



# Avaliação de stocks pesqueiros utilizando metodologias baseadas em comprimentos

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# Como avaliar o estado de exploração de um stock pesqueiro?



Dados por muitas vezes não disponíveis ou inexistentes (**Data-Limited**)

## Modelos baseados em comprimentos<sup>2</sup>

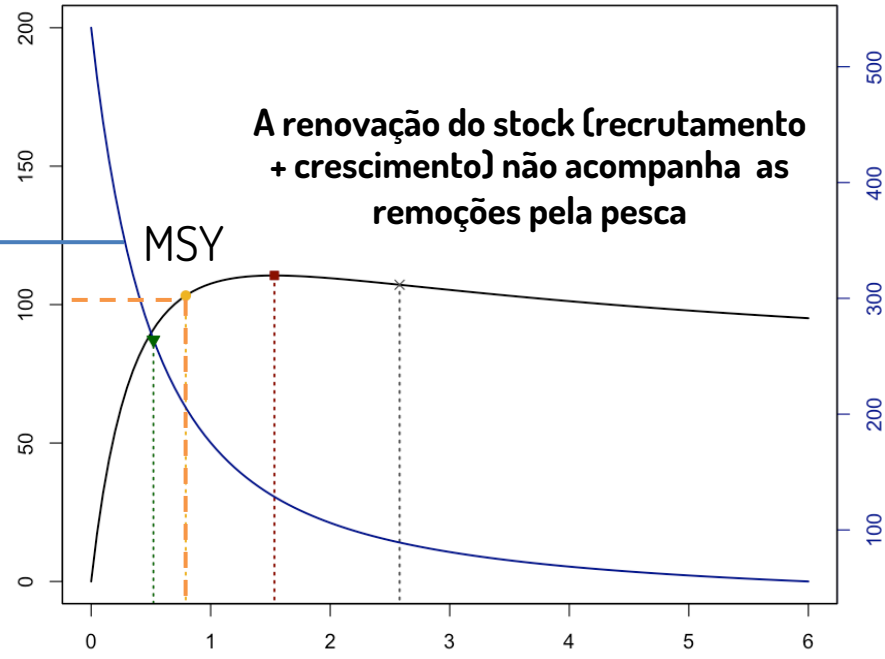


<sup>1</sup>Hilborn and Walters (1992); <sup>2</sup>Mildenberger et al. (2017)

# Como avaliar o estado de exploração de um stock pesqueiro?



Ganho de rendimento com o esforço



O caso do YPR

Fishing mortality



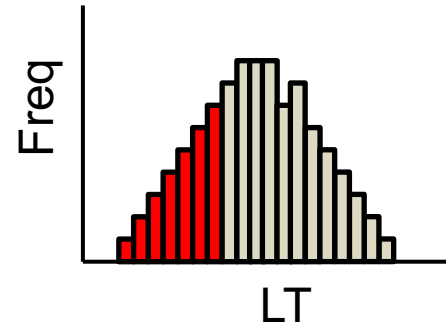
# Como avaliar o estado de exploração de um stock pesqueiro?

## Modelos baseados em comprimentos

### Dados

Métodos baseados na estrutura das composições de capturas

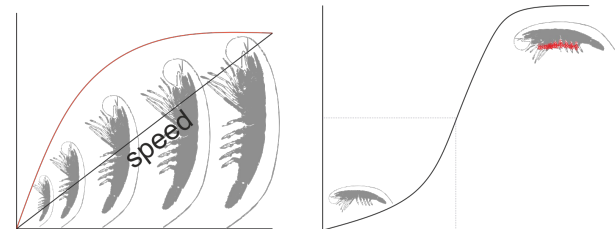
- Composições de comprimento
- Frequências de comprimento



### Parâmetros

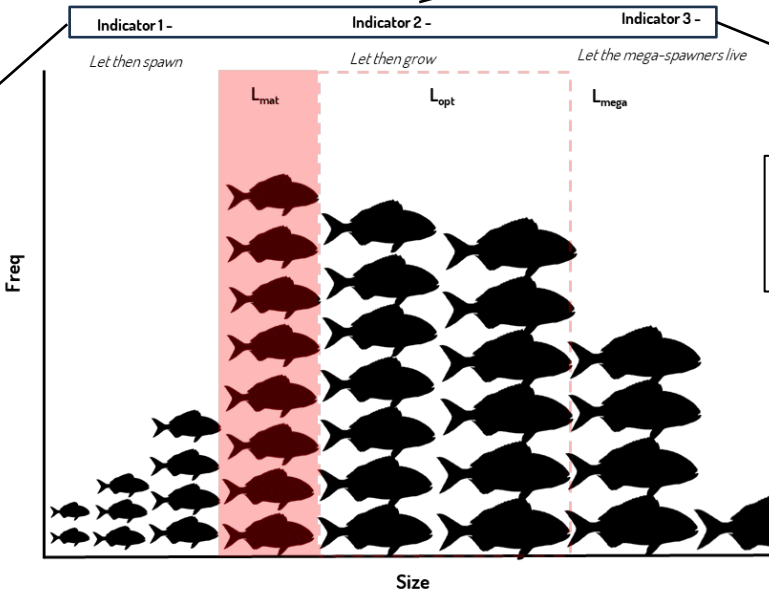
População e seletividade

- Comprimento máximo assintótico e L50
- Comprimento de primeira captura
- Mortalidade



# Length-Based Indicators (LBI)<sup>1</sup>

Porcentagem dos indivíduos capturados com o **COMPRIMENTO OPTIMO**. O alvo é que as capturas sejam compostas por peixes no comprimento ótimo.



