



**NOAA
FISHERIES**

NOAA Next-Generation Stock Assessment Goal: “Right-Sizing” Stock Assessments

SEFSC Staff

**GMFMC SSC Meeting
October 2-5, 2018
Tampa, FL**

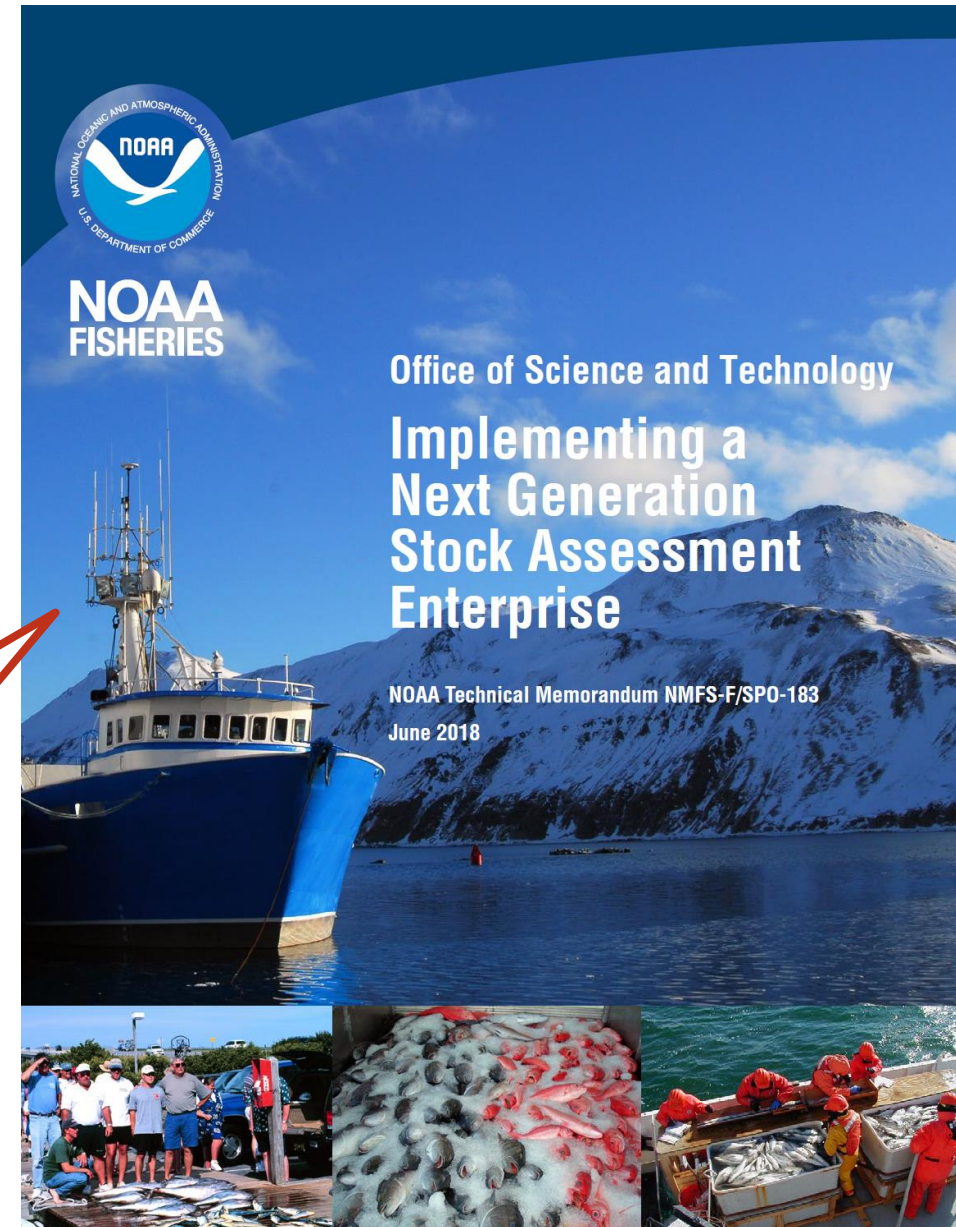


NOAA FISHERIES

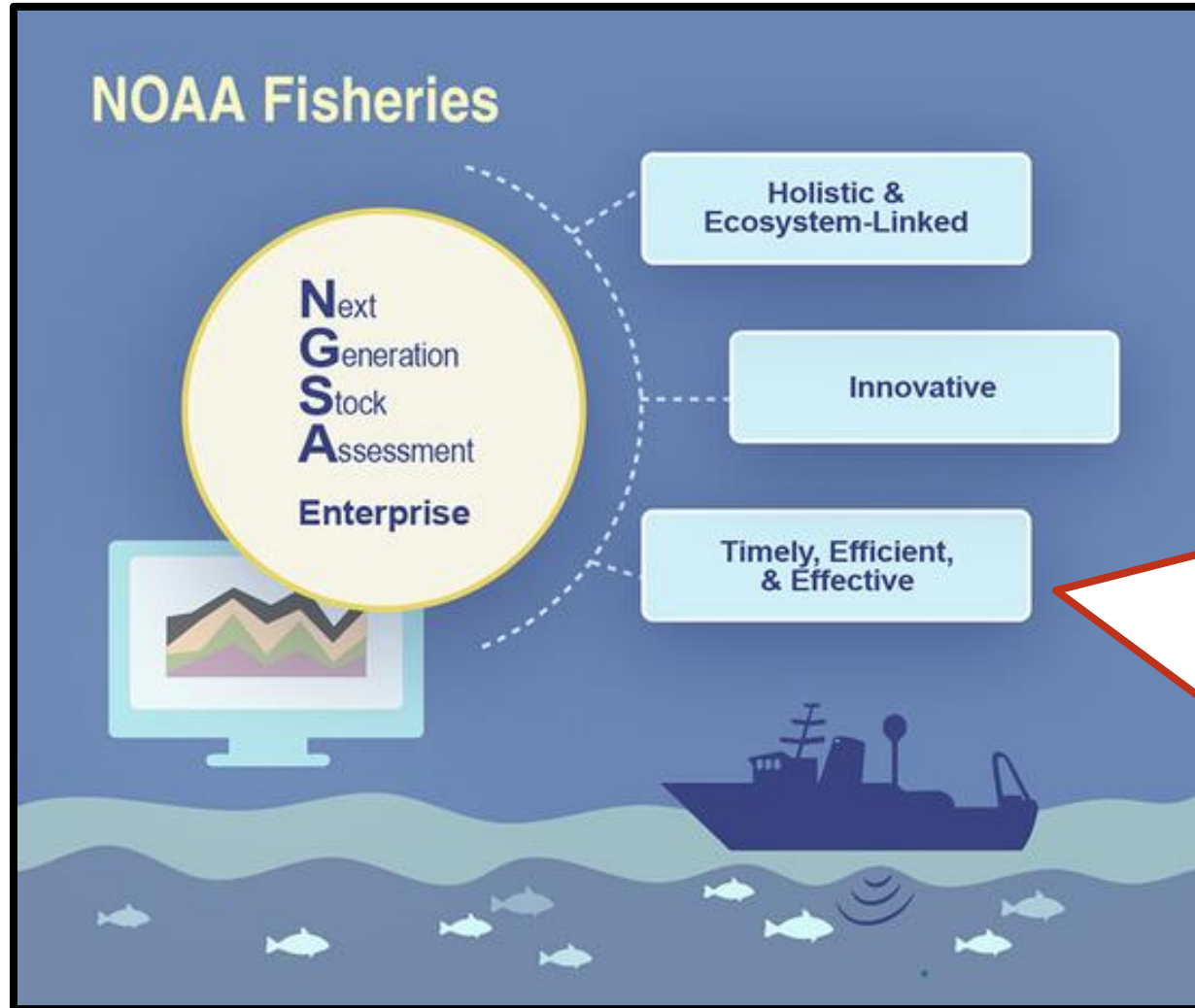
INTRODUCTION

- In 2001, NOAA Fisheries published the first Stock Assessment Improvement Plan.

In response to new legal mandates, decades of research and development of new scientific tools, a new strategic document was published in 2018

