

Economic Valuation of Goods and Services Derived from Coral Reefs



Results from the
Tobago Cays Marine Park Reefix Exercise

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Project Background

- Inter-American Biodiversity Information Network (**IABIN**)
 - to promote sustainable development and the conservation and sustainable use of biological diversity in the Americas
- **ReefFix**
 - an ICZM tool that trains participating countries in ecosystem valuation methodologies and management techniques to conserve marine ecosystems and the associated watersheds through integrated park management

Overview of Economic Valuation Techniques

- **Economic valuation** assesses the goods and services provided by an ecosystem which contribute to the wellbeing of human life (financial, social, biophysical, etc)
- By attributing a dollar value to natural resources, the benefits of conservation and some of the unforeseen “costs” of mismanagement are realised

Overview of Economic Valuation Techniques

- Much of the Caribbean tourism plant exists due to the presence of coral reefs (and associated ecosystems)
- Thus the profitability of the tourism industry is impacted by coral reef health however this is not taken into account when major policy decisions occur
- By assessing the **ecosystem services**, the tangible benefits provided by coral reefs to sustain and improve human life can be quantified.



Background

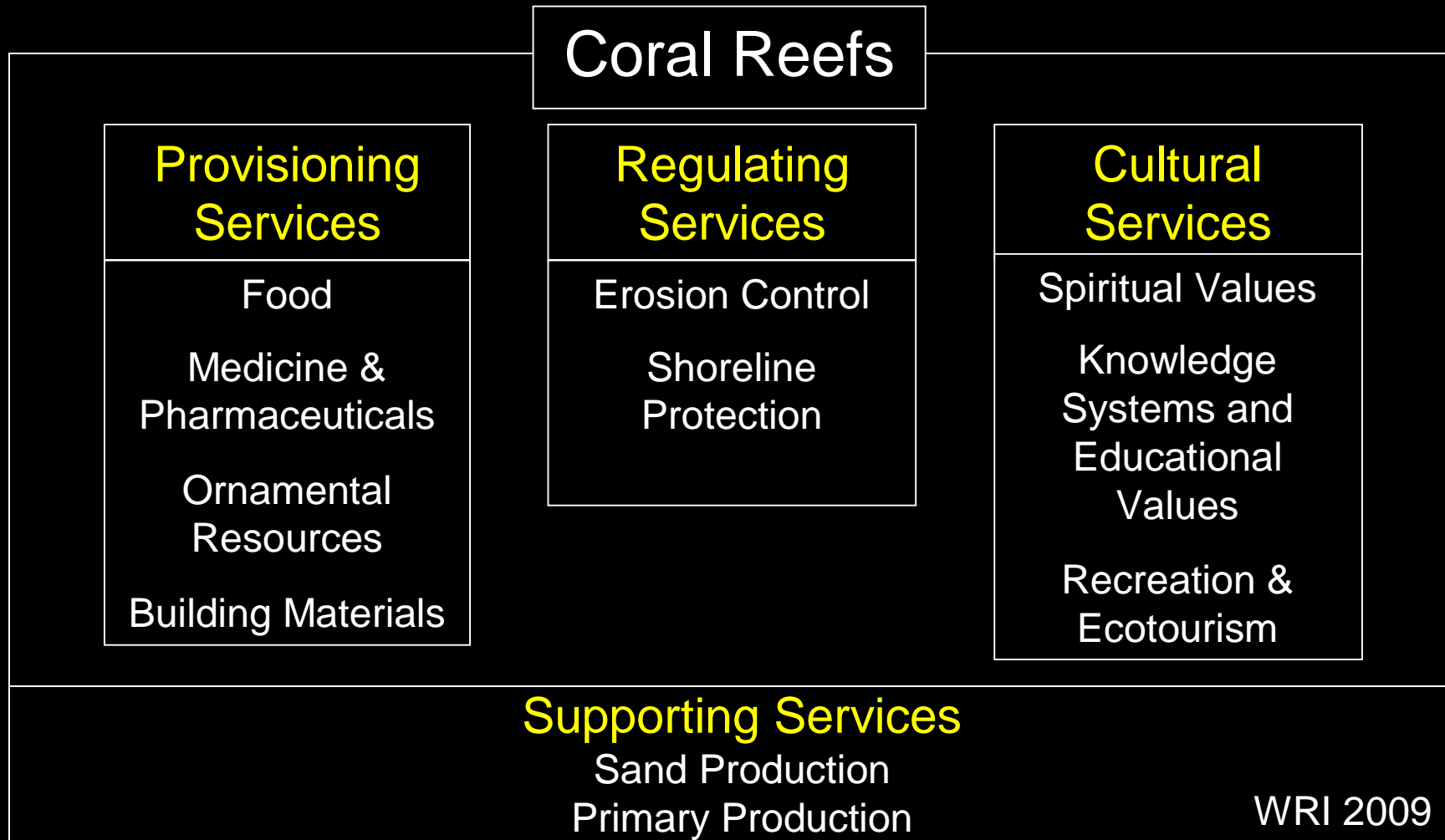
WRI Fisheries

WRI Tourism

Value Transfer

Discussion

Overview of Economic Valuation Techniques



Background

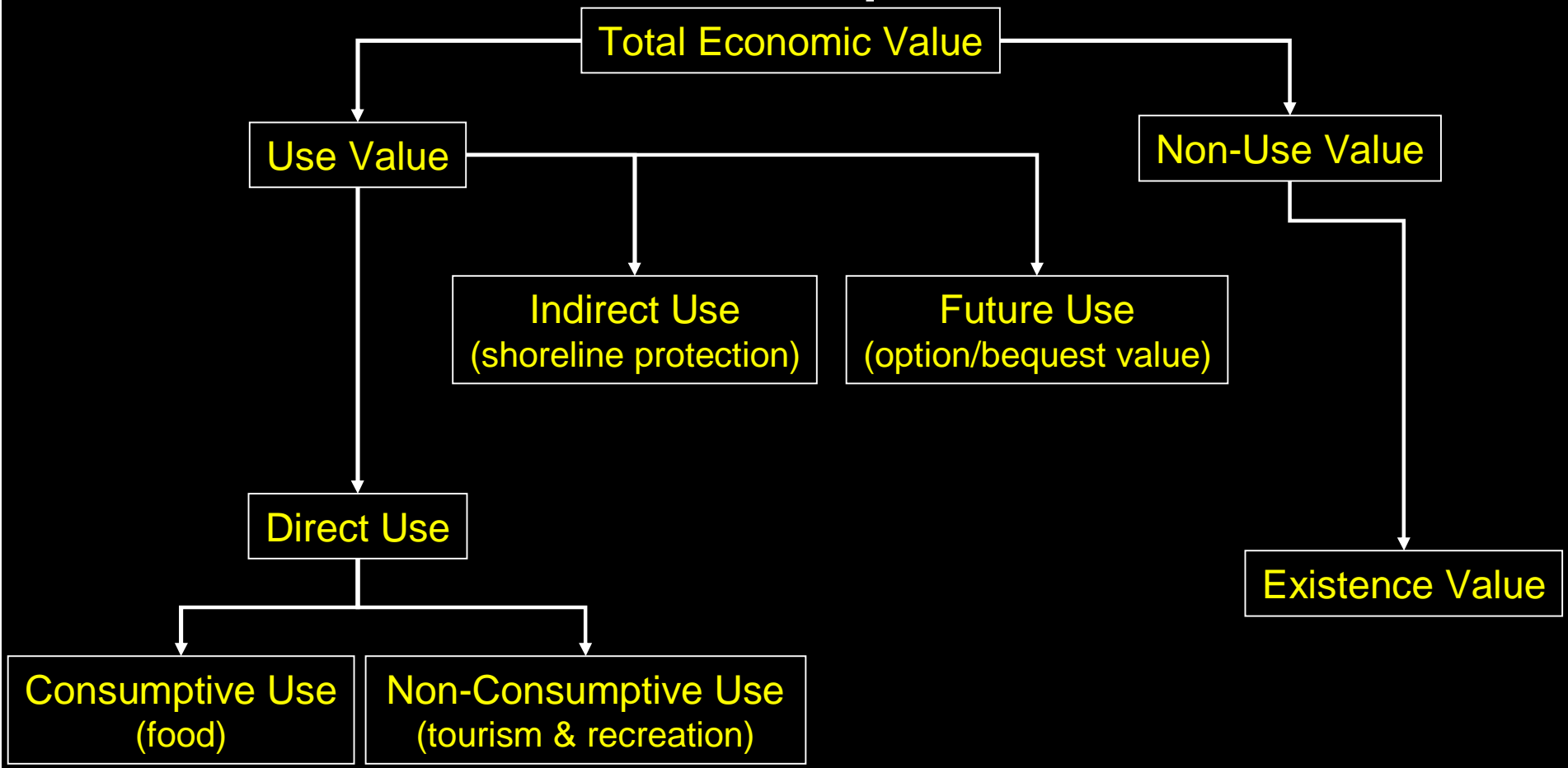
WRI Fisheries

WRI Tourism

Value Transfer

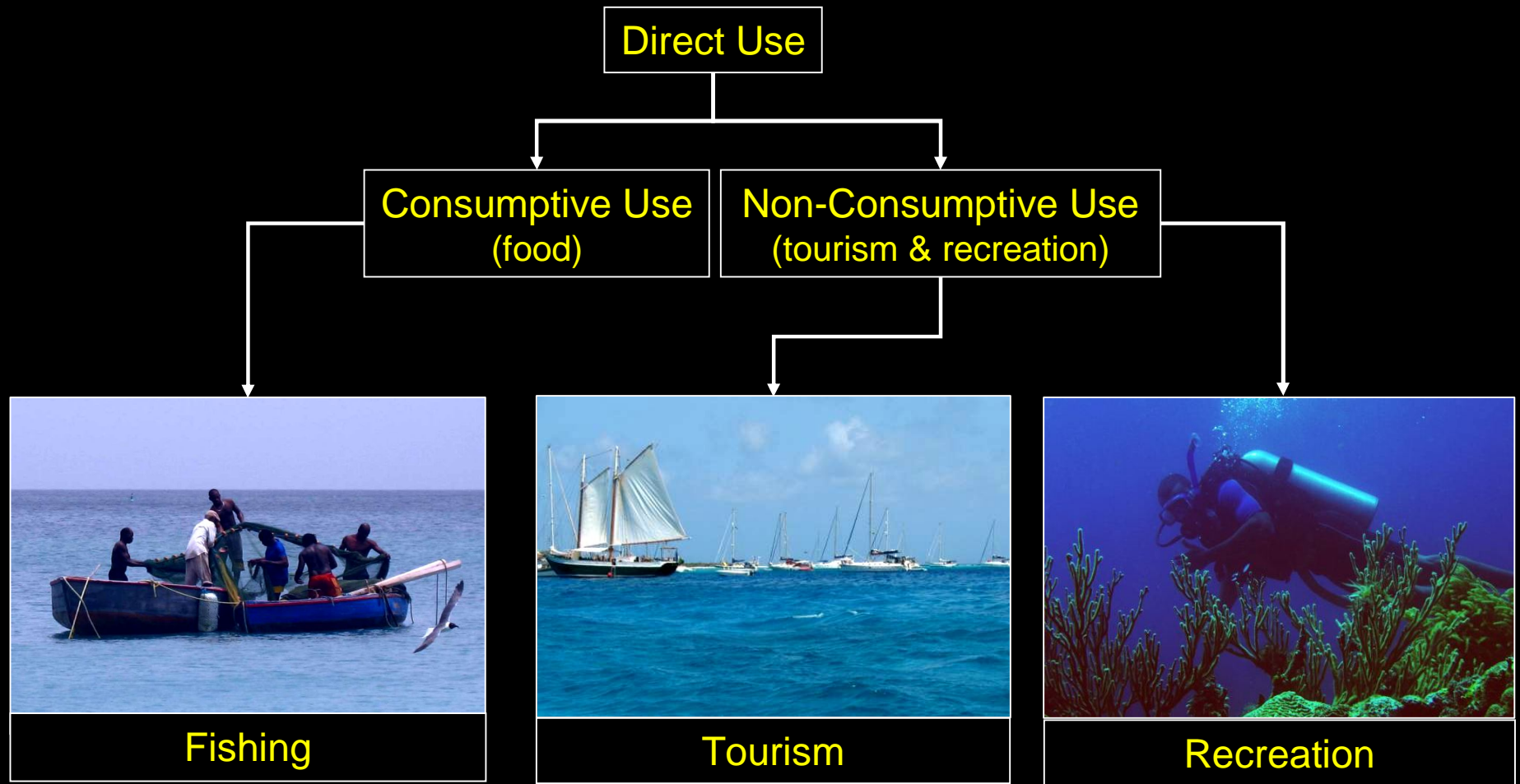
Discussion

Overview of Economic Valuation Techniques



WRI 2009

Overview of Economic Valuation Techniques



Background

WRI Fisheries

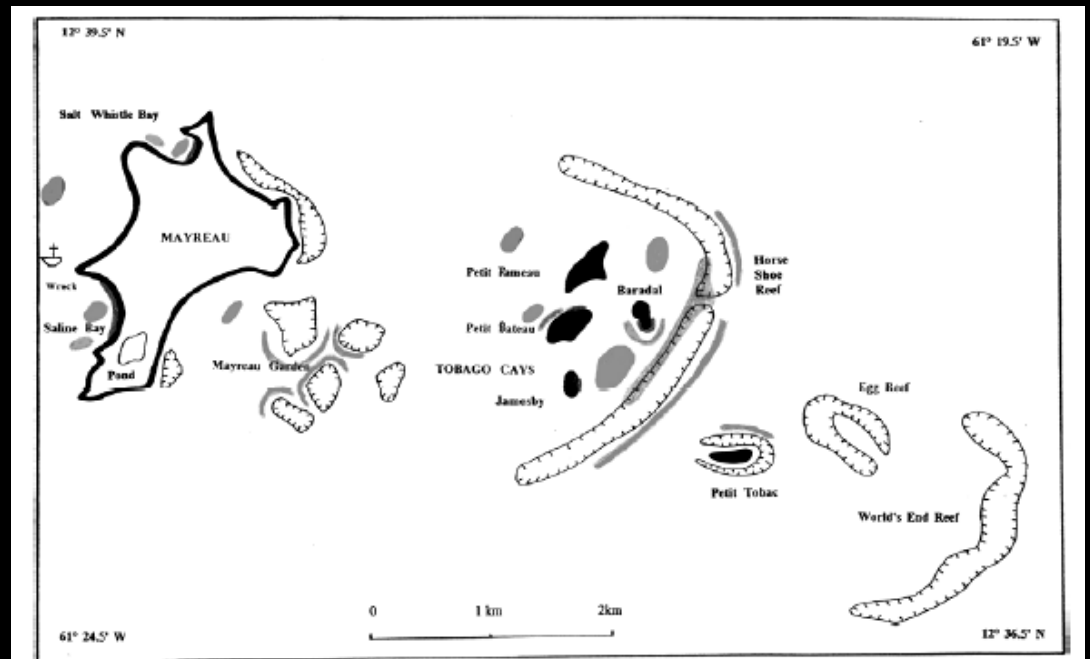
WRI Tourism

Value Transfer

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Site Background

- Tobago Cays Marine Park
- MPA Area = 14km²
- No-take zone
- Islands
 - Mayreau (~250 locals)
 - Petit Tabac
 - Baradal
 - Jamesby
 - Petit Bateau
 - Petit Rameau



