Introduction
Menu-driven fish stock assessment software
April 18 (Thu), Ruang Rapat Gedung BNC (BRIN) (1PM-)

Tom Nishida (PhD)

Representative

[MENU] Menu-driven stock assessment software development team

funded by Government of Japan (ODA)

aco20320@par.odn.ne.jp

https://www.esl.co.jp/products/menu

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(alphabetical order)

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Budi Nugraha	Imam Musthofa Zainudin	Nilanto Perbowo	Rudi Sujono	

From

National Research and Innovation Agency
Directorate General of Capture Fisheries（DGCF)
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Research Institute for Marine Fisheries（BPPL) (Muara Baru)
Research Center for Fisheries Management and Conservation (RCFMC)
Directorate of Fish Resources Management
Ministry of Marine Affairs and Fisheries
Center for Data, Statistic and Information
Harini

Informal meeting

Please ask any questions,

make comments & discussion anytime…

Important Abbreviation

SA : Stock Assessment

RFMO : Regional Fisheries Management Organizations
(example ➔ IOTC, WCPFC, CCSBT…)

F : Fishing mortality

SSB (SB) : Spawning Stock Biomass

TB : Total Biomass

PM : Production Model

Self-Introduction

Stock assessments (practical)

Fish GIS (http://www.esl.co.jp/Sympo/)

Study

Hokkaido University (BS)

University of Washington (BS+MS)

Tokyo University (PhD)

Work (39 years)

FAO (BOBP+IPTP)(Sri Lanka)

+

National Research Institute (Japan)

(IOTC, SIOFA, CCSBT, SEAFO, NAFO)

+

SEAFDEC (resource person)

GIS, Reviewers & Neritic/Oceanic tuna

Happy to work with

many bagus Indonesian scientists

Objectives (this meeting)

Part 1 : To introduce most recent software
(2024 April version)

Part 2 : To discuss Training & Collaborative works
(future)

But,
Our Final Goal

↓

Sustainable resources & fisheries (Indonesia)

↑

through training Collaborative works

Part 1

To introduce most recent software
(April 8, 2024 version)

Contents (Part 1)

(1) Background & Objectives

(2) Outline

(3) Menu-driven software

- CPUE standardization
- Stock and Risk assessment
  - Review
  - Production model (ASPIC and JABBA)
  - Age-Structured Models
- Management decision making tool (Kobe I+II)

(4) Summary

Backgrounds

Stock assessment & Management

Extremely important (world wide)

Sustainable resources utilization & fisheries

However SA is not easy to do for non experts

Backgrounds (2013)

SEAFDEC request → Capacity Building (SA)

Initial period

Programming languages + SA codes

No one can follow

↓

Excel (macros) + SA codes

Can use excel but many many processes → errors

+ still difficulty to use SA codes

(1) Backgrounds (2014-2023)

To solve problems ➔ Menu-driven software

Anyone can do stock assessments (short time)

without programming ➔ less errors

⬇

CPUE standardization, ASPIC(production model)

and management decision making tools (Kobe I+II)

⬇

Successfully utilized and provided Management advices

to SEAFDEC & ASEAN member countries.

Backgrounds (progress) (2023-2024)

Menu Software➔ Users still need some manual works

Some errors & mis handlings

Made improvement

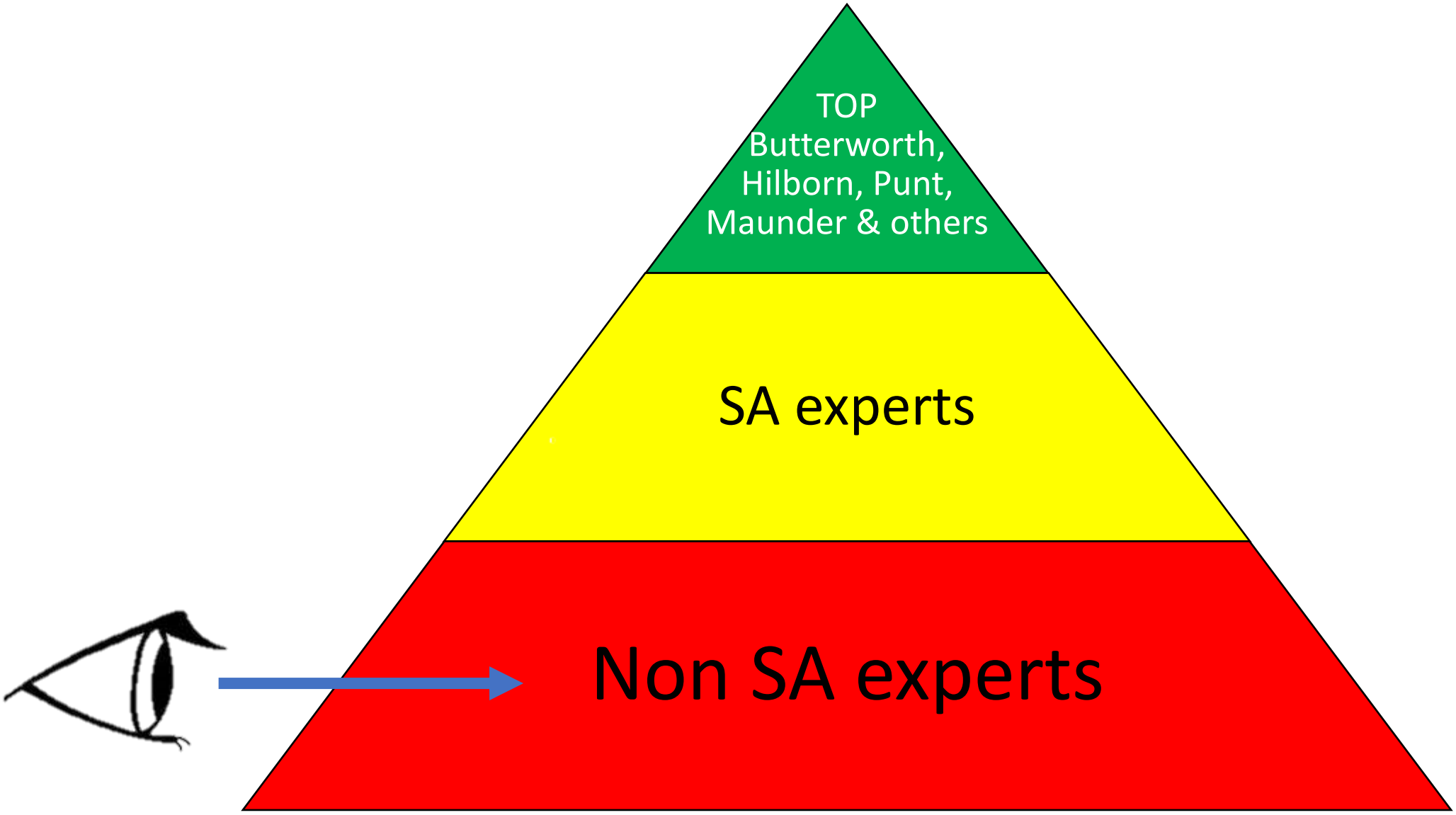
Almost automated processes ➔ no errors

(Sri Lanka & Thailand)

OBJECTIVES : Menu-driven software

- To develop SA software for ALL (especially for beginners)
  - ➔ Users friendly operations by menus without programing
  - ➔ Anyone can do (short time) (less errors)

- To conduct 3 important works
  - ➔ CPUE standardization
  - ➔ Stock assessment
  - ➔ Management decision making tools (Kobe I+II)


TOP
Butterworth,
Hilborn, Punt,
Maunder & others
SA experts
Non SA experts

WARNINGS : AUTOMATED (MENU) IS GOOD BUT USERS NEED…

- Users **need** understand theory & Input/Output
- In the **past** Capacity Building, we fully explained these points to users.

  ➔ we will continue to do SO…

- **IMPORTANT POINT**

We protect users not to become Auto-operating syndrome.

➔we don't want users

to be easy-going & lazy...

Lastly Very important issue

Developing countries

➔Need Multi-gear & Multi-species fisheries Management (MMM)

Our stock assessment➔ single species

How we can help MMM?

Our single species specific SA results ➔ just reference for MMM

Because A single species TAC cannot be used directly for MMM

as stock statuses are different among multi-species.

MMM should be implemented by mangers

considering ALL relevant factors together….

Stock statuses (all species), singles species specific TAC (our work),

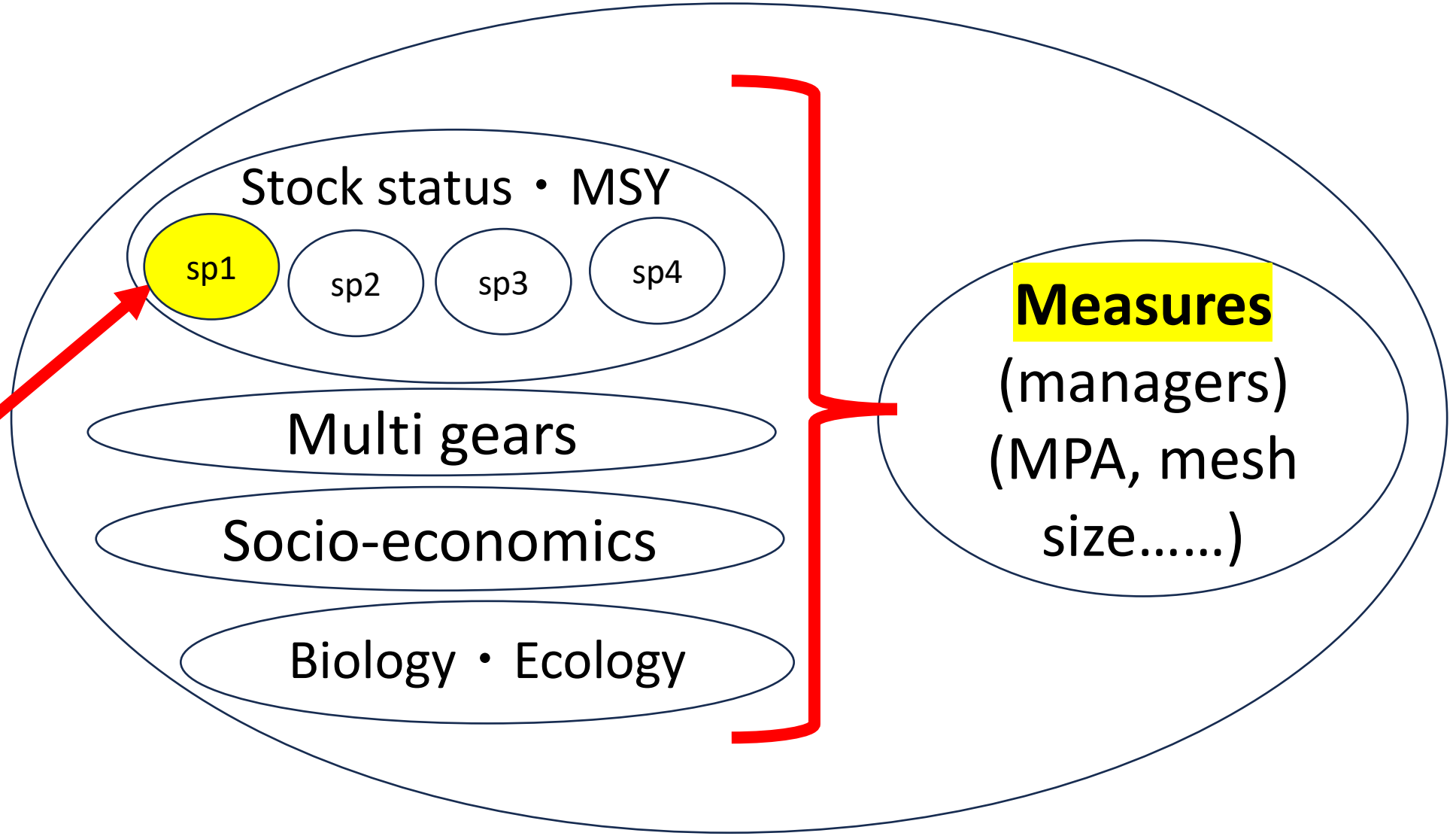
socio-economics, MPA, ecology & others

Summary: How our software can contribute to MMM

➔ Managers needs to consider all relevant factors together including our single species SA results

Our contribution

to provide stock status & MSY single species



MMM ➔ *Multi-gear & Multi-species fisheries Management*

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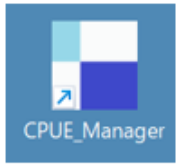
(4) Summary

(2) Outline

3 types
(A), (B), (C)
7 software

4 Manager
series
(all in one type)

Types		Name	Icon
(A) CPUE standardization		(1) CPUE_Manager	
(B) Stock assessment	Production model	(2) ASPIC_Manager	
		(3) JABBA_Manager	
	Age structured model	(4) ASPM (Age Structured Production Model)	
		(5) SCAA (Statistical-Catch-At-Age)	
		(6) SCAS (Statistical-Catch-At-Size)	
(C) Management decision making tools		(7) Kobe_I_II_Manager Kobe plot Risk matrix	

Input information

Types		Name	Input				
			Catch	CPUE	Biology	SA + RA results	Priors (Bayesian Approach)
(A) CPUE standardization		(1) CPUE_Manager					
(B) Stock assessment (SA)	Production models (PM)	(2) ASPIC_Manager					
		(3) JABBA_Manager					
	Age structured models	(4) ASPM					
		(5) SCAA					
		(6) SCAS					
(C) Risk assessment (RA) and Management decision making tools		(7) Kobe I+II Manager					

CPUE_Manager, ASPIC_Manager, JABBA_Manager & Kobe I+II Manager

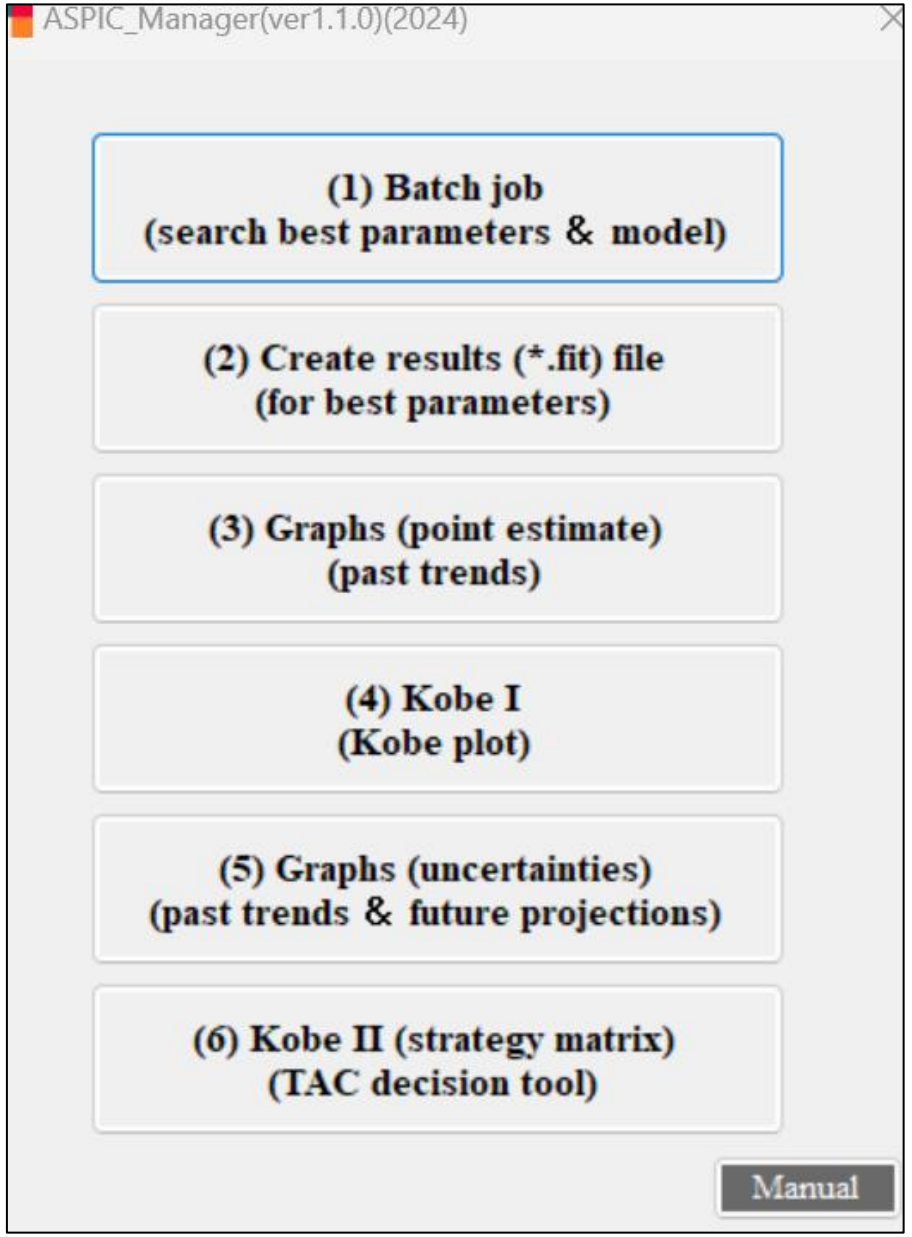
Why we call manger ?

Manager ➔ all-in-one, one system or suit

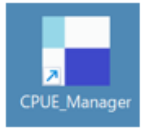
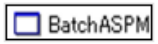
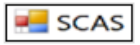
For example
ASPIC_Manager include 6 functions
(all necessary operations) ➔

Convenient (less errors)

If separated ➔ difficult to handle ➔ errors



SUMMARY

Types		Level (for beginners)	Name (*)	Icon	Input information: Catch	CPUE	Biology (**)	Others	Features	Current version year (start year)
CPUE standardization		*Basic to Intermediate*	(1) (*) CPUE_Manager						QC, CPUE standardization & weighed Ave of multiple CPUE by catch	ver1.2.0 2024 (2016)
Stock assessment (SA)	Production model (PM)		(2) (*) ASPIC_Manager						Production model incorporating observation (OBS) errors	ver1.1.0 2024 (2016)
		Advanced	(3) (Just Another Bayesian Biomass Assessment)					Prior information for input parameters	Best Bayesian PM incorporating both OBS & process errors	*(To be completed by the end of 2024)*
			(4) ASPM (Age Structured Production Model)	 (for both ASPM and SCAA)					In-between PM & age-structured model (selectivity: fixed)	ver4.0 2018 (2010)
	Age structured (integrated) model		(5) SCAA (Statistical-Catch-At-Age)						Catch-At-Age based age-structured model	ver4.0 2022 (2017)
			(6) SCAS (Statistical-Catch-At-Size)						Catch-At-Size based age-structured model	*(Under development)*
Management decision tools		*Basic to Intermediate*	(7) (*) Kobe_I_II Manager Kobe I: Kobe plot Kobe II: Strategy matrix (risk assessment)					Kobe I: SA results (F/Fmsy & B/Bmsy) Kobe II: Pr. violating MSY (F and Biomass) (Risk assessment)	Kobe I: Stock status trajectory plot Kobe II: Evaluation of the optimum catch level (TAC)	ver6.2.1 2024 (2011)

(*) "Manger" means one system, all-in-one or suit including all necessary applications/functions.

(**) Size, LW relation, Selectivity, M (natural mortality), Growth, Maturity-At-Age, Spawner-Recruit relation, Life span (Max. age), Fecundity, and others depending on the model.

Flow chart

[MENU]
Menu-driven stock assessment software

Part I: Stock assessments (point estimates)

INPUT

Data collection → Data base

- Catch
- Nominal CPUE → CPUE_Manager
- Biological information

Stock assessment

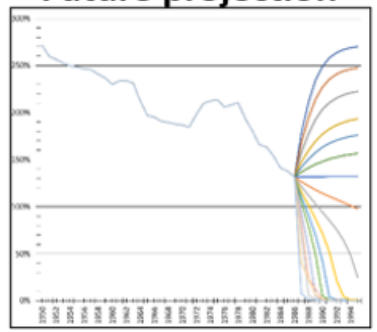
- Production Model (ASPIC+JABBA) → ASPIC_Manager -
- Age-Structured Model (ASPM・SCAA・SCAS) → BatchASPM, SCAS

Part II: Risk assessments (Projection & uncertainties)

Stock assessment results

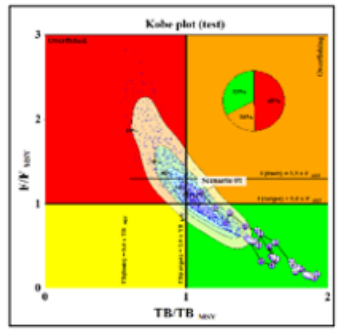
Kobe_I_II_Manager

Future projection



Uncertainties (bootstrap, MCMC)

Kobe I



Kobe II

USERS: 104 USERS (26 COUNTRIES)

Algeria, Argentina, Brunei Darussalam*, Cambodia*, China, Indonesia*, India, Iran, Japan*, Rep. Korea, Kenya, Malaysia*, Mexico, Myanmar*, Oman, Peru, Philippines*, Spain, Sri Lanka, Thailand*, Trinidad and Tobago, USA, Viet Nam*, Taiwan and Turkey.

(*) Southeast Asian Fisheries Development Center (SEAFDEC) member countries

Mainly Southeast Asia

Ali-san SEAFDEC

TRAINING

- All software : FREE of charge for anyone to utilize.
- If you want to use the software, please contact us.
- We will provide the on-site training.
- We will release software after we make sure that users understand the software (theory & input/output) and can handle software properly.

➔ Our responsibility

UTILIZATION AND COPYRIGHT(1/2)

- Software has copyright. If users want to use,
  ➔ Users need to obtain permission from us.

- It is requested that users should work with us.
  ➔ [MENU] needs to make sure all processes are OK.

- This is because if users use by themselves, there will be mis-use of software & data, which were happened in the past.
  Danger (WRONG advice ➔ Mis managements)

UTILIZATION AND COPYRIGHT (2/2)

Thus to avoid such situation and

to get reliable results & provide plausible management advices, users need to work with us.

We will discuss this in Part 2

(Training & Collaborative works)

Our ultimate goal

Stock assessments (SA) for ALL ☺

No more

- struggling with SA
- Only for SA experts (5~10%) (RFMO)

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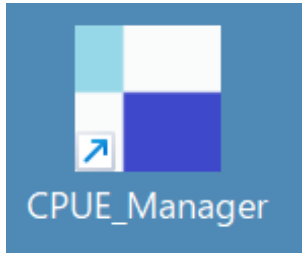
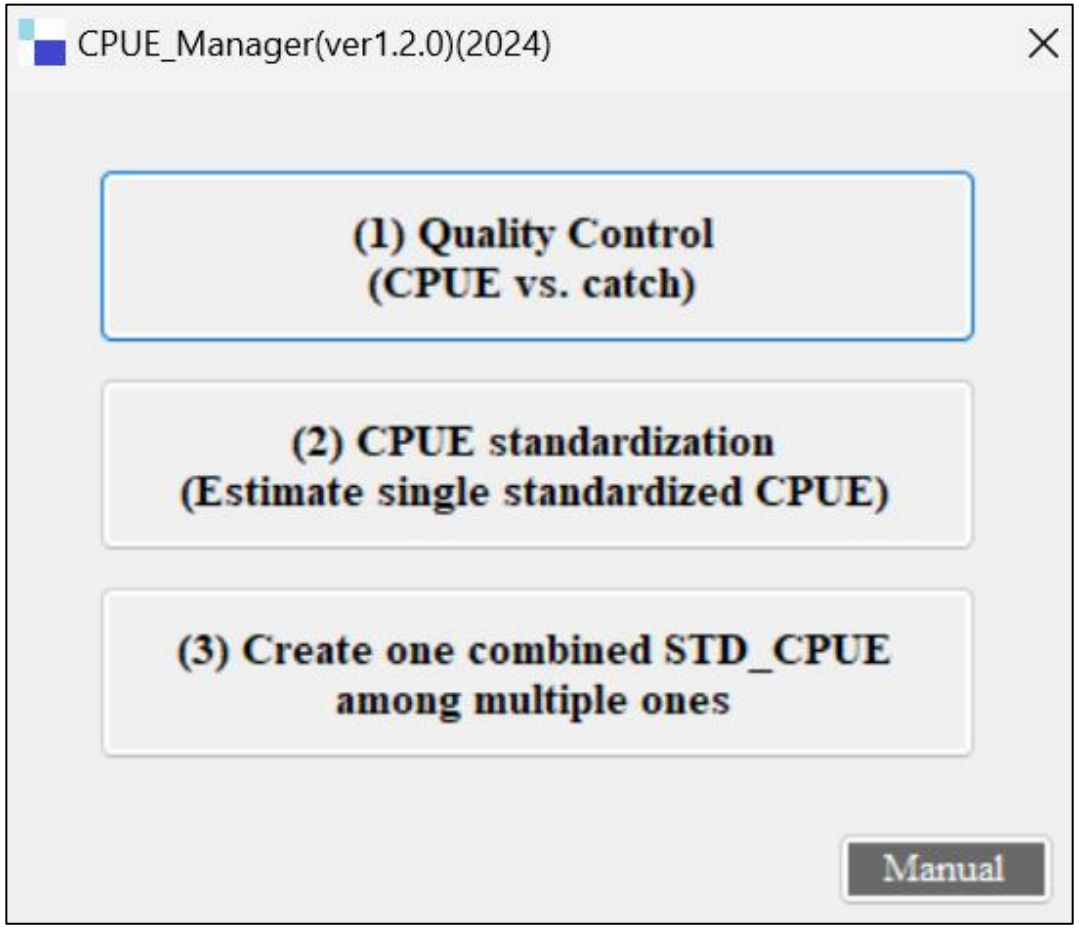
(4) Summary

CPUE_Manager(ver1.2.0)(2024)





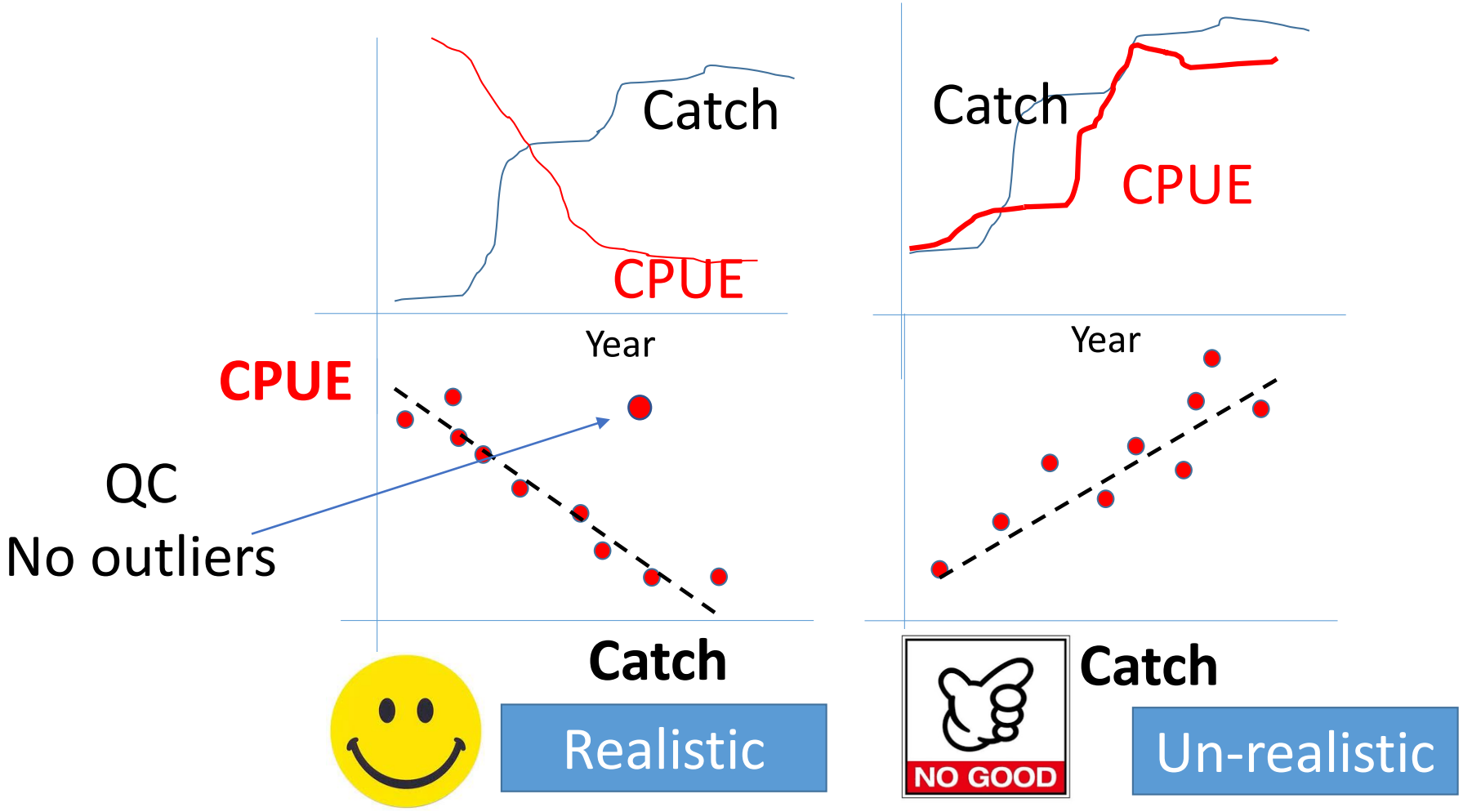
[1st menu] Quality Control (QC)

QC (data massage)

127

QC for CPUE vs Catch

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

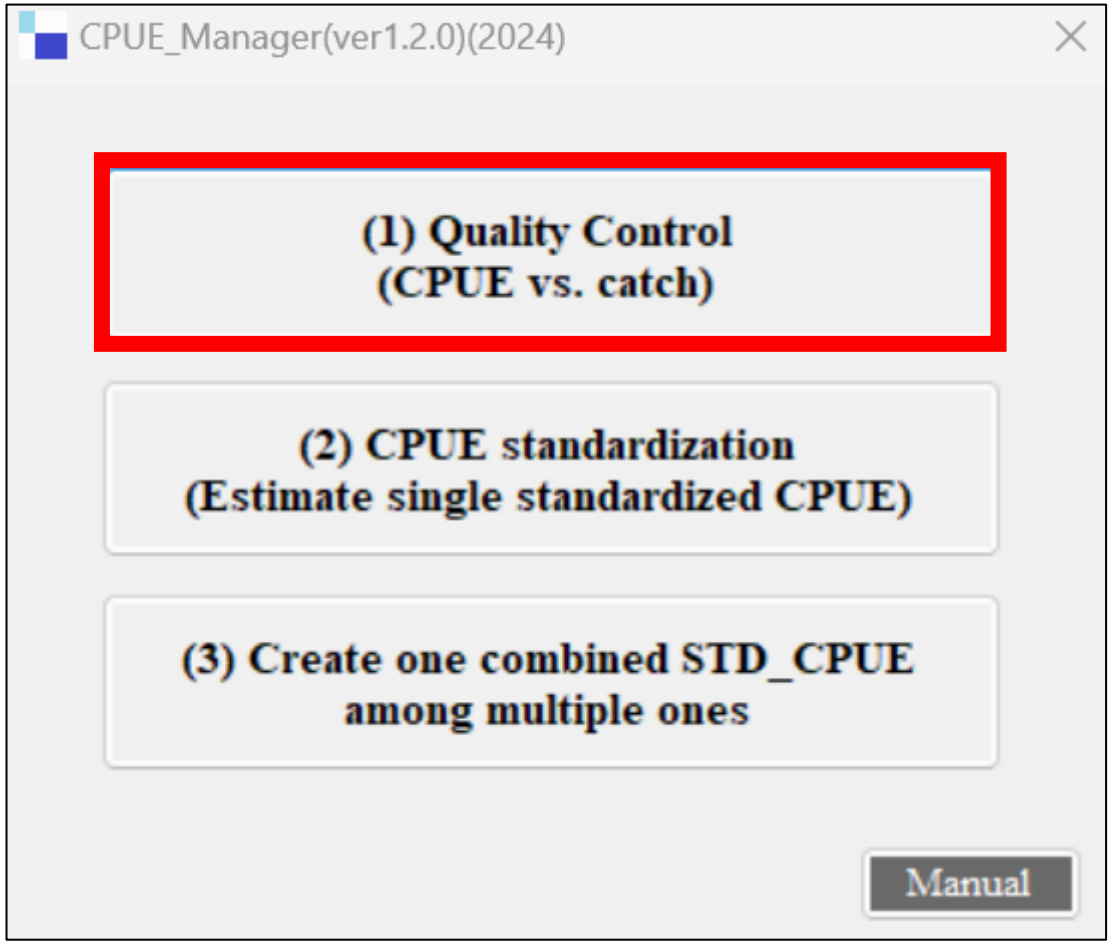


[1st menu] Data Quality Control (QC)

To check relations
between CPUE vs. Catch
if there are….

(a) Negative correlations
(b) Outliers

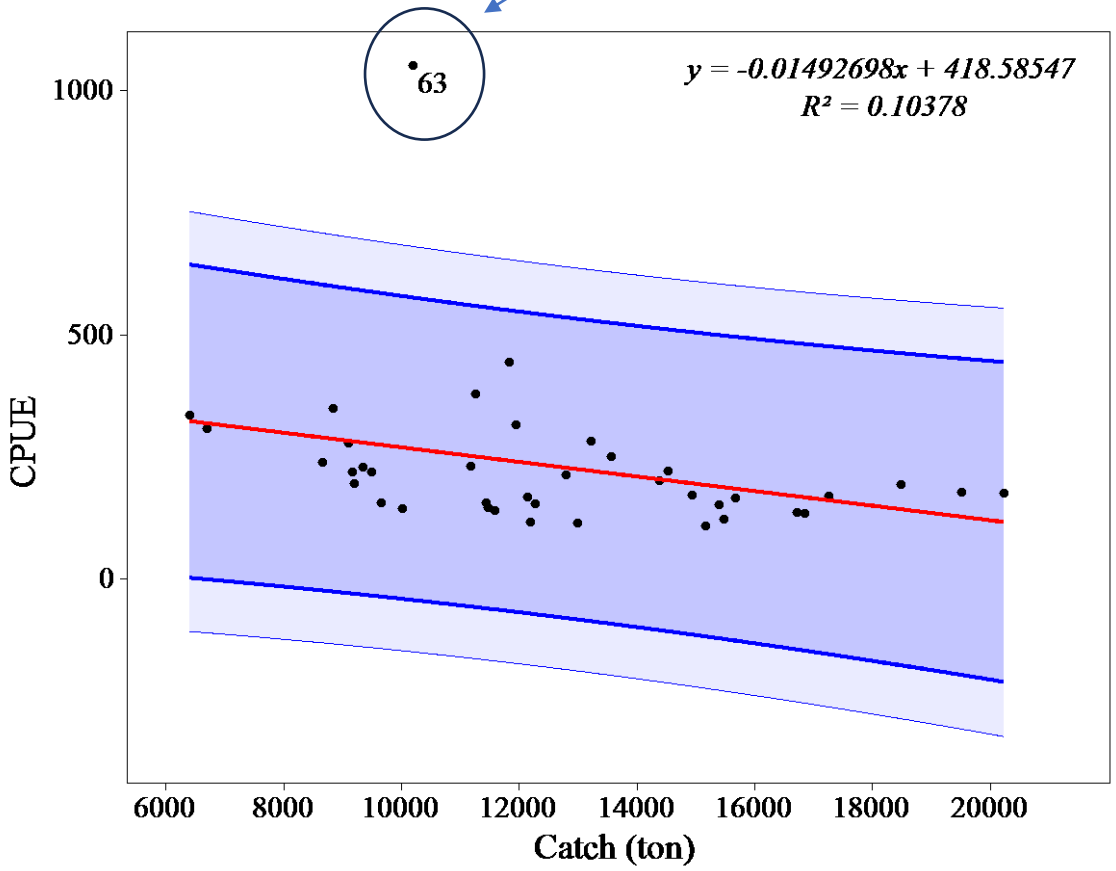
important for SA

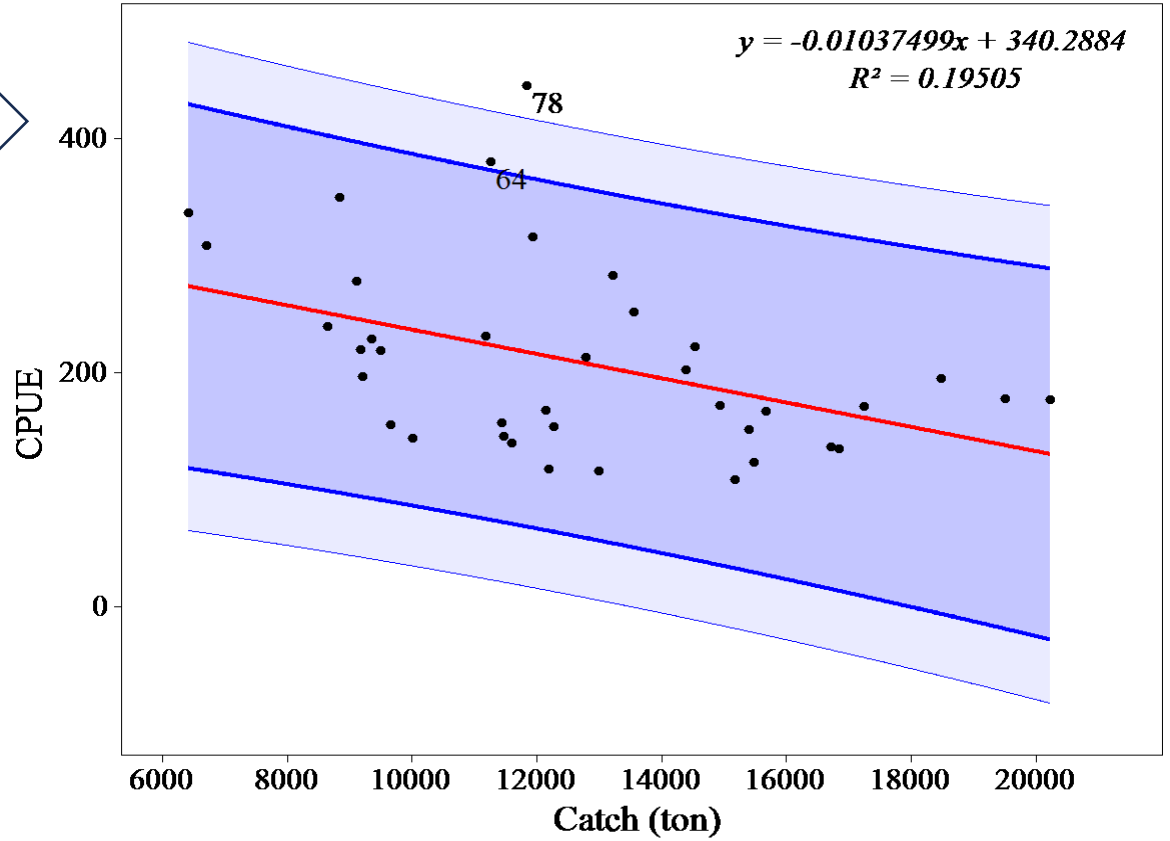


Outlier

➔Check original data

➔ if no error ➔ remove





r2 (improved) :10% ➔ 20%

Less uncertainties

➔ Reliable management advice

Outliers

- Very Critical if sample size is small

  before removal ➔ positive relation

  after removal ➔ normal (negative) (good for SA)

- Less critical if sample size are large

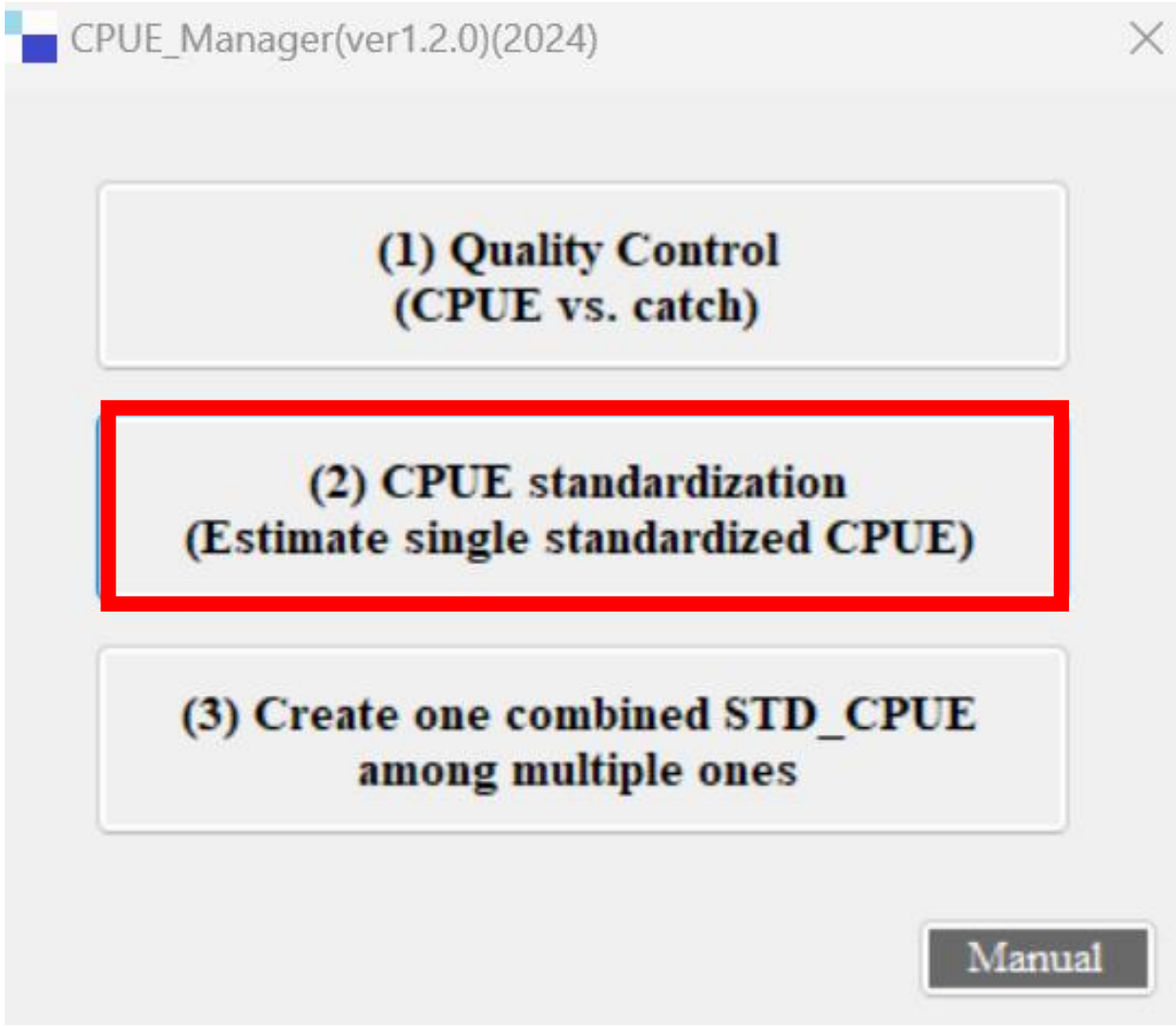
➔ Should check anyway

Other essential data Quality Control (QC) by users (not by software)

- Check outliers for each variable

  ➔catch, effort, CPUE, depth and others) (entry errors)
- Check ranges (e.g. if 1<=month<=12)
- Spatial check by mapping (e.g. if catch/effort is not from land)
- Check typos for names (e.g., boat, gear)
- Other ad hoc QC

[2nd menu] CPUE standardization



Why we need CPUE standardization?