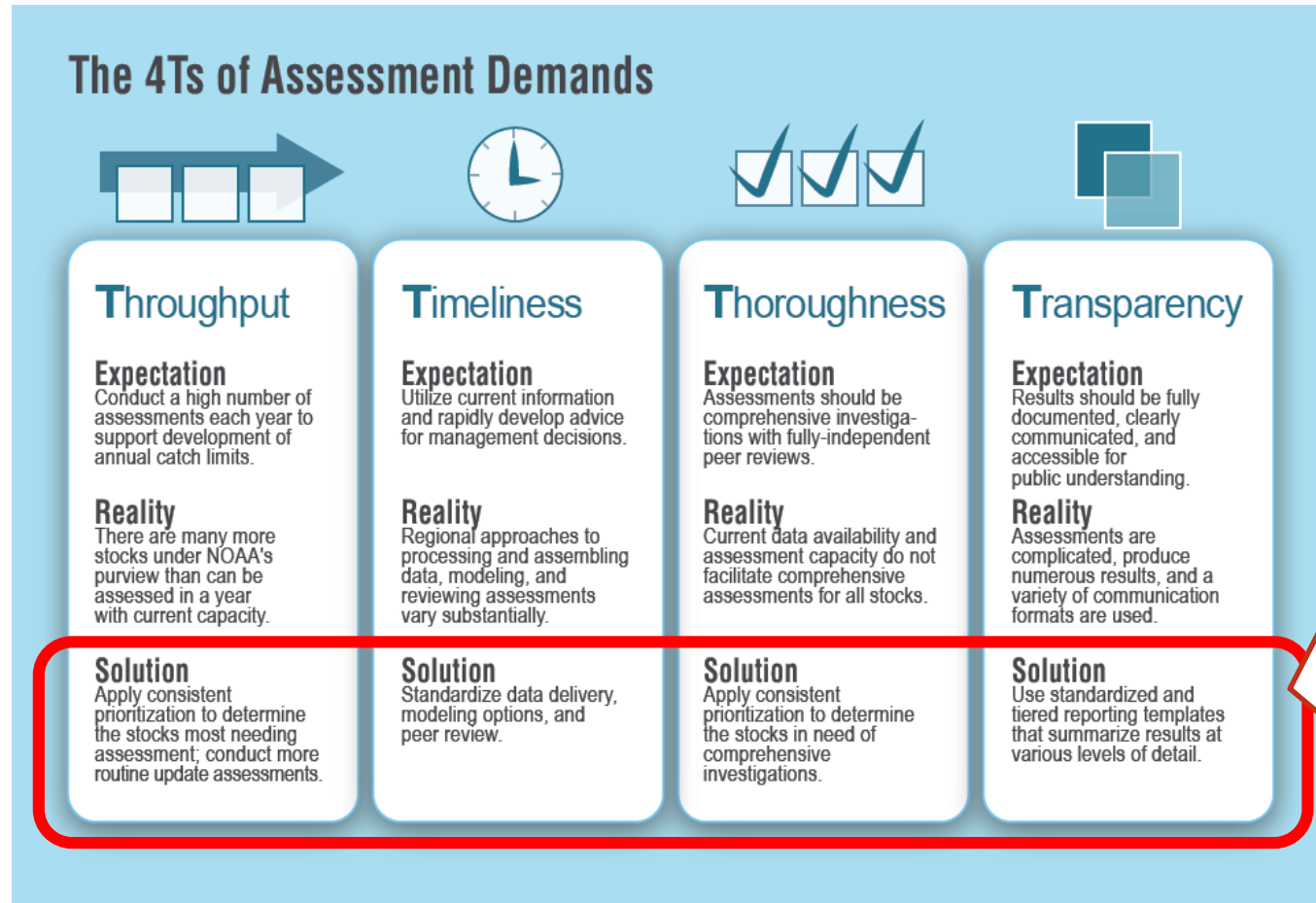


NEXT-GEN STOCK ASSESSMENT OBJECTIVES



This document includes guidance for meeting several “next-generation” stock assessment objectives, including achieving “**Timely, Efficient & Effective**” stock assessment advice for managers.

MEETING ASSESSMENT DEMANDS



- There are unrealistic expectations surrounding assessment demands (i.e. 4Ts).
- It is impossible to simultaneously achieve high grades for all components.
- Possible solutions are proposed.

MEETING ASSESSMENT DEMANDS

Throughput

Expectation

Conduct a high number of assessments each year to support development of annual catch limits.

Reality

There are many more stocks under NOAA's purview than can be assessed in a year with current capacity.

Solution

Apply consistent prioritization to determine the stocks most needing assessment; conduct more routine update assessments.

Thoroughness

Expectation

Assessments should be comprehensive investigations with fully-independent peer reviews.

Reality

Current data availability and assessment capacity do not facilitate comprehensive assessments for all stocks.

Solution

Apply consistent prioritization to determine the stocks in need of comprehensive investigations.

