Menu-driven software series (No. 3)

JABBA_MANAGER (VER 1.3.6) Manual

(May, 2025**)**

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[MENU]© Menu-driven stock assessment software development team(Japan)
https://www.esl.co.jp/assets/menu

Supervised by Dr Sheng-Ping Wang
Professor National Taiwan Ocean University
Peer reviewed by Dr Doug Butterworth
Professor Emeritus, University of Cape Town

Note: The current version is 1.3.6. Some software images show older versions, which is not a problem as they are the same.

ACRONYMS

AR	AutoRegressive model
ASPIC	A Stock-Production Model Incorporating Covariates
B_{MSY}	Total biomass or Spawning Stock Biomass at MSY
CI	Confidence Interval
CPUE	Catch Per Unit Effort
CV	Coefficient of Variation
DevTools	R package for web-developer tool
EC	Equilibrium Condition
F_{MSY}	Fishing mortality at MSY
GitHub	Git (file management tool) + Hub(center) (Internet hosting service)
HCR	Harvest Control Rule
JABBA	Just Another Bayesian Biomass Assessment
JABBA_Manager	Menu-driven software for JABBA
JAGS	Just Another Gibbs Sampler
MASE	Mean Absolute Scaled Error
MCMC	Markov Chain Monte Carlo methods
MSY	Maximum Sustainable Yield
OBS	Observed or Observation
PM	Production Model
POR	Portugal
PPC	Posterior Predictive Check
PPMR	Prior to Posterior Median Ratio
PPVR	Prior to Posterior Variance Ratio
psi	Depletion rate (B1/K)
R	Open-source & free programming language for statistical analyses & others
Reshape2	R package to transform data between wide and long formats.
RMSE	Root Mean Square Error
Sigma2	Process variance
SpiCT	Stochastic surplus production model in continuous time
SWO	Swordfish
TAC	Total Allowable Catch
TB	Total Biomass
TB_{MSY}	Total Biomass at MSY

SOFTWARE COPYRIGHT AND TERMS OF USE

[MENU] MENU-DRIVEN STOCK ASSESSMENT SOFTWARE DEVELOPMENT TEAM

- We are happy for everyone to use this software for their important work in fisheries managements.

- As we have many users, we have basic rules for users to utilize our software in a harmonious and trustworthy way.

- Thus, we maintain the current **SOFTWARE COPYRIGHT & TERMS OF USE.** See page 5~8 at https://www.esl.co.jp/products/menu/menu.pdf

- Please kindly follow rules.

Acknowledgements

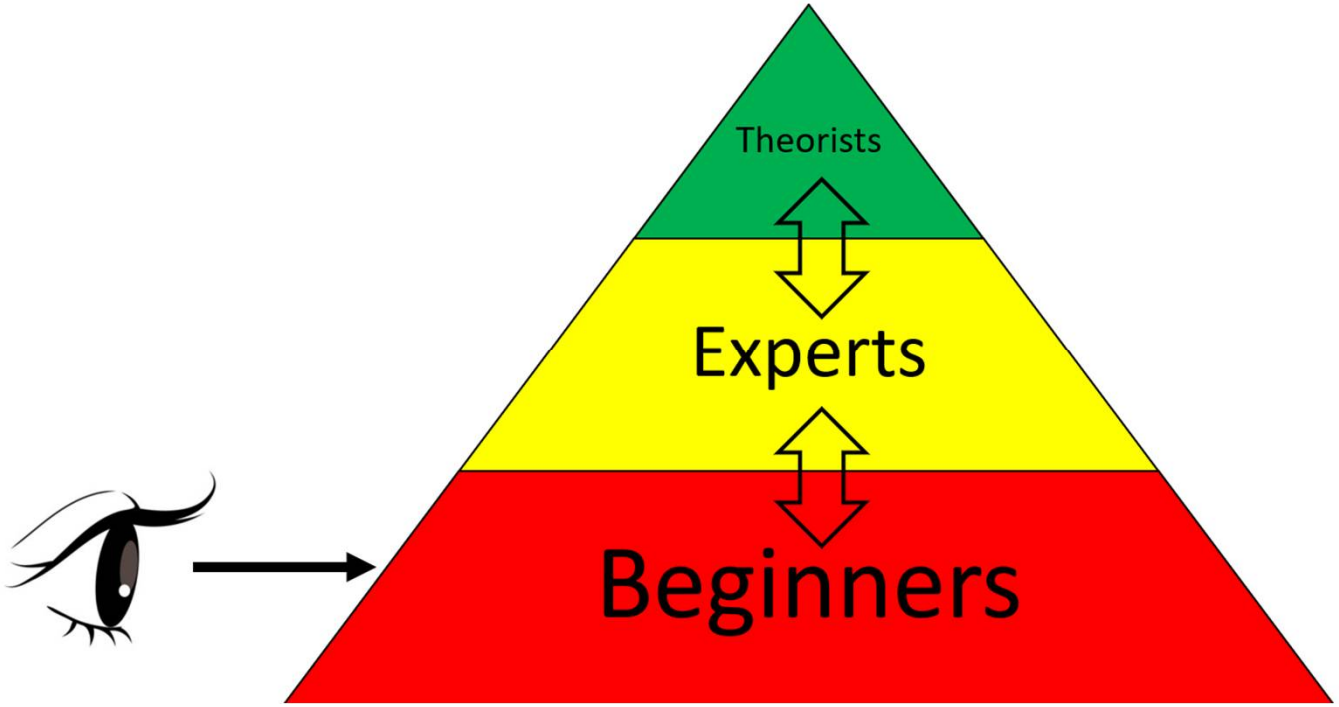
[MENU] Menu-driven stock assessment software development team is very grateful to Dr Henning Winker (FAO) and Dr Ai Kimoto) (ICCAT) for guiding JABBA through its initial learning phase.

We would also like to thank Dr Sheng-Ping Wang (Professor, National Taiwan Ocean University) for supervising this JABBA menu-driven software development and Dr Doug Butterworth (Professor Emeritus, University of Cape Town, South Africa) for peer reviewing.

Contents

1. Introduction
1.1 Backgrounds & JABBA Outline

This menu-driven stock assessment software (JABBA) is for beginners in stock assessments and also, for those who cannot manipulate R and need to run JABBA.
Therefore, this manual uses with less mathematical, statistical formulae & notations and no R commands.



Where does JABBA & this software fit into the classification of stock assessments?
➔ Type 3 : Data rich type with catch, CPUE & Priors.

	Data type	Information	Name (main data)	Data period	Reference Point (RP) (MSY, Fmsy, TBmsy, target & limit RP)	Models & Application (examples)	Implementation (R, code, package) (examples)
TYPE 1	Qualitative	Parameters	No data			• ERA (Ecosystem Risk Assessment) • PSA (Productivity Susceptibility Analysis)	✓ R ✓ Package
TYPE 2	Quantitative	✓ Real data ✓ Parameter valuses ✓ Priors (Bayesian approach)	Data Poor (length)	Shorter (< a few years)	Some available only for short period (snap shot SA)	• Length based models (ELEFAN, FiSAT, Y/R, S/R, LBSPR, Thompson & Bell)	✓ R ✓ Package (FAO & others)
			Data Poor (cach)	Longer (> 10 years pre-ferable)	Some avilable (relative & subject to assumptions)	• Delpetion rate assumed (CMSY & OCOM) • Depletion rate not assumed (ORCS & SSCOM) • Robin-hood methods	
TYPE 3			Data Rich (catch; CPUE; biological paramter values; and/or priors)		Available Realistic & objective (subject to assumptions) (most important for management)	• Surplus Production models (SPM) (ASPIC, SPiCT & JABBA) • Age/size structured model (VPA, ASPM, SCAA, SCAS) • Integrated models (SS, CASAL)	✓ Own codes (SS) ✓ R (JABBA) ✓ MENU driven (JABBA_Manager)

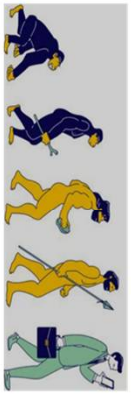
Nishida (2025)

1. Introduction
1.1 Backgrounds & JABBA Outline

- [MENU] Menu-driven stock assessment software development team, has been using ASPIC for the Surplus Production Model (SPM) in its menu-driven stock assessment software.

- However, recently, SPMs have been advanced substantially. (see Table next slide).

Evolution of SPM (Surplus Production Model) Color legend: Green (Advantage) and Yellow (data)

Evolution	Type	Author	Features									Comments
			Non-equilibrium condition	Bayesian approach	Error type				Time	Life history and Selectivity	Data	
					Observation error (CPUE)	Observation error (Catch)	Process error (Model)	Process error (F)	Continuous & Seasonal pattern			
	Original SPM	Shaeffer(1954), PT(1969) & Fox (1970)			YES						Annual catch & CPUE	Original (not recommended)
	ASPIC (ver2~5)	Prager (2004~2013)	YES									Outdated (not recommended)
	ASPIC (ver7)	Prager (2014~)		YES								
	SPiCT (Stochastic surplus production model in continuous time)	Pedersen & Berg (2017)				YES	YES	YES	YES		Quarterly or finer-scale catch & CPUE	Space state (all-in-one SPM) (recommended)
	JABBA (Just Another Bayesian Biomass Assessment)	Winker *et al* (2018)					YES				Annual catch & CPUE	
	JABBA -Select	Winker *et al* (2020)								YES	Annual catch, CPUE & length-composition	Advanced JABBA (suitable for moderate data) (recommended)

(Note) Representative SPMs are listed, while there are many other SPMs (for details, see Cousido-Roch et all, 2022)

1. Introduction
1.1 Backgrounds & JABBA Outline

- Based on the review of the SPM evolution, the best at the present is state space(model describing population change by observation & process errors) based on the Bayesian approach.

- Currently, there are 3 main state space SPM (SPiCT, JABBA & JABBA-Select) for general use, available via GitHub (internet hosting service) including many ready-made useful functions & graphs.

1. Introduction
1.1 Backgrounds & JABBA Outline

Choice of 3 models depends on the available data

JABBA	: Annual catch and CPUE data
JABBA-Select	: Annual catch, CPUE data and length-composition data
SPiCT	: high-resolution data, such as quarterly (or finer-scale) catch and CPUE data.

1. Introduction
1.1 Backgrounds & JABBA Outline

- Cousido-Rocha *et al* (2022) notes that SPiCT includes all important functions (see Table below).

	ASPIC	SPiCT	JABBA
R package	`connectASPIC`	`spict`	`JABBA`
(*) Type of formulation	Continuous-time	Continuous-time	Discrete-time
C_t observation error	✗	✓	✗
I_t observation error	✓	✓	✓
B_t process error	✗	✓	✓
F_t process error	✗	✓	✗
F_t seasonal patterns	✗	✓	✗
Projections	✓	✓	✓

Type of time formation (continuous & Discrete-time) are different among models

Only SPiCT can handle continuous time

See the next slide for details.

What is type of time formation (Continuous & Discrete-time)?

- A continuous-time model uses differential equations in time, and consequently can provide values of biomass, for example, at any point of time through the year.

- A discreet-time model (this includes JABBA) considers time jumps of one-year (usually), so gives biomass & other values only at the start of each year.

Why we choose JABBA ?

- We mainly use annual based data thus the data are not finer time resolution (good for JABBA-Select) nor continuous time data (good for SPiCT).
- Thus, we selected JABBA.
- In addition, JABBA has many useful ready-made graphs and results outputs.

We now introduce an outline & features of JABBA.

1. Introduction
   1.1 Backgrounds & JABBA Outline

Outline
JABBA (Winker *et al*, 2018)

(1) JABBA is an open-source modelling software under the class of generalized Bayesian State-Space Surplus Production Model;

(2) JABBA presents a unifying, flexible framework for biomass dynamic modelling, runs quickly and generates reproducible stock status estimates and diagnostic tools; and

(3) In recent years, this software has been widely applied in stock assessments around the world.

1. Introduction
   1.1 Backgrounds & JABBA Outline

JABBA: General features

- Integrated state-space tool for averaging multiple CPUE series;
- Fox, Schaefer or Pella Tomlinson production function;
- Advanced automatic fitting of multiple CPUE time series & associated standard errors;
- Data-weighting through estimation of additional observation variance for individual or grouped; and
- Inbuilt retrospective & hindcasting run and plotting options.

Comparison between ASPIC and JABBA

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

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

JABBA: Features in details

Graphics

- a suite of inbuilt graphics illustrating model fit diagnostics & stock status results.
- Kobe-type biplot plotting functions

Diagnostics

- Residual & MCMC diagnostics
- Model diagnostic tools

Estimation

- Estimating Catch with Error
- Estimating the shape of posterior for a given input prior
- Optional estimation additional observation variance for CPUE time series
- Estimating or fixing the process variance

Projection

- Future projections for alternative catch regimes
- Forecasting for alternative TACs

2 features in this software

(1) 2 models (Schaefer + Fox) are used

Pella Tomlinson is not used as Schaefer or Fox normally used as standard.

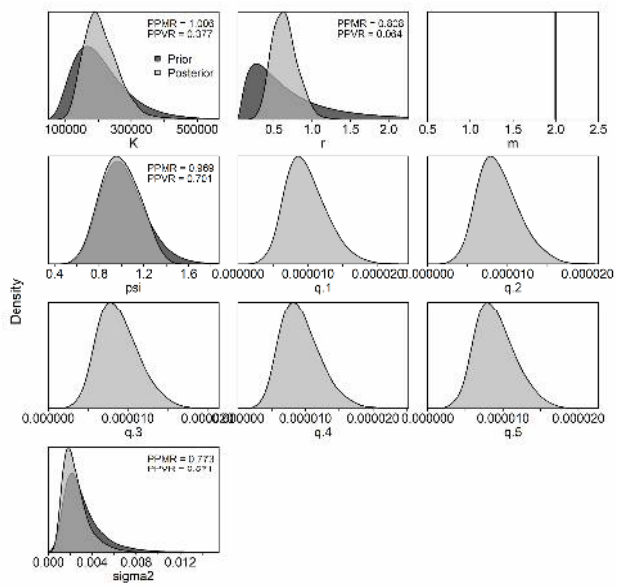
(2) **2 steps approach to estimate Posterior Probability Distribution Function of r and K**

1st step : range model (constant function) ➔ 2nd step: log normal model

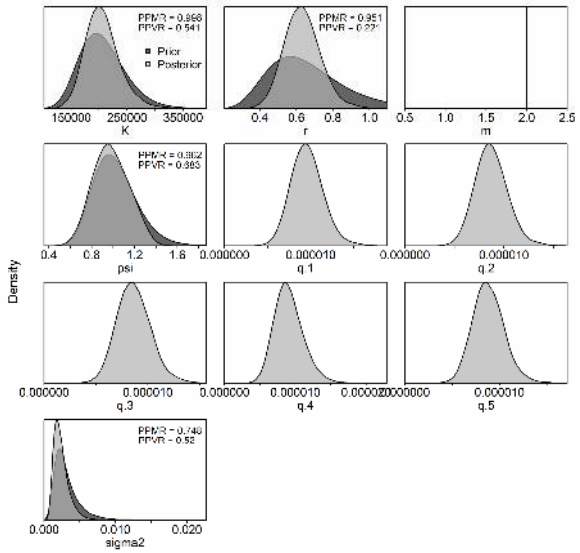
- 1st step: the constant model will estimate the initial (log normal) Posterior Probability Distribution Function(*).
- 2nd step: (*) will be used as the prior information for the log normal model (2nd step), then the final Posterior Probability Distribution Function will be estimated.

