70th Gulf and Caribbean Fisheries Institute
POSTER ABSTRACTS

Modelación Bioeconómica de Pesquerías Multiespecíficas en la Plataforma Suroriental de Cuba

Bioeconomic Modeling of Multispecific Fisheries in the Southeast Platform of Cuba

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

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RESUMEN

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

PALABRAS CLAVES: Bioeconomía, manejo, peces

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

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

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

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RESUMEN

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

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

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

PALABRAS CLAVES: Stingrays, Myliobatiformes, tamaño poblacional

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

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

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

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ABSTRACT

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

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

KEYWORDS: Fisheries, biodiversity, livelihoods

Large scale reef restoration in the Seaflower Biosphere Reserve - San Andres, Providence and Santa Catalina Archipelago, Colombian Caribbean

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

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

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ABSTRACT

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

KEYWORDS: Coral reef conservation, coral gardening, fisheries enhancement

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

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

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

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ABSTRACT

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

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

CARI'MAM (Caribbean Marine Mammal Preservation Network)

Red del Caribe para la Protección de los Mamíferos Marinos CARI'MAM

Réseau Caribéen pour la Protection des Mammifères Marins

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ABSTRACT

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

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

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

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

KEYWORDS: Marine mammal, Caribbean, MPA

Hybrid solution? Building the case for Acroporid restoration in Costa Rica

Solución Híbrida?

Desarrollando las Bases para la Restauración de Acropóridos en Costa Rica

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

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ABSTRACT

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

KEYWORDS: Acropora, hybrid, restoration

Community participation in the control and use of IAS in the International GEF / UNDP Project "Improving the Prevention, Control and Management of Invasive Exotic Species in Vulnerable Ecosystems in Cuba"

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

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

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ABSTRACT

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

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

KEYWORDS: Communities, invasive alien species, participation

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

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

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

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ABSTRACT

Marine management areas are created with the idea to conserve various species from overharvest and/or preserve an important ecosystem. For highly migratory fish, like billfish, this can be difficult due to the fact that they do not stay in the same place for long periods of time typically, but a number of management areas have been created over the past several decades with varying success. Nearly two decades ago, the Florida East Coast Pelagic Longline Closed Zone (FECPLLCZ) was established due to overfishing of the stock and the region being identified as a nursery ground for swordfish. The spatial analysis of tag and release data of blue marlin, sailfish, and swordfish was conduct-

ed with Geographic information systems (GIS) software by looking at management areas off Florida and billfish data reported to The Billfish Foundation (TBF) in order to investigate any correlation between conservation zones and recreational effort. Answering this question would help pave way to future management strategies to help advance billfish conservation as well as the rights of recreational anglers. The use of TBF's data was most logical seeing as it is widely recognized and used by many in the sportfishing community since 1990. The analysis showed that the FECPLLCZ was particularly effective for swordfish and sailfish species, as shown by the statistics presented in the high low clustering reports. Furthermore, the information found supports the idea that using proper management techniques and implementing marine conservation zones that are able to, at the same time, protect the right of recreational anglers ensures that the links between sportfishing, marine conservation, and both our local and global economy remain strong.

KEYWORDS: Marine management area, billfish, spatial analysis

Aprovechamiento Integral de la Pesca en Yucatán

Integral Exploitation of Fishing in Yucatan

Exploitation Intégrale de la Pêche au Yucatán

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RESUMEN

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

KEYWORDS: Subproductos, Yucatán, aletas

Optimizing coral reef restoration across network of coral nurseries Within the Dominican Coastal Restoration Consortium (CDRC)