SEFSC and Gulf Council Staff have completed a preliminary **Stock Assessment Prioritization**.

Improvements recommended by the SSC will be reviewed during next SSC meeting (Dec/Jan).

MEETING ASSESSMENT DEMANDS

Timeliness

Expectation

Utilize current information and rapidly develop advice for management decisions.

Reality

Regional approaches to processing and assembling data, modeling, and reviewing assessments vary substantially.

Solution

Standardize data delivery, modeling options, and peer review.

A national method (to be implemented regionally) for **categorizing** stock assessments is proposed to balance stock-specific needs, better use assessment resources, and identify gaps in NOAA's stock assessment enterprise.

Assessment category based on data availability/quality



Implementing “Next-Gen” Recommendations to Improve Timeliness, Efficiency and Efficacy of Stock Assessments

- **Step 1:** Conduct *stock assessment prioritization* to inform assessment “Target Level” – *in progress*
- **Step 2:** Conduct *stock assessment classification* to inform appropriate assessment category given current data availability/quality.
- **Step 3:** *Conduct gap analysis*

Step 2: Conduct Stock Assessment Classification

0 → Increasing Knowledge → 5

DATA INPUT	LEVEL
Catch	0) None, 1) Major gaps preclude use, 2) Major gaps in some sector(s), 3) Minor gaps across sectors, 4) Minor gaps in some sector(s), 5) Near complete knowledge
Size/Age Composition	0) None, 1) Major gaps preclude use, 2) Support data-limited only, 3) Gaps, but supports age-structured assessment, 4) Support fishery composition, 5) Very complete
Abundance	0) None, 1) Uncertain or expert opinion, 2) Standardized fishery-dependent, 3) Limited fishery-independent, 4) Comprehensive fishery-independent, 5) Absolute abundance
Life History	0) None, 1) Proxy-based, 2) Empirical and proxy-based, 3) Mostly empirical estimates, 4) Track changes over time, 5) Comprehensive over time and space
Ecosystem Linkages	0) None, 1) Informative or used to process input data, 2) Random variation, not mechanistic, 3) Direct linkage(s), 4) Linkage(s) informed by process studies, 4) Fully coupled

****** A detailed explanation of the approach is included in the supplementary slides at the end of this presentation**

Step 2: Assign Assessment to Appropriate Category



- **Stock assessment classification will inform choice of assessment category:**
 1. Data Limited
 2. Index Based
 3. Aggregated Biomass Dynamics
 4. Virtual Population Analysis
 5. Statistical Catch at Length
 6. Statistical Catch at Age

Step 3: Conduct Gap Analysis

- By comparing existing levels to targets, stock assessment gaps can be identified and prioritized.
- Data gaps can also be summarized to evaluate how close a stock is to target levels across data categories
- Going further, gaps could be summarized at various levels (fishery management plan, regional ecosystem, national scale) strategic planning purposes.

