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# RED TIDE AS A FISHERY ECOSYSTEM ISSUE: A CASE STUDY

Ecosystem Technical Committee Meeting  
Gulf of Mexico Fishery Management Council

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# Acknowledgements

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## **Crew and volunteers**

R/V Walton Smith

NOAA white ships

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# Purpose

1. Provide worked example of FEI loop using red tide
2. Make recommendations on FEP / FEI process

# What is the FEP loop?

1. Iterative process to operationalize EBFM (LGL, 2022)
2. Flexible guidance and not ready made cookbook (Essington et al. 2016)
3. Full cycle: ~10 years (Marshall et al. 2018)

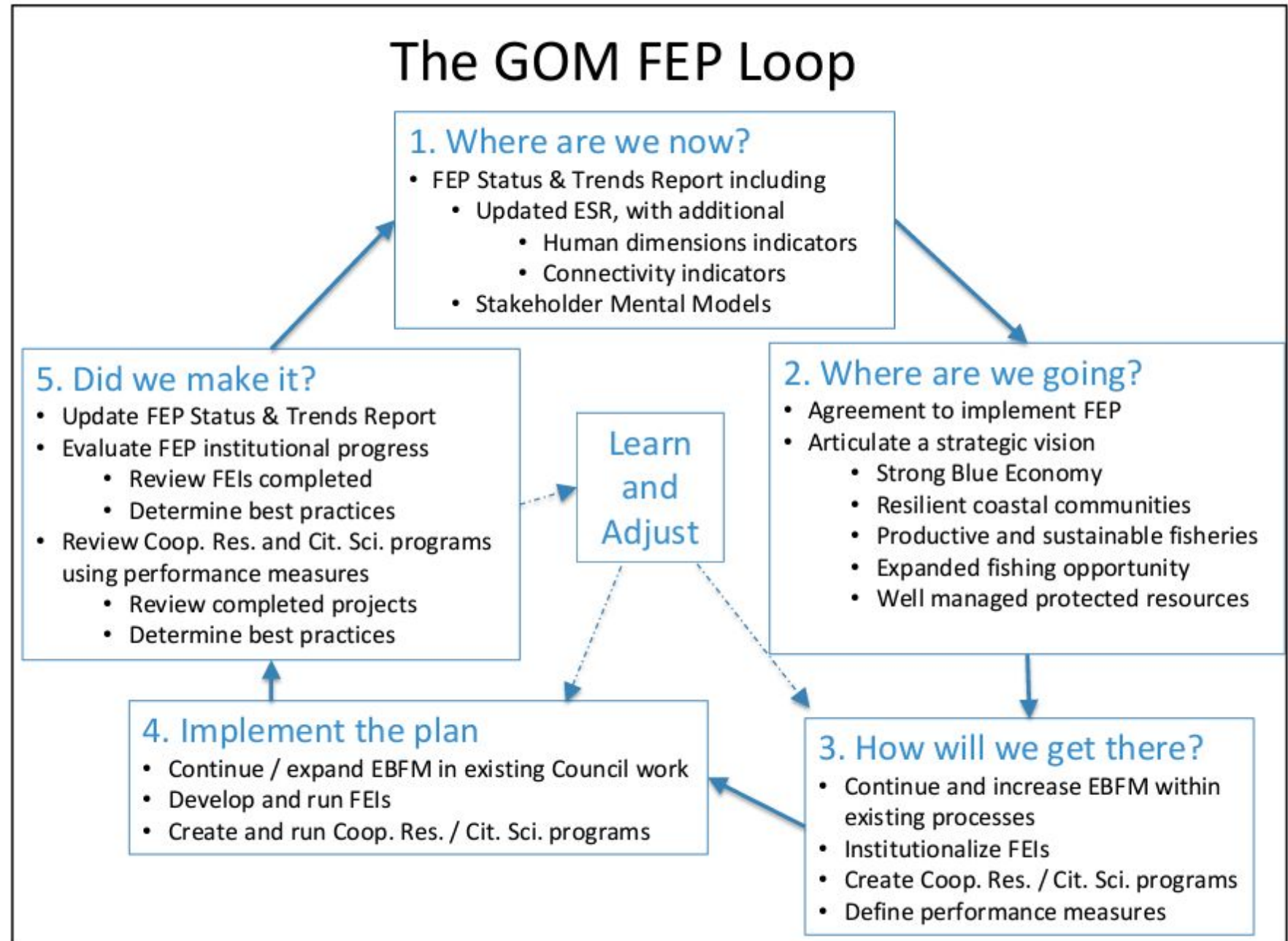


Figure: LGL, 2022

# What is the FEI loop?

1. “Structured, action-oriented planning processes that address specific fisheries issues” (LGL, 2022)
2. Full cycle: 4 months to 3 years (LGL, 2022)

