Comparing Alternative Harvest Strategies Under High Recruitment Variability: **A Case Study of Alaska Sablefish**

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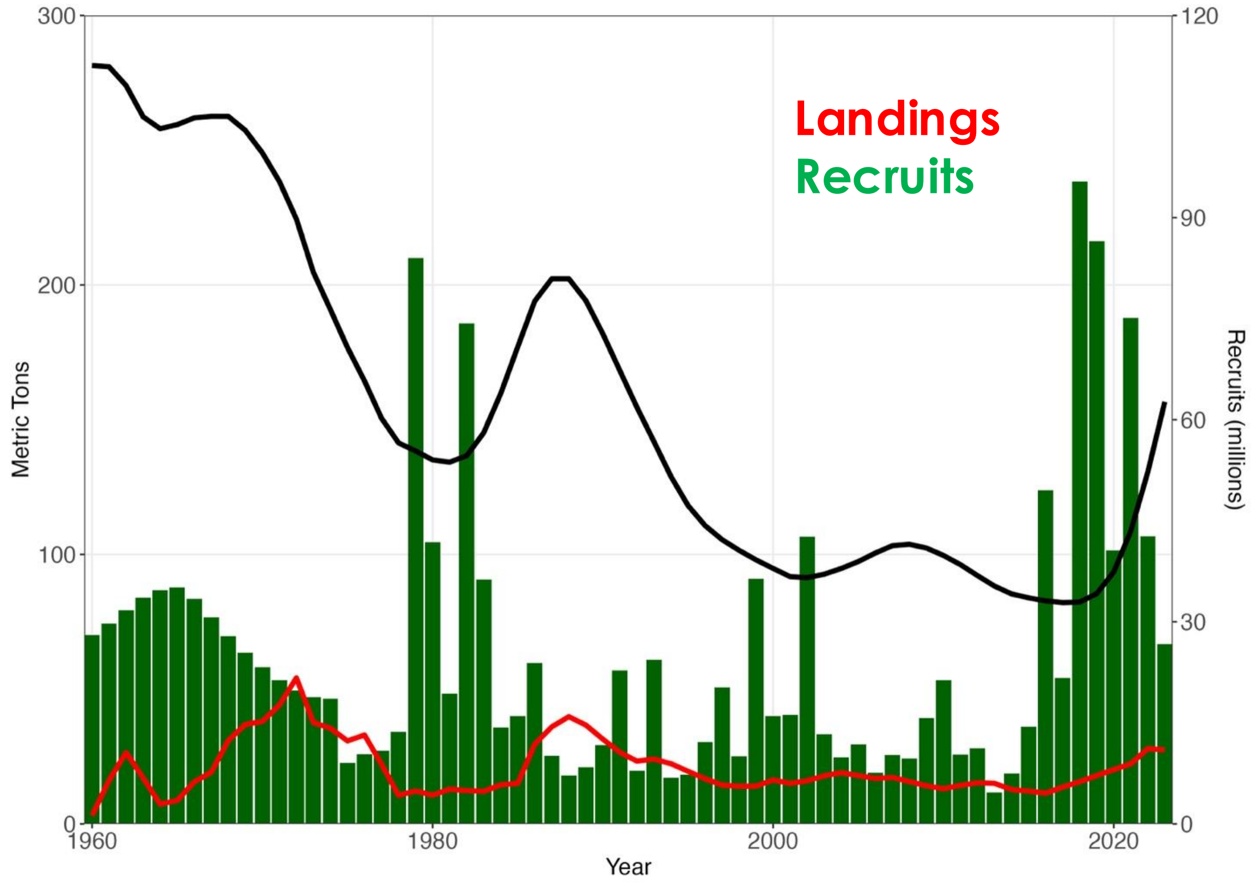
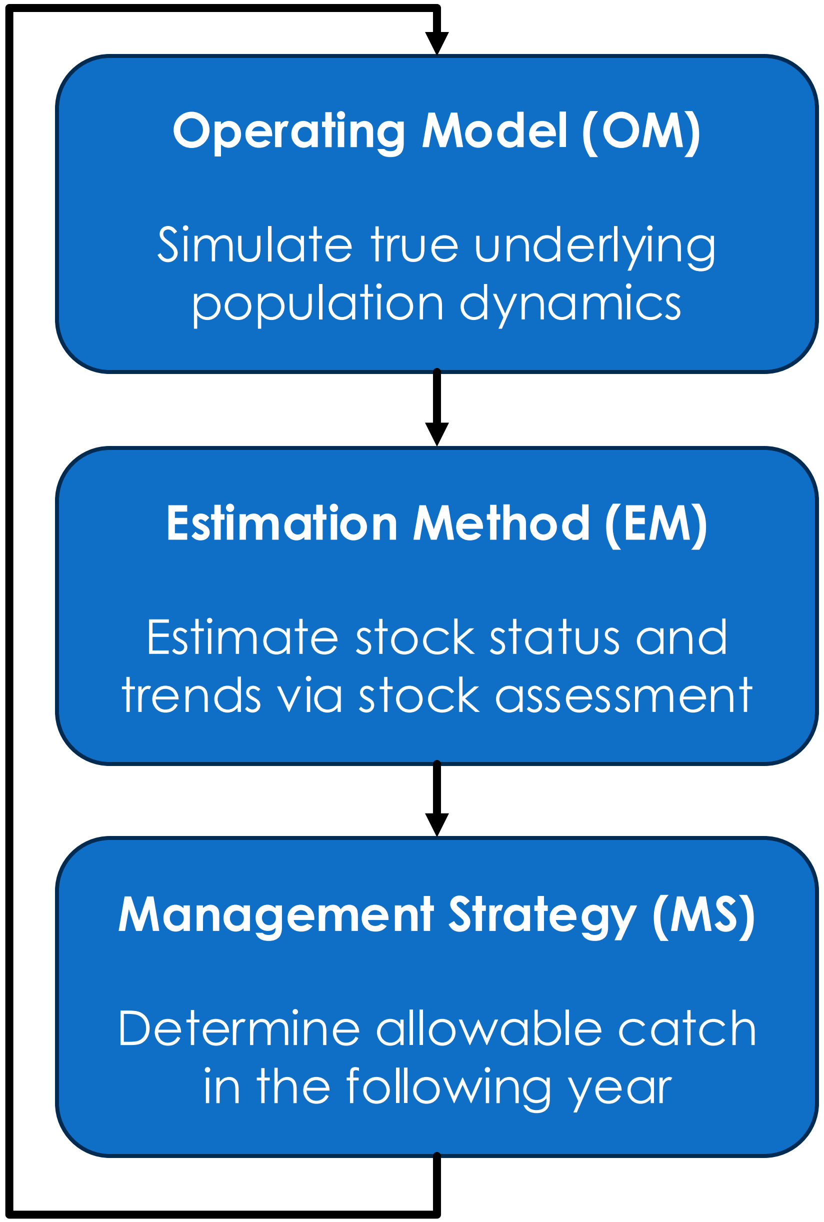
Sablefish in Alaska