MEDO 2003

- Seagrass beds, mangroves, reefs (Horseshoe Reef)
- Destination for ~50,000 annual visitors travelling on yachts, cruise ships, dayboats & other craft

Background

WRI Fisheries

WRI Tourism

Value Transfer

Discussion

Site Background

Significant impact from:

- Anchor damage
 - Pollution
 - Overfishing
 - Storm damage
-
- Surveys indicate varying levels of hard coral cover ranging from low to reasonable
-
- Low densities of commercially viable species attributed to overfishing



Background

WRI Fisheries

WRI Tourism

Value Transfer

Discussion

Methodology	Source
1. Value Transfer - Spatial Distribution of Ecosystem Service Values	Troy/Wilson
2. Coral Reef Valuation - Tourism & Recreation	World Resources Institute
3. Coral Reef Valuation - Fisheries	World Resources Institute



Coral Reef Valuation Tool (v2.0)
 A tool to guide the economic valuation of goods and services from coral reefs

Tourism and Recreation Component

Main Menu
 Project Description

Developed at the World Resources Institute
 In collaboration with Buccoo Reef Trust, Caribbean Natl. of Marine Affairs, Unvieristy of the West Indies-Sustainal and the Government of St. Lucia.

The Valuation Tool and Manual were developed through D. and Catherine T. MacArthur Foundation, the United N Caribbean Environment Program, the Ocean Foundation, the Curtis and Edith Munson Foundation, th Affairs, SwedBio, the Chino Cienega Foundation, the Int Network and the Buccoo Reef Trust.

PLEASE NOTE:
 By using the Coral Reef Valuation Tool you agree to be bound by a in the License Agreement. To view the terms of use and limitation

Coral Reef Valuation Tool (v2.1)
 A tool to guide the economic valuation of goods and services from coral reefs

Fisheries Component

Main Menu
 Project Description

Developed at the World Resources Institute
 In collaboration with Buccoo Reef Trust, Caribbean Natural Resources Institute, Institute of Marine Affairs, Unvieristy of the West Indies-Sustainable Economic Development Unit, and the Government of St. Lucia.

The Valuation Tool and Manual were developed through the generous support of the John D. and Catherine T. MacArthur Foundation, the United Nations Environment Program – Caribbean Environment Program, the Ocean Foundation, the Oak Foundation, the Henry Foundation, the Curtis and Edith Munson Foundation, the Netherlands Ministry of Foreign Affairs, SwedBio, the Chino Cienega Foundation, the International Coral Reef Action Network and the Buccoo Reef Trust.

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Photo: K. Desai

(Brian Zane)

Value Transfer: Spatial Distribution of Ecosystem Service Values

- Use available Satellite imagery (Google Earth™)
- Identify, define and measure area of significant land cover types
- Using values from heavily researched study site, apply values to current site by unit area (hectares)



WRI Coral Reef Valuation Methods: Fisheries & Tourism

DATA COLLECTION

- Utilised data available from:
 - Fisheries Division
 - TCMP
 - SVGTA & SVGHTA
 - Previous Studies
 - Expert Opinion

DATA INPUT

- values inputted into tool – Estimate of **Total Economic Impact** is generated

DATA VALIDATION

- Values reviewed and adjusted with new data
- Application of scenarios

Economic Valuation of Coral Reefs from Recreation and Tourism

Coral Reef Valuation > Tourism and Recreation > Accommodation Default Values

Accommodation Default Values

COSTS, TAXES, AND SERVICE CHARGES
This information will be used to calculate the costs incurred in the accommodation sector

Average hourly hotel wage (US\$) \$4.78
Hours worked per week 48.0
Persons employed per room 0.50
Non-labor Operating Costs (as a % of base revenue) 25%
Tax Rate (%) 7%
Service Charge Rate (%) 10%
*Note: the Tool assumes taxes and service charges are **not** included in the room rate.*

LEAKAGES
Percent of rooms that are foreign-owned 75%

AVERAGE REVENUES
These average values will substitute for missing information in the Accommodation Type table below

Average Room Rate (price per night in US\$, excluding taxes and service charges) \$256
Average Occupancy Rate 55%
Average Number of Rooms 88.9 *(average number of rooms per property, considering all types)*
Number of Accommodations in Study Area 20

DEFAULT REVENUES BY ACCOMMODATION TYPE

Include in valuation (yes or no)?	Accommodation Type*	Average Number of Rooms†	Average Occupancy Rate	Average Room Rate (price per night)	Total Number of Accommodations of This Type*	Percent of Visitors using Reef
No	Hotel	35	57%	\$597.84	10	85.0%
No	Apartments	10.75	55%	\$78.15	5	85.0%
No	Guest Houses	11	55%	\$93.25	5	85.0%
Total Number of Accommodations:					20	

Navigation: Title Page / Project Description / Main Menu / Overview / Site Description / Recreation & Tourism / Tourism Prof

Background

WRI Fisheries

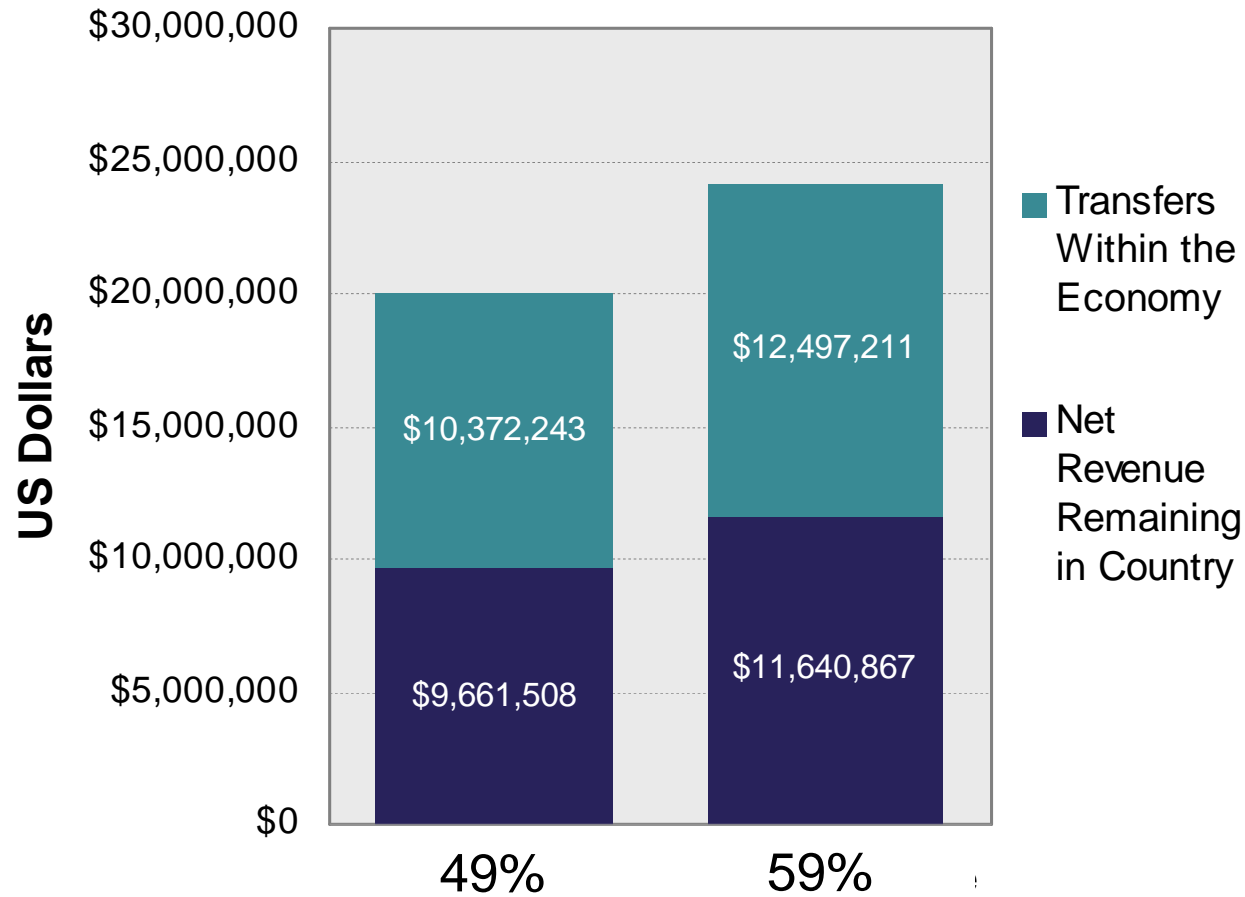
WRI Tourism

Value Transfer

Discussion

Sensitivity Analysis

Economic Valuation of Coral Reefs from Tourist Accommodation: Current and Projected Revenues and Transfers



