

73th Gulf and Caribbean Fisheries Institute

POSTER ABSTRACTS

Genetic variability evaluation of the *Chelonia mydas*, from mitochondrial DNA, nororiental sector Colombian Caribbean

Evaluación de la variabilidad genética de *Chelonia mydas*, a partir de ADN mitocondrial, sector nororiental Del Caribe Colombiano

Évaluation de la variabilité génétique de *Chelonia mydas*, sur la base de l'ADN mitochondrial, secteur nord-est des Caraïbes Colombiennes

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ABSTRACT

The Program for the Conservation of Turtles and Marine Mammals -ProCTMM-, has been carrying out studies aimed at evaluating the genetic variability of specimens ready for rehabilitation processes, due to the incidental fishing of the green turtle (*Chelonia mydas*), while they transit through the sector study. Through buccal smear and dermal tissue techniques, DNA extractions and amplification of 800 bp segments were performed, using primers LCM15382 and H950; later, they were sequenced and identified in Genbank for a total of 22 sequences, of which 11 corresponded to specimens found in Santa Marta and the other 11 sequences in organisms from La Guajira. Three haplotypes (CM-A5, CM-A8.1 and CM-A3.1) were found for Santa Marta and five (CM-A1.1, CM-A5, CM-A3.1, CM-A8.1 and CM-A8.2) for La Guajira, which are registered globally in the West Atlantic, East Atlantic and Mediterranean regions. In both regions, CM-A5 is the most frequent (54.54% and 45.45% respectively) which is recognized in the main feeding and breeding areas of Tortuguero, Buck Island, Bird Island, Suriname and Brazil. The above suggests a high genetic diversity, possibly due to the pattern of local oceanographic currents, which have made it easier for females from other Atlantic colonies to reach the Colombian coasts.

KEYWORDS: Green turtle, Mitochondrial DNA, Haplotypes

Comparison of age, size, and growth structure of lionfish in the Southern Caribbean and North-western Gulf Of Mexico

Comparación de edad, tamaño y estructura de crecimiento del pez león en el Caribe sur y el noroeste del Golfo de México

Comparaison de l'âge, de la taille et de la structure de croissance du lionfish dans le sud des caraïbes et le nord-ouest du Golfe du Mexique

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ABSTRACT

Indo-Pacific lionfish (*Pterois volitans*, *P. miles* complex) were first introduced off the coast of Florida in the 1980s and have become one of the most severe marine fish invaders in the Northwestern Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Age-specific life history parameters are required for use in models that can be used to determine removal rates needed to effectively manage lionfish densities. This study validated annual increment formation in sagittal otoliths to assess the age and growth of lionfish collected in Aruba in 2014 (n = 44) and the northwestern Gulf of Mexico (NWGoM) in the Flower Garden Banks National Marine Sanctuary (FGBNMS) in 2018 (n = 100). Additionally, Fulton's condition factor and asymptotic maximum lengths (L_∞) were calculated for each of the populations to compare the favorability of environmental conditions and respective growth characteristics. Results suggested that populations were significantly different between the two regions, with lionfish from Aruba exhibiting a greater L_∞, growth rate, and greater condition values than lionfish from the NWGoM. It is unclear if these differences were attributable to variability in species composition, or if they in fact, show that lionfish in Aruba have more favorable environmental conditions which resulted faster growth.

KEYWORDS: lionfish, age, national marine sanctuary

**Oldest Indo-Pacific lionfish (*Pterois volitans*/*P. miles*) on Record Collected From the
Northwestern Gulf of Mexico**

**El pez león del Indo-Pacífico (*Pterois volitans* / *P. Miles*) más antiguo registrado en los registros
del noroeste del Golfo de México**

**Le plus ancien poisson-lion de l'Indo-Pacifique (*Pterois volitans* / *P. Miles*) enregistré dans le
nord-ouest du golfe du Mexique**

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ABSTRACT

Indo-Pacific lionfish (*Pterois volitans/miles*) were first detected off the coast of Florida in the 1980s, with aquaria release being the most likely mechanism for introduction. Since then, lionfish have proliferated through the north-western Atlantic Ocean, Caribbean Sea, and Gulf of Mexico. Here, we report the oldest lionfish aged on record in their invaded range, removed from Flower Garden Banks National Marine Sanctuary (FGBNMS). In August 2018, a research expedition removed 776 lionfish from FGBNMS, of which a subset were retained for age and growth estimation. The oldest lionfish aged was a 10 yr old male, with total length 375 mm and weight 805 g. The back-calculated birth date (2008) preceded the first observation of lionfish at FGBNMS by three years (2011). It is not well understood if lionfish are having negative impacts at FGBNMS, but this report signifies the importance of continued monitoring and removal efforts of this protected area.

KEYWORDS: lionfish, age and growth, national marine sanctuary

Biscayne Bay - Miami's gem is losing its shine. How can stakeholders save it?

Biscayne Bay - la joya de Miami esta perdiendo su brillo. ¿Cómo puede los interesados salvarla?

**Biscayne Bay - le joyau de Miami perd de son éclat. Comment les parties prenantes
sauvegarde le?**

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ABSTRACT

The clear blue waters of Biscayne Bay in South Florida have reflected the sparkle of the Miami skyline as it has shone and grown over the last hundred years, but the beauty of the bay is now suffering through many crises as the population grows, the water warms, and infrastructure ages. Over the past few years, the bay has lost acres of seagrasses, gained masses of macroalgae, and most recently has experienced a sudden and smelly fish kill.

The local solid waste and waste water systems have had many failures, with plastic waste clogging canals and covering bay islands. Sewage has spilled into neighborhoods and into the bay. Local residents have documented these issues on social media, have organized, and have pushed their government leaders to respond. I'll give a brief overview of what may have led to its troubles and how local citizens and government representatives have responded and are attempting to help regain some of its former brilliance.