Conclusions

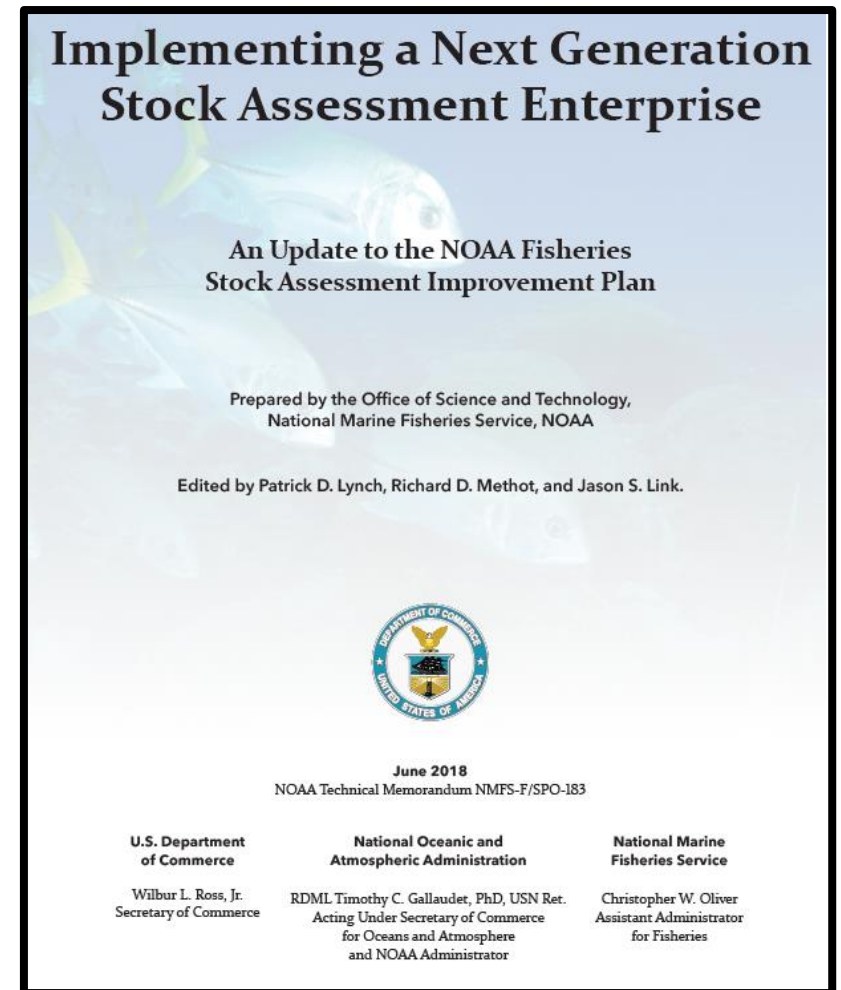
- There are many more federally managed fish stocks than can be assessed in a single year with NOAA Fisheries' current stock assessment capacity.
- To improve stock assessment timeliness, efficiency and efficacy, NOAA recommends prioritizing stock assessment activity through implementing the new **assessment data classification system**, and **gap analysis**.
- It is important to set the **frequency** at which assessments should be conducted, and determine **how comprehensive** each assessment should be (i.e., the key data sources that should be used to calibrate the assessment model as well as the nature of peer review that should occur).
- ***It is likely that some assessments are currently conducted with more complexity than is supported by the available data, or that the resources needed to support their complexity is unwarranted given their priority/importance. In other cases increased complexity may be warranted, but trade-offs may be required.***

ACKNOWLEDGEMENTS

- The content of this presentation was copied/paraphrased from NOAA Technical Memorandum NMFS-F/SPO-183

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SUPPLEMENTARY SLIDES

STOCK ASSESSMENT CATEGORIES

- **Data Limited**
 - **Example methods:** Depletion-Based Stock Reduction Analysis (DBSRA); Depletion Corrected Average Catch (DCAC); Surplus Production MSY; Mean Length Estimation; DLM Toolkit
 - **Data requirements:** Total catch and/or other biological information as available.
 - **Management advice:** Catch recommendation and sustainability of recent average catch.

STOCK ASSESSMENT CATEGORIES

- **Index Based**
 - **Example methods:** Basic linear models and time series analyses, An Index Method (AIM; NOAA Fisheries Toolbox*).
 - **Data requirements:** Time series of total catch and/or stock abundance.
 - **Management advice:** Qualitative advice about stock trends and whether management action is triggered as part of a harvest control rule (e.g., abundance index goes below a prespecified threshold).

STOCK ASSESSMENT CATEGORIES

- **Aggregated Biomass Dynamics**
 - **Example methods:** Schaefer or Pella-Tomlinson Production Models (ASPIC); delay-difference models.
 - **Data requirements:** Time series of total catch and at least one index of stock abundance; delay-difference models typically have abundance indices for each life stage, and information on growth and natural mortality.
 - **Management advice:** Estimates of maximum sustainable yield (MSY), current biomass (B) relative to BMSY, current fishing rate (F) relative to FMSY, and the current catch that corresponds to FMSY .

STOCK ASSESSMENT CATEGORIES

- **Virtual Population Analysis**
 - **Example methods:** VPA (ADAPT & VPA-2BOX).
 - **Data requirements:** Complete, high-quality catch-at-age and weight-at-age data for every time step and at least one abundance index for calibration (“tuning” in a VPA context).
 - **Management advice:** Estimates of maximum sustainable yield (MSY), current biomass (B) relative to BMSY, current fishing rate (F) relative to FMSY, and the current catch that corresponds to FMSY.

STOCK ASSESSMENT CATEGORIES

- **Statistical Catch at Length**
 - **Example methods:** Statistical Catch-At-Length (SCALE;); Stock Synthesis (SS); MultifanCL; crustacean models.
 - **Data requirements:** Total catch by fleet, at least one abundance index, length composition data from fleets/surveys (some missing data allowed); may allow the catch data to be separated into landings and discards.
 - **Management advice:** Stock status and forecasts of catch limits and targets relative to management reference points (if stock-recruitment dynamics are embedded); otherwise advice is limited to estimated time series of biomass and fishing rates.

