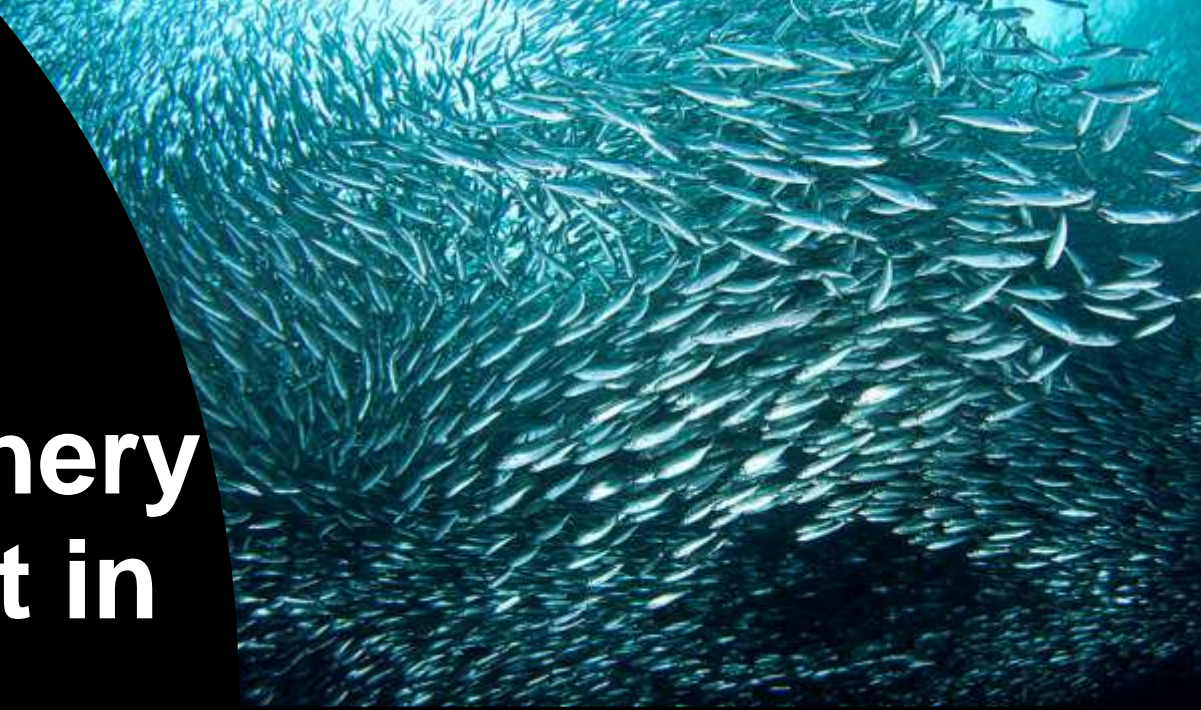


# Adaptive Fishery Management in Belize

## Training Module #4

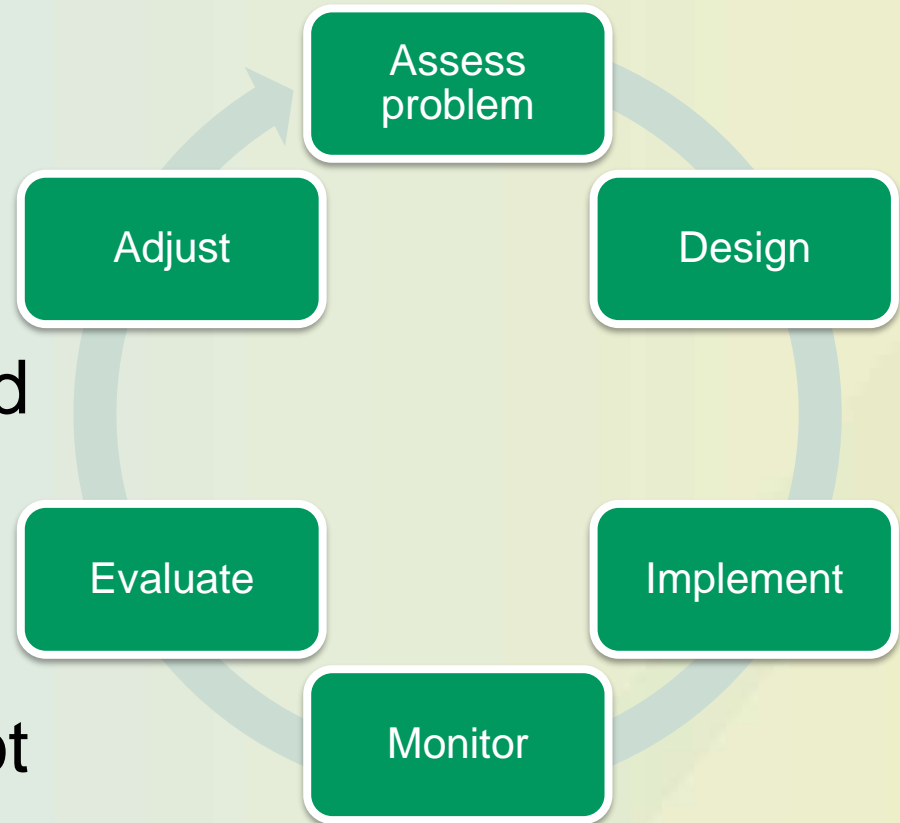


- Deep dive into adaptive fishery management (AFM)

