Alaska Sablefish Management Strategy Evaluation (MSE) Project Update

Groundfish Plan Team | September 2025

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Recent large recruitment events in the Alaska sablefish stock have led to a rapid rise in spawning biomass and increases in total allowable catch (TAC). Resulting landings of small fish have saturated markets and negatively impacted the fishery's economic performance (Goethel et al. 2025). This volatility has raised stakeholder concerns about whether the current management policy can consistently achieve both conservation goals and desirable fishery performance outcomes. This research project was undertaken to explore whether alternative harvest strategies might improve management performance when confronted with a range of uncertainties, specifically alternative recruitment scenarios representing potential future environmental states of nature. This research utilizes a simulation-based approach, where a management strategy evaluation (MSE) tool was developed, conditioned, and tailored to the Alaska sablefish population.

The MSE framework consists of three interacting components: an operating model (OM) that simulates the true underlying age and sex-structured population, an estimation method (EM) that fits simulated observations from the OM to estimate population status, and a harvest control rule (HCR) that uses the estimated population status to set future TACs. For this project, ten alternative HCRs were tested across three alternative OM scenarios. Despite known spatial heterogeneity in both the population and the behavior of the fishery, this initial phase of the project used a spatially aggregated OM and EM as a starting point. The three OM scenarios explored alternative hypotheses about future recruitment, simulating it as either fluctuating randomly, alternating between low and high regimes, or "crashing" to very low levels for an extended period before recovering to "average" conditions. The ten HCRs evaluated (Figure 1) include:

- The current 'threshold' (or sloped) $F_{40\%}$ policy
- Three alternative but more conservative threshold policies
- Two policies that limit year-to-year changes in annual TACs (stability constraints)
- Two policies that cap the maximum allowable TAC (harvest caps)
- Two constant fishing mortality policies.

The performance of each policy was evaluated across all future recruitment scenarios, where tradeoffs in performance were compared across a suite of conservation and fishery-oriented metrics.

Results from the spatially aggregated MSE indicate that the current $F_{40\%}$ policy is largely robust to substantial uncertainty in future recruitment. There was a strong negative tradeoff between average catch and average SSB across all HCRs among all recruitment scenarios.

Higher average catch levels were associated with lower average SSB, and high probabilities of overfishing (Figure 2). The stability constraint and harvest cap HCRs successfully reduced interannual variation in catch, particularly when recruitment alternated between regimes, but did not substantially increase long-term catch or SSB levels. Under the recruitment "crash" scenario, the stability constraint rules performed poorly, resulting in lower minimum SSB levels and substantially prolonged periods of reduced catch (as compared to the unconstrained threshold policies) once recruitment returned to "normal" conditions (Figure 2). In contrast, more conservative threshold strategies were most effective at keeping the stock above the biomass levels that trigger a formal rebuilding plan. In instances where the stock fell below those levels, these same strategies also promoted faster rebuilding times.

Based on these results, adopting simple conservative thresholds, stability constraints, or harvest caps alone are unlikely to improve upon the current management policy. Each alternative presents important tradeoffs that should be carefully considered. For instance, conservative threshold rules result in improved resiliency during periods of poor recruitment, but forego potential catch during more productive years. Harvest caps likely prevent market saturation (quota creep) during population booms, but result in lower long-term average catch. Stability constraints are useful for more slowly increasing catch levels during periods of population growth, but come with added risks during times of rapid population decline, as the size of quota reductions are also capped.

Results suggest that the development of a hybrid rule that combines elements of each of these strategies may help balance management objectives and improve relative management performance compared to the current $F_{40\%}$ policy in the context of Alaska sablefish. For instance, a policy based on an $F_{45\%}$ threshold HCR that is coupled with a "slow up, fast down" (one-way) stability constraint and a stakeholder-informed harvest cap could help simultaneously buffer against large, sudden increases in TACs, while also safeguarding the population during times of depressed recruitment.

