

# ***POSSIBLE USE OF A STOCK- PRODUCTION MODEL INCORPORATING COVARIATES (ASPIC) FOR STOCK ASSESSMENT OF DEMERSAL RAYS IN INDONESIA***

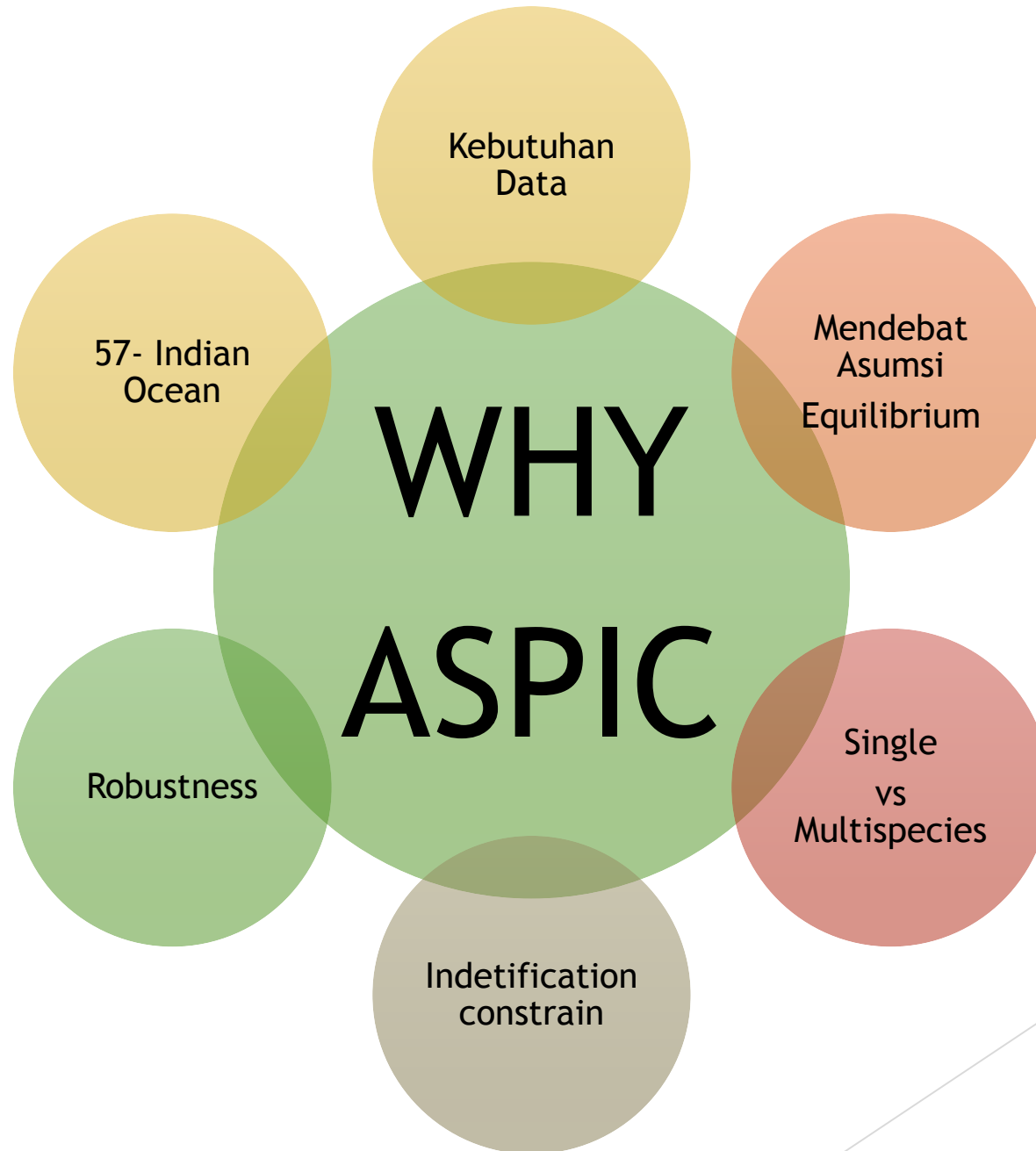
