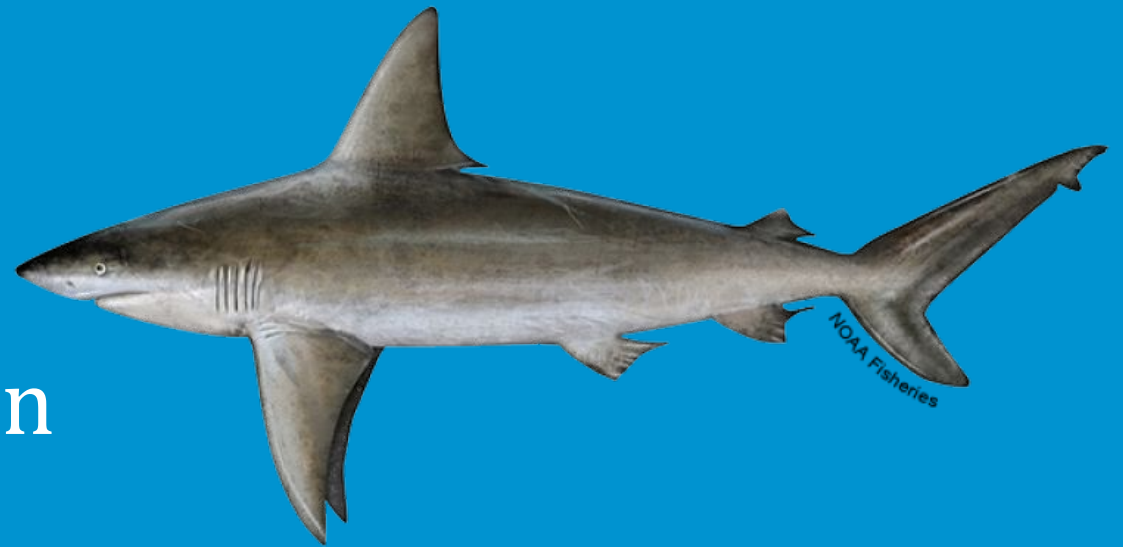




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SEDAR 101: Highly Migratory Species Sandbar Shark



Data Workshop Introduction
April 2026
Charleston, SC

Outline

- Data Workshop Goals
- Review data concerns and changes from previous assessments
- What is a Management Strategy Evaluation (MSE) and why use it?
- What are the data requirements for the models?

Analyst Goals for Data Workshop

- **Ensure quality over quantity:**
 - Convey model specifics and issues from past assessments as needed to participants (e.g. data providers and stakeholders)
 - Help data providers understand the implications of their data
 - Encourage data providers to share their expert opinions when discussing data quality and timelines for use in the models
 - Ensure documentation of decisions, expert opinion about the fisheries, and data uncertainty are clear in the DW report
- **Specifically for MSE:**
 - Characterize uncertainty for reference and robustness sets (details to come in later slides)
 - Provide alternate states of reality and their plausibility

Assessment History

- **Sandbar shark** have been assessed through the SEDAR process three times: 2006 (SEDAR 11), 2011 (SEDAR 21), 2017 (SEDAR 54)
- These models have increased in complexity as more data become available and computing becomes more powerful

Increasing Model Complexity

- **SEDAR 11 (2006) → SEDAR 21 (2011) → SEDAR 54 (2017)**
- **Start year:** 1975 → 1960 → 1960
- **Commercial catch:** One series → Gulf + Atlantic → Gulf + Atlantic
 - Different selectivity curves (double normal and asymptotic) with justifications regarding cryptic biomass (i.e. results-driven) for fleets
 - These decisions should be data-driven
- **Indices:** 8 indices (2 selectivities) → 11 indices (8 selectivities) → 11 indices (9 selectivities)

Is this increase in complexity giving us better management advice?

Current Focus

- Additional scrutiny is needed to avoid an unstable model with conflicting inputs
- Do we truly have data for the complexity in the model?
- Managing with highly uncertain data (e.g. catches) requires alternative management advice.

Management Strategy Evaluation



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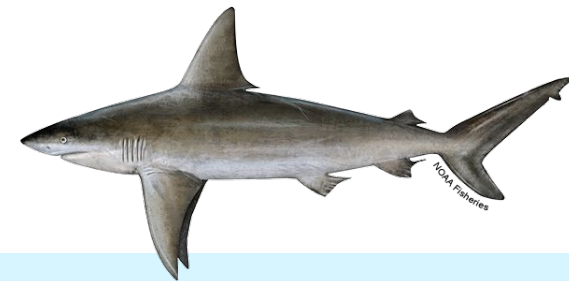
Why MSE?

