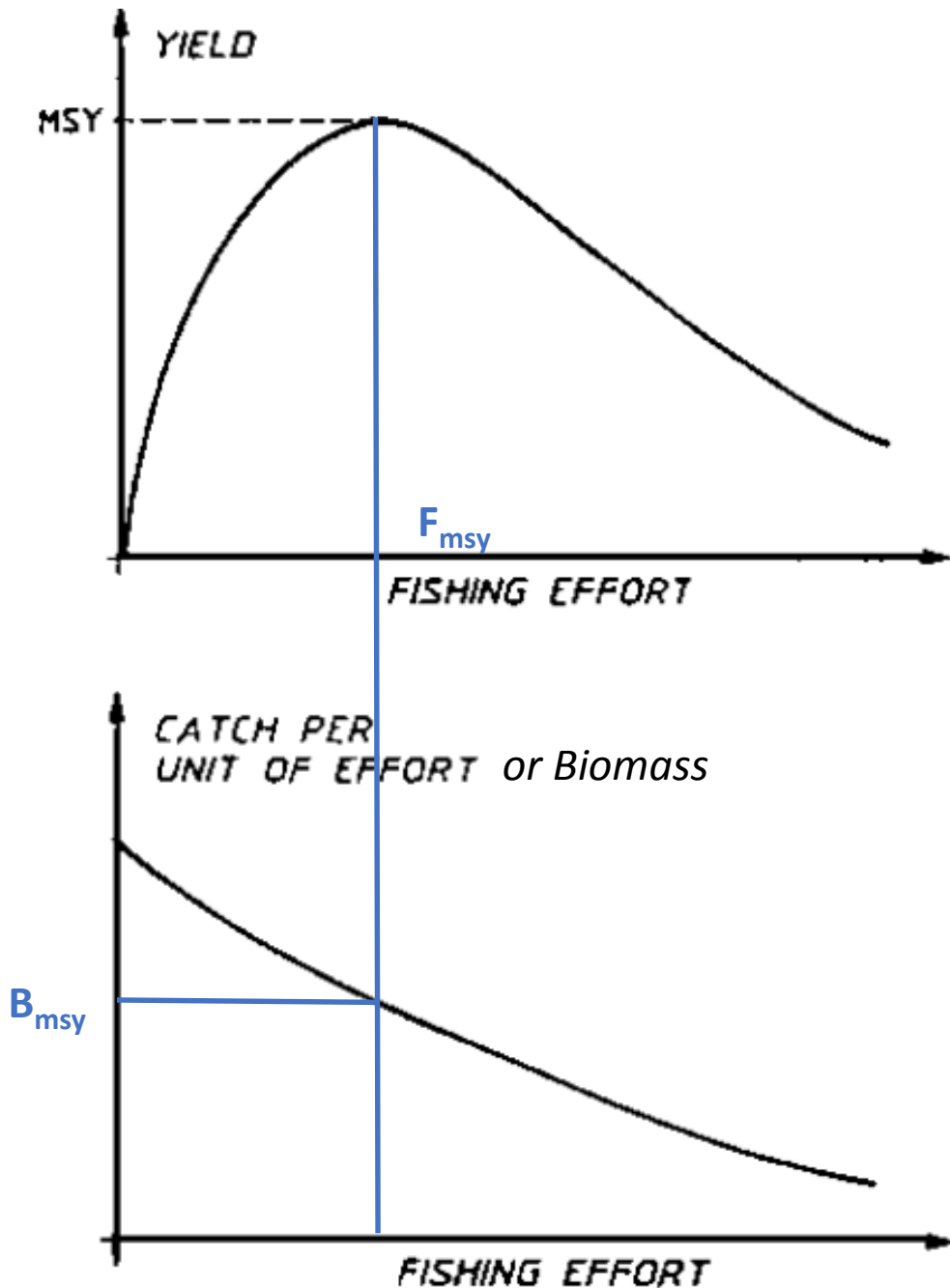


Fishing strategies and management terms in international organizations

Victor Restrepo

Kaohsiung, 16 December 2016



MSY, F_{msy} , B_{msy} are fundamental terms in RFMO management. They need to be viewed as working **on average**, not in any particular year.

MSY: The largest average catch or yield that can continuously be taken from a stock under existing environmental conditions. For species with fluctuating recruitment, the maximum might be obtained by taking fewer fish in some years than in others.

F_{MSY} : The level of fishing intensity that, if applied constantly year after year, would result in MSY.

B_{MSY} : The stock size (biomass) that would result on average if F_{MSY} was applied constantly year after year. B_{MSY} is sometimes measured by the total biomass of the stock and sometimes by the biomass of the spawners ("spawning biomass")

