Managing Stock Complexes Using Indicator Species: Pros and Cons

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Sustainable Fisheries Division

Southeast Fisheries Science Center, Miami, Florida
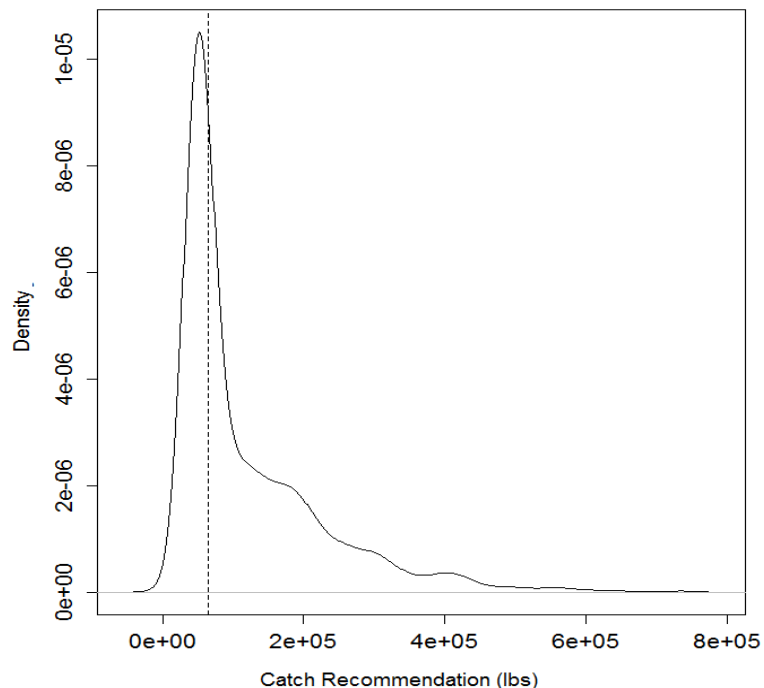
Caribbean Fishery Management Council:
SSC Meeting

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Calculation of Single-Stock OFL and ABC

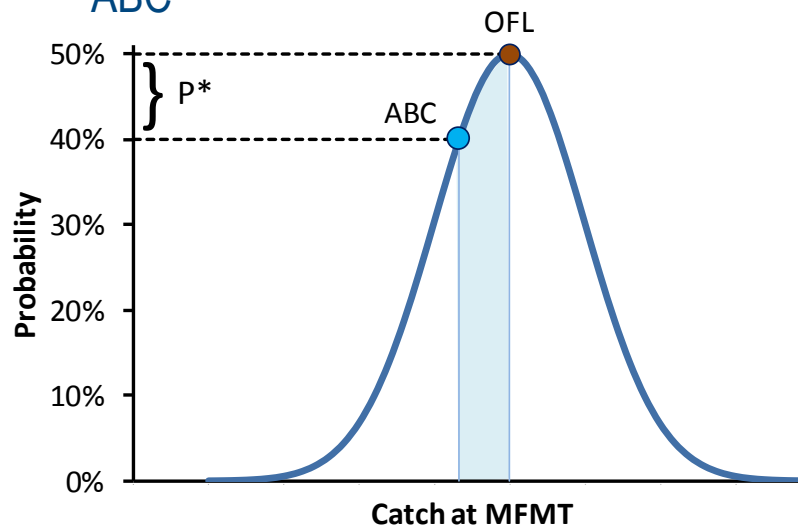| Recommended methods	PR_Hog
Index-based	Islope1, Islope4
Length-based	YPR_ML