Spatial Sablefish MSE

While this project initially developed a spatially-aggregated MSE framework, known spatial heterogeneity in sablefish demography and fishery behavior necessitated a spatially-explicit OM that also accounts for the spatially explicit management process. The new, higher spatial resolution permits a more accurate evaluation of how alternative management policies would affect different regions of Alaska. A spatial OM was developed based on the work of Cheng et al. (2025), where Alaskan federal waters are modeled as five regions: the Bering Sea, Aleutian Islands, Western GOA, Central GOA, and Eastern GOA. For the simulated sablefish population, age-specific movement is assumed (as estimated by the spatial assessment, Cheng et al., 2025) that governs connectivity between the regions. Additionally, implementation of regional ABC apportionment, region-fleet specific TAC allocations, and region-fleet specific TAC utilization rates allows the spatial model to capture more representative landings patterns and management dynamics across regions and fleets, a key limitation of the single-region MSE framework described above.

The spatial MSE is still in development, but will eventually be used to assess the regional impacts of alternative management policies in Alaska. The evaluation will consider several harvest control rules as refined by results from the single-region OM research, including the current $F_{40\%}$ policy, a more conservative $F_{50\%}$ policy, a 20kt harvest cap policy, and a stability oriented “slow up, fast down” approach. To address key uncertainties, future OM scenarios will explore alternative assumptions about stock movement, recruitment dynamics, and spatially-varying fishery selectivity.

Stakeholder Engagement

The goal of this project was to develop the tool necessary to perform an MSE for sablefish and pursue specific research-oriented explorations regarding HCR performance.To date there have been three public Alaska sablefish MSE meetings, including an in-person meeting during the June 2024 NPFMC meeting in Kodiak, AK. These meetings included participation from the fixed and trawl gear harvest sectors, NOAA-AFSC, NPFMC, and the University of Alaska Fairbanks. The purpose of these meetings was to inform stakeholders about the project, clarify goals and purpose, and summarize results to date. More importantly, they aimed to solicit feedback on the dynamics of the modeling framework, refine performance metrics, and ensure results aligned with expectations. These meetings were extremely helpful to the project team, as extensive feedback was received that helped refine all aspects of simulation model development and the range of harvest strategies that should be compared. Particularly, stakeholder feedback highlighted the need to develop a spatial model, and identified several HCRs, including one based on population age-structure, to investigate. Additional stakeholder meetings will be scheduled, as time and funding permits, specifically to discuss results from the spatially-explicit MSE. Further work to improve aspects of the MSE tool (e.g., an economic module) or for it to be adopted more formally as a management tool, may be explored, pending further funding.

GitHub Links

Operating Model: https://github.com/BenWilliams-NOAA/afscOM
SablefishMSE: https://github.com/Ovec8hkin/SablefishMSE
SpatialSablefishMSE: https://github.com/Ovec8hkin/SpatialSablefishMSE
Spatial Estimation Method: https://github.com/chengmatt/SPoRC

