source than do that of red snapper and blackfin snapper. Red snapper and blackfin snapper were more similar in nitrogen ratios, indicating that they exist in similar trophic levels and that is potential for interspecific competition for prey resources.

KEYWORDS: Trophic Ecology, red snapper, vermilion snapper, blackfin snapper, Gulf of Mexico

The Status of the Groupers Major Fishing Resources in the North of the Mexican Caribbean, Based Upon Simple Indicators

El Estado de la Pesquería de Meros en la Zona Norte del Caribe Mexicano con base en Indicadores Simples

L'état des Mérous dans les Nord des Caraïbes Mexicaines, sur la Base de Indicateurs Simples

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ABSTRACT

In coastal Quintana Roo (Mexico), also known as the Mexican Caribbean, there exists a reef fish multi-specific resource dominated by groupers and snappers which has been the major contributor to catch volume by weight for decades. In the Caribbean and adjacent areas the grouper supports an intense fishery due to its high value in the national and international market. However, there is only little data available for this fishery. Through the collection of information from interviews and intensive sampling of the landings of artisanal and industrial fleets in the Puerto Juarez-Cancun, a first evaluation of the subregional scale of the current state of the three principle species of grouper in the north of the Mexican Caribbean was carried out. Based on simple indicators it was found that i) *Epinephelus morio* experienced overfishing; ii) *Mycteroperca bonaci* is subjected to high exploitation; and iii) *Mycteroperca. microlepis* is subjected to a moderate fishing pressure, within an acceptable level of exploitation. Therefore, the following recommendations were proposed to management: minimal legal size (MLS); of 57.6 cm Lf for *M. microlepis* and *M. bonaci*, both species lacking MLS; the need to maintain the current level of fishing effort (number of fishermen and boats) and improve the catch-effort recordings by species, is also stressed.

KEYWORDS: Reef fish, data-poor fishery, *Epinephelus morio*, *Mycteroperca bonaci*, *Mycteroperca microlepis*

Tradeoff Analysis of the Conservation and Fisheries Benefits of Temporal Closures in a Spawning Aggregation Fishery

Análisis de Compensación de la Conservación y la Pesca Beneficios de los Cierres Temporales en una Pesca de Agregación de Desove

Analyse des Compromis entre les Bénéfices en Termes de Conservation et les Bénéfices pour les Pêcheries de Fermetures Temporaires d'un Pêcherie Ciblant une Agrégation de Ponte

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ABSTRACT

Fisheries that target spawning aggregations are often perceived as inherently unsustainable, with the assumption that even moderate exploitation of spawning fish will result in overfishing and marked population declines. Consequently, spawning aggregations may be fully protected from fishing without an evaluation of whether such restrictions are necessary for sustainability. We designed a parsimonious, non-spatial model to evaluate the effects of seven time-closure scenarios on egg-production-per-recruit (reproductive capacity; a conservation metric) and yield-per-recruit (exploitable biomass; a fisheries metric) of the Gulf Corvina, *Cynoscion othonopterus*, a vulnerable marine fish that is heavily exploited at its only known spawning grounds in northwest Mexico. Results of the model indicated that exploitable biomass was enhanced in five of the seven time-closure scenarios. Moreover, three scenarios offered a reasonable compromise between reproductive capacity and exploitable biomass, in which measurable increases in egg-production-per-recruit (16-42%) were accompanied by proportional increases in yield-per-recruit (33-44%) that resulted in a sustainable fishery. Our findings suggest that the implementation of specific time closures during the spawning season (e.g. closures during the peak spawning day each tide) can benefit both the conservation of the Gulf Corvina and its fishery through the sustainable exploitation of spawning aggregations. Results of the study also illustrate how detailed information on spawning and fishing activities can be directly incorporated into stock assessments and used for management strategy evaluations of aggregation fisheries.

KEYWORDS: Fish spawning aggregations, fisheries management, marine conservation, small-scale fisheries, reproductive resilience

Protecting Reefs with High Structural Complexity Benefits Fish Biomass in the Mexican Caribbean

Proteger Arrecifes con Alta Complejidad Estructural Favorece la Biomasa de Peces en el Caribe Mexicano

La Protection des Récifs à Haute Complexité Structurelle Profite à la Biomasse des Poissons dans les Caraïbes Mexicaines

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ABSTRACT

Areas closed to fishing benefit recovery of fish stocks, generally in terms of biomass; however, the effect of the design and management of these zones on their ecological performance is not yet clear. The present research evaluates the effect of protection and environmental variables and anthropogenic threats on reef fish biomass and describes the influence of management characteristics and the design configuration of closed areas such as the size, shape, spacing, protection time, number of staff, budget, among others. In the year 2016, 51 sites on the frontal reef along the Mexican Caribbean were studied that were in three different levels of protection to the fishing: unprotected, partially, and totally protected; these last two types were analyzed within six Marine Protected Areas. The results indicate that fully protected sites located on reefs with high structural complexity support the highest values of fish biomass, accounting for 36% of the variation observed throughout the Mexican Caribbean. Within the management and design characteristics, the protection time was the only substantial but not significant variable in the explanation of this response variable. Given the central role of reef complexity in providing ecological benefits, it is necessary to identify and implement measures to preserve and improve the quality of the reef habitat of the Mexican Caribbean, as well as adequate selection of sites, while taking into account Other environmental and anthropogenic variables, for the establishment of protected areas.

KEYWORDS: Coral reef, fish biomass, Mexican Caribbean, marine protected areas

Impulsar u Sustentar Procesos de Gestión Ecosistémica en el Caribe: Un Modelo-Piloto Regional en la República Dominicana

Promoting Ecosystem-based Management in the Caribbean: A Regional Pilot-template in the Dominican Republic

Promouvoir e Soutenir les Processus de Gestion Ecosystémique dans le Caribe: Un Model Régional en la République Dominicaine

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RESUMEN

El cartel ilustra los resultados del Proyecto Piloto Montecristi - Puerto Plata (República Dominicana), realizado conjuntamente entre ONU Medio Ambiente y la Agencia Italiana de Cooperación y Desarrollo en alianza con el Ministerio de Medio Ambiente y Recursos Naturales de la República Dominicana. Actualmente este proyecto piloto, focalizado en los espacios de las dos provincias costeras del país, se encuentra en fase avanzada de implementación, lo que incluye el establecimiento de un "modelo piloto" regional de sistema informático, metodologías y mecanismos de coordinación inter-institucional, para enlazar acciones de manejo sectoriales dentro de un marco integrado de Gestión Ecosistémica, creando un sistema de apoyo a la toma de decisiones denominado EBM-DSS. Los principales actores claves institucionales, sociales y económicos de las áreas piloto, se han conformado en un Grupo de Trabajo Interdisciplinario de más de 30 miembros. Durante cuatro ciclos de talleres de análisis participativo, este Grupo ha analizado las características del contexto ecosistémico costero-marino e interpretado las necesidades locales para un desarrollo sostenible. El proceso de análisis se ha realizado mediante un conjunto de diagramas de casillas y flechas que define la estructura y las interacciones entre los distintos componentes de los sistemas biofísicos y humanos relevantes. También se ha desarrollado y calculado diversos Indicadores específicos, que servirán para lograr poner en marcha el sistema informático EBM-DSS. Este EBM-DSS se utiliza para definir un conjunto de medidas de manejo ecosistémico integrado de los espacios costeros y marinos piloto, y funciona como instrumento de planificación, mecanismo de seguimiento y cuadro de monitoreo de eficacia del proceso de Gestión Ecosistémica.

PALABRAS CLAVES: Gestión Ecosistémica (EBM - Ecosystem-Based Management), sistema de apoyo a la toma de decisiones (DSS - Decision Support System), ecosistemas costeros marinos.

Temporal Changes in a Small-scale Artisanal Reef Fishery in Brazil: Management Efficiency and Technological Transformations

Cambios Temporales em una Escala Pequeña de Pesquería de Arrecife Artesanal en Brasil: Eficiencia de Manejo y Transformaciones Tecnológicas

Variations Temporales d'une Pêcherie Récifal à Petite Échelle au Brésil: L'effet de Gestion et Transformations Tecnologiques

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ABSTRACT

The small-scale artisanal reef fishery of Tamandaré, northeastern coast of Brazil, is characterized by its great variety of gears and fishing strategies as well as its economic, social, cultural and ecological relevance in the area. The municipality is located in the Costa dos Corais MPA and holds the first no-take zone established 18 years ago. Fishery data from 1999 (when no-take zone was implemented but measures where not yet effective) and 2017 was compared to evaluate two scenarios separated by intense socio-economic transformations. Results revealed structural changes in the fleet including the total substitution of sail, the traditional "jangadas", for small outboard motors as the main strategy for access to fishing grounds farther from the coast and an increase in the number of non-professional fishers, which currently exceeds the number of professionals. Fishing on the shallow reefs continues to be carried out dominantly by gears of line and spear, with replacement of rudimentary makeshift spears by pressure spear guns as a crucial technological innovation. There was a decrease in traditional mullet fishing attributed mostly to fading of mullet fishing culture and also due to alternative employment and tourist boat movements. Regarding fishery resources, grey parrotfish *Sparisoma axillare* remained as main component of the catch (over 40%) while mullets Mugil spp. declined and small epinephelids and squirrelfishes increased in representativeness. Trends in catches reveal consequences of fishery innovation, but also an increase in opportunistic fishing associated with a larger coastal population. A possible effect of the no-take zone is indicated. CPUE, mean fish length, tourism interactions and a fisher self-monitoring initiative, aimed for self-empowerment and co-management, are discussed.

KEYWORDS: Artisanal fishery, reef fishery management, Brazil, fishery evaluatio

Determine the Queen Conch *Strombus* (*Lobatus*) *gigas* Home-range During the Reproductive Period

Determinación del Espacio Vital del Caracol Rosa *Strombus* (*Lobatus*) *gigas* Durante el Periodo Reproductivo

Détermination du Domaine Vital du Lambi *Strombus* (*Lobatus*) *gigas* Pendant la Période Reproductive

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ABSTRACT

The Queen conch, *Strombus (Lobatus) gigas* (Linnaeus, 1758), is a gastropod with a economic and ecological importance in the Caribbean and it is an overfished marine ressouce. Previous studies have emphasized that conch increasing its activity during the reproduction period and diurnal activity, depending of solar radiations (Noguez Nuñez 2014, Goulié 2015). Diurnal activity is also high during low tides and neap tides (Goulié 2015). Aim of this study is determined activity of conch by area used (m²) and movement speed (m/h) during pre-reproductive season and reproduction season by sexes. Speed was calculated using distances covered by time unit. Area was calculated from irregular polygons method. For this study 150 conch were tagged (100 females and 50 males). Suveys were carried out from February to May. Males have an activity significantly higher during reproductive season than pre-reproductive period (2.16 m/h and 0.35 m/h, respectively). Females showed the same behavior, presenting a speed of 1.06 m/h during pre-reproductive period and 2.35 m/h during the reproductive season. During reproductive season, sexes do not present significant variation of activity, with or without bad weather. This study permitted to collect useful information in order to protect this endangered species with restoring programs in marines protected areas, to increase recovery of stocks

KEYWORDS: Conch reproduction, home range, females, males

Expanding the Collection and Use of Climate Data in the Caribbean

Ampliación de la Recopilación y Utilización de Datos Climáticos en el Caribe

Élargir la Collecte et L'utilisation des Données Climatiques dans les Caraïbes

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ABSTRACT

NOAA's Atlantic Oceanographic and Meteorological Laboratory in Miami, Florida, USA is partnering with the Caribbean Community Climate Change Centre in Belmopan, Belize, CA to expand the Coral Reef Early Warning System (CREWS) monitoring network. CREWS is a network of oceanographic and meteorological monitoring stations situated at coral reef areas around the globe. The monitoring buoys collect near real-time data which are archived at NOAA and made available to the public through the Coral Health and Monitoring Program (CHAMP) www.coral.noaa.gov. The data are used to develop ecological forecasts for coral bleaching, hydrodynamic events, and other marine environmental events of interest to stakeholders including environmental managers, researchers, and the public. Funding support from the Caribbean Climate Change Adaptation and Risk Reduction Initiative was secured in 2017 and is being used to install monitoring stations at specified locations throughout the Caribbean. Project activities include: developing a network of hydro-meteorological stations in the region which will contribute to the World Meteorological Organization's Global Climate Observing System; operating a CREWS monitoring network in the region; generating coastal topographic and bathymetric information; creating a clearinghouse of electronic files of climate change data and information from the Caribbean region; developing evidence-based decision making tools alongside end-users; preparing protocols for the collection of, interpretation and sharing of information. The initiative expands the in situ CREWS monitoring network to improve the understanding of changes in marine conditions for informed management and decision making of shared marine resources.

KEYWORDS: Coral reef ecosystems, real-time monitoring, Caribbean

Data-limited Marine Spatial Planning: Generating Maps of Priority Conservation Areas in Montserrat

Planeación Espacial Marina con Datos Limitados: Generando Mapas de Areas Prioritarias para Conservación en Montserrat

Planification Spatiale Marine en Limitation de Données: Identification des Zones Prioritaires de Conservation au Montserrat

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ABSTRACT

Marine spatial planning (MSP) can help balance economic, ecological and social objectives by minimizing overlap of incompatible activities, protecting important conservation areas, and ensuring sustainable fisheries. In the data- and capacity-limited situations common on small islands such as Montserrat, synthesizing available data into a format that can be easily integrated into the MSP process can be a challenge. To assist Montserrat's stakeholder-led MSP process, we used the freely available R package for systematic conservation prioritization, 'prioritizr', to integrate diverse data sources to create a map of priority conservation areas. We mapped the distribution of fishing effort around the island by combining spatial data collected through interviews with fishers with the locations of fishing pots. A benthic habitat map was created using point data from reef surveys, drop cameras, and historical data. Finally, we used reef survey data to generate a map of total coral and fish species richness. These three data sources (fishing effort, a habitat map, and species richness) were used as inputs to 'prioritizr'. Using stakeholder defined objectives of protecting 30% of coastal waters and areas of high coral cover and biodiversity, we set a target of protecting 30% of each habitat type and 50% of summed species richness, while seeking to minimize the overlap of protected areas with areas of high fishing activity. The resulting map of priority conservation areas has been an important input in guiding the MSP process in Montserrat. Lastly, we used the results of a length based fisheries assessment to inform regulations outside of the conservation areas. The scientific methods used here can be replicated in other data-limited MSP situations, and can be easily adjusted to fit the available data and desired targets.

KEYWORDS:Marine spatial planning, protected areas, conservation planning, Montserrat, data-limited

Lion King: Invasive Lionfish (*Pterois* sp.) Agonistic Behavior Observations

Rey León: Observaciones de Comportamiento Agonístico del Pez León Invasor (*Pterois* sp.)

Roi Lion: Observations sur les Comportements Agonistiques des Poissons Lions Envahissants

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ABSTRACT

Invasive lionfish (*Pterois* sp.) were first observed off southeast Florida in 1985 and are now established throughout much of the northwest Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Agonistic behavior has been observed in numerous reef fish species, including lionfish in aquaria and in their native range. However, there is a lack of documentation in the literature regarding the agonistic behavior of lionfish in their invaded range, despite several videos having captured aggressive actions. On July 26, 2017, two lionfish were observed at a small coral patch reef in Roatan, Honduras (16°19.783'N, 86°34.383'W) in 17m of water, exhibiting behavior similar to what has been described in the literature. The two lionfish were exhibiting what is described as 'high intensity acts' towards each other, including facial contact with the head and flanks of the other lionfish, as well as the venomous dorsal spines making direct contact with the opponent, resulting in several abrasions and punctures to both individuals. These acts of aggression continued at varying levels of intensity for approximately five minutes. The culmination of the agonistic behavior involved the quick retreat of the now subdominant lionfish (faded coloration), under temporary pursuit by the dominant lionfish (remained a darkened color). This documentation of agonistic behavior in invasive lionfish provides further evidence for their behavioral and ecological establishment in the invaded range and may affect future marine research, especially within invaded reef ecosystems.

KEYWORDS: Invasive species, Honduras, Caribbean, agonistic behavior

Mutton and Dog Snappers (*Lutjanus analis* and *Lutjanus jocu)* Spawning Aggregations in the Brazilian Northeastern Continental Shelf: Identification and Validation

Agrupaciones Reproductivas de *Lutjanus analis* y *Lutjanus jocu* en la Plataforma Continental del Nordeste Brasileño: Identificación y Validación

Identification et Validation des Agrégations Reproductives de *Lutjanus analis* et *Lutjanus jocu* sur le Plateau Continental du Nord-est Brésilien Mutton Snapper

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ABSTRACT

Lutjanus analis and dog snapper *Lutjanus jocu* are among the main demersal fisheries resources of artisanal fisheries on the northeastern coast of Brazil. The present study aims to identify and validate spawning aggregations of these species based on direct and indirect indicators. The developed methodology considered (1) exploratory analysis of catch and effort data (CPUE) for hand line fisheries in two regions along the NE Brazilian coast: the first in the north, off the state of Pernambuco (9ºS 35ºW), and the second in the south, off the state of Bahia (14º50'S 38º50'W to 12º50'S 38º12'W); (2) verification of the gonadosomatic index (GSI) of species from these fisheries; and (3) histological analysis of collected gonads to validate the spawning event. The highest CPUEs for both species, with values far above three times the annual average observed, were recorded from April to July (austral fall/winter) at the south portion and from September to March (austral spring/summer) at the north portion. Mutton snapper presented two periods of GSI peaks throughout the year in both areas, with one of them (November-December) coinciding in the two regions. L. jocu also had two periods of high GSI on the south and on the north, with the period between March and April representing a shared peak among the two regions. A histological analysis of the ovary of females caught in specific sites with highest CPUE values, revealed the presence of hydrated oocytes (imminent spawning indicator) and post ovulatory follicles (recent spawning indicator) validating spawning activity in both regions. The identification and validation of these reproductive aggregations can contribute to the planning of conservation and management strategies for sustainable exploitation of these important fish resources.

KEYWORDS: Spawning aggregation, reef fish, Brazil, artisanal fishery, snappers

Best Practices for the Co-management of Offshore FAD Fisheries in Grenada

Buena Practicá para Co-gestión Pesquero en Grenada

Bonne Pratique pour Co-gestion des Pêches des Grenada

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ABSTRACT

Grenada Fisheries Division in collaboration with Japan International Agency have implemented Caribbean Fisheries Co-Management (CAIRIFICO) Project since May 2013. The target site is Grenville, east coast of Grenada, and the target fishery is fish aggregating devices' (FADs) fishing. The project aims to develop and implement the co-management of offshore FAD fishery in sustainable manner.

Grenville FAD Fishers Organization (GFFO) Inc. was registered as a non-profit organization on October 2014. About 120 fishers belong to GFFO and a weekly meeting is continuously held to discuss issues among them today. Several technical trainings such as the FAD design, contraction and deployment, the vertical dropline fishing and the ice box construction were provided during the project. Though those trainings, fishers improved their fishing techniques and the catch of large tunas has increased by approximately 300 % since 2013. In addition, GFFO established financials mechanism for the sustainable maintenance and additional deployment of FADs. All the members pay an annual member fee (XCD 20) and catch fee (XCD 5 per 50 pound), as a result, about XCD 35,000 is deposited in their special account so far.

Co-management activities help uniting fishers and no conflict is observed in Grenville today. The socioeconomic status of offshore fishers was dramatically improved last four years. In addition, the empowerment of fishers spread the vitalization of entire community.

KEYWORDS: Co-Management, FAD, Grenada

Why and How Do Fisherwomen Build Their Own Organization?

¿Por qué y Cómo las Pescadoras Construyen su Propia Organización?

Pourquoi et Comment les Pêcheurs Construisent Leur Propre Organisation?

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ABSTRACT

Fisherwomen, despite their relative invisibility within the fisheries sector, formally organize themselves and claim their rights within the sector. This poster outlines conditions for establishment of such women groups, the type of actions undertaken by those groups, the difficulties they are facing and opportunities. Based on selected examples from different parts of the world, it brings in the debate of gender equality and construction of women's organization promoted in FAO Small-scale Fisheries (SSF) Guidelines. The objective is to outline past mistakes and allow for new initiatives to be built on firmer foundations than in the past.

KEYWORDS: Equality, fisherwomen, gender, organizations,

Fishes Collected in Association with Pelagic *Sargassum* in the Northcentral Gulf of Mexico During Surveys Conducted by the Gulf Coast Research Laboratory, 1999-2008; 2010-2011: A Checklist

Peces Asociados a *Sargazo* Pelagico en el Norte del Golfo de Mejico em Colecciones del Gulf Coast Research Laboratory: 1999-2008; 2010-2011: Lista de verificación

Poissons collectés en association avec les *Sargasses* pélagiques dans le Nord du Golfe du Mexique lors des Campagnes D'échantillonnage Conduites par le Gulf Coast Research Laboratory, 1999-2008; 2010-2011: Une Checklist

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ABSTRACT

A checklist of larval and juvenile fishes collected by the Gulf Coast Research Laboratory (GCRL) at pelagic *Sargassum* habitat in the northcentral Gulf of Mexico (GOM) during surveys conducted from 1999–2008 and 2010-2011 is presented. Over 25,000 specimens were collected in bongo and neuston net tows. The specimens comprised a list of 128 species representing 89 genera and 66 families. The most prominent families in terms of numeric abundance were Carangidae, Clupeidae, Scombridae, Exocoetidae, Mugilidae, Gerreidae, and Balistidae. Family Carangidae contained the greatest number of identifiable species (16), followed by Scombridae (10), Exocoetidae (9), Bothidae (7), Balistidae (4), Monacanthidae (4), and Nomeidae (4). The remaining 59 families were represented by 1 to 3 species. Sargassum habitat was considered to be features such as mats (both large and small), fields of clumps, and 'weedlines' associated with convergent zones or windrows. Pelagic *Sargassum* (Class Phaeophyta; *Sargassum natans* and *S. fluitans*), found only in the Atlantic Ocean, functions as essential habitat, often serving as a nursery, for a great diversity of fishes, invertebrates, and other marine forms. This checklist includes and expands on previous reports of larval and juvenile fishes collected at pelagic *Sargassum* in the northcentral GOM by the authors and published in prior GCFI Proceedings (2002, 2005).

KEYWORDS: Pelagic *Sargassum*, fishes, Gulf of Mexico, checklist, essential habitat

The Troika of Fishers, Government and Academia: Improving the Likelihood of Success in Fish Spawning Aggregation Conservation in the Mexican Mesoamerican Reef

La Troika de Pescadores, Gobierno y Academia: Mejorando la Probabilidad de Éxito para la Conservación de las Agregaciones Reproductivas de Peces en el Arrecife Mesoamericano Mexicano

Troïka des Pêcheurs, du Gouvernement et de L'académie : Pour L'amélioration de la Probabilité de Réussite de la Conservation des Agrégations de Poissons du Récif Corallien Mesoaméricain au Mexique

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ABSTRACT

Small-scale fishers on Caribbean coral reefs have exploited fish spawning aggregations (FSAs) for generations, but intense fishing has led to declines at traditional aggregation sites. The traditional ecological knowledge (TEK) of fishers has contributed greatly to the identification of spawning aggregations and the implementation of local conservation initiatives. Scientists have documented the TEK and made important contributions to the understanding of FSAs. Government fisheries and environment agencies have protected key FSA sites through the implementation of management tools such as no-take zones. By reviewing 30 years of examples from the Mexican Mesoamerican Reef, we explore the hypothesis that only in those areas where information and conservation initiatives from scientists, fishers and government were aligned, have the FSA been successfully protected. We examine the potential FSA sites identified by TEK, those near-misses where one component of the troika was lacking and effective FSA protection faltered, and the successful examples where multiple stakeholders have aligned to protect FSA. We conclude that without the participation of one of the three key sectors (fishers, government, academia) the possibilities for effective, long-term FSA conservation is limited.

KEYWORDS: Fish spawning aggregations, Mexico, participatory approach, conservation

Bajo la Superficie del Mar: Comportamiento de Buceo de Tortugas Marinas

Under the Sea Surface: Sea Turtles Diving Behavior

Au-dessous de la Surface de Mer : Comportement de Plongée des Tortues Marines

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RESUMEN

Los transmisores satelitales permiten colectar datos sobre el comportamiento de buceo de tortugas marinas y describir su comportamiento general y circadiano, además de asociarlo a etapas de movimiento. El objetivo de este estudio fue evaluar el comportamiento de buceo entre especies de tortugas post-anidatorias, entre etapas (Interanidación, Migración y Alimentación) y respecto al ciclo circadiano. Se analizaron datos de buceo obtenidos por rastreo satelital con transmisores Telonics-TAM4510-3, de 51 hembras de tortuga carey (*Eretmochelys imbricata*, n=13), blanca (*Chelonia mydas*, n= 32) y caguama (*Caretta caretta*, n= 6) desde playas de anidación del Golfo de México y Caribe mexicano. Las variables utilizadas para el análisis fueron la duración del último buceo y número de buceos realizados en períodos de 12 hrs. Los resultados revelaron que las hembras de tortuga blanca realizaron mayor número de buceos (47 buceos promedio) e inmersiones de corta duración (9 min cada uno). Las hembras de tortuga carey realizan en promedio 35 buceos con una duración de 21 min promedio, mientras que las tortugas caguama realizaron la menor cantidad de inmersiones (promedio de 17 buceos) aunque más prolongados (24 min en promedio). En Interanidación, las hembras de tortuga carey presentaron mayor número de buceos; en migración y alimentación las hembras de tortuga blanca realizaron mayor número de buceos, y las tortugas carey hicieron buceos más prolongados. Las tres especies mostraron un comportamiento de buceo general similar durante el ciclo circadiano, donde el número de buceos fue mayor durante el día, mientras que la duración de los buceos fue mayor durante la noche. Esto es coherente con la etología general de estas especies que tienen características particulares de conductas y hábitats ocupados en sus distintas etapas de vida.

PALABRAS CLAVES: Telemetría satelital, tortugas marinas, comportamiento de buceo, etapas de movimiento

Primeras Estimaciones de Niveles de Captura Sostenibles de los Principales Recursos de Escama Ribereña en el Litoral Veracruzano: Un Enfoque Simple Basado en las Capturas

First Estimations of Maximum Sustainable Yield of Main Finfish Fisheries Caught on the Coast of Veracruz: A Simple Catch-based Approach

Premières Estimations du Rendement Maximal Durable des Principales Pêcheries de Poissons sur la Côte de Veracruz: Une Approche Simple Basée sur les Captures

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RESUMEN

En el estado de Veracruz la pesca es esencialmente costera y cuenta con un gran número de personas dedicadas a la actividad. Si bien la flota dirige su esfuerzo a una gran variedad de recursos pesqueros, un grupo importante en términos de volumen de captura son los peces óseos, también conocidos con el nombre genérico de escama. Las capturas anuales de este grupo presentan una tendencia a la baja que prevalece desde finales de los 1990s. La estimación del estado actual de los recursos que conforman este grupo es difícil ya que por lo general estas pesquerías carecen de información suficiente para realizar evaluaciones formales. En esta propuesta se aplica el método simple para estimar la captura al máximo rendimiento sostenible (CMRS) basado en las capturas comerciales e información básica poblacional (tasa de crecimiento intrínseca, capacidad de carga) de alrededor de los 15 stocks de peces más importantes capturados en el litoral veracruzano durante 1990 a 2014 que representan el 90% de la captura total registrada. Se encontró que cerca del 75% de los stocks presentaron capturas anuales promedio cercanas a la CMRS estimada, por lo que pueden catalogarse como pesquerías completamente explotadas; mientras que el resto de los stocks presentan capturas por debajo de dicho valor de referencia, lo que puede ser un indicador de una situación no deseable para dichas pesquerías, entre las que se encuentran los recursos pesqueros lisa y lebrancha, trucha y curvina y bagres.

PALABRAS CLAVES: Pesca de escama, pesquerias con pocos datos, maximo rendimiento sostenible, Veracruz, Mexico

Variaciones en los Niveles de Reclutamiento del Mero Rojo (*Epinephelus morio*) en el Banco de Campeche durante 1980-2016

Variations in Recruitment Levels of Red Grouper (*Epinephelus morio*) at the Bank of Campeche during 1980-2016

Variations des Niveaux de Recrutement de Mérou Rouge (*Epinephelus morio*) à la Banque de Campeche en 1980-2016

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RESUMEN

La pesca de mero rojo (*Epinephelus morio*) en el Banco de Campeche es una pesquería importante que actualmente se encuentra catalogada como deteriorada. Este recurso sostiene una pesquería de tipo secuencial donde la flota menor que opera más cerca de la costa accede al componente juvenil de la población y una flota de mayor altura que alcanza zonas de pesca de mayor profundidad y accede a individuos de mayor tamaño. En este trabajo se analizaron las variaciones en los niveles de reclutamiento de los grupos de edad desde uno a tres años durante el periodo 1980-2016. Los niveles de reclutamiento se generaron con un análisis de población virtual por flota bajo el supuesto de que cada flota aplica una mortalidad por pesca diferencial sobre el recurso. Si bien los niveles de reclutamiento para ambas flotas muestran variaciones interanuales importantes para los tres grupos de edad, los reclutamientos de la flota mayor mostraron una tendencia decreciente a partir del año 2000 y hasta el final de la serie. En términos porcentuales, el grupo de edad 1 fue el dominante para ambas flotas a lo largo de la serie, sin embargo, para el caso de la flota menor, a partir del 2012, el grupo de edad 2 domina la serie. Por su parte, la flota mayor, después del 2000 comienza a dominar el grupo de edad 3. Con relación a las anomalías en los reclutamientos para ambas flotas, se distinguieron tres periodos: durante los 1980s se obtuvieron anomalías positivas, durante los 1990s se obtuvieron valores cercanos a cero (i.e., condiciones normales) y a partir de 2003 dominan las anomalías negativas. Considerando estos resultados no se espera una recuperación en el corto plazo del recurso, por lo que es necesario analizar la efectividad de las medidas de manejo actuales.

PALABRAS CLAVES: Reclutamiento, VPA, grupos de edad, mero rojo, Banco de Campeche

Economic Valuation of Mangrove Fisheries and Their Current Status

Valoración Económica de las Pesquerías Asociadas al Manglar y su Estado Actual

Évaluation Économique des Pêches Associé de Mangroves et de leur Statut Actuel

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ABSTRACT

The mangrove ecosystem is one of the most productive and diverse ecosystems on the planet, providing environmental goods and services to people living around it and offering services such as shoreline protection, natural barrier against hurricanes, building materials and fish production.

One of the main services offered by the mangrove ecosystem is to be a site of aggregation, reproduction and protection of commercial species; thus allowing the sustainability of the fishing activity. In Guatemala, there are some studies on the economic value of mangroves, but these studies are not specifically about the economic relationship between mangroves and fisheries.

The present research establishes the economic value of the mangrove ecosystem within the main fisheries of the Rio Sarstun protected area. The methodology applied was based on the bio-economic analysis of the fishing effort based on the catch volumes and an analysis of the value chain of the fishery products establishing the value of the same when passing to the next link of the productive chain.

Among the main results, it can be mentioned that the mangrove ecosystem generates a range of income between the Q100,000.00 to Q191,000.00 quetzals from the snook fishery. The snook fishery reports a good state of exploitation, presenting large organisms that surpass the first quality maturity. On the other hand, the shrimp fishery generates an approximate value of Q361,245.00 quetzals, showing also a state of controlled exploitation.

KEYWORDS: Economic valuation, mangrove, fisheries, snook, shrimp

Analysis of the Decision Support Systems for the Conservation of the Capurgana-Cabo Tiburón and Varadero Coral Reefs in Colombia

Análisis de los Sistemas Soporte de Decisión para la Conservación de los Arrecifes de Coral de Capurgana-CaboTiburón y Varadero en Colombia

Analyse des Systèmes D'aide à la Décision pour la Conservation de Les Récifs Coralliens Capurgana-CaboTiburón et Varadero en Colombie

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ABSTRACT

Direct cordial communication with the director of the National Parks Systems of Colombia presenting the results of the evaluation of indicators performance (ecological, social and the economic valuation) of these two remaing reefs to be protected, assisted in the rout of declaration to be included in the Marine Protected Areas of Colombia. Successful experiences of applying citizen science since 2008 to increase coastal resilience, raising awareness and increasing the MPAs. The involvement of artisanal fisherment after the social work sponsored by CAMPAM-SPAW-UNEP in 2012, empowered their right to protect their coral reefs from unsustainable development in Capurgana-CaboTiburón, Caribbean, Choco.

Debunking Myths identified as justifications for unsustainable development, facilitated the understanding about how to encourage the goverment to protect theDirect cordial communication with the director of the National Parks Systems of Colombia presenting the results of the evaluation of indicators performance (ecological, social and the economic valuation) of these two remaing reefs to be protected, assisted in the rout of declaration to be included in the Marine Protected Areas of Colombia. Successful experiences of applying citizen science since 2008 to increase coastal resilience, raising awareness and increasing the MPAs.

The involvement of artisanal fisherment after the social work sponsored by CAMPAM-SPAW-UNEP in 2012, empowered their right to protect their coral reefs from unsustainable development in Capurgana-CaboTiburón, Caribbean, Choco. Debunking Myths identified as justifications for unsustainable development, facilitated the understanding about how to encourage the goverment to protect the Varadero resilient and healthy coral reef.

KEYWORDS: MPA, new coral reef, Colombia

Monitoring of Herbivorous Fish in Coral Ecosystems of the Dominican Republic Using the Guidelines from the Global Coral Reef Nonitoring Network (GCRMN), 2017

Monitoreo de Peces Herbívoros en Ecosistemas Coralinos de República Dominicana Usando las Directrices de la Red Mundial de Monitoreo de Arrecifes de Coral (GCRMN), 2017

Surveillence de Poissons Hervibores dans des Écosystèmes Coralliens en République Dominicaine en Utilisant de les Directives du Réseau Mondial de Surveillence des Récifs Coralliens (GCRMN en Anglais), 2017

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RESUMEN

Los arrecifes de coral son uno de los ecosistemas más productivos del planeta. La contaminación y el desarrollo turístico acelerado han resultado en sobrepesca, sedimentación y sobre crecimiento de algas en los arrecifes de Coral, lo que conduce a su deterioro, y una merma en productividad y los servicios ambientales que ofrecen. Siendo estos una fuente de equilibrio medioambiental, recursos y empleo para países insulares, se hace necesario elaborar estudios que determinen las acciones necesarias para mejorar las condiciones de estos ecosistemas, mitigar los efectos del cambio climático y reducir los efectos de acciones humanas.

Para dar continuidad a la documentación del estado de los arrecifes coralinos en la República Dominicana, se hizo un monitoreo donde se evaluó la densidad de peces arrecifales depredadores y herbívoros de seis áreas marinas protegidas alrededor de República Dominicana, en alianza estratégica de Reef Check RD, la Fundación Propagas, la Universidad de Maine, la Pontificia Universidad Católica Madre y Maestra y la Universidad Autónoma de Santo Domingo. Los peces herbívoros ayudan a mantener el crecimiento de algas bajo control, lo cual aumenta la supervivencia de corales juveniles, uno de los aspectos mas importantes para la resiliencia del arrecife. Se contaron, y se estimó el tamaño, de los peces en 120 transectos de 10 x 2 m alrededor del país.

La abundancia relativa de las especies depredadoras y herbívoras amenazadas por la actividad pesquera frente al estado de los arrecifes estudiados se analizó para determinar el impacto de la pesca y acciones (o no) de manejo locales, en comparación con datos de monitoreos de años anteriores.

PALABRAS CLAVES: Áreas marinas protegidas, monitoreo, GCRMN, arrecifes de coral, peces arrecifales

Evaluation of the Satellite Transmitters' Behavior Using ARGOS System Used for Tracking Marine Turtles

Evaluación del Comportamiento de Transmisores Satelitales Usando el Sistema ARGOS Utilizados para el Rastreo de Tortugas Marinas

Évaluation du Comportement des Émetteurs Satellites Utilisant le Système ARGOS Utilisé pour le Suivi des Tortues Marines

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ABSTRACT

Studies of satellite telemetry of sea turtles are relevant to know their biology, so the performance of transmitters for location of individuals is transcendental. The objective of this work was to evaluate the transmission behavior and the location accuracy of satellite transmitters with the ARGOS System. Two Telonics satellite transmitters, model TAM4510-3 were used under controlled conditions and with different configurations: one by stages (CSteps), taking as reference periods of time of the movement stages of the sea turtles, and the other with programming of 24 H on (COpen) for the entire sampling time (12 d). They were placed in open skies and separated 1 m from each other, and the geographical coordinate was obtained with a GPS navigator (EGNOS) from an intermediate point between them for location reference. More than 55% of the signals were of the quality level (NC) 3, the maximum for ARGOS, followed by type 2 and B for both configurations (CSteps, n = 168, COpen, n = 222). Of type 0 were the least. It was observed that NCs with greater location accuracy were type 3, followed by type B and 2 with similar results. For both configurations the largest number of received messages was registered in slot 3 (06:00 a.m. to 12:00 p.m. local time); While the smallest number was recorded in slot 1 (06:00 p.m. to 12:00 a.m.) for COpen and in slot 4 (12:00 p.m. to 06 p.m.) for CSteps. This information contributes with criteria elements for the spatial analysis of data derived from the ARGOS System, providing a reference of the potential errors that can be expected from the location of individuals tracked with these transmitter models, as well as the periods of better communication with the Satellites

KEYWORDS: Transmitters, performance, evaluation, configurations, sea turtles

Participation of Women in GCFI

Participación de Mujeres en el GCFI

Participation des Femmes dans les GCFI

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ABSTRACT

A historical view of women participating in GCFI will be analyzed by reviewing the Proceedings, membership lists and other documents. The GCFI began in 1948 with the inaugural meeting held in Miami. Active participation of women in GCFI has grown steadily and we will be documenting the history of women participation in GCFI. We will try to answer such questions as who was the first woman to attend GCFI, and who was the first woman to be part of the board?

In the seventy years of the Institute, we have had 3 women as Chairpersons of the GCFI Board of Directors. Dalila Aldana Aranda was the first woman Chair from 2008-2010. Graciela García-Moliner was the Chairperson from 2014-2016, followed by Nancy Brown-Peterson in 2016-2018. Over that period of time we have had a total of 17 women on the Board between 1987 and the present.

The number of women participating in GCFI has increased throughout the years. Their participation has increased from 5% in 1987 to 50% in 2012; during the past three years, 43% of meeting registrants have been women. Additionally, 55% of student Travel Award winners (since 2005) and 54% of Student Achievement Award winners (since 1998) have been women, and women were the first recipients of both awards.

Women participation in other GCFI related activities has also increased, including in the Fishers Forum, with two women receiving the Gladding Memorial Award. The 69th GCFI in Grand Cayman saw the 1st Women in Fisheries calendar, which helped to highlight the increasing participation of fisher women in all aspects of fishing. Production of the calendar inspired GCFI and other fisheries organizations to bring forth the increased participation of women in all aspects of fisheries, an effort we would like to continue women history participation.

KEYWORDS: Gender, fisheries organizations, participation

Diferencias Espacio Temporal Relacionadas con la Edad, el Hábitat y la Estrategia Depredadora en el Pez León

Spatial and Temporal Differences Related to Age, Habitat and Predatory Strategies in Lionfish

Différences Spacio-temporelles en Relation avec L'âge, le Choix de L'habitat et la Strategie de Prédation chez la Rascasse Volante

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RESUMEN

El pez león Pterois volitans es una especie invasora exitosa que ha logrado dispersarse ampliamente en el Caribe ocupando diferentes hábitats. Sobre el comportamiento y uso del hábitat de la especie se conoce poco, que son preferentemente activos en horas crepusculares y que durante el día se refugian en cavernas. El presente estudio se centró en identificar la relación de la conducta y talla (edad) del pez león con las características ambientales de su hábitat. Registramos mediante observaciones directas el comportamiento y uso de hábitat de 793 individuos en la costa Maya, Quintana Roo, México. Nuestros resultados identificaron tres actividades y cinco posturas, describiendo por primera vez la postura horizontal para cazar. Demostramos que los peces no son solitarios y pueden presentar actividad nocturna. Observamos diferencias conforme a la edad de los peces león, los juveniles muestran diversidad de conductas en distintos hábitats cazando preferentemente de noche, mientras que los peces más grandes pueden estar activos a lo largo del día y se encuentran en mayor proporción en zonas arrecifales. Nuestro estudio sugiere que estas diferencias pueden estar relacionadas con la depredación y las posibilidades de canibalismo. Esta flexibilidad conductual es una característica más de Pterois volitans que le ha permitido su éxito como especie invasora.