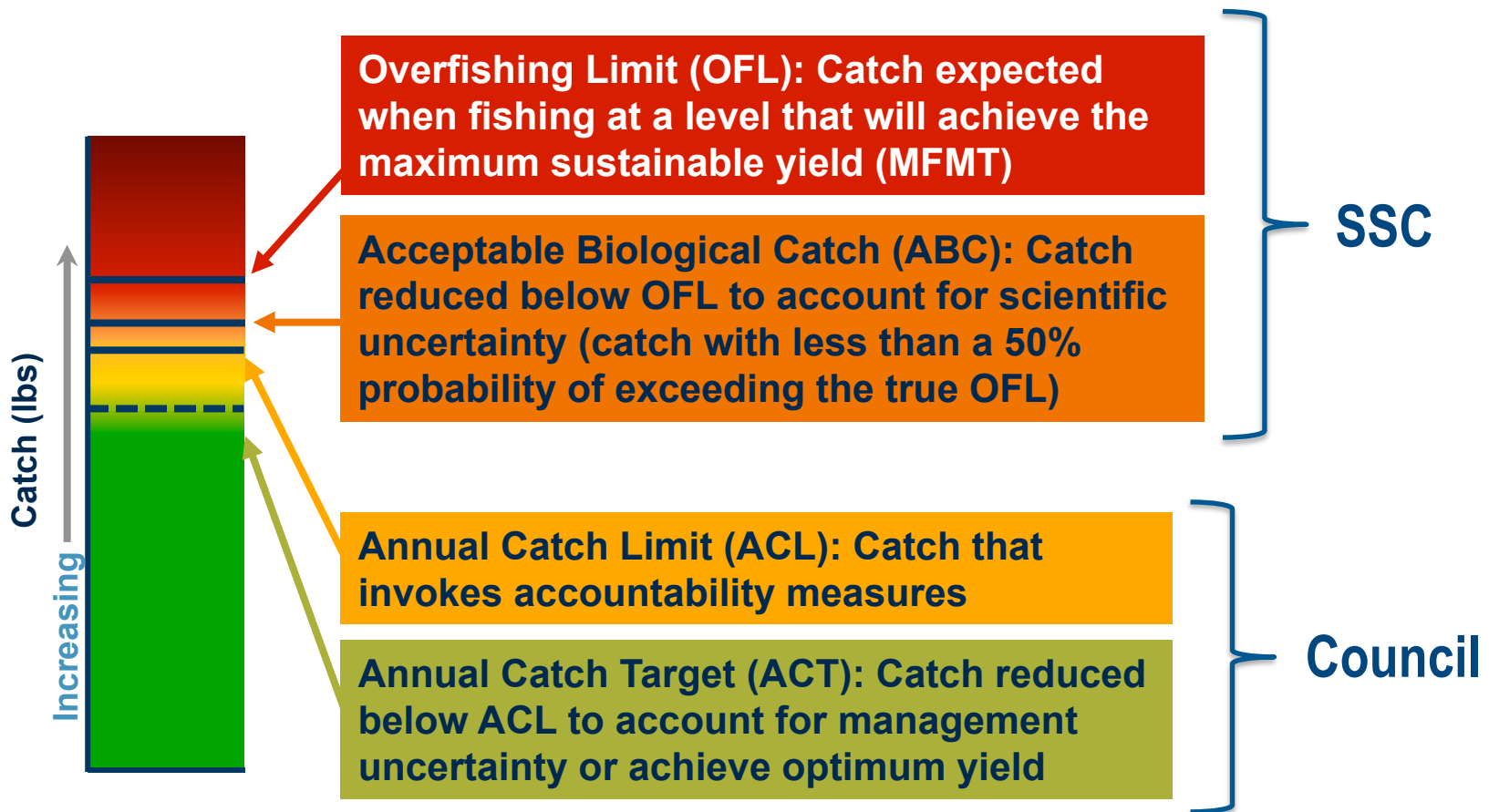Catch Recommendation (lbs)

Recommendation 1:
Consider model averaging or weighting of Islope1 and YPR-ML (i.e., recommended methods)

Steps:
1. Combine OFL TAC distributions of Islope1 and YPR_ML
2. Apply buffer on selected metric (e.g., median TAC) of combined OFL distributions to derive ABC

Catch at MFMT

Setting OFL and ABC

Overfishing Limit (OFL): Catch expected when fishing at a level that will achieve the maximum sustainable yield (MFMT)

Acceptable Biological Catch (ABC): Catch reduced below OFL to account for scientific uncertainty (catch with less than a 50% probability of exceeding the true OFL)

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Catch (lbs)

Increasing

Annual Catch Limit (ACL): Catch that invokes accountability measures

Annual Catch Target (ACT): Catch reduced below ACL to account for management uncertainty or achieve optimum yield

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ABC Control Rule Guidelines

- The ABC control rule should consider reducing fishing mortality (MFMT) as stock size declines

- The determination of ABC should be based, when possible, on the probability that a catch equal to the stock's ABC would result in overfishing (P*). The probability of overfishing cannot exceed 50% and should be a lower value.

