Risk Assessment Framework for Ecosystem-Based Fisheries Management in the U.S. Caribbean

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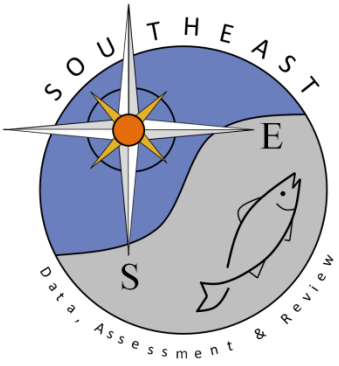

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A Risk Assessment Framework for Ecosystem-Based Fisheries Management in the U.S. Caribbean

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SEDAR 103: US Caribbean Application of Alternate Assessment Methods

Summary

The Risk Assessment Framework (RAF) is a scorecard-based decision-support tool developed for the Caribbean Fishery Management Council (CFMC) to support Ecosystem-Based Fisheries Management (EBFM) in the U.S. Caribbean. It quantifies the relative risk that recent changes in ecological or socio-economic conditions will cause fisheries to respond to management actions differently than they have historically. Indicators drawn from the CFMC Ecosystem Status Report (ESR) and other publicly available government sources are scored for directional trend, grouped into four risk categories — Ecosystem-Level Function, Distortive Pressure Sensitivity, Socio-Economic Sensitivity, and Coral Reef Ecosystem Sensitivity — and combined into an aggregate risk signal calculated separately for each U.S. Caribbean island group.

The RAF is not a stock assessment method. Its output is a relative risk score intended to complement assessment methods by providing ecosystem-risk context to management decisions, and — as described in this paper — it is structurally designed to incorporate the outputs of several ecosystem-level methods under review in this workshop. The framework can be used in two ways: as an informal reference in Council deliberations, or within a structured decision-making (SDM) process that links risk scores to the Council's strategic objectives and to candidate management tools. A completed pilot was created using the January 2025 draft ESR, demonstrating that the method is operational using currently available data.

I. Introduction

Fisheries in the U.S. Caribbean operate in a rapidly changing environment. Warming waters, sargassum inundation, coral reef degradation, shifting tourism pressure, and recurrent disasters can alter the ecological and social systems on which management depends. When those conditions change, a management action may no longer produce the response it would have produced historically, introducing uncertainty into decisions that are often already data-limited.

The RAF was developed for the CFMC to help identify and characterize this risk. It is grounded in the stakeholder-based conceptual model of U.S. Caribbean ecosystem threats and drivers developed by Seara et al. (2024), which established the working list of threats and drivers the framework is designed to monitor. The framework was refined through a collaborative process involving the CFMC's Ecosystem-Based Fishery Management Technical Advisory Panel (EBFM TAP), Council staff, and subject-matter experts.

Structure of the underlying report. This paper summarizes the full RAF report (Fletcher, 2025) which is organized into five chapters and three appendices: Chapter 1 presents the scorecard and instructions for use; Chapter 2 details each indicator, its data source, and its scoring criteria; Chapter 3 describes how risk scores can be incorporated into management decision-making, including three linking tables and four case studies; Chapter 4 documents the process used to identify risks, select indicators, and design the scoring methodology; and Chapter 5 sets out recommended future work. Appendix A contains a completed pilot scorecard, Appendix B provides plain-language profiles of the management tools referenced in Chapter 3, and Appendix C summarizes comparable risk-responsive management approaches used elsewhere.

II. Method Description

At the core of the RAF is a scorecard that evaluates directional trends in risk across a suite of ecological and socio-economic indicators. Each indicator's trend is categorized as increasing, decreasing, or consistent, so that the Council can see not only where risk exists but whether it is worsening, improving, or stable over time. The subsections below describe the data inputs, the analysis and outputs, the ways the results can inform management, and the method's current caveats.

A. Data Inputs

The RAF is designed to utilize existing, publicly available data, so that it can be applied and updated without new field sampling. Its indicators are organized into four risk categories, each representing a distinct pathway by which change can affect the Council's ability to meet its goals:

- **Ecosystem-Level Function** — risk associated with change in the overall biological function of the ecosystem. This category is defined in the scorecard but is not yet operational; indicator selection is the subject of recommended future work (Section II.D and below).
- **Distortive Pressure Sensitivity** — risk from human-induced changes to the marine ecosystem, from direct pressures such as tourism to indirect pressures such as climate-driven warming. Indicators include commercial landings (lobster, conch, finfish), recreational landings, sea surface temperature, sargassum inundation, ocean-economy measures (hotel, air, and cruise visitors), and water quality (enterococcus bacteria and turbidity), drawn from the ESR.
- **Socio-Economic Sensitivity** — risk from changes in the human population and economy that affect the fishing community. Indicators include population change and unemployment (ESR) and major disaster declarations (FEMA).

