Risk assessment
LOT+KAW

Pacific + Indian Ocean sides
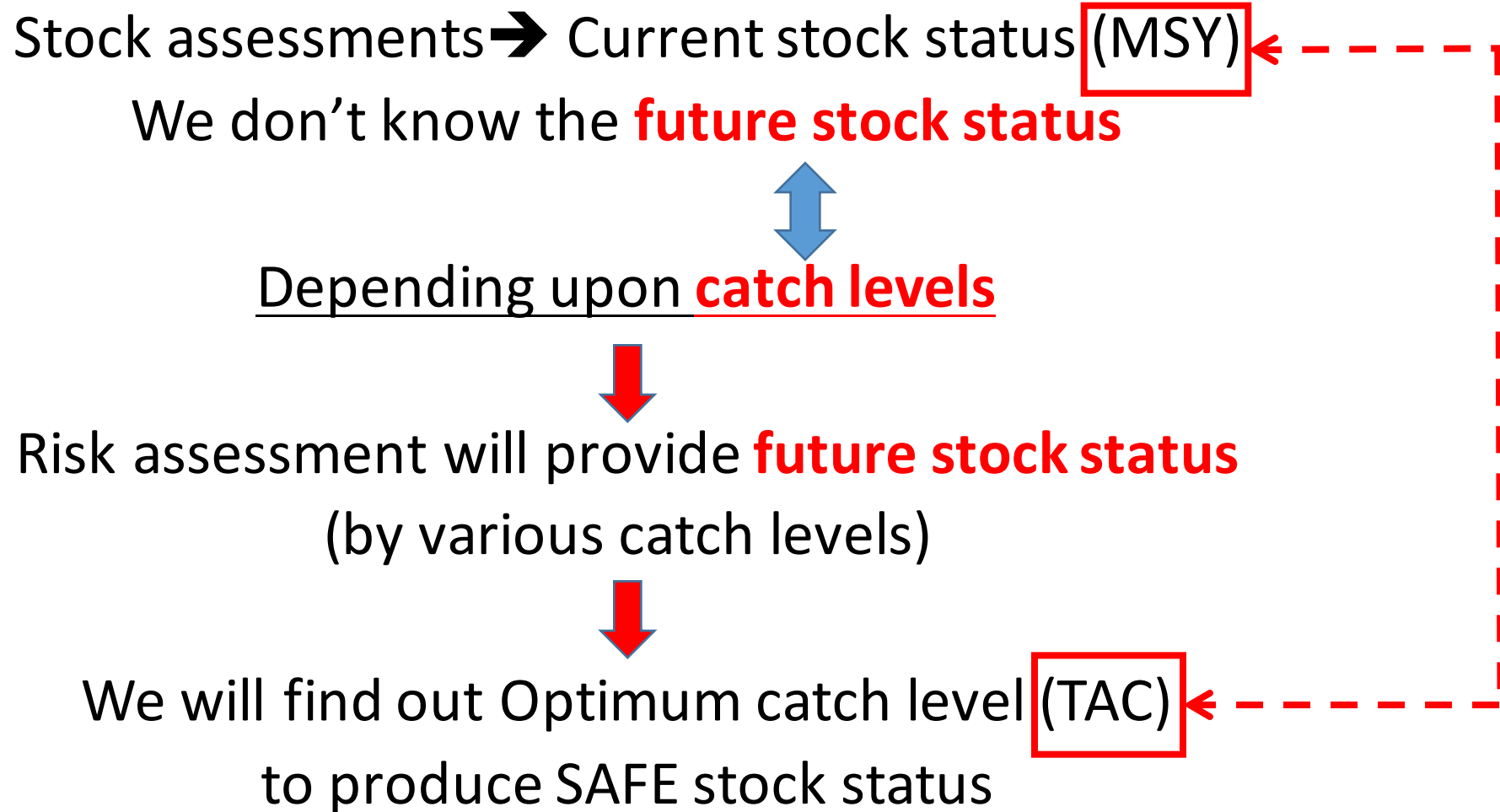## (SEAFDEC waters)

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Why we need Risk assessment?

Stock assessments not enough ?

Why we need Risk assessment?   Stock assessments   not enough ?

Stock assessments➜ Current stock status (MSY)

We don't know the **future stock status**

Depending upon **catch levels**

Risk assessment will provide **future stock status**
(by various catch levels)

We will find out Optimum catch level (TAC)

to produce SAFE stock status

What is the future stock status?

For example   stock assessments➜current stock status (red zone)
what happens the stock status
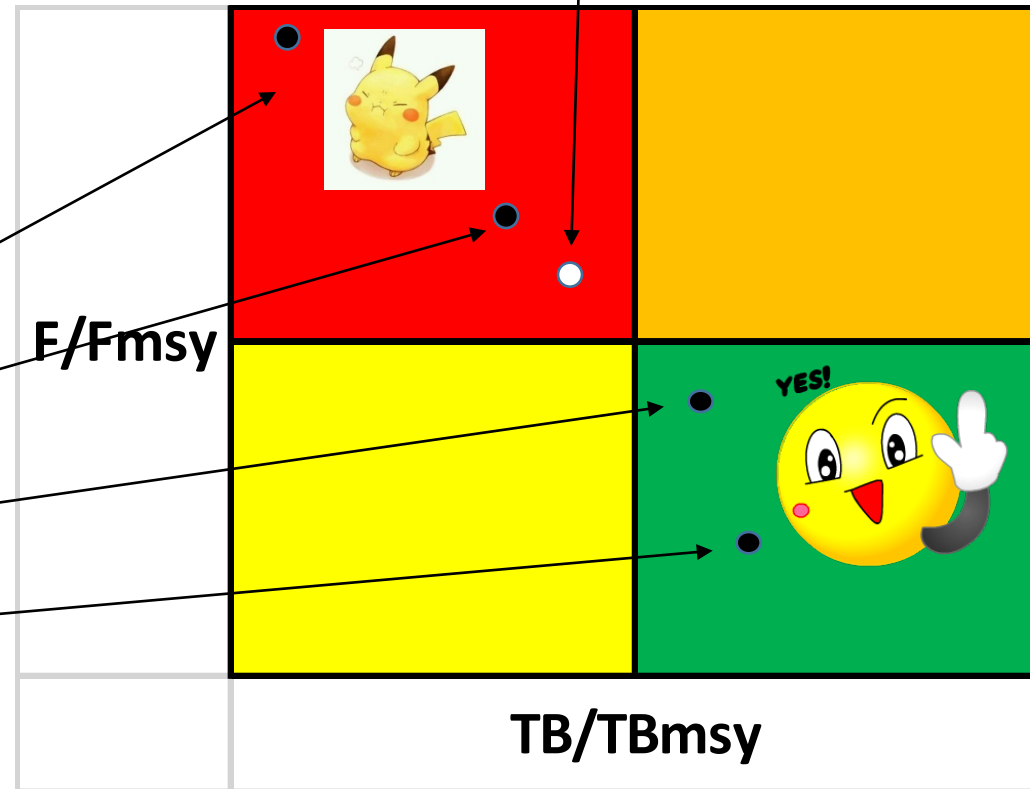***10 years later ?***

If following catch continued
Higher catch (20,000 t)
Current catch (10,000 t)
MSY (80,000 t)
Lower catch (5,000)

How to conduct the Risk assessment?

Use stock assessments results

Set up the catch scenarios

Tuna RFMOs (10 scenarios)

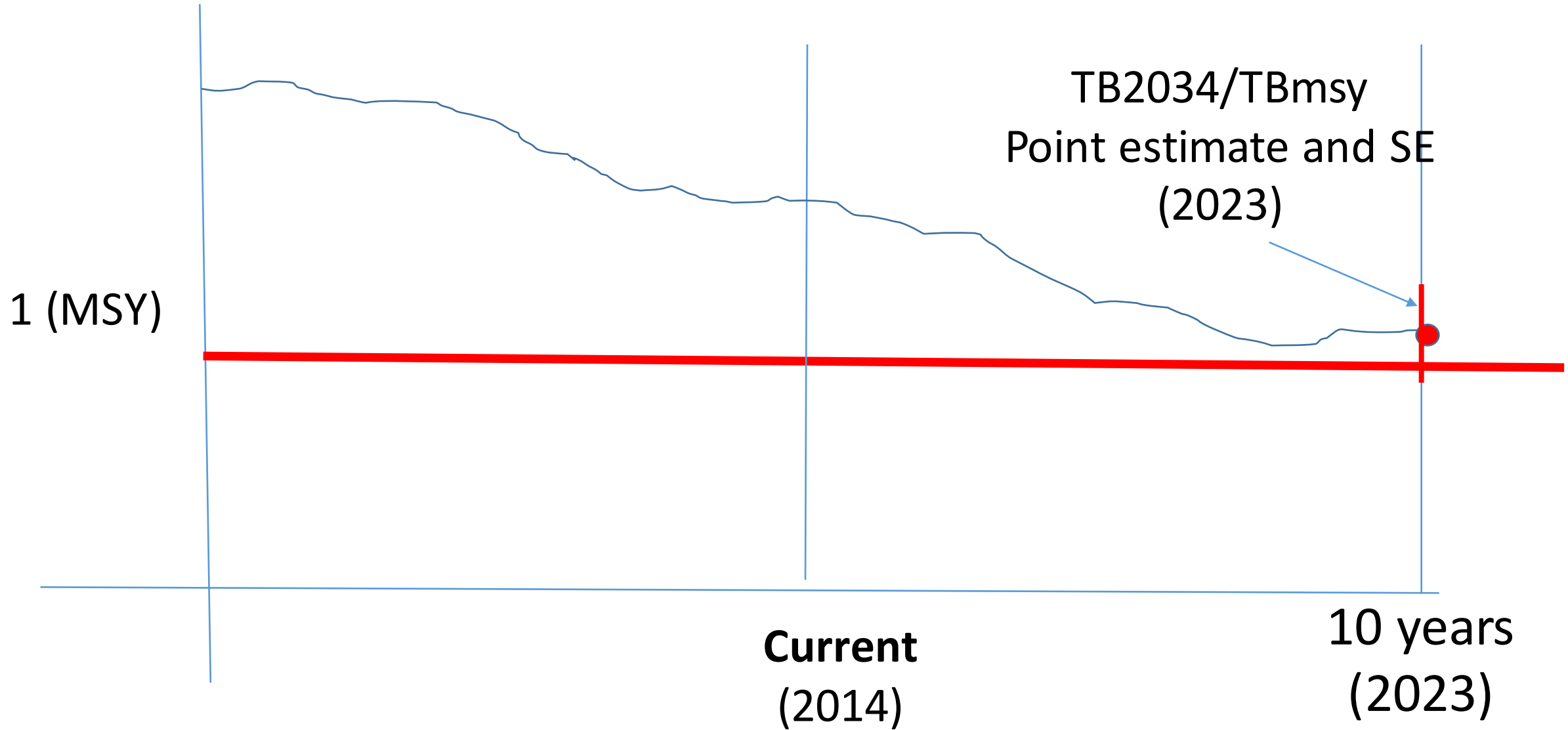-40%, -30%, -20%, -10%, 0% (status quo), 10%, 20%, 30%, 40%

+

MSY

We make future projections
TB/TBmsy (Total biomass) and F/Fmsy
➔ What does it mean?