PALABRAS CLAVES: Grupo cacería, refugio, etología, hábitat

Understanding Visual Ecology of Sharks and the Possible Use in Bycatch Reduction Devices

Ecología Visual de Tiburones y el Posible Uso en Dispositivos pare Evitar la Captura Incidental

Ecologie Visuelle des Requins et les Possibles Utilisation de Dispositifs afin D'éviter des Captures Accidentelles

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ABSTRACT

Sharks are an important component of the fisheries in many countries but mismanagement might compromise shark populations. Juvenile mortality affects many shark populations because the animals incidentally caught in fisheries do not recruit into the adult population. Many juvenile pelagic sharks are part of the bycatch of many of the fishing gears and it is one of the main problems in current fisheries. Several fishing practices and gear modifications have attempted to reduce bycatch using mechanical artifacts but more alternatives are required. Differences between visual characteristics of elasmobranches and teleost can be used to design attractants or deterrents to make the fishery more selective. Visual specializations of sharks directly relate to the environment where they live, specifically to the amount of light available. Many pelagic species have adaptations for dim light environment as more rods than cones in the retina (i.e. higher sensitivity) and horizontal photoreceptor cell distribution that may reflect scanning an open environment. The light spectrum that is absorbed by the rod photoreceptors might be used to design a by-catch reduction device similar to visual deterrents that are being tested to prevent shark attacks. The use of a strobe light flashes with specific light spectrum or contrast breaking patterns might be adapted to different fishing gears to avoid juvenile pelagic sharks. Similar devices may be applied in the Gulf and Caribbean region.

KEYWORDS: Elasmobranch, bycatch, visual ecology, retina, sharks

El Análisis de las Estructuras de Mercado en las Organizaciones Pesqueras de la Costa de Yucatan, Mexico

The Analysis of Market Structures in the Fisheries Organizations of the Coast of Yucatan, Mexico

L'analyse des Structures du Marche dans les Organisations de Peche au Large de Yucatan, Mexique

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RESUMEN

Conocer la estructura de mercado es imprescindible no solo para aquel que quiera participar en éste, particularmente desde la oferta, sino también para tomadores de decisiones quienes deberán velar por los intereses de los consumidores y procurar un entorno legal saludable para competir. Es decir, prever que la concentración derivada del poder de mercado de unos cuantos agentes, propicie monopolios o carteles, ya que de esta forma, se evitaría que las señales del mercado sean emitidas solo por un agente con capacidad de manipular los mecanismos para el intercambio en detrimento de potenciales vendedores y aún más importante, de los demandantes. Esto puede observarse en los mercados pesqueros, ya que los productos pesqueros se han convertido en mercados cada vez más atractivos dirigido por los precios, lo que influye en la distribución del ingreso entre los actores que participan en éstos. Lo anterior explica el paulatino incremento de los estudios que analizan la competencia en las pesquerías, no así para México, aun cuando su producción pesquera se encuentra en el lugar 16 a nivel global según la FAO y cuyo valor creció un 19% para junio de 2017. Este trabajo tiene como objetivo resaltar las bases conceptuales del análisis de las estructuras de mercado en las pesquerías mexicanas del Golfo de México para hacer más eficiente la toma de decisiones. La producción de esta región representa el 15% de la pesca nacional y su valor es el 14% del total, de cuyas especies destacan el pulpo, el pepino de mar y el mero, cuya presencia es cada vez más notoria en diversos segmentos de mercado internacionales.

PALABRAS CLAVES: Market organizations, fisheries, Yucatan

Developing Practical Solutions to Issues Faced by Working Women in the All-female Central Fish Processors Association (CFPA) in Barbados

Desarrollar Soluciones Prácticas a los Problemas que Enfrentan las Mujeres Trabajadoras en la Asociación Central de Procesadores de Pescado (CFPA) en Barbados

Développer des Solutions Pratiques aux Problèmes Rencontrés par les Femmes qui Travaillent dans L'ensemble des Femmes Association Centrale des Transformateurs de Poisson (CFPA) à la Barbade

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ABSTRACT

The Central Fish Processors Association (CFPA) was established in 2005 out of a need to address challenges small fish processors (fish vendors) were experiencing with their work area at the Bridgetown Fisheries Complex. Issues concerned refrigeration facilities, sanitation procedures, working hours and management communication. Unable to voice their concerns, this largely female group worked together to form the only fisheries postharvest association still in existence in Barbados. The CFPA began with approximately 20 members and was predominantly female with a female leader from its inception. Today the association is an all-female organization with 29 members. Despite not being a legally formal organization, participation in the CFPA and its activities is high, especially in times of crisis. Both institutionalized regular meetings and ad hoc meetings have proven partially successful at tackling problems and developing the CFPA, but more needs to be done. Persistent wicked problems prompted the president of the CFPA to seek partnership with the Gender in Fisheries Team (GIFT). Issues were identified from CFPA meeting minutes, other documents and discussions with the membership. GIFT conducted action research to obtain a good understanding of CFPA problems and concerns, and determine what the female members envision as possible practical solutions to enhance their fisheries occupation and domestic life. This research is framed conceptually in terms of livelihood and institutional analyses and adaptive capacity – the three linked research frameworks of GIFT.

KEYWORDS: Gender in Fisheries Team, fish, processors, Barbados

Involving Fishing Professionals in Lionfish Trap Evaluation

Participación de Pescadores en la Evaluación de Trampas para Pez León

Utiliser les Pêcheurs dans L'évaluation du Piège à Poisson-lion

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ABSTRACT

Recent modifications to lionfish trap designs improve fishing efficiency and make it possible to engage the commercial fishing community in further evaluation. Following successful early tests with prototype traps, a folding "purse" design was developed to reduce size and enable transport of a larger number of traps on fishing vessels. Coupled with a streamlined fish aggregation device (FAD), the purse trap travels vertically through the water column during deployment and retrieval, reducing drag and facilitating fishing operations. The National Marine Fisheries Service in the U.S. is planning to seek further testing and refinements on these FAD-based, non-containment curtain traps by issuing Exempted Fishing Permits to selected fishing professionals who will also evaluate capture proficiency, trap effectiveness in different environments, and several areas of potential risk, including bycatch, habitat impacts, entanglement of marine mammals and turtles, and ghost-fishing. We also expect fishermen will help determine the most appropriate trap construction materials and techniques, gear configurations (ground tackle, harness, lines, and floats) and fishing techniques (e.g., single traps vs. trawls).

KEYWORDS: Lionfish traps, FAD, effectiveness, impacts

Trophies, Fecundity, and Markets for Animal Parts: An Economic Case Study of *Pristis* spp. Extinction and Some Conservation Policy Solutions

Trofeos, Fecundidad y Mercados para las Partes Animales: Estudio de Caso Económico de la Extinción de *Pristis* spp. y Algunas Soluciones de Política de Conservación

Trophées, Fécondité et Marchés pour les Pièces Animales: Étude de cas Économique D'extinction de *Pristis* spp. et de Certaines Solutions de Politique de Conservation

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ABSTRACT

Extinctions of certain marine animals has posed significant conservation concerns over the last years. There is evidence that trade in body parts increases the extinction risk, especially in large marine fishes. The case of sawfish (*Pristis* spp.), is worrisome because they considered to be the most endangered marine group in the world. Recovery of a population in this group is likely to take decades depending on how effectively sawfish could be protected. From an economic standpoint, to avoid the extinction process and to obtain the maximum diversity out of the gene pool that remains, policy makers must know the relations between the biology of the species and the effect of market signals in an effort at mitigating extinction probability. We did a case study with available data on just one part of this problem with sawfish, which focuses on the market for the rostrum. During 2016 and 2017, a search for saws in internet auction houses was carried out. A total of 119 saws were found and regressions were performed in an effort to understand the physical characteristics and the real prices paid. We found a positive and significant correlation between size of rostrum and real price paid for the article. We also found that the addition of sawfish on Annex I of the CITES agreement may have led to higher prices for the rostrums. This species are usually caught accidentally, the likelihood of their being kept increases with size. We predict that these price signals of larger animals will accelerate extinction pathways, and become stronger as more and different parts are traded. Further, CITES designations may also accelerate extinction pathways by further driving prices of parts up, and driving the markets underground. Some policy solutions are discussed which may be helpful in reversing these trends.

KEYWORDS: Sawfish, rostrums, markets, CITES, policies

Cambios en las Abundancias y el Esfuerzo Pesquero en el Golfo de Salamanca Durante Diferentes Fases de las Operaciones Portuarias Carboníferas

Changes in the Abundance and Fishing Effort in the Gulf of Salamanca During Different Stages of Development of Coal Port Operations

Les Changements dans L'abondance et L'effort de Pêche dans le Golfe de Salamanca au cours des Différentes Phases des Opérations Portuaires de Charbon

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RESUMEN

El golfo de Salamanca (GdeS) constituye un área de importancia pesquera en el mar Caribe de Colombia. Sin embargo, desde la década de los 90 se iniciaron operaciones de almacenamiento y cargue de carbón mineral para exportación, limitando así las actividades de navegación y pesca en esta área. Con el objetivo de evaluar cambios en la captura y el esfuerzo pesquero en el GdeS durante diferentes fases de las operaciones portuarias carboníferas, se realizaron encuestas semi-estructuradas a pescadores artesanales de las comunidades costeras del golfo: Tasajera, Puebloviejo, Ciénaga, Aeropuerto y Pozos Colorados. Se indagó sobre el estado actual e histórico de diferentes aspectos de la pesquería artesanal y se compiló información bibliográfica relacionada con estas pesquerías. Se compararon los inventarios de artes, embarcaciones y la composición de especies de la pesca artesanal del GdeS durante el período estudiado. Los resultados indican que los pescadores del GdeS experimentaron una disminución de las abundancias en las capturas en los sitios tradicionales de pesca, lo cual conllevó a desplazarse hacia el margen occidental de golfo, incrementando la distancia promedio a los sitios de pesca (24,62 ± 4,25 mn). En consecuencia, aumentó la duración del viaje de pesca en busca de mayores abundancias del recurso, modificando los caladeros tradicionales y ampliando la frontera pesquera artesanal. Paralelamente, han disminuido los tamaños de malla de las redes de enmalle y han aumentado el poder de pesca, mediante la incorporación de cambios tecnológicos en sus artes y embarcaciones, como estrategias para disminuir las consecuencias derivadas de la disminución de las capturas en las zonas cercanas a las instalaciones carboníferas y las prohibiciones implícitas para ejercer la pesca en estos sitios.

PALABRAS CLAVES: Pesquería artesanal, carbón, golfo de Salamanca, Mar Caribe de Colombia

Women in Fisheries Forum (WIFF) in Belize: Promoting Gender Equality and Equity in Fisheries

Foro de Mujeres en la Pesca (WIFF) en Belice: Promover la Igualdad de Género y la Equidad en la Pesca

Le Forum des Femmes dans les Pêches (WIFF) au Belize: Promouvoir L'égalité entre les Sexes et L'équité dans les Pêcheries

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ABSTRACT

The first ever Women in Fisheries Forum (WIFF) in Belize, jointly organized by the Belize Marine Conservation and Climate Adaptation Project (MCCAP) and the Wildlife Conservation Society (WCS), has been a major step towards understanding the role of women in fisheries there. Geared towards promoting gender equality and equity in the allocation of resources, rights, status and responsibilities between women and men, the WIFF attracted 52 female participants representing all aspects of the fisheries value chain – fisheries management, gear/equipment services, harvesting and marketing, and processing and distribution – with the main objective of developing a Gender Action Plan to mainstream gender in the daily activities of government departments, NGOs and projects in Belize. The results of two studies, the MCCAP Knowledge, Attitude and Practice (KAP) survey and the Gender in Fisheries Team (GIFT) scoping survey of perspectives on Gender Equality in Caribbean Fisheries, informed group discussions on fisherfolk organizations, working conditions, fisheries management, development decision-making, formal credit for fisheries, and capacity development. We examine the discussions that highlighted women's issues, constraints and challenges in the fisheries sector, and set out recommendations for addressing these matters in a Gender Action Plan. Further discussion of the draft plan is needed prior to finalization. While it was the first WIFF to be convened, it will not be the last; MCCAP is committed to hosting another forum in 2018. Similar forums such as this should be held in other countries to better understand gender in small-scale fisheries.

KEYWORDS: Women in Fisheries Forum, Belize, gender equality and equity, Gender in Fisheries Team, small-scale fisheries

Spatio-temporal Distribution of *Octopus maya* by Age

Distribución Espacio-temporal de *Octopus maya* por Edades

Répartition Spatio-temporelle de L'âge *Octopus maya*

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ABSTRACT

The knowledge about the distribution of the species and the environmental factors that determine it, are fundamental information for its conservation and sustainable management. The objective of the present study was to determine the spatial-temporal distribution of *Octopus maya* by age group and its relationship with environmental variables. Two-year georeferenced data (2012-2014) were obtained from the catch per unit effort and the size structure of *O. maya* catches of the small-scale coastal fleet of the Yucatan peninsula, Mexico. Through a modal progression analysis and a multimodel evaluation method, the best growth model for *O. maya* was determined and a length - age key in terms of probability was constructed. The Boosted Regresion Trees model was used to determine the relationship between the abundance of *O. maya* and the sea surface temperature, depth, turbidity and season of the year. The results show an important concentration zone of young organisms (2 - 4 months old) off the coast of Sisal and Celestún. *Octopus maya* showed higher affinity at temperatures above 24 ° C but lower at 30 ° C in areas with low turbidity and at low depths (<15 m). These preferences changed according to their age, so it's suggested that population movements may occur in search of conditions suitable for their age. These spatio-temporal variations in the age structure of *O. maya* can affect the catches of commercial fleets, so the present study provides relevant knowledge for the sustainable management of this resource.

KEYWORDS: *Octopus maya*, distribution, growth model, length – age, key, catch-per-unit effort

Contamination of Scleractinian Corals by Microplastics in Guadeloupe Island (Lesser Antilles)

Contaminación de Corales Petreos por Microplásticos en la Isla de Guadeloupe (Antillas Menores)

Contamination de Coraux Scléractiniaires par les Microplastiques en Guadeloupe (Petites Antilles)

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ABSTRACT

Plastics contaminate the oceans worldwide. Microplastics are defined as plastic particles with a size comprised between 2 µm and 5 mm. While the contamination by microplastics of seawater and fish has been well documented, the contamination of corals has only been demonstrated in vitro. However, corals are key organisms in reef ecosystems and their contamination by microplastics could represent a critical threat for this environment, justifying an assessment of that pollution in reef habitats.

In Guadeloupe (Lesser Antilles), three sites have been studied to evaluate the level of contamination of Scleractinian corals by microplastics. They were located on the East (windward), West (leeward) and North coasts of the island in order to encompass different marine conditions. In each site, three co*ral colonies belonging to four coral species were collected: Agaricia agaricites, Siderastrea siderea, Porites astreoides* and *Orbicella faveolata*. Living tissues of each sample were dissolved using hypochlorite sodium. Then, microplastic particles were sorted under a binocular microscope and photographed. Image processing was used to count the number of particles of plastics found inside each coral colony and to sort them according to their morphology (fragment, fiber…).

Globally, 87.5 % of the sampled colonies contained microplastics, with a varying proportion of fragments and fibers according to species and sites. The size of the polyps was not significantly related to the level of contamination of the polyps. The site presenting the less contaminated corals appeared to be the most exposed to open oceanic waters and relatively sheltered from coastal anthropogenic activities. This preliminary study has revealed the importance of the contamination of Caribbean reef corals by microplastics.

KEYWORDS: Microplastic pollution, Caribbean, scleractinian corals, coral reef

Primeros Resultados sobre el Estudio del Proceso de Mordida del Mero Americano *Epinephelus morio* Utilizando un Modelo Biomecánico

First Results on the Study of the Bite Process of the American Mero *Epinephelus morio* Using a Biomechanical Model

Premiers Résultats sur L'étude de la Morsure du Mérou Rouge *Epinephelus morio* au Travers de L'utilisation d'un Modèle Biomécanique

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RESUMEN

La comprensión de los mecanismos de la toma de alimento en los peces teleósteos puede lograrse a través del estudio de la morfología funcional. El uso de modelos biomecánicos permite analizar la relación que existe entre las estructuras del sistema músculo-esquelético del cráneo involucradas en la alimentación y su funcionamiento. Con el propósito de caracterizar el proceso de mordida de uno de los depredadores topes de los ecosistemas tropicales y subtropicales, se analizó 14 medidas morfométricas de estructuras músculo-esqueléticas del cráneo de 208 especímenes de mero americano (24.5-73.8 cm de longitud total), capturados en aguas costeras de Yucatán, México. Por medio del uso del programa MandibLever (versión 3.5), el cual se basa en el principio mecánico de la palanca de tercer grado, estas medidas permitieron obtener los valores de las ocho variables biomecánicas más importantes relacionadas con el funcionamiento de la mandíbula de los peces: duración de mordida (Dm; ms), fuerza de mordida (Fm; N), Torque (Tq; Nm), Ventaja mecánica efectiva (Vm), velocidad de cierre (Vc; cm/ms), trabajo (Tb; Nm), poder muscular (Pm; W) y poder (P; W/kg). Los valores de las variables biomecánicas proporcionados por tres de las simulaciones ofrecidas por MandibLever (boca abierta, semi-cerrada y cerrada) fueron analizadas tomando en consideración las dos subdivisiones A2 y A3 del músculo abductor mandibular. Las variables predominantes fueron: Vc y Pm (A2) y Dm, Tb y P (A3) para la boca abierta y semi-cerrada y Fm, Tb y P (A3) para la boca cerrada. La aplicación de un PCA, revelo que solamente cinco de las variables estudiadas (Fm, T, Vc, Tb y Pm) caracterizaron el proceso de mordida del mero americano.

PALBRAS CLAVES: Biomecánica, alimentación, ontogenia, mordida, Epinephelidae

Identifying Key Biodiversity Areas for Marine Vertebrates in the Greater Caribbean

Identificación de Áreas Clave de Biodiversidad para Vertebrados Marinos en el Gran Caribe

Identification des Principaux Domaines de la Biodiversité pour les Vertébrés Marins dans la Grande Caraïbe

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ABSTRACT

Effective allocation of limited conservation resources is important for the preservation of global biodiversity. Well-established protected areas increase the likelihood of preserving species and habitats most at risk of extirpation, but traditional methods of choosing their placement using biological proxies are sometimes inadequate for targeting biodiversity conservation. A methodology for identifying Key Biodiversity Areas (KBAs), determined by specific criteria and thresholds, was proposed in 2016 by International Union for the Conservation of Nature (IUCN). These are founded on the principles of vulnerability and irreplaceability to iteratively identify sites where species and habitats are most urgently in need of protection. KBAs for marine vertebrates in the Greater Caribbean are identified using species-specific threat statuses, distribution, occurrence and population data. A number of KBAs are triggered within the boundaries of existing sites of conservation importance, such as Alliance for Zero Extinctions sites and Important Bird and Biodiversity Areas, while others are identified at sites previously unknown for their potential conservation value. These proposed KBAs provide spatial biodiversity data for local stakeholders and resource managers to refine plans for regional and national protected area networks to ensure they include sites most important to biodiversity conservation.

KEYWORDS: Key biodiversity areas, marine protected areas, vulnerability, irreplaceability, Caribbean

Environmental Physiology of Lionfish (*Pterois volitans* and *Pterois miles*) Metabolic Systems: Are There Physiological Limits to Inshore Invasion?

Fisiología Ambiental de los Sistemas Metabólicos del Pez León (*Pterois volitans* y *Pterois miles*): ¿Hay Límites Fisiológicos a la Invasión Costera?

La Physiologie de L'environnement des Systèmes Métaboliques Lionfish (*Pterois volitans* et *Pterois miles*): Existe-t-il des Limites Physiologiques à L'invasion Côtière?

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ABSTRACT

The invasive Indo-Pacific lionfish (*Pterois* sp.) is now well established in the western Atlantic and is broadly considered a significant threat to native fish populations and overall biodiversity as a result of its rapid geographic range expansion, fast individual growth, high fecundity, and high predation rates. This study examines the energetic physiology of lionfish via aerobic-metabolic scope under the influence of various temperature-hypoxia regimes using stop-flow respirometry to determine current and future invasion success into inshore temperate estuaries. Thirty lionfish were captured off southeast Florida and allowed a minimum of a two-week acclimation period prior to experimental trials. To determine relative hypoxia tolerances, lionfish metabolic scopes were observed under normoxic conditions and subsequently subjected to nine stepwise decreases in oxygen saturation of 10% to determine critical oxygen saturation (Scrit) values at four different temperatures. Lionfish aerobic scopes at 25°C and 30°C were observed to be 99 mg O_2/kg/h and 111 mg O_2/kg/h, respectively. Furthermore, lionfish exhibited a mean Scrit value of 23.8 ±2% at 25°C. Additional trials wereconducted to determine how influences of both mild and severe hypoxia limited metabolic scope under the respective temperatures. Data from this study will be incorporated into ecophysiological models to effectively determine current impacts of lionfish on sensitive ecosystems as well as forecast future impacts in light of concurring global temperature increases. Mechanistic physiological models from this study will directly enhance fisheries management agencies efforts to mitigate impacts from lionfish on commercially and ecologically important species thereby improving the integrity of sensitive ecosystems.

KEYWORDS: Lionfish, physiology, hypoxia, aerobic-scope respirometry

Migration of Mutton Snapper (*Lutjanus analis*) Between Home Range Areas and Spawning Aggregation Sites in the US Virgin Islands

Migración de Pargo Criollo (*Lutjanus analis*) entre los Rangos de Hogar y los Sitios de Agregaciónes Reproductivas en las Islas Vírgenes de los Estados Unidos

La Migration du Vivaneau sorbe (*Lutjanus analis*) entre les Domaine D'habitation et les Sites D'agrégation des Frayères en aux Îles Vierges Américaines

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ABSTRACT

Many large coral reef fish participate in transient fish spawning aggregations (tFSAs), events at certain times of year during which fish migrate tens of hundreds of kilometers to spawn in large groups at specific locations. One such species of economic and ecological importance in the US Virgin Islands is the mutton snapper (Lutjanis analis). They are known to use a site called Tampo, south of the island of St. John, a site on the southwest end of St. Croix, and are suspected to use a site on the Grammanik Bank, south of St. Thomas. The search for the locations of these aggregations and their source populations is an active area of research. To track individuals to and from aggregation sites, this study utilized passive acoustic telemetry, an effective method for quantifying spatiotemporal movements of many fish for long, continuous periods of time. Arrays were placed at the three spawning sites across the US Virgin Islands, as well as at Brewers Bay, St. Thomas, and Buck Island, St. Croix. Eight individuals were tagged in Brewers Bay, with all but one showing high residence time of >90% by hour for most of the year. Two swam from home sites in Brewers Bay, bypassed the closer aggregation at the Grammanik Bank, and swam to the spawning site at Tampo, while one tagged at the spawning site in St. Croix swam to its home site at Buck Island. This study compares movement patterns of mutton snapper at their home ranges to those at spawning sites. Species like mutton snapper are vulnerable to fishing during reproductive periods, due to a high concentration of large fish at predictable times and places. Knowledge of fish space use is essential to the implementation of effective management strategies that can benefit both the local economy and the environment, ensuring sustainability and ecosystem health for the long term.

KEYWORDS: Acoustic telemetry, mutton snapper, US Virgin Islands, spawning aggregations

Composition of Parrotfish (Labridae: Scarinae) in the Parque Nacional Arrecife Alacranes, Southern Gulf of Mexico

Composición de Peces Loro (Labridae: Scarinae) en el Parque Nacional Arrecife Alacranes, Sureste del Golfo de México

Composition de Poissons Perroquet (Labridae: Scarinae) dans le Parc National de Récif Alacranes, Sud du Golfe du Mexique

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ABSTRACT

Parrotfish (Labridae: Scarinae) are ecologically and functionally important species in coral reefs, where their different feeding habits allow them to influence the structure of benthic communities. In this study, we quantified the composition and structure of parrotfish species in the Parque Nacional Arrecife Alacranes (PNAA). This reef is located 130 km off the northern Yucatan Penisula, Mexico, where anthropogenic disturbance is relatively low compared to that in coral reefs in the Mexican Caribbean. We quantified parrotfish structure over two depth ranges: one shallow (1.5 to < 10 m) and one deep (12 and 18 m) in the Leeward and Windward zone, where a total of 14 species were recorded. Parrotfish species presented high abundance and large sizes, where the most abundant were Scarus guacamaia, S. coelestinus, S. coeruleus and Sparisoma viride. Parrotfish in the PNAA seem to be one of the best structured fish assemblages of the Yucatan Peninsula in terms of species richness, abundance, and size.

KEYWORDS: Parrotfish, assemblage, herbivorous fish,

Evaluación Pesquera de la Langosta Espinosa (*Panulirus argus*) en el Parque Nacional Arrecifes de Xcalak, México

Fisheries Assessment of the Spiny Lobster (*Panulirus argus*) in Xcalak Reefs National Park, Mexico

L'évaluation des Pêches de la Langouste (*Panulirus argus*) á Parc Nationale Récifs des Xcalak, Mexique

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RESUMEN

La langosta espinosa (*Panulirus argus*) es un recurso de importancia comercial en el Caribe. En Xcalak al sur del Caribe mexicano, representa una pesquería de tipo artesanal, generando ingresos a la localidad durante la temporada de pesca. Para darle seguimiento a la pesquería de esta especie, se realizó un estudio de la captura mensual de P. argus durante la temporada 2011-2012 en el Parque Nacional Arrecifes de Xcalak (PNAX). Se registró un total de 3815 organismos de los cuales 2008 (53%) fueron hembras y 1807 (47%) machos, con una proporción sexual a favor de las hembras ($X^2p = 10.59$; $p < 0.05$). La longitud abdominal (LA) osciló entre 110 a 273 mm (152 ± 14.54 mm LA), mientras que el peso abdominal (PA) estuvo entre 89 a 532 g (198.1 ± 52.96 g PA). La talla de primera captura fue de 148 mm LA, ubicado dentro del principal grupo modal de 130 a 160 mm LA. En cuanto a la relación longitud-peso, el tipo de crecimiento fue alométrico negativo con una pendiente de 2.5. La estimación de los parámetros de crecimiento fue obtenida por el método indirecto de Shepherd ($L\infty = 287.3$ mm LA, $k = 0.26$ y $t_0 = 0.34$). La Captura Por Unidad de Esfuerzo (CPUE), esfuerzo y zonas de pesca fueron determinadas a través de 157 entrevistas a embarcaciones pesqueras, se observó que al inicio de la temporada (Julio), tanto la CPUE y esfuerzo fueron significativamente mayores a los meses posteriores, además la captura estuvo enfocada en la parte centro-sur del polígono del PNAX. Con base a los resultados obtenidos y comparados con trabajos realizados para la misma localidad, se observó que la pesquería se considera de bajo impacto, debido a que los diferentes indicadores aquí reportados han permanecido constantes desde 2008-2014. La implementación de nuevas artes de pesca y vigilancia son necesarias para la sostenibilidad del recurso.

PALABRAS CLAVES: *Panulirus argus*, Xcalak, pesquería, CPUE, esfuerzo

Movement and Habitat Use of Whale Sharks (*Rhincodon typus*) Tagged in the Northern Gulf of Mexico

Movimiento y Hábitat de Tiburones de Ballena (*Rhincodon typus*) Embarcados en el Golfo Norte de México

Mouvement et Utilisation D'habitat de Tablons de Bien-vert (*Rhincodon typus*) Tagged dans le Golfe du Nord du Mexique

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ABSTRACT

Whale sharks (*Rhincodon typus*) are typically solitary animals; however, in the northern Gulf of Mexico they form large aggregations at shelf-edge banks during summer. While there is an understanding of their seasonal distribution in the region, knowledge of movements once they leave aggregation sites is limited. Here we report the movements of 44 satellite tagged whale sharks within the Gulf of Mexico from 2008-2014. Most sharks were tagged at an aggregation site off the coast of Louisiana. State-space modeling was applied to movement data to generate most probable tracks and used to analyze seasonal trends in distribution. Sharks ranged from 4.6-12.2 m total length (n = 44; mean 7.9 ± 0.3 m SE) with a male to female ratio of 5:1. Mean number of days-at-liberty was 97 days (± 15 SE) and all but four individuals remained within the Gulf of Mexico. Shark movements occurred throughout Gulf of Mexico with a net southward movement during cooler months. Additionally, several sharks moved into the Caribbean Sea, demonstrating connectivity among documented aggregation sites in the western North Atlantic Ocean. These broad movements necessitate multinational, cooperative efforts to improve management whale sharks in the western North Atlantic Ocean.

KEYWORDS: Whale sharks, aggregations, *Rhincodon typus*

Preliminary Results of a Fishery Independent Trap Survey of Marine Reserve and Fishing Areas on the South Coast of Antigua

Resultados Preliminares de una Encuesta de Pesca Independiente de la Trampa de la Reserva Marina y de las áreas Pesqueras en la Costa del Sur de Antigua

Résultats Préliminaires d'une Enquête sur les Piétons Indépendants de Pêche de la Réserve Marine et des Zones de Pêche sur la Côte Sud d'Antigua

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ABSTRACT

Fish traps (pots) were used to collect data on reef fish communities inside and outside of a major marine reserve (Cades Bay Marine Reserve) on the south coast of Antigua. The objectives were to: 1) obtain baseline primary data on various fisheries metrics (catch rate, species size, species diversity, catch rate and size for the invasive red lionfish, Pterois volitans, etc.) inside the protected area and adjacent unprotected areas; 2) evaluate the effectiveness of the marine reserve as a fisheries management tool; and 3) assess the status of the reef fishery and the impact of fish traps on fish communities. There was no significant spatial variability in the catch rate (kg per trap hauled) ($p > 0.05$) inside and outside the protected area. In most cases, the mean sizes for the main reef fish families (Acanthuridae, Haemulidae, Scaridae, Serranidae, Lutjanidae, etc.,) and the Caribbean spiny lobster (Panulirus argus) were not significantly different inside and outside the marine reserve ($p > 0.05$); pooled mean sizes for the various species were generally greater than the size at 50% maturity indicating that growth overfishing was restricted. The sustainability of the trap fishery with respect to mitigating juvenile retention was attributed to previous management strategy of protecting nearshore, shallow juvenile habitats (< 20 m) and shifting fishing effort to deeper, offshore areas (≥ 20 m). This along with the 2013 legislative requirement for biodegradable panels in traps should improve the long-term sustainability of the trap / reef species fishery.

KEYWORDS: Protected area, trap survey, reef fishery, Antigua, fisheries, management

Risk Perception of Diving Among Small-scale Fishers: A Qualitative Risk Assessment

Percepción de Riesgo del Buceo entre Pescadores de Pequeña-escala: Una Evaluación Cualitativa del Riesgo

La Perception du Risque de la Plongée chez les Pêcheurs de Petite Taille: Une Évaluation Qualitative du Risque

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ABSTRACT

In many small-scale fisheries in the Gulf of Mexico as well as in many coastal fisheries around the world, the hookah diving is the fishing method and gear used to harvest high-value species like sea urchin, sea cucumber, queen conch and spiny lobster, among others. However, diving related-accidents such as decompression sickness and carbon monoxide poisoning was associated with the fishing method, causing disabilities and death among small-scale fishers and negatively impact the social and economic status of households and coastal communities. Currently, there is also misunderstanding among fishers concerning diving risks. This study reports using a qualitative risk analysis the fishers perception of the likelihood of undesired health threatening events occur as a result of hookah diving, and the corresponding perceptions of impacts or consequences of such accidents. These risk perceptions were contrasted with actual hookah accidents occurring in the spiny lobster and sea cucumber small-scale fisheries in northeastern ports of the Yucatan coast. According to fishers, decompression sickness is a major problem with a possible likelihood of occurrence and disabilities can result as a consequence. Risk perception among older fishers was higher compared to the younger fishers, as well as, in married divers compared than single divers. In the 2014-2015 fishing season, 116 HBO2T to 111 divers were provided during the spiny lobster season and 157 HBO2T for 98 divers during the sea cucumber season. The method allows for identification of priority decisions relevant to the need for appropriate fishing technologies, fishers' capacity building in health precautionary measures, and increased community awareness of possible consequences of current fishing technology.

KEYWORDS: Small-scale fishery, risk assessment, hookah diving, fishers, risk perception

Catch of Postlarval Caribbean Spiny Lobster (*Panulirus argus*) Using Witham Collectors May Under Represent Peaks in Monthly Recruitment and Limit Assessment of Annual Trends

La Captura de la Langosta Espinosa del Caribe (*Panulirus argus*) de Etapas Post-larvales Utilizando Colectores de Witham Puede Detectar Insuficientemente Picos en Reclutamiento Mensual y Puede Limitar la Evaluación de las Tendencias Anuales

La Capture de la Langouste Épineux de la Caraïbe (*Panulirus argus*) de Stades Post-larves Utilisant les Collecteurs Witham Peut Sous-représenter Apogées dans le Recrutement Mensuellement et Limiter L'évaluation desTendances Annuelles

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ABSTRACT

In the Florida Keys, recruitment of postlarval Caribbean spiny lobster (*Panulirus argus*) has been monitored using modified Witham collectors since 1986. Recruitment occurs year-round peaking from November to May. However, analysis of this 31-year time series has shown no correlation between postlarval recruitment and fishery landings in Florida. In 2013, a new, more durable collector constructed using frayed polypropylene rope was developed. This rope collector caught more postlarval lobsters than Witham collectors during high recruitment months, but caught the same amount of postlarvae during low recruitment months. We hypothesize that our Witham collectors reached capacity in peak recruitment months and therefore underestimated recruitment during those months. This inability of Witham collectors to accurately measure peak recruitment may have compromised the identification of correlations between postlarval recruitment and landings in Florida's lobster fishery. A re-evaluation of potential correlations, or more accurately, the historic lack of correlations, between postlarval recruitment and the legal-sized lobster population is warranted in Florida and may be useful for localized populations in other areas of the Caribbean.

KEYWORDS: Witham collector, *Panulirus argus*, recruitment, postlarvae, Florida Keys

Fisheries Co-management Rules and Regulations: Toward Caribbean Fisheries Co-management Project

Reglas y Reglamentos de Cogestión de las Pesquerías: Para el Proyecto de Cogestión de las Pesquerías del Caribe

Règles et Règlements de Cogestion des Pêches : Vers le Projet de Cogestion des Pêches des Caraïbes

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ABSTRACT

The anchored FADs, Fish Aggregating Devices, which are located around 10-20 miles from shore in Caribbean water and fishers operate for day trip, tend to create a problem of conflict, e.g. congestion of users in Commonwealth of Dominica FADs, owners did not want other fishers to operate around the FADs, furthermore they fought on the land when they returned from sea.

FADs user group and government have been trying to reduce the conflict by the introduction of fishery co-management in Dominica.

A typically defined as a partnership arrangement between government and the local community of resource users (FAO). For instance, six eastern Caribbean Courtiers have practiced FADs Co-management by Caribbean Fisheries Co-management Project (CARIFICO) during 2013 to 2018.

During the project, some of the key issue are highlighted, that is the declaration of its ownership and supporting program for FADs sustainability financially. Consequently, in other words, FADs fisher group and government share the responsibility of managing the FADs by informal fisher's rules and/or formal government's regulations, as well as created its financial mechanisms.

In this poster, assuming that successful co-management level are categorized by the conflict and financial mechanism levels, the six countries case are examined. However, each country are at different stages after the four projects and still progressing, the result could extend to further discussion and improvement of the project, and share in the Gulf and Caribbean Region.

KEYWORDS: Fish Aggregating Devices, FADs, co-management, ownership

Capacity Building in Fishing Communities of the Gulf of Mexico

Promoción de Capacidades en Comunidades Pesqueras del Golfo de México

Renforcement des Capacités dans les Communautés de Pêcheurs dans le Golfe du Mexique

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ABSTRACT

The management of artisanal fisheries, especially those that are part of natural protected areas, must include the participation of fisheries, academic, and governmental sectors, in order to get a real sustainability. The fishery community of Antón Lizardo, Veracruz, Mexico, has made efforts to get a recognized participation in the core of decision of the governmental sector and in the management of fisheries resources, but no success has been obtained. A multidisciplinary group of the Universidad Veracruzana has been working in this community through the establishing of a training program which has two approaches, the enforcement of management skills, and the promotion of good management of artisanal fisheries in natural protected areas. The main achievements showed that all members of two cooperative societies are aware and committed with the conservancy of natural resources, they understand their function in the ecosystems, and they are worry and recognize the necessity of strengthen the team work. These two societies are developing as references and models for other fishery communities. The inclusion of the academic sector, in the development of fishery communities, enforces the management and conservancy actions of resources in natural protected areas, it also provides tools to social actors in order to get a better organization and involvement in the decision making that affect their own benefit and the sustainability of natural resources, in addition to promoting the economic and social development of the region.

KEYWORDS: Tools for fisheries management, artisanal fishing communities, fishing in protected areas, Gulf of Mexico

Variación Espacial en la Composición de Especies de Peces Capturadas con Palangre de Fondo en Aguas Litorales del Norte de la Península de Yucatán, México

Spatial Variation in the Composition of Fish Species Caught with Bottom Longline in Coastal Waters of the Northern Peninsula of Yucatán, México

Variation Spatiale de la Composition Spécifique de Poissons Capturés par Palangre de Fond dans les Eaux Littorales du Nord de la Péninsule du Yucatan

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RESUMEN

En el sur del Golfo de México, en la Península de Yucatán, el palangre de fondo es el principal arte de pesca utilizado por la flota artesanal para la pesca de peces demersales, siendo el mero (*Epinephelus morio*) la especie objetivo. Sin embargo, a pesar de ser un método selectivo, captura otras especies que no son objetivo directo de pesca. En el presente trabajo se analiza la composición y abundancia de la comunidad de peces que son capturados con el palangre de fondo en dos zonas costeras (Celestún y Río Lagartos). Entre junio 2016 y enero 2017, 3 palangres de fondo experimentales fueron operados mensualmente en cada zona, considerando tres rangos de profundidad (10-15m, 15-20 m y > 20 m). Un total de 1,141 individuos pertenecientes a 22 familias y 45 especies fueron capturados en las dos zonas de estudio, que compartieron un 62.2% del total de especies capturadas. Las familias Epinephelidae y Lutjanidae (6 especies cada una) y Carcharhinidae (5 especies) fueron las que presentaron mayor riqueza. La zona de Celestún presentó 43 especies y Río lagartos 30 especies. La especie dominante fue el mero americano E. morio, , en ambas zonas l (58.2% y 55.9%, respectivamente), seguido por Rhizoprionodon terraenovae (9.9%) en Celestún y Dasyastis americana (6.8%) y Ariopsis felis (6.9%) en Río Lagartos. El rango de profundidad con mayor abundancia y riqueza de especies fue el de 15-20 m en Celestún y 10-15 m en Río Lagartos. La mayor beta diversidad se encontró en el rango de 10-15m en las dos zonas; las especies que presentarón mayor contribución a la beta diversidad fueron: *Haemulon flavolineatus* (Celestún) y *Ariopsis felis* (Río Lagartos).

PALABRAS CLAVES: Ensamblaje de peces, abundancia y riqueza de especies, variación espacial palangre de fondo, Península de Yucatán

The Role of Surface Wind Forcing on the Movement and Distribution of *Sargassum* in the North Atlantic Ocean and Caribbean Sea

Influencia del Viento en Superficie en el Movimiento y Distribución de *Sargazo* en el Atlantico Norte y el Mar Caribe

Le Rôle du Forçage par le Vent sur le Déplacement et la Distribution des *Sargasses* dans l'Atlantique Nord et la Mer des Caraïbes

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ABSTRACT

During 2011, and again in 2014-2015, a number of Caribbean islands as well as west Africa and equatorial Brazil experienced the most widespread coastal accumulations of *Sargassum* seaweed ever reported for these regions. The resulting socioeconomic impacts spurred interest in the likelihood of similar events in the future, and in the prediction of such events for future planning and mitigation strategies. Several diverse hypotheses were put forward by the scientific community as to the source of the Sargassum and why it seemed to be blooming in such large quantities in areas where it had never been observed before, most significantly in the western tropical North Atlantic Ocean east of Barbados. Using a combination of NCEP/NCAR reanalysis fields of winds and surface currents, satellite-tracked surface drifter data from NOAA's Global Drifter Center, and high-resolution surface currents from the global HYCOM numerical model, we find that the key to understanding the typical abundance and distribution patterns of Sargassum as well as its anomalous presence during 2011 and 2014-15 in areas outside of its usual location in the Sargasso Sea and the Gulf of Mexico lies in the effect of direct wind forcing on the sea surface by "windage", Stommel shear, Stokes drift, or a combination thereof. These wind effects, which are not explicitly accounted for in the NCEP reanalysis or HYCOM fields and which do not play a major role in the movement of drogued surface drifters, are nevertheless very important to take into consideration. They explain not only the typical *Sargassum* distribution, but also the role of the extreme large-scale wind anomalies that occurred during the winters of 2010 and 2013 in dramatically (but perhaps temporarily) altering the usual *Sargassum* pattern.