Note: This 2 steps approach uses the same data twice, both in the likelihood to give the posterior at step (1), and then again in step (2) when producing the posterior for that. Thus, this approach will provide less uncertainties and overconfident of parameters. To avoid these problems, we will change to the 1 step (normal) approach (for r and K) in the next version, which will be the standard Bayesian approach.

1st step
r, K & q: constant
psi (depletion): log normal
sigma2 (process error) : inverse gamma (4, 0.01)



2nd step
r, K & q: log normal function
psi (depletion): log normal
sigma2 (process error) : inverse gamma (4, 0.01)



Note
(1) For the constant function, JABBA internally estimates log-transformed values, thus plots are the dorm shape (not flat shape).
(2) The initial estimated function is presented in light and the 2nd estimated posterior function in dark.
(3) PPMR/PPVR is Prior to Posterior Median/Variance Ratio.
(4) If ratios are close to 1, which means that posteriors (estimated values) are close to prior values.

JABBA: Features in details

Graphics

- a suite of inbuilt graphics illustrating model fit diagnostics & stock status results.
- Kobe-type biplot plotting functions

Diagnostics

- Residual & MCMC diagnostics
- Model diagnostic tools

Estimation

- Estimating Catch with Error
- Estimating the shape of posterior for a given input prior
- Optional estimation additional observation variance for CPUE time series
- Estimating or fixing the process variance

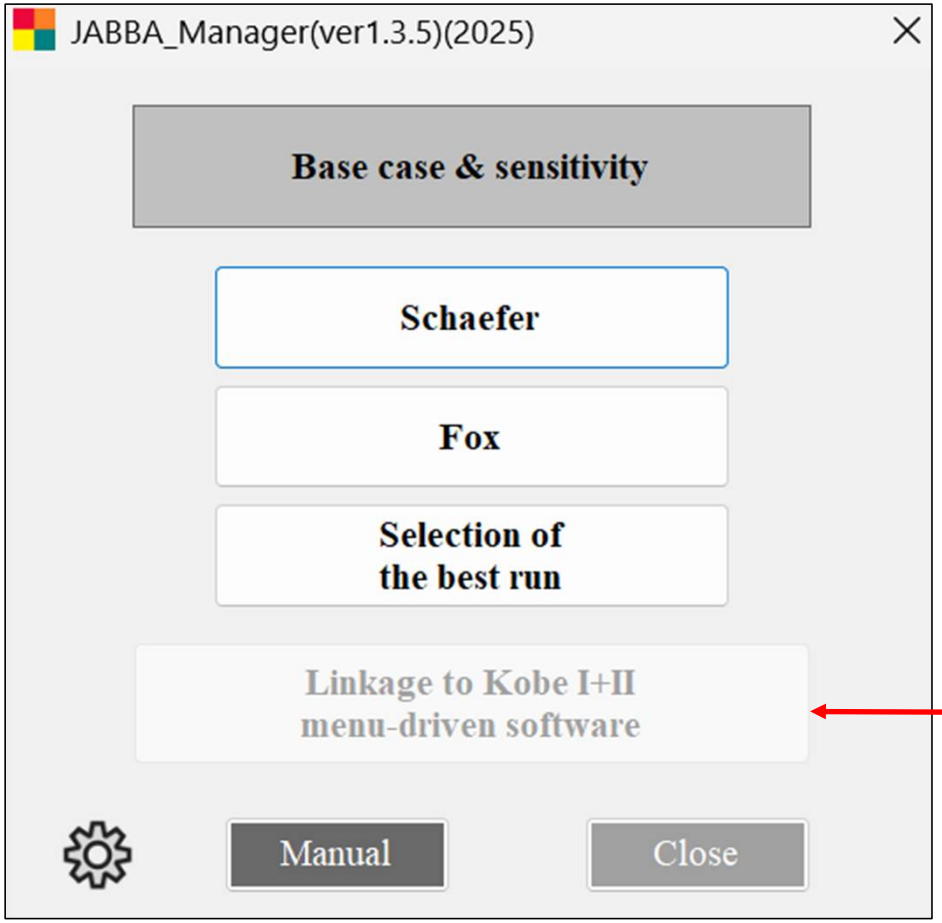
Projection

- Future projections for alternative catch regimes
- Forecasting for alternative TACs

1. Introduction
1.2 JABBA application to the menu driven software : Base case and sensitivity runs

- This software can implement both base case & sensitivities runs.
- The initial selection of the few most plausible runs are selected using key diagnostics available in page 3~4 of the Report.
- The best runs is selected by 14 diagnostics (refer to Selection form available in the 3rd menu).

JABBA sub-menu



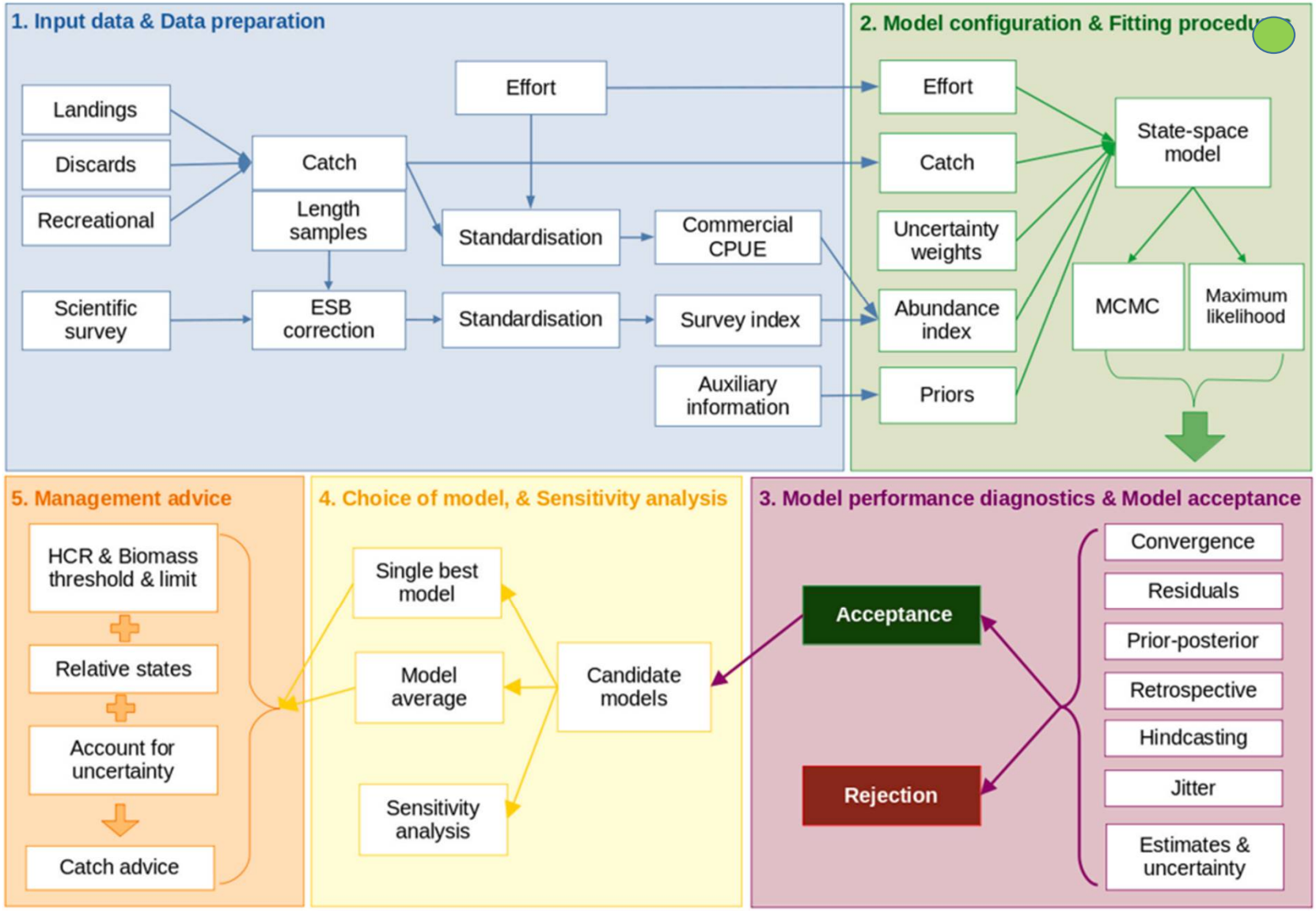
To be completed by 2026.

1. Introduction
1.2 JABBA application to the menu driven software

Implementing JABBA_Manager menu driven software

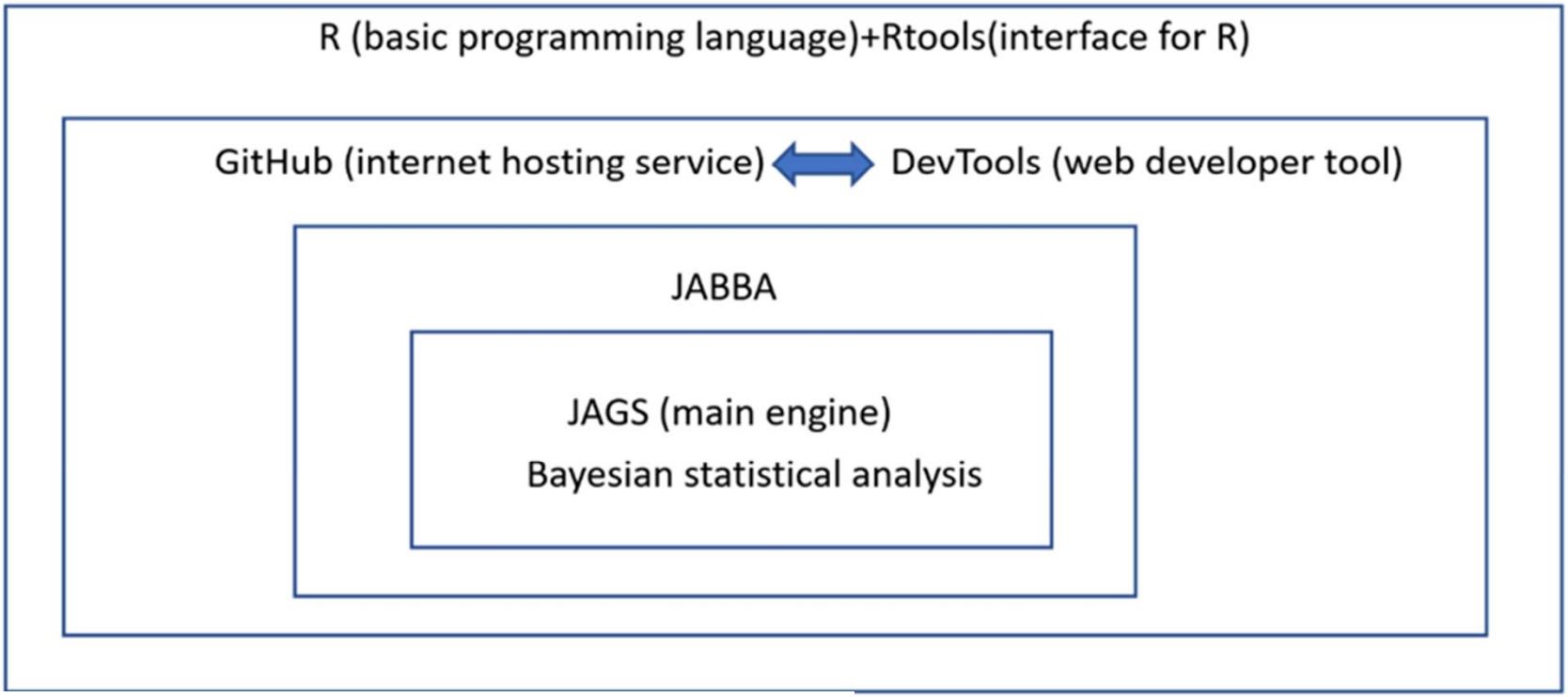
We follow suggestions made by "Good practices for surplus production models"

Kokkalis *et al.* (2024)



1. Introduction
1.2 JABBA (sub-menu) application to the menu driven software

Schematic diagram of JABBA components and their relations



Note: GitHub (Internet hosting service)
JAGS (Just Another Gibbs Sampler)

For details, refer to Section 2

Contents : Section 2 Preparations

2. Preparations
2.1 Requirements for PC & Remarks

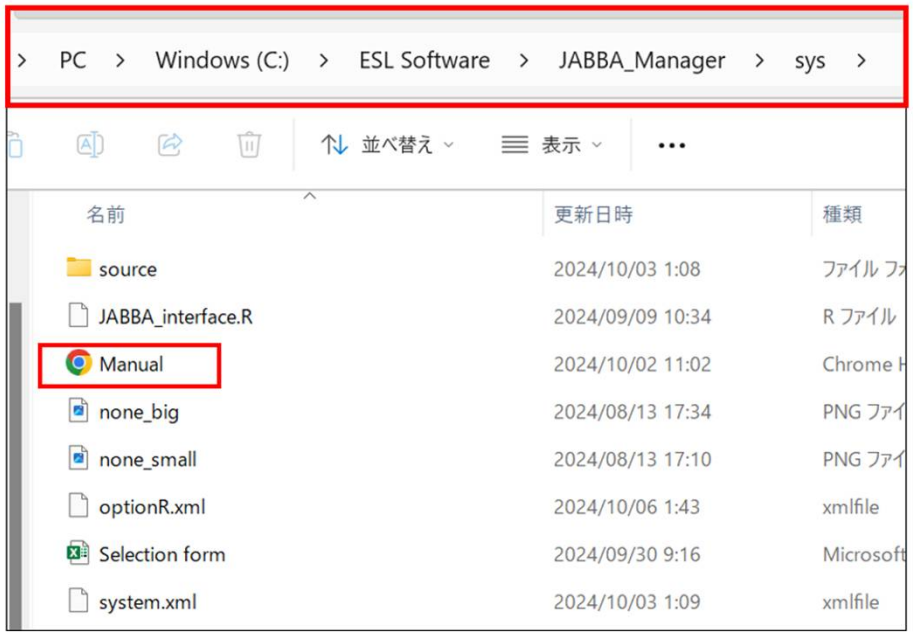
(1) Requirements for PC

- Screen resolution: 800x700 pixels or higher.
- If the menu & sub-menus do not fit within the screen, set the display setting in Windows to 100%.
- Operation System: MS window 10 or 11 (OS should be updated).
- **NOT applicable for MAC (apple) PC.**
- 64bit PC.
- RAM: minimum 2GB.
- Basic software (Word, Excel and Notepad)
- To make smooth operations, users need at least 30% of empty space of the hard disk.

