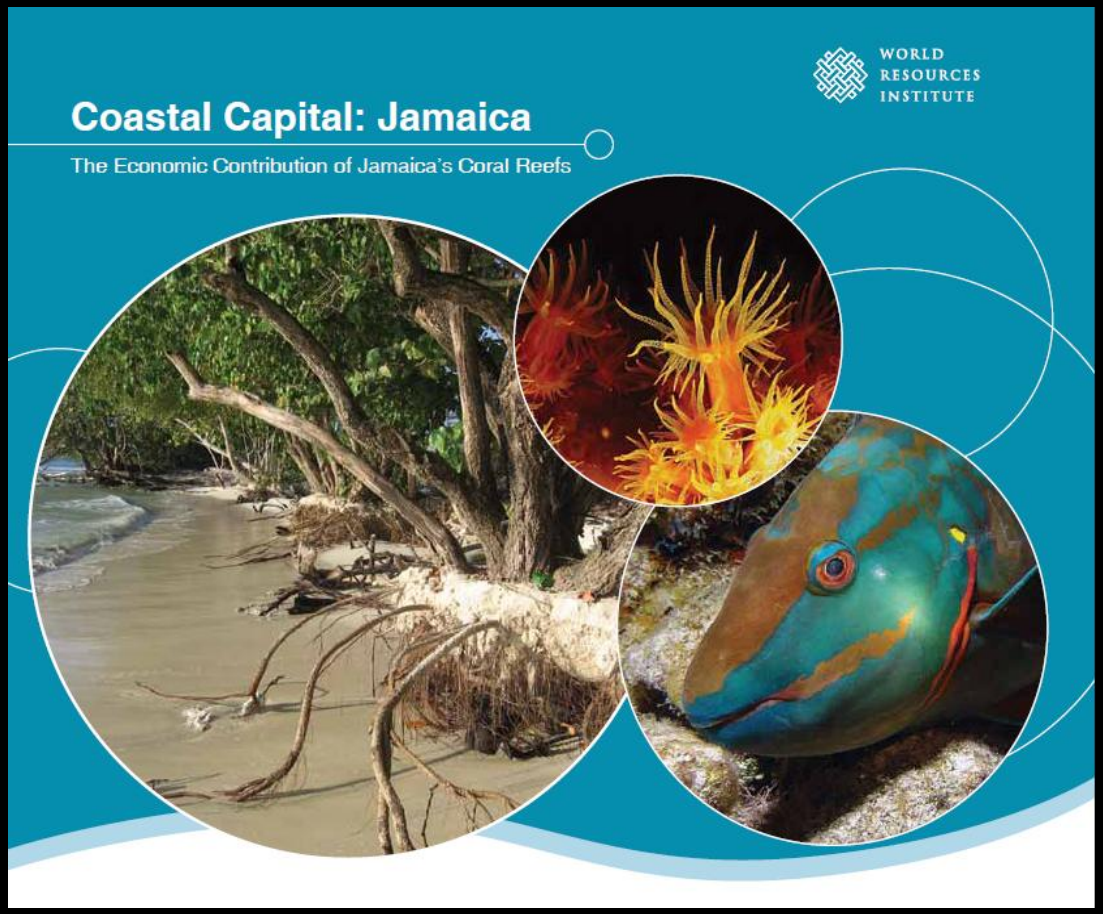
Coastal Capital: Jamaica



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Program

- *Reefs at Risk Revisited*
- *Coastal Capital: Jamaica* – overview
- Q&A
- Valuation of reef-related fisheries
- Q&A and Discussion
- Protection of shoreline by coral reefs
- Beach erosion in Negril
- Tourism losses from beach erosion
- Q&A and Discussion

Reefs at Risk Revisited
(Caribbean focus)

Lauretta Burke
World Resources Institute

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Major Partners

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WorldFish
CENTER

ICRAN
International Coral Reef Action Network

UNEP WCMC

GCRMN
Global Coral Reef Monitoring Network

Contributing Institutions

- Atlantic and Gulf Rapid Reef Assessment (AGRRA)
- Coastal Oceans Research and Development in the Indian Ocean (CORDIO)
- Conservation International (CI)
- Coral Reef Alliance (CORAL)
- Healthy Reefs for Healthy People
- Institut de Recherche pour le Développement (IRD)
- International Society for Reef Studies (ISRS)
- International Union for Conservation of Nature (IUCN)
- National Center for Ecological Analysis and Synthesis (NCEAS)
- Oceana
- Planetary Coral Reef Foundation
- Project AWARE Foundation
- Reef Check
- Reef Environmental Education Foundation (REEF)
- SeaWeb
- Secretariat of the Pacific Community (SPC)
- Secretariat of the Pacific Regional Environment Programme (SPREP)
- U.S. National Aeronautics and Space Administration (NASA)
- U.S. National Oceanic and Atmospheric Administration (NOAA)
- University of South Florida (USF)
- University of the South Pacific (USP)
- Wildlife Conservation Society (WCS)
- World Wildlife Fund (WWF)

Financial Support

- The Chino Cienega Foundation
- The David and Lucile Packard Foundation
- The Henry Foundation
- International Coral Reef Initiative
- The Marisla Foundation
- National Fish and Wildlife Foundation
- Netherlands Ministry of Foreign Affairs
- The Ocean Foundation
- Roy Disney Family Foundation
- The Tiffany & Co. Foundation
- U.S. Department of the Interior
- U.S. Department of State
- U.S. National Oceanic and Atmospheric Administration (NOAA)

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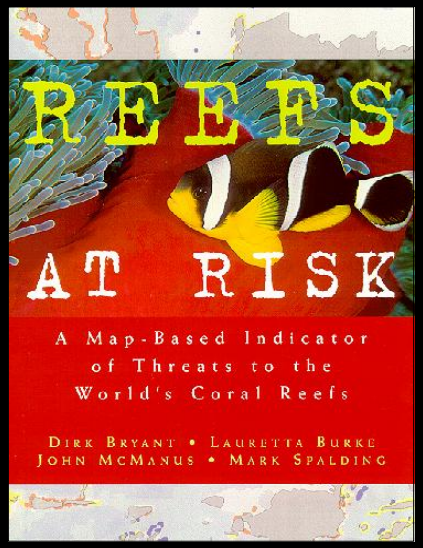

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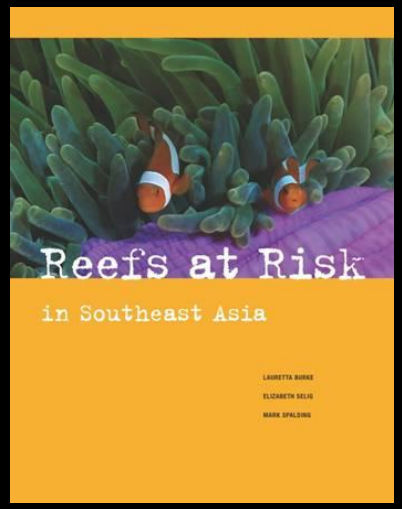

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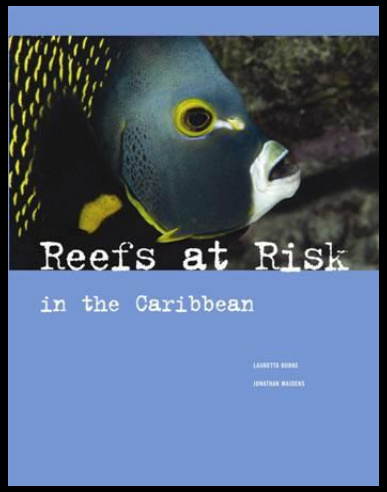
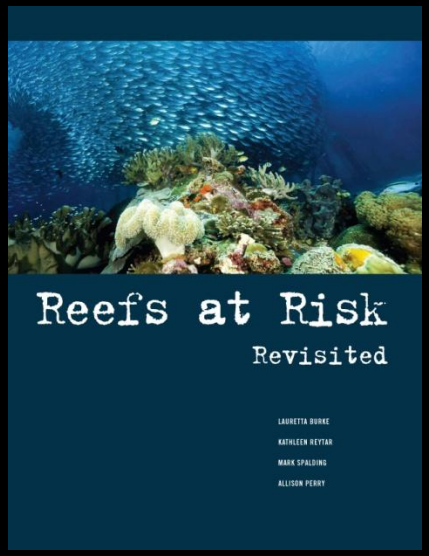
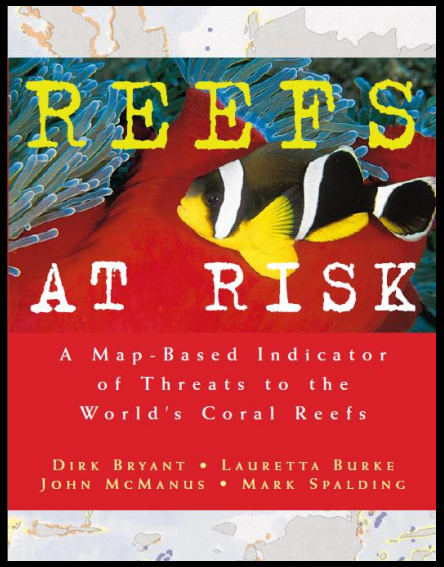


2004



2011



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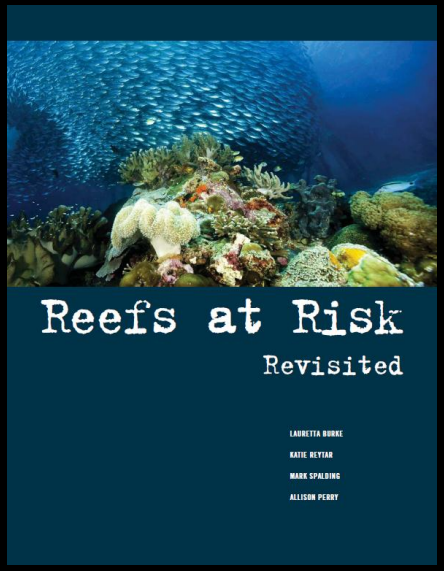


2011

What is new / important?

Data Improvements:

- Reef map is 64x
- Inclusion of global threats
- Social Vulnerability

Photo credit: Coral Reef Adventure/MacGillivray Freeman Films

Photo credit: Enric Sala

Photo Credit: Crispin Zeeman

Photo credit: Konstantin Tkachenko


Photo credit: Klaus Stiefel/Flikr

Photo credit: Steve Lindfield

Photo credit: Krishna Desai

Local Threats

- Coastal development
- Sediment and pollution
- Marine pollution and damage
- Overfishing
- Destructive fishing

