Comparisons between single area management and various forms of two area management for directed sardine TACs off South Africa

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with acknowledgement to OMP TT

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Sardine Stock Structure v Area Based Management

		The type of sardine TAC arising from the candidate MP	
		Single area TAC	Two area TAC
The underlying sardine stock OM	Single sardine stock		
	Two mixing sardine components		

Sardine Stock Structure v Area Based Management

		The type of sardine TAC arising from the candidate MP					
		Single area TAC1	Single area TAC2	Single area TAC3	Two area TAC1	Two area TAC2	Two area TAC3
The underlying sardine stock OM	Single sardine stock						
	Two mixing sardine components v1						
	Two mixing sardine components v2						
	Two mixing sardine components v3						
	Two mixing sardine components …						

Sardine Stock Structure v Area Based Management

		The type of sardine TAC arising from the candidate MS	
		Single area TAC	Two area TAC
The underlying sardine stock OM	Single sardine stock	All catch taken from single stock	Add TACs, and subsequent catch taken from single stock
	Two mixing sardine components		

Sardine Stock Structure v Area Based Management

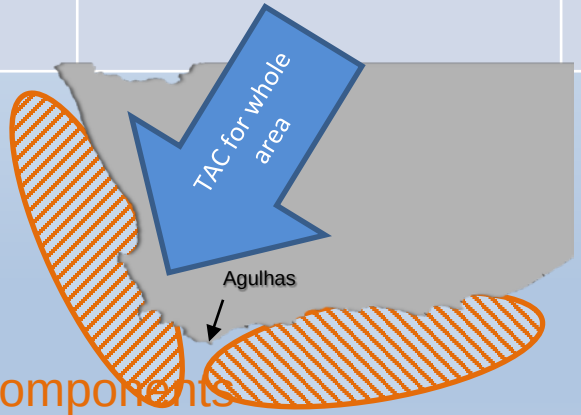
		The type of sardine TAC arising from the candidate MS	
		Single area TAC	Two area TAC
The underlying sardine stock OM	Single sardine stock	All catch taken from single stock	Add TACs, and subsequent catch taken from single stock
	Two mixing sardine components		West/south TAC taken from west/south component

Two sardine components

± Some flexibility in area boundary?

Sardine Stock Structure v Area Based Management

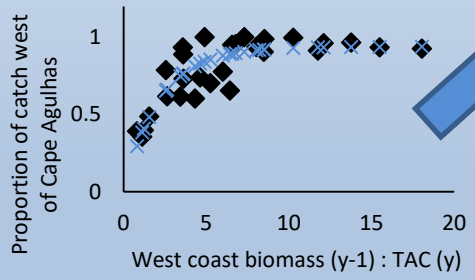
		The type of sardine TAC arising from the candidate MS	
		Single area TAC	Two area TAC
The underlying sardine stock OM	Single sardine stock	All catch taken from single stock	Add TACs, and subsequent catch taken from single stock
	Two mixing sardine components		West/south TAC taken from west/south component



Two sardine components

Sardine Stock Structure v Area Based Management

		The type of sardine TAC arising from the candidate MS	
		Single area TAC	Two area TAC
The underlying sardine stock OM	Single sardine stock	All catch taken from single stock	Add TACs, and subsequent catch taken from single stock
	Two mixing sardine components	Greater proportion of TAC caught from west component when TAC/WC biomass low	West/south TAC taken from west/south component



OMs selected for this work

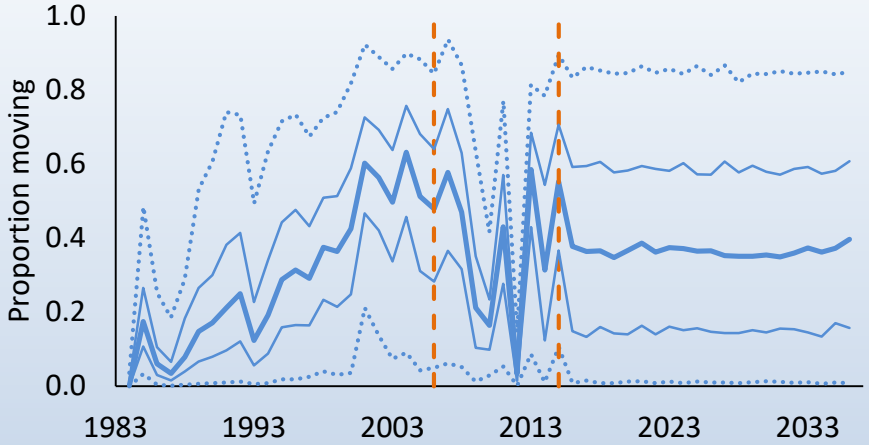
- Single stock hypothesis
- Two component hypothesis, p=0, MoveR
- Two component hypothesis, p=0.2, MoveR
- Two component hypothesis, p=0.6, MoveR
- Two component hypothesis, p=0, 0.5xMoveR/2
- Two component hypothesis, p=0.2, 0.5xMoveR/2
- Two component hypothesis, p=0.6, 0.5xMoveR

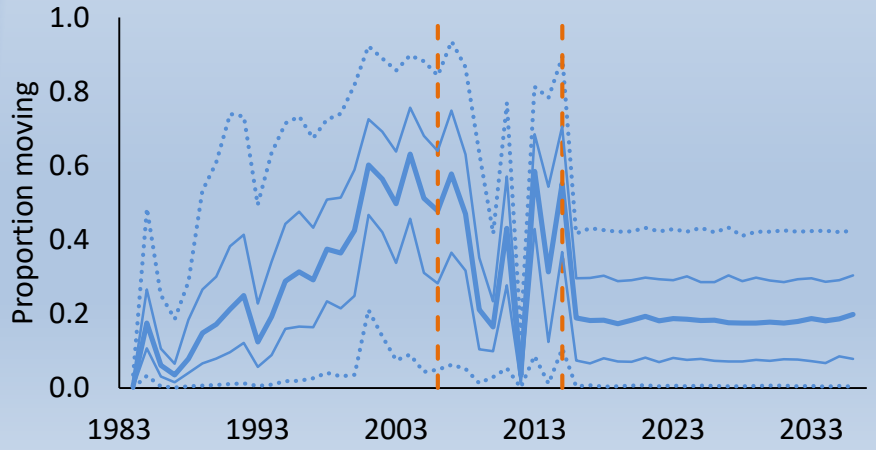
SR estimated after conditioning

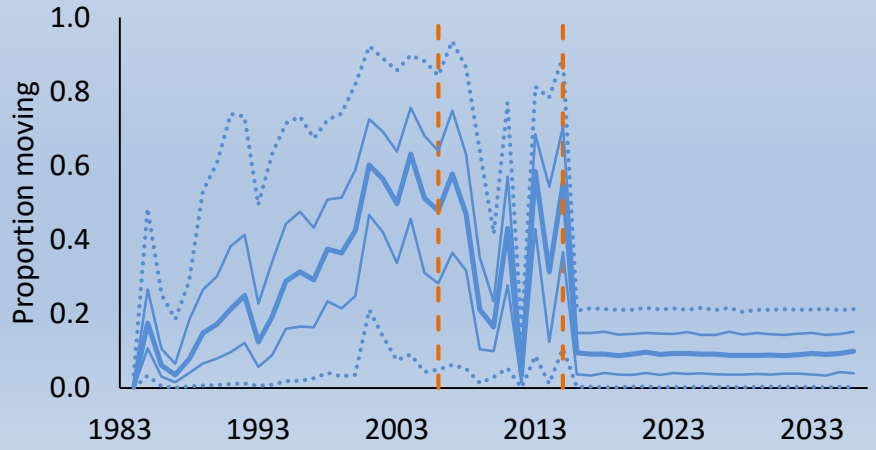
Baseline Anchovy OM

See Appendices A-D for alternatives

Future Southeast Movement







Sardine Management Scenarios Tested

- No catch
- No directed sardine catch (F=0)
- Constant harvest proportions (F=5, 10, 15, 20%)
- Constant harvest proportions, with 20% constraint in inter-annual decreases in TACs
- OMP-14

