Assessing Data-Limited Fisheries: the Framework for Integrated Stock and Habitat Evaluation (FISHE)

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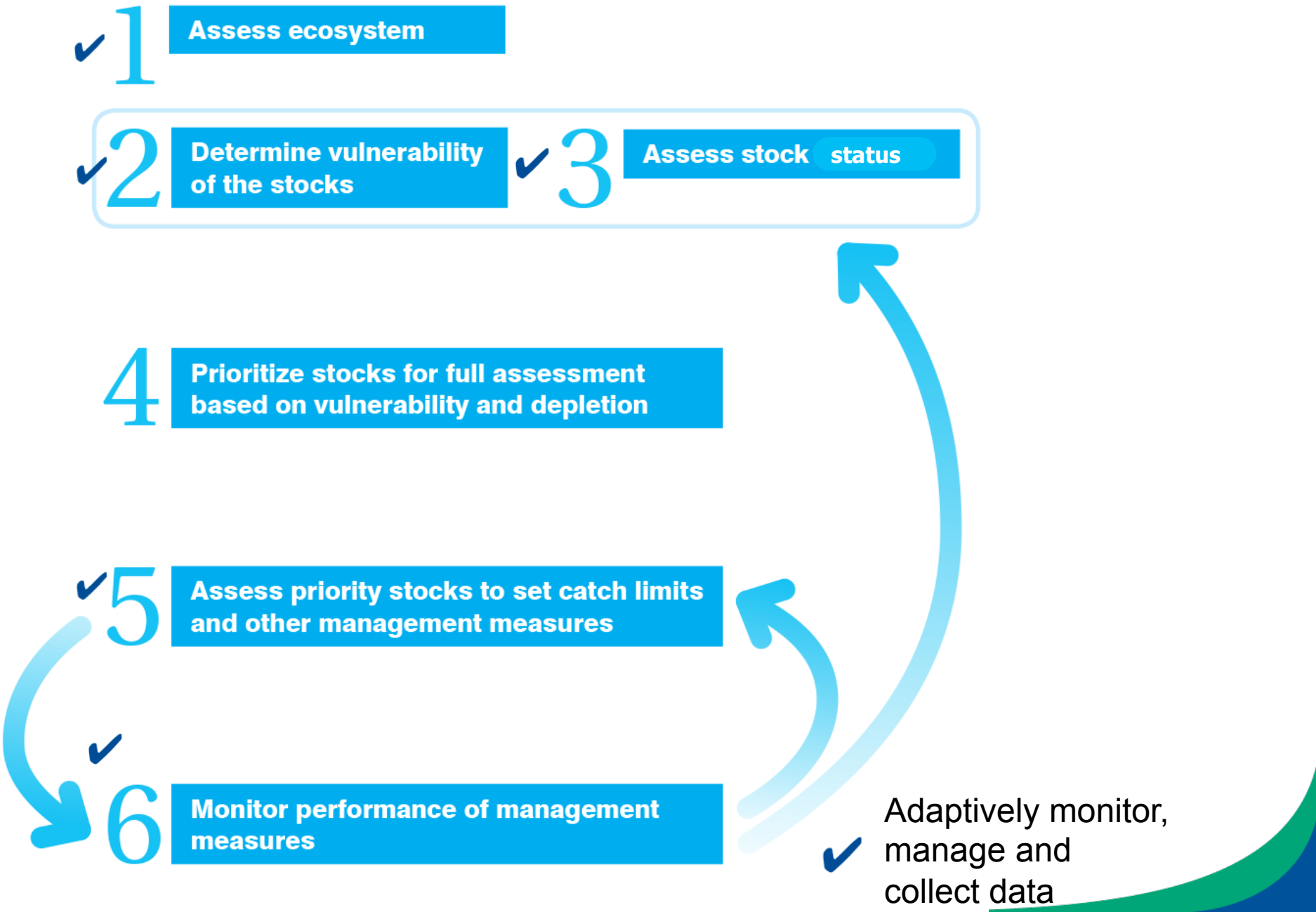
Fundamentals: Know Where You Are And Where You Want to Go

- >80% of fisheries in the world are unassessed
- Understanding stock and ecosystem health can help overcome limitations in data-limited fisheries

FISHE (Framework for Integrated Stock and Habitat Evaluation)



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Framework for Integrated Stock and Habitat Evaluation

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Better Decisions

Nearly 80% of fish worldwide come from "data-poor" fisheries and with little-to-no scientific information laying a foundation for management many are facing collapse. The Online Fishery Assessment Tool equips fishery managers with a low-cost and highly effective resource to assess and sustainably manage their data-limited fishery.

Get Started

Case Study: Gulf Corvina Fishery, Upper Gulf of California and Colorado River Delta Biosphere Reserve

Fishery Goals

1. To preserve the biomass and recruitment
2. To preserve yield and economical benefit
3. To reduce environmental interactions
4. To promote economic benefits to the society
5. To secure quality of the fishing products

