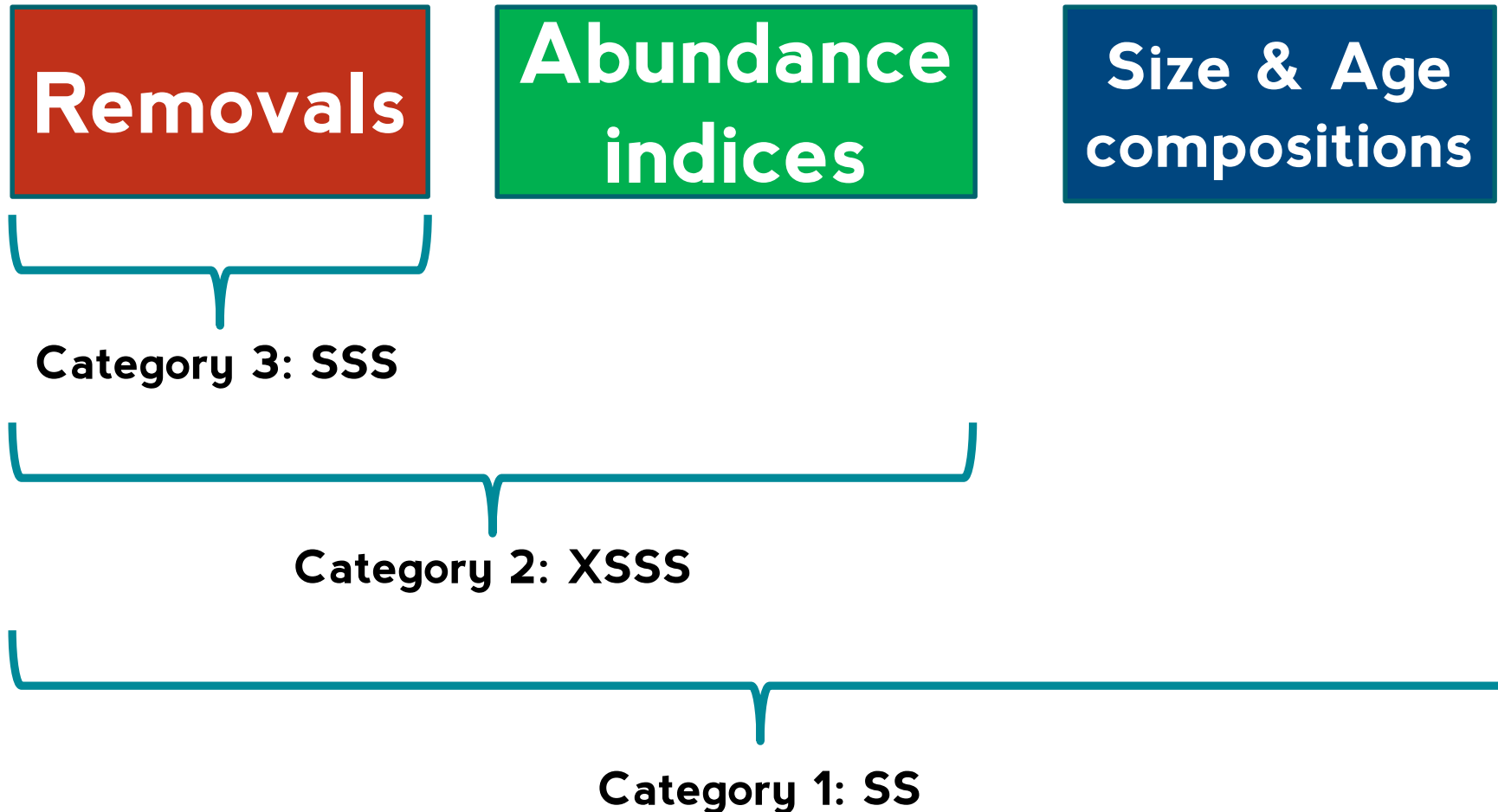


**DLM Methods:**  
**Age-structured modelling and Simple  
Stock Synthesis (SSS)**

# Stock Synthesis as modelling framework

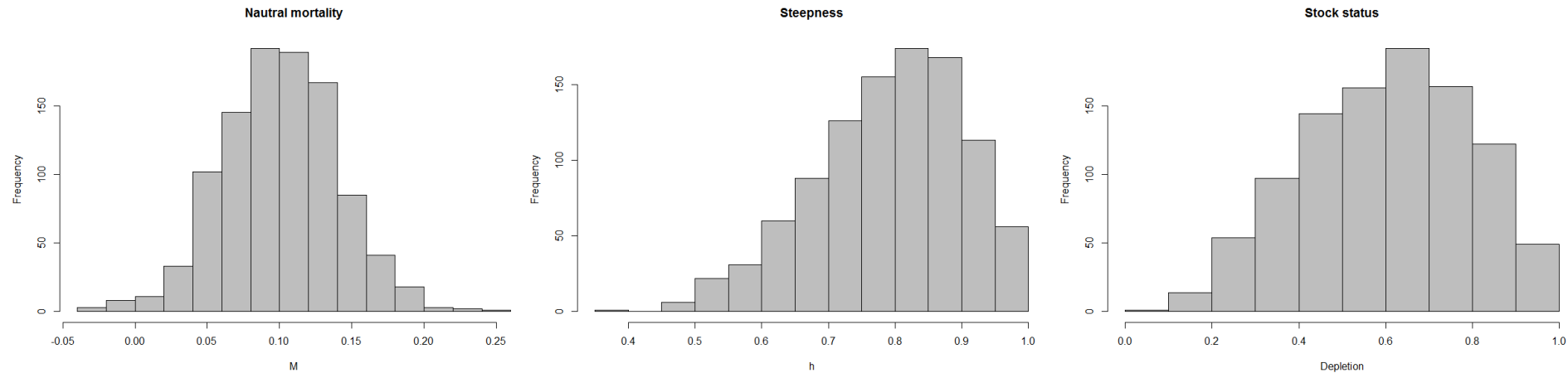
- Modelling framework used for west coast groundfish stock assessments
- Flexible (application to 60+ worldwide stocks)
- Typically used for data-rich, but recent extensions in data-limited conditions:
  - Catch-only (Simple Stock Synthesis (SSS); cat. 3): Cope *2013*
  - Catch & index (extended Simple Stock Synthesis (XSSS); cat. 2): Cope et al. 2015; Wetzel and Punt 2015

# Scaling up with data



# Simple Stock Synthesis (SSS)

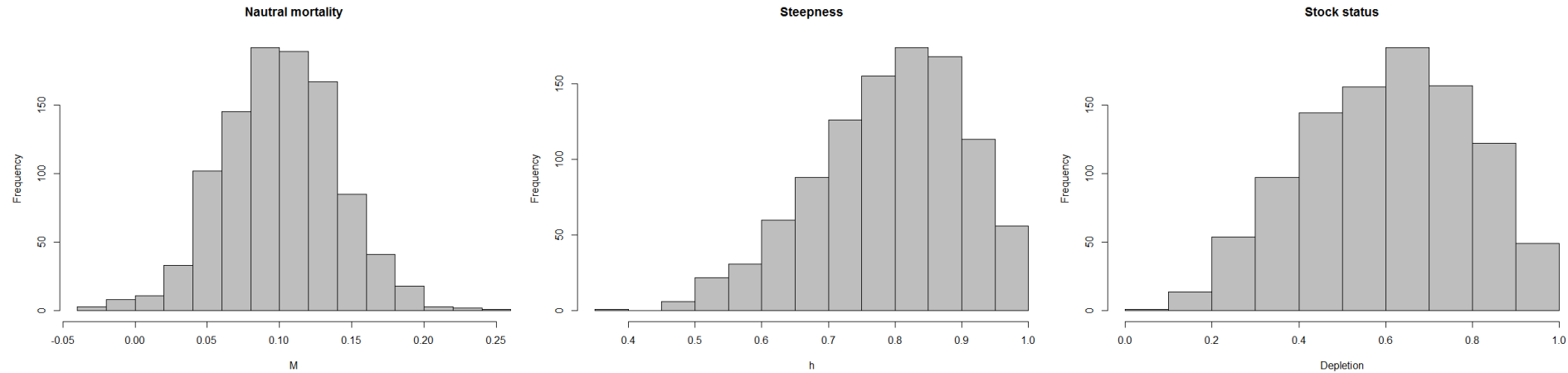
- Requires catches, VBGF, W-Lt, maturity
- Priors defined for  $M$ ,  $h$ , and stock status



- Priors are randomly sampled then model fit to catches
- Provides estimate of sustainable catches