- **Coral Reef Ecosystem Sensitivity** — risk associated with change in the condition of coral reef habitat. Indicators include degree heating weeks, percent coral cover, and fish density (ESR), and the number of listed endangered or threatened species (NOAA).

Nineteen indicators are currently usable from existing data. Several additional indicators are identified in the report as *future indicators* — for example coastal development, commercial fishing engagement, fishing reliance, and invasive species — which require a comparison year or additional time-series data before they can be scored. A small number of indicators reflect both ecological and socio-economic considerations; to avoid double-counting, those considerations are incorporated into the scoring of a single indicator rather than listing it under two categories. Indicators and summary of scoring depicted on scorecard. (Figure 1).

B. Analyses / Data Outputs

Each indicator is scored on a simple directional scale based on the trend shown in its data source: an increasing-risk trend is scored 3, a consistent trend 2, a decreasing-risk trend 1, and an indicator that cannot be scored 0. The scoring rules are indicator-specific — for most indicators the direction of the trend arrow in the ESR determines the score, while a few (such as fish density, which combines density and size-spectrum information) use defined multi-part rules. The scoring is designed so that a higher score reflects a greater likelihood that the ecosystem's biological response, or the fishing community's response, to a management action will deviate from its historical pattern, and therefore a greater risk to the goals and objectives in the Council's Strategic Plan.

Within each category, indicator scores are averaged to produce a category mean. The category means are summed, and a data-gap adjustment factor is added to account for categories in which one or more sub-indicators could not be scored and for the fact that the ecosystem-level function category is not yet operational. The result is a single aggregate risk score, calculated separately for Puerto Rico, St. Thomas/St. John, and St. Croix. Both individual category scores and the aggregate are interpreted on the same three-level scale — increasing, consistent, or decreasing risk — against defined thresholds. The scorecard also incorporates a feedback loop, allowing indicators to be re-scored as new information becomes available (Figure 1).

C. Implications for Management

The RAF is a decision-support tool: it characterizes risk so that the Council can decide whether and how to account for it, but it does not by itself prescribe a management action. The report describes two ways the framework can be incorporated into decision-making.

Pathway 1 — General consideration (ad hoc). The Council may adopt a policy to review and consider RAF risk scores in its decisions without committing to a fixed methodology. The report provides three example approaches of varying formality for this pathway.

Pathway 2 — Structured decision-making (SDM). The Council may adopt a structured, six-step process that explicitly incorporates the RAF alongside its strategic objectives and available management tools. This pathway is supported by three linking tables that form the analytical backbone of the framework:

- **Table 3.1 (Risk → Strategic Objectives)** identifies which of the Council's strategic objectives each category of risk can impede.
- **Table 3.2 (Risk → Management Tools)** identifies which types of management tools are most effective at addressing each category of risk.

- **Table 3.3 (Management Tools → Strategic Objectives)** scores how well each management tool supports each of the Council's 22 strategic objectives, enabling trade-off analysis.

Together these tables let a manager move from a risk signal to selecting actions to respond to the signal. For example, if the RAF signals increasing socio-economic risk, Table 3.1 of the report shows which objectives are threatened, Table 3.2 of the report identifies candidate tools to address the risk (such as community quotas, user-zone designation, or limited entry), and Table 3.3 of the report shows how those tools score across the full set of objectives. Plain-language profiles of every tool are provided in Appendix B. The process concludes with *de-risking* — practical strategies for reducing the exposure, sensitivity, or consequences associated with a given risk once a management action has been selected. Figure 3 illustrates this flow.