KEYWORDS: *Sargassum*, winds, surface currents, Atlantic, Caribbean

Some Effects of Hurricanes on Ichthyoplankton in the Upper Mixed Layer

Algunos Efectos de Huracanes en Ichthyoplankton en la Capa Mixta Superior

Quelques Effets des Hurricanes sur Ichthyoplankton dans la Couche Superieure Mixte

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ABSTRACT

In September of 2004 Hurricane Ivan crossed over the continental slope and shelf off Mississippi in the Gulf of Mexico as a category 3-5 storm. The Naval Research Laboratory (Stennis Space Center) located an array of upward beaming Acoustic Doppler Current Meters (ADCP) directly under the path of the hurricane, measuring current profiles, temperature and pressure at the depth of the instruments, and amplitude of acoustic return (echo). In this project, we are evaluating the effects of the resulting intense currents, waves and mixing on ichthyoplankton in the water column due to passage of the hurricane. The ADCP examined here, was deployed from May-October 2004 in ~ 60 m of water depth near the edge of the continental shelf. Significant wave heights of ~ 18-20 m and current amplitudes exceeding 200 cm/s were experienced at this site. Echo amplitudes changed dramatically over the entire water column (~ 60 m). Echo amplitude grew rapidly upward from the bottom and downward from the sea surface. Prior to the hurricane passage, clear diurnal signals were evident in echo amplitude in the upper 25 m of the water column. After passage, echo amplitudes in the upper layer were heavily diminished and remained so for the next 6 weeks until termination of mooring deployment, although echo amplitudes from below the mixed layer returned to normal. There is a significant link between echo returns and the presence of ichthyoplankton. Hurricane Ivan had a large impact on an area noted for a strong summer production.

KEYWORDS: Ichthyoplankton, ADCP, hurricanes

Pelagic *Sargassum* in the North Tropical Atlantic: Mortality, Growth and Seasonal Prediction

Sargassum Pelágico en el Atlántico Tropical Norte: Mortalidad, Crecimiento y Predicción Estacional

Pelagic *Sargassum* dans l'Atlantique Nord-tropical: Mortalité, Croissance et Prévision Saisonnière

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ABSTRACT

In this study, we discuss results from a Russian sea floor survey over the Mid-Atlantic Ridge north of the NERR (North Equatorial Recirculation Region) where large quantities of pelagic *Sargassum* were found both at the surface, and along the bottom in different stages of decomposition. Model backtracks from the survey location trace this *Sargassum* to the Gulf of Guinea along an extensive, indirect path where significant growth and mortality must have occurred. Growth and mortality of pelagic *Sargassum* are key parameters necessary for quantifying model based forecasts of *Sargassum* events when long transport times and distances are involved. It is also necessary for understanding important issues such as global carbon sequestration and potential increases in fishery biomasses. But it is poorly known. Previous work on mortality has focused on (1) beaching or transport into low salinity water, and (2) sinking to bladder failure depths in Langmuir cells. Predation is not considered a major mortality factor. Beaching, although impressive locally, in the long term can only account for a small percentage of mortality needed to balance the growth rate. We discuss breaking of *Sargassum* plants by wave action, Langmuir Cells, Langmuir Mixing and the need for relatively simple but standardized measurements of mortality by sinking.

KEYWORDS: *Sargassum*, mortality, langmuir, carbon sequestration, fishery, biomass

An Assessment of Conch Morphology on the Island of Saint Lucia and Possible Future Management Implications

Una Evaluación de La Morfología Concha en la Isla de Santa Lucía y Posibles Impuestos Futuros de la Gestión

Une Évaluation de la Morphologie Conchante sur L'île de Saint-Lucie et des Possibles Implications de Gestion Future

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ABSTRACT

Queen conch morphology assessment was carried out on the North and West of Saint Lucia's coast. The activities and analysis of data from sampled population helped to achieve the following objectives;

1. Develop baseline morphometric data of conch for Saint Lucia;
2. Determine any spatial variability in regards to conch morphology;
3. Examine length-weight relationships for maturity stages (juvenile, sub adult, adult and old adult);
4. Develop national-derived conversion factors for different levels of processed conch meat; and
5. Appraise management regimes (e.g., minimum size / weight).

For pooled adult conch, shell length and shell lip thickness differed significantly along the coast and among fishing areas in Saint Lucia ($p < 0.05$); conch from the west coast were larger and greater lip thickness than conch in the north. Analysis of adult conch further underpins the fact that queen conch exhibit sexual dimorphism as female queen conch are significantly larger and weighed more than male conch ($p < 0.001$).

Variations in sexual dimorphism and spatial variability among adult conch have implications for management regimes, as larger female conch may be favored over male conch; similarly the differences between the sexes with respect to the size at sexual maturity and the legal minimum size. Recognizing the variations that exist in the life history of the queen conch, conversion factors for the processing grade of conch revealed that there is a significant difference between the various process grade to nominal weight among the different stages of conch maturity ($p < 0.005$).

The results from this assessment highlights the need for the strengthening of current management approach, and considering one that is multifaceted, and based on participation and cooperation to ensure that the conch fishery is sustainable.

KEYWORDS: Queen conch, morphology, management, sexual maturity

Relationships Between Habitat and Fish Assemblages on Louisiana-Texas Shelf-edge Banks

Relaciones Entre el Hábitat y las Asociaciones de Peces en los Bancos Fronterizos de Louisiana y Texas

Relations Entre L'habitat et les Assemblages de Poissons sur les Berges Louisiana-Texas

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ABSTRACT

The banks off the Louisiana-Texas shelf in the northwestern Gulf of Mexico provide a diverse collection of habitat zones each with characteristic fish assemblages. These habitat-assemblage relationships have been shown to be consistent across several banks, but related to additional factors such as depth, bank size, and substrate complexity. Understanding the habitat drivers and associations of the many recreationally and commercially important fish species that inhabit these banks is critical to management. Video data were recorded at six shelf-edge bank sites (Rankin, Bright, McGrail, Sidner, Alderdice, and Jakkula) at varying depth and habitat type using a baited remote underwater video (BRUV) array consisting of two stereo pairs of cameras. Twenty minutes of each video was reviewed in EventMeasure software to identify fish to the lowest possible taxonomic level and measure abundance (calculated as MaxN, the maximum number of a given species in any single frame) as well as record habitat variables. Relationships between fish species assemblages, habitat zones, and other habitat characteristics were explored using traditional metrics of diversity, evenness, and richness as well as permutational multivariate analysis of variance (PERMANOVA), non-metric multidimensional scaling (NMDS), and principle component analysis (PCA) in R. With five of the six sites included in the preferred alternative for expansion of the Flower Garden Banks National Marine Sanctuary, understanding which species utilize habitats on these banks and what factors drive assemblages will directly inform the likely utility of sanctuary expansion and/or the habitats most in need of additional protection. Species, such as those of grouper and snapper, are of particular interest due to their economic importance and management status.

KEYWORDS: Fish assemblage, habitat zone, Gulf of Mexico, underwater video, BRUV

A Multi-criteria Spatial Analysis to Determine Shark Species at Risk in the Gulf of Mexico

Un Análisis Espacial Multicriterio para Determinar las Especies de Tiburones en Riesgo en el Golfo de México

Une Analyse Spatiale Multicritères pour Déterminer les Espèces de Requins en Péril dans le Golfe du Mexique

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ABSTRACT

Worldwide, many shark species are at risk of extinction due to overexploitation. In this work, we used spatial multiple-criteria analysis, based on the World Sharks Assessment data from shark species of the GOM, to map their distribution. Such mapping was based on the following four criteria: 1) high richness, 2) inclusion in any IUCN risk of extinction category, 3) inclusion in the Mexican National Fisheries Chart (MNFC), and (4) consideration of the Fish Base intrinsic vulnerability index. Studies in the northern GOM show a sharp decline in both coastal and oceanic shark populations. In our work, we found 60 shark species at risk of extinction, with some of them included in the MNFC, with this latter Mexican fishery instrument recognizing the fishery extraction of many of these species. In our mapping, many reported species showed a high concentration mainly at middle zones of the GOM. This finding calls for the establishment of international agreements between US and Mexico in terms of shark management and conservation in the GOM.

KEYWORDS: Sharks, Gulf of Mexico, fisheries, IUCN, mapping

NOAA's National Coral Reef Monitoring Program: Integrated Ecosystem Monitoring and Reporting in U.S. Coral Reef Areas to Inform Conservation and Management

Programa Nacional de Monitero de Arrecifes de Coral de da NOAA: Monitoreo e Informes Integrados de Ecosistemas en Áreas de Recife Coral de los Estados Unidos para Informar la Conservación y la Gestión

Le Programme National de Surveillance du Reef Coral de NOAA: Surveillance Intégrée de L'écosystème et Déclaration dans les Zones de Recherche Coral des États-Unis pour Informer la Conservation et la Gestion

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ABSTRACT

The National Oceanic Atmospheric Administration's Coral Reef Conservation Program (CRCP) strives to protect, conserve, and restore coral reef resources, including reef associated fisheries, by maintaining healthy ecosystem function. Since 2013, CRCP has supported the National Coral Reef Monitoring Program (NCRMP) to collect biological, physical, and socioeconomic data throughout the U.S. Atlantic, Caribbean, and Pacific coral reef areas. The overarching goal of this effort is to collect the information needed to gauge the changing conditions of U.S. coral reef ecosystems and support well-informed ecosystem-based conservation and management. NCRMP is a long-term approach to provide an ecosystem prospective via monitoring fish, benthic, climate, and socioeconomic variables in a consistent and integrated manner, to provide information supporting NOAA and our State, Territorial, and other Federal partners efforts to more effectively manage and conserve our nation's coral reefs. NCRMP's fishery-independent surveys gather data on reef fish abundance, size and species to better understand the status of reef fish populations. This work presents our current efforts in Florida, USVI, Puerto Rico and Flower Garden Banks to standardize methodologies and reporting to support the uptake and utilization of this data for management of coral reef fisheries.

KEYWORDS: Coral, reef fish, fishery-independent surveys

Improving Long-term Coral Reef Monitoring in the Wider Caribbean region: GCRMN-Caribbean Accomplishments for 2016

Mejorar el Monitoreo a Largo Plazo de los Arrecifes de Coral en el Caribe: Avances del GCRMN Caribe para el Año 2016

Améliorer le Suivi à Long Terme des Récifs Coralliens dans la Région des Caraïbes : Les Progrès du GCRMN Caraïbes pour L'année 2016

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ABSTRACT

Long-term, robust coral reef monitoring coupled with strategic reporting are essential drivers for ecosystem-based management and regional policy processes. There has been a move towards revitalizing the Caribbean component of the Global Coral Reef Monitoring Network (GCRMN). The foundation for restructuring the network was launched in August 2014, and the first three years of the GCRMN-Caribbean have seen the confirmation of a dynamic network, which has been bolstering its presence and regional acknowledgement. An expert steering committee and members-at-large have enabled the network to achieve substantial progress. GCRMN-Caribbean bio-physical guidelines have been improved and tested at several sites; communication and experience sharing have increased considerably; capacity building actions have been implemented for coral reef practitioners with a special focus on MPA managers; and there has been collaboration with major Caribbean programmes. This paper reports on the progress of the GCRMN-Caribbean in 2016: the implementation of the GCRMN-Caribbean bio-physical guidelines at different sites (Sint Marteen and Bermuda), the development of socio-economic guidelines for an integrated monitoring approach, and the start of the "Building capacity for coral reef and human dimensions monitoring within the Wider Caribbean" project, within a workshop-based training program to increase regional capacity for integrated bio-physical and socio-economic monitoring. Besides its achievements for the year, this paper also reports on GCRMN-Caribbean network challenges and next steps.

KEYWORDS: GCRMN-Caribbean, coral reef monitoring, bio-physical guidelines, socio-economic guidelines, capacity building

Using Acoustic and Optical Methods in Fish Spatial Distribution Assessment

Uso de Metodos Acusticos y Opticos para Monitorear la Distribución Espacial de Peces

Utilisation de Méthodes Acoustiques et Optiques dans L'évaluation de la Distribution Spatiale des Poissons

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ABSTRACT

This study combined acoustic (echo-sounder) and optical (stereo baited remote underwater video, referred to as stereo-BRUVs) methods to evaluate the distribution and abundance of fish. These techniques complement each other, as the echo-sounder can be used to map the location of fish schools and individuals over a large area, and the visual data can help identify the species composition of a school, which is often non-trivial to attain with acoustic methods alone. The non-extractive and non-invasive characteristics of these techniques are useful, particularly in conservation areas, such as marine parks. The objective of this study was to compare the spatial distribution of fish using acoustic and optical methods over different benthic habitats in Ningaloo Reef Marine Park, Western Australia. Acoustic data was collected using a single-beam echo-sounder at two frequencies 38 and 200 kHz. Optical data was collected using stereo-BRUVs, deployed at 656 different sampling points within the same region. Relative biomass per species was estimated using the stereo-BRUVs data for each point of deployment. Schools and single-targets were extracted and the target strength of the species representing the highest proportion of biomass, according to the stereo-BRUVs data was used as a preliminary way to convert the backscatter energy into relative biomass. Correlations between the relative biomass estimated with both methods were explored. The relative advantages and drawbacks of these methods for monitoring fish populations is discussed.

KEYWORDS: Demersal fish, echosounder, BRUVs, habitat distribution

Macroalgal Blooms in the Belize Barrier Reef Complex: Evidence of Long-term Nutrient Enrichment

Bloqueos de Macroalgas en el Complejo de Barreras de Belice: Evidencia de Enricuecimiento a Largo Plazo de Nnutrientes

Macroalgal Blooms dans le Complexe de Barrier do Corail de Belize: Preuve de Enrichissement de Nutriments a Long Terme

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ABSTRACT

Phase-shifts from coral to macroalgal dominated reef systems have been well documented throughout the wider Caribbean region. Although some biologists consider herbivore loss through disease and overfishing to be the causal factor, recent reef surveys in Belize indicated that expanding macoalgal blooms are not related to loss of herbivorous fishes. To assess the possible role of long-term nutrient enrichment, macroalgae from several mangrove and reef sites in the Belize Barrier Reef Complex (BBRC) were re-sampled in June 2017 and compared with previous tissue nutrient (carbon:nitrogen:phosphorus; C:N:P) data collected in the late 1980s. Comparative sampling sites included Man-O-Way Cay, Twin Cays, Tobacco Reef, and Curlew Reef. In addition, the 2017 sampling included collection of macroalgae from a variety of habitats at Glover's Reef that are experiencing macroalgal blooms. The dried macroalgal tissue was processed and analyzed for stable carbon and nitrogen isotopes, as well as C:N:P ratios. The comparative nutrient data showed significant increases in the N:P and C:P ratios at all sites since the late1980s, with parallel decreases in the C:N ratio. These data provide preliminary evidence of long-term nitrogen enrichment of the BBRC, which could explain the expanding macroalgal blooms without loss of herbivorous fishes. Macroalgae in the lagoon and fore reef habitats at Glover's Reef also had high N:P and C:P ratios, suggesting that this offshore location is also experiencing nitrogen enrichment. Stable nitrogen isotope values in the macroalgae were dependent on location, with some sites reflecting enriched values typical of wastewater, and other sites more depleted values typical of nitrogen fixation, fertilizers, and atmospheric deposition.

KEYWORDS: Belize, macroalgae, carbon, nitrogen, phosphorus

Innovative Approaches in Support to Fisheries Management and Stock Assessment Systems

Enfoques Innovadores en Apoyo al Manejo Pesquero y a los Sistemas de Evaluación de Stocks

Approches Innovantes en Appui aux Systèmes de Gestion et D'évaluation des Stocks

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ABSTRACT

FAO has been involved in recent years in the design and development of innovative tools in support to the fisheries statistics supply chain. As a global organization with a mandate to collect national statistics, FAO has been leading the creation of standards for the definition of information to be collected to address the need for sound statistics in support to evidence based policy making. Standard classifications such as the ASFIS list (list of species of interest for fisheries) are maintained and shared with different fisheries stakeholders; a new step is taken now to define standard formats for the key indicators to facilitate data sharing and exchange for national to regional and international level. The Coordinating Working Party on fishery statistics (CWP) will propose these standard data structure definitions inspired from the SDMX DSD.

These definitions are meant to be used as standard outputs for the Scalable Software Framework (SSF). This initiative aims to streamline support to Member states requesting assistance in fisheries statistics. It will also benefit from newly developed systems that increase quantity and quality of data collected from developing countries fishers such as Automatic Identification System (AIS); it allows the gathering of more precise information on fishing vessels location to improve computation of fishing effort indicator.

FAO has in the meantime developed an additional framework for smartphone application development, SmartForms, that is being used in different contexts to multiply source of information and data flowing in the SSFK (among other systems using SmartForms). This modern tool provides innovative approach to data collection for context where data are poorly available.

KEYWORDS: Data collection framework, software, SmartForms, Automatic Identification System, FAO

Underwater Acoustics for Ecosystem Research: Current Advances and Perspectives in Northeast Brazil

Acústica Subacuática para la Investigación de Ecosistemas: Avances y Perspectivas Actuales en el Nordeste de Brasil

Acoustique Sous-marine pour la Recherche sur les Écosystèmes: Avancées et Perspectives Actuelles dans le Nord-est du Brésil

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ABSTRACT

Recent improvements (e.g. multi-frequency, broad-band echosounders) allow to simultaneously characterise physical structures (e.g. thin layers, internal waves, eddies) and organisms (from zooplankton to whales) patterns of distribution across scales from meters to thousands of kilometres. These progresses open a variety of perspectives for understanding complex processes. On this basis we are developing in Northern Brazil the 'Acoustic along the Brazilian Coast' (ABRAÇOS) project. The main objective is to establish a 3D characterisation of the abiotic and biotic compartments and their interactions in coastal and oceanic ecosystems. The project is based on two multidisciplinary at-sea surveys performed on-board the IRD R/V Antea in Sept. – Oct. 2015 and April – May 2017 as well as small scale surveys using vessels of opportunity. The study area includes the Northeast coast Brazil and an oceanic area including the Archipelagos of Fernando de Noronha, the Atoll das Rocas and oceanic seamounts. These campaigns have three specific objectives: (i) characterisation of the water masses and their dynamics; (ii) ecosystem acoustics with the collection of multi-frequency acoustic data (38, 70, 120 and 200 kHz) coupled with pelagic and bottom trawls, zooplankton net sampling and video images; and (iii) biodiversity and trophic structure with the study of benthic, demersal and pelagic biodiversity, patterns of distribution, trophic ecology and contamination (mercury). First results provide a new vision of the ecosystem structure and dynamics and reveal, among other, the importance of gelatinous in both coastal and oceanic ecosystems. The perspectives include comprehensive mapping of demersal and pelagic patterns of distribution according to the habitat characteristics including coral reef areas.

KEYWORDS: Technology, acoustics, ecosystem, distribution, habitat

Evaluation of the Status of the *Panulirus argus* (Spiny Lobster) from 2004 through 2017 in the Turks and Caicos Islands

Evaluación del Estado del *Panulirus argus* (Langosta Espinosa) de 2004 a 2017 en las Islas Turcas y Caicos

Évaluation du Statut de *Panulirus argus* (Homard Épineux) de 2004 à 2017 dans les Îles Turques et Caïques

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ABSTRACT

With increasing anthropogenic pressures, the sustainable management of any fishery now requires an in-depth understanding of a species' biological attributes and the temporal and spatial scales by which they vary. Panulirus argus (*P. argus*) is the most commercially lucrative fishery of the Turks and Caicos Islands (TCI), yet few studies have addressed local trends in growth and reproduction. To examine how biological attributes of the P. argus vary in relation to both environmental and fisheries-dependent factors, carapace length, reproductive attributes, and sex ratio of P. argus landed at South Caicos processing facilities from 2004-2017 were assessed. The data of this study suggest that individual lobster as small as 76 mm carapace length (CL) are reproductively capable and that P. argus can be found reproducing year-round. Additional research from April through July (i.e. closed season) could provide assistance to determine if the current closed season is best for reproductive success.

Current trends of the fishery are examined through the biological, temporal and spatial factors that affect P. argus CL. Data suggest that variations in CL are related to both yearly and seasonal fluctuations; and can be associated with local geographic differences throughout the Caicos Bank. The Eastside of South Caicos and Fish Cay exhibited a higher proportion of tar chested female P. argus than the areas near Ambergris Cay, Bush and Sea Cays. However, commercial landings and environmental conditions in neighboring locations may impact the sustainability of the overall TCIs' *P. argus* fishery. Greater collaborations throughout the Caribbean would benefit the species and the TCIs monitoring initiatives could be designed to further investigate the fine-scale variation in P. argus reproductive biology observed in this study.

KEYWORDS: Lobster, reproduction, variations, spatial, Turks and Caicos Islands

Evaluation of the Local Trends in the Spatial and Temporal Variation of Hogfish – *Lachnolaimus maximus*, in South Caicos, Turks and Caicos Islands, BWIs

Evaluación de las Tendencias Locales en la Variación Espacial y Temporal de Hogfish - *Lachnolaimus maximus*, en South Caicos, Islas Turcas y Caicos, BWI

Évaluation des Tendances Locales dans la Variation Spatiale et Temporelle de Hogfish - *Lachnolaimus maximus*, dans le Sud Caïques, Îles Turques et Caïques, BWIs

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ABSTRACT

In the Turks and Caicos Islands, *Lachnolaimus maximus* (*L. maximus*, hogfish) is a highly valuable species, important for domestic consumption by both local communities and visiting tourists. Fisher-dependent measurements were used to assess spatial and temporal variation in the total length of hogfish landed on the island of South Caicos between 2004 and 2017. It was determined that 48.5% of the individuals sampled were below the average length of hogfish at sexual transition, indicating potential dangerous fishing patterns in the Turks and Caicos L. maximus fishery. Oscillating patterns in median total length over time from 2005 to 2012 suggest a 3-4 year size cycle, but this pattern has not been observed since 2014. Two study locations, on the northeast side of the Caicos bank, indicate a significant trend of increasing size, as well as an increase in fishing activity, which suggest increased fishing pressures to those areas. Possible impacts of intense fishing of larger individuals include reduced male populations, which could alter recruitment to the reproductive stock. This study illustrates the ability of total length measurements to detect subtle spatial differences and supports the argument that data-poor fisheries stand to benefit greatly from simplified monitoring techniques; and emphasizes the importance of monitoring and management of the L. maximus in the Turks and Caicos Islands.

KEYWORDS: Hogfish, geospatial, finfish, South Caicos, fisheries

Clima Pesca: Información Climática al Servicio del Sector Pesquero y Acuícola Regional

Clima Pesca: Climatic Information at the Service of the Regional Fisheries and Aquaculture Sector

Clima Pesca: Information sur le Climat au Service du Secteur de la Pêche et Aquaculture Régionale

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RESUMEN

Con el objetivo de dar a conocer y visibilizar los impactos del clima en el sector pesquero y acuícola, así como desarrollar esfuerzos de adaptación que permitan incrementar la producción y garantizar la seguridad alimentaria a pesar del cambio y la variabilidad climática, fue creada Clima Pesca.

.

Esta una iniciativa de la Organización del Sector Pesquero y Acuícola del Istmo Centroamericano (OSPESCA) y consiste en una iniciativa tecnológica con funcionalidades de comunicación horizontal entre la institucionalidad del sector y los pescadores, que incluye tanto aspectos climáticos, productivos, seguimiento de fenómenos naturales, comportamiento del mercado y por supuestos la relación entre estos elementos, que derivan en aspectos positivos o negativos para la población en general y para los pescadores y acuicultores en particular.

En el marco se esta iniciativa se propuso el desarrollo de tres herramientas en el Clima Pesca.

- **Clima Pesca Digital:** boletín digital de envío masivo y certificado de la información a los usuarios del boletín, así como almacenamiento histórico de la información producida.

- **Escritorio de Información para Pesca y la Acuicultura**: información climática que integra datos temperatura uperficial del mar, vientos, mareas, concentración de clorofila a tres y ocho días y predicción climática servida por Centro Clima

- **Clima Pesca App**: esta aplicación móvil es un nuevo canal disponible para toda la población interesada de la región, que de forma inmediata y actualizada puede obtener no solo información climática relacionada con la pesca y la acuicultura, sino que también puede consultar aspectos de este sector, recibiendo respuestas en el corto plazo del equipo de trabajo especializado en estos temas. Cuenta también con secciones de entretenimiento y educación sobre los impactos del cambio climático en la pesca y acuicultura para niños y jóvenes.

Además, OSPESCA trabaja de manera coordinada en amplios procesos de capacitación con organizaciones como CATIE, DAI e UICN. Durante junio - agosto/2017 se han capacitado alrededor de 400 personas, relacionadas a la pesca y acuicultura.

PALABRAS CLAVES: Clima pesca, información climática, acuicultura, educación

Rubia *Ocyrus chrysurus* Capture by the Artisanal Fishery in Antón Lizardo, Veracruz, México

Captura de Rubia *Ocyurus chrysurus* por Pesca Artesanal en Antón Lizardo, Veracruz, México

Prises du Poisson 'Vivaneau Queue Jaune' *Ocyurus chrysurus* par la Pêche Artisanale à Antón Lizardo, Veracruz, Mexique

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ABSTRACT

The rubia, *Ocyrus chrysurus*, has an important predator-prey relationship within the coral reef systems as well as an important economic resource for the artisanal fisheries. Because of this, it is important to evaluate the capture of the artisanal fishery and determine the sexual maturity through their length, weight and sex during a seven months survey in Antón Lizardo, Veracruz. In order to separate the fish according to their sex, male, female and juveniles, 30 individuals of different lengths were selected. Four sexual maturity stages were differentiated: the first for juvenile fish and three for mature, male or female. A total of 201 organisms were captured between March and September of 2016, adults were captured in a higher quantity during May (48) and the least number in June (7), for juveniles, the highest capture was in September (9) and were not present in March and May. The sex ratio was 1:1 and juveniles were only the 15% of all capture. The mean standard length for juveniles was 21 cm and the mean total length was 29.1 cm. For adults (males and females combined) the mean standard length was 29 cm and the mean total length was 40.5 cm. The weight-length relationship for juveniles was W = -0.573L1.993 and for adults W = -1.654L2.752 which is a negative allometric type of growth with a b < 3, and which was statistically different between juveniles and adults. The capture per unit of effort (CPUE) was higher in March, May and September, capturing up to 50% of the total with hooks # 4 and # 6. It is recommended to stop using hooks numbers 2, 3 10 and 15 since they target juvenile individuals. In this locality more adults than juveniles were captured between March and September. If this trend continues, probably the juvenile recruitment will be favored at the long term consequently a higher economic gain.

KEYWORDS: *Ocyurus chrysurus*, maturity, sexual allometry, CPUE

Habitat Preference of Sea Cucumber *Isostichopus badionotus* (Selenka, 1867)

Preferencia de Habitat del Pepino de Mar *Isostichopus badionotus* (Selenka, 1867)

Préférence D'habitat du Concombre de Mer *Isostichopus badionotus* (Selenka, 1867)

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ABSTRACT

The sea cucumber *Isostichopus badionotus* is heavily exploited in the Caribbean and Gulf of Mexico. However the knowledge about its ecology is very limited, especially of the factors that influence its distribution. The objective of this work was to determine the habitat preference of I. badionotus. From August 2015 to July 2016 off the coast of the port of Sisal in the northwest of the Yucatan peninsula, Mexico, information of density of organisms per square meter was obtained by means of dive transects. The characteristics of the benthic community were also obtained through analysis of videotransects, as well as granulometry, organic matter content of the sediment, temperature, salinity and dissolved oxygen of thewater of the sea floor and depth. The relationship between habitat variables and I. badionotus presences was examined by assembling distribution models of species such as random forest, artificial neural networks and generalized additive models, among others. The results show a higher probability of presence in areas with green algae coverage, depth greater than 20 m, temperature between 20 and 24 ºC, with high percentage of organic matter in the sediment and coarse grain size. The potential spatial distribution model of I. badionotus shows a greater probability of being present to the northwest of the study area above the 20 m isobath. The results are considered determinants for the design of Fishing Reserves, essential as a measure of conservation and fishery management.

KEYWORDS: Distribution, sea cucumber, fishery model, refuge

Cambios en las Abundancias y el Esfuerzo Pesquero en el Golfo de Salamanca Durante Diferentes Fases de las Operaciones Portuarias Carboníferas

Changes in the Abundance and Fishing Effort in the Gulf of Salamanca During Fifferent Stages of Development of Coal Port Operations

Les Changements dans L'abondance et L'effort de Pêche dans le Golfe de Salamanca au cours des Différentes Phases des Opérations Portuaires de Charbon

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RESUMEN

El golfo de Salamanca (GdeS) constituye un área de importancia pesquera en el mar Caribe de Colombia. Sin embargo, desde la década de los 90 se iniciaron operaciones de almacenamiento y cargue de carbón mineral para exportación, limitando así las actividades de navegación y pesca en esta área. Con el objetivo de evaluar cambios en la captura y el esfuerzo pesquero en el GdeS durante diferentes fases de las operaciones portuarias carboníferas, se realizaron encuestas semi-estructuradas a pescadores artesanales de las comunidades costeras del golfo: Tasajera, Puebloviejo, Ciénaga, Aeropuerto y Pozos Colorados. Se indagó sobre el estado actual e histórico de diferentes aspectos de la pesquería artesanal y se compiló información bibliográfica relacionada con estas pesquerías. Se compararon los inventarios de artes, embarcaciones y la composición de especies de la pesca artesanal del GdeS durante el período estudiado. Los resultados indican que los pescadores del GdeS experimentaron una disminución de las abundancias en las capturas en los sitios tradicionales de pesca, lo cual conllevó a desplazarse hacia el margen occidental de golfo, incrementando la distancia promedio a los sitios de pesca (24,62 ± 4,25 mn). En consecuencia, aumentó la duración del viaje de pesca en busca de mayores abundancias del recurso, modificando los caladeros tradicionales y ampliando la frontera pesquera artesanal. Paralelamente, han disminuido los tamaños de malla de las redes de enmalle y han aumentado el poder de pesca, mediante la incorporación de cambios tecnológicos en sus artes y embarcaciones, como estrategias para disminuir las consecuencias derivadas de la disminución de las capturas en las zonas cercanas a las instalaciones carboníferas y las prohibiciones implícitas para ejercer la pesca en estos sitios.

PALABRAS CLAVES: Pesquería artesanal carbón golfo de Salamanca mar Caribe de Colombia

Hábitos Alimenticios de la Doncella de Pluma *Lachnolaimus maximus* (Perciformes: Labridae) en la Costa Norte de Yucatán, México

Food Habits of Hogfish *Lachnolaimus maximus* (Perciformes: Labridae) from the North Coast of Yucatan, Mexico

Régime Alimentaire du Labre Capitaine *Lachnolaimus maximus* (Perciformes: Labridae) de la Côte Nord du Yucatan, Mexique

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RESUMEN

Lachnolaimus maximus, es una especie de alto valor comercial catalogada como "Vulnerable" por la UICN para toda su área de distribución geográfica (Golfo de México y Mar Caribe). El análisis de su dieta aporta información fundamental para describir y explicar mediante programas como el Ecopath y Ecospace, el aspecto funcional de las redes tróficas en las cuales está involucrada, y por ende para la conservación y el buen manejo pesquero de la especie. El objetivo del estudio fue caracterizar la composición de la dieta y sus variaciones espacio-temporales, ontogénicas y entre sexos de la población del sur del Golfo de México (Banco de Campeche). Esto se realizó por medio del análisis de contenido estomacal, tomando en cuenta la eficiencia del esfuerzo muestral evaluado con el modelo de Clench, para una caracterización precisa de la dieta. La composición de la dieta fue analizada usando el índice de importancia relativa (IIR). La variación de los componentes alimenticios se evaluó a través de un análisis multivariado no paramétrico (PERMANOVA), completado con una prueba de igualdad de varianzas mediante la función betadisper. Se analizaron 193 tractos digestivos con contenido estomacal, identificándose 186 componentes alimenticios, que correspondieron al 69% de la dieta teórica predicha por el modelo de Clench. De estos componentes se logró identificar el 35% a nivel especie. Los grupos taxonómicos fundamentales fueron las clases Mollusca y Crustacea que representaron el 68 % y 44% de IIR respectivamente. Los resultados obtenidos del análisis multivariado indicaron diferencias significativas en la composición de la dieta entre las regiones y tallas establecidas ($F = 2.49$, $p = 0.004$; $F = 2.60$, $p = 0.004$; respectivamente), pero no fueron significativas para las temporadas climáticas y el sexo de los individuos.

KEYWORDS: Labridae, dieta, Gulf of Mexico

Exploring Factors Determining the Sensitivity of Reef Fish Assemblages to Ocean Warming

Explorar Factores que Determinan la Sensibilidad de los Ensamblajes de Peces de Arrecife para Calentamiento de los Océanos

Explorer les Facteurs qui Déterminent la Sensibilité des Assemblages de Poissons de Récif de Réchauffement de L'océan

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ABSTRACT

Ocean warming is expected to impact biodiversity and fisheries in the tropics through shifts in species' distributions, leading to local extinctions and changes in species composition of catches. However, regional-scale patterns may differ from global trends due to in the influence of important environmental factors such as ocean warming and habitat availability. Here we use the Mean Temperature of the Catch to test the hypothesis that, for the period of 1971 – 2010, regional variation in species-turnover of exploited reef fish assemblages among nine Caribbean countries can be explained by differences in the rate of warming, species' thermal preferences and available reef habitat across the region. Sea surface temperature and the mean temperature of the catch displayed rates of increase of 0.14 ºC decade-1 and 0.19 ºC decade-1 respectively, slightly higher than the global average and more so when compared to the global average for all tropical fisheries. These rates also varied across across the nine countries, ranging from 0.04 – 0.18 ºC decade-1 for sea surface temperature and 0.10 – 0.62 ºC decade-1 for the mean temperature of the catch. Four countries displayed asymptotic MTC trends, explained by stark declines in Scomberomorus regalis, a species of particularly low thermal tolerance. Finally, model comparisons revealed that the interaction between the rate of sea surface temperature change and available reef habitat best explained regional variation in the rate of change in the mean temperature of the catch. These results suggest that reef fish communities in areas with less available reef habitat may be more sensitive to ocean warming and future decreases in available habitat, driven by climate or human stressors may exacerbate this relationship.

KEYWORDS: Ocean climate, coral reef, fish community, caribbean, island biogeography

Embajadores Pescan con Ciencia para la Mejor Administración del Ecosistema

Ambassadors Fishing with Science for Ecosystem Management

Les Ambassadeurs qui Pêchent avec la Science pour la Gestion des Écosystèmes

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RESUMEN

Dos embajadores ganadores del galardón del premio Gladding de pescadores comparten los conocimientos adquiridos con científicos, administradores y educadores buscando una mayor conciencia del público sobre los recursos marinos en Puerto Rico. Los dos actúan como maestros en las comunidades costeras donde se desempeñan a diario compartiendo conocimientos, inquietudes, experiencias y preguntas para tratar posibles soluciones a los problemas que afectan la pesca, el ambiente y el sustento de los pescadores. Ambos participan en diversas investigaciones asociadas a las pesquerías, la condición de los ecosistemas y en estudios socio-económicos. Los éxitos de pescar con propósitos científicos incluyen colectar muestras biológicas, compartir observaciones de especies claves, documentar hábitats importantes, anotar comportamientos de los organismos, probar tecnologías para su mejor utilidad en las pesquerías y avisar a investigadores de fenómenos en el mar, entre otras. Esta información a su vez se puede aplicar al desarrollo de acciones de administración pesquera y para conservar el ecosistema. La participación en campañas de educación ambiental ha sido notable y reconocida a nivel regional mediante programas de televisión, documentales y entrevistas. El conocimiento ecológico tradicional combinado con la habilidad de traducir los resultados de las investigaciones en las cuales participan permite llegar a un público mayor y a su vez impactan en el futuro de la pesca de la isla.

PALABRAS CLAVES: Gladding ambassador, fisher participation, Puerto Rico, outreach education

Vulnerabilidad de los Hábitat de las Tortugas Blanca (*C. mydas*) y carey (*E. imbricata*) ante la Actividad Petrolera en la Zona sur del Golfo de México

Vulnerability of Critical Habitats of Green (*C. mydas*) and Hawksbill Turtles (*E. imbricata*) to Oil Activity in the Southern Gulf of Mexico

Vulnérabilité de L'habitat Essentiel de la Tortue Blanche (*C. mydas*) et la Tortue Imbriquée (*E. imbricata*) à L'industrie Pétrolière dans le Sud du Golfe du Mexique

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RESUMEN

En el Golfo de México (GoM) se encuentran hábitats de gran importancia para la reproducción, alimentación y refugio de las tortugas marinas, catalogadas en peligro de extinción. Para preservar estas especies es necesario ejercer acciones para la conservación de sus hábitats, los cuales se han visto afectados por diversas actividades humanas que cambian en su intensidad de impacto y distribución geográfica a lo largo del GoM. En los últimos años la preocupación ha aumentado por la liberación de nuevas áreas para la exploración y extracción de hidrocarburos en aguas someras y profundas en el GoM, por lo que se busca identificar los impactos acumulados de 5 fuentes de presión que afectan a los hábitats de las tortugas marinas blanca (*C. mydas*) y carey (*E. imbricata*) así como cuantificar su vulnerabilidad a las actividades petroleras. Para esto se obtuvo información disponible sobre la distribución espacial de 3 de sus hábitats críticos (arrecifes de coral, praderas de pastos marinos y sargazo pelágico), 5 fuentes de presión que afectan a las tortugas marinas, las áreas contractuales de exploración y extracción de hidrocarburos y las zonas de salvaguarda donde se prohíbe la realización de cualquier actividad petrolera. Se utilizó información de transmisores colocados a 44 hembras anidantes (n = 28 verde y n =16 carey) para determinar sus zonas de agregación y corredores migratorios y se realizó una consulta a expertos en tortugas marinas por medio de encuestas para obtener una jerarquización de las fuentes de presión en las distintas zonas del GoM. Determinar la vulnerabilidad de estos hábitats ayuda a entender cómo son afectados por las actividades humanas y detectar cuales los más susceptibles; esto podría ser utilizado como una herramienta de manejo para la conservación de las tortugas marinas.

PALABRAS CLAVES: Transmisores satelitales, fuentes de presión, arrecifes coralinos, praderas de pastos marinos, sargazo marino

Marine Communications Range Analyzer and Data Observatory for Small-scale Fisheries

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Gamme de Communications Maritimes et de L'analyseur de l'Observatoire des Données de la Pêche à Petite Échelle

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ABSTRACT

Data and communications represent points of value intersection for all stakeholders in interactive fisheries governance. Data of high value to small-scale fishers provides insights into sea conditions. High value communications enables conveyance of warnings, alerts and other information regarding these conditions. Ecosystem-Based Management (EBM) and Ecosystem Approach to Fisheries (EAF) strategies which include related data and communications are of particular interest to small-scale fishers.

There exists considerable opportunity for interactive fisheries governance built around marine data and communications. Emerging technologies present exciting possibilities for the acquisition of wave height and emergency status data and its conveyance over potentially longer ranges than that of traditional communications. Real time and near real time processing of the former may facilitate nowcasting of sea state information of relevance to small-scale fishers. Geo-referencing and the use of appropriate image vocabularies can facilitate convenient and meaningful consumption of this information by fishers.

This presentation describes a tool that analyzes the fundamental and practical limits on the ranges of various communications technologies, traditional and emerging, in the Caribbean marine environment. Limits are displayed on Google maps imagery vis-à-vis data artefacts relevant to small-scale fisheries: typical fishing ranges, EEZ and other marine boundaries, etc. Eastern Caribbean countries are used to demonstrate the tool and how it may be used to (i) support decision-making for fishers (ii) inform development initiatives that seek to strengthen fishers' resilience to climate change and variability and (ii) design innovative marine-based Internet of Things (IoT) facilities to meet particularly Caribbean needs.