- Long-lived, highly mobile species
- Genetically well mixed, but managed across 6 spatial areas
- Extremely dynamic recruitment

- Long-term population decline
- Recent increase in SSB due to large recruitment events
- Catch increases → price declines



Are there alternative harvest control rules that can improve management outcomes when confronted with highly variable future recruitment conditions?



Management Strategy Evaluation

Simulation tool for comparing the performance of different management strategies across a range of demographic, estimation, and implementation uncertainties

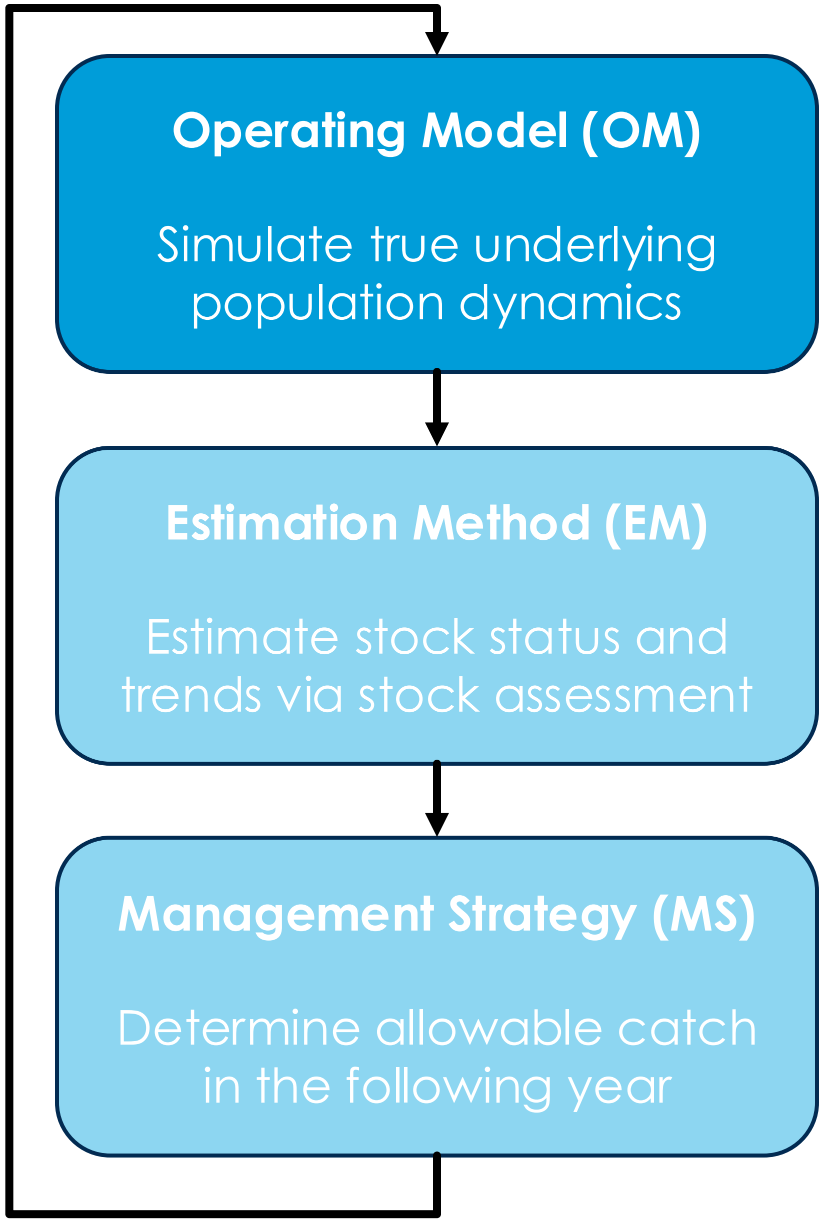
OM conditioned on sablefish population dynamics

