# Hotspots, Extinction Risk and Conservation Priorities of Greater Caribbean and Gulf of Mexico Marine Bony Shorefishes

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# HOTSPOTS, EXTINCTION RISK AND CONSERVATION PRIORITIES OF GREATER CARIBBEAN AND GULF OF MEXICO MARINE BONY SHOREFISHES

by

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# ABSTRACT

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Understanding the status of species is important for allocation of resources to redress biodiversity loss. Regional organizations tasked with managing threats to the 1,360 marine bony shorefishes of the Caribbean and Gulf of Mexico would benefit from a delineation of conservation priorities. However, prior to this study, conservation status was known for only one quarter of these shorefishes. Extinction risk assessment under IUCN Red List Criteria is a widely-used, objective method to communicate species-specific conservation needs. Data were collated on each species' distribution, population, habitats and threats and experts at three Red List workshops assigned a global level extinction risk category to nearly 1,000 greater Caribbean shorefishes. Since conservation is mostly implemented at a sub-global level, regional Red List assessments for the 940 shorefishes that occur in the Gulf of Mexico were conducted at two additional workshops. As a result, between 4-5% of these shorefishes are globally or regionally listed at a threatened level and 8-9% are Data Deficient. If all DD species are assumed threatened, the total threatened could be as high as 12% and 13%, respectively. The major threats are identified as overexploitation, habitat degradation (especially estuaries and coral reef) and invasive lionfish predation and half of the threatened or Near Threatened species are impacted by multiple threats. Data Deficient species are commonly known from only few

records or when impact from a threat is suspected, but poorly understood. Species richness analyses using distribution maps vetted during the Red List process indicate that hotspots of limited range endemics, which are species that may be more susceptible to extinction, are located in Venezuela, Belize and the northeastern Gulf of Mexico. Nearly a quarter of the Gulf endemics are threatened. The regional threat level for Gulf non-endemics is slightly lower than the global threat level. Immediate conservation needs are as follows: improve fishery management, reduce habitat degradation, control lionfish density, implement multiple threat scenario conservation planning and conduct diversity surveys in lesser explored areas. These baseline extinction risk assessments will provide an opportunity to measure conservation progress over time as well as inform future analyses of Key Biodiversity Areas.

This thesis is dedicated to my late father, Captain Derric F. Linardich, whose legacy inspired my love of the sea. Also to my mother, Teri Lynn Linardich, for making my life and all the beautiful things in it possible.

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# NOMENCLATURE

| | |
|---|---|
| *AOO* | Area of Occupancy |
| *CBD* | Convention for Biological Diversity |
| *CR* | Critically Endangered |
| *DD* | Data Deficient |
| *EN* | Endangered |
| *EOO* | Extent of Occurrence |
| *GL* | Generation Length |
| *IUCN* | International Union for the Conservation of Nature |
| *KBA* | Key Biodiversity Area |
| *LC* | Least Concern |
| *MPA* | Marine Protected Area |
| *NT* | Near Threatened |
| *RL* | Red List |
| *SPAW* | Specially Protected Areas and Wildlife |
| *STRI* | Smithsonian Tropical Research Institute |
| *VU* | Vulnerable |
| *WCMC* | World Conservation Monitoring Centre |
| *WDPA* | World Database of Protected Areas |

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# CHAPTER 1

# INTRODUCTION

Biological diversity supports overall ecosystem function, which in turn, is of high importance to the health and economy of human populations (Loreau 2000, Balmford et al. 2002). The loss of marine biodiversity directly degrades the ocean's ability to deliver natural resources and reduces the resiliency of marine ecosystems (Worm et al. 2006). Comprehensive studies on terrestrial biodiversity and extinction rates conclude that we are in the midst of the sixth great extinction event (Leakey and Lewin 1996, Barnosky et al. 2011), which is directly attributed to anthropogenic-based stressors (Ehrlich and Ehrlich 1981, Vitousek et al. 1997). Biodiversity in the marine realm is less understood than the terrestrial realm, but it is now well-recognized that marine species face many extinction risks (Norse 1995, Roberts and Hawkins 1999, Dulvy et al. 2003, Hutchings and Reynolds 2004) at a level similar to terrestrial systems (Webb and Mindel 2015). Due to rapid human population growth in coastal areas and the resulting demand for resources, threats to marine species are especially severe within nearshore ecosystems (Lotze et al. 2006, Halpern et al. 2008). Directed action for marine conservation has lagged behind that in terrestrial ecosystems, but is now at the forefront of many international to national-level conservation planning agendas (Edgar 2011). As a result, best-practice for identifying area-specific priorities and placement of reserves has undergone considerable exploration by marine conservation biologists (Agardy et al. 2011, Edgar et al. 2014).

### *1.1. Systematic conservation planning and IUCN Red List assessments*

Margules and Pressey (2000) recognized that overlooking the complexities involved in achieving conservation impedes success. They developed key principles in a six-stage framework that utilizes the scientific process to strengthen effective conservation decision-making. The first stage in this process is to measure and map biodiversity and the second stage is to identify conservation goals, both of which highlights the need for a dataset on species' distributions, population status, habitats and threats. For example, marine protected areas (MPAs) or marine spatial closures designated without some level of comprehensive species knowledge are generally ineffective and can even contribute to further harm when fishing effort is displaced (Agardy et al. 2011, Abbott and Haynie 2012, Spalding et al. 2013). These data needs can be fulfilled by conducting extinction risk assessments under the International Union for the Conservation of Nature (IUCN) Red List of Threatened Species.

The Red List began in the 1960s as a series of books and has since evolved into an extensive open-access database maintained by the IUCN Species Programme on www.iucnredlist.org. Consequently, the Red List is a powerful tool that can be used by a variety of stakeholders, including policy makers, scientists that analyze biodiversity patterns and members of the general public (Hoffmann et al. 2008). Building the Red List requires an extensive network of experts that systematically estimate extinction risk in thousands of taxa across the globe (Lamoreux et al. 2003). Depending on the quantitative knowledge of threat processes impacting a species' population and/or geographic range, it is assigned to one of nine extinction risk categories (Mace et al. 2008, Figure 1). Results from Red List assessments conducted across a taxonomic group or geography highlight at-risk species, and these data are consequently used to inform conservation priorities (Rodrigues et al. 2006, Schmitt 2011). Red List assessments also highlight priorities for directed research, such as needs for specific ecological surveys and studies on the impact of certain threat processes (Vié et al. 2009, Elfes et al. 2013).

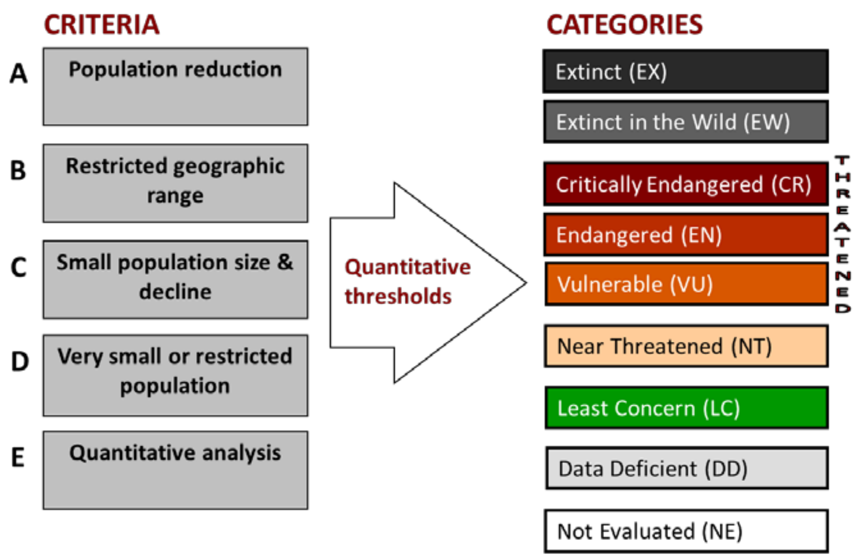



Figure 1. A simplified depiction of the five Red List criteria and nine extinction risk categories.

The third and fourth stages of systematic conservation planning are to review the capacity of established conservation areas to preserve biodiversity and to designate additional areas where there are gaps in coverage (Margules and Pressey 2000). Gap analyses of threatened species and MPA coverage can identify potential locations for expanding an MPA network (e.g., Polidoro et al. 2012). Sites that are sensitive to known threats and contain multiple threatened species – especially those limited in range - are the highest priority for conservation action (Edgar et al. 2008). The IUCN is developing a quantitative method similar to the Red List to identify Key Biodiversity Areas (KBAs) that would decrease bias and increase the effectiveness in prioritizing conservation areas. A KBA can be identified by applying data on threatened species to delineate areas with high vulnerability and irreplaceability (Eken et al. 2004, Edgar et al. 2008, Corrigan et al. 2014, Brooks et al. 2015). Irreplaceability relates to the amount of features in an area that cannot be replaced if lost, such as limited range endemics (Ferrier et al. 2000). Vulnerability is a measure of the impact of threat processes on an area (Wilson et al. 2005, Hoffmann et al. 2008). External political factors such as funding availability, stakeholder negotiations and limits on the amount of area that is realistically manageable also influences the eventual outcome.

*1.2. Identifying conservation priorities of greater Caribbean shorefishes*

The greater Caribbean biogeographic region contains the highest richness of marine species in the Atlantic Ocean and is considered a global biodiversity hotspot for tropical reef species (Roberts et al. 2002). Geopolitically, the region is comprised of 38 countries and territories, many of which are insular entities whose current domestic economies are highly supported by tourism and subsistence from the marine environment (Burke et al. 2011). Approximately 1,400 marine bony shorefishes inhabit the region, half of which are endemic (Robertson and Cramer 2014). Habitat degradation, overexploitation and the invasive lionfish threaten shorefish diversity, and subsequently, diminishes ecosystem function throughout the region (Paddack et al. 2009, Stallings 2009, Albins and Hixon 2013, Jackson et al. 2014, Micheli et al. 2014).

Hundreds of MPAs have been established with the intention of alleviating these stressors; however, only a small percentage are effective and many lack management plans (Burke et al. 2011, Bustamante et al. 2014, Knowles et al. 2015). To redress this deficiency, capacity development is currently being pursued through regional or national-level initiatives. Most countries are signatories of the Convention for Biological Diversity (CBD), under which the Aichi Biodiversity Targets 11 and 12 specifically state conservation goals to protect 10% of the world's coastal and marine area by 2020, to prioritize areas important for biodiversity and ecosystem services and to implement actions to prevent extinction events (CBD 2010, 2014). The Specially Protected Areas and Wildlife (SPAW) Protocol of the Cartagena Convention, an important legal framework under which many of the region's conservation bodies operate, relies on conditions that are advised by the presence of threatened biodiversity (UNEP 2010). The Caribbean Challenge Initiative, managed by The Nature Conservancy, is a region-specific example where ten countries have pledged to place at least 20% of their marine area under MPA coverage by the year 2020. The wide acceptance of these goals sets a precedence for conserving areas with threatened biodiversity.

Prior to this study, only one-quarter of the greater Caribbean marine bony shorefishes were officially assessed under Red List Criteria, which limited our ability to understand the most pervasive threats and conservation needs of this ecologically and economically important group. Development of a species database establishes a baseline under which Caribbean marine conservation targets - which have become fragmented due to the involvement of many regional and subregional organizations - can be organized (NOAA 2014). Data from these Red List assessments can be used to locate areas where current conservation actions may need adjustment in order to address specific needs for fishes previously unknown to be threatened. A richness analysis that accounts for limited range species may show biodiversity hotspots in different areas than an overall richness, which can be skewed by the presence of widely distributed species (Prendergast et al. 1993, Orme et al. 2005, Pimm et al. 2014). For example, Peters et al. (2013, 2015) showed that the highest richness of a marine snail genus (*Conus*) is in the Philippines, but that limited range species are concentrated in the eastern Atlantic off Africa. Limited range species often face higher risk for extinction and therefore, it is important to identify areas where these species may be concentrated (e.g., Hawkins et al. 2000, Harnick et al. 2012). This study explored two methods to identify hotspots, including assigning range-rarity scores and identifying the natural breaks with a histogram plot of all range sizes. Highlighting hotspots of limited range and/or threatened endemics will also bring attention to localities where the likelihood for extinction events is amplified. These data can then be applied during the first step towards nominating the region's first marine Key Biodiversity Areas. The second step integrates this knowledge into management plans via participation from stakeholders on the ground (IUCN 2013b).

### *1.3. Identifying region-specific conservation priorities of Gulf of Mexico shorefishes*

The Gulf of Mexico is a semi-enclosed water body that encompasses a large proportion of the greater Caribbean region. Though the Gulf and Caribbean share a similar shorefish assemblage (69% of greater Caribbean shorefishes occur in the Gulf), there are differences in habitat, threats and number of bordering governments. Compared to the Caribbean proper, the Gulf has a proportionally larger amount of soft bottom and wetland habitat and a smaller amount of reef habitat (Robertson and Cramer 2014). The Gulf of Mexico is bordered mostly by the continental U.S. and Mexico, but also includes the northwestern coast of Cuba; the greater Caribbean is comprised of over 20 insular countries and territories and 13 continental countries. Economically, most Caribbean nations rely on income from tourism, while the Gulf is dominated by industries associated with oil extraction and fisheries (Burke et al. 2011, Karnauskas et al. 2013).

The Gulf marine ecosystem is increasingly threatened by oil spills, warming waters, coastal development, polluted runoff and overfishing (Karnauskas et al. 2013, Fleming et al. 2014). Extensive shrimp trawl fisheries occur in U.S. and Mexican waters, though effort has declined significantly in the U.S. over the past decade. In the greater Caribbean, the threat from oil spills is not unique to the Gulf of Mexico (see Jackson et al. 1989), but the largest spills by volume have occurred there and the highest density of oil extraction activity is located in the northern Gulf. The two most notable spills were caused by oil well blowouts: the Ixtoc I event off Campeche in 1979 and the Deepwater Horizon event off Louisiana in 2010. The Ixtoc spill occurred in shallower waters and oiled a considerably larger area of shoreline than the Deepwater Horizon spill. There is no indication of short-term large-scale mortality of shorefishes following either of the two spills; however, the lack of studies or monitoring after Ixtoc prevents a full understanding of its impact (Fodrie and Heck 2011, Tunnell 2011, Amezcua-Linares et al. 2015, Schaefer et al. 2016). The amount of coral reef in the Gulf is scattered and small compared to the reef area in the greater Caribbean as a whole, but this does not undermine its worth to the shorefishes of the region. Frequently, the distribution of strongly reef-associated fishes in the Gulf is a reflection of the distribution of reef habitat, which is largely concentrated in the southern portion. The majority of these reefs have not been immune to the coral declines reported throughout the greater Caribbean, especially in the Florida Keys, U.S. and Veracruz, Mexico (Jackson et al. 2014). Coral reefs that are isolated from the coast, including the Flower Garden Banks and possibly reefs on the Campeche Bank such as Alacranes, have reported stable coral cover (Horta-Puga 2007, Hickerson et al. 2008).

Conservation policy is most frequently applied on a sub-global level and therefore, extinction risk assessments conducted on a regional level produce finer resolution information that can be used to develop site and species-level conservation plans, conduct an Environmental Impact Assessment, or maximize the efficiency of limited funding sources (Vié et al. 2009). Furthermore, species richness analyses dedicated to sub-global areas can identify hotspots within hotspots (Cañadas et al. 2014). The absence of a database with comprehensive information on the distributions, habitats and populations of Gulf marine species impedes the ability of regional conservation planners to prevent biodiversity loss (Campagna et al. 2011). For example, disaster response to the Deepwater Horizon oil spill was conducted largely without detailed information on the species likely to be most impacted, or the extinction risk of those species. In fact, several global level studies have expressed the need for applying extinction risk methods at the regional level (e.g., Comeros-Raynal et al. 2012, Croxall et al. 2012, Sadovy de Mitcheson et al. 2013, Böhm et al. 2013, Dulvy et al. 2014). In the marine realm, this has been completed for all marine fishes of the Mediterranean (Abdul Malak et al. 2011), Europe (Nieto et al. 2015) and the Persian Gulf (Buchanan et al. 2016). Additionally, most of the Gulf shorefish assessments occurred coincident to their global-level assessment, which presents a unique opportunity to compare their regional status to their global status.

*1.4. Study objectives*

The first objective of this study was to identify greater Caribbean shorefishes at an elevated risk for extinction and highlight the major threats impacting them. Besides this, the reasons why shorefishes were listed as DD were reviewed in order to highlight knowledge gaps. Spatial analyses of species distribution maps were used to identify richness hotspots. Areas with the most limited range threatened species were emphasized with the intention of informing potential priorities for conservation action. For the Gulf of Mexico shorefishes, the regional Red List categories were compared to their global categories to determine whether differences between them indicate that shorefishes are more or less threatened in the Gulf. Finally, a map of greater Caribbean MPAs was created to detect whether distributions of threatened endemics potentially overlap with possible conservation measures.

# CHAPTER 2

# METHODS

Choosing marine species for assessment under Red List Criteria has been clade-based and conducted on a global level, or based on their occurrence within a prioritized biogeographic or political region (e.g., Alava et al. 2009, Abdul Malak et al. 2011, Polidoro et al. 2011, Polidoro et al. 2012). In this study, the greater Caribbean (Figure 2A) was defined according to the biogeography of shorefishes reported by Robertson and Cramer (2014) and the Gulf of Mexico (Figure 2B) was defined according to geopolitical boundaries set by Felder et al. (2009).


Figure 2. Maps of the extent of (A) the greater Caribbean region and (B) the Gulf of Mexico region.


Figure 2. Continued

This study defines a shorefish as a species that mainly utilizes habitats from estuaries to the continental shelf edge, to a depth limit of less than 200 m. This includes demersal fishes and pelagic species that occur over the continental shelf and sometimes extend into deeper oceanic water. Data compiled from published literature and taxonomists resulted in a final list of 1,360 species. Within those species, 940 range in the Gulf of Mexico. An endemic shorefish is defined as a species with a range entirely within the region's boundaries or has no more than minor range extensions along the continental shelf beyond them (Robertson and Cramer 2014). All taxonomy was standardized against the online electronic version of the Catalog of Fishes which is maintained by the Institute for Biodiversity Science and Sustainability at the California Academy of Sciences, which is recognized as the global authority on fish taxonomy (Eschmeyer, Fricke and van der Laan 2015).

*2.1. Red List methods*

Extinction risk was assessed for each species under quantitative methods developed by the IUCN Red List (Mace et al. 2008, IUCN 2012). Supporting material required to inform each assessment includes the following: distribution, population status, habitats and ecology (including life history), use and trade, threats and conservation measures. These data were compiled in the IUCN Species Information Service (SIS) database by workers at the Global Marine Species Assessment via extensive literature review and polygonal distribution maps were drawn in ArcGIS 10.1. Red List assessment workshops were then held where experts in fish taxonomy, biology and population dynamics reviewed and improved the information in each species account. A facilitator trained in the Red List methods provided guidance to these experts to determine an appropriate extinction risk category. After the workshop, each account was reviewed by at least one person with knowledge of the Red List methods. Prior to publication on the Red List website, a final review was completed by a Red List expert to ensure that the guidelines for applying the Red List methods (IUCN 2012), as well as that the correct format described in the Red List manual (IUCN 2013a) had been followed.

The assessments included in this study have resulted from many Red List workshops. Previous to this initiative for Caribbean marine bony shorefishes, 372 of the species were already published on the Red List as part of a clade-based approach to assess the world's marine vertebrates. Three workshops, attended by 32 experts, were conducted for the nearly 1,000 unassessed Caribbean shorefishes: Barbados in 2010, Jamaica in 2012 and Trinidad in 2013. Two additional workshops (Texas, USA in 2014 and Yucatán, Mexico in 2015), attended by 30 experts, completed regional assessments for all the shorefishes of the Gulf of Mexico (Appendix A). Seven workshops that were part of separate global initiatives held between the years 2009-2011 also contributed species assessments (see Table 1). All resulting species data, maps and extinction risk categories are freely available on the Red List website.

Table 1. A list of the 10 workshops during which the 1,000 previously unassessed Caribbean shorefishes were evaluated for inclusion on the Red List and the two during which the 940 shorefishes of the Gulf of Mexico were regionally assessed.

| Taxonomic Group | Workshop location | Year |
|---|---|---|
| **Global assessments** | | |
| Sciaenidae | Brazil | 2009 |
| Pomacentridae | Fiji | 2010 |
| Caribbean diminutive shorefishes | Barbados | 2010 |
| Anguilliformes | Washington D.C., USA | 2011 |
| Tetraodontiformes | China | 2011 |
| Centropomidae, Mugilidae, Ariidae | Brazil | 2011 |
| Lutjanidae and Haemulidae | The Bahamas | 2011 |
| Gulf of Mexico endemic fishes | Texas, USA | 2011 |
| Caribbean shorefishes | Jamaica | 2012 |
| Caribbean shorefishes | Port of Spain, Trinidad | 2013 |
| **Regional assessments** | | |
| Gulf of Mexico shorefishes | Texas, USA | 2014 |
| Gulf of Mexico shorefishes | Mérida, Mexico | 2015 |

All five Red List criteria were considered during the assessment process; however, these species were primarily assessed under Criteria A (population decline) or B (restricted range). Due to the inherent difficulties in counting individuals in a fish population, the data required to qualify under Criteria C, D, or E were often lacking. On occasion, a species was assessed under Criteria D2 given its area of occupancy or number of locations were very small and a serious plausible threat was known.

As defined by the Red List, the level of uncertainty in the data was expressed by using the following vocabulary listed in decreasing confidence: observed, estimated, inferred, or suspected. A category of Near Threatened was applied only if quantified estimates of population decline or area of occupancy (AOO)/extent of occurrence (EOO) were very close to meeting the criteria for a threatened category. Data Deficient was applied to species known from very few specimens and localities because data on its distribution, population size and potential threats are wholly unknown. Even though only currently valid species were considered, a DD situation could be further complicated by taxonomic uncertainty. The DD category was also utilized for species where declines were likely occurring due to fishing pressure, but unquantified across a significant proportion of its range. This may have been due to a lack of landings data over a sufficient time period or a lack of species-specific data in a mixed-catch fishery. At times, the unknown impact of habitat degradation or the invasive lionfish on a species with a small range also resulted in a DD listing.

### 2.1.1. Criteria A: Population decline

Assessing a species under Criteria A requires data on population decline over a three generation length period or ten years, whichever is longer. Therefore, an estimate of generation length, which is defined as the average age of the parents of the current cohort of newborns, must be provided. This turnover rate of mature individuals can be estimated if data are available on natural mortality, maximum age and age at first maturity. Data on age-specific survival and age-specific fecundity can also be applied to a survivorship Excel worksheet developed by the Red List. The two equations that were used during these assessments are as follows:

Equation 1. GL = Age at first reproduction + (Age at last reproduction – age at first reproduction)/2

Equation 2. GL = 1/M + age at first reproduction, where M = pre-disturbance adult natural mortality

If all three data types were available for the fish, a range of values was calculated and the generation length was expressed as the midpoint between the two. Time series data from total landings, catch-per-unit-effort and biomass were considered to be appropriate indices of abundance for estimating population decline. When available, estimated biomass extracted from fishery stock assessments took precedence over other data types. Population decline was expressed by calculating the percent decline between the start year and end year of the time series. Since utilized fishes often have populations that extend across multiple political boundaries, data availability and fishing pressure vary by country; therefore, the abundance data available to the assessment varied both in uncertainty and time series. In these cases, each set of data was weighed by the estimated historical proportion of the global population within each area (if known) and declines were expressed as a range of values and an average according to the Red List guidelines.

#### 2.1.2. Criteria B: Restricted range

Assessing a species under Criteria B requires an estimate of area of occupancy (AOO) and/or extent of occurrence (EOO). The AOO, which is defined as the area within a species' EOO that it occupies, was estimated by calculating the area within the distribution polygon clipped to a bathymetric or habitat layer appropriate to the species. Bathymetric layers were sourced from the National Geophysical Data Center's ETOPO1 one arc-minute global relief model (Amante and Eakins 2009). Global-level habitat layers for seagrasses (Green and Short 2003, UNEP-WCMC and Short 2005), mangroves (Giri et al. 2011) and reef-building corals (WCMC et al. 2010) were sourced from the UNEP World Conservation Monitoring Centre (WCMC) website (http://www.unep-wcmc.org/resources-and-data). The EOO, which is defined as the shortest continuous imaginary boundary that encompasses all the sites of occurrence of a species, was estimated by calculating the area within a convex hull polygon drawn around the extent of the AOO polygon via the ArcGIS tool 'minimum bounding geometry'. Estimated AOO was calculated mostly based on bathymetric layers due to the general lack of mapped marine habitat types beyond seagrasses, mangroves and corals; this means that many of these AOOs should be considered conservative estimates that likely overestimate the actual area inhabited.

#### 2.1.3. Applying Red List criteria at the regional level

As required for regional Red List assessments for non-endemic species, the potential level of immigration of propagules from outside the region (rescue effect) was examined by reviewing literature and expert opinion on the Gulf of Mexico's connectivity with the Caribbean Sea and Atlantic Ocean. In general, there does appear to be some level of connectivity between the

Caribbean and the Gulf via the Loop Current, which enters the Gulf between Mexico and Cuba. Connectivity between the southeastern Gulf and the Caribbean is somewhat stronger than connectivity with the southwestern Gulf (Cowen et al. 2006). The Loop Current becomes the Florida Current as it exits the Gulf in the straits between south Florida and northern Cuba; where it enters the Atlantic, it transforms into the Gulf Stream. Due to the strength of the outflowing Florida Current, the potential for propagule immigration from the Atlantic into the Gulf is limited (Ritchie and Keller 2008). Unless some evidence was available on the connectivity of a species' Gulf of Mexico population with those outside the region, a precautionary approach was applied. This resulted in many species being marked in the SIS database as 'don't know the immigration of propagules' because knowledge of fish population connectivity is generally data-poor.

### *2.2. Reporting proportion threatened*

According to most scientists, the definition of a 'hotspot' is an area with a high richness of threatened species (Briscoe et al. 2016). However, estimates of proportion threatened can be uncertain due to the chance that a DD species may be threatened, especially if threats have been identified (Butchart and Bird 2010). For this reason, the proportion threatened is presented as both a midpoint and a range, where the upper bound represents the scenario that all DD species are threatened (Table 2).

Table 2. Equations for calculating proportion threatened (IUCN 2011).

| | **Equation** |
|---|---|
| Lower bound | (CR+EN+VU)/total assessed |
| Midpoint | (CR+EN+VU)/(total assessed – DD) |
| Upper bound | (CR+EN+VU+DD)/total assessed |

* A threatened species has been assessed as Vulnerable (VU), Endangered (EN), or Critically Endangered (CR)

*2.3. Distribution mapping methods*

Generalized distributions in GIS format of marine species for use in Red List Assessments were designed with two strategic considerations: 1) ability to visualize distributions in a variety of spatial scales and 2) ability to accurately analyze generalized distributions in concert with other data layers (e.g., habitat, depth etc.). To visualize at larger spatial scales, buffers are needed because of the narrow shelf areas around some islands and continents. These exaggerated buffers are intended to be removed when analyzing geographic patterns at finer spatial scales. Each distribution map was drawn as a polygon that encompassed its known occurrences based on data sourced from published literature, expert knowledge and point records compiled by fish researchers at the Smithsonian Tropical Research Institute (Robertson and Cramer 2014, Robertson and Van Tassell 2015). Cases of vagrancy were excluded. With the exception of open-ocean species, each distribution was standardized by clipping to a 100 km shoreline buffer or a maximum depth of 200 meters, whichever was further from the coastline. For the occasional situation where a species significantly inhabited the continental slope, the distribution polygon was extended to a maximum depth of 300 m.

Clipping to exaggerated buffers assumes a homogenous distribution across habitat types and depths and will therefore cause commission errors (false presence of species) in species that inhabit only inshore areas as well as in those that inhabit only deeper offshore areas (Rondinini et al. 2006). To potentially minimize this error, bathymetric layers were extracted from two global-level sources, the National Geophysical Data Center's ETOPO1 and the General Bathymetric Chart of the Oceans (GEBCO), with the intention that each species could be clipped to an appropriate bathymetry. However, I observed that the coarse resolution of depth data in areas with no continental shelf (e.g., the islands of the Antilles) caused omission errors (false absence of species). The extent of this error was tested by plotting point data extracted from the STRI database for 10% of all the species (n=125) and calculating the percentage of points that fell within the clipped distribution polygon. On average, the clipped polygons covered 24% less points than the unclipped polygon. Overall, the unclipped polygon covered an average of 83% of the points, while the clipped polygon covered only 38%. At times, shallow records appeared to fall on land, but this was due to the limited resolution of the country shoreline basemap. Since the distribution polygons do not include land, some points did not fall within the polygon. The average points covered by the unclipped polygon would approach 100% given the distributions were re-drawn to a higher resolution country basemap layer. In the interest of avoiding omission of species in an area, especially since these analyses are intended to inform conservation planning, distributions were not clipped to bathymetry. Efforts to impose a buffer around localities with small continental shelves were complicated by the geopolitical organization of the country basemap; for example, a buffer may be needed for the Colombian Providence Islands, but not the Colombian continent, however, it is not possible to split these entities due to the restrictions of the basemap layer properties.

*2.4. Species richness analyses*

Maps of overall richness, endemic richness, DD richness, threatened richness and threatened endemic richness were created for both regions. All shapefiles were transformed into the World Cylindrical Equal Area Projected Coordinate system and converted into a square grid raster of 5 x 5 km cell size using the 'polygon to raster' tool. The decision to use this cell size was based on the size of the smallest distribution polygon in the data set, which is 32 $km^2$ (Rahbek 2005). The cell assignment type was set to maximum combined area, which allowed a value of '1' to be assigned to each grid cell that the distribution polygon overlapped with regardless of the amount of overlap. Each raster was then added together using the 'cell statistics' tool so that the result is expressed as the number of species that occupy each grid cell. In order to account for the uncertainty that DD species introduce into the proportion of threatened species, the cell values were displayed in two additional maps as the proportion of species per cell for all threatened greater Caribbean species and all regionally threatened Gulf of Mexico species. The proportion threatened was also mapped while excluding the 70 offshore oceanic species. These rasters were created via the tool 'raster calculator' while applying the following equation from Böhm et al. (2013):

Equation 3. $Prop_{threat} = (CR + EN + VU)/(N - DD)$; where $N$ is the total number of species.

All symbology in the maps was classified by Jenks natural breaks into six classes with a color scheme of blue to red, where the highest scoring cells (class 6) are in red. The top ten areas with the most species were considered to be hotspots and the areas with the top 10% of cell values were identified. This dual definition was applied because, at times, the top 10-20% of high-value cells were concentrated in a single area with a relatively small difference in cell value between the area with top-valued cells and the area with the tenth highest value cells.

### 2.4.1. Detecting hotspots of limited range species

Methods similar to Roberts et al. (2002) and Peters et al. (2015), where a range-rarity score was assigned to each raster cell in the richness analysis by summing the reciprocal of the range size for all species present in the cell were applied. The range size was defined as the square kilometers within its distribution polygon and a field was created in the attribute table where the reciprocal of the range size was calculated. Each polygon was converted to a raster by setting the 'value field' as the field containing the reciprocal, a cell assignment type of 'maximum combined area' and cell size of 5 x 5 km. The final raster was made by adding all the rasters together with the tool 'cell statistics'. Besides running this process with all 1,360 species, I also ran it a second time where the 60 Data Deficient (DD) species that are known from very few specimens and localities were excluded. Since it is likely these species have a larger range than is currently known, this would potentially influence the results.

The resulting raster revealed a few high-scoring cells that were not visible unless highly zoomed in. This was driven by the fact that most range sizes are so large that there was little difference between the cell values. There were differences in the location of the high-scoring cells between the two iterations of this analysis, which indicates that the 60 DD species did influence the results as hypothesized. In the analysis that excluded those 60 species, the few cells that scored relatively high compared to the rest of the region are located in Belize and the Bahamas. I did not feel this was the best way to depict areas with concentrations of limited range species. As an alternative method, the range sizes of all endemics excluding 60 DD species known from very few specimens (n=674) were plotted in a histogram in R version 3.1.1 (R Core Team 2013) with a bin size of 20,000 km$^2$. Range size was defined as the square kilometers within the distribution polygon and calculated using the 'calculate geometry' function in ArcGIS 10.1. Natural breaks were detected at 80,000 km$^2$ and 430,000 km$^2$ (see Appendix F). Richness analyses were then conducted for the 64 species with range sizes of less than 80,000 $km^2$ as well as the 242 species of less than 430,000 $km^2$.

*2.5. Identifying major threats*

Highlighting threats that are most pervasive to threatened species informs the development of conservation action necessary to prevent biodiversity loss (Margules and Pressey 2000, Brooks et al. 2006, Edgar et al. 2008, Hoffmann et al. 2008, Salafsky et al. 2008). The threat types recorded for the NT and threatened species were presented in a bar graph.

*2.6. Detecting trends in Data Deficient species*

When developing conservation targets, data collection efforts needed to re-assess DD species should be given similar precedence as conservation action towards threatened species, especially when there is a known threat (Morais et al. 2013, Bland et al. 2012, 2015). A species can be listed as DD for the following reasons: 1. known from very few specimens/localities; 2. uncertain taxonomic status; and 3. lack of data on population trend, distribution, or threats (Butchart and Bird 2010). Similar to the table created for threatened species, the contributing factors that led to a listing of DD were recorded for each species, including threats. I also recorded each species' year of description, maximum length and whether it is deep-living or cryptic. This was intended to explore the hypothesis that the discovery of new diminutive, cryptic fishes in recent years may be a factor (Sparks and Gruber 2012, Victor 2012, 2013, 2014, Van Tassell et al. 2012, Baldwin and Robertson 2013, 2014, Baldwin and Johnson 2014, Conway et al. 2014).

*2.7. Comparing regional vs. global categories*

A Red List assessment on a country or regional level produces information at a resolution that better informs conservation planning and resource allocation (Vié et al. 2009). Non-endemic Gulf shorefishes with regional Red List categories that differ from their global category were identified. It was then determined if these species tended to be more or less threatened or DD within the Gulf than globally.

*2.8. Marine protected areas and threatened endemics*

By definition, the purpose of an MPA is to preserve biodiversity and ecological function. Therefore, conservation action for threatened species increases the value of an MPA's conservation outcomes (Pressey et al. 2015). Hundreds of MPAs have been designated in the greater Caribbean, with effectiveness varying widely. Spatial data for MPAs of the United States, Puerto Rico, Navassa Island and the U.S. Virgin Islands were sourced from the U.S. National Oceanic and Atmospheric Administration's National Marine Protected Areas Center website. Data on all other countries were sourced from the World Database of Protected Areas (WDPA). Since there are significant errors and data gaps associated with the WDPA, the area covered by MPAs is both overestimated and underestimated in some countries (Visconti et al. 2013, Knowles et al. 2015). Attempts to improve the quality these data followed methods described by Spalding et al. (2013), except that areas with an 'international' designation (i.e., UNESCO Heritage Sites or RAMSAR) were not included. Since mangroves are widely utilized by shorefishes, MPAs containing this habitat were included and identified by overlaying the USGS global distribution of mangroves (Giri et al. 2011) on the MPA layer.

Since hotspots of threatened endemics contain the greatest risk for extinction events, they should be considered 'first priority' candidate sites for conservation (Myers et al. 2000, Brooks et al. 2006). The location of these hotspots in relation to MPAs was described by overlaying the MPA layer with a merged shapefile containing the distribution polygons of all threatened endemics. The tool 'tabulate intersection' was used to identify the species that overlap with MPAs. In addition, x-y coordinates of records for each species were extracted from the STRI online database, a point shapefile was created and the 'tabulate intersection' tool was applied to determine the number of points that fall within MPAs.

# CHAPTER 3

# RESULTS

*3.1. Summary statistics*

The highest proportion of threatened species occurs in the Gulf of Mexico endemics with 26% (n=46). If all DD species are assumed threatened, the total number of threatened Gulf endemics could be as high as 35%. There is little difference between the proportions threatened when comparing across the other three groups, which ranges from 4% in all species of the Gulf of Mexico to 6% in the greater Caribbean endemics. The midpoint, which accounts for the uncertainty introduced by DD species, varied from the straight proportion of threatened species by only 1-3 percentage points across the four groups. The number of NT species is proportionally small (Figure 3) and generally the same across the four groups with a range between 1-2%. The proportion of DD species is higher in the greater Caribbean endemics (13%) than the other three groups, which are between 8-9% (Table 3). The category with the lowest number of species is CR and the highest is LC.

Table 3. Conservation status of shorefishes by Red List category with proportions in parentheses. Midpoint and range of proportion threatened accounts for the uncertainty introduced by species listed as Data Deficient. The upper bound of the range assumes that all DD species are threatened.

| | **Total species** | **# Threatened** | **# NT** | **# DD** | **Midpoint** | **Range of % threatened** | **# LC** |
|---|---|---|---|---|---|---|---|
| **Greater Caribbean** | 1360 | 65 (5%) | 18 (1%) | 114 (8%) | 5% | 5-13% | 1163 (86%) |
| **Greater Caribbean endemics** | 725 | 45 (6%) | 6 (1%) | 94 (13%) | 7% | 6-19% | 580 (80%) |
| **Gulf of Mexico** | 940 | 34 (4%) | 10 (1%) | 86 (9%) | 4% | 4-13% | 810 (86%) |
| **Gulf of Mexico endemics** | 46 | 12 (26%) | 1 (2%) | 4 (9%) | 29% | 26-35% | 29 (63%) |

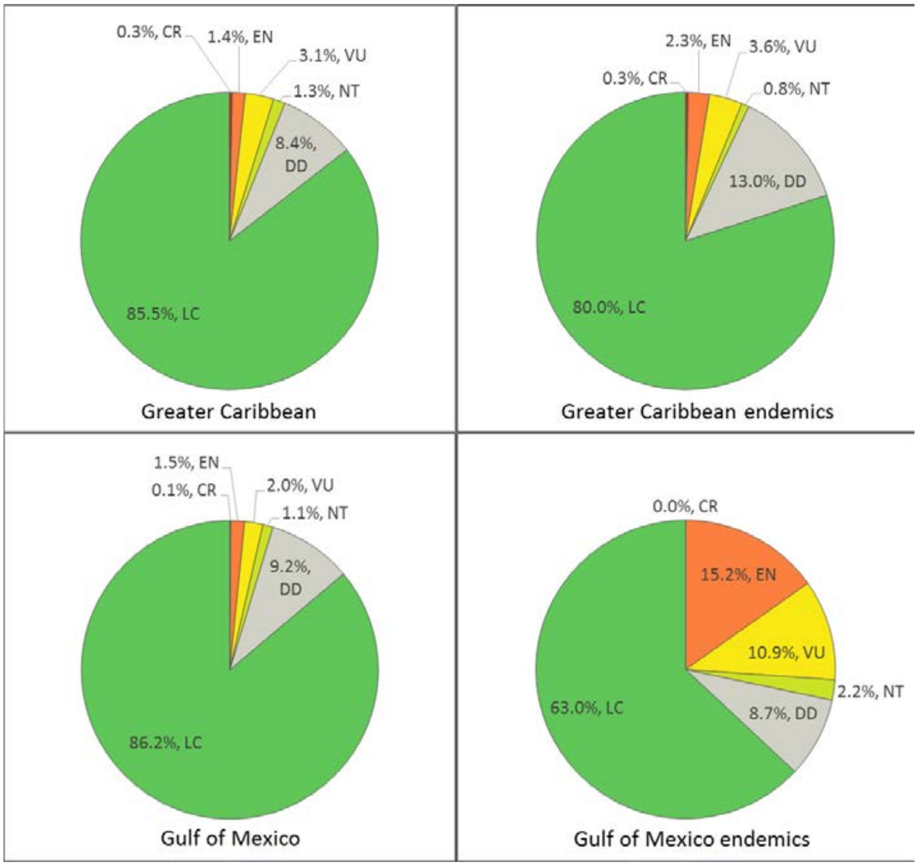



Figure 3. Proportions of species listed in each category.

### *3.2. Species richness*

When all 1,360 species are overlaid, the highest richness in the greater Caribbean is located in southern Florida (USA), Colombia to Venezuela, Panama, Belize to the Honduran Bay Islands and Puerto Rico to the Virgin Islands (Table 4, Figure 4A). Areas of lowest richness are located throughout the offshore oceanic waters and secondarily in the Cayman Islands, French Guiana, Bermuda, North Carolina to South Carolina (USA) and in the northwestern Gulf of Mexico from Louisiana (USA) to Tamaulipas (Mexico), except the Flower Garden Banks (Figure 4A). Patterns of high richness in greater Caribbean endemics are located in similar areas, with the only differences being that Trinidad and Tobago is excluded and the Bahamas is included (Figure 4B). Naming the top ten areas with the most species was considered to be more informative than reporting some percentage of the highest value cells based on the argument that an area where 11 threatened endemics occur is not necessarily of lower conservation priority than one with 17, especially when the total overall species count is only 45.

There are no clear hotspots in threatened species richness; cells containing between 20-28 threatened species occur throughout the majority of the region (Figure 4C). The lowest richness is located in similar areas as the richness that included all species: offshore oceanic waters, Guyana to French Guiana and along coastal northwestern Gulf of Mexico. Patterns in the distribution of threatened endemics are more discernible. In this case, hotspots are located in the Florida Keys, the Bahamas, the Cayman Islands, Puerto Rico to Dominica, Panama and along the northern Yucatán to the Mesoamerican Reef. A notable difference is that even though Grand Cayman Island has low overall species richness (Figure 4A), it has a high richness of threatened endemics (Figure 4D).

The area with highest DD richness is located along Venezuela (Figure 4E). Curaçao, Belize and northern Colombia also have a relatively high richness. Unlike the other five richness analyses, small localities such as Navassa Island (near Haiti), Arrowsmith Bank (Mexico) and the Exuma Sound (Bahamas) were highlighted as areas with relatively high numbers of DD species. Low DD richness occurs in the Gulf of Mexico and along much of the U.S. Atlantic coast.

Table 4. List of the top ten hotspots of species richness by species grouping type. The highest number of species recorded in a single cell within that hotspot is in parentheses. The bolded hotspots contain the top 10% of cell values.

| All species (n=1360) | All endemics (n=725) | All threatened (n=65) | Threatened endemics (n=45) | DD species (n=114) | Limited range endemics (n=242) |
|---|---|---|---|---|---|
| **Southeast Florida to the Florida Keys, USA (780)** | **Puerto Rico (326)** | **Belize (28)** | **Belize (17)** | **Venezuela (31)** | **Western Venezuela (48)** |
| **Venezuela (777)** | **Florida Keys, USA (324)** | **Florida Keys, USA (27)** | Grand Cayman Island (13) | Curaçao (25) | **Belize (46)** |
| **Puerto Rico (743)** | **Belize (322)** | **St. Croix (26)** | Colón, Panama (13) | Belize (25) | **Isla de Margarita, Venezuela (44)** |
| **Colombia (722)** | **U.S. Virgin Islands (309)** | **Northern Yucatán, Mexico (26)** | Florida Keys (12) | Northern Colombia (23) | **Northeastern Gulf of Mexico, USA (44)** |
| **Panama (714)** | **British Virgin Islands (300)** | **Saba Bank and St. Barthélemy (25)** | Northern Yucatán and Cozumel, Mexico (12) | Panama (21) | Colombia (41) |
| **Belize (712)** | Panama (286) | Honduran Bay Islands (24) | Honduran Bay Islands (12) | Puerto Rico (20) | Panama (40) |
| **U.S. Virgin Islands (704)** | The Bahamas (283) | Colón, Panama (24) | St. Croix, Saba Bank and St. Barthélemy (12) | Bonaire (20) | Southwest Florida, USA (32) |
| British Virgin Islands (685) | Curaçao (274) | Veracruz, Mexico (24) | Exuma Sound, Bahamas (11) | Costa Rica (19) | Southeast Florida, USA (31) |
| Trinidad and Tobago (667) | Isla de Margarita, Venezuela (271) | Flower Garden Banks, USA (24) | Southern Colombia (11) | Guyana to Suriname (19) | Puerto Rico and St. Croix (31) |
| Honduran Bay Islands (657) | Honduran Bay Islands (267) | Puerto Rico and Virgin Islands (24) | Puerto Rico to Dominica (11) | Navassa Island (19) | Flower Garden Banks, USA (27) |

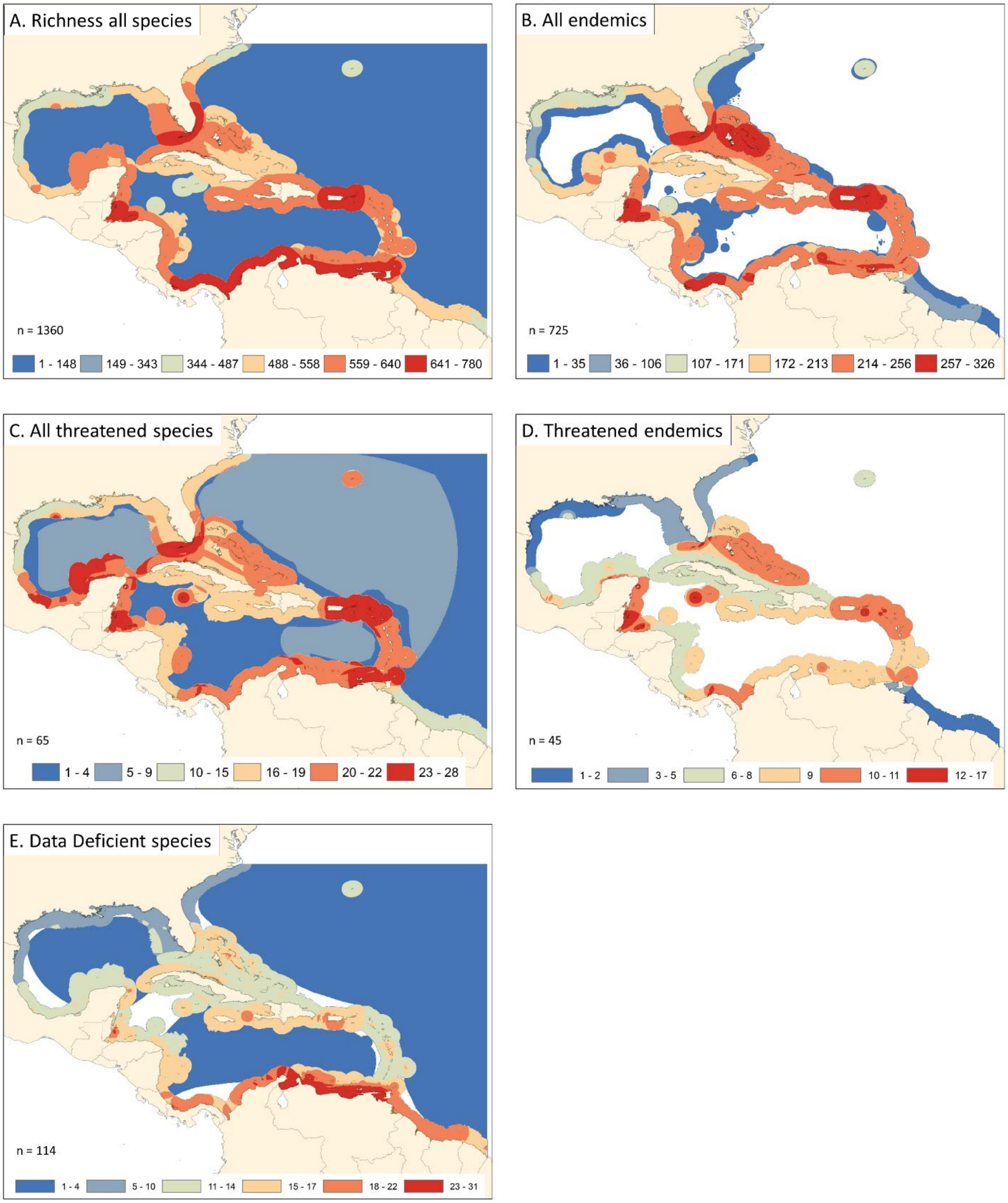



Figure 4. Number of marine bony shorefishes in the greater Caribbean per 25 km$^2$ grid cell for (A) all species, (B) all endemics, (C) globally threatened species, (D) globally threatened endemics, and (E) globally DD species. The total number of species is displayed in the bottom left of each map.