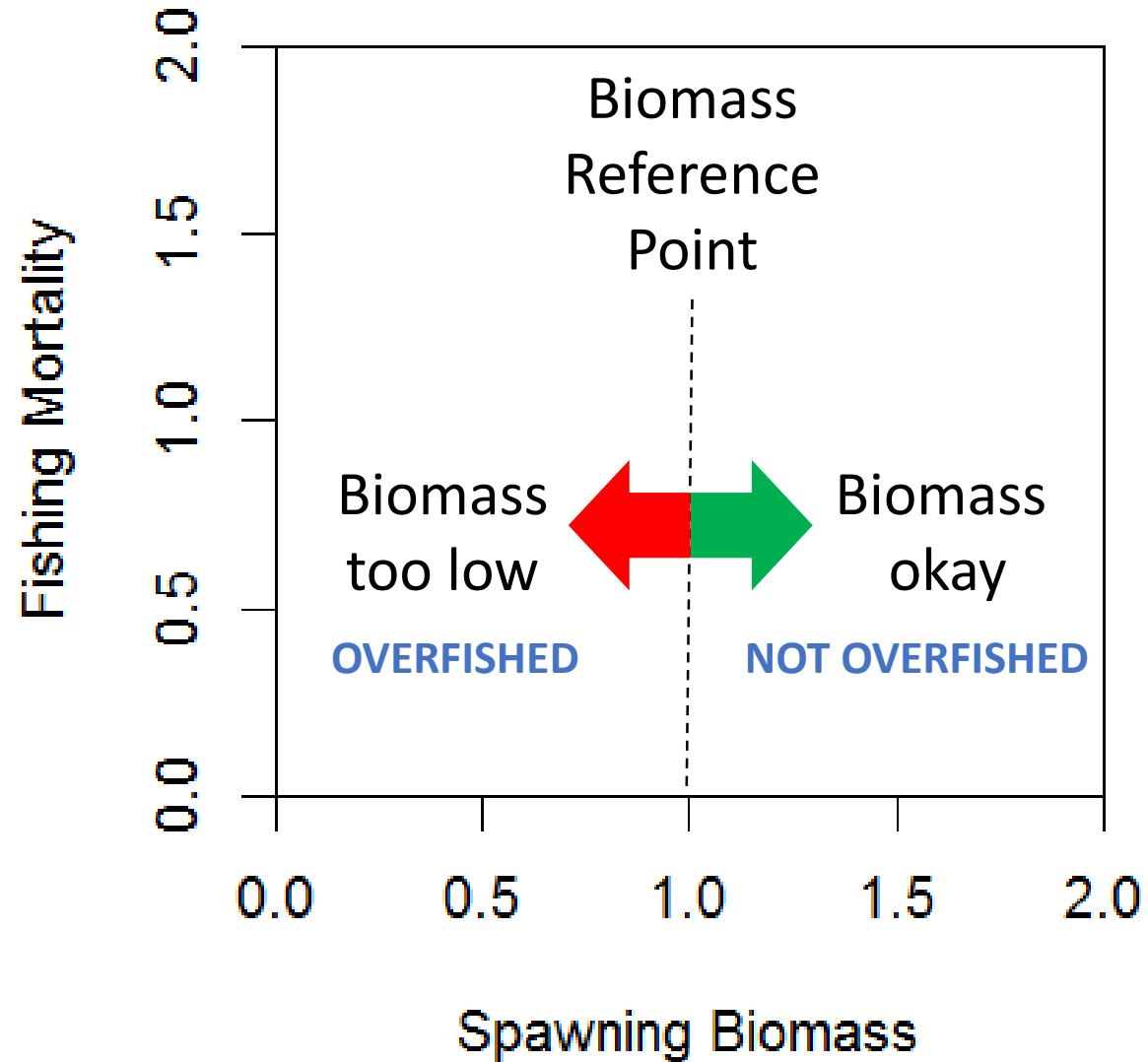


The Kobe Process Introduces Phase Plots and Decision Matrices to Tuna RFMOs

- 2007: The "**Kobe Plot**". A practical and user friendly way to determine "overfishing" and "overfished" stock status.
- 2009: The "**Kobe Strategy Matrix**". A tool to help decision making.

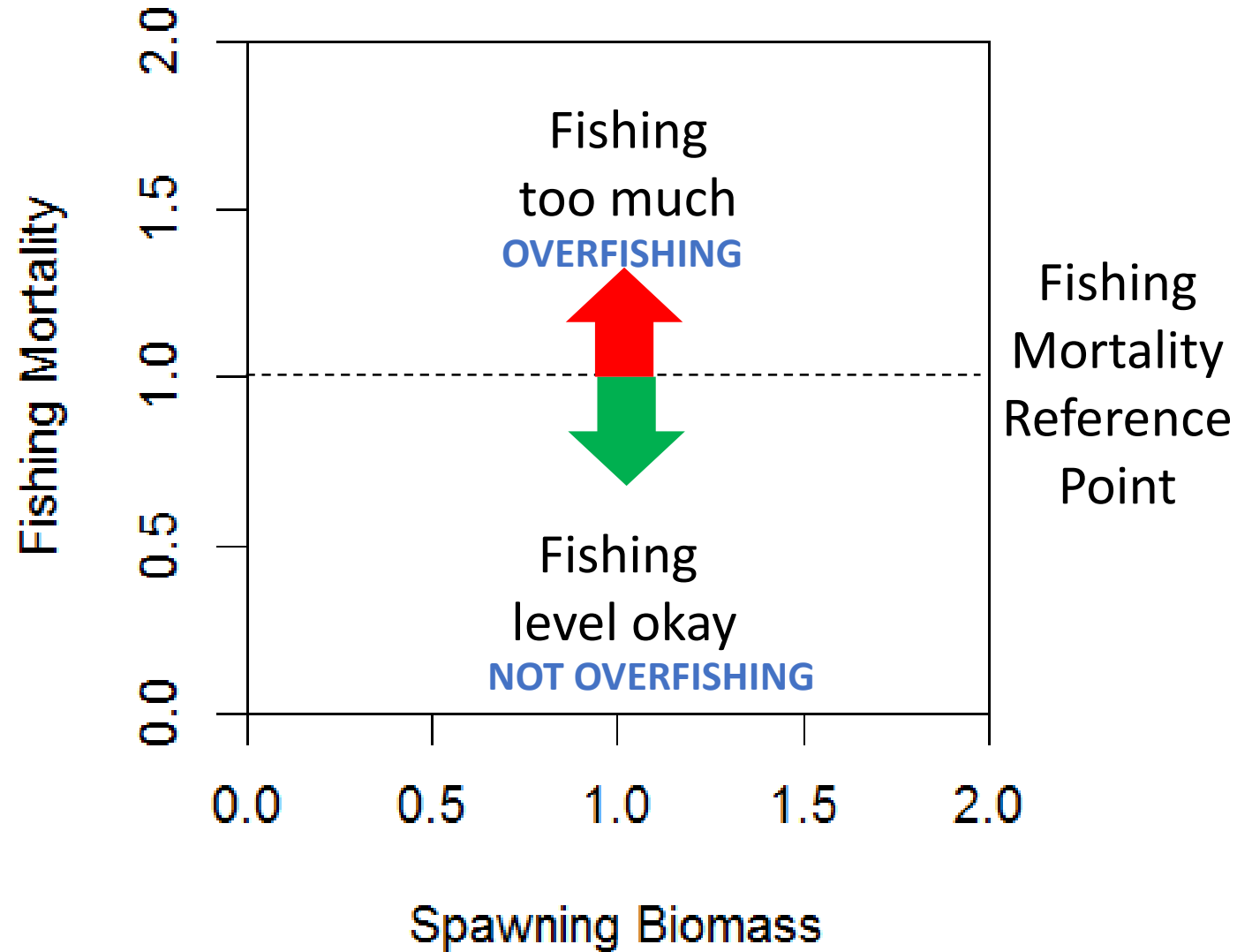
The Kobe Plot

(a fishery summary)



