

Adaptive Fisheries Assessment and Management Toolkit (AFAM) Overview

Road map for this session

- Presentation
 - Why AFAM?
 - What is AFAM?
 - AFAM walk-through with case study from Belize
- Breakout Group Activity
 - *Setting Goals and Characterizing your fishery*

The challenge:

Assessing and managing data-limited fisheries in a huge range
of contexts



The solution:

Adaptive fisheries assessment and
management toolkit (*AFAM*)!

The solution:

Adaptive fisheries assessment and management toolkit

Two Components

Online / Offline
Dashboard

AFAM Toolkit Dashboard

Instructions Step 1 – Upload data, select species, and determine assessment and management tier

Step 2 – Select fisheries management control(s) Step 3 – Select performance indicators and reference points Step 4: Define Harvest Control Rules

Step 5: Perform Assessment Techniques Step 6: Interpret Assessment Results

Step 7: Adjust fisheries management controls using defined harvest control rules Step 8: Complete your Fishery Management Plan

Click for help!

Instructions: Select available data types, upload data (you may choose either real or sample data), and enter additional information for the analysis such as the target species. A data summary will be shown on the right. Your assessment and management tier will also be automatically calculated.

Select the available data types

- Local Ecological Knowledge
- Length composition data
- Landings and Effort Data
- Underwater Visual Survey Data

Do you wish to use a real data set or a sample data set?

Below is a summary of your available data, your assessment and management tier (automatically calculated based on the available data), and tables of raw data (either sample data or real data)

Data Summary

Data Type	Is data available?	Years of available data
1 Local Ecological Knowledge	TRUE	1
2 Length composition data	TRUE	9
3 Landings and Effort Data	TRUE	10
4 Underwater Visual Survey Data	TRUE	7

Showing 1 to 4 of 4 entries

Assessment and Management Tier

Linked accompanying guidance document

AFAM Toolkit Guidance Document

Welcome

AFAM Toolkit Overview

- 0.1 Purpose Statement**
- 0.2 Suggested Audience**
- 0.3 Skills Necessary to Use Toolkit**
- 0.4 Toolkit Objectives**
- 0.5 When to Use the Toolkit**
- 0.6 Data Necessary to Use the Toolkit**
- 0.7 How this Toolkit was Developed**
- 0.8 How to use this toolkit**

1 Step 1 – Determine Assessment and Management Tier

- 1.1 Step 1a – Fill out your Data Inventory
- 1.2 Step 1b – Using your Data Inventory

2 Step 2 – Determine Appropriate Fisheries Management Controls

- 2.1 Step 2a – Summarize and Quantify Available Data
- 2.2 Step 2b – Preliminary Selection of Data
- 2.3 Step 2c – Consider Applying A Management Control

AFAM Toolkit Overview

0.1 Purpose Statement

- This toolkit provides you the tools you will need to estimate how your fishery is doing and achieve your fishery goals by managing it adaptively. The toolkit will help you implement fisheries management measures based on your best available science, learn how these management interventions are performing, and then adjust them as necessary.
- This toolkit will help you create an Adaptive Fisheries Management Plan
- See Figure . below for a step-by-step process schematic of the toolkit

0.2 Suggested Audience

- The toolkit is designed as a facilitation document that is led by one person. However, during each step, this person would work with a multi-stakeholder group to reach consensus and make decisions



The solution:

Adaptive fisheries assessment and management toolkit

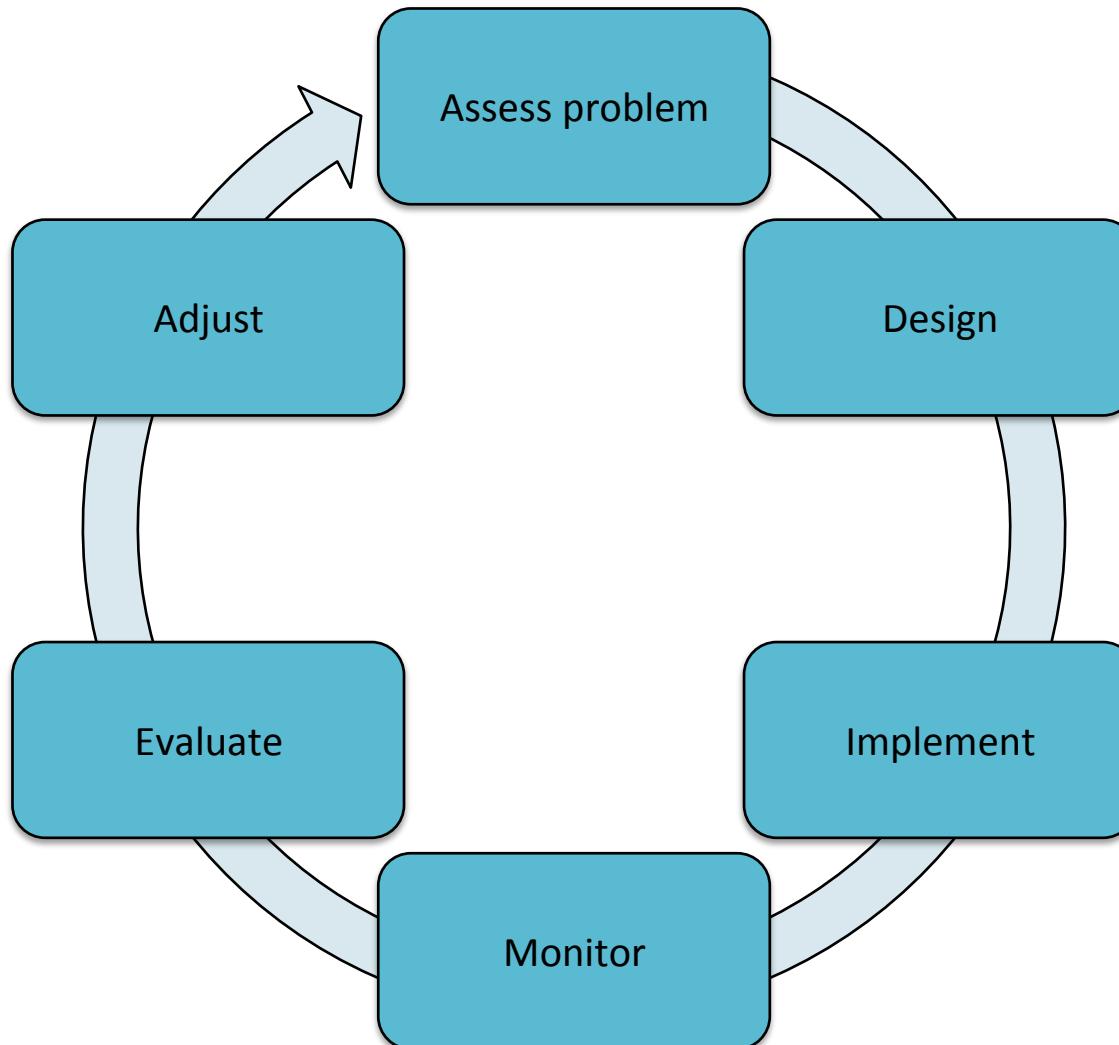
Dashboard and guidance document can be found at:

<https://sfg-ucsb.shinyapps.io/afam-dashboard/>

And here is a link for instructions for downloading and installing the dashboard for offline use:

<https://sfg-ucsb.github.io/afamGuidanceDocument/Step5.html#installing-the-dashboard-from-the-internet>

What is adaptive management?



Why is adaptive management important for data-limited fisheries?

- To maximize benefits of fisheries, must have good fisheries management
- How can you manage if you don't know how many fish there are, or how hard they are being fished?
- ...Like trying to budget for a new car without knowing how much money is in the bank

Why is adaptive management important for data-limited fisheries?

- Fisheries are dynamic systems
- Available data is often incomplete, uncertain, and accompanied by biases
- Full statistical stock assessments are usually not possible



Key features of this framework

- Process of designing the framework is collaborative and stakeholder-driven
- Local stakeholder knowledge is incorporated during data interpretation
- Flexibility to use multiple performance indicators appropriate for species, available data, and technical capacity for data analysis



AFAM 101

Audience:

- On-site staff (e.g., fisheries technicians or scientists for local NGOs, governments, etc.)
- Regional support staff who may support several sites

Skills

- General fisheries knowledge (ecology, management options, population dynamics, local policy)
- Familiarity with the fisheries management basics
- Familiarity with data analysis and visualization
- Facilitation skills to coordinate and run multi-stakeholder discussions
- Communication skills to communicate the benefits and tradeoffs of different fisheries assessment and management options to a variety of stakeholders

AFAM 101

Inputs

- Minimum:
 - Qualitative characterization of the fishery
 - Key target species for management
 - Prioritized goals for management
- Recommended:
 - Landings, effort, and CPUE
 - Fishery-dependent length composition
 - Underwater visual survey data