For example

If the current catch (2015) were continued next 10 years,

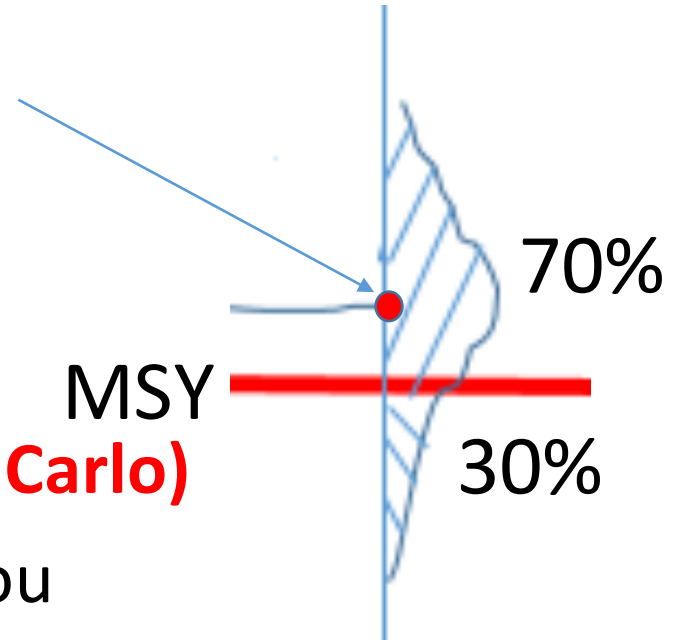What happen TB/TBmsy and F/Fmsy

next 10 years ?

How to get Uncertainties and compute Pr?

Uncertainties : re-sampling point (1000 times...)

Methods

Bootstrap or **MCMC (Markov Chain Monte Carlo)**

Don't worry ➔ Software will do it for you

70%

MSY

30%

In 1,000 times trials then if 300 points are below MSY

Then Pr (violating MSY for TB2023/TBmsy) =0.3

Methods Kobe II strategy management matrix (Kobe II).

10 different catch scenarios
(**current catch levels**, MSY levels, ± 10%, ± 20%, ± 30% and ± 40%).

If 10 different catch levels (scenarios) were continued to next 10 years

Probabilities violating (not sustaining) TBmsy Fmsy   (10 years)

How to define current catch levels (Status quo)

If your stock assessments end in 2015 for example

Normally ➔Catch in 2015 can be used for Risk assessment
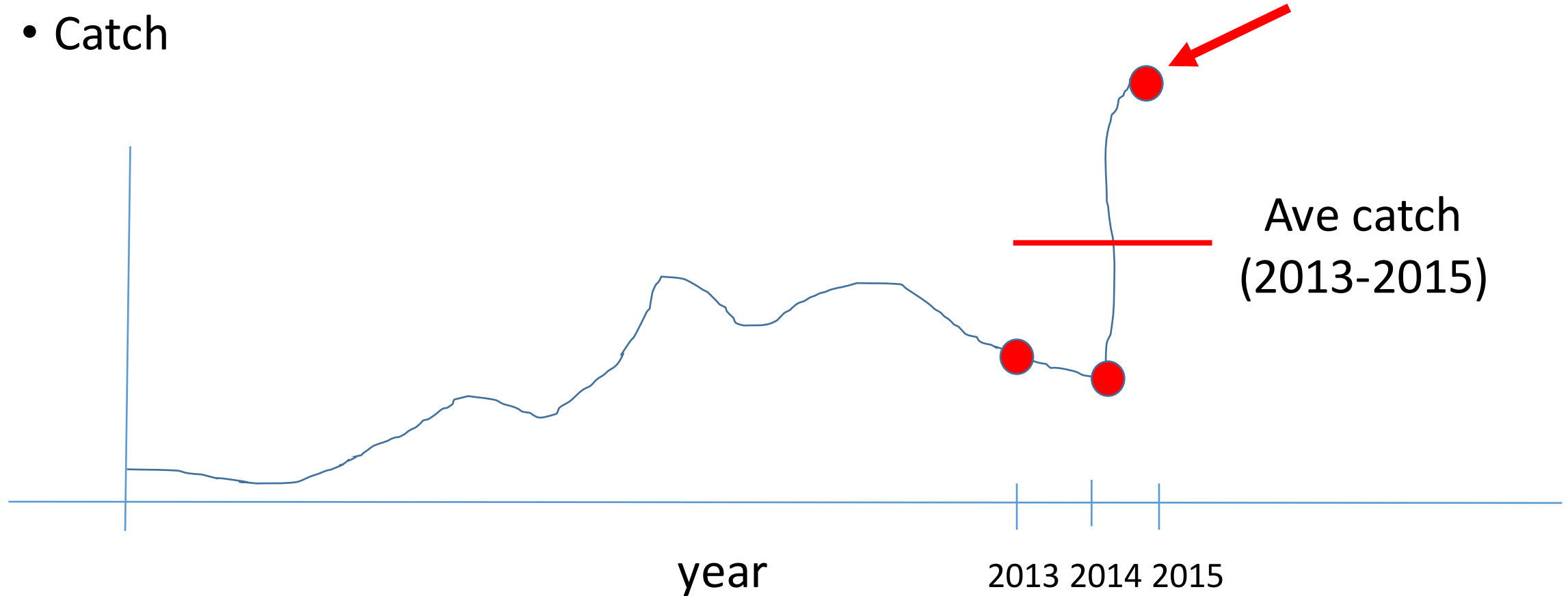
But we **use average catch** (2013-2015)➔ why??

Because the 2015 catch may extraordinary large or small values

What does it mean???

For example

If we have an extraordinary catch value in 2015 and If we use this value for risk assessment, then we will have BIASED results ➔ miss-managements

- Catch

Ave catch (2013-2015)

year

2013 2014 2015

METHODS HOW TO DETERMINE THE TAC (OPTIMUM CATCH)

Catch level can sustain TBmsy and Fmsy (10 years later)

with 50% (threshold value)

Normally close to MSY (as TAC)

Managers can choose different threshold values

Pr. (MSY)

For **<u>conservative</u>** measure (low TAC)➔ 30% (**lower risk**)

Trade-off

For **<u>optimistic</u>** measure (high TAC) ➔ 70% (**higher risk**)

Options of catch limit (TAC) and trade-off

management measure	Options		
	Conservative	Fair	Less conservative
Current catch	reduce	MSY	increase
TAC	lower	MSY	higher
Pr (keep MSY)	**30%**	**50%**	**70%**
Risk	**lower**	**average**	**higher**
Fishers	UN HAPPY ==> later happy	OK	HAPPY ==> later unhappy
Resources (managers)	GOOD (for ever)	OK	NOT GOOD (for ever)

Results Risk assessment

Kawakawa
(Indian Ocean side of the SEAFDEC waters)
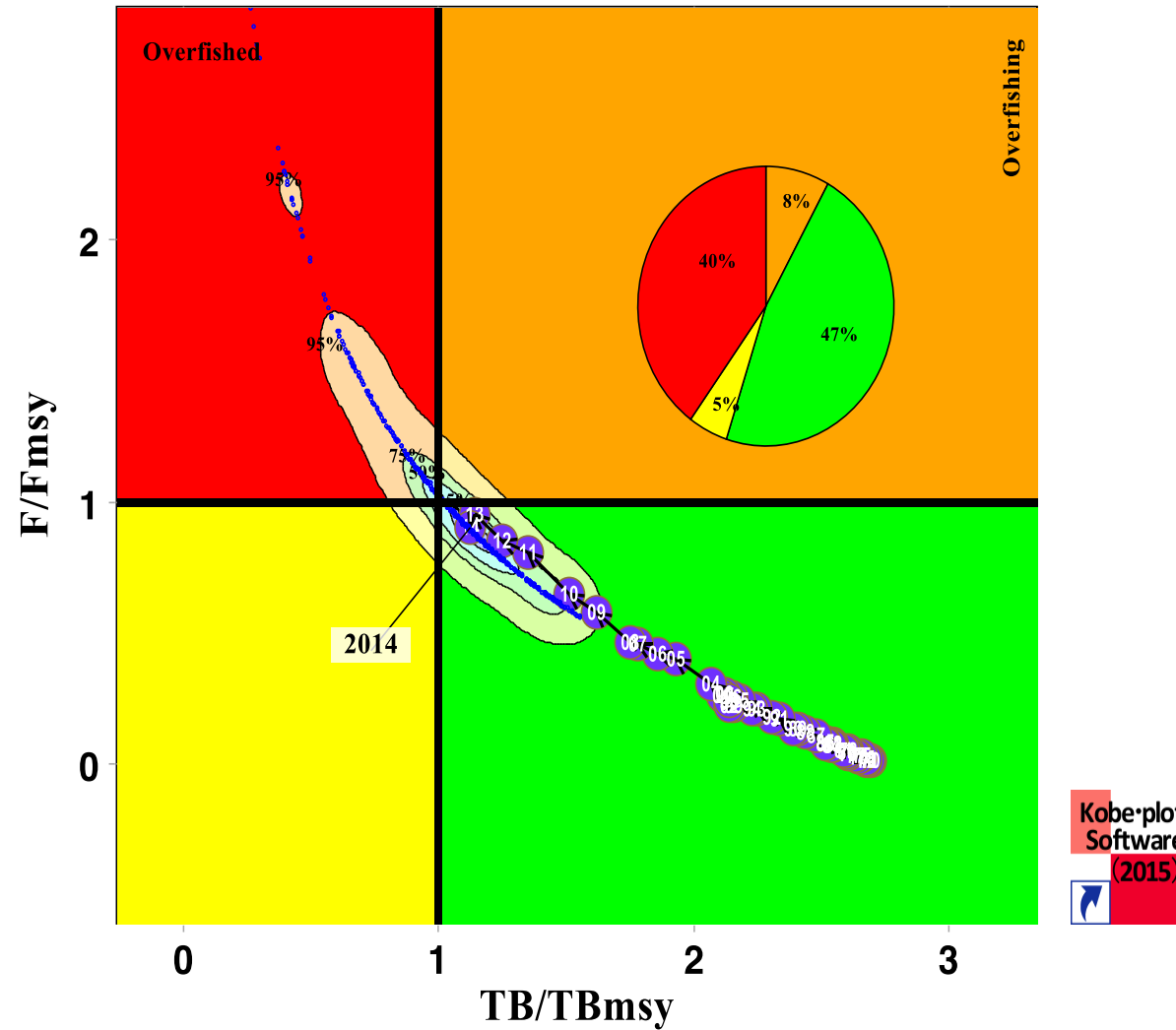
Table 1 Probabilities (%) violating TBmsy and Fmsy in 3 years (2017) and 10 years (2024) (Kawakawa, Indian Ocean side of the SEAFDEC water)

