Day 3 [MENU]　　PP (Revised)

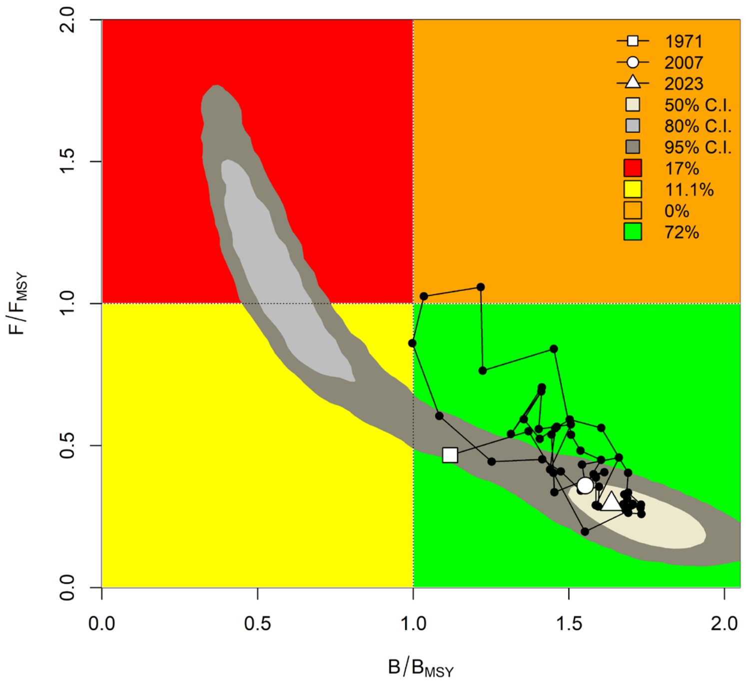
- Remaining (left over) issues (Day 2)
- Summary (Day 2)
- Outline of the whole Report (additional left over point)

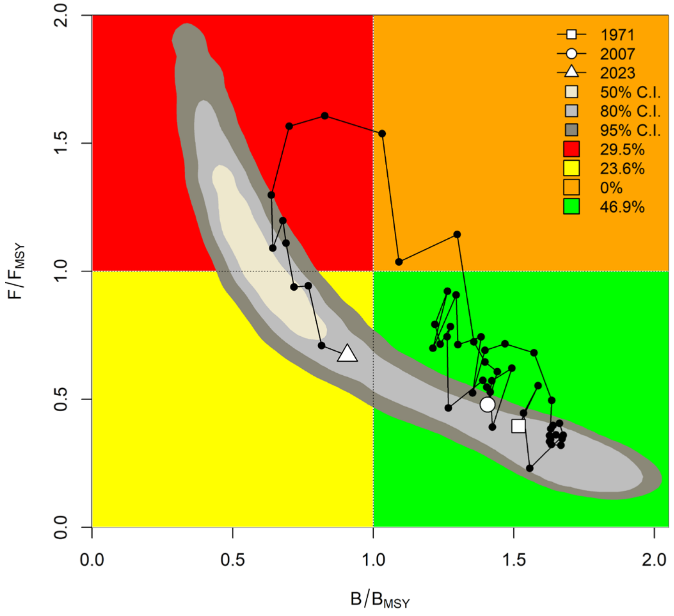
****

- Short mackerel　（Day 3）

Weerapol san question

- We will not accept strange Kobe plots (base case) in Selection form (5) (see the 1st example below).
- But in sensitivity Selection form (14) ➔ no diagnostics for Kobe plot.
- We will add in Selection form (14) ➔ we will reject strange Kobe plot in the final Selection form (14)➔(15).





Kobe plot issue (Prof Wang)

We often see strange (crazy) Kobe plots due to..

⬇

NG retrospective analyses

No Convergence & other problems

⬇

Estimation problems (JABBA)

We will reject such runs

Installation problem (Professor Wang)

Causes may not by

R version

Fire work(security level),

PC widow region (Japan, Thailand etc.)

⇩

(maybe) Some of the Thai PC and its system set up)

As all other country OK (Japan, Taiwan, Sri Lanka) (total 15 users)

⇩

Will be difficult to identify causes

So, what to do (future)

Core scientists

Nipa, Puy and Weerapol➔ PC Not working

⇩

JAM (PC) ?

⇩

Try check other PC ➔ if OK, we can work !

Otherwise …. Not possible to work

⇩

(last option) [MENU] buy PC (Japan) (English window)

Provide

Question Selection form (14)

Participants can work without hardcopy?

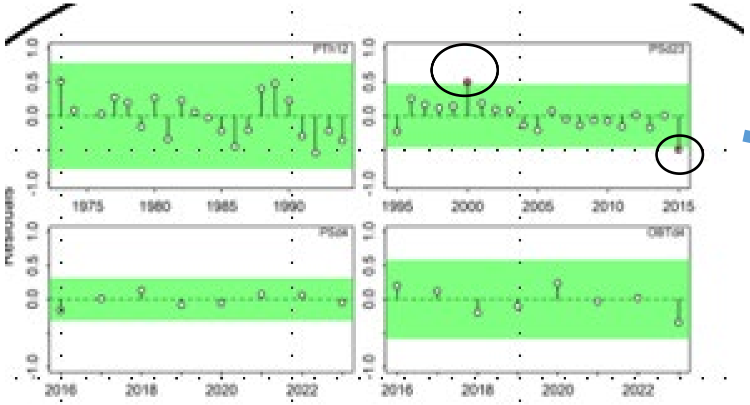
⇩

If so, they can use results (PC)

(no need hard copy)

Some notice
Selection form (14)

Total NO
of red band
=0



2.1 CPUE residuals	
95% CI band	
No of Red band Auto-correlation? No is better	total # of outliers less # is better
# 13 (p.3)	
5	6
0	2
0	2
0	1
same	0.7s

Total # of
outliers
2

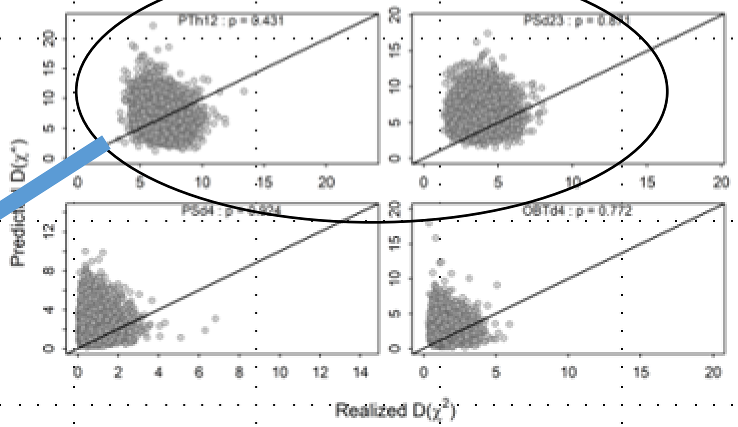
For this computation Use sheet (4)

See next page

el Fit	
2.3 Posterior Predictive Check (PPC)	
Average p values (compute yourself)	Visual inspection
Use the 5th sheet to compute. Closer to 0.5 is better	Ball shapes located in center are better (how many #?)
# 12 (p.4)	
8	9
(4)	
0.772	2ok
0.791	2ok
0.796	2ok
0.5s	same

Summary of results

MODEL FITS
(#12) (page 11) Posterior Predictive Check (PPC). p should be 0.2<p<0.8 and closer to 0.5 is better fit. *(Users: compute Ave.*



diagnostics:						Less # is better	less # is better	better fit	Closer to 0.5 is better	are better (how many #?)	(B & F ratio) less better	similar patterns.		smaller better
	Output # (page#)	# 20 (p.3)				# 13 (p.3)		# 10 (p.3)	# 12 (p.4)		# 42 (p.3)	# 40 (p.3)	# 43 (p.4)	
	diagnostics #	1	2	3	4	5	6	7	8	9	10	11	12	13
	Refer to sheet # how to do								(4)		(5)		(6)	
Sensitivity	0.5s										1			
base case	0.6s													
Sensitivity	0.7s													
decision														
Comments & decision	(1)													
	(2)													
	(3)													

(Note) *Referred by "Good practices for surplus production models" by Kokkalis et al (2024)*

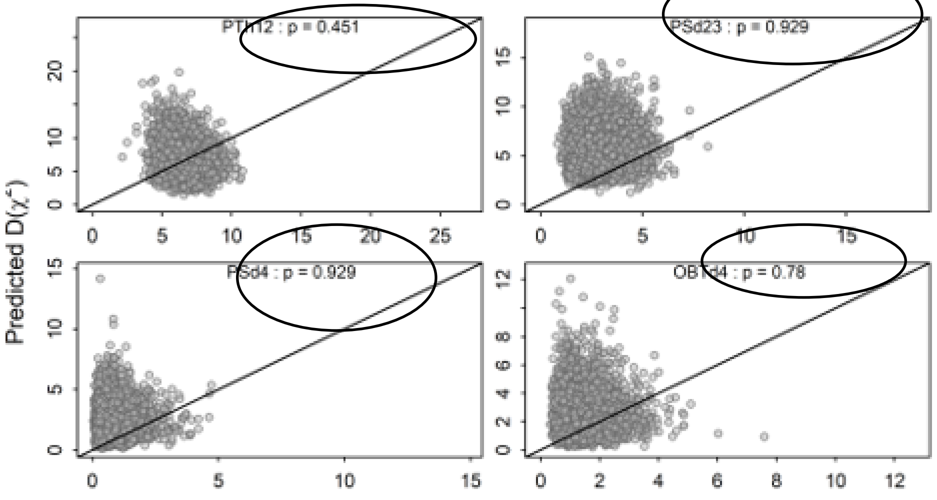
(3)Selection form(14)(scenario) (4) #12

準備完了

This is an example of Swordfish (SW

Model		
	p value (PPC)	
	Schaefer	Fox
fleet 1	0.980	0.990
fleet 2	0.612	0.670
fleet 3	0.971	0.960
fleet 4		
fleet 5		
fleet 6		
average	0.854	0.873

Scenario			
	p value (PPC)		
scenario #			
depletion	0.5s	0.6s	0.7s
fleet 1	0.451	0.500	0.519
fleet 2	0.929	0.948	0.947
fleet 3	0.929	0.916	0.915
fleet 4	0.780	0.799	0.79
fleet 5			
fleet 6			
average	0.772	0.791	0.793



Enter these numbers then average is computed automatically

Then copy & paste to the previous Page.

(4
0.772
0.791
0.796
0.5s

See sheets (4)

In the final selection (JAM san's question)

If count is tie (same) for 2 scenarios (final selection)

How to decide the best one?

⇩

(for example)

6 (same) counts for both 0.4s & 0.6s, 3 for 0.5s and 3 for same

⇩

How to select 0.4s or 0.6s

Check **(1) Retrospective patterns (Visual inspection)**

(2) Estimated r (see next page)

Select better one

Check estimated r compare to the values in FishBase (FAO) or other sources if median values is 0.50 (FishBase) and 0.45 (0.4s) and 0.7 (0. 6s)

➔ 0.4s is close to 0.5 ➔ 0.4s better ➔ 0.4s is the best scenario

ESTIMATED PARAMETER VALUES

(#21)

(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	677,990	524,327	883,533
r	Pop. growth rate	0.45	0.34	0.60
B0/K	Depletion (EST)	0.43	0.31	0.62
sigma.proc	Estimable process VAR	0.05	0.03	0.09
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.23	0.17	0.30
TBmsy	TB at MSY (t)	338,995	262,163	441,766
MSY	MSY (t)	76,619	69,781	84,034
Catch(2023)	Current catch	41,219		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(1971)/ K	Depletion (OBS)(start)	0.44	0.30	0.63
TB(2023)/ K	Depletion (OBS)(last)	0.36	0.22	0.55
TB/TBmsy	TB ratio	0.71	0.44	1.11
F/Fmsy	F ratio	0.76	0.46	1.30

We might add r to Selection form (14)

It will be Selection form (16) as we will add Kobe plot＋r

Will be more strict diagnostics (screening) ➔GOOD

Thanks for your suggestion

Summary(Day 2)

- JABBA reliable, practical & useful ➔ DOF can use
- JABBA Good standardized CPUE ➔key for successful JABBA
- Assessment results by JABBA (SU) ➔ publication (SEAFDEC)
- Annual species composition can be used to estimate SU catch
- 3q by period important for unbiased JABBA
- JABBA scenario approach ➔ robust & reliable
- New CPUE standardization with 7 Covariates ➔useful ENV, category
- Need to learn whole process (inc. data process)

➔ online work for publication

Outline of the whole Report

Start 11:10 AM

2nd workshop
Short mackerel Working Group (SM WG) 152

Sock assessment by JABBA
(1971~2023)
Trail & Discussion

SM WG

1. Introduction
2. Data
3. Catch & Effort
4. Selection of good CPUE for JABBA
    - 4.1 Nominal CPUE
    - 4.2 CPUE standardization
    - 4.3 Selection of good CPUE
5. JABBA
    - 5.1 Outline
    - 5.2 Implementation
    - 5.3 Let‘s try our SM data & comparisons with TB model

6. Practice & Homework
    - 6.1 JABBA
    - 6.2 CPUE standardization
    - 6.3 data process

7. Discussion, Summary and Future plan

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1. Introduction

SM WG (work plan)

Trial [MENU]

Presentation ➔ discussion

➔ practice ➔ finalize ➔ publication

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2. Data

Change of Catchability
Important topic before work

Weerapol san presented the situation (Day 2)

q is very useful for JABBA
(Bluetooth Lizardfish)

Short mackerel also try in the same way

Consideration of q catchability in Thai Fisheries for CPUE standardization & JABBA runs（DOF/Weerapol）

Thai fisheries and corresponding q (1960~2023)			
#	period	Development (changes) of Fisheries affecting q (catchability)	Assignments of q for JABBA (Short mackerel & Lizardfish)
q1	1960~1974	● Initial development Thai Fisheries ● Expansion from coastal to offshore fisheries	● q12 (1971~1994) (n=24). Because q1 (1971~1974) is only for 4 years, combined q12 will be used.
q2	1975~1994	● Expansion of large trawl fisheries to neighbor countries (sharp catch increase) ● Fisheries are limited to EEZ	
q3	1995~2015	● Both Thai & Foreign vessels operated in Thai EEZ ● Mix operations in both open sea & EEZ	● q3 (1995~2015) (n=21)
q4	2015~2023	● Establishment of strict management measures (effort limit, MPA & others) ● Change of data collection & report systems	● q4 (2016~2023) (n=8)

Why we need different q (same gear) (long period)? Simple example

(1) SU CPUE OBT (1971~1994) (before) in 1 hour ➔ 10Kg

(2) SU CPUE OBT (2016~2023) (current) in 1 hour ➔ 20KG

Under same biomass

(2) can catch 2 times higher than (1) in 1 hour

➔ Because gear equipment improvements

Thus, in stock assessment,

we need 2 different q (same fleet)

or use 2 different gear OTB1 & OBT2

Different meaning of q
➔ important for another reason

For Example,

If the strong regulation started in 2000

Before & after 2000 ➔ q are different (sudden decrease)

Difficult to adjust

Use 2 different q before & after 2000 (q1 & q2)

Like 2 different fisheries

CPUE standardization & Stock assessment

2 different of q for different data

Another example if 1995 data collection & process changes

It is useful to use 2q (before & after 1995)

JABBA for this time

Same example (Carp WG)

In 1995 data collection system change ← same as Marine Fisheries ?

We will apply 2 q → JABBA (future)

Some different approach (example in IOTC)

LL 1950-2023 74 years data ➔ q certainty heterogenous

No clear knowledge of clear-cut year for q (unlike DOF)

They use Bank interest method (compound system)

If q will increase by 1%

q (year i)=q(1 in 1950) X $(1+0.01)^i$

q(2023)=1x$(1.01)^{74}$ =2.1 (2.1 times increased)(Bias)

CPUE standardization will incorporate this and use standardize q

Other factors affecting q ➔technological evolutions

Bird Rader, echo sounder, sonar, navigation system,
gear development, Prediction of fishing grounds (HSI*),
Satellite system, oceanographic & weather conditions

***Habitat Suitability Index (HSI)**

So many evolution

Standardize (same) q important (CPUE & SA)

Many ways to adjust

➔ cut-off, compound, ad hoc

Data catalog 53 years

Important Task (IPTP) (RFMO) Why?

Short mackerel (GOT) (area 1~5) (Catch and Effort data)					
q catchability (refer to the text)	Source	Statistical division			Research (Port sampling)
	Catch	tons			
	Effort	Refer to the text			
	Covariate (CPUE standardization)	Year and area		Year, MO and area	
	Gear compositions	PS (55%) + Mackerel Gillnet(22%)+OTH(23%)			
q1 (1960-1974)	1971	(1) (q1234) CPUE standardization (1971~1994)	(2) (q12) CPUE standardization (1971~1994)		
q2 n=24	→ 1994				
q3 n=21	1995 → 2015			(3) (q34) CPUE standardization (1995~2023)	
q4 n=8	2016 → 2023				(4) (q4) CPUE standardization (2014~2023)

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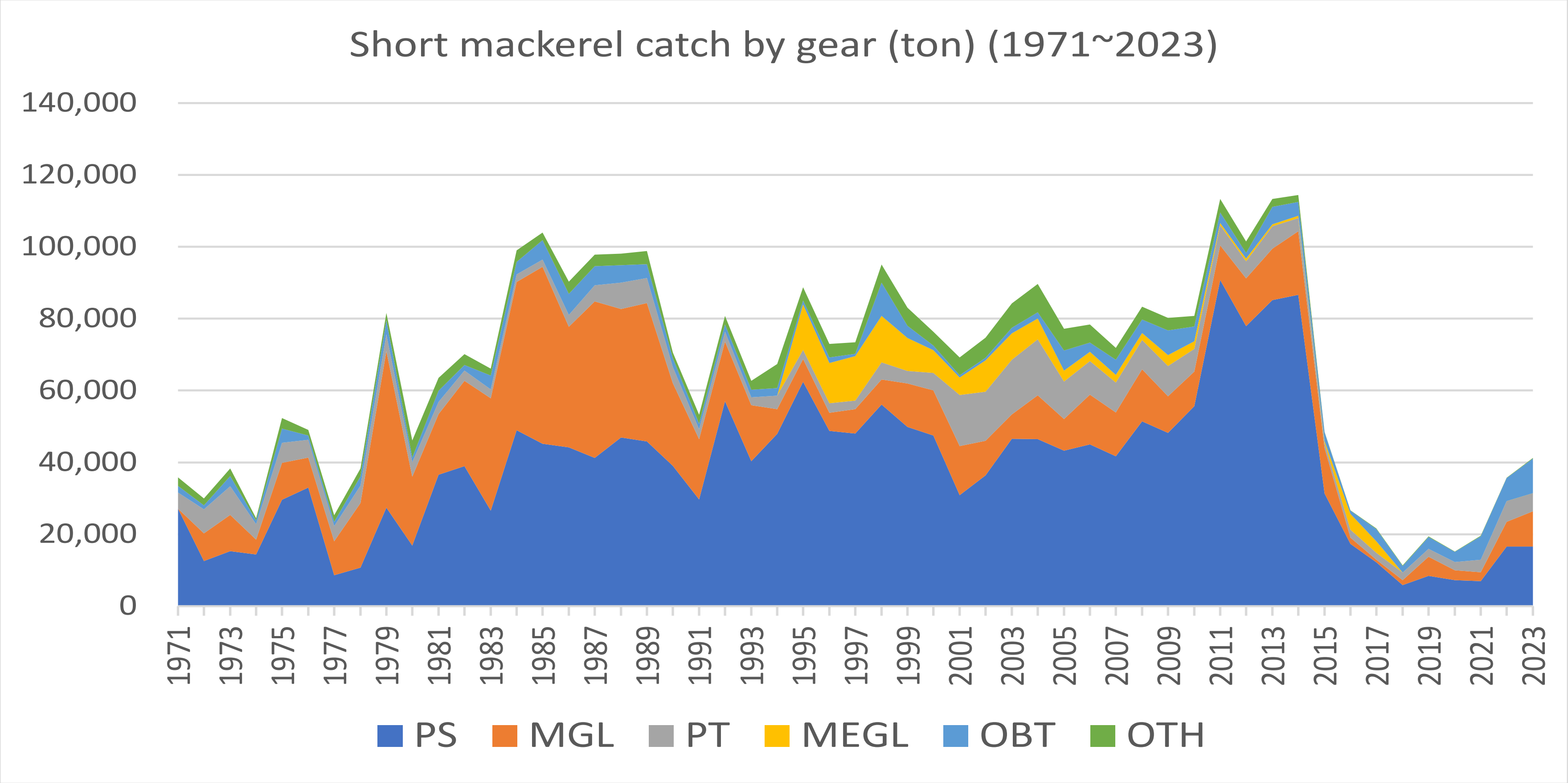
3. Catch and Effort

Catch (1971~2023)（Statistical Division）

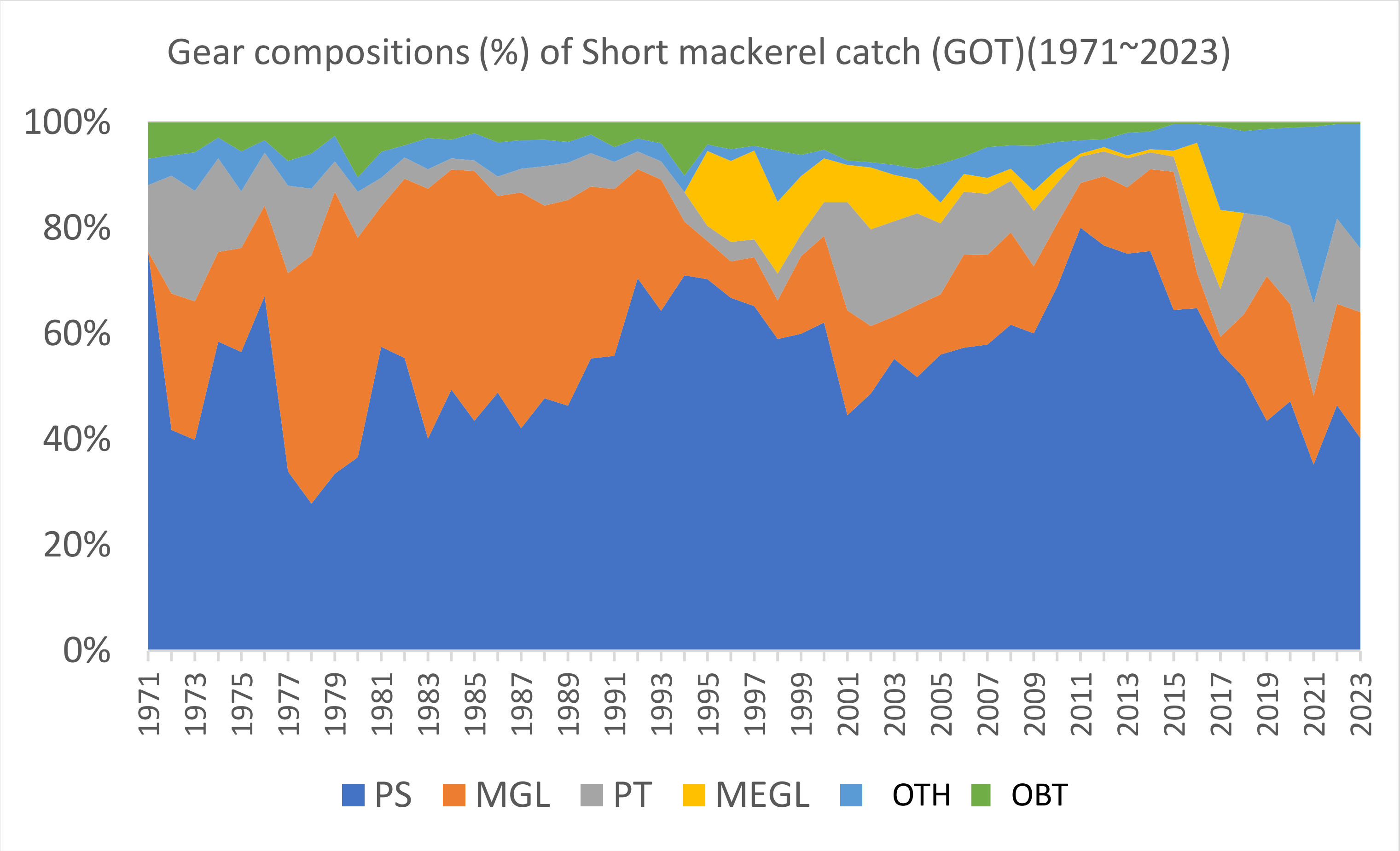
2 major gears

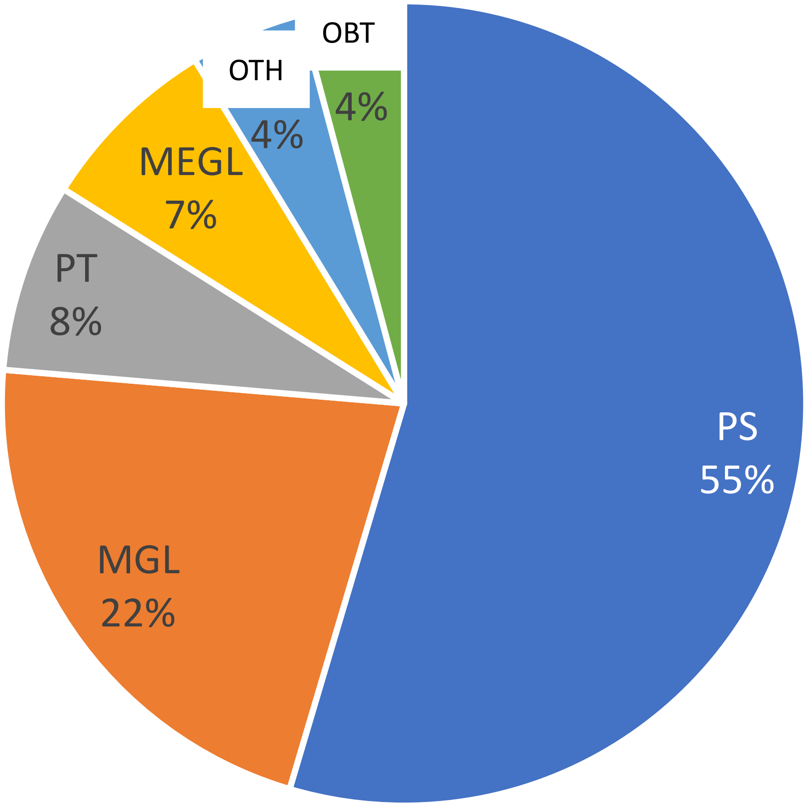
PS(55%)+MGL(22%)

+ Others(PT+MEGL+OBT+ OTH)(23%)

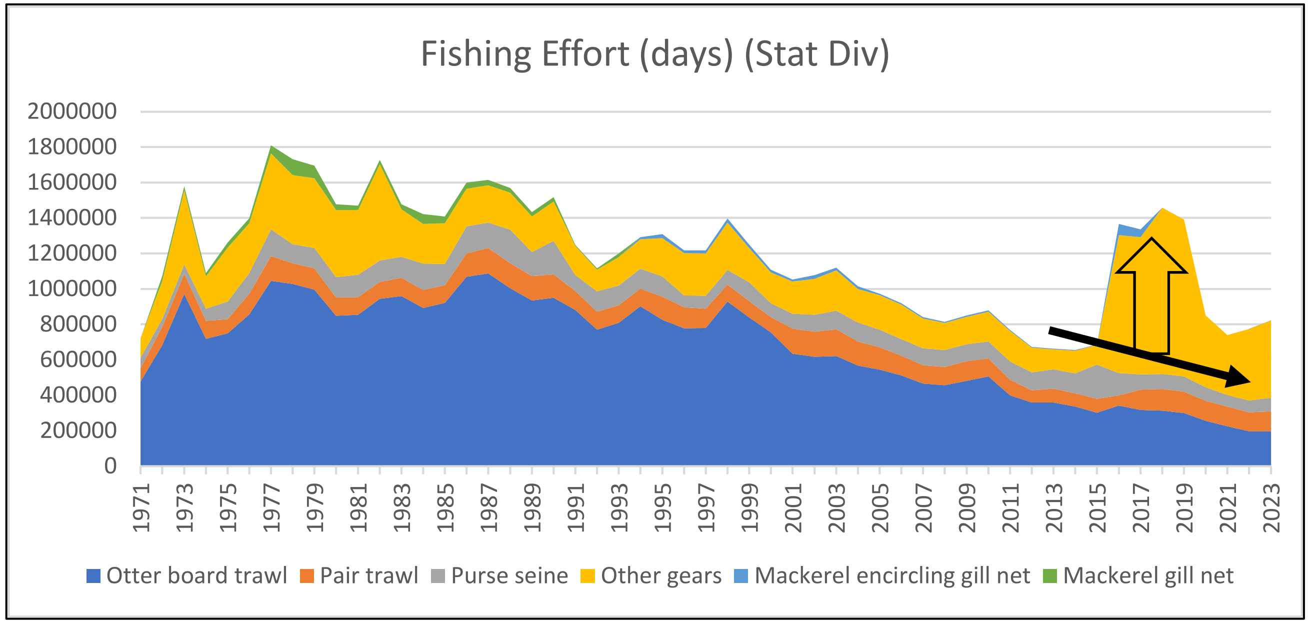


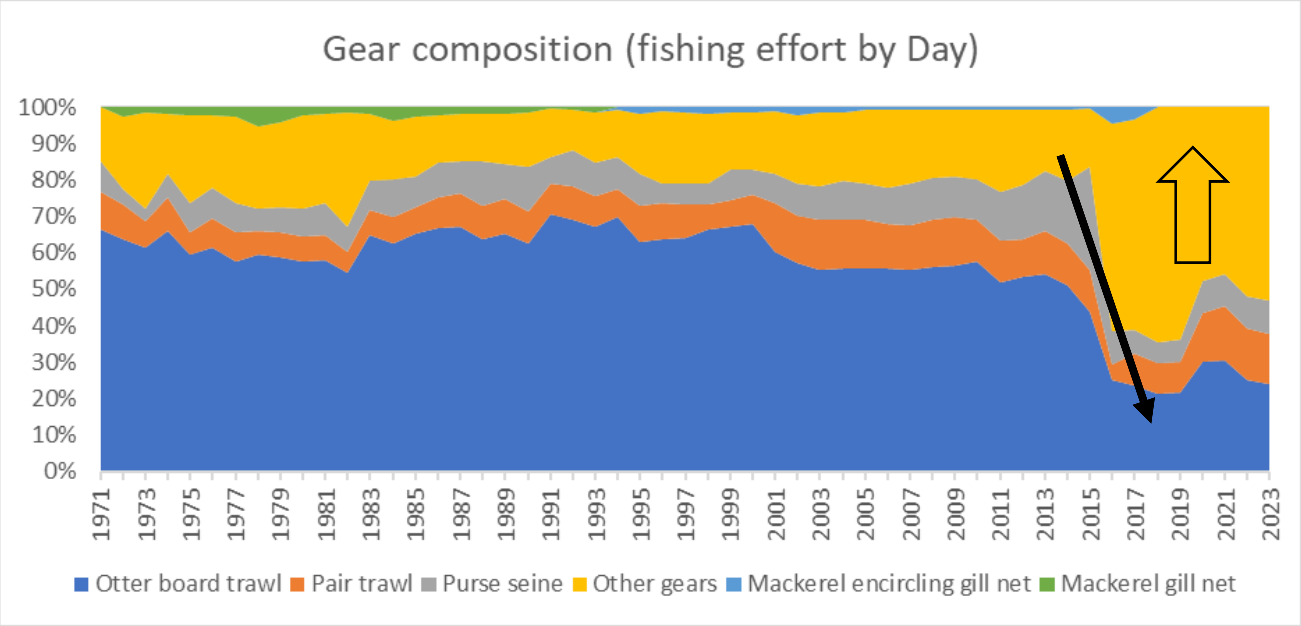
Gear composition





Fishing effort (day)





