

# Reliability and Limits of *MSY* Targets, Limits, and Uncertainty

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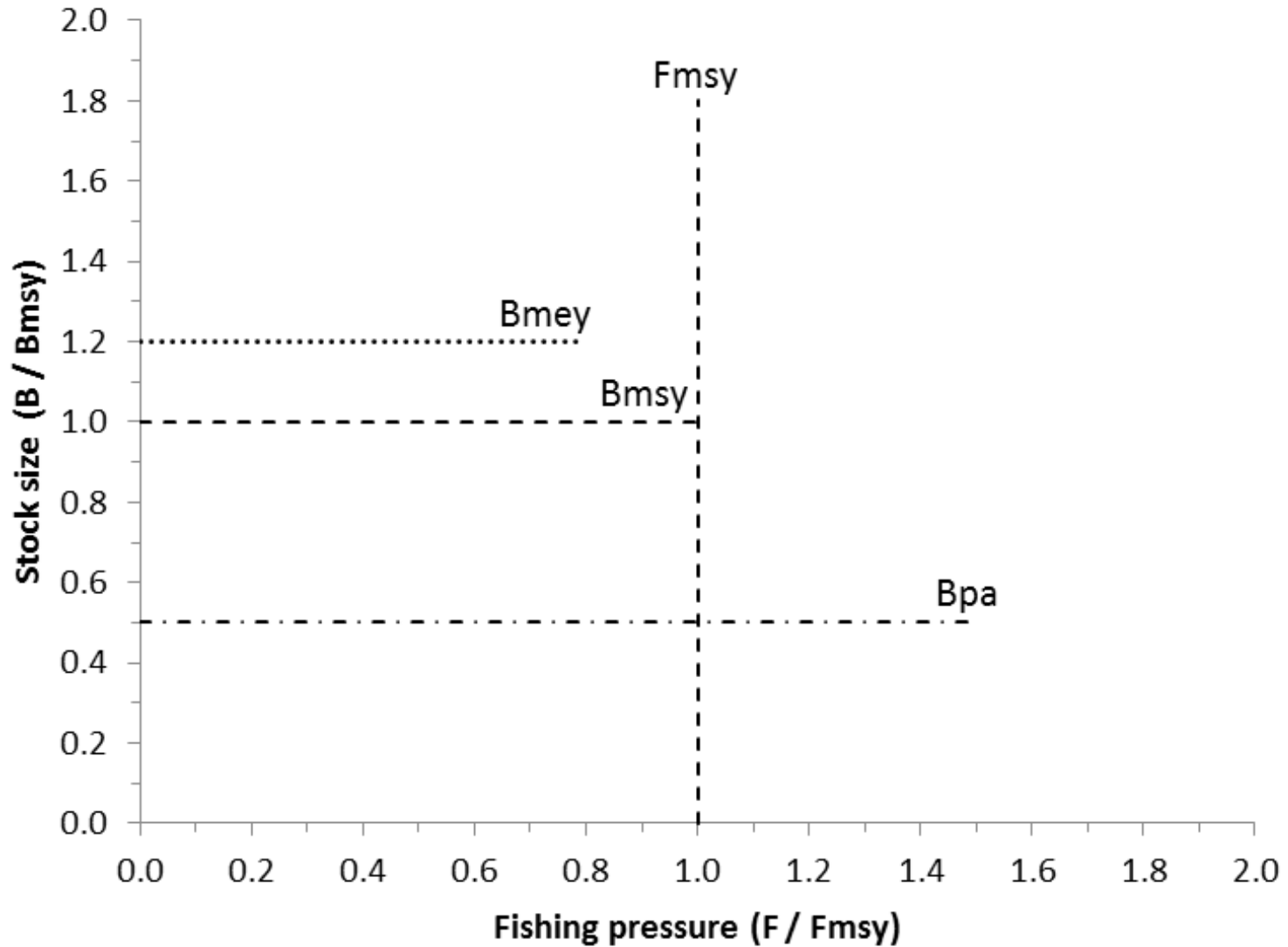