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	90%	93%	100%	110%	120%	130%	140%
					MSY level	Current catch (*)				
10 catch scenarios (tons)	35,854	41,829	47,805	53,780	55,380	59,756	65,732	71,707	77,683	83,658
$B_{2017} < B_{MSY}$	20	24	30	39	41	46	57	64	73	80
$F_{2017} > F_{MSY}$	9	14	20	36	42	59	80	95	100	100
$B_{2024} < B_{MSY}$	7	10	17	36	44	67	87	99	100	100
$F_{2024} > F_{MSY}$	7	9	16	35	45	71	95	100	100	100

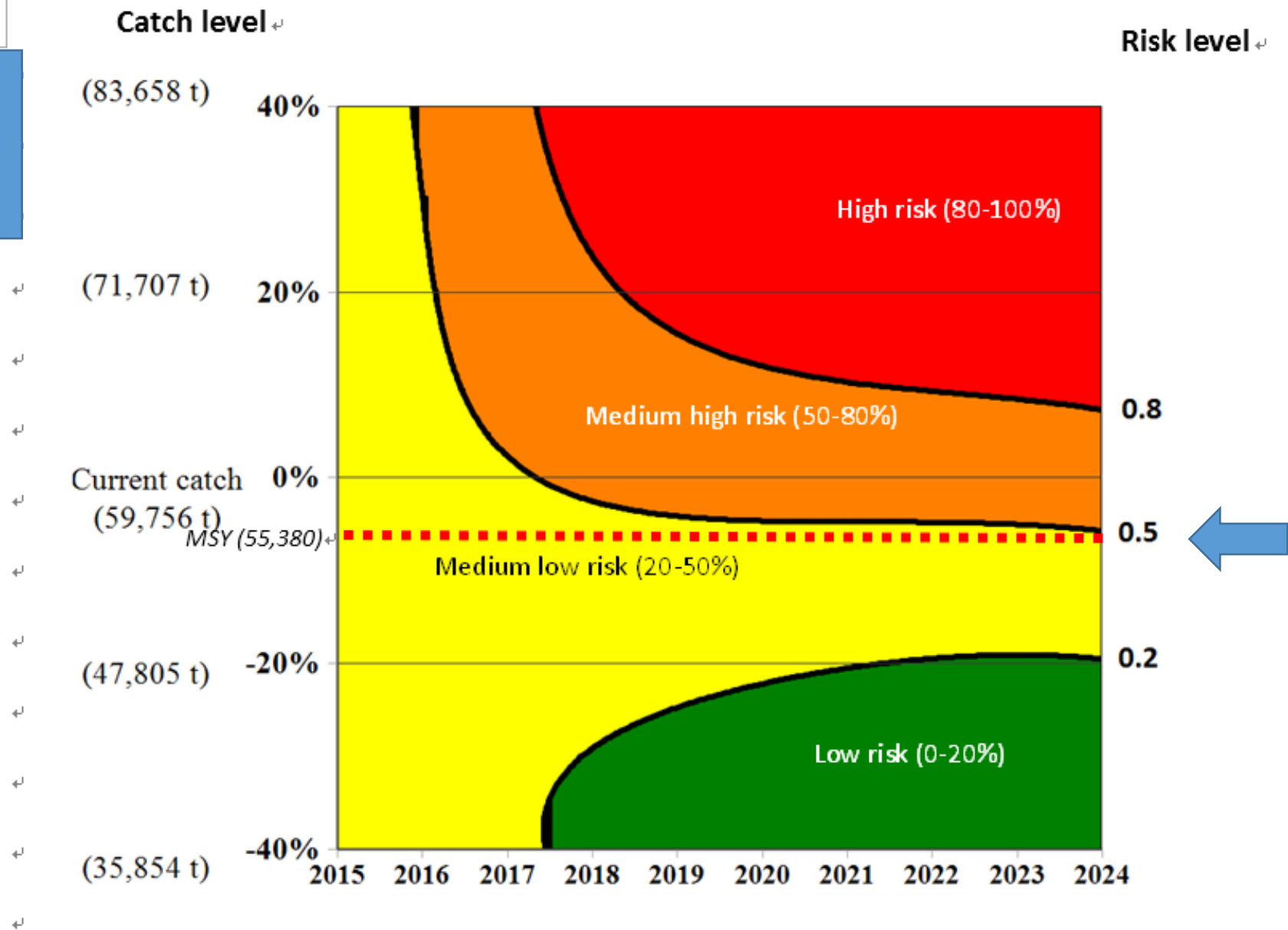(*) The current catch level is the average catch in 3 recent years (2012-2014).

Fig. 2 Risk level (probably) (%) violating TBmsy next 10 years (2015-2024) by different catch levels (Kawakawa, Indian Ocean side in the SEAFDEC water)
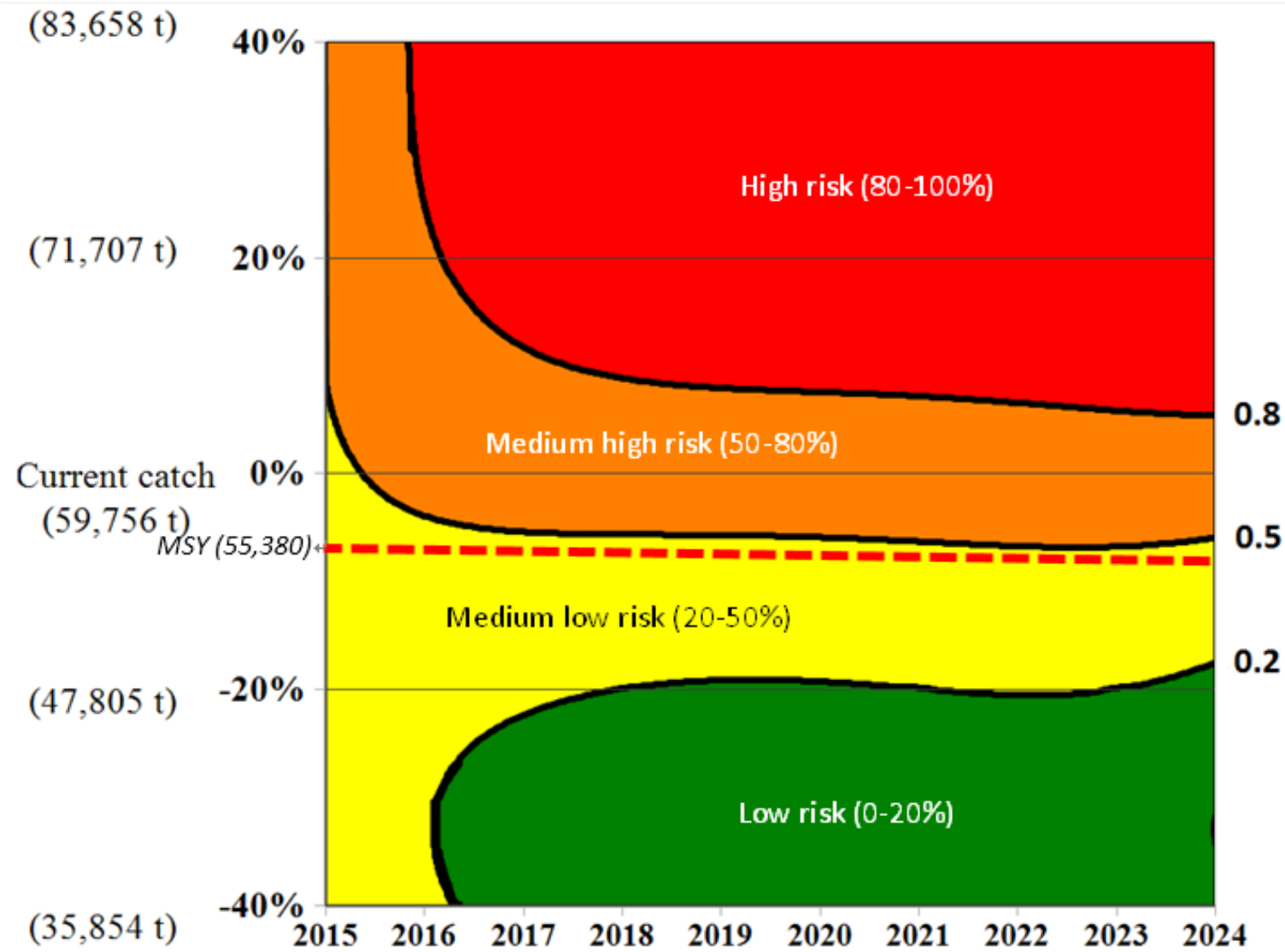
Fig. 3 Risk level (probably) (%) violating Fmsy next 10 years (2015-2024) by different catch levels (Kawakawa, Indian Ocean in the SEAFDEC water)