Porcentagem dos **GRANDES** indivíduos nas capturas, isto é, peixes maiores que o tamanho ótimo de captura + **10%**.

Porcentagem de indivíduos **MATUROS** nas capturas. O alvo é **let all (100%)** dos peixes desovarem ao menos uma vez, antes de serem capturados, para reconstruir a **biomassa desovante do stock**.

<sup>1</sup>Froese (2004)

# Length-Based Spawning Ratio (LBSPR)<sup>1</sup>

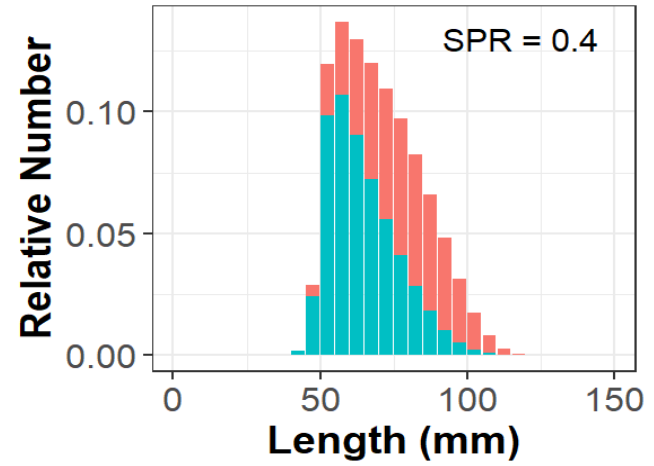
**Utilizado como um ponto de referência biológico**

## Spawning Potential Ratio (SPR)

“Proporção de potencial de desova não pescado em qualquer nível de pressão de pesca”

$$SPR = \frac{\text{SSBR pescado}}{\text{SSBR não pescado}}$$

Catch ■ Fished ■ Unfished



# Length-Based Spawning Ratio (LBSPR)<sup>1</sup>

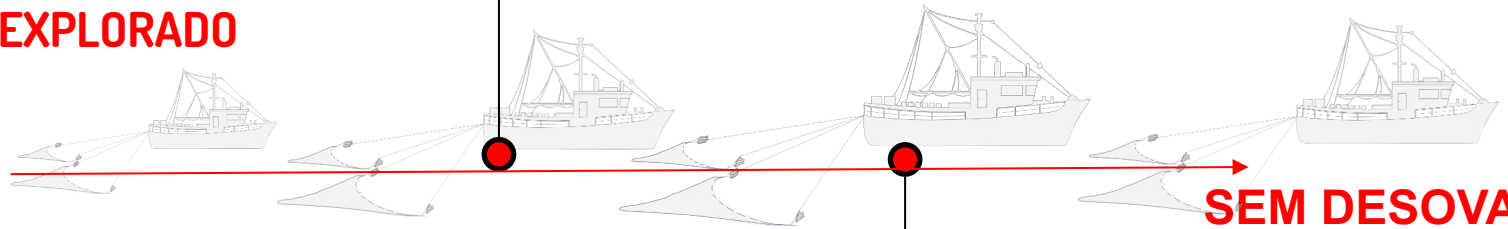
Spawning Potential Ratio (SPR)

Proxy de conservação ao nível do MSY

SPR= 0.3 (30%) FAO (2002)

**STOCK NÃO EXPLORADO**

SPR= 1 (100%)



**SEM DESOVA**

Todas as fêmeas maduras foram pescadas

SPR= 0.2 (20%)

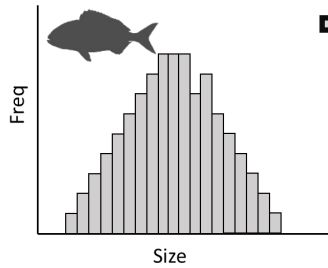
Proxy que indica a sobrepesca de recrutamento

<sup>1</sup>Hordryk et al (2015)

