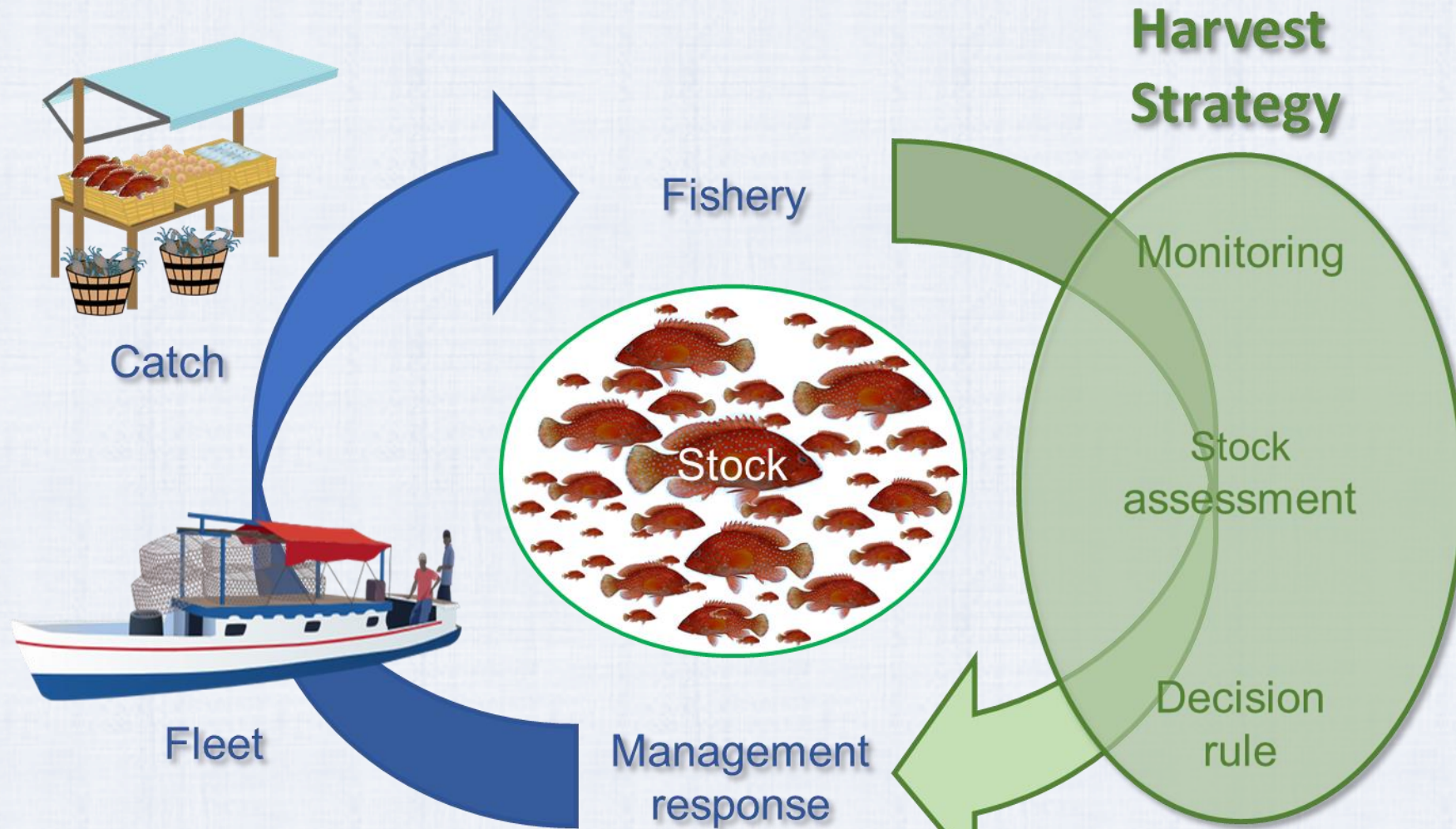


Harvest Strategies



Illustrations courtesy of the Integration and Application Network,
University of Maryland Center for Environmental Science (ian.umces.edu/symbols/)

Harvest Strategies

What you will learn:

- What are the key elements
- What is in a harvest strategy
- Reference points and performance indicators
- Commonwealth harvest strategy
- Examples harvest strategies in Torres Strait

Harvest Strategies

A harvest strategy should:

- Be easy to understand
- Be unambiguous
- Make sense
- Be precautionary

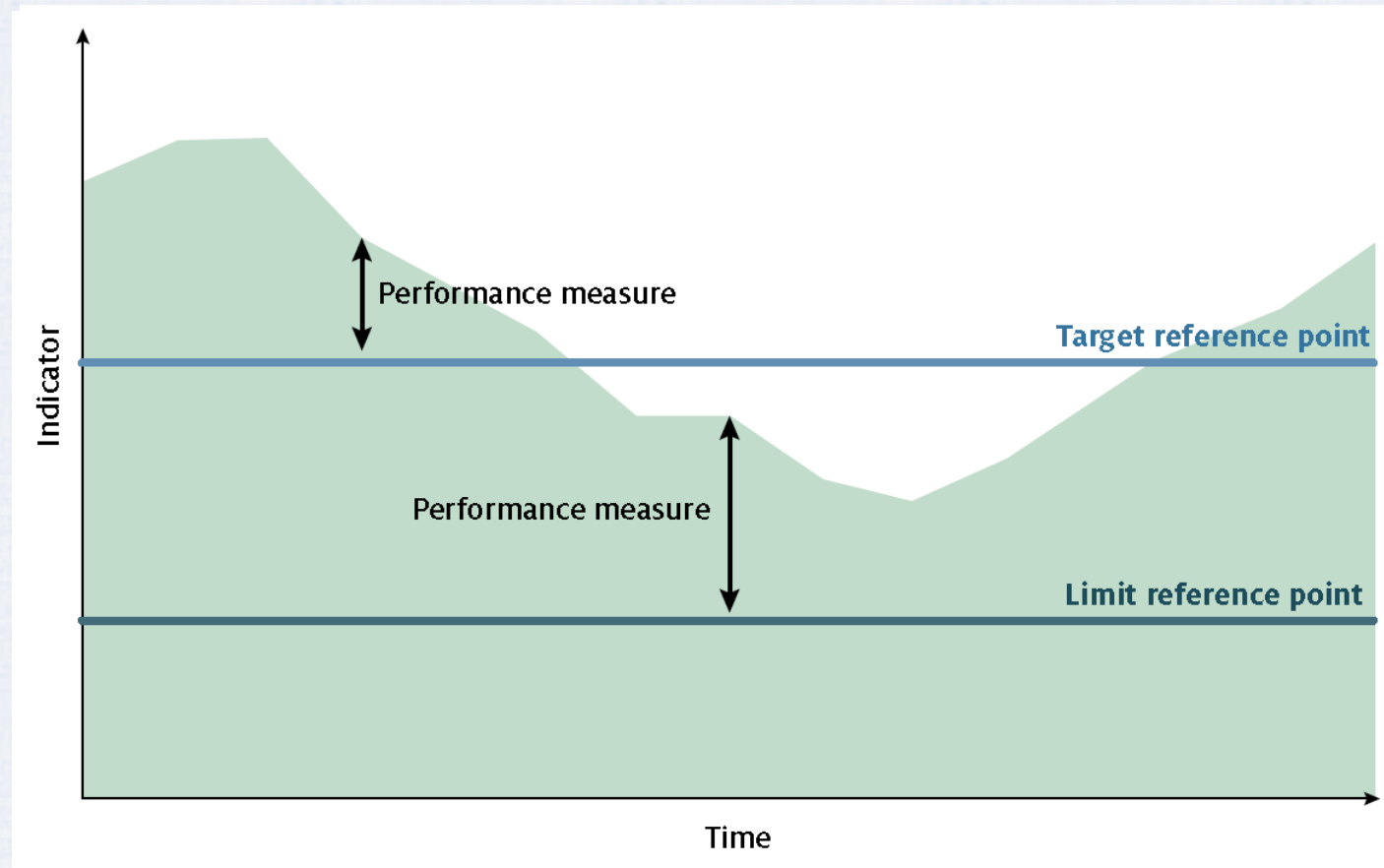
Harvest Strategies

Six Key Elements

1. Objective(s) – what you are trying to achieve
2. Reference Points – benchmarks
3. Indicator(s) – what you measure
4. Performance measure(s) – how you are tracking
5. Decision Rules – how you will react
6. Meta Rules (Exceptional Circumstances) – for when the unusual happens

Harvest Strategies

Definitions

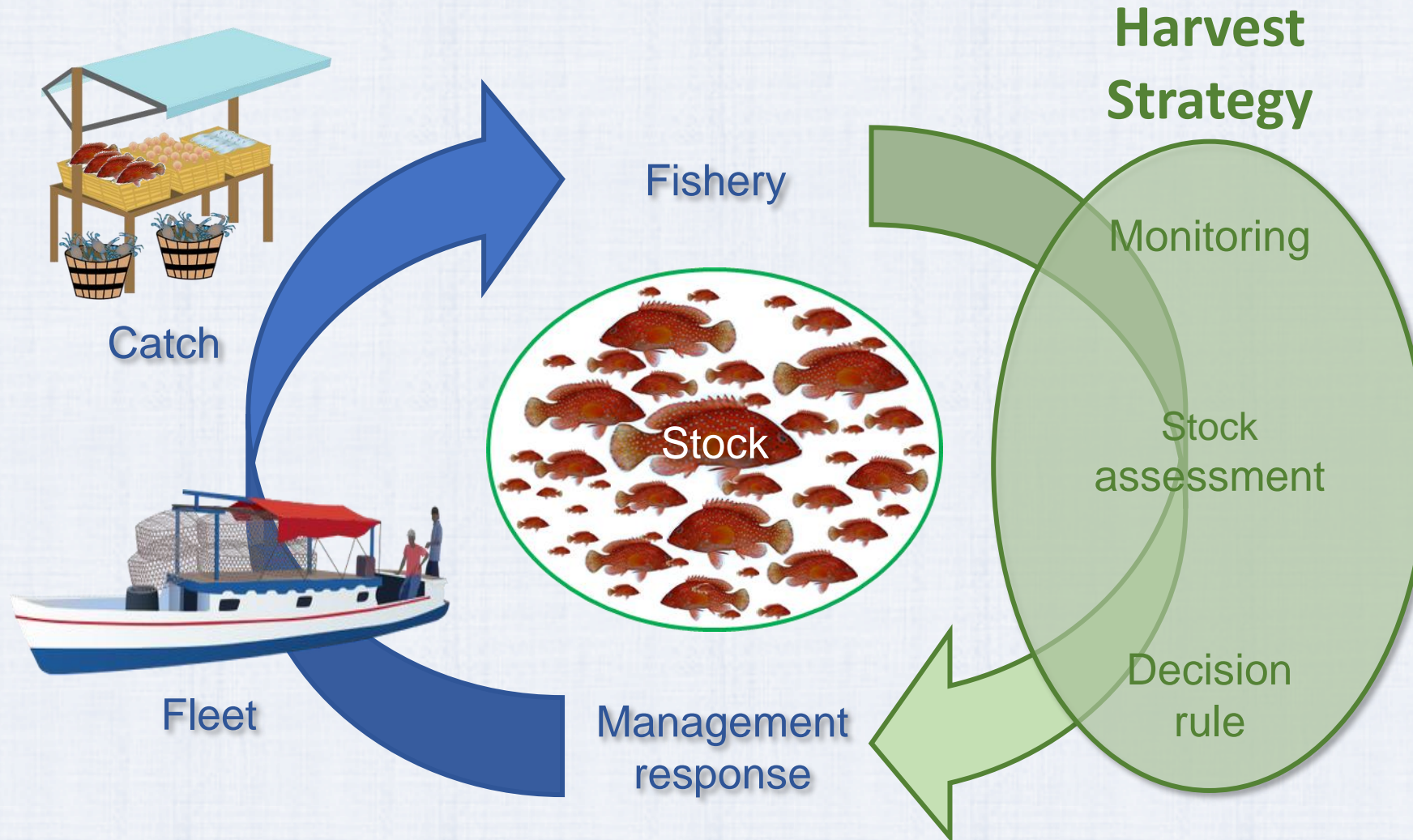


Example - fishery

Six Key Elements

1. Objective: Keep fishery sustainable and profitable
2. Reference Point: Fishing mortality \leq a target
3. Indicator: Current level of fishing mortality
4. Performance measure: How close to target
5. Decision Rule: Increase/decrease catch
6. Meta Rule; e.g. If bad signs in other indicators then further reduce the catch

Harvest Strategies



Harvest strategy - components

Monitoring + Assessment + Decision rule

- Monitoring ✘
- Assessment ✘
- Decision Rule ✘

Fisheries management is “flying blind”

- No idea what is happening
- Doesn't know what it means
- No informed way to respond



Harvest strategy - components

Monitoring + Assessment + Decision rule

- Monitoring ✓
- Assessment ✗
- Decision Rule ✗

Fishery management

- Can see what is happening
- Does not know what it means
- No informed way to respond



Harvest strategy - components

Monitoring + Assessment + Decision rule

- Monitoring ✓
- Assessment ✓
- Decision Rule ✗

Fisheries management

- Can see what is happening
- Knows what it means
- No informed way to respond



Harvest strategy - components

Monitoring + Assessment + Decision rule

- Monitoring ✓
- Assessment ✓
- Decision Rule ✓

Fisheries management

- Can see what is happening
- Knows what it means
- Has tools needed to respond





It's not that easy.....

