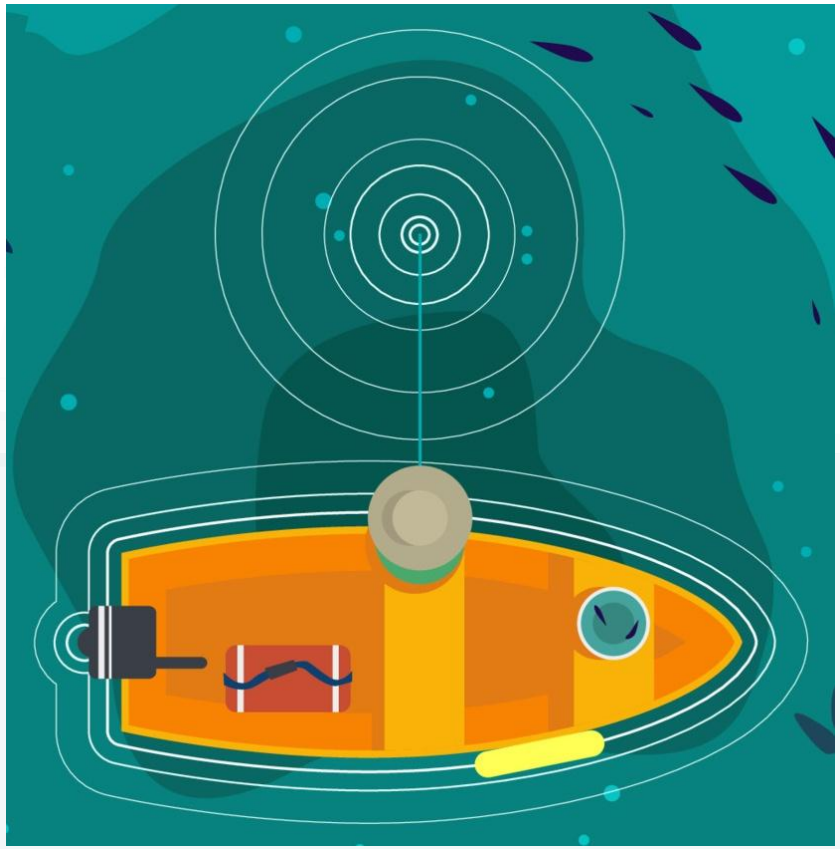
Food and Agriculture Organization
of the United Nations

Fishing Global and Regional Processes Team
Fisheries Division
Food and Agriculture Organization of the United Nations

Quantifying IUU Fishing- Issues and Methods

Shelley Clarke
Fishery Analyst

Presentation Overview



1. Benefits and challenges of quantifying IUU fishing
2. The importance of defining what to quantify
3. Estimation methods – what and why?
4. Indicator methods – what and why?

Image: Vecteezy.com (I Ketut Sukayasa)

Topic 1 - Benefits and Challenges of Quantifying IUU Fishing

- IUU fishing undermines effective fisheries management and therefore we need to combat it → but why do we need to quantify it?
  - To build political will (including acquiring resources) for countermeasures
  - To understand the scale and potential impacts of the problem (biological, economic and social)
  - To determine whether specific MCS elements are sufficient for deterrence
  - To be able to show whether deterrence is working

Things that can go wrong when Quantifying IUU Fishing - Scenario #1

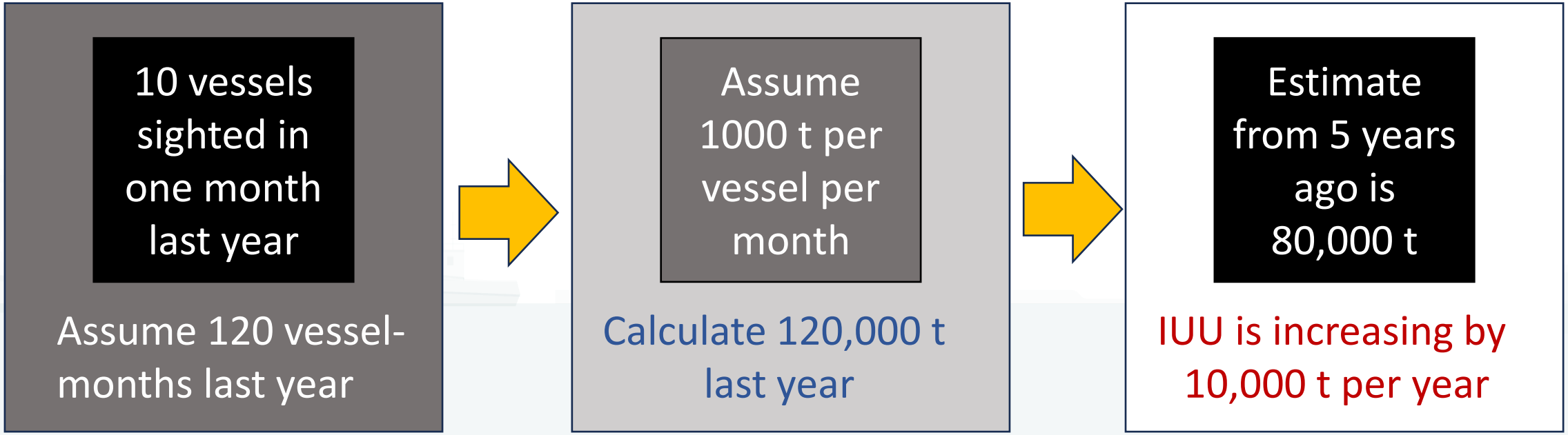
Issue: → Not enough information, resources or time

Therefore:

- Have to guess
- Can't document or can't convince
- Influenced by biased information

And then: → The estimate is not believable

Things that can go wrong when Quantifying IUU Fishing - Scenario #1



How credible is this estimate?

Things that can go wrong when Quantifying IUU Fishing - Scenario #2

Issue:

→ Many elements in the estimate are variable

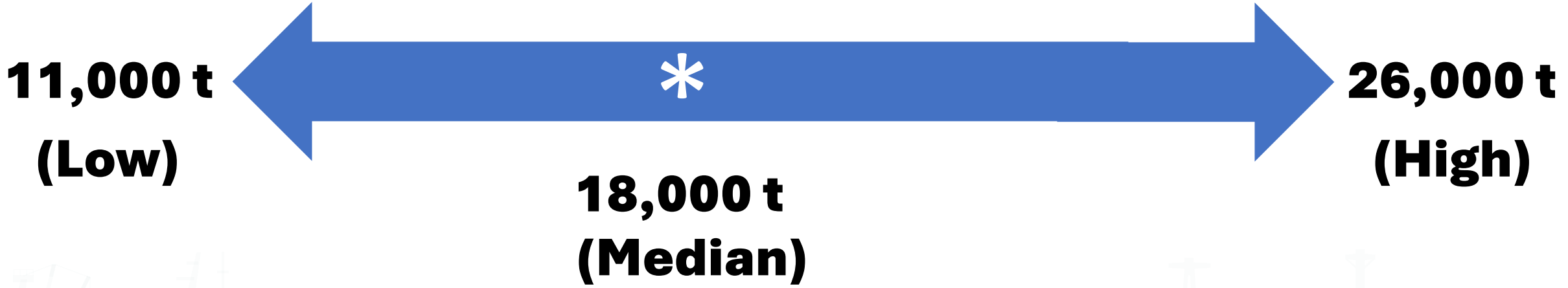
Therefore:

- Carefully document the range of values
- Carry those ranges through the entire estimate
- Explain the situation to managers

