Extinction Risk in the Marine Realm: The Global Marine Species Assessment and the Deepwater Horizon Oil Spill

Roger McManus & Kent Carpenter

Species Survival Commission, Old Dominion University, Biological Sciences &
IUCN Global Species Programme, Global Marine Species Assessment

NEW HAMPSHIRE CHARITABLE FOUNDATION AND TOM HAAS
OLD DOMINION UNIVERSITY
SSC Species Survival Commission
IUCN

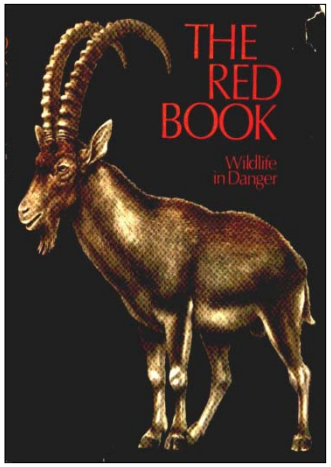
Red List launched to influence conservation action on biodiversity losses, but…

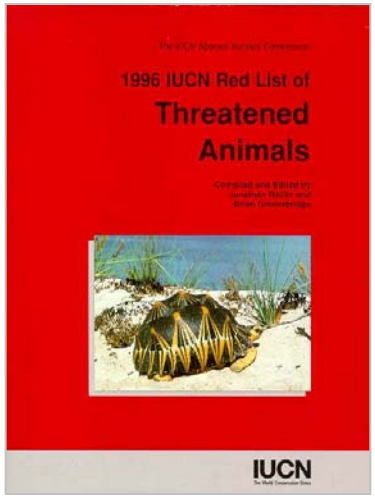
THE IUCN RED LIST OF THREATENED SPECIES™

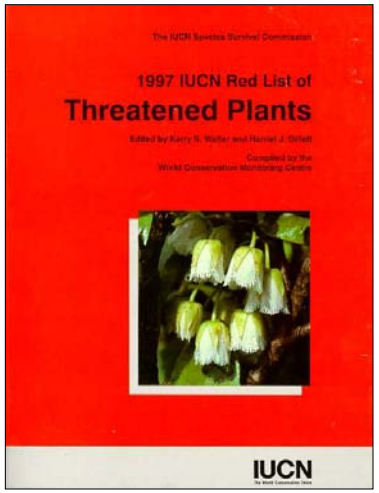
Marine species are poorly represented on the Red List

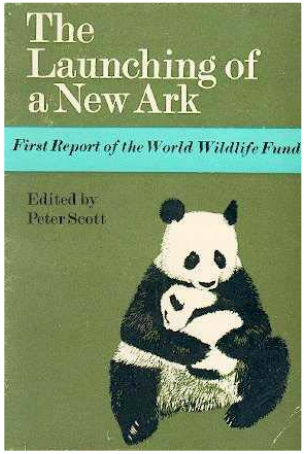
compared to terrestrial species (<1% before 2000)

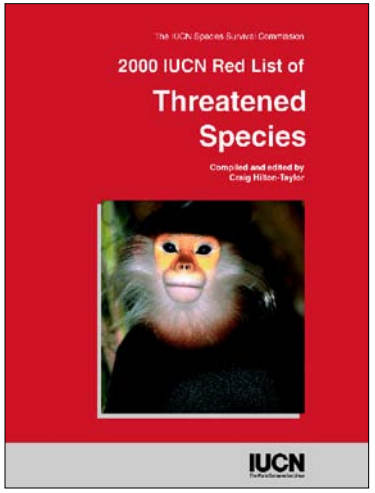
2.5% (40,177 total) in 2006











CONSERVATION INTERNATIONAL · IUCN · SSC Species Survival Commission · Old Dominion University · New Hampshire Charitable Foundation and Tom Haas

Global Marine Species Assessment created in 2005 to redress the imbalance: joint initiative

- IUCN/Species Survival Commission (SSC)
  - Species Programme
- Old Dominion University

- 2009 GMSA formalized as Marine Biodiversity Unit of IUCN Global Species Programme

Global Marine Species Assessment:

Laying the foundation for marine conservation

Vision: transform global marine conservation capabilities

Method: Complete Red List Assessments of a significant number of marine species.

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GMSA strategy, 2 parts

1) Complete ~20,000 Red List assessments of species in whole marine clades.