Stock assessment purpose: *What is the best estimate of current stock status?*

MSE purpose: *Can we develop effective management advice despite uncertainties in stock and fishery dynamics?*

For HMS sharks / sandbar:

- **High uncertainty:** Limited information content in data (rec uncertainty, international landings); historical uncertainty in species identification; uncertainties in life history (e.g., repro cycle)
- **Lack of robust management:** Management advice is predicated on things we may not know (many stock assessment assumptions)
- **Limited capacity:** limited analyst time and data quality to support complex assessment models; heightened focus on scientific streamlining
- **Good indicators:** to support empirical approaches
- **Sandbar** is comparatively data-rich (e.g., good first application)

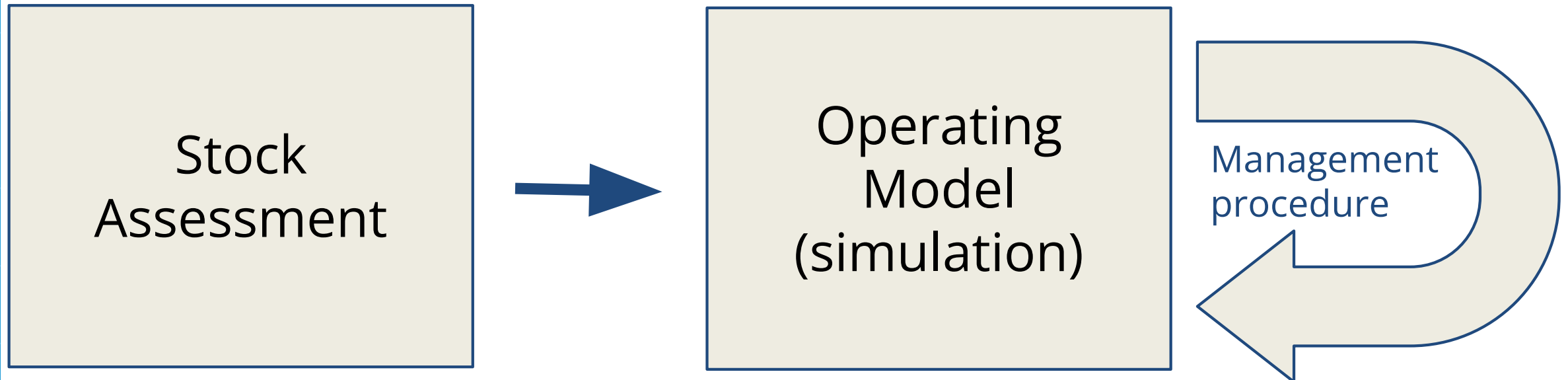




MSE as an extension of stock assessment

MSE is designed to stress-test candidate management procedures prior to implementation

With minimal modifications, we can easily convert a stock assessment into an MSE operating model for the purposes of management procedure testing



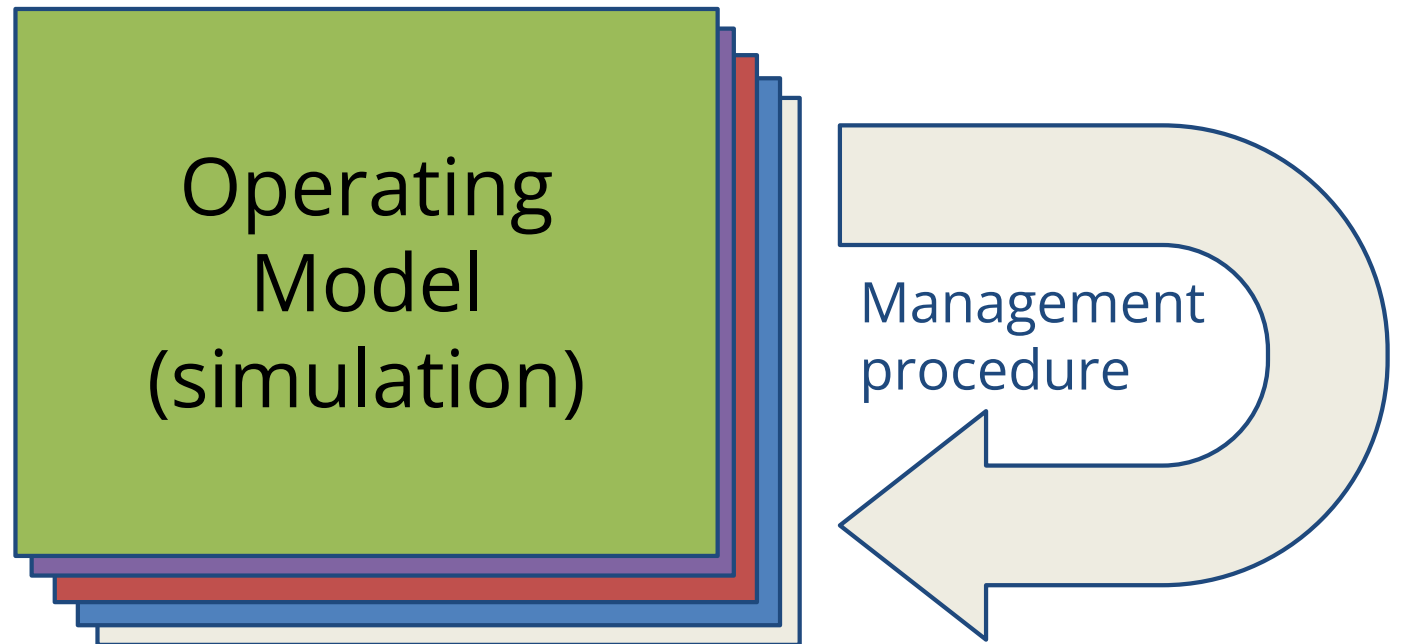


Encompass uncertainty

Develop multiple simulated operating models (states of nature) to encompass reasonable uncertainty in the stock, data, fishery, future.

