Science, Service, Stewardship

# Uncertainty, P*, and Control Rules: Setting ABCs in the South Atlantic Snapper-Grouper Complex

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# Outline

- Uncertainty from stock assessments
- P* approach
- SAFMC SSC proposed control rules
  - Data rich
  - Data poor

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# Uncertainty in SAFMC Assessments

| | |
|---|---|
| | Bayesian with full set of prior distributions<br>Monte Carlo/bootstrap |
| **Snowy Grouper, Tilefish** | Partial Bayesian – priors on key parameters/inputs<br>Monte Carlo methods for key parameters/inputs |
| **Red Porgy, Black Sea Bass, Greater Amberjack, Vermilion Snapper, Red Snapper, Spanish Mackerel** | Suite of key sensitivity runs<br>Multiple model types |
| | Inverse Hessian matrix error estimates from single model run |
| **Speckled Hind, Red Grouper, Black Grouper, Warsaw Grouper, Gray Triggerfish, White Grunt, etc.** | Single model run |

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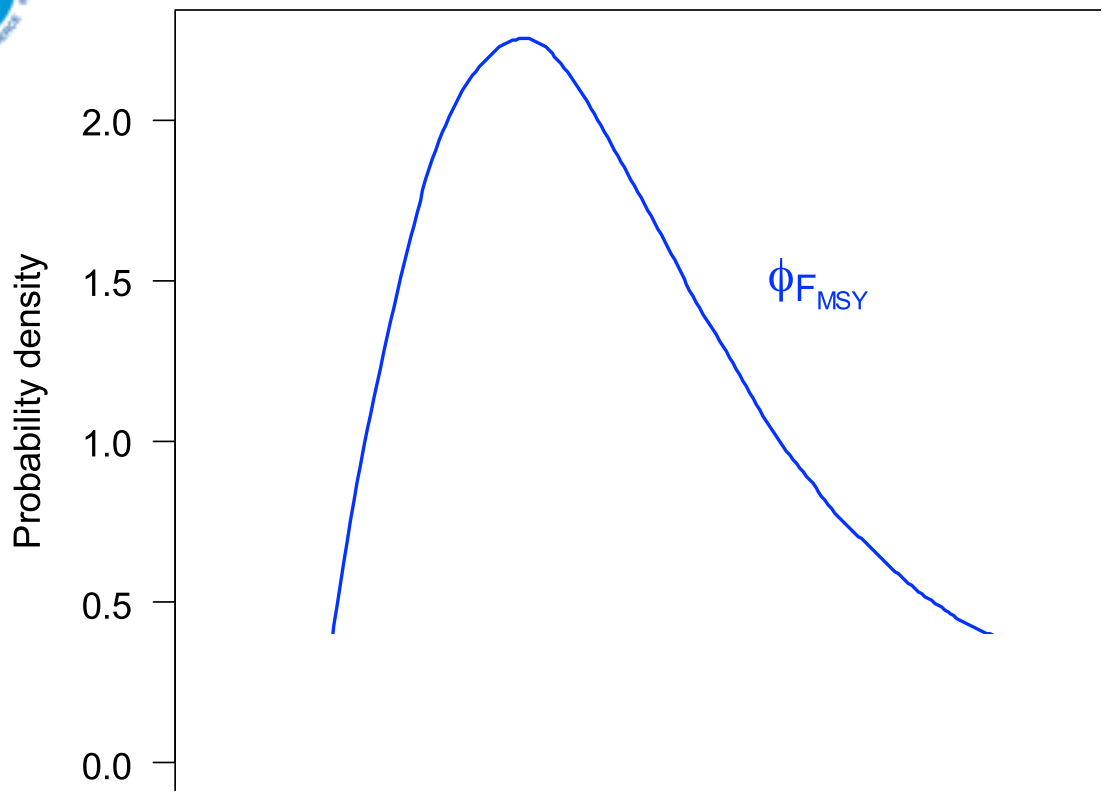
# Uncertainty from Stock Assessments