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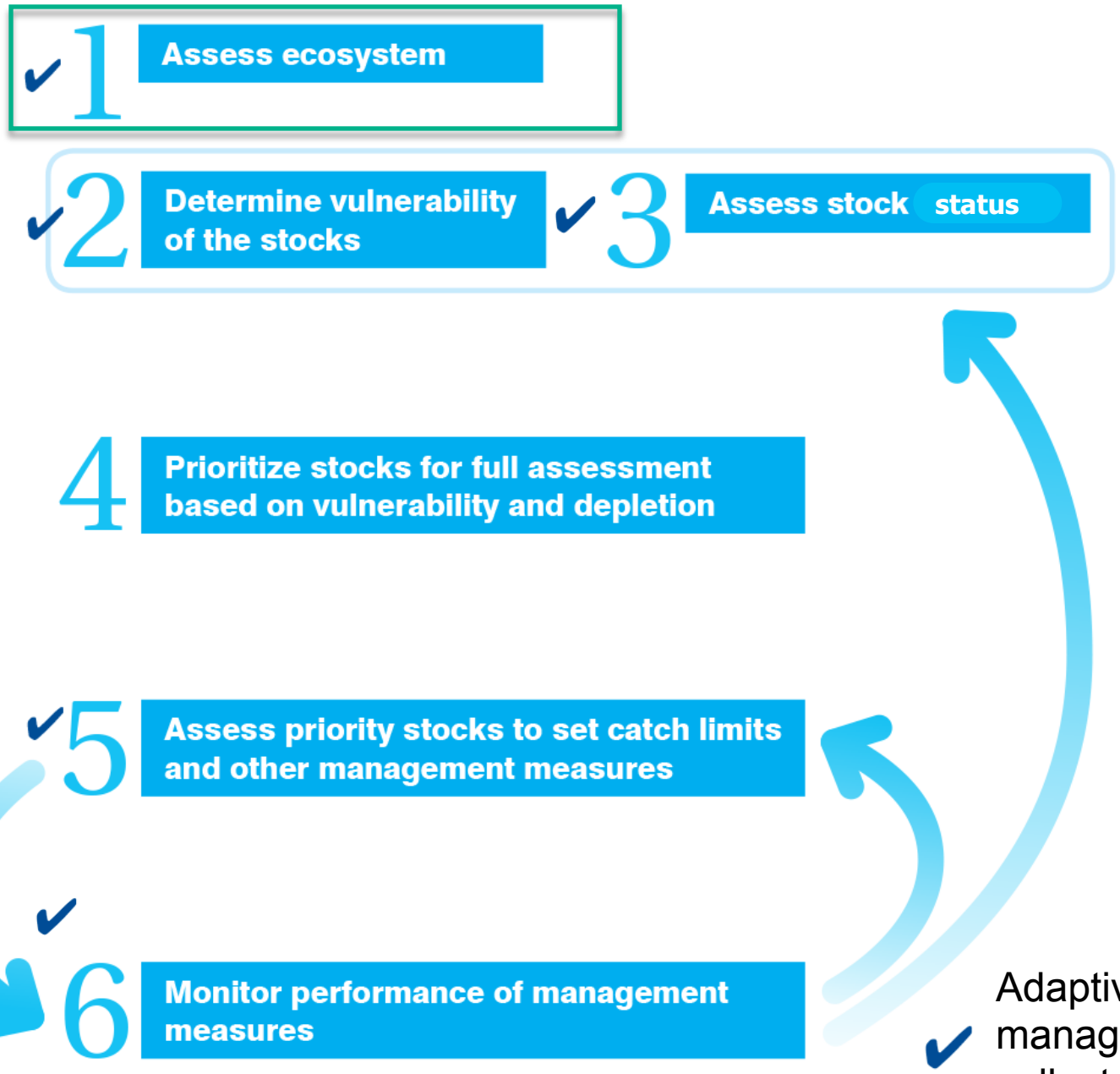
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Assess ecosystem
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Determine vulnerability of the stocks
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Prioritize stocks for full assessment based on vulnerability and depletion
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Assess priority stocks to set catch limits and other management measures
6
Monitor performance of management measures
Adaptively monitor, manage and collect data

Step 1. Ecosystem Assessment

How is the *ecosystem* doing? Can it support the fishery? Will a fishery intervention work?

- **Qualitative Risk Assessments:**
  - Ecological Risk Assessment for the Effects of Fishing (ERAEF) level 1: Scale Impact Consequence Analysis[1,2]
  - Comprehensive Assessment of Risks to Ecosystems (CARE)[3]

- **Quantitative:** Ecosystem Threshold analysis (coral reef systems)[4,5]

(1) Hobday et al., 2011; (2) Smith et al., 2007; (3) Battista et al. in review; (4) McClanahan et al., 2011; (5) Karr and Fujita et al. 2015

Step 1. Ecosystem Status Qualitative Risk Assessment

- CARE works by *quantifying qualitative information.*
- This allows the use of **local and expert knowledge** where data are limited.

$$\boldsymbol{Risk} = \boldsymbol{Exposure} * \boldsymbol{Response}$$

- $\boldsymbol{Exposure} = Scale * Frequency * Intensity$
- $\boldsymbol{Response} = Resistance * Recovery\ Time$

Step 1. Ecosystem Status
Qualitative Risk Assessment

Step 1: CARE Lite

- **Results:** Relative Risk Scores for each threat's potential impact on the ecosystem

Threat	Risk Score	Risk
Legal Fishing	**59.03**	**Moderate**
Illegal Fishing	20.90	Low
Mining - Gold	12.75	Very Low
Red Tide	23.79	Low
Methane & Oil Leaks	1.59	Very Low
Shrimp Aquaculture	28.47	Low