KEYWORDS: Marine, communications, range, data, IoT

Colombian Fisheries Statistical Service (SEPEC): A Computer Platform for the Integrated Management of Fishery Resources

Servicio Estadístico Pesquero Colombiano (SEPEC): Una Plataforma Informática para la Gestión Integral de los Recursos Pesqueros

Service Statistique de la Pêche de la Colombie (SEPEC): Une Plate-forme Informatique pour la Gestion Intégrée des Ressources Halieutiques

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ABSTRACT

The Colombian Fisheries Statistical Service (SEPEC) has been structured to collect, process and disseminate the following types of data: artisanal and industrial landings, biological aspects of strategic marine and continental resources, ornamental fish catches, aquaculture production, quota control, marketing of fishery products and socio-economic traits of the fishing communities. The main tool for developing the platform is Visual Studio Enterprise 2015 and the database manager is PostgreSql 9.4 64 bit. For each of the modules there are routines of statistical reports (graphics and tables). The system also has tools for checking, reviewing and auditing data. The SEPEC is designed to process statistical information under two approaches: census and sample. For the second, stratified random sampling is implemented, with the type of fishing gear as the primary stratification criterion. The system also allows the estimation of morphometric relationships from the biological-fishery data collected. An innovation is being implemented in the platform in the current year, aimed at obtaining estimates of landings and fishing effort not only at the level of sampling sites but also at each of the continental basins and coasts (pacific and Caribbean) of the country, with precision indexes generated by bootstrap resampling. For this, a structural or framework survey of economic fishing units at the national level has been carried out, which generates the necessary extrapolation factors for such estimates. This computer platform has become a relevant tool for a comprehensive management of national fishery resources in Colombia.

KEYWORDS: Fisheries statistics, landings, software, fishery biology, aquaculture

Historical Reconstruction of Red Snapper (*Lutjanus campechanus*) Size-at-Age

Reconstrucción Histórica del la Talla a la Edad del Red Snapper (*Lutjanus campechanus*)

Reconstruction Historique des Red Snapper (*Lutjanus campechanus*) Taille à L'âge

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ABSTRACT

Red snapper have remained an economically important fishery in the Gulf of Mexico since the mid-1800s, and thus have been subject to many years of constant fishing pressure and exploitation. The objective of this study was to examine size and age structure and growth rates of red snapper over time. Previously collected age and growth data (n = 31,445) were examined from 1995 until present in order to preform a multi-decadal size-at-age analysis. Indices such as ENSO events, fishing mortality and spawning stock biomass were used to identify potential trends in the growth across year and age classes. Variation in growth rate coefficients (K) and mean lengths-at-age exist in the data; however, the extent to which ENSO phenomena and/or anthropogenic pressures are sources of these differences is unknown. The information gained from this research will be used in the next benchmark SEDAR assessment for red snapper, and provides critical insight to changing population dynamics for the species over time.

KEYWORDS: Red Snapper, size-at-age, growth, multi-decadal, ENSO

Acoustic Assessment of Bathymetry, Bottom Types, and Characterization of Ichthyofaunal Community in Shallower Waters of Serrana Key Island, Biosphere Reserve Seaflower, Colombia

Evaluación Acústica de la Batimetría, Tipos de Fondo y Caracterización de la Comunidad Ictiofaunal en Aguas Someras de la Isla Cayo Serrana, Reserva de la Biosfera Seaflower, Colombia

Évaluation Acoustique de la Bathymétrie, des Types de Fond et Caractérisation de la Communauté Ichthyofaunale dans les Eaux peu Profondes de Serrana Key Island, Réserve de la Biosphère Seaflower, Colombie

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ABSTRACT

The Biosphere Reserve Seaflower since its declaration in 2000 has become a strategic region of conservation and sustainable development for Colombia. Therefore, the objective is to assess by hydroacoustics the bathymetry, bottom types and characterize the ichthyofaunal community in shallow waters (5-100 m) in Serrana Key, Reserve of the Biosphere Seaflower. The acoustic survey was carry out onboard in a boat at which a scientific echo sounder Biosonics DTX with a 38 kHz transducer was installed. In the bottom types analyzes, fine-sand sediments characteristics (-26.0 db) are shown. However, other types of bathymetric structures other than sediments with an echo of -35.0 dB, which may be a coral structure, are also shown. The depth ranged between 3.62 and 24.98 m (mean 11.39 ± 4.17 m). 59 species belong to 13 orders and 23 families were registered, being the more abundant Labridae (19%), Pomacentridae (10%) and Serranidae (9%) and with minor frequency Sphyraenidae and Scianidae (1%). The species *Thalassoma bifasciatum*, *Mulloidichthys martinicus*, and *Chromis cyanea* were the more abundant in all sampling stations, while *Clepticus parrae*, *Halichoeres garnoti*, *Stegastes partitus*, and *Gramma loreto* were sporadic. However, the fish species *Sphyraena barracuda*, *Pareques acuminatus*, *Equetus punctatus*, *Mycteroperca venenosa*, and *Ginglymostoma cirrat* showed lower relative abundances (<1%). The richness, diversity and composition of species were similar in all study area. According to similarity analysis two assemblages were found, the first one associated to bottoms with patches of coral reef with abundant octocorals and bigger coral heads, the second assemblage associated to patches of less complex coral and the infralittoral zone.

KEYWORDS: Bathymetry, bottom types, reef fish, Serrana Key, Colombia

Egg Morphometrics and Fertilization Rates from Recovering and Unexploited Populations: Nassau Grouper and Tiger Grouper in the Cayman Islands

Morfometría de los Huevos y Tasas de Fertilización de las Poblaciones que se Recuperan y Explotadas: Mero de Nassau y Mero Tigre en las Islas Caimán

Morphométrie des Œufs et Taux de Fécondation des Populations de la Récupération et Exploitées: Le Mérou de Nassau et le Mérou du Tigre dans les Îles Caïmans

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ABSTRACT

Nassau grouper (*Epinephelus striatus*) and Tiger grouper (*Mycteroperca tigris*) are species of reef fish known to form spawning aggregations. Throughout the year, these fish are solitary, posing a challenge for local fisherman, but during their annual mass aggregation they are easily exploited; resulting in declines of many Nassau grouper aggregations throughout their range. This study takes place on Little Cayman Island in the Cayman Islands. The Cayman Islands have passed strong protections for Nassau grouper spawning aggregations, resulting in one of the largest known aggregations being located on Little Cayman Island. Despite protections elsewhere, other aggregations have failed to recover. Some hypothesize that fertilization rates could be a cause of the populations' failure to increase. This study focuses on analyzing the fertilization rates of the grouper populations in Little Cayman from 2014-2017 using various methods. A series of statistical analyses were used to evaluate the method of egg collection; compare egg morphometrics between spawning batches, and measure overall fertilization rates. Fertilization rates for Nassau grouper and Tiger grouper, during this time period on Little Cayman, represent an optimal rate for recovering unexploited populations. These rates can be used as a baseline to compare against other populations and to also aid in recovery plans.

KEYWORDS: Nassau Grouper, Tiger Grouper, spawning aggregations, egg morphometry, fertilization rates

Densidad y Talla del Pez León y su Relación con Variables Ambientales y Ecológicas en Arrecifes Coralinos del Caribe Mexicano

Density and Size of Lionfish and its Relationship with Environmental and Ecological Variables in Coral Reefs of Mexican Caribbean

Densité et Hauteur de Lionfish et sa Relation avec les Variables Environnementales et Écologiques dans les Récifs Coralliens des Caraïbes Mexicaines

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RESUMEN

El pez león, es el primer pez marino en invadir y establecerse en la costa oeste del Océano Atlántico. A partir de su primer registro en México en 2009, se implementaron acciones de control poblacional para tratar de minimizar su invasión y los impactos sobre las comunidades nativas. El objetivo de este estudio fue cuantificar su abundancia en tres localidades del Caribe mexicano. La densidad y biomasa promedio se consideraron intermedias con respecto a lo reportado en otros sitios. La muestra estuvo constituida por adultos reproductores (80%). Asimismo la densidad de pez león fue igual o mayor que la registrada para las especies de meros. El microhabitat estuvo dominado en un 78% por coberturas de macroalgas, algas coralinas y sustrato abiótico. Por último este estudio evaluó la contribución de 10 variables (tres ambientales y siete ecológicas) que podrían explicar el éxito de su invasión reflejado en la densidad y tallas. La profundidad, la biomasa de presas y densidad de depredadores potenciales fueron los factores que mejor explicaron la variación de las densidades del pez león, mientras que la densidad de presas contribuyó significativamente en la variación de las tallas. Los resultados pueden sugerir que: 1) el pez león se encuentra en densidades intermedias en el Caribe mexicano, 2) prefiere hábitats que le proporcionan resguardo, 3) las mayores abundancias se encuentran en zonas de mayor profundidad y con abundancia de presas disponibles y 4) los depredadores nativos no ejercen la función de biocontrol significativo que reduzca el éxito invasor de P. volitans. Se recomienda priorizar acciones de manejo y control en arrecifes que reúnan las características antes mencionadas, las remociones serían más significativas y contribuirían a la conservación de las comunidades nativas que habitan en el arrecife.

PALABRAS CLAVES: *Pterois volitans*, Caribe mexicano, depredadores nativos, microhábitat, presas

Distribución Potencial de Ecosistemas Coralinos Mesofóticos en el Parque Nacional Sistema Arrecifal Veracruzano

Potential Distribution of Mesophotic Coral Ecosystems at the Veracruz Reef System National Park

Potentiel de Distribution D'écosystèmes Coralinos Mésusques au Parc National Systèmes des Récifs de Veracruz

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RESUMEN

Los Ecosistemas Coralinos Mesofóticos (ECM) distribuidos entre la zona intermedia y más baja de la zona eufótica raramente están incluidos en planes de manejo, su exclusión es debida principalmente a la comprensión limitada de su distribución espacial. El Parque Nacional Sistema Arrecifal Veracruzano (PNSAV) sufrió una modificación en su poligonal en 2012, el mapa resultante hace referencia de las diferentes estructuras arrecifales que constituyen el parque, sin embargo, solo se refiere a la parte somera dejando fuera sus pendientes arrecifales y los sitios potenciales de distribución de ECM. Se utilizaron técnicas hidrográficas para la modelación espacial y caracterización topográfica de zonas arrecifales en el PNSAV que se distribuyen a profundidades mayores a 30 m y se hipotetiza albergan comunidades coralinas mesofóticas bien desarrolladas. Los levantamientos hidrográficos se realizaron empleando un sonar monohaz y un sistema de sonar multihaz en arrecifes pertenecientes al PNSAV para la obtención de modelos digitales de terreno y estimación de batimetrías a escala gruesa y fina, respectivamente. Se realizaron análisis de variabilidad de terreno obteniendo información sobre la pendiente, orientación, curvatura, rugosidad y aspereza. Los modelos obtenidos permitieron identificar regiones con alta complejidad estructural que sugieren áreas potenciales de distribución para ECM bien desarrollados. Los arrecifes Santiaguillo y Anegadilla presentaron surcos, crestas y canales bien definidos y estructuralmente complejos, así como una continuidad física entre ambas estructuras arrecifales. Estos resultados permitirán planear de manera costo-efectiva la etapa de caracterización ecológica e identificar las zonas mesofóticas, mediante el uso de un vehículo operado remotamente y medición de la luz PAR, respectivamente.

PALABRAS CLAVES: Mesofótico, arrecifes, complejidad estructural, batimetría, ecosonda multihaz

Perils of Partnership

Peligros de la Asociación

Périls de Partenariat

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ABSTRACT

The quest for successful partnerships within the fisheries sector is increasing with the trend towards more participatory forms of governance and the ecosystem approach to fisheries. Instruments such as the Small-scale Fisheries (SSF) Guidelines, and initiatives such as the CLME+ Project (2015-2020), encourage such partnerships. Yet, there are practical perils in public sector, NGO or academic projects that include implementation partnerships with fisherfolk and their organizations. The fisherfolk are also at risk. These perils, or risks, may affect, and need to be considered by, all sides explicitly in the contexts of knowledge, learning and adaptive capacity. It would be naive of the parties to do otherwise. However, this is what often happens, especially with the intangibles rather than operational logistics, funding or technical content. Untested assumptions are made on all sides about information, skills, relationships, ethics, values, beliefs, attitudes and more that cannot be easily assessed in advance of the agreement to partner. One way to make both the one-sided and shared risks more tangible, transparent and manageable is to set them out systematically for discussion in early negotiation. This poster offers a perspective on how this can be done. it draws upon the experience of an applied research institution with a long history of partnering with fisherfolk and their organisations in projects.

KEYWORDS: Communication, learning, partnership, projects risk

Using Sunlight and Cell Networks to Bring New Management Tools to Small-scale Fisheries

Usando la Luz Solar y Redes Celulares para Crear Nuevas Herramientas de Gestión a la Pesca a Pequeña Escala

Utilisation de la Lumière du Soleil et des Réseaux Cellulaires pour Apporter de Nouveaux Outils de Gestion aux Pêches à Petite Echelle

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ABSTRACT

Traditionally, the efforts of small-scale fisheries have not been easily measured or managed. That means that the activities of the vast majority (~90%) of fishing vessels in the world have remained unquantified and largely opaque. With newly developed technology that harnesses solar power and cost-effective cellular networks to transmit data, it is becoming possible to provide vessel tracking systems on a large scale for vessels of all sizes. Furthermore, capitalizing on the relatively inexpensive cellular networks to transfer the data enables data of much higher granularity to be captured. By recording a vessel's position every few seconds, instead of minutes to hours as is typical of most satellite-based systems, we are able to resolve a diverse array of behaviors happening at sea including when and where fishing occurred and what type of fishing gear was used. When this information is integrated with other data streams, such as landings records, powerful tools become accessible to management bodies, the research community and individual fishers to support robust data-based decision making.

KEYWORDS: Small-scale fisheries, vessel tracking, cellular network

Situación Actual del Caracol Rosado (*Lobatus gigas*), Implicaciones para su Manejo Pesquero en el Sur del Caribe Mexicano

Current Situation of the Pink Snail (*Lobatus gigas*), Implications for its Fishery Management in the South of Mexican Caribbean

Situation Actuelle du Lambi (*Lobatus gigas*) Implications pour la Gestion des Peches dans le Sud Mexicain des Caraibes

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RESUMEN

El caracol rosado, Lobatus gigas, es uno de los recursos pesqueros más importantes del Caribe. No obstante, debido a sus características biológicas y a la alta demanda comercial sus poblaciones se han visto sobreexplotadas. En México, Banco Chinchorro es el único sitio donde se permite la extracción mediante cuotas de captura, sin embargo entre 2012-2017 se estableció una veda temporal para la recuperación de este recurso. El presente estudio realizó un análisis de la población del caracol rosado un año previo a la apertura de la veda en 2016. Se registraron un total de 7804 organismos cuyas tallas oscilaron entre 3.1 y 30.0 cm de Longitud sifonal (LS; 14.5 ± 4.9 cm). La población considerada como adulta estuvo entre el 14 y 15% tomando como criterio LS≥ 20 cm y Grosor de labio GL ≥ 15 mm respectivamente. En cuanto a la densidad promedio (0.07 ind/m^2), se encontró diferencia significativa entre los meses y zonas de monitoreo. Al estimar la densidad de caracoles adultos (0.0103 ind/m^2), se observa un valor considerablemente mayor al mínimo recomendado en la Carta Nacional Pesquera. Por último los parámetros de crecimiento fueron estimados a través de métodos indirectos resultando $L\infty$ = 30.7 cm LS, k = 0.30 y t0 = 0.55. Nuestros resultados, permiten comprender el estatus poblacional actual y observar una ligera recuperación del recurso el cual deberá tener un manejo adecuado para su aprovechamiento y conservación.

PALABRAS CLAVES: Cuota de captura, veda, caracol rosado, dinámica poblacional, crecimiento

Descripción de la Dieta del Pez León (*Pterois volitans*) en el Sistema Arrecifal Veracruzano, Suroeste del Golfo de México

Diet Composition of Lionfish (*Pterois volitans*) in the Veracruz Reef System, Southwestern Gulf of Mexico

Composition D'alimentation du Lionfish (*Pterois volitans*) dans le Système de Verre de Veracruz, Golfe du Sud-Ouest de Mexique

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RESUMEN

El pez león (*Pterois volitans*) es nativo de Indo-Pacífico y ha invadido el Atlántico occidental, desde la costa este de EUA hasta el este de Venezuela, incluyendo el Gran Caribe y el Golfo de México. En 2012 fue registrada por primera vez en el Sistema Arrecifal Veracruzano (SAV) y poco tiempo después se estableció plenamente en este sistema del suroeste del Golfo de México y a la fecha nada se sabe acerca de sus hábitos dietarios en esta nueva distribución. Con el objetivo de determinar el espectro trófico, la amplitud y el tipo de dieta, la contribución relativa por presas y evaluar la variabilidad espacial dentro del SAV de estos descriptores, se analizó el contenido estomacal de 656 individuos de P. volitans capturados de agosto de 2013 a diciembre de 2014 en 18 de los 23 arrecifes que componen al SAV. El intervalo de talla de los peces analizados fue de 9.2 a 40.5 cm LT y predominantemente fueron capturados en la parte sur del SAV. El espectro trófico del pez león del SAV consta de 18 taxa. Su dieta está basada casi exclusivamente en peces teleósteos (96% IIR) y especializada (Bi = 0.071) en *H. burekae* (55% IIR), especie endémica del Golfo de México. La contribución de crustáceos en la dieta es marginal y depende de la talla. Tanto el espectro dietario y especializado, así como el porcentaje de estómagos con al menos un ítem alimentario reconocible (43%), son sustancialmente menores respecto de otros sitios invadidos, lo que sugiere menor disponibilidad de presas probables en el SAV que en otras regiones invadidas. La especialización de la dieta del pez león en el SAV, es completamente contraria a lo documentado en cualquier otra parte del Atlántico occidental, donde se ha determinado que se trata de un depredador eminentemente generalista.

PALABRAS CLAVES: Pez león, alimentación, *Pterois volitans*, sistema arrecifal Veracruzano, xuroeste Golfo de México, especie invasora

Desempeño Técnico de Transmisores Satélitales sobre Tortugas Marinas Hembras en el Golfo de México y Mar Caribe

Technical Performance of Satellite Transmitters on Female Sea Turtles in the Gulf of Mexico and Caribbean Sea

Performances Techniques des Émetteurs Satellites sur Tortues de Mer Femelles dans le Golfe du Mexique et la Mer des Caraïbes

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RESUMEN

La telemetría satelital es una tecnología que permite conocer los movimientos de la fauna silvestre en sus amplios rangos de distribución. Con el uso de esta tecnología para el estudio de las tortugas marinas se pueden distinguir sus etapas de inter-anidación, migración y alimentación, por lo que el desempeño de los transmisores es fundamental para el éxito de tales investigaciones y se hace necesario conocer resultados de patrones generales de estos dispositivos. El objetivo fue evaluar el desempeño de 2 modelos de transmisores satélites a partir de indicadores de eficiencia, duración y conexión con satélites en el Golfo de México y Mar Caribe. Se examinaron rastreos del 2016 de 63 individuos de tortugas marinas hembras (*Caretta caretta*, *Chelonia mydas*, *Eretmochelys imbricata*, *Lepidochelys kempii*), con transmisores SPLASH-10-309-A (n = 12), y TAM-4510-3 (n = 51). Se evaluó por modelo de transmisor, especie y etapa, el tiempo de transmisión, número y calidad de mensajes, así como un indicador de éxito de transmisión (IET= relación de mensajes con y sin coordenadas). El mejor IET fue del modelo SPLASH, en la especie L. kempii y fue en la inter-anidación el mejor desempeño. El 60% de los mensajes recibidos fueron calidad A y B, con mayor frecuencia de recepción entre 12:00 -18:00 p.m. (UTC). El máximo tiempo de transmisión fue para *C. caretta* (252 ± 132 días). Los 30 primeros días de transmisión presentaron un promedio de 8 mensajes por día, con el mayor número de mensajes para *C. mydas*. Estos resultados se presentan como criterios para la selección y programación de transmisores de acuerdo con la investigación; y se aporta información sobre la ecología del movimiento de tortugas marinas, importante para su manejo y conservación.

KEYWORDS: Telemetry performance, satellite transmitters, animal movement, sea turtles, México

Developing a Strategic Initiative to Transition Technologies into Operations for Improving Reef Fish Ecosystem Surveys

Desarrollar una Iniciativa Estratégica para las Tecnologías de Transición en Operaciones para Mejorar las Encuestas de Ecosistemas de Peces de Arrecife

Développer une Initiative Stratégique Visant à Transformer les Technologies en Opérations Visant à Améliorer les Enquêtes sur les Écosystèmes de Poissons de Récifs

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ABSTRACT

Scientific information is often data-limited for the conservation and management of reef fish and their habitats due to the difficulties in sampling these complex ecosystems. Advances in the integration of sensor, platform, communication, and processing technologies have great potential for improving the quality, quantity, and timeliness of scientific information. Management priorities and information gaps should drive technology investments, and a change in the mindset of the corporate culture is often required with this strategic planning. In the evaluation of technologies, proven feasibility, calibrations, and stability in measurements are critical considerations when transitioning innovative technologies into sustained and reliable survey operations. For these reasons, evaluation of the technology's performance metrics and cost-benefits is necessary before investing in the transition phase. Ultimately, the transition from traditional sampling gear to technology requires acceptance by the scientific and management community as well as the stakeholders. Rapidly evolving technology presents challenges for survey operations, data management, and maintaining a high level of accuracy and precision in environmental monitoring and survey operations that rely on standardized measures to support our long-term time series. As organizations strive to augment or enhance survey operations with innovative technologies, disruptions should be minimized in existing business practices when the scientific information is used for effective policy decisions.

KEYWORDS: Technology, acoustics, reef fish, ecosystem conservation

North Coast of the Cuban Shelf: A Migratory Corridor for Sea Turtles in the Caribbean Sea Region

Costa Norte de la Plataforma Cubana: Un Corredor Migratorio para las Tortugas Marinas en la Región del Mar Caribe

Côte Nord de L'étagère Cubaine: Un Couloir Migratoire pour les Tortues Marines dans la Région de la Mer des Caraïbes

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ABSTRACT

The Cuban shelf constitutes an important area for foraging, nesting and at the same time a migratory corridor within the Caribbean Sea region for the Green turtle, Loggerhead and the Hawksbill turtle. Results obtained mainly from the metallic tagging indicated these species move to the east and west directions (favor and against the current), a movement towards the east prevailing for the Green turtle and the Hawksbill turtle, and a movement towards the west for the Loggerhead turtle. For this reason, it was proposed for the north coast of Cuba the possibility of constituting a migratory route for turtles of the three species on routes to habitat destinations on the southern coast of Cuba or to other sites (Moncada et al., 2006, 2010, and 2012). However, new evidences from satellite tracking of turtles from other areas of the Caribbean confirm that these turtles when they arrive to Cuba in transit along the north coast. Taking into account that the knowledge of migratory corridors is of vital importance for the development of effective international strategies for the conservation of sea turtles (Morreale et al., 1996), and also that for the study of their existence, studies are generally based mainly on the movements of post-nesting females observed within the same season; this paper aims to provide new elements based on tag-recapture data previously studied, but this time analyzed with this objective, and considering the data within each year, and / or tagging station, the size groups for each species and their movement along the coast. Information is also provided on turtles trawled in other areas swimming along the northern coast of Cuba, demonstrating and confirming the north coast of the Cuban shelf constitutes a migratory corridor that includes different species of turtles in different stages of life.

KEYWORDS: Cuba, sea turtle, migratory, Caribbean, corridor

Tails n' Scales: Use of an Innovative Reporting System for Red Snapper (*Lutjanus campechanus*) Management in Mississippi

Tails n' Scales: Uso de un Innovador Sistema de Reporte para Red Snapper (*Lutjanus campechanus*) Management en Mississippi

Tails n' Scales : Utilisation d'un Système de Reporting Innovant pour Red Snapper (*Lutjanus campechanus*) Management dans le Mississippi

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ABSTRACT

Red Snapper are one of the most targeted fish in the Gulf of Mexico (GOM) with over 5 million pounds of fish harvested by the recreational sector each year. It is also one of the most controversially managed fishes, as both recreational and commercial fisherman target this species for its excellent table fare and catchability. Due to the magnitude of fishing pressure, accurate and timely estimation of Red Snapper harvest is of the utmost importance so that fishermen will not exceed the allocated quota each year. Estimating the fish harvested by private recreational and for-hire fishermen in the GOM is complex, as nearly a million anglers participate in a short, derby-style fishing season each year. With this in mind, Mississippi's Commission on Marine Resources adopted a modification to Mississippi regulations in 2015, requiring mandatory reporting of all recreational Red Snapper landings in the state. That same year, Mississippi Department of Marine Resources (MDMR) partnered with a software developer to create a mobile and web-based application for users to report recreational Red Snapper landings. The goal of the program was to develop a simple and concise reporting system that is easily accessed and intuitive to the user. Data collected are analyzed and used to estimate catch, effort, compliance rates, and biomass harvested in real time for the recreational fishery. The program is currently in its third year, and is being peer-reviewed for certification through NOAA. Tails n' Scales represents a successful implementation of a Red Snapper reporting system and has increased accuracy for Red Snapper harvest estimates in the recreational sector. In the future, MDMR hopes to expand the program to incorporate data on other reef and inshore species.

KEYWORDS: Fisheries, red snapper, reef fish, fisheries management, recreational fishing

Vulnerability of the Caribbean Fisheries Sector and Identification of Appropriate Adaptation Pathways to Counter Climate Change Impacts in the Eastern Caribbean

Vulnerabilidad del Sector Pesquero del Caribe y Determinación de Vías Adecuadas de Adaptación para Contrarrestar los Efectos del Cambio Climático en el Caribe Oriental

Vulnérabilité du Secteur de la Pêche des Caraïbes et Identification de Voies D'adaptation Appropriées pour Contrer les Impacts du Changement Climatique dans les Caraïbes Orientales

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ABSTRACT

Based on current research, observations and climate projections for the Caribbean region it is clear that the fishery sector is highly vulnerable to climate change. Some of the negative impacts that are already observed in the region include coral bleaching, increasing intensity of storms together with increased sea level (damaging fish habitats, fishery access and assets), and sargassum influxes (disrupting fishing operations and communities and impacting the sustainability of the resource). Reductions in fish catches in the region can be expected to have significant socio-economic impacts on those working in the harvest and post-harvest sectors as well as their dependents. It will also have implications at the level of national governments in terms food security and food sovereignty; trade and foreign currency earnings as well as challenging the effectiveness of many current fishery management regulations. Developing and implementing different adaptation pathways by engaging in activities to build knowledge and awareness, build capacity of fisherfolk, aquaculturists and fisherfolk organizations and mainstreaming of climate change is therefore of crucial importance to improve resilience of the fisheries sector. The Climate Change Adaptation in the Eastern Caribbean Fisheries Sector Project (CC4FISH), started on January 2017 and executed by the FAO, is the largest adaptation project in fisheries in the region to date and could provide an example to the wider region. This paper will present an overview of: 1) the vulnerability of the fisheries sector in the region; 2) the differences in climate change impacts on the four most important fisheries in the region; 3) the various adaptation activities CC4FISH is embarking on to support climate change adaptation in the Eastern Caribbean.

KEYWORDS: Climate change, adaptation, vulnerability, fisheries, Eastern Caribbean

Impacto del Uso de Diferentes Anzuelos en la Pesquería de Mero (*Epinephelus morio*), en la Zona Costera de Yucatán: A través de un Enfoque Basado en las Tallas

Impact of the Use of Different Hooks in the Grouper Fishery (*Epinephelus morio*), in the Coastal Zone of Yucatán: Through a Size-based Approach

Impact de L'utilisation de Différents Crochets dans la Pêche pour le Mérou (*Epinephelus morio*) dans la Zone Côtière du Yucatan par une Approche Basée sur les Tailles

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RESUMEN

En el Banco de Campeche el mero rojo (*Epinephelus morio*) es fuertemente explotado de forma secuencial por dos flotas con diferente poder de pesca (artesanal y mediana altura), capturando diferentes componentes de la población. Considerando información recabada durante las temporadas de pesca 2013-2016, se evaluó el impacto de los tamaños y tipos de anzuelo (Recto y Curvo) sobre las tallas de *E. morio* capturados por la flota artesanal en la zona costera de Yucatán, a través de indicadores simples de sustentabilidad (Froese 2004) basados en la talla, tal como el porcentaje de organismos: menores a la longitud de primera maduración sexual (Lm), con la longitud al rendimiento óptimo (Lopt) y con la longitud máxima alcanzada en estas temporadas de pesca (Lmax). Asimismo, se analizó la composición de especies y el cumplimiento de la talla mínima de captura establecida para esta especie. Se analizó una muestra de 13,638 ejemplares capturados con tres tipos de anzuelo: recto pata corta y recto pata larga (8/0 y 9/0) y circular (9/0, 10/0, 11/0 y 12/0). Los anzuelos rectos (tipo "J") fueron utilizados con cordel o línea de mano y los curvos con palangre de mano. El intervalo de talla obtenido fue de 22 a 79 cm de longitud furcal (LF) y longitud promedio de 38.2 ± 7.0 cm LF. Los resultados muestran que esta flota está capturando un alto porcentaje de juveniles y que el tipo de anzuelo y la zona de pesca son factores importantes que definen la composición de especies en la captura. Los anzuelos circulares fueron los que registraron mayor porcentaje de E. morio en la captura y organismos con la mayor longitud promedio.

PALABRAS CLAVES: *Epinephelus morio,* tamaño y tipo de anzuelo, indicadores de sustentabilidad

Perceived Impact of FAD Development Programs on the Livelihoods of Caribbean Offshore Fishers

Percepciones Locales sobre el Impacto de Programa de Dispositivos de Concentración de Peces sobre la Vida y el Sustento de los Pescadores Artesanales del Caribe

Impact Perçu des Programmes de Développement des DCP sur les Moyens de Subsistance des Pêcheurs en Mer des Caraïbes

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ABSTRACT

Fisheries are an important source of food, income and cultural identity for Caribbean communities. Key to the efficient harvesting of thinly distributed pelagic fish is the use of fish aggregation devices (FADs). The Japanese government has supported the expansion of a public offshore FAD fishery in partnership with the governments of six Caribbean islands. The project, called Caribbean Fishery Co-Management (CARIFICO), aims to promote co-management arrangements among government and fisher stakeholders to expand, govern and sustain public or communal FAD systems. FAD co-management is being facilitated through consultations, trainings and supply of equipment; and by strengthening policy and organizational mechanisms. An ultimate goal of these CARIFICO interventions is to improve the livelihoods of artisanal fishers. This presentation will describe the results of a survey of 362 FAD fishers residing on islands participating in the CARIFICO project, with particular emphasis on whether the development of public FAD programs have resulted in a change in fisher's livelihoods. The Sustainable Livelihoods Framework was applied to evaluate current livelihood status and to show trends in natural, physical, human, financial and social assets over a five-year period, commensurate with initiation or expansion in public FAD programs. Significant regional trends in some livelihood assets are associated with fishers' participation in government-supported FAD programs. Notwithstanding, such programs also may be influencing a growing trend in the desire among fishers to set and maintain individual/private FADs. Opportunities for strengthening livelihood assets and reconciling conflicting attitudes towards government-supported and private/individual FAD setting also will be discussed.

KEYWORDS: Livelihood, FAD, artisanal fishers, perceptions, Caribbean

Changes in Coral Cover, Coral Size Distribution, and Fish Density in Reef Restoration Sites of the Mexican Caribbean

Cambios en la Cobertura Coralina, Distribución de Tallas de Corales y la Densidad de Peces en Sitios de Restauración de Arrecifes del Caribe Mexicano

Changements dans la Couverture Corallienne, la Distribution des Tailles de Corail et la Densité des Poissons dans les Sites de Restauration des Récifs des Caraibes Mexicaines

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ABSTRACT

Three years ago Oceanus and its partners started a Reef Restoration Program focused on strengthening resilience and the adaptation potential of coral reefs in the Gulf of Mexico and the Mexican Caribbean. The Program involves the transplant of thousands of colonies every year and identification of genetic material from healthy donor populations to increase diversity in restoration sites, thereby promoting natural resilience and resistance to climate change and local stressors. To date it have started efforts in a total of 17 restoration sites. After this time, sites are starting to show visible changes of recovery. Monitoring of trasplants has indicated success in survival and growth, which will mean sexual maturity in a short time and subsequent sexual reproduction. Results from initial monitoring in 2017 have shown, that on average, 80% of the transplanted colonies from previous years have survived for more than two years in the restoration sites. Due to the continuous input of new colonies (small sizes), cover of living tissue in each colony ranges from 1.5 cm^2 to 86 cm^2 with an average of 17cm^2. According to some authors, size can be an indicator of sexual maturity. In sizes starting from 60 cm^2 of living tissue, colonies are in the first stages of sexual maturity, with 7% of the colony already able to reproduce. According to field results to date, at least 10% of the total of colonies already trasplanted, at least in Xcalak, are in this stage. After achieving that size, every additional year of growth, the proportion of the colony that spawns will increase according to maturity. Sexual reproduction of transplanted colonies is the ultimate goal, as it will start the multiplier effect of restoration, sending hundreds or thousands of genetically diverse larvae and recruits to new sites on the reef.

KEYWORDS: Restoration, coral reef, coral growth, fish density, coral cover

Consolidation of a Coral Restoration Community Group in the National Park Reefs of Xcalak

Consolidación de un Grupo de Restauración Comunitario en el Parque Nacional Arrecifes de Xcalak

Consolidation d'un Équipe Communauté de Restauration des Récifs dans le Parc National Récif de Xcalak

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ABSTRACT

In 2014 Oceanus and its partners began implementing a Regional Reef Restoration Program (RRP) with special emphasis on recovering no-take areas to promote recovery of associated species of fish and invertebrates. Restoration techniques developed by Oceanus involve the construction of nurseries planted with coral fragments at selected sites at the Gulf of Mexico and the Mexican Caribbean, and the transplant of thousands of colonies every year. As coral restoration is labor intensive, the Program includes community involvement for various purpouses: (i) To secure local buy-in for setting up monitoring and scaling up of coral nurseries; (ii) to build local capacities for the continued engagement of local volunteers and personnel; (iii) to promote economic benefit in the short term for the participants and; (iv) for self-sustainability of the progam. Community involvement is managed through a Guide Certification Program. The first restoration community group was trained in Xcalak, Quintana Roo, a small fishing community inside a marine protected area. Participants have received training in restoration techniques and are now carrying out activities montly based on a 5-year strategic program, with the objective of trasplanting at least 1000 colonies every year. To promote economic benefit, they have consolidated a group that will be focus on restoration activities as part of their tourist services, improving infrastructure and service. This initiative is planned to be replicated in the different sites where the RRP is carried out. The consolidation of local restoration teams will help to multiply efforts, increasing restoration sites for recovery of the ecosystem, and generating in paralell, benefits to the comunity and a strategy for self-sustainability of the Program.

KEYWORDS: Restoration, Xcalak, local community, coral reef

Hydroacoustic Tools for Monitoring Shrimp Distribution, Movement, and Behavior in Natural and Built Environments

Herramientas Hidroacústicas para Monitorear la Distribución, Movimiento y Comportamiento del Camarón en Entornos Naturales y Construidos

Outils Hydroacoustiques pour la Surveillance de la Distribution, du Mouvement et du Comportement des Séjours dans des Environnements Naturels et Construits

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ABSTRACT

Shrimp and other underwater species have been monitored using both echo sounding and acoustic tagging techniques in various types of environments. These efforts have included sampling in a broad range of environmental conditions from studies in open systems measuring response to environmental disturbances and perturbations to studies in closed systems monitoring species interaction. The same basic principles of sound propagation apply to both echo sounding and acoustic telemetry techniques for shrimp monitoring. The selection of the most suitable hydroacoustic sampling tool will be based on the purpose of the investigation. We will look at strengths and limitations in using echo sounding and acoustic telemetry techniques for shrimp monitoring within several types of environments. Results of shrimp will be presented from hydroacoustic and acoustic telemetry studies.

KEYWORDS: Hydroacoustics, acoustic telemetry, acoustic tags, shrimp

Mobile Applications for Fishermen: Catching ICT at Sea and On the Road

Aplicaciones Móviles para Pescadores: LaC de las TIC en el Mar y en el Camino

Applications Mobiles pour les Pêcheurs: Attraper les TIC en Mer et sur la Route

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ABSTRACT

There is increasing interest in mobile applications for use in fisheries both on land and at sea, for harvest and postharvest sectors. Examples of these include mFisheries (in the Caribbean) and Abalobi (in South Africa). An important aspect of creating these products is moulding them to the real needs, capacities and constraints of fisherfolk who are often busy at sea and on the go. The process of co-design and the features of these apps needs to fully engage fisherfolk for there to be a good fit of practical form and function to the many possible configurations of the technology. We describe and discuss some of the features of both the mobile app process and product from experience of working with fisherfolk. We encourage fisherfolk to boldly explore with developers what information and communication technology (ICT) can do for them at sea and on land to help improve their livelihoods and well-being.

KEYWORDS: ICT, fisheries, mobile, mfisheries, abalobi

Guardians of Marine Protected Areas, an Effective Conservation Strategy

Guardas de Areas Marinas Protegidas, una Estrategia Efectiva de Conservacion

Gardes des Aires Marines Protégées, une Stratégie de Conservation Efficace'

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ABSTRACT

Los guardas de las Áreas Marinas Protegidas (AMP) somos pescadores artesanales de las islas de San Andrés y Providencia que trabajamos con otros grupos comunitarios interesados en la conservación que hemos sido sensibilizados y capacitados por CORALINA (entidad gubernamental y autoridad ambiental de las Islas) para apoyar la implementación del AMP Seaflower, Colombia. Luego más de tres años de trabajo, los guardas de Seaflower participamos activamente en los programas de monitoreo de ecosistemas y que incluyen playas, corales, manglares y pastos marinos. También en monitoreos dirigidos a especies protegidas o amenazadas como es el caso del caracol pala, tortugas, cangrejo negro, langosta espinosa, wheeks, peces loro, tiburones y aves marinas. Así mismo, nosotros los guardas de Seaflower apoyamos el mantenimiento de las boyas de demarcación y de amarre del AMP y más recientemente en el de las estaciones oceanográficas que toman datos ambientales continuos. Como actores directamente vinculados con el AMP, participamos en talleres de gestión de parques nacionales, en proyectos de investigación y en actividades de educación ambiental; y Además colaboramos con patrullajes de control y vigilancia. Nuestra experiencia y habilidades en la mar, han sido claves en la búsqueda de nuevas estrategias de conservación y permiten un uso eficiente de limitados recursos financieros. Como pescador ganador del premio Peter Gladding estoy orgulloso de demostrar como los pescadores artesanales contribuimos a mantener la productividad ambiental y la conservación de la biodiversidad.

Guardas AMP Pescadores y conservacion AMP Seaflower Monitoreos AMP

Ciclo Reproductivo y Tallas de Primera Madurez e Inversión Sexual de la Doncella de Pluma, *Lachnolaimus maximus*, en el Sur del Golfo de México

Reproductive Cycle and Sizes of First Maturity and Sexual Inversion of Hogfish, *Lachnolaimus maximus*, from the southern Gulf of Mexico

Cycle Reproducteur et Tailles de Première Maturité et D'inversion Sexuelle du Labre Capitaine, *Lachnolaimus maximus*, dans le Sud du Golfe du Mexique

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RESUMEN

En el sur del Golfo de México, la doncella de pluma *Lachnolaimus maximus* del Banco de Campeche, México, es considerada por los pescadores de Yucatán como una especie objetivo alterna de alto valor económico. A la fecha, la biología, el nivel de explotación y el estado de conservación de la población del Banco de Campeche no han sido objeto de estudio o evaluación. El propósito del presente trabajo fue caracterizar el ciclo sexual y estimar las tallas de primera madurez e inversión sexual de este labridae. Un total de 1,910 individuos (10.3-47.4 cm longitud furcal; LF) fueron capturados mensualmente entre julio 2011 y marzo 2015, en aguas someras de la costa de Yucatán. El sexo y el estado de madurez de todos los individuos fueron determinados a través del examen histológico de sus gónadas. La evolución mensual del índice gonadosomático y del porcentaje de las fases reproductivas indicaron que la temporada de desove de la especie se extiende durante 11 meses del año, con picos de desove entre febrero y mayo. La hembra y el macho maduros más pequeños (Lmin) tenían respectivamente una talla de 13.9 y 21.2 cm LF. El 50% de las hembras analizadas estaban maduras a partir de 15 cm LF (L50) mientras que el 50% de ellas habían cambiado de sexo a partir de una talla 32 cm LF (P50). En comparación con poblaciones de otras regiones, la doncella de pluma del Banco de Campeche presenta una temporada de desove más extensa; las hembras maduran por primera vez a una talla menor y la inversión sexual ocurre en un rango de talla más reducido (20-40 cm LF).

