Stock and Risk assessments for Indian Ocean albacore by ASPIC analyses (revised)

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Initial attempt ASPM (Rademeyer & Nishida, 2011)

(Age-Structured Production Model)

[PM]: too simple

[Integrated model]: complex

ASPM(SCAA), VPA (in-between) (S/R relation)

But VPA:CAA fixed ➔ less flexibility

ASPM(SCAA): CAA statically treated

more flexible (optimization) (NAFO: Butterworth)

Initial attempt ASPM

BUT the real world is not so easy, kind…..

Size data (Japan +Taiwan)

Sampling biases & less sample size (recent yrs)

IOTC data manager

Discourage to use for stock assessment

Conversion difficulty

Stop implementation (in half way)

So we needed to go back to the simple one

ASPIC (Prager)

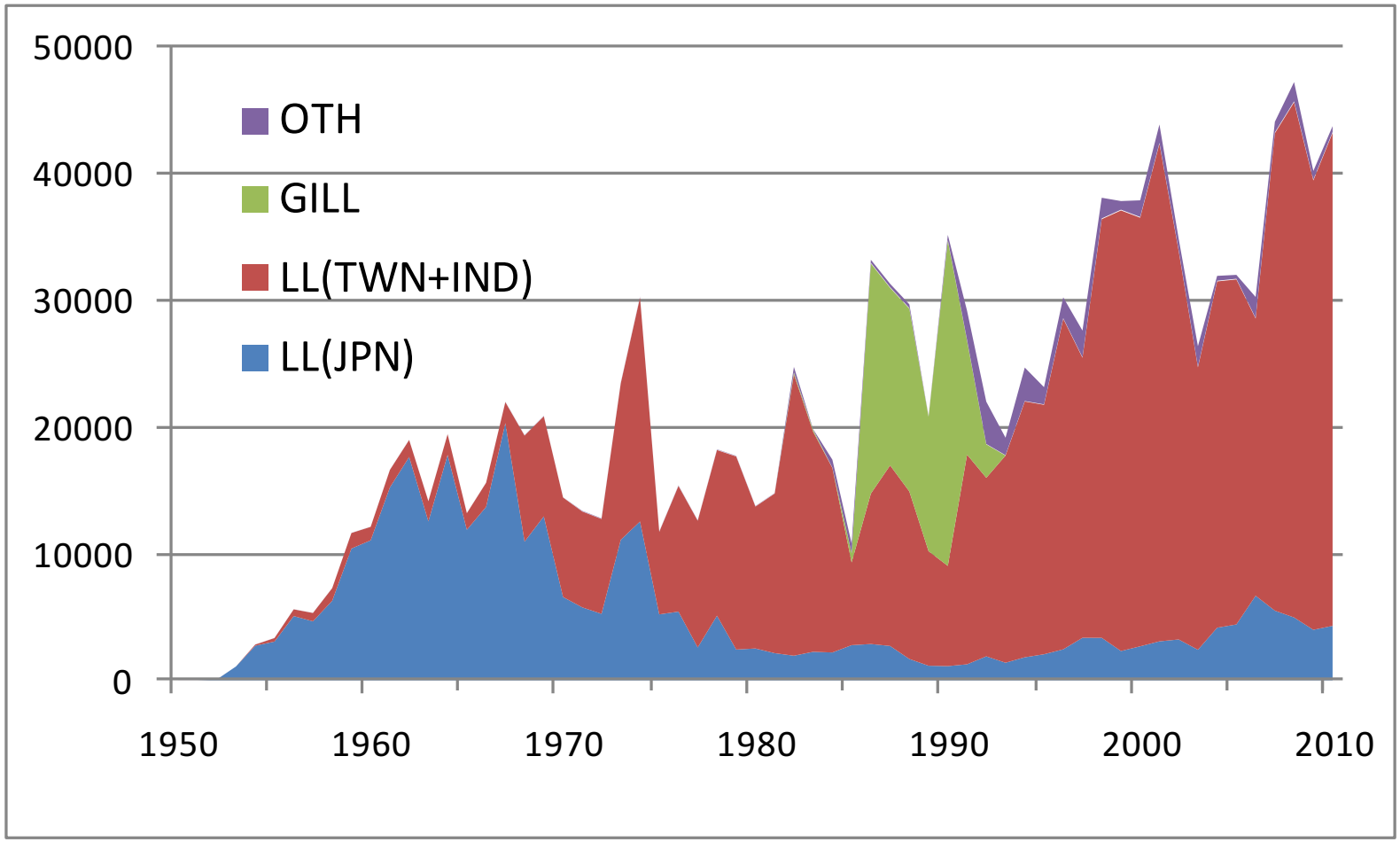
A Stock-Production Model Incorporating Covariates

(in-equilibrium PM) (FOX)

More realistic assumption

dB/dt‡0 : loss(F+M)‡gain(R+G)

Fleets（3 types）
LL(JPN)+LL(TWN)+(GILL+OTH)



What is LL(JPN) and LL(TWN)?

IOTC data manager

Before we use only one type of LL for SA

6-7 years ago? We started using 2 separate LL unique to each species for stock assessment

ALB

LL(Japan) like longline➔ incl. Korea

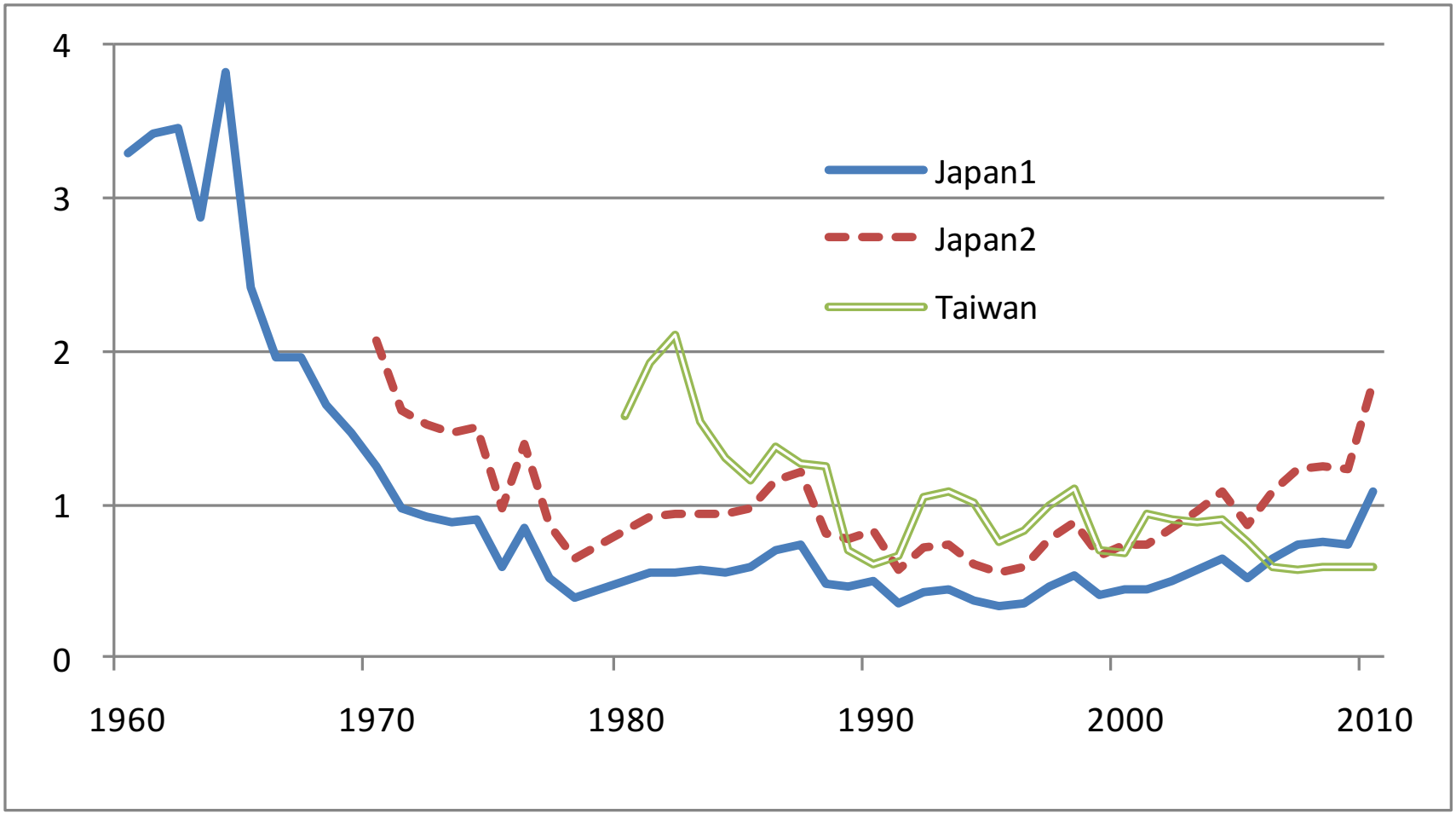
LL(Taiwan) like longline➔ incl. Indonesia, EU

Data used for ASPIC analyses

Catch by fleet

STD CPUE (Japan and Taiwan)

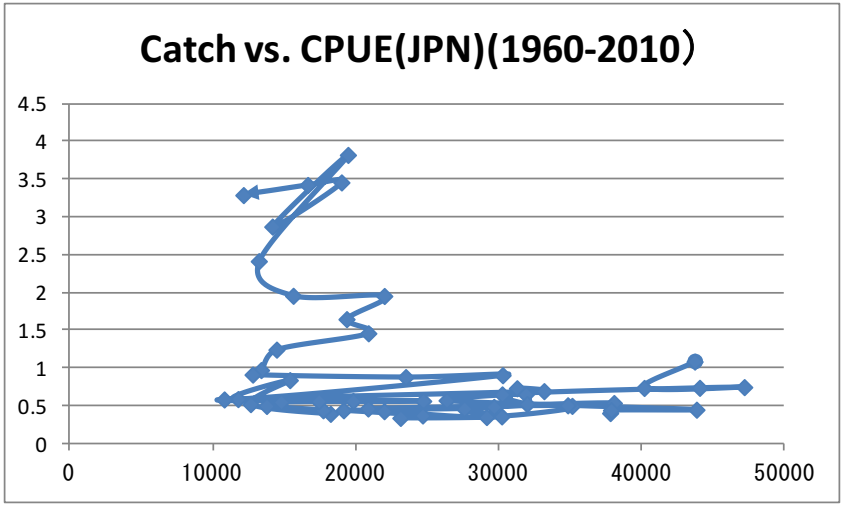
STD CPUE(scaled) [available data]

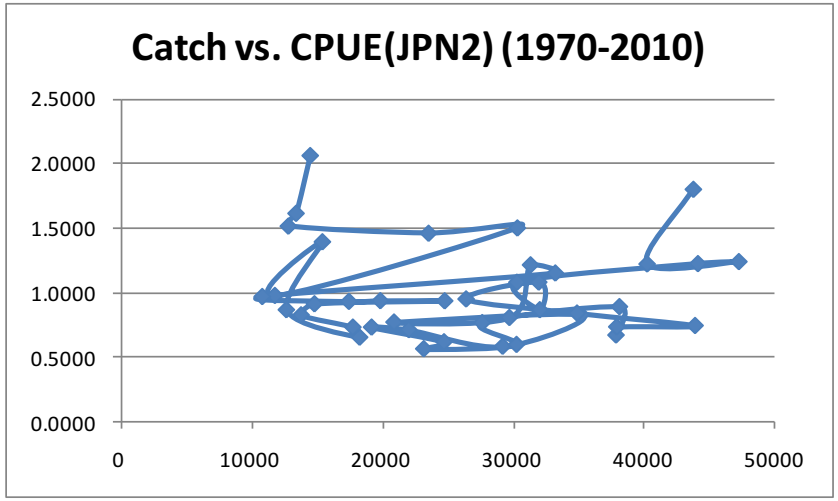


Investigation

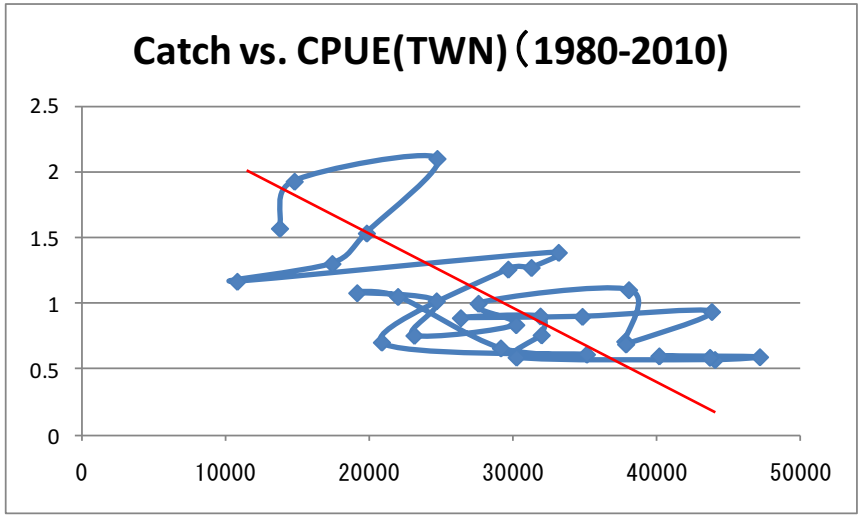
Catch vs. STD CPUE relation

Relation C vs. STD CPUE: Problems（Japan) (no negative CORR)