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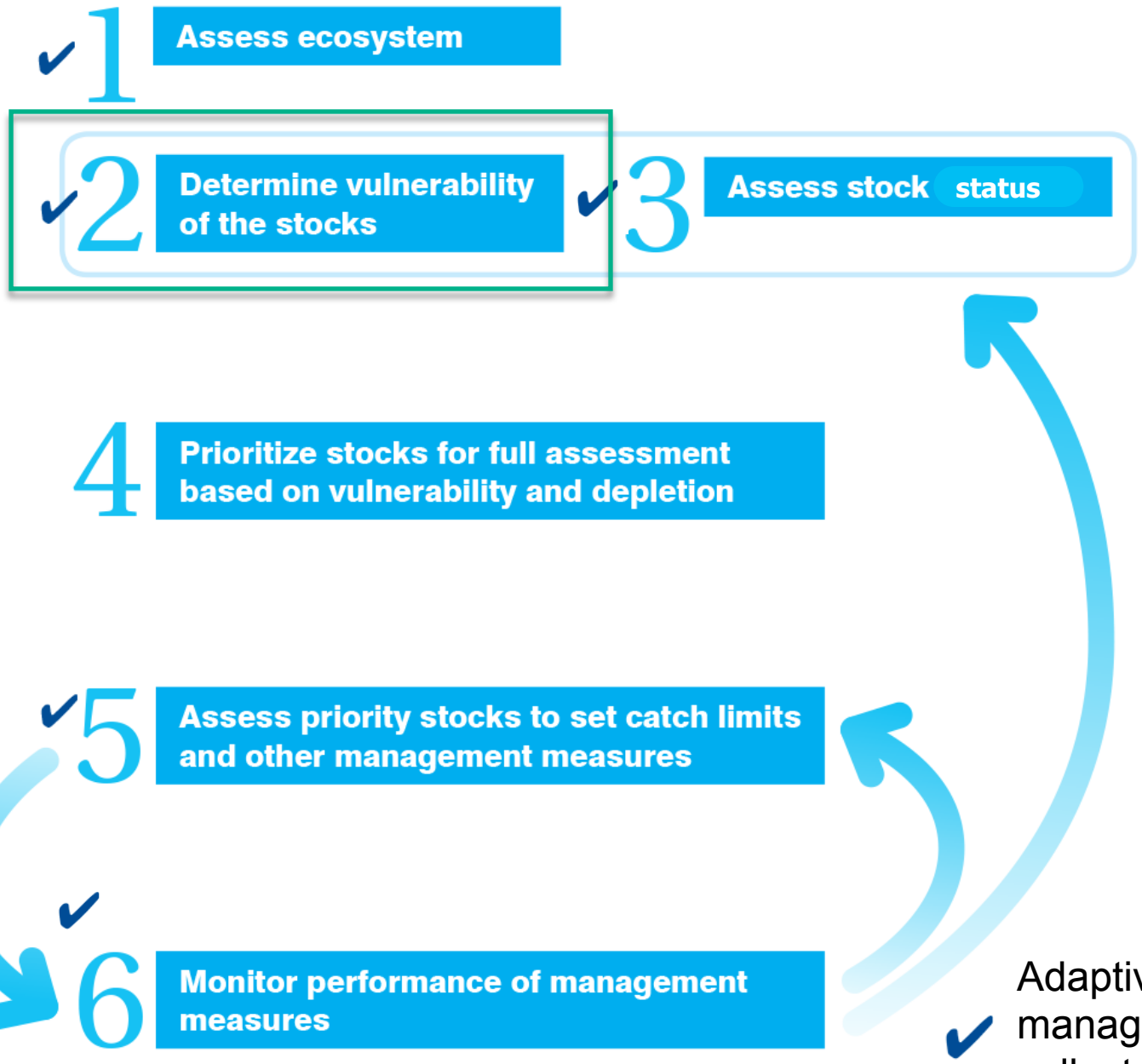
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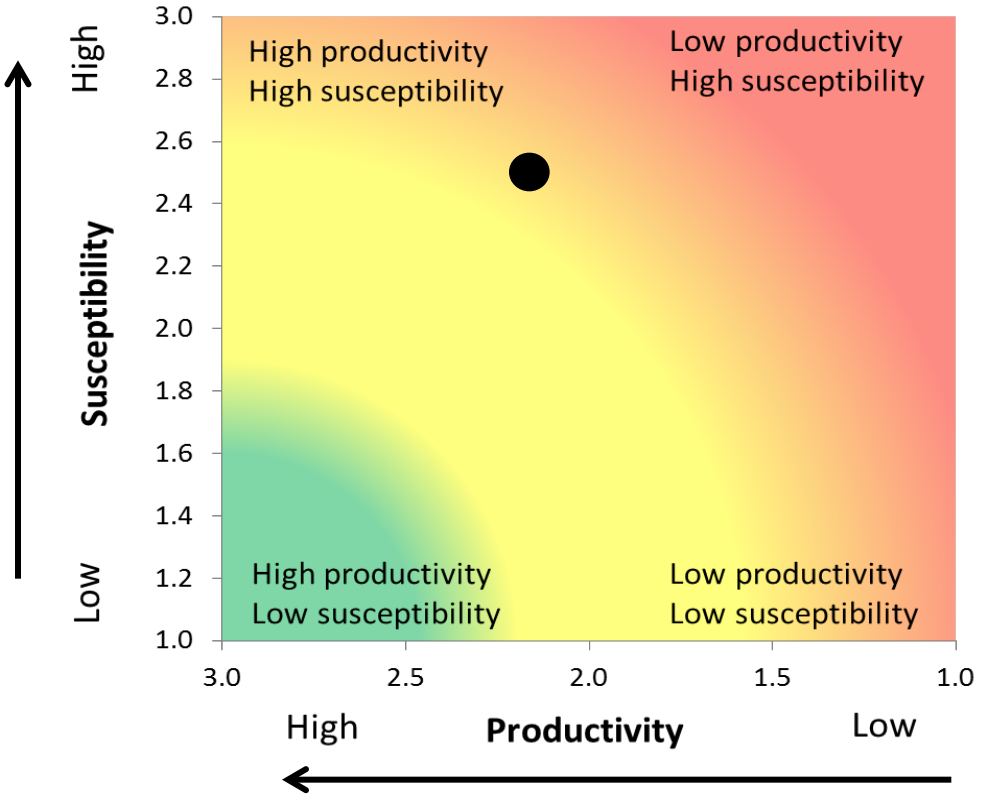
Step 2: Vulnerability of Stocks

Productivity and Susceptibility Analysis (PSA) [1]

- productivity of the stocks scored based on basic life history characteristics from the literature and local knowledge
- susceptibility of the stock to fishing scored through local knowledge