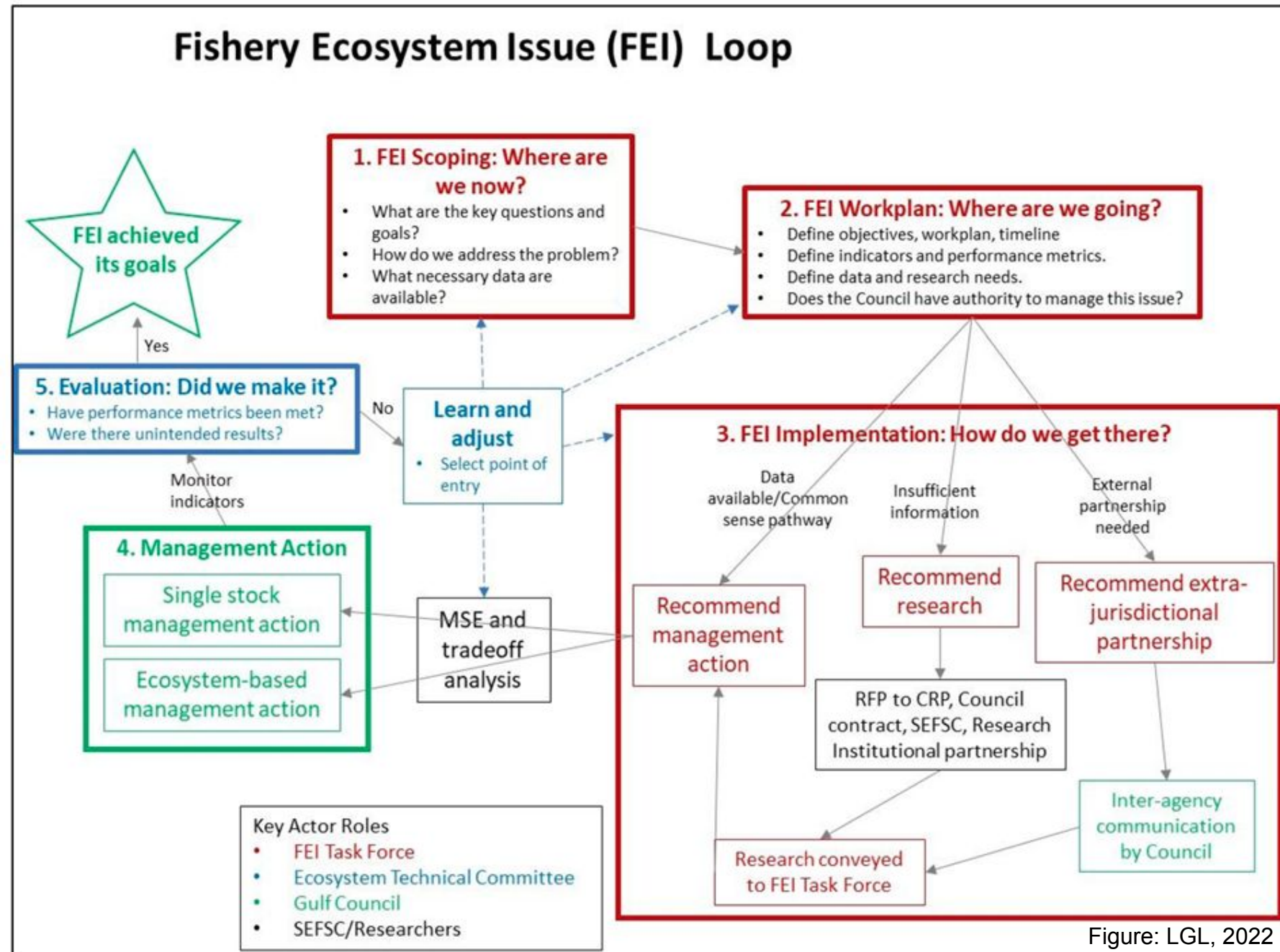


Figure: LGL, 2022

## Major milestones for red tide FEI

2006 - Acknowledged impacts from red tide to gag and red groupers

2009 - Red tide extra mortality estimated in stock assessments

2014 - Discard only fleet, ecosystem models, and red tide index in stock assessments