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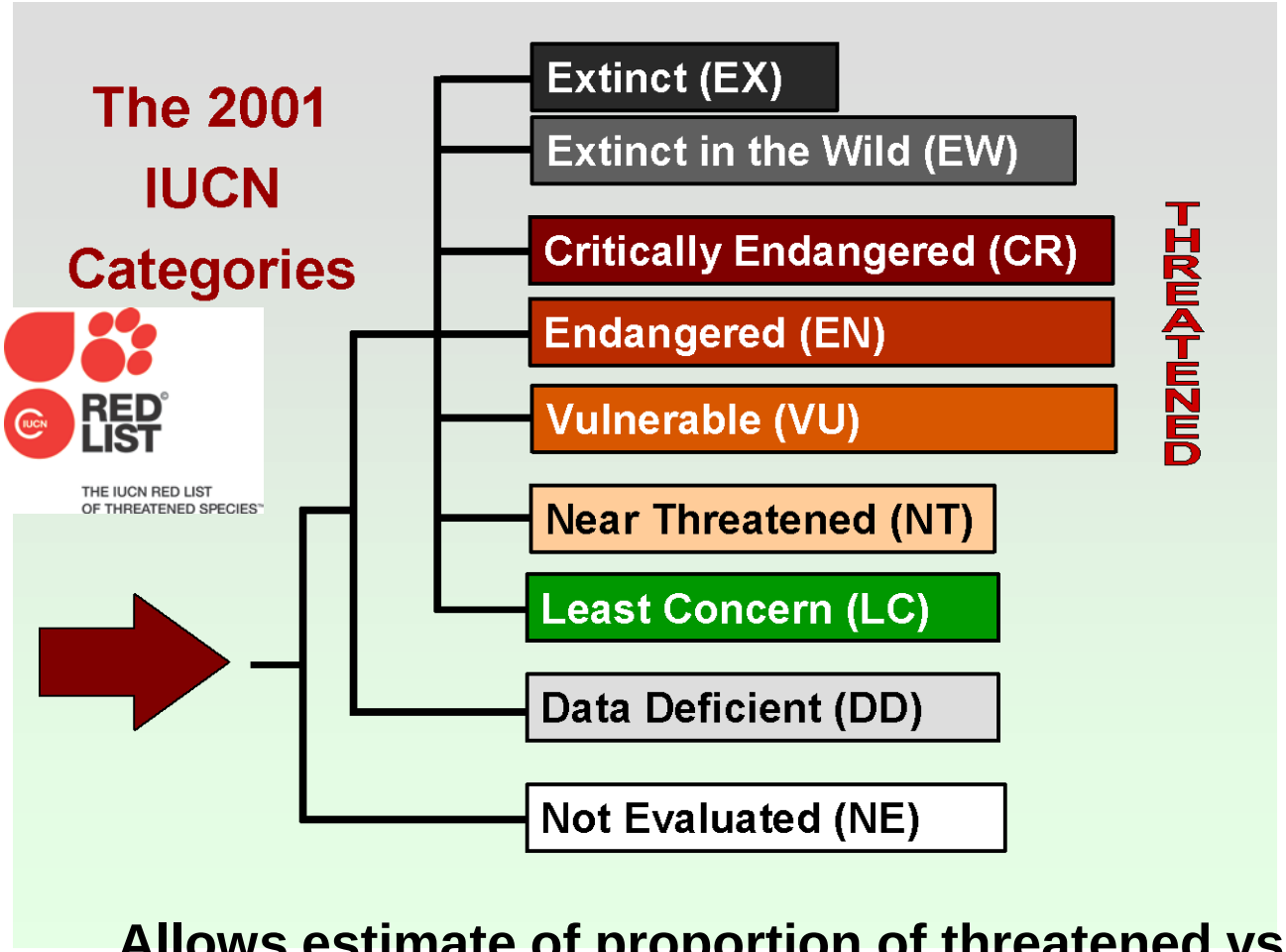
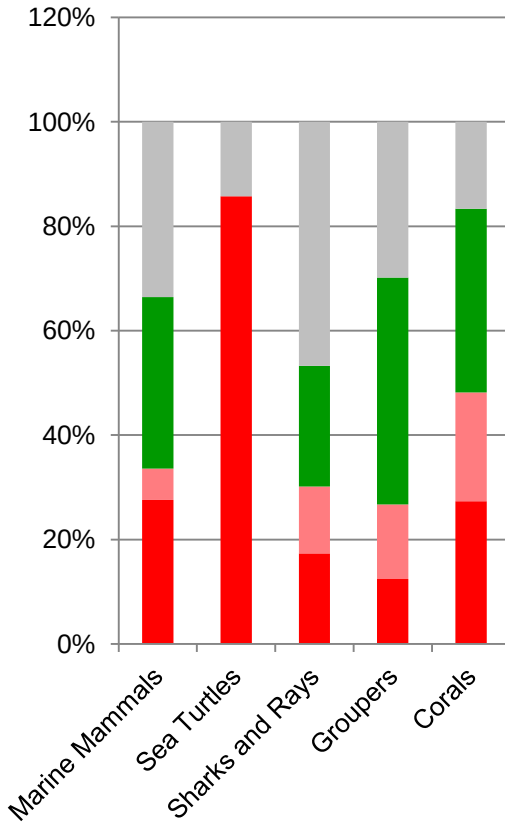
Clade-based approach coupled with standardized **Categories & Criteria**

Not every species on the Red List is Threatened





Allows estimate of proportion of threatened vs Least Concern: Biodiversity indicator with time & objective spatial analyses

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Choosing priority taxa given Over 250,000 marine species to choose from!

Strategy meeting (Nov 2005)

- Molluscs (>60,000 marine species) 37%
- Arthropods (mainly Crustaceans) 17%
- Vertebrates (mainly fishes, 15,000 spp) 9%
- Sponges 7%
- Cnidarians 6%
- Annelids (mostly polychaetes) 3%
- Echinoderms 3%
- All others18%

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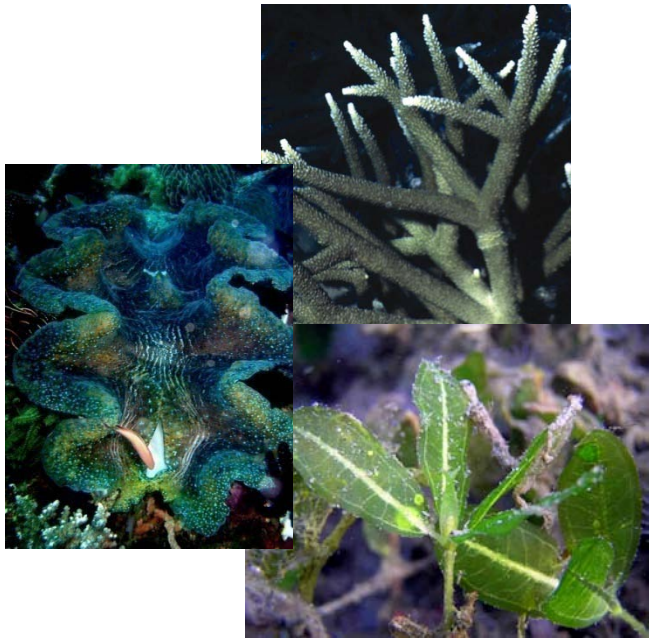
Priority non-fish groups



- Habitat forming primary producers
  - Selected macro-algae
  - Seagrasses and mangroves
  - Reef building corals
- Selected marine molluscs and crustaceans
- Exploited echinoderms (sea urchins and sea cucumbers)
- Sea snakes (marine mammals, turtles, birds already done).