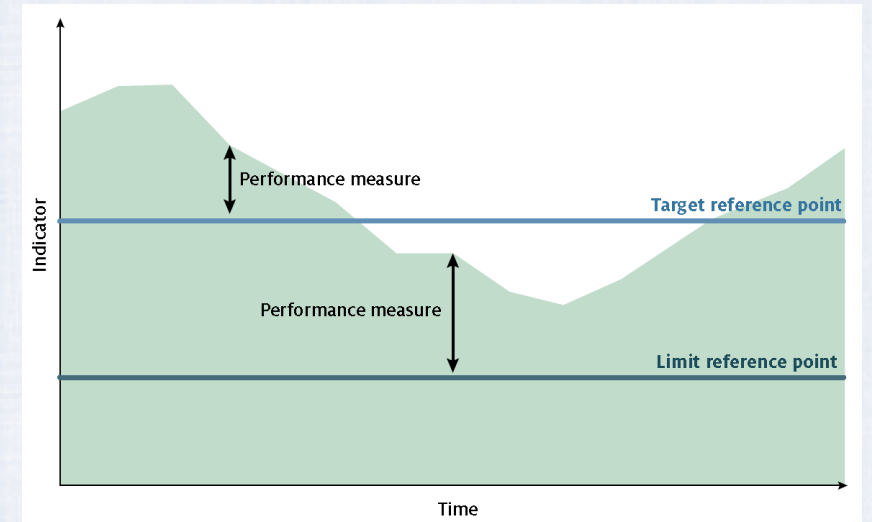
Defining some terms - defaults

- Biomass (B) is the total weight of fish (usually of spawners but has to be defined)
- Fishing mortality rate (F) is a particular form of an exploitation rate
- Target reference point (F_{TARG} or B_{TARG}) is an exploitation rate or biomass to be aimed for
- Limit reference point (F_{LIM} or B_{LIM}) is an exploitation rate or biomass to be avoided
- Exploitation rate is the fraction of the available stock that is caught ($=C/B$)

Defining some terms - defaults

Limit reference point

- To be avoided
- $B_{LIM} = 20\%$ original biomass
- May be higher for important food chain spp
- $F_{LIM} =$ High effort level will reduce biomass below 20% original biomass



Defining some terms - defaults

Target Reference Point

- B_{TARG} = 48% original biomass
- F_{TARG} is the desired exploitation rate to get you to B_{TARG}
- Biomass above B_{MSY} (Default B_{MSY} = 40%)
- B_{TARG} = 48% original biomass ($1.2 \times B_{MSY}$)
- F_{TARG} exploitation rate that reduces biomass to 48% original biomass
 - Only have biomass estimates from Tier 1 or 2 assessments
 - Proxies need to be developed for species without formal assessments.

Maximum Sustainable Yield (MSY)

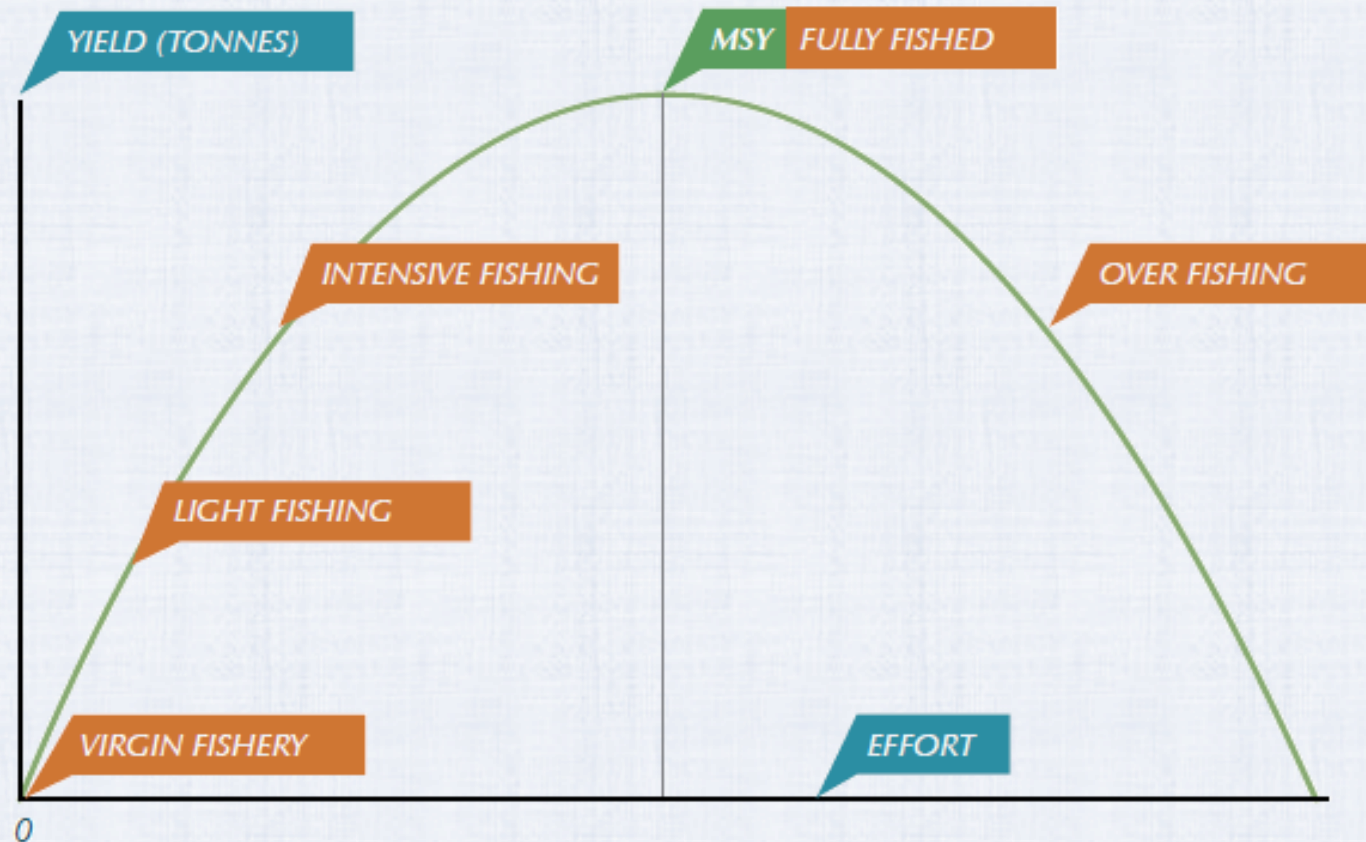
Calculate MSY used the following data

- Biological characteristics of the fish stock
 - Growth
 - Mortality
 - Recruitment
- Revenue



Maximum Sustainable Yield (MSY)

POINT OF MAXIMUM SUSTAINABLE YIELD (MSY)



Maximum Sustainable Yield (MSY)

- Theory developed in the 1950s
- The modelling was based on real life observations and experiments
- Seeks to find the highest long term catch that can be taken from a fish stock at **sustainable** levels
- But the problems with MSY include:
 - Fish stocks fluctuate with environmental conditions
 - It only considers revenue, not costs

Maximum Economic Yield (MEY)