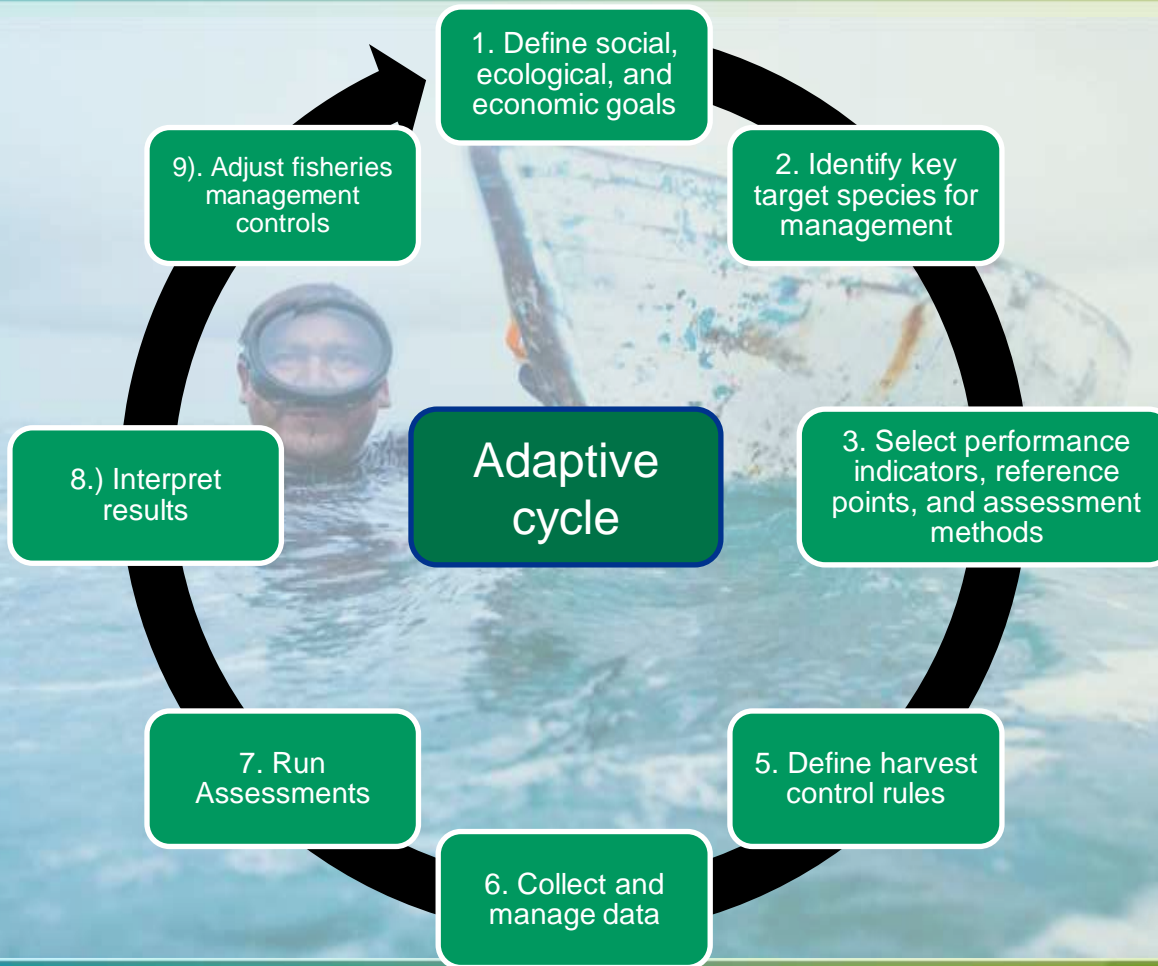


# Why is adaptive management important for data-limited fisheries?

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



# A multi-indicator framework for adaptive fishery management in Belize



# Key features of this framework

- Process of designing the framework is collaborative and stakeholder-driven
- Harvest control rules are transparent and objective
- Uses multiple performance indicators
- Uses performance indicators appropriate for available resources and technical capacity
- Local stakeholder knowledge is incorporated throughout the entire process

# A national adaptive management framework

*Setting sustainable, science-based, adaptable Total Allowable Catch (TAC) limits for conch and lobster*



## 1. Define social, ecological, and economic goals

2. Identify key target species for management

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

4. Define harvest control rules

5. Collect and manage data

6. Perform assessment methods

7. Interpret assessment results

8. Adjust fisheries management controls

# 1. Goals

End open access

Prevent decline in fisheries and increase abundance to protect the health of the Mesoamerican Reef

Improved livelihoods and a prosperous industry

Encourage collaboration between managers, fishermen, and NGOs

Improve overall management of fisheries, including compliance with international commitments