Recommendation :Management Measure (catch limit)
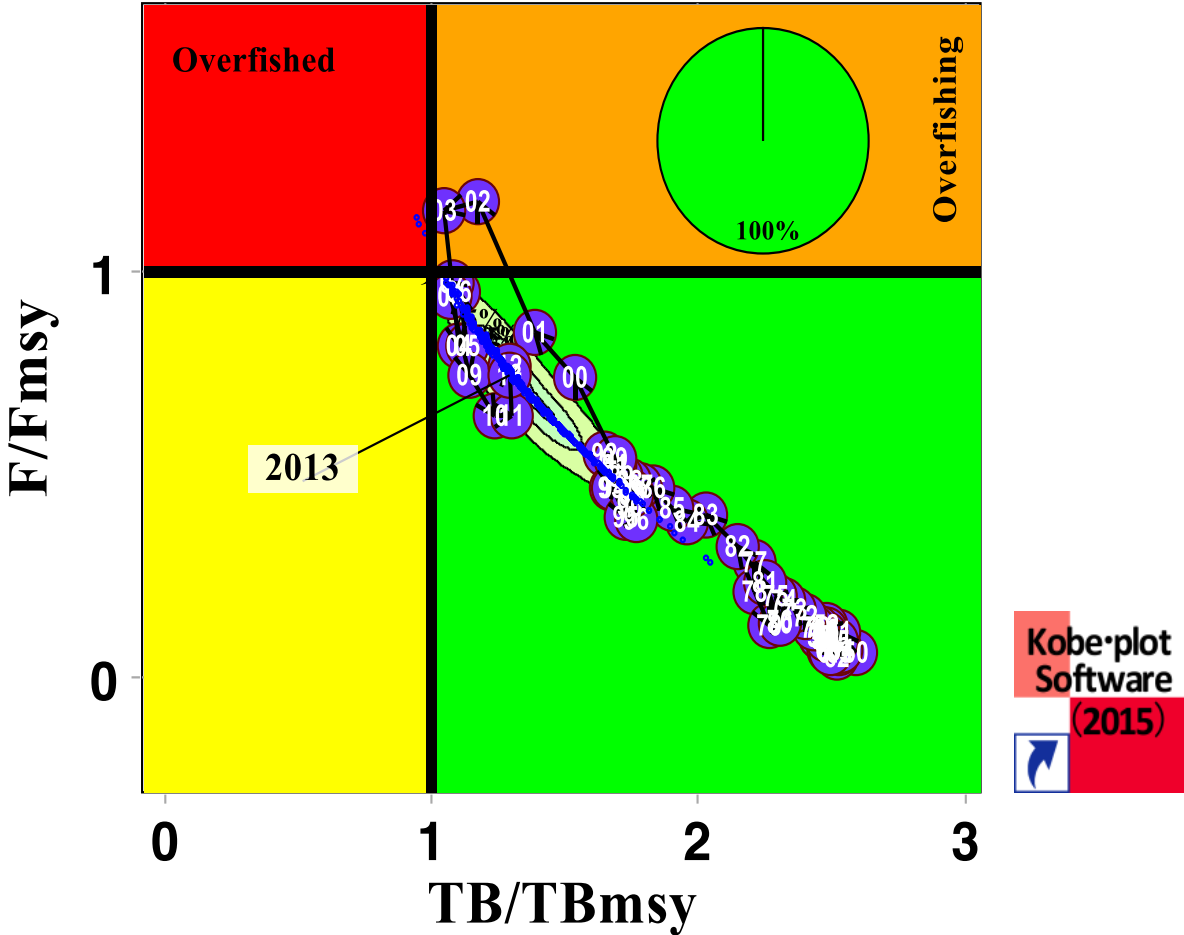
if MSY level (55,380 t) were continued in 10 years

Probabilities (risk) violating TBmsy and Fmsy are about 45%.

Recommendation : total catch
(kawakawa, Indian Ocean side of the SEAFDEC area)
should be less than its MSY level (55,380 t).

The current catch level (59,800 t) (Average of 2012-2014)
should be decreased by 7%.

3.2 Kawakawa
(Pacific Ocean side of the SEAFDEC waters)

Fig. 4 Kobe plot: results of stock assessments (Kawakawa, Pacific Ocean side in the SEAFDEC water)

Table 2 Probabilities (%) violating TBmsy and Fmsy in 3 years (2016) and 10 years (2023)
(Kawakawa, Pacific Ocean side of the SEAFDEC water)

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	90%	100%	109%	110%	120%	130%	140%
10 catch scenarios (tons)					Current catch (*)	MSY level				
Projected catch (tons)	102,571	119,666	136,762	153,857	170,952	185,400	188,047	205,142	222,238	239,333
$B_{2016} < B_{MSY}$	5	12	17	26	32	39	40	50	58	65
$F_{2016} > F_{MSY}$	0	0	0	0	16	41	46	73	90	96
$B_{2023} < B_{MSY}$	0	0	0	1	18	56	63	88	96	99
$F_{2023} > F_{MSY}$	0	0	0	0	3	56	66	93	99	100

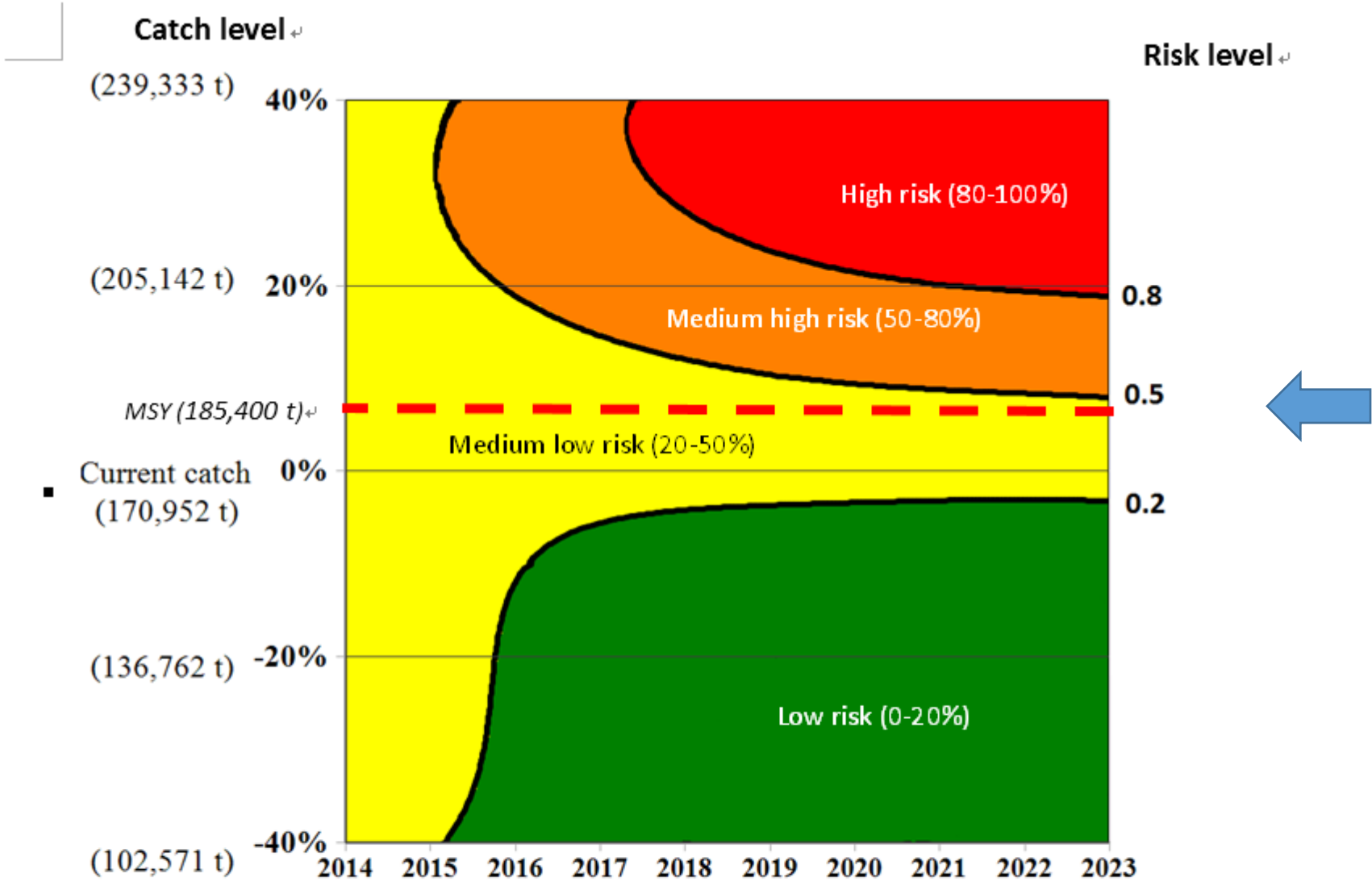*(*) The current catch level is the average catch in 3 recent years (2011-2013)*