Outputs

- Adaptive Fishery Management Plan

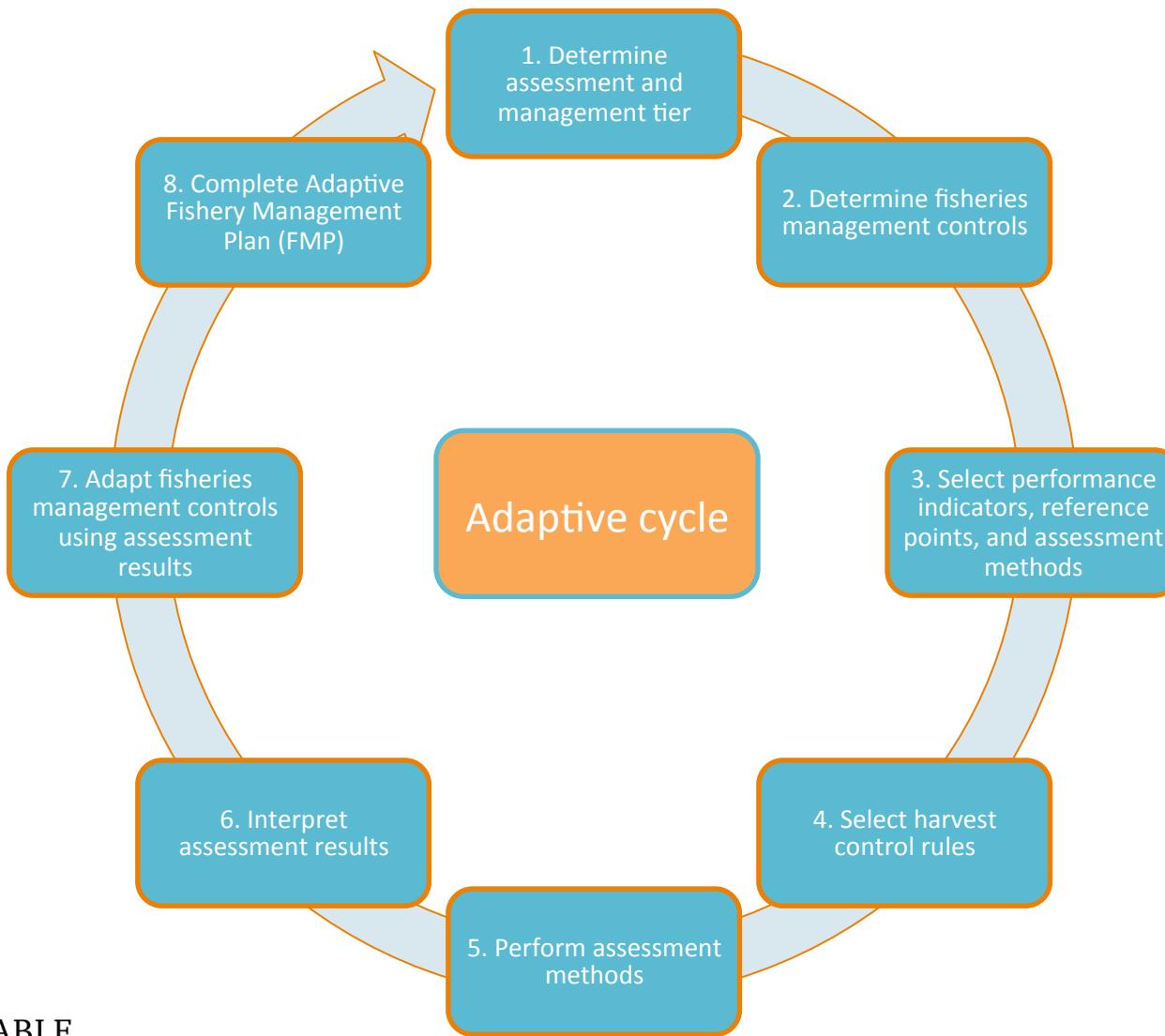


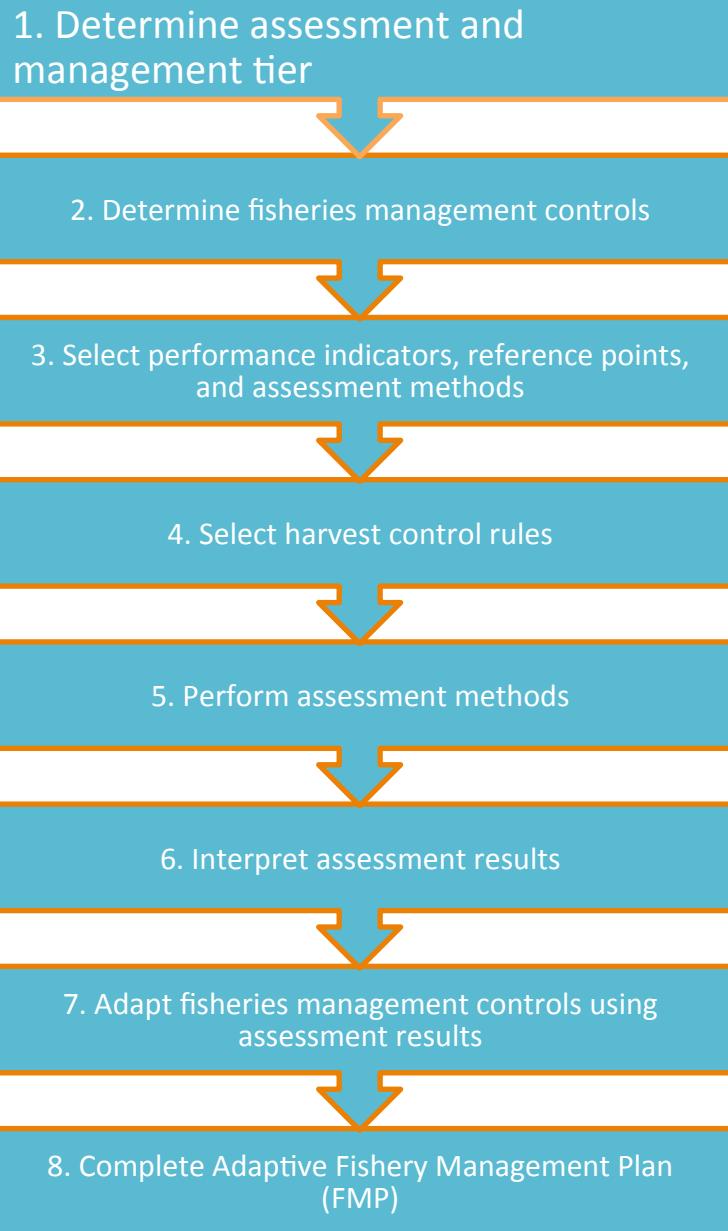
Walking through the AFAM toolkit with an example from Belize



Healthy Reefs
for healthy people

AFAM Toolkit 8-step process





**Before starting, check out the
“AFAM Toolkit Worksheet”**

The AFAM Toolkit dashboard will keep track of all of your steps and automatically generate a report once you've complete all steps. However, you may also wish to keep track of the outputs from each step on a hard copy piece of paper, especially since the dashboard does not currently allow you to save your work.

As you work through each step, fill out the following tables.

Step 1 – Determine assessment and management tier

Step 1 outputs – Data Inventory

Minimum Required Data	Needed?	Available?	Years of data
Qualitative characterization of the fishery	Required		
List of prioritized species for management	Required		
List of prioritized goals for management	Required		
Landings, effort, and CPUE of key target	Optional		

[3.4 Assessment Method Descript...](#)

[4 Step 4 – Define Harvest Control Rules](#)

[4.1 Step 4a – Define General Harv...](#)

[4.2 Step 4b – Add Specificity to H...](#)

[5 Step 5 - Perform Assessment Meth...](#)

[5.1 Installing the dashboard from ...](#)

[5.2 Installing the dashboard from ...](#)

[5.3 Running the AFAM Toolkit Das...](#)

[6 Step 6 – Interpret assessment results](#)

[6.1 Step 6a - Determine the Most ...](#)

[6.2 Step 6b – Verify Assessment R...](#)

[7 Step 7 – Adjust Fisheries Managem...](#)

[8 Step 8 – Complete Your Fishery Ma...](#)

[8.1 Fishery Management Plan Tem...](#)

[9 Glossary](#)

[10 References](#)

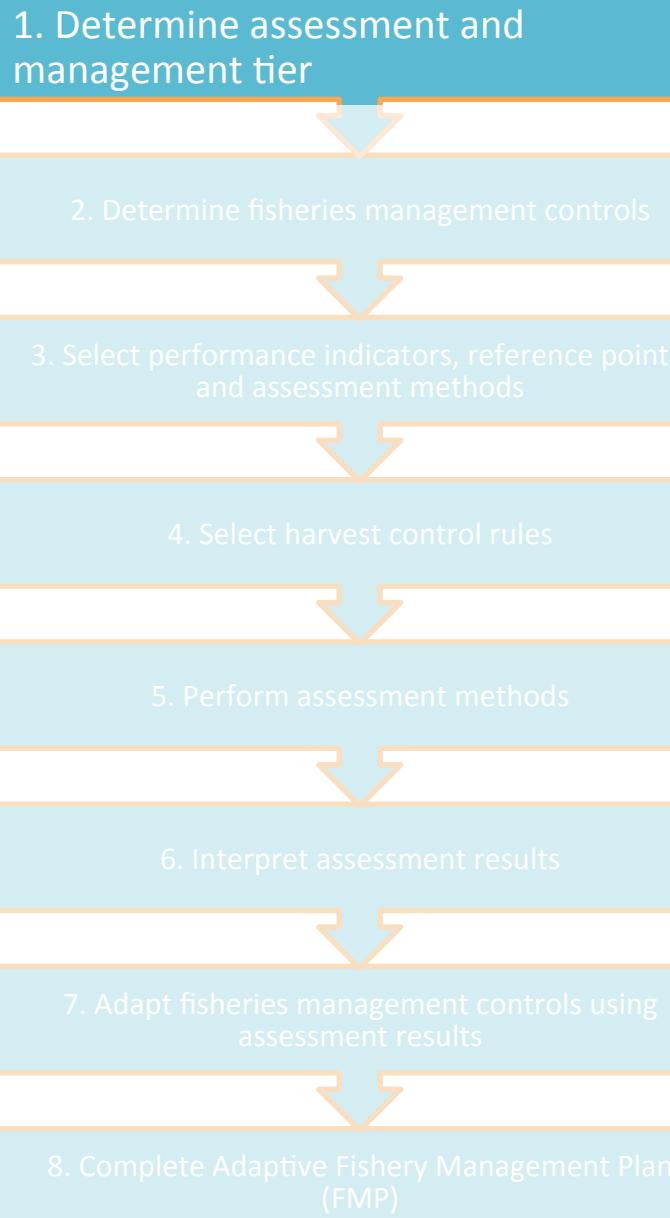
[11 AFAM Toolkit Worksheet](#)