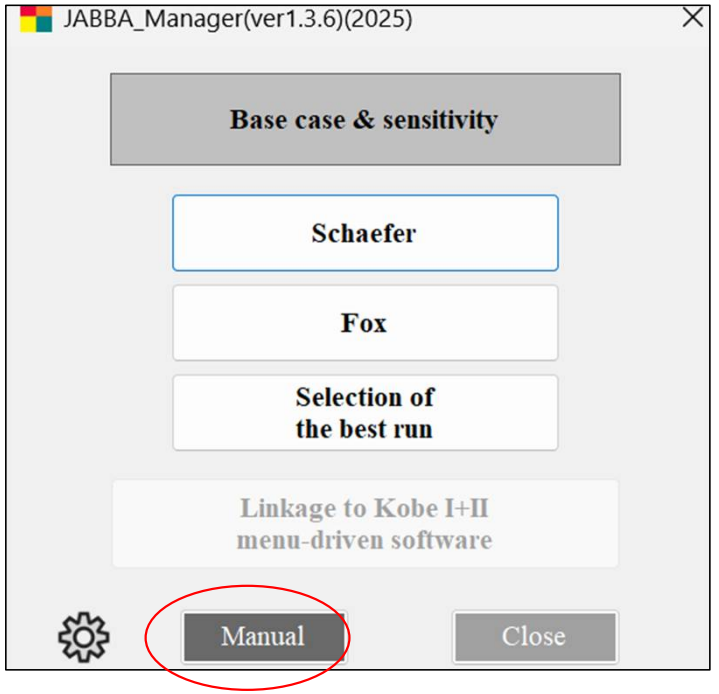
2. Preparations
2.1 Requirements for PC & Remarks

(2) Remarks (1/2) Manual

- This PowerPoint is the manual.
- Users can get the manual from ESL Software folder (PDF file) (see below).



- Manual is also available in the “call button” located in the main menu (see below)



(2) Remarks (2/2)

Keep the original files (important)
Don’t use original files. Make copies & use copies as work files like wk1, wk2, etc.

Operation by mouse
This manual explains operations based on “mouse”.
For “touch panel” or “key board”, follow corresponding manipulations.

Save
Save files frequently.

2. Preparations
2.2 Installation

2.2 Installation

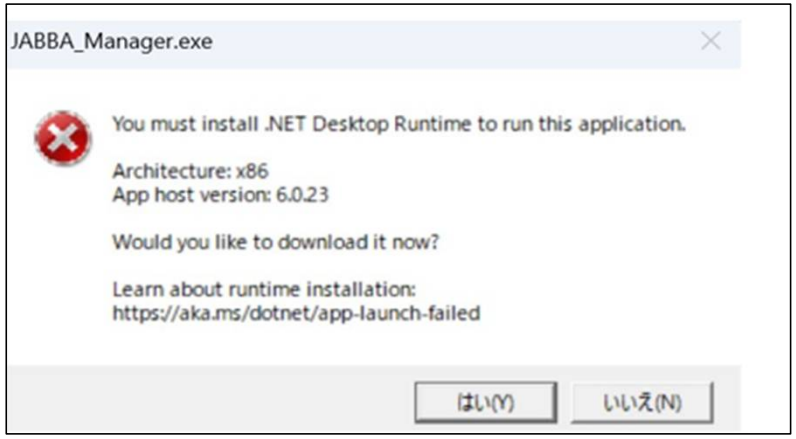
- 2.2.1 Internet environment
- 2.2.2 Microsoft .NET framework
- 2.2.3 R
- 2.2.4 JAGS
- 2.2.5 DevTools
- 2.2.6 Reshape2
- 2.2.7 JABBA_Manager

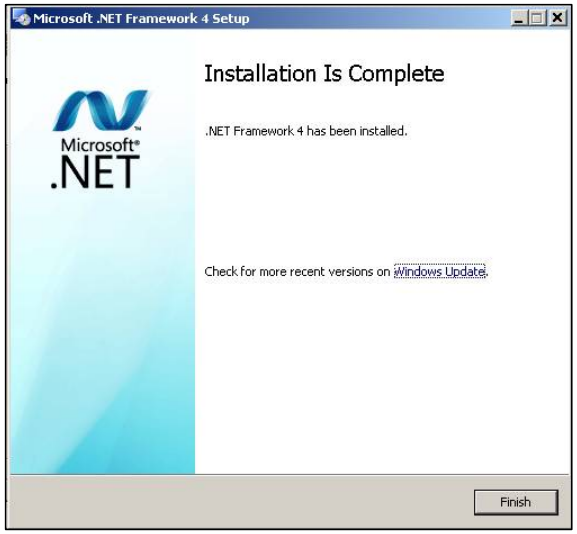
2. Preparations
2.2 Installation
2.2.1 Internet environment

- Use fiber optic internet
- Do not use a proxy internet (proxy server)
  - ➔ Sometimes its security system is too strong to install.
  - ➔ This was experienced in Sri Lanka

2. Preparations
2.2 Installation
2.2.2 Microsoft .NET framework

- Normally MS .NET framework is pre-installed.
- If not, users will see the warning during the installation (below left).
- Then install the newest version(right).





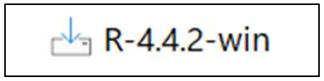
2. Preparation
2.2 Installation
2.2.3 R

If users currently use R-4.4.1, please continue to use.

If users don't have R-4.4.1, please Install R-4.4.2-win

(83MB, zipped)(187MB: unzipped) from

Download R-4.4.2 for Windows

Users will get the installer (zip file) 

then unzip & install.

What is R?

"R" is an open-source and free programming language that is widely used as a statistical software, data analysis and graphic tool.

2. Preparation
2.2 Installation
2.2.4 JAGS

Install JAGS-4.3.1 (installer : zipped 25MB) & Unzipped (98MB)
Download from
https://sourceforge.net/projects/mcmc-jags/files/

Users will get the installer

JAGS-4.3.1

Then unzip & Install.

2. Preparation
2.2 Installation
2.2.4 JAGS

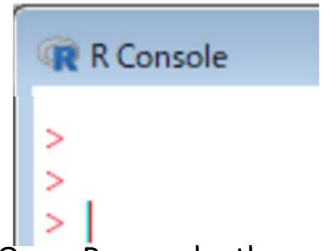
What is JAGS?
(Just Another Gibbs Sampler)

Application to execute
Bayesian models by MCMC
(developed by Dr Gibbs)

JAGS is the main engine for JABBA
（MCMC for JABBA)

2. Preparation
2.2 Installation
2.2.5 Devtools (R application)

- Users need to install “devtools” using the R console.



- Open R console, then execute (type)

  install.packages("devtools")

  Select “Yes” 2 times from choices (Yes/No/…)
- Enter then users will see the window (right)
- Then Click OK to finish.

*(Chrome) **DevTools** is a set of web developer tools built directly into the Google Chrome browser.*

2. Preparation
2.2 Installation
2.2.6 Reshape2 (R application)

- Users need to install “devtools” using the R console (see the previous page),
- Open R console, then execute (type)

  install.packages("reshape2")
- Enter, then users will see the window (right)
- Then Click OK to finish.

Data Reshaping in R (Reshape) is something like arranged rows and columns in your own way to use it as per your requirements.

2. Preparation
2.2 Installation
2.2.7 JABBA_Manager

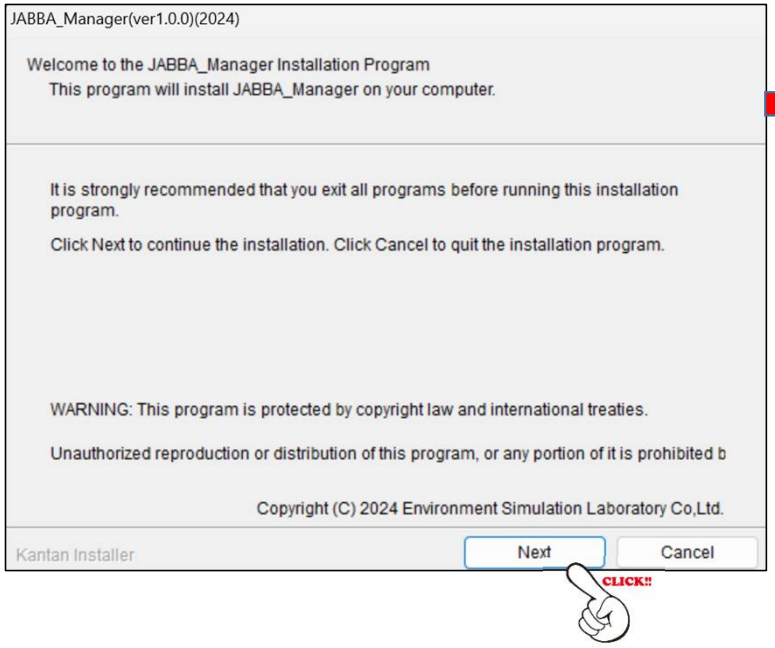
Users will get the download link (installer) from [MENU]

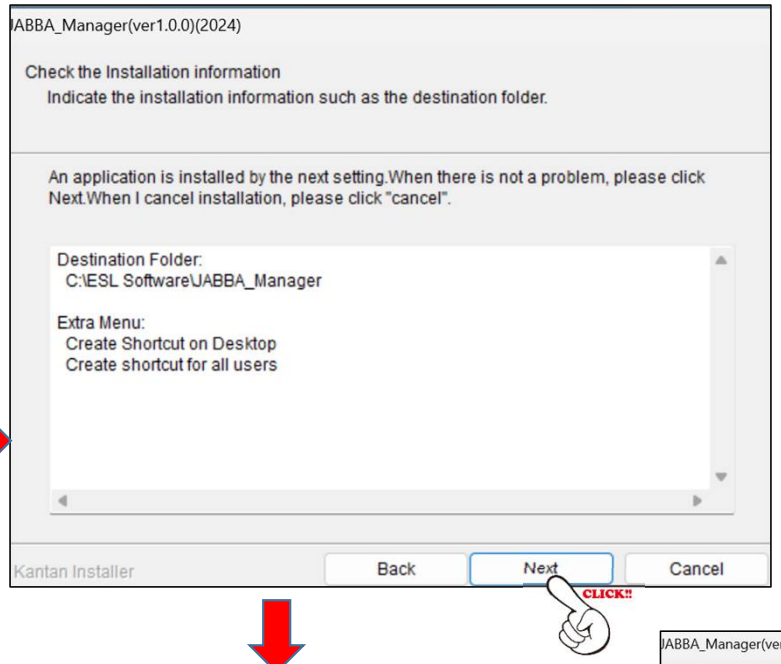
Double click the zipped installer

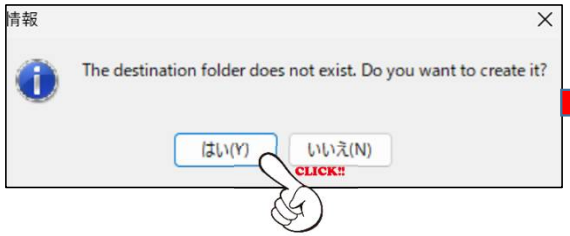
Installer (download folder)

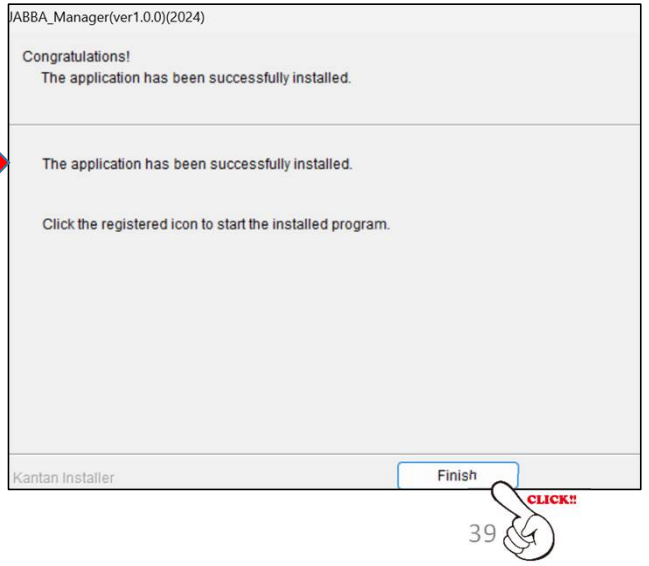
Installer (desktop)

2. Preparation
2.2 Installation
2.2.7 JABBA_Manager









2. Preparation
2.2 Installation
2.2.7 JABBA_Manager

Users will get the icon in the desktop, then double click.

If users have already Installed ".NetCore6.0", users will see the main menu (see next page).