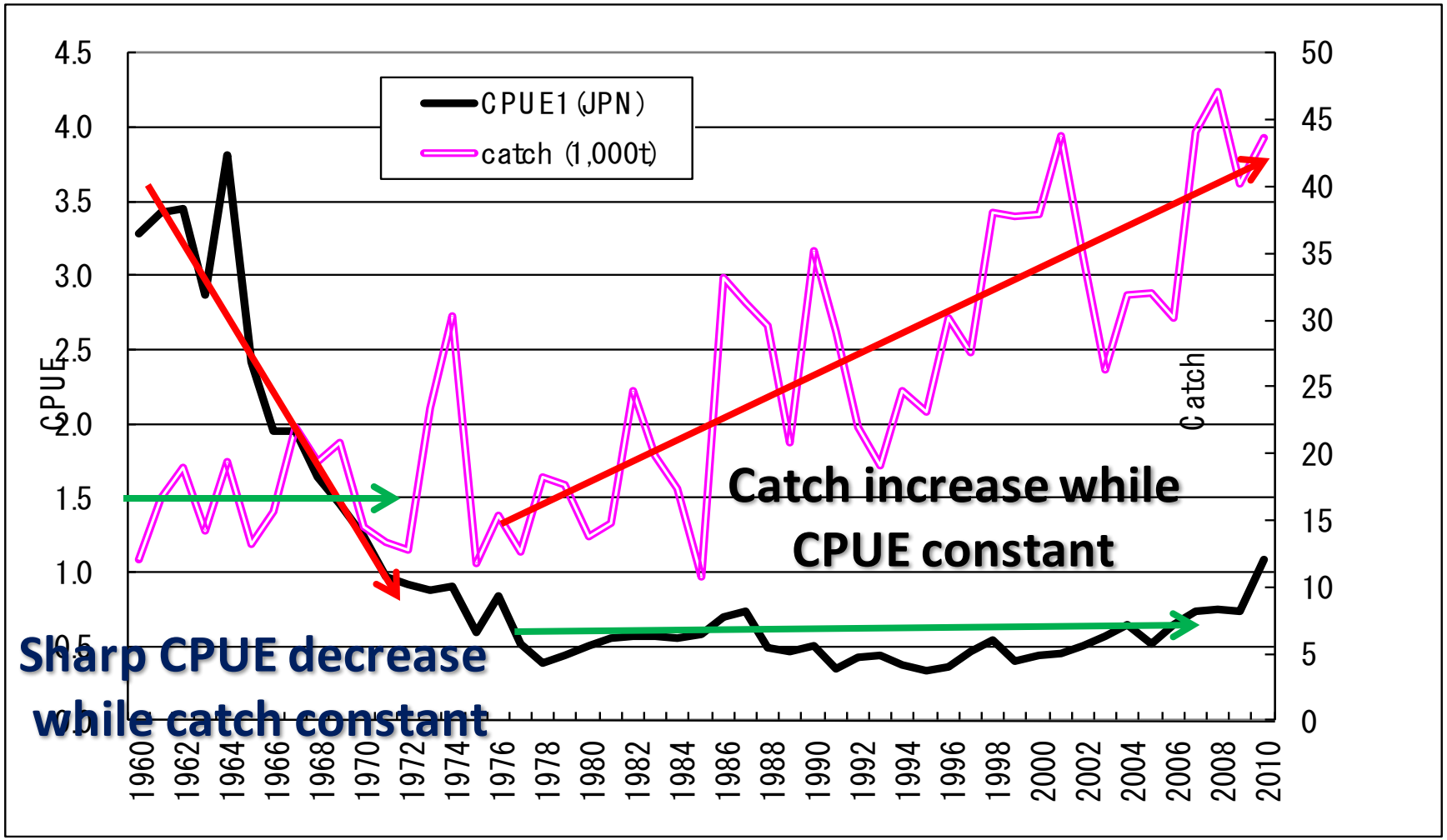




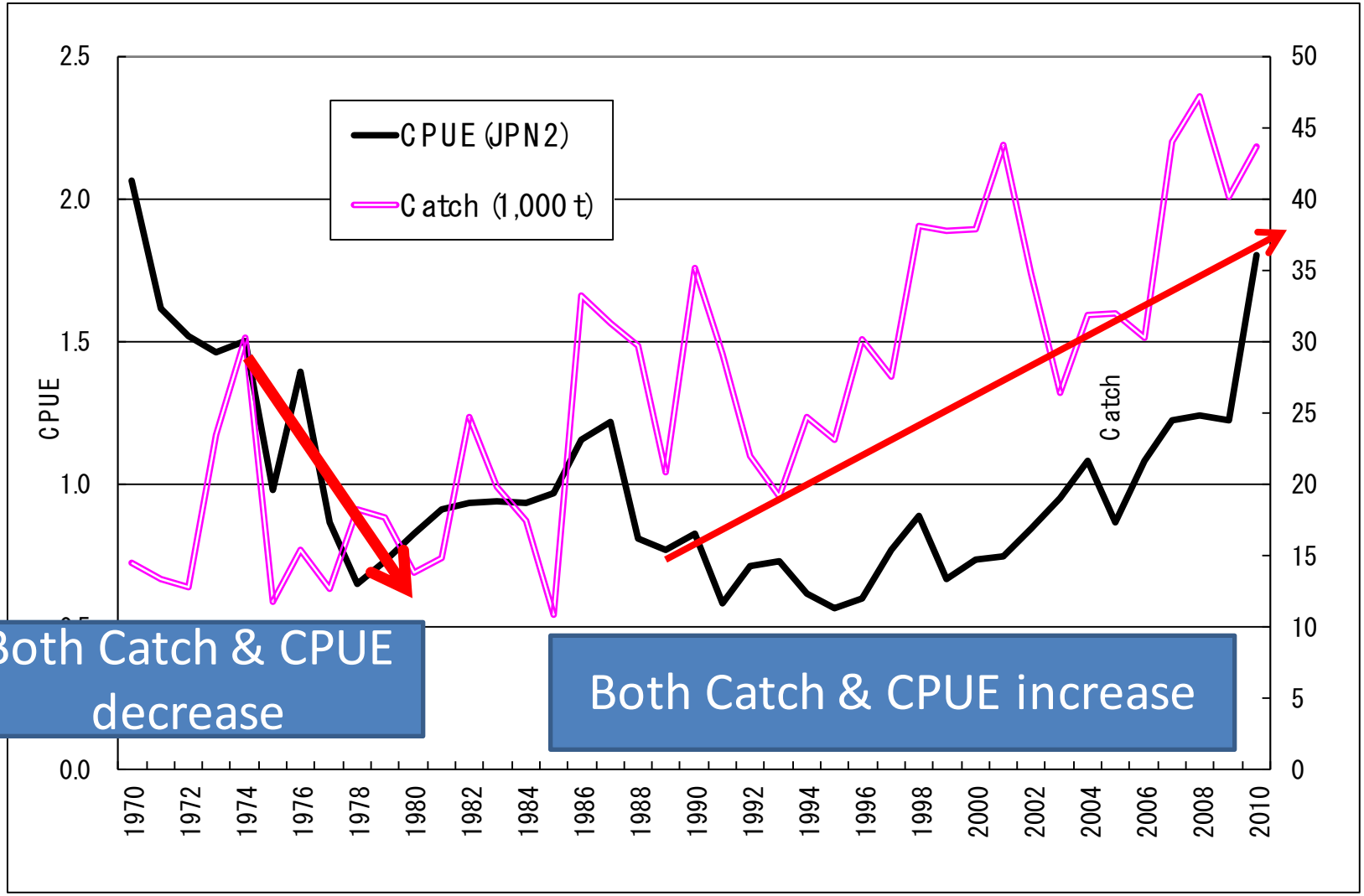
Taiwan :
A bit better situation



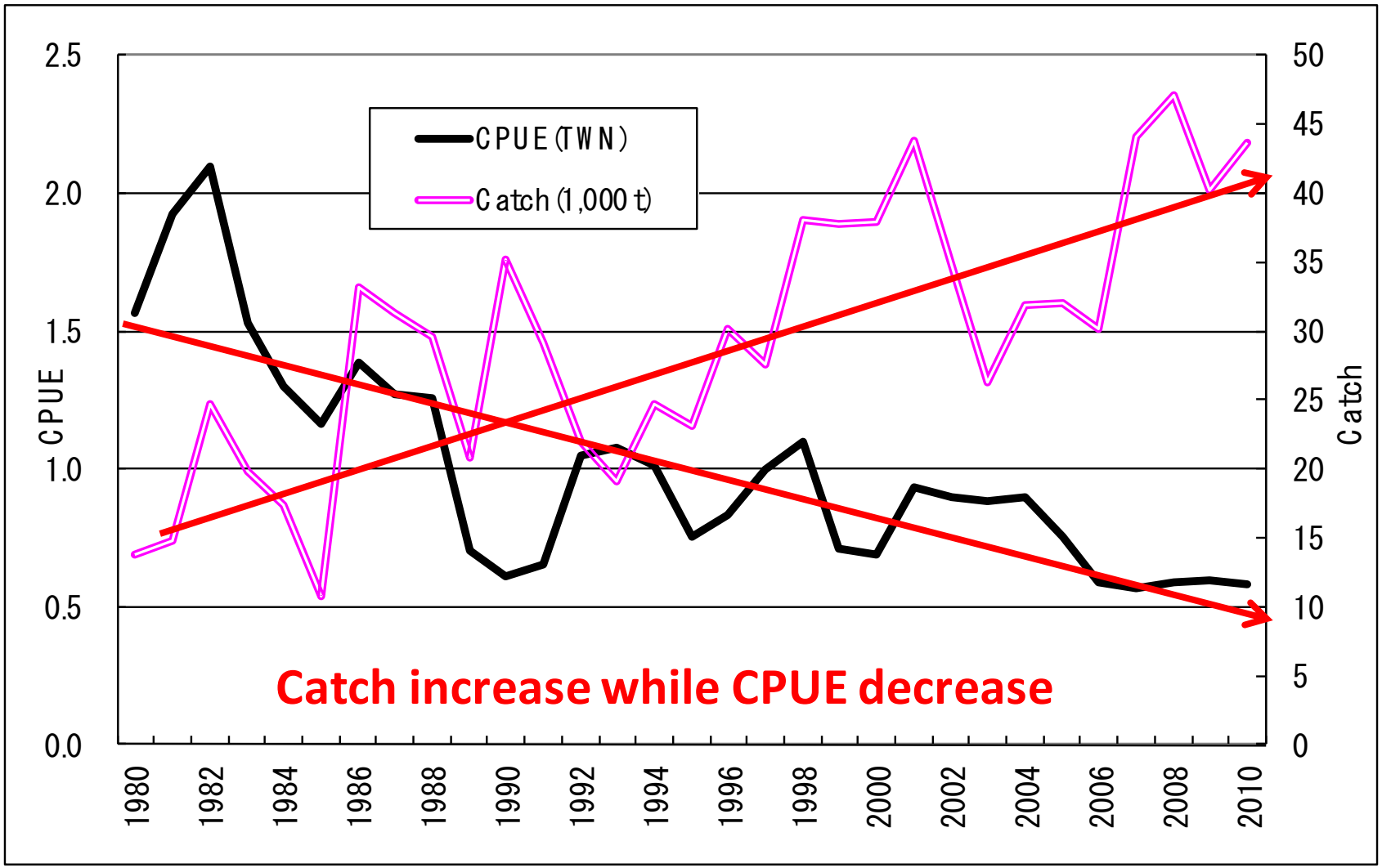
Problem C vs. CPUE(JPN1:1960-2010) not reflected [same situation as for YFT]



Problem C vs. CPUE(JPN2:1970-2010)



Reasonable C vs. CPUE(**TWN** 1980-2010)



22 Scenarios (Comb. of C & CPUE)

- **Catch (start year) (4)**

  1950-, 1960-, 1970- and 1980-

- **CPUE(3)**

  JPN1 (1960-2010), JPN 2(1970-2010),

  TWN(1980-2010)

Longer span of the data series : ideal

But due to the C vs. STD CPUE miss-match problem

we **evaluated** all possible cases to see **the global situation**

How combined ?