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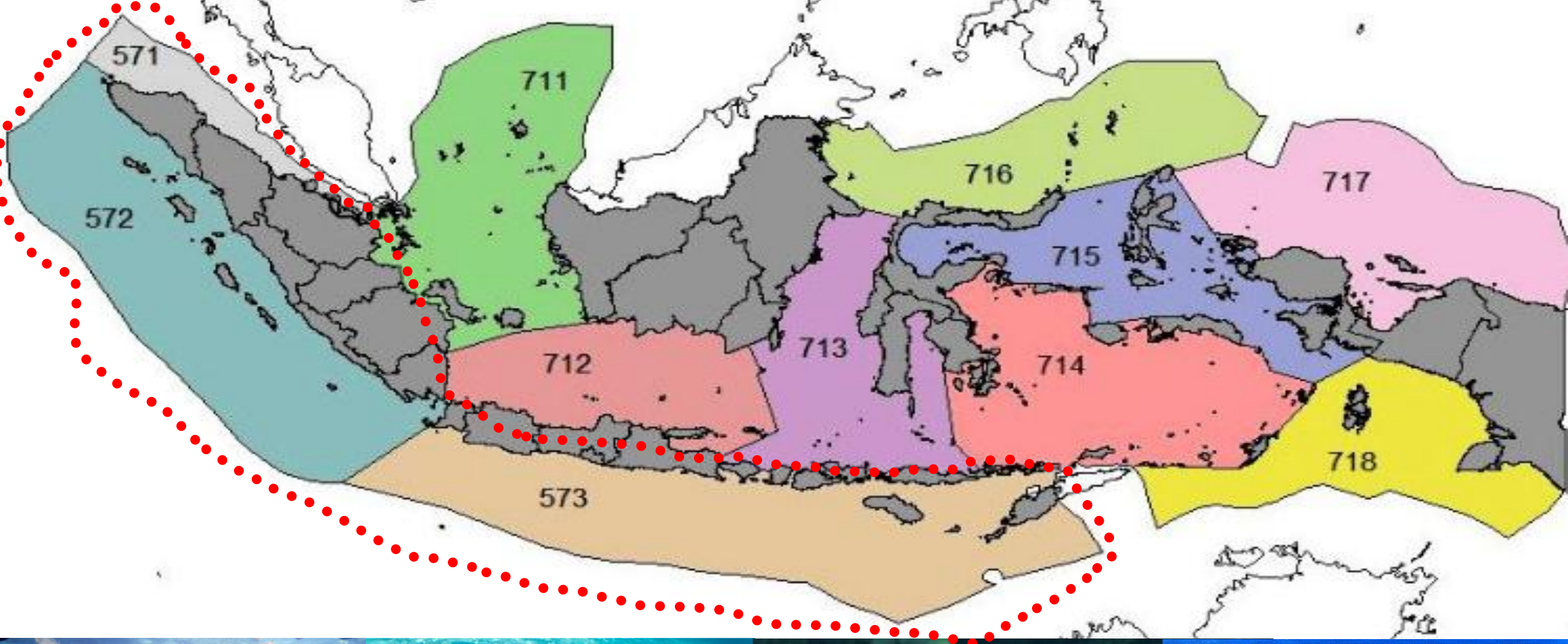
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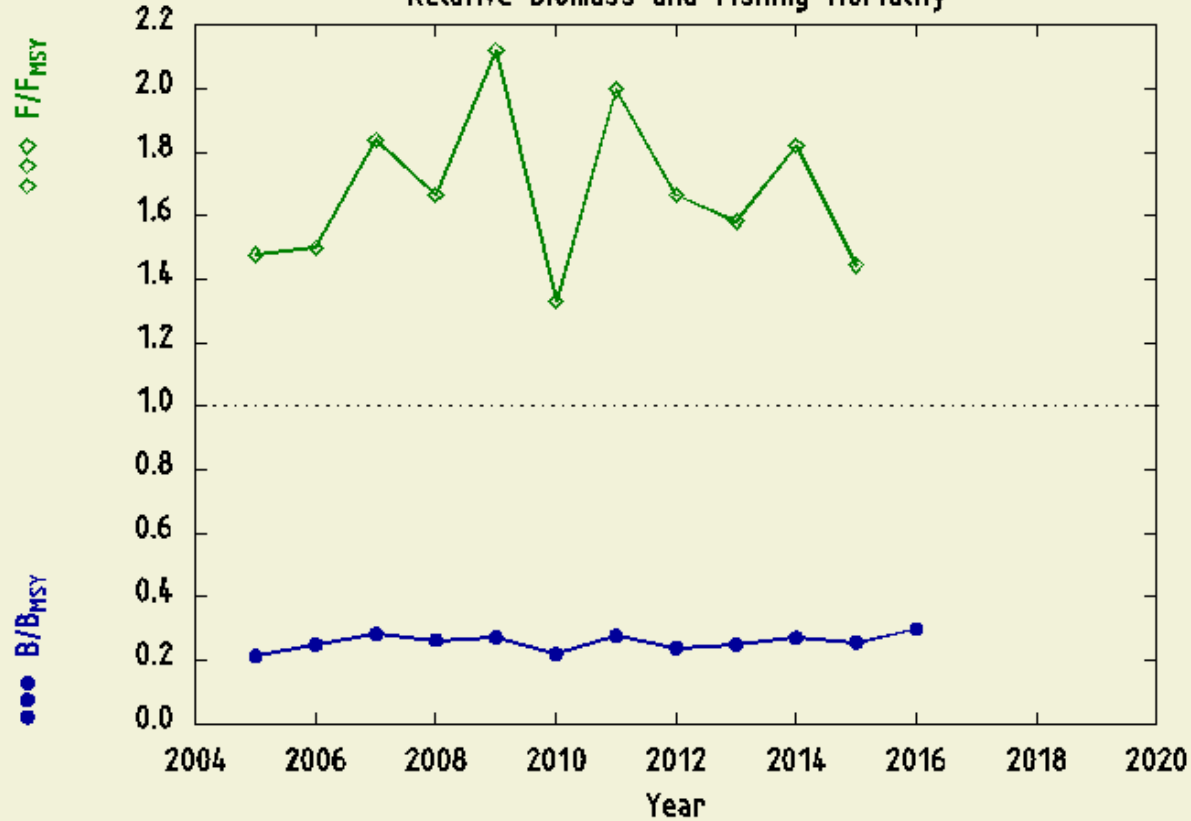