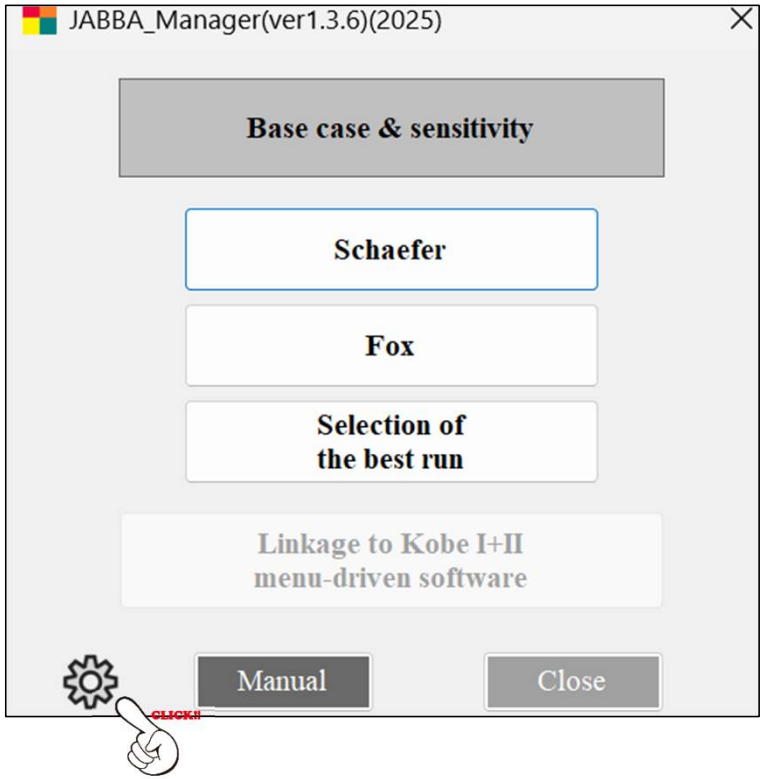
If not, users will be asked to install. Follow the instruction.

After completed, double click the icon again. Then users will see the main menu (see next page).

2. Preparation
2.2 Installation
2.2.7 JABBA_Manager

Users will get the icon in the desktop

Then, users will see the main menu.



Linkage to R

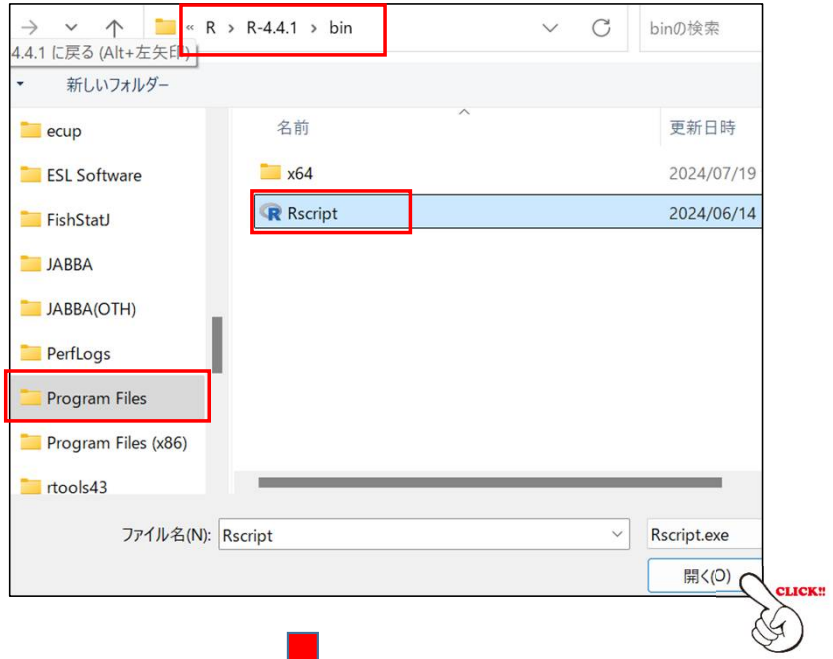
Before using the software, users need to link to R.

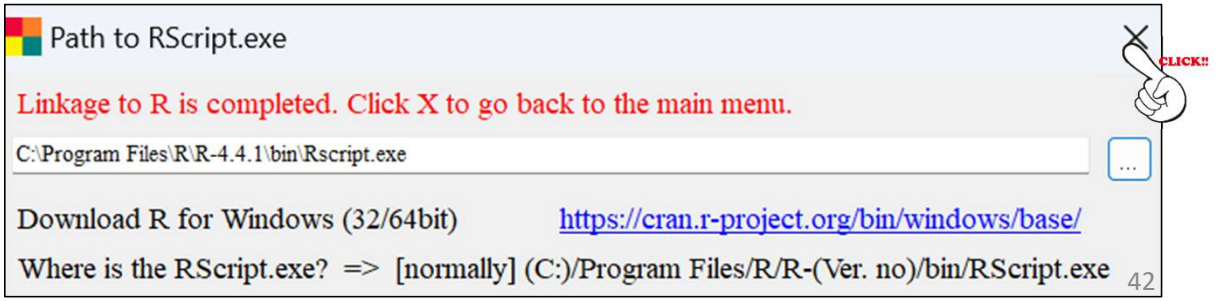
To do it, click the gear mark (lower left corner)

2. Preparation
2.2 Installation
2.2.7 JABBA_Manager

Users will see the window below to link to R (R-4.4.1 or R-4.4.2)

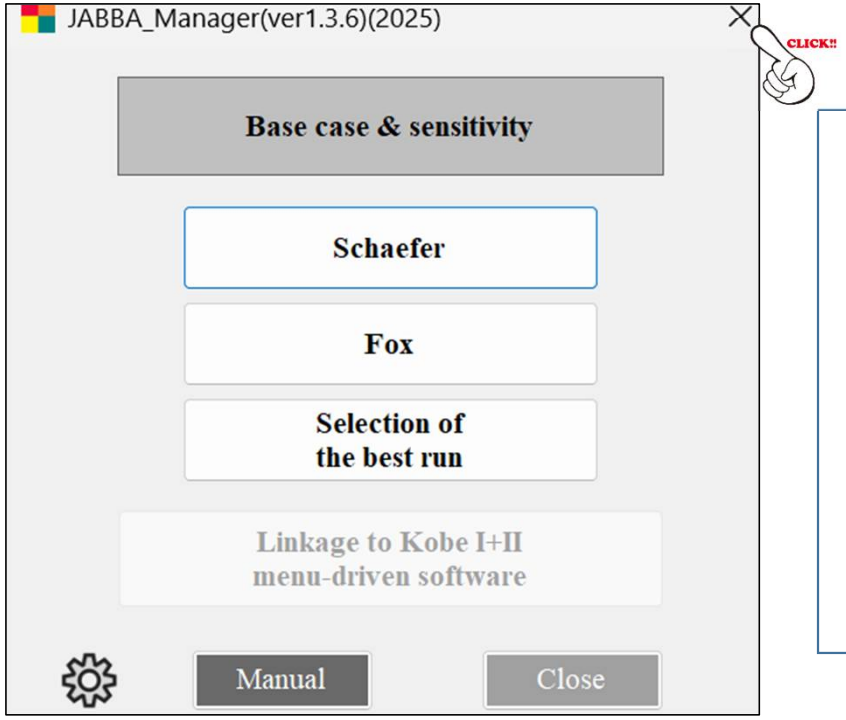
Then users will identify Rscript





2. Preparation
2.2 Installation
2.2.5 JABBA_Manager

Then, users will see the JABBA main menu again.



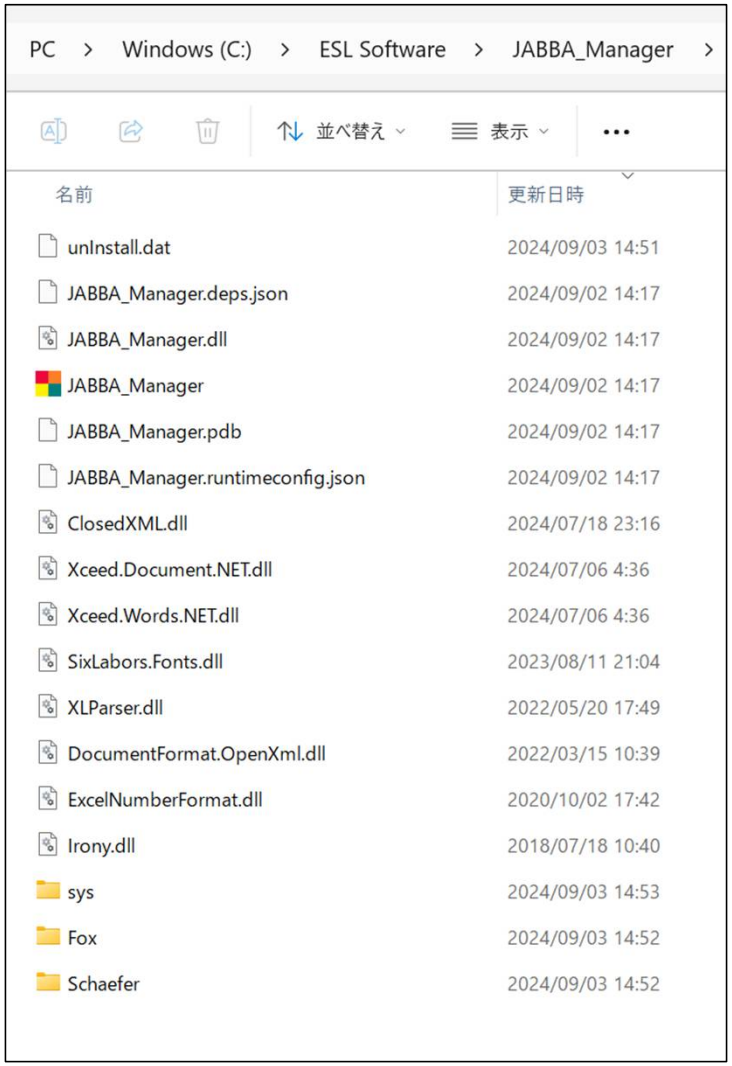
Now users are ready to use the software.

If users want to finish the software, click X.

2. Preparation
2.3 Uninstallation

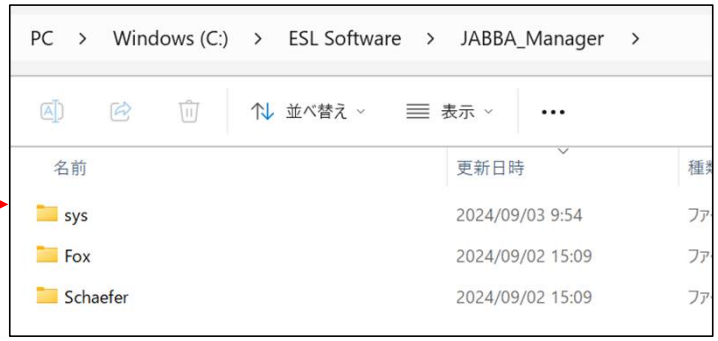
- When the new version of the menu driven JABBA_Manager is released, users need to re-install.
- Before re-installment, users need to un-install the current version.
- To un-install, users follow the normal procedures.
- After completed, some files & folders are still remained, which should be deleted (see next).

2. Preparation
2.3 Uninstallation



Original full folders & files before in-installation

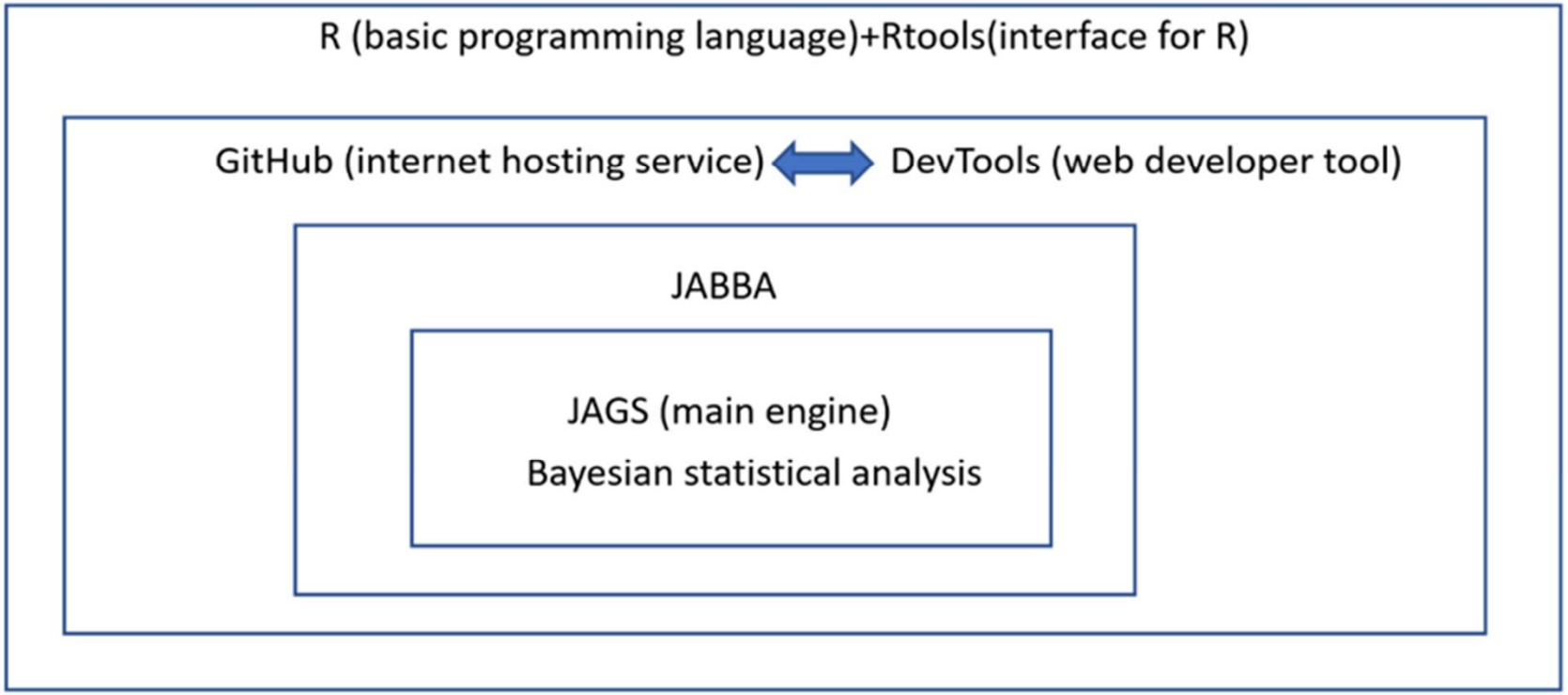
- Some folders & files in JABBA_Manager are not completely deleted in the ESL software folder (see lists before & after).
- Users need to delete left-over files & folders manually.



Left-overs after un-installation, which should be deleted manually.