- Nominal (raw) CPUE

  ➔ Bias➔ not real abundance index ➔ not good for SA

- Major bias by ➔ Y(Year), S(Season) & A(Area)

  Other bias by ➔ target, ENV, gear, vessel, skipper etc.

  ➔Could be explained by Y+S+A because biases are reflected by time & area

CPUE standardization by year

To be used as one of most important inputs for stock assessment as abundance index (year based)

CPUE standardization (Method)

Policy ➔ for non technical users ➔ Simple

GLM ➔ standard.

No complicated ones (VAST, regression tree, NN etc.)

Covariates (factors affecting nominal CPUE)

➔ Minimum (year, season, area)

➔ Data limited (developing countries)

Implementing CPUE standardization

This software apply 2 models for CPUE standardization
Depending upon 0 catch (CPUE) rate.

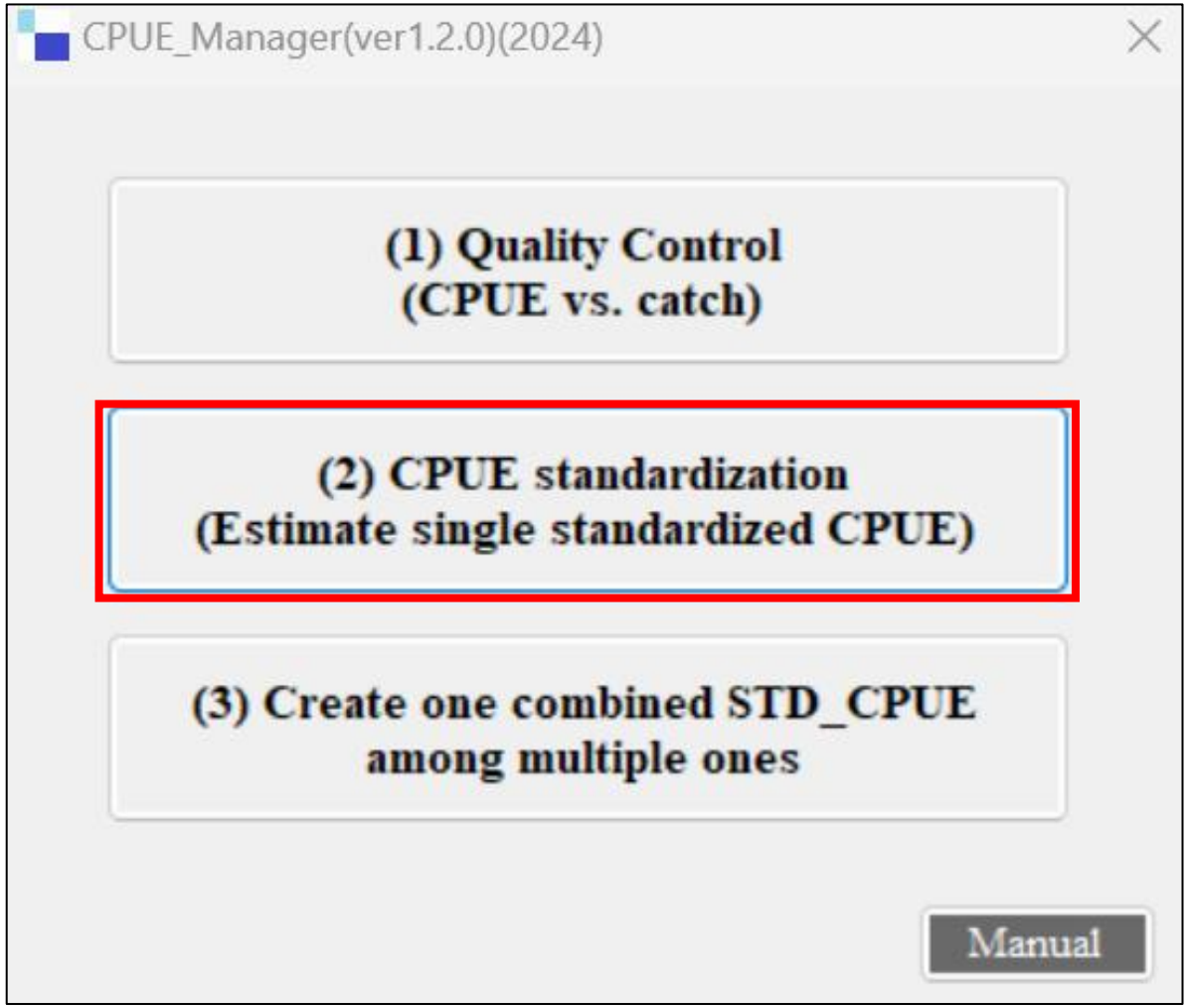
0 catch rate (%)	Model	Short name
0% ～ 30%	Log normal GLM	Log normal model
30% ～	Zero (0) inflated Delta 2 steps log normal GLM	Delta model

Software automatically provides 0% rate & assign the proper model

Implementing CPUE standardization

Log normal GLM (0 catch rate < 30%)

Implementing CPUE standardization log normal GLM

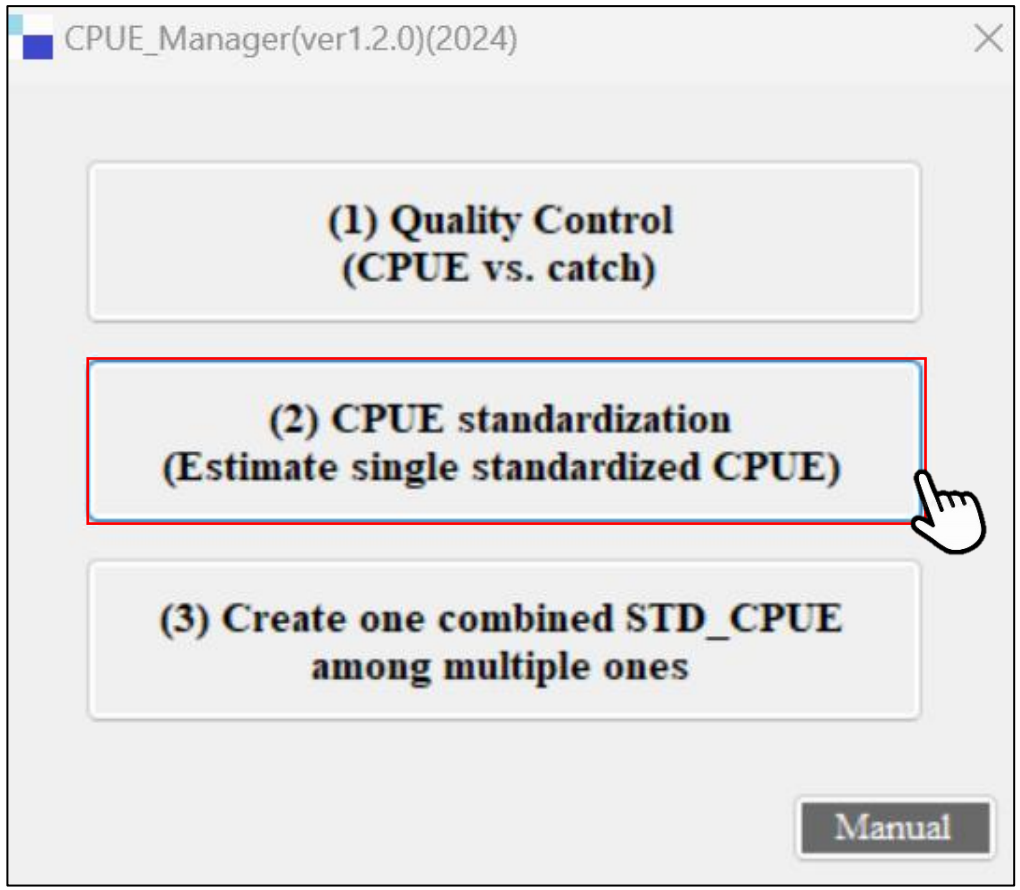


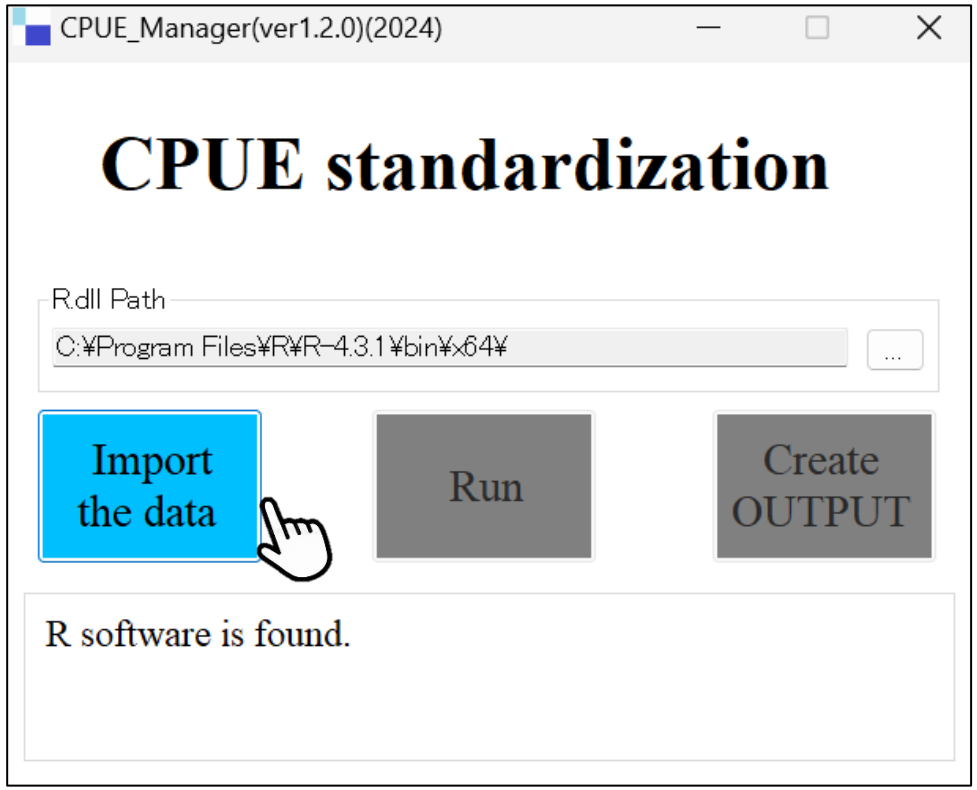
(Simple) Input data : Example

Year (1986-2006)(21), Season(4), Area(7) and Nominal CPUE

YR	Q	area	KAW CPUE (KG/HAUL)
2006	1	6	26.88
2006	1	6	0.00
2006	1	6	0.00
2006	2	6	163.35
2006	2	6	314.64
2006	2	6	37.69
2006	3	6	237.87
2006	3	6	429.18
2006	3	6	18.69
2006	4	6	29.62
2007	1	6	0.00
2007	1	6	0.00


CPUE_Manager


CPUE_Manager(ver1.2.0)(2024)
(1) Quality Control
(CPUE vs. catch)
(2) CPUE standardization
(Estimate single standardized CPUE)
(3) Create one combined STD_CPUE
among multiple ones
Manual


CPUE_Manager(ver1.2.0)(2024)
CPUE standardization
R.dll Path
C:¥Program Files¥R¥R-4.3.1¥bin¥x64¥
...
Import the data
Run
Create OUTPUT
R software is found.

Implementing CPUE standardization (log normal GLM): 1st window

Information of 0 (zero) catch, Selection of the model, and Selection of the covariates.

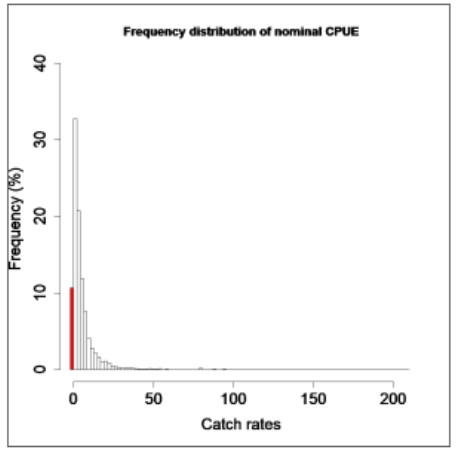
Sample size (n=)

Year	Sample size (n=)
2011	60
2012	48
2013	86
2014	310
2015	533
2016	518
2017	499
2018	514
2019	447
2020	60
2021	202
2022	257
2023	529

Month	Sample size (n=)
1	297
2	242
3	297
4	296

0 (zero) CPUE (catch) rate (red bar) = 11%

% frequency distribution of nominal CPUE



Select model

- (●) Log normal GLM: 0 (zero) CPUE (catch) rate < around 30%
- ( ) Delta type 2 steps log-normal model: 0 (zero) CPUE (catch) rate > around 30%

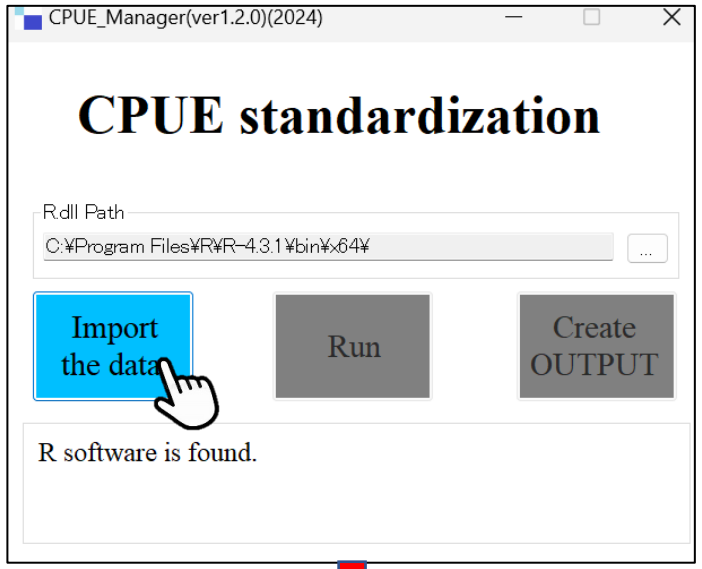
Select covariates

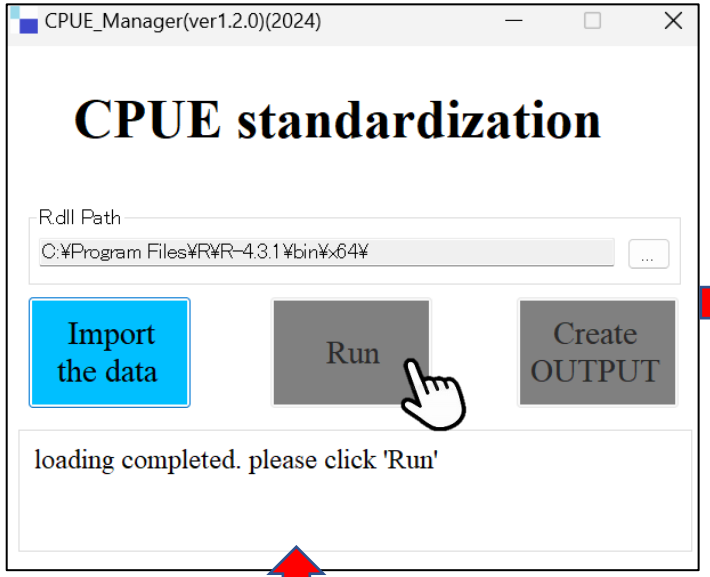
- [x] Year
- [x] Month
- [x] Area
- [x] Month * Area

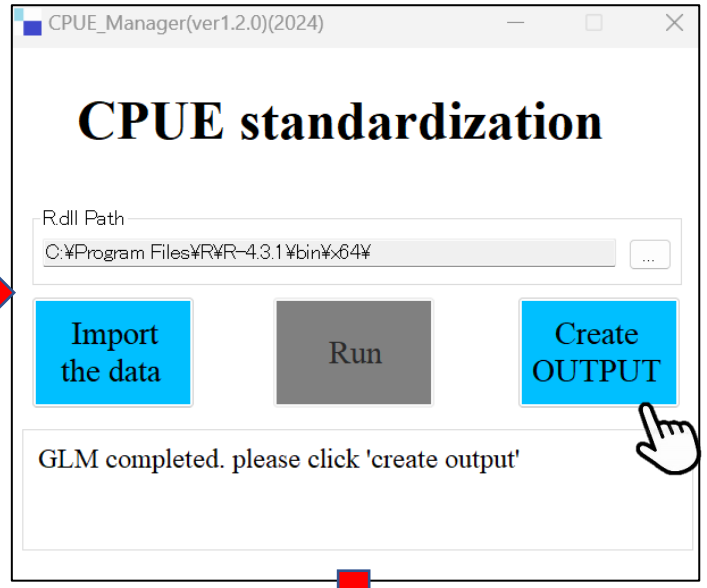
Note: Selection of covariates (for details, refer to the Manual)

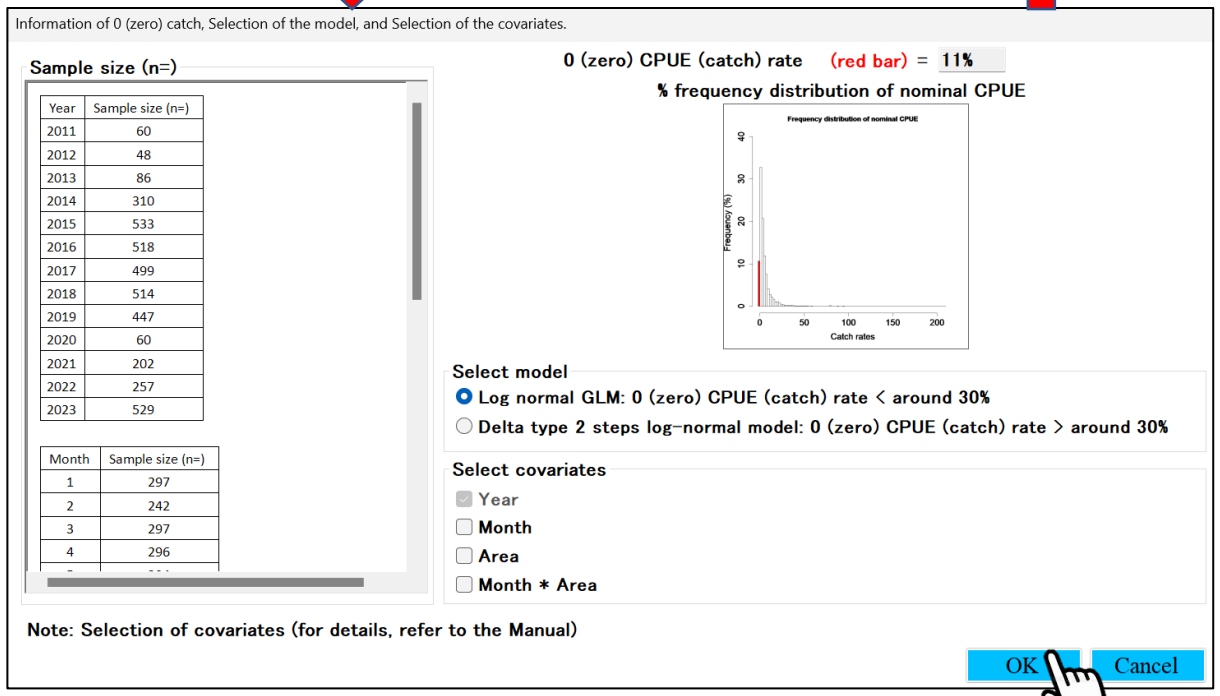
OK Cancel

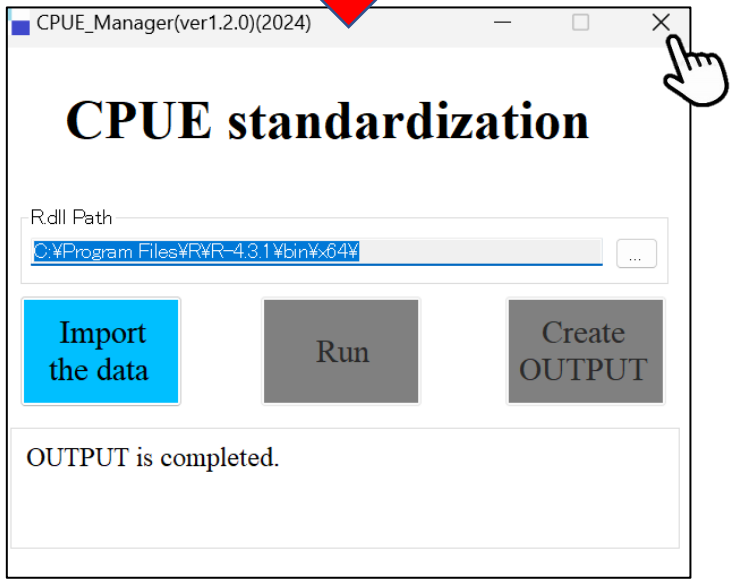
Implementing CPUE standardization(log normal GLM) : Steps











3 Outputs

(1) Sample size (excel)

(2) Numerical results (excel)

(3) Summary of results (word)➔ Your report is ready !

CPUE frequency distribution (0 CPUE)

ANOVA

Graphs

Diagnosis (residual analyses + QQ plot) (model evaluation)

(1) Sample size (excel)

(1) Sample size (Covariates)

Result(sample size)(Sample)(GLM)

Area	Sample size (n=)
NTS	3,291
STS	772

Year | Month | Area | Month x Area

Year	Sample size (n=)
2011	60
2012	48
2013	86
2014	310
2015	533
2016	518
2017	499
2018	514
2019	447
2020	60
2021	202
2022	257
2023	529

Year | Month | Area

Month	Sample size (n=)
1	297
2	242
3	297
4	296
5	294
6	266
7	313
8	417
9	413
10	389
11	475
12	364

Year | Month | Area | Month x Area

Month*Area	Sample size(n=)	
	Area	
Month	NTS	STS
1	244	53
2	186	56
3	223	74
4	212	84
5	213	81
6	201	65
7	252	61
8	327	90
9	344	69
10	341	48
11	429	46
12	319	45

Year | Month | Area | Month x Area

(2) Numerical results (excel)

(2) Standardized CPUE with its 95% CI (Confidence Interval) and nominal CPUE

numerical results
2 sheet (excel)

Result(data)(Sample)(GLM)

Original scale

	A	B	C	D	E
1		Observed (nominal) CPUE	Estimated (standardized) CPUE	Lower boundary of 95% CI (2.5%)	Upper boundary of 95% CI (97.5%)
2	2011	6.20	4.97	3.66	6.69
3	2012	9.98	7.95	5.73	10.95
4	2013	10.18	5.02	3.90	6.44
5	2014	4.77	4.91	4.30	5.60
6	2015	5.61	5.80	5.25	6.40
7	2016	5.98	6.40	5.79	7.07
8	2017	7.55	6.41	5.78	7.09
9	2018	4.66	4.78	4.31	5.30
10	2019	3.37	3.61	3.21	4.04
11	2020	6.20	4.97	3.66	6.69
12	2021	3.18	2.68	2.23	3.19
13	2022	8.52	7.61	6.61	8.75
14	2023	3.35	3.72	3.35	4.12
15					

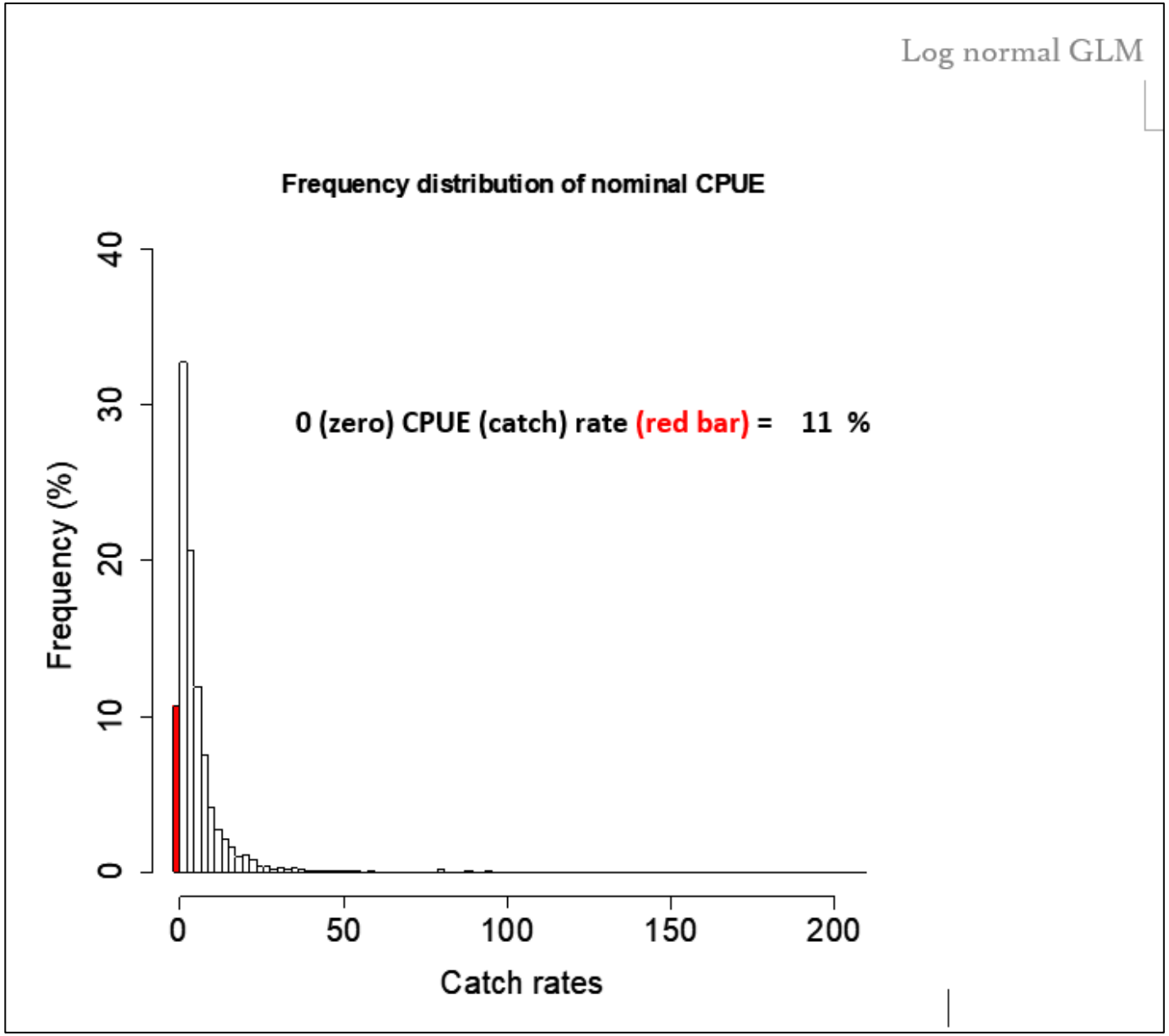
Original scale | Scaled CPUE (Ave=1)

Scaled as Ave=1

	A	B	C	D	E
1		Observed (nominal) CPUE	Estimated (standardized) CPUE	Lower boundary of 95% CI (2.5%)	Upper boundary of 95% CI (97.5%)
2	2011	1.01	0.94	0.82	1.06
3	2012	1.63	1.50	1.29	1.73
4	2013	1.66	0.95	0.88	1.02
5	2014	0.78	0.93	0.97	0.88
6	2015	0.92	1.10	1.18	1.01
7	2016	0.98	1.21	1.30	1.12
8	2017	1.23	1.21	1.30	1.12
9	2018	0.76	0.90	0.97	0.84
10	2019	0.55	0.68	0.72	0.64
11	2020	1.01	0.94	0.82	1.06
12	2021	0.52	0.51	0.50	0.50
13	2022	1.39	1.44	1.49	1.38
14	2023	0.55	0.70	0.75	0.65
15	Average	1	1	1	1
16					

Original scale | Scaled CPUE (Ave=1)

(3) Summary of results (word)


Frequency distribution of nominal CPUE
0 (zero) CPUE (catch) rate (red bar) = 11 %
Frequency (%)
0
10
20
30
40
0
50
100
150
200
Catch rates

ANOVA (Analysis Of Variance) Table for log normal GLM to test statistical significances on nominal CPUE

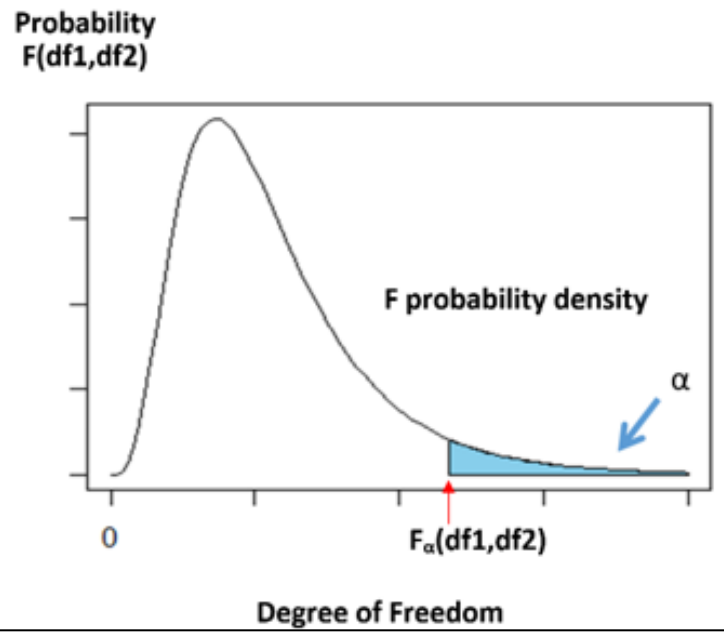
Adjusted R^2 = 0.31

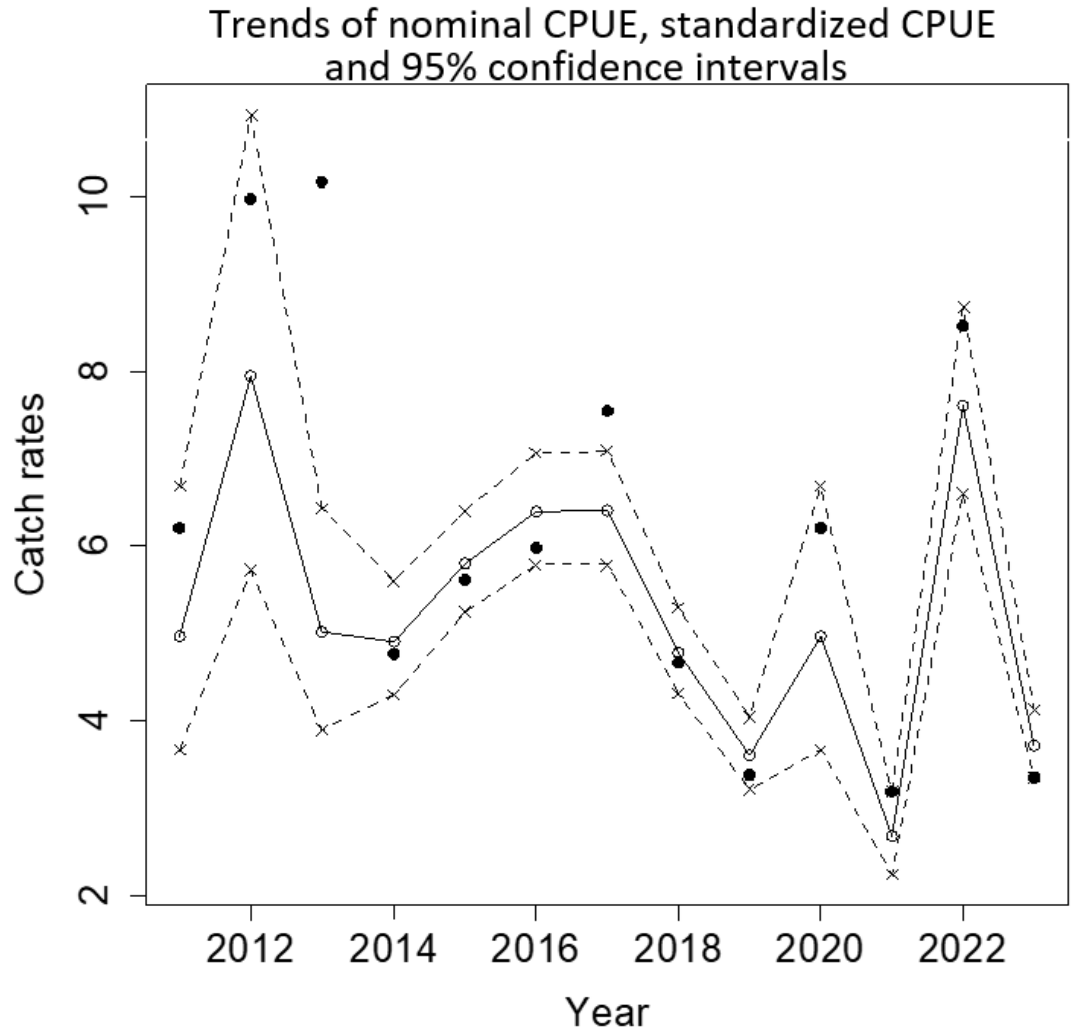
Sources	df1	df2	Type III SS (Sum of Square)	Mean Square	F (test statistic)	<α:Probabaility (>F) (*)
Model	35		594.67	16.99	20.56	0.000
Year	12		137.86	11.49	13.90	0.000
Month	11		231.91	21.08	25.51	0.000
Area	1		94.01	94.01	113.77	0.000
*Month*Area*	11		130.88	11.90	14.40	0.000
Error		4,027	3,327.66	0.83		

[Note]

df Degrees of Freedom

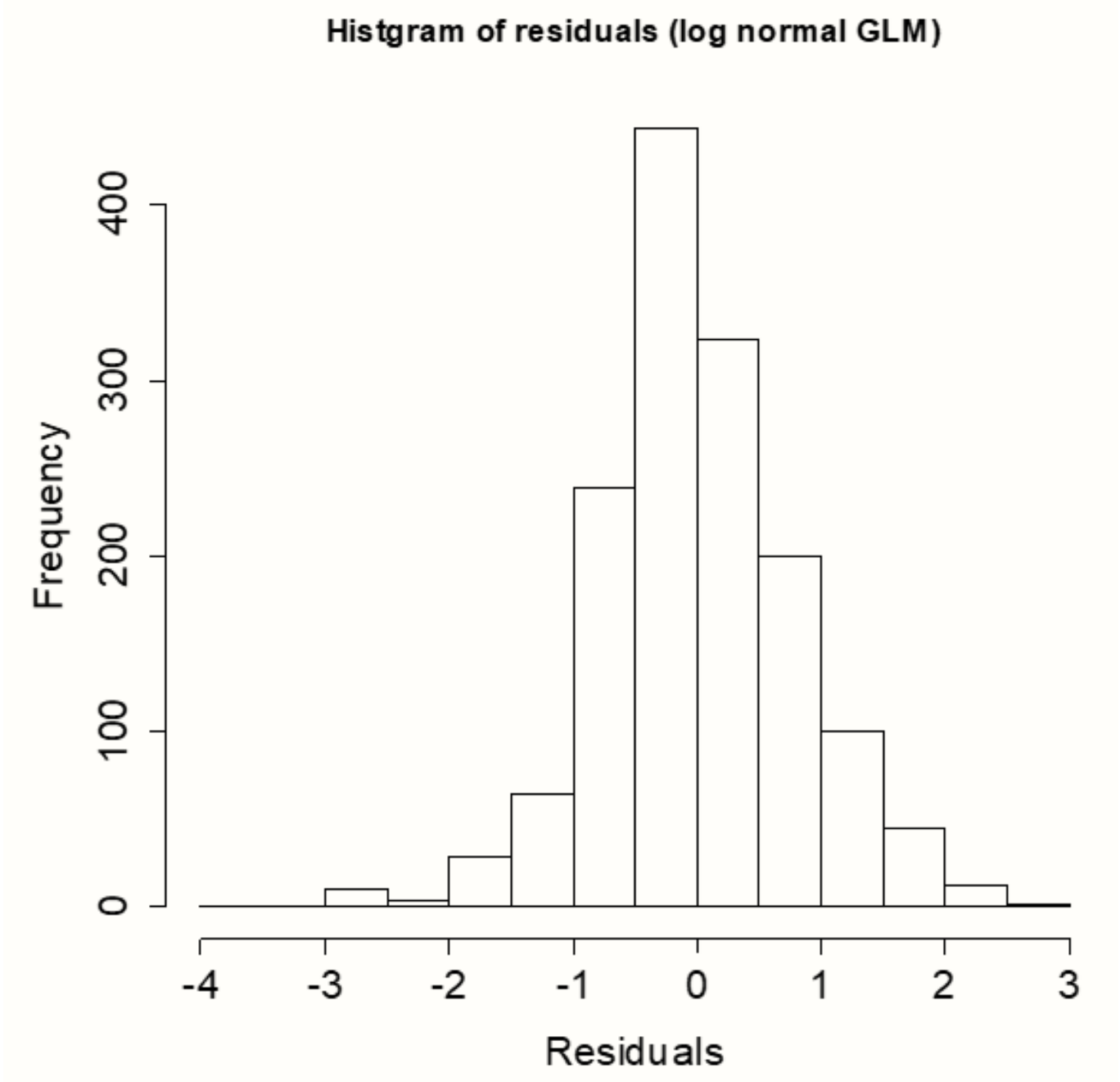
(*) Yellow marker Indicates $\alpha < 0.05$ (5%)

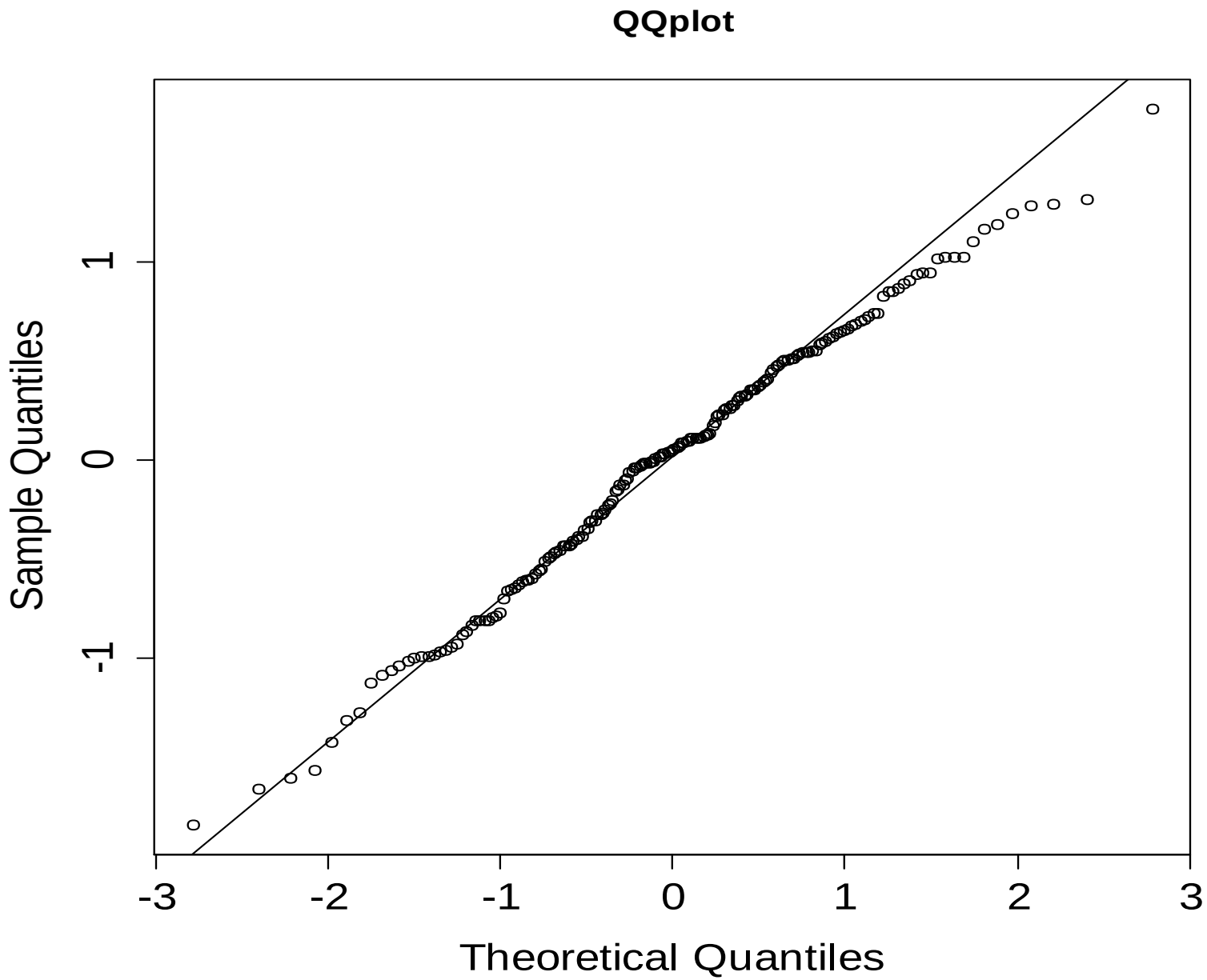




Legend

Point	(•)	: Nominal CPUE
Line	(o—o)	: Standardized CPUE (point estimate)
Dotted line	(×—×)	: 95% Confidence intervals


Histgram of residuals (log normal GLM)
Frequency
0
100
200
300
400
-4
-3
-2
-1
0
1
2
3
Residuals


QQplot
Sample Quantiles
Theoretical Quantiles
-3
-2
-1
0
1
2
3
-1
0
1

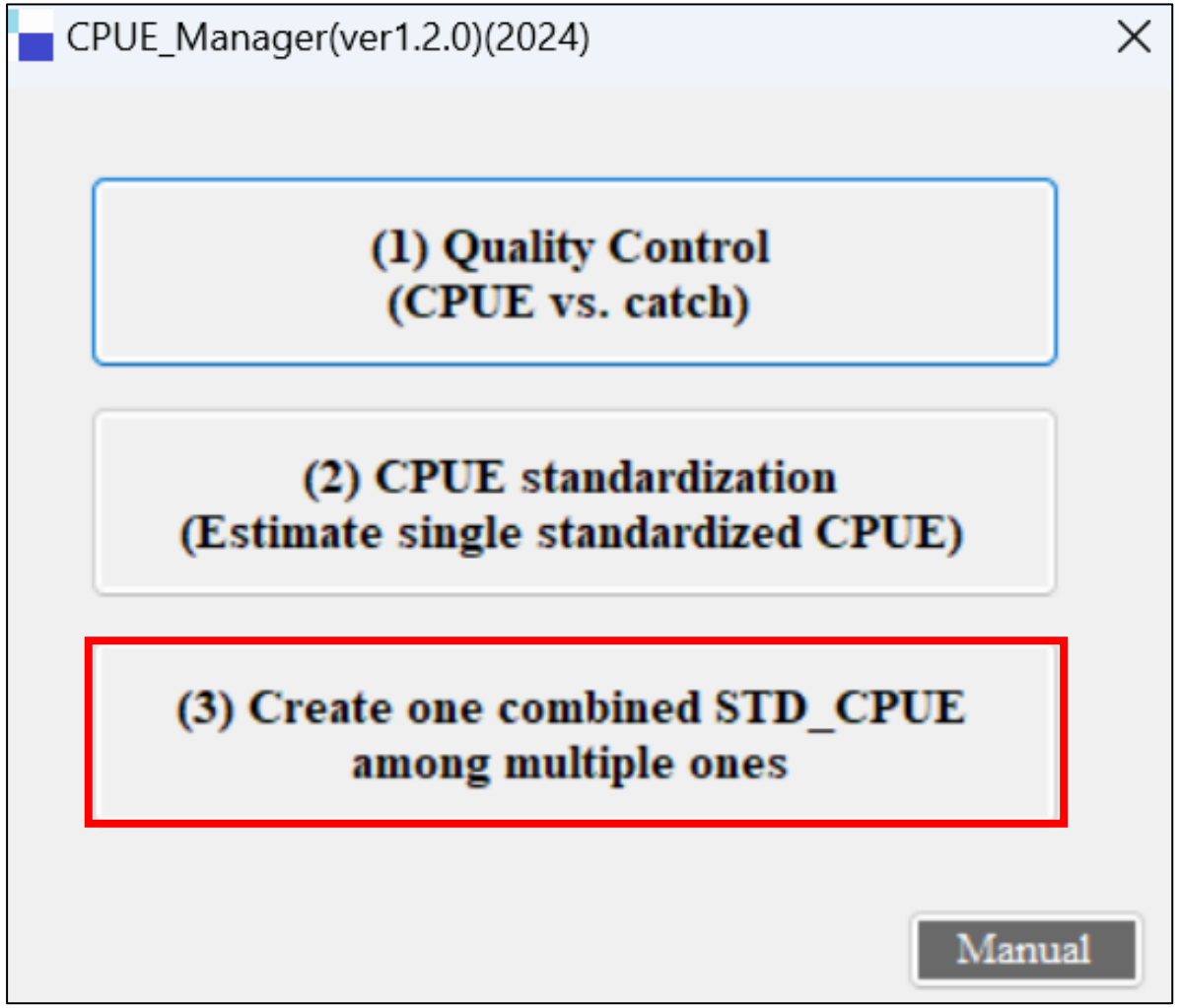
Implementing CPUE standardization (Delta model)

Zero inflated Delta 2 steps log normal GLM

bit different & complicated from log normal

➔ to be explained (training session)

[3rd menu]
Creating one common standardized CPUE



Why we need this menu
(making one CPUE among multiple CPUE)?

