

ABSTRACTS FROM
POSTER SESSION

Diseño, Desarrollo y Fabricación de Cavas Isotérmicas para el Mejoramiento de Manejo Post-Captura y Cadena de Frio, en Productos Pesqueros en el Archipiélago de San Andrés, Providencia y Santa Catalina

Design, Development and Manufacture of Insulated Boxes for Improving Post-Capture Management and Cold Chain, in Fishery Products in the Archipelago of San Andres, Providence and Santa Catalina

Conception, Développement et Fabrication de Conservateurs Isothermes pour L'amélioration de la Manipulation Post-Capture et de la Chaîne du Froid, pour les Produits de la Pêche de L'archipel de San Andrés, Providence et Santa Catalina

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RESUMEN

En el Archipiélago de San Andrés, Providencia y Santa Catalina (RB Seaflower), la pesca artesanal está ligada fuertemente por tradición a la cultura de sus nativos, quienes han ejercido la pesca y agricultura para su sustento diario. Principalmente se realiza sobre las plataformas adyacentes a las islas, se lleva a cabo en embarcaciones de madera y/o fibra de vidrio, con tamaños desde los 12 hasta los 28 pies, con autonomía de 50 millas aproximadamente. El aumento del esfuerzo pesquero sobre los ecosistemas que soportan esta pesquería, ha generado que el pescador artesanal deba desplazarse a zonas de pesca más distantes para garantizar una buena producción. Debido a esto, los pescadores artesanales han venido desarrollando faenas de pesca con un tiempo promedio de 8 a 15 horas, con una captura entre 5 a 100 kg, dejando el producto pesquero en la cubierta, expuesto al sol o en algunos casos cubiertos con una manta. Este comportamiento se ha venido realizando porque los pescadores han considerado poco importante el proceso de la cadena de frío, ya que culturalmente nunca se ha desarrollado esta práctica para estos periodos de tiempo. El objetivo de este trabajo fue diseñar una cava que garantice la cadena de frío y promueva las buenas prácticas para estas faenas. El material de fabricación fue la fibra de vidrio reforzada con resina poliéster y espuma de poliuretano. En prueba realizada en campo se pudo determinar que la pérdida de temperatura de la cava en condiciones ambientales normales (20 a 29 grados Celsius), fue de un grado por hora. La aplicación de cadena de frío mejoraría, las condiciones del producto pesquero.

PALABRAS CLAVE: R.B. Seaflower, cavas, cadena en frío, faena de pesca, producto pesquero

The Contribution of Artificial Reef Use to the Coastal Economies of Florida

La Contribucion del Uso de Arrecifes Artificiales para las Economias Costeras de Florida

La Contribution de L'utilisation de Recifs Artificiels pour les Economies Cotieres de la Floride

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ABSTRACT

Florida reportedly has more permitted artificial reefs than any other state in the US. Artificial reefs have been deployed in state and federal waters all along the Gulf and South Atlantic Coast of Florida. A long history of deployment programs has been met with strong support by local communities who derive significant economic benefit from the use of the reefs by both commercial and recreational user groups.

Some reefs meet local demands, while other artificial reef deployments attract users from around the state and the nation. Some recent large ship deployments are good examples of artificial reef programs that have created a reputation for artificial reefs in Florida as premier dive destinations, while other reefs continue to provide access to local anglers and divers. The users of the reefs create economic activity as they purchase fuel, supplies, lodging and other items necessary for the utilization of the artificial reefs. Many non-residents utilize the reefs, who bring in new dollars to the local economies. Key user groups include both private boaters and the fore-hire sector. The economic contribution of these artificial reef users can be significant to the local economies where the use occurs, as well as the overall economy of Florida. This poster provides an overview of the studies that have been conducted with the goal of quantifying the economic activity and impacts associated with artificial reef use in Florida.

KEY WORDS: Artificial reefs, economic, impact

First Observation of Sea Cucumbers on Jamaica's Island Shelf

Primera Observación de Pepinos de Mar en la Plataforma Insular de Jamaica

Première Observation de Concombres de Mer sur le Plateau de L'île de la Jamaïque

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ABSTRACT

Sea cucumbers have gained popularity as a fishery resource in the Caribbean in recent years. This is largely as a consequence of their overfished status in parts of the Pacific where they are used for food and traditional medicine purposes for centuries. In the Caribbean they are not consumed except by very small oriental communities, for example in Jamaica. This study revealed that sea cucumbers have been quietly fished in Jamaica and exported in small quantities to markets in Hong Kong and Singapore for a significant period of time. However, there is no known body of information on the biology of sea cucumbers in Jamaica's waters. This is an unsustainable situation, as no fishery can be sustainable if biological information on the fished species is lacking. A small-scale study of the sea cucumbers was done between 2012 and 2013. Visual survey techniques were used to assess the animals observed at representative sites around Jamaica. Results strongly suggest that stocks existing in the areas investigated were very small. The dominant species were *Holothuria mexicana* and *Actinopyga agassizii*. This study suggests that Jamaican commercial buyers especially since 2010 have been purchasing both fresh and dried sea cucumbers for exportation. Most nearshore shallow (< 10 m) areas examined had depauperate populations possibly due to overfishing. The Fisheries Division of the Ministry of Agriculture and Fisheries has moved to regulate this fishery and an indefinite ban on sea cucumber fishing and exportation is in place from 01 September 2013.

KEY WORDS: Sea cucumbers, overfishing, *Holothuria*, management, Jamaica

**Resilience in Reef Crests of the East of the Gulf of Batabanó, Cuba,
and Probable Determining Factors**

**Resiliencia en Crestas Arrecifales del este del Golfo de Batabanó, Cuba,
y sus Factores Determinantes Probables**

**Résilience en Crêtes Arrecifales du L'Est du Golfe de Batabanó, Cuba,
et ses Facteurs Déterminants Probables**

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ABSTRACT

The degree of resilience of six reef crest sites was compared at the east of the gulf of Batabanó, Cuba. Three of them were located at the north of the gulf of Cazones (Northern Stretch), while the remaining ones at west of Cayo Largo (Southern Stretch). Those of the Northern Stretch were Cazones beacon, north of the crest of Diego Pérez key and Diego Pérez beacon. The remaining sites were those of the Rico key, Los Ballenatos reefs, and Hijos de Los Ballenatos reefs. The AGRRA biological indicators were applied. The Northern Stretch presented the most resilient crests, mainly that of Cazones beacon. Those of the Southern Stretch did not reveal signs of resilience. Several interrelated factors were apparently more linked to resilience. Four of them were considered as driving forces: shelter from waves, usual cyclonic revolving water circulation in the Cazones cove, nutrient input from the great Zapata swamp and deep water, and the abundance of the herbivore sea urchin *Diadema antillarum*. Triggered by these driving forces, the remaining factors apparently were: less effect of waves and sediments; stabilization of live coral fragments; favorable benthic macro-algae indices; some retention of nutrient and plankton; increased coral heterotrophic feeding; better conditions for recruit settlement and viability, and for coral re-sheeting; faster coral growth and recuperation; and better thermal conditions against coral bleaching. Unexpectedly, in these specific conditions, herbivore and carnivore fish average biomass and density did not reveal to exert a clear influence in inferred higher resilience at Cazones beacon reef crest.

KEY WORDS: Coral reef, resilience, driving factors, Cuba

The Role of Education in Lionfish Control and Management in the Caribbean

El Papel de la Educación en el Control y Gestión del Pez León en el Caribe

Le Rôle de L'éducation dans le Contrôle et la Gestion des Poissons - Papillons dans les Caraïbes

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ABSTRACT

The invasive lionfish is a venomous, voracious predator currently causing ecological and economic harm throughout the Caribbean. Since their confirmation in the Caribbean region over two decades ago, a variety of management schemes have been established to quell their future spread. Education is a key aspect which governs the success of any invasive species management program. In the Caribbean, lionfish education schemes range from simple, local means via posters, brochures and newspapers to television and radio announcements to more regional and international means via social media and the internet. In the Caribbean, lionfish education schemes have had varying success rates. The type of media utilised, the target audience and their literacy levels and reinforcement are instrumental factors which are often overlooked. Trinidad and Tobago, Anguilla and Bonaire represent islands which are all at different stages of the

lionfish invasion and the development of their education schemes. Trinidad and Tobago, newest to the lionfish invasion, represents an island whereby literacy levels were not taken into account which affected their further control. Anguilla, an island represents an island where the education scheme backfired and instilled a fear of lionfish, which meant that lionfish were not being removed and instead were being set free. Bonaire represents the island with the most established education program in this study which has built the foundation for its excellent lionfish management scheme. This study highlights the important role education plays in lionfish management; good education fuels good management, however when inadequately executed, management is severely hindered.

KEY WORDS: Lionfish, invasive species, control, management, education

La Infestación y Mitigación de los Impactos del Pez León en el Caribe Guatemalteco

The Infestation and Mitigate the Impacts of Lionfish in the Caribbean Guatemalan

L'infestation et Atténuer les Impacts du Poisson-lion dans la Caraïbes Guatémaltèques

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RESUMEN

El pez león (*Pterois volitans* y *P. miles*) ha estado presente durante los últimos 20 años en las aguas del Atlántico Occidental, sin embargo su presencia en el Caribe guatemalteco fue reportado hasta en el año 2007, constituyéndose una amenaza para el ecosistema de arrecifes, la pesca comercial y de subsistencia por lo que desde 2012 se han realizado trabajos de investigación y de mitigación de los impactos de esta especie. Las densidades de pez león, reportadas para el Caribe guatemalteco por Andrino (2012) oscilan entre 0.20 y 0.10 organismos/m². Esta información sirvió de evidencia del potencial peligro e incentivo a las organizaciones estatales, privadas y académicas para promover la investigación e implementar acciones para la reducción de los impactos causados por el pez león. Como estrategia de manejo se ha promovido la utilización de dicho pez capacitando a los pescadores nuevas técnicas de pesca, manipulación y preparación del pez león. Como parte de las capacitaciones se les ha enseñado a realizar buceos de cacería del pez león a pescadores y personas interesadas en el tema. Estas actividades han ayudado a promover el buceo en el Caribe guatemalteco y apoyar la economía en las poblaciones pesqueras locales. Uno de los retos a seguir es promover que los pescadores alcancen darle un uso alimenticio, económico y ecológico ya que ello colaborará directamente a la mitigación de este pez en los arrecifes del Caribe guatemalteco.

PALABRAS CLAVE: Impactos, reduccion , mitigar, economia, alimenticio

Assessing the Recruitment of Juvenile Fish Through the Use of Standard Monitoring Units (Smurfs) at the South Padre Island Culvert Reef

Evaluando el Reclutamiento de Peces Juveniles a través del Uso de las Unidades de Control Estándar (Smurfs) en la Isla del Padre Sur Alcantarilla Arrecife

Évalué le Recrutement des Juvéniles de Poissons À Travers L'usage D'unités Standards de Surveillance (Smurfs) au Récif en Buses de Béton de South Padre Island, Texas

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ABSTRACT

Artificial reefs along the Texas coast bring millions of dollars in revenue every year through sport fishing and SCUBA diving, and they have been promoted as a means to enhance fish stocks. In 2011 the Texas Parks and Wildlife Department deployed 4,000 concrete culverts seven miles off the coast of Port Mansfield, TX. These concrete culverts can serve as habitat for highly desired sport fish species in the Gulf of Mexico. Because the means of fish recruitment to artificial reefs is unclear and may be attributed to direct settlement or movement of larger individuals to the reef sites, the aim of this study was to assess juvenile fish recruitment at particular culvert reef configurations and compare them with observed adult fish populations. Standard monitoring units for measuring the recruitment of fishes (SMURF) were used in this study. Eighteen artificial coral SMURFs enclosed in anti-predator cages were deployed at nine sites in the artificial reef grid. The structures were placed in discrete habitat types of clumped, patchy, and bare areas. Because epi-faunal community development on an artificial reef varies seasonally, the SMURFs were sampled bi-monthly. Analysis of fish recruitment differences at each site was conducted, and juvenile recruits were quantified by size class to the lowest taxonomic level. The use of SMURFs to characterize fish recruitment at the clumped, patchy, and bare areas at this artificial reef is useful to determine its function as an attraction device for larger fish or as habitat for fish settlement.

KEY WORDS: Artificial reef, juvenile, recruitment, management, fishing

Non Lethal Aging of Goliath Grouper (*Epinephelus itajara*) in French Guiana

Determinación No Letal de la Edad del Mero Gigante (*Epinephelus itajara*) de la Guayana Francesa

Détermination Non Létale de L'âge des Mérus Géants (*Epinephelus itajara*) de Guyane Française

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ABSTRACT

Goliath grouper, *Epinephelus itajara*, live in tropical and subtropical waters of the Atlantic Ocean from Florida to the south of Brazil. While their fishing is still allowed in French Guiana, this species is listed as critically endangered on the IUCN red list and is protected in some countries. It is essential to know the age structure of the goliath grouper population in French Guiana to be able to suggest appropriate fisheries management. Groupers are usually aged using their otoliths, which is a lethal method. To avoid this impact, a non-lethal methodology using dorsal finrays was modified for goliath grouper in French Guiana. In a tropical environment such as French Guiana the contrast between seasons is not strong and hence the visualization of the growth zones in the finrays was less than for fish from higher latitudes. Finrays of French Guiana goliath grouper were therefore cut at various thicknesses to enhance the growth rings.

Although the reading of the finray sections was difficult due to the presence of false annuli or “checks”, the annular pattern in the finrays was consistently discernible when finrays were sectioned at thicknesses between 1.1 and 1.4 mm. Using this method, a total of 200 fish between 38 to 194 cm total length were aged between 2010 and 2011. Goliath grouper in French Guiana were aged from 1 to 16 years old, with a mean of 4 years old. This highlighted the observation that French Guiana currently houses mostly a juvenile population of goliath grouper.

KEY WORDS: Goliath grouper, French Guiana, age, finrays

**A Participatory Marine Resource & Space-use Information System for the Grenadine Islands:
The Sandy Island Oyster Bed Marine Protected Area**

**A Participativa de Recursos Marinos y el Uso del Espacio-Sistema de Información para la
Granadina Islas: La Isla de Sandy Oyster Bed Marine Protected Area**

**Un Marine Participative des Ressources et Système D'information D'origine Spatiale Utilisation
Pour les Îles Grenadine: Le Sandy Island Oyster Bed Aires Marines Protégées**

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ABSTRACT

Ecosystem-based management recognizes the variety of spatial interactions within an area, including humans, rather than considering single issues, species, or ecosystem services in isolation. To implement such an approach, a diversity of social, economic and environmental information from all existing sources is needed in a format that is both appropriate and accessible to all stakeholders. A participatory geographical information system (PGIS) approach was employed in the transboundary Grenadine Islands as a conceptual framework to integrate, analyze and share multi-disciplinary and multi-knowledge information to assist ecosystem-based management. The resulting Grenadines Marine Resource and Space-use Information System (MarSIS) brings together a variety of information and can be used to uniquely identify areas important for conservation and livelihood, ultimately assisting ecosystem-based management and transboundary marine spatial planning. Here the potential of the MarSIS is showcased using the newly established Sandy Island Oyster Bed Marine Protected Area (SIOBMPA) in Carriacou, Grenada as a case study. The utility of PGIS specifically the ways in which information can be brought together, visualized and analyzed to create practical baseline inventories on marine habitats, resources and associated human activity of the SIOBMPA is illustrated.

KEY WORDS: Ecosystem-based management, participatory GIS (PGIS), Grenadine Islands, marine resource and space-use information, Sandy Island Oyster Bed Marine Protected

Actividades de Estudio y Conservación de Especies Claves en el Archipiélago de San Andrés, Providencia y Santa Catalina, Reserva de Biosfera Seaflower

Study and Conservation Actions of Key Species in the San Andres, Old Providence and Kethleena Archipelago, Seaflower Biosphere Reserve

Les Activités D'étude et de Conservation des Espèces Clés dans L'archipel de San Andrés, Providencia et Santa Catalina, Réserve de la Biosphère De Seaflower

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RESUMEN

La Corporación para el Desarrollo Sostenible CORALINA en busca de continuar las acciones de protección, conservación y uso sostenible de los ecosistemas estratégicos y los recursos naturales de la Reserva de Biosfera *Seaflower* -RBS-, aunó esfuerzos con la Gobernación del Departamento de San Andrés, Providencia y Santa Catalina para aumentar el conocimiento y mejorar la gestión frente a la conservación y manejo de especies amenazadas y su ecosistema, así como para el mejoramiento del control de especies invasoras en la RBS. Las acciones a realizar comprenden actividades de estudio y conservación de varias especies claves en el Archipiélago que incluyen: educación y sensibilización a través de jóvenes sobre las tortugas marinas; monitoreo de distribución y abundancia, estudio de aspectos reproductivos del *whelks Cittarium pica*; implementación de un protocolo de monitoreo de peces arrecifales con énfasis en peces loro (*Scarus* spp., *Sparisoma* spp.); monitoreo de abundancia de púerulos (postlarvas) de la langosta espinosa *Panulirus argus*; diseño de estrategias de conservación y manejo de tiburones; implementación un programa de monitoreo de abundancia y generación de acciones de control del pez león, así como diseñar estrategias de estímulo para su consumo. A través de estas actividades se le da continuidad a la implementación de las Áreas Marinas Protegidas *Seaflower* y para que se puedan aprovechar sosteniblemente los recursos naturales y el medio ambiente, a través de prácticas (culturales, sociales y económicas) sensatas con el medio ambiente en la Reserva de Biosfera Seaflower.

PALABRAS CLAVE: Archipiélago de San Andrés , Providencia, Reserva de Biosfera Seaflower, Areas Marinas Protegidas, especies clave

Desarrollo Histológico de los Ovarios de la Langosta Espinosa, *Panulirus argus* (Latreille, 1804), en la Zona Costera del Departamento del Atlántico, Caribe Colombian

Oovarian Histological Development of Spiny Lobster, *Panulirus argus* (Latreille, 1804), in the Coastal Zone of Atlantic Department, Colombian Caribbean

Développement Histologique des Ovaires le Langouste Blanche, *Panulirus argus* (Latreille, 1804), dans la Zone Côtière de L'atlantique Département, Caraïbes Colombiennes

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RESUMEN

En desarrollo del proyecto Validación de las nasas tipo hondureña para la captura de langosta espinosa, *Panulirus argus* (Latreille, 1804), en la zona costera del Departamento del Atlántico, ejecutado por la Universidad Simón Bolívar

de Barranquilla, se colectaron 1353 ejemplares procedentes de faenas de investigación con el objeto de determinar la evolución histológica de sus ovarios. A cada ejemplar se le tomó información biométrica, peso de las gónadas y estado de desarrollo gonadal. Las muestras fueron fijadas en formol al 5% y se realizaron cortes histológicos. El estudio permitió establecer que la langosta espinosa presenta crecimiento y desarrollo de ovocitos dentro de sacos foliculares en los cuales se llevan a cabo las etapas de desarrollo ovocitario: previtelogénesis y vitelogénesis. Los ovocitos vitelogénicos se sitúan en la periferia de los sacos foliculares, en tanto que los previtelogénicos se localizan en el centro. Se identificaron células en diferentes estados de desarrollo: ovogonias, ovocitos cromatina nucléolo, ovocitos perinucleolares, alveolos corticales, en inicio de vitelogénesis, vitelogénicos y ovocitos maduros. Estas observaciones indican que la langosta espinosa presenta un desarrollo gonadal de tipo asincrónico en más de dos grupos, dado que se observó un lote de ovocitos próximo a la puesta y varios lotes más en diferentes estado de desarrollo, incluyendo el lote de ovocitos de reserva, característico de las especies de zonas tropicales que se reproducen durante todo el año.

PALABRAS CLAVE: Langosta espinosa, *Panulirus argus*, desarrollo histológico, Caribe colombiano

A Land Based Monitoring Technique to Study the Abundance and the Distribution of Lemon Sharks Juveniles (*Negaprion brevirostris*) in the Nature Reserve of the Islets of Petite Terre (Guadeloupe, Lesser Antilles)

Una Técnica de Observación desde el Litoral para el Estudio de la Abundancia y de la Distribución de Tiburones Limón Juveniles (*Negaprion brevirostris*) en la Reserva Natural de Petite-Terre (Guadeloupe, Antillas Menores)

Technique de Suivi à Partir du Littoral de L'abondance et de la Distribution des Juvéniles de Requins Citron Juvéniles (*Negaprion brevirostris*) dans la Réserve Naturelle des Ilets de Petite Terre (Guadeloupe, Petites Antilles)

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ABSTRACT

Observations of lemon sharks are becoming nowadays more frequent in the *Réserve Naturelle de Petite Terre* in Guadeloupe (Lesser Antilles). The purpose of this study was to set up a monitoring protocol to answer the questions on the distribution and the abundance of juvenile lemon sharks, taking into account the environmental characteristics of the studied site (no mangrove and presence of beach rock). The tracking protocol developed is new for shark survey. The principle is to walk along the shore around the islets (referred transect) and to record each observation of juvenile sharks. In addition, sharks were captured to be marked with external tags able to be identified by visual information in the field.

Preliminary results showed the presence of 19 juvenile lemon sharks around the islet of Terre-de-Bas. These individuals, from different age groups, were observed along the transect (except in one site). However, the tagging of 15 individuals has revealed that each juvenile used specific home ranges that vary in size and location. This protocol will soon be used in other sites such as the Island of Saint-Martin.

KEY WORDS: Lemon shark, Lesser Antilles, transect technique, tagging, protected area

An Analysis of Spiny Lobster Movement Patterns: A Comparison of Two Sub-Populations Residing North and South of the Florida Keys, Florida, USA

Un Análisis de los Patrones de Movimiento de la Langosta Espinosa: Una Comparación de dos Subpoblaciones que Residen al Norte y al Sur de los Cayos De Florida, Florida, USA

Une Analyse des Habitudes de Déplacement de la Langouste: Une Comparaison des Deux Sous-Populations Résidant au Nord et au Sud de la Florida Keys, en Floride, USA

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ABSTRACT

Using acoustic monitoring technology, we tracked the movements of adult and sub-adult lobsters in two distinct habitats. The first area is the Western Sambo Ecological Reserve (WSER) south of the Florida Keys which contains numerous coral and rocky outcrops providing numerous natural shelters. Tagging studies occurred during the summer between 2003 and 2007 using a total of 143 tags. The second area is in the Gulf of Mexico north of the Florida Keys. The tagging study occurred during the summer of 2011 using a total of 31 tags. This area is relatively shelter poor but also contains numerous artificial shelters (casitas) used to concentrate lobsters for fishing. In both areas we deployed arrays of acoustic receivers to track lobsters fitted with acoustic transmitters. Although technical difficulties reduced the effectiveness of the tracking array in the Gulf of Mexico, we found that some overall daily movement patterns were similar in both areas. The daily probability of a spiny lobster shifting its location greater than 300 m was 9% in the Gulf and 10% for similar sized lobsters in WSER. Movement patterns were markedly different. All Gulf of Mexico lobsters moved to the west (between 225 and 295 degrees) whereas in WSER, movements could occur in any direction.