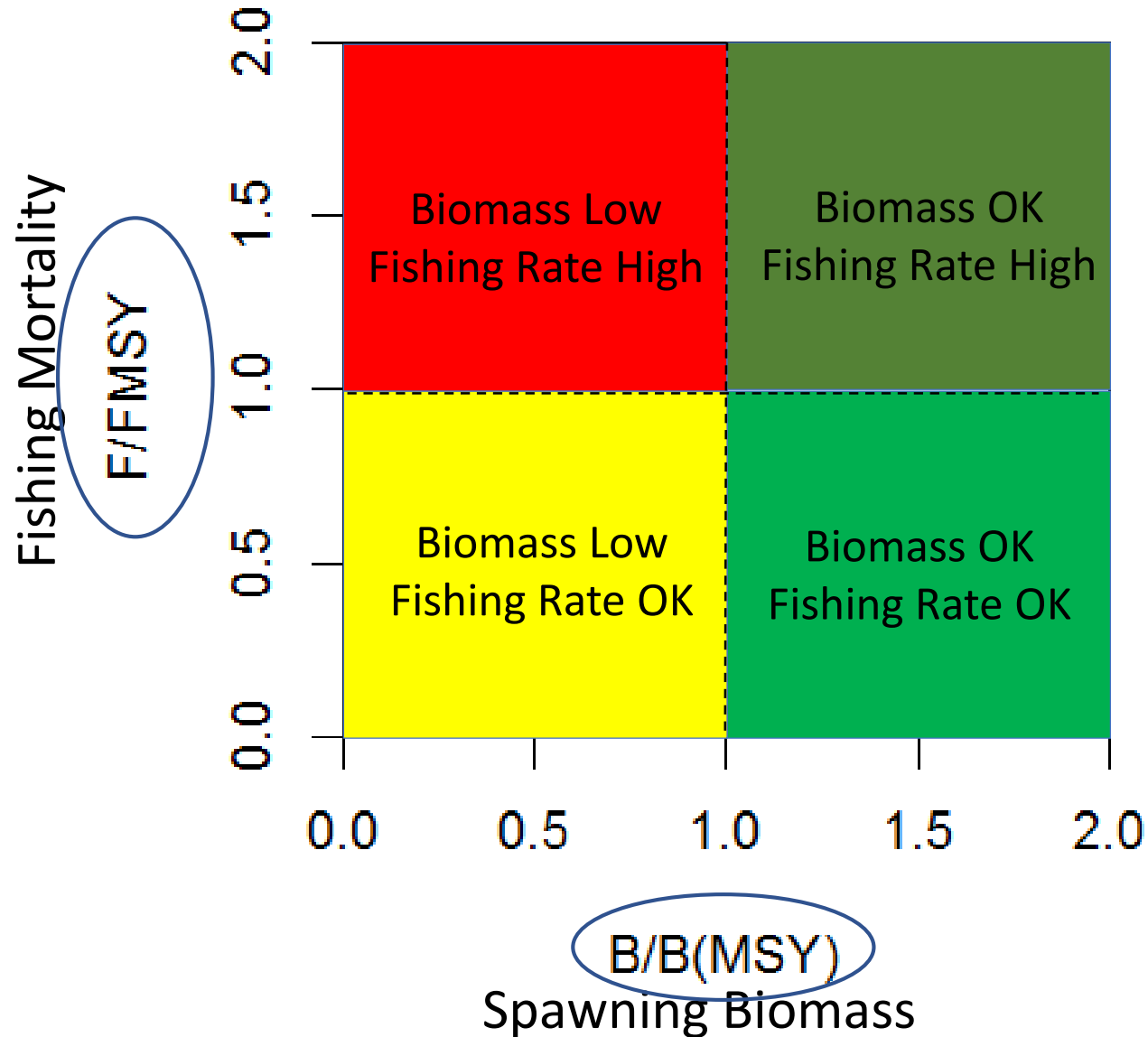
The Kobe Plot

(a fishery summary)



The Kobe Plot

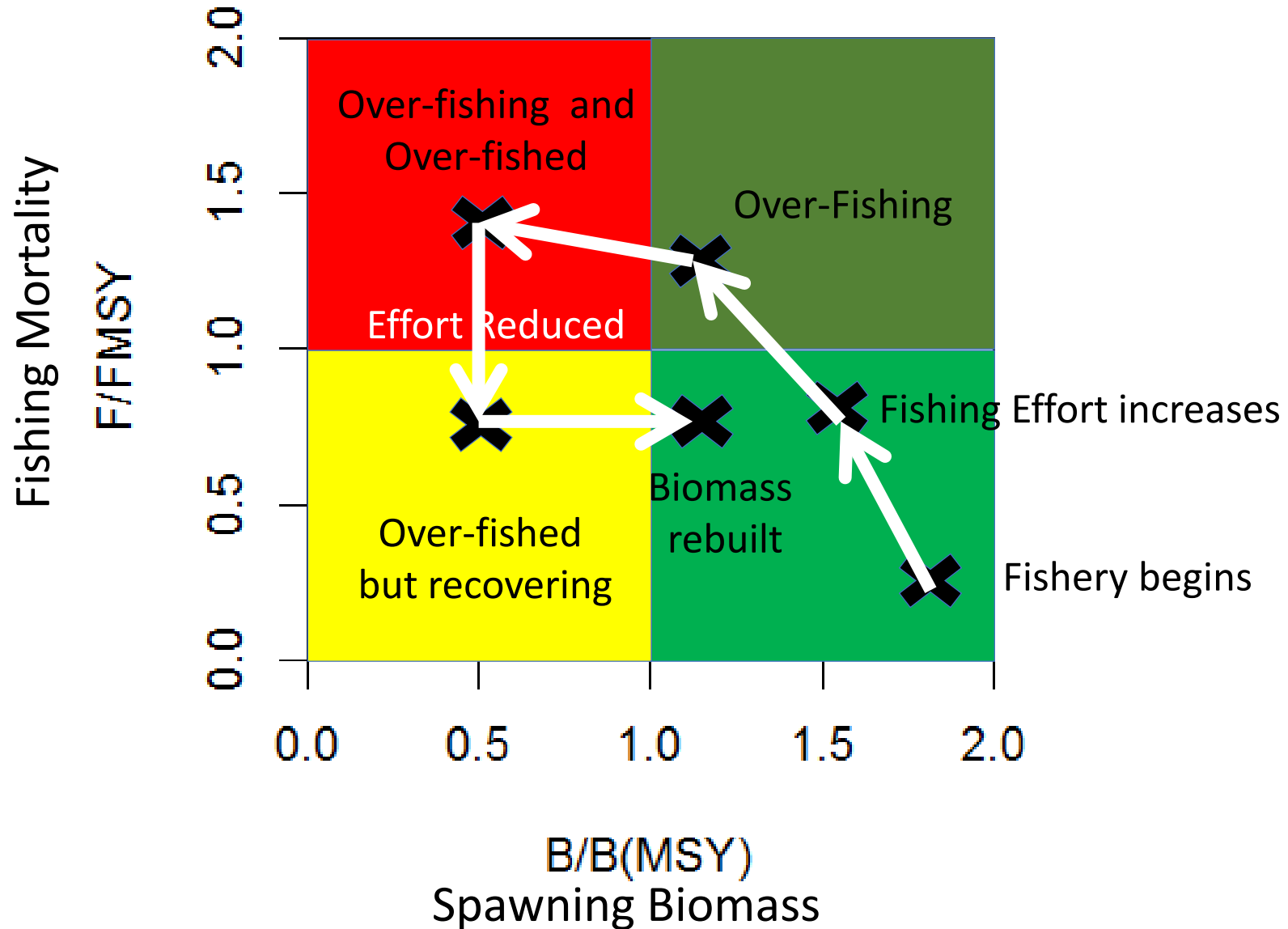
Where is your fishery now?