Single area TAC
Or
Two area TAC

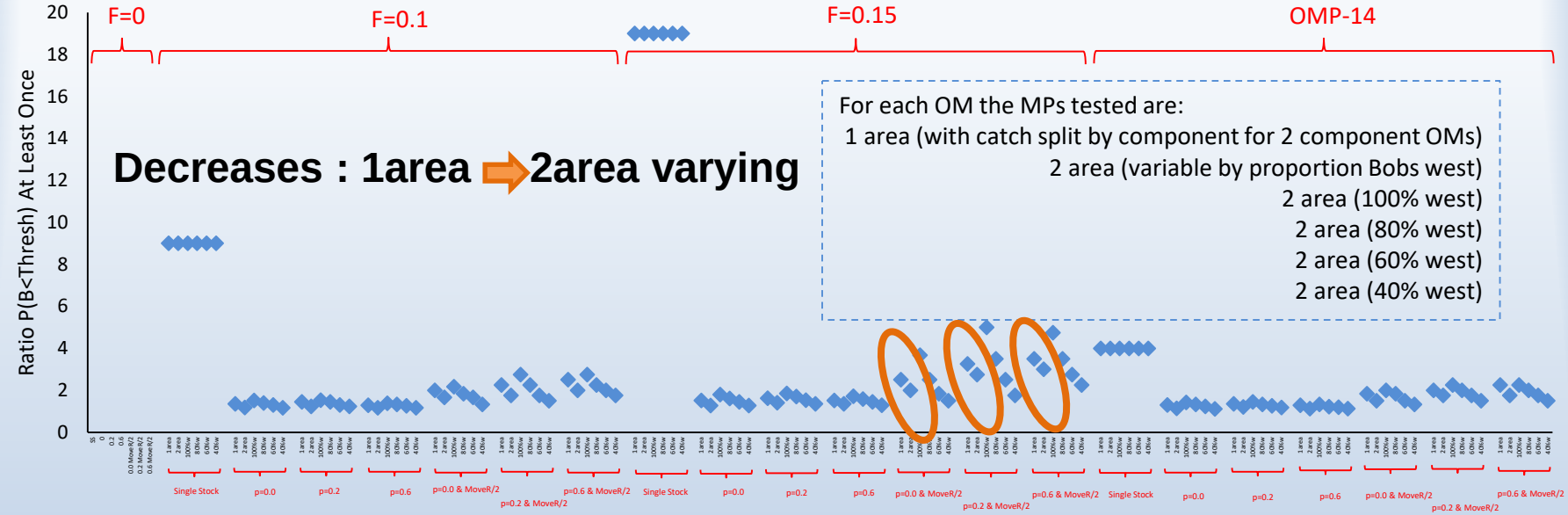
Proportional split constant or varying

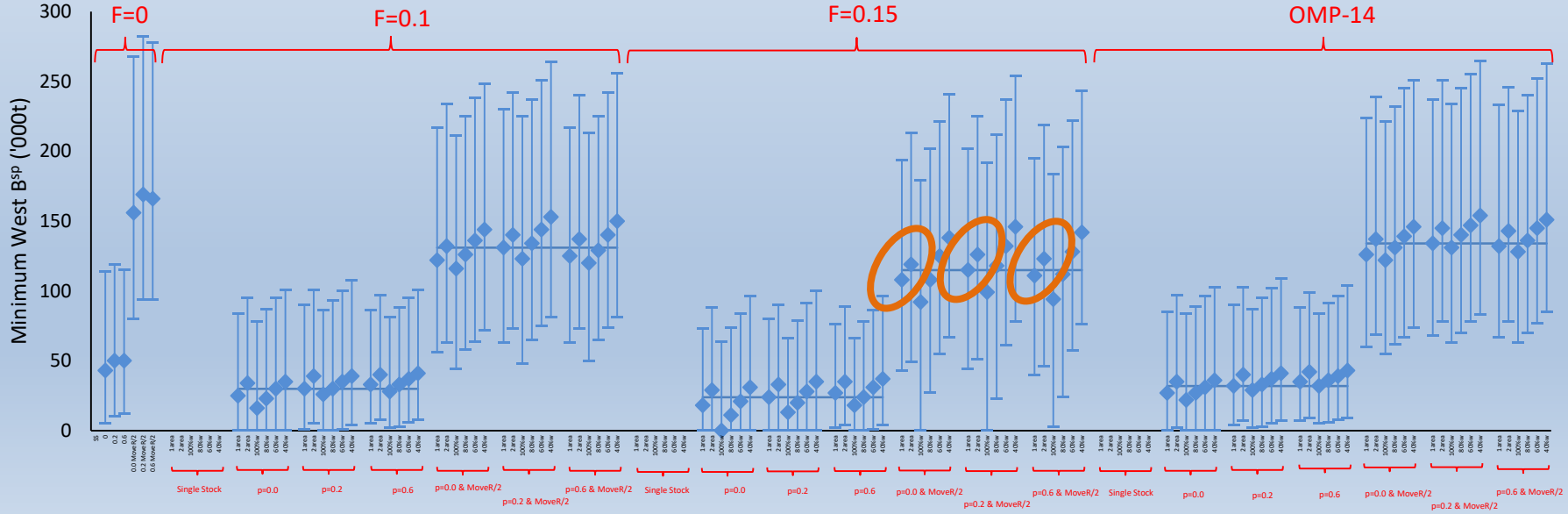
F denotes the proportion of survey biomass set as the TAC

Risk Thresholds

- Sardine: west coast total biomass in 2007
- Anchovy: 0.25 x total biomass in 1996

General Patterns in Results





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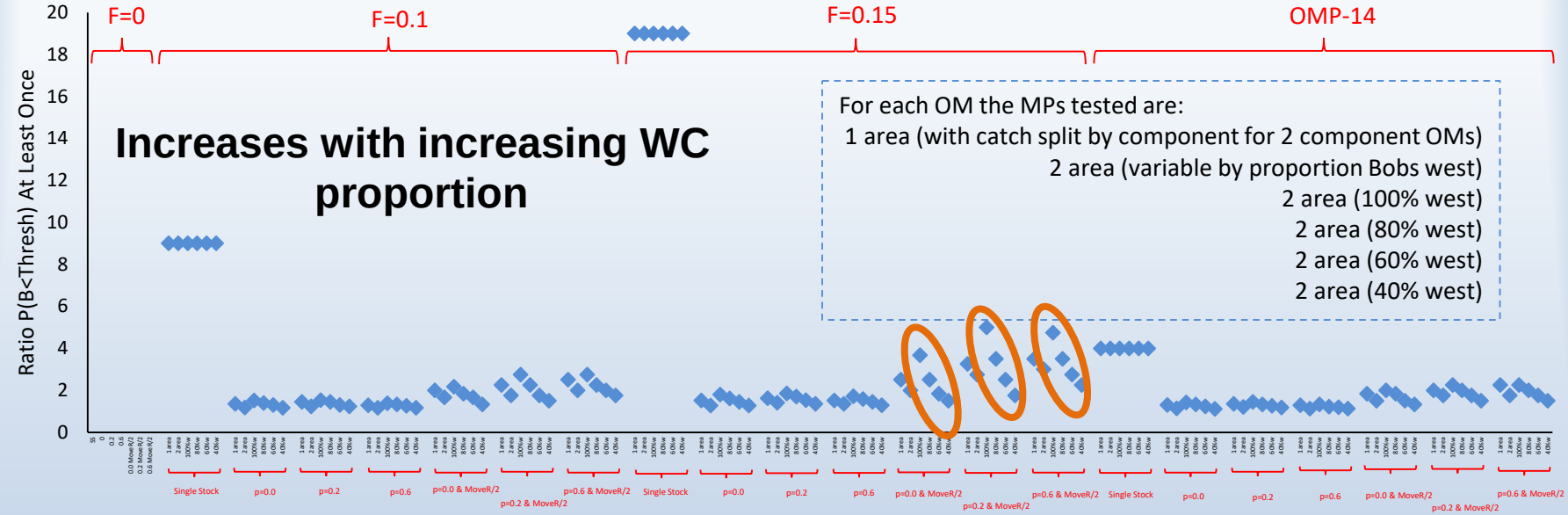

