Agenda Item D.10.a
Supplemental NMFS Powerpoint
(Electronic Only)
June 2015

Management Strategy Evaluation for Alternative Rebuilding Strategies for West Coast Groundfish

NOAA FISHERIES

NWFSC

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June Council Meeting
June 16, 2015

Outline

- Motivation
- MSE setup
  - Life-histories
- Alternative Strategies
- Results
- Discussion

Motivation

- Update and expand upon the previous analysis (Punt and Ralston 2007) to meet the current requirements for rebuilding federally managed overfished stocks.

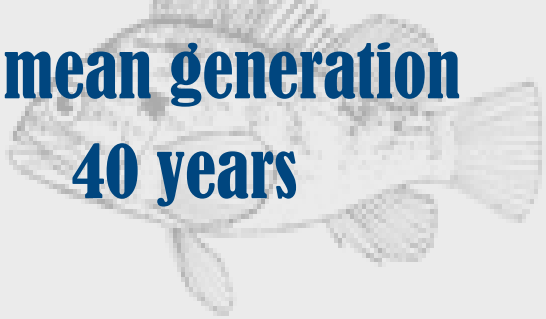
- Identify alternative rebuilding strategies for U.S. West Coast groundfish that meet the following management goals:
  - Rebuild the stock in shortest time possible while limiting impact across fisheries
  - Implement a rebuilding strategy that results in limited changes in harvest rates during rebuilding (predictability)

Evaluate Alternative Life- Histories

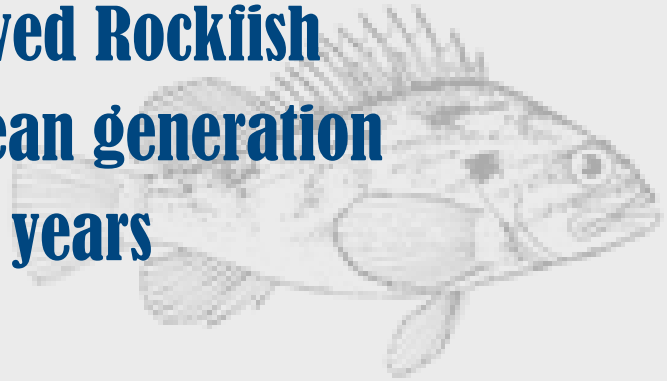
Flatfish
mean generation
23 years

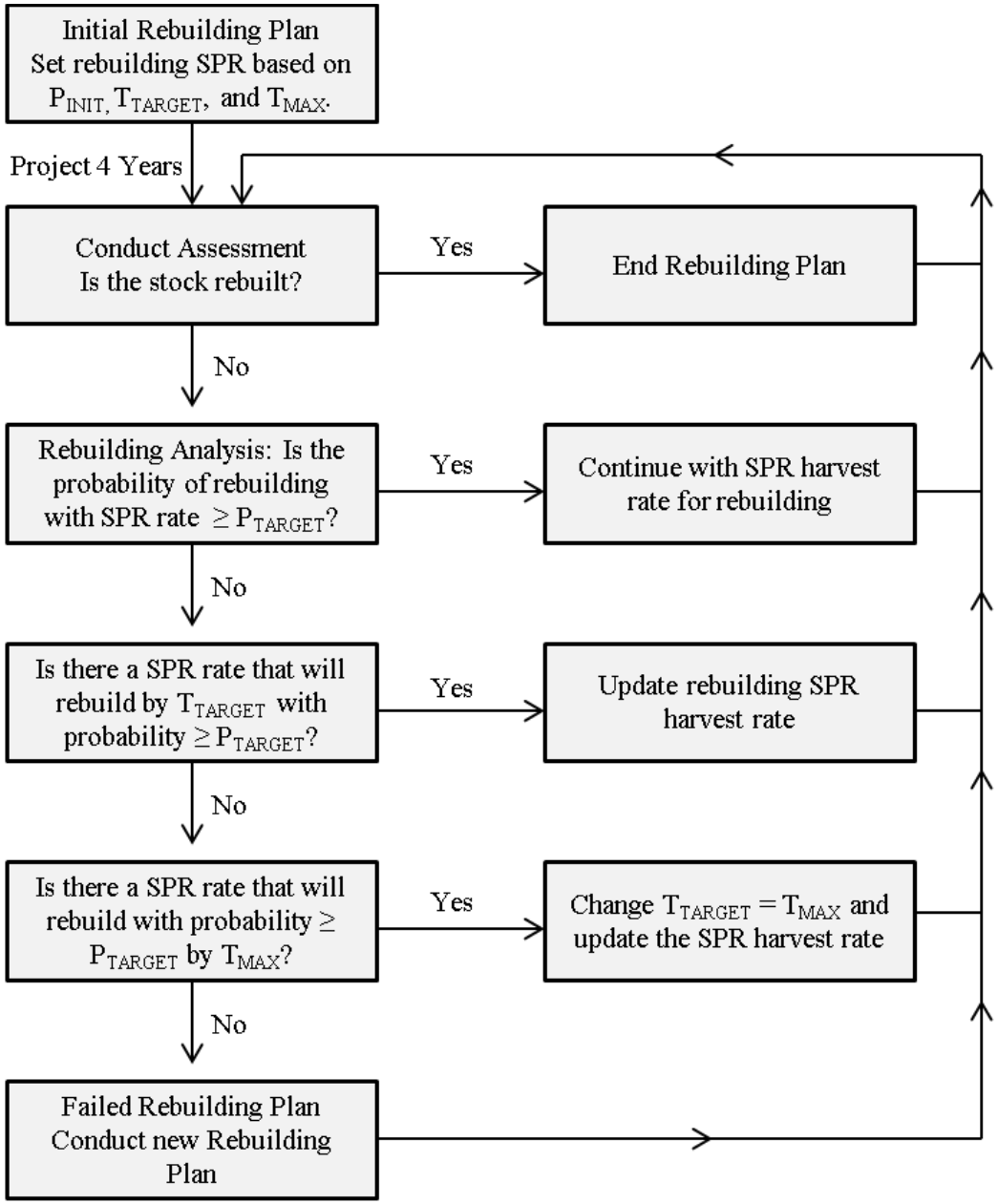
Roundfish
mean generation
23 years

Medium – Lived Rockfish
mean generation
40 years



Long – Lived Rockfish
mean generation
70 years




Initial Rebuilding Plan
Set rebuilding SPR based on P_{INIT}, T_{TARGET}, and T_{MAX}.
Project 4 Years
Conduct Assessment
Is the stock rebuilt?
Yes
End Rebuilding Plan
No
Rebuilding Analysis: Is the probability of rebuilding with SPR rate $\geq P_{TARGET}$?
Yes
Continue with SPR harvest rate for rebuilding
No
Is there a SPR rate that will rebuild by T_{TARGET} with probability $\geq P_{TARGET}$?
Yes
Update rebuilding SPR harvest rate
No
Is there a SPR rate that will rebuild with probability $\geq P_{TARGET}$ by T_{MAX}?
Yes
Change $T_{TARGET} = T_{MAX}$ and update the SPR harvest rate
No
Failed Rebuilding Plan
Conduct new Rebuilding Plan

Alternative Rebuilding Strategies

1. Status Quo

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch

- Minimum rebuilding probability by T_{TARGET} for continuing with the current SPR harvest rate for update rebuilding analyses = 0.50

- Stock assessed every 4th year with an update rebuilding plan while overfished.

*All strategies limit the change in catch between rebuilding plans by; 1.2 x current catch or 0.5 x current catch

Alternative Rebuilding Strategies

2. Flexible

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch
- Minimum Rebuilding Probability for Update Analyses = 0.40 to continue at the set SPR
- Stock assessed every 4th year with an update rebuilding plan while overfished.