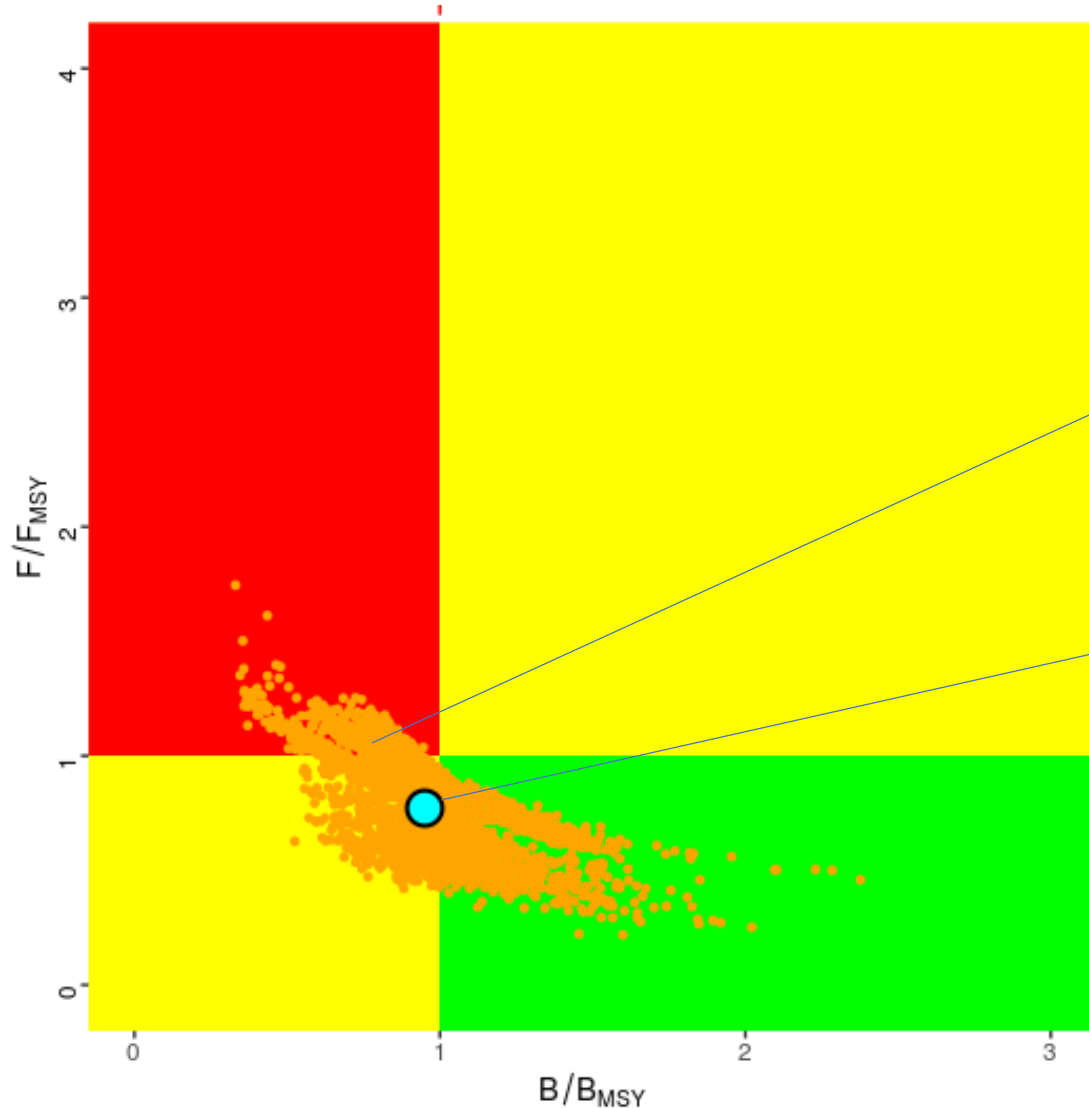
The Kobe Plot

A common fishery story

You are here



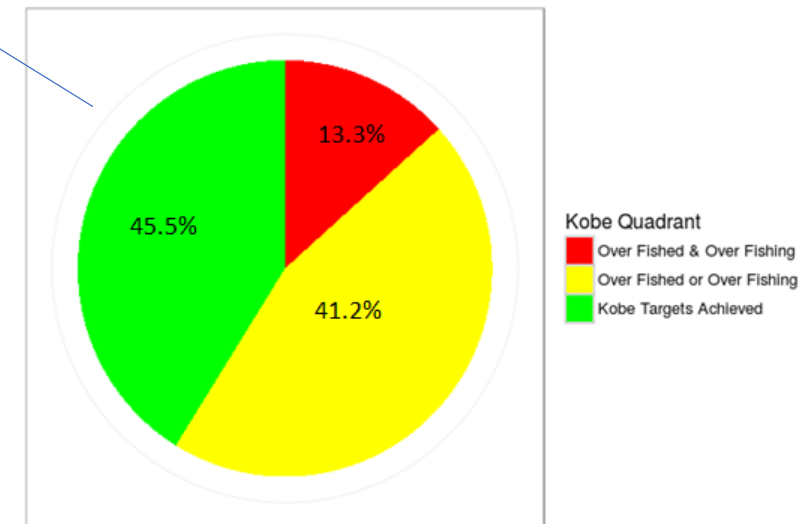
Kobe plots in different flavors: ICCAT Yellowfin