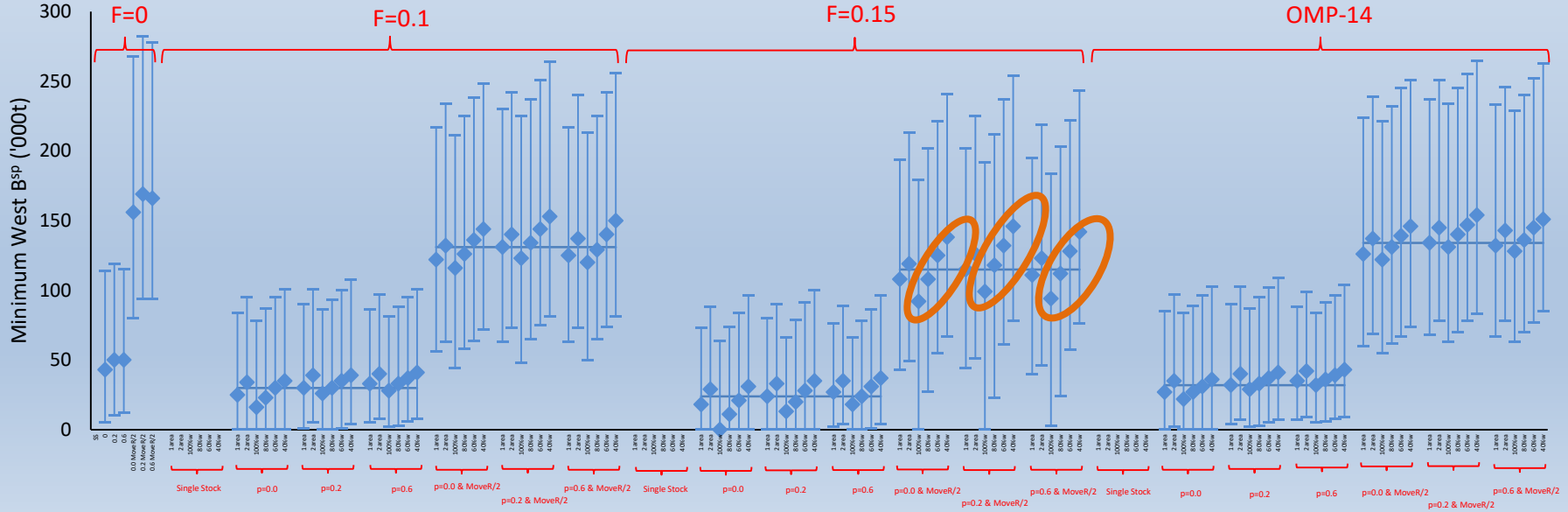

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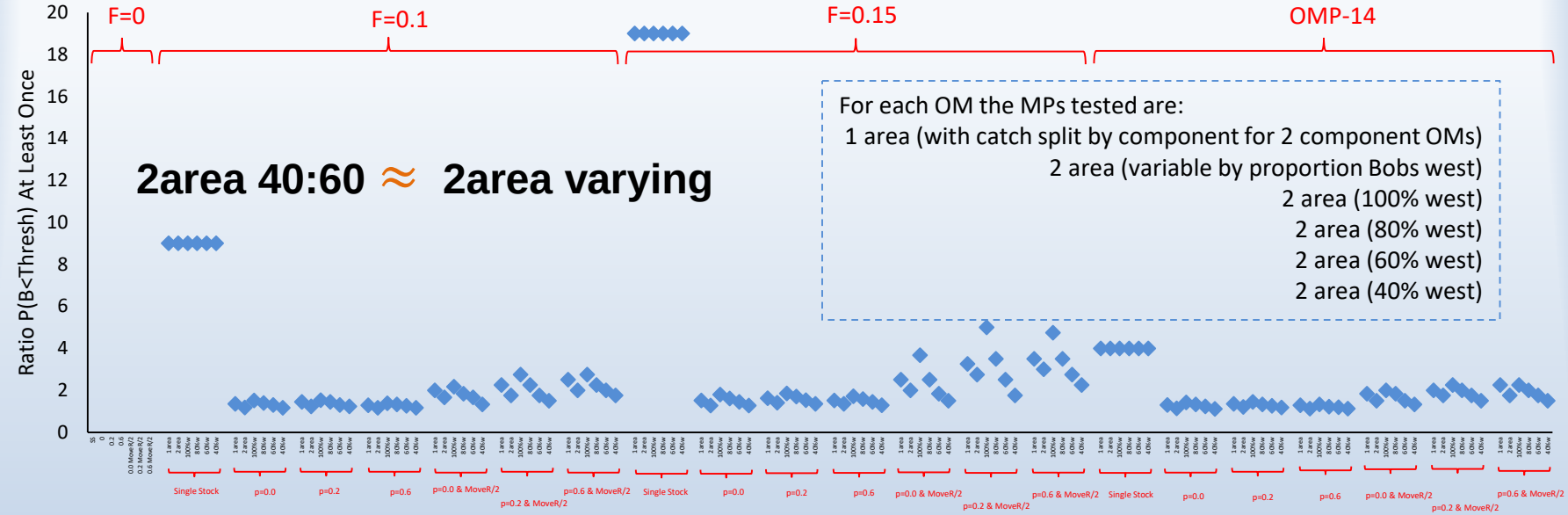

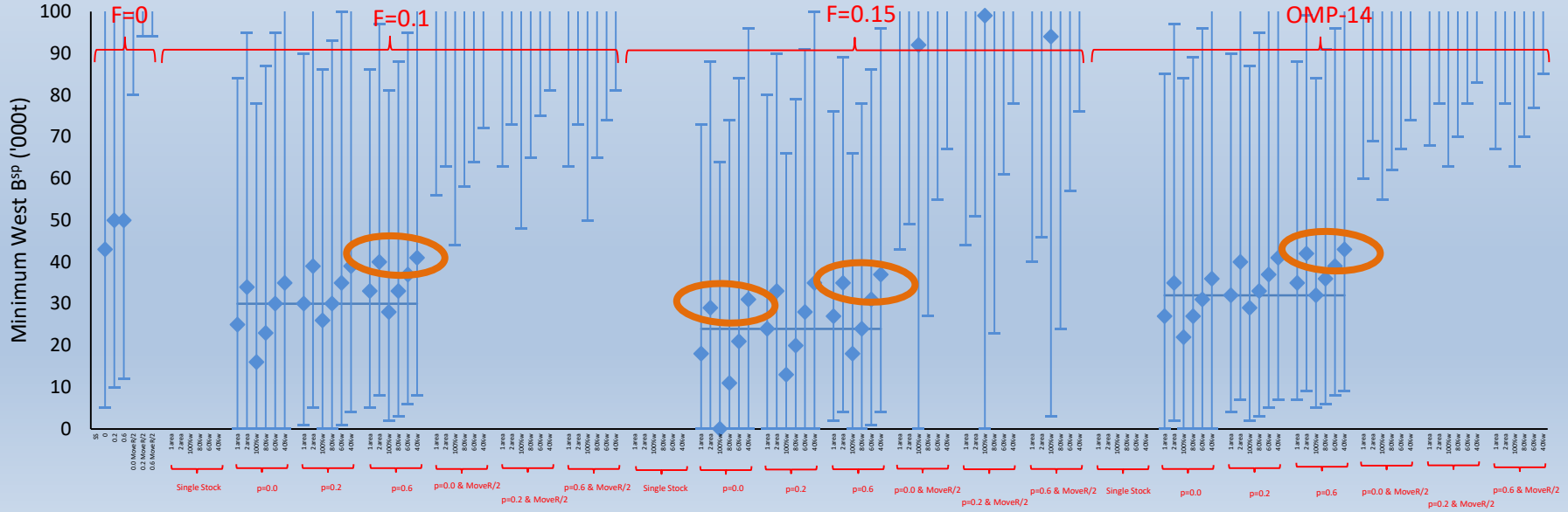

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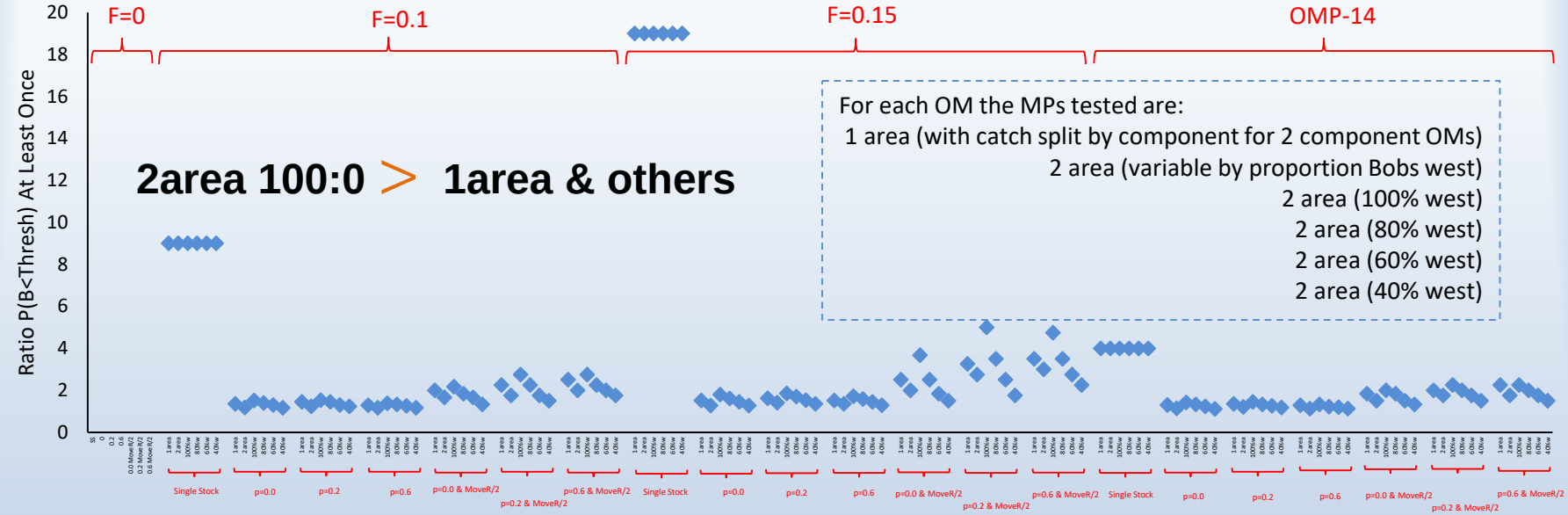