2. Preparation
2.4 Schematic diagram of JABBA

Schematic diagram of JABBA components and their relations



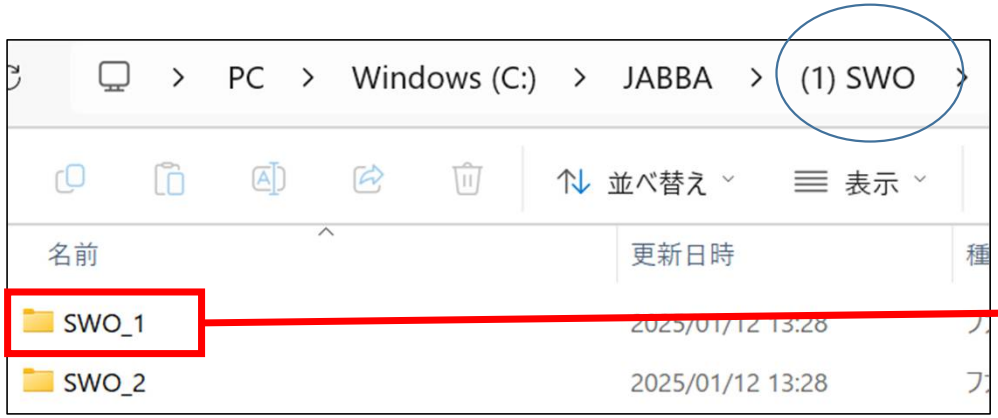
Note: JAGS (Just Another Gibbs Sampler)

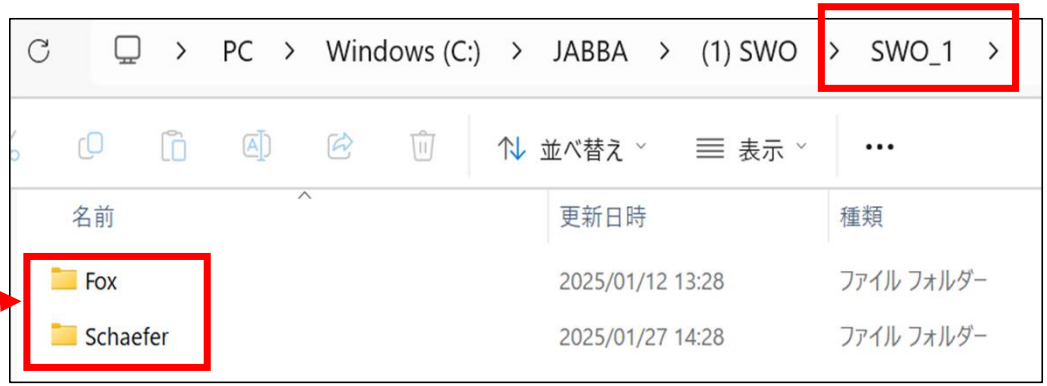
2. Preparation

2.5 Setting up folders & files

2. Preparation
2.5 Setting up folders & files

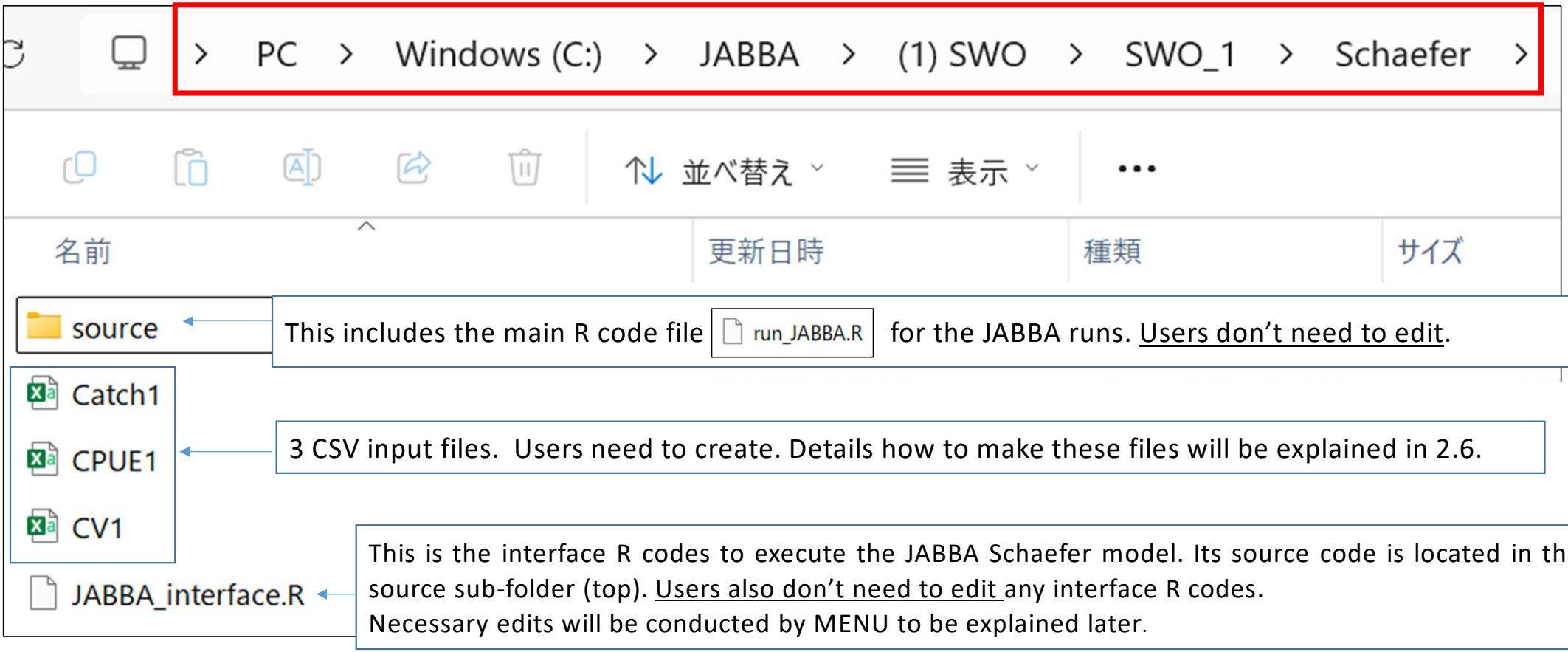
- Users need to create their own “base folders” as shown below (for our example, “JABBA”).
- Then, users need to create the working species folder, for our case, (1) SWO.
- Users need to create a few sub-folders (for our case, SWO_1 & SWO_2).
- This is because we normally need 1 or 2 runs to get the satisfactory results.
- In each sub-folder, we have 2 additional sub-folders, i.e., Schaefer & Fox.





Setting up sub folders & files (Schaefer & Fox).

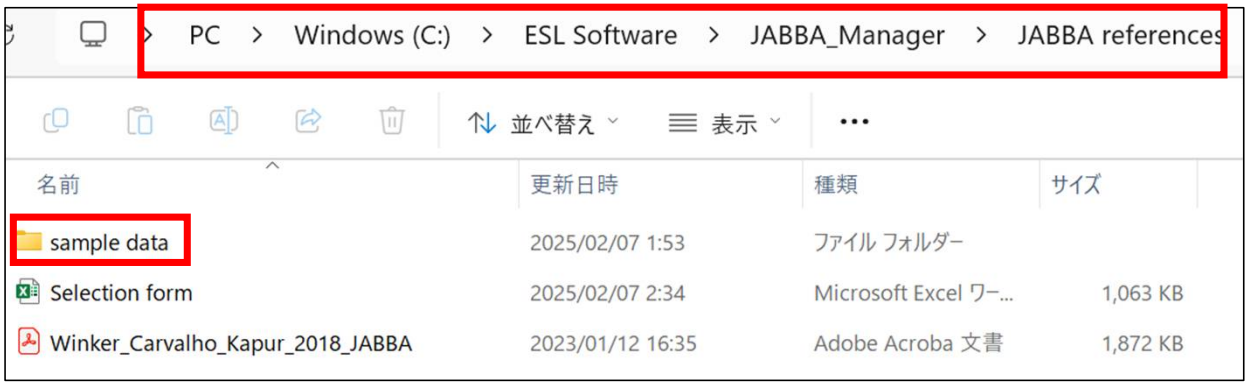
Set (1) 3 sample data files, (2) one R code and (3) one R code folder (see below). How to get these? (see next)



2. Preparation
2.5 Setting up folders & files

How to get the sample data and R codes ?

Location
(ESL software folder in C:)



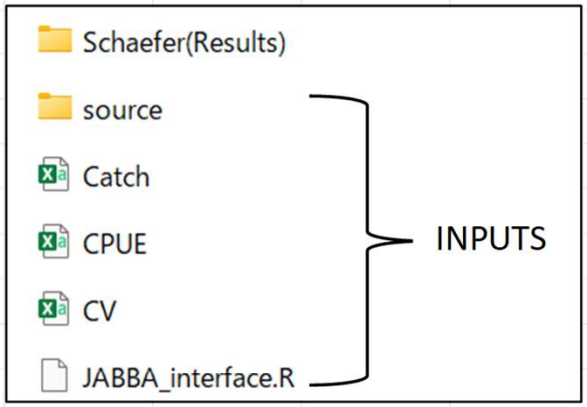
Copy & pastes
1 folder & 4 files
to your PC

Setting up working folders & files

Types of folders depend on objectives as examples below.

Main folder	Sub-folders			Model folder (fixed)
Species code	Scenario (examples)	Objectives	Examples	Model
SWO	SWO_1	To explore to find the best run	1st (trial run)	Schaefer
				Fox
	SWO_2		2nd (improved & best run)	Schaefer
				Fox
YFT	YFT_0.2	To explore to find the best depletion run	3 different depletion rates	Schaefer
				Fox
	YFT_0.4			Schaefer
				Fox
	YFT_0.6			Schaefer
				Fox
KAW	KAW_1	To explore to find the best run among base case & sensitivities	Base case	Schaefer
				Fox
	KAW_2		Sensitivity-1	Schaefer
				Fox
	KAW_3		Sensitivity-2	Schaefer
				Fox

In each model folder, there are INPUT (4 files & 1 folder) and RESULT (one result folder after run) (below is an example for Schaefer).



2. Preparations
2.6 Input Data (catch, CPUE & CV)

What are the contents of 3 CSV files ?

2. Preparations
2.6 Input Data
(catch, CPUE & CV)

SWO
example
1950-2021

Catch1.csv

	A	B
1	Year	Catch
2	1950	43
3	1951	41
4	1952	44
5	1953	65
6	1954	213
7	1955	275
8	1956	602
9	1957	425
10	1958	625
11	1959	641
12	1960	733
13	1961	934
14	1962	1116
15	1963	1030

66	2014	30268
67	2015	33812
68	2016	32958
69	2017	34924
70	2018	32804
71	2019	35256
72	2020	28783
73	2021	24528

Catch in tons

CPUE1.csv

5 fleets (codes)

	A	B	C	D	E	F
1	Year	POR	JP_NW	JP_NE	JP_SW	JP_SE
2	1950					
3	1951					
4	1952					
5	1953					
6	1954					
7	1955					
8	1956					
9	1957					
10	1958					
11	1959					
12	1960					
13	1961					
14	1962					
15	1963					

Data (1964~2013) is omitted

66	2014	0.733996	0.609026	1.119838		1.120943
67	2015	0.993452	1.191272	1.142645		0.867262
68	2016	0.8738	1.038984	1.562399		0.713356
69	2017	0.850906	1.257384	1.128261		0.641172
70	2018	0.848653	0.799839	1.195143		0.688178
71	2019	0.767575	0.955657	1.309505		0.601613
72	2020	0.786825	0.920594	1.46646		0.924082
73	2021	0.773936	0.962075	1.315307		0.67318

CV1.csv

	A	B	C	D	E	F
1	Year	POR	JP_NW	JP_NE	JP_SW	JP_SE
2	1950					
3	1951					
4	1952					
5	1953					
6	1954					
7	1955					
8	1956					
9	1957					
10	1958					
11	1959					
12	1960					
13	1961					
14	1962					
15	1963					

66	2014	0.2	0.2	0.2		0.2
67	2015	0.2	0.2	0.2		0.2
68	2016	0.2	0.2	0.2		0.2
69	2017	0.2	0.2	0.2		0.2
70	2018	0.2	0.2	0.2		0.2
71	2019	0.2	0.2	0.2		0.2
72	2020	0.2	0.2	0.2		0.2
73	2021	0.2	0.2	0.2		0.2

CV=0.2 or SE value
in CPUE standardization

No data or missing data for CPUE and CV ➔ blank

2. Preparations
2.6 Input Data
(catch, CPUE & CV)

Important Remarks

[Catch]

- Catch unit can be either tons or Kg.
- Catch need to be continuous (no missing years).
- No 0-catch data is allowed. 1 can be entered for 0.
- Minimum 10 years of catch data are preferred for reliable assessments.

2. Preparations
2.6 Input Data (catch, CPUE & CV)

Important Remarks

[CPUE]

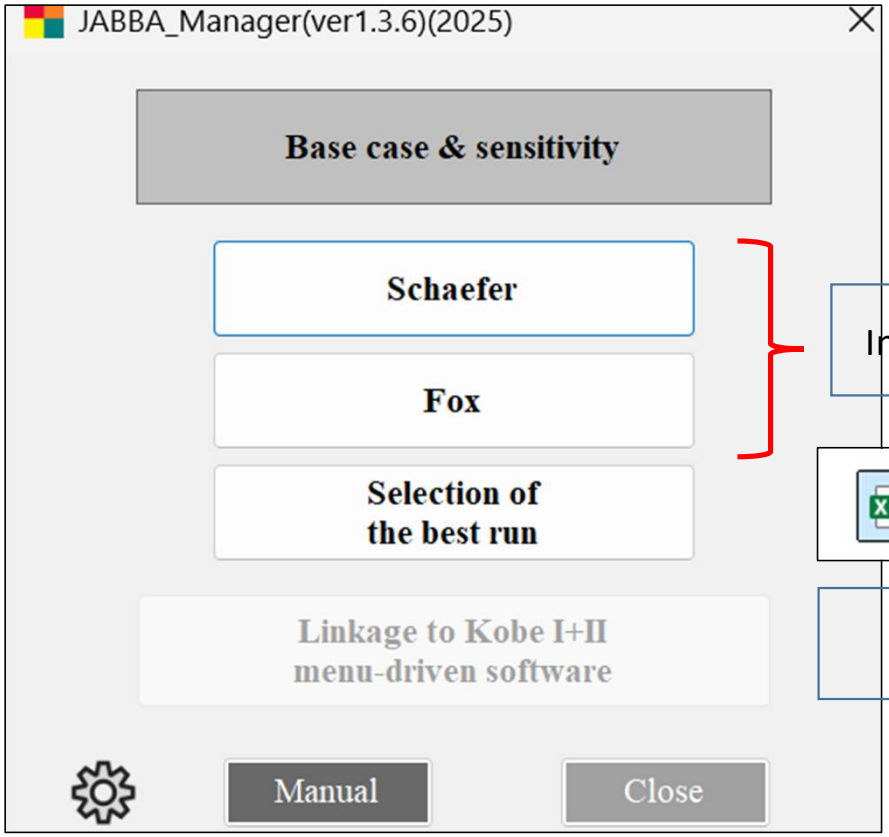
- Maximum 6 fleets of CPUE can be used due to the constraint in the software, although the original JABBA can accept more than 6 fleets.
- Minimum 10 years of CPUE data are preferable.
- Missing CPUE data are allowed, which should be minimal for effective time series analyses for AR(Auto Regressive model).
- CPUE at least recent 6 years need to be no missing data to implement retrospective & hindcast analyses.
- If missing data in recent years, average CPUE in years before & after can be substituted.

