WCPFC
MANAGEMENT OBJECTIVES WORKSHOP

Manila, Republic of the Philippines
28-29 November 2012

REFERENCE POINTS

MOW1-PRES/07
28 Nov 2012

SPC-OFP

Agenda item 4.2
Reference points

SPC, OFP

MOW1-WP-06

Structure

- What are they? (terminology)
- Limit (conservation) reference points
- Target (management) reference points
- Risk

What are reference points?

- A management tool that can be used to achieve biological and socio-economic management objectives.
- Relevant to a range of management activities, e.g. setting TACs or TAEs.

- Reference Point – is a pre-determined level of a given Indicator that corresponds to a particular state of the stock that management either seeks to achieve (target) or avoid (limit).

Limits

- **Limit** Reference Points (LRPs): describe an undesirable state that should be avoided (fish stock or fishery). LRPs set boundaries that are intended to constrain harvesting within 'safe biological limits'. i.e. avoiding places you don't want to go
  - Often defined by biology of the stock (science)

Targets

- **Target** Reference Points (TRPs): describe the intended outcome for the stock/fishery.
  - Defined by managers desires for the fishery
    - E.g. economic, social, biological

- Limits + Targets allow ‘strategies’ to be defined

Limit reference points

Limit reference points

- Aim to limit risk of stock or fishery collapse
  - The biomass of the stock a useful indicator
  - In particular the adult (spawning) biomass
- Can also limit the impacts on stocks
  - Fishing mortality indicator
  - Prevent the stock being reduced too quickly to control
  - Limit capacity within the fishery (prevent overcapacity?)
- Can use a biomass limit, a fishing mortality limit, or both!

WCPFC Background

- SC7 reviewed candidate limit reference points for key target species

Level	LRPs	Application
Level 1	F_{MSY} and B_{MSY}	
Level 2	$F_{X\%SPRo}$ and either $20\%SB_o$ or $20\%SB_{current,F=0}$	Bigeye, yellowfin tuna + albacore (SC8)
Level 3	$20\%SB_o$ or $20\%SB_{current,F=0}$	Other key spp

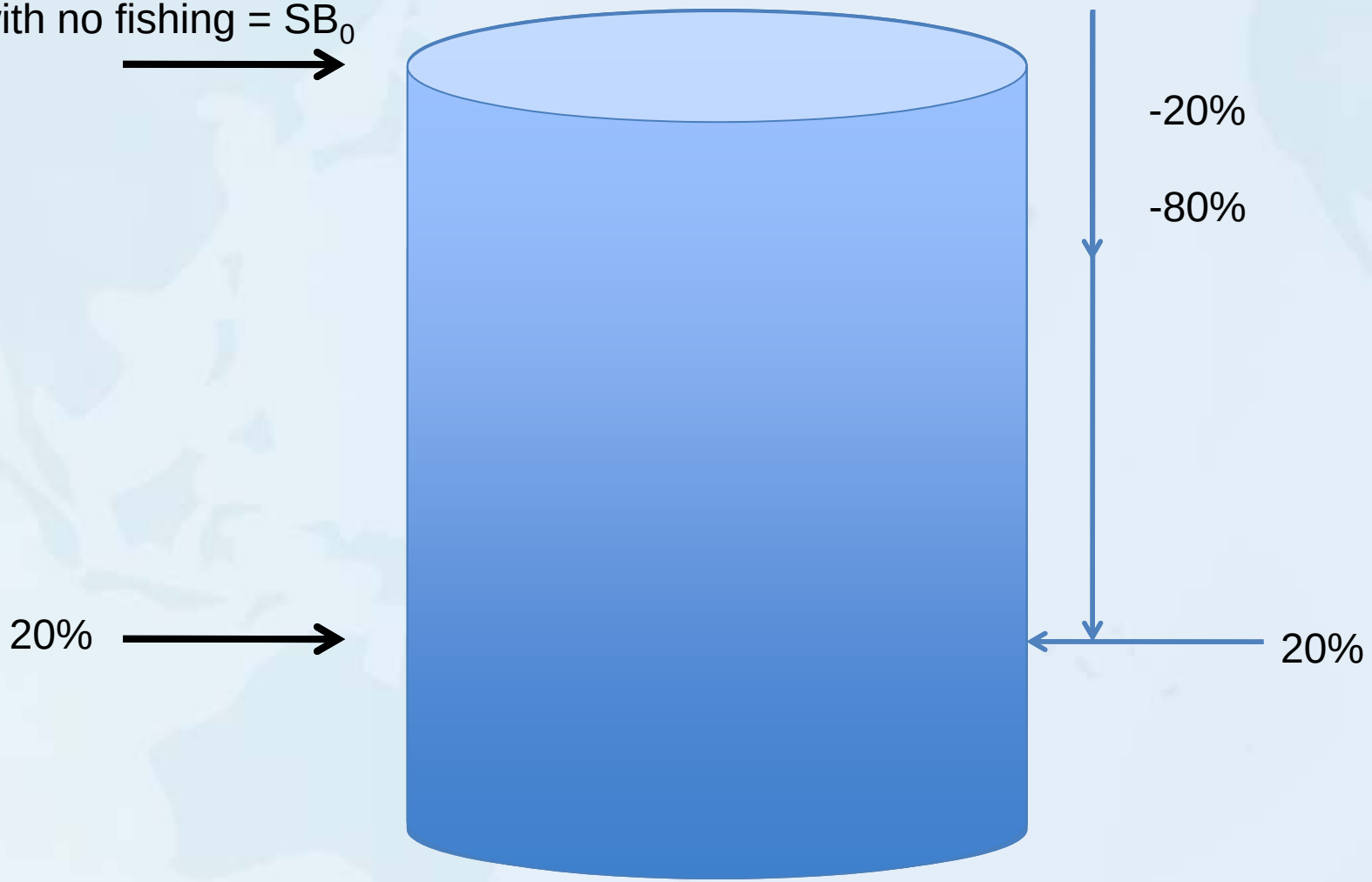
$SB_{current,F=0}$ is adult biomass that would be currently present in the absence of fishing

$F_{X\%SPR0}$ is the fishing mortality that reduces the average young produced by an individual recruit over its lifetime to X% of that number if no fishing were occurring.

