# THE 13th SESSION OF THE IPHC Scientific Review Board (SRB013): outcomes, general comments, and specific advice for management strategy evaluation

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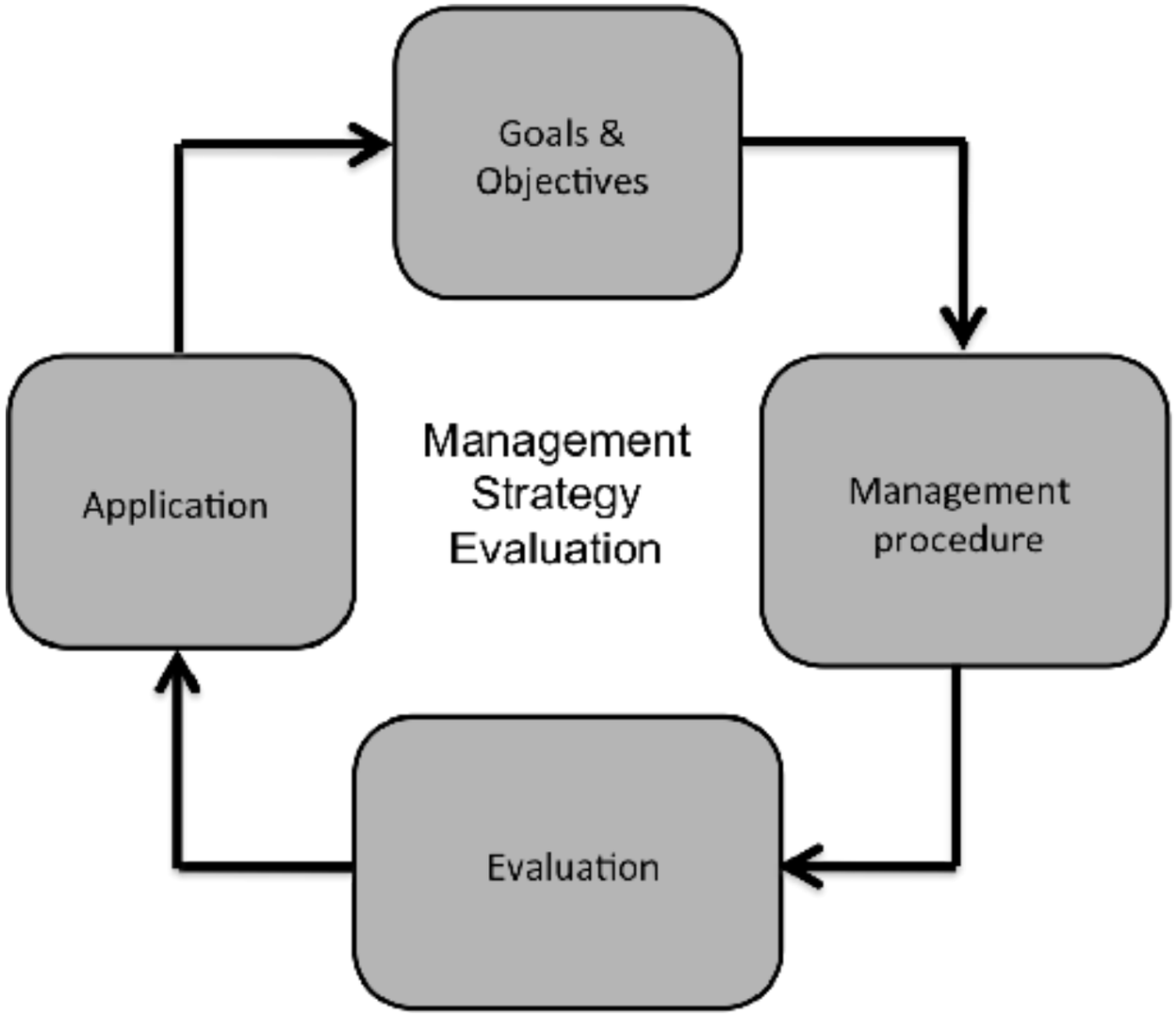
# General comments on MSE process

p22: Commend MSAB on MSE progress related to objectives

p23: MSE is an iterative process: "…it takes 10 years to create an overnight success!"