Test management procedures across all operating models to ensure robustness.

TORs: Important to document any important assumptions / uncertainties that may impact management and therefore should be included in the OM grid





MSE: Operating models

Operating Models (OMs) - the simulated dynamics of the system that represent distinct hypotheses or plausible realities of the current and future dynamics of the system

- Conditioned on available data to ensure simulated data are of realistic quality

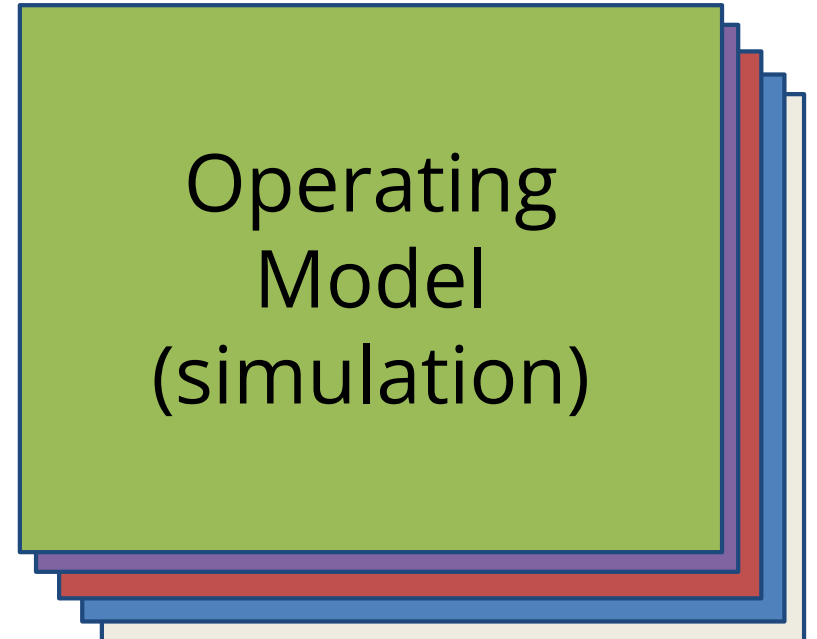
Multiple OMs designed to encompass reasonable uncertainty to which the MP should be robust

Reference / Base-case OM - single / central OM that represents best hypothesis of stock behavior

Reference set of OMs - set of OMs that include the most important uncertainties on which MP will be tuned (parameterized)

Robustness set of OMs - sensitivity OMs that include secondary uncertainties; used to further differentiate MP performance and designate exceptional circumstances

TORs: Important to further categorize assumptions / uncertainties into those of primary and secondary importance for reference and robustness OM grids.





MSE: Operating models

Reference / Base-case OM - stock assessment model

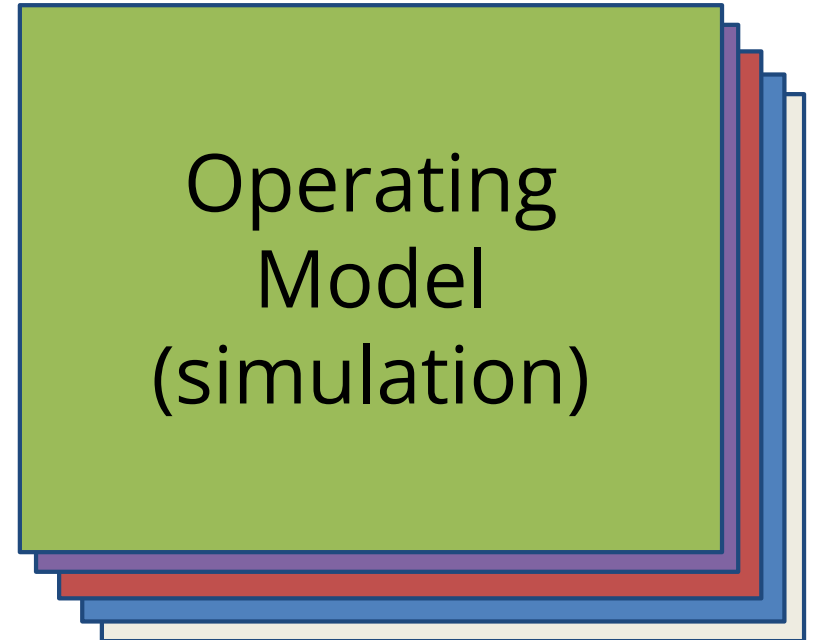
Reference OM uncertainties - set of models that include the most important uncertainties on which the MP will be tuned (parameterized)

- Examples:
 - Reproductive cycle
 - Historical species identification

Robustness OM uncertainties - sensitivity models that include secondary uncertainties; used to further differentiate MP performance and designate exceptional circumstances

- Examples:
 - Future nonstationarity
 - Mexican landings

TORs: Important to further categorize assumptions / uncertainties into those of primary and secondary importance for reference and robustness OM grids.