2. Preparations
2.6 Input Data (catch, CPUE & CV)

Numbering for Catch, CPUE & CV

- Any number & combination can be assigned
- Fox example, Catch0, CPUE1, CV3
- But same numbers like Catch1, CPUE1 & CV1 are easier for users to handle and distinguish.

2. Preparations
2.7 MENU



Input ➔ run ➔ Output ➔ Report

Selection form

To be completed by 2026

Section 3
JABBA runs (Schaefer▪Fox)
(Base case & sensitivity)

3. JABBA runs (Schaefer･Fox）

3.1 Outline

3.2 Virgin stock

(1) Swordfish (SWO)

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run

Sensitivity : No need as results are acceptable.

3.3 Non virgin stock

(1) Indian Mackerel (IM)

Schaefer + Fox : Base case & Sensitivity ➔ scenarios

Selection of the best scenario from base case & sensitivity.

3. JABBA runs
3.1 Outline

For JABBA runs, we need to consider 2 stock status (Virgin & Non virgin stock)

- In JABBA, for the virgin stock case, we set depletion value B1/K=1, which works OK. Estimated value is around 1 (no problem).

- However, in the non virgin stock case, seeding (guess) values for B1/K (such as 0.2, 0.4, 0.6) will estimate same (similar) values for all the time, i.e., different values (B1/K) cannot be estimated as in ASPIC.

- Simple test indicates this (Table left).

Seeding values for depletion (B1/K)	Estimated depletion values by JABBA (strangely almost same values are estimated)	
	Schaefer	Fox
0.2	0.21	0.20
0.4	0.39	0.39
0.6	0.59	0.58
0.8	0.80	0.82

3. JABBA runs
3.1 Outline

For JABBA runs, we need to consider 2 stock status (Virgin & Non virgin stock)

- Additional tests (Dr Wang) indicated that the long-term data (more information) can estimate different values, but unstable (not for all the time), while the short-term data cannot (same as above).

- Thus, we use the scenario approach using different B1/K seeing values (e.g., 0.2, 0.3, 0.4, 0.5) to identify the most plausible scenario (B1/K value)(for example 0.5) using diagnoses, then proceed JABBA.

Seeding values for depletion (B1/K)	Estimated depletion values by JABBA (strangely almost same values are estimated)	
	Schaefer	Fox
0.2	0.21	0.20
0.4	0.39	0.39
0.6	0.59	0.58
0.8	0.80	0.82

3. JABBA runs
3.1 Outline

For JABBA runs, we need to consider 2 stock status (Virgin & Non virgin stock).

Note

We will develop another approach in the next version without using scenarios, which was suggested by Dr Doug Butterworth (our peer reviewer) i.e.,

Specifying a prior for B1/K and seeing whether the posterior after adding the data in any way update this prior.

3. JABBA runs
3.1 Outline

Hence, we need 2 different types of JABBA runs.

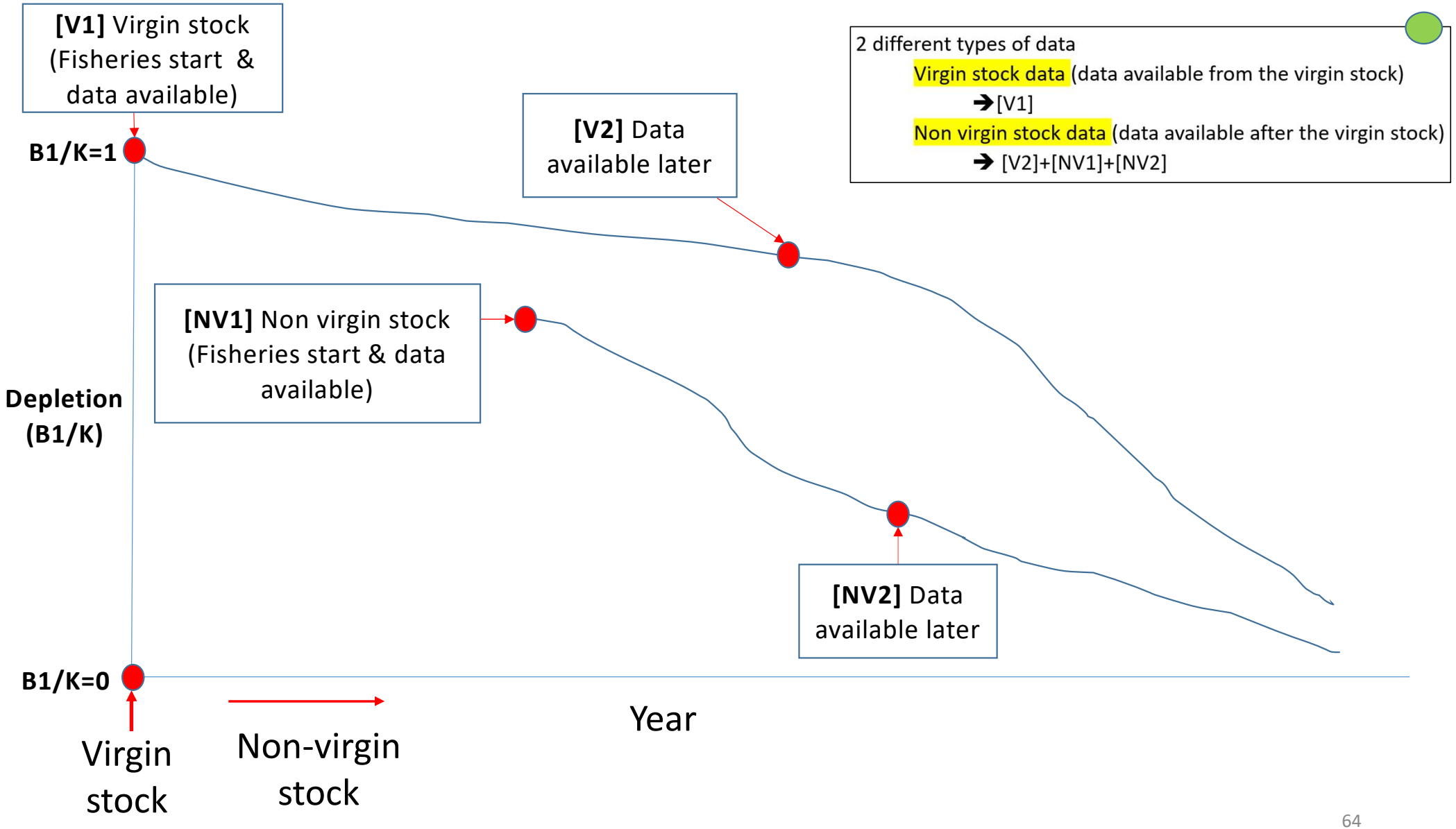
by stock level & data availability (see illustration, next page)

3.2 Virgin stock (data available from the virgin stock)

➔ Data type [V1]

3.2 Non virgin stock (data available after the virgin stock)

➔ Data type [V2]+[NV1]+[NV2]


[V1] Virgin stock (Fisheries start & data available)
B1/K=1
[V2] Data available later
2 different types of data
Virgin stock data (data available from the virgin stock)
➔[V1]
Non virgin stock data (data available after the virgin stock)
➔ [V2]+[NV1]+[NV2]
[NV1] Non virgin stock (Fisheries start & data available)
Depletion (B1/K)
[NV2] Data available later
B1/K=0
Virgin stock
Non-virgin stock
Year

3. JABBA runs
3.1 Outline

Summary of how to run JABBA, how to select the **best run** in each model (Schaefer & Fox) & how to select the **best model** run from 2 models by base case & sensitivity, by stock level and by data availability

Stock level	Data availability code	Base case runs					Sensitivity runs	
		Model	Run		Selection of the best run in **each** model	Selection of the best **model** run	Selection of the best run in **each** model	Selection of the best **model** run
Virgin	**[V1]**	Schaefer	run1	run2	(1) With B1/K=1, run until the best one is found (normally 1~2 runs). (2) In this case, run2 is the best for both models. (3) The best run (**each model**) can be selected by diagnoses available in page 3-4, Report of each run.	(1) Select the best **model** run using the Selection form (available in the separate excel file),	(1) Probably no need to run sensitivity as the plausible results can be obtained in the base case by the robust setting for B1/K=1. (2) If needed, apply the scenario approach used in the non virgin stock case.	
		Fox	run1	run2				
Non virgin	**[V2] [NV1] [NV2]**	Schaefer	(1) Set scenarios for B1/K, initially a **wider** range (e.g., 0.2,0.4,0.6, 0.8) (interval=0.2) then run.		(1) Select the best run initially by visual inspection (retrospective patterns & Kobe plot available in Report each run). (2) If it is difficult, use diagnoses available page 3-4, Report for each run.		(1) Set up **narrower** range (e.g., 0.1, 0.2, 0.3) (interval=0.1) based on results of the base case run, then apply the same scenario approach as in the base case run.	(1) Select the best **model** run by the selection form
		Fox						

Thus, [V1] and [NV2] are assigned for our examples (below)

3.2 Virgin stock

(1) Swordfish (SWO) Data type [V1] (see last 2 slides)

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run (*)

Sensitivity : No need

3.3 Non virgin stock

(1) Indian Mackerel (IM) Data type [NV2] (see last 2 slides)

Schaefer + Fox : Base case + Sensitivity ➔ Scenarios

Selection of the best model from base case and sensitivity (*)

So, we start from SWO Base case Schaefer run1

3.2 Virgin stock

(1) Swordfish (SWO) [V1]

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run

Sensitivity : No need

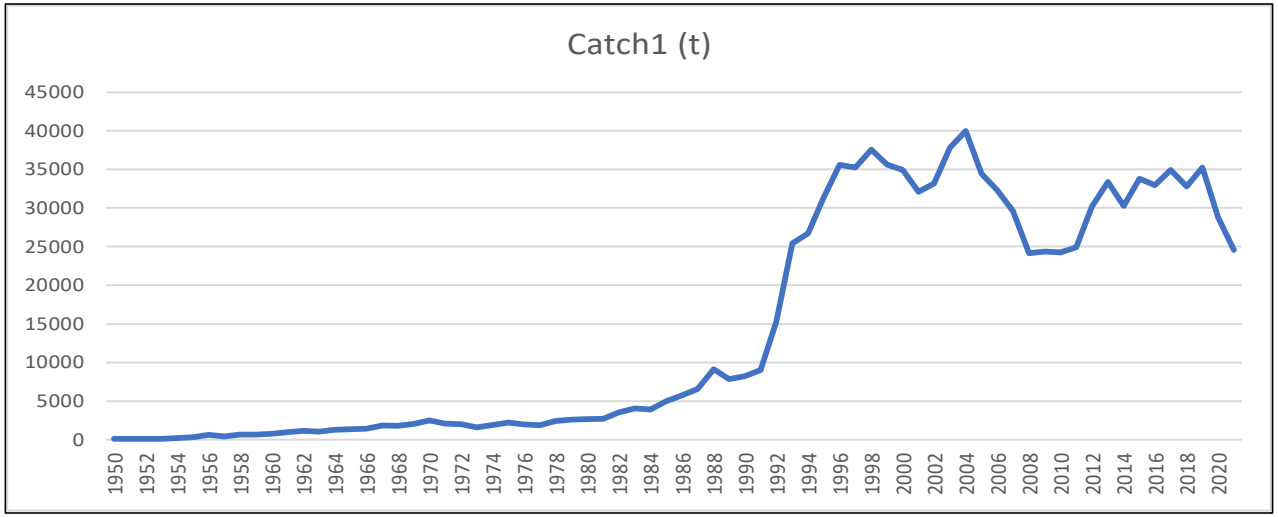
3.3 Non virgin stock

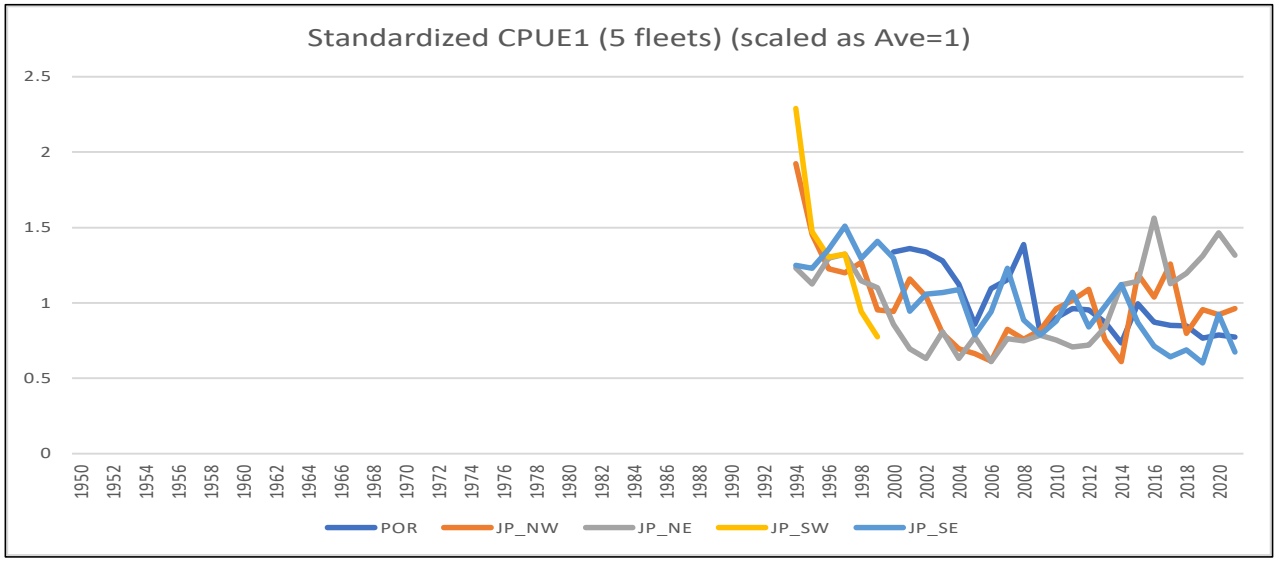
(1) Indian Mackerel (IM) [NV2]