The richness of the 64 species with considerably limited ranges (<80,000 $km^2$) resulted in a single main hotspot located off Belize, where 15 species occur (Figure 5A). The next highest richness is located off Bermuda with seven species. When the remainder of the limited range species (range size <430,000 $km^2$) were added to this analysis (Figure 5B), Belize remained a major hotspot with 46 species, but Venezuela (mainly western and the vicinity of Isla de Margarita) scored the highest with a maximum of 48 species.

Of the 242 limited range endemics with a range size less than 430,000 $km^2$, the average and median range sizes are 201,654 $km^2$ and 197,661 $km^2$, respectively. When comparing the richness of all species or all endemics against that of only limited range endemics, six of the hotspots are the same (Table 4, Figure 5B). However, hotspots that occur in the limited range endemics, but not in the overall endemics include the western Venezuela, Colombia, southern Florida (excluding the Keys), northeastern Gulf of Mexico and the Flower Garden Banks. Conversely, the Bahamas has a relatively high richness of overall endemics, but not of limited range endemics. Venezuela has relatively high numbers of DD species as well as limited range endemics. Both Belize and Panama occur within the top ten hotspots of all six richness maps (Table 4).

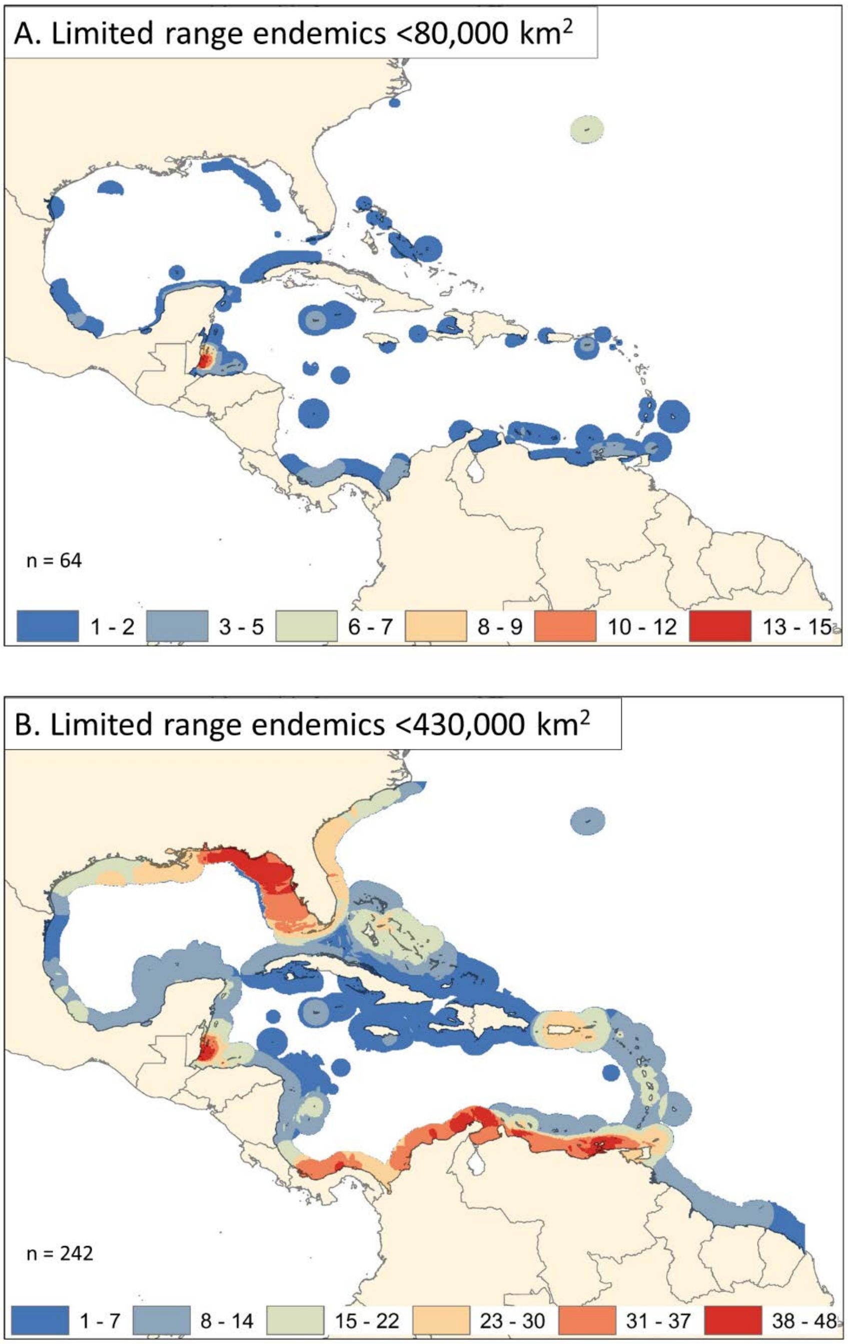



Figure 5. Number of marine bony shorefishes in the greater Caribbean per 25 $km^2$ grid cell for limited range endemics with range sizes of (A) <80,000 $km^2$ and (B) <430,000 $km^2$.

In both the greater Caribbean and Gulf of Mexico, the highest proportion threatened is located in the offshore oceanic zone (Figure 6A and B). In the greater Caribbean, the majority of nearshore cells have the same proportion (2-3%) throughout most the region. When the offshore oceanic species are excluded, areas with a slightly higher proportion are in Bermuda, the Cayman Islands, the Mexican Gulf coast, Belize, and Las Islas del Cisne (Honduras) (Figure 6C). The highest proportion threatened in the nearshore Gulf (3%) occurs off Veracruz to the northern Yucatán, Mexico as well as Cuba (Figure 6D).

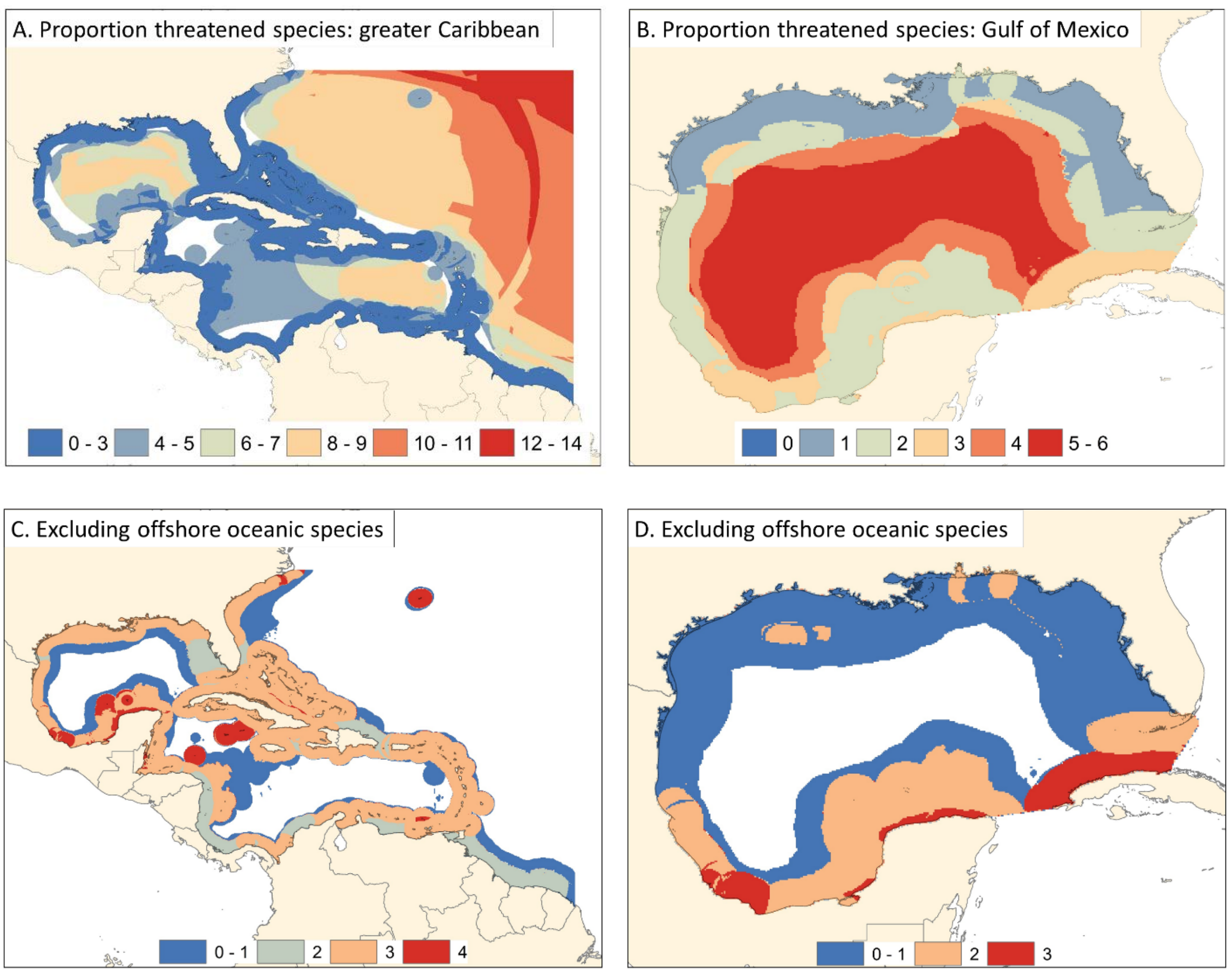



Figure 6. Proportion of marine bony shorefishes per 25 km$^2$ grid cell for (A) globally threatened greater Caribbean species (B) regionally threatened Gulf of Mexico species (C and D) same analyses but the offshore oceanic species (n=70) were excluded.

The highest richness of Gulf of Mexico shorefishes, where the top 20% of cell values are located, is in the Florida Keys (Figure 7A). Beyond this, southwest Florida, the Campeche Bank (Mexico) and the Flower Garden Banks also stand out. Similar to results from the greater Caribbean, the lowest richness in the Gulf is located in the offshore pelagic zone and along coastal Louisiana, Texas (U.S.) and Tamaulipas (Mexico). In the Gulf, only 46 out of the 940 shorefishes (5%) are endemic. This is considerably different from the greater Caribbean, where shorefish endemism is 53%. The richness pattern of these 46 species is nearly opposite from those seen in the overall Gulf richness; highest endemic richness is concentrated along the northern U.S. Gulf coast and lowest richness in south Florida and the Campeche Bank (Figure 7B). Areas that are hotspots in both overall and endemics include Veracruz, Mexico and the Flower Garden Banks.

The richness of threatened Gulf species is highest in the southern portion (from Veracruz to the Florida Keys and Cuba) and lowest along coastal Louisiana to Tamaulipas (Figure 7C). The distribution of DD species is generally the same through much of the region with cell values between 1 and 19 species (Figure 7D). However, a hotspot with 28-41 species is located in Cuba and the Florida Keys. Across the four richness maps, Cuba and the Florida Keys appear to have a high richness overall, including threatened and DD species, but have a low richness of endemics. The opposite trend is observed in the northwestern Gulf of Mexico, where richness is low except for endemics.

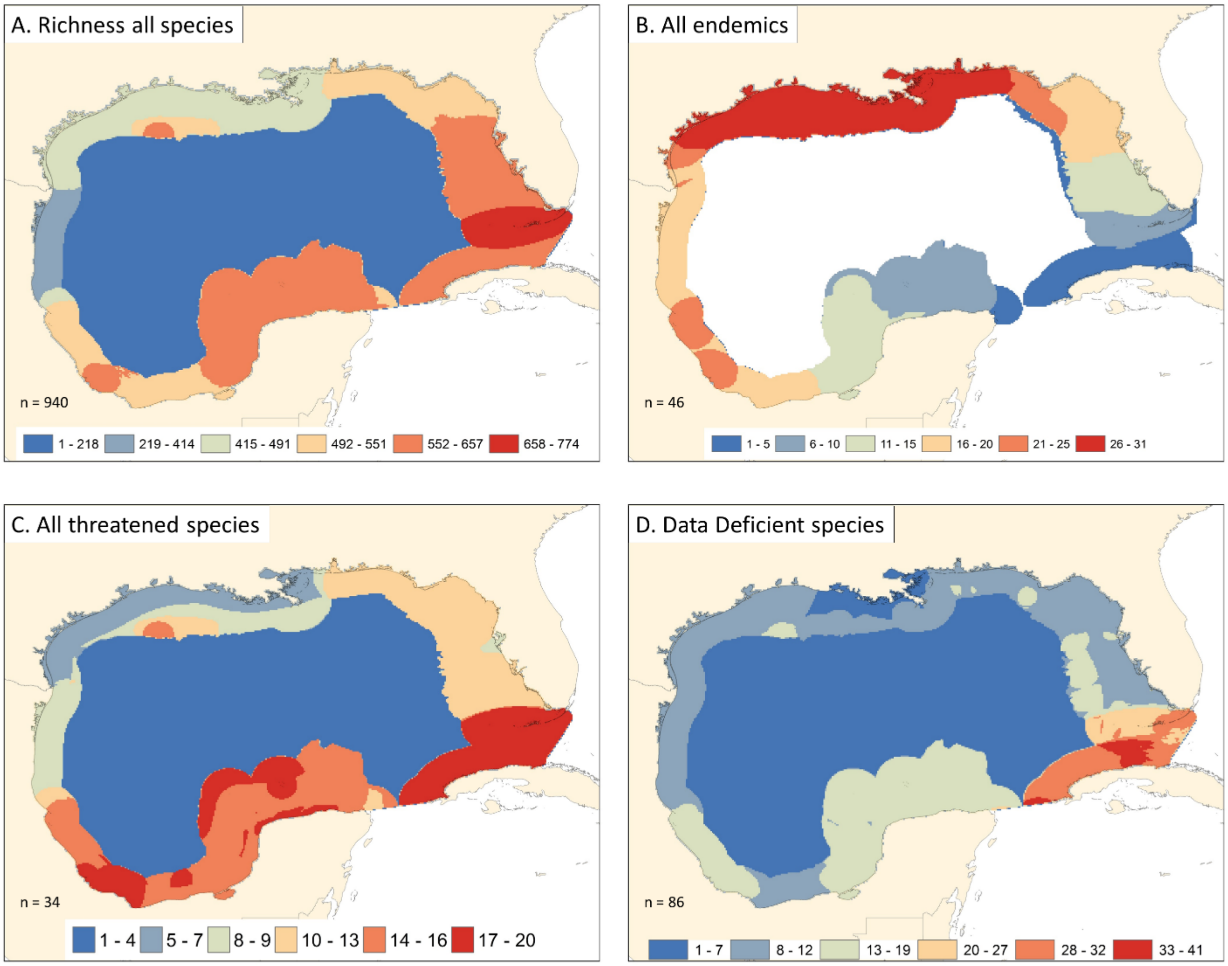



Figure 7. Number of marine bony shorefishes in the Gulf of Mexico per 25 km$^2$ grid cell for (A) all species, (B) all endemics, (C) regionally threatened species and (D) regionally DD species. The total number of species is displayed in the bottom left of each map.

### *3.3. Major threats*

In both the greater Caribbean and Gulf of Mexico, the most commonly recorded threat for NT and threatened species, by a significant margin, is overexploitation (Table 5, Figure 8). Coral reef degradation and invasive lionfish predation are threats that commonly occur together. The fourth most common threat is estuarine degradation. Mangrove and seagrass degradation follow; however, mangrove degradation is only recorded for the greater Caribbean. Freshwater diversion and competition with invasive species is recorded for some species that utilize both marine and freshwater habitats. The two remaining threat types were particularly specific and did not fit within the other categories: anchialine cave degradation for three Caribbean cavefishes (*Lucifuga spp*.) and the construction of a pier complex within the habitat of an endemic Gulf toadfish, *Sanopus reticulatus*. In general, the same types of threats were recorded in both the greater Caribbean and Gulf of Mexico assessments.

Table 5. The number of NT and threatened species impacted by threat type for each data set in descending order. Some species are impacted by more than one threat type.

| **Threat** | **# greater Caribbean species (n=83)** | **# Gulf of Mexico species (n=44)** |
|---|---|---|
| Overexploitation | 42 | 22 |
| Coral degradation | 26 | 14 |
| Invasive lionfish predation | 21 | 12 |
| Estuary degradation | 20 | 11 |
| Mangrove degradation | 9 | 0 |
| Seagrass degradation | 6 | 5 |
| Dams/freshwater diversion | 5 | 2 |
| Competition with invasives | 4 | 0 |
| Anchialine cave degradation | 3 | 0 |
| Pier complex construction | 1 | 1 |

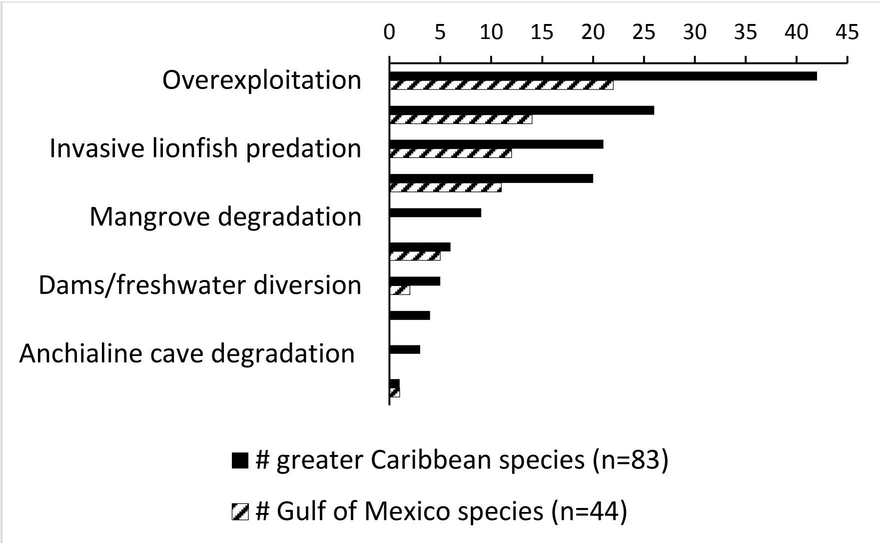



Figure 8. The number of NT and threatened species impacted by threat type for each data set in descending order. Some species are impacted by more than one threat type.

*3.4. Factors contributing to Data Deficient listings*

A species was listed as DD most commonly due to it being known from very few records and/or localities. In these cases, the uncertainty around whether the species could be highly limited in range or not did not allow it to be definitively placed in any other category. At times, taxonomic uncertainty also inhibited the understanding of a species' distribution. Species were also listed as DD if it was known to have a limited range size and a plausible threat had been identified, but the extent of the impact is unknown. The most common contributing factor related to threat was the lack of data on the impact of ongoing habitat degradation to a species (Table 6, Figure 9). Lack of fishery data was also a significant factor, especially for species that are known to be heavily exploited and susceptible to population decline, but for which quantified catch data is not available for a large proportion of the range. The lack of information on suspected impact from predation by the invasive lionfish was also a factor, especially if the species is known from a potentially limited range and exhibits traits of a preferred lionfish prey item. Lastly, four deep-living eels and one cusk-eel are known from very few specimens collected only within the vicinity of the Deepwater Horizon oil spill in the Gulf of Mexico. Besides the oil spill, there were generally no large differences between the factors in the greater Caribbean and the Gulf of Mexico assessments.

Table 6. The number of DD listings by contributing factor for each data set. Some species were listed as DD for more than one factor.

| **Factors contributing to DD listing** | **# greater Caribbean assessments (n=114)** | **# Gulf of Mexico assessments (n=86)** |
|---|---|---|
| Known from few records/localities | 82 | 72 |
| Taxonomic uncertainty | 18 | 19 |
| Range size limited | 19 | 5 |
| Lack habitat degradation data | 45 | 28 |
| Lack fishery data | 26 | 19 |
| Lack invasive lionfish impact data | 15 | 9 |
| Lack oil spill impact data | 1 | 5 |

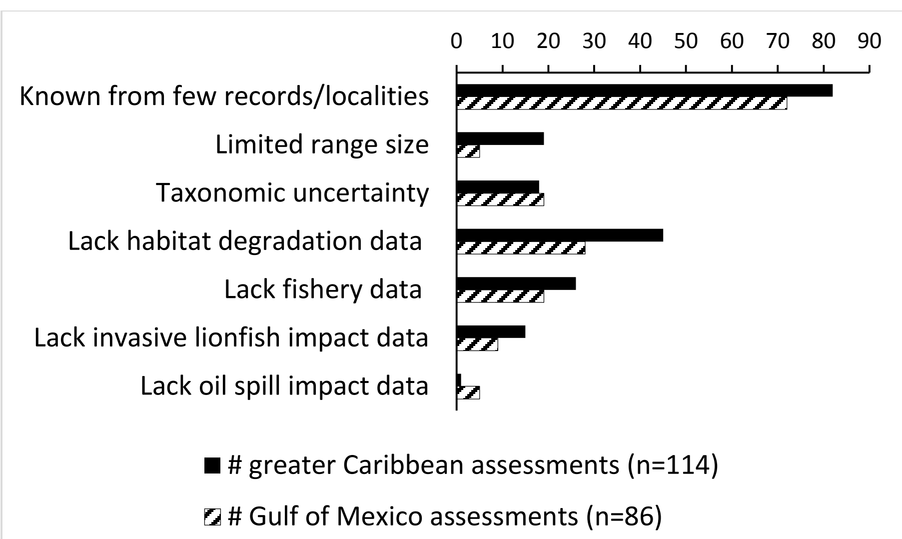



Figure 9. The number of DD listings by contributing factor for each data set. Some species were listed as DD for more than one factor.

*3.5. Differing global vs. regional Gulf of Mexico categories*

Of the 894 Gulf of Mexico non-endemics, 102 have regional categories that differ from their global category in four following ways: either more or less threatened in the Gulf or more or less Data Deficient in the Gulf. The majority that differ (65%) are listed as DD in the Gulf, but LC globally. Regionally, these 66 species lack data on their distribution and population because they are known from very few records collected in the Gulf. Species listed in NT or threatened categories were more commonly listed at a lower threat level in the Gulf of Mexico than globally (Figure 10).

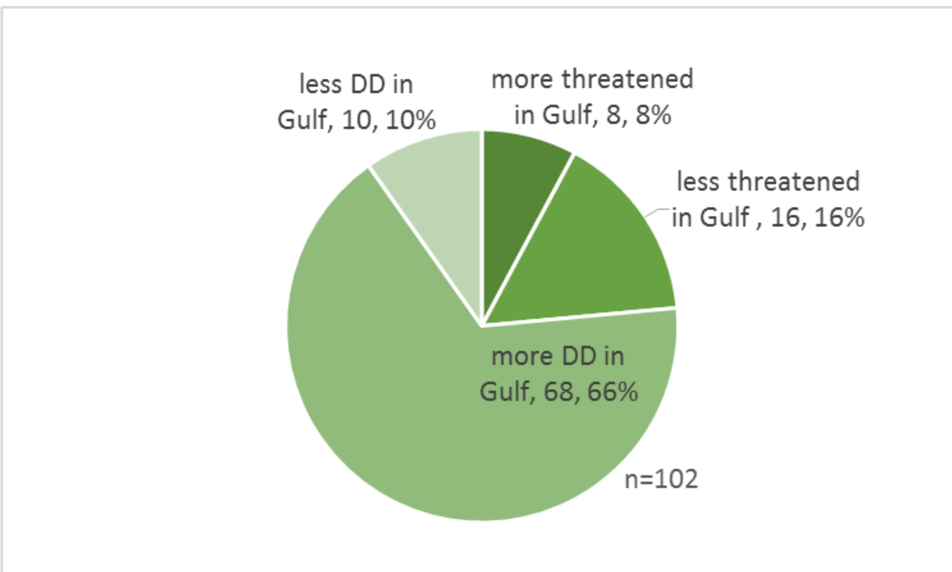



Figure 10. The number and percentage of species with differing global and regional categories where they either are listed at a higher threat category in the Gulf or lower compared to their global category and if they are listed as Data Deficient in the Gulf, but not globally and vice versa.

*3.6. Marine protected areas and threatened endemics*

Overall, 65 threatened shorefishes occur in the greater Caribbean, 45 of which are endemic. The final MPA layer resulted in a total of 987 individual MPAs (Figure 11). On average, each species distribution polygon intersected with 139 MPAs and overall values ranged between 1 to 742 MPAs. A total of 173 MPAs (17.5%) did not intersect with any species; of those 814 that did intersect, there was an average of eight species per MPA with a maximum of 18 species. All 45 distribution polygons intersected with at least one MPA, but when only point data from the STRI database were applied, 11 of the 45 species did not have records within a single MPA. Off Belize, the polygons of 18 species and point records of 16 species intersect with the Belize Barrier Reef Reserve System, which is also a UNESCO World Heritage site (Figure 11B). Eight of these species are nearly or fully endemic to Belize; four of them are impacted by the invasive lionfish and all by habitat degradation.

The top three hotspots of threatened endemics are located in Belize (17 species), central Panama (13) and Grand Cayman Island (13). Six other localities scattered throughout the region have 12 species each. Based on qualitative observation, the area covered by MPAs within these hotspots varies. For example, the Florida Keys National Marine Sanctuary covers a large portion of the Florida Keys hotspot (Figure 11A) as compared to central Panama, which has minimal to no coverage (Figure 11E).

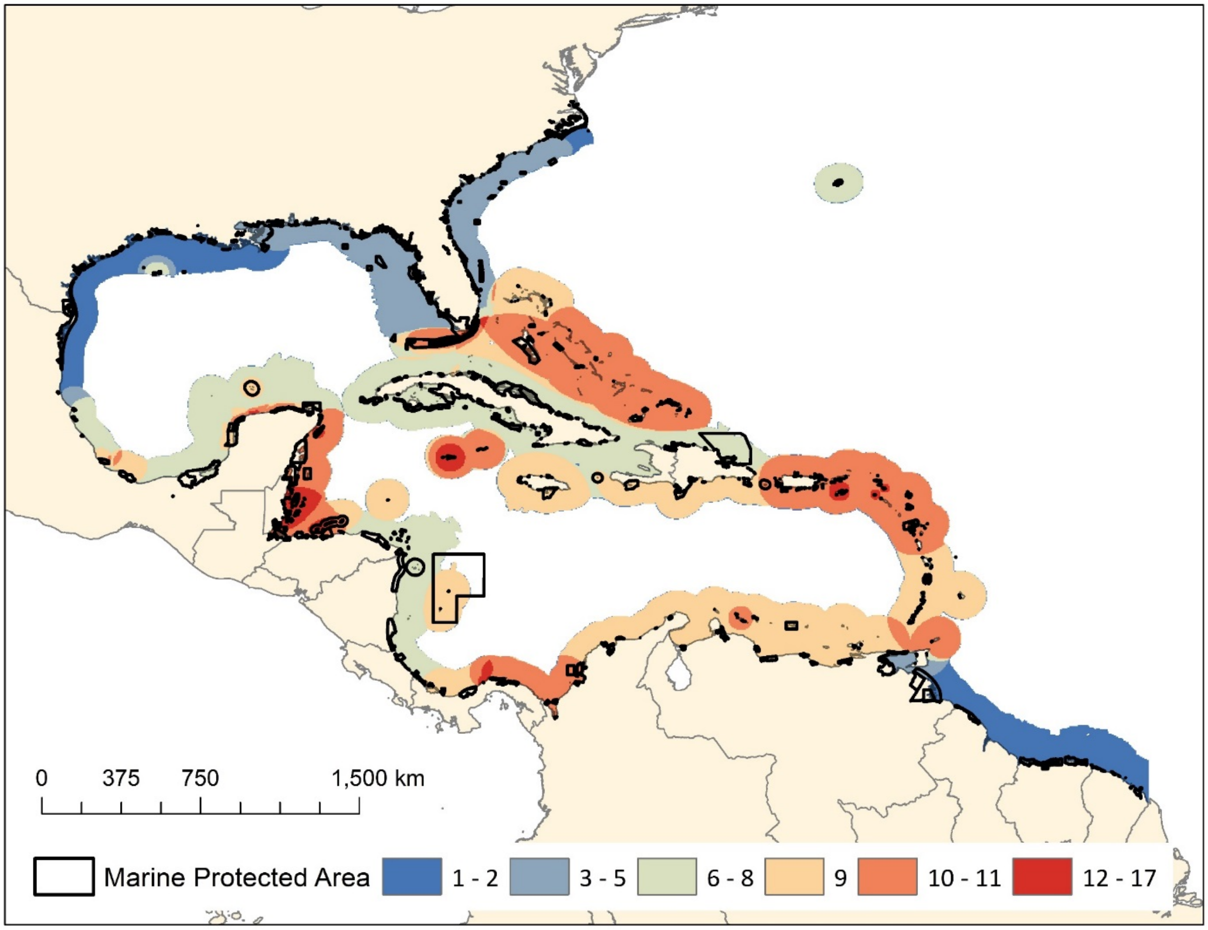



Figure 11. Number of threatened greater Caribbean endemic shorefishes per 25 km$^2$ grid cell overlaid with MPAs in heavy black outline. Insets on the right are enlarged images of areas with cells containing 12-17 species: (A) Florida Keys, USA; (B) Belize and Honduran Bay Islands; (C) Yucatán and Cozumel, Mexico; (D) Eleuthera Island and Exuma Sound, the Bahamas; (E) central Panama; (F) St. Croix, US Virgin Islands; (G) Saba Bank Atoll and St. Barthélemy; (H) Grand Cayman Island.

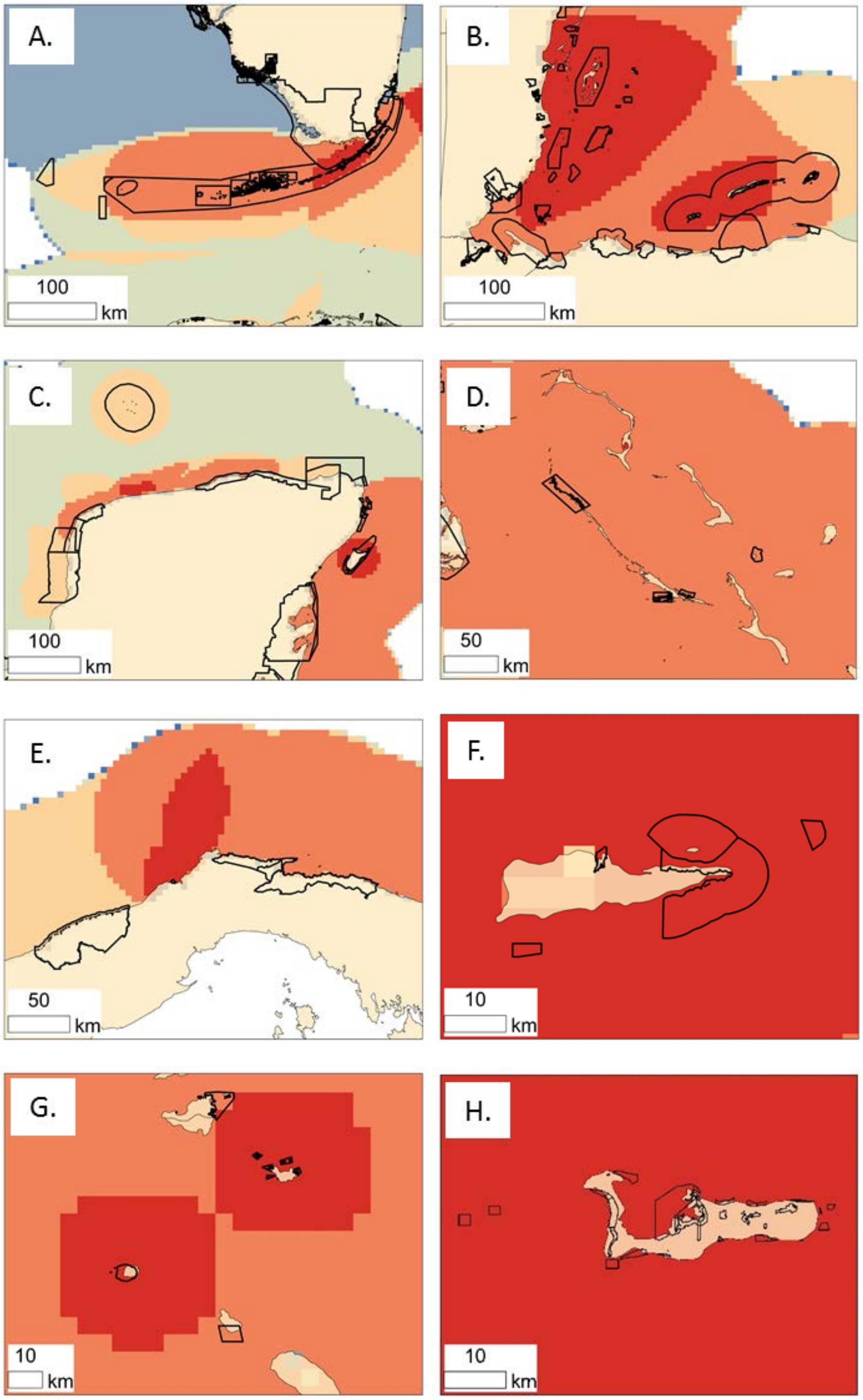



Figure 11. Continued

# CHAPTER 4

# DISCUSSION

Evaluating extinction risk has improved our understanding of the diversity and distribution as well as knowledge gaps and major threat processes of greater Caribbean shorefishes. The most pervasive threats to the 65 threatened and 18 NT species are overexploitation, coral reef and estuary degradation and the invasive lionfish. Furthermore, half of these species and 13% of DD species are impacted by more than one threat that may be acting concurrently to amplify extinction risk. This highlights the need for conservation planners to account for multiple threat scenarios. Localities with the highest number of threatened endemic species include Belize and Panama. Other hotspots may exist, but are poorly understood due to the lack of shorefish diversity sampling in certain areas of the greater Caribbean. That the majority of the 114 species listed as DD are known from very few records and half are small, cryptic or deep-living supports this hypothesis. The lack of resolution in bathymetric map layers and data gaps in MPA layers and effectiveness reduces the accuracy of a threatened species gap analysis and should be priorities for future research. Regardless, these new data on threatened shorefishes should be recognized by conservation agencies and their needs incorporated into management plans where appropriate.

Applying the Red List criteria at the regional scale in the Gulf of Mexico enhanced the identification of conservation priorities for widely distributed fishes, while also highlighting lesser known endemics that are falling through the cracks. More non-endemic shorefishes are at a lower threat level in the Gulf than globally, but the difference is slight. Gulf shorefishes are experiencing the same major threats; however, the threat from coral degradation on small, reef-dependent fishes is amplified due to the limited availability of coral habitat compared to the Caribbean. Since heavily exploited species are widely distributed in the Gulf, the generally effective fisheries management in U.S. Gulf waters benefits only part of the fished populations, and due to inadequate management in Mexican waters, was not sufficient enough for species to be listed in a lower threat category. Furthermore, this semi-enclosed sea covers a substantial portion of the greater Caribbean's area; however, if the Gulf shorefishes were not analyzed separately, then it would not have been realized that a large proportion of the region's relatively few endemics are threatened with extinction.

*4.1. Summary statistics*

In the Gulf of Mexico, the high proportion of threatened endemics (26%) highlights a need for conservation action aimed towards preserving unique biodiversity in an area with low overall shorefish endemism. The majority of these 12 endemics are diminutive in size, have small ranges and are impacted by habitat degradation in either estuarine or coral ecosystems. The overall proportion and midpoint of threatened species, which are respectively 4 and 5%, are the same in both the Gulf of Mexico and greater Caribbean data sets. When comparing across four other bony fish Red List initiatives (Table 7), the midpoints also do not notably differ from the proportion threatened. The midpoint and proportion threatened were also the same in a global Red List analysis of birds (Butchart and Bird 2010). Out of the six initiatives, the Eastern Tropical Pacific has the highest proportion threatened (9%), which is about four percentage points higher than the greater Caribbean. The proportions in the Mediterranean, Europe and Eastern Central Atlantic (2-3%) are slightly lower than the greater Caribbean and Gulf of Mexico.

The DD proportions recorded were generally the same in the Gulf of Mexico and greater Caribbean (8-9%), except for greater Caribbean endemics (13%). The DD species are mostly endemic to the region. Only 0.6% of the world's birds are assessed as DD, which is partly because birds are generally better known than other taxa (Butchart and Bird 2010). Fishes may have a higher DD proportion because of the lack of sampling and directed research towards non-fished species. However, the application of DD can easily be misunderstood by assessors; if an evidentiary approach is taken then DD proportions are likely to represent overestimates (Stuart et al. 2005). This can lead to comparison incompatibility with other Red List initiatives, especially since the Red List has increased stringency when reviewing DD listings prior to publication (Butchart and Bird 2010). Therefore, differing proportions of DD species is not necessarily explained by the level of sampling effort in a region.

Table 7. Percent threatened and DD reported by other Red List initiatives for marine bony fish. The Eastern Central Atlantic, Mediterranean and Europe initiatives assessed all marine bony fishes, including those the mesopelagic and deep sea taxa. The greater Caribbean, Gulf of Mexico and Eastern Tropical Pacific initiatives assessed only shorefishes.

| Study region | # species | % threatened | % DD | Midpoint | Scope of assessments | Reference |
|---|---|---|---|---|---|---|
| Greater Caribbean | 1360 | 5% | 8% | 5% | Global | this study |
| Gulf of Mexico | 940 | 4% | 9% | 4% | Regional | this study |
| Eastern Tropical Pacific | 1102 | 9% | 16% | 10% | Global | Polidoro et al. 2012 |
| Eastern Central Atlantic | 1288 | 3% | 13% | 3% | Global | Polidoro et al. in prep |
| Mediterranean | 442 | 3% | 29% | 4% | Regional | Abdul Malak et al. 2011 |
| Europe | 854 | 2% | 21% | 2.5% | Regional | Nieto et al. 2015 |

### *4.2. Patterns of species richness*

#### 4.2.1. Greater Caribbean – overall richness

Of the 1,360 greater Caribbean marine bony shorefishes, 53% are endemic. Robertson and Cramer (2014) reported that 45% of all greater Caribbean shorefishes are endemic (n=1,559; included elasmobranchs, which are mostly not endemic). Miloslavich et al. (2010) reported that 45% of 1,336 fishes (included elasmobranchs) of the Caribbean Sea were endemic and that it could have been higher if the entire greater Caribbean were considered. Smith et al. (2002) reported that 23% of 987 greater Caribbean fishes likely present in fisheries were endemic. However, the authors acknowledged that their study concentrated on exploited species and if gobies and other non-fished diminutive groups had been included, the endemism rate would have been higher.

Shorefish richness patterns may be driven by the following factors: 1) widely distributed species; 2) geographic isolation; 3) prevailing currents and water temperature; 4) availability of complex habitats; and 5) level of sampling effort. In the greater Caribbean, even the majority of endemics are widely distributed presumably due to the generally high level of connectivity in the region (Robertson and Cramer 2014). This could be driving the richness patterns seen in this study to some degree (Orme et al. 2005, Pimm et al. 2014). According to Cowen et al. (2006), however, the Caribbean is not lacking for complexity in subregional connectivity. Using point data in a cluster analysis, Robertson and Cramer (2014) reported the highest number of greater Caribbean shorefishes along the Central American coast from Mexico to Panama, as well as all the offshore islands except Bermuda and Tobago. These findings are similar to this study, but describe a much larger area with high richness.

The area with the most species, south Florida, has characteristics that fit several of the aforementioned richness drivers: it is well-studied, it has a large area of complex reef and the chance of settlement by propagules from Caribbean reefs is likely amplified by its position in the Florida Straits, which is where the Caribbean Current transitions into the Gulf Stream. Cuba shares these characteristics, but low sampling effort (Miloslavich et al. 2010) may be inhibiting it from appearing as a hotspot. Other areas with high richness include Belize and the Honduran Bay Islands, which are part of the Mesoamerican Reef Complex. This area is recognized for its substantial mangrove, seagrass and coral reef habitat (Robertson and Cramer 2014) and is somewhat isolated from areas to the north and south (Cowen et al. 2006). High richness in the Leeward Islands (Puerto Rico to Dominica) may be due to high sampling effort as compared to nearby areas such as Hispaniola (Miloslavich et al. 2010), or its relative isolation from the remaining eastern Caribbean (Cowen et al. 2006). Curaçao likely resulted as a hotspot due to recent specialized sampling that discovered species currently known only from that locality (Baldwin and Robertson 2013, 2014, Baldwin and Johnson 2014). Venezuela and Colombia have been well-studied, but high richness in this area is not necessarily explained by habitat complexity as the area is dominated primarily by rocky shorelines, upwelling and large river outflow (Robertson and Cramer 2014). The reef systems of Panama and Colombia are relatively isolated by a strong gyre (Cowen et al. 2006), which may contribute to its position as a hotspot for all species, endemics and limited range endemics. Robertson and Cramer (2014) designated northern South America as a major faunal subdivision of the greater Caribbean, and speculated that endemism there is likely higher than they were able to detect using point cluster analyses. Cowen et al. (2006) described the 'Venezuela Corridor' as a subregion within the Caribbean with ecological breaks at Aruba and Tobago, but the process behind the relatively high number of limited range species that occur there has not yet been studied. The Bahamas is a hotspot for endemics, but not for overall species; this may be partly explained by its geographic isolation from the majority of the Caribbean (Cowen et al. 2006).

The offshore oceanic zone has the lowest richness due to its resource-poor environment and low opportunity for niche diversification. In the nearshore area, low richness in the northwestern Gulf of Mexico, the Carolinas (U.S.) and French Guiana is likely due to the lack of complex habitat types (Robertson and Cramer 2014). Bermuda has a low richness because it is highly geographically separated from the rest of the region (Smith-Vaniz et al. 1999). Low richness in the Cayman Islands is not well-understood, but the area is known to be separated from the eastern Caribbean by the Cayman Trough, a deep undersea volcanic rift (Miloslavich et al. 2010).

### 4.2.2. Greater Caribbean – threatened richness

Since roughly half of the threatened species (31 out of 65) are widely distributed throughout the region, it is not unexpected that their richness does not show strong patterns. Conversely, hotspots are more distinct in the richness of threatened endemics because the majority of those species have a small range size (33 out of 45). Grand Cayman Island is a threatened endemics hotspot that was not recorded as a hotspot in the overall richness. This is likely due to the recent discovery of three endemic Cayman gobies (Victor 2014) that were listed as threatened.

Measuring the vulnerability of an area based only the distribution of threatened species can cause mismatches to occur because threat processes may not be homogenous across the entire range of a species (Wilson et al. 2005). For example, the Bluefish (*Pomatomus saltatrix*) is globally listed as Vulnerable due to overexploitation in many of its subpopulations; however, the greater Caribbean subpopulation is considered to be stable due to successful fishery management actions. Conversely, the Greater Amberjack (*Seriola dumerili*) is globally listed as Least Concern; however, overexploitation in the Gulf of Mexico caused it to be regionally listed as Near Threatened. Some of the most common major threats identified in this study (e.g., overexploitation, coral degradation and the invasive lionfish) are widely distributed throughout the region and occur at varying levels. The expansion of the Panama Canal, however, is a localized threat to limited range fishes off Colón, and partly explains why this area is a threatened endemics hotspot. Similarly, localized coastal development is a threat to sensitive habitats that support limited range fishes in Belize.

There is a considerable amount of overlap between the top ten greater Caribbean hotspots in each richness map; four hotspots are recorded across all three and eight are recorded in only one of the three (Table 8, Figure 12). In addition, seven out of ten hotspots overlap between all species and limited range, seven overlap between all species and threatened and five overlap between limited range and threatened. In a global study of bird diversity, Orme et al. (2005) found little overlap between hotspots across richness analyses of all species, limited range (referred to in the study as 'endemics') and threatened species. The authors concluded that the lack of overlap between threatened species versus all species and limited range was driven by the distribution of threat. The same conclusion cannot be drawn for greater Caribbean shorefishes, however. Global-level studies of the distribution of tropical reef fish would both agree (Roberts et al. 2002) and disagree (Hughes et al. 2002) with the level of overlap between hotspots of overall diversity and endemicity presented here. A more robust comparison against Roberts et al. and Hughes et al. (2002) may be possible by conducting these analyses while excluding non-tropical reef fish. Furthermore, since the aforementioned studies are global in scope and the study presented here is subglobal, the difference in geographic scale may cause the results to be less comparable (Rahbek 2005).

Table 8. The number (in parentheses) and name of hotspots by the combination of richness analysis type (can be one, two, or all of the following: all species, limited range, or threatened). There are 20 unique hotspots within the top ten areas that have the most species in each richness analysis.

| **Combination of richness types** | **Number and name of hotspots** |
|---|---|
| all species, limited range and threatened | (4) Puerto Rico, Panama, Belize, U.S. Virgin Islands |
| all species and limited range | (3) Venezuela, Colombia, Southeast Florida (USA) |
| all species and threatened | (3) Honduran Bay Islands, Florida Keys (USA), British Virgin Islands |
| threatened and limited range | (1) Flower Garden Banks |
| all species only | (1) Trinidad and Tobago |
| threatened only | (3) Northern Yucatán, Veracruz (Mexico), Saba and St. Barthélemy |
| limited range only | (4) Western Venezuela, Isla de Margarita (Venezuela), Northeastern Gulf of Mexico (USA), Southwest Florida (USA) |

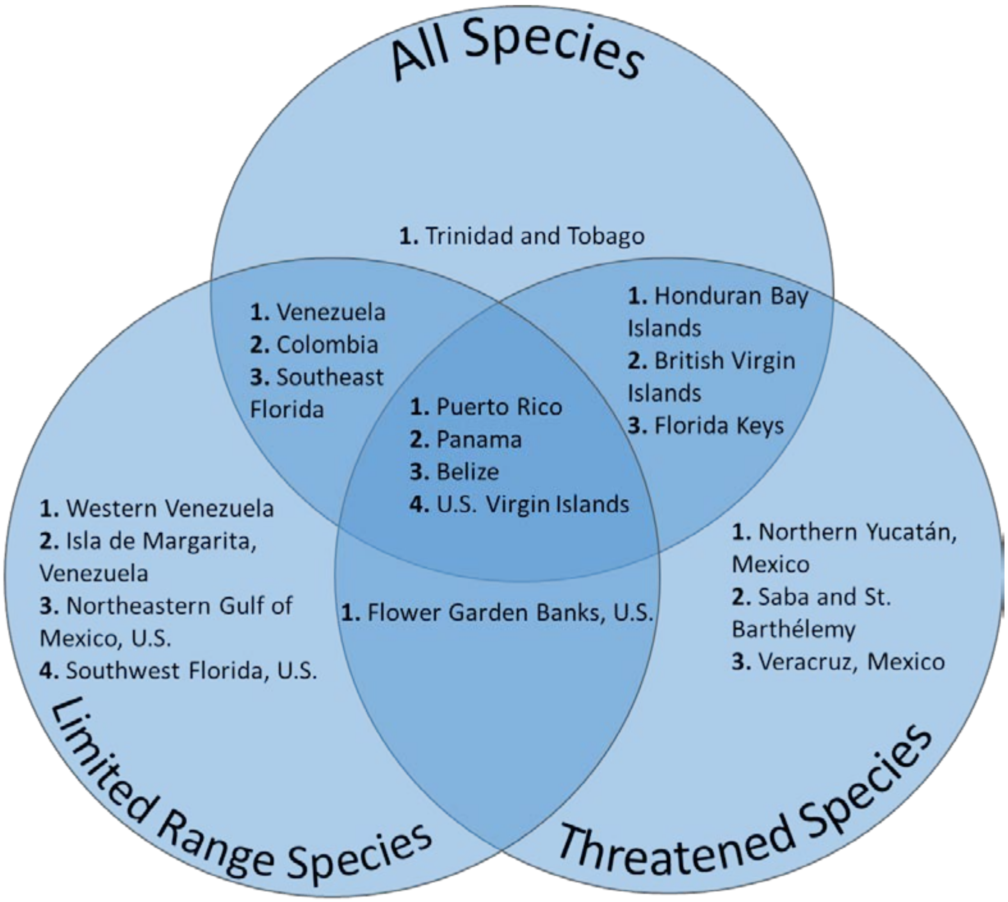



Figure 12. Venn diagram depicting hotspot overlaps by richness analysis type (can be one, two, or all of the following: all species, limited range, or threatened). There are 20 unique hotspots within the top ten areas that have the most species in each richness analysis.

