Overview of Productivity Susceptibility Analysis (PSA)

What is a PSA?

A Productivity and Susceptibility Analysis (PSA) is a method for assessing the vulnerability of a fishery species or stock, using a set of predetermined measurable attributes and score rankings. PSA assumes that the overall vulnerability of a fished species to impacts from fishing depends on two characteristics:

1. the *productivity* of a species/stock based on life history traits that determine whether a fished species could sustain or recover from fishery-related impacts
2. the *susceptibility* of the species/stock to impacts from fishery-specific activities.

A PSA can assist with prioritizing fisheries for management in a manner that is quantitative and transparent based on a species' relative vulnerability to fishing pressure.

What a PSA Does…

- Assesses potential vulnerability of stocks to fishing activities by comparing *relative* risk among assessed species
- Assesses both data-poor and data- rich species within the same analysis
- Alerts managers to fisheries that are likely to be most sensitive to a particular method of fishing
- Useful for a baseline comparison among many species with varying levels of available information
- Can be conducted alone or as part of a series of data analyses on vulnerability

What a PSA Doesn't Do…

- Does not provide information on the current status of a stock, only the vulnerability to fishing
- Does not assess *absolute* risk
- Does not specify harvest guidelines or management actions

Conducting a PSA

Using the PSA approach, productivity and susceptibility attributes of each stock are examined and scored. Common attributes scored in a PSA include natural mortality rate, age at maturity, and the aerial overlap of fishing activity with the species' range. Different PSA methods may have different sets of attributes that are scored. Scores are then used to calculate overall vulnerability and are graphed to produce a PSA plot (see right). Using this information, managers can prioritize stocks based on each fishery's need for management action. PSA results may also highlight gaps in understanding about a species' biology.
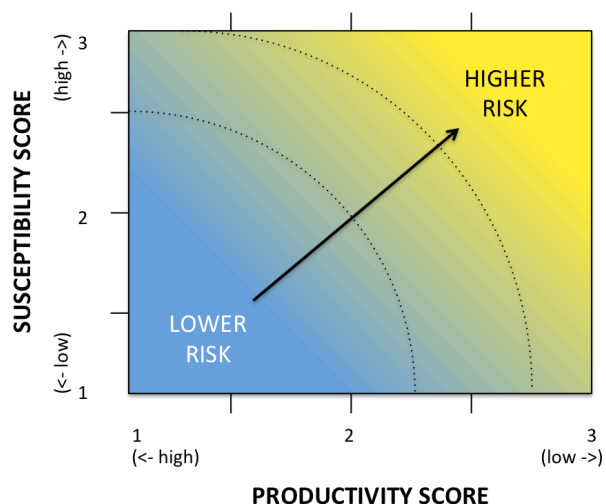
A PSA plot illustrates the relative vulnerability determined by the combination of productivity (x---axis) and susceptibility (y---axis). Rankings are given a score (1 to 3 for high to low productivity, respectively; and 1---3 for low to high susceptibility, respectively).

Pilot Project: Selecting and Applying a PSA for California Marine Fisheries

A PSA was conducted as part an information gathering process related to California's Marine Life Management Act (MLMA) Master Plan Amendment. Four versions of PSA methodologies were considered for use in this analysis. Each version was adapted from an approach developed by a joint Australian CSIRO/AFMA project for Ecological Risk Assessment for the Effects of Fishing[1], and provides a robust basis for a precautionary evaluation of vulnerability of fishery resources. Each method has slightly varying attributes and rankings.

The NOAA PSA was selected for this evaluation based on its inclusion of attributes that evaluate the management strategy and the value of a stock, and its ability to consider uncertainty in data sources as part of a separate data quality score. Scoring for this project was conducted by MRAG America's, with input and review from California Department of Fish and Wildlife experts.

How can PSA results be used?

PSA results can be used in several ways, depending on the needs of resource managers:
- The approach can provide information on stock needs in terms of management attention and data improvement;
- For relatively higher risk species, a PSA highlights the attributes which can potentially be altered through management to reduce a species' vulnerability to an identified fishery; and
- Comparing overall vulnerabilities across species can provide information to understand where management changes might offer benefits for reducing potential risk to a stock.

Next Steps

The PSA is anticipated to be a primary basis for the initial priority list of fisheries presented in the draft amended MLMA Master Plan. However, additional considerations including ecological interactions, the degree to which risks are being addressed, and economic opportunities may also help shape the prioritization component of the framework for MLMA-based management.

About this Project

This project was developed for consideration by the California Department of Fish and Wildlife (CDFW) to help inform the state's process to amend the Marine Life Management Act (MLMA) Master Plan. All final products from this project will be submitted to CDFW for review and may be integrated, in full or in part, into a draft Master Plan Amendment. Additional information about the amendment process, including key resources and opportunities for stakeholder engagement, is available at https://www.wildlife.ca.gov/Conservation/Marine/Master-Plan.

References
1. Hobday et al, 2007. https://publications.csiro.au/rpr/download?pid=changeme:3904&dsid=DS1
2. NOAA Fisheries Productivity Susceptibility Analysis
   http://www.nmfs.noaa.gov/sfa/laws_policies/national_standards/psa.html

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