

Melded Conceptual Models for the U.S. Caribbean

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Introduction

Project funded by the Lenfest Ocean Program (Cruz-Motta, Seara and Williams PIs) to generate data to help guide efforts by U.S. Caribbean Region to transition into Ecosystem Based Fisheries Management (EBFM) and develop a Fishery Ecosystem Plan (FEP).

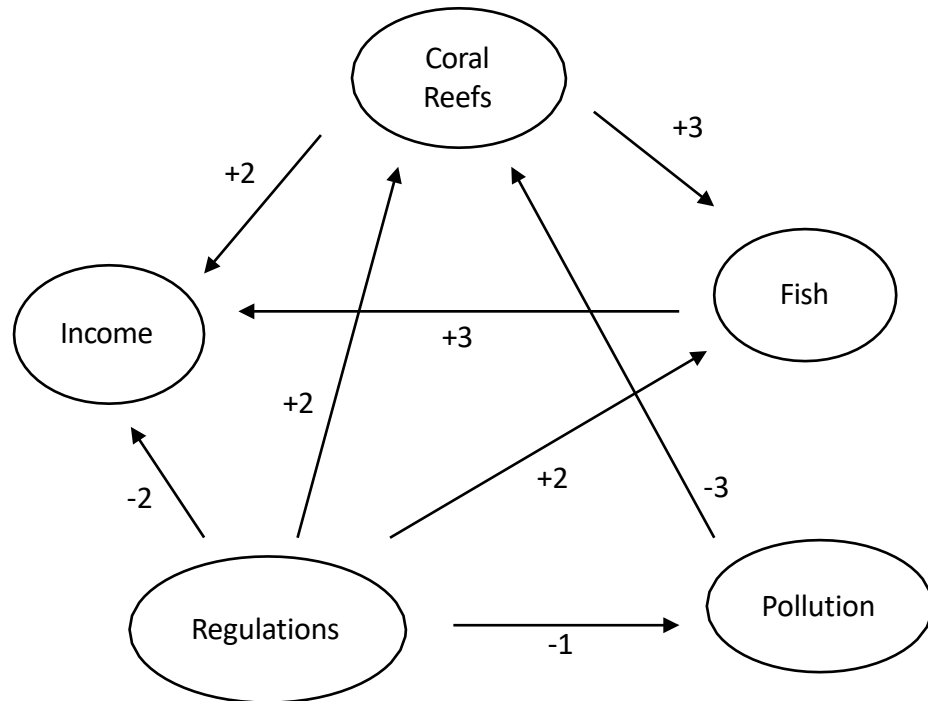
The Lenfest FEP Loop: (Levin et al. 2018)



Methods

Build Conceptual Models (Fuzzy Cognitive Maps) with different groups of U.S. Caribbean Fisheries Stakeholders.

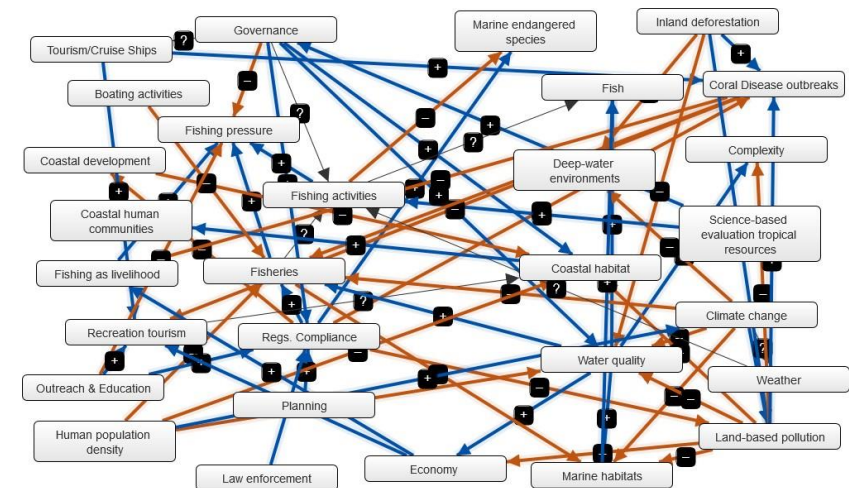
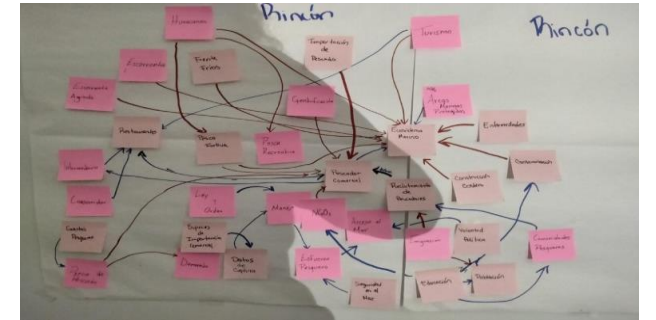
Simplified Conceptual Model Scheme:



Fisher workshop in Puerto Rico



Fisher workshop in St. Croix USVI



Conceptual Model built during virtual workshop

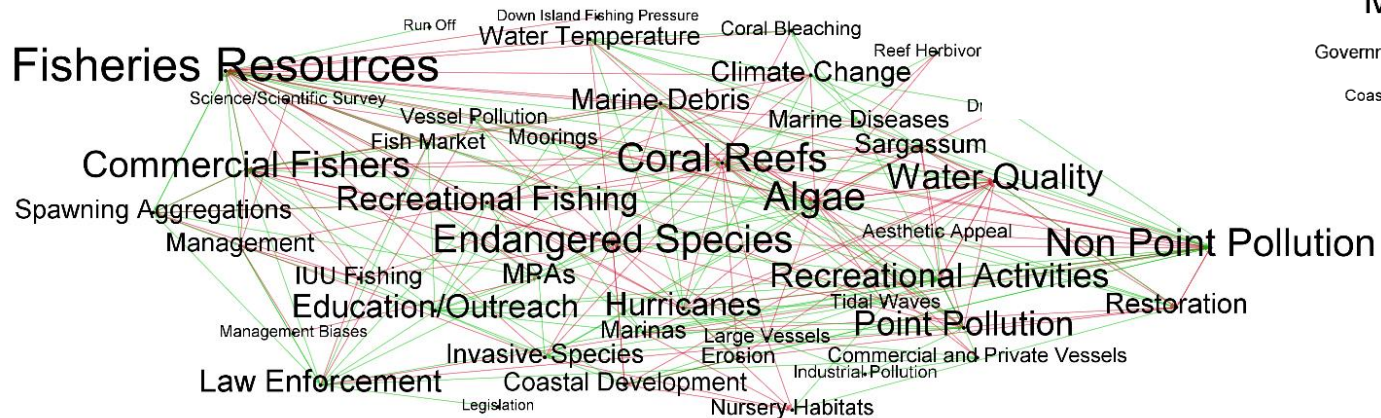
Methods

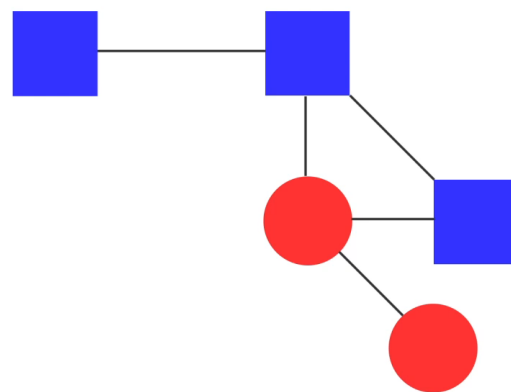
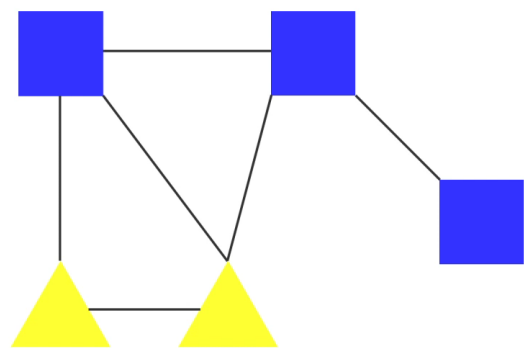
Stakeholder Group	Number of Workshops	Number of Participants	Island Grouping (Number of Workshops)	Group Leading Workshops	Method	Year
Commercial Fishers	12	117	PR (10); STT (1); STX (1)	Cruz-Motta et al.	In person	2022/23
Managers	3	9	PR (2); USVI (1)	Cruz-Motta et al.	Virtual	2021
Academics	4	24	PR (3); USVI (1)	Cruz-Motta et al.	Virtual	2021
Businesses	3	17	PR (1); STT (1); STX (1)	Mellivora Consulting	Virtual	2019/20
NGOs	3	20	PR (1); STT (1); STX (1)	Mellivora Consulting	Virtual	2019/20
DAPs	3	38	PR (1); STT (1); STX (1)	CFMC	In person	2018
SSC	1	11	U.S. Caribbean	CFMC	In person/Virtual	2018/19
<i>Total</i>	29	236	-	-	-	-