### 4.2.3. Greater Caribbean – DD richness

Since 72% of the 114 DD species are known from limited records, DD richness patterns are likely driven by sampling bias. Specialized sampling methods targeting deep and/or cryptic species commonly result in the discovery of new or poorly-known species. Such methods, however, have been implemented only rarely and opportunistically across the greater Caribbean (e.g., Williams 2002, Williams and Mounts 2003, Smith-Vaniz et al. 2006, Williams et al. 2010, Baldwin and Johnson 2014). Conducting a gap analysis between reef habitat and locations where rotenone and/or deep sampling methods have been applied in the greater Caribbean may guide priorities for biodiversity surveys as well as improve knowledge on species with unexplained distribution gaps (e.g., Bini et al. 2006). Furthermore, the majority of the well-known DD species are widely distributed and likely contributes to ambiguity in richness patterns. Nieto et al. (2015) suggested that the factors behind DD richness hotspots in European marine fishes may be related to areas with high fishing pressure and low availability of catch data, while also mentioning that fish diversity in the European region is relatively well-known. The greater Caribbean, however, is a region where both basic diversity knowledge as well as the availability of fishery data varies widely by country.

#### 4.2.4. Greater Caribbean – limited range richness

In studies across a variety of taxa, hotspot overlap was low between richness maps of all species and limited range species (Manne et al. 1999, Jetz and Rahbek 2002, Roberts et al. 2002, Schipper et al. 2008, Lucifora et al. 2011, Selig et al. 2014, Peters et al. 2015). However, overlap is high in greater Caribbean shorefishes, as seven hotspots are shared between all and limited range species (Figure 11). Hotspot overlap between threatened and limited range species was high in studies on passerine birds (Manne et al. 1999) and the world's mammals (Schipper et al. 2008). Greater Caribbean shorefishes, however, differ again by having a relatively small amount of overlap (five hotspots) between threatened and limited range species. These differences may be attributed to the tendency for threatened fishes to have larger distributions than threatened terrestrial species. The most common major threat to fishes is exploitation and most heavily exploited fishes are widely distributed, whereas the most common major threat to terrestrial species is habitat destruction, which can have a large impact on limited range species. It should be noted, however, that the body size of the limited range shorefishes is small, with an average maximum length of 16 cm (the average over all the species is 36 cm). Small-bodied fishes often have a limited potential dispersal distance, which can contribute to a species having a limited range (Cowen et al. 2006).

The northeastern Gulf of Mexico does not occur as a hotspot in any other greater Caribbean richness maps except in limited range species. Of particular concern, this area is within the vicinity of the large 2010 Deepwater Horizon oil spill. Since noteworthy oil-induced mortality events in coastal fishes were not detected and more than one study found evidence for increases in abundance in 2011, this was not considered to be a major threat to the nearshore fishes in this study. Interestingly, a short-term abundance increase has been attributed to the mortality release from the fisheries which were closed over about a six-month period during and after the spill due to concerns that the catch would not be fit for human consumption (Fodrie and Heck 2011, Schaefer et al. 2016). However, the potential for long-term impacts, especially on deep-living species, is not yet fully understood (Tunnell 2011, Montagna et al. 2013). Therefore, prioritizing research on these limited range species may be warranted as they are not targeted by fisheries and their ecology and population status are poorly-known.

#### 4.2.5. Proportion of threatened richness in the greater Caribbean and Gulf of Mexico

In both the Gulf of Mexico and greater Caribbean, the highest proportion of threatened species is in the offshore oceanic zone. Of the only 70 shorefishes that do occur there, several are listed in threatened categories (i.e., tunas and billfishes). This result may differ if the offshore, deep-living taxa were included, especially since those species experience few threats compared to shorefishes. The major threat to the threatened epipelagic, oceanic species is overexploitation by high-value multinational fisheries (Collette et al. 2011). Advances in dynamic ocean management may allow managers to avoid situations where displaced fishing effort inadvertently harms other threatened species as well as rebuild fished populations (Abbott and Haynie 2012, Maxwell et al. 2015, Briscoe et al. 2016).

When oceanic species are excluded, the proportion threatened varies little throughout the greater Caribbean, which is likely due to most species being widely distributed. North and South Carolina (U.S.), Las Islas del Cisne (Honduras), Bermuda and the Cayman Islands are areas with a slightly higher proportion. These areas also have a low overall species richness (see Figure 4A). Other areas include the Mexican coast from Veracruz to Yucatán and Belize, which are both hotspots of threatened and threatened endemic species. These may be areas with a genuinely high proportion of threatened species. The highest proportion threatened in the nearshore Gulf of Mexico occurs from Veracruz and the northern Yucatán off Mexico as well as Cuba. It is suspected that the species richness off Cuba may be underrepresented due to the relatively low sampling effort, but declines in coral and estuarine health within the vicinity of Havana were cited as a major threat for certain species with Gulf ranges limited mostly to that coast (e.g., *Stegastes otophorus*, *Neoopisthopterus cubanus*, *Coryphopterus lipernes*). The presence of threatened Gulf endemics on degraded Veracruz reefs (e.g., *Elacatinus jarocho*, *Hypoplectrus castroaguirrei*, *Tigrigobius redimiculus*) and estuaries of the northern Yucatán (e.g., *Fundulus grandissimus*, *F. persimilis*) also likely drives this pattern.

### 4.2.6. Gulf of Mexico richness

In the Gulf of Mexico, areas with reef habitat have the highest shorefish richness. For example, the Flower Garden Banks, Alacranes Reef, Cuba and the hard-bottom areas off southwest Florida (e.g., Pulley Ridge) contain habitat that attracts reef fish and have higher richness compared to other areas dominated by soft bottom habitat (i.e., northeastern Gulf). Besides differences in habitat complexity, the northern Gulf also differs by large river systems and lower water temperatures (Robertson and Cramer 2014). Spalding et al. (2007) reported the presence of a significant biogeographic break between the northern and southern Gulf; however, recent analyses by Robertson and Cramer (2014) reveal that the shorefish assemblages between these areas are strongly linked. Similar to the greater Caribbean, the highest richness of Gulf of Mexico shorefishes is located in the Florida Keys. Efforts to survey fish diversity on Mexican reefs in the Gulf have recently increased (e.g., González Gándara et al. 2012, Del Moral Flores et al. 2013, Zarco-Perello et al. 2014), but are still undersampled compared to U.S. reefs (McEachran 2009).

The richness of endemics, which is represented by only 5% of Gulf shorefishes, reveals a considerably different pattern. The lowest numbers of endemics are located in the southeastern portion and the highest along the northern coast. This is similar to results reported by Smith et al. (2002) and Robertson and Cramer (2014). One hypothesis supported by the presence of sister species along the U.S. east coast, is that speciation occurred in the northern Gulf due to climate-induced vicariance sometime prior to the establishment of the Florida peninsula (Smith et al. 2002). The recent discovery of a few reef fishes (Taylor and Akins 2007, Del Moral Flores et al. 2011, Tavera and Acero 2013) contributed to Mexico's Veracruz Reef System being identified as an endemics hotspot. Since connectivity between the Caribbean and the northern Yucatán is relatively low (Cowen et al. 2006), reefs west of the Yucatán may not receive propagules from other reefs. Furthermore, out of the entire greater Caribbean, reefs of the southwestern Gulf of Mexico were the last to be colonized by the invasive lionfish (Santander-Monsalvo et al. 2012). Such isolation could foster speciation.

Since the majority of threatened Gulf shorefishes are reef-associated (21 out of 34), it is appropriate that the highest richness of threatened species is concentrated in areas with live coral. Thirteen of these reef species are impacted by coral degradation, while eight are overexploited. Of the 86 regionally listed as DD, 72 are known from few records and is likely the driver behind DD hotspots in Cuba and the Florida Keys. These records potentially represent established populations of species that are naturally rare or cryptic in the Gulf or they could be waifs deposited from currents originating in the Caribbean.

#### 4.2.7. Error sources in spatial analyses

The results presented here are based on the best available data and should be considered a reliable starting point for informing large to moderate-scale conservation priorities (Rodrigues et al. 2004), but there are data gaps that may be influencing patterns. The distribution maps were reviewed by species experts and adjusted according to expert-vetted point locality data (Robertson and Van Tassell 2015), which reduced the propagation of errors inherent to distribution modelling. These maps were drawn with the underlying assumption that these species occur homogenously across their entire range, but in reality, fish are generally patchily distributed according to habitat or food availability, mobility and depth range preference. Due to the commission error, planners should be aware that the potential for misidentifying conservation areas based on only generalized distribution maps is possible (Rondinini et al. 2006, Pressey et al. 2015). When available, subregional bathymetric and/or habitat data sets can refine distribution models and should be considered prior to making conservation decisions. This is especially important when delineating protected areas based on the presence of threatened species (Rondinini et al. 2006).

In general, it is nearly impossible to quantify species richness patterns without some bias (Rahbek 2005). Despite the gradual increase in our knowledge of fish distributions, the results of the richness analyses in this study are likely influenced by incomplete sampling (Gotelli and Colwell 2001). In the study presented here, three hotspots - the Florida Keys, Puerto Rico and St. Croix - all fall under jurisdiction of the United States, which has the largest economy and ability to fund sampling. Beyond that, Belize and central Panama are where Smithsonian research facilities that specialize in cataloging biodiversity are located. Survey work by Colombia's Institute of Marine and Coastal Research and effort in Venezuela by the ichthyologist Fernando Cervigón also may have contributed to these areas being hotspots. In an analysis of marine biodiversity in the Caribbean, Miloslavich et al. (2010) expressed the likelihood that richness patterns may reflect areas where sampling effort has been disproportionately high. Robertson and Cramer (2014) also pointed out that the lack of records from certain areas does not likely represent low diversity, but is more likely due to lack of sampling. Some of the most undersampled areas include parts of Cuba, Hispaniola, the large shelf off Honduras and Nicaragua, and the banks between Nicaragua and Jamaica (Miloslavich et al. 2010). The overall richness of greater Caribbean shorefishes (Figure 4A) does show these areas as having relatively lower numbers of species.

The lack of biodiversity sampling is especially true for small-bodied taxa that inhabit depths beyond recreational scuba depth and/or require the application of rotenone methods (Collette et al. 2003, Smith-Vaniz et al. 2006). Considering that new species are continually described at a consistent rate, there is no doubt that many greater Caribbean fishes remain to be discovered (Eschmeyer et al. 2010, Baldwin and Johnson 2014). In the face of increasing threats to marine species, the lack of fundamental biodiversity data increases the possibility that species could be lost before they are described (Mora et al. 2008). This may be especially relevant to the Caribbean as the threat from the invasive lionfish on small-bodied reef-associated fishes extends to depths up to 300 m, which is well within an environment of which we know relatively little about.

### *4.3. Major threats*

Extinction events are commonly centered on a single major event or threat, but the final demise of a population is often caused by secondary synergistic influences (Brook et al. 2008). For example, the ecological extirpation of the Chesapeake Bay oyster reefs, which were once one of the most extensive in the world, was predicated first by overexploitation, followed by pollution and finally, parasitic diseases (Rothschild et al. 1994). Across this study of the greater Caribbean and Gulf of Mexico shorefishes, half of the NT and threatened species (44 out of 88) have more than one threat recorded. For example, the Mardi Gras Wrasse (*Halichoeres burekae*) and the Social Wrasse (*H. socialis*) are two restricted range, reef-associated species that are highly susceptible to predation by the invasive lionfish and inhabit reefs in areas where decline or destruction has been documented (Rocha et al. 2015). Intrinsic characteristics in fishes, such as large body size and late maturity, can also act synergistically with exploitation to amplify extinction risk (Reynolds et al. 2005). For example, the average maximum length of the exploited NT and threatened shorefishes (n=44), which is 145 cm, is substantially larger than the average size over all the greater Caribbean shorefishes (36 cm). Furthermore, the dependence of the overexploited Goliath Grouper (*Epinephelus itajara*), Lane Snapper (*Lutjanus synagris*) and Rainbow Parrotfish (*Scarus guacamaia*) on sensitive nearshore habitats further reduces their survivability.

#### 4.3.1. Overexploitation

Overexploitation directly impacts half the species listed as NT and threatened in the greater Caribbean and Gulf of Mexico. Other comprehensive Red List assessments of marine fishes also record overexploitation as the most common major threat (Collette et al. 2011, Sadovy de Mitcheson et al. 2013, Dulvy et al. 2014, Nieto et al. 2015). In the Eastern Tropical Pacific, impacts from increasing El Niño events was the most common threat, but overexploitation was also prominent, with many fished species listed as DD due to the lack of quantified fishery data (Polidoro et al. 2012). Fishes commonly utilized in reef fisheries comprise over half of the overexploited species (22 in the greater Caribbean and 14 in the Gulf of Mexico). A Red List initiative conducted by the IUCN Groupers and Wrasses Species Specialist Group identified the Caribbean Sea as a global-level hotspot for threatened groupers (Sadovy de Mitcheson et al. 2013). With the exception of three endemics, most of the five snappers (*Lutjanidae*) and eleven groupers (*Epinephelidae*) globally listed as NT or threatened have distributions that extend into the southwestern Atlantic, but a large proportion of their overall population is within the greater Caribbean. Intrinsic characteristics such as the formation of spawning aggregations, slow growth rate, longevity, protogynous hermaphroditism, degradation of sensitive nursery habitats, juvenile entrapment in shrimp trawls and high economic value contributes to their susceptibility to overfishing (Coleman et al. 2000).

Beyond the reef-complex fishes, another long-lived species, the Golden Tilefish (*Lopholatilus chamaeleonticeps*) supports a U.S. fishery that has grown in popularity relatively recently. Unfortunately, exploitation in the Gulf of Mexico caused an estimated 66% decline in its spawning stock biomass over the past three generation lengths. In addition, six of the highly-valued tunas and billfishes are threatened, and though their global distributions extend well beyond the greater Caribbean, the Atlantic Bluefin (*Thunnus thynnus*) has an important spawning ground located within the Gulf of Mexico (Collette et al. 2011). Few anadromous species occur in the region; however, four of them have declined considerably due to both exploitation and habitat destruction (e.g., the Blueback Herring, *Alosa aestivalis*). Similarly, two marine catfishes (*Notarius neogranatensis* and *Sciades parkeri*) and the large-bodied Southern Flounder (*Paralichthys lethostigma*) face threats from overexploitation as well as estuarine degradation. Collection for the aquarium trade along with habitat degradation, is a concern for the Lined Seahorse (*Hippocampus erectus*) and the Dwarf Seahorse (*H. zosterae*).

There is strong evidence for recovery of fished populations under strict management, especially in U.S. waters (NMFS 2015); however, populations continue to decline in less developed countries where fishing is insufficiently monitored or regulated (Worm et al. 2009, Worm and Branch 2012). For example, the highly-valued and overexploited Red Snapper (*Lutjanus campechanus*) is showing signs of recovery in U.S. waters, but was assessed at an elevated threat level due to the lack of fisheries management in the remainder of its range.

Furthermore, since many exploited fishes are distributed across a high number of jurisdictions that make up the Caribbean, the complexity of managing their populations is extensive.

### 4.3.2. Habitat degradation

#### 4.3.2.1. Coral degradation

A Red List assessment of the world's reef-building corals reported that the largest proportion of NT and threatened corals occurs in the Caribbean (Carpenter et al. 2008). A recent comprehensive study on the status of greater Caribbean reefs reported an overall average decline in coral cover of 59% that began in the mid-1970s (Jackson et al. 2014). This is driven primarily by human overpopulation, overfishing and the outbreak of diseases that decimated the *Acropora* corals and the ecologically important grazing sea urchin, *Diadema antillarum*. Pollution and extreme heating events associated with climate change are also likely contributing. The level of decline, however, varied highly across the region. Some localities recorded no decline (e.g., Flower Garden Banks and Bermuda), while the most severe declines occurred in the northeastern Caribbean and the Florida Keys.

Across the Caribbean, reef complexity has drastically deteriorated due to the loss of acroporid corals and mass bleaching events in 1998 and 2005 (Alvarez-Filip et al. 2009). Though the number of coral obligate fishes in the Caribbean is small, the majority of the shorefishes utilize reef structure in some way (Robertson and Cramer 2014). Studies conducted in the Caribbean have demonstrated that high complexity supports high fish richness (Gratwicke and Speight 2005), especially of those that are small-bodied (Pratchett et al. 2008). The overall density of both small and large Caribbean reef fishes has also declined (Paddack et al. 2009). Coral degradation is recorded as a threat for 31% of the NT and threatened species (27 out of 88). Five coral-dependent toadfishes (Batrachoididae) are distributed only in areas between the Campeche Bank (Mexico) to Belize, which also contains several areas where coral decline has been documented (Jackson et al. 2014). Furthermore, small-bodied reef specialists, such as the cryptic, live-bearing brotulas (Bythitidae) are potentially highly vulnerable to loss of reef complexity. Of the 25 Bythitidae species that occur in the greater Caribbean, all are endemic and 11 are only known to inhabit reefs; one is listed as threatened and four are DD. Several recently published studies (e.g., Rogers et al. 2014, Alvarez-Filip et al. 2015, Newman et al. 2015) echo the concern that future data on the impact of reef decline on these or similar species may elevate them into a higher threat category.

#### 4.3.2.2. Estuary degradation and freshwater diversions

Estuary degradation driven by overexploitation, destruction of wetland plants and pollution via terrestrially-sourced nutrient runoff, is historically and globally pervasive (Lotze et al. 2006). In addition, hypoxic conditions caused by eutrophication and harmful algal blooms stresses euryhaline fishes dependent on estuarine environments (Valiela et al. 1997, Steidinger 2009). Potential impacts from a large hypoxic zone associated with the Mississippi-Atchafalaya River Basin in the northern Gulf of Mexico and harmful algal blooms off Florida are concerning (Rabalais et al. 2007, Flaherty and Landsberg 2011). However, direct effects to mobile marine fishes are not considered to be extreme, as individuals are generally able to move out of the area when conditions are no longer tolerable (Bianchi et al. 2010).

Estuarine degradation is recorded as a threat for 24% of the NT and threatened species (21 out of 88). Six of these are diminutive, limited range Gulf of Mexico endemics that are also estuary specialists. In addition, two threatened estuarine gobies (*Gobiosoma hildebrandi* and *G. spilotum*) are limited to areas near the Panama Canal, where considerable habitat modification has occurred both in the past and recently. Many Eastern Tropical Pacific fishes are also impacted by degradation of mangrove and estuarine habitats (Polidoro et al. 2012).

Anadromous fishes, which utilize riverine habitats for spawning, are threatened by hydrologic alterations (e.g., dams) that reduce their ranges, destroy spawning habitat and decrease the survival of eggs (Pringle et al. 2000). River flow alteration also negatively impacts downstream estuaries by altering salinity gradients. For example, both the Alabama Shad (*Alosa alabamae*) and the Gulf Sturgeon (*Acipenser oxyrinchus desotoi*) are endemic to a few river systems in the northeastern Gulf of Mexico and have experienced steep declines and extirpation in some cases due to dams. The effects of river alteration on fishes is considered to be understudied in the tropical part of the greater Caribbean, such as Venezuela's Orinoco (Pringle et al. 2000, Rodríguez et al. 2007).

#### 4.3.2.3. Seagrass and mangrove degradation

Sensitive wetland habitats, such as mangroves and seagrasses, support important ecosystem linkages with coral reefs and provide essential habitat for fishes throughout the greater Caribbean (Beck et al. 2001, Mumby et al. 2004). On a global scale, the loss of mangroves in the Caribbean, which is caused by pollution and removal for urbanization purposes, is second only to Asia. However, effective legislation to protect and restore mangroves has been increasing in many areas of the Caribbean (FAO 2007). For example, in the northern Gulf of Mexico mangrove habitat has expanded and is well-protected in a large portion of that region (Karnauskas et al. 2013). Mangrove degradation is recorded as a threat for 11% of the NT and threatened greater Caribbean species (9 out of 83). Population declines of the Mangrove Blenny (*Lupinoblennius vinctus*), which is a mangrove specialist, are inferred to mirror the rate of mangrove decline, which was estimated by Wilkie and Fortuna (2003) at 3% annually since 1980. Mangrove degradation was not recorded as a major threat during the Gulf regional assessments.

Seagrasses, which also provide important habitat for Caribbean shorefishes, are impacted by pollution, reduced water clarity, coastal development, dredging, storms and damage by boat props (Orth et al. 2006, Waycott et al. 2009). According to a study by Van Tussenbroek et al. (2014), degradation in seagrass communities between 1993 and 2007 varied by locality, but was detected in 43% of 17 sites across the greater Caribbean. However, the primary drivers of the declines were not specifically identified. Florida Bay holds the largest expanse of seagrass flats in the Gulf of Mexico and is a significant site in the greater Caribbean as well. Between the late 1980s and 1990s, about half of the seagrass cover in this area was lost during a large die-off event caused by eutrophication (Matheson et al. 1999). Seagrass degradation is recorded as a threat for 9% of the NT and threatened species (8 out of 88). Two seagrass specialists, the Dwarf Seahorse (*Hippocampus zosterae*) and the Dusky Pipefish (*Syngnathus floridae*) are listed as NT in the Gulf of Mexico due to habitat loss. In addition, the overexploited Yellowfin Grouper

(*Mycteroperca venenosa*) and Mutton Snapper (*Lutjanus analis*) are seagrass-dependent during their juvenile stages.

#### 4.3.2.4. Cave degradation

Three species in the unique genus *Lucifuga* are assessed as threatened. These live-bearing, nearly blind fishes are only occur in small subpopulations that are restricted to a limited number of small Bahamian and Cuban anchialine (partial marine/fresh) caves. These unique environments are located within the terrestrial landscape and are connected to saltwater via subterranean passages (Moller et al. 2006). Some of these caves, especially those located near human populations, have become dumps for trash and sewage or been disturbed by hydrological manipulation (Proudlove 2001). In addition, freshwater species that have been introduced into some caves likely compete with *Lucifuga* spp. for limited resources (García-Machado et al. 2011). A single Bahamian locality, the Lucayan Caverns, is relatively well-protected due to its inclusion in the Lucayan National Park, but conservation actions for other caves are unknown.

### 4.3.3. Invasive lionfish

The recent unprecedented invasion of two non-native Pacific lionfishes (*Pterois miles* and *P. volitans*) throughout the greater Caribbean is an especially unique threat to shorefishes. The lionfish is a successful invader due to its generalist feeding and habitat preferences, fast growth, high fecundity, wide larval dispersal capability and its position as a novel predator that easily exploits the naïveté of its prey (Côté et al. 2013). In the Bahamas, where lionfish density is exceptionally high, declines in small reef fish richness as well as reductions in biomass by an average of 65% over a two-year period have been documented (Green et al. 2012, Albins 2015). Similar effects of lionfish were not detected on Belizean reefs, however, the density of the invader in this area has not yet reached the level of the Bahamas (Hackerott 2014). Beyond direct effects from predation on small fishes, longer term ecosystem-scale impacts could be realized in the future (Albins 2015).

The preferred prey items of lionfish are small (less than 15 cm total length), shallow-bodied species that rest on or hover just above the substrate (Green and Côté 2014). To date, more than 100 fishes have been reported from the guts of lionfish throughout the Caribbean (e.g., Morris and Akins 2009, Muñoz et al. 2011, Valdez-Moreno et al. 2012, Côté et al. 2013, Dahl and Patterson 2014). Many more species are likely going undetected since most of these studies have been conducted within the top 30 meters of the lionfish's 300 m depth range. For example, the Exuma Goby (*Elacatinus atronasus*), which is listed as EN, is restricted to the Exuma Sound in the Bahamas. It exhibits characteristics of a lionfish preferred prey item, including diminutive size and hovering above reef substrate. Commonly consumed taxa include reef-associated species, especially squirrelfishes, cardinalfishes, gobies, blennies, basslets, small labrids and damselfishes. A recent study by Ingeman and Webster (2015) showed that lionfish can cause localized extirpations of the Fairy Basslet (*Gramma loreto*), which may be of particular concern to its deeper-living sister species, the Cuban Gramma (*Gramma dejongi*). This brilliantly colored fish is listed as DD because it is recently described and currently known from only two localities. Studies on its distribution and population are greatly needed.

Furthermore, 17 of the 25 NT and threatened species impacted by coral degradation also recorded the lionfish as a threat. Gobies from the genus *Coryphopterus* are often some of the most frequently detected fishes in the diet (Côté et al. 2013, Albins 2015). As a result, eight out of the twelve western Atlantic members of this genus are listed as VU and one as DD. The Peppermint Goby and Masked Goby (*Coryphopterus lipernes* and *C. personatus*), both of which Alvarez-Filip et al. (2015) reported population declines for in their study on reef-specialists, are listed as VU. Clearly, well-designed surveys will be valuable in order to monitor and understand the conservation status of these at-risk fishes.

### *4.4. Data Deficient species*

Fishes that are difficult to collect are often either naturally rare, diminutive, deep-living, or exhibit cryptic behavior (Smith-Vaniz et al. 2006, Eschmeyer et al. 2010). Most of the DD species in this study are known from limited records and/or localities; 72% in the greater Caribbean (82 out of 114) and 84% in the Gulf of Mexico (72 out of 86). The majority of greater Caribbean DD shorefishes (83%, n=94) are endemic and 25% (n=29) primarily inhabit depths below 30 m. The average maximum length of the non-exploited DD species is 11.5 cm (n=88) and the majority are diminutive (83%). Over half (57%), have some combination of being diminutive, cryptic, or deep-living (Table 9). Based on trends in newly described species, Costello et al. (2015) predicted that undiscovered fishes are more likely to be small bodied, deep-living and have small ranges. Given that thousands of fishes remain undiscovered (Eschmeyer et al. 2010), the importance of cataloging species in the marine realm is emphasized by the possibility of species loss prior to description.

Table 9. Number of greater Caribbean DD species known from limited specimens/localities by characteristic. Diminutive is defined as having an adult maximum length of less than 15 cm. Deep-living is defined as generally inhabiting depths greater than 30 m.

| **Characteristics** | **# of species (n=82)** |
|---|---|
| diminutive | 68 |
| cryptic behavior | 25 |
| deep-living | 13 |
| diminutive and cryptic | 16 |
| diminutive and deep | 13 |
| deep and cryptic | 9 |
| diminutive, deep and cryptic | 8 |

That nearly a quarter of the DD species (n=17) were described only within the past decade (2005-2015) likely contributes to the lack of available species-specific data. Of these new species, 10 were discovered via either deep diving techniques (Sparks and Gruber 2012, Baldwin and Robertson 2013, 2014, Baldwin and Johnson 2014) or application of DNA barcoding methods (Tornabene et al. 2010, Victor 2010a, 2010b, Baldwin et al. 2011, Victor 2012, 2013). A study on the Red List status of the world's mammals (Schipper et al. 2008) also reported a high proportion (44%) of DD species as being recently described (after 1992).

Furthermore, a larger proportion of all the newly described species published on the Red List are assessed as CR (Pimm et al. 2014).

The uncertainty caused by DD species restricts our understanding of threat patterns, and therefore, reconciling DD listings should be of high research priority (Bland et al. 2012). Due to the spotty state of sampling effort across the greater Caribbean (Miloslavich et al. 2010), this study may not have detected other areas with high numbers of both limited range and threatened species. For example, due to relatively high numbers of DD species as well as limited range endemics, a threatened species hotspot may occur, but is undetected in Venezuela. The Venezuelan Grouper (*Mycteroperca cidi*) and Tropical Flounder (*Paralichthys tropicus*) have their global population centers restricted mostly to Venezuela, but the impact that fishing is likely having on their population is unquantified. Other limited range DD Venezuelan shorefishes include less charismatic species such as Blackburn's Anchovy (*Anchoviella blackburni*), the Shortstriped Round Herring (*Jenkinsia parvula*), the Backwaters Silverside (*Membras analis*) and the Wayuu Sea-Catfish (*Cathorops wayuu*), all of which depend on sensitive shallow water habitats where decline is likely occurring, but is unknown. Since species with small ranges are often associated with higher extinction risk, closing gaps in marine biodiversity knowledge should be considered a high priority. In addition, some of the DD species with highly uncertain distributions could be truly limited in range and potentially threatened.

Across the 182 greater Caribbean or Gulf of Mexico DD species, 52% (n=95) have at least one potential threat recorded and 13% (n=23) have two. Impacts from habitat degradation are suspected for 35% (n=64) of the DD species. Of particular concern are the 13 species known to have relatively limited ranges. For example, the Panamanian Greenbanded Goby (*Elacatinus panamensis*) is difficult to identify and known only from shallow shorelines amongst sea urchin patches along Panama; it is not known what proportion of this habitat may have been lost to construction associated with the Panama Canal, so it is listed as DD. The Yucatán Pipefish (*Syngnathus makaxi*) is a specialist in shallow algal/seagrass beds along Mexico's Yucatán Peninsula; however, the status of this sensitive habitat is unknown in this area. Similarly, the

Trinidad Anchovy (*Anchoa trinitatis*) is a mangrove specialist that occurs only from Cartagena, Colombia to Trinidad and is also utilized in bait fisheries.

The urgency to fill fundamental data gaps in fish diversity may be more serious in the Caribbean due to the potential for the invasive lionfish to be driving declines in small-bodied, reef fishes (Lesser and Slattery 2011, Rocha et al. 2015). Lack of data on the impact from lionfish predation contributed to 20 out of 182 species being listed as DD, and the majority (17 species) of them are known from very few records. For example, half of the greater Caribbean deep-reef basslets (Grammatidae) are listed as DD either globally or regionally since their distributions are poorly known and they exhibit characteristics of preferred lionfish prey. At least two limited range DD blennies, *Emblemariopsis randalli* and *Starksia leucovitta*, also have these characteristics (Rocha et al. 2015). *Starksia leucovitta*, which is known only from Navassa Island, has not been directly observed in the diet, but DNA barcoding studies in Mexico and Belize have identified three other *Starksia* species from the lionfish gut (Valdez-Moreno et al. 2012, Rocha et al. 2015).

Of the DD Gulf of Mexico and greater Caribbean species, respectively 19 and 23% of them lack sufficient fishery data for assessment. About half of the Eastern Tropical Pacific marine bony fishes were listed as DD for similar reasons (Polidoro et al. 2012). The lack of long-term catch data in large portions of the ranges of the highly valued western Atlantic snappers and grunts (*Lutjanidae* and *Haemulidae*) caused eight of these species to be globally listed as DD. Besides this, snappers and grunts are typically exploited in mixed-catch fisheries where species-specific data can be difficult to extract (Claro et al. 2009). In much of the region, recreational catch data is even less accessible than commercial landings, which is of concern especially for sportfishes (Cooke and Cowx 2004). For example, the Greater Amberjack (*Seriola dumerili*) is listed as NT in the Gulf of Mexico based on declines in estimated total biomass in U.S. waters, which represents half of its Gulf range. Mexico comprises the other half of its range, where it supports a valuable sportfishery from which no formal data are collected. The potential is high that this species could qualify for a threatened category in the Gulf, but the lack of data prohibits any estimation of decline beyond what is available in the U.S. stock assessment.

*4.5. Global vs. regional assessments*

Conducting regional Red List assessments can be more informative to conservation initiatives that operate on a subglobal level by reducing the potential for mis-allocating resources by selecting false positive conservation priorities. This is relevant to heavily exploited fishes, which tend to have large ranges that span multiple geopolitical boundaries and therefore, experience varying levels of exploitation (Sadovy de Mitcheson et al. 2013). For example, nine species that are listed as either DD, NT, or threatened globally are regionally listed as LC due to the lack of targeted effort by Gulf fisheries. Regional assessments may also be more appropriate for large areas with low fish endemism such as the Gulf of Mexico. Besides these reasons, conducting regional assessments improves the quality of data available to the global assessment. For example, a regional Red List workshop is more likely to have participation from experts who can contribute national fishery landings or abundance surveys that may not have been accessible otherwise. This helps reconcile DD assessments and contributes to the process of updating published assessments of threatened species, which builds the Red List index and enables the conservation community to monitor progress.

There is little difference between the proportion threatened in the greater Caribbean and the Gulf of Mexico, which may be due to similarity in major threats. More Gulf non-endemics are assessed at a lower level of threat in the Gulf than globally, though the uncertainty introduced by DD species could influence that. The majority of the non-endemic Gulf shorefishes with a regional category that differs from the global category are DD in the Gulf and LC globally (64 out of 102). These primarily consist of species that are known from very few Gulf records. However, 22 of these DD species also have at least one threat identified, including fishing, habitat degradation, the Deepwater Horizon oil spill and the invasive lionfish.

Stock assessments conducted by the U.S. government on economically important fishes are useful resources that provide high quality estimates of long-term population trends as well as life history data that can be used to calculate generation length. Furthermore, the stock assessment process and stringent regulation has allowed many overexploited populations to recover or begin recovering (NOAA 2015). However, most highly-valued Gulf fishes are also exploited off Mexico and Cuba where funding for fishery data collection, stock assessments, or regulation enforcement is mostly insufficient. The Atlantic Tarpon (*Megalops atlanticus*) and Cubera Snapper (*Lutjanus cyanopterus*) are globally listed as Vulnerable due to overexploitation, but are DD in the Gulf due to inadequate fishery data. The overexploited Nassau Grouper (*Epinephelus striatus*) and Blue Marlin (*Makaira nigricans*) are threatened both globally and in the Gulf of Mexico; however, since estimated population declines are higher in the Gulf, they are listed at a higher threat category regionally. In contrast, nine species are listed at a lower threat level in the Gulf due to successful fishing conservation measures. For example, populations of Goliath Grouper (*Epinephelus itajara*) have shown increases off Florida after a complete fishing moratorium was implemented in U.S. waters in the early 1990s (Koenig et al. 2011). However, the species remains at EN in the Gulf and CR globally due to its high intrinsic susceptibility to overexploitation and the lack of similar conservation measures elsewhere in its range. The Conchfish (*Astrapogon stellatus*), which depends on the Queen Conch for habitat, is a unique situation. This small cardinalfish is globally listed as DD due to the widespread overexploitation of the Queen Conch. In the Gulf of Mexico, however, it is listed as LC due to the mostly effective Queen Conch conservation measures employed by the U.S., Mexico and Cuba.

Significant declines in the abundance of large herbivorous reef fishes coincided with at least a 75% loss in stony coral cover in the Florida Keys between 1974 and 2000 (Alevizon and Porter 2014). Coral decline in the Keys continued despite the lack of parrotfish exploitation and the presence of a large, well-funded and long-standing MPA (Toth et al. 2014). Despite extensive studies, the drivers behind major coral decline in the Florida Keys are poorly understood, but are suspected to be related to disease and bleaching. Some have hypothesized that pollution is the driver (Pandolfi et al. 2005); however, offshore reefs, which are exposed to lower temperatures and nutrient loads, have been found to be significantly more degraded than inshore reefs (Lirman and Fong 2007, Kenkel et al. 2015). Declines in the Veracruz reef system (Jackson et al. 2014) are attributed to commercial shipping activity, coral disease and contaminated runoff (Rangel-Avalos et al. 2007, Horta-Puga 2007, Ortiz-Lozano 2012). The most immediate impact, is the recent dredging of reef and surrounding areas to accommodate the expansion of the Port of Veracruz (Ortiz-Lozano et al. 2013). The status of coral reefs along northwestern Cuba is largely unknown except where declines have been recorded in stony corals off Havana as a consequence of pollution, sedimentation and overfishing of herbivores (Alcolado et al. 2000, Alcolado et al. 2009). Coral decline contributed to nine species being listed at a higher threat level or as DD regionally versus globally. The rare Leopard Goby (*Tigrigobius saucrus*) is dependent on live coral heads and is likely susceptible to lionfish predation. In the Gulf, it is listed as VU due to its restriction to areas with documented coral declines including Veracruz, the Florida Keys and Cuba. However, it is globally listed as LC due to its wide distribution. Similarly, the cryptic Key Blenny (*Starksia starcki*) is listed as LC globally, but DD regionally since it is known from only six specimens taken at Looe Key Reef in the Florida Keys. It could potentially qualify for a threatened category due to reef decline and lionfish predation if it truly is limited in range.

Seven species regionally listed as DD are potentially being impacted by estuary degradation. *Stegastes otophorus*, a unique and patchily distributed damselfish, is restricted to brackish waters near river mouths. It is globally listed as DD due to the lack of understanding on impacts from habitat degradation. In the Gulf of Mexico it is regionally listed as EN, since it is known only from brackish habitats near Havana, Cuba that are considerably polluted. The Dogtooth Herring (*Chirocentrodon bleekerianus*), which is listed as LC globally and DD regionally, also has a distribution in the Gulf that is restricted to Cuban estuaries. The degradation of seagrass in the Gulf contributed to four species being listed at a higher level of concern than their global status. For example, the Seagrass Eel (*Chilorhinus suensonii*) is regionally listed as DD due to its limited range in the Gulf and the lack of understanding of its reliance on seagrass throughout its life history. In contrast, the stable health of Gulf mangroves contributed to the Bonefish (*Albula vulpes*) being regionally listed as LC, whereas globally it is listed as NT.

The large amount of chemical dispersant applied during the Deepwater Horizon oil spill likely exacerbated stress caused by the oiling of sensitive biota such as deep-sea corals (Etnoyer et al. 2016). The uncertainties associated with the impact of the spill contributed to five poorly known, deep-living species being listed as DD, one of which is thought to be a Gulf endemic (*Gordiichthys ergodes*). Records of these species have only been taken from the northeastern Gulf, which is where the spill occurred. Considering these fishes are benthic-oriented, it is of particular concern that interaction with contaminated sediment is occurring (Montagna et al. 2013) and research is needed to clarify their distribution.

*4.6. Marine protected areas and threatened endemics*

Though positive results from some established, well-enforced MPAs have been demonstrated (Edgar et al. 2014), the global impact of MPAs on preventing biodiversity loss is not known. Some suspect it is low due to pervasive inadequacies in planning and/or management (Agardy et al. 2011, Mora and Sale 2011, Devillers et al. 2015, Pressey et al. 2015). Many MPAs have been designed with a goal of encompassing a wide variety of habitats, which does not necessarily include threatened diversity. For this and other reasons, it should not be assumed that the presence of an MPA within the distribution of a threatened species is addressing their specific conservation needs (Beger et al. 2003, Edgar et al. 2008). Burke et al. (2011) were unable to assess the effectiveness of about half of the MPAs of the Atlantic region; of those that could be assessed, 40% were classified as ineffective. In addition, several studies on the state of knowledge of Caribbean and Gulf of Mexico MPAs indicate significant shortcomings and gaps (Rogers and Beets 2001, Appeldoorn and Lindeman 2003, Coleman et al. 2004, Guarderas et al. 2008, Gombos et al. 2011, Bustamante et al. 2014, Dalton et al. 2015, Knowles et al. 2015).

In the WDPA, many Caribbean MPAs are either erroneously-drawn, represented by only a point or entirely missing. The lack of true boundary information in the WDPA causes inaccuracies in protected area coverage (Visconti et al. 2013). Attempts to reconcile these issues have been made, but progress is inhibited since many countries lack the resources to accurately digitize their protected areas (Milam et al. 2016). There have been regional efforts to organize a data repository for MPAs (e.g., the Caribbean Marine Protected Area Management Network, Parks Caribbean and the Caribbean Biodiversity and Protected Areas Management Programme), but gaps remain, especially in the knowledge of management and enforcement levels. Knowles et al. (2015) developed a spatially accurate database of insular Caribbean MPAs, but this covers only part of the region considered in this study. Gap analyses of protected areas and species distributions make the precarious assumption that all the areas provide adequate protection for every species within it and the inclusion of 'paper parks' falsely inflates the amount of conservation potentially in place (Rodrigues et al. 2004, Rife et al. 2013). Therefore, due to the error associated with a large portion of the greater Caribbean MPA data and the likelihood of reporting misleading coverage of at-risk species, this study did not attempt to identify specific gaps in protection.

Acknowledging the presence of threatened species within MPAs can improve planning strategies, increase the value of conservation outcomes and provide an index against which progress can be directly measured (Edgar et al. 2008, Pressey et al. 2015). Prior to this Red List initiative, only 18 out of the 65 threatened shorefishes that occur in the greater Caribbean were assessed; consequently, our awareness of at-risk bony shorefishes has grown considerably. These data can be used to inform targets of large-scale conservation initiatives such as the Gulf of Mexico Large Marine Ecosystem Project, the Caribbean Challenge, the SPAW List of Protected Areas and the Aichi Biodiversity Targets. Though the ranges of all 45 threatened endemics overlap in some manner with at least one MPA, it is not likely that their conservation needs have been incorporated into management plans. For example, the comprehensive 2010-2015 management plan for Belize's South Water Caye Marine Reserve recognized the presence of 11 NT or threatened shorefishes, only one of which has a limited range (Wildtracks 2009). The results from this study indicate that at least 17 threatened shorefishes likely occur within the reserve, eight of which have the majority of their global population restricted to Belizean waters. Given these new data, the management plan may be modified to update priority actions. Furthermore, progress towards improving the survival of its unique biodiversity can be used to positively argue for its removal from the UNESCO World Heritage Danger List.

### *4.7. Identifying marine Key Biodiversity Areas: Case study of Veracruz*

The need of conservation decision makers for a standardized method of identifying "sites contributing significantly to the global persistence of biodiversity" was officially recognized by the IUCN in 2009. The KBA concept is based on the vulnerability (holds at least one threatened species) or irreplaceability (holds a significant proportion of a species' global population) of a site (Eken et al. 2004, Langhammer et al. 2007). The systematic nature of the KBA method is intended to reduce the confusion or bias associated with delineating marine conservation priorities, and consequently improve the efficiency of implementing action (Edgar et al. 2008).

A global effort spearheaded by the IUCN Joint Task Force on Biodiversity and Protected Areas has nearly completed a KBA methodology that parallels the Red List Criteria. Four main criteria are now set, while quantitative thresholds and minimum documentation requirements are nearing completion. Upon launch of the initial KBA standards document in September 2016, sites can be nominated for endorsement by the IUCN given that supporting data are adequate and reviewed by species experts, the engagement of key stakeholders is demonstrated and provisional boundaries are mapped (IUCN 2013b). The recent publication of these greater Caribbean bony shorefishes on the Red List facilitates a solid platform upon which the nomination of marine KBAs can be built.

The following case study will present the reefs of Veracruz, Mexico as a potential candidate for KBA nomination. No less than ten threatened shorefishes occur off Veracruz, five of which have limited ranges. At least three reefs are known to have been removed and used for building material during the 17$^{th}$ and 18$^{th}$ centuries (Horta-Puga 2007). Prior to the recent and ongoing reef removal related to port expansion, the estimated area of remaining reef was already small (approximately 22 $km^2$ according to UNEP-WCMC et al. 2010) and degraded (Jackson et al. 2014). Sediment plumes created by ongoing dredging activity likely further jeopardizes the survival of these stressed corals (Erftemeijer et al. 2012). Furthermore, the lionfish began its invasion of these reefs only two years ago and its population may expand to threatening levels if culling is not employed. The Veracruz Reef System is internationally recognized as a UNESCO Biosphere Reserve and has been designated as a national park since 1992, however, no effective management plan is in place and the Mexican government recently reconfigured the boundaries of the park to expand operations of the Port of Veracruz onto part of the reef (Ortiz-Lozano et al. 2013). A program to restore reefs by outplanting corals grown in nurseries is being implemented, but its potential for being effective alongside ongoing degradation processes is not known. In addition, recent biological surveys of Veracruz's relatively understudied reefs revealed a surprising number of new, non-cryptic shorefishes. This may indicate that more species remain to be discovered.

Evidence presented in this study and others could justify the qualification of Veracruz as a KBA under all four criteria (Table 10). Following the collation of these data, the next step will be to apply quantitative thresholds, engage with regional species experts, identify key stakeholders and delineate the proposed area in a GIS framework. Since they already demonstrated interest in taking steps to support shorefish conservation by volunteering their time, expertise and data, I propose that expert input could be sourced from those who participated in the Caribbean and Gulf of Mexico Red List workshops. Furthermore, stakeholder input could be sourced from the wide-ranging network of the Gulf and Caribbean Fisheries Institute.

Table 10. Summary of preliminary data supporting the nomination of Veracruz, Mexico as a marine KBA. The text in the 'Criteria' and 'Qualifier' columns are taken verbatim from the IUCN KBA Criteria and Delineation Workshop report released in 2013.

| Criteria | Qualifier | Justification |
|---|---|---|
| A. Threatened biodiversity | Taxa that are formally assessed as globally threatened | The distributions of ten threatened marine bony shorefishes overlap with the area. |
| B. Geographically restricted biodiversity | Species with ranges that are permanently or periodically geographically restricted | One DD and five threatened marine bony shorefishes have a large proportion of their global population restricted to the area. |
| C. Biodiversity through outstanding ecological integrity | The most outstanding places, within biogeographic regions, of relatively intact regionally distinct, contiguous areas of ecosystem and habitat diversity | The area is internationally recognized as a UNESCO Biosphere Reserve and Ramsar Site for important wetland and reef-related habitats. |
| D. Outstanding biological processes | Evolutionary processes of exceptional importance in maintaining biodiversity or driving rapid diversification | The area is relatively geographically isolated from other reef systems in the greater Caribbean, which may be contributing to the relatively high number of endemics present there. |

# CHAPTER 5

# CONCLUSIONS

### *5.1. Priorities for regional conservation initiatives*

The results from this study reiterate that both large and small marine fishes face a litany of growing threats that act concurrently to amplify extinction risk. This reinforces the need for systematic conservation planning that addresses multi-threat scenarios (Côté et al. 2016). Since funding is limited, the process of prioritizing conservation action should be carefully considered. The purpose of these Red List assessments is not intended to be a directive for decree, but as an expert-informed guide to conservation planners seeking to prioritize the most at-risk species. Regional initiatives can use these data to enhance the management of existing MPAs or inform the placement of new MPAs. Areas with high proportions of threatened, limited range endemics, such as those highlighted in this study, should be considered as priorities for receiving support (Rodrigues and Gaston 2001).

#### 5.1.2. Potential impacts of climate change

Climate change is likely to increase the virulence of stressors to many Caribbean shorefishes and may be a more prominent factor in future updates of these Red List assessments. Reef-specialists will be directly impacted by coral mortality/weakening caused by extreme heating events and acidification (Eakin et al. 2010). Mangroves may also be susceptible to negative impacts from sea level rise and increasing aridity in parts of the Caribbean, though deforestation will remain the greatest threat (Alongi 2015). Seagrasses are not expected to be negatively affected by acidification, but prolonged heating events may amplify stress caused by excess nutrients and sediment (Koch et al. 2015). Furthermore, warming waters will cause distribution shifts in some fishes and impact the success of temperature-regulated spawning activity. These effects will likely be amplified in semi-enclosed seas such as the Gulf of Mexico (Cheung et al. 2009, Fodrie et al. 2010, Karnauskas et al. 2015).