EM based on most recent Sablefish assessment model

Management Strategies: 9

OM Scenarios: 3

Simulation Period: 75 years



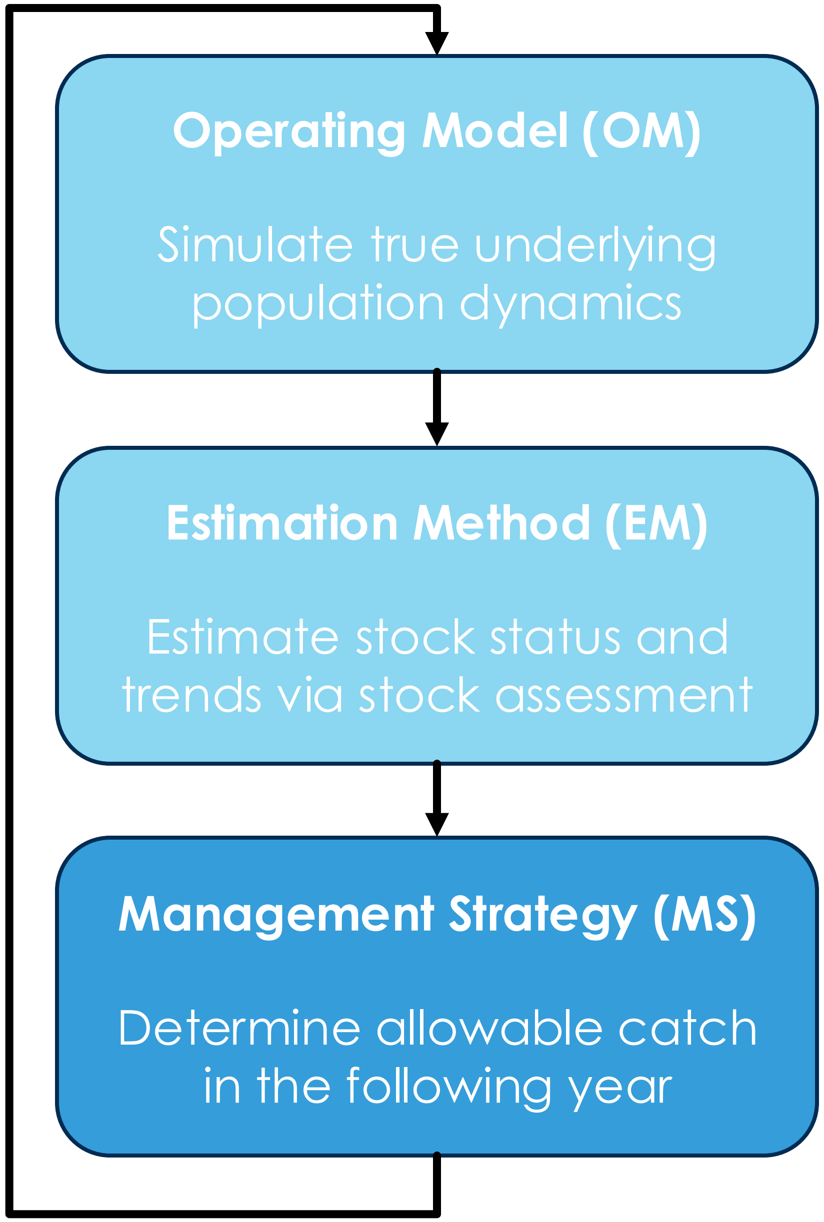
Recruitment Scenarios

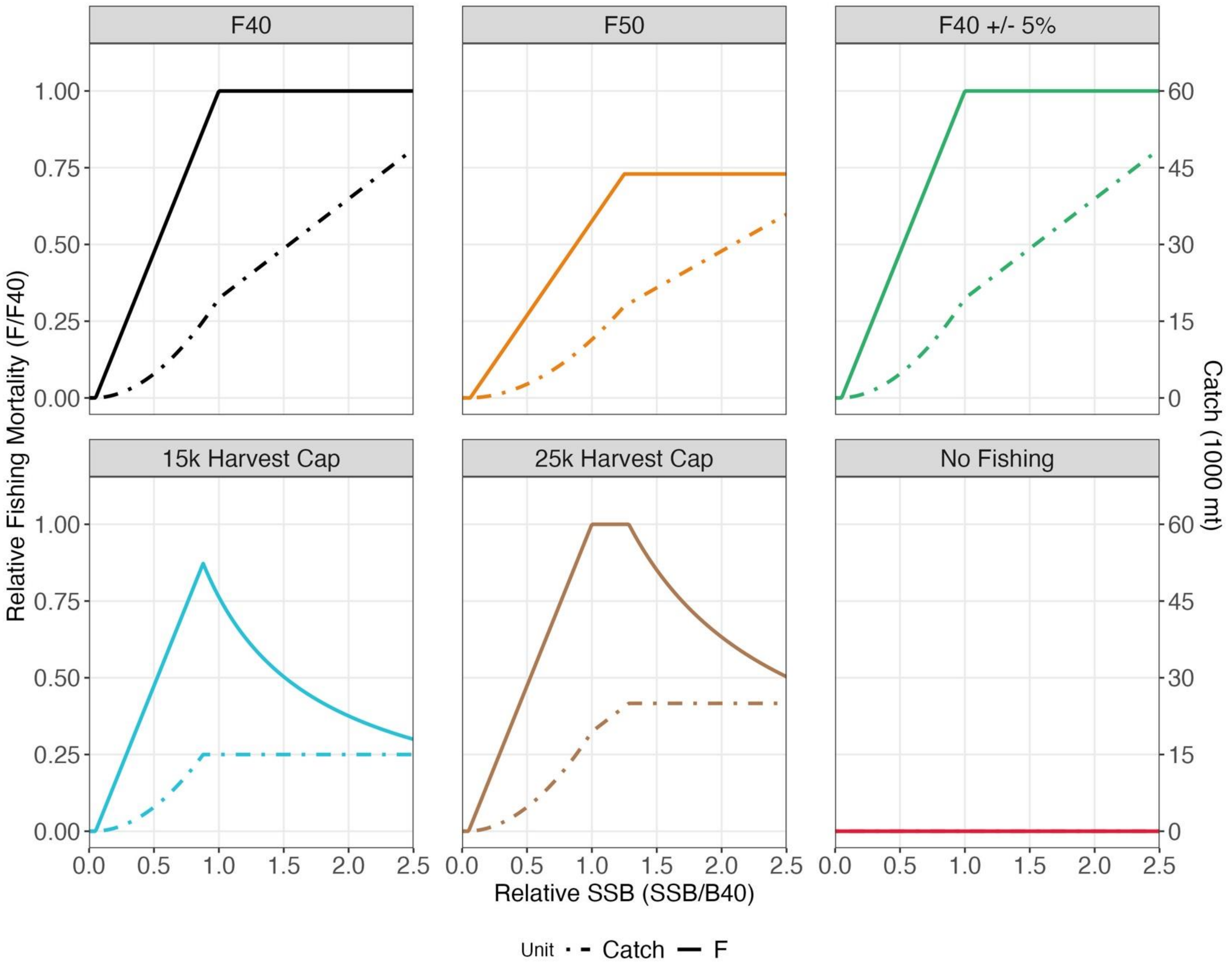
Random – resample from historical recruitment