# 2. Identify Targets

1. Define social, ecological, and economic goals

**2. Identify key target species for management**

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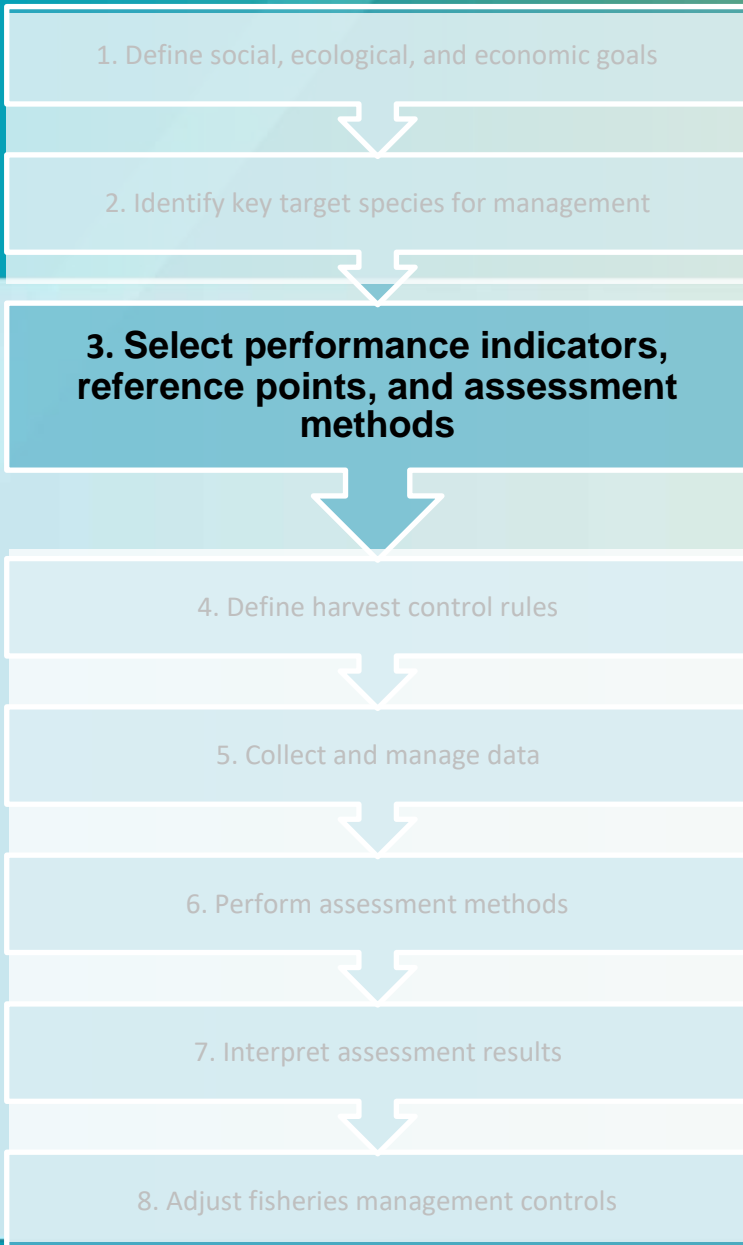
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# 3. Performance Indicators & reference points

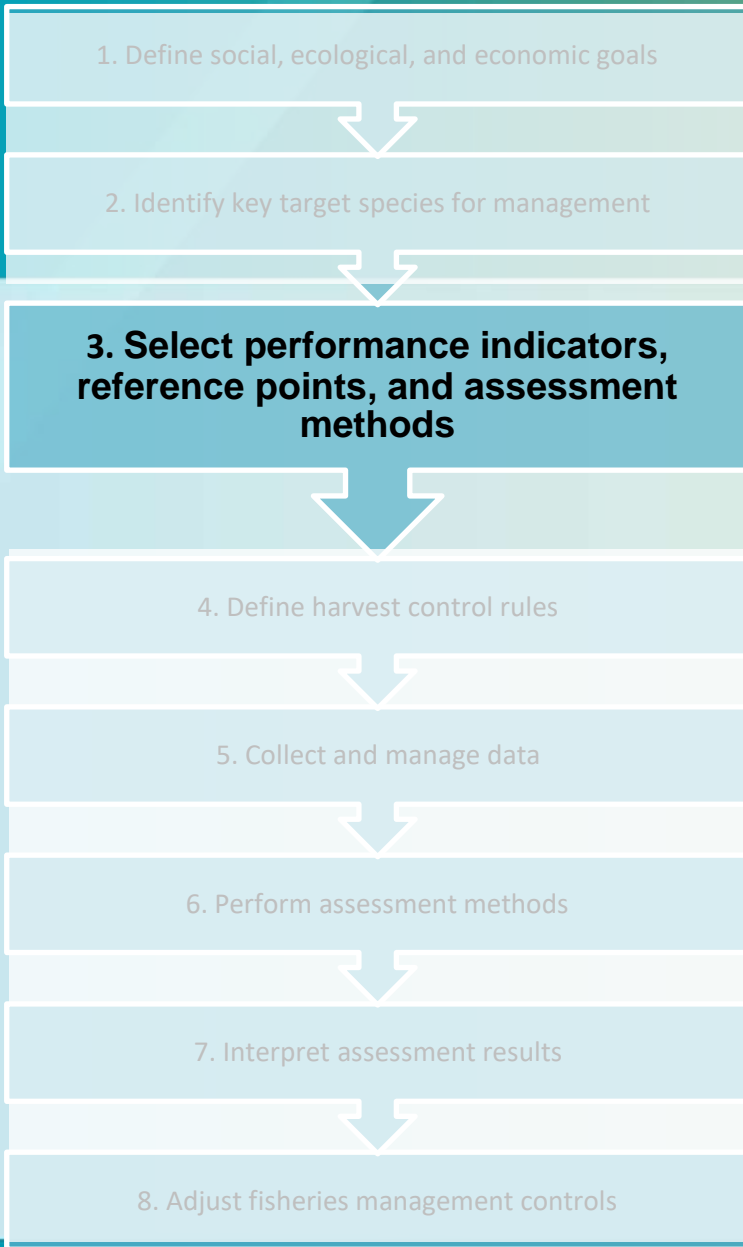


**Performance indicators** provide information about the current performance of the stock - they indicate how things are going

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)

# 3. Performance Indicators & reference points



Available Data	Who Collects the Data
Underwater Visual Survey - Density - Species identification	Government NGOs
Length Composition Survey - Species composition - Size and weight	Government NGOs
Catch Reporting System Total landings - CPUE	Fisherman (logbooks) Government