Tier 1: Precautionary Assessment and Management

No data or Less than one year of data

- Few assessment options
 - Rely on local knowledge
- Management Options
 - Prohibit use of destructive fishing practice, dynamite, chemicals
 - Prohibit use of fishing with small mesh size
 - Prohibit fishing on seasonal spawning aggregations



Tier 2 & 3: Preliminary and Multi-indicator Assessment and Management

One or more years of data

- Several assessment options
 - Use catch, effort, length, underwater visual survey data
- Management Options
 - Prohibit use of destructive fishing practice, dynamite, chemicals
 - Prohibit use of fishing with small mesh size
 - Prohibit fishing on seasonal spawning aggregations
 - Size limits
 - Effort restrictions
 - Total allowable catch



1. Determine assessment and management tier

2. Determine fisheries management controls

3. Select performance indicators, reference points, and assessment methods

4. Select harvest control rules

5. Perform assessment methods

6. Interpret assessment results

7. Adapt fisheries management controls using assessment results

8. Complete Adaptive Fishery Management Plan (FMP)



Conch

Available Data

Underwater Visual Survey

Length Composition Survey

Catch Reporting System (Catch and effort)

Lobster

Available Data

Underwater Visual Survey

Length Composition Survey

Catch Reporting System (Catch and effort)

Tier 3



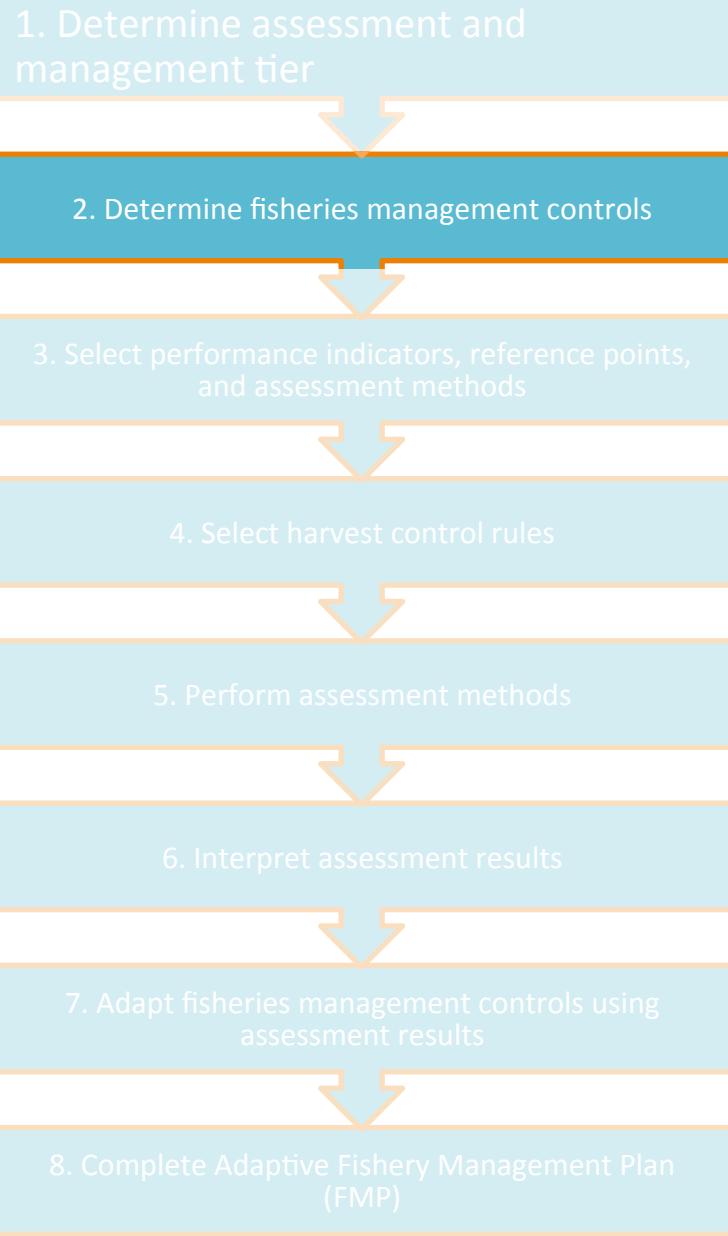
What are fisheries management controls...

Direct Controls:

- **How much:** Catch limits

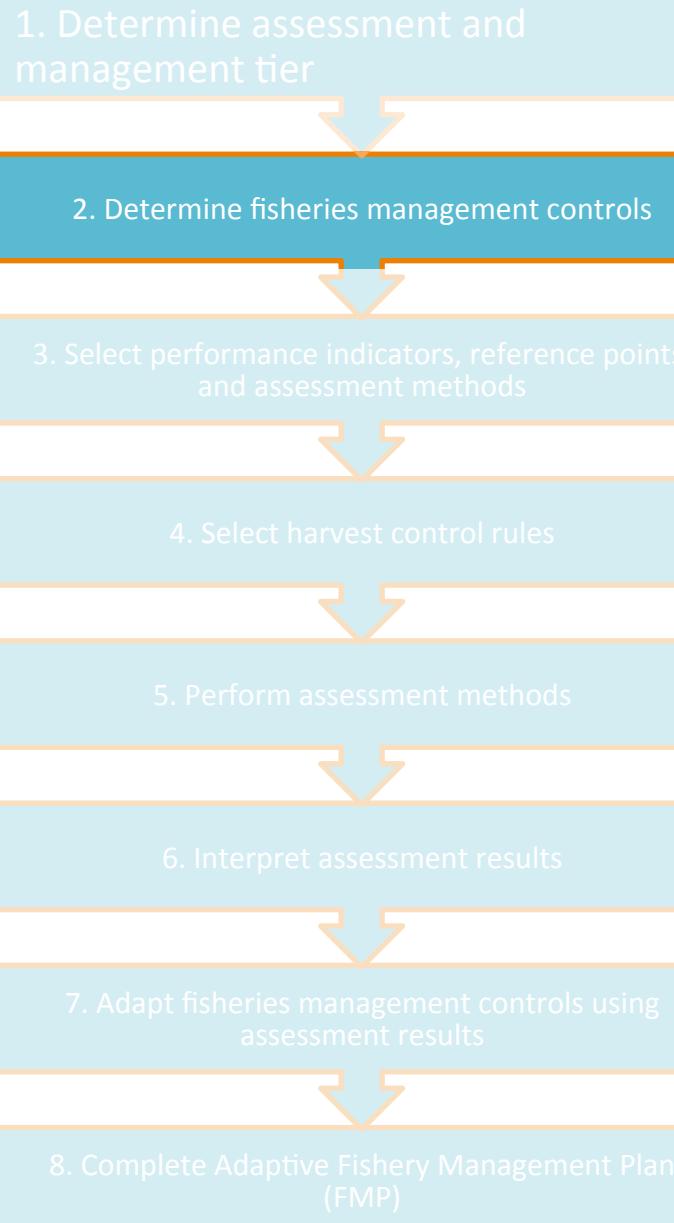
Indirect Controls

- **Who:** Licenses
- **Where:** Spatial closures
- **When:** Seasonal closures
- **How:** Effort Controls; Gear Restrictions
- **What:** Size and sex-specific regulations



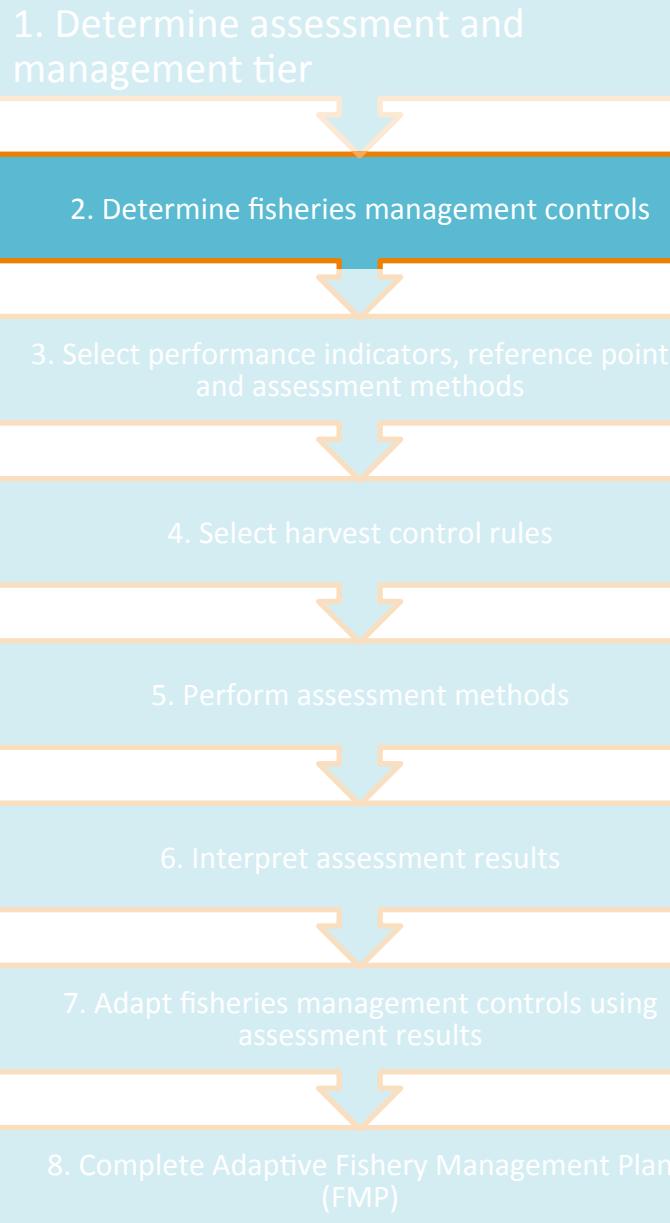
Considerations...