KEYWORDS: Biscayne Bay, seagrass, nutrients

Coral Beef: Barriers and Opportunities to a Culinary Lionfish Market in Florida
Carne de coral: barreras y oportunidades para un mercado culinario de pez león
en Florida

Coral Beef: Obstacles et opportunités pour un marché culinaire de poisson-lion en Floride

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ABSTRACT

Lionfish (*Pterois volitans*) are an aquatic invasive species in the western Atlantic that cause extensive negative ecological impacts. Following their arrival in the 1980's, lionfish have colonized ecosystems ranging from coral reefs to mangroves and have been documented at depths ranging from 1-300m. In addition to depleting native reef fish biomass, their impact upon herbivory on coral reefs threatens macroalgae induced phase shifts on shallow reefs. Conservation managers are presented with many considerations for managing invasive lionfish and their social-ecological impacts. Few examples exist for successful management of marine invasive species, but some lionfish removal studies have shown decreased lionfish density and significantly increased prey species biomass. A critical component, and challenge, for any lionfish removal effort is consistency. Consumptive markets are a management solution that requires consistent removals and offers the potential for both livelihood and ecological benefits. This study focuses on Florida's consumptive market following momentum behind state-wide "eat them to beat them" campaigns. Florida is home to a vibrant restaurant industry. This study aims to fill a large gap in understanding regarding a key stakeholder group: restaurant decision makers such as chefs, owners, and managers. The perspectives of these professionals are understudied, but they contribute to overall restaurant sustainability and can inform public perception about ecological issues. Although lionfish is commercially available in Florida, it is not yet widely used within the restaurant industry. Using a grounded theory approach we interviewed decision makers to understand their perceptions regarding the barriers and opportunities for serving lionfish. Results identified the top barriers (difficulty of harvest and price), top opportunities (processing and traps), previously unreported culinary yield figures, as well as a strong network of restaurant decision makers, researchers, and divers. Conservation managers can leverage this network to facilitate opportunities, address barriers, and promote public education about lionfish threats to coral reefs. This study captures only a small group of important stakeholders, so it's important to continue consulting these individuals in order to uncover additional opportunities that can meet their challenges and the challenges posed to coral reef ecosystems by invasive lionfish.

KEYWORDS: Lionfish, invasive species

Governability of the Marine Small-Scale Fisheries of Venezuela in the Context of the Western Central Atlantic Fishery Commission

Gobernabilidad de la pesca marina artesanal de Venezuela en el contexto de la Comisión de Pesca del Atlántico Centro-Occidental

Gouvernabilité de la petite pêche maritime du Venezuela dans le contexte de la Commission des pêches de l'Atlantique Centre-Ouest

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ABSTRACT

The fisheries of the Bolivarian Republic of Venezuela is dominated by small-scale fisheries (SSF) accounting for 245,477 tons (81%) of the national production (302,146 tons). Thus, the socio-economic importance of marine SSF cannot be overemphasized – contributing significantly to the provision of employment, income and as a source of protein for the population. The legal and institutional framework of the fisheries of Venezuela comprise of both national regulations and ratified international conventions. In addition, Venezuela is a member of the Western Central Atlantic Fishery Commission (WECAFC) - as one of the main producing countries by volume. Accordingly, regional governance is crucial for sustainable fisheries resources stewardship in the WECAFC area. This present a nested institutional arrangement situation in WECAFC countries with far reaching demands for institutional compatibility at multiple levels. Another issue which immediately becomes a concern is, the capability of the governance framework emanating from such nested institutions to address the inherent features of the SSF systems. This study will try to find out how equipped or well-marched are the principles and institutions of the governance system in the fisheries of Venezuela so as to address challenges and create opportunities in the marine SSF system. Nested institutional analysis allied with the interactive governance framework will be brought to bear on analyzing the fisheries system in Venezuela. This study results will provide the degree of institutional compatibility and the adequacy of the governing system to address the peculiar characteristics of the system to be governed for policy consideration.

KEYWORDS: Fisheries Governance, Governability, Regional Fisheries Management Organization

Barriers and motivations for divers to harvest lionfish in Florida: It's not all about the money**Barreras y motivaciones para que los buzos que pesquen pez león en Florida: no se trata solo del dinero****Obstacles et motivations pour les plongeurs à pêcher le poisson-lion en Floride: tout n'est pas une question d'argent**

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ABSTRACT

Lionfish (*Pterois volitans*) are an invasive species from the Indo-Pacific that have rapidly grown in number in the Caribbean, Gulf of Mexico, and West Atlantic since they were introduced in Florida in 1985. They reproduce early in their lifecycle and frequently and consume the juvenile native reef fish that are important to reef health and human livelihoods. In order to combat the spread of this species, management efforts in Florida have in part focused on the development of a market for lionfish. Despite their venomous spines, lionfish is safe to eat and tastes good. The lionfish market is established in Florida and currently supply cannot meet demand. Given that lionfish numbers are still high, why is there a shortage? We examined the motivations and barriers for recreational and commercial divers to harvest lionfish and for chefs to prepare and serve lionfish. We conducted 50 semi-structured interviews via snowball and convenience sampling with divers and chefs throughout Florida at lionfish events (tournaments, cook-offs). Thematic coding of interviews revealed primary motivations for spearing lionfish are recreational, financial, conservation-oriented, and for consumption. Barriers for most recreational and commercial divers to spear lionfish include time and cost, skill, diving risks, licensing, profit, and/or depth. Most chefs reported barriers as inconsistent supply, the small size of lionfish, price, and risk-oriented in relation to employees handling venomous spines. Combined with ecological data on lionfish populations and behavior, these findings elucidate opportunities for improved engagement with divers and chefs and, therefore, strategies for suppression of the invasion.