### 5.1.3. Addressing overexploitation

The benefits from properly managing fisheries on marine ecosystem health are well-known and therefore, action to regulate fishing effort should be prioritized (Botsford et al. 1997, Worm et al. 2006, Edgar et al. 2014). Countries that lack the resources to conduct formal stock assessments can alternatively improve fishery management by promoting community co-management, controlling illegal fishing, implementing data-poor fishery assessment techniques and setting precautionary catch limits somewhere below maximum yield (Worm and Branch 2012). Since major threats to terrestrial biodiversity differ from those to marine biodiversity, MPAs should adapt management practices that differ from terrestrial areas (Carr et al. 2003). The conservation of limited range fishes that are threatened by habitat loss could benefit from the static nature of MPAs. In order to protect exploited fishes, however, many scientists call for the establishment of MPAs to be coupled with conventional fishery management tools (Hilborn et al. 2004, Barner et al. 2015). A strictly enforced no-take marine reserve can allow localized fish populations to recover as well as enhance the economic value of an area (Lester et al. 2009, Sala et al. 2013). At this time, however, 94% of the world's MPAs allow some level of fishing (Costello and Ballantine 2015). In the greater Caribbean, no-take reserves are scarce (Appeldoorn and Lindeman 2003, Guarderas et al. 2008). Studies have demonstrated an increase in exploited groupers and snappers within well-enforced Caribbean MPAs compared to unprotected areas (Polunin and Roberts 1993, Sedberry et al. 1999), which indicates that MPAs can be particularly useful to protect reef fish spawning aggregations (Sadovy de Mitcheson et al. 2008). MPAs may also benefit exploited reef fishes by reducing or preventing degrading processes that commonly act on estuaries, seagrass beds, or mangroves (Lindeman et al. 2000).

### 5.1.4. Addressing habitat degradation

Considering that tropical marine ecosystems thrive when corals, seagrasses, and mangroves coexist, it is advantageous to maintain the persistence of each one (Nagelkerken et al. 2002, Mumby et al. 2004). The continuing decline of greater Caribbean coral reefs is likely to seriously impact many fishes and the solution to conserving reefs may not lie in establishing MPAs (Selig and Bruno 2010, Selig et al. 2012, Manfrino et al. 2013, Toth et al. 2014). The efficacy of coral restoration methods, such as coral gardening (lab-grown cultures from fragments), to counteract a rapidly acidifying ocean requires further study (Hoegh-Guldberg et al. 2007). Instead, Jackson et al. (2014) proposed the following solutions to increase the resiliency of Caribbean corals: restore parrotfish populations, standardize reef monitoring, foster cross-regional information exchange and enact legislation that prevents impact from localized anthropogenic activities such as coastal development. Successful restoration programs for mangrove and seagrass habitat have been demonstrated. Mangroves can recover given enough space and restoration of hydrologic integrity (Lugo 2002). Seagrasses have shown recovery following the reduction of sediment and nutrients from terrestrial sources (Greening and Janicki 2006). In addition, some efforts to transplant healthy plants into damaged beds have been successful (Orth et al. 2006).

Destruction of habitat and overexploitation of resources such as oysters has caused estuaries near dense human populations to become habitually degraded (Lotze et al. 2006). Restoration of estuarine function is lengthy, requires close monitoring and involves complex processes beyond the aquatic realm. However, the compendium of estuary restoration studies is large and can be mined for best practices. The recent trend towards ecosystem-based management recognizes the importance of the biogeochemical pathways between estuarine habitats, such as tidal wetlands, to the fishes that depend on them for recruitment (Weinstein and Litvin 2016).

### 5.1.5. Addressing invasive lionfish

The invasive lionfish is a unique, but significant, threat that is not likely to be totally eradicated. However, recurring spearfishing derbies have been found to reduce the density of a local lionfish population below a harmful threshold (Barbour et al. 2011, Green et al. 2014). As a result, region-wide public awareness campaigns highly encourage removal activities and efforts to build a commercial market for lionfish consumption are substantial. Methods to reduce lionfish populations below recreational scuba depths are not yet available, but specialized traps are currently being developed. Designating MPAs as focal points for removal efforts could be explored as a potential tool to mitigate localized lionfish impacts on susceptible shorefishes. Green and Côté (2014), who described the traits of susceptible prey fishes, has inspired an ongoing collaborative research project that seeks to identify the greater Caribbean shorefishes with the highest vulnerability to predation by applying a systematic traits-based analysis. A matrix will be built using data in the Red List assessments related to prey vulnerability traits, such as maximum body length, orientation in the water column and habitat preference. The Red List distribution maps will then be used to conduct a richness analysis on the most vulnerable species with the intention of informing the location of culling efforts. In addition, species with characteristics related to elevated extinction risk such as limited range or habitat specialization, will be specifically highlighted.

### *5.2. Immediate research needs*

Accurately tracking progress towards conservation targets is dependent on improving spatial data across the entire region (Brooks et al. 2004), especially since many threatened fishes are widely distributed. Development of GIS data layers that are either unavailable, of poor resolution, or cover only a subset of the greater Caribbean, such as nearshore bathymetry and important shorefish habitats (i.e., estuaries and rocky reef), would greatly improve future Red List assessments and hotspot analyses. A continued fragmented understanding of the region's MPAs will delay the realization of CBD goals by instilling a false sense of protection and potentially causing resource misallocation. Systematically rating the effectiveness of each MPA would allow the conservation community to track the true progress of biodiversity protection (Boonzaier and Pauly 2015, Pressey et al. 2015). Furthermore, strengthening our understanding of threatened diversity is dependent on the reconciliation of DD species, especially those with identified threats (Bland et al. 2015). Due to sparse sampling, knowledge of greater Caribbean shorefish diversity remains woefully incomplete in several areas and environments. This restricts our ability to properly conserve species. In addition, the lack of even basic fishery data in many areas inhibits our capacity to manage populations and leads to overexploitation. Investing in standardized, long-term habitat monitoring programs would also further improve our awareness of at-risk species. Conservation efforts should collaborate across boundaries to focus on saving these species – a major goal which most of these countries committed to when signing on to international-level conservation conventions.

# LITERATURE CITED

Abdul Malak, D., Livingstone, S.R., Pollard, D., Polidoro, B.A., Cuttelod, A., Bariche, M., Bilecenoglu, M., Carpenter, K.E., Collette, B.B., Francour, P., Goren, M., Kara, M.H., Massuti, E., Papaconstantinou, C., Tunesi, L., 2011. Overview of the Conservation Status of the Marine Fishes of the Mediterranean Sea. Gland, Switzerland and Malaga, Spain: IUCN. vii + 61pp.

Abbott, J.K., Haynie, A.C., 2012. What are we protecting? Fisher behavior and the unintended consequences of spatial closures as a fishery management tool. Ecological Applications 22, 762-777. doi: 10.1890/11-1319.1

Agardy, T., Sciara, G.N.D., Christie, P., 2011. Mind the gap: Addressing the shortcomings of marine protected areas through large scale marine spatial planning. Marine Policy 35, 226-232.

Alava, M.N.R., Carpenter, K.E., Palomar, M.J.S., Quicho, R.F.N., Polidoro, B., 2009. Red List Status of Marine Endemic Teleosts (Bony Fishes) of the Philippines (pp. 108). Global Marine Species Assessment for the Coral Triangle - First Philippine Conservation Incorporated.

Albins, M.A., Hixon, M.A., 2013. Worst case scenario: potential long-term effects of invasive predatory lionfish (*Pterois volitans*) on Atlantic and Caribbean coral-reef communities. Environmental Biology of Fishes 96, 1151-1157.

Albins, M.A., 2015. Invasive Pacific lionfish *Pterois volitans* reduce abundance and species richness of native Bahamian coral-reef fishes. Marine Ecology Progress Series 522, 231-243. doi: 10.3354/meps11159

Alcolado, P.M., Claro-Madruga, R., Estrada, R., 2000. Status and prospective of coral reef management in Cuba. Paper presented at the International Coral Reef Symposium, Bali, Indonesia.

Alcolado, P.M., Caballero, H., Perera, S., 2009. Trend of change of live stony coral cover in Cuban coral reefs. Serie Oceanológica 5, 1-14.

Alevizon, W.S., Porter, J.W., 2014. Coral loss and fish guild stability on a Caribbean coral reef: 1974–2000. Environmental Biology of Fishes 98, 1035-1045. doi: 10.1007/s10641-014-0337-5

Alongi, D.M., 2015. The Impact of Climate Change on Mangrove Forests. Current Climate Change Reports 1, 30-39. doi: 10.1007/s40641-015-0002-x

Alvarez-Filip, L., Dulvy, N.K., Gill, J.A., Côté, I.M., Watkinson, A.R., 2009. Flattening of Caribbean coral reefs: region-wide declines in architectural complexity. Proceedings of the Royal Society B: Biological Sciences 276, 3019-3025. doi: 10.1098/rspb.2009.0339

Alvarez-Filip, L., Paddack, M.J., Collen, B., Robertson, D.R., Côté, I.M., 2015. Simplification of Caribbean reef-fish assemblages over decades of coral reef degradation. PLoS ONE 10, e0126004. doi: 10.1371/journal.pone.0126004

Amante, C., Eakins, B.W., 2009. ETOPO1 1 Arc-Minute Global Relief Model: Procedures, Data Sources and Analysis NOAA Technical Memorandum NESDIS NGDC-24. doi:10.7289/V7285C8276M: National Geophysical Data Center, NOAA.

Amezcua-Linares, F., Amezcua, F., Gil-Manrique, B., 2015. Effects of the Ixtoc I Oil Spill on Fish Assemblages in the Southern Gulf of Mexico, in: Alford, J.B., Peterson, M.S., Green, C.C., (Eds.), Impacts of Oil Spill Disasters on Marine Habitats and Fisheries in North America. CRC Press, Boca Raton, pp. 209-226.

Appeldoorn, R.S., Lindeman, K.C., 2003. A Caribbean-wide survey of marine reserves: Spatial coverage and attributes of effectiveness. Gulf and Caribbean Research 14, 139-154.

Baldwin, C., Castillo, C.I., Weigt, L.A., Victor, B., 2011. Seven new species within western Atlantic *Starksia atlantica*, *S. lepicoelia*, and *S. sluiteri* (Teleostei, Labrisomidae), with comments on congruence of DNA barcodes and species. ZooKeys 79, 21-72. doi: 10.3897/zookeys.79.1045

Baldwin, C.C., Robertson, D.R., 2013. A new *Haptoclinus* blenny (Teleostei, Labrisomidae) from deep reefs off Curaçao, southern Caribbean, with comments on relationships of the genus. ZooKeys 306, 71-81. doi: 10.3897/zookeys.306.5198

Baldwin, C.C., Johnson, G.D., 2014. Connectivity across the Caribbean Sea: DNA barcoding and morphology unite an enigmatic fish larva from the Florida Straits with a new species of sea bass from deep reefs off Curaçao. PLoS ONE 9, e97661. doi: 10.1371/journal.pone.0097661

Baldwin, C.C., Robertson, D.R., 2014. A new *Liopropoma* sea bass (Serranidae, Epinephelinae, Liopropomini) from deep reefs off Curaçao, southern Caribbean, with comments on depth distributions of western Atlantic liopropomins. ZooKeys 409, 71-92. doi: 10.3897/zookeys.409.7249

Balmford, A., Bruner, A., Cooper, P., Costanza, R., Farber, S., Green, R.E., Jenkins, M., Jefferiss, P., Jessamy, V., Madden, J., Munro, K., Myers, N., Naeem, S., Paavola, J., Rayment, M., Rosendo, S., Roughgarden, J., Trumper, K., Turner, R.K., 2002. Economic reasons for conserving wild nature. Science 297, 950-953. doi: 10.1126/science.1073947

Barbour, A.B., Allen, M.S., Frazer, T.K., Sherman, K.D., 2011. Evaluating the potential efficacy of invasive lionfish (*Pterois volitans*) removals. PLoS ONE 6, e19666. doi: 10.1371/journal.pone.0019666

Barner, A.K., Lubchenco, J., Costello, C., Gaines, S.D., Leland, A., Jenks, B., Murawski, S., Schwaab, E., Spring, M., 2015. Solutions for Recovering and Sustaining the Bounty of the Ocean: Combining Fishery Reforms, Rights-Based Fisheries Management, and Marine Reserves. Oceanography 28, 252-263. doi:10.5670/oceanog.2015.51

Barnosky, A.D., Matzke, N., Tomiya, S., Wogan, G.O.U., Swartz, B., Quental, T.B., Marshall, C., McGuire, J.L., Lindsey, E.L., Maguire, K.C., Mersey, B., Ferrer, E.A., 2011. Has the Earth's sixth mass extinction already arrived? Nature 471, 51-57.

Beck, M.W., Heck, K.L., Able, K.W., Childers, D.L., Eggleston, D.B., Gillanders, B.M., Halpern, B., Hays, C.G., Hoshino, K., Minello, T.J., Orth, R.J., Sheridan, P.F., Weinstein, M.P., 2001. The identification, conservation, and management of estuarine and marine nurseries for fish and invertebrates. BioScience 51, 633-641. doi: 10.1641/0006-3568(2001)051[0633:ticamo]2.0.co;2

Beger, M., Jones, G.P., Munday, P.L., 2003. Conservation of coral reef biodiversity: a comparison of reserve selection procedures for corals and fishes. Biological Conservation 111, 53-62. doi: http://dx.doi.org/10.1016/S0006-3207(02)00249-5

Bianchi, T.S., DiMarco, S.F., Cowan Jr, J.H., Hetland, R.D., Chapman, P., Day, J.W., Allison, M.A., 2010. The science of hypoxia in the Northern Gulf of Mexico: A review. Science of the Total Environment 408, 1471-1484. doi: http://dx.doi.org/10.1016/j.scitotenv.2009.11.047

Bini, L.M., Diniz-Filho, J.A.F., Rangel, T.F.L.V.B., Bastos, R.P., Pinto, M.P., 2006. Challenging Wallacean and Linnean shortfalls: knowledge gradients and conservation planning in a biodiversity hotspot. Diversity and Distributions 12, 475-482. doi: 10.1111/j.1366-9516.2006.00286.x

Bland, L.M., Collen, B., Orme, C.D.L., Bielby, J., 2012. Data uncertainty and the selectivity of extinction risk in freshwater invertebrates. Diversity and Distributions 18, 1211-1220. doi: 10.1111/j.1472-4642.2012.00914.x

Bland, L.M., Collen, B., Orme, C.D.L., Bielby, J., 2015. Predicting the conservation status of data-deficient species. Conservation Biology 29, 250-259. doi: 10.1111/cobi.12372

Böhm, M., Collen, B., Baillie, J.E.M., Bowles, P., Chanson, J., Cox, N., . . . Zug, G., 2013. The conservation status of the world’s reptiles. Biological Conservation 157, 372-385. doi: http://dx.doi.org/10.1016/j.biocon.2012.07.015

Boonzaier, L., Pauly, D., 2015. Marine protection targets: an updated assessment of global progress. Oryx, 1-9. doi: 10.1017/S0030605315000848

Botsford, L.W., Castilla, J.C., Peterson, C.H., 1997. The management of fisheries and marine ecosystems. Science 277, 509-515. doi: 10.1126/science.277.5325.509

Briscoe, D.K., Maxwell, S.M., Kudela, R., Crowder, L.B., Croll, D., 2016. Are we missing important areas in pelagic marine conservation? Redefining conservation hotspots in the ocean. Endangered Species Research 29, 229-237.

Brook, B.W., Sodhi, N.S., Bradshaw, C.J.A., 2008. Synergies among extinction drivers under global change. Trends in Ecology & Evolution 23, 453-460. doi: http://dx.doi.org/10.1016/j.tree.2008.03.011

Brooks, T.M., da Fonseca, G.A.B., Rodrigues, A.S.L., 2004. Protected areas and species. Conservation Biology 18, 616-618.

Brooks, T.M., Mittermeier, R.A., da Fonseca, G.A.B., Gerlach, J., Hoffmann, M., Lamoreux, J.F., Mittermeier, C.G., Pilgrim, J.D., Rodrigues, A.S.L., 2006. Global biodiversity conservation priorities. Science 313, 58-61. doi: 10.1126/science.1127609

Brooks, T.M., Cuttelod, A., Faith, D.P., Garcia-Moreno, J., Langhammer, P., Pérez-Espona, S., 2015. Why and how might genetic and phylogenetic diversity be reflected in the identification of key biodiversity areas? Philosophical Transactions of the Royal Society of London B: Biological Sciences 370, 1-7.

Buchanan, J.R., Krupp, F., Burt, J.A., Feary, D.A., Ralph, G.M., Carpenter, K.E., 2016. Living on the edge: Vulnerability of coral-dependent fishes in the Gulf. Marine Pollution Bulletin 105, 480-488. doi: http://dx.doi.org/10.1016/j.marpolbul.2015.11.033

Burke, L., Reytar, K., Spalding, M., Perry, A., 2011. Reefs at Risk Revisited. Washington D.C.: World Resources Institute.

Bustamante, G., Canals, P., Di Carlo, G., Gomei, M., Romani, M., Souan, H., Vanzella-Khouri, A., 2014. Marine protected areas management in the Caribbean and Mediterranean seas: making them more than paper parks. Aquatic Conservation: Marine and Freshwater Ecosystems 24, 153-165. doi: 10.1002/aqc.2503

Butchart, S.H.M., Bird, J.P., 2010. Data Deficient birds on the IUCN Red List: What don't we know and why does it matter? Biological Conservation 143, 239-247. doi: http://dx.doi.org/10.1016/j.biocon.2009.10.008

Cañadas, E.M., Fenu, G., Peñas, J., Lorite, J., Mattana, E., Bacchetta, G., 2014. Hotspots within hotspots: Endemic plant richness, environmental drivers, and implications for conservation. Biological Conservation 170, 282-291. doi: http://dx.doi.org/10.1016/j.biocon.2013.12.007

Campagna, C., Short, F.T., Polidoro, B.A., McManus, R., Collette, B.B., Pilcher, N.J., Sadovy de Mitcheson, Y., Stuart, S.N., Carpenter, K. E., 2011. Gulf of Mexico oil blowout increases risks to globally threatened species. BioScience 61, 393-397.

Carpenter, K.E., Abrar, M., Aeby, G., Aronson, R.B., Banks, S., Bruckner, A., . . . Wood, E., 2008. One-third of reef-building corals face elevated extinction risk from climate change and local impacts. Science 321, 560-563. doi: 10.1126/science.1159196

Carr, M.H., Neigel, J.E., Estes, J.A., Andelman, S., Warner, R.R., Largier, J.L., 2003. Comparing marine and terrestrial ecosystems: Implications for the design of coastal marine reserves. Ecological Applications 13, 90-107. doi: 10.1890/1051-0761(2003)013[0090:CMATEI]2.0.CO;2

CBD, 2010. Strategic Plan for Biodiversity 2011–2020, including Aichi Biodiversity Targets. Convention on Biological Diversity. Montreal: CBD https://www.cbd.int/sp/targets/

CBD, 2014. Conference of the Parties 12 Decision XII/1 Mid-term review of progress in implementation of the Strategic Plan for Biodiversity 2011-2020 including the fourth edition of the Global Biodiversity Outlook, and actions to enhance implementation. Convention on Biological Diversity. Retrieved July 23, 2015, 2015, from https://www.cbd.int/decision/cop/default.shtml?id=13364

Cheung, W.W.L., Lam, V.W.Y., Sarmiento, J.L., Kearney, K., Watson, R., Pauly, D., 2009. Projecting global marine biodiversity impacts under climate change scenarios. Fish and Fisheries 10, 235-251. doi: 10.1111/j.1467-2979.2008.00315.x

Claro, R., Sadovy de Mitcheson, Y., Lindeman, K.C., García-Cagide, A.R., 2009. Historical analysis of Cuban commercial fishing effort and the effects of management interventions on important reef fishes from 1960–2005. Fisheries Research 99, 7-16. doi: http://dx.doi.org/10.1016/j.fishres.2009.04.004

Coleman, F.C., Koenig, C.C., Huntsman, G.R., Musick, J.A., Eklund, A.M., McGovern, J.C., Sedberry, G.R., Chapman, R.W., Grimes, C.B., 2000. Long-lived reef fishes: The grouper-snapper complex. Fisheries 25, 14-21. doi: 10.1577/1548-8446(2000)025<0014:LRF>2.0.CO;2

Coleman, F.C., Baker, P.B., Koenig, C.C., 2004. A review of Gulf of Mexico marine protected areas. Fisheries 29, 10-21. doi: 10.1577/1548-8446(2004)29[10:AROGOM]2.0.CO;2

Collette, B.B., Carpenter, K.E., Polidoro, B.A., Juan-Jordá, M.J., Boustany, A., Die, D.J., ... Yáñez, E., 2011. High value and long life-double jeopardy for tunas and billfishes. Science 333, 291-292.

Comeros-Raynal, M.T., Choat, J.H., Polidoro, B.A., Clements, K.D., Abesamis, R., Craig, M.T., . . . Carpenter, K.E., 2012. The likelihood of extinction of iconic and dominant herbivores and detritivores of coral reefs: The parrotfishes and surgeonfishes. PLoS ONE 7, e39825. doi: 10.1371/journal.pone.0039825

Collette, B.B., Williams, J.T., Thacker, C.E., Smith, M. L., 2003. Shore fishes of Navassa Island, West Indies: a case study on the need for rotenone sampling in reef fish biodiversity studies. Aqua 6, 89-131.

Conway, K.W., Baldwin, C., White, M.D., 2014. Cryptic diversity and venom glands in Western Atlantic clingfishes of the genus *Acyrtus* (Teleostei: Gobiesocidae). PLoS ONE 9, e97664. doi: 10.1371/journal.pone.0097664

Cooke, S.J., Cowx, I.G., 2004. The role of recreational fishing in global fish crises. BioScience 54, 857-859. doi: 10.1641/0006-3568(2004)054[0857:trorfi]2.0.co;2

Corrigan, C.M., Ardron, J.A., Comeros-Raynal, M.T., Hoyt, E., Notarbartolo Di Sciara, G., Carpenter, K.E., 2014. Developing important marine mammal area criteria: learning from ecologically or biologically significant areas and key biodiversity areas. Aquatic Conservation: Marine and Freshwater Ecosystems 24, 166-183. doi: 10.1002/aqc.2513

Costello, M.J., Ballantine, B., 2015. Biodiversity conservation should focus on no-take Marine Reserves: 94% of Marine Protected Areas allow fishing. Trends in Ecology & Evolution 30, 507-509. doi: http://dx.doi.org/10.1016/j.tree.2015.06.011

Costello, M.J., Lane, M., Wilson, S., Houlding, B., 2015. Factors influencing when species are first named and estimating global species richness. Global Ecology and Conservation 4, 243-254. doi: http://dx.doi.org/10.1016/j.gecco.2015.07.001

Côté, I.M., Green, S.J., Hixon, M.A., 2013. Predatory fish invaders: Insights from Indo-Pacific lionfish in the western Atlantic and Caribbean. Biological Conservation 164, 50-61.

Côté, I.M., Darling, E.S., Brown, C.J., 2016. Interactions among ecosystem stressors and their importance in conservation. Proceedings of the Royal Society of London B: Biological Sciences, 283, 1-9. doi: 10.1098/rspb.2015.2592

Cowen, R.K., Paris, C.B., Srinivasan, A., 2006. Scaling of connectivity in marine populations. Science 311, 522-527. doi: 10.1126/science.1122039

Croxall, J.P., Butchart, S.H.M., Lascelles, B.E.N., Stattersfield, A.J., Sullivan, B.E.N., Symes, A., Taylor, P., 2012. Seabird conservation status, threats and priority actions: a global assessment. Bird Conservation International 22, 1-34. doi: http://dx.doi.org/10.1017/S0959270912000020

Dahl, K.A., Patterson, W.F., 2014. Habitat-specific density and diet of rapidly expanding invasive red lionfish, *Pterois volitans*, populations in the northern Gulf of Mexico. PLoS ONE 9, e105852. doi:10.1371/journal.pone.0105852

Dalton, T., Forrester, G., Pollnac, R., 2015. Are Caribbean MPAs making progress toward their goals and objectives? Marine Policy 54, 69-76. doi: http://dx.doi.org/10.1016/j.marpol.2014.12.009

Del Moral-Flores, L.F., Tello-Musi, J.L., Martínez-Pérez, J.A., 2011. Descripción de una nueva especie del género Hypoplectrus (Actinopterygii: Serranidae) del Sistema Arrecifal Veracruzano, suroeste del Golfo de México. Revista de Zoología 22, 1-10.

Del Moral-Flores, L.F., Tello-Musi, J.L., Reyes-Bonilla, H., Pérez-España, H., Martínez-Pérez, J.A., Horta-Puga, G., Velazco-Mendoza, L.A., Álvarez del Castillo-Cárdenas, P.A., 2013. Systematic checklist and zoogeographic affinities of ichthyofauna from Sistema Arrecifal Veracruzano, Mexico. Revista Mexicana de Biodiversidad 84, 825-846.

Devillers, R., Pressey, R.L., Grech, A., Kittinger, J.N., Edgar, G.J., Ward, T., Watson, R., 2015. Reinventing residual reserves in the sea: are we favouring ease of establishment over need for protection? Aquatic Conservation: Marine and Freshwater Ecosystems 25, 480-504. doi: 10.1002/aqc.2445

Dulvy, N.K., Sadovy, Y., Reynolds, J.D., 2003. Extinction vulnerability in marine populations. Fish & Fisheries 4, 25-64. doi: 10.1046/j.1467-2979.2003.00105.x

Dulvy, N.K., Fowler, S.L., Musick, J.A., Cavanagh, R.D., Kyne, P.M., Harrison, L.R., . . . White, W. T., 2014. Extinction risk and conservation of the world’s sharks and rays. eLife 3, 1-34.

Eakin, C.M., Morgan, J.A., Heron, S.F., Smith, T.B., Liu, G., Alvarez-Filip, L., . . . Yusuf, Y., 2010. Caribbean corals in crisis: Record thermal stress, bleaching, and mortality in 2005. PLoS ONE 5, e13969. doi: 10.1371/journal.pone.0013969

Edgar, G.J., Langhammer, P.F., Allen, G., Brooks, T.M., Brodie, J., Crosse, W., De Silva, N., Fishpool, L.D.C., Foster, M.N., Knox, D.H., McCosker, J.E., McManus, R., Millar, A.J.K., Mugo, R., 2008. Key biodiversity areas as globally significant target sites for the conservation of marine biological diversity. Aquatic Conservation: Marine and Freshwater Ecosystems 18, 969-983. doi: 10.1002/aqc.902

Edgar, G.J., 2011. Does the global network of marine protected areas provide an adequate safety net for marine biodiversity? Aquatic Conservation: Marine and Freshwater Ecosystems 21, 313-316. doi: 10.1002/aqc.1187

Edgar, G.J., Stuart-Smith, R.D., Willis, T.J., Kininmonth, S., Baker, S.C., Banks, S., . . . Thomson, R. J., 2014. Global conservation outcomes depend on marine protected areas with five key features. Nature 506, 216-220.

Ehrlich, P., Ehrlich, A., 1981. Extinction: The Causes and Consequences of the Disappearance of Species. New York, NY: Random House Publishing.

Eken, G., Bennun, L., Brooks, T.M., Darwall, W., Fishpool, L.D.C., Foster, M., Knox, D., Langhammer, P., Matiku, P., Radford, E., Salaman, P., Sechrest, W., Smith, M.L., Spector, S., Tordoff, A., 2004. Key Biodiversity Areas as site conservation targets. BioScience 54, 1110-1118. doi: 10.1641/0006-3568(2004)054[1110:kbaasc]2.0.co;2

Elfes, C.T., Livingstone, S.R., Lane, A., Lukoschek, V., Sanders, K.L., Courtney, A.J., ... Murphy, J. C., 2013. Fascinating and forgotten: the conservation status of the world's sea snakes. Herpetological Conservation and Biology 8, 37-52.

Erftemeijer, P.L.A., Riegl, B., Hoeksema, B.W., Todd, P.A., 2012. Environmental impacts of dredging and other sediment disturbances on corals: A review. Marine Pollution Bulletin 64, 1737-1765. doi: http://dx.doi.org/10.1016/j.marpolbul.2012.05.008

Eschmeyer, W.N., Fricke, R., Fong, J.D., Polack, D. A., 2010. Marine fish diversity: history of knowledge and discovery (Pisces). Zootaxa 2525, 19-50.

Eschmeyer, W. N., Catalog of Fishes: Genera, Species, References. Retrieved 2015 http://researcharchive.calacademy.org/research/ichthyology/catalog/fishcatmain.asp

Etnoyer, P.J., Wickes, L.N., Silva, M., Dubick, J.D., Balthis, L., Salgado, E., MacDonald, I.R., 2015. Decline in condition of gorgonian octocorals on mesophotic reefs in the northern Gulf of Mexico: before and after the Deepwater Horizon oil spill. Coral Reefs 35, 77-90. doi: 10.1007/s00338-015-1363-2

FAO., 2007. The world's mangroves 1980-2005: A thematic study prepared in the framework of the Global Forest Resources Assessment. Food and Agriculture Organization of the United Nations, Forestry Paper 153.

Felder, D.L., Camp, D.K., Tunnell Jr., J.W., 2009. An Introduction to Gulf of Mexico Biodiversity Assessment, in Felder, D.L., Camp, D.K. (Eds.), Gulf of Mexico Origin, Waters, and Biota. Texas A&M University Press, College Station, Texas, Vol. 1, pp. 1-12.

Ferrier, S., Pressey, R.L., Barrett, T.W., 2000. A new predictor of the irreplaceability of areas for achieving a conservation goal, its application to real-world planning, and a research agenda for further refinement. Biological Conservation 93, 303-325.

Flaherty, K.E., Landsberg, J.H., 2010. Effects of a persistent red tide (*Karenia brevis*) bloom on community structure and species-specific relative abundance of nekton in a Gulf of Mexico estuary. Estuaries and Coasts 34, 417-439. doi: 10.1007/s12237-010-9350-x

Fleming, C.S., Tonioli, F., Agar, J.J., 2014. A review of principal coastal economic sectors within the southeast United States and U.S. Caribbean. NOAA Technical Memorandum NMFS-SEFSC-669, National Marine Fisheries Service Southeast Fisheries Science Center, pp. 44.

Fodrie, F.J., Heck, K.L., Powers, S.P., Graham, W.M., Robinson, K.L., 2010. Climate-related, decadal-scale assemblage changes of seagrass-associated fishes in the northern Gulf of Mexico. Global Change Biology 16, 48-59. doi: 10.1111/j.1365-2486.2009.01889.x

Fodrie, F.J., Heck, K.L., Jr., 2011. Response of coastal fishes to the Gulf of Mexico oil disaster. PLoS ONE 6, e21609. doi: 10.1371/journal.pone.0021609

García-Machado, E., Hernández, D., García-Debrás, A., Chevalier-Monteagudo, P., Metcalfe, C., Bernatchez, L., Casane, D., 2011. Molecular phylogeny and phylogeography of the Cuban cave-fishes of the genus Lucifuga: Evidence for cryptic allopatric diversity. Molecular Phylogenetics and Evolution 61, 470-483. doi: http://dx.doi.org/10.1016/j.ympev.2011.06.015

Giri, C., Ochieng, E., Tieszen, L.L., Zhu, Z., Singh, A., Loveland, T., Masek, J., Duke, N., 2011. Global distribution of mangroves forests of the world using earth observation satellite data. In Supplement to: Giri et al. (2011). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: data.unep-wcmc.org/datasets/21

Gombos, M., Arrivillaga, A., Wusinich-Mendez, D., Glazer, B., Frew, S., Bustamante, G., Doyle, E., Vanzella-Khouri, A., Acosta, A., Causey, B., Rolli, C., Brown, J., 2011. A Management Capacity Assessment of Selected Coral Reef Marine Protected Areas in the Caribbean. Commissioned by the National Oceanic and Atmospheric Administration Coral Reef Conservation Program, the Gulf and Caribbean Fisheries Institute and by the UNEP-CEP Caribbean Marine Protected Area Management Network and Forum, 269 pp.

González Gándara, C., Vicencio de la Cruz, F., Salas Pérez, J., Domínguez Barradas, C., 2012. Checklist of fishes from Tuxpan, Veracruz, Mexico. Revista Científica UDO Agrícola 12, 675-689.

Gotelli, N.J., Colwell, R.K., 2001. Quantifying biodiversity: procedures and pitfalls in the measurement and comparison of species richness. Ecology Letters 4, 379-391. doi: 10.1046/j.1461-0248.2001.00230.x

Gratwicke, B., Speight, M.R., 2005. Effects of habitat complexity on Caribbean marine fish assemblages. Marine Ecology Progress Series 292, 301-310.

Green, E.P., Short, F.T., 2003. World atlas of seagrasses. Prepared by UNEP World Conservation Monitoring Centre. Berkeley (California, USA), University of California, 332 pp.

Green, S.J., Akins, J.L., Maljkovi, A., Côté, I.M., 2012. Invasive lionfish drive Atlantic coral reef fish declines. PLoS ONE 7, e32596. doi: 10.1371/journal.pone.0032596

Green, S.J., Côté, I.M., 2014. Trait-based diet selection: prey behaviour and morphology predict vulnerability to predation in reef fish communities. Journal of Animal Ecology 83, 1451-1460. doi: 10.1111/1365-2656.12250

Green, S.J., Dulvy, N.K., Brooks, A.M.L., Akins, J.L., Cooper, A.B., Miller, S., Côté, I.M., 2014. Linking removal targets to the ecological effects of invaders: a predictive model and field test. Ecological Applications 24, 1311-1322. doi: 10.1890/13-0979.1

Greening, H., Janicki, A., 2006. Toward reversal of eutrophic conditions in a subtropical estuary: Water quality and seagrass response to Nitrogen loading reductions in Tampa Bay, Florida, USA. Environmental Management 38, 163-178. doi: 10.1007/s00267-005-0079-4

Guarderas, A.P., Hacker, S.D., Lubchenco, J., 2008. Current status of marine protected areas in Latin America and the Caribbean. Conservation Biology 22, 1630-1640. doi: 10.1111/j.1523-1739.2008.01023.x

Hackerott, S., 2014. The effect of invasive lionfish on reef fish community structure along the Mesoamerican Barrier Reef. (Master of Science), University of North Carolina at Chapel Hill, Chapel Hill.

Halpern, B.S., Walbridge, S., Selkoe, K.A., Kappel, C.V., Micheli, F., D'Agrosa, C., . . . Watson, R., 2008. A global map of human impact on marine ecosystems. Science 319, 948-952. doi: 10.1126/science.1149345

Harnik, P.G., Lotze, H.K., Anderson, S.C., Finkel, Z.V., Finnegan, S., Lindberg, D.R., Liow, L.H., Lockwood, R., McClain, C.R., McGuire, J.L., O'Dea, A., Pandolfi, J.M., Simpson, C., Tittensor, D. P., 2012. Extinctions in ancient and modern seas. Trends in Ecology & Evolution 27, 608-617. doi: http://dx.doi.org/10.1016/j.tree.2012.07.010

Hawkins, J.P., Roberts, C.M., Clark, V., 2000. The threatened status of restricted-range coral reef fish species. Animal Conservation 3, 81-88.

Hickerson, E.L., Schmahl, G.P., Robbart, M., Precht, W.F., Caldow, C., 2008. The State of Coral Reef Ecosystems of the Flower Garden Banks, Stetson Bank, and Other Banks in the Northwestern Gulf of Mexico. NOAA Flower Garden Banks National Marine Sanctuary, U.S. National Oceanic and Atmospheric Administration.

Hilborn, R., Stokes, K., Maguire, J.-J., Smith, T., Botsford, L.W., Mangel, M., . . . Walters, C., 2004. When can marine reserves improve fisheries management? Ocean & Coastal Management 47, 197-205. doi: http://dx.doi.org/10.1016/j.ocecoaman.2004.04.001

Hoegh-Guldberg, O., Mumby, P.J., Hooten, A.J., Steneck, R.S., Greenfield, P., Gomez, E., . . . Hatziolos, M.E., 2007. Coral reefs under rapid climate change and ocean acidification. Science 318, 1737-1742. doi: 10.1126/science.1152509

Hoffmann, M., Brooks, T.M., da Fonseca, G.A., Gascon, C., Hawkins, A.F.A., James, R.E., Langhammer, P., Mittermeier, R.A., Pilgrim, J.D., Rodrigues, A.S.L., Silva, J.M.C., 2008. Conservation planning and the IUCN Red List. Endangered Species Research 6, 113-125.

Horta-Puga, G., 2007. Environmental Impacts, in Tunnell Jr., J.W., Chavez, E.A., Withers, K. (Eds.), Coral Reefs of the Southern Gulf of Mexico. Texas A&M University Press, College Station.

Hughes, T.P., Bellwood, D.R., Connolly, S.R., 2002. Biodiversity hotspots, centres of endemicity, and the conservation of coral reefs. Ecology Letters 5, 775-784. doi: 10.1046/j.1461-0248.2002.00383.x

Hutchings, J.A., Reynolds, J.D., 2004. Marine fish population collapses: Consequences for recovery and extinction risk. BioScience 54, 297-309. doi: 10.1641/0006-3568(2004)054[0297:mfpccf]2.0.co;2

Ingeman, K.E., Webster, M.S., 2015. Native prey mortality increases but remains density-dependent following lionfish invasion. Marine Ecology Progress Series 531, 241-252.

IUCN., 2011. Annex 1 of the "Guidelines for Appropriate Uses of IUCN Red List Data. Incorporating the Guidelines for Reporting on Proportion Threatened and the Guidelines on Scientific Collecting of Threatened Species" as adopted by the IUCN Red List Committee and IUCN SSC Steering Committee in July 2011.
http://www.iucnredlist.org/documents/RL_Guidelines_Data_Use_ver2.pdf

IUCN., 2012. IUCN Red List Categories and Criteria: Version 3.1. Second edition. IUCN, Gland, Switzerland and Cambridge, UK, pp. 32.

IUCN., 2013a. Documentation standards and consistency checks for IUCN Red List assessments and species accounts (Version 2).
http://www.iucnredlist.org/documents/RL_Standards_Consistency.pdf.

IUCN., 2013b. Identifying sites that contribute significantly to the global persistence of biodiversity (Key Biodiversity Areas): Criteria and Delineation technical workshop report. Species Survival Commission and World Commission on Protected Areas, International Union for Conservation of Nature, Gland, Switzerland.

Jackson, J.B., Cubit, J.D., Keller, B.D., Batista, V., Burns, K., Caffey, H.M., ... Guzman, H.M., 1989. Ecological effects of a major oil spill on Panamanian coastal marine communities. Science 243, 37-44.

Jackson, J.B.C., Donovan, M., Cramer, K.L., Lam, V.V., 2014. Status and Trends of Caribbean Coral Reefs: 1970-2012. Gland, Switzerland: Global Coral Reef Monitoring Network, IUCN.

Jetz, W., Rahbek, C., 2002. Geographic range size and determinants of avian species richness. Science 297, 1548-1551. doi: 10.1126/science.1072779

Karnauskas, M., Schirripa, M.J., Kelble, C.R., Cook, G.S., Craig, J.K., 2013. Ecosystem status report for the Gulf of Mexico NOAA Technical Memorandum NMFS-SEFSC-653, National Oceanic and Atmospheric Administration National Marine Fisheries Service Southeast Fisheries Science Center, pp. 52.

Karnauskas, M., Schirripa, M.J., Craig, J.K., Cook, G.S., Kelble, C.R., Agar, J.J., Black, B.A., Enfield, D.B., Lindo-Atichati, D., Muhling, B.A., Purcell, K.M., Richards, P.M., Wang, C., 2015. Evidence of climate-driven ecosystem reorganization in the Gulf of Mexico. Global Change Biology 21, 2554-2568. doi: 10.1111/gcb.12894

Kenkel, C.D., Almanza, A.T., Matz, M.V., 2015. Fine-scale environmental specialization of reef-building corals might be limiting reef recovery in the Florida Keys. Ecology 96, 3197-3212. doi: 10.1890/14-2297.1

Knowles, J.E., Doyle, E., Schill, S.R., Roth, L.M., Milam, A., Raber, G.T., 2015. Establishing a marine conservation baseline for the insular Caribbean. Marine Policy 60, 84-97. doi: http://dx.doi.org/10.1016/j.marpol.2015.05.005

Koch, M.S., Coronado, C., Miller, M.W., Rudnick, D.T., Stabenau, E., Halley, R.B., Sklar, F.H., 2014. Climate change projected effects on coastal foundation communities of the Greater Everglades using a 2060 scenario: Need for a new management paradigm. Environmental Management 55, 857-875. doi: 10.1007/s00267-014-0375-y

Koenig, C.C., Coleman, F.C., Kingon, K., 2011. Pattern of recovery of the Goliath Grouper, *Epinephelus itajara*, population in the southeastern US. Bulletin of Marine Science 87, 891-911. doi: 10.5343/bms.2010.1056

Lamoreux, J., Resit Akçakaya, H., Bennun, L., Collar, N.J., Boitani, L., Brackett, D., Bräutigam, A., Brooks, T.M., da Fonseca, G.A.B., Mittermeier, R.A., Rylands, A.B., Gärdenfors, U., Hilton-Taylor, C., Mace, G., Stein, B.A., Stuart, S., 2003. Value of the IUCN Red List. Trends in Ecology & Evolution 18, 214-215. doi: http://dx.doi.org/10.1016/S0169-5347(03)00090-9

Langhammer, P.F., Bakarr, M.I., Bennun, L.A., Brooks, T.M., Clay, R.P., Darwall, W., De Silva, N., Edgar, G.J., Eken, G., Fishpool, L.D.C., da Fonseca, G.A.B., Foster, M.N., Knox, D.H., Matiku, P., Radford, E.A., Rodrigues, A.S.L., Salaman, P., Sechrest, W., Tordoff, A.W., 2007. Identification and Gap Analysis of Key Biodiversity Areas: Targets for Comprehensive Protected Area Systems. Gland, Switzerland: IUCN.

Leakey, R., Lewin, R., 1996. The Sixth Extinction: Patterns of Life and the Future of Humankind. New York, NY: Doubleday Books.

Lesser, M.P., Slattery, M., 2011. Phase shift to algal dominated communities at mesophotic depths associated with lionfish (*Pterois volitans*) invasion on a Bahamian coral reef. Biological Invasions 13, 1855-1868. doi: 10.1007/s10530-011-0005-z

Lester, S.E., Halpern, B.S., Grorud-Colvert, K., Lubchenco, J., Ruttenberg, B.I., Gaines, S.D., Airamé, S., Warner, R. R., 2009. Biological effects within no-take marine reserves: a global synthesis. Marine Ecology Progress Series 384, 33-46.

Lindeman, K.C., Pugliese, R., Waugh, G.T., Ault, J.S., 2000. Developmental patterns within a multispecies reef fishery: management applications for essential fish habitats and protected areas. Bulletin of Marine Science 66, 929-956.

Lirman, D., Fong, P., 2007. Is proximity to land-based sources of coral stressors an appropriate measure of risk to coral reefs? An example from the Florida Reef Tract. Marine Pollution Bulletin 54, 779-791. doi: http://dx.doi.org/10.1016/j.marpolbul.2006.12.014

Loreau, M., 2000. Biodiversity and ecosystem functioning: Recent theoretical advances. Oikos 91, 3-17. doi: 10.2307/3547469

Lotze, H.K., Lenihan, H.S., Bourque, B.J., Bradbury, R.H., Cooke, R.G., Kay, M.C., Kidwell, S.M., Kirby, M.X., Peterson, C.H., Jackson, J.B.C., 2006. Depletion, degradation, and recovery potential of estuaries and coastal seas. Science 312, 1806-1809. doi: 10.1126/science.1128035

Lucifora, L.O., García, V.B., Worm, B., 2011. Global diversity hotspots and conservation priorities for sharks. PLoS ONE 6, e19356. doi: 10.1371/journal.pone.0019356

Lugo, A.E., 2002. Conserving Latin American and Caribbean mangroves: Issues and challenges. Madera y Bosques 8, 5-25.

Mace, G.M., Collar, N.J., Gaston, K.J., Hilton-Taylor, C., Akcakaya, H.R., Leader-Williams, N., Milner-Gulland, E. J., Stuart, S.N., 2008. Quantification of extinction risk: IUCN's system for classifying threatened species. Conservation Biology 22, 1424-1442. doi: 10.1111/j.1523-1739.2008.01044.x

Manfrino, C., Jacoby, C.A., Camp, E., Frazer, T.K., 2013. A positive trajectory for corals at Little Cayman Island. PLoS ONE 8, e75432. doi: 10.1371/journal.pone.0075432

Manne, L.L., Brooks, T.M., Pimm, S.L., 1999. Relative risk of extinction of passerine birds on continents and islands. Nature 399, 258-261. doi: http://www.nature.com/nature/journal/v399/n6733/suppinfo/399258a0_S1.html

Margules, C.R., Pressey, R.L., 2000. Systematic conservation planning. Nature 405, 243-253.

Matheson, R.E., Camp, D.K., Sogard, S.M., Bjorgo, K.A., 1999. Changes in seagrass-associated fish and crustacean communities on Florida Bay mud banks: The effects of recent ecosystem changes? Estuaries 22, 534-551. doi: 10.2307/1353216

Maxwell, S.M., Hazen, E.L., Lewison, R.L., Dunn, D.C., Bailey, H., Bograd, S.J., . . . Crowder, L.B., 2015. Dynamic ocean management: Defining and conceptualizing real-time management of the ocean. Marine Policy 58, 42-50. doi: http://dx.doi.org/10.1016/j.marpol.2015.03.014

McEachran, J.D., 2009. Fishes (Vertebrata: Pisces) of the Gulf of Mexico, in: Felder, D.L., Camp, D.K. (Eds.), Gulf of Mexico Origin, Waters, and Biota (Vol. 1). Texas A&M University Press, College Station.

Micheli, F., Mumby, P.J., Brumbaugh, D.R., Broad, K., Dahlgren, C.P., Harborne, A.R., Holmes, K.E., Kappel, C.V., Litvin, S.Y., Sanchirico, J.N., 2014. High vulnerability of ecosystem function and services to diversity loss in Caribbean coral reefs. Biological Conservation 171, 186-194.

Milam, A., Kenney, S., Juffe-Bignoli, D., Bertzky, B., Corrigan, C., MacSharry, B., Burgess, N.D., Kingston, N., 2016. Maintaining a Global Data Set on Protected Areas: in Joppa, L.N., Baillie, J.E.M., Robinson, J.G. (Eds.), Protected Areas: Are They Safeguarding Biodiversity? Wiley Blackwell, Chichester, West Sussex.

Miloslavich, P., Díaz, J.M., Klein, E., Alvarado, J.J., Díaz, C., Gobin, J., . . . Ortiz, M., 2010. Marine biodiversity in the Caribbean: Regional estimates and distribution patterns. PLoS ONE 5, 1-25. doi: 10.1371/journal.pone.0011916

Moller, P.R., Schwarzhans, W., Iliffe, T.M., Nielsen, J., 2006. Revision of the Bahamian cave-fishes of the genus Lucifuga (Ophidiiformes, Bythitidae), with description of a new species from islands on the Little Bahama Bank. Zootaxa 1223, 23-46.

Montagna, P.A., Baguley, J.G., Cooksey, C., Hartwell, I., Hyde, L.J., Hyland, J.L., Kalke, R.D., Kracker, L.M., Reuscher, M., Rhodes, A.C.E., 2013. Deep-Sea benthic footprint of the Deepwater Horizon blowout. PLoS ONE 8, e70540. doi: 10.1371/journal.pone.0070540

Mora, C., Tittensor, D.P., Myers, R.A., 2008. The completeness of taxonomic inventories for describing the global diversity and distribution of marine fishes. Proceedings of the Royal Society B: Biological Sciences 275, 149-155.