Objectives of this presentation

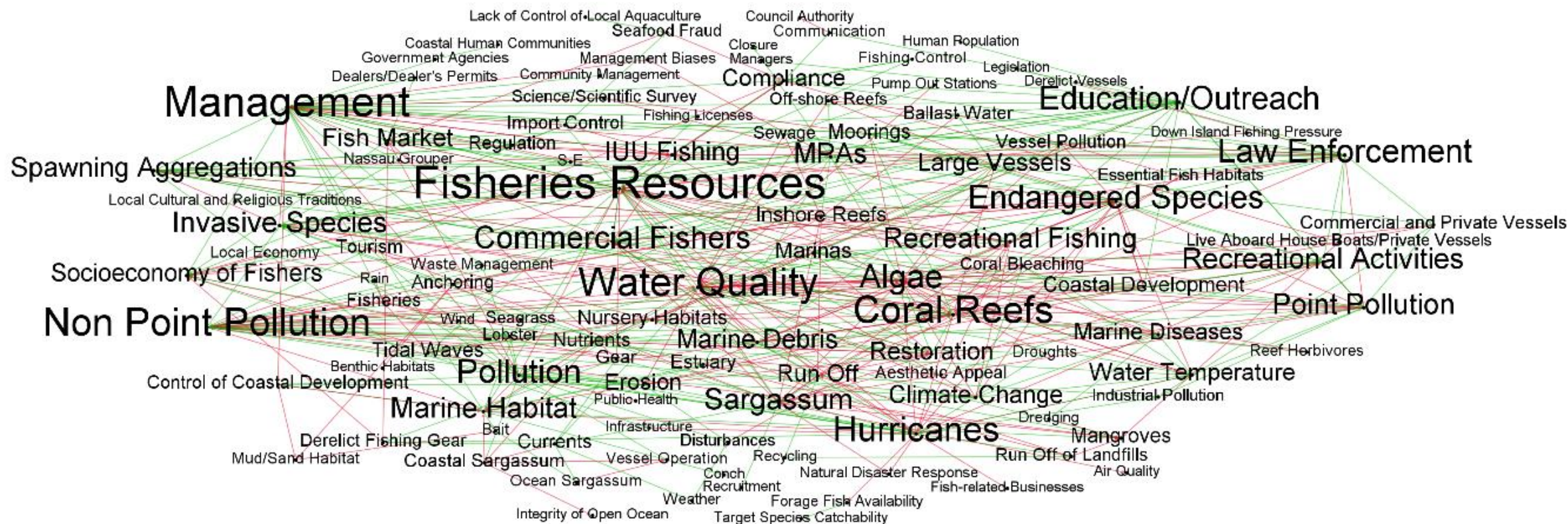
- Present the final melded models.
- Show examples of methods to select important ecosystem components and relationships between them.
- Provide examples of current and potential uses of the conceptual models.