MSE: Management Strategy Evaluation

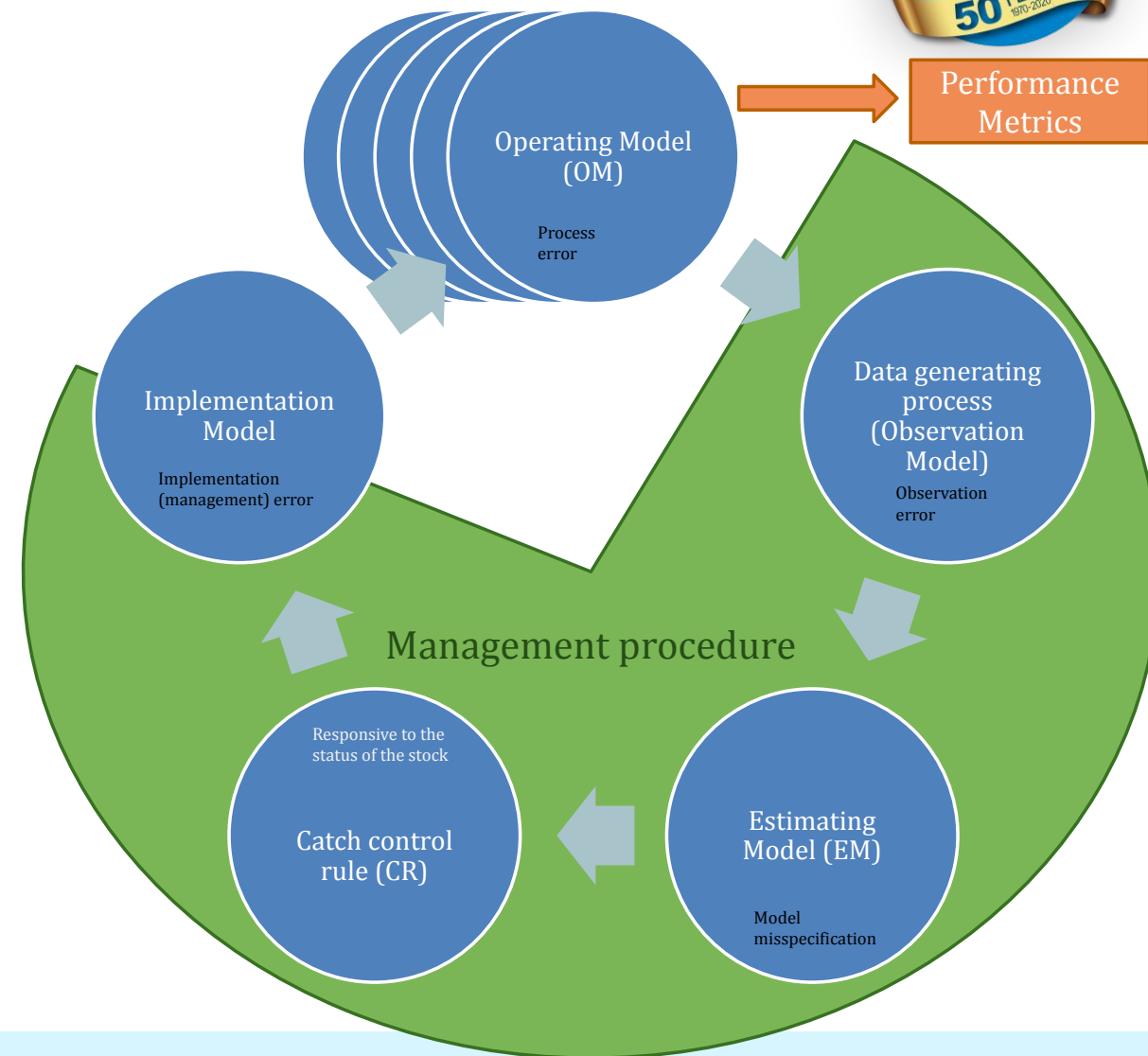


MSE - a framework in which alternate management procedures are developed and stress-tested across a suite of uncertainties through closed loop simulation

Operating Models - the simulated dynamics of the stock, fishery, and ecosystem that represent distinct hypotheses or plausible realities of the current and future dynamics of the system

Management procedures - pre-defined recipe for how management recommendations should be adaptively adjusted following the behavior of the stock