- The control rule may be used in a tiered approach to address different levels of scientific uncertainty
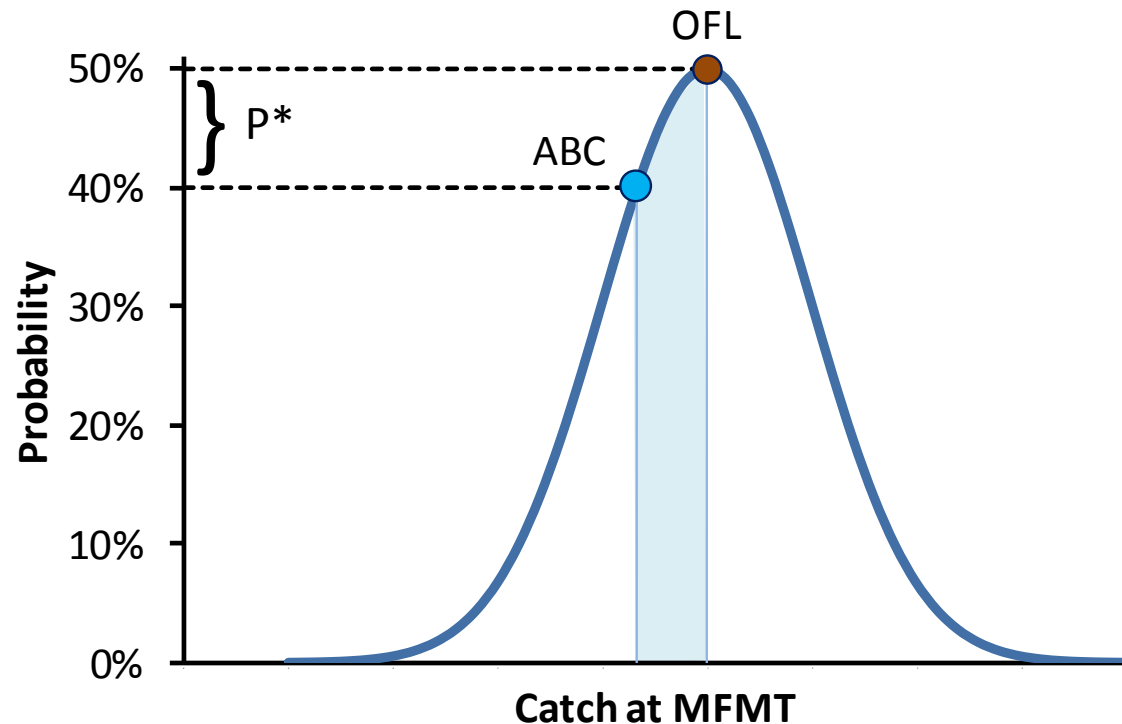
ABC Control Rule

- The ABC control rule should consider reducing fishing mortality (MFMT) as stock size declines
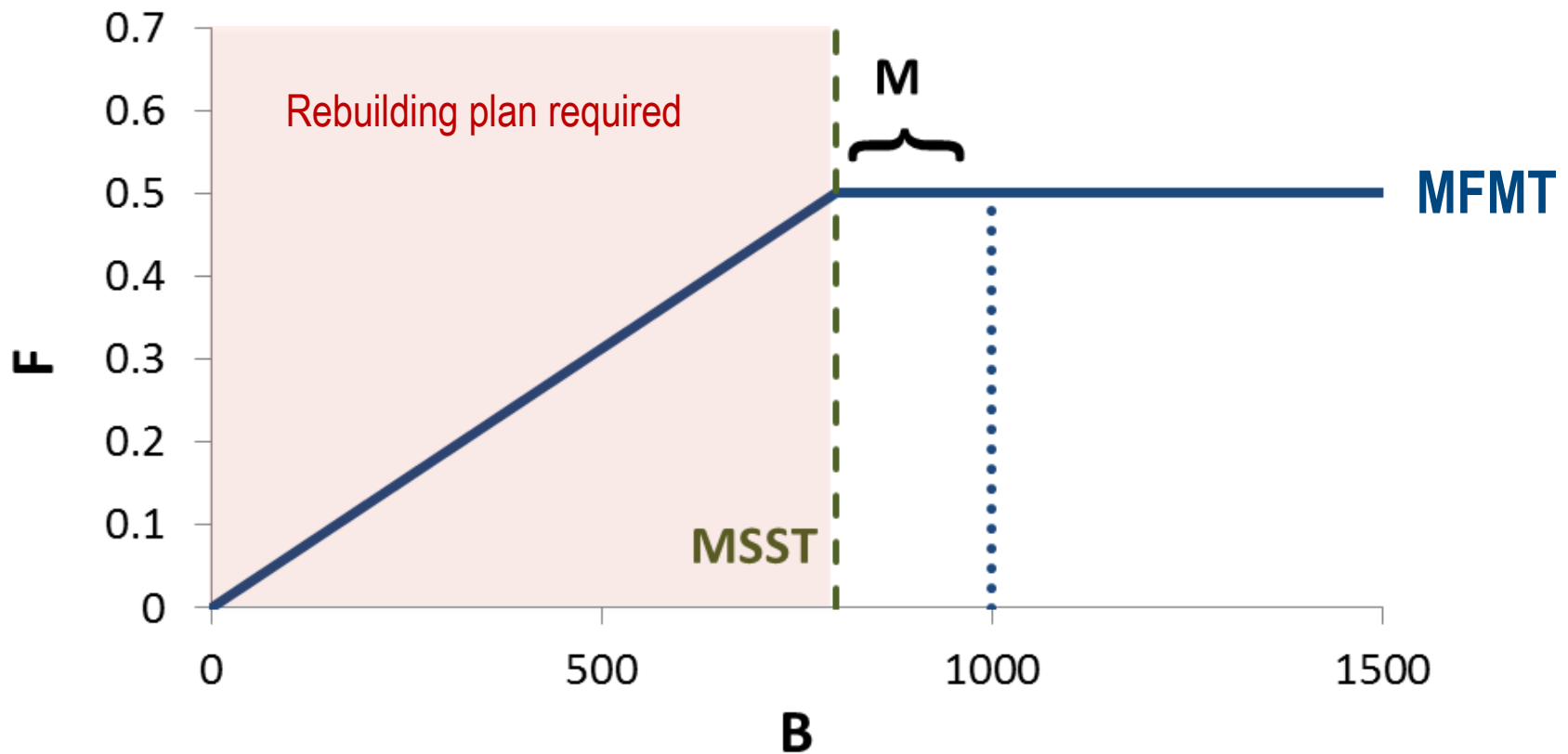
ABC Control Rule

- The determination of ABC should be based, when possible, on the probability that a catch equal to the stock's ABC would result in overfishing (P*). The probability of overfishing cannot exceed 50% and should be a lower value.