ASPIC (past experiences)

Multiple CPUE ➔ Difficult to converge

One CPUE ➔ easier to converge

Make one CPUE by weighted average by catch

JABBA (advance)➔ no problem

Contents (Part 1)

(1) Background & Objectives

(2) Outline

(3) Menu-driven software

- CPUE standardization
- Stock and Risk assessment
    - Review
    - Production model (ASPIC and JABBA)
    - Age-Structured Models
- Management decision making tool (Kobe I+II)

(4) Summary

Review: Stock assessments

Review of stock assessment (SA)

Important to understand the global SA models

Understand which model is good for your data
(maybe one model or more)

Most important point ➔ Try a few possible models
If results are same ➔ Confident ➔ Good advise (management)

If NOT ➔ data problem ➔ check your data
➔ You might use one good (fitness) model.

How many SA models ? More than 50 (IOTC, 2015) (a list and not classified)

Method	Data Requirements		Reference Points	Management Advice	Pros	Cons
	Biology	Fishery				
PSA	Qualitative	Qualitative	No	Qualitative	Easy to use if LH parameters available	Difficult to relate to current abundances and fishing mortality.
Demographic Models/Elasticity Analysis	Age & growth, Fecundity, Natural Mortality	Several fishery characteristics	No	Mostly qualitative (change of gear) and F	Easy to use if LH Parameters available. Can provide guidance on gear usage/ selectivity	Must assume that LH parameters are correct, but uncertainties can be introduced. Difficult to relate to current abundances and fishing mortality.
Catch free LH Based	M, growth curve parameters, and Age at full Maturity or Max Age	Selectivity	Yes (F_{MSY})	F_{MSY}	Easy to get LH parameters if available. Zhou et. al. (2011) provides equations that are relevant to species. Could run a meta-analysis and run as well using a Bayesian Hierarchical Model Approach. Provides a Target F.	Guidelines provided for Fishing Mortality, but no specifics on current status. No idea what current Biomass and F are. However some guidelines could be provided based on theoretical carrying capacity, current depletion levels, and whether current take are meeting or exceeding targets.
Catch free CPUE Based	M, growth curve parameters, and Age at full Maturity or Max Age & recruitment	Selectivity and CPUE Series	Yes (F_{MSY} & B_{MSY})	F_{MSY} & B_{MSY}	Easy to parameterize with LH data. Estimate recruitment, F and selectivity to tune to the CPUE series. Provides target F, Yield levels and where we are with regards to these rates. Provides target B as well and where we are with regards to that.	LH based assumptions could be misleading. CPUE series may not be representative of abundance series if from a limited fleet and area. Catch at size should be estimated from the viewpoint of the operational patterns
Catch Based SRA	r & K	Catch series	Yes (F_{MSY} & B_{MSY})	F_{MSY} & B_{MSY}	Set of data that currently exist (but may not be too good). Tried and tested approach in ICES, Walters, etc. Easy to run, provides Yield targets and FMSY & BMSY	Uncertainty in catch series can give misleading results. Based on assumptions of depletion range in current years that may give misleading results. May not be very accurate in terms of FMSY and BMSY
Surplus Production (Bayesian or Otherwise)	r & K	Catch series & CPUE series	Yes (F_{MSY} & B_{MSY})	F_{MSY} & B_{MSY}	Traditional approaches. Used extensively in literature. Provides yield targets and FMSY and BMSY	Length of time-series and uncertainty in catch series and CPUE series can bias results. Models may have problems converging to a solution if there is no contrasting information.
Integrated assessments	Recruitment, M by age, growth paramters, maturation schedule, fecundity, recruitment	Catch series, Length based samples, CPUE data (and or have tagging data), fishery selectivity	Yes (F_{MSY} & B_{MSY})	F_{MSY} & B_{MSY}	Most robust approach. Incorporates all information in a dynamic model. Provides most representative yield targets and FMSY and BMSY	Highly data dependent. Models can have problems converging. Learning curve steep.

These models can be classified into 3 types

3 types of SA models (Nishida, 2024) (TYPE3➔most important)

	Data type	Information	Data period	Reference Point (RP) (MSY, Fmsy, Tbmsy, target & limit RP)	Models & Application (examples)	Implementation (R, own code, package) (example)
TYPE 1	Qualitative	Parameters			● ERA (Ecosystem Risk Assessment) ● PSA (Productivity Susceptibility Analysis)	✓ R ✓ Package
TYPE 2	Quantitative	✓ Real data ✓ Parameters ✓ Priors for Bayesian approach	Short term (a few years)	Temporal & Subjective (snap shot)	● Length based models (ELEFAN, FiSAT, Y/R, S/R, LBSPR, Thompson & Bell) ● SRA (Stock Reduction Analysis) (Longer term catch also can be applied)	✓ R (Y/R, S/R) ✓ Packages (FAO)
TYPE 3			Long term (> 10 years)	Realistic & Objective (important for management)	● Production models (ASPIC & JABBA) ● Age (size) structured model (VPA, ASPM, SCAA, SCAS) ● Integrated models (SS, CASAL)	✓ Own codes (SS) ✓ R (JABBA) ✓ Package (MENU: ASPIC_Manager)

Type 3 (important) for robust assessments (long term data) (not like snap-shop TYPE 2 SA)

Models		Example	Data and parameters								
			Stock structure	Catch	CPUE	size / age	M (natural mortality)	LW relation	Growth	Maturity + fecundity	Space & movement
Data limit approach		SRA (Catch only)									
Production model		ASPIC									
		JABBA									
Age / size structured model	Simple model (no CPUE)	Cohort analysis									
	Simple integrated model	ASPM									
	Integrated model	SCAA, SCAS, SS3, CASAL									SS3

Based on the summary

SEAFDEC training
We considered which models should be used
for menu-driven software

We consider…
Simpler (easier) model ➔ for beginners
Data limited ➔ for developing countries

Production Model (Catch and CPUE)

Evolution of PM (Production Model)

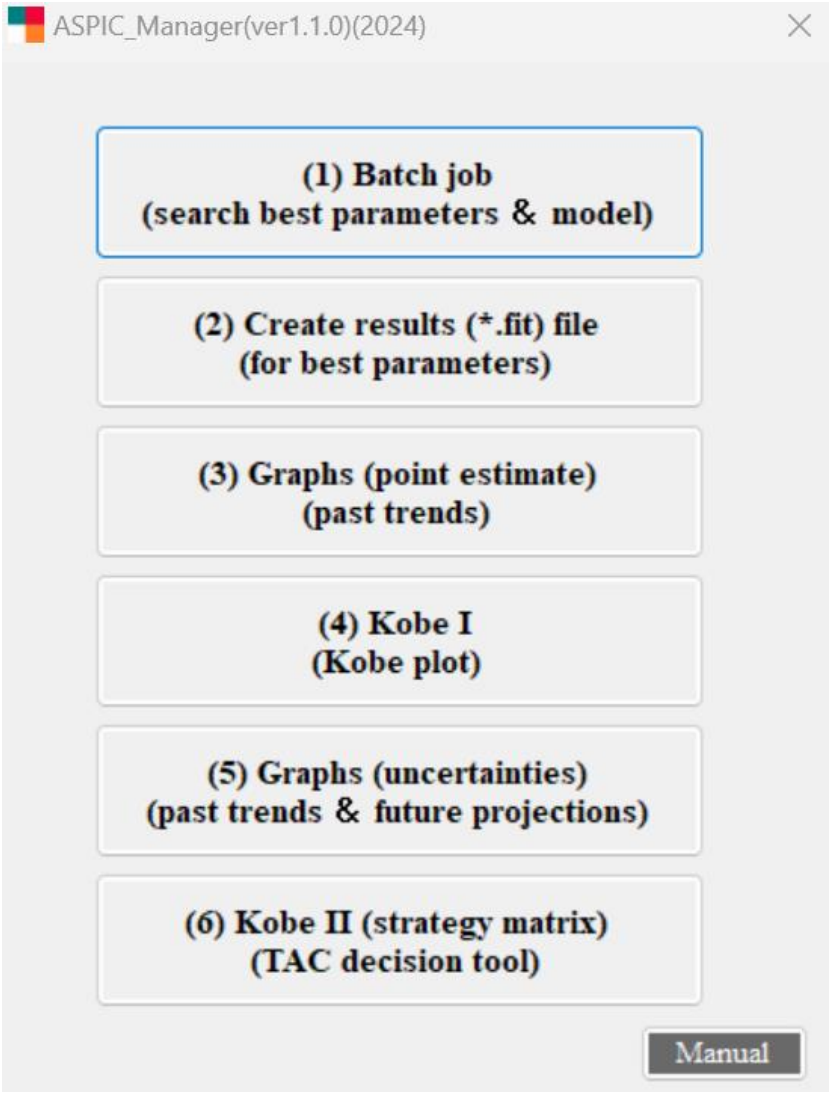
Evolution	Type	Primnary author	Features				Comments
			Equilibrium Condition (EC) (death=increase) (un-reaistic)	Error type		Bayesian (better) Approach	
				Observation (data) error	Process (model) error		
old	Original PM	Shaeffer(1954), PT(1969) & Fox (1970)	YES				Classical (Not recommended to use due to EC)
	ASPIC (Ver5.05)	Prager (2004)	NO				Basic, standard & commonly used among RFMOs & fishing countries
	ASPIC (ver7.5)	Prager (2017)					
new	JABBA (Just Another Bayesian Biomass Assessment)	Winker (2018)					Best but high standard (slowly expanding) Recommended

In 2013-15, ASPIC is available but JABBA (2018) is not available

We have been developing and improving ASPIC to now (2024)

For training & joint works

(SEAFDEC + many fishing countries (world wide)



As JABBA is the best PM
➔ We started to develop (2023)

Fisheries Research 204 (2018) 275–288

Contents lists available at ScienceDirect

Fisheries Research

journal homepage: www.elsevier.com/locate/fishres

JABBA: Just Another Bayesian Biomass Assessment

Henning Winker[a,b,*], Felipe Carvalho[c], Maia Kapur[c,d]

[a] *Department of Agriculture, Forestry and Fisheries, Private Bag X2, Vlaeberg, 8018, South Africa*
[b] *Centre for Statistics in Ecology, Environment and Conservation (SEEC), Department of Statistical Sciences, University of Cape Town, South Africa*
[c] *NOAA Pacific Islands Fisheries Science Center, 1845 Wasp Boulevard, Building 176, Honolulu, HI, 96818, United States*
[d] *Joint Institute for Marine and Atmospheric Research, University of Hawaii, 1845 Wasp Boulevard, Building 176, Honolulu, HI, 96818, United States*

Menu-driven JABBA will be ready (2024)

Next year (2025) ➔ we can offer training

How about Age-Structured Model?
We recommend ASPM (simpler than others)

Models		Example	Data and parameters								
			Stock structure	Catch	CPUE	size / age	M (natural mortality)	LW relation	Growth	Maturity + fecundity	Space & movement
Data limit approach		SRA (Catch only)									
Production model		ASPIC									
		JABBA									
Age / size structured model	Simple model (no CPUE)	Cohort analysis									
	Simple integrated model	ASPM									
	Integrated model	SCAA, SCAS, SS3, CASAL									SS3

Why we don't select data poor method (snap shot approach)? TYPE 2

	Data type	Information	Data period	Reference Point (RP) (MSY, Fmsy, Tbmsy, target & limit RP)	Models & Application (examples)	Implementation (R, own code, package) (example)
TYPE 1	Qualitative	Parameters			● ERA (Ecosystem Risk Assessment) ● PSA (Productivity Susceptibility Analysis)	✓ R ✓ Package
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TYPE 3			Long term (> 10 years)	Realistic & Objective (important for management)	● Production models (ASPIC & JABBA) ● Age (size) structured model (VPA, ASPM, SCAA, SCAS) ● Integrated models (SS, CASAL)	✓ Own codes (SS) ✓ R (JABBA) ✓ Package (MENU: ASPIC_Manager)

Why we don't cover data poor method (snap shot approach)?

TYPE 2

Because ➔ many software & training (FAO, SEAFDEC & others)

(1) Length based method

ELEFAN, FiSAT, Y/R, S/R, LBSPR, Thompson & Bell, others

(2) SRA (Catch only method)

Thus [MENU] concentrate traditional stock assessments TYPE 3

as NO users friendly software & NO trainings

➔ Thus [MENU] develops Menu-driven software

Lastly Very important issue

Developing countries

➔ Need Multi-gear & Multi-species fisheries Management (MMM)

Our stock assessment➔ single species

How dose it help MMM?

Our single species specific SA results ➔ just reference for MMM

A single species TAC cannot be used directly for MMM

as stock statuses are different among multi-species.

MMM should be implemented by mangers

considering relevant factors together….

Stock statuses (all species), singles species specific TAC (our work),

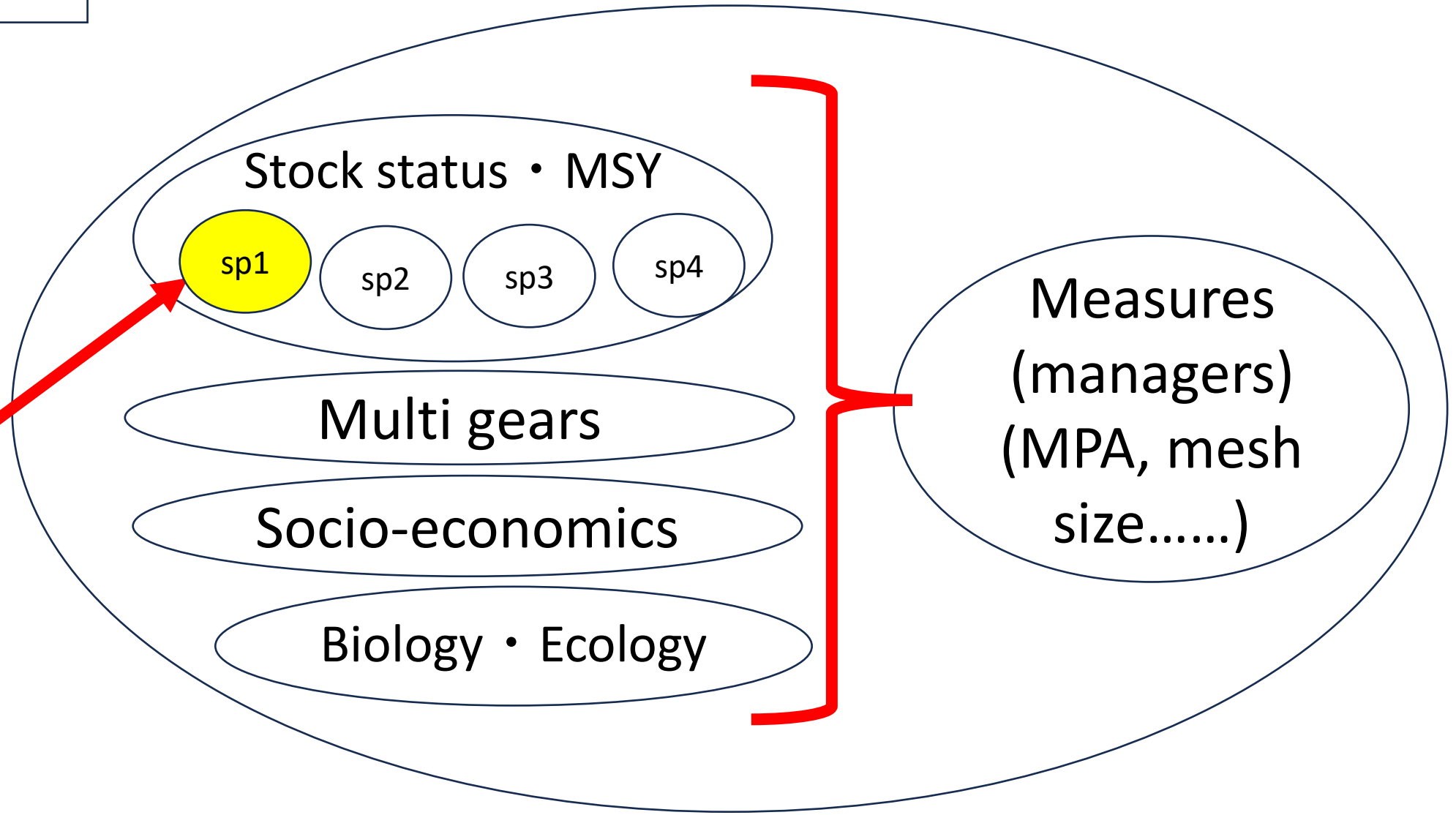
socio-economics, MPA, ecology/biology & others

Summary

Multi-gear & Multi-species fisheries Management (MMM)
Manager needs to consider all relevant factor together

Our role

to provide stock status & MSY by single species



Contents

Review: Risk assessment

Why we need to do Risk assessment ?
Stock assessments are not enough ?

Stock assessments are enough to the some extent

We know the stock status

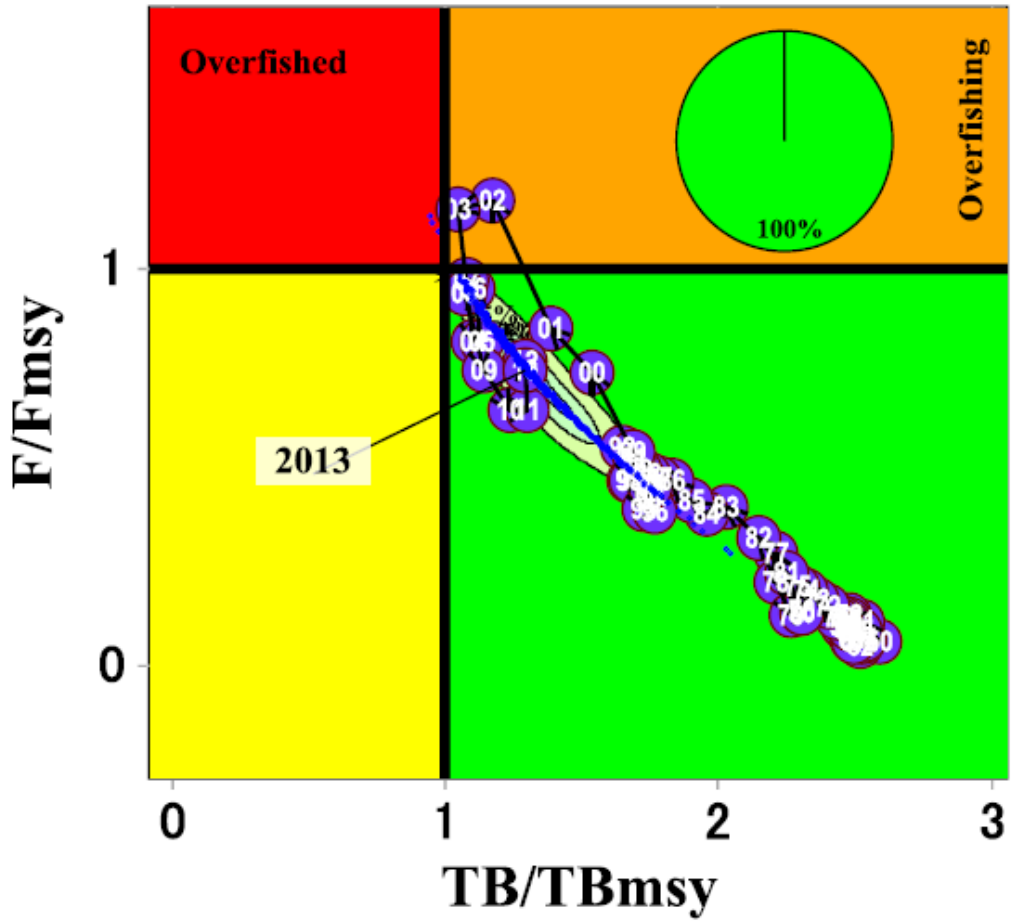
We can set up TAC (e.g. MSY)

Maybe that is enough and OK??

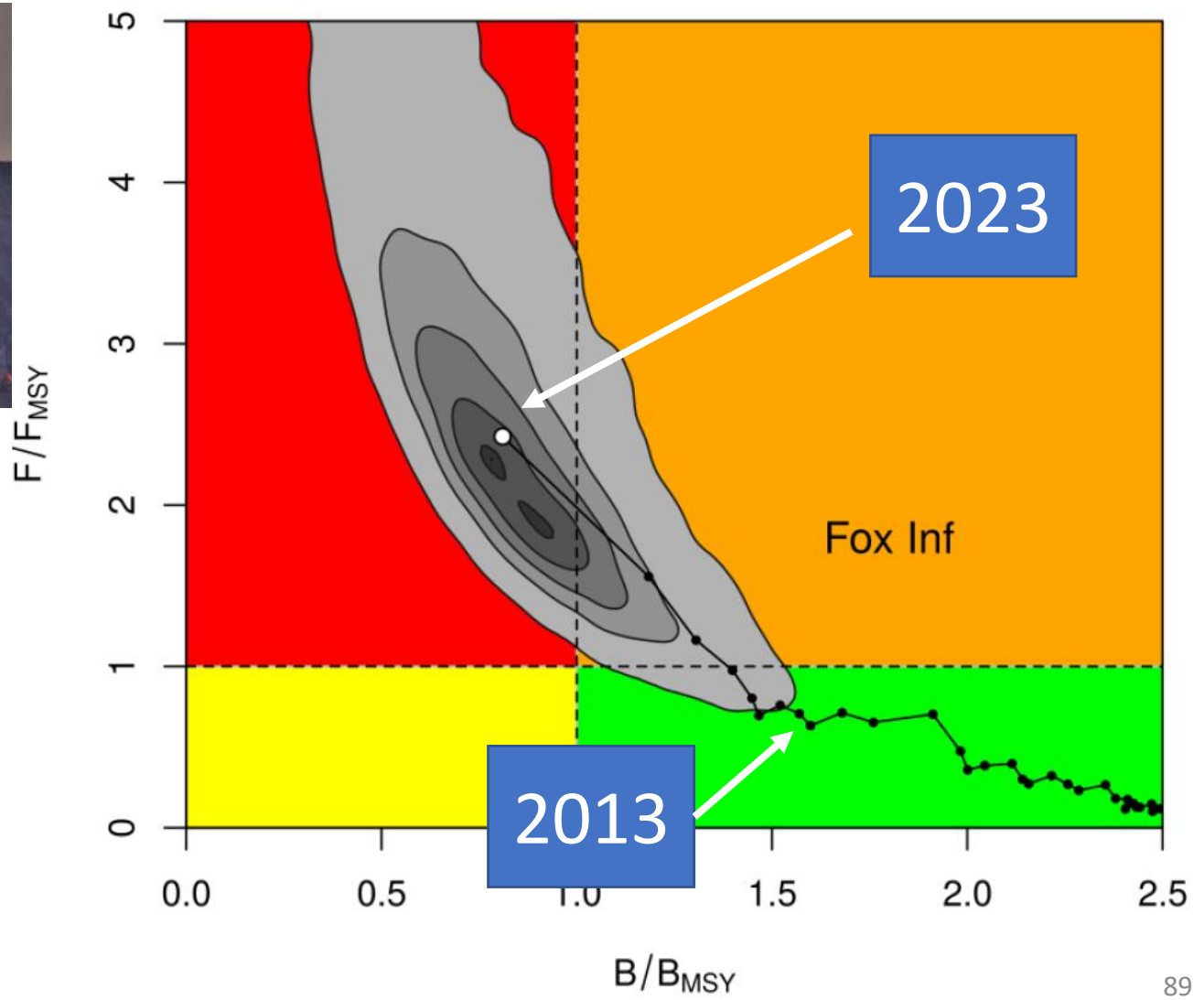
Not OK…➔ we need Risk assessment.. Why?

We know the current stock status ➔ green (happy) zone ☺

So, we are OK, finish our work and we can relax …



But danger is…if the current catch level were continued… then we may end up the RED ZONE in 10 years !



How do we know the future stock status?

For example stock assessments➔current stock status (red zone)

<u>what happens the stock status</u>

<u>10 years later ?</u>

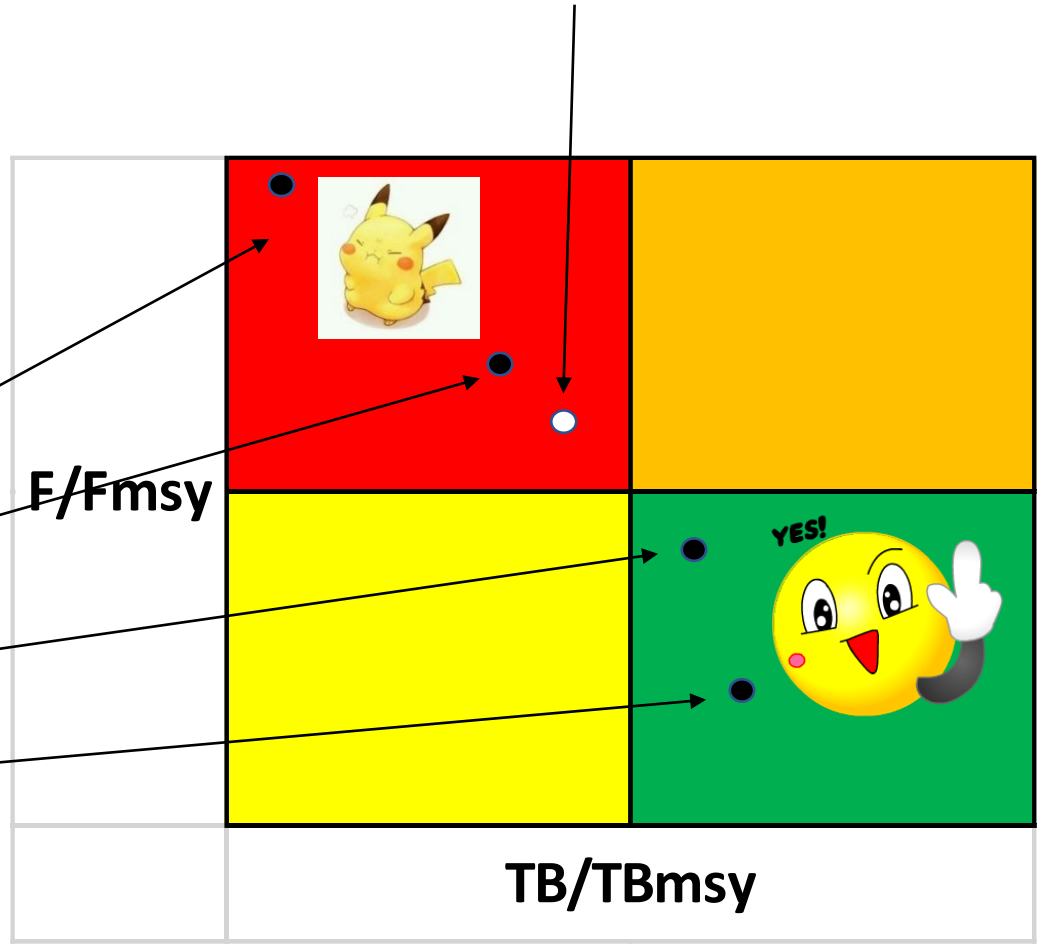
<u>Depending on the catch levels</u>

Higher catch (20,000 t)

Current catch (10,000 t)

<u>MSY level (8,000 t)</u>

Lower catch (5,000)



- Simply if catch level is higher

  ➔ more RISK to violate MSY levels

- And vice versa

  lower catch ➔ less risk to violate MSY level

We should certainly avoid HIGH RISK

➔ We need to select **OPTIMUM CATCH level for sustainable MSY levels (TB+F) (future)**

For this purpose, we need to do Risk assessment (TB and F)

To determine the optimum catch

Kobe II : Strategy matrix

We can secure sustainable resources and Fisheries

Risk Matrix → Risk Probability (%) to violate F(MSY) in the future

Example (IOTC) → 10 years (Pr < 50%) → TAC: > 10% reduction

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%
MSY →	-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%
% decreased from the current catch level	-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%

For TB → > 10% reduction → TAC < 12,160 ton

	%	Catch (tons)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
% Increased from the current catch level	200%	40,533	36%	41%	85%	97%	100%	100%	100%	100%	100%	100%
	150%	33,778	36%	41%	79%	94%	99%	100%	100%	100%	100%	100%
	100%	27,022	36%	41%	71%	87%	95%	98%	99%	100%	100%	100%
	80%	24,320	36%	41%	66%	83%	91%	96%	98%	99%	100%	100%
	60%	21,618	36%	41%	61%	77%	87%	93%	96%	98%	99%	99%
	40%	18,915	36%	41%	57%	70%	80%	87%	91%	94%	95%	97%
	30%	17,564	36%	41%	54%	67%	75%	82%	87%	91%	93%	95%
	20%	16,213	36%	41%	52%	61%	70%	77%	81%	86%	89%	90%
	10%	14,862	36%	41%	49%	56%	63%	69%	75%	79%	82%	84%
* Current catch	0%	13,511	36%	41%	47%	51%	56%	60%	64%	68%	71%	74%
% decreased from the current catch level	-5.60%	**12,760	36%	41%	45%	47%	50%	54%	57%	59%	62%	64%
	-10%	12,160	36%	41%	43%	45%	47%	50%	52%	53%	56%	58%
	-20%	10,809	36%	41%	40%	39%	37%	37%	37%	37%	37%	38%
	-30%	9,458	36%	41%	35%	31%	29%	27%	24%	23%	22%	21%
	-40%	8,107	36%	41%	32%	26%	19%	16%	14%	13%	12%	11%
	-60%	5,404	36%	41%	26%	13%	8%	6%	6%	6%	6%	6%
	-80%	2,702	36%	41%	19%	6%	3%	3%	3%	3%	3%	3%
	-100%	0	36%	41%	12%	2%	1%	1%	1%	1%	1%	1%

Summary

Stock assessments not enough ➔ Risk assessment

Stock assessments ➔ Current stock status (MSY)

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

Depending upon **catch levels**

Risk assessment will provide **future risks to violate MSY**

(by various catch levels)

We will find out Optimum catch level (TAC)

to sustain SAFE stock status ➔ < 50% Risk violating MSY (10 years)

Contents (Part 1)

(1) Background & Objectives

(2) Outline

(3) Menu-driven software

- CPUE standardization
- Stock and Risk assessment
  - Review
  - Production model (ASPIC and JABBA)
  - Age-Structured Models
- Management decision making tool (Kobe I+II)

(4) Summary

ASPIC

A Stock Production Model Incorporating Covariates

Outline

INPUT
Catch &
CPUE

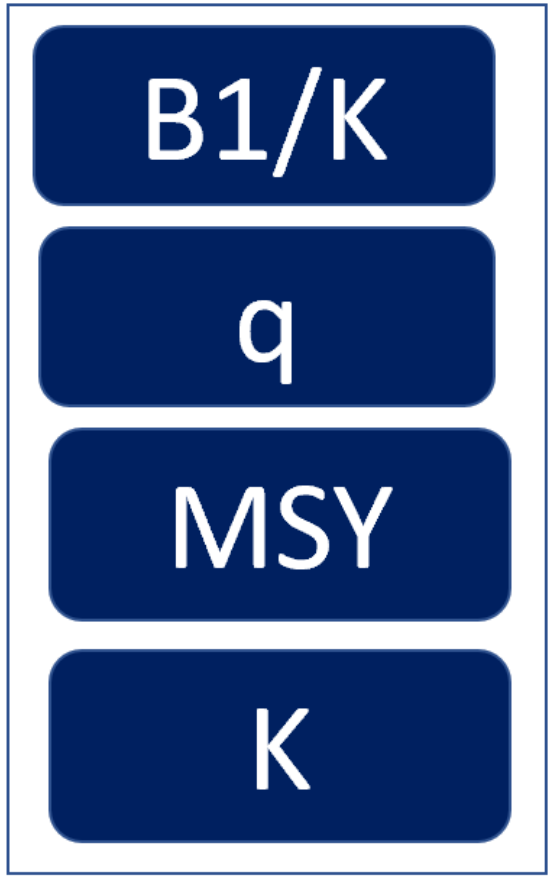
4 parameters
(to be estimated)

- B1/K
- q
- MSY
- K

OUTPUT (estimation)

- **Population (tons)**
- **Reference points (MSY, Fmsy, TBmsy)**
- **Pop growth (r and K)**
- **F and B1/K (depletion)**
- **q (catchability)**

What are 4 parameters ?



K

Carrying Capacity (Maximum biomass)

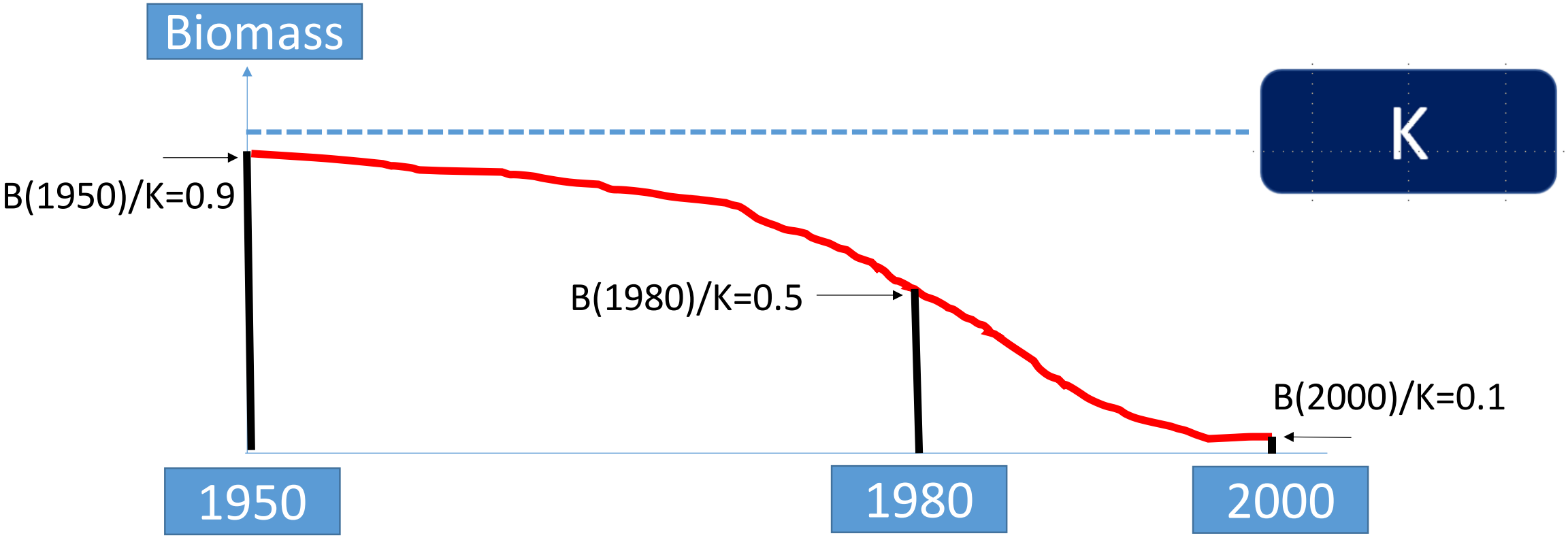
[B1]

Biomass

B1/K

Depression (% decrease from K)➔ example: B(1980)/K=0.5 (50%)

Range: 0~1 (0%~100%)



q

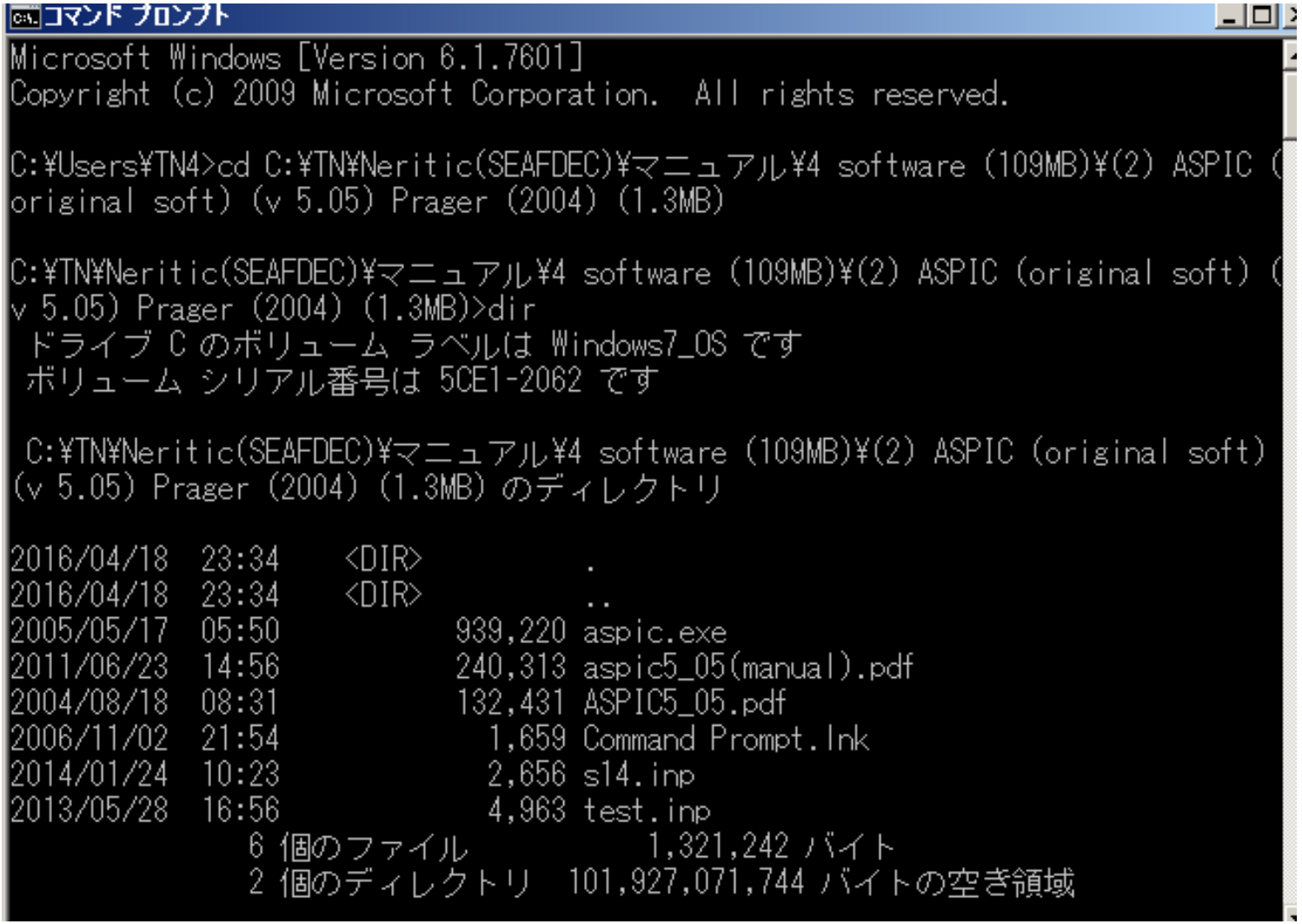
Catchability coefficient *(efficiency of catch).*

If gear A catches 2 times higher than gear B in the same effort,
q=1.0 (gear A) and q=0.5 (gear B)

Gear A is 2 times efficient
to catch same amount of catch in the same effort by Gear B

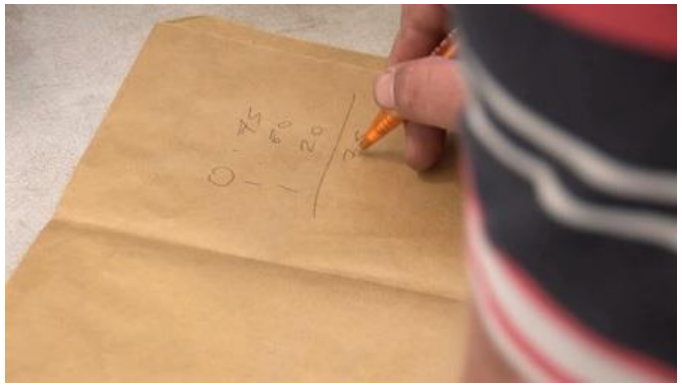
Running ASPIC

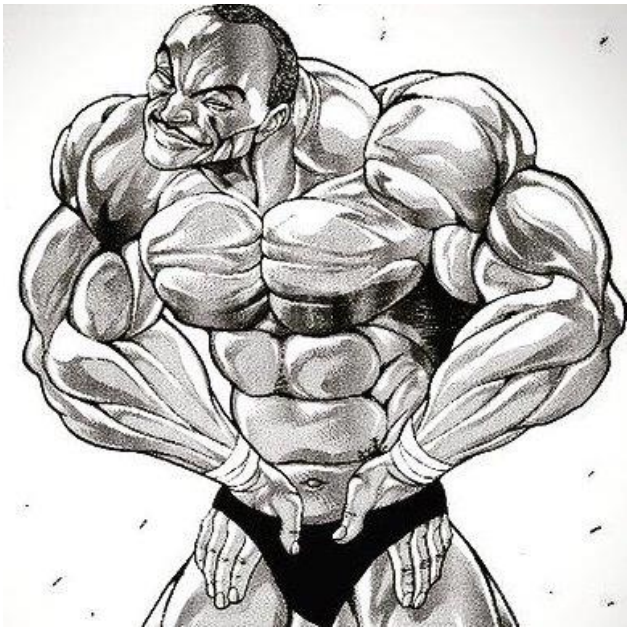
Original ASPIC：A Single run/time



If you have several scenarios on K, B1/K, q and MSY for example 3 each

- $4^{3=}$ 256
- With 2 models (Schaefer and FOX)
- **Then Total 512 combinations**
- Too much to do by hand (one by one) (Pencil and Paper method)





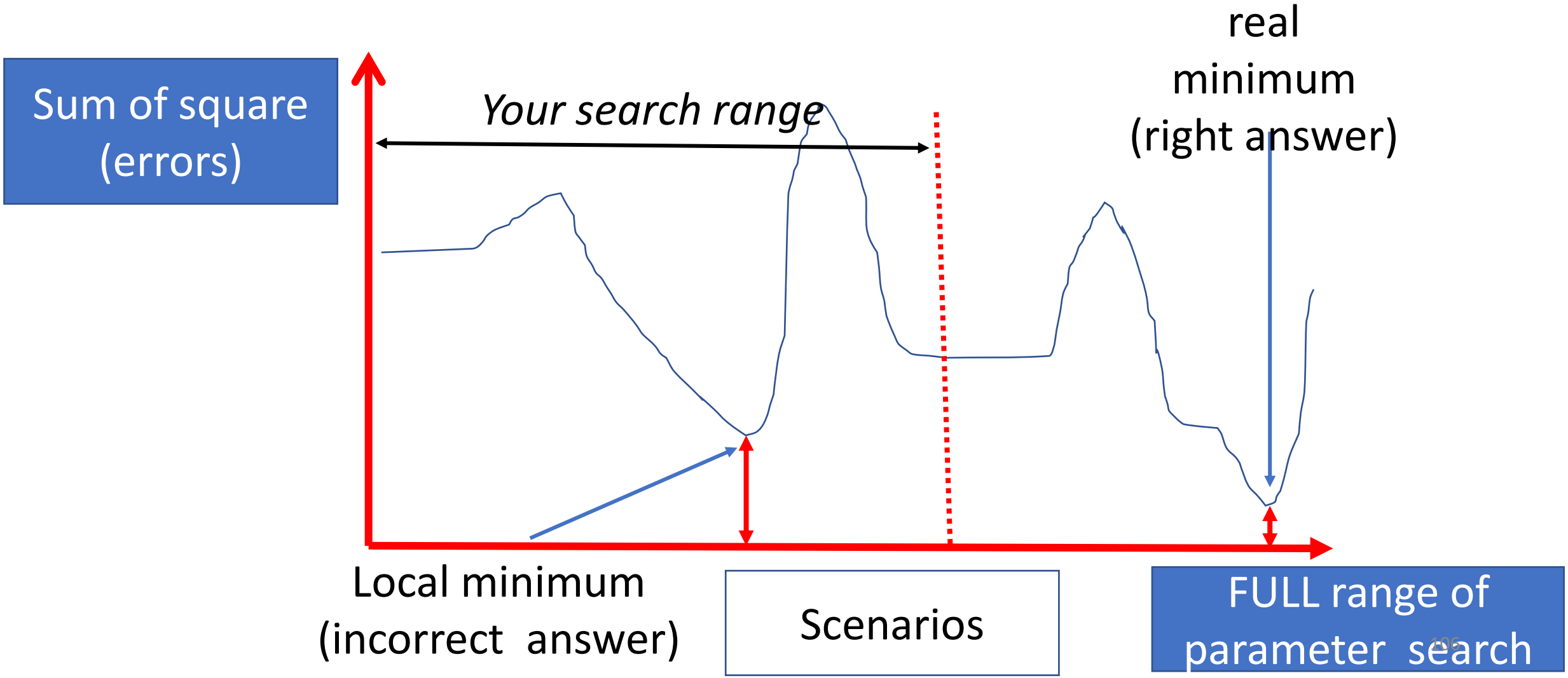
➔you will be tired

you need strong muscle!

