Review Candidate Fisheries Objectives and Performance Metrics for Investigation

MSAB Meeting Oct 16-17, 2013

Outline

- Where are we in the process
- Why do we need an operating model
- The worry list
- Example ... “The Sporer Management Procedure”
- Discussion

MSE – The light on the Hill

Vickie Wooten

Key Ingredients (A.D.M Smith)

1. A clearly defined set of management objectives.

2. A set of performance criteria related to the objectives.

3. A set of management strategies or options to be considered.

4. A means of calculating the performance criteria for each strategy.

Working Fisheries Objectives

1. Minimum number of mature female halibut coast-wide (e.g. 1 million) with probability of 0.99.

2. Maintain a minimum spawning biomass of 20% of unfished in each year with a probability of 0.95 (SSB limit).

3. Maintain spawning biomass above 30% of unfished in each year with a probability of 0.75 (SSB threshold).

4. Maintain directed fishing opportunity each year, conditional on satisfying objectives 1 and 2, with a probability of 0.95.

5. Maximize yield in each regulatory area each year without exceeding the target harvest rate in a given area 50% of the time.

Working Fisheries Objectives

6. Limit annual changes in TAC, coast wide and/or by regulatory area, to less than 15% per year conditional on satisfying objectives 1 and 2.

7. Maintain median catch with ±10% of the 1993-2012 average within five years of implementing the procedure.

8. Maintain average catch at >70% of historical 1993-2012 average, 90% of the time.

9. Reduce bycatch mortality to within 5% of total catch limits – minimize bycatch to the extent practicable.

Working Performance Metrics

1. Absolute number of sexually mature female halibut (re: objective 1).

2. Ratio of current SSB relative to unfished SSB_o (where SSB_o is based on current size-at-age (re: objectives 1 & 2).

3. Total catch and directed catch from each regulatory area (re: objectives 4, 5, 6, 7, & 8).

4. Legal biomass in each regulatory area in each year (re: objective 5).

5. Bycatch from each regulatory area in each year (re: objective 9).

What is required of the operating model?

Steve Martell

Operating Model Requirements

- **Dimensions**:
  - Area, Stock, Sex, Time, Age, Size, Gears.
- **Regimes (Scenarios)**:
  - Growth, recruitment, availability, mortality, selectivity, regulatory, discarding, etc.
- **Procedures:**
  - Harvest control rules, assessment models, data, incidental catch, feedback controls
- **Worry list:**
  - **<u>can manage = ‘procedure’</u>**
  - **<u>can’t manage = ‘scenario’</u>**

The worry list (think of it as a matrix)

	Things we can manage	Things we cannot manage
Things were certain about	**PROCEDURES** ●Size limits ●Catch limits ●Rate of TAC change ●Allocation among sectors ●...	**SCENARIOS** ●PDO - recruitment variation ●Changes in size-at-age ●Migration, dispersal ●...
Things were uncertain about	●Bycatch ●Wastage ●Discard mortality rates ●...	●Natural mortality ●Recent recruitment trends ●Range contraction ●...

Averting a crisis | Plan for it!

The worry list (matrix)

	Things we can manage	Things we cannot manage
Things were certain about	●Size limits ●Catch limits ●Rate of TAC change ●Allocation among sectors ●...	•**PDO - recruitment variation** ●Changes in size-at-age ●Migration, dispersal ●...
Things were uncertain about	●Bycatch ●Wastage ●Discard mortality rates ●...	●Natural mortality ●Recent recruitment trends ●Range contraction ●...

Chris Sporer is about to become famous, or infamous!

Example: The ‘Sporer MP’

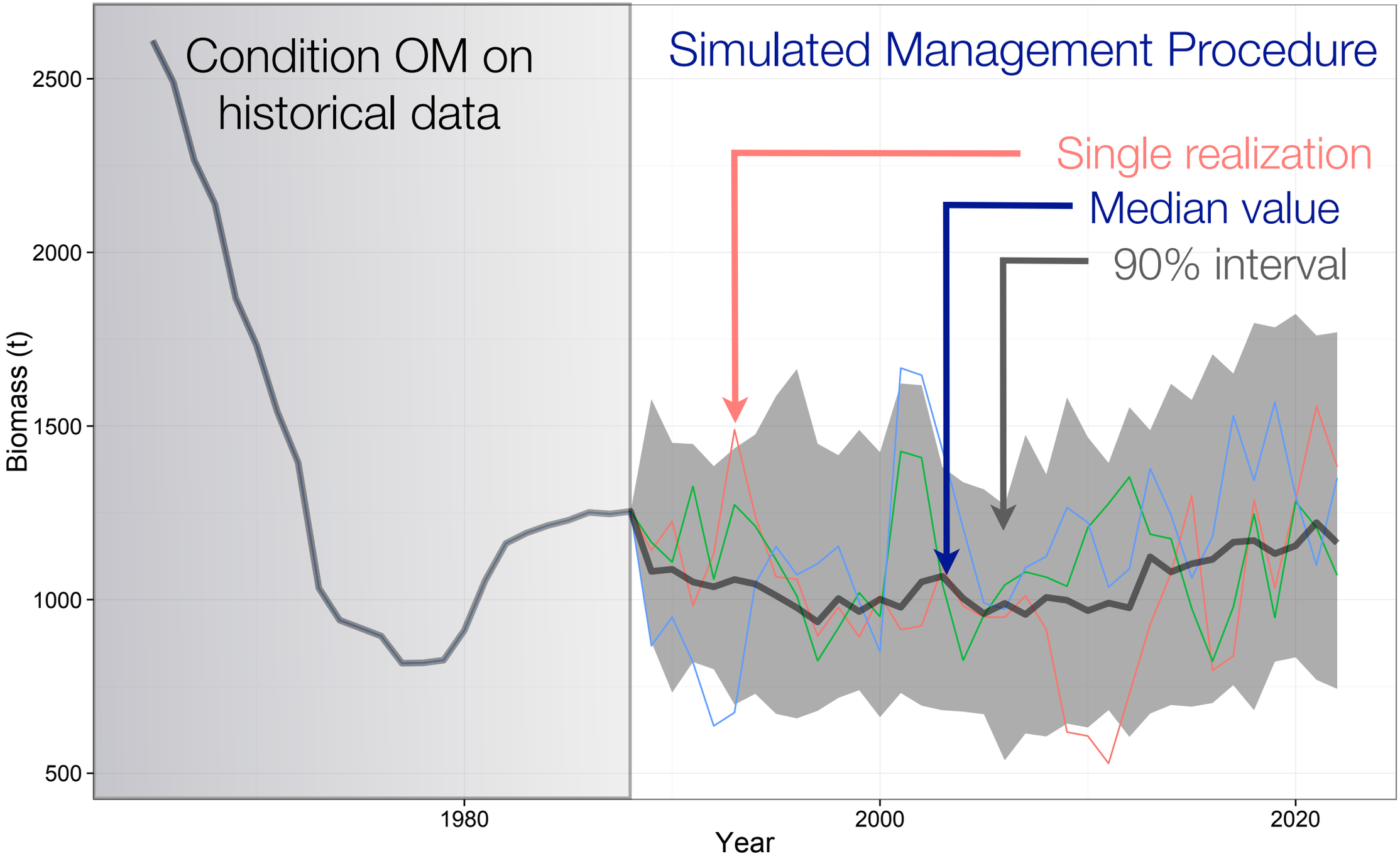
	Things we can manage	Things we cannot manage
Things were certain about	●Size limits ●Catch limits •**Rate of TAC change** ●Allocation among sectors ●...	●PDO - recruitment variation ●Changes in size-at-age ●Migration, dispersal ●...
Things were uncertain about	●Bycatch ●Wastage ●Discard mortality rates ●...	●Natural mortality ●Recent recruitment trends ●Range contraction ●...

Example: The ‘Sporer MP’