PALABRAS CLAVES: Temporada de desove madurez sexual, cambio de sexo, Labridae, México

Línea Base Biológica para Zonas de Recuperación Pesquera en el Caribe de Honduras

Biological Baseline for Fishing Replenishment Areas in the Honduran Caribbean

Ligne de Base Biologique pour les Zones de Conservation des Pêches dans les Caraïbes du Honduras

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RESUMEN

Comunidades pesqueras del Caribe hondureño, en su preocupación por el declive de sus pesquerías, han propuesto proteger áreas que ayuden a la recuperación del recurso marino declarando zonas de recuperación pesquera (ZRP). Con el fin de respaldar esta iniciativa, se previó la necesidad de levantar una línea base biológica del recurso marino en las áreas a declarar, en donde, se utiliza un protocolo que evalúa el estado del recurso, siguiendo criterios biofísicos, indicadores biológicos y conocimiento tradicional de las comunidades pesqueras. Este protocolo ha sido aplicado en dos áreas del país: Utila y Roatán, los resultados reflejan que las familias de peces loros (Scaridae) son los más abundantes sobrepasando la media de la región, posicionando a este grupo según el índice de la salud Arrecifal (ISA) en categoría de "Muy bueno". así mismo, las especies comerciales importantes para la pesca, cuentan con un ISA en estado "Critico", debido a una presión de pesca. Sin embargo, se determinó en acuerdo con las comunidades pesqueras en proteger las especies de langosta espinosa (*Panulirus argus*), caracol reina (*Lobatus gigas*) y pepino de mar (*Holothuria mexicana*) determinándolas como especies focales, ya que las áreas propuestas para ZRP cuentan con hábitat marinos ideales para sitios de agregación y crianza para dichas especies. Con un manejo adecuado, se podrá alcanzar el efecto de desborde deseado que beneficiará económicamente a las comunidades pesqueras aledañas. Los resultados de este estudio de línea base biológica, ayudará a determinar a través del tiempo con monitoreos biológicos comparativos, si la acción de manejo de la ZRP está ayudando a la recuperación del recurso marino de la zona.

PALABRAS CLAVES: Hábitats marinos, ecología marina, caribe hondureño, especie de interés comercial

Financial Sustainability of the Fishing Replenishment Zones of Guanaja, Bay Islands

Sostenibilidad Financiera de las Zonas de Recuperación Pesquera de Guanaja, Islas de la Bahía

La Viabilité Financière des Ddomaines de la Pêche, de Récupération Guanaja Bay Islands

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ABSTRACT

Aware of the ecological and economical importance of the marine ecosystems, fishermen via alliances with stakeholders are implementing actions in order to achieve the creation of a network of Fishing Replenishment Zones (FRZ). This zones are permanent protected species in which any type of extraction or captures are prohibited, possess diversity of marine species and constitute the optimal habitat for the reproduction, growth and refuge. This prohibition allows that after a certain period of time of effective protection, fish grow in size and number, and having such an increase in fishes, this migrate to other areas; generating a spillover effect. A big challenge for the management of the FRZ that are being stablished in the country is the financial topic. An identified opportunity is the "Ecotax", create by the country's National Congress. This Ecotax finances the protected areas and wildlife fund (FAPVS according Spanish acronym), administered by the National Forestry and Conservation Institute (ICF). This fund is meant to finance management and conservation initiatives of the country. In Guanaja, which features two FRZ with an area coverage of 15.63 km^2, enabled the establishment of an environmental fund. This fund stems from the voluntaries contributions of tourists that visit the island (USD$10 /p). Of the total recollected, 33% goes to BICA, 33% for the EMU, 33% for the groups of organized fisherman and 1% for administrative expenses. The environmental fund finances the following activities: implementation environmental education program at 5 educational centers; support 260 marine patrols; and strengthening of two fishermen´s associations. In order to further promote the environmental fund is of the upmost priority to perform studies on economic viability or the FRZ in its different productive sectors.

KEYWORDS: Ecological, economical, fund, productive fisherman

Reproductive Biology of Striped Mojarra *Eugerres plumieri* (Cuvier, 1830) in the Cordoba Caribbean Sea, Colombia

Biología Reproductiva de la Mojarra Rayada *Eugerres plumieri* (Cuvier, 1830) en el Mar Caribe Cordobés, Colombia

Biologie de la Reproduction de Striped Mojarra *Eugerres plumieri* (Cuvier, 1830) dans la Mer des Caraïbes de Cordoba, Colombie

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ABSTRACT

Reproductive ecology of Striped mojarra *Eugerres plumieri* in the Cordoba´s Caribbean Sea, Colombia, was studied. 405 Individuals with total length (TL) ranged between 10.0 and 35.7 cm and total weight (TW) ranged between 11.6 and 740.0 grams were collected. The gonads were placed in Gilson solution, the Holden & Raitt scale was applicated and sexual proportion, maturity index, spawning season, length at first maturity, ovocites's diameter and fecundity were estimated. 229 females, 151 males and 25 undifferentiated were found, with sexual proportion female: male 1.5:1, differently than expected, and sexual dimorphism in size, since females reach larger sizes than males. Length at first maturity was estimated in 20.3 cm TL for both sexes, similar value to the length at first maturity estimated for the species in the Cienaga Grande de Santa Marta, Colombia. Several sizes of oocytes were found, with average diameter of 344 microns for mature oocytes and average fecundity was estimated in 300,000 oocytes by spawning batch. The results achieved suggest that Striped mojarra is a fish whose spawning season extends during the year with partial spawning, small oocytes and high fecundity associated to the ovaries´s weight.

KEYWORDS: Sexual maturity, fecundity, spawning season, reproductive ecology

A Note on Lionfish Removals in St. Thomas/St. John, U.S. Virgin Islands

Una Nota sobre Mudanzas de Lionfish en St. Thomas / St. John, Islas Vírgenes de los Estados Unidos

Une Note sur les Déménagements de Lionfish à St. Thomas / St. John, Îles Vierges Américaines

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ABSTRACT

Small individuals of the invasive lionfish first made an appearance in St. Thomas' plastic lobster traps with 2.5 mm gaps between slats in late 2009. Larger individuals which could be retained in fish traps (with 5.9 mm mesh size) were not present until mid-2010. By 2012 they were the 19th most common species caught in a trapping study. Catch per Unit effort values from that study and from one of the project fishermen indicate that fish and lobster trap fishermen are removing between 10 and 12,000 lionfish annually. Removal by sport divers has been reported since 2010. Sport Divers are currently removing between 1,200 and 3,000 lionfish annually.

KEYWORDS: Lionfish, commercial fishery, sport divers, trap selectivity

A Study of the Virgin Islands Spiny Lobster Fishery: Growth, Population Size and Mortality

Un Estudio de las Pesquerías de Langosta Espinosa Islas Vírgenes: Crecimiento, Tamaño de la Población y la Mortalidad

Une Étude sur les Pêcheries de Homard Épineux des Iles Vierges

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ABSTRACT

Development of the tourism industry in the Virgin Islands led to development of a fishery for Spiny Lobster (Panulirus argus) as it is not a traditional element of the Virgin Islands diet. It is currently the basis of one of the Virgin Islands most important fisheries and supplies an important product to local restaurants and hotels. Members of the St. Thomas Fishermen's Association have undertaken a tag and recapture study of the fishery in St. Thomas/St. John and St. Croix. Preliminary results were presented at the 66th Gulf and Caribbean Fisheries Institute meeting (Olsen, et. al, 2014). Tag recaptures continued through November of 2016 which permitted calculation of growth, movement, mortality and population size and additional information about movement of the resource in St. Thomas and St. John. Analysis of historical data collected by the Territorial Government have provided information about long term trends in average Carapace Length and Mortality. Management recommendations are provided. The project is a clear indication of the value of collaboration between fishermen and fishery managers.

KEYWORDS: Spiny lobster, growth, mortality, movement, management

The Mona Island MPA 13 Years After No-take Designation: Testing the NEOLI Paradigm

El MPA de la Isla Mona 13 Años Después de la Designación de la Reserva Marina: Probar el Paradigma NEOLI.

Le MPA de L'île de Mona 13 Ans Après la Désignation sans Prise en Charge: Test du Paradigme NEOLI

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ABSTRACT

Marine protected areas (MPAs) are capable of rebuilding biodiversity and increase fishery output. However, MPA success is not always achieved, and assessment of MPA performance is necessary for management accountability to stakeholders. MPA success requires adequate design, compliance and time. Success probability is enhanced if an MPA meets 4 of the 5 NEOLI criteria: No-take, Enforced, Old, Large, and Isolated, but often some of these factors are not accounted for when assessing MPA performance. Here we present preliminary results of a study evaluating patterns of temporal variation of fish assemblages of two MPAs with distinct management and enforcement plans: the no-take area of the Mona Island Natural Reserve, an offshore island between Puerto Rico and Hispaniola, and the La Parguera Natural Reserve, off the southwest coast of Puerto Rico. Both are considered large and old by NEOLI criteria, but differ in no-take status and degree of isolation, with enforcement unquantified in both areas. A prior study at Mona Island, 5-years after no-take designation, found only marginal changes in abundance for larger, commercially important species, with the largest increases in abundance detected for smaller species of groupers and early life stages. Non-compliance at Mona Island has been cited as a potential hindrance to the recovery, but this has not been formally assessed. In the present study, structure and composition of fish assemblages associated with coral reefs (collected via belt transects) are being analyzed using permutational multivariate analyses of variance (PERMANOVA) based on a multifactorial mixed model that considered several spatial and temporal scales, while compliance is being indirectly evaluated with a series of scaled stakeholder surveys. If compliance within the no-take zone at Mona Island is suffi

KEYWORDS: No-take zones, MPA, reef fish, compliance, ecosystem-based management

Towards a Participatory Management Model Through an Advisory Fishery Council: The Case of the Gulf Corvina in the Gulf of California

Hacia un Modelo de Manejo Participativo a través de un Comité Consultivo: El Caso de la Curvina Golfina en el Golfo de California

Vers un Modèle de Gestion Participative à travers un Comité Consultatif : Le Cas du Acoupa du Golfe dans le Golfe de Californie

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ABSTRACT

The gulf corvina (*Cynoscion othonopterus*) fishery captures an endemic fish of high social and economic importance in the Upper Gulf of California. This fishery has gone through important changes since the implementation of rights-based management (RBM) in 2011, including the establishment of an Advisory Corvina Fishery Council. The analysis showcased in this presentation comes from the yearly surveys that EDF de Mexico implements in each of the four communities participating in the fishery. These surveys collect data on fishing costs and revenue, commercialization, subsidies and other government programs, as well as fishermen's perceptions on the corvina fishery's management, governance and biological performance. Our analysis shows that respondents perceive that RBM has brought about social and economic benefits, even if there are still opportunities for improvement. In the context of these results, we discuss the role of the Advisory Corvina Fishery Council as an example of governance body, and as a stakeholders participation model that could be used in other regions of Mexico and particularly in the Grouper fishery of the Yucatán Peninsula.

KEYWORDS: Governance, finfish, small-scale fisheries, rights-based-management

Structure and Functioning of the Trophic Web of Gulf of Salamanca, Colombian Caribbean

Estructura y Funcionamiento de la Red Trófica del Golfo de Salamanca, Caribe Colombiano

Structure et Fonctionnement de la Web Trophique du Golfe de Salamanque, Colombien Caraïbes

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ABSTRACT

A mass-balance model (Ecopath) of 19 components was elaborated for the gulf of Salamanca, based on the AUNAP landings information for 2013 and discards of trawls operating in the gulf. The consumption and production of the components were derived from the 1997 model. Structural and functional changes were evaluated in the trophic network that have occurred in the last two decades with the help of estimates of biomass, trophic levels, 15 ecosystem attributes and mixed trophic impact. This suggests changes in the structure and function of gulf of Salamanca, related to the reduction of biomass, trophic levels and loss of maturity. It has consequences in the stability of the system and the capacity of withstand natural or man-made alterations. The detritus exerts bottom-up control in the trophic network due to the impacts that it has in the ecosystem. The artisanal fishery operating in the Gulf has more impacts on the upper part of the food web, noting that the impact of artisanal trawling is localized and generates less impacts than other types of gears (e.g. gillnet).

KEYWORDS: Gulf of Salamanca, trophic web, Ecopath with Ecosim, ecological attributes

Advancing Area-Based Planning and Network Approaches in Areas Beyond National Jurisdiction: A Global Review of Data on Connectivity for Migratory Marine Animals

Avanzando los Mecanismos de Ordenación Basados en Zonas Geográficas en Áreas más Allá de la Jurisdicción Nacional: Una Revisión Global de los Datos sobre la Conectividad de Especies Migratorias Marinas

Faire Progresser les Mécanismes de Gestion Basés sur des Zones Géographiques dans les Zones Au-delà de la Juridiction Nationale: Un Examen Complet de la Connectivité des Animaux Marins Migrateurs

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ABSTRACT

Due to their wide-ranging behaviors, migratory fish, marine mammal, seabird and sea turtle species experience a variety, and increasing amount, of anthropogenic pressures over the course of their life histories. Combined with conservation strategies that largely fail to consider spatial connectivity over the life cycle, these threats are resulting in declining populations worldwide. It has become clear that there is a major knowledge gap on marine migratory connectivity on the high seas that can be provided the many marine spatial planning initiatives involving areas beyond national jurisdiction (ABNJ). The Marine Geospatial Ecology Lab of Duke University is leading a consortium to develop The Migratory Connectivity in the Ocean (MiCO) system to fill this knowledge gap. MiCO seeks to compile and, where necessary, synthesize scaled-up knowledge on migratory connectivity for species utilizing ABNJ. MiCO will convey information on connectivity among "nodes" (aggregations of areas used for a particular life cycle activities) and via "corridors" (aggregations of paths animals travel between nodes). Data from a wide array of sources including telemetry, mark/recapture, stable isotope, genetic, and acoustic sampling are being gathered from direct contributions by collaborating partners and a systematic literature review. The literature review encompasses over 200 species listed in the Convention on Migratory Species or managed by a Regional Fisheries Management Organization and the complete system will address nearly 1000 migratory species across the four taxa. Over 50% of the species in the literature review are listed as Near Threatened, Vulnerable, Endangered, or Critically Endangered by the IUCN. Here we present initial results detailing the information available on ecological connectivity in or across ABNJ.

KEYWORDS: Migratory, ABNJ, connectivity, high seas, movement

Caracterización de las Operaciones de Pesca de una Flota Multi-específica: Caso de Estudio en Sisal, Yucatán, México

Fishing Operations Characterization of a Mixed Fleet: Case Study at Sisal, Yucatan, Mexico

Caractérisation des Opérations de Pêche d'une Flotte Multispécifique: Cas D'étude à Sisal, Yucatan, Mexique

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RESUMEN

Las pesquerías artesanales son multi-especies y multi-artes, que se realizan principalmente en países en desarrollo. A pesar de su naturaleza multi-específica, su evaluación y manejo han sido con un enfoque uniespecífico, el cual no siempre ha sido exitoso. La evaluación y el manejo de este tipo de pesquerías son complejos por la diversidad de especies objetivo y el uso de múltiples artes de pesca. Con el fin de entender la dinámica de estas pesquerías se ha desarrollado el enfoque de métiers, que son una combinación de arte de pesca, ensamblaje de especies y sitio de pesca. Lo anterior contribuye a entender la complejidad de este tipo de pesquerías. En este estudio se analizan las operaciones de la pesca artesanal en Sisal, Yucatán, México para entender su dinámica. De agosto de 2016 a julio de 2017 se obtuvieron datos para: 1) conocer la percepción de los pescadores sobre sus actividades de manera global a través de entrevistas estructuradas; y 2) caracterizar las operaciones de pesca usando entrevistas semi-estructuradas mensuales durante los desembarques. Destaca en los resultados, que los pescadores coinciden en que la abundancia y talla de las tres especies que históricamente han contribuido con los mayores volúmenes y divisas han disminuido. El mayor número de especies (21) fueron capturadas con cordel. Los viajes de pesca con jimba-cordel presentaron el mayor tiempo de pesca, mientras el uso de palangre se dio en zonas de mayor profundidad. Los mayores costos de viaje e ingresos fueron con palangre. Los resultados de este estudio resaltan la dinámica y complejidad de una pesquería multi-específica, donde el enfoque basado en métiers mostró ser apropiado. Se discute sobre la utilidad de dicho enfoque en el monitoreo de las operaciones de pesca y por ende la evaluación y manejo de pesquerías multi-específicas.

PALABRAS CLAVES: Pesca artesanal, multi-especies, multi-artes, métiers, México

Densidad y Distribución Espaciotemporal de Tortugas Marinas en la Plataforma de Yucatán, México

Density and Spatiotemporal Distribution of Sea Turtles on the Yucatan Shelf, Mexico

La Densité et la Distribution Spatio-temporelle des Tortues Marines dans la Plate-Forme du Yucatan, Mexique

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RESUMEN

Las tortugas marinas son especies migratorias que utilizan diversos hábitats marinos durante su complejo ciclo de vida. De manera particular el Golfo de México es ampliamente usado por cinco de las siete especies que existen en el mundo. El litoral de Yucatán es considerado un hábitat crítico para la anidación de tortuga carey y se reconoce a toda la Plataforma como un importante corredor migratorio para las tortugas carey, blanca y caguama. El objetivo del presente estudio fue evaluar la densidad y la distribución espaciotemporal en ambientes neríticos y oceánicos de las tortugas marinas que se distribuyen en la Plataforma de Yucatán. Para el conteo de individuos se implementó el método de conteo de individuos sobre transectos lineales realizado desde buques oceanográficos. Se realizaron tres campañas en la Plataforma de Yucatán y Banco de Campeche con una duración mínima de 10 días, G4 (Nov,2015 - 20 días), S6 (Mar,2016-10 días) y G5 (Ago-Sept, 2016 – 17 días). El esfuerzo de muestreo global fue de 54 transectos cubriendo 4,300 km lineales en 950 h, y se contaron 28 individuos de tortugas marinas, principalmente adultas de la especie Chelonia mydas y en menor proporción Eretmochelys imbricata, con lo que se calculó una densidad de 0.0026 tortugas/Km^2 ($\chi 2 = 4.6$, $\alpha = 0.19$, $n = 28$). El área con mayor ocurrencia fue la franja somera de la Península de Yucatán (<30 m), destacando la porción oriente con 17 tortugas observadas en 7 transectos. La densidad obtenida es comparable con datos reportados para el Pacífico Mexicano para otras especies, particularmente la golfina. Esta información contribuye a la consolidación y refinamiento de una línea base de la densidad de tortugas marinas en la región, a partir de un método para el cual existen protocolos y procedimientos de análisis estandarizados y que son frecuentemente socorridas.

PALABRAS CLAVES: Tortugas marinas, ambiente pelágico, plataforma de Yucatán, densidad, distribución

Community Structure of a New Potential Deep-sea Resource of Commercial Importance in the Colombian Caribbean Sea

Estructura de la Comunidad de un Nuevo Recurso Potencial de Aguas Profundas de Importancia Comercial en el Caribe Colombiano

Structure Communautaire D'une Nouvelle Ressource Potentielle D'importance Commerciale dans la Mer des Caraïbes Colombienne

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ABSTRACT

Recent studies in the Colombian Caribbean Sea describe the potential for a new deep-sea fishery between 200 a 550 m depth. In order to support appropriate management plans for their sustainable utilization, the goal of this paper is to investigate the community structure of fisheries resources accompanying deep-sea crustaceans of the Colombian Caribbean coast. A catch of 8759 N/km^2 and 226 kg/km^2 was reported and the major contribution was supported by teleostean fish (89 species 60.4% abundance and 72.5% biomass), dominating the depth stratum 200-300 m, followed by crustaceans (37.3% and 22.0%, respectively), for deeper waters (> 500 m). Most important species were the fish Coelorinchus caelorhincus (20.2 N/km^2; 16.7 kg/km^2) and the crustaceans Penaeopsis serrata (579 N/km^2, 6.6 % of the abundance) and Pleoticus robustus (12.6 kg/km^2, 5.7 % of the biomass). The distribution of the abundance and biomass of the captures was assumed to be driven by depth; nevertheless no statistical differences (Kruskal-Wallis test, p = 0.692; *p* = 0.177) between depth strata were found. The information obtained is part of the base line required for describe the potential ecosystem effects of these fisheries and support future decisions about use, management and conservation of deep resources for this region.

KEYWORDS: Deep-sea, fishery, crustaceans, Colombia, Caribbean

Contributions to the Diversification of Artisanal Fisheries in the Marine and Coastal Area of the Department of Magdalena, Colombian Caribbean

Aportes a la Diversificación de las Pesquerías Artesanales en el Área Marina y Costera del Departamento del Magdalena, Caribe Colombiano

Des Contributions à la Diversification de la Pêche Maritime Artisanale et de la Zone Côtière Département de Magdalena, Caraïbes Colombiennes

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ABSTRACT

In the Colombian Caribbean, most artisanal fisheries are at maximum exploitation or over-exploited levels. Therefore, the future development of the artisanal fisheries sector should focus on the search for new fishing resources and alternative fishing techniques that make its exploitation economically attractive without jeopardizing its sustainable exploitation. One of the most relevant problems of artisanal fisheries in the Department of Magdalena is the lack of technology related to fishing activity. The objective of the project was to evaluate the potential of deep fishes and crustaceans (100-400 m) as an alternative for artisanal fisheries development in the Department of Magdalena. It was found a potential fishing resource that can be constituted as an alternative of artisanal fishing development. However, it requires the acquisition of capture technology equipment such as Echo sounder, GPS and mechanized gears to access these deep-water resources by artisanal fishing.
Link: https://youtu.be/DpmM-EepDPM

KEYWORDS: Atisanal fishing, deep-sea resources, technology, Caribbean, Colombia

Evaluation of Energy Efficiency in the Process of the Brown Sea Cucumber in Yucatán

Evaluación la Eficiencia Energética en el Proceso del Pepino de Mar Café en Yucatán

Détermination de Lefficacité Énergétique dans le Processus de Décoction de Bêche-de-mer en Yucatan

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ABSTRACT

Energy efficiency of butane gas consumption was determined. The data were collected were during processing a batch of 374 kg of brown sea cucumber, Isostichopus badionotus, in a fishing cooperative in the state of Yucatan. Based on these data, it was calculated that the total heat, for heating the cooking water and cook sea cucumber, was approximately 67,370 kcal. By comparing these data with real-butane gas consumption, in the practice were consumed 12.64 kg and theoretically requires 6.33 kg of butane gas. Finally, it was shown that there is an energy loss of about 50% mainly due to heat dissipation to the environment because of rudimentary systems for cooking.

KEYWORDS: Sea cucumber, *Isostichopus badionotus*, energy efficiency

The 2017 Mesoamerican Reef Report Card Measures Increasing Fish Biomass and Reef Health over the Last Decade

El Reporte de Salud del Arrecife Mesoamericano 2017 Mide el Aumento de la Biomasa de Peces y la Salud Arrecifal Durante la Última Década

Le Bulletin de Récif Mesoaméricain 2017 Mesure L'augmentation de la Biomasse des Poissons et la Santé des Récifs au cours de la Dernière Décennie

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ABSTRACT

The 2017 Mesoamerican Reef Report Card includes 319 reef sites and marks the ten-year anniversary of data collection and reporting by the Healthy Reefs for Healthy People Initiative (HRI). Overall, the reef condition in the MAR graded as 'fair' for 2017 (2.8 out of 5), with improvements in coral cover and fish biomass. Fish biomass has increased overall, particularly due to fishing replenishment zones, or no-fishing zones. Overall (MAR wide) snapper and grouper biomass increased from 560 to 909 g/100m^2 from 2006 to 2016, while parrotfish and acanthurids increased from 1895 to 2731 g/100m^2, respectively. The increase in commercial and herbivorous fish biomass was mostly seen inside fish refuges versus in the open fishing areas. One of the main benefits of these fish refuges is to allow fish to grow to their fully reproductive size, a feature which is particularly difficult for larger bodied species like Black grouper or Cubera snapper. Overall, the fish refuges had 6.4 reproductively mature fish per site versus 1.4 in the open fishing areas, or 1.5 in the fished zones of the MPAs. In order for MPAs to be effective they must be well enforced. 13 of the 47 MPAs in the MAR ranked as having good enforcement, although this varies by country. The reef health indicator that has continued to decline over the last decade is fleshy macroalgae cover, which has almost doubled from 13% to 23% form 2006 to 2016. The highest abundances of fleshy macro algae were found in in Northern Belize (33%), Guanaja (31%) and Utila (30%), interestingly all tourist islands with inadequate sewage treatment facilities. HRI and partners continue to call for improved sewage treatment in the region, and are now also exploring additional management options like direct macroalgal reduction and Diadema enhancement to control macroalgal proliferation.

KEYWORDS: Report card, Mesoamerican, reef fish biomass, replenishment zones

The New Gulf and Caribbean Research-GCFI Partnership: A Peer-reviewed, Open Access option for Publication of GCFI Manuscripts

La Nueva Asociación entre Gulf and Caribbean Research y GFCI: Una Opción Revisada por Pares y de Acceso Abierto para la Publicación de Manuscritos del GFCI

Le Nouveau Partenariat entre Gulf and Caribbean Research et GFCI: Une Option D'accès Libre, Évaluée par des Pairs, pour la Publication des Manuscrits GFCI

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ABSTRACT

Peer-reviewed publication of work presented at annual GCFI meetings is important for many GCFI members. Thus in 2017, GCFI initiated a partnership with the Gulf and Caribbean Research (GCR) journal for publication of peer-reviewed, Open Access articles. The GCR was founded in 1961 by Gordon Gunter as a publication of the Gulf Coast Research Laboratory and was titled Gulf Research Reports; that name persisted through 1999. The name was changed to Gulf and Caribbean Research in 2000 to better reflect the scope of manuscripts, and the journal was published in traditional hard-copy format through 2013. GCR migrated to a fully online delivery platform in April 2015 (http://aquila.usm.edu/gcr/) and offers a hybrid publication format: 1) Open Access for a fee; or 2) the abstract only available online for no fee. GCR focuses on coastal and marine resources from the Gulf of Mexico and Caribbean Sea; ~75% of the papers published are on fisheries-related topics and 25% are from the Caribbean area including Mexico. All papers published since 1961 (n = 511) have functional doi's; papers from the most recent five years of publication are available for a nominal charge, while all earlier papers are Open Access. In 2016, GCR published the first in a series of Open Access invited articles from eminent senior scientists with a significant history of research in the Gulf of Mexico and Caribbean Sea called 'Ocean Reflections.' The first GCFI Partnership article was published in July 2017, and three more Partnership articles are currently in review. Submission of articles based on GCFI presentations for peer-review and free Open Access publication is available to all GCFI members in good standing.

KEYWORDS: Gulf and Caribbean Research, GCFI, partnership,

The Effects of Hard-bottom Habitat Degradation on the Ecology and Biology of the Florida Stone Crab *Menippe mercenaria* from the Florida Keys

Los Efectos de la Degradación del Hábitat del Hábitat en la Ecología y la Biología del Cangrejo de Piedra de Florida *Menippe mercenaria* de los Cayos de la Florida

Les Effets de la Dégradation de L'habitat du Fond dur sur L'écologie et la B crabe de Pierre de la Floride *Menippe mercenaria* des Florida Keys

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ABSTRACT

The stone crab *Menippe mercenaria* supports one of the most economically important fisheries in the southeastern United States, with Florida leading overall landings. Hard-bottom in the Florida Keys is an important habitat for Florida stone crabs and is characterized by a porous limestone substrate covered by sponges, octocorals, macroalgae and a thin layer of sediment. Over the past three decades cyanobacteria blooms have periodically occurred in Florida Bay, resulting in mass sponge mortalities. Mostly juvenile and young adult *M. mercenaria* are predominantly found residing in hard-bottom in solution holes and under loggerhead sponges *Spheciospongia vesparium*. Blooms have decimated populations of this sponge and the loss of habitat appears to affect the population structure and condition of the stone crabs that reside in impacted areas. Our research is examining the effects of hard-bottom degradation on stone crab nutritional condition, population size structure, site fidelity and whether *M. mercenaria* use chemical cues from sponges or macroalgae to navigate their home range. The results of this study will increase our understanding of the effects of habitat degradation on an important member of the benthic community in the Florida Keys.

KEYWORDS: Stone crab, Florida, habitat degradation

Managing Fish Spawning Aggregations in a Changing Climate: A Case Study of Red Hind (*Epinephelus guttatus*) in Bermuda

Manejo de las Agregaciones de Desove de Peces en un Clima Cambiante: El Ejemplo de Red Hind (*Epinephelus guttatus*) en las Bermudas

Gérer les Agrégations de Géniteurs de Poissons dans un Climat Changeant: L'exemple de Red Hind (*Epinephelus guttatus*) des Bermudes

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ABSTRACT

Many species of groupers (Serranidae) spawn in large aggregations that form in specific locations at predictable times, making them vulnerable to overexploitation, so prohibiting fishing on spawning aggregations is now considered best practice. Bermuda has protected spawning aggregations of the Red Hind (*Epinephelus guttatus*) since the 1970s, closing known spawning areas to fishing during the spawning season (May 1 through August 31) each year. However, the timing of spawning is determined by a number of factors, including temperature, and ocean temperature regimes are changing along with the global climate. The Bermuda Department of Environment and Natural Resources received reports of large catches of Red Hind from the spawning aggregation areas during the month of April in both 2014 and 2016, although not in 2015. We therefore conducted a retrospective analysis of catch reports in conjunction with climate records and moon phase data, and examined vessel activity at the sites during April of 2016. This showed that in the two years with large April catches, both March and April temperatures were substantially above the long term averages. In order to continue to provide effective protection to Red Hinds while they are spawning, a variety of management responses were considered, including a reactive model that would be triggered by elevated temperatures. Following consultation with stakeholders, it was determined that a fixed start to the closed season was preferred, but that closing the areas earlier in the year should be balanced by an earlier re-opening time. Therefore, the Red hind spawning aggregation areas will now be closed to fishing from April 15 through August 14 each year. An acoustic tagging study is currently underway to monitor the presence of Red Hinds at one aggregation site over the next five years.

KEYWORDS: Spawning aggregations, Red Hind, climate change, fisheries management

Decision Support Tool for the Prioritization of Coral Reefs in the U.S. Virgin Islands

Instrumento de Apoyo de Decisión para la Priorización de Arrecifes de Coral en las U.S. Virgin Islands

Outil D'aide à la Décision pour le Classement par Ordre de Priorité es Récifs Coraliens aux U.S. Virgin Islands

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ABSTRACT

The coral reef ecosystems of the U.S. Virgin Islands are some of the most intensively surveyed and threatened tropical ecosystems on earth. These coral reefs vary widely in terms of biophysical structure, seascape context, socio-economic value and exposure to threats presenting a complex challenge for resilience-based management. How and where should managers prioritize actions to maximize conservation outcomes? To meet multiple conservation objectives, a novel map-based decision-support tool was designed to synthesize large amounts of spatial data to help managers identify and rank coral reefs according to multiple ecological qualities, ecosystem services and threats. The spatial framework integrates local expert knowledge from SCUBA divers, scientific field data and spatial models to characterize and rank priority coral reefs. With user-defined flexibility, the tool provides information to guide management processes such as risk assessments of coastal development, management of protected areas, site selection in science and monitoring design, broader marine spatial planning and community education and outreach.

KEYWORDS: Management, risk assessment, coral reefs, decision support, tool mapping

Procesamiento del Pepino de Mar en la Costa de Yucatán y sus Implicaciones en el Manejo de la Pesquería

Processing of Sea Cucumber on the Coast of Yucatan and Its Implications on the Fishery Management

Procesamiento du Pepino de Mar sur la Côte de Yucatán et ses Implications dans la Gestion de la Pesquería

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RESUMEN

Se analizan diferentes técnicas de procesamiento del pepino de mar Isostichopus badionotus empleadas en la costa de Yucatán durante el desarrollo de la pesquería de esta especie. Se presentan los cambios en las tallas y pesos durante las etapas de su procesamiento, así como las fórmulas para su conversión. Los datos del presente trabajo provienen de experimentos realizados durante las temporadas de pesca 2011 y 2012, así como de mediciones en ejemplares frescos y procesados durante el periodo 2010 a 2017. Los rendimientos del peso entero al peso eviscerado pueden variar de 62 a 67%, mientras que del peso eviscerado al primer cocimiento varían de 24 a 30%, y del eviscerado al salmuerado de 18 a 20%. En esta tercera etapa, si los ejemplares se salan sin permitir que se forme el agua de sal, se obtiene un rendimiento de 22.5 a 23.3% a partir del peso eviscerado. La etapa final del procesamiento, el secado, da un rendimiento de aprox. el 7%. Se recomienda estandarizar el método de procesamiento que permita obtener el mejor rendimiento sin afectar la calidad y establecer una talla y pesos mínimos para su exportación en estado seco. Para el control de las exportaciones de ejemplares en estado seco, se recomienda una talla mínima de 7 cm de longitud dorsal o 6 cm de longitud ventral, con un peso mínimo de 12 g.

PALABRAS CLAVES: Pepino de mar, técnicas de procesamiento, relaciones talla-peso, manejo pesquero, Yucatán

Healthy Fisheries Need Healthy Fishermen: An Overview of the Work-related Health Problems of the Artisanal Diving Fishermen of Yucatan, Mexico

Las Pesquerías Saludables Necesitan Pescadores Saludables: Una Visión General de los Problemas de Salud Relacionados con el Trabajo de los Pescadores Artesanales de Yucatán, México

Les Pêches Saines Ont Besoin de Pêcheurs en Bonne Santé: Un Aperçu des Problèmes de Santé Liés au Travail des Pêcheurs de Plongée Artisanale du Yucatan, Au Mexique

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ABSTRACT

Small-scale fishermen of the state of Yucatan, Mexico use surface supplied compressed air via hookah systems in order to dive and increase their catches to support their livelihoods. Using this hookah technology, they are able to extract greater catches and exploit novel fisheries, but they also dive beyond accepted safety guidelines leading to decompression sickness (DCS). As many as 75% of Yucatan fishermen will suffer from DCS, with permanent disability and death in the most severe cases. Although these dangers are present year-round, the sea cucumber fishery, begun in the past several years for the export market, has proven highly lucrative yet highly dangerous for these fishermen with many cases of both disabling DCS and death. We illustrate not only the diving behavior and health problems of the fishermen, but also the logistical challenges in providing effective treatment. Additional health risks arise from locally manufactured air compressors that often contain significant amounts of oil in the volume tanks in excess of safety standards as well as no system for separating the compressor air intake and exhaust, leading to carbon monoxide poisoning. In 2014, an intervention to separate intake and exhaust gases was implemented aboard seven boats in Rio Lagartos. During subsequent visits, we observed fishermen's recognition of this health risk and the proliferation of the gas separation system throughout the fleet. Future studies will focus on behavioral interventions that we hope will lead to improved diving practices and fewer cases of diving injuries and fatalities.

KEYWORDS: Artisanal fishery, sea cucumber, dive, medicine, healthcare

Desarrollo y Uso de Aplicaciones para la Promoción de la Pesca y el Consumo Responsables, y el Fortalecimiento de la Gestión Gubernamental para la Conservación de los Recursos Marino Costeros: La Experiencia de Fundación Marviva

Development and Use of Applications for the Promotion of Responsible Fishing and Consumption, and the Strengthening of Governmental Management for the Conservation of Coastal Marine Resources: The Experience of Fundación Marviva

Développement et Utilisation des Applications pour la Promotion de la Pêche et la Consommation Responsable, et Renforcement de la Gestion Gouvernementale pour la Conservation des Ressources Marines Côtières: L'expérience de la Fundación Marviva

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RESUMEN

Fundación MarViva, ONG regional, impulsa la conservación y uso sostenible de recursos marino-costeros, buscando garantizar un Pacífico Tropical Oriental biodiverso y saludable, generando bienestar para presentes y futuras generaciones. Dos de sus líneas de acción son: 1) fomentar la pesca y el consumo responsable y 2) fortalecer la gestión gubernamental. Adaptándose a los tiempos, MarViva ha desarrollado aplicaciones (3), mientras que experimenta con otra. La **Guía Semáforo para el Consumo Responsable de Pescado de Mar** orienta a los consumidores a través de una lista de especies cuya captura, comercialización y consumo imitan el funcionamiento de un semáforo: verde (adelante), amarillo (precaución) y rojo (alto). **Vigilantes del Mar** permite hacer reportes ciudadanos sobre actividades irregulares que afectan la navegación, el ambiente y los recursos marino-costeros en las provincias de Chiriquí y Veraguas, contribuyendo con las autoridades en sus labores de supervisión, control y seguimiento de presuntas infracciones y/o delitos. Apoyando igualmente la gestión gubernamental desarrolló una aplicación que permite la **Actualización Remota de Registros de Ordenamiento Pesquero**, facilitando el trabajo de inspectores portuarios quienes pueden acceder y actualizar el registro de embarcaciones, licencias y permisos otorgados por la autoridad de pesca, como parte del esfuerzo para combatir la pesca ilegal, no declarada, no reglamentada. Por último tiene a prueba la aplicación **"OurFish"**, desarrollada por el Dr. Stephen Box para darle seguimiento a los desembarques pesqueros artesanales en dos comunidades del Área Protegida Golfo de Montijo, a la espera de que las autoridades nacionales consideren elevar su uso a escala nacional.

PALABRAS CLAVES: Conservación, sostenible de recursos marino-costeros, pesqueros artesanales

Helmintos Parásitos de *Lutjanus campechanus* (Poey, 1860) en la Zona Central del Estado de Veracruz, México

Helminth Parasites of *Lutjanus campechanus* (Poey, 1860) in the Central Zone of the State of Veracruz, Mexico

Helminthes Parasites de *Lutjanus campechanus* (Poey, 1860) dans la Zone Centrale de L'état du Veracruz, Mexique

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RESUMEN

El huachinango, *Lutjanus campechanus* (Poey, 1860) es una de las especies de mayor importancia comercial, siendo el principal componente de la pesquería de lutjanidos a lo largo de la plataforma continental del Golfo de México. A pesar de ser una especie de relevancia biológica y un recurso valioso de pesca en la región, su helmintofauna parásita a escala local es poco conocida en comparación con otras especies de lutjanidos. Por tanto, en este trabajo determinamos la composición de especies parásitas de *L. campechanus* capturados por la pesca artesanal en la barra de Chachalacas, Veracruz, en el sur del Golfo de México. Se examinó el tracto digestivo (estómago e intestino) de 22 individuos. Para el procesamiento del material biológico se aplicó la técnica parasitológica acorde al grupo de parásito encontrado. Se realizó la identificación y descripción taxonómica de los parásitos y se calcularon los parámetros ecológicos en parasitología: prevalencia (P), intensidad promedio de infección (I) y abundancia (A). Se colectaron 155 helmintos parásitos pertenecientes a 10 especies, de las cuales 3 son trematodos, 2 cestodos, un acantocéfalo y 4 nematodos. El trematodo *Metadena* sp. fue la especie con mayor prevalencia y abundancia, representando el 72% de los helmintos colectados, seguido por el nematodo *Hysterothylacium reliquens* (10%). Ocho de las 10 especies de helmintos se registran como adultos en el intestino, indicando que actúa principalmente como hospedero definitivo, aunque para *Anisakis* sp.; *Hysterotylacium* sp. y el acantocéfalo *Serrantis sagittifer* actúa como hospedero intermediario. La presencia de larvas de nematodos podría suponer un problema de zoonosis en la región. El registro de estos parásitos se asocia a los hábitos alimenticios del hospedero debido a que todas las especies son transmitidas tróficamente.