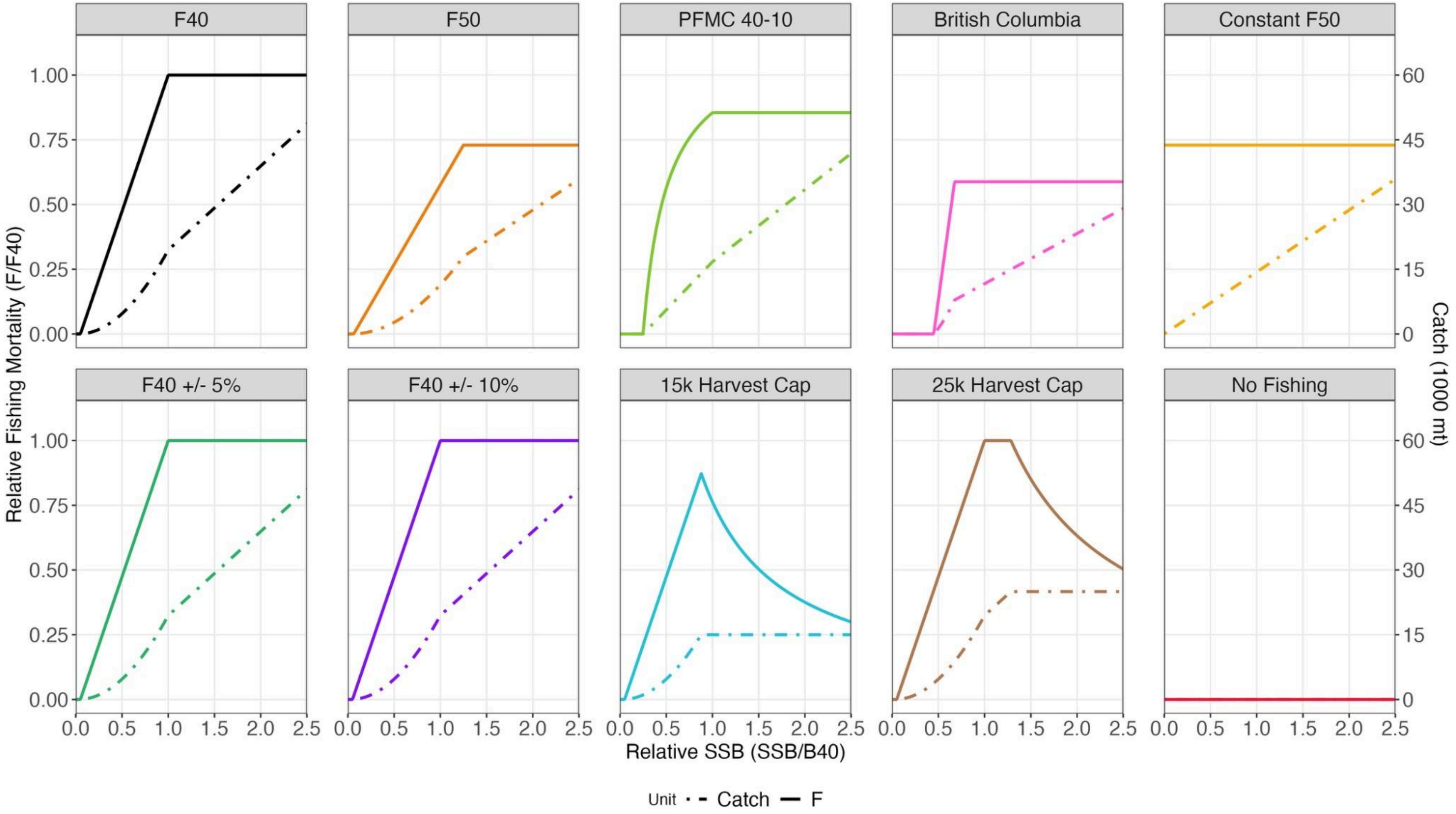

Figure 1: Relationship between relative spawning stock biomass (SSB/B_{40}) and relative fishing mortality (F/F_{40}; solid lines) or catch (dotted lines) under each of the ten management strategies (MS). Note that the annual stability constraints that differentiate the F40, F40 +/- 5%, and F40 +/- 10% MS are not shown.