# 3. Performance Indicators, reference points

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## Conch

Density ratio

**Density ( juveniles and adults)**

**Shell length**

Lip thickness

Percent mature

**CPUE (early and late season)**

**Previous Season's Catch**

## Lobster

Density ratio

Density

**Tail Weight**

Carapace Length

Percent Mature

**CPUE (early and late season)**

**Previous Season's Catch**

# 3. Performance Indicators & reference points

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Performance Indicator	Reference Point
Pre-season adult and sub-adult patch density	Target – Average over last 10 years Limit – 88 individuals/Ha
Previous season's total catch	Average over last 10 years
<b>Pre-season average shell length</b>	<b>Average over last 10 years</b>
Early and late season CPUE	Average over last 10 years



Performance Indicator	Reference Point
Early and late season CPUE	Average over last 10 years
Previous season's total catch	Average over last 10 years
Previous season's average tail weight	Average over last 10 years

## 4. Harvest Control Rules

**A harvest control rule translates the interpretation of assessment results into adjustments in fisheries management measures that control fishing**

***It's important to agree on these before performing fishery assessments***

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## 4. Harvest Control Rules

Scientists and managers work with fishermen and other fishery actors to define harvest control rules.

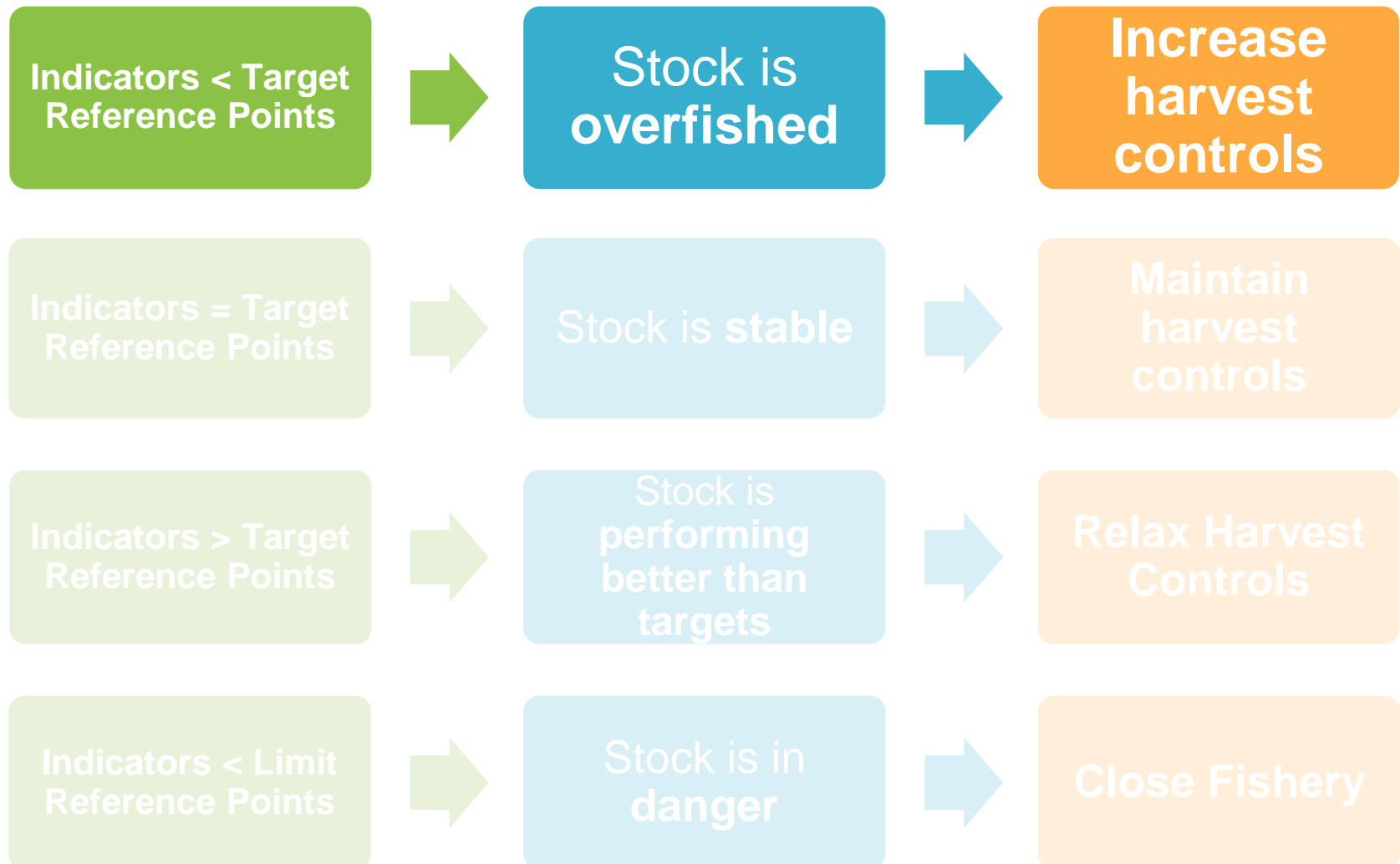
These rules guide managers and tell them what to do in case the indicators are near or below targets and limits.