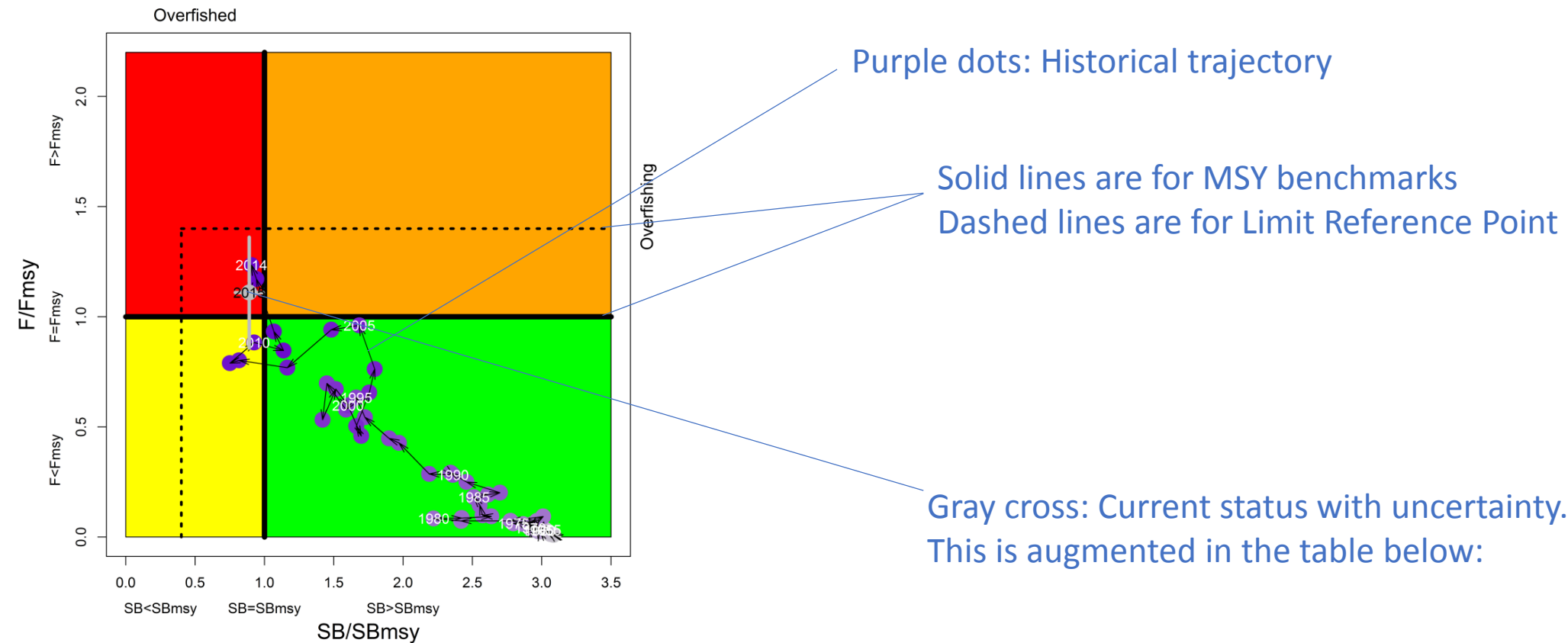
Cloud of points for
current status
reflects uncertainty