But danger is the local minimum

- False convergences (answers)
  (incorrect parameters estimated)

What is the local minimum?
We select optimum parameters when SSE (errors) is minimum.
You might find the incorrect SSE (➔parameters)
if your search range is limited.



To protect damages of your muscle & to avoid local minimum we develop special software

ASPIC Grid search (Batch job)software (menu driven)(1st version)

Automatic search ➔ optimum parameters

(based on combination of 4 parameters+2 models)

No need pencil and paper method

Software works for you (you can rest)

No worry about the local minimum

However there are still a lot of manual works
➔ errors + mis-handling

To solve this problem

Menu-driven ASPIC_Manager was developed (2024)

(no more manual works ➔ almost automatic)

Pervious ASPIC software (2023 or before)

Only one menu (batch job)

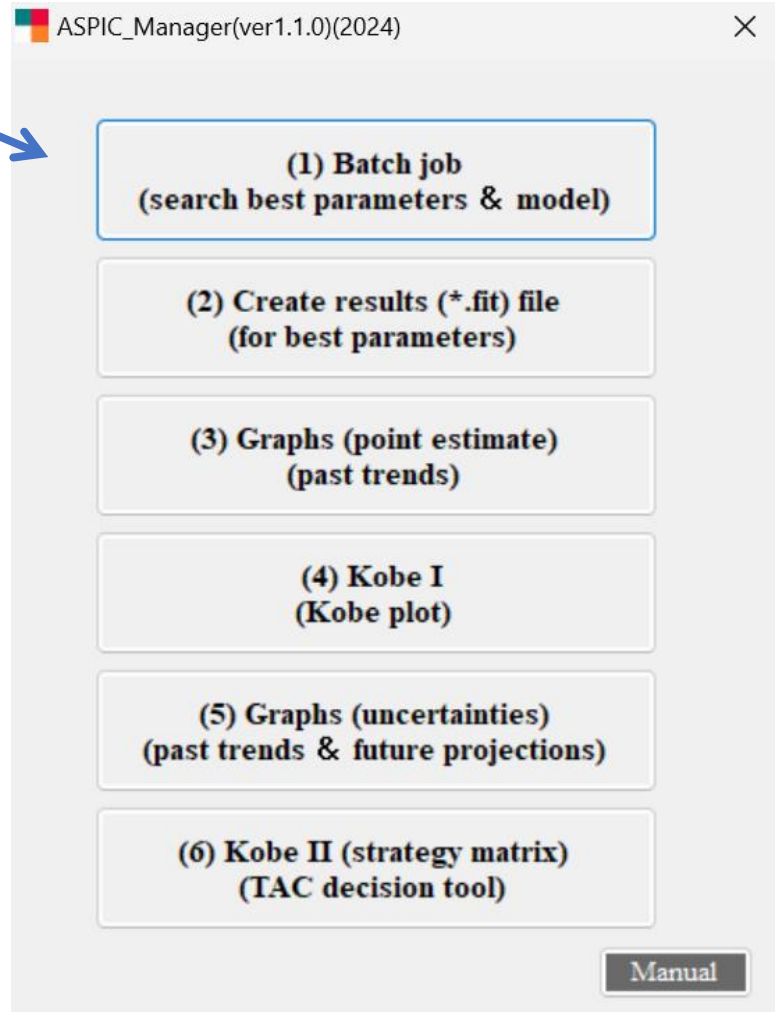
(1)~(6) ➔ separate works

caused many errors & mis handlings

New software ASPIC_Manager (2024) (6 menus)

(ALL-in-one & Automated)

Simple & friendly operations ➔No errors



Running software (6 menus)
ASPIC_Manager

ASPIC
one input file

Users don't need to edit this.

Users only need to make the data set (MUNE)

ASPIC_Manager will do all works for users

Program

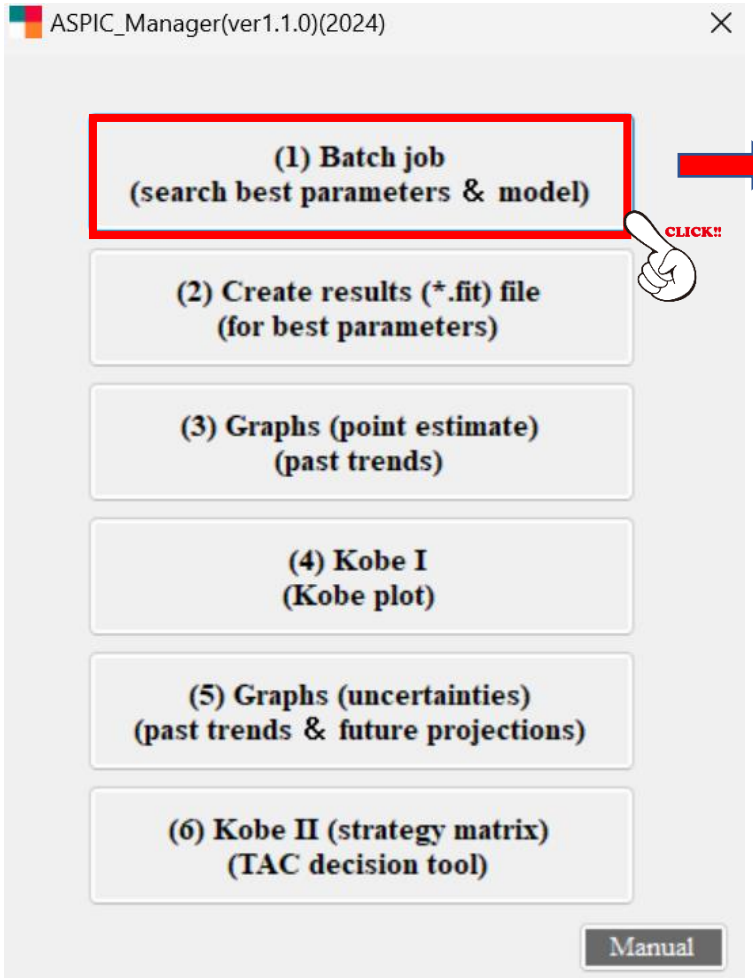
```
FIT                 ## Run type (FIT, BOT, or IRF)
"test"              ## title
LOGISTIC YLD SSE    ## Modeltype, conditioning, loss fn
2                   ## Verbosity on screen (0-3); add 10 for SUM & PRN file
1000                ## Number of bootstrap trials, <= 1000
0 20000             ## 0=no MC search, 1=search, 2=repeated srch; N trials
1d-8                ## Convergence crit. for simplex
3d-8  6             ## Convergence crit. for restarts, N restarts
1d-4  24            ## Conv. crit. for F; N steps/yr for gen. model
8d0                 ## Maximum F when cond. on yield
1d0                 ## Stat weight for B1>K as residual (usually 0 or 1)
1                   ## Number of fisheries (data series)
1                   ## Statistical weight for data series
1                   ## B1/K (starting guess, usually 0 to 1)
7300                ## MSY (starting guess)
70000               ## K (carrying capacity) (starting guess)
0.004               ## q (starting guesses -- 1 per data series)
0 1 1 1             ## Estimate flags (0 or 1) (B1/K, MSY, K and q)
3000 15000          ## Min and max constraints -- MSY
23000 170000        ## Min and max constraints -- K
39332385            ## Random number seed (large integer)
35                  ## Number of years of data in each series
"CPUE Catch"        ## Title for 1st series (<=40 chars)
```

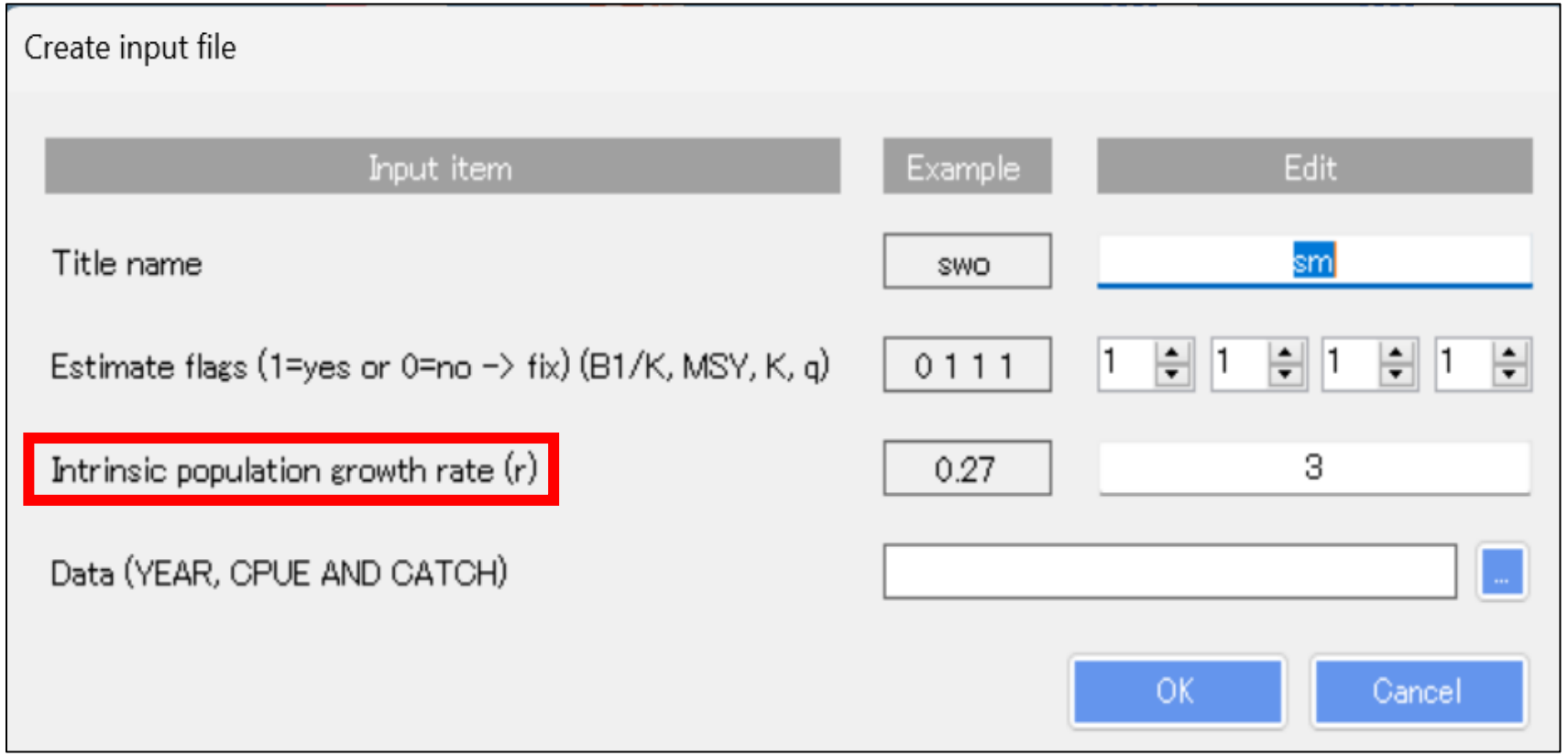
Data

CC	## Series type (CC = CPUE, catch)	
1950	-1	3646
1951	-1	2581
1952	-1	2993
1953	-1	3303
1954	-1	3034
(omitted)		
1964	380	11258
1965	240	8652
1966	229	9349
1967	278	9107
1968	220	9172
1969	197	9203
1970	219	9495
1971	-1	5266
1972	-1	4766
1973	-1	6074
1974	-1	6362
1975	350	8839
1976	309	6696
1977	337	6409
1978	445	11835
1979	316	11937
1980	252	13558
1981	231	11180
1982	283	13215
1983	222	14527
1984	213	12791

(1) Batch job

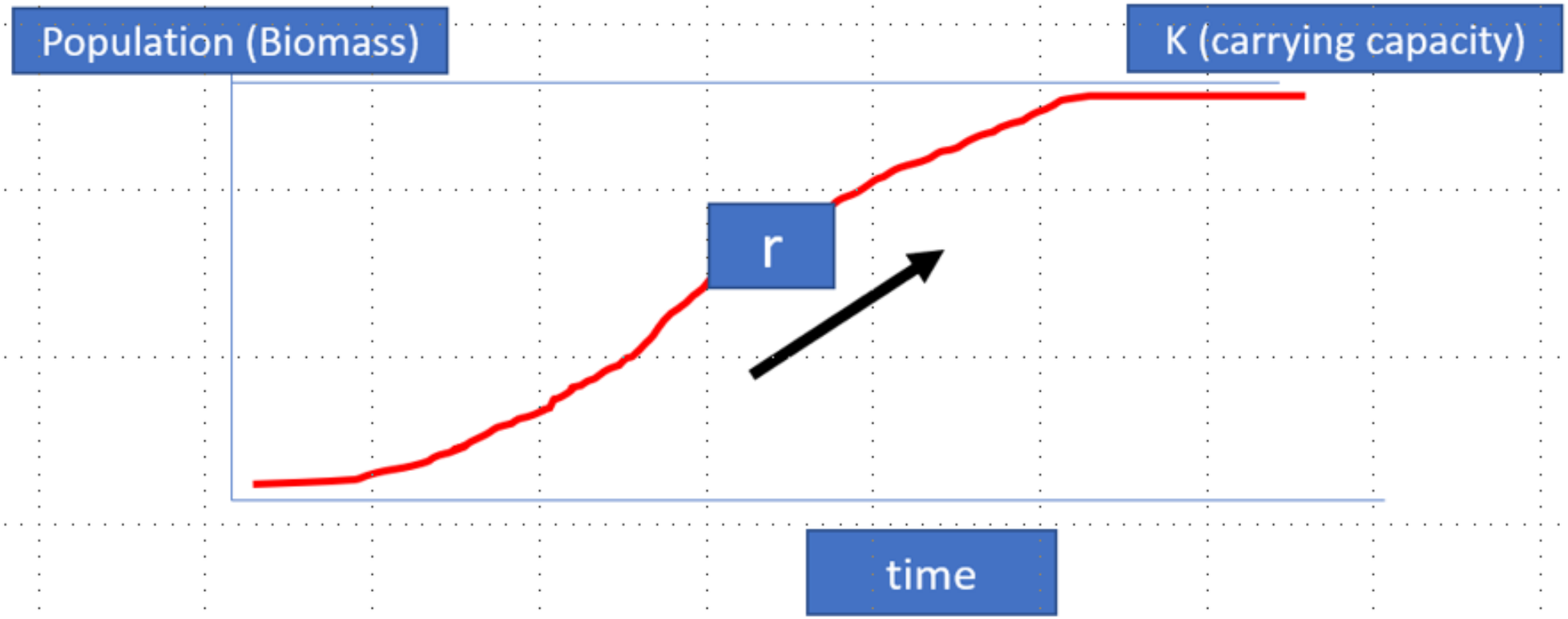
DOUBLECLICK





What is the intrinsic population growth rate (r) ?

Speed of population increase



r is different by species

long live species → smaller r short live species → larger r

How to search Intrinsic population growth rate (r) ?

r can be found FAO FishBase and/or Literatures

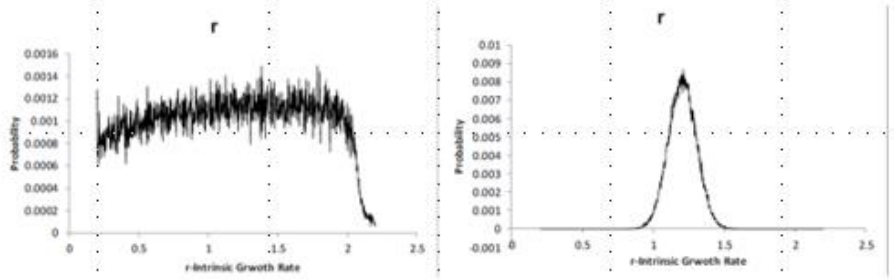
FishBase

Estimated r can be also found results of stock assessment.

Age and growth of longtail tuna (*Thunnus tonggol*) in tropical and temperate waters of the central Indo-Pacific

Shane P. Griffiths, Gary C. Fry, Fiona J. Manson, and Dong C. Lou

Griffiths, S. P., Fry, G. C., Manson, F. J., and Lou, D. C. 2010. Age and growth of longtail tuna (*Thunnus tonggol*) in tropical and temperate waters of the central Indo-Pacific. – ICES Journal of Marine Science, 67: 125–134.

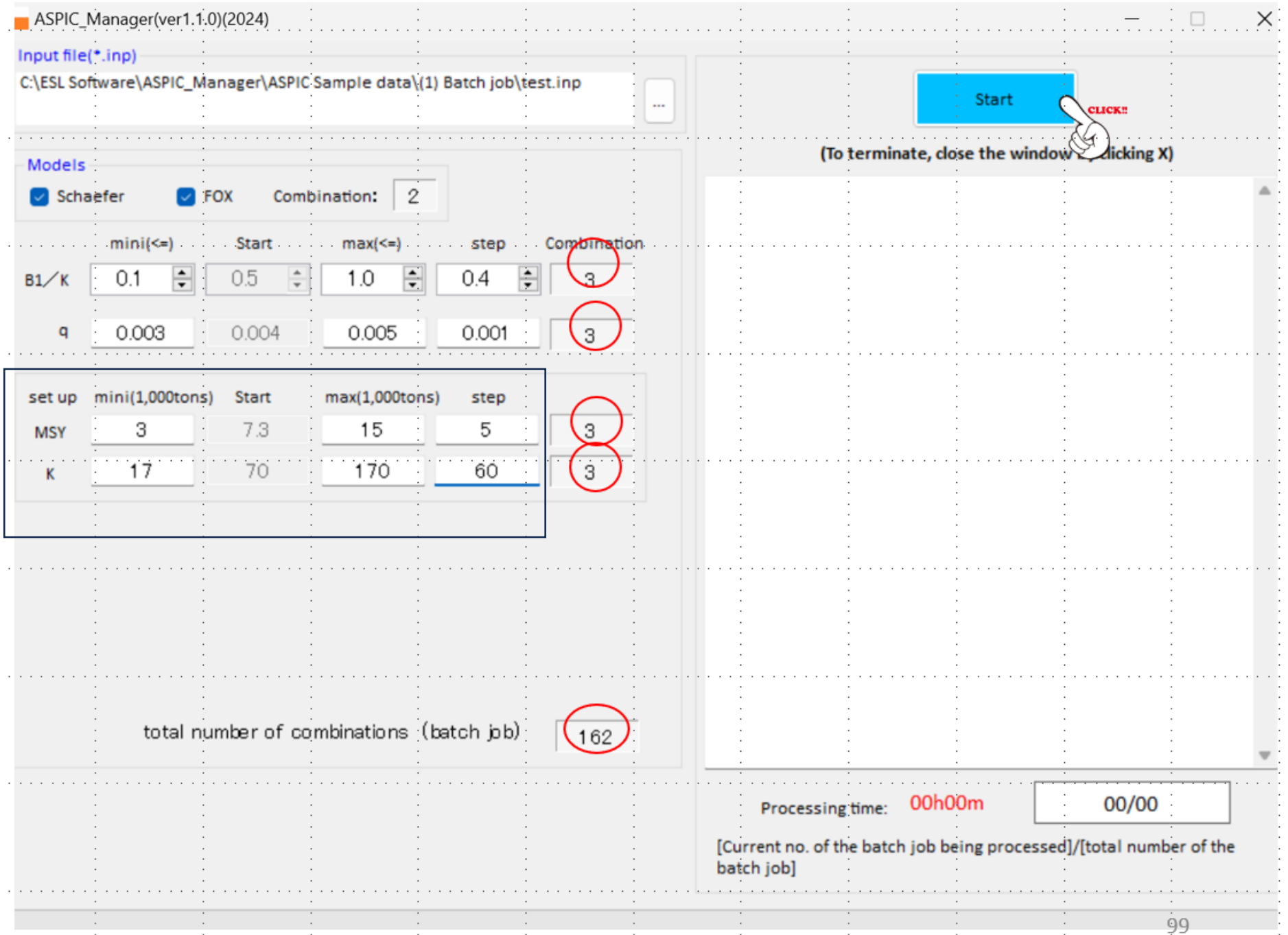


Froese et al. (2017)

Setting up entries
➔ 162
Combinations
(optimum)

Difficult task to set
MSY & K
(mini, start, max)

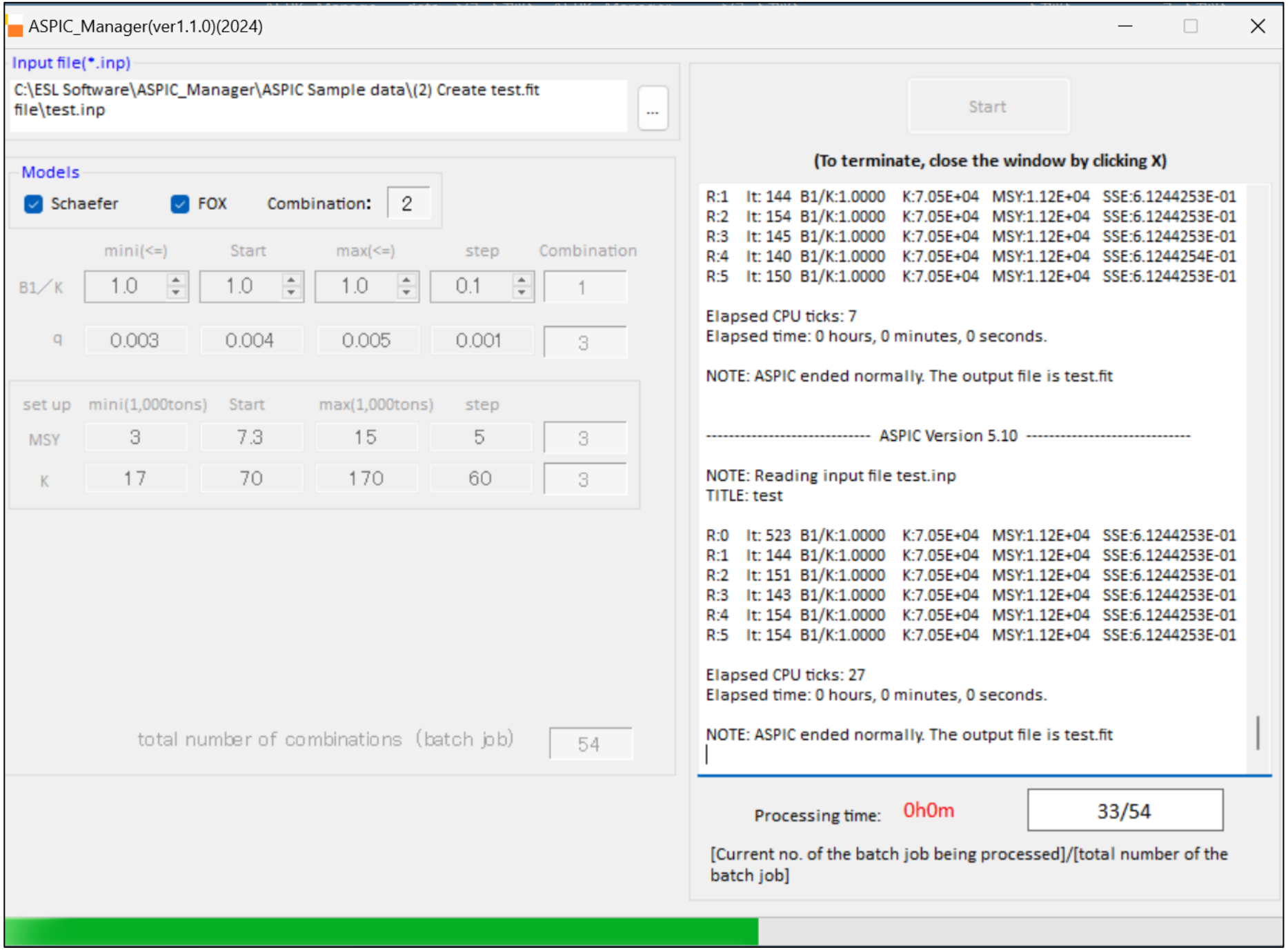
Software provides
theoretically
valid values
automatically.



What are theoretically valid values?

Parameter	Min	Start	Max
MSY	Average catch of 3 lowest annual catches	1/2 of Max catch	Maximin Catch
K	1.1 times of Max MSY	1.1 times of Min K	4(Schaefer)*Max (MSY)/r
q		0.2*Ave CPUE/Ave catch (average in last 5 years)	

Snapshot Batch job runs



All results are saved in the excel 2 sheets (converged: yes & no)

Time	0h2m	No of jobs	162	Average	0.0180	Min/job	1.08	Sec/job
Parameters	Model	B1/K	q	MSY	K			
Range (step)	Fox and Schaefer	0.8-1 by 0.1	0.003-0.005 by 0.001-3	3-15 by 5	23-170 by 60			
Flag (0: fixed / 1: estimate)		1	1	1	1			
Weight unit (1,000 tons)								

Combination

No	B1/K	MSY (min)	MSY (start)	MSY (max)	K(min)	K(start)	K(max)	q
13	0.8	3	8	15	23	83	170	0.003
14	0.8	3	8	15	23	83	170	0.004
15	0.8	3	8	15	23	83	170	0.005
16	0.8	3	8	15	23	140	170	0.003
17	0.8	3	8	15	23	140	170	0.004
18	0.8	3	8	15	23	140	170	0.005
22	0.8	3	13	15	23	83	170	0.003
23	0.8	3	13	15	23	83	170	0.004
24	0.8	3	13	15	23	83	170	0.005
25	0.8	3	13	15	23	140	170	0.003
26	0.8	3	13	15	23	140	170	0.004
27	0.8	3	13	15	23	140	170	0.005
40	0.9	3	8	15	23	83	170	0.003
41	0.9	3	8	15	23	83	170	0.004
42	0.9	3	8	15	23	83	170	0.005
43	0.9	3	8	15	23	140	170	0.003
44	0.9	3	8	15	23	140	170	0.004
45	0.9	3	8	15	23	140	170	0.005
49	0.9	3	13	15	23	83	170	0.003
50	0.9	3	13	15	23	83	170	0.004
51	0.9	3	13	15	23	83	170	0.005
52	0.9	3	13	15	23	140	170	0.003
53	0.9	3	13	15	23	140	170	0.004
54	0.9	3	13	15	23	140	170	0.005
67	1	3	8	15	23	83	170	0.003
68	1	3	8	15	23	83	170	0.004
69	1	3	8	15	23	83	170	0.005
70	1	3	8	15	23	140	170	0.003

Results

R2	RMS	r [Est]	Model	B1/K [Est]	MSY [Est]	K [Est]	q [Est]	Current catch	TBmsy [Est]	TB [Est]	Fmsy [Est]	B/Bmsy [Est]	F/Fmsy [Est]	note
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3432	Schaefer	0.113	9.533	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3436	Schaefer	0.113	9.534	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3436	Schaefer	0.113	9.534	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3436	Schaefer	0.113	9.534	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.473	2.58	ASPIC ended normally.
0.524	0.175	0.3436	Schaefer	0.113	9.534	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.51	31.69	0.172	0.473	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3432	Schaefer	0.113	9.533	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.473	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3436	Schaefer	0.113	9.534	111	0.0066	12.79	55.52	31.69	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.51	31.69	0.172	0.473	2.58	ASPIC ended normally.
0.524	0.175	0.3433	Schaefer	0.113	9.534	111.1	0.0066	12.79	55.53	31.7	0.172	0.472	2.58	ASPIC ended normally.

Converged | Not converged or Errors

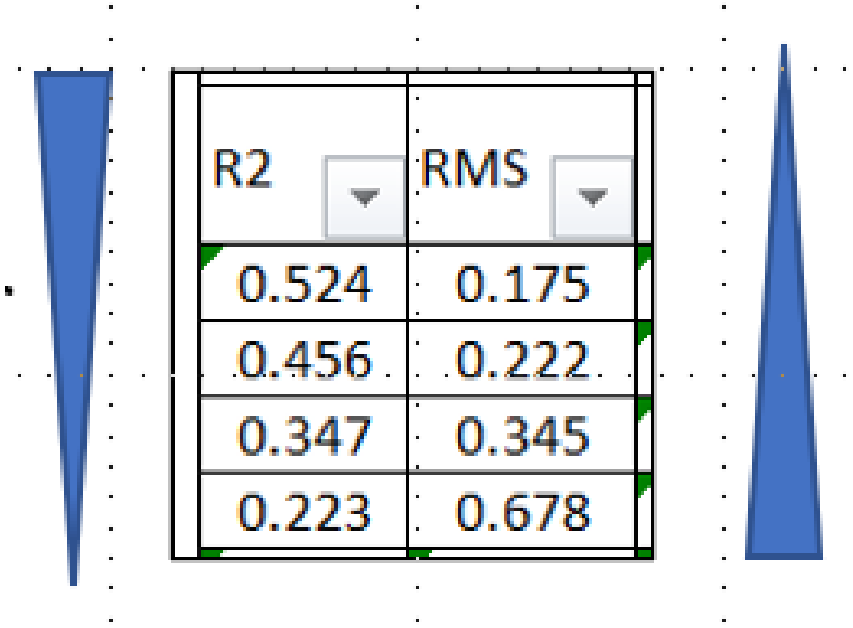
How to decide the best run from converged tuns?

Select the run with

(1) Highest R2 (correlation coefficient)

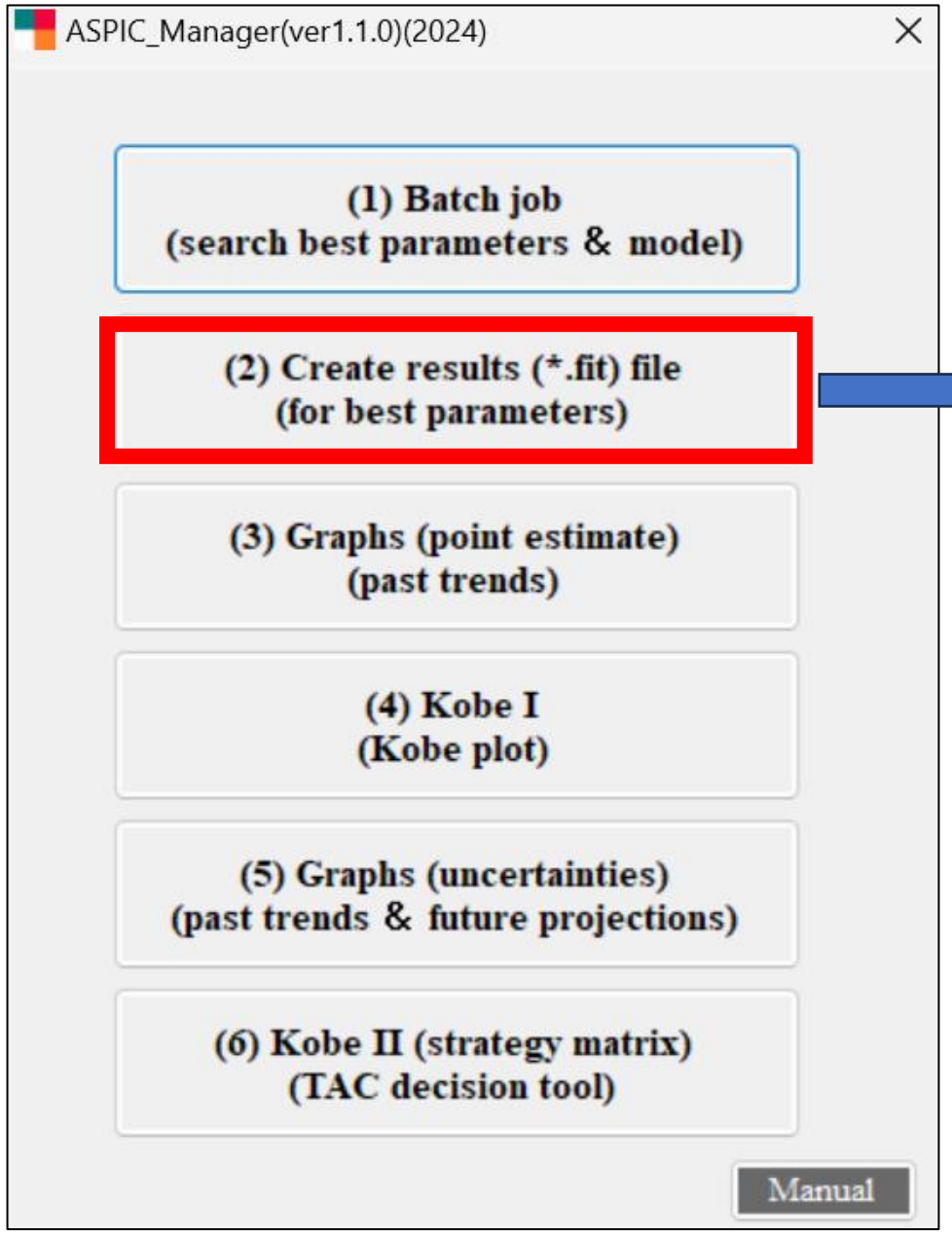
and

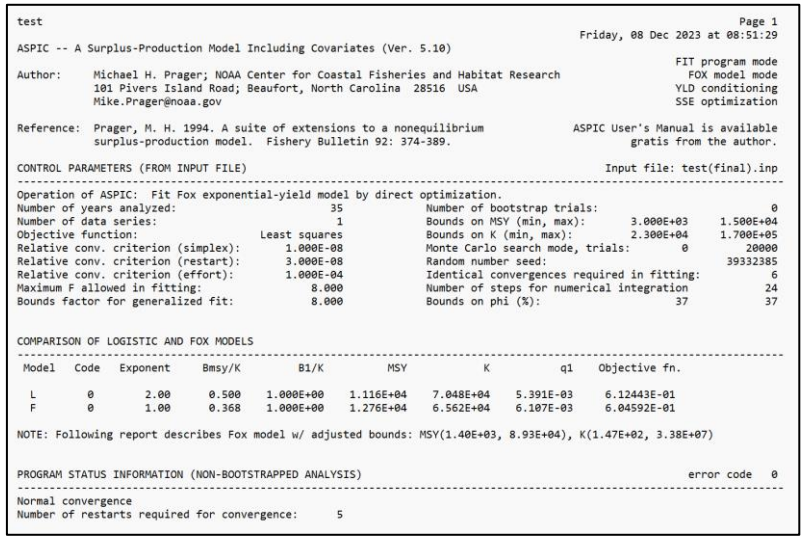
(2) Lowest RMS (errors)



R2	RMS
0.524	0.175
0.456	0.222
0.347	0.345
0.223	0.678

Getting the ASPIC results for the selected (best) run





test Page 1
Friday, 08 Dec 2023 at 08:51:29

ASPIC -- A Surplus-Production Model Including Covariates (Ver. 5.10)

FIT program mode
FOX model mode
YLD conditioning
SSE optimization

Author: Michael H. Prager; NOAA Center for Coastal Fisheries and Habitat Research
101 Pivers Island Road; Beaufort, North Carolina 28516 USA
Mike.Prager@noaa.gov

Reference: Prager, M. H. 1994. A suite of extensions to a nonequilibrium surplus-production model. Fishery Bulletin 92: 374-389.

ASPIC User's Manual is available gratis from the author.