Alternative Rebuilding Strategies

3. Risk Averse

- Initial Rebuilding Probability = 0.75 for first rebuilding plan catch
- Minimum Rebuilding Probability for Update Analyses = 0.60 to continue at the set SPR
- Stock assessed every 4th year with an update rebuilding plan while overfished.

Alternative Rebuilding Strategies

4. Fixed Rebuilding

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch

- Do not change the SPR harvest rate, T_{TARGET}, or T_{MAX}.

- If not rebuilt by T_{TARGET} set the SPR harvest rate to either 75% SPR_{proxy} or the rebuilding SPR harvest rate, whatever is greater.

* The buffer and harvest control rule was accidently applied to update analyses resulting an increased level of precaution.

Summary Rebuilding Strategies

1. Status Quo

- P_{INIT} = 0.60, P = 0.50, Assess & Rebuild every 4th year

2. Flexible

- P_{INIT} = 0.60, P = 0.40, Assess & Rebuild every 4th year

3. Risk Averse

- P_{INIT} = 0.75, P = 0.60, Assess & Rebuild every 4th year

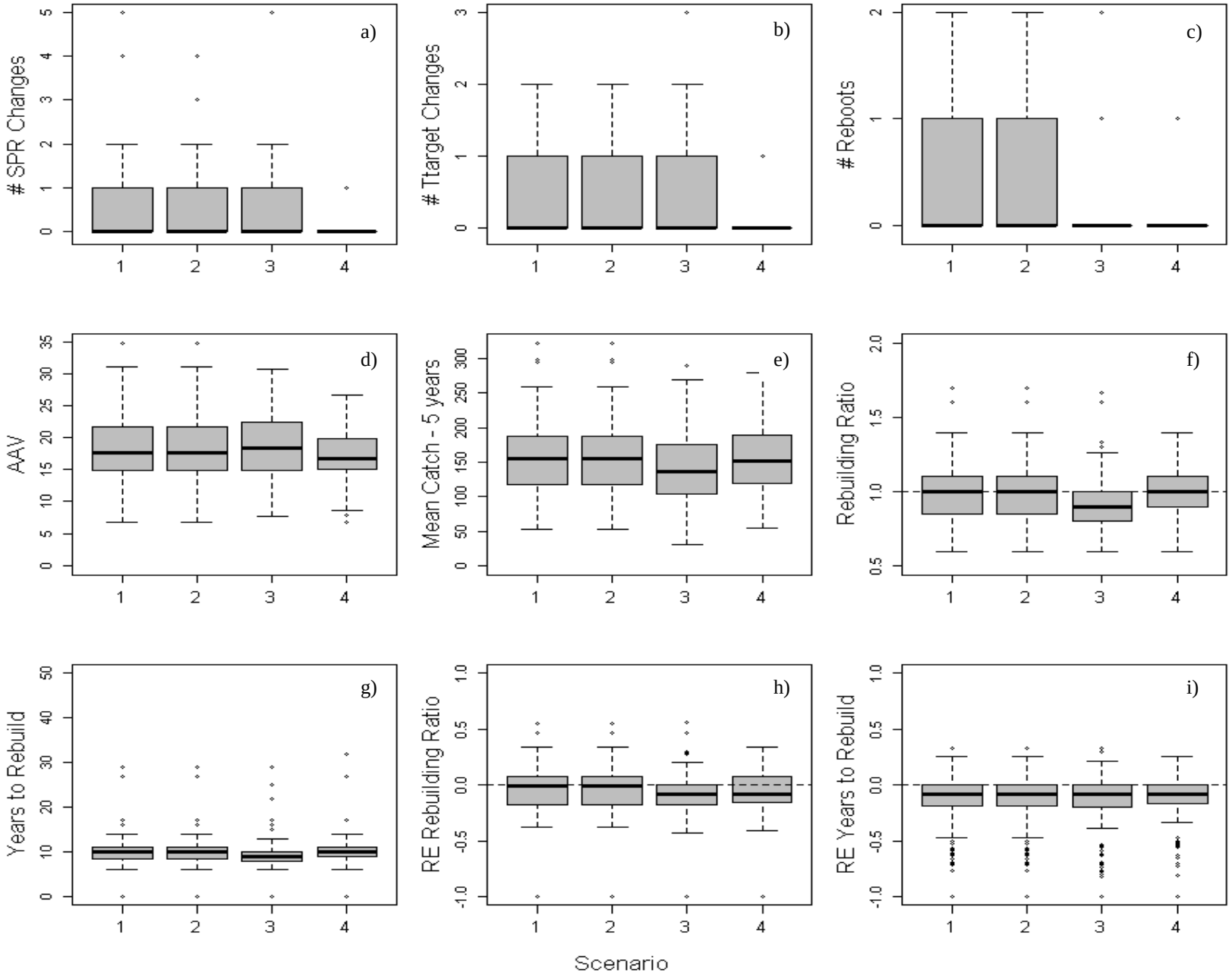
4. Fixed Rebuilding

- P_{init} = 0.60, fixed SPR harvest rate until T_{TARGET}, if not rebuilt change SPR = 75% SPR_{proxy} or keep at current SPR

Evaluating Performance

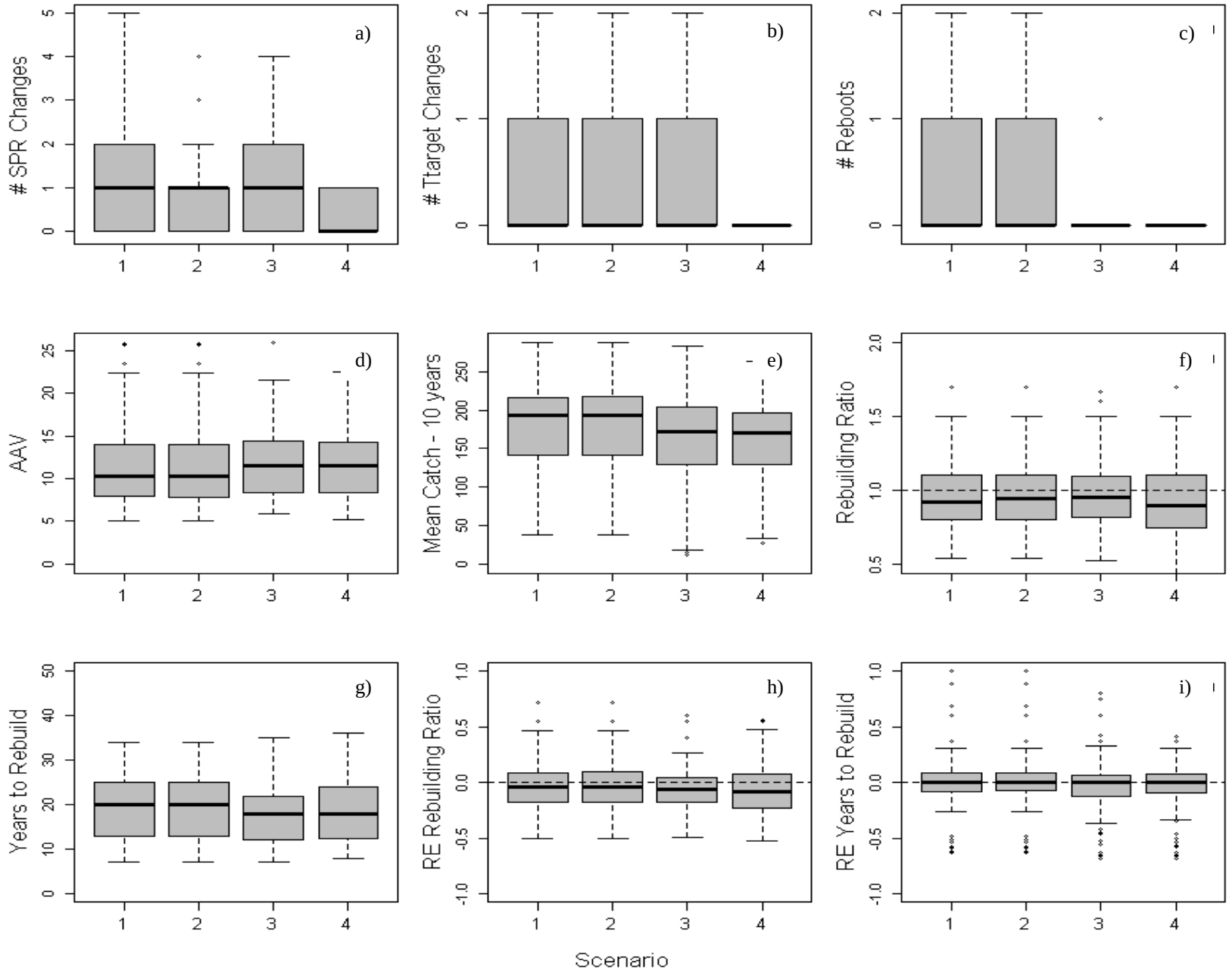
1. Number of SPR changes during rebuilding
2. Number of changes in T_{TARGET}
3. Number of times the rebuilding plan failed (termed a "reboot")
4. Average catch over a fixed period during rebuilding
5. Average annual variability of the catches (AAV)
6. Rebuilding Ratio = Number of years to rebuild / Initial T_{TARGET}
7. Relative Error
    1. RE rebuilding ratio
    2. RE rebuilding time