Fig. 5 Risk level (probably) (%) violating TBmsy in 10 years (2014-2023) by different catch levels (Kawakawa, Pacific Ocean side of the SEAFDEC water)
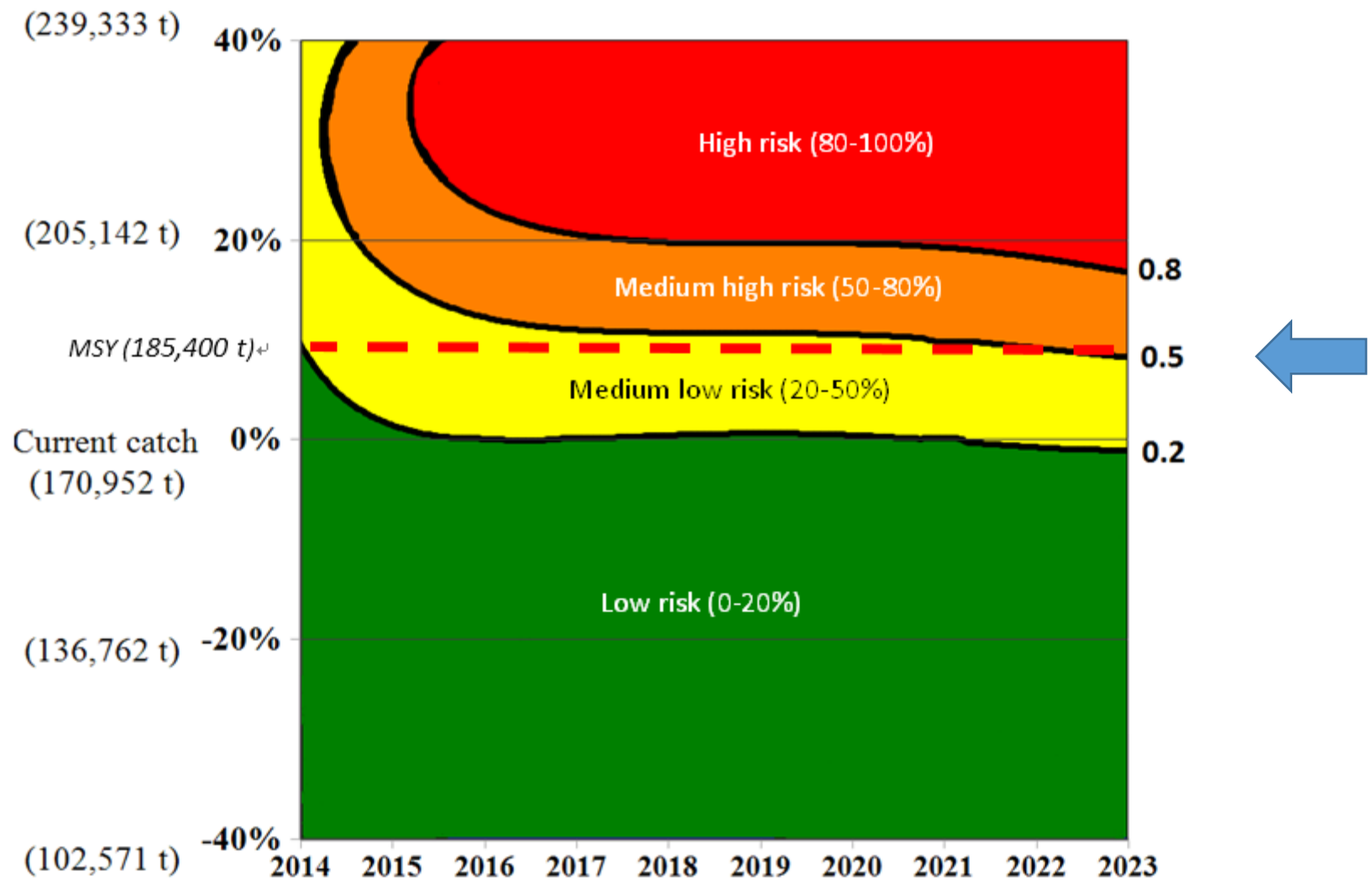
Fig. 6 Risk level (probably) (%) violating Fmsy in 10 years (2014-2023) by different catch levels (Kawakawa, Pacific Ocean side of the SEAFDEC water)

Recommendation :Management Measure (catch limit)

if MSY level (185,400 t) were continued in 10 years

⬇

Probabilities (risk) violating TBmsy and Fmsy are about 56%.
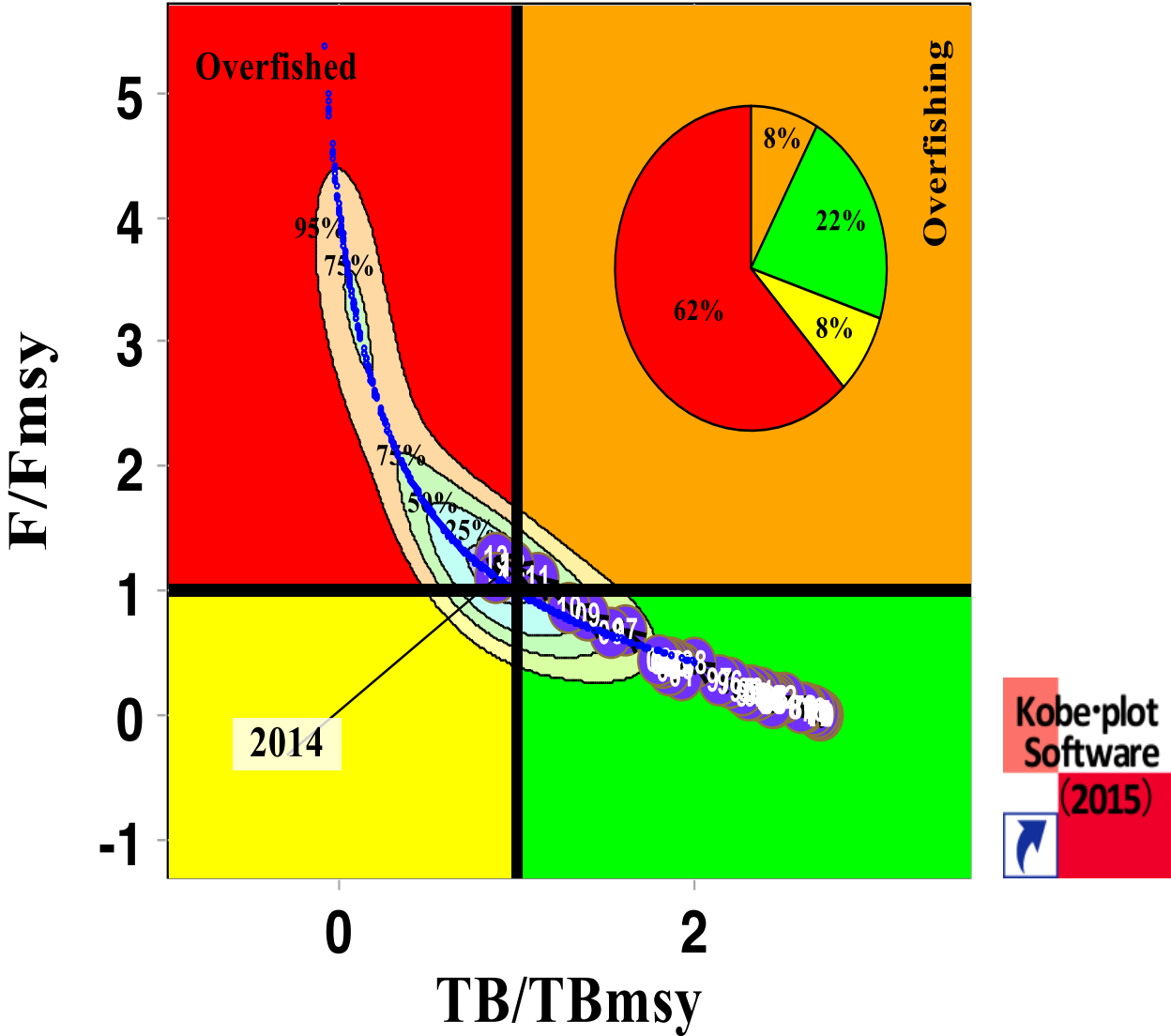
⬇

Recommendation : total catch
(kawakawa, Pacific Ocean side of the SEAFDEC area)
should be less than its MSY level (185,400 t).