KEYWORDS: Lionfish, Florida, Diver

Status of Stony Coral Tissue Loss Disease in the Caribbean Region
Estado de la enfermedad de pérdida de tejido en corales duros en la región del Caribe
Situation de la maladie de la perte de tissu corallien sur coraux durs dans la région des Caraïbes

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ABSTRACT

Stony Coral Tissue Loss Disease (SCTLD) affects approximately half of all known stony coral species in the Caribbean region. The SCTLD epidemic started in 2014 in Florida and this aggressive disease has now spread to at least 16 Caribbean countries and territories. The number of affected Caribbean countries and territories has more than doubled in the 12 months to October 2020. We present the latest known status of this disease in the Caribbean region using the recently-developed SCTLD regional dashboard. We summarize the status of cooperation efforts to build capacity for monitoring, detection and correct identification of SCTLD, and for response including outreach and partnership efforts for prevention, treatment, rescue and restoration in the Caribbean region.

KEYWORDS: Stony coral, disease

Environmental DNA Analysis of Forage Fish Diversity and Distribution in the Indian River Lagoon**Análisis de ADN ambiental de la diversidad y distribución de peces de forraje en la laguna del Indian River****Analyse ADN environnementale de la diversité et de la distribution des poissons fourragers dans la lagune de l'Indian River**

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*University of Central Florida 4110 Libra Drive Orlando Florida 32816 United States emilyfarrell@knights.ucf.edu***ABSTRACT**

The Indian River Lagoon is one of the most species-rich estuaries in the United States, providing habitat to over 400 species of fish. Among these are critical forage fishes, such as menhaden, anchovy, and sardines, as well as many of their commercially important predators. The Florida Fish and Wildlife Conservation Commission (FWC) conducts monthly seine surveys in the IRL, which provide the basis for most fisheries resource management and conservation decisions in the region. However, many key species are systematically overlooked by these surveys due to gear bias, resulting in data deficiencies for many forage fish species and their dependent predators. This ongoing study aims to circumvent these issues by utilizing environmental DNA (eDNA) metabarcoding to conduct a survey of forage fish species in the IRL and create a rapid and cost-effective survey toolkit complimenting existing survey efforts. As part of this effort, we have collected water samples from 16 sites across the northern IRL alongside FWC's monthly surveys just before seine net deployment. Using protocols optimized in our lab at the University of Central Florida, we will extract DNA from these samples and prepare Illumina libraries using 16S primers. Species composition and individual occurrence records at each sample site and habitat will be evaluated based on the eDNA data. These results will be compared to those obtained from the FWC survey to evaluate the relative strengths and weaknesses of each method. Combining the data, we will create local and regional biodiversity hotspot maps for forage fishes that can be used to supplement FWC's species occurrence database.

KEYWORDS: forage fish, environmental DNA, metabarcoding

Site fidelity and monthly growth rates of invasive Lionfish calculated from in-situ observations in Choctawhatchee Bay Estuary, Florida.

Fidelidad del sitio y tasas de crecimiento mensual del invasor pez león calculadas a partir de observaciones in situ en el estuario de la bahía de Choctawhatchee, Florida.

Fidélité au site et taux de croissance mensuels des poissons-lions envahissants calculés à partir d'observations in situ dans l'estuaire de la baie de Choctawhatchee, en Floride

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ABSTRACT

Invasive lionfish (*Pterois volitans*) and their impacts to the ecosystems they have invaded have been well documented since their invasion began in the mid-1980s. Life history characteristics such as age and growth have been estimated from lionfish otoliths but there is a paucity of studies utilizing in-situ tag recapture methodologies to describe lionfish growth. Further, invasive lionfish have been observed in estuaries around the Caribbean and in South Florida but site fidelity in bays and estuaries of northwest Florida have not been described. Due to the relatively shallow artificial reef habitat (<8m) utilized for this study, lionfish were able to be captured and brought to the surface for tagging and measurement with no observed effects of barotrauma. The water temperature in the Choctawhatchee Bay Estuary (CBE) can drop to temperatures close to and in some cases below the lethal limit of lionfish (~10°C). Observations from the last year indicate that lionfish in the CBE are able to survive these lower temperatures for short periods of time. While this study is still ongoing, 12 tagged lionfish have been at large for 14 to 103 days and have a mean growth rate of 0.33mm per day which is less than growth rates reported for lionfish studied in Loxahatchee River estuary, Florida (0.46mm/day). Lastly, all lionfish tagged in the CBE have strong site fidelity with the exception of one lionfish which moved 1,114m from its tagging location to another reef site monitored for this study.

KEYWORDS: Tagging, Fisheries, Estuary

Vulnerability analysis of local fishing resources from fishers' traditional knowledge**Análisis de vulnerabilidad de los recursos pesqueros locales a partir del conocimiento tradicional de los pescadores****Analyse de la vulnérabilité des ressources halieutiques locales à partir des connaissances traditionnelles des pêcheurs**

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ABSTRACT

We integrated fishers' traditional knowledge and scientific information to assess the vulnerability of the stocks in Dibulla, La Guajira, Colombia. We gathered local information on commercial important fishes in Dibulla, to contribute to a Productivity and Susceptibility Assessment (PSA), an expert opinion-based model that combines information about the productivity of a stock with its susceptibility to fishing activities, pollution, habitat degradation, or other factors. This project sought local expertise to develop a PSA for nearshore species at a small spatial scale, so we can better understand local dynamics, pressures, and vulnerabilities of the stocks. We applied this technique by combining biological data for 11 species with information obtained from fishermen during a series of surveys. We found high susceptibilities for all the species and prioritized three species with a high vulnerability to overfishing, and identified the activities that are negatively impacting small-scale fisheries in the area. While PSA provides only general information on vulnerability and stock status, it can be useful to identify important local differences in stock susceptibility to fishing or other impacts that may be lost when stocks are monitored at a wider scale.