- Catch (4 starting years)

  X

- STD CPUE (Japan 1, Japan 2 and Taiwan)
  - 2 separate CPUE
  - Single CPUE

  } Original STD CPUE

  - Simple average CPUE
  - Weighted average CPUE

  } AVE STD CPUE

Scenario 1-14 (original STD CPUE) (only one 14: with TWN CPUE converged)

years	S. No	Fleets			CPUE			R2	MSE	MSY 1000t tons	TB 2010 million tons	TB msy	TB ratio	F 2010	F msy	F ratio
		LL (J)	LL (T)	GL	JPN		TWN									
					1960-2010	1970-2010	1980-2010									
1950-2010	1	on	on	on	on		on	NC								
	2	on	on	on		on	on	NC								
	3	on		on	on			NC								
	4	on		on		on		NC								
	5	on		on			on	NC								
1960-2010	6	on	on	on	on		on	NC								
	7	on	on	on		on	on	NC								
	8	on		on	on		on	NC								
	9	on		on		on	on	NC								
	10	on		on			on	NC								
1970-2010	11	on	on	on		on	on	NC								
	12	on		on		on		NC								
	13	on		on			on	NC								
1980-2010	14	on		on			on	0.73	0.047	36.1	0.21	0.16	1.33	0.20	0.23	0.89

Scenario 15-18
Simple AVE CPUE (JPN2+TWN)
No conversion

years	S. No	Fleets			Simple AVE CPUE (JPN2+TWN)	R2	MSE	MSY 1000t tons	TB 2010 million tons	TB msy	TB ratio	F 2010	F msy	F ratio
		LL (J)	LL (T)	G L	1980-2010									
1950-2010	15	on		on	on	NC (not converged)								
1960-2010	16	on		on	on	NC (not converged)								
1970-2010	17	on		on	on	NC (not converged)								
1980-2010	18	on		on	on	NC (not converged)								

Scenario 19-22:weighted AVE CPUE (JPN+TWN) (weighted by catch) (poor fitness)

years	S. No	Fleets			Weighted AVE CPUE (JPN2+TWN) (weighted by catch)	R2	MSE	MSY 1000t tons	TB 2010 million tons	TB MSY million tons	TB ratio	F 2010	F msy	F ratio
		LL (J)	LL (T)	G L	1980-2010									
1950-2010	19	on		on	on	14.9 too low	0.0108 too low	46.0	0.162	0.099 too low	1.59	0.27	0.47	0.59
1960-2010	20	on		on	on	NC (not converged)								
1970-2010	21	on		on	on	NC (not converged)								
1980-2010	22	on		on	on	NC (not converged)								

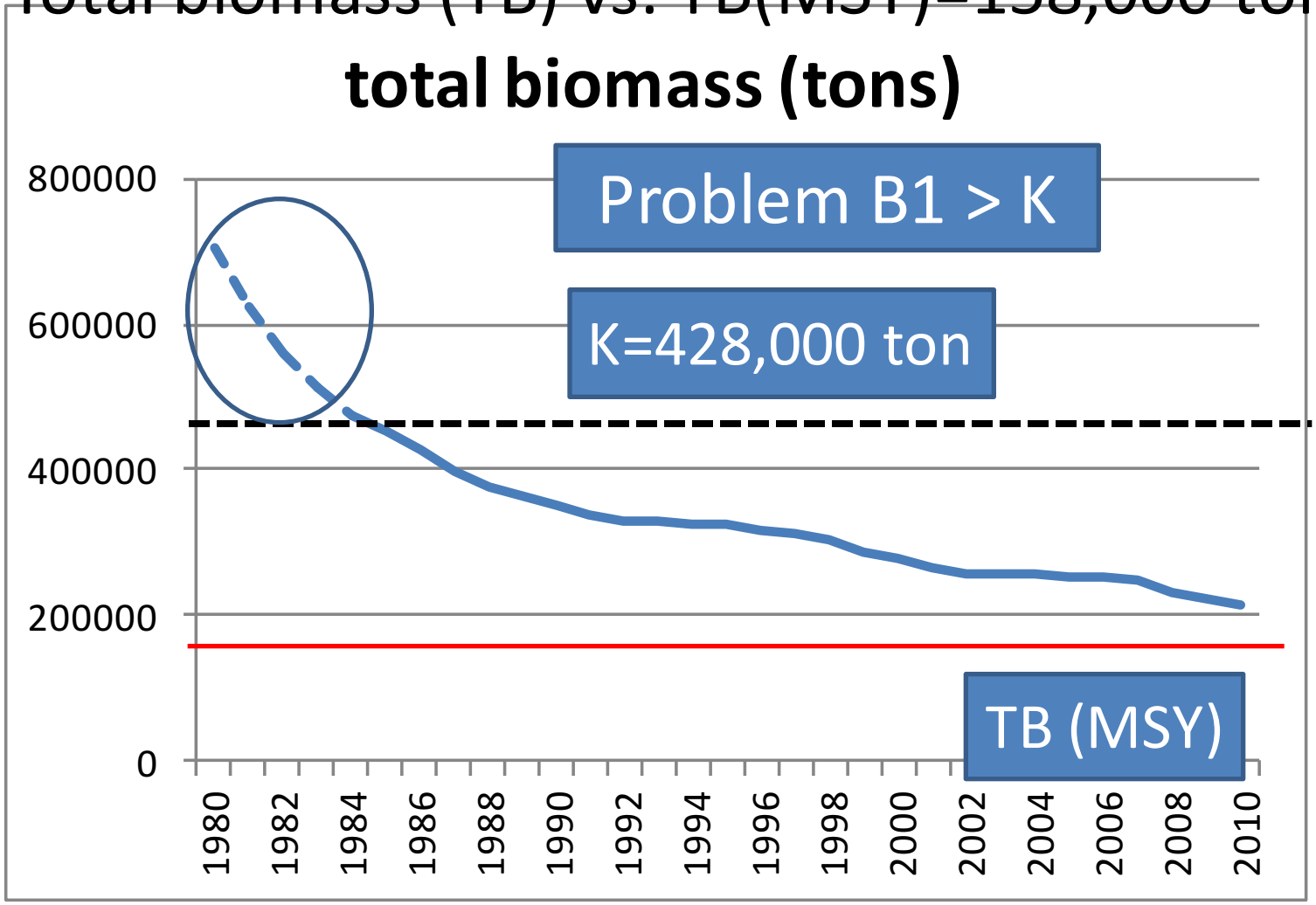
SCENARIO 14

1980-2010	14	on		on		on	0.73	0.0047	36.1	0.21	0.16	1.33	0.20	0.23	0.89

Scenario 14 (best scenario)

Results of Scenario 14

Total biomass (TB) vs. TB(MSY)=158,000 tons



Suggestion from Prager

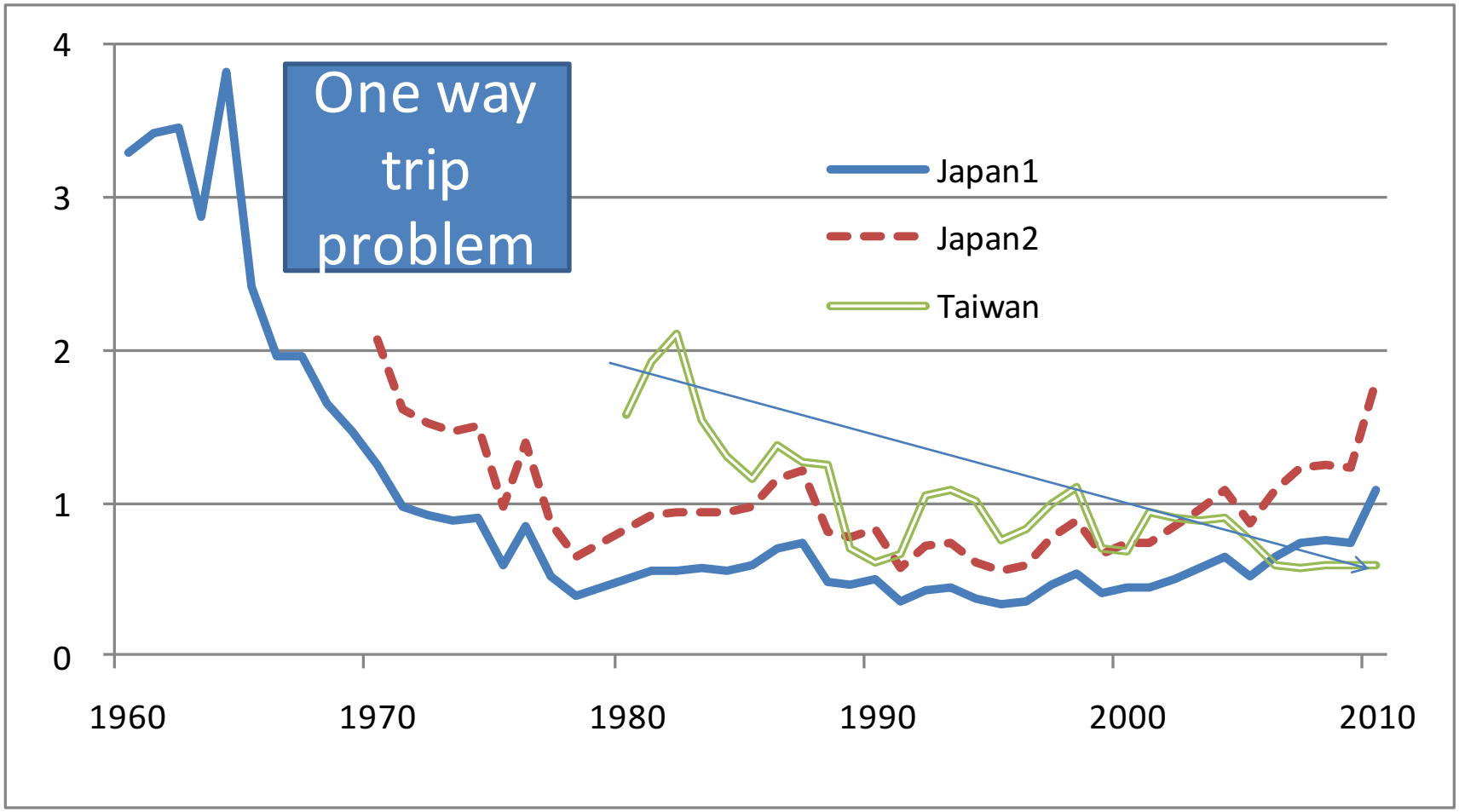
- **From:** Mike Prager
- **Sent:** Wednesday, September 21, 2011 10:35 PM
- **To:** T_NISHIDA (Away)
- **Subject:** Re: ASPIC
- Hi Tom,

  B1 > K can occur when the series starts with a declining abundance. Too technical to explain the reasons for that now.