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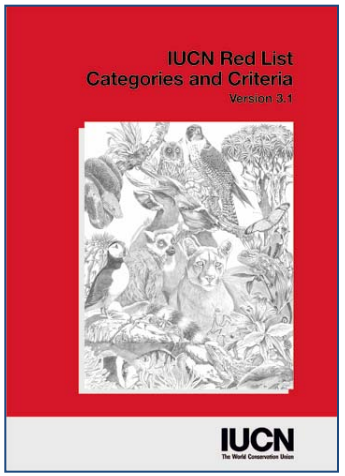
MBU strategy, 2 parts

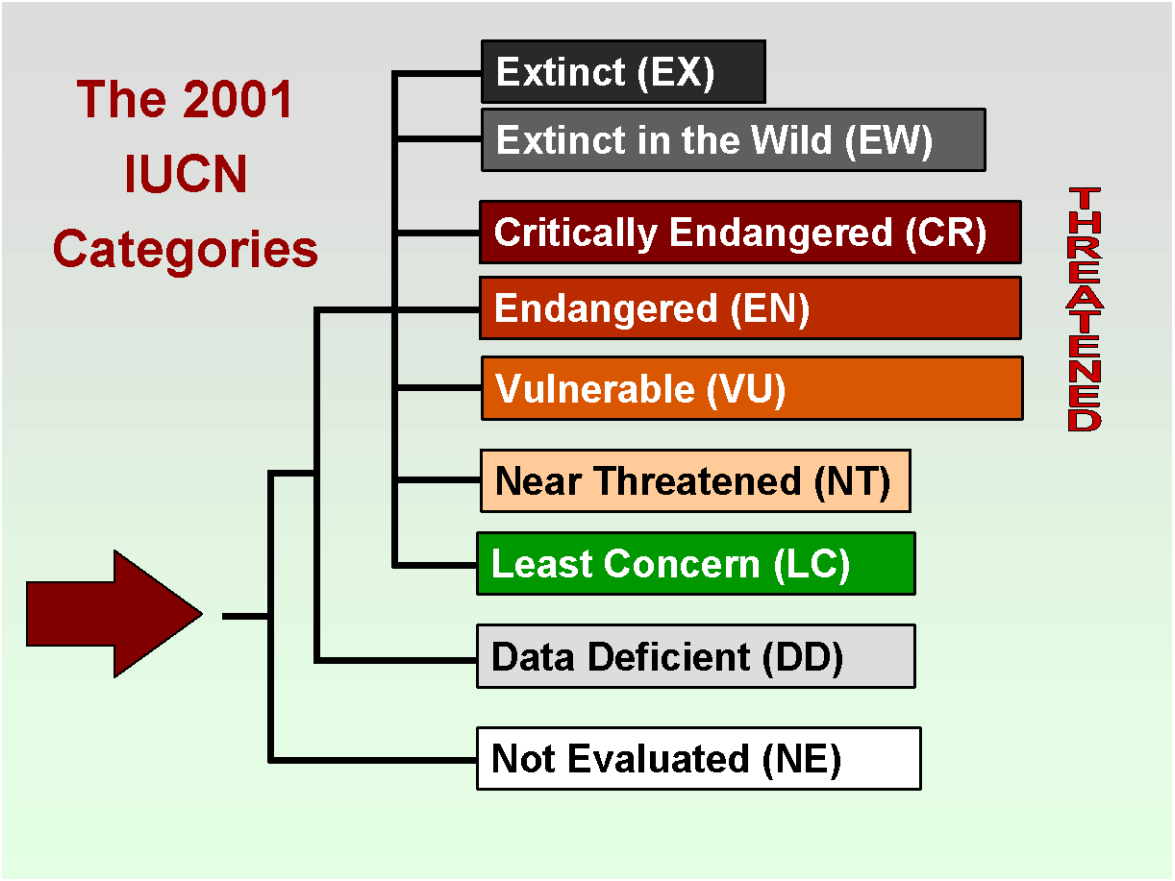
1) Complete ~20,000 Red List assessments in next 5 years

2) Use Biodiversity Assessment Unit methodology

- Previously relied on volunteer network (very slow)
- Workshop setting using Red List Criteria.



The MBU has completed 50 workshops beginning 2006



523 experts

53 countries

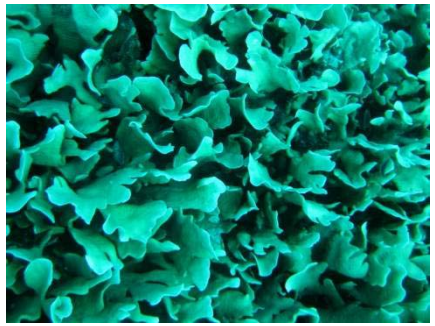
311 institutions

RED LIST

THE IUCN RED LIST OF THREATENED SPECIES™

The MBU has assessed over 11,000 species (~half way), including:

Global Tunas and Billfishes
Global Hagfishes
Global Mangroves
Global Seagrasses
Global Reef-building corals
Global Groupers (SSG assist)
Global Shark & Rays (SSG assist)
Global Wrasses
Global Parrotfishes
Global Damselfishes
Global Butterflyfishes and Angelfishes
Global Commercial Sea Cucumbers
Global Triggerfishes, Pufferfishes
Global Surgeonfishes
Global Cone shells
Global Reef-Building Bivalves



The MBU has completed over 11,000 species including:

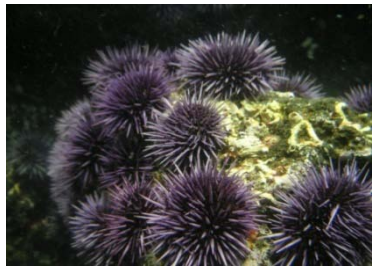
Regional Initiatives:

Eastern Tropical Pacific
Mediterranean
Oceania
Gulf of Mexico
Caribbean
Persian Gulf
West African







14 Peer reviewed Published papers (4 in *Science*) 2008-2012

AQUATIC CONSERVATION: MARINE AND FRESHWATER ECOSYSTEMS
Aquatic Conserv: Mar. Freshw. Ecosyst. **21**: 401–411 (2011)
Published online 6 July 2011 in Wiley Online Library (wileyonlinelibrary.com). DOI: 10.1002/aqc.1202

Conservation status of the world's hagfish species and the loss of phylogenetic diversity and ecosystem function

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[a]*IUCN Species Programme/SSC/Conservation International Global Marine Species Assessment, Biological Sciences, Old Dominion University, Norfolk, VA, USA*

[b]*Grupo de Sistemática e Biologia Evolutiva, Núcleo e... Janeiro, CP*

1. Hagfishes represent an ancient and un... organic matter and other nutrients to mair...
2. Fisheries worldwide directly profit fro... positive habitat effects hagfishes provide for... are major threats to several hagfish species...
3. In order to evaluate the effect of thes... Nature (IUCN) Red List Categories and C... world's known hagfish species.
4. Nine of the 76 hagfish species (12%) ... risk of extinction. Particular areas and sp... species present were determined to be at an... 50% of hagfish species present are at an ele... East China Sea, Pacific coast of Japan, ... threatened with extinction.
5. The loss of hagfish species will have d... depend on them, especially in the many ar...
6. Better information, data, regulation... populations are urgently needed to ensure...

