1	Thanks for the opportunity to present an overview of the species status assessment process. I'm presenting on behalf of the Framework Implementation Team and, in particular, for my colleagues: Heather Bell, Nathan Allan, and Susan Oetker.
2	The ESA has been around for 40 years, and during that time there's been a lot of advancement in the area of species assessment. Improving the assessment process for ESA decisions was an idea whose time had come. As we set about the task of improving the assessment process, we had plenty of Objectives • FWS had undergone a listing program evaluation that said, of the 12 months given to complete an assessment they spent the majority of the time in review and responses, not in understanding the science of the species. So, an objective was for the new workflow to allocate more time for the science to understand the risk to the species and less time rewriting documents. [Spend more time on Science] • The previous threat-focused assessments tended to look at single threats or factors without specific assessment of the species response to multiple threats or combinations of threats and conservation efforts to mitigate those threats. So, the new process should include interactive factors [Cope with Interactive Factors] • Decision making is about the making choices that affect the future. So, the new process should be explicit about forecasting the future for a species or its habitat [Improve Forecasting] • A series of critiques from the conservation biology community on the role of science in ESA decisions called for improved transparency and consistency in species risk assessments [Improve Transparency & Consistency] • Much has been written about the need for clear distinctions between science input and policy application. So, the new process was designed to be the science step nested within a larger decision context [Distinct Science and Policy]. • It's inefficient when an assessment done for one decision is not useful for subsequent decisions. Also, core elements of an assessment are common to multiple ESA determinations. So, the new process should be useful for multiple ESA decisions/programs [Useful for multiple decisions/programs] • Additionally, states and other stakeholders were asking for more input. We all know that collaboration is needed for conservation to be successful. So, the new process should be conducive to scientific collaboration. [Increase Collaboration].

3	A listing decision can be followed by a sequence of linked decisions each with somewhat different inputs but common outputs. So, the new process, which is called the Species Status Assessment or SSA, needs to be adaptable to the different decision contexts and updateable to include new data and information. For example, if an SSA is developed prior to a listing decision, that analysis and information will also be used to inform candidate conservation plans (and perhaps preclude a listing) and the listing process and then if the species is provided the ESA's protection (i.e. listed) it "follows the species" and is updated to be used in subsequent recovery planning decisions, section 7 decisions, or 5-year reviews, or any other ESA decision.
4	The SSA is a distinct Science step in the FWS Workflow, which results in a scientific product that informs a separate decision analysis. The separation between the SSA and the decision may seem subtle, but is an important one. Several benefits come from keeping the SSA as a distinct science step. First, SSA is an "honest broker" assessment intended to avoid bias and preconceived assumptions about what the decision should be. Second, it provides an opportunity to work with the States and other Experts from Tribes, Federal agencies, NGOs, and academia to better understanding the Science. And as this diagram shows by the respective sizes of the boxes, the intent is to spend the bulk of the time on the Science.
5	The species status assessment (SSA) process has three successive stages, each building on the previous: 1) document the species' life history and ecological relationships to provide the foundation for the assessment, 2) describe the species' current condition and hypothesize its causes, and 3) forecast the species' future condition. The SSA is fundamentally about assessing species viability or conversely, species risk of extinction. Towards that end, the future condition refers to the species' ability to sustain populations in the wild under plausible future scenarios.

6	The SSA process applies the conservation biology principles of *representation*, *resiliency*, and *redundancy* (sometimes referred to as the 3Rs) to evaluate the current and future condition of the species (Shaffer and Stein 2000; Redford et al. 2011; Waples et al. 2013; Wolf et al. 2015; Earl et al. 2017). In general, the species' risk of extinction will decrease, or at least will not increase, with increases in *representation*, *resiliency*, and *redundancy*. The 3Rs are not operational as metrics in and of themselves, but are properties that emerge from particular levels or states of abundance, intrinsic growth rate, spatial distribution, and diversity, which are the basic autecological parameters that can be measured, estimated, and predicted. The 3R concept links to demographic factors, distribution (spatial structure), and diversity. Population factors, such as abundance and productivity, contribute to resiliency (population persistence). The distribution (spatial structure) includes connectivity that improves meta-population persistence, as well as distributional extent that contributes to redundancy through spreading risk. Diversity, as represented in genetic, geographic, or life-history variation, contributes to adaptive capacity and can inform ESA decisions related to listable entity.
7	The first stage of an SSA is an exploration of the species' life history and ecology, which lays the foundation for the subsequent stages of the assessment. Stage 1 results in a description of the life history and ecological relationships, including ● trophic niches, ● reproductive strategies, ● biological interactions, and ● habitat requirements to determine how individuals at each life stage survive and reproduce. The entire range of historical conditions under which the species was presumably self-sustaining serves as a starting point to understand how the species functions (or functioned) to maintain populations across its range. This is also the time to identifies areas representing significant geographic, genetic, or life history variation informed by historical as well as present distribution. These representative areas will help to structure the assessment.
8	The SSA can be thought of as a model of what influences species viability. At the start, the core conceptual model captures the ecological relationships and helps to