## Ex: vermilion snapper

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# P* approach

- P* = the acceptable probability of overfishing
- Smaller P* provides larger buffer against overfishing resulting in reduced catches
- Desirable because it directly addresses the language in MSRA

$$ACT \leq ACL \leq ABC < OFL$$

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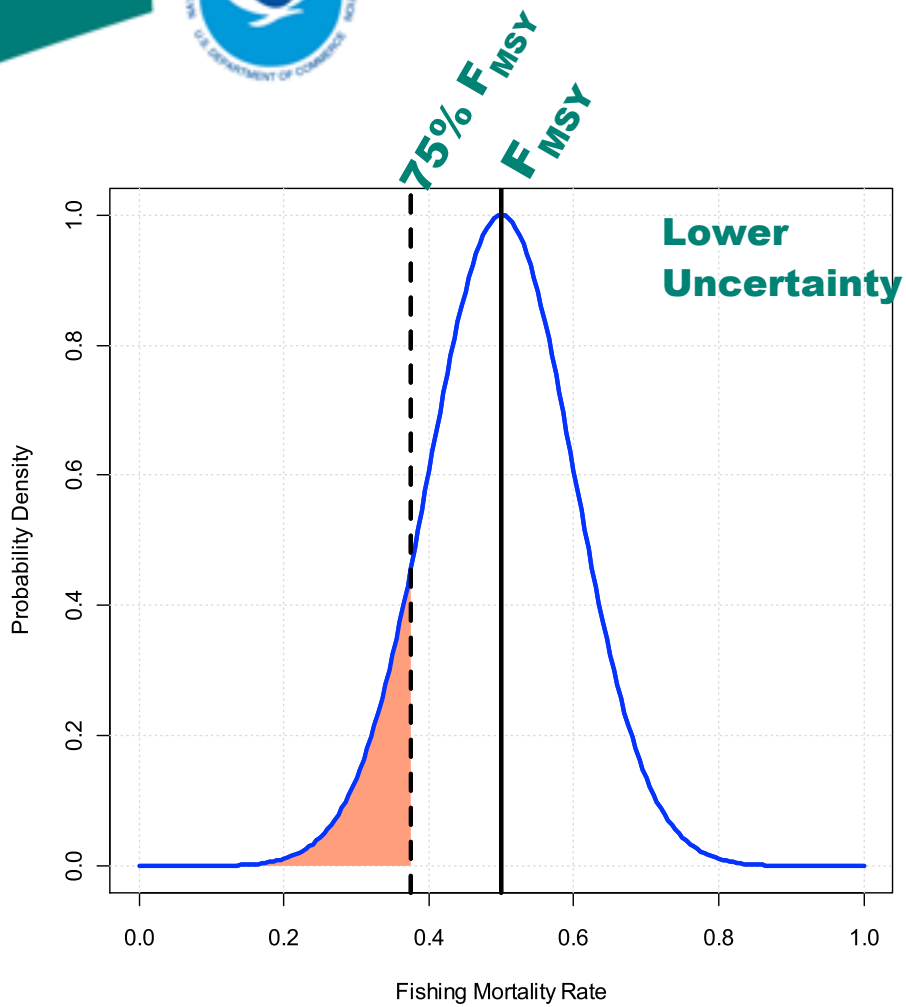
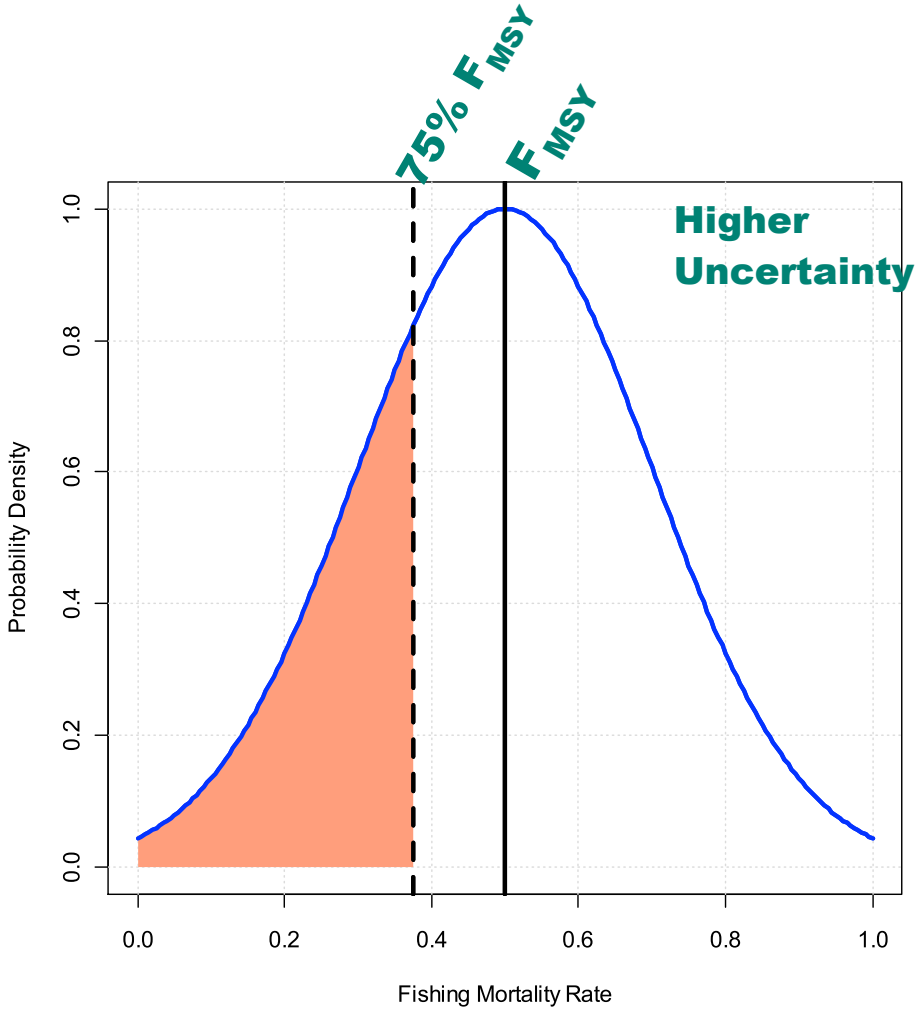
# Scientific Uncertainty in OFL
## Given F = 75% $F_{MSY}$