The six-step structured decision-making process

When the SDM pathway is used, the RAF is applied through a repeatable six-step process. The process is designed so that a risk signal is not simply noted but is carried through to a management choice, with explicit attention to trade-offs and to reducing the chance of poor outcomes:

1. **Clarify the management problem.** The specific decision before the Council is stated plainly, so that the risk analysis is focused on an actual management question rather than a general concern.
2. **Restate and link objectives.** The Council's broad Strategic Plan goals are translated into case-specific objectives and linked to the numbered Strategic Objectives they serve, using the Strategic Objectives matrix. This step makes explicit what the decision is trying to achieve before alternatives are considered.
3. **Identify management alternatives.** Using the three linking tables, the relevant risk categories are connected to the objectives they threaten (Table 3.1) and to the management tools capable of addressing them (Table 3.2), and a set of candidate alternatives is assembled.
4. **Evaluate consequences.** The candidate alternatives are scored against the restated objectives in a decision matrix, drawing on Table 3.3, producing a structured comparison of options.
5. **Evaluate trade-offs and worst-case outcomes.** The Council revisits the Strategic Objectives matrix to examine the trade-offs among alternatives and to identify whether any outcomes fall outside acceptable bounds — an explicit check against worst-case results before a choice is made.
6. **Select and implement with a de-risking strategy.** The Council selects the alternative that best balances risk, feasibility, and alignment with its objectives, and — particularly where the aggregate risk score is high — pairs implementation with a de-risking strategy.

De-risking

De-risking means designing the action to reduce the likelihood or consequences of poor outcomes and to preserve flexibility as new information becomes available. An increasing aggregate risk score is treated as a trigger for the Council to consider whether de-risking elements should be added to a policy under consideration. De-risking can be considered in both ad-hoc and structured decision-making. The report describes a range of de-risking techniques, including:

- time-limiting an action through sunset clauses or scheduled review;
- adding or adjusting precautionary buffers around numeric limits;
- adopting incremental or phased pathways that allow midstream adjustment;

- using scenario planning to evaluate best- and worst-case outcomes;
- implementing multiple actions to account for variability in ecosystem response;
- gathering additional information before a policy is implemented;
- establishing or expanding monitoring to evaluate the effect of the action;
- adding capacity-building (education, training, or funding) to support cooperative implementation;
- structuring policies as pilot or experimental programs;
- incorporating trigger-based adaptive strategies; and
- linking decisions to research mandates.

D. Caveats

The framework's principal limitations are matters of scope and maintenance:

- **Ecosystem-level function is not yet operational.** No indicators have yet been selected for this category. In the interim, a fixed data-gap adjustment accounts for the associated uncertainty. Candidate indicators are identified in the report and discussed in the Discussion below.
- **Additional indicators await data.** In the other three categories, several indicators have been identified that require additional time-series data before they can be scored.
- **Dependence on the ESR.** The framework relies on the continued production of the Ecosystem Status Report in a consistent format; most indicators are drawn from it.
- **Periodic maintenance.** The external tables (FEMA disaster declarations and NOAA ESA listings) require annual updating. If the SDM pathway is adopted, the linking tables (3.1–3.3) require review whenever the Council's Strategic Plan or Fishery Ecosystem Plan is updated, new management tools are identified, or new indicators are added.

III. Applications of the Method

The RAF has been applied in two ways that together demonstrate both that the scoring is operational and that the decision process has been worked through in practice.

Completed pilot

A completed pilot (Appendix A, shown as Figure 2) applied the scorecard to the data summarized in the January 2025 draft ESR. The pilot confirms that every currently usable indicator can be scored from existing public data and that the scoring, category means, data-gap adjustment, and per-island aggregation function end-to-end.

Case studies in the RAF report

Chapter 3 of the report works through four hypothetical case studies that apply the full six-step SDM process — including the decision matrices and de-risking strategies — to four different types of decision. They are hypothetical worked examples and are not based on actual Council decisions. The four case studies are:

- **Catch-limit decision (Lane Snapper, Puerto Rico) —** applies the process to whether a commercial ACL should be revised.
- **Spatial-management decision (Lane Snapper, St. Thomas/St. John) —** applies the process to an area-based measure, demonstrating tool selection for spatial management.

- **Endangered-species evaluation (Queen Conch, St. Croix) —** uses the framework to structure the Council's consideration of management in the context of an Endangered Species Act listing.
- **Research prioritization —** demonstrates using RAF risk signals to prioritize research and monitoring investments, including the data needed to support future stock assessments.

Comparable approaches elsewhere. Appendix C of the report summarizes risk-responsive and structured decision-making approaches used by other regional fishery management councils and in other jurisdictions, providing context for the RAF's design.