# Framework

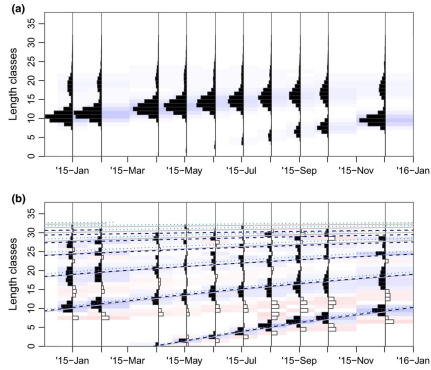
## Aquisição dos dados

DCF data (1990-2022) por *métier*



## Seleção dos parâmetros de história de vida :

ELEFAN\_GA



## Modelos utilizados



Input



Assumption

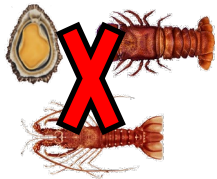
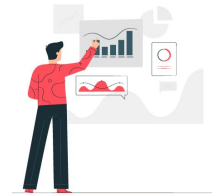


Output

Input	Assumption	Output
<b>LBI</b> <ul style="list-style-type: none"> <li>Length-frequency data</li> <li>Asymptotic length (<math>L_{\infty}</math>)</li> <li>Mk</li> <li>Length-weight relationship (<math>a</math> and <math>b</math>)</li> <li>Length-at-maturity (<math>L_{mat}</math>)</li> </ul>	<ul style="list-style-type: none"> <li>Stock in equilibrium</li> <li>Selectivity follows a logistic curve</li> <li>A length-based proxy for MSY is <math>LF = M = 0.75L_{\infty} + 0.25L_{mat}</math> and the length of optimal yield is <math>L_{opt} = 2/3L_{\infty}</math></li> </ul>	<ul style="list-style-type: none"> <li><math>L_{opt}/L_{mat}</math></li> <li><math>L_{95\%}/L_{mat}</math></li> <li><math>L_{mat}/L_{\infty}</math></li> <li><math>P_{msy}</math></li> <li><math>L_{msy}/L_{opt}</math></li> <li><math>L_{msy}/LF = M</math></li> </ul>
<b>LBSPR</b> <ul style="list-style-type: none"> <li>Length-frequency data</li> <li>Asymptotic length (<math>L_{\infty}</math>)</li> <li>Mk</li> <li>Length-weight relationship (<math>a</math> and <math>b</math>)</li> <li>Length-at-maturity (<math>L_{mat}</math>)</li> <li><math>L_{95\%}</math></li> </ul>	<ul style="list-style-type: none"> <li>Stock in equilibrium</li> <li>M and growth rates are constant</li> <li>Selectivity and maturity follow a logistic curve</li> <li>Sexes have the same growth curve</li> <li>Sex ratio is equal</li> <li>Lengths at each age are normally distributed around a mean length-at-age value</li> </ul>	<ul style="list-style-type: none"> <li>F/M ratio</li> <li>Length at 50% selectivity (<math>L_{50\%}</math>)</li> <li>Length at 95% selectivity (<math>L_{95\%}</math>)</li> <li>SPR</li> </ul>
<b>LBB</b> <ul style="list-style-type: none"> <li>Length-frequency data</li> <li>Asymptotic length (<math>L_{\infty}</math>)</li> <li>Mk</li> <li>Length at first capture (<math>L_c</math>)</li> <li>Length-at-maturity (<math>L_{mat}</math>)</li> </ul>	<ul style="list-style-type: none"> <li>Growth, mortality and recruitment are constant</li> <li>Selectivity follows a logistic curve</li> </ul>	<ul style="list-style-type: none"> <li><math>L_{mat}/L_{opt}</math></li> <li><math>L_c/L_{opt}</math></li> <li>F/M ratio</li> <li><math>B/B_0</math></li> <li><math>B/B_{MSY}</math></li> </ul>

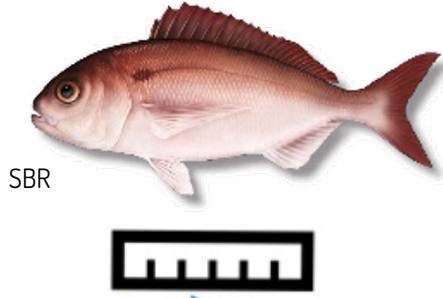
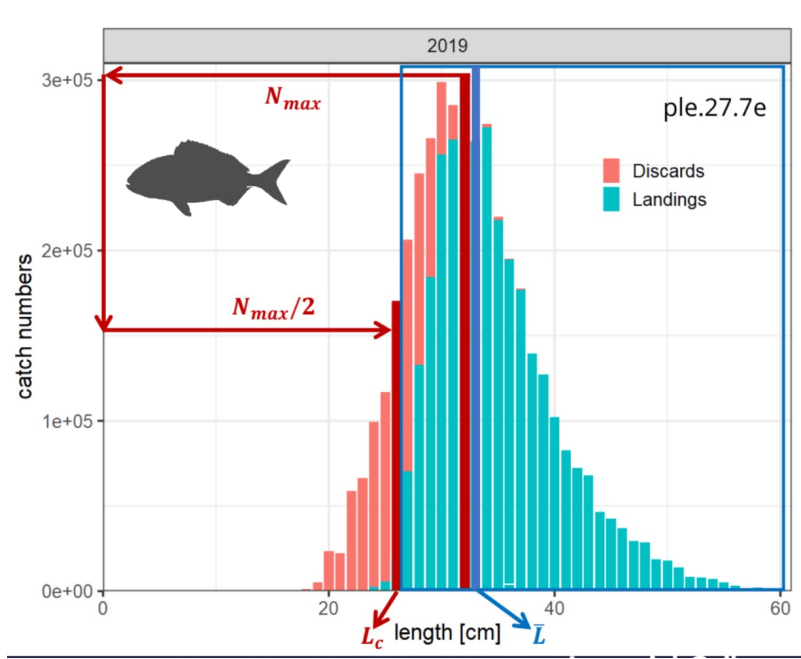