  I suggest you **fix** (don't estimate) **B1/K** at a series of values to assess sensitivity to this quantity. **Try 0.9, 0.8, 0,7,** and possibly some values in between.

  Regards,
  Mike

STD CPUE(scaled) [available data]

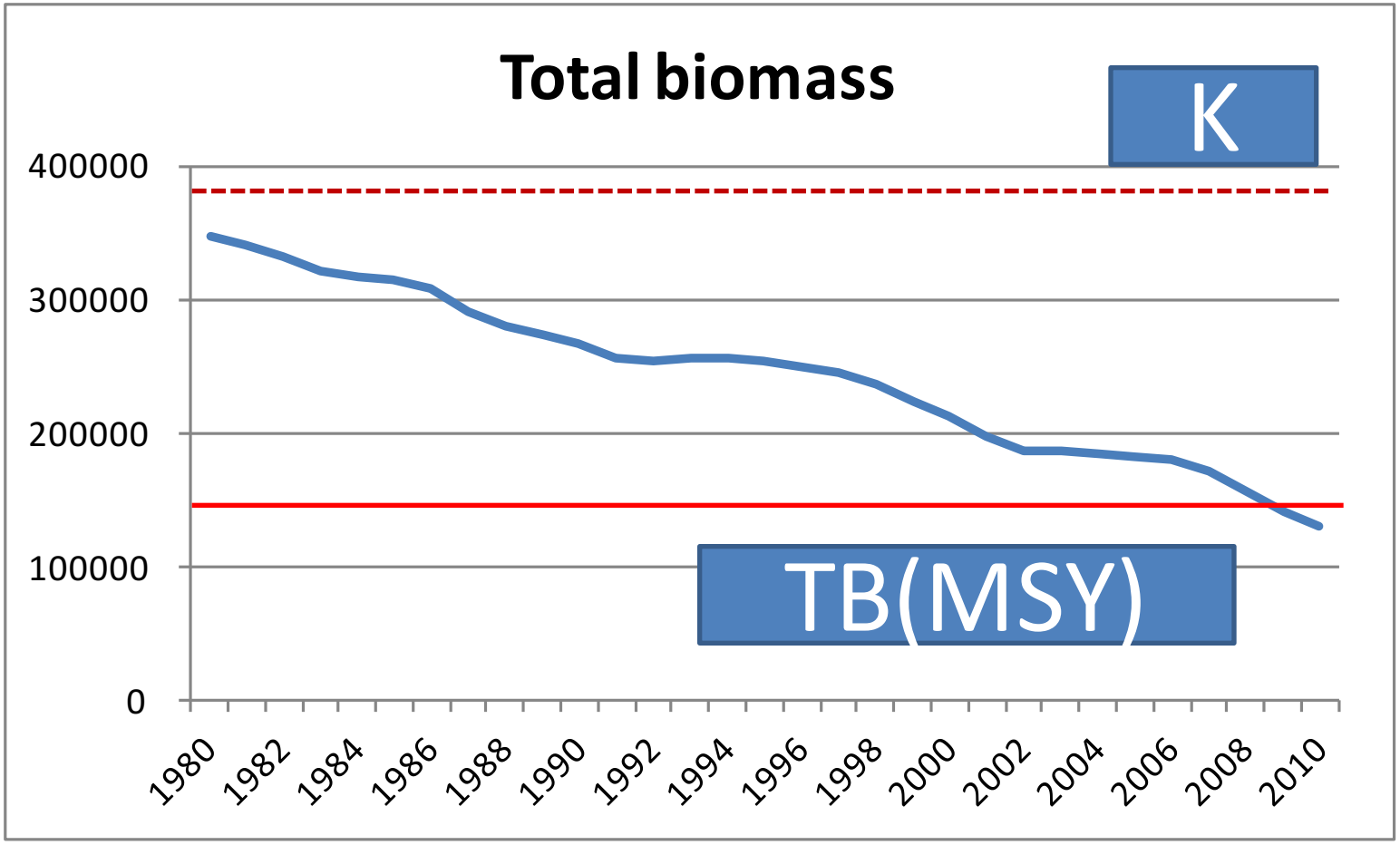


K1/B (fixed) : sensitivity

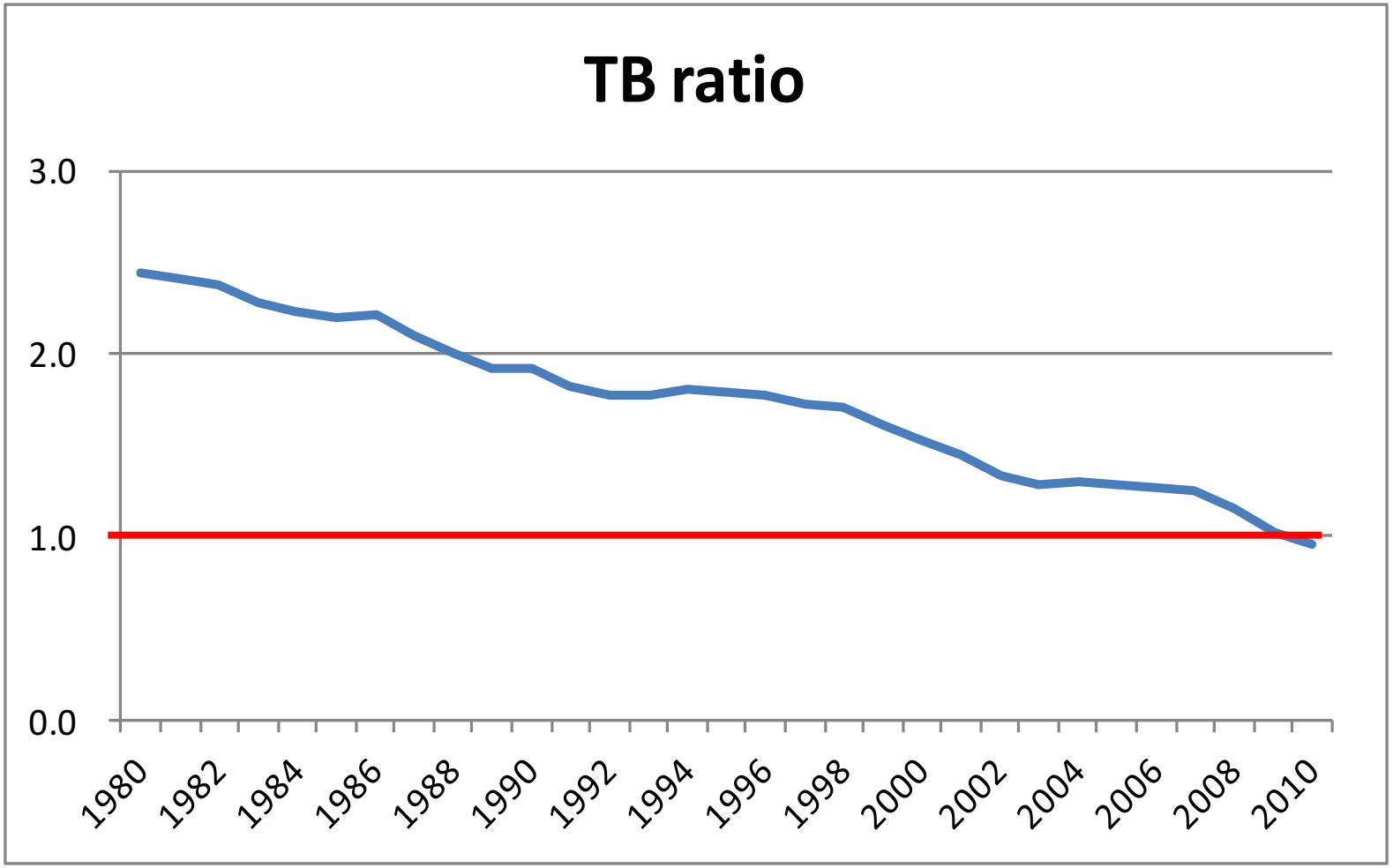
K1/B	R2	MSE	MSY	TBratio	F ratio
0.90	**0.59**	**0.0059**	**29,940**	**0.86**	**1.61**
0.80	NC				
0.70	NC				

Results Scenario 14
(fixed B1/K=0.9)

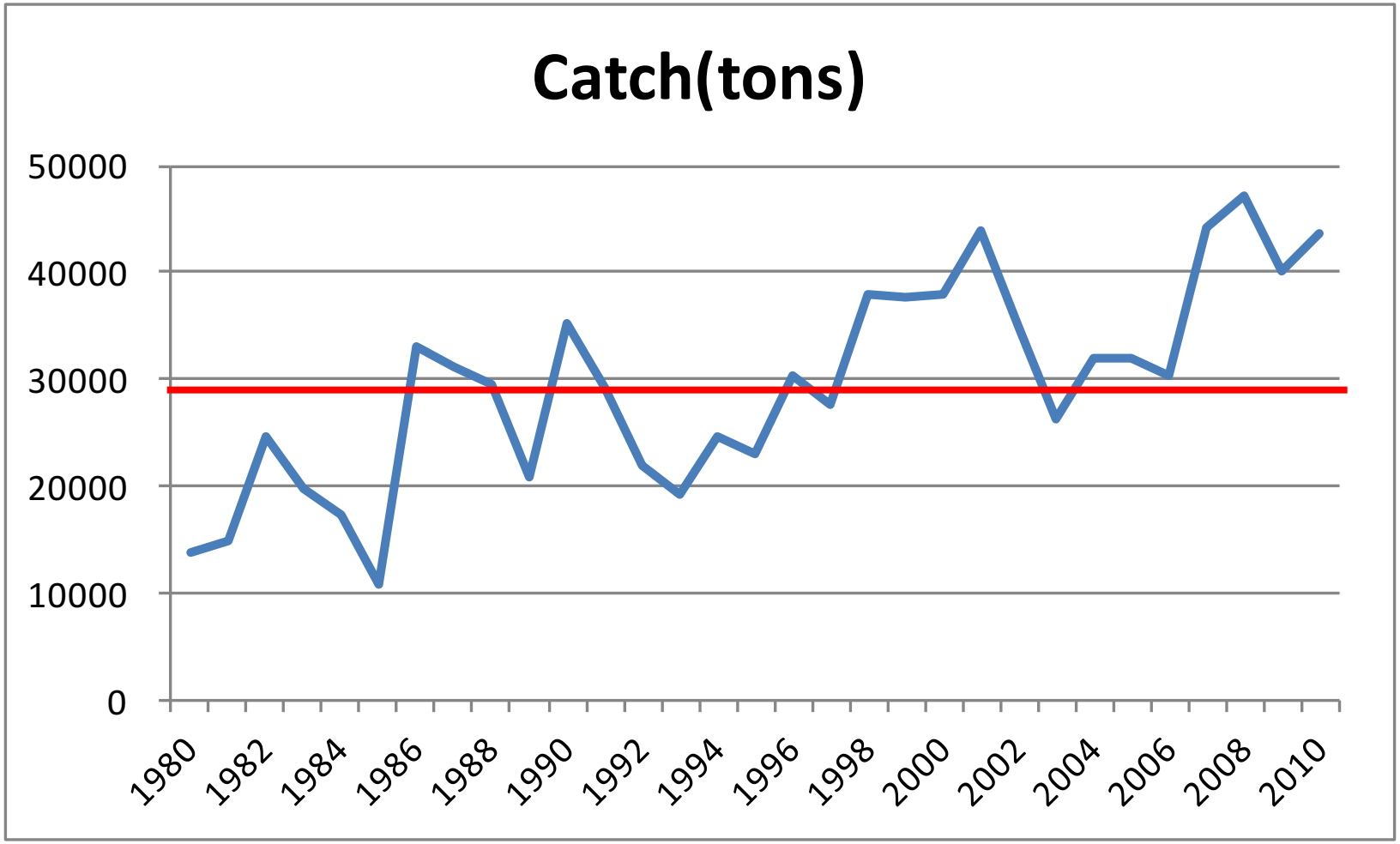
TB vs. K vs. TB(MSY)



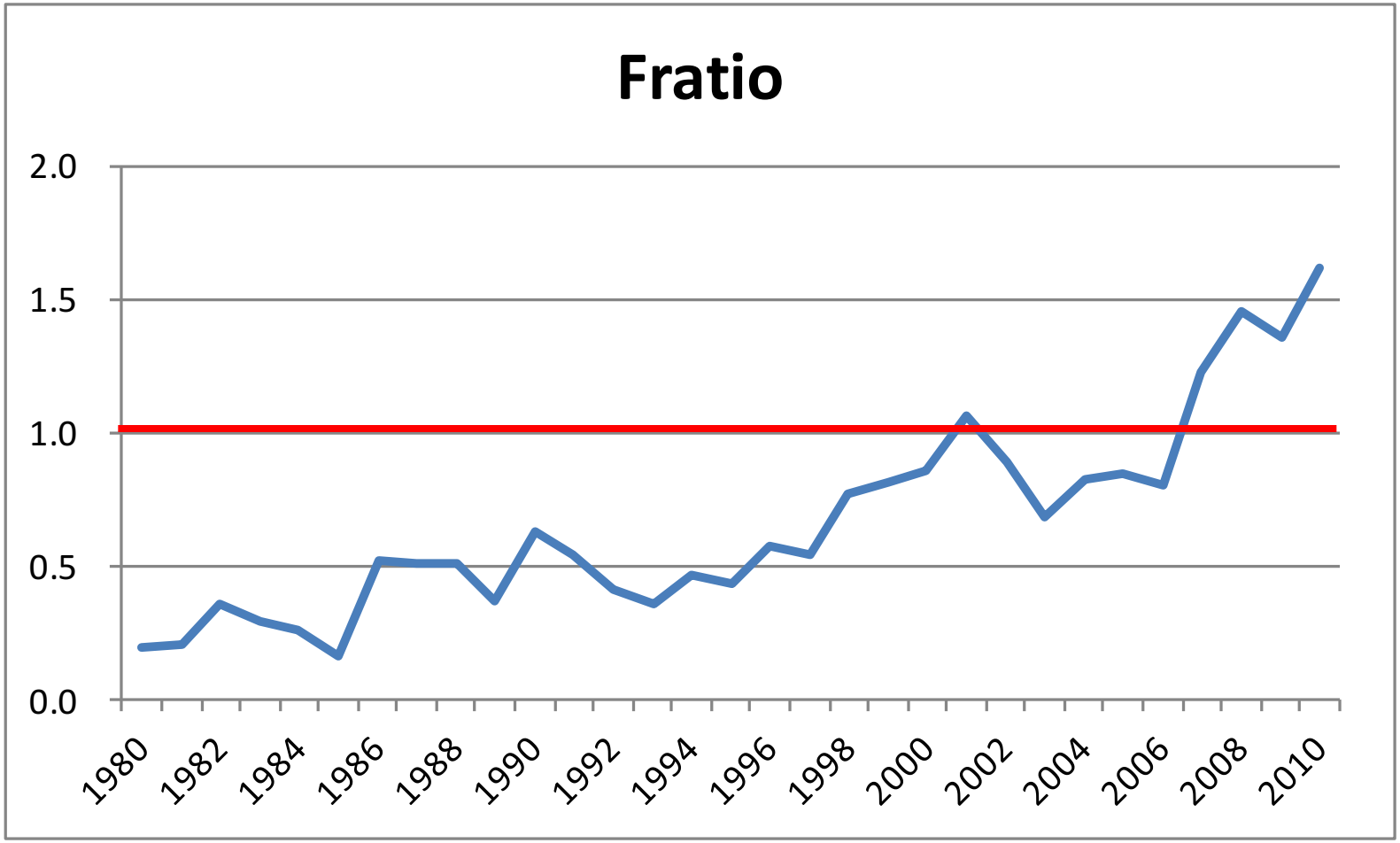
TB ratio


TB ratio
3.0
2.0
1.0
0.0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

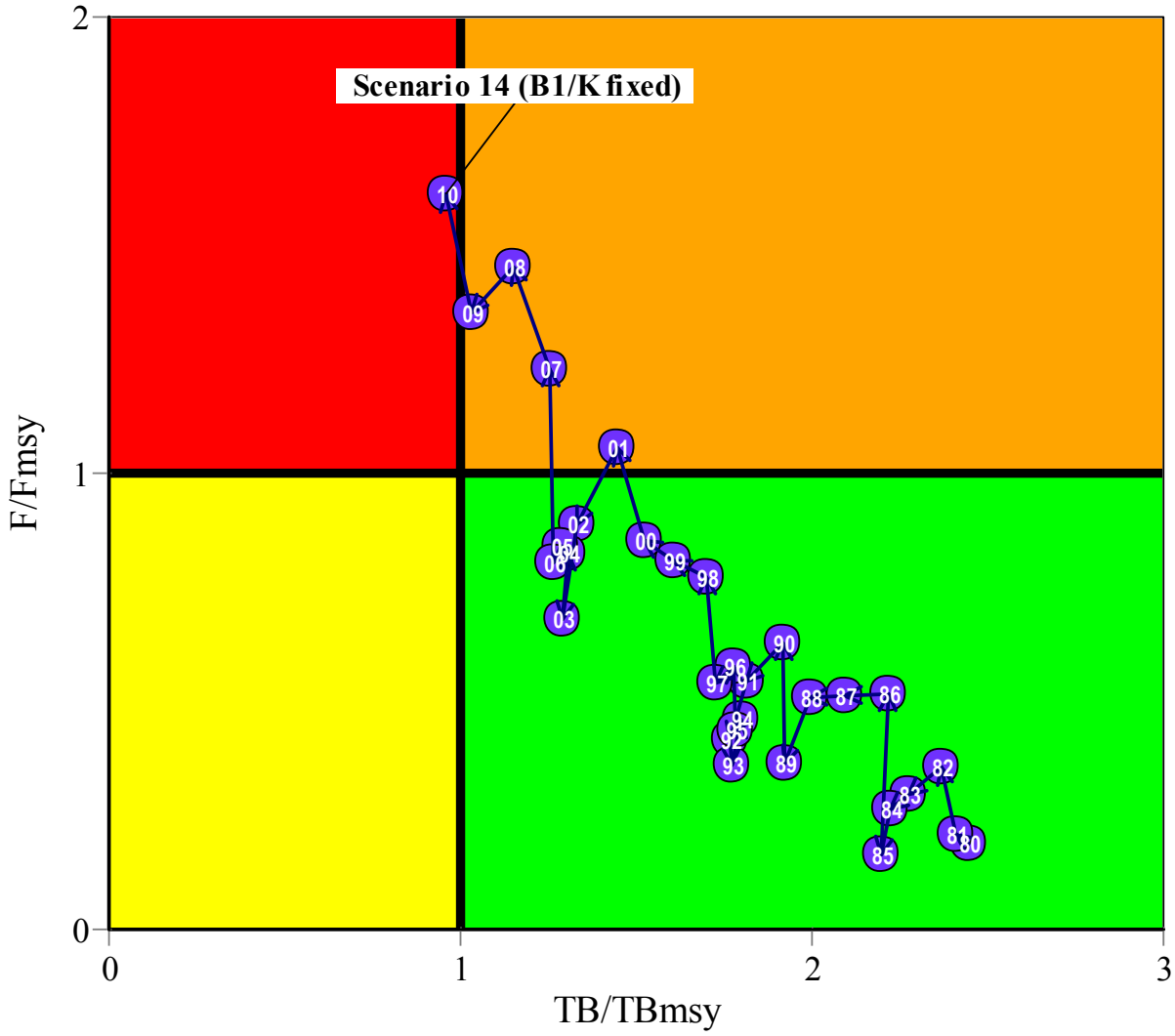
Catch vs. MSY (29,900 tons)



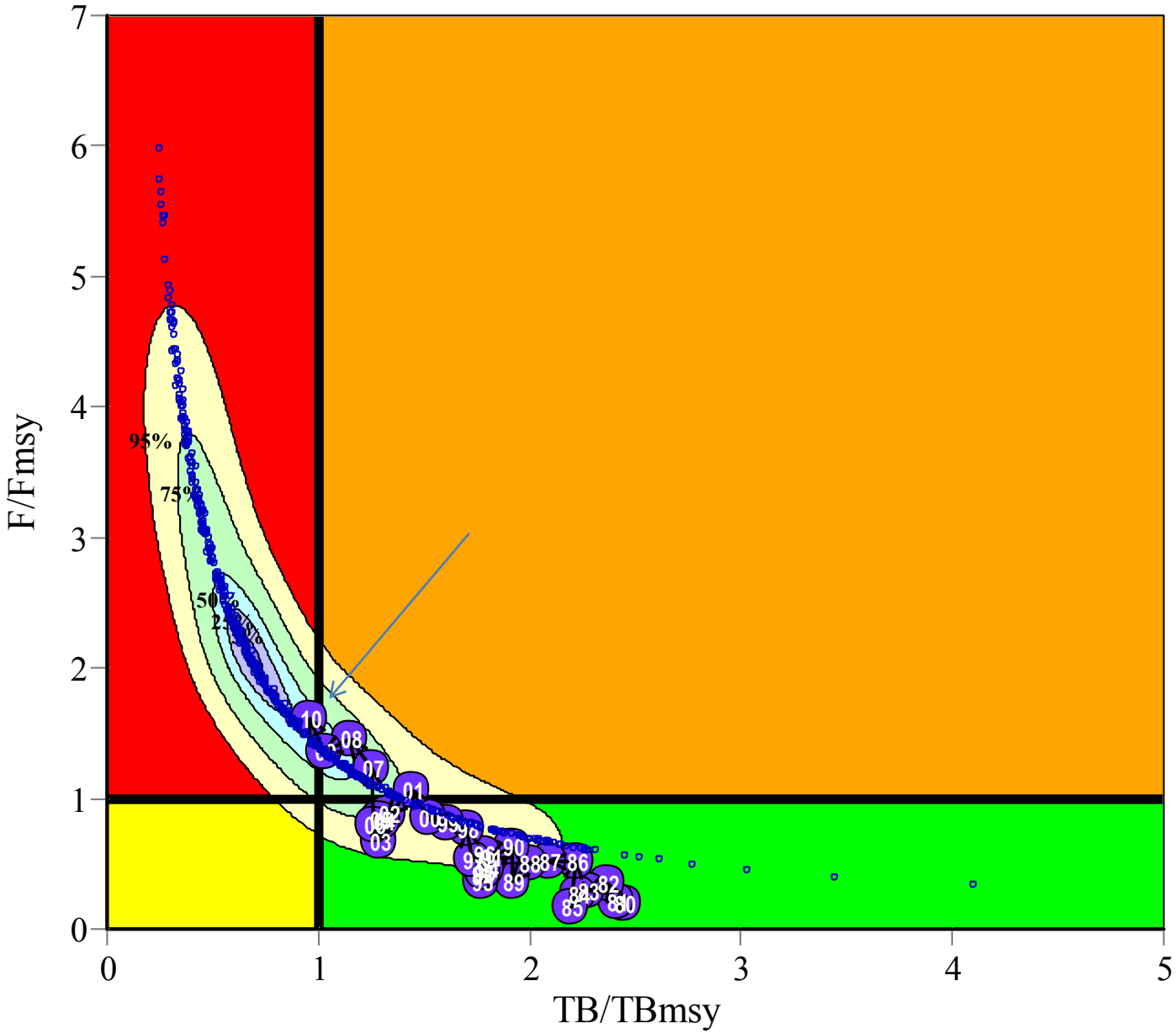
Fratio


Fratio
2.0
1.5
1.0
0.5
0.0
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010

