Productivity Susceptibility Analysis
Part 1: Method Characterization

Assessment Category: Risk Analysis/Vulnerability

- PSA is a risk assessment method used in resource prioritization to identify which species are most at risk of overexploitation.
- Utilizes existing literature and expert knowledge to score species using 22 attributes of productivity (such as natural mortality rate) and fishery susceptibility (such as release mortality rate)
- Scores are combined across all attributes to calculate a total species risk
- Variable weights can be given to multiple scores for each attribute which are sampled via monte-carlo bootstrap to calculate a total risk distribution

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Data Inputs: Species biology, geographic range, fishery interaction

- 10 Productivity attributes and 12 Susceptibility attributes are scored
- Scores of 1, 2, and 3 represent low, moderate, or high values for a given attribute
  - High productivity (score 3) represents lower risk
  - High susceptibility (score 3) represents higher risk
- Score weights facilitate characterizing knowledge uncertainty
- A total weight for each attribute also allows species attribute prioritization

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Productivity Attributes	High(3)	Moderate(2)	Low(1)
R (intrinsic increase)	>0.5	0.5 – 0.16	<0.16
Maximum age	<10 years	10 – 30 years	>30 years
Maximum size	<60 cm	60 – 150 cm	>150 cm
VonBert (K)	>0.25	0.15 – 0.25	<0.15
Natural Mortality (M)	>0.4	0.2 – 0.4	<0.2
Measured fecundity	>10e4	10e2 – 10e4	<10e2
Recruitment	frequent	moderate	infrequent
Age at maturity	<2 years	2 – 4 years	>4 years
Mean trophic level	<2.5	2.5 – 3.5	>3.5

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Susceptibility Attributes	Low(1)	Moderate(2)	High(3)
Management strategy	catch limits and proactive accountability	catch limits and reactive measure	no catch limits
Areal overlap	<25% stock in fished area	25 – 50%	>50%
Geographic concentration	Stock in >50% of its range	25-50%	<25%
Vertical overlap	<25% stock in fished depths	25 – 50%	>50%
Spawning stock biomass	B/B0>0.4	B/B0 0.25 – 0.4	B/B0<0.25
F/M	<0.5	0.5 – 1	>1
Seasonal Migration	decrease fishery overlap	no impact	increase fishery overlap
Schooling and other behavior	decrease catchability	no impact	increase catchability
Morphology/gear selectivity	Low	Moderate	High
Post release survival	>67%	33-67%	<33%
Fishery desirability/value	High	Moderate	Low
Fishery impact to ESF	Minimal	Significant but mitigated	Significant and unmitigated

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Assessment Output: Other Control Rule Metric

- Does not provide management advice just risk characterization

Management Measure: Other

- Characterizes risk to inform species assessment prioritization

Asessment Tier: Pre-assessment Stock Prioritization (SP)

Productivity Susceptibility Analysis

https://connect.fisheries.noaa.gov/psa/

Productivity Susceptibility Analysis
Part 2: Method Evaluation

The required data are currently available for some number of Caribbean species based on the data reviews provided in the Data Webinars.

- Data are available to score many attributes for many species

Current data align with the necessary spatial and temporal coverage, extent, and resolution needed for the method.

- Basic categorization of values from low to high risk

The method is comprised of analyses that rely on solid theoretical ground.

- Original approach has been used in dozens of published applications for thousands of species

The method is not sensitive if data or parameters are limited or missing.

- Ability to incorporate uncertainty could increase robustness of method to missing data

The method effectively characterizes significant sources of uncertainty.

- Monte-carlo capabilities now allow uncertainty in parameter scores to be incorporated

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Part 2: Method Evaluation

The method, in one application, has the ability to cover multiple taxa simultaneously.

- Partially. Inputs only cover one taxa or group at a time. Can be plotted simultaneously after input.

The method considers broader aspects of ecosystem productivity, structure, and/or function including biodiversity and/or trophic flows.

- No, primarily single species focused.

The method accounts for impacts to the taxa including environmental dynamics or changing ocean conditions.

- Many existing categories in susceptibility could be adapted to consider broader environmental factors.

The method considers impacts of broader societal, cultural, indigenous, and economic conditions.

- Yes through fishery desirability.

The method produces comprehensive reference points relative to actionable management by the CFMC (e.g., biological, ecosystem, and/or economic).

- Method is targeted at species prioritization, produces a vulnerability reference point that can be used to prioritize and justify the need for more intensive assessment methods.

Productivity Susceptibility Analysis
Part 3: Method Characterization

Method practicality

- Relatively fast to implement with sufficient expert knowledge. Uncertainty would be best characterized by a group implementation effort

Method bottleneck or caveats

- Basic categorization of species from low to high risk so that limited assessment resources can be targeted at most at risk species

Expected method timeline

- Fast to implement once required information has been collected

Required data acquisition, preparation, or analyses

- Requires relevant literature data to be collected and knowledgeable experts to be available to score attributes without published data