Melded Models





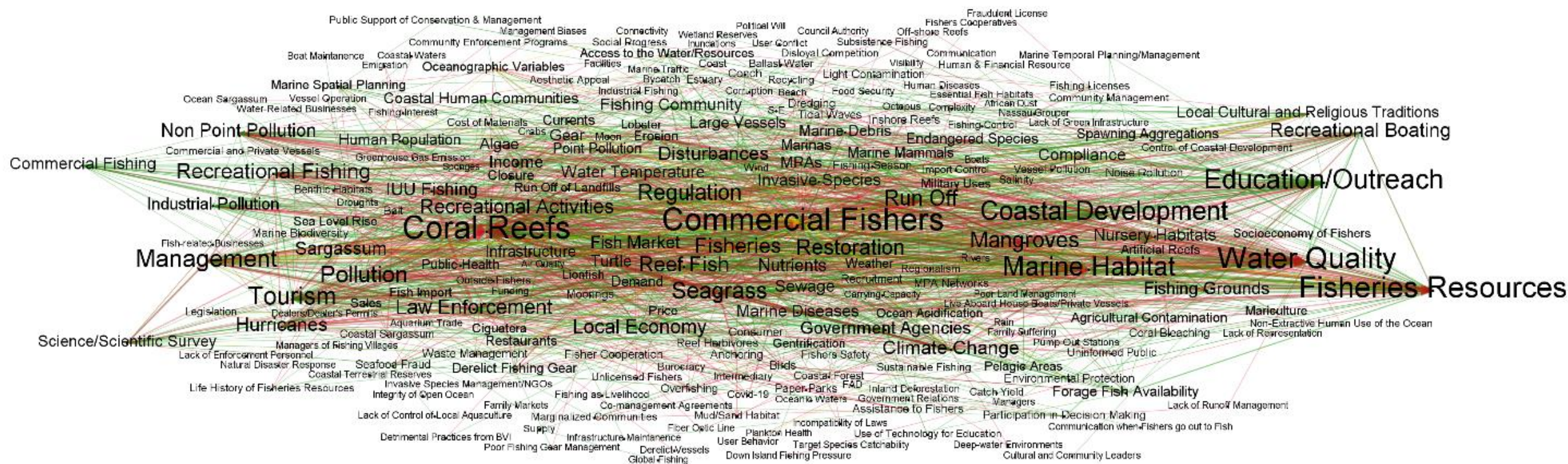
DAPs Melded Conceptual Model for U.S. Caribbean:



Fishers Melded Conceptual Model for U.S. Caribbean:



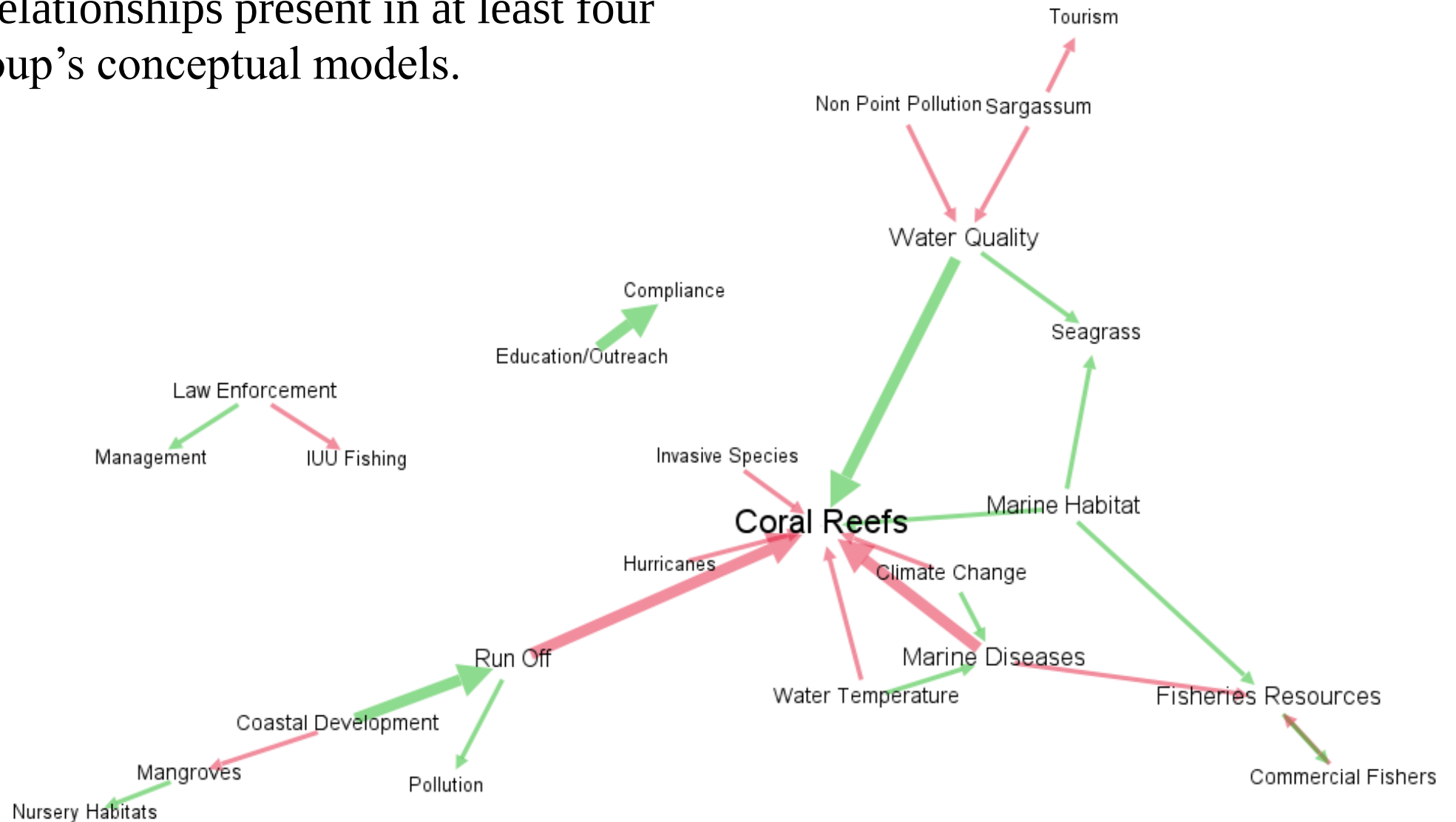
Melded Model for the US Caribbean:



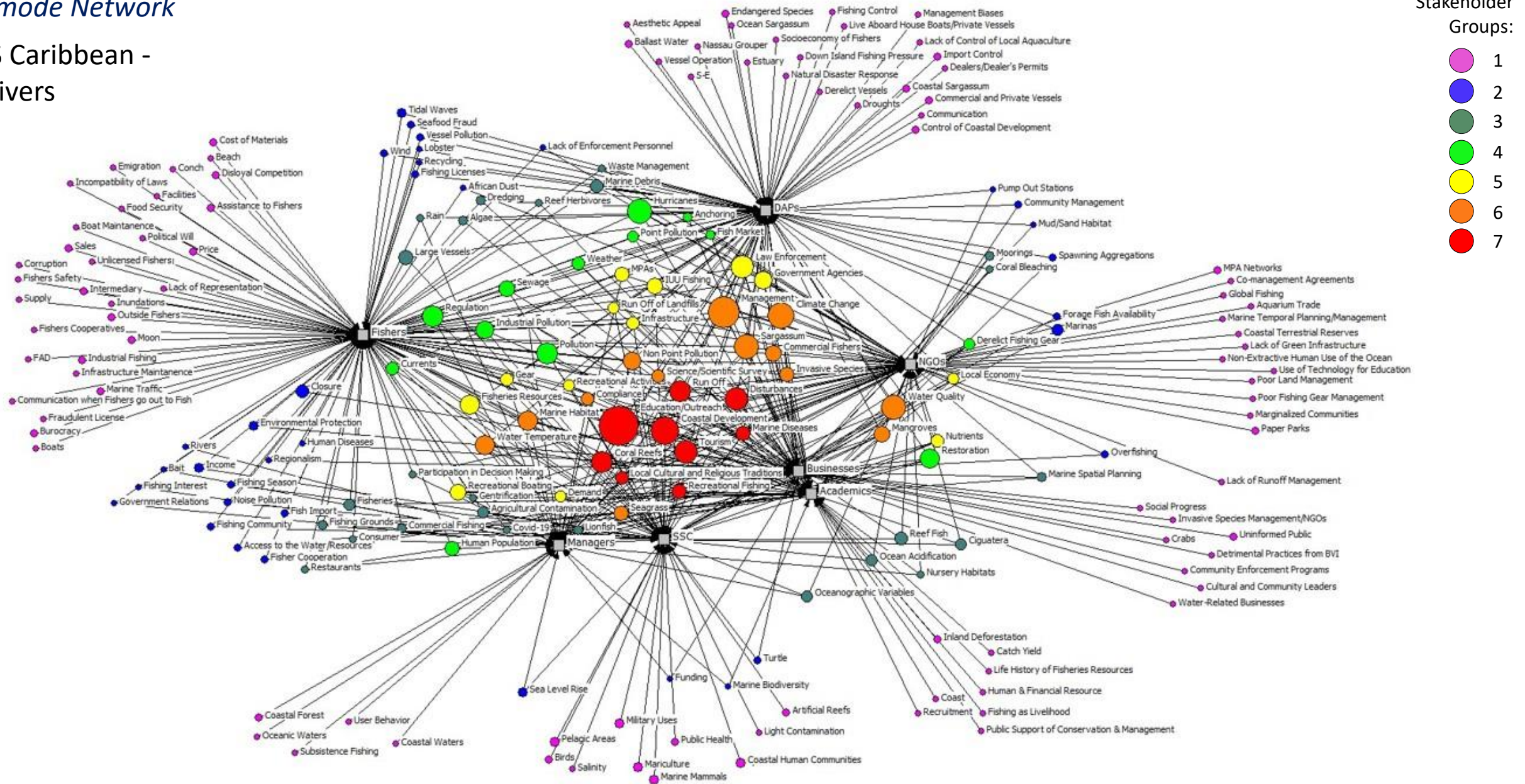
Examples of Methods to Select Ecosystem Components and Relationships