Percent of "hotel" visitors use TCMP

Background

WRI Fisheries

WRI Tourism

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World Resource Institute Coral Reef Valuation Tool



Fisheries Valuation

WRI Coral Reef Valuation- Fisheries

Commercial Fishing

Total Estimated Landings
- cost of fishing (wages, operating costs)

Fish Processing

Total Estimated Processing Revenue
(processing, cleaning)
- cost of operations (wages, operating costs)

Local Fishing

Fishing for (sale, enjoyment, consumption)

**TOTAL
ECONOMIC
IMPACT OF
FISHING**

Background

WRI Fisheries

WRI Tourism

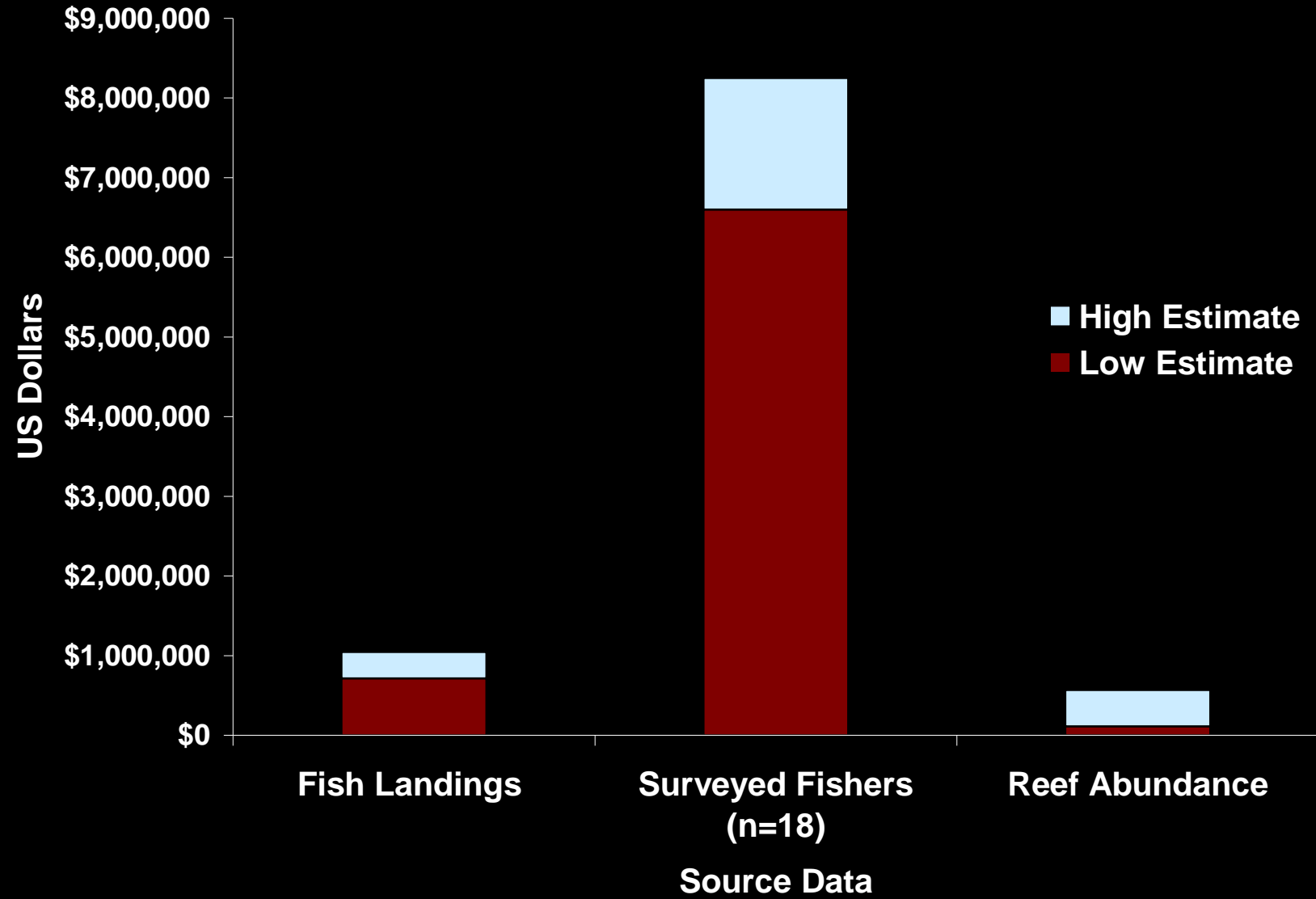
Value Transfer

Discussion

WRI Coral Reef Valuation- Fisheries

- Case study assumes Tobago Cays & surrounding nearshore reefs provide supporting services to the fished reefs
- Quality data was limited
 - aggregated landings data from one site only (extrapolations used)
 - unknown # of (commercial) fishers
 - variations in estimates of # locals fishing for recreation & consumption
 - non-labour operating costs unknown
 - fisher surveys: likely overestimation of landings

WRI Coral Reef Valuation- Commercial Fisheries Results



WRI Coral Reef Valuation- Fisheries

Category	Value (US Dollars)
1. Commercial Fisheries	
Gross Revenue	\$1,046,544
Net Revenue	\$470,945
Transfers to the economy (Wages)	\$261,636
Total Commercial Fishing Value	\$732,581
2. Fish Processing and Cleaning	\$0
3. Local Fishing	\$227,574
TOTAL DIRECT ECONOMIC IMPACTS OF FISHING	\$953,303

Background

WRI Fisheries

WRI Tourism

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World Resource Institute: Coral Reef Valuation Tool



Tourism & Recreation Valuation

WRI Coral Reef Valuation- Tourism & Recreation

Accommodation

Total Estimated Revenue (occupancy rates, room rates, # rooms, % visitors using reef)

- labour, operating costs, tax rates, service charges, leakages

MPA Revenue

Entrance fees – collection costs

Snorkeling and Boating

Total Estimated Revenue (prices, # snorkelers, equipment rentals, # all inclusive trips)

- labour, operating costs, taxes, service charges

Diving

Total Estimated Diving Revenue (prices, # divers, # certifications, equipment, all inclusive trips)

- labour, operating costs, taxes, service charges

Local Use

Beach use, reef-associated use

**TOTAL
ECONOMIC
IMPACT OF
TOURISM &
RECREATION**

Other Revenue

Vendors, food sales

Background

WRI Fisheries

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WRI Coral Reef Valuation- Tourism and Recreation

- Assumes 39-59% of hotel guests in surrounding islands are using Tobago Cays
- Quality data was limited
 - occupancy rates were rough estimates (high room rate properties can skew data)
 - tax revenue dependant on accountability of operators
 - other recreational activities not accounted for (e.g. kite surfing)