CONTROL PARAMETERS (FROM INPUT FILE) Input file: test(final).inp

Operation of ASPIC:	Fit Fox exponential-yield model by direct optimization.		
Number of years analyzed:	35	Number of bootstrap trials:	0
Number of data series:	1	Bounds on MSY (min, max):	3.000E+03 1.500E+04
Objective function:	Least squares	Bounds on K (min, max):	2.300E+04 1.700E+05
Relative conv. criterion (simplex):	1.000E-08	Monte Carlo search mode, trials:	0 20000
Relative conv. criterion (restart):	3.000E-08	Random number seed:	39332385
Relative conv. criterion (effort):	1.000E-04	Identical convergences required in fitting:	6
Maximum F allowed in fitting:	8.000	Number of steps for numerical integration	24
Bounds factor for generalized fit:	8.000	Bounds on phi (%):	37 37

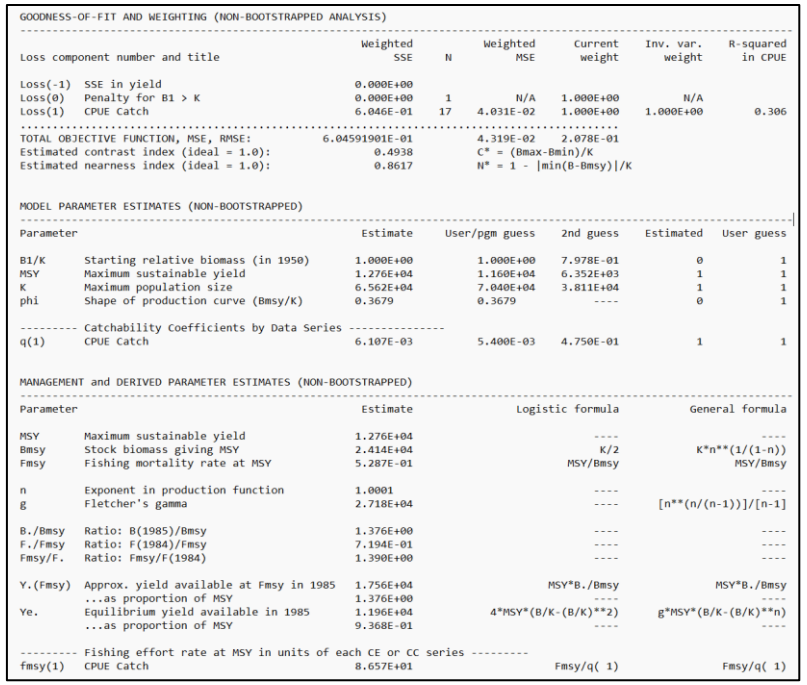
COMPARISON OF LOGISTIC AND FOX MODELS

Model	Code	Exponent	Bmsy/K	B1/K	MSY	K	q1	Objective fn.
L	0	2.00	0.500	1.000E+00	1.116E+04	7.048E+04	5.391E-03	6.12443E-01
F	0	1.00	0.368	1.000E+00	1.276E+04	6.562E+04	6.107E-03	6.04592E-01

NOTE: Following report describes Fox model w/ adjusted bounds: MSY(1.40E+03, 8.93E+04), K(1.47E+02, 3.38E+07)

PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS) error code 0

Normal convergence
Number of restarts required for convergence: 5



GOODNESS-OF-FIT AND WEIGHTING (NON-BOOTSTRAPPED ANALYSIS)

Loss component number and title		Weighted SSE	N	Weighted MSE	Current weight	Inv. var. weight	R-squared in CPUE
Loss(-1)	SSE in yield	0.000E+00					
Loss(0)	Penalty for B1 > K	0.000E+00	1	N/A	1.000E+00	N/A	
Loss(1)	CPUE Catch	6.046E-01	17	4.031E-02	1.000E+00	1.000E+00	0.306
TOTAL OBJECTIVE FUNCTION, MSE, RMSE:		6.04591901E-01		4.319E-02	2.078E-01		
Estimated contrast index (ideal = 1.0):		0.4938		C* = (Bmax-Bmin)/K			
Estimated nearness index (ideal = 1.0):		0.8617		N* = 1 - |min(B-Bmsy)|/K			

MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

Parameter		Estimate	User/pgm guess	2nd guess	Estimated	User guess
B1/K	Starting relative biomass (in 1950)	1.000E+00	1.000E+00	7.978E-01	0	1
MSY	Maximum sustainable yield	1.276E+04	1.160E+04	6.352E+03	1	1
K	Maximum population size	6.562E+04	7.040E+04	3.811E+04	1	1
phi	Shape of production curve (Bmsy/K)	0.3679	0.3679	----	0	1
---------	Catchability Coefficients by Data Series	----------				
q(1)	CPUE Catch	6.107E-03	5.400E-03	4.750E-01	1	1

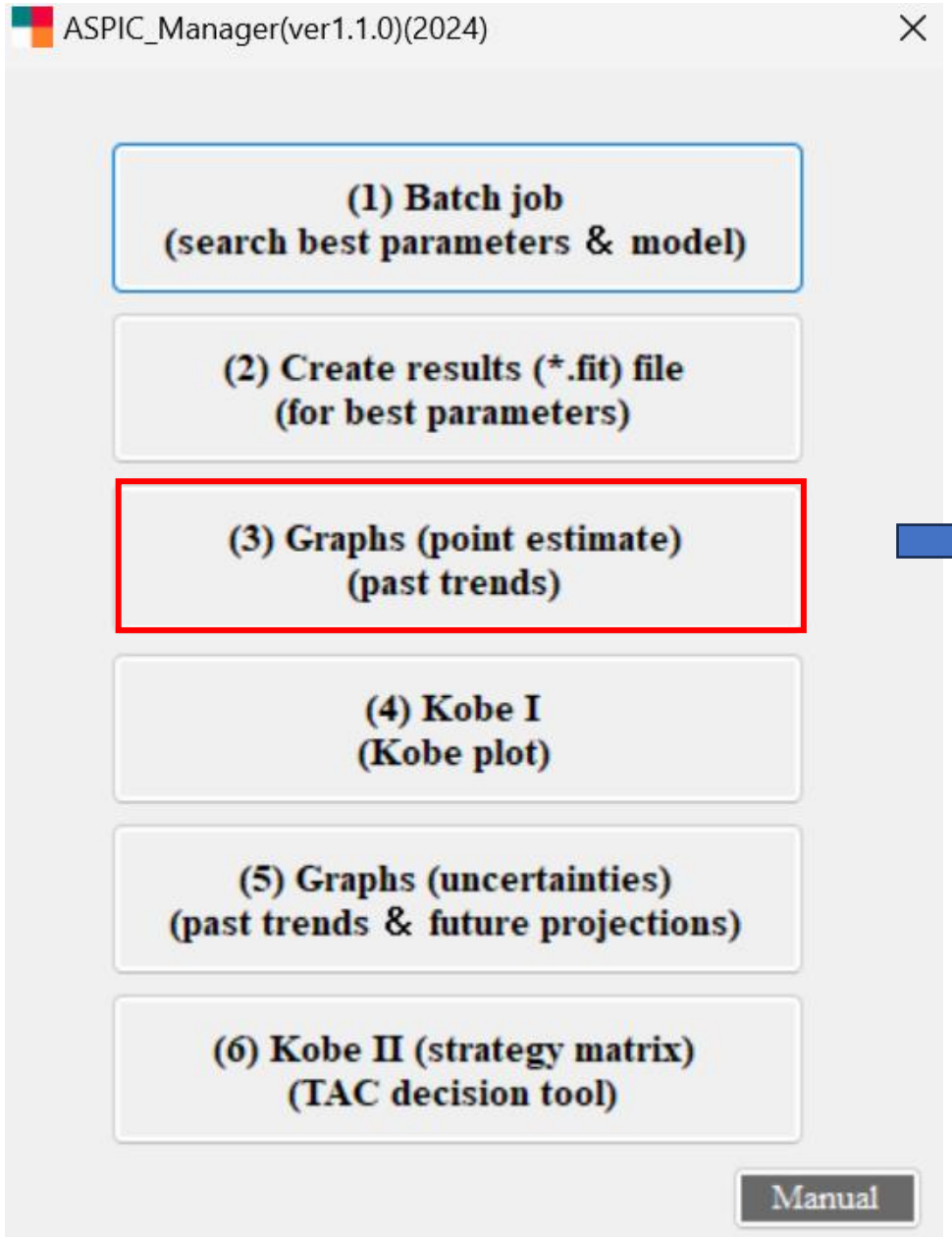
MANAGEMENT and DERIVED PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

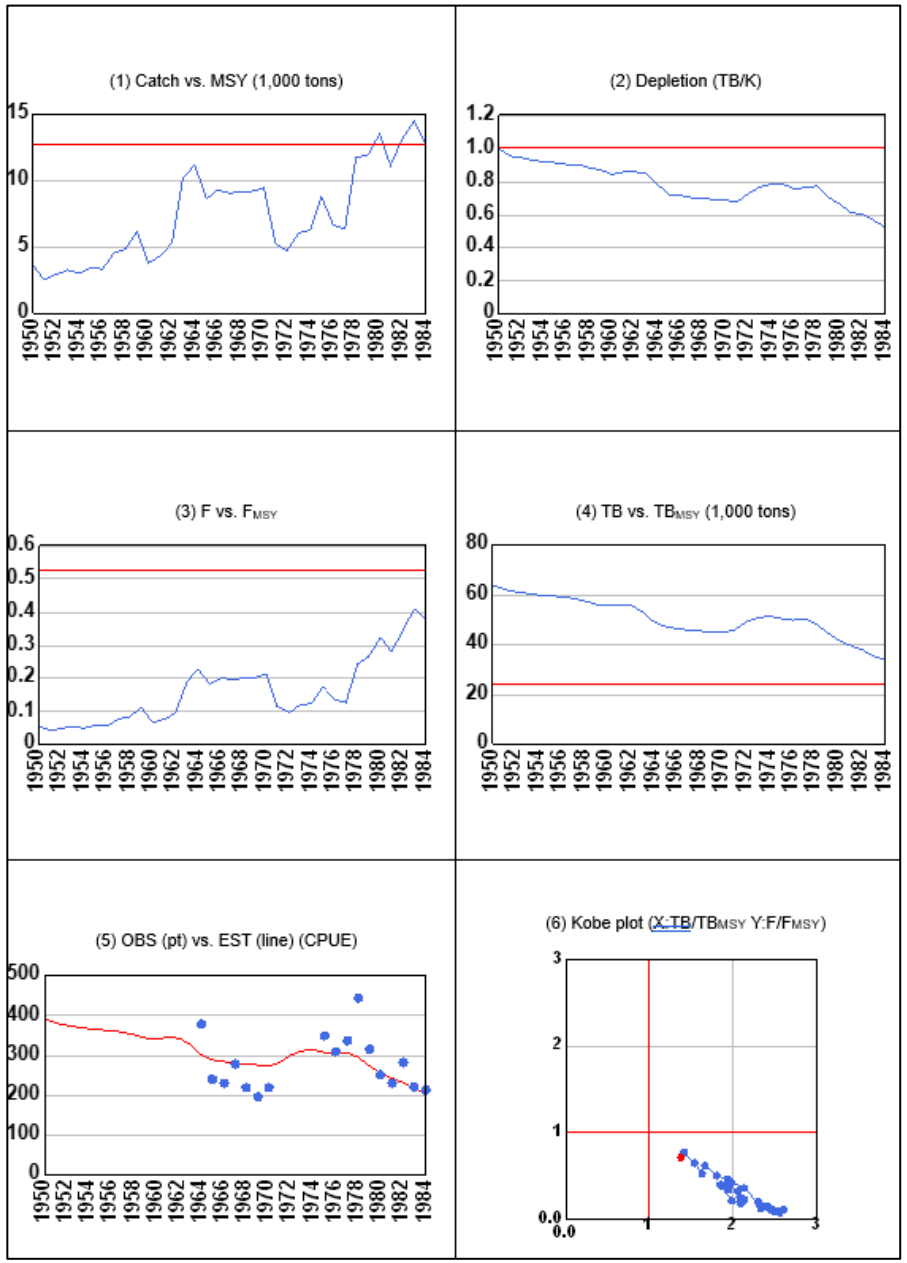
Parameter		Estimate	Logistic formula	General formula
MSY	Maximum sustainable yield	1.276E+04	----	----
Bmsy	Stock biomass giving MSY	2.414E+04	K/2	K*n**(1/(1-n))
Fmsy	Fishing mortality rate at MSY	5.287E-01	MSY/Bmsy	MSY/Bmsy
n	Exponent in production function	1.0001	----	----
g	Fletcher's gamma	2.718E+04	----	[n**(n/(n-1))]/[n-1]
B./Bmsy	Ratio: B(1985)/Bmsy	1.376E+00	----	----
F./Fmsy	Ratio: F(1984)/Fmsy	7.194E-01	----	----
Fmsy/F.	Ratio: Fmsy/F(1984)	1.390E+00	----	----
Y.(Fmsy)	Approx. yield available at Fmsy in 1985	1.756E+04	MSY*B./Bmsy	MSY*B./Bmsy
	...as proportion of MSY	1.376E+00	----	----
Ye.	Equilibrium yield available in 1985	1.196E+04	4*MSY*(B/K-(B/K)**2)	g*MSY*(B/K-(B/K)**n)
	...as proportion of MSY	9.368E-01	----	----
---------	Fishing effort rate at MSY in units of each CE or CC series	---------		
fmsy(1)	CPUE Catch	8.657E+01	Fmsy/q(1)	Fmsy/q(1)

Uses will not use this

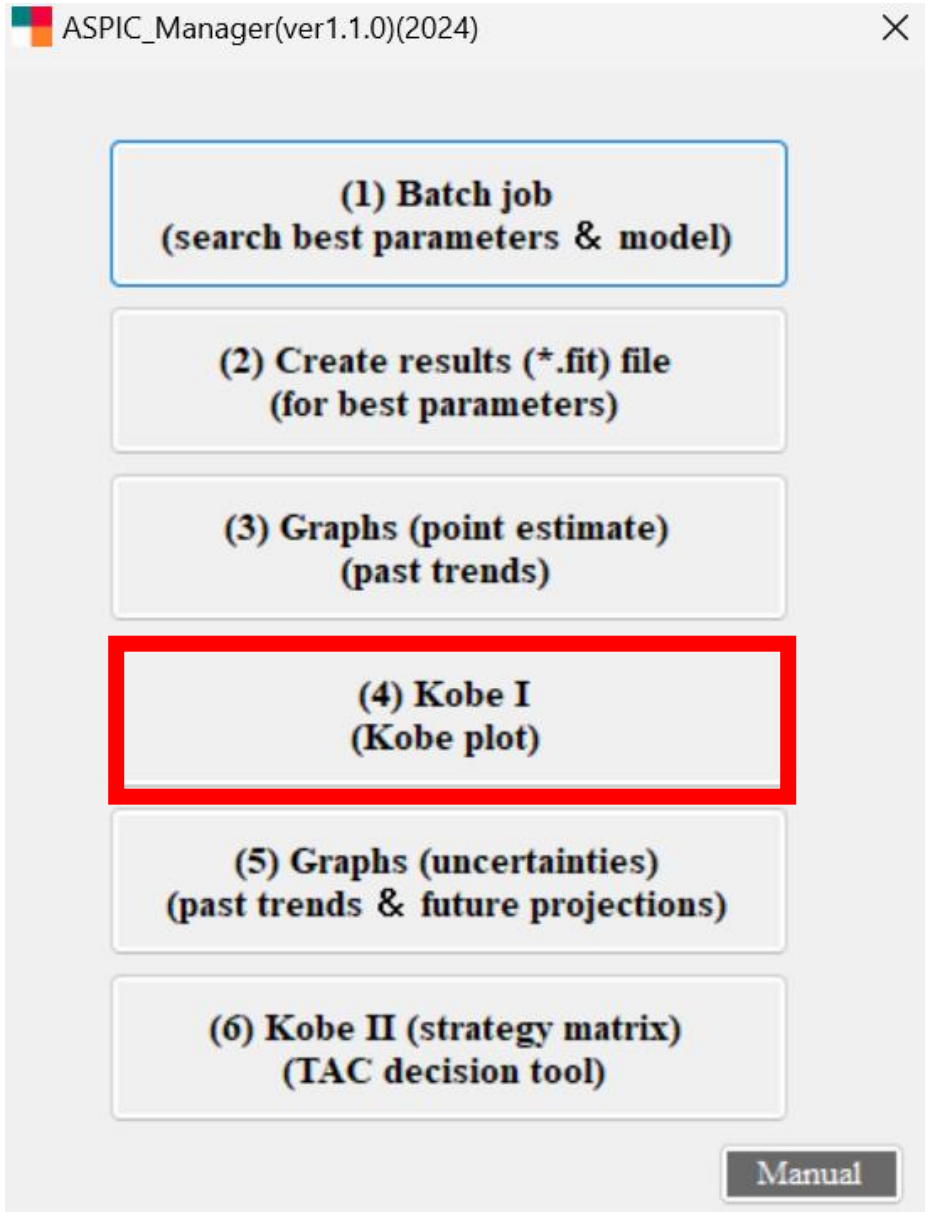
ASPIC_Manager will use to make figures, Kobe plot, Kobe matrix etc.

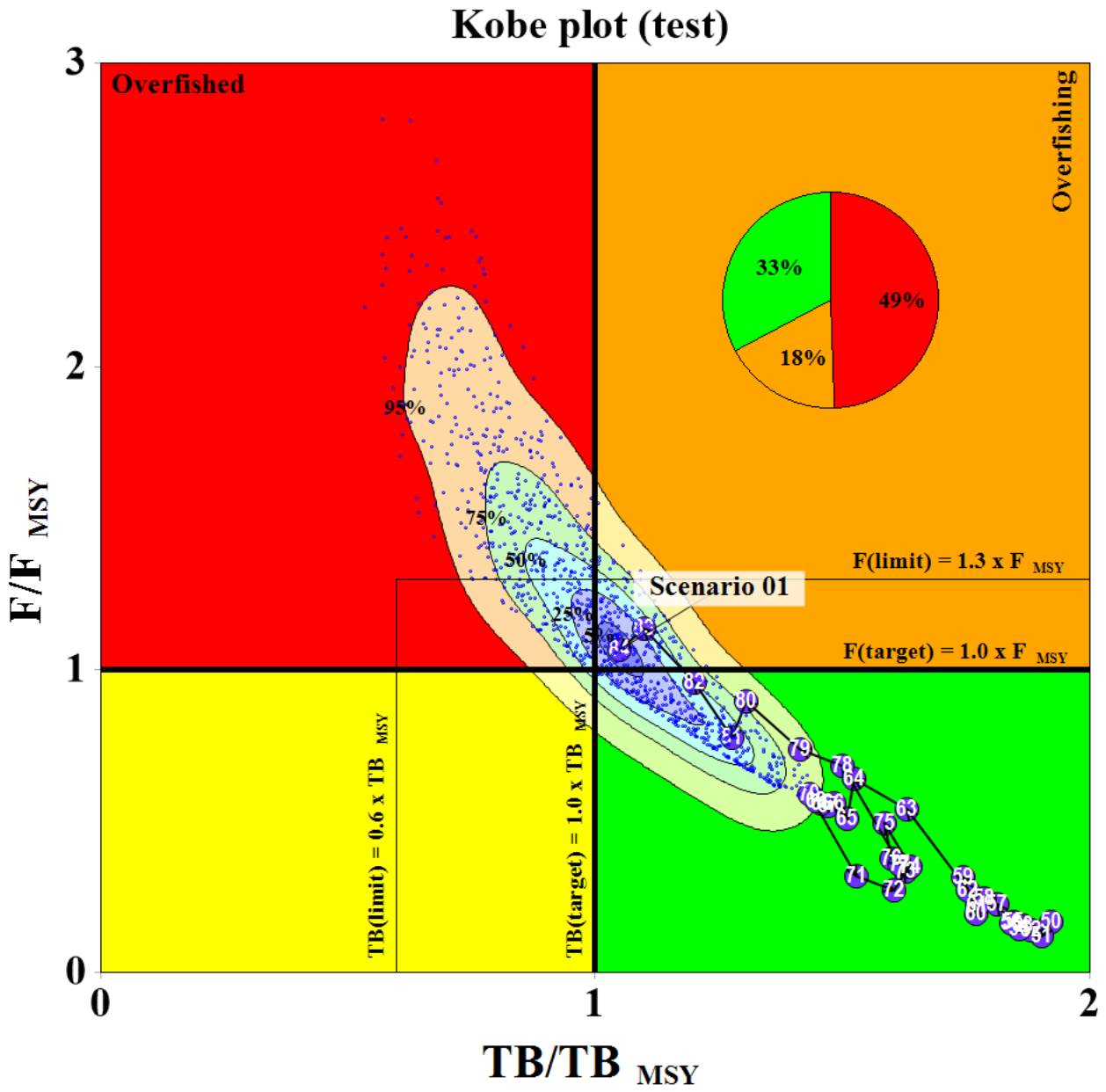
Getting graphs for the selected run



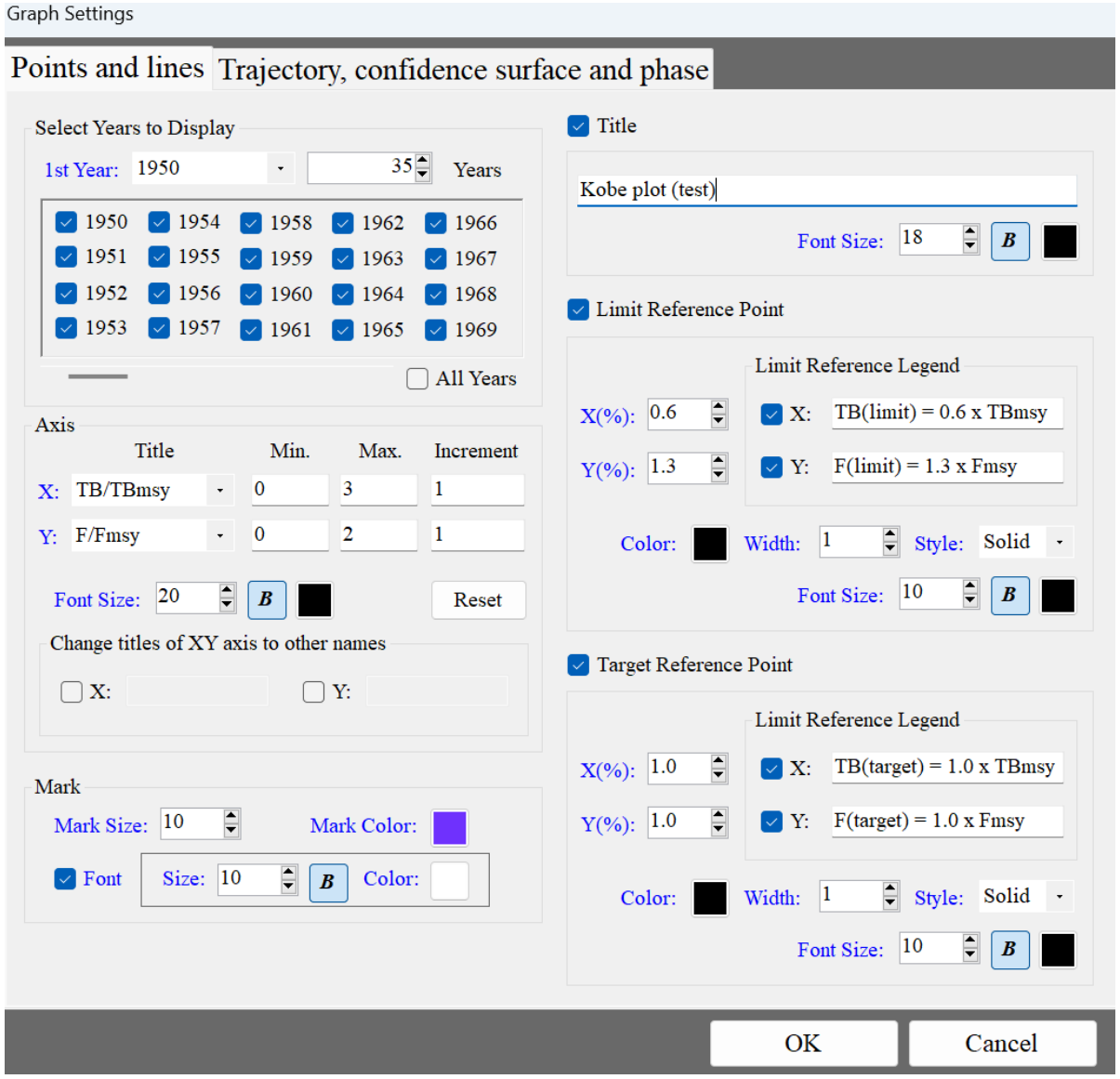


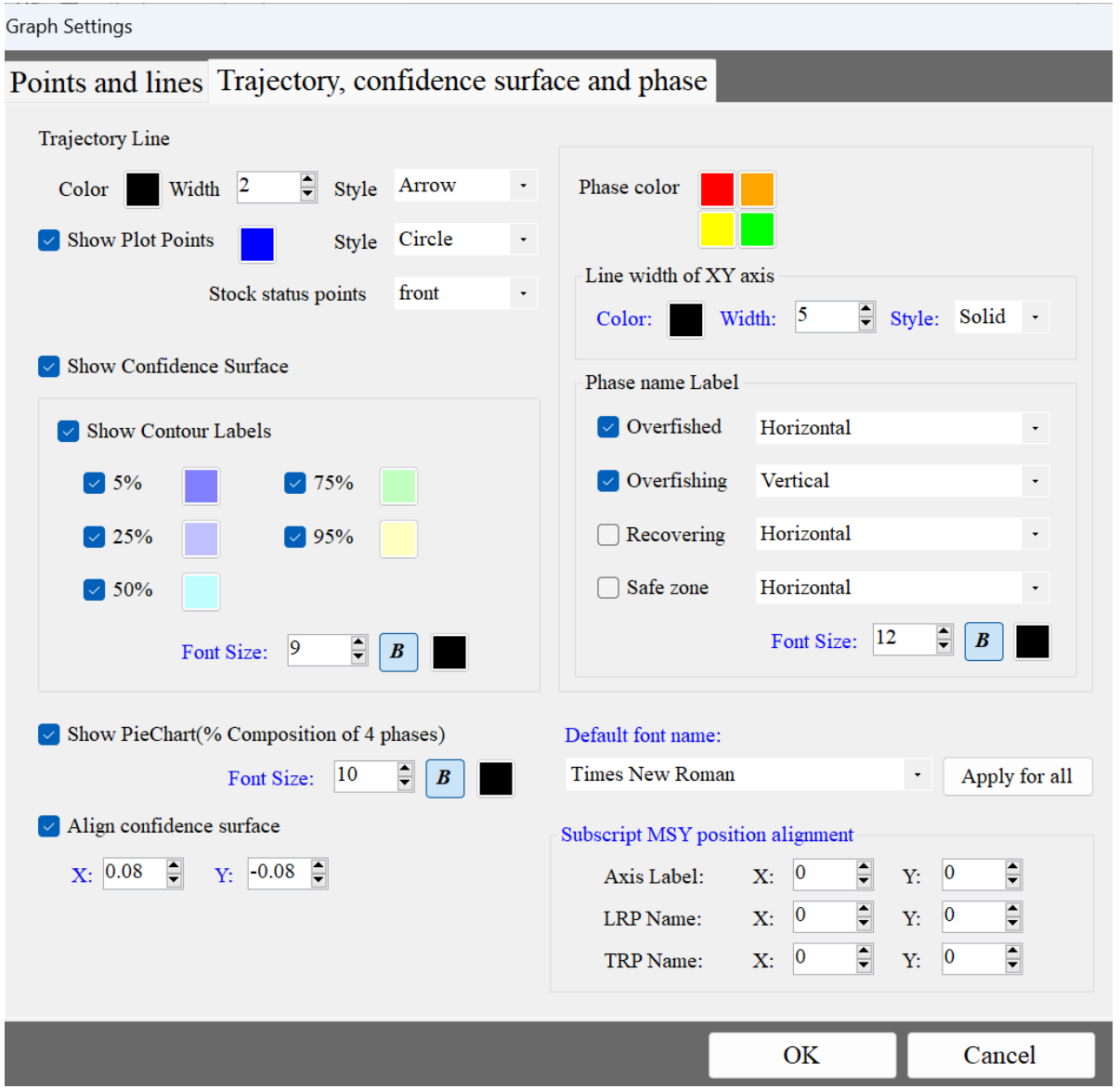
Getting Kobe plot



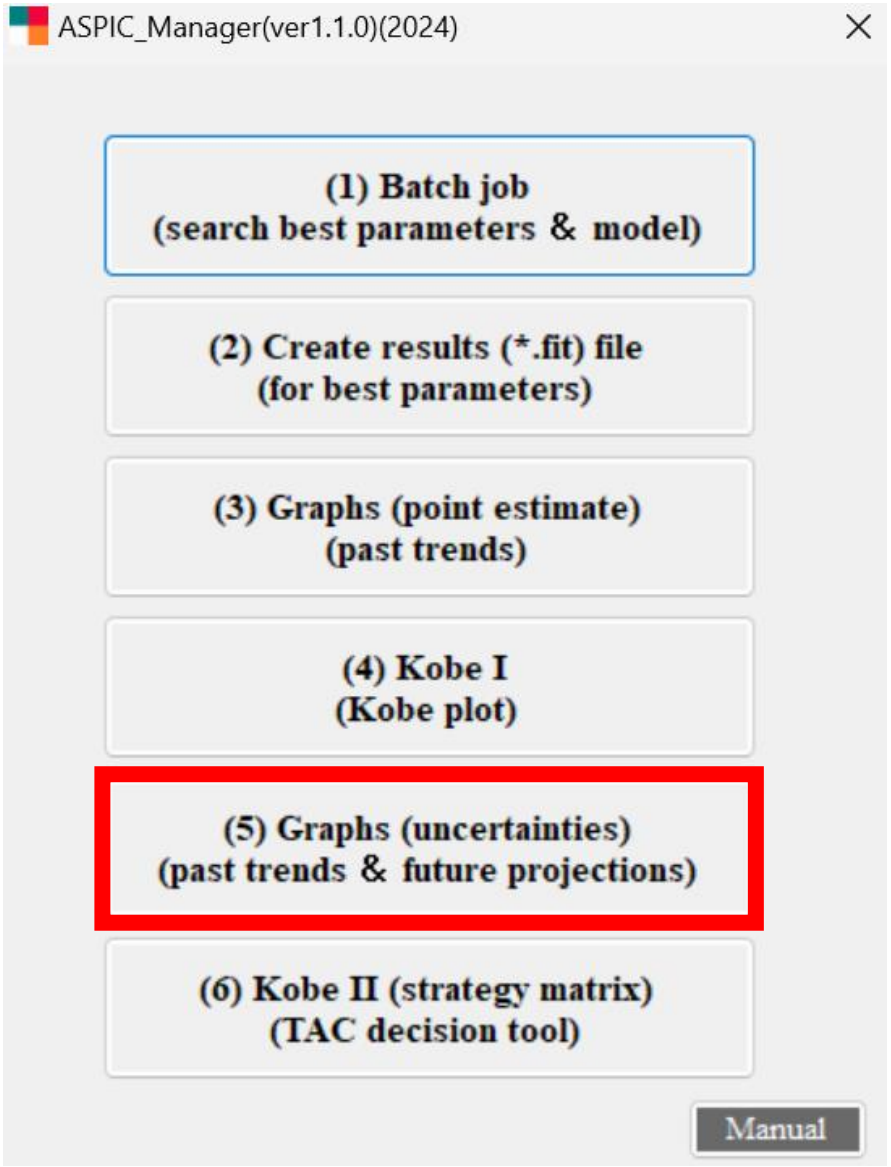


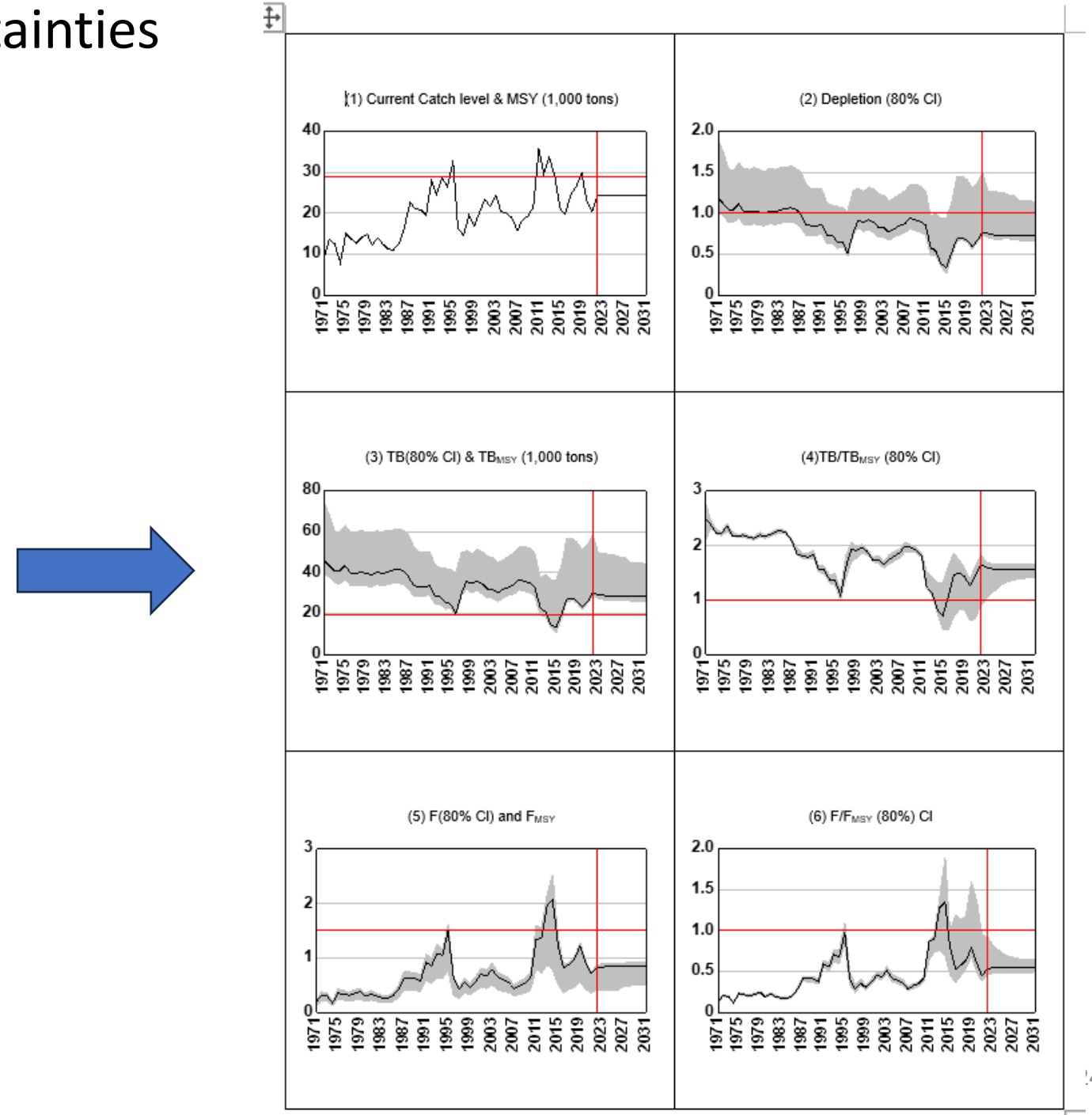
Editing Kobe plots by Graph setting functions



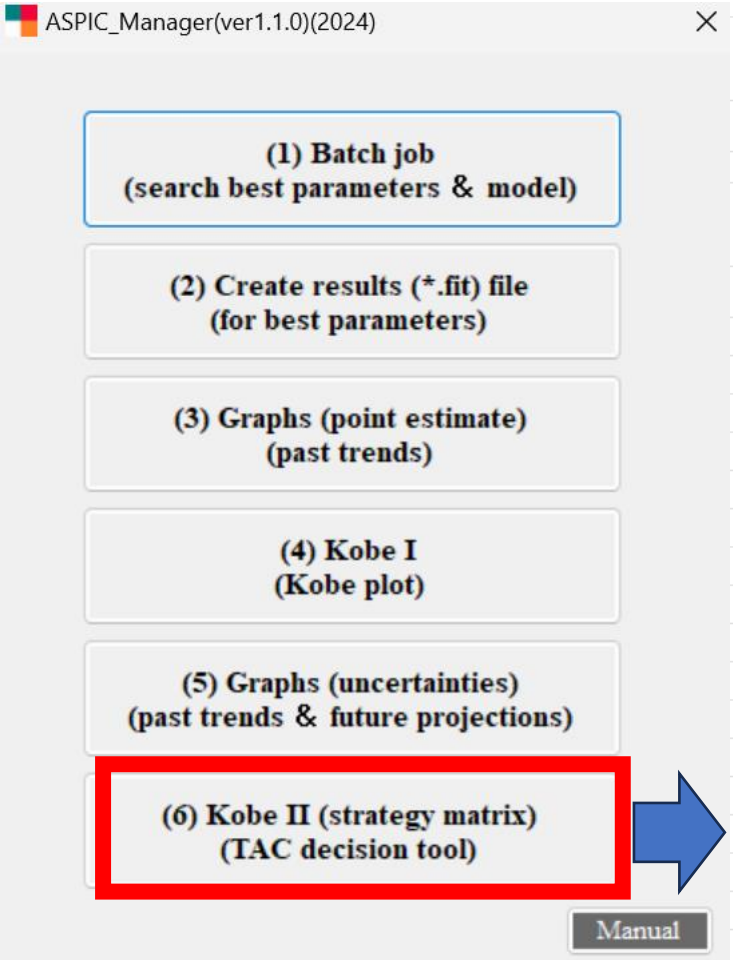


Getting graphs with uncertainties (past & future)





Kobe II (risk matrix)



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

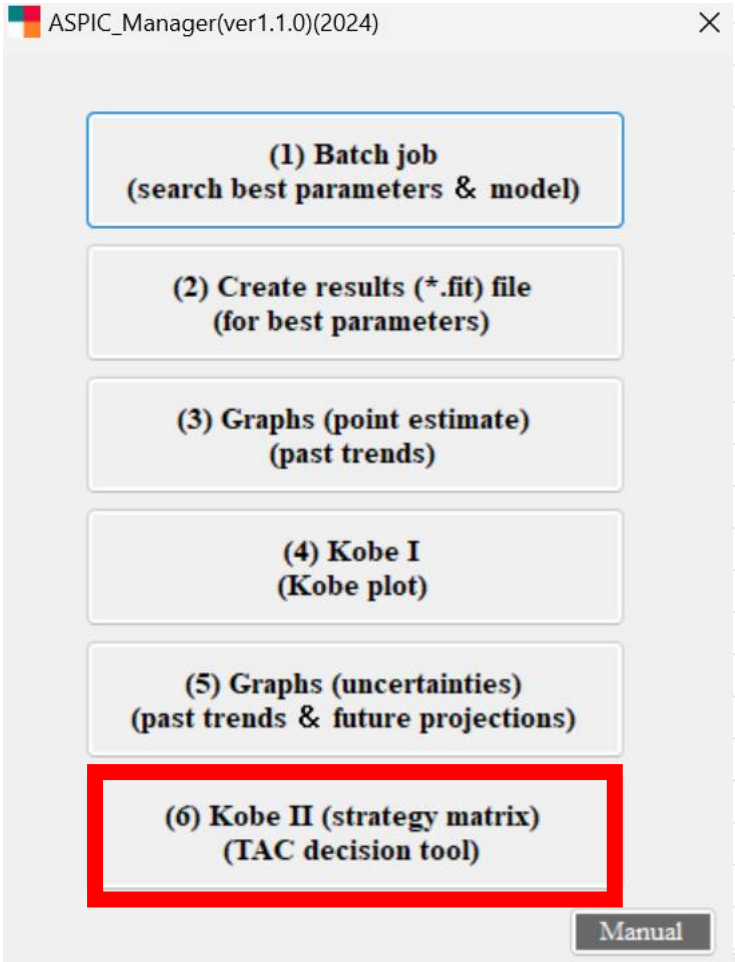
Color legend				
Risk levels	Low risk	Medium low risk	Medium high risk	High risk
Probably	0 - 25%	25 - 50%	50 - 75%	75 - 100%

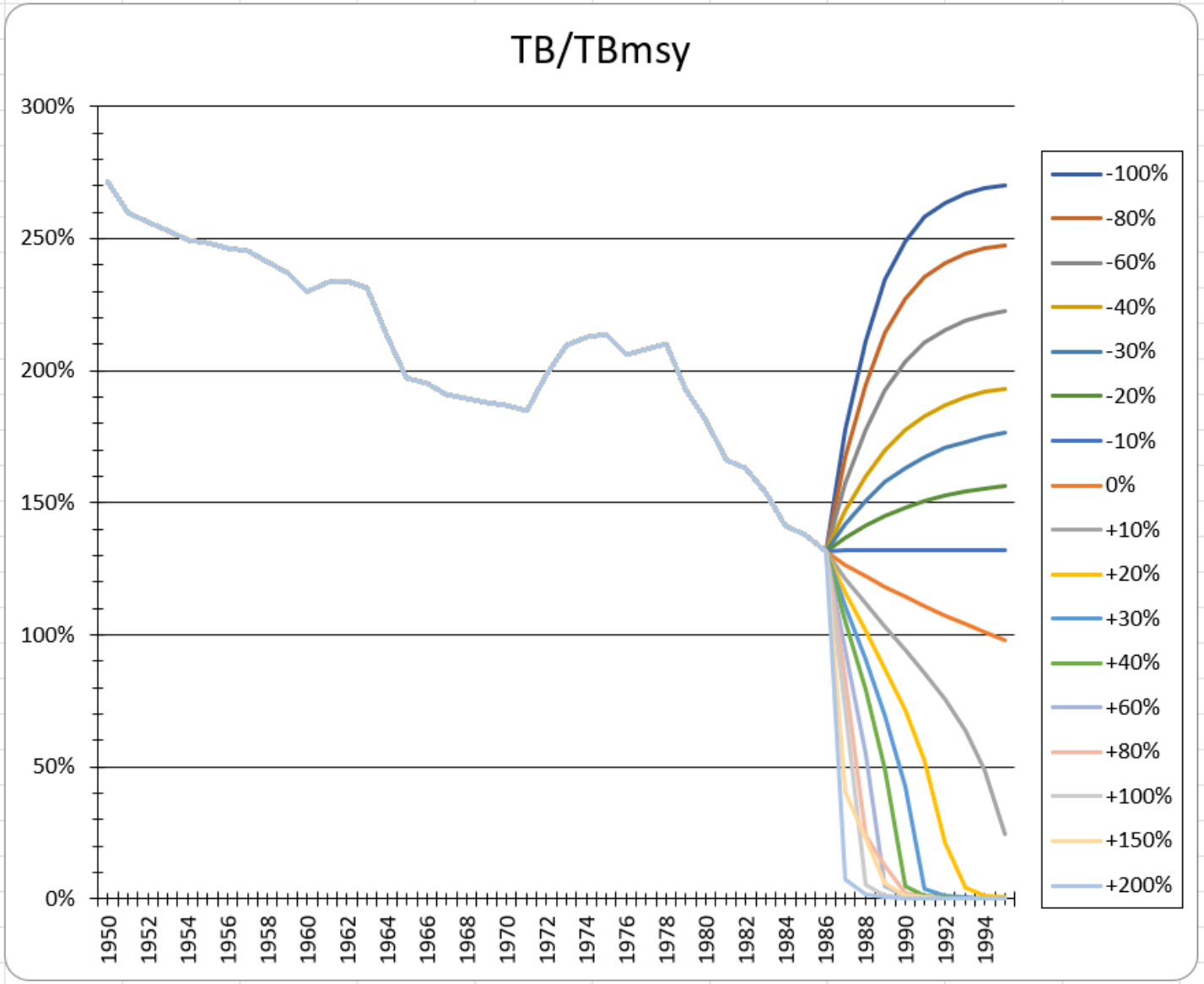
	%	Catch (tons)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
% Increased from the current catch level	200%	40,533	36%	41%	85%	97%	100%	100%	100%	100%	100%	100%
	150%	33,778	36%	41%	79%	94%	99%	100%	100%	100%	100%	100%
	100%	27,022	36%	41%	71%	87%	95%	98%	99%	100%	100%	100%
	80%	24,320	36%	41%	66%	83%	91%	96%	98%	99%	100%	100%
	60%	21,618	36%	41%	61%	77%	87%	93%	96%	98%	99%	99%
	40%	18,915	36%	41%	57%	70%	80%	87%	91%	94%	95%	97%
	30%	17,564	36%	41%	54%	67%	75%	82%	87%	91%	93%	95%
	20%	16,213	36%	41%	52%	61%	70%	77%	81%	86%	89%	90%
	10%	14,862	36%	41%	49%	56%	63%	69%	75%	79%	82%	84%
* Current catch	0%	13,511	36%	41%	47%	51%	56%	60%	64%	68%	71%	74%
% decreased from the current catch level	-5.60%	**12,760	36%	41%	45%	47%	50%	54%	57%	59%	62%	64%
	-10%	12,160	36%	41%	43%	45%	47%	50%	52%	53%	56%	58%
	-20%	10,809	36%	41%	40%	39%	37%	37%	37%	37%	37%	38%
	-30%	9,458	36%	41%	35%	31%	29%	27%	24%	23%	22%	21%
	-40%	8,107	36%	41%	32%	26%	19%	16%	14%	13%	12%	11%
	-60%	5,404	36%	41%	26%	13%	8%	6%	6%	6%	6%	6%
	-80%	2,702	36%	41%	19%	6%	3%	3%	3%	3%	3%	3%
	-100%	0	36%	41%	12%	2%	1%	1%	1%	1%	1%	1%

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

TB_Kobe_II_Matrix | F_Kobe_II_Matrix | TB_Projection | F_Projection

Projection





TB_Kobe_II_Matrix | F_Kobe_II_Matrix | TB_Projection | F_Projection

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(4) Summary

JABBA : Just Another Bayesian Biomass Assessment

Under construction

Theoretically Best Production model

There are several similar hand-made models

JABBA : best ➔ Standardized Input/Output

Bayesian, Good Graphics, Diagnosis, MCMC……

JABBA (Complicated & many functions)