2016 - Ecosystem model based MSE recommendations

2018 - Stock Synthesis based MSE recommendations

2019 - Collaborative monitoring of red tide & hypoxia initiated

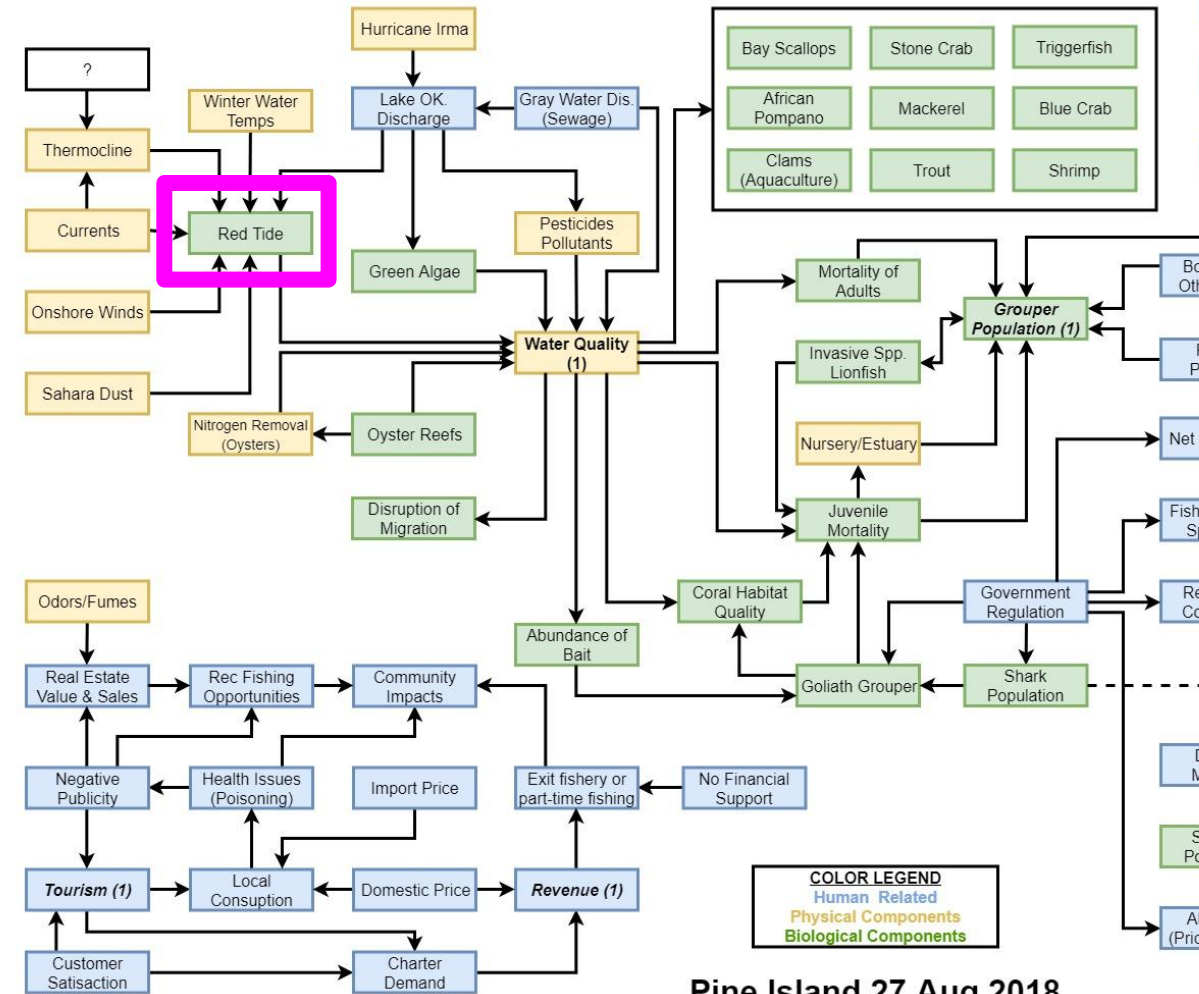
2021 - Use of hypoxia monitoring data in catch limit deliberations

**Full lifecycle (thus far) ~17 years**

# 1. FEI Scoping: Where have we been?

1. What are the key questions and goals?
  - a. How do red tides affect managed stocks?
2. How do we address the problem?
  - a. Interdisciplinary team – NOAA Integrated Ecosystem Assessment efforts (USF, UF, FWRI, SEFSC, AOML) and external funding sources (FATE, RESTORE)
  - b. Stakeholder participatory modeling
3. What necessary data are available?
  - a. FWRI HAB cell count data, Local Ecological Knowledge, Satellite data