Major gear Drop (regulation)

Other (minor) gear Increased

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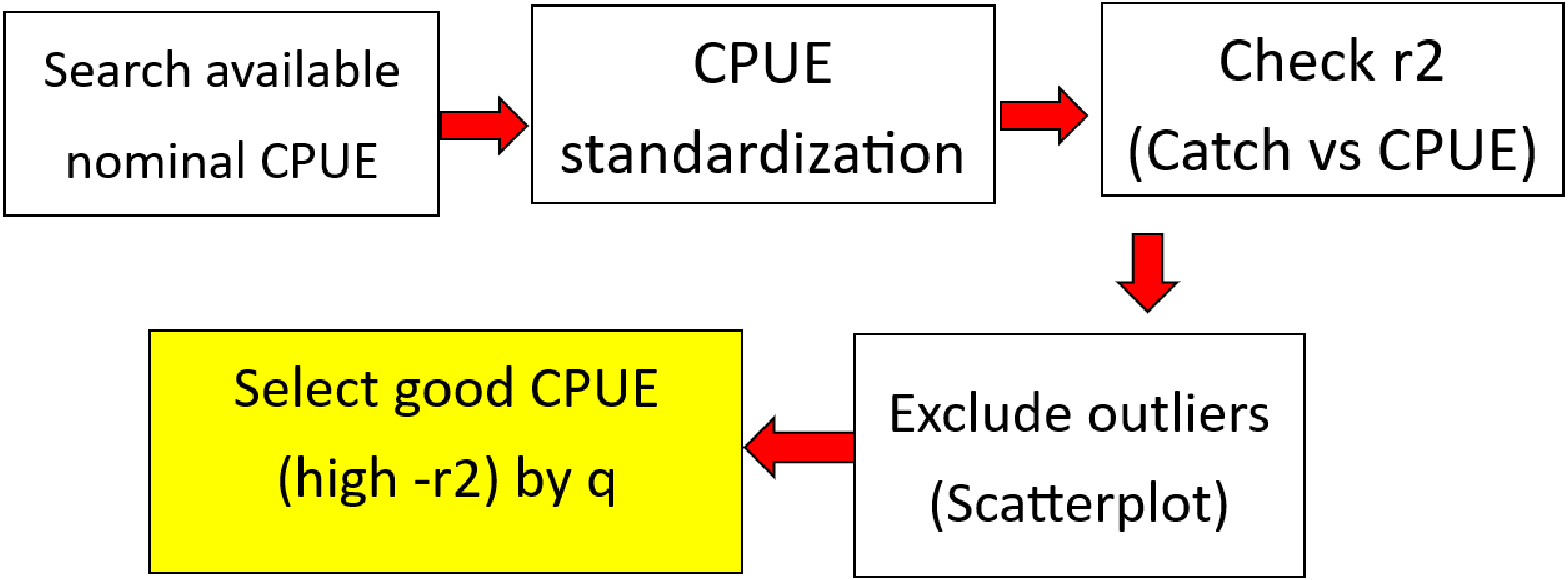
4. Selection of good CPUE for JABBA

4.1 nominal CPUE

4.2 CPUE standardization

4.3 Selection of good CPUE

Flowchart to select good CPUE for JABBA



4.1 nominal CPUE

Compute available nominal CPUE for all gears referring to data catalog

Data catalog

Important

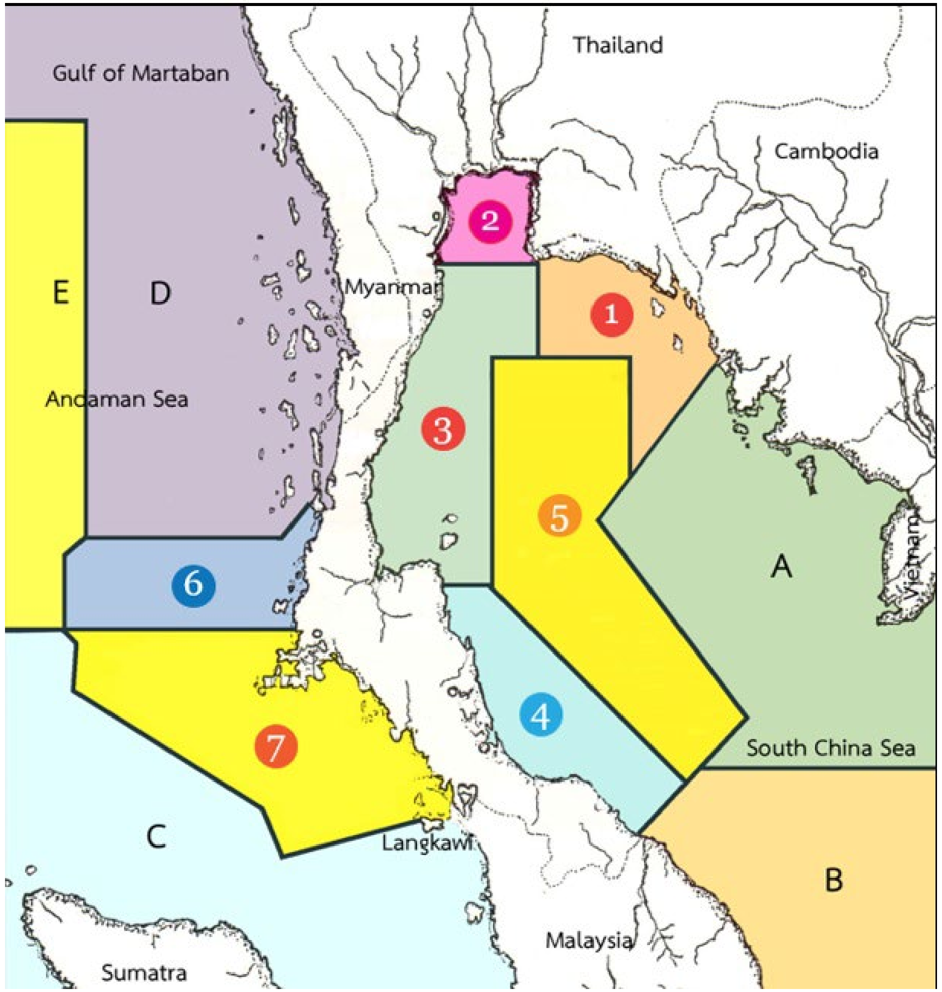
<table>
<tr><th colspan="6">Short mackerel (GOT) (area 1~5) (Catch and Effort data)</th></tr>
<tr><td rowspan="5">q
catchability
(refer to the text)</td><td>Source</td><td colspan="3">Statistical division</td><td>Research
(Port sampling)</td></tr>
<tr><td>Catch</td><td colspan="4">tons</td></tr>
<tr><td>Effort</td><td colspan="4">Refer to the text</td></tr>
<tr><td>Covariate (CPUE standardization)</td><td colspan="2">Year and area</td><td colspan="2">Year, MO and area</td></tr>
<tr><td>Gear compositions</td><td colspan="4">PS (55%) + Mackerel Gillnet(22%)+OTH(23%)</td></tr>
<tr><td>q1 (1960-1974)</td><td>1971</td><td rowspan="4">(1)
(q1234)
CPUE
standardization
(1971~1994)</td><td rowspan="2">(2)
(q12)
CPUE
standardization
(1971~1994)</td><td rowspan="2"></td><td rowspan="3"></td></tr>
<tr><td>q2</td><td>↓
1994</td></tr>
<tr><td>q3</td><td>1995
↓
2015</td><td rowspan="2"></td><td rowspan="2">(3)
(q34)
CPUE
standardization
(1995~2023)</td></tr>
<tr><td>q4</td><td>2016
↓
2023</td><td>(4) (q4)
CPUE
standardization
(2014~2023)</td></tr>
</table>

Results
28
nominal CPUE

Statistical Division						Research Port sampling (set by set)			
data set #			(1)	(2)	(3)		(4)		
q			q1234	q12	q3	q	(4) q4		
Period (years)(*)			1971~2023 (n=29)	1971~1994 (n=24)	1995~2023 (n=19)	Period (years)	2016~2023 (n=8)		
Covariates			Year and Area		year, Mo, area and Mo*area	Covariates	year, Mo, area and Mo*area		
No	gear	unit (Kg per)				No	gear	unit (Kg per)	
1	MEGL	day				15	APS	day	
2		hr				16		hr	
3	MGL	day				17	BT	day	
4		hr				18		hr	
5	OBT	day				19	FAD	day	
6		haul				20		haul	
7	PT	day				21	LPS	day	
8		haul				22		haul	
9	PS	day				23	OBT	day	
10		hr				24		hr	
11	OTH	day				25	PT	day	
12		hr				26		hr	
13	ALL	day				27	TPS	day	
14		hr				28		haul	

(*) n= is the maximum numbers. However, sometimes less number as outliers and/or errors are removed.

5 area (GOT)



Thailand
Gulf of Martaban
Cambodia
2
Myanmar
E
D
1
Andaman Sea
3
5
A
Vietnam
6
4
7
South China Sea
C
Langkawi
B
Malaysia
Sumatra

Preparation of nominal CPUE data set

(1) Port sampling (set by set data) (2014~2023)

(2) Statistical Division (by area data) (1971~1994) (no month)

(by Mo & area data) (1995~2023)

Data process (outline)
We need to practice together (take time & complicated)

Statistical Division(1971~2023)

monthly stat_catch (GOT) 1971-2023_rev1

Year

Month

Area(1~5) (GOT)

Catch (Small Mackerel) (tons) by gear

Effort (days or hour) by gear

Gear

Mackerel encircling gill net	Mackerel gill net	Otter board trawl	Pair trawl	Purse seine	Other gears	Grand Total

catch (tons) by gear in GOT

year A.D.	Month	stat area	Mackerel encircling gill net	Mackerel gill net	Otter board trawl	Pair trawl	Purse seine	Other gears	Grand Total
1971	NA	1			99	757	4880	14	5750
1971	NA	2			886	688	8190	1658	11422
1971	NA	3			1145	2124	14048	114	17431
1971	NA	4			301	941		0	1242
1971	NA	5			25			0	25
1972	NA	1		3014	195	181	4260	36	7686
1972	NA	2		2823	770	3066	3562	956	11177
1972	NA	3		1886	462	2192	3311	149	8000
1972	NA	4			434	304	1381	0	2119
1972	NA	5			3	945		0	948
1973	NA	1		7266	302	874	4305	66	12813
1973	NA	2		638	658	3516	7315	2681	14808
1973	NA	3		2166	212	3281	3141	37	8837
1973	NA	4			985	354	538	0	1877
1973	NA	5			8			0	8
1974	NA	1		1900	99	594	1778	129	4500
1974	NA	2		651	88	1211	6058	755	8763
1974	NA	3		1605	114	1824	4754	79	8376
1974	NA	4			394	482	1751	4	2631
1974	NA	5				211		0	211
1975	NA	1		2632	276	3414	4170	505	10997
1975	NA	2		1550	530	1173	14196	3355	20804
1975	NA	3		6134	697	630	10041	86	17588
1975	NA	4			1229	379	1167	0	2775
1975	NA	5			131			0	131
1976	NA	1		1969	65	2472	4203	128	8837
1976	NA	2		1430	182	695	21844	953	25104

Remark:
Catch includes commercial and artisanal

NA1 meanse no monthly data
NA2 means aggregated catch of artisanal catch

Catch (tons)

short mackerel catch (ton) | lizardfish catch (ton) | threadfin bream catch (ton) | effort (day) | effort (hr) | ref

Effort (day)

	year B.E.	year A.D.	Month	stat area	Mackerel encircling gill net	Mackerel gill net	Otter board trawl	Pair trawl	Purse seine	Other gears	Grand Total
3	2514	1971	NA	1			131629	13782	22724	7829	175964
4	2514	1971	NA	2			150252	28438	17995	87432	284117
5	2514	1971	NA	3			105071	21077	17795	12940	156883
6	2514	1971	NA	4			88570	11318		0	99888
7	2514	1971	NA	5			2824			0	2824
8	2515	1972	NA	1		6484	227832	15313	16914	10623	277166
9	2515	1972	NA	2		11792	185742	59586	12351	128409	397880
10	2515	1972	NA	3		10377	110111	18049	9545	18259	166341
11	2515	1972	NA	4			157410	4817	4118	57162	223507
12	2515	1972	NA	5			623	6387		0	7010
13	2516	1973	NA	1		7361	257635	41579	22617	36862	366054
14	2516	1973	NA	2		7369	266927	39581	16256	210267	540400
15	2516	1973	NA	3		8033	162758	27924	7566	51429	257710
16	2516	1973	NA	4			282745	5400	4549	120839	413533
17	2516	1973	NA	5			1113		229	0	1342
18	2517	1974	NA	1		4011	125939	29040	18438	21241	198669
19	2517	1974	NA	2		6298	224319	42263	25639	100466	398985
20	2517	1974	NA	3		8465	163474	20953	21502	20047	234441
21	2517	1974	NA	4			204350	6061	4661	39753	254825
22	2517	1974	NA	5				2868		0	2868
23	2518	1975	NA	1		3754	140614	19990	28063	27892	220313
24	2518	1975	NA	2		8368	266816	49755	35867	178075	538881
25	2518	1975	NA	3		17165	159406	4375	31287	39277	251510
26	2518	1975	NA	4			180482	5134	4442	59045	249103
27	2518	1975	NA	5			2178			0	2178
28	2519	1976	NA	1		3060	185290	36885	34556	54011	313802
29	2519	1976	NA	2		7318	252632	44218	31081	118957	454206

Remark:
Only commercial effort is available

NA means no monthly data

Effort (day)

short mackerel catch (ton) | lizardfish catch (ton) | threadfin bream catch (ton) | effort (day) | effort (hr) | ref

Effort (hour)

year B.E.	year A.D.	Month	stat area	Mackerel encircling gill net	Mackerel gill net	Otter board trawl	Pair trawl	Purse seine	Other gears	Grand Total
2514	1971	NA	1			1550954	204842		0	1755796
2514	1971	NA	2			1850458	326231		0	2176689
2514	1971	NA	3			1383168	329380		0	1712548
2514	1971	NA	4			1357434	185892		0	1543326
2514	1971	NA	5			26547			0	26547
2515	1972	NA	1			2605110	209066		0	2814176
2515	1972	NA	2			2780287	691774		360454	3832515
2515	1972	NA	3			2003858	211971		84916	2300745
2515	1972	NA	4			2532347	58645		534719	3125711
2515	1972	NA	5			8791	107516		0	116307
2516	1973	NA	1			3255695	443474		166879	3866048
2516	1973	NA	2			3171328	456669		1231978	4859975
2516	1973	NA	3			3093520	307183		384074	3784777
2516	1973	NA	4			4131840	60727		1121183	5313750
2516	1973	NA	5			12145			0	12145
2517	1974	NA	1			1490468	318208	125854	78603	2013133
2517	1974	NA	2			2778932	527799	153666	584700	4045097
2517	1974	NA	3			2743135	233779	110115	308949	3395978
2517	1974	NA	4			3131297	61180	49237	767687	4009401
2517	1974	NA	5				33010		0	33010
2518	1975	NA	1			1593260	327648		90487	2011395
2518	1975	NA	2			3868901	546544		530671	4946116
2518	1975	NA	3			2375958	49733		229844	2655535
2518	1975	NA	4			2792048	47306		451501	3290855
2518	1975	NA	5			31716			0	31716
2519	1976	NA	1			1892903	403638		64413	2360954
2519	1976	NA	2			2887664	516310		508265	3912239

Remark:
Only commercial effort is availabl

NA means no monthly data

Effort (hour)

short mackerel catch (ton) | lizardfish catch (ton) | threadfin bream catch (ton) | effort (day) | effort (hr) | ref

We will make nominal CPUE data set

We need a lot of process, need QC to check errors

➔ 1-2 days

We need Merge(Catch & Effort)

Simple R codes for merge are developed

VLOOKUP (Excel)

Results of final nominal CPUE for CPUE standardization STAT data 4 Covariates

	A	B	C	F
1	year	mo	area	CPUE
2	2003	1	4	1.2
3	2003	1	4	0.552
4	2003	1	5	0.07
5	2003	1	5	0.108
6	2003	1	5	3.14
7	2003	1	5	0.3
8	2003	1	5	0.658

4.2 CPUE standardization

Objectives

To search good abundance indices for JABBA

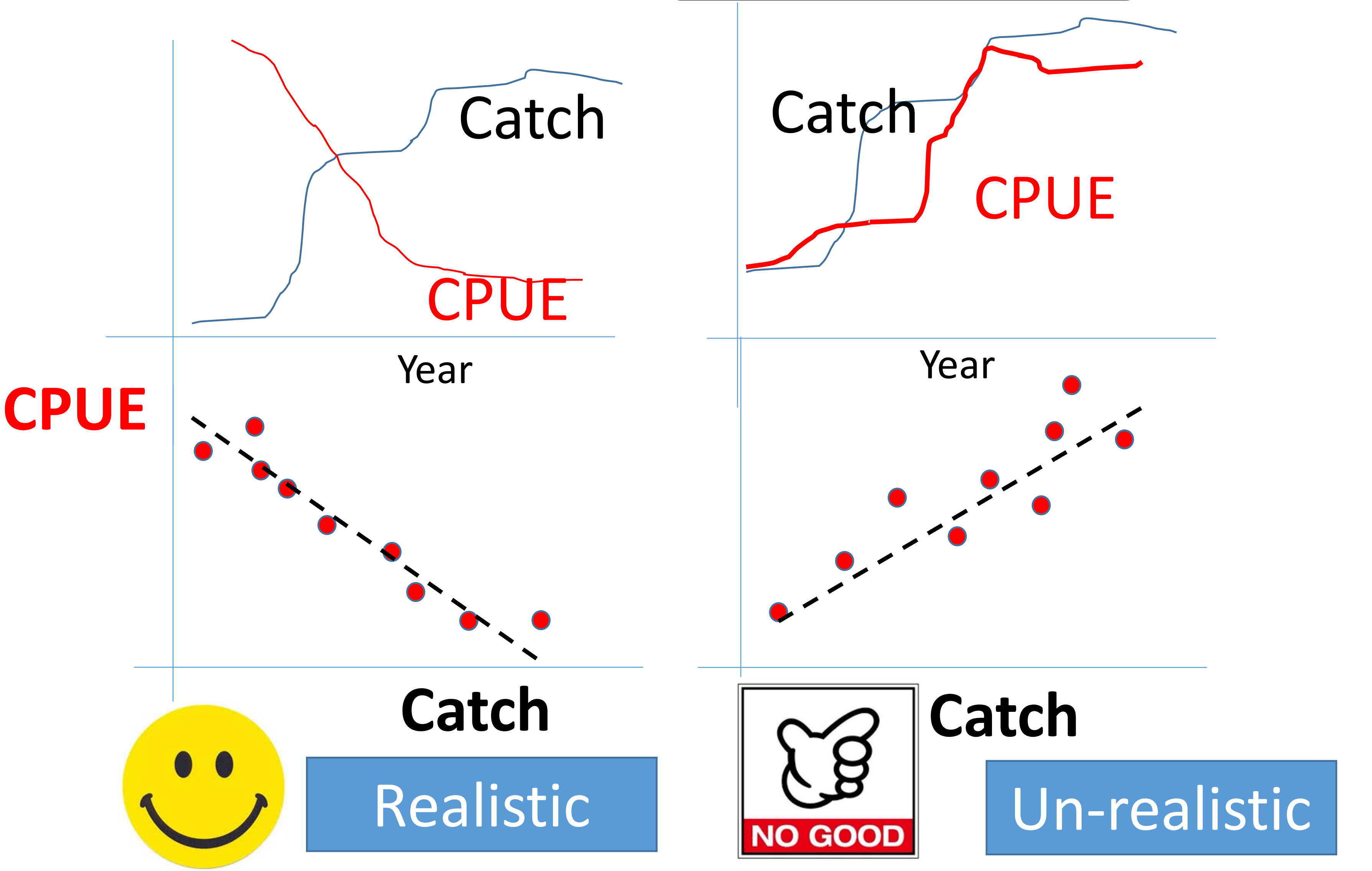
Bad STD_CPUE➔NG JABBA results.

JABBA results depend on quality of STD_CPUE

Good standardized CPUE is critical for JABBA.

If good STD_CPUE➔ good JABBA results (short time).

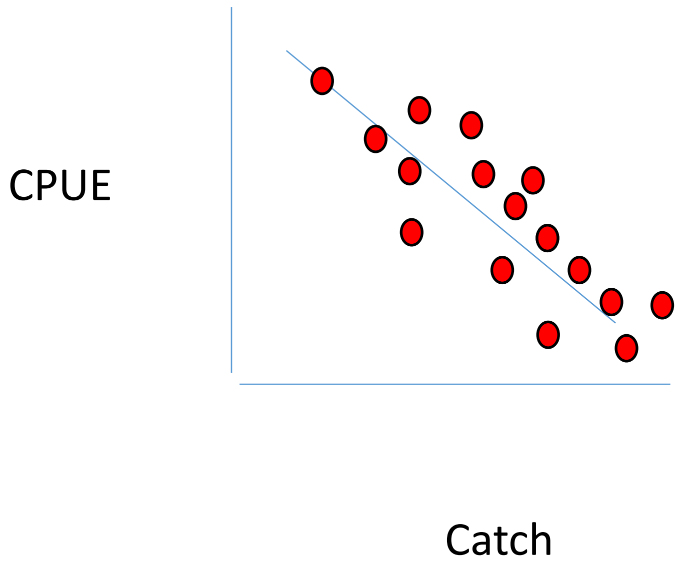
: Catch vs. CPUE => should be inversely correlated (realistic)

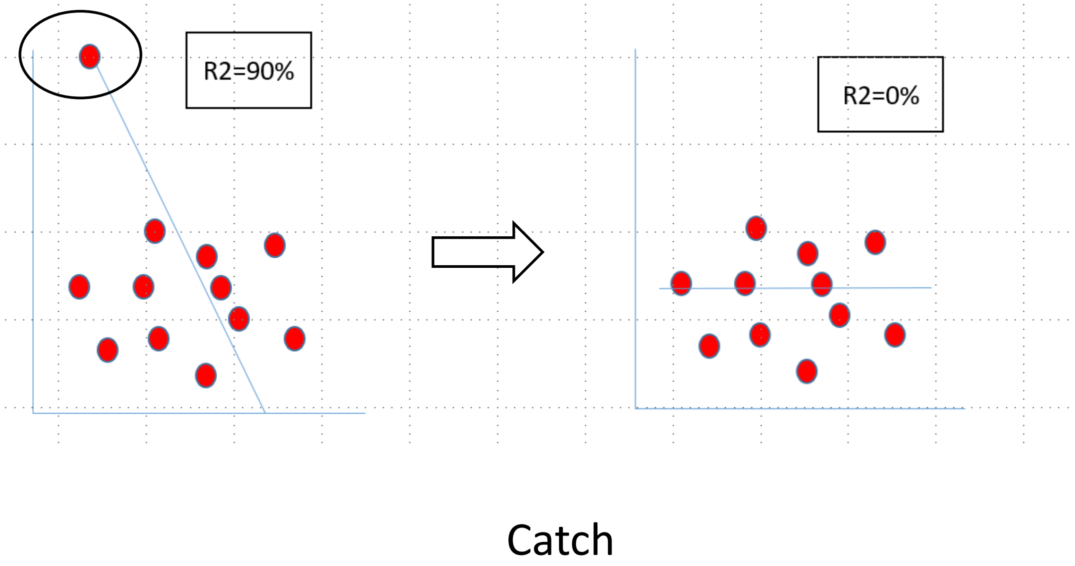


How to search good standardized (STD) CPUE? scatterplot & -r2

Good STD_CPUE
high negative correlation (-r2)
against catch

Be careful for apparent good –r2
affected by outliers





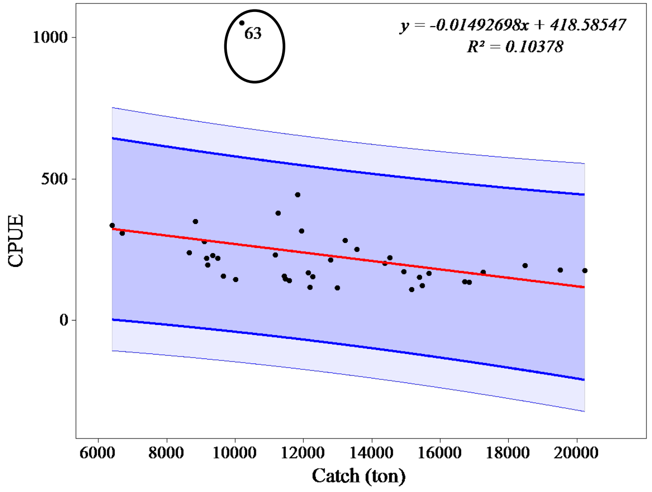
Detection bad CPUE (outliers) & good CPUE (2 ways)

(1) Scatterplot

Catch vs CPUE based outliers

Remove outliers

Select high –r2 ➔ Good CPUE

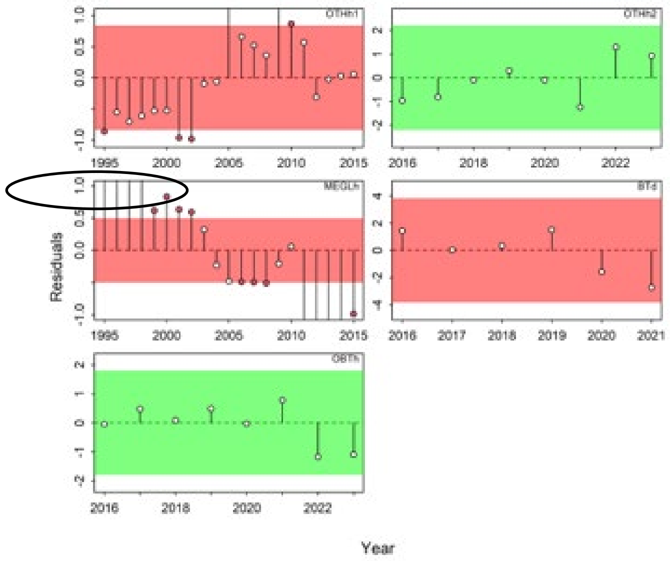


(2) JABBA

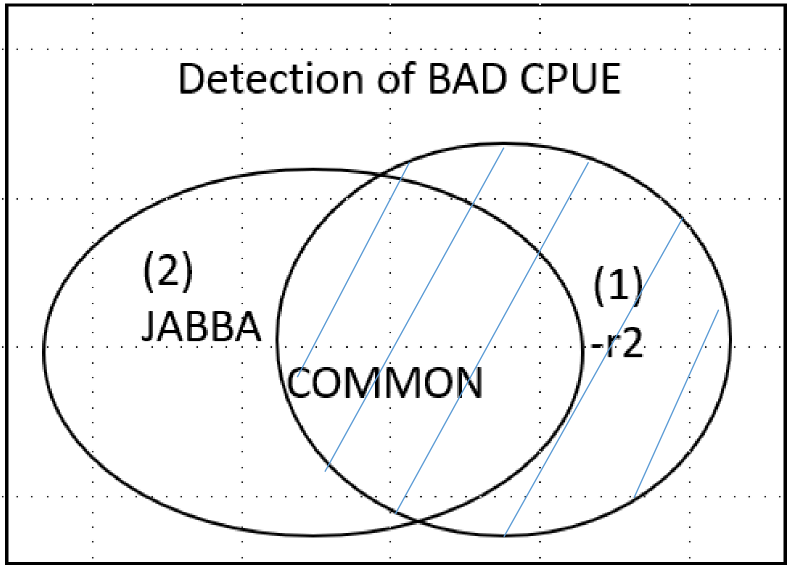
Model based outliers

Delete red points➔ green

Select Good CPUE (green)



Relation of outliers between (1) & (2)



Removed outliers in (1) remove

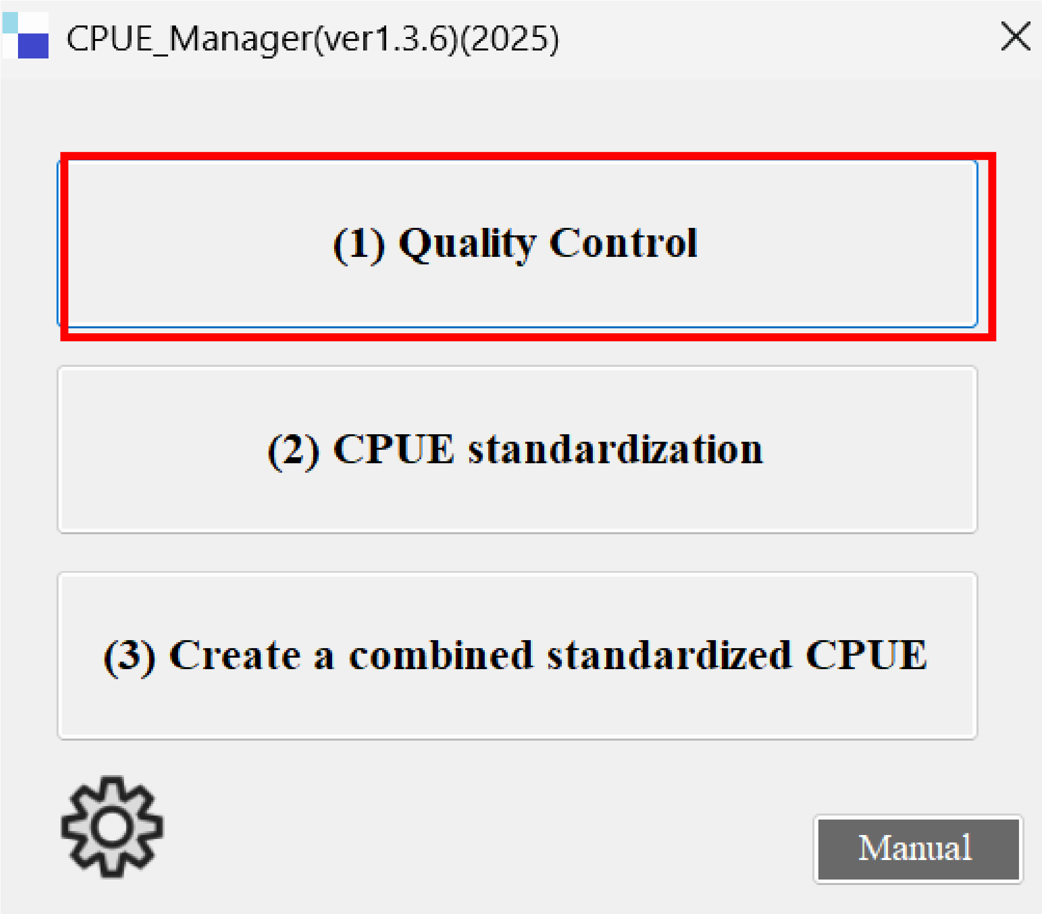
Good results (short time)

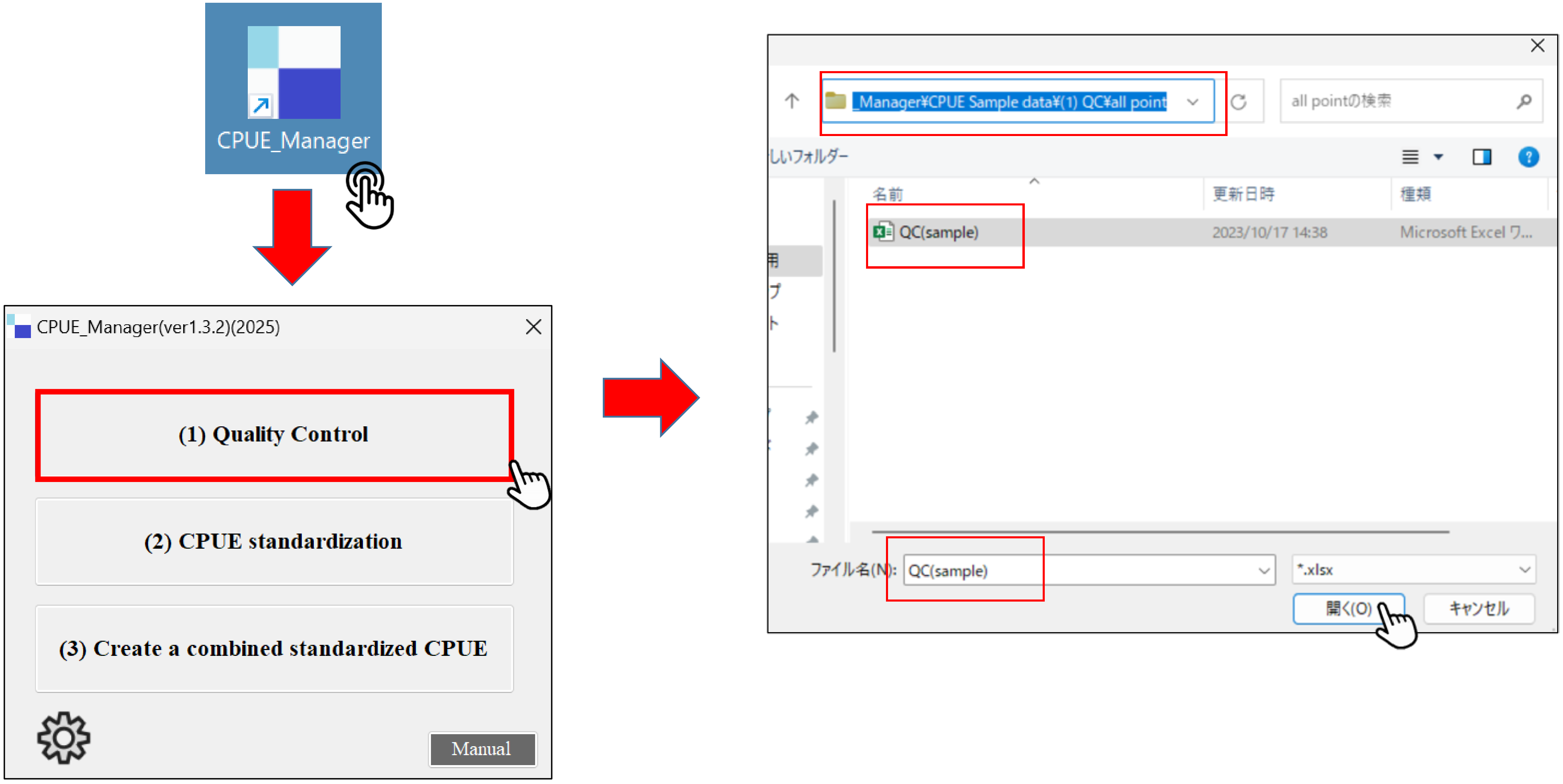
How to define large outliers?

