



NOAA
FISHERIES

A Social-Ecological System Diagnostics Framework

Integrating Social Science Information into the Management of U.S. Caribbean Fisheries

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Human behaviour is a key uncertainty for fisheries management, because it receives too little attention in conventional fisheries science and management.

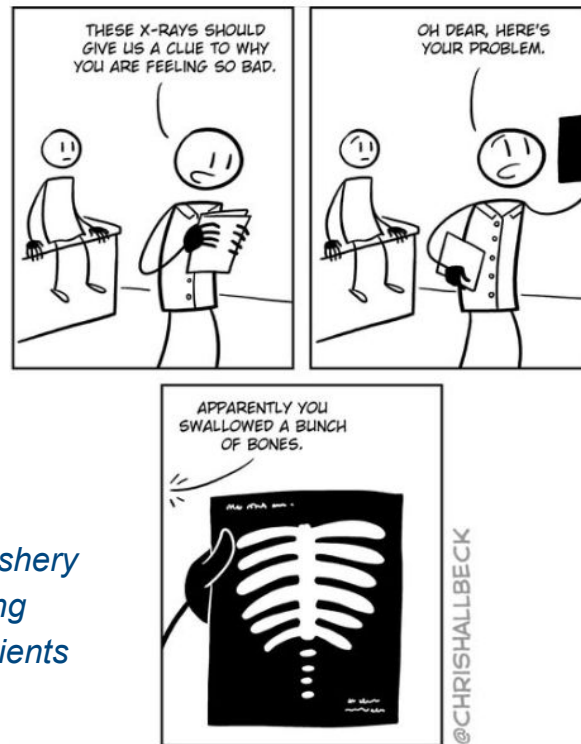
— Wijermans et al.
(2019)

Conventional Management Limitations

Traditional fisheries decision-making relies heavily on biological inputs (e.g., stock assessments, biomass) to alter human behavior.

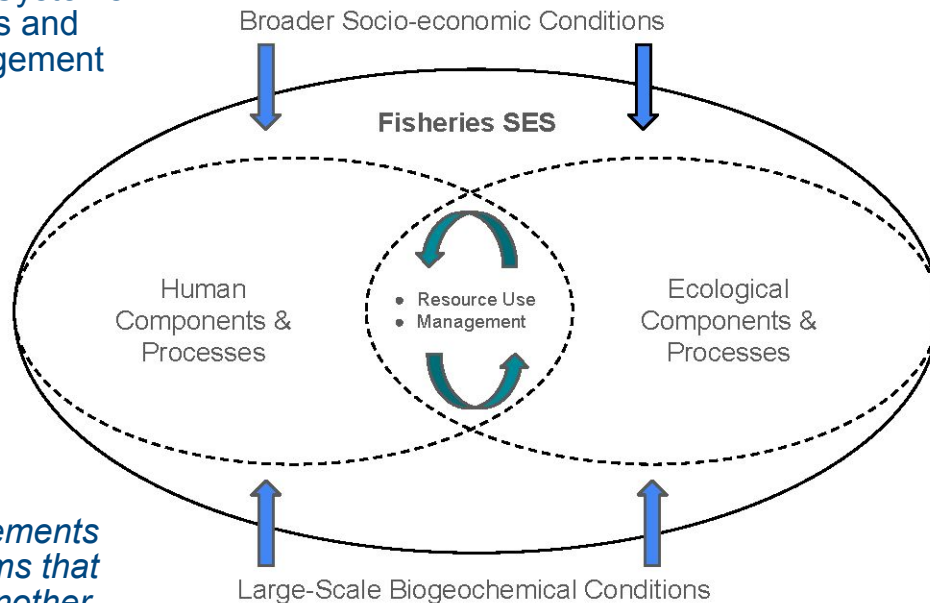
- Human behavior remains a critical uncertainty.
- Socioeconomic and other drivers when considered are evaluated in isolation, rather than as a coupled system.

The "X-Ray Only" Analogy: Managing a complex fishery using biological data alone is akin to a doctor relying solely on x-ray results to diagnose and treat all patients regardless of the nature of their symptoms.