**Missing from FEI loop: Explicit inclusion of stakeholder engagement**



Pine Island 27 Aug 2018  
SEFSC Participatory Modeling Initiative

## 2. FEI Work Plan: Where did we go?

1. Does Council have authority to manage issue **(do this during scoping phase)**
  - a. Can manage fishing mortality
  - b. Cannot stop red tides, but communicate impacts to other management bodies
2. Define objectives, workplan, timeline
  - a. Include red tide mortality in single species stock assessment
  - b. Develop ecosystem models to explore tradeoffs
  - c. Create red tide index
3. Define indicators and performance metrics
  - a. **Unknown**
4. Define data and research needs
  - a. Outlined in SEDAR reports

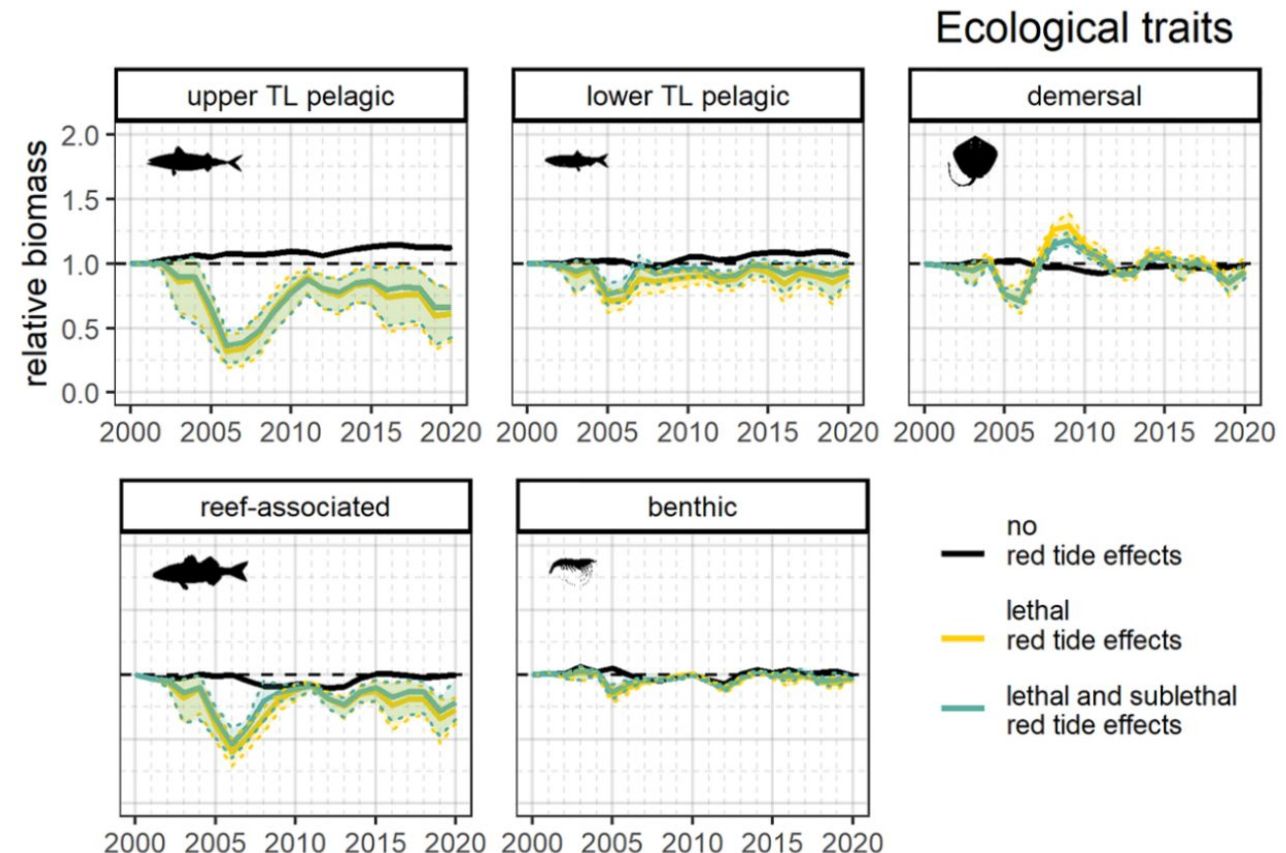
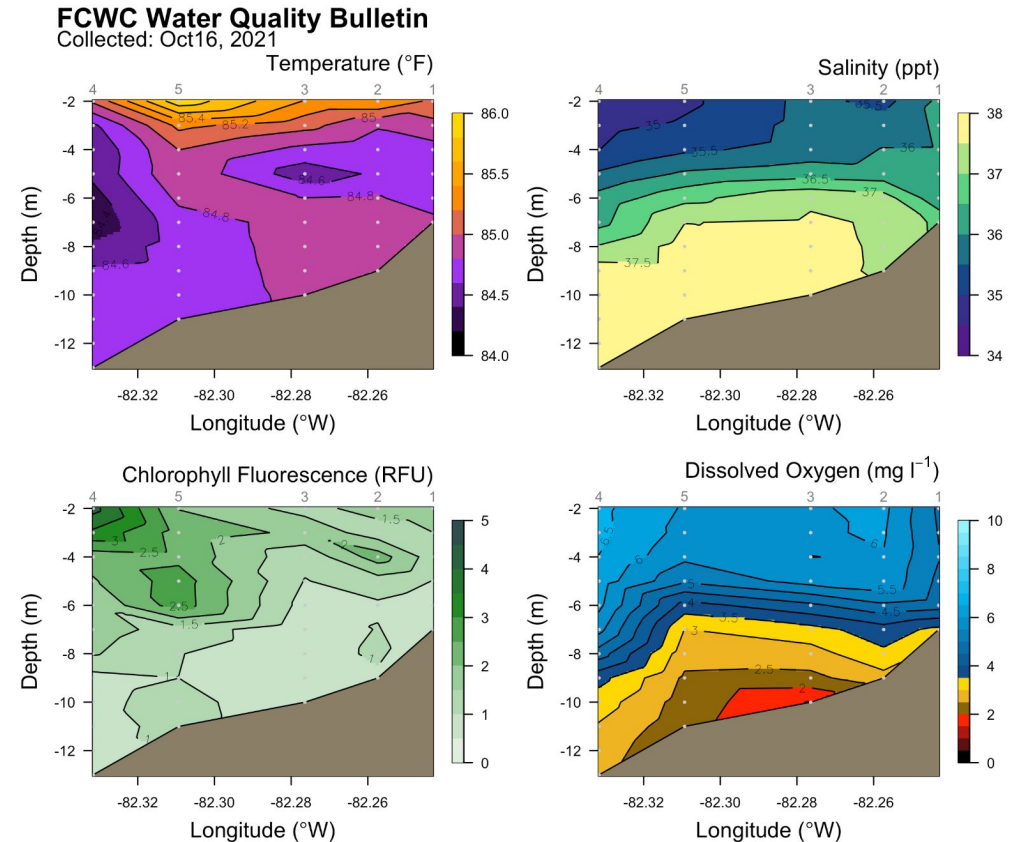