	structure the SSA analysis. The relationships shown in this conceptual model can be fleshed out narratively or sometimes quantitatively. Species viability depends on <u>populations</u> and on the health or resiliency of those populations. Population resiliency depends on demographic parameters of ● Abundance and distribution ● Reproductive success, survival, and migration ● And ultimately, population growth rate Demographics in turn depend on <u>habitat</u> quality, quantity and connectivity We BUILD on this model throughout the 3 Stages of the SSA.
9	Example: Texas hornshell conceptual model
10	The next stage of the SSA results in an empirical description of the current 1) population structure, distribution, abundance, demographic rates, diversity (ecological, genetic, life-history), and habitat, 2) changes from historical to current condition (i.e., trends), and 3) explanations or hypotheses of the causes and effects of stressors and conservation efforts that resulted in the current condition.
11	The metrics used for estimating current condition should be comparable to the metrics used for forecasting future condition. The numerical resolution and spatial and temporal scale of the metrics will depend on data availability and the information needed for the decision context. Potential metrics include: 1. Abundance or population sizes, 2. Population growth rates, 3. Number of populations, 4. Spatial distribution of populations Habitat can be a proxy or leading indicator of population condition For many species, an estimate of population abundance will not be available, but assignment to a category of abundance (e.g., <500, 500 to 1000, or >1000) would be consistent with available data. When data are sufficient, analysis on a continuous scale might be the thing to do. However, when data are sparse, analysis on a categorical scale might be better supported. In either case, the assessment is

	quantitative. The difference, therefore, is not between quantitative vs qualitative assessment, but rather between continuous vs categorical scales of risk; both involve quantitative analyses. Evaluation of current condition is done within EACH of the representative areas.
12	Again, here is our core conceptual model, where we are now interested in modeling the anthropogenic and environmental factors influencing populations, directly or indirectly through habitat. We are interested in understanding the past and current stressors that have affected the populations, as the arrows indicate.
13	Example: Texas hornshell conceptual model to include stressors
14	Example: Texas hornshell historical range
15	Example: Texas hornshell map showing current condition. Point out the 3Rs
16	In the final stage, an SSA results in the prediction of the species' response to a range of plausible future scenarios of environmental conditions and conservation efforts. This step entails an analysis of future hypothesized stressors with or without conservation efforts to project consequences on the species ability to sustain populations in the wild over time.
17	Let's look at the conceptual model to understand how this stage works. To determine the species' future condition, we start with a projection of what Anthropogenic and Environmental Factors, potentially both stressors and conservation efforts – negative effects and positive effects. And then we project the likely species' condition in response to changes in its Habitat and Demographics. But WHICH future? There are multiple plausible futures.
18	We are not clairvoyant, but we can use scenario analysis to look at the range of plausible future scenarios and predict species' response to those scenarios.

	As mentioned previously, all decision making is oriented towards the future, thus involve some amount of forecasting. Forecasting to inform ESA decisions involves trying to understand as best as possible <u>the likely future condition of the species and its environment</u>. Scenario analysis helps the assessment to be explicit about uncertainty. We start with the species' current condition, and then consider where might it go in the future. In a simplistic view, a logical starting point is to consider what if things continue along existing trends? Then consider the species' response to increasing stressors. Finally, consider the species' response to implementation of conservation efforts. For each scenario, predict the species' response. These predictions rely on the species ecology, cause-effect relationships, and current condition developed in previous stages of the SSA. The variation in species' future condition in response to the range of scenarios along with the uncertainty in predictions within each scenario help communicate uncertainty in species risk to decision makers.
19	Example: Texas hornshell scenario table
20	Example: Texas hornshell future condition under the SQ scenario
21	The SSA explicitly analyzes a species' response to stressors and conservation, which was not always included in the past threat-focused process. This adds analytical demands on an already stressed system. So, there is a clear need to build capacity, particularly in the area of predictive sciences. It is reasonable to expect that, all else equal, the scientific rigor of an SSA is a direct function of analytical capacity relative to the demand on time, effort, and expertise; this capacity per demand relationship underlies the conclusions reached by some (e.g., Lowell and Kelly 2016) that limited institutional capacity can impede the use of best available science in ES decision making. It's important to recognize that the most demanding SSAs, which are associated with high data availability, wide range, spatial complexity and extensive stressors, comprise a minority, perhaps less than 10% of the workload. Proper scaling of the

	assessment complexity help improve efficiency. However, there remains a need to build institutional capacity. As we rush to marshal resources to address capacity in the short term, we should not lose sight of what is needed to build the capacity for the long term.
22	To deal with the capacity problem, Waples et al. (2013) recommend the formation of a diversely qualified team who could be responsible for all status reviews over an extended period of time, incorporating localized expertise of field staff as appropriate. They go on to recommend that the national team would periodically reviews information about unlisted species and screen for those that should receive priority for full assessments. Their approach would help “bend the Quality/Capacity curve”, increase efficiency and consistency in the risk assessment, and direct the needed capacity and efforts toward species most likely to warrant listing sooner rather than later. Although Waples et al. (2013) envision a national team, the approach is scalable to a regional level. And it could be a virtual team, which was an idea from the FWS’s Long-term Listing Transformation: “Expertise at a “virtual tech center” would be available to assist with viability/risk analysis, economic analysis, and other technological needs (e.g., conservation genetics, decision support, modeling).“
23	The SSA builds upon the past threat-focused assessment by including systematic and explicit analyses of the species’ future response to stressors and conservation, and as a result, we believe it provides an improved scientific analysis for ESA decisions. For more information…