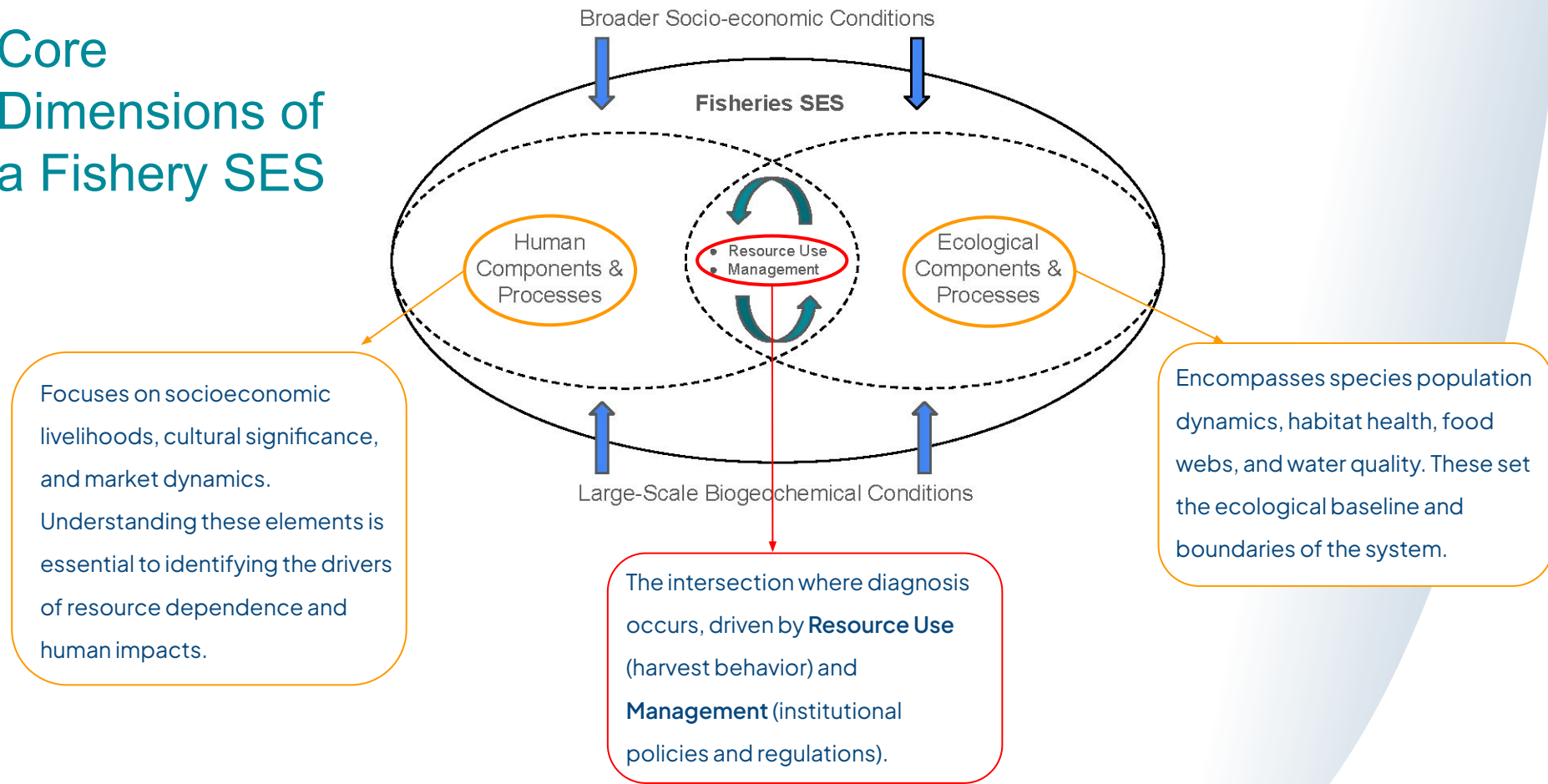
The SESD Framework

Builds on the concept of Social-Ecological Systems (SES) and its utility for diagnosing problems and their root causes in natural resource management (Ostrom 2007, 2009).