Productivity + Susceptibility = Relative vulnerability to overfishing



(1) Patrick et al., 2009

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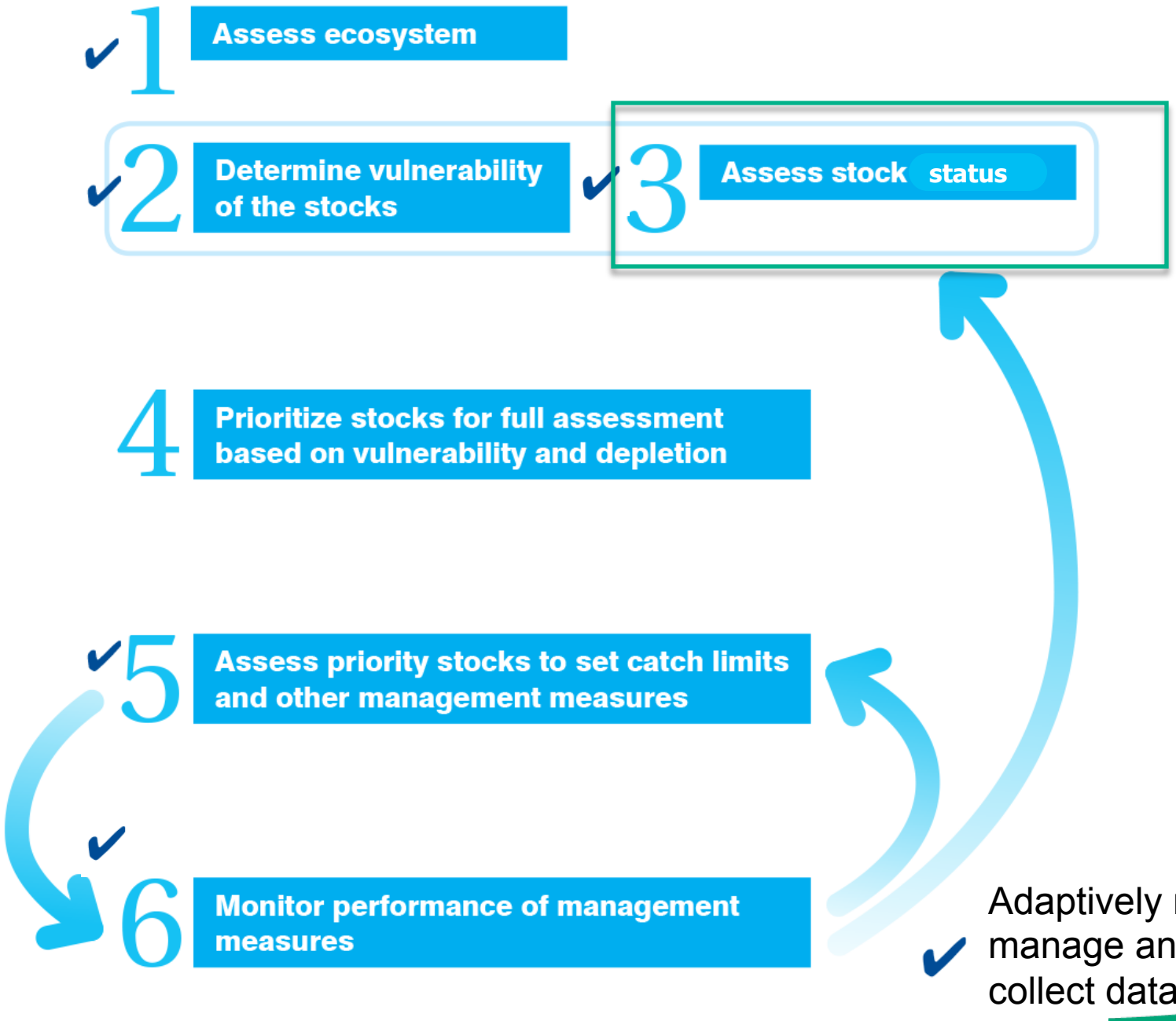
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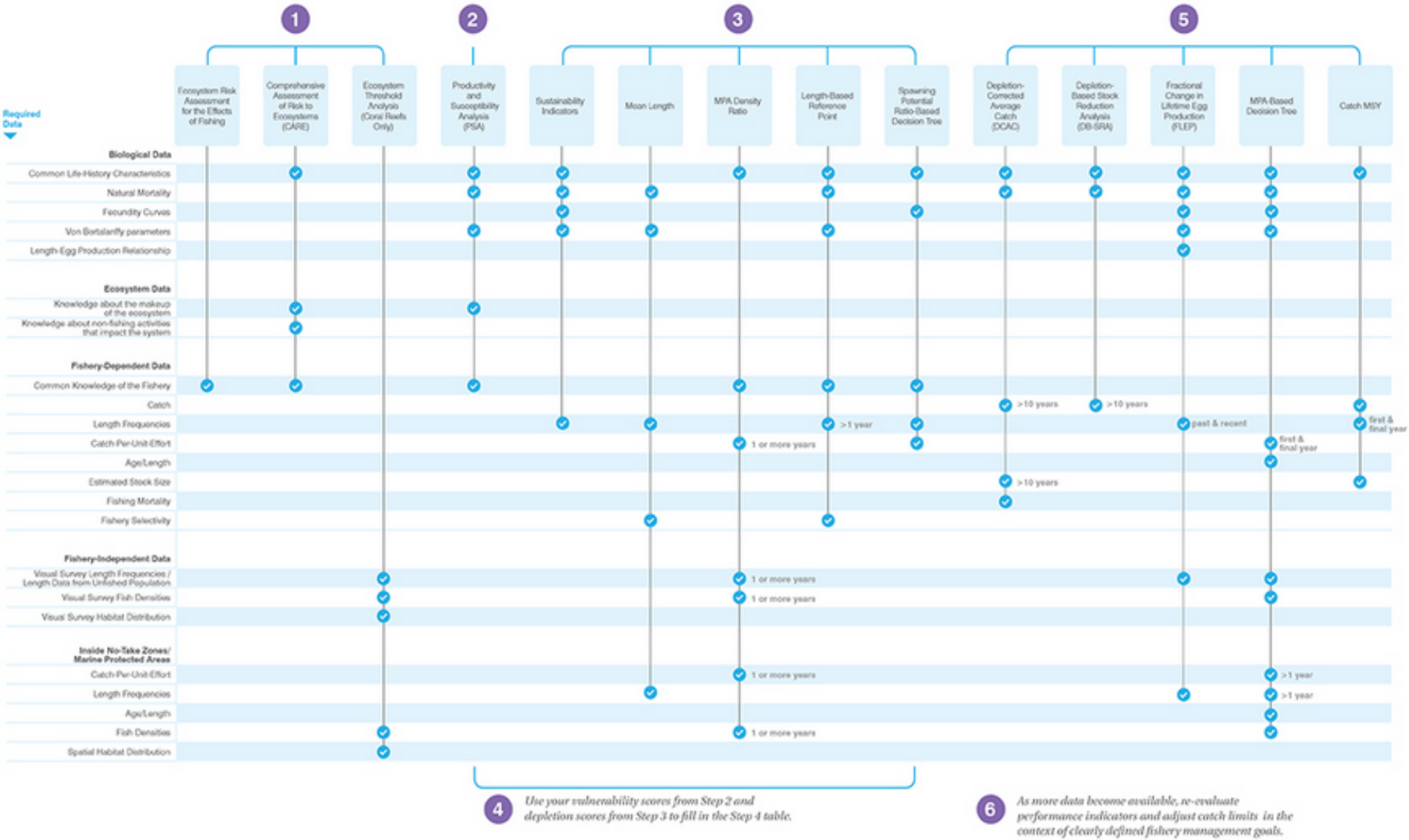
Step 3. Assess Stock Status

Method Matrix

Use the answers from your species data worksheets to determine which assessment method(s) are most appropriate for your fishery.



Step 3: Assess Stock Status

	Status	Goal
Catch Trends		
Lc (avg. length at first capture)	730mm TL not increasing	> Lmat (295 mm TL)
Froese Sustainability Indicator		
Pmat	1.00	1.00
Popt	0.89	1.00
Pmega	0.01	< 0.30

Modified from Erisman et al. 2014:

Note: even though Pmega ≤ Goal Pmega, it is likely that few large adults are left in this stock, and that this pattern is not necessarily a result of current fishing practices/ regulations.

Fishery independent monitoring (i.e., sonar surveys) might be able to answer this question and estimate total fish biomass.