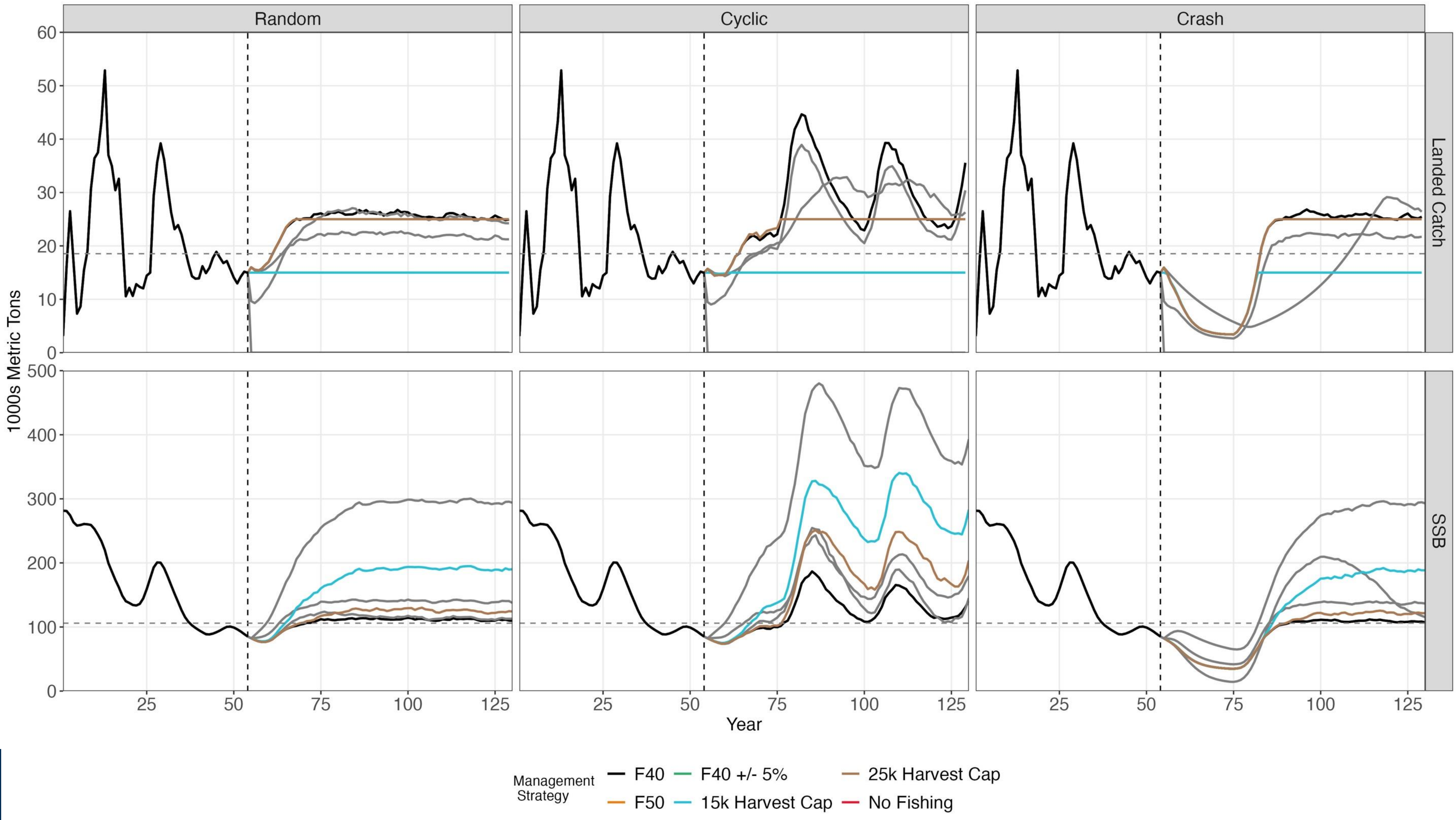
BH Regime – alternating low/high productivity regimes