## SENSITIVITY ANALYSIS:





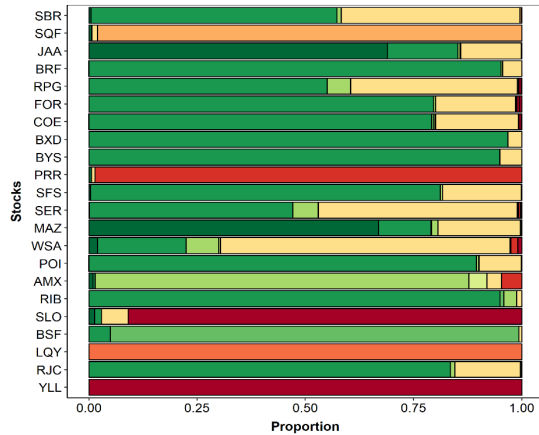
# Framework



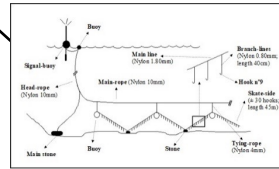
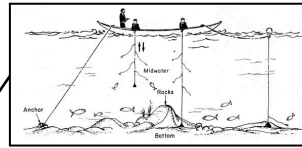
$L_c$  = Tamanho de primeira captura

# Seletividade

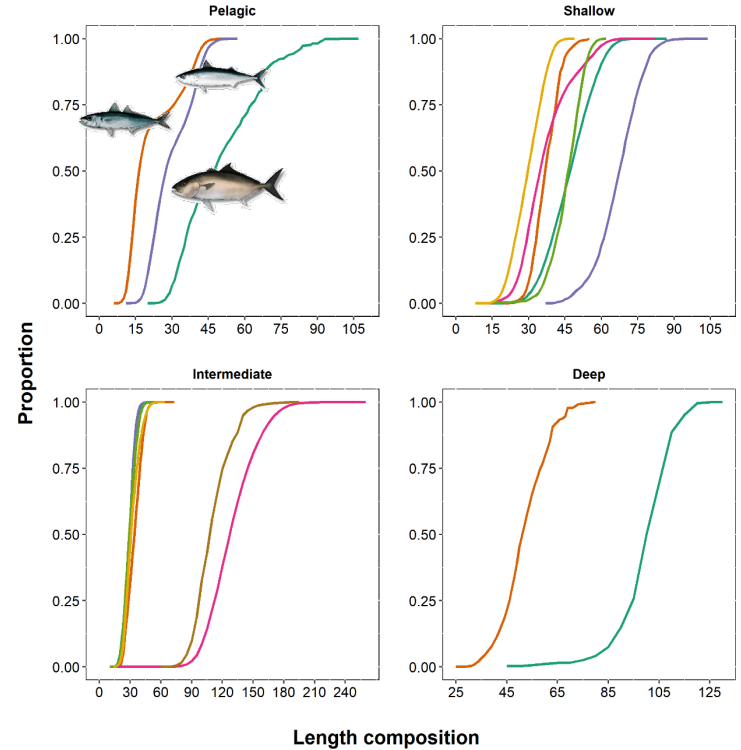
## Métiers



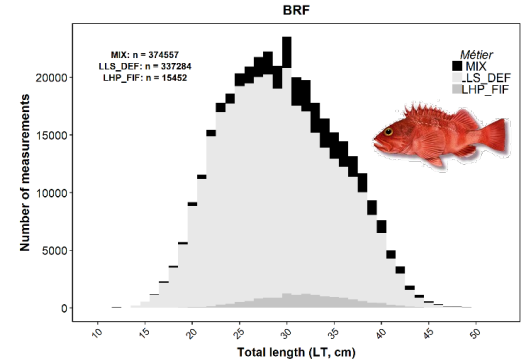
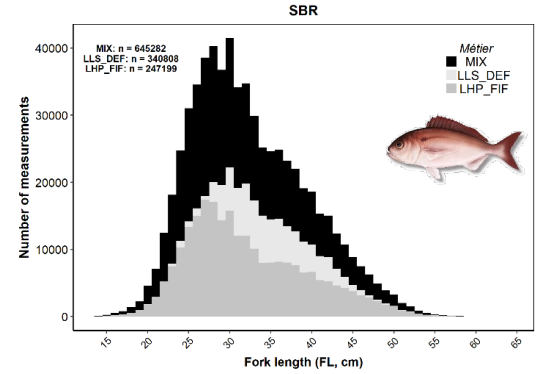
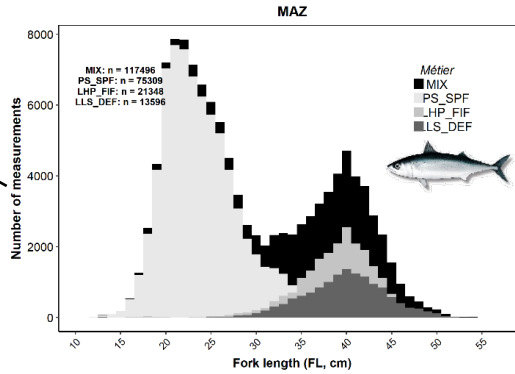
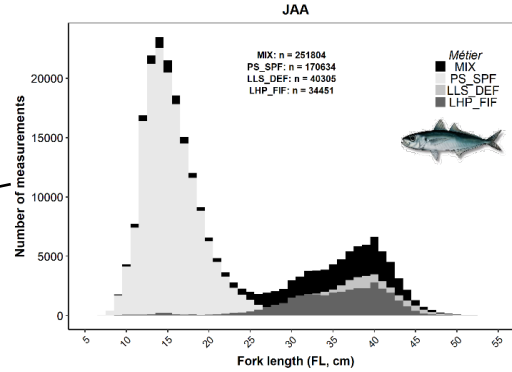