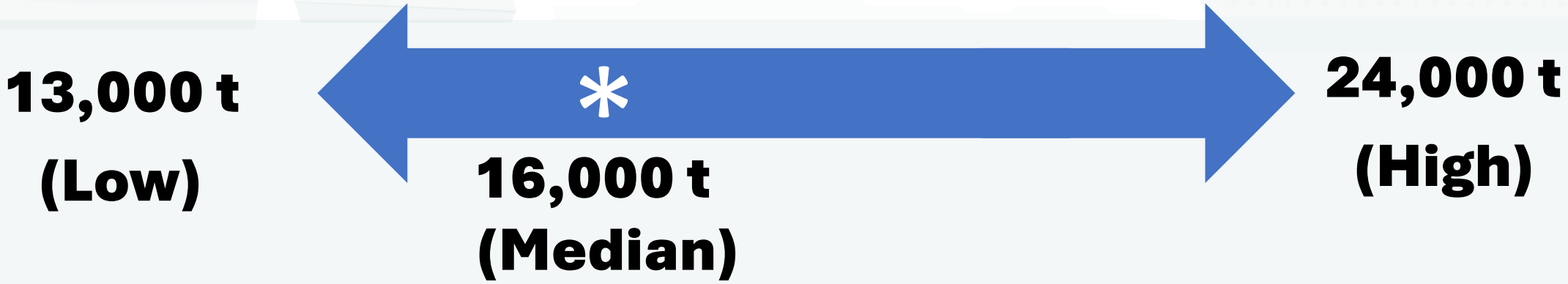
And then:

→ It is difficult to understand what the result means

Things that can go wrong when Quantifying IUU Fishing - Scenario #2



Next year another estimate is made:



Has IUU fishing decreased?

Things that can go wrong when Quantifying IUU Fishing - Scenario #3

Issue:

→ The reason for analyzing IUU fishing is to better understand how to fight it

Therefore:

- Use the best available information
- Produce a credible estimate
- Attract attention to the problem

And then:

→ Managers want to know what to do next

Things that can go wrong when Quantifying IUU Fishing - Scenario #3

Reported catch by species A, B, C	X	Expert survey of the amount of IUU fishing for species A, B, C (high, medium or low)	=	Amount of IUU catch of species A, B, C

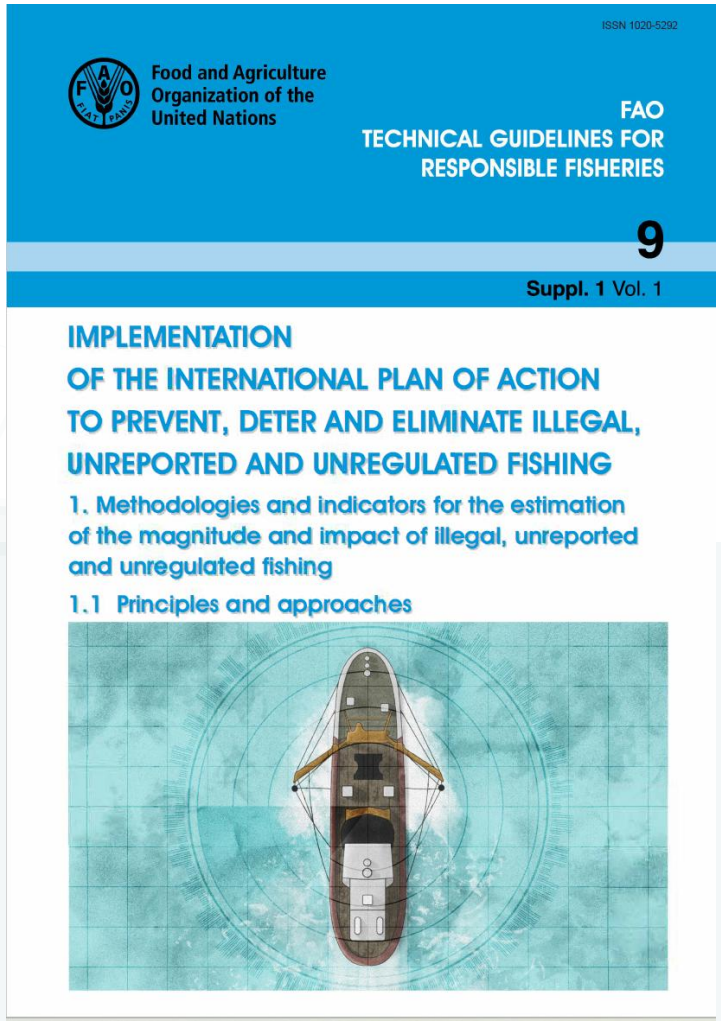
What are the most urgent management steps?

Summary of IUU Fishing Quantification Challenges

- Amount of available data varies widely (sometimes there is none!)
- Quality of available data varies widely ("garbage in, garbage out")
- Easy methods can over-simplify, complex methods can be costly and hard to explain (there is no universally preferred method)
- Assumptions and uncertainties are often ignored, and if not, work against a clear conclusion
- Difficult to compare between studies
- Difficult to know what to do next

Image: Vecteezy.com (Andres Ramos)

Volume 1 – Principles and Approaches



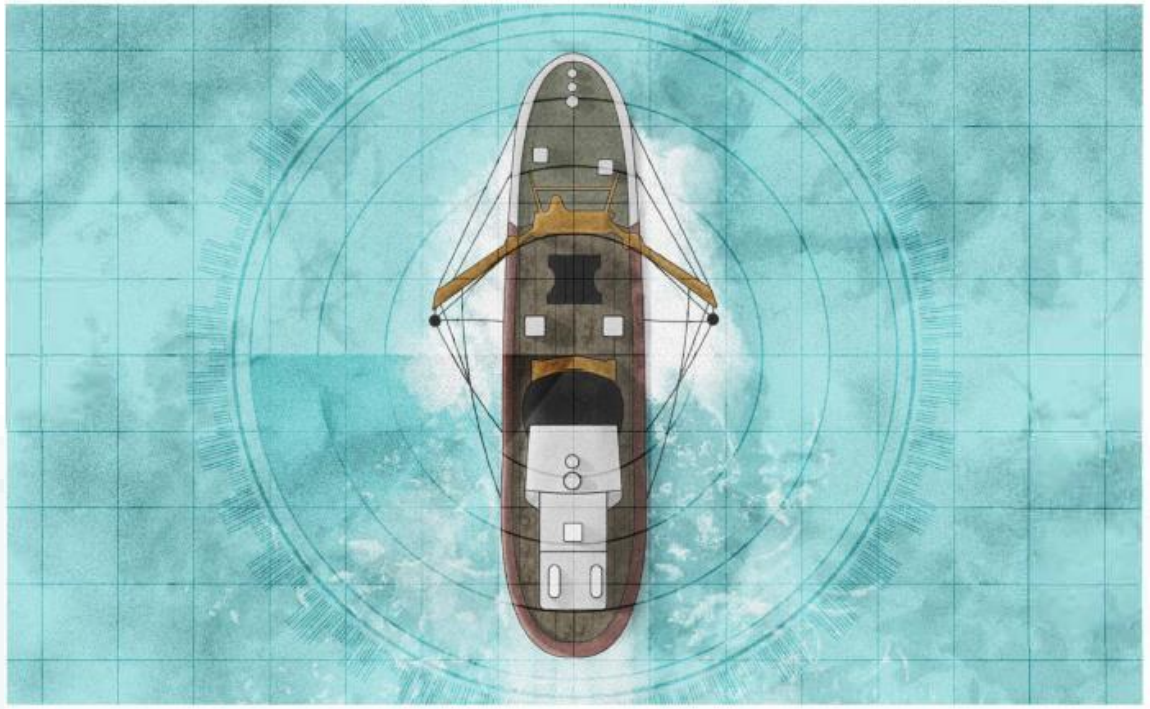
- Explains how to define the scope of the estimate
- Highlights characteristics of a robust estimate
- Classifies IUU fishing risk types and suggests ranking them

Topic 2: Defining What to Quantify

1. Define the scope of interest (area, fishery, species)
2. Identify and assess types of risks (IUU fishing activities)
3. Compile and assess available data
4. Select an assessment approach