Relationship	Sign	MAN	EXP	DAPs	BUS	NGO	FISH	SSC	# of Groups
Run Off-Coral Reefs	-	1	1	0	1	1	1	0	5
Marine Diseases-Coral Reefs	-	0	1	1	1	1	1	0	5
Water Quality-Coral Reefs	+	0	1	1	1	1	0	1	5
Coastal Development-Run Off	+	0	1	0	1	1	1	1	5
Education/Outreach-Compliance	+	1	1	1	0	1	0	1	5
Invasive Species-Coral Reefs	-	0	1	1	0	1	1	0	4
Water Temperature-Coral Reefs	-	0	1	1	1	0	1	0	4
Non-Point Pollution-Water Quality	-	1	1	1	0	1	0	0	4
Coastal Development-Mangroves	-	0	1	0	1	1	1	0	4
Sargassum-Tourism	-	1	1	1	0	0	1	0	4
Commercial Fishers-Fisheries Resources	-	1	1	1	0	0	1	0	4
Sargassum-Water Quality	-	1	0	1	1	1	0	0	4
Marine Diseases-Fisheries Resources	-	1	1	1	0	0	1	0	4
Climate Change-Coral Reefs	-	0	1	0	1	1	1	0	4
Hurricanes-Coral Reefs	-	0	1	1	0	1	1	0	4
Law Enforcement-IUU Fishing	-	0	0	1	1	1	1	0	4
Water Temperature-Marine Diseases	+	0	1	1	0	0	1	1	4
Water Quality-Seagrass	+	0	1	0	1	1	0	1	4
Marine Habitat-Coral Reefs	+	1	1	1	0	0	0	1	4
Marine Habitat-Seagrass	+	1	1	1	0	0	0	1	4
Run Off-Pollution	+	0	1	1	1	0	0	1	4
Marine Habitat-Fisheries Resources	+	1	1	1	0	0	1	0	4
Fisheries Resources-Commercial Fishers	+	1	1	1	0	0	1	0	4
Climate Change-Marine Diseases	+	1	0	1	1	1	0	0	4
Law Enforcement-Management	+	0	1	1	0	1	1	0	4
Mangroves-Nursery Habitats	+	0	1	1	1	1	0	0	4

Consensus conceptual model for the U.S. Caribbean showing only relationships present in at least four stakeholder group's conceptual models.