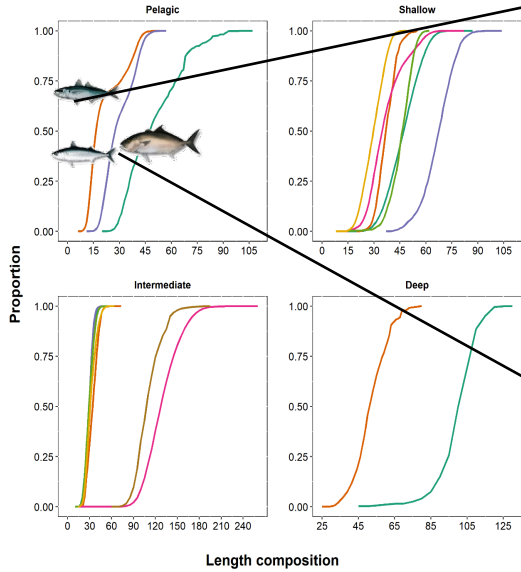
- Métier**
- FPO\_CRU
  - GNS\_FIF
  - HDP
  - LHP\_CEP
  - LHP\_FIF
  - LHP\_LPF
  - LHP\_MDP
  - LLD
  - LLS\_DEF
  - PS\_SPF



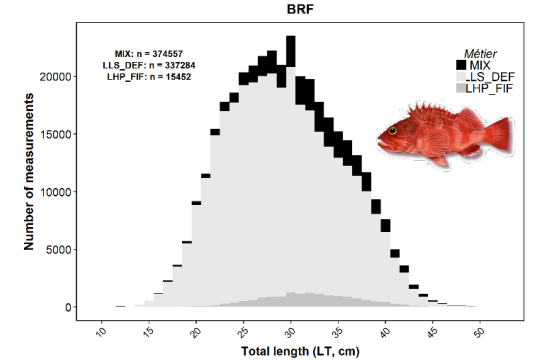
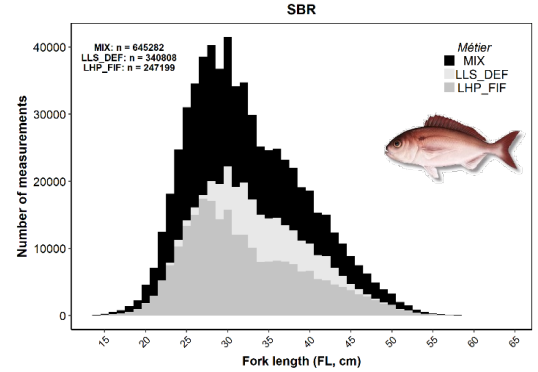
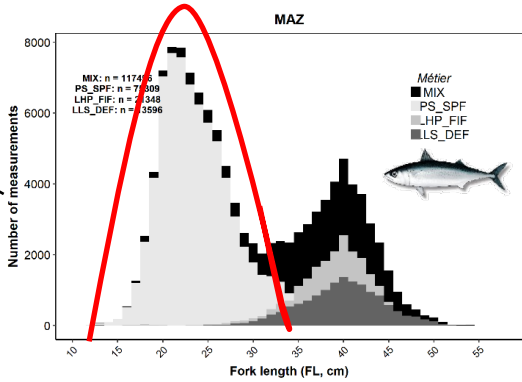
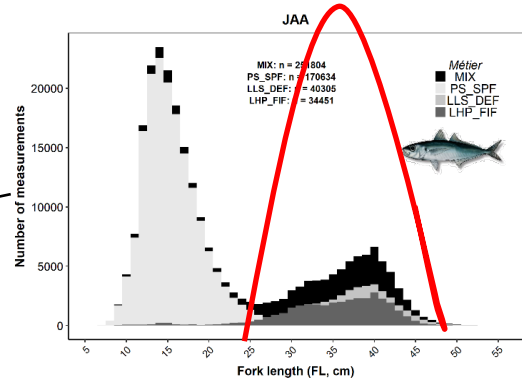
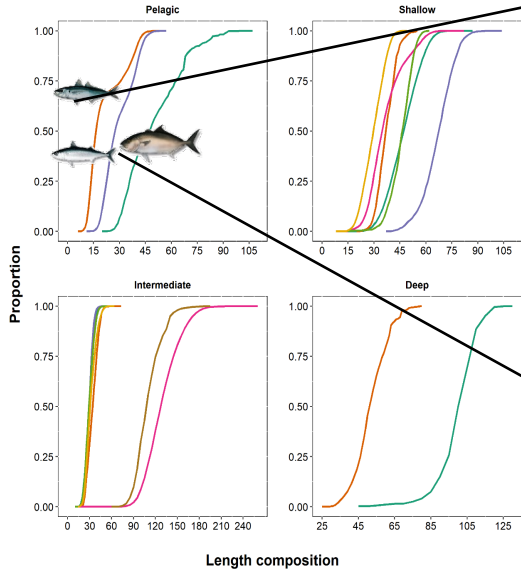
## Pressuposto de Seletividade<sup>1</sup>