Global Threats

- Warming seas
- Ocean acidification

Threat: Coastal Development

Photo credit: Wolcott Henry

Threat: Sediment and pollution

Photo credit: Owen Day

Threat: Marine pollution and damage

Photo credit: Chad King/NMS


Photo credit: Wolcott Henry

Threat: Overfishing

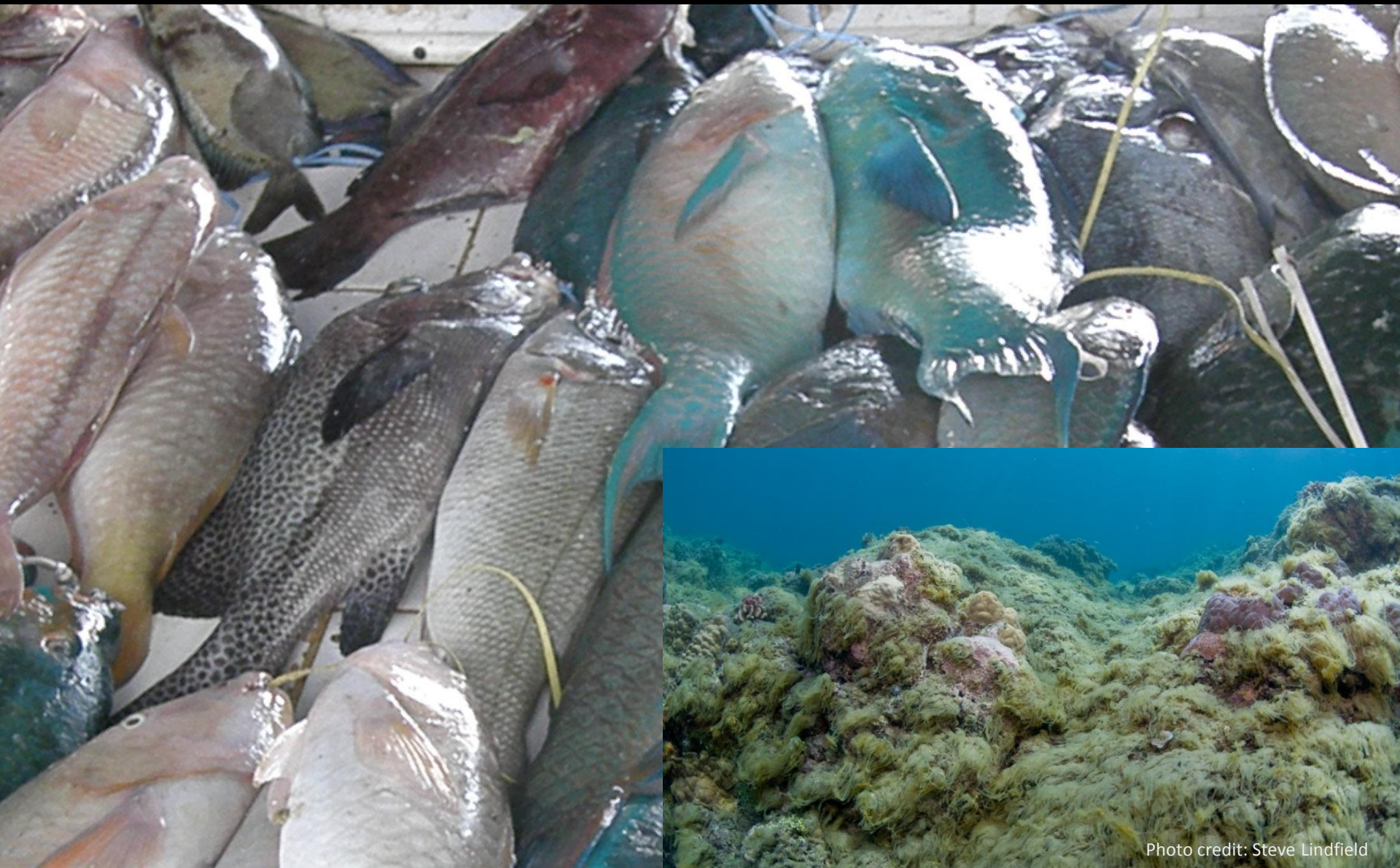


Photo credit: Steve Lindfield

Threat: Destructive Fishing

Photo credit: Lynn Funkhauser

Photo credit:
Wolcott Henry

Threat: Warming Seas

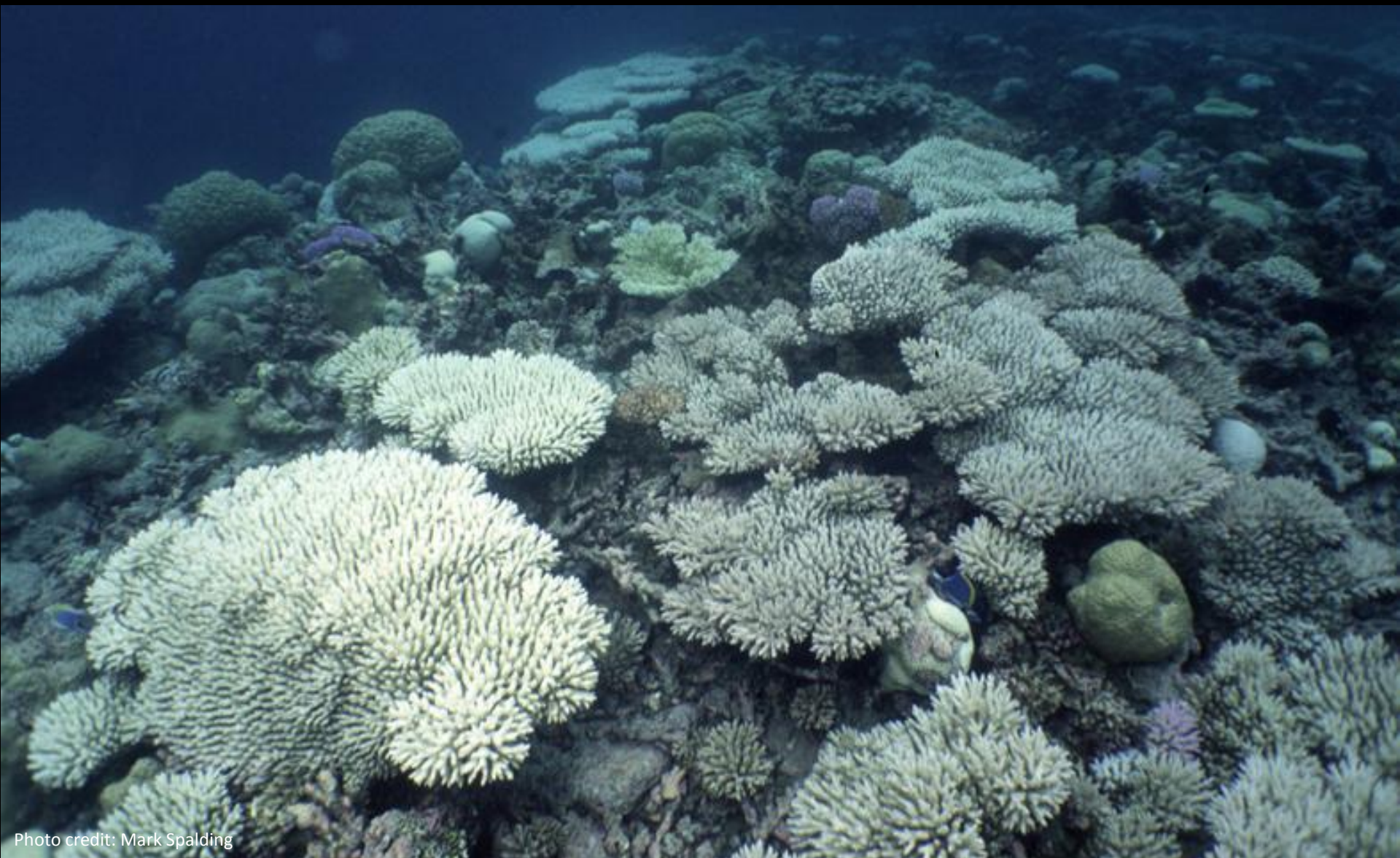
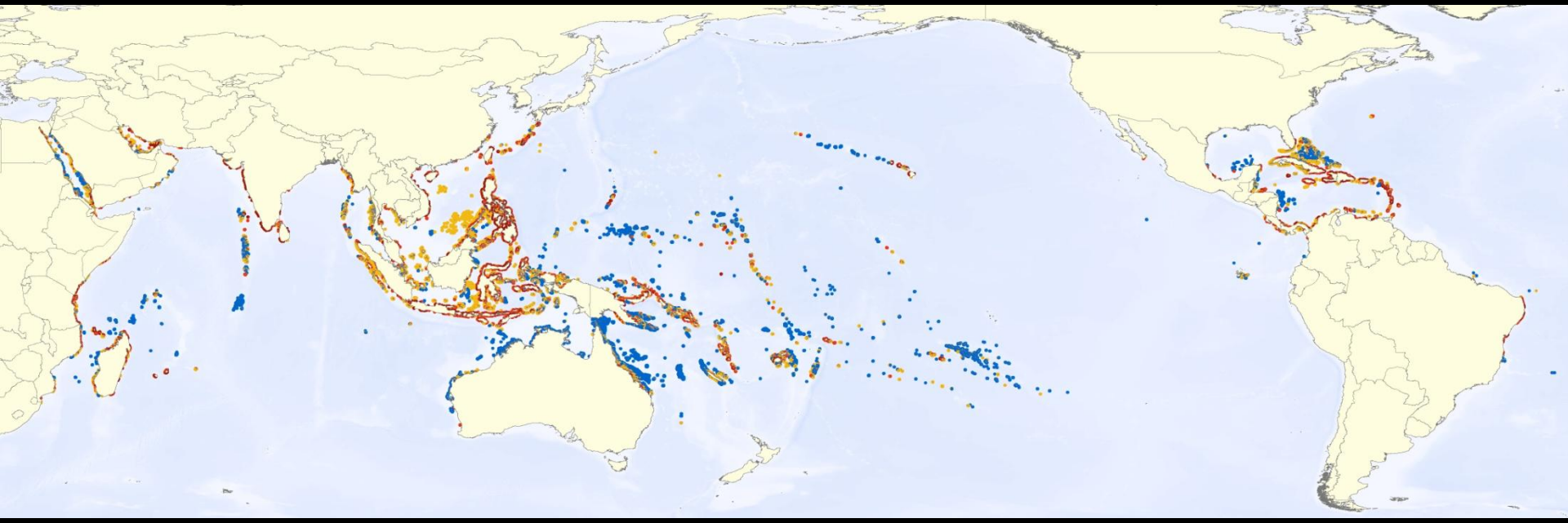


Photo credit: Mark Spalding

Key Findings: Local Threats

Integrated local threats to coral reefs



Low Medium High Very High

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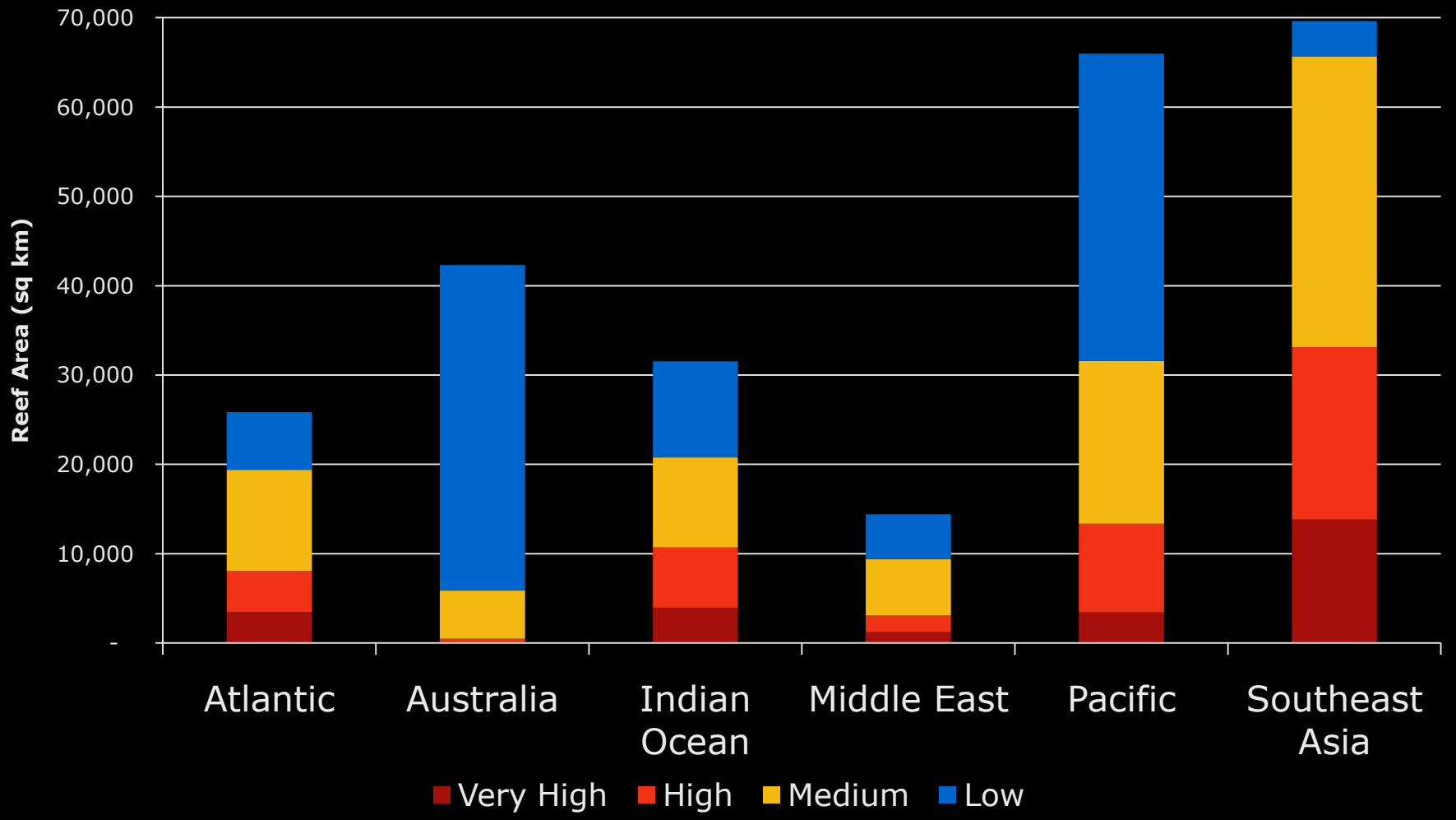
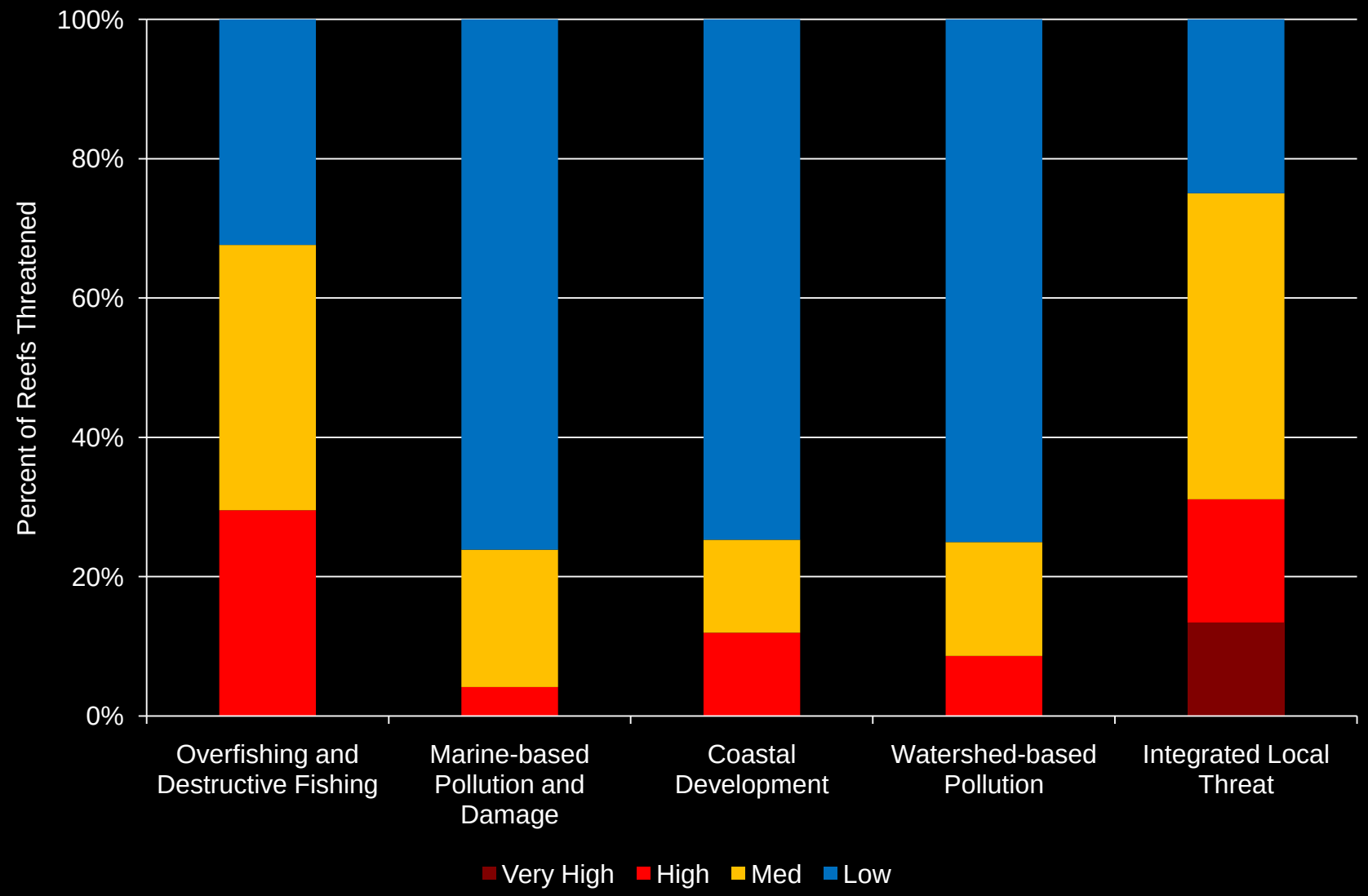
Integrated local threat by region (by reef area)