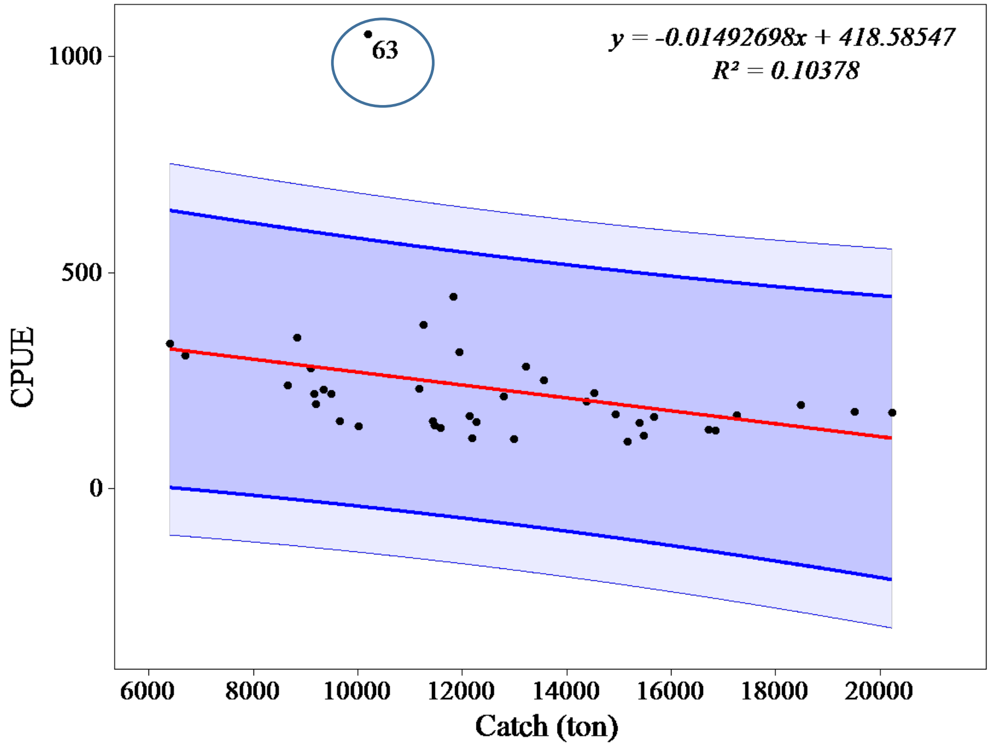
(1) Visual inspection
(expert judgement)

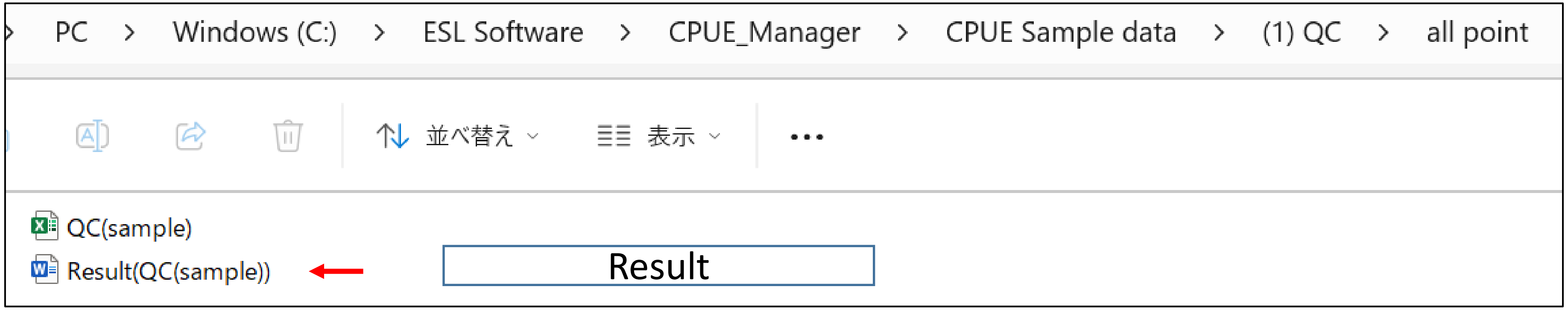
(2) Numerical criteria
(> ±4*SE)

CPUE_Manager
➔ QC make scatterplot detect outliers

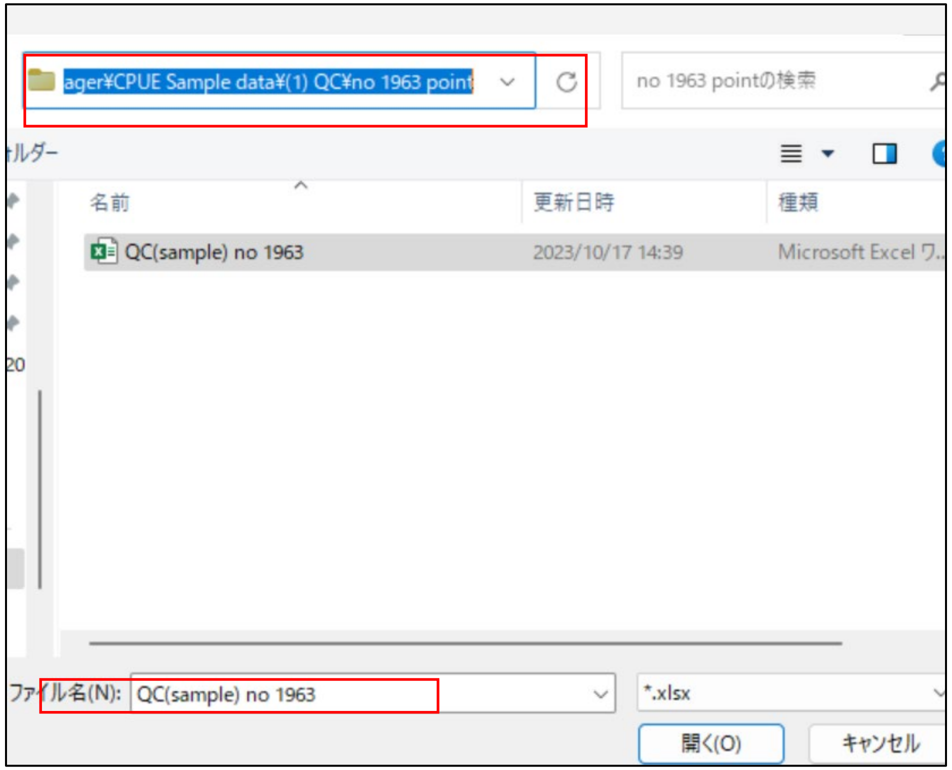


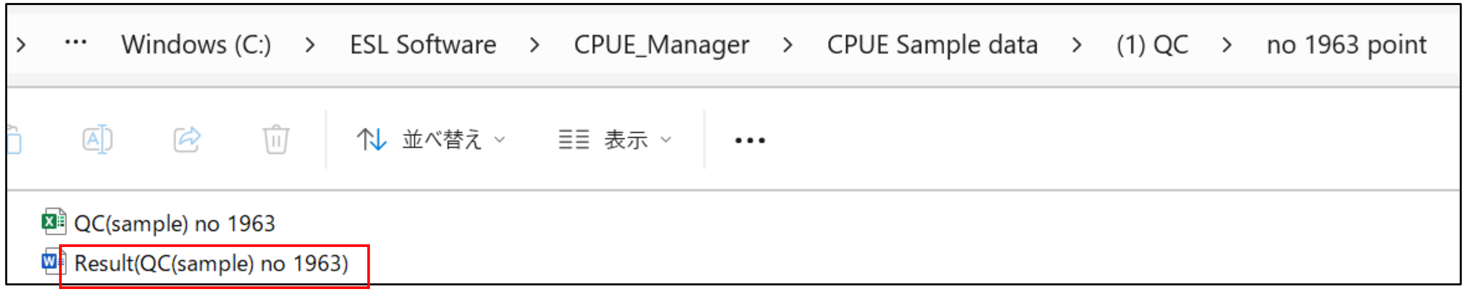

CPUE_Manager
CPUE_Manager(ver1.3.2)(2025)
(1) Quality Control
(2) CPUE standardization
(3) Create a combined standardized CPUE
Manual
_Manager¥CPUE Sample data¥(1) QC¥all point
all pointの検索
しいフォルダー
名前
更新日時
種類
QC(sample)
2023/10/17 14:38
Microsoft Excel ワ...
ファイル名(N):
QC(sample)
*.xlsx
開く(O)
キャンセル


y = -0.01492698x + 418.58547
R² = 0.10378
63
1000
500
0
CPUE
6000
8000
10000
12000
14000
16000
18000
20000
Catch (ton)

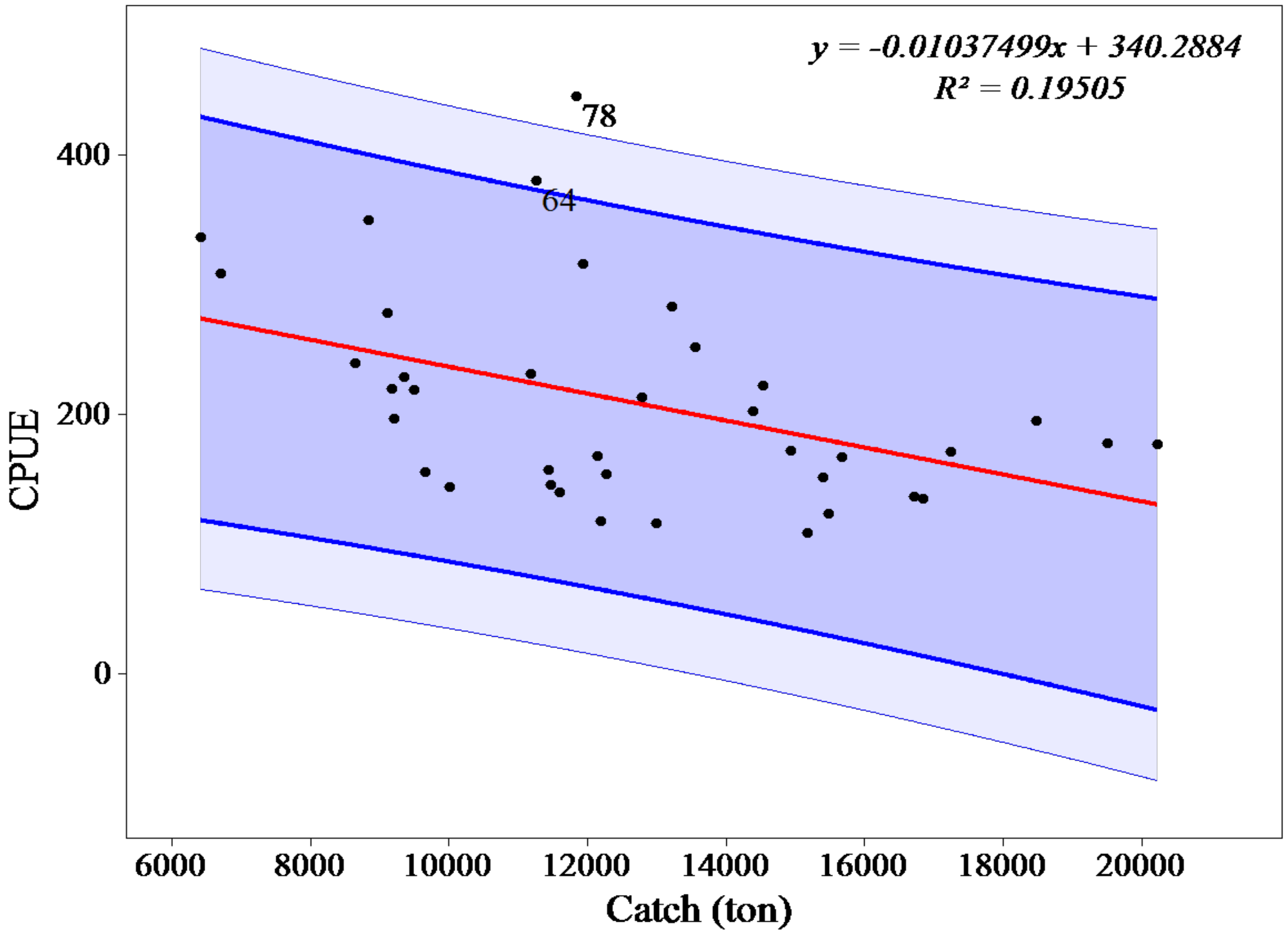

PC > Windows (C:) > ESL Software > CPUE_Manager > CPUE Sample data > (1) QC > all point
並べ替え
表示
QC(sample)
Result(QC(sample))
Result

Make a new data file
Without
1963 data





After removal of one outlier (1963)



RESULTS

Negative CORR relation

<u>is improved</u>, i.e.,

r2 increased (10% to 20%)

No need to remove

the 1978 point as close to

the 99% Confidence band.

Why we need standardized CPUE for ALL gears?

Major gears (large catch) important ➔ But not always good CPUE

minor gears (not important) ➔ sometimes good CPUE

In general, what is the good CPUE?

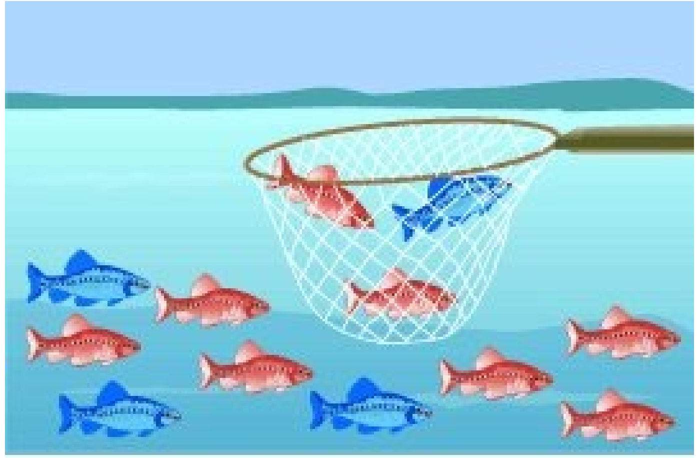
Good CPUE ➔ **simple random sampling**

(high -r2 with catch)

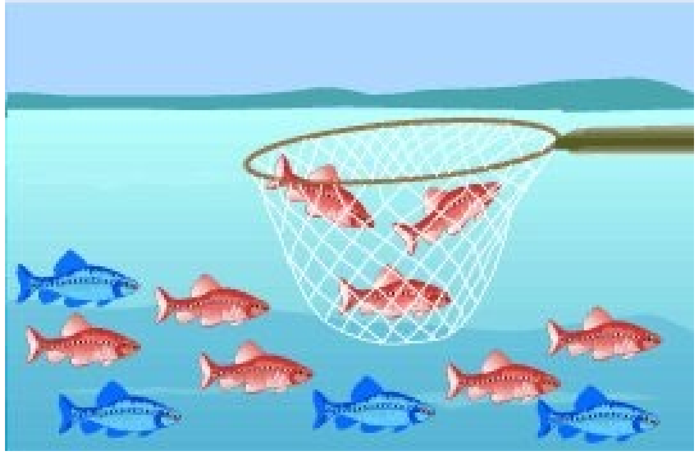
➔ Good reflection of abundance

What is simple random sampling ?
Why so important?

https://www.youtube.com/watch?app=desktop&v=Zd2UpbvMP_8&ab_channel=ANAPH



Simple random sampling
➔ Proportional red & blue
Reflect population



Target only red fish
Biased sampling
➔NO reflection of population

Why major gear not good for CPUE ?

Target ➔ not SRS **(simple random sampling)** (bias) ➔ NG

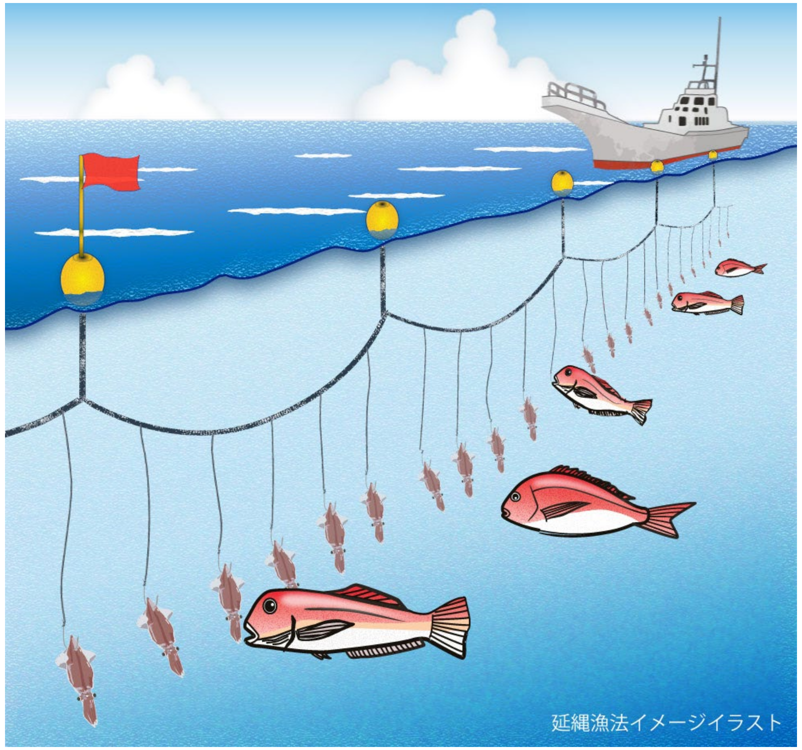
Minor gears may do more SRS

⇩

Because Not targeting thus more SRS

Some interesting story about tuna longline CPUE (IOTC)

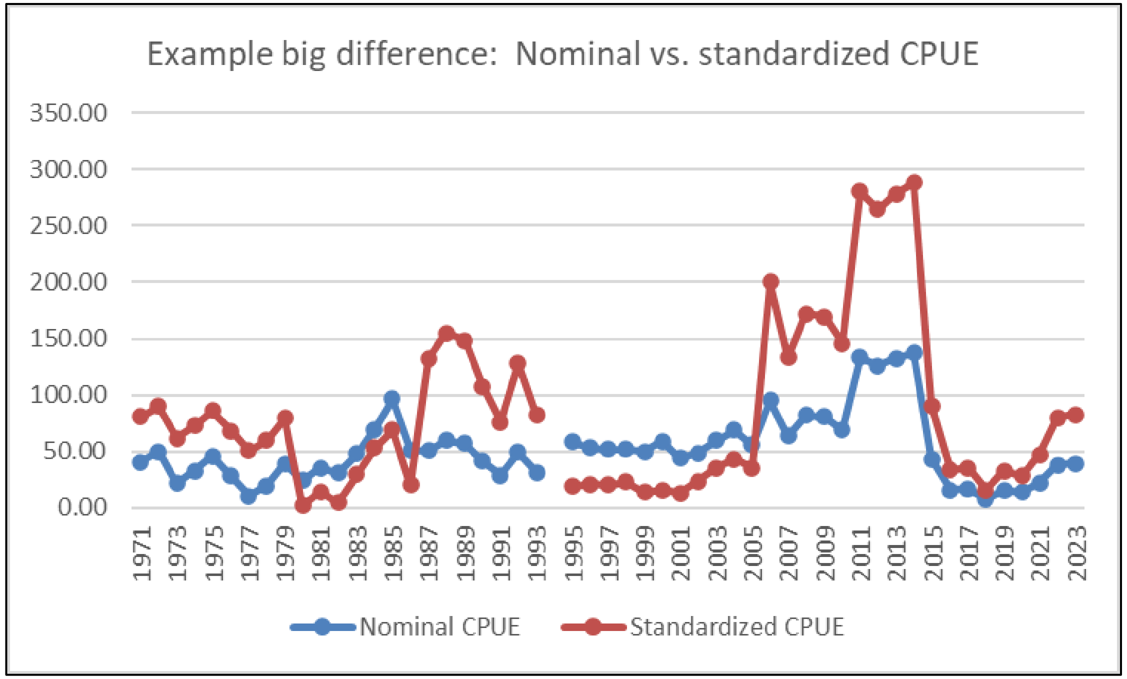
- Yellowfin catch (tuna LL) ➔ very low (5%) (recent years)
  (piracy, reduction of boats as no fishers ← only old crew…)
- Before PS started, LL catch was highest.
- Should not use LL CPUE as catch is very low.
- But we still use CPUE as the best CPUE because LL **(simple random sampling).**
- So, the catch amount does not matter.

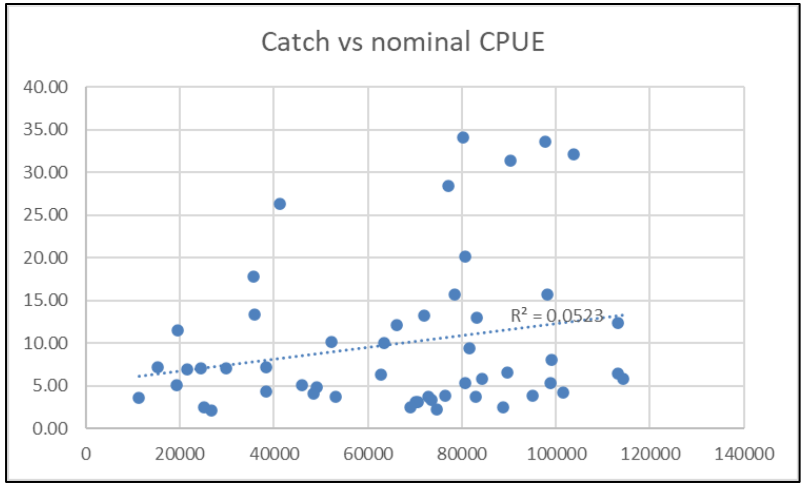


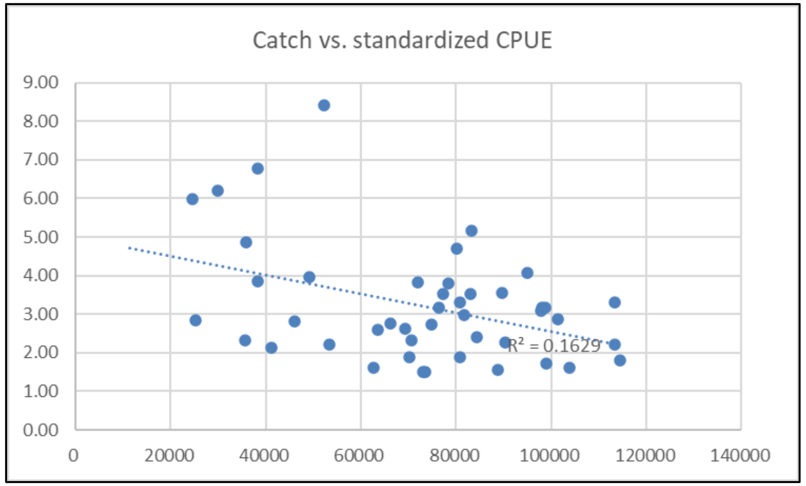
Why nominal CPUE is not used?

Because standardized CPUE is directly used for JABBA ➔ affect JABBA results.

Nominal CPUE is different from standardized CPUE, thus should not be used.