State space model

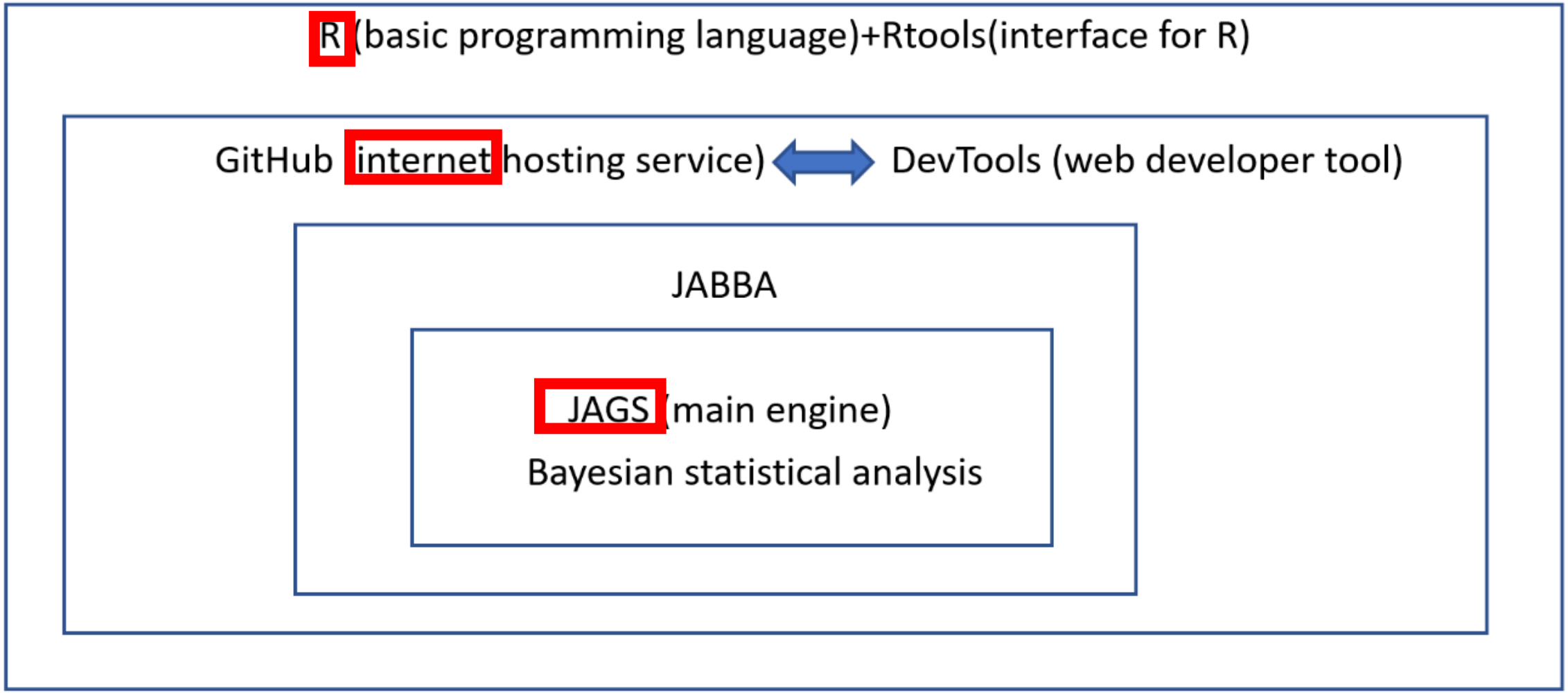
Many sub-models incorporated➔ good for future projection

Process & OBS error, Bayesian, MCMC (uncertainties),

& diagnostics (retrospective analyses & hind casting)

But basic idea is the production model (catch & CPUE)(**simple**)

Outline (Nishida & Wang 2023)(3 key words)
JABBA applies recent internet & computing technologies



JAGS : **J**ust **A**nother **G**ibbs (MCMC) **S**ampler

Rough Image of Menu-driven JABBA_Manager (by the end of 2024)

(1)
Base case (FOX & Schaefer)
input (catch/CPUE & priors)
Scenarios➔ Select the best model

(2)
Sensitivity analyses
➔ Select the best run
from base case & sensitivities

(3)
Summary of results

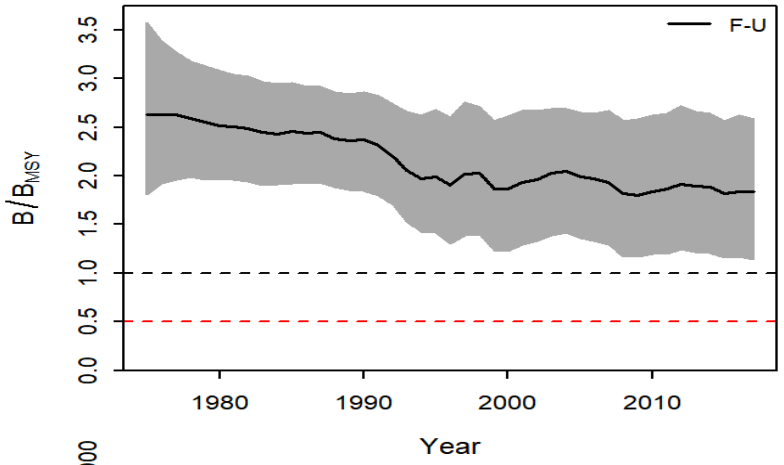
(4)
Kobe I (plot) + Kobe II (matrix)

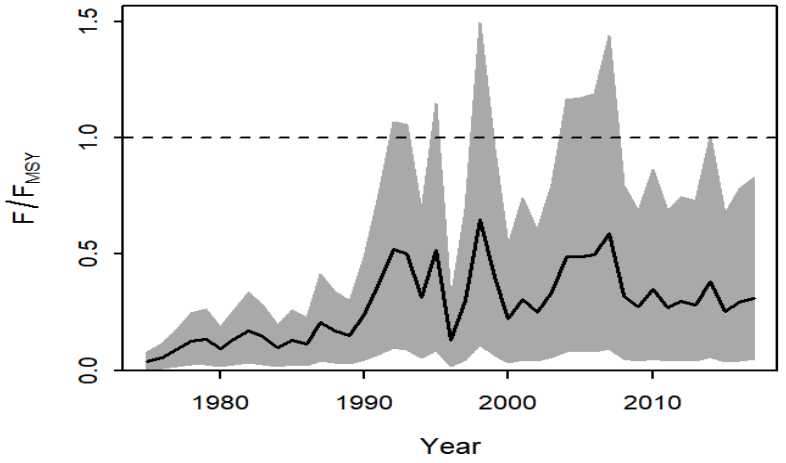
Sample outputs (many useful graphs)

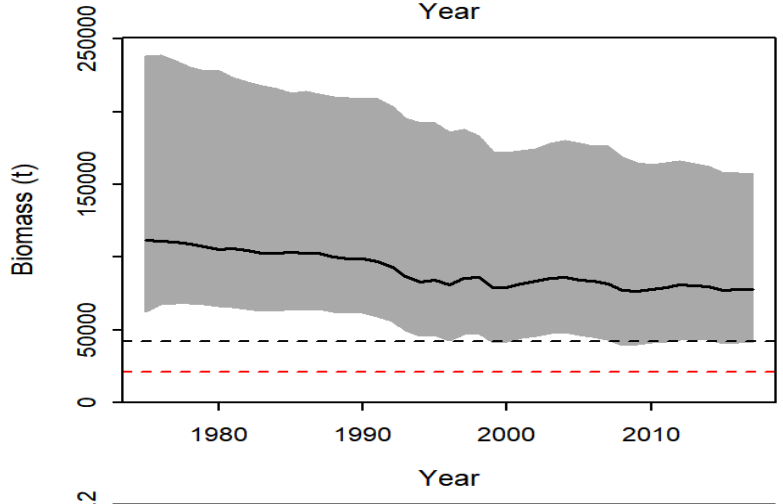
To be explained in the users manual
when the software is completed (2024)

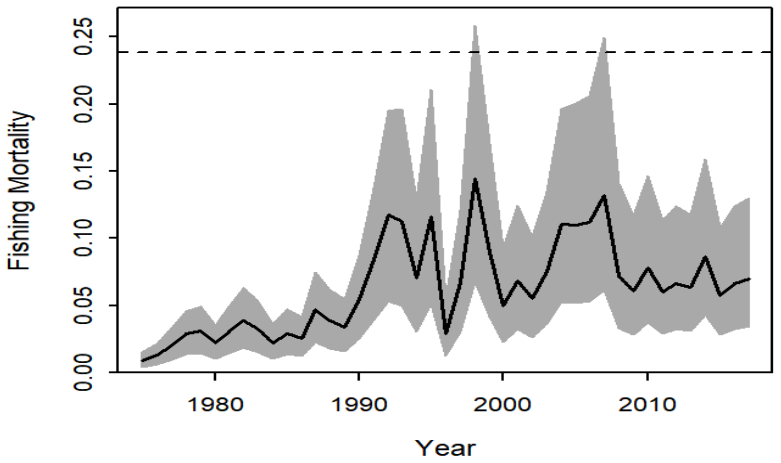
Estimated parameters with Uncertainties (JAGS MCMC)

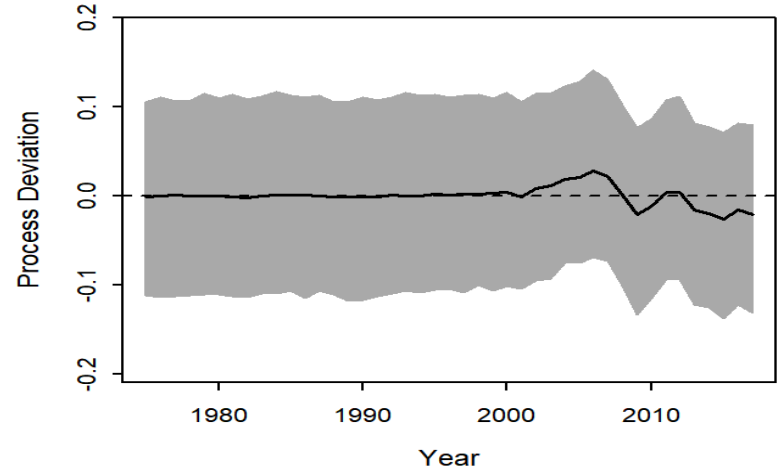
Similar to ASPIC

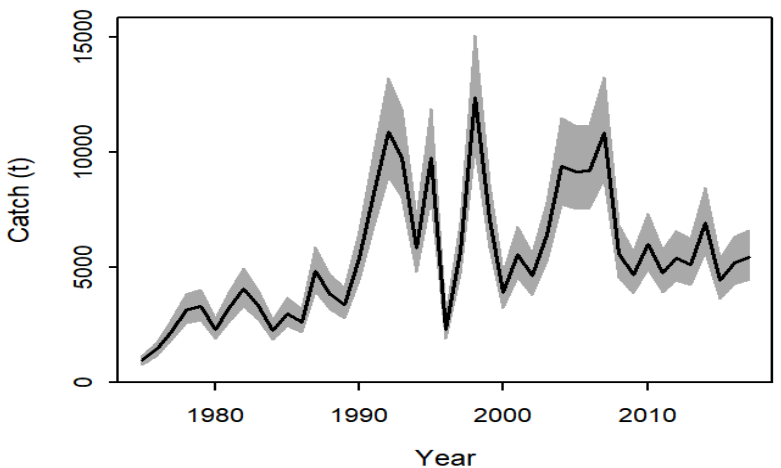




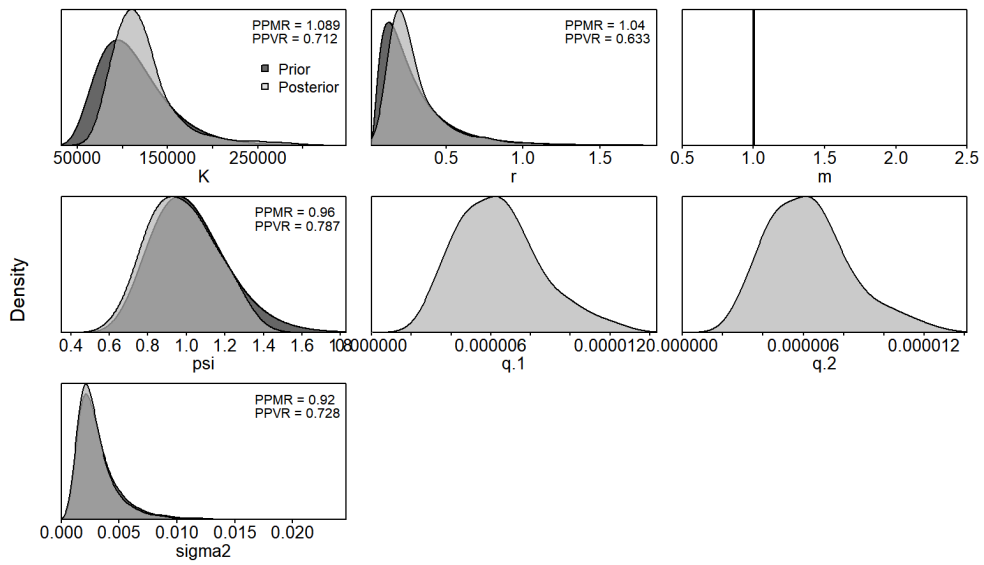


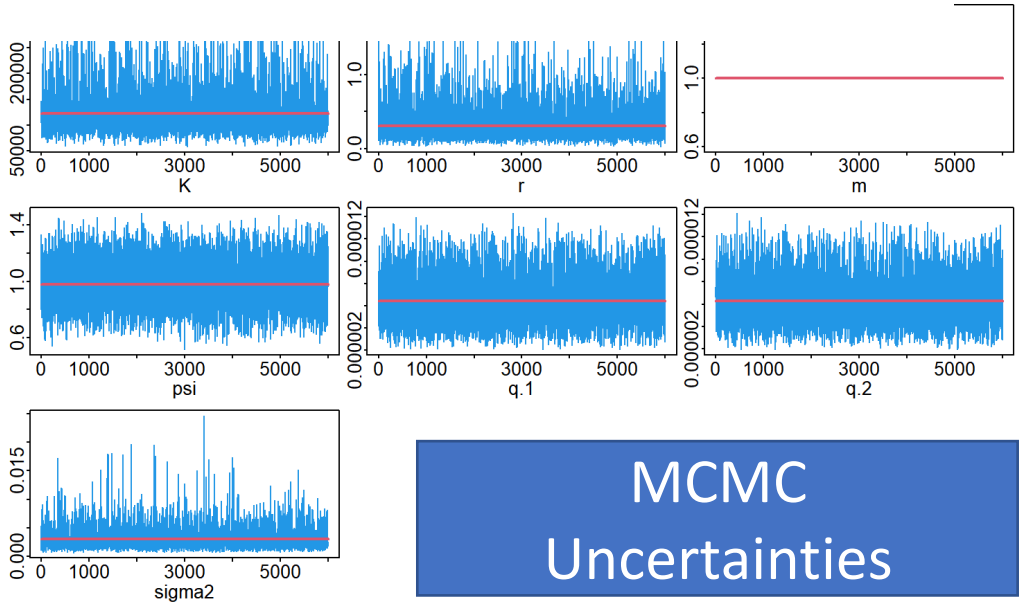






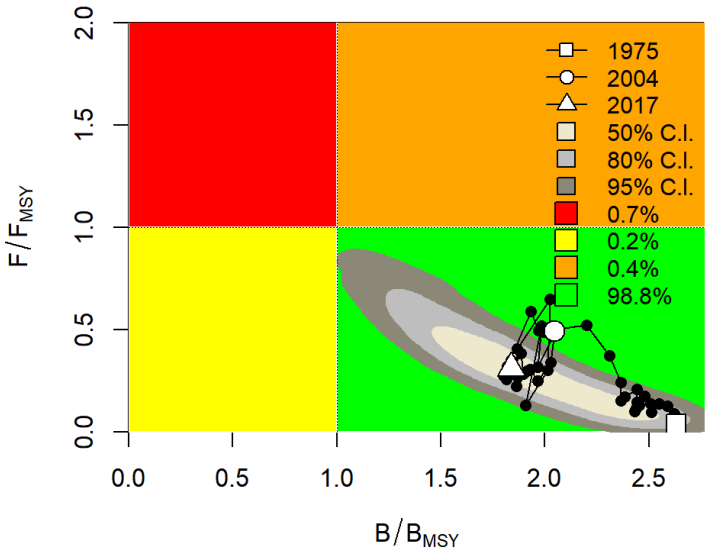
Bayesian (Priors and Posteriors)



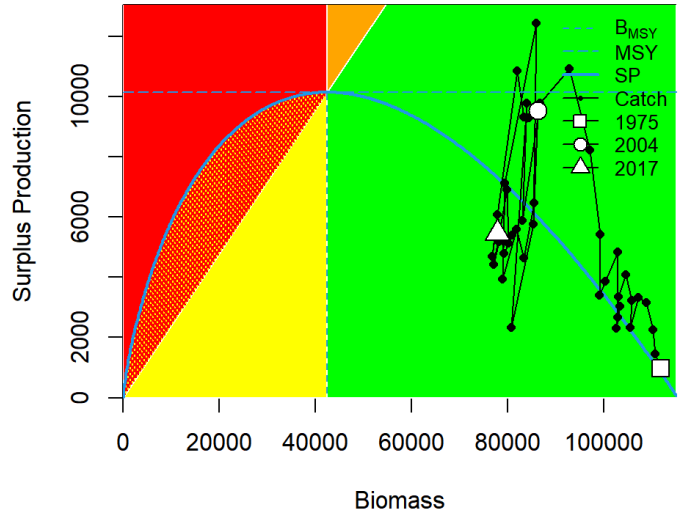


MCMC Uncertainties

Kobe plot



Surplus production phase plot



One weak point : JABBA

No Risk assessment ➔ We will add Risk assessment to JABBA

Menu-driven JABBA_Manager (2024) ➔ **World most powerful PM**

JABBA

+

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	36%	41%	85%	97%	100%	100%	100%	100%	100%	100%
	150%	33,778	36%	41%	79%	94%	99%	100%	100%	100%	100%	100%
	100%	27,022	36%	41%	71%	87%	95%	98%	99%	100%	100%	100%
	80%	24,320	36%	41%	66%	83%	91%	96%	98%	99%	100%	100%
	60%	21,618	36%	41%	61%	77%	87%	93%	96%	98%	99%	99%
	40%	18,915	36%	41%	57%	70%	80%	87%	91%	94%	95%	97%
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	20%	16,213	36%	41%	52%	61%	70%	77%	81%	86%	89%	90%
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% decreased from the current catch level	-5.60%	**12,760	36%	41%	45%	47%	50%	54%	57%	59%	62%	64%
	-10%	12,160	36%	41%	43%	45%	47%	50%	52%	53%	56%	58%
	-20%	10,809	36%	41%	40%	39%	37%	37%	37%	37%	37%	38%
	-30%	9,458	36%	41%	35%	31%	29%	27%	24%	23%	22%	21%
	-40%	8,107	36%	41%	32%	26%	19%	16%	14%	13%	12%	11%
	-60%	5,404	36%	41%	26%	13%	8%	6%	6%	6%	6%	6%
	-80%	2,702	36%	41%	19%	6%	3%	3%	3%	3%	3%	3%
	-100%	0	36%	41%	12%	2%	1%	1%	1%	1%	1%	1%

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

Risk assessment

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(4) Summary

ASPM(Age-Structured Production Model) is recommended

Models		Example	Data and parameters								
			Stock structure	Catch	CPUE	size / age	M (natural mortality)	LW relation	Growth	Maturity + fecundity	Space & movement
Data limit approach		SRA (Catch only)									
Production model		ASPIC									
		JABBA									
Age / size structured model	Simple model (no CPUE)	Cohort analysis									
	Simple integrated model	ASPM									
	Integrated model	SCAA, SCAS, SS3, CASAL									SS3

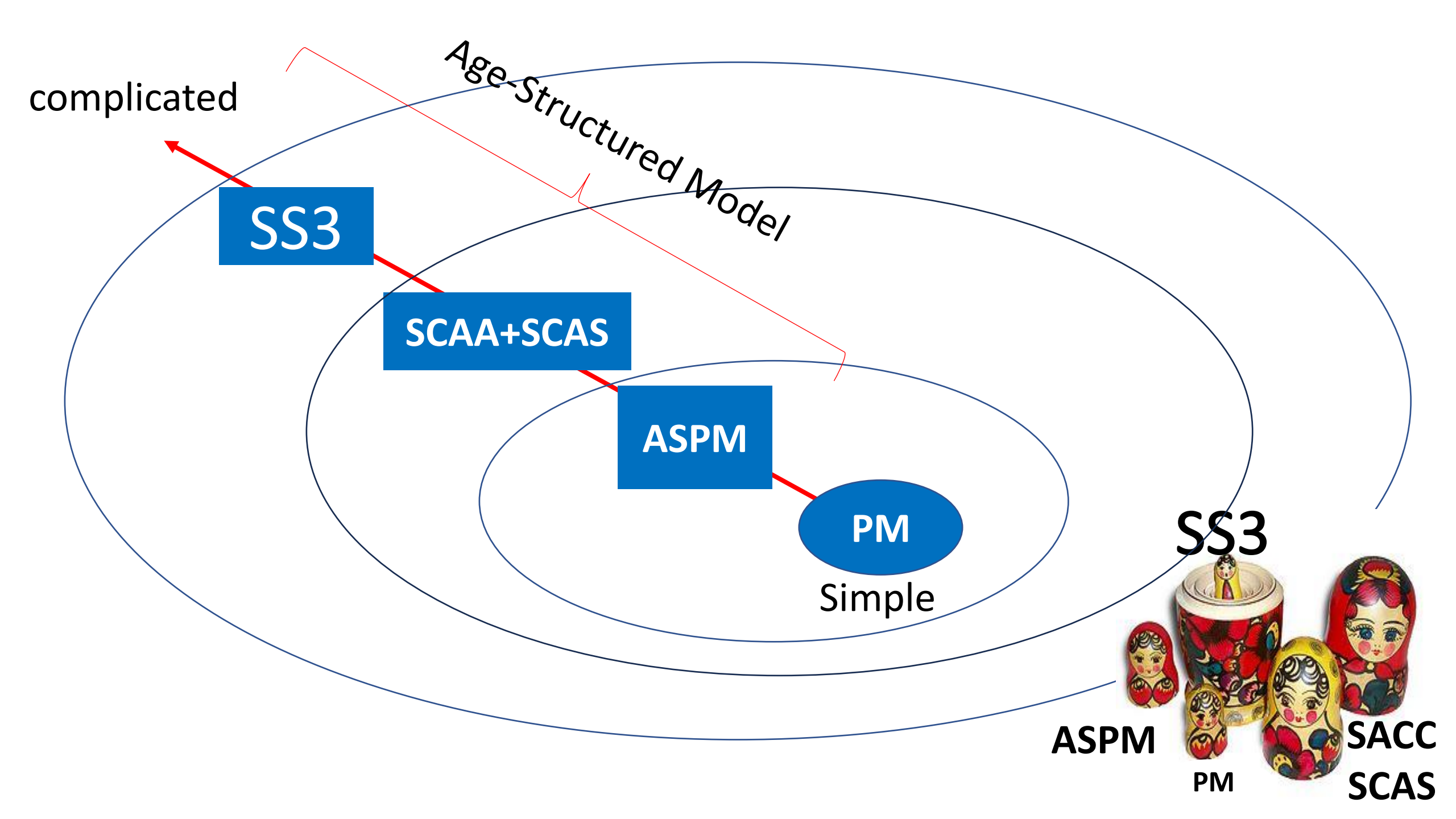
Why ASPM recommended ?

Simpler than other Age structured models

No CAA (catch at age) ➔ Selectivity fixed ➔ easy to converge

Biological data (utilized)

Good (bagus) for beginners


complicated
Age-Structured Model
SS3
SCAA+SCAS
ASPM
PM
Simple
SS3
ASPM
PM
SACC
SCAS

ADMB Implemented ASPM

Tom Nishida
[MENU]
Menu-driven stock assessment software developing team

Doug Butterworth + Rebecca Rademeyer
(Univ of Cape Town, South Africa)

Original ASPM (ICCAT)

Restorep (1997) FORTAN (outdated)

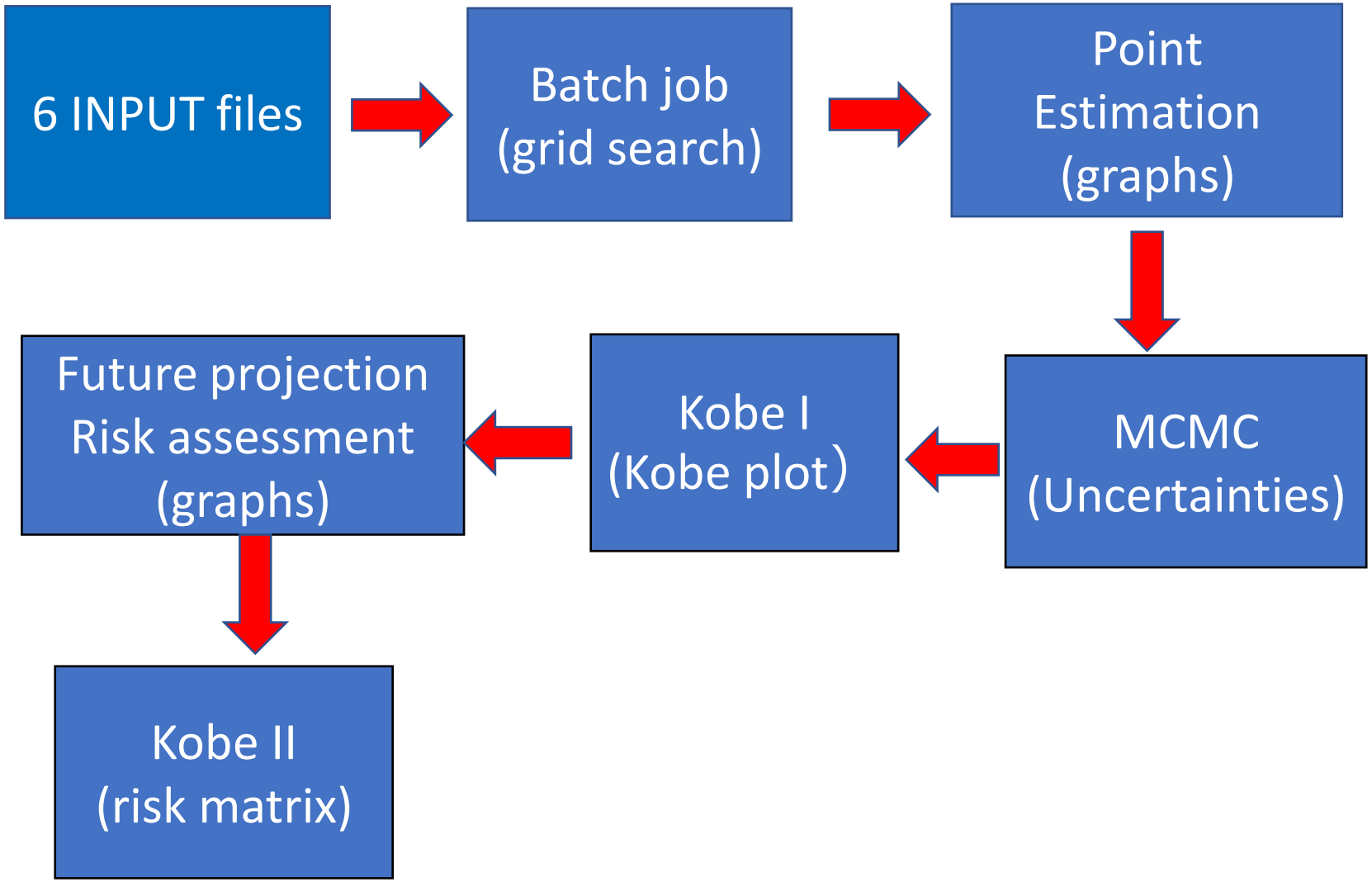
Re-coded by AD Model Builder

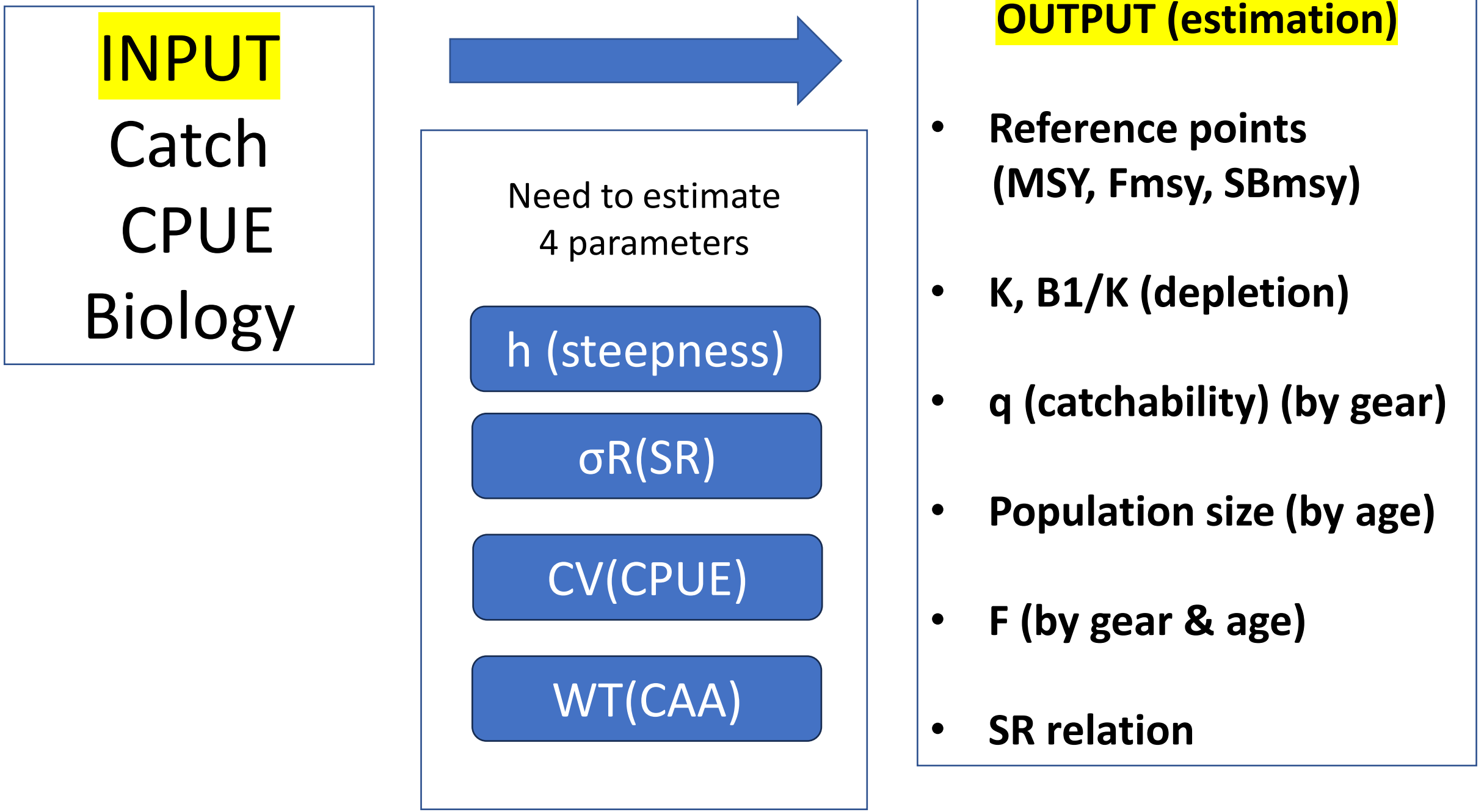
We developed the user's friendly software

(menu-driven)

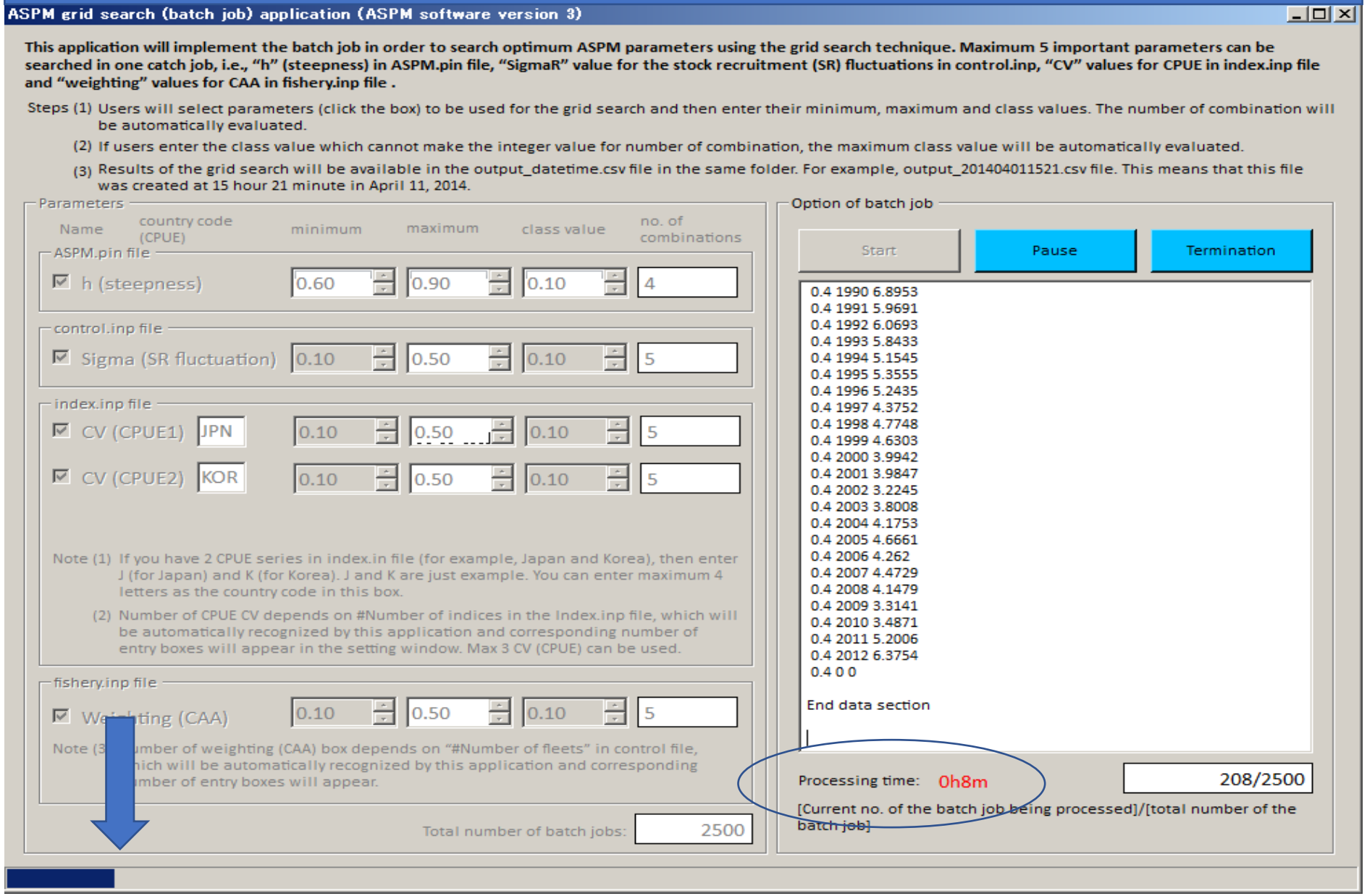
6 years

ASPM: Flow

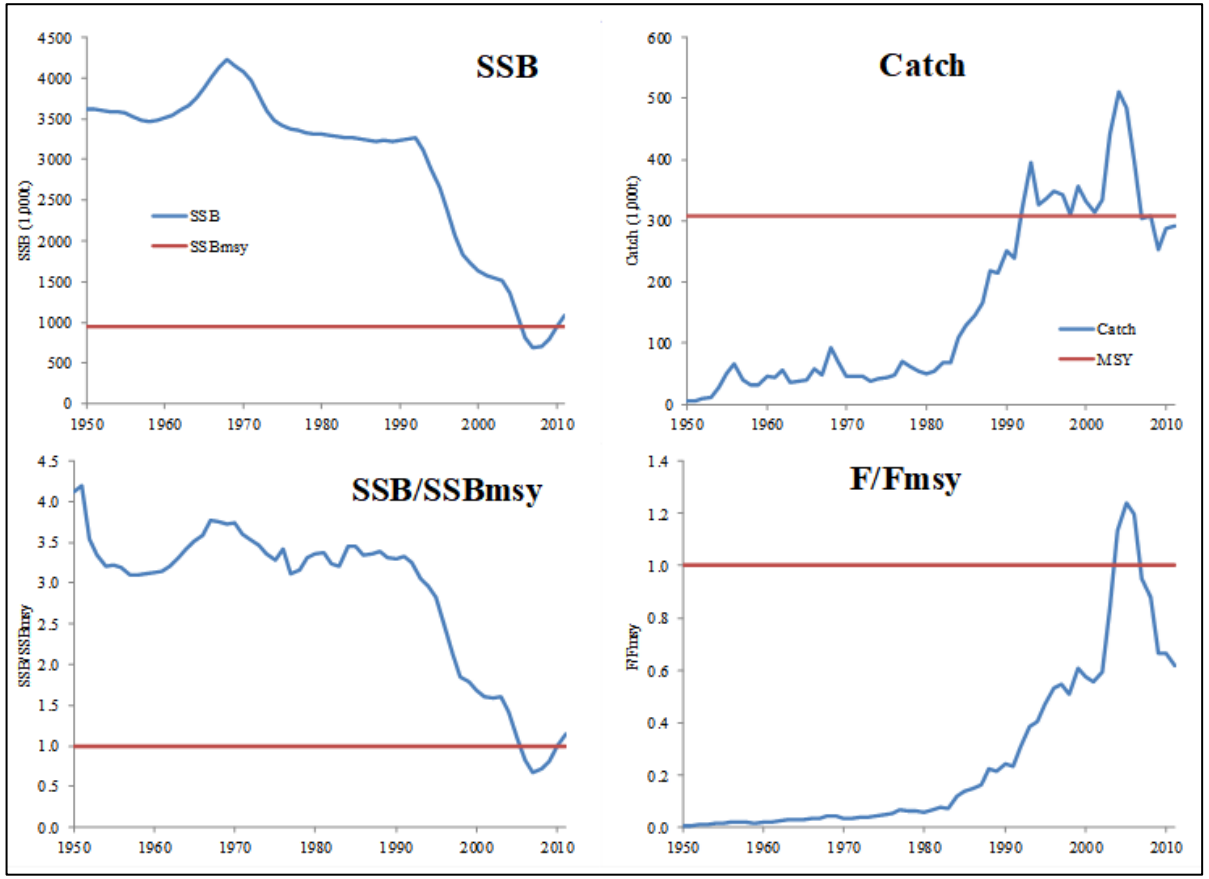

6 INPUT files
Batch job
(grid search)
Point
Estimation
(graphs)
MCMC
(Uncertainties)
Kobe I
(Kobe plot)
Future projection
Risk assessment
(graphs)
Kobe II
(risk matrix)

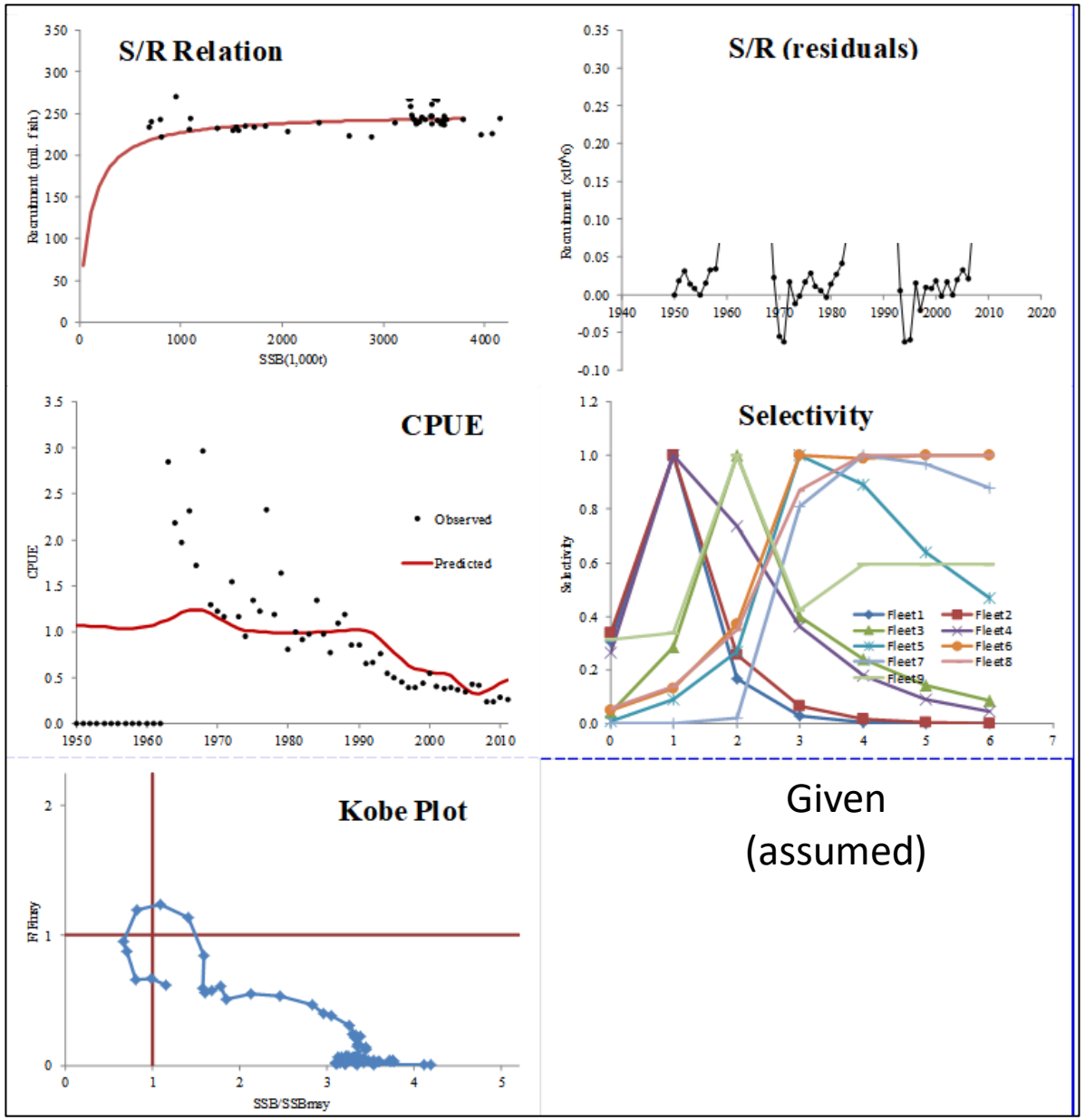

INPUT
Catch
CPUE
Biology
Need to estimate
4 parameters
h (steepness)
σR(SR)
CV(CPUE)
WT(CAA)
OUTPUT (estimation)
Reference points
(MSY, Fmsy, SBmsy)
K, B1/K (depletion)
q (catchability) (by gear)
Population size (by age)
F (by gear & age)
SR relation