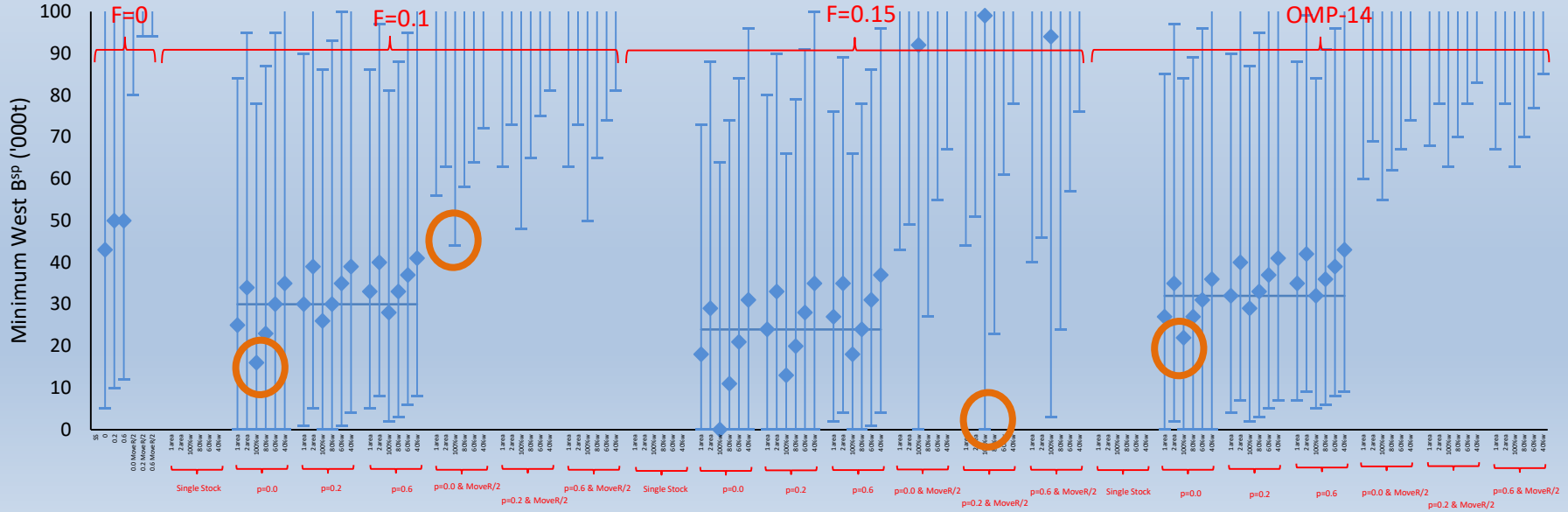

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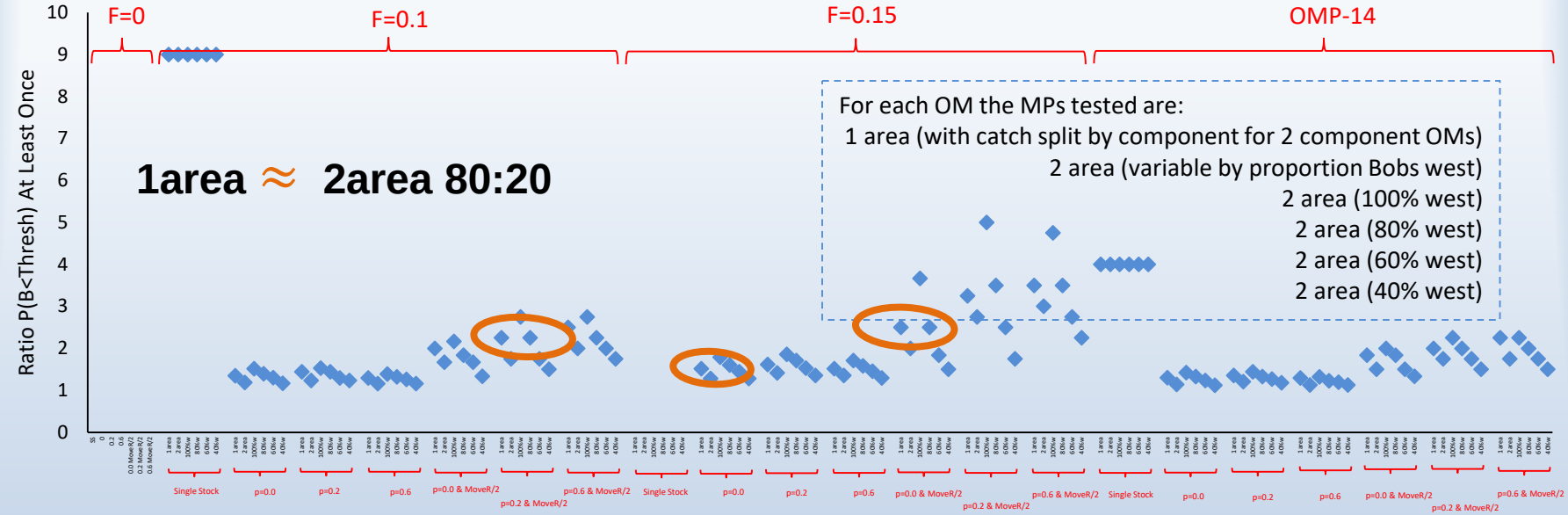