WRI Coral Reef Valuation- Accommodation

Category	Value (US Dollars)
Percent of accommodation revenue that is reef-related	49%
Reef-associated Gross Revenue	\$53,280,733
Reef-associated Net Revenue (Gross minus costs)	\$38,646,031
Net revenue remaining in the country (net revenue - leakages)	\$9,661,508
Transfers to the economy (taxes, via wages and service charges)	\$10,372,243
Total Accommodation Value	\$20,033,750

Background

WRI Fisheries

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WRI Coral Reef Valuation- Recreation

Category	Value (US Dollars)
Diving	
Gross Revenue	\$542,000
Net Revenue (Gross minus costs)	\$108,400
Transfers to the economy (taxes, via wages and service charges)	\$162,600
Total Diving Value	\$271,000
Snorkeling	
Gross Revenue	\$1,659,384
Net Revenue (Gross minus costs)	\$663,754
Transfers to the economy (taxes, via wages and service charges)	\$663,754
Total Snorkeling Value	\$1,327,507

Background

WRI Fisheries

WRI Tourism

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WRI Coral Reef Valuation- Tourism and Recreation Totals

Category	Value (US Dollars)
1. Accommodation	\$20,033,750
2. Diving	\$271,000
3. Snorkeling and Boating	\$1,327,507
4. Marine Parks	\$221,048
5. Other Direct Expenditures (Vending, food sales) - Total Value	\$28,680
TOTAL DIRECT AND INDIRECT IMPACTS	\$21,881,985
Local Use of Coralline Beaches	\$772,209
Local Use from reef recreation	\$3,089
TOTAL ECONOMIC IMPACT OF REEF-RELATED TOURISM AND RECREATION	\$22,657,283

Background

WRI Fisheries

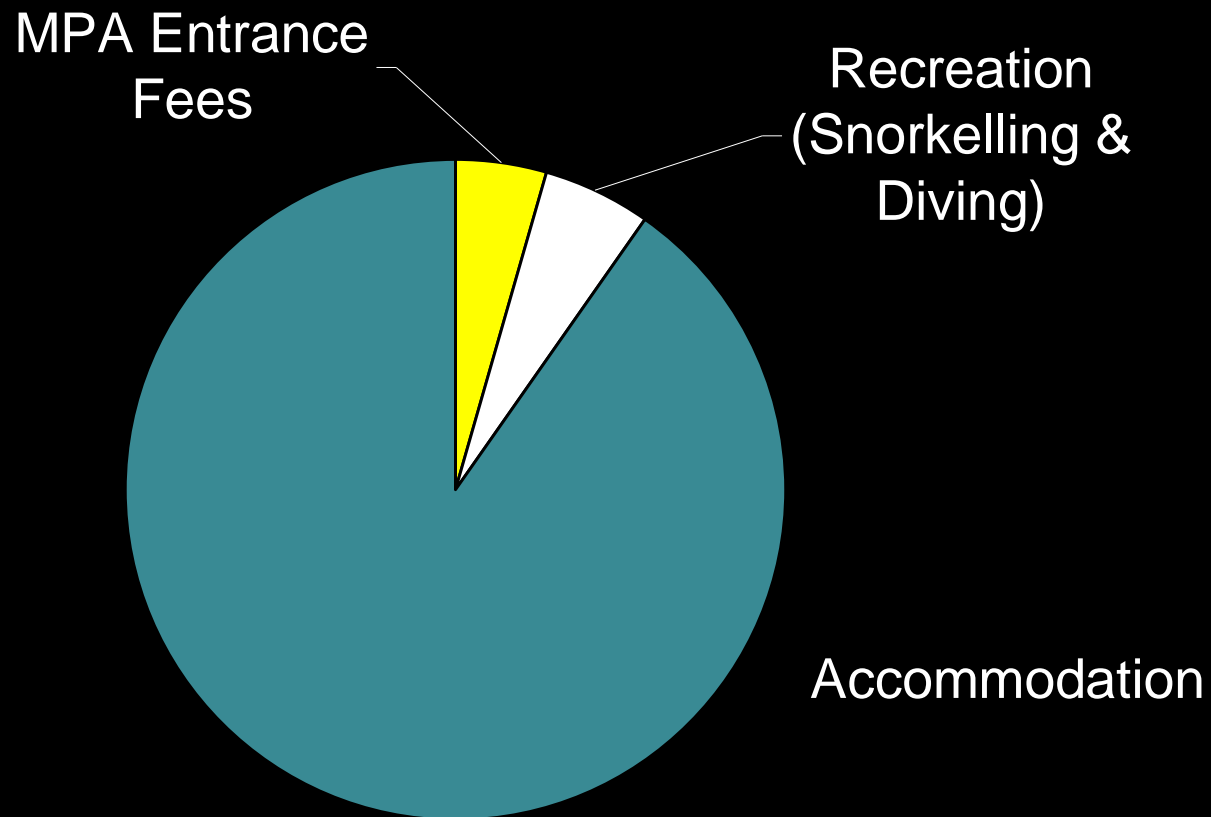
WRI Tourism

Value Transfer

Discussion

WRI Coral Reef Valuation- Government Revenue

Total = US\$ 4.1 million



Background

WRI Fisheries

WRI Tourism

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WRI Coral Reef Valuation- Results