Example ABC Control Rule in words

Tier 1

- Condition for use: Assessment provides estimate of OFL based on maximum sustainable yield or its proxy and a probability density function of the OFL that reflects scientific uncertainty

- MFMT = dF_{MSY}, where $d = \begin{cases} 1 & \text{if } B \geq MSST \\ B/MSST & \text{if } B < MSST \end{cases}$

- OFL = catch at MFMT

- ABC determined from PDF of OFL where acceptable probability of overfishing is 40%

Species Complexes

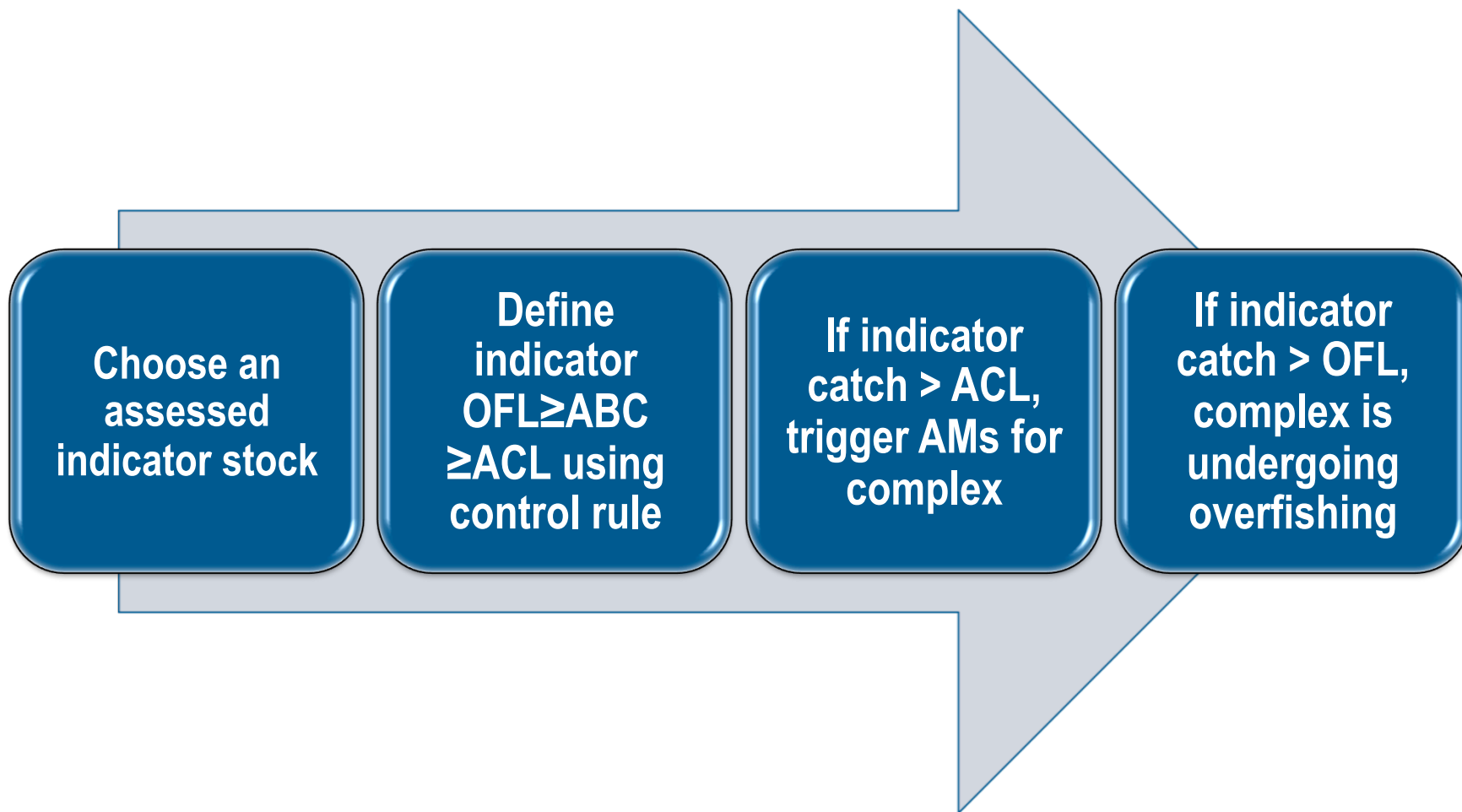| List of Species	Snappers
Snapper Unit 1	Silk / Chillo
	Blackfin / Alinegra, Negrita
	Vermillion / Besugo
	Wenchman / Limosnera, Muniama
	Black/ Chopa negra

NS1 (proposed rule) guidelines:

- **Definition:** A stock complex is a tool to manage groups of stocks within an FMP with consideration of a geographic distribution, life history characteristics and vulnerabilities to fishing pressure such that the impact of management actions on the stocks is similar.

