Has the MSA Led to Stock Rebuilding?

a synthesis of all U.S. overfished stocks

Bevan Symposium

Seattle, WA

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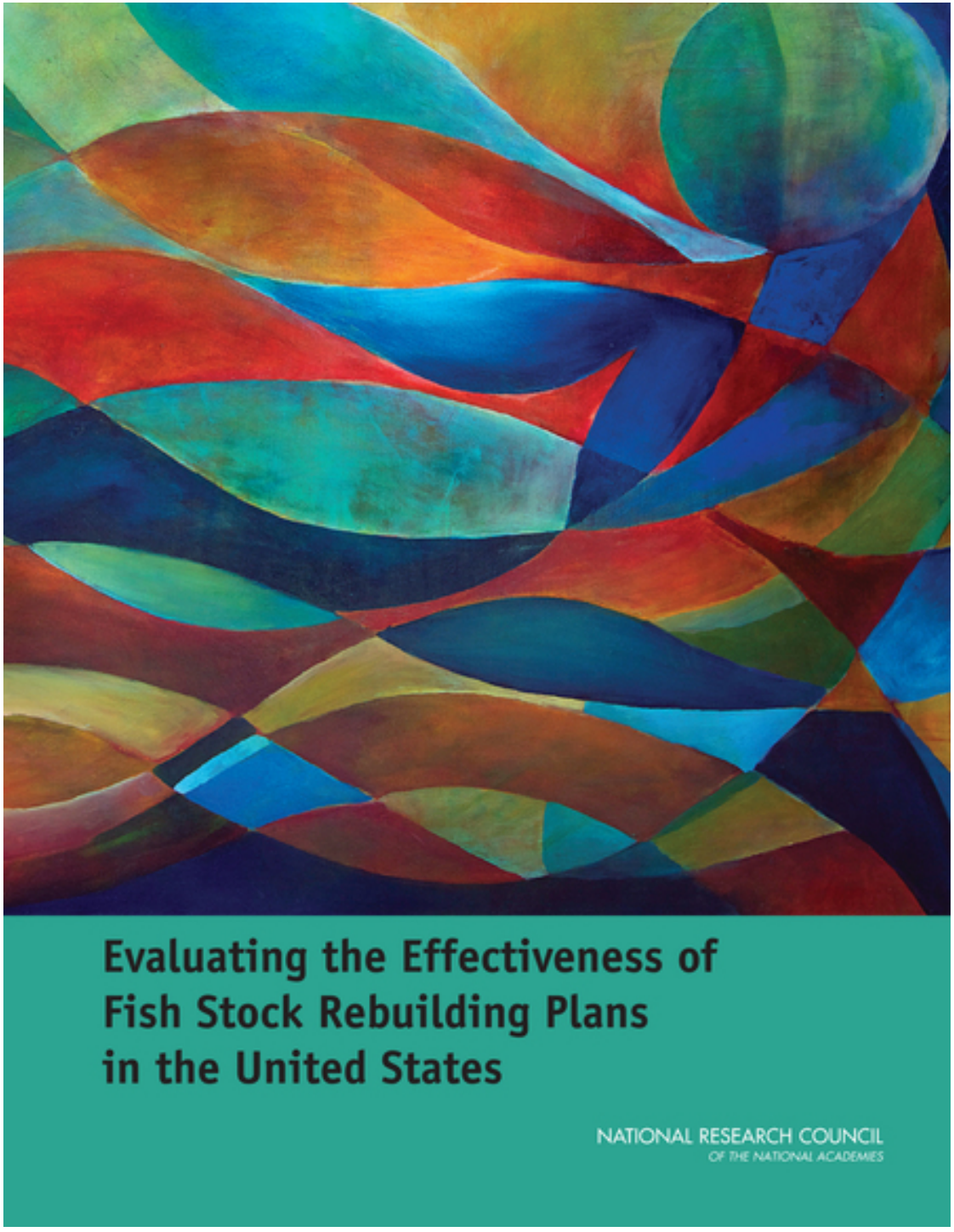
Ana Parma

Centro Nacional Patagónico

Argentina

CONICET

CENPAT



In 2011, NOAA commissioned the National Research Council of the National Academies to analyze the effects of the MSA mandate to rebuild overfished stocks

Cover art by Ben Miller
“Abstract Fish”

NATIONAL ACADEMIES

…and the ***NRC Committee on Evaluating the Effectiveness of Fish Stock Rebuilding Plans in the United States***

- Patrick Sullivan (Co-Chair), Cornell University
- Jeremy Collie, University of Rhode Island
- Troy Hartley, College of William & Mary
- William Heyman, Texas A&M University
- Robert Johnston, Clark University
- André Punt, University of Washington
- Kenneth Rose, Louisiana State University
- James Sanchirico, University of California
- Michael Sissenwine, Woods Hole Oceanographic Institution
- George Sugihara, University of California

The committee was tasked with:

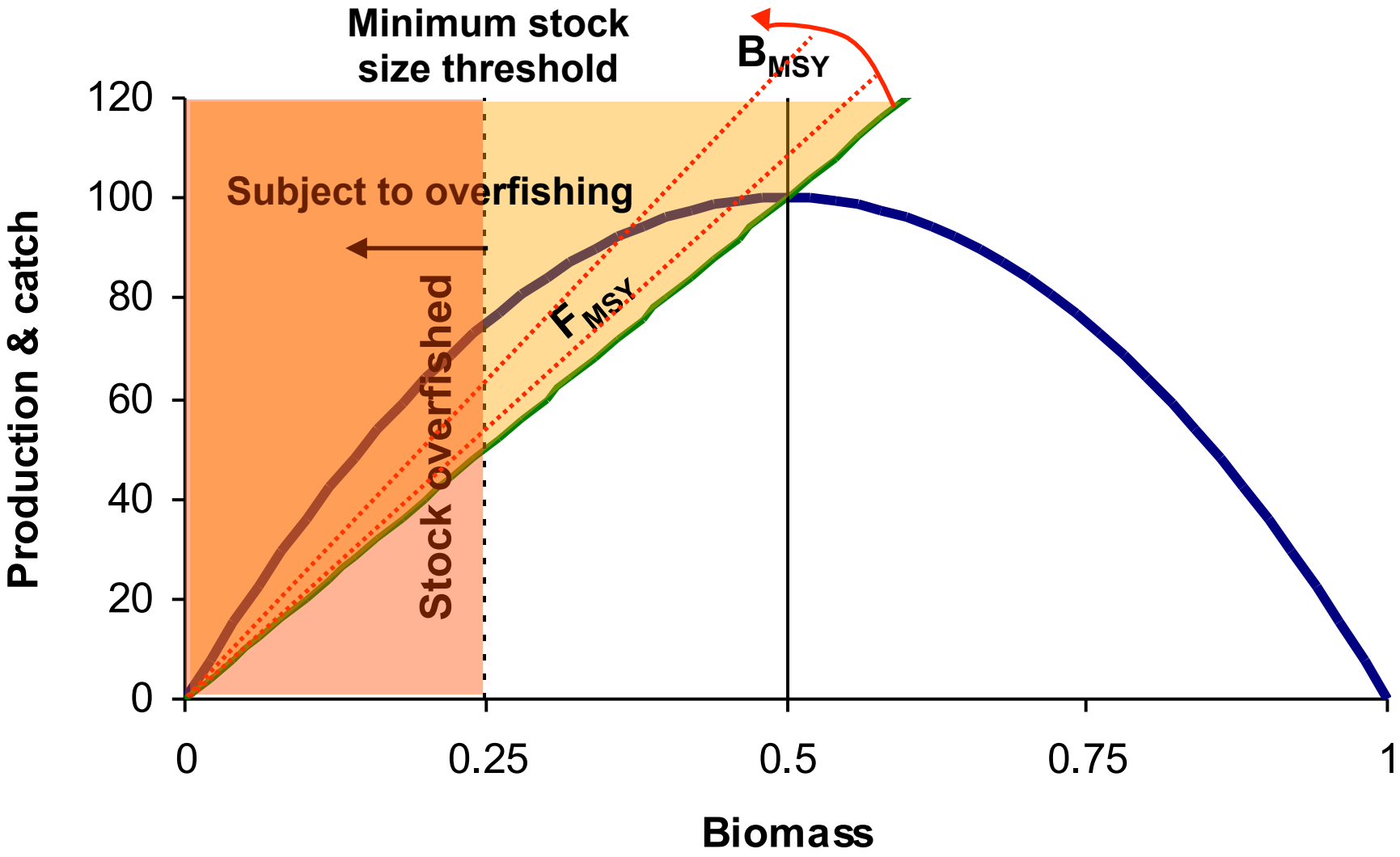
Identifying changes made to fisheries management in response to the MSA rebuilding requirements and evaluating the success in stock rebuilding, including:

1. Methods and approach
2. Outcomes of rebuilding plans
3. Effects of uncertainty
4. Environmental Considerations
5. Economic and social impacts
6. Effects of management measures
7. Knowledge gaps

MSA rebuilding requirements

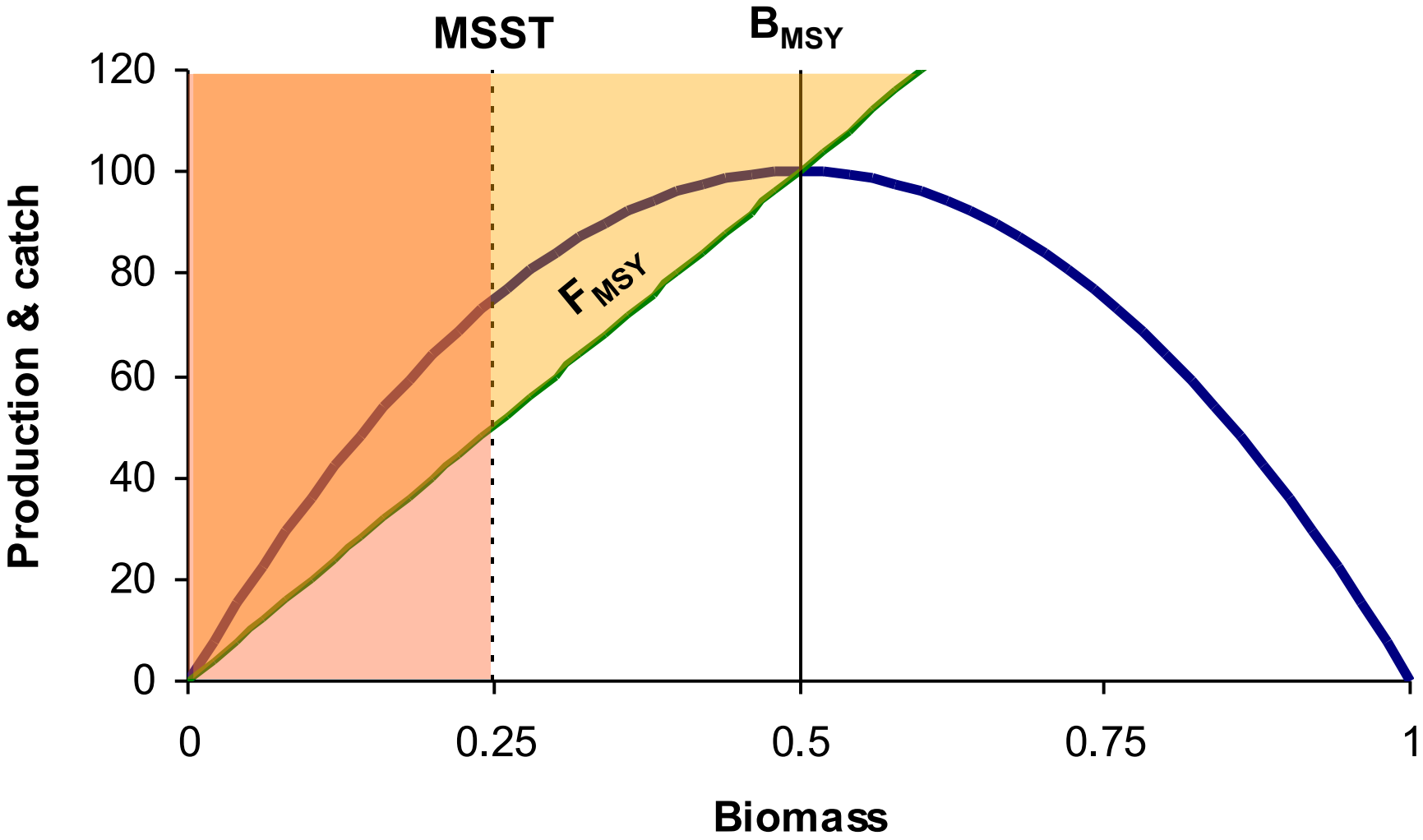
1996 – Sustainable Fisheries Act	Define overfishing as $F \geq F_{MSY}$ Required overfished stocks to be rebuilt Limited the rebuilding time to 10 years with exceptions
2006 Amendment	Called for overfishing to end immediately Required annual catch limits (ACLs) Required accountability measures if ACLs are exceeded