# Methods

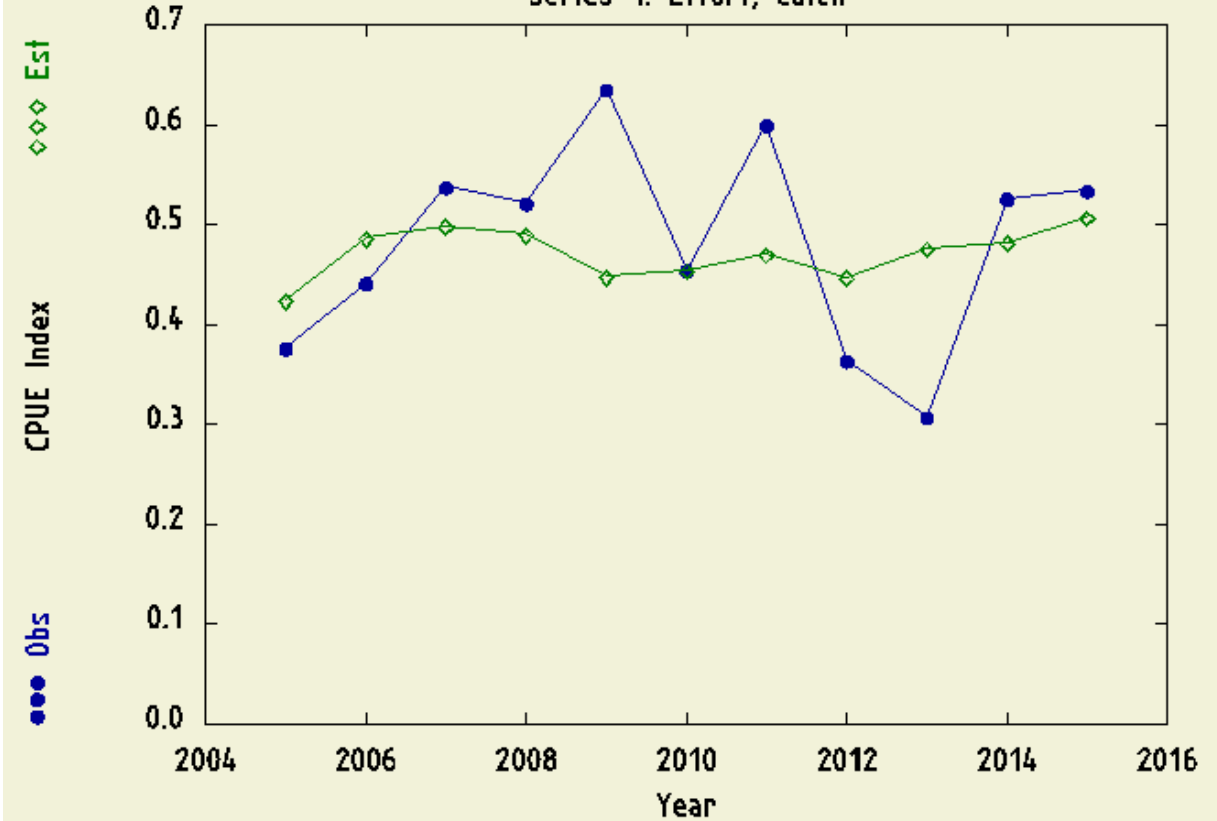
- ▶ MSY Problem
  - ▶ Uncertainty
  - ▶ Equilibrium
  - ▶ Simplicity
- ▶ ASPIC program developed by Prager (1994, 2002 & 2016)
- ▶ LOGISTIC
  - ▶  $g(B_t) = r \cdot B_t \cdot (1 - B_t/K)$