# Extended Simple Stock Synthesis (SSS)

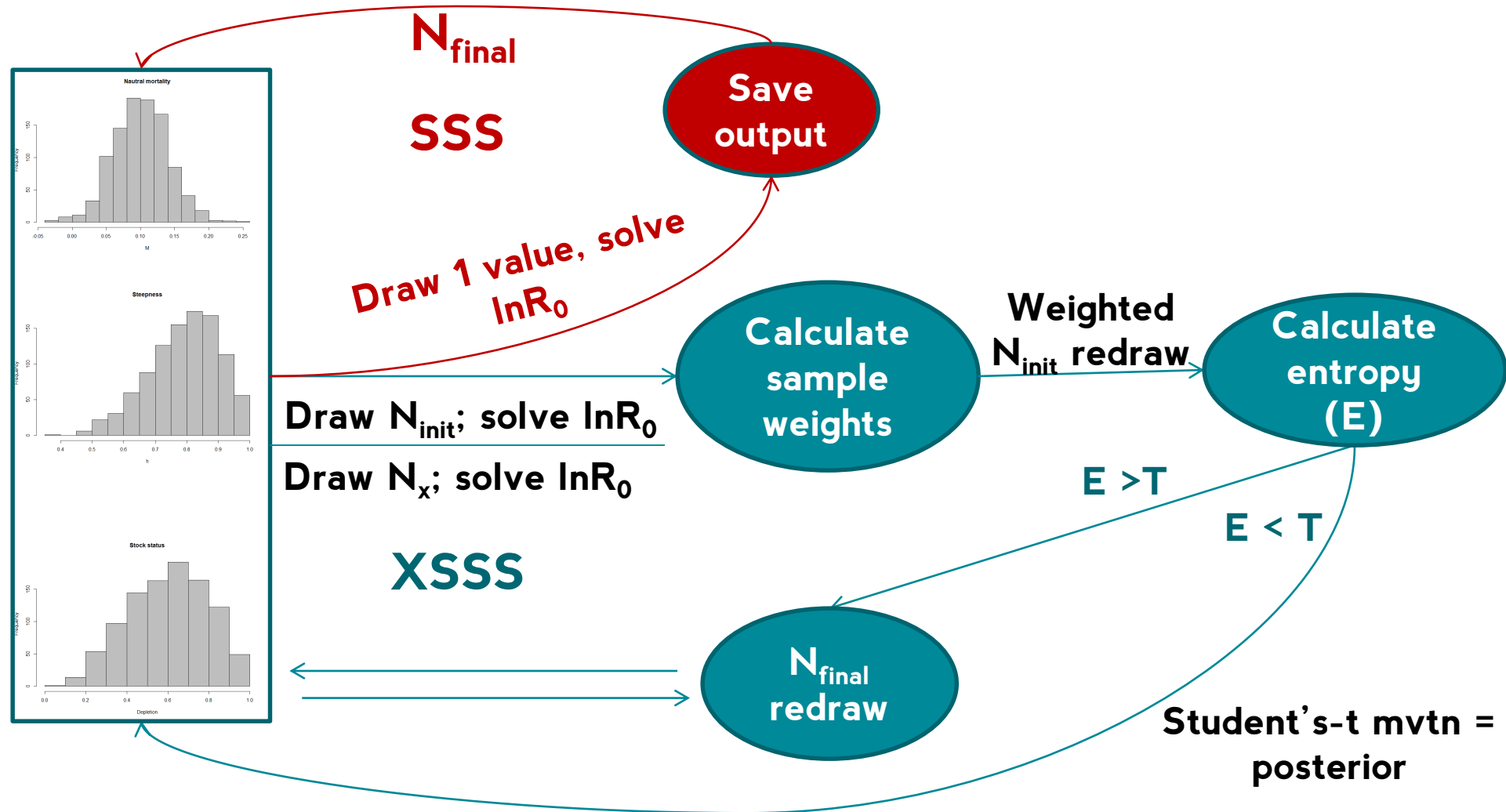
- Priors defined for  $M$ ,  $h$ , and depletion



- Set-up SS files with catches and indices (XSSS)
- Solve for  $\ln R_0$  and extra SD on indices (XSSS)