CPUE Unit → also relates to Good standardized CPUE

Kg/hour, Kg/day and Kg/haul

basically proportional (linear relation) → produce similar STD_CPUE

But some times different quality → non linear relation

↓

Different unit produce BETTER STD_CPUE (sometimes)

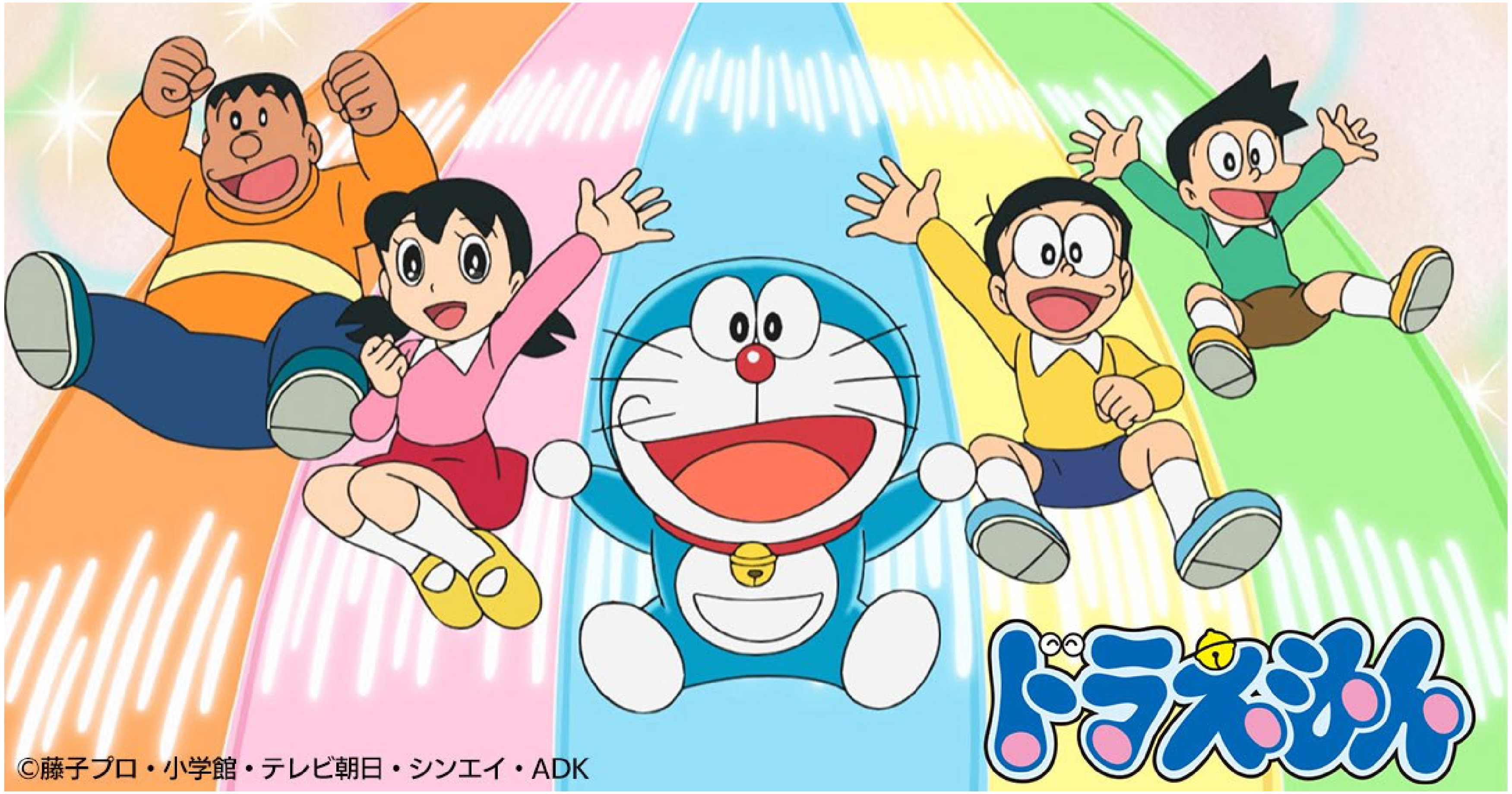
↓

For example, in the same gear

-r2 (Kg/hr)=-32% vs. –r2(Kg/day)=-10%

In this case, we use Kg/day

Start 1 PM



PC window ➔ English

➔ May be OK

Results 28 nominal CPUE

Statistical Division						Research Port sampling (set by set)			
data set #			(1)	(2)	(3)		(4)		
q			q1234	q12	q3	q	(4) q4		
Period (years)(*)			1971~2023 (n=29)	1971~1994 (n=24)	1995~2023 (n=19)	Period (years)	2016~2023 (n=8)		
Covariates			Year and Area		year, Mo, area and Mo*area	Covariates	year, Mo, area and Mo*area		
No	gear	unit (Kg per)				No	gear	unit (Kg per)	
1	MEGL	day				15	APS	day	
2		hr				16		hr	
3	MGL	day				17	BT	day	
4		hr				18		hr	
5	OBT	day				19	FAD	day	
6		haul				20		haul	
7	PT	day				21	LPS	day	
8		haul				22		haul	
9	PS	day				23	OBT	day	
10		hr				24		hr	
11	OTH	day				25	PT	day	
12		hr				26		hr	
13	ALL	day				27	TPS	day	
14		hr				28		haul	

CPUE standardization

STOCK ASSESSMENT FOR ALL
MENU-DRIVEN SOFTWARE DEVELOPMENT TEAM

Menu-driven software series (No. 1)

CPUE_Manager (ver1.3.6) (2025) Manual

May, 2025

Tom NISHIDA (PhD) (Representative)
aco20320@par.odn.ne.jp
Kazuharu Iwasaki (Software Engineer)
[MENU] © Menu-driven stock assessment software developing team(Japan)
https://www.esl.co.jp/products/menu

*Note: The current version is 1.3.6. Some software images in this Manual are from older versions,
But this is not a problem as they are the same.*

2 GLM model for CPUE standardization

0 catch rate (%)	Model	Short name
0% ～ 30%	Log normal GLM	Log normal model
30% ～	Zero (0) inflated Delta 2 steps log normal GLM	Delta model

Formula of 2 models

[A] Log normal GLM

log (CPUE + Constant) =Intercept + Year + Season + Area + Season*Area

Categorical data + Other covariates (Max 3) + Error ~ N(0, σ^2)

*See next page about Constant (0.1*average of nominal CPUE)*

[C] Delta 2 steps log normal model

1st step (delta model using logit model)

E [log{q/(1-q)}] =intercept + Year + Season + Area + Season*Area

Categorical data + Other covariates (Max) ,where q(ratio of zero-CPUE)~Binominal (θ)

2^{nd} step (log normal model for non 0 CPUE)

log(CPUE)=Intercept + Year + Season + Area + Season*Area

Categorical data + Other covariates (Max 3) + Error ~ N(0, σ^2)

MONTH➔Season by Monsoon for CPUE standardization (Not systematic Q1~Q4)➔ <u>more meaningful</u>

Change month to season by monsoon

Jan-Feb & Nov ~ Dec	NE (NE monsoon)
Mar ~ April	IM (Inter Monsoon)
May ~Oct	SW (SW monsoon)

However, 3 season too rough

➔ results ➔ **not sensitive** ➔ NG for ANOVA

Month ➔ <u>**more sensitive**</u> ➔ good reflection for ANOVA

4.3 Selection of Good CPUE

3 best

Statistical Division						Port sampling (set by set)			
data set #			(1)	(2)	(3)	(4)			
q			q1234	q12	q3	q4			
Period (years)(*)			1971~2023 (n=53)	1971~1994 (n=24)	1995~2023 (n=19)	(2016~2023) (n=8)			
Covariates			Year and Area		year, Mo, area and Mo*area	year, Mo, area and Mo*area			
No	gear	unit (Kg per)	r2(%) Grey : negative r2 and Green : Selected			No	gear	unit (Kg per)	r2(%) Grey : negative r2 Green : Selected
1	MEGL	day	NA	NA	-21	15	APS	day	26
2		hr	NA	NA	-6	16		hr	15
3	MGL	day	58	58	36	17	BT	day	-7
4		hr	NA	NA	NA	18		hr	-1
5	OBT	day	30	2	48	19	FAD	day	22
6		haul	27	2	-7	20		haul	18
7	PT	day	-13	-35 (**)	32	21	LPS	day	70
8		haul	-16 (q123) (**)	-32 (**)	35	22		haul	83
9	PS	day	44	2	77	23	OBT	day	-23
10		hr	35	19	64	24		hr	-21
11	OTH	day	5	13	0	25	PT	day	0
12		hr	0	32	-7	26		hr	1
13	ALL	day	62	44	73	27	TPS	day	73
14		hr	52	42	59	28		haul	72

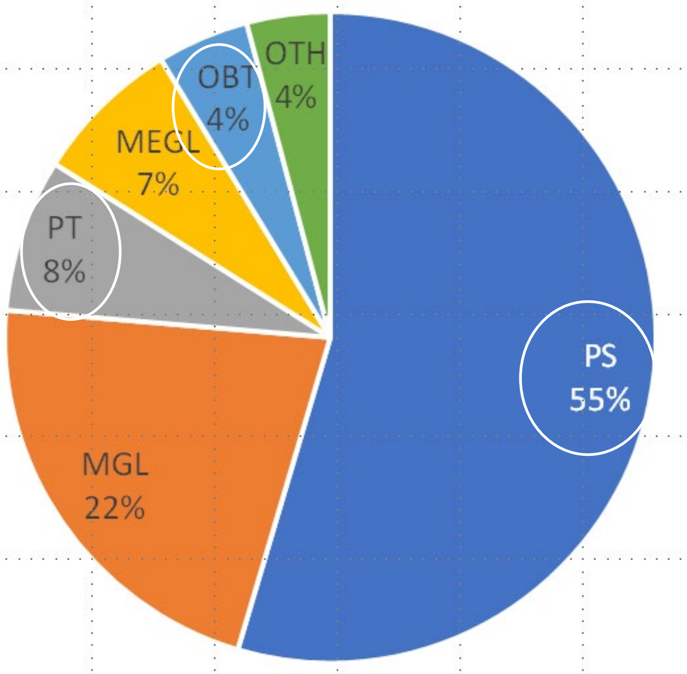
Summary of CPUE standardization

- Model
  - Log normal — if 0 CPUE < 30%
  - Delta log normal — if 0 CPUE >30%)
- Covariates — [Yr + Mo] or [Yr] + [area] or [Yr] + [Mo] + [area]
- Implementation — Menu-driven CPUE standardization software
- Results — see next page
- Selected STD_CPUE(3) — PT(haul) (q123), MEGL(q3) and OBT(day)(q4)

1 major gear (PS)

2 minor gears (PT+OBT)

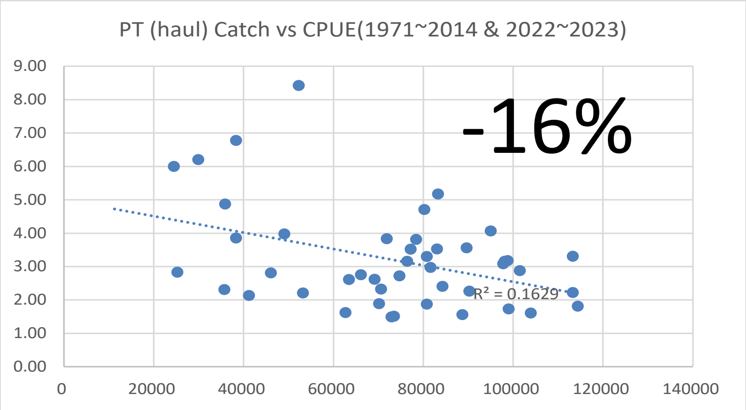
➔ minor gears more SRS

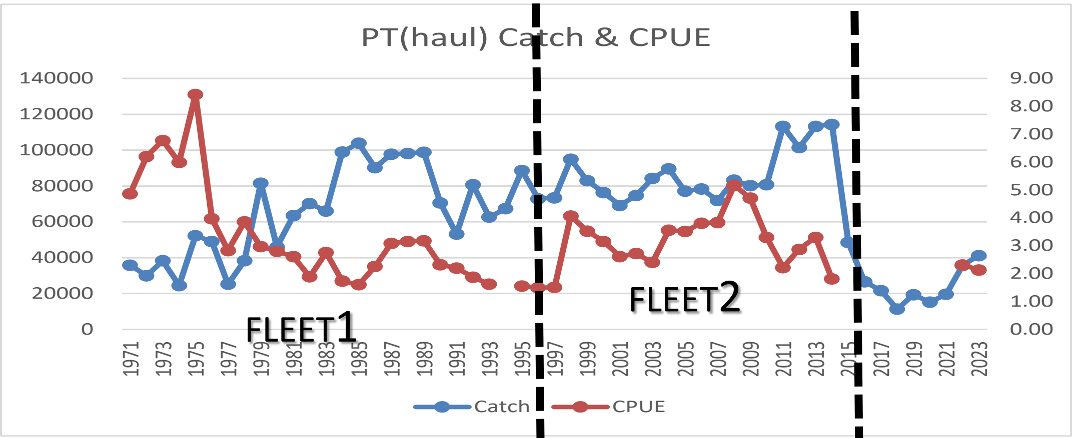


Good to have a very long CPUE (53 years)

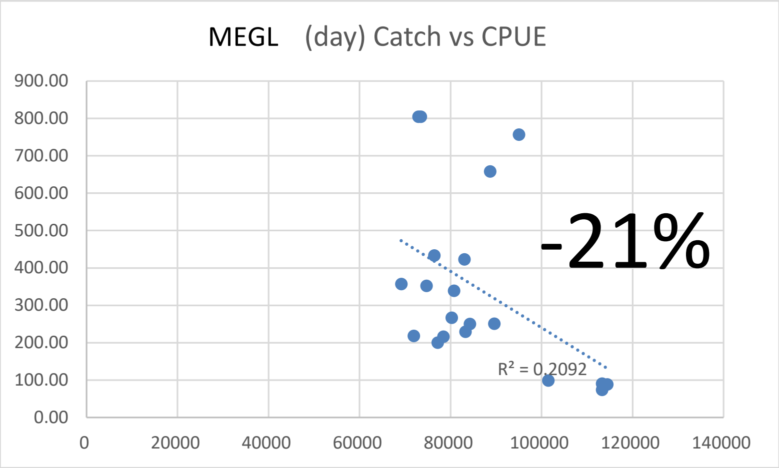
(SM) Results of selected standardized CPUE for JABBA						
q catchability (refer to the text)		Source	Statistical division			Research (Port sampling)
		Catch	tons			
		Effort	Refer to the text			
		Covariate (CPUE standardization)	Year and area		Year, MO and area	
Actual	Our case	Gear compositions	PS (55%) + Mackerel Gillnet(22%)+OTH(23%)			
q1 (1960-1974)	q12 (n=24)	1971	(1) (q12) not available	(2) (q12) PT haul SELECTED		
q2		↓ 1994				
q3	q3 (n=21)	1995 ↓ 2015	(1) (q34) PT(haul) r2=-16% SELECTED		(3) (q3) MEGL (day) r2=-21% SELECTED	
q4	q4 (n=8)	2016 ↓ 2023				(4) (q4) OBT (day) r2=-23% SELECTED

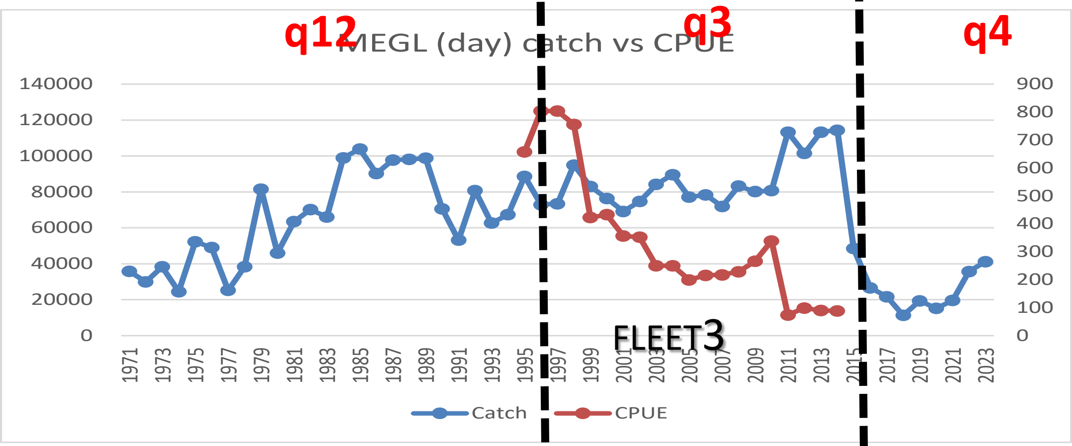
PT (haul)
fleet1
q12
1971~1994
fleet2
q34
1995~2023



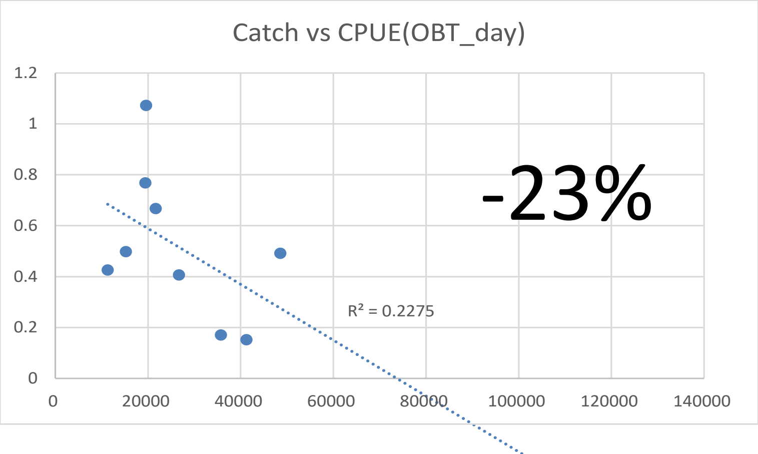


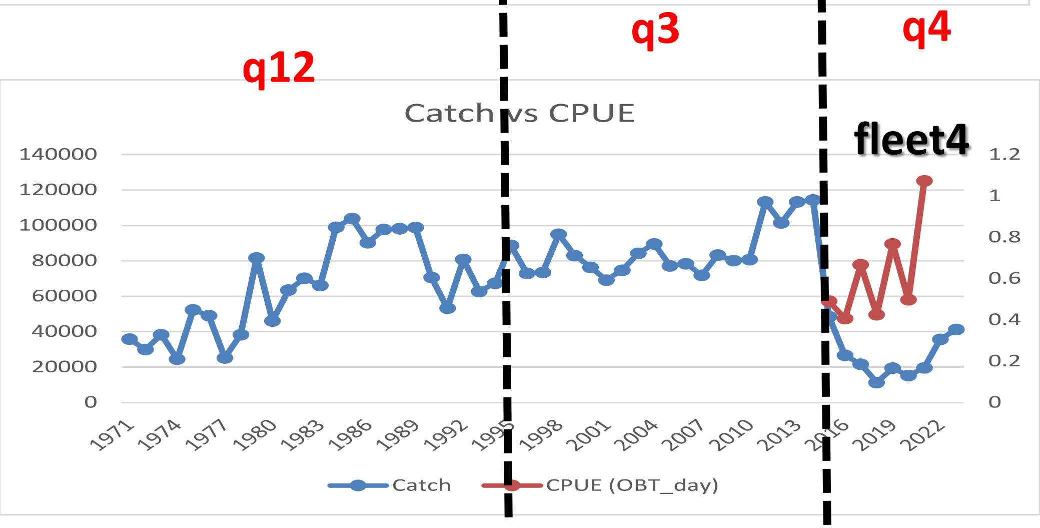
fleet3
MEGL(day)
q3
1995~2015

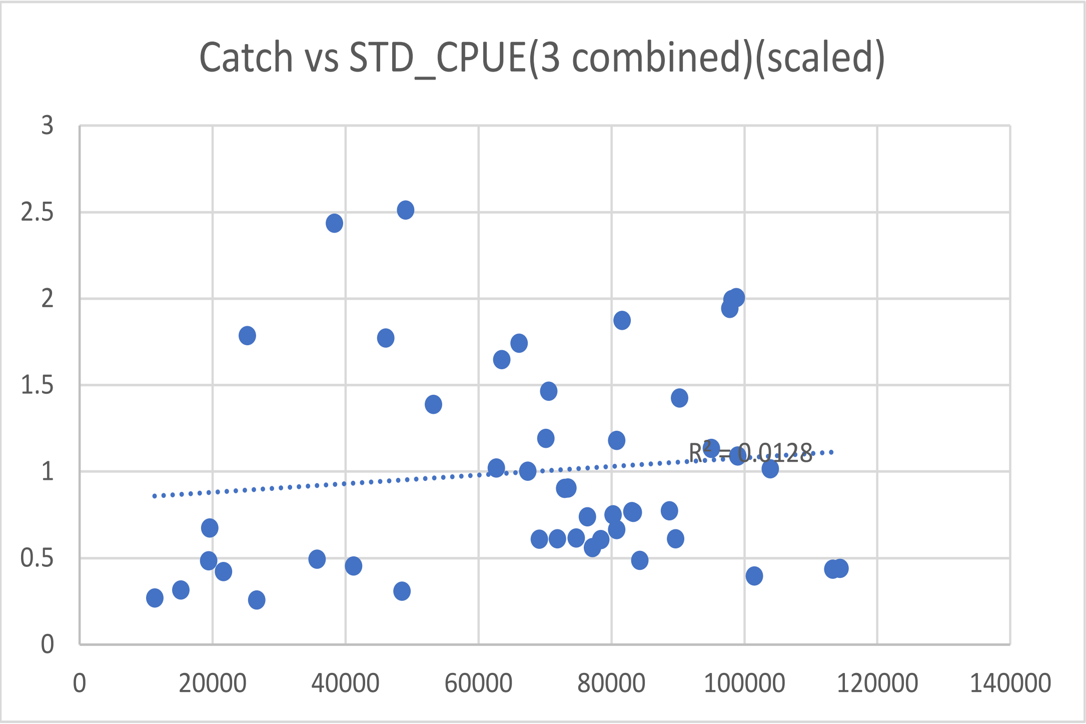


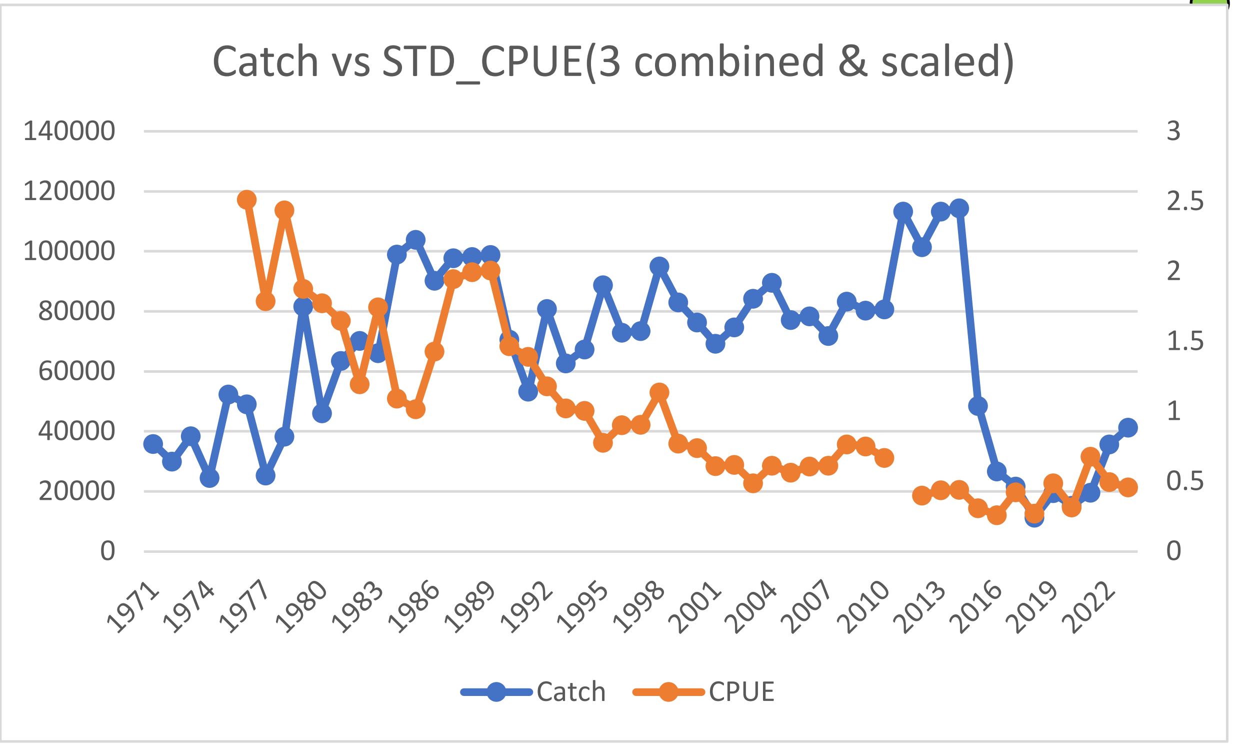


fleet4
OBT(day)
q4
2016~2023









Global STD
R2=+1.2%
Just reference
(No use)

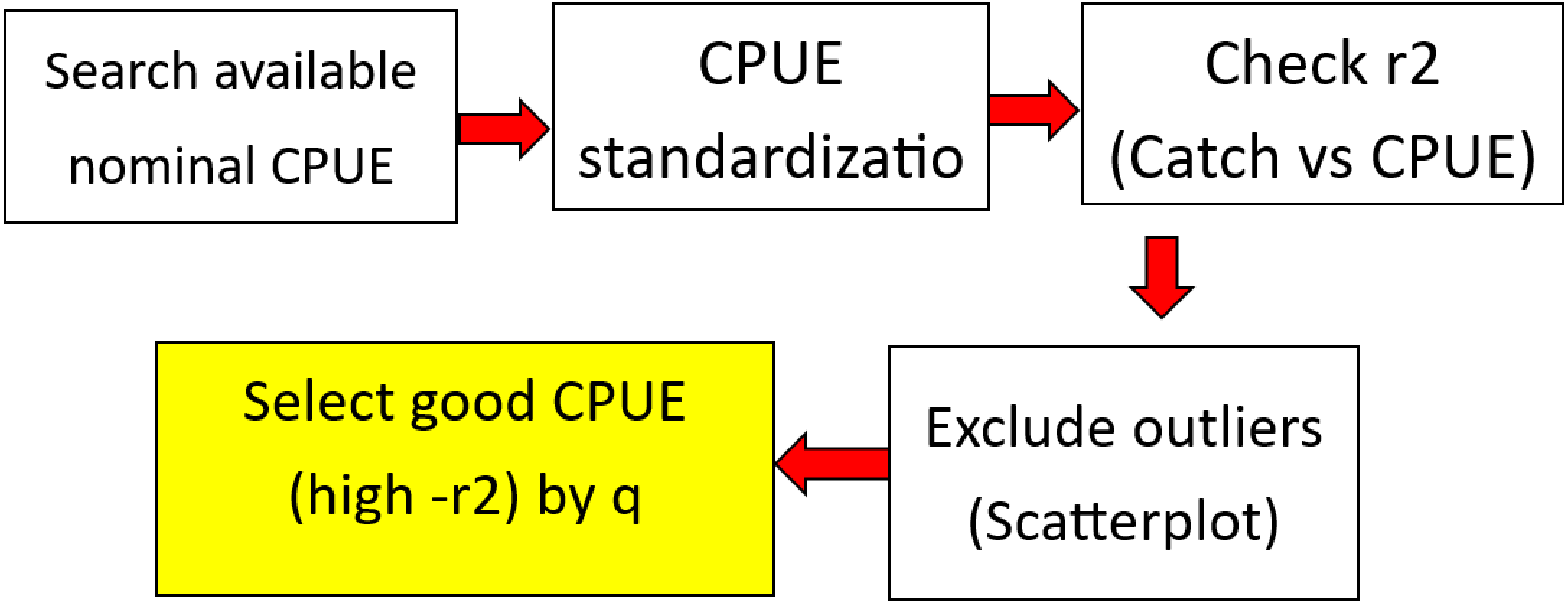
Visually
Good relation
(4 individual CPUE➔ good)

Note on selected standardized CPUE

- Same 4 STD_CPUE can be used next 3~5 years if no big changes in fisheries affecting STD_CPUE.

- 3~5 years later and/or if there are some big changes on fisheries, we need to update and find the good STD_CPUE again.

Flowchart to select good CPUE for JABBA



SM WG

5. JABBA

Contents (JABBA)

5.1 Implementation

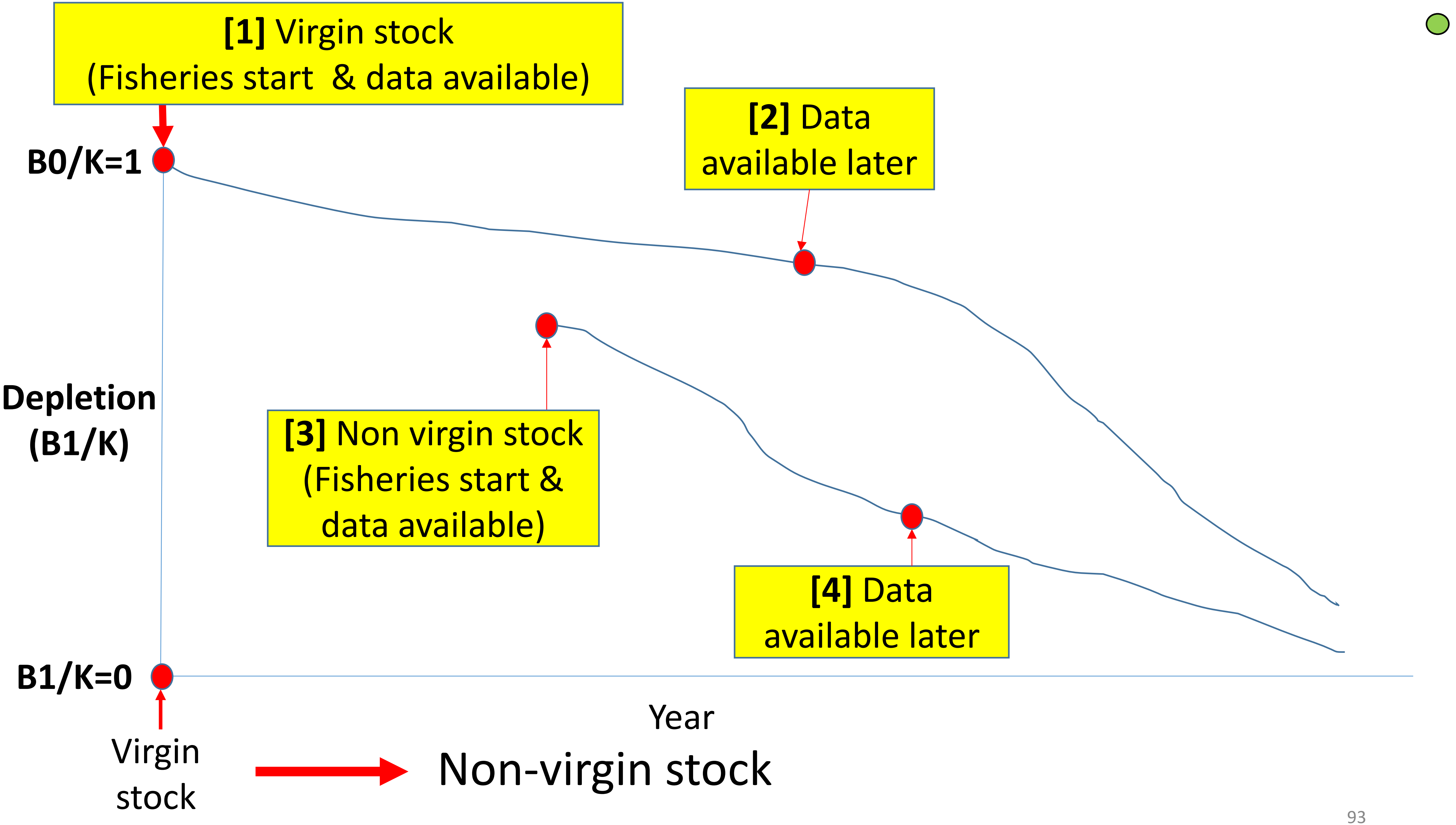
5.2 Let‘s try our SM data

5.3 Comparisons with TB model

5.1 Implementation

4 cases

What & why are 4 cases?


[1] Virgin stock
(Fisheries start & data available)
[2] Data
available later
B0/K=1
Depletion
(B1/K)
[3] Non virgin stock
(Fisheries start &
data available)
[4] Data
available later
B1/K=0
Year
Virgin
stock
Non-virgin stock

Implementation case [1]~[4]

Case [1] ➔ direct (normal) approach

Vs.

Case [2]~[4] ➔ Scenario approach

Case [2]~[4]
Why scenario approach ? Why not normal approach?
Butterworth & Wang

To use direct (normal) estimation approach : Case [1]

➔ Virgin stock & data available

(Need long, stable & reliable data)

➔ Tuna & BILL fish data (RFMO) 1950~ OK

RFMO Regional Fisheries Management Organization

Why scenario approach ? Why not direct approach?
Nishida + Butterworth + Wang

- If fisheries start after virgin stock ➔ B1/K cannot be estimated
- Problem [2]~[4] normal approach

  ➔ Seeded B1/K itself is estimated!