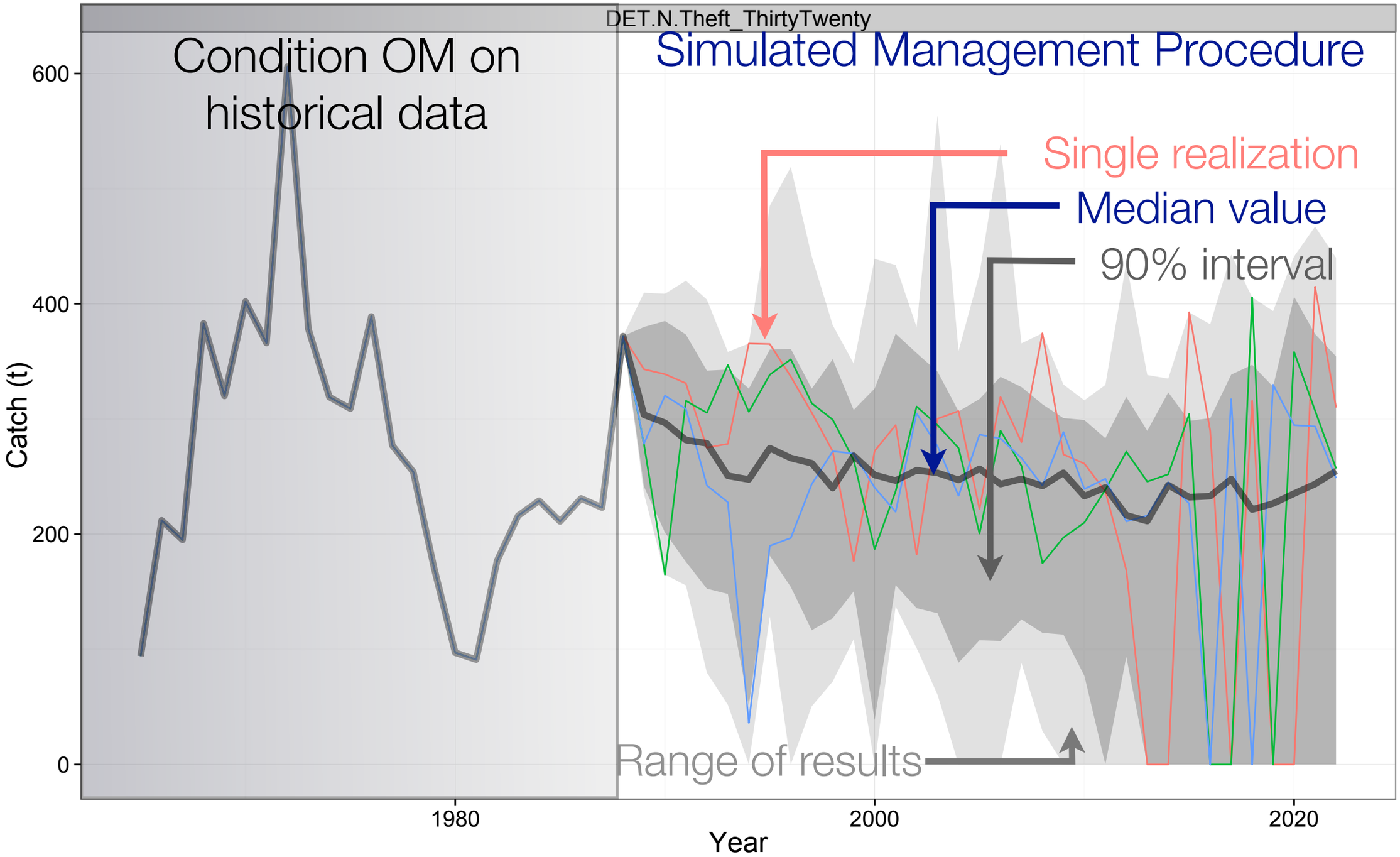
	Things we can manage	Things we cannot manage
Things were certain about	•Size limits •Catch limits •**Rate of TAC change** •Allocation among sectors •...	•PDO - recruitment variation •Changes in size-at-age •Migration, dispersal •...
Things were uncertain about	•Bycatch •Wastage •Discard mortality rates •...	•Natural mortality •Recent recruitment trends •Range contraction •...

6. Limit annual changes in TAC, coast wide and/or by regulatory area, to less than 15% per year conditional on satisfying objectives 1 and 2.