‘Depletion’

‘Depletion’

Spawning Biomass (SB) with no fishing = SB_0



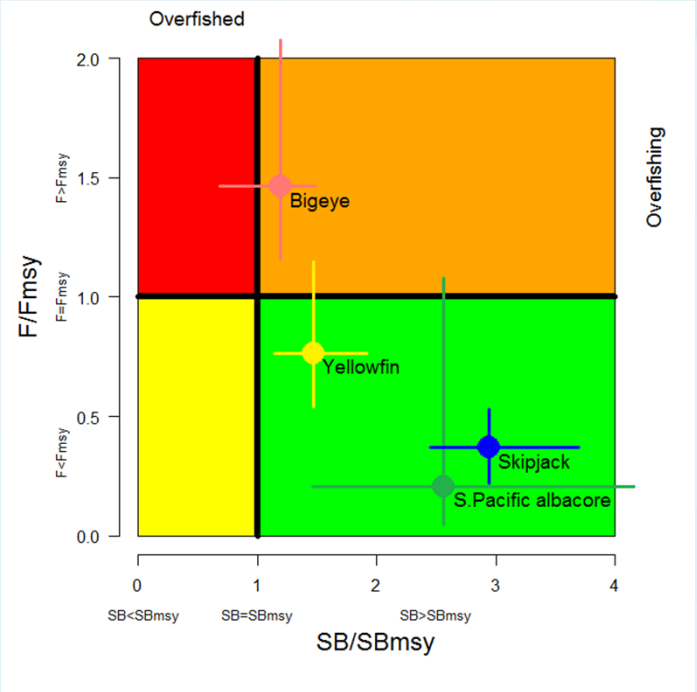
SC8 preliminary recommendations

- Avoid recruitment overfishing
  - spawning stock-based indicator

- depletion estimator of 0.20 of unfished levels

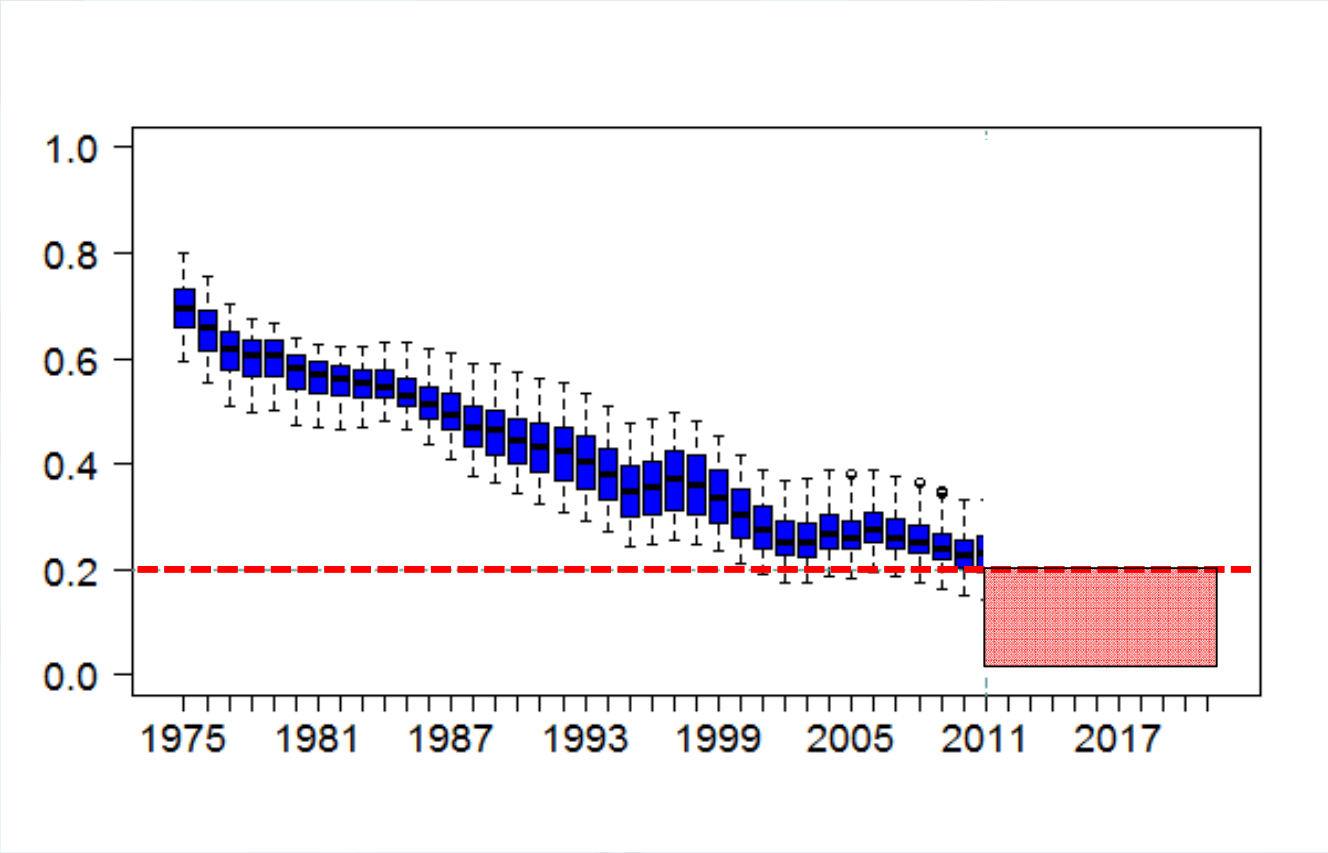
Risk

- ‘Risk of exceeding limit reference points is very low’ (UN Annex II)
- Uncertainty within the system – our knowledge is not perfect
- Assess this risk when considering future management strategies due to:
  - The level of fishing allowed depleting the stock
  - Variability in nature
  - Uncertainty in knowledge and our ability to estimate stock sizes



Current approach

- Population projections
- Fixed (constant) conditions assumed into the future
- Uncertainty can be incorporated



SC8 preliminary recommendations

- Probability of 0.1 (10%, 1 in 10) as an acceptable measure of risk of exceeding the LRP (could be more precautionary, e.g. 5%)

"We don't want the stock to fall below a stock status of X, Y% amount of the time."