  ➔ NG

  Normally different estimated values

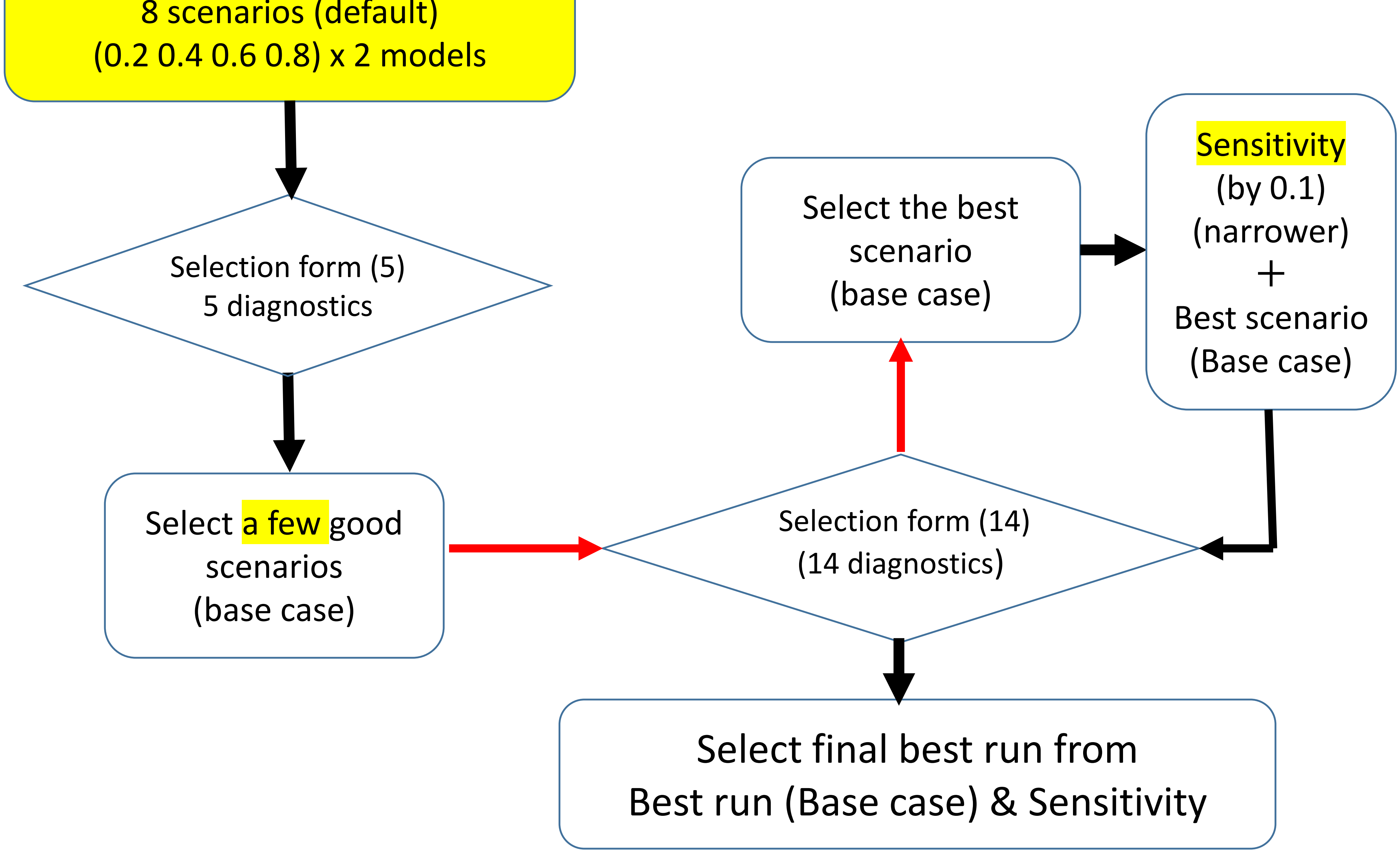
Need Scenario (robust) approach

Good for non virgin & data available later

Initial Seeding values (B1/K) Depletion	Estimated B1/K (almost same) NG	
	Schaefer	Fox
0.2	0.21	0.20
0.4	0.39	0.39
0.6	0.59	0.58
0.8	0.80	0.82

How to implement cases [2]~[4]?

Implementation
JABBA runs Case 2~4 (Scenario approach)



Set up scenarios for depletion (B0/K)
Model Schaefer & Fox

(1) Default (no pre-knowledge of B0/K)

➔ Default 4 B0/K (0.2 0.4 0.6 0.8) (to search wider range)

➔ **Then 8 scenarios 4B0/K x 2 models**

(2) Pre-knowledge (search smaller range)

	Stock level	B0/K	# of scenario	total #
Example 1 ➔	likely low	0.2, 0.3 & 0.4	6	12
Example 2 ➔	likely middle	0.4, 0.5 & 0.6	6	12
Example 3 ➔	likely high	0.7, 0.8 & 0.9	6	12

5.2 Let’s try our SM data

BAD NEWS

It took a very long time (1 week) to find the best run

So, we cannot spend one week.

We will practice the last stage of runs

Selection form (5)➔ Whole search work. Red Box ➔ exploratory runs.
Green BOX (good runs) is the final stage runs🡐 we will practice

								Strategy	1st (individual CPUE)						2nd (average)									
Source	Period		fleet	n=	Gear	Kg per	r2 (%)	Serial #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
								Scenario #	1	2	3	4	5	6	1	2	3	4	5	6	7	8	9	10
								depletion	0.6	0.6	0.6	0.2	0.4	0.4	0.4	0.4	0.2	0.2	0.4	0.4	0.6	0.6	0.8	0.8
								Model s(Schaefer) f(Fox)	s	s	s	s	s	f	s	s	s	f	s	f	s	f	s	f
								run ID	SM-ID1-0.6s	SM-ID2-0.6s2	SM-ID3-0.6s3	SM-ID4-0.2s	SM-ID5-0.4s	SM-ID6-0.4f	SM-AV1-0.4s	SM-AV2-0.4s2	SM-AV3-0.2s	SM-AV4-0.2f	SM-AV5-0.4s	SM-AV6-0.4f	SM-AV7-0.6s	SM-AV8-0.6f	SM-AV9-0.8s	SM-AV10-0.6f
Statistical Division	1971~1994	q12	fleet1	24	PT	haul	-16	Assignment of CPUE											Ave					
	1995~2023	q3	fleet2	21															Ave					
	2016~2023	q3	fleet3	21	MEGL	day	-21																	
Port sampling	2016~2023	q4	fleet4	8	OBT	day	-23												Ave					
Diagnoses & Results								Kobe plot	ok	ok	ok	ok	ok	ng	ok	ok	ng	ng	ok	ok	ok	ok	ok	ok
								CPUE	ng	ng	ng	ng	ng	ng	ng	ng	ok	ok	ok	ok	ok	ok	ok	ok
								Retrospective analyses	ok	ok	ok	ok	ng	ng	ok	ok	ng	ng	ok	ok	ok	ok	ok	ok
								Convergence	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ng	ok	ok	ok	ok
								retro&hind (Table)	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok	ok
								Results	ng	ng	ng	ng	ng	ng	ng	ng	ng	ng	ok	ng	ok	ok	ok	ok

Set up folders & files
0.4s is prepared. You need to set up all others

Input data sets
(available in 0.4s folder, Base case)

(1)Catch
(2)CPUE
(3)CV

Catch (1971~2023)

	A	B
1	yr	all
2	1971	35870
3	1972	29930
4	1973	38343
5	1974	24481
6	1975	52295
7	1976	49069
8	1977	25247
9	1978	38332
10	1979	81623
11	1980	46063
12	1981	63486
13	1982	70147
14	1983	66106
15	1984	99008
16	1985	103905
17	1986	90259
18	1987	97798
19	1988	98106
20	1989	98782
21	1990	70583
22	1991	53221
23	1992	80780
24	1993	62701
25	1994	67393
26	1995	88715
27	1996	72935
28	1997	73459
29	1998	95017
30	1999	83044
31	2000	76392
32	2001	69170
33	2002	74723
34	2003	84244
35	2004	89620
36	2005	77161
37	2006	78415
38	2007	71885
39	2008	83292
40	2009	80225
41	2010	80761
42	2011	113283
43	2012	101478
44	2013	113291
45	2014	114402
46	2015	48522
47	2016	26658
48	2017	21655
49	2018	11307
50	2019	19423
51	2020	15225
52	2021	19598
53	2022	35708
54	2023	41219

CPUE(4 fleets)

yr	f1(PTh12)	f2(PTh34)	f3(MEGLd3)	f4(OBTd4)
1971	4.87			
1972	6.2			
1973	6.78			
1974	5.99			
1975	8.42			
1976	3.98			
1977	2.83			
1978	3.86			
1979	2.97			
1980	2.81			
1981	2.61			
1982	1.89			
1983	2.76			
1984	1.73			
1985	1.61			
1986	2.26			
1987	3.08			
1988	3.16			
1989	3.18			
1990	2.32			
1991	2.2			
1992	1.87			
1993	1.62			
1994	1.59			
1995		1.56	657.77	
1996		1.49	803.99	
1997		1.51	803.96	
1998		4.07	756	
1999		3.53	422.78	
2000		3.16	433.03	
2001		2.62	357.02	
2002		2.72	352.16	
2003		2.4	250.08	
2004		3.56	250.29	
2005		3.52	199.66	
2006		3.81	216.05	
2007		3.84	217.77	
2008		5.17	228.91	
2009		4.71	266.38	
2010		3.3	338.77	
2011		2.22	73.91	
2012		2.87	98.9	
2013		3.3	90.07	
2014		1.81	88.56	0.96
2015				0.49
2016				0.41
2017				0.67
2018				0.43
2019				0.77
2020				0.5
2021				1.07
2022		2.31		
2023		2.13		

q12

q3

q4

CPUE code
f1 fleet1
PT gear
h haul
12 q12

	A	B	C	D	E
1	yr	f1(PTh12)	f2(PTh34)	f3(MEGLd3)	f4(OBTd4)
2	1971	4.87			
3	1972	6.2			
4	1973	6.78			
5	1974	5.99			
6	1975	8.42			
7	1976	3.98			
8	1977	2.83			

CV
For CPUE
Default
0.2
(same as ASPIC)

yr	f1(PTh12)	f2(PTh34)	f3(MEGJd4)	f4(OBTd4)
1971	0.2			
1972	0.2			
1973	0.2			
1974	0.2			
1975	0.2			
1976	0.2			
1977	0.2			
1978	0.2			
1979	0.2			
1980	0.2			
1981	0.2			
1982	0.2			
1983	0.2			
1984	0.2			
1985	0.2			
1986	0.2			
1987	0.2			
1988	0.2			
1989	0.2			
1990	0.2			
1991	0.2			
1992	0.2			
1993	0.2			
1994	0.2			
1995		0.2	0.2	
1996		0.2	0.2	
1997		0.2	0.2	
1998		0.2	0.2	
1999		0.2	0.2	
2000		0.2	0.2	
2001		0.2	0.2	
2002		0.2	0.2	
2003		0.2	0.2	
2004		0.2	0.2	
2005		0.2	0.2	
2006		0.2	0.2	
2007		0.2	0.2	
2008		0.2	0.2	
2009		0.2	0.2	
2010		0.2	0.2	
2011		0.2	0.2	
2012		0.2	0.2	
2013		0.2	0.2	
2014		0.2	0.2	0.2
2015				0.2
2016				0.2
2017				0.2
2018				0.2
2019				0.2
2020				0.2
2021				0.2
2022		0.2		
2023		0.2		

q12

q3

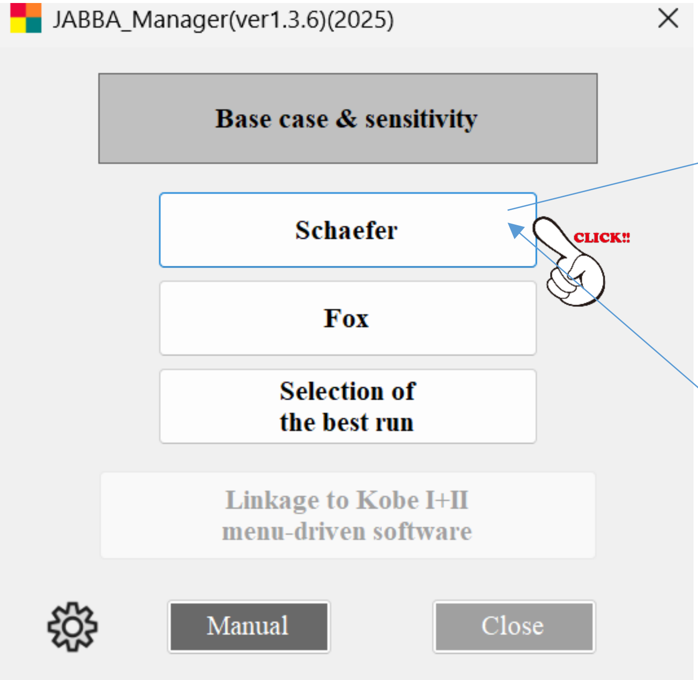
q4

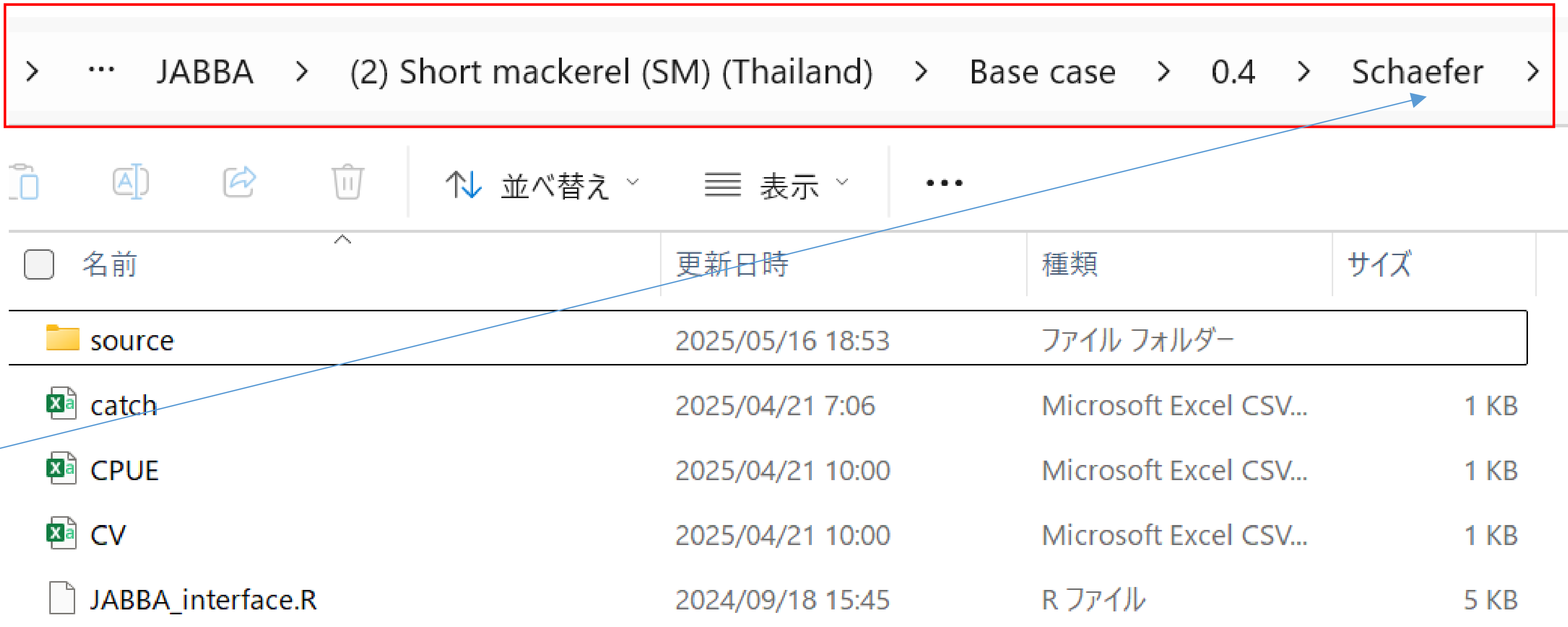
Let’s try 0.4s together then you do the rest

This Selection form (5) is available in Data Practice folder

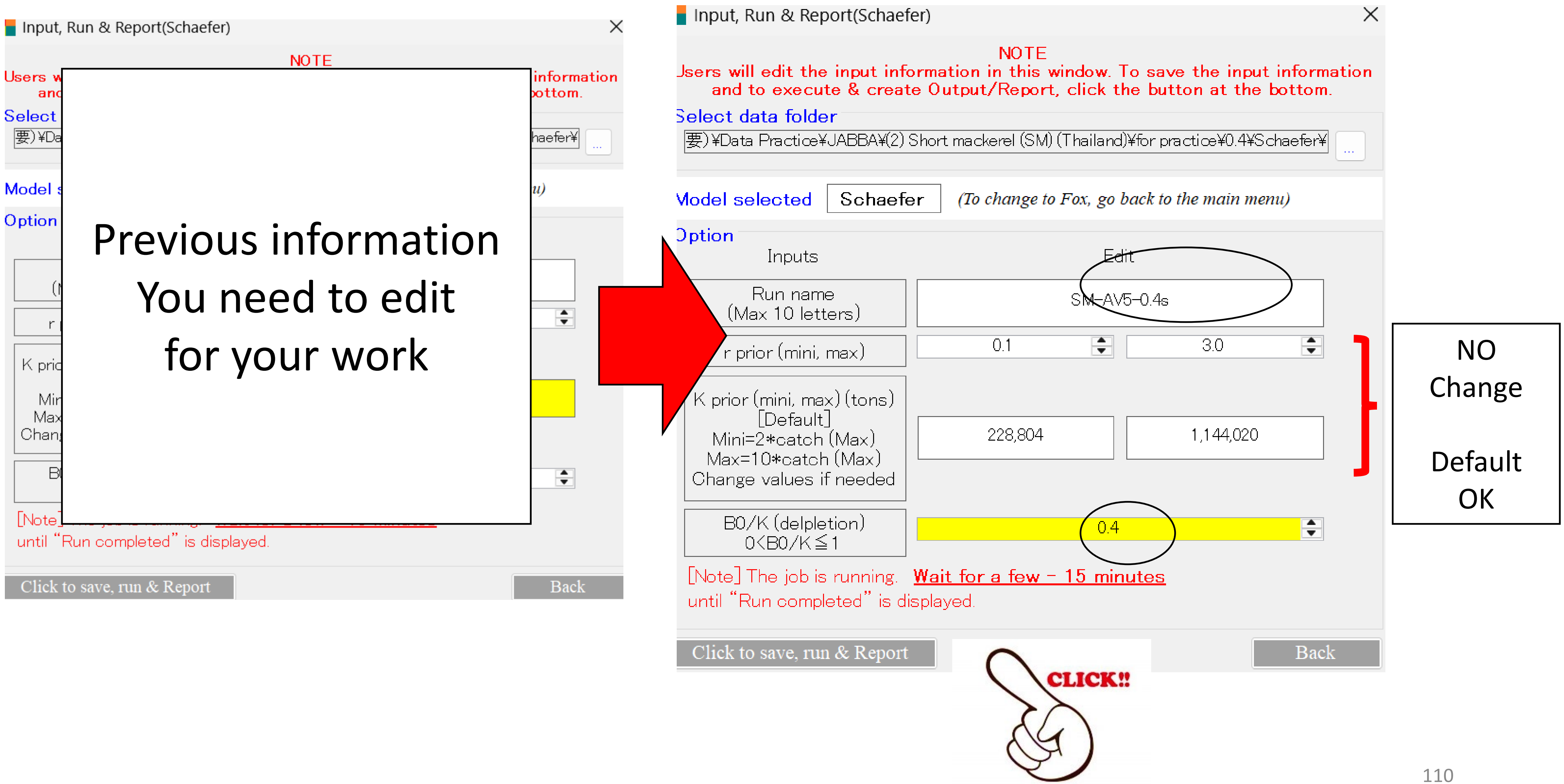
								Strategy	
Source	Period		fleet	n=	Gear	Kg per	r2 (%)	Serial #	11
								Scenario #	5
								depletion	0.4
								Model s(Schaefer) f(Fox)	s
								run ID	SM-AV5-0.4s
Statistical Division	1971~1994	q12	fleet1	24	PT	haul	-16	Assignment of CPUE	
	1995~2023	q3	fleet2	21					
	2016~2023	q3	fleet3	21	MEGL	day	-21		
Port sampling	2016~2023	q4	fleet4	8	OBT	day	-23		
Diagnoses & Results								Kobe plot	
								CPUE	
								Retrospective analyses	
								Convergence	
								retro&hind (Table)	
								Results	

JABBA runs

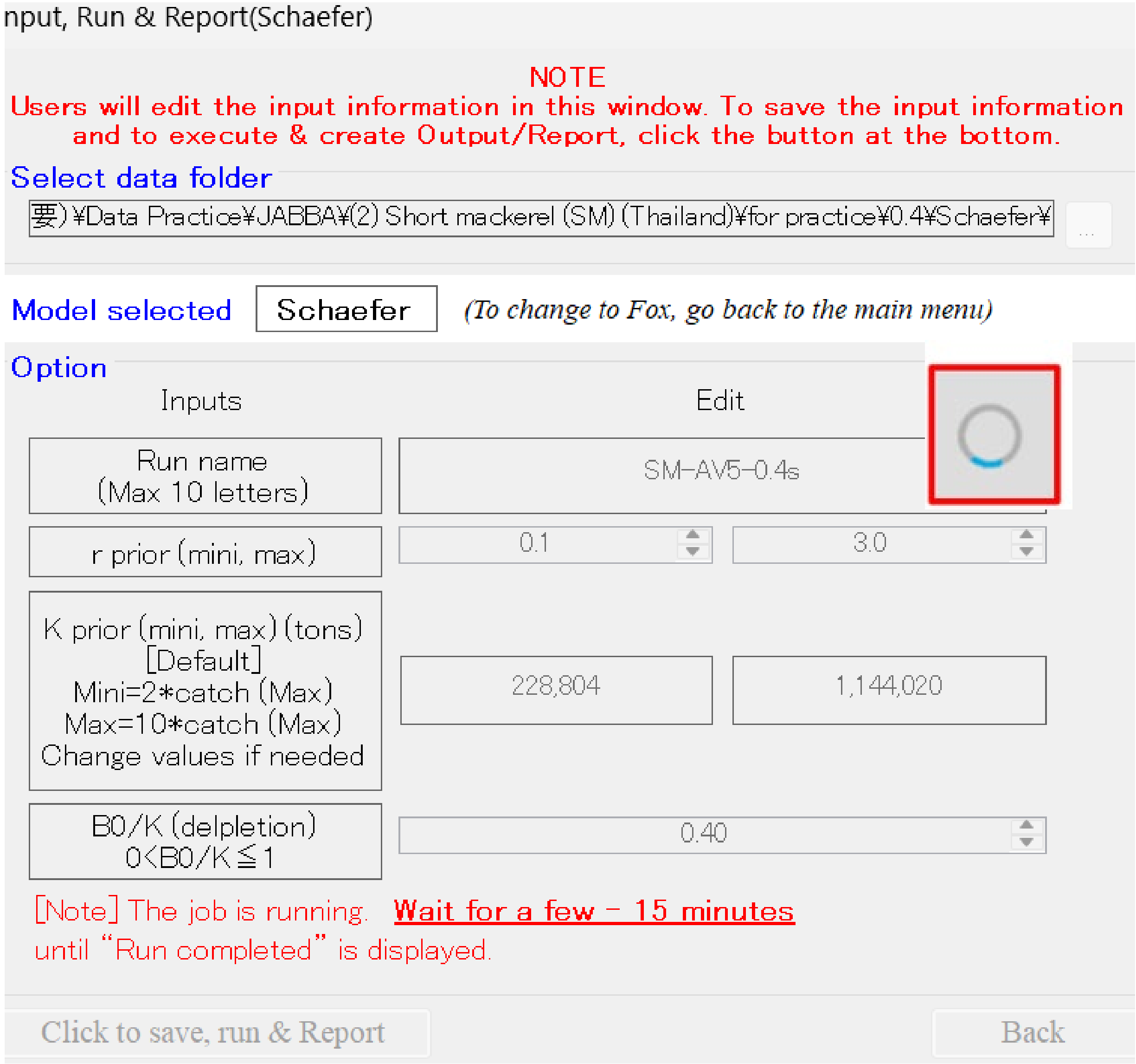




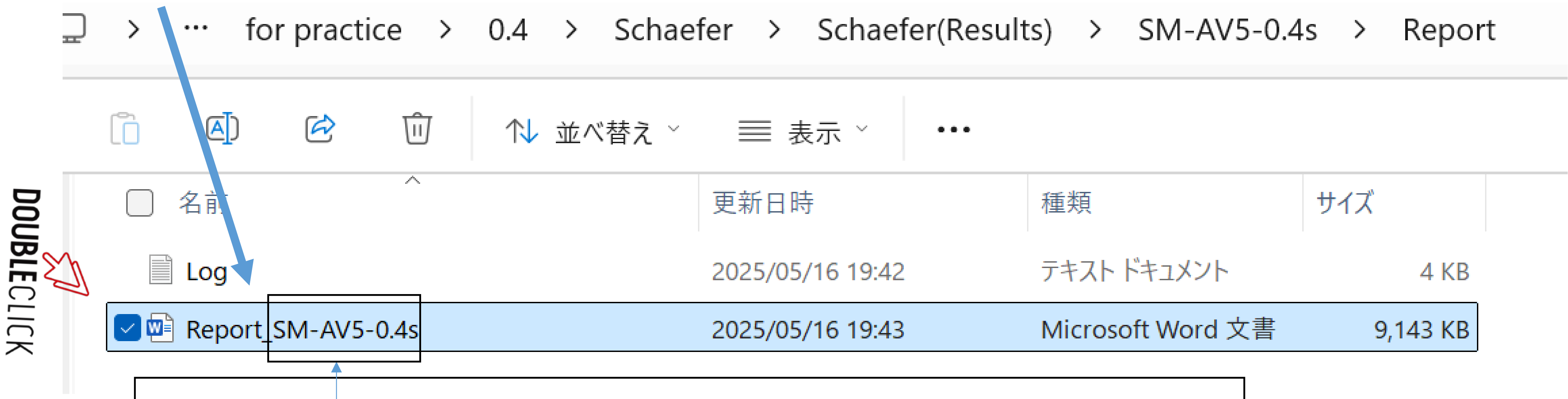
Import Schaefer folder


Input, Run & Report(Schaefer)
NOTE
Previous information
You need to edit
for your work
Click to save, run & Report
Back
Input, Run & Report(Schaefer)
NOTE
Users will edit the input information in this window. To save the input information and to execute & create Output/Report, click the button at the bottom.
Select data folder
要)¥Data Practice¥JABBA¥(2) Short mackerel (SM) (Thailand)¥for practice¥0.4¥Schaefer¥
Model selected
Schaefer
(To change to Fox, go back to the main menu)
Option
Inputs
Edit
Run name (Max 10 letters)
SM-AV5-0.4s
r prior (mini, max)
0.1
3.0
K prior (mini, max) (tons) [Default] Mini=2*catch (Max) Max=10*catch (Max) Change values if needed
228,804
1,144,020
B0/K (delpletion) 0<B0/K≦1
0.4
[Note] The job is running. Wait for a few – 15 minutes until "Run completed" is displayed.
Click to save, run & Report
Back
CLICK!!
NO Change
Default OK

Takes 5-15 minutes depending on your PC



Results (very deep in the folder)



SM→ Short mackerel

AVE →2nd Strategy (average) scenario #5

0.4 →Depletion 0.4 by Schaefer

Page 1

SM-AV5-0.4s(Schaefer)

Report_SM-AV5-0.4s (Schaefer)

SM
AVE5 individual
Scenario #5
Run # 0.4S

Contents

Note: Sometimes there are blank figures and/or tables due to space limitations. In such a case, please copy and paste from the original output files located one before this Report folder). If there are no outputs, please leave it empty.

Page 2

Output (43 files) *(24 files are used in this Report, while not for 19 files with X)*

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Posteriors__Schaefer_Unif	MCMC__Schaefer_Unif	Posteriors__Schaefer_LNorm	MCMC__Schaefer_LNorm	Comp_Unif-LNorm_summary__Schaefer	Comp_Unif-LNorm_trajectory__Schaefer	Index__Schaefer	Catch__Schaefer	Catch-fit__Schaefer	Index_Residuals__Schaefer
(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
Index-biomass__Schaefer	Index_PP_ckeck__Schaefer	Index_Residual-Runs-Tests__Schaefer	Index-logFits__Schaefer	ProcDev__Schaefer	Trajectory__Schaefer	Surplus-Production_phase__Schaefer	Kobe-plot__Schaefer	Summary__Schaefer	_Estimates_MCMC
(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)
_Estimates	_CPUE_Fits	_Estimate_MainQ_80%CI	_Trajectory_80%CI	_Trajectory_Projection_default_80%CI	_Kobe2_Red_default	_Kobe2_Green_annual_default	Projection_default__Schaefer	Projection_default_main_	Projection_default_recent__Schaefer
(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)
Projection_default_recent_main_	_Trajectory_Projection_AR1_80%CI	_Kobe2_Red_AR1	_Kobe2_Green_annual_AR1	Projection_AR1__Schaefer	Projection_AR1_main_	Projection_AR1_recent_Schaefer_	Projection_AR1_recent_main_	Projection_Compare_default-AR1_	Retro_Schaefer
(41)	(42)	(43)							
Hind-Cast_CV	_Mohns	_MASE							

All outputs x are not used

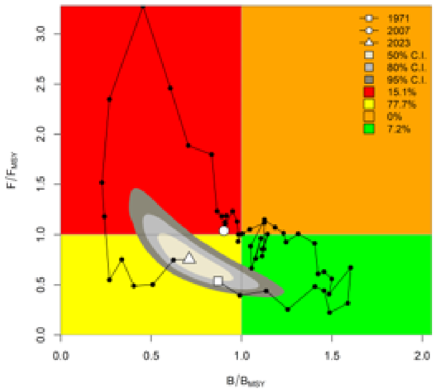
(Note) Blanks means implausible results or not available.