Figure: Vilas et al. 2023

### 3. FEI Implementation: How did we get there?



1. Data availability / common sense pathway
  - a. Recommend management actions using SEDAR assessments
2. Insufficient information
  - a. Recommend research
  - b. Collaborative research with commercial and recreational fishermen (e.g., FCWC; [floridawatermen.org](http://floridawatermen.org))
3. External partnership needed
  - a. Extrajurisdictional partnerships to address nearshore water quality improvements (e.g., Hypoxia Task Force)
  - b. Advise ACE on Lake Okeechobee releases



## 4. Management Action

1. Single stock management actions
  - a. **Primary mode of action for council**
  - b. Adjust OFL, ABC, and ACL for gag and red groupers
  
2. Ecosystem-based management actions
  - a. **None enacted**, not because science wasn't available (see Grüss et al. 2017)
  - b. Use of ecosystem models
  - c. Ecological reference points (e.g., environmental drivers, species interactions)

### Amendments explicitly considering red tide mortality

Year	Gag	Red Grouper
2022		Amendment 53 & Modification
2021		
2020		
2019		Modification
2018		
2017	Amendment 44	
2016	Framework Action	Framework Action
2015		
2014		
2013		
2012	Amendment 32	
2011		Regulatory Amendment
2010		Regulatory Amendment
2009	Amendment 30B	