The current catch level (171,000 t) (Average of 2011-2013)
can be increased by 9%.
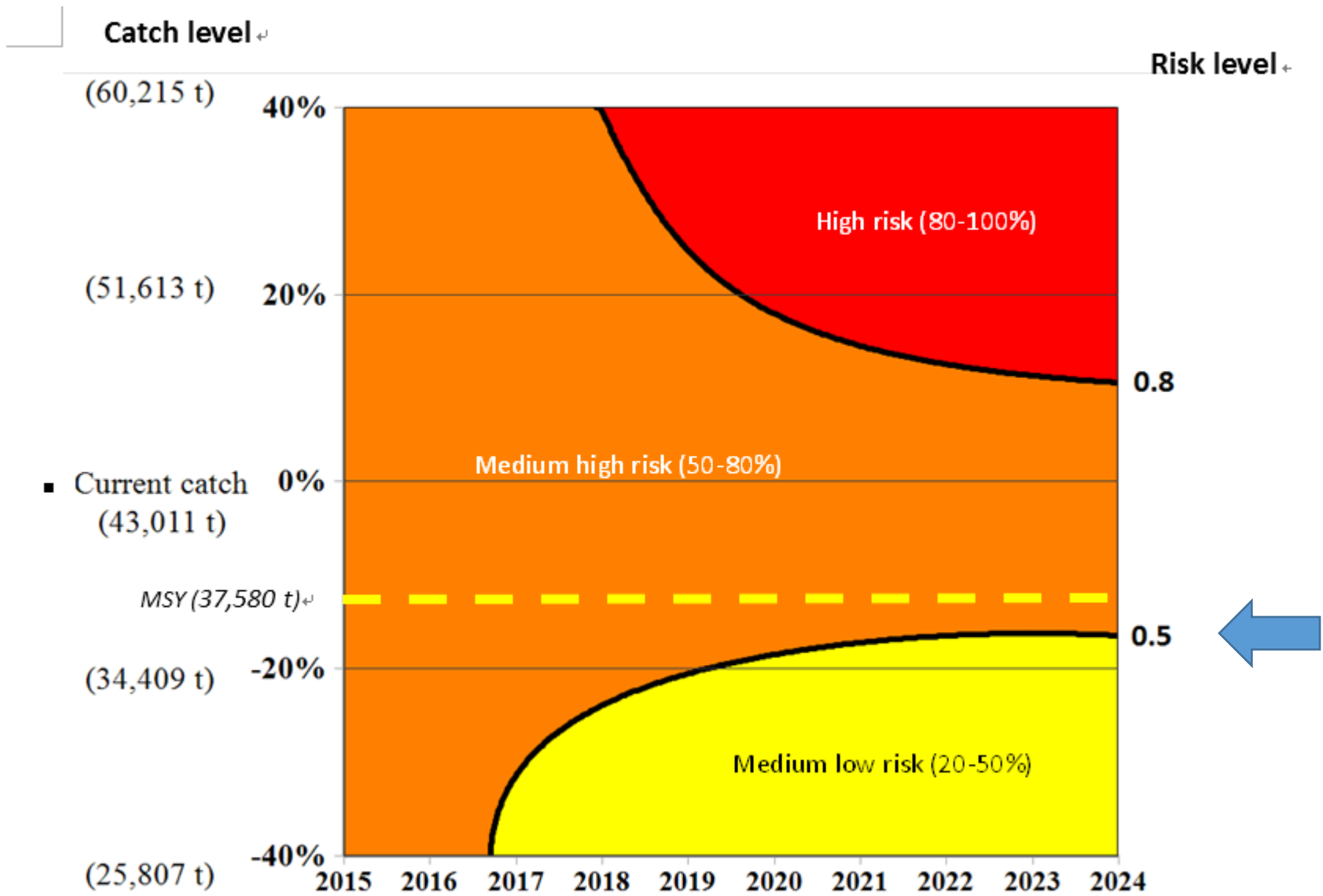
Longtail tuna (Indian Ocean side in the SEAFDEC waters)

Table 3 Probabilities (%) violating TBmsy and Fmsy in 3 years (2017) and 10 years (2024) (Longtail tuna, Indian Ocean side of the SEAFDEC water)

Color legend					
Risk levels	Low risk	Medium low risk	Medium high risk	High risk	
Probably	0-20%	20-50%	50-80%	80-100	

Catch level	60%	70%	80%	87%	90%	100%	110%	120%	130%	140%	
				MSY level		Current catch (*)					
10 catch scenarios (tons)	25,807	30,108	34,409	37,580	38,710	43,011	47,312	51,613	55,914	60,215	
$B_{2017} < B_{MSY}$	48	51	55	57	58	61	64	68	71	74	
$F_{2017} > F_{MSY}$	35	41	49	56	59	71	79	87	92	96	
$B_{2024} < B_{MSY}$	31	36	45	54	57	71	80	87	90	94	
$F_{2024} > F_{MSY}$	31	35	42	53	57	75	87	92	96	98	

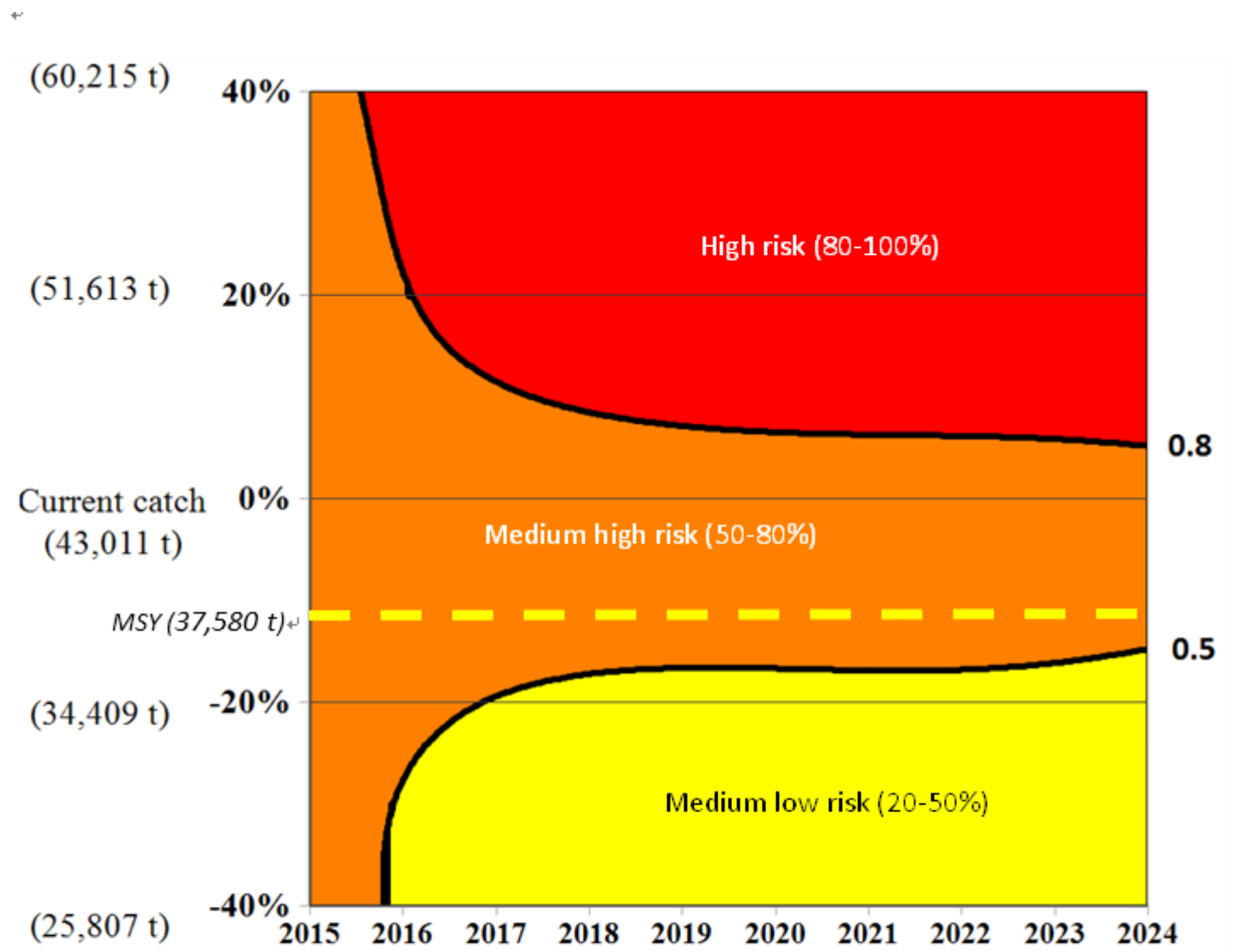(*) The current catch level is the average catch in 3 recent years (2012-2014)

Fig. 9 Risk level (probably) (%) violating Fmsy in 10 years (2015-2024) by different catch levels (Longtail tuna, Indian Ocean side of the SEAFDEC water)

Recommendation :Management Measure (catch limit)

if MSY level (37,580 t) were continued in 10 years

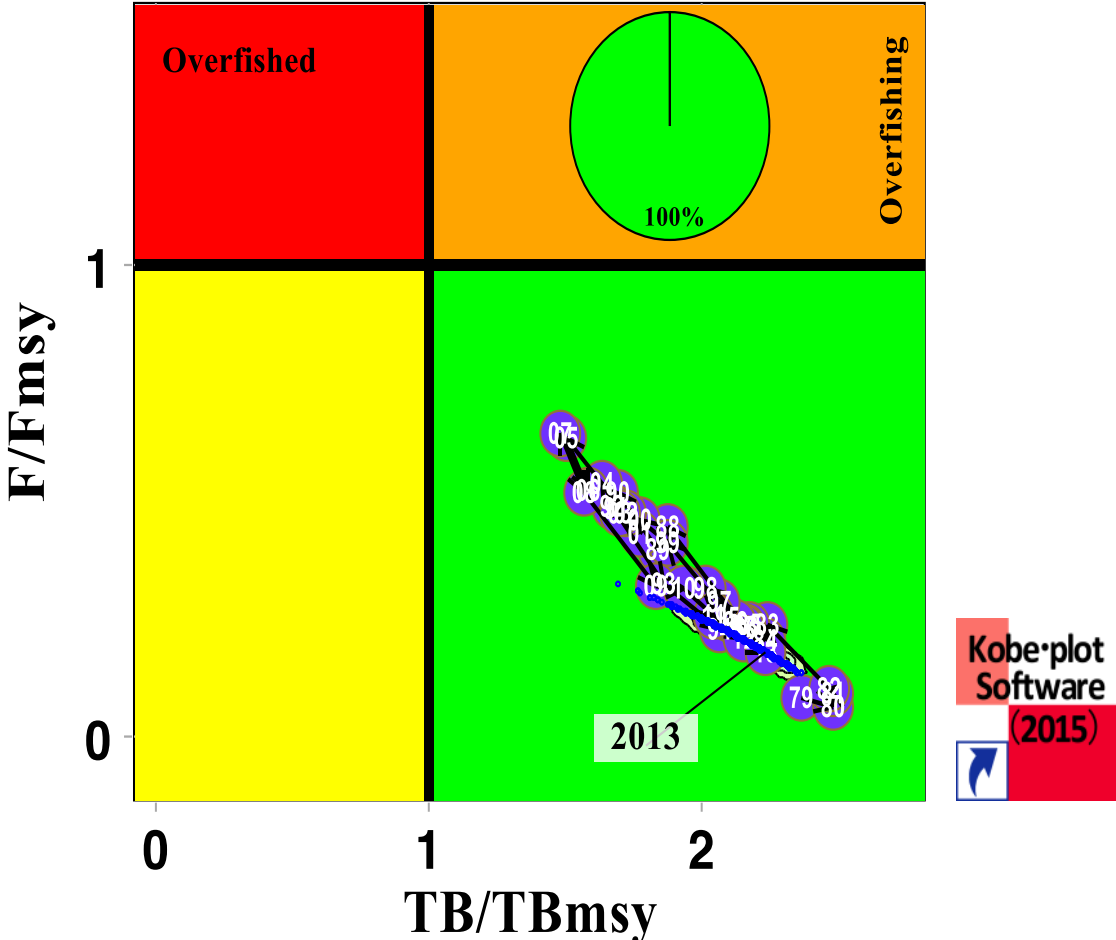Probabilities (risk) violating TBmsy and Fmsy are about 53%.