Results: Flatfish



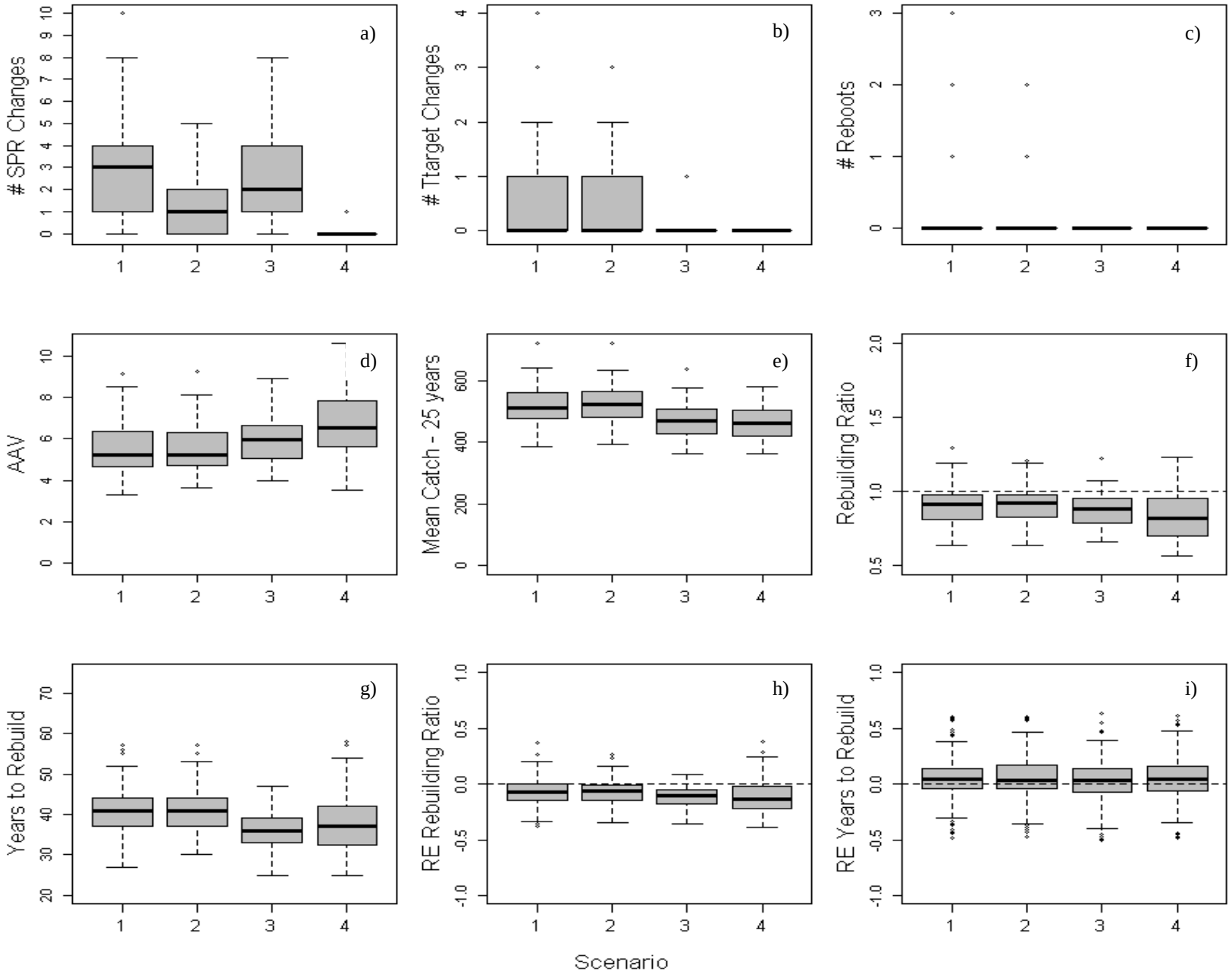
1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed

Results: Roundfish



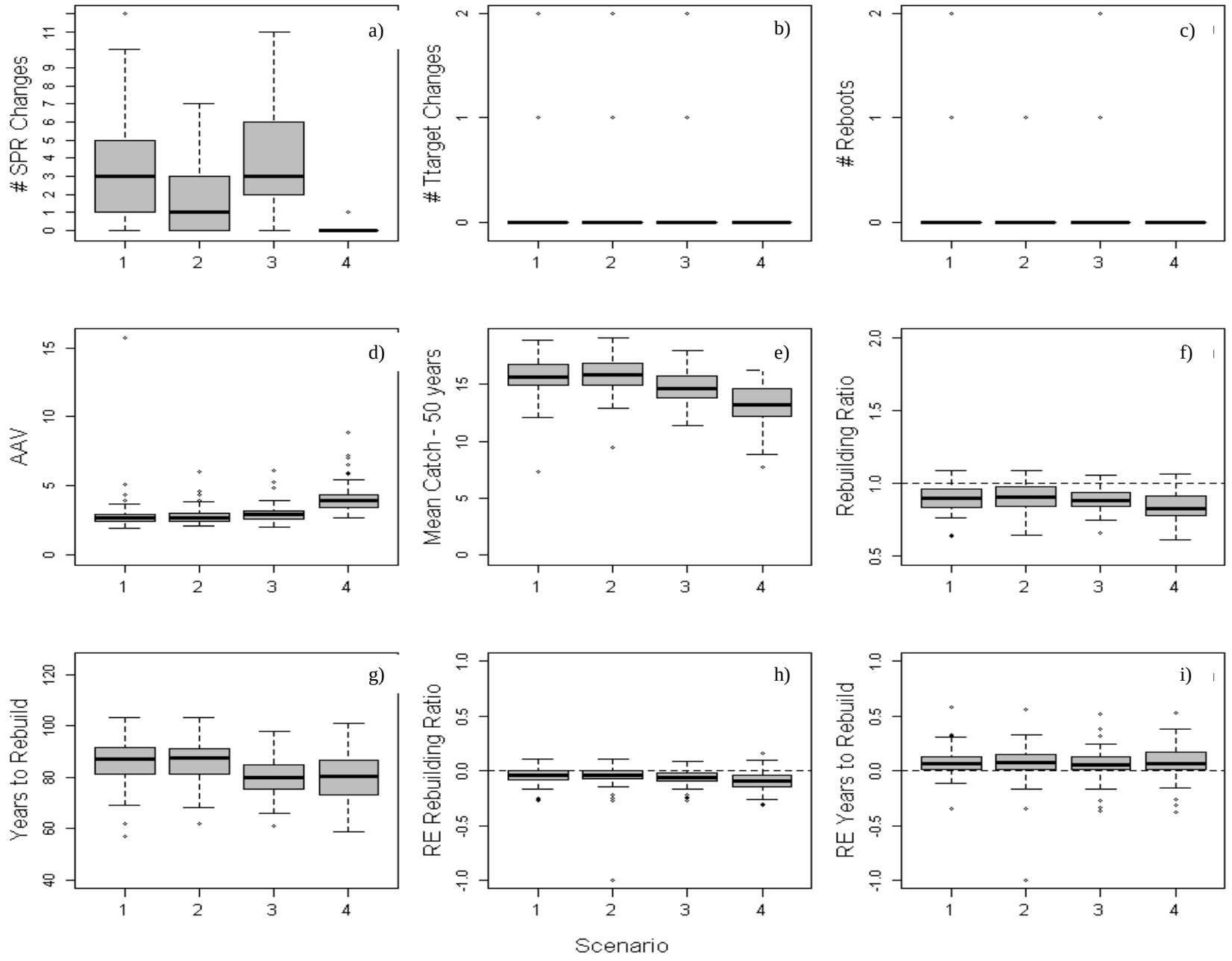
1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed

Results: Medium-Lived Rockfish



1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed

Results: Long-Lived Rockfish

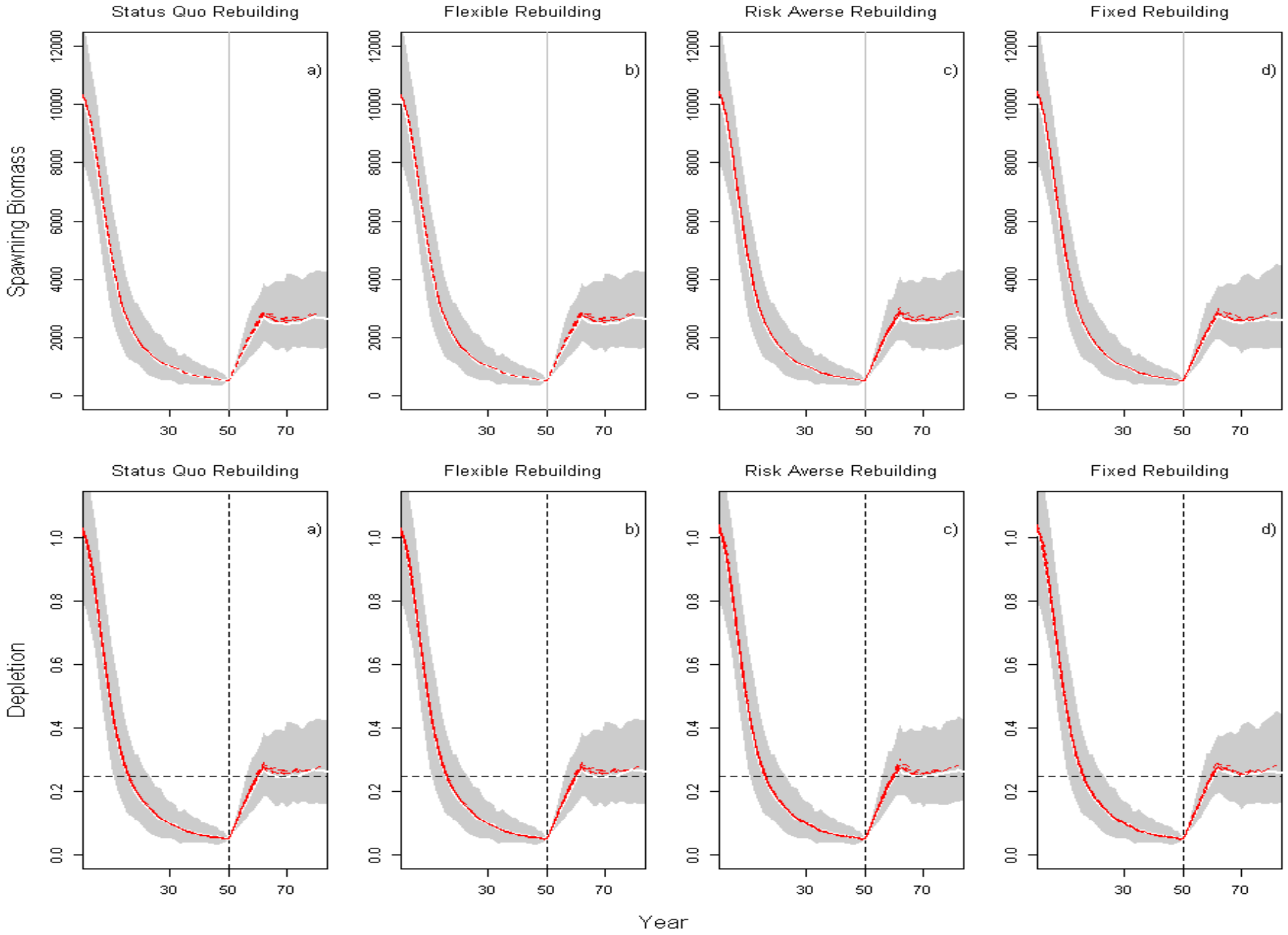


1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed

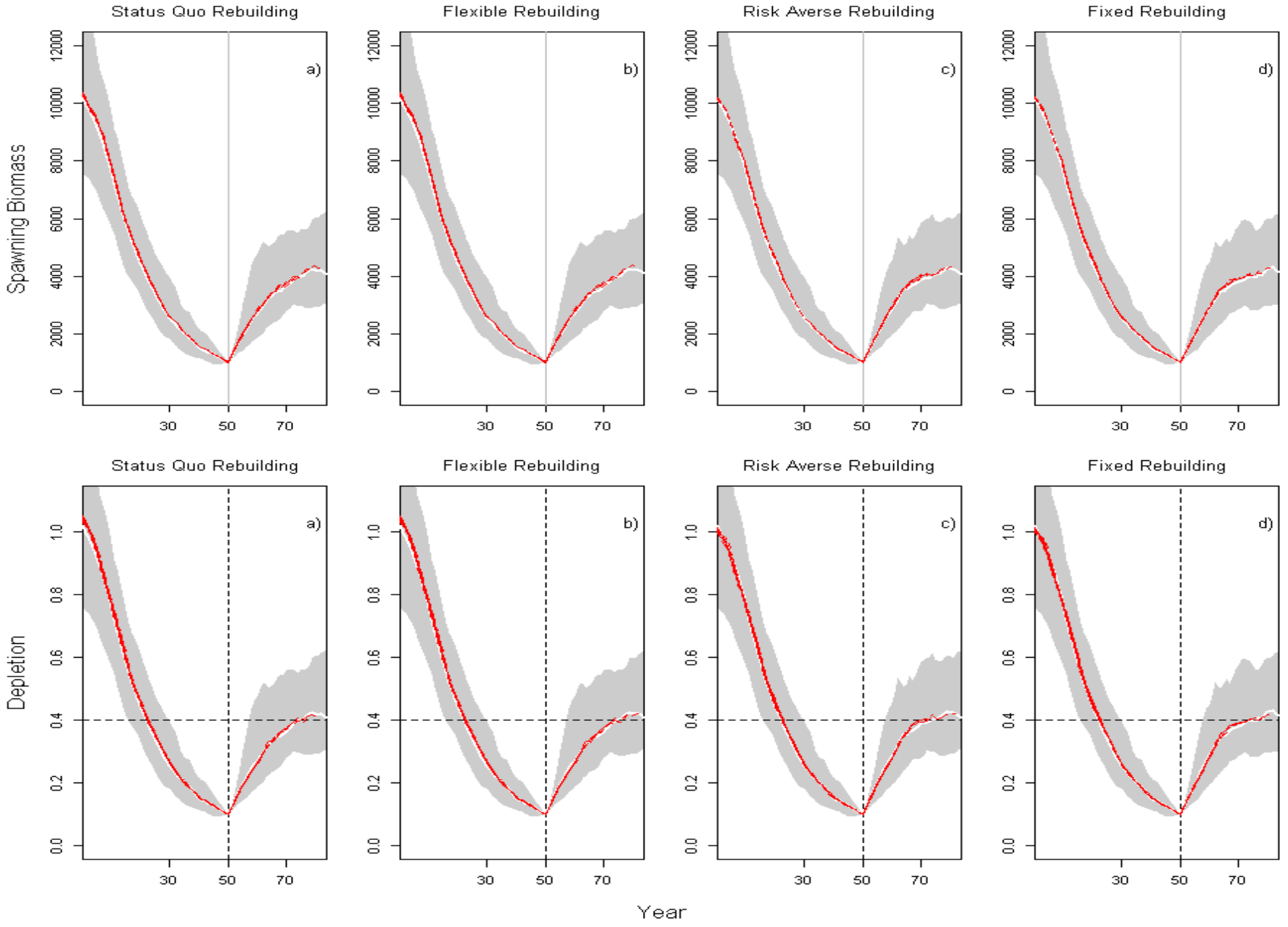
Discussion

- Minimal difference in rebuilding performance across strategies that alter probabilities
  - Allowing a P= 40% threshold did not negatively impact rebuilding
