Management strategy evaluation made operational with Stock Synthesis

Nathan Vaughan, Kathryn Doering, John Walter, Rick Methot, Skyler Sagarese, Matthew Smith, Nancie Cummings, and Nick Farmer

CAPAM

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Goals of this presentation (and this week)

- Objectives of the SSMSE project
- Describe our planned features
- Obtain feedback on desired features
- *Solicit interested volunteers to act as a review panel and/or beta testing user group*

Regardless of the nature of next-generation assessments, capacity to function as operating models is quite important in our opinion. More complicated EMs might not be necessary in many assessment situations, however incorporating necessary degrees of complexity is critical for OMs.

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What is the SSMSE project?

- The Stock Synthesis management strategy evaluation (SSMSE) project is a joint collaboration between SEFSC/SERO and NWFSC

- Our goal is to enable management strategy evaluation (MSE) to be performed more directly within the Stock Synthesis Framework (SS) utilizing as much of the SS 'engine' as possible

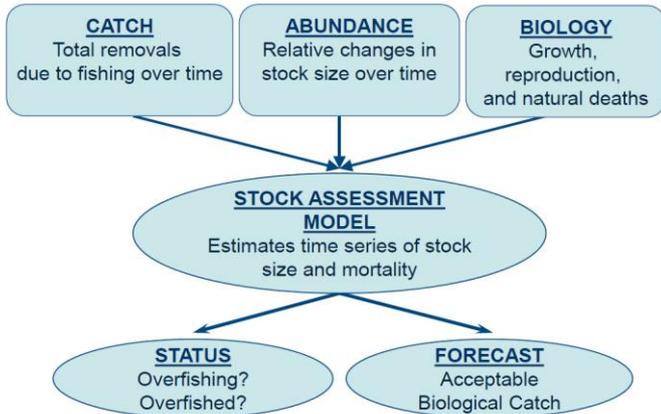- Expected development time of 2 years

Existing approaches

- FLR, DLMtool, MSEtool - utilize information from existing SS stock assessments and use it to configure a simplified, non-SS operating model

- ss3sim - simulation study R package using SS operating models, but lacks feedback to make it truly an MSE

- MSEs for specific stocks have used SS operating models (e.g., North Pacific Albacore), but not generic

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Origins of the SSMSE project?

• Southeast U.S. stock assessments tend to include additional complexities not required in other regions:

• Discards and bycatch

• Fleet allocations

• Large recreational component for some stocks

SEDAR52, Gulf of Mexico Red Snapper

Potential Application: Interim Analysis

Operational

CATCH	ABUNDANCE	BIOLOGY
Total removals due to fishing over time	Relative changes in stock size over time	Growth, reproduction, and natural deaths

STOCK ASSESSMENT MODEL
Estimates time series of stock size and mortality

STATUS
Overfishing?
Overfished?

FORECAST
Acceptable
Biological Catch

Interim Analysis

Index increasing ABC_{t+1}

ABC_t **No change** ABC_{t+1}

Index decreasing ABC_{t+1}
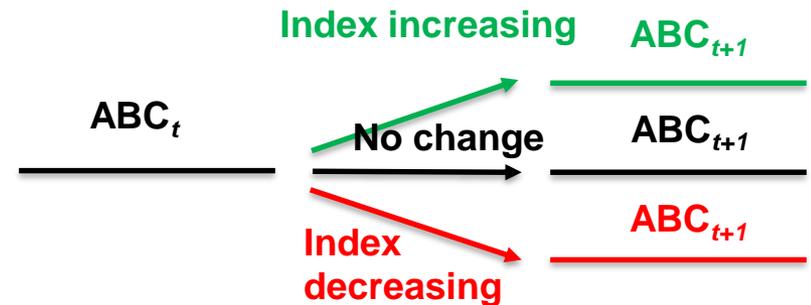
Data Collection & Analyses:
- Catch
- Survey Indices