- *Defer recommendation on the value of X% in the fishing mortality-based LRP of F**x%**SPR to SC9*

Target reference points

Making Objectives operational

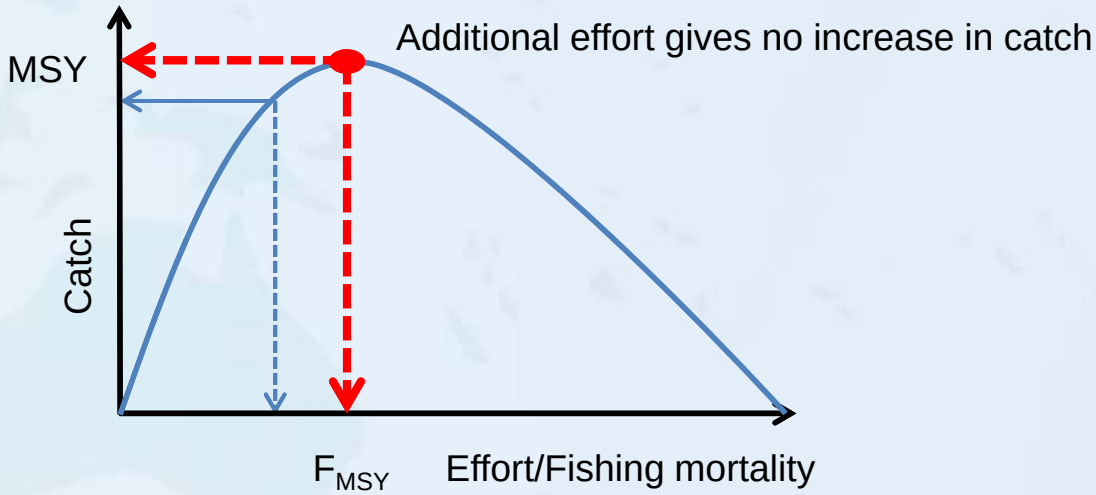
- TRPs are defined by Objectives

- Translate TRPs into states of stock or fishery required to make them achievable, e.g.:
  - CPUE (measured direct from the fishery)
  - Adult population size (measured through stock assessment)
  - Number of vessels (measured direct from the fishery)

- Aim: manage the fishery to achieve the target reference points ‘on average’

Current WCPFC 'Default': MSY

- Lack of constant conditions mean MSY easy to 'miss'
- Risk of overfishing
- Often not ideal economically – smaller fish, lower CPUE
- Similar catch (and better economics) can be achieved at lower total effort



Making Objectives operational

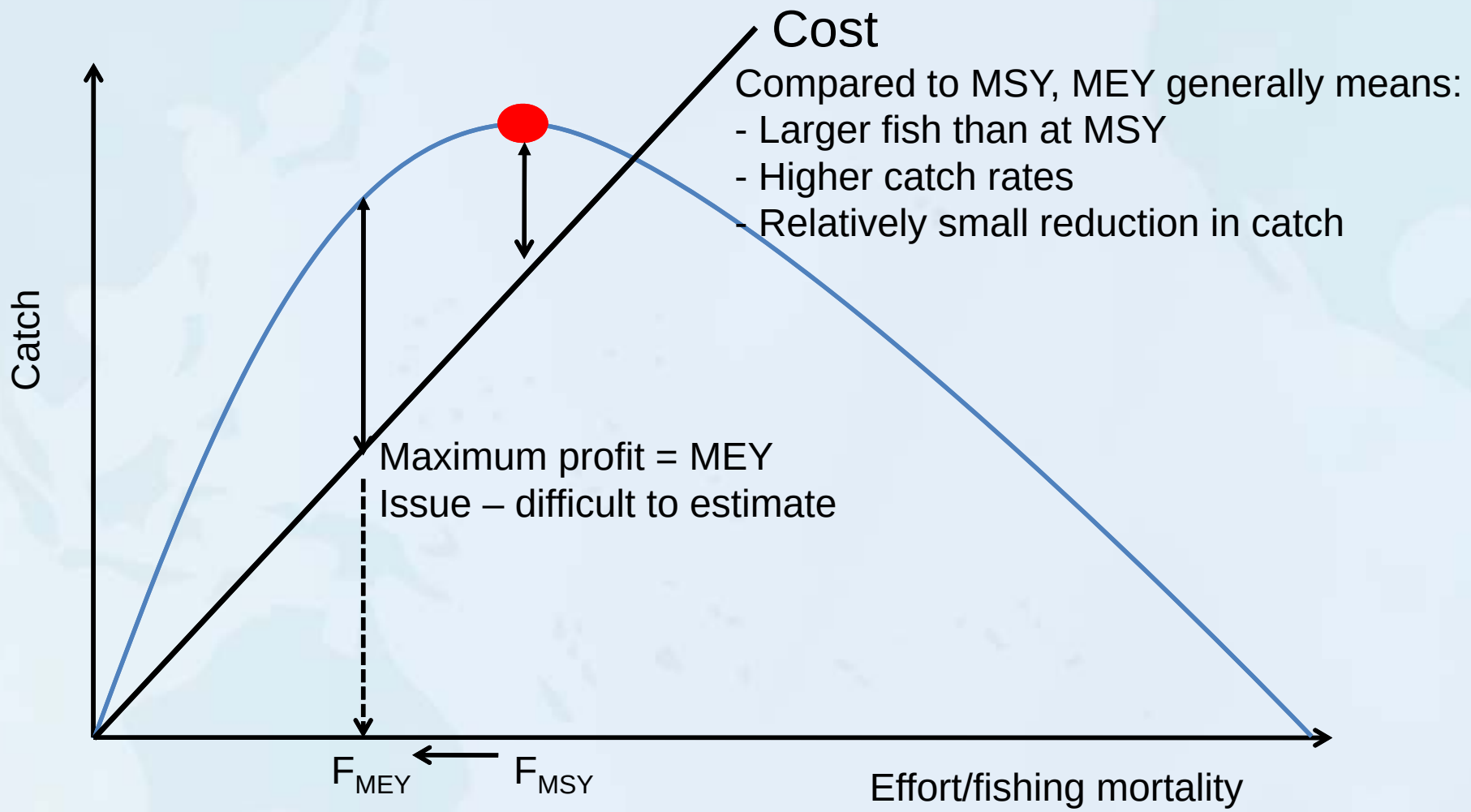
- E.g. objective = ‘maximise economic potential’