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

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

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ABSTRACT

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

KEYWORDS: Restoration, coral reefs, ecosystem services

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

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

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

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ABSTRACT

Coral reefs are undergoing rapid changes because of a combination of local and global stressors. In the Caribbean, populations of reef-building corals are declining at unprecedented rates, underscoring the need for urgent action to preserve these ecosystems. Coral restoration has gained a great deal of attention as a strategy to help corals and coral reefs to withstand increasing disturbances. While coral reef restoration science has improved in past decades, strong experimental design and monitoring plans are key to assess success and upscale restoration efforts. Experimental ecology has played an important role in restoration programs in many terrestrial and marine ecosystems. Herein, we propose an experimental framework for coral reef restoration and discuss its advantages/disadvantages using a reef section located at Bayahibe as study case. A mixed experimental design which includes fixed and nested factors will be

implemented in the Sombrero Reef, Bayahibe, the Dominican Republic. Fixed factors will include plots to be restored (i.e., a set of experimental units impacted and rehabilitated) using sexual and asexual recruits (i.e., micro fragmentation), control plots (i.e., a set of experimental units impacted) and reference plots (i.e., a set of experimental units less impacted where rehabilitation is not necessary). Plots will be monitored for 3 years after establishing a baseline (T0) prior to intervention. The experiment will also measure the potential effects of seasonality over the restoration outcome. The proposed experiment renders seven sources of variation allowing testing if restoration will be effective for a known reef section and whether the outcome varies in space and time. We hope our experience in the Sombrero Reef in Bayahibe will contribute to coral restoration experimental design in the Dominican.

KEYWORDS: Restoration, coral, experimental design

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

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

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

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RESUMEN

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

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

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

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

L'action Face aux Changements Sociaux et Écologiques dans les Communautés Côtières à travers la Co-création d'Idées et d'Arts Visuels

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ABSTRACT

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

KEYWORDS: Governance, marine conservation, knowledge co-production

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

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

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

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ABSTRACT

Human fishing behavior has included construction and use of fish aggregating devices (FADs) to attract fish in the open ocean for millennia. The pelagic environment is a relatively featureless region of water with little or no structure. Floating material will typically attract fish, and the longer that material remains, the more colonists (and prey items) will inhabit the floating material and the water column immediately adjacent to the structure. FADs are present around many Caribbean islands, however, very few FADs occur in American waters and none have been deployed (legally) around the continental USA, specifically in the Gulf of Mexico. The first FAD network consisting of eight buoys will be deployed in the northern Gulf of Mexico in 200 – 600 m of water and 95 – 130 km from shore. The pur-

pose is to create habitat for pelagic game fishes as well as expand and enhance recreational and sport fishing opportunities across the region. The FAD network is estimated to provide an economic impact of

$56million to not only the fishing industry in the region but to regional tourism and will also provide a unique platform for pelagic research. Specifically, collaborations with universities, non-profits, and government agencies will result in utilizing the FAD network as a platform to conduct research in a relatively inaccessible environment. Passive monitoring equipment will be used to monitor oceanographic and biological conditions and to detect and track movements of specific species of interest. The purpose of this presentation is to quantify the anticipated tourism benefit and proposed monitoring methodologies.

KEYWORDS: Pelagic, fisheries, tourism

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

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

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

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ABSTRACT

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

KEYWORDS: Data-limited, National Standard 1, FishPath

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

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

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

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RESUMEN

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

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

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

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

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

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ABSTRACT

This study focused on the interactions and connections between mole crabs in comparison to high vs. low human impact beaches along with water and sediment quality. Sediment cores were completed at Clearwater Beach (high impact) and Indian Rocks Beach (low impact) in order to observe the presence or absence of *Emerita talpoida*. At

each site there were 5 sediment and 5 water samples collected at the mid-swash zone in order to assess sediment grain size and water quality. There were significant differences between turbidity, alkalinity, and temperature between sites; Clearwater Beach had higher levels of all three factors. However, there was no difference in sediment grain size based on site. While there was no *E. talpoida* found in any of the sediment cores, there was a presence of coquina clams which served as an indicator of *E. talpoida* occupation in the habitat. The higher levels of turbidity and alkalinity could have been the result of no *Donax variabilis* being found at Clearwater Beach in comparison to Indian Rocks Beach. This creates a great concern because *E. talpoida* populations are key indicators of overall beach health.