PALABRAS CLAVES: Helmintos, *Lutjanus campechanus*, Veracruz

Evaluation of the CaMPAM Marine Protected Areas Database and its Relevance for Application of EBM Concepts and Tools

Evaluacion de la Base de Datos de Areas Marinas Protegidas de CaMPAM y su Relevancia para la Aplicacion de los Conceptos y Herramientas de EBM

Évaluation de la Base de Données sur les Zones Protégées de CaMPAM et sa Pertinence pour L'application des Concepts et des Outils EBM

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ABSTRACT

Effective management of protected areas requires sufficiently robust tools to evaluate their status with regards to existing capacity and resources. The UN Caribbean Environment Programme (CEP) through its Specially Protected Areas and Wildlife (SPAW) Sub-programme developed a Marine Protected Area (MPA) regional database as a management tool that offers MPA information on 46 parameters from four main categories: identification, legal aspects, physical description and management. Currently, this MPA database is comprised of a total of 320 Marine Protected Areas across the Wider Caribbean region, and since 2007 has been hosted by the Gulf and Caribbean Fisheries Institute (GCFI). As part of the implementation of the project entitled "Biodiversity for Sustainable Development in the Caribbean through Ecosystem Based Management", a partnership with the Italian Ministry of Foreign Affairs, this database is being evaluated. The MPA database evaluation will provide information on its shape and structure, along with its usefulness to different kind of users, and relevance for 1) implementing a Decision Support System (DSS), with an ecosystem-based approach, and 2) supporting marine spatial planning initiatives in Wider Caribbean region. It is expected that results from this evaluation will promote and enhance the capacity of MPA managers, with a particular focus on valorizing their role as interface between science and management, as well as and help guide CEP's efforts related to capacity building regionally and also those of UNEP globally. This presentation summarizes the evaluation results.

KEYWORDS: MPA, database, EBM, Information evaluation

Un Enfoque Multi-institucional para Modelos Bioeconómicos Pesqueros en Cuba

A Multi-institutional Approach to Bio-economic Fishery Models in Cuba

Une Approche Multi-institutionnelle pour des Modèles Bioéconomiques pour la Pêche à Cuba

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RESUMEN

Los ecosistemas marino-costeros y la biodiversidad en Cuba sustentan la actividad de alrededor de 10,000 embarcaciones y 50,000 personas relacionadas con la pesca repartidas en cuatro zonas pesqueras . Se pescan invertebrados de alto valor comercial como la langosta y el camarón rosado, junto con más de 50 especies de peces y condrictios de importancia comercial. Al mismo tiempo, administradores y científicos reconocen que la mayoría de stocks en Cuba están agotados. Además, el incremento del turismo y el desarrollo costero aumentan la presión sobre estos recursos y su hábitat. Estos factores ponen en riesgo la salud de los ecosistemas marino-costeros de la isla de los que depende el futuro de la economía de comunidades costeras y de la industria pesquera. Por estas razones, se creó un grupo de trabajo multi-institucional para aplicar un modelo bioeconómico que evalúe reformas de manejo pesquero que permitan recuperar stocks agotados, alcanzar metas de producción y de conservación. Se utilizó una versión adaptada al contexto cubano del modelo bioeconómico upside con parámetros específicos para pesquerías prioritarias incluyendo estimaciones de mortalidad por pesca atribuida a pesca ilegal, para estimar estado actual y beneficios potenciales de captura, ganancia económica y biomasa, contrastando distintos escenarios de manejo. Se comenzó con un modelo piloto en la plataforma suroriental donde se captura el 40% de la producción total de escama. Los stocks priorizados se escogieron a partir de un estudio de Productividad y Susceptibilidad . Los resultados obtenidos ayudarán a trazar una visión del potencial de pesquerías multi-específicas con la aplicación de reformas de manejo sustentables.

PALABRAS CLAVES: Modelo bioeconómico, Cuba, multi-institucional pesquería, sustentable reforma manejo

Monitoring the Soundscape of Paradise Reef, Cozumel: A Tool for Assessment and Conservation Planning

Paisaje sonoro Submarino del Arrecife Paraíso en Cozumel: Una Herramienta de Evaluación, Monitoreo y Conservación

Paysage Sonore Sous-marin de Paradise Reef, Cozumel: Un Outil pour l'Évaluation, la Surveillance et la Conservation

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ABSTRACT

Tourism is an essential ecosystem service provided by diverse coral reefs. The economic benefits derived from these services sustain coastal cultures and social structure, contributing several billion dollars annually to local and national economies. Cozumel is visited by approximately 3 million tourists every year, drawn to the island's coral reefs. Diving and snorkeling tourism in the National Reef Park of Cozumel is the main economic driver of Cozumel. Given the relative importance of this ecosystem service, maintaining healthy coral reefs is essential. Coral reef biodiversity studies have traditionally relied on intensive survey techniques that are costly, infrequent or sporadic, limited to depths accessible to human divers, and generally conducted only during daylight. Sound measurement is an emerging alternative that uses non-invasive, passive acoustic monitoring (PAM) to measure reef soundscapes and biodiversity. JASCO in partnership with the Parque Nacional Arrecifes de Cozumel, deployed an Autonomous Multichannel Acoustic Recorder (AMAR) on Paradise Reef in July 2017. The AMAR recorded two months of continuous acoustic data. The objectives of the study included characterizing the anthropogenic and natural soundscape of this location that is heavily trafficked by cruise ships and dive boats, and is home to the iconic Splendid toadfish (Sanopus splendidus). The data collected will provide information regarding the volume of anthropogenic noise at this location and the potential for effects of on the reef fauna, including masking of biologically important activities, and will facilitate identification of additional Splendid toadfish habitat in future deployments. This initial study is demonstrating the power of acoustics as a tool for biodiversity assessment, monitoring and conservation.

KEYWORDS: Biodiversity, ecosystem services, soundscapes, passive acoustic monitoring, conservation

How Do We Adapt Stakeholder Engagement for Effective Ocean Planning in the Caribbean? A Case Study of the Waitt Institute's Stakeholder Engagement Toolkit

¿Cómo Podemos Adaptar la Participación de las Partes Interesadas para Lograr una Planeación Oceánica Efectiva? Un Estudio de Caso de los Instrumentos del Waitt Institute

Comment Adapter L'engagement des Parties Prenantes pour une Planification Efficace de L'océan? Une Étude de Cas de l'Institut Waitt

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ABSTRACT

The Waitt Institute partners with local governments and island communities to achieve sustainable ocean management through marine spatial planning, fisheries management, and community stewardship. Stakeholder engagement is a critical part during assessments, policy planning, implementation and long-term management. The Institute's work on three Caribbean islands in Barbuda, Curaçao, Montserrat provides case studies on how stakeholder engagement can occur and how it can be adapted to provide most-effective management results across different island settings.

The Waitt Institute's toolkit for stakeholder engagement includes (1) surveys and focus groups that map ocean uses, explore value and belief systems, and gauge support for ocean management, (2) participatory mapping exercises, stakeholder meetings and committees to draft a marine spatial plan, and (3) education and outreach to raise awareness and enhance public knowledge about ocean use and management. Using this toolkit, the Waitt Institute's Blue Halo partnerships gather critical data to make policy recommendations, solicit stakeholder feedback, and strengthen public support for sustainable ocean management initiatives. However, project sites have unique attributes that require flexibility in the design and implementation of the stakeholder engagement toolkit. This talk will describe the Institute's stakeholder engagement toolkit, and discuss both different approaches and lessons learned.

KEYWORDS: Stakeholder engagement, marine spatial planning, marine protected areas, ocean use mapping, education & outreach

Direct Assessment of Biomass, Spatial Distribution, and Current State of Southern Pink Shrimp Fishery (*Farfantepenaeus notialis*) in the Colombian Caribbean

Evaluación Directa de la Biomasa, Distribución Espacial y Estado Actual de la Pesquería del Camarón Rosado (*Farfantepenaeus notialis*) en el Caribe Colombiano

Évaluation Directe de la Biomasse, de la Distribution Spatiale et de L'état Actuel de la Pêche au Sud de la Crevette Rose (*Farfantepenaeus notialis*) dans les Caraïbes Colombiennes

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ABSTRACT

The shallow-water shrimp fishery is one of the most important socio-economic resources in the Caribbean region, with Farfantepenaeus notialis being the target species. The present study aims to evaluate the biomass and spatial distribution of the shallow water shrimp in the Colombian Caribbean. The direct evaluation was carried out by means of a fisheries research survey in the months of October and September of 2013. The highest biomass values of F. notialis were found in the south of the Colombian Caribbean, within the first five nautical miles (n.mi.) of the coast, between depths of 20 and 50 m, this result was contrasted by the low values of biomass that were obtained in the north zone, within the five nautical miles and depths of 40 and 50 m. Results of association between CPUA of F. notialis and habitat variables show significant associations ($p < 0.001$) with temperature, salinity, distance to coast and depth. The higher values of CPUA were associated with temperatures between 27.5 to 28.0 ºC, salinities between 35.60 to 35.90 psu, and distance to coast between 3 to 7 n.mi. and depths between 30 to 45 m. Currently, the shallow-water shrimp fishery is in a recovery phase.

KEYWORDS: Southern pink shrimp, direct assessment, distance to coast, Caribbean, Colombia

Network of Recovery Areas in the Caribbean Guatemala as a Tool for Management and Conservation of Marine and Coastal Resources and Ecosystems

Red de Zonas de Recuperación Pesquera en el Caribe de Guatemala como una Herramienta de Manejo y Conservación de los Recursos Marino-Costeros y Ecosistemas

Réseau de Zones de Récupération dans les Caraïbes du Guatemala comme un Outil pour la Gestion et la Conservation des Ressources Marines et Côtières et des Écosystèmes

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ABSTRACT

The coastal marine area of the Caribbean of Guatemala is a representative site due to its rich biodiversity and diverse ecosystem services providing the region and local communities. For more than four years FUNDAECO has worked closely with local fishermen in the conservation and management of coastal marine resources, implementing various management methods, one of which is the fishery recovery areas. To the date, five fishing recovery zones have been established in the Caribbean of Guatemala; to evaluate its functionality a monitoring protocol was designed to analyze the increase of certain species inside and outside these zones. A total of nine fishermen who have a direct impact on the implementation site were certified in scuba diving and research methods, teaming with FUNDAECO's technical staff. In addition, biological reports indicate that there is an increase in the abundance of two species of commercial importance -Vieja maculicauda and Mugil Curema- inside and outside of the fishing recovery areas. In order to strengthen existing fisheries recovery areas and increase its network in the Caribbean Guatemala, FUNDAECO has worked collectively with fishermen and local authorities to define new sites, prioritizing management guidelines and developing management plans to identify the main objects of conservation, threats and management strategies. The participation of fishing communities in the conservation and management of coastal marine resources has been relevant to the success of the various processes involved in designing a fisheries recovery area.

KEYWORDS: Zonas de Recuperación Pesquera, comunidades pesqueras, especies de peces de tipo comercial

Metazoarios Parásitos de *Sardinella aurita* (Clupeiformes: Clupeidae) en la Costa Central del Estado de Veracruz, México

Metazoan Parasites of *Sardinella aurita* (Clupeiformes: Clupeidae) in the Central Coast of the State of Veracruz, Mexico

Métazoaires Parasites de *Sardinella aurita (*Clupeiformes: Clupeidae) sur Létat de la Côte Centrale de Veracruz, un Mexique

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RESUMEN

Se examinaron las branquias y tracto digestivo de 54 ejemplares de S. aurita capturados por la pesca artesanal en Chachalacas, Veracruz; para determinar sus metazoos parásitos, analizar sus niveles de infección y discutir las posibles causas del establecimiento de la relación parásito-hospedero. Las muestras se fijaron en formaldehído al 10% para su posterior análisis en el laboratorio. La extracción y procesamiento de los parásitos se realizó de acuerdo a las técnicas establecidas. La determinación taxonómica se llevó a cabo con literatura especializada para cada grupo de parásito. Para caracterizar las infecciones se determinaron los patrones ecológicos de prevalencia, abundancia e intensidad media propuestos por Bush et al. (1997). Todos los especímenes de *S. aurita* estuvieron parasitados por al menos una especie de metazoario parásito. Se obtuvieron 3112 individuos pertenecientes a cuatro especies: un monogéneo, dos digéneos y un copépodo. El digéneo *Aphanurus* sp. fue la especie con mayor prevalencia y abundancia, representando el 59% de los metazoarios parásitos colectados. Así mismo, registró los valores más altos de prevalencia e intensidad media de infección (100% y 34 ± 15 gusanos por hospedero parasitado, respectivamente), seguido por *Hemiurus* sp. con el 96% y 22 ±12 gusanos por hospedero parasitado, respectivamente. La composición de metazoarios parásitos de S. aurita es similar a lo registrado en otros peces clupeidos, en donde digéneos endoparásitos destacan cuantitativamente. La alimentación de *S. aurita*, la cual está predominantemente compuesta por copépodos zooplanctónicos, puede favorecer la transmisión de estos parásitos, que muchos de ellos actúan como hospederos intermediarios de digéneos. Con este estudio, aportamos información sobre los metazoos parásitos de S. aurita para el Golfo de México.

PALABRAS CLAVES: Helmintos, monogéneos, digéneos, copépodos, Golfo de México

Is Mangrove Restoration Worth the Effort?

¿Vale el Esfuerzo la Restauración de Manglares?

La Restauration des Mangroves Vaut-Elle L'effort?

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ABSTRACT

Jamaica has several towns and communities established within or in close proximity to coastal mangrove forests. Portland Cottage is located in the largest protected area in the island, the Portland Bight Protected Area, and is one such community with a population showing varying levels of dependence on the adjacent mangrove forests. The general area was severely affected by Hurricane Ivan (2004), which caused loss of human life, destruction of houses and the toppling of hundreds of acres of mangrove trees. Extensive blocking of tidal channels occurred resulting in mangrove die-off, due to anoxic and hyper-saline conditions.

In April 2012, the National Environment and Planning Agency with assistance from the European Union (EU) embarked on the ecological restoration of approximately 5 hectares of mangrove forest in Portland Cottage. This project sought to rehabilitate the ecological character and functional capacity of the forest. Activities included the construction of tidal canals, planting of nursery grown seedlings and propagules from the surrounding forest, fencing to exclude grazing by goats and capacity building of stakeholders.

The mangrove forest pilot project in Portland Cottage has responded positively to the ecological restoration approach. The results showed a 40% survival of planted mangrove saplings with development of prop roots and/or pneumatophores. Transplanted and naturally recruited seedlings accounted for an impressive increase in overall seedling density and mean height of 127% and over 100% respectively relative to Time Zero (September 2012) as well as a 1:2 ratio of transplanted versus naturally recruited seedlings.

KEYWORDS: Jamaica, mangroves, restoration, protect areas, habitat

Sagittae Morphology of Economically Important Fishes from Southern Gulf of Mexico

Morfología de la Sagitta de Peces de Importancia Comercial del Sur del Golfo de México

Morphologie de la Sagitta de Poissons D'importance Commerciale du Sud du Golfe du Mexique

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ABSTRACT

Otoliths, calcium carbonate concretion of fish inner ear, are used to determine age and growth, for taxonomic purposes, to reconstruct life history in individuals and to discriminate fish stocks. Sagittae morphological characteristics were described in twenty species of highly economical important fishes form southern Gulf of Mexico. These species belong to the Epinephelidae (Groupers), Labridae (Wrasses) and Lutjanidae (Snappers) families. Scanning electron microscopy was used to obtain digital images in which morphological characteristics of the inner face of the sagitta (saccular otolith) were recorded. Sagittae were air dried, gold and platinum sputter-coated, and mounted on an aluminum stub using double-sided carbon tape. Images were acquired through a SEM Phillips XL 30 at 25 KV. Right and left sagittae measurements recorded, using the image processing software Image Pro Plus, were: area (Ao, mm2), aspect (Aso, %), fractal dimension (Fo), sulcus length (SL, mm), cauda length (CL, mm), ostium length (OSL, mm), rostrum width (RW, mm), and rostrum length (RL, mm). Subsequently, shape indices such as percentage of the sulcus length occupied by the cauda (CL/SL, %), percentage of the sulcus length occupied by the ostium length (OSL/ SL, %) and rostrum aspect ratio (RW/RL, mm) were calculated. To date it is the first description of the sagittae morphology for these species in the area.

KEYWORDS: Otolith morphology, commercial fishes, southern Gulf of Mexico

Análisis de la Forma del Otolito en Meros de Diferentes Hábitats del sur del Golfo de México

Otolith Shape Analysis in Groupers from Different Southern Gulf of Mexico Habitats

Analyse de la Forme de L'otolithe de Mérous du Sud Golfe du Mexique en Relation con su Habitat

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RESUMEN

Otolith morphology has been used in trophic studies and in the identification of population and species. Otolith shape is species–specific with significant interspecific variability mainly due to otolith growth. Otolith growth and therefore otolith shape is affected by genetic and environmental factors, such as depth, water temperature and substrate type, and phylogenetic relationships. The objective of this study is to relate otolith shape variations with type of habitat and depth. Otolith shape variation was analyzed in sagittae of sixteen grouper species belonging to four genera (*Cephalopholis* spp; *Epinephelus* spp; *Hyporthodus* spp; and *Mycteroperca* spp.) from southern Gulf of Mexico. Taking into account their distinctive habitats and depths of occurrence, species were classified in: 1) Reef-associated species in shallow depths (10 - 60 m): *C. fulva, E. adscensionis, E. guttatus, E. striatus, M. bonaci, M. interstitialis, M. phenax, M. tigris and M. venenosa*; 2) Soft bottoms and rocky ledges with 60-120 m depth: E. morio, M. microlepis; and 3) Deep water species (< 120 - 600 m) with hard bottoms: *E. drummondhayi, H. flavolimbatus, H. mystacinus, H. nigritus* and *H. niveatus*. Using digital image processing, otolith shape was described by linear otolith morphometrics (area, otolith length, otolith width, perimeter and ellipse), shape indices (rectangularity and roundness) and by the analysis of the fourth wavelet function decomposition of otolith contour. Otolith shape patterns were explored based on the variability of specific landmarks in the contour and morphometrics for each genus.

PALABRAS CLAVES: Otolith shape, groupers, southern Gulf of Mexico

Efecto del Tamaño del Anzuelo y de la Carnada sobre la Talla de Captura del Mero Americano (*Epinephelus morio)* en Aguas Costeras de la Península de Yucatán, México

Effect of Hook Size and Bait Size on the size at Catch of the Red Grouper (*Epinephelus morio)* in Coastal Waters of the Yucatan Peninsula, Mexico

Effet de la Dimension de L'hameçon et de L'appât sur la Taille de Capture du Mérou Rouge (*Epinephelus morio*) dans les Eaux Côtières de la Péninsule du Yucatan, Mexique

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RESUMEN

En sur del Golfo de México, el stock de mero americano se encuentra sobreexplotado. La flota artesanal mexicana incide principalmente sobre los juveniles y aporta hasta el 42% del total de los desembarques de mero en Yucatán. La normatividad vigente de manejo pesquero de la especie impone, entre otras medidas, una talla mínima de captura (TMC) de 36.3 cm de longitud total (Lt) y el uso de anzuelos circulares del número 10/0 a 12/0 en el caso de la flota artesanal. Sin embargo, estos tamaños de anzuelo no permiten respetar la TMC impuesta. En el presente estudio, tres tamaños anzuelos superiores a los establecidos por la normativa (#13/0, #14/0 y #15/0) y dos tamaños de carnada (4 cm y 8 cm) fueron experimentados para la captura del mero americano, a través del uso de tres palangres de fondo en dos áreas de operación de la flota artesanal. Entre junio 2016 y 2017, un total de 1,063 ejemplares de mero americano (24.2–73.8 cm Lt) fueron capturados. El efecto del tamaño del anzuelo y de la carnada sobre la talla de los individuos capturados fue analizado mediante un análisis de varianza multivariado de dos factores, con base en 1000 permutaciones (PERMANOVA). El tamaño del anzuelo (gl = 2, pseudo-F = 9.80, pseudo p = 0.001) y de la carnada (gl = 1, pseudo-F = 26.93, p = 0.001) ejercieron un efecto selectivo sobre la talla promedio de captura. No se observó interacción anzuelo-carnada. El anzuelo #15/0 y la carnada de mayor tamaño fueron los más selectivos (41.63 ± 8.87 y 41.8±8.45 cm Lt respectivamente). Sin embargo, la captura de meros sub legales (< TMC) siempre ocurrió: 17.5% (#13/0), 14.8% (#14/0), 7.5% (#15/0); 23.7% (4 cm) y 16.1% (8 cm).

PALABRAS CLAVES: Selectividad, arte de pesca, pesca artesanal, Epinephelidae, Golfo de México

Co-manejo en la Atenuación del Impacto de la Pesquería de Pepino de Mar sobre la Pesquería de Langosta en la Costa de Yucatán, México

Co-management in the Mitigating Impact of Sea Cucumber Fishery on the Lobster Fishery of Yucatan Coast, Mexico

Co-gestion dans la L'diminution de L'impact de la Pêche de Bêche de Mer sur la Pêche de Langouste dans la Côte de Yucatán, Mexique

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RESUMEN

Con la finalidad de obtener información del comportamiento de los recursos pesqueros y sobre los cambios en el ambiente costero, relacionados con el efecto de los diferentes fenómenos que ocurren en la costa de Yucatán, tanto naturales, comolos ocasionados por el hombre, se ha fomentado la participación de los pescadores en la generación de información. La información obtenida durante campañas de monitoreo oficiales y de investigación, es limitada debido principalmente a los altos costos, pero es enriquecida con la participación de los pescadores. En este estudio se mide el impacto de la pesquería de pepino de mar sobre la pesquería de langostaPanulirusargus. La temporada de pesca de pepino 2017 se abrió un mes antes que la temporada de langosta, ambos recursos son capturados con la misma técnica (buceo), facilitándose la pesca furtiva de langosta. Ante esta problemática los pescadores de langosta,llevaron a cabo: a) un monitoreo de las existencias de su recurso antes de que abriera la pesca de pepino; b) organizaron un sistema de vigilancia intensiva en sus zonas de pescadurante la temporada de pesca de pepino;c) al terminar la temporada de pepino y antes de empezar la temporada de langosta, en coordinación con investigadores del Instituto Nacional de Pesca y Acuacultura, realizaronotra campaña de monitoreo en los mismos sitios. A partir de la información obtenida en ambas campañas se obtuvo un indicador del impacto de la pesquería de pepino sobre la pesquería de langosta en la franja costera, se estimaron costos de vigilancia y se obtuvieron estimaciones de abundancia, densidad y biomasa de langosta para diferentes tipos de fondo de la zona de estudio.

PALABRAS CLAVES: Co-manejo, langosta, *P. argus*, pepino de mar, habitat, vigilancia comunitaria

Helmintos Parásitos Intestinales de Algunos Tiburones en la Costa Central del Estado de Veracruz, México

Intestinal Parasitic Helminths of Some Sharks in the Central Coast of the State of Veracruz, Mexico

Helminthiases Quelques Requins dans la Côte Centrale de L'état de Veracruz, Mexique

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RESUMEN

Se registran los helmintos intestinales de ocho tiburones pertenecientes a cuatro especies: *Carcharhinus plumbeus* (n = 1), *Galeocerdo cuvier* (n = 1), *Isurus oxyrhinchus* (n =3) y *Squatina dumeril* (n = 3), capturados por la pesca artesanal en Chachalacas, Veracruz, en octubre-noviembre de 2014 y octubre de 2015. Cada intestino se colocó en una bolsa de plástico con formaldehído al 10% y se transportaron al laboratorio. Se determinaron 20 especies pertenecientes a seis órdenes. Se colectaron 619 individuos helmintos, de estos, 615 son cestodos de 19 especies y cuatro nematodos de una especie. Los órdenes Trypanorhyncha y Phyllobothriidea registraron el mayor número de especies con ocho y seis, respectivamente. El número de especies de helmintos por especie de tiburón varió de cuatro en *S. dumeril* a seis en *I. oxyrhinchus* y *G. cuvier*. Todos los tiburones estuvieron parasitados con al menos una especie de parásito. El mínimo de helmintos parásitos registrados en un tiburón fue de uno (*I. oxyrhinchus* y *S. dumeril*), mientras que G. cuvier registró el mayor número con 253 individuos. Los cestodos *Aberrapex* sp.; *Calyptrobothrium* sp. y *Paraorygmatobothrium* sp., se registraron una sola vez en *S. dumeril*, *I. oxyrhinchus* y *G. cuvier* con un solo individuo, mientras que *Thysanocephalum crispum* registró el mayor número con 208 individuos en G. cuvier. El cestodo *Disculiceps pileatus* se registra por primera vez en *C. plumbeus*. Los hábitos alimenticios y la especificidad hospedatoria son factores importantes que influyen en la composición de especies de helmintos parásitos en estos tiburones. Con estos datos ampliamos la distribución geográfica, el registro de nuevos hospederos y contribuimos al conocimiento de los helmintos parásitos de elasmobranquios en México, un componente integral de la biodiversidad que es necesario estudiar y valorar.

PALABRAS CLAVES: Cestodos, nematodos, Golfo de México, playa, Chachalacas, elasmobranquios

Predictions of the Presence of Coastal Pelagic Fishes off Georgia, USA, from Local Oceanographic and Biological Conditions

Predicciones sobre la Presencia de Peces Pelágicos Costeros en Georgia, USA, Basadas sobre Condiciones Oceanográficas y Biológicas

Prédictions de la Présence de Poissons Pélagiques Côtiers au Large de la Géorgie, aux États-Unis, à Partir des Conditions Océanographiques et Biologiques Locales

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ABSTRACT

Understanding how specific environmental variables affect the presence of coastal pelagic fishes can improve the ecological understanding of and ability to sample these species. We provide a description of environmental conditions that were associated with the presence of blue runner (*Caranx crysos*), reef sharks (*Carcharinus* sp.), scads (*Decapterus* sp.), little tunny (*Euthynnus alletteratus*), ocean sunfish (*Mola mola*), greater amberjack (*Seriola dumerili*), Alcamo jack (*S. rivoliana*), and great barracuda (*Sphyraena barracuda*) off the Southeastern USA coast. We used generalized linear models and a suite of environmental variables (forage fish presence, salinity, temperature, time of day) to predict the presence of pelagic species at a human-made reef at a mid-shelf location, over eight years, as characterized by hourly ultra-short videos. We used Akaike's information criterion to evaluate candidate model fit for each species. Blue runner, greater amberjack, Alcamo jack, and little tunny were more likely to be present when forage fish (scads) were present. The probability of presence of all species increased with increasing temperatures, except little tunny and ocean sunfish, for which the probability of presence decreased 1.2 – 1.4 times with each 1°C temperature increase. Probability of presence was positively associated with salinity for scads and Alcamo jack and negatively associated with salinity for blue runner and little tunny. Water temperature followed a predictable seasonal pattern, while salinity, which influenced some species' presence, varied greatly among years. Although the variance in model results was large, our study provides a tool for monitoring the presence of migratory species and an understanding of variables that influence their presence.

KEYWORDS: Coastal pelagic fishes, predictive modeling, human-made reef, fisheries oceanography

Output and Conversion Factors Obtained from the Dehydration Process in Yucatan, Mexico Sea Cucumber

Factores de Conversión y Rendimiento Obtenidos del Proceso de Deshidratacion del Pepino de Mar en Yucatan, Mexico

Performance et les Facteurs de Conversion Provenant de la Déshydratation du Processus dans le Yucatan, Mexique Holothurie

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ABSTRACT

The commercial fishing of sea in the Yucatan Peninsula cucumber began starting in 2013. These privileges are subject to the fisheries 2012 National Charter, which establishes the resource management and the regulatory measures of minimum size. The monitoring and control of the fishing quotas of the sea on the coasts of Yucatán cucumber is made through processed weight to live weight conversion, based on the studies conducted by the National Fisheries Institute (INAPESCA). However, these conversion factors used only processed weight loss and such a subjective way conversion factors, it could apply which can generate differences with the producers, because there is not a standardized method. So, the present study carried out in the laboratory of exploitation of marine resources of the technological Institute of Mérida, with sea cucumbers *Isostichopus badionotus* aims get conversion factors and yield of cucumber in a standardized process of dehydration. A cooperative sea cucumber specimens were obtained. The stages of the process of dehydration were: first cooking and salted. It was performed in triplicate, then a material balance for each stage, and the average yield of sea cucumber was: 16. 67 ± 0.74%, corresponding to a conversion factor of 6.0. This conversion factor obtained for this study serve to validate processing to live weight, weight conversion resulting in better monitoring and control of quotas allocated to fishermen, favouring a responsible and sustainable fishing.

KEYWORDS: Sea cucumber, *Isostichopus badionotus*, dehydration, conversion factor

Monitoring of Fishery of the Grouper in the Port of San Felipe, Yucatán, Mexico

Monitoreo de Pesquería del Mero en el Puerto de San Felipe, Yucatán, Mexico

Surveillance de la Pêche de la Mérou dans le Port de San Felipe, Yucatán, Mexique

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ABSTRACT

Grouper fish, lobster and Octopus resort is one of the main fisheries of the State of Yucatán and has been economic livelihood for fishermen. Currently, there is a great concern, because, catches have declined drastically, to such extent that 80% of the boats of the fleet of medium height do not go fishing and a minimum of 1.5 T of catch is required to avoid losses. On the coast, other fishing gear is used to have more catch. There is no recovery for the grouper and prices due to scarcity are increasing, putting more pressure on the resource because there is no respect for management measures, mainly the minimum size. Of the arrival data of the fishermen´s cooperative of San Felipe in the State of Yucatán, an analysis was made of annual trends in catches, the prices/kg and catch per unit of effort (CPUE). Even though there has been a great effort on the part of the authorities to restore the fishery, like the establishment of the closed season for two months, this is still worsening and the stock over-exploited. It is recommended that before the fishery will collapses the following be done: increase the closed season to three months instead of two, from January 15 to April 15, respect minimum size, and moratorium for sports fishing and continue respecting the set of laws for the vessels. It is proposed in this work a commitment, involving the users, to fill out a registration form of catch by species of the family Serranide, to respect the minimum size and the closed season dates.

KEYWORDS: Catch, fishery, grouper, San Felipe, Yucatan, serranide

Distribución Potencial de las Comunidades de Manglar en México Utilizando Modelos Correlativos de Nicho

Potential Distribution of Mangrove Communities in Mexico Using Correlative Niche Models

Distribution Potentielle des Communautés de Mangrove au Mexique Utilisant des Modèles Corrélatifs de Niche

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RESUMEN

Los manglares son ecosistemas altamente productivos, proporcionando gran riqueza biológica y variedad de servicios ambientales (barreras naturales, sumideros de CO_2, zonas de protección, crianza y desove para especies comerciales). México es el cuarto país con mayor extensión de manglar a nivel mundial y la Península de Yucatán posee el 55% de ellos, siendo a su vez una zona muy productiva en cuanto actividad pesquera de alto valor comercial. A pesar de estos beneficios, la cobertura se pierde a un ritmo acelerado debido a las actividades humanas. El objetivo de este trabajo es estimar la distribución potencial de las comunidades de manglar en México por medio de Modelos Correlativos de Nicho (MCN) utilizando: 1) ocurrencias de cuatro especies de manglar, y 2) una selección de variables ambientales. Los datos de ocurrencia se obtuvieron depurando bases digitales, y seleccionando dos subconjuntos (calibración y validación). Las capas bioclimáticas, de suelo y topografía se obtuvieron de bases globales. Los datos se procesaron con MaxEnt 3.3.3 k, realizando combinaciones con diferentes parametrizaciones. La evaluación fue con el criterio de Akaike y curvas ROC. La distribución del manglar generada por MCN se comparó con la distribución generada por medio de imágenes satelitales de la Comisión Nacional para el Conocimiento y Uso de la Biodiversidad. Los resultados muestran diferencias importantes atribuibles a que se proyectan ambientes favorables para el manglar. En México, este es el primer trabajo donde se utilizan MCN para caracterizar la distribución potencial del manglar. Los resultados son de utilidad en la toma de decisiones para conservación y manejo de estos importantes ecosistemas costeros al identificarse espacios potenciales para su distribución.

PALABRAS CLAVES: Manglare,s comunidades, distribución, modelos, nicho

"Boat to Boat" a MPA Management Approach to Increase Stakeholder Involvement from Fishing Communities in Northern Belize

"Boat to Boat" un Enfoque de Gestion Zonas Marinas Protegidas para Aumentar la Participación de las Partes Interesadas en las Comunidades Pesqueras del Norte de Belice

"Boat to Boat" dans des Aires Marines Protegees, une Approache de la Gestion pour Augmenter la Participation des Parties Prenantes au Sein des Communautes de Peche du Nord au Belize

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ABSTRACT

The management of Marine Protected Areas (MPA's) involves the application of a wide range of strategies that aim to create a balance between people and the environment. Along with securing long-term sustainable funding, the next biggest challenge is working with stakeholders that have direct positive and negative impacts on the resources within the MPA. One such important stakeholder group is fishers who depend on the resources within the Lighthouse Reef Atoll (LHRA) and MPA to support their livelihoods. Despite working in the fishing communities of Chunox, Copper Bank and Sarteneja, for more than 20 years through various programs, projects and communication mediums, the Belize Audubon Society (BAS) has seen that changing perceptions, fishing practices and influencing livelihoods of fishers takes several generations.

Over the last five years, key factors identified between the MPA managers and the fishers due to their fishing practices was the communication gap and meeting fatigue in the villages. These traditional fishers of LHRA and by extension Blue Hole Natural Monument and Half Moon Caye Natural Monuments use sailboats and stay at sea for 5-10 days per trip. Taking this into account, BAS pioneered and embarked on a new strategy called the "Boat to Boat" outreach, to maximize the number of fishers engaged in Community Outreach efforts. This approach has helped to increase the number of fishers that are engaged, increased the amount of valuable information obtained from fishers, builds trust which ultimately assists with enforcement efforts, allow for hands-on interaction between fishers and MPA managers, and sharing research and monitoring findings. In addition, it also provides a gateway for strengthening of relationships between these two groups that are vital to the successful management of MPAs.

KEYWORDS: Fisher, MPA, “Boat to Boat”, Belize Audubon Society, Lighthouse Reef Atoll

Coupling Echosounder and Hydrophone Surveys at Spawning Aggregations: Relationships Between Levels of Fish Sound Production and Density

Combinando Monitoreos entre Ecosondas e Hidrófonos en las Agregaciones Reproductivas: Descubriendo Relaciones Entre el Sonido que Producen los Peces y su Densidad

Couplage D'études par Echosondeur et par Hydrophone dans les Frayères: Relations entre les Niveaux de Production de Son et de Densité de Poissons

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ABSTRACT

Advancements in the use of acoustic methods to characterize, map, and assess spawning aggregations has expanded our understanding of the reproductive biology, life histories, and stock sizes of vulnerable species. The versatility of active acoustics (echosounders) has permitted the estimation of fish abundances and biomasses in challenging environments, such as reefs and estuaries, while the efficiency of passive acoustics (hydrophones) to monitor the sounds produced by aggregating fishes has increasingly been embraced to identify spawning areas and periods. However, a logical and desirable progression to efficiently and accurately estimate fish abundances from their sounds has been hindered by the complexity of fish calling rates and acoustic propagation. In this study, we compared Gulf Corvina (Cynoscion othonopterus) sound levels with simultaneous measurements of densities from echosounder surveys recorded at a spawning aggregation in the Colorado River Delta, Mexico, to investigate empirical relationships between fish sound levels and density. We observed aggregations comprised of more than 1.5 million fish and elevated sound levels distributed over 25 km of the delta. The relationship between sound levels and density varied within surveys but stabilized during the two-hour period of peak spawning, resulting in an equation to estimate densities from received sound levels. Our results support the inclusion of active acoustics into assessments of spawning stock abundance and indicate that sound levels can be used to estimate fish densities when relationships are scaled to the spatial and temporal dynamics of spawning activity. Our approach is applicable to other soniferous, aggregating fishes, providing an efficient method to assess and monitor reproductive stocks using passive acoustics.

KEYWORDS: Passive acoustics, active acoustic, hydroacoustic, fish sound production, spawning aggregation

Aggregations as a Proxy for Changes in Abundance in a Threatened Reef Fish, the Nassau Grouper

Agregations de Desove como Medida de Abundancia en la Evaluation del Estatus de Conservacion del Mero Cherna

Les Agregations de Ponte come Mesure de la Situation de Conservation d'un Merou

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ABSTRACT

Assessing the conservation status of poorly managed species can be a challenge due to lack of information which tends to become even less as population numbers decline and species become of conservation concern. Therefore, in assessing population status and trends over time, proxies may have to be used, as, for example, when doing IUCN Red List assessments. A method is presented using the changing status of spawning aggregations of the Nassau grouper, *Epinephelus striatus*, as a proxy for population status changes over time and to assist in updating the conservation status of this threatened species.

KEYWORDS: Conservation, proxy, population, abundance, status

A Guide to Managing Fish Aggregation Devices (FADs) in the Caribbean

Una Guía para Manejar los Dispositivos de Agregación de Peces en el Caribe

Un Guide pour la Gestion des Dispositifs D'agrégation des Poissons dans les Caraïbes

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ABSTRACT

Whether for protection, stock survival and enhancement, or feeding purposes, it has been observed time and again that fish congregate around structures floating in the open ocean. For centuries humans have taken advantage of this behavior by deploying objects, known as fish aggregating devices (FADs), to make fishing in the vast seas easier. As technological developments improved the efficiency of these devices, management was not as quick to follow. In the Caribbean, moored FADs are rapidly being deployed by a variety of stakeholders—from artisanal fishermen to development agencies to governments—creating a variety of conflicts, both biological and socioeconomic. This project aims to develop a useful tool to guide the community, fishery manager, or researcher in implementing a FAD management strategy that works for a particular community or island. Examples of FAD management methods from Australia, the Dominican Republic, Mauritius and more are examined, and the existing situation of FAD management in the Caribbean is presented thoroughly. The final product of this research is a guide that outlines steps to develop a FAD management plan, noting the crucial elements that must be addressed throughout the process. The guide stays general enough to consider the varied nuances of the Caribbean region, while still specifying the elements for success. Several potential FAD management strategies are suggested in the end, though there is limited literature on such attempts in the field. It is hoped this tool will be useful in the Caribbean, and beyond, as FADs continue to be actively deployed with little regard for organization or unification.

KEYWORDS: Fisheries management, co-management, artisanal fisheries, recreational fishing, fisheries policy

How Small-scale Fisheries in the Yucatan Peninsula Have Evolved? Expert Eye's Perceptions

¿Cómo Han Evolucionado las Pesquerías de Pequeña Escala dn Yucatán? La Visión del Ojo Experto

Comment la Pêche à Petite Échelle dans la Péninsule du Yucatan A-T-Elle Évolué? Les Perceptions de L'œil d'un Expert

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ABSTRACT

Elder fishers represent a critical source of information about historical changes in fisheries. Through time they have accumulated detailed knowledge about their resources, fishing practices, and environmental conditions that impact both users and fishing communities. This study seeks to understand the development of the small-scale fisheries in the Yucatan coast since the 1950s to date, looking at resource availability, fishing operations, market, and different challenges and constraints faced by small-scale fishers over decades. To do so, information from interviews, statistical data, and literature were analysed. In-depth interview was applied to fishers ranging 59-81 years old in Dzilam de Bravo fishing community. Resource depletion, lack of opportunities, capacity enhancing, and openness of new fisheries were principal triggers for changing conditions. Replacement of main target species, such as sharks by others like sea cucumber and octopus were reported by fishers; these changes were also evident in catch trends of official records. Fiberglass vessels, outboard motor, and efficient fishing gears replaced the small wooden vessels "cayucos", paddles, and organic fibers used 60 years ago, which allowed fishers to move to deeper waters far from the coast. Weather conditions remain among the most mentioned issues that make them vulnerable yet, while product conservation and commercialization no longer concern fishers, young fishers' inexperience, piracy, addictions, and immigration were cited among those impacting fishing communities nowadays. Traditional knowledge has proved to be a powerful tool in fisheries assessment; learning about historical changes can define a different base line when assessing fisheries and dealing with management and conservation.