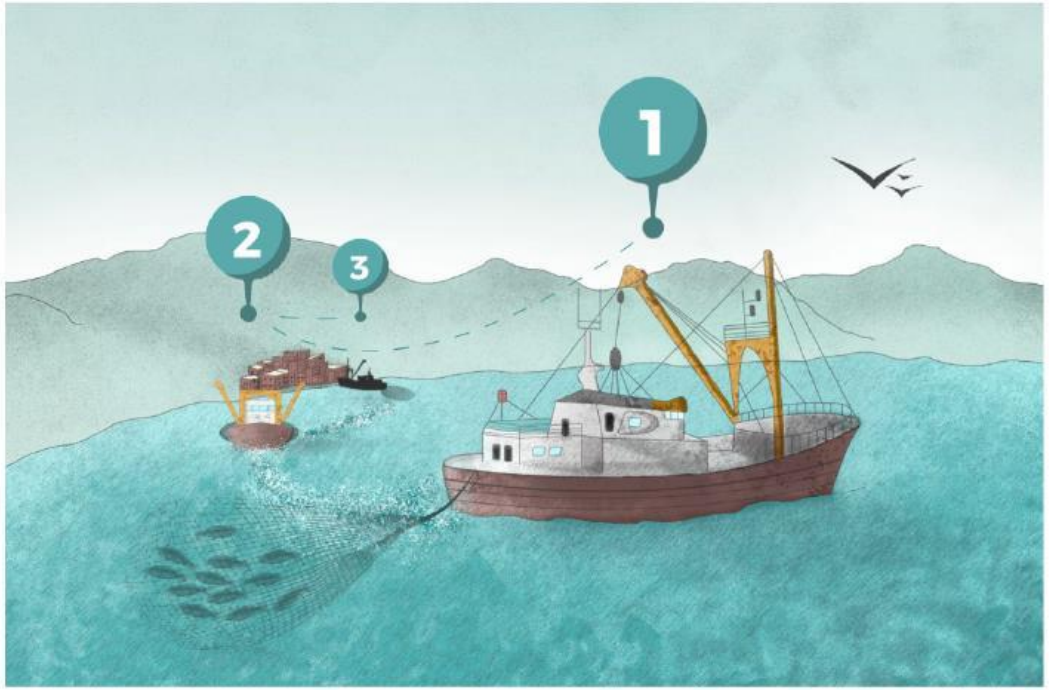
Graphic: vecteezy.com

Step 1: Define the Scope of Interest



- By fisheries/sectors
- By species
- By area/region
- By timeframe
- By what is considered IUU fishing (e.g. include unregulated?)

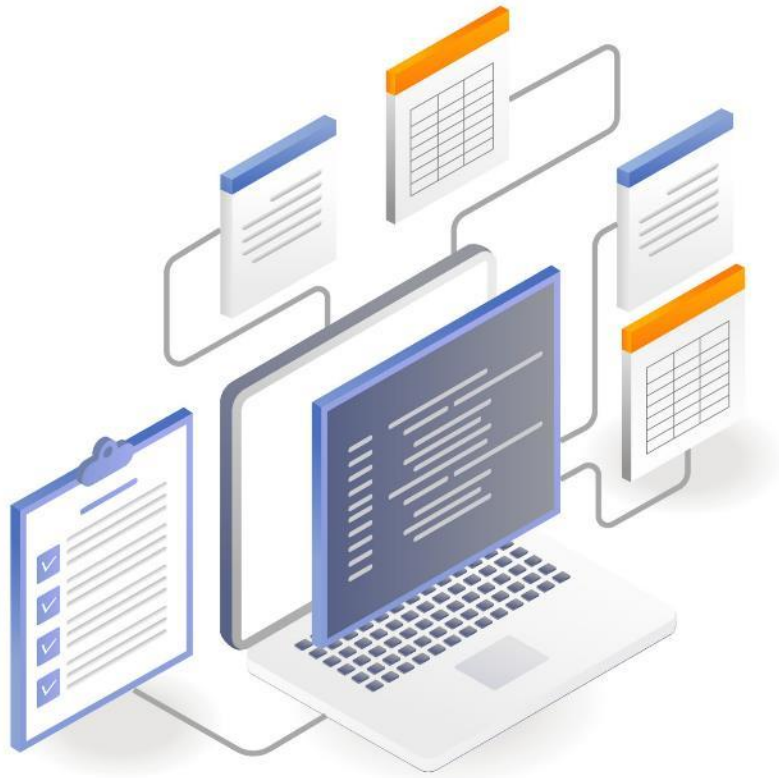
Step 2: Identify and Assess Types of Risks



- Unlicensed fishing
- Reporting issues
- Non-compliance with licensing conditions
- Illegal transshipment
- Improper landing
- Other?

Step 3: Compile and Assess Available Data

- VMS
- logbook
- observer
- landings
- satellites
- stock assessments
- trade records
- expert opinion surveys

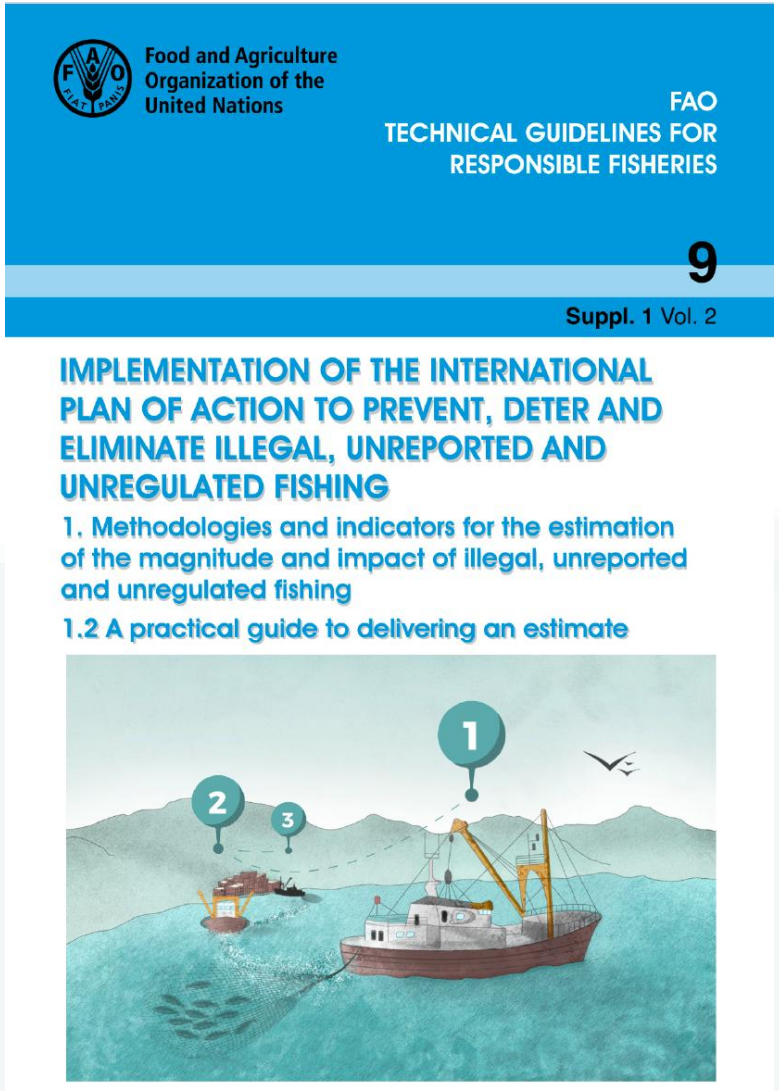


Graphic: vecteezy.com

Consider quantity, quality, relevance and accessibility of data for each risk

Volume 2 – Practical Guide

- Flowchart of steps for “project managing” an IUU fishing estimate
- Table of potential data types and their strengths and weaknesses
- Emphasis on stakeholder involvement