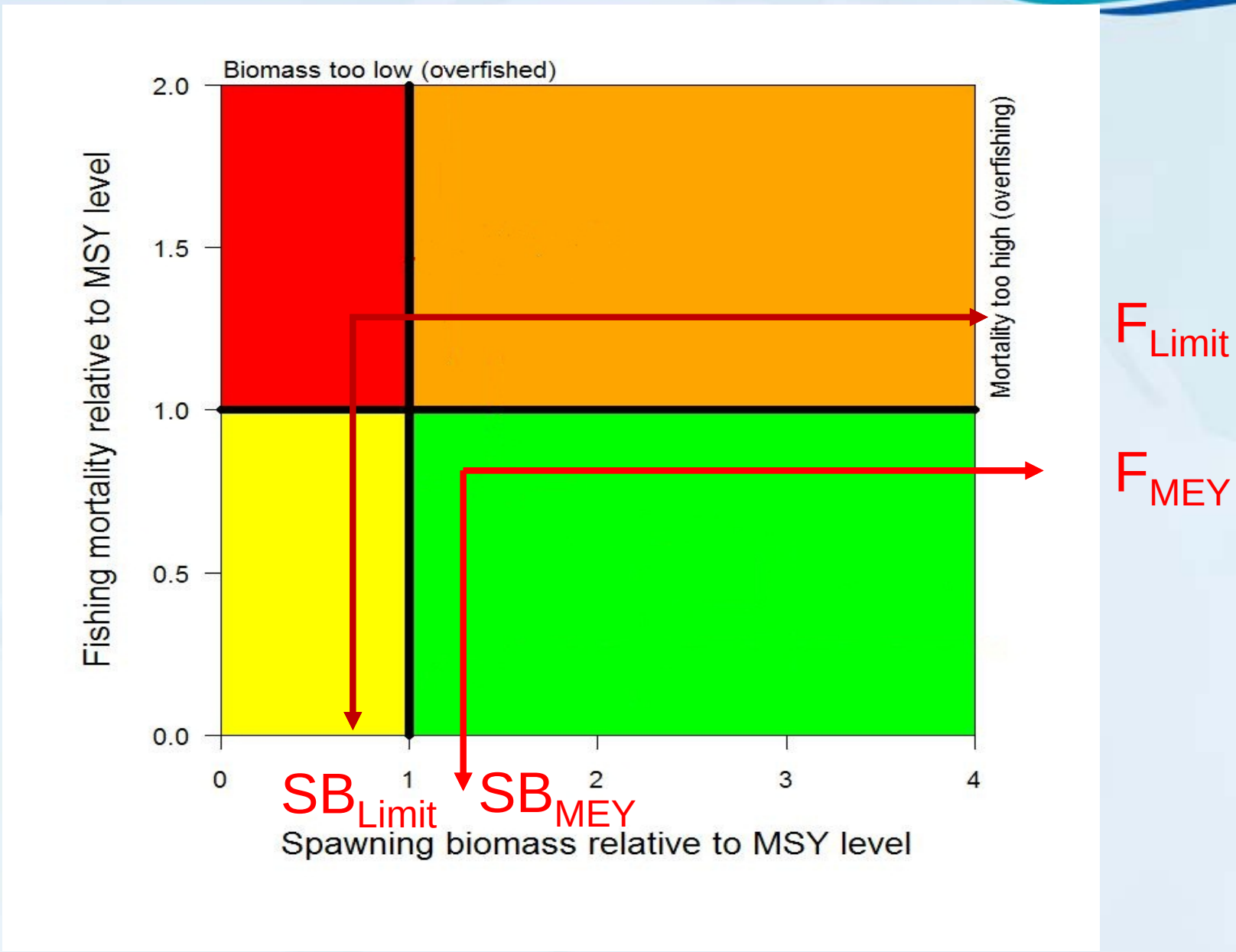
- Stock sizes larger than MSY/fishing pressure lower than MSY
  - gives ‘better economic performance’
  - Concept of ‘Maximum Economic Yield’ (MEY)

MSY vs MEY


Cost – increases with effort
Catch
F_{MSY}
Effort/fishing mortality

MSY vs MEY


Cost
Compared to MSY, MEY generally means:
- Larger fish than at MSY
- Higher catch rates
- Relatively small reduction in catch
Catch
Maximum profit = MEY
Issue – difficult to estimate
F_{MEY}
F_{MSY}
Effort/fishing mortality