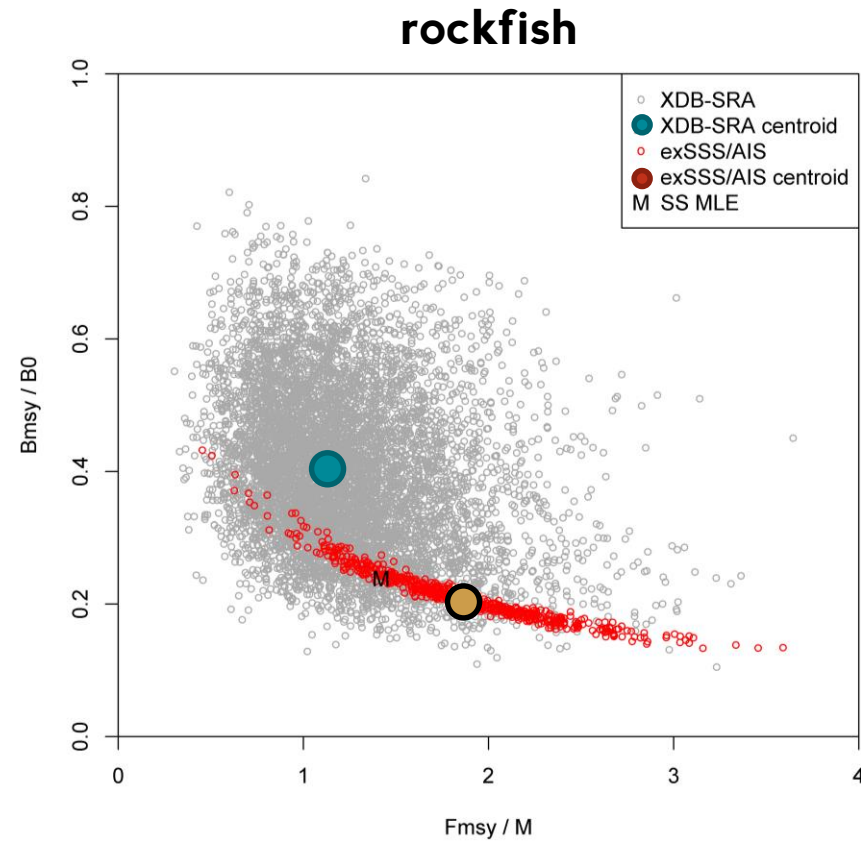
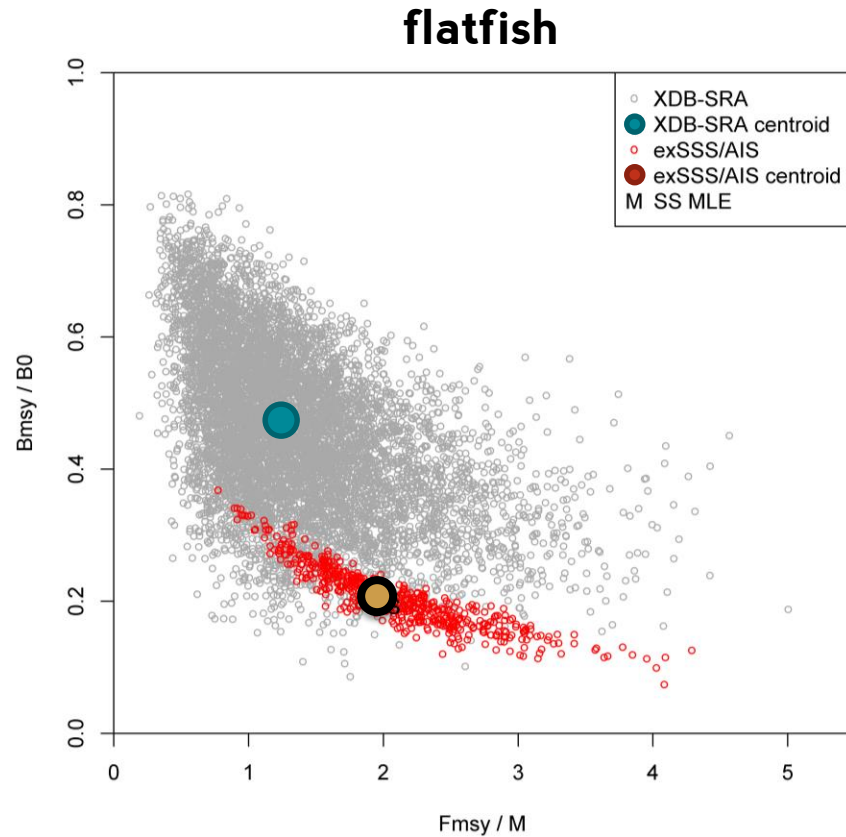
# Methods: SSS and XSSS protocol: estimation