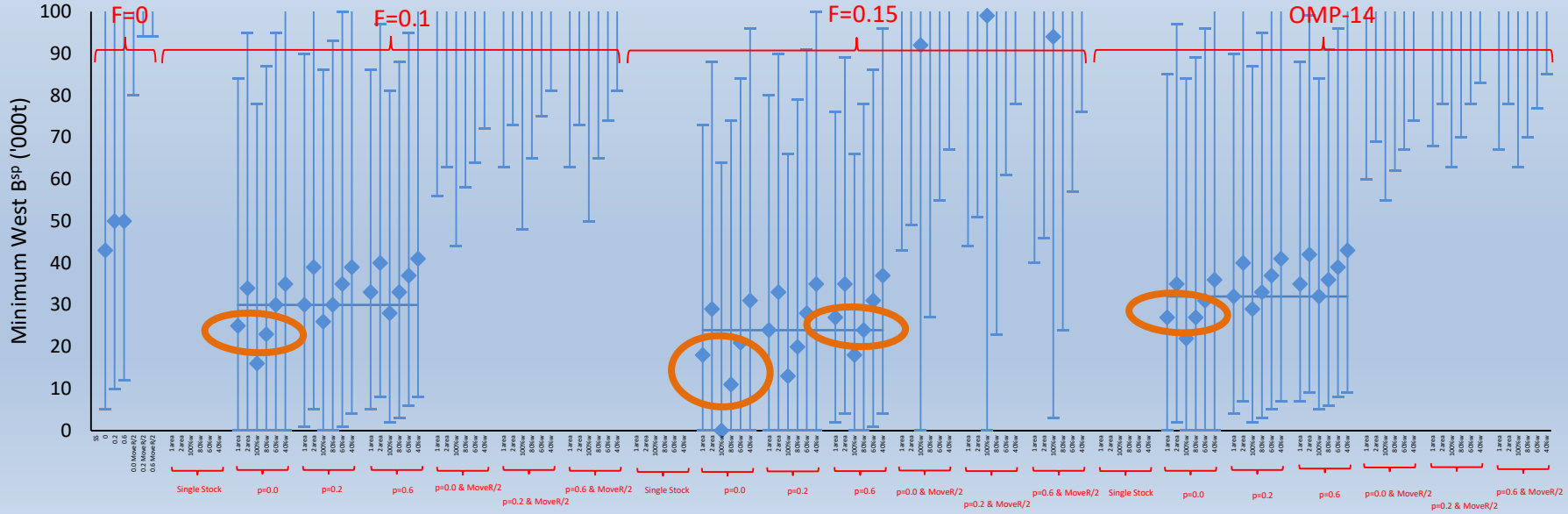

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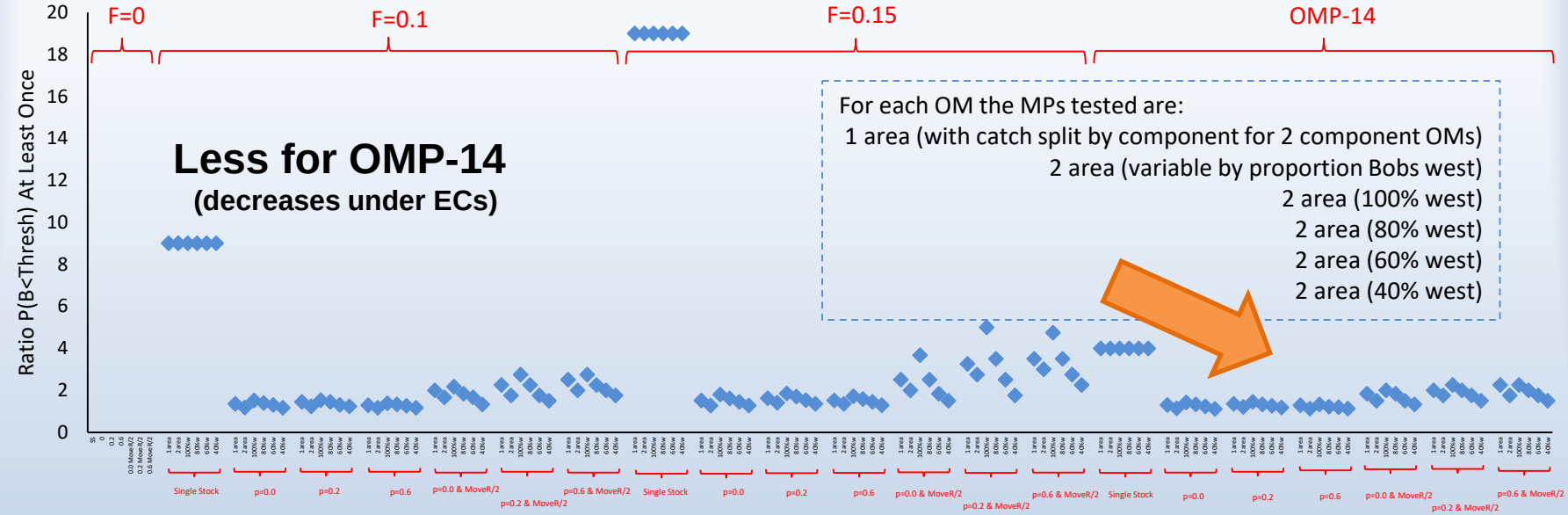
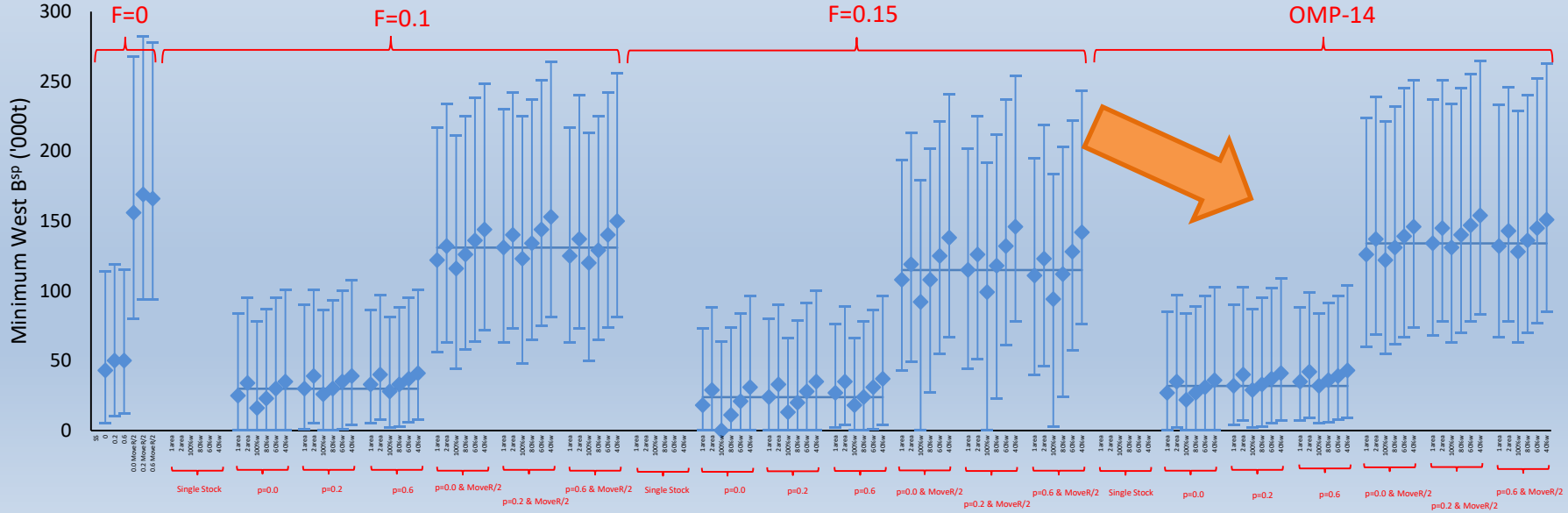
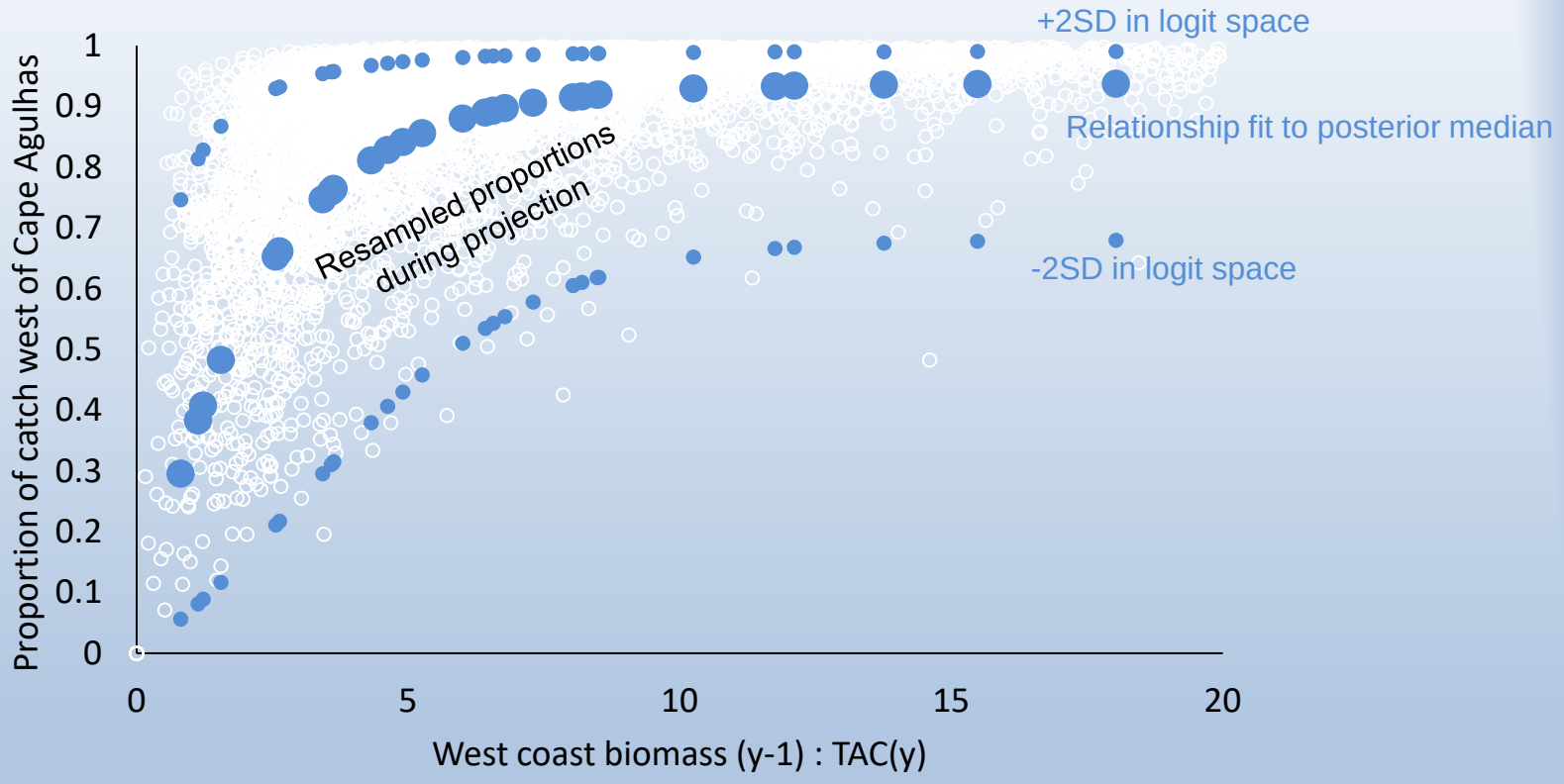