KEYWORDS: Traditional knowledge, small-scale fisheries, fishing operations, governance, Yucatan Peninsula

Primeras Aportaciones de los Aspectos Oceanográficos en el SAR, "El Blanquizal", Xcalak, Quintana Roo, México, Mediante Observaciones *in situ.*

First Contributions of the Oceanographic Aspects in the SAR, "El Blanquizal", Xcalak, Quintana Roo, Mexico, through *in situ* Observations

Premières Contributions des Aspects Océanographiques dans le SAR, "El Blanquizal", Xcalak, Quintana Roo, Mexique, à Travers des Observations *in situ.*

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RESUMEN

En el Mar Caribe Mexicano se han detectado y comprobado ocho Sitio de Agregación Reproductiva (SAR) distribuidos a lo largo de la Costa Maya, entre ellos resalta el SAR denominado "El blanquizal de Santa Julia" o "El Blanquizal" ubicado dentro del polígono del Área Natural Protegida Arrecifes de Xcalak, Quintana Roo, México. Dicho sitio es históricamente conocido por pescadores de la región y por el arribo de diversas especies de importancia comercial. A la fecha los estudios que vinculan la relación entre procesos hidrodinámicos con sitios de agregación reproductiva, son nulos. El presente trabajo pretende mostrar resultados previos sobre los patrones hidrodinámicos del SAR "El Blanquizal", obtenidos a partir de mediciones *in situ* a través del uso de métodos lagrangeanos, los cuales consistieron en la liberación de boyas integradas con GPS. Adicionalmente, se realizaron observaciones con ADCP y lances de CTD con el objetivo de conocer la variación del campo de velocidades de la corriente y estructura termohalina. Los resultados observados mostraron una amplia variabilidad en la capacidad difusiva del sitio de estudio (de K = 0.14 m^2/s a K = 4.51 m^2/s), siendo esta afectada principalmente por el factor viento y la interacción de las corrientes con la batimetría. Así mismo, se presenta una batimetría actualizada del sitio con datos de profundidad obtenidos de los recorridos con el ADCP e información de diversas fuentes para ser utilizada en modelación numérica. Estos resultados representan las primeras descripciones de los procesos oceanográficos de un SAR en el Caribe Mexicano y sus posibles efectos en la dispersión inicial de huevos de peces.

PALBRAS CLAVES: Xcalak, hidrodinámica, agregaciones reproductivas,

Evaluación del Impacto del Pez León en la Comunidad Peces de Arrecifes Coralinos en el Caribe Colombiano

Assessment of the Impact of Lionfish on Coral Reef Fish Community in the Colombian Caribbean

Évaluation de L'impact du Rascasse Volante dans les Communatés des Poissons de Récif dans la Caraïbe Colombienne

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RESUMEN

Entre marzo de 2016 y agosto de 2017 se evaluó cada dos meses a través de censos visuales, el impacto del pez león en los ensamblajes de peces en dos ambientes arrecifales en el Caribe colombiano (sectores de Cartagena y Santa Marta) con características físicas y oceanográficas distintas. Se colocaron 18 estaciones: seis seleccionadas como control, seis en las que se eliminaron peces león bimestralmente y seis en las que se extrajeron cuatrimestralmente. Las posibles presas (LT < 15 cm) de Pterois volitans fueron evaluadas en bandas de 25 x 2 m y los demás peces en bandas de 25 x 10 m. Se detectaron 169 especies de peces, 152 presas y 155 con tallas superiores a 15 cm. La abundancia del pez león varió entre 24 y 160 individuos/ha. La disminución promedio en la abundancia del pez león en las estaciones en que hubo extracción fue de 56,9 + 18,1%, evidenciando un control de la población. En la comunidad íctica se detectaron diferencias significativas entre sectores (ANOSIM, p = 0.001) y entre la época de transición y las otras dos épocas climáticas (ANOSIM, $p < 0.05$) pero no entre las estaciones (ANOSIM, $p = 0.76$). El ensamblaje de presas también presentó diferencias significativas entre sectores (ANOSIM, $p = 0.001$) y entre la época de transición y las otras dos épocas (ANOSIM, $p < 0.05$) pero no entre las estaciones (ANOSIM, $p = 0.48$). Se infiere que la remoción continua del pez león surte efecto localmente para controlar la población pero si se deja de hacer, las áreas son recolonizadas relativamente rápido; así mismo, las abundancias actuales de *P. volitans* en el Caribe colombiano no cambian significativamente la estructura de los ensamblajes ícticos arrecifales en el corto plazo.

PALABRAS CLAVES: Especie invasora, *Pterois volitans*, ensamblaj, íctico arrecifal depredación, especie invasora

Estrategias Reproductivas de *Strombus* (*Lobatus*) *gigas*

Reproductive Strategies of *Strombus* (*Lobatus*) *gigas*

Stratégies de Reproduction *Strombus* (*Lobatus*) *gigas*

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RESUMEN

En el presente trabajo se estudio la duración y frecuencia del desove por hembra del Caracol rosa, *Strombus (Lobatus) gigas*, mediante la técnica de captura-marcaje-recaptura y monitoreo continuo de hembras, quincenalmente de mayo a septiembre y diario en julio con un esfuerzo de muestreo de 10 h, en la caleta Xel-Ha, Quintana Roo, México. Se realizó un seguimiento de 287 hembras, se observaron 424 desoves, con un máximo de 40 desoves por día y una mediana de 9 desoves/100m^2, Respecto a la frecuencia de desove por hembra se obtuvo que 185 hembras presentaron un solo desove en todo el ciclo reproductivo (63.7%), 71 hembras presentaron dos (25.1%) y 31 hembras (11.2%) presentaron de tres a 5 desoves parciales; en un tiempo entre ellos de 18 h a 10 días, excepto por dos hembras que presentaron un tiempo entre los desoves de 30 días. Respecto a la duración del desove, se registró la actividad de 72 hembras de principio a fin. El promedio de desove fue de 5.89 h ± 6.54 (79% de las hembras) con un mínimo de 0.06 h y un máximo de 31.3 h, solo el 4% tuvo un desove continuo de hasta 30 h. Se concluye que el desove de *L. gigas* se realiza en un solo desove o este se efectúa de manera parcial, con interrupción de 18 h como minimo hasta 30 días máximo siendo la misma masa ovigera. Estos nuevos resultados sobre la duración del desove y su esfuerzo reproductivo son importantes para mejorar su protección.

KEYWORDS: *Stombus*, conch, spawn, reproduction

Dinámica de la Pesca Artesanal Entre los Años 2004 a 2016 en el Área de Influencia de la Isla de San Andrés, Reserva de Biosfera Seaflower, Caribe Colombiano

Dynamics of Artisanal Fishing Between 2004 and 2016 in the Area of Influence of the Island of San Andres, Seaflower Biosphere Reserve, Colombian Caribbean

Dynamique de la Pêche Artisanale Entre 2004 et 2016 dans la Zone D'influence de L'île de San Andres, Réserve de la Biosphère du Seaflower Colombiennes, des Caraïbes

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RESUMEN

En la Reserva de Biosfera Seaflower se realiza la pesca artesanal principalmente por parte de la comunidad raizal. La Gobernación Departamental - Secretaría de Agricultura y Pesca, implementó monitoreos de desembarco de pesca artesanal en el sistema SIPEIN (SAPD, 2017), los cuales fueron analizados para conocer la dinámica y hacer propuestas de manejo. El análisis multitemporal se realizó por grupos de recursos, arte de pesca y con variables de desempeño pesquero como Captura, Esfuerzo y Captura por Unidad de Esfuerzo CPUE y el Rendimiento Máximo Sostenible RMS, con los modelos de producción excedente Schaefer y Fox. En San Andrés la captura total anual entre 2004 y 2016, presentó una variación entre 44,13 a 249,48 toneladas. Siendo las capturas, en un 98,5% de peces (104 especies), 1,03% moluscos y 0,52% crustáceos (2 especies cada uno). El esfuerzo promedio anual para el arte línea de mano fue 4118 faenas; con un máximo en 2009 de 7532 faenas. En buceo el esfuerzo promedio anual fue 223 faenas. La CPUE de línea obtuvo un máximo de 41 Kg/faena en 2007; entre 2008 al 2011 y 2014 y 2015, se presentó un descenso de la CPUE, pero aumento en el esfuerzo, lo cual revela indicios de sobrepesca. El modelo producción excedente, muestra una tendencia que podría tener un punto de referencia limite, RMS cercano a los 204.48 toneladas/año; pero se debe tener en cuenta que se trata de pesquerías multi-especies. Es necesario tomar medidas de manejo para garantizar la sustentabilidad ambiental.

PALABRAS CLAVES**:** Evaluación de recursos, pesca artesanal, San Andrés isla, Reserva de Biosfera Seaflower Caribe colombiano.

Variaciones en el Reclutamiento y Biomasa Desovante del Pulpo Rojo (*Octopus maya*) en la Península de Yucatán Durante las Temporadas de Pesca 2007-2016

Variations in Recruitment and Spawning Stock Biomass of the Red Octopus (*Octopus maya*) in the Yucatan Peninsula during Fishing Seasons 2007-2016

Variations en Recrutement et Biomasse Reproduction de L'octopus Rouge (*Octopus maya*) dans la Péninsule de Yucatan Pendant les Saisons de Pêche 2007-2016

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RESUMEN

La pesquería de pulpo rojo (*Octopus maya*) es la más importante en la península de Yucatán por los volúmenes de captura, principalmente en los estados de Yucatán y Campeche. En los últimos 19 años, los niveles de captura del recurso han oscilado entre 9,500 (1998) y 28,377 ton (2016). En este estudio se realizó un análisis de población virtual (APV) por sexo considerando que con base en la estructura de edades en las capturas, los machos y las hembras se reclutan a la pesquería a edades diferentes. De esta manera, con el APV se estimaron los niveles de reclutamiento (número de organismos de 4 meses de edad para los machos y 5 meses para las hembras) y la biomasa de la fracción desovante por temporada de pesca (agosto-diciembre). De acuerdo al APV, en la temporada de pesca 2008 se estimaron los valores mensuales de reclutamiento y biomasa desovante consistentemente más bajos de toda la serie; y en 2012 y 2015 se estimaron valores de biomasa desovante más altos. En 2012, estos valores de biomasa se obtuvieron en septiembre y octubre; mientras que en 2015, el mayor de biomasa se obtuvo en noviembre, que de hecho corresponde al más alto de la serie disponible al momento. Con relación al número promedio de reclutas, se obtuvo para temporada 2015, los valores más altos de toda la serie para el periodo de agosto a noviembre, con una tendencia a incrementarse desde agosto y en noviembre alcanza el mayor valor de reclutamiento de toda la serie, para en diciembre volver a disminuir a un valor cercano al promedio general de la serie. De acuerdo a la dinámica del pulpo rojo en la península de Yucatán, los sobrevivientes de los picos masivos identificados tanto en biomasa como en reclutamiento son los que se reproducen hacia finales del año y constituyen el stock parental de las cohortes que a su vez se reproducirán durante la veda

PALABRAS CLAVES: APV, estructura de edades, pulpo maya, Península de Yucatán

Coupling Passive Acoustic Techniques to Survey Fish Spawning Habitats in Puerto Rico

Combinando Técnicas de Acústica Pasiva para Estudiar Hábitats de Desoves de Peces en Puerto Rico

Couplage des Techniques Acoustiques Passives pour Enquêter sur les Habitats des Poissons Reproducteurs a Puerto Rico

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ABSTRACT

Measuring habitat use by reef fishes for spawning aggregations is enhanced with non-invasive passive acoustic monitoring. Some advantages that can be applied to cases where species are known to produce sound associated with reproduction include a low cost of deployment and recovery of the instruments, high sampling frequency, night-time sampling and a record of the soundscape. Some of these pros make passive acoustics instrumental to gather occupation data given the logistical constraints of *in-situ* surveys during the short time period this critical habitat is used by some species. Notable disadvantages include the technical requirements of signal recognition in large datasets, not being able to verify why fish are not being detected, and masking of sounds by other sound sources including anthropogenic. Nassau grouper produce courtship associated sounds during reproductive behaviors that were recorded simultaneously with two seasons when 29 individuals had been tagged internally with acoustic tags at Bajo de Sico a seamount off western Puerto Rico. Receivers deployed throughout the spawning area allowed for the verification of absence of fish when no sounds were detected. The combination of passive acoustic monitoring techniques and internal tagging of spawning grouper at this site provided evidence of temporal and spatial patterns of diel habitat use continuously during six months. With this information, a remotely monitored component of fish spawning aggregations research can help answer important site specific questions.

KEYWORDS: Passive acoustic, sound production, Puerto Rico, spawning aggregation, Nassau Grouper

Innovative Electronic Monitoring Applications for Rural Small-scale Fishing Vessels in Caribbean

Aplicaciones Innovadoras de Monitoreo Electrónico en Flotas Artesanales en el Caribe

Applications Innovantes pour la Surveillance Electronique des Flottilles Artisanales dans les Caraïbes

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ABSTRACT

Small-scale fisheries dominate emerging and developing markets, have a critical role in seafood security, procurement and environmental protection. Validation, stakeholder input, and benefits to stakeholders are a key component to correct implementation of electronic reporting systems. This talk wishes to present EM that is being applied in the Caribbean, Chile and Mexico for catch accounting, compliance with catch retention requirements and even supply chain marketing. Talk will touch on the role big data plays as systems scale to obtain thousands of fishing trips in web based environments.

KEYWORDS: Electronic monitoring, small-scale fisheries, seafood security

Developing a Fishery Management Plan for the Bahamas Spiny Lobster Fishery

Elaboración de un Plan de Gestión Pesquera para la Pesquería de Langosta Espinosa de las Bahamas

Élaborer un Plan de Gestion des Pêches pour la Pêche au Homard Epineux de Bahamas

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ABSTRACT

The Bahamas hosts one of the world's largest spiny (or rock) lobster fisheries, with landings ranging from six to ten thousand tons per season. The industry is comprised of an industrial sector that utilizes most of the Bahamian banks and a small-scale sector that fishes closer to home ports; together, the sectors' spiny lobster landings account for most of Bahamas' fishery exports, with frozen tails sold mainly to the US and France. Since 2009, from when the fishing industry applied to be certified under the Marine Stewardship Council (MSC) to allow for greater access to the European Union fishery market, the spiny lobster fishery has undergone several changes as part of a fishery improvement project (to aid in certification).

A key initiative to improve the strategic management of The Bahamas spiny lobster fishery was the finalization of a fishery management plan (FMP), developed in conjunction with stakeholders over an iterative and participatory process in 2016. The steps in the FMP process included a literature review and analysis, stakeholder interviews and working group discussions, and fishing community workshops. The information obtained from these steps was used to identify management deficiencies and opportunities. Presented as suite of management options across disciplinary boundaries, the FMP created 37 priority-based measures (activities) that would promote sustainability.

The FMP listed three measures as paramount to the effective management of the spiny lobster fishery: A census of the fishery participants, vessels, and gear; a licensing system to account for fishery effort; and a reporting system to fishery landings. Each measure will greatly improve the information base required to evaluate and predict changes in fishery stocks and to best accommodate participation in the fishery sectors.

KEY WORDS: Fisheries, fishery management, spiny lobster, *Panulirus argus*, The Bahamas

Opportunities to Strengthen Co-management of Caribbean Offshore FAD Fisheries

Oportunidades para Fortalecer el Co-manejo de la Pesca y Uso de FAD en el Caribe

Possibilités de Renforcer la Cogestion des Pêches des Caraïbes Offshore FAD

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ABSTRACT

The Japanese government has supported fisheries development in the Caribbean region for the past several decades. This support has taken the form of infrastructure development, including the construction of landing sites, fisheries complexes and fish processing centers. More recently, the Japanese government, under the auspices of the Japan International Cooperation Agency (JICA) partnered with six Caribbean island nations to implement a program called Caribbean Fisheries Co- Management (CARIFICO). The goal of CARIFICO is to motivate the sharing of responsibility for the management of pelagic fisheries involving fish aggregation devices (FADs) among fisher and government stakeholders as a means to sustain public FAD deployment, reduce user conflicts and improve the livelihoods of artisanal fishers. Two primary objectives support this goal (1) to strengthen institutional and organizational mechanisms to develop, manage and sustain FAD fisheries, and (2) to strengthen the management and productivity of fisheries facilities. During the course of the five-year CARIFICO project eight actions have underpinned these objectives: Consultations, fisher trainings, introduction of FAD technologies, organizing fishers, establishing user fees, codifying user rules, implementing data collection and marketing catch. This presentation will characterize the implementation of FAD fisheries co-management in the Caribbean region and offer opportunities to strengthen and sustain broader co-management efforts. The presentation will draw from the results of a regional CARIFICO workshop held in July 2017 and the results of an interview-based survey of 362 FAD fishers, conducted in 2016, on six islands participating in the JICA/CARIFICO project.

KEYWORDS: Co-management, FAD, governance

Acoustic Assessment of Zooplankton Biomass in the Coast of Magdalena, Colombian Caribbean

Evaluación Acústica de la Biomasa Zooplancton en la Costa del Magdalena, Caribe Colombiano

Évaluation Acoustique de la Biomasse du Zooplancton dans la Côte de Magdalena, Caraïbes Colombiennes

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ABSTRACT

Zooplankton is one of the main components of biological communities in marine ecosystems. Traditionally they had been caught with net tows in order to be studied. However, in recent years, new technologies such as acoustics and optical instruments have allowed newer and deeper insights into these organisms. The present study uses a general model to correlate acoustic backscatter with the dry weight biomass of zooplankton. Data for the zooplankton biomass were obtained by a vertical trawl net in specific locations and the acoustic data were taken using a scientific echosounder Biosonics DTX with a transducer of 38 kHz. A linear model was used to correlate hydroacoustic backscatter with biomass. The survey was carried out during May 2016 in the Magdalena Department, localized in the Caribbean Colombian Coast. The relationship between zooplankton dry weight and acoustic backscatter was significant ($p < 0.001$) and explained 54% of variability in dry weight data. The mean mesozooplankton dry weight biomass estimated from plankton net tows and acoustic were not significantly different ($p = 0.99$). The spatial distribution of zooplankton showed higher aggregations in front of Tayrona National Park and Ciénaga Grande of Santa Marta. This work constitutes the first estimation of the acoustic conversion factor for the zooplankton in the Colombian Caribbean Sea.

KEYWORDS: Biomass, zooplankton, acoustics, Caribbean, Colombia

Caribbean Small-Scale Fisherwoman Learning Exchange in Costa Rica: Women's Voices

Encuentro de Mujeres Pescadoras de Pequeña Escala en Costa Rica: Voces de Mujer Mar

Échange D'apprentissage de Pêcheur à Petite Échelle des Caraïbes au Costa Rica: Les Voix des Femmes

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ABSTRACT

The Small-Scale Fisherwoman Learning Exchange, facilitated by CoopeSoliDar R.L. in July 2017, strengthened the capacities of fisherwomen from several Caribbean countries as well as their Costa Rican hosts and counterparts. The Caribbean women, selected by the Caribbean Network of Fisherfolk Organisations (CNFO) learned from experiences in Costa Rica, while contributing their knowledge on Caribbean artisanal fishery value chains. The women were from the fishery sectors in Barbados, St. Kitts and Nevis, Grenada and Belize. They shared experiences with the women from Tarcoles Fishing Cooperative and Chomes mollusks Cooperative. They visited Consorcio Por La Mar, and had a close look at the co-management process of Cahuita National Park and the South Caribbean Diving Centre: Embajadores del Mar. This knowledge exchange sought to build links and shared experiences among women from fishing communities from personal, economic and political/organizational empowerment perspectives, strengthening bridges among islands of the Caribbean and Costa Rica. It was designed with a participatory approach, favouring a horizontal transmission of knowledge. Each experience showcased significant and different aspects of learning such as social, economic, cultural and organisational present in Costa Rica's artisanal fisheries, with special emphasis on women. The visitors shared their perceptions, recommendations and learning, maintaining a two way communication with the women from Costa Rica. The women co-designed an Innovation Plan that was built along the sharing and learning exchange route. This way they could include new visions and strategies observed on site visits. Parallel to the site visits there was the design of artistic material representing the discussions and learning. It was shared with a wider audience trough social media.

KEYWORDS: Woman Learning Exchange, small-scale fishery

Consumer Demand for Lionfish : A Multi-disciplinary Analysis of the Potential for a Lionfish Market in the US Virgin Islands

Examen de la Demanda de Pez León como Alimento: Un Análisis Multidisciplinar de la Posibilidad de un Mercado de Pez León en las Islas Vírgenes

Examen de la Demande de Poisson comme Aliment : Une Analyse Multidisciplinaire du Potentiel d'un Marché de Poissons-papillons dans les Iles Vierges Américaines

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ABSTRACT

Seafood marketing studies are common to assess the preferences and opinions of potential consumers, especially for new products. Usually those studies focus on the characteristics of the fish, or even how and where it was harvested and handled. Such studies seek to determine if consumers will pay more or eat more if products can be guaranteed to be safe, fresh, correctly labeled, larger, or harvested in a new or more sustainable manner (e.g., aquaculture). For the invasive lionfish, one source of control would be to foster targeting of fishing effort toward lionfish. Such a strategy would, however, only be successful if there was sufficient demand for the new seafood product. This study sought to fill a gap in the analysis of potentially sustainable solutions to controlling invasive lionfish by surveying potential consumers about their preferences for adding the species to their portfolio of seafood choices. Only by fostering the demand for lionfish by consumer can a commercial fishery for lionfish be developed. This study is complemented by one that sought the preferences of fisherman in order to compare the potential supply with demand to assess the viability of a new commercial fishery in the USVI. We present an analysis of the potential demand for lionfish as food from spatial, qualitative, and quantitative perspectives. This includes analyses of both local consumers' and tourists' willingness to try and willingness to pay for lionfish, mapping of interest in lionfish, and analyzing the cultural barriers to lionfish consumption (including concerns about ciguatera toxin). Outreach efforts to address these barriers are also briefly discussed This is the second of two proposed presentations reporting on the findings and outcomes of two-year NOAA-funded project to assess the viability of a lionfish market in St. Croi

KEYWORDS: Lionfish, *Pterois volitans*, US Virgin Islands, markets, demand

Driving Market Demand Toward Sustainable Seafood Products

Empujando a Demanda del Mercado hasta el Pescado Sustentable

Demande de Conduite vers des Produits de Fruits de Mer Durables

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ABSTRACT

Since the global commercial fishing industry adopted large-scale, industrial level fishing techniques and technology in the 1970s, a majority of global fish stocks have been overfished or are subject to overfishing. Although there has been many positive steps taken by national governments and multinational regulatory bodies to combat overfishing of target species and non-target species, regulatory policy has proven a timely and expensive process in making the global fishing industry more sustainable. As with many other environmental issues, a market based approach is necessary in helping expedite change. Consumers hold significant clout in driving demand that places positive pressure on commercial fisheries and the bodies regulating them to instill more sustainable fishing practices. Unfortunately, quality, price, and geography, not sustainability, are currently the major drivers in purchasing behavior among consumers. The majority of consumers don't understand how the seafood products they purchase violate their concerns regarding marine sustainability. Awareness and sustainable seafood marketing campaigns should increase their focus on educating the consumer more on the specific reasons behind why certain products are sustainable (or unsustainable), e.g. how gear types affect target and non-target species. Presenting the consumer with this sort of information will aid in creating a strong post-exposure preference that influences purchasing behavior.

KEYWORDS: Demand, consumer, sustainable seafood, education

Recasting Rights in the Barbadian Flyingfish Fishery: A Gendered Perspective

Refundición de Derechos en la Pesquería de Barbados: Una Perspectiva de Género

Rectification des Droits dans la Pêche au Poisson volant de Barbade: Une Perspective Sexospécifique

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ABSTRACT

The global fisheries rights debate couched in conventional terms of fishing (tenure and access) rights more recently has moved to acknowledging the importance of human rights (including social, cultural, and economic rights) via the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (the Small-Scale Fisheries (SSF) Guidelines). It is the case, however, that Caribbean perspectives on all types of rights in fisheries are under-researched. This is especially so regarding a gender perspective on rights in fisheries. There is little documented evidence on how fishing rights and human rights are perceived or acted upon differently by men and women in the fishing industry. Therefore, as the fisheries governance discourse continues to evolve to include the need for defining and understanding the rights of small-scale fishers and other fisherfolk, how the concepts of gender equality and equity are enacted as rights in context-specific circumstances deserves consideration. It is important for legal and institutional scholars to investigate the formal aspects of rights in Caribbean fisheries. Also important is a need to understand and incorporate the perspectives of the women and men involved in fisheries livelihoods. As a contribution, this poster provides gendered perspectives regarding how small-scale fisherfolk in the Barbados flyingfish fishery perceive and act on what they consider to be their rights within the fishery on their own terms.

KEYWORDS: Fisheries, gender, rights, Caribbean, flyingfish fishery

The Use of Tagging Data and Ecological Niche Models to Establish the Baseline of Pelagic Fish Vulnerability to Deep Oil Spills in the Mexican Portion of the Gulf of Mexico: The Yellowfin Tuna Case

El Uso de Datos de Marcaje y Modelos de Nicho Ecológico para Establecer la Línea Base de la Vulnerabilidad de los Peces Pelágicos a Derrames Profundos de Petróleo en la Porción Mexicana del Golfo de México: El Caso del Atún Aleta Amarilla

L'utilisation de Données de Marquage et de Modèles de Niche Écologiques pour Établir la Ligne de Base de la Vulnérabilité des Poissons Pélagiques aux Déversements D'hydrocarbures Profonds dans la Partie Mexicaine du Golfe du Mexique: Le Cas de Thon Jaune

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ABSTRACT

Most of the Mexican oil production comes from the Gulf of Mexico (GOM), where deeper oil wells are constantly wanted. Since 2015 a Mexican Research Consortium (CIGOM) was created and funded by the Ministry of Energy to establish the baseline in order to understand the potential ecological impact of deep oil spills in some areas of the Mexican portion of the GOM. In order to understand deep oil spill threats to yellowfin tuna (Thunnus albacares) at the GOM, we constructed temporal potential distribution maps of this species, using the MaxEnt platform, and considering two depth layers (surface and >200m) based on the proportion of depth used by the tuna. The proportion of depth use was estimated using the results of a tagging experiment of ten yellowfin tuna in the southern part of the GOM (off Coatzacoalcos), during June 2017. Each tuna was tagged with a MiniPat satellite tag (Wildlife computers), which was programed to deploy after 90 days. This is a work under development, and we will present the risk to oil spills based on one possible spill scenario combined with the potential distribution in each of the depth layers. We will also discuss about further steps that are planned to finally measure the vulnerability of the yellowfin tuna distributed in the GOM, considering other biological variables.

KEYWORDS: Yellowfin tagging, data, ecological niche, model, deep oil spills, Mexican portion of the GOM

Comprehensive Approach in Assessing Release Mortality of Targeted and Non-targeted Reef Fishes in the Gulf of Mexico

Enfoque Integral en la Evaluación de la Mortalidad por Liberación de Peces de Arrecifes Objetivo y no Objetivo en el Golfo de México

Approche Globale pour Évaluer la Mortalité par Libération de Poissons de Récif Ciblés et non Ciblés dans le Golfe du Mexique

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ABSTRACT

Management restrictions have led to an increase in the catch-and-release of targeted and non-targeted reef fish species in the Gulf of Mexico (GOM). Dramatic environmental changes coupled with stress of capture may result in deleterious effects, ultimately affecting survival. While release mortality in popular recreational fish has received considerable attention, it has yet to be fully assessed in by-catch reef species. Furthermore, release mortality estimates are rarely combined with physiological parameters which may yield valuable insight into specific stressors that influence survival. We assessed release mortality and physiological stature in five managed reef species (Red Snapper, Vermilion Snapper, Scamp, Greater Amberjack, Gray Triggerfish) in the northern GOM during summer and winter of 2016-2017. Our results showed species-specific differences with Scamp and Triggerfish more susceptible at greater capture depths, and Vermilion with greater thermal changes during capture. Amberjack showed no increased susceptibility with the varying parameters. Additionally, we examined recovery potential in Red Snapper after on-board housing for 30 minutes which revealed to have the greatest impact on release mortality. As recreationally caught fish inherently experience depth and temperature changes during capture, as well as on-board time, it is likely that these factors are decreasing their ability to survive catch-and-release practices.

KEYWORDS: Release mortality, reef fish, management restrictions

Mapping Fine-scale Dispersal of Nassau Grouper (*Epinephelus striatus*) Eggs from a Spawning Aggregation with a Novel Plankton Imaging System

Mapeo de la Dispersión a Escala Fina de Huevos de una Agregación Reproductiva de Mero de Nassau (*Epinephelus striatus*) con una Nueva Sistema de Imágenes de Plancton

Cartographie de la Dispersion à Petite Échelle des Oeufs Produits par une Agrégation de Mérous de Nassau (*Epinephelus striatus*) lors du Frai avec un Nouveau Système D'imagerie du Plancton

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ABSTRACT

Nassau Grouper (*Epinephelus striatus*) populations have declined throughout the Caribbean largely due to overexploitation of fish spawning aggregations (FSAs). The FSA off the west end of Little Cayman Island is one of the largest remaining of the species and has dramatically increased in size since protections took effect in 2003. However, it remains unclear how this increased reproductive capacity will support population recovery and productivity via recruitment. Understanding the mechanisms underlying recruitment is important to linking changes in adult numbers to future, long-term population status. Here, we use novel *in situ* plankton imaging to investigate the fine-scale dispersal of Nassau Grouper eggs, as well as the ocean conditions and plankton community of the waters they were spawned into. We successfully followed one cohort in February 2016 (4 hours) and three cohorts in February 2017 (16, 36, and 6 hours), mapping the density of eggs at fine spatial scale (10s of meters horizontal, 1s of meters vertical). We observed eggs from cohort #2 in 2017 hatching into yolk-sac larvae. Ocean conditions at the FSA were anomalously calm in 2017, and all five drifters released with cohort #2 stayed within 2 km of Little Cayman Island and grounded on the reef. Finally, we develop and evaluate the ability of a physical advection-diffusion model to calculate expected egg concentrations in time and space. Our work to develop mechanistic understanding of how eggs survive to become spawning adults will allow for appropriate management to help protect this species.

KEYWORDS: Dispersal, egg recruitment, advection, diffusion

Commercial Fishermen's Willingness to Harvest Lionfish: A Multi-disciplinary Analysis of the Potential Supply in the US Virgin Islands

Entender la Voluntad de los Pescadores Comerciales de Pez León de la Cosecha: Un Análisis Multidisciplinar de la Fuente para un Mercado de Pez León en las Islas Vírgenes

Comprendre la Volonté des Pêcheurs Commerciaux de Récolter les Poissons-papillons : Une Analyse Multidisciplinaire de la Fourniture d'un Marché de Poissons-papillons dans les Iles Vierges Américaines

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ABSTRACT

The rapid expansion and ecological effects of invasive lionfish are well-documented (Morris and Akins 2009, Albin and Hixon 2008). Early control efforts focused on eradication (cites) often relied on paid (cite) or volunteer efforts (cite), and efforts to engage recreational divers, often through competitions such as lionfish derbies (Trotta et al 2014, Forrester 2014). However, this approach is inefficient, expensive, and can pose safety concerns for unskilled lionfish handlers (Bogdanoff et al 2014). Instead, developing seafood markets for lionfish could be a more effective option for long-term suppression (Hixon 2014, Bowden 2014). Until now, a rigorous assessment of the viability of creating a market for lionfish as a local food source was unavailable. We present an analysis of the potential supply for lionfish as food from spatial, qualitative, and quantitative perspectives. This includes considering commercial fishermen's willingness to harvest lionfish and the price required to motivate lionfish targeting. Fishermen's knowledge of potential barriers to harvest (including perceived presence of ciguatera toxin and presence of lionfish) are mapped, and cultural barriers to harvesting lionfish are analyzed. Outreach efforts to address these barriers are also briefly discussed This is the first of two proposed presentations reporting on the findings and outcomes of a two-year NOAA-funded project to assess the viability of a lionfish market in St. Croix and St. Thomas, in the US Virgin Islands.

KEYWORDS: Lionfish, *Pterois volitans*, US Virgin Islands, markets, supply

Mortality Estimates for Red Snapper, *Lutjanus campechanus*, Based on Acoustic Telemetry and Conventional Tagging in the Northern Gulf of Mexico

Estimaciones de Mortalidad de Pargo Rojo, *Lutjanus campechanus*, Basado en la Telemetría Acústica y Marcado Convencional en el Norte del Golfo de México

Estimations de la Mortalité pour le Vivaneau Rouge, *Lutjanus campechanus*, Basé sur la Télémétrie Acoustique et le Marquage Conventionnel dans le Nord du Golfe du Mexique

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ABSTRACT

We used the VEMCO VPS to estimate mortalities and fine-scale movements (~1 m) of red snapper, Lutjanus campechanus, on artificial reef sites (n = 4) in the northern Gulf of Mexico from 2015 to 2017. Additional receivers (n = 22) on surrounding sites confirmed emigrations of tagged red snapper from the tagging sites. We applied a 6-d tagging recovery period before fish were included in the analyses. In 2015 there were 50 transmitter tagged red snapper available for recapture: four emigrated after tracking for 213 to 963 d, 20 were caught (F = 1.1) and M = 0.04. In 2016 there were 38 red snapper available for recapture: six fish emigrated after tracking for 337 to 1380 d, 14 were caught (F = 0.52) and M = 0.03. Among the 2015 recaptures, 18 (90 %) were reported and two (10 %) were not reported, but identified as caught from telemetry data. Among the 2016 recaptured red snapper 86 % (n = 12) were reported and 14 % (n = 2) were not reported. We also released 846 external tagged red snapper from 2015 to 2017 on 84 artificial reefs at close to 10 tagged fish per reef and offered a $150 reward for recaptured fish. Based on conventional tagging and applying 10 % non-reporting rate from telemetry F = 0.36 in 2015. In 2016, fishing mortality decreased to F = 0.25 after applying a 14 % non-reporting rate. In 2017 preliminary estimates showed F = 0.18 after applying a 32 % non-reporting rate from 2017 telemetry data, but more tag returns are expected as fishing was still occurring. Telemetry based estimates were higher than conventional tag estimates and may have overestimated fishing mortality, but provided important information on non-reporting rates. The combined telemetry and conventional tagging provided the best approach for estimating fishing mortality for red snapper on the continental shelf in the northern Gulf of Mexico.

KEYWORDS: Red snapper, fishing mortality, artificial reefs, residency, natural mortality

Overview of Caribbean Fisheries Co-management Project

Visión de Conjunto de Co-gestión Pesquero en Caribe

Vue D'ensemble de Co-gestion des Pêches des Caraïbes

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ABSTRACT

Fishery resources in the Caribbean region are under pressure due to overexploitation, environmental degradation and inadequate management. Thus, the management practices for the sustainable utilization of fishery resources need to be developed and implemented. Today, co-management is recognized as one of the effective management tools for the small-scale fishery engaged by the majority of fishers in the Caribbean island states.

Caribbean Fisheries Co-management (CARIFICO) Project (2013 – 2018) under the technical cooperation of Japan International Cooperation Agency (JICA) has been implemented in collaboration with local fishers, Fisheries Division of St. Kitts and Nevis, Antigua and Barbuda, Dominica, St. Lucia, St. Vincent and Grenadines and Grenada, Caribbean Regional Fisheries Mechanism (CRFM) Secretariat and University of Florida/Florida Sea Grant. The purpose of this project is to develop the fisheries co-management approaches suitable for each target country and to share its good practices in the Caribbean region. CARIFICO consists of three pilot projects, 1) the co-management of fish aggregating device (FAD) fishery 2) the co-management of conch fishery, and 3) the co-management of fish pot.
The purpose of this presentation is to provide overall information about the strategies, activities and outputs of CARIFICO. In addition to this presentation, 1) the good practices of fishery co-management specifically in Antigua and Barbuda, St. Lucia and Grenada, 2) the socioeconomic impacts of FAD fishery co-management and 3) the opportunities for fisheries co-management will be presented. The series of presentation may serve to apply for the development and promotion of fishery co-management approaches in the Caribbean region.

KEYWORDS: Co-management, FAD, conch, fish pot

Overview of the GCFI-SEAC Acoustic Workshops for Building Scientific Capacity to Improve Reef Fish Ecosystem Surveys

Visión General de los Talleres Acústicos del GCFI-SEAC para Crear Capacidad Científica para Mejorar las Encuestas de Ecosistemas de Peces de Arrecife

Vue D'ensemble des Ateliers Acoustiques GCFI-SEAC pour Renforcer les Capacités Scientifiques pour Améliorer les Enquêtes sur les Écosystèmes de Poissons de Récifs

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ABSTRACT

Given the diversity of fish communities and the complexity of the life history and habitat of coral reef fishes, the difficulties of sampling these ecosystems have resulted in data-limited assessments in the Gulf of Mexico and Caribbean regions. Ongoing advances in both active and passive underwater acoustic technologies have brought a variety of tools to scientists for improving surveys and experimental research in reef habitats that can address a variety of operational research objectives. The GCFI, NOAA and SouthEast Acoustics Consortium co-hosted a three-part training workshop during this conference to build the capacity for implementing acoustics in fishery ecosystem assessments in the Gulf and Caribbean. We will summarize the outcomes from a training workshop that exposed participants to the methods for conducting acoustic survey operations, data collection, analyses and interpreting data to improve the scientific information used for the sustainability of reef fish ecosystems. We will also evaluated technical guidelines and best practices for implementing fishery acoustic surveys to address various operational objectives, and provided recommendations for building acoustic expertise and scientific capacity in the region. A technical report will be published following this workshop series.

KEYWORDS: Technology, acoustics, reef fish, ecosystem conservation

Use of Melanin from *Octopus maya* from Yucatan as Antibacterial Agent

Uso de la Melanina del pulpo *Octopus maya* de Yucatán como Agente Antibacteriano

Utilisation de Mélanine de *Octopus maya* comme Agent Antibactérien

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ABSTRACT

In the Yucatan Peninsula there are marine organisms that sustain a sustainable fishing activity, such as the octopus *Octopus maya* that is the main octopus in Yucatan, and first national place in capture and sale (SAGARPA, 2016). The Mayan octopus is endemic to the Yucatan Peninsula, it contains a great diversity of metabolites, which are susceptible to generate the elaboration of various drugs. (Blanco et al., 2007). *Octopus maya* octopus ink is a fish by-product that has melanin, a substrate that has been attributed to endless properties and applications for humans. Studies using the metabolites contained in the melanin of molluscs have been carried out, in the case of the Mayan octopus, it is tried to establish if any metabolite present in the melanin of the mollusk is susceptible to be used as an antimicrobial agent against some common bacteria in the medium and Hence the possibility of producing a product that serves this purpose.

To determine the antimicrobial activity of the octopus melanin of Yucatan octopus, using the *bacterium Salmonella typhi* ATCC 14028, to produce a natural antimicrobial that combats salmonellosis.

KEYWORDS: *Octopus maya*, actividad antimicrobiana, *Melanina*, *Salmonella*, endémico

Examining Caribbean Spiny Lobster Size at Maturity Using External Reproductive-related Structures in Belize

Examen del Tamaño de la Langosta Espinosa del Caribe en la Madurez Utilizando Estructuras Externas Relacionadas con la Reproducción en Belice

Examen de la Taille du Homard Épinicole des Caraïbes à la Maturité en Utilisant des Structures Externes Liées à la Reproduction au Belize

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ABSTRACT

A basic principle of sustainable fisheries management has been to allow a significant proportion of individuals within exploited populations at least one opportunity to reproduce. In so doing, many individuals will contribute to genetic diversity and ecosystem functions of the species. The harvest of mature individuals will often be associated with increased productivity to fisheries livelihoods creating a real economic incentive to adhere to minimum size regulations. A maximum harvestable size may also be implemented in order to protect larger individuals with disproportionally high fecundity or survival of offspring. The presence of reproductive products and body parts that develop with maturity or are disproportionally sized in mature individuals may be used to make the determination of maturity with reasonable confidence. In Belize, the Caribbean spiny lobster is the primary target of small-scale fishers operating from skiffs, sailboats and canoes. In an effort to advice on improvements to the lobster fisheries management regime we examined several thousand lobsters captured using hooksticks as well as traps and artificial structures in central Belize to determine sex-specific sizes of maturity. External indicators of maturity examined included the length of setae on pleopods and the length of pleopods on females and the length of the second pair of walking legs and gonopore diameter on males. These features were compared to carapace length with the size at fifty percent maturity for both male and females being significantly greater than the present minimum size for Caribbean spiny lobster in Belize.

KEYWORDS: Lobster, fisheries, maturity, management, Belize

Why Teach Fundamental Marine Conservation Concepts in Schools in Mayan Fishing Communities Using Maya (Yucateco) as the Language of Instruction?

¿Por qué Enseñar Conceptos Fundamentales de Conservación Marina en las Escuelas de las Comunidades Pesqueras Mayas Usando Maya (Yucateco) como el Idioma de Instrucción?

Pourquoi Enseigner des Concepts Fondamentaux de Conservation Marine dans les Écoles des Communautés de Pêche Mayas Utilisant Maya (Yucateco) comme Langue D'enseignement?