The Operating Model: Biomass

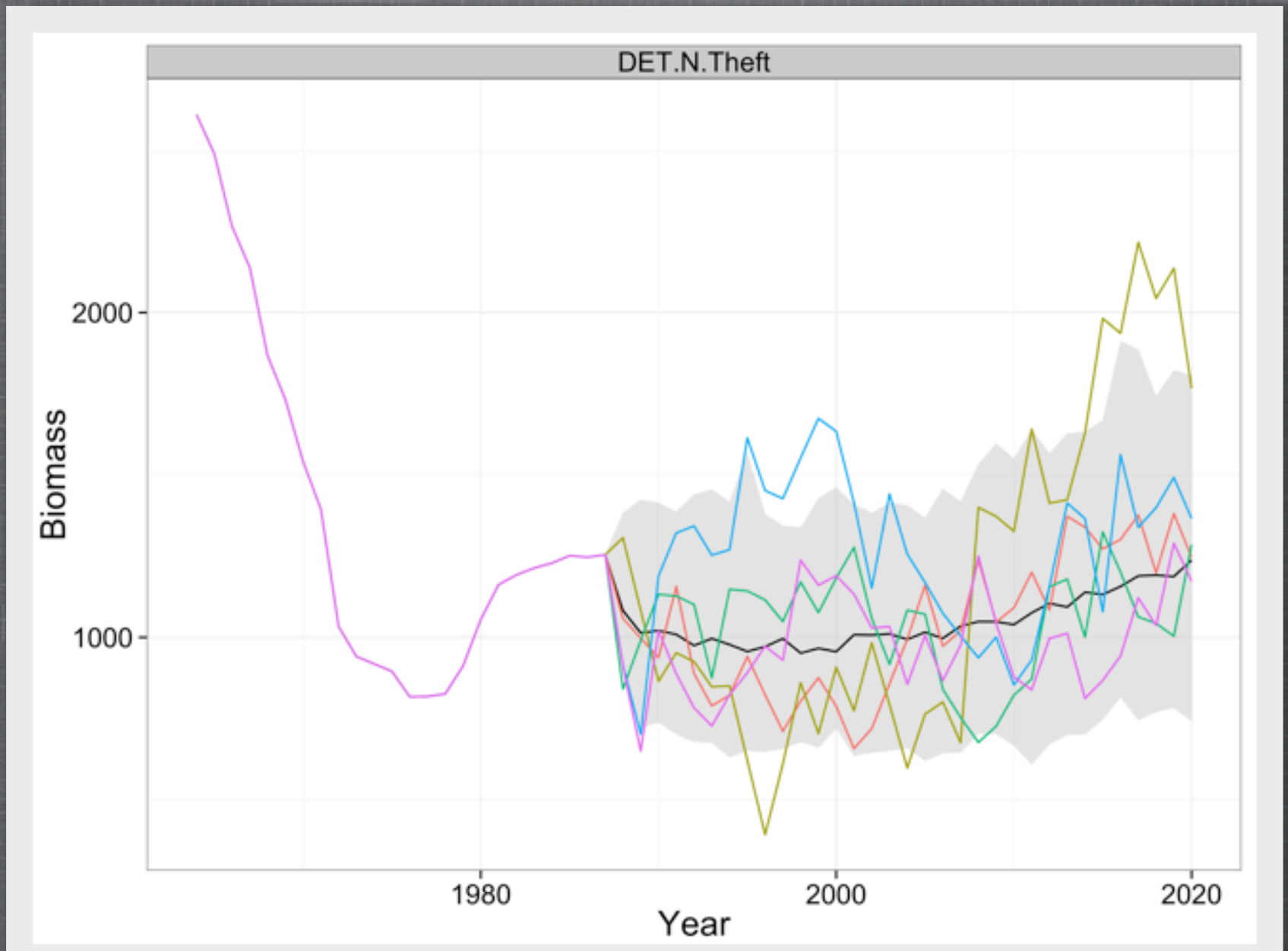


The Operating Model: Landings



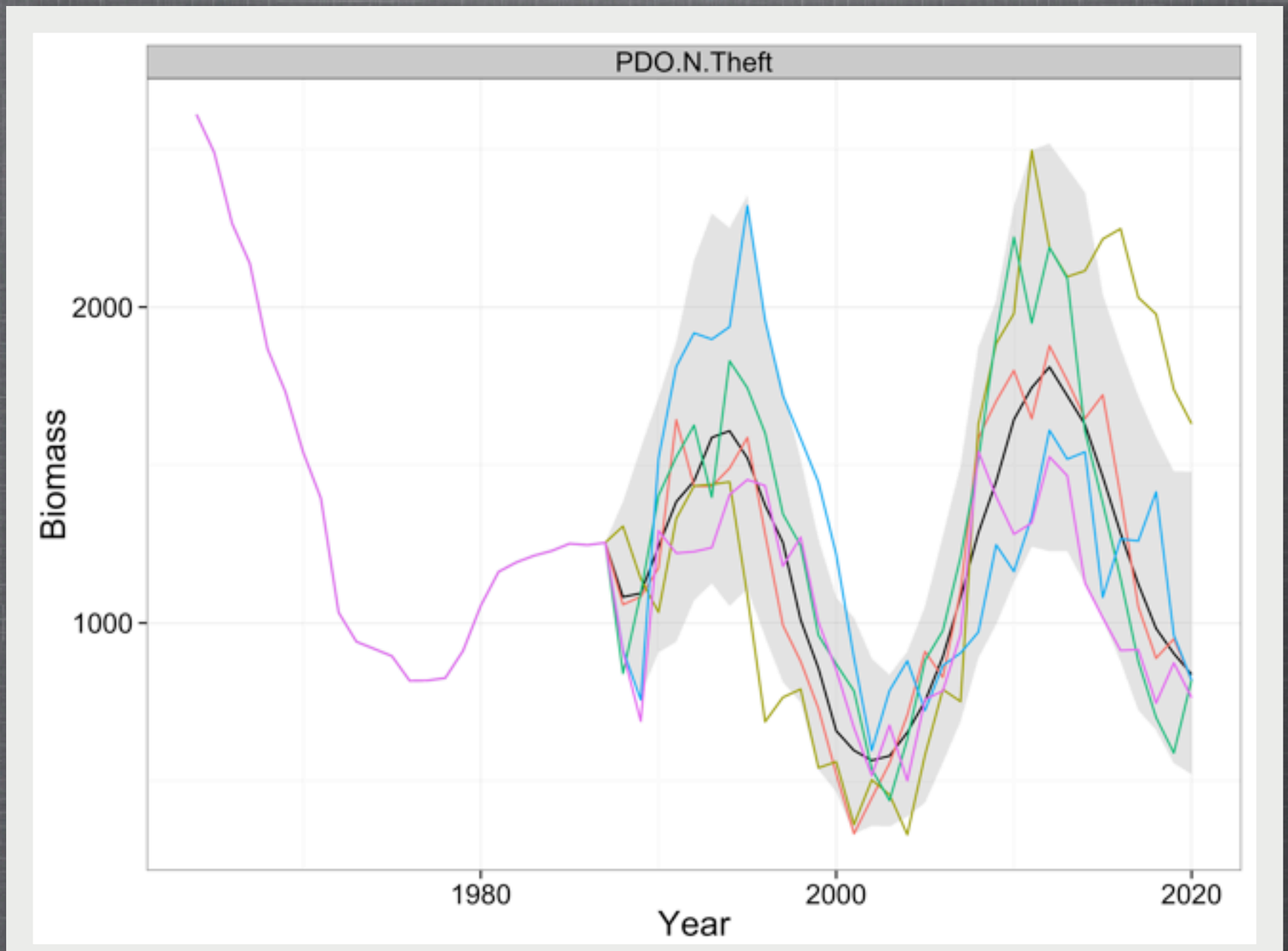
SCENARIO 1; MP=30:20

Deterministic production



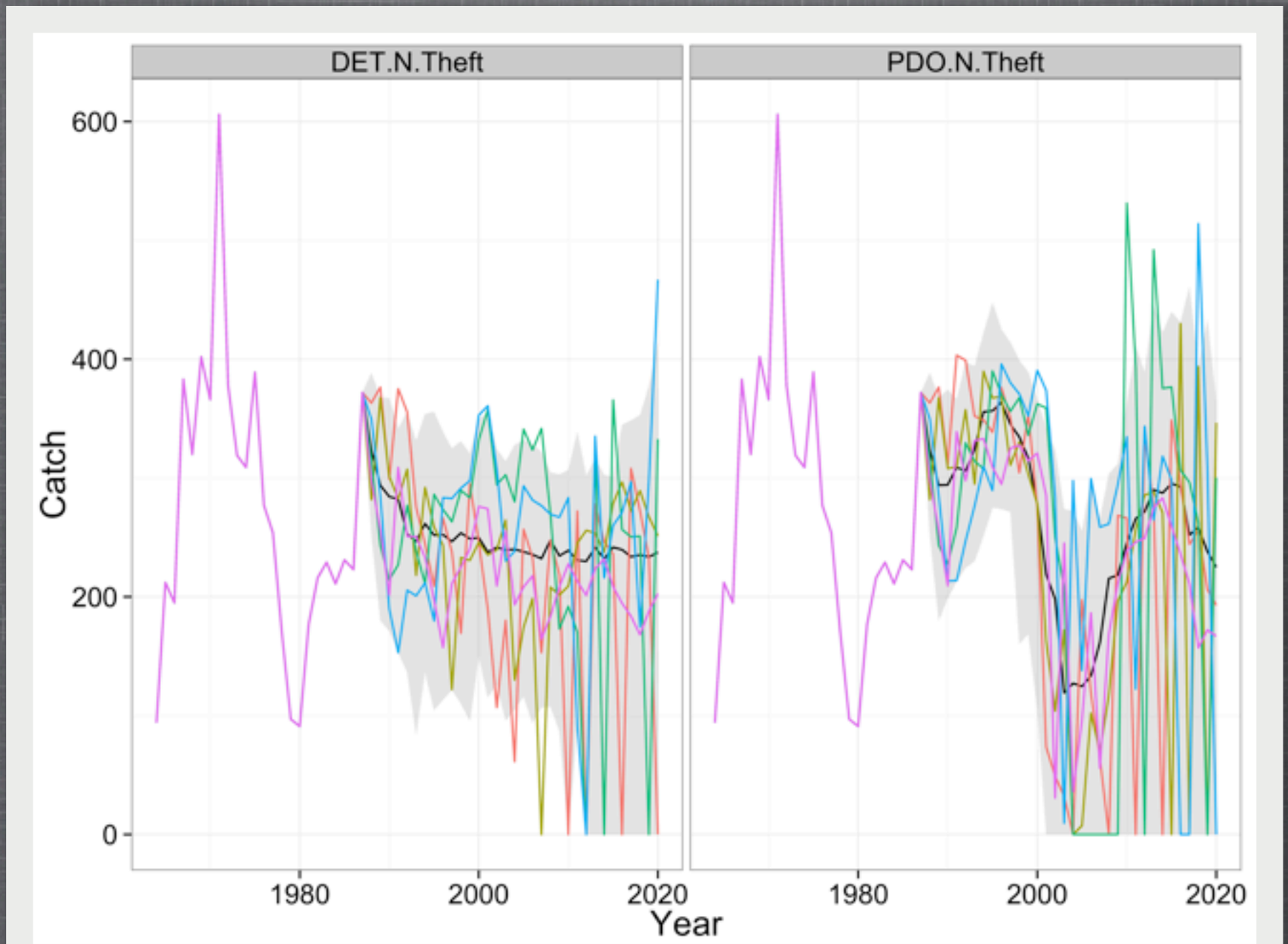
SCENARIO 2; MP=30:20

Pacific Decadal Oscillation (PDO)