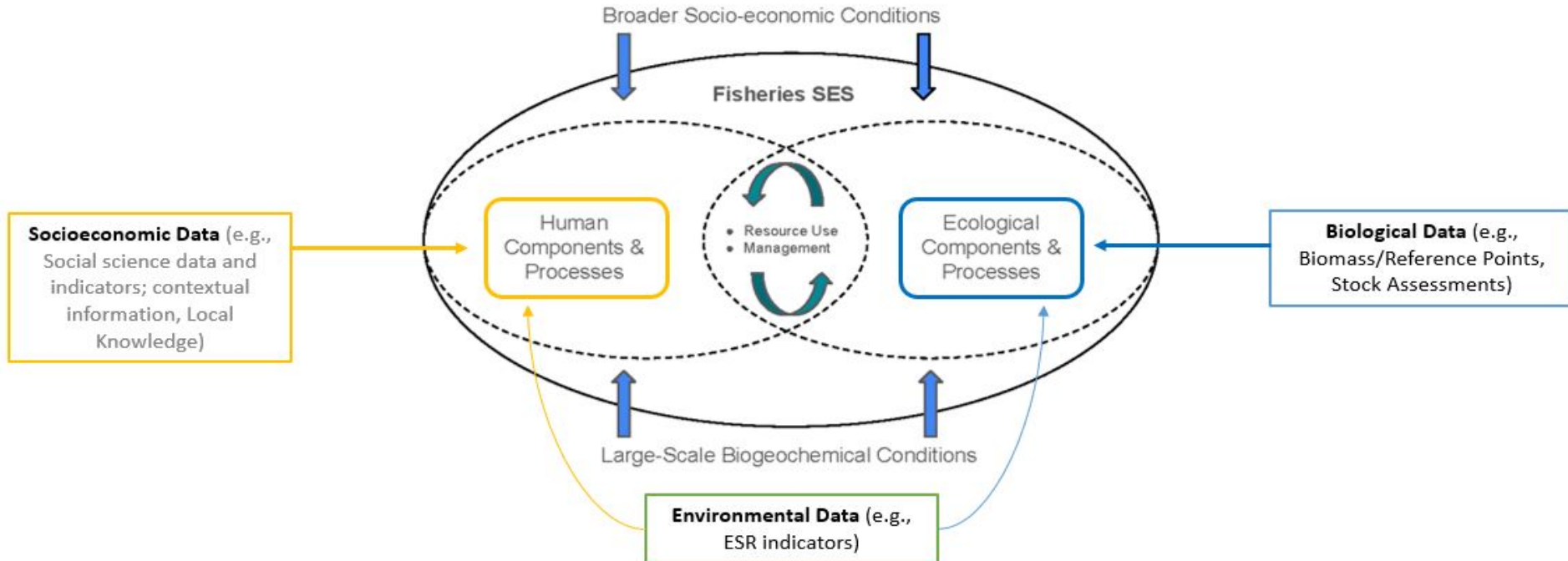
In a SES Human and Natural elements are coupled, interdependent systems that continually shape one another.

Core Dimensions of a Fishery SES



The SES Diagnostics Framework

The **SESD framework** identifies the **data inputs** needed to assess fishery ecosystem status and change to guide fisheries decision-making and understand the impacts of management actions.