MSA requires annual reports to Congress on the status of stocks



Stock overfished: Biomass < Minimum stock size threshold

Subject to overfishing: Fishing mortality rate > F_{MSY}



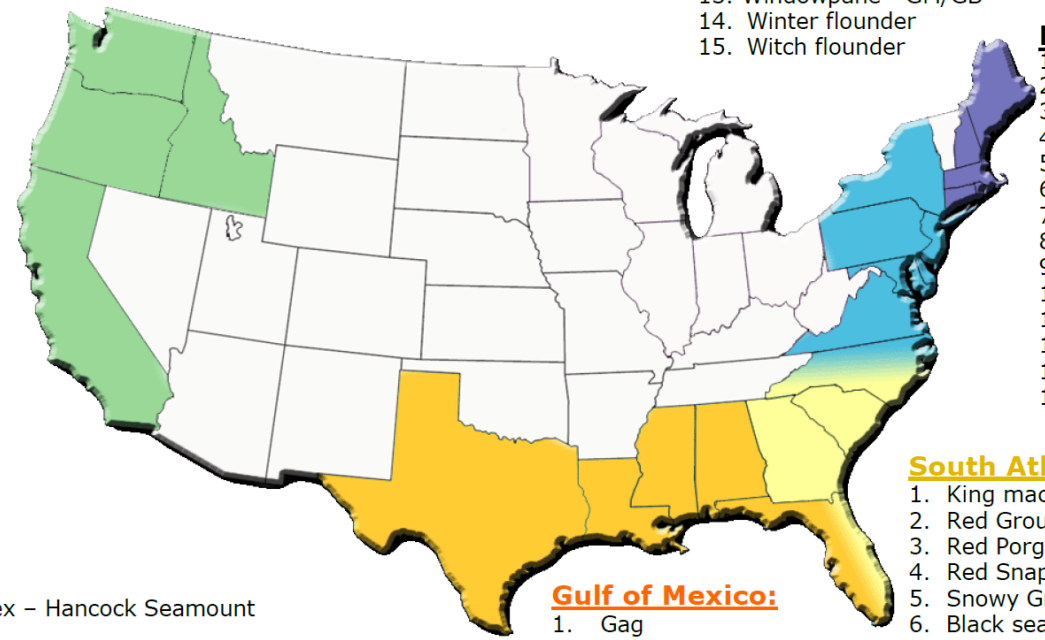
85 federally managed stocks declared overfished over 1997-2011

North Pacific:
1. Blue king crab – Pribilof I.
2. Blue king crab - Saint Mathew I.
3. Southern Tanner crab - Bering Sea
4. Snow crab - Bering Sea

New England:
1. Acadian redfish
2. American plaice
3. Atlantic cod – GB
4. Atlantic cod - GM
5. Atlantic halibut
6. Atlantic salmon
7. Atlantic wolffish
8. Ocean pout
9. Yellowtail flounder–GB
10. Yellowtail flounder– SNE/Mid-Atlantic
11. Yellowtail flounder– C. Cod/Gulf of Maine
12. White hake
13. Windowpane - GM/GB
14. Winter flounder
15. Witch flounder
16. Barndoor skate
17. Smooth skate
18. Thorny skate
19. Sea scallop
20. Haddock- GB
21. Haddock- GM
22. Pollock
23. Silver hake-GM
24. Silver hake
25. Windowpane-SNE
26. Winter skate
27. Goosefish- GM
28. Goosefih- GB/MA
29. Spiny dogfish

Pacific:
1. Boccacio
2. Canary rockfish
3. Cowcod
4. Darkblorched rockfish
5. Pacific ocean perch
6. Petrale sole
7. Chinook salmon - CA Central Valley: Sacramento (fall)
8. Coho salmon - WA Western Strait of Juan de Fuca
9. Lingcod - Pacific coast
10. Yelloweye rockfish
11. Pacific hake
12. Widow rockfish
13. Chinook salmon - Klamath
14. Coho salmon - Queets

Western Pacific
1. Seamount Groundfish Complex – Hancock Seamount



Highly Migratory Species:
1. Albacore – North Atlantic
2. Blacknose shark
3. Blacktip shark - Gulf of Mexico
4. Blacktip shark - South Atlantic
5. Blue marlin – Atlantic
6. Bluefin tuna – West Atlantic
7. Bigeye tuna - Atlantic
8. Dusky shark
9. Porbeagle shark
10. Sandbar shark
11. Sailfish – West Atlantic
12. Scalloped hammerhead
13. Swordfish - N Atlantic
14. White marlin – Atlantic

Gulf of Mexico:
1. Gag
2. Gray triggerfish
3. Greater amberjack
4. Red snapper
5. Vermillon snapper
6. Red grouper

South Atlantic:
1. King mackerel
2. Red Grouper
3. Red Porgy
4. Red Snapper
5. Snowy Grouper
6. Black sea bass
7. Yellowtail snapper

Mid-Atlantic:
1. Black sea bass
2. Bluefish
3. Butterfish
4. Scup
5. Summer flounder
6. Tilefish

Caribbean:
1. Grouper Unit 1
2. Grouper Unit 2
3. Grouper Unit 4
4. Queen conch

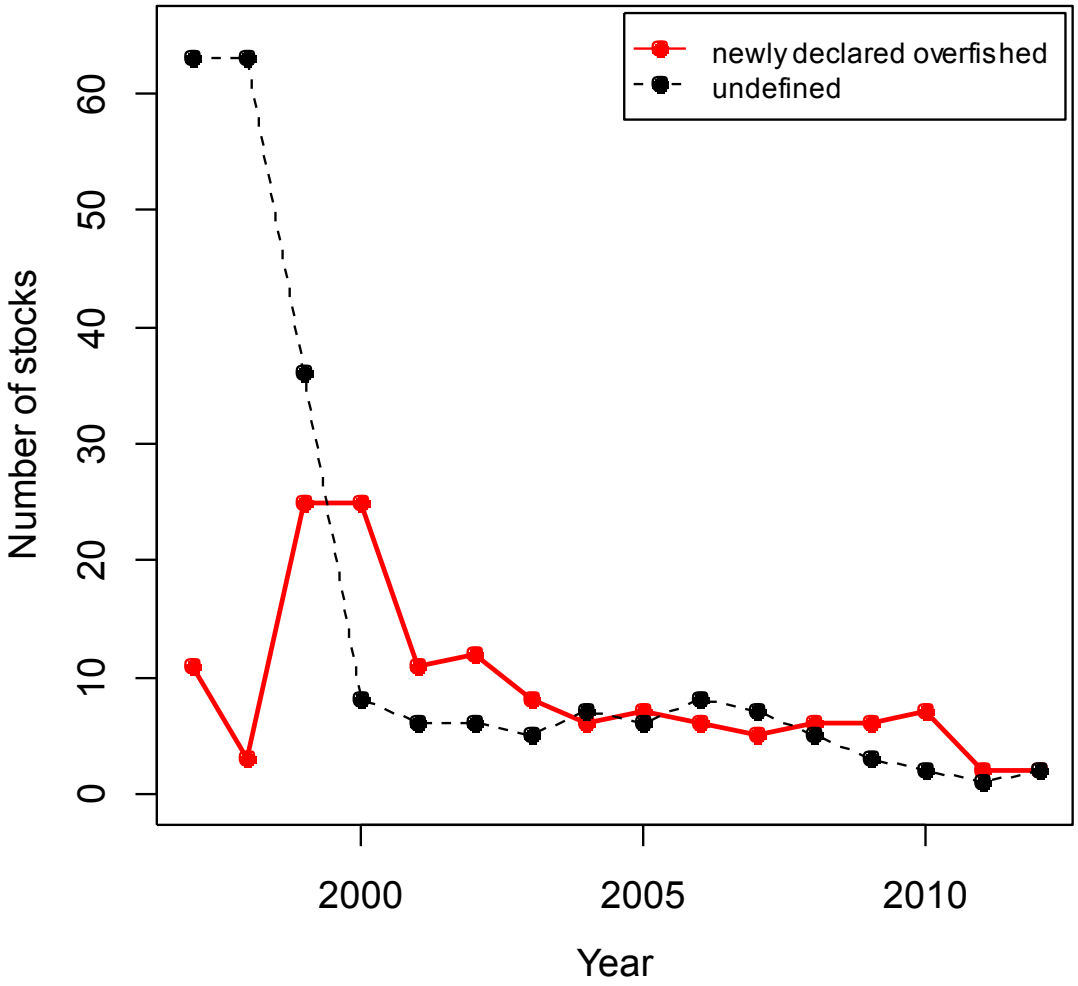
Approach of the study

Evaluate the effectiveness of rebuilding plans based on these 85 stocks

The talk will cover two aspects:

- **Part I: Management response to MSA rebuilding requirements**
- **Part II: Outcomes of management actions**
- Conclusions

Most stocks were declared overfished within the first 4 years after the Sustainable Fisheries Act of 1996



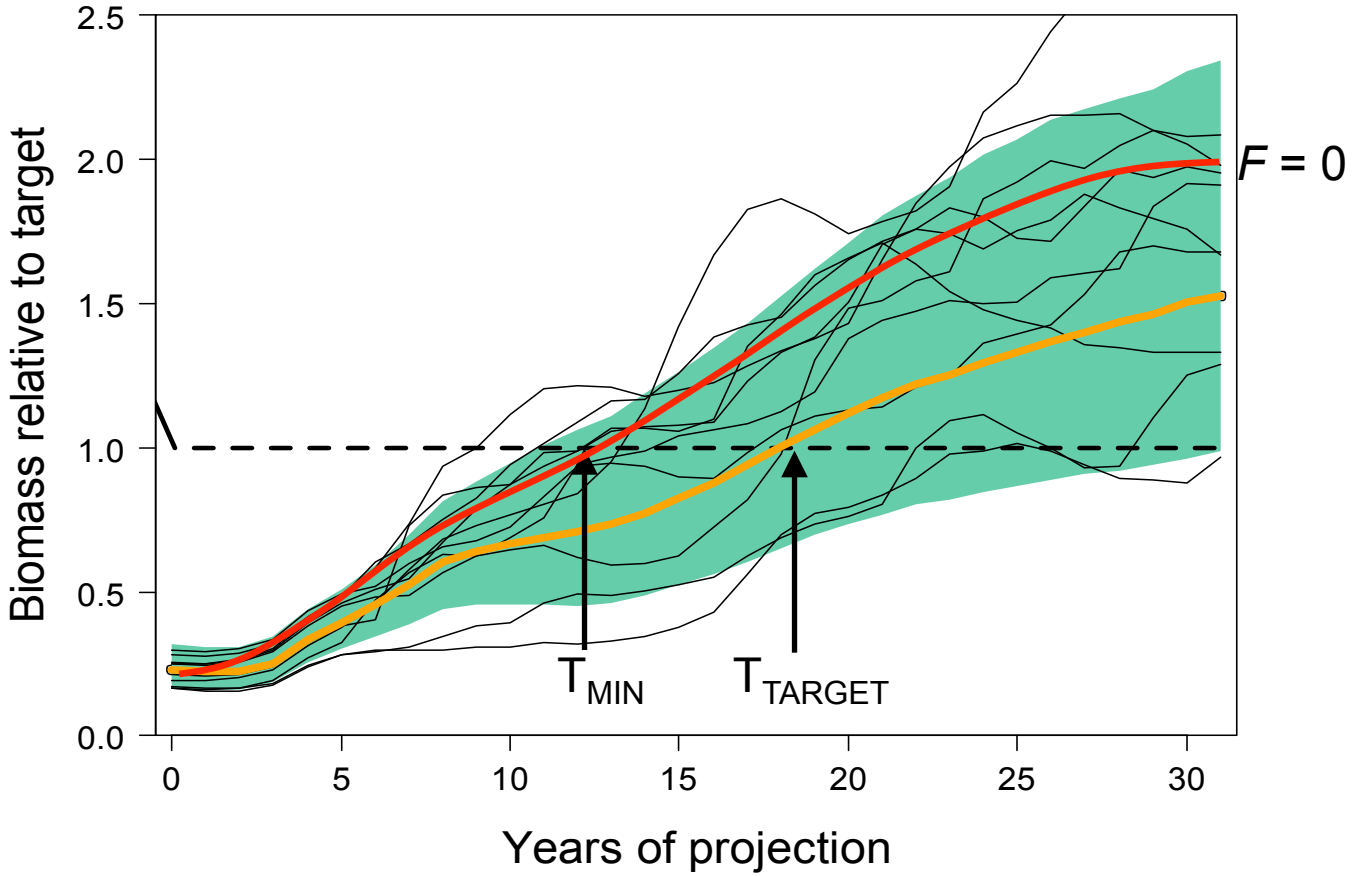
Rebuilding plans were implemented for 79 stocks