# MSE is an iterative process: BC Sablefish




Aims to build a scientifically defensible harvest strategy

Adapted over time in response to new objectives, information, and hypotheses

Currently, **5th iteration** of MSE cycle

- 2008 Empirical MPs, SCA, SSPM
- 2011 SSPM
- 2013 SSPM w Floor
- 2017 SSPM no Floor, lower U
- 2020 SSPM, DDM, Juv Avoidance

# General comments on MSE process

p22: Commend MSAB on MSE progress related to objectives

p23: MSE is an iterative process: "…it takes 10 years to create an overnight success!"

p25-26: Proposed objectives adequate for ranking MPs. But, some things to consider

# Focus on ENDS objectives

| Goal | Objective | Measurable Outcome | Probability | Time-frame | Intent |
|---|---|---|---|---|---|
| **Biological Sustainability** | 1.1. Keep biomass above a **limit** below which no fishing can occur | a) Maintain a minimum number ***[spawning potential ratio]*** of mature female Pacific halibut coast-wide | 0.99 | Each year | • Ensure that conservation needs of the stock are met for long-term sustainability with a high degree of certainty<br>• Regularly monitor stock biomass (i.e. continuation and improvement of survey and stock assessment efforts) to detect changes in status and abundance<br>• **Define reference points and harvest targets (e.g. MSY)**<br>• Take a risk-averse approach when the stock is below the threshold |
| | | b) 2) Maintain a minimum spawning stock biomass of 20% of the unfished biomass | 0.95 | Each year | |
| | 1.2. Account for all sizes in the population? | *c)* | | | |
| | 1.3. Reduce harvest rate when abundance is below a threshold | d) Maintain a minimum spawning stock biomass of 30% of the unfished biomass | 0.75 | Each year | |
| | 1.4. Risk tolerance and assessment uncertainty | e) When Limit < estimate biomass < Threshold, limit the probability of declines | 0.05 – 0.5, depending on est. stock status | 10 years | |

**Objective** column is mostly "means objectives" or what to do. It should be "ends objectives" or outcomes that MSAB wants.

**Measurable Outcome** column has more ends objectives.

# Separate Biomass and Fishery objectives

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1.1) mixes biomass and fishery objectives. The **limit** is usually determined based on biological processes. Where fishing stops is an MP question to be evaluated, not an objective.

# Identify key trade-offs

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1.1.a) is a trade-off between SPR threshold and probability that needs to be evaluated in MSE before adopting either one (99% may not be realistic). Timeframe cannot be "each year"

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1.1.b) seems like a more realistic objective than 1.1.a. Still, should examine trade-off between minimum %B0 and probability choices (as well as how B0 is measured).

# Infeasible objective

| Goal | Objective | Measurable Outcome | Probability | Time-frame | Intent |
|---|---|---|---|---|---|
| **Fishery Sustainability and Stability and Assurance of Access – Minimize Probability of Fishery Closures** | 2.1. Maintain an economically sufficient level of catch (i.e., target) across regulatory areas | a) Maintain directed fishing opportunity | 0.95 | Each year | • Ensure that the directed fishery has viable fishing opportunities every year<br>• Provide directed fisheries that are economically beneficial to individual participants, local businesses, and broader communities<br>• Support efforts to allow continued access to the halibut resource within acceptable conservation limits |
| | | b) Maximize [Optimize?] yield in each regulatory area | 0.5 | Each year | |
| | | c) Maintain median catch within ±10% of 1993-2012 average | ? | Within 5 yrs | |
| | | d) Maintain average catch at > 70% of historical 1993-2012 average | 0.9 | Each year | |
| | 2.2. Limit catch variability | e) Limit annual changes in TAC, coast-wide and/or by Regulatory Area, to < 15% | | Each year | |

2.1.b) cannot be maximized "each year", especially in "each regulatory area". Probability is irrelevant here - can only maximize average yield over particular timeframes, e.g., short- vs long-term. "Optimize" would need to be defined. Maximization is normally subject to Biomass Sustainability objectives (see slides 14-15 below).