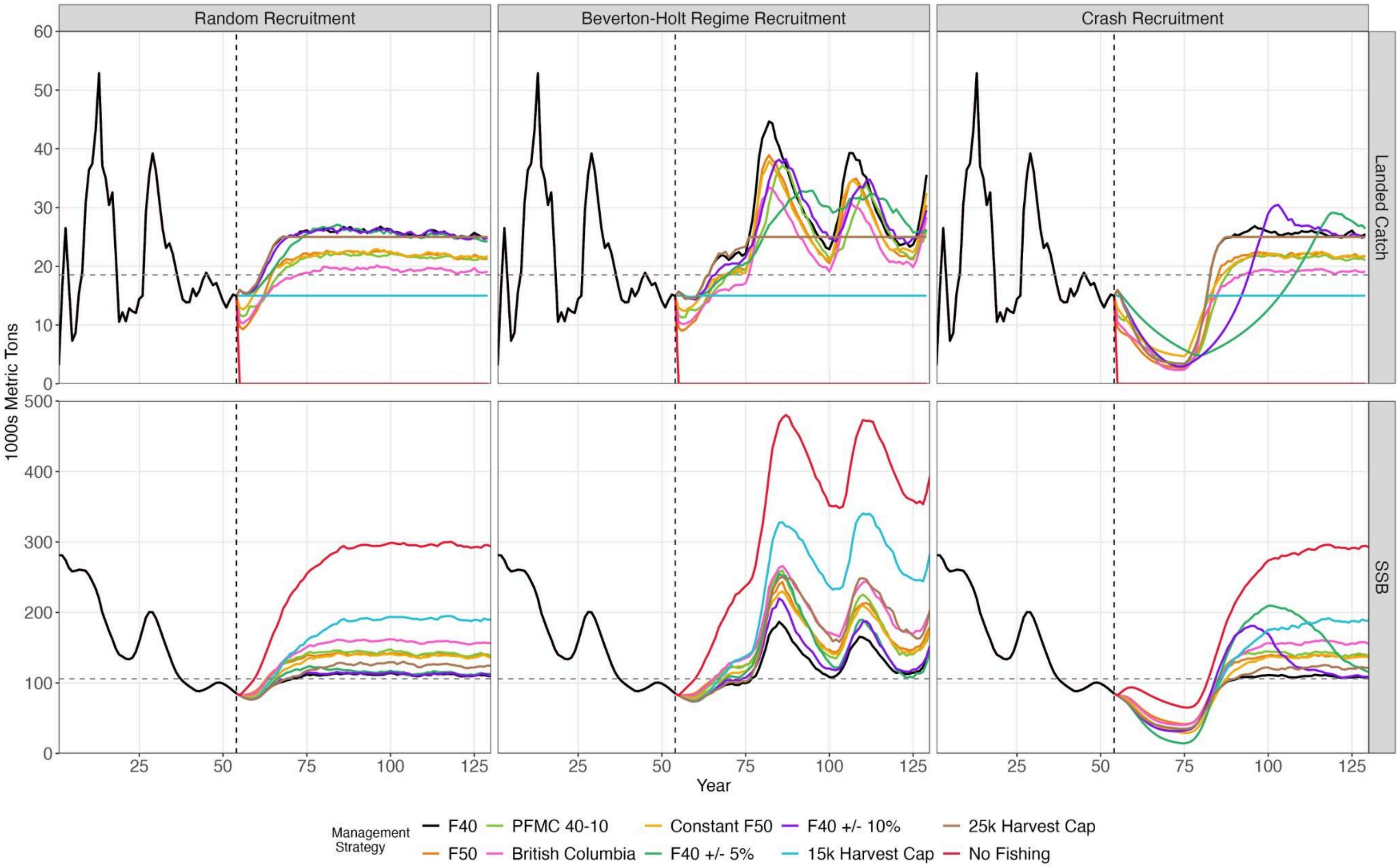

Figure 2: Landed catch (top) and spawning stock biomass (SSB; bottom) trajectories across management strategy (color) and OM scenario (columns). Lines represent the median annual catch and SSB in each simulation year across 200 replicate simulations. The dashed vertical line indicates the start of the simulation period when alternative management strategies are applied. Horizontal dashed reference lines indicate (1) the median ABC from 2014-2023 (18,358 mt; top row) and (2) the most recent operational assessment estimate of B_{35} (105,935 m; bottom row; Goethel and Cheng 2024).