Most likely

Pie chart summarizes current status

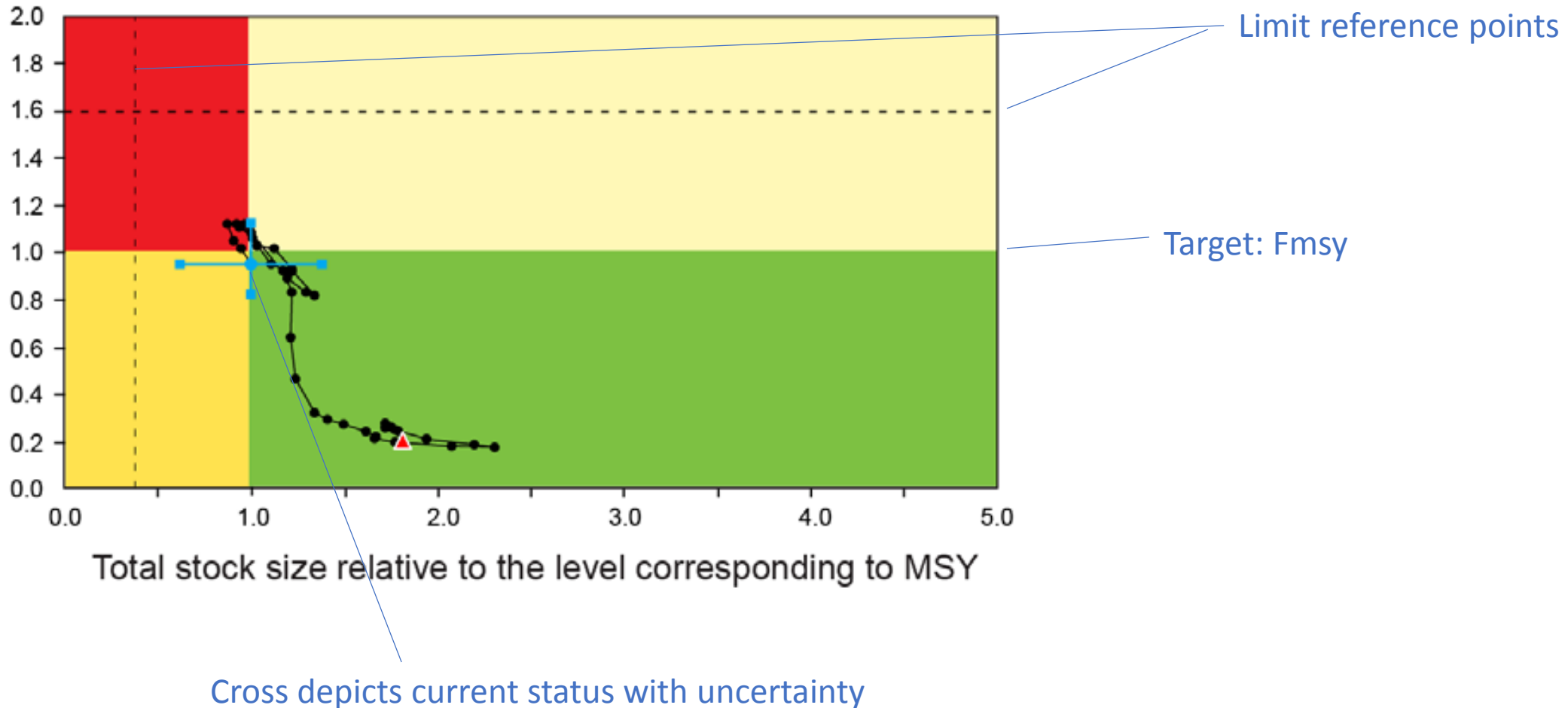


Kobe plots in different flavors: IOTC Yellowfin

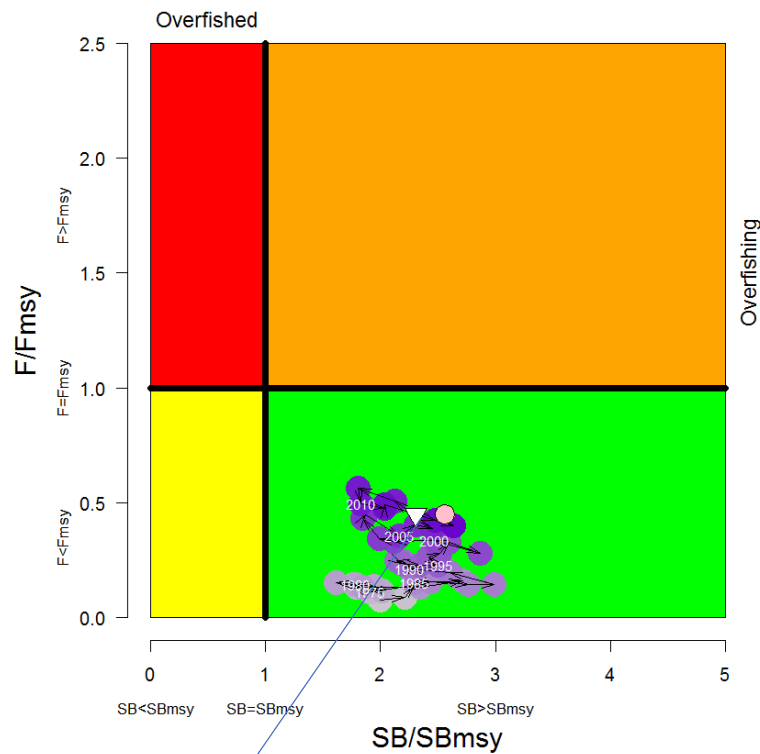


Colour key	Stock overfished ($SB_{year}/SB_{MSY} < 1$)	Stock not overfished ($SB_{year}/SB_{MSY} \geq 1$)
Stock subject to overfishing($F_{year}/F_{MSY} > 1$)	67.6%	3.7%
Stock not subject to overfishing ($F_{year}/F_{MSY} \leq 1$)	27.3%	1.4%
Not assessed/Uncertain		

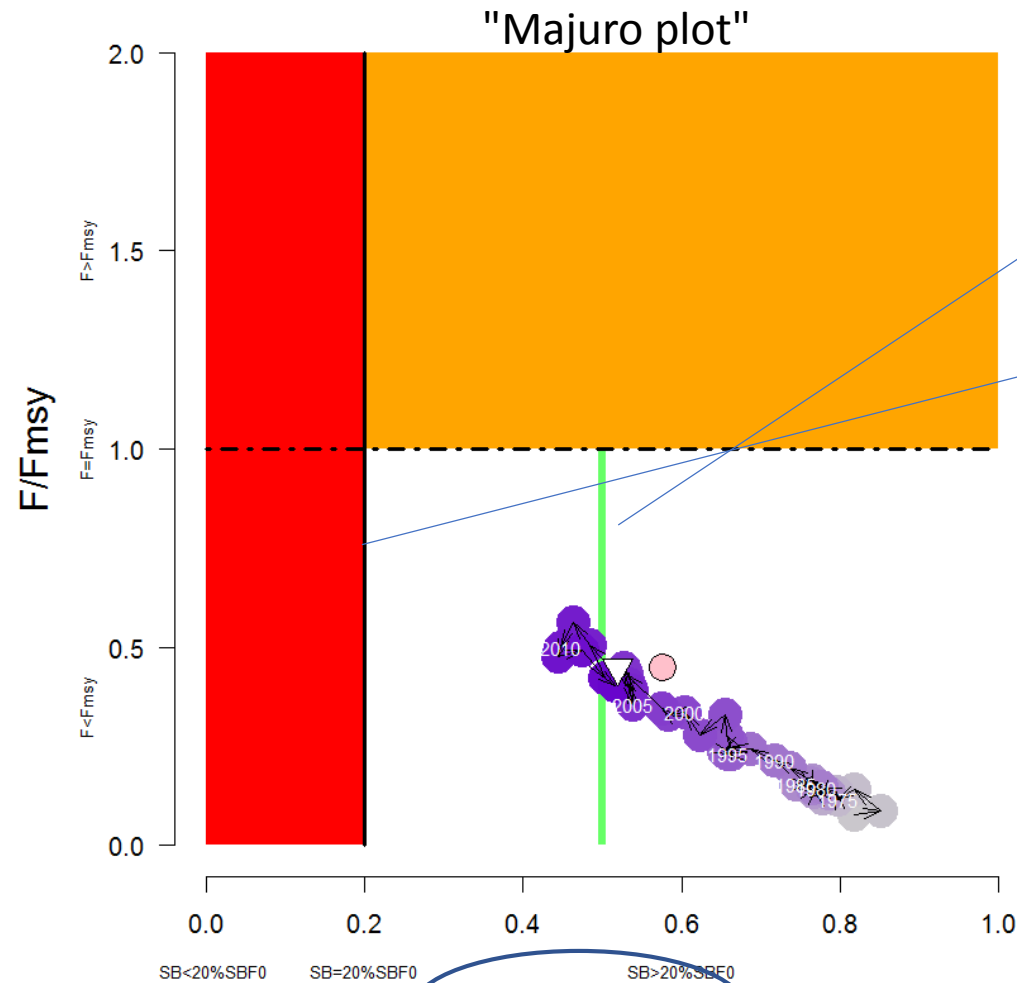
Kobe plots in different flavors: IATTC bigeye



Kobe plots in different flavors: WCPFC Skipjack



Trajectory and current status



SB/SBF_0

Different metric: Relative to unfished biomass

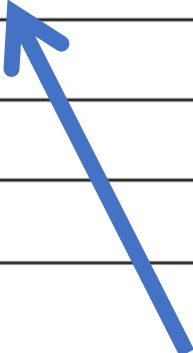
Kobe plots in different flavors

- There is variability between RFMOs on how information is presented. This is also the case within RFMOs
- But, the intention is very similar: Use the plots to determine stock status (overfishing; overfished)
- As each RFMO adopts new reference points, they are included in the plots. The axis can also change (e.g. "Majuro plot" at WCPFC)

The Kobe 2 Strategy Matrix (2009 San Sebastian)

Strategy Matrix for Setting Management Measures

Management Target	Time Frame	Probability of Meeting Target		
		A%	B%	C%
<Fishing Mortality Target>	In x years			
	In y years			
	In z years			



Probabilities reflect uncertainties

K2SM Looks into the future: What could happen if we do A, B or C, in years x, y and z?