**Recommendation : total catch
(Longtail tuna, Indian Ocean side of the SEAFDEC area)
should be less than its MSY level (37,580 t).**

The current catch level (43,000 t) (Average of 2012-2014)
should be decreased by 13%.

3.4 Longtail tuna
(Pacific Ocean side of the SEAFDEC waters)

Table 4 Probabilities (%) violating TBmsy and Fmsy in 3 years (2016) and 10 years (2023)
(Longtail tuna, Pacific Ocean side of the SEAFDEC water)

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0-20%	20-50%	50-80%	80-100

Catch level	60%	70%	80%	90%	100%	110%	120%	130%	140%	223%
					Current catch(*)					MSY
10 catch scenarios (tons)	52,894	61,710	70,526	79,341	88,157	96,973	105,788	114,604	123,420	196,700
$B_{2016} < B_{MSY}$	0	0	0	0	0	0	0	0	0	0
$F_{2016} > F_{MSY}$	0	0	0	0	0	0	0	0	0	0
$B_{2023} < B_{MSY}$	0	0	0	0	0	0	0	0	0	52
$F_{2023} > F_{MSY}$	0	0	0	0	0	0	0	0	0	53

(*) The current catch level is the average catch in 3 recent years (2011-2013)
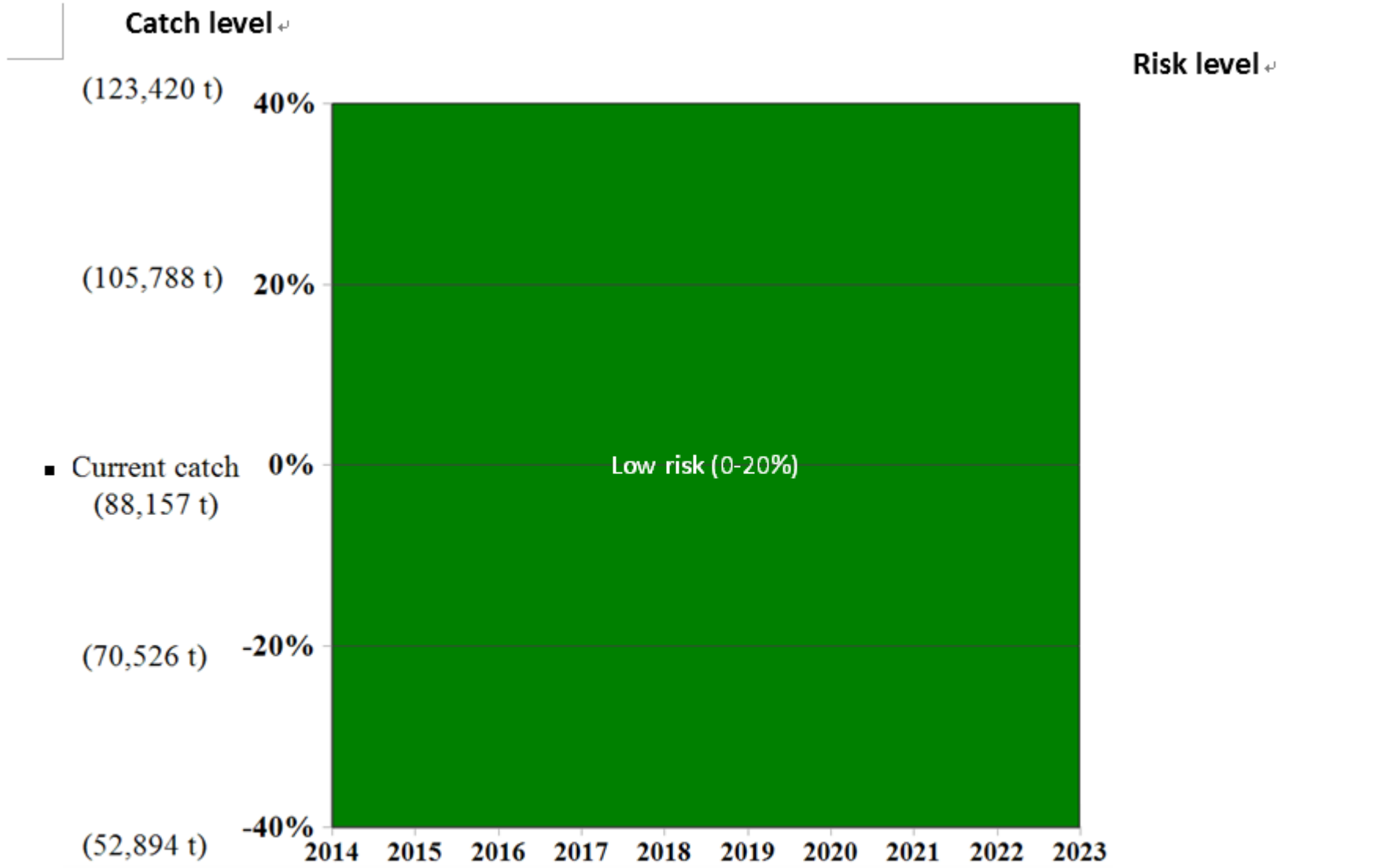
Fig. 11 Risk level (probably) (%) violating TBmsy in next 10 years (2014-2023) by different catch levels (Longtail tuna, Pacific Ocean side of the SEAFDEC water)
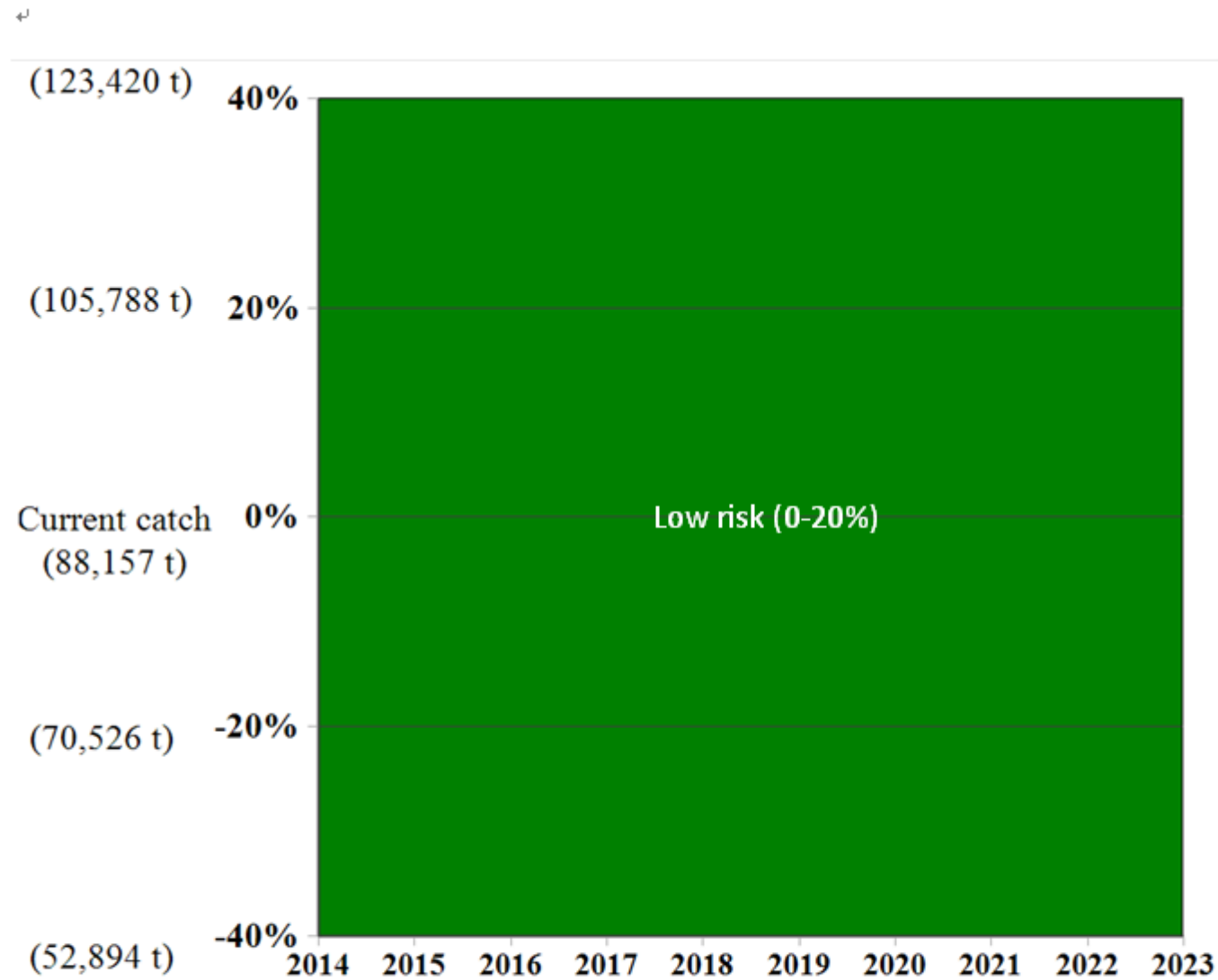
Fig. 12 Risk level (probably) (%) violating Fmsy in next 10 years (2014-2023) by different catch levels (Longtail tuna, Pacific Ocean side of the SEAFDEC water)

- Table 5 Probabilities (%) violating TBmsy and Fmsy in 3 years (2016) and 10 years (2023) if the current catch were increased by 150%, 200%, 250% and 300% (Longtail tuna, Pacific Ocean side of the SEAFDEC water)