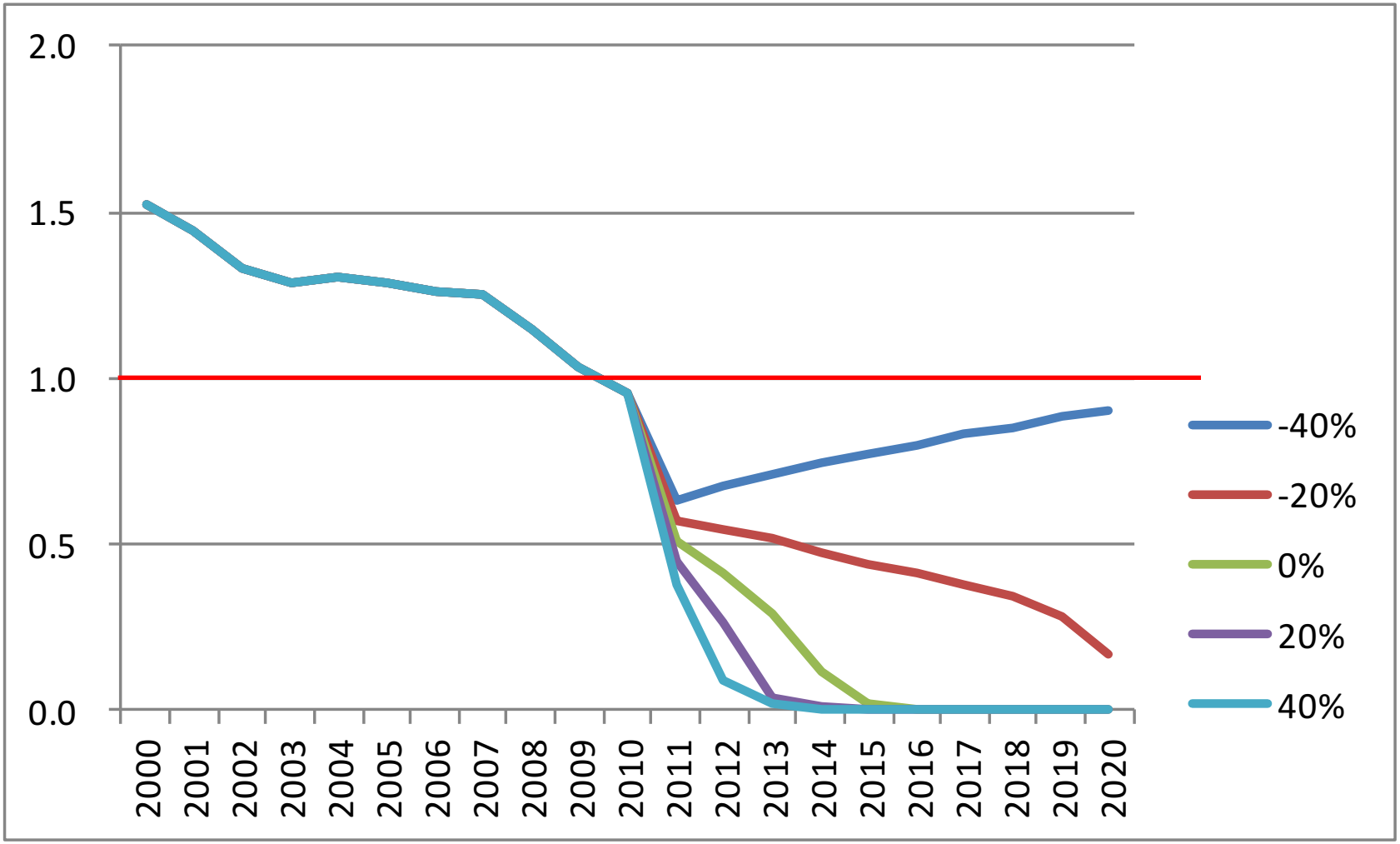
Kobe 1 plot (stock trajectory)



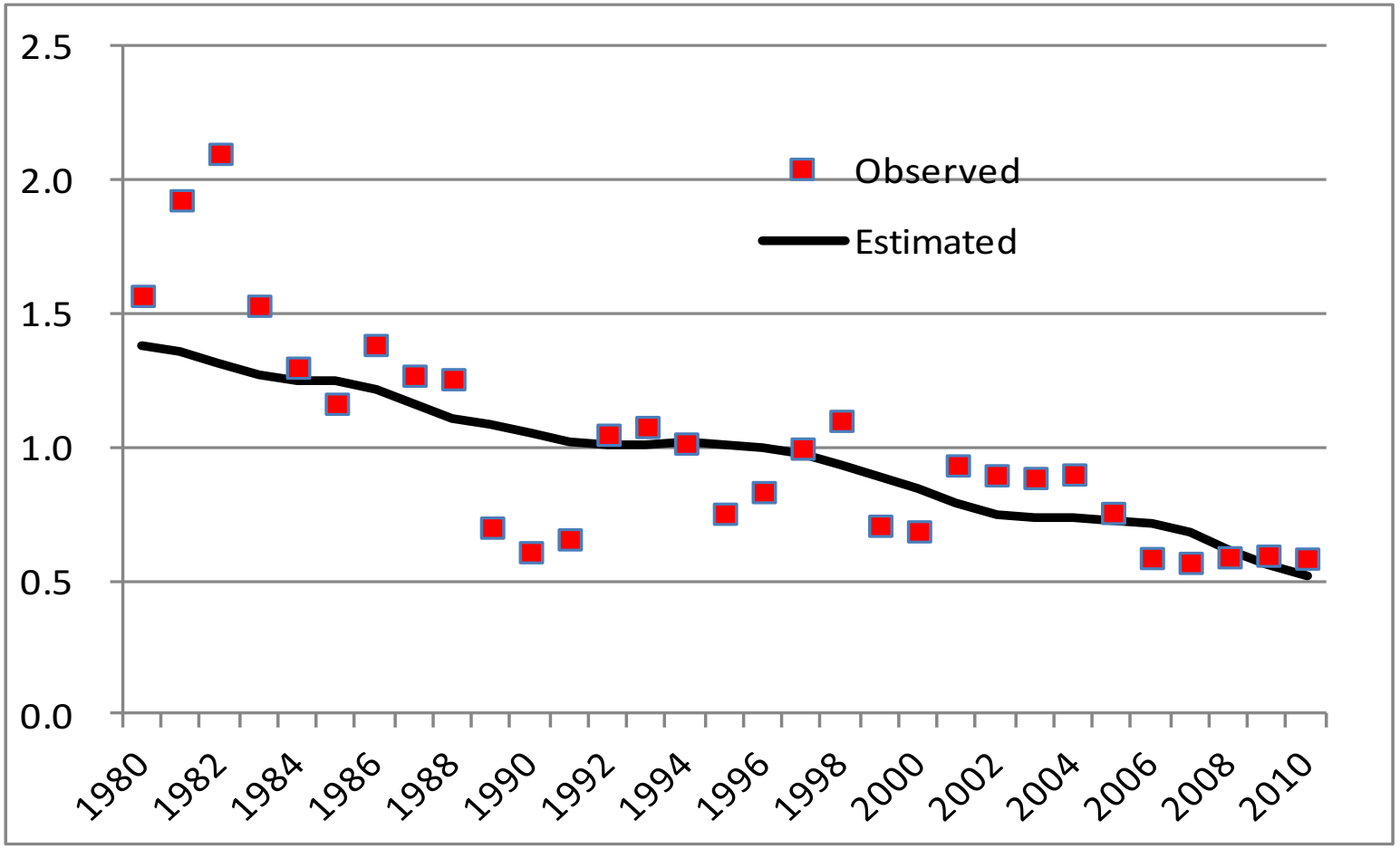
Kobe 1 (stock trajectory with confidence surface)



Future projection TB ratio



Goodness of fitness (residuals)



Kobe plot & risk matrix

5 tuna RFMO recommendation

Kobe I plot (stock trajectory)

Kobe, Japan (2007)

Kobe II Risk matrix

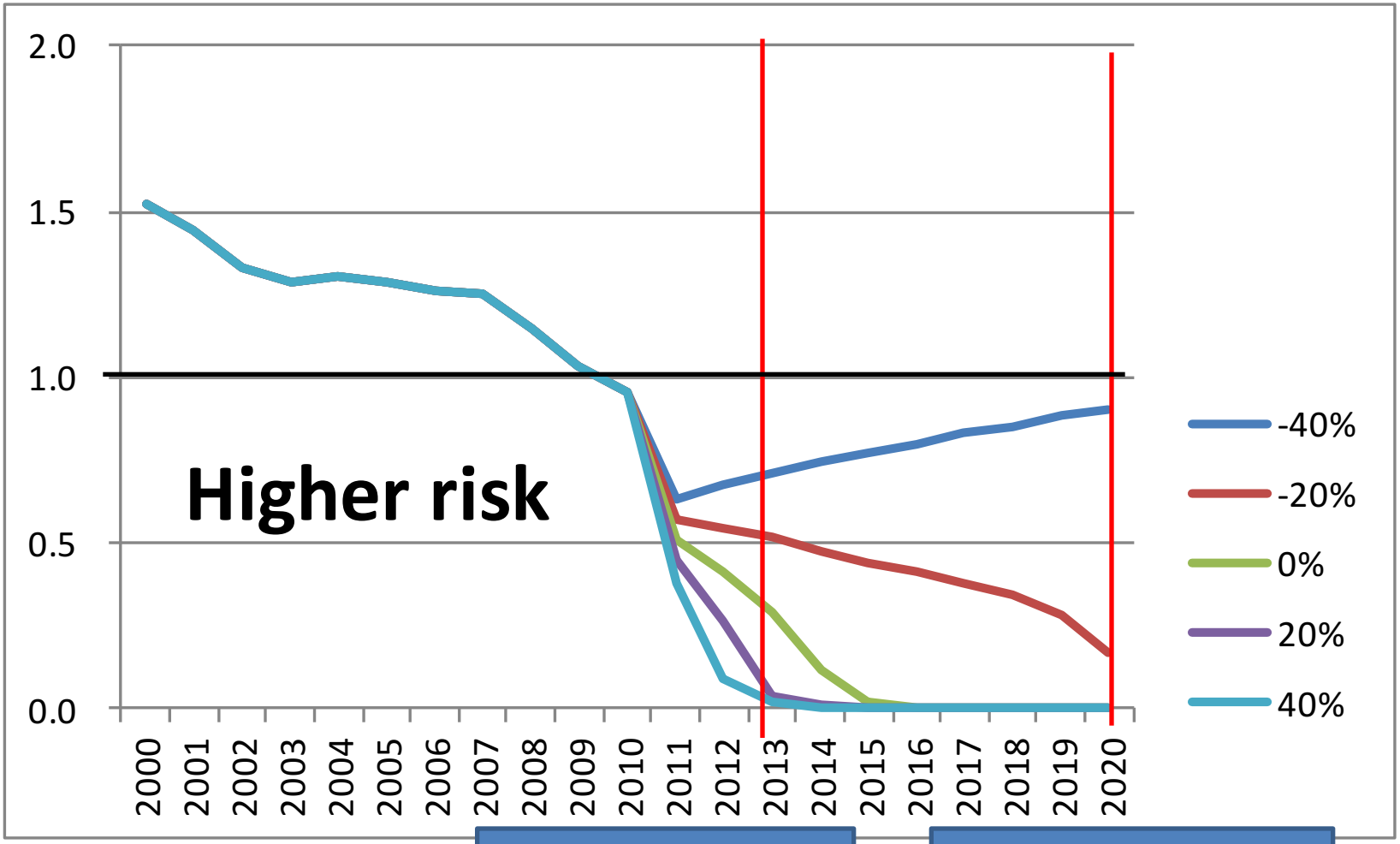
Barcelona, Spain (2010)

Projection and risk assessment (Constant catch scenario)

5 tuna RFMO

TB (total biomass) ratio

Projection of TB (total biomass) ratio (constant catch scenario)(500 bootstrap)