Implicit Spatial Structuring of Catches Given Single Area TAC



General Patterns in Results

In addition:

- median directed total sardine catches F=0.1 ≈ OMP-14; the upper and lower PIs lower under OMP-14
- the median (and range of) directed west coast catches decreases with decreasing fixed proportion of TAC west
- the median west coast catches are similar between the single area and fixed 100:0 two area MPs, but this is dependent on ‘p’
- the median west coast catches under variable two area MP > two area 40:0 (MoveR) or 60:0 (0.5MoveR)
- upper 95%ile of the west coast catch under the variable two area TAC > two area 60:0 MP

General Patterns in Results

In addition:

- AAV in total catches is similar over all cases, except 100:0
- AAV in west coast catches higher under variable two area MP
- Under OMP-14, the AAV in total and west coast catches decreases from a single stock OM to a two component OM, and decreases further ‘p’ increases; the AAV in west coast catches highest for two component OM managed under variable 2-area TAC
- 95%PI of AAV under OMP-14 > F=0.1 or F=0.15 given the OMP allows for greater than 20% inter-annual decreases at upper and lower

General Patterns in Results

- Less west to south movement -> more optimistic results (lower risk, (slightly) higher catches)
- Results similar for p=0.2 and p=0.6, less optimistic for p=0

Is Spatial Management Necessary?

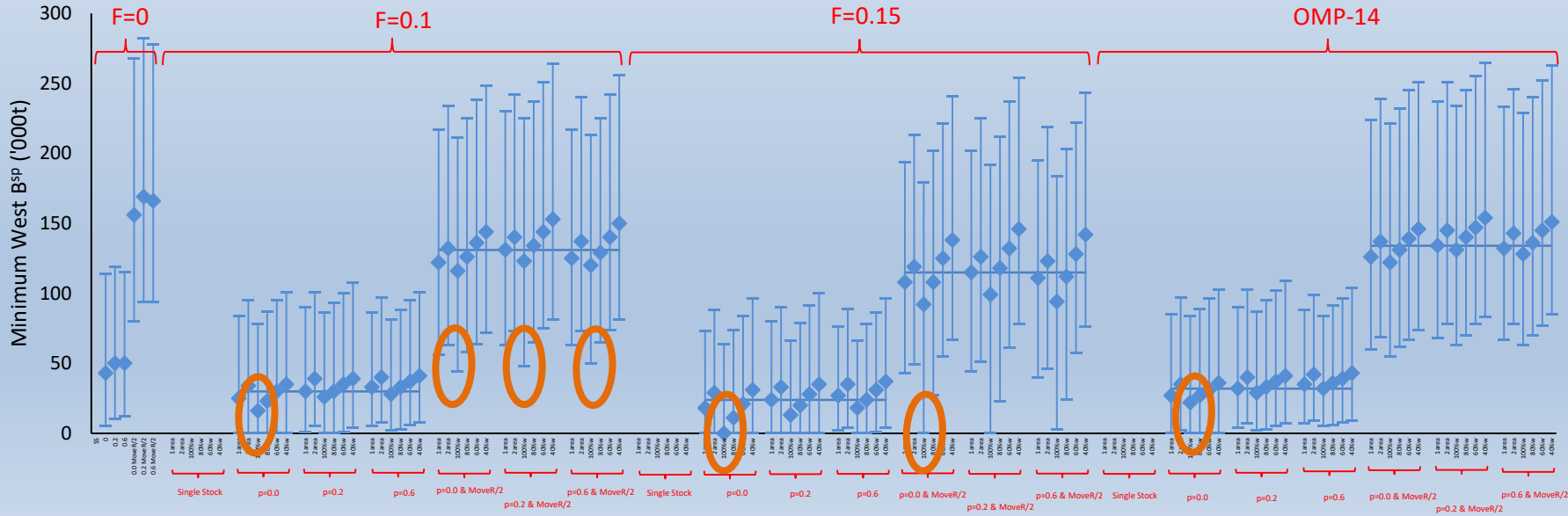
	F=0.10			F=0.15			OMP-14		
	Total	West	South	Total	West	South	Total	West	South
F=0	317[179,459]	50[10,119]	152[79,254]	317[179,459]	50[10,119]	152[79,254]	317[179,459]	50[10,119]	152[79,254]
1area	230[38,362]	30[1,90]	115[33,205]	190[12,320]	24[0,80]	95[9,180]	239[79,384]	32[4,90]	121[50,215]
2area	243[69,376]	39[5,101]	109[42,197]	209[17,335]	33[0,90]	88[12,170]	251[104,394]	40[7,103]	114[53,202]
100%	222[32,359]	26[0,86]	116[31,208]	170[26,311]	13[0,66]	96[26,182]	234[66,380]	29[2,87]	122[49,215]
80%	230[32,366]	30[0,93]	111[31,202]	187[20,317]	20[0,79]	92[20,175]	240[72,386]	33[3,95]	117[50,207]
60%	238[43,374]	35[1,100]	107[32,196]	200[15,330]	28[0,91]	86[13,169]	247[88,394]	37[5,102]	112[49,201]
40%	245[70,381]	39[4,108]	102[35,192]	211[20,337]	35[0,100]	78[11,164]	253[103,396]	41[7,109]	106[45,198]

2 component OM, p=0.2, MoveR

Risk to sardine resource higher than deemed acceptable during OMP-14 development

Is Spatial Management Necessary?

Yes!