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Received 10 December 2010; Revised 10 M...

KEY WORDS: hagfish; biodiversity; red list; hagf...

INTRODUCTION

Hagfishes are evolutionarily significant organisms... phylogenetically unique. These species represent... ancient lineage of fishes and are one of only two group... jawless fishes (Nelson, 2006). Their morphology is... and a new subphylum, the Craniata, was created to a... the hypothesis that they may not belong to Vertebra... they do not possess the metamerically arranged en... elements flanking the spinal cord and other fea... characterize vertebrates (Donoghue *et al.*, 2000; Janv...

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FISH and FISHERIES

FISH and FISHERIES

Fishing groupers towards extinction: a global assessment of threats and extinction risks in a billion dollar fishery

Yvonne Sadovy de Mitcheson[1], Matthew T Craig[2], ... Cheung[5,6], John H Choat[7], Andrew S Cornish[8], Sea... Min Liu[12], Robert F Myers[13], David A Pollard[14], ... Melita A Samoilys[18] & Jonnell Sanciangco[4]

[1]Swire Institute of Marine Science, School of Biological Scienc... Puerto Rico Mayagüez, PO Box 9000, Mayagüez, PR 006861, ... Rua Abel Capela, 863 Bloco D6/ap31, Coqueiros – Florianópo... International Global Marine Species Assessment, Biological Sci... Environmental Sciences, Norwich NR4 7TJ, UK; [5]Centre for Er... Marine and Tropical Biology, James Cook University, Townsville... Hong Kong, Hong Kong; [7]Oceanographic Research Institute, P... de Oceanografia, Universidade Federal de Pernambuco, Recife, ... Biodiversity, Private Bag 1015, Grahamstown, 6140 South Af... Laboratory of Marine Environmental Science, College of Ocean... Xiamen 361005, Fujian, China; [13]Coral Graphics, 412 Rainbo... Museum, Six College Street, Sydney, NSW 2010, Australia; [15]... University of Hawaii at Hilo, 200 W. Kawili St., Hilo, HI 96720... Gate Park, San Francisco, CA, 94118, USA; [17]Museum and Ar... [18]Coastal Oceans Research and Development – Indian Ocean ...

Abstract

Groupers are a valuable fishery resource of reef... species most vulnerable to fishing pressure bec... including longevity, late sexual maturation and ... economic importance, few grouper fisheries are ... the species level, and many are reported to be un... threats to groupers, the International Union for ... List criteria were applied to all 163 species. Red Li... (12%) risk extinction if current trends continue. ... are considered to be Near Threatened. The ... Southeast Asia contain a disproportionate nur... numerous poorly documented and Near Threate... In all, 30% of all species are considered to be D... threat is overfishing, accompanied by a general... fishery management, the prognosis for restorati... Threatened species is poor. We believe that few r... key biological processes (e.g. spawning aggregatic... uncontrolled fishing. Mariculture, through hatch...

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doi: 10.3354/meps09545

MARINE ECOLOGY PROGRESS SERIES
Mar Ecol Prog Ser

Published February 23

Patterns of extinction risk and threat for marine vertebrates and habitat-forming species in the Tropical Eastern Pacific

B. A. Polidoro[1,*], T. Brooks[2,3,4], K. E. Carpenter[1], G. J. Edgar[5,6,7], S. Henderson[6], J. Sanciangco[1], D. R. Robertson[8]

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[6]Conservation International, Arlington, ...
[7]Charles Darwin Foundation, Puerto Ayora, San...
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ABSTRACT: Marine conservation activities around the... absence of comprehensive species-specific information. ... species assemblages of major marine taxa are being progr... and Criteria of the International Union for the Conservati... ened Species. The present study is the first analysis of en... large marine biogeographic region conducted in the Trop... recently completed IUCN Red List assessments for all kn... shorefishes, corals, mangroves, and seagrasses in the TE... assessed are in threatened categories, indicative of elevat... assessed taxonomic groups, including previous IUCN Re... mammals, and marine turtles, highlights specific geog... species richness. The distribution of threatened species in ... high rates of overfishing, habitat loss, and increasing El N... impacts, as well as oceanic islands with high stochastic ri... assigned to the highest threat categories have life history t... to various regional and site-specific threats. Comprehensi... List assessments combined with spatial analysis will great... specific marine conservation priorities in the TEP.

OPEN ACCESS Freely available online

PLoS one

The Likelihood of Extinction of Iconic and Dominant Herbivores and Detritivores of Coral Reefs: The Parrotfishes and Surgeonfishes

Mia T. Comeros-Raynal[1*], John Howard Choat[2], Beth A. Polidoro[3], Kendall D. Clements[4], Rene Abesamis[4], Matthew T. Craig[5], Muhammad Erdi Lazuardi[6], Jennifer McIlwain[7], Andreas Muljadi[8], Robert F. Myers[9], Cleto L. Nañola Jr.[10], Shinta Pardede[11], Luiz A. Rocha[12], Barry Russell[13], Jonnell C. Sanciangco[1], Brian Stockwell[14], Heather Harwell[1], Kent E. Carpenter[1]

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Abstract

MBU Conservation Biology Results & Global Climate Change Debate

One-Third of Reef-Building Corals Face Elevated Extinction Risk from Climate Change and Local Impacts