K2SM in different flavors: IOTC ALB

Reference point and projection timeframe		Alternative catch projections (relative to the catch level for 2014) and probability (%) of violating MSY-based target reference points ($SB_{\text{targ}} = SB_{\text{MSY}}$; $F_{\text{targ}} = F_{\text{MSY}}$)								———— % of current catch
		60%	70%	80%	90%	100%	110%	120%	130%	
		(23,821)	(27,791)	(31,761)	(35,731)	(39,701)	(43,671)	(47,641)	(51,611)	
Targets	$SB_{2017} < SB_{\text{MSY}}$	1	2	4	7	14	19	24	33	44
	$F_{2017} > F_{\text{MSY}}$	0	1	5	18	33	47	59	71	77
	$SB_{2024} < SB_{\text{MSY}}$	4	8	9	31	42	50	62	NA	92
	$F_{2024} > F_{\text{MSY}}$	0	0	3	NA	39	56	66	70	100
Reference point and projection timeframe		Alternative catch projections (relative to the catch level for 2014) and probability (%) of violating MSY-based limit reference points ($SB_{\text{lim}} = 0.4 SB_{\text{MSY}}$; $F_{\text{lim}} = 1.4 F_{\text{MSY}}$)								———— % of current catch
		60%	70%	80%	90%	100%	110%	120%	130%	
		(23,821)	(27,791)	(31,761)	(35,731)	(39,701)	(43,671)	(47,641)	(51,611)	
Limits	$SB_{2017} < SB_{\text{Lim}}$	0	0	0	0	0	0	1	1	4
	$F_{2017} > F_{\text{Lim}}$	0	0	0	0	2	10	20	34	46
	$SB_{2024} < SB_{\text{Lim}}$	0	0	1	13	20	24	30	NA	65
	$F_{2024} > F_{\text{Lim}}$	0	0	0	NA	10	27	48	60	100

2017 and 2024: Two different end points

K2SM in different flavors: ICCAT ALB

13 years

Probability of Not overfished AND Not Overfishing

12 TACs

Catch (t)	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	
12,000	74%	80%	94%	95%	95%	96%	96%	96%	96%	96%	96%	96%	96%	
14,000	74%	78%	93%	94%	95%	95%	95%	96%	96%	96%	96%	96%	96%	
16,000	73%	77%	90%	93%	94%	94%	95%	95%	95%	95%	95%	95%	95%	
18,000	68%	72%	83%	89%	91%	92%	92%	93%	93%	93%	93%	94%	94%	
20,000	63%	65%	71%	81%	83%	84%	84%	85%	86%	86%	86%	87%	87%	
22,000	62%	63%	65%	73%	78%	79%	79%	79%	80%	80%	80%	80%	80%	
24,000	61%	60%	60%	63%	69%	72%	72%	72%	71%	71%	70%	70%	69%	
26,000	55%	54%	53%	52%	52%	55%	56%	57%	56%	55%	54%	53%	52%	
28,000	48%	45%	42%	40%	37%	35%	35%	35%	35%	35%	35%	35%	35%	
30,000	39%	35%	33%	30%	28%	26%	24%	23%	21%	20%	19%	18%	18%	
32,000	32%	29%	26%	24%	22%	19%	17%	16%	14%	13%	12%	11%	11%	
34,000	28%	25%	22%	19%	15%	13%	11%	9%	8%	7%	7%	6%	6%	
														Average catch
F	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2017-2019
0.75*FMSY	75%	76%	89%	90%	90%	91%	91%	92%	92%	92%	92%	92%	92%	18,801
0.80*FMSY	74%	75%	86%	88%	89%	89%	89%	89%	89%	89%	90%	90%	90%	19,627
0.85*FMSY	72%	73%	81%	85%	86%	86%	86%	86%	86%	86%	86%	86%	86%	20,445
0.90*FMSY	69%	69%	74%	81%	81%	82%	82%	82%	82%	82%	82%	82%	82%	21,253
0.95*FMSY	64%	64%	65%	73%	75%	75%	77%	77%	77%	77%	77%	77%	77%	22,052
1.00*FMSY	59%	59%	57%	61%	66%	67%	67%	67%	63%	59%	57%	56%	57%	22,842

6 effort scenarios

Average catch

K2SM in different flavors

- There is variability between RFMOs on how information is presented. This is also the case within RFMOs
- But, the intention is very similar: Use the tables to inform decision-makers in "what-if" scenarios



Generic Management Decision Table

Performance Measure	Management Options		
	A ✖	B	C ✖
Biomass	X% ✖	X%	X%
Catch	X%	X%	X% ✖
CPUE	X% ✖	X%	X%

i.e.: Performance measures not limited to B/B_{MSY} and F/F_{MSY}
Management Options not limited to constant catch

Overview so far

- Kobe Plots are a visually friendly way to show current stock status and the uncertainty around it
- Kobe Strategy Matrices are a type of Decision Table used to inform managers about the future consequences of alternative management choices

What Strategies do RFMOs use?

strategy 
noun | strat·e·gy | \-jē\

Simple Definition of STRATEGY

Popularity: Top 1% of lookups

- : a careful plan or method for achieving a particular goal usually over a long period of time
- : the skill of making or carrying out plans to achieve a goal

Source: Merriam-Webster's Learner's Dictionary

For the most part, RFMOs do not follow a strategy (except CCSBT). But they do use management plans

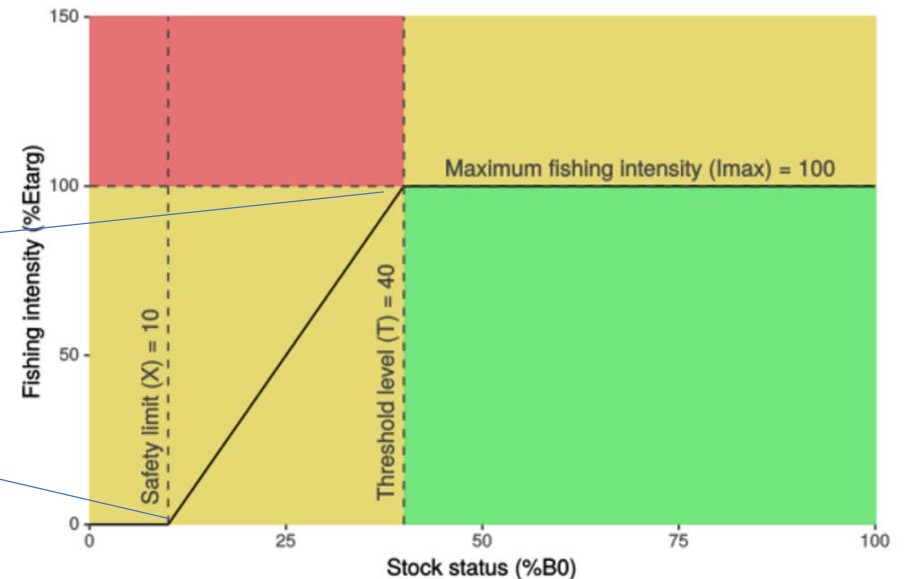
What Plans do RFMOs use?