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

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

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

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

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ABSTRACT

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

KEYWORDS: Billfish

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

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

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

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ABSTRACT

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

KEYWORDS: Pelagic, stable isotopes

Distribution and Composition of Fish Aggregating Devices as Marine Debris

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

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

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ABSTRACT

Marine debris is increasingly seen as an environmental threat. However, little is known about the contribution of drifting Fish Aggregating Devices (dFADs), a gear accessory often used by commercial purse-seine fishers to increase efficiency and catches of target species, particularly tunas. dFADs are simply a surface or sub-surface platform with construction ranging from commercially manufactured plastic discs to home-made rafts. Many also have subsurface netting to increase prey attraction, as well as satellite-linked electronic buoys that allow remote monitoring of fish aggregations underneath. Particularly in pelagic waters, dFADs contribute to the growing problem of Abandoned,

Lost, and Discarded Fishing Gear (ALDFG) identified by the FAO. To date, little has been done to quantify the dFADs abandoned and beached in the Greater Caribbean. Using primarily social media, reports and photographs of stranded dFADs in the western Atlantic (n = 153) were compiled from 1999 to present, including details on construction and designs, with locations throughout the Greater Caribbean in the western Atlantic and eastward to Scotland and the Azores. Two general trends were observed: 1) FAD platforms initially consisted of hand-made bamboo rafts, but the manufactured plastic discs that were developed in 2016 were first reported in October 2017, 2) an increasing frequency of home-made dFAD platforms composed of multiple jugs wrapped in netting within PVC or metal frames since January 2018. As reports of adverse anthropogenic impacts on the oceans increase, a need for sustainable, less damaging fishing gear and better fisheries management practices has become apparent, especially for dFADs. Better dFAD monitoring and reporting is recommended at the international RFMO/RFAB level.

KEYWORDS: Fish Aggregating Device, distribution, Caribbean

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

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

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

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RESUMEN

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

PALABRAS CLAVES: Pesca artesanal, batoideos, rayas

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

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

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

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ABSTRACT

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

KEYWORDS: SocMon, socioeconomic monitoring, coastal zone management

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

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

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

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ABSTRACT

Coral reef ecosystems provide important natural services to developing world societies, but are expected to show significant declines in species diversity, shifts in community composition and declines in productivity under climate change, increasing vulnerability of dependent societies to external shocks. Given current climate trajectories, adapting to these changes is an important goal for developing world societies and developing means of measuring changes in the functioning of coral reef ecosystems. Resilience is defined as the ability for an ecosystem to return to its original state of functioning following some external impact and can be represented by species diversity, particularly in eco-

systems exposed to medium to high levels of disturbance, such as coral reefs, where high diversity plays an important role in maintaining ecosystem functioning. Here, we used species distribution models to produce projected changes in the species diversity of coral reef ecosystems in the ecologically distinct Caribbean large marine ecosystem, a socially and ecologically vulnerable region. The results of this study can provide a basis for the development of climate-proof policies for resource management and further explorations of resilience as a measure of ecosystem integrity.

KEYWORDS: Coral reef, climate, species diversity

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

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

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

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ABSTRACT

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

KEYWORDS: Chronology, fish death, event

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

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

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

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ABSTRACT

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

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

KEYWORDS: Puerto Rico, commercial landings, queen conch

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

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

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

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ABSTRACT

The Fisheries Research Laboratory (FRL) of the Puerto Rico Department of Natural and Environmental Resources (DNER) monitors the commercial landings of fish and shellfish in Puerto Rico since 1967. The CFSP receive commercial fisheries landings reports, collect and process biostatistics data. The biostatistics data collection occurred at the fishing centers (places where fishers landings). Many fishing centers have "Villas Pesqueras", they are buildings that Puerto Rico's Agriculture Department or municipality provided to commercial fishers, where they have place to storage their fishing gear,

vessels, fish house and some have ramps and/or dock. In September 20, 2017 Hurricane María impacted Puerto Rico. This was a catastrophic hurricane. The Puerto Rico population was impacted with category five winds of 175 – 200 MPH. Most of the 88 fishing centers active before the Hurricane María and Villas Pesqueras where seriously damaged. The CFSP make an inventory to know how many fishing centers and "Villas Pesqueras" still active after two years of the hurricane impact.