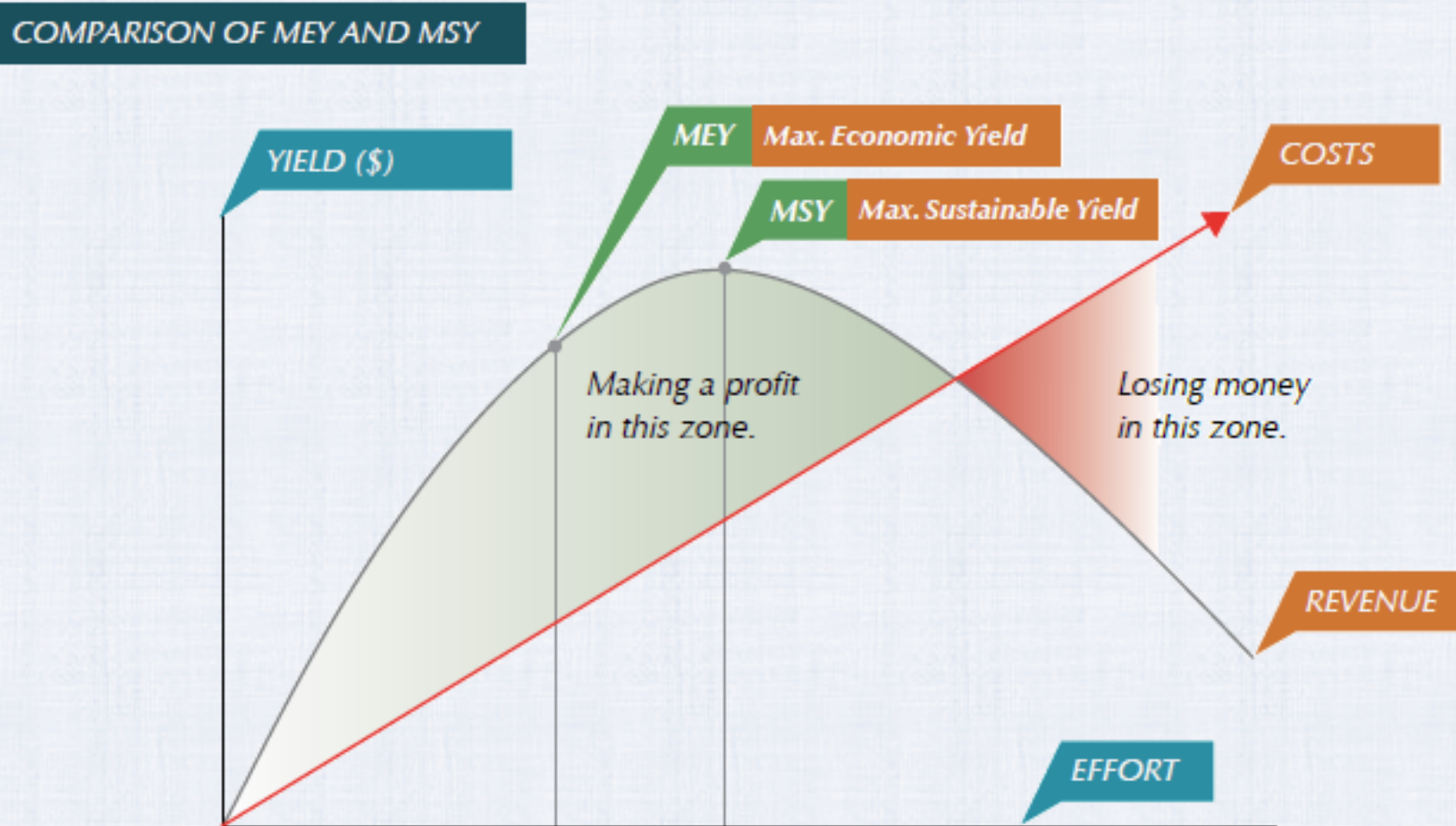
Calculating MEY uses the data used for MSY

- Biological characteristics of the fish stock
 - Growth
 - Mortality
 - Recruitment
- Revenue

As well as

- Costs
- Catch and effort

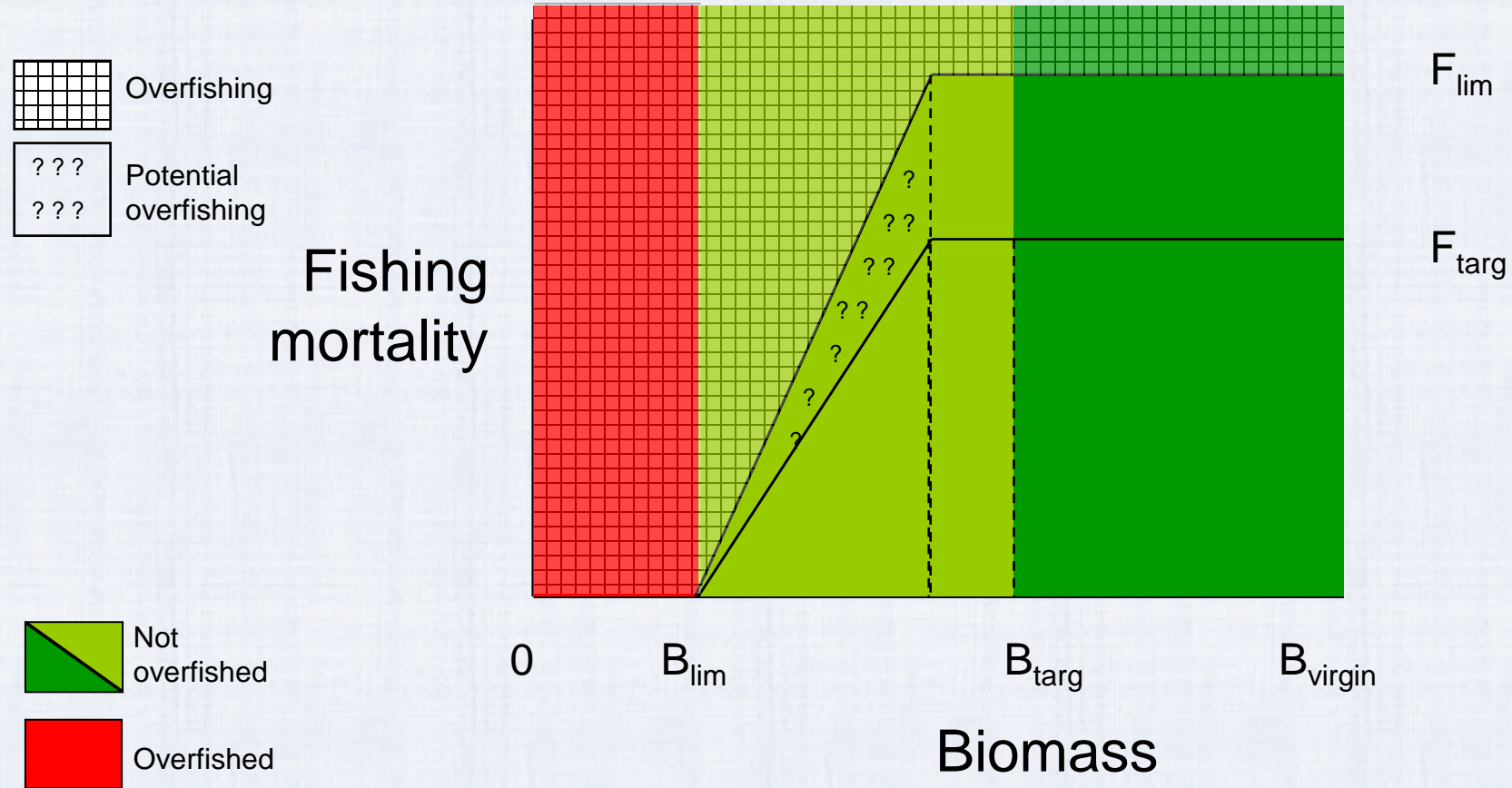
Maximum Economic Yield (MEY)