Observation Model - data-generating process to include observation error



MSE: Management Strategy Evaluation



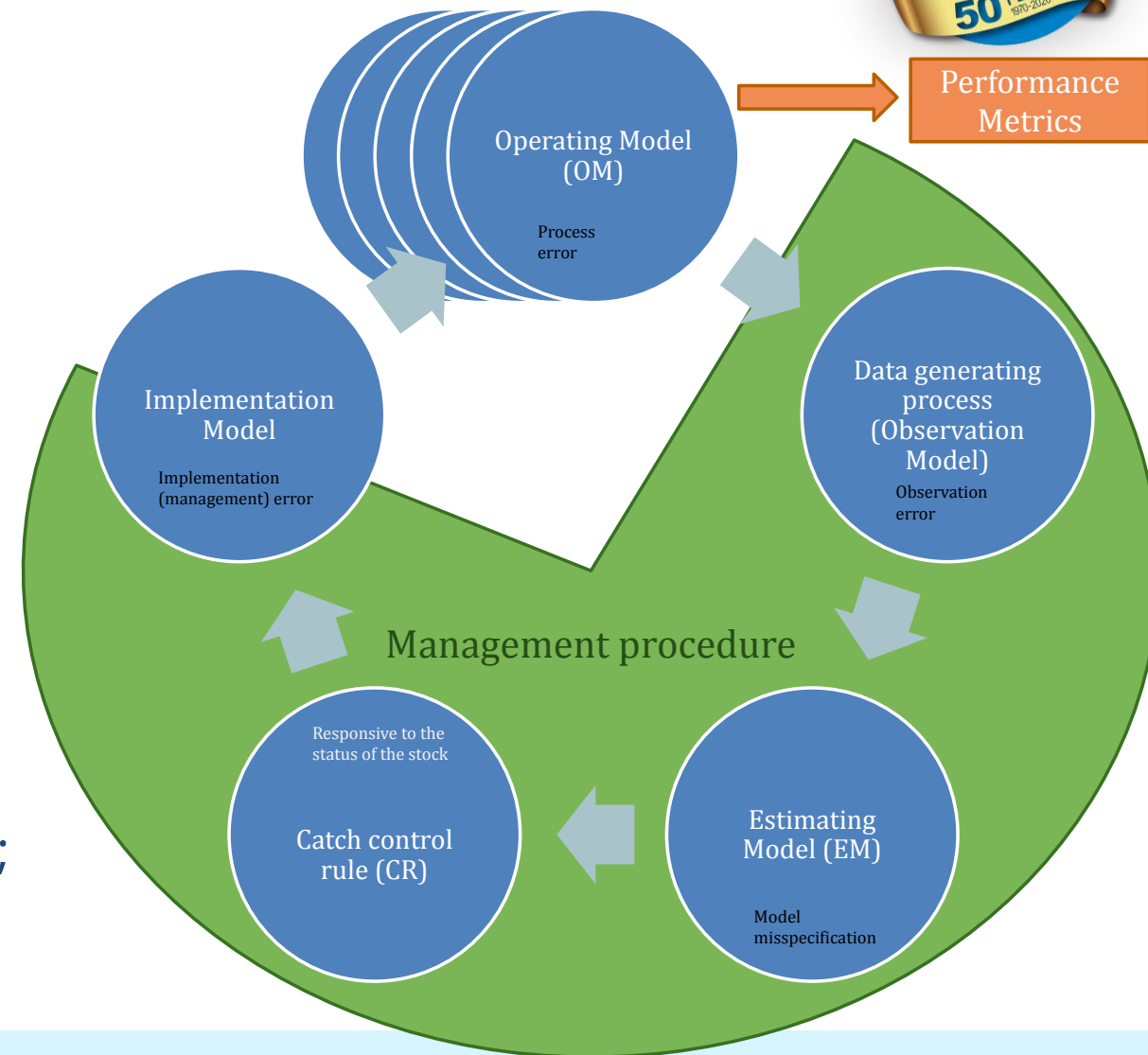
Estimating Model - data analysis process to include model error

ABC Control Rule - algorithm to adjust management based on perceived state of stock

Implementation Model - management implementation with associated implementation error

Performance Metrics - statistics that summarize MP performance and reflect management objectives / goals

Exceptional Circumstances Provisions - MP guardrails that ensure adopted MP is not applied in scenarios that were not MSE tested; provide scientific ground to overrule MP