“IF we find that our fishery is doing X, then we will do Y”

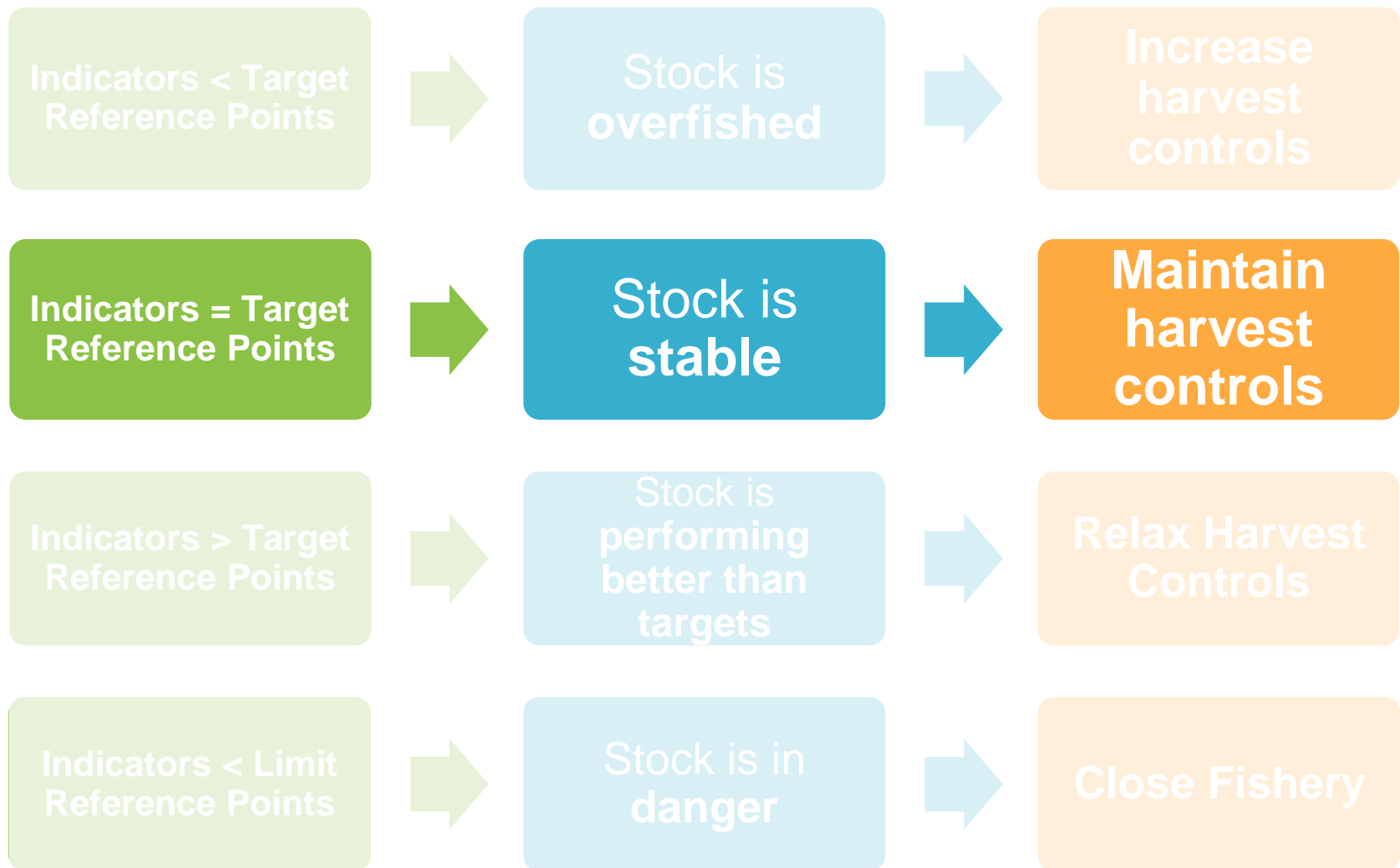
### **Examples:**

- If all indicators show that stock is abundant and productive, fishing mortality can remain the same
- If all indicators show that stock is in decline, fishing mortality will be reduced by X% (depending on severity)

# Compare Performance Indicators to Target and Limit Reference Points and Adjust Harvest Controls

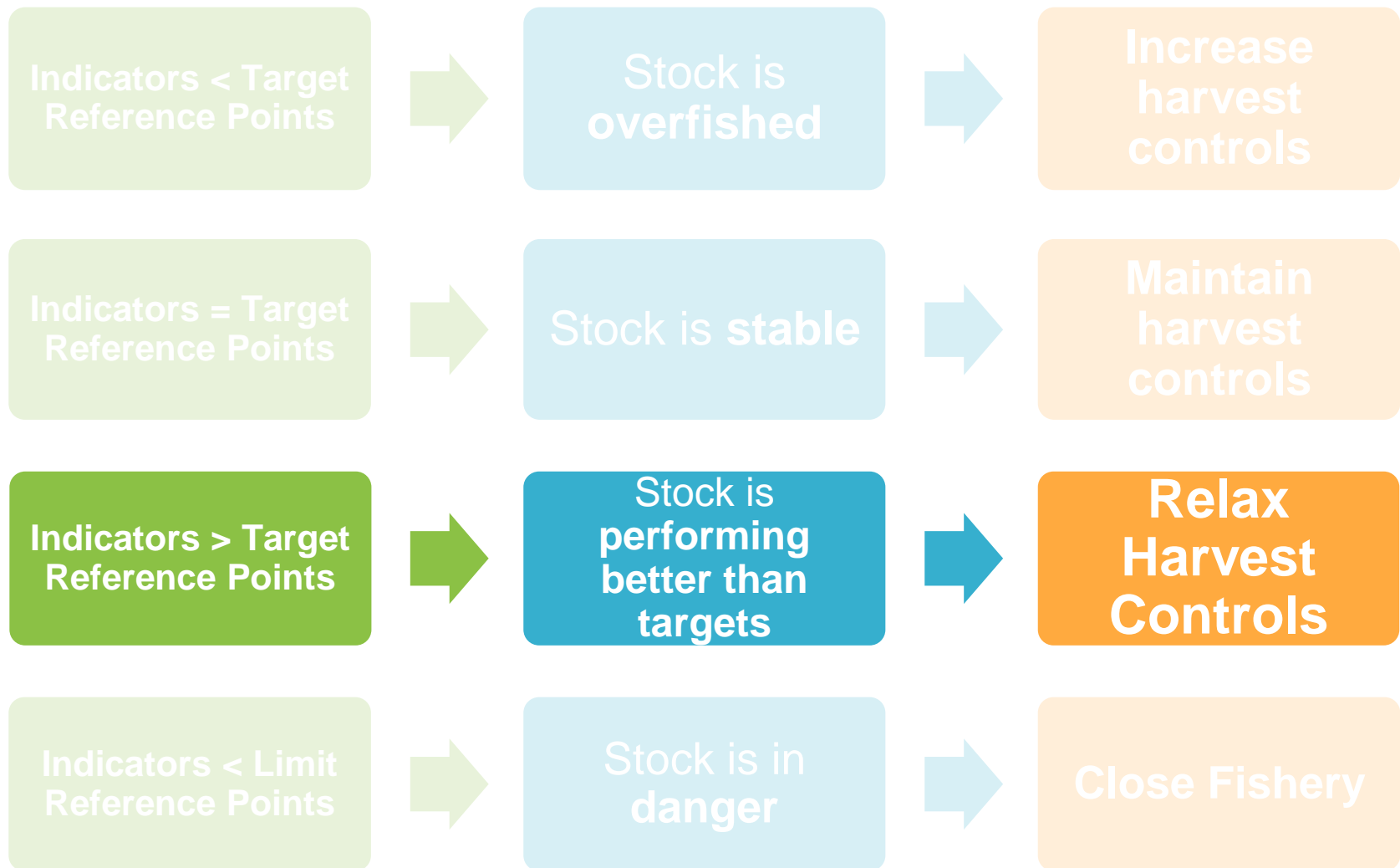


# Compare Performance Indicators to Target and Limit Reference Points and Adjust Harvest Controls

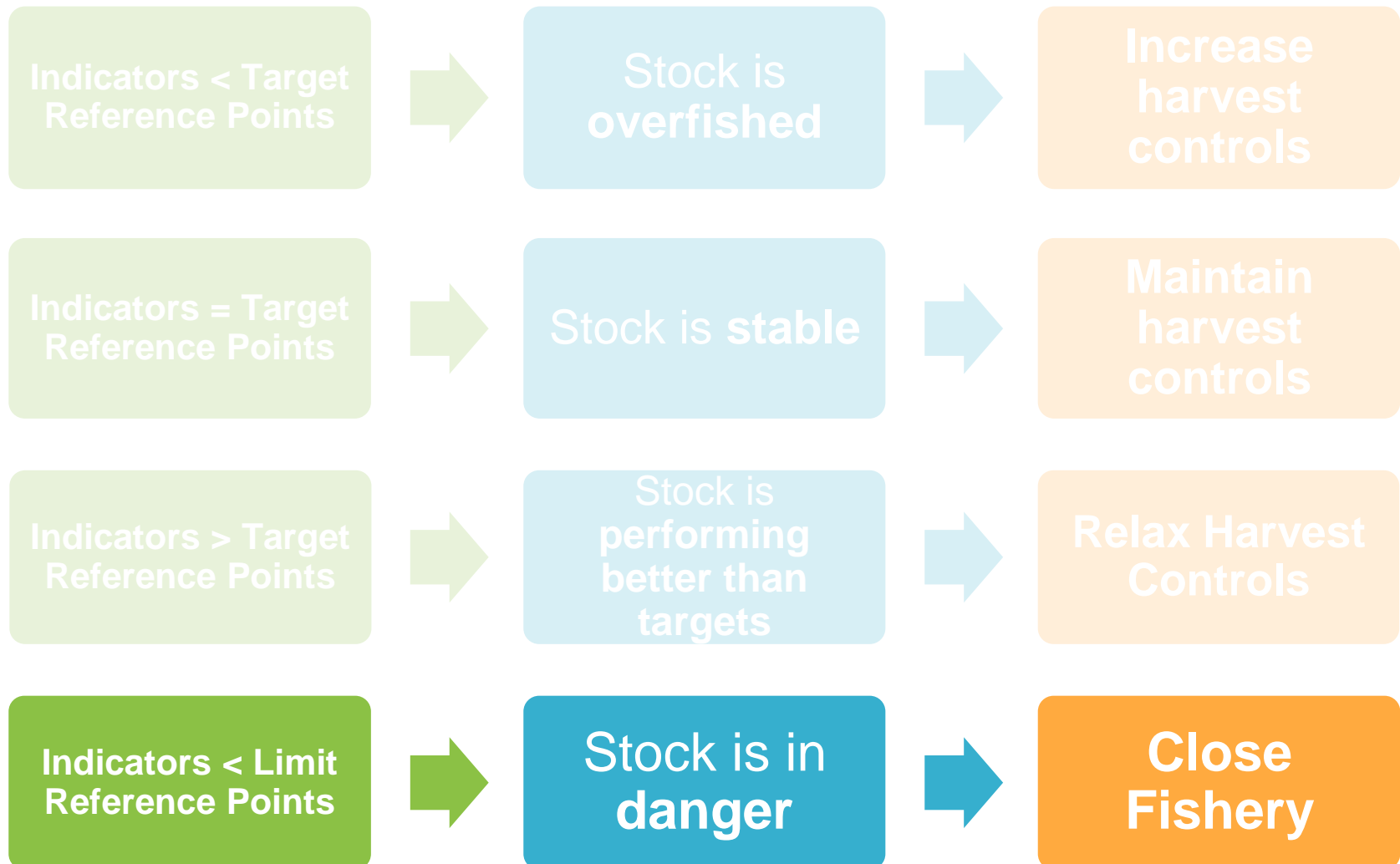




# Compare Performance Indicators to Target and Limit Reference Points and Adjust Harvest Controls



# Compare Performance Indicators to Target and Limit Reference Points and Adjust Harvest Controls



## 4. Harvest Control Rules

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2. Identify key target species for management