Crash – initial recruitment crash followed by resampling

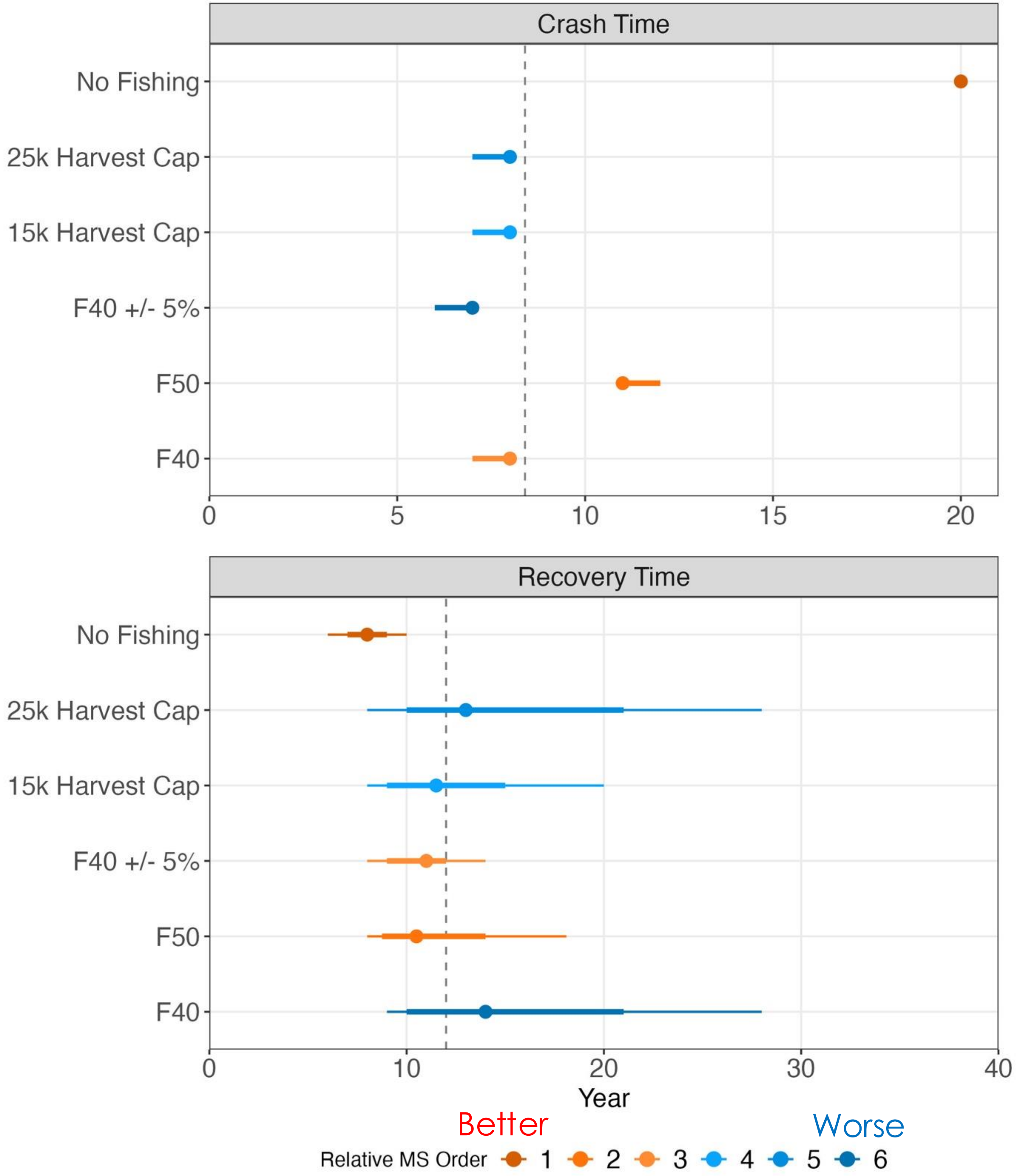
Management Strategies







Random
Cyclic
Crash
Landed Catch
SSB
1000s Metric Tons
Year
Management Strategy
F40
F40 +/- 5%
25k Harvest Cap
F50
15k Harvest Cap
No Fishing