T_{TARGET}: target time period for rebuilding the stock to B_{MSY}

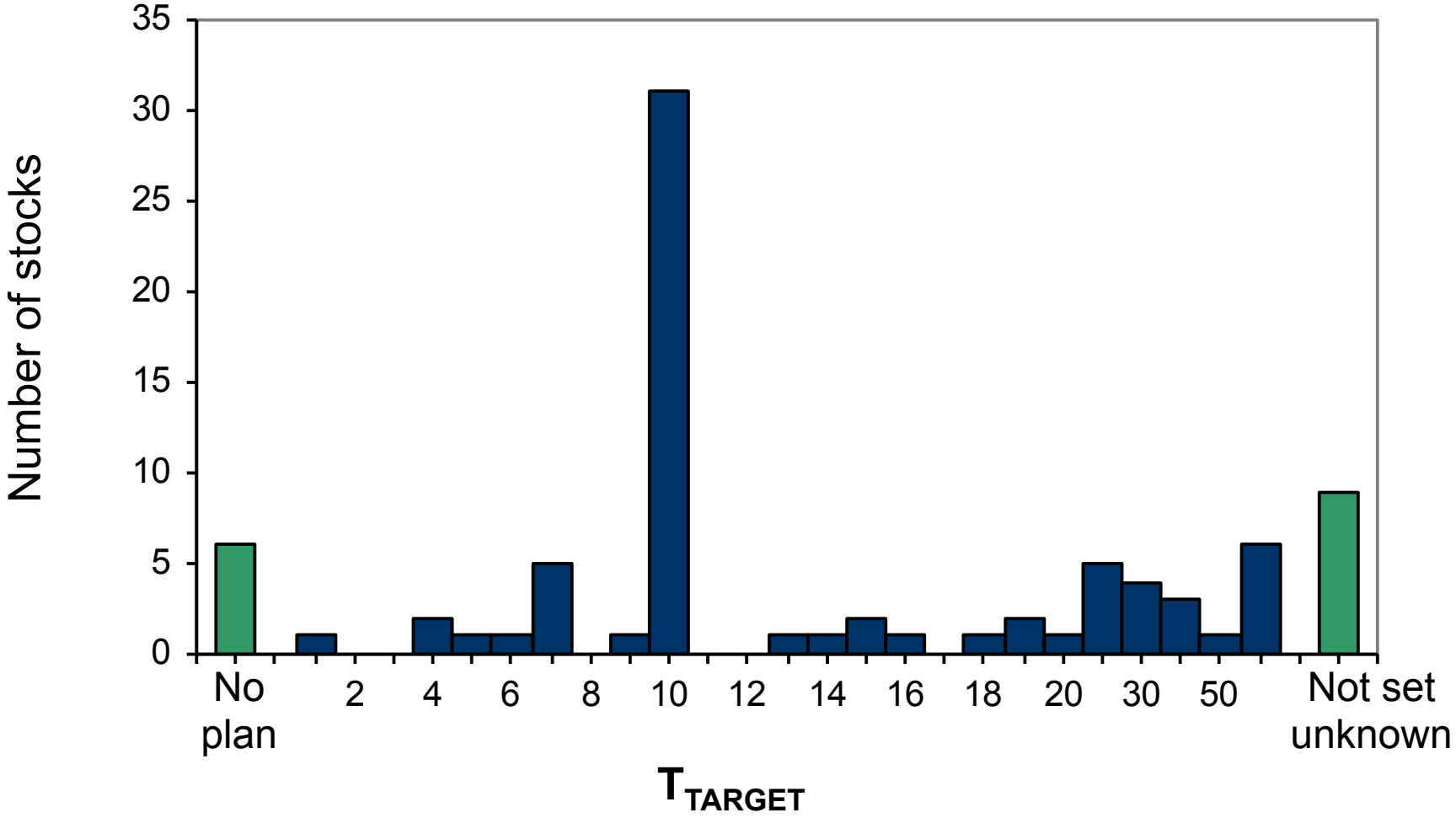
$$T_{MIN} < T_{TARGET} < T_{MAX}$$

T_{MIN}: minimum time to rebuild in the absence of all future fishing

T_{MAX}: maximum rebuilding time set at 10 years except when T_{MIN} > 10 years

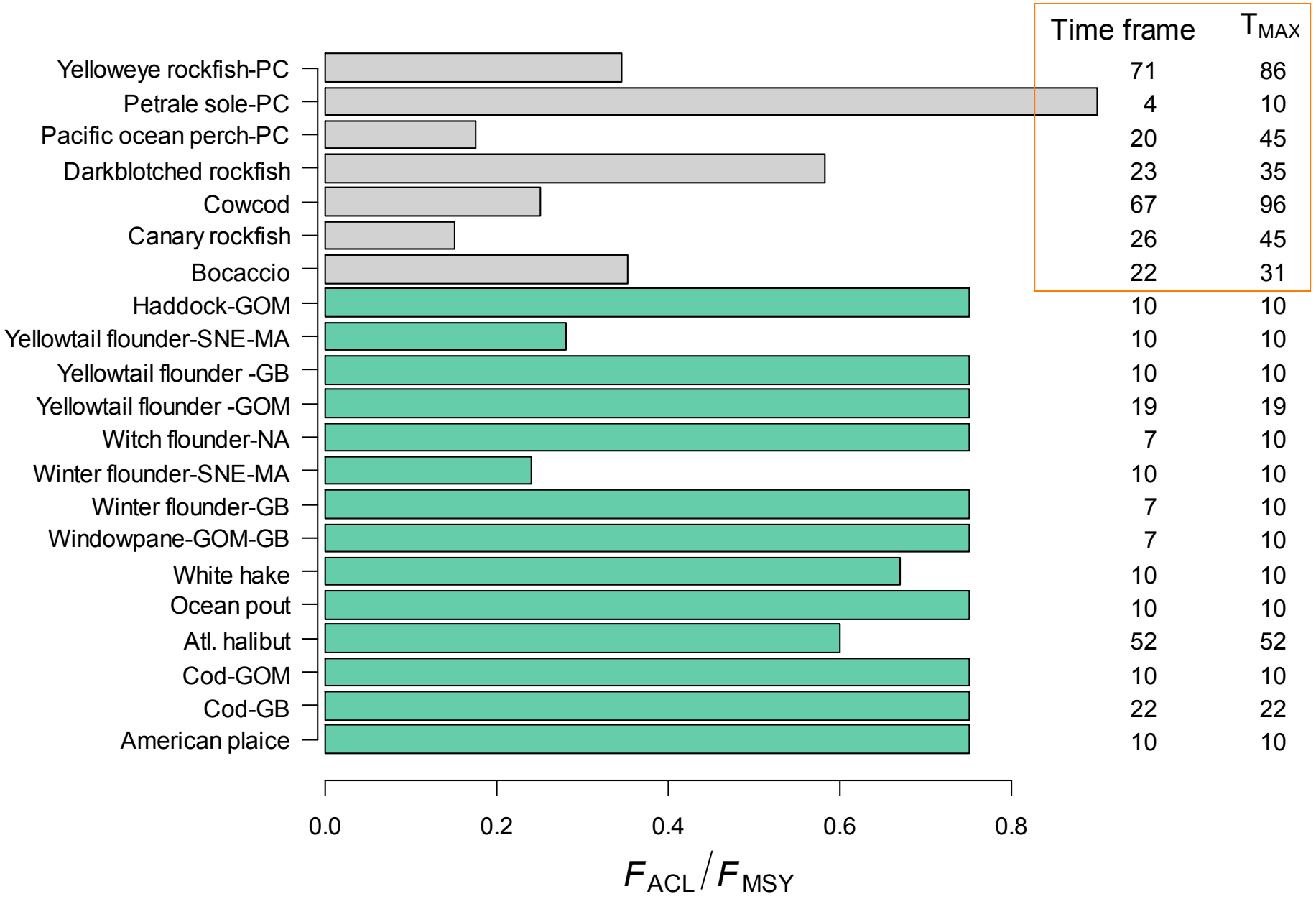


Target time period for rebuilding for the 79 plans



The 10-year rule determined the target year for rebuilding for 40% of the rebuilding plans implemented

Target fishing mortalities used to calculate 2012 acceptable catches for groundfish stocks subject to rebuilding plans under NEFMC & PFMC



On the 10-year rule

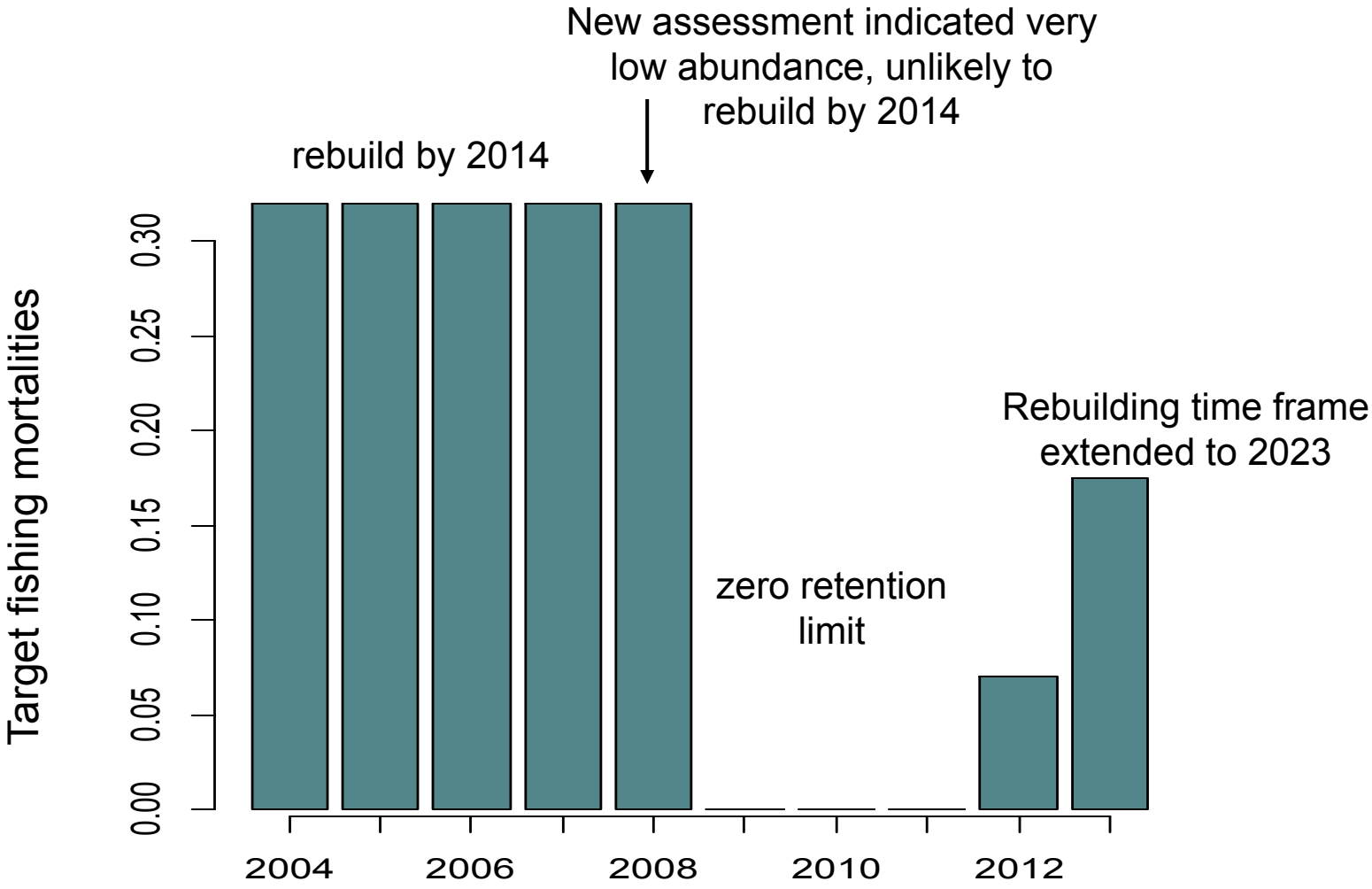
- When the 10-year rule was binding, fishing mortalities that satisfied the rule were in most cases higher than 0.75 F_{MSY}
- Much larger reductions in *F* were introduced when rebuilding of abundance was slower than anticipated initially and the target year for rebuilding was approaching