- Goals
- Species of interest
- Existing information & capacity for data collection
- Costs of implementation
 - Gear switches can be expensive
- Ease of enforcement and adoption



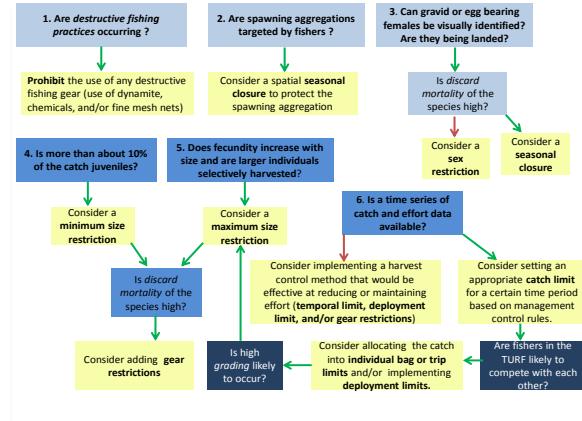
Before making any changes...

***Assess current FMCs if they exist
(qualitatively and quantitatively)***



If no FMCs currently exist, or changes are necessary...

Guided decision-tree



Tables and case studies

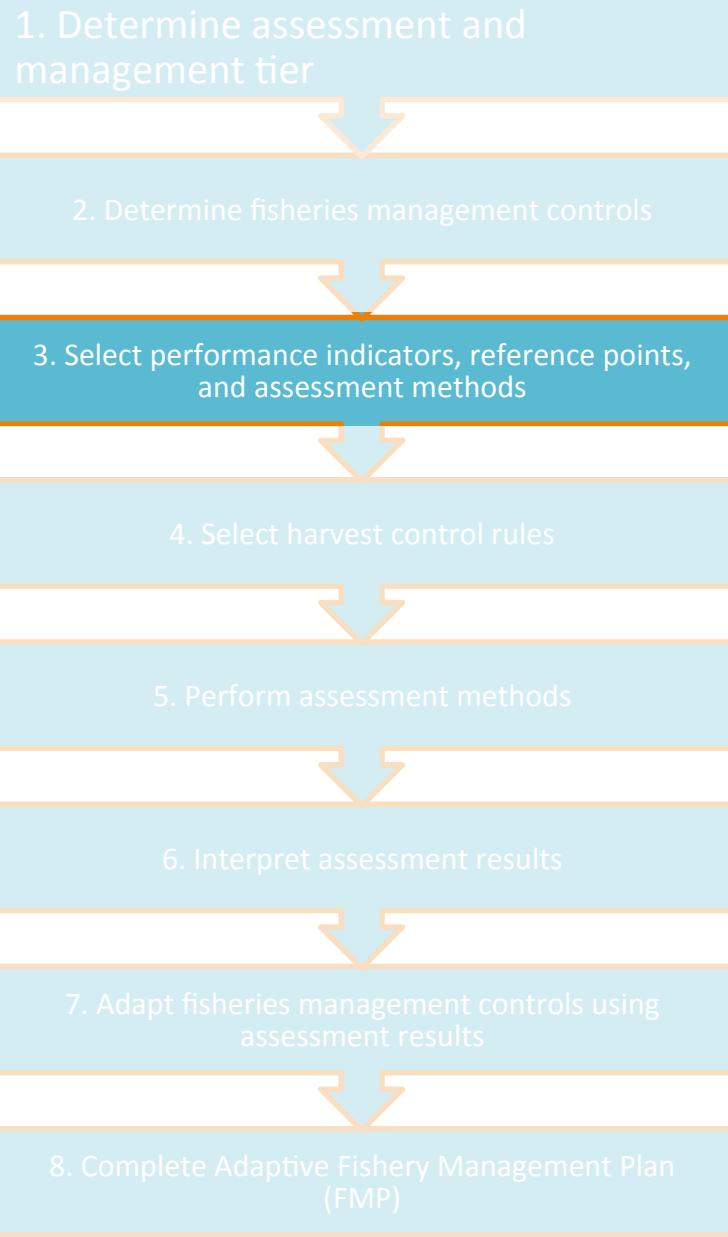
2 Step 2 – Determine Appropriate Fisheries Management Controls	Seasonal Closures to Protect Vulnerable Life History Stages	Protect vulnerable life history stages by restricting the fishery during certain seasons.	Can be enforced if landings are relatively centralized but may be more difficult if landing sites are more dispersed.
2.1 Step 2a – Summarize and Quantify Information	Protect vulnerable life history stages	Information on seasonal behavior such as spawning aggregations and migrations, and the temporal and spatial variability of these behaviors	Seasonal closures are more straightforward to monitor if the closure covers all species, but may be more difficult if the closure only covers a certain species in the fishery.
2.2 Step 2b – Preliminary Selection of Management Options			
2.3 Step 2c – Consider Applying A...			
2.4 Step 2d – Consider Implications of...			
2.5 Step 2e – General Guidance fo...			
2.6 Fisheries Management Control Descri...			
3 Step 3 – Select Performance Indicators			
3.1 Step 3a – Select Performance Indicat...			
3.2 Step 3b – Select Reference Points			
3.3 Step 3c – Select Assessment Methods			
3.4 Assessment Method Description			
4 Step 4 – Define Harvest Control Rules			
4.1 Step 4a – Define General Harvest Co...			
4.2 Step 4b – Add Specificity to H...			
5 Step 5 – Perform Assessment Meth...			
5.1 Installing the dashboard from ...			
5.2 Installing the dashboard from ...			
6.4 Download the AFM4 Toolkit Doc			



Controls on conch and lobster:

- Total Allowable Catch
- Minimum size limit
- Closed season
- Gear restrictions

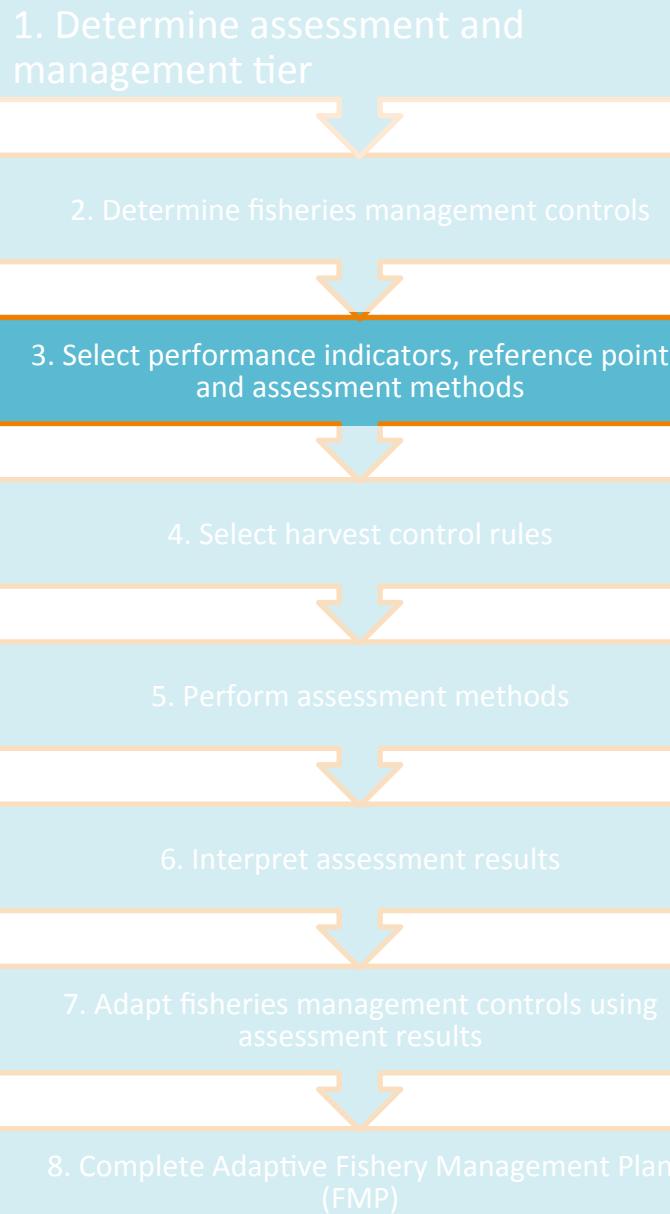




Performance indicators provide information about the current performance of the stock - they indicate how things are going

A target reference point is a numerical value that indicates that the performance of a stock is at a desirable level

A limit reference point is numerical value that indicates that the status of a stock is unacceptable (e.g. highly overfished)