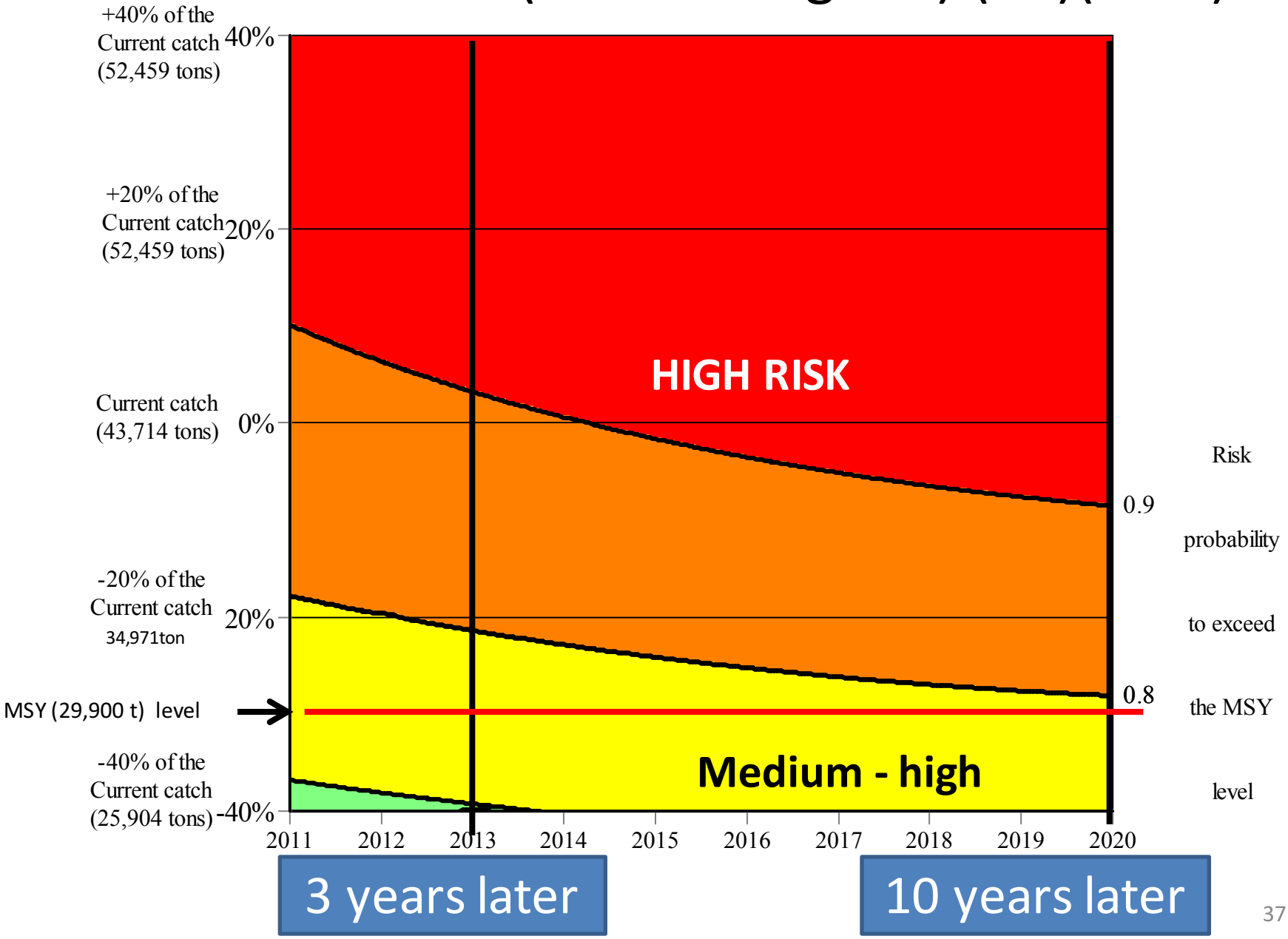
Kobe II : risk matrix (TB) probability exceeding TB(MSY)

Legend		0.9-1.0		0.8-0.9		0.7-0.8		< 0.7		
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
-40%	0.698	0.768	0.762	0.742	0.716	0.704	0.688	0.676	0.664	0.64
-20%	0.722	0.77	0.782	0.794	0.818	0.842	0.856	0.882	0.894	0.912
0%	0.828	0.82	0.84	0.86	0.892	0.918	0.932	0.96	0.974	0.982
20%	0.948	0.944	0.946	0.952	0.954	0.962	0.98	0.988	0.99	0.992
40%	0.988	0.986	0.988	0.988	0.988	0.99	0.99	0.992	0.996	0.996

3 years later

10 years later

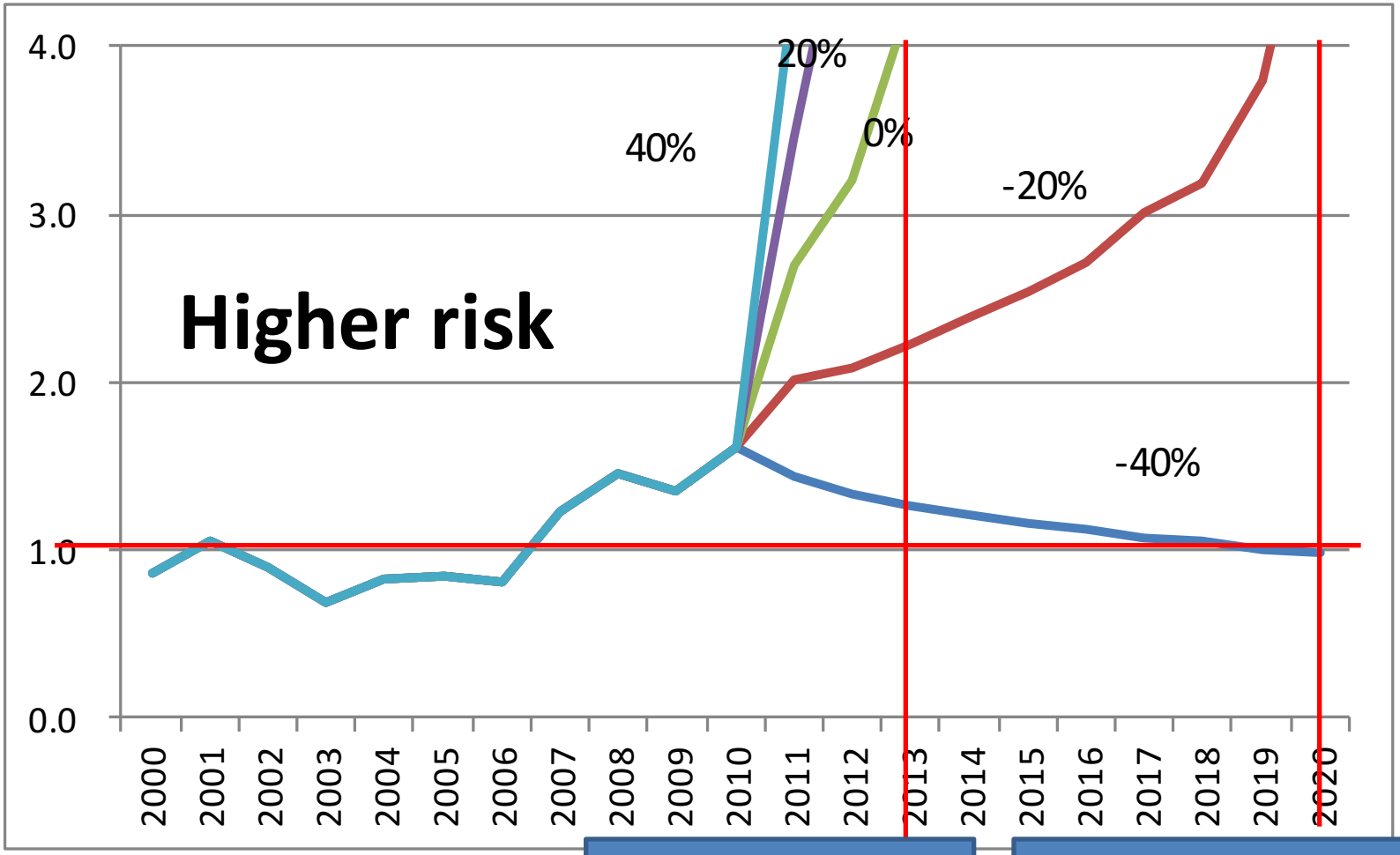
Risk assessment (Kobe II diagram) (TB)(MSY)



Projection and risk assessment (Constant catch scenario)

F ratio

Projection of F ratio (constant catch scenario)(500 bootstrap)



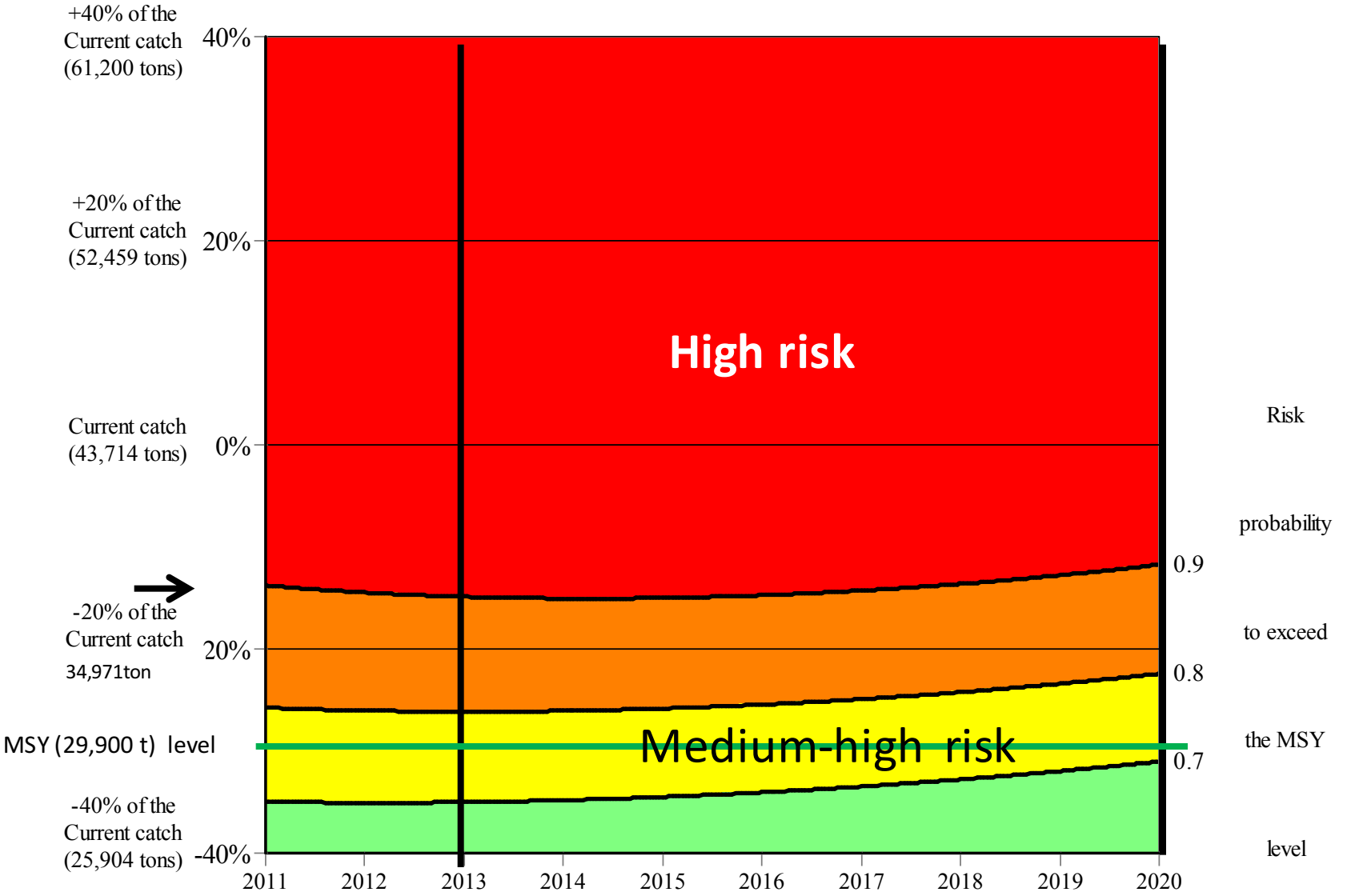
Kobe II : risk matrix (F)
probability exceeding F(MSY)

Legend		0.9-1.0		0.8-0.9		0.7-0.8		< 0.7		
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
-40%	0.678	0.662	0.652	0.644	0.614	0.586	0.558	0.534	0.514	0.48
-20%	0.836	0.856	0.872	0.892	0.908	0.916	0.924	0.94	0.954	0.954
0%	0.912	0.932	0.954	0.98	0.982	0.988	0.99	0.992	0.992	0.996
20%	0.968	0.984	0.99	0.992	0.994	0.996	0.996	0.998	0.998	0.998
40%	0.988	0.992	0.994	0.996	0.998	0.998	0.998	1	1	1

3 years later

10 years later

Risk assessment for F(MSY) (Kobe II diagram)



Discussion

What is the real CPUE trends in recent years ?

increasing or stable trends ?