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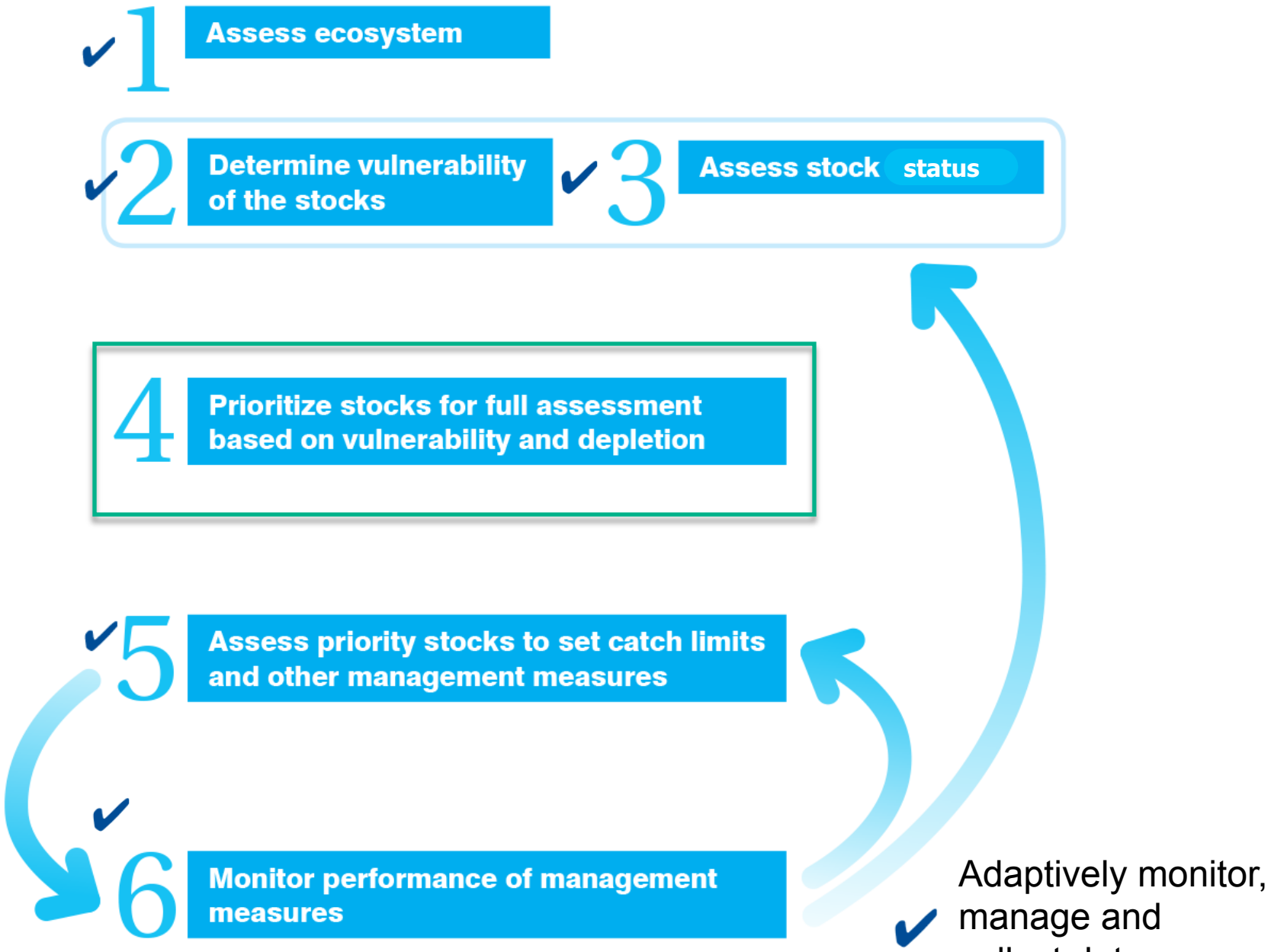
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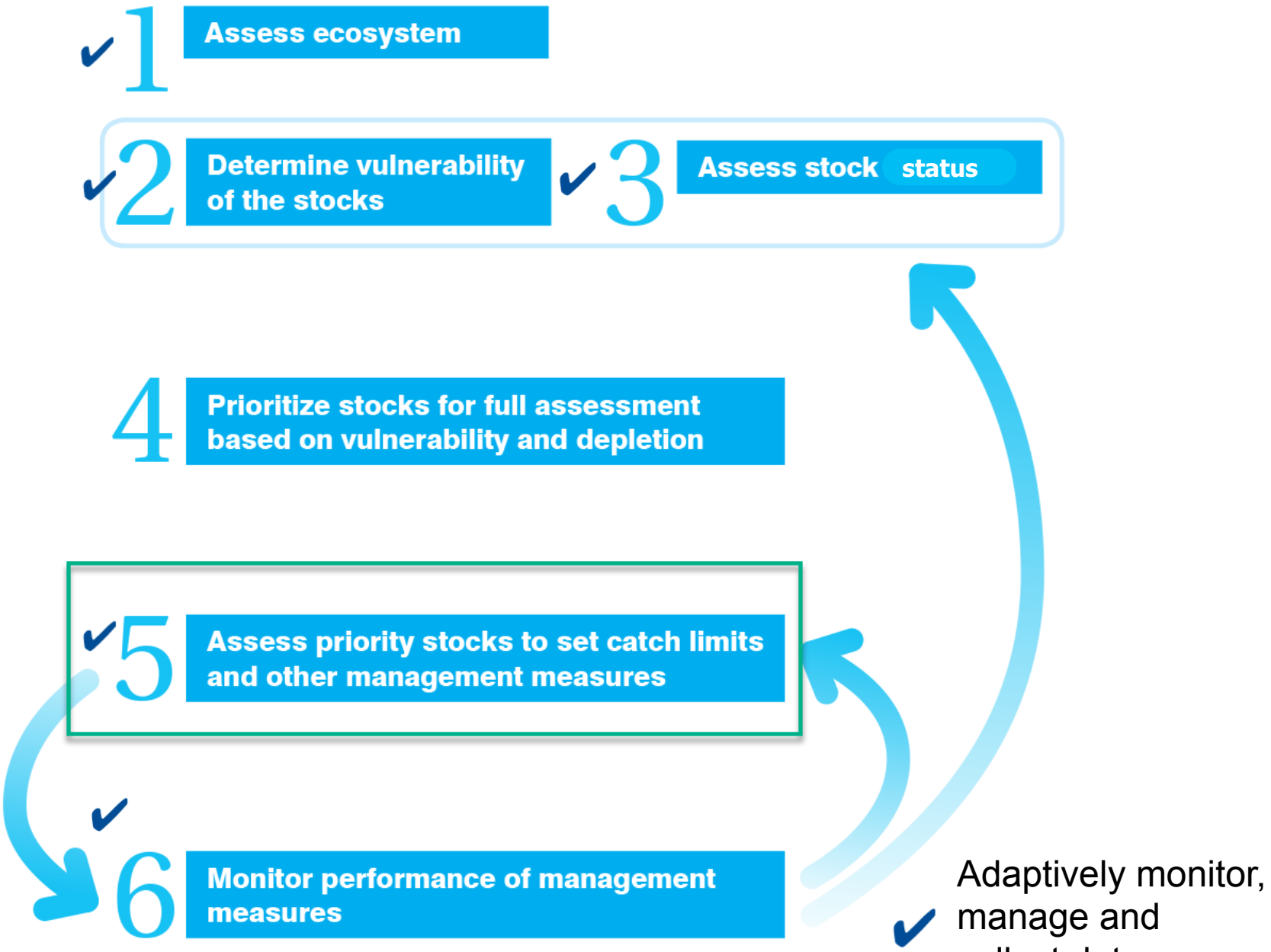
Step 4: Prioritize Stocks