Mora, C., Sale, P.F., 2011. Ongoing global biodiversity loss and the need to move beyond protected areas: a review of the technical and practical shortcomings of protected areas on land and sea. Marine Ecology Progress Series 434, 251-266.

Morais, A.R., Siqueira, M.N., Lemes, P., Maciel, N.M., De Marco Jr, P., Brito, D., 2013. Unraveling the conservation status of Data Deficient species. Biological Conservation 166, 98-102. doi: http://dx.doi.org/10.1016/j.biocon.2013.06.010

Morris Jr, J.A., Akins, J.L., 2009. Feeding ecology of invasive lionfish (*Pterois volitans*) in the Bahamian archipelago. Environmental Biology of Fishes 86, 389-398.

Mumby, P.J., Edwards, A.J., Ernesto Arias-Gonzalez, J., Lindeman, K.C., Blackwell, P.G., Gall, A., Gorczynska, M.I., Harborne, A.R., Pescod, C.L., Renken, H., Wabnitz, C., Llewellyn, G., 2004. Mangroves enhance the biomass of coral reef fish communities in the Caribbean. Nature 427, 533-536. doi: http://www.nature.com/nature/journal/v427/n6974/suppinfo/nature02286_S1.html

Muñoz, R.C., Currin, C.A., Whitfield, P.E., 2011. Diet of invasive lionfish on hard bottom reefs of the Southeast USA: insights from stomach contents and stable isotopes. Marine Ecology Progress Series 432, 181-193.

Myers, N., Mittermeier, R.A., Mittermeier, C.G., da Fonseca, G.A.B., Kent, J., 2000. Biodiversity hotspots for conservation priorities. Nature 403, 853-858. doi: http://www.nature.com/nature/journal/v403/n6772/suppinfo/403853a0_S1.html

Nagelkerken, I., Roberts, C.M., Van Der Velde, G., Dorenbosch, M., Van Riel, M.C., De La Moriniere, E.C., Nienhuis, P.H., 2002. How important are mangroves and seagrass beds for coral-reef fish? The nursery hypothesis tested on an island scale. Marine Ecology Progress Series 244, 299-305.

Newman, S.P., Meesters, E.H., Dryden, C.S., Williams, S.M., Sanchez, C., Mumby, P.J., Polunin, N.V.C., 2015. Reef flattening effects on total richness and species responses in the Caribbean. Journal of Animal Ecology 84, 1678-1689. doi: 10.1111/1365-2656.12429

Nieto, A., Ralph, G.M., Comeros-Raynal, M.T., Kemp, J., García Criado, M., Allen, D.J., Dulvy, N. K., . . . Scott, J., Serena, F., Smith-Vaniz, W.F., Soldo, A., Stump, E. and Williams, J.T., 2015. European Red List of marine fishes. Publications Office of the European Union Luxembourg, IUCN.

NMFS., 2015. Status of the Stocks 2014: Annual Report to Congress on the Status of US Fisheries. http://www.nmfs.noaa.gov/sfa/fisheries_eco/status_of_fisheries/archive/2014/2014_status_of_stocks_final_web.pdf

NOAA., 2014. National Oceanic and Atmospheric Administration Caribbean Strategy: NOAA Coastal Services Center.

NOAA., 2015. Status of Stocks 2014: Annual Report to Congress on the Status of U.S. Fisheries: National Oceanic and Atmospheric Administration Fisheries.

Norse, E.A., 1995. Maintaining the world's marine biological diversity. Bulletin of Marine Science 57, 10-13.

Orme, C.D.L., Davies, R.G., Burgess, M., Eigenbrod, F., Pickup, N., Olson, V.A., Webster, A.J., Ding, T., Rasmussen, P.C., Ridgely, R.S., Stattersfield, A.J., Bennett, P.M., Blackburn, T.M., Gaston, K.J., Owens, I.P.F., 2005. Global hotspots of species richness are not congruent with endemism or threat. Nature 436, 1016-1019. doi: http://www.nature.com/nature/journal/v436/n7053/suppinfo/nature03850_S1.html

Orth, R.J., Carruthers, T.J.B., Dennison, W.C., Duarte, C.M., Fourqurean, J.W., Heck, K.L., Hughes, A.R., Kendrick, G.A., Kenworthy, W.J., Olyarnik, S., Short, F.T., Waycott, M., Williams, S.L., 2006. A global crisis for seagrass ecosystems. BioScience 56, 987-996. doi: 10.1641/0006-3568(2006)56[987:agcfse]2.0.co;2

Ortiz-Lozano, L., 2012. Identification of priority conservation actions in marine protected areas: Using a causal networks approach. Ocean & Coastal Management 55, 74-83. doi: http://dx.doi.org/10.1016/j.ocecoaman.2011.10.013

Ortiz-Lozano, L., Pérez-España, H., Granados-Barba, A., González-Gándara, C., Gutiérrez-Velázquez, A., Martos, J., 2013. The reef corridor of the southwest Gulf of Mexico: Challenges for its management and conservation. Ocean & Coastal Management 86, 22-32. doi: http://dx.doi.org/10.1016/j.ocecoaman.2013.10.006

Paddack, M.J., Reynolds, J.D., Aguilar, C., Appeldoorn, R.S., Beets, J., Burkett, E.W., . . . Côté, I., 2009. Recent region-wide declines in Caribbean reef fish abundance. Current Biology 19, 1-6. doi: 10.1016/j.cub.2009.02.041

Pandolfi, J.M., Jackson, J.B.C., Baron, N., Bradbury, R.H., Guzman, H.M., Hughes, T.P., Kappel, C.V., Micheli, F., Ogden, J.C., Possingham, H.P., Sala, E., 2005. Are U.S. coral reefs on the slippery slope to slime? Science 307, 1725-1726.

Peters, H., O'Leary, B.C., Hawkins, J.P., Carpenter, K.E., Roberts, C.M., 2013. *Conus*: First comprehensive conservation Red List assessment of a marine gastropod mollusc genus. PLoS ONE 8, e83353. doi: 10.1371/journal.pone.0083353

Peters, H., O'Leary, B.C., Hawkins, J.P., Roberts, C.M., 2015. Identifying species at extinction risk using global models of anthropogenic impact. Global Change Biology 21, 618-628. doi: 10.1111/gcb.12749

Pimm, S.L., Jenkins, C.N., Abell, R., Brooks, T.M., Gittleman, J.L., Joppa, L.N., Raven, P.H., Roberts, C.M., Sexton, J.O., 2014. The biodiversity of species and their rates of extinction, distribution, and protection. Science 344. doi: 10.1126/science.1246752

Polidoro, B.A., Elfes, C.T., Sanciangco, J.C., Pippard, H., Carpenter, K.E., 2011. Conservation status of marine biodiversity in Oceania: An analysis of marine species on the IUCN Red List of Threatened Species. Journal of Marine Biology 2011, 1-14. doi: 10.1155/2011/247030

Polidoro, B.A., Brooks, T., Carpenter, K.E., Edgar, G.J., Henderson, S., Sanciangco, J., Robertson, D.R., 2012. Patterns of extinction risk and threat for marine vertebrates and habitat-forming species in the Tropical Eastern Pacific. Marine Ecology Progress Series 448, 93-104.

Polunin, N.V., Roberts, C.M., 1993. Greater biomass and value of target coral-reef fishes in two small Caribbean marine reserves. Marine Ecology Progress Series 100, 167-176.

Pratchett, M.S., Munday, P., Wilson, S.K., Graham, N.A., Cinner, J.E., Bellwood, D.R., Jones, G.P., Polunin, N.V., McClanahan, T.R., 2008. Effects of climate-induced coral bleaching on coral-reef fishes - Ecological and economic consequences: in Gibson, R. N., Atkinson, R.J.A., Gordon, J.D.M. (Eds.), Oceanography and Marine Biology: Annual Review 46. CRC Press, Boca Raton, Vol. 46, pp. 251-296.

Prendergast, J.R., Quinn, R.M., Lawton, J.H., Eversham, B.C., Gibbons, D.W., 1993. Rare species, the coincidence of diversity hotspots and conservation strategies. Nature 365, 335-337.

Pressey, R.L., Visconti, P., Ferraro, P.J., 2015. Making parks make a difference: poor alignment of policy, planning and management with protected-area impact, and ways forward. Philosophical Transactions of the Royal Society of London B: Biological Sciences 370. doi: 10.1098/rstb.2014.0280

Pringle, C.M., Freeman, M.C., Freeman, B.J., 2000. Regional effects of hydrologic alterations on riverine macrobiota in the New World: Tropical-Temperate comparisons. BioScience 50, 807-823. doi: 10.1641/0006-3568(2000)050[0807:reohao]2.0.co;2

Proudlove, G.S., 2001. The conservation status of hypogean fishes. Environmental Biology of Fishes 62, 201-213. doi: 10.1023/a:1011828726038

R Core Team, 2013. R version 3.1.1: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria.

Rabalais, N.N., Turner, R.E., Sen Gupta, B.K., Boesch, D.F., Chapman, P., Murrell, M.C., 2007. Hypoxia in the northern Gulf of Mexico: Does the science support the plan to reduce, mitigate, and control hypoxia? Estuaries and Coasts 30, 753-772. doi: 10.1007/bf02841332

Rahbek, C., 2005. The role of spatial scale and the perception of large-scale species-richness patterns. Ecology Letters 8, 224-239. doi: 10.1111/j.1461-0248.2004.00701.x

Rangel-Avalos, M.A., Jordan, L.K.B., Walker, B.K., Gilliam, D.S., Hinojosa, E.C., Spieler, R.E., 2007. Fish and coral reef communities of the Parque Nacional Sistema Arrecifal Veracruzano (Veracruz Coral Reef System National Park) Veracruz, Mexico: Preliminary results. Paper presented at the 60th Gulf and Caribbean Fisheries Institute, Punta Cana, Dominican Republic.

Reynolds, J.D., Dulvy, N.K., Goodwin, N.B., Hutchings, J.A., 2005. Biology of extinction risk in marine fishes. Proceedings of the Royal Society B: Biological Sciences 272, 2337-2344.

Rife, A.N., Erisman, B., Sanchez, A., Aburto-Oropeza, O., 2013. When good intentions are not enough … Insights on networks of “paper park” marine protected areas. Conservation Letters 6, 200-212. doi: 10.1111/j.1755-263X.2012.00303.x

Ritchie, K.B., Keller, B.D., 2008. A scientific forum on the Gulf of Mexico: The islands in the stream concept. Paper presented at the Gulf of Mexico Science Forum, Sarasota, Florida.

Roberts, C.M., Hawkins, J.P., 1999. Extinction risk in the sea. Trends in Ecology & Evolution 14, 241-246. doi: http://dx.doi.org/10.1016/S0169-5347(98)01584-5

Roberts, C.M., McClean, C.J., Veron, J.E.N., Hawkins, J.P., Allen, G.R., Don, E.M., Mittermeier, C.G., Schueler, F.W., Spalding, M., Wells, F., Vynne, C., Werner, T.B., 2002. Marine biodiversity hotspots and conservation priorities for tropical reefs. Science 295, 1280-1284. doi: 10.2307/3075918

Robertson, D.R., Cramer, K.L., 2014. Defining and dividing the Greater Caribbean: Insights from the biogeography of shorefishes. PLoS ONE 9, e102918. doi: 10.1371/journal.pone.0102918

Robertson, D.R., Van Tassell, J., 2015. Shorefishes of the Greater Caribbean: online information system. Version 1.0 from http://biogeodb.stri.si.edu/caribbean/en/pages

Rocha, L., Rocha, C., Baldwin, C., Weigt, L., McField, M., 2015. Invasive lionfish preying on critically endangered reef fish. Coral Reefs 34, 803-806. doi: 10.1007/s00338-015-1293-z

Rodrigues, A.S.L., Gaston, K.J., 2001. How large do reserve networks need to be? Ecology Letters 4, 602-609. doi: 10.1046/j.1461-0248.2001.00275.x

Rodrigues, A.S.L., Andelman, S.J., Bakarr, M.I., Boitani, L., Brooks, T.M., Cowling, R.M., . . . Yan, X., 2004. Effectiveness of the global protected area network in representing species diversity. Nature 428, 640-643. doi: http://www.nature.com/nature/journal/v428/n6983/suppinfo/nature02422_S1.html

Rodrigues, A.S.L., Pilgrim, J.D., Lamoreux, J.F., Hoffmann, M., Brooks, T.M., 2006. The value of the IUCN Red List for conservation. Trends in Ecology & Evolution 21, 71-76. doi: http://dx.doi.org/10.1016/j.tree.2005.10.010

Rodríguez, M.A., Winemiller, K.O., Lewis, W.M., Taphorn Baechle, D.C., 2007. The freshwater habitats, fishes, and fisheries of the Orinoco River basin. Aquatic Ecosystem Health & Management 10, 140-152. doi: 10.1080/14634980701350686

Rogers, C.S., Beets, J., 2001. Degradation of marine ecosystems and decline of fishery resources in marine protected areas in the US Virgin Islands. Environmental Conservation 28, 312-322.

Rogers, A., Blanchard, J.L., Mumby, P.J. 2014. Vulnerability of coral reef fisheries to a loss of structural complexity. Current Biology 24, 1000-1005. doi: http://dx.doi.org/10.1016/j.cub.2014.03.026

Rothschild, B.J., Ault, J.S., Goulletquer, P., Heral, M., 1994. Decline of the Chesapeake Bay oyster population : a century of habitat destruction and overfishing. Marine Ecology Progress Series 111, 29-39.

Rondinini, C., Wilson, K.A., Boitani, L., Grantham, H., Possingham, H.P., 2006. Tradeoffs of different types of species occurrence data for use in systematic conservation planning. Ecology Letters 9, 1136-1145. doi: 10.1111/j.1461-0248.2006.00970.x

Sadovy de Mitcheson, Y.S., Cornish, A., Domeier, M., Colin, P.L., Russell, M., Lindeman, K.C., 2008. A global baseline for spawning aggregations of reef fishes. Conservation Biology 22, 1233-1244.

Sadovy de Mitcheson, Y., Craig, M.T., Bertoncini, A.A., Carpenter, K.E., Cheung, W.W.L., Choat, J.H., . . . Sanciangco, J., 2013. Fishing groupers towards extinction: a global assessment of threats and extinction risks in a billion dollar fishery. Fish and Fisheries 14, 119-136. doi: 10.1111/j.1467-2979.2011.00455.x

SAGARPA., 2012. Status of the Fisheries of Mexico. Diario Oficial Secretaria De Agricultura, Ganaderia, Desarrollo Rural, Pesca Y Alimentacion.

Sala, E., Costello, C., Dougherty, D., Heal, G., Kelleher, K., Murray, J. H., Rosenberg, A.A., Sumaila, R., 2013. A general business model for marine reserves. PLoS ONE 8, e58799. doi: 10.1371/journal.pone.0058799

Salafsky, N., Salzer, D., Stattersfield, A.J., Hilton-Taylor, C., Neugarten, R., Butchart, S.H.M., Collen, B.E.N., Cox, N., Master, L.L., O'Connor, S., Wilkie, D., 2008. A standard lexicon for biodiversity conservation: Unified classifications of threats and actions. Conservation Biology 22, 897-911. doi: 10.1111/j.1523-1739.2008.00937.x

Santander-Monsalvo, J., López-Huerta, I., Aguilar-Perera, A., Tuz-Sulub, A., 2012. First record of the red lionfish (*Pterois volitans* [Linnaeus, 1758]) off the coast of Veracruz, Mexico. BioInvasions Records 1, 121-124.

Schaefer, J., Frazier, N., Barr, J., 2016. Dynamics of near-coastal fish assemblages following the Deepwater Horizon Oil Spill in the Northern Gulf of Mexico. Transactions of the American Fisheries Society 145, 108-119. doi: 10.1080/00028487.2015.1111253

Schipper, J., Chanson, J.S., Chiozza, F., Cox, N.A., Hoffmann, M., Katariya, V., . . . Young, B.E., 2008. The status of the world's land and marine mammals: Diversity, threat, and knowledge. Science 322, 225-230. doi: 10.1126/science.1165115

Schmitt, C., 2011. A Tough Choice: Approaches Towards the Setting of Global Conservation Priorities: in Zachos, F.E., Habel, J.C. (Eds.), Biodiversity Hotspots. Springer, Berlin Heidelberg, pp. 23-42.

Sedberry, G.R., Carter, H.J., Barrick, P.A., 1999. A comparison of fish communities between protected and unprotected areas of the Belize reef ecosystem: Implications for conservation and management. Paper presented at the 45th Gulf and Caribbean Fisheries Institute, Charleston, South Carolina.

Selig, E.R., Bruno, J.F., 2010. A global analysis of the effectiveness of marine protected areas in preventing coral loss. PLoS ONE 5, e9278. doi: 10.1371/journal.pone.0009278

Selig, E.R., Casey, K.S., Bruno, J.F., 2012. Temperature-driven coral decline: the role of marine protected areas. Global Change Biology 18, 1561-1570. doi: 10.1111/j.1365-2486.2012.02658.x

Selig, E.R., Turner, W.R., Troëng, S., Wallace, B.P., Halpern, B.S., Kaschner, K., Lascelles, B.G., Carpenter, K.E., Mittermeier, R.A., 2014. Global priorities for marine biodiversity conservation. PLoS ONE 9, e82898.

Smith, M.L., Carpenter, K.E., Waller, R.W. 2002. An Introduction to the Oceanography, Geology, Biogeography, and Fisheries of the Tropical and Subtropical Western Central Atlantic, in: Carpenter, K.E. (Ed.), The Living Marine Resources of the Western Central Atlantic. Food and Agriculture Organization of the United Nations, Rome, Vol. 1, pp. 1-23.

Smith-Vaniz, W.F., Collette, B.B., Luckhurst, B.E., 1999. Fishes of Bermuda: History, zoogeography, annotated checklist, and identification keys. American Society of Ichthyologists and Herpetologists (Special Publication 4).

Smith-Vaniz, W.F., Jelks, H.L., Rocha, L.A., 2006. Relevance of cryptic fishes in biodiversity assessments: a case study at Buck Island Reef National Monument, St. Croix. Bulletin of Marine Science 79, 17-48.

Spalding, M.D., Fox, H.E., Allen, G.R., Davidson, N., Ferdaña, Z.A., Finlayson, M., . . . Robertson, J., 2007. Marine ecoregions of the world: A bioregionalization of coastal and shelf areas. BioScience 57, 573-583. doi: 10.1641/b570707

Spalding, M.D., Meliane, I., Milam, A., Fitzgerald, C., Hale, L.Z., 2013. Protecting marine spaces: Global targets and changing approaches. Ocean Yearbook Online 27, 213-248. doi: doi:10.1163/22116001-90000160

Sparks, J.S., Gruber, D.F., 2012. A new mesophotic clingfish (Teleostei: Gobiesocidae) from the Bahamas. Copeia 2012, 251-256. doi: doi:10.1643/CI-11-124

Stallings, C.D., 2009. Fishery-independent data reveal negative effect of human population density on Caribbean predatory fish communities. PLoS ONE 4, e5333. doi: 10.1371/journal.pone.0005333

Steidinger, K.A., 2009. Historical perspective on *Karenia brevis* red tide research in the Gulf of Mexico. Harmful Algae 8, 549-561. doi: http://dx.doi.org/10.1016/j.hal.2008.11.009

Stuart, S.N., Chanson, J.S., Cox, N.A., Young, B.E., Rodrigues, A.S.L., Fischman, D.L., Waller, R.W., 2005. Response to comment on "Status and trends of amphibian declines and extinctions worldwide". Science 309, 1999-1999. doi: 10.1126/science.1113265

Taylor, M.S., Akins, L., 2007. Two new species of *Elacatinus* (Teleostei: Gobiidae) from the Mexican coast of the Gulf of Mexico. Zootaxa 1425, 45-51.

Tavera, J., Acero, A.P., 2013. Description of a new species of *Hypoplectrus* (Perciformes: Serranidae) from the Southern Gulf of Mexico. Aqua 19, 1-21.

Tornabene, L., Baldwin, C., Weigt, L.A., Pezold, F., 2010. Exploring the diversity of western Atlantic Bathygobius (Teleostei: Gobiidae) with cytochrome c oxidase-I, with descriptions of two new species. Aqua 16, 141-170.

Toth, L.T., Woesik, R., Murdoch, T.J.T., Smith, S.R., Ogden, J.C., Precht, W.F., Aronson, R.B., 2014. Do no-take reserves benefit Florida's corals? 14 years of change and stasis in the Florida Keys National Marine Sanctuary. Coral Reefs 33, 565-577. doi: 10.1007/s00338-014-1158-x

Tunnell Jr., J.W., 2011. An expert opinion of when the Gulf of Mexico will return to pre-spill harvest status following the BP Deepwater Horizon MC 252 oil spill. Harte Research Institute for Gulf of Mexico Studies: Texas A&M University – Corpus Christi.

UNEP-WCMC, Short, F.T., 2005. Global distribution of seagrasses (version 2). Updated version of the data layer used in Green and Short (2003). Cambridge (UK): UNEP World Conservation Monitoring Centre. URLs: data.unep-wcmc.org/datasets/10 (polygons) and data.unep-wcmc.org/datasets/9 (points)

UNEP-WCMC, WorldFish Centre, WRI, TNC, 2010. Global distribution of warm-water coral reefs, compiled from multiple sources (listed in “Coral_Source.mdb”), and including IMaRS-USF and IRD (2005), IMaRS-USF (2005) and Spalding et al. (2001). Cambridge (UK): UNEP World Conservation Monitoring Centre. URL: data.unep-wcmc.org/datasets/13

UNEP., 2010. Guidelines and Criteria for the Evaluation of Protected Areas to be Listed Under the SPAW Protocol: United Nations Environment Programme.

Valdez-Moreno, M., Quintal-Lizama, C., Gómez-Lozano, R., García-Rivas, M.D.C., 2012. Monitoring an alien invasion: DNA barcoding and the identification of lionfish and their prey on coral reefs of the Mexican Caribbean. PLoS ONE 7, e36636. doi: 10.1371/journal.pone.0036636

Valiela, I., McClelland, J., Hauxwell, J., Behr, P.J., Hersh, D., Foreman, K., 1997. Macroalgal blooms in shallow estuaries: controls and ecophysiological and ecosystem consequences. Limnology and Oceanography 42, 1105-1118.

Van Tassell, J.L., Tornabene, L., Colin, P.L., 2012. Review of the western Atlantic species of Bollmannia (Teleostei: Gobiidae:Gobiosomatini) with the description of a new allied genus and species. Aqua, International Journal of Ichthyology 18, 61-93.

van Tussenbroek, B.I., Cortés, J., Collin, R., Fonseca, A.C., Gayle, P.M.H., Guzmán, H.M., . . . Weil, E., 2014. Caribbean-wide, long-term study of seagrass beds reveals local variations, shifts in community structure and occasional collapse. PLoS ONE 9, e90600. doi: 10.1371/journal.pone.0090600

Victor, B., 2010a. The Redcheek Paradox: the mismatch between genetic and phenotypic divergence among deeply-divided mtDNA lineages in a coral-reef goby, with the description of two new cryptic species from the Caribbean Sea. Journal of the Ocean Science Foundation 3, 2-16.

Victor, B., 2010b. *Emblemariopsis carib* and *Emblemariopsis arawak*, two new chaenopsid blennies from the Caribbean Sea: DNA barcoding identifies males, females, and juveniles and distinguishes sympatric cryptic species. Journal of the Ocean Science Foundation 4, 1-29.

Victor, B., 2012. *Hypoplectrus floridae* n. sp. and *Hypoplectrus ecosur* n. sp., two new Barred Hamlets from the Gulf of Mexico (Pisces: Serranidae): more than 3% different in COI mtDNA sequence from the Caribbean *Hypoplectrus* species flock. Journal of the Ocean Science Foundation 5, 1-19.

Victor, B., 2013. The Caribbean Roughhead Triplefin (*Enneanectes boehlkei*): DNA barcoding reveals a complex of four West Indian sympatric cryptic species (Teleostei: Blennioidei: Tripterygiidae). Journal of the Ocean Science Foundation 7, 44-73.

Victor, B., 2014. Three new endemic cryptic species revealed by DNA barcoding of the gobies of the Cayman Islands (Teleostei: Gobiidae). Journal of the Ocean Science Foundation 12, 25-60.

Vié, J.-C., Hilton-Taylor, C. and Stuart, S.N., 2009. Wildlife in a Changing World - An Analysis of the 2008 IUCN Red List of Threatened Species. IUCN, Gland, Switzerland, pp. 180.

Visconti, P., Di Marco, M., Álvarez-Romero, J.G., Januchowski-Hartley, S.R., Pressey, R.L., Weeks, R., Rondinini, C., 2013. Effects of errors and gaps in spatial data sets on assessment of conservation progress. Conservation Biology 27, 1000-1010. doi: 10.1111/cobi.12095

Vitousek, P.M., Mooney, H.A., Lubchenco, J., Melillo, J.M., 1997. Human domination of Earth's ecosystems. Science 277, 494-499. doi: 10.1126/science.277.5325.494

Waycott, M., Duarte, C.M., Carruthers, T.J.B., Orth, R.J., Dennison, W.C., Olyarnik, S., . . . Williams, S.L., 2009. Accelerating loss of seagrasses across the globe threatens coastal ecosystems. Proceedings of the National Academy of Sciences 106, 12377-12381. doi: 10.1073/pnas.0905620106

Webb, Thomas J., Mindel, Beth L., 2015. Global patterns of extinction risk in marine and non-marine systems. Current Biology 25, 506-511.

Weinstein, M.P., Litvin, S.Y., 2016. Macro-restoration of tidal wetlands: A whole estuary approach. Ecological Restoration 34, 27-38. doi: 10.3368/er.34.1.27

Wildtracks, 2009. 2010-2015 Management Plan of the South Water Caye Marine Reserve World Heritage Site. http://swcmr.org/

Wilkie, M.L., Fortuna, S., 2003. Status and trends in mangrove area extent worldwide. FAO Forest Resources Division Rome, Forest Resources Assessment Working Paper No. 63.

Williams, J.T., 2003. Three new species of blennioid shore fishes discovered at Navassa Island, Caribbean Sea. Aqua 6, 11-16.

Williams, J.T., Mounts, J.H., 2003. Descriptions of six new Caribbean fish species in the genus Starksia (Labrisomidae). Aqua 6, 145-164.

Williams, J.T., Carpenter, K.E., Van Tassell, J.L., Hoetjes, P., Toller, W., Etnoyer, P., Smith, M., 2010. Biodiversity assessment of the fishes of Saba Bank Atoll, Netherlands Antilles. PLoS ONE 5, e10676. doi: 10.1371/journal.pone.0010676

Wilson, K., Pressey, R.L., Newton, A., Burgman, M., Possingham, H., Weston, C., 2005. Measuring and incorporating vulnerability into conservation planning. Environmental Management 35, 527-543. doi: 10.1007/s00267-004-0095-9

Worm, B., Barbier, E.B., Beaumont, N., Duffy, J.E., Folke, C., Halpern, B.S., Jackson, J.B.C., Lotze, H.K., Micheli, F., Palumbi, S.R., Sala, E., Selkoe, K.A., Stachowicz, J.J., Watson, R., 2006. Impacts of biodiversity loss on ocean ecosystem services. Science 314, 787-790. doi: 10.1126/science.1132294

Worm, B., Hilborn, R., Baum, J.K., Branch, T.A., Collie, J.S., Costello, C., . . . Zeller, D., 2009. Rebuilding global fisheries. Science 325, 578-585. doi: 10.1126/science.1173146

Worm, B., Branch, T.A., 2012. The future of fish. Trends in Ecology & Evolution 27, 594-599. doi: http://dx.doi.org/10.1016/j.tree.2012.07.005

Zarco Perello, S., Moreno Mendoza, R., Simões, N., 2014. Checklist of fishes from Madagascar Reef, Campeche Bank, México. Biodiversity Data Journal 2, e1100. doi: 10.3897/BDJ.2.e1100

# APPENDIX A.

## RED LIST WORKSHOP PARTICIPANTS

List of Red List workshop participants alphabetical by first name, affiliation, and workshop attended. Barbados = first Caribbean shorefishes workshop held in 2010; Jamaica = second Caribbean shorefishes workshop held in 2012; Trinidad = third Caribbean shorefishes workshop held in 2013; Texas, USA = first Gulf of Mexico shorefishes workshop held in 2014; Mérida, Mexico = second Gulf of Mexico shorefishes workshop held in 2015; ‘y’ = yes, the person participated in the workshop, while blanks indicate they did not. A list of the Red List facilitators follows.

| Expert Name | Affiliation | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|---|
| Alberto Abad Uribarren | CICIMAR-IPN La Paz (Mexico) | | | | | y |
| Alfonso Aguilar Perera | Universidad Autónoma de Yucatán (Mexico) | | | | | y |
| Andrea Polanco Fernandez | Instituto de Investigaciones Marinas y Costeras - Invemar (Colombia) | | y | y | | |
| Arturo Acero Pizarro | Universidad Nacional de Colombia sede Caribe (Colombia) | | | y | | |
| Barry Russell | Museum and Art Gallery of the Northern Territory (Australia) | | | y | | |
| Brian Zane | Montego Bay Marine Park Trust (Jamaica) | | y | | | |

| Expert Name | Affiliation | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|---|
| Bruce B. Collette | National Marine Fisheries Service/NOAA/Tuna and Billfishes SSG (USA) | | y | y | y | y |
| David Ross Robertson | Smithsonian Tropical Research Institute (Panama) | | y | y | y | y |
| David Wells | Texas A&M University, Galveston (USA) | | | | | y |
| Dayne Buddo | Univ. of the West Indies (Jamaica) | | y | | | |
| Fabian Pina Amargos | Centro de Investigaciones de Ecosistemas Costeros (Cuba) | | y | y | | |
| Frank Pezold | Texas A&M University, Corpus Christi (USA) | y | | | y | |
| George Sedberry | NOAA Office of National Marine Sanctuaries (USA) | | | | y | |
| Georgina Milagrosa Bustamante | Caribbean Marine Protected Area Management Network (USA) | | y | | | |
| Hazel Oxenford | University of the West Indies - Cave Hill (Barbados) | y | | y | | |
| Hector Espinosa Perez | Instituto de Biología, UNAM - Mexico City (Mexico) | | | | y | y |
| Horacio Perez Espana | Universidad Veracruzana (Mexico) | | | | | y |
| Howard Jelks | USGS Southeast Ecological Science Center, Florida (USA) | | | | y | |

| Expert Name | Affiliation | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|---|
| James Cowan | Louisiana State University (USA) | | | | y | |
| James K. Dooley | Adelphi University (USA) | | | y | | |
| James Tolan | Texas Parks and Wildlife, Coastal Fisheries Division (USA) | | | | y | |
| James Tyler | Smithsonian National Museum of Natural History (USA) | | | | | y |
| James Van Tassell | American Museum of Natural History (USA) | y | | | | |
| Jean-Luc Bouchereau | Université des Antilles et de la Guyane (Guadeloupe) | y | | | | |
| Jean-Philippe Marechal | Observatoire du Milieu Marin Martiniquais (Martinique) | | | y | | |
| Jed Brown | Integrated Seawater Energy & Agriculture System Project (United Arab Emirates) | | y | | | |
| Jeffrey T. Williams | Smithsonian National Museum of Natural History (USA) | y | y | | y | |
| John D. McEachran | Texas A&M University, College Station (USA) | | | y | y | |
| Jon A. Moore | Florida Atlantic University (USA) | | | y | | |
| Jorge Brenner | The Nature Conservancy - Corpus Christi, Texas (USA) | | | | y | |

| Expert Name | Affiliation | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|---|
| Karl A. Aiken | University of the West Indies - Mona (Jamaica) | y | y | y | | |
| Kathy Goodin | NatureServe (USA) | | | | y | |
| Kent E. Carpenter | Old Dominion University / IUCN-GMSA (USA) | y | y | y | y | |
| Kenyon Lindeman | Florida Institute of Technology/Snapper, Sea Bream, Grunt SSG (USA) | | | | y | |
| Labbish Chao | Museum of Marine Biology and Aquarium Taiwan/Sciaenidae SSG (USA) | | | | y | |
| Luiz Rocha | California Academy of Sciences/Groupers and Wrasses SSG (USA) | | | | y | |
| Luke Tornabene | Texas A&M University, Corpus Christi (USA) | y | | | y | |
| Lyda Marcela Grijalba Bendeck | Universidad Jorge Tadeo Lozano (Colombia) | | y | | | |
| Maria Eugenia Vega Cendejas | CINVESTAV-IPN, Unidad Merida (Mexico) | | | | y | y |
| Matthew Craig | University of Puerto Rico - Mayaguez/Groupers and Wrasses SSG (USA) | y | | | | |

| Expert Name | Affiliation | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|---|
| Michelle Zapp-Sluis | Texas A&M University, Corpus Christi (USA) | | | | y | |
| Monique Curtis | National Environment & Planning Agency (Jamaica) | | y | | | |
| Richard Grant Gilmore Jr. | Estuarine, Coastal and Ocean Science, Inc. (USA) | y | y | | | |
| Riley Pollom | Project Seahorse – University of British Columbia Fisheries Centre (Canada) | | | | y | |
| Robert H. Robins | Florida Museum of Natural History (USA) | | | y | | y |
| Rodolfo Claro | Instituto de Oceanología CITMA. La Habana (Cuba) | | | | y | |
| Rosemarie Kishore | Institute of Marine Affairs (Trinidad and Tobago) | | | y | | |
| Steve Ross | University of North Carolina - Wilmington (USA) | | | | | y |
| Susan Singh-Renton | Caribbean Regional Fisheries Mechanism (St. Vincent and the Grenadines) | | | y | | |
| Thomas Fraser | Florida Museum of Natural History (USA) | y | | | | y |
| Thomas Munroe | National Marine Fisheries Service/NOAA (USA) | | y | y | | y |

| Expert Name | Affiliation | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|---|
| Tomas Camarena Luhrs | National Commission of Natural Protected Areas – SEMARNAT (Mexico) | | | | y | |
| William D. Anderson Jr. | Grice Marine Biological Laboratory (USA) | | y | | | |
| William Eschmeyer | Florida Museum of Natural History and California Academy of Sciences (USA) | | y | | | |
| William Smith-Vaniz | Florida Museum of Natural History (USA) | | y | | | y |
| Xavier Chiappa Carrara | Universidad Autónoma de Sisal (Mexico) | | | | | y |

| Red List Facilitators | Barbados | Jamaica | Trinidad | Texas, USA | Mérida, Mexico |
|---|---|---|---|---|---|
| Andrew Hines | y | | | | |
| Beth Polidoro | | | | y | y |
| Christi Linardich | | | y | y | y |
| Christiane Elfes | y | | | | |
| Claire Gorman | | | | | y |
| Fabien Barthelat | y | y | y | | |
| Gina Ralph | | | | y | y |
| Heather Harwell | | y | y | y | |
| Jack Buchanan | | | y | | |
| Kyle Strongin | | | | y | y |
| Mia Comeros-Raynal | | y | | y | |
| Tulia Defex | | y | y | | |

# APPENDIX B.

## LIST OF ALL SPECIES WITH RED LIST CATEGORIES

List of all 1,360 marine bony shorefishes alphabetical by family and then by species name (all species lists except F follow this rule). The global and the Gulf of Mexico regional categories are also listed; CR = Critically Endangered, EN = Endangered, VU = Vulnerable, NT = Near Threatened, LC = Least Concern, DD = Data Deficient, NE = not evaluated because it does not occur in the Gulf of Mexico.

| **Family** | **Species Name** | **Global** | **Gulf of Mexico** | **Greater Caribbean endemic?** | **Gulf of Mexico endemic?** |
|---|---|---|---|---|---|
| Acanthuridae | Acanthurus chirurgus | LC | LC | no | no |
| Acanthuridae | Acanthurus coeruleus | LC | LC | no | no |
| Acanthuridae | Acanthurus tractus | LC | LC | yes | no |
| Achiridae | Achirus achirus | LC | NE | no | no |
| Achiridae | Achirus declivis | LC | NE | no | no |
| Achiridae | Achirus lineatus | LC | LC | no | no |
| Achiridae | Apionichthys dumerili | LC | NE | no | no |
| Achiridae | Gymnachirus melas | LC | LC | no | no |
| Achiridae | Gymnachirus nudus | LC | DD | no | no |
| Achiridae | Gymnachirus texae | LC | LC | yes | yes |
| Achiridae | Trinectes inscriptus | LC | NE | yes | no |
| Achiridae | Trinectes microphthalmus | LC | NE | no | no |
| Achiridae | Trinectes paulistanus | LC | NE | no | no |
| Acipenseridae | Acipenser brevirostrum | VU | NE | no | no |
| Acipenseridae | Acipenser oxyrinchus | NT | NE | no | no |
| Acropomatidae | Synagrops bellus | LC | LC | no | no |
| Acropomatidae | Synagrops spinosus | LC | LC | no | no |
| Acropomatidae | Synagrops trispinosus | LC | DD | yes | no |
| Acropomatidae | Verilus sordidus | LC | DD | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Albulidae | Albula nemoptera | DD | NE | no | no |
| Albulidae | Albula vulpes | NT | LC | yes | no |
| Ammodytidae | Protammodytes sarisa | DD | NE | yes | no |
| Anomalopidae | Kryptophanaron alfredi | LC | NE | yes | no |
| Antennariidae | Antennarius multiocellatus | LC | LC | no | no |
| Antennariidae | Antennarius pauciradiatus | LC | LC | yes | no |
| Antennariidae | Antennarius striatus | LC | LC | no | no |
| Antennariidae | Antennatus bermudensis | LC | NE | yes | no |
| Antennariidae | Fowlerichthys ocellatus | LC | LC | yes | no |
| Antennariidae | Fowlerichthys radiosus | LC | LC | no | no |
| Antennariidae | Histrio histrio | LC | LC | no | no |
| Apogonidae | Apogon aurolineatus | LC | LC | yes | no |
| Apogonidae | Apogon binotatus | LC | LC | yes | no |
| Apogonidae | Apogon gouldi | LC | NE | yes | no |
| Apogonidae | Apogon lachneri | LC | LC | yes | no |
| Apogonidae | Apogon leptocaulus | LC | NE | yes | no |
| Apogonidae | Apogon maculatus | LC | LC | yes | no |
| Apogonidae | Apogon mosavi | LC | NE | yes | no |
| Apogonidae | Apogon phenax | LC | LC | yes | no |
| Apogonidae | Apogon pillionatus | LC | LC | yes | no |
| Apogonidae | Apogon planifrons | LC | LC | yes | no |
| Apogonidae | Apogon pseudomaculatus | LC | LC | no | no |
| Apogonidae | Apogon quadrisquamatus | LC | LC | no | no |
| Apogonidae | Apogon robbyi | LC | NE | no | no |
| Apogonidae | Apogon robinsi | LC | DD | yes | no |
| Apogonidae | Apogon townsendi | LC | LC | yes | no |
| Apogonidae | Astrapogon alutus | LC | LC | yes | no |
| Apogonidae | Astrapogon puncticulatus | LC | LC | no | no |
| Apogonidae | Astrapogon stellatus | DD | LC | no | no |
| Apogonidae | Paroncheilus affinis | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Apogonidae | Phaeoptyx conklini | LC | LC | yes | no |
| Apogonidae | Phaeoptyx pigmentaria | LC | LC | no | no |
| Apogonidae | Phaeoptyx xenus | LC | LC | yes | no |
| Apogonidae | Zapogon evermanni | LC | NE | no | no |
| Argentinidae | Argentina striata | LC | LC | no | no |
| Argentinidae | Glossanodon pygmaeus | LC | LC | yes | no |
| Ariidae | Amphiarius phrygiatus | LC | NE | no | no |
| Ariidae | Ariopsis felis | LC | LC | yes | no |
| Ariidae | Bagre bagre | LC | NE | no | no |
| Ariidae | Bagre marinus | LC | LC | no | no |
| Ariidae | Cathorops arenatus | LC | NE | no | no |
| Ariidae | Cathorops belizensis | DD | NE | yes | no |
| Ariidae | Cathorops higuchii | LC | NE | yes | no |
| Ariidae | Cathorops wayuu | DD | NE | yes | no |
| Ariidae | Notarius grandicassis | LC | NE | no | no |
| Ariidae | Notarius neogranatensis | VU | NE | yes | no |
| Ariidae | Notarius quadriscutis | LC | NE | no | no |
| Ariidae | Notarius rugispinis | LC | NE | no | no |
| Ariidae | Sciades couma | LC | NE | no | no |
| Ariidae | Sciades herzbergii | LC | NE | no | no |
| Ariidae | Sciades parkeri | VU | NE | no | no |
| Ariidae | Sciades passany | DD | NE | no | no |
| Ariommatidae | Ariomma bondi | LC | LC | no | no |
| Ariommatidae | Ariomma regulus | LC | LC | yes | no |
| Atherinidae | Atherinomorus stipes | LC | LC | no | no |
| Atherinidae | Hypoatherina harringtonensis | LC | LC | yes | no |
| Atherinopsidae | Atherinella beani | DD | NE | yes | no |
| Atherinopsidae | Atherinella blackburni | LC | NE | no | no |
| Atherinopsidae | Atherinella brasiliensis | LC | NE | no | no |
| Atherinopsidae | Atherinella milleri | LC | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Atherinopsidae | Melanorhinus microps | LC | LC | yes | no |
| Atherinopsidae | Membras analis | DD | NE | yes | no |
| Atherinopsidae | Membras argentea | DD | NE | yes | no |
| Atherinopsidae | Membras martinica | LC | LC | no | no |
| Atherinopsidae | Menidia beryllina | LC | LC | yes | no |
| Atherinopsidae | Menidia clarkhubbsi | DD | DD | yes | yes |
| Atherinopsidae | Menidia colei | EN | EN | yes | yes |
| Atherinopsidae | Menidia conchorum | EN | EN | yes | yes |
| Atherinopsidae | Menidia menidia | LC | NE | no | no |
| Atherinopsidae | Menidia peninsulae | LC | LC | yes | no |
| Aulostomidae | Aulostomus maculatus | LC | LC | no | no |
| Balistidae | Balistes capriscus | VU | NT | no | no |
| Balistidae | Balistes vetula | NT | LC | no | no |
| Balistidae | Canthidermis maculata | LC | LC | no | no |
| Balistidae | Canthidermis sufflamen | LC | LC | no | no |
| Balistidae | Melichthys niger | LC | LC | no | no |
| Balistidae | Xanthichthys ringens | LC | LC | no | no |
| Batrachoididae | Amphichthys cryptocentrus | LC | NE | no | no |
| Batrachoididae | Batrachoides gilberti | LC | NE | yes | no |
| Batrachoididae | Batrachoides manglae | LC | NE | yes | no |
| Batrachoididae | Batrachoides surinamensis | LC | NE | no | no |
| Batrachoididae | Opsanus beta | LC | LC | yes | no |
| Batrachoididae | Opsanus dichrostomus | LC | LC | yes | no |
| Batrachoididae | Opsanus pardus | LC | LC | yes | no |
| Batrachoididae | Opsanus phobetron | LC | LC | yes | no |
| Batrachoididae | Opsanus tau | LC | LC | no | no |
| Batrachoididae | Porichthys oculofrenum | DD | NE | yes | no |
| Batrachoididae | Porichthys pauciradiatus | LC | NE | yes | no |
| Batrachoididae | Porichthys plectrodon | LC | LC | no | no |
| Batrachoididae | Sanopus astrifer | VU | NE | yes | no |