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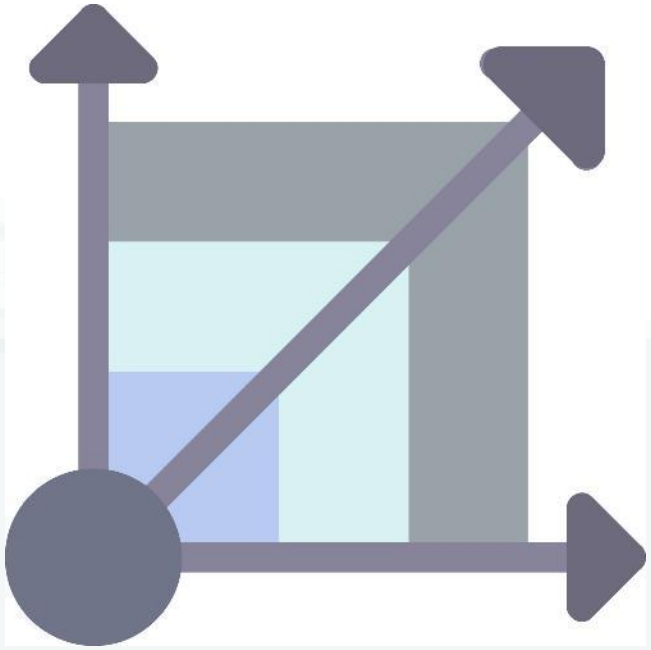
Graphic: vecteezy.com

Topic 3 - Estimation Methods: What and Why?

Estimates



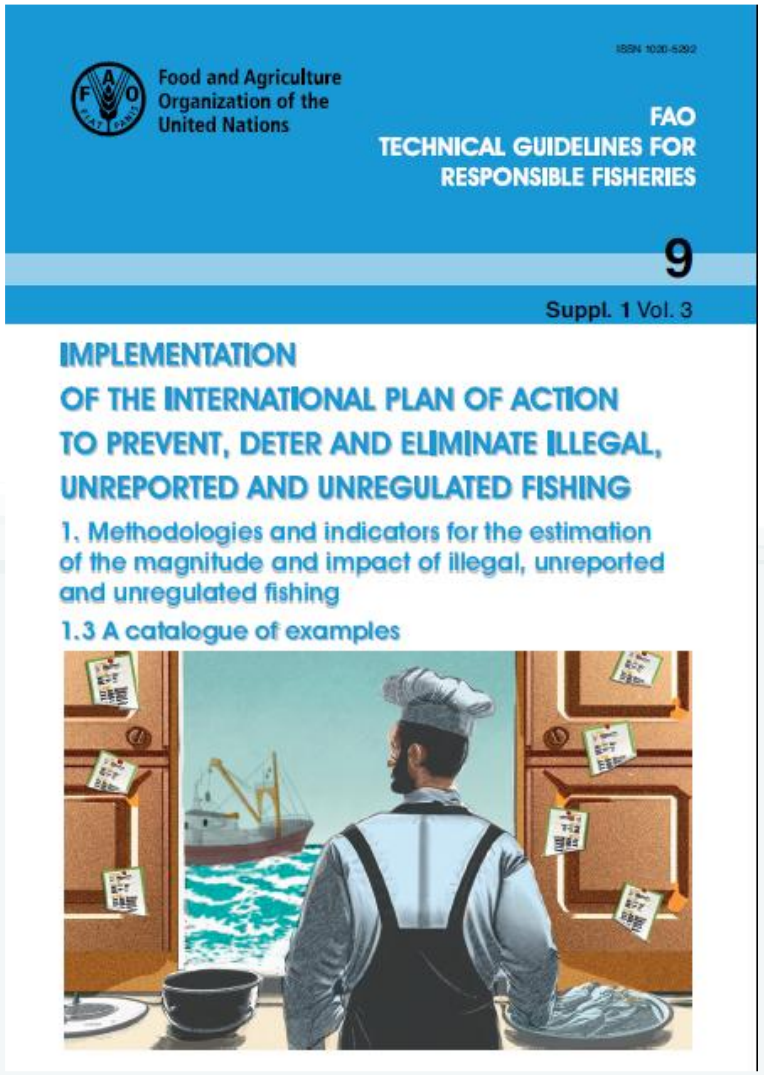
Aim for the best possible measure of the amount of IUU fishing (quantity or value)

Graphic: vecteezy.com

Indicators

Aim to measure several different signals of whether things are getting better or worse

Volume 3 – Catalog of Examples



- Detailed guidance on how to actually do an estimate
- Each situation will be unique, so providing detailed advice in every case is impossible
- Examples from all types of fisheries around the world in the form of 26 “recipe cards”

Example "Recipe Card"

Reference

Summary

Indexing

HEADER

Study

Clarke, S.C., McAllister, M.K., Mil… d, E.J., Kirkwood, G.P., Michielsens, C.G., Agnew, D.J., Pikitch, E.K., Nakano… anivji, M.S. 2006. Global estimates of shark catches using trade records from commercial markets. *Ecology Letters*, 9(10): 1115–1126.

Simple summary

Converted records of shark products from a centralized commercial market to whole shark equivale… extrapolated to the total quantity in trade and compared to reported catche…

Approach

Estimat… mus reported catch

Yellow approach group

…al sources

Data group 2

INGREDIENTS

…ey constituents	How they sourced it	Other ways to source it
1. Quantity of product traded per unit time	Compiled market (auction) records showing trade name, product sizes and quantities	• repeated observational market surveys (e.g. photos, counts) • published records of wholesale markets (if product is a standard weight/size)
2. Species identity of product	Used genetic testing to match trade name to species	• rely on market names to be species-specific, or use expert judgement to make an allowance for mixing • if doing market observational surveys, use visual identification • gather and apply expert judgement
3. Conversion factors from product to whole fish	Used morphometrics from literature and sampling whole fish	• use measurements from photographs • gather and apply expert judgement
4. Conversion factors from sampled market to entire market	National customs statistics from major markets	• trade compendiums e.g. FishStatJ or COMTRADE • gather and apply expert judgement • estimate from sales quantity or value figures

RECIPE

Steps	Example	Cautions
1. Estimate the total product quantity traded per unit time	Each auction handles 400 kg of shark fins. Auctions are held on Mondays. 400 kg x 52 = 20.8 tonnes of shark fins per year	• Account for variability in quantities traded. • May need to fill in missing data. • Some trade data are only available monthly or yearly.
2. Break the total quantity into species-specific quantities	If 20.8 tonnes of shark fin per year, and half is blue shark, = 10.4 tonnes of blue shark fins	• Account for uncertainty in species proportions. • If species identification is unavailable, estimates may need to stay at a higher taxonomic level.
3. Convert the product to whole fish	If dried fins are 2% of wet weight, 10.4 tonnes of blue shark fins represents 520 tonnes of blue shark	• Conversion factors may vary by species. • Products may not all be the same size. • It is necessary to account for uncertainty in the conversion.
4. Extrapolate the quantity of whole fish to the total volume of trade	If one of three equally sized markets were sampled, a total of 3 x 520 tonnes = 1 560 tonnes of blue shark were traded (live equivalent)	• The products in unsampled markets may differ. • Ideally the size of each market is known from trade statistics, but domestic supplies may also be present.
5. Compare estimate to catch	1 560 tonnes of blue shark is X% of reported catch	• This comparison will be most meaningful if the sampled market is a centralized outlet for a majority of the catch. • There may be a time lag between catch and trade.

APPLICABILITY

Best suited to:	Difficult to apply when:
• conspicuous and valuable internationally traded products; • a central market node that can represent a large portion of the trade; and • situations where fishery data are lacking or likely to be less reliable than trade data.	• products are not distinguished (or mixed) in trade/market statistics; • there are many or diverse markets; • conversion factors are imprecise or unavailable; and • personnel are unfamiliar with statistical methods for incorporating uncertainty.