	Low Vulnerability	Medium Vulnerability	High Vulnerability
Healthy Status	**Low Priority** Potential for increased harvest	**Medium Priority** Potential for increased harvest; monitor the stock	**Medium Priority** Use precaution; assess if targeted for expanded fishing effort or if bycatch rates are high
Medium Status	**High Priority** Potential for relatively high sustainable yield; assess and set management measures	**High Priority** Potential for relatively high sustainable yield; assess and set management measures	**High Priority** Potential for low or moderate sustainable yield; assess and set management measures
Poor Status	**High Priority** Reduce fishing; anticipate rapid rebuilding	**High Priority** Reduce fishing; anticipate slower rebuilding	**High Priority** Ban fishing; anticipate slow rebuilding

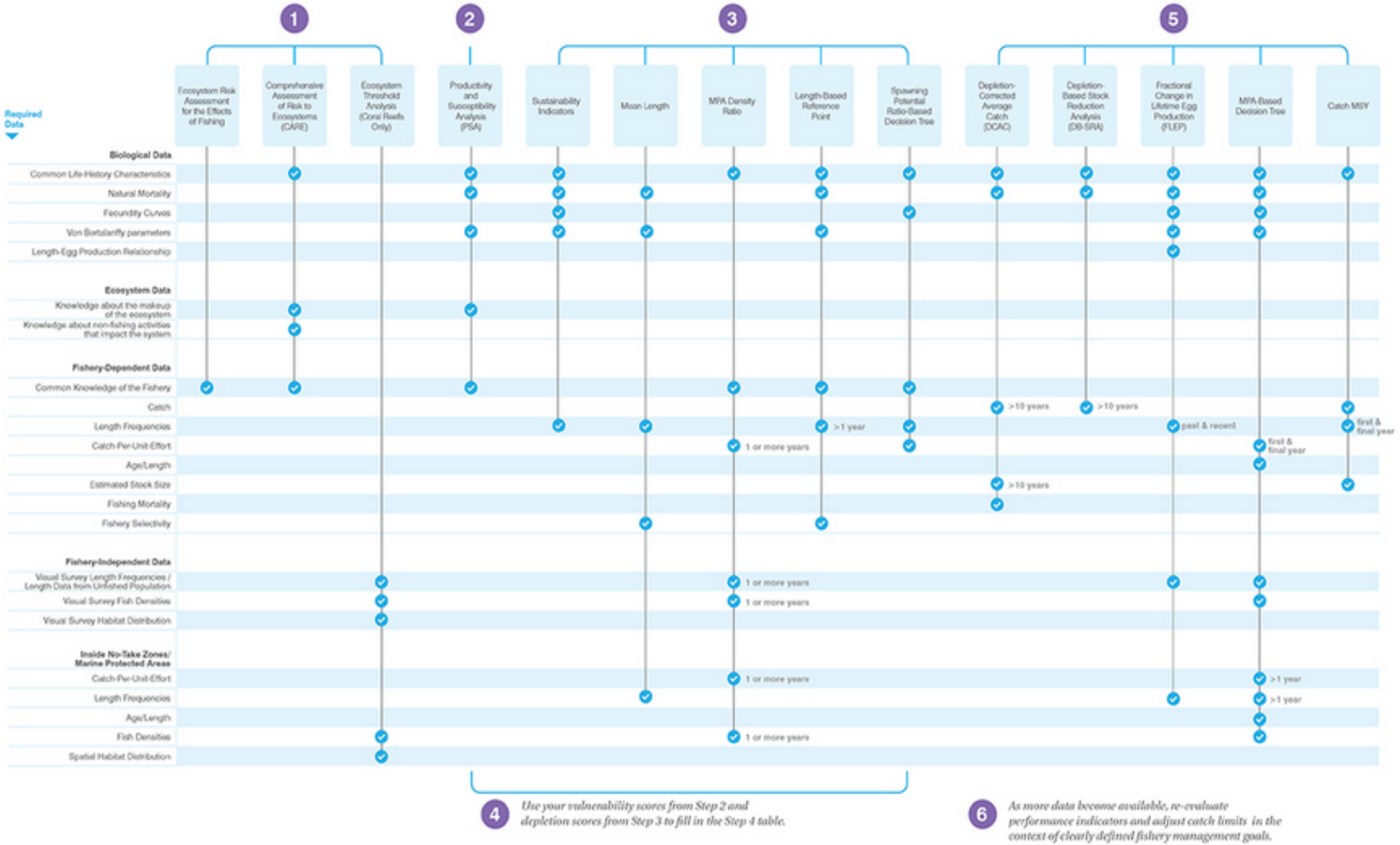
6 Step Framework



Step 5. Assess priority species

Method Matrix

Use the answers from your species data worksheets to determine which assessment method(s) are most appropriate for your fishery.