Harvest Strategy

Australian Commonwealth Fisheries

Harvest Strategy - Commonwealth



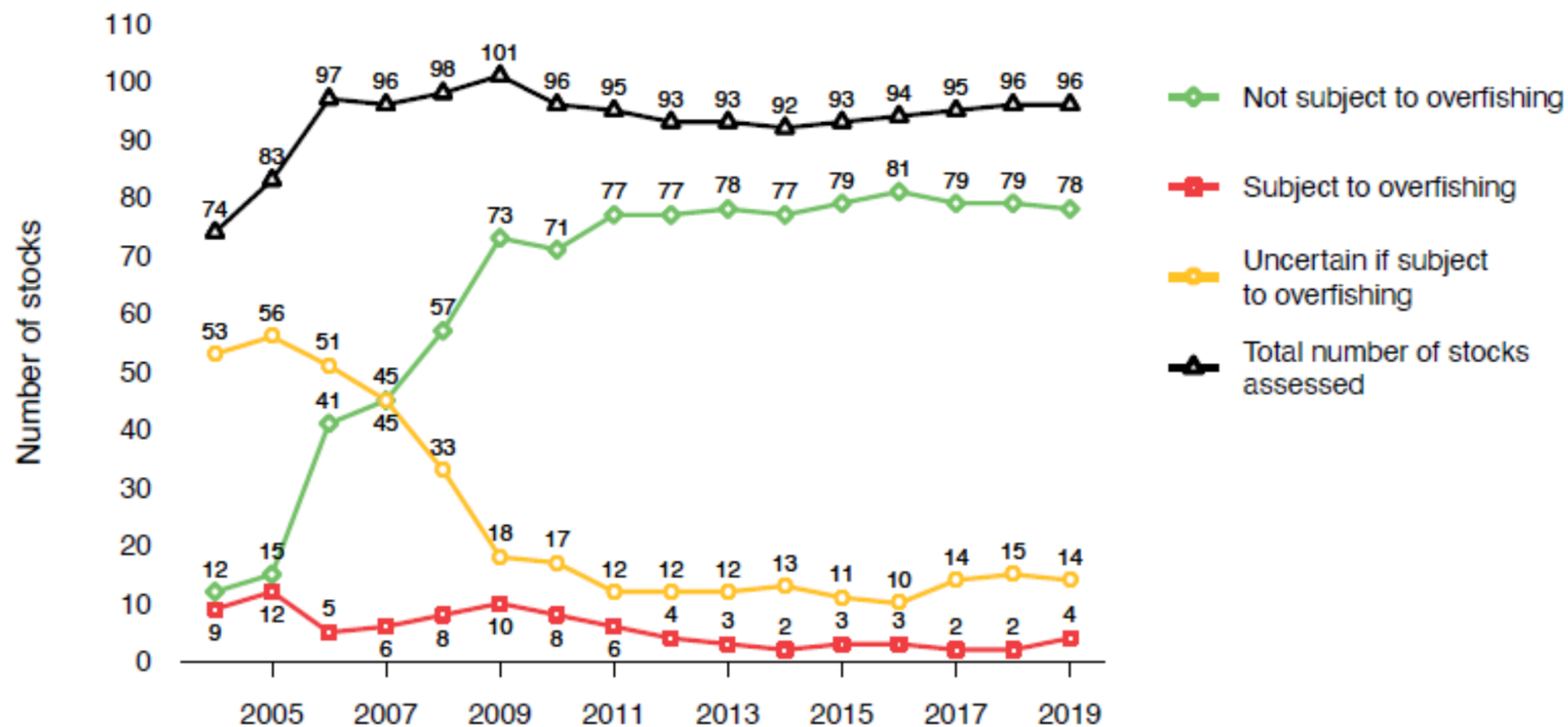
Harvest Strategy - Commonwealth

Applies to key commercial species

- Target reference point
 - Stock biomass (B_{Targ}) required to produce maximum economic yield from the fishery (B_{MEY})
 - Fishing mortality (F_{Targ}) that results in biomass depletion to 48 % of the unfished biomass.
- Limit reference point
 - All stocks must be maintained above their biomass limit reference point (B_{LIM}) >90 % of the time
 - Fishing mortality point (F_{LIM}) above which the removal rate from the stock is too high and will result in the stock falling below B_{LIM}