Batch job


ASPM grid search (batch job) application (ASPM software version 3)
This application will implement the batch job in order to search optimum ASPM parameters using the grid search technique. Maximum 5 important parameters can be searched in one catch job, i.e., "h" (steepness) in ASPM.pin file, "SigmaR" value for the stock recruitment (SR) fluctuations in control.inp, "CV" values for CPUE in index.inp file and "weighting" values for CAA in fishery.inp file .
Steps (1) Users will select parameters (click the box) to be used for the grid search and then enter their minimum, maximum and class values. The number of combination will be automatically evaluated.
(2) If users enter the class value which cannot make the integer value for number of combination, the maximum class value will be automatically evaluated.
(3) Results of the grid search will be available in the output_datetime.csv file in the same folder. For example, output_201404011521.csv file. This means that this file was created at 15 hour 21 minute in April 11, 2014.
Parameters
Name
country code (CPUE)
minimum
maximum
class value
no. of combinations
ASPM.pin file
h (steepness)
0.60
0.90
0.10
4
control.inp file
Sigma (SR fluctuation)
0.10
0.50
0.10
5
index.inp file
CV (CPUE1)
JPN
0.10
0.50
0.10
5
CV (CPUE2)
KOR
0.10
0.50
0.10
5
Note (1) If you have 2 CPUE series in index.in file (for example, Japan and Korea), then enter J (for Japan) and K (for Korea). J and K are just example. You can enter maximum 4 letters as the country code in this box.
(2) Number of CPUE CV depends on #Number of indices in the Index.inp file, which will be automatically recognized by this application and corresponding number of entry boxes will appear in the setting window. Max 3 CV (CPUE) can be used.
fishery.inp file
Weighting (CAA)
0.10
0.50
0.10
5
Note (3 umber of weighting (CAA) box depends on "#Number of fleets" in control file, hich will be automatically recognized by this application and corresponding mber of entry boxes will appear.
Total number of batch jobs:
2500
Option of batch job
Start
Pause
Termination
0.4 1990 6.8953
0.4 1991 5.9691
0.4 1992 6.0693
0.4 1993 5.8433
0.4 1994 5.1545
0.4 1995 5.3555
0.4 1996 5.2435
0.4 1997 4.3752
0.4 1998 4.7748
0.4 1999 4.6303
0.4 2000 3.9942
0.4 2001 3.9847
0.4 2002 3.2245
0.4 2003 3.8008
0.4 2004 4.1753
0.4 2005 4.6661
0.4 2006 4.262
0.4 2007 4.4729
0.4 2008 4.1479
0.4 2009 3.3141
0.4 2010 3.4871
0.4 2011 5.2006
0.4 2012 6.3754
0.4 0 0
End data section
Processing time: 0h8m
208/2500
[Current no. of the batch job being processed]/[total number of the batch job]

Point Estimates



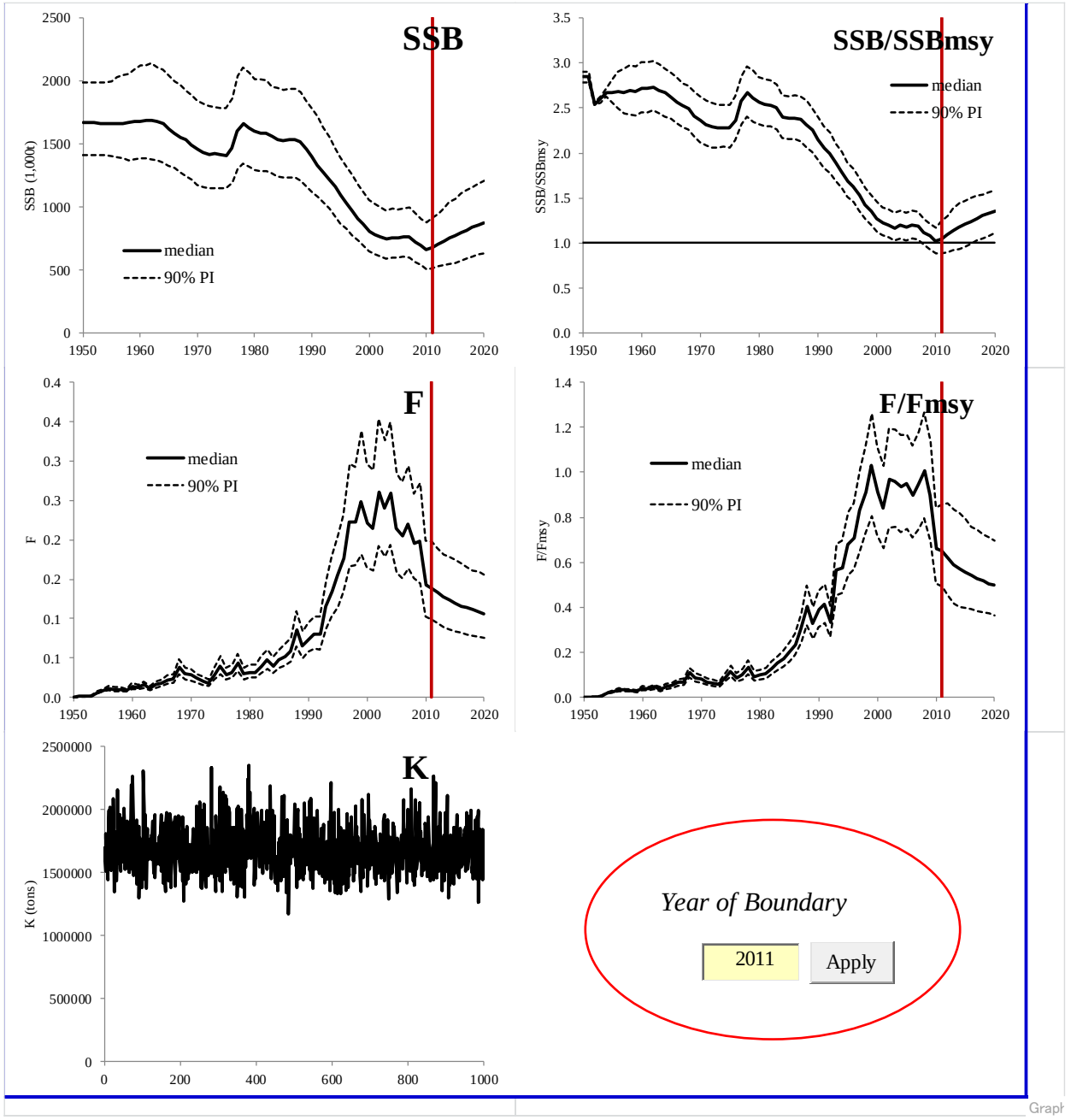


MCMC

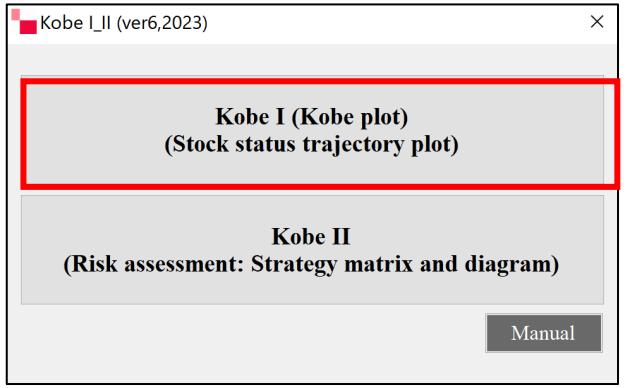
uncertainties

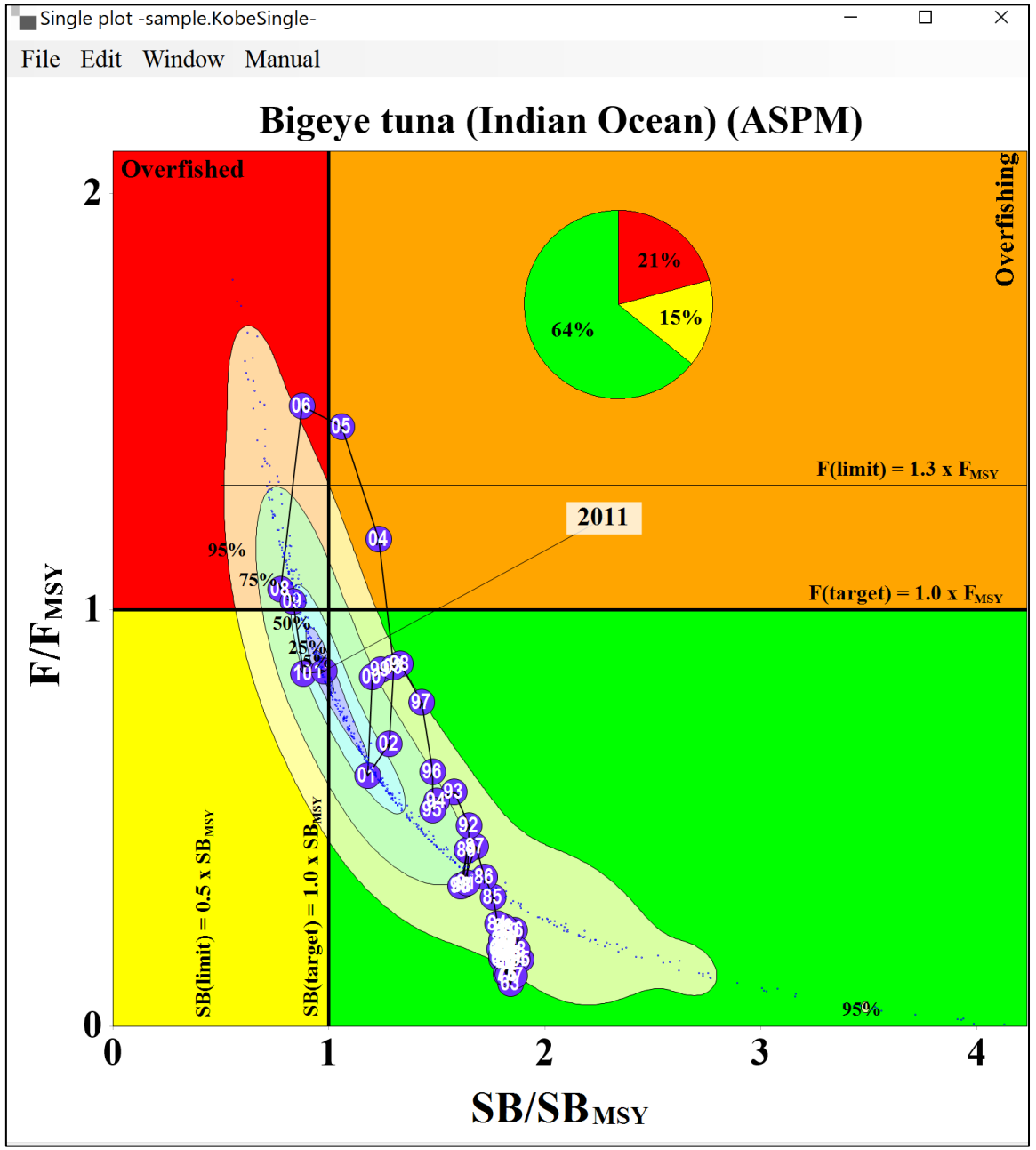
+

Projections




Kobe plot I_II


Kobe I_II (ver6,2023)
Kobe I (Kobe plot)
(Stock status trajectory plot)
Kobe II
(Risk assessment: Strategy matrix and diagram)
Manual


Single plot -sample.KobeSingle-
File Edit Window Manual
Bigeye tuna (Indian Ocean) (ASPM)
Overfished
Overfishing
21%
15%
64%
F(limit) = 1.3 x FMSY
F(target) = 1.0 x FMSY
2011
95%
75%
50%
25%
5%
SB(limit) = 0.5 x SBMSY
SB(target) = 1.0 x SBMSY
F/FMSY
SB/SBMSY
0
1
2
3
4

Kobe II (risk matrix)

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	36%	41%	85%	97%	100%	100%	100%	100%	100%	100%
	150%	33,778	36%	41%	79%	94%	99%	100%	100%	100%	100%	100%
	100%	27,022	36%	41%	71%	87%	95%	98%	99%	100%	100%	100%
	80%	24,320	36%	41%	66%	83%	91%	96%	98%	99%	100%	100%
	60%	21,618	36%	41%	61%	77%	87%	93%	96%	98%	99%	99%
	40%	18,915	36%	41%	57%	70%	80%	87%	91%	94%	95%	97%
	30%	17,564	36%	41%	54%	67%	75%	82%	87%	91%	93%	95%
	20%	16,213	36%	41%	52%	61%	70%	77%	81%	86%	89%	90%
	10%	14,862	36%	41%	49%	56%	63%	69%	75%	79%	82%	84%
*** Current catch**	0%	13,511	36%	41%	47%	51%	56%	60%	64%	68%	71%	74%
% decreased from the current catch level	-5.60%	**12,760	36%	41%	45%	47%	50%	54%	57%	59%	62%	64%
	-10%	12,160	36%	41%	43%	45%	47%	50%	52%	53%	56%	58%
	-20%	10,809	36%	41%	40%	39%	37%	37%	37%	37%	37%	38%
	-30%	9,458	36%	41%	35%	31%	29%	27%	24%	23%	22%	21%
	-40%	8,107	36%	41%	32%	26%	19%	16%	14%	13%	12%	11%
	-60%	5,404	36%	41%	26%	13%	8%	6%	6%	6%	6%	6%
	-80%	2,702	36%	41%	19%	6%	3%	3%	3%	3%	3%	3%
	-100%	0	36%	41%	12%	2%	1%	1%	1%	1%	1%	1%

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

TB_Kobe_II_Matrix | F_Kobe_II_Matrix | TB_Projection | F_Projection

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  - Age-Structured Models
- Management decision making tool (Kobe I+II)

(4) Summary

Kobe I+II Manager
Most recent version (v6.2.1) (2024)

Management decision making tool

Kobe I+II

Kobe I (Kobe plot) (stock status trajectory)

- Effective tool to understand changes of historical status of stock
- Recent stock status ➔ important for management advice

Kobe II (Strategy matrix) (Risk assessment)

- Effective tool to understand Probabilities of risks to violate MSY for F and Biomass in the future by different catch level ➔ advice for TAC

Kobe I+II : Visualized tool

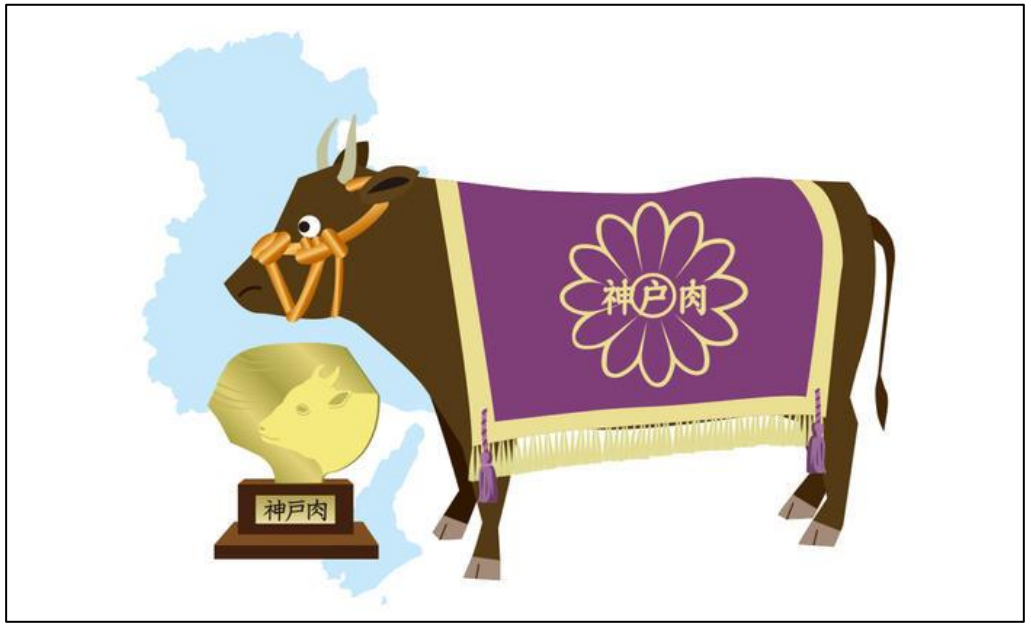
Comprehensive tool:
to bridge
scientists → managers/industry

This Kobe I+II Manager → Independent use
why ?

Kobe I+II customized for ASPIC_Manager & JABBA_Manager
are available within their software

That is why this software is for
Independent & general use

Why we call KOBE （神戸）？
Any relation to the Kobe beef?



Kobe I (Kobe plot) + II (strategy matrix) agreed by 5 tuna RFMO meetings (IOTC+4)

Kobe I (Kobe plot) Stock status trajectory plot

First meeting in 2007 (**Kobe**, Japan)

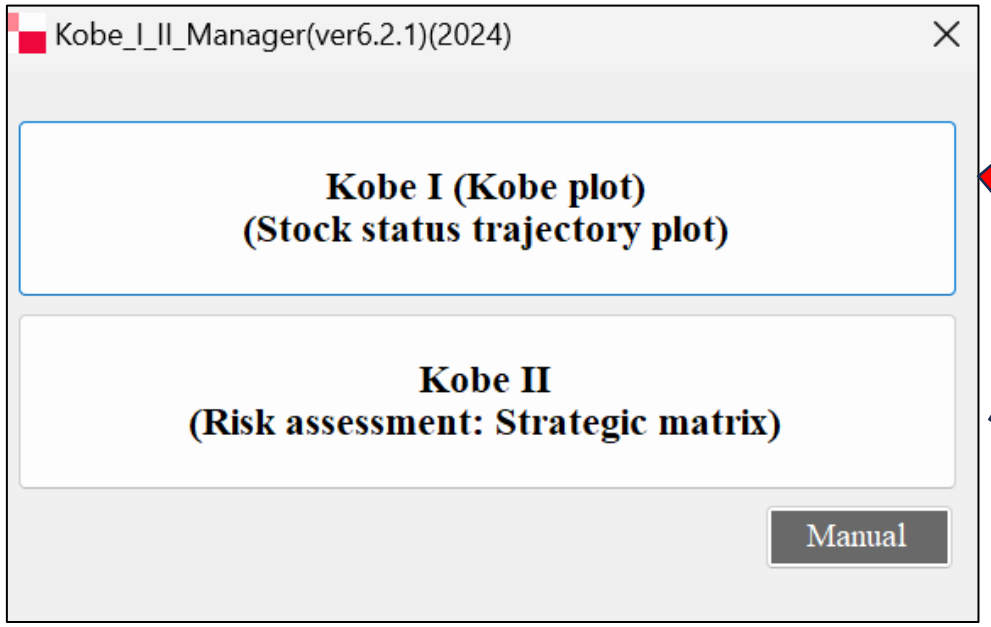
Second meeting in 2009 (Barcelona, Spain)

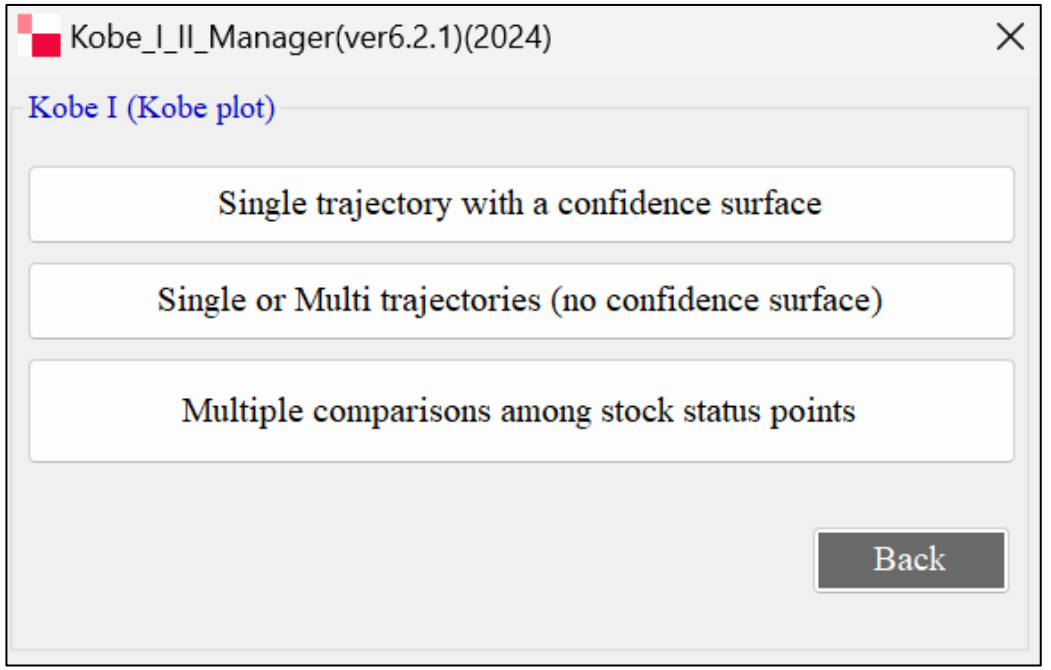
Kobe II (strategy matrix)

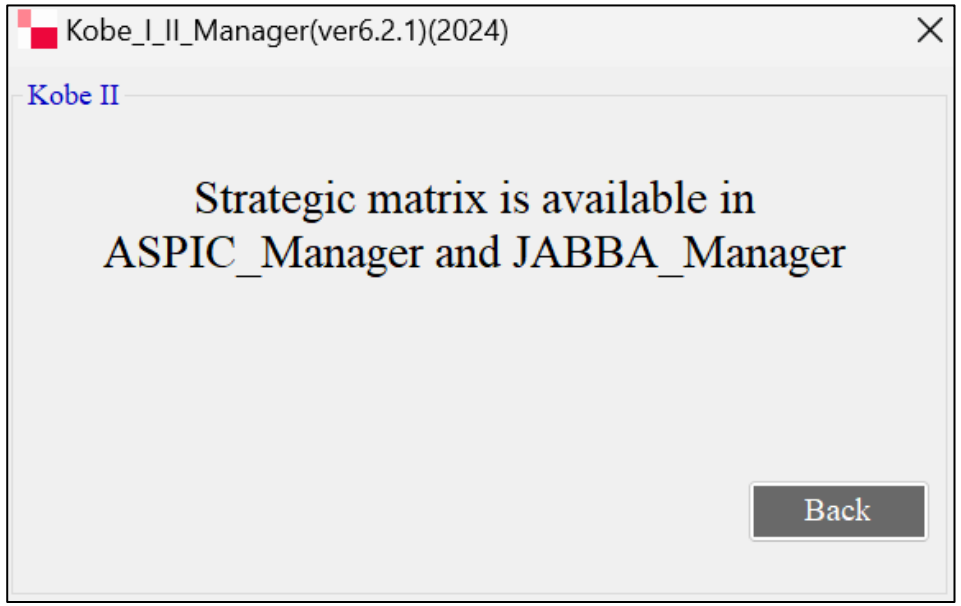
Spreading also to demersal RFMOs and others

(e.g. NAFO, SEAFO, NPFC……)


Kobe_I_II_Manager

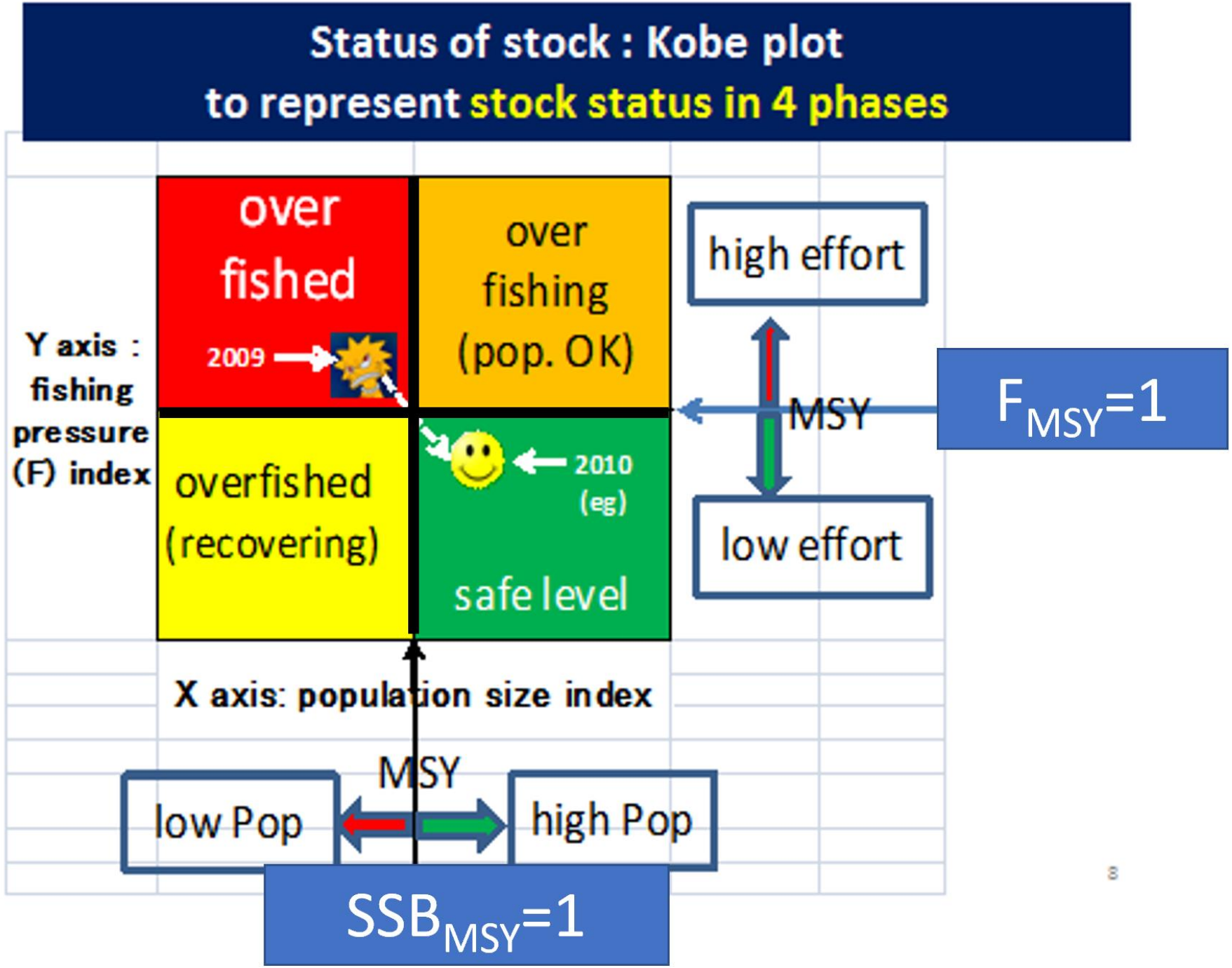

Kobe_I_II_Manager(ver6.2.1)(2024)
Kobe I (Kobe plot)
(Stock status trajectory plot)
Kobe II
(Risk assessment: Strategic matrix)
Manual

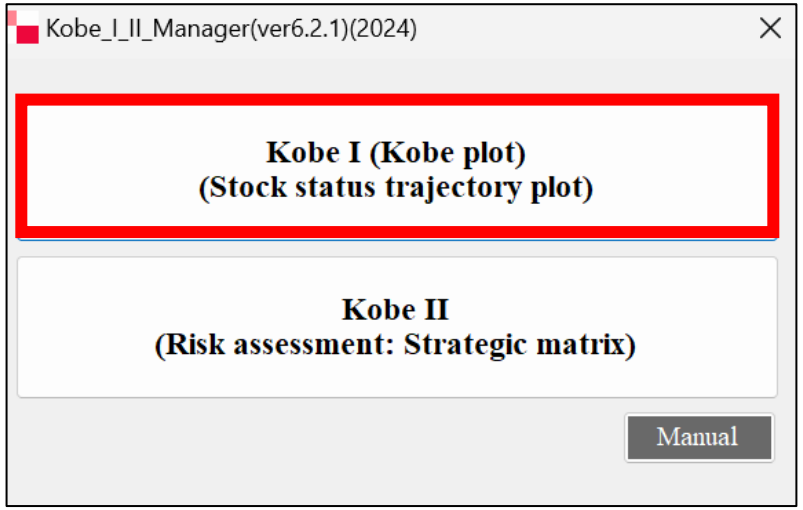

Kobe_I_II_Manager(ver6.2.1)(2024)
Kobe I (Kobe plot)
Single trajectory with a confidence surface
Single or Multi trajectories (no confidence surface)
Multiple comparisons among stock status points
Back

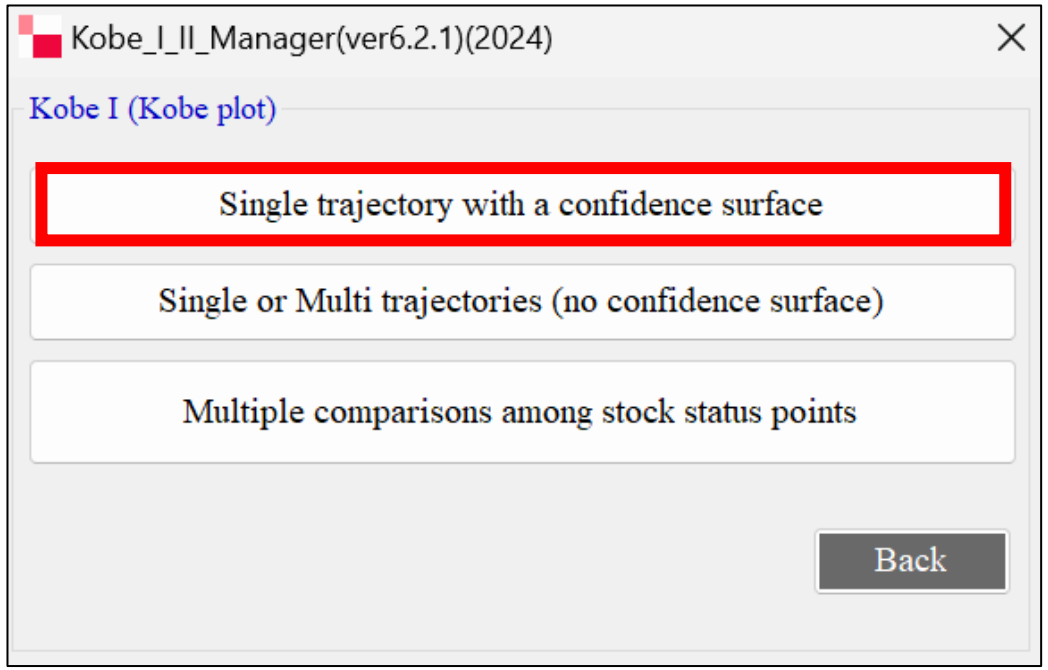

Kobe_I_II_Manager(ver6.2.1)(2024)
Kobe II
Strategic matrix is available in
ASPIC_Manager and JABBA_Manager
Back

Concept

Kobe plot




Kobe_I_II_Manager(ver6.2.1)(2024)
Kobe I (Kobe plot)
(Stock status trajectory plot)
Kobe II
(Risk assessment: Strategic matrix)
Manual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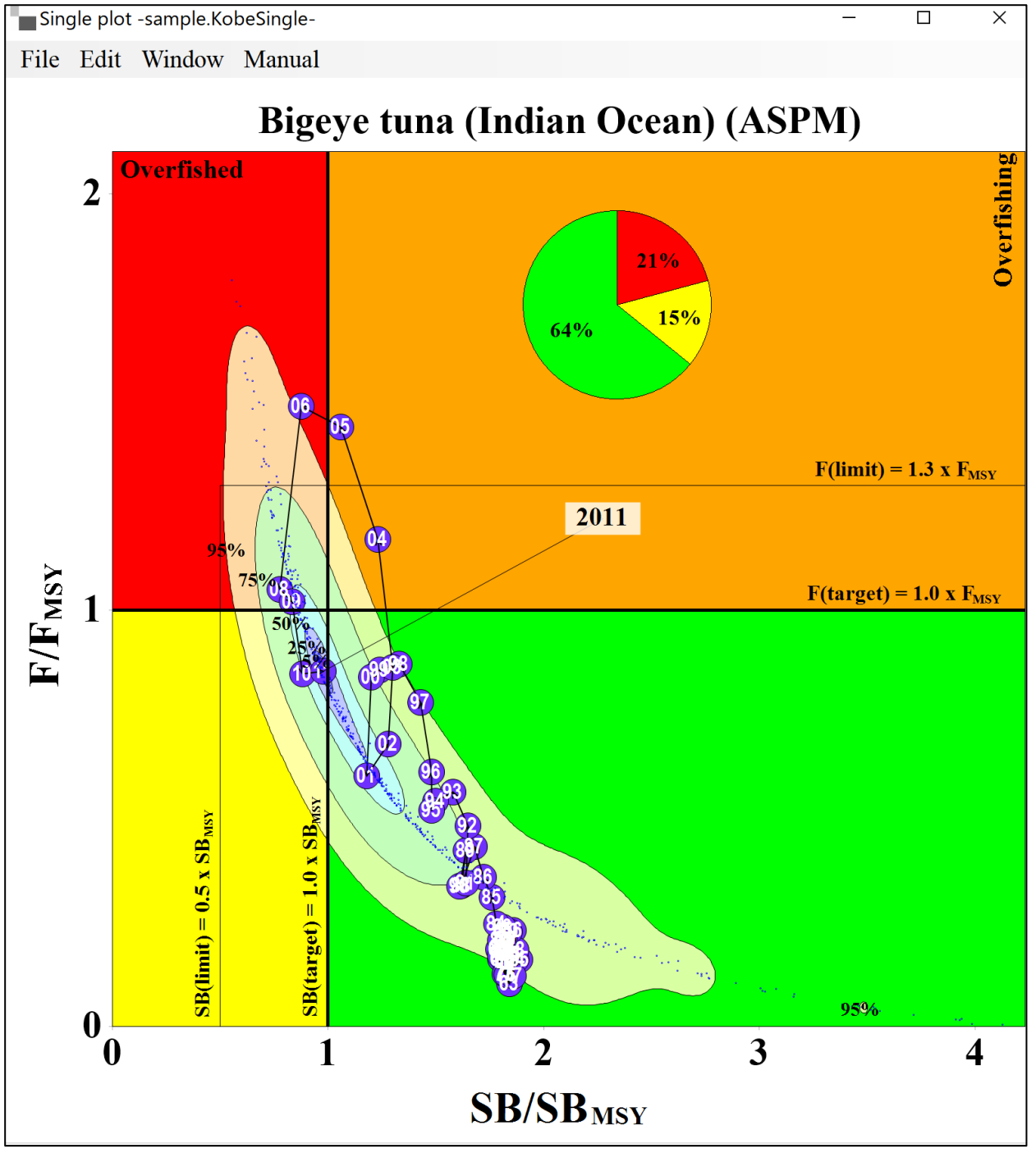
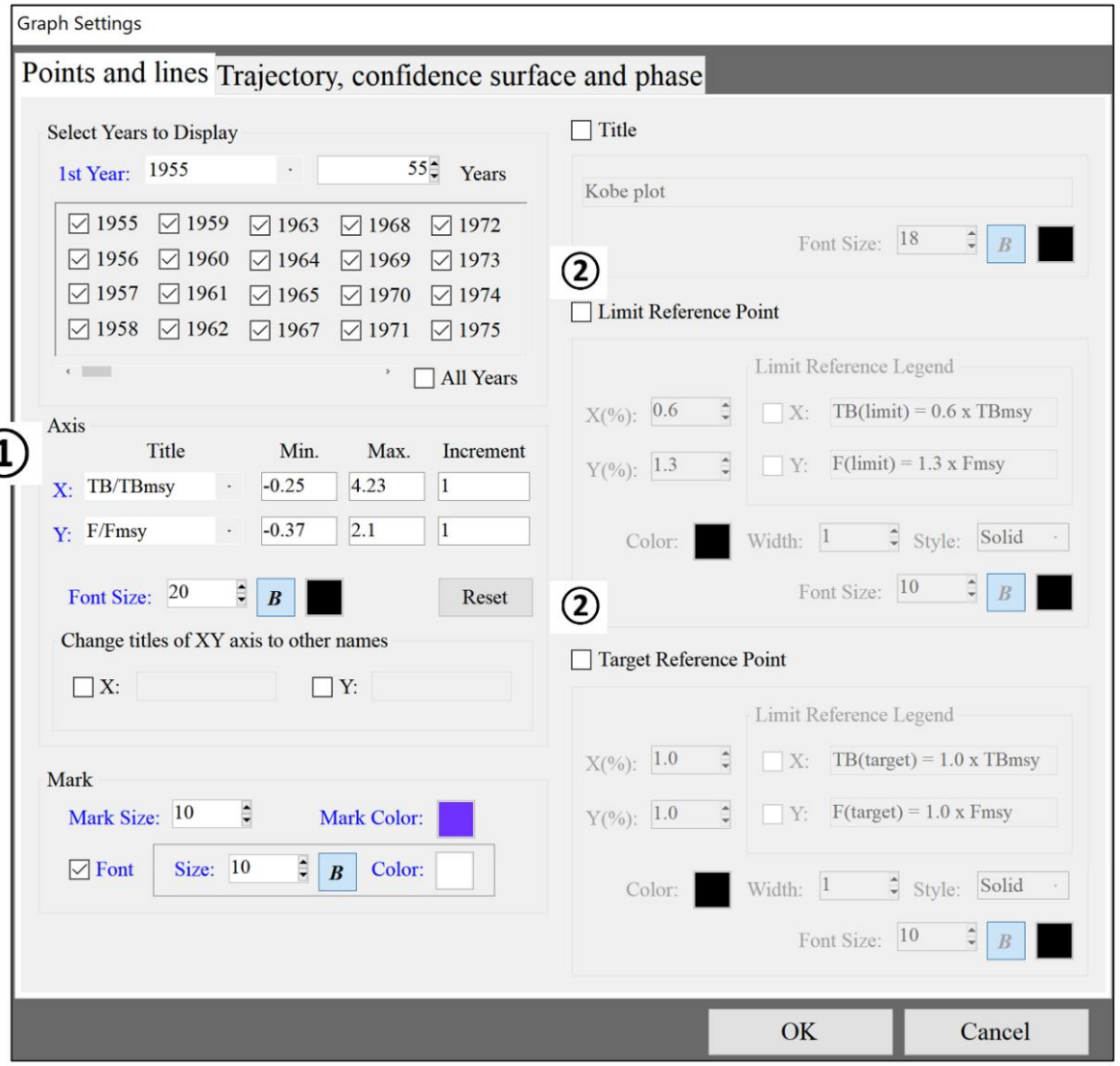
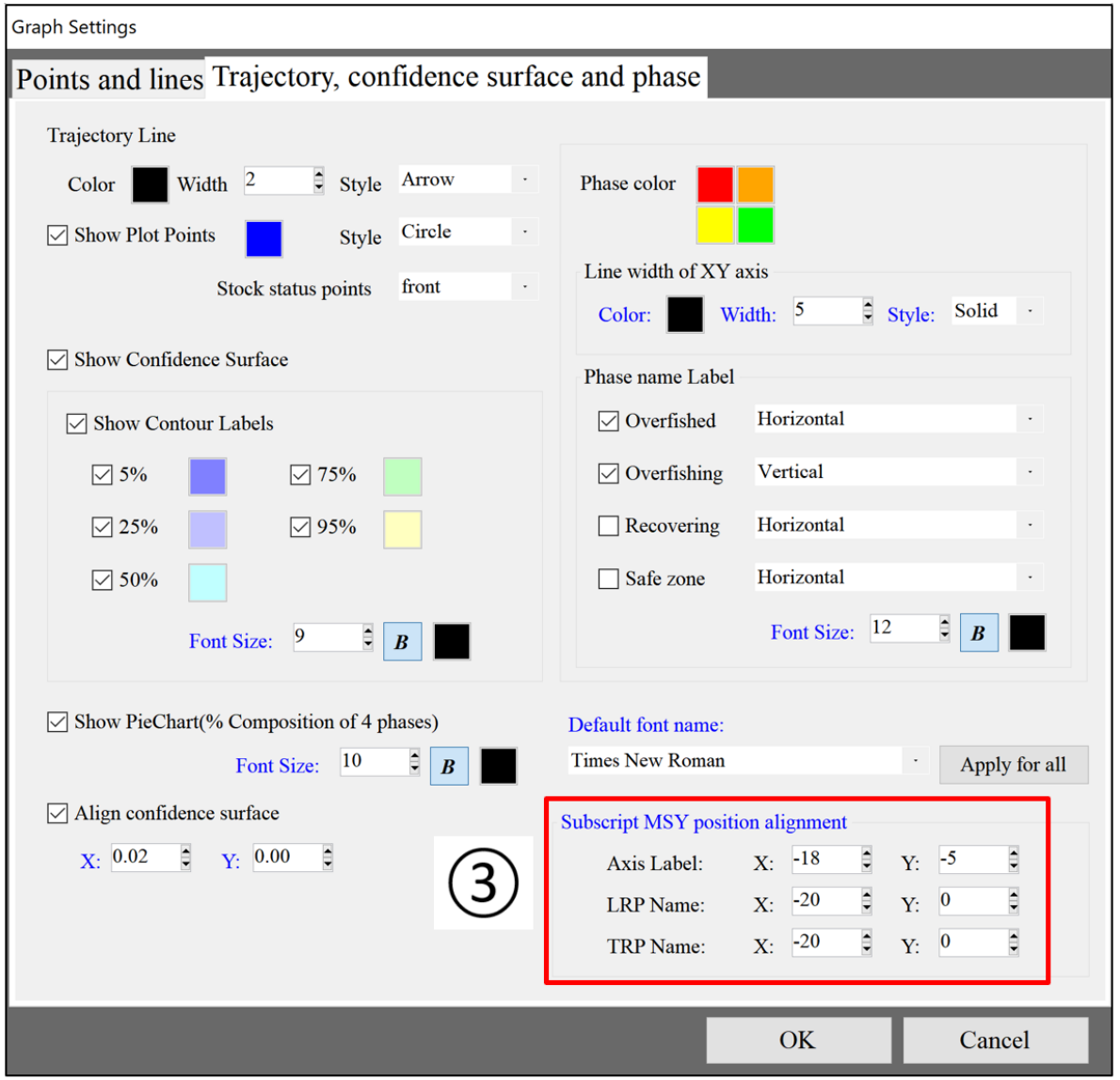
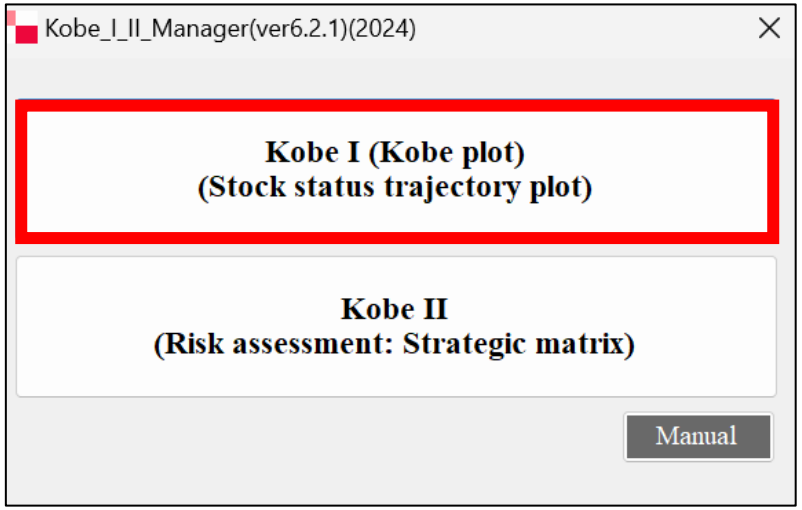

Single plot -sample.KobeSingle-
File Edit Window Manual
Bigeye tuna (Indian Ocean) (ASPM)
Overfished
Overfishing
21%
15%
64%
F(limit) = 1.3 x F_MSY
F(target) = 1.0 x F_MSY
2011
95%
75%
50%
25%
SB(limit) = 0.5 x SB_MSY
SB(target) = 1.0 x SB_MSY
F/F_MSY
SB/SB_MSY
0
1
2
3
4