4 *Use your vulnerability scores from Step 2 and depletion scores from Step 3 to fill in the Step 4 table.*

6 *As more data become available, re-evaluate performance indicators and adjust catch limits in the context of clearly defined fishery management goals.*

Step 5: Assess priority species

Method	Status	Goal
Exploitation Rate	0.84	E=M
Catch Curve	0.81	E=M
Beverton–Holt mortality estimator	0.83	E=M
Survival Estimation in Non-Equilibrium (SEINE)	0.84	E=M
M= 0.26 - 0.38 yr -1		
Length-based Reference Points		
Pobj	1.78	2.00
SPR	0.3 (avg.)	> 0.35

- Exploitation rate > Natural mortality
- Exceeds the limit reference points, because $L_{mat} < 0.75\ L_{opt}$ and $P_{mat} > 0.90$
- $SPR < SPR_{limit}$

Modified from Erisman et al. 2014, using data from 2010-2012

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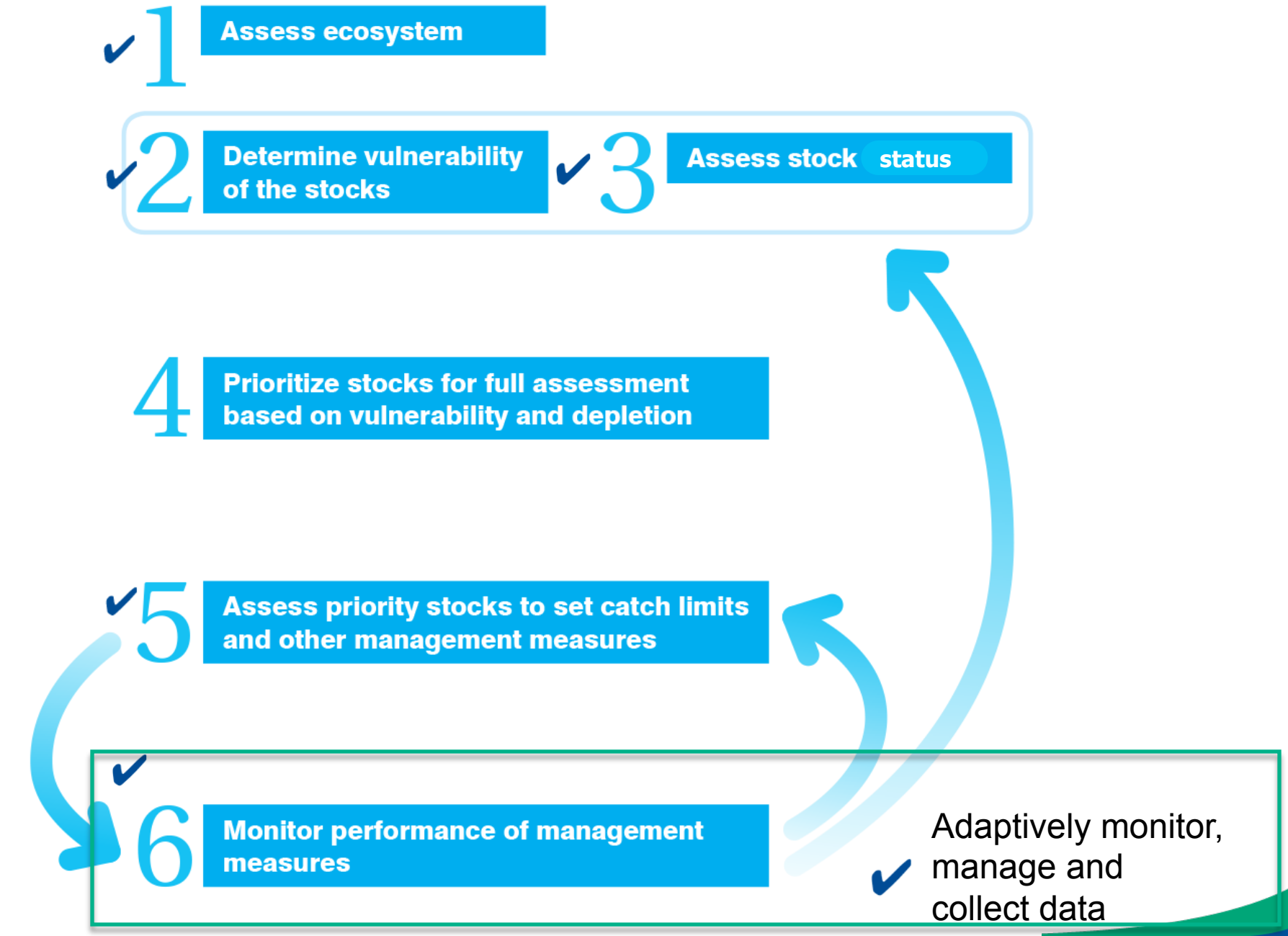
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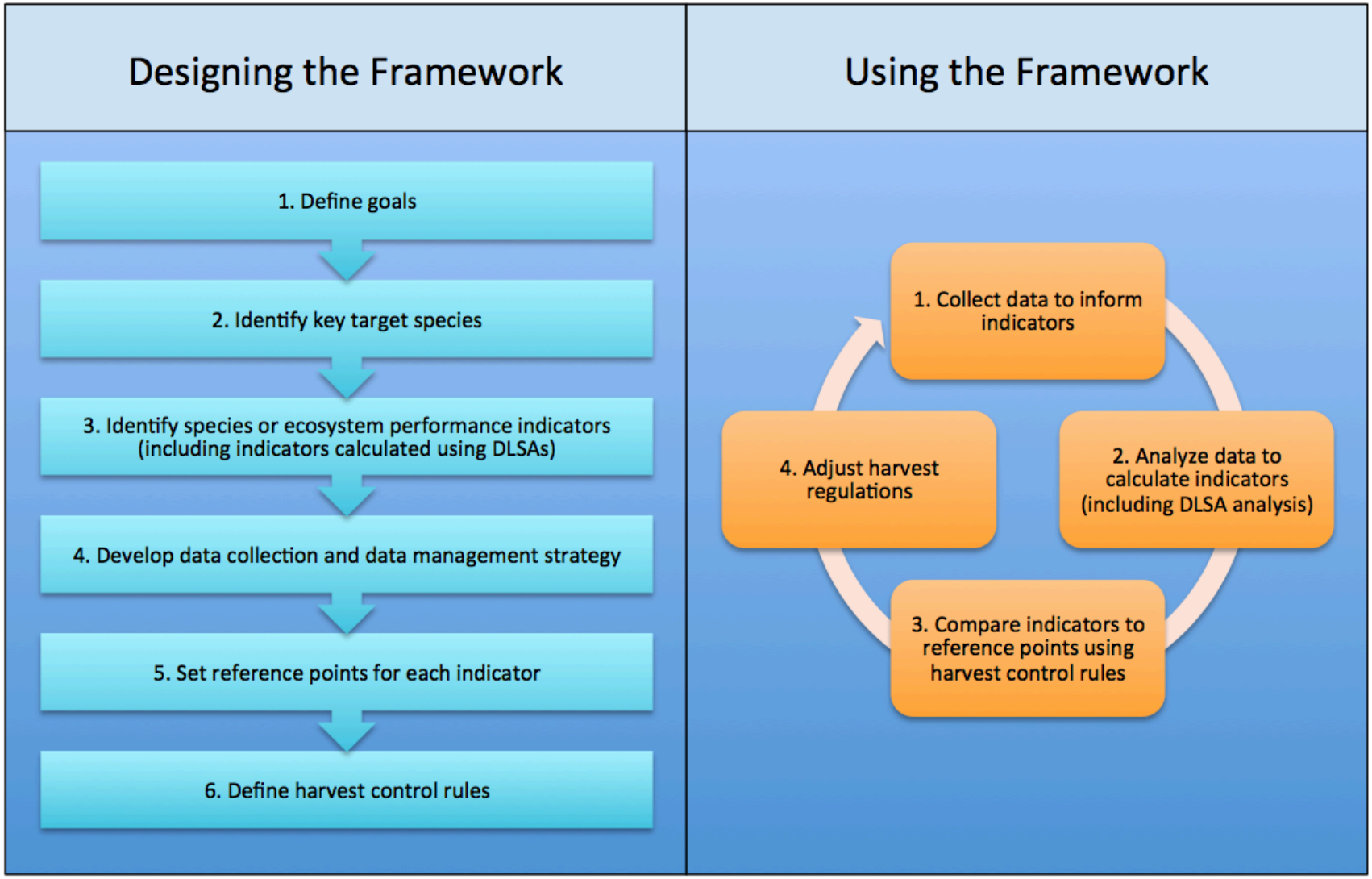
Adaptive Assessment and Management Framework