| **Family** | **Species Name** | **Global** | **Gulf of Mexico** | **Greater Caribbean endemic?** | **Gulf of Mexico endemic?** |
|---|---|---|---|---|---|
| Batrachoididae | Sanopus barbatus | LC | NE | yes | no |
| Batrachoididae | Sanopus greenfieldorum | VU | NE | yes | no |
| Batrachoididae | Sanopus johnsoni | DD | NE | yes | no |
| Batrachoididae | Sanopus reticulatus | EN | EN | yes | yes |
| Batrachoididae | Sanopus splendidus | EN | NE | yes | no |
| Batrachoididae | Thalassophryne maculosa | LC | NE | yes | no |
| Batrachoididae | Thalassophryne megalops | LC | NE | yes | no |
| Batrachoididae | Thalassophryne nattereri | LC | NE | no | no |
| Batrachoididae | Vladichthys gloverensis | VU | NE | yes | no |
| Belonidae | Ablennes hians | LC | LC | no | no |
| Belonidae | Platybelone argalus | LC | LC | no | no |
| Belonidae | Strongylura marina | LC | LC | no | no |
| Belonidae | Strongylura notata | LC | LC | yes | no |
| Belonidae | Strongylura timucu | LC | LC | no | no |
| Belonidae | Tylosurus acus ssp. acus | LC | LC | no | no |
| Belonidae | Tylosurus crocodilus ssp. crocodilus | LC | LC | no | no |
| Blenniidae | Chasmodes bosquianus | LC | NE | no | no |
| Blenniidae | Chasmodes longimaxilla | LC | LC | yes | yes |
| Blenniidae | Chasmodes saburrae | LC | LC | yes | no |
| Blenniidae | Entomacrodus nigricans | LC | LC | yes | no |
| Blenniidae | Hypleurochilus bermudensis | LC | LC | yes | no |
| Blenniidae | Hypleurochilus caudovittatus | LC | LC | yes | yes |
| Blenniidae | Hypleurochilus geminatus | LC | NE | yes | no |
| Blenniidae | Hypleurochilus multifilis | LC | LC | yes | yes |
| Blenniidae | Hypleurochilus pseudoaequipinnis | LC | NE | no | no |
| Blenniidae | Hypleurochilus springeri | LC | LC | yes | no |
| Blenniidae | Hypsoblennius exstochilus | LC | NE | yes | no |
| Blenniidae | Hypsoblennius hentz | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Blenniidae | Hypsoblennius invemar | LC | LC | no | no |
| Blenniidae | Hypsoblennius ionthas | LC | LC | yes | no |
| Blenniidae | Lupinoblennius nicholsi | LC | LC | yes | no |
| Blenniidae | Lupinoblennius vinctus | NT | NE | yes | no |
| Blenniidae | Ophioblennius macclurei | LC | LC | yes | no |
| Blenniidae | Parablennius marmoreus | LC | LC | no | no |
| Blenniidae | Scartella cristata | LC | LC | no | no |
| Bothidae | Bothus lunatus | LC | LC | no | no |
| Bothidae | Bothus maculiferus | LC | DD | no | no |
| Bothidae | Bothus ocellatus | LC | LC | no | no |
| Bothidae | Bothus robinsi | LC | LC | no | no |
| Bothidae | Engyophrys senta | LC | LC | no | no |
| Bothidae | Monolene megalepis | LC | NE | yes | no |
| Bothidae | Monolene sessilicauda | LC | LC | no | no |
| Bothidae | Trichopsetta caribbaea | LC | NE | yes | no |
| Bothidae | Trichopsetta melasma | LC | NE | yes | no |
| Bothidae | Trichopsetta orbisulcus | LC | NE | yes | no |
| Bothidae | Trichopsetta ventralis | LC | LC | yes | yes |
| Bramidae | Brama dussumieri | LC | LC | no | no |
| Bramidae | Pterycombus brama | LC | LC | no | no |
| Bramidae | Taractichthys longipinnis | LC | LC | no | no |
| Bregmacerotidae | Bregmaceros atlanticus | LC | LC | no | no |
| Bregmacerotidae | Bregmaceros cantori | LC | LC | no | no |
| Bregmacerotidae | Bregmaceros houdei | LC | LC | yes | no |
| Bythitidae | Alionematichthys minyomma | LC | NE | yes | no |
| Bythitidae | Calamopteryx goslinei | LC | NE | yes | no |
| Bythitidae | Calamopteryx robinsorum | LC | LC | yes | no |
| Bythitidae | Grammonus claudei | LC | LC | yes | no |
| Bythitidae | Gunterichthys longipenis | LC | LC | yes | yes |
| Bythitidae | Lucifuga lucayana | EN | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Bythitidae | Lucifuga simile | CR | NE | yes | no |
| Bythitidae | Lucifuga spelaeotes | VU | NE | yes | no |
| Bythitidae | Ogilbia boehlkei | LC | NE | yes | no |
| Bythitidae | Ogilbia cayorum | LC | LC | yes | no |
| Bythitidae | Ogilbia jeffwilliamsi | LC | NE | yes | no |
| Bythitidae | Ogilbia mccoskeri | DD | NE | yes | no |
| Bythitidae | Ogilbia sabaji | LC | LC | yes | no |
| Bythitidae | Ogilbia suarezae | LC | LC | yes | no |
| Bythitidae | Ogilbia tyleri | LC | NE | yes | no |
| Bythitidae | Ogilbichthys ferocis | EN | NE | yes | no |
| Bythitidae | Ogilbichthys haitiensis | DD | NE | yes | no |
| Bythitidae | Ogilbichthys kakuki | LC | NE | yes | no |
| Bythitidae | Ogilbichthys longimanus | LC | NE | yes | no |
| Bythitidae | Ogilbichthys microphthalmus | LC | NE | yes | no |
| Bythitidae | Ogilbichthys puertoricoensis | DD | NE | yes | no |
| Bythitidae | Ogilbichthys tobagoensis | DD | NE | yes | no |
| Bythitidae | Parasaccogaster melanomycter | DD | NE | yes | no |
| Bythitidae | Pseudogilbia sanblasensis | DD | NE | yes | no |
| Bythitidae | Stygnobrotula latebricola | LC | LC | yes | no |
| Callionymidae | Callionymus bairdi | LC | LC | no | no |
| Callionymidae | Diplogrammus pauciradiatus | LC | LC | yes | no |
| Callionymidae | Foetorepus agassizii | LC | LC | no | no |
| Callionymidae | Foetorepus goodenbeani | LC | LC | no | no |
| Callionymidae | Synchiropus dagmarae | LC | NE | yes | no |
| Caproidae | Antigonia capros | LC | LC | no | no |
| Caproidae | Antigonia combatia | LC | LC | no | no |
| Carangidae | Alectis ciliaris | LC | LC | no | no |
| Carangidae | Caranx bartholomaei | LC | LC | no | no |
| Carangidae | Caranx crysos | LC | LC | no | no |
| Carangidae | Caranx hippos | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Carangidae | Caranx latus | LC | LC | no | no |
| Carangidae | Caranx lugubris | LC | LC | no | no |
| Carangidae | Caranx ruber | LC | LC | no | no |
| Carangidae | Chloroscombrus chrysurus | LC | LC | no | no |
| Carangidae | Decapterus macarellus | LC | LC | no | no |
| Carangidae | Decapterus punctatus | LC | LC | no | no |
| Carangidae | Decapterus tabl | LC | LC | no | no |
| Carangidae | Elagatis bipinnulata | LC | LC | no | no |
| Carangidae | Hemicaranx amblyrhynchus | LC | LC | no | no |
| Carangidae | Naucrates ductor | LC | LC | no | no |
| Carangidae | Oligoplites palometa | LC | NE | no | no |
| Carangidae | Oligoplites saliens | LC | NE | no | no |
| Carangidae | Oligoplites saurus ssp. saurus | LC | LC | no | no |
| Carangidae | Pseudocaranx dentex | LC | NE | no | no |
| Carangidae | Selar crumenophthalmus | LC | LC | no | no |
| Carangidae | Selene brownii | LC | DD | no | no |
| Carangidae | Selene setapinnis | LC | LC | no | no |
| Carangidae | Selene vomer | LC | LC | no | no |
| Carangidae | Seriola dumerili | LC | NT | no | no |
| Carangidae | Seriola fasciata | LC | LC | no | no |
| Carangidae | Seriola rivoliana | LC | LC | no | no |
| Carangidae | Seriola zonata | LC | LC | no | no |
| Carangidae | Trachinotus carolinus | LC | LC | no | no |
| Carangidae | Trachinotus cayennensis | LC | NE | no | no |
| Carangidae | Trachinotus falcatus | LC | LC | no | no |
| Carangidae | Trachinotus goodei | LC | LC | no | no |
| Carangidae | Trachurus lathami | LC | LC | no | no |
| Carangidae | Uraspis secunda | LC | LC | no | no |
| Carapidae | Carapus bermudensis | LC | LC | no | no |
| Carapidae | Echiodon dawsoni | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Centriscidae | Macroramphosus scolopax | LC | LC | no | no |
| Centrolophidae | Hyperoglyphe bythites | LC | LC | yes | yes |
| Centropomidae | Centropomus ensiferus | LC | LC | no | no |
| Centropomidae | Centropomus mexicanus | LC | LC | no | no |
| Centropomidae | Centropomus parallelus | LC | LC | no | no |
| Centropomidae | Centropomus pectinatus | LC | LC | no | no |
| Centropomidae | Centropomus poeyi | DD | LC | yes | no |
| Centropomidae | Centropomus undecimalis | LC | LC | no | no |
| Chaenopsidae | Acanthemblemaria aspera | LC | LC | yes | no |
| Chaenopsidae | Acanthemblemaria betinensis | LC | NE | yes | no |
| Chaenopsidae | Acanthemblemaria chaplini | LC | LC | yes | no |
| Chaenopsidae | Acanthemblemaria greenfieldi | LC | NE | yes | no |
| Chaenopsidae | Acanthemblemaria harpeza | DD | NE | yes | no |
| Chaenopsidae | Acanthemblemaria johnsoni | LC | NE | yes | no |
| Chaenopsidae | Acanthemblemaria maria | LC | LC | yes | no |
| Chaenopsidae | Acanthemblemaria medusa | LC | NE | yes | no |
| Chaenopsidae | Acanthemblemaria paula | DD | NE | yes | no |
| Chaenopsidae | Acanthemblemaria rivasi | LC | NE | yes | no |
| Chaenopsidae | Acanthemblemaria spinosa | LC | LC | yes | no |
| Chaenopsidae | Chaenopsis limbaughi | LC | NE | yes | no |
| Chaenopsidae | Chaenopsis megalops | DD | NE | yes | no |
| Chaenopsidae | Chaenopsis ocellata | LC | LC | yes | no |
| Chaenopsidae | Chaenopsis resh | LC | NE | yes | no |
| Chaenopsidae | Chaenopsis roseola | LC | LC | yes | no |
| Chaenopsidae | Chaenopsis stephensi | DD | NE | yes | no |
| Chaenopsidae | Coralliozetus cardonae | LC | NE | yes | no |
| Chaenopsidae | Ekemblemaria nigra | LC | NE | yes | no |
| Chaenopsidae | Emblemaria atlantica | LC | LC | yes | no |
| Chaenopsidae | Emblemaria biocellata | LC | NE | yes | no |
| Chaenopsidae | Emblemaria caldwelli | LC | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Chaenopsidae | Emblemaria caycedoi | LC | NE | yes | no |
| Chaenopsidae | Emblemaria culmenis | DD | NE | yes | no |
| Chaenopsidae | Emblemaria diphyodontis | LC | NE | yes | no |
| Chaenopsidae | Emblemaria hyltoni | DD | NE | yes | no |
| Chaenopsidae | Emblemaria pandionis | LC | LC | yes | no |
| Chaenopsidae | Emblemaria piratula | LC | LC | yes | no |
| Chaenopsidae | Emblemaria vitta | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis arawak | DD | NE | yes | no |
| Chaenopsidae | Emblemariopsis bahamensis | LC | LC | yes | no |
| Chaenopsidae | Emblemariopsis bottomei | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis carib | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis dianae | DD | NE | yes | no |
| Chaenopsidae | Emblemariopsis diaphana | LC | LC | yes | no |
| Chaenopsidae | Emblemariopsis leptocirris | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis occidentalis | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis pricei | VU | NE | yes | no |
| Chaenopsidae | Emblemariopsis ramirezi | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis randalli | DD | NE | yes | no |
| Chaenopsidae | Emblemariopsis ruetzleri | LC | NE | yes | no |
| Chaenopsidae | Emblemariopsis signifer | LC | NE | no | no |
| Chaenopsidae | Emblemariopsis tayrona | LC | NE | yes | no |
| Chaenopsidae | Hemiemblemaria simulus | LC | LC | yes | no |
| Chaenopsidae | Lucayablennius zingaro | LC | NE | yes | no |
| Chaenopsidae | Protemblemaria punctata | LC | NE | yes | no |
| Chaenopsidae | Stathmonotus gymnodermis | LC | NE | yes | no |
| Chaenopsidae | Stathmonotus hemphillii | LC | LC | yes | no |
| Chaenopsidae | Stathmonotus stahli | LC | NE | yes | no |
| Chaenopsidae | Stathmonotus tekla | LC | LC | yes | no |
| Chaetodontidae | Chaetodon capistratus | LC | LC | yes | no |
| Chaetodontidae | Chaetodon ocellatus | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Chaetodontidae | Chaetodon sedentarius | LC | LC | no | no |
| Chaetodontidae | Chaetodon striatus | LC | LC | no | no |
| Chaetodontidae | Prognathodes aculeatus | LC | LC | yes | no |
| Chaetodontidae | Prognathodes aya | LC | LC | yes | no |
| Chaetodontidae | Prognathodes guyanensis | LC | LC | no | no |
| Chlopsidae | Catesbya pseudomuraena | DD | NE | yes | no |
| Chlopsidae | Chilorhinus suensonii | LC | DD | yes | no |
| Chlopsidae | Chlopsis bicolor | LC | DD | no | no |
| Chlopsidae | Chlopsis dentatus | DD | DD | yes | no |
| Chlopsidae | Kaupichthys hyoproroides | LC | DD | no | no |
| Chlopsidae | Kaupichthys nuchalis | LC | LC | yes | no |
| Chlopsidae | Robinsia catherinae | LC | NE | no | no |
| Chlorophthalmidae | Parasudis truculenta | LC | LC | no | no |
| Cirrhitidae | Amblycirrhitus pinos | LC | LC | no | no |
| Clupeidae | Alosa aestivalis | VU | NE | no | no |
| Clupeidae | Alosa alabamae | NT | NT | yes | yes |
| Clupeidae | Alosa chrysochloris | LC | LC | yes | yes |
| Clupeidae | Alosa sapidissima | LC | NE | no | no |
| Clupeidae | Brevoortia gunteri | LC | LC | yes | yes |
| Clupeidae | Brevoortia patronus | LC | LC | yes | yes |
| Clupeidae | Brevoortia smithi | LC | LC | yes | no |
| Clupeidae | Brevoortia tyrannus | LC | NE | no | no |
| Clupeidae | Etrumeus sadina | LC | LC | no | no |
| Clupeidae | Harengula clupeola | LC | LC | no | no |
| Clupeidae | Harengula humeralis | LC | LC | yes | no |
| Clupeidae | Harengula jaguana | LC | LC | no | no |
| Clupeidae | Jenkinsia lamprotaenia | LC | LC | yes | no |
| Clupeidae | Jenkinsia majua | LC | LC | yes | no |
| Clupeidae | Jenkinsia parvula | DD | NE | yes | no |
| Clupeidae | Jenkinsia stolifera | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Clupeidae | Lile piquitinga | LC | NE | no | no |
| Clupeidae | Opisthonema oglinum | LC | LC | no | no |
| Clupeidae | Sardinella aurita | LC | LC | no | no |
| Congridae | Ariosoma anale | LC | LC | no | no |
| Congridae | Ariosoma balearicum | LC | LC | no | no |
| Congridae | Conger esculentus | LC | NE | yes | no |
| Congridae | Conger oceanicus | LC | LC | no | no |
| Congridae | Conger triporiceps | LC | LC | yes | no |
| Congridae | Gnathophis bracheatopos | LC | LC | yes | no |
| Congridae | Heteroconger camelopardalis | LC | NE | no | no |
| Congridae | Heteroconger longissimus | LC | LC | no | no |
| Congridae | Heteroconger luteolus | LC | LC | yes | no |
| Congridae | Paraconger caudilimbatus | LC | LC | no | no |
| Congridae | Rhynchoconger flavus | LC | LC | yes | no |
| Congridae | Rhynchoconger gracilior | LC | LC | yes | no |
| Congridae | Rhynchoconger guppyi | LC | NE | yes | no |
| Congridae | Uroconger syringinus | LC | LC | no | no |
| Coryphaenidae | Coryphaena equiselis | LC | LC | no | no |
| Coryphaenidae | Coryphaena hippurus | LC | LC | no | no |
| Cynoglossidae | Symphurus arawak | LC | DD | yes | no |
| Cynoglossidae | Symphurus caribbeanus | LC | LC | yes | no |
| Cynoglossidae | Symphurus civitatium | LC | LC | yes | no |
| Cynoglossidae | Symphurus diomedeanus | LC | LC | no | no |
| Cynoglossidae | Symphurus minor | LC | LC | yes | no |
| Cynoglossidae | Symphurus oculellus | LC | NE | no | no |
| Cynoglossidae | Symphurus ommaspilus | LC | NE | yes | no |
| Cynoglossidae | Symphurus parvus | LC | LC | yes | no |
| Cynoglossidae | Symphurus pelicanus | LC | LC | yes | no |
| Cynoglossidae | Symphurus piger | LC | LC | yes | no |
| Cynoglossidae | Symphurus plagiusa | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Cynoglossidae | Symphurus plagusia | LC | NE | no | no |
| Cynoglossidae | Symphurus pusillus | LC | DD | no | no |
| Cynoglossidae | Symphurus rhytisma | LC | NE | no | no |
| Cynoglossidae | Symphurus tessellatus | LC | DD | no | no |
| Cynoglossidae | Symphurus urospilus | LC | LC | yes | no |
| Cyprinodontidae | Cyprinodon artifrons | LC | LC | yes | no |
| Cyprinodontidae | Cyprinodon variegatus | LC | LC | no | no |
| Cyprinodontidae | Floridichthys carpio | LC | LC | yes | no |
| Cyprinodontidae | Floridichthys polyommus | LC | LC | yes | no |
| Dactylopteridae | Dactylopterus volitans | LC | LC | no | no |
| Dactyloscopidae | Dactylagnus peratikos | DD | NE | yes | no |
| Dactyloscopidae | Dactyloscopus boehlkei | LC | NE | yes | no |
| Dactyloscopidae | Dactyloscopus comptus | LC | NE | yes | no |
| Dactyloscopidae | Dactyloscopus crossotus | LC | DD | no | no |
| Dactyloscopidae | Dactyloscopus foraminosus | LC | DD | no | no |
| Dactyloscopidae | Dactyloscopus moorei | LC | LC | yes | no |
| Dactyloscopidae | Dactyloscopus poeyi | LC | LC | yes | no |
| Dactyloscopidae | Dactyloscopus tridigitatus | LC | LC | no | no |
| Dactyloscopidae | Gillellus greyae | LC | LC | no | no |
| Dactyloscopidae | Gillellus healae | LC | LC | yes | no |
| Dactyloscopidae | Gillellus inescatus | DD | NE | yes | no |
| Dactyloscopidae | Gillellus jacksoni | LC | NE | yes | no |
| Dactyloscopidae | Gillellus uranidea | LC | LC | yes | no |
| Dactyloscopidae | Leurochilus acon | LC | NE | yes | no |
| Dactyloscopidae | Myxodagnus belone | DD | NE | yes | no |
| Dactyloscopidae | Platygillellus rubrocinctus | LC | LC | yes | no |
| Dactyloscopidae | Platygillellus smithi | DD | NE | yes | no |
| Diodontidae | Chilomycterus antennatus | LC | LC | yes | no |
| Diodontidae | Chilomycterus antillarum | LC | LC | no | no |
| Diodontidae | Chilomycterus reticulatus | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Diodontidae | Chilomycterus schoepfii | LC | LC | no | no |
| Diodontidae | Chilomycterus spinosus ssp. spinosus | LC | NE | no | no |
| Diodontidae | Diodon eydouxii | LC | DD | no | no |
| Diodontidae | Diodon holocanthus | LC | LC | no | no |
| Diodontidae | Diodon hystrix | LC | LC | no | no |
| Echeneidae | Echeneis naucrates | LC | LC | no | no |
| Echeneidae | Echeneis neucratoides | DD | DD | no | no |
| Echeneidae | Phtheirichthys lineatus | LC | LC | no | no |
| Echeneidae | Remora albescens | LC | LC | no | no |
| Echeneidae | Remora australis | LC | LC | no | no |
| Echeneidae | Remora brachyptera | LC | LC | no | no |
| Echeneidae | Remora osteochir | LC | LC | no | no |
| Echeneidae | Remora remora | LC | LC | no | no |
| Eleotridae | Dormitator maculatus | LC | LC | no | no |
| Eleotridae | Eleotris amblyopsis | LC | LC | no | no |
| Eleotridae | Eleotris perniger | LC | LC | no | no |
| Eleotridae | Eleotris pisonis | LC | NE | no | no |
| Eleotridae | Erotelis smaragdus | LC | LC | no | no |
| Eleotridae | Gobiomorus dormitor | LC | LC | no | no |
| Eleotridae | Guavina guavina | LC | LC | no | no |
| Eleotridae | Leptophilypnus fluviatilis | LC | NE | yes | no |
| Elopidae | Elops saurus | LC | LC | yes | no |
| Elopidae | Elops smithi | DD | DD | no | no |
| Emmelichthyidae | Emmelichthys ruber | LC | DD | no | no |
| Emmelichthyidae | Erythrocles monodi | LC | DD | no | no |
| Engraulidae | Anchoa cayorum | LC | LC | yes | no |
| Engraulidae | Anchoa choerostoma | EN | NE | yes | no |
| Engraulidae | Anchoa colonensis | LC | LC | yes | no |
| Engraulidae | Anchoa cubana | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Engraulidae | Anchoa filifera | LC | NE | no | no |
| Engraulidae | Anchoa hepsetus | LC | LC | no | no |
| Engraulidae | Anchoa lamprotaenia | LC | LC | yes | no |
| Engraulidae | Anchoa lyolepis | LC | LC | no | no |
| Engraulidae | Anchoa mitchilli | LC | LC | no | no |
| Engraulidae | Anchoa parva | LC | LC | no | no |
| Engraulidae | Anchoa spinifer | LC | NE | no | no |
| Engraulidae | Anchoa trinitatis | DD | NE | yes | no |
| Engraulidae | Anchovia clupeoides | LC | DD | no | no |
| Engraulidae | Anchoviella blackburni | DD | NE | yes | no |
| Engraulidae | Anchoviella brevirostris | LC | NE | no | no |
| Engraulidae | Anchoviella cayennensis | LC | NE | no | no |
| Engraulidae | Anchoviella elongata | LC | NE | yes | no |
| Engraulidae | Anchoviella lepidentostole | LC | NE | no | no |
| Engraulidae | Anchoviella perfasciata | LC | LC | yes | no |
| Engraulidae | Cetengraulis edentulus | LC | LC | no | no |
| Engraulidae | Engraulis eurystole | LC | LC | no | no |
| Engraulidae | Lycengraulis grossidens | LC | NE | no | no |
| Ephippidae | Chaetodipterus faber | LC | LC | no | no |
| Epinephelidae | Alphestes afer | LC | LC | no | no |
| Epinephelidae | Cephalopholis cruentata | LC | LC | yes | no |
| Epinephelidae | Cephalopholis fulva | LC | LC | no | no |
| Epinephelidae | Dermatolepis inermis | NT | LC | no | no |
| Epinephelidae | Epinephelus adscensionis | LC | LC | no | no |
| Epinephelidae | Epinephelus drummondhayi | CR | LC | yes | no |
| Epinephelidae | Epinephelus guttatus | LC | LC | yes | no |
| Epinephelidae | Epinephelus itajara | CR | EN | no | no |
| Epinephelidae | Epinephelus morio | NT | NT | no | no |
| Epinephelidae | Epinephelus striatus | EN | CR | yes | no |
| Epinephelidae | Gonioplectrus hispanus | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Epinephelidae | Hyporthodus flavolimbatus | VU | LC | no | no |
| Epinephelidae | Hyporthodus mystacinus | LC | LC | no | no |
| Epinephelidae | Hyporthodus nigritus | CR | NT | no | no |
| Epinephelidae | Hyporthodus niveatus | VU | LC | no | no |
| Epinephelidae | Liopropoma aberrans | LC | LC | yes | no |
| Epinephelidae | Liopropoma carmabi | LC | LC | yes | no |
| Epinephelidae | Liopropoma eukrines | LC | LC | yes | no |
| Epinephelidae | Liopropoma mowbrayi | LC | LC | yes | no |
| Epinephelidae | Liopropoma olneyi | DD | NE | yes | no |
| Epinephelidae | Liopropoma rubre | LC | LC | yes | no |
| Epinephelidae | Liopropoma santi | DD | NE | yes | no |
| Epinephelidae | Mycteroperca acutirostris | LC | LC | no | no |
| Epinephelidae | Mycteroperca bonaci | NT | VU | no | no |
| Epinephelidae | Mycteroperca cidi | DD | NE | yes | no |
| Epinephelidae | Mycteroperca interstitialis | VU | VU | no | no |
| Epinephelidae | Mycteroperca microlepis | LC | LC | no | no |
| Epinephelidae | Mycteroperca phenax | LC | LC | yes | no |
| Epinephelidae | Mycteroperca tigris | LC | LC | no | no |
| Epinephelidae | Mycteroperca venenosa | NT | EN | no | no |
| Epinephelidae | Paranthias furcifer | LC | LC | no | no |
| Epinephelidae | Pseudogramma gregoryi | LC | LC | no | no |
| Epinephelidae | Rypticus bistrispinus | LC | LC | no | no |
| Epinephelidae | Rypticus bornoi | LC | NE | yes | no |
| Epinephelidae | Rypticus carpenteri | LC | LC | yes | no |
| Epinephelidae | Rypticus maculatus | LC | LC | yes | no |
| Epinephelidae | Rypticus randalli | LC | DD | no | no |
| Epinephelidae | Rypticus saponaceus | LC | LC | no | no |
| Epinephelidae | Rypticus subbifrenatus | LC | LC | no | no |
| Exocoetidae | Cheilopogon cyanopterus | LC | LC | no | no |
| Exocoetidae | Cheilopogon exsiliens | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Exocoetidae | Cheilopogon furcatus | LC | LC | no | no |
| Exocoetidae | Cheilopogon heterurus | LC | NE | no | no |
| Exocoetidae | Cheilopogon melanurus | LC | LC | no | no |
| Exocoetidae | Cypselurus comatus | LC | DD | no | no |
| Exocoetidae | Exocoetus obtusirostris | LC | LC | no | no |
| Exocoetidae | Exocoetus volitans | LC | LC | no | no |
| Exocoetidae | Hirundichthys affinis | LC | LC | no | no |
| Exocoetidae | Hirundichthys speculiger | LC | LC | no | no |
| Exocoetidae | Hirundichthys volador | LC | LC | no | no |
| Exocoetidae | Parexocoetus hillianus | LC | LC | no | no |
| Exocoetidae | Prognichthys glaphyrae | LC | NE | no | no |
| Exocoetidae | Prognichthys occidentalis | LC | LC | no | no |
| Fistulariidae | Fistularia petimba | LC | LC | no | no |
| Fistulariidae | Fistularia tabacaria | LC | LC | no | no |
| Fundulidae | Fundulus grandis | LC | LC | yes | no |
| Fundulidae | Fundulus grandissimus | VU | VU | yes | yes |
| Fundulidae | Fundulus jenkinsi | VU | VU | yes | yes |
| Fundulidae | Fundulus majalis | LC | NE | no | no |
| Fundulidae | Fundulus persimilis | EN | EN | yes | yes |
| Fundulidae | Fundulus pulvereus | LC | LC | yes | yes |
| Fundulidae | Fundulus similis | LC | LC | yes | no |
| Fundulidae | Fundulus xenicus | LC | LC | yes | yes |
| Gempylidae | Gempylus serpens | LC | LC | no | no |
| Gerreidae | Diapterus auratus | LC | LC | no | no |
| Gerreidae | Diapterus rhombeus | LC | LC | no | no |
| Gerreidae | Eucinostomus argenteus | LC | LC | no | no |
| Gerreidae | Eucinostomus gula | LC | LC | no | no |
| Gerreidae | Eucinostomus harengulus | LC | LC | no | no |
| Gerreidae | Eucinostomus havana | LC | LC | yes | no |
| Gerreidae | Eucinostomus jonesii | LC | LC | no | no |

| **Family** | **Species Name** | **Global** | **Gulf of Mexico** | **Greater Caribbean endemic?** | **Gulf of Mexico endemic?** |
|---|---|---|---|---|---|
| Gerreidae | Eucinostomus lefroyi | LC | LC | no | no |
| Gerreidae | Eucinostomus melanopterus | LC | LC | no | no |
| Gerreidae | Eugerres awlae | LC | LC | yes | no |
| Gerreidae | Eugerres brasilianus | LC | LC | no | no |
| Gerreidae | Eugerres plumieri | LC | LC | yes | no |
| Gerreidae | Gerres cinereus | LC | LC | no | no |
| Gobiesocidae | Acyrtops amplicirrus | LC | NE | yes | no |
| Gobiesocidae | Acyrtops beryllinus | LC | LC | no | no |
| Gobiesocidae | Acyrtus artius | LC | NE | no | no |
| Gobiesocidae | Acyrtus lanthanum | LC | NE | yes | no |
| Gobiesocidae | Acyrtus rubiginosus | LC | NE | yes | no |
| Gobiesocidae | Arcos nudus | LC | NE | yes | no |
| Gobiesocidae | Derilissus altifrons | LC | NE | yes | no |
| Gobiesocidae | Derilissus kremnobates | DD | NE | yes | no |
| Gobiesocidae | Derilissus lombardii | DD | NE | yes | no |
| Gobiesocidae | Derilissus nanus | DD | NE | yes | no |
| Gobiesocidae | Derilissus vittiger | DD | NE | yes | no |
| Gobiesocidae | Gobiesox barbatulus | LC | NE | no | no |
| Gobiesocidae | Gobiesox lucayanus | LC | NE | yes | no |
| Gobiesocidae | Gobiesox nigripinnis | LC | NE | yes | no |
| Gobiesocidae | Gobiesox punctulatus | LC | NE | yes | no |
| Gobiesocidae | Gobiesox strumosus | LC | LC | no | no |
| Gobiesocidae | Tomicodon briggsi | LC | NE | yes | no |
| Gobiesocidae | Tomicodon clarkei | DD | NE | yes | no |
| Gobiesocidae | Tomicodon cryptus | LC | NE | yes | no |
| Gobiesocidae | Tomicodon fasciatus | LC | NE | yes | no |
| Gobiesocidae | Tomicodon lavettsmithi | DD | NE | yes | no |
| Gobiesocidae | Tomicodon leurodiscus | LC | NE | yes | no |
| Gobiesocidae | Tomicodon reitzae | LC | LC | yes | no |
| Gobiesocidae | Tomicodon rhabdotus | LC | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Gobiesocidae | Tomicodon rupestris | LC | LC | yes | no |
| Gobiidae | Akko dionaea | DD | NE | no | no |
| Gobiidae | Antilligobius nikkiae | LC | NE | yes | no |
| Gobiidae | Awaous flavus | LC | NE | no | no |
| Gobiidae | Barbulifer antennatus | LC | NE | yes | no |
| Gobiidae | Barbulifer ceuthoecus | LC | LC | no | no |
| Gobiidae | Bathygobius antilliensis | LC | LC | yes | no |
| Gobiidae | Bathygobius curacao | LC | LC | yes | no |
| Gobiidae | Bathygobius geminatus | DD | NE | yes | no |
| Gobiidae | Bathygobius lacertus | LC | LC | yes | no |
| Gobiidae | Bathygobius mystacium | LC | LC | no | no |
| Gobiidae | Bathygobius soporator | LC | LC | no | no |
| Gobiidae | Bollmannia boqueronensis | LC | LC | yes | no |
| Gobiidae | Bollmannia communis | LC | LC | yes | yes |
| Gobiidae | Bollmannia eigenmanni | LC | LC | yes | no |
| Gobiidae | Bollmannia litura | LC | NE | yes | no |
| Gobiidae | Chriolepis benthonis | DD | DD | yes | yes |
| Gobiidae | Chriolepis bilix | LC | DD | yes | no |
| Gobiidae | Chriolepis fisheri | LC | NE | no | no |
| Gobiidae | Chriolepis vespa | LC | LC | yes | yes |
| Gobiidae | Coryphopterus alloides | VU | NE | yes | no |
| Gobiidae | Coryphopterus dicrus | LC | LC | no | no |
| Gobiidae | Coryphopterus eidolon | VU | VU | yes | no |
| Gobiidae | Coryphopterus glaucofraenum | LC | LC | no | no |
| Gobiidae | Coryphopterus hyalinus | VU | VU | yes | no |
| Gobiidae | Coryphopterus kuna | DD | NE | yes | no |
| Gobiidae | Coryphopterus lipernes | VU | VU | yes | no |
| Gobiidae | Coryphopterus personatus | VU | VU | yes | no |
| Gobiidae | Coryphopterus punctipectophorus | LC | LC | yes | no |