Graph settings to edit






Kobe_I_II_Manager(ver6.2.1)(2024)
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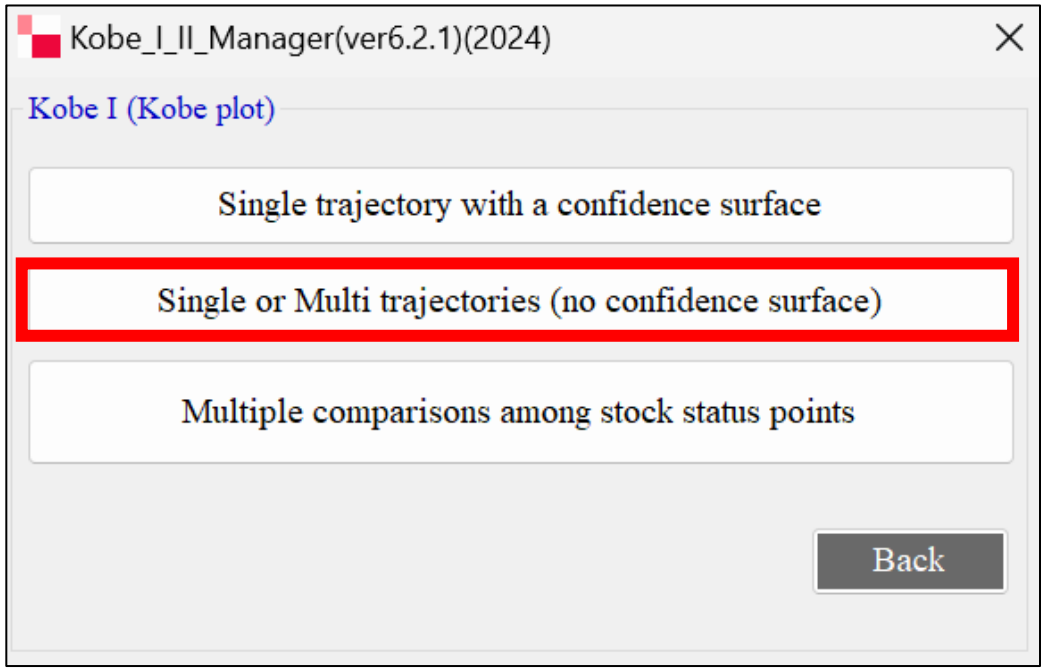
Kobe II
(Risk assessment: Strategic matrix)
Manual


Kobe_I_II_Manager(ver6.2.1)(2024)
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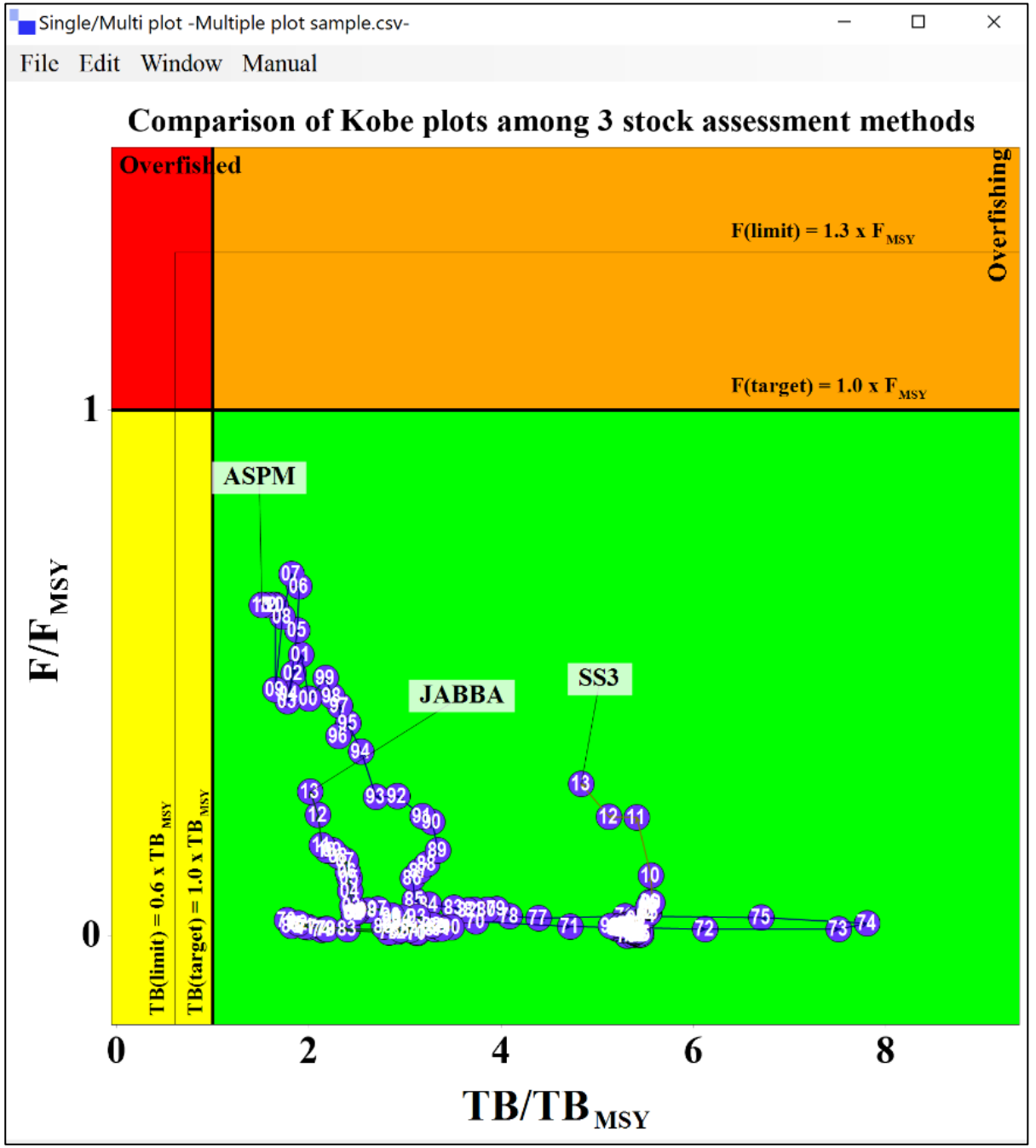
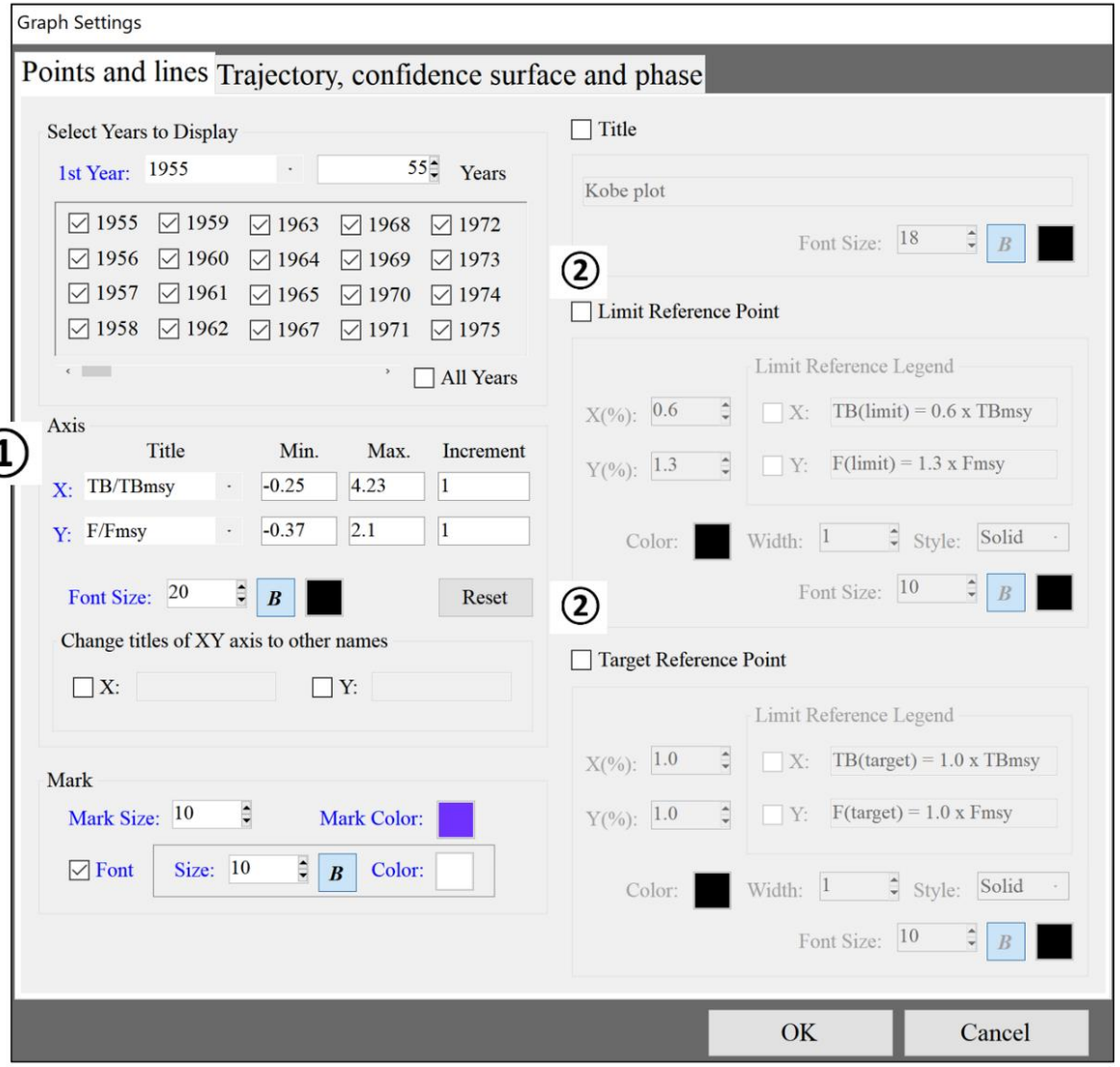
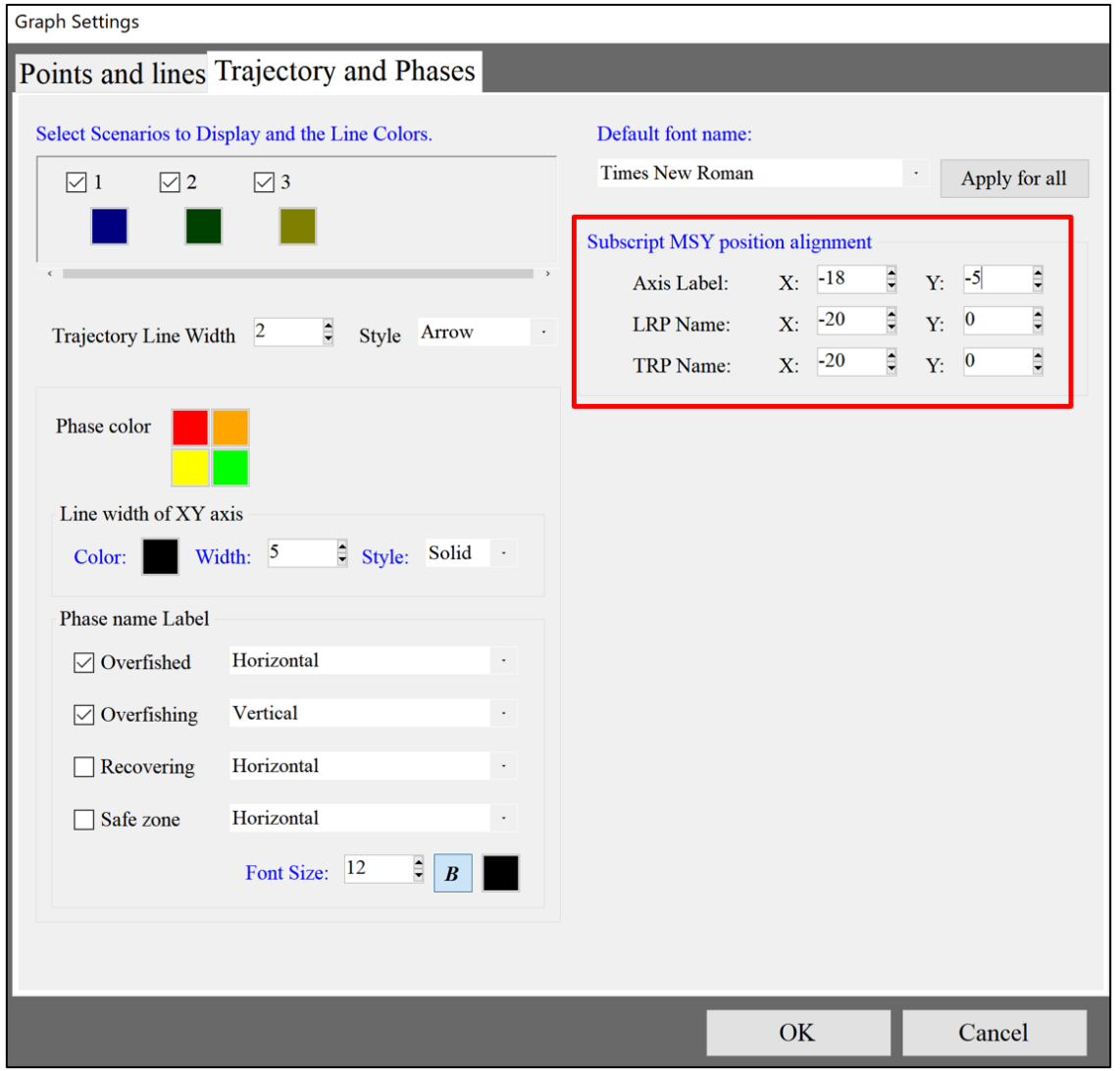
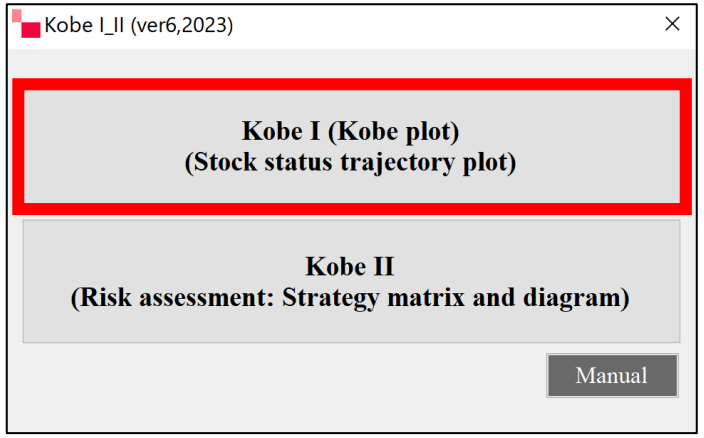

Single/Multi plot -Multiple plot sample.csv-
File Edit Window Manual
Comparison of Kobe plots among 3 stock assessment methods
Overfished
Overfishing
F(limit) = 1.3 x F MSY
F(target) = 1.0 x F MSY
ASPM
JABBA
SS3
F/F MSY
TB/TB MSY
TB(limit) = 0.6 x TB MSY
TB(target) = 1.0 x TB MSY
0
1
2
4
6
8

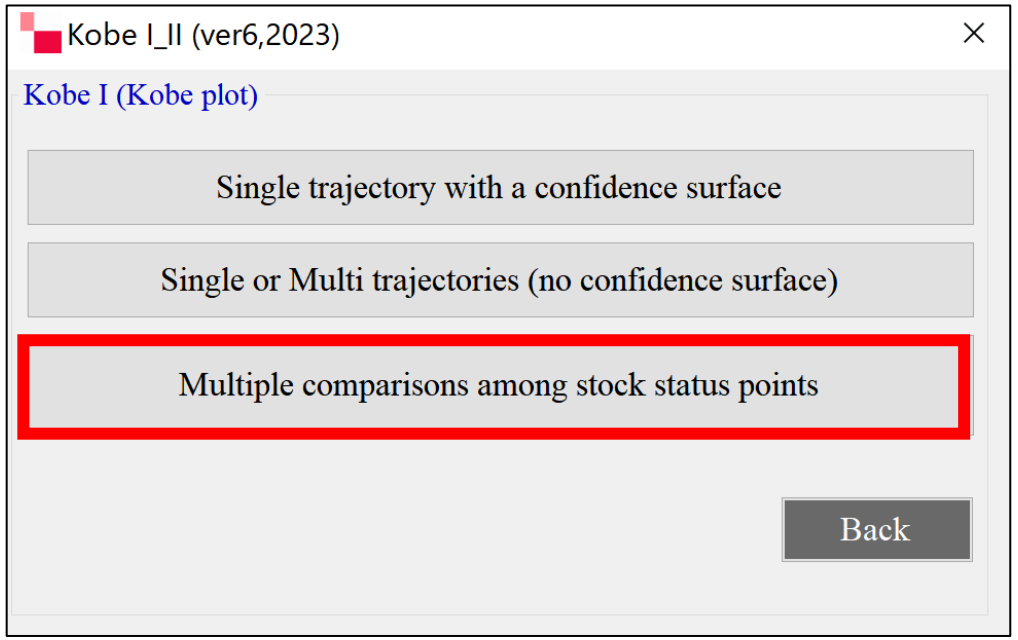
Graph settings to adjust formats of the Plot

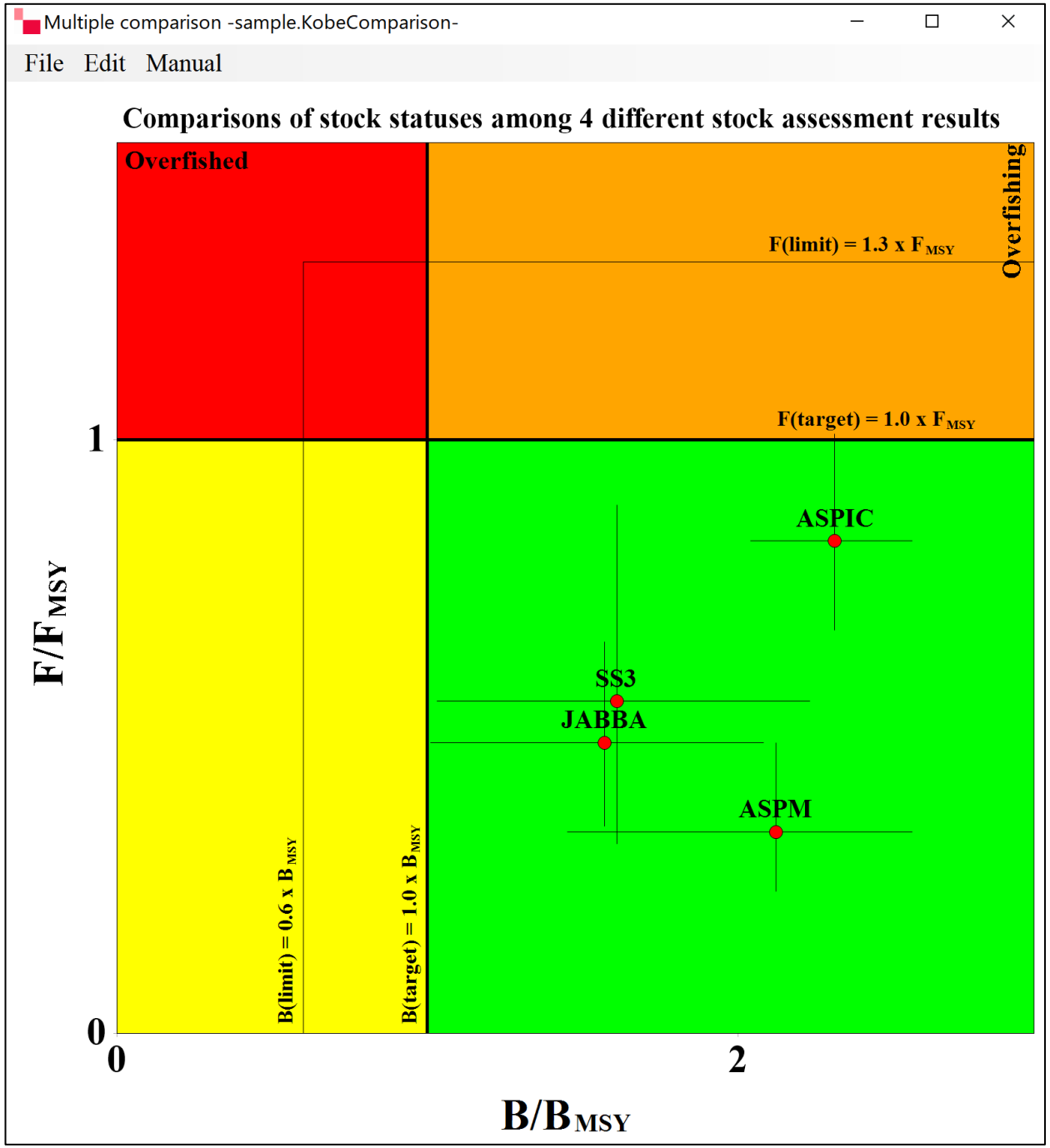
(many functions are available to produce users' desired plot)






Kobe I_II (ver6,2023)
Kobe I (Kobe plot)
(Stock status trajectory plot)
Kobe II
(Risk assessment: Strategy matrix and diagram)
Manual

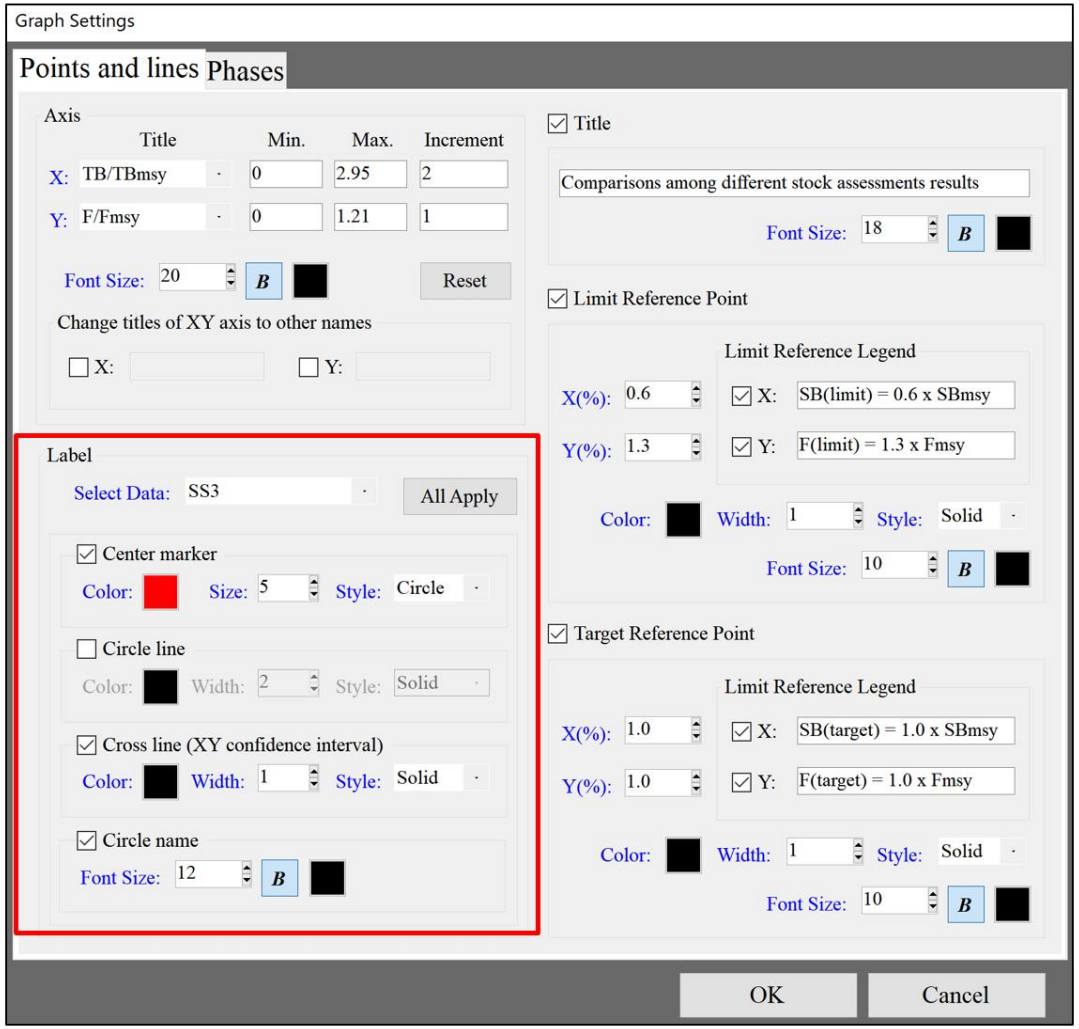

Kobe I_II (ver6,2023)
Kobe I (Kobe plot)
Single trajectory with a confidence surface
Single or Multi trajectories (no confidence surface)
Multiple comparisons among stock status points
Back

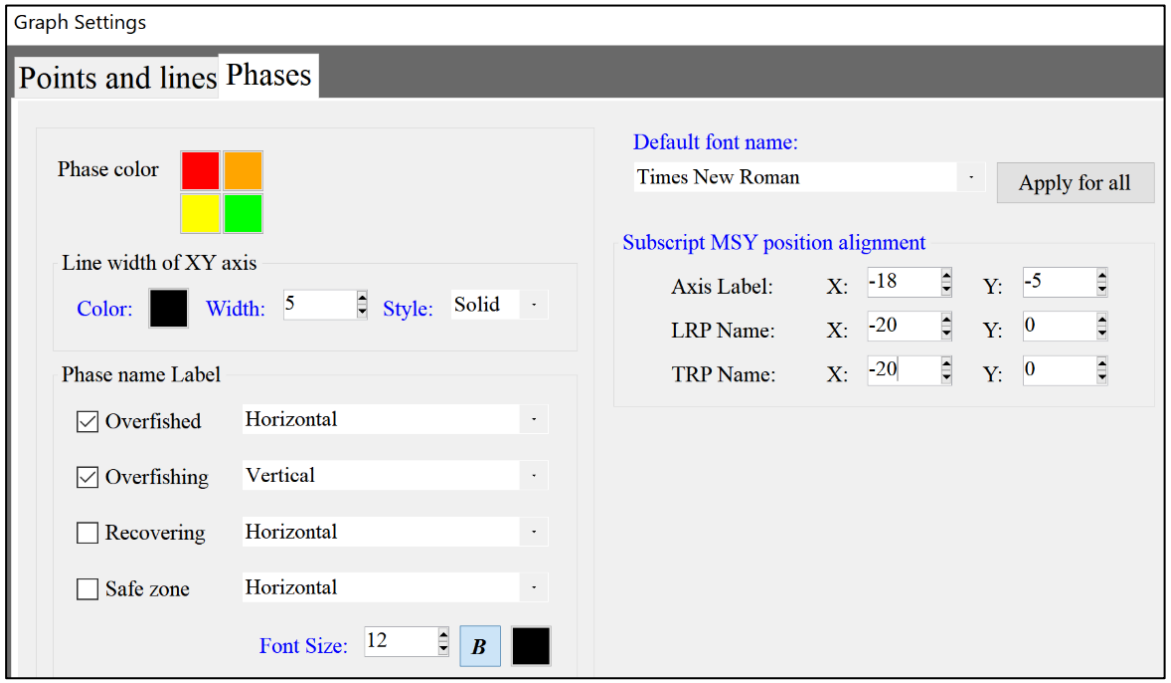

Multiple comparison -sample.KobeComparison-
File Edit Manual
Comparisons of stock statuses among 4 different stock assessment results
Overfished
Overfishing
F(limit) = 1.3 x F MSY
F(target) = 1.0 x F MSY
ASPIC
SS3
JABBA
ASPM
B(limit) = 0.6 x B MSY
B(target) = 1.0 x B MSY
F/F MSY
B/B MSY
1
0
0
2

Graph settings to adjust formats of the Plot

(many functions available to produce users' desired plot)

④





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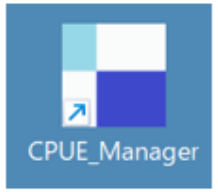
(4) Summary

[MENU] Menu-driven stock assessment software (7)

4 Manager series (all-in-one)

Types		Name	Icon
(A) CPUE standardization		(1) CPUE_Manager	
(B) Stock assessment	Production model	(2) ASPIC_Manager	
		(3) JABBA_Manager	
	Age structured model	(4) ASPM (Age Structured Production Model)	
		(5) SCAA (Statistical-Catch-At-Age)	
		(6) SCAS (Statistical-Catch-At-Size)	
(C) Management decision tools		(7) Kobe_I_II_Manager Kobe plot Risk matrix	

Procedure

Part I: Stock assessments (point estimates)

INPUT

Data collection → Data base

- Catch
- Nominal CPUE → CPUE_Manager
- Biological information

Stock assessment

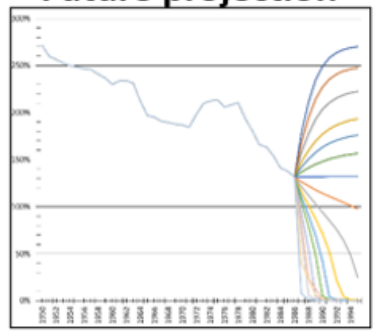
- Production Model (ASPIC+JABBA) — ASPIC_Manager -
- Age-Structured Model (ASPM・SCAA・SCAS) — BatchASPM, SCAS

Part II: Risk assessments (Projection & uncertainties)

Stock assessment results

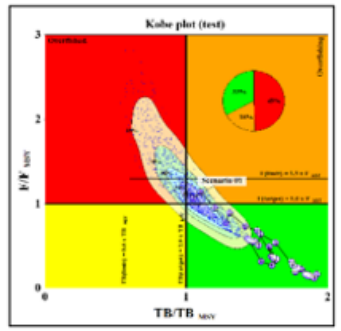
Kobe_I_II_Manager

Future projection



Uncertainties (bootstrap, MCMC)

Kobe I



Kobe II

Important note (1) Multiple stock assessment

Try 2 or more SA with different structured (data) models

(PM, Age structured, data poor models….)

Compare results

If similar ➔ confident to provide advice

If different ➔ check fitness ➔ use SA results with better fitness

(less confident, but still good references)

Important Note (2) MMM

➔ Need Multi-gear & Multi-species fisheries Management (MMM)

(Developing countries)

Our stock assessment➔ single species

How dose it help & incorporate to MMM?

Our single species specific SA results ➔ just reference for MMM

A single species TAC cannot be used directly for MMM

as stock statuses are different among multi-species.

MMM should be implemented by mangers

Considering all relevant factors together….

Stock statuses (all species), singles species specific TAC (our work),

socio-economics, MPA, ecology & others

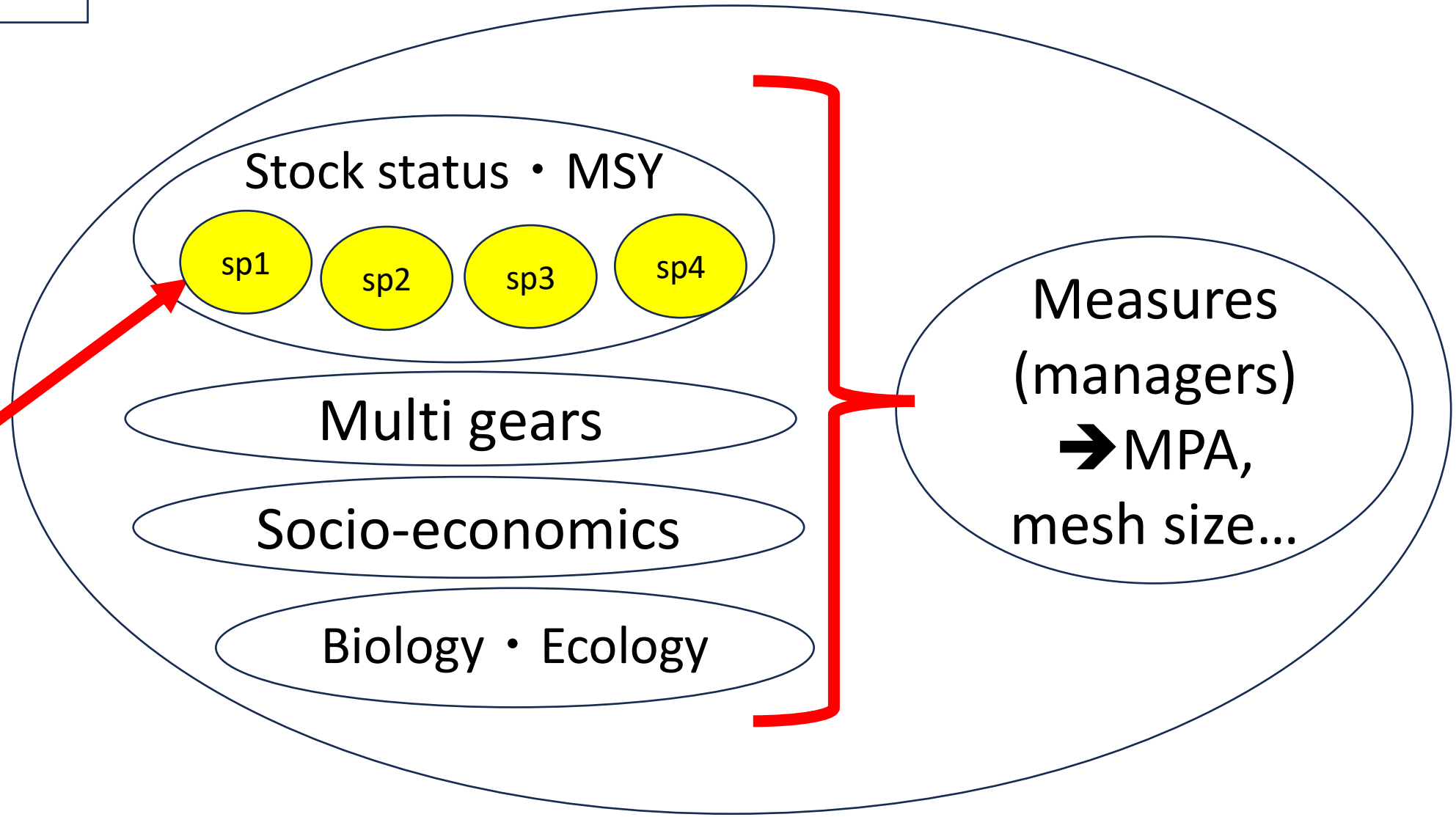
Summary

Multi-gear & Multi-species fisheries Management (MMM)
Manager needs to consider all relevant factor together

Our role

↓

to provide stock status & MSY by single species



Our ultimate goal

Stock assessments (SA) for ALL ☺

➔ no more struggling for SA

➔ No more only for SA experts

Acknowledgements

Terima kasih & Arigato gozaimasu

Drs Fayakun Satria, Lilis Sadiyah and Ririk Sulistyaningsih
National Research and Innovation Agency

to help and organize this meeting !

Acknowledgements again!
Fayakun Satria, lilis Sadiyah and Ririk Sulistyaningsih

Agus Budhiman	Dyah Retnowati	Khom Sakiro	Poppy Retno Andamari	Saraswati
Agustinus Widodo	Edwison Setya Firmana	Kusno Susanto	Prawira Atmaja Rintar	Satria Fayakun
Ali Suman	Fenni Eddrisea	Mahiswara	Reniwatenu	Saut Tampubolon
Bachtiar Gafa	Hari Eko Irianto	Mahiswara Sudardjo	Renny Wulansari	Subhat Nurhakim
Bram Setyadji	Hetty Priyanti Efendi	Muhamad Anas	Riana Handayani	Susiyanti
Budi Iskandar	Hety Hartaty	Mukti Zainuddin	Rista Devi Januar	Wudianto
Budi Nugraha	Imam Musthofa Zainudin	Nilanto Perbowo	Rudi Sujono	

From

National Research and Innovation Agency
Directorate General of Capture Fisheries （DGCF)
Research Institute for Tuna Fisheries (Bali)
Research Institute for Marine Fisheries （BPPL) (Muara Baru)
Research Center for Fisheries Management and Conservation (RCFMC)
Directorate of Fish Resources Management
Ministry of Marine Affairs and Fisheries
Center for Data, Statistic and Information
Harini

Our ultimate goals

Sustainable resources & fisheries (Indonesia)

Training & Collaborative works


Stock assessments for ALL
STOCK ASSESSMENT
SOFTWARE DEVELOPING TEAM
33%
60%
7%
STOCK ASSESSMENT FOR ALL
MENU-DRIVEN SOFTWARE DEVELOPMENT TEAM

Questions,
Comments,
?

Part 2
Training & Collaborative works (future)

If Indonesia is interested in Training & Collaborative works….

[MENU] can offer….

4-5 days training for 3 software

➔ CPUE_Manager ＋ ASPIC_Manager + Kobe I+II Manager

October or November, 2024

JABBA_Manager will be in 2025

If OK, we will have collaborative works
for 2 most important species to manage (Indonesia)
using [MENU] software

For your information

Sri Lanka	Pelagic (Spotted Sardinella & Indian Mackerel)
Thailand	Demersal (threadfin breams + Lizardfish)
	Fresh water (Carp)

Why we need Collaborative works?

Practice using real data are much more important, meaningful and our Gool.

This is a good opportunity to attempt important species (Indonesia)

Important conditions

➔**Need minimum 10 year data (catch and CPUE)**

2 species WG (working Group) will be established

Today or intersessionally

Training for Trainers (1st step)
Focus for 6 core participants

Training will be concentrated to 6 persons

(from 2 WGs & others)

[MENU] will make sure that 6 persons learn perfectly

Core participants (trainers) can train others (future)

Trainings & Collaborative works (summary)

Training for trainers (Oct/Nov, 2024)(4-5 days)

Collaborative works (2 WGs) (2025-2026)

WG1 (species A)

WG2 (species B)

Others

Core participants
(max 6 persons)
(must learn perfectly)
[MENU]
(Responsibility)
↓
future trainers

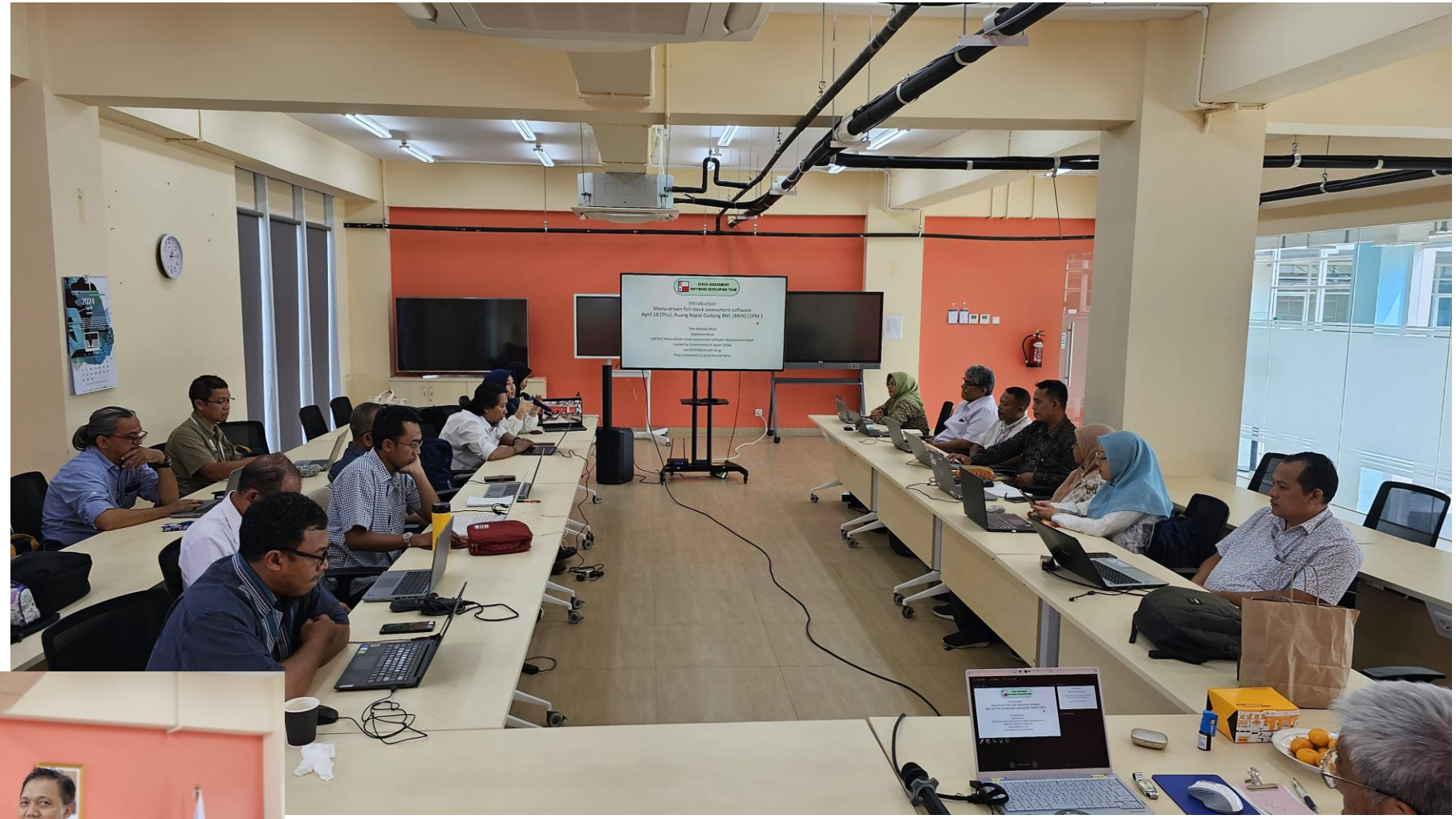
Observers
(welcome)
& others
↓
can be learned from core participants (trainers)

Workshops
Intersessional works
(SEAFDEC will cooperate)
↓
Publication

Appendix Participants

1. Dr. Erfind Nurdin, S.Pi., M.Si
2. Dr. Khairul Amri, S.Pi., M.Si
3. Moh Natsir, S.Pi, M.Si, Ph.D
4. Lilis Sadiyah, S.Si., Ph.D
5. Dr. Thomas Hidayat, A.Pi., M.Si
6. Dr. Tegoeh Noegroho, S.ST.Pi., M.Si
7. Drs. Karsono Wagiyo, M.Si
8. Umi Chodrijah, S.P., M.Si
9. Anthony Sisco Panggabean, S.Si., M.Si
10. Asep Priatna, S.Pi., M.Si
11. Prihatiningsih, S.Pi., M.Si
12. Duranta Diandria Kembaren, S.Pi., M.Si
13. Moh. Fauzi, S,Si., M.Si
14. Tirtadanu, S.Pi., M.F.Sc
15. Muhammad Taufik, S.T, M.Si
16. Andina Ramadhani Putri Pane, S.Pi, M.M
17. Ririk Kartika Sulistyaningsih, S.Pi, M.App.Sc
18. Ralph Thomas Mahulette, S.Pi, M.Si
19. Nurulludin, S.St.Pi, M.Si
20. Pratiwi Lestari, S.Si., M.Si


Le Minerale


STOCK ASSESSMENT
SOFTWARE DEVELOPING TEAM
Introduction
Menu-driven fish stock assessment software
April 18 (Thu), Ruang Rapat Gedung BNC (BRIN) (1PM-)