- Applying a higher probability reduces rebuilding time but also catch and requires SPR to be updated more frequently for rockfishes.
- Fixed Rebuilding – resulted in slightly lower rebuilding times, but produced lower average catches.

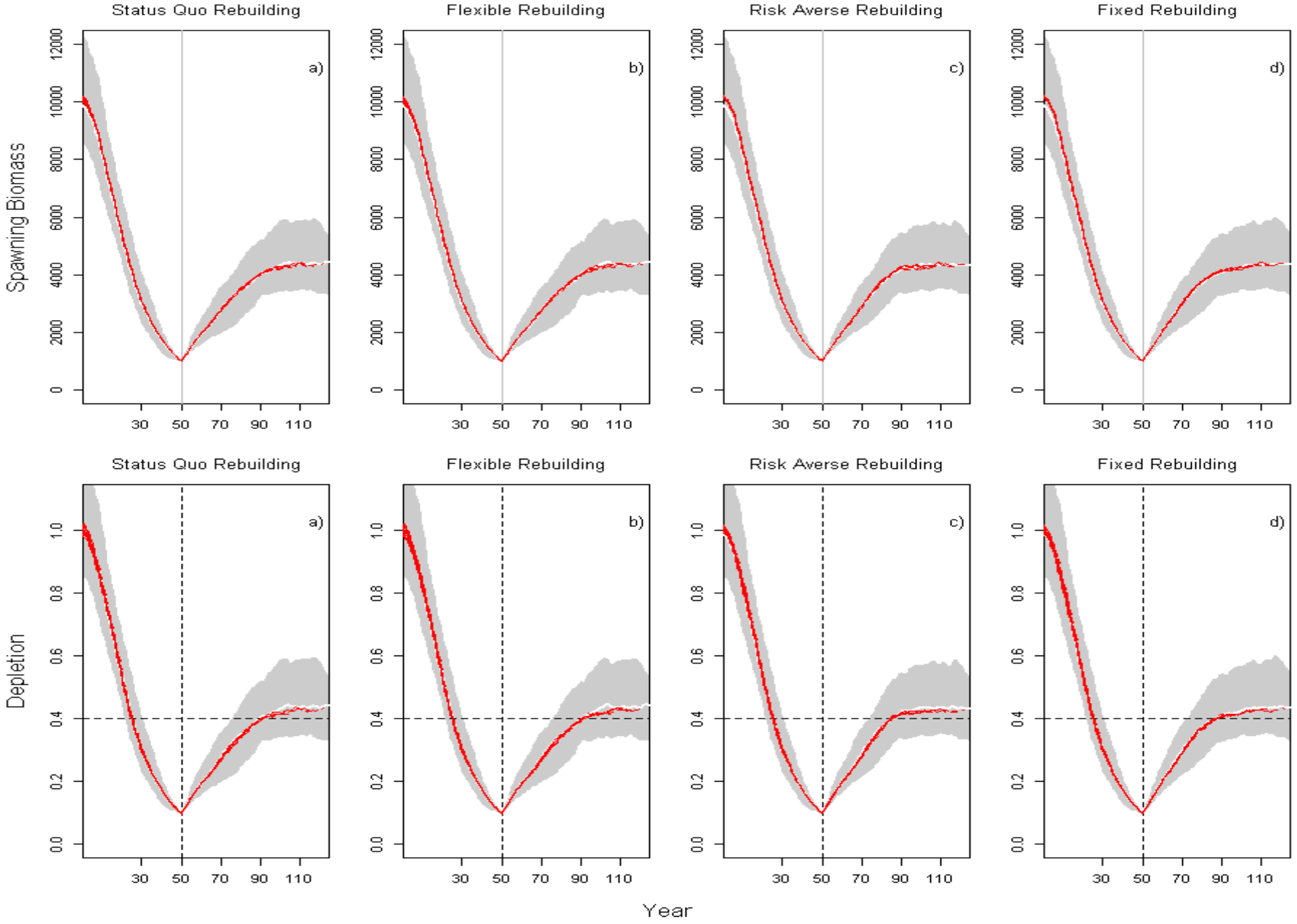
Flatfish


Status Quo Rebuilding
Flexible Rebuilding
Risk Averse Rebuilding
Fixed Rebuilding
a)
b)
c)
d)
Spawning Biomass
0
2000
4000
6000
8000
10000
12000
Depletion
0.0
0.2
0.4
0.6
0.8
1.0
30
50
70
Year