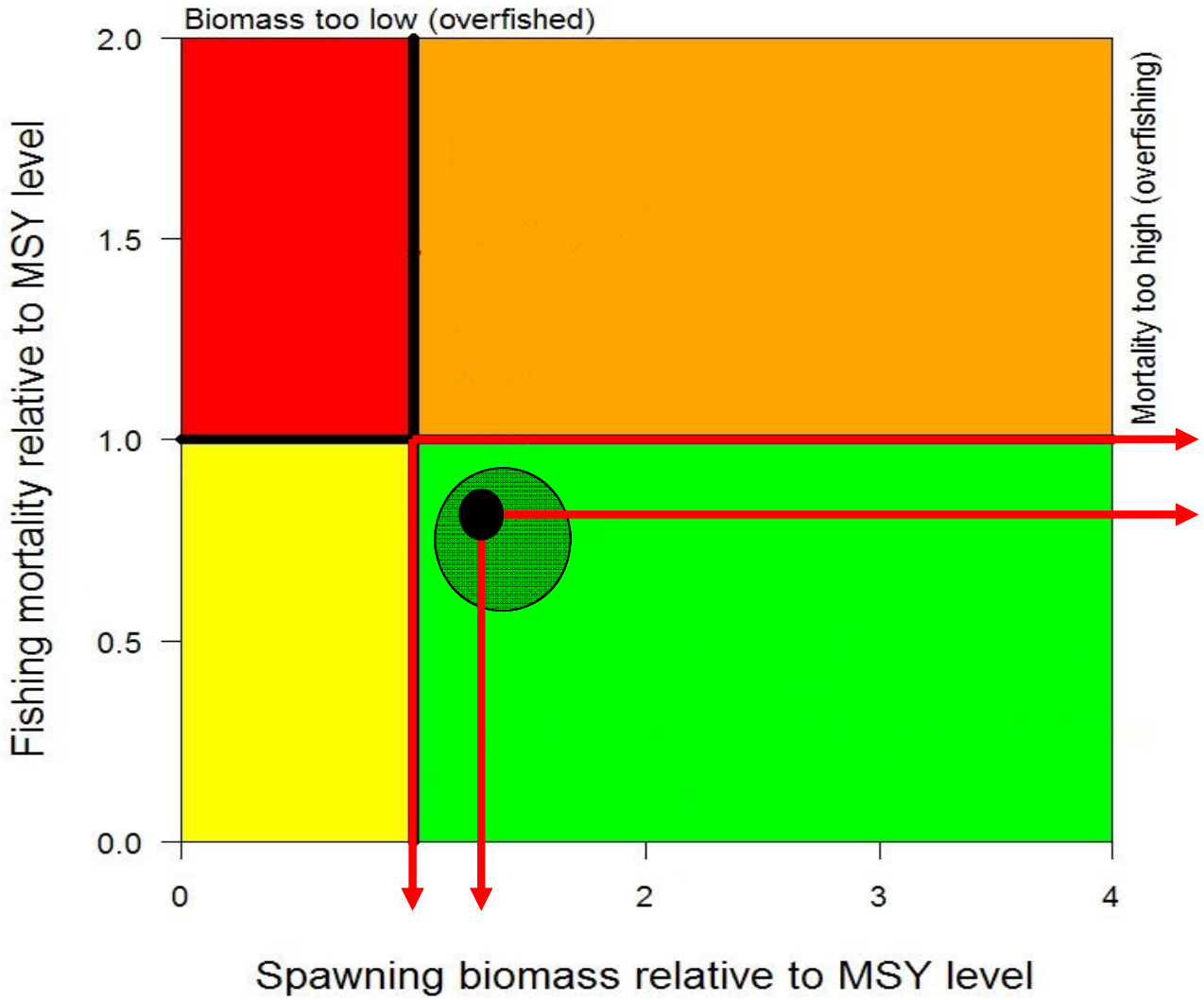

Biomass too low (overfished)
Mortality too high (overfishing)
Fishing mortality relative to MSY level
2.0
1.5
1.0
0.5
0.0
0
1
2
3
4
SB Limit
SB MEY
Spawning biomass relative to MSY level
F Limit
F MEY

Empirical Target Reference Points

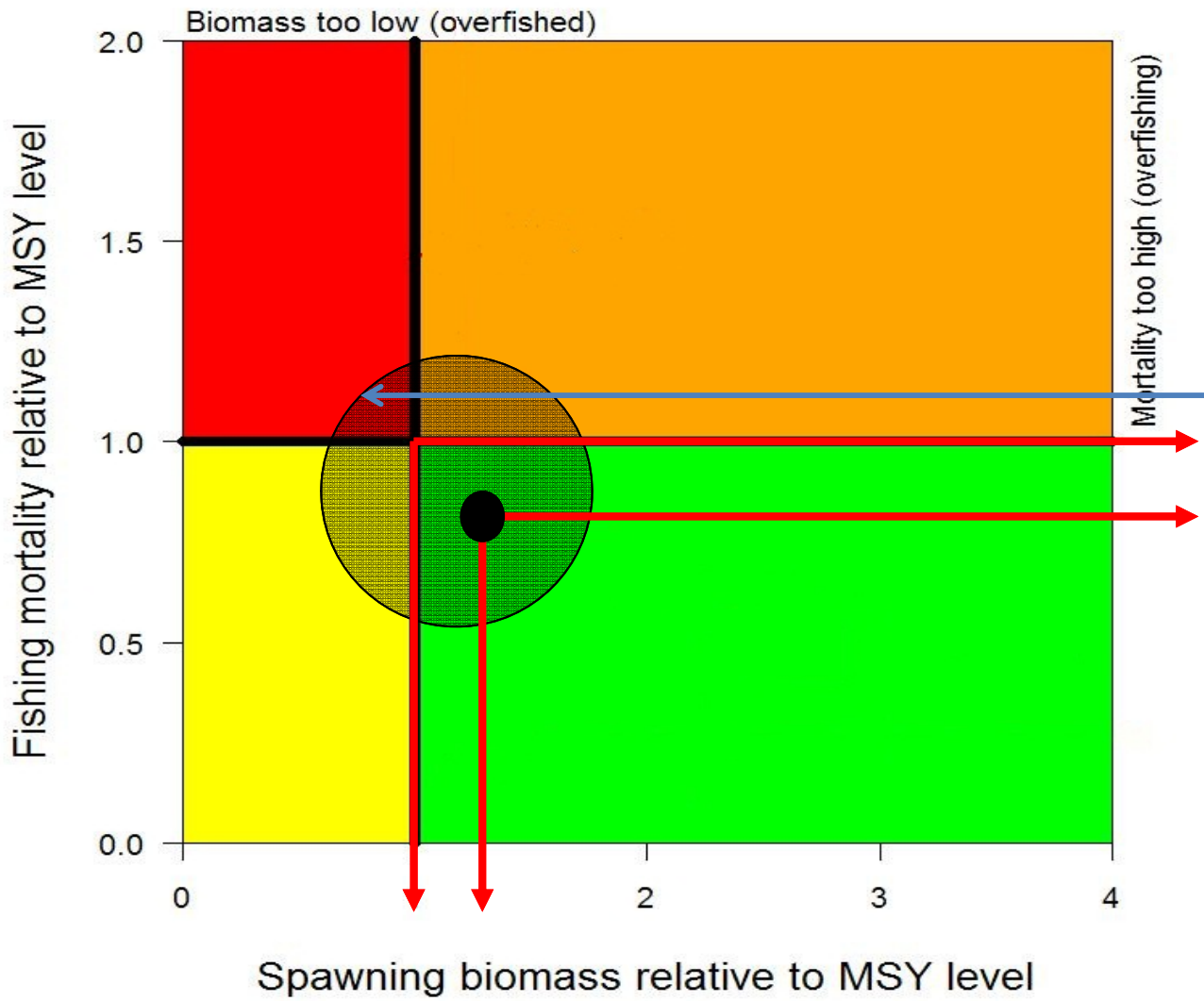
- Potential to use data direct from the fishery? E.g.:
  - Catch
  - Catch rate
  - Size composition of the catch
- Easier to monitor, more ‘reactive’ that assessments?
- Role may be to act as a trigger for action/assessments
- Area of continuing study