Schaefer + Fox : Base case & Sensitivity ➔ Scenarios

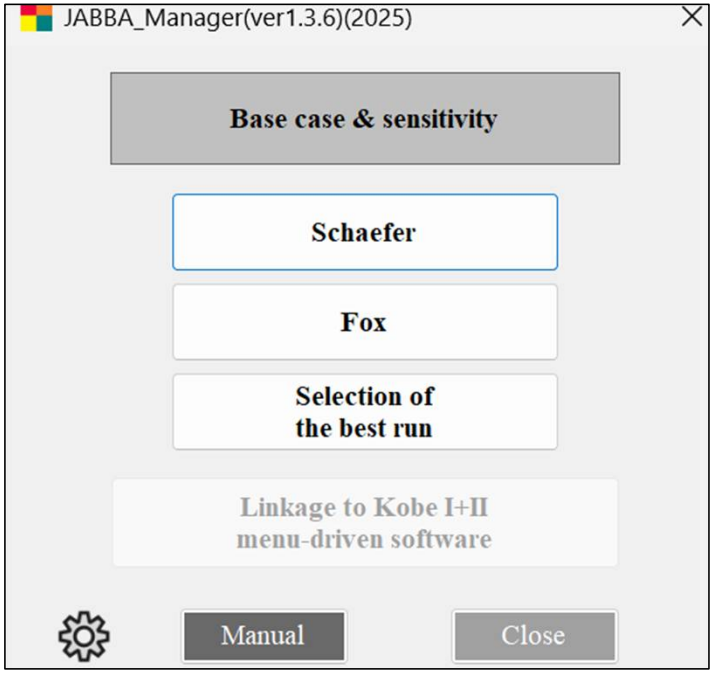
Selection of the best run from Base case & Sensitivity

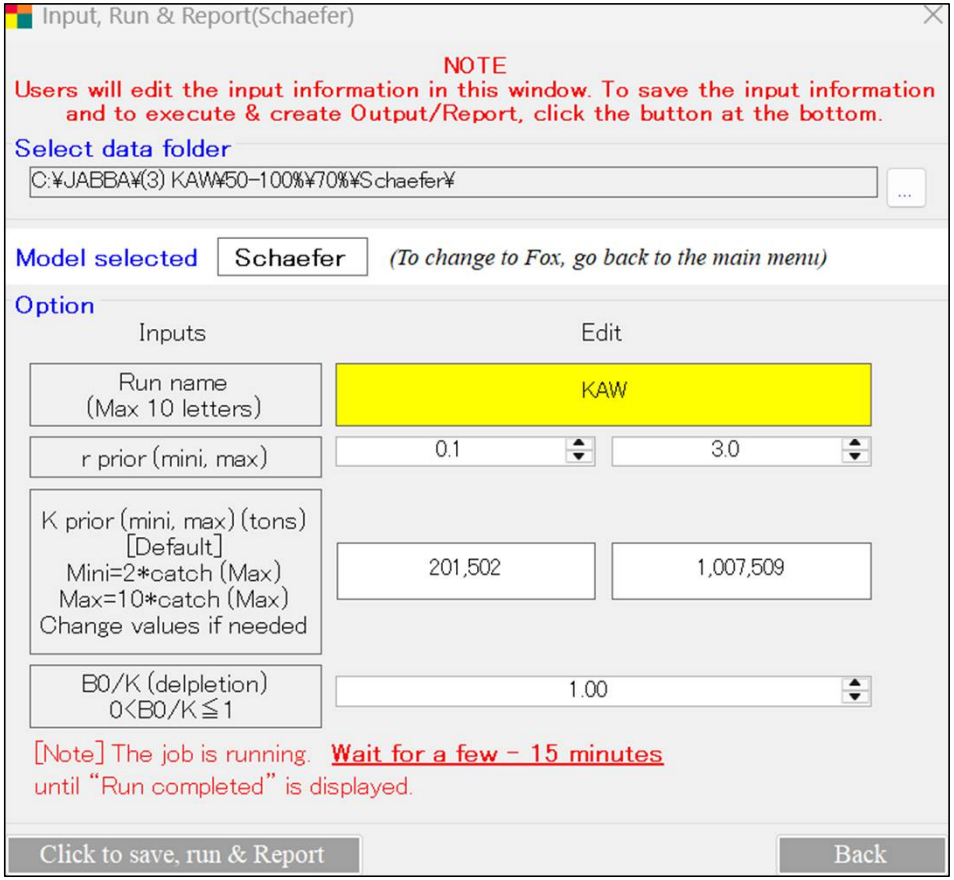
Catch and standardized CPUE (5 fleets) used to run SWO_1 (Schaefer & Fox)



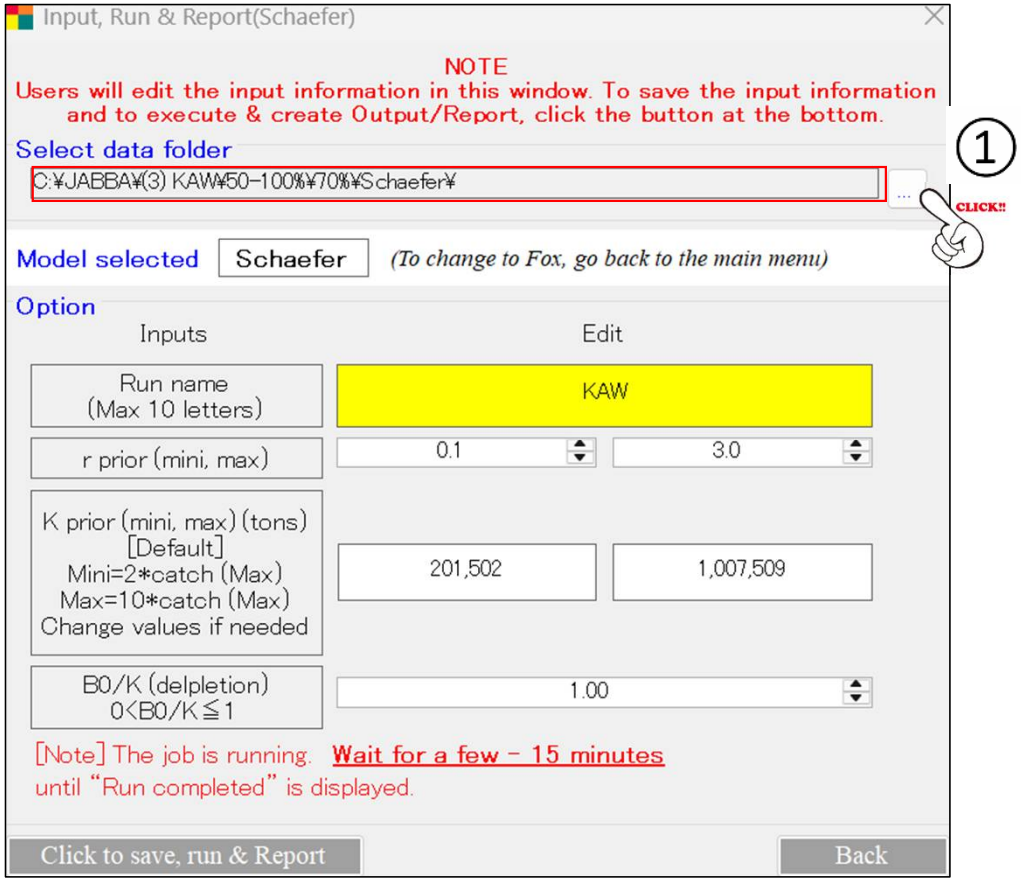


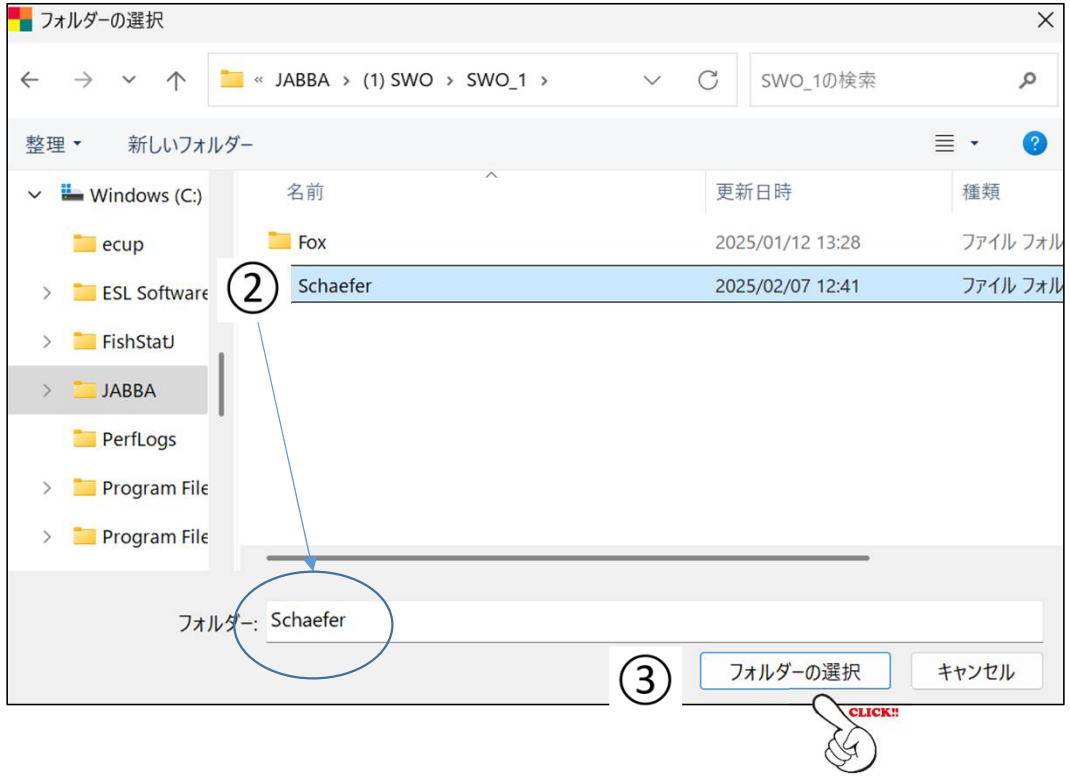
To start JABBA_Manager, double click the icon then click “Schaefer” (example). Users will see the window (below right) (information from the previous run is still remained).





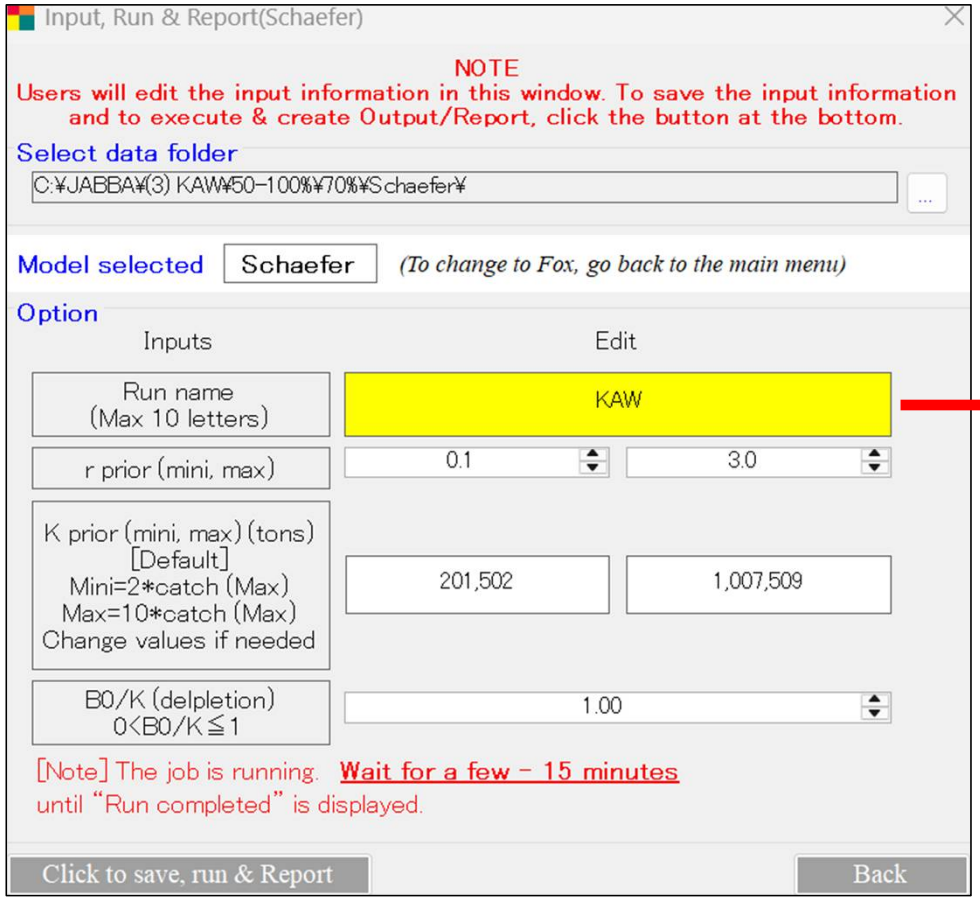
To select the data folder. Click ① “Select data folder” button, then ② go to the Schaefer folder and ③ click.