- Priors defined for  $M$ ,  $h$ , and depletion



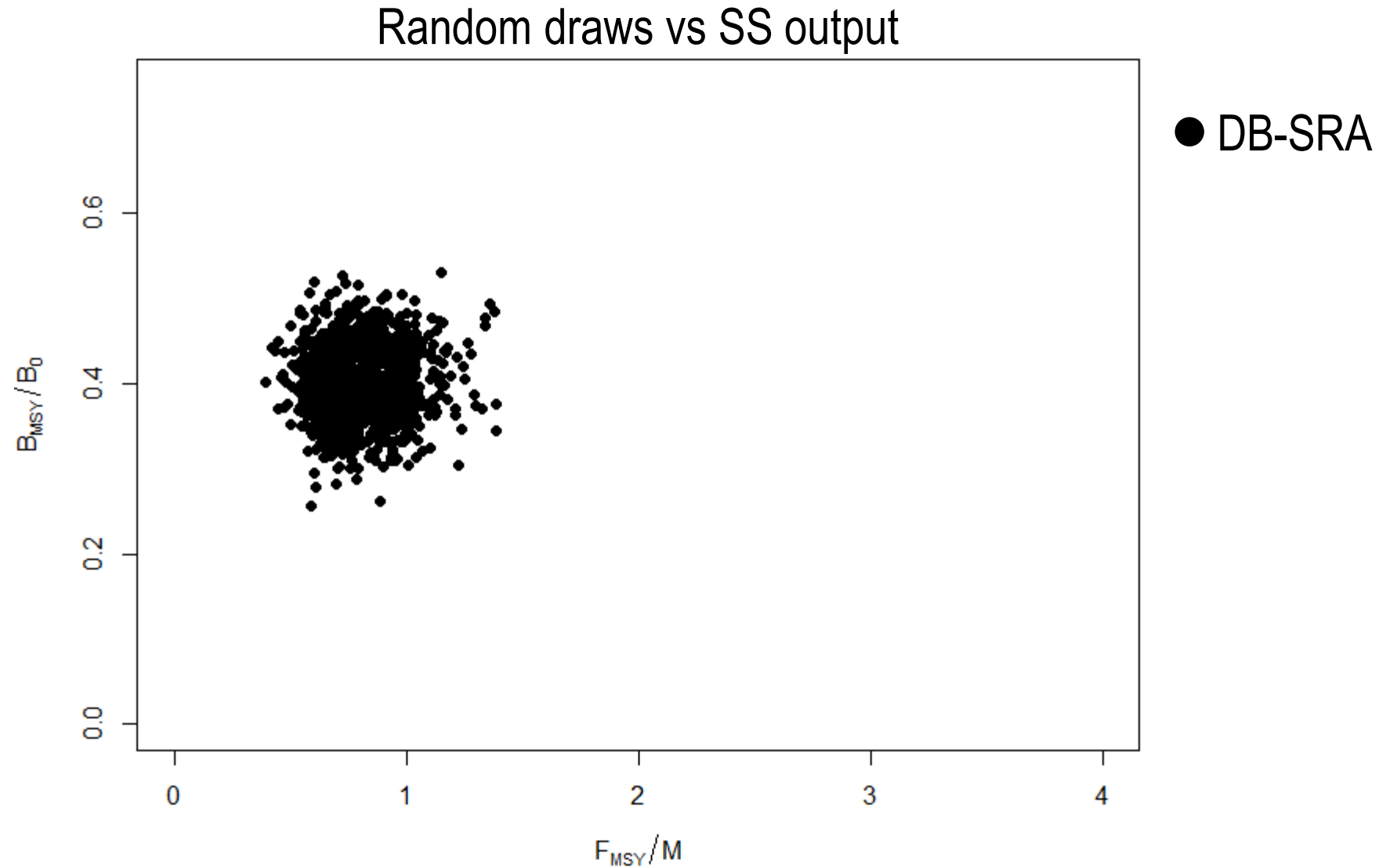
**Demo: SSS**

# Comparing parameterization: productivity

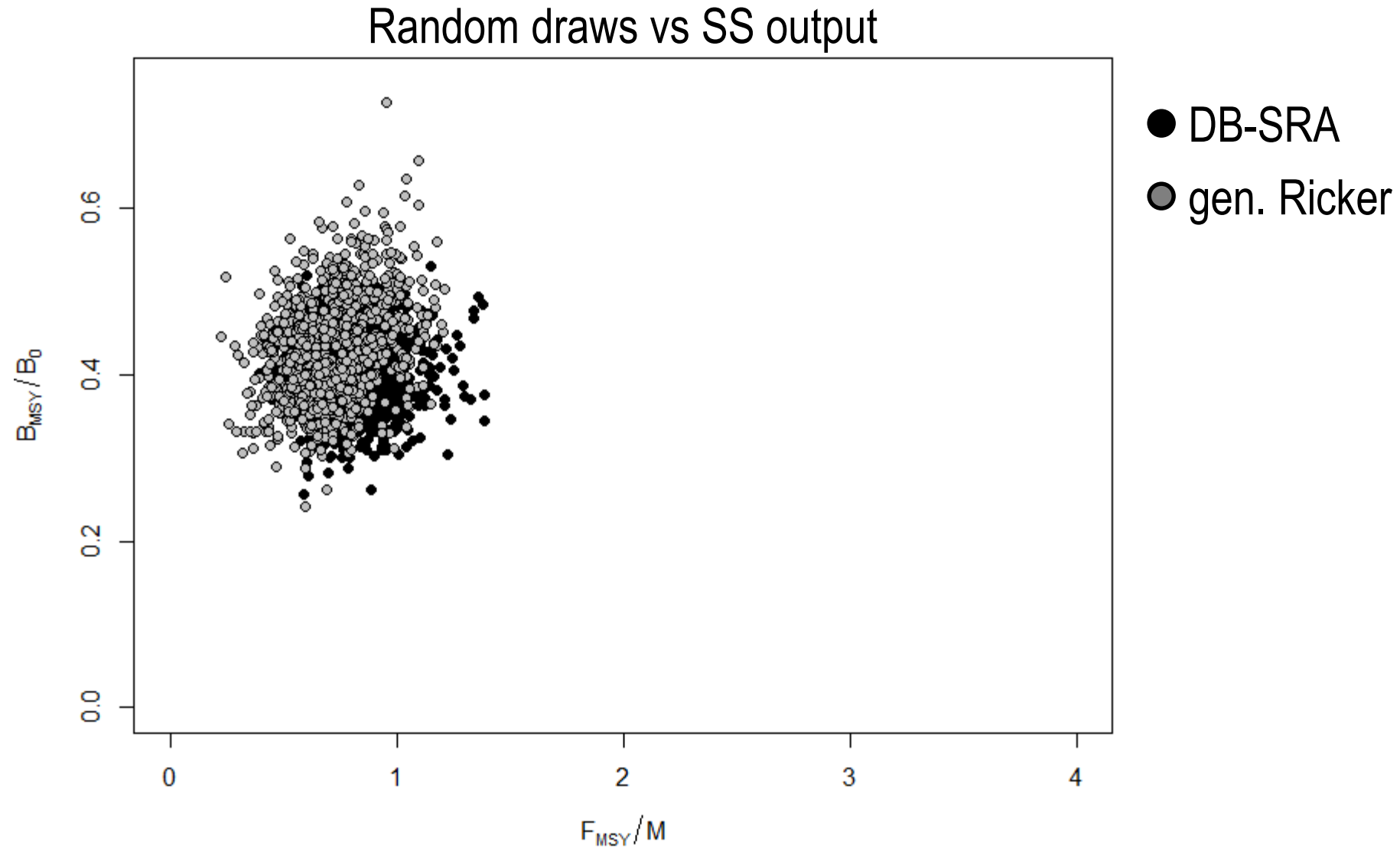




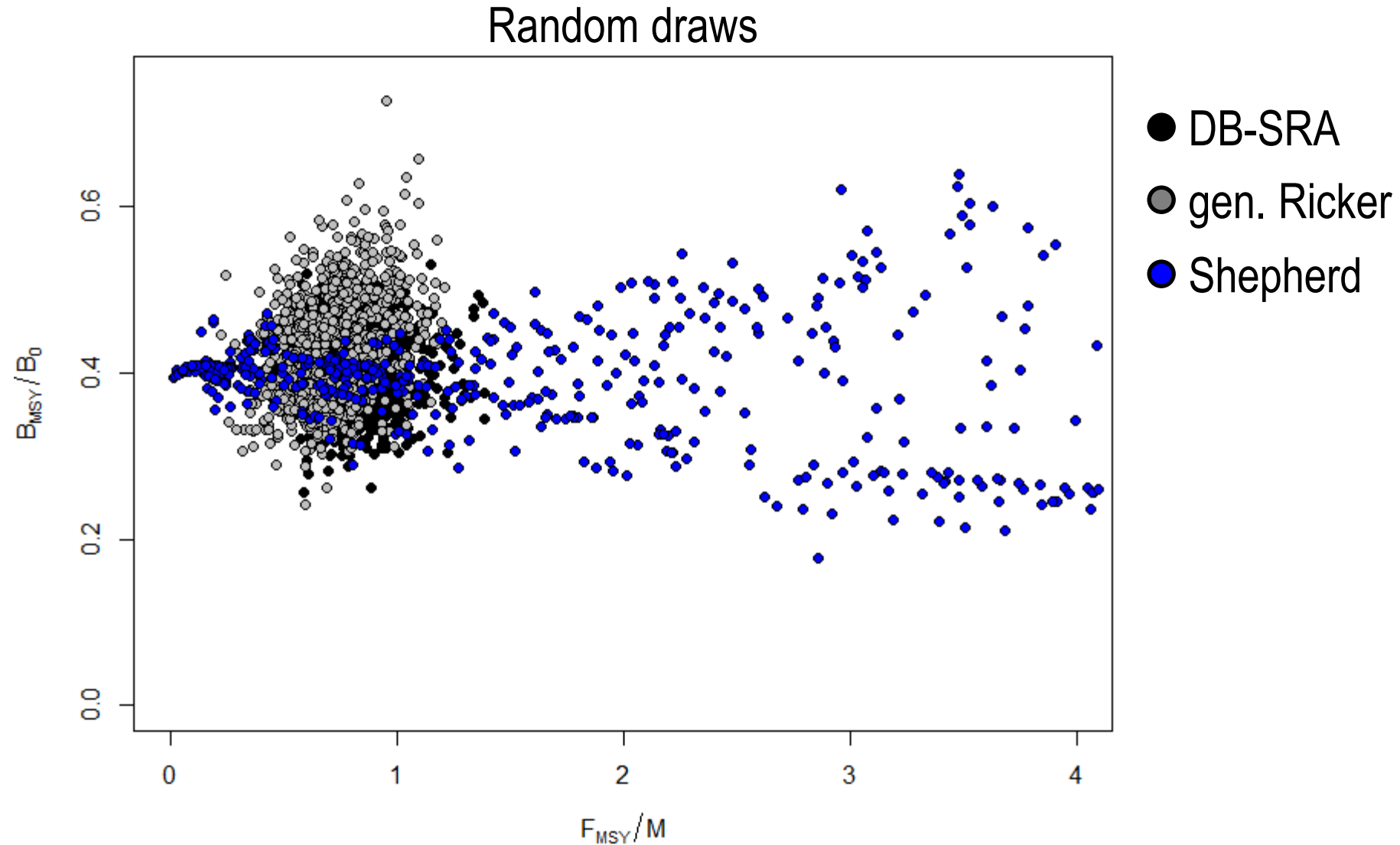
# Sampling space: DB-SRA vs SSS models



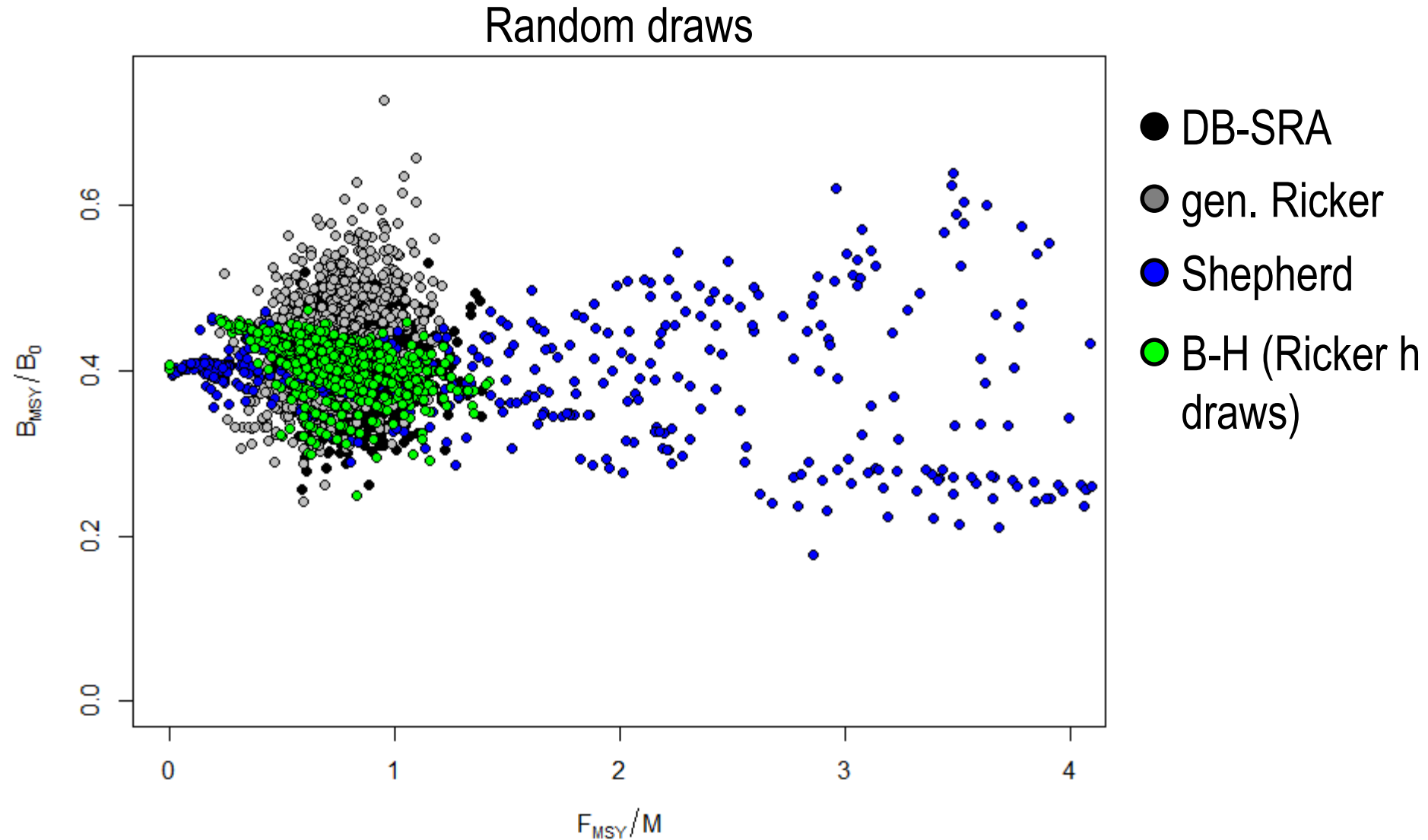
# Sampling space: DB-SRA vs SSS models



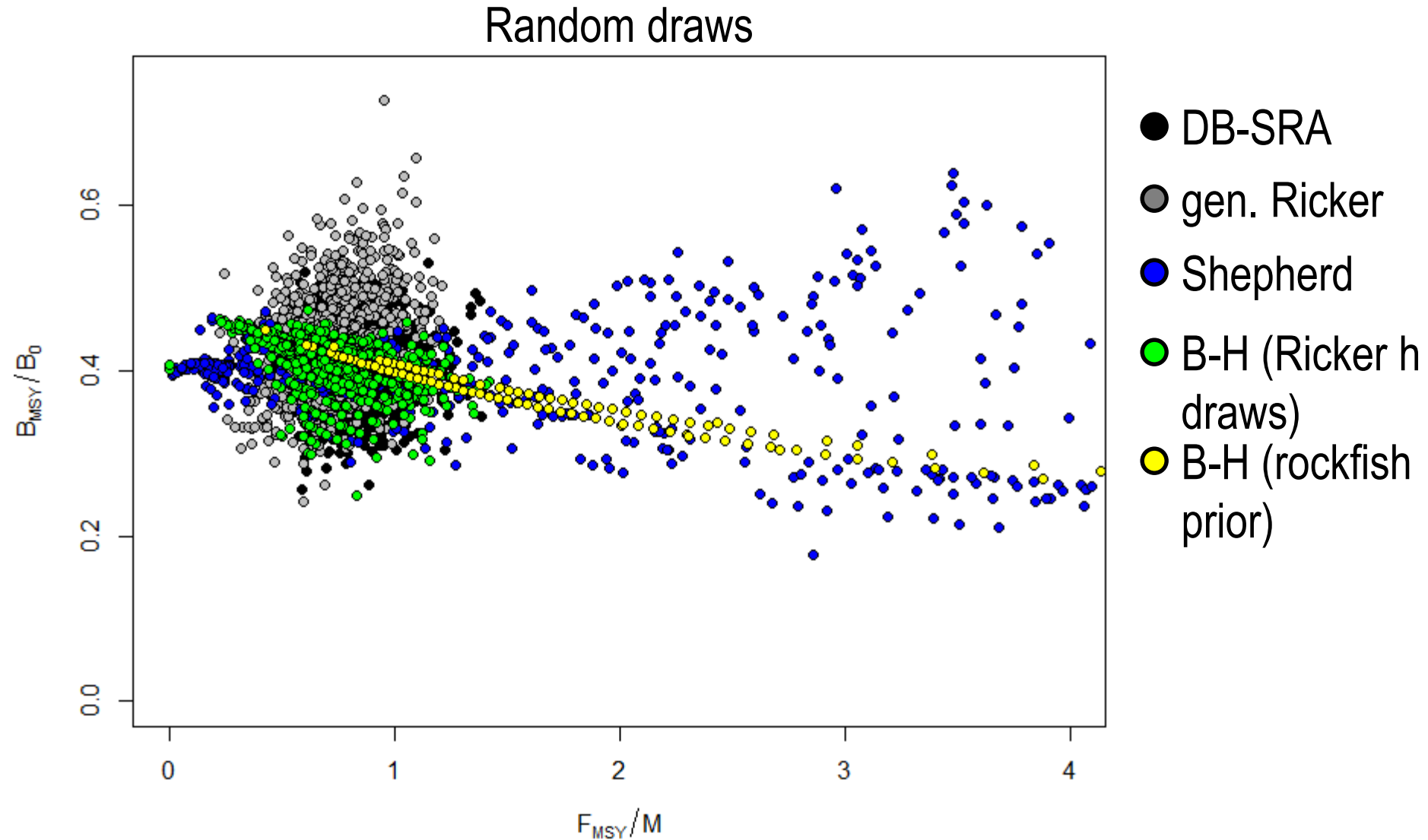