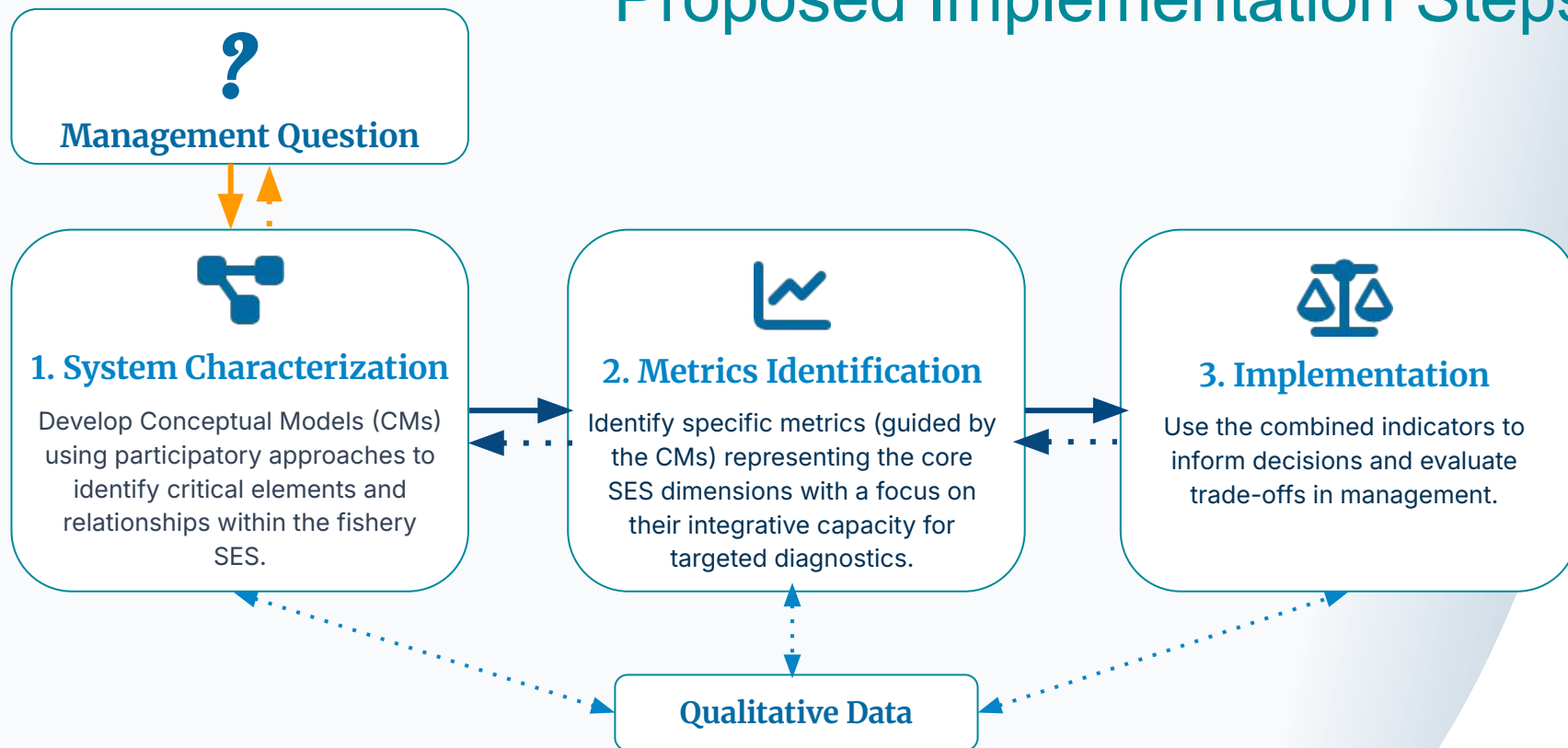
SESD Force Multiplier Effect

The primary goal of SESD is to maximize integrative capacity of data inputs. Rather than relying on a single data stream, the framework combines three core dimensions to guide management.

E.g.: Biomass Trends (Bio) + Water Temp (Env) + Market Prices (Socio) = Holistic Management Action