Population Resiliency

Crash Time – number of years required for SSB to decline to 52,500 mt

Recovery Time – number of years required for SSB to return to 105,000 mt

No MS could prevent a population crash.

Recovery times are similar across MS but highly variable.

Conclusions

- F40 strategy is largely robust to uncertainty in future recruitment
- Conservative threshold strategies improve resiliency during periods of poor recruitment
- Symmetric stability constraints carry potential risks during periods of recruitment failure without improving performance during times of normal recruitment
- Harvest caps allow for extended periods of stable intermediate catch

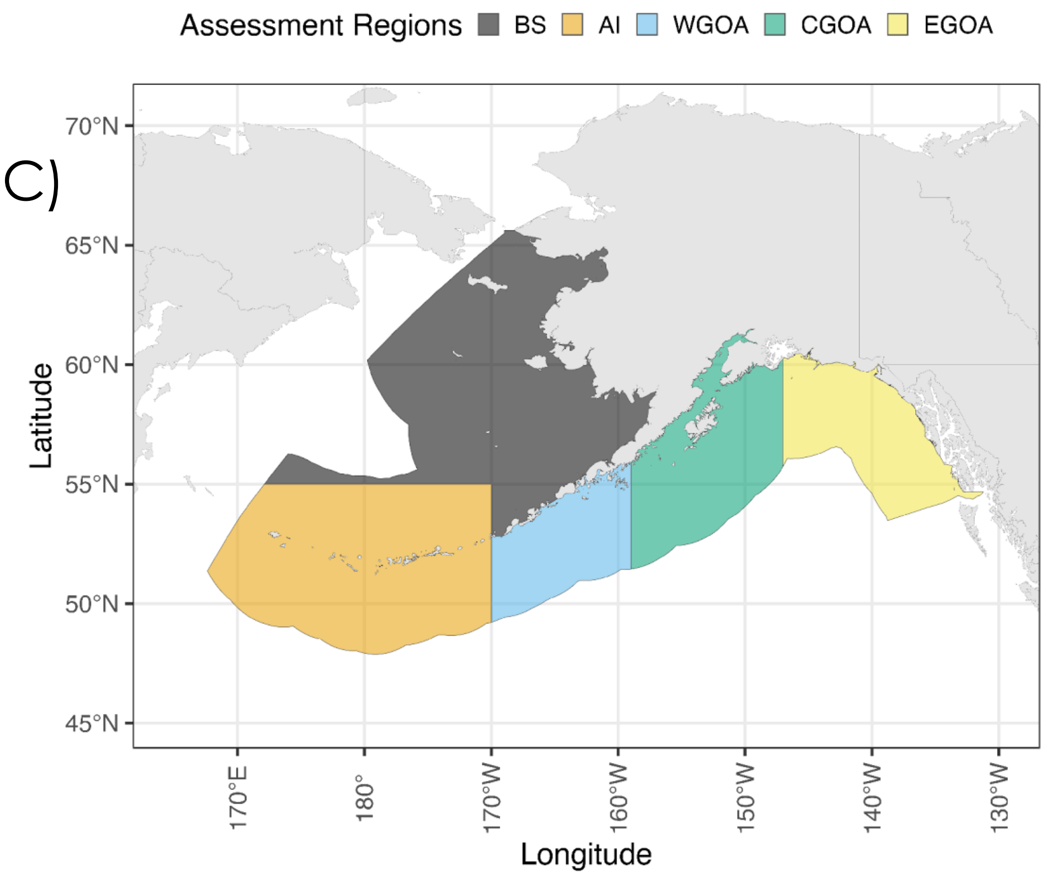
A hybrid rule that combines elements of these strategies may improve relative management performance:

e.g., $F_{xx\%}$ threshold policy, with one-way stability constraints, and a stakeholder informed harvest cap.