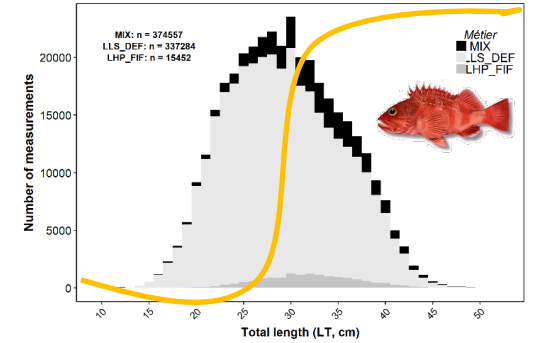
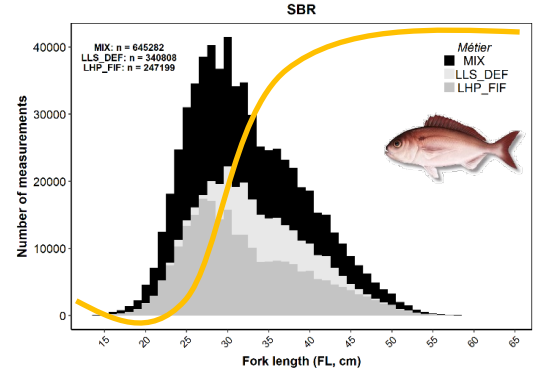
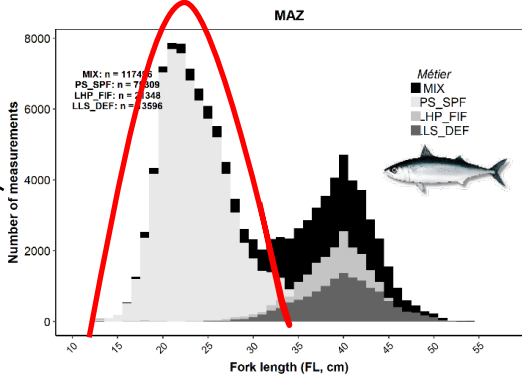
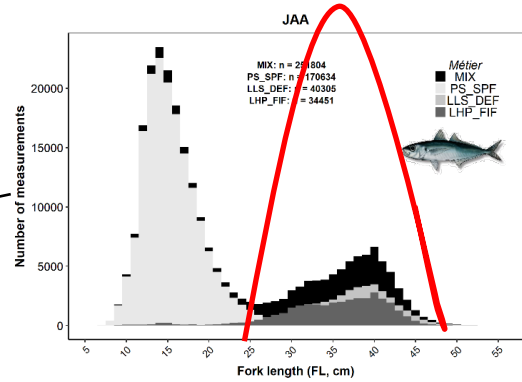
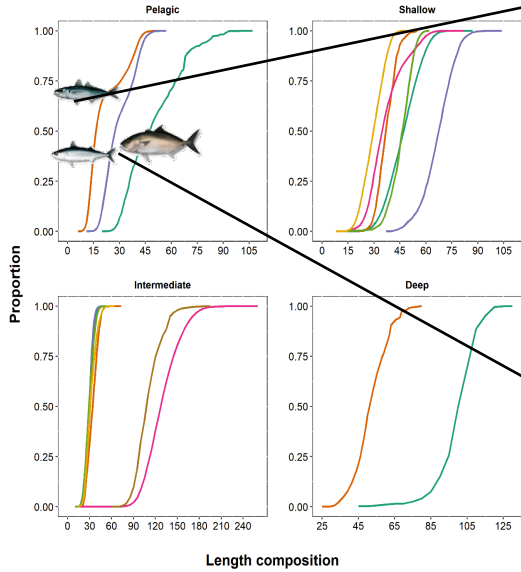
# Seletividade