Proposed Implementation Steps



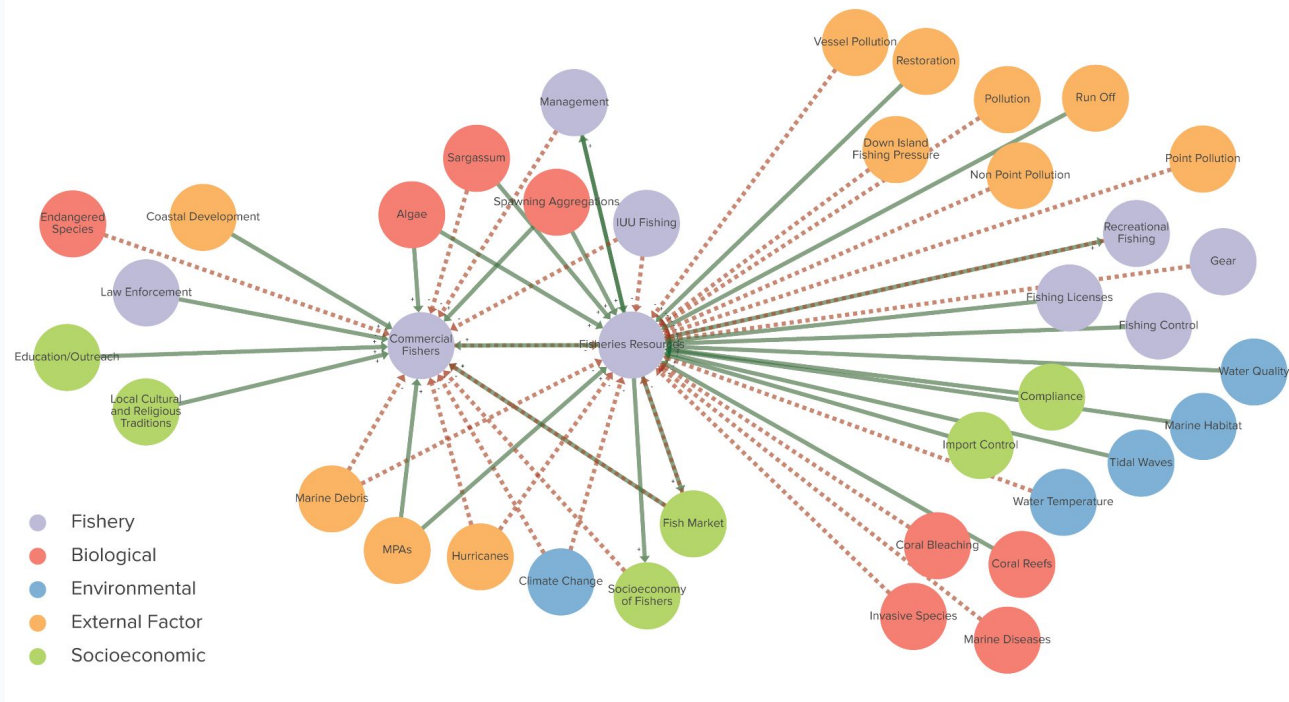
Proof of Concept: DAPs CMs

Extracting Submodels

Data from the DAPs CMs (Seara et al. 2024) served as the starting point.

Specific submodels were isolated to identify hypothesized relationships.

Submodel 1 Focus: Commercial Fishers & Fisheries Resources;
Provides proof of concept of Caribbean SES.



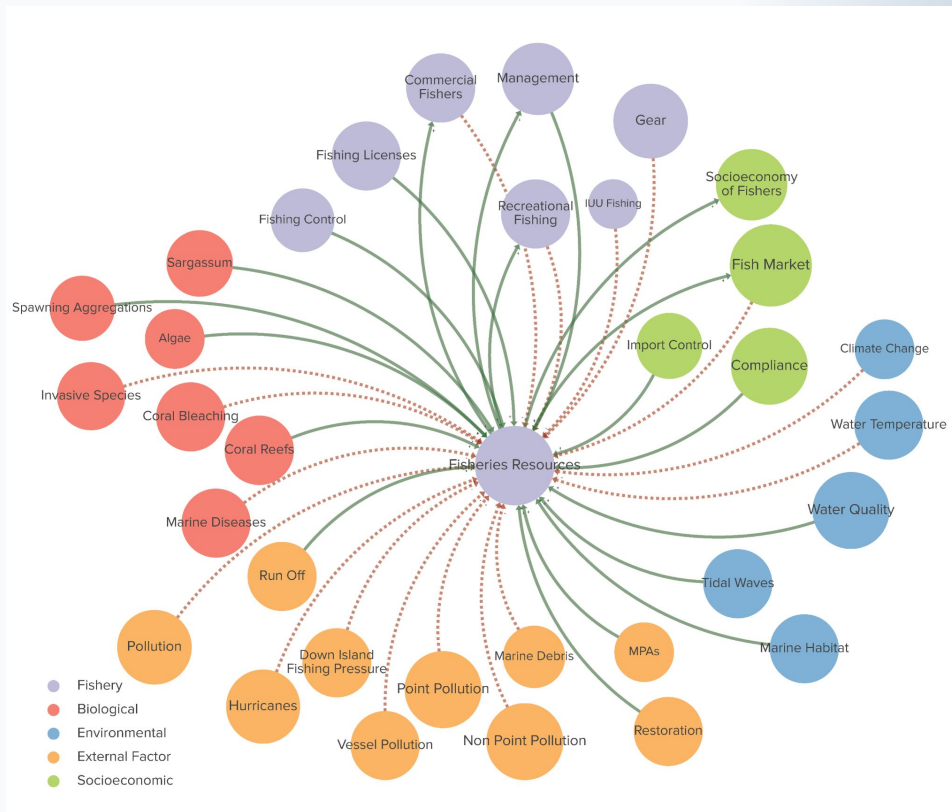
Proof of Concept: DAPs CMs

Submodel 2 Focus: Fisheries Resources.