KEY WORDS: Spiny lobster, Florida, acoustic, movement

Lobster Artificial Shelters: Financial Alternatives for Responsible Managing of Fishing Areas, Pilot Project in Punta Gorda and Guanaja, Bay Islands, Honduras

Refugios Artificiales: Alternativas Económicas para Manejar Áreas de Pesca Responsable, Proyecto Piloto en Punta Gorda y Guanaja, Islas de la Bahía, Honduras

Refuges Artificiels de Langouste: Alternatives Économiques pour la Gestion Responsable de Zones de Pêche, Projet Pilote à Punta Gorda et Guanaja, Îles de la Baie, Honduras

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ABSTRACT

In 2010, the National Marine Park of the Bay Islands was created with an area of 16,000 hectares. This park has extensive live corals coverage: a natural breeding area for a great variety of marine organisms. It is an evidence for local fishermen, that there is a need in this park to create, define and delimit areas which are essential for the protection and the conservation of fisheries resources. Artisanal fishermen of Guanaja and Punta Gorda face different challenges in their livelihood, consequently they have expressed interest in learning about the functioning of the Cuban Casitas (lobster shadows), which are artificial shelters that enable sustainable fishing of spiny lobster and the improvement of their economy. According to research already conducted in the region of the Mesoamerican Reef, this artificial shelter initiative should consider three factors -biological, ecological and social- before its application. This knowledge will ensure the

success or failure of the project. The fishermen of Punta Gorda and Guanaja communities consider that the first step is to be legally registered into an association of Artisanal Fishermen, in order to participate in the management and get better benefits of productive projects. Another important factor that fishermen consider essential is the declaration of a pilot area as an exclusive fishing area, managed by members of Fishermen's Associations. Besides, they recognize the importance of establishing criteria to make an equitable distribution of benefits within the association, developing regulations and marketing the product under the guidance of responsible seafood consumption.

KEY WORDS: Management, fishermen, associations, economy, resources

Age and Growth Characteristics of Lesser Known Species of Reef Fish from the Southeastern United States

Características de la Edad y el Crecimiento de las Especies Menos Comunes de Peces de Arrecifes del Sureste de Estados Unidos

Âge et les Caractéristiques de Croissance des Espèces Moins Connues de Poissons de Récif du Sud-Est États Unis

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ABSTRACT

Ageing studies of species that are abundant in recreational and commercial fisheries landings provide valuable information about growth and age at maturity. In the southeastern U.S., the Southeast Data, Assessment and Review (SEDAR) process is a driving mechanism behind which species are the subject of ageing studies. Since SEDAR's inception in 2002, stock assessments have been completed or scheduled for 20 reef fish species in the South Atlantic, 13 species in the Gulf of Mexico, and 11 species in the U. S. Caribbean. Age-growth studies are time- and labor intensive, and stock assessment demands limit the ability of staff to conduct studies on reef fishes that are less abundant in the landings. These species may nonetheless be important for a variety of reasons (e.g., top predators in reef ecosystem, indicators of ecosystem health, valuable trophy fish, and commercial value). Species which occur infrequently in sampled catches require more time to accumulate sufficient biological samples to conduct a proper ageing study. We attempt in this poster to offer a preliminary look at age-growth characteristics of four less commonly occurring species of reef fishes: yellowmouth grouper (*Mycteroperca interstitialis*), n = 391; yellowfin grouper (*Mycteroperca venenosa*), n = 277; warsaw grouper (*Epinephelus nigritus*), n = 188; and cubera snapper (*Lutjanus cyanopterus*), n = 96. All fish were aged using sectioned otoliths, and growth curves were generated using von Bertalanffy growth models. Information about growth rates of less common species will be critical to the effective management of those species, particularly as more common species come under increasing regulations and harvest restrictions.

KEY WORDS: Ageing, stock assessment, less common species

**The National Natural Reserve of Saint-Martin:
A Well Managed and Recognized Marine, Terrestrial and Lake Protected Area**

**Reserva Natural Nacional de Saint-Martin:
Un Área Marina, Terrestres y Lacustres Protegida Manejada Reconocido**

**La Réserve Naturelle Nationale de Saint-Martin:
Une Aire Protégée Marine, Terrestre et Lacustre Gérée Reconnue**

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ABSTRACT

The National Natural Reserve of Saint-Martin represents about 3 054 hectares of natural marine, terrestrial, and lake areas protected since september the 3rd of 1998. The management of the areas was entrusted to the Association de Gestion de la Réserve Naturelle Nationale de Saint-Martin, according to a Management Plan setting and prioritizing managing goals for five years. These managing goals are to promote the improvement of knowledge on protected areas, to control the anthropological impacts, to extend the management to new areas, to restore degraded backgrounds and populations, to promote environmental education, to optimize the use of resources and to develop regional cooperation. The Conservatoire de l'Espace Littoral et des Rivages Lacustres owner of these protected areas has also entrusted the management of 14 ponds on the french part of the Island. Conservancy and management developed by both entities in recent years has been recently recognized and rewarded by a double labelling from RAMSAR (2011) and SPAW (2012) protocols. These dual certification is rewarding the work performed the last 15 years and opens new opportunities to the manager, as well as for the MPA.

KEY WORDS: MPA, Saint-Martin, management, SPAW, RAMSAR

**All Boom and No Bust as the Lionfish Invasion
Progresses in Bacalar Chico Marine Reserve, Belize**

La Invasión del Pez León Crece sin Cesar en la Reserva Marina Bacalar Chico, Belice

L'invasion des Poissons Lions S'agrandit dans Fin dans le Réserve Marine Bacalar Chico, Belize

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ABSTRACT

Lionfish (*Pterois volitans*) were introduced to the Atlantic in the 1980s, with the first confirmed sighting in Belize in 2008. The species is now well established throughout the country, promoting concerns for threatened fish stocks and overall coral reef health. The mean frequency of lionfish sightings in Bacalar Chico Marine Reserve, northern Belize, increased between 2011 (1.9 fish/hr \pm 0.1 SEM) and 2012 (2.7 fish/hr \pm 0.2 SEM), coupled with a significant upward shift in size class frequency distribution ($\chi^2 = 333.74$, d.f. = 4, $p < 0.01$). The majority of sightings (89%) were made on the forereef. Culled lionfish were dissected to record stomach contents, sex and maturity. A change in diet was observed between years: in 2011, the majority of prey items were fish, including parrotfish, wrasse, damselfish and grouper. However, in 2012 invertebrates, predominantly shrimp, comprised the majority of the diet. A similar change in lionfish diet has been observed in Port Honduras Marine Reserve, southern Belize. Results also confirm that lionfish in Belize reproduce throughout the year. With market development heralded as the most feasible management solution to

prevent lionfish population growth and spread, protected areas may provide a refuge not only for native species, but also lionfish. Given that consistent removal of more than one third of the population is required to prevent population growth and expansion, an open-minded approach to developing alternative management solutions for the invasion within protected areas must be applied.

KEY WORDS: Lionfish, status, management, protected area, Belize

Biorock Production for Reef Restoration

Producción de Biorock por Restauración de Arrecifes

Biorock Production pour la Restauration des Récifs

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ABSTRACT

The use of electrified metals to aggregate carbonates has been shown to accelerate the growth of calcareous organisms, such as corals and oysters. This method accelerates coral growth up to 3 - 5 times relative to normal rates. The method includes installing a cathode and an anode in the electrolyte and applying an electrical current at a low voltage across the cathode and the anode to induce electrolysis. This method increases recruitment and enhances growth of calcareous organisms in the vicinity of the cathode. Pieces of rebar ranging from one inch to six inches were pre-weighed, then exposed to experimental conditions for 3 - 4 weeks. Final weights of rebar were collected, and SEM and photomicrographs were taken of each sample of these replicated experiments weekly. We evaluated voltage (intensity and type), and polarity to optimize conditions for carbonate accretion. Initial laboratory experiments established that direct current resulted in maximal weight increase in carbonates. A second laboratory experiment was used to determine optimal voltage. Through the analysis of the growth trends and photographs of the lab structures, the best power source and voltage were chosen that result in 15 mm carbonate accretion over the study period. We built 3 - 4"x1" reefs and deployed these in Packery Channel, Corpus Christi Bay for 3 weeks to assess efficiency and growth rate in the field.

KEY WORDS: Biorock, electrolysis, oyster, calcium carbonate, restoration

Spatial Fidelity of Juvenile Goliath Groupers, *Epinephelus itajara*, in a Mangrove Area: Implications for Conservation

Fidelidad Espacial de Meros Juveniles, *Epinephelus itajara*, en Áreas Manglares: Implicaciones para su Conservación

Fidélité Spatiale des Juvéniles du Mérrou Géant, *Epinephelus Itajara*, dans une zone de Mangrove: Implications pour la Conservation

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ABSTRACT

In northeastern Brazil, the estuarine complex of Rio Formoso (PE), formed by the Ariquindá, Formoso and Passos

Rivers, is enclosed in two Environmental Protection Area (EPA): the EPA of Guadalupe and the federal EPA Costa dos Corais - the largest marine conservation unit with an extension of over 135 km of coastline. This area is characterized by a large diversity of coastal ecosystems such as mangroves, seagrass beds, sand banks and coral reefs that together form a complex network of energy transfer that sustain shelter and food for several species throughout their life cycle. The federally protected goliath grouper, *Epinephelus itajara*, is a mangrove-dependent species that show a remarkable ontogenetic shift with juveniles being found in mangrove areas and adults on coral reefs, patch or rocky reefs and artificial structures. To study the distribution and movement of juvenile groupers in different areas of the estuary, using conventional tagging, we surveyed the artisanal camboa, performed by the fishing communities of the surrounding area, and used traps manzuá to capture larger juveniles groupers. The results show a large vulnerability of the goliath grouper with a capture of 0.04 individuals/100 m of net by the camboa fishing and 0.07 individuals/trap. Also, the high recapture rate, 20.4%, helps proving the high spatial fidelity of the juveniles while in the estuary. This study aims to further define spatial fidelity and distribution patterns of this species in the area, using acoustic telemetry, as well as to help designing and implementing new management policies.

KEY WORDS: Conventional tagging, recapture, marine protected area

Pesquerías Sostenibles en la Región Occidental del Archipiélago Cubano: Papel de la Educación Ambiental

Sustainable Fisheries in the Western Cuban Archipelago: The Role of Environmental Education

Pêcheries Durables dans la Région Ouest de L'archipel Cubain: Le Rôle de L'éducation

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RESUMEN

La educación ambiental busca armonizar las relaciones que se establecen entre el hombre y el medio ambiente, promoviendo acciones educativas para garantizar un mejor uso de los recursos naturales. La experiencia en el campo de la Educación Ambiental alcanzada por Cuba es alta, existen un gran número de organismos que contribuyen con sus acciones a eliminar o minimizar los problemas ambientales existentes en las comunidades pesqueras así como la explotación sostenible de los recursos pesqueros. En la actualidad es evidente que los problemas ambientales tienen su fundamento en fenómenos sociales y por tanto los cambios en este sentido tienen que modificar radicalmente las formas de apropiación de la naturaleza y sus transformaciones tecnológicas en comparación con las formas tradicionales, así como la influencia social en la gestión de pesquerías sostenibles. El presente trabajo tiene como objetivo mostrar los resultados obtenidos a partir de la aplicación de un programa de educación ambiental en comunidades pesqueras de la región occidental del archipiélago cubano a partir de: ausencia de normas en su relación con el medio ambiente, poco conocimiento de la vida en el mar y su relación con la costa, deterioro ambiental y falta de conciencia y gestión propia ante los problemas de la comunidad. Se aplica una metodología de investigación científica –acción–participación.

PALABRAS CLAVE: Environmental education, sustainable fisheries, fishing communities, Cuba

Queen Conch Demography Influences Reproductive Behavior and Fecundity: Implications for Fisheries Management

Demografía Influencia el Comportamiento Reproductivo y la Fecundidad del Caracol Rosado: Implicaciones para el Manejo de la Pesquería

Influences de la Démographie Comportement en Matière de Procréation et de la Fécondité: Implications pour la Gestion de la Pêche

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ABSTRACT

Queen conch (*Lobatus gigas*) are harvested intensively throughout the Caribbean for their meat, shell, and pearls. To ensure sustainability, fishery management strategies need to consider the distinctive biology of the species (e.g. density-dependent reproduction, determinate growth). In this vein, it is unknown if fecundity is influenced by size and age as in fish and lobster. Therefore, managers need to know if fecundity declines with age (i.e. thicker lips), and if so, does compensation occur by increasing mating and spawning frequency. We tracked 22 female conch at Looe Key, Florida and collected all egg masses laid from June to August 2011. Conch were grouped into age classes based on lip thickness: young adult 11 - 15 mm, adult 15 - 25 mm, very old > 25 mm. Female fecundity (i.e. the estimated number of eggs in an egg mass) showed no significant difference among age groups. However, transect surveys of spawning aggregations throughout the Florida Keys from 2003 - 2011 showed that young adults did not mate or spawn as frequently as adults and very old adults ($p < 0.001$). So while age does not seem to affect an individual's fecundity, young adults as a group have lower reproductive output because they do not engage in reproductive activities as frequently as older individuals. As such, population demographics play a crucial role in recovery and/or sustainable harvest. This argues for incorporating management approaches that maximize reproductive output from mature aggregations whose densities exceed minimum thresholds to avoid Allee effects.

KEY WORDS: Queen conch, fecundity, reproduction, age, lip thickness

Using a Landing Cradle to Fill the Data Gap Left by Really Big Fish

El Uso de un Soporte para Llenar el Vacío de Información Dada por los Peces Grandes

L'utilisation d'un Berceau pour Comblar le Vide de Données Donnée par les Gros Poissons

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ABSTRACT

In 2006, the Dauphin Island Sea Lab (DISL) began conducting bottom longline surveys along the north central Gulf of Mexico. The data gathered from these surveys are used to make ecological connections between organisms and their environment, as well as inform stock assessment models and the resulting management decisions. While DISL has caught and gathered data on thousands of fish since beginning the program, the gear available on the vessels did not allow for accurate measurements on large species that could not be safely boated. While encounters with these large fish provide valuable catch and effort data, our inability to boat them precludes precise measurements and maturity status determinations. To address these limitations, in 2010 the DISL developed a low-cost landing cradle to safely lift large fishes onto the deck of the boat. The implementation of this cradle has resulted in accurate length measurements of an additional 74 large coastal sharks across 8 species. The addition of a spring scale in 2013 has provided weight data for 14 large sharks that would otherwise have gone unweighed. Our preliminary results demonstrate how the integration of a landing cradle into longline surveys provides researchers a safe platform for accurately inserting intramuscular tags,

getting precise (mm) length measurements, taking blood and tissue samples, and getting proper sex and sexual maturity information. Given current harvest restrictions (for example, closure of the commercial fishery for Sandbar shark *Carcharhinus plumbeus*), the landing sling is an additional tool researchers can employ to gather increasingly important life history data for shark populations recovering from overexploitation.

KEY WORDS: Fish, methods, cradle, shark, sampling

Effect of Season and Scale on Power to Detect Change in Mangrove Fish Assemblages

Efectos Temporales y de Escala como Poder para Detectar Cambios en Comunidades de Peces de Mangle

L'effet du Saison et de L'échelle sur la Probabilité de Découvrir des Changements dans les Assemblages des Poissons dans les Mangroves

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ABSTRACT

An expansion is underway of a nuclear power plant on the shoreline of Biscayne Bay, Florida, USA; the effects of its construction and operation on surrounding marine habitats and fishes are unknown. The fringing intertidal mangrove stands that border the power plant property are critical habitat for a number of fish species of ecological and commercial importance. The present study examined data gathered as part of an ongoing monitoring survey of mangrove fish communities. Our objective was to determine the adequacy of the survey to detect fish community changes, should they occur, at three spatial scales. Using seasonally-resolved data recorded during 477 fish surveys over a 5-year period, power analyses were performed for three metrics: fish diversity, fish density and the occurrence of two ecologically-important fish species (*Lutjanus griseus* and *Floridichthys carpio*). Results indicated that the monitoring study at current sampling intensity allows for detection of a < 30% change in fish density and diversity metrics in both the wet and the dry season. However, sampling effort is insufficient in either season to detect a < 30% change in species-specific occurrence metrics for the two important fish species examined. More effective monitoring strategies could be achieved by increasing sampling intensity within each season until effort allocation is sufficient to detect 30% change for each metric after only one year of post-impact sampling. Responsible monitoring practices are increasingly important in light of cumulative impacts to the coastal zone resulting from hydrological alteration, coastal development and water quality degradation, among others.

KEY WORDS: Mangrove, assessment, fish assemblage, monitoring, power

Vertical Longline Gear Performance on Artificial Reefs of the Texas Coastal Bend

Rendimiento de los Palangres Verticales en los Arrecifes Artificiales de Texas Coastal Bend

Les Performances de la Palangre Verticale sur les Récifs Artificiels du Texas Coastal Bend

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ABSTRACT

Fishery-independent surveys provide a means to acquire standardized abundance and diversity data that are adequately replicated over time and space. The standardization of these surveys control gear and/or sample-related variability which allows researchers to assess the impact of seasonality, habitat, and a variety of other factors that affect abundance fluctuations of fisheries species. Following the Southeastern Area Monitoring and Assessment Program (SEAMAP) protocol we recently implemented a vertical longline (VLL) survey for demersal fishes inhabiting artificial reefs of the Texas coast. These reefs are dominated by cutoff and toppled oil and gas platforms which vary in complexity, size, water depth and distance from shore. Three hook sizes (15/0, 11/0 and 8/0) were used to sample reefs varying between 30 and 60 m total depth. A subset of the deployments was accompanied by a GoPro© camera to supplement catch data with visual estimates of abundance, depredation events, and escapes. Neither hook size nor drop order affected the number of fish captured or seen, suggesting there was no enhanced baiting by larger gear or prolonged deployment times. The abundance and diversity of catch per deployment was not affected by the addition of the GoPro© camera. Preliminary results show a positive correlation between fish size (total length and weight) and hook size while diversity decreases as hook size increases. Our findings indicate that vertical longline surveys are a valid assessment tool for estimating fish abundance on Texas artificial reefs. However, as has been demonstrated elsewhere, VLL gear tends to target Red Snapper.

KEY WORDS: Artificial reef, vertical kongline, red snapper, Texas, demersal fish

Characterization of Diet Composition of the Lionfish, *Pterois volitans*, at Turneffe Atoll, Belize

Caracterización de la Dieta Composición del Pez León, *Pterois volitans*, en Turneffe Atoll, Belice

Caractérisation de Régime Composition de la Rascasse Volante, *Pterois volitans*, à Turneffe Atoll, Belize

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ABSTRACT

Examining the feeding ecology and dietary composition of an invading species is critical for understanding the impact of the invader on the indigenous populations and community structure. The indo-pacific lionfish has emerged as the preeminent marine invasive species in the Caribbean. Here we examined a Western Caribbean reef community at Turneffe atoll in Belize. We visually inspected the stomach contents of 255 lionfish from 7 sites around the atoll. Sixty-five percent of the lionfish stomachs contained identifiable individuals, while 19% were completely empty. Four different orders of invertebrates were identified, and 15 species of teleosts from 11 families. The bluehead wrasse (Labridae), *Thalassoma bifasciatum*, and the masked goby (Gobiidae), *Coryphopterus personatus*, accounted for 59% of all identified teleost specimens. However, 43% were unidentifiable specimens due to advanced digestion, DNA barcoding analysis may reveal the identity of these digested contents.

KEY WORDS: Lionfish, diet composition, feeding ecology, invasive species, stomach content

Glover's Reef Marine Reserve (GRMR) Charting the Way Forward for Improved MPA Management in Belize

Reserva Marina de Arrecife de Glovers (GRMR) Traza el Camino a Seguir para Mejorar la Gestion AMP en Belice

Reserva Marine de Glover Reef (GRMR) Tracer la Route à Suivre pour Améliorer Marin Protégé la Zone Gestion au Belize

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ABSTRACT

Up to a couple of years ago, all the Belize fishing waters were managed under an open-access system. Under this system, fishers are driven by a race to fish with little regard to regulations, as their primary objective is to maximize profits in the shortest length of time. The number of licensed commercial fishers in Belize has increased steadily, and fishers target two fully-exploited species, conch and lobster. The increasing number of fishers translates to insecure livelihoods, unstable incomes, and diminishing local, sustainable sources of protein. GRMR is one of two marine reserves in Belize managed under a rights-based regime called managed access that was introduced in mid-2011. This program provides traditional fishers a secure, dedicated share of a fishing area. It encourages fishers and local communities to become stewards of the marine reserve, by ensuring that they benefit from conserving the resources – leading to resource sustainability and secure livelihoods. Managed access strengthens the role of the fully-protected replenishment zones by improving patrols through better planning and reporting, and increasing penalties via a “three strike” rule. Preliminary results are very positive, showing an increase in catches and catch-per-unit-effort (CPUE) of conch over the past three years. The number of infractions, as well as their gravity, has also been reduced. These results are attributed to better enforcement and a more responsible cohort of fishers using the atoll. Encouraged by these improvements, the GRMR staff continues to work with its partners to seek innovative ways to strengthen management effectiveness of the reserve.

KEY WORDS: Rights-based management, Belize, open access, replenishment zones

Ciguatera Fish Poisoning in the Northwestern Gulf of Mexico

Intoxicación por Ciguatera Peces en el Noroeste del Golfo de México

Empoisonnement du Ciguatera Poisson dans le Nord-Ouest du Golfe du Mexique

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ABSTRACT

In 2007, the Food and Drug Administration (FDA) confirmed a case of ciguatera fish poisoning (CFP) from a Gag Grouper caught in the Flower Garden Banks National Marine Sanctuary (FGBNMS). As a response, researchers from FGBNMS and University of Texas Marine Science Institute sampled 12 species of fish around the FGBNMS for ciguatoxins. The analysis by FDA resulted in high levels of ciguatoxins in 13% of the sampled fish, leading FDA to issue a letter of guidance to seafood processors recommending they avoid purchasing large carnivorous reef fish caught near FGBNMS. In 2011, FGBNMS researchers were notified of another CFP case from the consumption of Grouper caught within the sanctuary, which was confirmed by the FDA. This led FGBNMS and FDA to begin a collaborative study to

reexamine ciguatera in the Northwestern Gulf of Mexico. The study is examining the concentrations of ciguatoxins in a variety of carnivorous reef fish species, as well as concentrations of ciguatera causing dinoflagellates (*Gambierdiscus* spp.) found on algae. Ongoing opportunistic fish sampling is currently underway, looking at various species of Snapper, Grouper, Jack, and Mackerel, and invasive Pacific lionfish, as well as other commercially and recreationally important species. In order to more fully understand the human health issues of consuming fish caught in the sanctuary, FGBNMS researchers are also investigating mercury levels of sampled fish species.