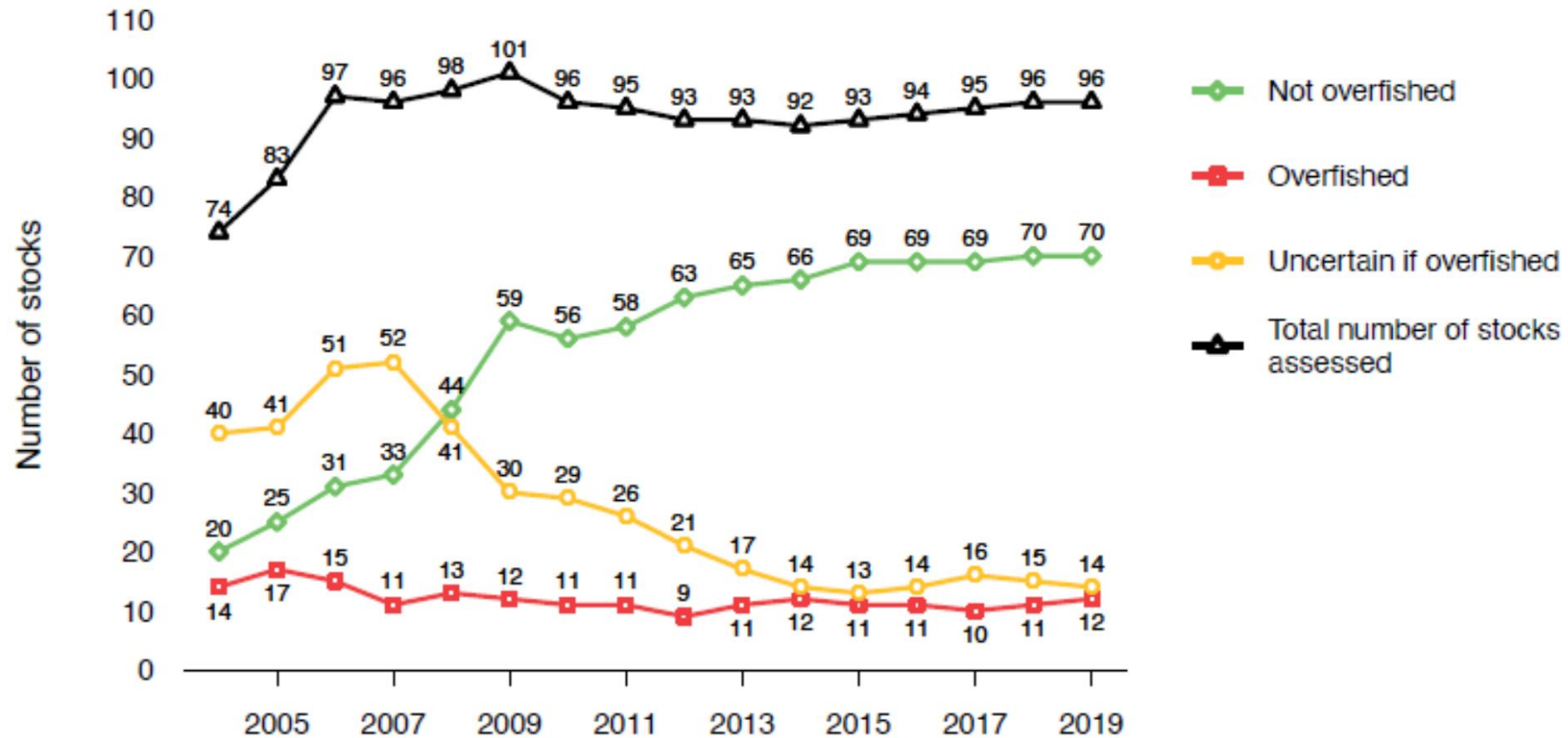
Australian stocks – fishing mortality

FIGURE 1.3 Fishing mortality status (number of stocks), 2004 to 2019

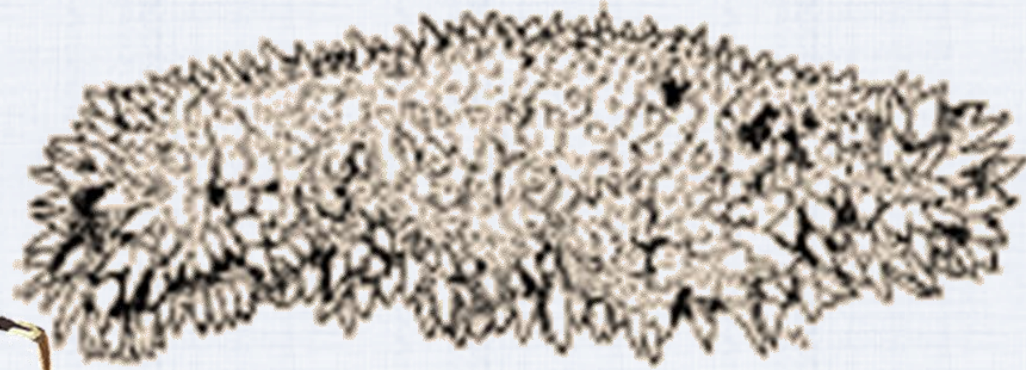


Australian stocks – Biomass

FIGURE 1.4 Biomass status (number of stocks), 2004 to 2019



Harvest Strategy



Torres Strait



TRL Harvest Strategy

Target reference point

- B_{TARG} is the spawning biomass level equal to recent levels (2005-2015)
- $B_{TARG} = 0.65 B_0$
- F_{TARG} is the estimated level of fishing mortality rate that maintains the spawning biomass around B_{TARG}
- $F_{TARG} = 0.15$

Limit reference point

- B_{LIM} is the spawning biomass level below which the risk to the stock is unacceptably high
- $B_{LIM} = 0.32 B_0$

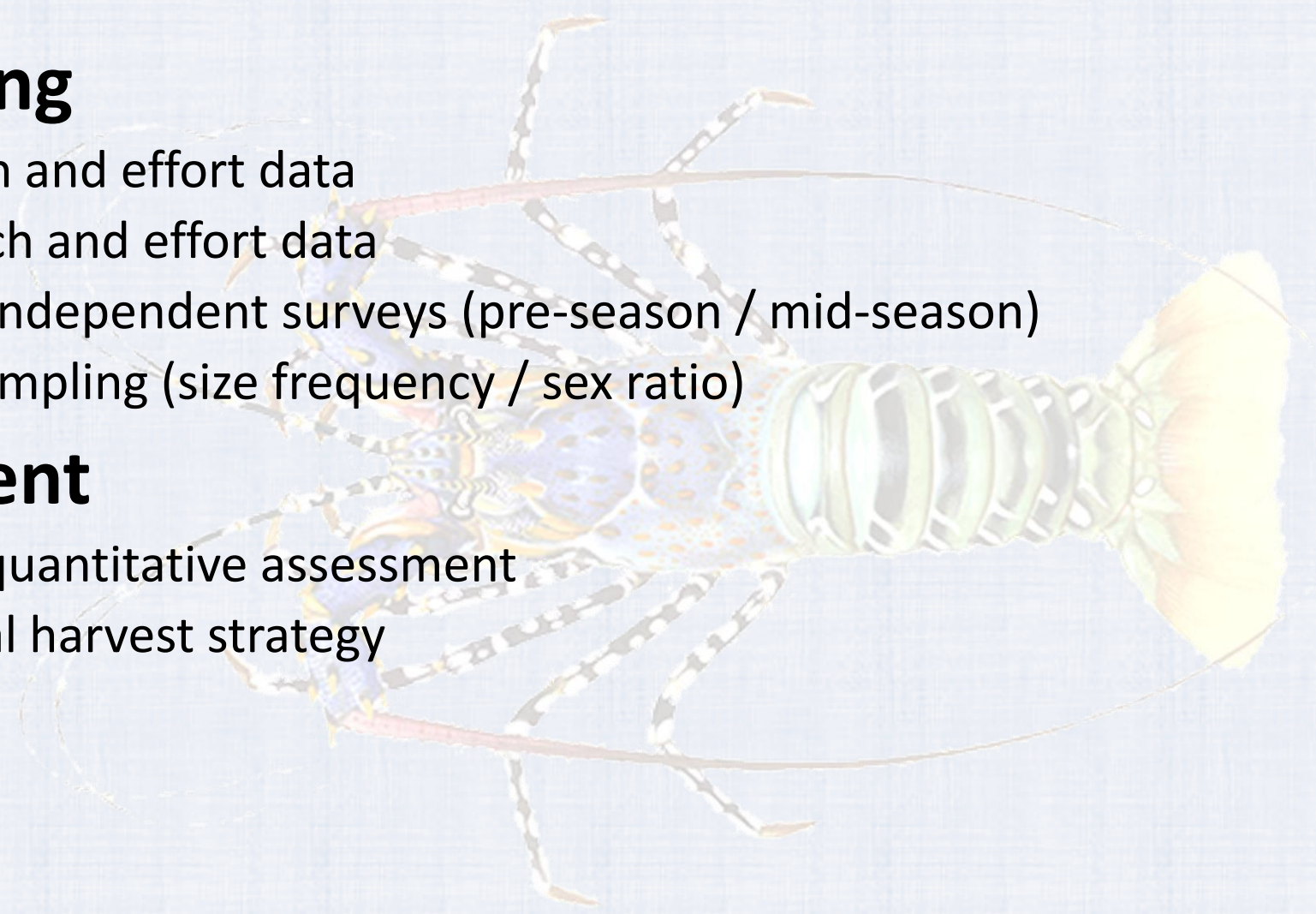
TRL Harvest Strategy

Monitoring

- TIB catch and effort data
- TVH catch and effort data
- Fishery independent surveys (pre-season / mid-season)
- Catch sampling (size frequency / sex ratio)