# Feasibility of objectives

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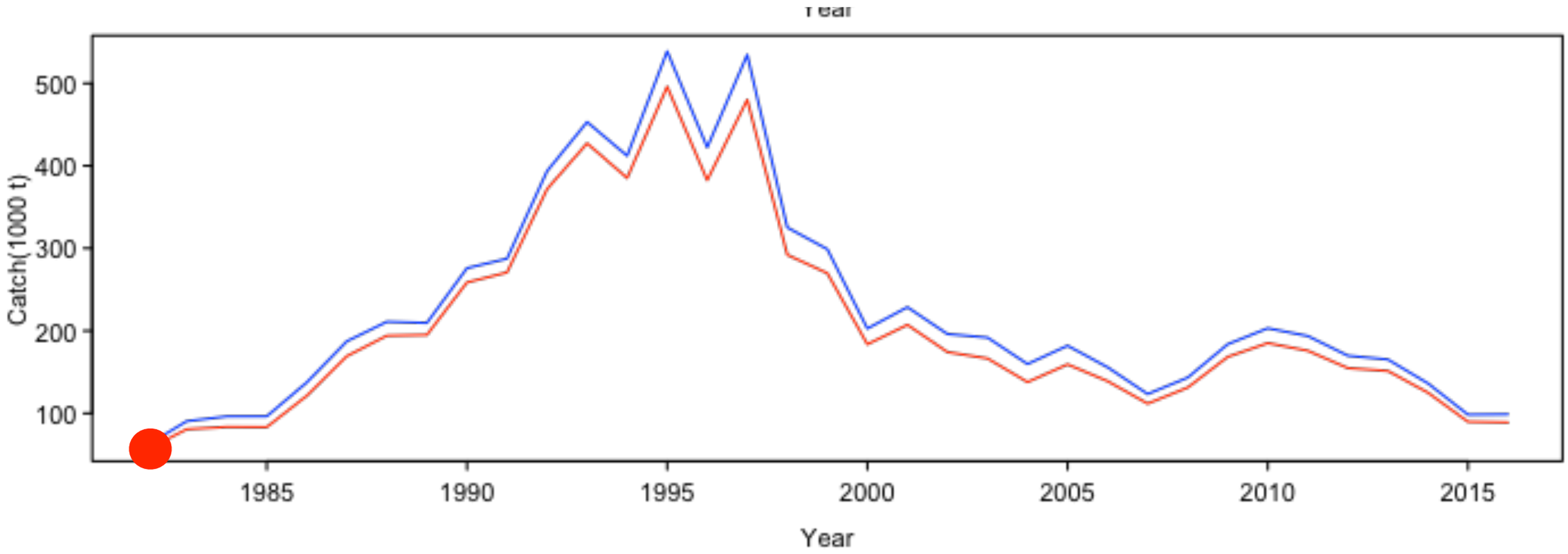
One goal of MSE should be to evaluate how realistic 2.1.c/d are, especially with probability 0.9 in d). A minimum viable catch needs to be realistic given history and stock dynamics (e.g., what is the lowest ever halibut catch?)

# Example: Western Horse Mackerel Catch,1981-2016




Industry-chosen Minimum Catch Threshold is 61,000 t for MSE work…way less than 70% of 1993-2016 average

# Objectives vs TAC constraints

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2.2.e) could either be an Objective or a TAC constraint on MP (i.e., SRB-013 p29.b). Needs to be averaged if used as Objective and "each year" if MP (needs evaluation because limit transfers risk from catch to biomass)

# B.C. Herring Biomass Objectives: Prioritized

1. Avoid the limit reference point (LRP) of 0.30 $B_0$ with high probability over three herring generations, where "high probability" is defined as 75-95% (DFO 2009).

LRP

2. Maintain spawning stock biomass in the Healthy zone, at or above the Upper Stock Reference (USR) of 0.60 $B_0$, with 50% probability over three herring generations.

3. Maintain spawning stock biomass at or above a target biomass level of 0.75$B_0$ with 75% probability over three herring generations (WCVI only).

4. Maintain spawning stock biomass at or above a target biomass level equivalent to the average biomass from 1990-1999, with 75% probability over two herring generations (WCVI only).

USR
options

# B.C. Herring Fishery Objectives: Prioritized

5. **Subject to conservation objectives**, maintain average annual variability in catch (AAV) of less than 25% over three herring generations
6. **Subject to conservation objectives**, maximize the median average catch over three herring generations.

Fishery yield and yield variability objectives normally conditional on satisfying biomass sustainability…this implements the precautionary approach.

# B.C. Sablefish Objectives: Prioritized

1. **Maintain female spawning stock biomass (SSB) above the limit reference point LRP = 0.4BMSY**, where BMSY is the operating model female spawning biomass at maximum sustainable yield (MSY), in 95% of years measured over two sablefish generations (36 years);

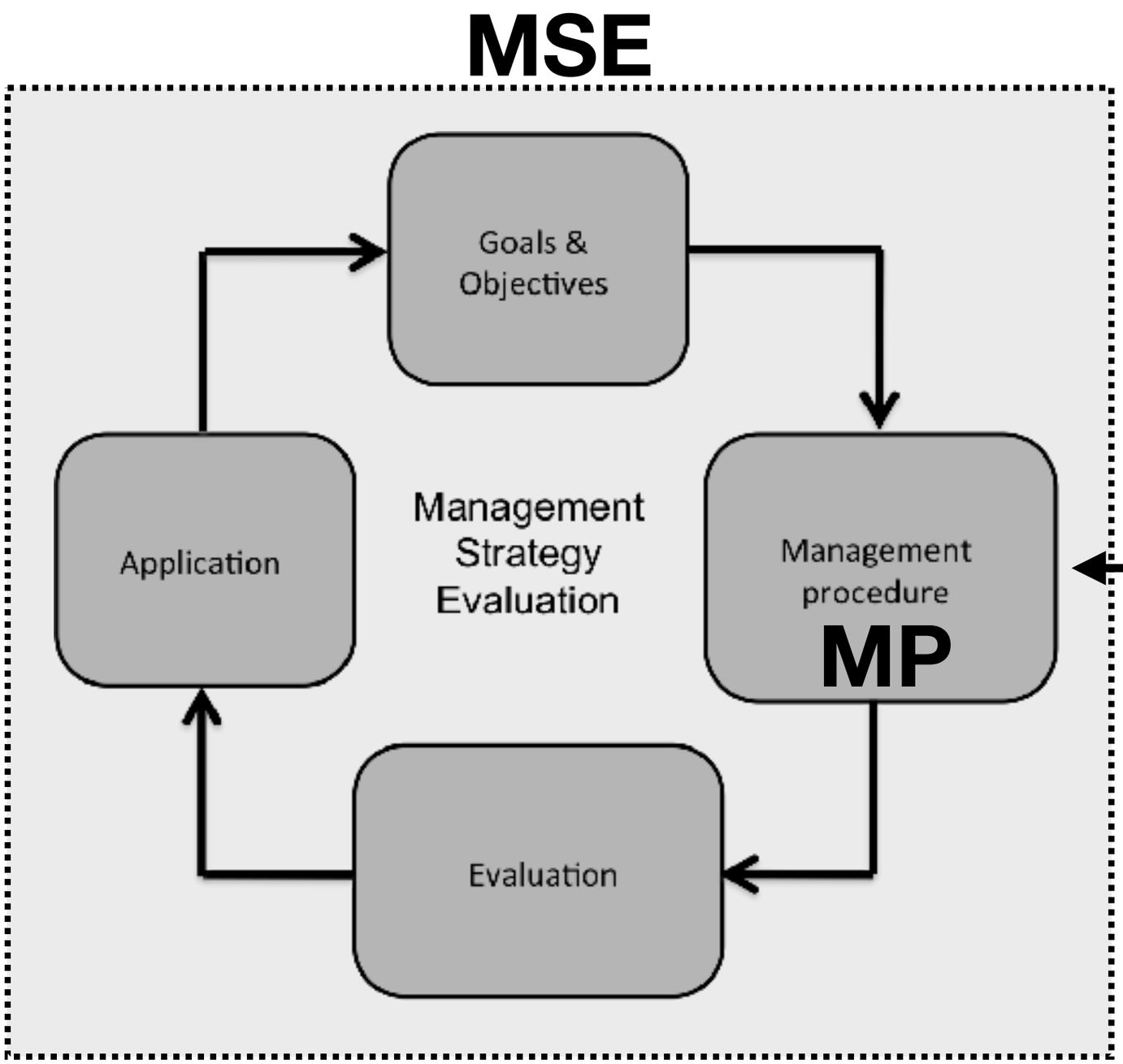
2. When female SSB is between 0.4BMSY and 0.8BMSY, **limit the probability of decline over the next 10 years** from very low (5%) at the LRP to moderate (50%) at BMSY. At intermediate stock status levels, define the tolerance for decline by linearly interpolating between these probabilities;

3. **Maintain the female spawning biomass above (a) BMSY, or (b) 0.8 BMSY** when rebuilding from the Cautious zone, in 50% of the years measured over 2 sablefish generations;

4. Maximize probability that **annual catch levels remain above 1,992 tonnes** measured over two sablefish generations.

5. **Maximize the average annual catch over 10 years** subject to Objectives 1-4.

# SRB-012-p30: Stock assessment and MSE are different

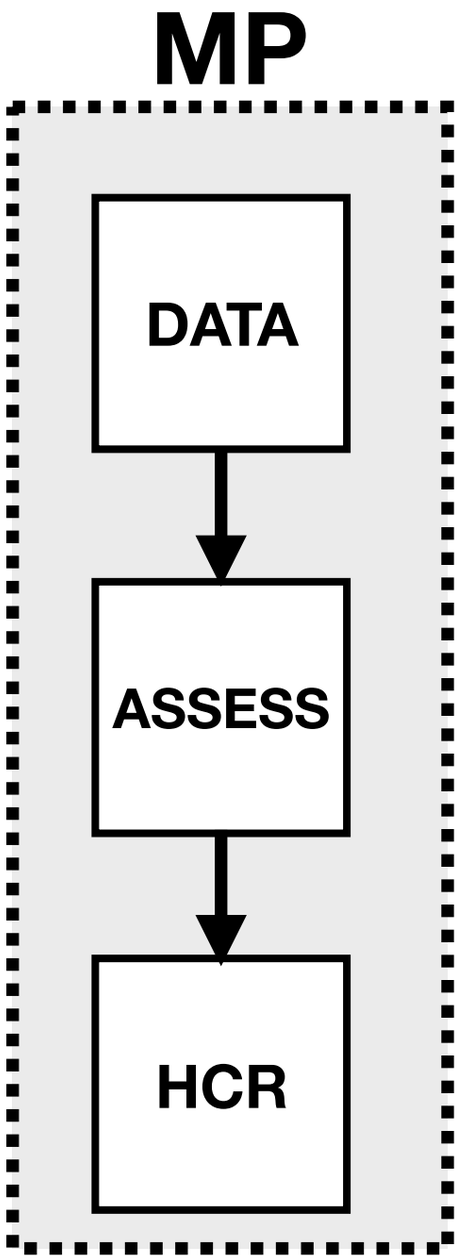



**Stock assessment** is one component of the MP

It cannot assess performance related to Objectives because it doesn't account for feedback over time or alternative OM scenarios

Probabilities from short-term assessment and long-term MSE are not comparable

# SRB-012-p30: Stock assessment and MSE are different



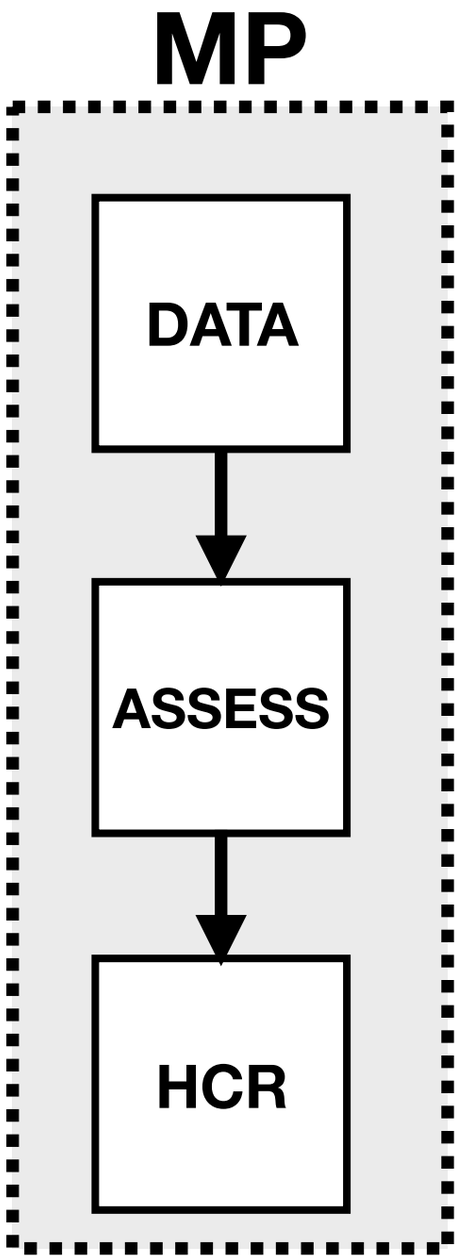

**Data to collect**

**How to analyze it**

**How analysis translates into actions**

An **MP** requires specific choices for Data, Assessment Model, and Harvest Control Rule

# SRB-012-p30: Stock assessment and MSE are different

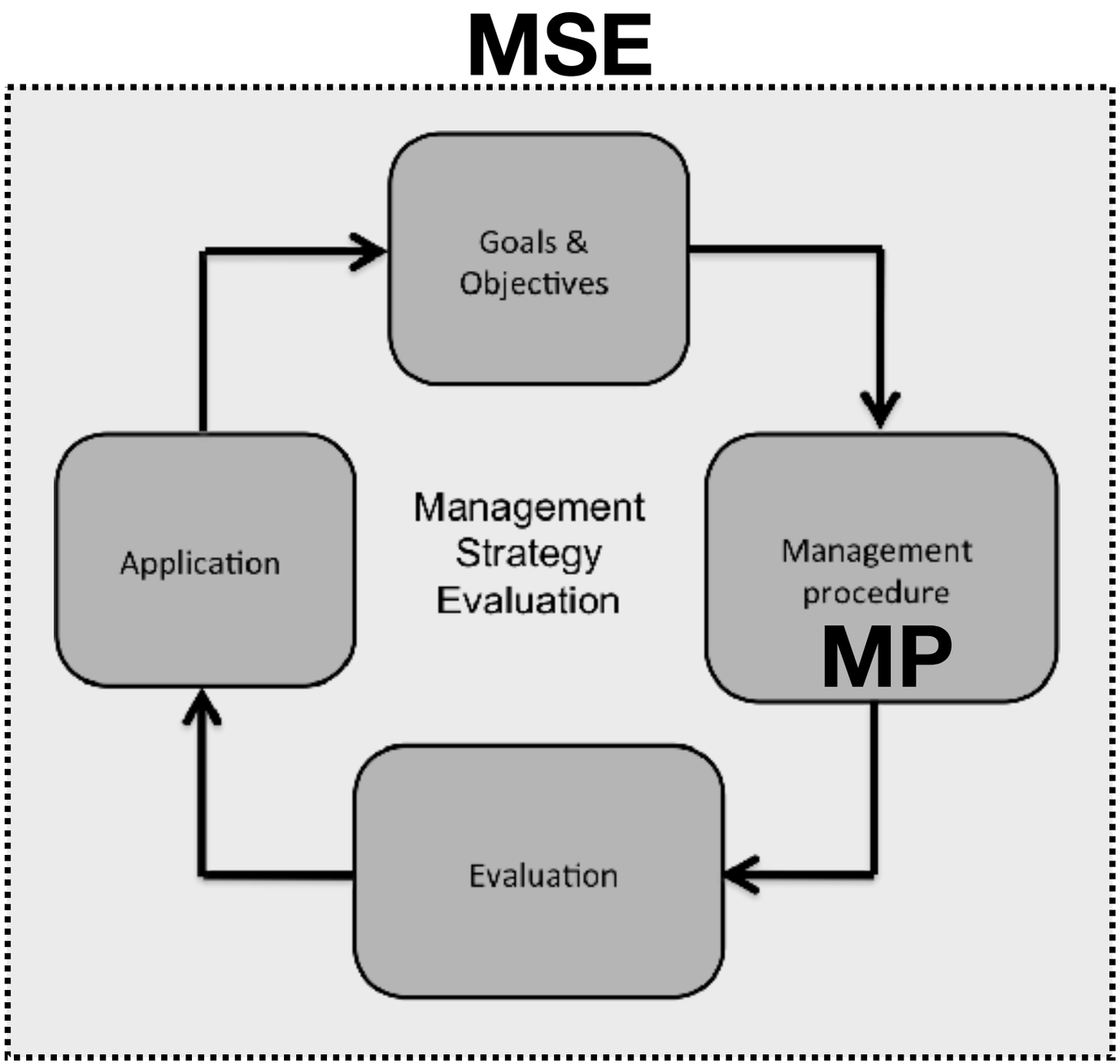



Stock assessments make forecasts to guide specific short-term choices (e.g., TACs)

Forecasts (2-3 yrs) are CONDITIONAL on specific assumptions about models, ensemble wts, and decisions

Long-term forecasts lose reliability because they don't account for the errors and decisions made along the way (feedback)

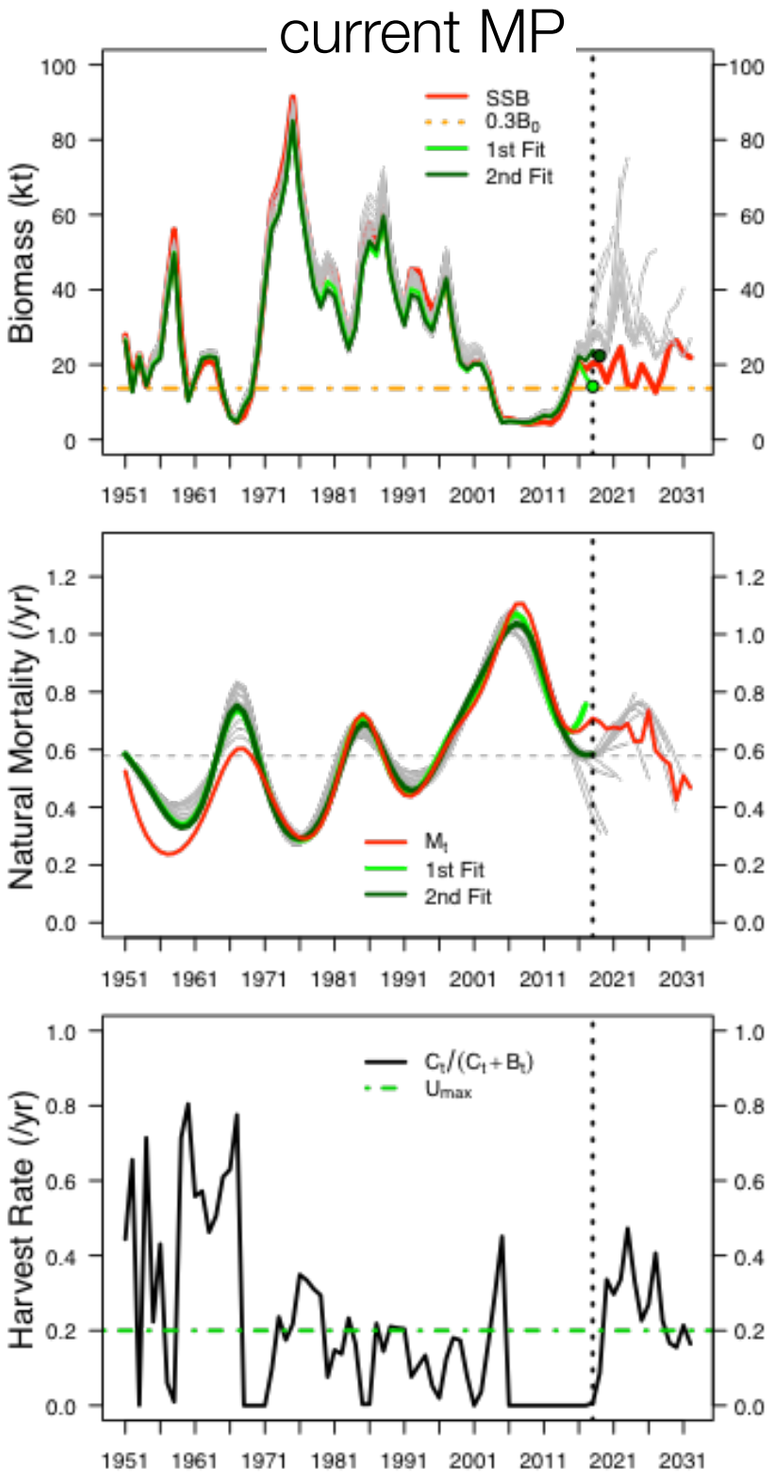
# SRB-012-p30: Stock assessment and MSE are different




**MSE** aims to identify a set of **MP** assumptions and choices that, <u>when repeated over time</u>, will help the fishery achieve it's objectives

Accounts for cumulative impact of errors

# Example simulation replicate: BC Herring




True SSB

Est SSB

**ERROR**: Assessment is consistently wrong…but fits the data great! (not shown)

True $M_t$

Est $M_t$

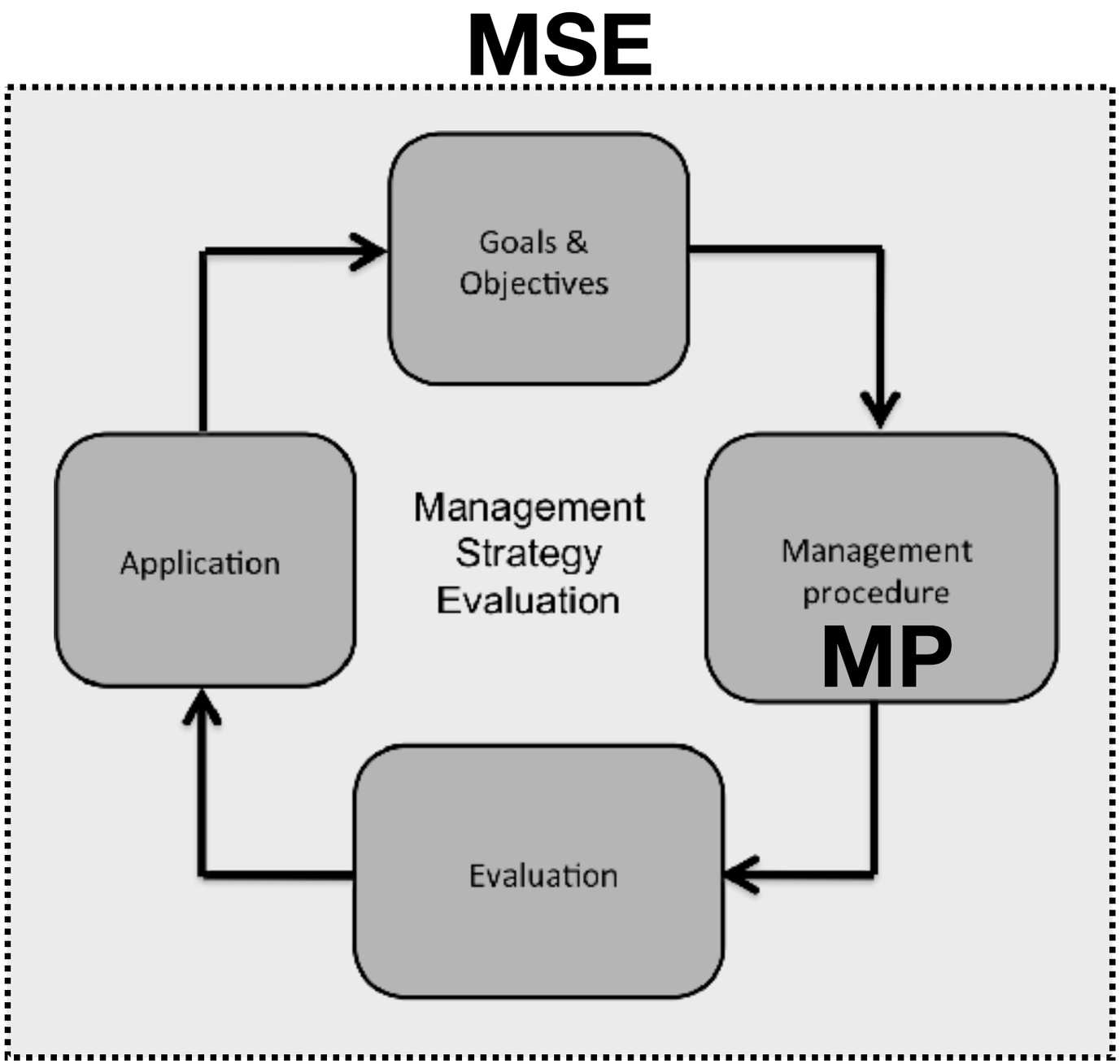
Poor tracking of changing natural mortality goes undetected

**True HR**

Target HR

Realized harvest rate is much larger than shown in stock assessment

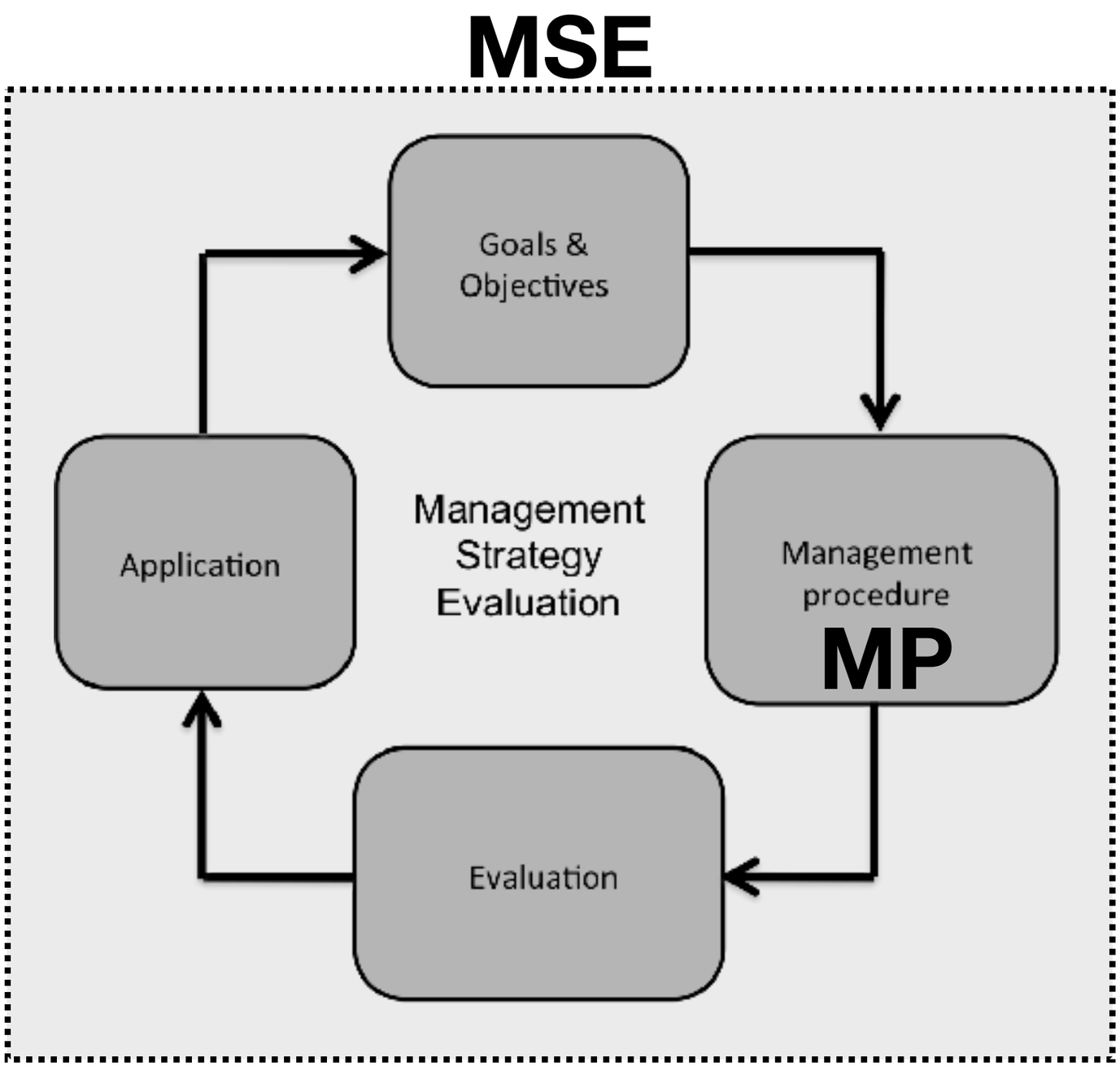
# SRB-012-p30: Stock assessment and MSE are different




**MSE** aims to **rank** MPs based on performance across a range of assumptions and hypotheses

Attempts to be more UNCONDITIONAL than stock assessment

# SRB-012-p30: Stock assessment and MSE are different




MSE is an MP **RANKING** tool

Ultimately, decision is to chose **1 MP**

MSE is NOT a short-term investment advisor