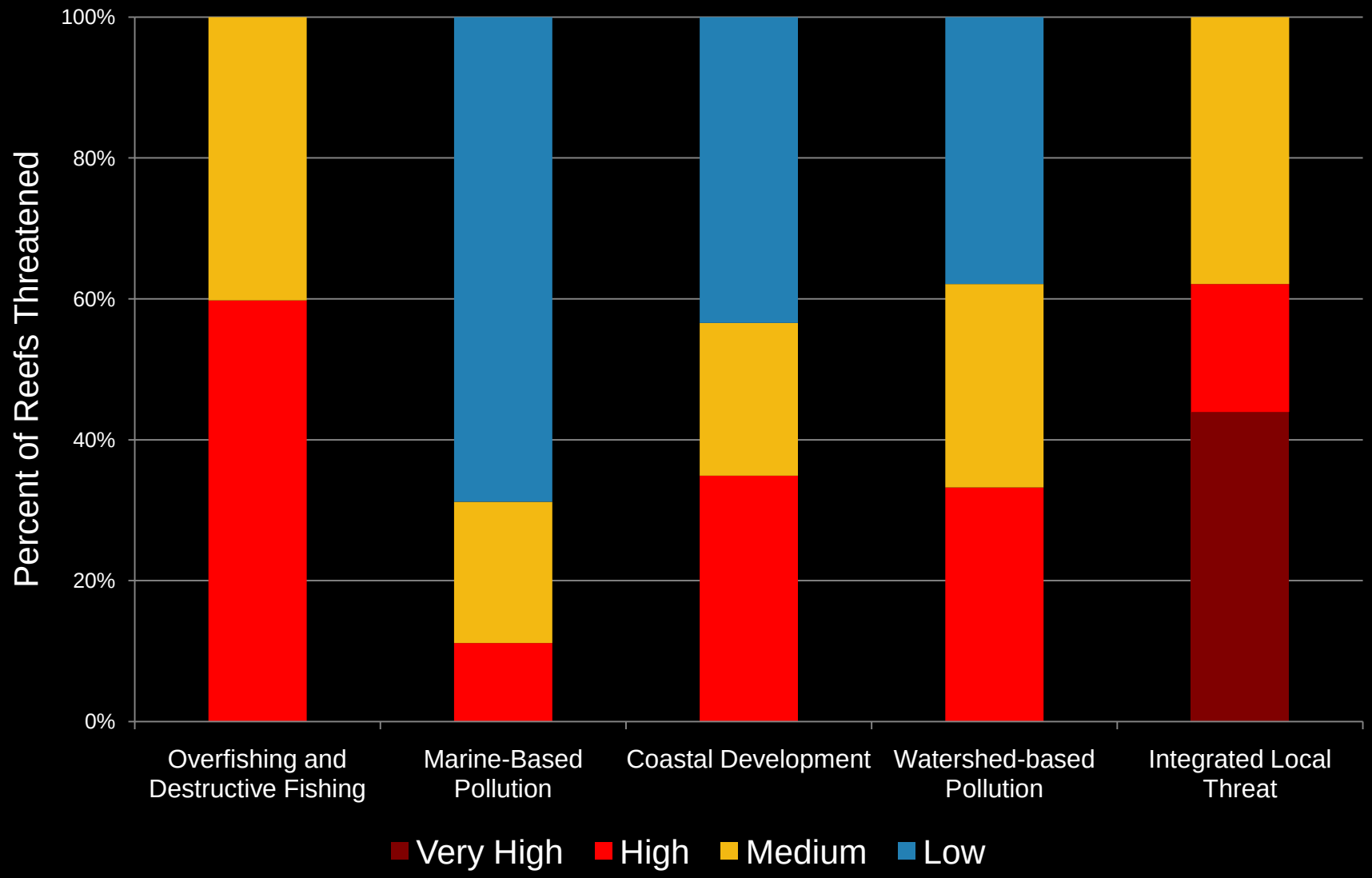
Integrated local threats to coral reefs

Low Medium High Very High

In the Caribbean, more than 75% of reefs are threatened by local activities

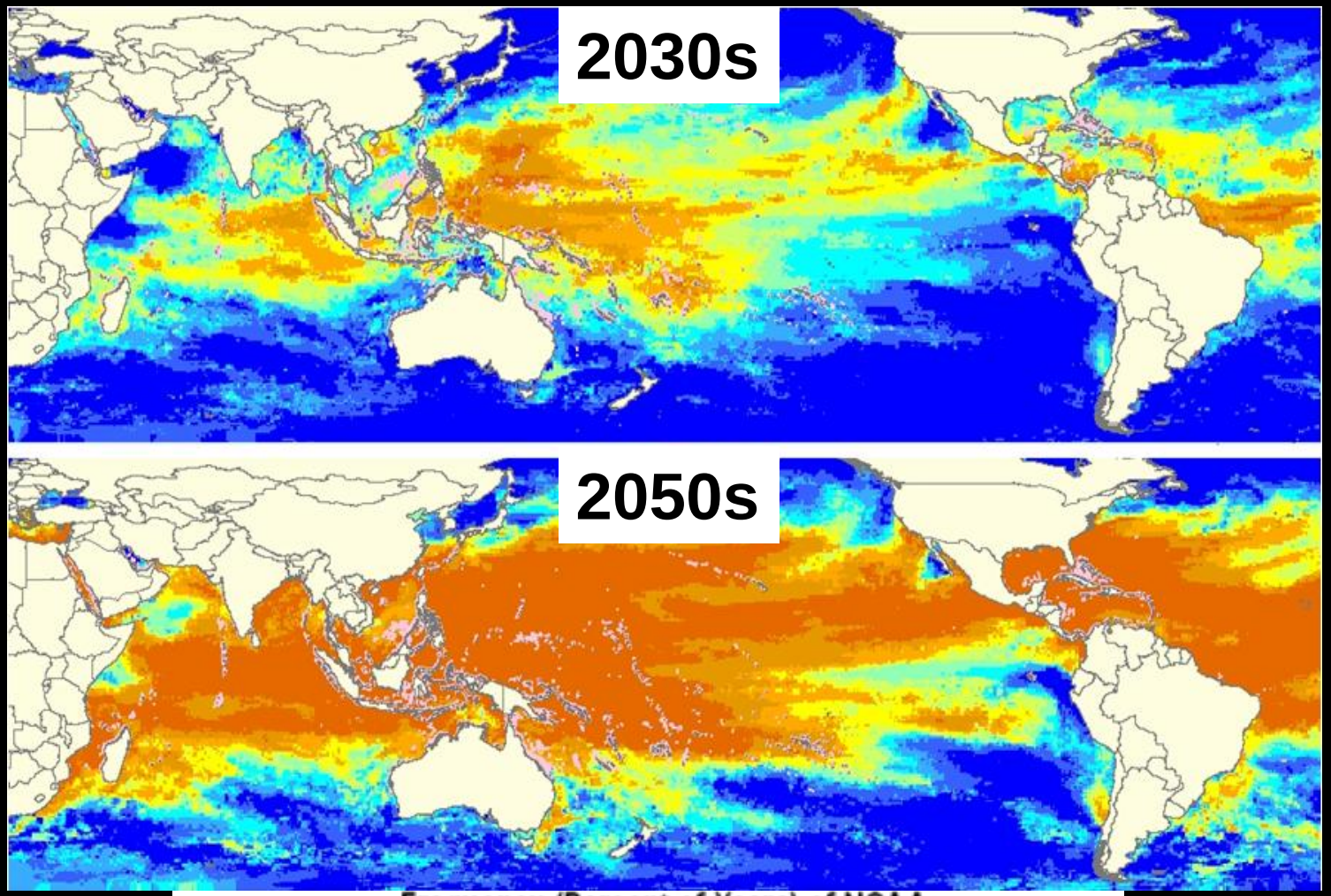


In Jamaica, all reefs are rated as threatened



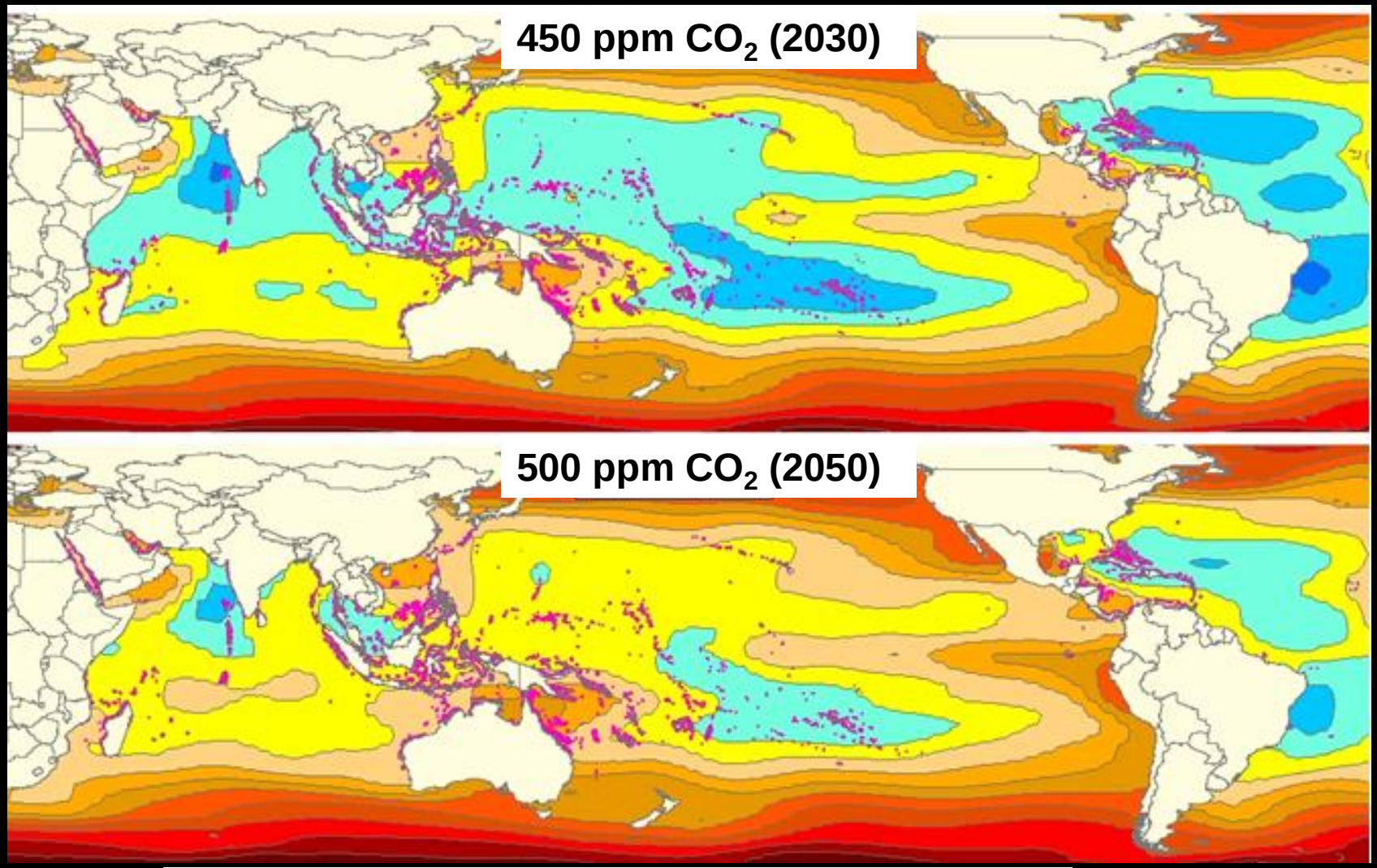
Key Findings: Global Threats

Projections of thermal stress (2030 and 2050)



Source: Donner, 2009.

Projections of ocean acidification (2030 and 2050)



Source: Cao and Caldeira, 2008.

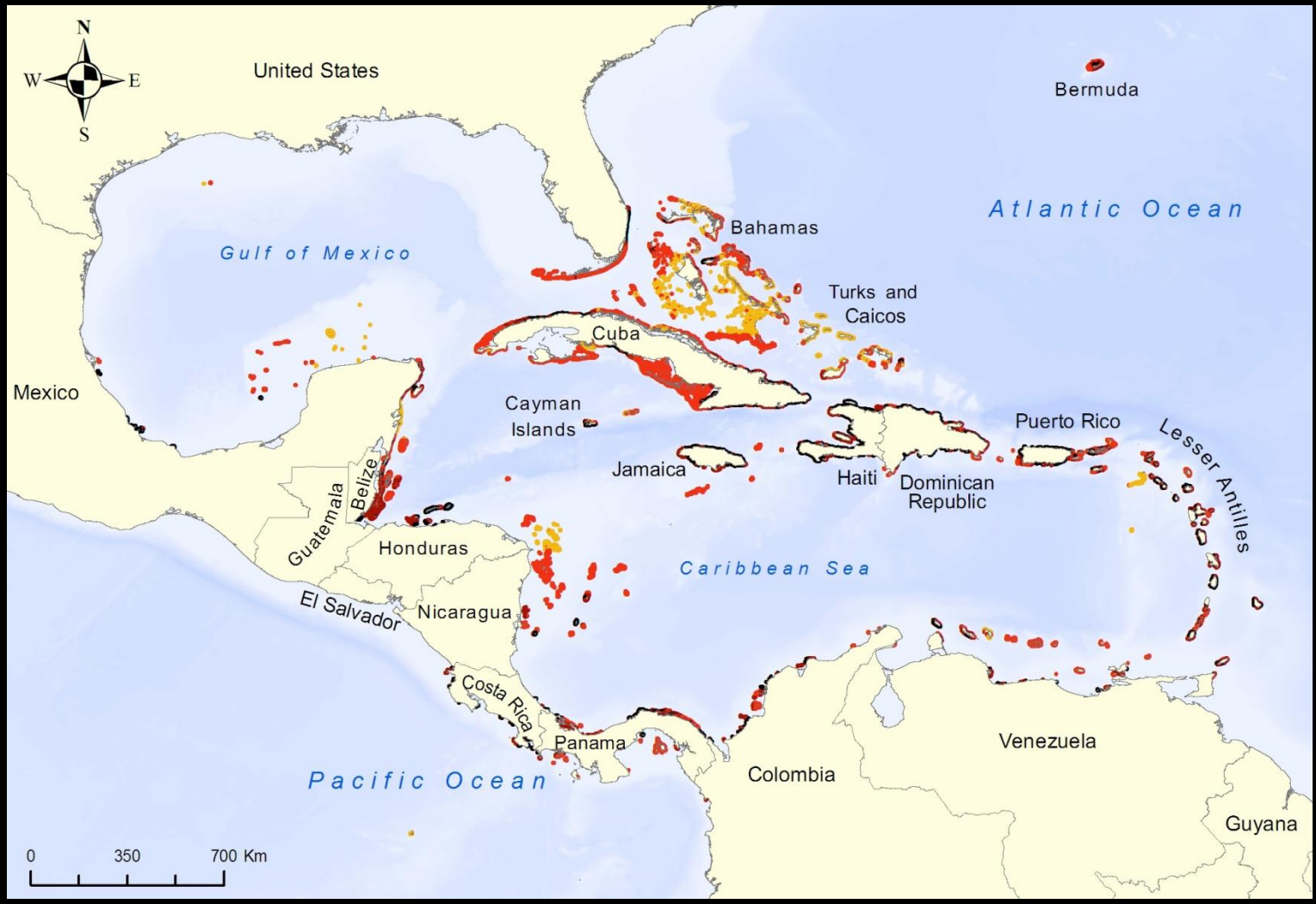
Integrated threat from local activities: today

Low Medium High Very High

Integrated local and global threat: 2030

Low Medium High Very High Critical

Integrated local and global threat: 2050



Low Medium High Very High Critical

What is at stake?

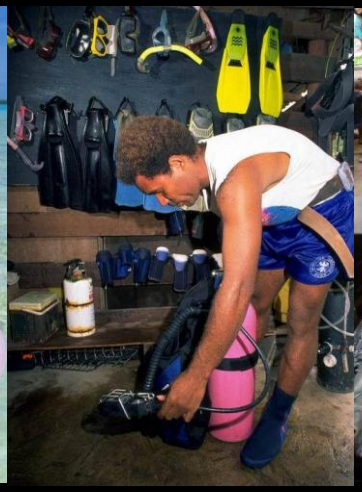
Photo credit: PATH Foundation

Photo credit: Amos Nachoum

Vulnerability Analysis

Where are threats to reefs likely to have the most serious social and economic consequences for reef nations?