Example "Recipe Card"

Constituents

Alternatives

Sources

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ch group	Yellow approach group
total catch minus reported catch	
Data	Data group 2
Com ources	

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Examples

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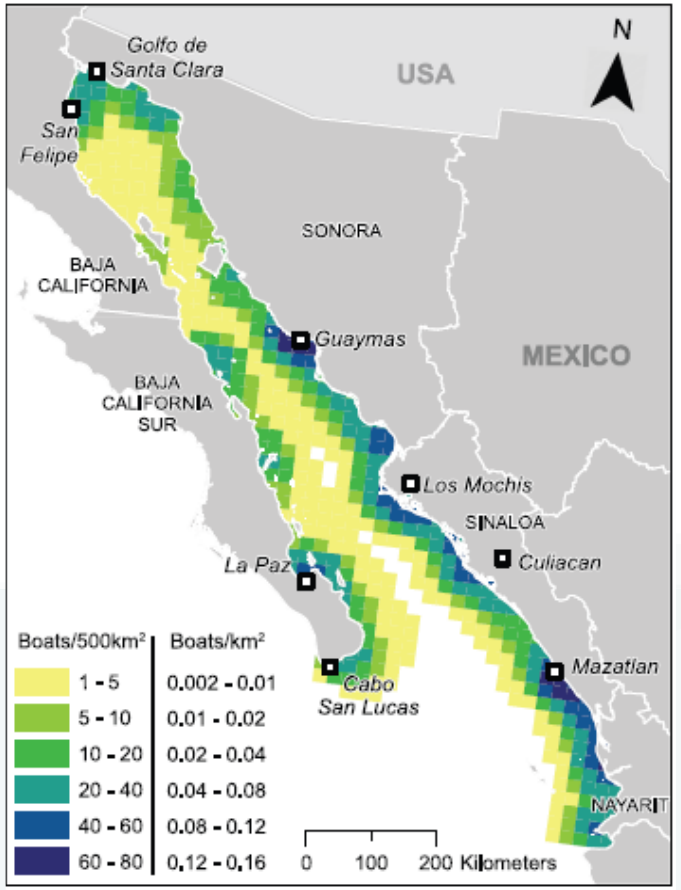
Best suited to

Difficult to apply to

Example 1 – Small-scale Fishery in Gulf of California

1. Correlated the number of vessels (from aerial photos) and population data
2. Assigned known vessels to a grid cell based on population
3. Used VMS on some vessels to check whether the number of vessels per grid cell was correct
4. Used landings data from some areas to predict catch per vessel, then extrapolated to fill missing catch

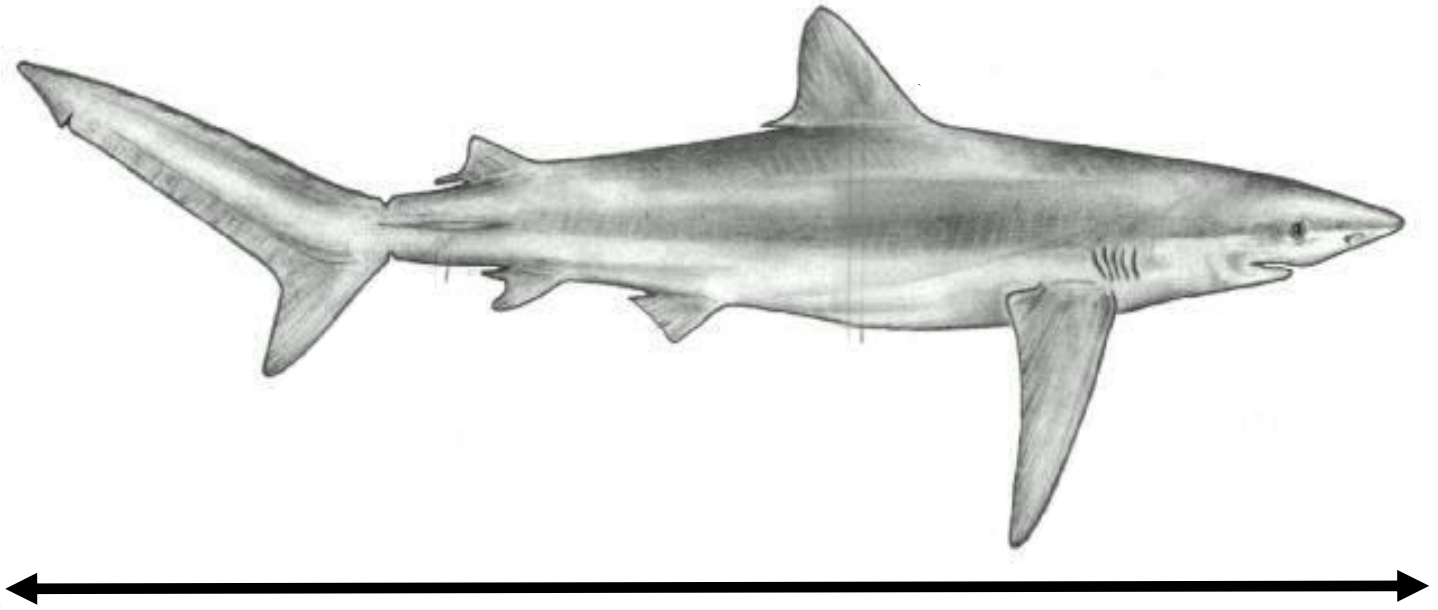


Johnson et al. (2017)

This study was focused on effort rather than catch, but the same method could be used to predict unreported/unregulated catch

Example 2 – Sharks for the Fin Trade

1. List products and quantities in one major market
2. Use genetics to identify species from product names
3. Convert product size/weight to whole size/weight by species
4. Extrapolate from one major market to global amounts



Clarke et al. (2006)

→ Found that shark biomass in the fin trade is 3-4x higher than reported shark catch worldwide

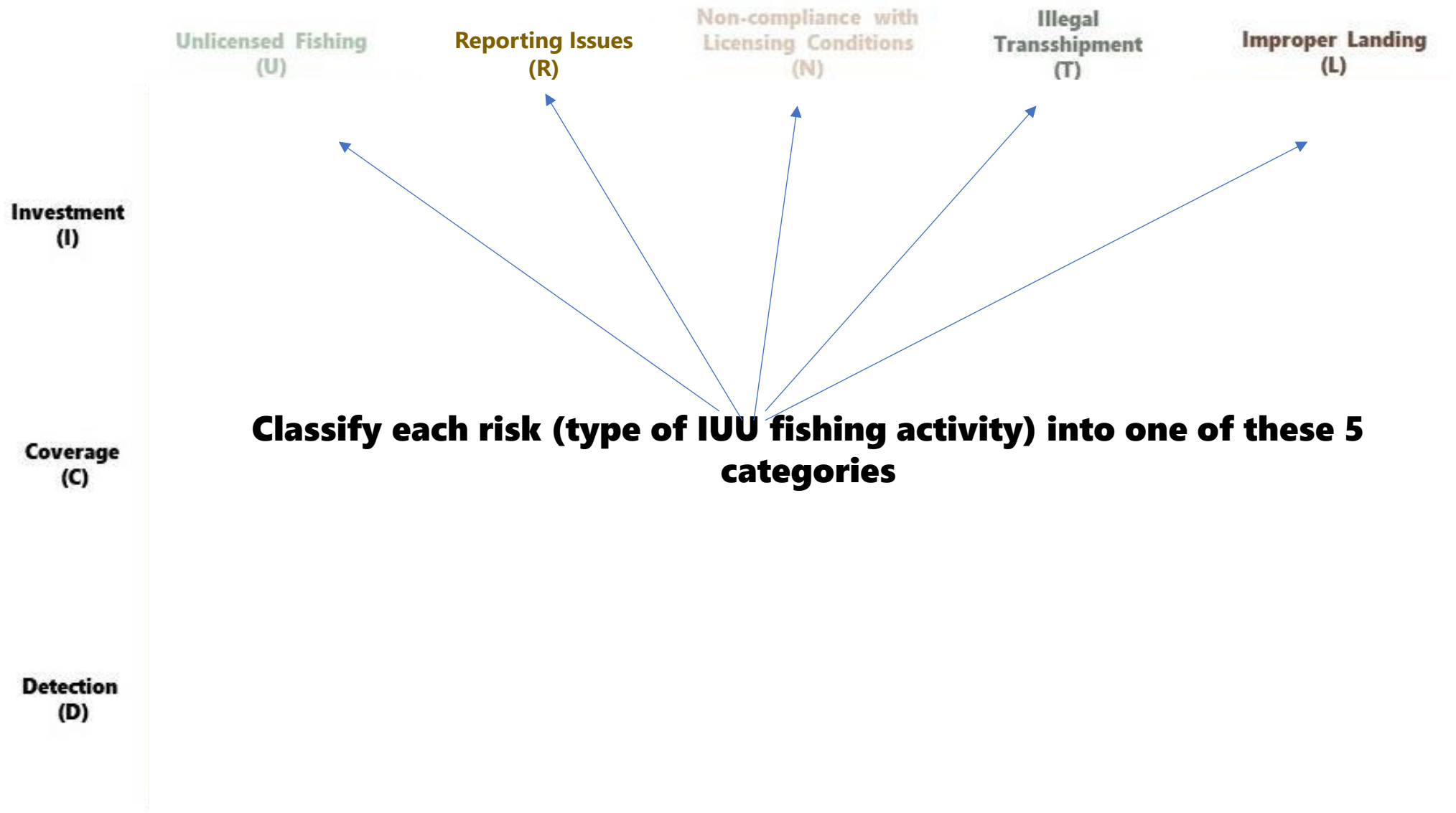
Topic 4 - Indicator Methods: What and Why?

- If estimates are too complicated (due to data quality or quantity, lack of resources or expertise), indicators can be used to understand risks and whether they are getting better or worse
- This can be more helpful in developing a strategy to combat IUU fishing

Indicators

Aim to measure several different signals of whether things are getting better or worse

Universal IUU Fishing Indicator Framework



Classify each risk (type of IUU fishing activity) into one of these 5 categories

Universal IUU Fishing Indicator Framework

Universal IUU Fishing Indicator Framework

	Unlicensed Fishing (U)	Reporting Issues (R)	Non-compliance with Licensing Conditions (N)	Illegal Transshipment (T)	Improper Landing (L)
Investment (I)					
Coverage (C)					
Detection (D)					

How much potential IUU fishing did you find?

Universal IUU Fishing Indicator Framework

	Unlicensed Fishing (U)	Reporting Issues (R)	Non-compliance with Licensing Conditions (N)	Illegal Transshipment (T)	Improper Landing (L)
Investment (I)					
Coverage (C)					
Detection (D)					

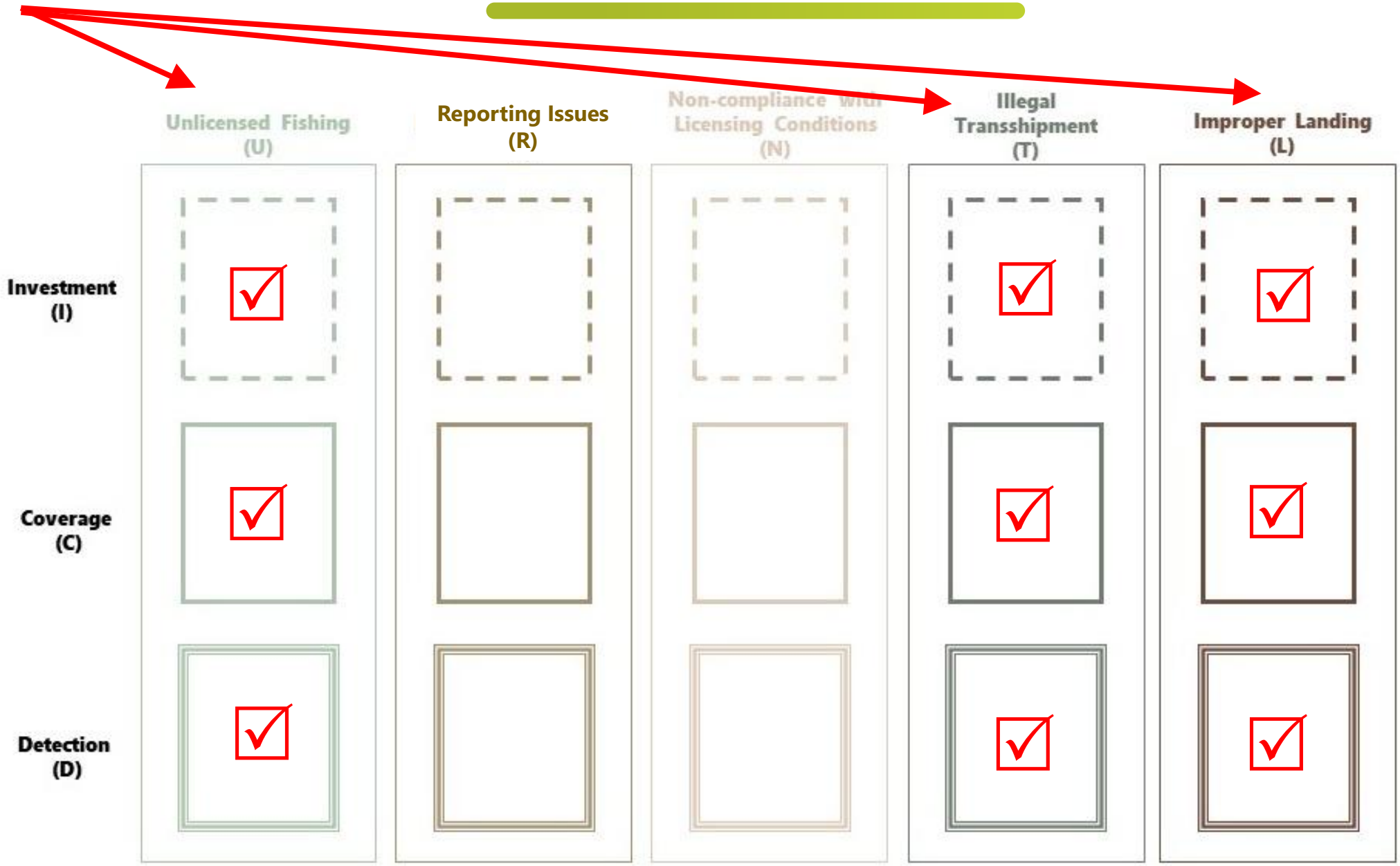
How hard did you look?

Universal IUU Fishing Indicator Framework

	Unlicensed Fishing (U)	Reporting Issues (R)	Non-compliance with Licensing Conditions (N)	Illegal Transshipment (T)	Improper Landing (L)
Investment (I)					
Coverage (C)					
Detection (D)					

How much did you invest in your system?