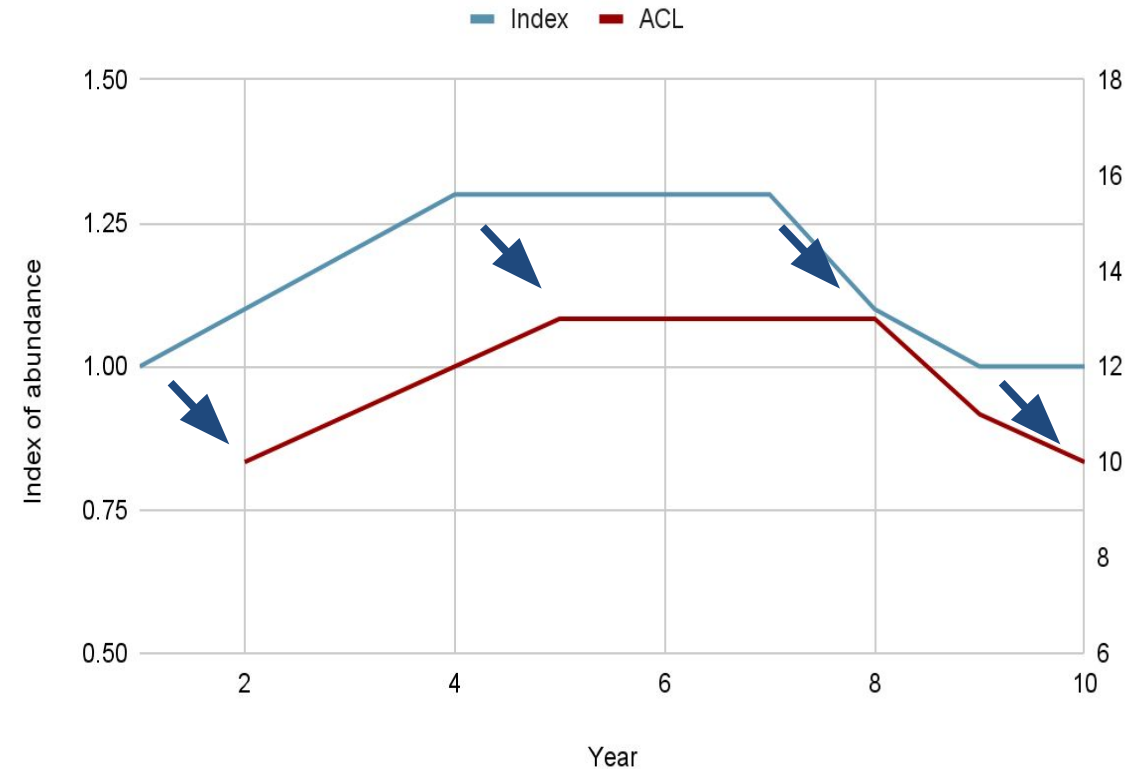
MSE: Management procedure

Management procedures (MP) - pre-defined recipe for how management recommendations should be adaptively adjusted following the behavior of the stock

- **Empirical MP** – indicator-based MP, where management recommendation (ACL) follows behavior of indicator of relative abundance (e.g., survey index)

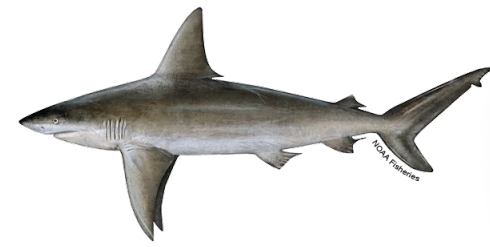
MP tuning - parameterizing the MP to meet key management performance targets (e.g., achieve biomass equal to B_{MSY} by end of rebuilding period)

TORs: important to document data-stream that would be useful indicators for MP



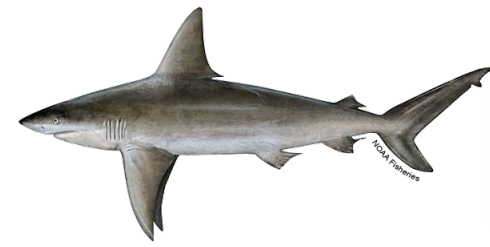
* simplified example

MSE: TORs



- For each data stream:
 - As appropriate, identify uncertainties in [data] that should be considered within the MSE.
- For indices:
 - As appropriate, identify available indices for consideration as management procedure indicators.

MSE: TORs



- If concluded at the data scoping webinar that there is sufficient data identified and available on ecosystem, climate, species interactions, habitat considerations, and/or episodic events that would be reasonably expected to affect population dynamics, then these should be provided as appropriate.
 - As appropriate, provide key levels of historical and projected uncertainty to be considered in the MSE.
 - Identify how future nonstationarity should be characterized and modeled within the MSE.
- Categorize key axes of uncertainty into reference (primary) or robustness (secondary) uncertainties.
 - As appropriate, identify a most likely set of parameter values to serve as the base-case scenario.

SEDAR101 Data Working Groups

- **Life History**
- **Catch Statistics**
- **Indices**
- **Ad Hoc Working Groups**
 - **Discard Mortality**
 - **Bycatch**

Life History

- **Workgroup Leads:** *Michelle Passerotti with Trey Driggers (remote)*
- **Data Sources**
 - Age and growth
 - Tag recapture
 - Reproduction
- **Data Uncertainty**
 - Reliability of ageing vertebrae?
 - Maximum age? Maturity at age?
 - Reproductive cycle?