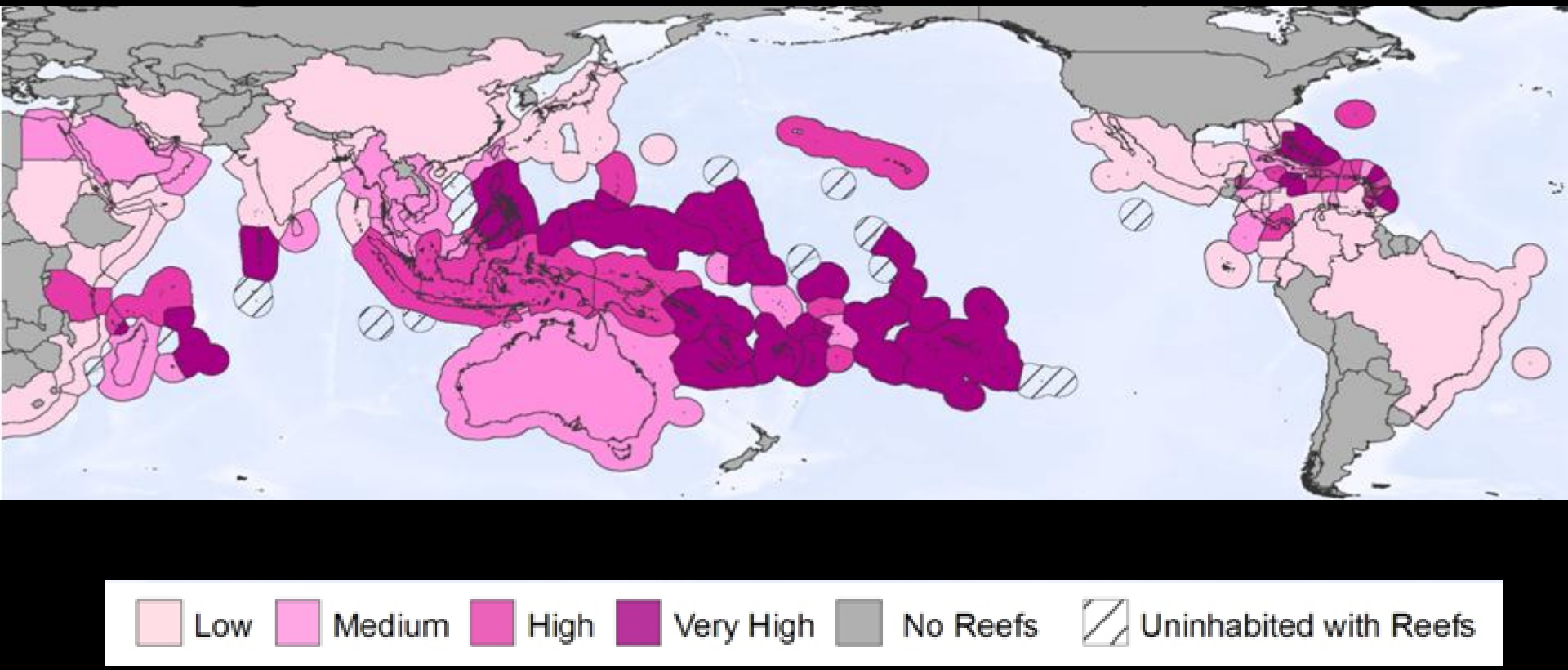


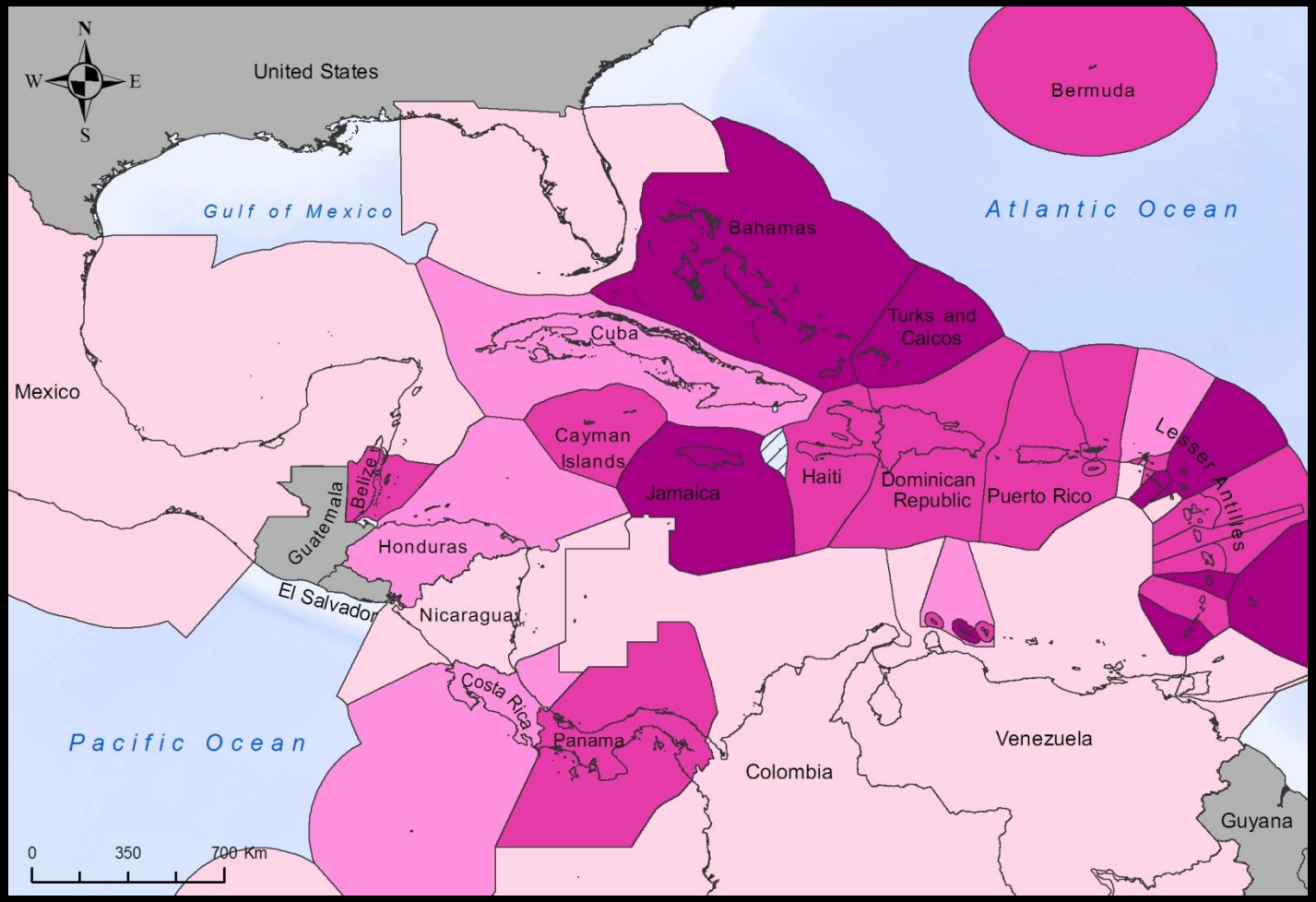

Vulnerability of 108 countries and territories

1. **Reef threats**
2. **Reef-dependence**
   - population
   - fisheries employment
   - exports
   - nutritional dependence
   - tourism
   - shoreline protection
3. **Adaptive capacity**
   - economic resources
   - education
   - health
   - governance
   - access to markets
   - agricultural resources

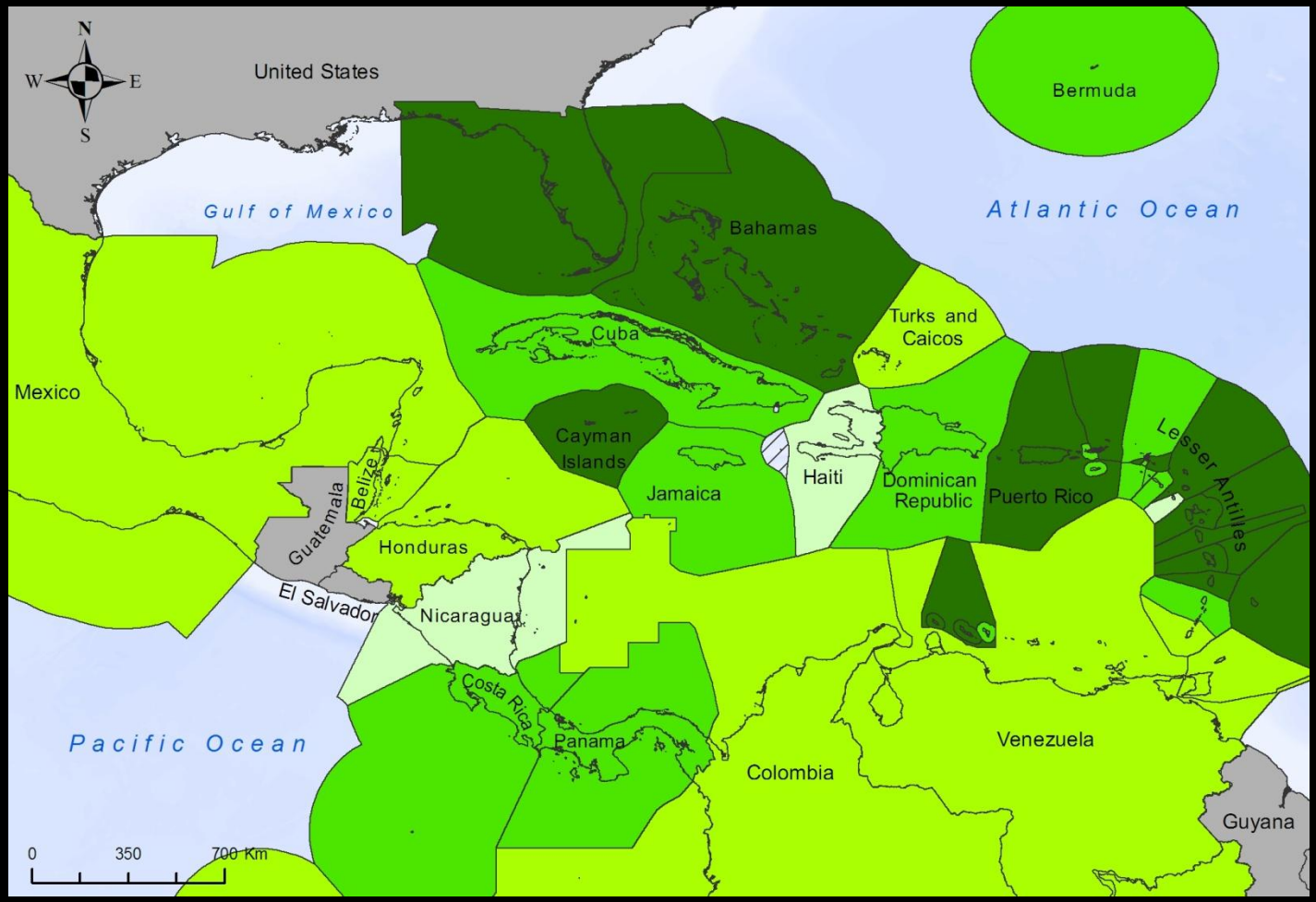
Social and economic dependence on coral reefs



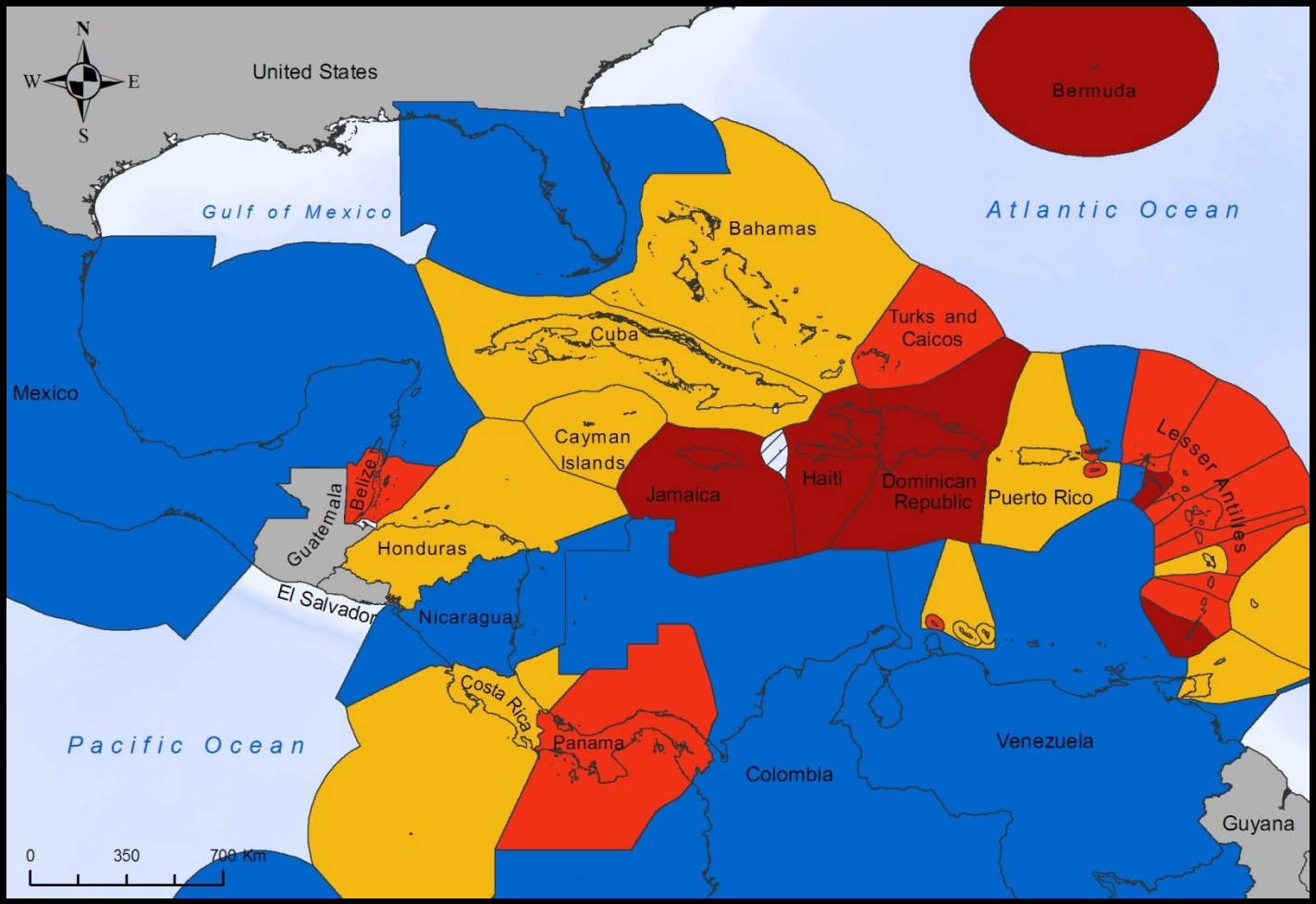
Social and economic dependence on coral reefs



Capacity to adapt to degradation and loss of reefs



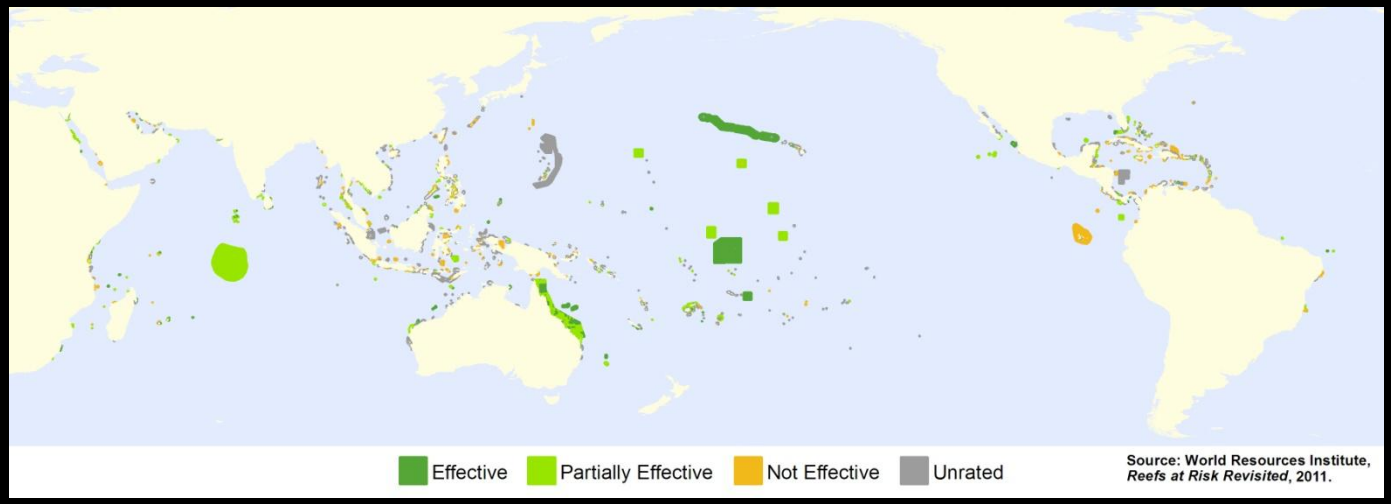
Social and economic vulnerability to reef degradation