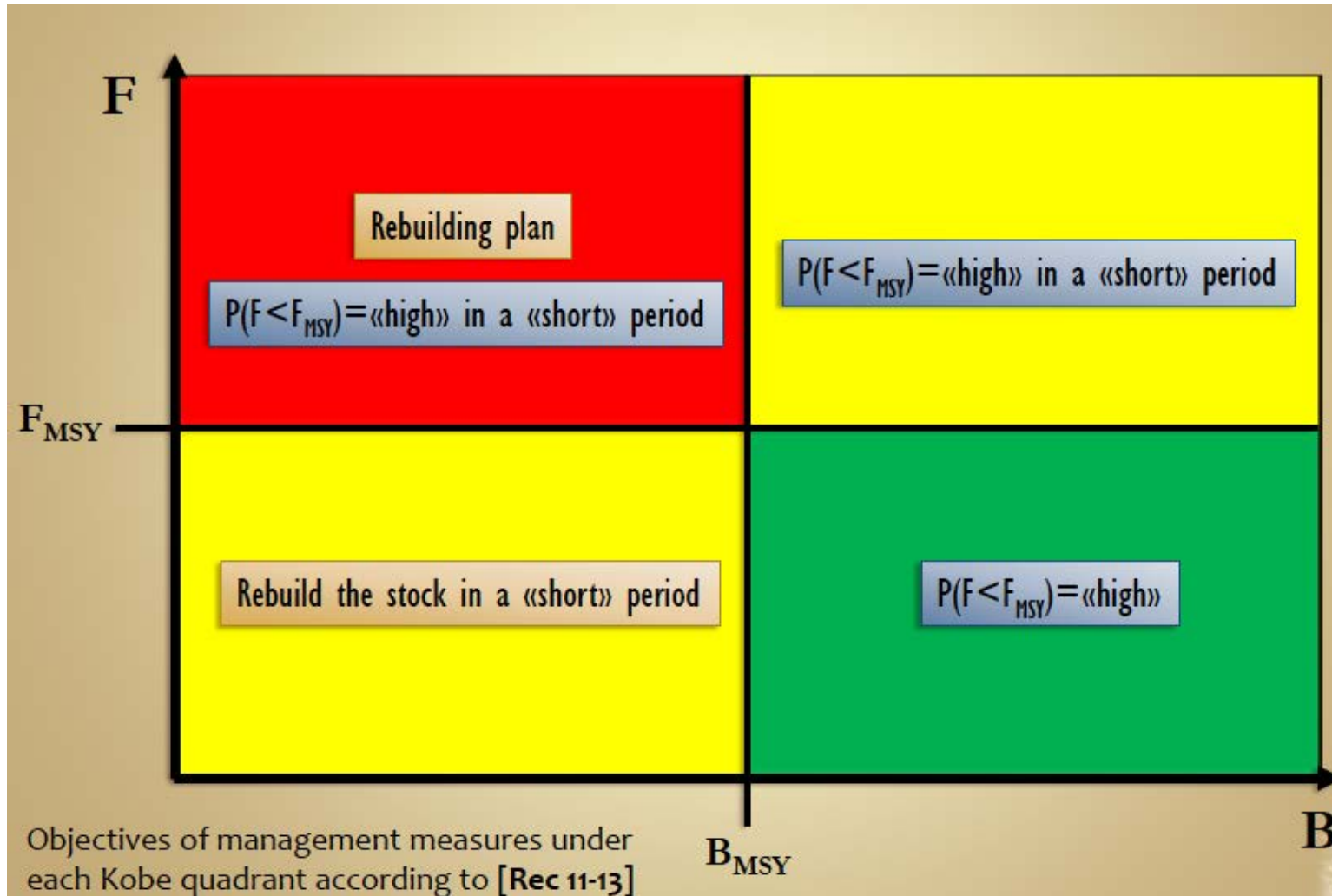
- Usually do nothing until a stock is very overfished
- For overfished stocks: Plan is to rebuild (to B_{MSY}) with a given % chance, within a given time period. ICCAT: Bigeye, Swordfish-N, Albacore-N, Bluefin-E/W all had rebuilding plans.
- These rebuilding plans have some of the same elements of a Harvest Strategy:
 - A time frame
 - A target for rebuilding
 - Management actions (e.g. TACs, capacity reduction)
- CCSBT also has a rebuilding plan, which follows a formal harvest strategy

Harvest Control Rules (HCRs)

HCR: An agreed rule (algorithm) that describes how harvest is intended to be controlled by management in relation to the state of some indicator of stock status. For example, a harvest control rule can describe the various values of fishing mortality which will be aimed to be achieved at corresponding values of the stock abundance. Constant catch and constant fishing mortality are two types of simple harvest control rules.

In other words: How much to harvest depending on the status of the stock with respect to the **target** and the **limit** reference points.

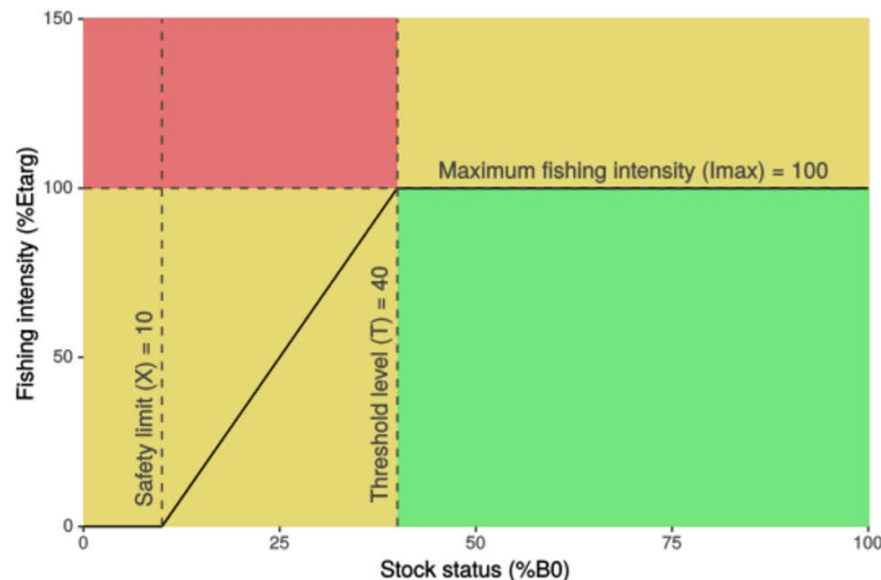




ICCAT and IOTC's "decision-making framework" is almost like a HCR. It lacks details, but the idea is the same

Harvest Control Rules (HCRs)

- IATTC adopted an HCR for tropical tunas (C-16-02). It dictates how the scientific recommendations for management (PS fishery closure) are made depending on stock status
- IOTC adopted an HCR for skipjack (Res 16/02). It specifies how catch limits are calculated, the frequency of assessments, etc.



Both HCRs have been adopted without Management Strategy Evaluation (i.e., they have not been tested)

Harvest Control Rules (HCRs)

HCRs are one element of a Harvest Strategy

More on the next presentation