- *Stocks may be grouped into complexes for various reasons:*
  - Stocks in a multispecies fishery cannot be targeted independently
  - When there is insufficient data to determine a stock's status
  - When fishermen cannot distinguish individual stocks among their catch

Can DLM results inform management of species complexes?

- ***Yes***, with or without an indicator species.

- ***Note***: the proposed NS1 guidance encourages that:

  - Where practicable, stock complexes should be comprised of one or more ***indicator stocks*** (each with status determination criteria and an ACL).

  - Furthermore, NS1 discourages the practice of removing a stock from a complex once it has been assessed.

Option 1: Use Indicator Stock ACL

Choose an assessed indicator stock

Define indicator OFL≥ABC ≥ACL using control rule

If indicator catch > ACL, trigger AMs for complex

If indicator catch > OFL, complex is undergoing overfishing

Option 1: Use Indicator Stock ACL

PROS	CONS
Requires only one assessment per complex	Requires "frequent" assessments of the indicator
Promotes productive and sustainable resources	Risk of foregone yield for less vulnerable members
Don't need accurate catch statistics for non-indicator species	Risk of overfishing for more vulnerable members of complex

OPTION 2a: Indicator Stock + individual ACLs

Choose an assessed indicator stock

Define indicator OFL≥ABC ≥ACL using control rule

Determine required % reduction in ACL of indicator

Apply the same reduction to the ACLs of the non-assessed members (e.g. from recent landings).
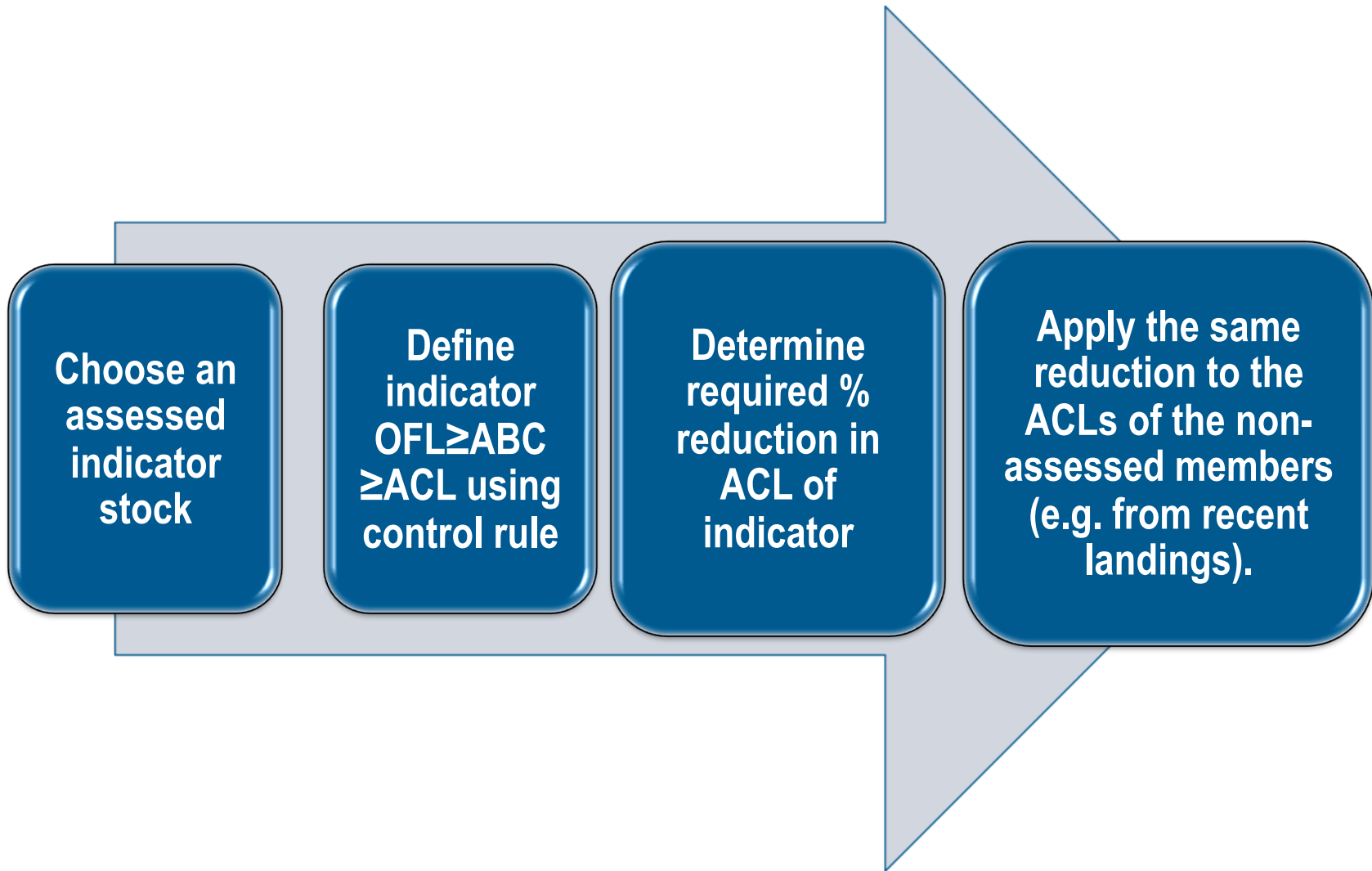
OPTION 2a: Indicator Stock + individual ACLs