Kent E. Carpenter,[1*] Muhammad Abrar,[2] Greta Aeby,[3] Richard B. Aronson,[4] Stuart Banks,[5] Andrew Bruckner,[6] Angel Chiriboga,[7] Jorge Cortés,[8] J. Charles Delbeek,[9] Lyndon DeVantier,[10] Graham J. Edgar,[11,12] Alasdair J. Edwards,[13] Douglas Fenner,[14] Héctor M. Guzmán,[15] Bert W. Hoeksema,[16] Gregor Hodgson,[17] Ofri Johan,[18] Wilfredo Y. Licuanan,[19] Suzanne R. Livingstone,[1] Edward R. Lovell,[20] Jennifer A. Moore,[21] David O. Obura,[22] Domingo Ochavillo,[23] Beth A. Polidoro,[1] William F. Precht,[24] Miledel C. Quibilan,[25] Clarissa Reboton,[26] Zoe T. Richards,[27] Alex D. Rogers,[28] Jonnell Sanciangco,[1] Anne Sheppard,[29] Charles Sheppard,[29] Jennifer Smith,[1] Simon Stuart,[30] Emre Turak,[10] John E. N. Veron,[10] Carden Wallace,[31] Ernesto Weil,[32] Elizabeth Wood[33]

BLEACHED ELKHORN CORAL, VIRGIN ISLANDS

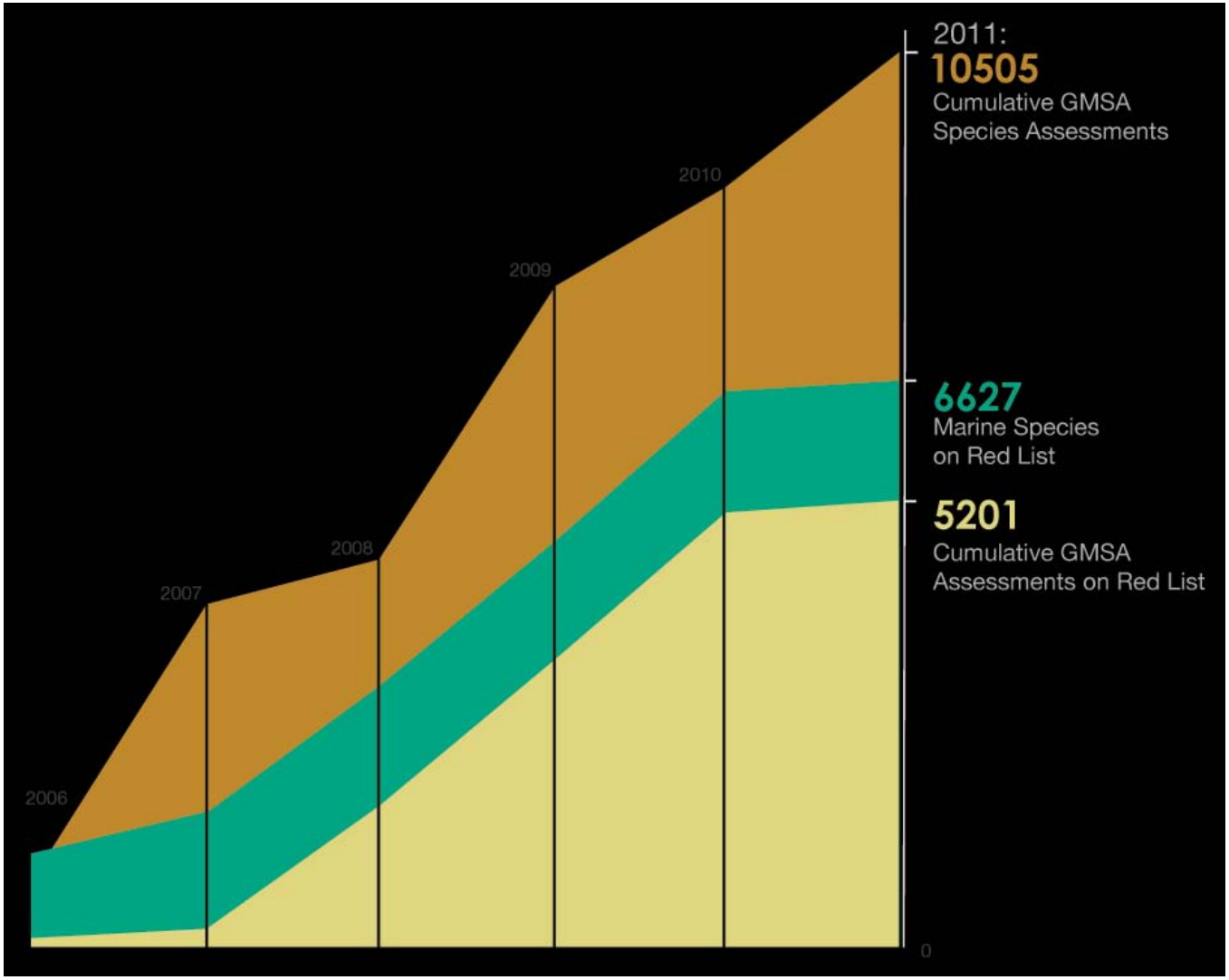
Science AAAS

11th International Coral Reef Symposium Fort Lauderdale, Florida, USA July 7–11, 2008

845 species

Conservation International · IUCN · SSC Species Survival Commission · Old Dominion University · New Hampshire Charitable Foundation and Tom Haas