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

KEYWORDS: Commercial fishery, fishing centers, Villa Pesquera

Five Key Factors to Elevating *Sargassum* Mitigation Efforts

Cinco Factores clave para Elevar los Esfuerzos de Mitigación del Sargazo

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

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ABSTRACT

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

KEYWORDS: *Sargassum*, cimate change, innovative

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

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

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

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ABSTRACT

The presence of fragments or pieces of large plastic or macro plastic in the marine environment have generated great concern worldwide given its persistence in the environment. Due to the degradation suffered by these materials, there is

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

KEYWORDS: Microplastics, sediment, surfacewater

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

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

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

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ABSTRACT

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

KEYWORDS: Habitat mapping, multibeam echosounder, seabed imagery

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

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

Caracterisation de la Peche d'Organismes Marins a des Fins Ornementales en Republique Dominicaine

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ABSTRACT

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

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

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

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

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

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ABSTRACT

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

models with Cuban officials and stakeholders such as fishers, industry members, and researchers. The event brought together Cuban fisheries experts and international experts to;

Present international and domestic models for sportfishing management in Cuba,

Identify the scientific basis needed for sportfishing management in Cuba, and

Review models, identify gaps, and sketch a roadmap for future implementation

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

KEYWORDS: Sportfishing, Cuba, recreational fishing

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

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

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

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ABSTRACT

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

KEYWORDS: Reproduction, *Pterois volitans*, Alacranes Reef

Culture of Macroscopic Marine Algae *Gracilaria Spp. E Hypnea Musciformis* In the Reef Platform of Old Providence and Santa Santa Catalina Islands, Biosphere Reserve Seaflower

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

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

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ABSTRACT

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

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

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

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

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

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RESUMEN

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

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

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

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

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

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ABSTRACT

Pollution is evident on coasts around the world. Marine debris on beaches is as unsightly as is it harmful to marine organisms. This study assessed the types, abundance and distribution of plastic debris on two study sites located on the coast of Demerara Mahaica, Guyana. The study sites were Marriott beach and Bee-Hive beach and were sampled for macro-plastics and micro-plastics for a period of eight weeks. Selection of the beaches was based on the level of anthropogenic activity. At Marriott beach, surrounded by an urban area, plastic caps had the highest abundance while at Bee-Hive beach, surrounded by a rural community, plastic bottles dominated. Compared to Bee- Hive beach, Marriott beach had the highest abundance of debris with the exception of plastic bottles and unidentifiable plastics

indicating that rivers draining from populous areas are the major source of debris to the study site. Overall, plastics accounted for 93.7% of the total marine debris collected. The most abundant types of plastics found were bottles (52.9%), plastic bottle caps (11.3%), and straws (9.8%). Micro-plastics were only present at Bee- Hive beach and were secondary in nature. The findings demonstrate there is a need for management actions to prevent further accumulation of marine debris and reduce the current debris on the coast by implementing better waste management strategies.

KEYWORDS: Marine debris, micro-plastic

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

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

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

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RESUMEN

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

PALABRAS CLAVES: Pesca artesanal, CPUE, chinchorro

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

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

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

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ABSTRACT

A major goal of ecological research is the ability to model food web dynamics so that predictions regarding changes in food web and ecosystem structure can be made. Before accurate models can be constructed, information pertaining to trophic relationships among functional groups, including estimates of trophic position using both stomach content analysis (SCA) and stable isotope analysis (SIA)are needed. Currently, several data sets utilizing SCA to describe trophic structure of micronketon (2-10 cm) in the deep-pelagic Gulf of Mexico (GoM) exist but studies using SIA are less common. Using a dataset including 58 species, we describe the trophic structure of deep- pelagic micronekton assemblages in the GoM using δ13C and δ15N using. Both vertically migrating, and non- migrating taxa representing a range of feeding modes, depth distributions, and putative trophic levels were selected to describe trophic variability within deep-pelagic assemblages. Additionally, samples of particulate organic matter (POM) from the epi-, meso-, and bathypelagic were used to delineate carbon source isotopic signatures. Isotopic signatures of POM samples were significantly different across depth zones displaying a pattern of enrichment in 15N with increasing depth. The δ13C values of micronekton varied among species, ranging from -22.73‰ to - 16.35‰ suggesting consumers utilize POM throughout the water column. Micronekton δ15N values ranged from 1.85‰ to 10.97‰ encompassing ~3 trophic levels. Elevated δ15N values in many non-migratory taxa suggest an increased reliance on deep-suspended POM when compared to migratory taxa who receive the bulk of their carbon from epipelagic sources. This project provides data that can be used to inform ecosystem models and will provide insight into the structure of the GOM's deep-pelagic ecosystem.