Two examples in which the rebuilding framework has led to abrupt changes in regulations:

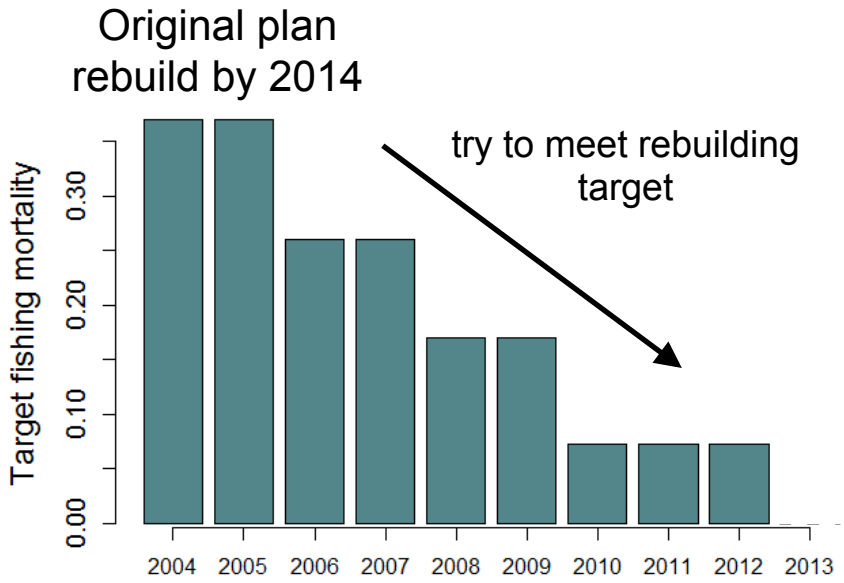
1) Winter flounder: rebuilding clock reset after major efforts to try to meet the original schedule

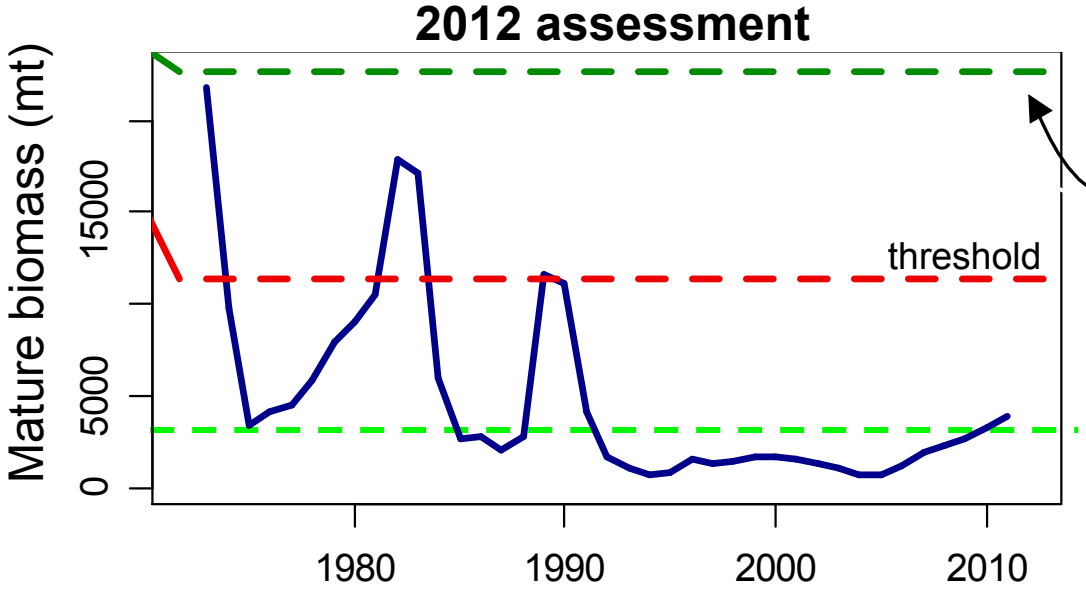
2) Yellowtail flounder: stock status reclassified after updated stock assessments

Winter flounder- Southern New England



Yellowtail flounder- Southern New England





Two scenarios considered:

1- Low recruitments due to small spawning stock size

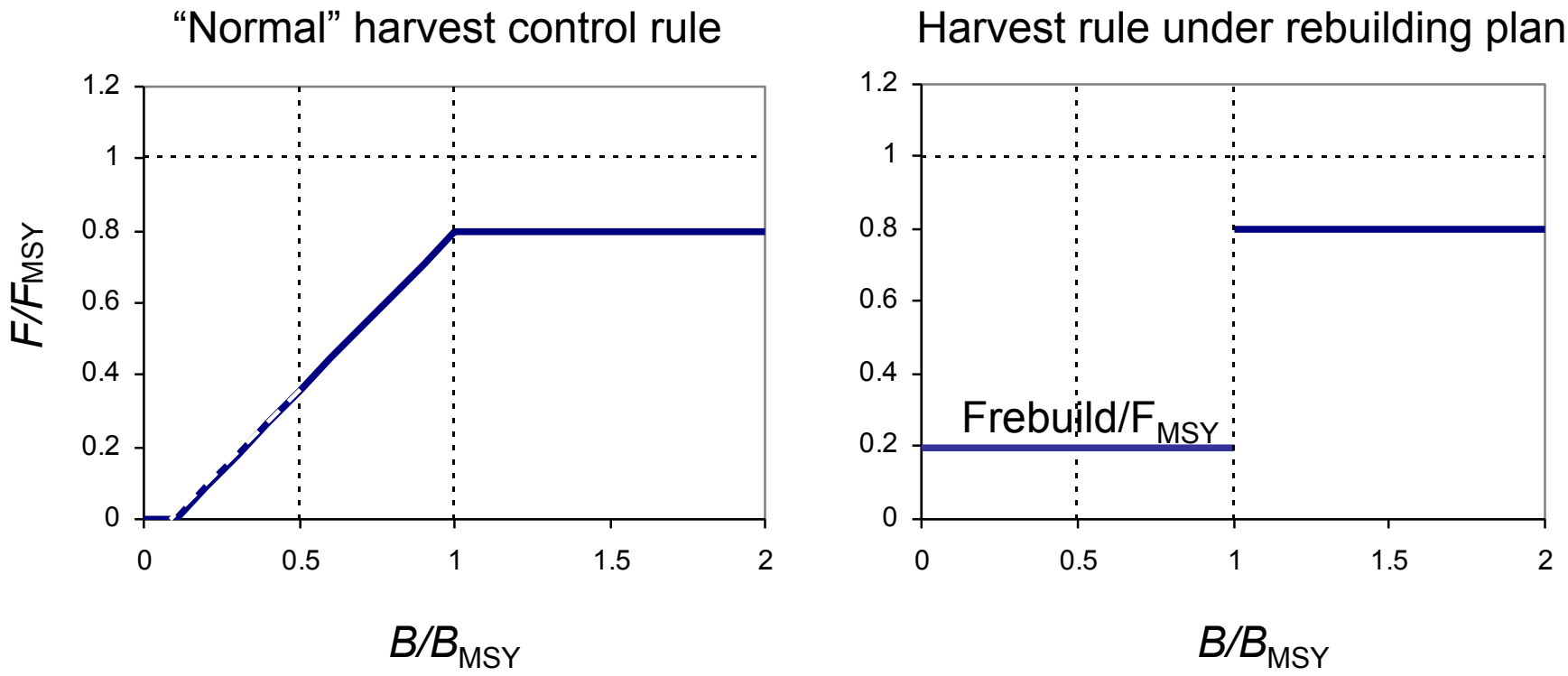
B_{MSY} = 22,615 mt

2- Productivity reduced after 1990

B_{MSY}= 2,995 mt

Stock re-classified as rebuilt

Discontinuity in the harvest control rule



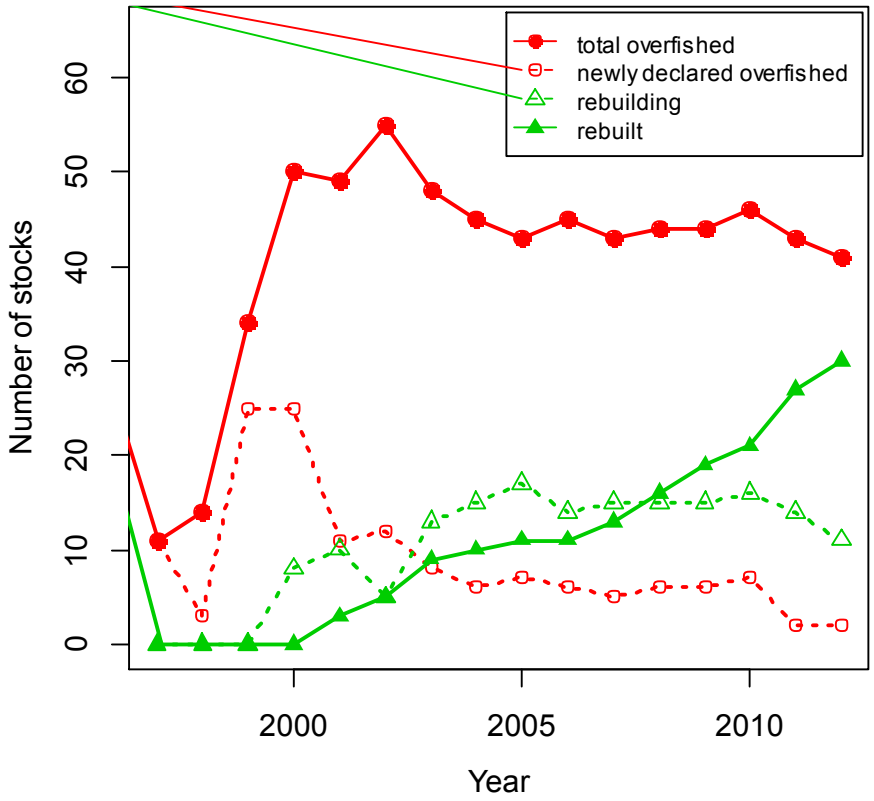
Policy dependence on biomass thresholds and targets exacerbates the impact of uncertainty causing abrupt changes in management