Assessment

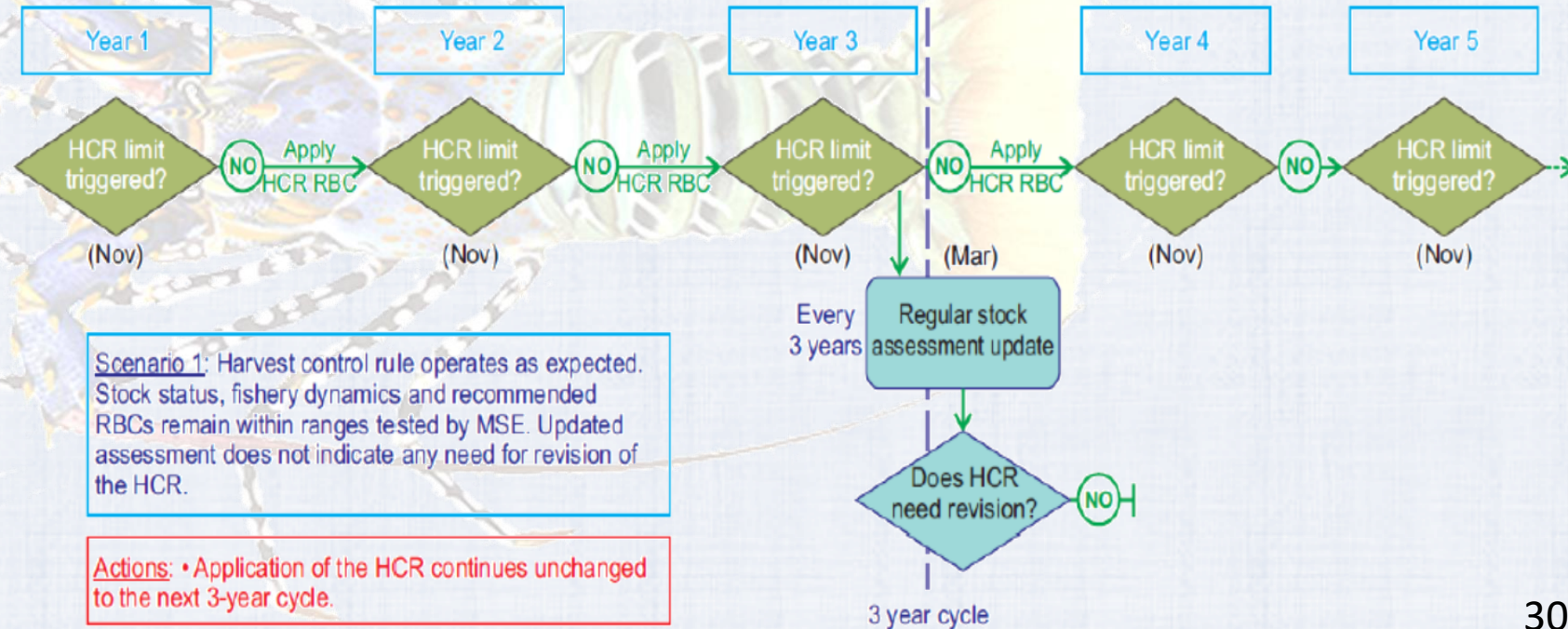
- Formal quantitative assessment
- Empirical harvest strategy



TRL Harvest Strategy

Decision Rules

- Maximum catch limit of 1000 t
- 1+ pre-season survey ≤ 1.25 → assessment
- $< \text{Blim}$ 2 years → fishery closure
- Various scenarios



BDM Harvest Strategy

No proxies consistent with Commonwealth HSP

- Too variable
- Not cost-effective
- Intention to meet the HSP

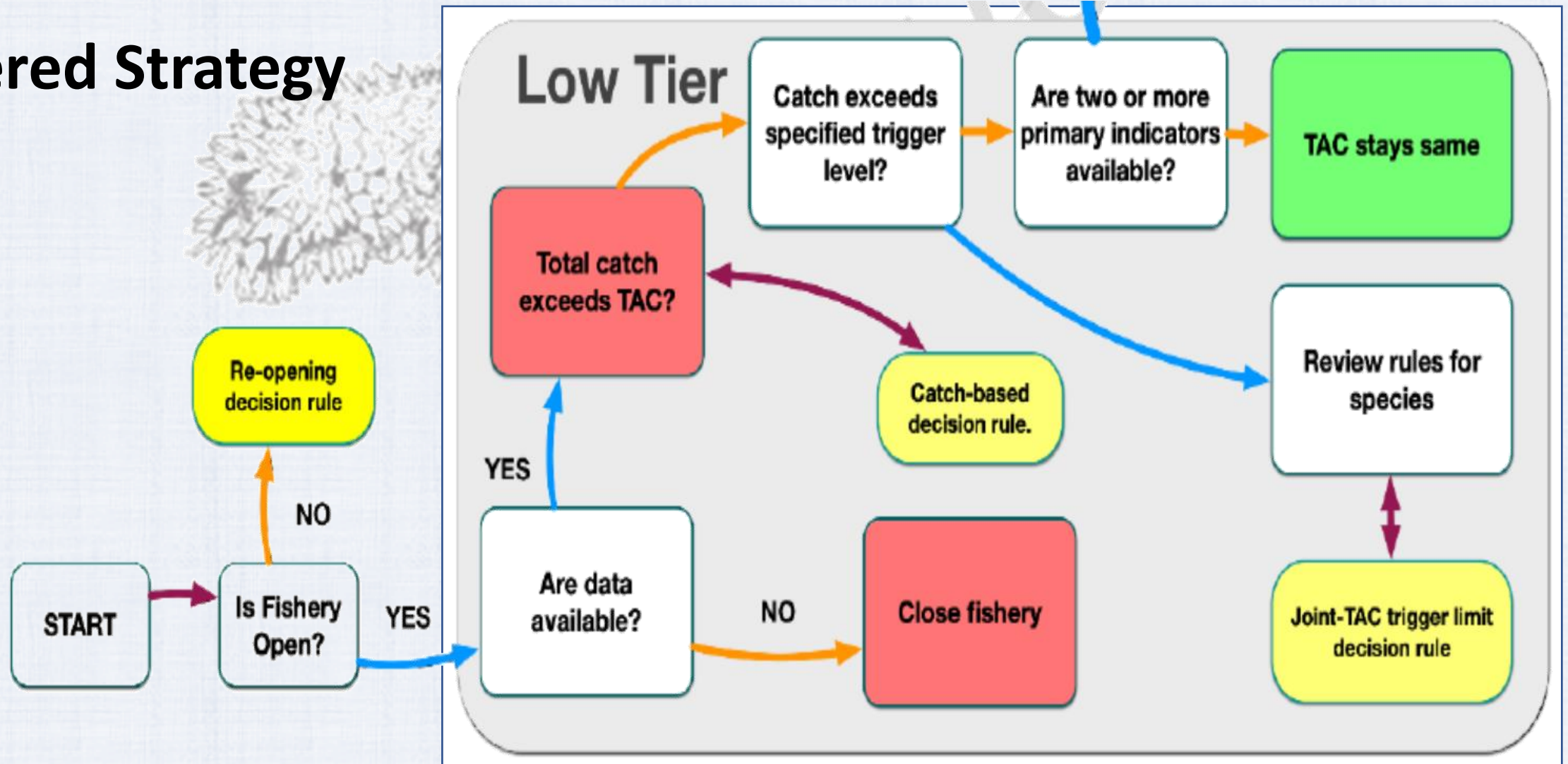
Have adopted a Tiered harvest strategy

- High Tier – lots of data
- Low Tier – poor data
- Decision Rules
 - Catch-based
 - Joint TAC trigger limit



