

Linking Decisions to Stakeholder Values in the Guánica Bay Watershed, Puerto Rico

Ecosystem Service Valuation of Puerto Rico's Coral Reef Ecosystems

Dr. Vernon R. (Bob) Leeworthy

Chief Economist, NOAA

Office of National Marine Sanctuaries

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Ecosystem Service Valuation of Puerto Rico's Coral Reef Ecosystems

Five Ecosystem Services Valued

Cultural

Recreation-tourism

Provisioning

Food Supply – Commercial fisheries

Ornamentals – Aquarium trade

Natural Products – Pharmaceuticals and Biochemicals

Regulating

Shoreline Protection – Property Values

Ecosystem Service Valuation of Puerto Rico's Coral Reef Ecosystems

Recreation-tourism

Measures: Use by activity type; spending and associated impact on economy in terms of output/sales, value added, income and employment; importance-satisfaction ratings; non-market economic value and how value changes with changes in coral reef and user attributes.

Method: Surveys: Residents and Visitors to Puerto Rico. Input-output Model IMPLAN for market economic impacts of coral reef use. Stated Preference/conjoint models (multinomial logit or random parameters).

Principal Investigator: Bob Leeworthy

Bob.Leeworthy@noaa.gov

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Food Supply –Commercial Fisheries

Measures: Harvest Revenues from reef-dependent species.

Method: Economic Valuation Method V3.0 World Resources Institute (WRI, 2009) World Resources Institute. 2009. "Value of Coral Reefs & Mangroves in the Caribbean: Economic Valuation Methodology V3.0." Washington, DC: World Resources Institute. Accessible at: <www.wri.org/coastal-capital>

Principal Investigator: Justin Bousquin
Bousquin.Justin@epa.gov

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Ornamentals – Aquarium Trade

Measures: Harvest Revenues of aquarium trade from marine life collection of reef-dependent tropical fish and invertebrates.

Method: Economic Valuation Method V3.0 World Resources Institute (WRI) World Resources Institute. 2009. “Value of Coral Reefs & Mangroves in the Caribbean: Economic Valuation Methodology V3.0.” Washington, DC: World Resources Institute. Accessible at: <www.wri.org/coastal-capital>

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Natural Products – Pharmaceuticals and Biochemicals

Measures: Net Revenue from Marine-based Products or Value of Life-Extensions/Quality of Life

Method: to be determined

Principal Investigator: Peter P. Principe
principe.peter@epa.gov

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Shoreline Protection – Property Values

Measures: Property Value Damage Avoided

Methods: Sheppard Model (Sheppard et al 2005) for functional assessment, WRI methods from Jamaica (Burke et al 2011) for damage assessment.

World Resources Institute. 2009. "Value of Coral Reefs & Mangroves in the Caribbean: Economic Valuation Methodology V3.0." Washington, DC: World Resources Institute. Accessible at: <www.wri.org/coastal-capital>

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Legend

- Region 1
- Region 2
- Region 3
- Region 4
- Region 5



0 5 10 20 Miles

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Recreation-tourism

Valuation Approach – Stated Preference/Conjoint

36 Choices over 9 Versions of the Survey with each respondent answering four choices

11 reef attributes (9 at 3 levels and 2 at 2 levels— for analysis 2 combined as composite) Price at 6 levels

This design leads to 157,464 possible combinations of attributes

Statistical design is used to get orthogonal and balanced design to allow us to estimate marginal values of attributes

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Recreation-tourism

Reef Attributes

- 1. Stony corals** – Abundance & Diversity
- 2. Soft coral & sponges** – Abundance & Diversity
- 3. Consumptive fish** – Abundance & Diversity
- 4. Tropical/Ornamentals** – Abundance & Diversity
- 5. Macroinvertebrates** (conch, lobster and urchins) – Abundance & Diversity
- 6. Opportunity to see large wildlife** (sharks, rays, turtles, manatees, and dolphins)
- 7. Opportunity to see or catch Sport/Trophy Fish**
- 8. Water Clarity/Visibility**
- 9. Water Cleanliness** – healthy for swimming
- 10. Depth of reefs**
- 11. Crowdedness** – number of people