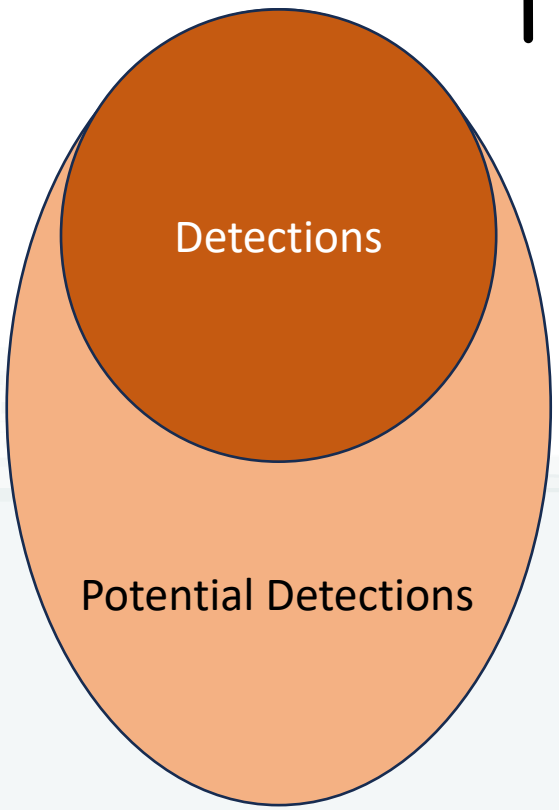
Universal IUU Fishing Indicator Framework



Indicator Structure

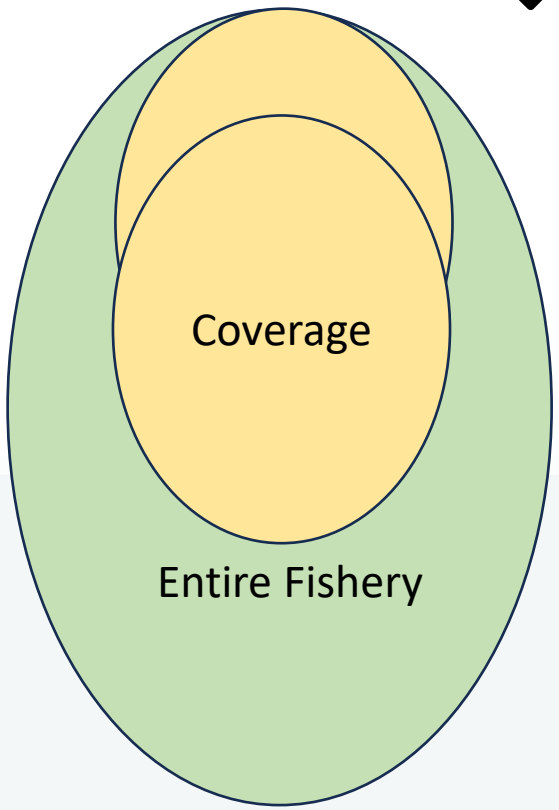
Positive direction of change:

Detections shrink



Detection Indicators (ratios)

Coverage expands

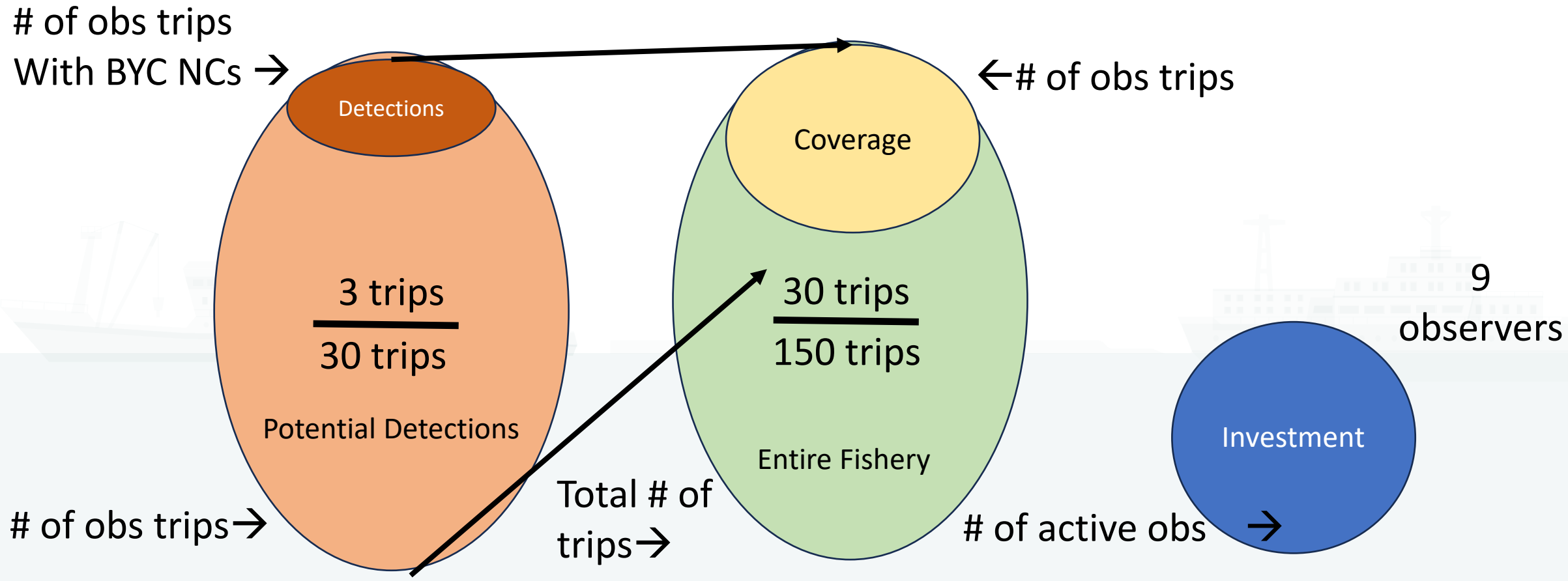


Coverage indicators (ratios)

Investments increase

Investment indicators (quantities)