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# Scientific Uncertainty in OFL

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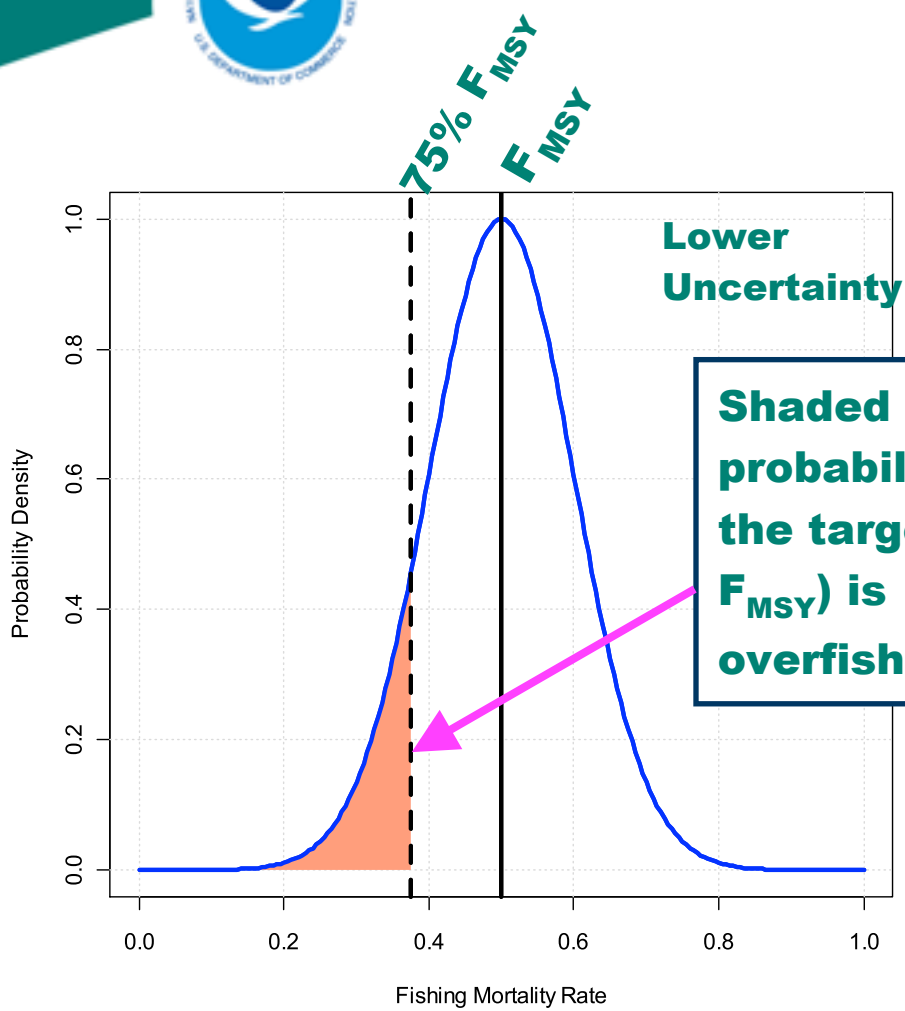
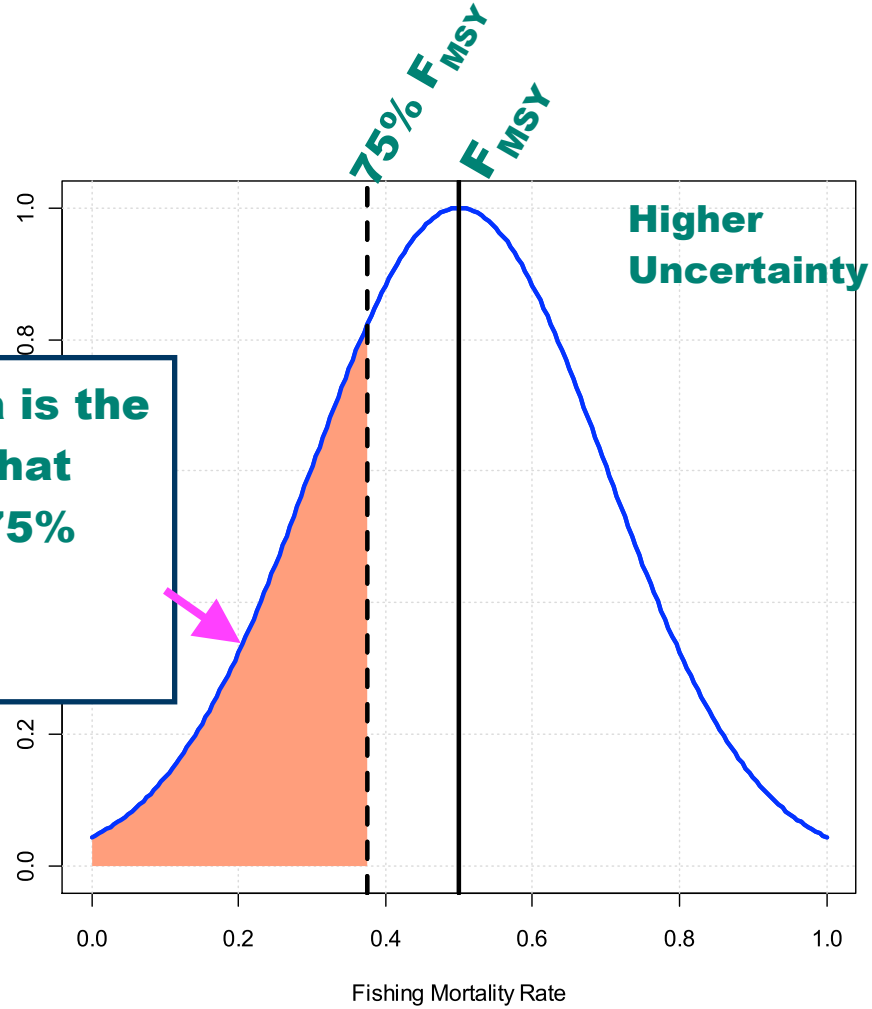