Fishing

US\$466,801 - US\$980,282



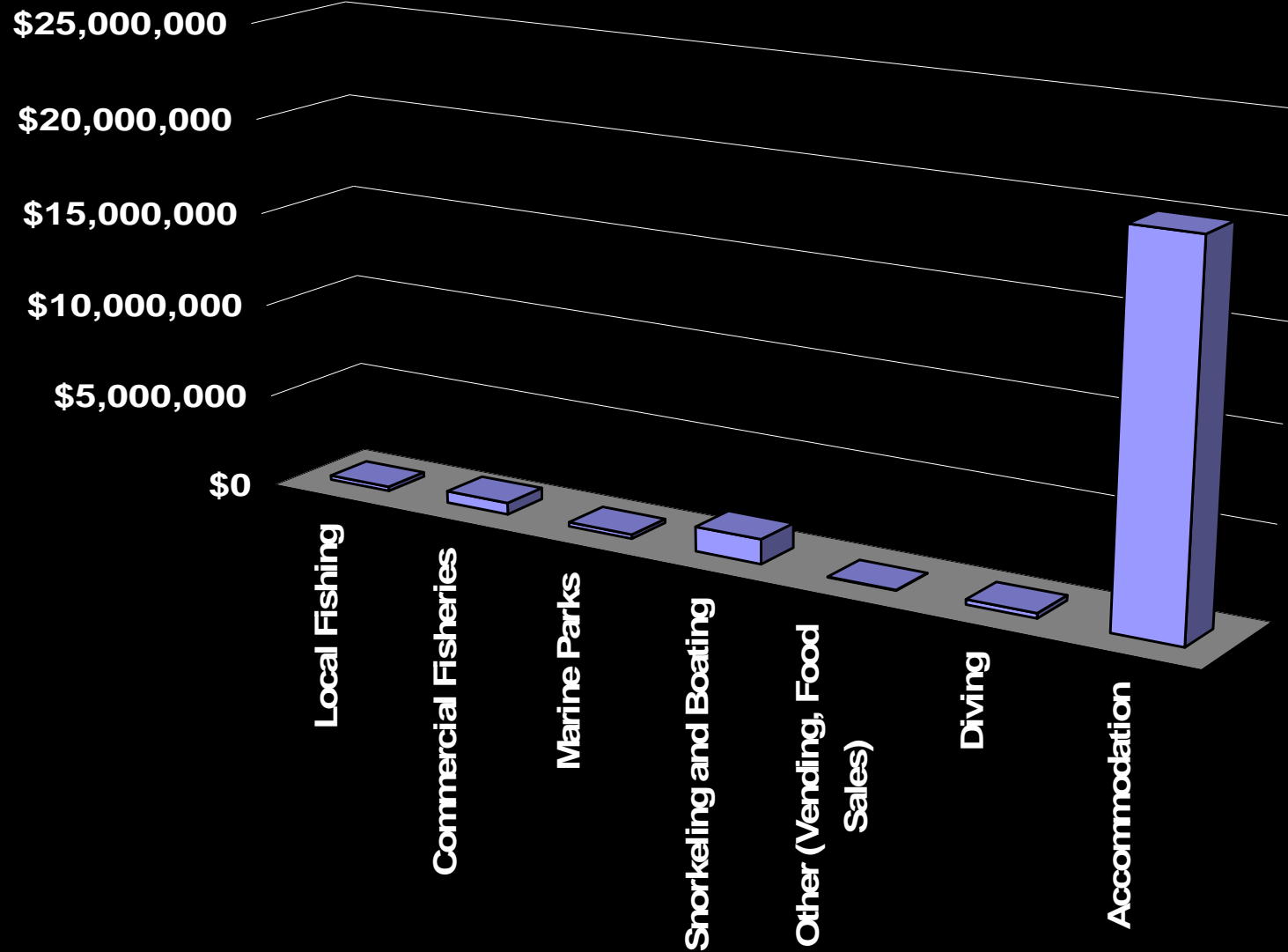
Tourism



Recreation

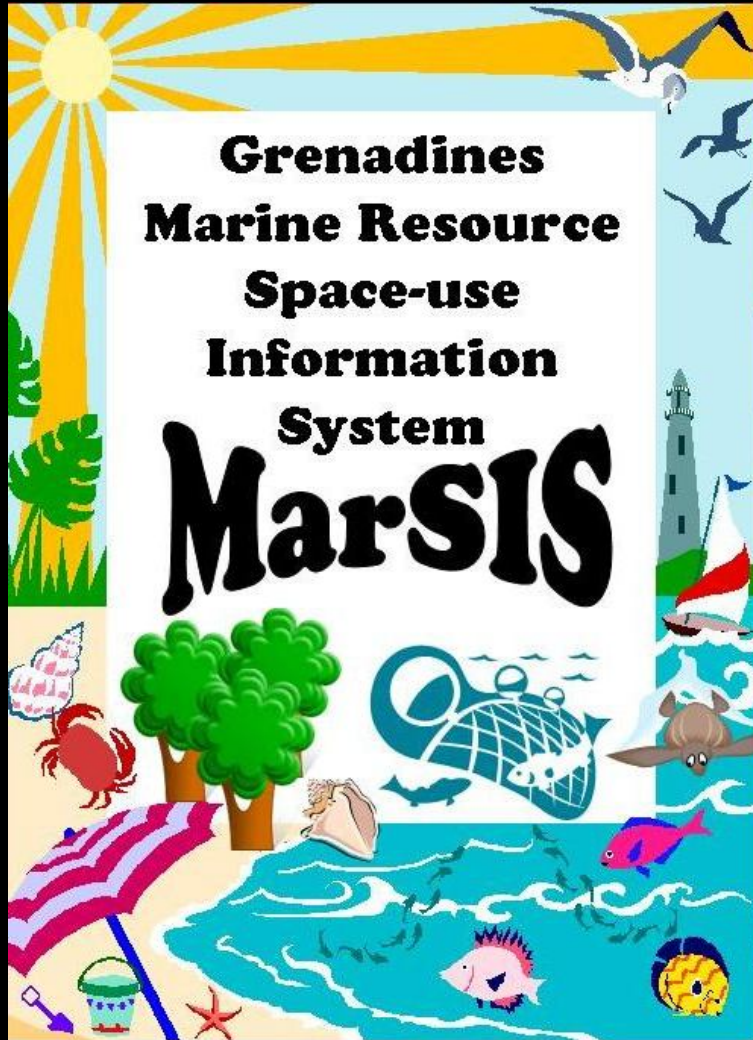
US\$11,207,956 - US\$35,066,989

WRI Coral Reef Valuation- Total



Value Transfer: Spatial Distribution of Ecosystem Service Values

Value Transfer Methodology



- seeks to aid marine space use planning and management in the Grenadines
- visual representation of critical habitats, areas important for livelihoods, fishing grounds, space use conflict, etc.

Background

WRI Fisheries

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Value Transfer Methodology

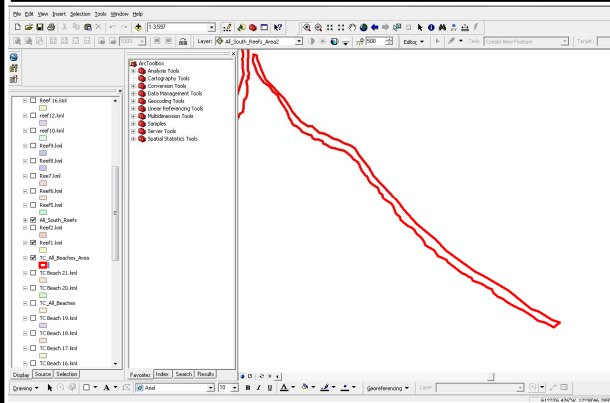
Identify Features



Outline Features



Import & Re-Project Features



Calculate Areas & Apply Conversion Factors for Associated Values

Land Cover	Ave.\$/ha/ yr	Lower Bound	Upper Bound	Area (ha)	Total ESV Flow (US Dollars)
Disturbed and Urban Beach					\$0
Beach	88,000	77,000	99,000	8.71788699	\$767,174
Beach near dwelling	117,000	140,000	94,000	0	\$0
Coastal & Riparian Forest	1826	5542	13,000	0	\$0
Freshwater Stream	1595	1231	939	0	\$0
Freshwater Herbaceous Swamp	72,787	32,000	96,000	5.362221	\$390,300
Grassland/pasture	118	118	118	0	\$0
Near shore aquatic habitat	16,283	4630	27,935	365.2	\$5,946,552
Coral Reef environ	100,000			1335.694061	\$133,569,406
Mangrove	37,500			4.339961	\$162,749
Mangrove	500,000	200,000	900,000	0	\$0
Mangrove restoration		225	216,000	0	\$0
TOTAL					\$140,836,180