| **Family** | **Species Name** | **Global** | **Gulf of Mexico** | **Greater Caribbean endemic?** | **Gulf of Mexico endemic?** |
|---|---|---|---|---|---|
| Gobiidae | Coryphopterus thrix | VU | VU | yes | no |
| Gobiidae | Coryphopterus tortugae | VU | VU | yes | no |
| Gobiidae | Coryphopterus venezuelae | VU | NE | yes | no |
| Gobiidae | Ctenogobius boleosoma | LC | LC | no | no |
| Gobiidae | Ctenogobius claytonii | VU | VU | yes | yes |
| Gobiidae | Ctenogobius fasciatus | LC | NE | yes | no |
| Gobiidae | Ctenogobius phenacus | LC | NE | yes | no |
| Gobiidae | Ctenogobius pseudofasciatus | LC | NE | yes | no |
| Gobiidae | Ctenogobius saepepallens | LC | LC | yes | no |
| Gobiidae | Ctenogobius shufeldti | LC | LC | yes | no |
| Gobiidae | Ctenogobius smaragdus | LC | LC | no | no |
| Gobiidae | Ctenogobius stigmaticus | LC | LC | no | no |
| Gobiidae | Ctenogobius stigmaturus | LC | LC | yes | no |
| Gobiidae | Ctenogobius thoropsis | LC | NE | no | no |
| Gobiidae | Elacatinus atronasus | EN | NE | yes | no |
| Gobiidae | Elacatinus cayman | VU | NE | yes | no |
| Gobiidae | Elacatinus centralis | EN | NE | yes | no |
| Gobiidae | Elacatinus chancei | LC | NE | yes | no |
| Gobiidae | Elacatinus colini | LC | NE | yes | no |
| Gobiidae | Elacatinus evelynae | LC | DD | yes | no |
| Gobiidae | Elacatinus genie | LC | NE | yes | no |
| Gobiidae | Elacatinus horsti | LC | NE | yes | no |
| Gobiidae | Elacatinus illecebrosus | LC | NE | yes | no |
| Gobiidae | Elacatinus jarocho | EN | EN | yes | yes |
| Gobiidae | Elacatinus lobeli | NT | NE | yes | no |
| Gobiidae | Elacatinus lori | LC | NE | yes | no |
| Gobiidae | Elacatinus louisae | LC | NE | yes | no |
| Gobiidae | Elacatinus oceanops | LC | LC | yes | no |
| Gobiidae | Elacatinus panamensis | DD | NE | yes | no |
| Gobiidae | Elacatinus prochilos | VU | EN | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Gobiidae | Elacatinus randalli | LC | NE | yes | no |
| Gobiidae | Elacatinus rubrigenis | DD | NE | yes | no |
| Gobiidae | Elacatinus serranilla | LC | NE | yes | no |
| Gobiidae | Elacatinus tenox | LC | NE | yes | no |
| Gobiidae | Elacatinus xanthiprora | LC | LC | yes | no |
| Gobiidae | Evermannichthys bicolor | DD | NE | yes | no |
| Gobiidae | Evermannichthys convictor | DD | NE | yes | no |
| Gobiidae | Evermannichthys metzelaari | LC | NE | yes | no |
| Gobiidae | Evermannichthys silus | DD | NE | yes | no |
| Gobiidae | Evermannichthys spongicola | LC | LC | yes | no |
| Gobiidae | Evorthodus lyricus | LC | LC | no | no |
| Gobiidae | Ginsburgellus novemlineatus | LC | NE | yes | no |
| Gobiidae | Gnatholepis thompsoni | LC | LC | no | no |
| Gobiidae | Gobioides broussonnetii | LC | LC | no | no |
| Gobiidae | Gobioides grahamae | DD | NE | no | no |
| Gobiidae | Gobionellus oceanicus | LC | LC | no | no |
| Gobiidae | Gobiosoma bosc | LC | LC | no | no |
| Gobiidae | Gobiosoma ginsburgi | LC | NE | no | no |
| Gobiidae | Gobiosoma grosvenori | LC | LC | yes | no |
| Gobiidae | Gobiosoma hildebrandi | VU | NE | yes | no |
| Gobiidae | Gobiosoma longipala | LC | LC | yes | yes |
| Gobiidae | Gobiosoma robustum | LC | LC | yes | no |
| Gobiidae | Gobiosoma spes | LC | NE | yes | no |
| Gobiidae | Gobiosoma spilotum | EN | NE | yes | no |
| Gobiidae | Gobiosoma yucatanum | LC | NE | yes | no |
| Gobiidae | Gobulus myersi | LC | LC | no | no |
| Gobiidae | Lophogobius cyprinoides | LC | LC | no | no |
| Gobiidae | Lythrypnus crocodilus | LC | NE | yes | no |
| Gobiidae | Lythrypnus elasson | LC | LC | yes | no |
| Gobiidae | Lythrypnus heterochroma | LC | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Gobiidae | Lythrypnus minimus | LC | NE | yes | no |
| Gobiidae | Lythrypnus mowbrayi | LC | NE | yes | no |
| Gobiidae | Lythrypnus nesiotes | LC | LC | yes | no |
| Gobiidae | Lythrypnus okapia | LC | NE | yes | no |
| Gobiidae | Lythrypnus phorellus | LC | LC | yes | no |
| Gobiidae | Lythrypnus spilus | LC | LC | yes | no |
| Gobiidae | Microgobius carri | LC | LC | yes | no |
| Gobiidae | Microgobius gulosus | LC | LC | no | no |
| Gobiidae | Microgobius meeki | LC | NE | no | no |
| Gobiidae | Microgobius microlepis | LC | LC | yes | no |
| Gobiidae | Microgobius signatus | LC | DD | yes | no |
| Gobiidae | Microgobius thalassinus | LC | LC | no | no |
| Gobiidae | Nes longus | LC | LC | yes | no |
| Gobiidae | Oxyurichthys stigmalophius | LC | LC | yes | no |
| Gobiidae | Palatogobius paradoxus | LC | LC | yes | no |
| Gobiidae | Pariah scotius | LC | NE | yes | no |
| Gobiidae | Parrella macropteryx | LC | DD | no | no |
| Gobiidae | Priolepis dawsoni | LC | NE | no | no |
| Gobiidae | Priolepis hipoliti | LC | LC | no | no |
| Gobiidae | Priolepis robinsi | LC | NE | yes | no |
| Gobiidae | Psilotris alepis | LC | LC | yes | no |
| Gobiidae | Psilotris amblyrhynchus | DD | NE | yes | no |
| Gobiidae | Psilotris batrachodes | LC | NE | yes | no |
| Gobiidae | Psilotris boehlkei | VU | NE | yes | no |
| Gobiidae | Psilotris celsus | LC | NE | no | no |
| Gobiidae | Psilotris kaufmani | LC | NE | yes | no |
| Gobiidae | Pycnomma roosevelti | LC | NE | yes | no |
| Gobiidae | Risor ruber | LC | LC | no | no |
| Gobiidae | Robinsichthys arrowsmithensis | DD | NE | yes | no |
| Gobiidae | Sicydium punctatum | LC | NE | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Gobiidae | Tigrigobius dilepis | LC | LC | yes | no |
| Gobiidae | Tigrigobius gemmatus | LC | NE | yes | no |
| Gobiidae | Tigrigobius harveyi | EN | NE | yes | no |
| Gobiidae | Tigrigobius macrodon | LC | LC | yes | no |
| Gobiidae | Tigrigobius multifasciatus | LC | LC | yes | no |
| Gobiidae | Tigrigobius pallens | LC | NE | yes | no |
| Gobiidae | Tigrigobius redimiculus | VU | VU | yes | yes |
| Gobiidae | Tigrigobius saucrus | LC | VU | yes | no |
| Gobiidae | Tigrigobius zebrellus | LC | NE | yes | no |
| Gobiidae | Varicus imswe | DD | NE | yes | no |
| Gobiidae | Varicus marilynae | DD | DD | yes | no |
| Gobiidae | Vomerogobius flavus | DD | NE | yes | no |
| Grammatidae | Gramma dejongi | DD | NE | yes | no |
| Grammatidae | Gramma linki | LC | NE | yes | no |
| Grammatidae | Gramma loreto | LC | LC | yes | no |
| Grammatidae | Gramma melacara | LC | NE | yes | no |
| Grammatidae | Lipogramma anabantoides | LC | DD | yes | no |
| Grammatidae | Lipogramma evides | LC | NE | yes | no |
| Grammatidae | Lipogramma flavescens | DD | NE | yes | no |
| Grammatidae | Lipogramma klayi | LC | NE | yes | no |
| Grammatidae | Lipogramma regia | LC | DD | yes | no |
| Grammatidae | Lipogramma robinsi | DD | NE | yes | no |
| Grammatidae | Lipogramma rosea | LC | NE | yes | no |
| Grammatidae | Lipogramma trilineata | LC | DD | yes | no |
| Haemulidae | Anisotremus moricandi | LC | NE | no | no |
| Haemulidae | Anisotremus surinamensis | DD | DD | no | no |
| Haemulidae | Anisotremus virginicus | LC | LC | no | no |
| Haemulidae | Conodon nobilis | LC | LC | no | no |
| Haemulidae | Emmelichthyops atlanticus | LC | LC | yes | no |
| Haemulidae | Genyatremus cavifrons | DD | NE | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Haemulidae | Haemulon album | DD | DD | yes | no |
| Haemulidae | Haemulon aurolineatum | LC | LC | no | no |
| Haemulidae | Haemulon bonariense | LC | LC | yes | no |
| Haemulidae | Haemulon boschmae | LC | LC | yes | no |
| Haemulidae | Haemulon carbonarium | LC | LC | yes | no |
| Haemulidae | Haemulon chrysargyreum | LC | LC | yes | no |
| Haemulidae | Haemulon flavolineatum | LC | LC | yes | no |
| Haemulidae | Haemulon macrostomum | LC | LC | yes | no |
| Haemulidae | Haemulon melanurum | LC | LC | no | no |
| Haemulidae | Haemulon parra | LC | LC | no | no |
| Haemulidae | Haemulon plumierii | LC | LC | no | no |
| Haemulidae | Haemulon sciurus | LC | LC | yes | no |
| Haemulidae | Haemulon steindachneri | LC | NE | no | no |
| Haemulidae | Haemulon striatum | LC | LC | no | no |
| Haemulidae | Haemulon vittatum | LC | LC | yes | no |
| Haemulidae | Haemulopsis corvinaeformis | LC | NE | no | no |
| Haemulidae | Orthopristis chrysoptera | LC | LC | no | no |
| Haemulidae | Orthopristis ruber | LC | NE | no | no |
| Haemulidae | Pomadasys crocro | DD | DD | no | no |
| Hemiramphidae | Chriodorus atherinoides | LC | LC | yes | no |
| Hemiramphidae | Euleptorhamphus velox | LC | LC | no | no |
| Hemiramphidae | Hemiramphus balao | LC | LC | no | no |
| Hemiramphidae | Hemiramphus bermudensis | LC | NE | yes | no |
| Hemiramphidae | Hemiramphus brasiliensis | LC | LC | no | no |
| Hemiramphidae | Hyporhamphus collettei | LC | NE | yes | no |
| Hemiramphidae | Hyporhamphus meeki | LC | LC | no | no |
| Hemiramphidae | Hyporhamphus roberti | LC | NE | no | no |
| Hemiramphidae | Hyporhamphus unifasciatus | LC | LC | no | no |
| Hemiramphidae | Oxyporhamphus micropterus similis | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Heterenchelyidae | Pythonichthys sanguineus | LC | NE | yes | no |
| Holocentridae | Corniger spinosus | LC | LC | no | no |
| Holocentridae | Holocentrus adscensionis | LC | LC | no | no |
| Holocentridae | Holocentrus rufus | LC | LC | no | no |
| Holocentridae | Myripristis jacobus | LC | LC | no | no |
| Holocentridae | Neoniphon marianus | LC | LC | yes | no |
| Holocentridae | Ostichthys trachypoma | LC | LC | no | no |
| Holocentridae | Plectrypops retrospinis | LC | LC | no | no |
| Holocentridae | Sargocentron bullisi | LC | LC | no | no |
| Holocentridae | Sargocentron coruscum | LC | LC | yes | no |
| Holocentridae | Sargocentron poco | LC | LC | yes | no |
| Holocentridae | Sargocentron vexillarium | LC | LC | yes | no |
| Istiophoridae | Istiophorus platypterus | LC | LC | no | no |
| Istiophoridae | Kajikia albida | VU | VU | no | no |
| Istiophoridae | Makaira nigricans | VU | EN | no | no |
| Istiophoridae | Tetrapturus georgii | DD | DD | no | no |
| Istiophoridae | Tetrapturus pfluegeri | LC | LC | no | no |
| Kyphosidae | Kyphosus bigibbus | LC | NE | no | no |
| Kyphosidae | Kyphosus cinerascens | LC | LC | no | no |
| Kyphosidae | Kyphosus sectatrix | LC | LC | no | no |
| Kyphosidae | Kyphosus vaigiensis | LC | LC | no | no |
| Labridae | Bodianus pulchellus | LC | LC | no | no |
| Labridae | Bodianus rufus | LC | LC | no | no |
| Labridae | Clepticus parrae | LC | LC | yes | no |
| Labridae | Cryptotomus roseus | LC | LC | no | no |
| Labridae | Decodon puellaris | LC | LC | no | no |
| Labridae | Doratonotus megalepis | LC | LC | no | no |
| Labridae | Halichoeres bathyphilus | LC | LC | yes | no |
| Labridae | Halichoeres bivittatus | LC | LC | no | no |
| Labridae | Halichoeres burekae | EN | EN | yes | yes |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Labridae | Halichoeres caudalis | LC | LC | yes | no |
| Labridae | Halichoeres cyanocephalus | LC | LC | yes | no |
| Labridae | Halichoeres garnoti | LC | LC | yes | no |
| Labridae | Halichoeres maculipinna | LC | LC | yes | no |
| Labridae | Halichoeres pictus | LC | LC | yes | no |
| Labridae | Halichoeres poeyi | LC | LC | no | no |
| Labridae | Halichoeres radiatus | LC | LC | yes | no |
| Labridae | Halichoeres socialis | EN | NE | yes | no |
| Labridae | Lachnolaimus maximus | VU | VU | yes | no |
| Labridae | Nicholsina usta | LC | LC | no | no |
| Labridae | Scarus coelestinus | DD | LC | yes | no |
| Labridae | Scarus coeruleus | LC | LC | yes | no |
| Labridae | Scarus guacamaia | NT | LC | yes | no |
| Labridae | Scarus iseri | LC | LC | yes | no |
| Labridae | Scarus taeniopterus | LC | LC | yes | no |
| Labridae | Scarus vetula | LC | LC | yes | no |
| Labridae | Sparisoma atomarium | LC | LC | yes | no |
| Labridae | Sparisoma aurofrenatum | LC | LC | yes | no |
| Labridae | Sparisoma chrysopterum | LC | LC | yes | no |
| Labridae | Sparisoma frondosum | DD | NE | no | no |
| Labridae | Sparisoma griseorubrum | DD | NE | yes | no |
| Labridae | Sparisoma radians | LC | LC | no | no |
| Labridae | Sparisoma rubripinne | LC | LC | yes | no |
| Labridae | Sparisoma viride | LC | LC | yes | no |
| Labridae | Thalassoma bifasciatum | LC | LC | yes | no |
| Labridae | Xyrichtys martinicensis | LC | LC | no | no |
| Labridae | Xyrichtys novacula | LC | LC | no | no |
| Labridae | Xyrichtys splendens | LC | LC | no | no |
| Labrisomidae | Brockius albigenys | LC | NE | yes | no |
| Labrisomidae | Brockius nigricinctus | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Labrisomidae | Gobioclinus bucciferus | LC | LC | yes | no |
| Labrisomidae | Gobioclinus filamentosus | LC | DD | yes | no |
| Labrisomidae | Gobioclinus gobio | LC | LC | yes | no |
| Labrisomidae | Gobioclinus guppyi | LC | LC | yes | no |
| Labrisomidae | Gobioclinus haitiensis | LC | LC | yes | no |
| Labrisomidae | Gobioclinus kalisherae | LC | LC | yes | no |
| Labrisomidae | Haptoclinus apectolophus | DD | NE | yes | no |
| Labrisomidae | Haptoclinus dropi | DD | NE | yes | no |
| Labrisomidae | Labrisomus nuchipinnis | LC | LC | yes | no |
| Labrisomidae | Malacoctenus aurolineatus | LC | LC | yes | no |
| Labrisomidae | Malacoctenus boehlkei | LC | NE | yes | no |
| Labrisomidae | Malacoctenus delalandii | LC | NE | no | no |
| Labrisomidae | Malacoctenus erdmani | LC | LC | yes | no |
| Labrisomidae | Malacoctenus gilli | LC | LC | yes | no |
| Labrisomidae | Malacoctenus macropus | LC | LC | yes | no |
| Labrisomidae | Malacoctenus triangulatus | LC | LC | yes | no |
| Labrisomidae | Malacoctenus versicolor | LC | LC | yes | no |
| Labrisomidae | Nemaclinus atelestos | LC | DD | yes | no |
| Labrisomidae | Paraclinus barbatus | LC | NE | yes | no |
| Labrisomidae | Paraclinus cingulatus | LC | NE | yes | no |
| Labrisomidae | Paraclinus fasciatus | LC | LC | yes | no |
| Labrisomidae | Paraclinus grandicomis | LC | LC | yes | no |
| Labrisomidae | Paraclinus infrons | LC | DD | yes | no |
| Labrisomidae | Paraclinus marmoratus | LC | LC | yes | no |
| Labrisomidae | Paraclinus naeorhegmis | LC | NE | yes | no |
| Labrisomidae | Paraclinus nigripinnis | LC | LC | yes | no |
| Labrisomidae | Starksia atlantica | LC | NE | yes | no |
| Labrisomidae | Starksia culebrae | LC | NE | yes | no |
| Labrisomidae | Starksia elongata | LC | NE | yes | no |
| Labrisomidae | Starksia fasciata | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Labrisomidae | Starksia greenfieldi | LC | NE | yes | no |
| Labrisomidae | Starksia guttata | LC | NE | yes | no |
| Labrisomidae | Starksia hassi | LC | NE | yes | no |
| Labrisomidae | Starksia langi | LC | NE | yes | no |
| Labrisomidae | Starksia lepicoelia | LC | DD | yes | no |
| Labrisomidae | Starksia leucovitta | DD | NE | yes | no |
| Labrisomidae | Starksia melasma | LC | NE | yes | no |
| Labrisomidae | Starksia nanodes | LC | DD | yes | no |
| Labrisomidae | Starksia occidentalis | LC | NE | yes | no |
| Labrisomidae | Starksia ocellata | LC | LC | yes | no |
| Labrisomidae | Starksia rava | LC | NE | yes | no |
| Labrisomidae | Starksia robertsoni | LC | NE | yes | no |
| Labrisomidae | Starksia sangreyae | LC | NE | yes | no |
| Labrisomidae | Starksia sella | DD | NE | yes | no |
| Labrisomidae | Starksia sluiteri | LC | NE | yes | no |
| Labrisomidae | Starksia smithvanizi | LC | NE | yes | no |
| Labrisomidae | Starksia springeri | DD | NE | yes | no |
| Labrisomidae | Starksia starcki | LC | DD | yes | no |
| Labrisomidae | Starksia variabilis | DD | NE | yes | no |
| Labrisomidae | Starksia weigti | LC | DD | yes | no |
| Labrisomidae | Starksia williamsi | LC | NE | yes | no |
| Labrisomidae | Starksia y-lineata | DD | NE | yes | no |
| Lampridae | Lampris guttatus | LC | LC | no | no |
| Lobotidae | Lobotes surinamensis | LC | LC | no | no |
| Lophiidae | Lophiodes reticulatus | LC | LC | yes | no |
| Lophiidae | Lophius gastrophysus | LC | LC | no | no |
| Lutjanidae | Apsilus dentatus | LC | LC | yes | no |
| Lutjanidae | Etelis oculatus | DD | LC | no | no |
| Lutjanidae | Lutjanus analis | NT | LC | no | no |
| Lutjanidae | Lutjanus apodus | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Lutjanidae | Lutjanus buccanella | DD | LC | no | no |
| Lutjanidae | Lutjanus campechanus | VU | VU | yes | no |
| Lutjanidae | Lutjanus cyanopterus | VU | DD | no | no |
| Lutjanidae | Lutjanus griseus | LC | LC | no | no |
| Lutjanidae | Lutjanus jocu | DD | LC | no | no |
| Lutjanidae | Lutjanus mahogoni | LC | LC | yes | no |
| Lutjanidae | Lutjanus synagris | NT | NT | no | no |
| Lutjanidae | Lutjanus vivanus | LC | LC | no | no |
| Lutjanidae | Ocyurus chrysurus | DD | LC | no | no |
| Lutjanidae | Pristipomoides aquilonaris | LC | LC | no | no |
| Lutjanidae | Pristipomoides freemani | LC | NE | no | no |
| Lutjanidae | Pristipomoides macrophthalmus | LC | LC | yes | no |
| Lutjanidae | Rhomboplites aurorubens | VU | VU | no | no |
| Luvaridae | Luvarus imperialis | LC | DD | no | no |
| Malacanthidae | Caulolatilus chrysops | LC | LC | no | no |
| Malacanthidae | Caulolatilus cyanops | LC | LC | yes | no |
| Malacanthidae | Caulolatilus guppyi | LC | NE | yes | no |
| Malacanthidae | Caulolatilus intermedius | LC | LC | yes | yes |
| Malacanthidae | Caulolatilus microps | DD | DD | yes | no |
| Malacanthidae | Caulolatilus williamsi | DD | NE | yes | no |
| Malacanthidae | Lopholatilus chamaeleonticeps | EN | EN | no | no |
| Malacanthidae | Malacanthus plumieri | LC | LC | no | no |
| Megalopidae | Megalops atlanticus | VU | DD | no | no |
| Merlucciidae | Merluccius albidus | LC | LC | no | no |
| Merlucciidae | Merluccius bilinearis | NT | NE | no | no |
| Microdesmidae | Cerdale floridana | LC | LC | yes | no |
| Microdesmidae | Microdesmus bahianus | LC | NE | no | no |
| Microdesmidae | Microdesmus carri | LC | LC | yes | no |
| Microdesmidae | Microdesmus lanceolatus | LC | LC | yes | yes |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Microdesmidae | Microdesmus longipinnis | LC | LC | yes | no |
| Microdesmidae | Microdesmus luscus | DD | NE | yes | no |
| Microdesmidae | Ptereleotris calliura | LC | LC | yes | no |
| Microdesmidae | Ptereleotris helenae | LC | DD | yes | no |
| Microdesmidae | Ptereleotris randalli | LC | NE | no | no |
| Molidae | Masturus lanceolatus | LC | LC | no | no |
| Molidae | Mola mola | VU | LC | no | no |
| Molidae | Ranzania laevis | LC | DD | no | no |
| Monacanthidae | Aluterus heudelotii | LC | LC | no | no |
| Monacanthidae | Aluterus monoceros | LC | LC | no | no |
| Monacanthidae | Aluterus schoepfii | LC | LC | no | no |
| Monacanthidae | Aluterus scriptus | LC | LC | no | no |
| Monacanthidae | Cantherhines macrocerus | LC | LC | no | no |
| Monacanthidae | Cantherhines pullus | LC | LC | no | no |
| Monacanthidae | Monacanthus ciliatus | LC | LC | no | no |
| Monacanthidae | Monacanthus tuckeri | LC | LC | yes | no |
| Monacanthidae | Stephanolepis hispidus | LC | LC | no | no |
| Monacanthidae | Stephanolepis setifer | LC | LC | no | no |
| Moridae | Physiculus fulvus | LC | LC | no | no |
| Moringuidae | Moringua edwardsi | LC | LC | no | no |
| Moringuidae | Neoconger mucronatus | LC | LC | no | no |
| Moronidae | Morone saxatilis | LC | NE | no | no |
| Mugilidae | Mugil cephalus | LC | LC | no | no |
| Mugilidae | Mugil curema | LC | LC | no | no |
| Mugilidae | Mugil incilis | LC | NE | no | no |
| Mugilidae | Mugil liza | DD | DD | no | no |
| Mugilidae | Mugil margaritae | DD | NE | yes | no |
| Mugilidae | Mugil rubrioculus | LC | DD | no | no |
| Mugilidae | Mugil trichodon | LC | DD | yes | no |
| Mullidae | Mulloidichthys martinicus | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Mullidae | Mullus auratus | LC | LC | no | no |
| Mullidae | Pseudupeneus maculatus | LC | LC | no | no |
| Mullidae | Upeneus parvus | LC | LC | no | no |
| Muraenesocidae | Cynoponticus savanna | LC | NE | no | no |
| Muraenidae | Anarchias similis | LC | LC | no | no |
| Muraenidae | Channomuraena vittata | LC | DD | no | no |
| Muraenidae | Echidna catenata | LC | LC | no | no |
| Muraenidae | Enchelycore anatina | LC | NE | no | no |
| Muraenidae | Enchelycore carychroa | LC | LC | no | no |
| Muraenidae | Enchelycore nigricans | LC | LC | no | no |
| Muraenidae | Gymnothorax funebris | LC | LC | no | no |
| Muraenidae | Gymnothorax hubbsi | LC | LC | yes | no |
| Muraenidae | Gymnothorax kolpos | LC | LC | yes | no |
| Muraenidae | Gymnothorax maderensis | LC | DD | no | no |
| Muraenidae | Gymnothorax miliaris | LC | LC | no | no |
| Muraenidae | Gymnothorax moringa | LC | LC | no | no |
| Muraenidae | Gymnothorax nigromarginatus | LC | LC | yes | no |
| Muraenidae | Gymnothorax ocellatus | LC | NE | no | no |
| Muraenidae | Gymnothorax polygonius | LC | DD | no | no |
| Muraenidae | Gymnothorax saxicola | LC | LC | no | no |
| Muraenidae | Gymnothorax vicinus | LC | LC | no | no |
| Muraenidae | Monopenchelys acuta | LC | DD | no | no |
| Muraenidae | Muraena retifera | LC | LC | no | no |
| Muraenidae | Muraena robusta | LC | NE | no | no |
| Muraenidae | Uropterygius macularius | LC | DD | no | no |
| Nettastomatidae | Hoplunnis diomediana | LC | LC | yes | no |
| Nettastomatidae | Hoplunnis macrura | LC | LC | no | no |
| Nettastomatidae | Hoplunnis tenuis | LC | LC | no | no |
| Nettastomatidae | Nettenchelys pygmaea | LC | LC | yes | no |
| Nettastomatidae | Saurenchelys cognita | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Nomeidae | Cubiceps gracilis | LC | DD | no | no |
| Nomeidae | Nomeus gronovii | LC | LC | no | no |
| Nomeidae | Psenes cyanophrys | LC | LC | no | no |
| Nomeidae | Psenes pellucidus | LC | LC | no | no |
| Ogcocephalidae | Halieutichthys aculeatus | LC | LC | yes | no |
| Ogcocephalidae | Halieutichthys bispinosus | LC | LC | yes | no |
| Ogcocephalidae | Halieutichthys intermedius | LC | LC | yes | yes |
| Ogcocephalidae | Ogcocephalus corniger | LC | LC | yes | no |
| Ogcocephalidae | Ogcocephalus cubifrons | LC | LC | yes | no |
| Ogcocephalidae | Ogcocephalus declivirostris | LC | LC | yes | yes |
| Ogcocephalidae | Ogcocephalus nasutus | LC | LC | yes | no |
| Ogcocephalidae | Ogcocephalus notatus | LC | NE | no | no |
| Ogcocephalidae | Ogcocephalus pantostictus | LC | LC | yes | yes |
| Ogcocephalidae | Ogcocephalus parvus | LC | LC | yes | no |
| Ogcocephalidae | Ogcocephalus pumilus | LC | NE | yes | no |
| Ogcocephalidae | Ogcocephalus rostellum | LC | LC | yes | no |
| Ogcocephalidae | Zalieutes mcgintyi | LC | LC | yes | no |
| Ophichthidae | Ahlia egmontis | LC | LC | no | no |
| Ophichthidae | Aplatophis chauliodus | LC | LC | yes | no |
| Ophichthidae | Aprognathodon platyventris | LC | LC | yes | no |
| Ophichthidae | Apterichtus ansp | LC | DD | no | no |
| Ophichthidae | Apterichtus kendalli | LC | LC | no | no |
| Ophichthidae | Bascanichthys bascanium | LC | LC | yes | no |
| Ophichthidae | Bascanichthys inopinatus | DD | NE | yes | no |
| Ophichthidae | Bascanichthys scuticaris | LC | LC | yes | no |
| Ophichthidae | Callechelys bilinearis | LC | DD | no | no |
| Ophichthidae | Callechelys guineensis | LC | LC | no | no |
| Ophichthidae | Callechelys muraena | LC | LC | yes | no |
| Ophichthidae | Callechelys springeri | DD | NE | yes | no |
| Ophichthidae | Caralophia loxochila | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Ophichthidae | Echiophis intertinctus | LC | LC | no | no |
| Ophichthidae | Echiophis punctifer | LC | LC | no | no |
| Ophichthidae | Ethadophis akkistikos | LC | LC | yes | yes |
| Ophichthidae | Gordiichthys ergodes | DD | DD | yes | yes |
| Ophichthidae | Gordiichthys irretitus | LC | LC | yes | no |
| Ophichthidae | Gordiichthys leibyi | LC | DD | no | no |
| Ophichthidae | Gordiichthys randalli | LC | DD | yes | no |
| Ophichthidae | Ichthyapus ophioneus | LC | LC | no | no |
| Ophichthidae | Letharchus velifer | LC | LC | yes | no |
| Ophichthidae | Myrichthys breviceps | LC | LC | no | no |
| Ophichthidae | Myrichthys ocellatus | LC | LC | no | no |
| Ophichthidae | Myrophis anterodorsalis | LC | NE | yes | no |
| Ophichthidae | Myrophis platyrhynchus | LC | DD | no | no |
| Ophichthidae | Myrophis plumbeus | LC | NE | no | no |
| Ophichthidae | Myrophis punctatus | LC | LC | no | no |
| Ophichthidae | Ophichthus cylindroideus | LC | NE | no | no |
| Ophichthidae | Ophichthus gomesii | LC | LC | no | no |
| Ophichthidae | Ophichthus hyposagmatus | LC | DD | yes | no |
| Ophichthidae | Ophichthus melanoporus | LC | LC | yes | no |
| Ophichthidae | Ophichthus ophis | LC | LC | no | no |
| Ophichthidae | Ophichthus puncticeps | LC | LC | yes | no |
| Ophichthidae | Ophichthus rex | LC | LC | yes | yes |
| Ophichthidae | Ophichthus spinicauda | LC | DD | yes | no |
| Ophichthidae | Pseudomyrophis frio | LC | NE | no | no |
| Ophichthidae | Pseudomyrophis fugesae | LC | LC | no | no |
| Ophichthidae | Quassiremus ascensionis | LC | DD | no | no |
| Ophidiidae | Brotula barbata | LC | LC | no | no |
| Ophidiidae | Lepophidium aporrhox | LC | NE | yes | no |
| Ophidiidae | Lepophidium brevibarbe | LC | LC | no | no |
| Ophidiidae | Lepophidium collettei | LC | NE | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Ophidiidae | Lepophidium crossotum | LC | LC | yes | no |
| Ophidiidae | Lepophidium cultratum | LC | NE | yes | no |
| Ophidiidae | Lepophidium entomelan | LC | LC | yes | no |
| Ophidiidae | Lepophidium gilmorei | LC | DD | yes | no |
| Ophidiidae | Lepophidium jeannae | LC | LC | yes | no |
| Ophidiidae | Lepophidium marmoratum | LC | DD | yes | no |
| Ophidiidae | Lepophidium pheromystax | LC | LC | yes | no |
| Ophidiidae | Lepophidium profundorum | LC | LC | no | no |
| Ophidiidae | Lepophidium robustum | LC | NE | yes | no |
| Ophidiidae | Lepophidium staurophor | LC | LC | yes | no |
| Ophidiidae | Lepophidium wileyi | LC | NE | yes | no |
| Ophidiidae | Lepophidium zophochir | LC | NE | yes | no |
| Ophidiidae | Neobythites gilli | LC | LC | yes | yes |
| Ophidiidae | Neobythites marginatus | LC | LC | yes | no |
| Ophidiidae | Neobythites monocellatus | LC | NE | no | no |
| Ophidiidae | Neobythites multiocellatus | LC | NE | yes | no |
| Ophidiidae | Ophidion antipholus | LC | LC | yes | no |
| Ophidiidae | Ophidion dromio | LC | LC | yes | no |
| Ophidiidae | Ophidion grayi | LC | LC | yes | no |
| Ophidiidae | Ophidion guianense | LC | NE | yes | no |
| Ophidiidae | Ophidion holbrookii | LC | LC | no | no |
| Ophidiidae | Ophidion josephi | LC | LC | yes | no |
| Ophidiidae | Ophidion lagochila | LC | NE | yes | no |
| Ophidiidae | Ophidion marginatum | LC | NE | no | no |
| Ophidiidae | Ophidion nocomis | LC | NE | yes | no |
| Ophidiidae | Ophidion selenops | LC | LC | yes | no |
| Ophidiidae | Otophidium chickcharney | LC | NE | yes | no |
| Ophidiidae | Otophidium dormitator | LC | LC | yes | no |
| Ophidiidae | Otophidium omostigma | LC | LC | yes | no |
| Ophidiidae | Parophidion schmidti | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Ophidiidae | Petrotyx sanguineus | LC | LC | yes | no |
| Opistognathidae | Lonchopisthus higmani | LC | NE | yes | no |
| Opistognathidae | Lonchopisthus lemur | LC | NE | no | no |
| Opistognathidae | Lonchopisthus micrognathus | LC | LC | yes | no |
| Opistognathidae | Opistognathus aurifrons | LC | LC | yes | no |
| Opistognathidae | Opistognathus gilberti | LC | NE | yes | no |
| Opistognathidae | Opistognathus leprocarus | LC | NE | yes | no |
| Opistognathidae | Opistognathus lonchurus | LC | LC | no | no |
| Opistognathidae | Opistognathus macrognathus | LC | LC | yes | no |
| Opistognathidae | Opistognathus maxillosus | LC | LC | yes | no |
| Opistognathidae | Opistognathus megalepis | LC | NE | yes | no |
| Opistognathidae | Opistognathus melachasme | LC | NE | yes | no |
| Opistognathidae | Opistognathus nothus | LC | LC | yes | no |
| Opistognathidae | Opistognathus robinsi | LC | LC | yes | no |
| Opistognathidae | Opistognathus signatus | LC | NE | yes | no |
| Opistognathidae | Opistognathus whitehursti | LC | LC | no | no |
| Ostraciidae | Acanthostracion polygonius | LC | LC | no | no |
| Ostraciidae | Acanthostracion quadricornis | LC | LC | no | no |
| Ostraciidae | Lactophrys bicaudalis | LC | LC | no | no |
| Ostraciidae | Lactophrys trigonus | LC | LC | no | no |
| Ostraciidae | Lactophrys triqueter | LC | LC | no | no |
| Paralichthyidae | Ancylopsetta cycloidea | LC | NE | yes | no |
| Paralichthyidae | Ancylopsetta dilecta | LC | LC | yes | no |
| Paralichthyidae | Ancylopsetta kumperae | DD | NE | no | no |
| Paralichthyidae | Ancylopsetta ommata | LC | LC | yes | no |
| Paralichthyidae | Citharichthys abbotti | LC | LC | yes | no |
| Paralichthyidae | Citharichthys amblybregmatus | DD | NE | yes | no |
| Paralichthyidae | Citharichthys arctifrons | LC | LC | no | no |
| Paralichthyidae | Citharichthys arenaceus | LC | LC | no | no |
| Paralichthyidae | Citharichthys cornutus | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Paralichthyidae | Citharichthys dinoceros | LC | LC | no | no |
| Paralichthyidae | Citharichthys gymnorhinus | LC | LC | yes | no |
| Paralichthyidae | Citharichthys macrops | LC | LC | no | no |
| Paralichthyidae | Citharichthys minutus | LC | NE | yes | no |
| Paralichthyidae | Citharichthys spilopterus | LC | LC | no | no |
| Paralichthyidae | Citharichthys valdezi | LC | NE | yes | no |
| Paralichthyidae | Cyclopsetta chittendeni | LC | LC | no | no |
| Paralichthyidae | Cyclopsetta fimbriata | LC | LC | no | no |
| Paralichthyidae | Etropus crossotus | LC | LC | no | no |
| Paralichthyidae | Etropus cyclosquamus | LC | LC | yes | no |
| Paralichthyidae | Etropus delsmani ssp. delsmani | DD | NE | yes | no |
| Paralichthyidae | Etropus rimosus | LC | LC | yes | no |
| Paralichthyidae | Gastropsetta frontalis | LC | LC | yes | no |
| Paralichthyidae | Paralichthys albigutta | LC | LC | yes | no |
| Paralichthyidae | Paralichthys dentatus | LC | NE | no | no |
| Paralichthyidae | Paralichthys lethostigma | NT | NT | yes | no |
| Paralichthyidae | Paralichthys oblongus | LC | DD | no | no |
| Paralichthyidae | Paralichthys squamilentus | LC | LC | yes | no |
| Paralichthyidae | Paralichthys tropicus | DD | NE | yes | no |
| Paralichthyidae | Syacium gunteri | LC | LC | yes | no |
| Paralichthyidae | Syacium micrurum | LC | LC | no | no |
| Paralichthyidae | Syacium papillosum | LC | LC | no | no |
| Pempheridae | Pempheris poeyi | LC | LC | no | no |
| Pempheridae | Pempheris schomburgkii | LC | LC | no | no |
| Percophidae | Bembrops anatirostris | LC | LC | yes | no |
| Percophidae | Bembrops gobioides | LC | LC | no | no |
| Percophidae | Bembrops macromma | LC | LC | yes | no |
| Peristediidae | Peristedion gracile | LC | LC | yes | no |
| Peristediidae | Peristedion miniatum | LC | LC | no | no |
| Phycidae | Urophycis earllii | LC | DD | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Phycidae | Urophycis floridana | LC | LC | yes | no |
| Phycidae | Urophycis regia | LC | LC | no | no |
| Poeciliidae | Gambusia rhizophorae | LC | LC | yes | no |
| Polynemidae | Polydactylus octonemus | LC | LC | yes | no |
| Polynemidae | Polydactylus oligodon | LC | DD | no | no |
| Polynemidae | Polydactylus virginicus | LC | DD | no | no |
| Pomacanthidae | Centropyge argi | LC | LC | yes | no |
| Pomacanthidae | Centropyge aurantonotus | LC | NE | no | no |
| Pomacanthidae | Holacanthus bermudensis | LC | LC | yes | no |
| Pomacanthidae | Holacanthus ciliaris | LC | LC | no | no |
| Pomacanthidae | Holacanthus tricolor | LC | LC | no | no |
| Pomacanthidae | Pomacanthus arcuatus | LC | LC | no | no |
| Pomacanthidae | Pomacanthus paru | LC | LC | no | no |
| Pomacentridae | Abudefduf saxatilis | LC | LC | no | no |
| Pomacentridae | Abudefduf taurus | LC | LC | no | no |
| Pomacentridae | Chromis bermudae | LC | NE | yes | no |
| Pomacentridae | Chromis cyanea | LC | LC | yes | no |
| Pomacentridae | Chromis enchrysura | LC | LC | no | no |
| Pomacentridae | Chromis insolata | LC | LC | yes | no |
| Pomacentridae | Chromis multilineata | LC | LC | no | no |
| Pomacentridae | Chromis scotti | LC | LC | no | no |
| Pomacentridae | Microspathodon chrysurus | LC | LC | no | no |
| Pomacentridae | Stegastes adustus | LC | LC | yes | no |
| Pomacentridae | Stegastes diencaeus | LC | LC | yes | no |
| Pomacentridae | Stegastes leucostictus | LC | LC | yes | no |
| Pomacentridae | Stegastes otophorus | DD | EN | yes | no |
| Pomacentridae | Stegastes partitus | LC | LC | yes | no |
| Pomacentridae | Stegastes planifrons | LC | LC | yes | no |
| Pomacentridae | Stegastes xanthurus | LC | LC | yes | no |
| Pomatomidae | Pomatomus saltatrix | VU | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Priacanthidae | Heteropriacanthus cruentatus | LC | LC | no | no |
| Priacanthidae | Priacanthus arenatus | LC | LC | no | no |
| Priacanthidae | Pristigenys alta | LC | LC | yes | no |
| Pristigasteridae | Chirocentrodon bleekerianus | LC | DD | no | no |
| Pristigasteridae | Neoopisthopterus cubanus | VU | VU | yes | yes |
| Pristigasteridae | Odontognathus compressus | LC | NE | yes | no |
| Pristigasteridae | Odontognathus mucronatus | LC | NE | no | no |
| Pristigasteridae | Pellona harroweri | LC | NE | no | no |
| Rachycentridae | Rachycentron canadum | LC | LC | no | no |
| Regalecidae | Regalecus glesne | LC | LC | no | no |
| Sciaenidae | Bairdiella chrysoura | LC | LC | no | no |
| Sciaenidae | Bairdiella ronchus | LC | LC | no | no |
| Sciaenidae | Corvula batabana | LC | LC | yes | no |
| Sciaenidae | Corvula sanctaeluciae | LC | LC | yes | no |
| Sciaenidae | Ctenosciaena gracilicirrhus | LC | NE | no | no |
| Sciaenidae | Cynoscion acoupa | LC | NE | no | no |
| Sciaenidae | Cynoscion arenarius | LC | LC | yes | yes |
| Sciaenidae | Cynoscion jamaicensis | LC | NE | no | no |
| Sciaenidae | Cynoscion leiarchus | LC | NE | no | no |
| Sciaenidae | Cynoscion microlepidotus | LC | NE | no | no |
| Sciaenidae | Cynoscion nebulosus | LC | LC | no | no |
| Sciaenidae | Cynoscion nothus | LC | LC | no | no |
| Sciaenidae | Cynoscion similis | LC | NE | yes | no |
| Sciaenidae | Cynoscion steindachneri | LC | NE | no | no |
| Sciaenidae | Cynoscion virescens | LC | NE | no | no |
| Sciaenidae | Equetus lanceolatus | LC | LC | no | no |
| Sciaenidae | Equetus punctatus | LC | LC | yes | no |
| Sciaenidae | Isopisthus parvipinnis | LC | NE | no | no |
| Sciaenidae | Larimus breviceps | LC | NE | no | no |
| Sciaenidae | Larimus fasciatus | LC | LC | no | no |

| **Family** | **Species Name** | **Global** | **Gulf of Mexico** | **Greater Caribbean endemic?** | **Gulf of Mexico endemic?** |
|---|---|---|---|---|---|
| Sciaenidae | Leiostomus xanthurus | LC | LC | no | no |
| Sciaenidae | Lonchurus elegans | DD | NE | yes | no |
| Sciaenidae | Lonchurus lanceolatus | LC | NE | no | no |
| Sciaenidae | Macrodon ancylodon | LC | NE | no | no |
| Sciaenidae | Menticirrhus americanus | LC | LC | no | no |
| Sciaenidae | Menticirrhus littoralis | LC | LC | no | no |
| Sciaenidae | Menticirrhus saxatilis | LC | LC | no | no |
| Sciaenidae | Micropogonias furnieri | LC | LC | no | no |
| Sciaenidae | Micropogonias undulatus | LC | LC | no | no |
| Sciaenidae | Nebris microps | LC | NE | no | no |
| Sciaenidae | Odontoscion dentex | LC | LC | no | no |
| Sciaenidae | Ophioscion panamensis | DD | NE | yes | no |
| Sciaenidae | Ophioscion punctatissimus | LC | NE | no | no |
| Sciaenidae | Paralonchurus brasiliensis | LC | NE | no | no |
| Sciaenidae | Pareques acuminatus | LC | LC | no | no |
| Sciaenidae | Pareques iwamotoi | LC | LC | yes | no |
| Sciaenidae | Pareques umbrosus | LC | LC | yes | no |
| Sciaenidae | Pogonias cromis | LC | LC | no | no |
| Sciaenidae | Protosciaena bathytatos | LC | NE | yes | no |
| Sciaenidae | Protosciaena trewavasae | LC | NE | yes | no |
| Sciaenidae | Sciaenops ocellatus | LC | LC | no | no |
| Sciaenidae | Stellifer chaoi | LC | NE | yes | no |
| Sciaenidae | Stellifer colonensis | LC | NE | yes | no |
| Sciaenidae | Stellifer griseus | LC | NE | no | no |
| Sciaenidae | Stellifer lanceolatus | LC | LC | yes | no |
| Sciaenidae | Stellifer microps | LC | NE | no | no |
| Sciaenidae | Stellifer naso | LC | NE | no | no |
| Sciaenidae | Stellifer rastrifer | LC | NE | no | no |
| Sciaenidae | Stellifer stellifer | DD | NE | no | no |
| Sciaenidae | Stellifer venezuelae | LC | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Sciaenidae | Umbrina broussonnetii | LC | NE | yes | no |
| Sciaenidae | Umbrina coroides | LC | LC | no | no |
| Sciaenidae | Umbrina milliae | LC | NE | yes | no |
| Scombridae | Acanthocybium solandri | LC | LC | no | no |
| Scombridae | Auxis rochei | LC | LC | no | no |
| Scombridae | Auxis thazard | LC | DD | no | no |
| Scombridae | Euthynnus alletteratus | LC | LC | no | no |
| Scombridae | Katsuwonus pelamis | LC | LC | no | no |
| Scombridae | Sarda sarda | LC | LC | no | no |
| Scombridae | Scomber colias | LC | LC | no | no |
| Scombridae | Scomberomorus brasiliensis | LC | NE | no | no |
| Scombridae | Scomberomorus cavalla | LC | LC | no | no |
| Scombridae | Scomberomorus maculatus | LC | LC | no | no |
| Scombridae | Scomberomorus regalis | LC | LC | no | no |
| Scombridae | Thunnus alalunga | NT | LC | no | no |
| Scombridae | Thunnus albacares | NT | LC | no | no |
| Scombridae | Thunnus atlanticus | LC | LC | no | no |
| Scombridae | Thunnus obesus | VU | NT | no | no |
| Scombridae | Thunnus thynnus | EN | EN | no | no |
| Scorpaenidae | Neomerinthe beanorum | LC | DD | yes | no |
| Scorpaenidae | Neomerinthe hemingwayi | LC | LC | no | no |
| Scorpaenidae | Pontinus castor | LC | LC | yes | no |
| Scorpaenidae | Pontinus helena | DD | NE | yes | no |
| Scorpaenidae | Pontinus longispinis | LC | LC | no | no |
| Scorpaenidae | Pontinus nematophthalmus | LC | DD | no | no |
| Scorpaenidae | Pontinus rathbuni | LC | LC | no | no |
| Scorpaenidae | Scorpaena agassizii | LC | LC | no | no |
| Scorpaenidae | Scorpaena albifimbria | LC | LC | no | no |
| Scorpaenidae | Scorpaena bergii | LC | LC | yes | no |
| Scorpaenidae | Scorpaena brachyptera | LC | NE | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Scorpaenidae | Scorpaena brasiliensis | LC | LC | no | no |
| Scorpaenidae | Scorpaena calcarata | LC | LC | no | no |
| Scorpaenidae | Scorpaena dispar | LC | LC | no | no |
| Scorpaenidae | Scorpaena elachys | LC | DD | yes | no |
| Scorpaenidae | Scorpaena grandicornis | LC | LC | no | no |
| Scorpaenidae | Scorpaena inermis | LC | LC | yes | no |
| Scorpaenidae | Scorpaena isthmensis | LC | NE | no | no |
| Scorpaenidae | Scorpaena plumieri | LC | LC | no | no |
| Scorpaenidae | Scorpaenodes caribbaeus | LC | LC | no | no |
| Scorpaenidae | Scorpaenodes tredecimspinosus | LC | LC | yes | no |
| Serranidae | Anthias nicholsi | LC | LC | no | no |
| Serranidae | Anthias woodsi | LC | LC | yes | no |
| Serranidae | Baldwinella aureorubens | LC | LC | no | no |
| Serranidae | Baldwinella vivanus | LC | LC | no | no |
| Serranidae | Bullisichthys caribbaeus | LC | NE | yes | no |
| Serranidae | Centropristis fuscula | LC | LC | no | no |
| Serranidae | Centropristis ocyurus | LC | LC | yes | no |
| Serranidae | Centropristis philadelphica | LC | LC | yes | no |
| Serranidae | Centropristis striata | LC | LC | no | no |
| Serranidae | Choranthias tenuis | LC | LC | yes | no |
| Serranidae | Diplectrum bivittatum | LC | LC | no | no |
| Serranidae | Diplectrum formosum | LC | LC | no | no |
| Serranidae | Diplectrum radiale | LC | LC | no | no |
| Serranidae | Hemanthias leptus | LC | LC | yes | no |
| Serranidae | Hypoplectrus aberrans | LC | LC | yes | no |
| Serranidae | Hypoplectrus atlahua | DD | DD | yes | yes |
| Serranidae | Hypoplectrus castroaguirrei | EN | EN | yes | yes |
| Serranidae | Hypoplectrus chlorurus | LC | LC | yes | no |
| Serranidae | Hypoplectrus ecosur | DD | DD | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Serranidae | Hypoplectrus floridae | LC | LC | yes | no |
| Serranidae | Hypoplectrus gemma | LC | LC | yes | no |
| Serranidae | Hypoplectrus gummigutta | LC | LC | yes | no |
| Serranidae | Hypoplectrus guttavarius | LC | LC | yes | no |
| Serranidae | Hypoplectrus indigo | LC | LC | yes | no |
| Serranidae | Hypoplectrus maculiferus | DD | DD | yes | no |
| Serranidae | Hypoplectrus maya | VU | NE | yes | no |
| Serranidae | Hypoplectrus nigricans | LC | LC | yes | no |
| Serranidae | Hypoplectrus providencianus | LC | NE | yes | no |
| Serranidae | Hypoplectrus puella | LC | LC | yes | no |
| Serranidae | Hypoplectrus randallorum | LC | LC | yes | no |
| Serranidae | Hypoplectrus unicolor | LC | LC | yes | no |
| Serranidae | Paralabrax dewegeri | LC | NE | no | no |
| Serranidae | Parasphyraenops atrimanus | LC | NE | yes | no |
| Serranidae | Parasphyraenops incisus | LC | NE | yes | no |
| Serranidae | Plectranthias garrupellus | LC | LC | yes | no |
| Serranidae | Pronotogrammus martinicensis | LC | LC | no | no |
| Serranidae | Schultzea beta | LC | LC | yes | no |
| Serranidae | Serraniculus pumilio | LC | LC | yes | no |
| Serranidae | Serranus annularis | LC | LC | yes | no |
| Serranidae | Serranus atrobranchus | LC | LC | no | no |
| Serranidae | Serranus baldwini | LC | LC | no | no |
| Serranidae | Serranus chionaraia | LC | LC | no | no |
| Serranidae | Serranus flaviventris | LC | NE | no | no |
| Serranidae | Serranus luciopercanus | LC | LC | yes | no |
| Serranidae | Serranus maytagi | LC | NE | yes | no |
| Serranidae | Serranus notospilus | LC | LC | yes | no |
| Serranidae | Serranus phoebe | LC | LC | no | no |
| Serranidae | Serranus subligarius | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Serranidae | Serranus tabacarius | LC | LC | no | no |
| Serranidae | Serranus tigrinus | LC | LC | yes | no |
| Serranidae | Serranus tortugarum | LC | LC | yes | no |
| Sparidae | Archosargus probatocephalus | LC | LC | no | no |
| Sparidae | Archosargus rhomboidalis | LC | LC | no | no |
| Sparidae | Calamus arctifrons | LC | LC | yes | no |
| Sparidae | Calamus bajonado | LC | LC | no | no |
| Sparidae | Calamus calamus | LC | LC | no | no |
| Sparidae | Calamus campechanus | DD | DD | yes | no |
| Sparidae | Calamus cervigoni | LC | NE | yes | no |
| Sparidae | Calamus leucosteus | LC | LC | yes | no |
| Sparidae | Calamus nodosus | LC | LC | yes | no |
| Sparidae | Calamus penna | LC | LC | no | no |
| Sparidae | Calamus pennatula | LC | LC | no | no |
| Sparidae | Calamus proridens | LC | LC | yes | no |
| Sparidae | Diplodus argenteus ssp. caudimacula | LC | LC | yes | no |
| Sparidae | Diplodus bermudensis | LC | NE | yes | no |
| Sparidae | Diplodus holbrookii | LC | LC | no | no |
| Sparidae | Lagodon rhomboides | LC | LC | no | no |
| Sparidae | Pagrus pagrus | LC | LC | no | no |
| Sparidae | Stenotomus caprinus | LC | LC | yes | no |
| Sparidae | Stenotomus chrysops | NT | NE | no | no |
| Sphyraenidae | Sphyraena barracuda | LC | LC | no | no |
| Sphyraenidae | Sphyraena borealis | LC | LC | no | no |
| Sphyraenidae | Sphyraena guachancho | LC | LC | no | no |
| Stromateidae | Peprilus burti | LC | LC | yes | yes |
| Stromateidae | Peprilus paru | LC | LC | no | no |
| Symphysanodontidae | Symphysanodon octoactinus | LC | NE | yes | no |
| Synaphobranchidae | Dysomma anguillare | LC | LC | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Syngnathidae | Acentronura dendritica | LC | LC | no | no |
| Syngnathidae | Anarchopterus criniger | LC | LC | no | no |
| Syngnathidae | Anarchopterus tectus | LC | LC | no | no |
| Syngnathidae | Bryx dunckeri | LC | LC | no | no |
| Syngnathidae | Bryx randalli | LC | NE | yes | no |
| Syngnathidae | Cosmocampus albirostris | LC | LC | no | no |
| Syngnathidae | Cosmocampus brachycephalus | LC | LC | yes | no |
| Syngnathidae | Cosmocampus elucens | LC | LC | yes | no |
| Syngnathidae | Cosmocampus hildebrandi | LC | LC | yes | no |
| Syngnathidae | Hippocampus erectus | VU | VU | no | no |
| Syngnathidae | Hippocampus reidi | DD | LC | no | no |
| Syngnathidae | Hippocampus zosterae | DD | NT | yes | no |
| Syngnathidae | Micrognathus crinitus | LC | LC | no | no |
| Syngnathidae | Microphis lineatus | LC | LC | no | no |
| Syngnathidae | Minyichthys inusitatus | DD | NE | yes | no |
| Syngnathidae | Penetopteryx nanus | LC | NE | yes | no |
| Syngnathidae | Syngnathus caribbaeus | LC | DD | yes | no |
| Syngnathidae | Syngnathus dawsoni | DD | NE | yes | no |
| Syngnathidae | Syngnathus floridae | LC | NT | yes | no |
| Syngnathidae | Syngnathus fuscus | LC | NE | no | no |
| Syngnathidae | Syngnathus louisianae | LC | LC | yes | no |
| Syngnathidae | Syngnathus makaxi | DD | DD | yes | no |
| Syngnathidae | Syngnathus pelagicus | LC | LC | no | no |
| Syngnathidae | Syngnathus scovelli | LC | LC | yes | no |
| Syngnathidae | Syngnathus springeri | LC | LC | yes | no |
| Synodontidae | Saurida brasiliensis | LC | LC | no | no |
| Synodontidae | Saurida caribbaea | LC | LC | no | no |
| Synodontidae | Saurida normani | LC | LC | no | no |
| Synodontidae | Saurida suspicio | LC | NE | yes | no |
| Synodontidae | Synodus bondi | LC | NE | no | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Synodontidae | Synodus foetens | LC | LC | yes | no |
| Synodontidae | Synodus intermedius | LC | LC | no | no |
| Synodontidae | Synodus macrostigmus | LC | LC | yes | no |
| Synodontidae | Synodus poeyi | LC | LC | no | no |
| Synodontidae | Synodus saurus | LC | LC | no | no |
| Synodontidae | Synodus synodus | LC | LC | no | no |
| Synodontidae | Trachinocephalus myops | LC | LC | no | no |
| Tetraodontidae | Canthigaster figueiredoi | LC | NE | no | no |
| Tetraodontidae | Canthigaster jamestyleri | LC | LC | yes | no |
| Tetraodontidae | Canthigaster rostrata | LC | LC | yes | no |
| Tetraodontidae | Colomesus psittacus | LC | NE | no | no |
| Tetraodontidae | Lagocephalus laevigatus | LC | LC | no | no |
| Tetraodontidae | Lagocephalus lagocephalus | LC | DD | no | no |
| Tetraodontidae | Sphoeroides dorsalis | LC | LC | yes | no |
| Tetraodontidae | Sphoeroides georgemilleri | DD | NE | yes | no |
| Tetraodontidae | Sphoeroides greeleyi | LC | NE | no | no |
| Tetraodontidae | Sphoeroides maculatus | LC | NE | no | no |
| Tetraodontidae | Sphoeroides nephelus | LC | LC | yes | no |
| Tetraodontidae | Sphoeroides pachygaster | LC | LC | no | no |
| Tetraodontidae | Sphoeroides parvus | LC | LC | yes | yes |
| Tetraodontidae | Sphoeroides spengleri | LC | LC | no | no |
| Tetraodontidae | Sphoeroides testudineus | LC | LC | no | no |
| Tetraodontidae | Sphoeroides tyleri | LC | NE | no | no |
| Tetraodontidae | Sphoeroides yergeri | LC | NE | yes | no |
| Triacanthodidae | Parahollardia lineata | LC | LC | yes | no |
| Trichiuridae | Evoxymetopon taeniatus | LC | LC | yes | no |
| Trichiuridae | Trichiurus lepturus | LC | LC | no | no |
| Triglidae | Bellator brachychir | LC | LC | no | no |
| Triglidae | Bellator egretta | LC | LC | no | no |
| Triglidae | Bellator militaris | LC | LC | yes | no |

| Family | Species Name | Global | Gulf of Mexico | Greater Caribbean endemic? | Gulf of Mexico endemic? |
|---|---|---|---|---|---|
| Triglidae | Bellator ribeiroi | LC | NE | no | no |
| Triglidae | Prionotus alatus | LC | LC | yes | no |
| Triglidae | Prionotus beanii | LC | NE | no | no |
| Triglidae | Prionotus carolinus | LC | LC | no | no |
| Triglidae | Prionotus evolans | LC | NE | no | no |
| Triglidae | Prionotus longispinosus | LC | LC | yes | yes |
| Triglidae | Prionotus martis | LC | LC | yes | yes |
| Triglidae | Prionotus murielae | DD | NE | yes | no |
| Triglidae | Prionotus ophryas | LC | LC | yes | no |
| Triglidae | Prionotus paralatus | LC | LC | yes | yes |
| Triglidae | Prionotus punctatus | LC | LC | no | no |
| Triglidae | Prionotus roseus | LC | LC | no | no |
| Triglidae | Prionotus rubio | LC | LC | yes | no |
| Triglidae | Prionotus scitulus | LC | LC | yes | no |
| Triglidae | Prionotus stearnsi | LC | LC | no | no |
| Triglidae | Prionotus tribulus | LC | LC | yes | no |
| Tripterygiidae | Enneanectes altivelis | LC | LC | no | no |
| Tripterygiidae | Enneanectes atrorus | LC | NE | yes | no |
| Tripterygiidae | Enneanectes boehlkei | LC | LC | yes | no |
| Tripterygiidae | Enneanectes deloachorum | LC | NE | yes | no |
| Tripterygiidae | Enneanectes jordani | LC | LC | yes | no |
| Tripterygiidae | Enneanectes matador | LC | NE | yes | no |
| Tripterygiidae | Enneanectes pectoralis | LC | LC | yes | no |
| Tripterygiidae | Enneanectes wilki | DD | NE | yes | no |
| Uranoscopidae | Astroscopus guttatus | LC | NE | no | no |
| Uranoscopidae | Astroscopus y-graecum | LC | LC | no | no |
| Uranoscopidae | Kathetostoma albigutta | LC | LC | yes | no |
| Uranoscopidae | Xenocephalus egregius | LC | LC | yes | no |
| Xiphiidae | Xiphias gladius | LC | LC | no | no |
| Zeidae | Zenopsis conchifer | LC | LC | no | no |

# APPENDIX C.

# LIST OF NEAR THREATENED AND THREATENED SPECIES WITH THREATS

List of globally Near Threatened and threatened species with Red List category and threats; ‘1’ = the threat was recorded, ‘0’ = the threat was not recorded. A list of the regional Gulf of Mexico NT and threatened species follows in the same style.

| **Family** | **Species Name** | **Global Category** | **Overexploitation** | **Invasive lionfish** | **Coral degradation** | **Estuary degradation** | **Dams** | **Mangrove degradation** | **Seagrass degradation** | **Other invasives** | **Cave degradation** | **Pier complex construction** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acipenseridae | Acipenser brevirostrum | VU | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Acipenseridae | Acipenser oxyrinchus | NT | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Albulidae | Albula vulpes | NT | 1 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |
| Ariidae | Notarius neogranatensis | VU | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ariidae | Sciades parkeri | VU | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Atherinopsidae | Menidia colei | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Atherinopsidae | Menidia conchorum | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Balistidae | Balistes capriscus | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Balistidae | Balistes vetula | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Batrachoididae | Sanopus astrifer | VU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Batrachoididae | Sanopus greenfieldorum | VU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Batrachoididae | Sanopus reticulatus | EN | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |

| Family | Species Name | Global Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Mangrove degradation | Seagrass degradation | Other invasives | Cave degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Batrachoididae | Sanopus splendidus | EN | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Batrachoididae | Vladichthys gloverensis | VU | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Blenniidae | Lupinoblennius vinctus | NT | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Bythitidae | Lucifuga lucayana | EN | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| Bythitidae | Lucifuga simile | CR | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| Bythitidae | Lucifuga spelaeotes | VU | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| Bythitidae | Ogilbichthys ferocis | EN | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Emblemariopsis pricei | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Clupeidae | Alosa aestivalis | VU | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Clupeidae | Alosa alabamae | NT | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Engraulidae | Anchoa choerostoma | EN | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Dermatolepis inermis | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Epinephelus drummondhayi | CR | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Epinephelus itajara | CR | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Epinephelidae | Epinephelus morio | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Family | Species Name | Global Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Mangrove degradation | Seagrass degradation | Other invasives | Cave degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Epinephelidae | Epinephelus striatus | EN | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Hyporthodus flavolimbatus | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Hyporthodus nigritus | CR | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Hyporthodus niveatus | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Mycteroperca bonaci | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Mycteroperca interstitialis | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Mycteroperca venenosa | NT | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Fundulidae | Fundulus grandissimus | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fundulidae | Fundulus jenkinsi | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Fundulidae | Fundulus persimilis | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus alloides | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus eidolon | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus hyalinus | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus lipernes | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Family | Species Name | Global Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Mangrove degradation | Seagrass degradation | Other invasives | Cave degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gobiidae | Coryphopterus personatus | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus thrix | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus tortugae | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus venezuelae | VU | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Ctenogobius claytonii | VU | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus atronasus | EN | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus cayman | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus centralis | EN | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus jarocho | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus lobeli | NT | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus prochilos | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Gobiosoma hildebrandi | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Gobiidae | Gobiosoma spilotum | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Psilotris boehlkei | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Tigrigobius harveyi | EN | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Family | Species Name | Global Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Mangrove degradation | Seagrass degradation | Other invasives | Cave degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Gobiidae | Tigrigobius redimiculus | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Istiophoridae | Kajikia albida | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Istiophoridae | Makaira nigricans | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labridae | Halichoeres burekae | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labridae | Halichoeres socialis | EN | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Labridae | Lachnolaimus maximus | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labridae | Scarus guacamaia | NT | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lutjanidae | Lutjanus analis | NT | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Lutjanidae | Lutjanus campechanus | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lutjanidae | Lutjanus cyanopterus | VU | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Lutjanidae | Lutjanus synagris | NT | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Lutjanidae | Rhomboplites aurorubens | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Malacanthidae | Lopholatilus chamaeleonticeps | EN | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Megalopidae | Megalops atlanticus | VU | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Merlucciidae | Merluccius bilinearis | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Family | Species Name | Global Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Mangrove degradation | Seagrass degradation | Other invasives | Cave degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Molidae | Mola mola | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Paralichthyidae | Paralichthys lethostigma | NT | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pomatomidae | Pomatomus saltatrix | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Pristigasteridae | Neoopisthopterus cubanus | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scombridae | Thunnus alalunga | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scombridae | Thunnus albacares | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scombridae | Thunnus obesus | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scombridae | Thunnus thynnus | EN | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Serranidae | Hypoplectrus castroaguirrei | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Serranidae | Hypoplectrus maya | VU | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Sparidae | Stenotomus chrysops | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Syngnathidae | Hippocampus erectus | VU | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |

| Family | Species Name | Gulf endemic? | Regional Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Seagrass degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|
| Atherinopsidae | Menidia colei | yes | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Atherinopsidae | Menidia conchorum | yes | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Balistidae | Balistes capriscus | no | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Batrachoididae | Sanopus reticulatus | yes | EN | 0 | 0 | 1 | 0 | 0 | 0 | 1 |
| Carangidae | Seriola dumerili | no | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Clupeidae | Alosa alabamae | yes | NT | 1 | 0 | 0 | 1 | 1 | 0 | 0 |
| Epinephelidae | Epinephelus itajara | no | EN | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Epinephelidae | Epinephelus morio | no | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Epinephelus striatus | no | CR | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
| Epinephelidae | Hyporthodus nigritus | no | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Mycteroperca bonaci | no | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Mycteroperca interstitialis | no | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Mycteroperca venenosa | no | EN | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Fundulidae | Fundulus grandissimus | yes | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Fundulidae | Fundulus jenkinsi | yes | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Fundulidae | Fundulus persimilis | yes | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 |

| Family | Species Name | Gulf endemic? | Regional Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Seagrass degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|
| Gobiidae | Coryphopterus eidolon | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus hyalinus | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus lipernes | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus personatus | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus thrix | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus tortugae | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Ctenogobius claytonii | yes | VU | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Gobiidae | Elacatinus jarocho | yes | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus prochilos | no | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Tigrigobius redimiculus | yes | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Gobiidae | Tigrigobius saucrus | no | VU | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Istiophoridae | Kajikia albida | no | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Istiophoridae | Makaira nigricans | no | EN | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labridae | Halichoeres burekae | yes | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Labridae | Lachnolaimus maximus | no | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| Family | Species Name | Gulf endemic? | Regional Category | Overexploitation | Invasive lionfish | Coral degradation | Estuary degradation | Dams | Seagrass degradation | Pier complex construction |
|---|---|---|---|---|---|---|---|---|---|---|
| Lutjanidae | Lutjanus campechanus | no | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lutjanidae | Lutjanus synagris | no | NT | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Lutjanidae | Rhomboplites aurorubens | no | VU | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Malacanthidae | Lopholatilus chamaeleonticeps | no | EN | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Paralichthyidae | Paralichthys lethostigma | no | NT | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Pomacentridae | Stegastes otophorus | no | EN | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Pristigasteridae | Neoopisthopterus cubanus | yes | VU | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Scombridae | Thunnus obesus | no | NT | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scombridae | Thunnus thynnus | no | EN | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Serranidae | Hypoplectrus castroaguirrei | yes | EN | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| Syngnathidae | Hippocampus erectus | no | VU | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Syngnathidae | Hippocampus zosterae | no | NT | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Syngnathidae | Syngnathus floridae | no | NT | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