KEY WORDS: Ciguatera, Flower Garden Banks National Marine Sanctuary, *Gambierdiscus*, Gulf of Mexico, mercury

**Benthic Community Composition Associated with a Gas Platform, High Island A-389-A,
Located within the Flower Garden Banks National Marine Sanctuary**

**Composicion de la Comunidad Bentonica Asociada a una Estructura de Petroleo, Hi-A-389-A,
Ubicado dentro de Flower Garden Banks National Marine Sanctuary**

**Composition de la Communauté Benthique Associee a une Structure de Petrole, Hi-A-389-A,
Situe au Sein de Flower Garden Banks National Marine Sanctuary**

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ABSTRACT

The High Island A-389-A (HI-A-389-A) gas platform is located within the boundaries of the Flower Garden Banks National Marine Sanctuary (FGBNMS) in the Northwestern Gulf of Mexico. The platform emerges from 124 meters water depth, 185 kilometers southeast of Galveston, Texas, and is 1.6 km from the coral reef crest of the East Flower Garden Bank. HI-A-389-A was installed in 1981 and has developed a complex benthic and fish community over the past thirty two years by providing hard substrate within the water column. Much scientific debate has centered on what role oil and gas platforms and other artificial reefs play in the larger Gulf of Mexico ecosystem and what their relationship and level of similarity is to natural coral reefs. FGBNMS research team divers conducted benthic surveys of the vertical and horizontal structures of the platform to document the biological components from forty meters depth to the surface. The benthic community of the platform did not resemble the coral reefs of the FGBNMS and was dominated by fouling organisms. The dominant coral species on the platform was an invasive species of *Tubastraea*. Relatively few native hermatypic coral colonies were recorded.

KEY WORDS: Platform, coral reef, artificial reef, *Tubastraea*, Flower Garden Banks

**A Preliminary Analysis of Community-Based Live Fish Monitoring
in Four Fish Sanctuaries in Jamaica**

**Un Analisis Preliminar de Seguimiento Comunitario Peces Vivos
en Cuatro Santuarios de Pescado en Jamaica**

**Une Analyse Preminiaire de Suivi Communautaire de Poissons Vivent
dans Quatre Sanctuaires de Poisson en Jamaïque.**

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ABSTRACT

Data collection within Marine Protected Areas (MPAs) and fish sanctuaries have traditionally been done by teams of scientist with specialized skills. The Caribbean Fish Sanctuary Partnership (C-FISH) Initiative has, so far, initiated the Community-based Live Fish (CLIF) methodology in five fish sanctuaries or MPAs in Jamaica and one in the Eastern Caribbean. This methodology involves fishers, wardens and community members, utilizing activities similar to fishing methods they already employ in the trap fishery within their respective islands. CLIF involves catching fish using traditional fish traps over a one month period, with two day soak times. Fish were anesthetised using a natural product (clove oil), identified, weighed, and measured. After recovery from the anesthetic, fish were released using a specially designed container to ensure safe transition to the reef without being predated on. Here we present preliminary results from the first round of CLIF monitoring in fish sanctuaries in Jamaica (Oracabessa, Bluefields, Salt Harbour and Galleon). Mean fish biomass per trap inside the sanctuaries ranged from $0.18 \pm 0.05\text{kg} - 0.46 \pm 0.08\text{kg}$, Bluefields and Oracabessa respectively; While mean fish biomass per trap outside the sanctuaries ranged from $0.09 \pm 0.04 \text{ kg} - 0.42 \pm 0.17 \text{ kg}$, in Oracabessa and Galleon respectively. All things being equal the value of fish catches to a fisher using ten traps (seven traps inside the sanctuary and three traps outside) over a period of one month, based on current market prices, ranges from US\$ 140.40 – 269.76 in Bluefields and Galleon, respectively.

KEY WORDS: Marine Protected Areas (MPAs), fish sanctuaries, community-based fish monitoring

**A Socioeconomic and Livelihood Assessment of Fishers in Communities Adjacent to
Sandy Island Oyster Bed MPA (SIOBMPA) in the Grenadine Island of Carriacou**

**Una Evaluación Socioeconómica y el Sustento de los Pescadores en Comunidades Adyacentes a
Sandy Island Oyster Cama Mpa (SIOBMPA) en la Isla de Granadina de Carriacou**

**A Évaluations Socio-Économiques et la Subsistance des Pêcheurs de Communautés Adjacentes
Sandy Island Oyster Bed Mpa (SIOBMPA) dans L'île de Carriacou Grenadine**

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ABSTRACT

Artisanal fishing has always been an important source of employment for Caribbean coastal communities. However, reduction in profitability of fishing due to pollution, over-fishing, as well as introduction of Marine Protected Areas have forced many fishers out of the sector. Attempts to engage fishers in alternative livelihoods are often unsuccessful primarily because of a lack of understanding of socioeconomic drivers as well as level of interest in a particular suite of supplementary livelihood strategies. The Caribbean fish sanctuary partnership initiative (CFISH) currently supports several fish sanctuaries or marine protected areas in the Caribbean Region. Here we present a pos-

sible model for continued engagement of fishers of the Eastern Caribbean in MPA related governance as well as a better understanding of alternative or supplementary livelihood opportunities of interest prior to interventions to support these activities. Baseline data was collected through structured and open-ended interviews with randomly selected fishers after an island wide census of fishers was done in Carriacou. This was followed by a 1-day stakeholder consultation workshop. A total number of 68 full time and part time fishers were identified. A total of 40 fishers were interviewed using the C-FISH socio-economic and preliminary livelihood assessment survey forms. The survey results were validated during a one-day workshop. In both processes fish aggregating devices (FADS) and fish marketing was rated as the first priority alternative/ supplementary livelihood option for future funding considerations. Sea Moss farming was rated as the second priority and eco-tourism tours as third priority alternative/ supplementary livelihood option.

KEY WORDS: Marine Protected Areas (MPAs), alternative/ supplementary livelihoods, fishers

Novel Predator, Novel Habitat: A Diet Analysis and Experimental Test of the Ecological Effects of Invasive Lionfish in Florida Bay

Un Depredador sin Igual Asechando un Nuevo Hábitat: Análisis Alimenticio y Prueba Experimental de los Efectos Ecológicos del Invasor Pez León en la Bahía de Florida

Nouveau Prédateur, Nouvel Habitat: Une Analyse de la Nutrition et un Test Expérimental sur les Effets Écologiques de L'invasion de la Baie de Floride par les Rascasse Volante

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ABSTRACT

Since its introduction to the western Atlantic and Caribbean the Indo-Pacific lionfish (*Pterois volitans*) has undergone a population explosion which threatens the ecosystems it is invading. Determining the diet of invading lionfish among the various habitats where they are found is critical for understanding the ecological effects of the invasion. Our study combined a diet analysis and experimental transplant experiment of lionfish found on the hardbottom habitats of Florida Bay. During June and July 2013 we collected and analyzed the stomach contents of lionfish (n = 32) associated with limestone solution-holes north of Marathon, FL. Prey found in collected stomachs was composed predominantly of teleost fishes, although we also found a significant number of crustaceans in the diet (38% by number). Of the identifiable teleost prey consumed, Gobiidae was the dominant prey item followed by Haemulon; palaemonid shrimp were the most common crustacean in the diet. For the transplant experiment we captured lionfish (n = 4) and released them at unoccupied solution holes. Prey communities were monitored by divers on SCUBA for six weeks and compared to solution holes where lionfish were already present (n = 5) and control holes without lionfish (n = 9). The presence of lionfish significantly reduced the number of all juvenile fishes (< 5-cm) after just three weeks, while the addition of lionfish to unoccupied holes reduced the number of palaemonids by 41%. Our study of lionfish in Florida Bay adds to the mounting evidence on the ecological effects of this novel invasive predator.

KEY WORDS: Lionfish, diet, invasion, ecology

Metodología para el Monitoreo de Uso Público en Áreas Marinas Protegidas

Methodology for the Monitoring of Public Use in Marine Protected Areas

Méthodologie pour la Surveillance de L'usage Public Des Secteurs Marins Protégés

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RESUMEN

La sostenibilidad ambiental de las Áreas Marina Protegidas desde el punto de vista del uso turístico, ha sido una preocupación del Centro Nacional de Áreas Protegidas, así como de diferentes instituciones científicas en Cuba. Desde el 2006 se definieron una serie de indicadores y umbrales para el manejo del uso público en nuestras áreas, siguiendo el enfoque basado en la Capacidad de Carga combinado con el monitoreo y los cambios. Sin embargo, poco se ha llevado a vías de hecho. Uno de los aspectos que puede atentar en contra de la realización continuada de los mismos, es la ausencia de protocolos para su ejecución. Por ello el objetivo del presente trabajo, es proponer métodos que permitan medir y diferenciar, con carácter comparativo y científico, los indicadores y umbrales que proponen Perera-Valderrama y colectivo de autores. Se proporcionan diferentes métodos para evaluar los 26 indicadores propuestos. Se recomienda precisar algunos umbrales para poderlos medir de una manera más certera y se añaden 4 indicadores socio – económicos con los umbrales correspondientes para su análisis. Se recomienda la aplicación de este protocolo en las áreas marinas protegidas de Cuba, además del Parque Nacional Jardines de la Reina, para evaluar su efectividad.

PALABRAS CLAVE: Sustainability, public use, marine protected areas

Recreational Fisheries in Jardines de la Reina, Cuba: Characterization and Perception About the Conservation Status of the Area

Pesca Recreativa en Jardines de la Reina, Cuba: Caracterización y Percepción Sobre el Estado de Conservación del Area

Pêcheries de Loisir à Jardines de la Reina, Cuba : Caractérisation et Perception du Statut de Conservation de la Région

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ABSTRACT

Recreational fisheries are very popular around the world, being catch and release increasingly preferred. Few studies have been carried out concerning recreational fisheries in Cuba, and not one of them has focused on the socio-economic characteristics of the activity. The aim of this research is (1) to socioeconomically characterize recreational fisheries in Jardines de la Reina and (2) to evaluate visitors' perception concerning natural resources conservation. 93 recreational fishermen from 13 countries were interviewed, mainly from United Kingdom, Canada, Argentina and United States of America. The sample was dominated by males, 41 to 50 years old, married and with university degrees. 37

% had visited Jardines de la Reina before, 4 times average. These repeaters currently consider the area in better environmental conditions than in previous visits. Recreational fishery is ranked good or excellent by interviewees and 100 % of them would recommend Jardines de la Reina as a fishing destination. The main attraction is the abundance of target species (first, tarpon (*Megalops atlanticus*); second, bonefish (*Albula vulpes*) and third, permits (*Trachinotus* sp.). It could be concluded that Jardines de la Reina are in a good environmental conservation status. Recreational fishery is compatible with the conservation status of protected area and is ranked as excellent and with international recognition by visitors. Jardines de la Reina exceed the expectation from recreational fishermen when visit the area.

KEY WORDS: Recreational fisheries, catch and release, socio-economics, conservation, management

Translocación y Repoblamiento del Caracol Pala, *Strombus gigas* en el Sector Centro del Área Marina Protegida Seaflower, Colombia

Translocation and Restocking of the Queen Conch, *Strombus gigas* in the Central Zone of Marine Protected Area Seaflower, Colombia

Translocation et le Repeuplement du Lambi, *Strombus gigas* dans la Zone Centrale de Protection Marine Seaflower, Colombie

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RESUMEN

El caracol pala, *Strombus gigas*, es una especie con alta importancia histórica, social, cultural y económica en el Archipiélago de San Andrés, Providencia y Santa Catalina –ASPS (localizados entre 11° 30' y 16° 30' N y 78° 28' y 82° 00' W). Sin embargo, durante los últimos años la población del Caracol Pala en la Isla de Providencia (AMP centro Seaflower) ha disminuido considerablemente, siendo la pesca de individuos juveniles, la extracción del producto en épocas de veda (1 de junio- 31 de octubre) unos de los posibles causantes. En mayo del 2012, se estimó la densidad y abundancia del recurso mediante evaluaciones visuales con buceo autónomo (scuba) y se obtuvo una densidad de $6,79 \pm 20,97$ ind/ha, reflejando que no se ha producido una recuperación de la población de la especie en el área. En miras de promover la recuperación y la conservación de esta especie, el gobierno departamental junto con instituciones como Coralina, la Universidad Nacional, la AUNAP y fundaciones locales, ha desarrollado durante los últimos 6 Años actividades de re-poblamiento del caracol pala en la Isla de Providencia, por medio de traslocación de individuos juveniles, semi-adultos y adultos desde el Cayo Serrana y Cayo Roncador. Como resultado a la fecha se han liberado en la isla de Providencia más de 15.000 Caracoles Juveniles (round Shell) y Adultos (breadth Leaf); se espera que con la continua participación de la comunidad e instituciones locales, nacionales e internacionales seguir contribuyendo en la preservación de este recurso pesquero

PALABRAS CLAVE: *Strombus gigas*, AMP centro Seaflower, translocación, repoblamiento

**Understanding Aspects of the Barbados Deep-Water Snapper Fishery
as a Social-Ecological System**

**Comprensión de los Aspectos de la Pesquería de Pargo Barbados Aguas Profundas
como un Sistema Socio-Ecológico**

**Comprendre les Aspects de la Pêche au Vivaneau Barbade en eau
Profonde Comme un Système Socio-Écologique**

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ABSTRACT

The Barbados deep-water snapper fishery peaks during July-October, the “off-season” when the major migratory pelagic species are scarce. It is a multi-gear fishery, using traps and handlines. Three snappers are most often caught: silk snapper (*Lutjanus vivanus*), vermilion snapper (*Rhomboplites aurorubens*) and queen snapper (*Etelis oculatus*). However, little is known about many aspects of the Barbados snapper fishery, including most ecological characteristics, location of the fishing grounds, current fishing techniques and the socio-economic circumstances of active fisherfolk. Limited knowledge of the social-ecological fishery system makes it difficult to monitor, thus having implications for adaptive management by the state and stewardship by other stakeholders. This research aimed at understanding aspects of the Barbados deep-water snapper fishery as a social-ecological system. It examined what ecological changes such as in habitat or climate could have impacted, or may impact, the social system of the fishery. It also investigated social changes and their ecological or fishery impacts such as due to fluctuating numbers of fishers, shifts in harvest and post-harvest demographics and socio-economics, changing fishing and marketing methods or technological innovations. External factors, such as energy costs and climate change were also considered. A better understanding of social-ecological relationships within small-scale fisheries should result in interventions and practices that contribute more to sustainable fisheries and livelihoods. Well-managed small-scale fisheries are vital for small islands that depend heavily on the ocean for resilience and their future.

KEY WORDS: Barbados, deep-water, fishery, snapper, social-ecological system

**Fish Diversity Differs Among Varying Patchiness of Culvert Reefs
in the South Padre Island Reef, Texas**

**La Diversidad de Peces Difiere entre Densidades Variables de Tubos de Concreto
en el Arrecife de la Isla de South Padre, Texas**

**La Diversité des Poissons Diffère Selon la Densité des Buses de Béton
au Récif de L'île de South Padre, Texas**

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ABSTRACT

The western Gulf of Mexico (GOM) along the Texas coast is characterized by limited natural coral and hard structure, where sand and mud bottom are prevalent. Due to the loss of numerous oil and gas platforms from the “idle iron” policy, placement of hard substrate in the form of concrete and steel structures has increased at a rapid pace. These artificial reef structures are predicted to increase available habitat for economically important fishes, such as red snapper *Lutjanus campechanus*, and other reef species. Monitoring the artificial reefs is an important step in determining the effectiveness of the configurations and constructions of reefs, such as culvert reefs. Few studies have reported any relationship between patchiness of culvert reefs and their assimilated reef fishes. To remedy this gap in research,

an 18 month study monitoring three structurally distinct habitat types is being conducted at the South Padre Island culvert reef, TX. SCUBA divers are collecting data on species richness and abundance in bare areas, loosely scattered patches, and dense patches of culverts. Alongside the visual surveys, SCUBA divers are quantifying red snapper by size class to determine culvert patch size on snapper populations. Current analysis has shown the highest species richness and abundance on dense patches, yet the abundance of red snapper has been comparable in dense and loose patches, with hundreds of individuals observed per patch. From these findings, future reef deployments can be altered to meet specific structural guidelines determined through this research.

KEY WORDS: Red snapper, artificial reef, culvert reef, artificial reef survey, fish survey

A Comparison of Site Fidelity and Habitat Use of Red Snapper on Two South Texas Artificial Reefs Utilizing Acoustic Telemetry

Una Comparación de Fidelidad al Sitio y el Uso del Hábitat del Huachinango en dos Arrecifes Artificiales en el Sur de Texas Utilizando Telemetría Acústica

Comparaison de Fidelité de Site et Usage D'habitat du Vivaneau Campêche Sur Deux Récifs Artificiels au Sud du Texas Utilisant Télémétrie Acoustique

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ABSTRACT

Evaluation of artificial reefs is becoming an increasingly important component of fisheries management. This is particularly true for the southwestern Gulf of Mexico where natural hard substrate is limited and 359 petroleum platforms are scheduled for removal in 2013 due to the “idle iron” policy. This study compared the performance of two artificial reef configurations off the South Texas coast, the Texas Clipper and South Padre Island Reefs that differ in material, depth, and distance from shore, with respect to behavior of red snapper, *Lutjanus campechanus*, an important recreational and commercial species. Snapper were implanted with depth and identification tags. Receivers were moored at each site to record presence and vertical movements of red snapper. In order to better understand the function of these two artificial reefs, comparisons of behavior during day and night periods, as well as residency time were performed to characterize red snapper-artificial reef interactions. In addition, a mark and recapture study using external dart tags was also used to estimate fishing pressure at each site. Residency time was significantly higher at the near-shore site as well as angler tag return rate, while the offshore site provided more usable vertical habitat based on daily recorded depth profiles for each fish. This evaluation of which reef configuration type provides the better usable habitat for red snapper may serve as a reference for future artificial reef planning along the Texas coast.

KEY WORDS: Red snapper, artificial reef, acoustic telemetry, site fidelity, residency time

**Goliath Grouper, *Epinephelus itajara* on Natural and Artificial Reefs in Brazil:
A Participative Survey**

**Mero Guasa, *Epinephelus itajara* en los Arrecifes Naturales y Artificiales en Brasil:
Una Encuesta Participativa**

**Mérou, *Epinephelus itajara* sur les Récifs Naturels et Artificiels au Brésil:
Une Enquête Participative**

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ABSTRACT

Developing survey strategies for rare and threatened species is often limited by access to sufficient individuals to acquire information needed to design appropriate conservation measures. The goliath grouper (*Epinephelus itajara*) is a globally threatened reef fish. In Brazil, fishing has been prohibited over 11 years and one of the policy prescriptions attached to the fishing ban has been the amalgamation of data to subsidize species' recovery and management solutions. Herein we report habitat use and abundance of *E. itajara* in Brazil drawn from a participatory survey proposed by Projeto Meros do Brasil, which engaged volunteer divers in data-collection. A total of 188 sightings were recorded between 2005 to 2011, reporting 306 individuals and three aggregations sites. Habitat type influenced the occurrence of *E. itajara* regarding total length and depth. This study underscores the importance of developing conservation measures addressing specific habitats and locations to enhance population recovery. Artificial structures (shipwrecks and manmade reefs) are strategic habitats that must be considered as highly sensitive areas to *E. itajara* conservation policies. We suggest the enforcement of surveillance, as well as, creation and implementation of marine protected areas as a key strategy for the conservation of *E. itajara*, especially high relief sites with relevant species aggregations.

KEY WORDS: Volunteers survey, collaborative research, marine conservation, endangered species, Epinephelidae

**Composición y Variación Espacial de la Dieta de *Lutjanus synagris*
(Lutjanidae: Lutjaninae) de la Costa Norte de Yucatán, México**

**Composition and Spatial Variation in the Diet of *Lutjanus synagris*
(Lutjanidae: Lutjaninae) on the North Coast of Yucatan, Mexico**

**Composition et Variation Spatial du Régime Alimentaire de *Lutjanus synagris*
(Lutjanidae: Lutjaninae) de la Côte Nord du Yucatan, Mexique**

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RESUMEN

Los hábitos alimenticios del pargo biajaiba *Lutjanus synagris* fueron estudiados en tres localidades de la costa norte de Yucatán, entre febrero 2008 y enero 2009. Los análisis cualitativo y cuantitativo (frecuencia de ocurrencia; porcentaje en número; porcentaje en peso y coeficiente alimentario) de la dieta fueron realizados a partir de los contenidos estomacales de 220 individuos colectados en Celestún, Dzilam de Bravo y Río Lagartos. El análisis comparativo de la

composición de la dieta entre localidades de estudio fue llevado a cabo mediante el cálculo de un índice de similitud y la aplicación de una prueba de ANOVA multivariado permutado (PERMANOVA). Un total de 64 categorías de presa fueron identificadas. La bíaiba es un pargo eurifago, carnívoro que se alimenta principalmente de organismos bentónicos. Los crustáceos decápodos (Peneidea, Brachyura y Natantia indeterminados) representaron las presas preferenciales mientras que los peces fueron consideradas como presas accidentales. No se observó una variación espacial en la composición específica de las presas consumidas pero sí en la abundancia de cada una de ellas en la dieta de la especie. Los individuos de bíaiba presentaron la tendencia a consumir más camarones (Penaeidae) en la zona oriental (Río Lagartos) que en las zonas central (Dzilam de Bravo) y occidental (Celestún) de la región de estudio. A lo largo de la costa norte de Yucatán, la bíaiba se alimenta a partir de las mismas categorías de presa, las cuales son consumidas en proporciones diferentes según la zona de distribución de la especie.