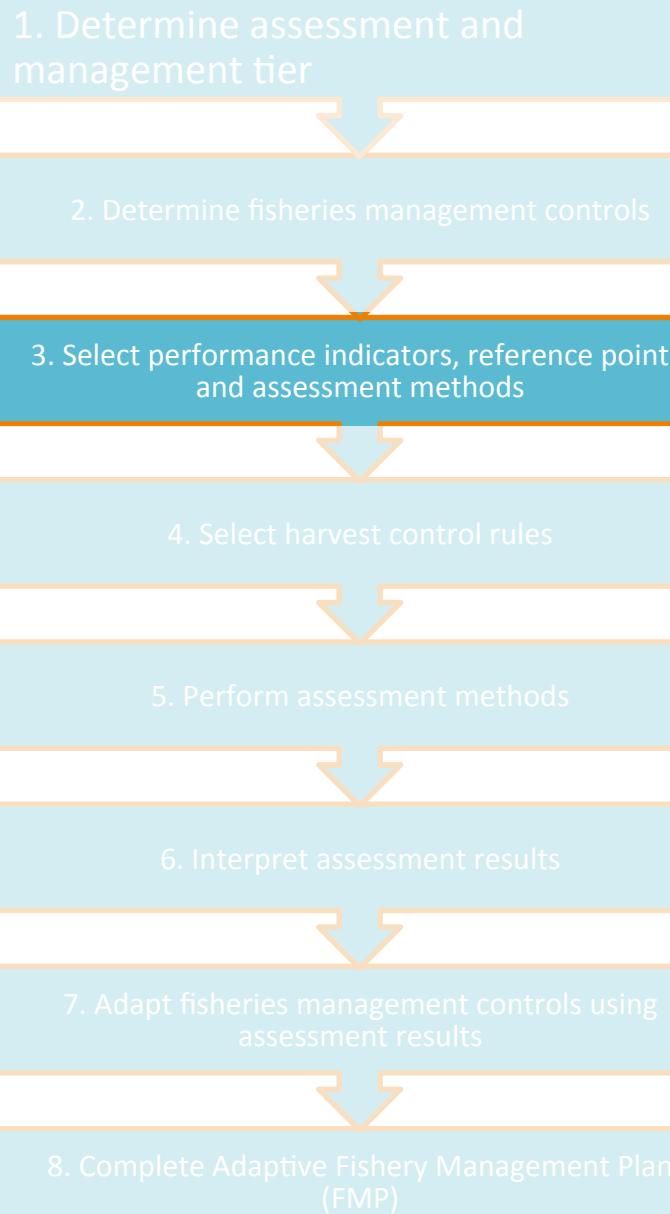


Performance indicators provide clues about how the fishery is doing

Reference points indicate what those clues mean

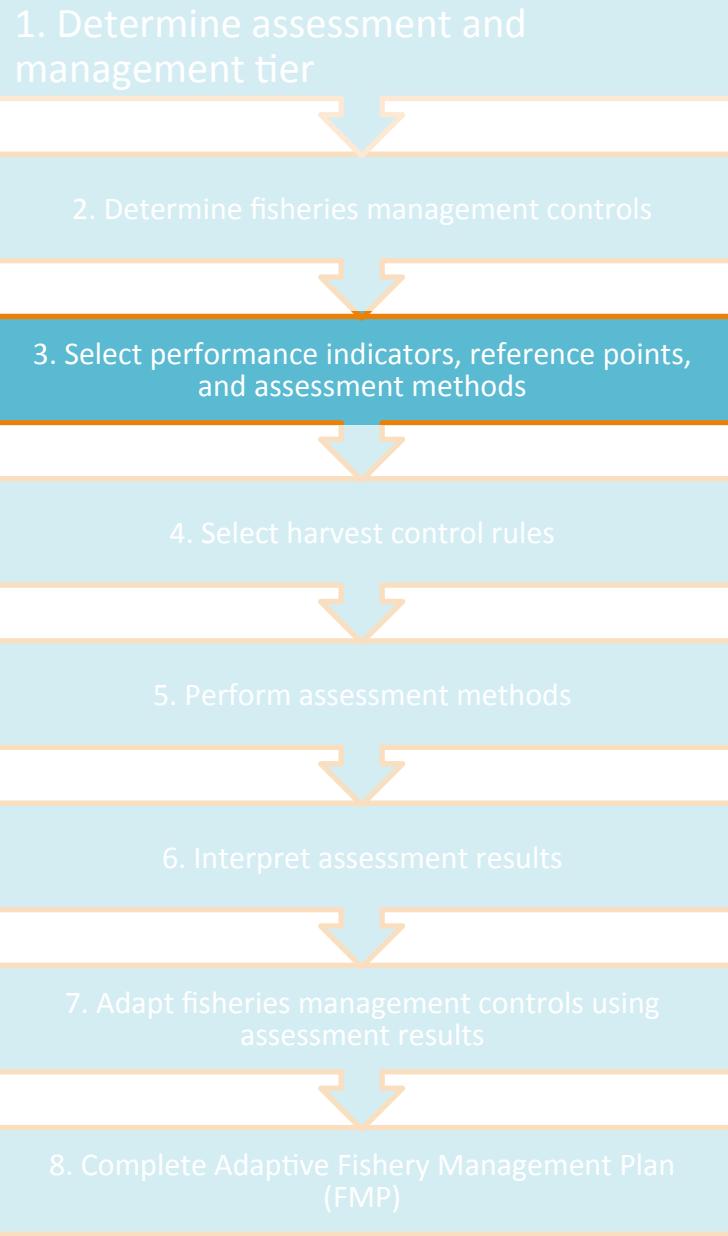


Knowing the status of the fishery or fishing pressure can inform management

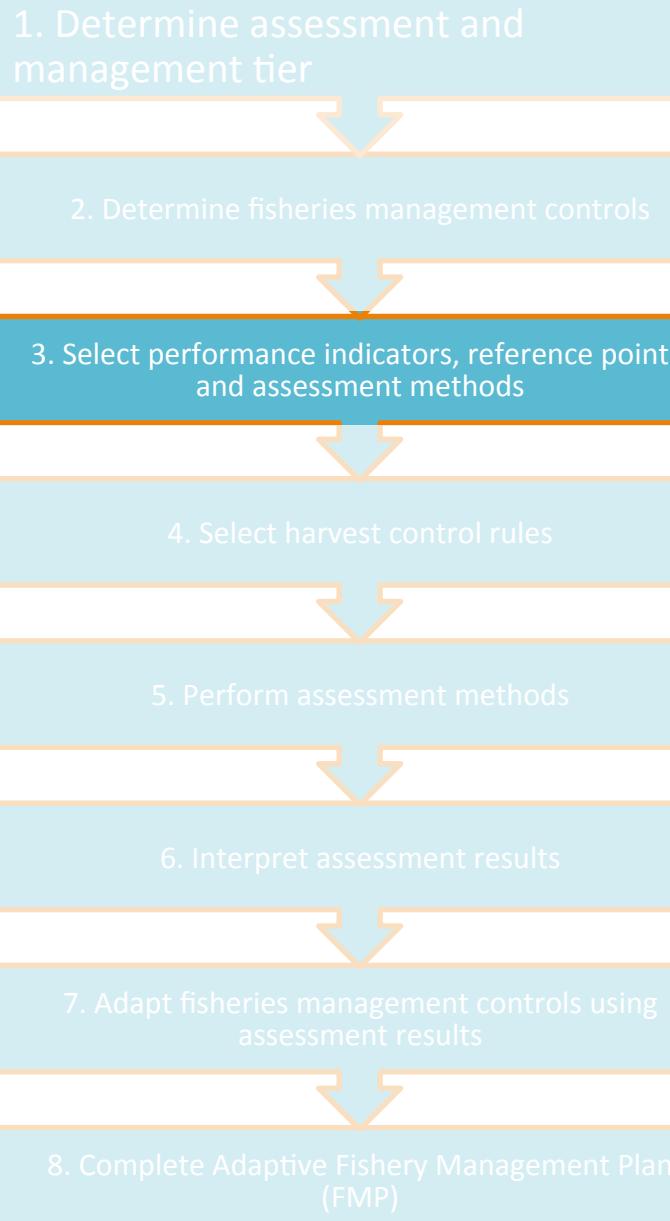


Example performance indicators and reference points...

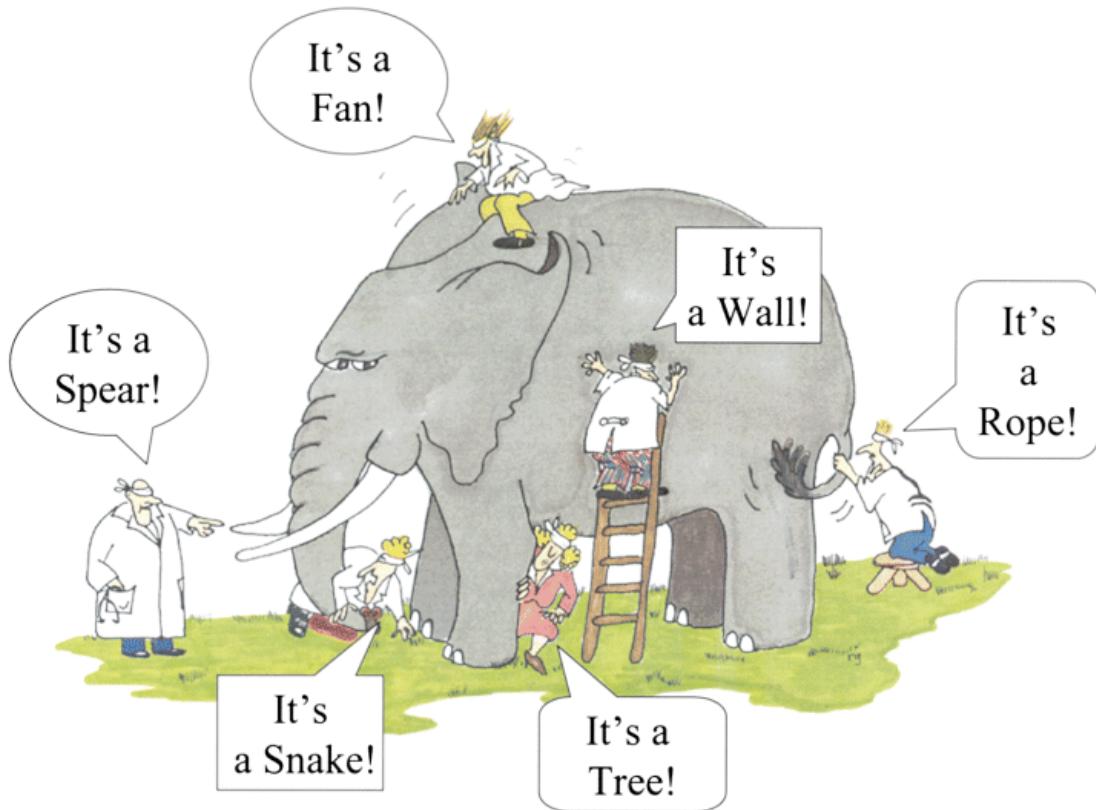
Performance Indicator	Reference Point	Data Required
CPUE	CPUE is stable or increasing	Catch reporting system
Total Catch	Total catch is stable	Catch reporting system
Average Length	Average length is greater than length at maturity	Length composition survey
Fishing Mortality	Fishing mortality is equal to natural mortality	Length composition survey
Spawning Potential Ratio	Spawning potential ratio is greater than 40%	Length composition survey
Ratio of fish density inside/outside NTZ	Density ratio is 40%	Underwater visual survey