# APPENDIX D.

## LIST OF DATA DEFICIENT SPECIES WITH CONTRIBUTING FACTORS

List of globally Data Deficient species with the reasons that contributed to the DD listing; ‘1’ = the reason was recorded, ‘0’ = the reason was not recorded. A list of the regional Gulf of Mexico DD species follows in the same style.

| | | **Contributing factors** | | | **Potential threats** | | |
|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Few records** | **Taxonomic uncertainty** | **Small distribution** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** |
| Albulidae | Albula nemoptera | 0 | 1 | 0 | 0 | 0 | 0 |
| Ammodytidae | Protammodytes sarisa | 1 | 0 | 0 | 0 | 0 | 0 |
| Apogonidae | Astrapogon stellatus | 0 | 0 | 0 | 0 | 1 | 0 |
| Ariidae | Cathorops belizensis | 1 | 0 | 1 | 0 | 1 | 0 |
| Ariidae | Cathorops wayuu | 1 | 0 | 1 | 1 | 1 | 0 |
| Ariidae | Sciades passany | 0 | 0 | 1 | 1 | 0 | 0 |
| Atherinopsidae | Atherinella beani | 1 | 0 | 0 | 0 | 1 | 0 |
| Atherinopsidae | Membras analis | 1 | 0 | 0 | 0 | 1 | 0 |
| Atherinopsidae | Membras argentea | 1 | 0 | 0 | 0 | 0 | 0 |
| Atherinopsidae | Menidia clarkhubbsi | 1 | 1 | 0 | 0 | 1 | 0 |
| Batrachoididae | Porichthys oculofrenum | 1 | 0 | 0 | 0 | 0 | 0 |
| Batrachoididae | Sanopus johnsoni | 1 | 0 | 0 | 0 | 1 | 0 |
| Bythitidae | Ogilbia mccoskeri | 1 | 0 | 0 | 0 | 1 | 0 |
| Bythitidae | Ogilbichthys haitiensis | 1 | 0 | 0 | 0 | 1 | 0 |
| Bythitidae | Ogilbichthys puertoricoensis | 1 | 0 | 0 | 0 | 1 | 0 |
| Bythitidae | Ogilbichthys tobagoensis | 1 | 0 | 0 | 0 | 1 | 0 |
| Bythitidae | Parasaccogaster melanomycter | 1 | 0 | 0 | 0 | 1 | 0 |
| Bythitidae | Pseudogilbia sanblasensis | 1 | 0 | 0 | 0 | 1 | 0 |

| | | Contributing factors | | | Potential threats | | |
|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Few records** | **Taxonomic uncertainty** | **Small distribution** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** |
| Centropomidae | Centropomus poeyi | 0 | 0 | 1 | 1 | 1 | 0 |
| Chaenopsidae | Acanthemblemaria harpeza | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Acanthemblemaria paula | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Chaenopsis megalops | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Chaenopsis stephensi | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Emblemaria culmenis | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Emblemaria hyltoni | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Emblemariopsis arawak | 1 | 0 | 0 | 0 | 0 | 0 |
| Chaenopsidae | Emblemariopsis dianae | 1 | 0 | 1 | 0 | 0 | 0 |
| Chaenopsidae | Emblemariopsis randalli | 0 | 0 | 1 | 0 | 0 | 1 |
| Chlopsidae | Catesbya pseudomuraena | 1 | 0 | 0 | 0 | 0 | 0 |
| Chlopsidae | Chlopsis dentatus | 1 | 1 | 0 | 0 | 0 | 0 |
| Clupeidae | Jenkinsia parvula | 1 | 0 | 0 | 0 | 0 | 0 |
| Dactyloscopidae | Dactylagnus peratikos | 1 | 0 | 0 | 0 | 1 | 0 |
| Dactyloscopidae | Gillellus inescatus | 1 | 0 | 0 | 0 | 0 | 0 |
| Dactyloscopidae | Myxodagnus belone | 1 | 0 | 0 | 0 | 0 | 0 |
| Dactyloscopidae | Platygillellus smithi | 1 | 0 | 0 | 0 | 0 | 0 |
| Echeneidae | Echeneis neucratoides | 0 | 1 | 0 | 0 | 0 | 0 |
| Elopidae | Elops smithi | 1 | 1 | 0 | 1 | 1 | 0 |
| Engraulidae | Anchoa trinitatis | 0 | 0 | 1 | 0 | 1 | 0 |
| Engraulidae | Anchoviella blackburni | 1 | 1 | 1 | 0 | 1 | 0 |
| Epinephelidae | Liopropoma olneyi | 1 | 0 | 0 | 0 | 0 | 1 |
| Epinephelidae | Liopropoma santi | 1 | 0 | 0 | 0 | 0 | 1 |
| Epinephelidae | Mycteroperca cidi | 0 | 0 | 1 | 1 | 0 | 0 |
| Gobiesocidae | Derilissus kremnobates | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiesocidae | Derilissus lombardii | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiesocidae | Derilissus nanus | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiesocidae | Derilissus vittiger | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiesocidae | Tomicodon clarkei | 1 | 0 | 0 | 0 | 0 | 0 |

| | | Contributing factors | | | Potential threats | | |
|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Few records** | **Taxonomic uncertainty** | **Small distribution** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** |
| Gobiesocidae | Tomicodon lavettsmithi | 1 | 0 | 0 | 0 | 1 | 0 |
| Gobiidae | Akko dionaea | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Bathygobius geminatus | 1 | 0 | 0 | 0 | 1 | 0 |
| Gobiidae | Chriolepis benthonis | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Coryphopterus kuna | 0 | 0 | 0 | 0 | 0 | 1 |
| Gobiidae | Elacatinus panamensis | 0 | 0 | 1 | 0 | 1 | 0 |
| Gobiidae | Elacatinus rubrigenis | 1 | 0 | 0 | 0 | 1 | 0 |
| Gobiidae | Evermannichthys bicolor | 1 | 0 | 1 | 0 | 0 | 0 |
| Gobiidae | Evermannichthys convictor | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Evermannichthys silus | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Gobioides grahamae | 1 | 0 | 0 | 0 | 1 | 0 |
| Gobiidae | Psilotris amblyrhynchus | 1 | 0 | 0 | 0 | 1 | 1 |
| Gobiidae | Robinsichthys arrowsmithensis | 1 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Varicus imswe | 1 | 1 | 0 | 0 | 1 | 0 |
| Gobiidae | Varicus marilynae | 1 | 0 | 0 | 0 | 0 | 1 |
| Gobiidae | Vomerogobius flavus | 1 | 0 | 0 | 0 | 1 | 1 |
| Grammatidae | Gramma dejongi | 1 | 0 | 0 | 0 | 0 | 1 |
| Grammatidae | Lipogramma flavescens | 1 | 0 | 0 | 0 | 0 | 1 |
| Grammatidae | Lipogramma robinsi | 1 | 0 | 0 | 0 | 0 | 1 |
| Haemulidae | Anisotremus surinamensis | 0 | 0 | 0 | 1 | 0 | 0 |
| Haemulidae | Genyatremus cavifrons | 0 | 0 | 0 | 1 | 1 | 0 |
| Haemulidae | Haemulon album | 0 | 0 | 0 | 1 | 0 | 0 |
| Haemulidae | Pomadasys crocro | 0 | 0 | 0 | 1 | 1 | 0 |
| Istiophoridae | Tetrapturus georgii | 0 | 1 | 0 | 1 | 0 | 0 |
| Labridae | Scarus coelestinus | 0 | 0 | 0 | 1 | 0 | 0 |
| Labridae | Sparisoma frondosum | 0 | 1 | 0 | 1 | 1 | 0 |
| Labridae | Sparisoma griseorubrum | 0 | 1 | 1 | 0 | 1 | 0 |
| Labrisomidae | Haptoclinus apectolophus | 1 | 0 | 0 | 0 | 0 | 0 |
| Labrisomidae | Haptoclinus dropi | 1 | 0 | 0 | 0 | 0 | 0 |

| | | Contributing factors | | | Potential threats | | |
|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Few records** | **Taxonomic uncertainty** | **Small distribution** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** |
| Labrisomidae | Starksia leucovitta | 0 | 0 | 1 | 0 | 0 | 1 |
| Labrisomidae | Starksia sella | 1 | 0 | 0 | 0 | 0 | 0 |
| Labrisomidae | Starksia springeri | 1 | 0 | 1 | 0 | 0 | 1 |
| Labrisomidae | Starksia variabilis | 1 | 0 | 0 | 0 | 0 | 0 |
| Labrisomidae | Starksia y-lineata | 1 | 0 | 0 | 0 | 0 | 0 |
| Lutjanidae | Etelis oculatus | 0 | 0 | 0 | 1 | 0 | 0 |
| Lutjanidae | Lutjanus buccanella | 0 | 0 | 0 | 1 | 0 | 0 |
| Lutjanidae | Lutjanus jocu | 0 | 0 | 0 | 1 | 1 | 0 |
| Lutjanidae | Ocyurus chrysurus | 0 | 0 | 0 | 1 | 1 | 0 |
| Malacanthidae | Caulolatilus microps | 0 | 0 | 0 | 1 | 0 | 0 |
| Malacanthidae | Caulolatilus williamsi | 1 | 0 | 0 | 0 | 0 | 0 |
| Microdesmidae | Microdesmus luscus | 1 | 0 | 0 | 0 | 1 | 0 |
| Mugilidae | Mugil liza | 0 | 1 | 0 | 1 | 1 | 0 |
| Mugilidae | Mugil margaritae | 1 | 0 | 0 | 1 | 0 | 0 |
| Ophichthidae | Bascanichthys inopinatus | 1 | 0 | 0 | 0 | 0 | 0 |
| Ophichthidae | Callechelys springeri | 1 | 1 | 0 | 0 | 0 | 0 |
| Ophichthidae | Gordiichthys ergodes | 1 | 0 | 0 | 0 | 1 | 0 |
| Paralichthyidae | Ancylopsetta kumperae | 0 | 0 | 0 | 1 | 0 | 0 |
| Paralichthyidae | Citharichthys amblybregmatus | 1 | 0 | 0 | 0 | 0 | 0 |
| Paralichthyidae | Etropus delsmani ssp. delsmani | 1 | 1 | 0 | 0 | 0 | 0 |
| Paralichthyidae | Paralichthys tropicus | 0 | 0 | 0 | 1 | 0 | 0 |
| Pomacentridae | Stegastes otophorus | 1 | 0 | 0 | 0 | 1 | 0 |
| Sciaenidae | Lonchurus elegans | 1 | 0 | 1 | 1 | 1 | 0 |
| Sciaenidae | Ophioscion panamensis | 1 | 1 | 0 | 0 | 1 | 0 |
| Sciaenidae | Stellifer stellifer | 0 | 0 | 0 | 1 | 0 | 0 |
| Scorpaenidae | Pontinus helena | 1 | 0 | 0 | 0 | 0 | 0 |
| Serranidae | Hypoplectrus atlahua | 1 | 1 | 0 | 0 | 1 | 1 |
| Serranidae | Hypoplectrus ecosur | 1 | 1 | 0 | 0 | 1 | 1 |
| Serranidae | Hypoplectrus maculiferus | 1 | 1 | 0 | 0 | 1 | 1 |

| | | Contributing factors | | | Potential threats | | |
|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Few records** | **Taxonomic uncertainty** | **Small distribution** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** |
| Sparidae | Calamus campechanus | 0 | 0 | 1 | 1 | 0 | 0 |
| Syngnathidae | Hippocampus reidi | 0 | 0 | 0 | 1 | 1 | 0 |
| Syngnathidae | Hippocampus zosterae | 0 | 0 | 0 | 1 | 1 | 0 |
| Syngnathidae | Minyichthys inusitatus | 1 | 0 | 0 | 0 | 0 | 0 |
| Syngnathidae | Syngnathus dawsoni | 1 | 0 | 1 | 0 | 0 | 0 |
| Syngnathidae | Syngnathus makaxi | 0 | 0 | 1 | 0 | 1 | 0 |
| Tetraodontidae | Sphoeroides georgemilleri | 1 | 0 | 1 | 0 | 1 | 0 |
| Triglidae | Prionotus murielae | 1 | 0 | 0 | 0 | 0 | 0 |
| Tripterygiidae | Enneanectes wilki | 1 | 1 | 0 | 0 | 0 | 0 |

| | | | Contributing factors | | | Potential threats | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Gulf endemic?** | **Few records** | **Taxonomic uncertainty** | **Small range** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** | **Oil spill** |
| Achiridae | Gymnachirus nudus | no | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Acropomatidae | Synagrops trispinosus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Acropomatidae | Verilus sordidus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Apogonidae | Apogon robinsi | no | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Atherinopsidae | Menidia clarkhubbsi | yes | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| Bothidae | Bothus maculiferus | no | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Carangidae | Selene brownii | no | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

| | | | Contributing factors | | | Potential threats | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Gulf endemic?** | **Few records** | **Taxonomic uncertainty** | **Small range** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** | **Oil spill** |
| Chlopsidae | Chilorhinus suensonii | no | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Chlopsidae | Chlopsis bicolor | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chlopsidae | Chlopsis dentatus | no | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Chlopsidae | Kaupichthys hyoproroides | no | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Cynoglossidae | Symphurus arawak | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cynoglossidae | Symphurus pusillus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Cynoglossidae | Symphurus tessellatus | no | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Dactyloscopidae | Dactyloscopus crossotus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dactyloscopidae | Dactyloscopus foraminosus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Diodontidae | Diodon eydouxii | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Echeneidae | Echeneis neucratoides | no | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Elopidae | Elops smithi | no | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| Emmelichthyidae | Emmelichthys ruber | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Emmelichthyidae | Erythrocles monodi | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Engraulidae | Anchovia clupeoides | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Epinephelidae | Rypticus randalli | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Exocoetidae | Cypselurus comatus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | Contributing factors | | | Potential threats | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Gulf endemic?** | **Few records** | **Taxonomic uncertainty** | **Small range** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** | **Oil spill** |
| Gobiidae | Chriolepis benthonis | yes | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Chriolepis bilix | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Elacatinus evelynae | no | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| Gobiidae | Microgobius signatus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Parrella macropteryx | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Gobiidae | Varicus marilynae | no | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Grammatidae | Lipogramma anabantoides | no | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Grammatidae | Lipogramma regia | no | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Grammatidae | Lipogramma trilineata | no | 1 | 0 | 0 | 0 | 0 | 1 | 0 |
| Haemulidae | Anisotremus surinamensis | no | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Haemulidae | Haemulon album | no | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Haemulidae | Pomadasys crocro | no | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Istiophoridae | Tetrapturus georgii | no | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| Labrisomidae | Gobioclinus filamentosus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labrisomidae | Nemaclinus atelestos | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labrisomidae | Paraclinus infrons | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Labrisomidae | Starksia lepicoelia | no | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| Labrisomidae | Starksia nanodes | no | 1 | 1 | 0 | 0 | 1 | 0 | 0 |
| Labrisomidae | Starksia starcki | no | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| Labrisomidae | Starksia weigti | no | 1 | 1 | 0 | 0 | 0 | 0 | 0 |

| | | | Contributing factors | | | Potential threats | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Gulf endemic?** | **Few records** | **Taxonomic uncertainty** | **Small range** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** | **Oil spill** |
| Lutjanidae | Lutjanus cyanopterus | no | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Luvaridae | Luvarus imperialis | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Malacanthidae | Caulolatilus microps | no | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| Megalopidae | Megalops atlanticus | no | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Microdesmidae | Ptereleotris helenae | no | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| Molidae | Ranzania laevis | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Mugilidae | Mugil liza | no | 0 | 0 | 0 | 1 | 1 | 0 | 0 |
| Mugilidae | Mugil rubrioculus | no | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| Mugilidae | Mugil trichodon | no | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| Muraenidae | Channomuraena vittata | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Muraenidae | Gymnothorax maderensis | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Muraenidae | Gymnothorax polygonius | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Muraenidae | Monopenchelys acuta | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Muraenidae | Uropterygius macularius | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Nomeidae | Cubiceps gracilis | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophichthidae | Apterichtus ansp | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophichthidae | Callechelys bilinearis | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophichthidae | Gordiichthys ergodes | yes | 1 | 0 | 0 | 0 | 1 | 0 | 1 |

| | | | Contributing factors | | | Potential threats | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Gulf endemic?** | **Few records** | **Taxonomic uncertainty** | **Small range** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** | **Oil spill** |
| Ophichthidae | Gordiichthys leibyi | no | 1 | 0 | 1 | 0 | 1 | 0 | 1 |
| Ophichthidae | Gordiichthys randalli | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophichthidae | Myrophis platyrhynchus | no | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| Ophichthidae | Ophichthus hyposagmatus | no | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| Ophichthidae | Ophichthus spinicauda | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophichthidae | Quassiremus ascensionis | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Ophidiidae | Lepophidium gilmorei | no | 1 | 0 | 0 | 0 | 1 | 0 | 1 |
| Ophidiidae | Lepophidium marmoratum | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Paralichthyidae | Paralichthys oblongus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Phycidae | Urophycis earllii | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Polynemidae | Polydactylus oligodon | no | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| Polynemidae | Polydactylus virginicus | no | 1 | 1 | 0 | 1 | 1 | 0 | 0 |
| Pristigasteridae | Chirocentrodon bleekerianus | no | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Scombridae | Auxis thazard | no | 1 | 1 | 0 | 1 | 0 | 0 | 0 |
| Scorpaenidae | Neomerinthe beanorum | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Scorpaenidae | Pontinus nematophthalmus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

| | | | Contributing factors | | | Potential threats | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Family** | **Species Name** | **Gulf endemic?** | **Few records** | **Taxonomic uncertainty** | **Small range** | **Lack fishery data** | **Habitat degradation** | **Lionfish predation** | **Oil spill** |
| Scorpaenidae | Scorpaena elachys | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Serranidae | Hypoplectrus atlahua | yes | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| Serranidae | Hypoplectrus ecosur | no | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| Serranidae | Hypoplectrus maculiferus | no | 1 | 1 | 0 | 0 | 1 | 1 | 0 |
| Sparidae | Calamus campechanus | no | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Syngnathidae | Syngnathus caribbaeus | no | 1 | 0 | 0 | 0 | 1 | 0 | 0 |
| Syngnathidae | Syngnathus makaxi | no | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| Tetraodontidae | Lagocephalus lagocephalus | no | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

# APPENDIX E.

# LIST OF SPECIES WITH DIFFERING REGIONAL AND GLOBAL RED LIST CATEGORIES

List of the 102 species where the regional category differs from the global.

| **Family** | **Species Name** | **Regional category** | **Global category** |
|---|---|---|---|
| Achiridae | Gymnachirus nudus | DD | LC |
| Acropomatidae | Synagrops trispinosus | DD | LC |
| Acropomatidae | Verilus sordidus | DD | LC |
| Albulidae | Albula vulpes | LC | NT |
| Apogonidae | Apogon robinsi | DD | LC |
| Apogonidae | Astrapogon stellatus | LC | DD |
| Balistidae | Balistes capriscus | NT | VU |
| Balistidae | Balistes vetula | LC | NT |
| Bothidae | Bothus maculiferus | DD | LC |
| Carangidae | Selene brownii | DD | LC |
| Carangidae | Seriola dumerili | NT | LC |
| Centropomidae | Centropomus poeyi | LC | DD |
| Chlopsidae | Chilorhinus suensonii | DD | LC |
| Chlopsidae | Chlopsis bicolor | DD | LC |
| Chlopsidae | Kaupichthys hyoproroides | DD | LC |
| Cynoglossidae | Symphurus arawak | DD | LC |
| Cynoglossidae | Symphurus pusillus | DD | LC |
| Cynoglossidae | Symphurus tessellatus | DD | LC |
| Dactyloscopidae | Dactyloscopus crossotus | DD | LC |
| Dactyloscopidae | Dactyloscopus foraminosus | DD | LC |
| Diodontidae | Diodon eydouxii | DD | LC |
| Emmelichthyidae | Emmelichthys ruber | DD | LC |
| Emmelichthyidae | Erythrocles monodi | DD | LC |
| Engraulidae | Anchovia clupeoides | DD | LC |
| Epinephelidae | Dermatolepis inermis | LC | NT |
| Epinephelidae | Epinephelus drummondhayi | LC | CR |

| Family | Species Name | Regional category | Global category |
|---|---|---|---|
| Epinephelidae | Epinephelus itajara | EN | CR |
| Epinephelidae | Epinephelus striatus | CR | EN |
| Epinephelidae | Hyporthodus flavolimbatus | LC | VU |
| Epinephelidae | Hyporthodus nigritus | NT | CR |
| Epinephelidae | Hyporthodus niveatus | LC | VU |
| Epinephelidae | Mycteroperca bonaci | VU | NT |
| Epinephelidae | Mycteroperca venenosa | EN | NT |
| Epinephelidae | Rypticus randalli | DD | LC |
| Exocoetidae | Cypselurus comatus | DD | LC |
| Gobiidae | Chriolepis bilix | DD | LC |
| Gobiidae | Elacatinus evelynae | DD | LC |
| Gobiidae | Elacatinus prochilos | EN | VU |
| Gobiidae | Microgobius signatus | DD | LC |
| Gobiidae | Parrella macropteryx | DD | LC |
| Gobiidae | Tigrigobius saucrus | VU | LC |
| Grammatidae | Lipogramma anabantoides | DD | LC |
| Grammatidae | Lipogramma regia | DD | LC |
| Grammatidae | Lipogramma trilineata | DD | LC |
| Istiophoridae | Makaira nigricans | EN | VU |
| Labridae | Scarus coelestinus | LC | DD |
| Labridae | Scarus guacamaia | LC | NT |
| Labrisomidae | Gobioclinus filamentosus | DD | LC |
| Labrisomidae | Nemaclinus atelestos | DD | LC |
| Labrisomidae | Paraclinus infrons | DD | LC |
| Labrisomidae | Starksia lepicoelia | DD | LC |
| Labrisomidae | Starksia nanodes | DD | LC |
| Labrisomidae | Starksia starcki | DD | LC |
| Labrisomidae | Starksia weigti | DD | LC |
| Lutjanidae | Etelis oculatus | LC | DD |
| Lutjanidae | Lutjanus analis | LC | NT |
| Lutjanidae | Lutjanus buccanella | LC | DD |
| Lutjanidae | Lutjanus cyanopterus | DD | VU |
| Lutjanidae | Lutjanus jocu | LC | DD |

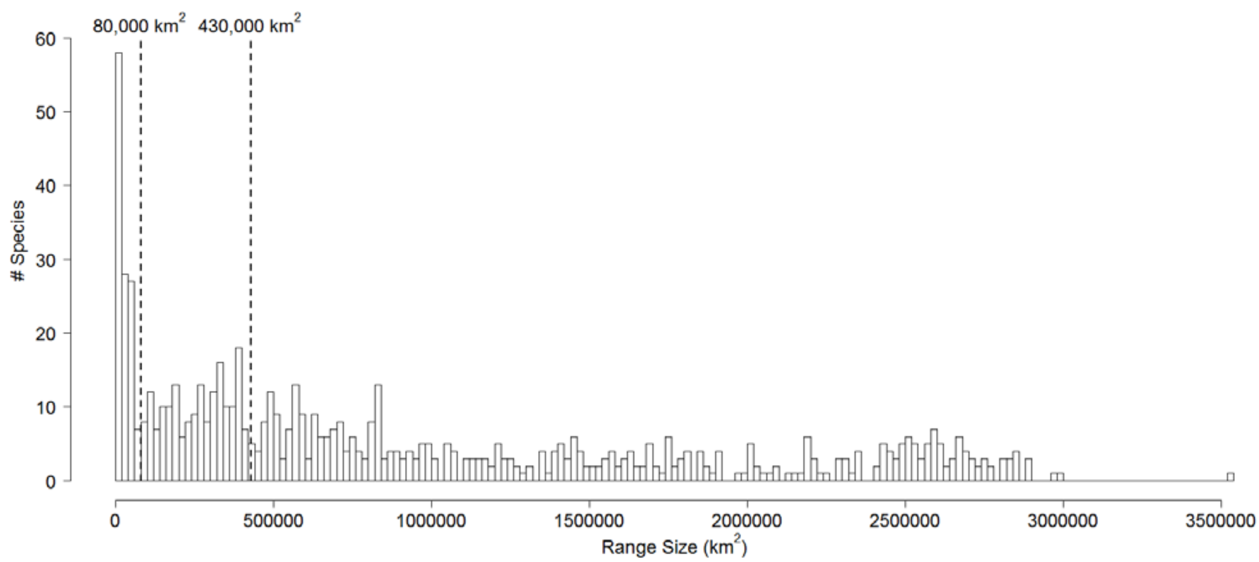
| Family | Species Name | Regional category | Global category |
|---|---|---|---|
| Lutjanidae | Ocyurus chrysurus | LC | DD |
| Luvaridae | Luvarus imperialis | DD | LC |
| Megalopidae | Megalops atlanticus | DD | VU |
| Microdesmidae | Ptereleotris helenae | DD | LC |
| Molidae | Mola mola | LC | VU |
| Molidae | Ranzania laevis | DD | LC |
| Mugilidae | Mugil rubrioculus | DD | LC |
| Mugilidae | Mugil trichodon | DD | LC |
| Muraenidae | Channomuraena vittata | DD | LC |
| Muraenidae | Gymnothorax maderensis | DD | LC |
| Muraenidae | Gymnothorax polygonius | DD | LC |
| Muraenidae | Monopenchelys acuta | DD | LC |
| Muraenidae | Uropterygius macularius | DD | LC |
| Nomeidae | Cubiceps gracilis | DD | LC |
| Ophichthidae | Apterichtus ansp | DD | LC |
| Ophichthidae | Callechelys bilinearis | DD | LC |
| Ophichthidae | Gordiichthys leibyi | DD | LC |
| Ophichthidae | Gordiichthys randalli | DD | LC |
| Ophichthidae | Myrophis platyrhynchus | DD | LC |
| Ophichthidae | Ophichthus hyposagmatus | DD | LC |
| Ophichthidae | Ophichthus spinicauda | DD | LC |
| Ophichthidae | Quassiremus ascensionis | DD | LC |
| Ophidiidae | Lepophidium gilmorei | DD | LC |
| Ophidiidae | Lepophidium marmoratum | DD | LC |
| Paralichthyidae | Paralichthys oblongus | DD | LC |
| Phycidae | Urophycis earllii | DD | LC |
| Polynemidae | Polydactylus oligodon | DD | LC |
| Polynemidae | Polydactylus virginicus | DD | LC |
| Pomacentridae | Stegastes otophorus | EN | DD |
| Pomatomidae | Pomatomus saltatrix | LC | VU |
| Pristigasteridae | Chirocentrodon bleekerianus | DD | LC |
| Scombridae | Auxis thazard | DD | LC |
| Scombridae | Thunnus alalunga | LC | NT |

| Family | Species Name | Regional category | Global category |
|---|---|---|---|
| Scombridae | Thunnus albacares | LC | NT |
| Scombridae | Thunnus obesus | NT | VU |
| Scorpaenidae | Neomerinthe beanorum | DD | LC |
| Scorpaenidae | Pontinus nematophthalmus | DD | LC |
| Scorpaenidae | Scorpaena elachys | DD | LC |
| Syngnathidae | Hippocampus reidi | LC | DD |
| Syngnathidae | Hippocampus zosterae | NT | DD |
| Syngnathidae | Syngnathus caribbaeus | DD | LC |
| Syngnathidae | Syngnathus floridae | NT | LC |
| Tetraodontidae | Lagocephalus lagocephalus | DD | LC |

# APPENDIX F.

# HISTOGRAM PLOT OF RANGE SIZES WITH LIST OF SPECIES USED IN THE LIMITED RANGE RICHNESS ANALYSES

Histogram of the range sizes of all greater Caribbean endemics excluding 60 DD species (n=674) with a bin size of 20,000 km$^2$. Two vertical dashed lines mark natural breaks at 80,000 km$^2$ and 430,000 km$^2$. The figure is followed by a list of the 242 species with range sizes less than 430,000 km$^2$, which were used to create richness maps to show the distribution of limited range species. The list is sorted by smallest to largest range size.




| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Ariidae | Cathorops belizensis | DD | 32 |
| Bythitidae | Lucifuga lucayana | EN | 155 |
| Labridae | Halichoeres socialis | EN | 235 |
| Bythitidae | Lucifuga spelaeotes | VU | 323 |
| Bythitidae | Lucifuga simile | CR | 732 |
| Gobiidae | Gobiosoma spilotum | EN | 1169 |

| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Gobiidae | Elacatinus rubrigenis | DD | 2756 |
| Serranidae | Hypoplectrus castroaguirrei | EN | 3774 |
| Batrachoididae | Sanopus reticulatus | EN | 3809 |
| Batrachoididae | Sanopus splendidus | EN | 3833 |
| Atherinopsidae | Menidia conchorum | EN | 4251 |
| Gobiesocidae | Tomicodon lavettsmithi | DD | 6648 |
| Serranidae | Hypoplectrus maya | VU | 7195 |
| Atherinopsidae | Menidia colei | EN | 7417 |
| Fundulidae | Fundulus persimilis | EN | 8643 |
| Chaenopsidae | Emblemariopsis dianae | DD | 8977 |
| Gobiidae | Psilotris boehlkei | VU | 9042 |
| Opistognathidae | Opistognathus melachasme | LC | 10902 |
| Gobiidae | Elacatinus cayman | VU | 11088 |
| Labrisomidae | Starksia leucovitta | DD | 11417 |
| Gobiidae | Tigrigobius harveyi | EN | 13352 |
| Batrachoididae | Sanopus greenfieldorum | VU | 14076 |
| Fundulidae | Fundulus grandissimus | VU | 15817 |
| Batrachoididae | Sanopus astrifer | VU | 15854 |
| Gobiidae | Elacatinus atronasus | EN | 17769 |
| Opistognathidae | Opistognathus nothus | LC | 18224 |
| Batrachoididae | Vladichthys gloverensis | VU | 22502 |
| Ariidae | Notarius neogranatensis | VU | 23967 |
| Gobiesocidae | Tomicodon briggsi | LC | 25569 |
| Opistognathidae | Opistognathus megalepis | LC | 26252 |
| Gobiidae | Elacatinus colini | LC | 27526 |
| Syngnathidae | Syngnathus makaxi | DD | 27728 |
| Ophichthidae | Ophichthus hyposagmatus | LC | 28778 |
| Gobiidae | Chriolepis bilix | LC | 28801 |
| Chaenopsidae | Protemblemaria punctata | LC | 29003 |
| Engraulidae | Anchoviella blackburni | DD | 32141 |
| Sparidae | Diplodus bermudensis | LC | 32172 |
| Hemiramphidae | Hemiramphus bermudensis | LC | 32173 |
| Hemiramphidae | Hyporhamphus collettei | LC | 32173 |

| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Engraulidae | Anchoa choerostoma | EN | 32173 |
| Pomacentridae | Chromis bermudae | LC | 32173 |
| Gobiidae | Gobiosoma hildebrandi | VU | 34244 |
| Gobiidae | Elacatinus jarocho | EN | 36194 |
| Labrisomidae | Starksia springeri | DD | 39128 |
| Gobiidae | Chriolepis vespa | LC | 40360 |
| Labrisomidae | Starksia starcki | LC | 40604 |
| Labridae | Halichoeres burekae | EN | 44665 |
| Opistognathidae | Opistognathus leprocarus | LC | 44953 |
| Gobiidae | Elacatinus lori | LC | 46220 |
| Dactyloscopidae | Dactylagnus peratikos | DD | 48801 |
| Chaenopsidae | Emblemariopsis ruetzleri | LC | 48840 |
| Chaenopsidae | Acanthemblemaria johnsoni | LC | 49019 |
| Chaenopsidae | Emblemariopsis pricei | VU | 50333 |
| Pristigasteridae | Neoopisthopterus cubanus | VU | 51937 |
| Chaenopsidae | Emblemariopsis randalli | DD | 52027 |
| Bythitidae | Ogilbichthys microphthalmus | LC | 57571 |
| Gobiidae | Elacatinus serranilla | LC | 58027 |
| Serranidae | Parasphyraenops atrimanus | LC | 58557 |
| Bythitidae | Ogilbichthys ferocis | EN | 59005 |
| Gobiidae | Elacatinus centralis | EN | 63612 |
| Ophichthidae | Gordiichthys randalli | LC | 69353 |
| Gobiidae | Lythrypnus mowbrayi | LC | 69982 |
| Gobiidae | Elacatinus panamensis | DD | 72455 |
| Ophichthidae | Myrophis anterodorsalis | LC | 73329 |
| Atherinopsidae | Atherinella beani | DD | 82064 |
| Labrisomidae | Starksia rava | LC | 82394 |
| Labrisomidae | Starksia sangreyae | LC | 83812 |
| Chaenopsidae | Emblemaria diphyodontis | LC | 90146 |
| Labridae | Sparisoma griseorubrum | DD | 91932 |
| Gobiidae | Elacatinus lobeli | NT | 92071 |
| Tetraodontidae | Sphoeroides georgemilleri | DD | 95527 |
| Ophichthidae | Callechelys springeri | DD | 96555 |

| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Gobiidae | Gobiosoma yucatanum | LC | 102129 |
| Gobiidae | Priolepis robinsi | LC | 107319 |
| Gobiesocidae | Derilissus altifrons | LC | 109501 |
| Gobiesocidae | Tomicodon leurodiscus | LC | 109582 |
| Bythitidae | Ogilbia tyleri | LC | 109944 |
| Poeciliidae | Gambusia rhizophorae | LC | 113048 |
| Ariidae | Cathorops higuchii | LC | 116380 |
| Labrisomidae | Starksia sluiteri | LC | 116773 |
| Gobiidae | Ctenogobius claytonii | VU | 117259 |
| Syngnathidae | Penetopteryx nanus | LC | 118122 |
| Phycidae | Urophycis earllii | LC | 118136 |
| Labrisomidae | Starksia robertsoni | LC | 119342 |
| Tripterygiidae | Enneanectes wilki | DD | 124892 |
| Gobiidae | Psilotris kaufmani | LC | 129391 |
| Atherinopsidae | Atherinella milleri | LC | 134479 |
| Atherinopsidae | Membras analis | DD | 136130 |
| Chaenopsidae | Emblemaria caycedoi | LC | 136992 |
| Chaenopsidae | Acanthemblemaria betinensis | LC | 138874 |
| Labrisomidae | Starksia weigti | LC | 140322 |
| Ariidae | Cathorops wayuu | DD | 141923 |
| Sparidae | Calamus cervigoni | LC | 141989 |
| Blenniidae | Hypleurochilus geminatus | LC | 147727 |
| Labrisomidae | Starksia melasma | LC | 148840 |
| Bothidae | Trichopsetta orbisulcus | LC | 151634 |
| Bythitidae | Ogilbichthys kakuki | LC | 151779 |
| Chaenopsidae | Acanthemblemaria greenfieldi | LC | 153933 |
| Sciaenidae | Umbrina milliae | LC | 155037 |
| Chaenopsidae | Ekemblemaria nigra | LC | 156985 |
| Ophidiidae | Lepophidium gilmorei | LC | 160087 |
| Ophichthidae | Ethadophis akkistikos | LC | 161511 |
| Engraulidae | Anchoviella elongata | LC | 161550 |
| Blenniidae | Chasmodes saburrae | LC | 167536 |
| Microdesmidae | Microdesmus lanceolatus | LC | 167950 |

| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Clupeidae | Alosa alabamae | NT | 168334 |
| Ophichthidae | Gordiichthys ergodes | DD | 169645 |
| Fundulidae | Fundulus jenkinsi | VU | 169773 |
| Batrachoididae | Batrachoides manglae | LC | 173275 |
| Sparidae | Calamus campechanus | DD | 176639 |
| Fundulidae | Fundulus pulvereus | LC | 184119 |
| Chaenopsidae | Emblemariopsis diaphana | LC | 188972 |
| Ogcocephalidae | Halieutichthys intermedius | LC | 189362 |
| Centropomidae | Centropomus poeyi | DD | 189409 |
| Batrachoididae | Thalassophryne megalops | LC | 189518 |
| Paralichthyidae | Citharichthys valdezi | LC | 190419 |
| Blenniidae | Chasmodes longimaxilla | LC | 191200 |
| Sciaenidae | Stellifer chaoi | LC | 191420 |
| Chaenopsidae | Chaenopsis roseola | LC | 192212 |
| Gobiidae | Tigrigobius redimiculus | VU | 193225 |
| Batrachoididae | Batrachoides gilberti | LC | 194797 |
| Labrisomidae | Nemaclinus atelestos | LC | 200526 |
| Cyprinodontidae | Cyprinodon artifrons | LC | 203242 |
| Engraulidae | Anchoa trinitatis | DD | 205055 |
| Gobiidae | Gobiosoma spes | LC | 207752 |
| Serranidae | Anthias woodsi | LC | 217911 |
| Batrachoididae | Sanopus barbatus | LC | 218213 |
| Blenniidae | Hypleurochilus caudovittatus | LC | 222867 |
| Ophidiidae | Otophidium chickcharney | LC | 224836 |
| Clupeidae | Jenkinsia parvula | DD | 228490 |
| Ophichthidae | Ophichthus melanoporus | LC | 231443 |
| Labrisomidae | Starksia langi | LC | 232405 |
| Apogonidae | Apogon gouldi | LC | 232994 |
| Gobiidae | Lythrypnus phorellus | LC | 236146 |
| Eleotridae | Leptophilypnus fluviatilis | LC | 238070 |
| Gobiesocidae | Tomicodon rhabdotus | LC | 244034 |
| Congridae | Heteroconger luteolus | LC | 245133 |
| Cyprinodontidae | Floridichthys carpio | LC | 246990 |

| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Chaenopsidae | Emblemaria piratula | LC | 247068 |
| Ogcocephalidae | Ogcocephalus rostellum | LC | 247354 |
| Gobiidae | Elacatinus illecebrosus | LC | 247579 |
| Bythitidae | Ogilbichthys longimanus | LC | 253719 |
| Clupeidae | Alosa chrysochloris | LC | 255234 |
| Gobiidae | Tigrigobius zebrellus | LC | 259042 |
| Chaenopsidae | Chaenopsis resh | LC | 261558 |
| Sciaenidae | Protosciaena trewavasae | LC | 261589 |
| Chaenopsidae | Acanthemblemaria rivasi | LC | 263646 |
| Gobiidae | Ctenogobius phenacus | LC | 265281 |
| Gobiidae | Palatogobius paradoxus | LC | 265292 |
| Chaenopsidae | Emblemariopsis tayrona | LC | 265623 |
| Syngnathidae | Syngnathus dawsoni | DD | 266057 |
| Clupeidae | Brevoortia smithi | LC | 267941 |
| Heterenchelyidae | Pythonichthys sanguineus | LC | 269310 |
| Chlopsidae | Catesbya pseudomuraena | DD | 269481 |
| Paralichthyidae | Citharichthys minutus | LC | 270032 |
| Labrisomidae | Paraclinus barbatus | LC | 275063 |
| Labrisomidae | Starksia guttata | LC | 277828 |
| Chaenopsidae | Emblemaria atlantica | LC | 280425 |
| Triglidae | Prionotus longispinosus | LC | 283530 |
| Epinephelidae | Mycteroperca cidi | DD | 284494 |
| Apogonidae | Apogon mosavi | LC | 286280 |
| Cynoglossidae | Symphurus minor | LC | 288544 |
| Serranidae | Hypoplectrus floridae | LC | 290789 |
| Ogcocephalidae | Ogcocephalus declivirostris | LC | 297644 |
| Bythitidae | Ogilbia cayorum | LC | 298171 |
| Congridae | Gnathophis bracheatopos | LC | 301435 |
| Ophidiidae | Lepophidium marmoratum | LC | 301992 |
| Ophichthidae | Callechelys muraena | LC | 302240 |
| Ophichthidae | Letharchus velifer | LC | 302367 |
| Gobiidae | Elacatinus tenox | LC | 303750 |
| Bythitidae | Ogilbia sabaji | LC | 309024 |

| Family | Species Name | Global Red List | Range Size (km$^2$) |
|---|---|---|---|
| Ophichthidae | Pseudomyrophis fugesae | LC | 309117 |
| Clupeidae | Brevoortia gunteri | LC | 310075 |
| Chaenopsidae | Emblemaria vitta | LC | 311271 |
| Dactyloscopidae | Dactyloscopus comptus | LC | 312225 |
| Sciaenidae | Umbrina broussonnetii | LC | 316083 |
| Paralichthyidae | Citharichthys abbotti | LC | 318611 |
| Labrisomidae | Starksia greenfieldi | LC | 320254 |
| Tripterygiidae | Enneanectes deloachorum | LC | 320904 |
| Chaenopsidae | Emblemariopsis carib | LC | 320906 |
| Dactyloscopidae | Dactyloscopus boehlkei | LC | 324208 |
| Grammatidae | Lipogramma klayi | LC | 325074 |
| Ophidiidae | Lepophidium robustum | LC | 325087 |
| Malacanthidae | Caulolatilus guppyi | LC | 326264 |
| Ophichthidae | Gordiichthys irretitus | LC | 327226 |
| Opistognathidae | Opistognathus signatus | LC | 330100 |
| Batrachoididae | Thalassophryne maculosa | LC | 331666 |
| Chaenopsidae | Emblemariopsis ramirezi | LC | 332844 |
| Gobiidae | Evermannichthys spongicola | LC | 333611 |
| Serranidae | Serranus maytagi | LC | 334634 |
| Bythitidae | Gunterichthys longipenis | LC | 335142 |
| Ophidiidae | Lepophidium staurophor | LC | 338421 |
| Bythitidae | Calamopteryx robinsorum | LC | 338632 |
| Anomalopidae | Kryptophanaron alfredi | LC | 340744 |
| Fundulidae | Fundulus xenicus | LC | 340970 |
| Gobiidae | Ctenogobius shufeldti | LC | 341037 |
| Sciaenidae | Stellifer colonensis | LC | 341125 |
| Grammatidae | Lipogramma regia | LC | 341176 |
| Chaenopsidae | Emblemariopsis bottomei | LC | 342598 |
| Sciaenidae | Protosciaena bathytatos | LC | 343241 |
| Cyprinodontidae | Floridichthys polyommus | LC | 345833 |
| Gobiesocidae | Tomicodon cryptus | LC | 346944 |
| Gobiidae | Pycnomma roosevelti | LC | 358427 |
| Scorpaenidae | Scorpaena elachys | LC | 362036 |

| Family | Species Name | Global Red List | Range Size ($km^2$) |
|---|---|---|---|
| Sciaenidae | Cynoscion similis | LC | 363231 |
| Gobiidae | Gobiosoma longipala | LC | 363515 |
| Centrolophidae | Hyperoglyphe bythites | LC | 364338 |
| Tetraodontidae | Sphoeroides yergeri | LC | 367769 |
| Ophidiidae | Ophidion nocomis | LC | 368121 |
| Blenniidae | Hypsoblennius ionthas | LC | 368693 |
| Ophichthidae | Ophichthus spinicauda | LC | 369157 |
| Chlopsidae | Chlopsis dentatus | DD | 379470 |
| Dactyloscopidae | Gillellus healae | LC | 379962 |
| Sparidae | Calamus arctifrons | LC | 381201 |
| Callionymidae | Synchiropus dagmarae | LC | 383302 |
| Ophidiidae | Ophidion josephi | LC | 384298 |
| Blenniidae | Lupinoblennius nicholsi | LC | 384400 |
| Bothidae | Trichopsetta melasma | LC | 386706 |
| Paralichthyidae | Etropus cyclosquamus | LC | 388150 |
| Apogonidae | Apogon leptocaulus | LC | 388836 |
| Paralichthyidae | Paralichthys tropicus | DD | 390161 |
| Gobiidae | Lythrypnus okapia | LC | 390361 |
| Chaenopsidae | Emblemaria biocellata | LC | 390826 |
| Syngnathidae | Cosmocampus hildebrandi | LC | 391227 |
| Sciaenidae | Stellifer venezuelae | LC | 391617 |
| Dactyloscopidae | Gillellus jacksoni | LC | 393655 |
| Labrisomidae | Starksia occidentalis | LC | 393898 |
| Ophidiidae | Lepophidium zophochir | LC | 395207 |
| Nettastomatidae | Saurenchelys cognita | LC | 395751 |
| Sciaenidae | Lonchurus elegans | DD | 395752 |
| Muraenidae | Gymnothorax hubbsi | LC | 396024 |
| Bythitidae | Ogilbia boehlkei | LC | 401469 |
| Batrachoididae | Opsanus dichrostomus | LC | 401481 |
| Batrachoididae | Opsanus phobetron | LC | 408626 |
| Gobiesocidae | Acyrtus lanthanum | LC | 412780 |
| Synodontidae | Synodus macrostigmus | LC | 415939 |
| Ophidiidae | Ophidion guianense | LC | 416332 |

| Family | Species Name | Global Red List | Range Size ($km^2$) |
|---|---|---|---|
| Ogcocephalidae | Ogcocephalus pantostictus | LC | 419261 |
| Ophidiidae | Otophidium omostigma | LC | 422223 |
| Labrisomidae | Paraclinus naeorhegmis | LC | 426704 |
| Blenniidae | Hypleurochilus multifilis | LC | 426905 |
| Pristigasteridae | Odontognathus compressus | LC | 427251 |

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## EDUCATION

Bachelor of Arts (Marine Science), Florida Gulf Coast University, Fort Myers, Florida. 2006.

## PROFESSIONAL EXPERIENCE

**Research Associate**, August 2012 – Present, International Union for Conservation of Nature's Global Species Programme Marine Biodiversity Unit, Old Dominion University, Norfolk, Virginia

**Marine Technician**, November 2010 – March 2012, North Carolina Division of Marine Fisheries, Elizabeth City, North Carolina

**Scientific Aid**, August 2007 – March 2010, California Department of Fish and Game, Los Alamitos, California

**Marine Lab Intern**, March 2003 – February 2007, Florida Gulf Coast University Coastal Watershed Institute, Fort Myers, Florida

## THESIS-RELATED PRESENTATIONS

**November 2015**. Oral presentation: Threatened endemic bony shorefishes of the greater Caribbean: Implications for area-specific conservation priorities. Gulf and Caribbean Fisheries Institute annual meeting in Panama City, Panama

**August 2014**. Poster presentation: Extinction risk assessments of Gulf of Mexico bony fishes. International Marine Conservation Congress in Glasgow, Scotland

## PUBLICATIONS

Jarvis, E.T., **C. Linardich**, and C.F. Valle. 2010. Spawning-related movements of Barred Sand Bass, *Paralabrax nebulifer*, in southern California: Interpretations from two decades of historical tag and recapture data. Bulletin of the Southern California Academy of Sciences. 109(3):123-143.

Tolley, S.G., A.K. Volety, M. Savarese, L.D. Walls, **C. Linardich**, and E.M. Everham III. 2006. Impacts of salinity and freshwater inflow on oyster-reef communities in Southwest Florida. Aquatic Living Resources 19(4):371-387.