If catch > individual ACL, trigger AM for that stock

If catch > individual OFL, stock is undergoing overfishing

OPTION 2a: Indicator Stock + Individual ACL

PROS	CONS
Requires only one assessment per complex	Requires "frequent" assessments of the indicator
Promotes productive and sustainable resources	Need accurate catch statistics for each non-indicator species
	Some risk of overfishing for more vulnerable members of complex (or underfishing less-vulnerable members)

OPTION 2b: Indicator Stock + Aggregate ACL

Calculate aggregate OFL and ACL for complex

If complex catch > ACL, trigger AMs for complex

If complex catch > OFL, complex is undergoing overfishing
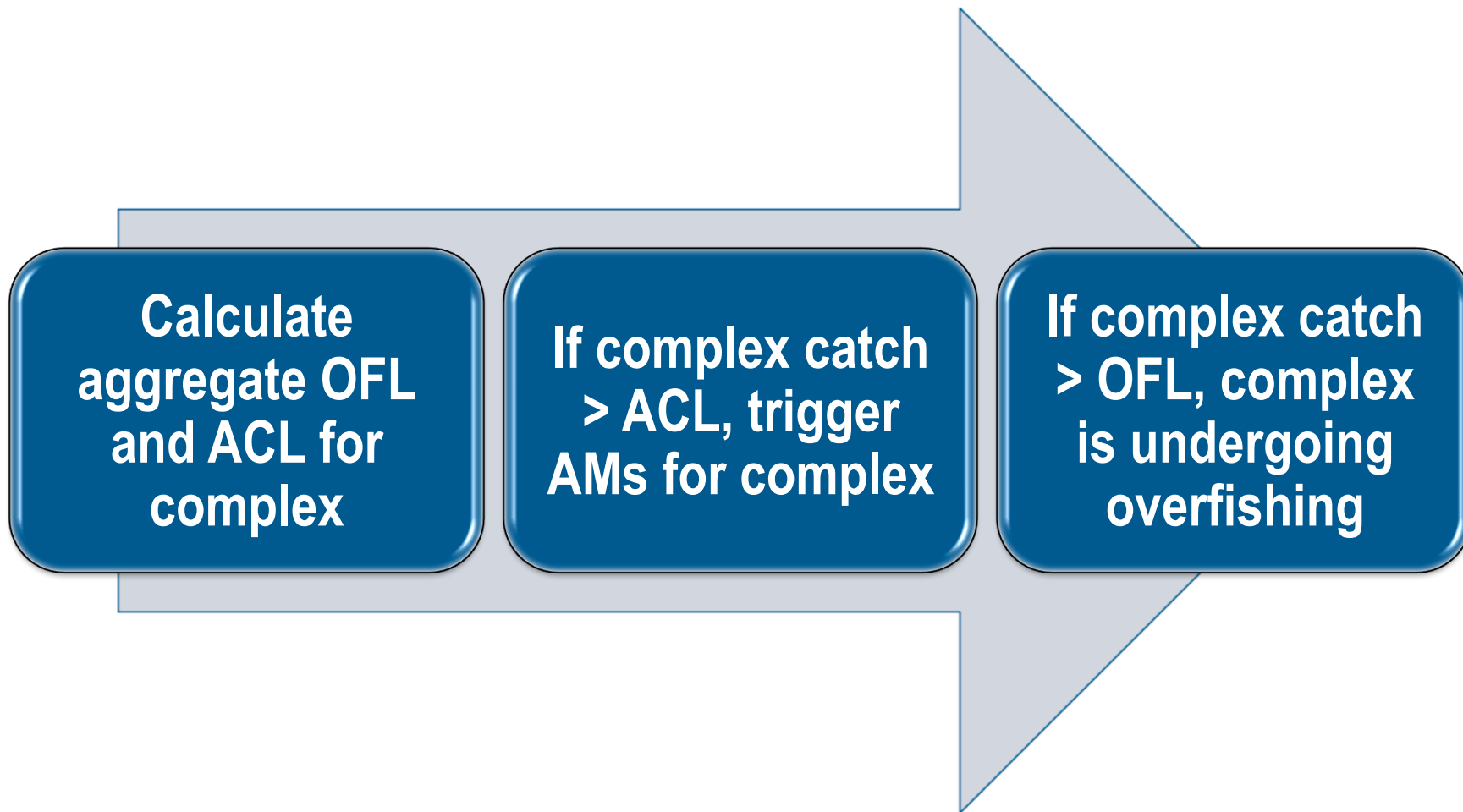
OPTION 2b: Indicator Stock + Aggregate ACL