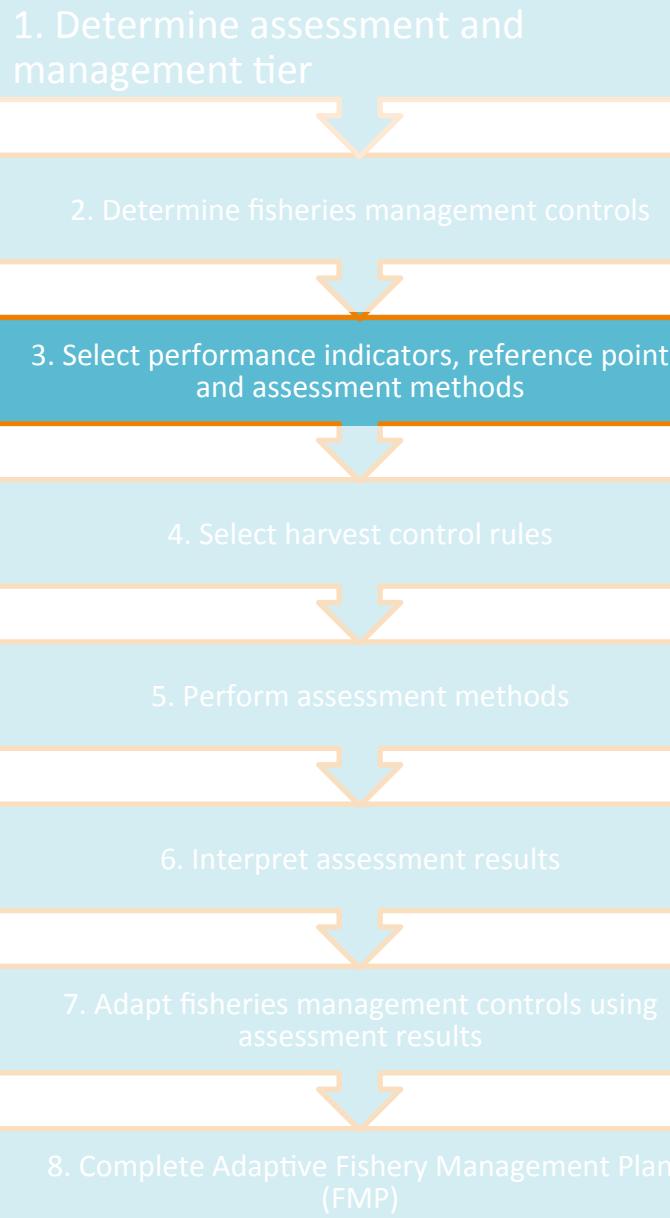


- *No single clue is perfect!*
 - Each has different inputs and outputs
 - Each has strengths and weaknesses
 - Use multiple clues, from multiple data sources, when possible



- *No single clue is perfect!*





Tables with guidance on how to select these

- 2 Step 2 – Determine Appropriate Fisheries Management Control Options
- 2.1 Step 2a – Summarize and Quantify Key Data
- 2.2 Step 2b – Preliminary Selection of Management Options
- 2.3 Step 2c – Consider Applying Alternative Options
- 2.4 Step 2d – Consider Implications of Different Options
- 2.5 Step 2e – General Guidance for Selecting Options
- 2.6 Fisheries Management Control Options
- 3 Step 3 – Select Performance Indicators
- 3.1 Step 3a – Select Performance Indicators
- 3.2 Step 3b – Select Reference Points
- 3.3 Step 3c – Select Assessment Methods**
- 3.4 Assessment Method Descriptions
- 4 Step 4 – Define Harvest Control Rules
- 4.1 Step 4a – Define General Harvest Control Rules
- 4.2 Step 4b – Add Specificity to Harvest Control Rules
- 5 Step 5 – Perform Assessment Methods
- 5.1 Installing the dashboard from scratch
- 5.2 Installing the dashboard from an existing template
- 5.3 Planning the AFAM Toolkit Data

3.3 Step 3c – Select Assessment Methods

During this step, select the appropriate assessment method for each of your chosen performance indicators. The table below outlines these options. Most performance indicators have only one associated assessment method; however, the performance indicator of fishing mortality has several options. There are also detailed descriptions below for more details about each specific assessment method including inputs, outputs, and caveats.

Table 3.1: Selecting your performance indicators, reference points, and assessment methods

Data stream Options	Performance Indicator Options	Target Reference Point	Limit Reference Point	Assessment Methods	Target Species
Qualitative Survey	DESTRUCTIVE FISHING GEAR <i>Pros:</i> Relatively easy metric to monitor using local ecological knowledge <i>Cons:</i> No destructive fishing practices being used <i>Notes:</i> Qualitative survey methods are appropriate for assessing fishing mortality for all fish and invertebrates	No destructive fishing practices being used	Destructive fishing practices being used	Qualitative assessment methods	All fish and invertebrates



1. Determine assessment and management tier

2. Determine fisheries management controls

3. Select performance indicators, reference points, and assessment methods

4. Select harvest control rules

5. Perform assessment methods

6. Interpret assessment results

7. Adapt fisheries management controls using assessment results

8. Complete Adaptive Fishery Management Plan (FMP)

Conch

Performance Indicator	Reference Point
Density	Target - Average over last 10 years Limit – 88 individuals/Ha
Total catch	Average over last 10 years
Average shell length	Average over last 10 years
CPUE	Average over last 10 years

Lobster

Performance Indicator	Reference Point
CPUE	Average over last 10 years
Total catch	Average over last 10 years
Average tail weight	Average over last 10 years



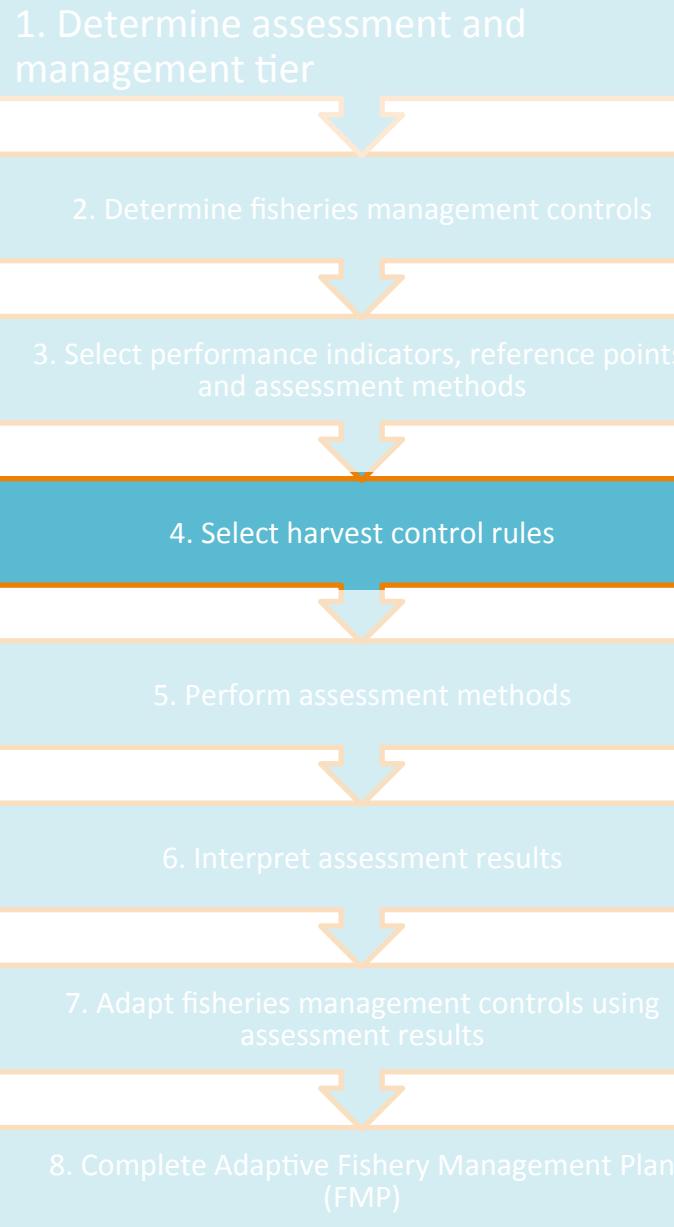
How are assessment results used to adapt fisheries management controls?

Harvest control rules!



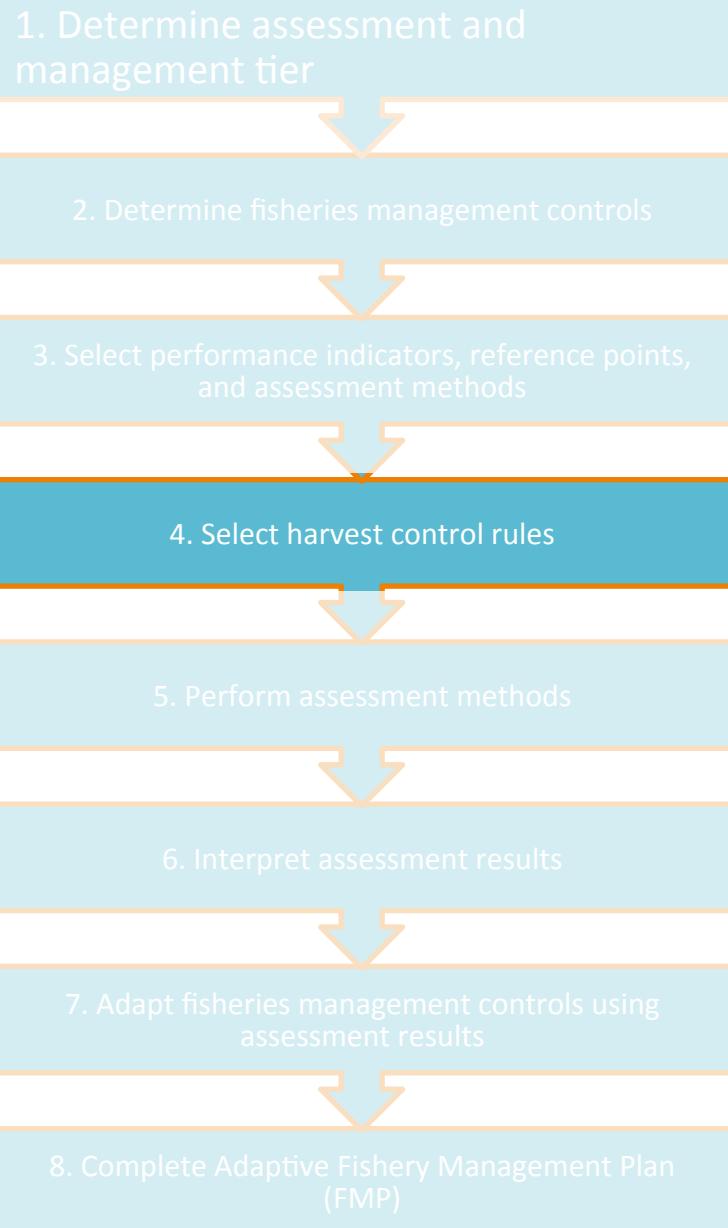
A harvest control rule translates the interpretation of assessment results into adjustments in fisheries management controls

It's important to agree on these before performing assessments



Harvest control rules for a single-indicator framework

Scenario	Interpretation	Harvest Control Rule
Above target reference point	Things are in great shape	Management controls may become less restrictive (i.e., raise TAC)
At target reference point	Things are where they should be	No change in management controls
Between limit and target reference point	Things are in rough shape	Management controls should be further restricted (i.e., lower TAC)
At or below limit reference point	Stock is in danger of collapse	Close the fishery



Tables with guidance on how to define harvest control rules

2 Step 2 – Determine Appropriate Fis...

2.1 Step 2a – Summarize and Qua...

2.2 Step 2b – Preliminary Selectio...

2.3 Step 2c – Consider Applying A...

2.4 Step 2d – Consider Implicatio...

2.5 Step 2e – General Guidance fo...

2.6 Fisheries Management Control...

3 Step 3 – Select Performance Indica...

3.1 Step 3a – Select Performance ...

3.2 Step 3b – Select Reference Po...

3.3 Step 3c – Select Assessment ...

3.4 Assessment Method Descripti...

4 Step 4 – Define Harvest Control Rules

4.1 Step 4a – Define General Harv...

4.2 Step 4b – Add Specificity to H...

5 Step 5 - Perform Assessment Meth...

5.1 Installing the dashboard from ...

5.2 Installing the dashboard from ...

5.3 Running the AFAM Toolkit Do...

Stock, marine reserves are analogous to an emergency savings account. Protecting a fraction of a fish stock reduces the risk of overfishing and the chance of stock collapse in the long term.

Displaced fishing effort and unintended consequences resulting after implementation of a reserve can be mitigated when effective FMCs are in place outside of the reserve. When harvest levels are appropriately controlled a spillover of biomass from marine reserves to the adjacent fishery may occur that can benefit fisheries.

Table 4.1: Indicators for Tier 1: Possible interpretations, management implications, and suggested harvest control rules

Performance Indicator	Assessment Result	Interpretation	Result	Management Response
Fishing Gear	Destructive fishing practices being used	Non-destructive fishing practices are no longer able to efficiently catch fish and/or destructive fishing practices have not yet been banned	Yellow	1. Ban destructive fishing practices

1. If there is no reason to



In Belize...

Harvest control rules for a multi-indicator framework for both conch and lobster

Harvest control rules were made for all foreseeable scenarios (combinations of performance indicators and reference points)

Harvest control rules integrated into fishery management plans

1. Determine assessment and management tier

2. Determine fisheries management controls

3. Select performance indicators, reference points, and assessment methods

4. Select harvest control rules

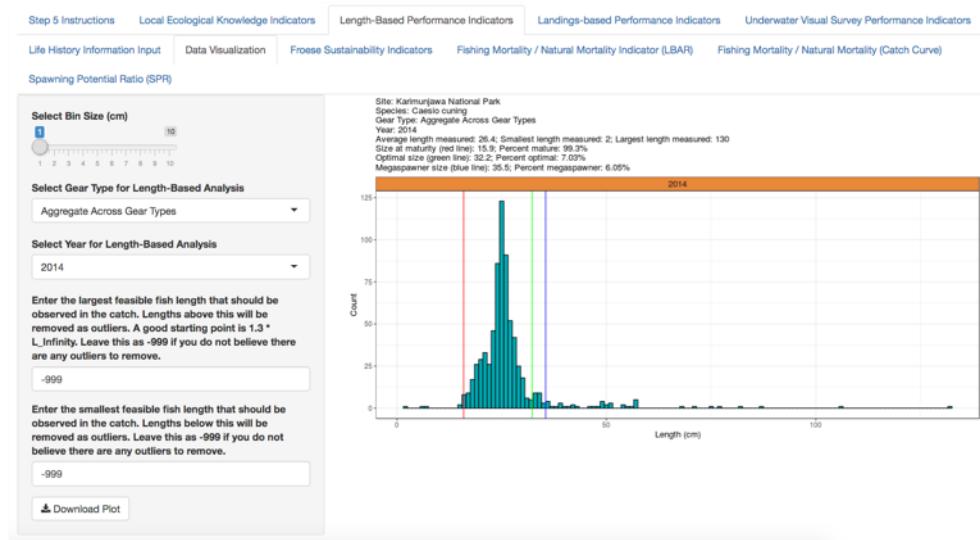
5. Perform assessment methods

6. Interpret assessment results

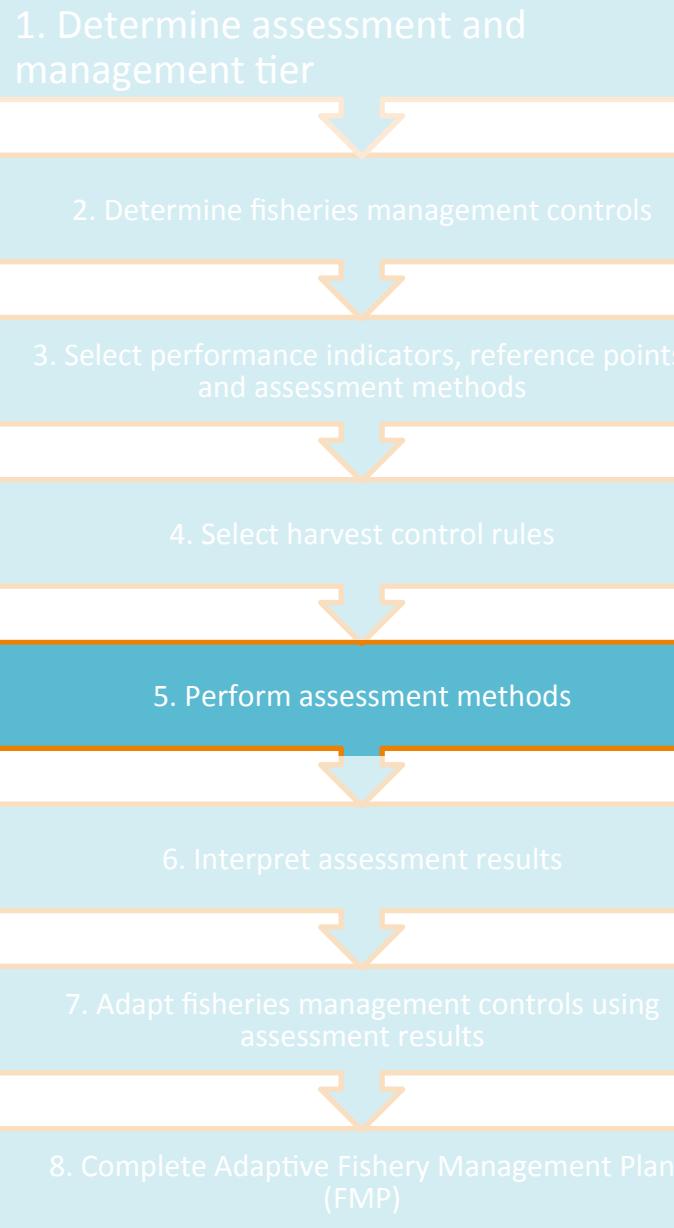
7. Adapt fisheries management controls using assessment results

8. Complete Adaptive Fishery Management Plan (FMP)

Online/offline dashboard



- Accompanying guidance document provides background on each method (definitions, references, etc.)
- Dashboard includes data input, visualization, and analysis



Modules for

- **Length data**
 - Fishing mortality from Mean length (LBAR)
 - Fishing mortality from Catch curve
 - Spawning potential ratio
 - Froese sustainability indicators
- **Catch and effort data**
 - Trends in catch
 - Trends in CPUE
- **Underwater visual survey data**
 - Fished:unfished biomass ratio (coral reef ecosystem indicator)
 - Fished:unfished density ratio (target species indicator)