Choosing targets

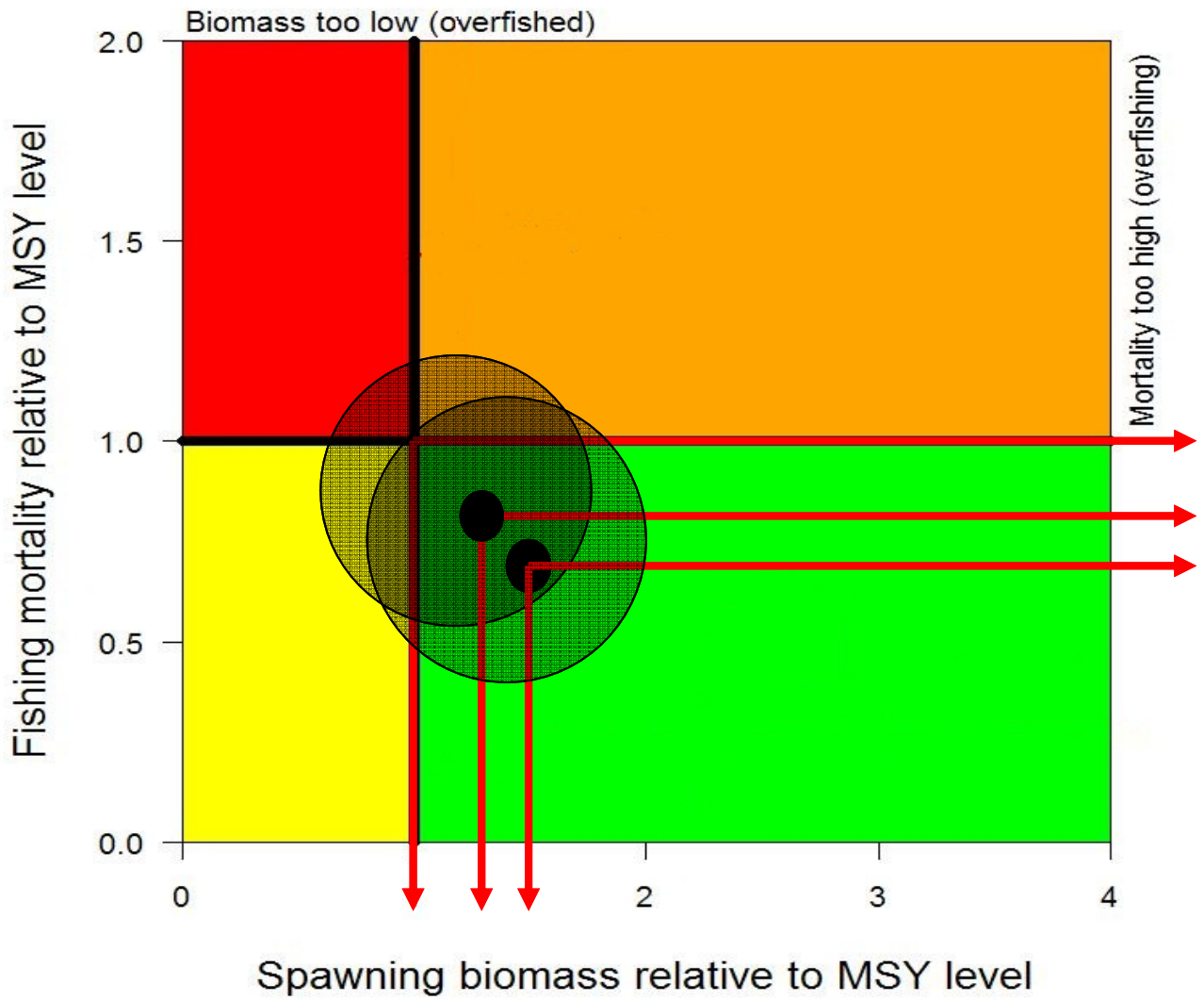
- Trade-offs
- Link back to Management Objectives
  - Stock sustainability
  - Optimising economics
  - Ensuring social benefits
  - Ecosystem impacts
- Quantifying the acceptable trade-offs therefore important
- Risk – targets and limits cannot be too close together!