Low Condition



Illustration by Daniel Irizarri Oquendo

Medium Condition

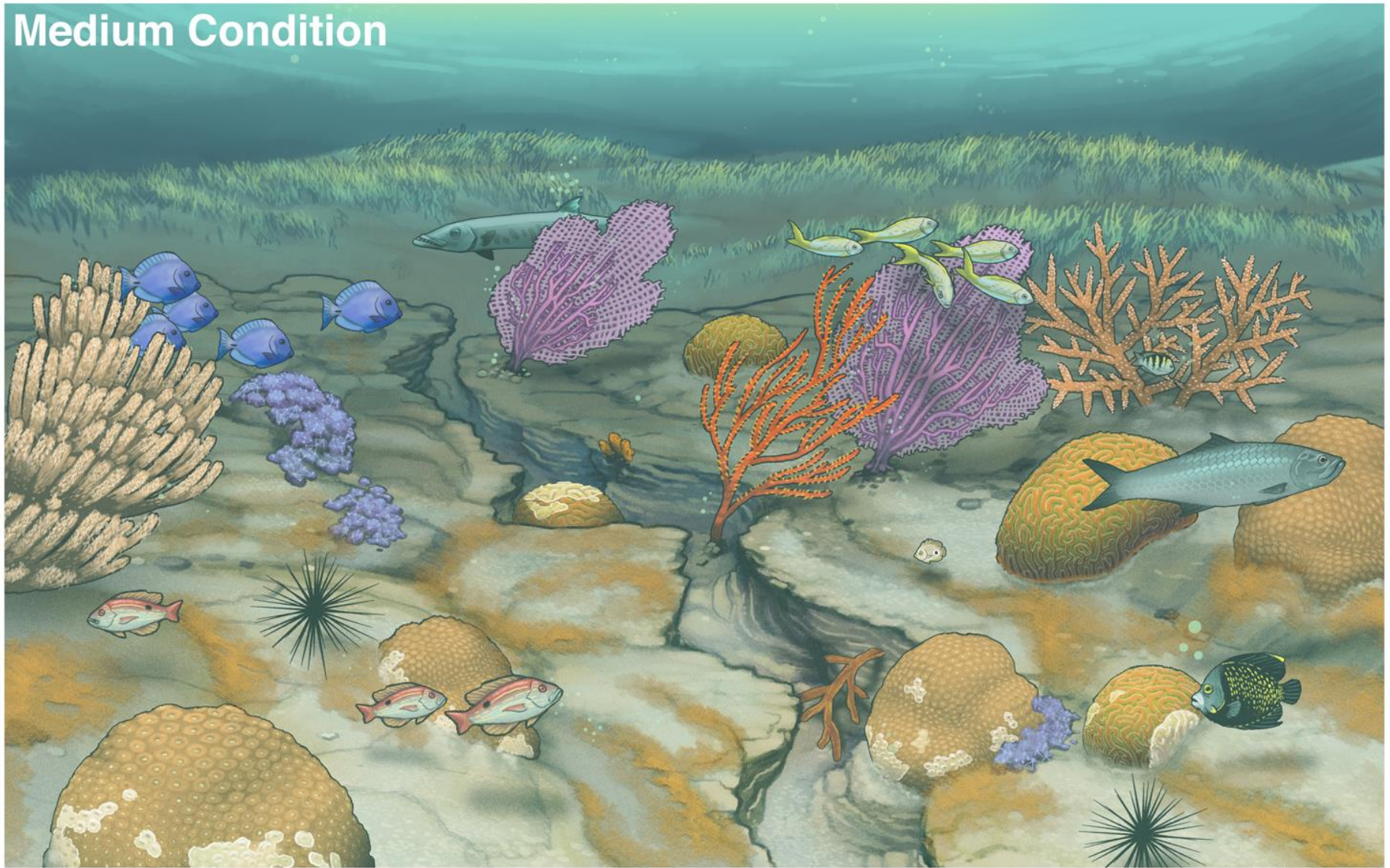


Illustration by Daniel Irizarri Oquendo

High Condition

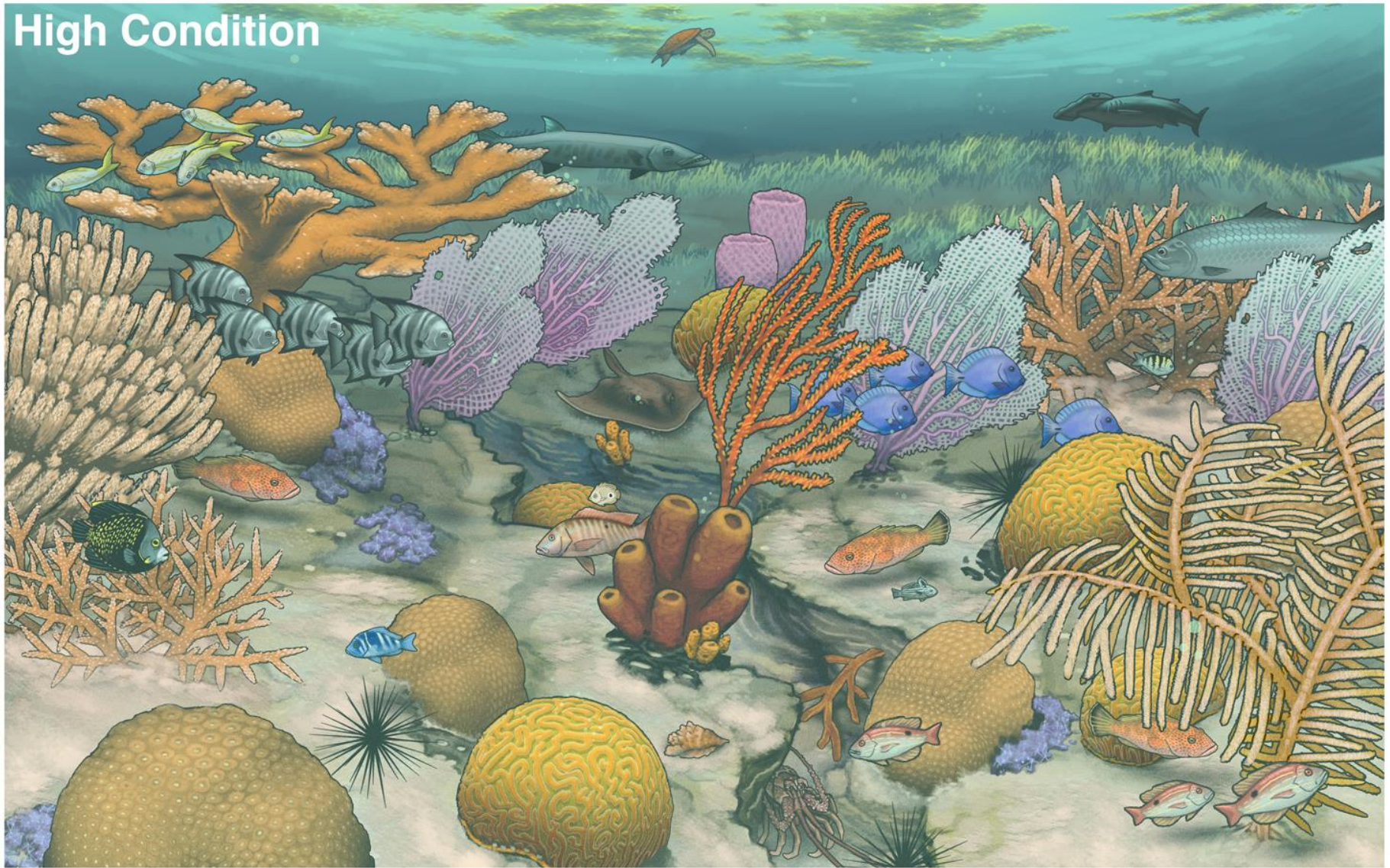


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Recreation-tourism

Option A: Status Quo – No changes in Management (All attributes in low condition)	Option B: All attributes in medium level condition)	Option C: All attributes in high level of condition)
Corals and Sponges	Corals and Sponges	Corals and Sponges
No stony corals, only soft corals and sponges	Up to 4 species of stony corals covering 5 to 20% of hard-bottom with 60 to 90% live coral tissue.	5 to 17 species of stony corals covering more than 20% and up to 100% of hard-bottom with over 90 to 100% live coral tissue.
Other Attributes	Other Attributes	Other Attributes
\$0	\$250	\$500
(Cost to your household per year)	(Cost to your household per year)	(Cost to your household per year)

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Recreation-tourism

Planned Analyses of Non-market Economic Values

Multi-attribute Utility Theory

$$V = \beta_0 + \beta_1(\text{Stony Corals change}) + \beta_2(\text{Soft Corals and Sponges change}) + \beta_3(\text{Consumptive fish change}) + \beta_4(\text{tropical fish change}) + \beta_5(\text{macroinvertebrates change}) + \beta_6(\text{Opportunity to see large wildlife change}) + \beta_7(\text{Opportunity to see or catch trophy fish change}) + \beta_8(\text{Water Clarity/Visibility change}) + \beta_9(\text{Water Cleanliness change}) + \beta_{10}(\text{Composite variable of Depth of Reefs and Crowdedness change}) + \beta_{11}(\text{Cost})$$

Multinomial logit or Random parameters models

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Integration

- You cannot do ecosystem service valuation without integrating the physical/natural and social sciences.
- Integration is not easy.

Physical/natural and social scientists don't speak the same language.