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**Harvest Control Rule:** Generally, what we want to do under certain scenarios in order to meet our goals  
“Reduce fishing pressure”  
“Don’t catch babies”

**Harvest Control Measure:** Actual mechanism through which we will accomplish the harvest control rule (e.g. catch limit, gear restriction, RBM)

# What are fisheries management measures?

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## Direct Measures:

- **How much:** Catch limits

## Indirect Measures

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

## 4. Data

Data collection programs need to be tied to goals, assessment methods and management needs to save money and time, and to provide useful data.

Identify information gaps in priority fishery related to assessment and management, adapt & continue current sampling regime:

- 

1. Define social, ecological, and economic goals

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3. Identify performance indicators

4. Set reference points for each performance indicator

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# FISHERY DEPENDENT DATA

A fisherman wearing a green shirt and orange gloves is holding a large fish on a boat. The background shows the sea and a clear blue sky. The fisherman is wearing a large, clear diving mask. The boat's hull is visible in the upper left corner.

## Catch monitoring

- logbooks from fishers & samplers to cross-check logbooks and fill in gaps
- At-sea, Landings, Markets

Intent: collecting data regularly on bycatch and landed catch.

You participate in collecting these data regularly. Every time you complete a logbook or trip ticket report, or talk to a sampler, you are providing data that may ultimately make it into an assessment

# FISHERY INDEPENDENT MONITORING

Measures of Abundance/Diversity/Size  
– help to estimate the fish in the sea  
or the unfished stocks

- Scientific surveys in the field
- Visual Surveys



# 4. Connecting data to performance indicators and data streams

Whenever possible, use **multiple performance indicators** from **multiple independent data streams**.

## Data Streams

Fishery Independent Length-Composition

Fishery Dependent Length-Composition Survey

Catch Reporting System & Boat Intercept/Landing Site Survey

## Fishery-independent data

- Scientific survey of length frequencies
- Scientific survey of densities
- Scientific survey of habitat distribution
- Scientific survey of catch per unit effort

## Fishery-dependent data

- Knowledge about how fisheries interact with stocks
- Catch data
- Length frequency
- Catch per unit effort
- Estimated stock size
- Selectivity of the fishery



# 4. Connecting data to performance indicators and data streams

Choosing indicators: think about the management goals and the available data

Goals	Indicators	What it indicates
Sustainable yields	Fishing mortality (F)	How much fishing pressure is occurring
	Froese indicators	How many fish caught are of sufficient age to reproduce.
	Average length	What length is the most commonly caught.
	Total capture	Total amount of fish caught.
	Density	How many of the target stock there in an area.
Strong fishery profits	Catch per unit effort (CPUE)	Amount of fish caught per unit of effort (e.g., day, hours).
Healthy stocks and ecosystems	MPA density ratio	Ratio of fish density outside:inside a no take zone.
	Spawning potential ratio (SPR)	Percentage of the stock's full reproductive potential

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## 6. Data



### 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)

1. Define social, ecological, and economic goals

2. Identify key target species for management

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## 7. Perform assessments

- **Length data**
  - Catch curve
  - Spawning potential ratio
  - Mean length (LBAR)
  - Froese sustainability indicators
- **Catch and effort data**
  - Trends in catch
  - Trends in CPUE
  - Mean weight
- **Underwater visual survey data**
  - Coral reef indicators
  - MPA density ratio

1. Define social, ecological, and economic goals

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**8. Interpret assessment results**