LANDINGS: MP=30:20

Deterministic PDO

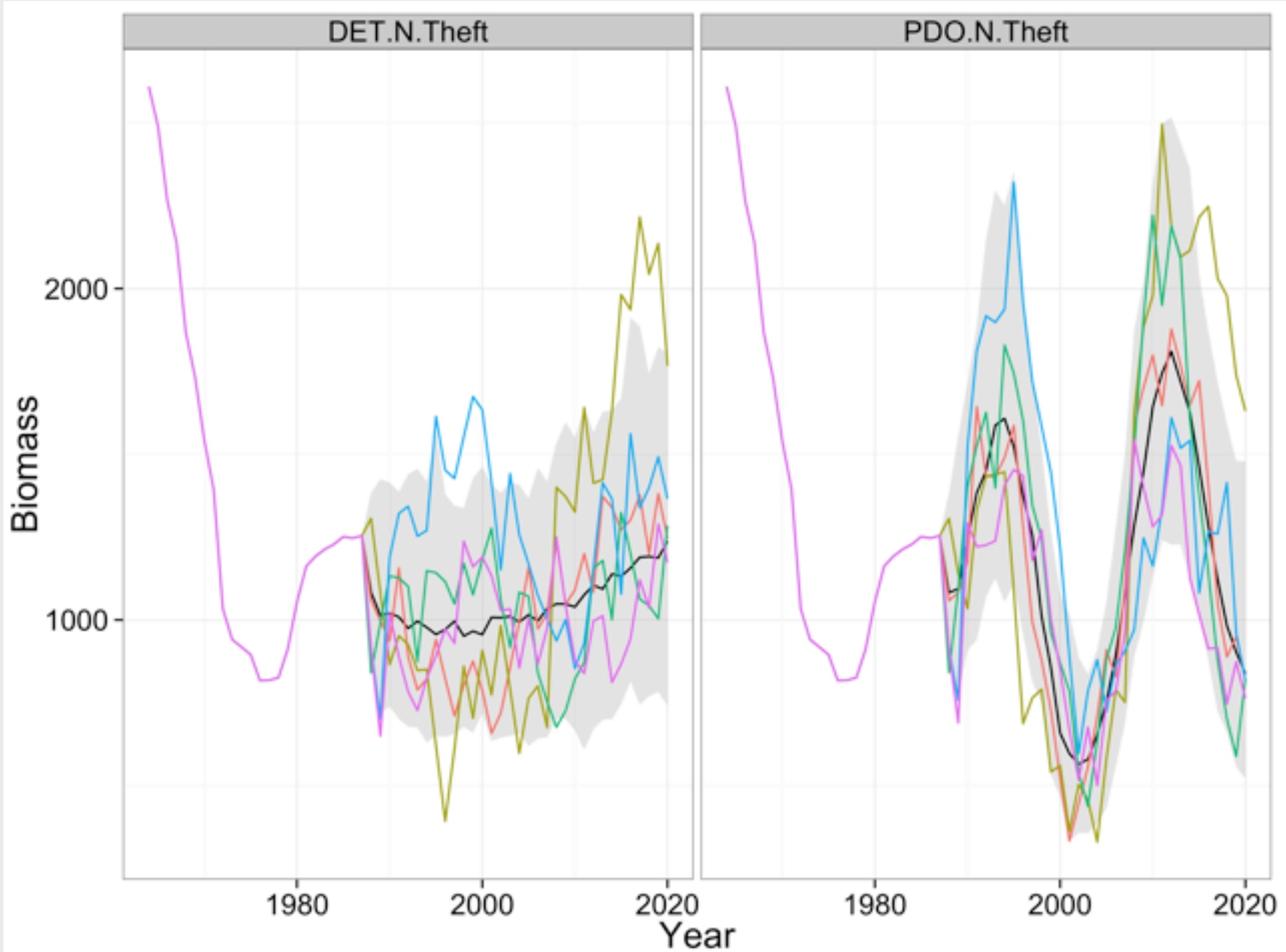


Chris wants to pave a new way

Banksy

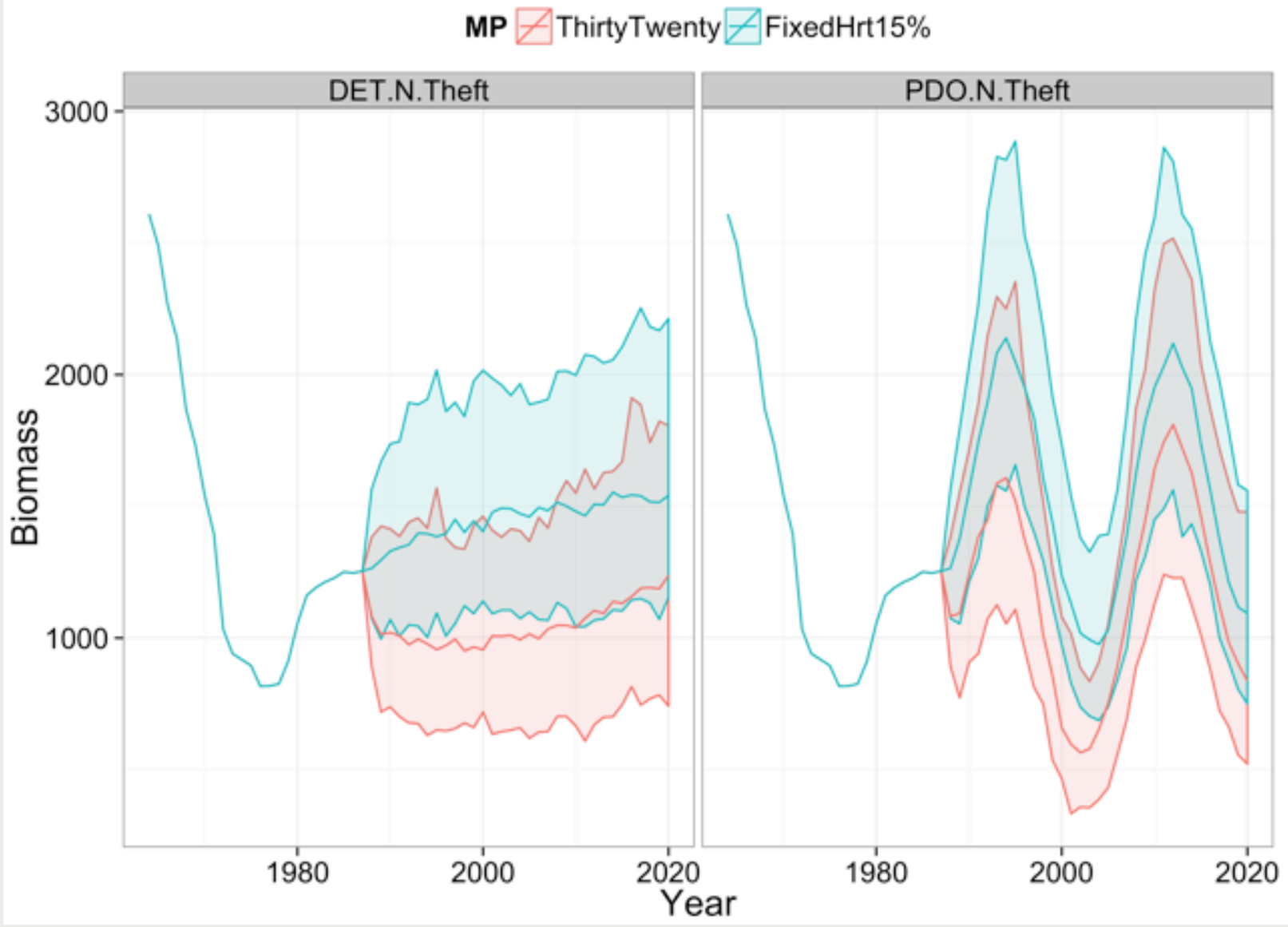
SPORER MP

Biomass using 30:20 MP



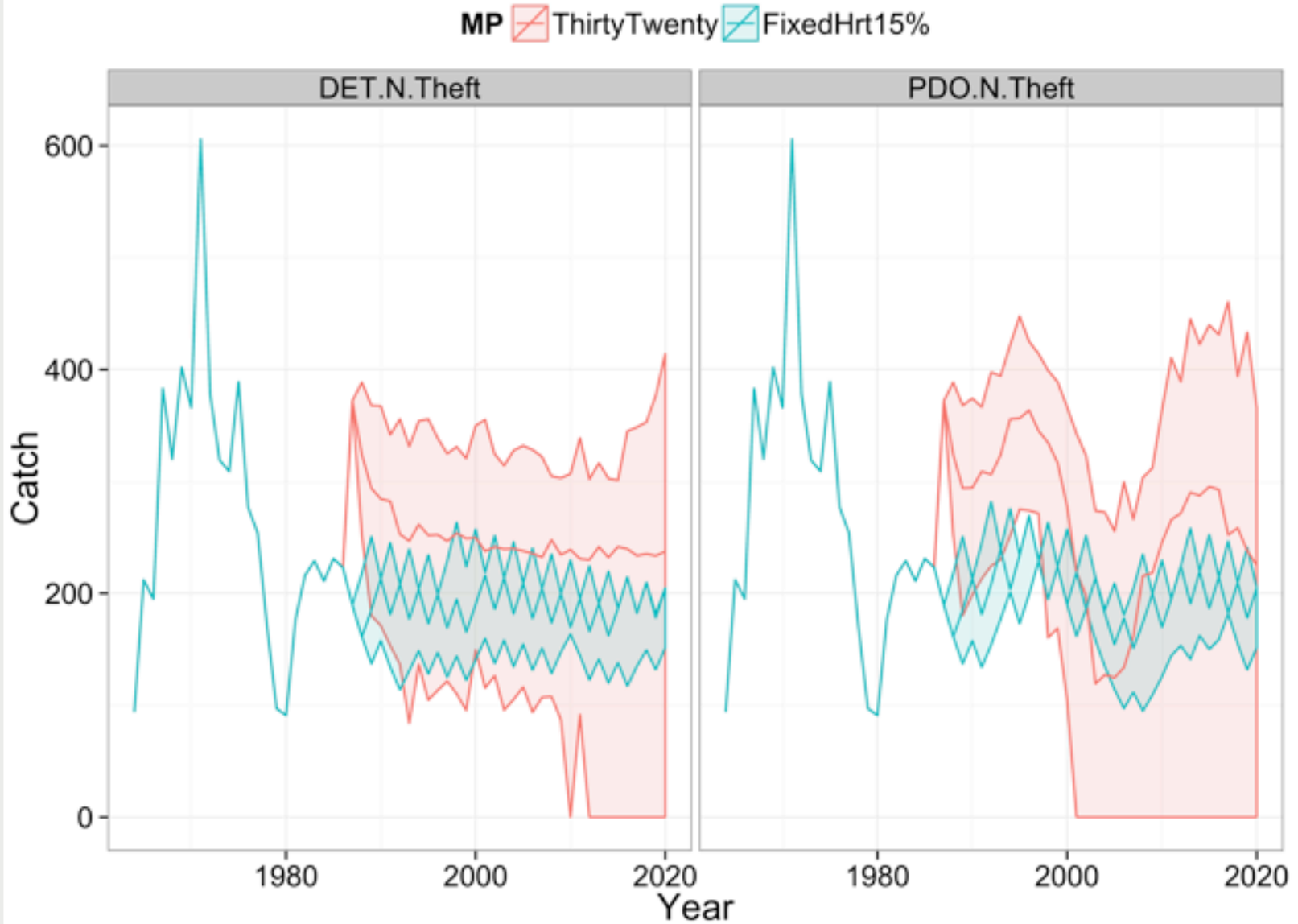
SPORER MP

Biomass using 30:20 and Sporer MP



SPORER MP

Landings



Average Catch (2000-2015)

	Deterministic Scenario	Pacific Decadal Oscillation Scenario
30:20 HCR	240.88	217.73
Sporer HCR	189.03	189.53

Average Depletion (2000-2015)

	Deterministic Scenario	Pacific Decadal Oscillation Scenario
30:20 HCR	39%	44%
Sporer HCR	57%	58%

5-Year AAV in Catch (2000-2015)

	Deterministic Scenario	Pacific Decadal Oscillation Scenario
30:20 HCR	16%	45%
Sporer HCR	13%	13%

Lessons

- Transition (Adopting the Sporer MP):
  - Implies immediate reductions (~50%) in landings in the first year.
  - Fishery never closes & biomass immediately increases.
  - Reduced variance in annual catch comes with a tradeoff of lowering the total catch.
  - The max 15% change imposes dangerous lags.
  - What about ... ?

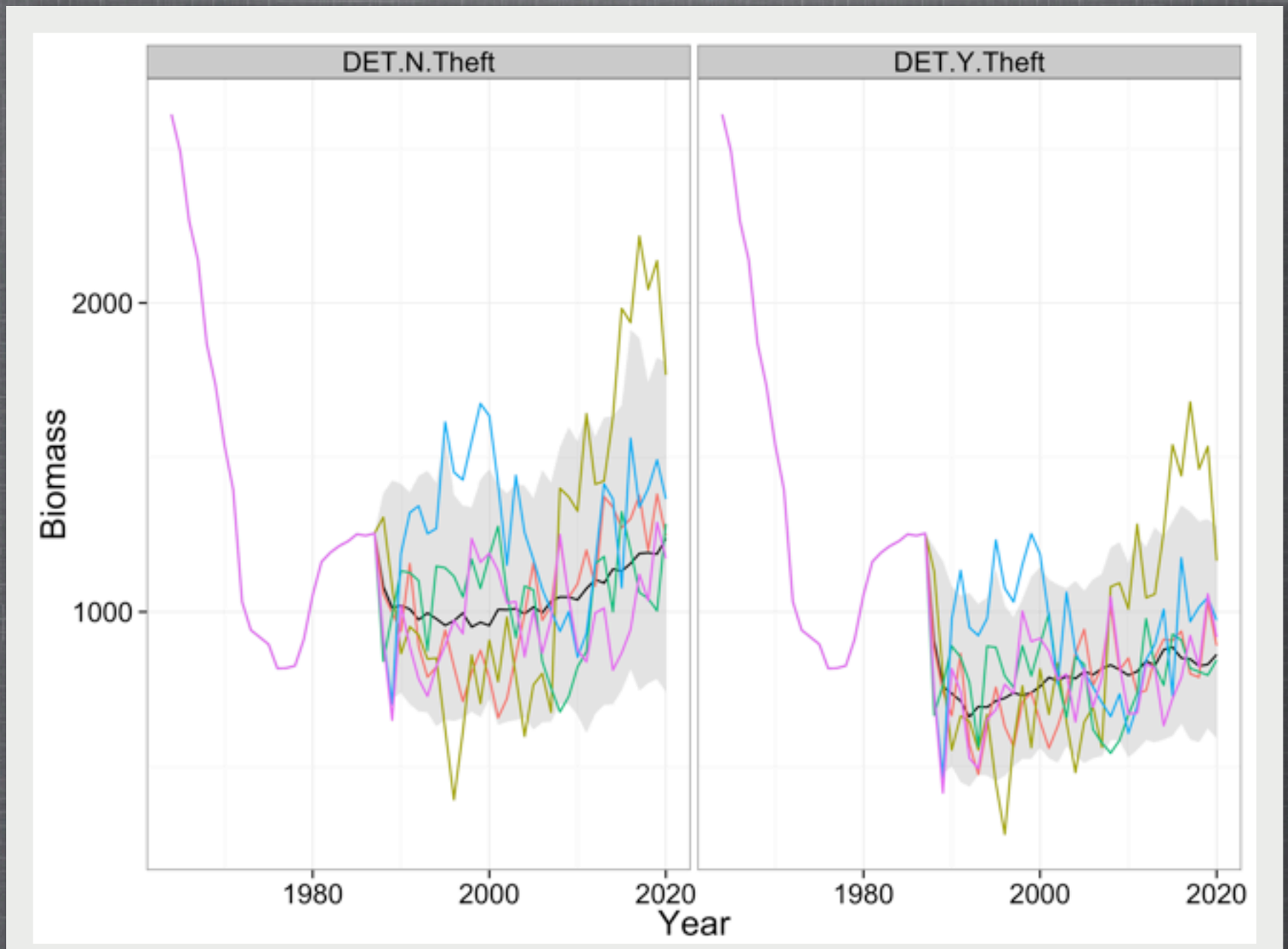
What about other issues the analyst is hiding?