But what about spatial dynamics?

SpatialSablefishMSE

- 5-region OM w/ support for regionally varying demographic rates (Cheng et al. 2025)
- 1-region EM, mimicking current assessment (SPoRC)
- Support for detailed regional fishery dynamics
  - Region-specific selectivity
  - ABC apportionment
  - Fleet TAC allocation
  - Fleet TAC utilization



Evaluate alternative HCRs across different assumptions about stock movement, spatial recruitment dynamics, and spatial patterns in fishery selectivity

Acknowledgements

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Stakeholders:

Linda Behnken

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GitHub Links

OM: BenWilliams-NOAA/afscOM

SablefishMSE: ovec8hkin/SablefishMSE

SpatialSablefishMSE: ovec8hkin/SpatialSablefishMSE

SPoRC: chengmatt/SPoRC

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Questions?

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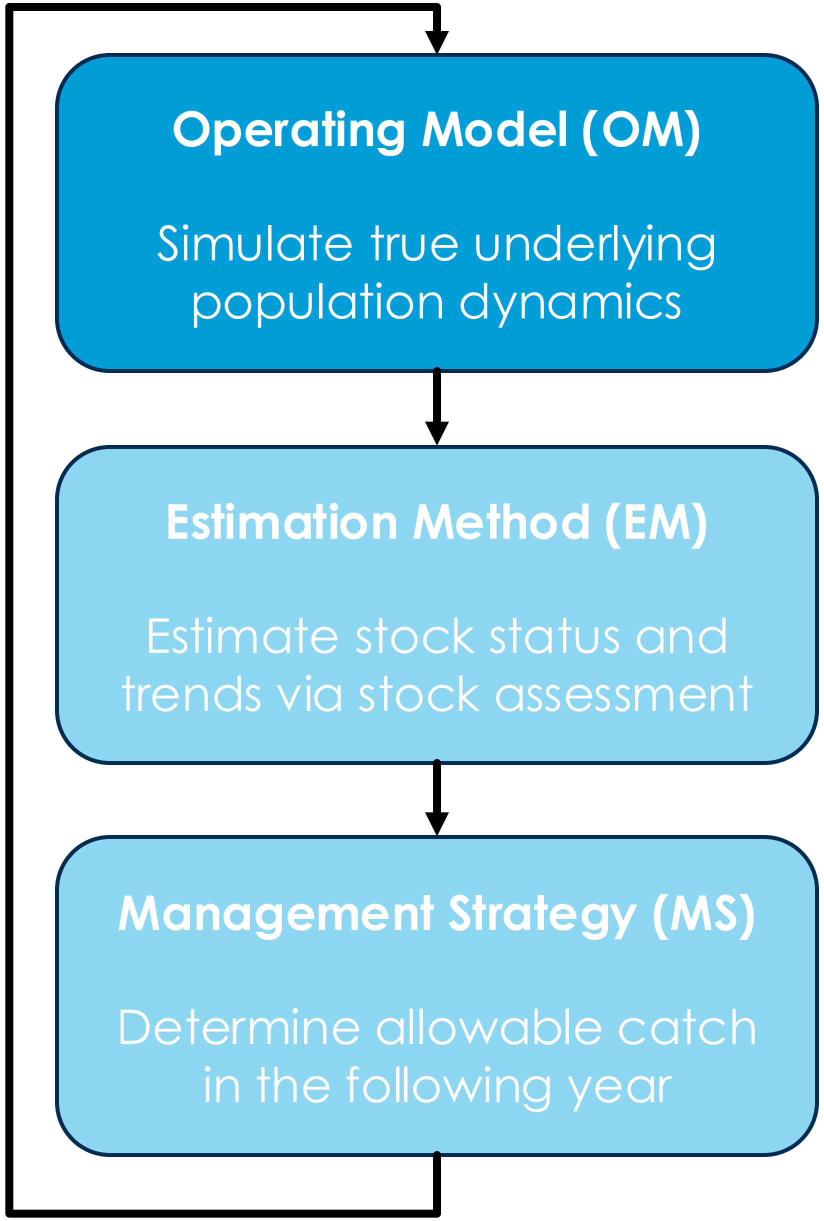

OM Demographics

Age-and-sex structured population model

Two fishery fleets: fixed gear and trawl

Single spatial region

Constant natural mortality