KEYWORDS: Stable isotopes, food webs, mesopelagic

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

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

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

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ABSTRACT

The management of artisanal fisheries often sidelines the human dimension, which is key to understanding its impact. The Tela Bay (Honduras) is currently transitioning towards the co-management of fishing resources, with the local communities increasingly becoming stewards of their resources. To anticipate the impact of this transition, we assessed the socioeconomic landscape of fishing communities in Tela through open-ended interviews and surveys.

Tela has a unique natural resource management entity known as the Environmental Committee that is comprised by actors from the public and private sector, including the National Fishing Authority, who work together in the management of the fishery. The Tela artisanal fishery displays a high level of diversity in harvesting patterns and gears among communities. Furthermore, fishing was reported as the main source of income and food security, it is the main livelihood for 65% of respondents and 90% of all landings remain within the fishers' local community. Despite fishing being viewed as a low-income profession, fishers report average monthly earnings up to 5 times the minimum wage. The disparity between reported incomes and poverty in the region indicates that management efforts should focus on promoting the equitable distribution of the resource and providing fishers the tools necessary to make the most out of their earnings. Co-management appears to be an advantageous alternative to fishery management in the Tela Bay since the area has a bridging organization between the National authorities and the local communities, it can aid in the development of strategies targeted to each group of users and it can promote the equitable distribution of the resource. Tela can be a useful learning platform for future scaling-up efforts throughout the region.

KEYWORDS: Co-management, socioeconomic, Honduras

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

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

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

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ABSTRACT

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

KEYWORDS: Taxonomic classification, wideband echosounder, boundary element method

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

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

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

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ABSTRACT

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

KEYWORDS: Coral restoration, restoriation, fishery management

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

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

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

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ABSTRACT

The queen conch (*Lobatus gigas*), is a large gastropod mollusk known mostly for its economic importance in commercial and artisanal fishing, in addition to its representativeness in Caribbean culture and society. In Mexico, the pink snail is located around the Yucatan Peninsula, distributed along the coastal area of the state of Quintana Roo and on the sandbars near Isla Contoy, Isla Mujeres, Cozumel and Banco Chinchorro, and in the Yucatan state there is a population in Alacranes Reef. Currently, fishing for this mollusk is only allowed in the Biosphere Reserve of Banco Chinchorro. The National Institute of Fisheries and Aquaculture (INAPESCA), has carried out assessments of the snail population in this site since 1989 and due to the decline of the queen conch populations in 2012, a ban of almost

5 years was decreed for the recovery of the resource and it was not until March of 2017 that the fishery was opened again. Currently, fishing is carried out by approximately 100 fishermen in 30 vessels, belonging to three fishing cooperatives "Langosteros del Caribe", "Pescadores de Banco Chinchorro", and "Andrés Quintana Roo." The closed season in Mexico includes a period of 8 months, from May to November and February However, a previous study is necessary to determine the fishing quota, in 2017 a quota of 9 tons of queen conch pulp or meat was granted, which was captured in 3 effective days of fishing The dynamics of fishing in the Biosphere Reserve of Banco Chinchorro is very peculiar. This work describes the catch that was made in January 2018 and includes an analysis of catches by boat, cooperatives, fishing areas, yields and catch sizes (Siphonal length and lip thickness).