IV. Discussion

What the method is and is not. The RAF is a transparent, data-light decision-support tool that turns existing ecosystem and socio-economic information into a structured risk signal and connects that signal to the Council's objectives and available management tools. It is not a quantitative risk calculation; its output is a relative risk score intended to complement assessment methods.

Relationship to the methods under review in this workshop. The RAF's fourth category — Ecosystem-Level Function — is intended to capture macro-level change in the marine ecosystem, providing context for the finer-grained indicators in the other three categories. To date no indicators have been selected for this category. Several of the methods being evaluated in SEDAR 103 are candidate indicators that were workshopped during the RAF development process. The report specifically identifies the Ryther index, the Fogarty index (the ratio of total catch to primary productivity), and the Friedland index (the ratio of total catch to chlorophyll a) as candidate ecosystem-level function indicators (Chapter 5, Figure 5.2), and references ongoing ecosystem-modeling work by Cruz-Motta and Williams.

Relationship to stock assessments. The relationship runs in both directions. As the RAF is applied, it can help prioritize the research and monitoring that feed assessments (as in the research-prioritization case study). Conversely, as SEDAR stock assessments are completed for U.S. Caribbean stocks, they may in time offer alternative data sources for RAF indicators — though the report notes a current limitation: existing assessments generally do not include data from the most recent years, which is the period the RAF's trend analysis depends on.

V. References

Fletcher, L. (2025). Risk Assessment Framework for Ecosystem-Based Fisheries Management in the U.S. Caribbean. Prepared for the Caribbean Fishery Management Council. BioImpact, Inc.

Seara, T., Williams, S. M., Acevedo, K., Garcia-Molliner, G., Tzadik, O., Duval, M., et al. (2024). Development and analyses of stakeholder-driven conceptual models to support the implementation of ecosystem-based fisheries management in the U.S. Caribbean. *PLOS ONE, 19*(5), e0304101. https://doi.org/10.1371/journal.pone.0304101

Caribbean Fishery Management Council. 2022–2026 Strategic Plan.

Caribbean Fishery Management Council. U.S. Caribbean Ecosystem Status Report (ESR), draft January 2025.

Note: References utilized in developing the RAF are included at the end of each chapter of the RAF.

VI. Figures

Figure 1. The RAF scorecard, showing indicators, scoring key, category means, the data-gap adjustment, and the aggregate risk score. (Report Figure 1.2.)