STOCK ASSESSMENT CATEGORIES

- **Statistical Catch at Age**
 - **Example methods:** Stock Synthesis (SS); Age-Structured Assessment Program (ASAP); Beaufort Assessment Model (BAM); MultifanCL; C++ Algorithmic Stock Assessment Library (CASAL)
 - **Data requirements:** Total catch by fleet, at least one abundance index, samples of age compositions by fleet/survey; missing data are allowed; some implementations allow the catch data to be separated into landings and discards.
 - **Management advice:** Stock status and forecasts of catch limits and targets relative to management reference points (if stock-recruitment dynamics are embedded); otherwise advice is limited to estimated time series of biomass and fishing rates.

National Stock Assessment Classification Criteria

	LEVEL					
	0	1	2	3	4	5
Catch	None	Some catch data, but major gaps for some fishery sectors or for historical periods such that their use in assessments is not supported	Enough catch data establish magnitude of catch and trends in catch for a major fishery sector in order to apply a data-limited assessment method. This includes fisheries that are closed and it is known that negligible catch is occurring	Catch data is generally available for all fishery sectors to support quantitative stock assessment, but some gaps exist such as low observer coverage, high levels of self-reported catch, weak information on discard mortality	No data gaps substantially impede assessment, but catch is not without uncertainty (e.g., recreational catches estimated from surveys)	Very complete knowledge of total catch
Size/Age Comp	None	Some size or age composition data has been collected, but major gaps in coverage, and not used in stock assessment	Enough size or age composition data has been collected to enable data-limited assessment approaches	Enough size or age composition data is collected over a sufficient time series to be informative in age/size structured assessment models	Enough age composition data has been collected over a sufficient time series to enable assessment methods that need age composition data from the fishery	Very complete age and size composition data, including, as needed on stock-specific basis, knowledge of ageing precision, spatial patterns or other issues

National Stock Assessment Classification Criteria: Data Inputs

	LEVEL					
	0	1	2	3	4	5
Abundance/CPUE	None	Fishery-dependent catch rates (CPUE) are available, but high uncertainty about their standardization over time; or expert opinion on degree of stock depletion over time	Fishery-dependent catch rates (CPUE) are sufficiently standardized to enable their use in full assessments; data from fishery-independent sources are not available or sufficient to estimate abundance trends	Limited fishery-independent survey(s) provide estimates of relative abundance; however, the temporal or spatial coverage of the stock is limited or the sampling variability is high	Complete fishery-independent survey(s) provide estimates of relative abundance, and the survey(s) cover a large proportion of the spatial extent of the stock with several years of tracking at a level of precision that supports assessments	Calibrated fishery-independent survey(s) or tag-recapture provide estimates of absolute abundance

National Stock Assessment Classification Criteria: Data Inputs

	LEVEL					
	0	1	2	3	4	5
Life History	None	Most life history factors not based on empirical data; derived using proxies, meta-analyses, borrowed from other species, or without scientific basis	Some life history factors based on stock-specific empirical data, but at least one derived using life history proxies, meta-analyses, borrowed from other species, or without scientific basis. Generally supports data-limited assessments	Estimates of most life history factors based on stock-specific empirical data	Data are sufficient to track changes over time in at least growth	No major gaps in life history knowledge, including detailed stock structure, spatial and temporal patterns in natural mortality, growth, and reproductive biology
Ecosystem Linkages	None	Ecosystem-based hypotheses inform the assessment model structure and/or are used for processing assessment inputs (e.g., abundance index), but no explicit link-age to any ecosystem drivers (environment, climate, habitat, predator-prey, etc.)	The assessment includes some form of variability or effect to explicitly account for unidentified ecosystem dynamic(s) (e.g., time/space "regimes", random variation, or other approaches to changing features without direct inclusion of ecosystem data)	One or more assessment features is linked to a dynamic from at least one of the following categories: environment, climate, habitat, predator-prey data.	The assessment model is linked to at least one ecosystem dynamic, and one or more process studies directly support the manner in which environmental, climate, habitat, and/or predator-prey dynamics are incorporated.	The assessment approach is configured to be coupled or linked with an ecosystem process (e.g., multispecies, coupled biophysical, climate-linked models)