Scenario	Reference Point			Interpretation / possible causes	Suggested management response sequence
	Popt= 100% (Lopt= 715 mm TL)	**E LIMIT**	**SPR TRP = 0.35**		
1	↑	↑	↑	• Stock productivity and fishery performance stable and/or increasing • Current regulation in place and functional	*No response required, but optionally:* 1)Monitor reference point (RP) trends a)Make no change (if RP trends are stable or just above limits) b)Ease harvest rate regulation (if RP trends high/increasing)
2	↓	↑	↑	• Fishery lightly harvested (i.e., fishing effort and harvest rates are low)	*No response required, but optionally:* 1)Monitor reference E and SPR trends and recruitment, gear and behavior patterns a)Make no change (if E/SPR trends stable/just above limits) b)Ease harvest rate regulation (if E/SPR trends increasing)
3	↓	↑	↓	• Overfishing, or • Error in calculations	*Response required; recommended action sequence:* 1)Harvest rate reduction (lower catches or reduce effort, gear restrictions) 2)Confirm/monitor SPR with multiple models/ approaches 3)If trend persists consider additional regulatory options a)Increase min size limit

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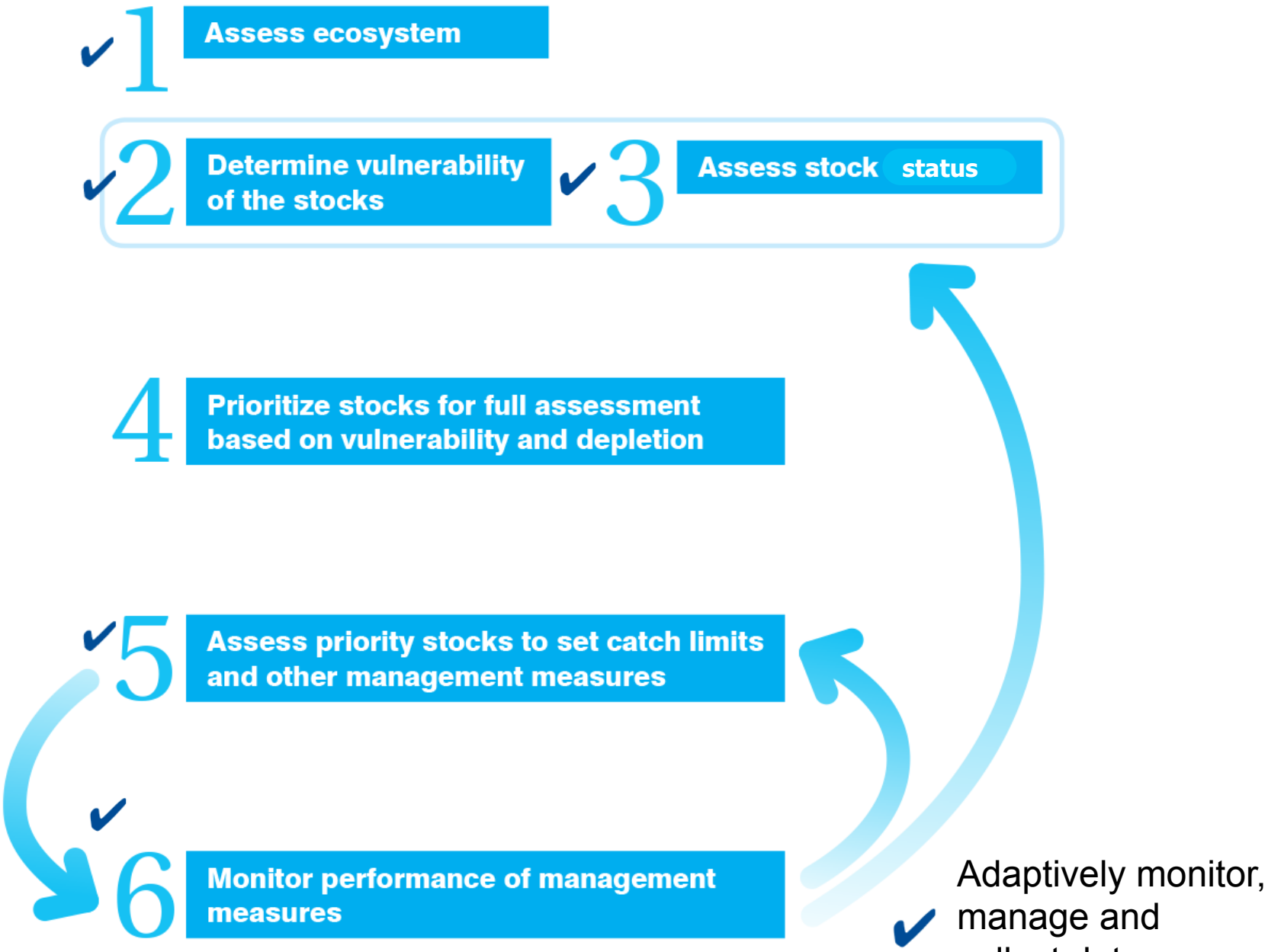
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Questions?
Thank you!