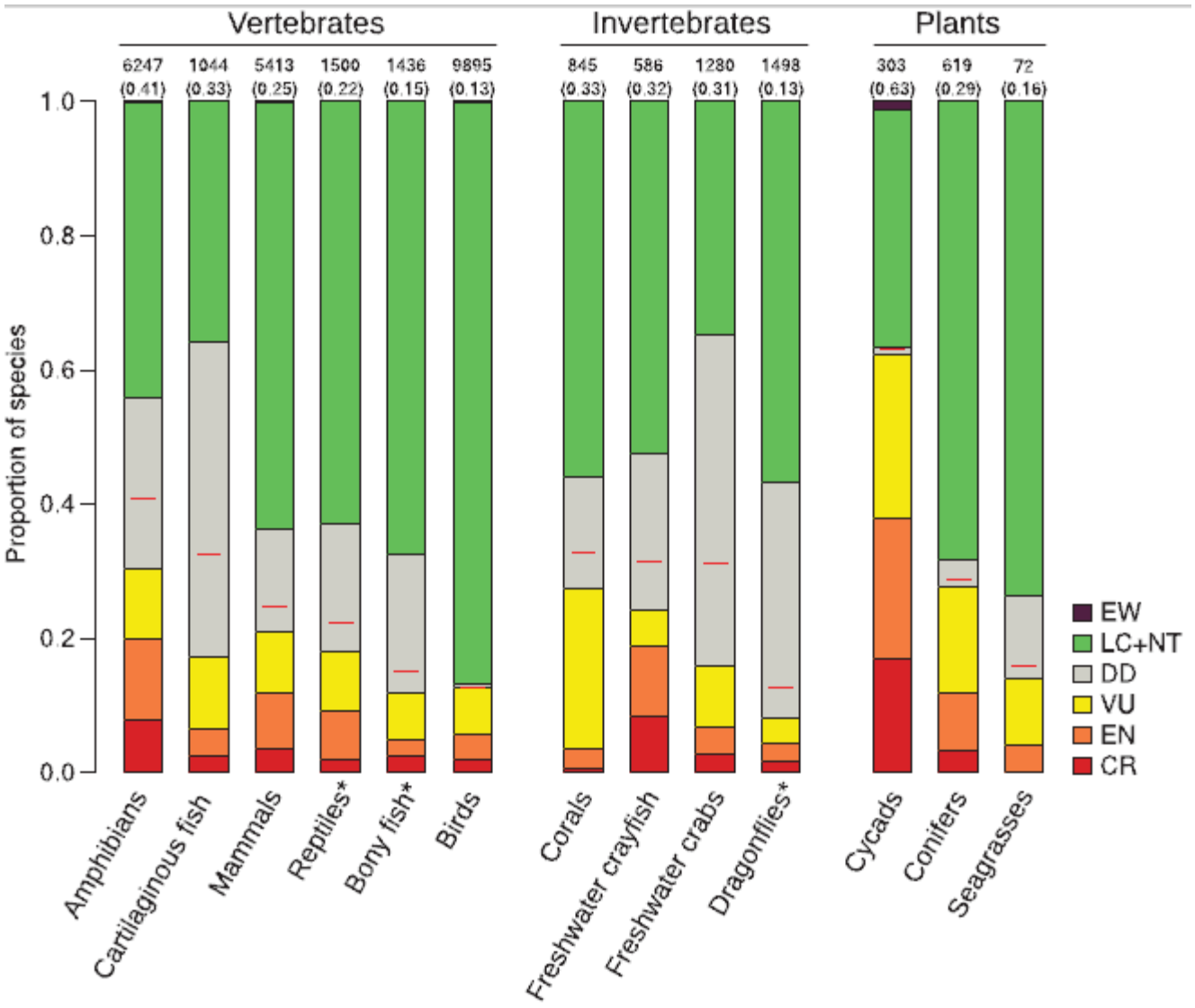
Marine Species Assessed & on Red List



Redressing the imbalance: ~30% new are marine; 2006=2.5%; 2011=8%

General Results and Trends

- **21% (midpoint estimate) of all marine species assessed to date in threatened categories: similar to terrestrial**



GMSA Conservation Biology to Conservation Action

- Results to conservation action:
  - Species specific conservation action
    - Key Biodiversity Area identification
    - Global policy on Threatened Species
  - Regional conservation policy
  - Global marine biodiversity threat analyses
    - Global conservation policy
  - Trends/Outcomes monitoring – success or failure of conservation action over time

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Red List Results
Gulf of Mexico

- **Deepwater Horizon Disaster**
- **Gulf Threatened Species and BioScience Publication**
- **GMSA analysis of endemism**
- **Harte Research Institute partnership**

Gulf of Mexico Oil Blowout Increases Risks to Globally Threatened Species

CLAUDIO CAMPAGNA, FREDERICK T. SHORT, BETH A. POLIDORO, ROGER McMANUS, BRUCE B. COLLETTE, NICOLAS J. PILCHER, YVONNE SADOVY DE MITCHESON, SIMON N. STUART, AND KENT E. CARPENTER

BioScience 61: 393–397.

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Gulf of Mexico Oil Blowout Increases Risk to Globally Threatened Species

Table 1. Marine species in International Union for Conservation of Nature threatened Red List categories (critically endangered, endangered, or vulnerable) that have a distribution directly overlapping the area of the oil spill, or that are found in the greater Gulf region extending from Texas to Miami, Florida.