Page 3 (most important)

Summary of results & diagnoses (1/2) (Key diagnoses)

Kobe plot

(#18) (page 18) Kobe plot

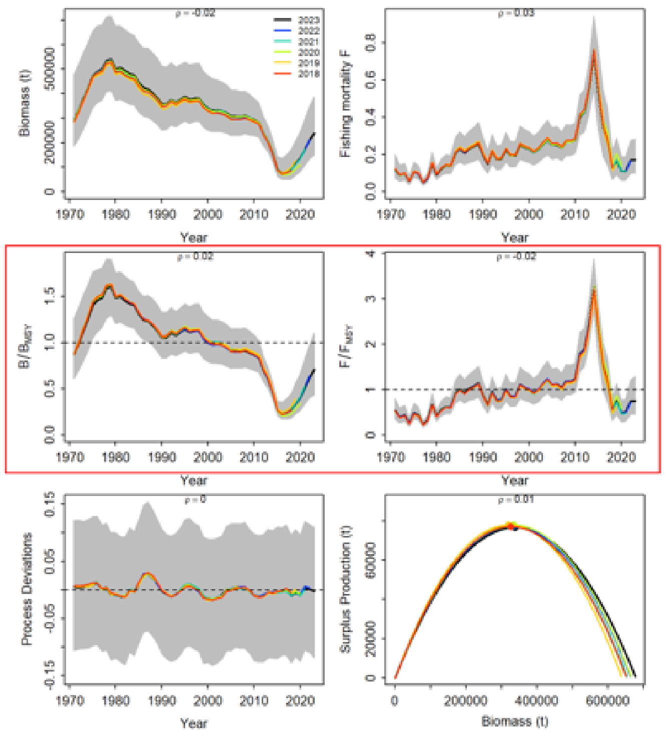


Retrospective analyses

(#42) (p.12) Retrospective analyses
for 2 most important parameters (B & F)
Mohan ρ (-0.15 < ρ < 0.2) ➔ Converged
(value closer to 0.025 is better)
Yellow marker (not converged)

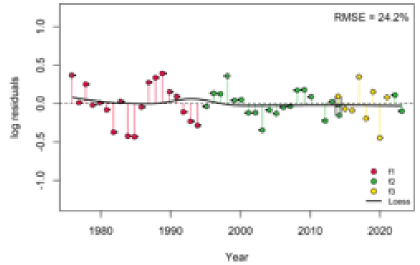
Mohan ρ	B	F
2023	0.01	-0.01
2022	0.01	-0.01
2021	-0.19	0.22
2020	0.11	-0.10
2019	-0.05	0.04
Average	-0.02	0.03

(#40) (p.14) Retrospective patterns

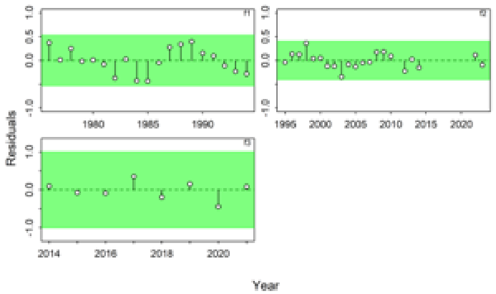


CPUE fitness

(#10) (page 8) CPUE fitness (1)
(lower RMSE better)



(#13) (page 7) CPUE fitness (2)
Red band: No randomness
Red points: outliers



Convergence

(#20) (p.5) Convergence (MCMC)
(> 0.05) (higher better)
Yellow markers
(not converged)

	Geweke.p	Heidel.p
K	0.78	0.40
r	0.88	0.66

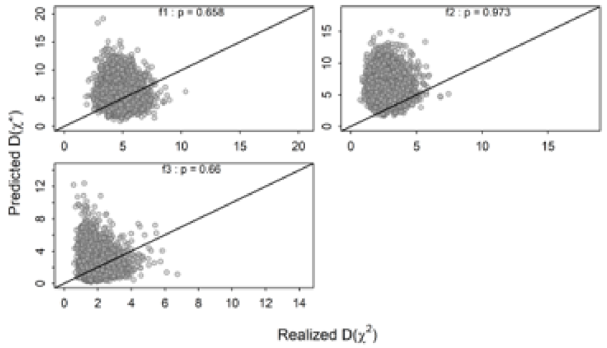
Page 4 (most important)

Summary of results & diagnoses (2/2)

MODEL FITS

(#12) (page 11)
Posterior Predictive Check (PPC).
p should be
0.2<p<0.8
and closer to 0.5
is better fit.
(Users: compute Ave. & write below)

Ave. p=___



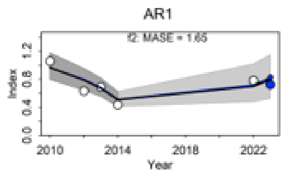
HINDCAST ANALYSES

(#41) (page 15) Hindcast
(predictive skill)
If predicted color points > 95% CI
➔NG for prediction

(#43) (page 14)
MASE
(Predictive skill)
(< 1)
(smaller better)

Yellow markers (> 1)
Not acceptable

Index	MASE
f1	NA
f2	1.65
f3	NA
Average	NA



ESTIMATED PARAMETER VALUES

(#21)
(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	677,990	524,327	883,533
r	Pop. growth rate	0.45	0.34	0.60
B0/K	Depletion (EST)	0.43	0.31	0.62
sigma.proc	Estimable process VAR	0.05	0.03	0.09
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.23	0.17	0.30
TBmsy	TB at MSY (t)	338,995	262,163	441,766
MSY	MSY (t)	76,619	69,781	84,034
Catch(2023)	Current catch	41,219		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(1971)/K	Depletion (OBS)(start)	0.44	0.30	0.63
TB(2023)/K	Depletion (OBS)(last)	0.36	0.22	0.55
TB/TBmsy	TB ratio	0.71	0.44	1.11
F/Fmsy	F ratio	0.76	0.46	1.30

From page 5~19
Detail explanation of results

Last page 20
For next step
Selection form (to be explained later)

How to evaluate the results ?
5 Key diagnoses

Visual inspection (3 diagnoses)

(1) Kobe plot

(2) CPUE (Autocorrelation) (green)

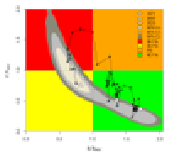
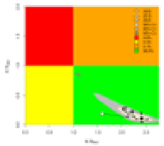
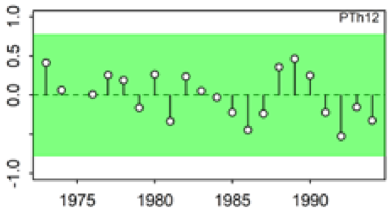
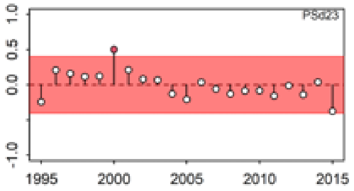
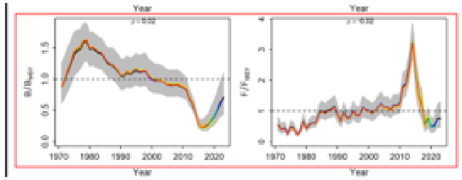
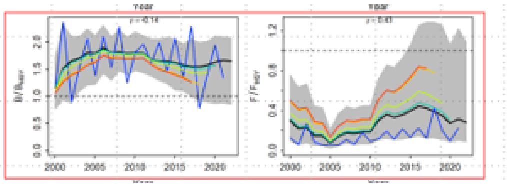
(3) Retrospective pattern (B & F)

Numerical inspection (2 diagnoses)

(4) Convergence

(5) Retro & Hind cast Table

5 Quick diagnostics (refer to Report or Manual for details)

Type	Contents	Criteria	Judgment: OK	Judgment: NG
Kobe plot	Stock status	Should reflect the plausible stock status		Too optimistic 
Time series residual CPUE		No autocorrelation, i.e., time series patterns of CPUE should be random and no patterns.		
		Outliers	OK	One outlier Remove then may become green
Retrospective analyses	Justification of JABBA runs	Retrospective patterns should be similar (especially for B/Bmsy & F/Fmsy)		
Convergence	All parameters are properly estimated.	Non-significant in Geweke p & Welch p tests	NG for yellow markers	

	Geweke.p	Heidel.p
K	0.04	0.22
r	0.97	0.56

Let's see results one by one

do you have this ? If so, complete all Selection form (5)

								Strategy	
Source	Period		fleet	n=	Gear	Kg per	r2 (%)	Serial #	11
								Scenario #	5
								depletion	0.4
								Model s(Schaefer) f(Fox)	s
								run ID	SM-AV5-0.4s
Statistical Division	1971~1994	q12	fleet1	24	PT	haul	-16	Assignment of CPUE	
	1995~2023	q3	fleet2	21					
	2016~2023	q3	fleet3	21	MEGL	day	-21		
Port sampling	2016~2023	q4	fleet4	8	OBT	day	-23		
Diagnoses & Results								Kobe plot	ok
								CPUE	ok
								Retrospective analyses	ok
								Convergence	ok
								retro&hind (Table)	ok
								Results	ok

You are now working

You might have different results

due to visual inspection (subjective)

But it is OK.
Let see your results.

Source	Period		fleet	n=	Gear	Kg per	r2 (%)	Serial #	11	12	13	14	15	16
								Scenario #	5	6	7	8	9	10
								depletion	0.4	0.4	0.6	0.6	0.8	0.8
								Model s(Schaefer) f(Fox)	s	f	s	f	s	f
								run ID	SM-AV5-0.4s	SM-AV6-0.4f	SM-AV7-0.6s	SM-AV8-0.6f	SM-AV9-0.8s	SM-AV10-0.6f
Statistical Division	1971~1994	q12	fleet1	24	PT	haul	-16	Assignment of CPUE	IND					
	1995~2023	q3	fleet2	21					Ave					
	2016~2023	q3	fleet3	21	MEGL	day	-21							
Port sampling	2016~2023	q4	fleet4	8	OBT	day	-23		IND					
Diagnoses & Results								Kobe plot	ok	ok	ok	ok	ok	ok
								CPUE	ok	ok	ok	ok	ok	ok
								Retrospective analyses	ok	ok	ok	ok	ok	ok
								Convergence	ok	ng	ok	ok	ok	ok
								retro&hind (Table)	ok	ok	ok	ok	ok	ok
								Results	ok	ng	ok	ok	ok	ok

hybrid

Start 3:15 PM

What is the important diagnostics

Numerical evaluation # of non convergence (B & F)

(excluding average)

Below 4 are not converged (0.6f)

RETROSPECTIVE ANALYSES

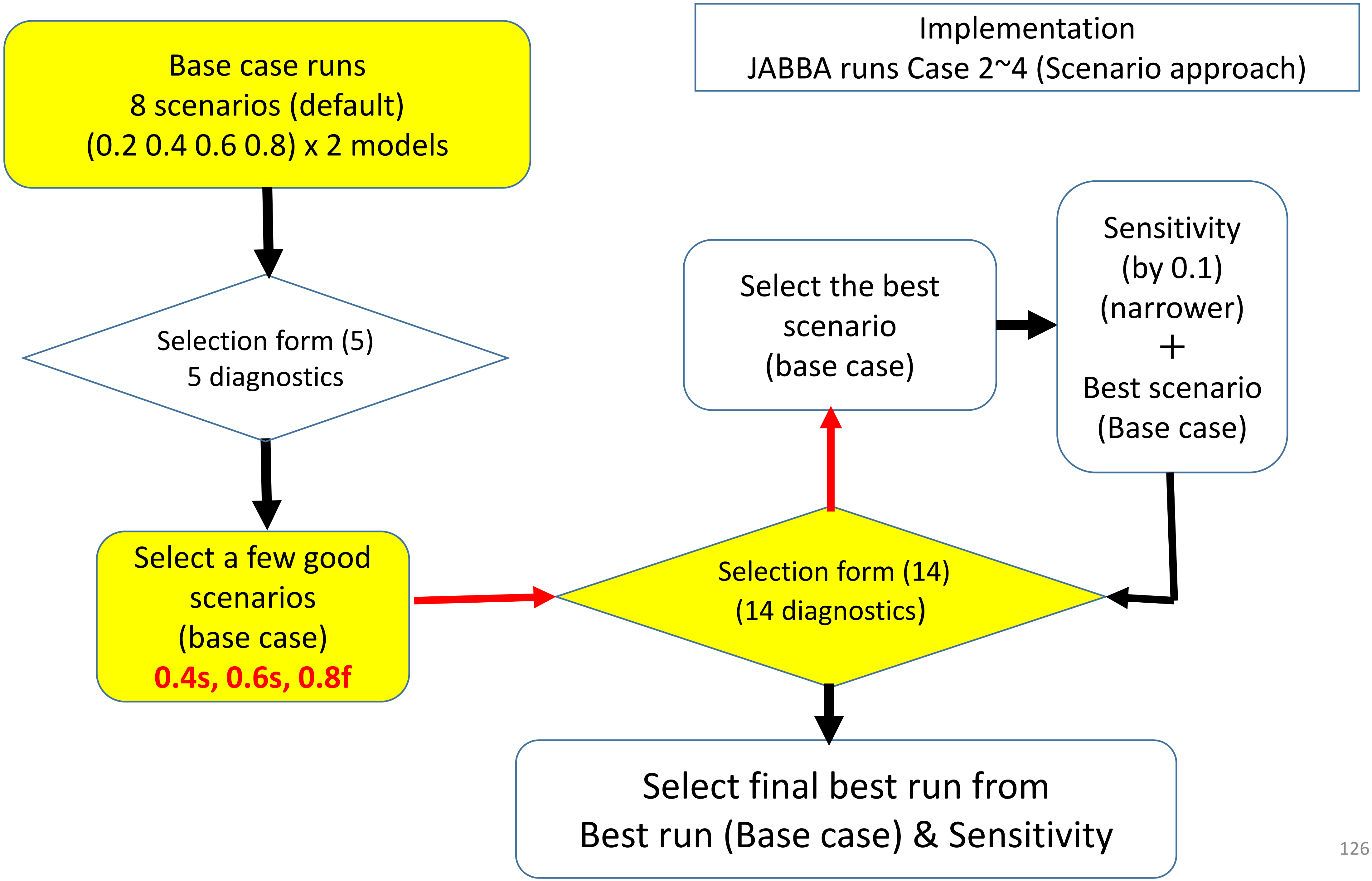
(#42) (p.12) Retrospective analyses for 2 most important parameters (B & F)
Mohan ρ (-0.15 < ρ < 0.2) ➔ Converged
(value closer to 0.025 is better)
Yellow marker (not converged)

Mohan ρ	B	F
2023	0.06	-0.05
2022	-0.22	0.28
2021	-0.14	0.16
2020	-0.03	0.02
2019	0.26	-0.20
Average	-0.01	0.04

I checked for you

0.4s, 0.6s & 0.8f selected

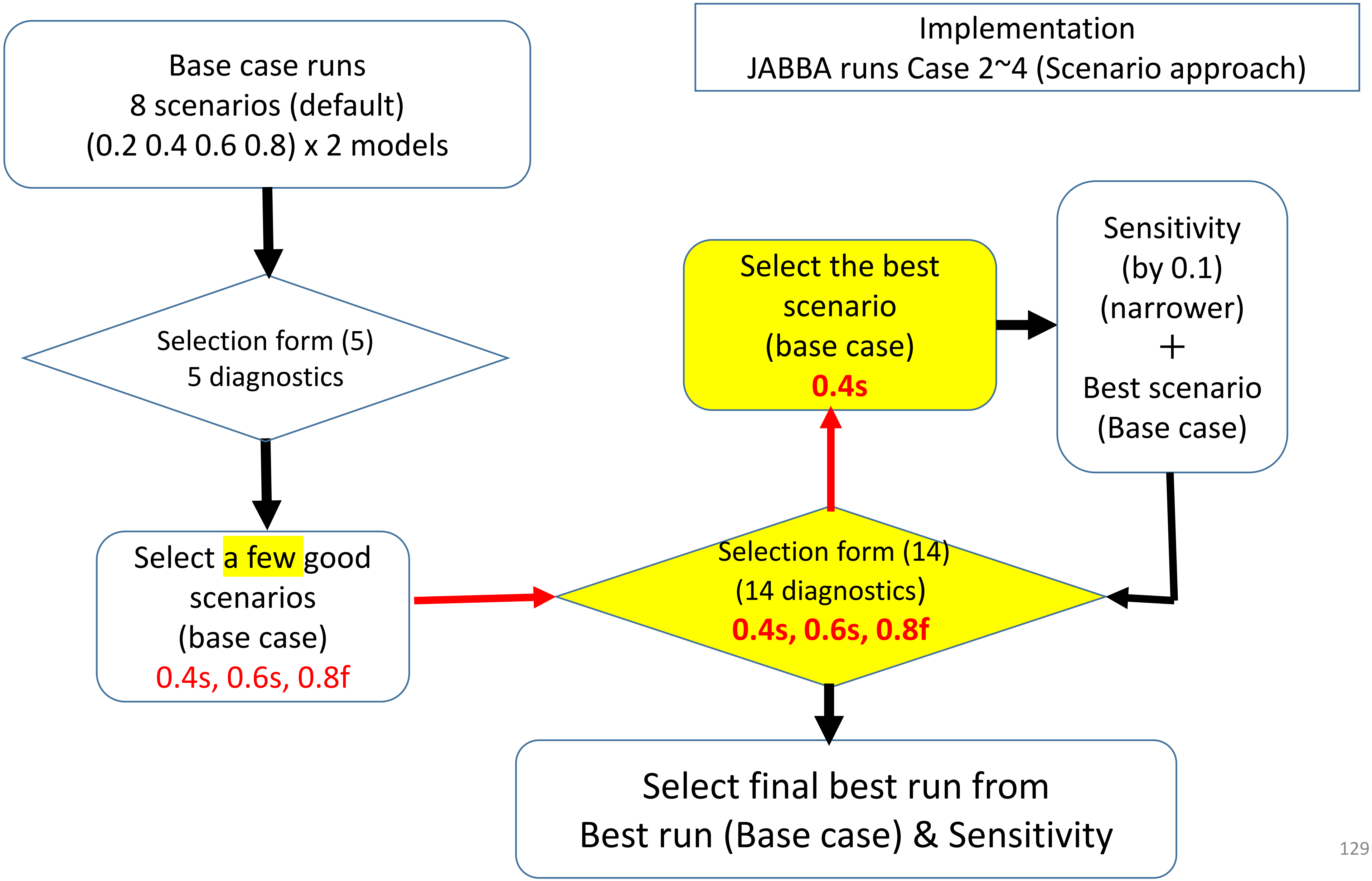
Source	Period		fleet	n=	Gear	Kg per	r2 (%)	Serial #	11	12	13	14	15	16
								Scenario #	5	6	7	8	9	10
								depletion	0.4	0.4	0.6	0.6	0.8	0.8
								Model s(Schaefer) f(Fox)	s	f	s	f	s	f
								run ID	SM-AV5-0.4s	SM-AV6-0.4f	SM-AV7-0.6s	SM-AV8-0.6f	SM-AV9-0.8s	SM-AV10-0.6f
Statistical Division	1971~1994	q12	fleet1	24	PT	haul	-16	Assignment of CPUE	Ave					
	1995~2023	q3	fleet2	21					Ave					
	2016~2023	q3	fleet3	21	MEGL	day	-21							
Port sampling	2016~2023	q4	fleet4	8	OBT	day	-23		Ave					
Diagnoses & Results								Kobe plot	ok	ok	ok	ok	ok	ok
								CPUE	ok	ok	ok	ok	ok	ok
								Retrospective analyses	ok	ok	ok	ok	ok	ok
								Convergence	ok	ng	ok	ok	ok	ok
								retro&hind (Table)	ok	ok	ok	ok	ok	ok
								Results	ok	ng	ok	ok	ok	ok
								# of yellow (retro)	2	4	2	4	4	2


Implementation
JABBA runs Case 2~4 (Scenario approach)
Base case runs
8 scenarios (default)
(0.2 0.4 0.6 0.8) x 2 models
Selection form (5)
5 diagnostics
Select a few good scenarios
(base case)
0.4s, 0.6s, 0.8f
Selection form (14)
(14 diagnostics)
Select the best scenario
(base case)
Sensitivity
(by 0.1)
(narrower)
+
Best scenario
(Base case)
Select final best run from
Best run (Base case) & Sensitivity

We will use Selection form (14) to decide the best run (base case)

- We will work together
- Results (see next page)
- Use copies of page 4-5 (each report) (0.4s, 0.6s & 0,8f) to fill out the Selection form (14)

Please see Manual for details on diagnostics.	Evaluation	1. Convergence (MCMC)				2. Model Fit					3. Retrospective analyses		4. Hindcast analyses		
		Heidelberger and Welch p test				2.1 CPUE residuals		2.2 RMSE	2.3 Posterior Predictive Check (PPC)						
	Methods	Geweke.p (larger value better)		Heidel.p (larger value better)		95% CI band		RMSE	Average p values (compute yourself)	Visual inspection	Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (# of yellow: non significant=NG predicted skill) (for B & F)	MASE (Average value)	Visual inspection
	Criteria	K	r	K	r	Red band Auto-correlation? No is better	total # of outliers less # is better	Less % better fit	Use the 5th sheet to compute. Closer to 0.5 is better	Ball shapes located in center are better (how many #?)	# of yellow markers (B & F ratio) less better	All trends should be similar patterns.	Less # better	should be < 1 & smaller better	# OBS points beyond the 95% CI band
	Output # (page#)	# 20 (p.3)				# 13 (p.3)		# 10 (p.3)	# 12 (p.4)		# 42 (p.3)	# 40 (p.3)	# 43 (p.4)		# 41 (p.4)
	diagnostics #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Refer to sheet # how to do								(4)		(5)		(6)		
Sensitivity	0.4s	0.78	0.88	0.40	0.66	0	0	24.2	0.764	2OK	2	OK	1	NA	OK
Nest run (base case)	0.6s	0.31	0.71	0.19	0.43	0	0	23.8	0.782	2OK	2	OK	1	NA	OK
Sensitivity	0.8f	0.44	0.37	0.24	0.40	0	0	23.6	0.768	1OK	2	OK	1	NA	OK
	Best scenario?	0.4s	0.4s	0.4s	0.4s	same	same	0.8f	0.4s	0.4s & 0.6s	same	same	same	same	same
Comments & decision	(1)	# of the best diagnosis for 0.4s is 6, 0.6s is 1 and 0.8s is 2.													
	(2)	Thus 0.4s is the best and main reason is that Convergences are much better than others.													
	(3)	Thus we select 0.4s													


Implementation
JABBA runs Case 2~4 (Scenario approach)
Base case runs
8 scenarios (default)
(0.2 0.4 0.6 0.8) x 2 models
Selection form (5)
5 diagnostics
Select a few good scenarios
(base case)
0.4s, 0.6s, 0.8f
Select the best scenario
(base case)
0.4s
Sensitivity
(by 0.1)
(narrower)
+
Best scenario
(Base case)
Selection form (14)
(14 diagnostics)
0.4s, 0.6s, 0.8f
Select final best run from
Best run (Base case) & Sensitivity

0.4s is selected as the best run (base case)

Sensitivity by 0.1 (before & after 0.4s)

0.3s & 0.5s

New ID

SM-final-0.3s

SM-AV8-0.4s (original)

SM-final-0.5s

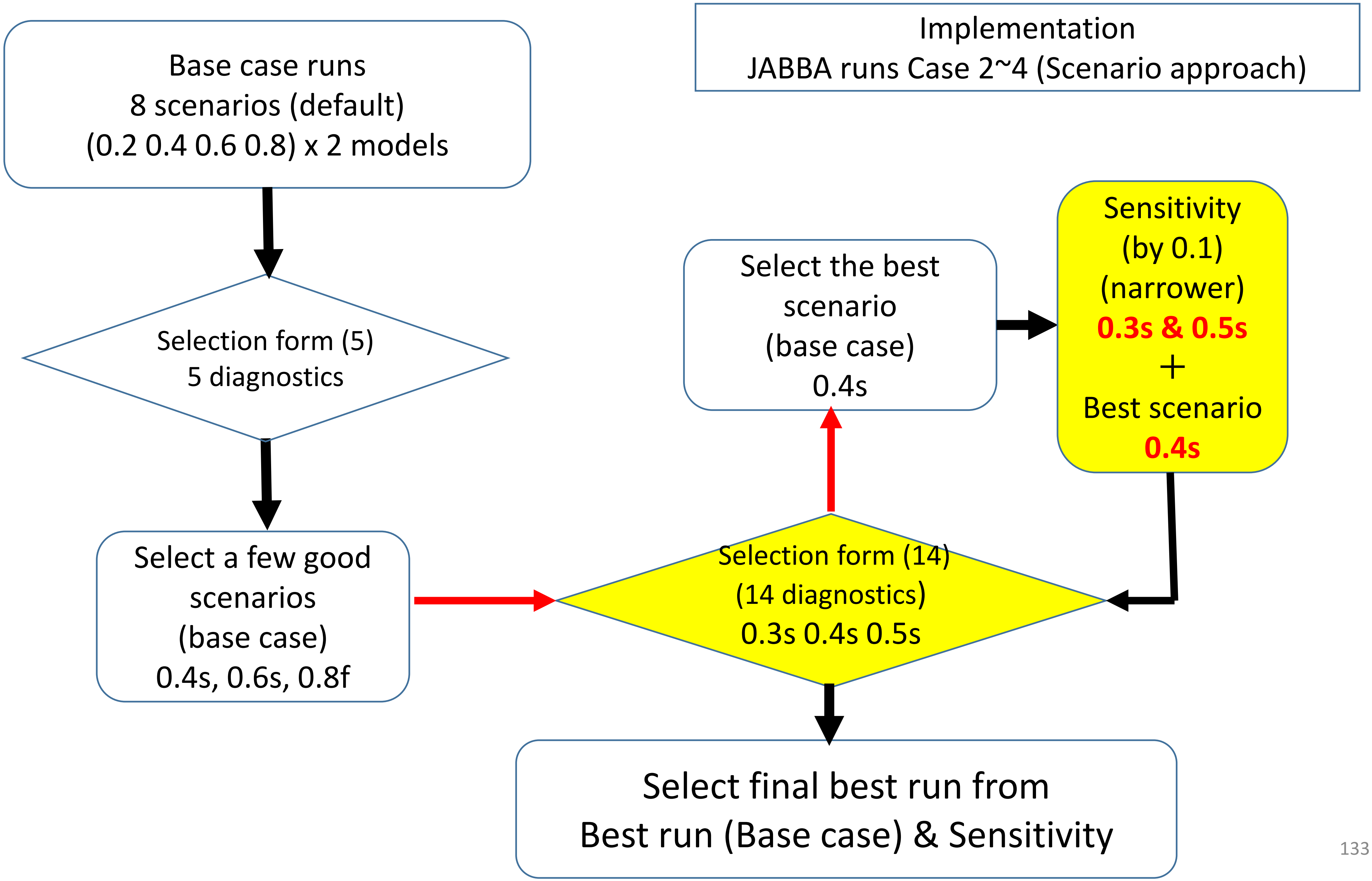
0.3s, 0.4s, 0.5s will be compared

Selection form (14)

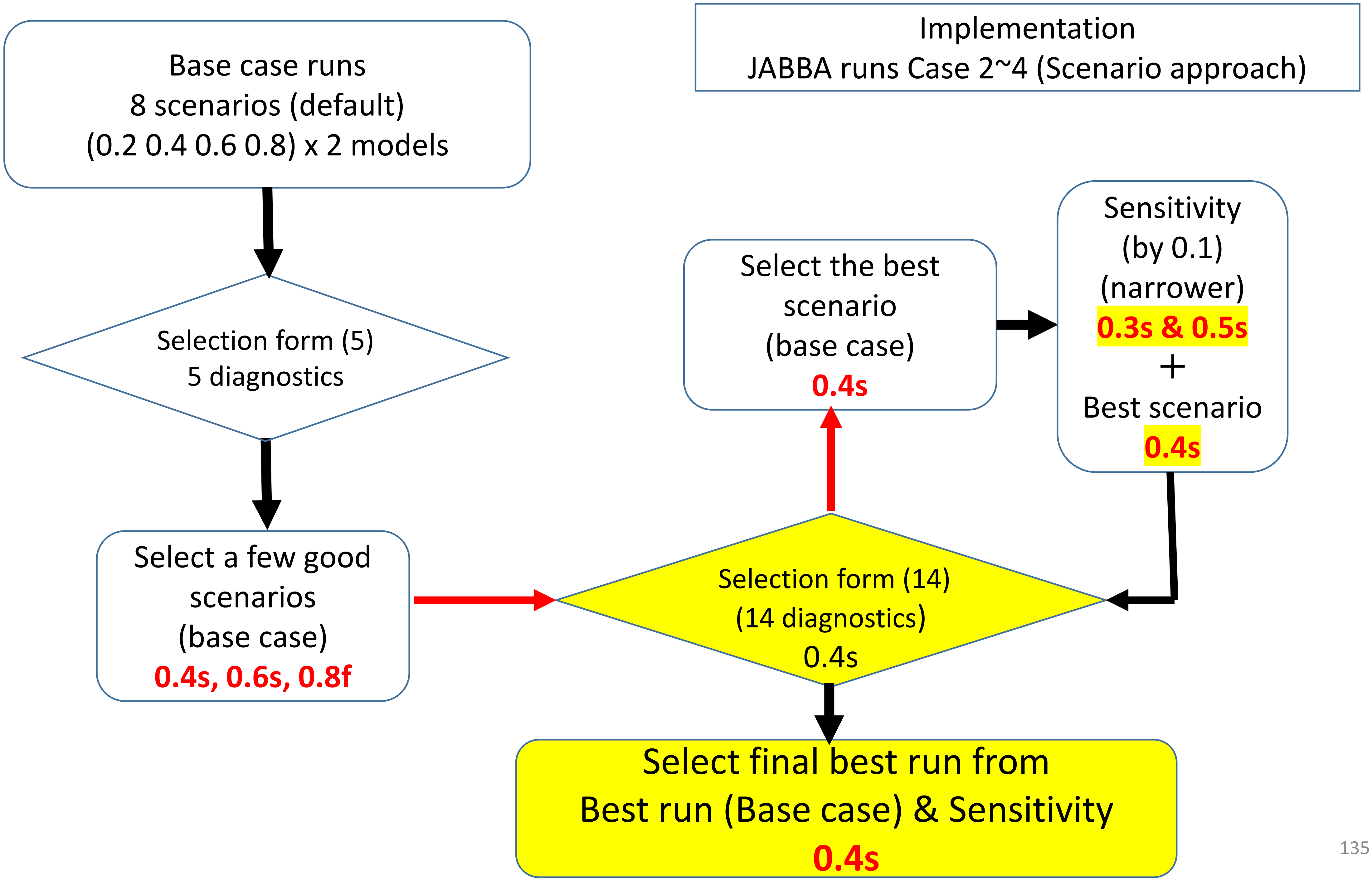
Now you can do it by yourself

Selection form (14) (final) is available in Data Practice folder

	Evaluation	1. Convergence (MCMC)				2. Model Fit					3. Retrospective analyses		4. Hindcast analyses		
		Heidelberger and Welch p test				2.1 CPUE residuals		2.2 RMSE	2.3 Posterior Predictive Check (PPC)						
Please see Manual for details on diagnostics.	Methods	Geweke.p (larger value better)		Heidel.p (larger value better)		95% CI band		RMSE	Average p values (compute yourself)	Visual inspection	Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (# of yellow: non significant=NG predicted skill) (for B & F)	MASE (Average value)	Visual inspection
	Criteria	K	r	K	r	Red band Auto-correlation? No is better	total # of outliers less # is better	Less % better fit	Use the 5th sheet to compute. Closer to 0.5 is better	Ball shapes located in center are better (how many #?)	# of yellow markers (B & F ratio) less better	All trends should be similar patterns.	Less # better	should be < 1 & smaller better	# OBS points beyond the 95% CI band
	Output # (page#)	# 20 (p.3)				# 13 (p.3)		# 10 (p.3)	# 12 (p.4)		# 42 (p.3)	# 40 (p.3)	# 43 (p.4)		# 41 (p.4)
	diagnostics #	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Refer to sheet # how to do								(4)		(5)		(6)		
Sensitivity	0.3s														4
Nest run (base case)	0.4s														
Sensitivity	0.5s														
	Best scenario?														
Comments & decision	(1)														
	(2)														
	(3)														


Implementation
JABBA runs Case 2~4 (Scenario approach)
Base case runs
8 scenarios (default)
(0.2 0.4 0.6 0.8) x 2 models
Selection form (5)
5 diagnostics
Select a few good scenarios
(base case)
0.4s, 0.6s, 0.8f
Selection form (14)
(14 diagnostics)
0.3s 0.4s 0.5s
Select the best scenario
(base case)
0.4s
Sensitivity
(by 0.1)
(narrower)
0.3s & 0.5s
+
Best scenario
0.4s
Select final best run from
Best run (Base case) & Sensitivity

What is your results?


Implementation
JABBA runs Case 2~4 (Scenario approach)
Base case runs
8 scenarios (default)
(0.2 0.4 0.6 0.8) x 2 models
Selection form (5)
5 diagnostics
Select a few good scenarios
(base case)
0.4s, 0.6s, 0.8f
Selection form (14)
(14 diagnostics)
0.4s
Select the best scenario
(base case)
0.4s
Sensitivity
(by 0.1)
(narrower)
0.3s & 0.5s
+
Best scenario
0.4s
Select final best run from
Best run (Base case) & Sensitivity
0.4s

Explanation of final results (0.4s) 2nd Strategy (average)

Before start, why average is Good?

Good progress in the 2nd strategy (average CPUE)

Beginning of the 2nd strategy

➔ good results (very quick)

As averages are BETTER indicator.