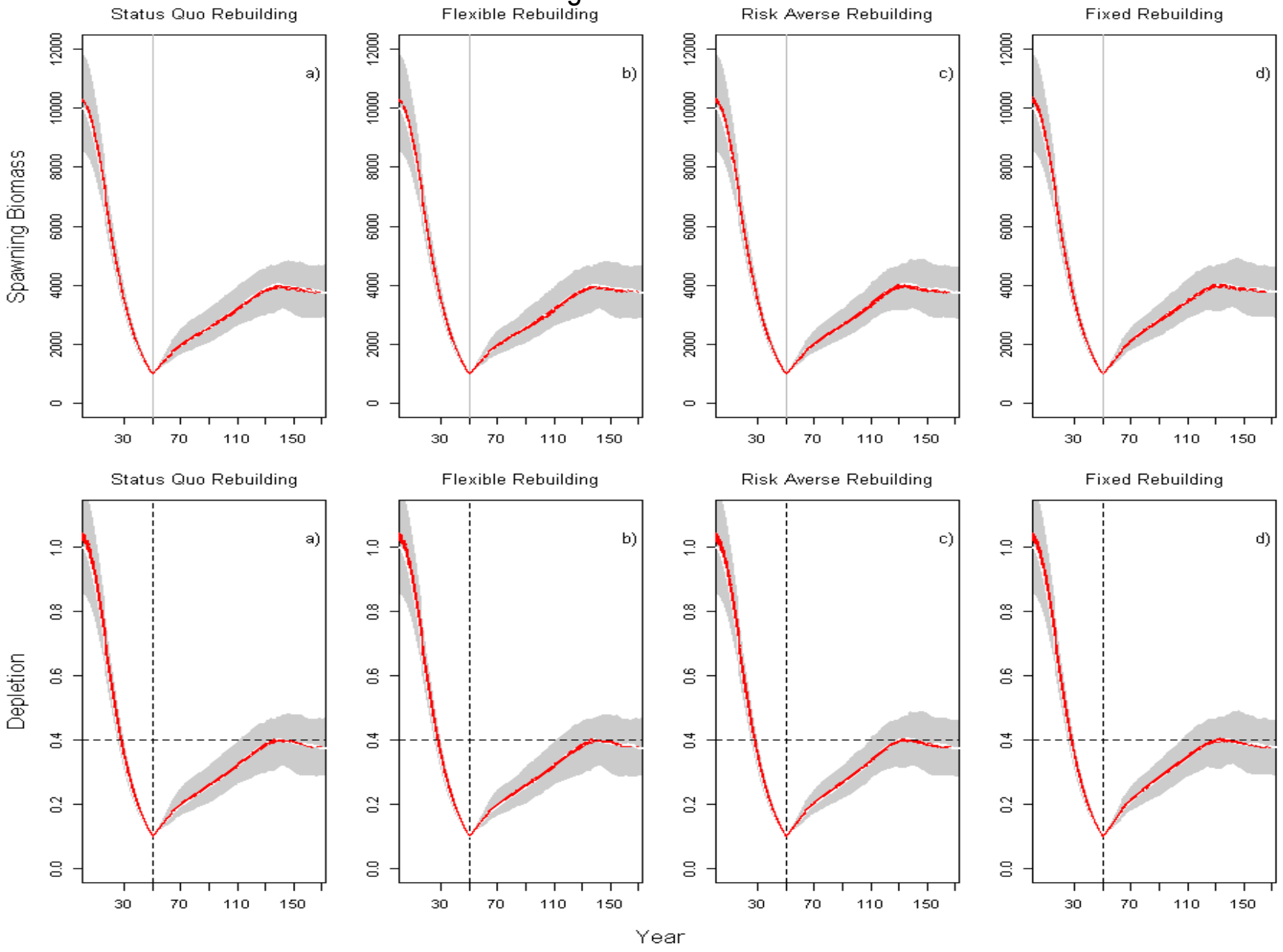
Roundfish


Status Quo Rebuilding
Flexible Rebuilding
Risk Averse Rebuilding
Fixed Rebuilding
a)
b)
c)
d)
Spawning Biomass
Depletion
Year
0
2000
4000
6000
8000
10000
12000
0.0
0.2
0.4
0.6
0.8
1.0
30
50
70

Medium – Lived Rockfish

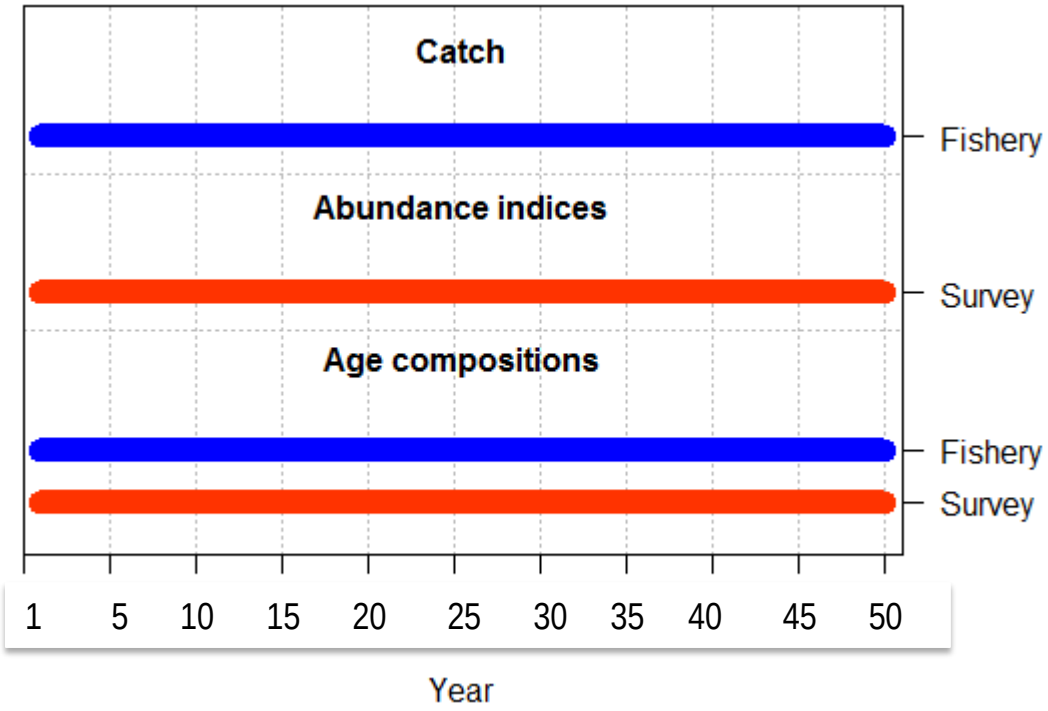


Long – Lived Rockfish



Operating Model Setup

- First Assessment in Year 50



- Fishery & Survey Age N = 100 annually

Alternative Rebuilding Strategies

Status Quo - Frequency

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch
- Minimum Rebuilding Probability for Update Analyses = 0.50 to continue at the set SPR
- Stock assessed every 2nd/8th year with an update rebuilding plan while overfished.
  - Flatfish & Roundfish – 2
  - Rockfishes - 8

Alternative Rebuilding Strategies

Flexible - Frequency

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch
- Minimum Rebuilding Probability for Update Analyses = 0.40 to continue at the set SPR
- Stock assessed every 2nd/8th year with an update rebuilding plan while overfished.
  - Flatfish & Roundfish – 2
  - Rockfishes - 8

Alternative Rebuilding Strategies

Natural Mortality (Base: all years)

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch
- Update Rebuilding Probability = 0.50 to continue at the set SPR
- Stock assessed every 4th year with an update rebuilding plan while overfished.
- Natural mortality misspecified for all years
  - Positively biased by 10%