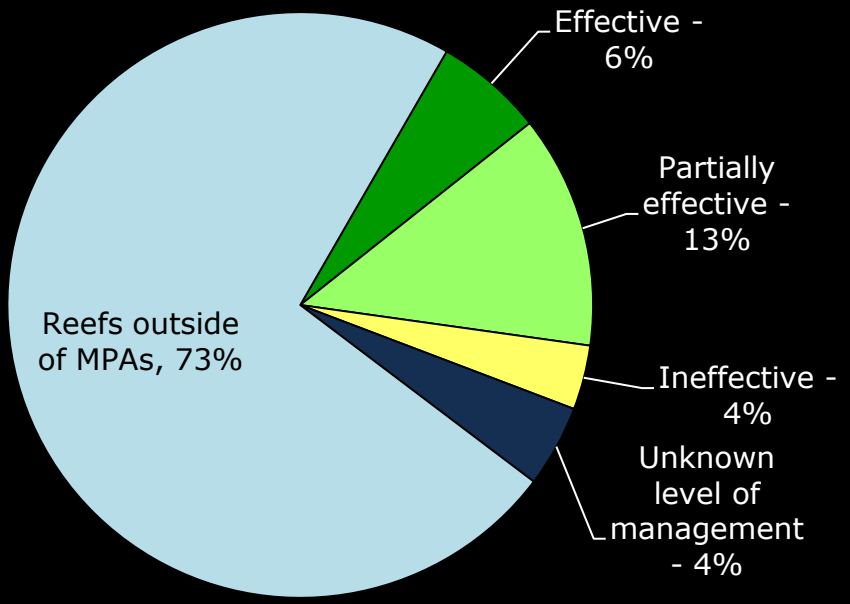


Reasons for hope

Photo credit: Steve Lindfield

Management and Protected Areas





Caribbean:

Total: 30%

Effective: 2%

Partially Effective: 9%

Actions needed:

1) Reduce local pressures

- Manage fisheries sustainably
- Retain mangroves
- Enforce coastal development regulations
- Honor EIA process
- Manage tourism sustainably

Photo credit: GBRMPA

Actions needed:

2) Manage for global pressures

- Tackle GHG emissions
- Manage for climate –
  - Connectivity
  - Resilience

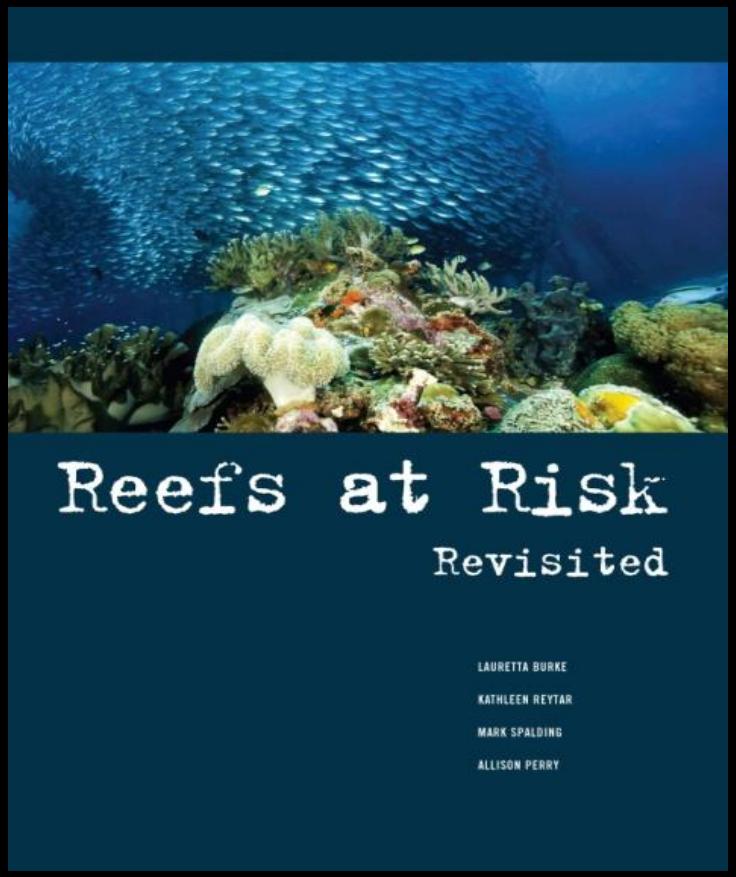
Photo credit: GBRMPA

Actions needed:

3) Build consensus and capacity

- Research – OA, compound threats, resilience
- Education and communication
- Economic valuation
- Inclusive planning
- Management and enforcement capacity

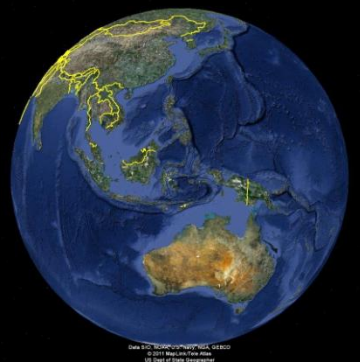
Photo credit: GBRMPA



Available online:

- Report
- Maps
- Google Earth
- Video
- and more……

www.wri.org/reefs



Coastal Capital:

Economic Valuation of Coral Reefs in the Caribbean

Ecosystem Services from Coral Reefs

Provisioning Services

- fish and shellfish
- medicines and pharmaceuticals
- ornamental resources
- building materials

Regulating Services

- erosion control
- storm protection

Supporting Services

- sand formation
- primary production

Cultural Services

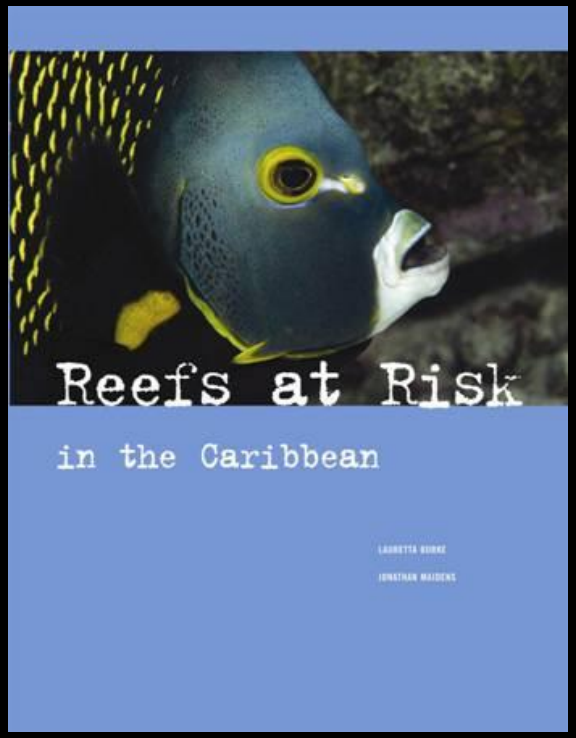
- inspiration
- aesthetic values
- social traditions
- spiritual values
- recreation & tourism

Why Economic Valuation?

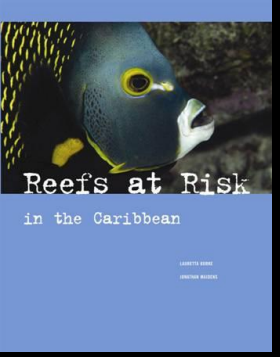
$ Speaks – Many of these services go uncounted in decision-making

- Highlight economic importance
- Encourage investment in management
- Decision-making tool
- Fee setting
- Damage compensation

The beginning…



- Regional valuation:
  - Fisheries
  - Dive Tourism
  - Shoreline Protection



Regional Valuation – Reefs at Risk in the Caribbean (2004)

- Value = US$ 3.0 – 4.6 billion / year
- Losses of US$ 350 – 870 million / year estimated to result from degradation

3 Goods and Services Evaluated

Fisheries

Tourism

Shoreline Protection

3 Goods and Services Evaluated

Fisheries

Tourism

Shoreline Protection

Benefits:

- *Tangible*
- *Relevance to national and local economies*
- *Data available*

3 Goods and Services Evaluated

Fisheries

Tourism

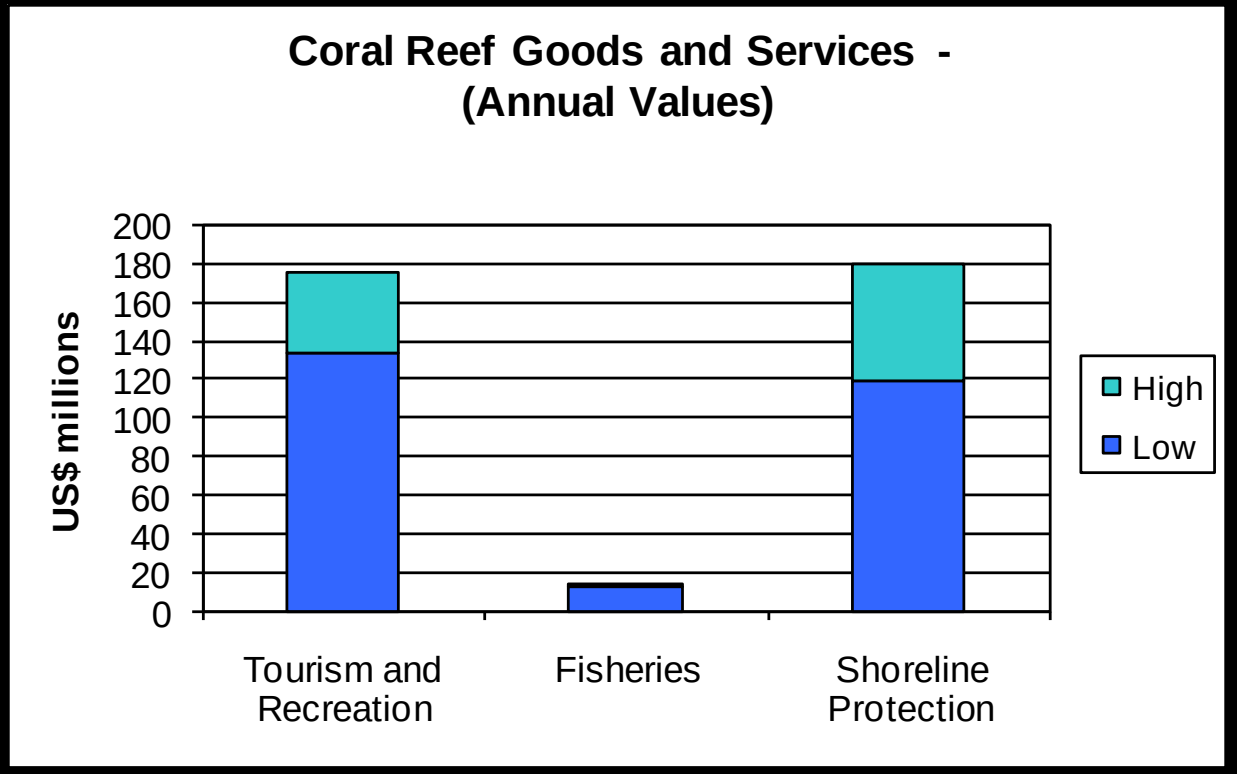
Shoreline Protection

Limitations:

- *Omitted Values –*
  - *Pharmaceutical*
  - *Local use*
  - *Raw materials*
  - *Existence / spiritual*

Coastal Capital: study locations

Belize: Annual economic contribution of **coral reefs** was between US$270 and $370 million in 2007



Source: Cooper et al, 2008.

Valuation Approaches

- Fisheries – direct economic impact / financial analysis; $$

- Shoreline Protection –
  - Tobago, St L, BZ – Relative protection provided by reefs; avoided damages from presence of reef; $$
  - Jamaica – map of change in flooded area resulting from severe coral degradation

Valuation Approaches - Tourism

- Tobago, St. Lucia, Belize – economic contribution of coral reef-related tourism (expenditures by tourists on reef-recreation days); $$

- DR and Jamaica –
  - Focus on beaches
  - Marginal change in value due to coral degradation; $

Coral Reef Valuation in Jamaica

- Many past studies – 14 identified
  - 2 National Studies
  - 6 for Montego Bay
  - Negril, Ocho Rios, Portland Bight, Discovery Bay

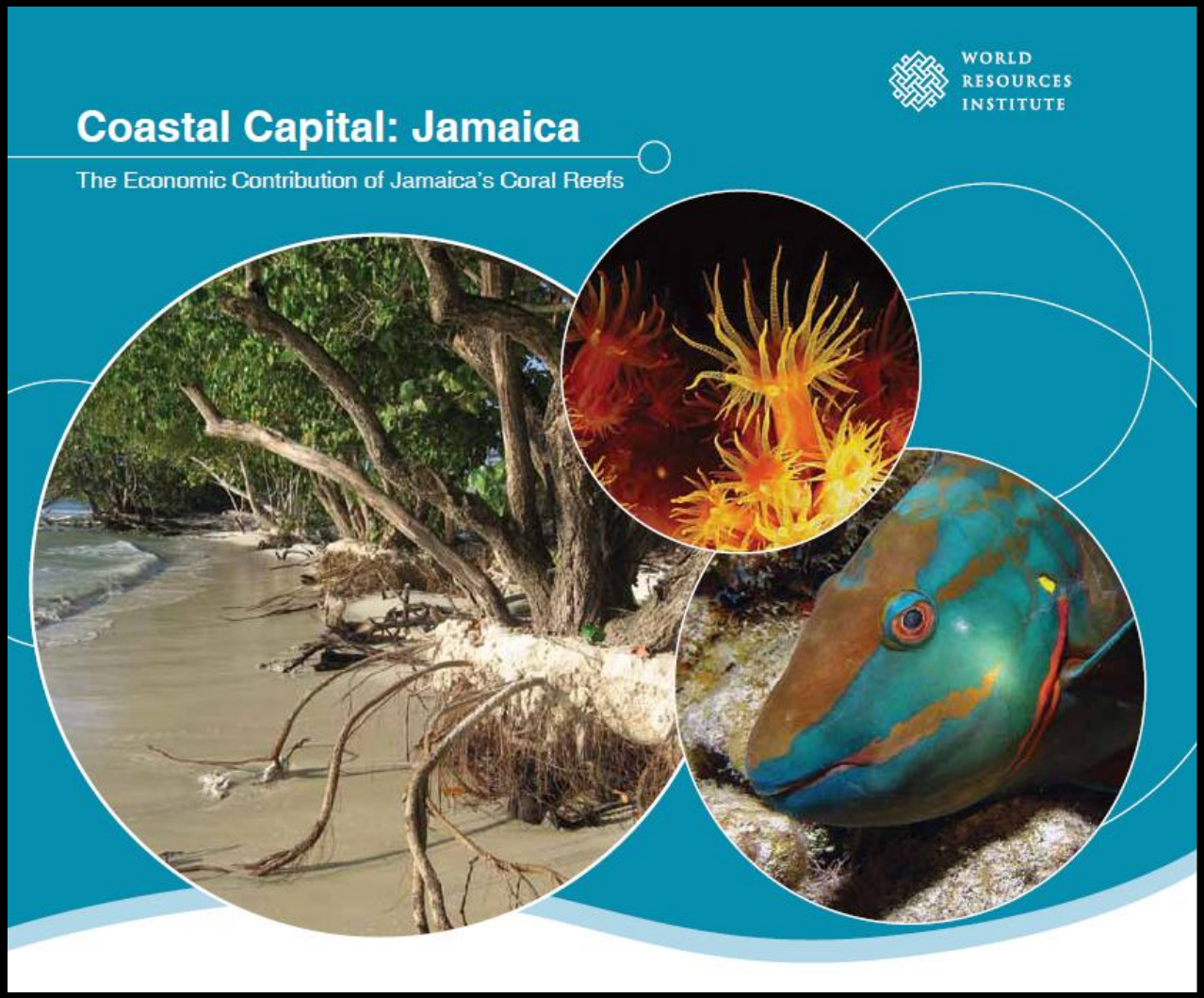
Coral Reef Valuation in Jamaica

Key Themes of past studies:

- High reliance on coral reefs
- High economic value
- Degradation reduces value

- Tourists to Jamaica have high consumer surplus
  - Willing to pay park entrance fee of US$5
  - Willing to pay US$2 environmental tax or $1 hotel tax
  - Willing to pay IF FOR ENVIRONMENTAL PROTECTION

Coastal Capital: Jamaica



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Coastal Capital: Jamaica

- Coral reef-related fisheries
- Shoreline protection and coastal inundation
- Beach erosion and impacts to tourism

The Economic Value of Jamaica's Coral Reef-Related Fisheries

Photo credits: Krishna Desai, Peter Espeut

Richard Waite
World Resources Institute

Nathalie Zenny
The Nature Conservancy

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Reef-Related Fisheries

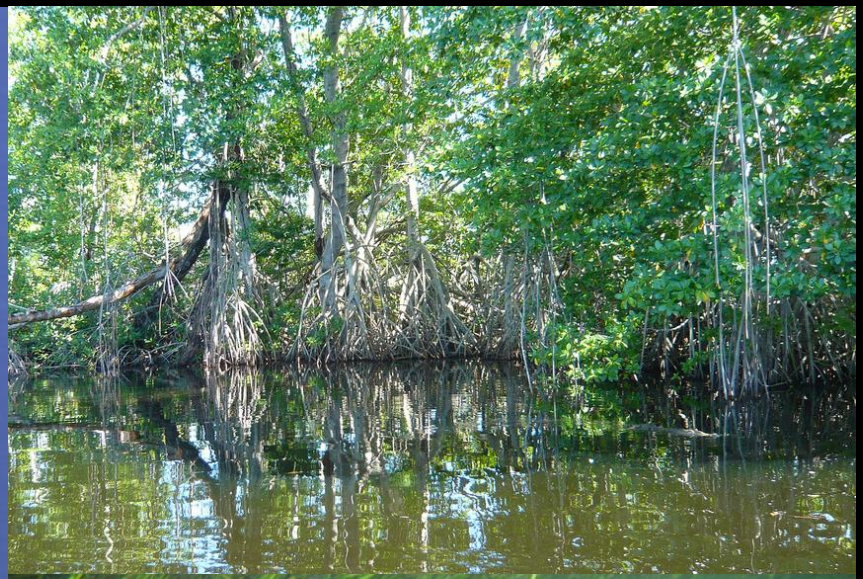


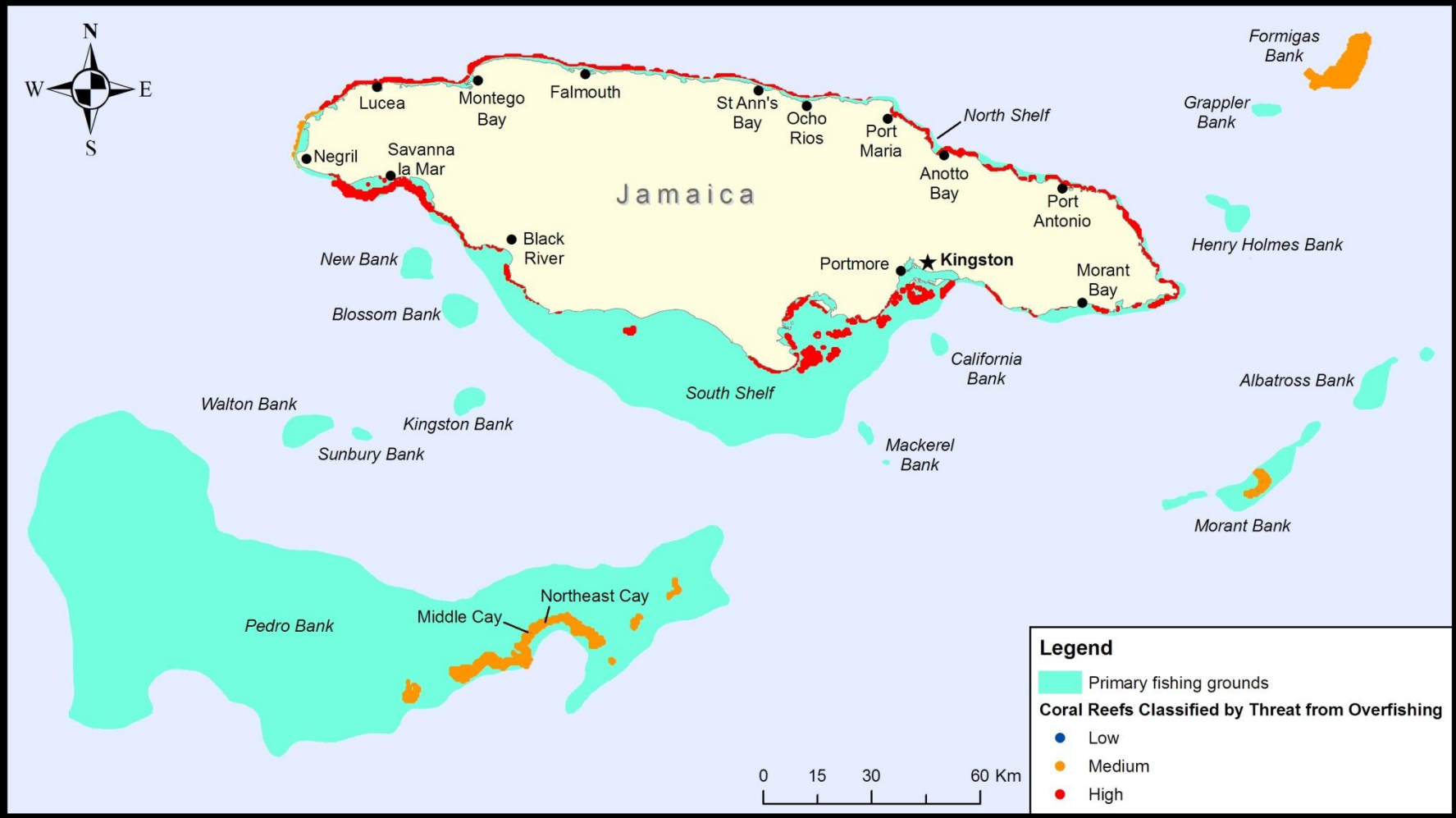
Photo credits: Carl Lee, Flickr users mpgulley, Paul and Jill

Fisheries Support Livelihoods

- 15,000-20,000 fishermen
- Directly and indirectly support at least 100,000 people

Photo credits: Brandon Hay, ECOST 2007.

Widespread Overfishing



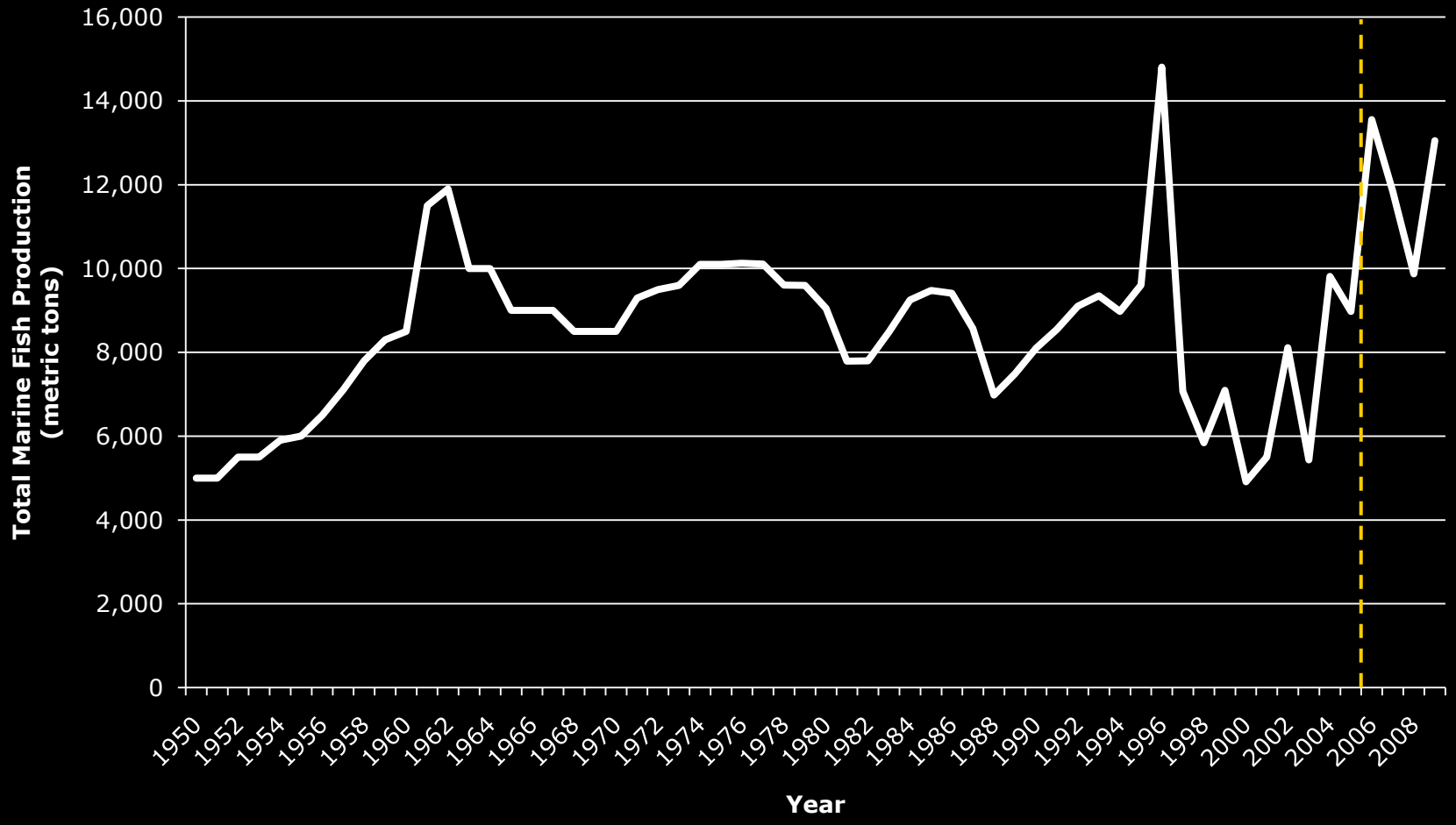
Sources: Burke et al. 2011, Aiken and Kong 2000.

A more recent threat…

Photo credit: Wolcott Henry

Trends in Catch Volume and Value

Marine Fish Production in Jamaica, 1950-2009



Sources: FAO 2007, Murray 2008, Fisheries Division 2010, Aiken et al. 2006, Aiken et al. 1999.
Note: increases observed from 2006-2009 (indicated by dashed yellow line) may be due to improved data collection methods rather than actual increases in landings.

Fish catch data are relatively stable, however…

Quality of fish landed: ↓

Average size of fish landed: ↓

Effort to maintain level of catch: ↑

Level of fishing effort: Unsustainable

If overfishing continues…

Future yields: ⬇

Future revenue: ⬇

Food security: ⬇

Jamaica: Average annual revenues from reef-related fisheries, 2001-2005

	Avg. annual Catch (MT)	% exported	Total gross revenues (US$ millions)
Finfish	6,383	10%	$23.8
Conch	717	95%	$5.3
Lobster	269	40%	$3.7
Shrimp	198	0%	$0.3
Total Value	**7,566**	-	**$33.1**

Value of subsistence catch: US$1.2 million/year

Adjusted average annual fish catch value: **US$34.3 million/year**

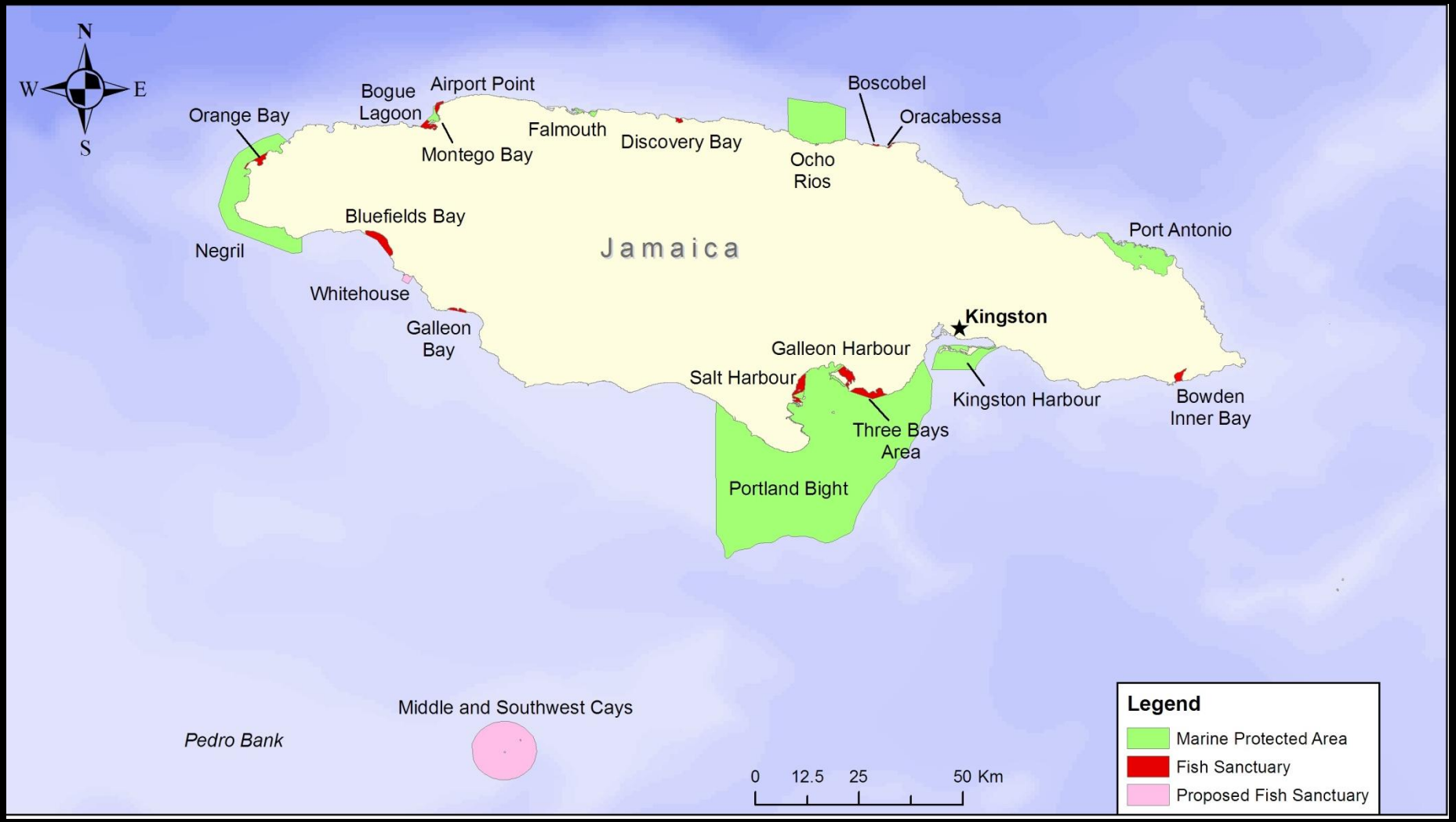
Sources: ECOST 2007, STATIN 2007 in ECOST 2007 and Murray 2008. Adjusted to US$ 2011.
Figures may not total correctly due to rounding.