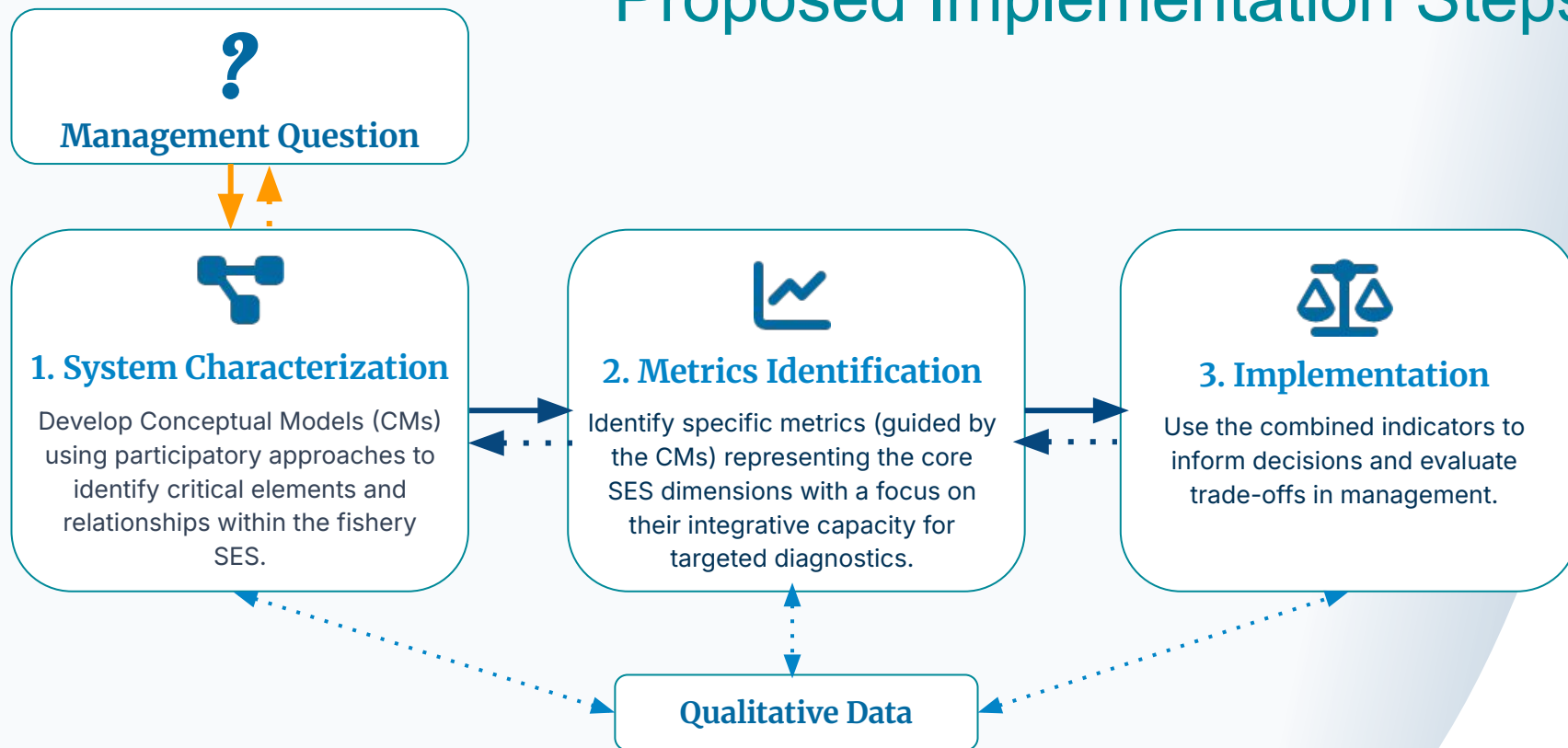
Key Socioeconomic Drivers Identified:

Socioeconomy of Fishers, Fish Market, Import Control, and Compliance.

Application: Understanding market prices and fleet demographics helps shape decisions that balance resource sustainability with community economic viability.



Proposed Implementation Steps



Moving Forward

To enable practical adoption of SESD in the U.S. Caribbean, we must prioritize resources for consistent (e.g., annual) socioeconomic and LEK data collection and CM iteration.

- E.g., Fishery Performance Reports (MAFMC model); socioeconomic surveys.

Once critical elements are identified and monitored, this method can guide effective EBFM and help the CFMC balance trade offs and conduct scenario planning analyses.