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ABSTRACT

The greater Caribbean basin is a multi-ethnic and multi-linguistic region hosting a large variety of coastal and marine social/ecological systems. These provide habitats for ecologically and commercially important species, and support the well-being of coastal populations. It is thus crucial to reduce the pressure on these habitats and species, and empower these peoples with the knowledge to protect and use their resources sustainably. One way to achieve this goal is to teach the same fundamental marine conservation concepts across the region. Yet, considering the multiple linguistic and cultural contexts in the region, it becomes necessary to provide conservation education resources using local indigenous languages. One of these languages, the Maya (Yucateco), is the mother tongue of more than 800 000 people in the Yucatán Peninsula in México and northern Belize. “U taak’inil Caribe” or Treasures of the Caribbean, are marine science educational instruments created by “Ajkanan K’ak’náabo’on Ma’ Su’up’il” or Marine Conservation without Borders. They are preparing twenty bilingual chapters in Yucatec/Spanish and Yucatec/English focused on species, ecosystems, and local issues of the marine environment. The curriculum aims to target fishers and students from preschool through 6th Form in an institutional setting in Mayan communities in México and Belice. It also aims to promote cultural and language conservation. Some locations in Belice and México where these curricula would be useful are Celestún, Telchac, Xel-Há, 'Chunox, Yo Creek and Sarteneja (Belize’s largest fishing village) to name a just a few.

KEYWORDS: Marine conservation, education, Yucatec Maya, language, conservation, Ichil Maya

Fundamental Marine Conservation Concepts Should be Taught in Fishing Communities Using Native Languages as the Language of Instruction

Los Conceptos Fundamentales de Conservación Marina deben ser Enseñados en Comunidades de Pesca Usando Lenguas Nativas como el Idioma de Instrucción

Conceptos Fundamentales de Conservación Marina se les deben Enseñar en las Comunidades Pesqueras con Lenguas Nativas como Lengua de Instrucción

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ABSTACT

Marine resources provide significant benefits to the Caribbean region by providing food security, livelihood, and employment at the local level. Much of the local catch is exported to provide significant foreign exchange which, providing significant economic gains which ties the country with international consumers. It is imperative that these resources be protected from over-exploitation and used sustainably if that these marine products are to be available in the future. One way to achieve this goal is to teach the same fundamental marine conservation concepts across the region. Such a program would also protect and strengthen all national and local economic structures dependent upon healthy marine ecosystems.

An individual's mother tongue connects him/her to their ethnic group, shapes their identity, and strengthens pride and self-worth. Language is integral in affirming and maintaining wellbeing, self-esteem and a strong sense of identity. Languages contain complex nuances connecting people's culture and their surrounding ecosystems. Cultural heritage and knowledge is passed on throughout each generation by language. A wealth of evidence associates health, education, and employment with general wellbeing and culture. Indigenous languages connect people to their culture. Educating fisher-folk and youth in their home language allows them to engage and improve marine governance in the region. As shareholders local peoples should be involved in using local mechanisms and local culture to integrate their knowledge to chart their course into the future. Our program provides poly-lingual teaching materials that can used in many areas of the region.

KEYWORDS: Marine conservation, education, indigenous languages

Diet Composition of Yellowtail Snapper, *Ocyurus chrysurus* (Bloch, 1971) Captured by the Artisanal Fishery of Antón Lizardo Veracruz, México

Composición de la Dieta del Pez Rubia *Ocyurus chrysurus* (Bloch, 1971), Capturados por la Pesqueria Artesanal de Antón Lizardo, Veracruz, Mexico

Composition du Régime Alimentaire du Poisson Vivaneau Queue Jaune *Ocyurus chrysurus* (Bloch, 1971) Capturé par la Pêche Artisanale à Anton Lizardo, Veracruz, Mexique

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ABSTRACT

The yellowtail snapper (*Ocyurus chrysurus*) is a marine species living on hard substrates mostly in coral reefs; it is an important economic resource and an important ecological role in the predator-prey relationship. Because of this the interest arise to study the feeding habits of individuals captured by the artisanal fishery of Antón Lizardo in the National Park Veracruz Reef System by analyzing the diet by sex development (juvenile and adult), by sex (male and female) and in general. The stomach content of 190 organisms were analyzed captured between March and September 2017. The frequency of occurrence (FA), relative abundance %N), the Levins standardized diet amplitude (Be), and the Shannon-Weiner diversity index (H') were calculated. In general, the diet was composed by 25 items of five Phylla: Arthropoda, Annelida, Mollusca, Echinodermata and Chordata. For the Arthropoda five families and one genus were identified, for Annelida one Class, for the Mollusca were identified two families with one genus each, for the Echinodermata one class was identified, and for the Chordata two families were identified. The main prey was fish remains (29.37%) and crustacean (20.24%), and the genus Lucifer as a secondary prey with 10.71%. *O. chrysurus* was a specialist species as shown by the Levins index value of 0.2 and the Shannon-Weiner diversity value of 0.95. The yellowtail snapper can be considered as zooplankton and zoobenthos carnivore.

KEYWORDS: *Ocyurus chrysu*rus, red trófica, diversidad, zooplancton carnivore, zoobenthos carnivore

Evaluación de la Variabilidad Genética de *Caretta caretta* y *Chelonia mydas,* a Partir de ADN Mitocondrial, Sector Nororiental del Caribe Colombiano

Genetic Variability Evaluation of the *Caretta caretta* and *Chelonia mydas,* from Mitochondrial DNA, Nororiental Sector Colombian Caribean

Evaluation Variabilité Génétique *Caretta caretta et Chelonia mydas,* Basée sur l'ADN Mitochondrial, Secteur Nord Colombien del Caribe

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RESUMEN

Desde el año 2013 el ProCTMM, viene adelantando estudios tendientes a evaluar la variabilidad genética en estadíos juveniles de *Caretta caretta*, provenientes de zonas de anidación de los departamentos de Magdalena y La Guajira y de *Chelonia mydas*, dispuestos a procesos de rehabilitación, a causa de la pesca incidental, mientras transitan por el sector de estudio. Mediante técnicas de frotis bucal y tejido dérmico, se realizaron extracciones de ADN y amplificación de segmentos de 800 bp, usando los cebadores LCM15382 y H950; posteriormente, se secuenciaron e identificaron en Genbank para un total obtenido de 63 secuencias de ADNmt de *C. caretta* y 24 de *C. mydas*. Revelando por primera vez, la presencia de 4 haplotipos para *C. Caretta*: dos de origen basal que definen la presencia de los haplogrupos CC-A1.4 y CC-A2.1 y dos derivados CC-A17.1 y CC-A43.1, registrados a nivel global en regiones del Atlántico oeste, Atlántico este y Mediterráneo, particularmente, en áreas de forrajeo. Para C. Mydas, se hallaron 5 haplotipos CM-A1.1, CM-A3.1, CM-A8.1, CM-8.2, CM-A5, siendo este último el más frecuente y ancestral y al igual que los demás, reconocidos en las principales zonas de alimentación y reproducción de Tortuguero, Isla Buck, Isla Aves, Surinam y Brasil. Lo anterior sugiere una alta diversidad genética en el Caribe nororiental colombiano, posiblemente debido a la edad geológica y estabilidad ambiental de la región, la cual proporciona las condiciones adecuadas para sus procesos ecológicos: reproductivos, de desarrollo y desplazamiento en sus rutas migratorias, favorecidas por las macrocorrientes globales y microcorrientes locales, brindándose, información haplotípica relacionada con agregaciones a nivel mundial, destacándose la contribución del lugar, en el mantenimiento de sus colonias anidantes y poblaciones en general.

PALABRAS CLAVES: Caribe colombiano, tortugas marinas, variabilidad genetica, haplotipos, vonservación

Evidence of Variable Growth Rates in Hogfish (*Lachnolaimus maximus*) Depending on Reef Tract

Evidencia de Tasas de Crecimiento Variables en Boquinete (*Lachnolaimus maximus*) Dependiendo del Área de Arrecife

Preuve de Taux de Croissance Variable dans Labre Capitaine (*Lachnolaimus maximus*) Selon la Superficid des Récifs

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ABSTRACT

Hogfish (*Lachnolaimus maximus*) is a reef-associated fish species found in the western Atlantic Ocean, which supports a moderate commercial and recreational fishery. For the past three years, this U.S. fishery has been under review and found to be overfished in East Florida. However, the majority of life history data used for this assessment was collected solely in the Florida Keys. Previous studies used in the most recent assessment reported significantly stunted growth rates of hogfish in regions closer to high human population density in comparison to distant locations, such as the Dry Tortugas islands. This study examines the age-length relationship of hogfish populations in Broward County, Florida (USA), which has a much larger human population and more accessible reefs than the Florida Keys. In this study, over 170 hogfish were collected from 2016-2017 and aged using otolith analysis. The findings indicate that, despite the higher human population in Broward County, the observed growth rate was higher than the Florida Keys. In addition, growth rates of hogfish collected from different reef tracts which run parallel the coast were significantly different. In contrast with prior studies, the most accessible reef tract (ca. 4-6m deep) had a significantly higher growth rate than the outermost reef (ca. 15-25 m deep). This data demonstrates the importance of factoring in sample location when determining regional growth rates of a species and should be a consideration for resource managers when assessing a fishery stock.

KEYWORDS: Hogfish, *Lachnolaimus maximus*, growth rate

Comportamiento Espacial y Perfil de las Capturas de la Flota Ribereña de Yucatán, México

Spatial Behavior and Profile of the Small-scale Fleet Catches in Yucatán, México

Comportement Spatial et Profil des Captures de la Pêche Artisanale en Yucatán, Mexique

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RESUMEN

En el estado de Yucatán la actividad pesquera es de gran importancia, ya que genera beneficios tanto económicos como de bienestar social. La flota ribereña del estado de Yucatán es multi-específica y multi-arte y está conformada por aproximadamente 4,400 embarcaciones que operan a lo largo de la zona costera. En este trabajo, se analizó el comportamiento espacial de la flota y el perfil de las capturas. La información para generar este trabajo incluyó el monitoreo de la captura de 1,910 viajes de pesca realizados entre 2013 y 2016, en 11 comunidades pesqueras. Además, se aplicaron entrevistas al capitán de cada embarcación para registrar información de la operación de pesca en relación a: zona, profundidad de operación y arte de pesca. Con el programa Quantum Gis se generaron mapas que permitieron identificar las zonas de pesca utilizadas por los pescadores de seis comunidades (Celestún, Sisal, Progreso, Dzilam de Bravo, San Felipe y Rio Lagarto). Se identificaron 47 especies de peces en la captura de esta flota, un molusco (*Octopus maya*) y un crustáceo, de las cuales sólo cinco fueron especies objetivo: mero rojo (*Epinephelus morio*), rubia (*Lutjanus synagris*), canané (*Ocyurus chrysurus*), boquinete (*Lachnolaimus maximus*) y langosta (*Panulirus argus*). Se identificaron patrones de comportamiento de los pescadores entre comunidades pesqueras que reflejan similitud en la composición de sus capturas.

PALABRAS CLAVES: Flota ribereña, comunidades pesqueras, perfil de las capturas, Quantum Gis

Spatial Features of Sea Turtle Post-nesting Migrations and Core Use Areas in the Southern Gulf of Mexico and Caribbean Sea

Patrones Migratorios y Características de Áreas Núcleo de Tortugas Marinas Post-anidantes en el sur del Golfo de México y Mar Caribe

Schémas Migratoires et les Caractéristiques Essentielles des Zones de Tortues Marines après Nidification dans le Sud du Golfe du Mexique et la Mer des Caraïbes

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ABSTRACT

The migratory patterns and the features of the used areas displayed by sea turtles after the reproductive seasons are of the highest interest because of the ecological information that can be obtained from an ethological point of view. In this study, we characterized post-nesting movements and core areas of 73 individuals of four species (*Eretmochelys imbricata* –hawksbill-, *Chelonia mydas* –green-, *Caretta caretta* –loggerhead- and *Lepidochelys kempii* – kemp's ridley-) that were tracked from their nesting beaches. All species showed similar patterns of migration, moving relatively near to the coast (< 50 km), and above the continental shelf (slope < 0.2°) in shallow waters. Kemp's ridley migrated in waters with a median depth of 30 m, in contrast with loggerheads that move a cross deeper waters (IQR 0-1,500 m); although both species travel longer distances (IQR 860-1900 km) in comparison with greens and hawksbills (IQR 160-685 km). All species but kemp's ridley connect the Gulf of México with the Caribbean Sea, especially loggerheads, since they showed migrations from de Caribbean into the Gulf. At least one individual of all species traveled through two or more countries. After their migration, they exhibit one or two core areas that can be assumed as foraging grounds. Greens and hawksbills showed the smallest core areas (72 ± 65 km^2) in shallow coastal waters, followed by loggerheads (150 ± 95 km^2) which can use areas further away from land. Kemp's ridley exhibited the largest core areas, but also the highest variance (3400 ± 4800 km^2). These results helped to discern migratory patterns between and amongst species, and provided basic information about the movements of post-nesting sea turtles in southern Gulf of Mexico to support management and conservation practices

KEYWORDS: Spatial ecology, feeding grounds, satellite telemetry

A Preliminary Analysis of Marine Fishery Catches Along Southeast Haiti

Un Análisis Preliminar de Las Capturas de la Pesca Marina en el Sureste De Haití

Une Analyse Préliminaire des Captures de la Pêche Maritime le Long du Sud-est d'Haïti

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ABSTRACT

With estimates of up to 50,000 fishers and one of the largest coastlines in the insular Caribbean, the marine fishery in Haiti remains one of the least documented in the region. Here, a large dataset of fishery landing surveys conducted between 2007 and 2014 and spanning approximately 150 km of coastline along southeast Haiti is rigorously analysed for the first time. The results of this analysis will shed light onto the socio-economic and biological components of the marine fishery in Haiti.

KEYWORDS: Marine fishery, Haiti, artisanal fishery, fishery landings, catch composition

Estado de la Invasión del Pez León *Pterois volitans* en el Caribe Continental Colombiano, Monitoreo a Escala Nacional

State of the Invasion of Lionfish *Pterois volitans* in the Continental Caribbean Colombian Coast, Nationwide Monitoring

État de L'invasion Lionfish *Pterois volitans* Continental Caraïbes Colombien, Surveillance Nationwide

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RESUMEN

Las invasiones biológicas se consideran la segunda causa de pérdida de biodiversidad en ambientes marinos después de la degradación del hábitat, el pez león *Pterois volitans* se ha convertido en un invasor en el Atlántico occidental que puede poner en peligro la integridad de la trama alimentaria marina y los ecosistemas en los que se encuentre . Para evaluar el estado de la invasión del pez león en los arrecifes someros del Caribe continental colombiano, el INVEMAR con apoyo del Minambiente desarrolló un monitoreo a escala nacional durante los años 2015 y 2016. Se visitaron 56 estaciones en seis localidades costeras del país: Rosario, San Bernardo, Capurganá, Isla Fuerte, Tayrona y Salmedina, encontrándose peces león en el 89% de ellas. Para el 2015 la mayor densidad de pez león se reportó para Isla Fuerte (390 ± 80 Ind/ha) y para el 2016 en Capurganá (130 ± 90 Ind/ha). La mayor talla fue 420 mm LT en el 2015 en Rosario y la menor fue 22 mm LT (Tayrona) en 2016. Hubo diferencias estadísticamente significativas en la densidad promedio de pez león en el 57.98 % de las estaciones entre años, observándose aumento en las estaciones de Capurganá y Salmedina, lo cual posiblemente está asociado con características intrínsecas de las localidades como por ejemplo el poco buceo debido a la lejanía de ambas zonas y la profundidad en Salmedina. En las demás hubo una disminución en la densidad entre años, observación que fue compartida por actores locales (ej. pescadores, guardaparques, buzos). Sin embargo los únicos trabajos publicados para años anteriores en el Caribe continental colombiano corresponden al Tayrona y muestran una disminución en las densidades y las tallas del pez león entre estos años para esta localidad, haciendo necesario más trabajos de este tipo para poder estimar la dinámica de la invasión en el país.

PALABRAS CLAVES: *Pterois volitans*, invasión, Colombia

Variabilidad Temporal de Descriptores Ecológicos en la Comunidad de Peces Demersales del Mar Caribe de Colombia

Temporal Variability of Ecological Descriptors in the Demersal Fish Community of the Caribbean Sea of Colombia

Variabilité Temporelle de Descripteurs Écologiques dans la Communauté de Poissons Démersaux de la Mer des Caraïbes de la Colombie

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RESUMEN

En el Caribe de Colombia se han documentado muy pocos trabajos que evalúan descriptores ecológicos en las comunidades demersales y menos aún, un análisis temporal que involucra por lo menos tres décadas. Así, se analizó la variabilidad temporal en la comunidad de peces demersales del mar Caribe colombiano, utilizando los índices de riqueza, diversidad y equidad para describir cambios en la estructura de la comunidad a partir de información de cruceros científicos efectuados entre 1970 y 2001 y que se encuentran almacenados en el Sistema de información Evaluación y Ecología Pesquera. El análisis se realizó para tres grandes áreas del mar Caribe de Colombia: Sur, desde la frontera con Panamá hasta la desembocadura del río Magdalena, golfo de Salamanca, entre la desembocadura del río Magdalena y el cabo de la Aguja y Norte, entre el cabo de la Aguja y la frontera con Venezuela. Los descriptores ecológicos resultaron variables en el tiempo, con diferencias significativas ($p < 0.05$) entre algunos periodos. Particularmente, la riqueza de especies para el periodo de 1996 en las tres áreas, obtuvo valores por encima de dos, considerándolo un periodo de buena biodiversidad. La diversidad específica obtuvo valores por debajo del logaritmo de S, indicando que la distribución de las especies dentro de los nichos no fue equitativa en ninguno de los periodos. La uniformidad específica exhibió valores similares en todos los periodos, mostrando equidad relativa en las abundancias y el aprovechamiento de los recursos por parte de las especies. Estos resultados son un insumo para el entendimiento de los cambios temporales de la comunidad íctica de la región, en el contexto del enfoque ecosistémico para el estudio de los recursos pesqueros.

PALABRAS CLAVES: Riqueza diversidad, uniformidad, peces demersales, Colombia

Determination of Cd, Pb, and Zn in the Oyster *Crassostrea virginica* from Carmen Lagoon, Tabasco, México

Determinación de Cd, Pb y Zinc en el Ostión *Crassostrea virginica* de la Laguna el Carmen, Tabasco, México

Détermination de Cd, Pb et Zn dans L'huître *Crassostrea virginica* de Carmen Lagoon, Tabasco, Mexique

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ABSTRACT

Estuaries and coastal lagoons are complex ecosystems that are home for their unique characteristics to a large number of organisms of commercial and ecological importance and their location, serve as urban settlements, ports and industrial systems that use these areas as dumping water waste, mainly in the Gulf of Mexico oil industry. To assess contamination in an aquatic ecosystem, it is necessary to resort to certain bodies of their habitat and location in the food chain, serve as indicators, they also must have certain characteristics: to present a wide geographical distribution, being sedentary, sessile and have preferably economic importance, so the shellfish are considered monitors of change caused by environmental pollution, within this group, bivalves are regarded as the best biomarkers, not only for their lifestyle and food habits, but also as a source important food, this is the situation of oysters (*Crassostrea virginica*, *C. gigas* and *C. corteziensis*), mussels (*Mytilus edulis* and *M. californianus*) and clam (*Mya arenaria*). Toxicity studies are more significant when carried out on important species in fisheries. The accumulation of heavy metals in oysters, C. virginica, from lagoon system along the gulf coast of Mexico, results from inputs provided by anthropogenic activities and the physicochemical and ecophysiological processes ocurring in these systems. The objective of this study was to determine concentrations of Cd, Pb and Zn in C. virginica from Carmen Lagoon, Tabasco. Three sampling sites were selected, and each sample consisted of 100 oysters of commercial size. Concentrations of Cd, Pb and Zn were determined using atomic absorption spectrophotometry.

KEYWORDS: Heavy metals, oyster, contamination, *Crassostrea virginica*, Tabasco

Juvenile Population Dynamics of Families Lutjanidae and Serranidae in the Northern Gulf of Mexico, with Respect to the Loop Current and other Hydrographic Features

Dinámica de la Población Juvenil de las Familias Lutjanidae y Serranidae en el Norte del Golfo de México, con Respecto a la Corriente de Bucle y otras Características Hidrográficas

Dynamique de la Population Juvénile des Familles Lutjanidae et Serranidae dans le Nord du Golfe du Mexique, en ce qui Concerne le Courant de Boucle et D'autres Caractéristiques Hydrographiques

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ABSTRACT

The Gulf of Mexico (GoM) is a uniquely dynamic environment with a variety of hydrographic features and oceanographic processes taking place. These features include; the Loop Current, cyclonic and anticyclonic eddies, and the Mississippi River Plume. These important features are major drivers of the biological processes occurring in the GoM and are directly responsible for the extent to which the Deep Water Horizon Oil Spill (DWH) spread throughout the Gulf. The relationship these features have on the long term community assemblages of Families Lutjanidae and Serranidae has been of great interest from both biological and economic standpoints. These families are home to some of the most economically important fisheries in the GoM and represent some of the larger predators found in reef ecosystems. Identifying the role these features play in the transportation of larval and juvenile nearshore species to offshore environments is vital to resource managers. Using historical data collected shortly after the DWH Oil Spill via the NOAA Natural Resource Damage Assessment (NRDA) in 2011 as a baseline, we plan to analyze the community assemblages of lutjanids and serranids in the Northern GoM. In conjunction with this data, cruises conducted by the Deep Pelagic Nekton Dynamics of the Gulf of Mexico (DEEPEND) Consortium from 2015-2017 will be analyzed to identify the natural variability of species assemblages for lutjanids and serranids. In comparing these two data-sets we hope to identify the potential long term affects the DWH Oil Spill may have had on these fish assemblages and the faunal composition of these two families in an oceanic setting.

KEYWORDS: Lutjanidae, Serranidae, Gulf of Mexico, oceanography, juvenile

Evidence of Risk on *Epinephelus morio* by Recreational Fishing in the Coast of Yucatan and the Alacranes Reef (Mexico)

Evidencias de Riesgo en *Epinephelus morio* ante la Pesca Deportiva-recreativa en la Costa de Yucatan y el Arrecife Alacranes (Mexico)

Evidences du Risques dans *Epinephelus morio* Face a la Peche Recreative dans les Cotes de Yucatan et le Recif Alacranaes (Mexique)

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ABSTRACT

In Yucatan, sport-recreational fishing also captures species of grouper without official records of fishing effort or catch volumes; therefore, its impact on these species is unknown. This paper analyzes some evidence of the impact of recreational fishing on the red grouper *Epinephelus morio*, using spatial information on recreational catch areas (exposure), its proportion in tournament catches (threat) and three indicators based on size of captured red grouper in tournaments (vulnerability). In the summers of 2015 and 2016, samples were taken of specimens collected during fishing tournaments in Yucatan. Total proportions in the catch, proportion of mature organisms (Pmat), proportion in the optimum length (Popt) and proportion of megabreeders (Pmega) were calculated and the catch sites were located with information from the fishermen. The size of 532 fish captured in 146 trips was obtained. In 2015, their catch represented 38% of the total, while in 2016 it represented 52%. The main catch sites for coastal tournaments are located in shallow waters (< 20 m deep), while deep-sea tournaments fish around Arrecife Alacranes (> 50m deep). In the coastal tournaments the groupers correspond to 20-72% of the catch per boat, while in deepwater tournaments they occupy 4-15%. The three size-based indicators obtained were very low (Pmat (2015 and 2016) < 0.5%, Popt (2015 and 2016) < 0.2% and Pmega (2015 and 2016) < 0.1% .The results showed high risk of impact for red grouper in its three elements: threat, exposure and vulnerability by sport-recreational fishing. It is necessary to implement catch and release measures for juveniles of this species and to regulate this growing fishery.

KEYWORDS: Recreational fisheries, risk assessment, red grouper, Yucatan

Network Analysis of the Fishing Product Trade: An Alternative Method for Governance of Rural Fisheries — The Yucatan Sea Cucumber Case (Mexico)

Análisis de Redes de Comercialización de Productos Pesqueros: Una Alternativa para la Gobernanza del Sector Pesquero Rural — El Caso del Pepino de Mar en Yucatán (México)

L'analyse des Resaux Comerciaux de Produits de la Peche: Une Alternative pour la Governance du Secteur de la Peche Rural — Le Cas du Concombre de Mer au Yucatan (Mexique)

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ABSTRACT

The sea cucumber fishery on the coast of Yucatan is perceived as an important alternative for the development of the rural fishing sector and the local economy for the currencies it generates. Although there are management measures focused on fishing effort and catch quotas, ports of extraction show important scenarios of environmental, social and economic deterioration with little or no attention. This work presents a network analysis of the trade of sea cucumber in seven ports of Yucatan, in order to identify its structural characteristics. 110 surveys were applied to permit holders, chairmen of nautical committees, intermediaries, fishing cooperatives and surveillance committees of seven fishing communities. A coded binary matrix of 92 nodes with three differentiated roles was constructed and analyzed using the Ucinet version 6.0 software and Python libraries. The results show a Barabási-Albert (scale-free) network with 310 links, a density of 0.074, a clustering index of 0.475, a diameter of 5 and an energy value of 13,230. Ten crucial actors were identified in the connectivity of the network, where around a node converges of the 80% of the commercial flows. Characteristics of the subnetworks are presented by port and by role. This information can be used to identify key players with market price bargaining ability, to analyze the impact of hypothetical scenarios of change on the network structure, and to design alternatives for up-bottom trade governance that will promote an equitable distribution of the wealth of this lucrative fishery and do not favor the emergence of monopolies.

KEYWORDS: Rural fisheries, governance, trade, network analysis, sea cucumber, Yucatan

Distributional Performance of a Small-scale Lobster Fishery Managed Under a TURF Scheme

Desempeño Distribucional de una Pesquería de Langosta de Pequeña Escala Administrada Bajo un Esquema Tipo TURF

Performance de la Distribution d'une Petite Pêche au Homard Gérée dans le Cadre d'un Programme TURF

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ABSTRACT

How the incomes and benefits spreads between the participants of a fishery has been mentioned as a key aspect on the sustainable management of a fishery, hence the need for their evaluation. Although there are studies on the distributional aspects of rights based fisheries, those reports have been about ITQ schemes. The distributional performance of fisheries managed under Territorial Use Rights Fishery (TURF) systems has been acknowledged as a relevant topic but has not been enough addressed yet. Therefore, the aim of this work is present the distributional performance among owners of fishing grounds in the spiny lobster (Panulirus argus) fishery of Punta Allen, Mexico. Members of the local fishing cooperative, have exclusive access to individual fishing grounds where artificial shelters are deployed. These bottom devices provide refuges for lobsters, reducing predation mortality while facilitating lobster harvesting by free diving and using hand nets. Inequality metrics (Lorenz curve and Gini index G) were applied to income indicators (revenues, quasi-profits of the variable costs, profits, and resource rent) achieved by fishers in seven lobster seasons (2007-2014). The G index of the fishing revenues showed low values (0.387±0.017) and a stable trend in the seven lobster seasons analyzed. Although the G index of the resource rent among campo owners had the highest value, there were no statistically significant differences in the resource rent earned by age groups of campo owners. This study showed that the lobster fishery of Punta Allen presented low inequality values and intergenerational equity among current lobster fishers.

KEYWORDS: Distributional performance, inequality, metrics, Lorenz curve and Gini index, small-scale fishery, TURF fishery

Selectivity, Abundance, and Density of Males and Females of *Callinectes sapidus* on the Coast of Yucatan

Selectividad, Abundancia y Densidad de Machos y Hembras de *Callinectes sapidus* en la Costa de Yucatán

Sélectivité, L'abondance et la Densité des Mâles et des Femelles de *Callinectes sapidus* sur la Côte du Yucatan

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ABSTRACT

A mark-recapture method was used to make sex-related estimates of the selectivity of the fishing gear, abundance and density of the Atlantic blue crab (*Callinectes sapidus*) on the northern coast of the Yucatan Peninsula, using both the Jolly-Seber model and the density by catchability (CPUE * q), both derived from data obtained from a period of six consecutive fishing days. For this purpose, 52 traps were used, divided into four transects placed parallel to the coastline. The traps were placed at dusk and checked at dawn, standardizing the fishing effort in 17 hours trap-1 day-1. A total of 614 crabs were captured, of which 594 did not register marks and 20 were recaptured with mark. The sex ratio male: female throughout the capture was 1:3.78. In relation to size (carapace width, CW), a different sex ratio was also observed for almost all size classes. The selectivity of the fishing gear or first catch size (L50) was estimated at 142.3 and 153.3 mm CW, for females and males, respectively. The catch per unit of effort (CPUE) was estimated in 0.15 (males) and 1.92 (females)/trap organisms. According to the Jolly-Seber model, the average abundance of males was 347 organisms and 2912 for females, resulting in a population of 3259 crabs. Based on these estimations of abundance by sex, it was observed that the density for males was 0.0039 crabs/m^2 (39 males per hectare) and for females of 0.0323 crabs/m^2 (323 females per hectare). Meanwhile, based on to the catchability density (CPUE * q), similar densities of 0.0340 males/m^2 and 0.0243 females/m^2 were observed.

KEYWORDS: *Callinectes sapidus*, Jolly–Seber model, catchability, CPUE, density

Property Rights in Fisheries Management: The Case of Belize's Managed Access Program

Los Derechos de Propiedad en la Gestión de la Pesca: El Caso del Programa de Acceso Administrado de Belice

Droits de Propriété dans la Gestion des Pêches: Le Cas du Programme D'accès Géré du Belize

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ABSTRACT

Fisheries reform has been a trending topic in global fisheries management over the past decade, due to decreases in fish stock, biodiversity loss and destruction of marine ecosystems. Belize is no exception. With the ultimate goal of ensuring the sustainability of the fisheries sector, Belize recently implemented managed access fisheries, a rights-based territorial system aimed at incentivizing sustainability in fishing communities by promoting ownership and stewardship of fisheries resources and ecosystems. The implementation of the managed access system across Belize's territorial and exclusive economic zones brings with it an interaction of actors and institutions at the local, regional and international scale, that raise questions about the feasibility and potential for success of the program. In order to address these questions and provide insights to complex issues of sustainability in small-scale fisheries, in this paper we outline Belize's journey to implementing managed access, and analyze managed access through the framework of marine and coastal property rights. To achieve these goals, we present an overview of Belize's fisheries sector, discuss and analyze the role of property rights in managed access, and explore the implications of separation of rights between fishers and the State. These goals are discussed within the guiding principles of small-scale fisheries in Latin America and the Caribbean.

KEYWORDS: Managed access, Belize, property rights, TURFs, small-scale fisheries

Shrimp Fishery Bycatch in the Bay of Campeche. Is it a Problem?

La Captura Incidental en la Pesca de Camaron en la Bahía de Campeche ¿Es un Problema?

Les Captures Accessoires dans Pêche à la Crevette dans le Baie de Campeche. C'est un Problème?

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ABSTRACT

Information from shrimp fishery observers program of was analyzed. It recorded discard and retained bycatch from pink shrimp (*Farfantepenaeus duorarum*) fishery in the Bay of Campeche during the 2016-2017 fishing season. 578 trawls were analyzed. We obtained estimates of shrimp catch, retained bycatch (RB) and discard bycatch (BD) rates of fishing season. The RB was 15.17% ± 1.57 (SE) and DB was 52.56 % ± 2.04. Months with the highest RB and DB values were December 2016 and January 2017. The fishing season rate of shrimp catch- bycatch ratio was 1: 3.93. 82 species were register in DB and 39 species in RB. Results show us that shrimp catch: bycatch rates found are low compared with other regions of the world. This situation is possibly result of adequate use of try net, the turtle excluder devices use, the empirical knowledge of the captains and the implementation of closed season.

KEYWORDS: Pink shrimp, *Farfantepenaeus duorarum*, bycatch, Campeche

Comparing Management Actions and Assessing Trends in Populations of Reef Fish That Form Spawning Aggregations in the Caribbean

Comparación de las Acciones de Manejo y Evaluación de Tendencias en Poblaciones de Peces de Arrecife que Forman Agregados de Desove en el Caribe

Comparer les Actions de Gestion et Évaluer les Tendances dans les Populations de Poissons de Récif qui Forment des Agrégations de Frai dans les Caraïbes

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ABSTRACT

Species that form fish spawning aggregations to reproduce often do so at predictable locations and times, making these species easy targets for exploitation. Caribbean species from the genera *Mycteroperca* and *Epinephelus* are often targeted during their spawning seasons, with multiple members of these genera listed as Near-Threatened, Threatened, or Endangered under the International Union of the Conservation of Nature Red List. Since 1993, volunteers with Reef Environmental Education Foundation (REEF) have conducted reef fish surveys (species-specific presence/absence and relative abundance), using either SCUBA or snorkeling, at sites throughout the Caribbean. Using these data, we examined trends in the presence and abundance of marine fishes from the genera Mycteroperca and Epinephelus. In particular, we compared trends between locations with management protections in place for aggregating species, such as the Nassau Grouper, versus those without such protections. Our goal is to identify locations with evidence of rebuilding aggregations, and explore causal mechanisms in socio-political and resource management frameworks.

KEYWORDS: *Epinephelus*, *Mycteroperca*, citizen science, fisheries management, spawning aggregations

What are the Factors Affecting Trip Satisfaction for the For-hire Industry in South Carolina in relation to the Black Sea Bass Bag Limit?

¿Cuáles son los Factores que Afectan la Satisfacción del Viaje para la Industria de Alquiler en Carolina del Sur en Relación con el Límite de la Bolsa de Bajos del Lubina?

Quels sont les Facteurs qui Influent sur la Satisfaction du Voyage pour L'industrie à but Lucratif en Caroline du Sud par Rapport à La limite du Black Sea Bass Bag?

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ABSTRACT

The marine charter/headboat industry is a worldwide economically important recreational activity that thrives in tourist destinations such as the Gulf and Caribbean. Trip satisfaction for clients is important to understand in order to inform regulation and aid for-hire fishing businesses. This study took place in South Carolina, located in the South Atlantic region of the U.S. Black sea bass (*Centropsis striata*) is a popular recreational species and in recent years recreational harvest limits have undergone several management changes. In this study, perceptions and impacts of recreational bag limits were used to assess the effect of bag limits on trip satisfaction on charter/headboats. To evaluate the factors that determine trip satisfaction and assess how bag limits affect trip satisfaction, a multi-method research design was employed using qualitative and quantitative methods. Captain, crew and customers were the target participants. Direct behavior observation was employed while onboard fishing trips. Interviews were conducted with captain and crew, and questionnaire surveys were provided to customers to evaluate factors of trip satisfaction. Preliminary results indicate that the drivers of trip satisfaction for customers include catching a fish and taking home fish. For captain and crew, bag limits seem to have some effect on trip satisfaction. The results of this study have relevance to areas in the Gulf and Caribbean region that depend on tourism and for areas balancing conservation and economic impact when managing fisheries with for-hire components. The use of this multi-method research design could be applied in concentrated areas of charter/headboat businesses to evaluate trip satisfaction in the Gulf and Caribbean region, aiding fisheries managers and charter businesses alike in decisions on management.

KEYWORDS: Recreational, charter/headboats, black sea bass, trip satisfaction, harvest limits

Innovative Technologies Used for Ocean Observing

Innovadoras Tecnologías Utilizadas para la Observación de Océano

Les Technologies Innovantes Utilisées pour L'observation de L'océan

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ABSTRACT

The National Science Foundation funded Ocean Observatories Initiative (OOI) deploys and operates a variety of state of the art, ocean observing instruments. The instruments are deployed in seven ocean and coastal arrays in the North and South Atlantic and Pacific oceans. The OOI manages and integrates data from the over 800 instruments deployed among its seven arrays. Instruments are located on a myriad of platforms including gliders, AUVs, surface buoys, profilers, inductive mooring cables, and seafloor junction boxes. Overall there are nearly 75 models of specialized instrumentation used throughout the OOI that collect over 200 unique data products. The types of instruments used in the arrays are Fluorometers, HD Digital Cameras, Acoustic Doppler Current Profilers, Bio-acoustic sonar and many more. http://oceanobservatories.org/

Each year the instrument manufactures improve their instruments which in turn allows the OOI to increase its ocean observing capabilities. These technologies will continue to evolve for the foreseeable future, thus enabling GCFI members to increase data collection and their understanding of our oceans and seas.

The data collected from the OOI instruments can be analyzed and used to support reef surveys and wildlife movement. The instruments and technologies can also be used to analyze the impact of storms, seismic events and man made events like oil spills, on our reef systems. The way we use ocean observing technologies, is just as important as the technologies themselves. Instruments deployed on moorings can be moved to collect information, in anticipation of seasonal events and migratory patterns of sea life. Underwater autonomous vehicles can travel long distances while collecting data. The knowledge gained from using these technologies will increase man's understanding.

KEYWORDS: Technologies, ocean observatories, AUV platforms

Leveraging IT to Counter IUU Fishing and Improving SAR Operations

Aprovechamiento de las TIC para Combatir la Pesca no Reglamentada/no Reportada y Mejorar las Operaciones SAR

Utilisation des Technologies de l'information pour Lutter contre la Pêche non Réglementée et Améliorer les Opérations SAR

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ABSTRACT

Given the rapid and drastic decline in marine fishery due to environmental degradation by natural disasters and poaching, consideration was given for the use of Unmanned Aerial Vehicle (UAV), as a force multiplier via increased law enforcement presence within Jamaica's maritime jurisdiction.

The former Minister of Agriculture and Fisheries of Jamaica announced the intent of his Ministry to facilitate the acquisition of two drones to enhance the surveillance capacity within Jamaica's vast maritime space. Consequently, a Drone Pilot Project was conducted over the period 17 – 23 April 2015 with the aim of testing the protocols and live video footage in operating a drone in a safe, effective and efficient manner within the Pedro Cays environs. The Pedro Cays is located on the Pedro Bank which is approximately 50 nautical miles from mainland Jamaica – the country's largest and primary fishing ground.

The next step was to operationalize the use of drones as a tool to enhance maritime law enforcement and search and rescue operations. However, before such can be achieved it was proposed that a Working Group comprising representatives from the Jamaica Defence Force and Jamaica's Civil Aviation Authority be formed to:

1. Identify tasks which would be assigned to the drone.
2. Identify minimum specifications of the drone to accomplish identified tasks.
3. Assign a cost to operationalize the drone(s) which would include sourcing of the drone, maintenance and operators' training cost, among others.
4. Conduct a cost/benefit analysis between the present cost to operate vessels and aircrafts to achieve missions vis-a-vis a drone.
5. Recommend at least two drone platforms and confirm the lead-time for sourcing drones.

KEYWORDS: Unmanned aerial vehicle, drones, fishery enforcement

Use of Open Accelerometer Tag to Detect Grouper Courtship Associated Sounds: A Pathway to Spawning-Stock Size Determination

Uso de Accelerometros para Detectar Sonidos Asociados a la Reproducción en Meros: Una Vía Para Determinar el Tamaño de la Población Reproductora

Utilisation de L'étiquette D'accéléromètre Ouvert pour Détecter les Sons Liés à la Parade de Grouper: Un Chemin Vers la Détermination de la Taille du Stock de Frai

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ABSTRACT

Many species of marine fishes produce species-specific sounds associated with reproductive behaviors. Passive acoustic monitoring has been used to study groupers that produce courtship associated sounds (CAS) when they aggregate to spawn. This technique has revealed patterns of sound production during spawning aggregations with extremely high temporal resolution. A primary goal to continue to expand the application of passive acoustics is to measure trends in abundance over time and apply this to spawning stock or population estimates during critical life stages. Underwater visual census has been most commonly used to estimate fish abundances during aggregations, but with several limitations (i.e. weather constraints, depth, fish behavior, water quality) that restrict its long-term effectiveness. A factor that limits the extrapolation of CAS counts to fish abundance is knowing the call rate of an individual fish. Groupers have a sound production mechanism made up of cranial muscles vibrating onto the swimbladder and generating sound waves. During the 2017 spawning season, red hind (*Epinephelus guttatus*) where held in a 1,500-gallon tank with an accelerometer tag and a low frequency hydrophone to record CAS. By placing the accelerometer tags near the fish the vibrations generated during sound production were detected, and correlated with CAS. In additional experiments, stronger signals of induced alarm calls produced by red hind were simultaneously recorded by both methods, confirming the potential of this approach to make passive acoustic monitoring useful for assessing spawning aggregations of groupers.

KEYWORDS: Passive acoustic monitoring, accelerometer, tags, red hind, spawning aggregations, grouper