PALABRAS CLAVE: Régimen alimenticio, pargo bíaiba, Península de Yucatán

Eighteen Protected Areas from the Wider Caribbean Listed by Parties Under the SPAW Protocol

Dieciocho Áreas Protegidas de la Región del Gran Caribe Listados por las Partes Bajo el Protocolo SPAW

Dix-Huit Aires Protégées de la Grande Région Caraïbe Listées par les Parties au Titre Du Protocole SPAW

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ABSTRACT

According to Article 7 of the SPAW Protocol (Cartagena Convention, UNEP Caribbean Environment Programme), Contracting Parties shall establish a list of protected areas to create a regional network of protected areas and develop cooperation programmes. The purpose of this List is to identify those areas that are of particular importance to the Wider Caribbean region, that are to be accorded priority for scientific and technical research pursuant to Article 17, and that are to be accorded priority for mutual assistance pursuant to Article 18, as well as to protect the listed areas from activities that would undermine the purposes for which they were listed. 18 Caribbean Protected Areas from six countries fulfilling the common guidelines and criteria adopted by the Parties and established pursuant to Article 21, are now listed under the SPAW Protocol. All significantly contribute to the conservation of marine and coastal biodiversity in the Caribbean, while targeting various and complimentary features, habitats and species. A specific database (<http://www.spaw-palisting.org>) has been developed and is managed by the Regional Activity Center for the SPAW Protocol (SPAW-RAC) to compile data on the protected areas listed and allow for specific statistics and analyses. A dedicated cooperation programme (2013-2014) is currently being developed by the SPAW Secretariat with CaMPAM and the SPAW RAC, in consultation with Parties and interested partners in order to support the 18 PAs and to promote the listing of other PAs under SPAW. Contact: franck.gourdin.carspaw@guadeloupe-parcnational.fr

KEY WORDS: SPAW, Protected Area, cooperation programme, Caribbean, UNEP CEP

Beyond Aggregated Catch Data: Intra-Annual Dynamics of the Data-poor Mutton Snapper (*Lutjanus analis*) Fishery at Gladden Spit, Belize

Más Allá de las Datos Agregados de Captura: Dinámicas Estacionales de la Pesquería Deficiente en Datos de Pargo Criollo (*Lutjanus analis*) de Gladden Spit, Belice

Au-Delà des Données Agrégées de Capture: Dynamiques Intra-Annuelles de la Pêche Pauvre en Données de Vivaneau Sorbe (*Lutjanus analis*) du Gladden Spit, Belize

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ABSTRACT

Since the 1950s, artisanal fishers have harvested mutton snapper (*Lutjanus analis*) at Gladden Spit, southern Belize Barrier Reef. However, fishery data collections started until 1998 and analyses of fishery statistics have been sparse. The fishery targets the peak of the species spawning aggregations, which recurs annually in March-June, 10-12 days around the full moon days. In order to characterize for the first time the size, age, and maturation structures of reproductive mutton snapper at Gladden Spit, we followed a stratified balanced sampling design to survey the landings of the fishery between -2 and 7 days relative to full moon (drfm) in March-June 2011. We measured, weighted, and macroscopically examined the gonad state of 5,047 individuals and randomly collected 115 pair of sagittae for age determination. Relative abundances of mutton snapper varied significantly in relation to drfm and among months. Individual sizes ranged between 315 - 905 mm TL, weights 0.5 - 11.8 kg, otolith-based ages 2 - 16 years, and von-Bertalanffy-growth-model projected ages 2 - 50 years. PERMANOVAs revealed significant monthly variations in the size, age, and maturation structures of aggregating individuals. Older individuals dominated in March-May, while younger individuals in June. Most males were mature throughout the season, while most females were predominantly immature in June. Our results suggest that the reproductive output from mutton snapper that aggregate to spawn at Gladden Spit is seasonally structured, a life-history characteristic that must be considered in stock assessments and management strategies for mutton snapper in Belize and elsewhere in the western Atlantic.

KEY WORDS: Data-poor fisheries, reef fish spawning aggregations, Lutjanidae, age and growth, maturation

Abundance and Distribution of the Marsh Clam *Rangia cuneata* in the Mission-Aransas National Estuarine Research Reserve

Abundancia y Distribución de la Marisma Almeja *Rangia cuneata* en la Mission-Aransas National Estuarine Research Reserve

Abondance et Distribution du Marais Clam *Rangia cuneata* dans la Mission-Aransas National Estuarine Research Reserve

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ABSTRACT

Rangia cuneata, are brackish water clams that act as key indicator species of freshwater inflow in Texas coastal watersheds. They are more abundant at the mouth of rivers where they enter into bays. The Mission-Aransas National Estuarine Research Reserve (MANERR), established in 2006, is one of the newest in the National Estuarine

Research Reserve (NERRS) system. Located about 30 miles north of Corpus Christi, TX, its main purpose is to provide relatively natural settings for long term research. It is important to know abundance and distribution of *R. cuneata* to determine habitat quality in coastal watersheds. The objectives of this project were to determine whether the clams are present in the MANERR, and, if present, determine preliminary distribution and abundance. This study was conducted throughout June and July of 2013. The Aransas and Mission River systems were surveyed. A dredge was used every mile up the river from the mouth, and live and dead *R. cuneata* were enumerated, when found. Once a bed of live clams was located, quadrat sampling was used. There were no beds found in the Mission system. In Aransas River, however, 3 beds were found and surveyed. At each site, 5 quadrats were taken, and any extra clams found were measured and collected. The data collected did not yield a clear picture of abundance and distribution, however, *R. cuneata* are present in small refuge populations during the current extended drought. Future research should be conducted to determine more detailed abundance and distribution.

KEY WORDS: *Rangia cuneata*, freshwater inflow

Digestion Rate Analysis of Fish Prey Items in Lionfish (*Pterois volitans*)

Análisis de la Tasa de Digestión de las Presas de Pescado en el Pez León (*Pterois volitans*)

Analyse du Taux de Digestio des Proies de Poisson dans Lionfish (*Pterois volitans*)

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ABSTRACT

Feeding ecology studies have provided valuable insight into the impacts of lionfish on the native reef fish communities of the Western Atlantic and Caribbean. The lionfish are known to consume over 70 fish species, but their relative abundance as lionfish prey is strongly site specific. However, the majority of these studies have been based on morphological identification, usually of partially digested specimens. Morphological identification can be biased and prone to human error, depending on the digestive level of the prey item. Additionally, lionfish feed during crepuscular hours, while many lionfish collections occur at opportune times for researchers and scientists, which usually do not correlate with feeding. The aforementioned points support the need for quantifying digestion rates for more accurate feeding ecology studies or for understanding existing biases. This study analyzed the digestion rate of known teleost prey items in lionfish stomachs, over a given period of time, to provide an estimate of digestion rate at basal metabolism. Three size classes of lionfish were examined, utilizing ten or more individuals per size class. Time intervals of 30 minutes to an hour were used to identify digestion rate. Approximately 5+ hours are required before a known fish prey item is deemed unrecognizable to the species level. Additionally, this rate is likely dependent on lionfish size and prey size. Faster digestion rates are predicted for more active lionfish. Studies utilizing morphological identification should structure their experimental design to incorporate this information to obtain a higher percentage of undigested prey items for analysis.

KEY WORDS: Lionfish, digestion, feeding ecology

¿Qué Papel Juegan las Diatomeas en la Alimentación del Caracol Rosa *Strombus gigas*?

What is the Role of Diatoms in Feeding of Queen Conch, *Strombus gigas*?

Quel est le Role des Diatomées dans L'alimentation du Lambi, *Strombus gigas*?

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RESUMEN

Strombus gigas habita de aguas a 60 m de profundidad, asociado a praderas marinas y diversos fondos arenosos. Sus poblaciones están sobreexplotadas, especie protegida por CITES y desde los años 80 se trabaja en su gestión pesquera y domesticación acuícola. Para juveniles se han formulado algunas dietas, desconociéndose aún sus requerimientos nutricionales. El objetivo de este estudio fue conocer el papel de las diatomeas en la alimentación de *S. gigas* y cómo hipótesis: Es *S. gigas* es una especie selectiva en su alimentación. Se analizaron heces de caracoles en la mañana (8am) y tarde (2pm) y sedimentos, con microscopía óptica y electrónica. Los caracoles colectados en la mañana, no tuvieron producción de heces, sólo en la tarde. La riqueza específica de diatomeas fue: 94, en sedimento 62 y en heces 44. Los géneros con mayor número de especies en heces: Amphora (17), Cocconeis (11) Mastogloia y Navicula (9) y las más abundantes: *Paralia capitata* (72%) y *Seminavis robusta* (19.3%). Las heces presentaron además foraminíferos, cladoceros y copépodos. El sedimento tuvo como especies dominantes: *Seminavis robusta* y *Paralia capitata*. El análisis de similitud mostró diferencia en la abundancia de diatomeas en sedimento entre horas, pero no en los caracoles. El análisis de abundancia relativa mostró que *P. capitata* se distribuye homogéneamente en sedimento y caracoles, mientras *S. robusta* presentó variación. Los resultados muestran el papel importante de las diatomeas en la alimentación de *S. gigas* y la probable selectividad de esta especie, aunque los resultados aún no sean concluyentes

PALABRAS CLAVE: Feeding, habitat, diatoms, behavior, queen conch

Mitochondrial Genome Organization and Phylogeographic Analyses in *Mithrax spinosissimus* (Crustacea: Brachyura), an Important Species for Artisanal Fisheries in the Caribbean Sea

Organización del Genoma Mitocondrial y Análisis Filogeográficos en *Mithrax spinosissimus* (Crustacea: Brachyura), una Especie Importante en Pesquerías Artesanales de Crustáceos en el Mar Caribe

L'Organisation du Génome Mitochondrial et Analyses Phylogeographiques dans *Mithrax spinosissimus* (Crustacea: Brachyura), une Espèce Important en Pêcheries Artisanales du la Mer Des Caraïbes

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ABSTRACT

Here, we show the development and evaluation of bioinformatic analyses for the mitochondrial genome assembly, and for the detection of mitochondrial molecular markers for phylogeographic studies in the Caribbean king crab *Mithrax spinosissimus* (Brachyura: Decapoda: Mithracidae). This crab is an overexploited species that inhabit coral and rocky reef ecosystems from the Caribbean sea and the Florida Keys in USA. The purpose of this work is focused in the conservation genetics of this species because of their ecological -biological control of benthonic algae- and economi-

cal -in artisanal fisheries in the caribbean sea-, features that they play into the ecosystems where they inhabit. Collections of *M. spinosissimus* muscle tissue were taken from October 2011 to March 2012, in three different coral and rocky reef ecosystems in Colombia. Genome sequencing and assembly from one of the Colombian specimens were obtained by using the NGS technology GS-FLX 454. Mitochondrial DNA genome organization was performed and it was compared with information from genetic databases -GenBank, NCBI. We found 13 protein-coding mitochondrial genes, two rRNAs, 22 tRNAs, and a putative mitochondrial control region. We also amplified sequences from the mitochondrial regions COI and control region (1200 bp each, approximately), and we found too a preliminary population genetic structure of *M. spinosissimus* in the Colombian islands. We expect to generate data from the molecular ecology and evolutionary aspects of *M. spinosissimus* to be useful in conservation genetics for this species. Also, we expect to carry out management recommendations derived from the population structure analyses.

KEY WORDS: Mitochondrial genome assembly, phylogeographic studies, *Mithrax spinosissimus*, coral and rocky reef ecosystems, Caribbean Sea

**Acciones Implementadas para el Control del Pez León (*Pterois* sp.)
en el Parque Nacional Arrecife de Puerto Morelos, Quintana Roo, México**

**Implemented Actions to Control Lionfish (*Pterois* sp.)
in the Parque Nacional Arrecife de Puerto Morelos, Quintana Roo, México**

**Actions Mis en Œuvre a Contrôler le Lionfish (*Pterois* sp.)
sur le Parque Nacional Arrecife de Puerto Morelos, Quintana Roo, Mexique**

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RESUMEN

A partir de los primeros registros de la invasión del pez león en el Caribe Mexicano (2009), se han tomado medidas para el conocimiento y diagnóstico de la especie. En el Parque Nacional Arrecife de Puerto Morelos (PNAPM) se incrementaron los esfuerzos para el control y monitoreo de esta especie invasora, reduciendo su efecto sobre las especies nativas y los arrecifes de la zona. Las acciones implementadas mediante el Programa de control de pez león en el área, son resultado de una estrecha colaboración entre el personal del Parque con apoyo del gobierno y asociaciones civiles que forman parte de una integración social entre la cooperativa de pescadores y la comunidad en general, promoviendo la captura y comercialización de la especie, generando conciencia entre la sociedad y así mismo incrementando el consumo. Las capturas se realizan dentro y fuera del polígono del Parque Nacional con la utilización de arpón, equipo de buceo SCUBA y buceo libre, con profundidades de 30 a 150 pies. Entre el año 2011 y 2012 se han capturado más de 25 000 ejemplares con tallas promedio (LS) de 371 y 439 cm y pesos de promedio de 22 y 23 cm respectivamente. En total se tienen registradas más de 10 toneladas de pez entero de la cuales 3 toneladas se comercializaron como filete.

PALABRAS CLAVE: Puerto Morelos, pez león, integración, control, captura

**Indo-Pacific Lionfishes (*Pterois volitans/miles*) Invade the
Flower Garden Banks National Marine Sanctuary in the Northwest Gulf Of Mexico**

**Los Peces León (*Pterois volitans/miles*) del Océano Indo-Pacífico Invaden
el Santuario Marino Nacional Flower Garden Banks en el Noroeste del Golfo de México**

**Lionfishes Indo-Pacifique (*Pterois volitans/miles*) Envahissent la
Flower Garden Banks Sanctuaire Marin National dans le Nord-Ouest du Golfe du Mexique**

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ABSTRACT

Indo-Pacific lionfishes (*Pterois volitans* and *P. miles*) are the first invasive marine fishes to become established in the Western Atlantic Ocean and Caribbean Sea. Lionfishes, with their venomous spines, insatiable appetites, wide habitat distribution, and prolific reproduction, are a serious threat to native fishes and coral reef communities. Since the introduction of these species into the Western Atlantic in the late 1980s, lionfishes have spread and become established throughout the Western Atlantic and Caribbean, and were first recorded in the Gulf of Mexico in 2009. In late 2010, lionfishes were observed at Sonnier Bank and nearby oil and gas platforms. By mid 2011, lionfishes were observed on all three banks comprising the Flower Garden Banks National Marine Sanctuary (FGBNMS), which harbors the northernmost coral reefs in the continental United States. We document the appearance and subsequent spread of lionfishes within the FGBNMS, as well as the surrounding banks and artificial structures in the Northwest Gulf of Mexico. We assessed lionfish diet with stomach content analysis, and analyzed changes in native fish communities at the FGBNMS with long-term monitoring visual fish survey data. Between 2011 and 2012, lionfish sightings increased tenfold within the FGBNMS. While fish biomass at the FGBNMS remains high, the full invasion is likely still developing and negative impacts on the reef community may not be recognized for several years. Lionfish impacts, combined with pre-existing stressors such as overfishing and global climate change, may cause cascading changes in the food chain and coral reef communities in the region.

KEY WORDS: Lionfish, marine sanctuary, invasion, Gulf of Mexico

**Gulf of Mexico Red Snapper IFQ Program Survey Assessment:
Change in Attitude of the Fishermen**

**Evaluación del Programa de Cuotas de Pesca en la Pesquería
de Pargos Rojo del Golfo de México: Cambio de Perspectiva de los Pescadores**

**Evaluation de L'enquête sur le Programme de Quotas de Pêche Individuels
pour le Rouget du Golfe du Mexique: Changement D'attitude des Pêcheurs**

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ABSTRACT

On January 1, 2007 the Gulf of Mexico Fishery Management Council implemented the red snapper individual fishing quota (IFQ) program to reduce overcapacity and mitigate, to the extent possible, derby-fishing conditions. The program also sought to increase market stability, eliminate fishing seasons, increase flexibility for fishing operations, facilitate enforcement, improve safety at sea, and enhance the net social, economic, and biological benefits from fish-

ery. This paper discusses the findings of a mail survey used to investigate fishermen's attitudes and perceptions towards the program to assist in the Council mandated five year review of the IFQ program. The study found that participants with large shareholdings tended to be very satisfied with the IFQ program, whereas those with small shareholdings were the least satisfied with the program. About 65% of respondents stated that they did not make any major capital investments or dis-investments since the onset of the program. The study also found that the industry believed that the IFQ program had reduced derby-fishing conditions. Additionally, medium and large shareholders, as well as western Gulf shareholders, agreed that the IFQ program had increased harvesting flexibility and decreased crowding on fishing grounds.

KEY WORDS: Individual fishing quota, red snapper, shareholders

**Understanding the Stakeholders in the Caribbean Sportfishing Community:
The Potential for Sportfishing Development in the Caribbean**

**Cómo Comprender a los Accionistas de la Comunidad de Pesca Deportiva del Caribe:
El Potencial para Desarrollo de la Pesca Deportiva en el Caribe**

**Comprendre les Intervenants de la Communauté de Pêche Sportive des Caraïbes :
Le Potentiel de Développement de la Pêche Sportive dans es Caraïbes**

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ABSTRACT

Sportfishing, a sustainable form of ecotourism, can bring socioeconomic benefits to local economies as and conserve local marine resources. Caribbean nations show great potential to capture these benefits by expanding or promoting their areas, but this is dependent on having effective and responsible management of gamefish (highly migratory) species. TBF is engaged with stakeholders to collect relevant data to demonstrate the potential for the development of sportfishing in Caribbean nations and raise awareness of the benefits that sportfishing can accrue. Discourse with relevant stakeholders and local officials are also intended to encourage their active participation in fisheries management issues and engage officials to promote sportfishing and conservation in their respective nations. Highlighting the potential for nations to capture these many benefits as well as relevant fisheries management issues is also intended to ensure that nations maximize socioeconomic benefits for stakeholders through responsible use of their marine resources. TBF also intends to demonstrate that sportfishing offers a much more viable, sustainable means of accruing benefits for its citizens than some of the current practices in place in many Caribbean nations.

KEY WORDS: Sportfishing, Caribbean, conservation, gamefish

Discrimination of Chemical Signatures in Otoliths of Juvenile Yellowfin Tuna (*Thunnus albacares*) from Nursery Areas in the Atlantic Ocean

Discriminación de Señales Químicas en los Otolitos de Juveniles Rabil (*Thunnus albacares*) del Áreas de Críadero en el Océano Atlántico

Comparaison des Signatures Chimiques des Otolithes de Juvéniles de Thons Jaunes (*Thunnus albacares*) Provenant de Différentes Nurseries de L'océan Atlantique

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ABSTRACT

Yellowfin tuna (*Thunnus albacares*) are highly migratory cosmopolitan fish that are currently managed as a single panmictic stock in the Atlantic Ocean; however, our understanding of the migration patterns and connectivity of Atlantic populations is minimal. Naturally occurring chemical tracers in otoliths provide valuable information that is widely used to classify populations and reconstruct environmental histories of fishes. The aim of this study is to evaluate the otolith microchemistry of young-of-the-year (YOY) yellowfin tuna to determine whether chemical signatures are distinct across different putative spawning areas in the Atlantic Ocean. YOY yellowfin tuna otoliths were collected from five locations in the Atlantic Ocean (Gulf of Mexico, Brazil, Martinique, Dominican Republic, and Gulf of Guinea) in 2012 and 2013 and trace elemental and stable isotopic analyses will be conducted to investigate regional variation in the chemical composition of otoliths. In this paper, we present preliminary results from the first year of our study and evaluate the feasibility of using these natural tracers to discriminate juveniles from different nursery areas. This research is ongoing and we will extend our sampling into 2014 and 2015 at all locations. After we establish our baseline of natal signatures, these data will be used to assign adult yellowfin tuna from the Gulf of Mexico to their nursery of origin. Results of this study will ultimately provide an improved understanding of the stock structure and movement of yellowfin tuna in the Atlantic Ocean.

KEY WORDS: yellowfin tuna, trace elements, stable isotopes, otolith chemistry, Atlantic Ocean

**Bonefish Pond National Park Restoration:
Increased Management Effectiveness Through Community Restoration Projects**

**Parque Nacional 'Bonefish Pond':
Mayor Eficacia de la Gestión a Través de Proyectos de Restauración de la Comunidad**

**Parc National 'Bonefish Pond': Augmentation de L'efficacité
de la Gestion à Travers les Projets de Restauration Communautaires**

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ABSTRACT

In the Bahamas the ecological importance of mangrove is often neglected. Though mangroves are the natural protection of the coastal habitat, they are often dredged for marinas or filled to create hard land for further development. Mangrove habitats are also often dumping grounds. Prior to its establishment as a national park managed by the Bahamas National Trust, the area that became the Bonefish Pond National Park (BPNP) was used in precisely this way. This coastal wetland system is situated on the southern portion of New Providence, the densely populated capital of the

Bahamas. It was used as a copper burning site, a dump site for debris, a launching site for boats and for fishing. BPNP is over 1,000 acres of coastal mangrove habitat. It serves as an important nursery habitat for the nearby offshore reefs providing shelter for commercially important fish during their most vulnerable stage of life. Since its establishment as a national park in 2002 a number of restoration projects were conducted in the BPNP to improve its effectiveness as a nursery habitat for nearby offshore reefs. These projects have helped return the area to a more pristine condition through improving tidal flows that were previously obstructed, removing invasive plants, increasing suitable fish habitat and increasing education to visitors, neighbouring residents and potential users to the area. These projects have been possible through public, private and community based groups coming together to help increase the management effectiveness of the Park; preserving its important ecological services.

KEY WORDS: Coastal wetlands, restoration, national park, fisheries, Caribbean Challenge Initiative

**Comparisons of Age and Growth Parameters of Red Snapper (*Lutjanus campechanus*)
at an Artificial Reef and at a Natural Shelf-Edge Reef**

**Comparación entre la Edad y los Parámetros de Crecimiento del Huachinango
(*Lutjanus campechanus*) tanto en un Arrecife Artificial como en un Arrecife Natural
al Borde de la Plataforma Continental**

**Les Comparaisons de L'âge et des Paramètres de Red Snapper (*Lutjanus campechanus*)
à un Récif Artificiel Croissance et à un Reef Conservation Natural Edge**

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ABSTRACT

Red snapper is an important recreational and commercial finfish in the northern Gulf of Mexico. Red snapper inhabit several different habitat types: low-relief artificial structures, toppled and standing oil and gas platforms, and natural banks located on the mid-shelf and the shelf-edge. Red snapper populations are currently managed as a single stock both east and west of the Mississippi River. Nieland et al. (2007) reported a decline in ages of red snapper across the Louisiana commercial fishery indicating the population may be overfished and undergoing overfishing. The Gulf of Mexico Fisheries Management Council has set of a goal of reaching maximum sustainable yield by 2032. This study will compare age structure of red snapper from both a low-relief artificial habitat and a natural shelf edge bank, respectively in the East Cameron Oil Lease Planning Area (n = 135) and at Bright Bank (n = 92). Otoliths were collected from red snapper at each habitat over a period of three years with quarterly research trips. The otoliths were sectioned and read using marginal increment analysis according to Beckman et al (1988). This study will address differences in size-at-age, weight-at-age, and the age distribution at each habitat. Previous studies have reported significant differences in age and growth parameters between artificial habitats and natural banks. This analysis will help define biological reference points as well as the quality and role of both habitats. Unbiased age estimates will give fishery managers tools to make informed decisions about the best methods to regulate the red snapper fisheries.