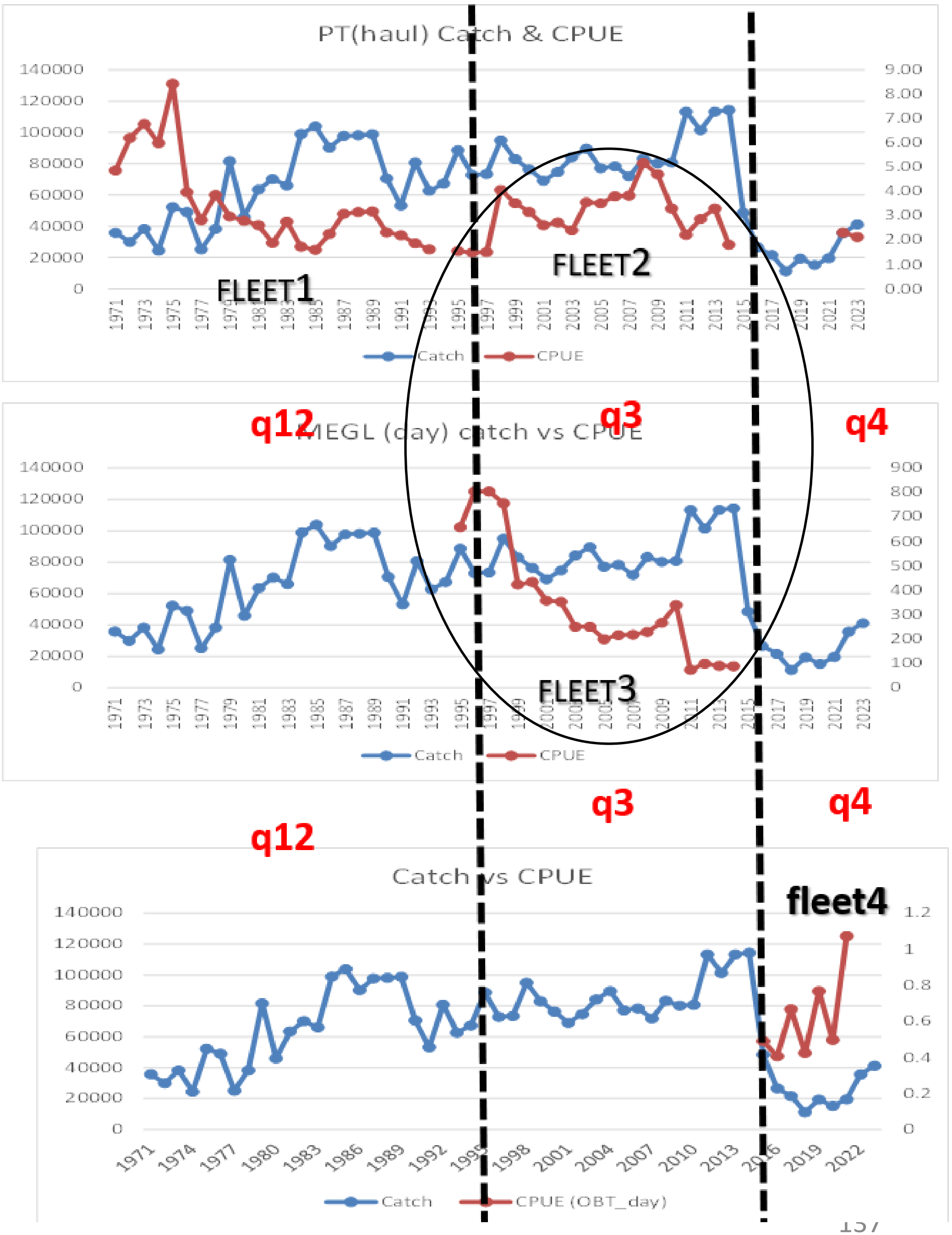
⬇

Speed up JABBA

with good Results

We could start from 2nd Strategy

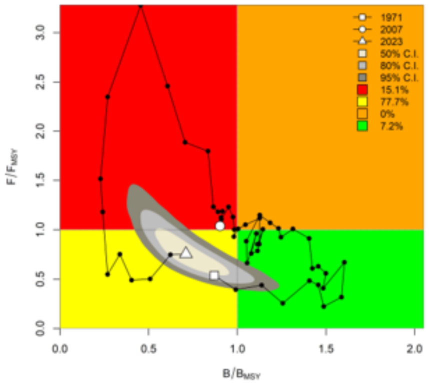
But normally start with 1st Strategy (individual)



Summary of results & diagnoses (1/2) (Key diagnoses)

Kobe plot

(#18) (page 18) Kobe plot



Convergence

(#20) (p.5) Convergence (MCMC)
(> 0.05) (higher better)
Yellow markers
(not converged)

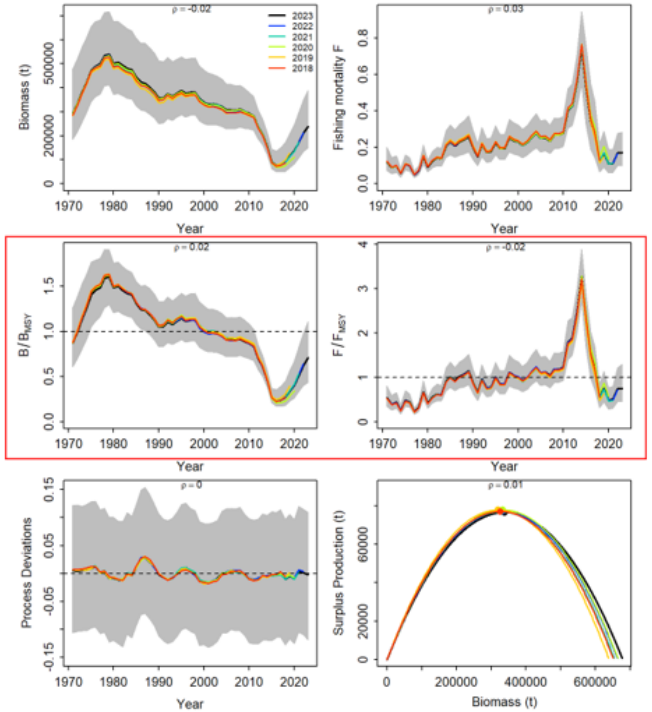
	Geweke.p	Heidel.p
K	0.78	0.40
r	0.88	0.66

Retrospective analyses

(#42) (p.12) Retrospective analyses
for 2 most important parameters (B & F)
Mohan ρ (-0.15 < ρ < 0.2) ➔ Converged
(value closer to 0.025 is better)
Yellow marker (not converged)

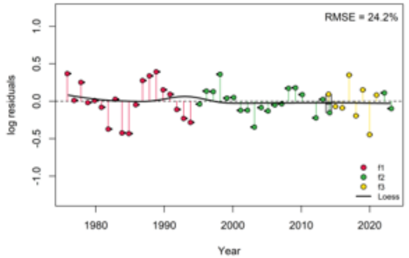
Mohan ρ	B	F
2023	0.01	-0.01
2022	0.01	-0.01
2021	-0.19	0.22
2020	0.11	-0.10
2019	-0.05	0.04
Average	-0.02	0.03

(#40) (p.14) Retrospective patterns

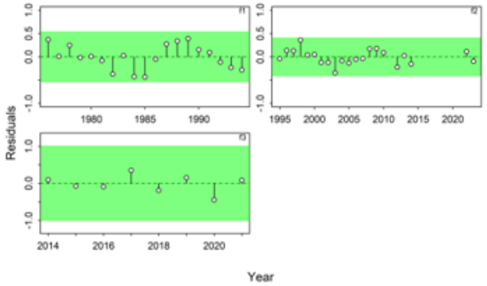


CPUE fitness

(#10) (page 8) CPUE fitness (1)
(lower RMSE better)



(#13) (page 7) CPUE fitness (2)
Red band: No randomness
Red points: outliers

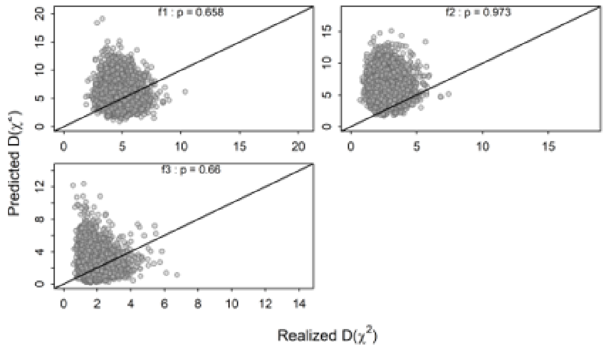


Summary of results & diagnoses (2/2)

Model fits

(#12) (page 11)
Posterior Predictive Check (PPC).
p should be
0.2<p<0.8
and closer to 0.5
is better fit.
(Users: compute Ave. & write below)

Ave. p=___



Estimated Depletion=0.43

Estimated parameter values

(#21)
(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	677,990	524,327	883,533
r	Pop. growth rate	0.45	0.34	0.60
B0/K	Depletion (EST)	0.43	0.31	0.62
sigma.proc	Estimable process VAR	0.05	0.03	0.09
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.23	0.17	0.30
TBmsy	TB at MSY (t)	338,995	262,163	441,766
MSY	MSY (t)	76,619	69,781	84,034
Catch(2023)	Current catch	41,219		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(1971)/ K	Depletion (OBS)(start)	0.44	0.30	0.63
TB(2023)/ K	Depletion (OBS)(last)	0.36	0.22	0.55
TB/TBmsy	TB ratio	0.71	0.44	1.11
F/Fmsy	F ratio	0.76	0.46	1.30

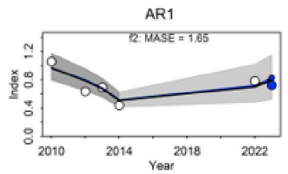
Hindcast analyses

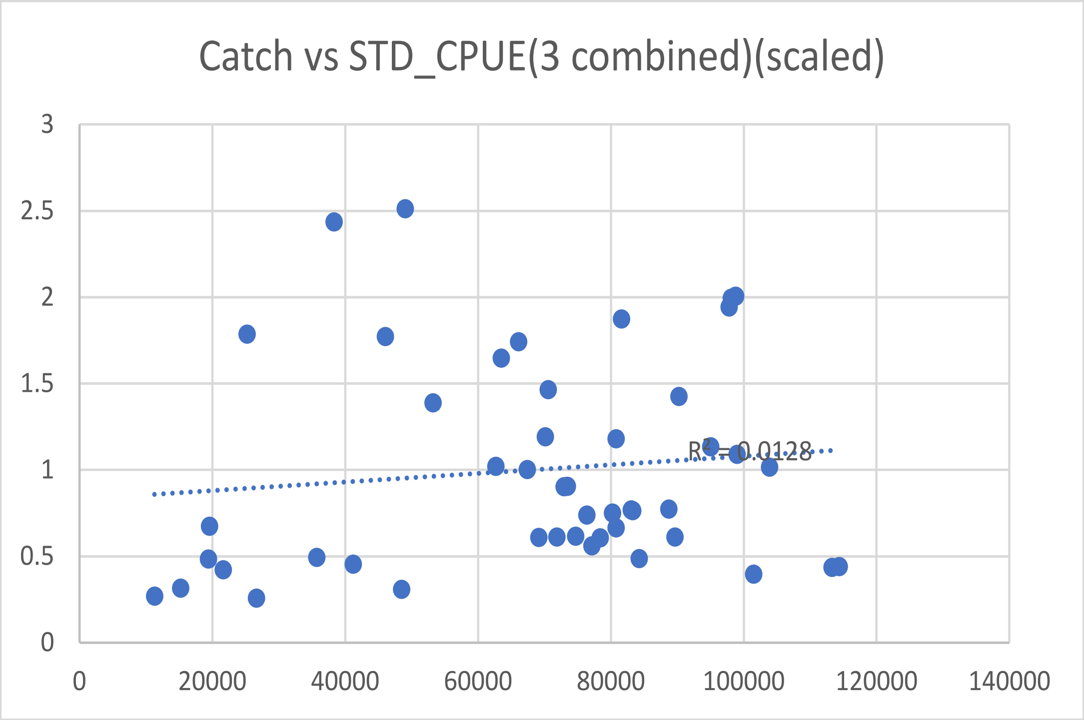
(#41) (page 15) Hindcast
(predictive skill)
If predicted color points > 95% CI
→NG for prediction

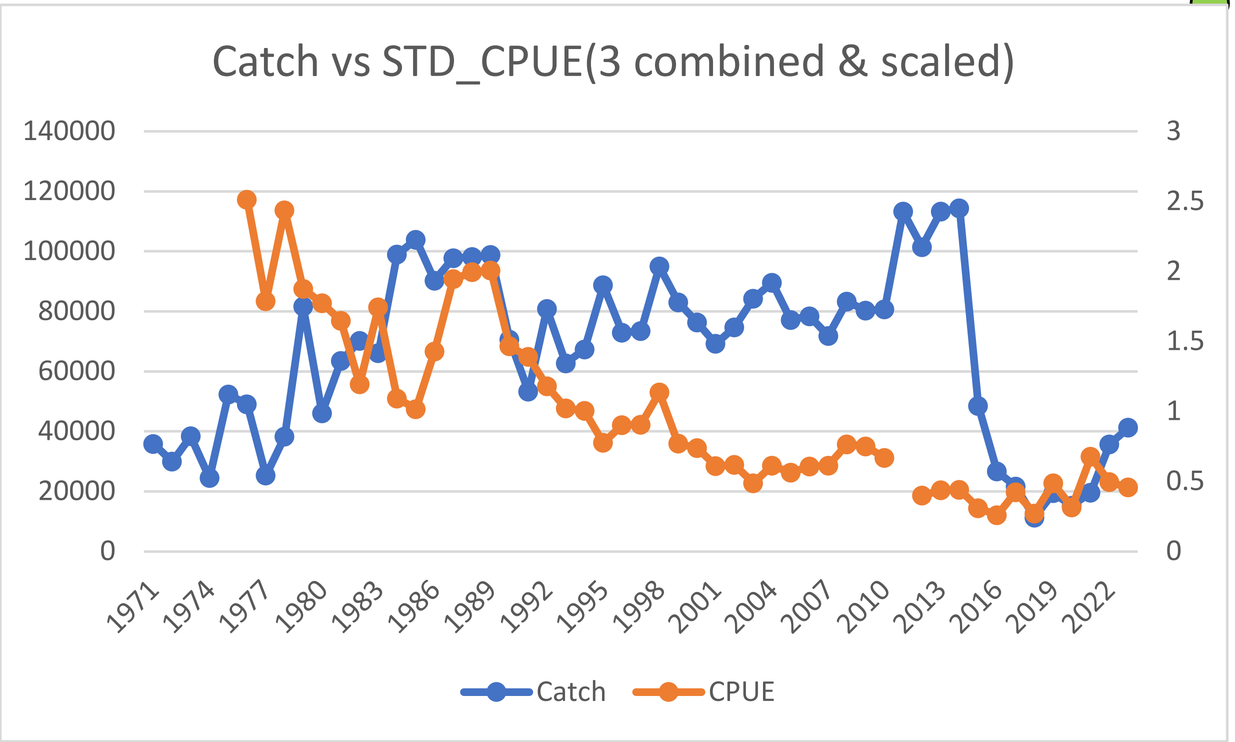
(#43) (page 14)
MASE
(Predictive skill)
(< 1)
(smaller better)

Yellow markers (> 1)
Not acceptable

Index	MASE
f1	NA
f2	1.65
f3	NA
Average	NA



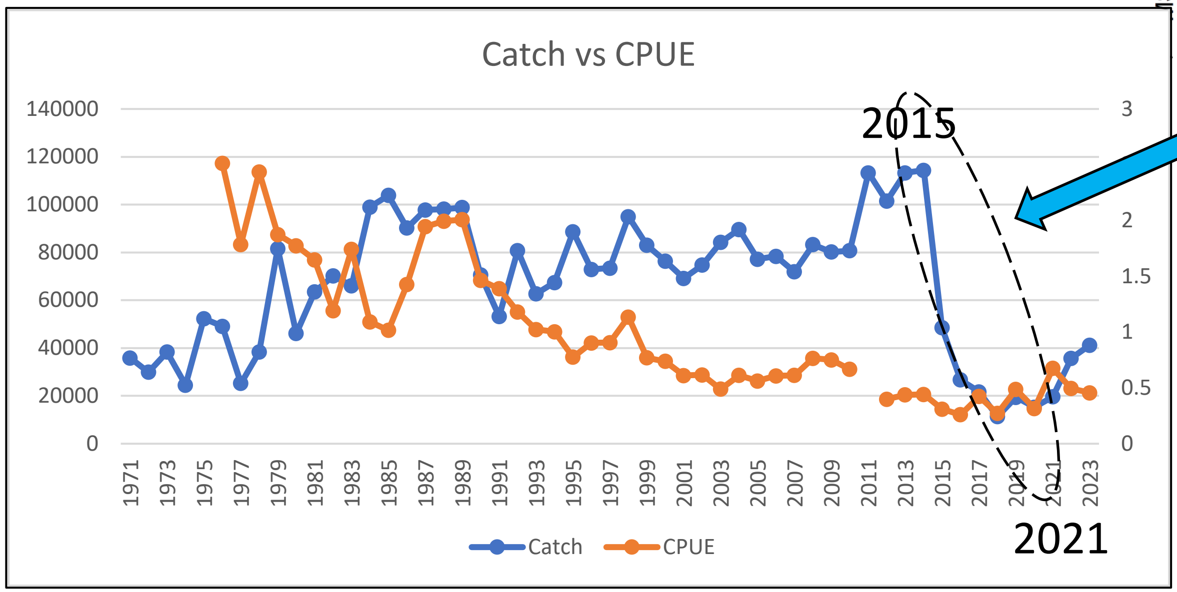


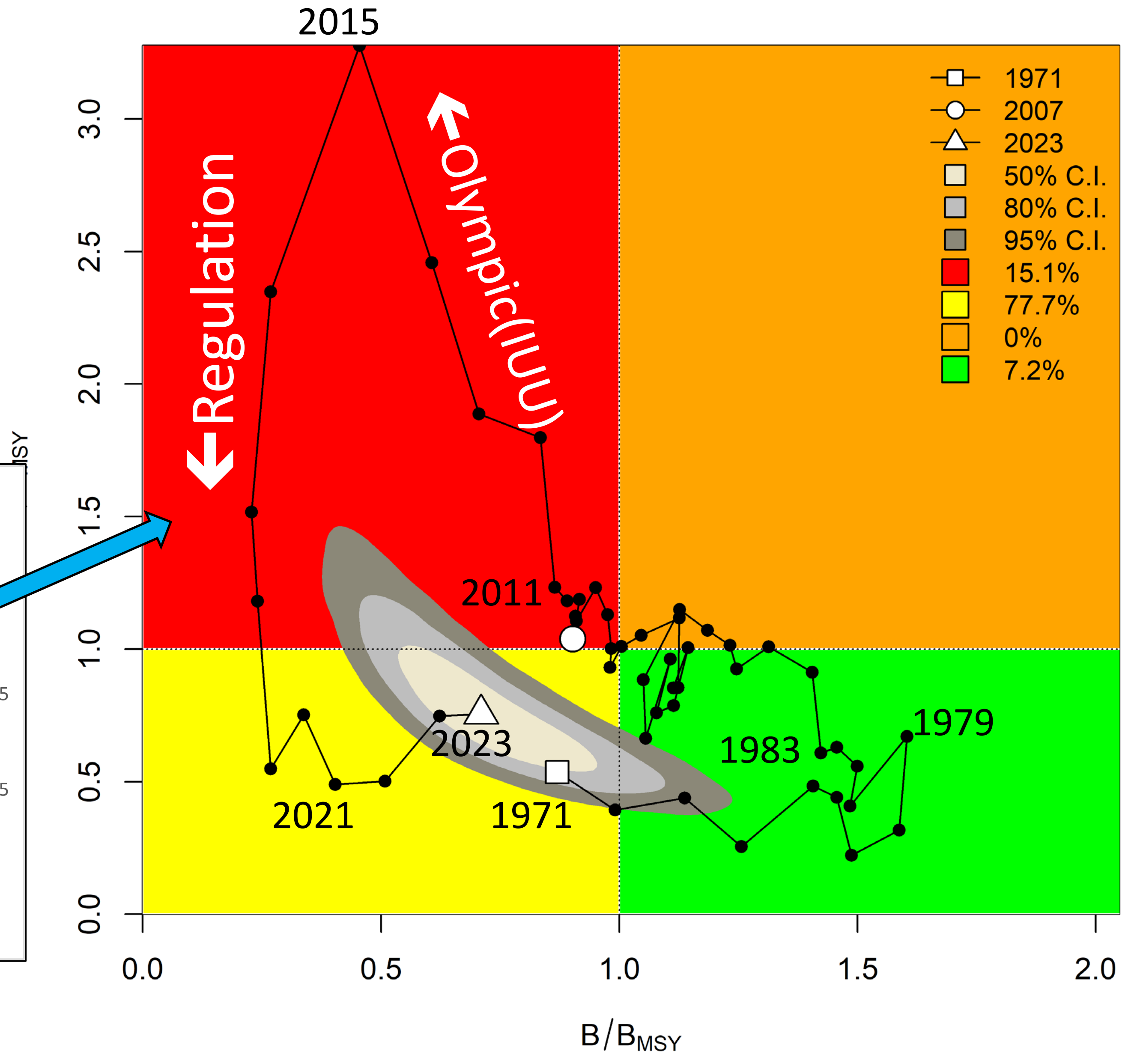


3 selected individual CPUE had high –r2, but the combined one r2=1.2% (almost flat).
This is due to combined effect. It does now show a good correlation. But it is no problem as the individual CPUE had high –r2.

The global situation shows very good relation between catch and STD_CPUE.

Stock status (SS) (2023) ➔ Yellow

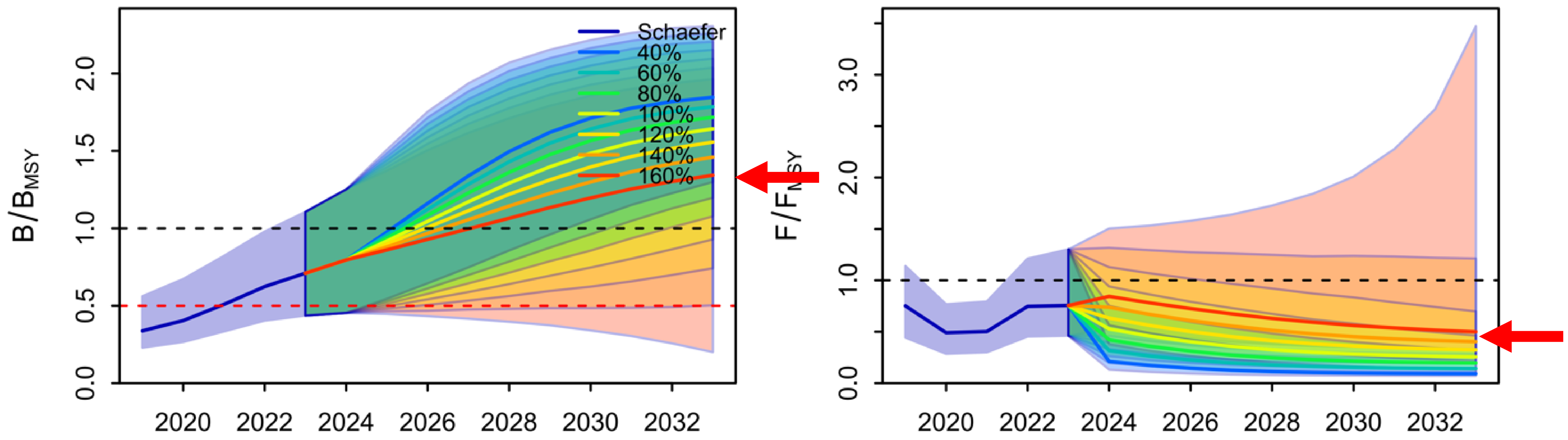




Catch & CPUE changes are well reflected by the Kobe plot

Projection (10 years, until 2032) (page 19, Report)

- Low catch level (2023) (41K) ➔Biomass recover MSY level (77K) in 2025 (2 years).
- F is very low (2023), even if **60%** catch increased ➔ F (2032) (far below Fmsy).
- Considering the above, TAC can be increased to at least 60% (67K) (MSY=77K).



(#43) (page 14)

MASE

(Predictive skill)

(< 1)

(smaller better)

Yellow markers (> 1)
Not acceptable

Index	MASE
f1	NA
f2	1.65
f3	NA
Average	NA

Prediction power (no so good)

➔TAC (just reference)

➔ need precautionary approach.

➔ Manger will decide (multi species gear)

f1 & f3 NA (no recent CPUE for prediction).

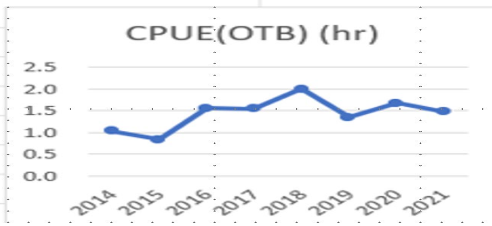
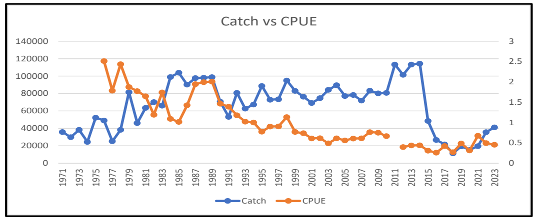
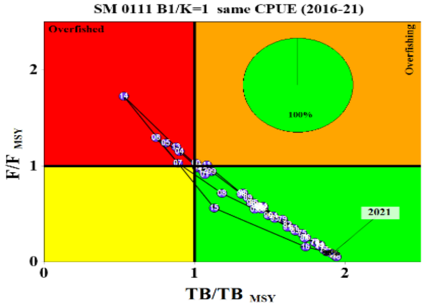
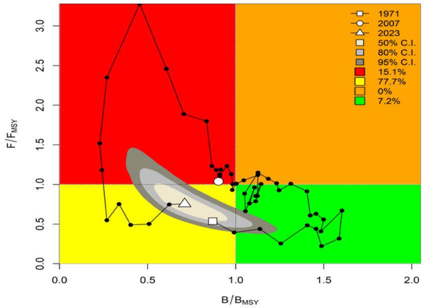
f2 is not significant (not reliable).

➔ Results with caution

5.3 Let’s compare with TB & other models

Nipa san

Comparison with other SA models

<table>
<tr><th colspan="3">Comparisons of major SA results: Last year vs This year</th></tr>
<tr><td></td><td>last year</td><td>this year</td></tr>
<tr><td>catch</td><td colspan="2">1971~2023 (n=53)</td></tr>
<tr><td># of CPUE</td><td>1</td><td>3</td></tr>
<tr><td>period</td><td>short (2014~2022) (n=9)</td><td>long (1976~2023) (n=48)</td></tr>
<tr><td>standardized CPUE</td><td>
</td><td>
</td></tr>
<tr><td>model</td><td>ASPIC</td><td>JABBA</td></tr>
<tr><td># q</td><td>1</td><td>3</td></tr>
<tr><td>Kobe plot</td><td>Strange： straight line & no uncertainties

</td><td>Explain the situation very well

</td></tr>
</table>

Last year (ASPIC)
vs.
This year(JABBA)

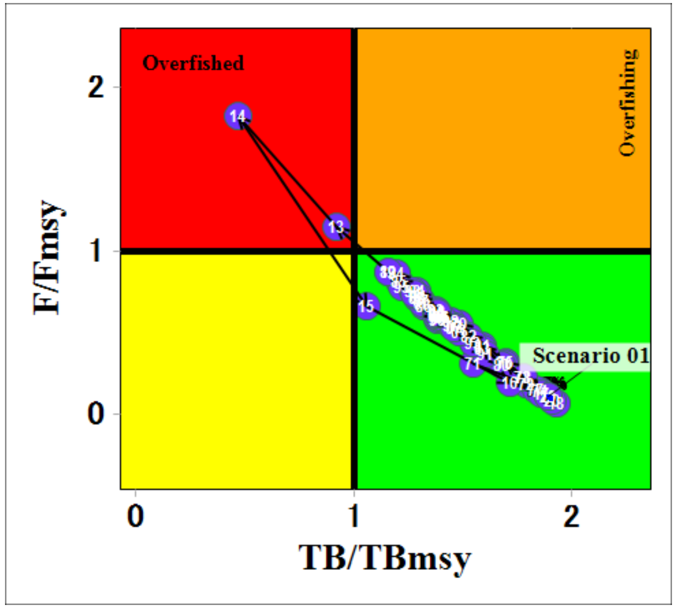
Longer CPUE
1971~2023
3 good CPUE

Good
Improvement

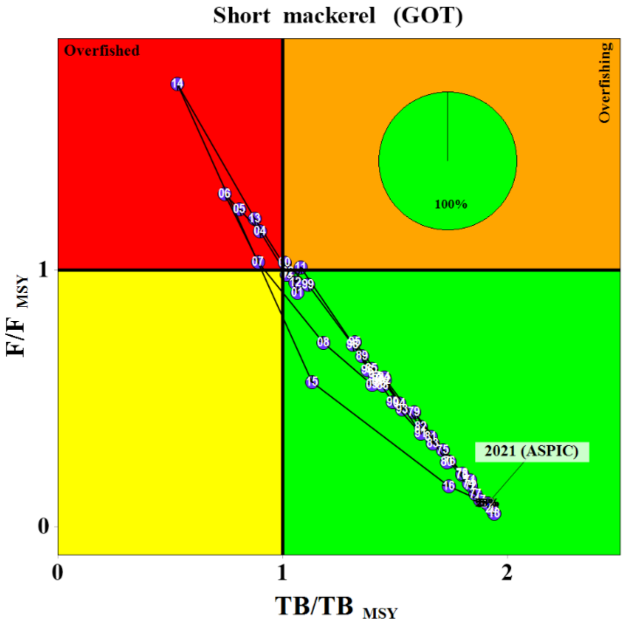
Don’t use ASPIC & CPUE(short period) & gear (non-SRA)
➔ mislead Stock statuses（Kobe plot）

Not explained
(no uncertainties+ strange trajectory)

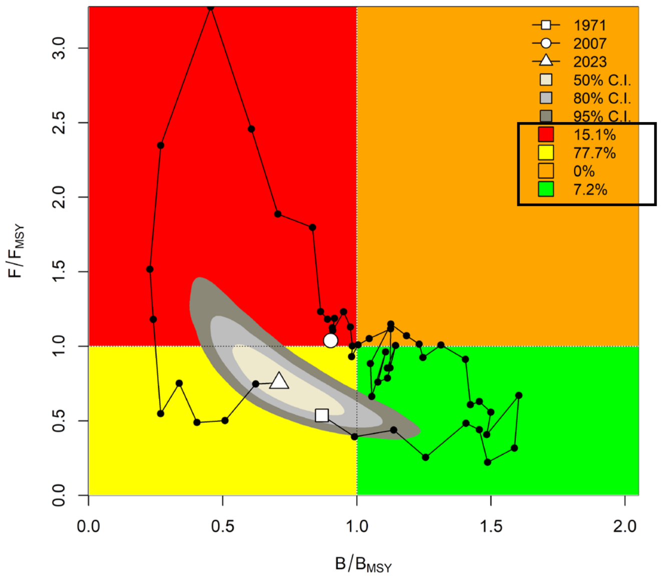
Well explained



DOF internal discussion (2022)
ASPIC+CPUE(short)+1 Gear(SRS?)