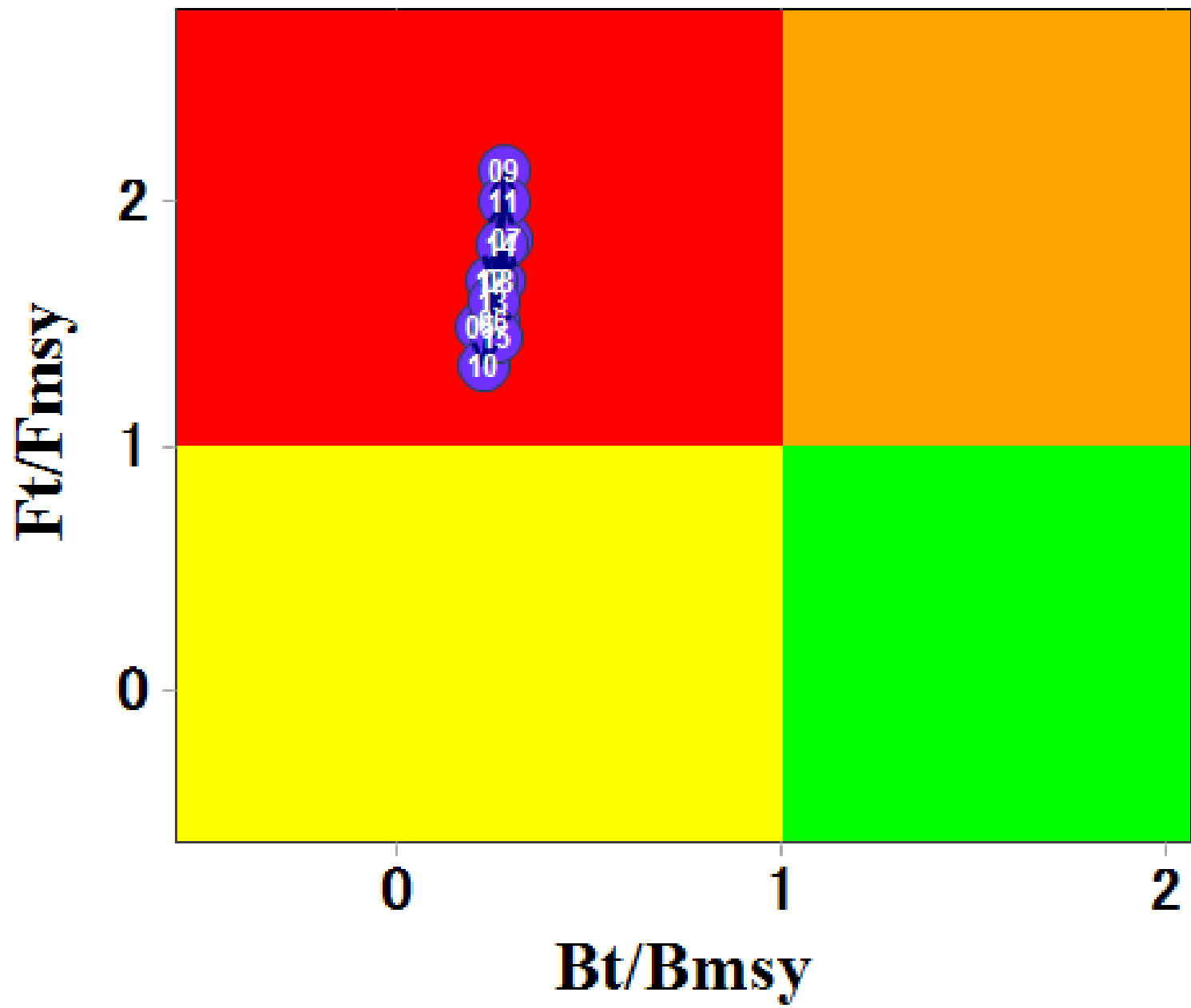
# Results

Indian Ocean - Ray - DEMERSAL FISHERY (ANDHIKA)  
Relative Biomass and Fishing Mortality



Indian Ocean - Ray - DEMERSAL FISHERY (ANDHIKA)  
Series 1: Effort, Catch





Kobe Plot

- ▶ overfishing and overfished
  - ▶ ( $B_{2016}/B_{msy}=0.304$ ;  $F_{2015}/F_{msy}=1.45$ ).
- ▶ An effort reduction urgently required
  - ▶ about 45% of an effort in 2015
  - ▶ (24,506 unit that equal to danish seine).

Suggestion

- ▶ Unsystematic Data
- ▶ Unstructured problem / highly dynamic / bervariasi tinggi ( $R^2 = 0.074$ )

Problem