KEY WORDS: Red snapper, habitat, artificial, age, growth

**Quantify Oyster (*Crassostrea virginica*) Habitat by Coupling
Acoustic Technologies Within Texas Bays and Estuaries**

**Cuantificar hábitat de Ostras (*Crassostrea virginica*) Mediante el Acoplamiento
de las Tecnologías Acústicas en Bahías y Estuarios de Texas**

**Huître Habitat (*Crassostrea virginica*) en Couplant Technologies Acoustiques
à L'intérieur du Texas Baies et les Estuaires**

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ABSTRACT

(*Crassostrea virginica*) reefs occur in shallow turbid waters along the Texas coast and are an important component of Texas estuaries, providing a wide array of ecosystem services. Oysters are the State's second largest commercial fishery and Texas Parks and Wildlife Department (TPWD) data indicate that the oyster industry contributed more than \$57,600,000 to the State's economy in 2010. Mapping oyster reefs is a key component of managing oysters. The turbid waters in which oysters reside do not allow for use of remote sensing data from satellites imagery and lidar. To quantify the extent of the oyster habitat within Texas estuaries, the TPWD couples two hydro acoustic technologies: a bathymetric side scan sonar (Teledyne Benthos C3D) and single beam echo sounder (Biosonics DTX). Simultaneously collected, we utilize the echo sounder data to classify the side scan imagery. To accomplish the classification of habitat from echo sounder data we utilized raster reclassification (ArcGIS 10.2) was used to relay the habitat value provided by the echo sounder to the image captured by the side scan sonar. Point locations of oysters were obtained from the reclassified raster and point density analysis identified areas of high and lower density oyster habitat. The habitats were ground truth by sampling within the habitats identified. Coupling side scan sonar and habitat classifying echo sounders and relating them through raster reclassification in ArcGIS has proved to be an effective unbiased way of quantifying oyster habitats within Texas estuaries.

KEY WORDS: Oyster, GIS, habitat, acoustic, side scan

Examining Current Mercury Concentrations in Northern Gulf of Mexico Red Drum

**Al Examinar las Concentraciones de Mercurio Actuales en
el Norte del Golfo de México Red Drum**

**Examen Concentrations de Mercure Actuels dans le
Nord du Golfe du Mexique Tambour Rouge**

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ABSTRACT

Mercury (Hg) is a toxic metal that bioaccumulates in tissues of long-lived fishes and can pose health risks to humans when consumed in large quantities. While the accumulation of Hg in marine fishes in the Gulf of Mexico (GOM) has been established, Hg levels above the United States Environmental Protection Agency (USEPA) methylmercury criterion (0.3 ppm) and the United States Food and Drug Administration (FDA) action limit (1.0 ppm) have only recently been reported for Red Drum (*Sciaenops ocellatus*). Recent studies of Hg concentrations in Red Drum from Florida and Texas waters showed larger size classes accumulated Hg to levels above acceptable USEPA and FDA limits; however, Hg levels for large Red Drum were lacking from the north central region of the GOM. Our study examined total Hg in north central GOM Red Drum and compared Red Drum total Hg to that of other GOM species. Results

indicated mean total Hg was 0.67 ppm and 0.47 ppm for fishery independent and fishery dependent collections, respectively. Approximately 80% of all Red Drum in this study had tissues containing concentrations greater than the EPA criterion and 5% were above the FDA action limit. The allowable catch limits for all GOM states except Florida include large sizes and present the possibility for human consumption of high total Hg concentrated Red Drum. Understanding concentrations of Hg in GOM Red Drum is essential to effectively include this public health issue in management strategies.

KEY WORDS: *Sciaenops ocellatus*, mercury, bioaccumulation, biomagnification, management

Aspectos Poblacionales de las Jaibas Roja (*Callinectes bocourti*) y Azul (*C. sapidus*) de la Zona Noroccidental de la Ciénaga Grande de Santa Marta, Caribe Colombiano

Population Aspects of Blunntooth Swimcrab (*Callinectes bocourti*) and Blue Crab (*C. sapidus*) from Ciénaga Grande de Santa Marta Northwest Area, Colombian Caribbean

Aspects de la Population de Crabe Chancre (*Callinectes bocourti*) et de Crabe Bleu (*C. sapidus*) Zone Nord-Ouest de Ciénaga Grande de Santa Marta, Caraïbes Colombiennes

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RESUMEN

Se determinaron aspectos poblacionales en jaibas roja (*Callinectes bocourti*) y azul (*C. sapidus*) procedentes de la zona noroccidental de la Ciénaga Grande de Santa Marta, Caribe colombiano, desembarcadas en una planta de proceso durante el periodo seco de 2013 para contribuir con información biológica en la adopción de medidas de administración de la pesquería. Fueron examinados 217 ejemplares, 193 *C. bocourti* y 24 *C. sapidus*. Los parámetros biométricos registrados fueron los establecidos en el Protocolo de captura de información pesquera, biológica y socio-económica en Colombia. Para *C. bocourti*, ABEL fue 8,15 cm, Lca 4,76 cm, Pt 95,3 g y la proporción macho: hembra fue 1:3,8. Para *C. sapidus*, ABEL fue 9,38 cm, Lca 5,04 cm, Pt 125 g y la proporción macho: hembra fue 1:1. La maduración sexual en *C. bocourti* muestra que el 67,5% eran hembras maduras, 30% madurando y 2,5% inmaduras, mientras que el 76,5% de los machos eran adultos y el 23,5% juveniles. En *C. sapidus*, el 75% de las hembras eran maduras, el 8,3% estaban madurando y 16,7% inmaduras, mientras que el 66,7% de los machos eran adultos y el 33,3% juveniles. Se concluye preliminarmente que *C. bocourti* continúa siendo la especie de mayor presencia en el área y presenta amplia dominancia de hembras. Los datos biométricos registrados para las dos especies, están por debajo de reportes anteriores para esta zona y al comparar estos promedios con ejemplares en actividad reproductiva, se encuentra una probable maduración a tallas menores, posible indicador de que se está presentando sobre-explotación del recurso y que las especies han adoptado este mecanismo como protección de sus poblaciones.

PALABRAS CLAVE: *Callinectes*, jaiba, aspectos poblacionales, Ciénaga Grande de Santa Marta

Establishing Acropora Coral Nurseries Throughout the Bahamas

El Establecimiento de Coral Acropora Viveros Largo de las Bahamas

Établir Acropora Pépinières Corail des Bahamas

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ABSTRACT

Across the Caribbean and Florida, coral reefs are declining as a result of human induced and natural elements. To help restore degraded Acropora reefs throughout the Bahamas, The Nature Conservancy's Northern Caribbean Program has begun establishing and maintaining in-water coral nurseries. Currently there are two coral nurseries – one located in the southwest area of New Providence and in Central Andros Island. Adapting the method developed by Ken Marks, fragments of opportunity are identified in the wild, collected and reared in the nursery for up to two years, then outplanted to selected restoration areas. Outplant sites will provide an opportunity for cross fertilization between genetically distinct populations that would otherwise not reproduce naturally due to their separate domestic sites. It is expected that the nurseries will lead to an increase in Acropora larval production. The Conservancy will also conduct genetic testing to determine connectivity between corals in the USVI, Florida, and the Bahamas to facilitate better management of the coral reef network in the region. Genetic testing will also help to identify the most resilient Acroporid coral genomes and the optimum environmental factors which foster the best coral reef recovery. The nurseries will therefore make available a “bank” of corals that can help repair Acropora reefs damaged by ship groundings, and other human induced factors as well as major storm events.

KEY WORDS: *Acropora*, coral nursery, Bahamas, Caribbean

Assessment of the Breeding Success of Red-Billed Tropicbirds on St. Eustatius

Evaluación del Éxito de la Reproducción del Ave Rabijunco Etéreo en la Isla de San Eustaquio

Evaluation du Succès Reproducteur du Phaéton à Bec Rouge à Sainte- Eustache

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ABSTRACT

We assessed the breeding success of Red-billed Tropicbirds *Phaethon aethereus* on St. Eustatius, particularly in relation to predation at the nest. We conducted weekly surveys at five sites during 2012 - 2013 and measured chick and adult morphometrics. Apparent nest success ranged from 55-100% across five breeding areas, while apparent fledge success ranged from 63 - 100% at those same locations. We used cameras and baited rat traps to document the presence of predators at nest sites. Predation rates captured on cameras were low (ca. 200 images of predators from ca. 263,000 images over 11 weeks). Cameras documented cats and rats at accessible nests. Although we could not confirm the cause of egg loss or the death of some chicks, the presence of cats and rats suggests that additional effort be expended to accurately measure their impact.

KEY WORDS: Tropicbird, St. Eustatius, nesting, predation

Assessment of Governance Arrangements for Pedro Bank, Jamaica

Evaluación de los Mecanismos de Gobernanza de Pedro Bank, Jamaica

Évaluation des Mécanismes de Gouvernance pour Pedro Bank, Jamaïque

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ABSTRACT

Pedro Bank, lying about 100 km south of Jamaica is two-thirds the size of Jamaica (8,040 km²). Two of the three cays on the southeast edge of the bank are inhabited by fishing communities. Pedro Bank supports valuable conch, lobster and reef fish fisheries. The purpose of this governance assessment is to dissect and display the governance arrangements for the major living marine resource issues identified for the bank and to examine their degree of integration for an ecosystem approach. The assessment focussed mainly on the governance arrangements or architecture, but included a preliminary assessment of functionality according to several basic principles. Six key living marine resource issues requiring governance were identified for on Pedro Bank: (1) Finfish fishing, conch fishing, lobster fishing, seabird and sea turtle biodiversity, land-based pollution on marine ecosystems, marine-based pollution. The first observation is that there is the need to clarify the individual governance arrangements for the six issues and make them known to all stakeholders. A second observation is that the governance arrangements for the six issues do not appear to be well integrated at either the policy level or the management level. The recommended the long-term perspective for the Pedro Bank is as a Fisheries Management Area (FMA) as provided for in the new Fisheries Act. With regard to the assessment of functionality, stakeholders did not perceive the processes as being highly functional with regard to the principles examined.

KEY WORDS: Policy, EBM, reefs, management, offshore bank

Portrait of the Deep Water Snapper Fishery in Puerto Rico During 1988 - 2012

Semblanza de la Pesquería de Pargos de Aguas Profundas en Puerto Rico Durante 1988 - 2012

Un Portrait de la Pêche de la Crevette Vivaneaux à Puerto Rico au Cours de 1988 - 2012

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ABSTRACT

The deep water snapper has been the most important finfish fishery in Puerto Rico since 1970's. During the mentioned 1970 - 1990, there were approximately 25 fishing vessels 40 feet length or larger dedicate to deep water snapper fishery. From 1990's to the present there was observed that approximately 100 fishing vessels of 22 - 25 feet length has been used successfully for the deep water snapper fishery. This fishing activity occurs around the Puerto Rico. The fishing time duration of the fishing trip is approximately 10 - 12 hours. There are five species of deep water snapper in Puerto Rico, silk snapper *Lutjanus vivanus*, blackfin snapper *Lutjanus bucanella*, queen snapper *Etelis oculatus*, vermilion snapper *Rhomboplites aurorubens* and cardinal snapper *Pristipomoides macrophthalmus*. During the 1970 -1990, silk snapper was the most important species of deep water snapper landed in pounds in Puerto Rico. However, since 1995, the queen snapper has been the most important landed species in pounds. Since 2005, the deep water snapper fishery was protected by the Department of Natural and Environmental Resources (DNER) and the NOAA Fisheries DNER. Both agencies established a yearly closed season from October 1st to December 31st. This paper will show the trends in deep water snappers landings data, biostatics data and fishing census for deep water snapper during 1988 - 2012. Also, we will discuss the closed season to protect the resources established by NOAA Fisheries and the DNER and the trend observed after five years of the closed season establishment.

KEY WORDS: Deep water snapper fisheries, landings, Puerto Rico

Marine Protected Areas, Reef Resiliency and the Prevalence of Coral Diseases & Compromised Reef Health in the Cayman Islands, North West Caribbean

Areas Protegidas Marinas, Resiliencia y Prevalencia de las Enfermedades Coralinas y la Salud en Peligro de los Arrecifes de las Islas Caiman, Caribe del Noroeste

Aires Protégées Marines, Résilience et Prédominance des Maladies Coralliennes et la Santé Compromise des Recifs des Îles Caïmans, Caraïbes du Nord Ouest

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ABSTRACT

Coral bleaching and disease are recognized as major drivers of coral reef decline globally and are increasing in prevalence, regularity and severity with global climate change. Marine Protected Areas (MPAs) are a leading strategy in the conservation of biodiversity and are increasingly being used with the new aim of enhancing resilience in the face of global climate change. This study compared the prevalence of bleaching, disease and compromised health states in scleractinian (stony) and milleporid (fire) corals at 60 monitoring sites, within and outside of MPAs within the Cayman Islands, to determine if resilience was increased (and therefore prevalence lower) within MPAs. Overall, the study found that the Caymanian MPAs did not enhance the resilience of reef building corals to bleaching and disease, with the prevalence of white plague actually higher within MPA sites overall (MPA: 1.31% ± 0.39 S.E., non-MPA: 0.88% ± 0.22 S.E.). However, the prevalence of compromised health states and growth anomalies were reduced within MPA sites. Disease prevalence was patchy and varied according to island and aspect. Prevalence was highest on Cayman Brac and Little Cayman (combined disease: 13.10% ± 1.19 S.E. and 10.91% ± 1.53 S.E.), on southern coasts. Key diseases and hosts were typical of the wider Caribbean; white plague, yellow band disease, dark spot disease and dark spot syndrome, were recorded at the highest prevalence within important reef building species. Mean bleaching prevalence during the study was low (3.97% ± 0.56 S.E.), with an increase at the deep sites (6.52% ± 0.94 S.E.).

KEY WORDS: Marine protected areas, coral disease, reef resilience, bleaching, Cayman Islands

Depredation of Catch by Bottlenose Dolphin (*Tursiops truncatus*) and Observation of Atlantic Spotted Dolphin (*Stenella frontalis*) in the Gulf of Mexico Commercial Reef Fish Fishery

Depredación de la Captura por Delfines Mulares (*Tursiops truncatus*) y Observación de Delfines Moteados del Atlántico (*Stenella frontalis*) en el Golfo de México Comercial Pesca Peces de Arrecife

Déprédation des Captures par Grands Dauphins (*Tursiops truncatus*) et D'observation de la Dauphins Atlantique Tachetés (*Stenella frontalis*) Dans le Golfe du Mexique Commercial Poissons de Récif Pêche

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ABSTRACT

Several species of marine mammals are known to interact with commercial fishing operations in the Gulf of Mexico. Depredation can have negative consequences for fisherman through loss of fish, bait, or gear which devalues catch and can result in injury to marine mammals through gear entanglement or retaliatory actions of fisherman. Depredation of catch by bottlenose dolphins (*Tursiops truncatus*) was observed from June 2011 to March 2012 while onboard commercial reef fish fishing vessels in the Exclusive Economic Zone (EEZ) off the coast of Texas and Florida (n=177 sets, 489 hours). Atlantic spotted dolphins (*Stenella frontalis*) were near fishing vessels however none were observed depredating or directly interacting with vessels. Depredation of catch by bottlenose dolphins occurred during 12.2% of fishing time and during 20.9% of sets. Of 124 total bottlenose dolphins sighted 120 were observed depredating catch. Atlantic spotted dolphins were near fishing vessels 0.91% of fishing time. Data was analyzed using ANOVA and post hoc tests with dependent variables of statistical management zone (SMZ) and fishing gear or target fishery. There were no differences in depredation among gear types ($p = 0.6163$, $F = 0.49$). Juvenile dolphins were observed more in SMZ 6, near Tampa, Florida than in other SMZs ($p = 0.0004$, $F = 4.85$, $n = 177$). Atlantic spotted dolphins were seen more frequently in SMZ 5 and 6 than in other SMZs ($p = 0.0357$, $F = 2.45$, $n = 177$). Bottlenose dolphins were commonly sighted near fishing vessels off the coast of Texas and Florida and when present both adults and juveniles frequently depredated catch of commercial reef fish vessels.

KEY WORDS: Fisheries interaction, marine mammals, Lutjanidae, Delphinidae

A Mixed Management Approach - Artificial Reefs and Fish Sanctuaries - Towards Fisheries Enhancement

Un Enfoque de Gestión Mixta - Arrecifes Artificiales y Santuarios de Peces - A Incrementar la Pesca

Une Approche de Gestion Mixte - Récifs Artificiels et les Sanctuaires de Poissons - Vers la Mise en Valeur des Pêches

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ABSTRACT

Traditionally, wildlife management was either Custodial or Manipulative Management both of which, though acceptable are highly subjective. Artificial reefs are a common example of manipulating a fish population arguably by aggregating fish or increasing the biomass. However, if the artificial reef is deployed within a protected area (custodial), then the outcome is more important than the mechanism. With Jamaica's inshore fisheries severely depleted,

its Government has taken steps towards reversing this by implementing 14 Special Fishery Conservation Areas or fish sanctuaries. One such is the Bluefields Bay SFCA where artificial reefs were deployed towards enhancing its fisheries populations. In this reef limited sanctuary, 350 modules of EcoReefs®, designed to mimic elk horn corals, were anchored in a section (~416 m² in area) of sand patch completely surrounded by seagrass, at a depth of approximately 8m. The baseline survey showed a low fish species richness and density of 2 and 0.014fish/m², respectively. Whilst post deployment at 6 and 7 months the fish species richness and densities increased significantly to 16 and 6.72 fish/m² and 17 and 13.65 fish/m², respectively. Two years later the density is sustained and this exceptional large gathering of fish remains protected from the threats of fishers while being able to attain larger body sizes and in turn increased fecundity. This coupled with the "spill over" effect; the artificial reef can function to generate income from eco-tourism to the benefit of the fishers and other community members whilst sustainably financing the management of this community-based sanctuary.

KEY WORDS: Fish sanctuary, artificial reef

Preliminary Study of *Halophila stipulacea*, an Invasive Species of Marine Magnoliophyta in Guadeloupe Island (Lesser Antilles)

Estudio Preliminar de *Halophila stipulacea*, una Especies Invasora de Fanerógama Marina en la Isla de Guadeloupe (Antillas Menores)

Étude Préliminaire de L'espèce Invasive de Magnoliophyte Marin, *Halophila stipulacea*, en Guadeloupe (Petites Antilles)

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ABSTRACT

The invasive marine Magnoliophyta *Halophila stipulacea*, originating from the Indian Ocean and the Red sea, was first observed in the Antilles, in 2002, in Grenada and reached Guadeloupe in 2011. Cartographies by video transect have shown that the species preferentially settled in sheltered areas on sandy to muddy sediments. *H. stipulacea* has largely colonized the bottoms of the bays of the leeward coast of Guadeloupe, from 3 to 55 m. Where present, this species has replaced indigenous species such as *Syringodium filiforme* and *Halophila decipiens*. The seagrass formed by *H. Stipulacea* presented linear growth rates varying from 0.9 ± 0.3 to 1.4 ± 0.1 cm per day according to the site. The maximum recorded horizontal growth rate reached 7 cm per day. These values can explain the expansion success of this invader. According to the sites, total biomass (dry weight of leaves, rhizomes and roots) fluctuated from 172.6 ± 37.0 g/m² to 308.8 ± 84.8 g/m². Roots are short and the plant is weakly anchored in the sediment.

This characteristic confers to this plant a low resistance to currents and surge. The leaf length varied between 3.8 ± 0.1 cm and 4.4 ± 0.1 cm. The small size of the leaves does not offers an important potential shelter to the associated macrofauna. A preliminary study of the macrofauna (> 2 mm) associated to this new species was performed with an epibenthic sledge completed by underwater visual surveys. A total of 148 invertebrates and 69 fish species were identified.

KEY WORDS: *Halophila stipulacea*, marine magnoliophyta, invasive species, linear growth, associated fauna

**Efecto de las Vedas en las Poblaciones de Tortugas Marinas en Cuba.
Caso de Estudio: Sur de la Isla de la Juventud**

**Effect of Season Closures on Populations of Sea Turtles in Cuba.
Case Study: South of Isla de la Juventud**

**Les Effets de le Cloturéé de Saison sur les Populations de Tortues Marines a Cuba.
Cas Étudié: Sud de Isla de la Juventud**

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RESUMEN

Las tortugas marinas constituyeron un recurso pesquero para Cuba hasta el 2007, cuya pesquería estaba controlada por varias medidas regulatorias para la protección y conservación de estas especies, recomendadas por el Centro de Investigaciones Pesqueras. Teniéndose en cuenta que estas medidas deben evaluarse para conocer sus efectos en la recuperación de las poblaciones, y que el monitoreo llevado a cabo durante 30 años en la playa "El Guanabaco" (sur de la Isla de la Juventud), posibilita analizar el impacto de algunas de estas medidas sobre la anidación en esa playa, este trabajo tiene como objetivo, determinar el efecto de las vedas establecidas sobre las poblaciones anidadoras de tortugas verde y caguama en el sur de la Isla de la Juventud. Con este propósito, se realizó un análisis de la captura (comportamiento para el periodo, y por periodo de veda) y la anidación (para cada especie por periodo) en cuatro etapas: PVI (1982 - 1987), PV2 (1988 - 1994), PV3 (1995 - 2007) y PV4 (2008 - 2011), que representan un periodo de veda diferente. Se comprobó que la variación anual de la captura de tortuga verde y caguama muestra para todo el periodo una disminución en el tiempo para ambas especies vinculadas con las vedas establecidas, mientras que en la anidación se observó una variación de la anidación para ambas especies según las vedas.

PALABRAS CLAVE: Season closures, catch, loggerhead turtles, sea turtles, green turtle

Are Small-Island Developing States Fisheries' Really that Vulnerable to Climate Change?