WS1 (2024)
ASPIC+CPUE(n=9)+ 1 gear (SRS)



WS2 (2025)
JABBA+CPUE (n=48)+3 gear(SRS)

Long period of CPUE 1971~2023
Gear (SRS: simple random sampling)

PT (haul), MEGL(day) & OBT (day)← recommended

other gears will provide biased abundance index

LONG term CPUE available

We did not notice until now (big treasure)

1971~1994 Year area → CPUE standardization OK without MO

1995~2023 Year, MO & area → CPUE standardization better

JABBA Comparisons with ASPIC

JABBA Far better

Technical & practical aspect

(ASPIC very outdated)

⇩

JABBA Estimation (robust) Space-State

No local minimum problem (ASPIC)

because of the Bayesian approach

Multi CPUE (flexible)

Many useful outputs

Comparison between ASPIC and JABBA

Based on the description on JABBA outlines & features, a summary is made on reasons why JABBA is superior to ASPIC. This is because we have been using ASPIC for many years, thus, we need a comparison for users to understand.

	JABBA	ASPIC
(1) Estimation methods	Estimation method (Bayesian approach based on likelihood) used by JABBA is theoretically much better, more flexible and superior than the least squares (tractional) method used by ASPIC.	
(2) Parameter estimation	JABBA can estimate parameters much easily & effectively in a short time by the Bayesian approach with MCMC.	ASPIC needs a tedious grid (pin point) search (Batch job), which sometimes produces incorrect parameters due to local (false) minima.
(3) CPUE	JABBA can accept any CPUE series. After the run, implausible CPUE will be detected.	ASPIC needs to check CPUE series if it is plausible in advance by the data QC. Otherwise, it is difficult to get convergence.
(4) Outliers	Outliers can be found easily after runs by inspecting the residual plots.	Need to check outliers before runs. It may be difficult to detect outliers after run as no effective graphs as in JABBA.
(5) Theory	JABBA theory is difficult & complicated. But it is easy to implement if the menu-driven software is used.	Theory is not difficult as for JABBA. But implementation by the menu-driven software is not as easy nor effective as for JABBA.

Important: Evaluation of JABBA runs

Final results (selection) Base case & Final

May be different among scientists (OK)

⇩

Visual inspection → Subjective → different answers

Numerical inspection → Objectives →same answer

⇩

Selection → close → results similar

⇩

BUT Better discuss among a few scientists for the final decision

→ Affect management decision

JABBA Comparisons of result with TB model or other models (DOF)

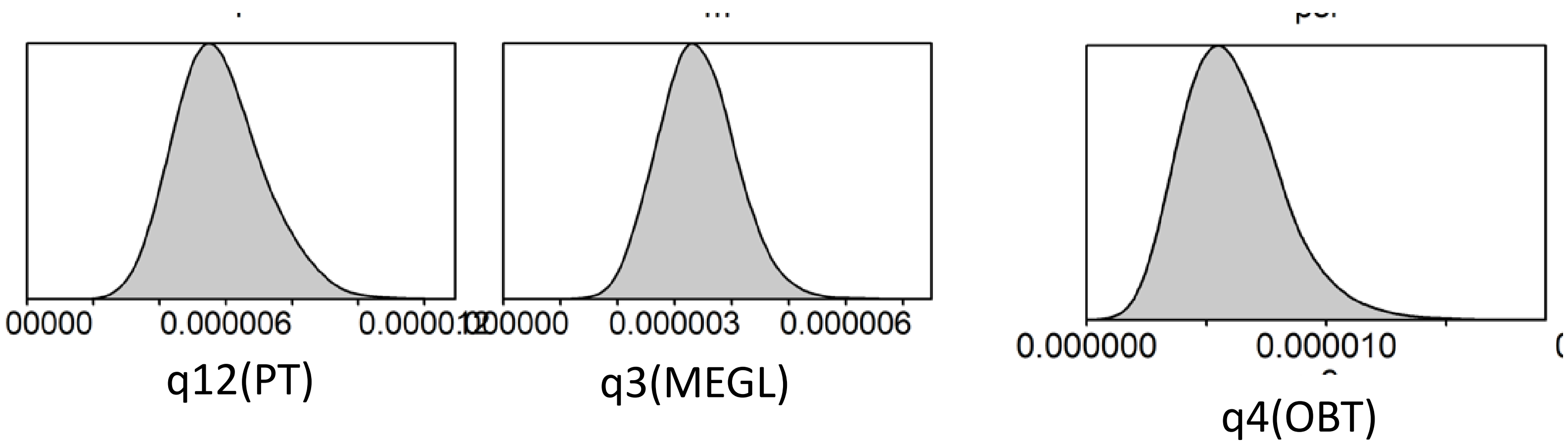
We will discuss Day 5

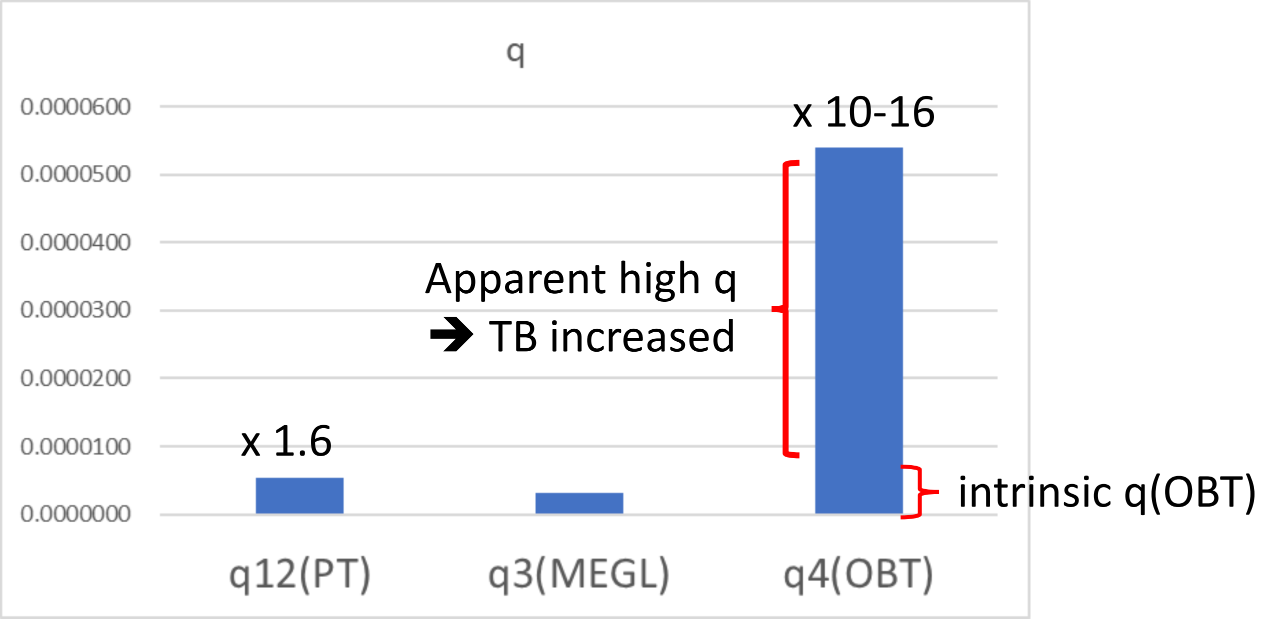
(very important issue)

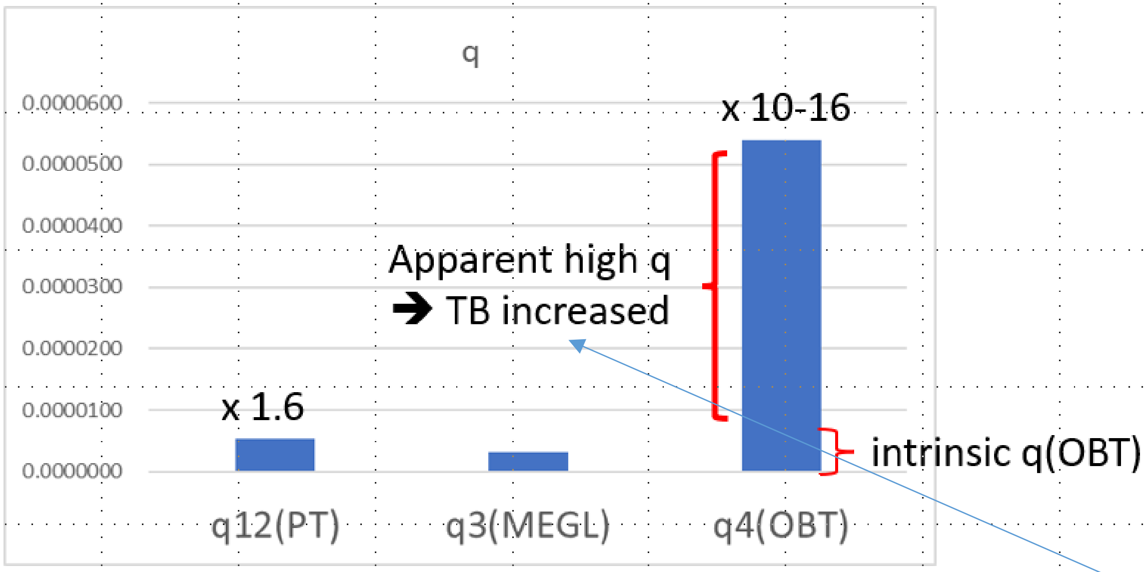
q catchability

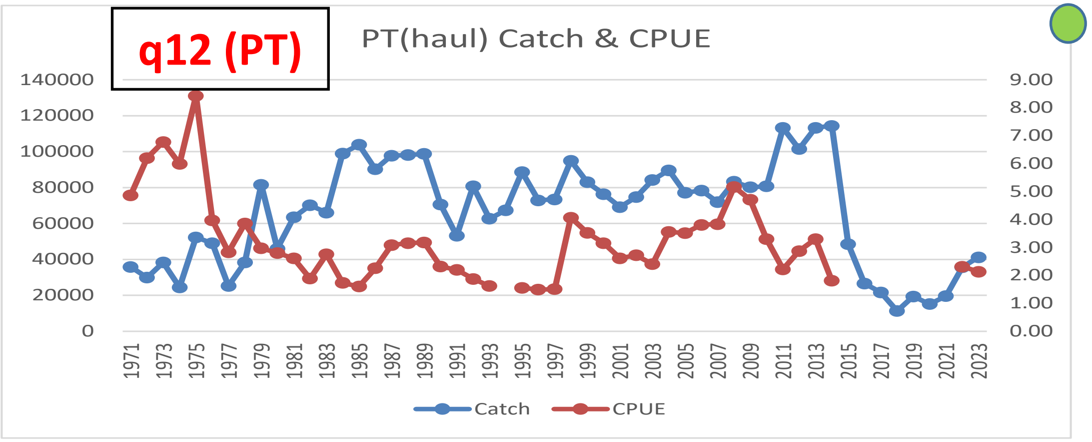
3q ➔ good Strategy 1995 regulation

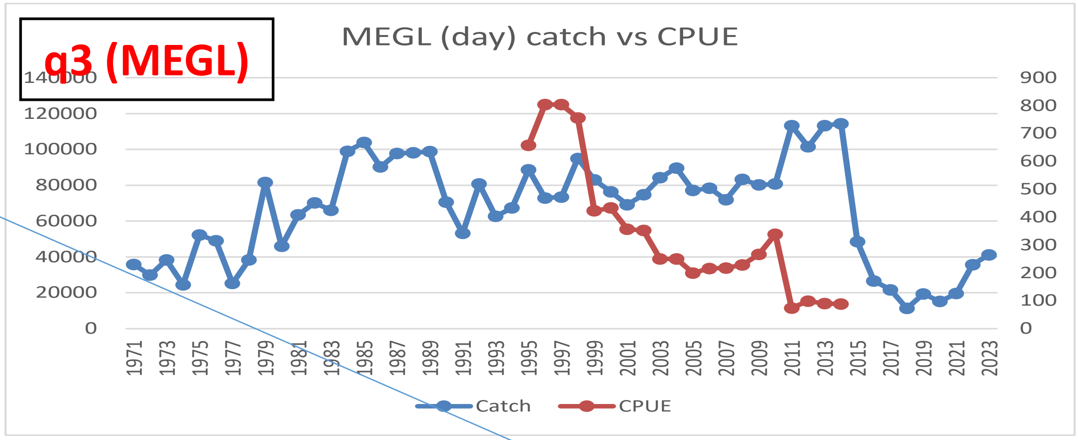
Catch sharp drop ➔ TB increase ➔ apparent q increase

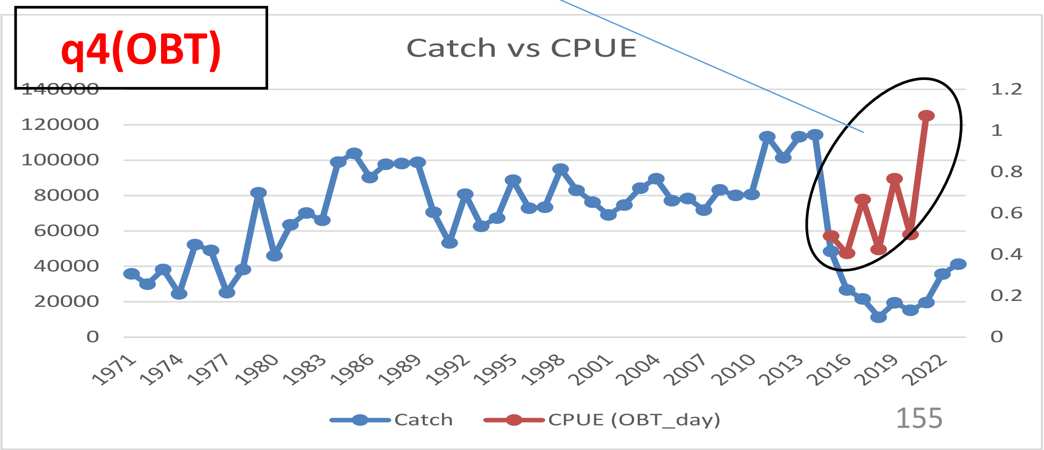












SM

q12(PT) & q2(MEGL) Low

q4 (OBT) high

Clear different q effect

➔ Good for JABBA

About q

- As explained by Weerapol san, Situation Fisheries are changed by 3 times since 1960.

- However, actual q (catchability) among gears are likely similar as q values are almost constant (1971~2015).

- The big increased of q is after 2016.

About q

- This is due to sudden technical evolution ?

- Probably no, but there may be small contribution.

- Real cause ➔ TB increase after sudden drop of catch in 1996
  Introduction of new regulation

- Thus, it was good to estimate 3 q and incorporate to JABBA

JABBA

JABBA

- Good CPUE → good results in short runs (time).
- JABBA will detect bad data (outliers).
- Remove in advance by –r2 → smooth run (a short run).
- BAD CPUE → many runs & hours → end up NO results
- NO result → one of good solution
- Scenario approach:

  Quick diagnostics (base case) → Selection form (5)

  Full diagnosis (final) → Selection form (14)

JABBA Good CPUE

High -r2 (Scatterplot)

Exclude large outliers

JABBA ➔ detect model-based outliers

(some are same as -r2 based outliers)

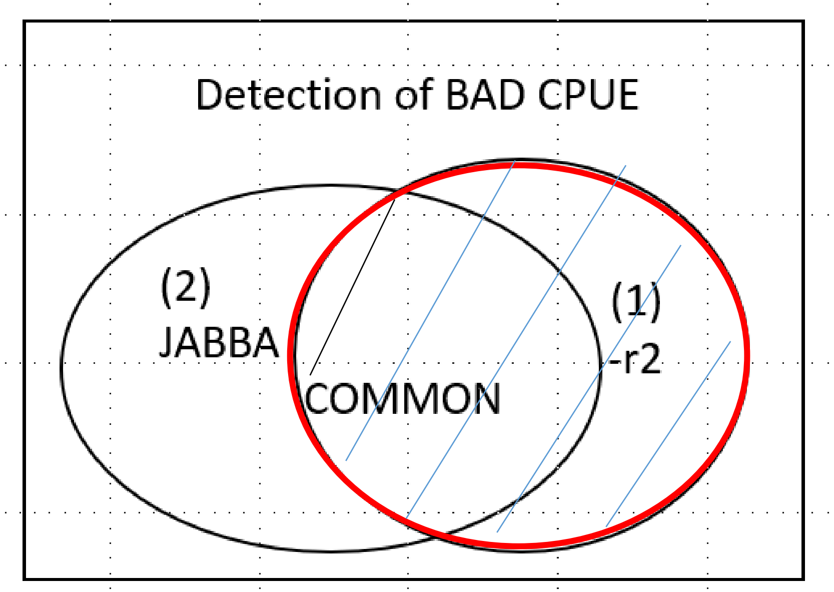
Thus if –r2 based large outliers are excluded

(in advance)

⇩

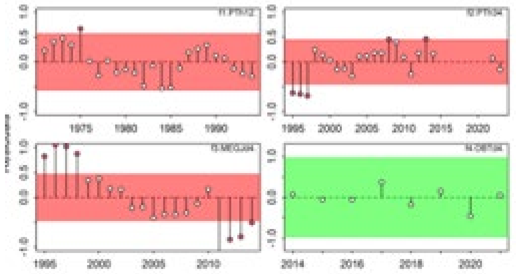
Less work & less time to find good results

Relation of outliers between (1) & (2)



BIG outliers excluded before JABBA (1) –r2,

➔ JABBA will produce less outliers (red points) & Produce more Green



Provide good results in a short time.

Otherwise, takes a long time

JABBA good CPUE

Standardized CPUE**(minor gear)** ➔ Good for some cases

Need to check all available nominal CPUE

In the same gear, effort unit also need to check

➔some good CPUE

For example(same gear different r2) ,

OBT (kg/day) r2=-34%

OBT(kg/hr) r2=+2%

JABBA GOOD CPUE

We found 3 gears ➔ GOOD CPUE (1 major & 2 minor gears)

STAT : PS(kg/day) & PT (kg/hr)

Port sampling : OBT (kg/day)

⬇

Next 3-4 year

we can use same 3 gears (with updated data) as it takes time

Unless some big change in fisheries

⬇

After 3-4 years, we need to check ALL again

JABBA scenario approaches

Robust & effective

Direct approach unstable

(depletion rate)

Recommended

Butterworth, Wang and other (papers)

Special treatment if data not for a long period

estimation unstable

Future

Future Publication

We will publish Fish for the People (SEAFDEC)

as it directly relates to SEAFDEC (good contribution)

Nipa + Puy + Nishida

DOF stock assessment

If DOF is OK,
we can do JABBA assessment routinely
for important species as reference
as JABBA quite reliable & effective

Can be considered

software

JABBA menu driven software

- If you know R, you can use JABBA.

- But JABBA have many options, so that you need to know details on JABBA (highly technical) and manipulate by R.

- You need to change r codes. It will be tough.

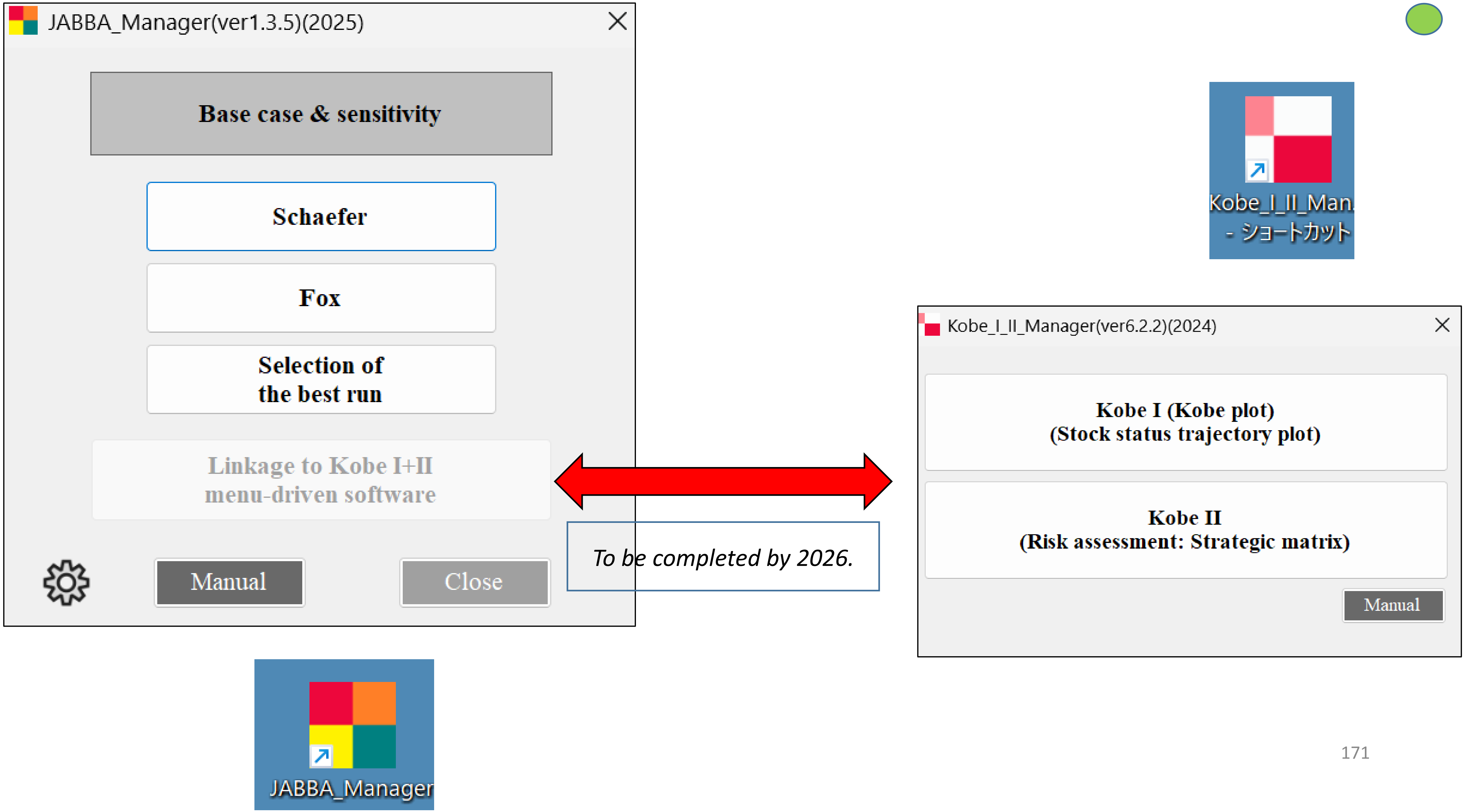
JABBA menu driven software

- Default is standard and good enough to get useful results.
  Software is very easy & simple to use.

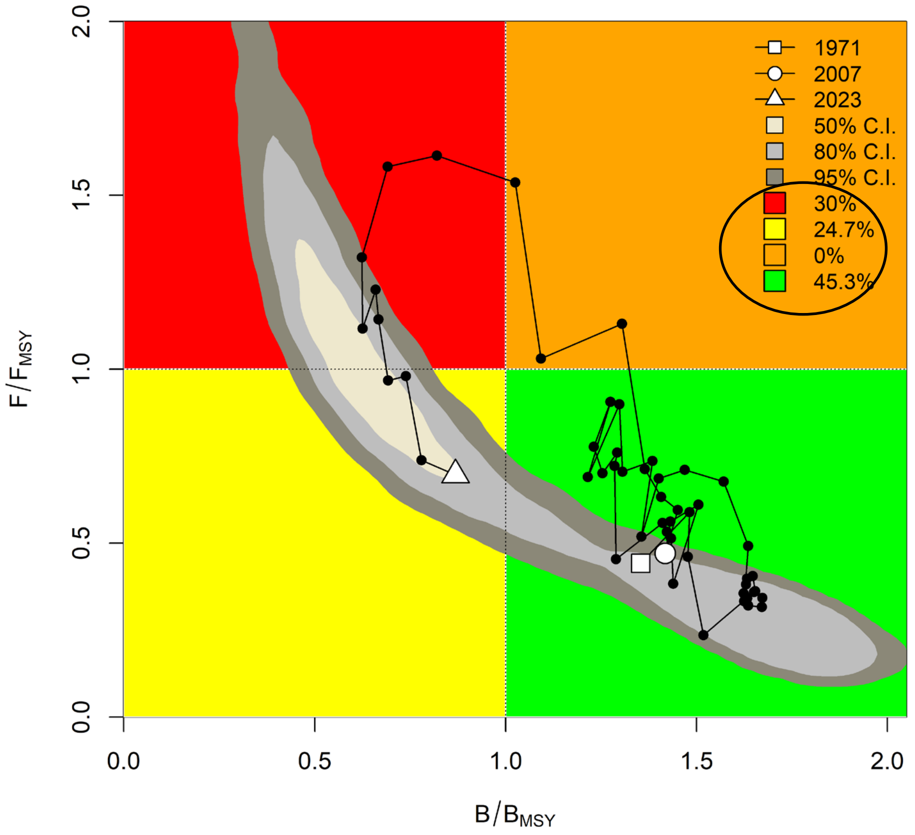
- Then you can run freely without worrying about details of JABBA.

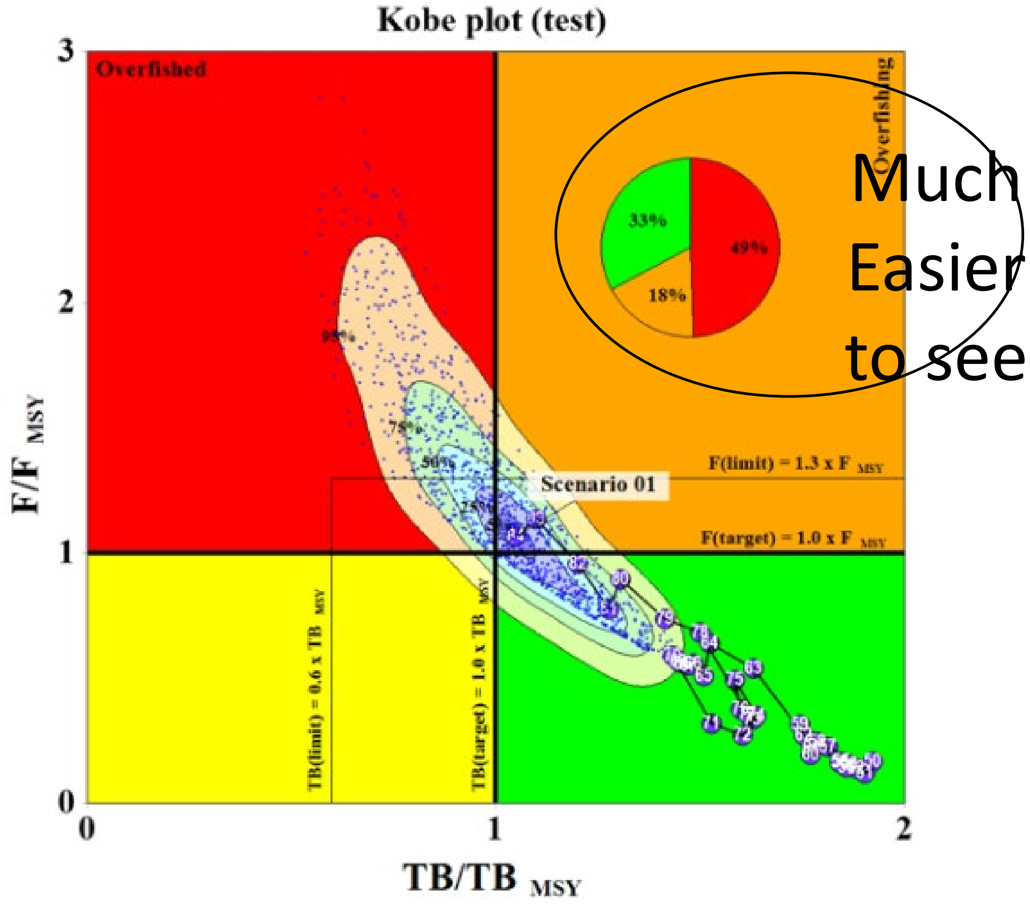
- However, scenario manipulation is a bit tedious.

- But after practice, you can easily handle the software.


JABBA_Manager(ver1.3.5)(2025)
Base case & sensitivity
Schaefer
Fox
Selection of the best run
Linkage to Kobe I+II menu-driven software
Manual
Close
JABBA_Manager
To be completed by 2026.
Kobe_I_II_Man.
- ショートカット
Kobe_I_II_Manager(ver6.2.2)(2024)
Kobe I (Kobe plot)
(Stock status trajectory plot)
Kobe II
(Risk assessment: Strategic matrix)
Manual

Better Kobe plot ➔ Pie Chart + Target/Limit Reference Point
Thai use Reference points (0.9*TB and 1.1*F as RP)





Much Easier to see

Kobe II Risk assessment ➔Good for Management (TAC)

Risk probability (%) violating TB(MSY) level by catch level

Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0 - 25%	25 - 50%	50 - 75%	75 - 100%

	%	Catch (tons)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
% Increased from the current catch level	200%	40,533	42%	99%	100%	100%	100%	100%	100%	100%	100%	100%
	150%	33,778	42%	96%	99%	100%	100%	100%	100%	100%	100%	100%
	100%	27,022	42%	89%	96%	99%	100%	100%	100%	100%	100%	100%
	80%	24,320	42%	85%	93%	97%	99%	100%	100%	100%	100%	100%
	60%	21,618	42%	79%	88%	93%	96%	98%	99%	100%	100%	100%
	40%	18,915	42%	71%	80%	87%	91%	94%	96%	97%	98%	99%
	30%	17,564	42%	65%	75%	82%	87%	91%	93%	95%	96%	97%
	20%	16,213	42%	60%	69%	76%	81%	86%	89%	91%	92%	93%
	10%	14,862	42%	54%	60%	68%	73%	77%	81%	84%	86%	88%
*** Current catch**	0%	13,511	42%	48%	51%	56%	61%	64%	68%	72%	75%	77%
% decreased from the current catch level	-5.6%	**12,760	42%	42%	45%	48%	51%	54%	57%	60%	62%	64%
	-10%	12,160	42%	39%	41%	43%	45%	48%	50%	52%	54%	55%
	-20%	10,809	42%	30%	28%	28%	27%	26%	27%	27%	27%	27%
	-30%	9,458	42%	21%	15%	11%	9%	8%	8%	8%	8%	9%
	-40%	8,107	42%	10%	4%	2%	1%	1%	1%	1%	1%	1%
	-60%	5,404	42%	1%	0%	0%	0%	0%	0%	0%	0%	0%
	-80%	2,702	42%	0%	0%	0%	0%	0%	0%	0%	0%	0%
	-100%	0	42%	0%	0%	0%	0%	0%	0%	0%	0%	0%

*(Note) * Average catch for 3 last assessments years   ** MSY level*

Summary

- JABBA effective & useful ➔ DOF can use
- Good CPUE (SRS) ➔ ALL available nominal CPUE ➔ QC(-r2)
- JABBA Good standardized CPUE ➔key for successful JABBA
- Good assessment results by JABBA (SM) ➔ publication (SEAFDEC)
- q by period important (different by evolution, regulation etc)

  ➔ need incorporate in stock assessment (standardized q)
- JABBA scenario & strategy approach

  ➔ robust & reliable estimation
- New CPUE standardization with 7 Covariates ➔useful ENV, category

Day 4

(1) Practice case [1]   Swordfish (1950~2023)

(2) Home work

➔ **much less** than the initial idea as only 2 PC can be used.