KEYWORDS: Small-scale fisheries, Traditional ecological knowledge, Productivity and susceptibility analysis

**The current status of the marine environment of the Moriah Harbour Cay National Park:
Results of the 2019 rapid ecological assessment**

**Estado actual del medio ambiente marino del Parque Nacional Moriah Harbour Cay:
Resultados de la evaluación ecológica rápida realizada en el 2019**

**L'état actuel du milieu marin du parc national de Moriah Harbour Cay: résultats de
l'évaluation écologique rapide de 2019**

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ABSTRACT

Between the 12th and 17th of September 2019, a Rapid Ecological Assessment (REA) was conducted on selected reefs and mangroves found within and surrounding the Moriah Harbour Cay National Park (MHCNP), a national park found on mainland Exuma, in the central Bahamas. Standard methods were used to assess fish and benthic communities in both habitats as well as coral community composition and health for reefs: the Atlantic & Gulf Rapid Reef Assessment (AGRRA) for the reefs and a modification of AGRRA for mangroves. The assessment was to provide information relating to the marine habitats and living marine species through mainland Exuma; information gained from the assessment will serve as baseline data feeding into the recently completed management plan and upcoming projects that will be undertaken within the park.

A total of ten (10) coral reef sites and three (3) mangrove sites were surveyed. Of those sites surveyed, fish abundance and live coral cover within the mangroves and coral reefs that were surveyed was higher than average when compared to other sites within The Bahamas that have been surveyed in the past few years. There was a difference in the relative abundance of snappers/grunts on the reefs and within the mangroves; the mangroves had significant higher representation of those families. Twenty-one (21) species of coral were observed on site with four (4) families observed as large recruits and one (1) family observed as a small recruit.

Based on the result of this rapid ecological assessment, the benthic, coral and fish communities are in relatively good conditions. Implementation of the current management plan would help to increase resilience on the systems. Restoration projects, particularly for those reef-building corals can help contribute to the overall improvement of the productivity of the system.

KEYWORDS: MPA, Coral Reefs, Mangroves

The classification of nearshore habitats and organisms around Chacachacare Bay, Chacachacare Island, Trinidad and Tobago using a drop camera video system.

La clasificación de los hábitats y organismos cercanos a la costa alrededor de la Bahía Chacachacare, Isla Chacachacare, Trinidad y Tobago utilizando un sistema de video de cámara de caída.

La classification des habitats et des organismes côtiers autour de la baie de Chacachacare, sur l'île de Chacachacare, à Trinité-et-Tobago à l'aide d'un système vidéo à caméra de descente.

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ABSTRACT

Due to a paucity of information regarding the impact of threats faced by coastal ecosystems throughout the world, it is difficult to effectively plan and implement strategies to prevent the decline of these ecosystems. The detailed mapping of coastal areas to identify and locate habitats and ecosystems is an essential first step in creating resources management plans. A coastal classification scheme was developed for Trinidad and Tobago in 1983 by the Institute of Marine Affairs, however, this classification scheme lacks the components necessary to facilitate detailed planning. The Coastal and Marine Ecological Classification Standard (CMECS) was developed to offer a flexible and hierarchical framework that can be applied across various scales making it an ideal system to contribute to effective coastal management planning. For this study the CMECS was applied to the nearshore marine habitats within Chacachacare Bay, Trinidad and Tobago. A drop camera video system was used as the primary data collection tool. Application of CMECS to 63 sites identified 27 rocky, 15 sandy and 21 coral reef habitats throughout the study area which appeared to have experienced a recent phase shift from *Porites porites* to dominated by macro-algae. The 63 sites surveyed comprised of 4 significantly different biotic groups: branching coral reef, diverse colonizers, leathery/leafy algal bed and turf algal bed. The CMECS method of generating coastal habitat information proved to be a relatively inexpensive yet rapid means of filling gaps in our knowledge of tropical coastal ecosystems.

KEYWORDS: Tropical coastal ecosystems, Coastal classification, CMECS

The fish ecology of thermal springs in Jamaica
La ecología de los peces de las aguas termales en Jamaica
L'écologie des poissons des sources thermales en Jamaïque

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ABSTRACT

Jamaica has over 30 springs. There is a lack of information on tropical springs. Springs that discharge water above the mean annual air temperature (MAAT), which is 24.91°C in Jamaica, are referred to as thermal springs. There are two types of thermal springs- warm and hot springs. Warm springs' temperatures range from 1-2°C higher than the MAAT up to 37°C. Hot springs have a temperature higher than 37°C. In this study both warm and hot springs have been investigated. Fish species have only been identified in the warm springs. Based upon monthly samples collected over a period of 14 months the following fish families and species were observed:

Eleotridae - *Gobiomorus dormitor* (n=2),

Poeciliidae - *Limia melanogaster* (n=38), *Gambusia wrayi* (n=75) and *Xiphophorus maculatus* (n=5), Cichlidae - *Parachromis managuensis* (n=105),

Mugilidae - *Agonostomus monticola* (n=20) and Gobiidae -

Awaous banana (n=12)

Of the species captured at the warm spring, *X. maculatus* and *P. managuensis* are Jamaican introduced species, making up 43% of the entire fish population. *P. managuensis* was the most abundant fish species and they constituted 95% of the introduced species population.

Gut-content analyses provided data on the feeding habits of the species. *P. managuensis*, *G. wrayi* and *G. dormitor* mainly fed on invertebrates. *X. maculatus* and *L. melanogaster* mainly fed on diatoms while *A. monticola* and *A. banana* mainly fed on filamentous algae. Pianka's Index was used to identify the percentage overlap for the invertebrates recorded during the gut analyses. This was highest between *P. managuensis* and *A. monticola* (76%). Therefore, they might be in competition for food. This is currently being investigated.