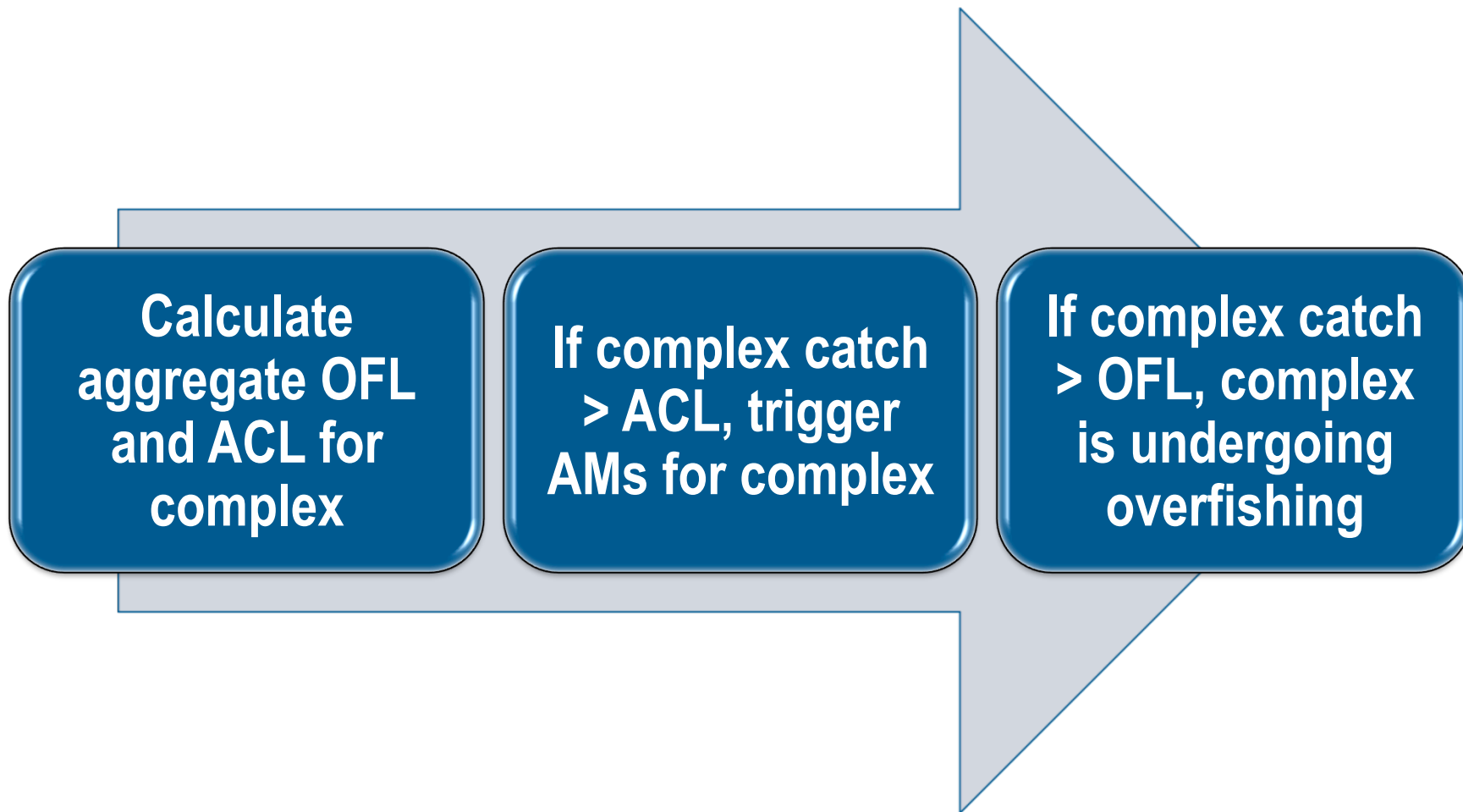| PROS	CONS
Requires only one assessment per complex	Requires "frequent" assessments of the indicator
Promotes productive and sustainable resources	Need accurate aggregate catch statistics for non-indicator species
	Risk of overfishing for more vulnerable members of complex (or underfishing less-vulnerable members)

OPTION 3: No Indicator Stock

For all assessed members, define OFL≥ABC ≥ACL using control rule

For other members, use recent landings to estimate OFL≥ABC ≥ACL

OPTION 3: No Indicator Stock

Calculate aggregate OFL and ACL for complex

If complex catch > ACL, trigger AMs for complex

If complex catch > OFL, complex is undergoing overfishing

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OPTION 3: No Indicator Stock