What has already been lost?

- Discovery Bay study
- 13% decline in fish catch volume
- 17.3% decline in fish catch value
- Possible lost revenue between 1975-2000: US$1.6 billion (or $64 million / year)

Source: Sary et al. 2003.
Photo credit: Carl Lee

Fisheries Management - Recent Positive Steps



Source: TNC 2010.

Draft National Fisheries Policy

Many positive aspects:

- Sustainable fisheries management
- More stringent regulations
- Finance for improved enforcement
- Co-management
- Improved research and data collection

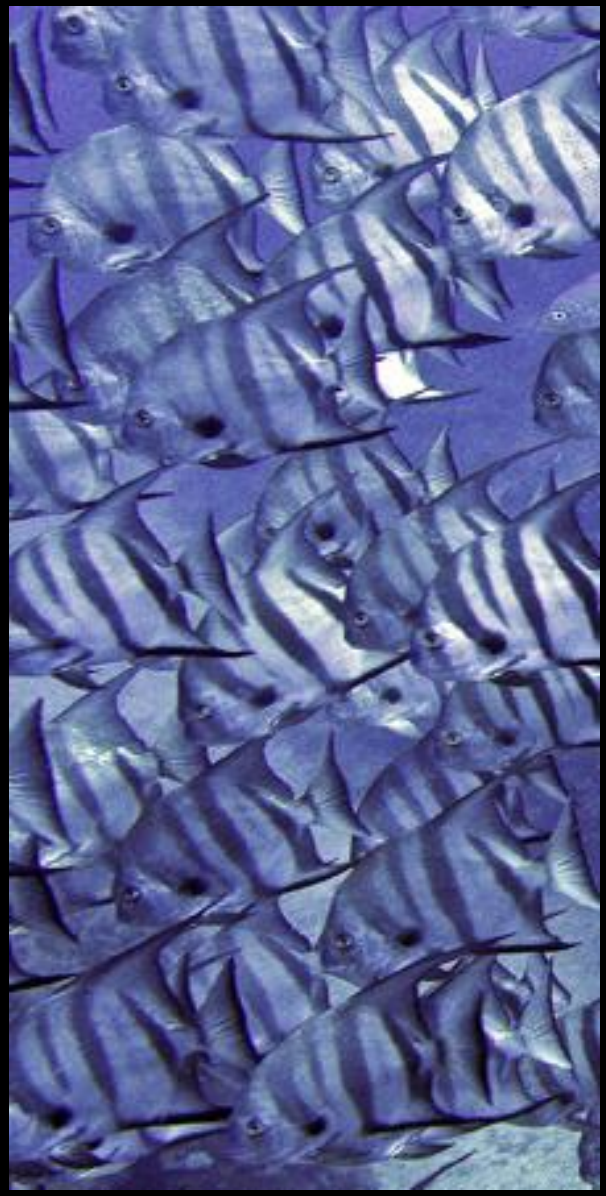


Photo credit: Carl Lee

Recommendations

- Strengthen fisheries management
- Invest in protection of coral reefs and other coastal ecosystems

Photo credit: Carl Lee

Shoreline Protection by Jamaica's Coral Reefs

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World Resources Institute

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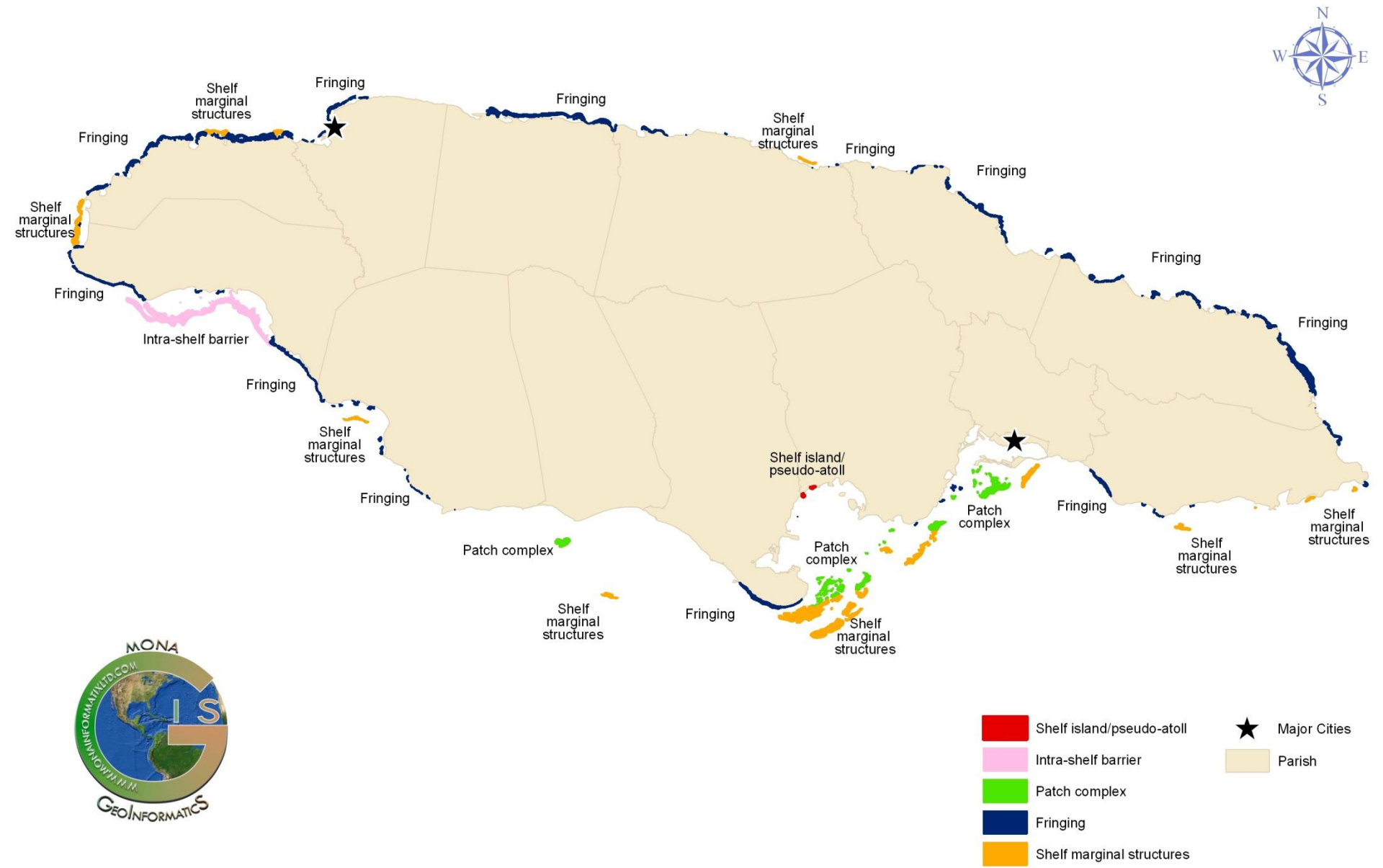
Photo credits: Ted Robinson, Owen Day

Economic Valuation of Coastal Ecosystems in Jamaica

Derived Reef



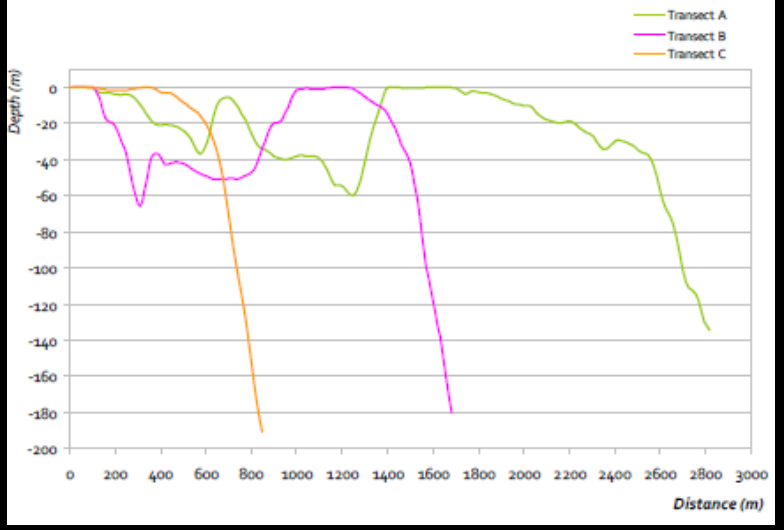
Oceanographic Studies Division - Mona GeoInformatix Institute (OSD-MGI), University of the West Indies (UWI) in collaboration with World Resources Institute (WRI), Marine Geology Unity (MGU), UWI and Texas A&M Universtiy

Modeling Impacts of Reef Degradation

- Modeled wave attenuation
  - Reduced water level at shoreline
  - Reduced erosion
- Mapped inundated areas based on water level at shore
  - Identified land and structures affected
- Did not estimate economic impact

Modeling Wave Attenuation by Reefs

- 3 pilot sites
  - Negril
  - Discovery Bay
  - Kingston / Port Royal
- Mike 21 Model
  - Storm scenarios
  - Reef scenarios



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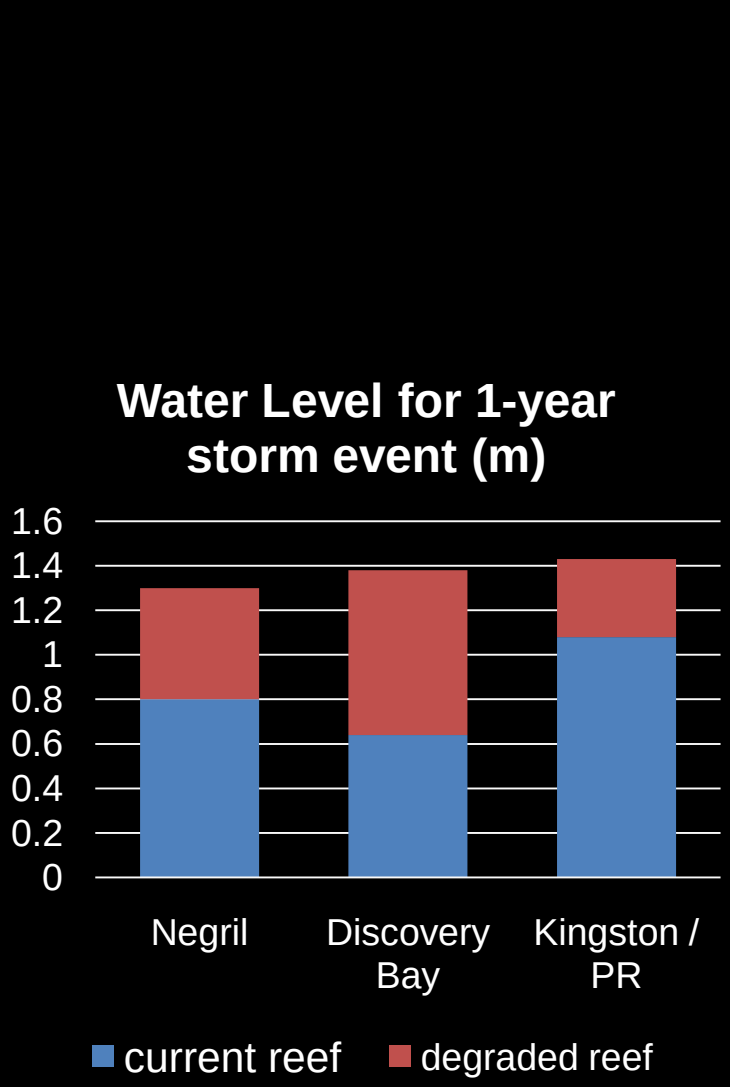
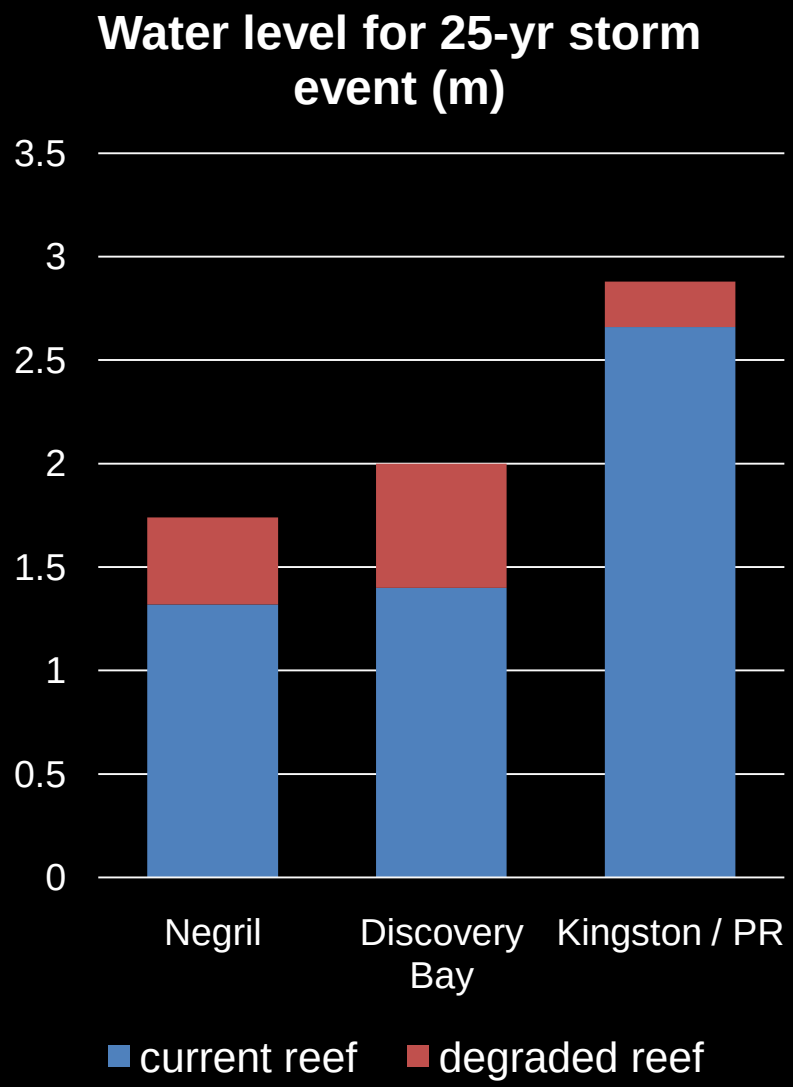
Change in water level at shore due to reef degradation





Inundation at Discovery Bay during 25-year storm event

Current Reef
(1.4m level)

Degraded Reef
(2.0 m level)

Coastal Inundation Map Series

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Coastal Characterization

- Extrapolation from pilot sites based on coastal characteristics
  - Reef Type
  - Reef shape and complexity
  - Reef distance from shore
  - Orientation relative to shore

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Relative levels of protection

Communities with high protection from reefs (H)

Coral Gardens	Morant Point	Southern Negril
Discovery Bay	Savanna-La-Mar	St. Ann's Bay
Falmouth		