Part I: concluding remarks

- Guidelines on maximum timeframes for rebuilding are useful for planning and for selecting harvest rates according to rebuilding goals
- Adjustments of rebuilding parameters to try to meet the original rebuilding timeframes can lead to abrupt changes in regulations and present difficult challenges especially in the case of mixed-stock fisheries
- The change from the "normal " fishery management plan to a rebuilding plan can lead to a marked change in allowable fishing mortality and catch

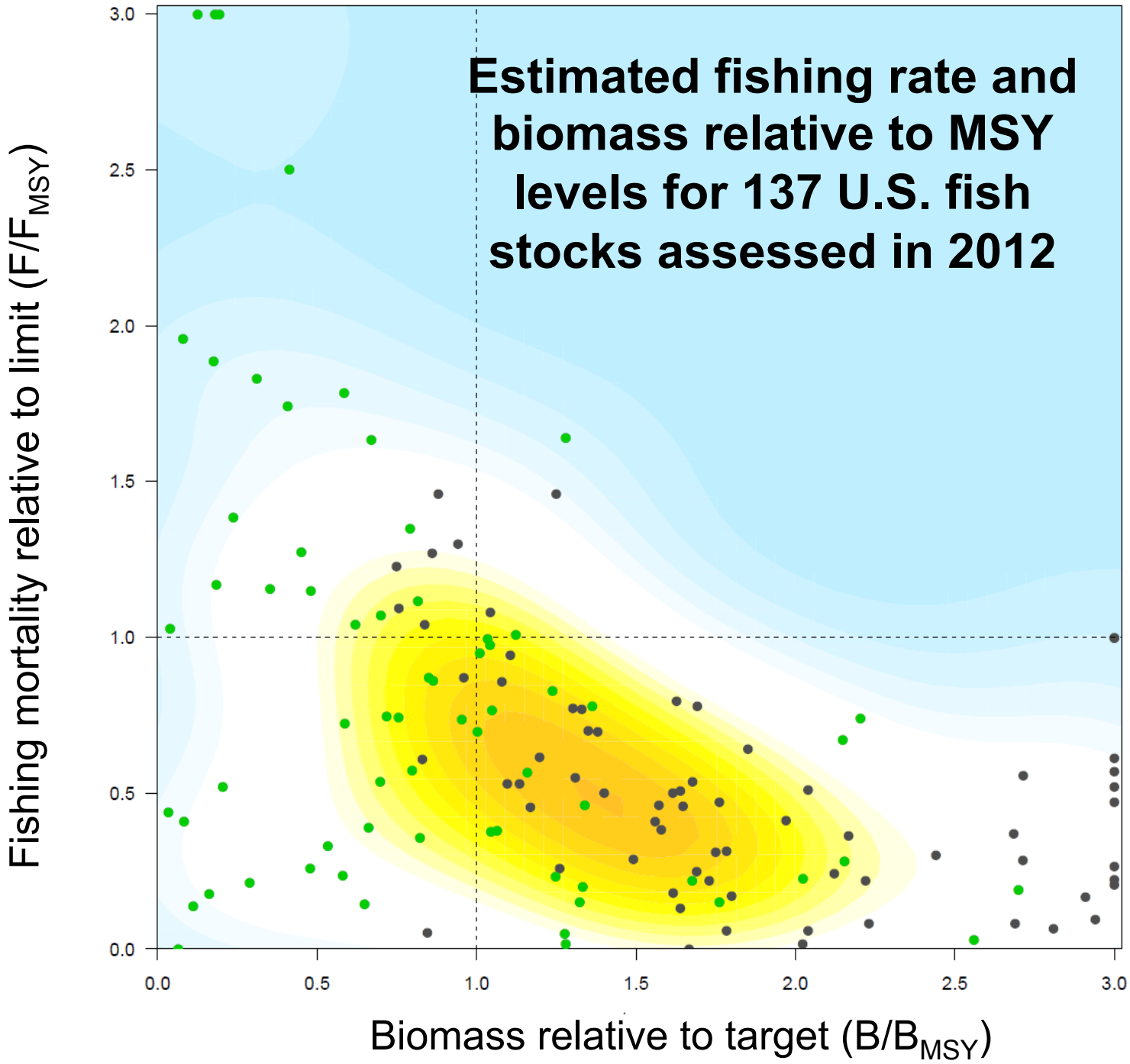
Part II: Outcomes of rebuilding plans

Tally of stocks by biomass status category over time for the 85 stocks declared overfished



Outcomes were analyzed in more detail based on a subset of 55 stocks that had:

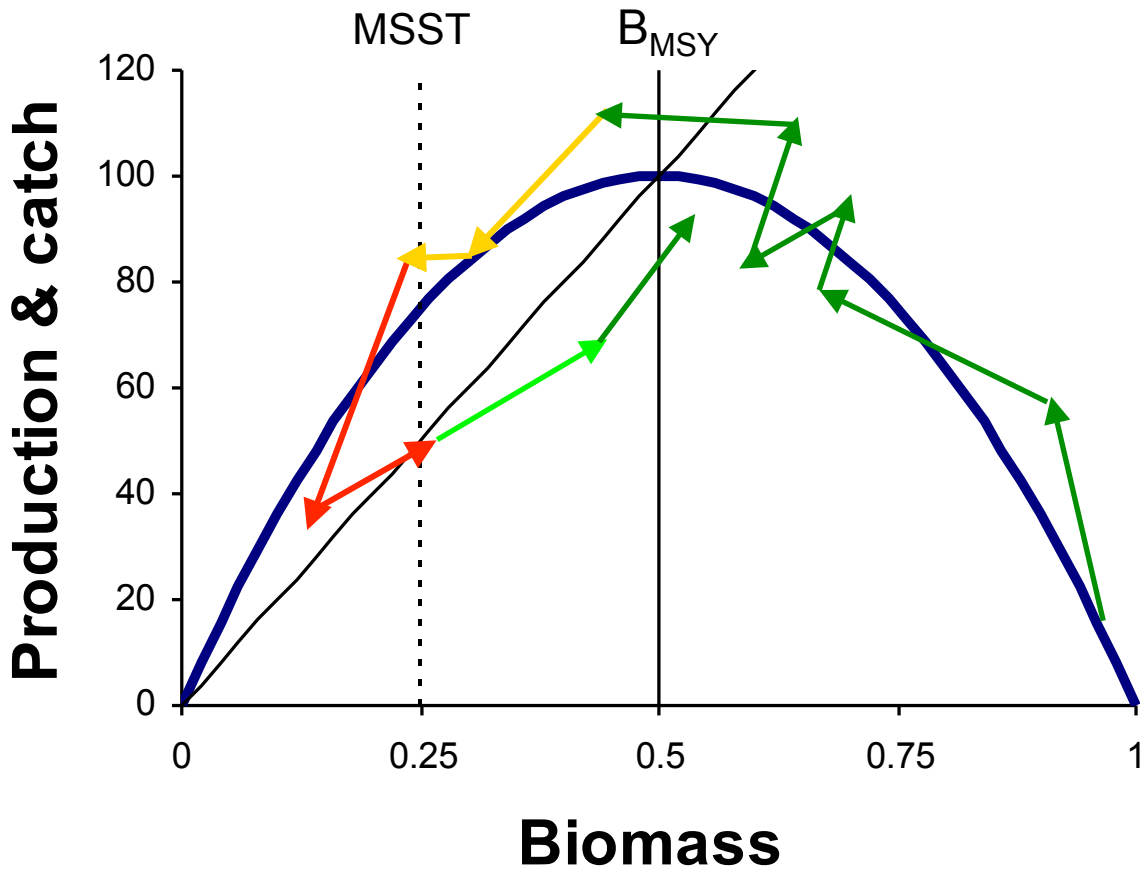
- Quantitative stock assessments providing estimates of trends in fishing mortality and biomass relative to F_{MSY} and B_{MSY}
- At least 3 years of estimates of F/F_{MSY} and B/B_{MSY} after the stock was declared overfished


Estimated fishing rate and biomass relative to MSY levels for 137 U.S. fish stocks assessed in 2012
Fishing mortality relative to limit (F/F$_{MSY}$)
Biomass relative to target (B/B$_{MSY}$)
0.0
0.5
1.0
1.5
2.0
2.5
3.0

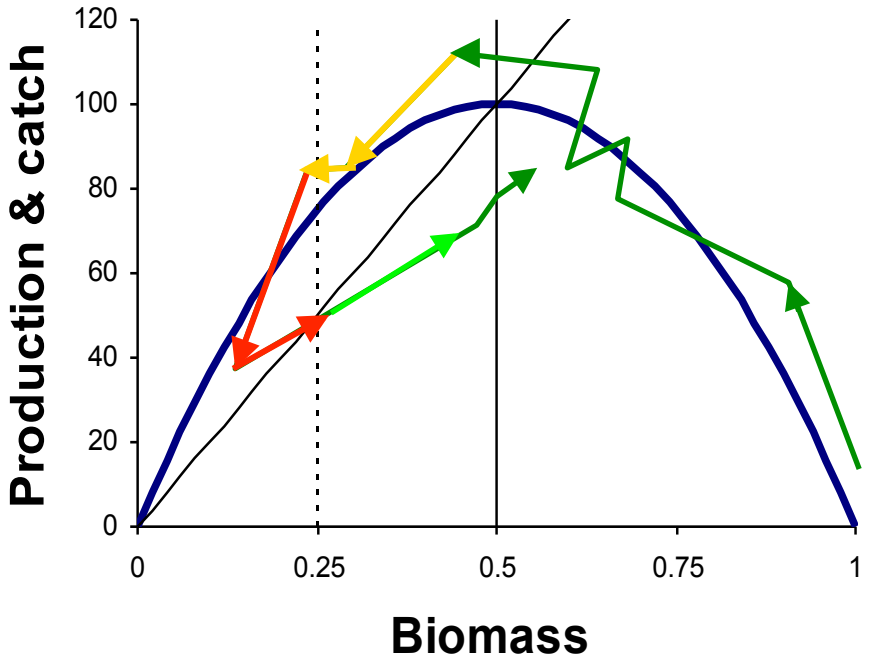
Main questions addressed for this subset of stocks

1) How reliable are the classifications of stock status that trigger implementation of rebuilding plans?
2) How successful were rebuilding plans at reducing fishing mortality?
3) How are stock sizes responding?

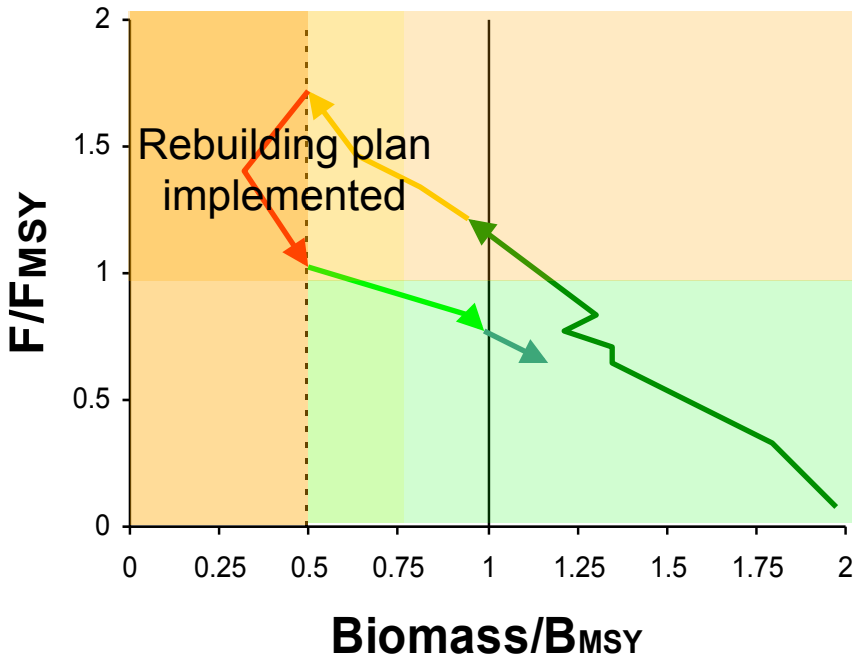
Typical sequence of stages leading to an overfished state followed by rebuilding