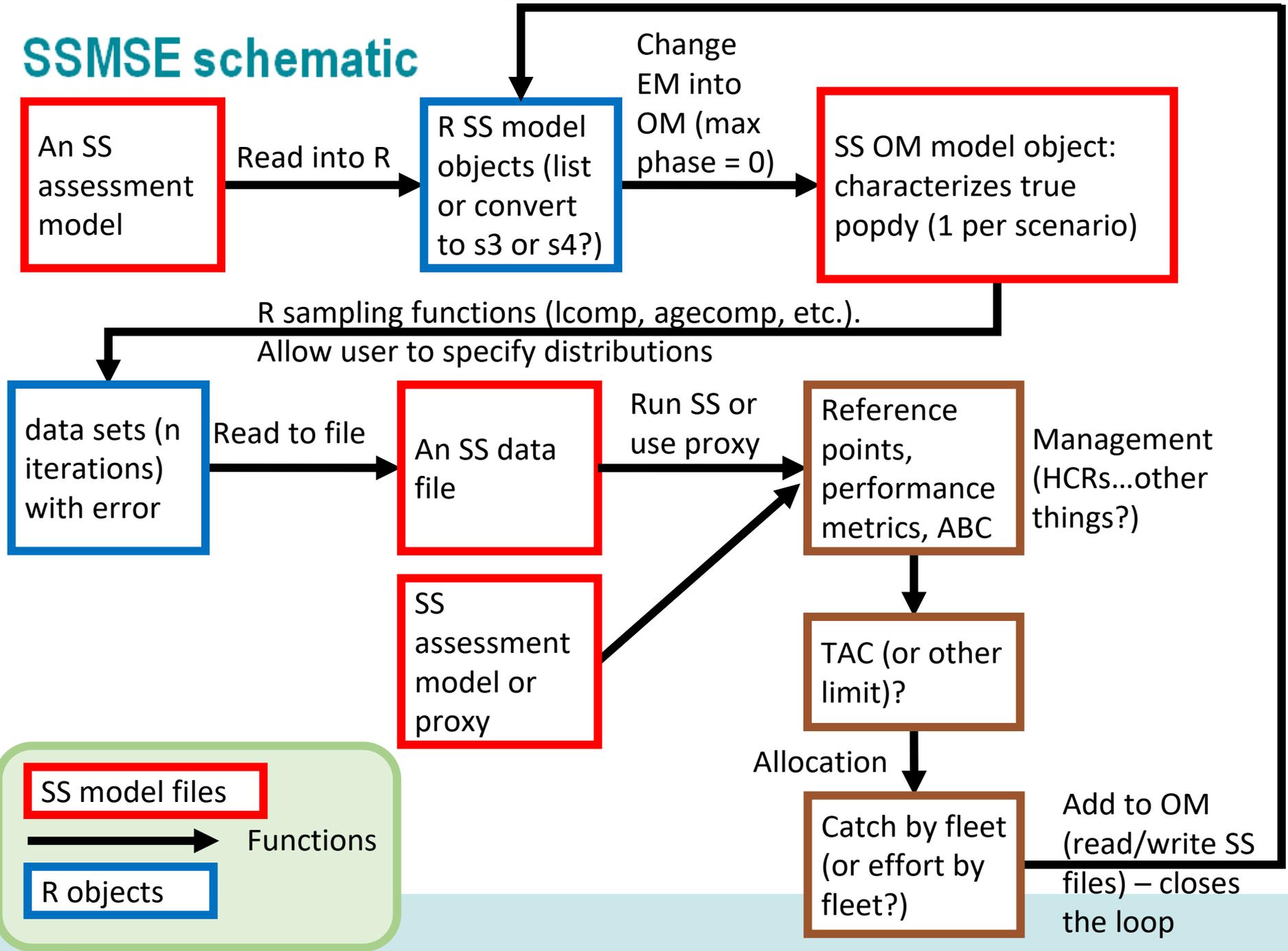**Year _t_**   **Year _t + 1_**

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SSMSE proposed approach

- Build on existing approaches to make an MSE tool that can use **ANY** SS model as a basis for creating OMs in SS and run a closed-loop MSE

- Use fitted and peer-reviewed SS stock assessment models for creating operating models with SS

- Expand on data generation capabilities within SS to develop more realistic-looking datasets

SSMSE schematic

An SS assessment model → **Read into R** → R SS model objects (list or convert to s3 or s4?) → **Change EM into OM (max phase = 0)** → SS OM model object: characterizes true popdy (1 per scenario)

R sampling functions (lcomp, agecomp, etc.).
Allow user to specify distributions

data sets (n iterations) with error → **Read to file** → An SS data file → **Run SS or use proxy** → Reference points, performance metrics, ABC

Management (HCRs…other things?)

SS assessment model or proxy

Reference points, performance metrics, ABC → TAC (or other limit)?

Allocation

TAC (or other limit)? → Catch by fleet (or effort by fleet?) → **Add to OM (read/write SS files) – closes the loop**

SS model files

→ Functions

R objects

Advantages of leveraging SS as OM

- Numerous peer-reviewed models already exist

- A large existing user base

- One of the most complex general models available

- Extensive testing and cross validation of underlying model structure and results

- Continuous support and updates

- Integrates the stock assessment and MSE processes

SSMSE planned features

- Simulate sample data with biases and uncertainty
  - Catches/Discards
  - Indices
    - Important for multi-index assessments and interim assessments
  - Age/Size Composition

- Need to generate distributions that reflect historic trends

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SSMSE planned features

- Proposed time-varying deviations in
    - Recruitment
        - Need randomized deviations that reflect the historic trends (autocorrelation, variability)
    - Natural mortality
    - Fleet selectivity
    - Fleet allocations
- Proposed estimation models
    - SS as EM (degrees of sin?), simple catch proxies

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Balancing internal SS modifications with creation of external R functions

- Utilizing internal SS functions
  - Ensures compatibility with future SS updates
  - Facilitates use by SS users for purposes beyond MSE
- Implementing external R functions
  - Simplifies collaboration in feature development
  - Does not risk adding code to SS that could slow down SS for all users
  - Individual R functions are available for purposes beyond MSE
  - But...requires updating with changes to SS

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    - Ian Taylor
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Questions/Discussion

WE WANT YOU!

We are hoping to solicit all interested participants to form a project steering/review committee and users to act as initial beta testers.