Banksy

So, How would the ‘Sporer Procedure’ perform if the catch accounting system was missing a significant amount of halibut?

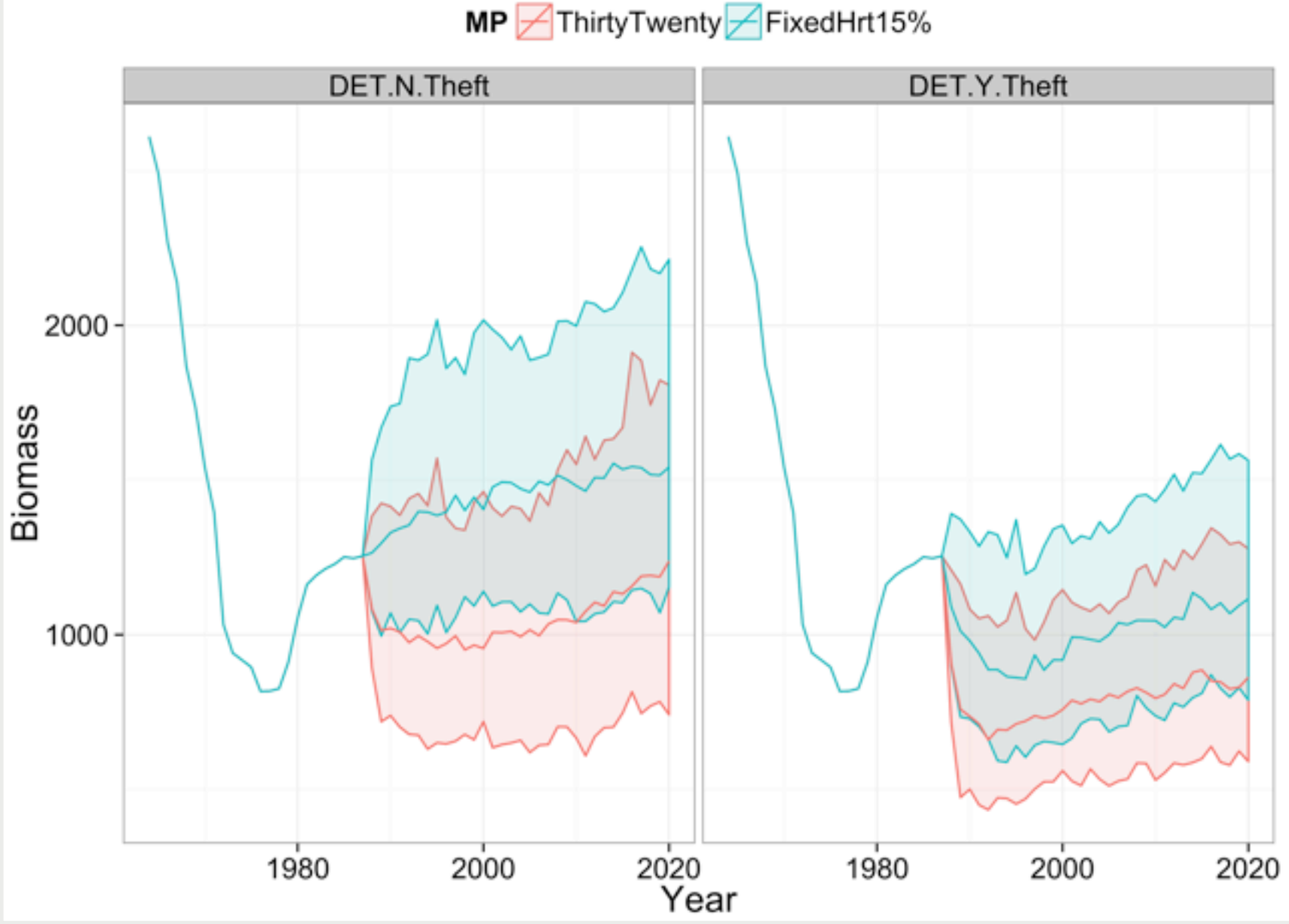
DETERMINISTIC OM

Biomass with 30:20 HCR



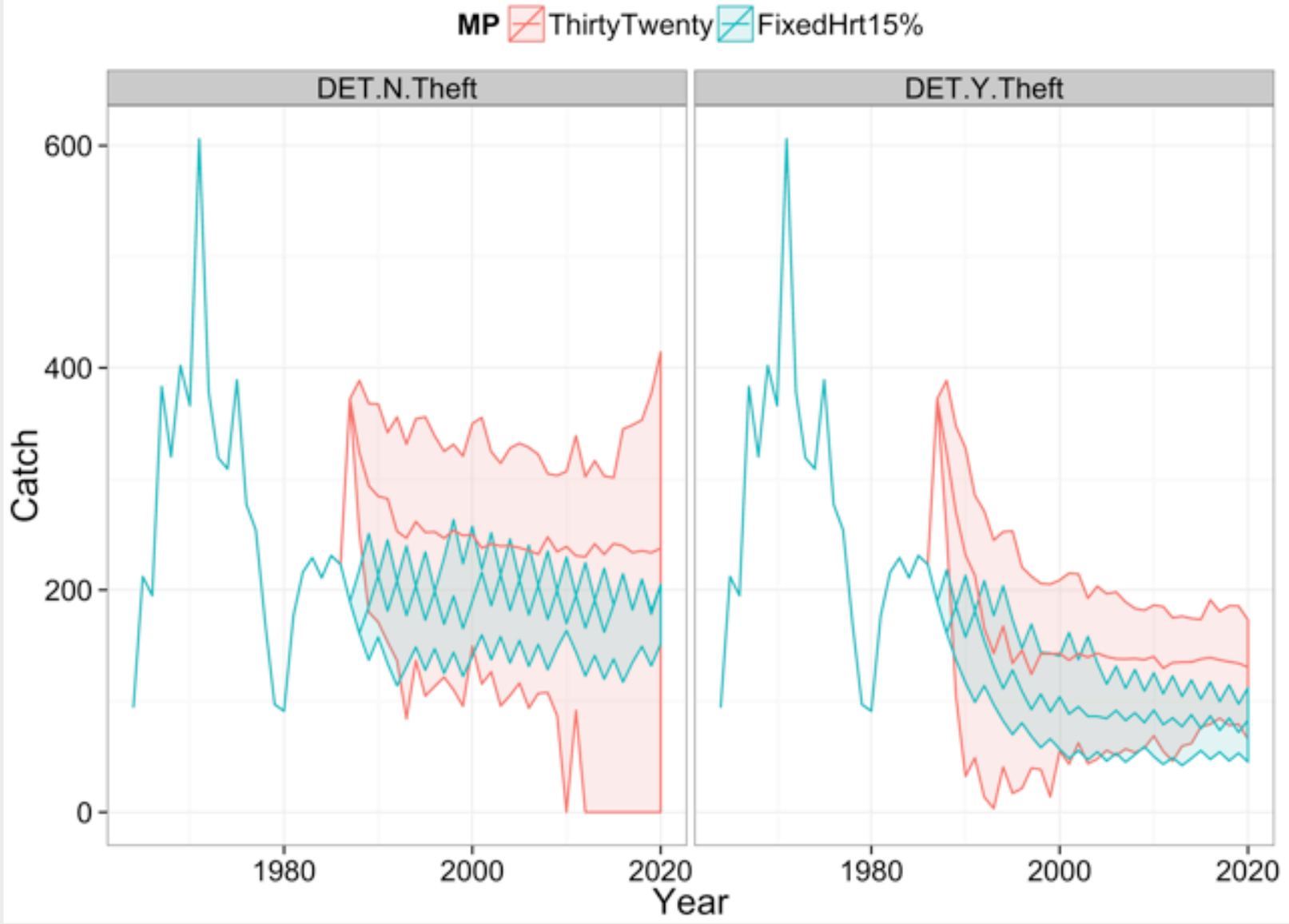
DETERMINISTIC OM

Biomass with 30:20 and Sporer HCR



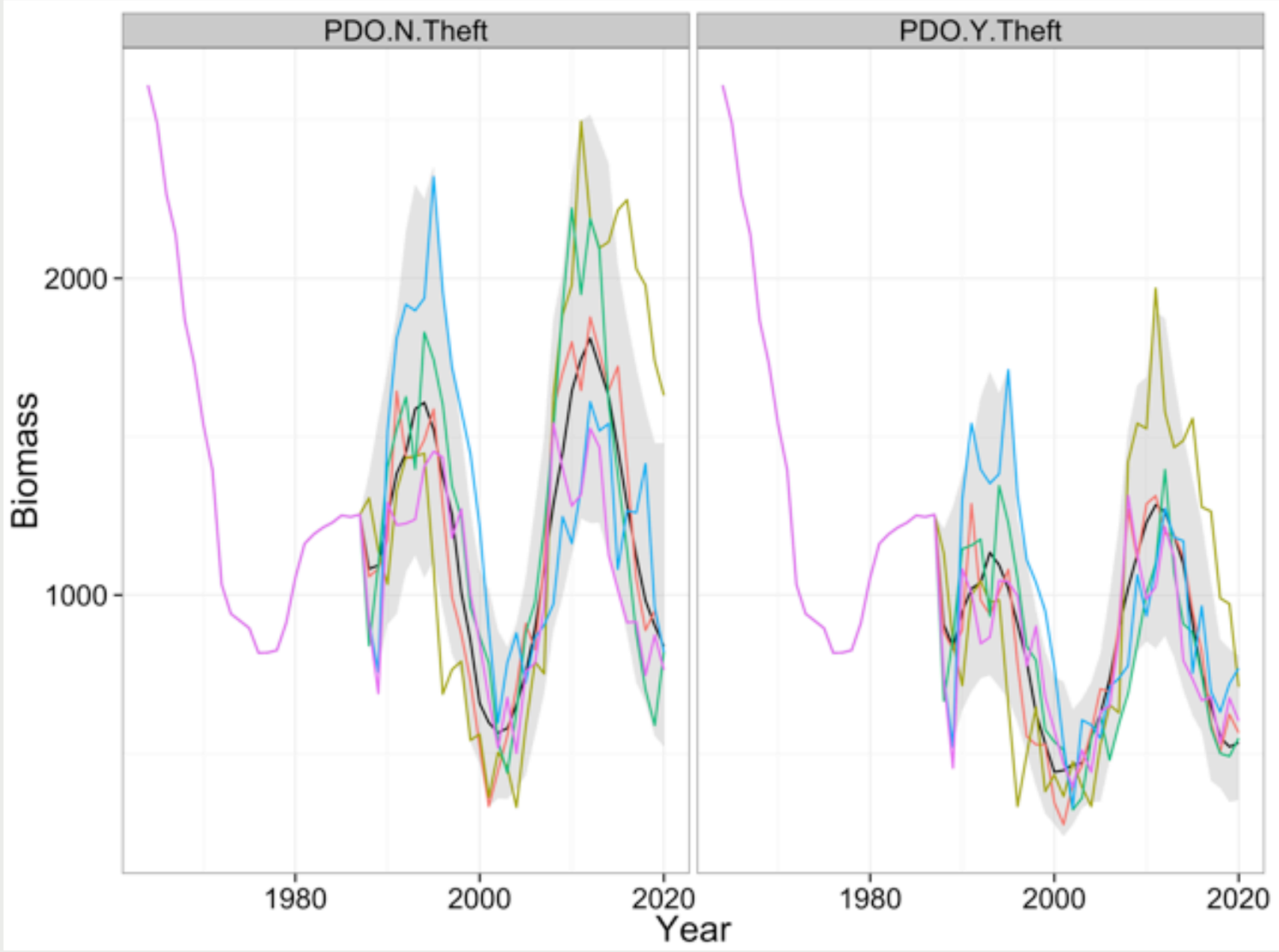
DETERMINISTIC OM

Landings



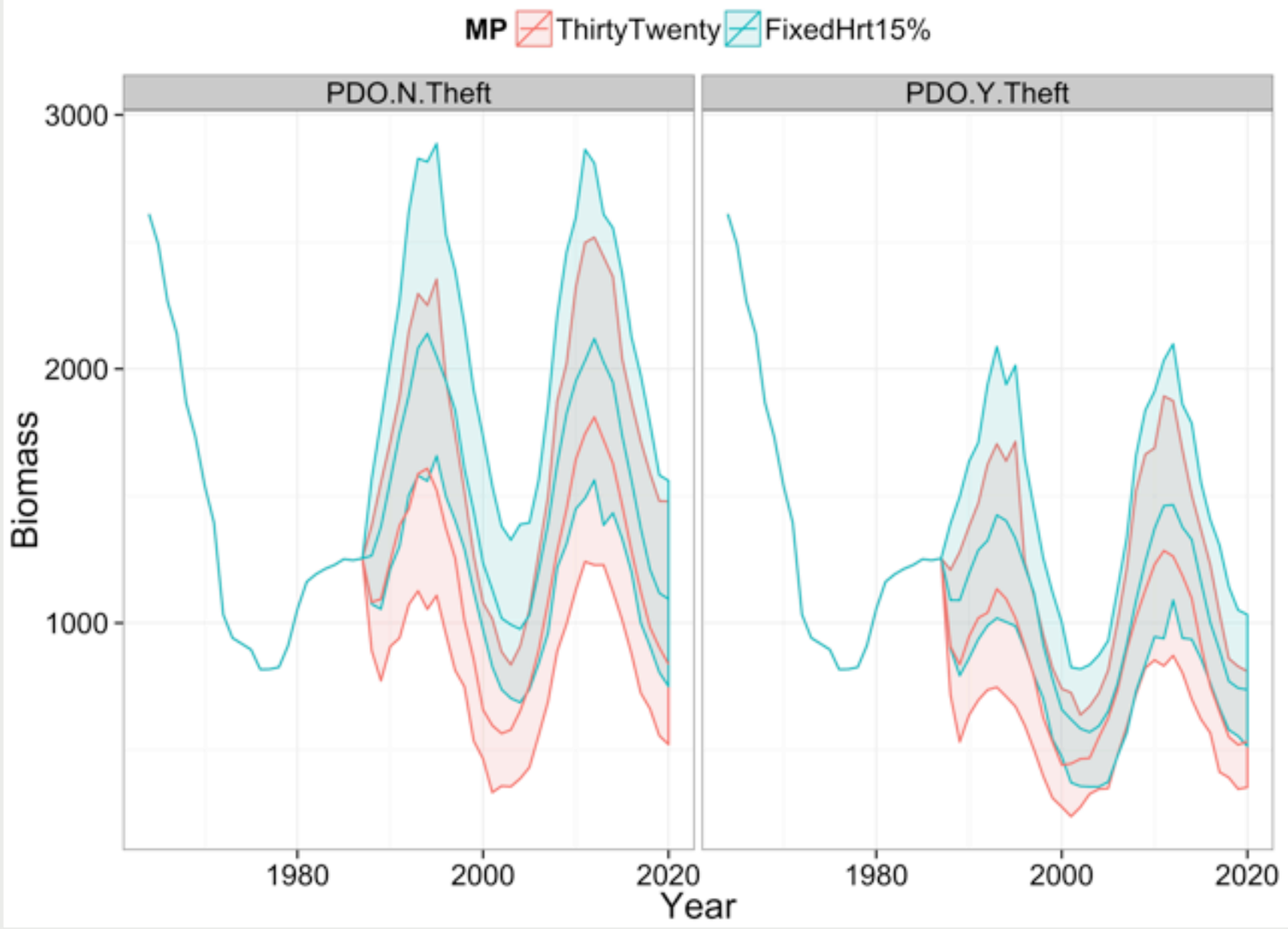
PDO OM

Biomass with 30:20 HCR



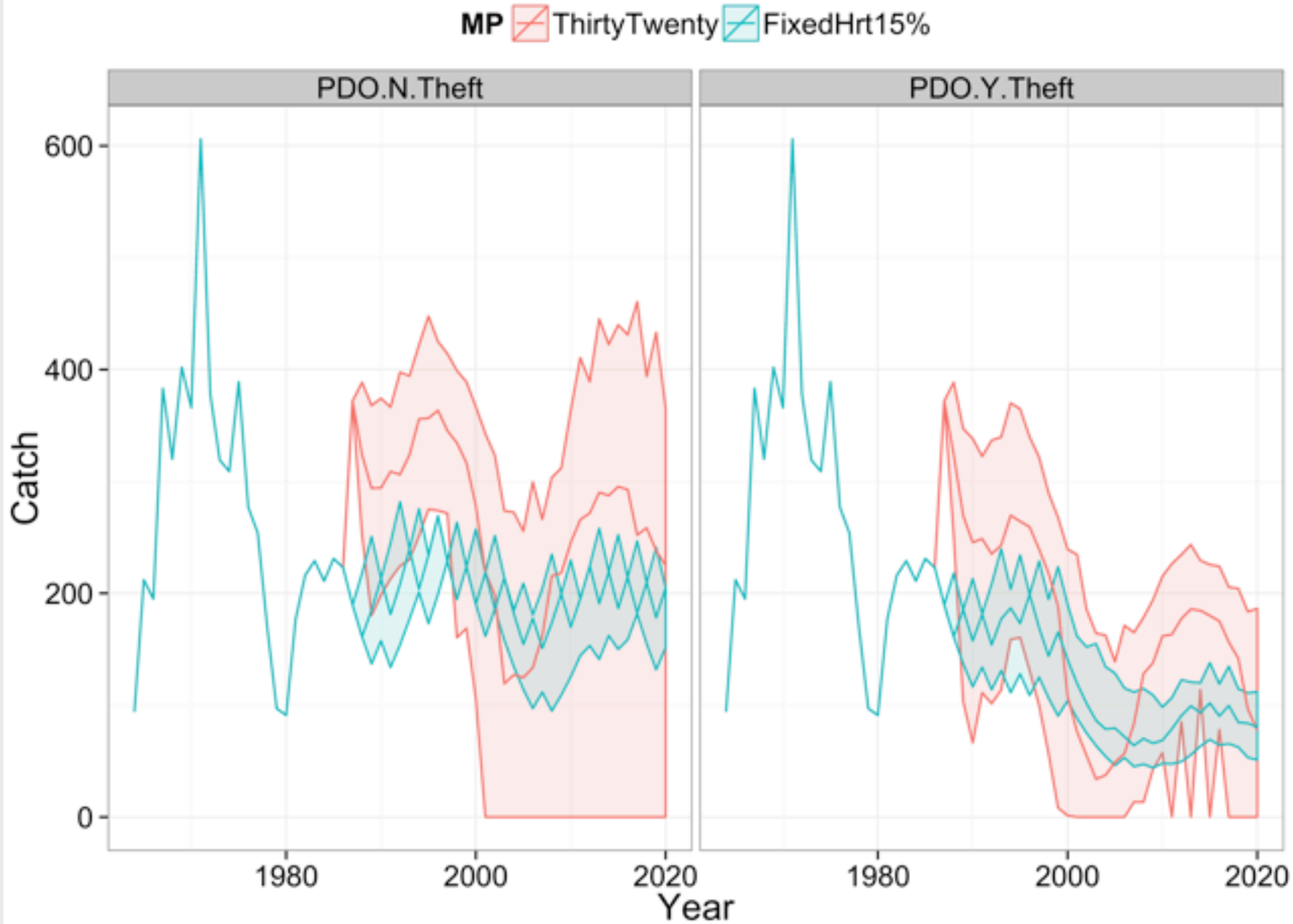
PDO OM

Biomass with 30:20 and Sporer HCR



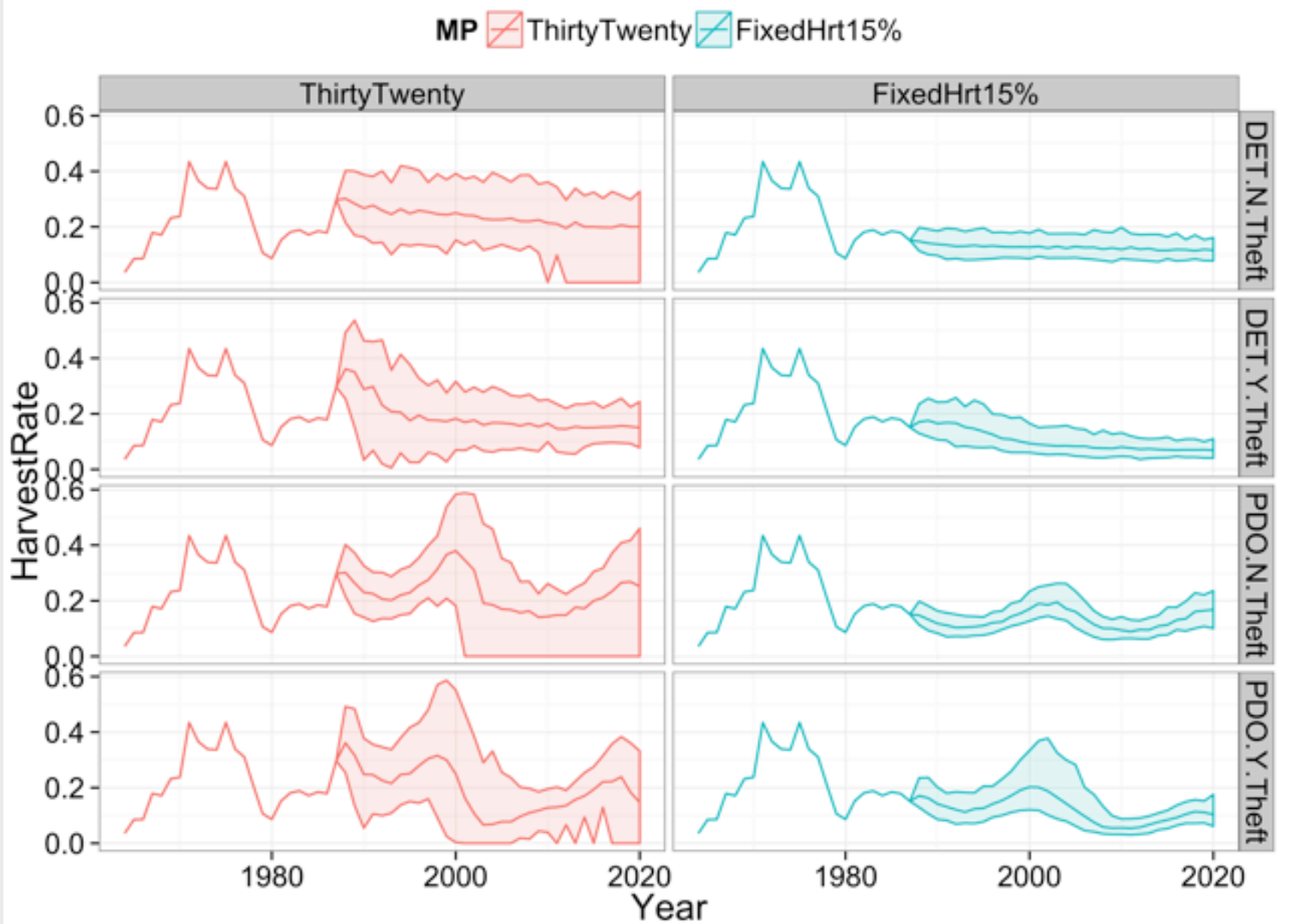
PDO OM

Landings



HARVEST RATE

(Catch/Biomass)



Average Catch (2000-2015)

	Determ. Scenario No Theft	Determ. Scenario w Theft	PDO Scenario No Theft	PDO Scenario w Theft	