# Seletividade



# Seletividade



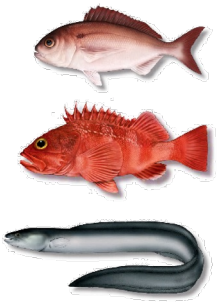
# Length-Based Indicators

		Conservation				Optimizing Yield	MSY
		Lc / Lmat	L25% / Lmat	Lmax5% / Linf	Pmega	Lmean / Lopt	Lmean / LF=M
		> 1	> 1	> 0.8	> 0.3	~ 1 (> 0.9)	≥ 1
		<b>Intermediate</b>					
SBR	2015	0.72	0.81	0.85	0.13	0.91	1.02
	2016	0.78	0.84	0.89	0.18	0.95	1.02
	2017	0.87	0.90	0.91	0.26	1.02	1.02
BRF	2015	1.12	1.22	0.78	0.11	0.93	1.01
	2016	1.12	1.22	0.79	0.12	0.93	1.00
	2017	1.22	1.31	0.79	0.15	0.96	0.98
COE	2015	0.93	1.01	0.90	0.49	1.12	1.06
	2016	1.01	1.05	0.91	0.58	1.15	1.03
	2017	1.09	1.13	0.93	0.83	1.20	1.02

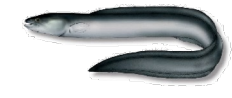
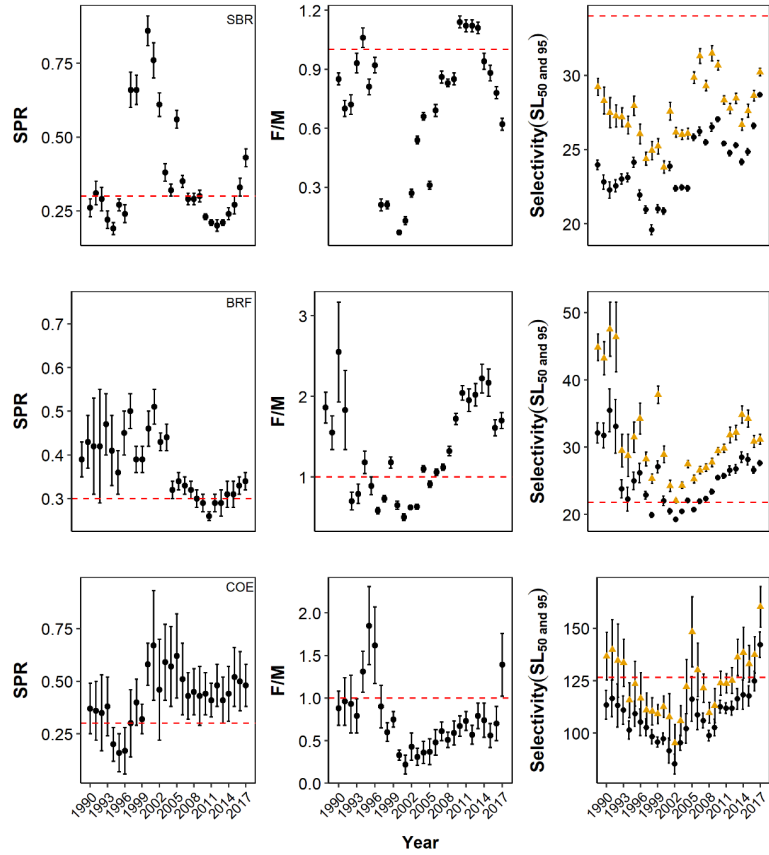
Indicator 1: Let then spawn