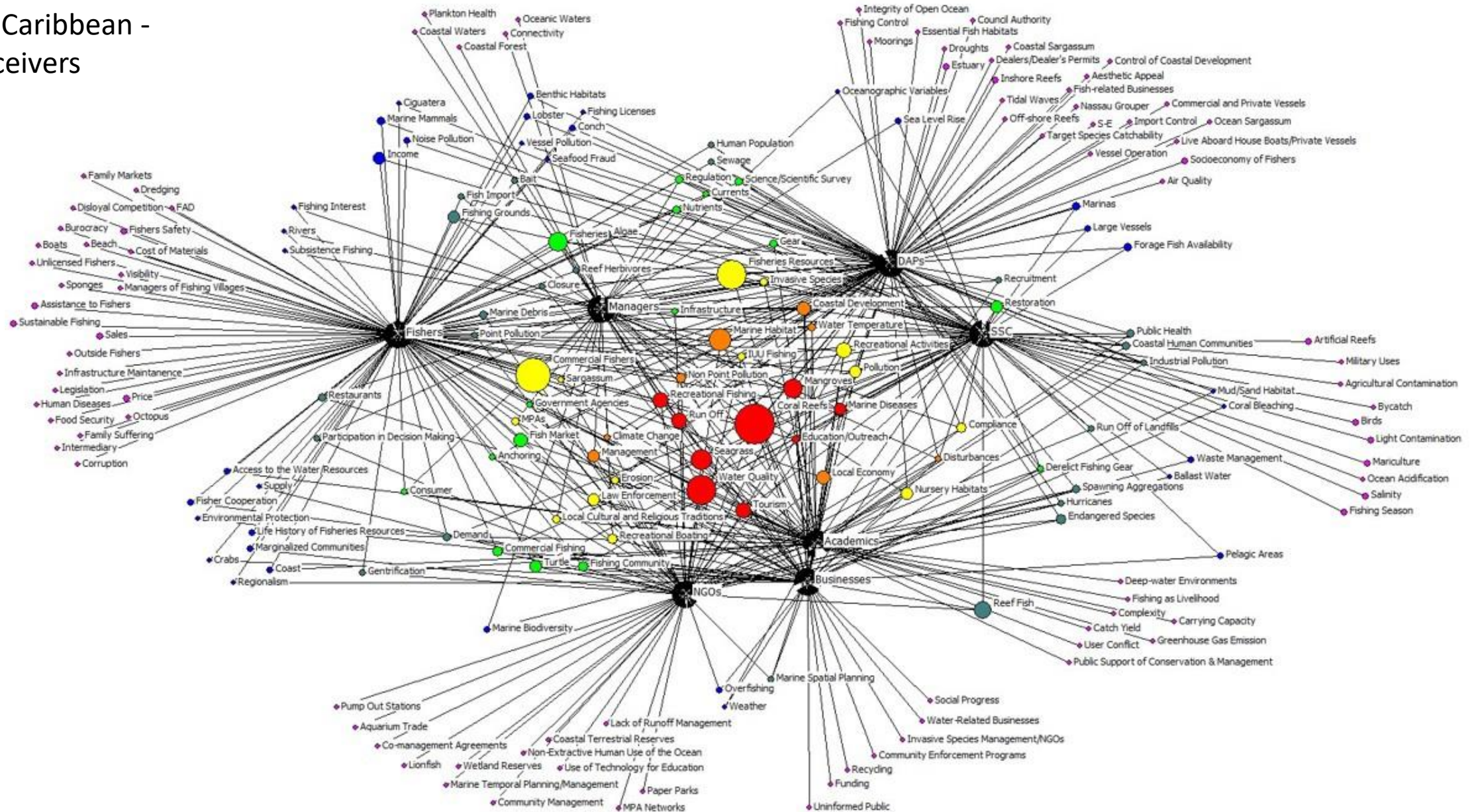


US Caribbean - Drivers



2-mode Network

US Caribbean - Receivers



Ecosystem Components identified by all 7 stakeholder groups as important drivers and receivers:

Ecosystem Components

Recreational Fishing (D/R)

Coral Reefs (D/R)

Run-off (D/R)

Tourism (D/R)

Education/Outreach (D/R)

Marine Diseases (D/R)

Disturbances (D)

Coastal Development (D)