30:20 HCR	240.88	136.87	217.73	111.64	
Sporer HCR	189.03	86.02	189.53	88.23	

Average Catch (2000-2015)

	Determ. Scenario No Theft	Determ. Scenario w Theft	PDO Scenario No Theft	PDO Scenario w Theft	
30:20 HCR	240.88	136.87	217.73	111.64	
Sporer HCR	189.03	86.02	189.53	88.23	

Which Scenario is right?

Average Catch (2000-2015)

	Determ. Scenario No Theft	Determ. Scenario w Theft	PDO Scenario No Theft	PDO Scenario w Theft	Average
30:20 HCR	240.88	136.87	217.73	111.64	176.88
Sporer HCR	189.03	86.02	189.53	88.23	138.20

Average Depletion (2000-2015)

	Determ. Scenario No Theft	Determ. Scenario w Theft	PDO Scenario No Theft	PDO Scenario w Theft	Average
30:20 HCR	39%	31%	44%	32%	36%
Sporer HCR	57%	39%	58%	37%	48%

5-Year AAV in Catch (2000-2015)

	Determ. Scenario No Theft	Determ. Scenario w Theft	PDO Scenario No Theft	PDO Scenario w Theft	Average
30:20 HCR	16%	21%	45%	41%	31%
Sporer HCR	13%	13%	13%	13%	13%

2-minute drill

- Write down which procedure (‘Sporer’ or current IPHC 30:20) you would pick, and at least two reasons why it is preferable.

Person with the correct answer gets a free lunch!

This discussion is why we must articulate objectives!

Tools for examining heaps of simulated output

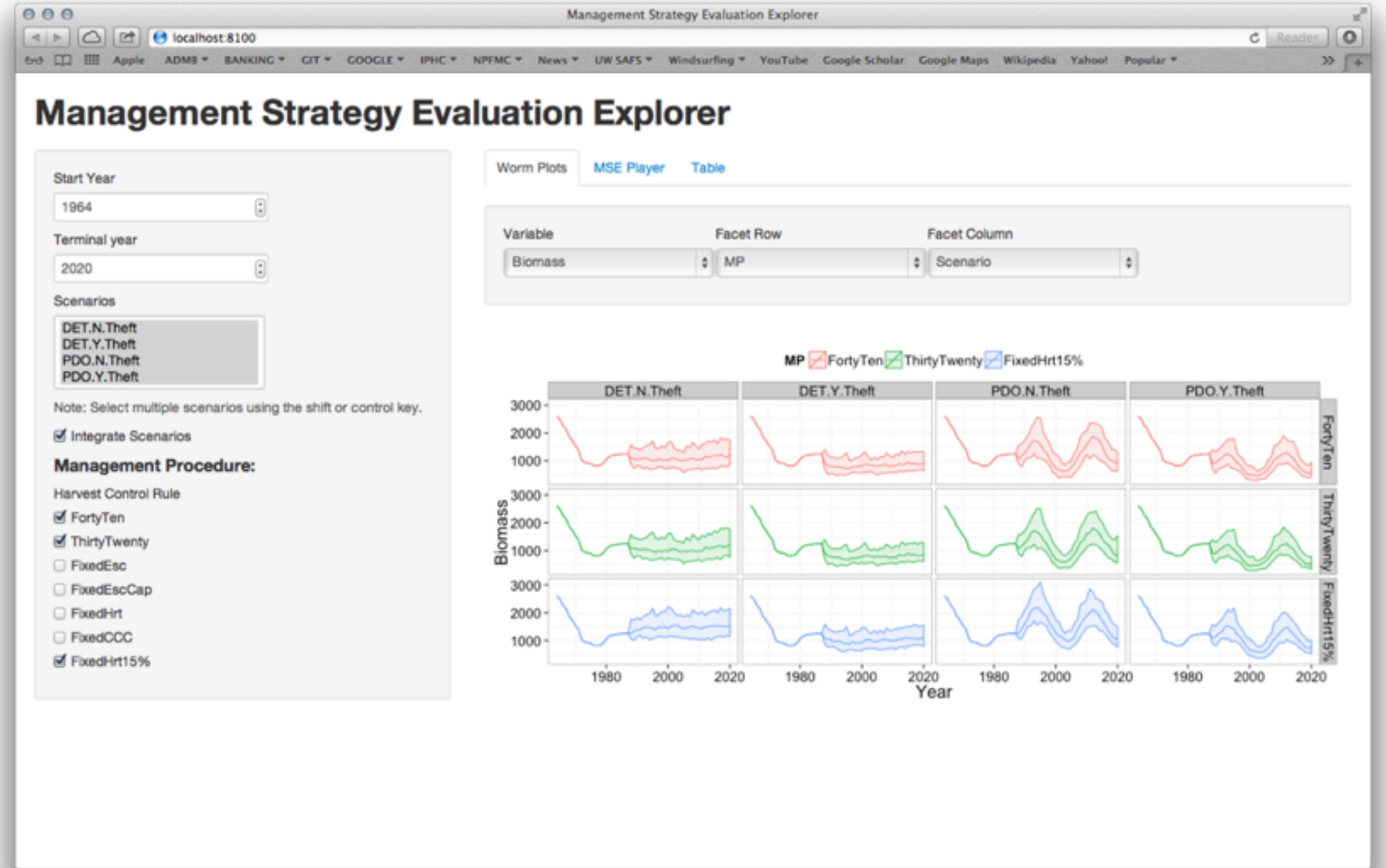
- A major difficulty with MSE is dealing with the permutations & combinations (combinatorics) of Management Procedures, Scenarios, and Performance metrics.

- We are working on an interactive web-site that allows users to compare the combinatorics.

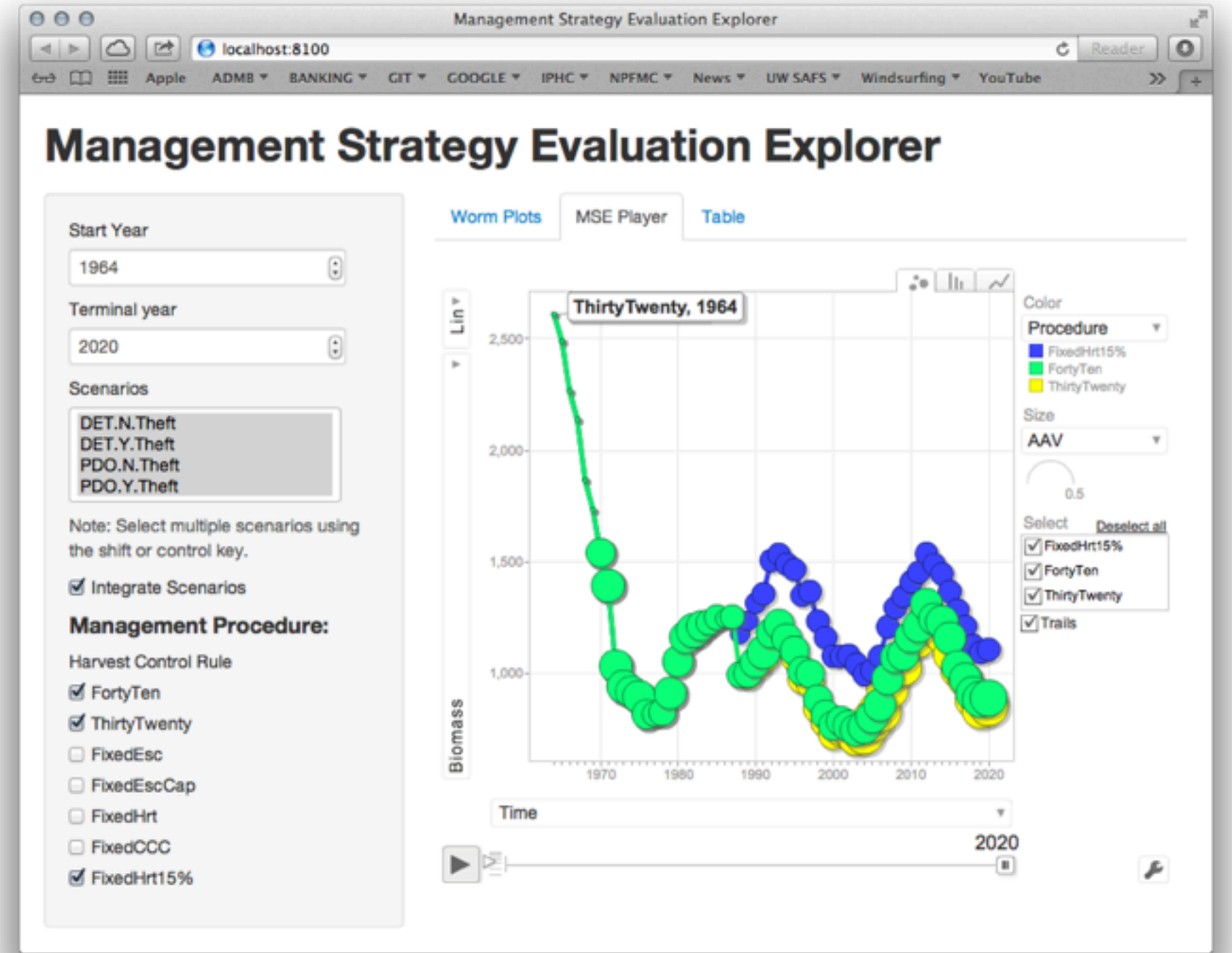
Statistics for this MSE Demo

- # of Scenarios = 4
- # of Realizations = 100
- # of Management Procedures = 7
- # of assessments per realization = 36
- Average # of function evaluations per assessment = 201
- Total # of function evaluations 20,260,800
- Total runtime is roughly 21 minutes

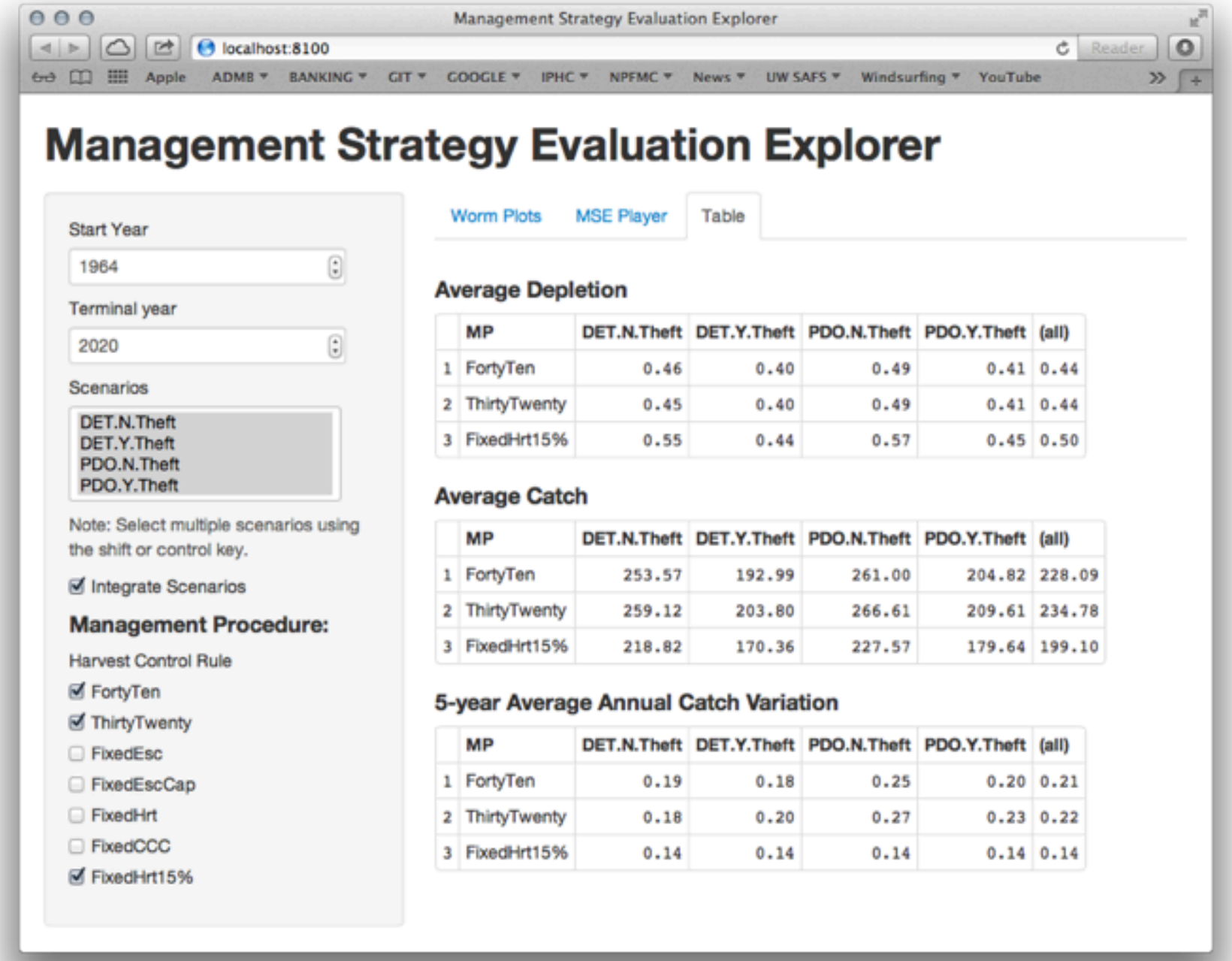
Worm plots by MP & Scenario



Dynamic Motion Charts



Summary Tables



	MP	DET.N.Theft	DET.Y.Theft	PDO.N.Theft	PDO.Y.Theft	(all)
1	FortyTen	0.46	0.40	0.49	0.41	0.44
2	ThirtyTwenty	0.45	0.40	0.49	0.41	0.44
3	FixedHrt15%	0.55	0.44	0.57	0.45	0.50

	MP	DET.N.Theft	DET.Y.Theft	PDO.N.Theft	PDO.Y.Theft	(all)
1	FortyTen	253.57	192.99	261.00	204.82	228.09
2	ThirtyTwenty	259.12	203.80	266.61	209.61	234.78
3	FixedHrt15%	218.82	170.36	227.57	179.64	199.10

	MP	DET.N.Theft	DET.Y.Theft	PDO.N.Theft	PDO.Y.Theft	(all)
1	FortyTen	0.19	0.18	0.25	0.20	0.21
2	ThirtyTwenty	0.18	0.20	0.27	0.23	0.22
3	FixedHrt15%	0.14	0.14	0.14	0.14	0.14

Demo MSEE

Yes it will even work on your ipad, or PC tablet, probably your android phone as well, but I haven't tried.

http://192.168.100.48:3838/QDF/