Indicator 2: Let then grow

Indicator 3: Let the mega-spawners live



# Length-Based Spawning Potential Ratio (LBSPR)



# Sensitivity Analysis



MAZ



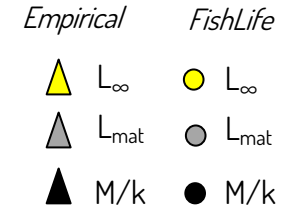
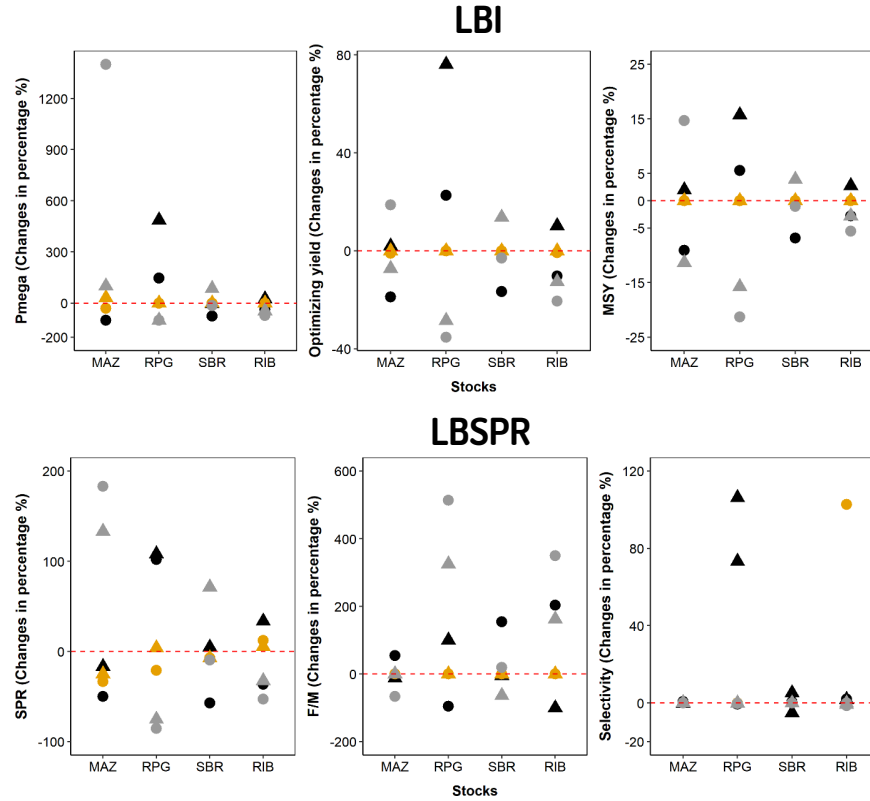
RPG



SBR



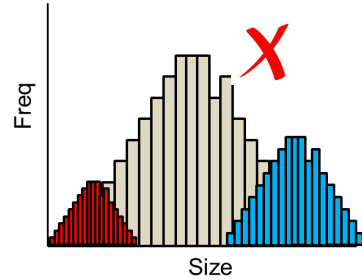
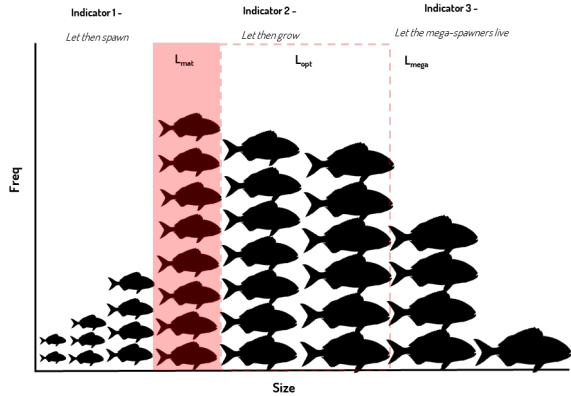
MMO



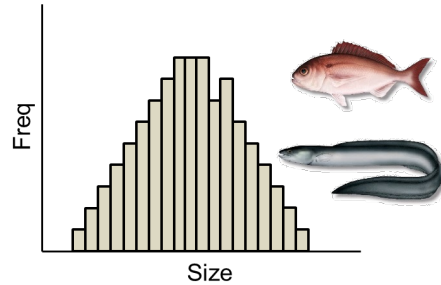


# Conclusões e aplicabilidade

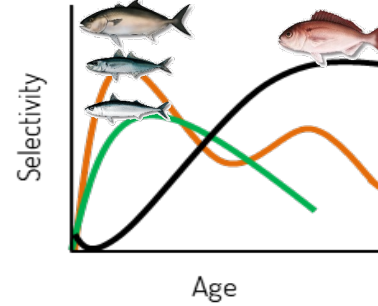
Base de dados robusta (~ 27 anos) por *métier*



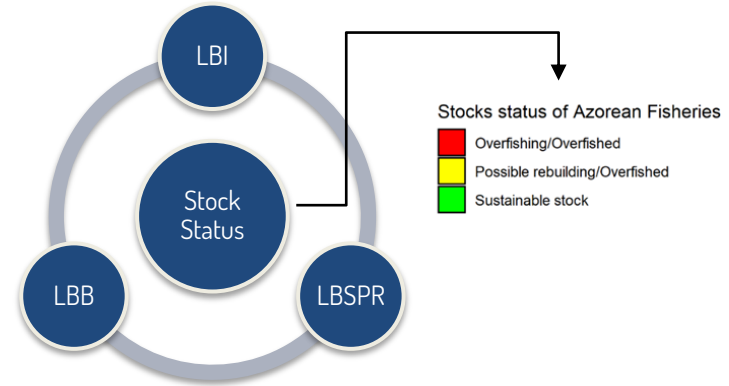
Stocks com ciclo de vida curto



Stocks com ciclo de vida médio-longo



Irrealista ↑ F/M e ↓ SPR



# Obrigado!



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/azoresfisheries