\*Interim rules not included

## 5. Evaluation: Did we make it?

1. Have performance metrics been met?
  - a. Stock assessment output better fit to indices of abundance (assessment metric)
  - b. *No management metrics defined*
2. Were there unintended results?
  - a. *Unclear; retrospective analysis needed*
  - b. **“Red tide fatigue” – objectives, timeline, and performance metrics not initially defined**

*If NO, reiterate any previous step and/or perform MSE and tradeoff analysis*

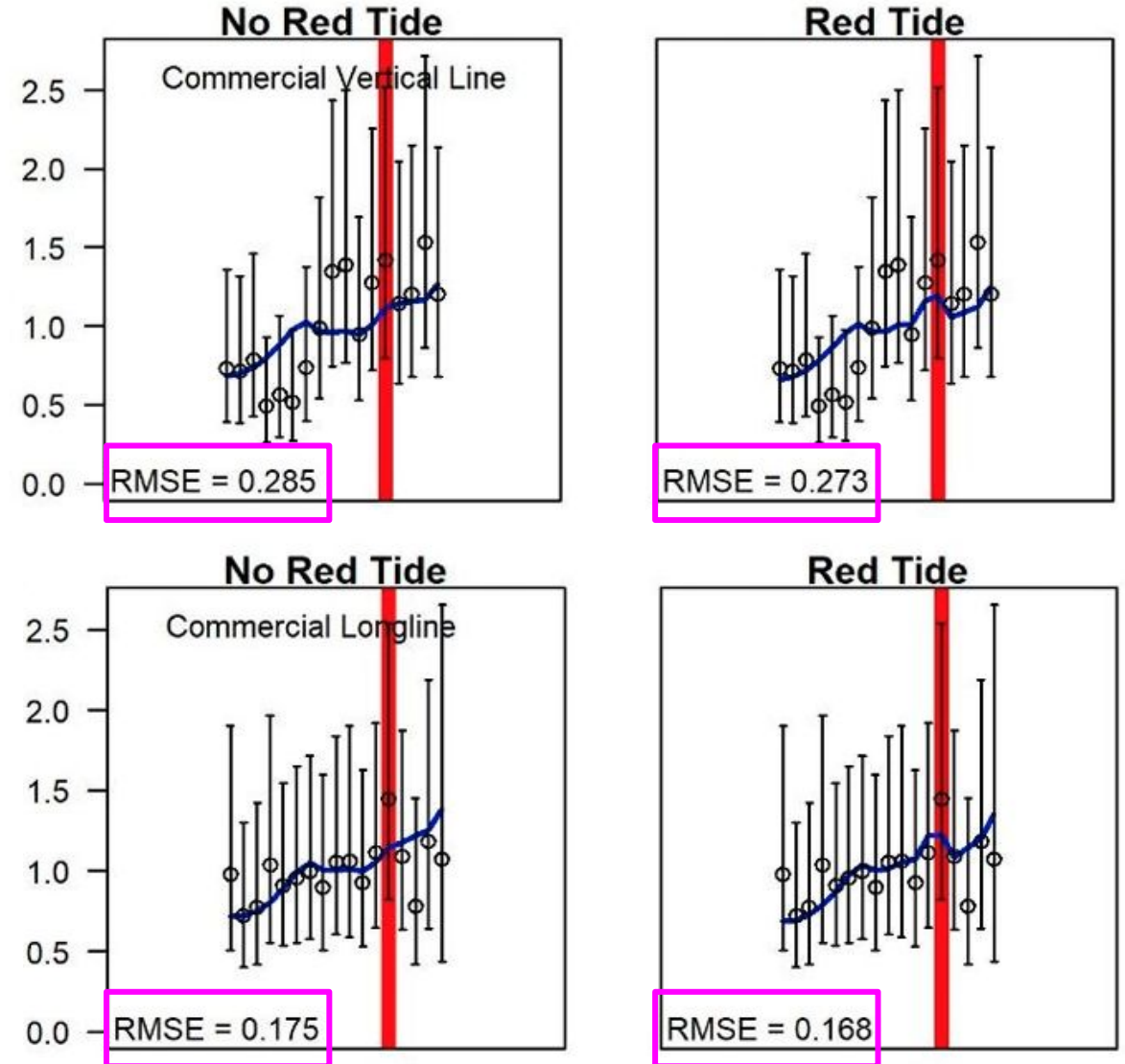


Figure: Sagarese et al. 2021

## 6. Learn and Adjust

1. Management Strategy Evaluation (MSE)
  - a. Ecosystem model based (Grüss et al. 2016)
  - b. Stock Synthesis based (Harford et al. 2018, Sagarese et al. 2021)
2. Tradeoff analysis
  - a. MSEs considered reactive strategies vs. increased buffers (*preferred*)
  - b. Reactive strategies can achieve higher catches but are data hungry
  - c. Projections without red tide increase probability of overfishing
  - d. Ecosystem models suggest broader trophodynamic impacts