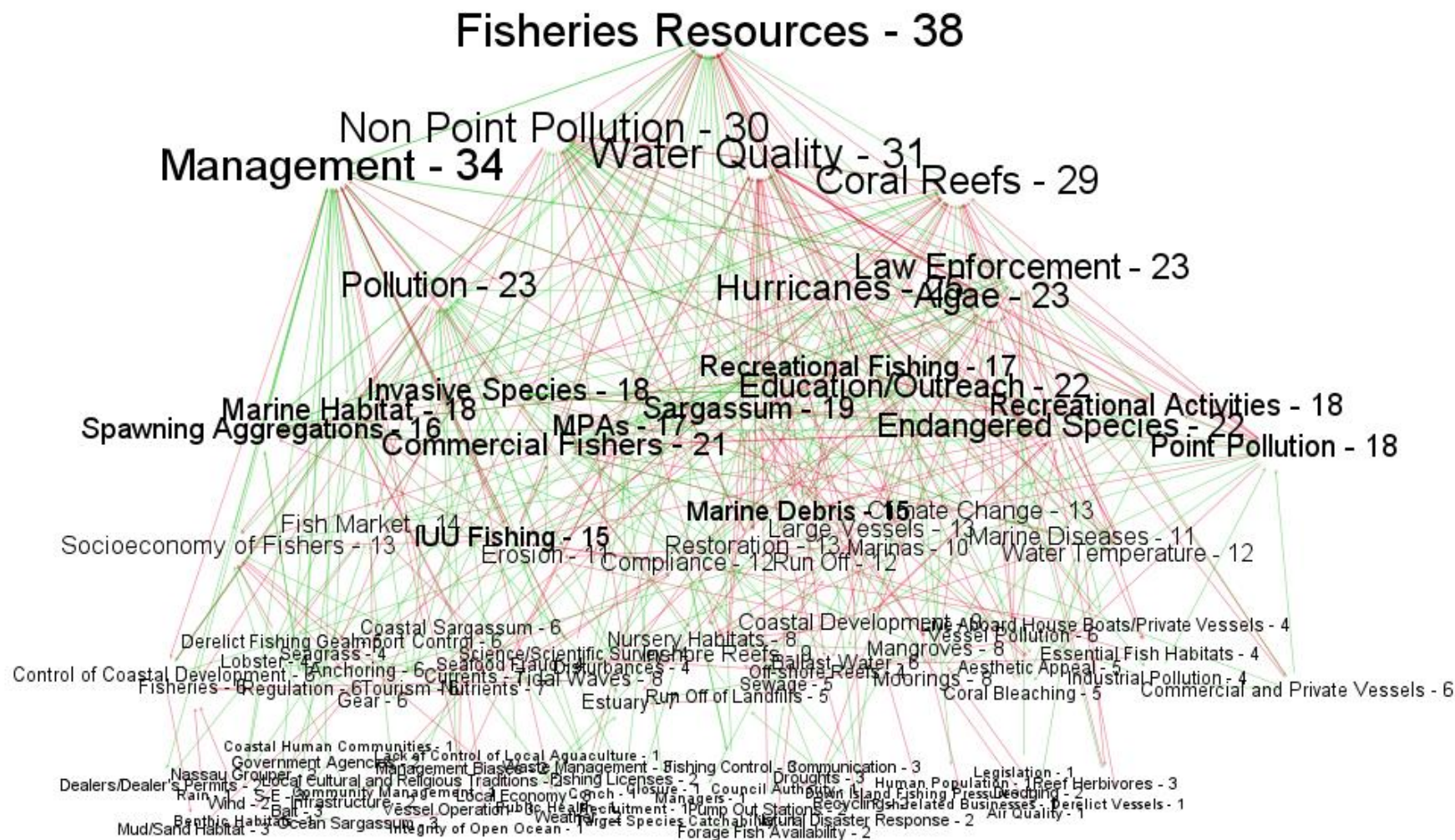
Local Cultural and Religious Traditions (D)

Water Quality (R)

Mangroves (R)

Seagrass (R)

Conceptual model for the U.S. Caribbean DAPs with components ranked by number of connections:



Components with highest number of connections by stakeholder group.

Stakeholder Group	Top Component
Businesses	Coral Reefs
DAPs	Fishery Resources
NGOs	Water Quality
Academics	Water Quality
Fishers	Commercial Fishers
Managers	Marine Habitat
SSC	Coastal Development

Major Threats*	Components Affected
Run Off	Coral Reefs
Climate Change	Marine Habitat**
	Water Quality
Hurricanes	Coral Reefs
	Recreational Fishing
Tourism	Marine Habitat*
	Education/Outreach
Non-Point Pollution	Marine Habitat*
	Water Quality
Marine Diseases	Coral Reefs
Invasive Species	
Water Temperature	
Coastal Development	Marine Habitat*
Disturbances	
Anchoring	
Nutrients	Water Quality
Erosion	
Point Pollution	
Sargassum	Tourism

Current and Potential Uses of the Conceptual Models

Uses CMs data

- FEP development, e.g.:
 - Informing description of the ecosystem in FEP document
 - Guiding strategic objectives and risk assessment priorities
- Outreach materials; simplified model representations
- Publications and conference presentations
- *Identifying knowledge gaps and informing research priorities*

Thank you!

Funding:

