

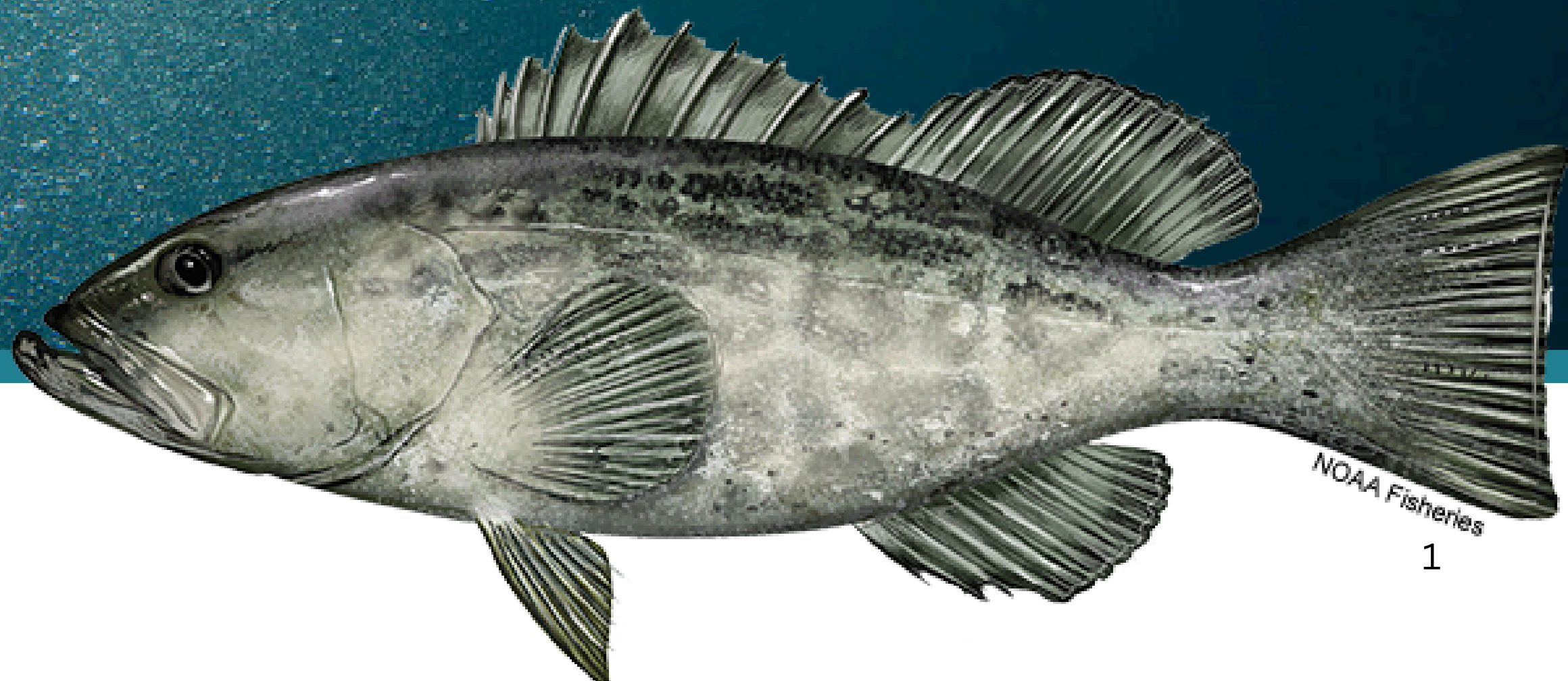
Black Grouper MSE

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October 20, 2026



NOAA Fisheries

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Focus on science as a process, leads to good products!

Part 1: Progress addressing management challenges



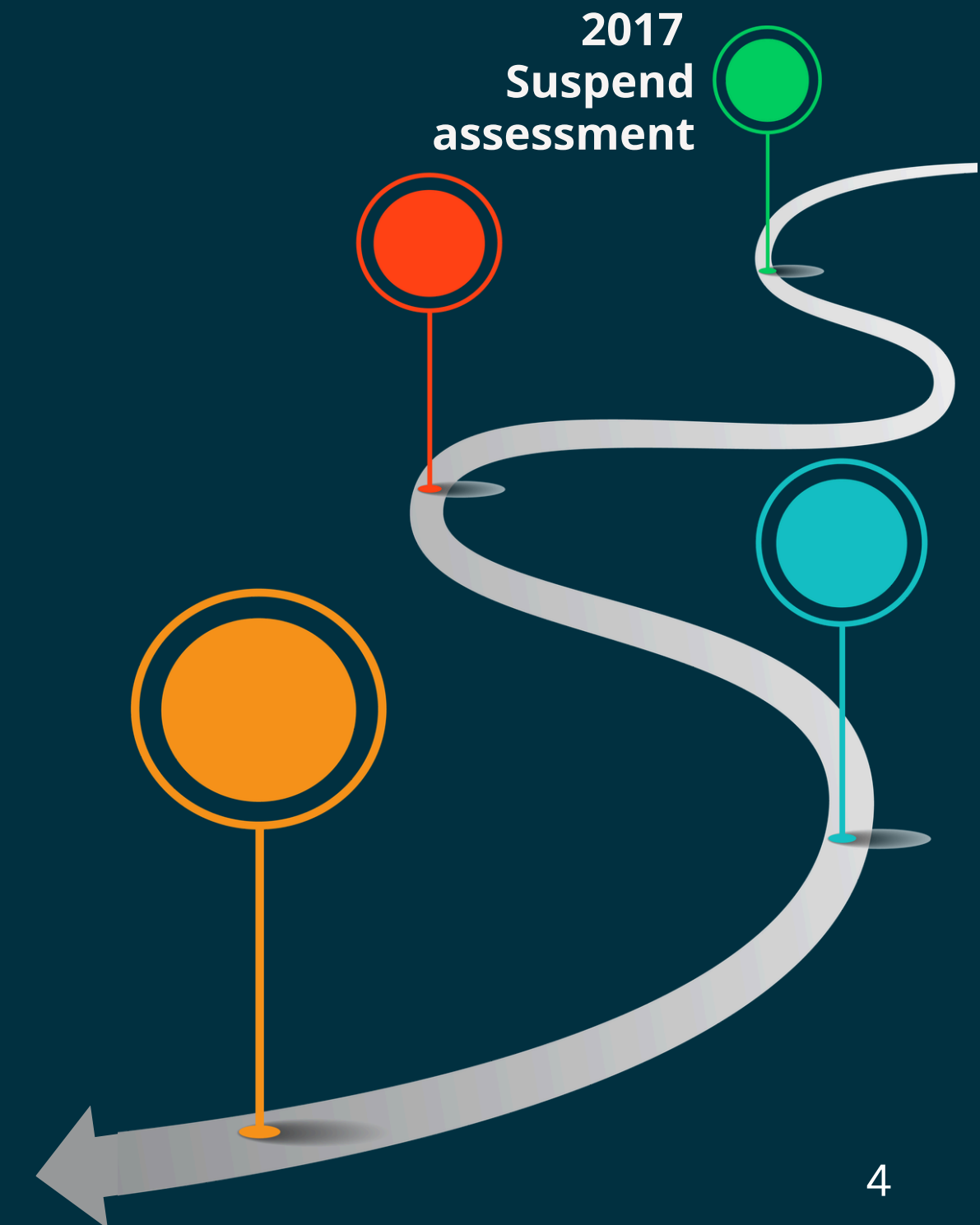
Suspended stock assessment

PART 1: TIMELINE

- In 2017, FWC suspended its stock assessment.
- Information quality called into question, especially related to accuracy and precision of landings.
- Thus, need to explore alternative pathways for provision of management advice.



Biomass scaling
problem



Management regulations for the South Atlantic Fishery

- Permits for commercial fishers.
- ACLs and accountability measures (commercial and recreational).
- Gear types and usage regulations (commercial and recreational).
- Seasonal closure to protect spawners (commercial and recreational).
- Eight deep-water marine protected areas (MPAs) and five spawning special management zones (SMZs) to protect habitats (fishing prohibited year-round).
- Minimum size limits (24 inches in total length) (commercial and recreational).
- Bag limit, aggregate bag, and recreational vessel limits (recreational).

Management regulations for the Gulf Fishery

- Individual Fishing Quota (IFQ) program and reef fish permit (commercial)
- ACLs and accountability measures (commercial and recreational).
- Gear types and usage regulations (commercial and recreational).
- Seasonal closure to protect spawners (commercial and recreational).
- Minimum size limits (24 inches in total length) (commercial and recreational).
- Bag Limit (recreational).

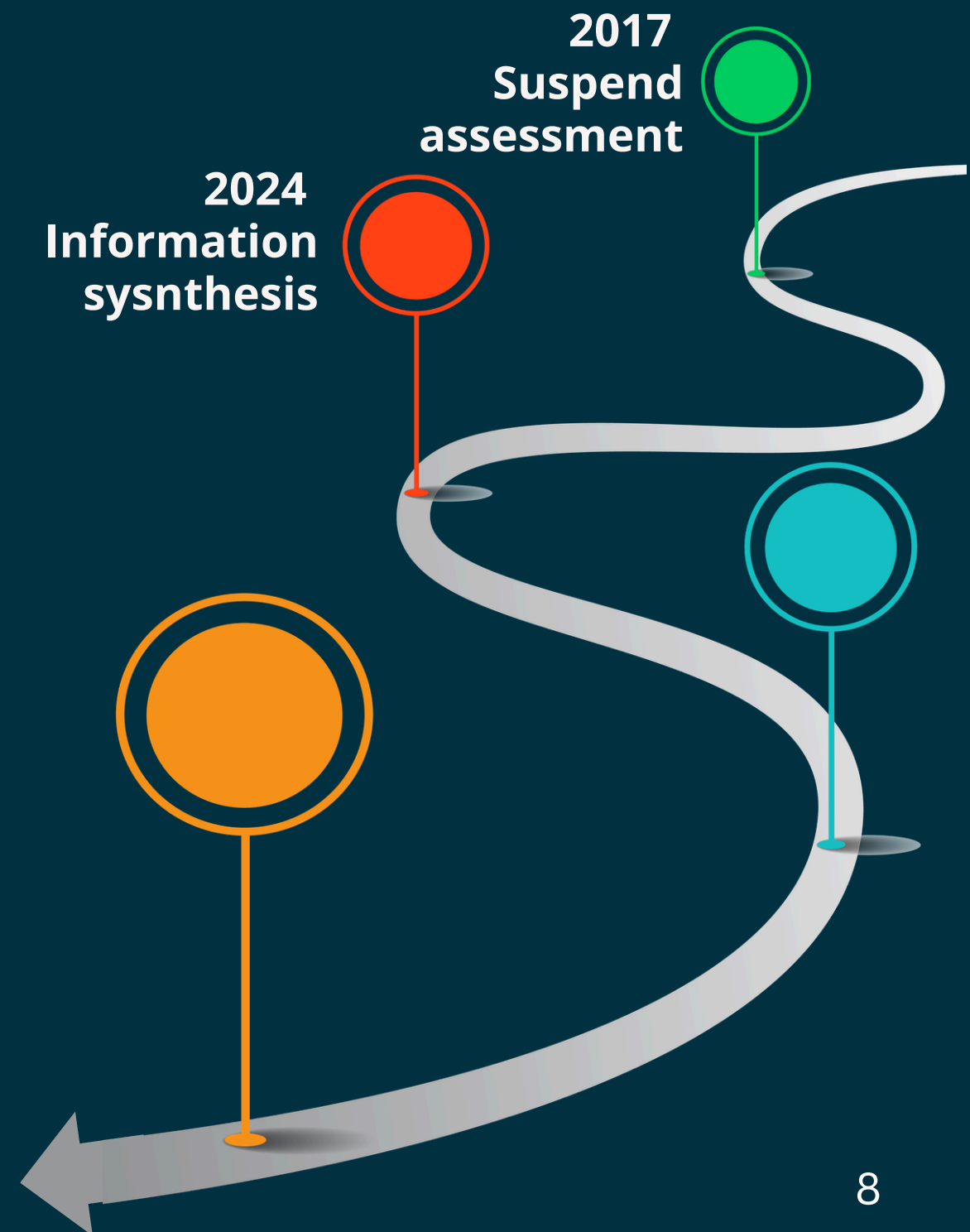
Current decision-making process

- **The South Atlantic Fishery Management Council**
 - Level 4 - No stock assessment ; “only reliable catch stocks” (ORCS).
 - ABC rule: Catch-based, guided by ORCS approach.
- **The Gulf Management Council**
 - Tier 3a - No assessment, landings data available, expert opinion suggest recent landings sustainable.
 - ABC control rule: Catch-based (mean of landings plus SDs).

Information synthesis

PART 1: TIMELINE

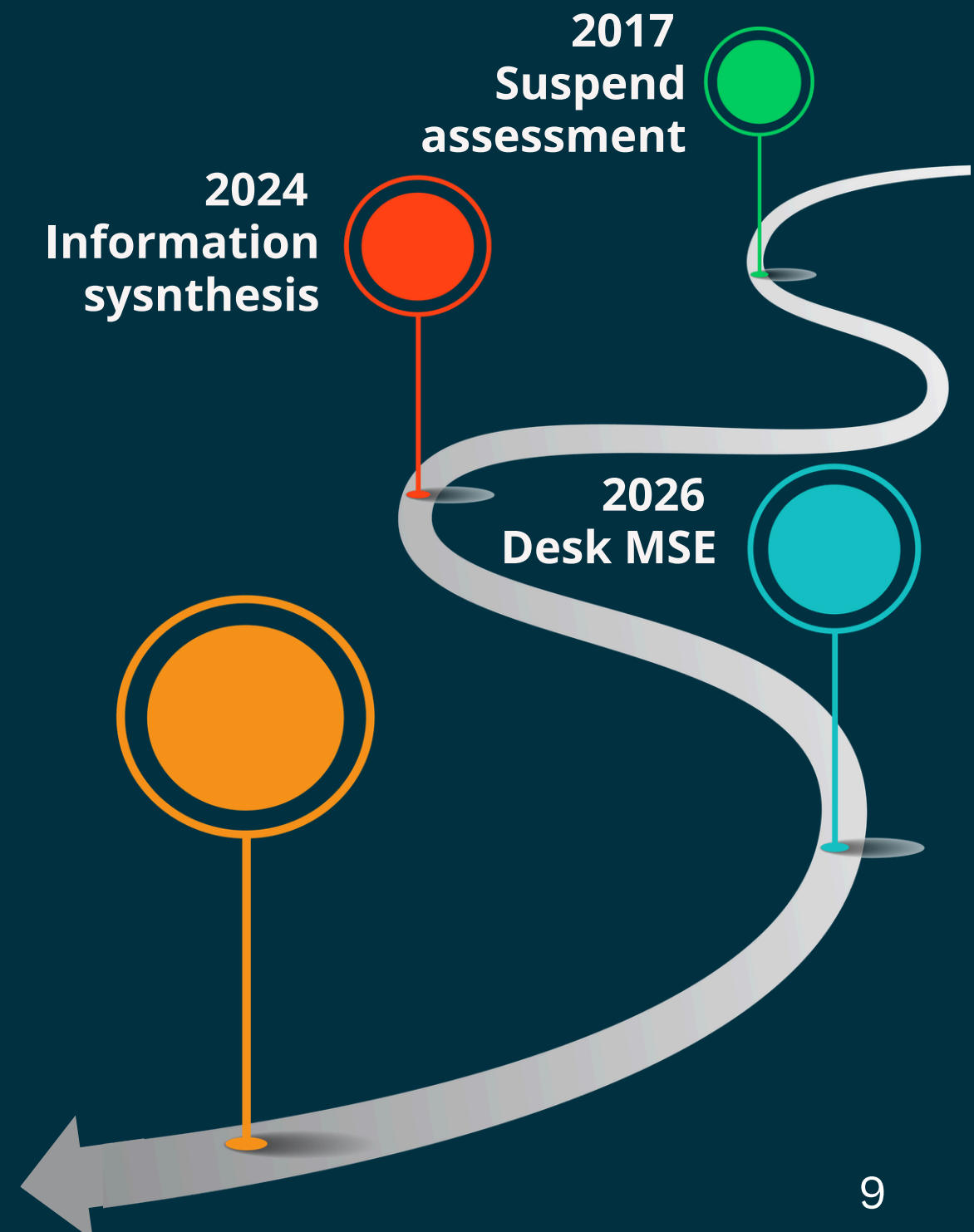
- In 2024, FWC completed an information synthesis.
- Identified data strengths and weaknesses.
- Viability and limitations of an MP approach, with promising results:
 - Several data streams of reasonable quality.
 - Existing MP styles align with available data.
 - *Real-world* examples applied to similar fisheries.
- Met with Gulf SSC to request feedback during Aug. 2024



Desk MSE

PART 1: TIMELINE

- In 2025/2026, FWC completed a desk-based MSE.
- Multi-indicator MPs designed based on the previous information synthesis.
- MSE relied on existing knowledgebase from previous stock assessments & reports.
- Highlighted utility of existing data streams to support adaptive catch limits. (more on this later).



Take aways

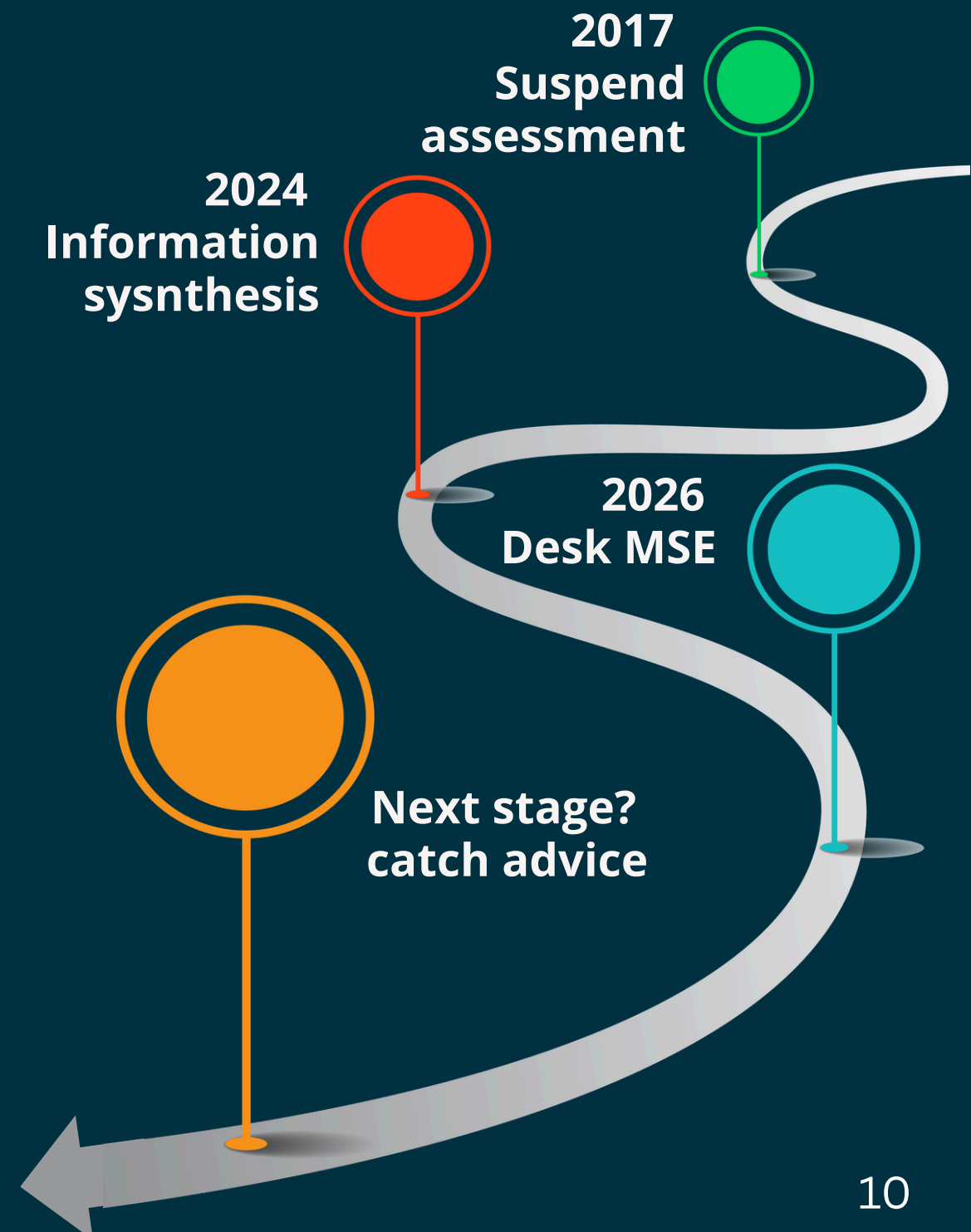
PART 1: TIMELINE

Demonstrated successes:

- Evaluation strengths and weaknesses of data.
- Potential for responsive management without a stock assessment.

Building blocks towards:

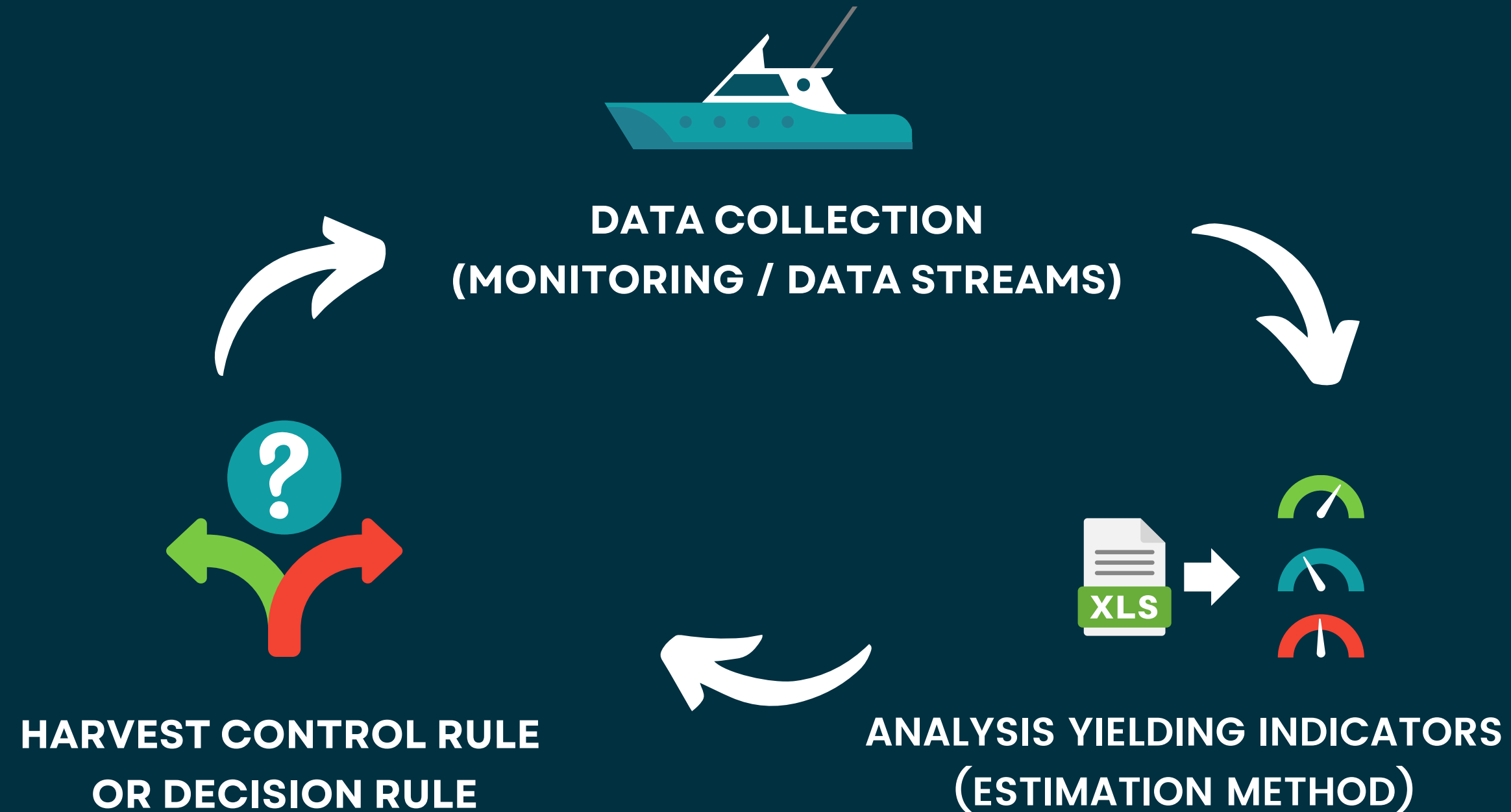
- Refinement of MP(s) via engagement & MSE.
- Achievement of catch advice via an endorsed MP.



Part 2: Design of management procedures (MPs)



Refresher on Management Procedures

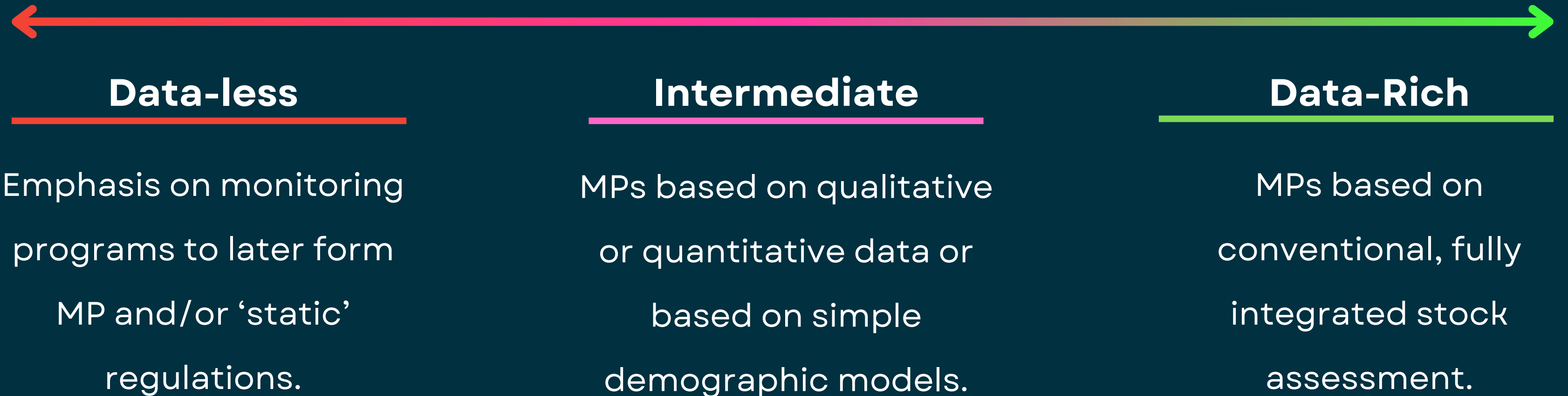


Emphasis on how data collection, analysis
and a decision rule work holistically

Refresher on Management Procedures

MPs exist along a spectrum of complexity

Data limitation is likely to form the basis of proposed solutions



Refresher on Management Procedures

Indicators are observations or estimates of resource condition,
often proxies for variables of interest

Multi-indicator MPs respond to a composite profile resource condition,
where information and contrasting signals are interpreted collectively.

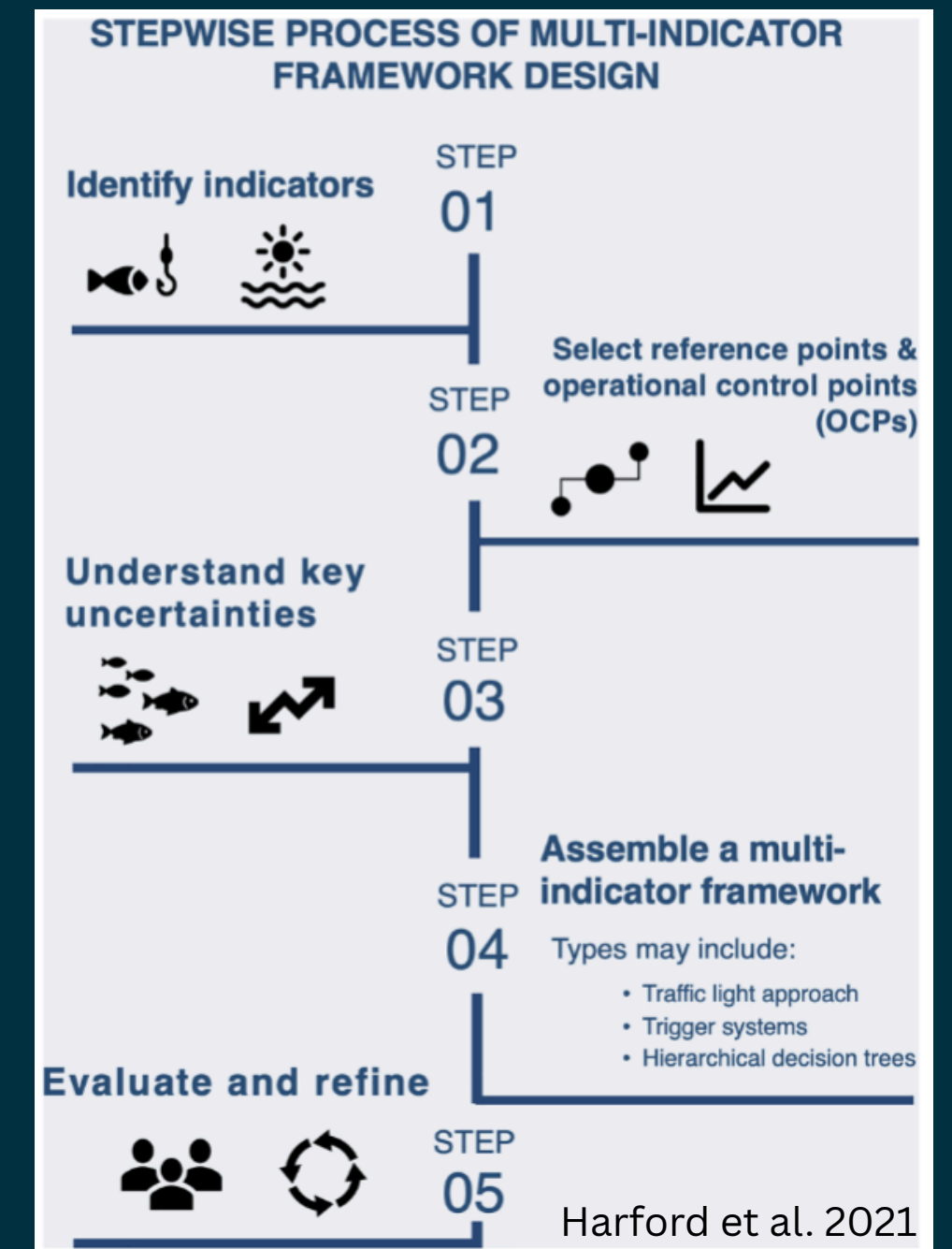
Intermediate

MPs based on qualitative
data, derived from raw
data, or based on simple
demographic models.

Start by bounding the problem

Goal: Design multi-indicator MPs to cope with existing data limitations.

- MPs to rely on near-past data points, based on best available programs for data collection.
- Do not attempt to estimate biomass.
- Be pragmatic regarding management outcomes.
- Create a scientific foundation for MP design.



01: Identify indicators

PART 2: MP DESIGN

Abundance indicators

Screen strengths
and shortcomings

Link indicator attributes
to condition of system

Data stream	Indicator attribute	Linkage
Recreational fishery SRFS	Common lengths: ~61 to 100 cm ~24 to 39 inches	Primarily tracks female sub-adult to adult abundance.
Survey RVC	Common lengths: ~25 to 100 cm ~10 to 39 inches	Primarily tracks female sub-adult to adult abundance.



LENGTH AT 50% MATURITY
85.6 CM / 33.7 IN

LENGTH AT 50% TRANSITION
120.8 CM / 47.6 IN

01: Identify indicators

PART 2: MP DESIGN

Length compositions

Data stream	Indicator attribute	Linkage
Recreational fishery SRFS	Common lengths: ~61 to 100 cm ~24 to 39 inches	Tracks recreational fishing pressure and cohort size.
Survey RVC	Common lengths: ~25 to 100 cm ~10 to 39 inches	Tracks fishing pressure and cohort size.
Commercial fishery Longline	Common lengths: > ~86 cm > 34 inches	Tracks commercial fishing pressure and cohort size.
Catch(N)-weighted recreational & commercial	Annual mean length in the catch.	Tracks fishing pressure.



LENGTH AT 50% MATURITY
85.6 CM / 33.7 IN

LENGTH AT 50% TRANSITION
120.8 CM / 47.6 IN

02: Reference points



- NS1 – Optimum Yield defines reference points as:
 - Status Determination Criteria (SDC),
 - Maximum sustainable yield (MSY), OY, ABC and ACL
 - SDC are MFMT, OFL, and MSST, and their proxies.
- NS1 offers alternative pathways to ABC calculation:
 - SAFMC: scientific uncertainty tiers where ABC calculated without OFL.
 - NEFMC: Thorny Skate fishery managed using abundance to establish ABC.

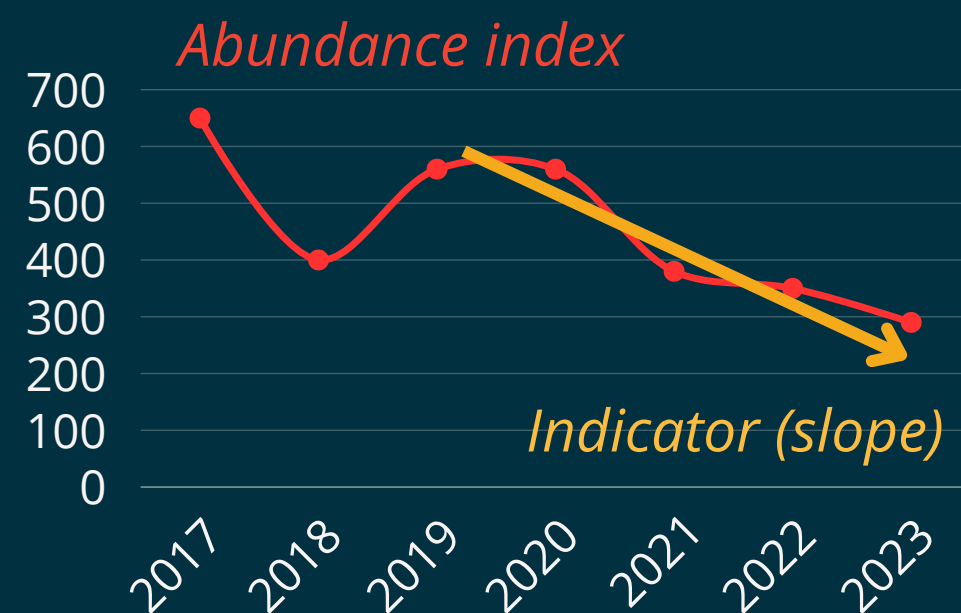
02: Reference points



- Be pragmatic about what is achievable.
- Empirical indicators - *Those having been derived more-or-less from raw data.*

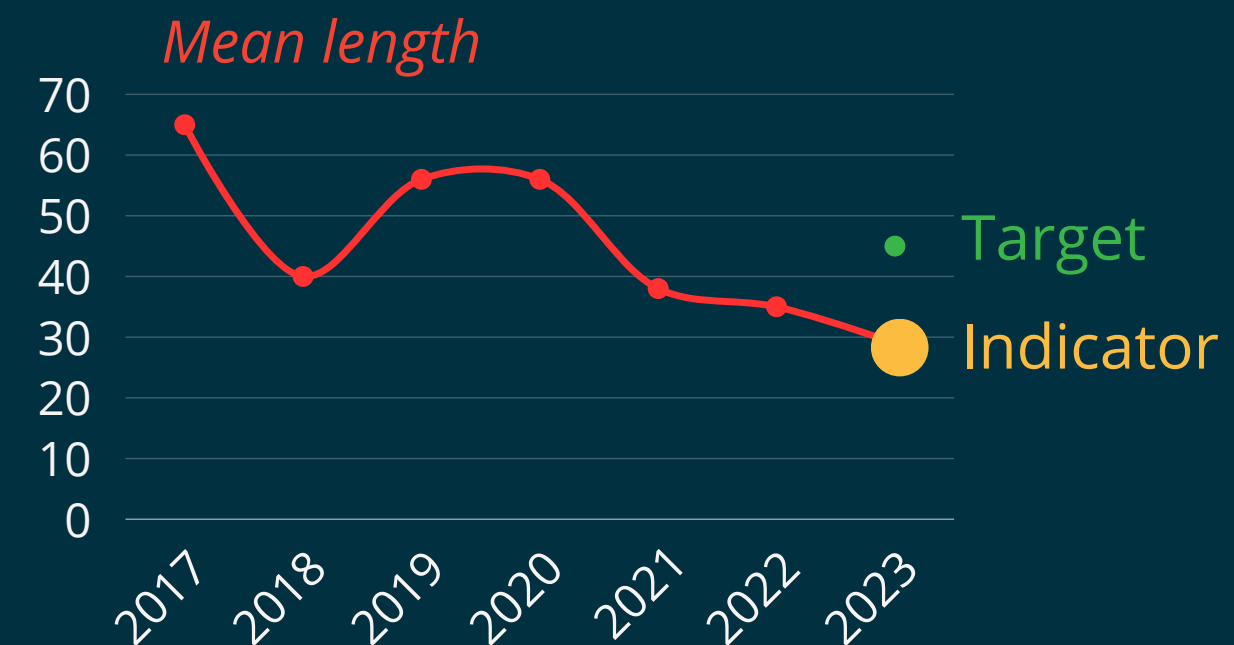
Stability seeking.

Slope trending down, change course to maintain stability



Target seeking.

Mean length low, change course towards optimal harvest.



02: Reference points

PART 2: MP DESIGN



Abundance indicators

Data stream	Indicator attribute	Linkage	Indicator type
Recreational fishery SRFS	Common lengths: ~61 to 100 cm ~24 to 39 inches	Primarily tracks female sub-adult to adult abundance.	Stability. e.g., directional trend.
Survey RVC	Common lengths: ~25 to 100 cm ~10 to 39 inches	Primarily tracks female sub-adult to adult abundance.	Stability. e.g., directional trend, cohort strength.

02: Reference points

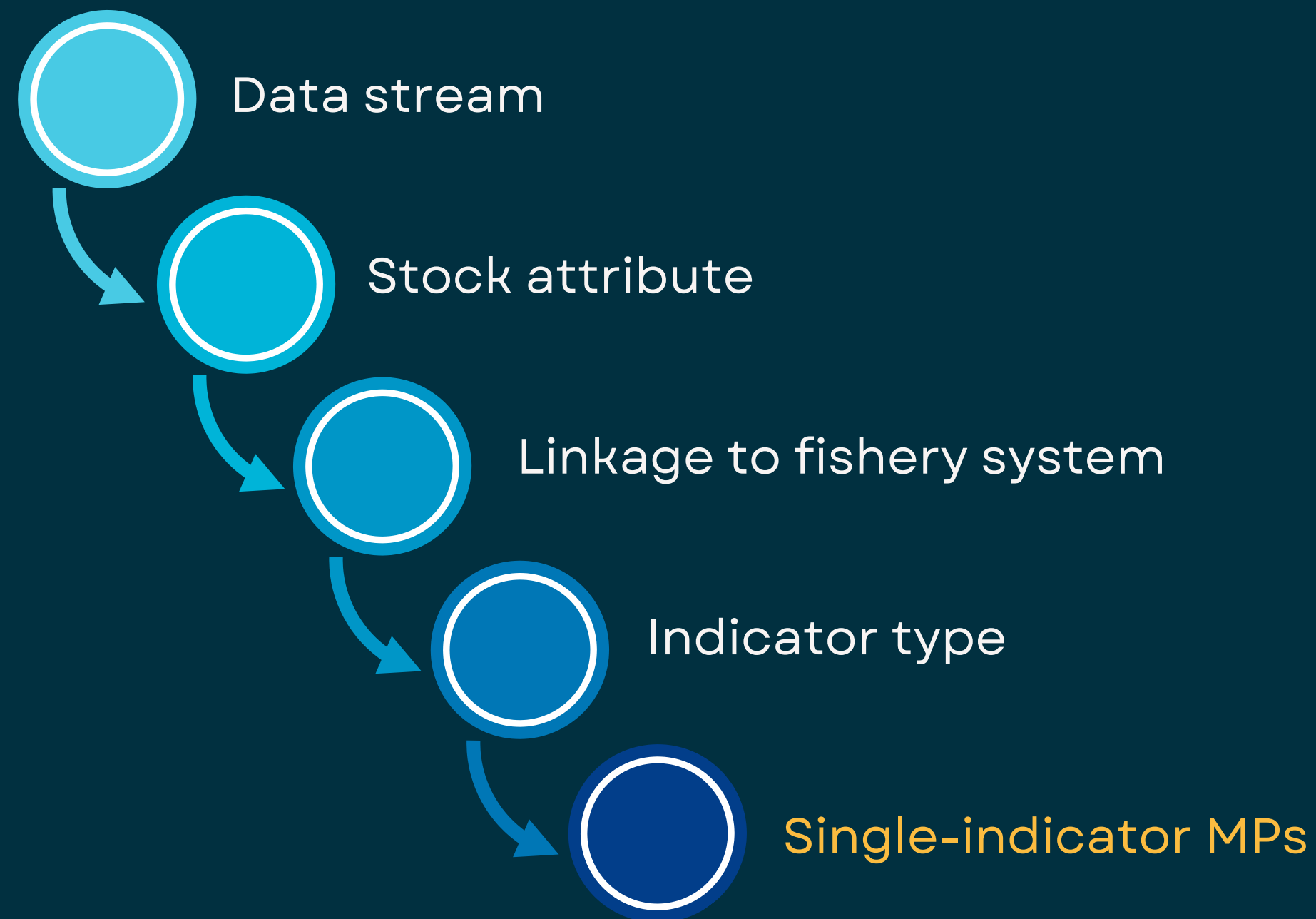
PART 2: MP DESIGN



Length compositions

Data stream	Indicator attribute	Linkage	Indicator type
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Commercial fishery Longline	Common lengths: > ~86 cm > 34 inches	Tracks commercial fishing pressure and cohort size.	Stability. e.g., directional trend.
Catch(N)-weighted recreational & commercial	Annual mean length in the catch.	Tracks fishing pressure.	Target seeking. relative to proxy MSY target

Thus far ...



Desk-MSE

9 single-indicator
MPs evaluated

Provides context
for building
multi-indicator MPs

03: Key uncertainties



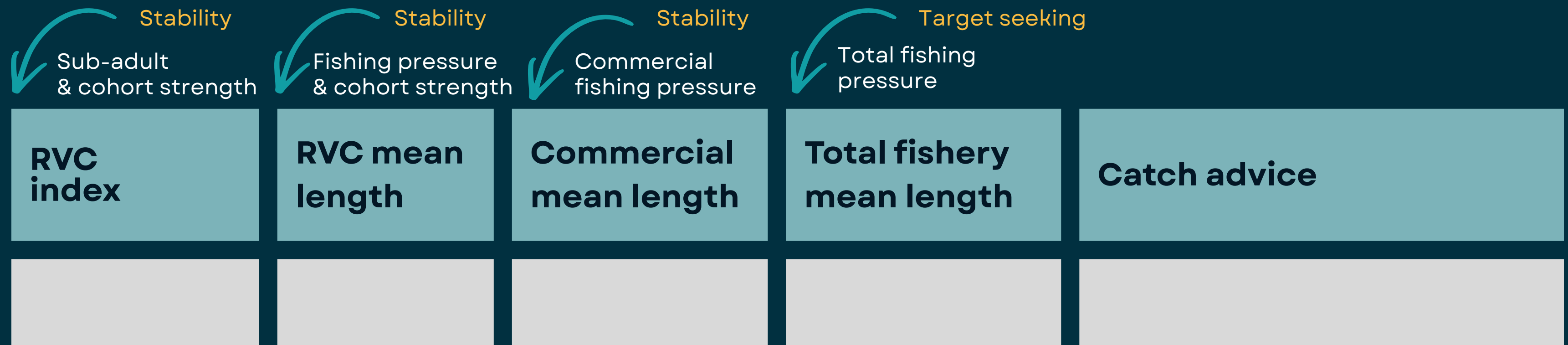
- Two categories prioritized:
 - Imprecision and/or bias in data streams
 - Conditions under which MPs were expected to perform (OMs), such as uncertainty in:
 - Steepness
 - Depletion
 - Recruitment variability
 - Historical fishing mortality trends
- We will return to this in the desk MSE discussion.

04: Assemble multi-indicator MPs

PART 2: MP DESIGN



Conceptual

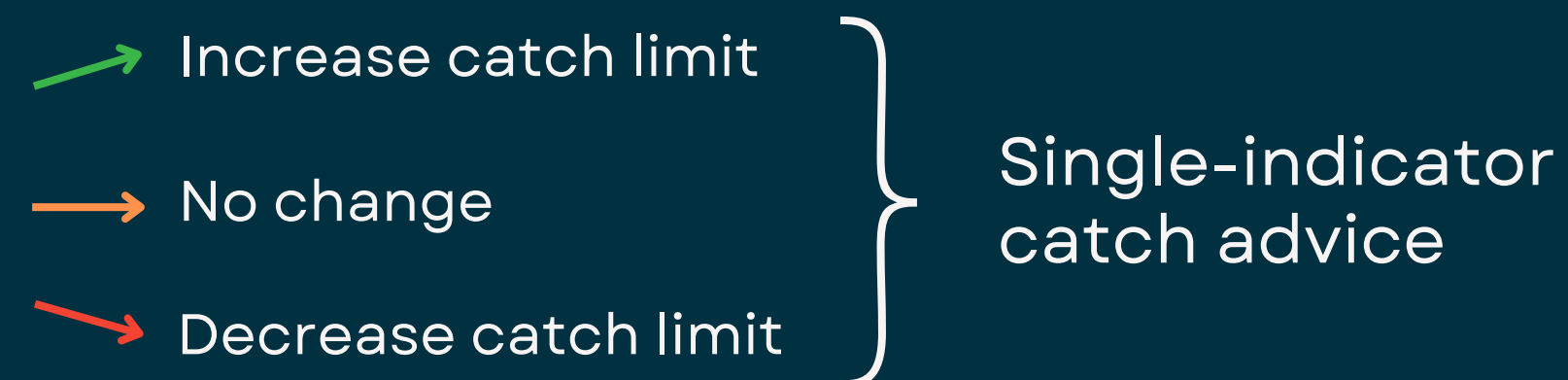
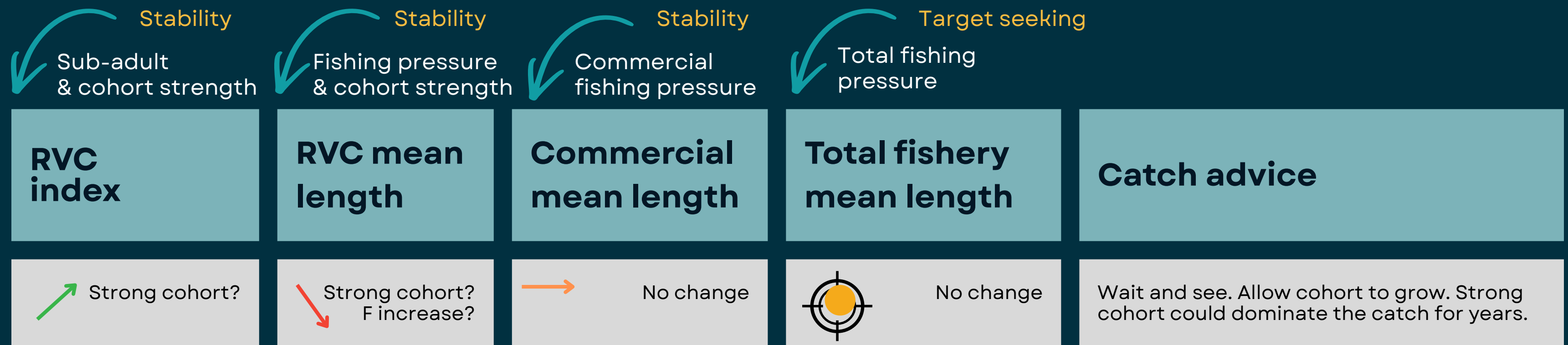


04: Assemble multi-indicator MPs

PART 2: MP DESIGN



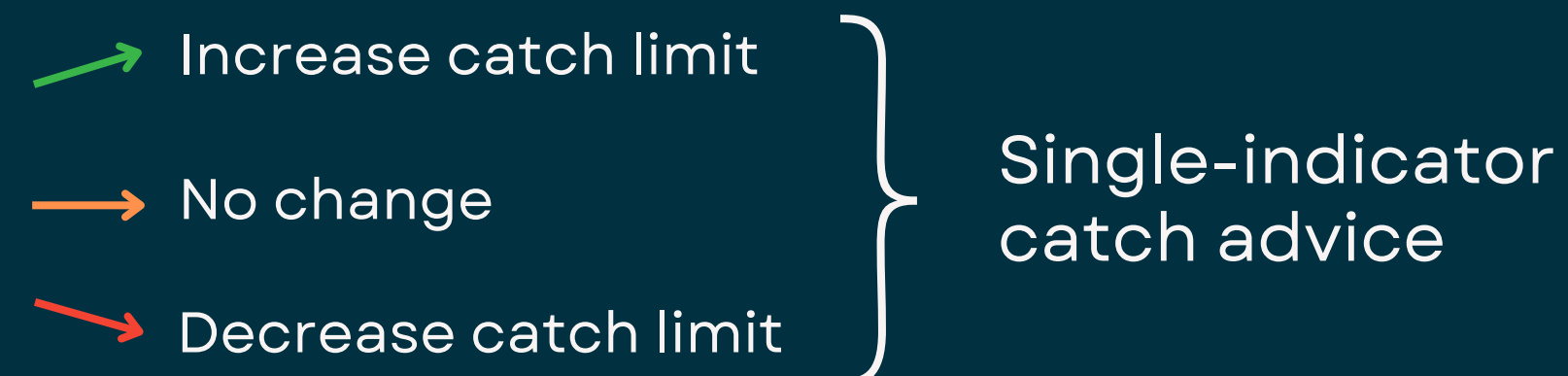
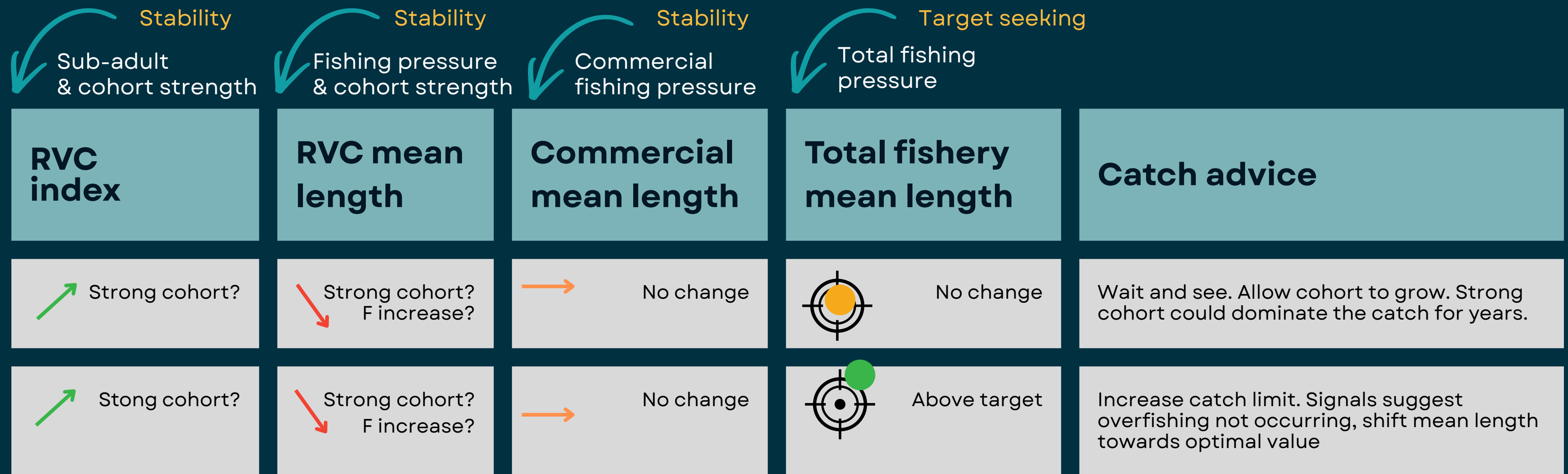
Conceptual



04: Assemble multi-indicator MPs

PART 2: MP DESIGN

Conceptual



Multi-indicator MPs respond to a composite profile resource condition, where information and contrasting signals are interpreted collectively.

- Combination of stability-seeking and target-seeking indicators is useful:
 - While sometimes antagonistic, act as guardrails where data precision is low.
 - Target-seeking move stock towards SPR of 0.3, but for long-lived species stability indicators slow the process.
 - Stability-seeking avoids over-shooting targets due to cause-effects lags in length-based indicators.
 - Tracking cohort strength could be a virtue, as could delaying catch limit increases to produce larger individuals.
 - Worthwhile tracking mean length in adult stage (commercial fishery) relative to other indicators.

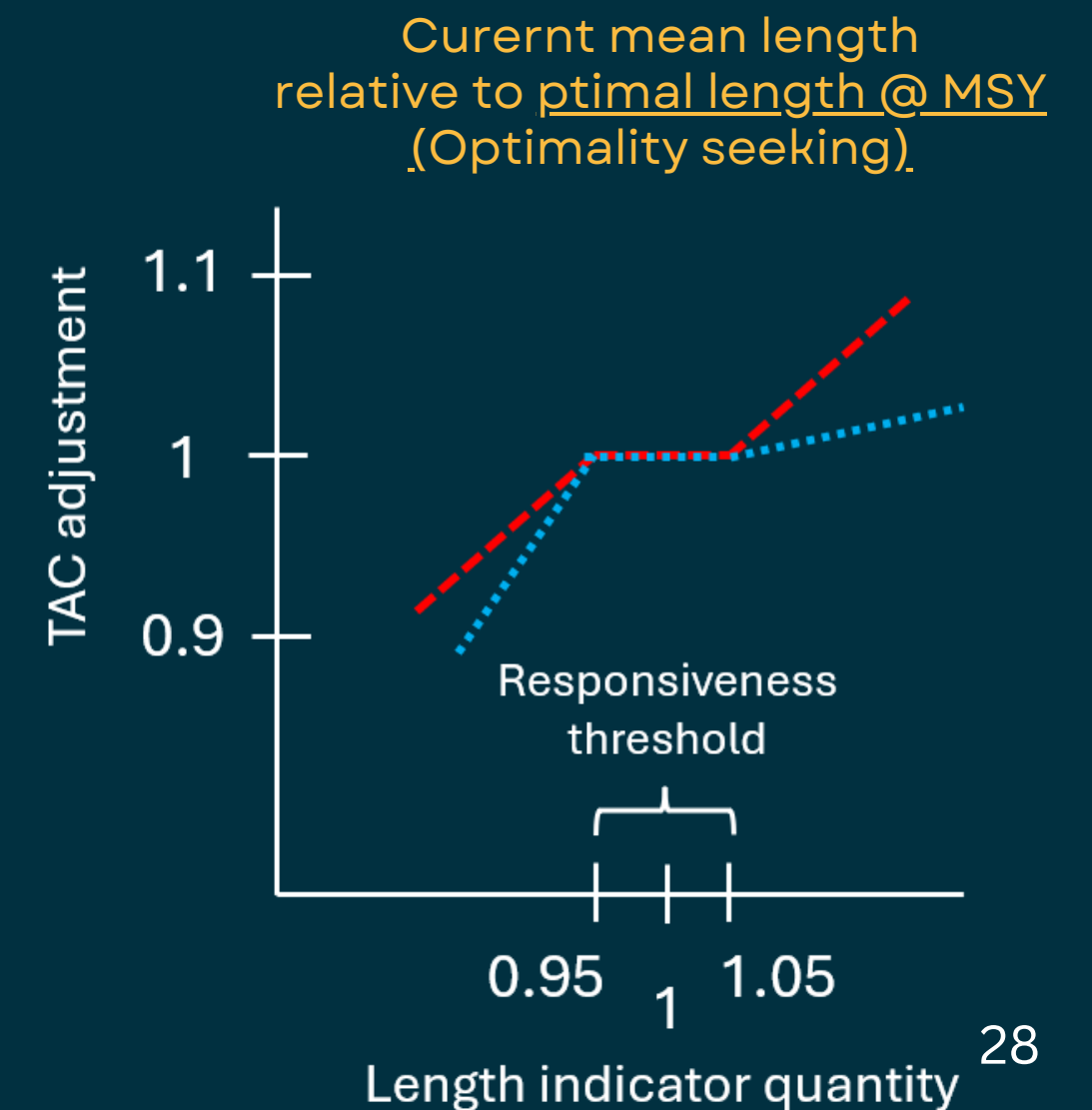
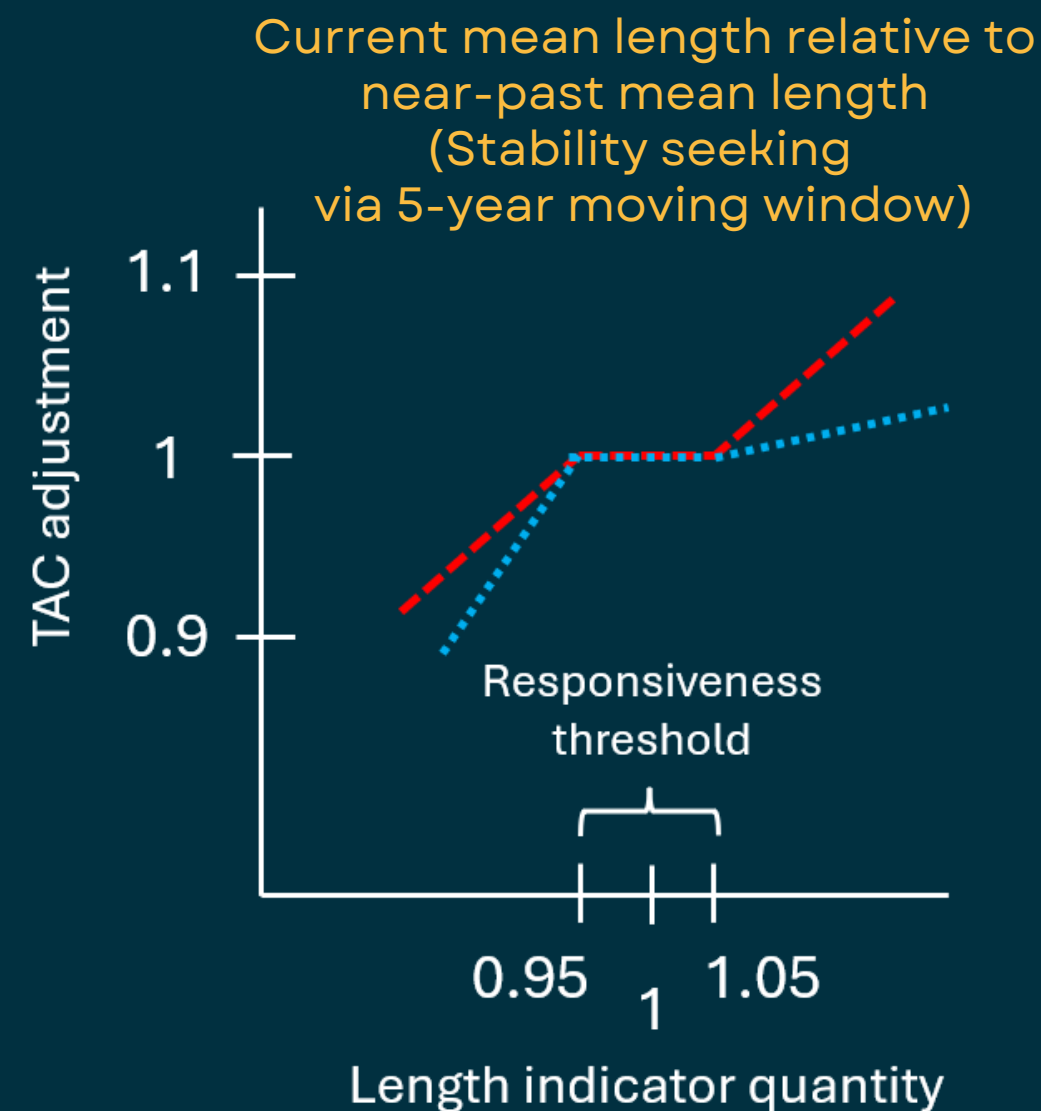
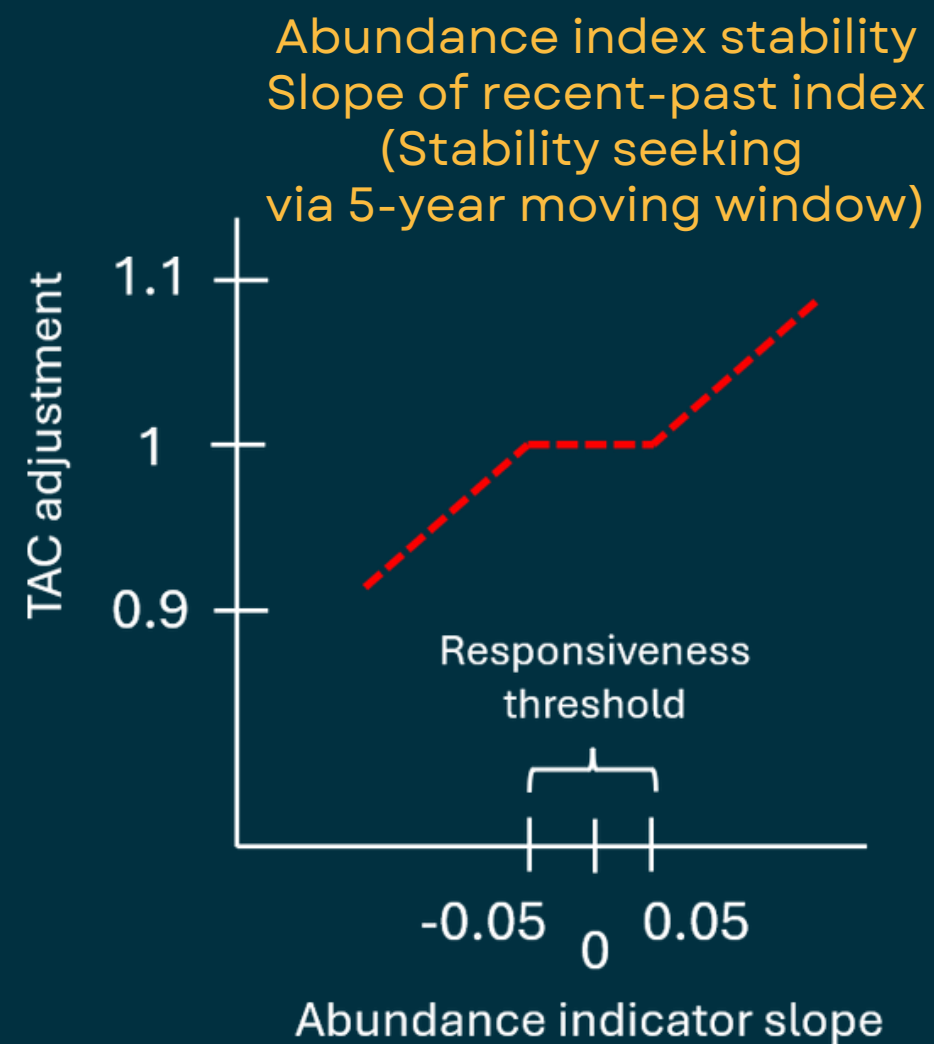
04: Assemble multi-indicator MPs

PART 2: MP DESIGN



Algorithm for catch advice

- 1 Calculate adjustment for each indicator



04: Assemble multi-indicator MPs

PART 2: MP DESIGN



Algorithm for catch advice

2

Calculate previous catch limit

- Moving average of previous 11-year average. Why?
- Approximate cohort exposure time to recent-past catches.

3

Combine multiple indicators to calculate new catch limit

$$\text{New catch limit} = \text{Previous} \times \text{Adj}[1] \times \text{Adj}[2] \times \text{Adj}[3] \times \text{Adj}[4]$$

- Each indicator has a multiplicative effect on new catch limit

4

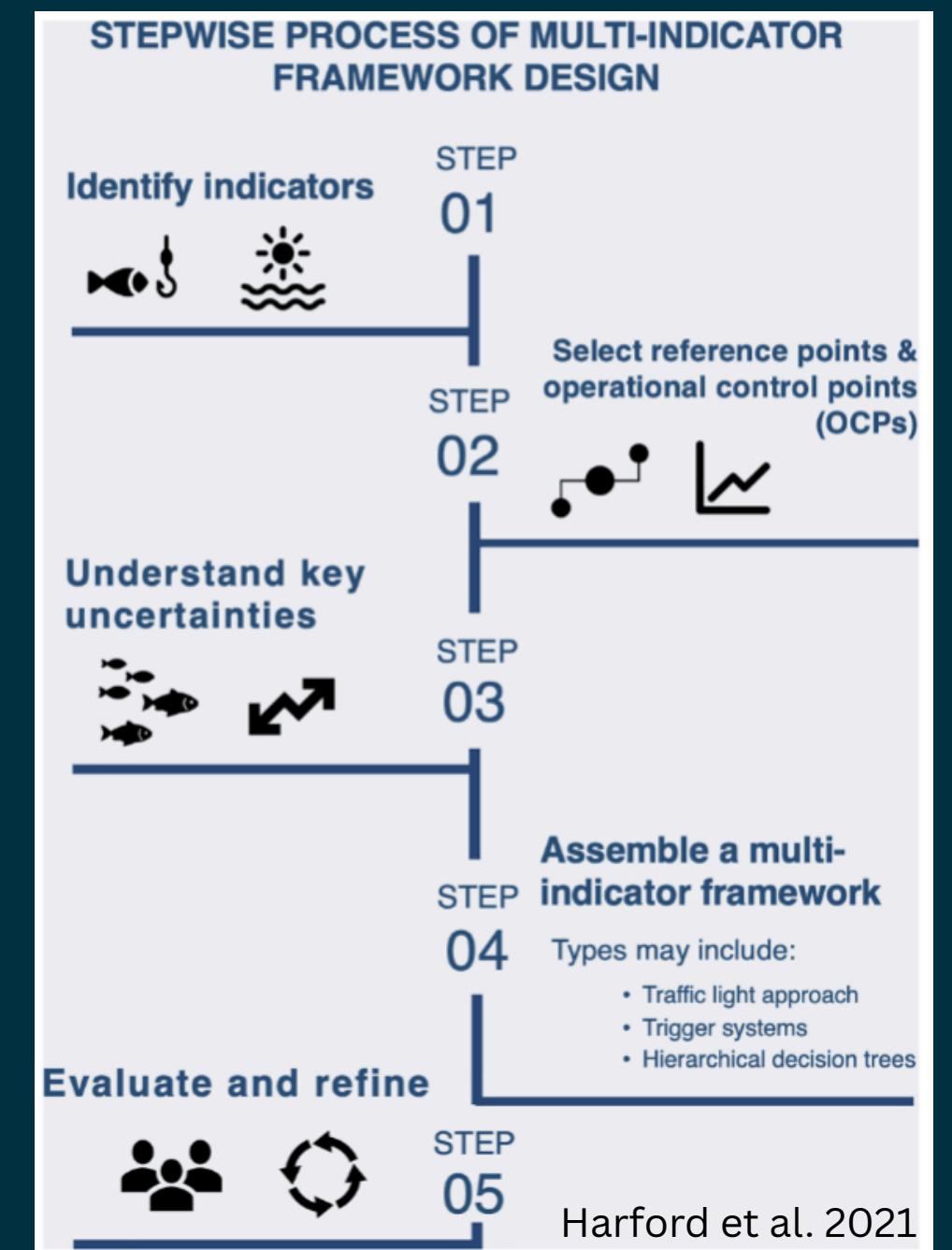
Apply stability clause

- New catch limit cannot change by more than +/- 10%

Take aways

Demonstrated successes:

- A scientific process for MP design.
- Pragmatic, promoting stable stock, nudged slowly towards MSY.
- Now feasible to set catch limits (6 multi-indicator MPs).



Part 3: Desk MSE



A refresher on MSE

How is the MSE process is applied to Black Grouper?

OPERATING MODEL

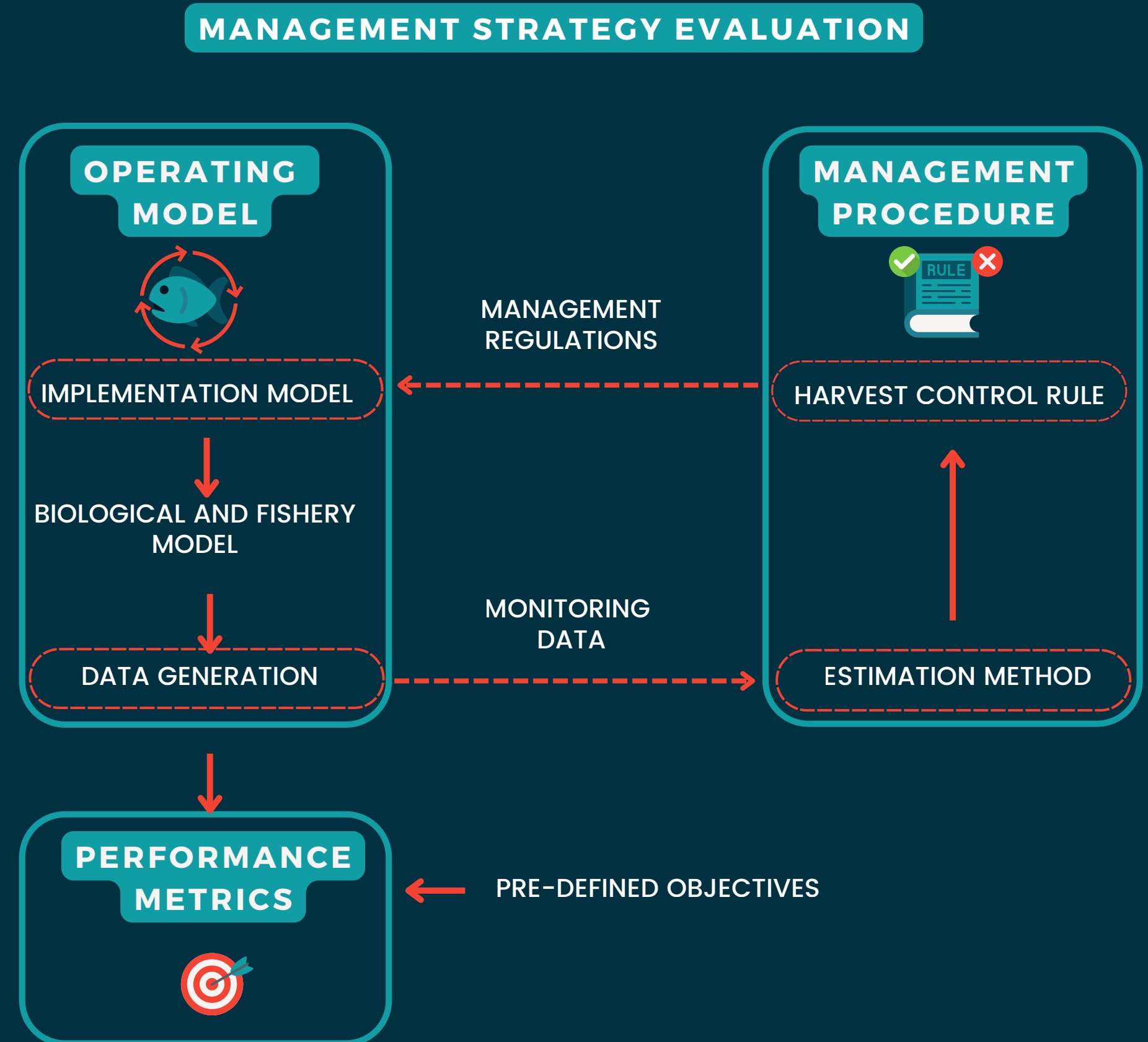
A mathematical-statistical model used to simulate a representation of the fishery system and its monitoring programs.

MANAGEMENT PROCEDURE (MP)

A management procedure is a pre-agreed process defining how a fishery will be managed, with the primary role being to take fishery information and return a management recommendation.

PERFORMANCE METRICS

Statistics that summarize different aspects of the results of MSE to illuminate how well an MP achieves some or all of the management objectives.



Operating model

PART 3: DESK MSE



Step 1: Define the modeling framework

fishSimGTG

- R package by Nature Analytics.
- Open source, on GitHub.
- Age-structured population dynamics.
- Single-stock, multi-fleet.
- Management options examined via MSE.

Applications

- Hawaii, French Polynesia, Canada inland fisheries, Belize, Bahamas, Gulf of Mexico, Guam / Am Samoa.

Operating model

PART 3: DESK MSE



Step 2: Specify inputs

Life history

Parameter (cm, TL)	Notes
von Bertalanffy $K = 0.13$, $L_{\infty} = 136.7$	Recommended by SEDAR 48
Maturity $L_{50} = 85.6$, $L_{95} = 97.0$	Recommended by SEDAR 48
Sex transition $H_{50} = 120.8, 139.2$	Recommended by SEDAR 48
Natural mortality (per year) 0.13 to 0.20	Hamel & Cope 2022, 33 yr max. Uniform uncertainty range

Operating model

PART 3: DESK MSE



Step 2: Specify inputs

Stock-recruit

Parameter	Notes
Steepness	Beta distribution from Shertzer and Conn (2012). Mode of 0.83 50% centered distribution: 0.74 to 0.86
Inter-annual recruitment variation logSD 0.2 to 0.4	Uniform uncertainty range

Operating model

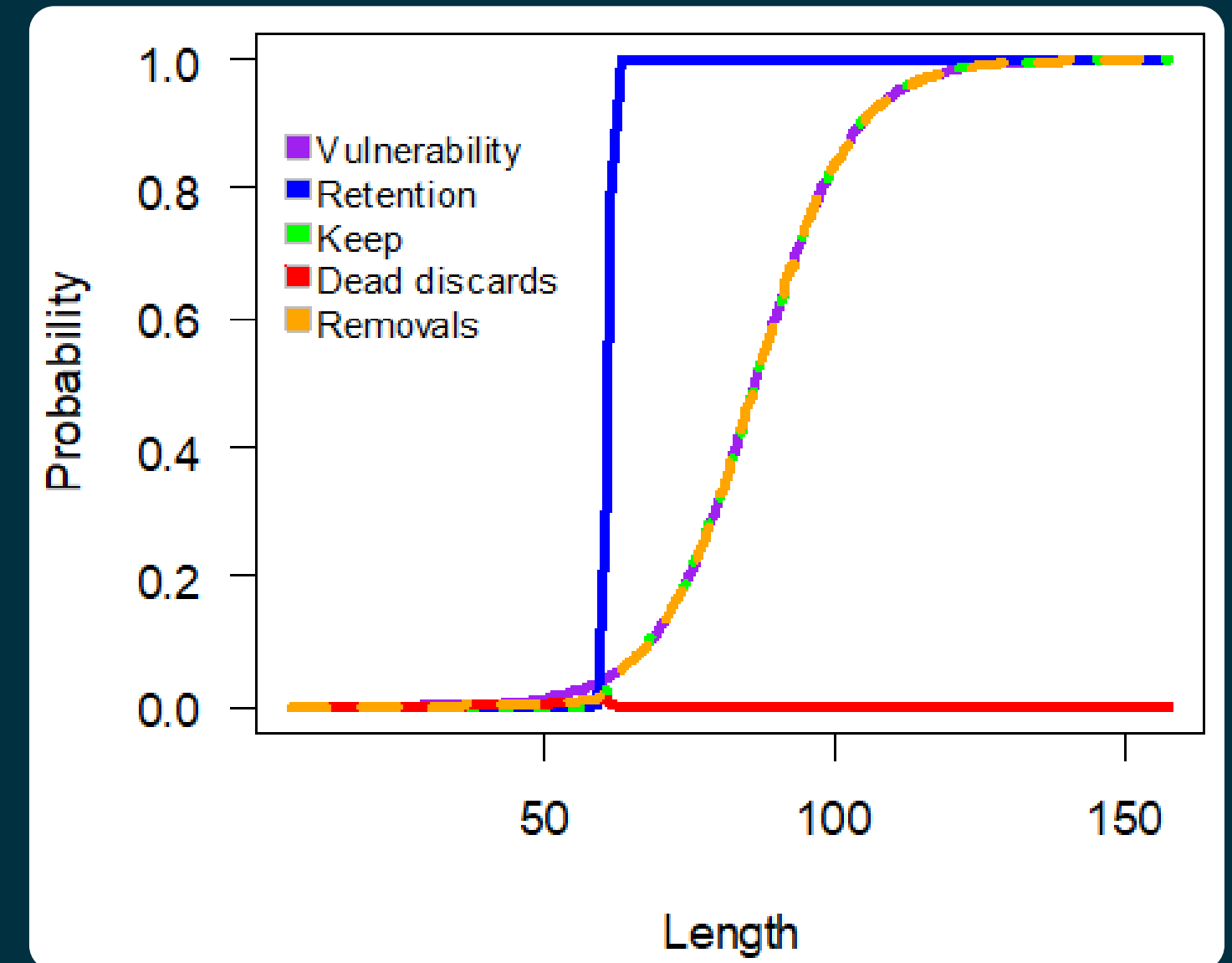
PART 3: DESK MSE



Step 2: Specify inputs

Commercial fishery

- Logistic selectivity: $SL_{50} = 86.3$ cm, $SL_{95} = 110.8$ cm
- Full retention at 61 cm (24 inches min. size limit)
- Discard mortality 37.5%, recommended by SEDAR 48



Operating model

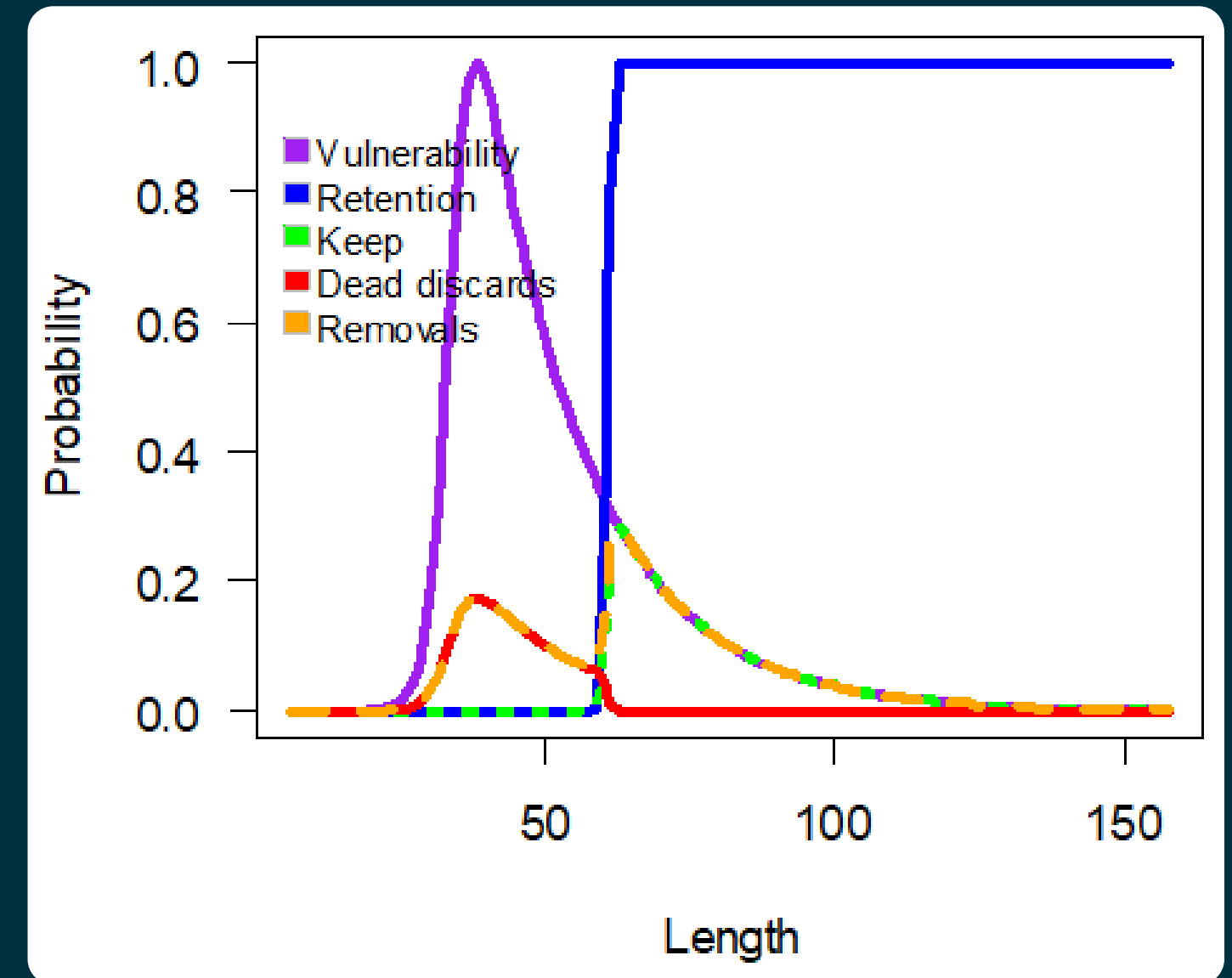
PART 3: DESK MSE



Step 2: Specify inputs

Recreational fishery

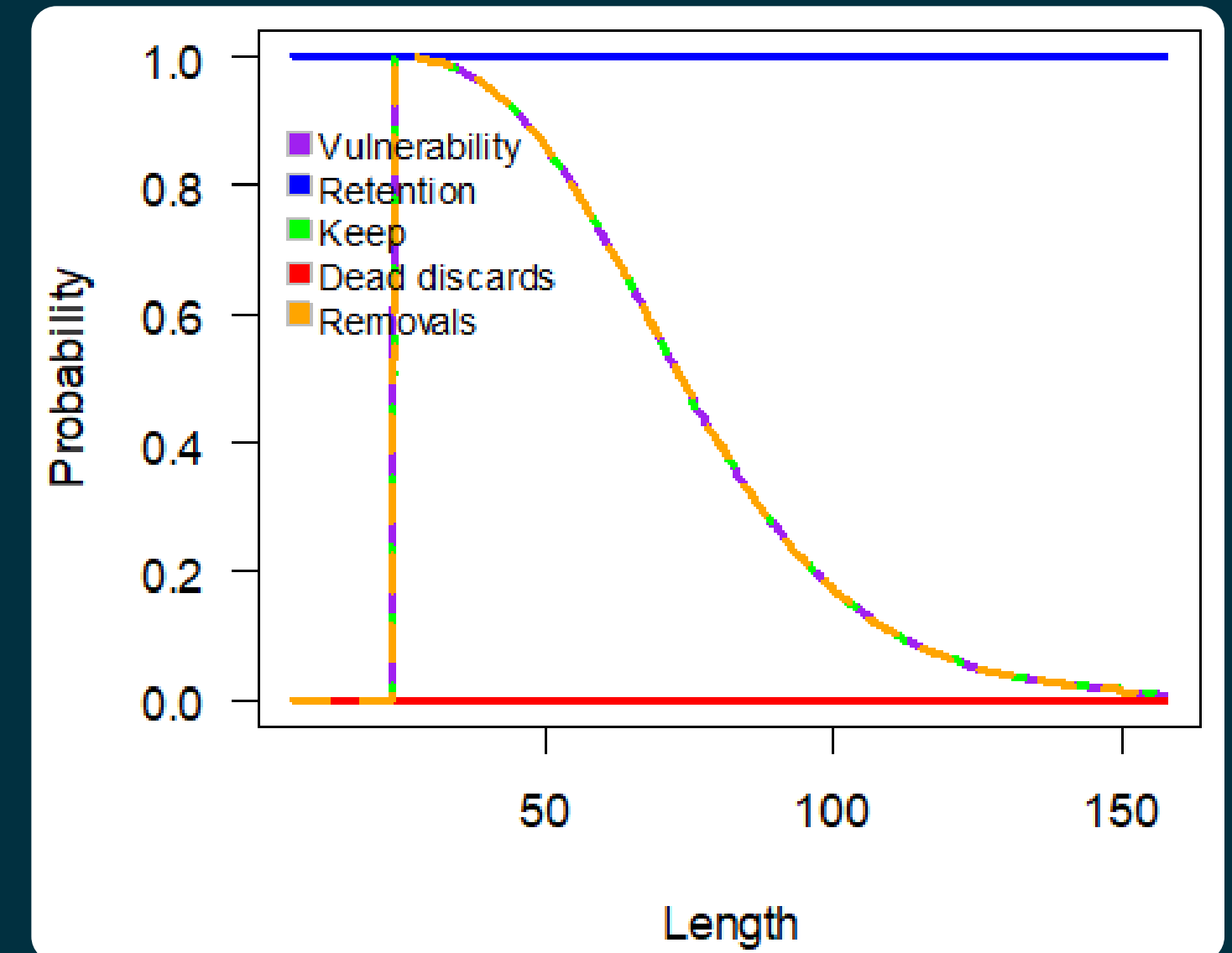
- Dome-shaped selectivity to mimic the MRIP selectivity curves estimated in SEDAR 19
- Selectivity: peak at 38.3 cm
- Full retention at 61 cm
- Discard mortality 17.5%, recommended by SEDAR 48



Operating model

Step 3: Specify observation sub-models (imperfect monitoring)

- Dome-shaped selectivity using exponential logistic.
- Selectivity: peak at 24.2 cm
- Approximated based on SEDAR 19 (2010)



Operating model

PART 3: DESK MSE



Step 3: Specify observation sub-models

Recreational fishery data

Parameter	Notes
Recreational catches (what?) Lognormal SD 0.42	Obtained from FWRI data
Recreational abundance index Lognormal SD 0.36 to 0.95	Assumed CPUE var'n > Catch var'n
Recreational length composition. ESS = 100	Weak assumption

Operating model

PART 3: DESK MSE



Step 3: Specify observation sub-models

Commercial fishery data

Parameter	Notes
Commercial catches (what?) Lognormal SD 0.1	Assumed reliably reported.
Commercial length composition. ESS = 100	Weak assumption

Operating model

PART 3: DESK MSE



Step 3: Specify observation sub-models

RVC data

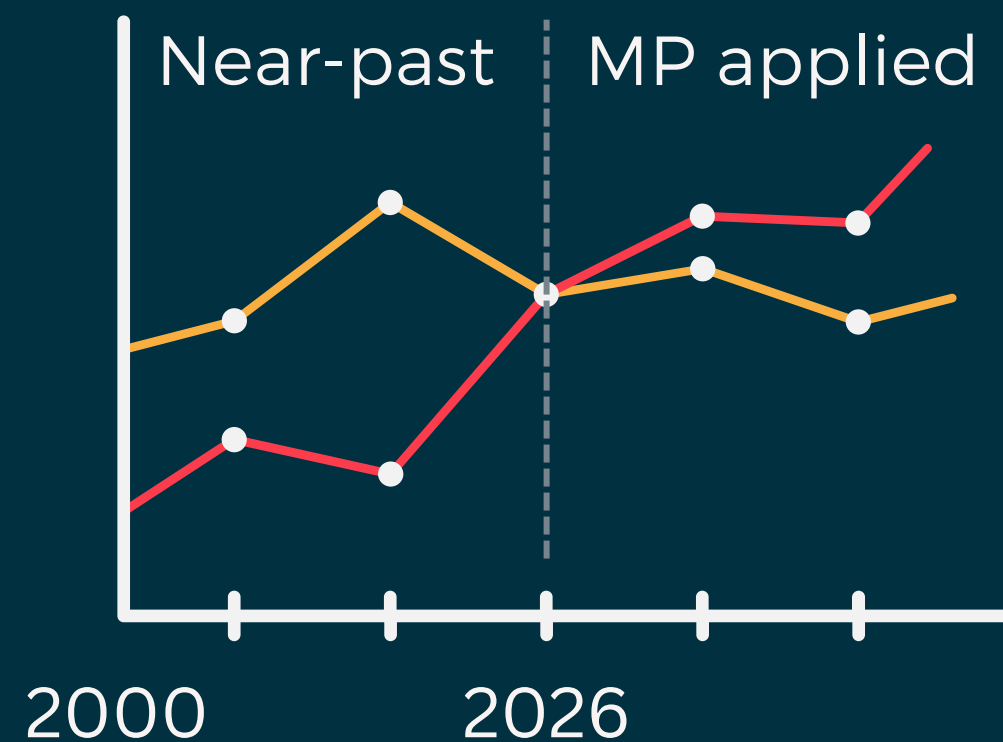
Parameter	Notes
Index of abundance lognormal SD 0.086 to 0.208	From SEDAR 48
Commercial length composition. ESS = 150	Weak assumption

Operating model

PART 3: DESK MSE



Step 4: Specify near-past conditions



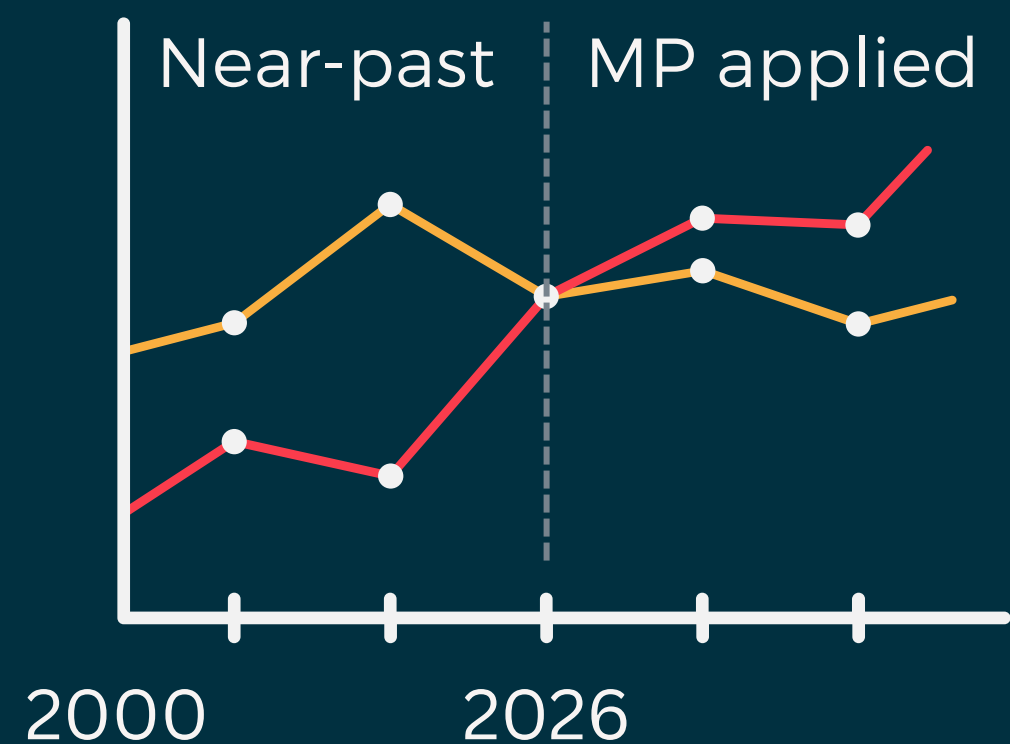
- Data-limited approach. No stock assessment, no attempt at historical reconstruction.
- Also, only reliant on recent 5 years of simulated monitoring for MPs.
- Initial equilibrium year 2000, assumed SPR of 0.4 to 0.6, fully exploited fishery.
- Flat abundance trend during 2000's (SEDAR 2010)
- Reasonably consistent regulations, except federal waters of Gulf where 24 in size limit in 2026.

Operating model

PART 3: DESK MSE



Step 4: Specify near-past conditions



- OM 1: Stable fishing mortality 2000 to 2025.
 - Flat fishing mortality trend.
 - Inter-annual variability of 13% to 25%.
- OM2: Increasing fishing mortality 2000 to 2025
 - Increasing at 0.5% annually.
 - Not intended to reflect reality, rather test how MPs respond.
- Other key uncertainties addressed in robustness set OMs (see report).



OM



Mult-indicator MPs

MP-10

SRFS Index (S)
RVC index (S)
Total Lmean 30% SPR (O)

MP-11

SRFS Index (S)
RVC index (S)
Total Lmean 50% SPR (O)

MP-12

SRFS Index (S)
RVC index (S)
Total Lmean ratio (S)

MP-13

RCV Index (S)
RVC length ratio (S)
Commercial length ratio (S)
Total Lmean 30% SPR (O)

MP-14

RCV Index (S)
RVC length ratio (S)
Commercial length ratio (S)
Total Lmean 50% SPR (O)

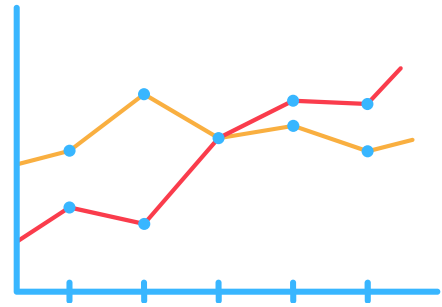
MP-15

RCV Index (S)
RVC length ratio (S)
Commercial length ratio (S)

(S) Stability seeking indicator

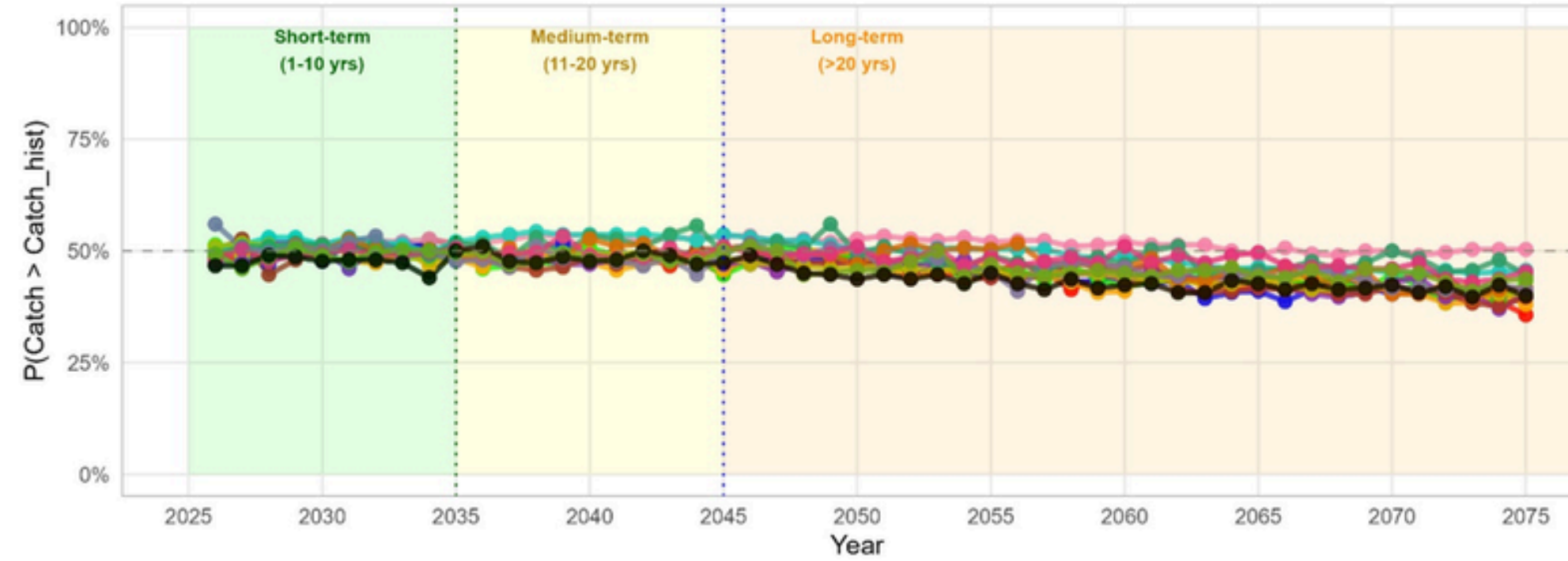
(O) Optimality seeking indicator

Stable F



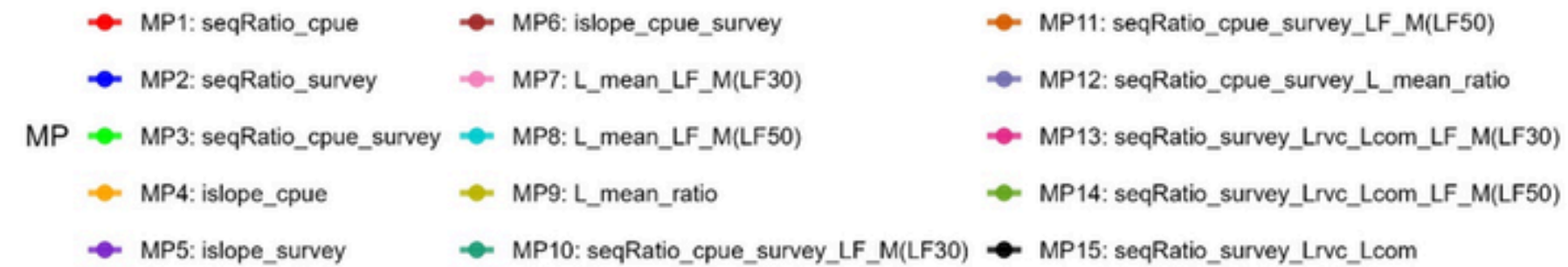
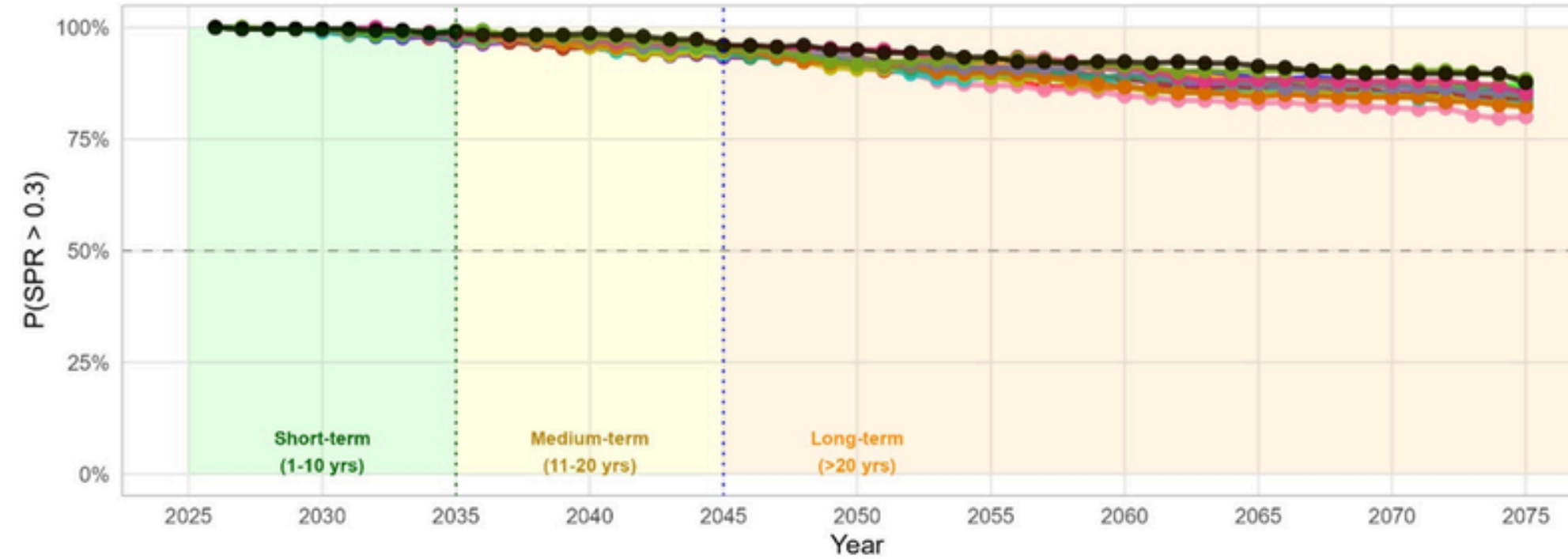
Catch Performance

Probability catch exceeds final historical year

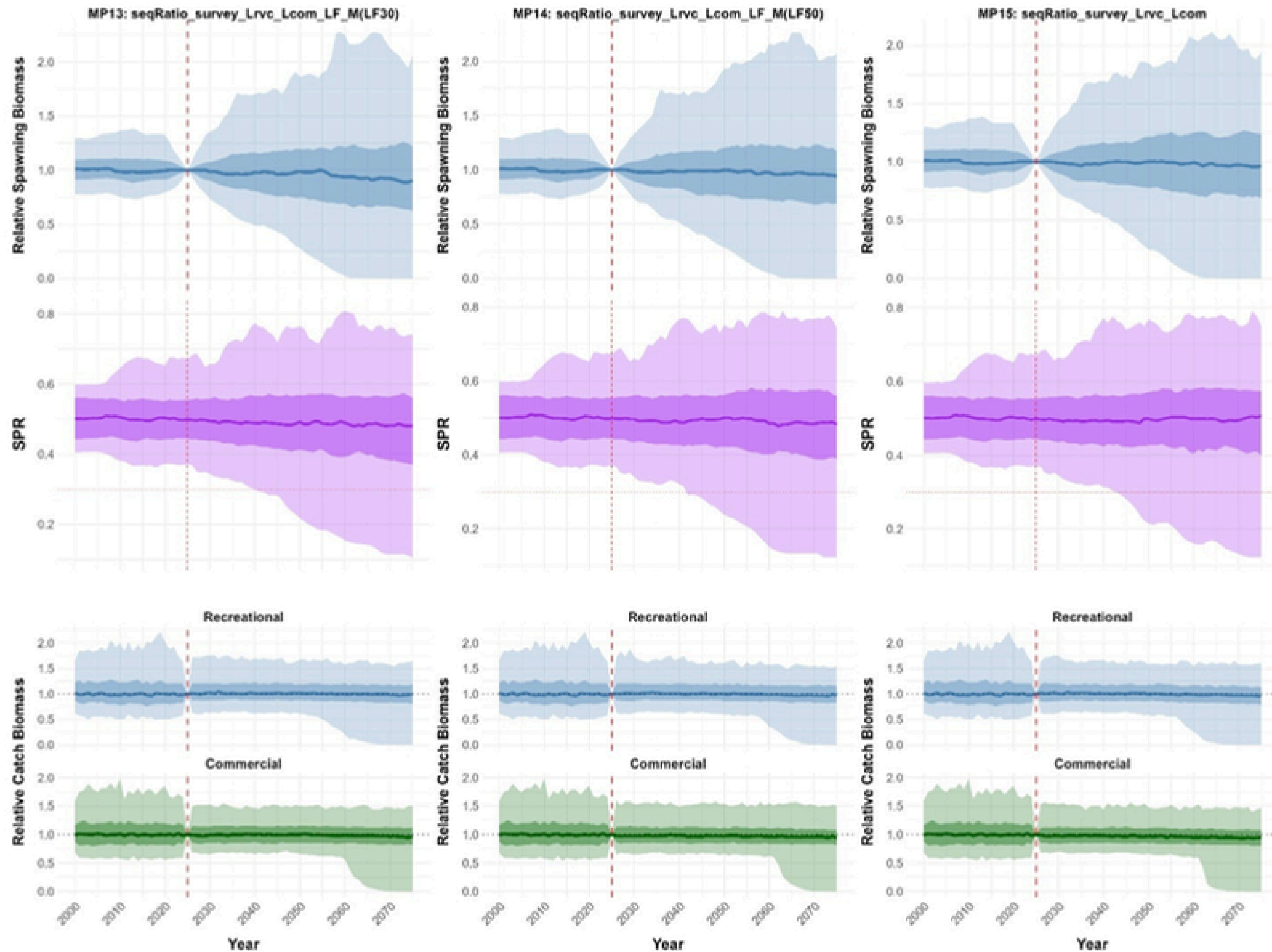
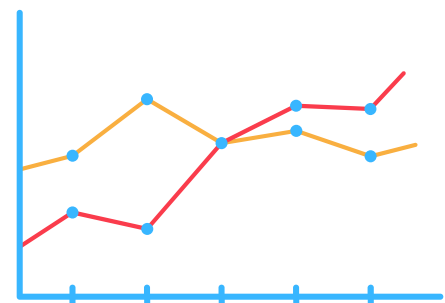


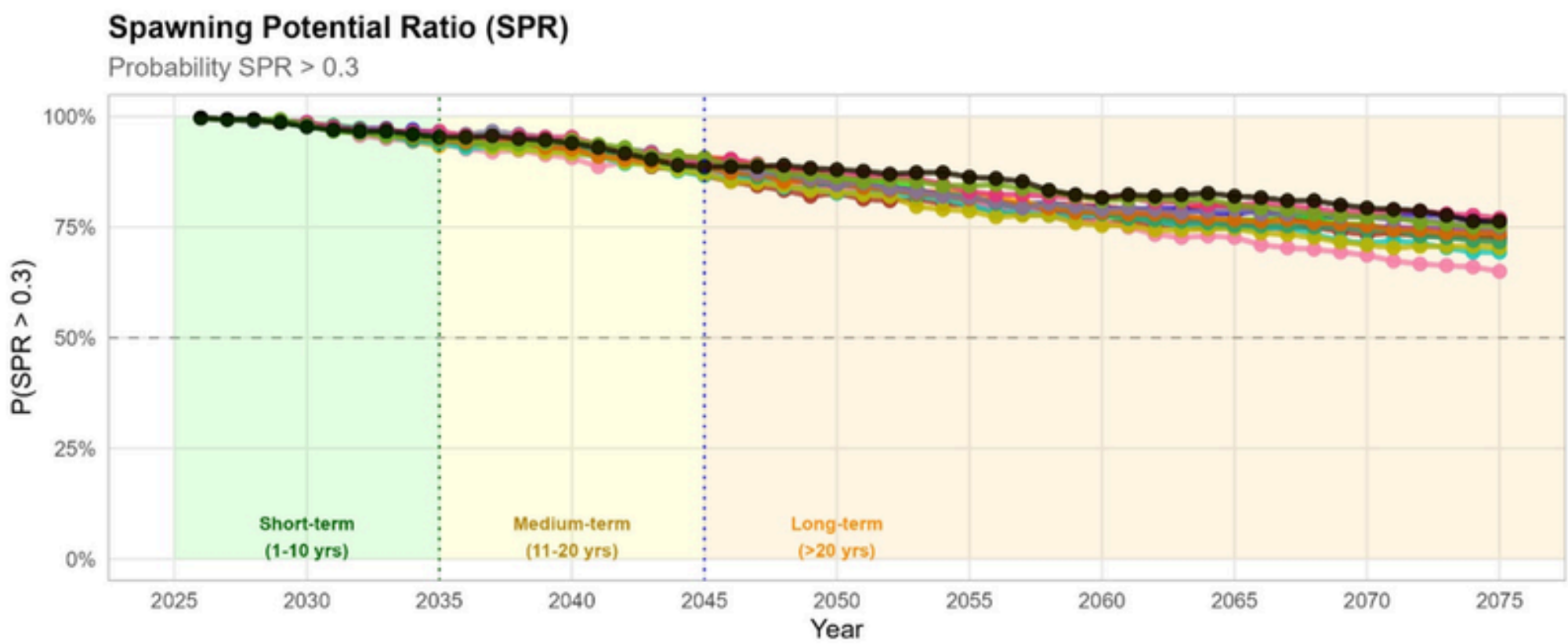
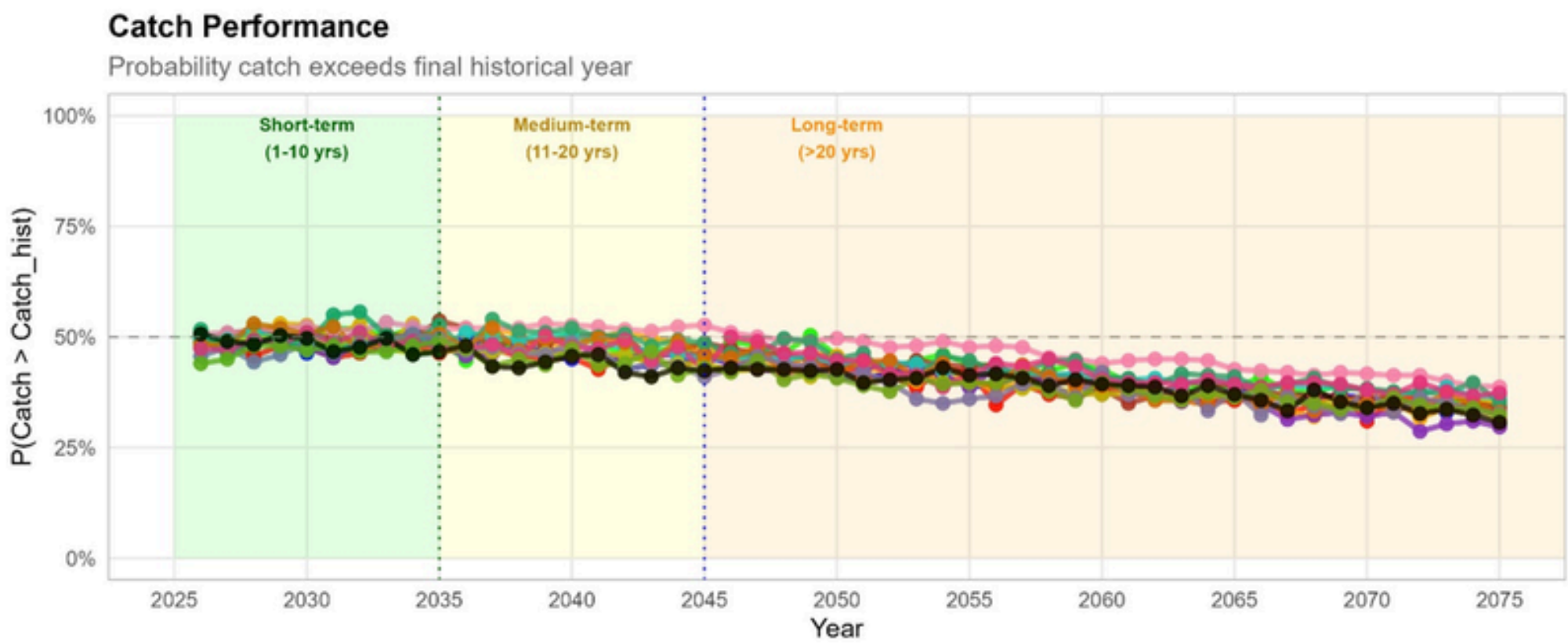
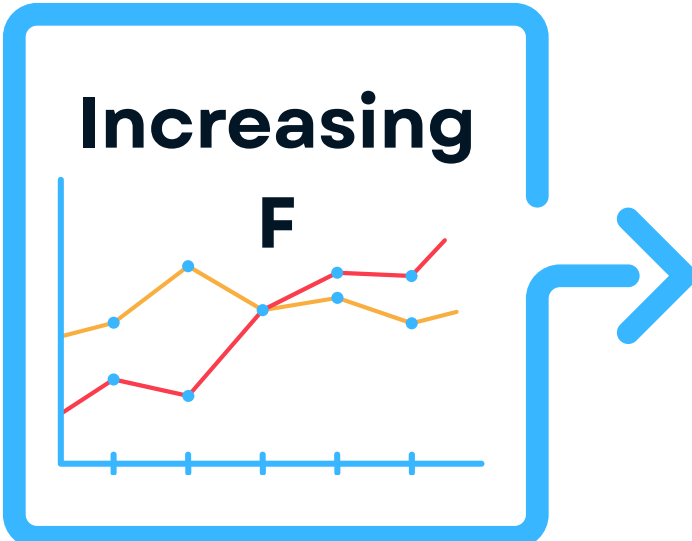
Spawning Potential Ratio (SPR)

Probability SPR > 0.3

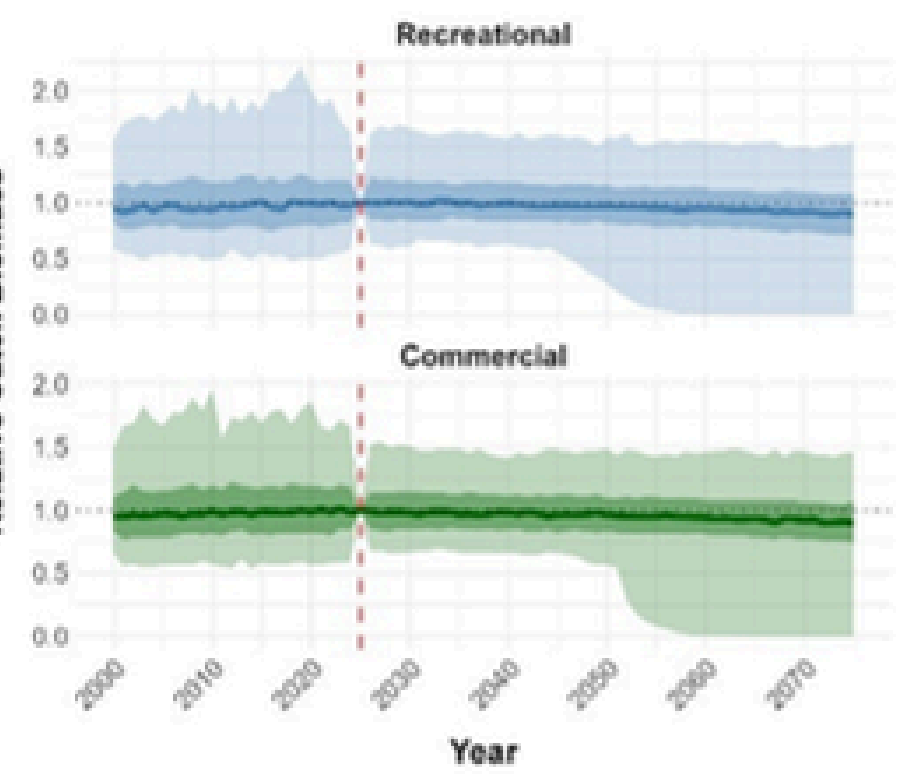
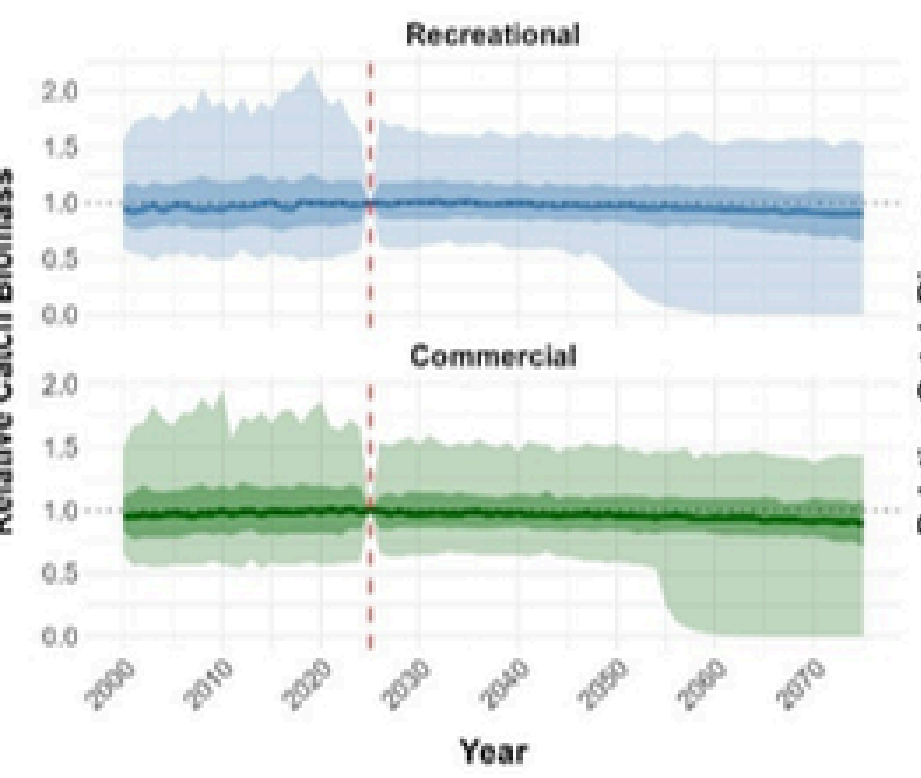
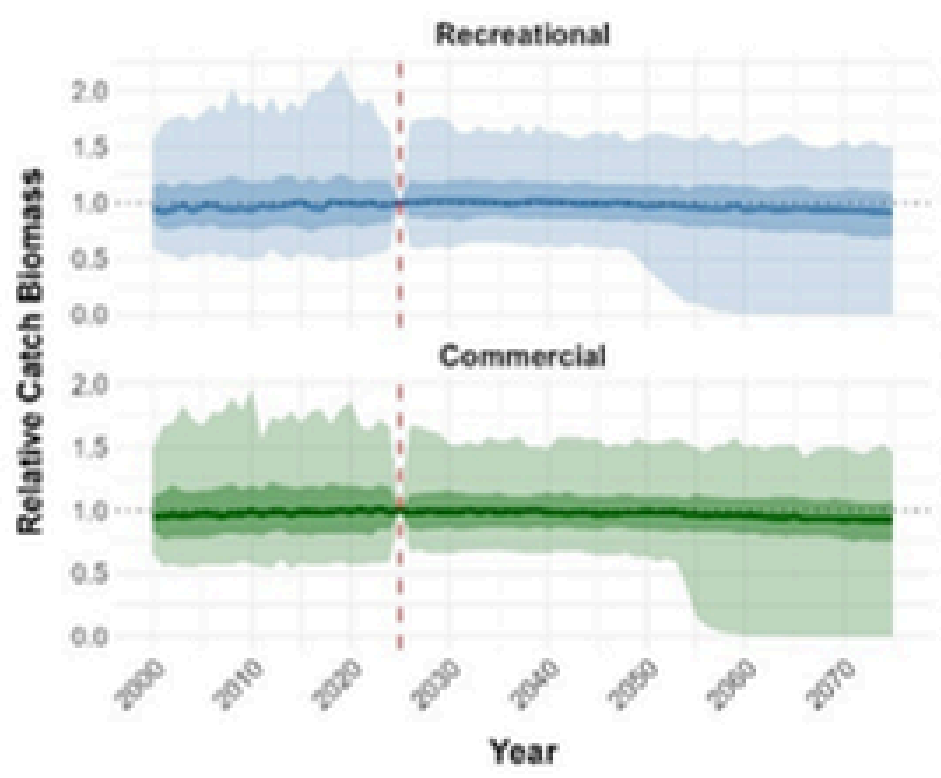
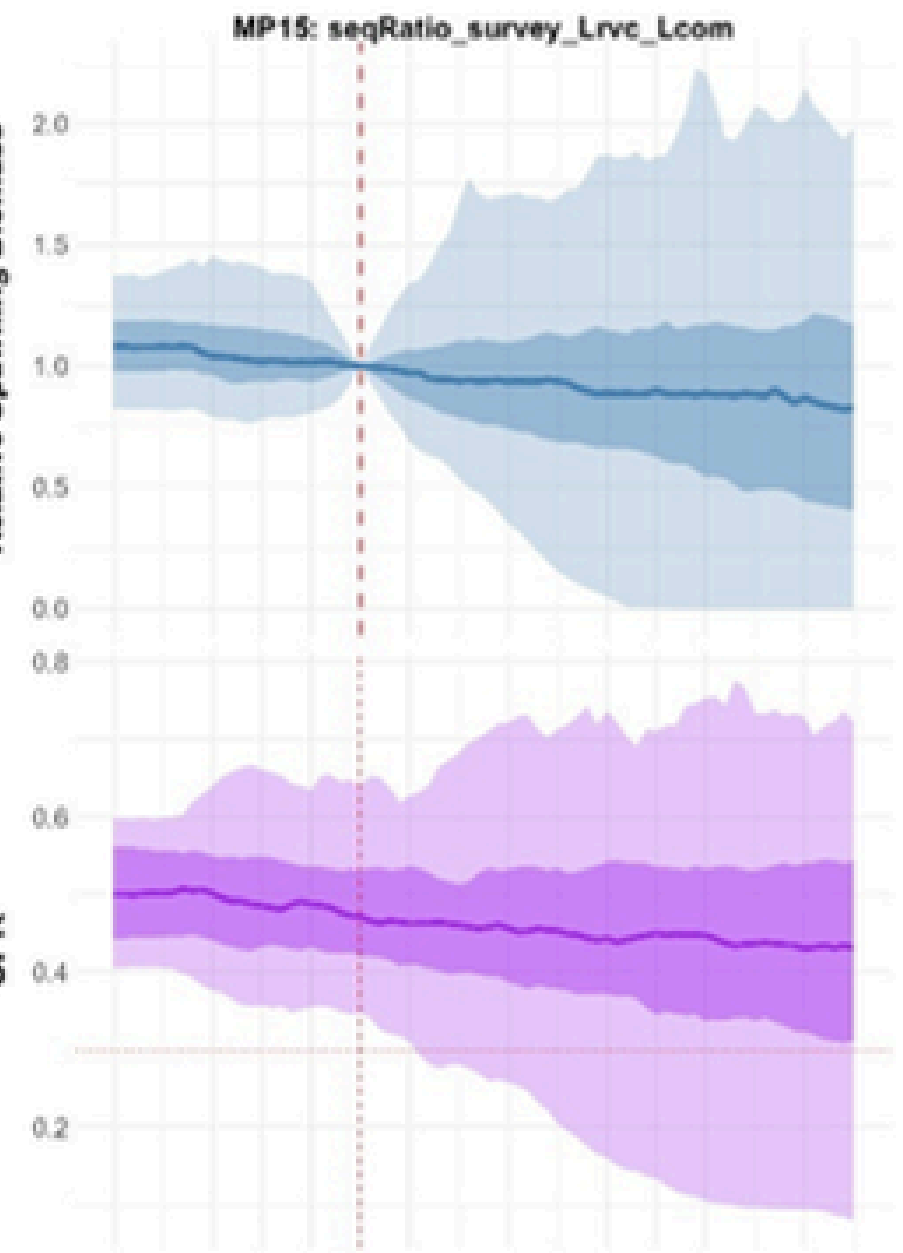
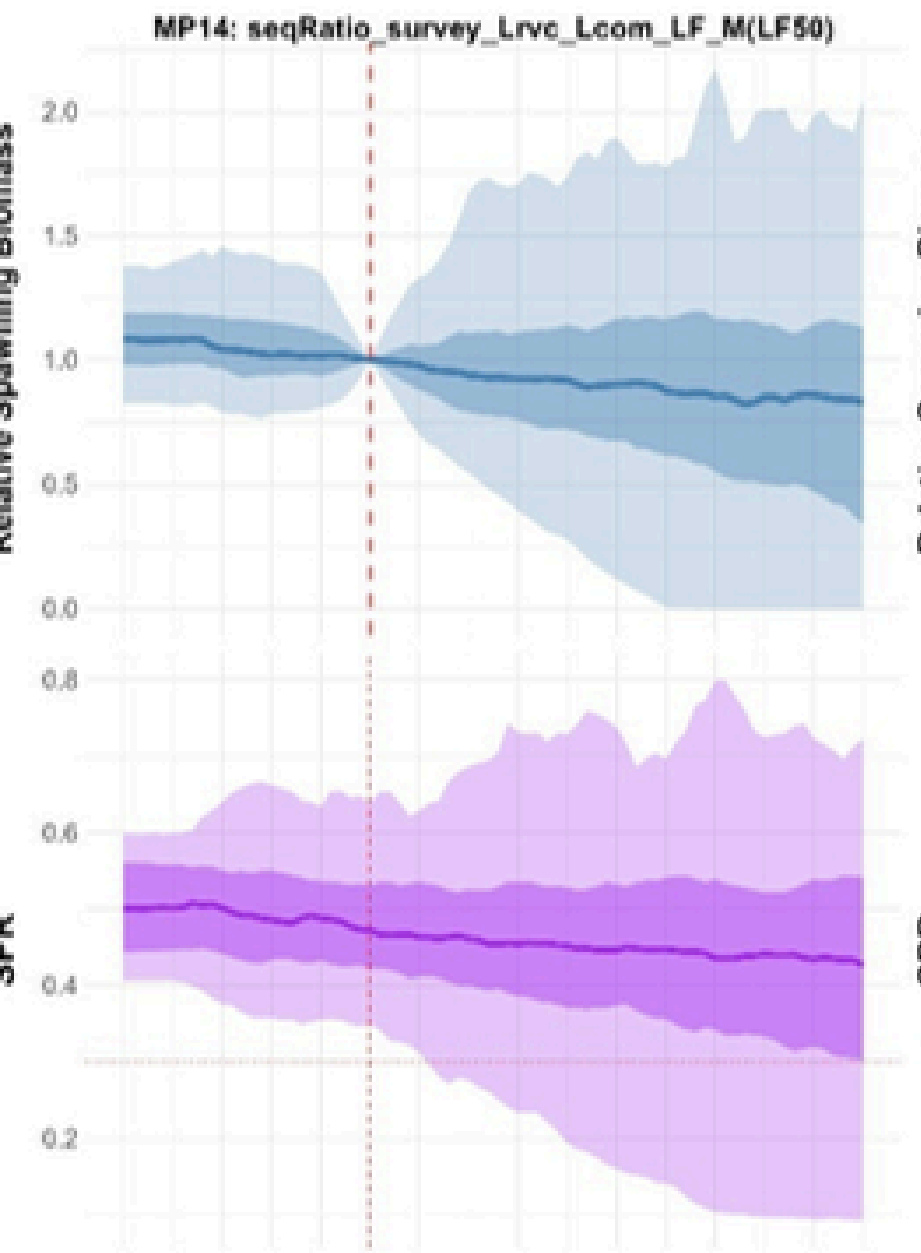
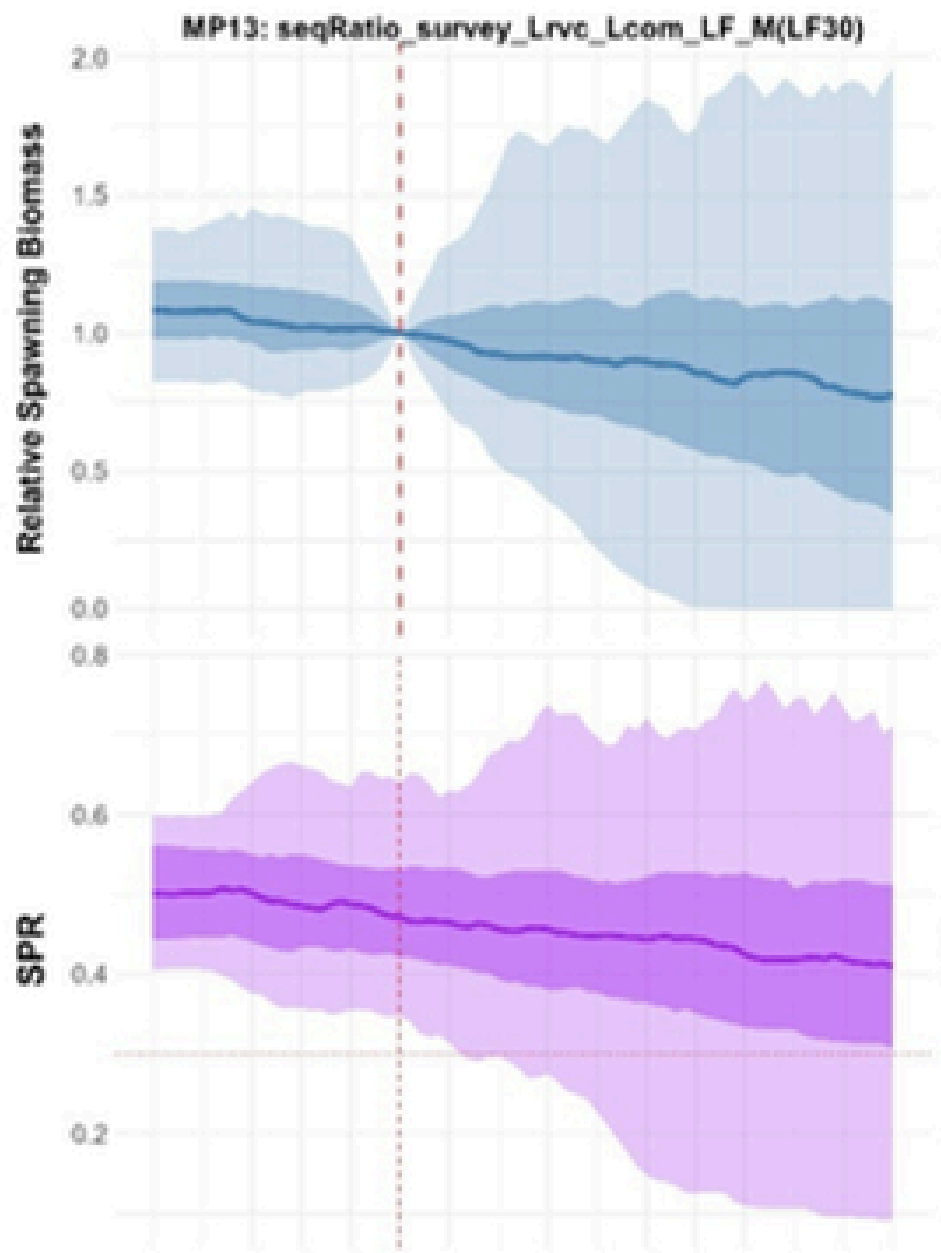
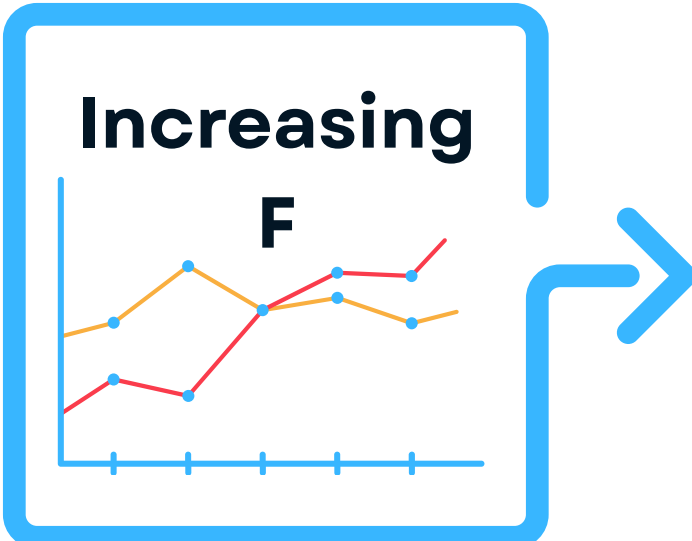


Stable F





- MP
- | | | |
|---------------------------|---------------------------------------|--|
| MP1: seqRatio_cpue | MP6: islope_cpue_survey | MP11: seqRatio_cpue_survey_LF_M(LF50) |
| MP2: seqRatio_survey | MP7: L_mean_LF_M(LF30) | MP12: seqRatio_cpue_survey_L_mean_ratio |
| MP3: seqRatio_cpue_survey | MP8: L_mean_LF_M(LF50) | MP13: seqRatio_survey_Lrvc_Lcom_LF_M(LF30) |
| MP4: islope_cpue | MP9: L_mean_ratio | MP14: seqRatio_survey_Lrvc_Lcom_LF_M(LF50) |
| MP5: islope_survey | MP10: seqRatio_cpue_survey_LF_M(LF30) | MP15: seqRatio_survey_Lrvc_Lcom |



Multi-indicator MPs respond to a composite profile resource condition, where information and contrasting signals are interpreted collectively.

- Combination of stability-seeking and target-seeking indicators is useful:
 - While sometimes antagonistic, act as guardrails where data precision is low.
 - Target-seeking move stock towards SPR of 0.3, but for long-lived species stability indicators slow the process.
 - Stability-seeking avoids over-shooting targets due to cause-effects lags in length-based indicators.
 - Tracking cohort strength could be a virtue, as could delaying catch limit increases to produce larger individuals.
 - Worthwhile tracking mean length in adult stage (commercial fishery) relative to other indicators.

Take aways



Demonstrated successes:

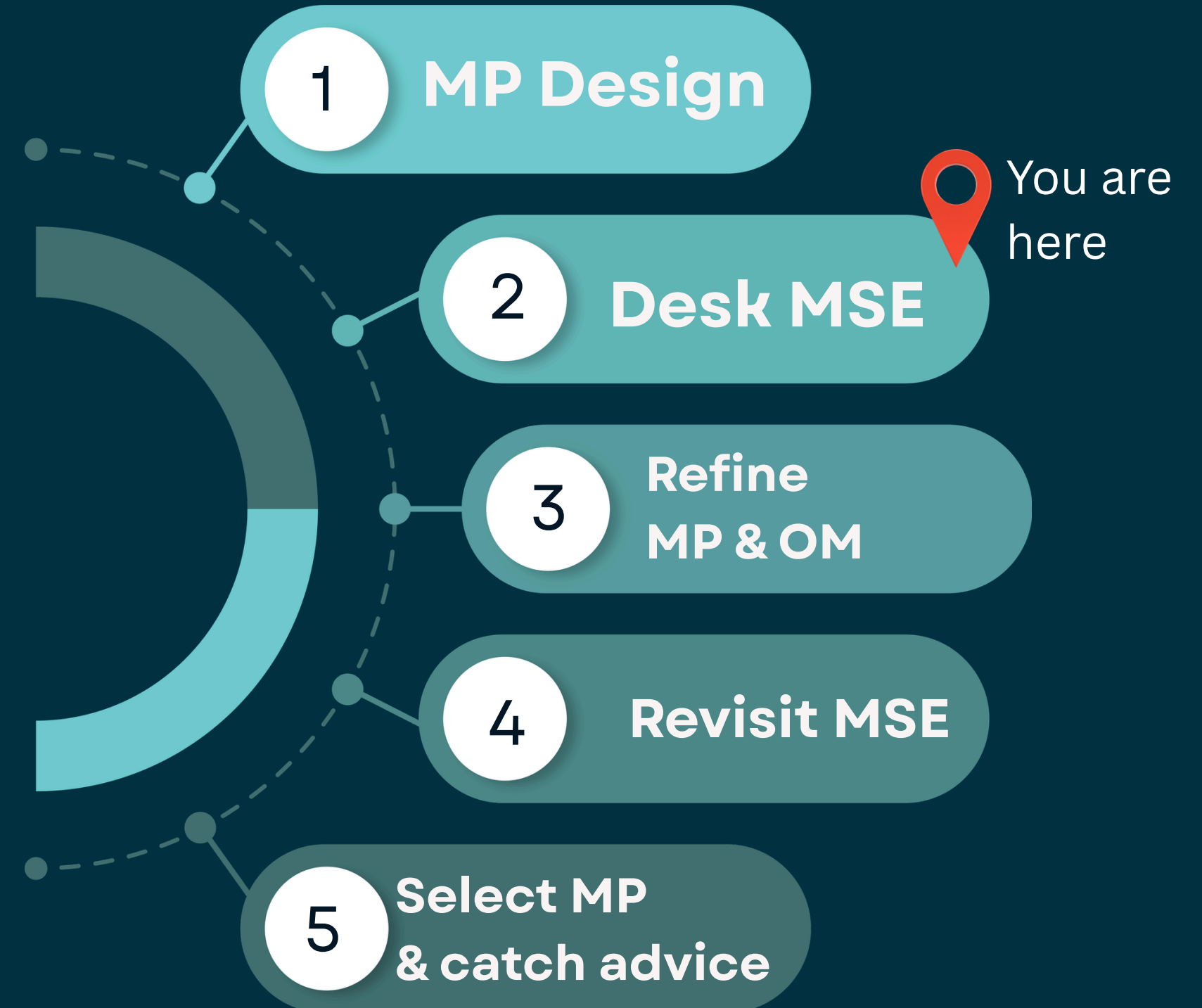
- Evaluated performance of 6 multi-indicator MPs.
- Results confirm that MPs promote stable stock, nudge towards MSY.
- Science-based foundation for MP evaluation.

Part 4: Towards catch advice



How do we get to catch advice?

PART 4: CATCH ADVICE



*Chip Collier, SAFMC June 2026

MP improvements?

PART 4: CATCH ADVICE



- Implement process to narrow set of MPs.
- Review operational control points (i.e. the parameters of the HCRs), to ensure:
 - Suitable responsiveness to changing conditions (too slow, too fast).
 - Evaluate MP under conditions requiring rebuilding.
- Expand to model-based MPs?
 - Stock Synthesis Data-limited tool?
- Construct alternative MPs with stakeholders, SSCs, scientists, Councils?
 - Retain focus on process of MP design.

OM improvements?

PART 4: CATCH ADVICE



- Improve OM realism through analysis of statistical properties of empirical data.
 - More realistic observation models.
 - Incorporate uncertainty in selectivity patterns.
- Incorporate uncertainty in life history parameters.
 - Evaluate effect of misaligned OM params, with inputs to MPs.

MSE process improvements?

PART 4: CATCH ADVICE



- How could a broader MSE process with more engagement be structured?
- Could performance metrics be refined with stakeholder input?
- Are there other collaborative opportunities to consider?

Next steps summary

- Refine process for MP design + engagement.
- Strengthen science of OMs through better alignment with properties of the data.
- Refine engagement process & inputs from stakeholders, SSCs, scientists, Councils.