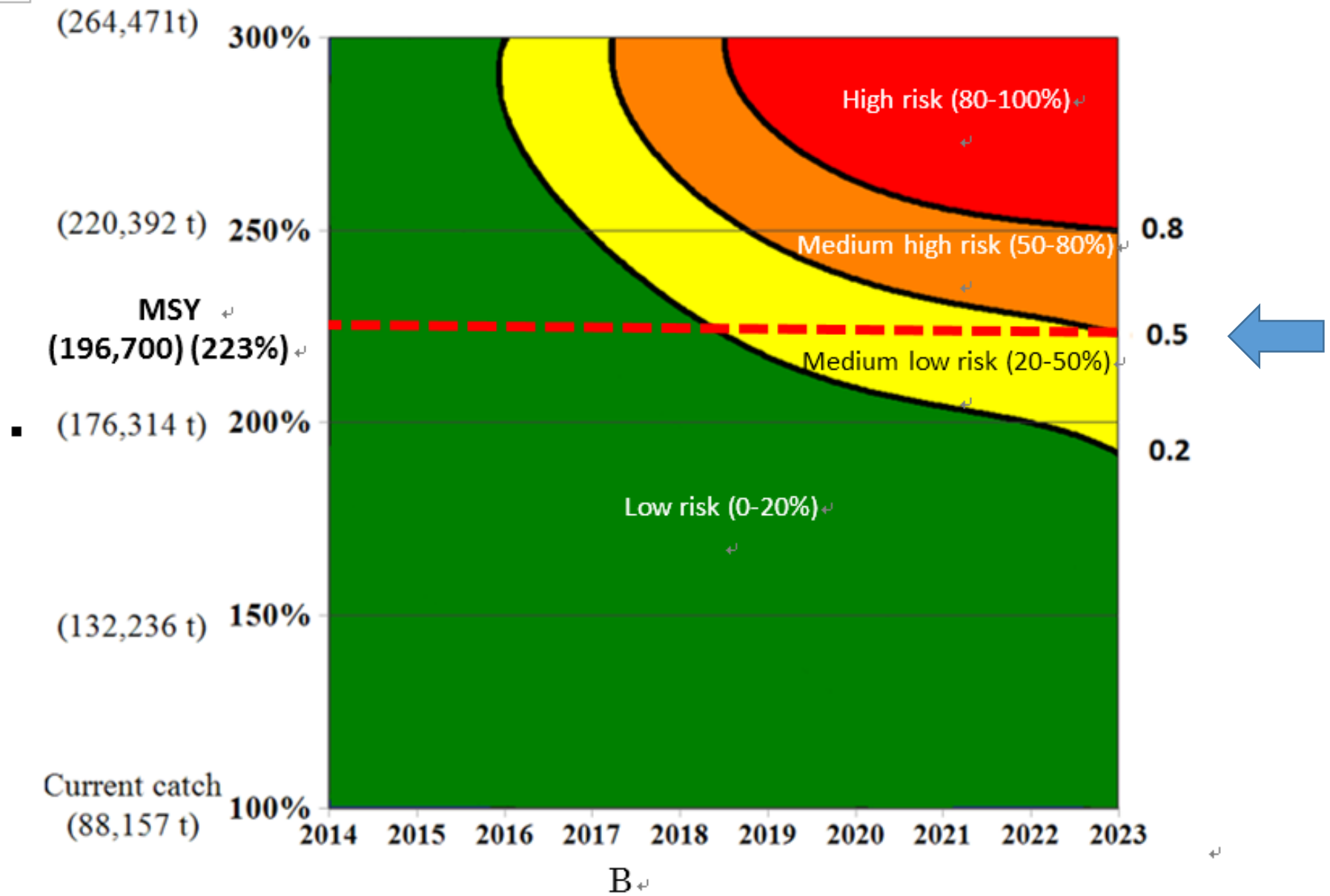| Reference point and projection timeframe	Alternative catch projections (relative to the average catch level from 2011–13) and probability (%) of violating MSY-based target reference points ($B_{targ} = B_{MSY}$; $F_{targ} = F_{MSY}$)					
	Current catch (*)			MSY		
Catch level	100%	150%	200%	223%	250%	300%
Projected catch (tons)	88,157	132,236	176,314	196,700	220,392	264,471
$B_{2016} < B_{MSY}$	0	0	0	0	0	0
$F_{2016} > F_{MSY}$	0	0	0	0	0	78
$B_{2023} < B_{MSY}$	0	0	24	52	84	100
$F_{2023} > F_{MSY}$	0	0	19	53	88	100

Fig. 13 Risk level (probably) (%) violating TBmsy in next 10 years (2014-2023) by different catch levels (100%, 150%, 200%, 250 and 300%)
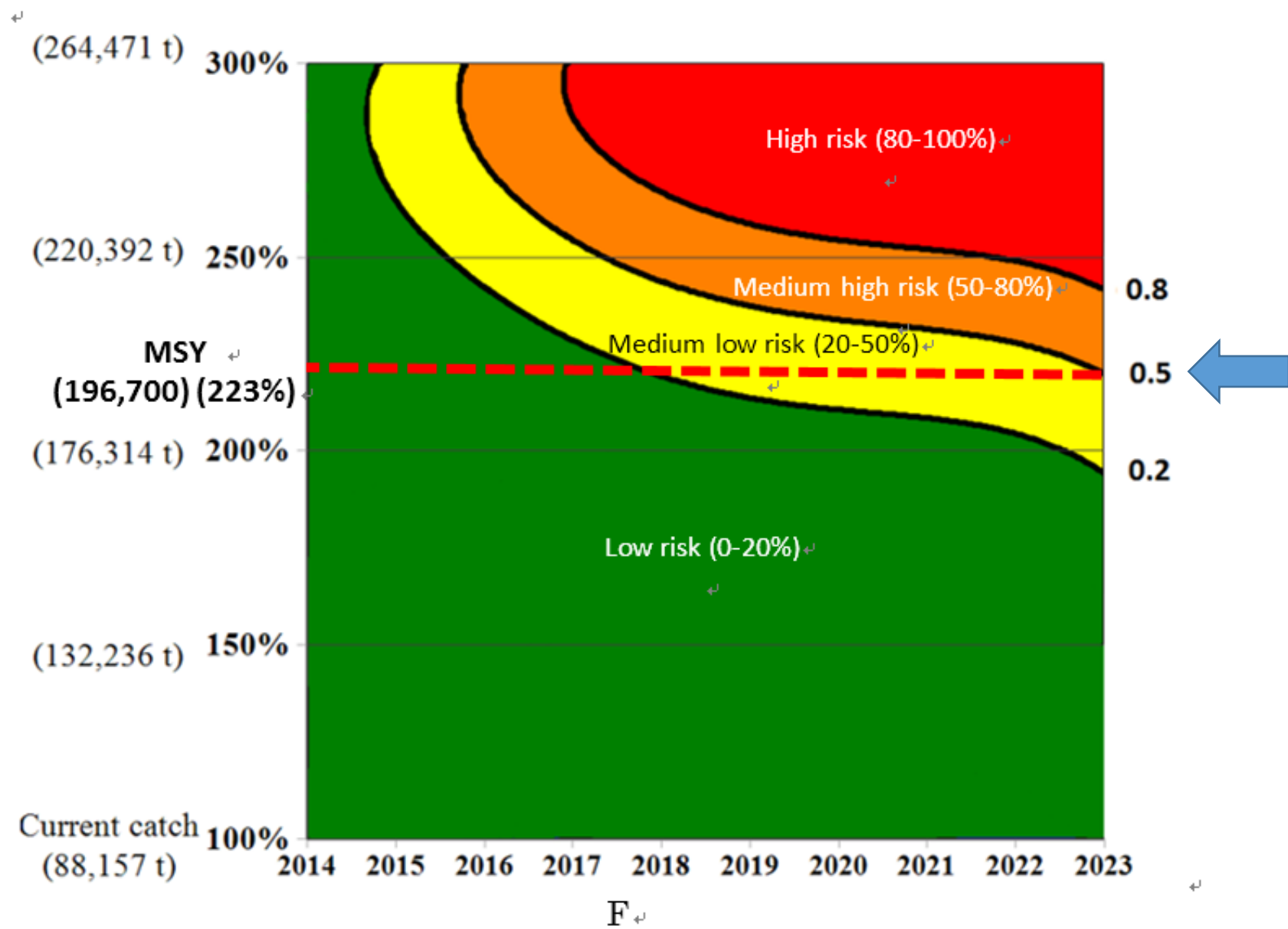**(Longtail tuna, Pacific Ocean side of the SEAFDEC water)**

Fig. 14 Risk level (probably) (%) violating Fmsy in next 10 years (2014-2023) by different catch levels (100%, 150%, 200%, 250 and 300%)
(Longtail tuna, Pacific Ocean side of the SEAFDEC water)

Recommendation :Management Measure (catch limit)

Even if the current catch were increased to the MSY level (196,700 t)
(223% higher than the current catch level (88,200 t) (Ave of 2011-2013)

Probabilities (risk) violating TBmsy and Fmsy are about 50%.

Recommendation
No catch limit but should be less than its MSY level (196,700 t)
(Longtail tuna, Pacific Ocean side of the SEAFDEC area)

How to conduct the Risk assessment?

- We plan to do the training course on the Risk assessment next year

Summary

	Kawakawa		Longtail tuna	
	Indian Ocean	Pacific Ocean	Indian Ocean	Pacific Ocean
stock status	🟩	🟩	🟥	🟩
Management measure(TAC)	MSY (55,380 t)	MSY (185,400 t)	MSY (37,600 t)	MSY (196,700 t)
Current catch	59,800 t	170,900 t	43,000 t	88,200
Reduction (-) or increase (+) from the current catch	-4,400 t (-7%)	+14,100 t (+9%)	-5,400 t (-13%)	+ 108, 500 t ~~+196,700t~~ (+223%)

Now our business and discussion how do we set up TAC (KAW+LOT)?

SEAFDEC (no RFMO) Recommendation

NO binding and NO obligation

ASEAN Recommendation

Binding and Obligation