Alternative Rebuilding Strategies

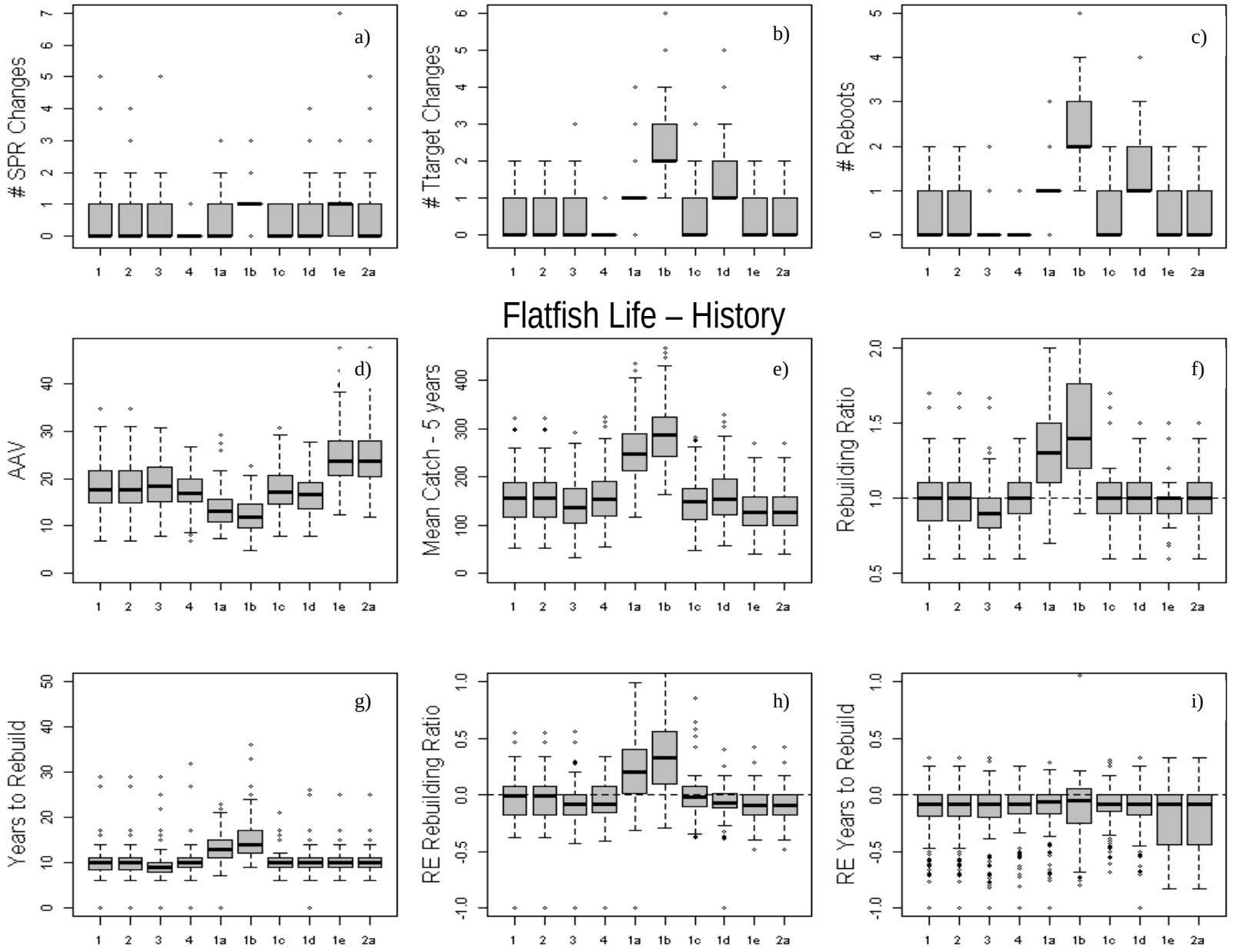
Historical Catch Underestimation (Base)

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch
- Update Rebuilding Probability = 0.50 to continue at the set SPR
- Stock assessed every 4th year with an update rebuilding plan while overfished.
- The historical catch history was assumed to only be 80% of the true annual removals.

Alternative Rebuilding Strategies

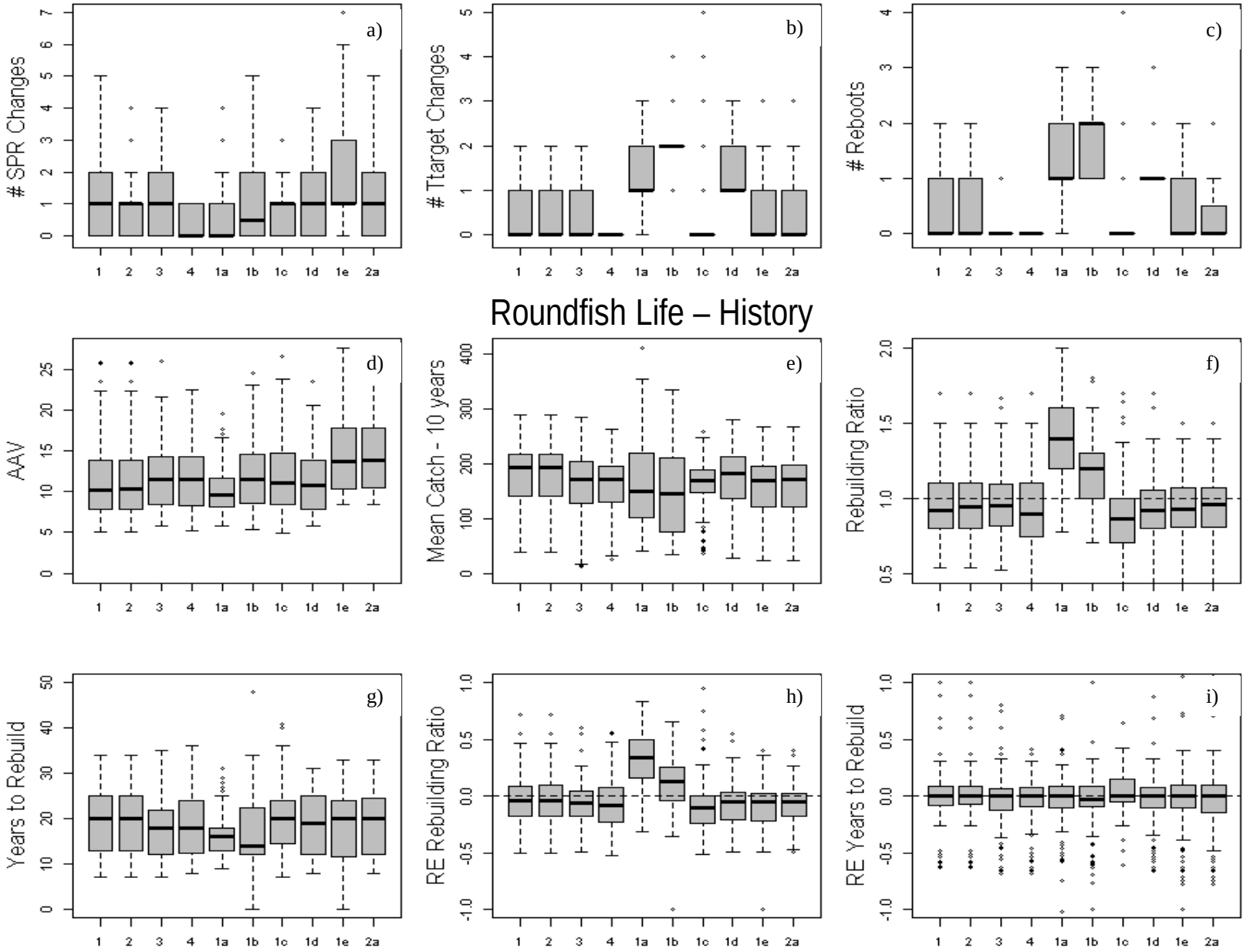
<u>Natural Mortality (Base: half of rebuilding)</u>

- Initial Rebuilding Probability = 0.60 for first rebuilding plan catch
- Update Rebuilding Probability = 0.50 to continue at the set SPR
- Stock assessed every 4th year with an update rebuilding plan while overfished.
- Natural mortality misspecified for half of the rebuilding period
  - Positively biased by 10%