RISK ASSESSMENT FRAMEWORK SCORECARD					
	INDICATORS	DATA SOURCE	SCORING KEY	PUERTO RICO	ST THOMAS/ST JOHN	ST. CROIX
			3=Increasing Risk;2=Consistent Risk;1 =Decreasing Risk 0=not scored	(If no island specific, use US Caribbean)	(If no island specific Data use USVI)	(If no Island specific Data use USVI)
Ecosystem Level Function Indicators						
To Be Identified in the Future/not scored		*To be determine*	*Scoring to be Determined*			
	MEAN ECOSYSTEM LEVEL FUNCTION INDICATOR SCORE		Add Scores from each indicator in this section and divide by the number of Ecosystem Level Sensitivity Indicators that were scored >0			
Distortive Pressure Sensitivity Indicators						
	Commercial Landings-Lobster	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0			
	Commercial Landings - Conch	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0			
	Commercial Landings -Finfish	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0			
	Recreational Landings	ESR	Use Arrow: Up=3;Flat=2; Down=2 no arrow =0			
	Sea Surface Temperature	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0			
	Sargassum Inundation	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0			
	Ocean Economy - Hotel Occupancy	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0			
	Ocean Economy - Air Visitors	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0			
	Ocean Economy - Cruise Visitors	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0			
	Water Quality - Enterococcus Bacteria Levels	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0			
	Water Quality- Turbidity by Ocean Color	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0			
	Ocean Economy -Permitted Offshore Energy/Aquacultı	ACOE/BOEMUS VI DPNR/ PRDNR	new permit in yr=3; no change but at least 1 permit =2; fewer permits than previous yr or no permits=1			
	Future Indicator: Coastal Development -Landscape Dei	*To be determine*	*Increase over Baseline=3; Decrease from baseline=2; Consistent with Baseline=2*			
	MEAN DISTORTIVE PRESSURE SENSITIVITY SCORE		Add Scores from each indicator in this section and divide by the number of Distortive Pressure Sensitivity Indicators that were scored >0			
Socio-Economic Sensitivity Indicators						
	Population Change	ESR	Use Arrow: Up=3;Flat=1; Down=3 no arrow =0			
	Unemployment Rate	ESR	Use Arrow: Up=3;Flat=1; Down=1 no arrow =0			
	Major Disaster Declarations	FEMA data	>/=one dec current yr=3; >/=none in curent but >/=1 dec in prior 3 yr=2; no dec in 3+ yr=1			
	Future Indicator: Commercial Fishing Engagement (no score until comparison year included)	ESR	# of communities=3or4 increases or decreases by 50+%=3; # of communities =3 or 4 increases or decreases by 25-49%=2; number of communities =3 or 4 increases or decreases by <25%=1			
	Future Indicator: Fishing Reliance (no score until comparison year included)	ESR	# of communities=3or4 increases or decreases by 50+%=3; # of communities =3 or 4 increases or decreases by 25-49%=2; number of communities =3 or 4 increases or decreases by <25%=1			
	MEAN SOCIO-ECONOMIC SENSITIVITY SCORE		Add Scores from each indicator in this section and divide by the number of Socio-Economic Sensitivity Indicators that were scored >0			
Coral Reef Ecosystem Sensitivity Indicators						
	Degree Heating Weeks	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0			
	Percent Coral Cover	ESR	Use Arrow: Up=1;Flat=2; Down=3 no arrow =0			
	Fish Density	ESR	Use both Density and Slope of Size Spectrum Arrows:Both Up=1;Arrows Mixed, Flat or One arrow missing=2; Both Down=3; Both arrows missing =0			
	Endangered/Threatened Species	NOAA	# of listed species increases =3; no change in # of listed species =2; # of listed species decreases =1			
	Future Indicator: Invasive Species	USVI DPNR/PRD	# of invasive species increases =3; no change in # of invasive species =2; # of invasive species decreases =1			
	MEAN CORAL REEF SENSITIVITY SCORE		Add Scores from each indicator in this section and divide by the number of Coral Reef Ecosystem Sensitivity Indicators that were scored >0			
	DATA GAP ADJUSTMENT FACTOR		A) Assign 1 point for each category where 1 or more of the subindicators is not scored (excluding Future Indicators) and multiply by .25. B) Assign .25 points if Ecosystem Level Category is not used. Add A +B and record.			
	OVERALL RISK SCORE		Sum Mean Scores from each category (colored Boxes) and add Data Gap Adjustment Factor. Before Ecosystem Level Indicator added =/> 7 = INCREASING RISK; Total Score between <7-5= CONSISTENT RISK; Total Score between <5-3 =DECREASING RISK After Ecosystem Level Function Category Added: Total Score >10=INCREASING RISK; Total Score between 5-10=CONSISTENT RISK Total Score <5=DECREASING RISK			

Figure 2. Completed pilot scorecard using the January 2025 draft ESR, shown as an example of a fully scored output. (Report Appendix A.)