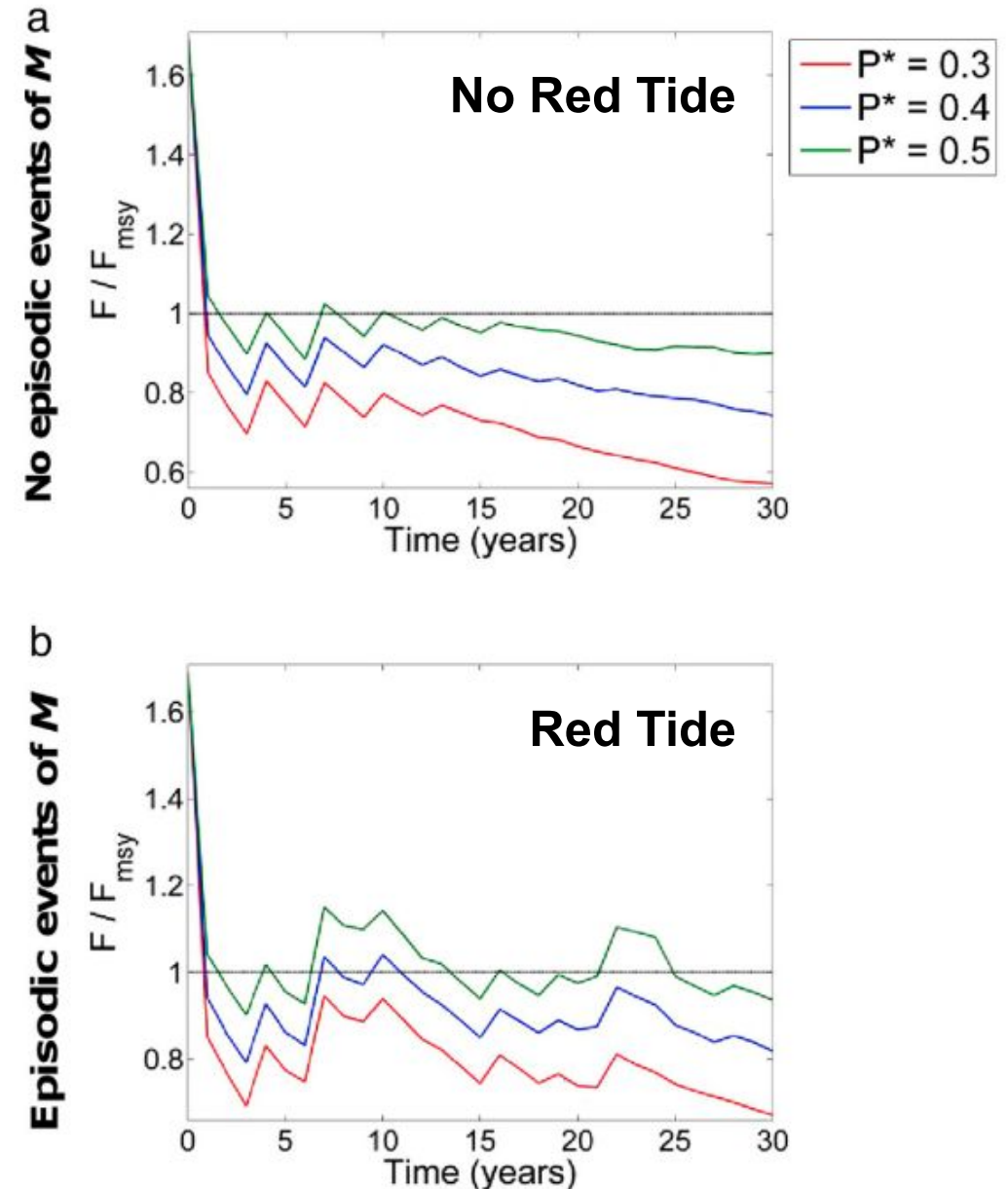
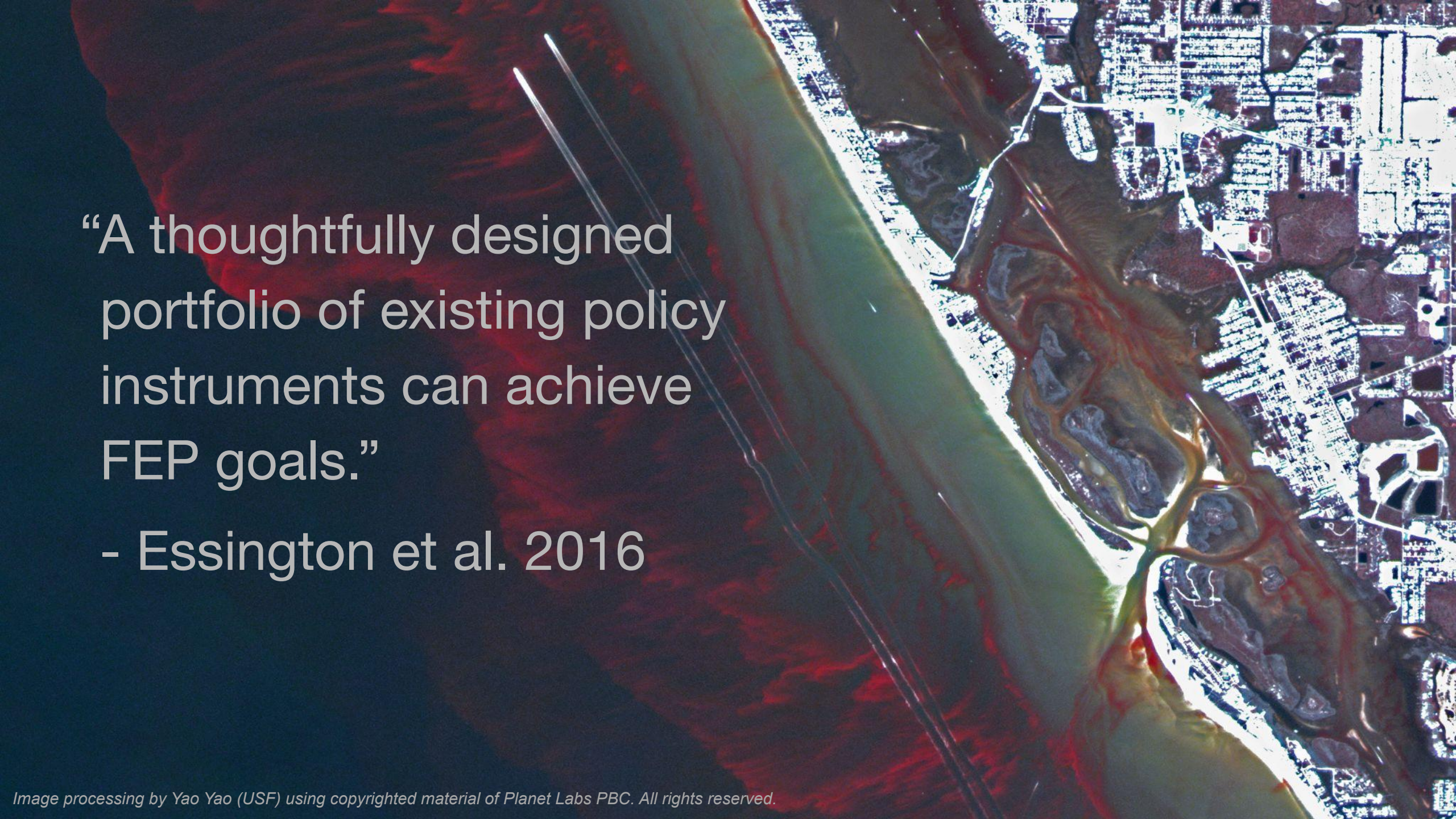


Figure: Grüss et al. 2016

# Recommendations

1. Listen to fishermen and seek active stakeholder engagement
2. Review potential FEIs together to find common issues; or find common solutions that satisfy multiple issues
  - a. e.g., red tide = episodic mortality event, and episodic mortality likely more common with climate change
3. Clearly define FEIs and performance metrics
4. Need SEDAR-like environmental data review process
  - a. Satisfy MSA National Standard 2 – best scientific information available

An aerial photograph of a city, likely San Francisco, showing a dense urban grid on the right side and a large, green, open field on the left. A river or canal winds through the city. The image is processed with a color gradient, transitioning from dark blue on the left to bright yellow and white on the right.

“A thoughtfully designed  
portfolio of existing policy  
instruments can achieve  
FEP goals.”

- Essington et al. 2016