Indicator Example #1 - Bycatch

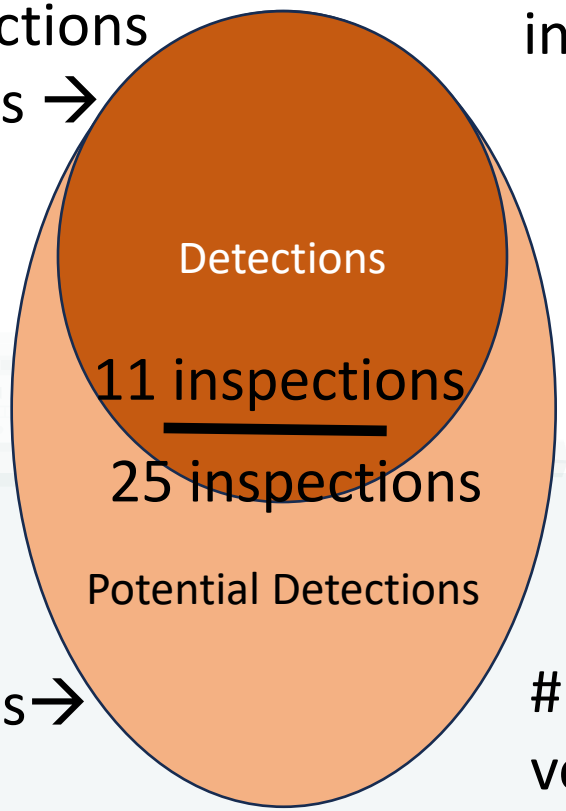


Detection Indicator = 0.1

Coverage indicator = 0.2

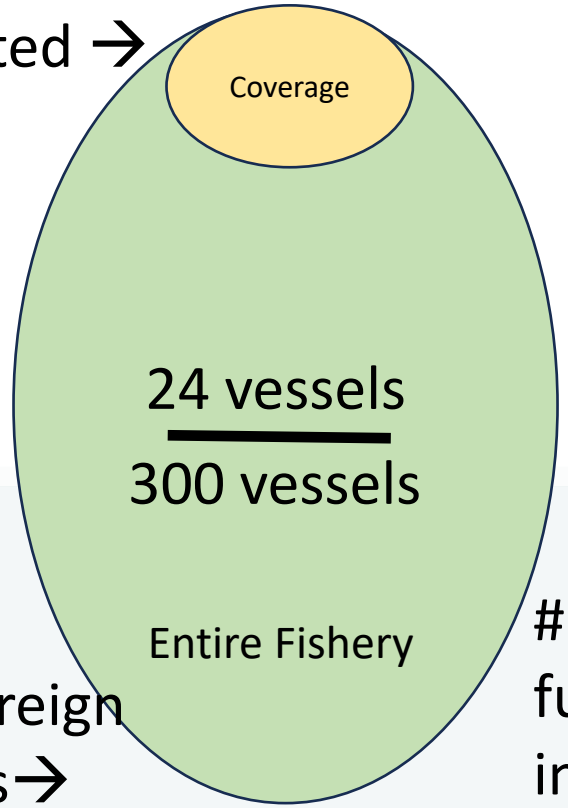
Investment indicator = 9 observers

Indicator Example #2 – PSMA Inspections



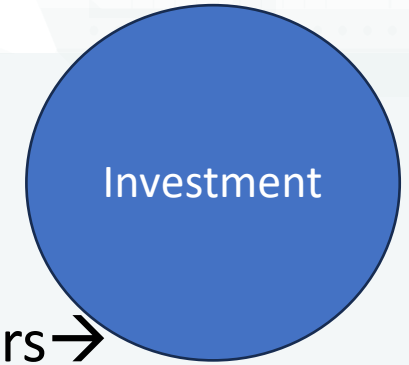
Detection Indicator =

0.44



Coverage indicator =

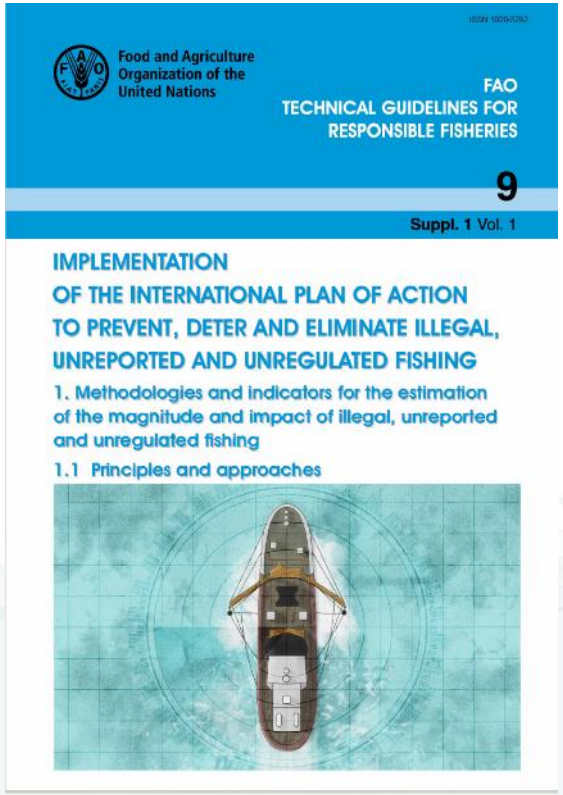
0.08



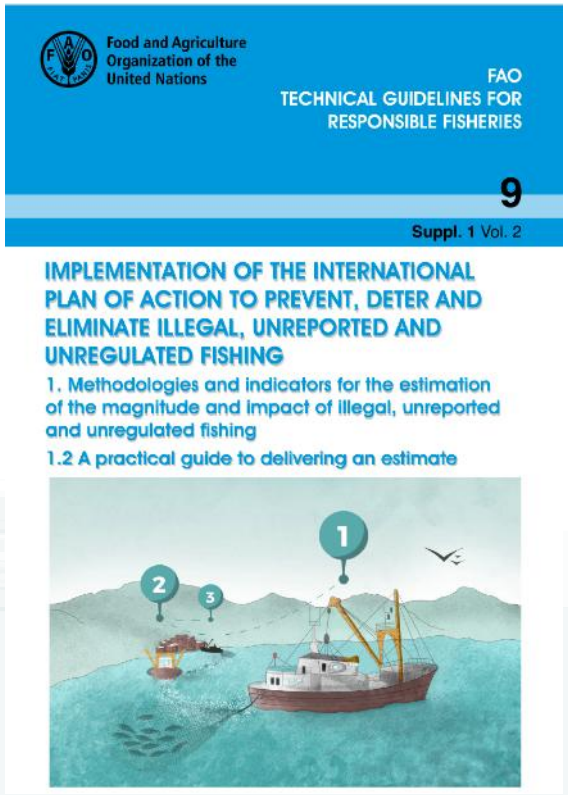
Investment indicator =

4 inspectors

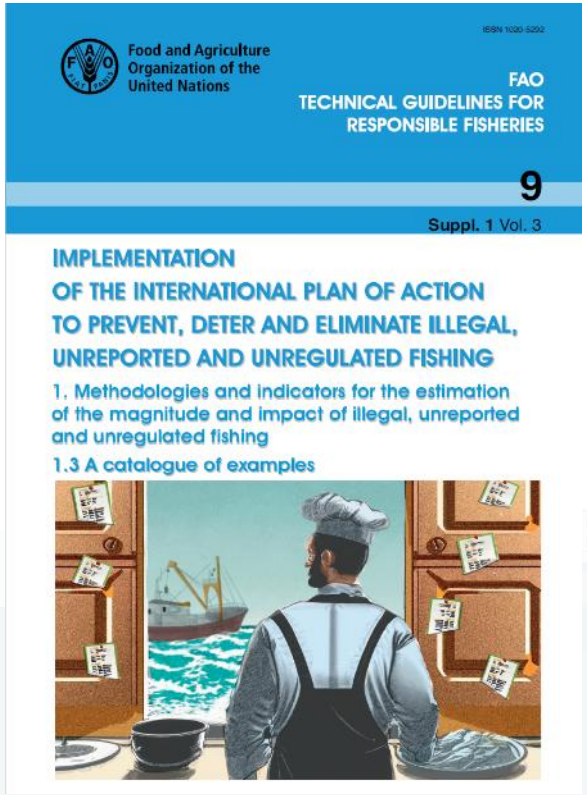
Volume 4 – Indicators of Performance



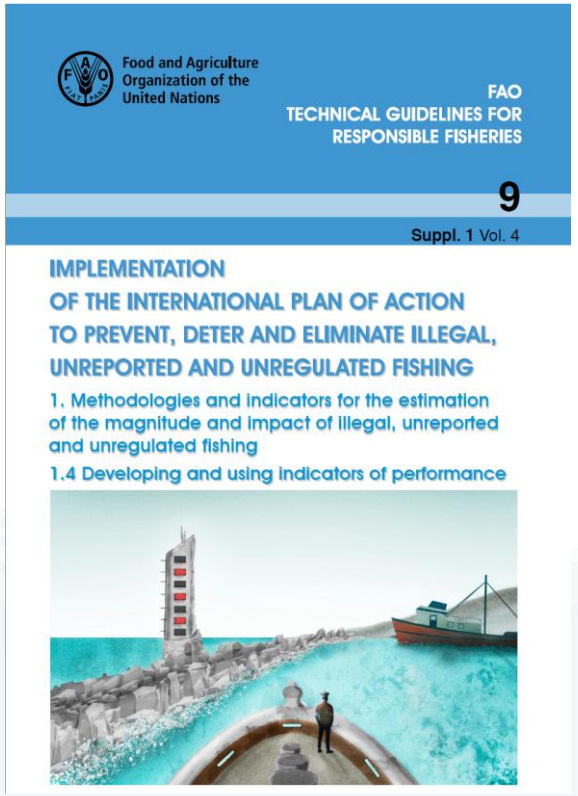
Volume 1
Principles and Approaches



Volume 2
Practical Guide



Volume 3
Catalogue of Examples



Volume 4
Indicators of Performance

https://www.fao.org/iuu-fishing/tools-and-initiatives/quantifying-iuu-fishing/en/