RISK ASSESSMENT FRAMEWORK SCORECARD

RISK ASSESSMENT FRAMEWORK SCORECARD 2025					
INDICATORS	DATA SOURCE	SCORING KEY 3=Increasing Risk;2=Consistent Risk;1 =Decreasing Risk; 0=Not Scored	PUERTO RICO (If no Puerto Rico specific data use U.S. Caribbean)	ST THOMAS/ST JOHN (If no Island specific Data use USVI; If no USVI use US Caribbean)	ST. CROIX (If no Island specific Data use USVI; If no USVI use US Caribbean)
Ecosystem Level Indicators					
To Be Identified in the Future/not scored	*To be determine*	*Scoring to be Determined*			
MEAN ECOSYSTEM LEVEL INDICATOR SCORE		Add Scores from each indicator in this section and divide by the number of Ecosystem Level Sensitivity Indicators that were scored >0			
Distortive Pressure Sensitivity Indicators					
Commercial Landings-Lobster	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0	2	2	3
Commercial Landings - Conch	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0	2	2	2
Commercial Landings -Finfish	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0	2	2	2
Recreational Landings	ESR	Use Arrow: Up=3;Flat=2; Down=2 no arrow =0	2	2	2
Sea Surface Temperature	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0	2	2	2
Sargassum Inundation	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0	2	2	2
Ocean Economy - Hotel Occupancy	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0	2	2	2
Ocean Economy - Air Visitors	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0	3	3	3
Ocean Economy - Cruise Visitors	ESR	Use Arrow: Up=3;Flat=2; Down=3 no arrow =0	3	3	3
Water Quality - Enterococcus Bacteria Levels	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0	0	3	3
Water Quality - Turbidity by Ocean Color	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0	2	2	2
Ocean Economy -Permitted Offshore Energy/Aquacultu	ACOE/BOEMUS VI DPNR/ PRDNR	new permit in yr=3; no change but at least 1 permit =2; fewer permits than previous yr or no permits =1	1	1	1
Future Indicator: Coastal Development -Landscape Dev	*To be determined*	*Increase over baseline=3;Decrease from baseline=1;Consistent with baseline=2*			
MEAN DISTORTIVE PRESSURE SENSITIVITY SCORE		Add Scores from each indicator in this section and divide by the number of Distortive Pressure Sensitivity Indicators that were scored >0	2.1	2.2	2.3
Socio-Economic Sensitivity Indicators					
Population Change	ESR	Use Arrow: Up=3;Flat=1; Down=3 no arrow =0	1	1	1
Unemployment Rate	ESR	Use Arrow: Up=3;Flat=1; Down=1 no arrow =0	1	1	1
Major Disaster Declarations	FEMA data	>/=one dec current yr=3; >/=none in current but >/=1 dec in prior 3 yr=2; no dec in 3+ yr=1	3	3	3
Future Indicator: Commercial Fishing Engagement (no score until comparison year included)	ESR	# of communities=3or4 increases or decreases by 50+%=3; # of communities =3 or 4 increases or decreases by 25-49%=2; number of communities =3 or 4 increases or decreases by <25%=1			
Future Indicator: Fishing Reliance (no score until comparison year included)	ESR	# of communities=3or4 increases or decreases by 50+%=3; # of communities =3 or 4 increases or decreases by 25-49%=2; number of communities =3 or 4 increases or decreases by <25%=1			
MEAN SOCIO-ECONOMIC SENSITIVITY SCORE		Add Scores from each indicator in this section and divide by the number of Socio-Economic Sensitivity Indicators that were scored >0	1.7	1.7	1.7
Coral Reef Ecosystem Sensitivity Indicators					
Degree Heating Weeks	ESR	Use Arrow: Up=3;Flat=2; Down=1 no arrow =0	3	3	3
Percent Coral Cover	ESR	Use Arrow: Up=1;Flat=2; Down=3 no arrow =0	3	3	3
Fish Density	ESR	Use both Density and Slope of Size Spectrum Arrows:Both Up=1;Arrows Mixed, Flat or One arrow missing=2; Both Down=3; Both arrows missing =0	2	2	2
Endangered/Threatened Species	NOAA	# of listed species increases =3; no change in # of listed species =2; # of listed species decreases =1	3	3	3
Future Indicator: Invasive Species	USVI DPNR/PRD	# of invasive species increases =3; no change in # of invasive species =2; # of invasive species decreases =1			
MEAN CORAL REEF SENSITIVITY SCORE		Add Scores from each indicator in this section and divide by the number of Coral Reef Ecosystem Sensitivity Indicators that were scored >0	2.8	2.8	2.8
DATA GAP SCORE ADJUSTMENT FACTOR		A) Assign 1 point for each category where 1 or more of the subindicators is not scored (excluding Future Indicators) and multiply by .25. B) Assign .25 points if Ecosystem Level Category is not used. Add A +B and record.	0.5	0.25	0.25
OVERALL RISK SCORE		Sum Mean Scores from each category (colored Boxes) and add Data Gap Adjustment Factor. Before Ecosystem Level Indicator added =/> 7 = INCREASING RISK; Total Score between <7 5= CONSISTENT RISK; Total Score between <5 3 =DECREASING RISK After Ecosystem Level Function Category Added: Total Score >10=INCREASING RISK; Total Score between 5-10=CONSISTENT RISK Total Score <5=DECREASING RISK	7.1	7	7.1

Figure 3. Conceptual flow of decision-making with the RAF using the structured decision-making process, connecting risk scores to strategic objectives and management-tool selection. (Report Figure 1.1.)