50% above and below TRP (TRP achieved 'on average')



~15% chance of overfished AND overfishing



Adjust target levels to take account of risk

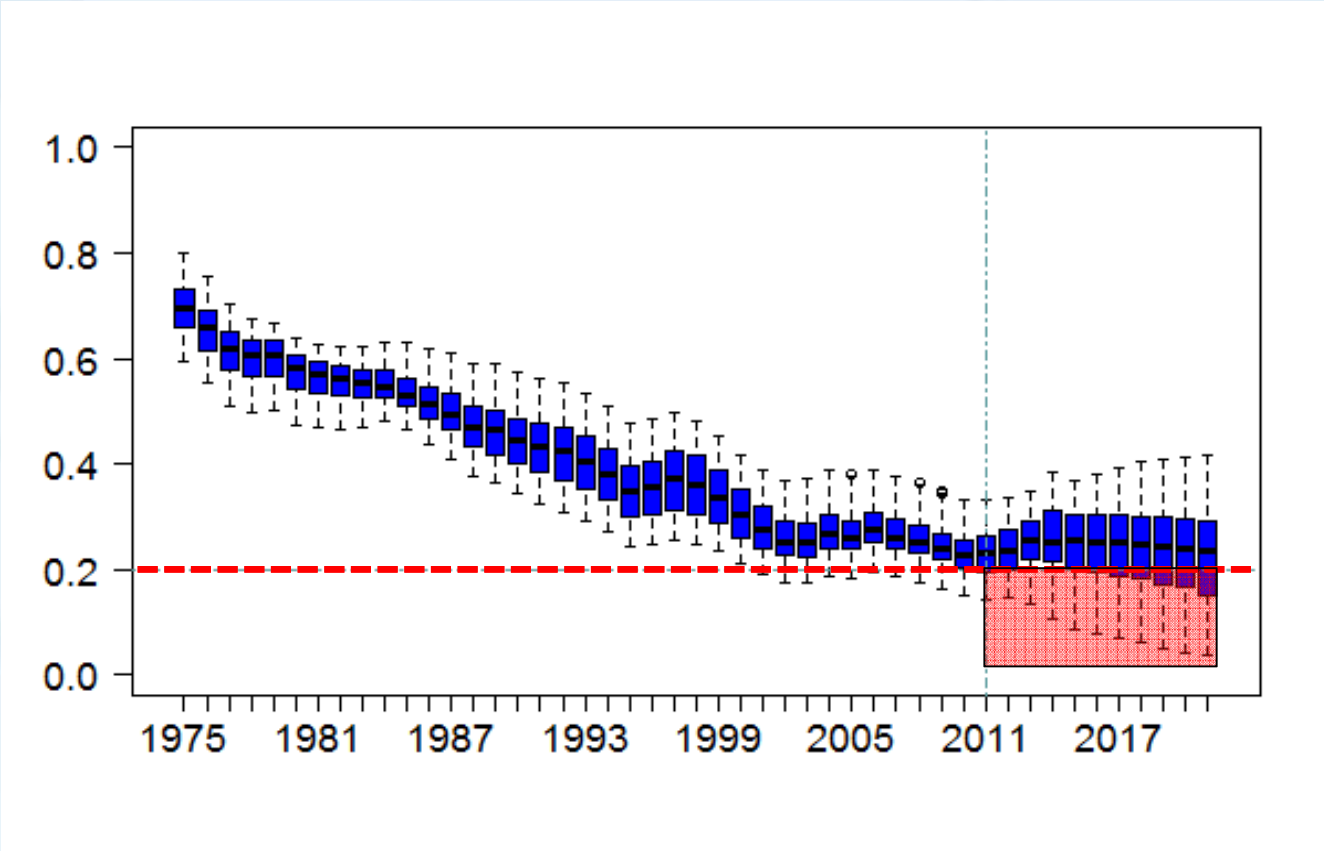
Illustrating risk and trade offs

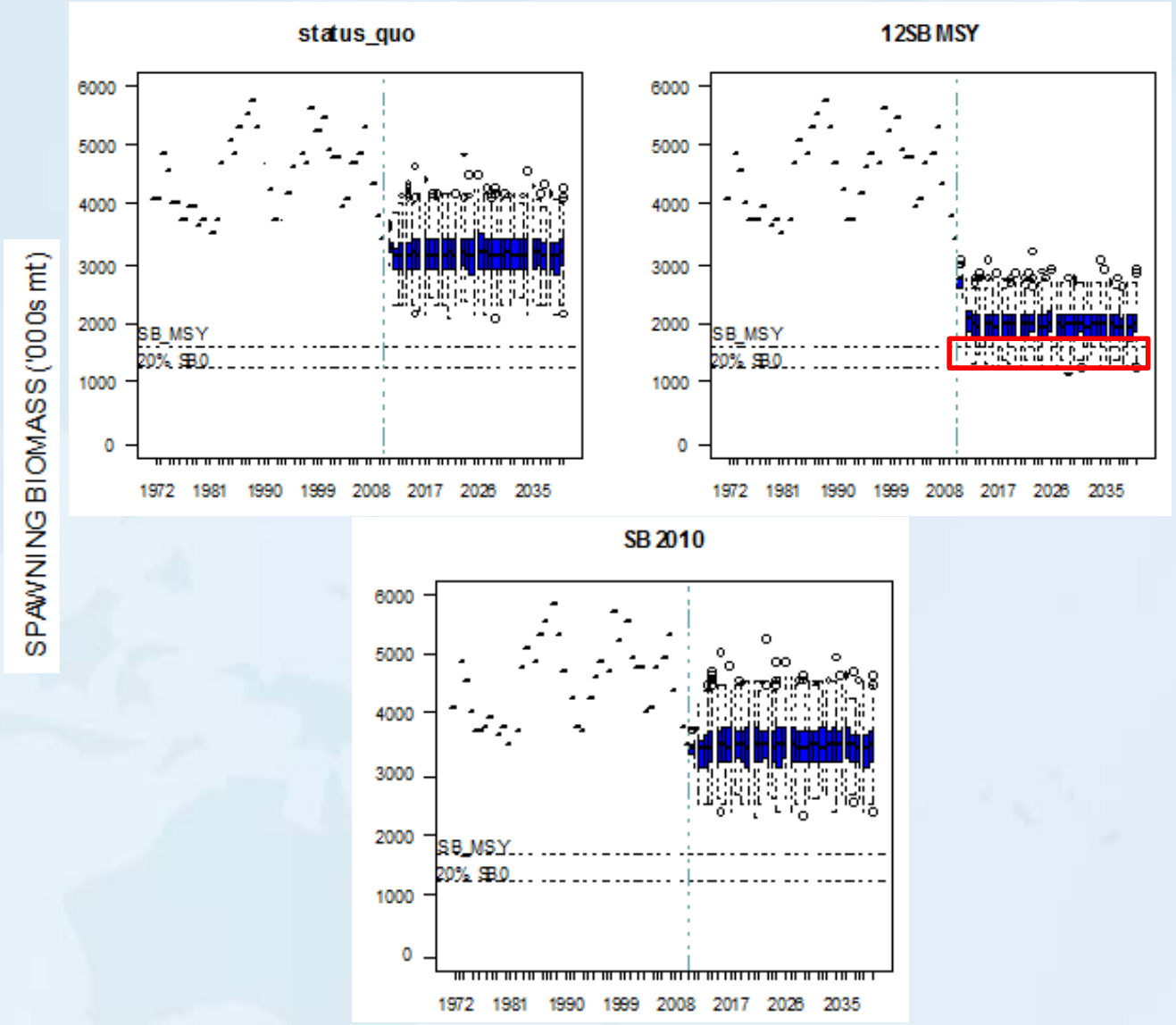
- SC8-WP-02 used the WCPO skipjack stock to illustrate issues to be considered
- **NOT** identifying which TRP is 'best' – defined through Management Objectives