Shaded area is the probability that the target (75% $F_{MSY}$) is overfishing




**P* = 10.5%**

**P* = 26.6%**

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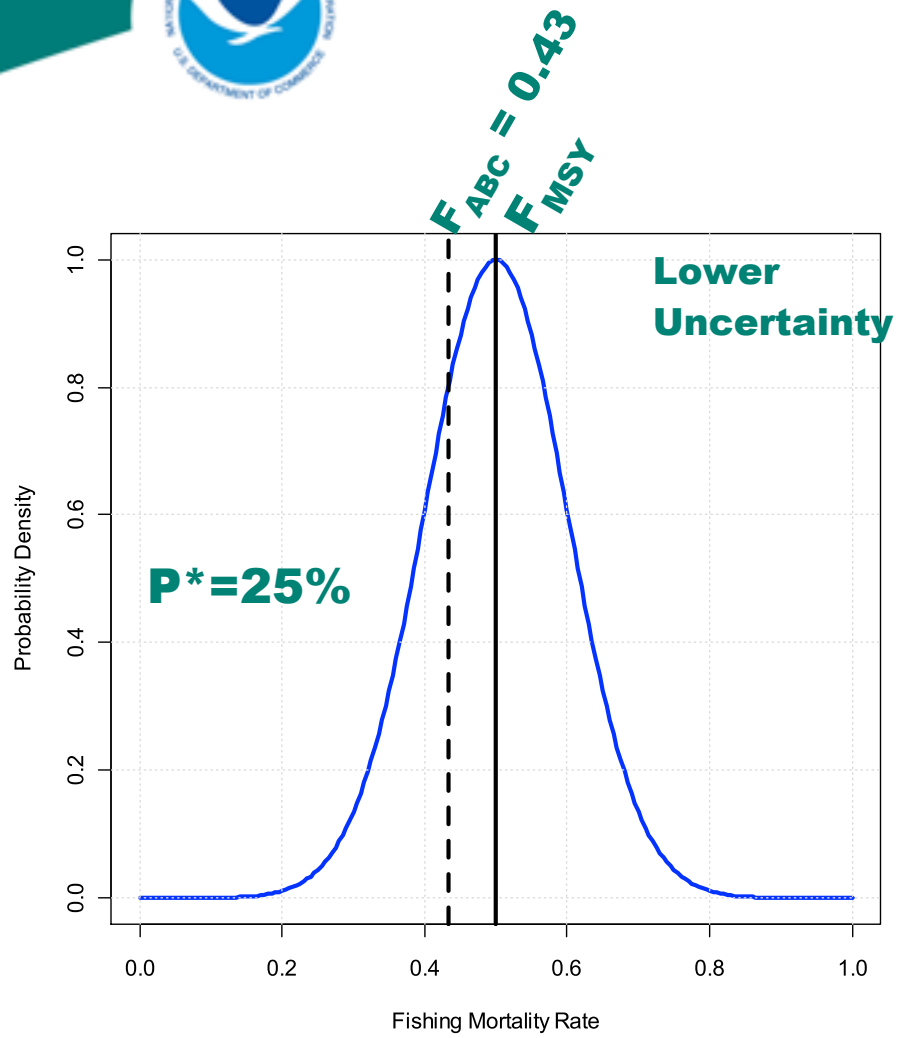
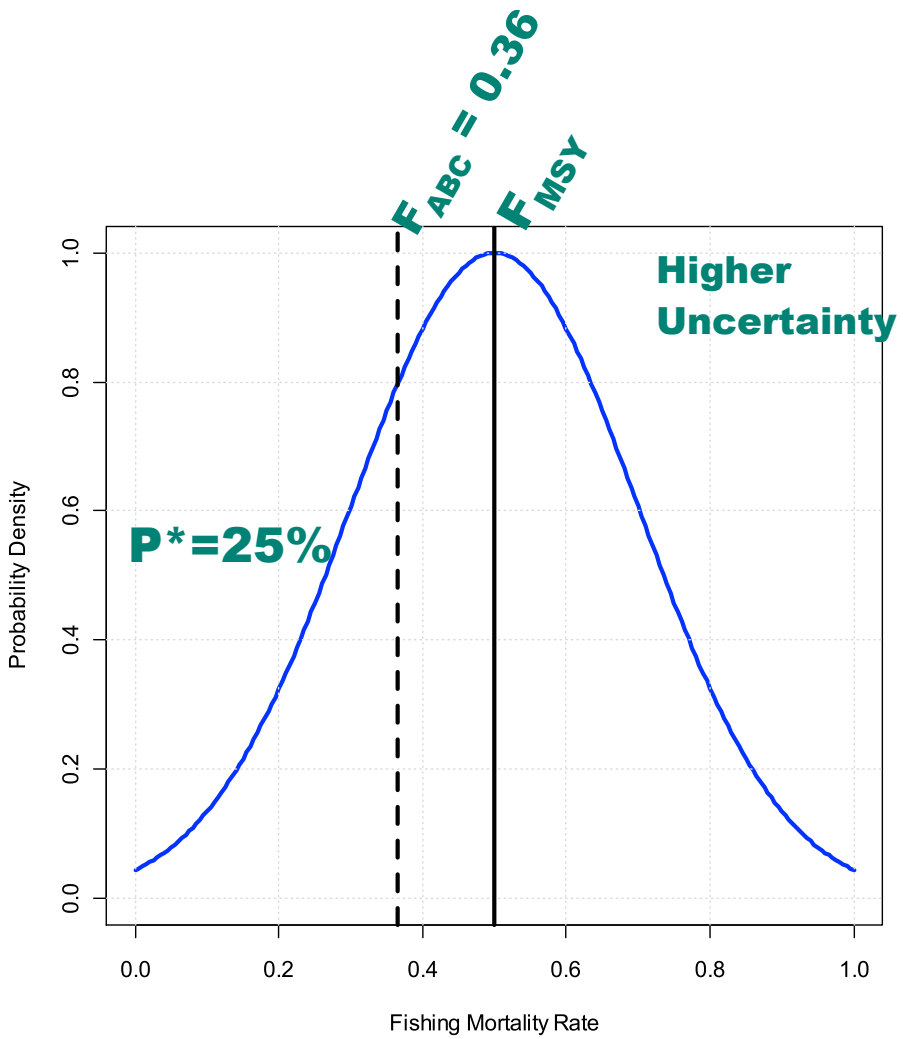
# Probability of overfishing (P*) set to 25%