9. Adjust fisheries management controls

## 8. Interpret assessment results



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

# 9. Adapt

1. Define social, ecological, and economic goals

2. Identify key target species for management

3. Identify performance indicators

4. Set reference points for each performance indicator

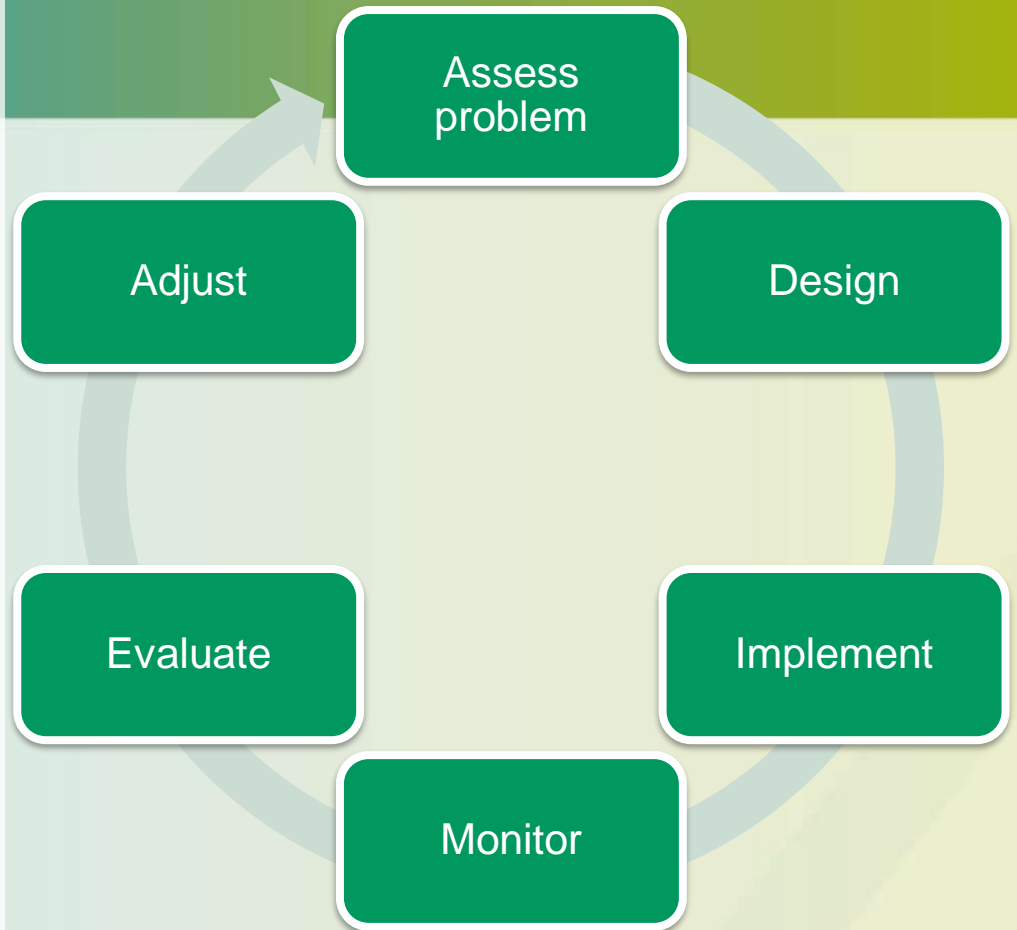
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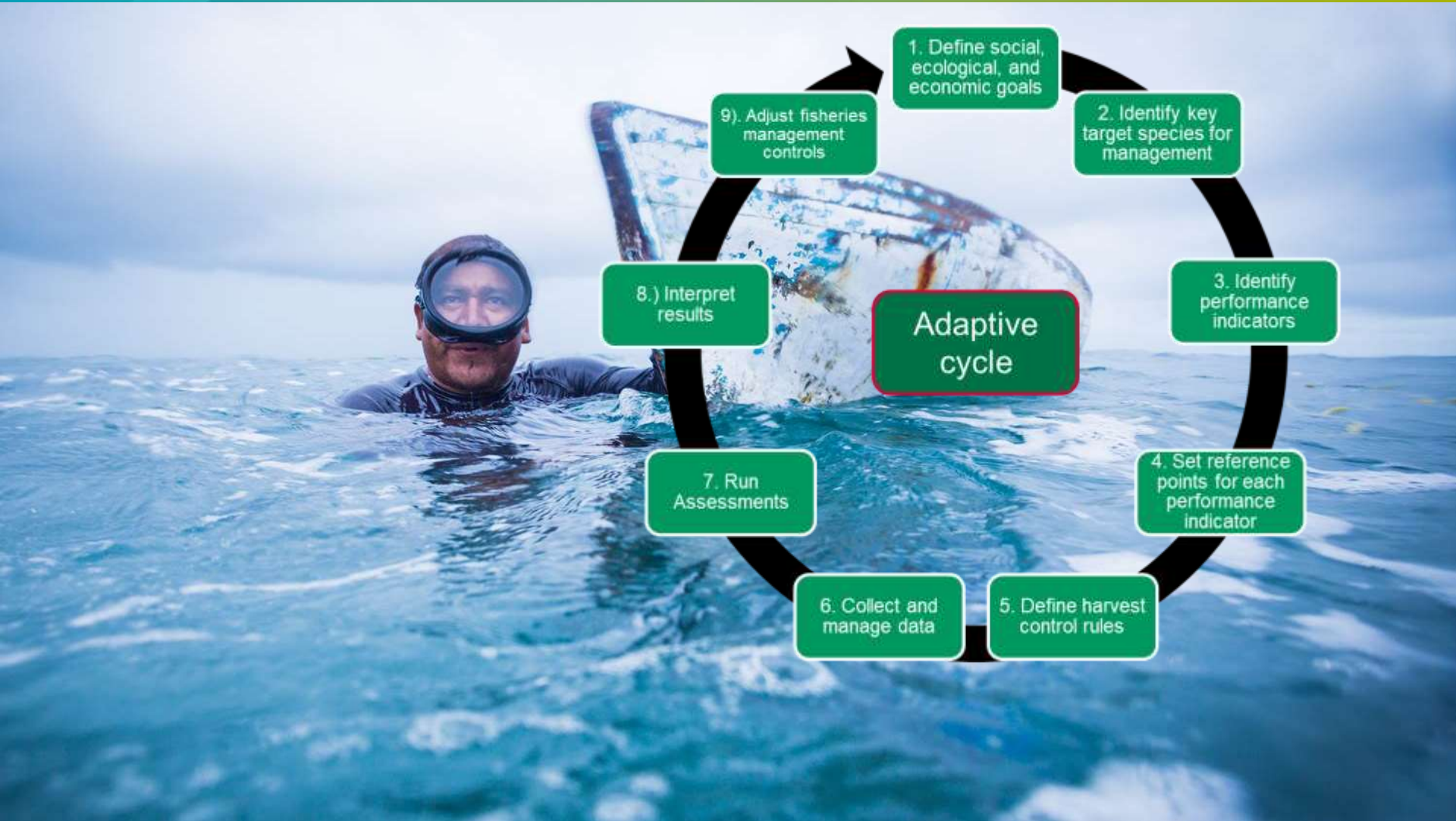
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# Science to action



# Questions?