**Es Realmente la Pesca en los Pequeños Estados Insulares en Desarrollo
tan Vulnerable al Cambio Climático?**

**Les Pêcheries des Petits Etats Insulaires en Développement Sont-Elles
Réellement si Vulnérables Face aux Changements Climatiques?**

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ABSTRACT

Small-Island Developing States (SIDS) are expected to be disproportionately affected by climate change due to their social, economic and geographical characteristics – such as limited size, proneness to natural hazards, low-lying areas, and low adaptive capacity. In recent years various vulnerability assessments of national fisheries to potential climate change impacts have been carried out. These studies (see e.g. Allison et al., 2009 and Hughes et al., 2012), however, scarcely include SIDS despite the particular importance of fisheries in these countries. This study has replicated, with slightly modified methods, the 2009 vulnerability assessment by Allison et al. (2009) with most recent data and has broadened the analysis to include nearly all coastal states in the world including all, except one, Small-Island Developing States. This study assesses the outcome and relevance of this vulnerability assessment for SIDS and discusses a possible new framework integrating the advances in the field of national level vulnerability studies that have been made since the previous assessment.

KEY WORDS: SIDS, climate change, vulnerability assessment, fisheries, Caribbean

Gulfbase as a Tool to Foster Research Collaborations and Better Disaster Preparedness

Gulfbase como una Herramienta para Fomentar la Colaboración en Investigación y una Mejor Preparación para los Desastres

Gulfbase comme un Outil pour Favoriser les Collaborations de Recherche et une Meilleure Préparation aux Catastrophes

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ABSTRACT

GulfBase is a portal on research resources in the Gulf of Mexico, developed in 2002 by the Harte Research Institute, Texas A&M University-Corpus Christi. Its goal is to provide free access to information on the Gulf to researchers, policy makers and the public, to insure the long-term sustainable use and conservation of the Gulf of Mexico. It currently contains information on over 2300 researchers, 493 institutions, 500 projects, 583 conferences and events related to the Gulf, besides hundreds of islands, reefs, bays, etc. GulfBase hosts several databases, including the Biodiversity of the Gulf of Mexico (BioGoMx) database, a comprehensive biotic inventory covering over 15,000 species. The Deepwater Horizon oil spill in 2010 has made clear the need to know what resources are available, who are the experts are, and to be better prepared for disasters. As a result, several new “products” are coming to Gulf-Base, including: 1) BioGoMx partnered with IUCN Red List to augment information on Gulf species and develop a directory of experts; 2) inventory of ocean assets (research vessels, ROVs, gliders, etc.), in partnership with the Gulf of Mexico University Research Collaborative (GOMURC), to increase collaborations and for improved response to ocean events; and 3) Directory of Education and Outreach (E&O) Professionals, in collaboration with the Gulf of Mexico Alliance (GOMA). Additionally, a new website with new features is expected to be released in early 2014.

KEY WORDS: Research, collaboration, disaster preparedness, conservation, online portal

Using Volunteer Educators to Enhance MPA Outreach: Lessons Learned

Utilizando Educadores Voluntarios para Aumentar la Sensibilización Ambiental en AMPs: Lecciones Aprendidas Utiliser Éducateurs

Bénévoles pour Accroître la Sensibilisation Environnementale dans les ZPM: Leçons Apprises

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ABSTRACT

Education and outreach activities can promote environmental stewardship and help build awareness and understanding of marine protected areas (MPAs). Education is an essential component of building compliance and enhancing MPA enforcement, but marine reserves often lack the necessary staff, time, experience and funding. Recent experience in Belize shows volunteer educators can be a useful resource for building MPA education and outreach efforts. In CaM-PAM’s Caribbean MPA Management Capacity Assessment, Belize Fisheries Department staff managing South Water

Caye Marine Reserve (SWCMR) identified outreach and education as the priority area for capacity building and assistance. Given implementation funding for activities with schools via a GCFI-NOAA Cooperative Agreement, the MPA manager called for an expert volunteer to first help design a new outreach and education plan for SWCMR. Once in the field, the volunteer conducted a needs assessment with local schools. A *Reef Keeper Workbook* and a presentation about SWCMR were created. These were piloted in the classroom, guest lectures were given by MPA staff and outdoor environmental activities were held for school students. An informal learning assessment was made indicating student knowledge and understanding about MPAs improved. The project was completed with minimal use of MPA staff time and resources, yet it resulted in increased visibility for the reserve, meaningful contact with local schools, and materials and activities that can be built upon in future. Lessons learned about the steps in working with education volunteers can help enhance the success of other such MPA education programs in the Caribbean.

KEY WORDS: Volunteer, education, marine protected areas, Belize, South Water Caye

Fish Communities Associated with Benthic Biological Zones at the Flower Garden Banks National Marine Sanctuary and Other Banks in the Northwestern Gulf of Mexico

Las Comunidades de Peces Asociadas con las Zonas Biológicas Bentónicas en el Santuario Marino Nacional Flower Garden Banks y Otros Bancos en el Noroeste del Golfo de México

L'association des Communautés de Poissons dans les Secteurs Biologique Benthique au Flower Garden Banks National Marine Sanctuary et D'autres Rives dans le Nord-Ouest du Golfe du Mexique

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ABSTRACT

The Flower Garden Banks National Marine Sanctuary (FGBNMS) is comprised of three uplifted salt dome features located in the northwestern Gulf of Mexico (East Bank, West Bank, and Stetson Bank), between 70-115 miles offshore of Galveston, Texas. These features represent three of dozens of reefs and banks in the Northwestern Gulf of Mexico. The banks rise from the surrounding seafloor at approximately 55-145 m and crest between 17-21 m of the sea surface, and support well-developed benthic communities throughout. Distinct biological zones describing the habitats within FGBNMS have been developed, including coral reef, coral community, coralline algae (including coralline algae reefs and algal nodules), deep coral, soft bottom, brine seep, and mud volcano. Each of these biological zones harbors a distinct and characteristic benthic community. This study presents the addition of fish community data associated with these biological zones, linking dominant fish species to each habitat. While the data presented here originates from surveys at the three banks located within FGBNMS, extensive remotely operated vehicle surveys of nearby locations by the sanctuary and partners indicate these biological zones and associated fish communities possess a wider applicability to the many reefs and banks of the northwestern Gulf of Mexico.

KEY WORDS: Northwestern GoMex, biological zones, fish community, benthic community

Ecología Trófica del Guabino (Pisces: Eleotridae) en el Mar Caribe Cordobés, Colombia

Trophic ecology of Guabino (Pisces: Eleotridae) in the Cordoba's Caribbean Sea, Colombia

Trophique Écologie du Guabino (Pisces: Eleotridae) dans la Mer des Caraïbes de Cordoba, Colombie

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RESUMEN

Se estudió la ecología trófica del Guabino en el mar Caribe Cordobés, Colombia, analizando estómagos de individuos capturados entre enero y diciembre, con tallas entre 20.0-38.1 cm de longitud total (LT) y peso total (WT) entre 68.0-538.0 g. Se estimó el Coeficiente de vacuidad, Grado de digestión, Frecuencia de ocurrencia, Frecuencia numérica, Gravimetría y el Índice de importancia relativa (IIR). El 58.6 % de los estómagos se encontró vacío y el 11.7 % de las presas estaban frescas, 73.3 % medio digeridas y 15.0 % digeridas. Se identificaron tres grupos alimentarios: Peces, Crustáceos y Otros, siendo Peces el grupo más frecuente (69.6 %), encontrándose en casi todos los meses del año, excepto en mayo, el más abundante (66.7 %) y con mayor composición en peso (86.9 %). El IIR presentó valores de 60.5 % para Peces. Los resultados obtenidos permiten inferir que el Guabino es un pez de hábitos alimenticios carnívoros con tendencia piscívora.

PALABRAS CLAVE: Alimentación, dieta, hábitos alimentarios, Mar Caribe

Composición Isotópica de ^{15}N y ^{13}C Del Tejido de Esponjas como Indicador del Impacto de Aguas Residuales Humanas sobre los Sistemas Arrecifales de la Isla de San Andrés, Caribe Colombiano

Isotopic Composition of ^{15}N and ^{13}C in Sponge Tissues as an Indicator of Human Sewage Impacts on Reef Systems at San Andres Island, Colombian Caribbean

Composition Isotopique du ^{15}N et ^{13}C dans les Tissus des Éponge Comme un Indicateur de L'impact des Humaines Eaux Usées sur les Récifs Systèmes de L'île de San Andres, Caraïbes Colombiennes

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RESUMEN

El aumento de la densidad poblacional y desarrollo urbanístico sin planificación durante las últimas 5 décadas, sumado al vertimiento de aguas residuales sin control al mar, ha expuesto los sistemas arrecifales de gran parte del mundo, del mar Caribe en general, y de San Andres isla en particular, a un constante estrés. No obstante, algunas especies de organismos como las esponjas aparentemente se ven beneficiados a través de diferentes estrategias fisiológicas, permitiendo su uso como indicadores biológicos de contaminación. El análisis de isotopos estables de nitrógeno ($\delta^{15}\text{N}$) se ha convertido en una poderosa herramienta para discriminar las fuentes de N natural y antropogénico en ambientes marinos. Así mismo la $\delta^{13}\text{C}$ es usada para determinar la dieta de los organismos a través de la caracterización de los recursos alimentarios asimilados. Considerando que la alimentación de las esponjas se basa fundamentalmente en la gran cantidad de agua que puede circular por su sistema acuífero, y en la capacidad y eficiencia de retener y asimilar partículas y materia orgánica disuelta mediante diferentes procesos metabólicos, se estudió la $\delta^{15}\text{N}$ y $\delta^{13}\text{C}$ del tejido de tres especies de esponjas como indicador del efecto de la eutrofización crónica de sistemas arrecifales en función de la

oferta de nutrientes. Los resultados muestran diferencias en $\delta^{15}\text{N}$ y $\delta^{13}\text{C}$ entre el tejido interno y externo de al menos dos de las especies de esponjas, las cuales se conocen son mixotróficas por la presencia de fotosimbiontes. También se pudo determinar que las estaciones cercanas a la principal fuente de descargas presentan mayores valores de $\delta^{15}\text{N}$ mostrando similitud con registros de diversos autores respecto a sistemas arrecifales bajo la influencia de aguas residuales de origen antropogénico.

PALABRAS CLAVE: Isótopos, bioindicadores, eutroficación, esponjas, arrecifes

Patterns of Rarity of Reef Fishes in the Caribbean Basin

Los Patrones de Rareza de los Peces de Arrecife en la Cuenca Del Caribe

Les Modèles de la Rareté des Poissons de Récif dans le Bassin des Caraïbes

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ABSTRACT

Rare species are an important conservation target, and can provide key insights regarding the processes driving patterns in regional diversity. However, while many studies of Caribbean reef fish assemblages have examined patterns in richness, few have focused specifically on the rarity. The abundance and composition of rare species within assemblages may be influenced by evolutionary history, biogeography, and habitat specificity within taxa. Anthropogenic impacts may also influence the prevalence of rare species. We use observations from the Reef Environmental Education Foundation (REEF) Fish Monitoring Project to characterize patterns in rarity throughout the Caribbean basin. The REEF Fish Monitoring Project is a large, multi-decadal citizen science effort that has generated over 120,000 diver hours of reef fish species observations across the Caribbean. Using these data, we assess rarity patterns throughout the region, and compare these to expectations based on species ecology, evolutionary histories, and habitat characteristics.

KEY WORDS: Reef fish, diversity, Reef Environmental Education Foundation, citizen science, rarity

Successes and Challenges in Achieving Sustainability in Gulf and Caribbean Fisheries: A Conservation Perspective

Un Análisis Conservacionista de los Avances y Dificultades para Lograr una Pesca Sostenible en Golfo y El Caribe: Une Perspective de Conservación

Succès et Défis dans L'atteinte de la Durabilité des Pêcheries du Golfe du Mexique et des Caraïbes: Une Perspective de Conservation

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ABSTRACT

The Monterey Bay Aquarium Seafood Watch program provides sustainability ratings for seafood in order to help consumers and businesses make choices for healthy oceans. The Seafood Watch program defines sustainable seafood as seafood from sources that can maintain or increase production without jeopardizing the structure and function of affected ecosystems. Our recent assessments of Gulf of Mexico and Caribbean fisheries highlight both dramatic successes, and some remaining challenges, of achieving this goal of sustainability in the region. In general, there has been progress

rebuilding previously depleted stocks, demonstrating management's commitment to ending overfishing. However, bycatch of protected and vulnerable species remains a concern in some fisheries. The selectivity of harvest methods and management of bycatch plays a large role in determining Seafood Watch recommendations for Gulf and Caribbean species. In many cases, proven technological solutions to bycatch problems exist and, if fully implemented and enforced, could help mitigate or eliminate significant bycatch concerns. Future attention to these areas could help fisheries achieve recognition as Seafood Watch "best choices" or "good alternatives," which may provide improved market access for fishermen.

KEY WORDS: Sustainable fisheries, bycatch, fishery management

Impacts of Oil Spill Disasters on Marine Fisheries and Their Habitats in North America - A New Book of Current Deepwater Horizon Research Including Reviews of the Exxon Valdez and Ixtoc I Spills

Impactos de Desastres de Derrames de Hidrocarburos a las Pesquerías Marinas y Sus Hábitats en América del Norte - Un Nuevo Libro de Investigaciones Corrientes sobre Deepwater Horizon Incluye Reseñas de Derrames de Exxon Valdez y Ixtoc I

Impacts des Marées Noires Catastrophiques sur les Pêcheries Marines et Leurs Habitats en Amérique du Nord - Un Nouveau Livre Portant sur les Recherche en Cours sur les Conséquences de L'accident du Deepwater Horizon y Compris des Revues des Marées Noires Causées par L'exxon Valdez et L'ixtoc I

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ABSTRACT

The 2010 Deepwater Horizon (DWH) oil spill was one of the largest marine spills in the world (McNutt et al. 2011), leaked 7.94×10^8 – 1.11×10^9 L of crude oil into the northern Gulf of Mexico, and lasted for 84 days. The estimated peak flow was 1.552×10^7 L d⁻¹ (Ryerson et al. 2012). At its maximum, the surface expression of the discharge covered 62,159 km² (Norse and Amos 2010). This response included use of 2.9×10^6 L of Corexit dispersant (Place et al. 2010) that was applied at the surface and the 1500 m deep subsurface leak at the wellhead. At the 2010 American Fisheries Society (AFS) meeting in Pittsburgh, a symposium was held to address response, recovery and research efforts following this historic spill. Subsequently, the editors of this new book, brought together experts researching the Exxon Valdez, Ixtoc I and DWH spills at the 2011 AFS meeting in Seattle for a symposium. This forum presented timely information regarding large-scale oil disaster impacts to North American marine ecosystems. There are 15 chapters of peer-reviewed manuscripts presented in three sections: Ecotoxicology of fishes impacted by oil-derived compounds, Oil impacts to physical habitat in coastal ecosystems, and Population and community dynamics following oil spill disasters. The estimated release date for the book, which will be published by CRC Press, is January-February 2014.

KEY WORDS: Deepwater Horizon, Gulf of Mexico, Book, fisheries, habitats

Visualizing Hypoxia in the Northern Gulf of Mexico**Visualización de Hipoxia en el Golfo Norte de México****Visualisation de L'hypoxie dans le Nord du Golfe du Mexique**

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*Dauphin Island Sea Lab, 101 Bienville Blvd., Dauphin Island, Alabama 36528 USA. * aaron.pilnick@gmail.com.***ABSTRACT**

Hypoxic waters with critically low levels of dissolved oxygen are well established in coastal regions in the Northern Gulf of Mexico (NGOM). These dead zones, largely associated with massive freshwater outflows from river systems such as the Mississippi and Atchafalaya deltas, have the potential to disrupt biological systems including some of the nation's most productive and important fisheries. Hypoxia was discovered East of the Mississippi in the NGOM in 2011; however, much of the spatial and temporal extent of this dead zone has yet to be fully quantified. In July of 2012 and 2013 we recorded surface and bottom dissolved oxygen, temperature, and salinity values using a SeaBird CTD (conductivity, temperature, depth instrument) at a subset of 56 total stations located East of the Mississippi River. Despite not finding hypoxic conditions (< 2 mg/l) in 2012 and 2013, the lowest dissolved oxygen (3.10 mg/l) and salinity (20.26 psu) levels were recorded at stations proximal to Biloxi Marsh, Mississippi. Preliminary analysis indicate that the 2011 opening of the Bonnet Carre spillway may have enabled hypoxic conditions to develop because of a substantial influx of nutrient rich freshwater into the Biloxi Marsh Area. We tracked this influx by using satellite imagery to analyze changes in chlorophyll concentrations and surface salinity levels. Cumulatively, these data indicate that elevated nutrient levels and water column stratification from the spillway outflow in addition to high summer surface temperatures potentially caused the 2011 dead zone east of the Mississippi.

KEY WORDS: Hypoxia, NGOM, oxygen, chlorophyll, salinity

**Coral Bleaching in Arrecifes de Cozumel National Park Cozumel, Mexico,
After the Passing of Tropical Storm Rina in October 2011****Coral Blanqueado en Parque Nacional Arrecifes de Cozumel Cozumel, México,
Tras el Paso de la Tormenta Tropical Rina en Octubre de 2011****Corail Blanchi en Parc National Récifs de Cozumel Cozumel, Le Mexique,
Après le Pas de L'orage Tropical Lutte en Octobre 2011**

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*Tropical Discoveries, P.O. Box 305731, St Thomas, VI 00803 US Virgin Islands. *norman_q@hotmail.com.***ABSTRACT**

Extensive bleaching of *Montastrea annularis* spp. group and several other scleractinian species occurred on the reefs within the Arrecifes de Cozumel National Park of Cozumel after the passage of Hurricane/Tropical Storm Rina. Bleaching was noted at depths of 10 - 40m and in a variety of scleractinian species. Considering that local dive guides had not observed bleaching prior to the storm and the sea surface temperature did not exceed the local bleaching threshold, it is likely that the extensive rainfall associated with Rina lowered salinity sufficiently via subsurface freshwater springs to cause bleaching in susceptible species. This suggests the necessity to monitor not only subsurface sea temperature but also subsurface salinity in localities where freshwater springs occur.

KEY WORDS: Hurricanes, coral damage, salinity, coral bleaching, marine protected area

Mitochondrial DNA Variation in Queen Conch *Strombus gigas* from Archipelago of San Andres, Old Providence and Santa Catalina, Sea Flower Biosphere Reserve

Variación del ADN Mitocondrial del Caracol Pala *Strombus gigas* en el Archipiélago de San Andrés, Providencia y Santa Catalina, Reserva de Biosfera Sea Flower

La Variation du ADN Mitochondriel du Lambi *Strombus gigas* dans L'Archipel San Andres, Providencia et Santa Catalina Reserve du Biosphere Sea Flower

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ABSTRACT

Queen Conch *Strombus gigas* is a large gastropod of significant economic importance across the Greater Caribbean region and currently considered as a commercially threatened species. To complement the genetic connectivity patterns for this specie through the Caribbean region, a primer pair flanking an AT rich mitochondrial region obtained from whole genome shotgun sequencing of *S. gigas* genome was used for assess the genetic diversity of queen conch populations from Archipelago of San Andres, Old Providence and Santa Catalina (ASPSC). Average nucleotide and haplotype diversity within *S. gigas* were found to be high. The neighbor joining tree of these haplotypes showed the presence of two different mitochondrial groups suggesting the possibility that two mitochondrial lineages of *S. gigas* are distributed through the ASPSC atolls. Remain to explore whether these haplotypic differences explain the high intrapopulation diversity previously reported in queen conchs from ASPSC and the distribution of these two mitochondrial groups in other Caribbean regions which would be crucial for selecting better fishery management rules.

KEY WORDS: Population genetics, Sea Flower Biosphere Reserve, mitochondrial DNA, genetic diversity

Age and Growth of *Epinephelus morio* from Southern Gulf of Mexico

Edad y Crecimiento de *Epinephelus morio* del Sur del Golfo de México

Age et Croissance D'*Epinephelus morio* dans le Sud du Golfe du Mexique

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ABSTRACT

Epinephelus morio (red grouper) is the most important grouper species in southern Gulf of Mexico, contributing from 1999 to 2009 with 58% to 61% (% gutted weight) of total captured volume. CPUE data shows grouper landings decline from 19,886 tonnes (T) in 1972 to 6,212 T in 2011. Red grouper is considered as near threatened specie by IUCN and its fishery overexploited and in danger of collapse. During 1996 - 1999, 420 red groupers were captured using long line by artisanal and industrial Mexican fishing fleets. Otoliths were up through the gills-removed, alcohol cleaned and stored dry. Age determination was performed by assigning annuli based on the number of opaque zones from the otolith core to the otolith margin, in left sagittae thin sections. Individuals ranged in size from 39.0 - 89.0 cm (L_F) and in age from 2 - 14 years. Age-7 fish were the most numerous in the sample ($N = 106$), followed in frequency by age-6 ($n = 99$), age-8 ($n = 51$) and age-5 ($n = 45$), representing 71.6 % of total specimens. Young fish with age-2 and age-3 (each one $n = 1$) and older fish with age-13 and age-14 ($n = 3$, $n = 1$, respectively) were poorly represented. Edge-type analysis confirmed the formation of a single growth annulus per year, recording the smallest marginal increment values between July (0.6241 mm) and August (0.64421 mm). The relationship between furcal length and age was described by von Bertalanffy growth model: $L_t = 79.49[1 - \exp(0.18(t - 0.997))]$.

KEY WORDS: Red grouper, otoliths, age, growth

**Inventory of Crustaceans, Molluscs and Echinoderms in Guadeloupe and Saint-Martin,
French West Indies: An Exceptional, Underestimated Biodiversity**

**Inventaire des Crustacés, Échinodermes et Mollusques de Guadeloupe et
Saint-Martin aux Antilles Françaises: Une Biodiversité Exceptionnelle Méconnue**

**Inventario de los Crustáceos, Moluscos y Equinodermos en Guadalupe y San Martín,
Antillas Francesas: Una Biodiversidad Excepcional Desconocida**

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ABSTRACT

1,500 mollusc species, 350 decapod crustacean species, 81 echinoderm species and 30 species new to science : those are the first results of the inventories carried out in Guadeloupe and Saint-Martin in 2012, that are already confirming the exceptional biodiversity of those French overseas territories. Those inventories led by the National Park of Guadeloupe and the Saint-Martin National Nature Reserve were funded by the French Ministry of Ecology and the European Union. French and American universities, the French National Museum of Natural History and the Florida Museum of Natural History have combined their efforts and know-how to complete this unprecedented scientific mission successfully. A total of 60 scientists, naturalists and protected areas managers and staff have worked in the field for over a month. Numerous sampling techniques have been implemented to prospect each ecological niche, day and night (underwater vacuum filtering and brushing baskets, dredging, baited traps, yabby pumps and soil sifting). Thus, marine protected areas managers will be provided with baselines to build conservation actions upon. Researchers aim to establish a “new generation” collection with molecular sequencing that will feed in scientific publications. The taxonomic groups that have been surveyed through these campaigns play a key role in the functioning of tropical marine ecosystems, and there is a need to build a better knowledge of their diversity to preserve them better. In that regard, complementary inventories of marine biodiversity must be developed, including other poorly studied compartments (deep sea) but also other groups (sponges, bryozoans and ascidians).