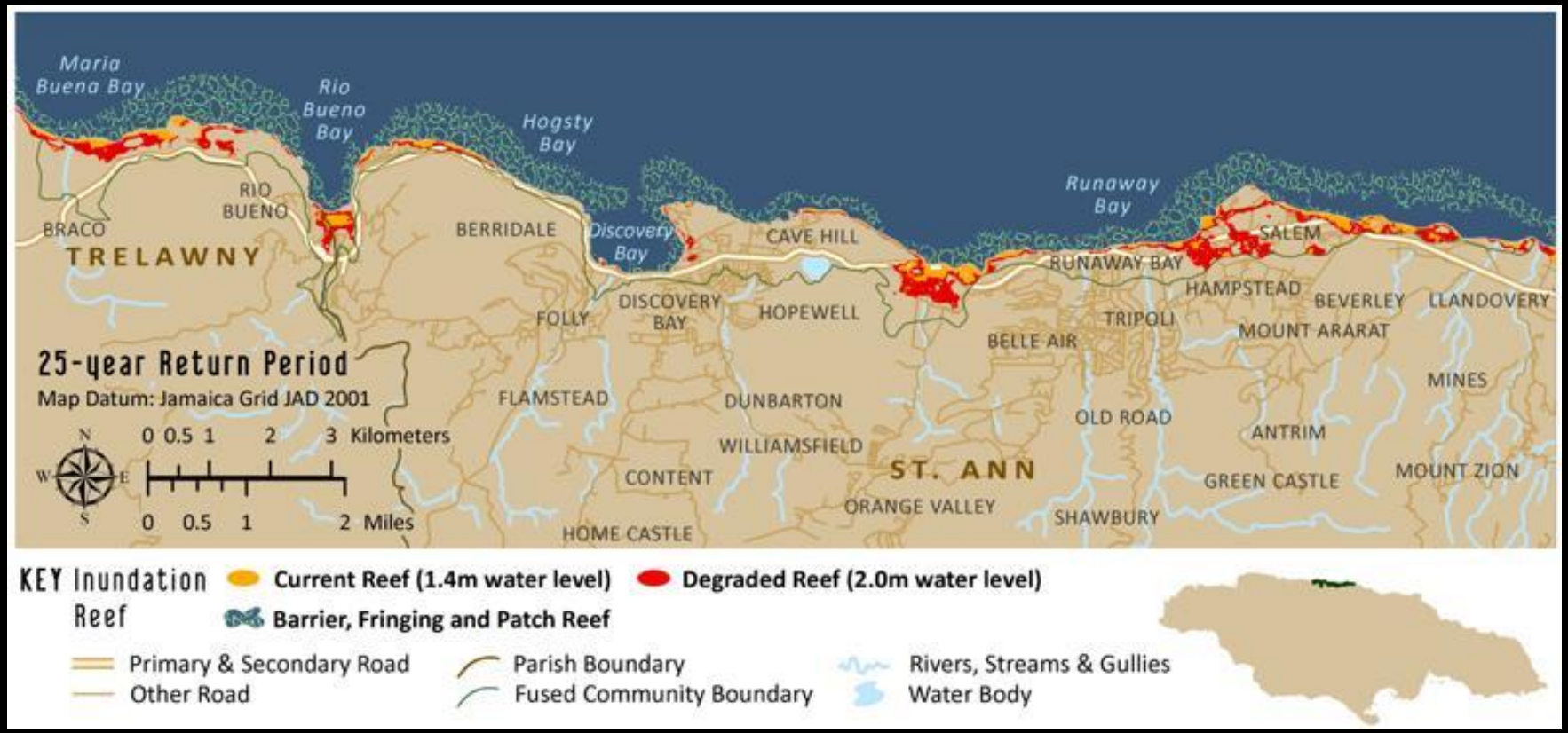
Communities with medium protection from reefs (M)

Annotto Bay	Montego Bay	Orange Bay
Buff Bay	Negril	Port Maria
Green Island	Ocho Rios	Sandy Bay
Long Bay	Oracabessa	White House
Lucea		

Communities with low protection from reefs (L)

Black River	Lionel Town	Port Morant
Cross Keys	Milk River	Salt Pond
Hellshire	Old Harbour	Treasure Beach
Kingston	Port Antonio	Yallahs

25-year storm scenario



Property Affected:
Current reef – 39 buildings
Degraded Reef – 154 buildings,
including 2 hotels, church, airfield

Coastal Inundation Map Series

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Conclusions

- Innovative approach to isolate influence of coral degradation on coastal flooding
- MGI maps for 1-year and 25-year storms for areas where reefs offer high protection
- Property values and damage estimates could be included to produce estimates of value – “avoided damages”

Coral Reefs, Beach Erosion and Impacts to Tourism in Jamaica

Photo credit: Flikr_04deveni

Benjamin Kushner
World Resources Institute

WORLD RESOURCES INSTITUTE

Overview

- Significance of beach tourism
- Analysis
  - Modeling the impact of reef loss
  - Loss in value associated with beach loss
- Discussion

Photo credit: Amos Nachoum

Jobs and Revenue:

- 24% of GDP
- 23% of jobs

Why Jamaica?

Photo credit: 04deveni

Quantitative beach width ranges associated with each quality level

Beach quality	Associated beach width
Poor	0 - 5m
Fair	5.1 - 10m
Good	10.1 - 20m
Excellent	20.1 - 30m

Source: Edwards 2009.

Results of simulating the welfare changes for a change in the beach attribute for beach quality

Beach Quality Change	Economic Value* per person (US$)
Good to Poor (15m loss)	-$95
Good to Fair (10m loss)	-$51
Fair to Poor (5m loss)	-$44

Source: Edwards 2009.

We looked at:

- Coral reef loss and beach erosion
- Economic impacts of beach erosion

Coral reef loss and beach erosion

Photo credit: Steve Lindfield

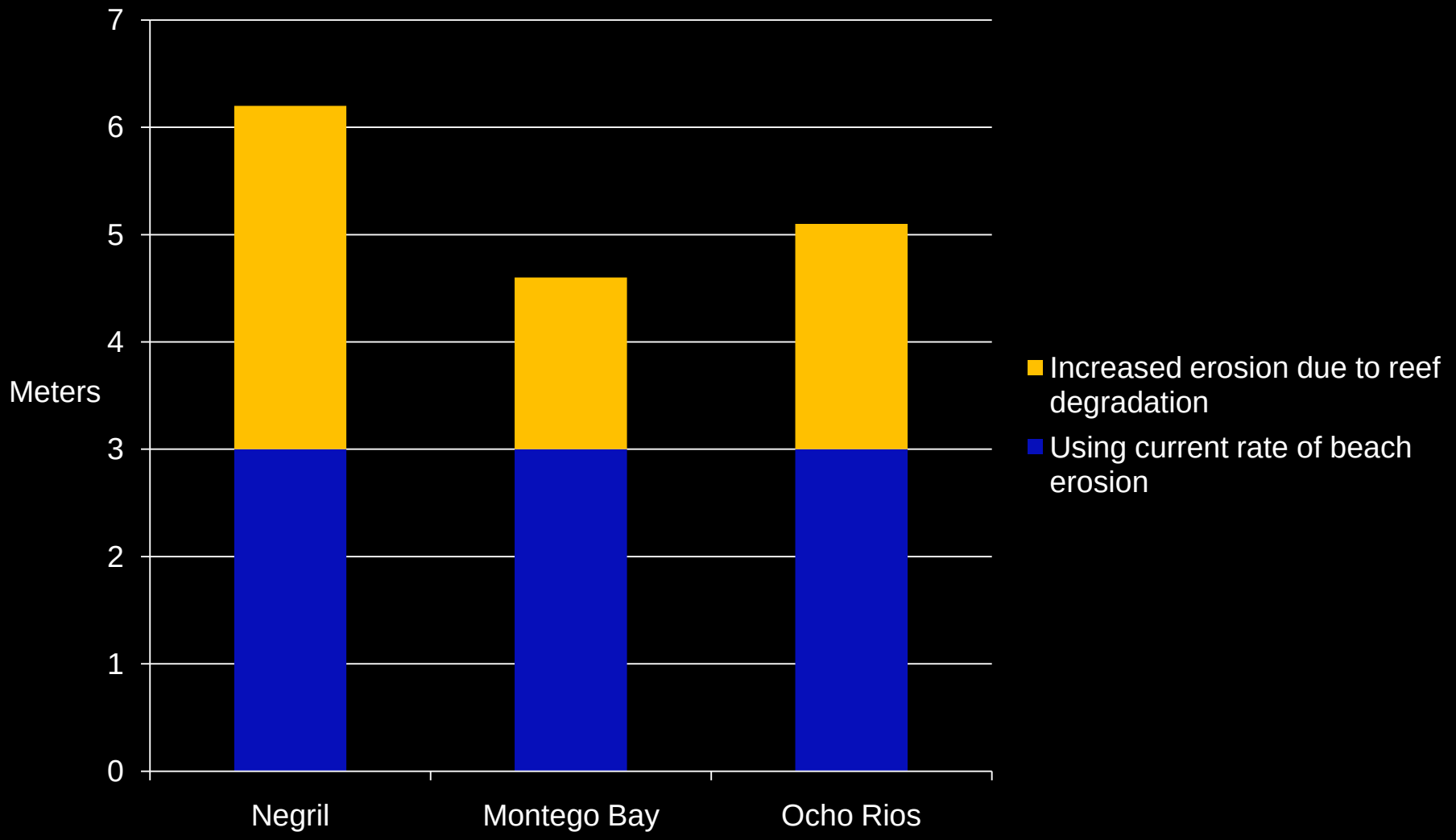
Photo credit: Emily Cooper

Photo source: Krishna Desai

Photo credit: Krishna Desai

Photo credit: Owen Day

10 year erosion projection



Economic impacts of beach erosion

Loss in consumer satisfaction per visitor

Location	Loss per tourist due to current rates of beach erosion	Loss per tourist if the beach erodes faster due to reef degradation
Negril	$15	$30
Montego Bay	$15	$23
Ocho Rios	$15	$26

Loss in consumer satisfaction given current number of tourists

Location	Loss in value due to current rates of beach erosion	Loss in value if the beach erodes faster due to reef degradation	Difference due to further reef degradation
Negril	$5.5 million	$10.9 million	$5.3 million
Montego Bay	$7.1 million	$10.7 million	$3.6 million
Ocho Rios	$6.5 million	$11.1 million	$4.6 million
Total:	**$19.0 million**	**$32.7 million**	**$13.5 million**

Loss from beach erosion due to reef degradation (after 10 years of erosion)

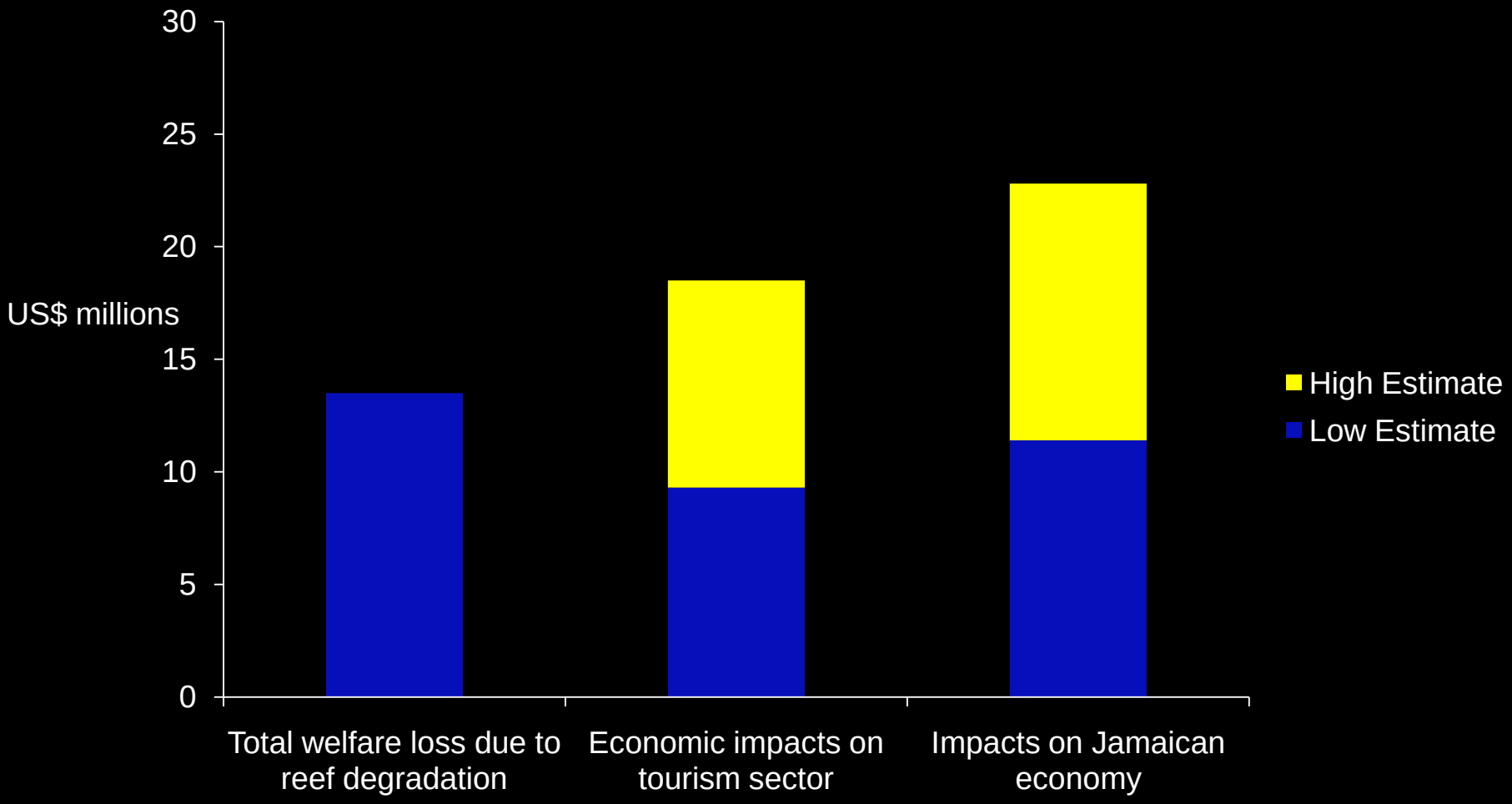


Photo credit: Owen Day

Still competitive?

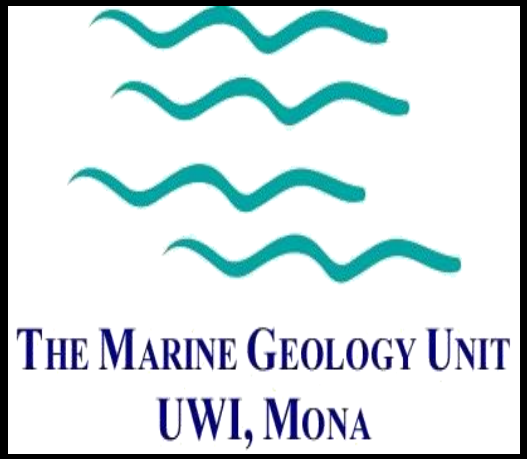
Photo credit: Steve Lindfield

Photo credit: Owen Day

Key Findings

- 70-80% of tourists care strongly about the presence of beaches
- If reefs degrade further, in year 10 erosion will increase
  - 50% in Montego Bay
  - 70% in Ocho Rios
  - 100% in Negril
  - Additional loss of US$13.5 million per year—a 70% increase in the annual loss of value from the current erosion rate
  - Tourism will decrease between 9,000-18,000 stopover visitors per year
- The loss in visitation could cost an estimated
  - US $9-19 million per year to the Jamaican tourism industry
  - US $11-23 million per year to the entire Jamaican economy

Main Partners



Thank you!

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