Red List category species name	Common name	Protection status
Critically endangered		
Lepidochelys kempii	Kemp's ridley turtle	ESA-E
Eretmochelys imbricata	Hawksbill turtle	ESA-E
Dermochelys coriacea	Leatherback turtle	ESA-E
Thunnus thynnus	Atlantic bluefin tuna, western stock	
Epinephelus drummondhayi	Speckled hind	
Epinephelus itajara	Atlantic goliath grouper	
Epinephelus nigritus	Warsaw grouper	
Pristis pectinata	Smalltooth sawfish	ESA-E
Pristis perotteti	Largetooth sawfish	
Narcine bancroftii	Lesser electric ray	
Acropora cervicornis	Staghorn coral	ESA-T
Acropora palmate	Elkhorn coral	ESA-T
Endangered		
Balaenoptera borealis	Serving whale	ESA-E, MMPA
Balaenoptera musculus	Blue whale	ESA-E, MMPA
Balaenoptera physalus	Finback whale	ESA-E, MMPA
Pterodroma caribbaea	Jamaica petrel	
Pterodroma hasitata	Black-capped petrel	MBTA
Caretta caretta	Loggerhead turtle	ESA-T
Chelonia mydas	Green turtle	ESA-E, ESA-T (by range)
Sphyrna lewini	Scalloped hammerhead shark	
Sphyrna mokarran	Great hammerhead shark	
Montastraea annularis	Boulder star coral	
Montastraea faveolata	Mountainous star coral	
Vulnerable		
Trichechus manatus	Manatee	ESA-E, MMPA
Physeter macrocephalus	Sperm whale	ESA-E, MMPA
Vulnerable (continued)		
Epinephelus flavolimbatus	Yellowedge grouper	
Epinephelus niveatus	Snowy grouper	
Mycteroperca interstitialis	Yellowmouth grouper	
Lachnolaimus maximus	Hogfish	
Alopias superciliosus	Bigeye thresher shark	
Alopias vulpinus	Common thresher shark	
Carcharhinus longimanus	Oceanic whitetip shark	
Carcharhinus obscurus	Dusky shark	
Carcharhinus plumbeus	Sandbar shark	
Carcharhinus signatus	Night shark	
Centrophorus granulosus	Gulper shark	
Cetorhinus maximus	Basking shark	
Carcharodon carcharias	Great white shark	
Isurus oxyrinchus	Shortfin mako	
Isurus paucus	Longfin mako	
Carcharias taurus	Sand tiger shark	
Odontaspis ferox	Small-tooth sand tiger shark	
Rhincodon typus	Whale shark	
Sphyrna zygaena	Smooth hammerhead	
Squalus acanthias	Spiny dogfish	
Gymnura altavela	Butterfly ray	
Agaricia lamarcki	Lamarck's sheet coral	
Montastraea franksi	Montastraea coral	
Dendrogyra cylindrus	Pillar coral	
Dichocoenia stokesii	Elliptical star coral	
Mycetophyllia ferox	Rough cactus coral	
Oculina varicose	Large ivory coral	
Halophila baillonii	Clover seagrass	

ESA-E, endangered under the Endangered Species Act (ESA); ESA-T, threatened under the ESA; MBTA, listed on the Migratory Bird Treaty Act; MMPA, listed on the Marine Mammal Protection Act.
Source: IUCN 2010. See the supplementary table online at *dx.doi.org/10.1525/bio.2011.61.5.8.*

Campagna et al. 2011, *Bioscience*

Red List Assessment Workshop:
Gulf of Mexico Endemic Fishes
August, 2011, Harte Research Institute

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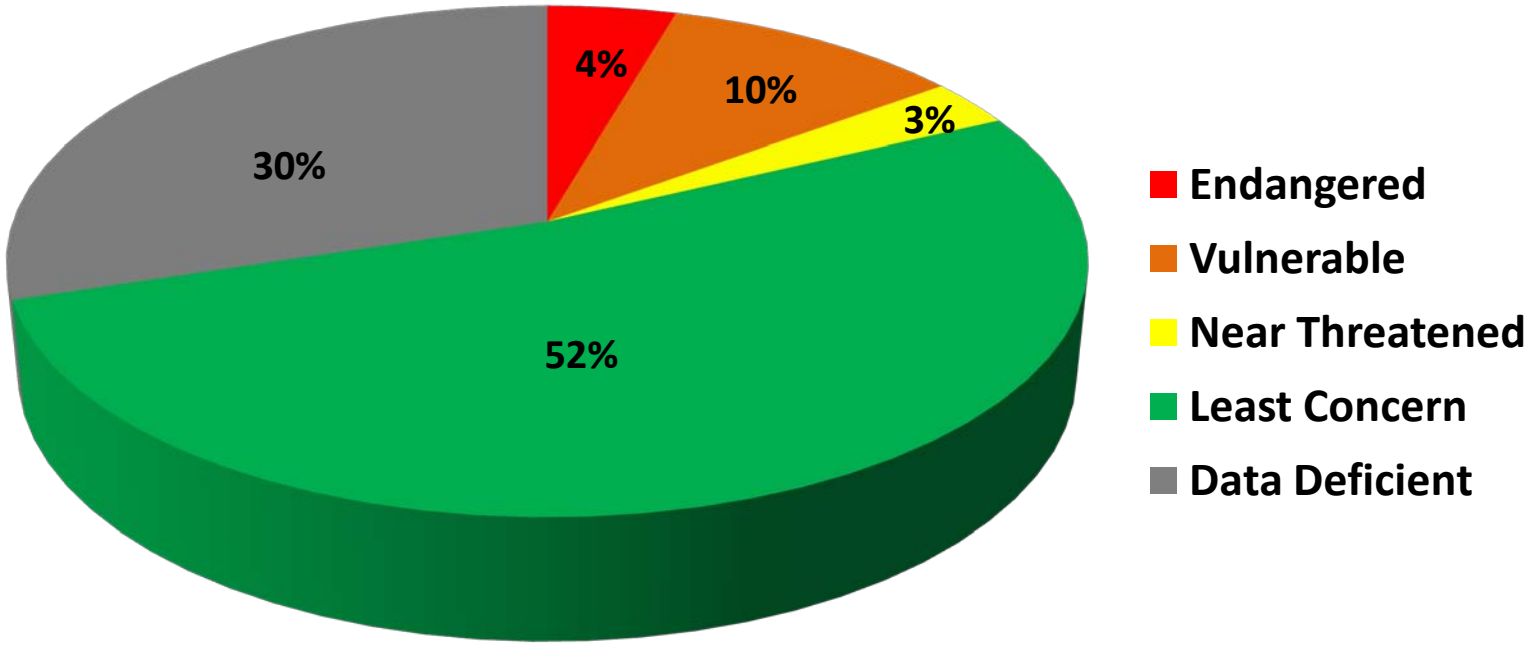
Preliminary Results: Endemic Fishes

- 67 species assessed; 10 species threatened
- Primary threats were habitat loss and degradation from:
  - urban/agricultural pollution
  - eutrophication
  - oil spills
  - hypoxia
- Shallow water species in sensitive near-shore habitats