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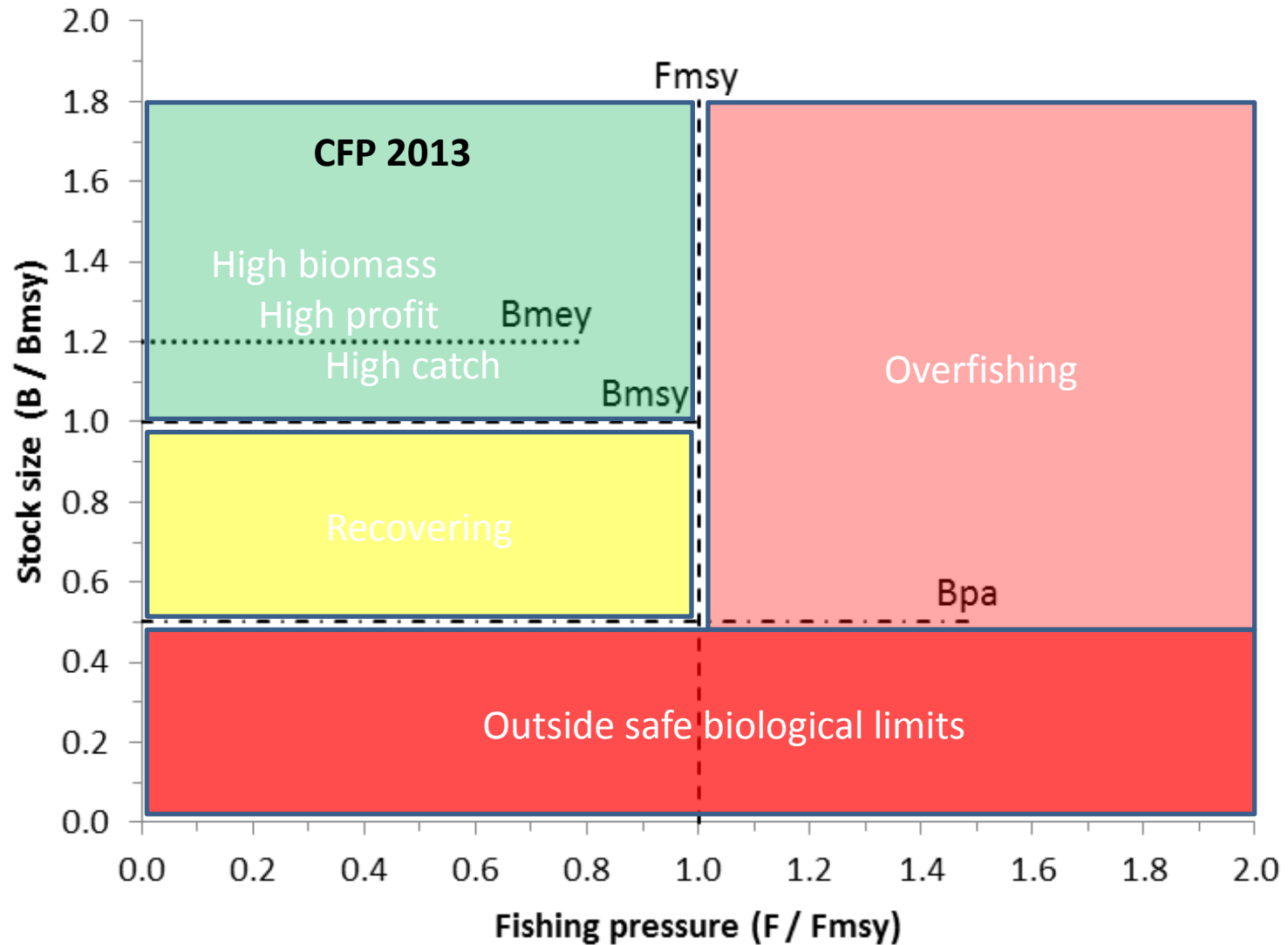
# Quick & Dirty Definitions