KEYWORDS: springs, fish ecology, fish composition

**ddRADseq reveals a genetic break in the South Caribbean: the case of West Indian “whelk”
Cittarium pica (Gastropoda: Trochidae)**

**ddRADseq revela un quiebre genético en el Caribe de Colombia: el caso del Burgao
Cittarium pica (Gastropoda: Trochidae)**

**ddRADseq révèle une rupture génétique dans les Caraïbes colombiennes: le cas du Burgo
Cittarium pica (Gastropoda: Trochidae)**

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ABSTRACT

The West Indian top shell (*Cittarium pica*) is a key fishery resource in many Caribbean areas. This mollusk lives in intertidal and shallow subtidal conditions on rocky shores and has a short-lived larval phase (<5 days). On the other hand, it is overexploited in a large part of its distribution and listed in the red books of threatened species. Despite its well-recognized conservation importance, there is a lack of molecular resources currently available. For this reason, we used the double digest restriction site-associated DNA sequencing (ddRad-seq) to evaluate the population genomic structure across the Colombian Caribbean. 65 samples were collected in five locations (Cabo de la Vela=12; Santa Marta=15; Cartagena=8; Isla Fuerte=15; Capurganá=15) between 2017 and 2018. A total of 55,112 SNPs were identified, with 35,594 of them being on average polymorphic. Several analyses about the genetic structure performed with AMOVA ($F_{st}=0.224$; $p<0.05$), PCoA, Structure ($K=3$), and an ML tree (3 clusters) indicated that *C. pica* presents three populations (pop 1: Cabo de la Vela; pop 2: Santa Marta; pop 3: Cartagena+Isla Fuerte+Capurganá). Interestingly, all the analyses showed a genetic break between Cabo de la Vela and Santa Marta ($F_{st}=0.175$; $p<0.05$) due to the absence of rocky shore habitats along the 300 km of coastline. We discuss that *C. pica* is a good biological model to explain how the southern Caribbean biogeographic barrier operates for those marine organisms that live on rocky intertidal habitats and exhibit a short-lived larval phase or lack it completely. Consequently, these findings open a new debate about the importance of evaluating the effects of the barrier on other aspects of these marine organisms. Finally, the results will improve the management and conservation strategies proposed for *C. pica* in Colombia.

KEYWORDS: Population genomics, Biogeographic barrier, Colombian Caribbean

CNFO Regional Code of Conduct for Caribbean Fisheries
CNFO Código de conducta regional para la pesca del Caribe
CNFO Code de conduite régional pour la pêche des Caraïbes

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ABSTRACT

In order to advance Ecosystem Approach to Fisheries (EAF) management in the Caribbean, there is the need for a Code of Conduct which articulates a shared understanding of what EAF entails at regional and national levels. The Caribbean Network of Fisherfolk Organisations (CNFO) has taken the lead in developing a Regional Code of Conduct for Caribbean Fisheries. This Code was formulated by and for persons in the fishing industry to enhance ecosystem stewardship for fisheries sustainability. The ten Articles of the Code were heavily influenced by FAO Code of Conduct for Responsible Fisheries (CCRF), the Voluntary Guidelines for Securing Sustainable Small-Scale Fisheries in the Context of Food Security and Poverty Eradication (SSF Guidelines), the Caribbean Community Common Fisheries Policy and its associated Protocols, and the Sustainable Development Goals (SDGs). The Code was accepted by stakeholders on the 30th July 2020 and will be formally endorsed and adopted at the CNFO General Assembly in November. The development of the regional Code is an activity delivered under the ‘Developing Organizational Capacity for Ecosystem Stewardship and Livelihoods in Caribbean Small-Scale Fisheries (StewardFish) project’. This project aims to promote EAF application by empowering fisherfolk to engage in resource management and decision making. This poster will illustrate an iterative social learning process which emphasizes industry engagement, formal endorsement, implementation and participatory monitoring and evaluation. Next steps and recommendations suggest actions to inform the implementation of the regional Code and adaptation to the national contexts of seven StewardFish project countries.

KEYWORDS: SSF Guidelines, EAF, fisheries management

Determination of the population structure and connectivity of the commercially important fish "Lane snapper" (*Lutjanus synagris*) and "White grunt" (*Haemulon plumieri*) as a tool for fisheries management in the Honduran Caribbean

Determinación de la estructura y conectividad poblacional de los peces de importancia comercial "Calale" (*Lutjanus synagris*) y "Ronco" (*Haemulon plumieri*) como herramientas para la gestión pesquera en el Caribe hondureño

Détermination de la structure de la population et de la connectivité des poissons commercialement importants " vivaneau de voie " (*Lutjanus synagris*) et " grognon blanc" (*Haemulon plumieri*) en tant qu'outil de gestion des pêches dans les Caraïbes honduriennes

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ABSTRACT

Artisanal fishing is an important economic activity in the Honduran Caribbean, however scientific information is required to identify the adequate management scale for these fisheries. To identify a suitable management scale, we worked with two commercially important fish species, lane snapper (*Lutjanus synagris*) and white grunt (*Haemulon plumieri*), in 4 fishing sites in the Honduran Caribbean. Variations in the body shape of both species were studied through geometric morphometry. These estimates were correlated with environmental variables, to infer the possible cause of the observed variations. In addition, population genetic studies were performed using two mitochondrial (Dloop and ND4) and one nuclear (S7-1) gene. The results of geometric morphometry allowed the identification of populations associated with the environmental conditions of each site. Furthermore, river discharge appears to be the main driving force for the differentiation of body shape for both species. The results of the genetic analysis show a high connectivity and genetic diversity, considering the lane snapper as a single genetic stock and the white grunt with different populations within the area. These results emphasize the need to carry out an integrated coastal marine management at a National level through a marine biological corridor, which can help curb the main threats to marine species such as river discharges.