Catch and biomass

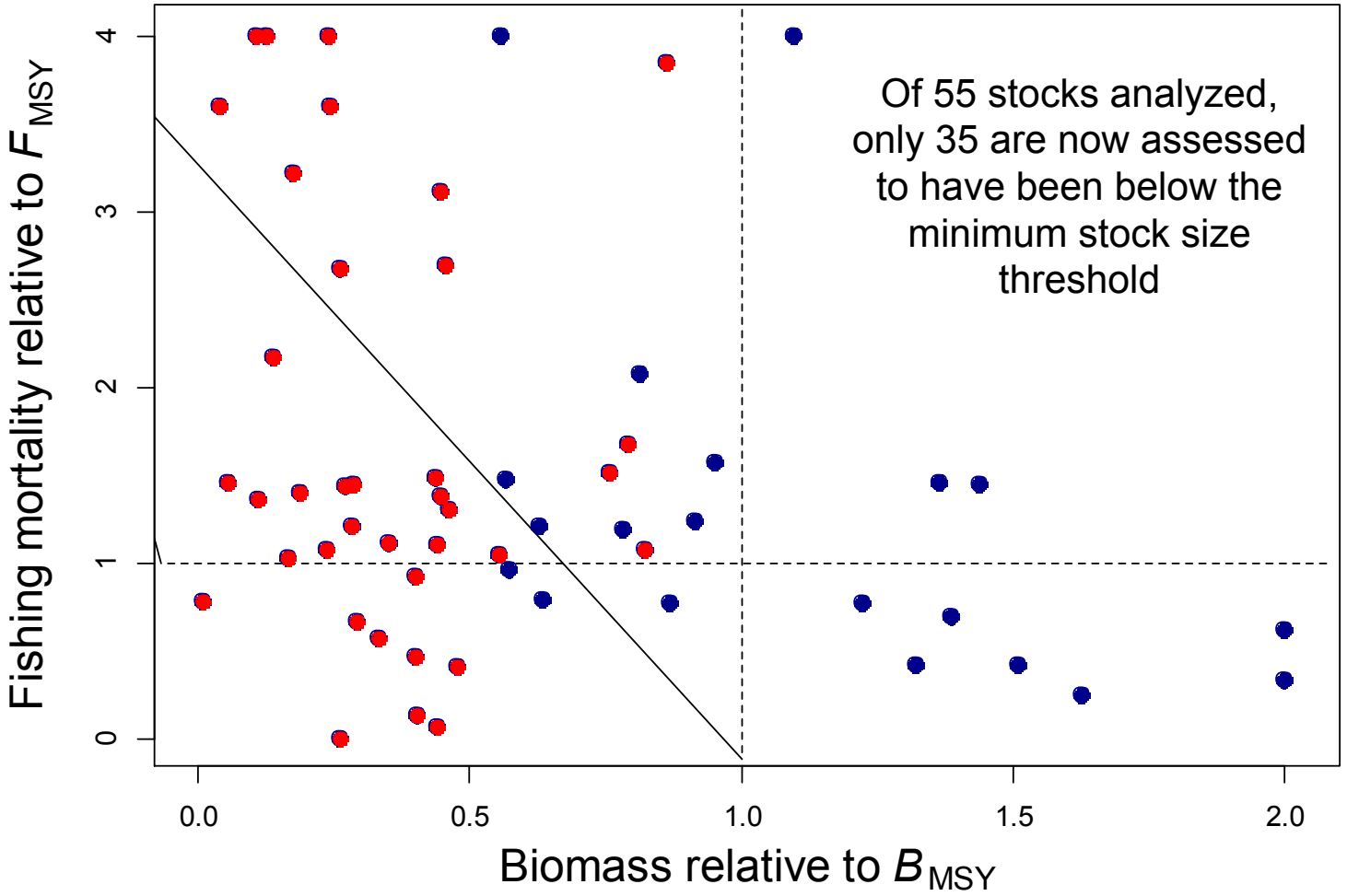


Fishing mortality *vs* biomass

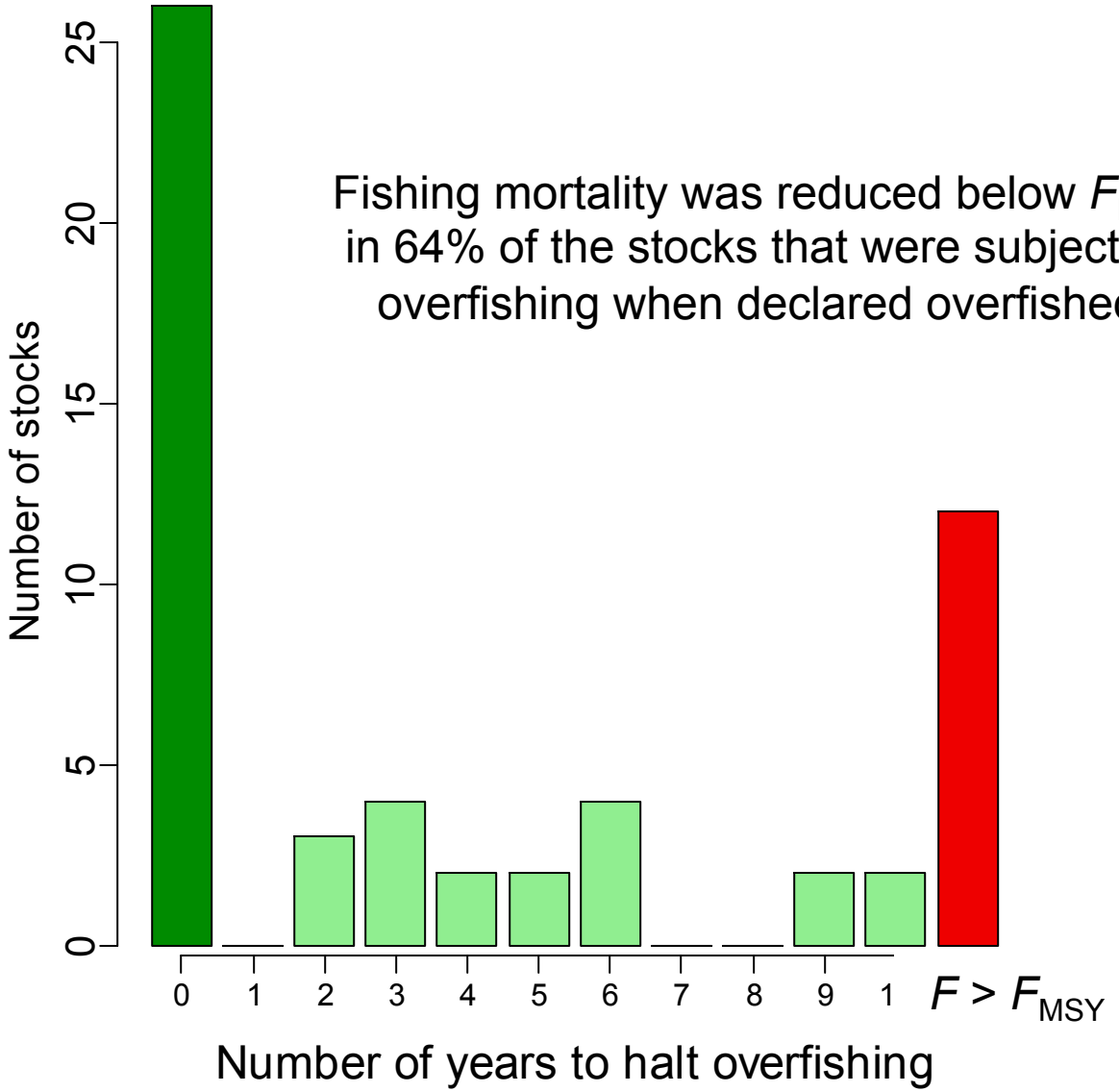


1) How reliable are the classifications of stock status that triggered the implementation of rebuilding plans?

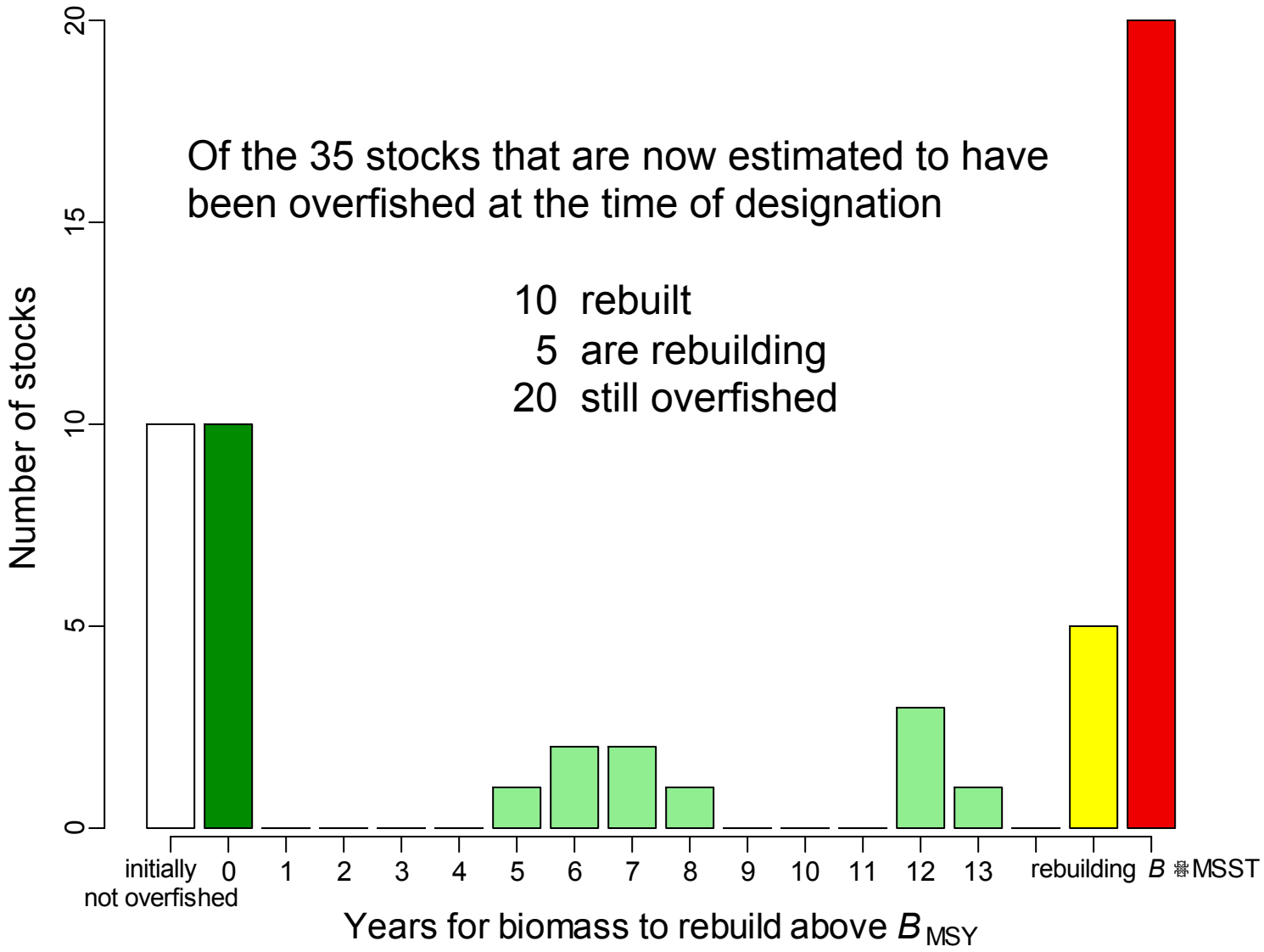
Status at the time of overfished designation according to most recent assessment



2) How successful were rebuilding plans at reducing fishing mortality?