- ***MSY*** is the maximum catch that a stock can support; taking more will shrink the stock and will shrink future catches
- ***Bmsy*** is the smallest biomass (stock size) that can support *MSY*
- ***F*** is the proportion of fish in the water (on average over the year) that are killed by the fishery
- ***Fmsy*** is the maximum *F* that is compatible with the *MSY* concept; *Fmsy* will lead to *MSY* and *Bmsy*, albeit very slowly
- ***Bmey*** is the biomass with maximum profit for the fishers
- ***Bpa*** is the biomass below which reproduction may be compromised

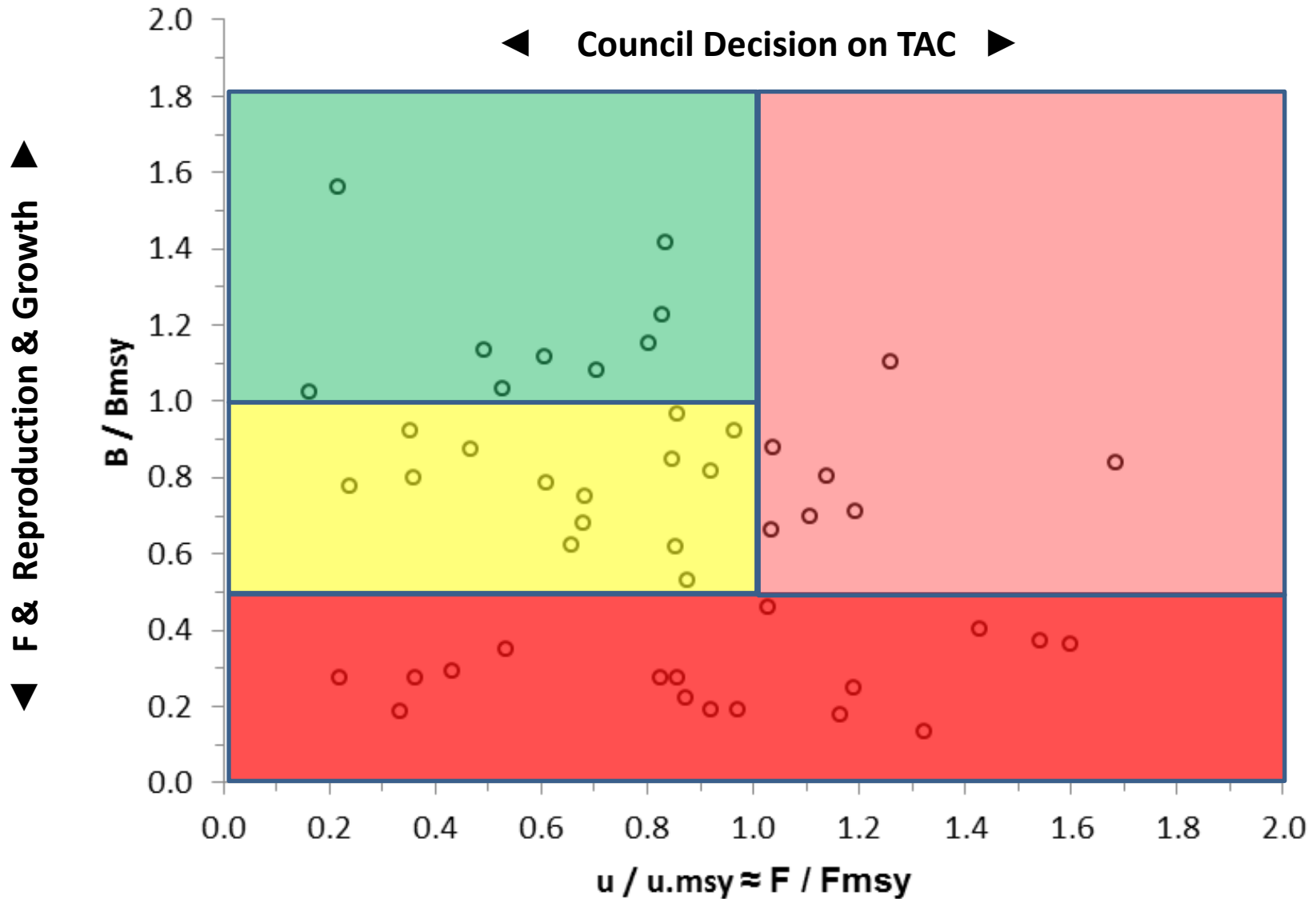
# The *MSY* Framework



# The *MSY* Framework



# Northeast Atlantic Stocks in 2013



# *MSY* Pitfalls & Failures

## Using *MSY* or *Fmsy* as a target

- Reproduction and growth of stocks fluctuate naturally
- Estimates of *MSY* or *Fmsy* have a 50% chance of being too high
- Taking more than the true *MSY* or *Fmsy* will shrink the stock and future catches
- Achieving a biomass above the level that can produce *MSY* (CFP 2013) requires *F* below *Fmsy*
- Overshooting *MSY* or *Fmsy* must therefore be avoided with a high probability, e.g. by targeting 0.8 *MSY* and 0.8 *Fmsy*

# *MSY* Pitfalls & Failures

## Using *MSY* or *Fmsy* for all stocks

- Forage fish such as anchovy, sprat, herring or sardines are the crucial link between lower and upper trophic levels in the food web
- Forage fish transport energy from copepods to cods
- Forage fish typically have the lowest ex-vessel price and are mostly used for animal feed; it makes more economic sense to direct fisheries towards human consumption
- Forage fish must therefore be fished less, e.g. with 0.5 *MSY* or 0.5 *Fmsy*



# *MSY* Pitfalls & Failures

## Catching the fish before they could grow and reproduce

- Fish grow throughout their lives; growth rate is highest at about  $2/3$  of maximum length
- Fish mature between  $1/3$  and  $2/3$  of maximum length; first time spawners have low success
- For a given  $F$ , catches are highest near  $2/3$  of max length
- For a given catch, the number of fish to be killed is lowest near  $2/3$  of max length
- Gear selectivity shall therefore be set such that the mean length in the catch is near  $2/3$  of max length; this will also reduce by-catch and discards and increase market price

# Summary

- The CFP sets the correct goal of rebuilding stocks above levels that can produce *MSY*
- Above *Bmsy* is the area where high catches are obtained from large stocks at low cost of fishing
- Above *Bmsy* can only be achieved if  $F < F_{msy}$
- Forage fish must be fished less to maintain crucial ecosystem functions
- To minimize the impact of fishing, minimum conservation reference size must be set such that fish can grow and reproduce before capture

# Thank You

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