Background

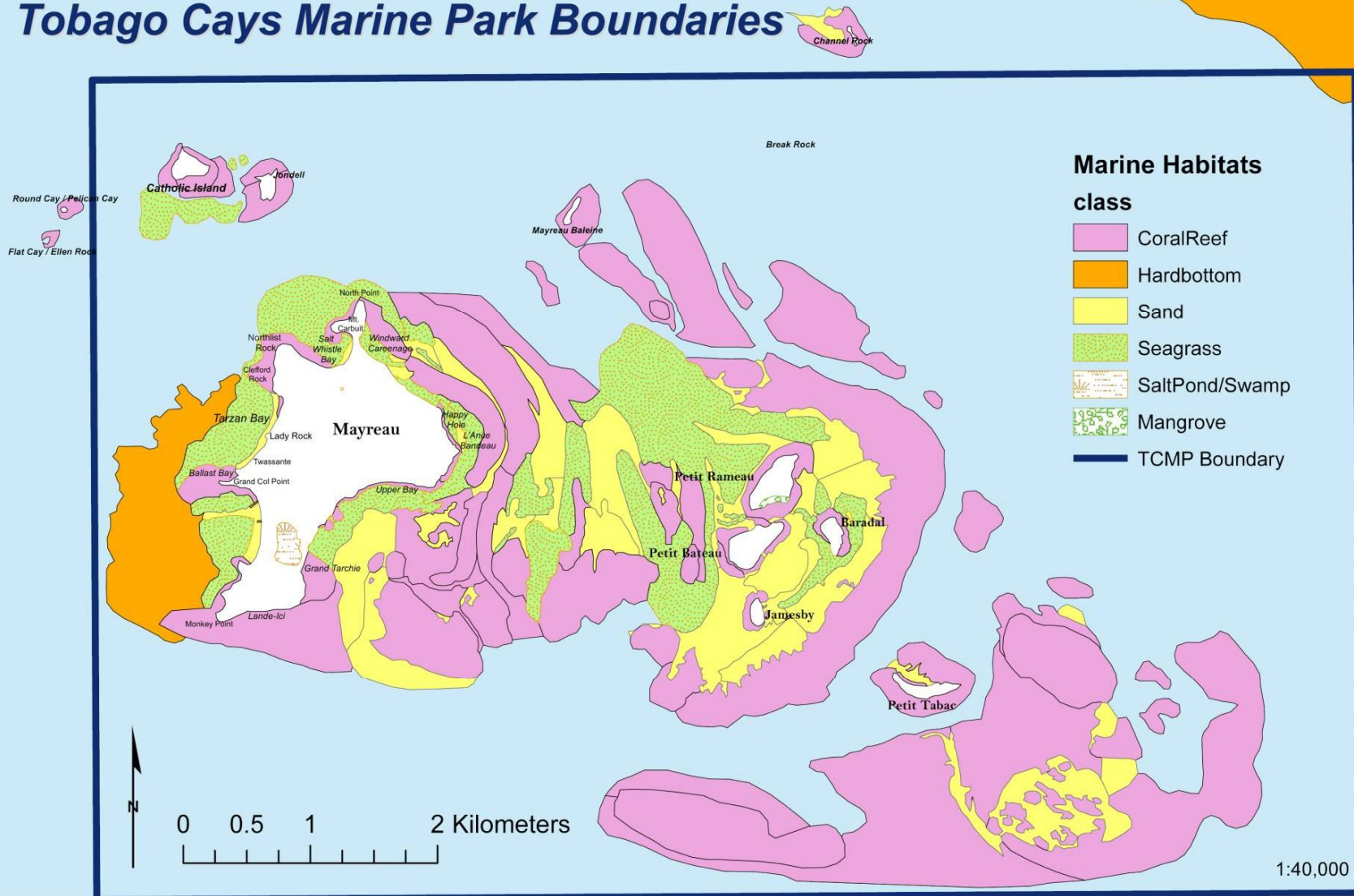
WRI Fisheries

WRI Tourism

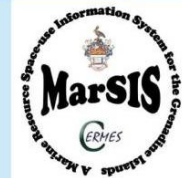
Value Transfer

Discussion

Tobago Cays Marine Park Boundaries



Projected Coordinate System: WGS 84 UTM Zone 20 N
 Marine Habitat Information has been provided by the Grenadines MarSIS research
 Created by Kim Baldwin
 September 2009



Background

WRI Fisheries

WRI Tourism

Value Transfer

Discussion

Value Transfer Methodology

Ecosystem Type	\$/ha/yr	Total Hectares*	Total Contribution
Beach	\$88,000	8.7	\$767,174
Coastal & Riparian Forest	1826	165.6	\$302,312
Grassland/pasture	118	1.0	\$116
Freshwater Herbaceous Swamp*	\$72,787	5.4	\$390,300
Near shore aquatic habitat (seagrass*)	\$16,283	365.2	\$5,946,552
Coral Reef environ*	\$100,000	1335.7	\$133,569,406
Mangrove*	\$37,500	4.3	\$162,749
TOTAL TCMP Ecosystem Service Value			\$141,138,608

(*Baldwin 2009)

Background

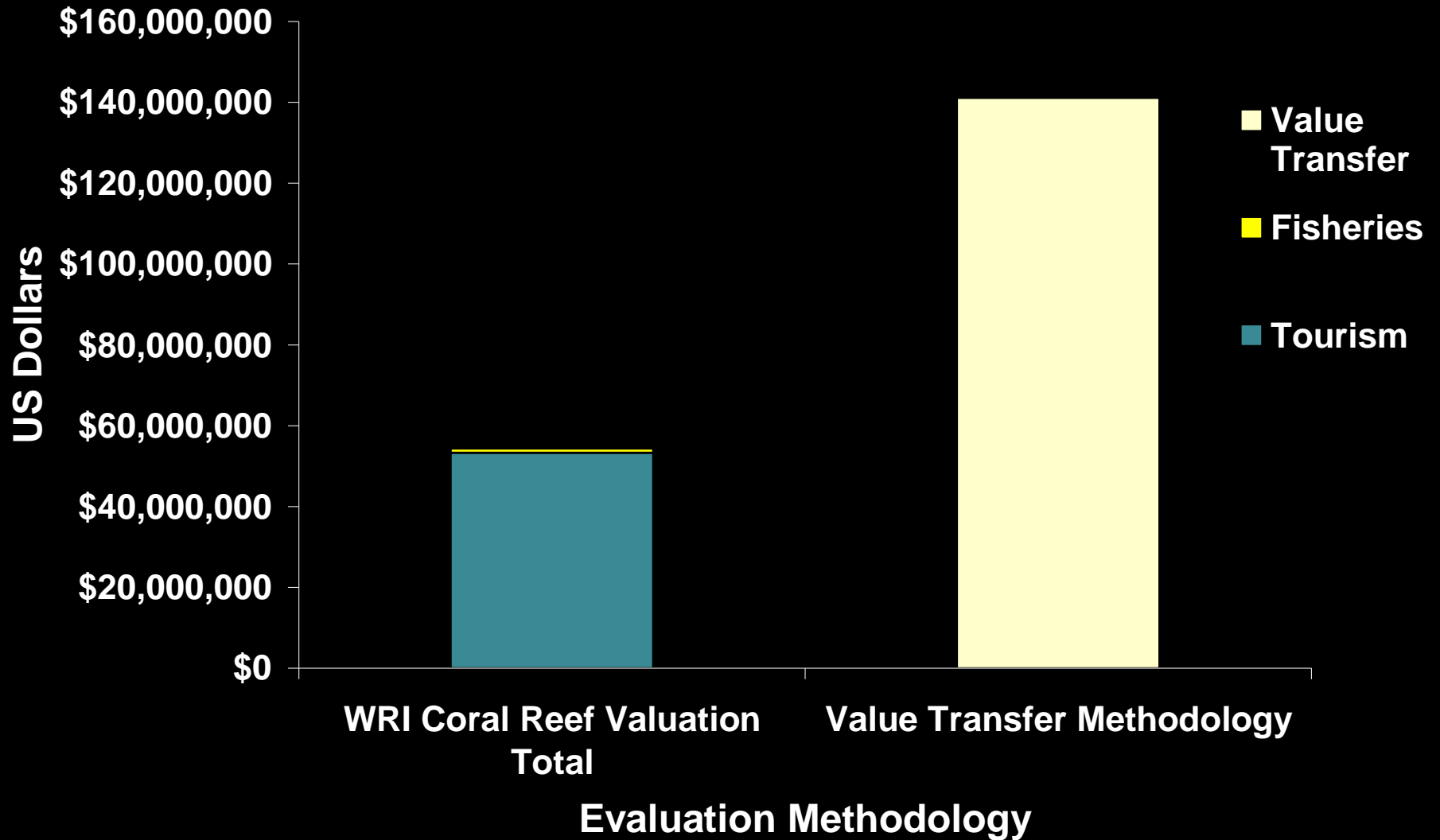
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Results Comparison



Background

WRI Fisheries

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WRI Coral Reef Valuation- Strengths