KEY WORDS: biodiversity, inventories, MPA, Saint Martin, Guadeloupe

Hydroacoustic and Video Surveys at Toppled and Standing Petroleum Platforms in the Northern Gulf of Mexico: Community Structure and Implications for Fisheries Management

Estudios Hidroacústicos, Vídeo en Permanente Derrocado y Plataformas de Petróleo en El Norte del Golfo de México: Estructura de la Comunidad y Las Consecuencias para la Ordenación de la Pesca

Hydroacoustiques et Vidéo des Enquêtes à Renversé Permanent et Plates-Formes Pétrolières dans le Nord du Golfe du Mexique : Structure de la Communauté et les Implications pour la Gestion de la Pêche

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ABSTRACT

There has been relatively little study of the efficacy of decommissioned oil and gas platforms as artificial reef habitats for various species of fish in the Gulf of Mexico. A variety of fish species have been reported to occur on these structures; but the species biomass distribution and community structure has not been studied thoroughly. Hydroacoustic and video surveys are being conducted quarterly during a two-year study from June 2013 to June 2015 to gain information about the differences between the community structures of the two toppled and two standing platforms located approximately 130 km off the coast of Louisiana in the northern Gulf of Mexico, at 90 m depth. The decommissioned platforms in our study are a part of the Louisiana Artificial Reef Program (LARP) and have been in place since 2002. Stereo-cameras will be utilized for the video surveys, allowing us to post-process the lengths and frequencies of the fishes recorded. Hydroacoustics will be used to define the spatial distribution of fish biomass. Determination of the community structure differences between the sites will allow for further understanding of how artificial reef structures in the Gulf of Mexico impact the ecology of the fish communities. Additional data collection will allow us to gain more knowledge both about these structures and their roles and applications for management of fisheries in the Gulf of Mexico.

KEY WORDS: Artificial reef, biomass, species, ecology, fisheries

Impacts of Recreational and Artisanal Fisheries, Cayman Islands, Caribbean

Impactos de la Pesca Recreacional y Artesanal, Islas Caiman, Caribe

L'impact de la Pêche Récréative et Artisanale aux Îles Caïmans, Caraïbes

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ABSTRACT

To examine the potential impact of recreational and artisanal fisheries on reef ecosystems in the Cayman Islands (where there is no commercial fishing), the level of fishing pressure was investigated by using structured questionnaires directed at fishers. Illegal fishing pressure was investigated using marine enforcement officer reports spanning 1993 - 2010. Within a monthly period, fishers reported catching 14,968 fish on Grand Cayman and 5,205 fish on the Sister Islands (88% and 80% of which were reef fish, respectively). The mean catch size was 72 (\pm SD 152) fish month⁻¹ on Grand Cayman, and catch size was significantly higher for respondents targeting reef fish than for those targeting pelagic species (Mann-Whitney U test, $p < 0.01$). The mean number of days spent fishing month⁻¹ ranged between 5.1 (\pm SD 6.5) and 8.4 (\pm SD 7.4). While Lutjanids were caught in greatest numbers, of greatest concern were the num-

bers of herbivores extracted. Fishing effort was non-uniformly distributed around the islands (Chi-square tests, $p < 0.01$) being aligned closely with fringe reefs, populated areas and shore access points. Poaching in the MPAs and other illegal fishing activities remain an issue, with the queen conch (*Strombus gigas*) representing the major target organism. Despite major support for the idea of marine environmental management, over 50% of interviewed fishers believed that enforcement of marine park laws is currently inadequate. The impacts of artisanal and recreational fishing is often overlooked; this study indicates that both practices are significant in the Cayman Islands, with the potential to influence reef resilience and ecosystem functioning.

KEY WORDS: Recreational fishery, artisanal fishery, questionnaires, fisheries management, Cayman Islands

Estimating Marine Reserve Effects through Quantification of Macro-algal Biomass, Cayman Islands

Estimacion de los Efectos de las Reservas Marinas por Medio de la Cuantificacion de Biomasa de Macroalgas, Islas Caiman

Estimation des Effets des Reserves Marines en Relation a la Quantification de la Biomasse De Macroalgues

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ABSTRACT

Marine protected areas (MPAs) are widely considered to aid resiliency to hard-coral/macroalgal phase shifts. To determine the effectiveness of an established marine reserve in Grand Cayman, algal biomass was compared within and outside the reserve. Between November-December 2010, macroalgae was extracted from five 0.25m² quadrats at 12 shallow reef sites at an 8 - 10m depth (4 sites MPA, 8 non-MPA), samples identified to genus and weighed to attain mean biomass measures per site. A total dry-weight of 544.45g was collected (mean biomass at sites ranged from 3.47 - 6.26g West-MPA; 3.80 - 5.90g North-non-MPA; and 6.82 - 26.05g South-non-MPA), with *Dyctiota*, *Halimeda*, *Lobophora*, filamentous turf algae and other turfing algae comprising total biomass at most sites. Reserve effect was not detected ($p > 0.05$), though variability between sites based on aspect differentials were observed. Biomass was significantly higher in the South than North and West ($p < 0.05$), which exhibited similar biomass values ($p > 0.05$). Species composition varied between sites with southern sites displaying a significantly different algal community structure ($p < 0.05$), driven by comparatively minimal biomass of *Lobophora*, consistently large proportion of *Halimeda* and a greater biomass of turf algae than the North and West. Differences in biomass around the island may indicate natural variation between reefs of different exposures determining habitat complexity, reef fish populations, nutrient levels and available spores for algal recruitment. Intra-habitat variation may be responsible for concealing reserve effect in the West. Similarly, algae around the island may have reached a "size refuge" whereby keystone herbivores no longer graze upon them and thus minimal "effect" would be evident.

KEY WORDS: Marine protected areas, macroalgae, phase shift, extraction, Cayman Islands

An Analysis of the Spatial Distribution and Impacts of Recreational Lobster Diving and Spear Fishing Activities in Bermuda

Un Análisis de la Distribución Espacial y los Impactos de la Pesca de la Langosta y la Pesca Submarina para el Ocio en las Bermudas

Une Analyse de la Distribution Spatiale et les Impacts de la Pêche de Langouste et de la Pêche au Harpon pour les Loisirs dans les Bermudes

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ABSTRACT

Bermuda is a small, densely populated oceanic island with a broad range of marine stakeholder groups, and recreational fishing in its various forms is an important part of the local lifestyle. Spatial data gathered during a recent survey of recreational fishing was analyzed using Geographical Information Systems (GIS) to produce a geospatial map of recreational fishing intensity. A more detailed analysis of lobster diving and spear fishing activities utilised reported catch and effort data from these two groups of licensed recreational fishers. The distribution of catches was mapped in GIS using the grid-based reporting system for these fisheries. Further, spear fishing catches at the species level were compared to published geospatial maps of target species density. Profiles of these specialized user groups were developed based on their reported catch and effort, information from the recreational fishing survey and a targeted questionnaire. It was interesting to note skewed distributions of catch and effort even within these specialized sectors. Data indicate that recreational lobster divers and spear fishers in Bermuda do not appear to be having a large impact on local marine resources, as these in-water fisheries have a small number of participants who typically have small catches. However, these very specialized resource users utilize particular areas and have a high stake in the management of Bermuda's marine environment. Accordingly, they should be given due consideration during marine spatial planning. This analysis will inform management, help prioritize enforcement activities and contribute to the development of a marine spatial plan for Bermuda waters.

KEY WORDS: Recreational fishing, lobstering, spear fishing, Bermuda, marine spatial planning

Descripción de la Pesquería, en el Archipiélago de San Andrés, Providencia y Santa Catalina, Reserva de la Biosfera Seaflower

Description of the Fishery, in the Archipelago of San Andres, Providencia and Santa Catalina, Biosphere Reserve Seaflower

Description de la Pêche, dans L'archipel de San Andrés, Providencia et Santa Catalina, Réserve de la Biosphère Seaflower

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RESUMEN

La Actividad pesquera en el Archipiélago de San Andrés, Providencia y Santa Catalina, Reserva de Biosfera Seaflower, es desarrolla a escala artesanal e industrial, y se caracteriza por ser multiespecífica en las especies capturadas, empleando varios tipos de artes y métodos de pesca en varios tipos de flotas pesqueras. La pesca está dirigida a tres principales recursos: Peces de escama, langosta espinosa (*Panulirus argus*) y el caracol pala (*Strombus gigas*). En la pesca Artesanal se utiliza como arte principal la línea de mano y Anzuelo con varios sub-métodos, le sigue el palangre ver-

tical, el Buceo con arpón y por ultimo las nasas de pescado. Por su parte la pesca industrial emplea como artes: el palangre vertical, el palangre horizontal de fondo y las nasas de langosta. La producción realizada por la flota industrial entre el 2001 y el 2005 oscila entre los 300 - 350 tn anuales para Peces de escamas y, a partir del 2006 la captura no sobrepasa los 200 tn; siendo para el 2012 valores de extracción de 117 tn. Para el 2012 la producción de langosta Espinosa fue de 133 tn. Se cuenta con poca información sobre la composición de especies de peces de escamas en las capturas industriales, la cual está dirigida a su la mayor parte a la extracción de peces de la familia Lutjanidae y Serranidae. Para la Pesca Artesanal la producción entre el 2004 y el 2006 oscila entre 100 y 110 tn para peces de escamas, sin embargo desde el 2007 se evidencia un incremento de hasta 100% de la captura. Captura que corresponden en su mayor parte a las familias: Lutjanidae, Serranidae, Carangidae y Scombridae.

PALABRAS CLAVE: Pesqueria, San Andres Islas, Seaflower, industrial, artesanal

**Distribución y Abundancia de la Langosta Espinosa “*Panulirus argus*”,
en el Sector Sur del Área Marina Protegida de la Reserva de la Biosfera Seaflower**

**Distribution and Abundance of the Spiny Lobster “*Panulirus argus*”,
in the Southern Sector of the Marine Protected Area of the Seaflower Biosphere Reserve**

**Distribution et L'abondance de la Langouste *Panulirus argus*,
dans le Secteur Sud de la Zone de Protection Marine de la Réserve de Biosphère Seaflower**

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RESUMEN

La langosta espinosa *Panulirus argus* es uno de los principales recursos pesqueros del archipiélago de San Andrés, Providencia y Santa Catalina. Los Cayos del sur (Cayo Bolívar y Cayo Albuquerque) son las zonas de mayor influencia de los pescadores artesanales de San Andrés. Recientemente, se ha notado una disminución de las capturas provenientes de Cayo Bolívar, probablemente como resultado del aumento en la frecuencia e intensidad de pesca. Con el objetivo mejorar el conocimiento de la abundancia y distribución de este organismo nos y dar una aproximación al estado del recurso, se realizaron en los cayos Bolívar (34 estaciones) y Albuquerque (38 estaciones) monitoreos de distribución y abundancia de la langosta espinosa mediante reconocimientos visuales en trayectos errantes a profundidades menores de 20 metros. Se determinó la densidad para cada tipo de fondo y con ayuda de técnicas geoestadísticas, como el “kriging”, se analizaron las variables correlacionadas espacialmente correspondientes a la información obtenida del tipo de fondo en los cuales se encontraba langosta. La densidad estimada para la langosta fue de 0.7 Ind/ha para el cayo bolívar y 3.36 Ind/ha para Bolívar; siendo el sustrato “Arenas con escombros coralinos” con mayor número de langosta avistadas para ambos cayos. Las densidades estimadas están por debajo de valores reportadas para otras áreas del Caribe como México y Cuba. Es mucho lo que falta por conocer acerca de la especie en cuestión; es necesario hacer énfasis en el estudio del número, tamaño y estructura por área de las poblaciones de aguas profundas para estimar el verdadero estatus poblacional.

PALABRAS CLAVE: Langosta espinosa, distribución, abundancia, SEAFLOWER, densidad

Gulf of Mexico Data Atlas: Digital Data Discovery and Access

Atlas de Datos del Golfo de Mexico: Descubrimiento y Acceso a Datos Digitales

Atlas de Données du Golfe du Mexique: Découverte et L'accès aux Informations Digitales

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ABSTRACT

The Gulf of Mexico Data Atlas is an online data discovery and access tool that allows users to browse a growing collection of ecosystem-related datasets visualized as map plates. Thematically, the Atlas provides updated long-term assessments of the physical, biological, environmental, economic and living marine resource characteristics that indicate baseline conditions of the Gulf of Mexico. These data provide crucial support to restoration and monitoring efforts in the Gulf. A multi-agency executive steering committee including members from international, federal, state, and non-governmental organizations was formed to guide Atlas development and to contribute data and expertise. The Atlas currently contains over 230 maps in 70 subject areas. Each map plate is accompanied by a descriptive summary authored by a subject matter expert and each data set is fully documented by metadata in Federal Geographic Data Committee (FGDC)-compliant standards. Source data are available in native formats and as web mapping services (WMS). Datasets are also searchable through an accompanying Map Catalog and RSS feed. The Gulf of Mexico Data Atlas is an operational example of the philosophy of leveraging resources among agencies and activities involved in geospatial data as outlined in the US Department of Interior and FGDC "Geospatial Platform Modernization Roadmap v4 - March 2011". We shall continue to update and add datasets through existing and new partnerships to ensure that the Atlas becomes a truly ecosystem-wide resource.

KEY WORDS: Gulf of Mexico, ecosystem, restoration, geospatial, data access

Trophic Ethology of the Lionfish *Pterois volitans* in Guadeloupe Island (Lesser Antilles)

Éthologie Alimentaire du Poisson-Lion *Pterois volitans* en Guadeloupe (Petites Antilles)

Etología Alimentar del Pez León *Pterois volitans* en Guadeloupe (Antillas Menores)

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ABSTRACT

The lionfish *Pterois volitans* is an invasive species introduced in Florida in the 1980s. Lionfishes were first reported in Guadeloupe in 2010. The lack of predators allowed that invader to reach high densities that threaten local assemblages of reef fishes. In order to study their potential impact in Guadeloupe Island (Lesser Antilles), the trophic ecology of lionfishes was investigated through the study of stomach contents. A total of 355 fishes from 5.5 cm to 33.9 cm (TL) were examined. The preys were characterized by their percentage in frequency, in numbers and in biomass. In Guadeloupe, teleost preys were present in 87% of stomachs, the remains being shrimps (44% of stomachs). The most important fish families in biomass were Pomacentridae (59,9%), Mullidae (13,4) and Labridae (6,2%). Moreover, lionfish feeding ethology exhibits an important ontogenic variation, shifting from a Crustacean dominated diet for young fishes to a piscivorous diet for fishes whose size exceeds 10 cm (TL). In addition, Acanthurid and Scarid fishes are poorly consumed by lionfish, which does not corroborate the hypothesis that lionfish could contribute to the depletion of herbivorous fishes on Caribbean reefs.

KEY WORDS: *Pterois volitans*, feeding habits, Guadeloupe Island, Caribbean

**Quantification and Classification of Garbage Presence and Marine Debris
Along the Coasts of the Veracruz, Veracruz, Mexico**

**Cuantificación y Clasificación de la Presencia de Basura y Desechos Marinos
Encontrados en las Costas de Veracruz, Veracruz, México**

**Quantification et la Classification de la Présence de Déchets et Débris Marins
Sur les Côtes de la Veracruz au Mexique**

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ABSTRACT

Marine debris on coastal shores has many detrimental effects to ecosystems, including hazards to the health and safety of marine life, as it often entangles or is ingested by seabirds, marine fish, and mammals. Debris has varying effects locally; in certain cities in Mexico, garbage presence has caused severe levels of impacts to the coastal zone. This study is aimed at supporting marine researchers and conservation efforts in Mexico by addressing the issues of debris presence along the coastal zone of Veracruz via assessing how much and what types of marine debris is present. Veracruz is of particular importance, as it home to a system of 17 coral reefs that are protected by the government. These protection efforts and the health of these reef ecosystems are thwarted by the high amounts of refuse and debris on local beaches. Garbage collection occurred between May, 2013 and June, 2013 along three separate collection sites of varying composition. The total area for collection was 1.06 miles of rocky and sandy shores. Debris abundance ranged between .01 pounds/meter and .55 pounds/meter, while this varied according to collection site. A total of 1806 pounds was collected, the majority (over 90%) of which were recyclable materials, such as glass, plastics, rubber, paper, cardboard, and aluminum. The most abundant type of refuse collected was glass. This study provides a baseline for future debris scholarship and conservation efforts on the coasts of Veracruz, Mexico, and the Caribbean.

KEY WORDS: Garbage presence, marine debris, Mexico, Veracruz reef system, collection

**Pilot Assessment of the Spatial Distribution of Artisanal Fishing Vessels
in the Southeastern Mexico through VMS: Challenges and Opportunities**

**Evañuación Piloto de la Distribución Espacial de Embarcaciones Artesanales en el
Sureste de México a Través de un Sistema de Monitoreo Satelital: Retos y Oportunidades**

**Evaluation Pilote de la Distribution Spatiale des Bateaux Artisanaux dans le Sud-Est du Mexique
à L'aide D'un Système de Surveillance des Navires par Satellite: Défis et Opportunités**

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ABSTRACT

In Mexico, as in many other countries, an increase in fishing effort and a decrease in catches is becoming the rule more than the exception. This scenario demands to learn more about the spatial distribution of the fleet and their operations. Better understanding on the fleet dynamics can help to address externalities and other problems faced by fisheries, including illegal fishing. Through international agreements, Mexico has adopted vessel monitoring systems (VMS) since 2004. However, this system has been implemented only for industrial fleets due to technical and economical features, and recently became mandatory for artisanal fleets. The challenges to cover a large and complex fleet should not be dismissed though. In 2010, a pilot project was undertaken, including development and implementation of a moni-

toring system for artisanal fleet in the Southeastern Mexico. We present preliminary results from this project addressing the spatial distribution of the artisanal fleet in four states from the study region. Variables associated to fishing activities from geographic coordinates of fishing trips (e.g., speed, distance, time) were estimated. A summary of trends on the areas of concentration of the fleet and frequency of trips were analyzed. The potential use of VMS for artisanal fisheries is stressed after this study. It could offer important information for fisheries management, given the complexity of artisanal fisheries (variety of target species and use of multiple gears). We discuss the challenges and the potential use of VMS for the artisanal fisheries management in the region.

KEY WORDS: Spatial distribution, artisanal fleet, vessel monitoring system, fleet dynamics, Southeastern Mexico

Enhancing Stewardship within Fisherfolk Organisation

Administración de Enhancing dentro de Organización Fisherfolk

Gestion d'Enhancing dans l'Organisation Fisherfolk

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ABSTRACT

Small-scale fisheries are dynamic and evolving socio-economic sectors throughout the world, often employing labour intensive harvesting, processing and distribution technologies to exploit marine and inland fishery resources to meet the demands of international and domestic markets. These interactions are typically embedded within a variety of often poorly documented institutional arrangements for stewardship that govern or guide the management of fisheries systems through community or organisational collective action. The paucity of research in this area within small-scale fisheries has resulted in major gaps in knowledge and information. Our understanding of marine fisheries stewardship by individuals, organisations and communities in the Caribbean is not well developed. Understanding collective action and the roles that fisherfolk organisations may play in stewardship is essential given an increasing interest in co-management, other means of fisheries governance and the ecosystem approach to fisheries (EAF). The attention now being paid to the Caribbean Network of Fisherfolk Organisations (CNFO) by the Caribbean Regional Fisheries Mechanism (CRFM) and other organisations is evidence of this trend. Understanding the roles that fisherfolk organisations may play will be critical to success. This research examines the nature of stewardship in fisherfolk organisations in Guyana and Dominica, and the potential for enhancing stewardship within them by investigating individual and collective action that may lead to improved management of resources to the benefit of the fishing industry.

KEY WORDS: Small-scale fisheries, stewardship, fisherfolk organisation, collective actions

**Evaluación de la Biomasa de Población de Pulpo (*Octopus maya*)
en la Península de Yucatán, 2012**

Octopus (*Octopus maya*) Biomass Evaluation in the Yucatan Peninsula during 2012

**Evaluation de la Biomasse de la Population de Poulpe (*Octopus maya*)
dans la Peninsule du Yucatan, 2012**

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RESUMEN

En México, la pesca de pulpo ocupa el cuarto lugar nacional por su volumen y valor. El 94% de la producción la aportan los estados Yucatán y Campeche, siendo *Octopus maya* la especie mayoritaria. Se realizó una evaluación poblacional de la especie mediante dos indicadores de abundancia: 1) Dependiente de la pesquería, mediante el monitoreo del recurso en diez puertos pesqueros del litoral de Yucatán en las temporadas de pesca 2007 - 2012, aplicando un Análisis de Población Virtual y 2) Independiente de la pesquería, mediante 50 campañas de muestreo a bordo de embarcaciones comerciales, aplicando el método de área barrida para la estimación de la densidad de organismos (pulpos/m²). Los resultados muestran que la estructura de edades en la captura comercial varía desde 1 mes hasta 18 meses; los machos mayormente representados fueron de 4 meses de edad y las hembras entre 4 y 5 meses de edad. En la temporada de pesca 2012, la biomasa del stock desovante, así como los niveles de reclutamiento mensuales alcanzaron los niveles máximo de la serie disponible con 12,000 t y 7,700,000 individuos, respectivamente, entre septiembre y octubre en relación directa con el índice de abundancia independiente, para posteriormente disminuir a los valores más bajos de la serie. Esto último puede estar relacionado con los altos niveles de captura mensual en la temporada de captura, excediendo en un 68% la cuota de captura. Estos valores pueden afectar la fracción de la población que sobrevive a la temporada de captura y reproduce en los meses posteriores, produciendo niveles de abundancia bajos del recurso durante 2013.