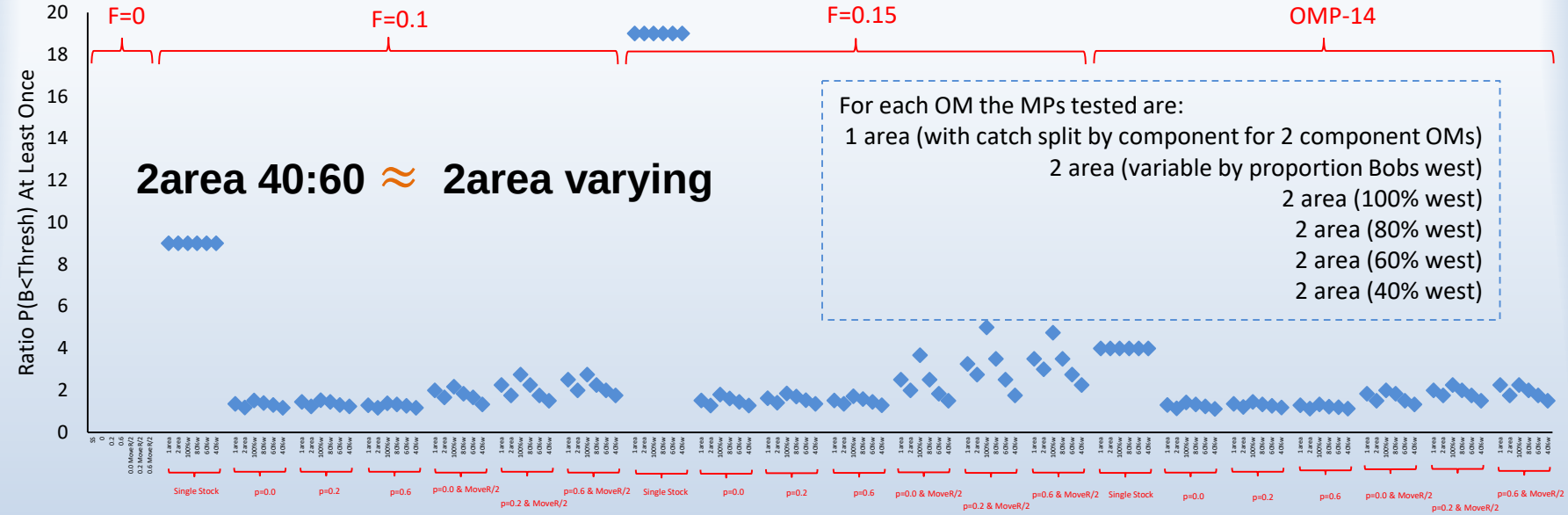


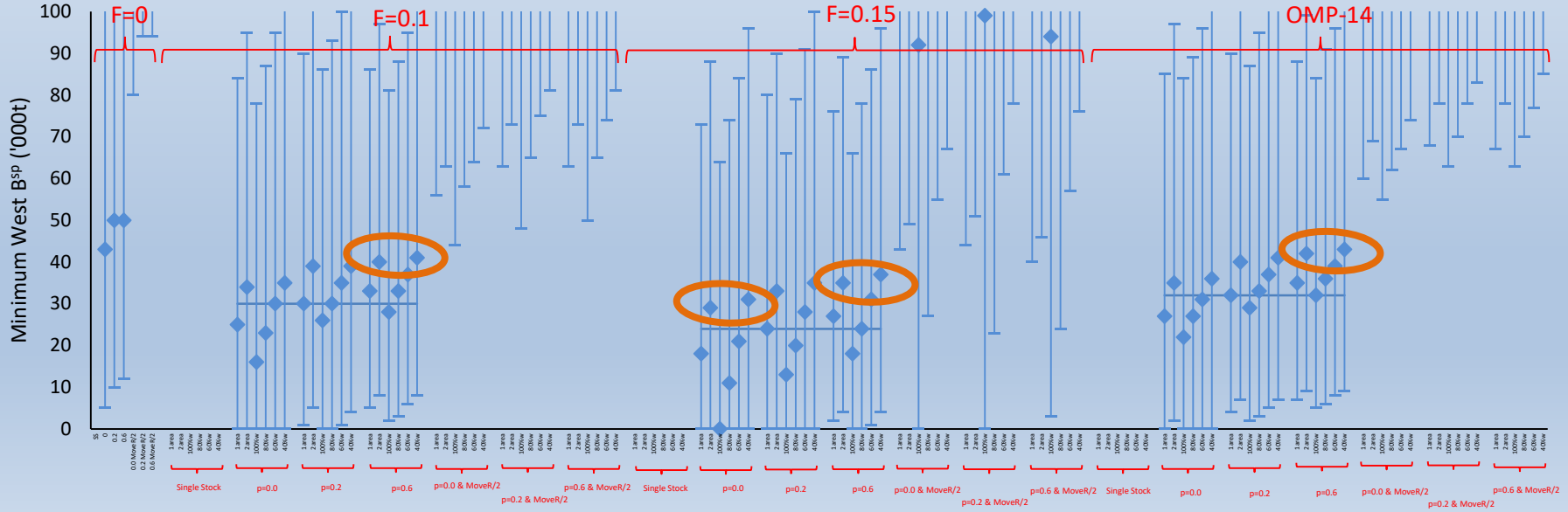
If So, How?

i) Single area with caveats
ii) Two area, varying
iii) Two area, fixed

Sufficient info in the survey data to adequately inform inter-annual changes in TAC proportions

General Patterns in Results





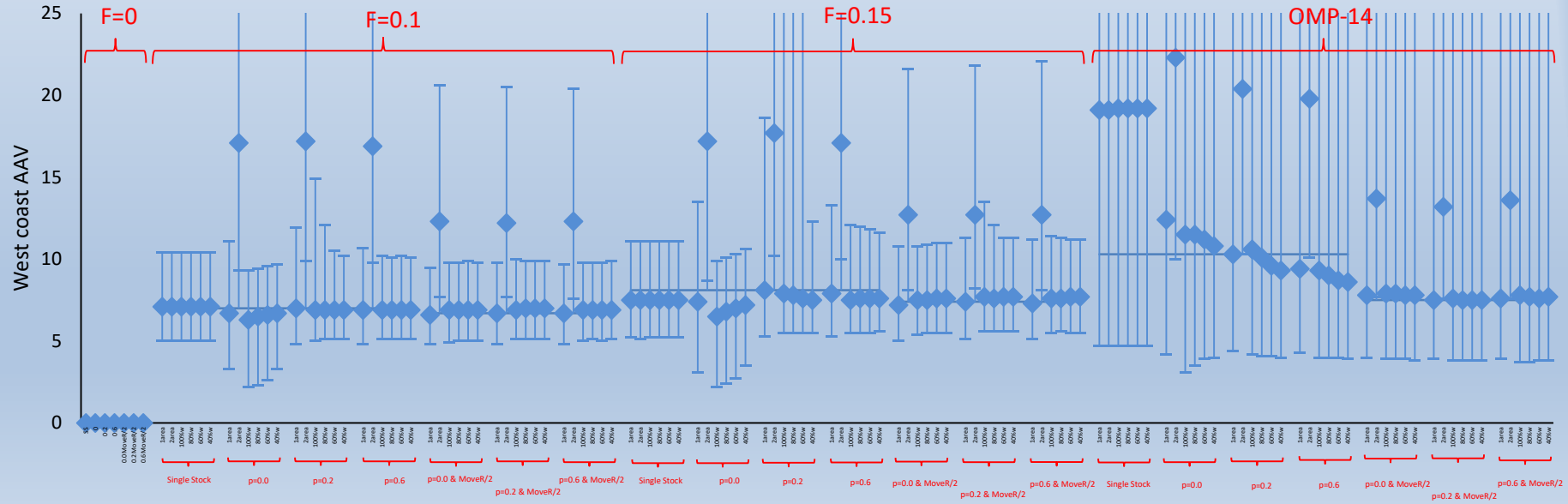
If So, How?

i) Single area with caveats

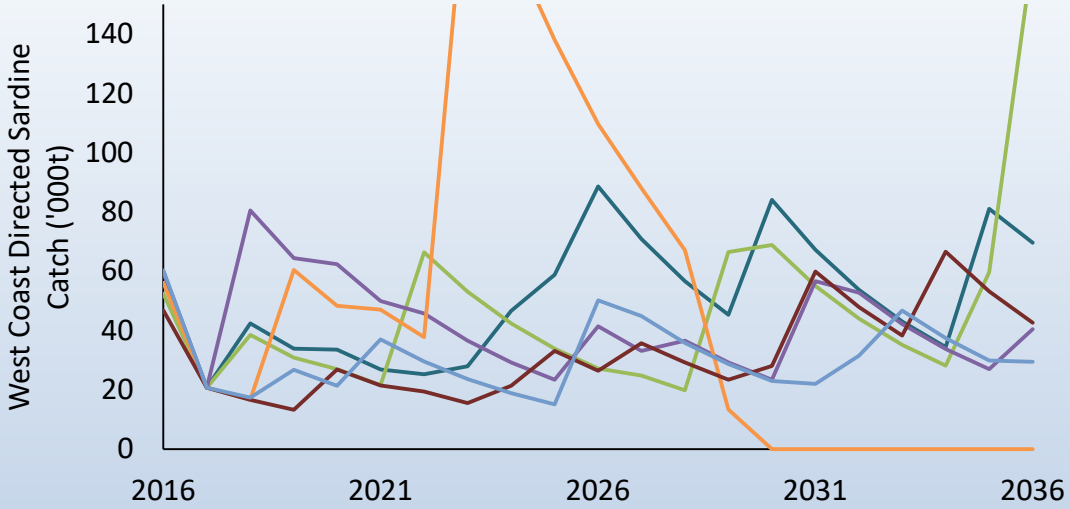
ii) Two area, varying ✖ in current form

iii) Two area, fixed

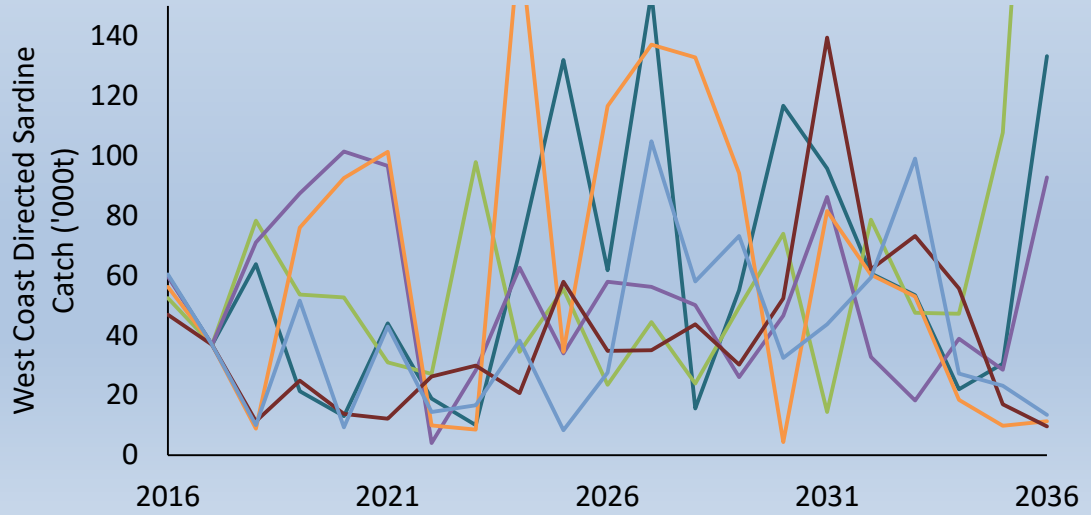
Note AAV is *change* in TAC not just *decrease*