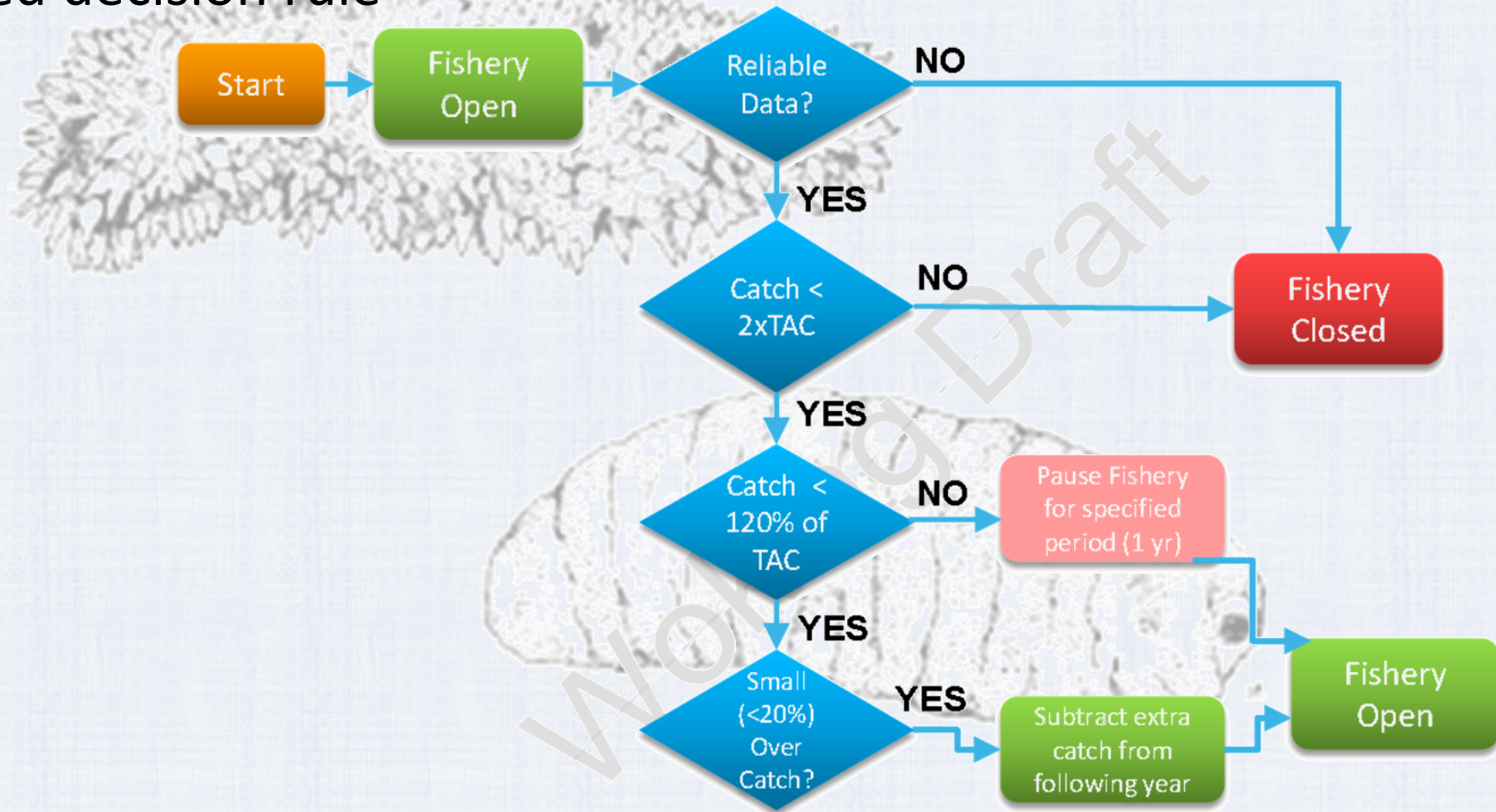
BDM Harvest Strategy

Tiered Strategy



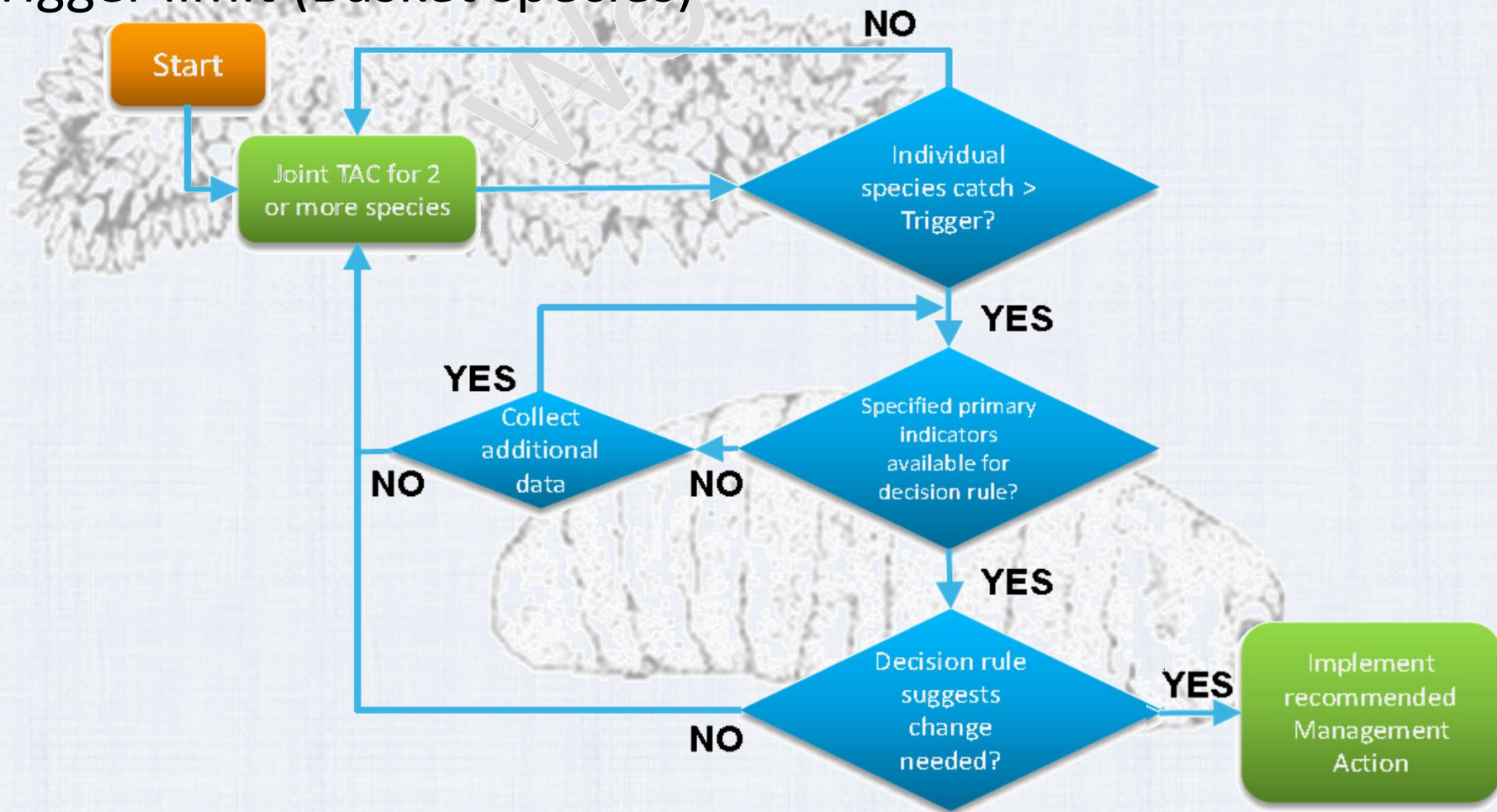
BDM Harvest Strategy

- Catch-based decision rule



BDM Harvest Strategy

- Joint TAC trigger limit (Basket species)





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www.fishwell.com.au

<http://www.youtube.com/user/FishwellConsulting>