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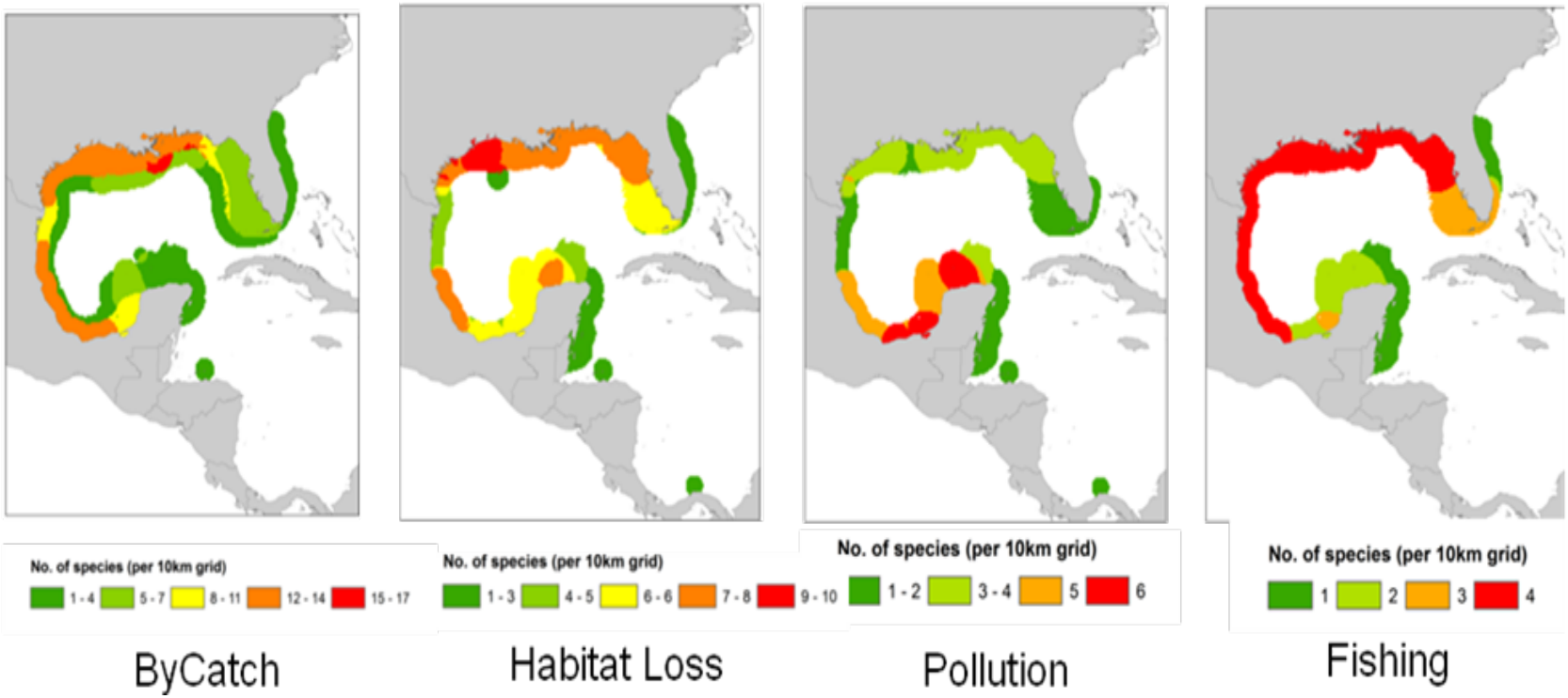
Gulf of Mexico Endemics



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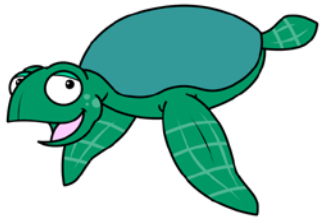
Development of a Model by IUCN and the Harte Research Institute for Applying Species Information to Conservation Action

- Complete the GMSA for the Gulf of Mexico
- Develop a Gulf Species Resource Center with Three Primary Purposes
  1. Responses to Catastrophic Events (e.g., oil spills)
  2. Responses to Chronic Events (e.g., non-point pollution)
  3. Planning and Implementing Recovery Programs by the Public and Private Sectors

Strategy for Completion of Comprehensive Regional Analysis

30

395



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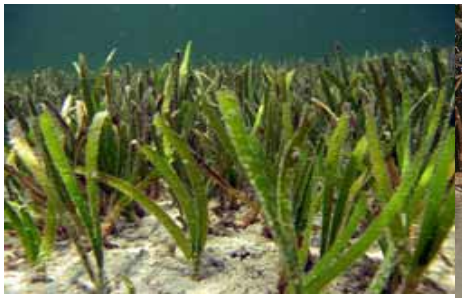

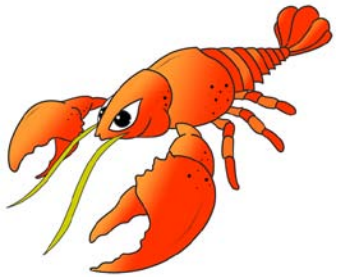

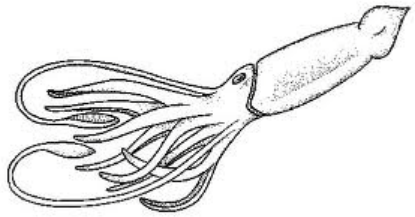

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Complete the GMSA for the Gulf of Mexico

- 3 assessment workshops to complete regional assessments for all 1500 fishes

- Regional assessments of species with existing global assessments:

  - Consultation with SSGs
  - Review at Final Synthesis Workshop

- Publication of resulting assessments online, feeding into Gulf Database, analyses in literature

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Establish Resource Center with the Harte Institute

- Overhaul Current BioGoMex Data Base
- Incorporate SSC Species Data
- Maintain Maps of Species Distributions
- Provide Capacity for Spatial Planning
- Include a List of Experts Working on the Biology and Stewardship of Gulf of Mexico Species
- Include Information on Species Recovery Efforts in the Gulf of Mexico.

Expanding Regional Coverage of GMSA and Threatened Species Recovery Efforts Including Disaster Preparedness

Expand Gulf of Mexico GIS Biodiversity Disaster Preparedness (BDP) application to include inverts

Other Possible Geographies

With active interest –

Arctic and Coral Triangle

Also of U.S. interest –

Wider Caribbean and American Tropical Pacific

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Thank you!
Questions?

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