TRP example	
Status quo	(baseline)
$1.2SB_{MSY}$	MEY proxy?
Current (2010) spawning biomass	

Risk

- Does achieving the target on average lead to the limit being breached? If so, with what risk?

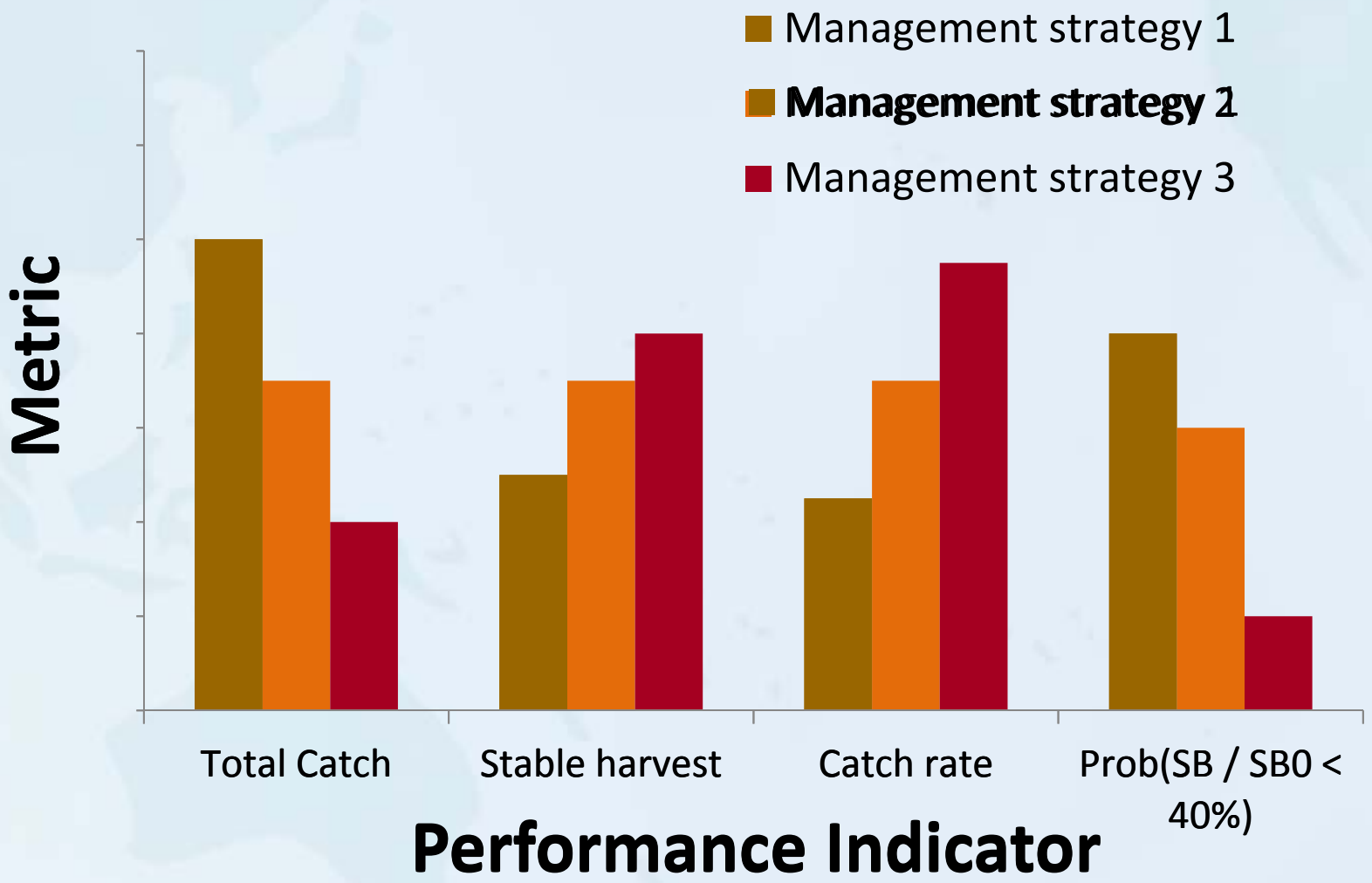




12% chance of falling below SB_{MSY}

- NOTE: uncertainty underestimated here

Quantify Tradeoffs



Trade-offs!

- Increased catch = lower CPUE = more risk
- Increased catch ~ more processing
- Lower CPUE ~ decreased profitability? Lower licence fees?
- Increased risk ~ greater potential for lower recruitments/stock size
- Multispecies trade-offs (target vs ‘bycatch’ status)
- Therefore need Managers to consider which target fulfills the Management Objectives…