KEYWORDS: Marine conservation, Fishing stocks, Body shape

The Caribbean has a data MERMAID!
¡El Caribe tiene una MERMAID de datos!
Les Caraïbes ont une MERMAID de données!

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ABSTRACT

The Marine Ecological Research Management AID (MERMAID) was conceptualized as a field-ready tool which vastly reduces the time taken for survey data to be translated into evidence-based management decisions. The need was seen for a tool which reduced the effort spent in validating and reformatting data to facilitate collaboration, communications and decision making. Data collectors log in using either a dedicated or a Google account to enter raw data directly into the platform, where it is automatically cleaned, validated, and georeferenced. MERMAID's platform allows web browsers to store data offline, uploading it to the cloud when internet connectivity is resumed. This function allows field scientists to enter their data even in remote locations with no internet access.

After the data is submitted, administrators are able to download and share a .csv containing the data and its metadata for analysis, and a map-based dashboard allows stakeholders and decision makers to see the sites that have been surveyed from any browser. The public can also see the surveying organisation, and charts describing characteristics such as benthic cover and fish species biomass and composition.

Initial development was a collaborative effort between the Wildlife Conservation Society, The World Wildlife Fund and SparkGeo, and was based on Indo-Pacific taxa. In early 2020, MERMAID launched in the Atlantic region, adding hundreds of Atlantic-specific species and support for AGRRA-compatible surveys, with Glover's Reef in Belize as its pilot site. We are in the process of ingesting legacy data from Glover's Reef into the database.

KEYWORDS: Data, Conservation, GIS

Natural shields for Caribbean insular territories: Wave and wind attenuation by coral reef barriers and mangroves at San Andrés Island, Seaflower Biosphere Reserve, Colombian Caribbean.

Escudos naturales para territorios insulares del Caribe: Atenuación de olas y viento por barreras de arrecifes de coral y manglares en la Isla San Andrés, Reserva de la Biosfera Seaflower, Caribe Colombiano.

Boucliers naturels pour les territoires insulaires des Caraïbes: Atténuation des vagues et du vent par les barrières de corail et les mangroves sur l'île de San Andrés, Réserve de biosphère de Seaflower, Caraïbes colombiennes.

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ABSTRACT

Caribbean insular and coastal territories are exposed to strong winds, waves, storms, and hurricanes. Coral reefs and mangroves can provide coastal protection ecosystem services (ES) that become vital for human wellbeing specially under an insular context. Despite of that, these ecosystems has been deteriorated by several anthropic pressures worldwide, putting on risk the benefits we receive from them. Changes on management and decision making are needed to protect these necessary ecosystems for our survival, and for Caribbean people's wellbeing, in our study we collected evidences from the field to better visualize the importance of coral reef barriers and mangroves at insular territories such as the San Andrés, Island, Seaflower Biosphere Reserve located at the Archipelago 180.000 km² of Colombian oceanic waters. For that, we measured on field wave attenuation provided by barrier reefs and found wave height attenuation up to 90% under different sea conditions, waves at forereef up to 4.5 m height (Hs), were reduced to 50 cm due to barrier reefs. We also conducted wind speed field measurements during a high-speed winds season during 2020 at areas with and without mangrove trees over the windward coastline, and found that just one single mangrove can reduce 70% of wind speed on average, our theoretical projections suggest that mangroves can reduce wind speed maintaining non damaging conditions to infrastructure even under a category 2 hurricane. These results motivate us to keep on further research on these subjects and are evidences that encourage decision makers at Caribbean to invest on protection and restoration of these ecosystems as a Nature Based Solutions-NBS for coastal protection.

KEYWORDS: Coastal management, Ecosystem Services, Seaflower

Mitochondrial analysis reveals *Octopus insularis* as the common shallow-water octopus of the Colombian Caribbean

Análisis mitocondrial revela que *Octopus insularis* es el pulpo común en las aguas poco profundas del Caribe colombiano

L'analyse mitochondriale révèle *Octopus insularis* comme la pieuvre commune des eaux peu profondes des Caraïbes colombiennes

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ABSTRACT

The common octopus of the Colombian Caribbean has been considered for several years as *Octopus vulgaris*, local artisanal fisheries exploit this species of great ecological and economic importance, and however, a complete evaluation of its identity has not been made so far. In order to address its identification and its relationships with other members of the *Octopus vulgaris* species complex, 58 octopuses were sampled from five localities of the Caribbean coast (Providencia, San Andrés, Santa Marta, Cartagena and Isla Fuerte) and were genetically identified. The molecular analysis of the 16S ribosomal RNA (r16S), Cytochrome oxidase subunit III (COIII) and Cytochrome oxidase subunit I (COI) mitochondrial genes revealed the presence of *Octopus insularis* as the common shallow-water octopus of the Colombian Caribbean. The topologies generated by the three genes confirmed the monophyletic status of the specie showing individuals collected in this study and *O. insularis* from different locations, as a solid cluster supported by high values. Genetic distances of the mitochondrial genes also confirmed this finding (0.000 – 0.003). Our results allow to extend the known distribution of *O. insularis* to the southwestern Caribbean – Colombian coast, solving the identity of the common octopus in this region. We discuss our results in the context of the recent octopus species misidentifications involving members of the *O. vulgaris* species complex in Colombia and emphasize the importance of molecular studies in the delimitation and clarification of species identity, especially those that are exploited, in such a way that marine resources can be properly managed.