If So, How



40:60 fixed two area TAC



variable two area TAC, using survey p_{west}

If So, How?

i) Single area with caveats

ii) Two area, varying

iii) Two area, fixed ? may require sacrifice in total catches

	F=0	RiskS (F with 20% constraint)			Median total catch ('000t)			Median west catch ('000t)		
		40:60			40:60			40:60		
p = 0	0.43	0.50 (F=0.10)			70			30		
p = 0.2	0.34	0.42 (F=0.10)			83			33		
p = 0.6	0.31	0.36 (F=0.10)			85			34		

If So, How?

i) Single area with caveats

ii) Two area, varying

iii) Two area, fixed ? may require sacrifice in total catches

	F=0	RiskS (F with 20% constraint)			Median total catch ('000t)			Median west catch ('000t)		
		40:60	60:40	80:20	40:60			40:60		
p = 0	0.43	0.50 (F=0.10)	0.49-0.51 (F=0.06-0.07)	0.49-0.51 (F=0.04-0.05)	70			30		
p = 0.2	0.34	0.42 (F=0.10)	0.42 (F=0.08)	0.42 (F=0.06)	83			33		
p = 0.6	0.31	0.36 (F=0.10)	0.36 (F=0.07)	0.35-0.37 (F=0.05-0.06)	85			34		

If So, How?

i) Single area with caveats

ii) Two area, varying

iii) Two area, fixed ? may require sacrifice in total catches

	F=0	RiskS (F with 20% constraint)			Median total catch ('000t)			Median west catch ('000t)		
		40:60	60:40	80:20	40:60	60:40	80:20	40:60	60:40	80:20
p = 0	0.43	0.50 (F=0.10)	0.49-0.51 (F=0.06-0.07)	0.49-0.51 (F=0.04-0.05)	70	49 - 53	35 - 42	30	30 - 31	28 - 33
p = 0.2	0.34	0.42 (F=0.10)	0.42 (F=0.08)	0.42 (F=0.06)	83	67	52	33	40	42
p = 0.6	0.31	0.36 (F=0.10)	0.36 (F=0.07)	0.35-0.37 (F=0.05-0.06)	85	61	47 - 52	34	36	38 - 42

If So, How?

i) Single area with caveats

ii) Two area, varying

iii) Two area, fixed ? may require sacrifice in total catches

OMP-14	F=0	$\beta = 0.0869$		
		40:60	60:40	80:20
p = 0	0.43	0.48		
p = 0.2	0.34	0.40		
p = 0.6	0.31	0.35		

If So, How?

i) Single area with caveats

ii) Two area, varying

iii) Two area, fixed ? may require sacrifice in total catches

OMP-14	F=0	$\beta = 0.0869$	$\beta = 0$	$\beta = 0$
		40:60	60:40	80:20
p = 0	0.43	0.48	0.514	0.551
p = 0.2	0.34	0.40	0.419	0.443
p = 0.6	0.31	0.35	0.360	0.377

If So, How?

Alternative variable two area TACs (with lower west coast AAV?):

- 0.6<proportion<0.8 dependent on survey p_{west}
- proportion dependent on avg survey p_{west}
- spatial restrictions only applying when avg B_{west}^{obs} < threshold
- spatial restrictions only applying when avg catch p_{west} > threshold

No guarantee any of these will be satisfactory – still to be simulation tested

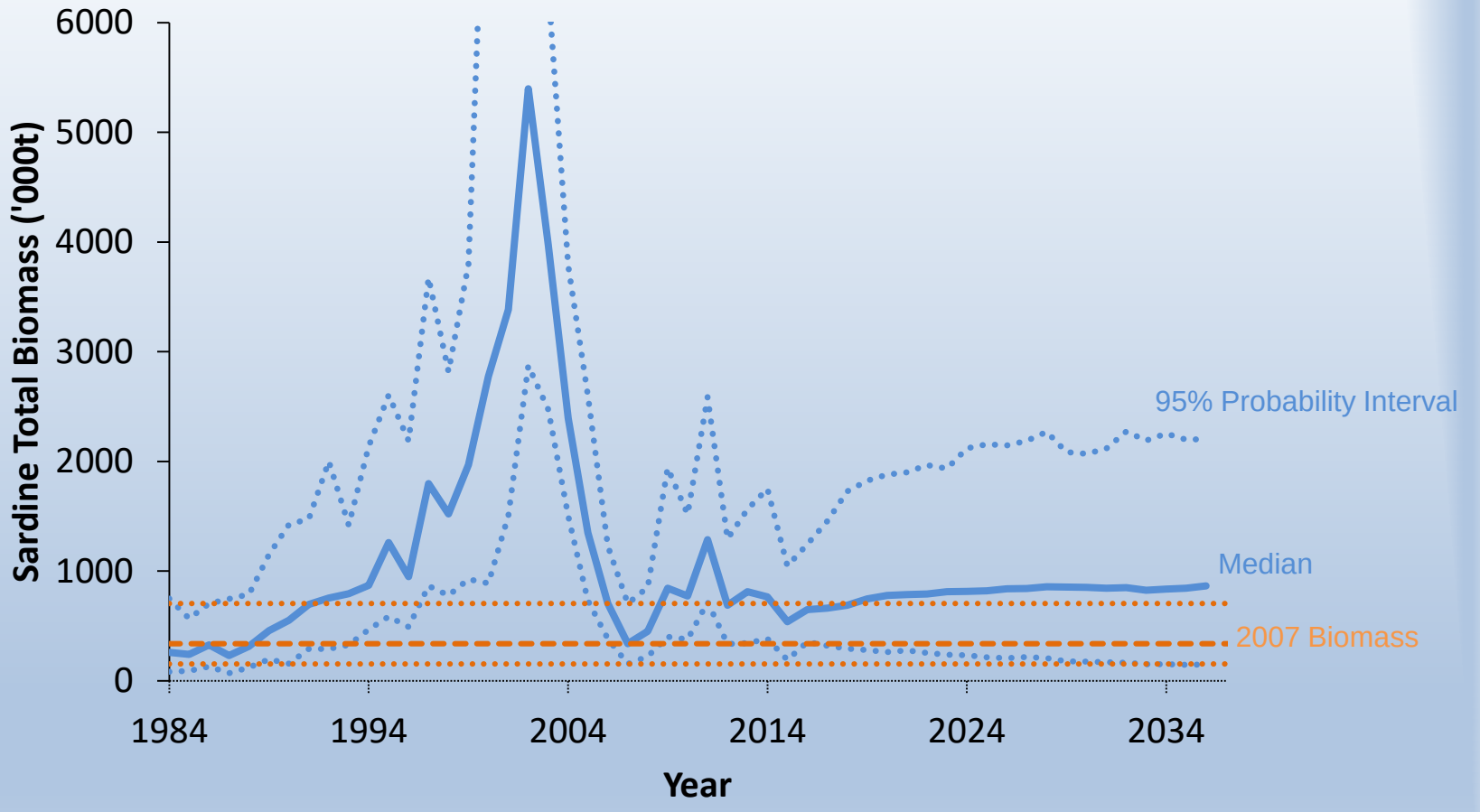
If So, How?

Alternative single area TACs:

- spatial restrictions applying when avg B_{west}^{obs} < threshold
- spatial restrictions applying when avg catch p_{west} > threshold

No guarantee any of these will be satisfactory – still to be simulation tested

Sardine Risk (Single Stock OM)



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Thank you for your attention

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