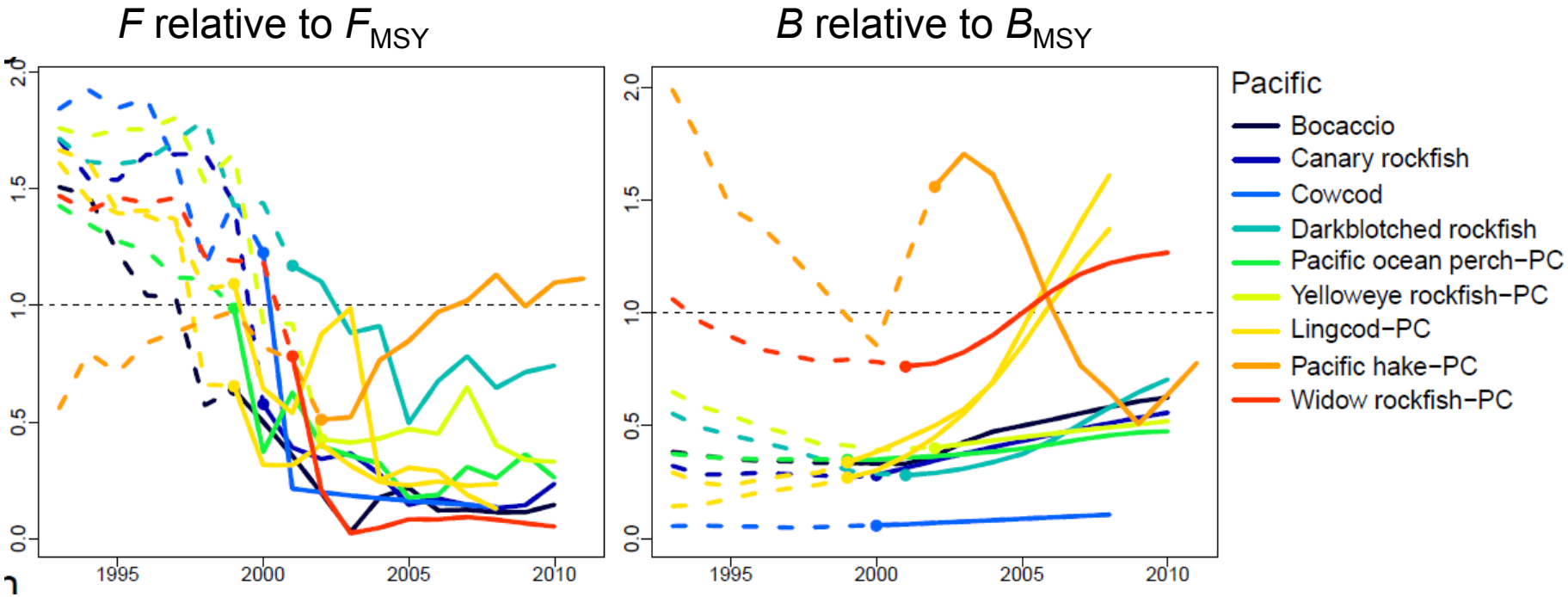


3) How are stock sizes responding?