PROS	CONS
Incremental improvement over status quo	Highest risk of overfishing for more vulnerable members of complex (or underfishing less-vulnerable members)
Dependability may improve as more members are assessed	Need accurate catch statistics

OPTION 4: No Indicator Stock, Remove Assessed Stocks

For all members, use recent landings to estimate OFL≥ABC ≥ACL

Calculate aggregate OFL and ACL for complex

If complex catch > ACL, trigger AMs for complex

If complex catch > OFL, complex is undergoing overfishing
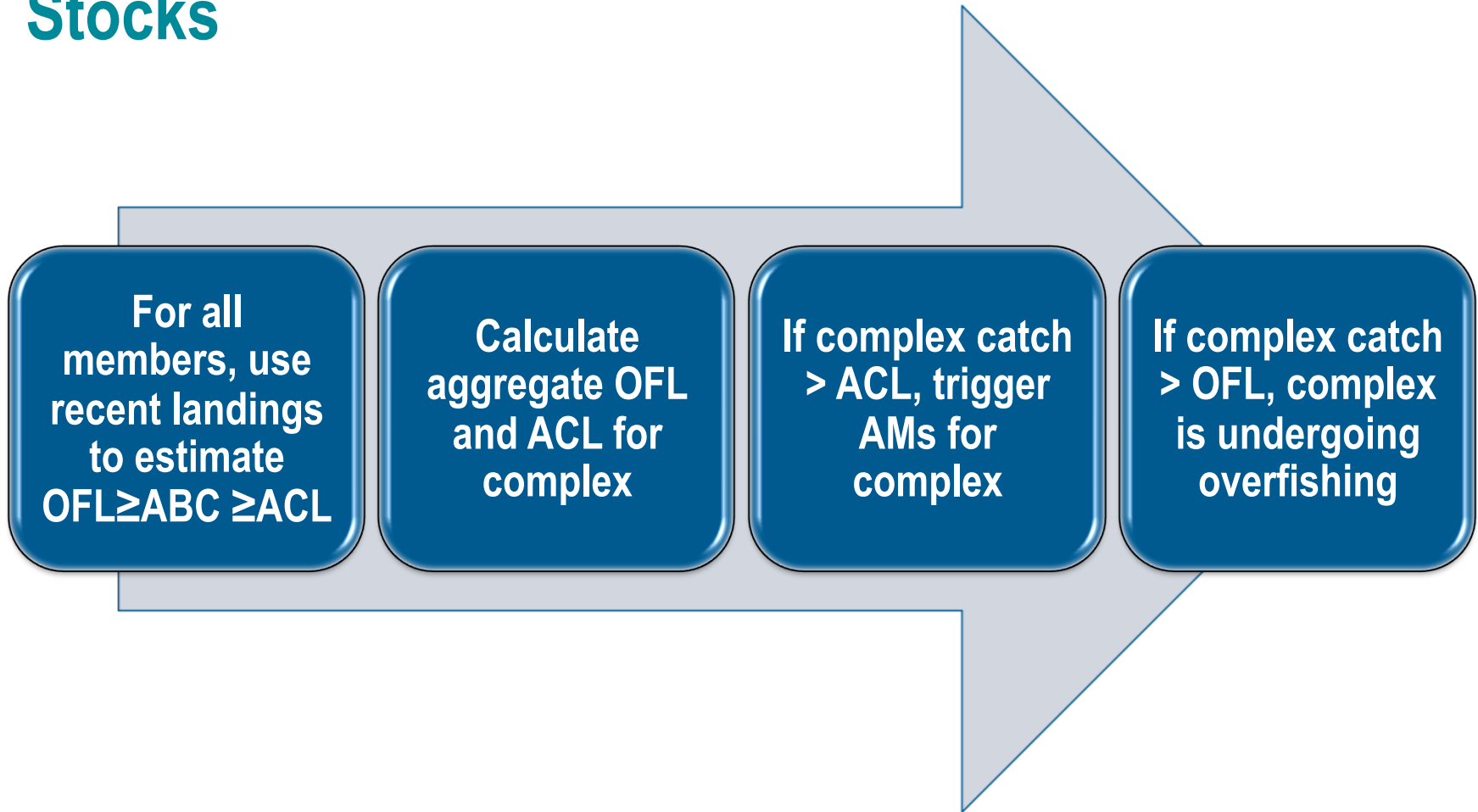
OPTION 4: No Indicator Stock

PROS	CONS
Does not require stock assessments	Discouraged by NS1 (Proposed Rule)
	No basis for status determination of any stock in complex
	Requires accurate catch statistics
	Highest risk of overfishing for more vulnerable members of complex (or underfishing less-vulnerable members)
	Dependability may degrade as assessed members are removed (increasing data-limitations).

Conclusions

1. NMFS and the SEFSC support the use of indicator species to manage species complexes.

2. Stock complexes should be comprised of species with similar geographic range, life history, vulnerability etc.

3. Given bullet 2, options #1 and #2ab are preferred as they are most likely to promote productive and sustainable resources.