KEYWORDS: Caracol rosado, fisheries, México

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

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

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

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ABSTRACT

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

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

Soundscape monitoring in U.S. National Marine Sanctuaries

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

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

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ABSTRACT

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

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

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

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

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

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ABSTRACT

Suriname, located on the northeast coast of South America, is under the influence of the nutrient-rich Amazon River effluents, making its coastal waters very productive, supporting a variety of fish stocks. Whilst fishermen target certain species of marketable fish, there is also substantial bycatch of unwanted species. WWF Guianas has been monitoring for bycatch of endangered, threatened and protected (ETP) species in the coastal artisanal fisheries in the Suriname since 2006. This paper presents the data analysis for the monitoring efforts in 2015-2016. Analysis of these data resulted in landing profiles of target species and bycatch data for a selection of shark, ray and sea turtle species. Ex-

trapolation of these data to the entire coastal artisanal fleet of Suriname, resulted in an estimation of the annual ETP bycatch per fishing technique. Results are alarming; annually, more than 4,000 sea turtles, over 130,000 sharks and almost 130,000 rays are being entangled by the Surinamese coastal artisanal fleet. Moreover, we can assume that the extrapolated data is an underestimation of the real situation especially as there are regular instances of illegal, unreported and unregulated fishing in Surinamese coastal waters. Based on this study, we can state that various shark, ray and sea turtle species are indeed under pressure from the coastal artisanal fishery in Suriname. A reduction of bycatch of these species therefore is a priority. More continuous monitoring of bycatch in different fisheries and across seasons should be carried out in order to gain a better understanding of the occurrence, distribution and status of the different species caught as bycatch over time. Therefore, ETP species bycatch monitoring remains a priority focus for WWF Guianas and its partners.

KEYWORDS: Bycatch, sea turtles, ETP

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

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

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

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ABSTRACT

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

KEYWORDS: Artisanal fisheries, climate change, dolphinfish

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

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

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

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ABSTRACT

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

KEYWORDS: Tarpon, *Megalops*, Central America

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

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

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

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ABSTRACT

The citizen science project held in the platform iNaturalist, called "Biodiversidad de Playa El Derrumbao y Zonas Aledañas" (Biodiversity of El Derrumbao beach and nearby places) gathers an extensive photographic catalog of various species presented in the area of Las Salinas and Las Calderas Bay in Peravia province in the Dominican Republic, with a focus

on its marine and coastal fauna. In these late years, this area has taken preponderance as a birdwatching scene and more recently as a diving and snorkeling spot thanks to its proximity to the city and the variety of habitats that can be found, such as mangroves, dunes, coral reefs, coastal lagoons, and salt pans. Despite the importance of these sites, its marine fauna and coastal resources have not been exhaustively studied. This project was created in mid-2017 and has to date more than 300 observations of 141 different species of terrestrial and aquatic fauna and flora. More than 80% of the observations are marine or coastal fauna, including marine reptiles, fish, stony and soft corals, mollusks, crustaceans, echinoderms and more. Other marine-coastal biodiversity is comprised of plants such as mangroves, macroalgae and seagrasses. More than 75% of the observations are research grade. We have recorded 19 species of stony corals, several of them threatened, such as the ones of the genus Acropora and at least seven species of soft corals, zoanthids and hydrocorals. The fish diversity is rich, we have observed more than 40 species of fish including sharks, rays and reef fishes. This project has had the participation of people not directly related to science and also presents evidence on the fishing practices in the area. We think this can be a promising ecotouristic destination and the location of future scientific research.