KEYWORDS: Mitochondrial DNA, Species delimitation, cryptic species

Spatial dynamics modelling of small-scale fishing fleets with a Random walk approach
Modelación de la dinámica espacial de flotas pesqueras artesanales con el enfoque Random Walk
Modélisation de la dynamique spatiale des flottes de pêche artisanale avec l'approche Random Walk

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ABSTRACT

The understanding of fishing effort allocation has been recognized as a key feature within fisheries' spatial management. In small-scale fisheries this assessment is challenging because their multiespecific context. Thus has resulted in management regulations that do not fulfill their objectives. Therefore, understanding the relationship between fishing gears and target species is important for the assessment and management of fisheries. To characterize fishing trips from multiespecific small-scale fleet a Random Walk approach was used. The data analyzed here come from 156 fishing trips carried out in three fishing seasons (2018, 2019 and 2020) by the small-scale fleet of Yucatán, México. The activities of three gears (hand net, handline, longline) and two fishing methods (diving, "gareteo") were recorded with a GPS. The fitness of seven RW's was evaluated for trajectories data: Brownian (BW), Transpose brownian (TBW), Levy walk (LW), Levy Transpose walk (LTW), Correlated (CRW), Transpose correlated (TCRW) and Composite correlated (CCRW). To compare the relative and absolute fit of the models a delta Akaike and G-Tests were used respectively. A total of 143 trajectories showed conclusive evidence to establish a CCRW-type movement, the remaining 13 trajectories fit for three models (CCRW, TRW and CRW) but G-test was not significant. Our results highlight the usefulness of low-cost tracking devices such as GPS to acquire data from spatial distribution of small-scale vessels as there is no VMS program to monitor these fisheries. For future studies we suggest increasing the base of fishing trips and conducting specific studies by gear and fishing method.

KEYWORDS: Small-scale, fishing fleet, spatial dynamic, random walk

Functional diversity: a need for assessing the ecological response of reef fish assemblages to a disturbance in protection strategies

Diversidad funcional: Una necesidad para evaluar las respuestas ecológicas de los ensamblajes de peces arrecifales a disturbios en estrategias de protección

Diversité fonctionnelle: nécessité d'évaluer la réponse écologique des assemblages de poissons de récif à une perturbation des stratégies de protection

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ABSTRACT

Developing and evaluating process-oriented metrics, such as functional trait diversity metrics, is a high priority to assess the ecological responses of reef fish communities to disturbances and for adaptive ecosystem-based management in marine protected areas (MPAs). We applied five functional diversity metrics (functional entities, redundancy, richness, dispersion, and evenness) to fish assemblage data from an 11-year monitoring dataset of coral reefs in the U.S. Virgin Islands to assess: 1) the spatio-temporal variance in the trophic function of fish communities before, during and after a mass coral bleaching event in 2005; and 2) the association of fish functional diversity with benthic composition, diversity, and structure of reefs inside and outside of No-Take and Multiple Use MPAs. The lack of spatial variation in fish functional diversity metrics suggested no MPA effects during the evaluated time. After the coral bleaching event in 2005, the number of fish functional entities, functional richness, and variation (dispersion) declined inside a No-Take MPA in St. Croix, failing to return to pre-disturbance values over the subsequent seven years. Reefs with high topographic complexity and hard coral species richness supported high richness and redundancy of functional roles. We concluded that functional diversity metrics based on the trophic function of fishes should be considered as tools to monitor ecological functional recovery in MPAs.

KEYWORDS: Functional diversity, fish assemblages, coral reefs

**Fish structure in three reef areas with different management actions, Colombian Caribbean
Seaflower Biosphere Reserve**

**Estructura de peces en tres áreas arrecifales con distintas acciones de manejo, Reserva de
Biosfera Seaflower Caribe Colombiano**

**Structure des poissons dans trois zones récifales avec différentes actions de gestion, Réserve de
biosphère des Seaflower des Caraïbes colombiennes**

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ABSTRACT

The Caribbean region contains a high diversity of fish and a large part of them are associated with coastal ecosystems, including coral reefs, despite the loss of coverage and coral species and the lack of management, the structure of the fish community is changing. Therefore, it was proposed to assess the structure of the fish community associated with the reef areas with different management actions in the San Andrés y Providencia Archipelago - Seaflower Biosphere Reserve. Visual censuses were carried out by diving, in 15 transects of 100 m² band, in three areas during the year 2019, on San Andrés Bajo Bonito Island (SBB) and Providencia Island Pináculos Norte (PPN) and Pináculos Parque (PPP), this last in the MacBean National Natural Park AMP (PNNMB). The results present a spatial gradient and direct relationship from lowest to highest, according to management actions. Thus in SBB the results show the lowest figures, in abundance (1548 individuals), richness (32 species), biomass (16,553 g / 100 m²), while in PPP the highest abundance (3717 individuals), richness (136 species) and biomass (112,023 g / 100 m²). Likewise, it is highlighted that the PPP area has several species that were categorized as threatened, which in other areas are decimated or absent, such as fish of commercial interest (groupers and chernas) and ecologically (parrotfish). In San Andrés there is greater overfishing and loss of habitat, which requires more effective management and on the island of Providencia the purpose of the PNNMB to conserve ecosystems and key species is contributing to fishing productivity and environmental sustainability.

KEYWORDS: Marine protected areas, fish assemblage, ichthyofauna

Contemporary and emerging fisheries in The Bahamas— Conservation and management challenges, achievements and future directions

Pesquerías contemporáneas y emergentes en las Bahamas — Desafíos de conservación y ordenación, logros y direcciones futuras

Pêcheries contemporaines et émergentes aux Bahamas — Défis, réalisations et orientations futures en matière de conservation et de gestion

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ABSTRACT

Marine resources are culturally and economically vital to The Bahamas and other small island developing states. Species including Caribbean spiny lobster (*Panulirus argus*), queen conch (*Lobatus gigas*), Nassau grouper (*Epinephelus striatus*) along with other fish and invertebrate species are sold both locally and to international markets. Illegal, unreported and unregulated fishing coupled with inadequate regulations and enforcement are the main factors contributing to the decline of Bahamian fisheries along with other anthropogenic impacts. Using case studies of economically and ecologically important species, we highlight conservation successes, knowledge gaps and deficiencies in existing management approaches. Ultimately by enhancing conservation management strategies for traditional and emerging fisheries, biodiversity loss can be mitigated, and ecosystem services can be improved for the benefit of the people of The Bahamas.