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# Example: vermilion snapper

## One Year Projections

## $F_{MSY}$ = 0.386, MSY = 1665

| P* | Year | F | ABC (klb) | SSB ($10^{12}$ eggs) |
|---|---|---|---|---|
| | 2008 | 0.384 | 1536 | 7.92 |
| 0.5 | 2009 | 0.39 | 1505 | 7.41 |
| 0.4 | 2009 | 0.338 | 1328 | 7.52 |
| 0.3 | 2009 | 0.29 | 1160 | 7.63 |
| 0.25 | 2009 | 0.267 | 1077 | 7.68 |
| 0.2 | 2009 | 0.243 | 990 | 7.73 |
| 0.1 | 2009 | 0.192 | 795 | 7.85 |

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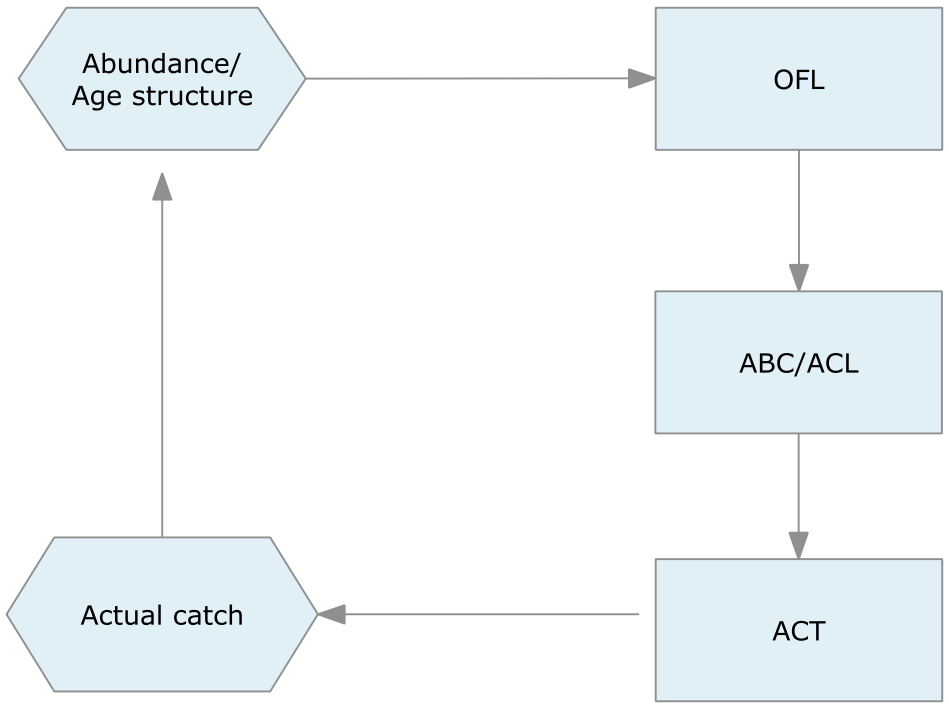
# Multi-year catch levels

- Setting catch levels for multiple years requires a projection model, because of feedback among catch levels and the stock
- ABCs and ACTs should not be set independently



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# Complicating Factors

- Beyond one year, the uncertainty increases, meaning further reductions needed to achieve the same level of P*.
- This means longer time horizons = reduced ABCs and ACTs.
- Accurately predicting the future not yet possible.

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# SAFMC
# ABC Control Rule
## (SSC's recommendation)

Applicable when the OFL can be stated in fish weight and some measure of statistical uncertainty about the OFL can be estimated

*(if this is not available then other method must be used – data poor)*

Setting ABC = OFL implies P* = 50%

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# SAFMC ABC Control Rule (SSC's recommendation)

- Framework comprised of
  - Dimensions – characteristics of uncertainty
  - Tiers – levels reflecting the information available
- The framework currently assumes equal weights for dimensions and for tiers within dimensions
- The framework generates an uncertainty "penalty" that is applied to determine the P* to be used for management
- Start at P*=50%, based on penalties above could be as low as P*=10%

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# SAFMC ABC Control Rule Dimensions

**Assessment information (0-10)**

—Reflects available data and assessment output (e.g. MSY)

**Characterization of uncertainty (0-10)**

—Reflects how well uncertainty is characterized on a qualitative scale

**Stock Status (0-10)**

—Based directly on the final status determinations

**Productivity and Susceptibility (0-10)**

—Evaluation of biological “risk”.

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# SAFMC ABC Control Rule
# Example: Gag grouper

## Start at P* = 50%

| Dimension | Criteria | Score |
|---|---|---|
| Assessment Information | Estimates of MSY benchmarks available | -0% |
| Characterization of Uncertainty | Key uncertainties addressed, but projections only include uncertainty in recruitment | -5% |
| Stock Status | Stock is overfishing | -5% |
| Productivity and Susceptibility | Low (PSA score > 3.18) | -10% |