Stock Structure

- Modeled as a single stock
 - Tagging studies suggest that one unit stock exists from Cape Cod south down the U.S. Atlantic coast and into the Gulf of America (SEDAR11)
 - Genetic data indicate no significant differentiation between the Gulf of America and western North Atlantic (SEDAR21)
 - Unchanged from SEDAR54

FIGURES FROM SECTION 3.1 Replication Analysis

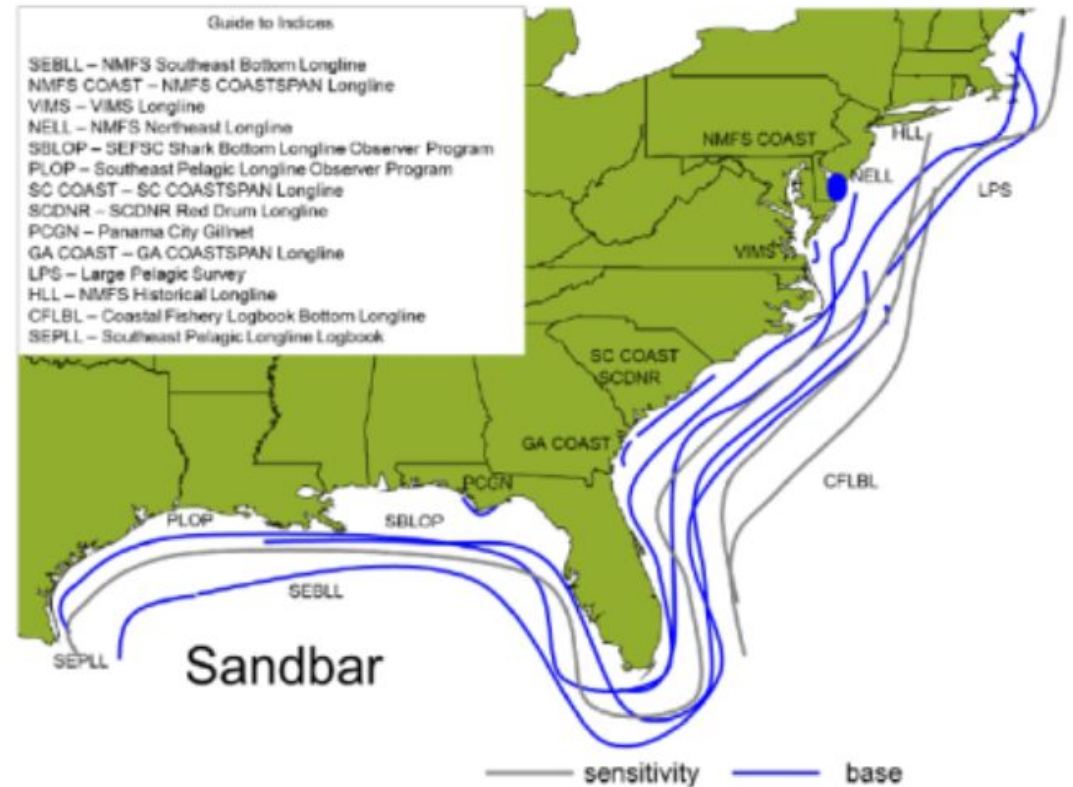


Figure 3.1.1. Approximate linear coverage of specific abundance indices for sandbar sharks (*Carcharhinus plumbeus*) along the coast of the Gulf of Mexico and Atlantic Ocean. Blue lines indicate the indices of abundance used in the SEDAR 21 base case assessment, as well as in the SEDAR 54 replication analysis. Grey lines indicate indices of abundance used in the SEDAR 21 sensitivity analysis.

Reproductive Output

- **SEDAR 11 (2006) → SEDAR 21 (2011) → SEDAR 54 (2017)**
- Median maturity: 19yrs → 13yrs → 13yrs
- Reproductive cycle: 2yrs → 2.5yrs → 2.5yrs
 - 2.5yr estimate cited compromise between 2yr and 3yr
 - Under MSE, can provide these as a reference set if desired

All is up for discussion as data support.

Age, Growth, and Mortality

- SEDAR 11 (2006) → SEDAR 21 (2011) → SEDAR 54 (2017)
- Age validation? Reliability of ageing vertebrae?
- Maximum age?
 - Life span: 40 yrs → 27 yrs → 31 yrs
 - Tag-recapture study where a shark was **at large for 27.7 years** (Andrews et al. 2011)
- Growth parameter K
 - Growth parameter K: 0.09 → 0.12 → 0.12
- Natural mortality
 - Uncertainty ranges associated with maximum age?

Catch Statistics

- **Workgroup Lead:** *Vivian Matter*
- **Data Sources**
 - Commercial landings
 - Recreational landings
- **Data Uncertainty**
 - Species identification issues?
 - Impact of low sample sizes on estimate magnitude?
 - Regulatory effects / selectivity?
 - Impact of Mexican landings / fleet?