# Sampling space: DB-SRA vs SSS models



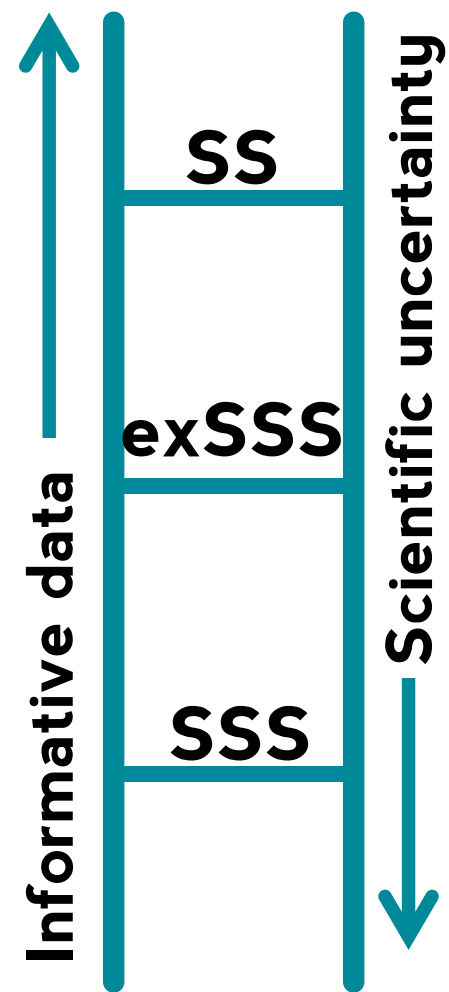
# Sampling space: DB-SRA vs SSS models



# Sampling space: DB-SRA vs SSS models



# SS as a scalable modelling framework



Stock category	Default OFL uncertainty	Affiliated assessment type	Data types
1	$\sigma=0.36$	Statistical Catch at Age	Catch, detailed life history, indices, <b>length/age comps.</b>
2	$\sigma=0.72$	Index-based methods	Catch, basic life history, <b>abundance indices</b>
3	$\sigma=1.44$	Catch-only	<b>Catch</b> , basic life history

# Using a common framework

## Stock status prior?

		Y	N		
Index?	Y	NA	SS	Y	comps?
		XSSS	SRA	N	
	N	NA	CC-SRA	Y	
		SSS	Borel's Paradox	N	

**SSS: Simple Stock Synthesis**

**CC-SRA: Catch curve stock reduction analysis**

**XSSS: Extended Stock Synthesis**

**SRA: Stock reduction analysis**

**SS: Stock Synthesis (normal application)**

# Summary: Integrated platforms

- Common modelling framework that includes data-limited to data-rich
- Avoids the jump from platform to platform when adding new data
- Inherit the structure and parameterization of the integrated platform