**Final Adjustment = -20%**

**Final P* = 30%**

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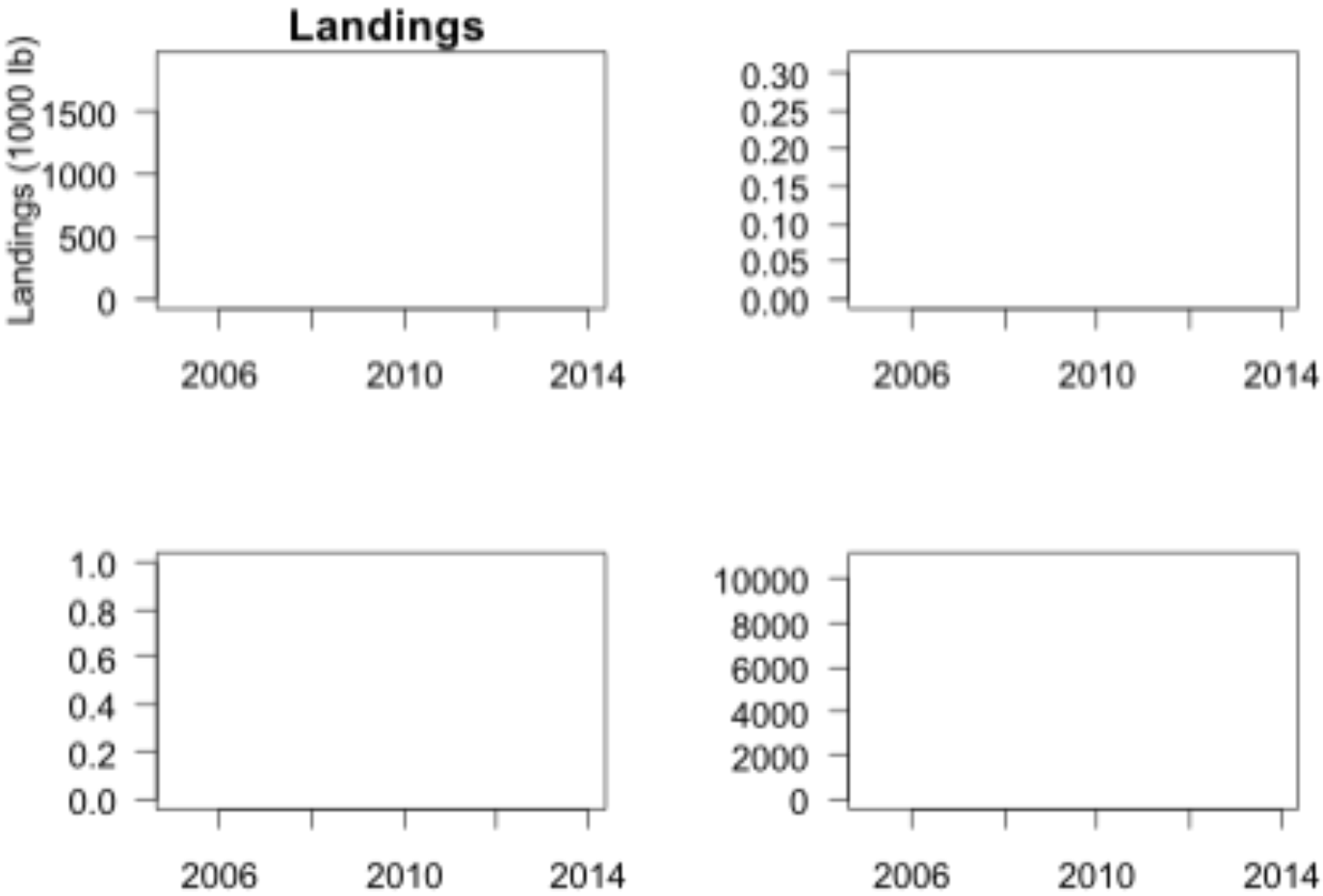
# SAFMC ABC Control Rule Example: Gag grouper




**Final P***

**= 30%**

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# SAFMC
# Data-Poor ABC Control Rule
## (SSC's recommendation)

- Assumes we at least have an OFL estimate, likely based on average landings.
- ABC = OFL * fraction (ranging from 0-75%)
- Developed criteria or "dimensions" for increasing the fraction from 0.

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# SAFMC
# Data-Poor ABC Control Rule
## (SSC's recommendation)

| Criteria | Points |
|---|---|
| Indication of depletion - yes, no, unknown<br>Yes +0<br>No +15 | 15 |
| Critical ecosystem role, habitat, forage etc<br>(e.g. sargassum, coral are EFH, habitat)<br>Yes +0 | 15 |
| Not Long Lived/PSA score<br>Low risk +20<br>med risk +10 | 20 |
| Reliability of OFL estimate<br>Range: +0 to 25 | 25 |

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# SAFMC Future Challenges

- Finalizing ABC control rules
- Improving and standardizing stock assessment and projection methods for characterizing uncertainty
- Finding methods and resources to reduce uncertainty

  (↑time = ↑uncertainty = ↓catch)

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# Questions?