Taiwan whole IO

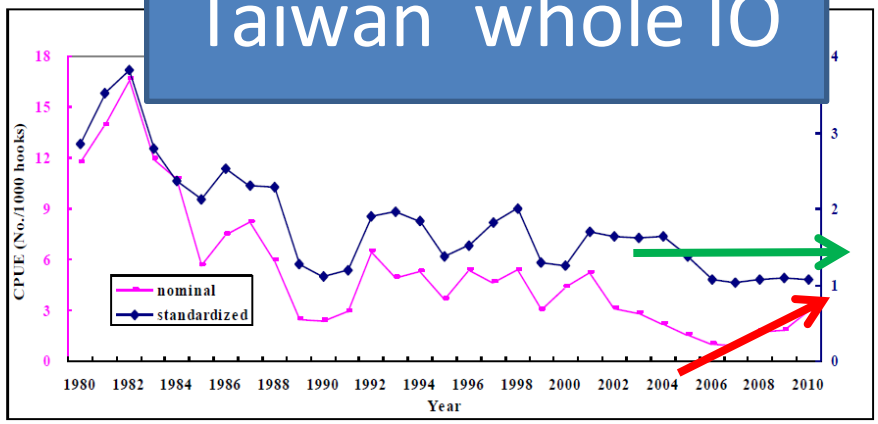
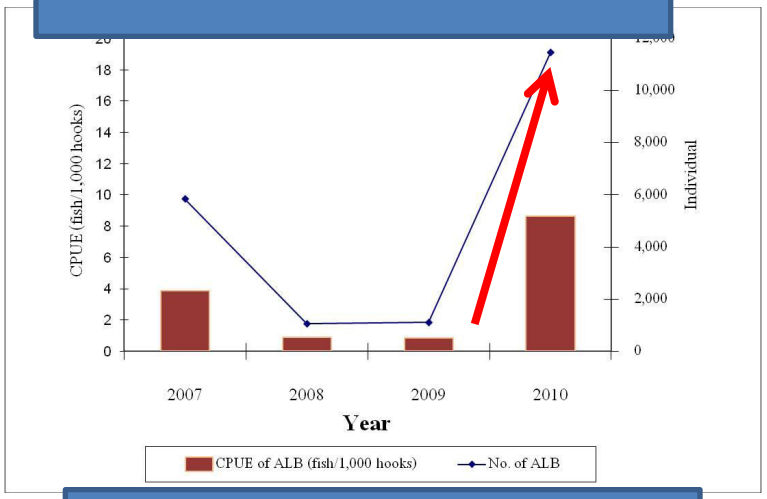
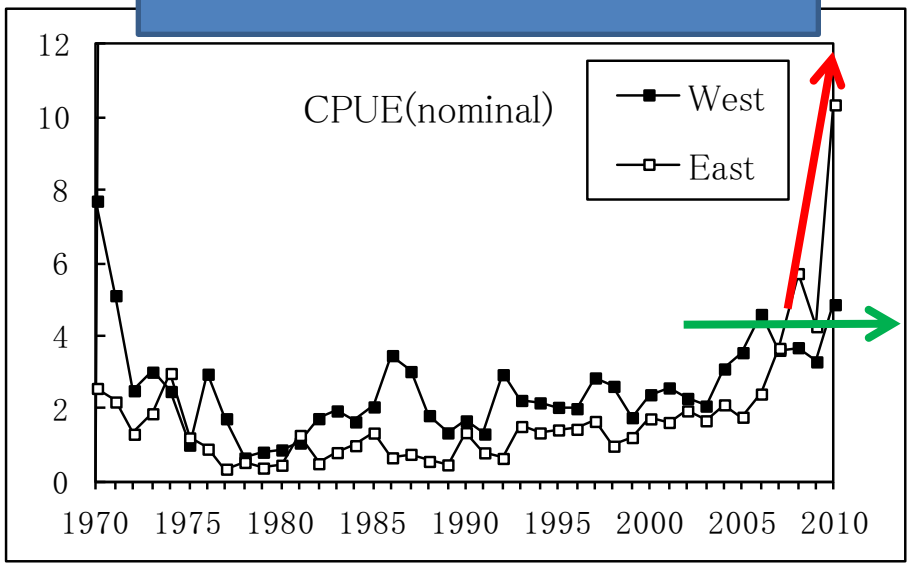


Figure 4. Yearly nominal and standardized CPUE (No/1000 Hooks) trends of Indian albacore based on

Thailand SE



Japan E and W



Korea Whole IO

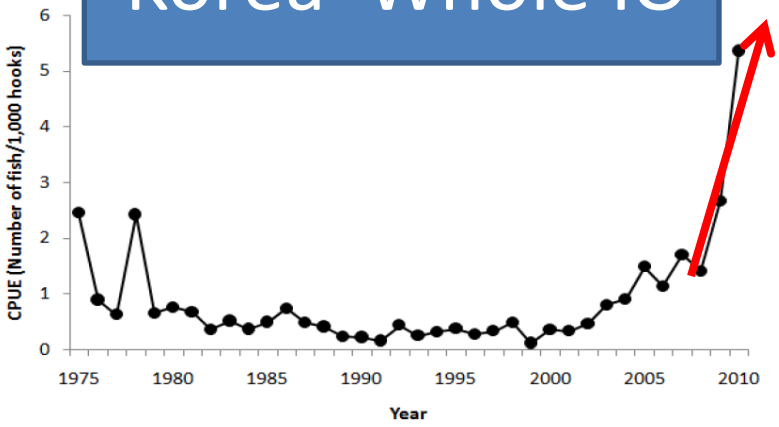


Fig.5. The nominal CPUE of albacore caught by Korean longline vessels.

Probably stable trends why ?

Thailand, Japan and Korea

Very minor catch

SE locally high CPUE trends → true

Taiwan : **majority catch**

nominal CPUE increased but STD CPUE stable

global STD CPUE : stable

Summary

Summary 1 (Japan SSTD CPUE)

JPN STD CPUE vs. catch :not well reflected

No conversion

1st WPTmT (2004)

ACPIC could not get reasonable parameters with Japanese STD CPUE.

Summary 2 (Taiwan STD CPEU)

Taiwanese STD CPUE vs. Catch (1980-2010) reasonably reflected

ASPIC converged

2nd WPTmT (2008) only Taiwan STD CPUE reasonable parameters

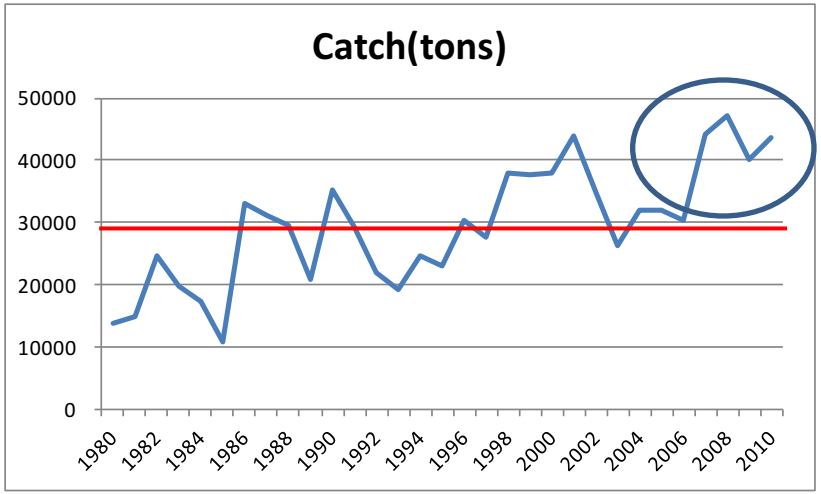
Summary 3 (Stock status)

Recent large catch (more than 40,000 tons)

> MSY(29,900 tons)

10,000 ton higher !

Catch vs. MSY (29,900 tons)



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Summary 3 (Stock status)

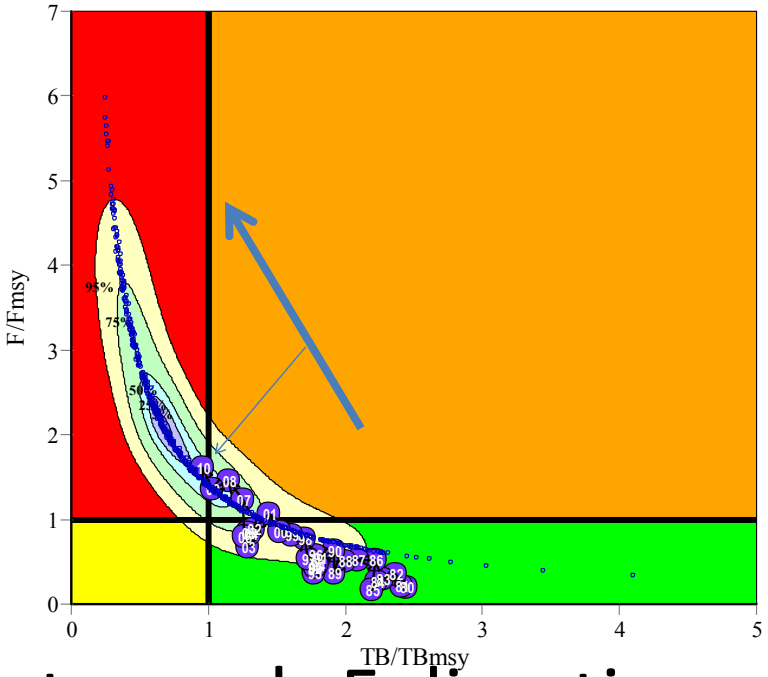
F(MSY) =1.61

TB(MSY)=0.86

Both are beyond MSY

(red zone)

Kobe 1 (stock trajectory with confidence surface)



F ratio is more serious

Confidence surface more towards F direction

Summary 4 (Risk assessments)

TB(MSY) in 10 years

➔ Current catch: 85% to exceed TB(MSY)

➔ MSY level : 80% to exceed TB(MSY)

F(MSY) in 10 years

➔ Current catch: 80%< to exceed TB(MSY)

➔ MSY level : 70 % < to exceed TB(MSY)

Conclusion

- Catch & F :

  ➔ both should be far below MSY levels

  MSY= 29,900t

  F (MSY)=0.209

Table x. Aggregate Indian Ocean Stock status summary table (ASPIC)

Management Quantity	Aggregate Indian Ocean
Most recent catch estimate (t) (2010)	43,714
Mean catch over last 5 years (t) (2006-2010)	41,076
MSY (1000 t) (80%CI)	29.9 (33.7-29.3)
Current Data Period	1980-2010
F(Current)/F(MSY) (80% CI)	1.61 (1.19-2.22)
B(Current)/B(MSY) (80% CI)	0.89 (0.65-1.12)
SB(Current)/SB(MSY)	NA
B(Current)/B(0) (80% CI)	0.39 (NA)
SB(Current)/SB(0)	NA
SB(Current)/SB(Current, F=0)	NA

Paper with the abstract (final version)

- To be ready by today…….