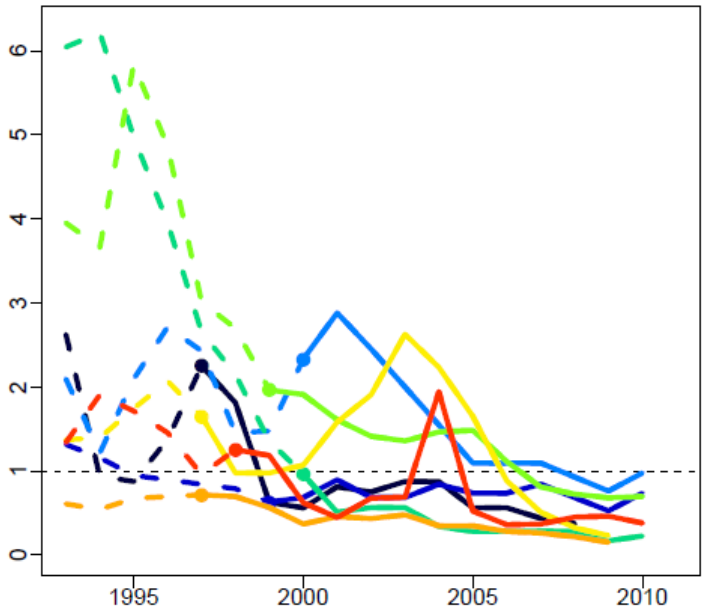
Trends in fishing mortality and biomass

Pacific Council

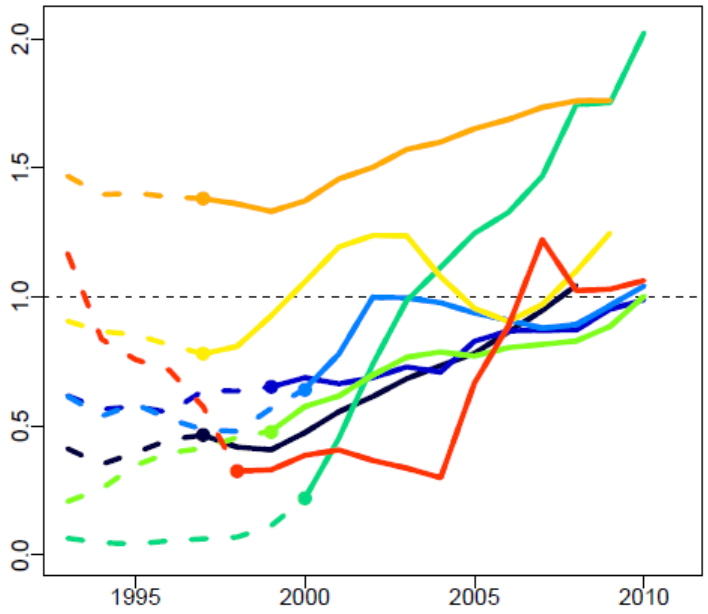


Mid Atlantic and New England/Mid Atlantic

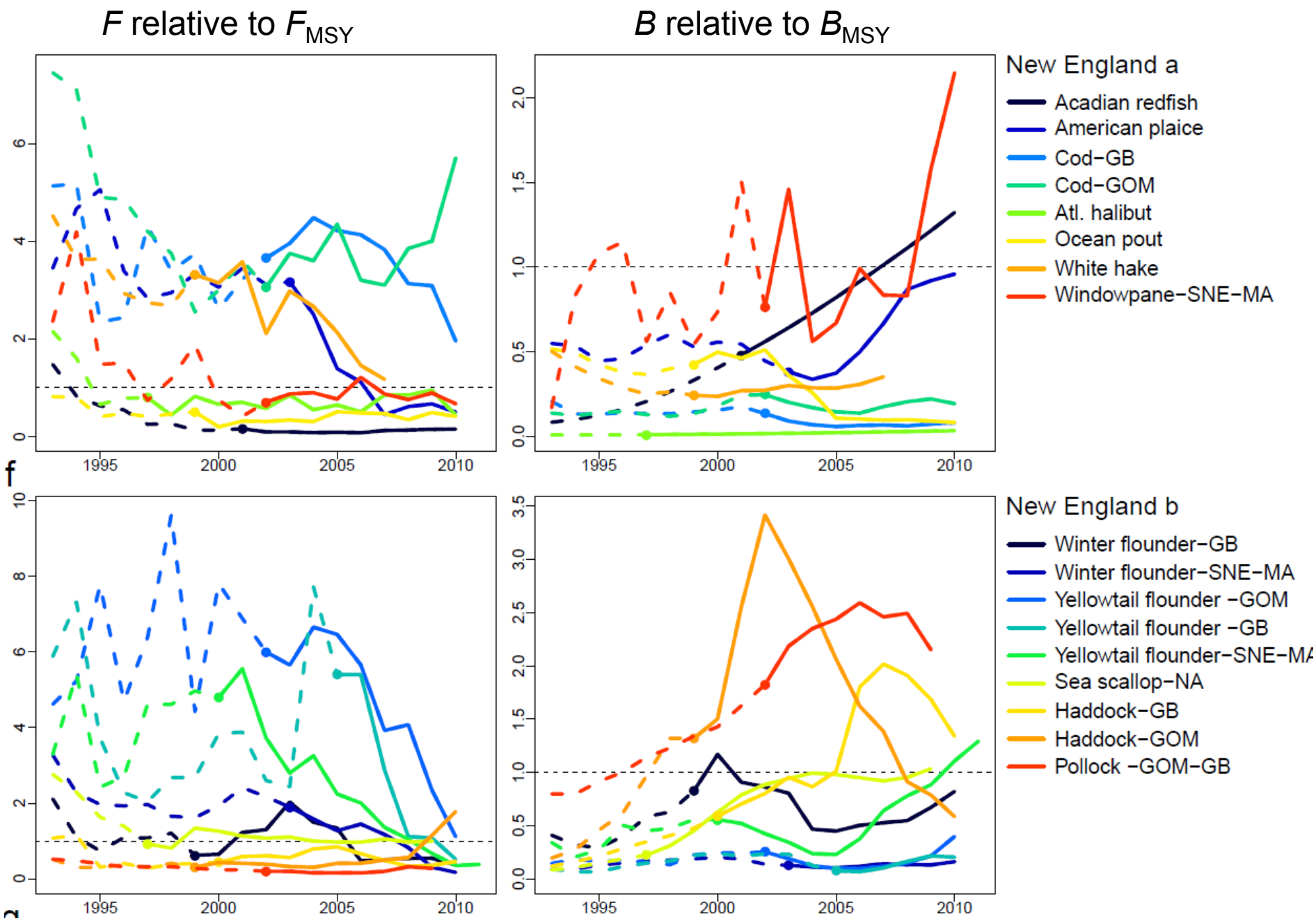
F relative to F_{MSY}



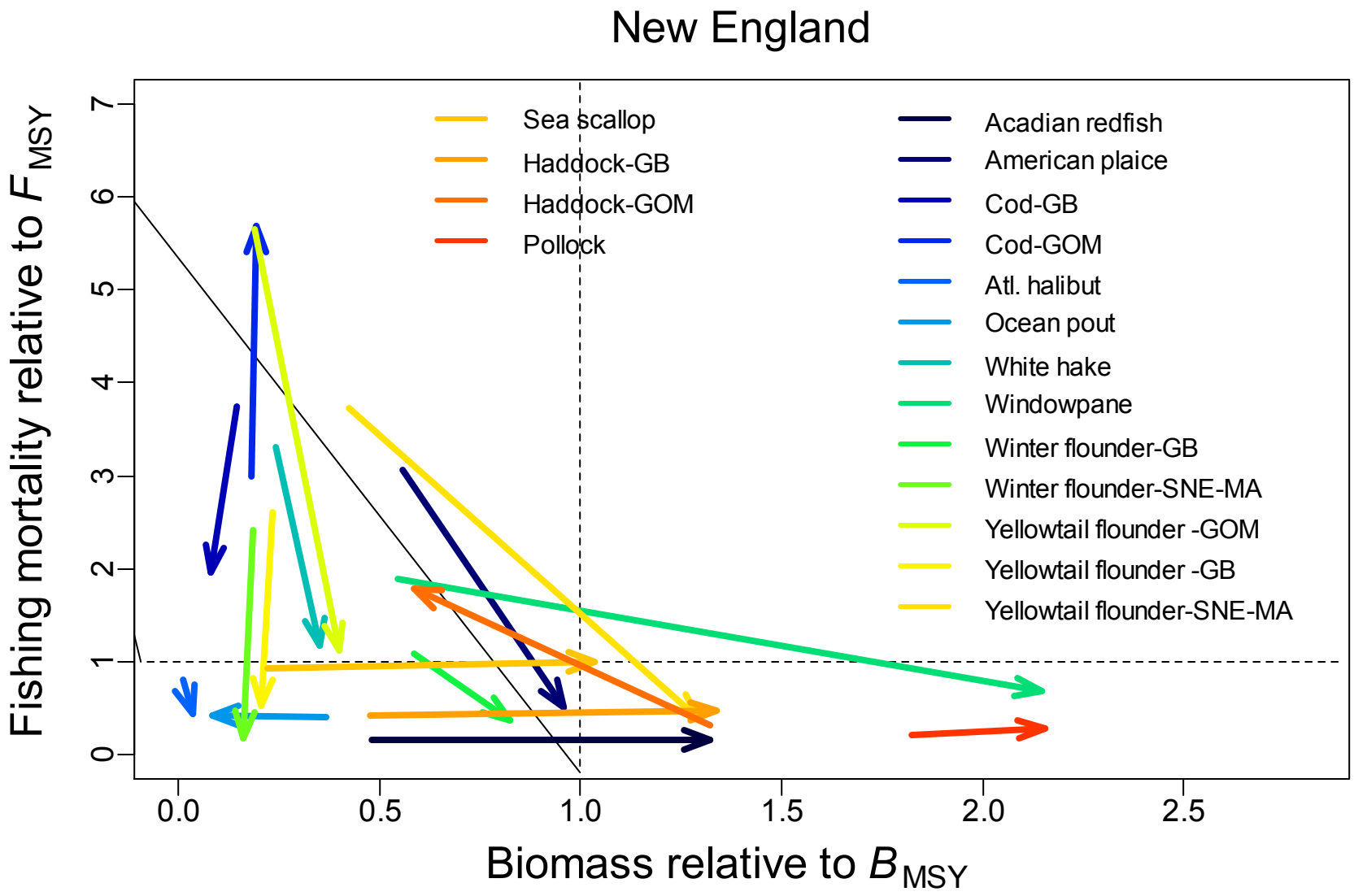
B relative to B_{MSY}

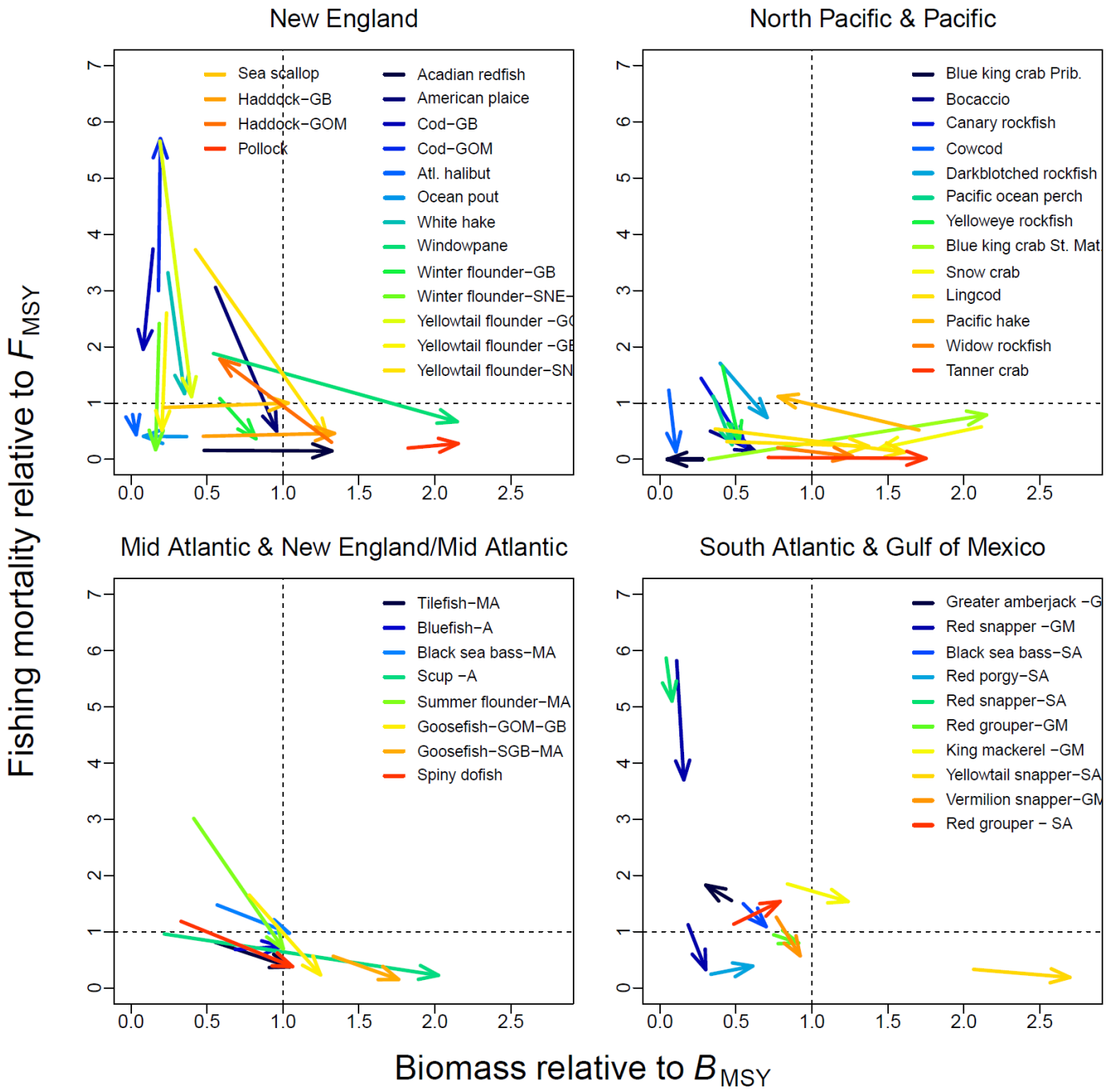


New England Council

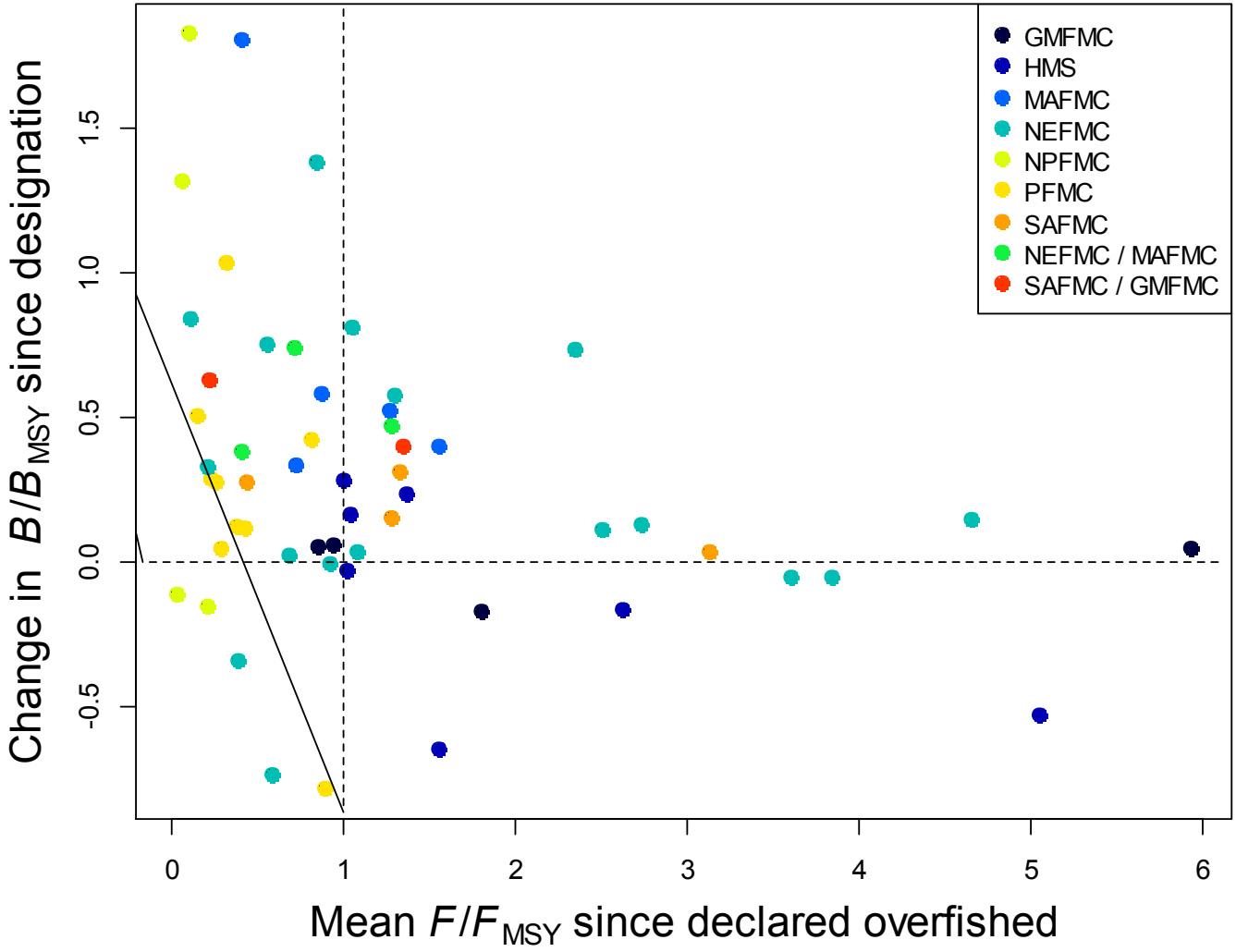


Changes in biomass and fishing mortality from year of overfished designation




New England
Sea scallop
Haddock−GB
Haddock−GOM
Pollock
Acadian redfish
American plaice
Cod−GB
Cod−GOM
Atl. halibut
Ocean pout
White hake
Windowpane
Winter flounder−GB
Winter flounder−SNE−
Yellowtail flounder −G
Yellowtail flounder −GB
Yellowtail flounder−SN
North Pacific & Pacific
Blue king crab Prib.
Bocaccio
Canary rockfish
Cowcod
Darkblotched rockfish
Pacific ocean perch
Yelloweye rockfish
Blue king crab St. Mat
Snow crab
Lingcod
Pacific hake
Widow rockfish
Tanner crab
Mid Atlantic & New England/Mid Atlantic
Tilefish−MA
Bluefish−A
Black sea bass−MA
Scup −A
Summer flounder−MA
Goosefish−GOM−GB
Goosefish−SGB−MA
Spiny dofish
South Atlantic & Gulf of Mexico
Greater amberjack −G
Red snapper −GM
Black sea bass−SA
Red porgy−SA
Red snapper−SA
Red grouper−GM
King mackerel −GM
Yellowtail snapper−SA
Vermilion snapper−GM
Red grouper − SA
Fishing mortality relative to F_{MSY}
Biomass relative to B_{MSY}
0.0
0.5
1.0
1.5
2.0
2.5
0
1
2
3
4
5
6
7

Stocks that rebuilt or whose biomass increased appreciably were, in almost all cases, experiencing fishing mortalities below F_{MSY}



Some overall numbers

For the 55 stocks analyzed, the most recent assessments indicate that:

- Overfishing was halted in 23 of the 36 stocks that had fishing mortalities above F_{MSY} when declared overfished
- 20 stocks were not overfished at the time of overfished designation and 10 were actually above B_{MSY}.
- Of the 35 stocks that were overfished:
  - 10 have rebuilt and 5 are rebuilding
  - of the 20 stocks estimated to still be overfished, 11 currently have fishing mortalities well below F_{MSY}
- 9 overfished stocks continued to be subject to overfishing even though fishing mortality targets were set at or below 75% F_{MSY} to allow for rebuilding within the maximum time frame

Failure to achieve intended reductions in fishing mortality

- Ineffective input controls and lack of accountability measures prior to 2007
- Difficulties reducing fishing mortality of species caught as bycatch in other fisheries
- Overestimation of stock size

Final remarks

- The mixed performance of rebuilding plans was attributed in part to uncertainty in the determination of stock status relative to reference points, and the fact that estimates of stock size and productivity often change markedly between successive assessments
- The current policy dependence on biomass thresholds and targets often triggers abrupt changes in management, exacerbating the impact of the inherent variability and uncertainty of stock assessments

Key findings for consideration by scientists, managers, and policy makers

- Harvest control rules that gradually reduce fishing mortality as estimated stock size falls below B_{MSY} could
  - reduce the likelihood of a stock becoming overfished
  - allow for rebuilding if necessary
- Rules that have discontinuities, such as the "10-year rule" used to set the maximum rebuilding time, are problematic because a small change in information or assumptions can lead to a major change in regulations
- Rebuilding plans that focus more on meeting fishing mortality targets than on exact schedules for attaining biomass targets may be more robust to assessment uncertainties, natural variability, and ecosystem considerations