KEYWORDS: Biodiversity, citizen science, marine biodiversity

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

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

Poissons Marins Et Estuariens De La Collection Scientifique du Muséum National d’Histoire Naturelle “Prof. Eugenio de Jesús Marcano” en RépubliqueDominicaine

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ABSTRACT

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

KEYWORDS: Scientific collection, fishes, Hispaniola

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

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

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

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ABSTRACT

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

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

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

KEYWORDS: Herbivorous fishes, conservation, carbon

Dominican Reef Network: A Conservation Alliance in Dominican Republic

Red Arrecifal Dominicana: Una Alianza por la Conservación de Corales en la República Dominicana

Réseau de Récifs Dominicains: Une Alliance pour la Conservation es Coraux en République Dominicaine

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ABSTRACT

Red Arrecifal Dominicana (RAD), is a conservation alliance, founded by Propagas Foundation, The Nature Conservancy, Reef Check Dominican Republic, Grupo Puntacana Foundation, CODOPESCA and FUNDEMAR. RAD was launched in 2016, after publishing the report "Situation of the Coral Reefs in the Dominican Republic". This report revealed the level of degradation of coral reefs in the country and the need to act in collaboration to ensure the future of this ecosystem for generations to come.

Currently, RAD and its more than 20 members are an example to other countries in the Caribbean, regarding na-

tional cooperation for coral reef conservation, management, restoration and monitoring. RAD ensures active participation of the Government, Private Sector, Academia and Local Communities to define actions for achieving sustainable management of coral reef ecosystems.

RAD works in four strategic lines: conservation, management, restoration and education. Our vision is to strengthen a partnership among key institutions and to stablish a nationwide action plan which defines attention priorities with regards to coral reef management and, with the cooperation of all, to achieve most efficient results in the least possible time. The main objectives of RAD are:

i) Designing and promoting strategies for coral reef ecosystem.
ii) To facilitate responsiveness given the threats faced by coral reefs.
iii) To be an open forum for information exchange.
iv) To promote the sustainable management and rehabilitation of fisheries.
v) To identify research areas and institutional strengthen for applying the regulations.
vi) To disseminate coral reef values.

KEYWORDS: Ecosistema arrecifal, alianza, conservación

Comparative Evaluation of the CPUE Before and After the Installation of Artificial Reefs in the Pozos Colorados Sector, Caribbean Sea of Colombia

Evaluación Comparativa de la CPUE Antes y Después de la Instalación de Arrecifes Artificiales en el Sector de Pozos Colorados, Mar Caribe de Colombia

Évaluation Comparative de la CPUE Avant et Après l'Installation de Récifs Artificiels dans le Secteur de Pozos Colorados, dans la Mer des Caraïbes, en Colombie

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RESUMEN

La bahía frente a Pozos Colorados y su zona costera en el Caribe de Colombia, ha sido una región con gran diversidad y presencia de ecosistemas para la actividad pesquera. No obstante, las actividades de desarrollo costero y la implementación de zonas restringidas para el cargue de carbón y líneas submarinas para el transporte de hidrocarburos, se han convertido en una amenaza para la sostenibilidad del ambiente marino, evidenciado tanto en los ecosistemas acuáticos como en las poblaciones de especies explotadas por las pesquerías artesanales. En consecuencia, de lo anterior, los principales afectados por esta problemática han sido las comunidades de pescadores artesanales que han visto la necesidad de desplazar espacialmente su esfuerzo pesquero. En aras de preservar la biodiversidad e impulsar el ecoturismo, la Empresa Ecopetrol S.A. instaló doce arrecifes artificiales (AAs), El objetivo de este trabajo consistió en evaluar la variación de la CPUE de los principales artes de pesca, comparando la información histórica de los desembarcos de la pesca artesanal, antes de la instalación de los AAs, con el estado actual, para lo cual se utilizó la metodología del monitoreo de sus desembarcos haciendo uso de encuestas semi- estructuradas dirigidas a las Unidades Económicas de Pesca (UEP), registrando datos correspondientes a la abundancia relativa (Captura por Unidad de Esfuerzo - CPUE) de cada UEP, expresada en kg.faena-1. Mediante la prueba no paramétrica de Mood se compararon las medianas de la CPUE antes y después de los AAs. Los principales resultados indicaron diferencias estadísticas entre los periodos evaluados, estas diferencias se expresaron a nivel de las artes de pesca comparadas (línea de mano, chinchorro y red de enmalle), siendo mayores antes de la instalación de los AAs.

PALABRAS CLAVES: Pesca artesanal, arrecifes artificiales