1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed 1a. M 1b. h

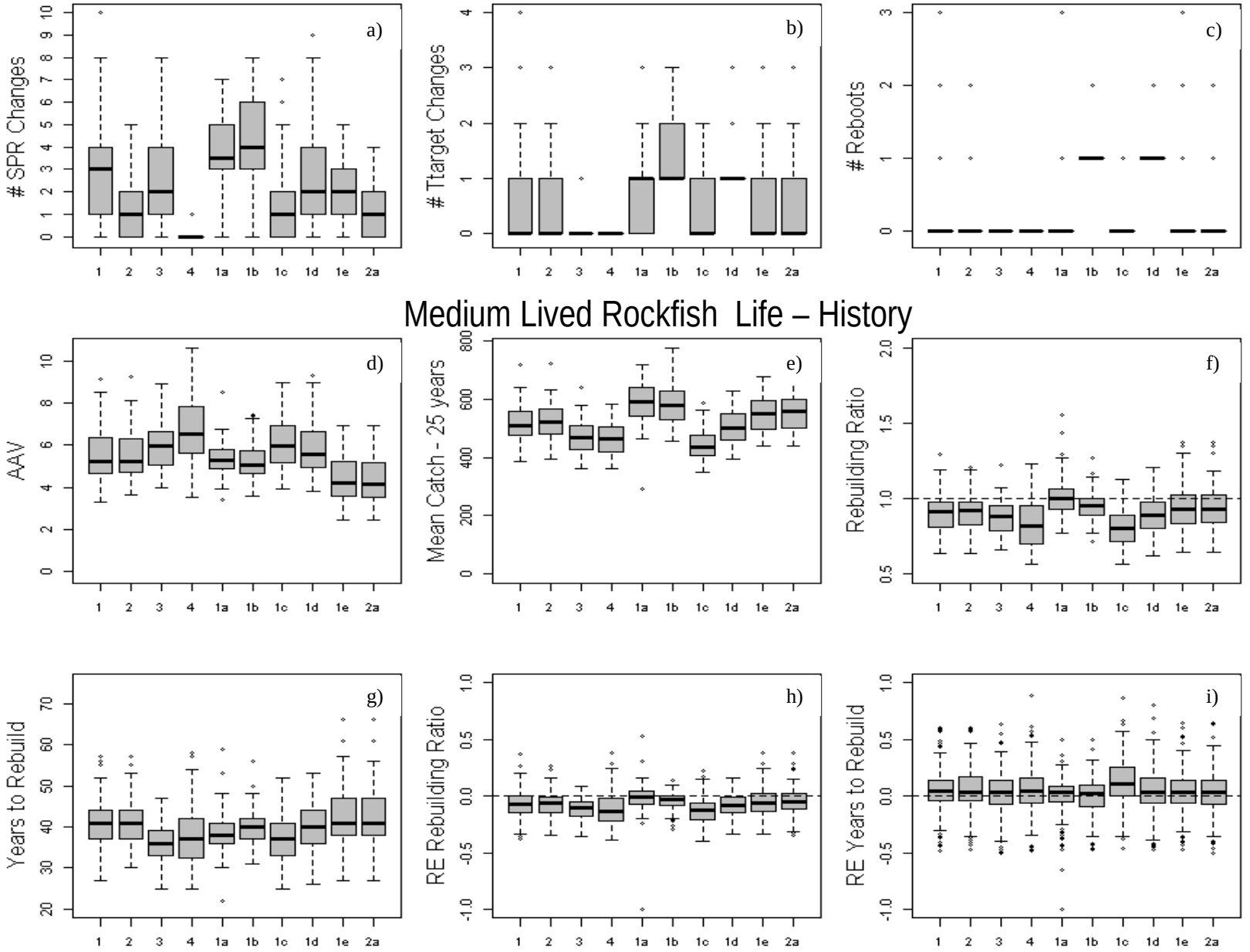
1c. Hist. Catch 1d. Catch Constraints 1e Status Quo – Frequency 2a. Flexible – Frequency



Roundfish Life – History

1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed 1a. M 1b. h

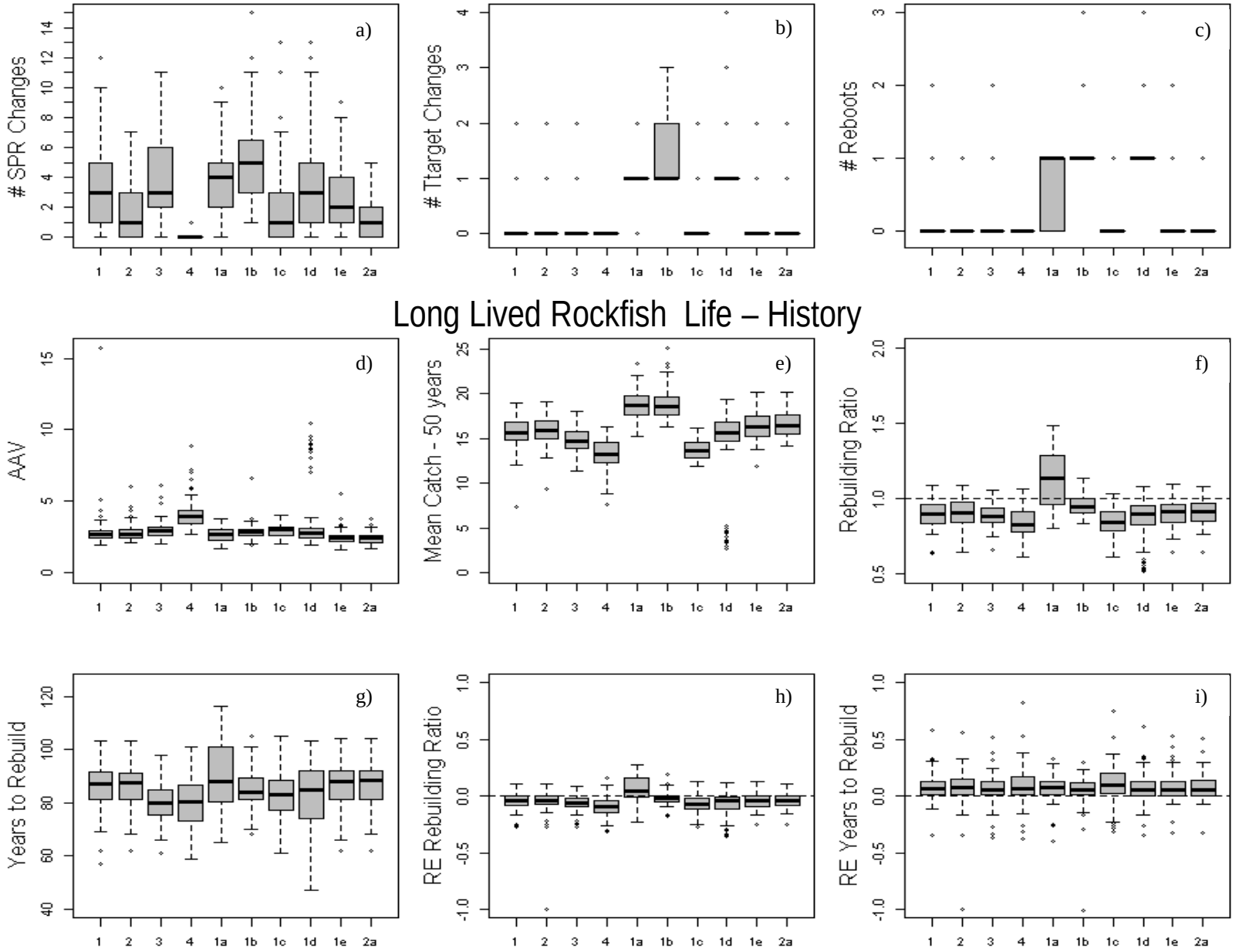
1c. Hist. Catch 1d. Catch Constraints 1e Status Quo – Frequency 2a. Flexible – Frequency



Medium Lived Rockfish Life – History

1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed 1a. M 1b. h

1c. Hist. Catch 1d. Catch Constraints 1e Status Quo – Frequency 2a. Flexible – Frequency



Long Lived Rockfish Life – History

1. Status Quo 2. Flexible 3. Risk Averse 4. Fixed 1a. M 1b. h

1c. Hist. Catch 1d. Catch Constraints 1e Status Quo – Frequency 2a. Flexible – Frequency