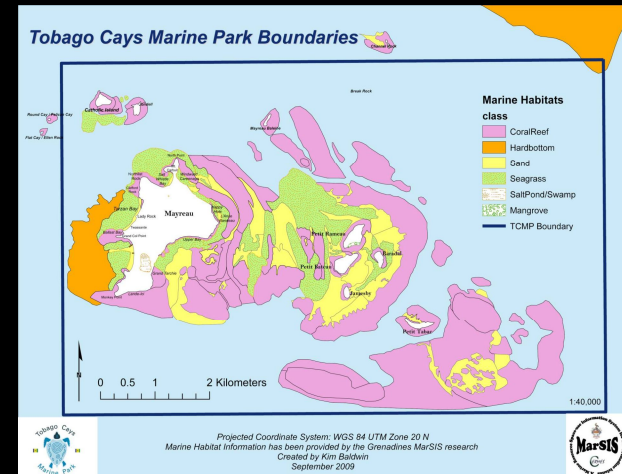
- Facilities dynamic data (allows updating and expansion)
- Detailed and allows for categorisation of results
- When new data is added, outputs of results & corrections are generated instantaneously
- **Sensitivity analysis** as response to potential errors in data
- Accounts for often overlooked value of local use
- Some level of adaptability
 - can be applied to sites where data availability is basic or exhaustive
- More data improves applicability of results (site-specific output)

WRI Coral Reef Valuation- Weaknesses

- Data gaps increases reliance on expert opinion
- Requires full cooperation of relevant agencies and is dependent on the quality of their data
- Errors are magnified with some calculations (e.g. fisher surveys)
- Can encourage overconfidence in results if warnings about data quality is ignored.
- Currently no valuation of economic impact of cruise ships and shoreline protection
- Results are not visual and not as easy to communicate as the **Value Transfer** method

Value Transfer Methodology Strengths

- Availability of data source (Google Earth™)
- Rapid results
- No extensive data collection required from multiple agencies
- Results are visual (maps) and can be easily communicated



Ecosystem Type	\$/ha/yr	Total Hectares*	Total Contribution
Beach	\$88,000	9	\$767,174
Freshwater Herbaceous Swamp	\$72,787	5	\$390,300
Near shore aquatic habitat (seagrass)	\$16,283	365	\$5,946,552
Coral Reef environ	\$100,000	1,336	\$133,569,406
Mangrove	\$37,500	4	\$162,749
TOTAL TCMP Ecosystem Service Value			\$140,836,180

Background

WRI Fisheries

WRI Tourism

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Value Transfer Methodology

Weaknesses

- Results are static
- Dependent on quality of aerial/satellite data (if absent requires intensive ground-truthing)
- Requires knowledge of mapping software (not ubiquitous)
- Economic values not developed in the Caribbean



Background

WRI Fisheries

WRI Tourism

Value Transfer

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Other Case Study Sites

Montego Bay Marine Park (Brian Zane)

Value Transfer Methodology

Pros

- Produces both graphic and numeric results
- Low dependence on external/hard to locate data sources

Cons

- Challenging to develop local values, which are critical to the accuracy and validity of the tool

Background

WRI Fisheries

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Other Case Study Sites

Montego Bay Marine Park (Brian Zane)

WRI Coral Reef Valuation

Strengths

- Highly detailed results
- Triangulates ESV of coral reefs
- Tools – MS Excel

Weaknesses

- Data - Heavily dependent upon external data sources
- Aspects not yet developed (Coastal Protection)
- Dependencies/Assumptions (built into formulas)
- Complexity reduces probability of widespread adoption



Background

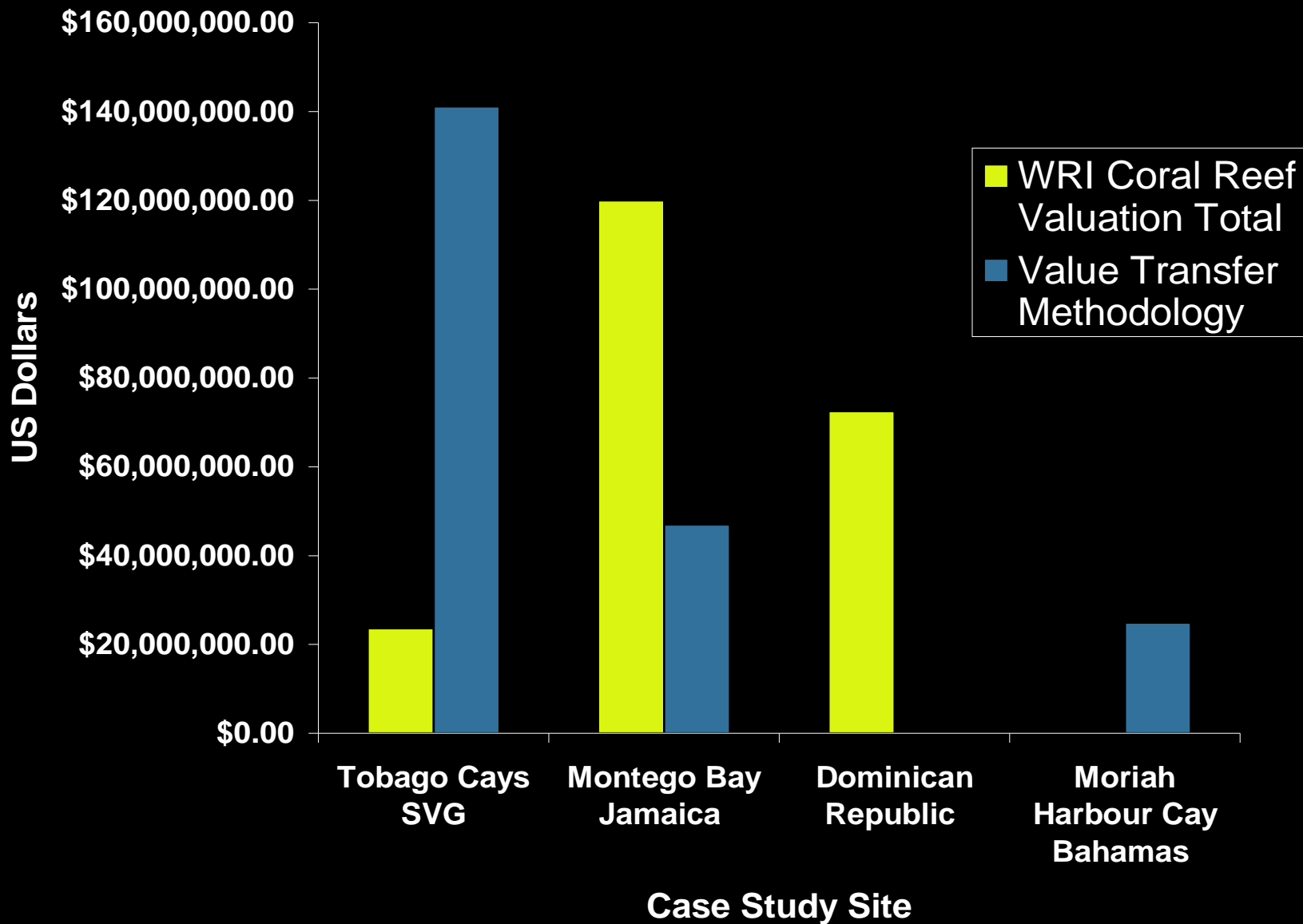
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Conclusion

- Large variation in the results from the WRI & Value Transfer methodology could be attributed to coral reef coastal protection services
- Total Economic Impact of Fisheries is unclear due to large variations in the commercial landings data (US\$113,893 -US\$8,250,412)
- Significant leakages in the accommodation sector (75-85%)
- Possible sustainable revenue generation for park

Conclusion

- Good use of the informal sector (watertaxis) but low local use of park
- Study does not attempt to evaluate sustainable use levels and/or carrying capacity
- Differences between methodologies increase the adaptability of ReefFix to various study sites
- Very effective tools however need to be calibrated to Caribbean environment

Further Research Options

- Fill necessary data gaps (fish landings, occupancy rates) to reduce errors from assumption
- quantification and inclusion of other revenue generating activities (kite-surfing) within the park
- Expansion of study to the entire Grenadines
- Assessment of the **regulating services** provided (shoreline protection value)
- Reef fish stock assessment
- Maintenance of the MarSIS database
- Preliminary research into carrying capacity of TCMP

Questions?