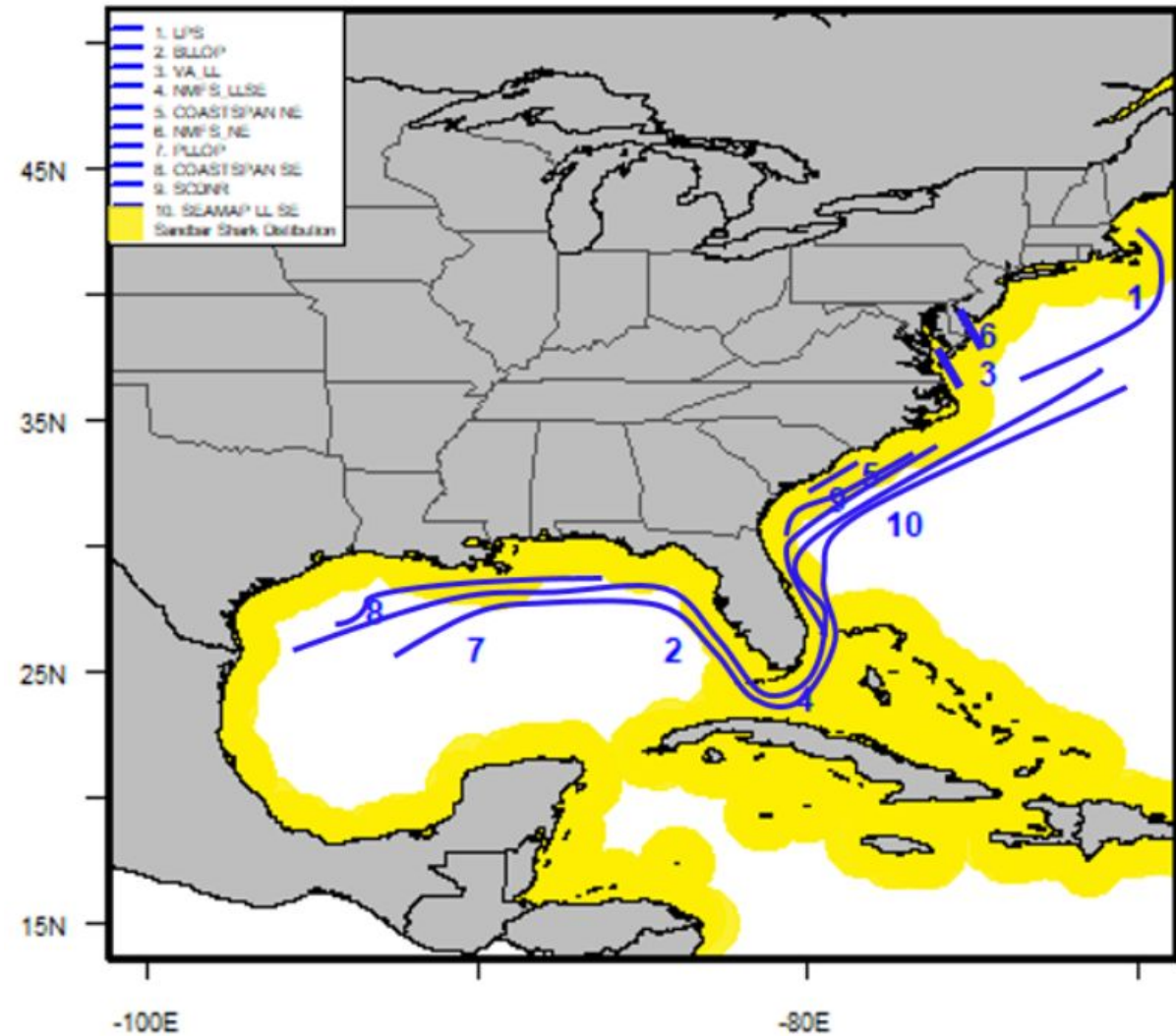
Indices

- **Workgroup Lead:** *John Carlson*
- **Data Sources**
 - Fishery-Independent Indices
 - Fishery-Dependent Indices
- **Data Uncertainty**
 - Spatial footprint representative of entire stock?
 - Proportion positive sufficient? / Regulatory effects?
- **Empirical Management Procedure**
 - Candidate indices to represent population?

Indices

- Are these all adding to the quality of information in the assessment?
- Characterize the portion(s) of the population represented by each index in space and time, and provide estimates of uncertainty

SEDAR 54 Study Area



Discard Mortality (Ad Hoc)

- **Workgroup Leads:** *Dean Courtney and Annsli Hilton*
- **Data Sources**
 - Discard mortality estimates
- **Data Uncertainty**
 - Plausible ranges for MSE
 - Spikes in discards around mid-late-2000's
 - Due to regulations? (Capture effects)
 - Due to how data were collected? (Remove effects)

Bycatch (Ad Hoc)

- **Workgroup Leads:** *John Carlson and Vivian Matter*
- **Data Sources**
 - Bycatch / discard estimates
- **Data Uncertainty**
 - ‘Targeted trip’ impacts?

Presentation Recap

- We encourage data providers to directly answer questions raised during this presentation and in the Terms of Reference, and document suggested time blocks for data sources in final working group reports.
- Data workshop expectation is quality data over quantity, specifically considering (e.g.):
 - Life history parameterization
 - Documenting uncertainty in catch statistics
 - Index recommendations, particularly for MSE

Questions?

Contacts

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