1. Determine assessment and management tier

2. Determine fisheries management controls

3. Select performance indicators, reference points, and assessment methods

4. Select harvest control rules

5. Perform assessment methods

6. Interpret assessment results

7. Adapt fisheries management controls using assessment results

8. Complete Adaptive Fishery Management Plan (FMP)



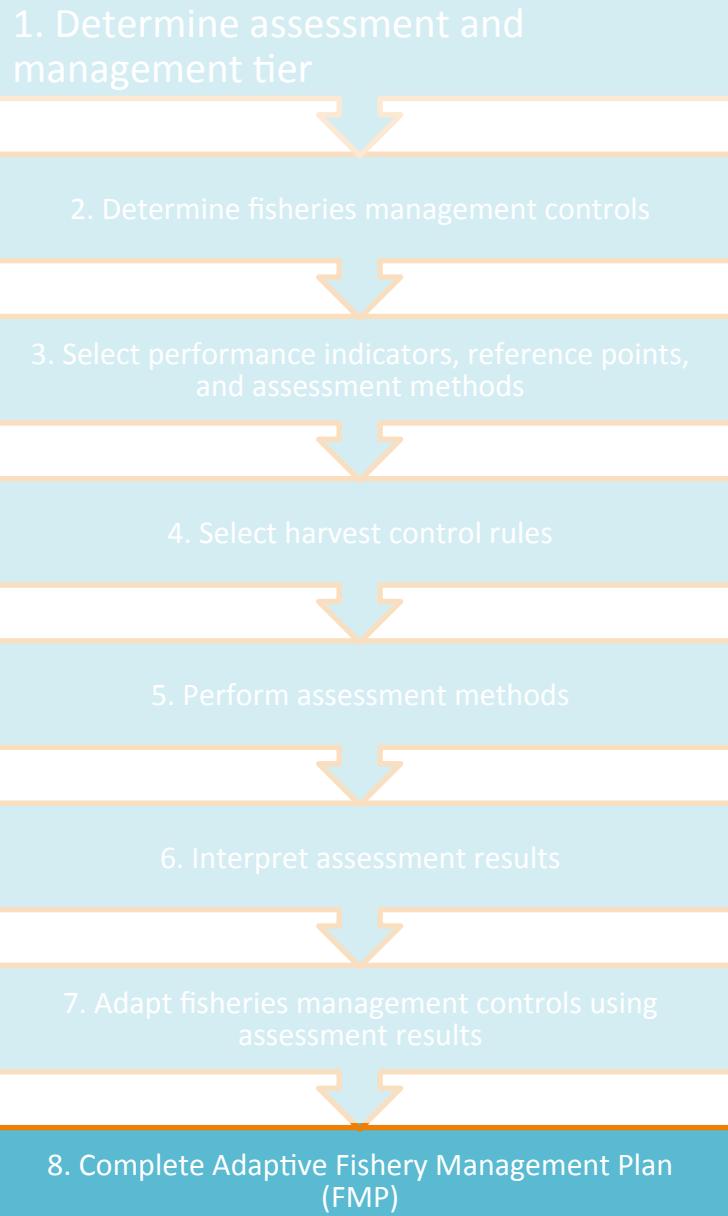
Photo: Jason Hartman/Face

**Interpret and verify results;
draw on the knowledge of scientists,
fishers, government agencies, and others**



Adapt using pre-defined harvest control rule

(A harvest control rule translates the interpretation of assessment results into adjustments in fisheries management controls)



Automatic summary reports in dashboard

Click for help!

Once you have completed all steps, you are ready to create your Fishery Management Plan. To get a copy of your AFAM report, first click the Generate Report button. The report will then appear on the right. You may also download a copy of the report below.

Note: You must first complete all 8 steps of the dashboard, or these buttons and the report will not appear. Specifically, you must interpret the results in Step 6 and select a management response in Step 7.

[Generate Report](#)

If you wish to save a copy of your report, select the format for your download:

HTML Word PDF

[Download AFAM summary document](#)

AFAM Summary

This document summarizes the outputs of each step of the AFAM process. This can be used as the basis for your site-level adaptive fisheries management plan.

Step 1: Upload data, select species, and determine assessment and management tier

Here is a summary of your available data:

Data Type	Is data available?	Years of available data
Local Ecological Knowledge	TRUE	1
Length composition data	TRUE	9
Landings and Effort Data	FALSE	0
Underwater Visual Survey Data	FALSE	0

Your assessment and management level is Tier 2

Step 2: Select fisheries management control(s)

Here is a list of your fisheries management control(s):

Fisheries management control(s)
Gear Restrictions – Gear Type (such as banning destructive fishing gear)

Fishery Management Plan template

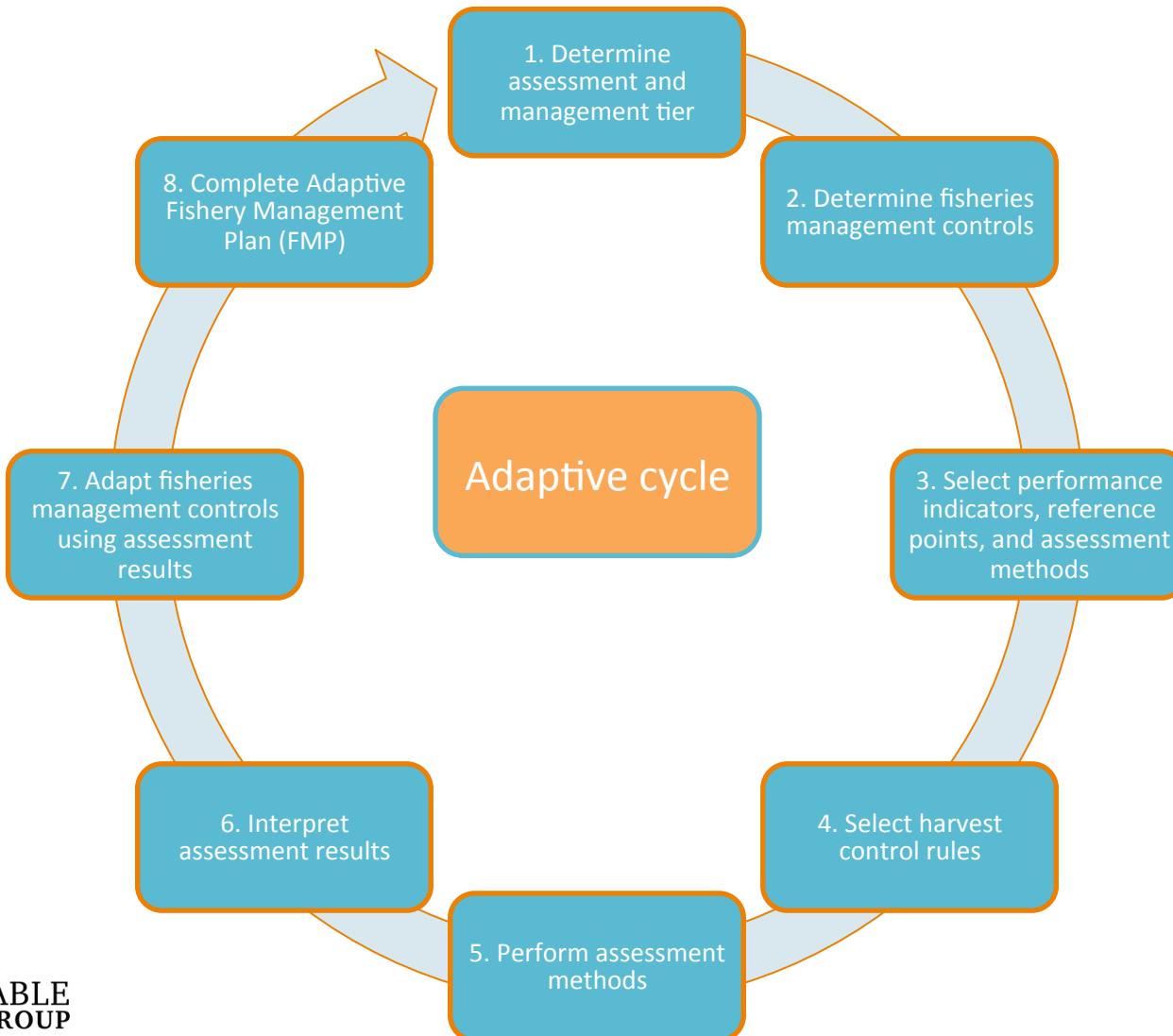
- 3 Step 3 – Select Performance Indica...
- 3.1 Step 3a – Select Performance ...
- 3.2 Step 3b – Select Reference Po...
- 3.3 Step 3c – Select Assessment ...
- 3.4 Assessment Method Descripti...
- 4 Step 4 – Define Harvest Control Rules
- 4.1 Step 4a – Define General Harv...
- 4.2 Step 4b – Add Specificity to H...
- 5 Step 5 - Perform Assessment Meth...
- 5.1 Installing the dashboard from ...
- 5.2 Installing the dashboard from ...
- 5.3 Running the AFAM Toolkit Das...

8.1 Fishery Management Plan Template

- **Fishery Overview:**
 - **Location of the Fishery:** Country, state, city, management zone (if applicable).
 - **History:** Provide a brief history of the fishery.
 - **Type(s) of Fishery:** Commercial, recreational, etc. and whether near shore, off shore, or mixed.
 - **Participants:** Number of fishers, number of vessels, number of communities (if applicable), and spatial distribution of participants/ communities.
 - **Fishery Characteristics:** Describe the gear types utilized in the fishery (i.e. fixed gear, mobile gear, etc), including numbers for each if possible, as well as the general timeframe (i.e. season) of when the fishery occurs.
 - **Management Characteristics:** Type of method currently used to manage the fishery

What makes this an “adaptive” framework?

Repeat Steps 1-8 on a periodic basis



What is the “Adaptive Fisheries Assessment and Management Toolkit”?

- Guidance document that outlines *step-by-step process* and provides explicit guidance for *using data to make decisions* at each step
- *User-friendly* online/offline dashboard that guide user through *using data to perform assessments*

Thank you!