KEYWORDS: extractive fisheries, marine protected areas, recreational fishing

Founder effect in an invasive marine fish: the case of the lionfish *Pterois volitans* in the southwestern Caribbean

Efecto fundador en un pez marino invasor: el caso del pez león *Pterois volitans* en el suroeste del Caribe

Effet fondateur sur un poisson marin envahissant: le cas du poisson-lion *Pterois volitans* dans le sud-ouest des Caraïbes

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ABSTRACT

The lionfish *Pterois volitans* has become an invader of the greater Caribbean for more than a decade, and since then, the detailed study of its biology and attributes has become of great importance for understanding its impact on the dynamics and structure of ecosystems. Mitochondrial studies have shown that although lionfish have adaptive strategies that make him an excellent invader, its populations have suffered a drastic reduction in their genetic diversity due to the founder effect, and consequently, its evolutionary potential has been reduced. In order to confirm this, a mitochondrial DNA analysis was carried out and 10 novel species-specific nuclear microsatellite were designed. Samples were taken from two locations in the Southwestern Caribbean: San Andrés (SA) and Santa Marta (SM), during the initial period of the invasion (2009-2012). Mitochondrial analysis of the control region included 432 sequences (155 SA and 277 SM) that initially showed the presence of three haplotypes (H1, H2 and H4) in the invasive population of Colombia, and the arrival of a fourth haplotype (H3) represented by a single individual collected in San Andres in 2010. Moreover, a spatio-temporal nuclear analysis of 364 samples (187 of SA and 177 of SM) indicated significant deviation from Hardy–Weinberg equilibrium in all the loci due to an excess of homozygotes. Observed heterozygosity values (H_o) were below the expected heterozygosity (H_e) and no spatial differences were found between SA and SM. Nevertheless, temporal analysis showed annual differences between years, with a structure in four subpopulations $K = 4$. These results are evidence of the arrival of genetic material from the source population in the mentioned periods, with differences in reproduction rates of each cluster inside each location. Our findings clearly demonstrate the initial action of the founder effect on the invasive lionfish populations, represented in a high reduction of its genetic variability, deficit of heterozygotes, inbreeding processes and genetic drift, and therefore, in an increase in the expression of deleterious alleles and reduction of their adaptive potential, which constitutes a disadvantage for the success of this invasive fish.

KEYWORDS: Founder effect, Mitochondrial DNA, Microsatellite

Expansion of the invasive lionfish (*Pterois miles* and *Pterois volitans*) along the northern reef tract of Bermuda from 2014 - 2019

Expansión del pez león invasor (*Pterois miles* y *Pterois volitans*) a lo largo de la zona de arrecifes del norte de las Bermudas de 2014 a 2019

Expansion du poisson-lion invasif (*Pterois miles* et *Pterois volitans*) le long du récif nord des Bermudes de 2014 à 2019

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ABSTRACT

Bioinvasions have impacted Western Atlantic and Caribbean coral reef ecosystems, reducing their resilience and capacity to cope with other stressors. *Pterois miles* and *P. volitans*, originally from the Indo-Pacific and collectively known as lionfish, have now spread throughout the Western Atlantic, and pose a significant ecological threat to important native fishes and coral reef ecosystems. In 2000, Bermuda was the first jurisdiction outside of the United States to document non-native lionfish and, although they were initially uncommon, a lionfish culling program was established in 2008, and extensive surveys of lionfish densities and distribution across the Bermuda platform were carried out in 2013-14. Here we reassess the status and impact of the invasive population by repeating surveys of lionfish density, prey fish density, and prey fish biomass at five of the previously surveyed sites, across four depth zones: 10 m, 20 m, 30 m and 60 m, with a primary focus on the northern reef tract where initial lionfish densities were low and there has been little culling effort. Between 2014 and 2019, significant increases in lionfish density were found at sites along the northern reef tract at depths of 30 m and 60 m. Sites along the southern reef tract at 60 m depth with historically high lionfish densities maintained significantly greater lionfish densities than those on the northern reef tract. Prey fish diversity and biomass increased significantly at nearly all sites and depths. Notably, the XL site at 60 m experienced a significant reduction in lionfish density from 2014 to 2019, which is attributed to regular culling at that site. This reduction in lionfish density at XL coincided with a significant increase in fish biomass, highlighting the importance of active management to control lionfish populations.

KEYWORDS: bioinvasion, lionfish, prey fish

Microplastic studies in the Bay Islands, Honduras
Estudios de microplástico en Islas de la Bahía, Honduras
Études microplastiques dans les îles de la Baie, Honduras

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ABSTRACT

Approximately eight million metric tons of plastic enter the oceans every year. Microplastic in marine species have multiple effects like weight loss, reduced feeding activity, hepatic toxicity, change in behavior, endocrine alteration and even death. Plastics are associated with chemical additives which bioaccumulate and thus transfer to the rest of the food chain.

To date, there has been no studies on microplastics conducted in the Bay Islands National Marine Park (BINMP), Honduras. This study aims to determine the amount of microplastic pollution by processing the digestive tracts of varying species with potassium hydroxide (KOH). Furthermore, we will identify the organisms that these species are feeding on. Targeted species to be processed include: lionfish (*Pterois sp.*), commercial fishes and beached animal samples (Hammerhead shark (*Sphyrna lewini*), Beaked whale (*Mesoplodon europaeus*), hawksbill turtle (*Eretmochelys imbricata*) and Red footed booby (*Sula sula*)).

Results from this study will establish a baseline on microplastics in BINMP. Data will be presented to managers of the marine protected area to increase mitigation actions against marine litter.

KEYWORDS: Microplastic, Pollution, Lionfish