PALABRAS CLAVE: Biomasa, pulpo, reclutamiento, pesquería, análisis población virtual

**Management Applications of Black Grouper (*Mycteroperca bonaci*)
Sounds at Spawning Aggregations**

**Aplicaciones de Gestión de los Sonidos de Guajil Prieto (*Mycteroperca bonaci*)
en las Agregaciones Reproductivas**

Applications de Gestion du les Sons do Mérrou Noir (*Mycteroperca bonaci*) dans Zones de Frai

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ABSTRACT

The black grouper, *Mycteroperca bonaci*, is an important component of Atlantic fisheries. Their reproductive behavior involves spawning aggregations that concentrates their populations making them vulnerable yet easy to assess during this time. Passive acoustic and synchronous video recordings were made at two spawning aggregation sites to

study the sounds associated to reproductive behaviors of *M. bonaci*. A characteristic sound produced during courtship displays involves behaviors commonly observed for groupers of this genus at spawning aggregations. Courtship-associated sounds quantified over the spawning season at Mona Island, Puerto Rico revealed seasonality and periodicity. Most of the daily sound production occurred during a period of two hours prior to sunset. The highest rates of sound production lasted for a period of ten days with a peak 10 d after full moon with lunar periodicity over three consecutive months (January to March). The maxima in courtship-associated sounds were within the reported season of reproduction in the Caribbean (December to March), but prior to seasonal management regulations in the US Caribbean EEZ waters (February to April). Passive acoustics provide an additional manner to measure the temporal variability of reproductive activity and to evaluate current management strategies (seasonal bans or marine reserves), which are critical for the recovery of threatened groupers.

KEY WORDS: Black grouper, courtship-associated sounds, spawning aggregation, management, Mona Island

Seasonal Relationships of Caloric Density and Liver Weight of Red Snapper on Natural Hard-bottom Banks and Artificial Reefs in the Northwestern Gulf of Mexico

Relaciones Estacionales de la Densidad Calórica y el Peso del Hígado de Pargo Rojo en los Bancos de Fondos duros Naturales y Arrecifes Artificiales en el Noroeste del Golfo de México

Les Rapports Saisonnières de Densité Calorique et Poids du Foie de Vivaneau Sur dur Naturel Bas-banques et les Récifs Artificiels dans le Nord-Ouest du Golfe du Mexique

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ABSTRACT

Information was gathered on seasonal variation of two condition factors of red snapper, *Lutjanus campechanus*, taken from the Louisiana (LA) continental shelf banks. Red snapper were collected from September 2011 to October 2013 from three natural banks on the LA shelf, those being Jakkula, McGrail, and Bright, and one artificial reef in the East Cameron Artificial Reef Planning Area. The two condition factors chosen were the liver-somatic index (LSI) and caloric density. LSI was calculated as the proportion of liver weight to eviscerated body weight. Caloric density of fish muscle tissue was estimated directly with a Parr 6200 oxygen bomb calorimeter. In general, LSI began to increase from December-March, peaked in May, and declined thereafter until October. LSI differed between natural and artificial reefs, and the LSI was higher in females, indicating more energy invested towards reproduction. The caloric density of red snapper exhibit a similar pattern to that of the LSI, but the trends were not as clear, owing to significant annual variability. The caloric density was higher in 2012 compared to 2013, indicating that red snapper were able to store more energy within their muscle tissues in 2012. The caloric density of red snapper from the sites with coral substrate (Bright and McGrail) was generally lower from that of the non-coral substrate sites (Jakkula and East Cameron). Red snapper appear to be using energy stores from both the liver and muscle tissue for reproduction and the site-specific differences seen may be attributable to dietary and environmental factors.

KEY WORDS: Caloric density, liver-somatic index, red snapper, Gulf of Mexico

Finfisheries Associated with Deep-Sea Sponge-Coral Ecosystems Off the Southeastern U.S.**Pesquerías Asociadas con Esponjas y Corales Ecosistemas de las Profundidades
Marinas Fuera de los Ee. Uu. del Sudeste****Pêches Associés aux Éponges et de Corail Écosystèmes de la Mer Profonde
au Large du Sud-Est Américain**

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ABSTRACT

A deepwater (> 300 m) demersal fishery developed off the southeastern U.S. in the 1980s, targeting wreckfish (*Polyprion americanus*) in sponge-coral and hard-bottom habitat. Declining populations and increasing regulations in shallow-water fisheries provided incentive for fishermen to develop alternatives. Rapid expansion in the wreckfish fishery led to a management plan that includes gear restrictions, a spawning closure, an annual catch limit and individual quotas for the commercial fishery. The plan was amended recently to include a bag limit, seasonal closure and annual catch limit for the recreational sector. U.S. management has resulted in a small sustainable fishery for wreckfish, in contrast to other parts of its wide range where the fishery has collapsed. Several species that are economically important in other parts of the world are caught with wreckfish in the U.S. but no management has been developed for them, as they are considered bycatch. Blackbelly rosefish (*Helicolenus dactylopterus*), red bream (*Beryx decadactylus*) and barrelfish (*Hyperoglype perciformis*) are, like wreckfish, desirable species that grow slowly and are long-lived (30, 69, 85 and 78 years, respectively). Because of their biology and limited habitat, they can be easily overfished. Genetic studies on some of these species show connectivity between the U.S. and other areas of the world where they are fished in targeted fisheries. Those fisheries could result in depletion of U.S. stocks if local recruitment is dependent on distant populations. Regional management should be developed for the U.S. that considers all of the species landed and fisheries in other parts of their range.

KEY WORDS: Polyprionidae, Berycidae, Scorpaenidae, Centrolophidae, Blake Plateau

**Biología Reproductiva de la Anchova *Mugil incilis* Hancock, 1830
en el Mar Caribe Cordobés, Colombia**

**Reproductive Biology of Parassi Mullet *Mugil incilis* Hancock, 1830
in the Cordobas Caribbean Sea**

**Biologie de la Reproduction de Anchova *Mugil incilis* Hancock, 1830
dans la Mer des Caraïbes de Cordoba, Colombie**

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RESUMEN

Para estudiar la biología reproductiva de la Anchova en el mar Caribe Cordobés, se colectaron 356 individuos entre enero y diciembre 2007, cuyas tallas y pesos oscilaron entre 18.9 - 45.0 cm de longitud total y 62.0 - 718.0 g. Se estimó proporción sexual, índices de madurez sexual, época de desove, talla media de madurez sexual, diámetro de ovocitos maduros y fecundidad. Se encontraron 219 hembras, 132 machos y 5 individuos indiferenciados, por lo que la proporción sexual hembra: macho observada fue 1.7:1, diferente a lo esperado; con dimorfismo sexual a la talla, puesto que las hembras alcanzan tallas mayores que los machos. Los índices de madurez sexual muestran que la época de desove se extiende de febrero a diciembre con picos reproductivos en marzo, junio, agosto y octubre para hembras y abril, septiembre y noviembre para machos. La talla media de madurez sexual fue estimada en 26.8 cm LT, el diámetro de los ovocitos fue 569 µm y la fecundidad promedio estimada fue de 250000 ovocitos. Al relacionar toda esta información se infiere que la Lisa es un pez con desove parcial, época de reproducción prolongada a lo largo del año, ovocitos pequeños y alta fecundidad.

PALABRAS CLAVE: Fecundidad, ecología reproductiva, Mugilidae, Colombia

**Age and Growth Validation of the Common Thresher Shark
(*Alopias vulpinus*) in the Northeastern Pacific Ocean**

**Validación de la Edad y Crecimiento del Tiburón Zorro Común
(*Alopias vulpinus*) en el Noreste del Océano Pacífico**

**Validation de L'âge et de la Croissance du Requin Renard Commun
(*Alopias vulpinus*) dans l'Océan Atlantique Nord-Est**

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ABSTRACT

The common thresher shark (*Alopias vulpinus*) supports important commercial and recreational fisheries in the northeastern Pacific Ocean. It is a relatively long-lived species with a late age-at-maturity, thus a comprehensive understanding of the status of the thresher shark population is essential to guiding sustainable management decisions. The purpose of this study was to use oxytetracycline (OTC) tagging to validate the band pair deposition rate in thresher shark vertebrae. OTC is absorbed by calcifying structures in the thresher shark vertebrae so that time-at-liberty can be correlated to the number of band pairs deposited post tagging for direct validation. OTC tagging occurred off southern California from 1998-2012. A total of 2,137 thresher sharks were tagged with conventional tags and 1,445 of these animals, ranging in size from 56 to 309 cm fork length (FL), were injected with OTC. Vertebrae from 57 OTC-tagged and recaptured animals ranging from 58 to 168 cm FL at the time of tagging have been returned. Twenty-six of these

samples are from individuals at-liberty for over one year, with a maximum time-at-liberty of 1,389 days (3.8 years). Annual vertebral band pair deposition rates are currently being determined and will be used to estimate growth rates of the thresher shark at multiple life stages. This information can be used to provide accurate age and growth models for the common thresher shark in the northeast Pacific Ocean and provide information necessary for accurate stock assessments.

KEY WORDS: Age and growth, common thresher shark, oxytetracycline (OTC), validation

**Relative Abundance and Size Structure of Red Snapper, *Lutjanus campechanus*,
Across Habitat Types in the Northwestern Gulf of Mexico**

**La Abundancia Relativa y Estructura de Tallas de Pargo Rojo, *Lutjanus campechanus*,
a Través de los Tipos de Hábitat en el Noroeste del Golfo de México**

**L'abondance Relative et la Structure de Taille de Vivaneau Rouge, *Lutjanus campechanus*,
tous les Types d'habitat dans le Nord-ouest du Golfe du Mexique**

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ABSTRACT

Artificial reef development is a popular management tool used to enhance fish stocks, provide additional recreational fishing and diving opportunities, and increase the quality or quantity of existing habitat for marine species. Despite the popularity of artificial reef programs, the impact of this new structured habitat on economically and ecologically important species is not fully understood. Specifically, few fisheries-independent surveys regarding the ecological performance of fish on artificial and natural habitats have been conducted. Therefore, the goal of this study was to evaluate the relative abundance and size structure of red snapper across three different habitat types (standing petroleum platforms, artificial reefs, and natural banks) in the northwestern Gulf of Mexico. Between October 2012 and July 2013, we conducted 103 vertical longline drops and captured 396 red snapper ranging from 282 to 735 mm TL. Red snapper CPUE averaged 0.77 fish/drop/minute and was significantly higher on natural bank habitats (1.01 fish/drop/minute) than artificial reefs (0.61 fish/drop/minute). Mean TL of red snapper differed by hook size, with larger hooks sampling larger fish. Across habitat types, mean TL was greater on natural and artificial reefs than standing platforms. The results of our study have important implications for artificial reef management and recovery of Gulf of Mexico red snapper. Further use of standardized fishery-independent surveys and additional data regarding habitat specific age and growth will help elucidate the role artificial reefs play in maintaining reef fish stocks in the region.

KEY WORDS: Artificial reef, relative abundance, size structure, habitat, red snapper

Population Biology of *Pterois volitans* in the Coastal Waters of Northeast Florida

Biología de la Población de *Pterois volitans* en Lasaguas Costeras del Noreste Florida

La Biologie des Populations des *Pterois volitans* dans les Eaux Côtières du Nordest Florida

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ABSTRACT

The Indo-Pacific lionfish (*Pterois volitans*), a predatory marine invader into the western Atlantic, Gulf of Mexico, and Caribbean Sea, has caused harm to native species through its proliferation. Scientific investigations on the impacts of lionfish have been focused predominantly in tropical ecosystems, and no research has been focused on the southern portion of the South Atlantic Bight. Generally, fish life history parameters, especially growth rates, vary with a suite of environmental (e.g., temperature), biological and ecological (e.g., prey availability) factors; and as a result, the population dynamics of lionfish will vary regionally and among ecosystems. This research aims to provide baseline data on population biology for lionfish in a new region, including accurate age, growth, and demographic information. Approximately 1,000 specimens of lionfish were caught between May and August 2013 off the coast of Jacksonville, Florida during local tournaments. Length frequency analysis revealed a bimodal population with distinct cohorts that are growing at an exceptional rate. Analysis of otoliths to precisely measure age and growth is ongoing. These data will be used to determine lionfish: (1) size at age (2) population age structure and (3) growth rate in the region. This study will fill key knowledge gaps on population dynamics of lionfish in the South Atlantic Bight and provides information on age and growth of lionfish necessary to understanding the impacts lionfish in this region.

KEY WORDS: Lionfish, population dynamics, growth, Florida

Pelagic Recreational Fishing and Economic Growth in Colombia

Pesca Recreativa Pelágica y Crecimiento Económico en Colombia

Pêche Sportive Pélagique et la Croissance Économique en Colombie

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ABSTRACT

Recreational highly migratory species (HMS) fisheries can achieve long-term sustainable growth through domestic and international tourism. Despite the economic opportunities provided by recreational HMS fishing, socioeconomic impacts have generally been understudied. This report provides a baseline for the economic importance of recreational HMS fishing in Colombia. Data were gathered for this report through detailed surveys distributed to recreational anglers in Colombia in the fall of 2012. Survey responses were analyzed and compared to the results from a similar study performed by The Billfish Foundation (TBF) in the Northern Caribbean. Findings show that Colombian anglers are willing to spend a considerable amount of money to pursue sport fish species, and that many opportunities are available to expand not only the current recreational fishing industry, but also the conservation efforts surrounding that industry. By expounding upon these results, this report offers insight to recreational HMS fisheries managers who must tackle significant challenges in developing effective regional management strategies. The ultimate goal of this report aligns with TBF's mission to improve the standing of recreational fishing and associated tourism industries as an economic priority.

KEY WORDS: Billfish, Colombia, recreational fisheries, economic impacts, HMS

The Utility of Simple Coral Reef Fish Community Metrics as Indicators for Ecosystem-based Fisheries Management in the Caribbean

La Utilidad de Variables Sencillas Derivadas de Comunidades de Peces de Arrecife Como Indicadores para la Gestión de Pesca Basada en el Ecosistema en el Caribe

L'utilité de Variables Simples Dérivées des Communautés de Poissons de Récif comme Indicateurs pour la Gestion de Pêche Basée sur l'écosystème dans la Caraïbe

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ABSTRACT

The usefulness of fish community metrics as indicators for Ecosystem-Based Fisheries Management (EBFM) has been mostly investigated in temperate systems. Here, we use 415 coral reef-surveys spanning the Caribbean to assess and compare the potential of four simple fish community metrics, i.e. fish biomass, fish density, mean fish weight and species richness, to separate fishing effects from natural variation at both local (10s of kms) and broad (100 - 1000s of kms) spatial scales. We found that these metrics differed considerably in redundancy, environmental correlates and the spatial scales underlying metric-environment associations. Mean fish weight and fish biomass were largely redundant and sensitive to fishing at both spatial scales, although mean fish weight was better at specifically detecting fishing effects than fish biomass. Fish density and species richness were also largely redundant but sensitive to temperature over broad scales and to macro-algae and relief height over local ones. This redundancy was likely driven by environmental effects on species richness, ultimately affecting fish density. In contrast, mean fish weight and fish density exhibited little redundancy, indicating that they were driven by fundamentally different processes. All four metrics were negatively correlated with macro-algae over broad scales, supporting the value of macro-algae as an indicator of the integrity of entire reef ecosystems. Finally, most of the metric-fishing covariance operated over broad scales, highlighting the need for a Caribbean-wide view of resource status to prevent shifting baselines. Our study clarifies the utility of simple fish community metrics as indicators for EBFM in the Caribbean.

KEY WORDS: Indicators, fisheries, fish metrics

Diseñando Una Área de Pesca Artesanal Exclusiva - Una Alternativa Viable para los Pueblos de la Moskitia Hondureña

Designing an Exclusive Area for Artisanal Fisheries – A Viable Alternative for the Communities of the Moskitia, Honduras

La Conception d'une zone Exclusive de Pêche Artisanale - Une Alternative Viable pour les Communautés de la Moskitia au Honduras

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RESUMEN

Los Cayos de La Moskitia Hondureña, son un sistema de 53 cayos arenosos que están rodeados de arrecifes de coral y pastos marinos. Por décadas, los recursos marinos asociados con estos ecosistemas principalmente la langosta espinosa y el caracol gigante, han sido objeto de aprovechamiento por parte del sector industrial. Como método de extrac-

ción se emplean buzos, principalmente gente indígena. El buceo para la extracción de langosta es la principal fuente de empleo e ingreso en esta región postergada del país. Pero también la principal causa de invalidez y muerte. La preocupación por los costos sociales del buceo, llevó a un acuerdo regional para prohibir la práctica en todo Centro América. Aunque la medida está orientada a salvaguardar vidas humanas, crea una enorme incertidumbre por la pérdida de empleos y la vulnerabilidad de la economía local en la región de la Moskitia. En vista que a la fecha existen pocas alternativas para los pueblos Miskitos, los mismos pueblos han decidido utilizar el cierre de la pesca industrial de langosta, como oportunidad para desarrollar nuevas pesquerías, sostenibles, rentables y más seguras. Utilizando ciencia marina, tecnología de punta y el conocimiento ancestral de los pescadores, se ha diseñado un Área de Pesca en los cayos de la Moskitia que permitirá de forma exclusiva la pesca artesanal y el uso preferente de los recursos por las comunidades locales. Retomando sus prácticas tradicionales mediante métodos que promuevan la conservación de la naturaleza y los servicios ecosistémicos, así como la promoción del desarrollo económico local, se asegura la recuperación de las pesquerías y su disponibilidad a futuro, y se mantiene el potencial económico para los pueblos de la Moskitia.

PALABRAS CLAVE: La Moskitia, pesca artesanal, buceo, comunidades, prácticas tradicionales

**Launch of the UNEP-CEP/CaMPAM Mentorship Program:
Using Caribbean MPA Management Expertise to Expedite the Dissemination of Best Practices**

**Lanzamiento del Programa de Tutoría PNUMA-PAC/CaMPAM: El Uso de la Experiencia
de Gestión de AMP de la Región para Acelerar la Difusión de las Mejores Prácticas**

**Lancement du Programme de Tutorat PNUE-PEC/CaMPAM: L'utilisation de L'expertise
de Gestion de la MPA de la Région à Accélérer la Diffusion des Meilleures Pratiques**

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ABSTRACT

The Wider Caribbean has realized a sharp increase in newly designated MPAs in recent years. Many of these sites struggle to build management capacity, acquire and train staff, and secure public support for the sustainable use and conservation of marine resources. In early 2013, senior Caribbean marine resource professionals gathered in the Dominican Republic to collaboratively design and initiate launch of a mentorship program that supports peer-to-peer sharing of knowledge, skills and lessons learned in effective MPA management. Mentoring has long been recognized as an effective means to improve individual and organizational capacity and performance. The mentorship program represents the newest addition to the suite of tools and resources brought forth by the Caribbean Marine Protected Area Managers Network and Forum (CaMPAM). The primary goal is to sustainably enhance professional capacities of MPA managers and practitioners throughout the region by responding directly to common training and technical needs. The program will enhance the transfer of new skills into practice from learning theory combined with demonstration, practice, evaluation during training and both in-situation and ongoing support. The initiative builds upon the *Training of Trainers Course on Marine Protected Area Management*, CaMPAM's flagship training that started in 1999 and has since enhanced professional development for hundreds of MPA managers across the Caribbean.

KEY WORDS: MPA, mentorship, network, mentor, mentee

Incorporating GIS into Socioeconomic Monitoring for Coastal Managers (SocMon)**La Incorporación de Los SIG en el Monitoreo Socioeconómico
para los Administradores Costeros (SocMon)****L'intégration SIG en Suivi Socio-Économique pour les Gestionnaires Côtiers (SocMon)**

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ABSTRACT

Understanding the biological and physical parameters of coastal ecosystems and resources is vital for prudent and adaptive management. But the socio-economic context within which any coastal management initiative is undertaken also impacts its success or failure. Monitoring the nature, status and trends of socio-economic characteristics is necessary to determine the most appropriate approaches for successfully managing both the resources and the human interactions at and around the site. Socioeconomic Monitoring for Coastal Managers (SocMon), is a global program which provides a practical, yet flexible, standardized methodology for collecting social and economic monitoring data for coastal management. The socio-economic information from SocMon can help managers balance sustainable resource use, protection and conservation with community needs for livelihoods, food security and equitable use of resources. Although SocMon was not designed explicitly for use with Geographic Information Systems (GIS), many of the monitoring variables are spatially based. SocMon can be enhanced through spatial representation of information by incorporating GIS, including stakeholder participation where possible. The mapping of information and incorporation into a GIS presents an additional method of storing, analyzing and representing some socio-economic variables by providing spatial references locations, boundaries, trends and changes, regarding resources, people and their interrelationships. This paper sets out research undertaken in the Caribbean on a standard methodology for efficiently and effectively assimilating GIS into the SocMon methodology to develop *SocMon Spatial* as an enhanced application for coastal, marine and fisheries management.

KEY WORDS: Caribbean, SocMon, Socio-economic Monitoring, GIS, PGIS

**A Comparison of Trophic Structure among Artificial Reefs
of the Northwestern Gulf of Mexico****Una Comparación de la Estructura Trófica entre los
Arrecifes Artificiales del Golfo Noroeste de México****Une Comparaison de la Structure Trophique Parmi les
Récifs Artificiels du Nord-Ouest du Golfe du Mexique**

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ABSTRACT

Artificial reefs are man-made structures that are used to create habitat in locations where there is little natural hard bottom habitat (coral, limestone, etc.). In the Gulf of Mexico, structures used to create artificial reefs include decommissioned oil and gas platforms, tanks, ships, and concrete. The ecosystem structure, and consequently the trophic assemblage, can differ among artificial reefs based on differences in individual site characteristics, such as structure type. This study examined the trophic structure of the fish community at thirteen artificial reef structures in the northwestern Gulf of Mexico along the Texas coast. These reef sites were predominately composed of oil and gas platforms (either cutoff

or toppled), but some reefed ships were also included in the analysis. In order to characterize and determine if differences existed between structure types, we analyzed video data collected using a remotely operated vehicle (ROV). A trophic level and trophic guild were assigned to each fish species identified using data from FishBase. No significant differences were found in overall mean trophic level among individual reef sites and structure types. The two most dominant trophic guilds present at all three structure types (cutoff rigs, toppled rigs, and ships) were piscivores and invertivores, though this was likely biased by large size and thus “visibility” of these groups. Additional analyses from on-going surveys should provide a more comprehensive assessment of artificial reef trophic structure and include characteristics such as structure age and proximity to other artificial reef or natural bank sites.

KEY WORDS: Artificial reef, trophic level, trophic guild, ROV survey, structure type