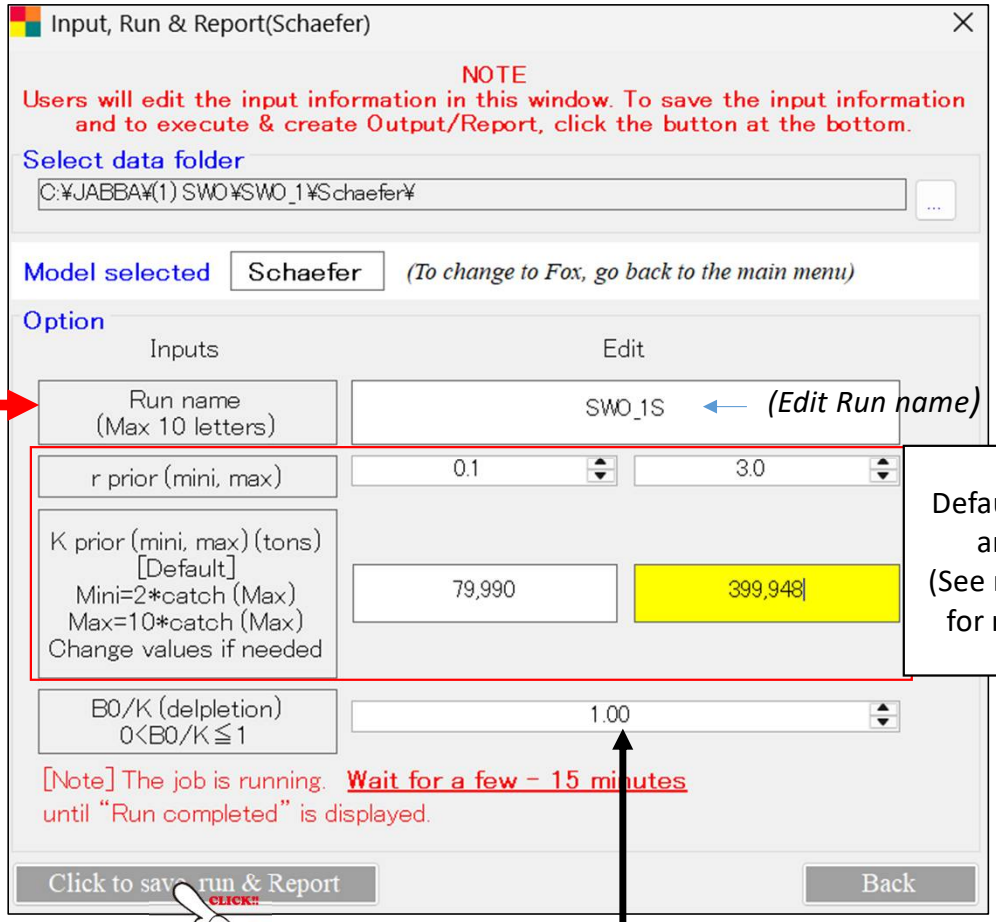




1st window (information from the previous run)

Edit for the next run. Click to start to run.





Default values are OK. (See next page for reasons)

This is the virgin stock case [V1]. For the non-virgin case, see section 3.2.2.

Why default prior seeding values (r & K) OK?

r (intrinsic population growth rate) for fish & shark range: 0.1~3.0

based on RAM Legacy stock assessment database, FishBase (FAO) & Dr Pattarapongpan(SEAFDEC)

K (Capacity Building) (Schaefer & Fox): based on expert judgements

Min K=2*(max) catch & Max K=10*(max) catch

Using these seeding values,

JABBA will optimize probability distribution functions

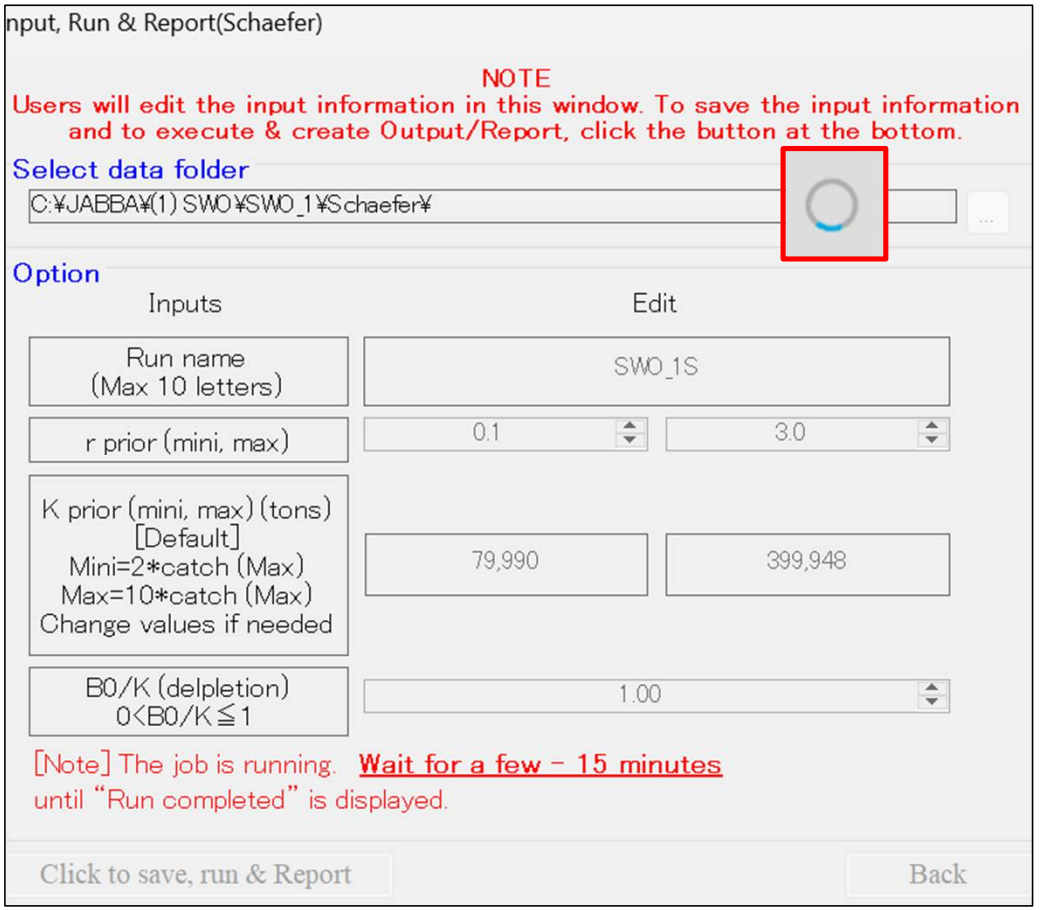
by the Bayesian approach with 2 steps (range & log normal functions)

This will be the effective way to estimate.

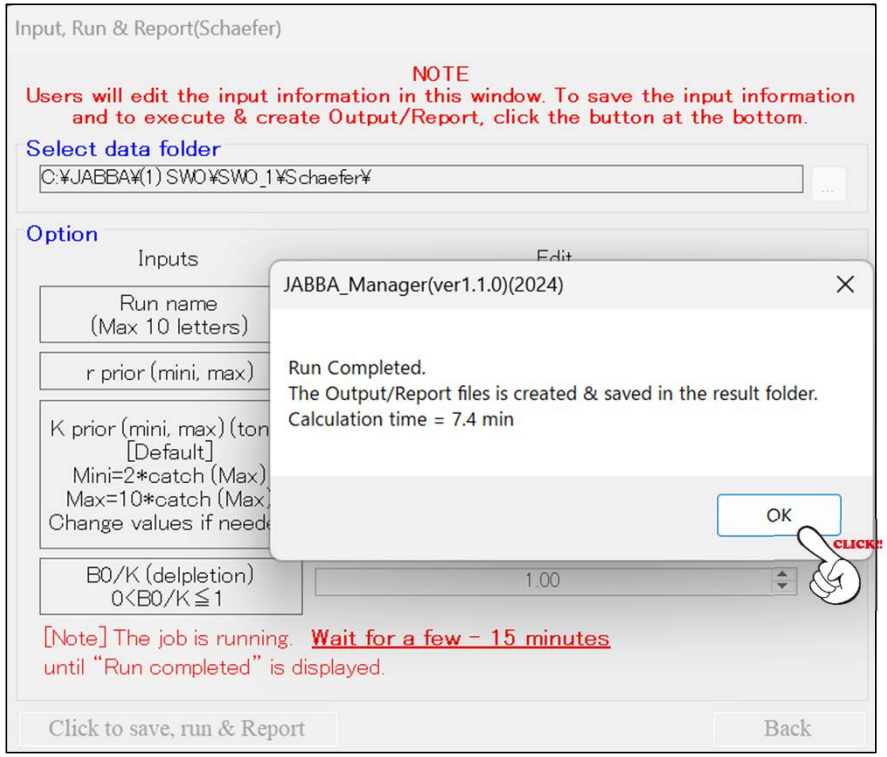
If users want to change, please do so using the window.

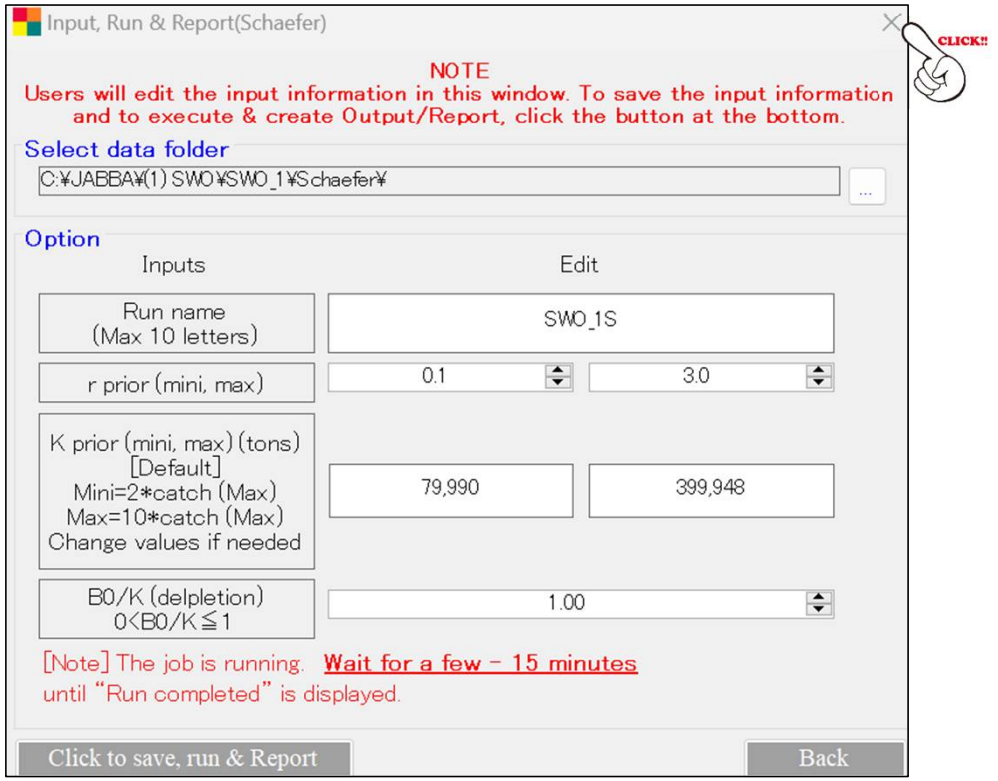
During the process, the processing marker (waiting time sign by the go around in circles) will appear.

To complete the run, it will take a few - 15 minutes depending on data volume (# of years & fleet) and PC performance.



After the run is completed, “Run completed” window appears (below left). Then click OK. Users will see the same window again (below). Click X to close.





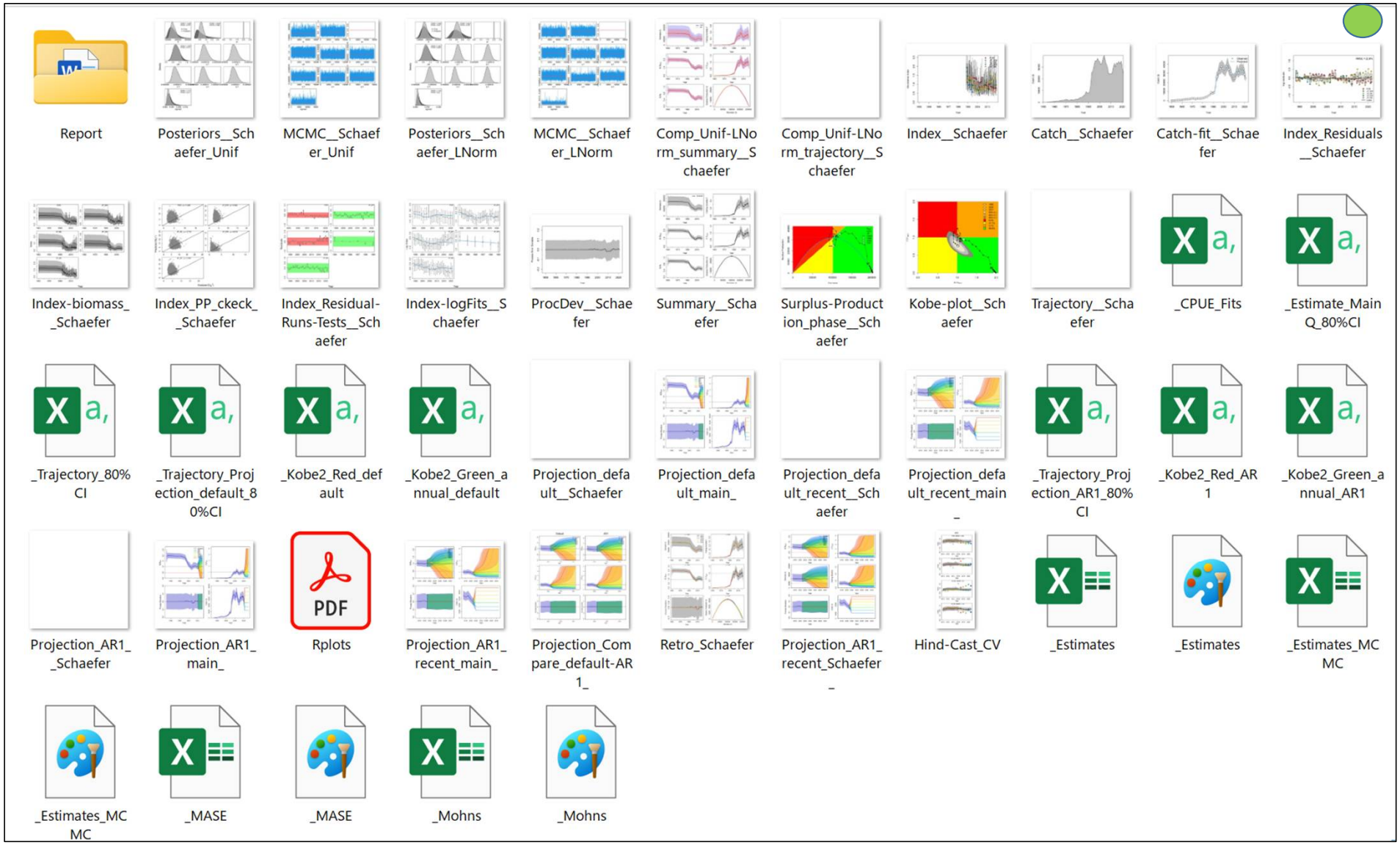
All outputs & Report are saved in the result folder (see next page).

- Results are saved in Schaefer(results) folder.
- In our case, results of the (first) Run name (SWO_1S) are stored.
- Contents of SWO_1 is shown in next page.

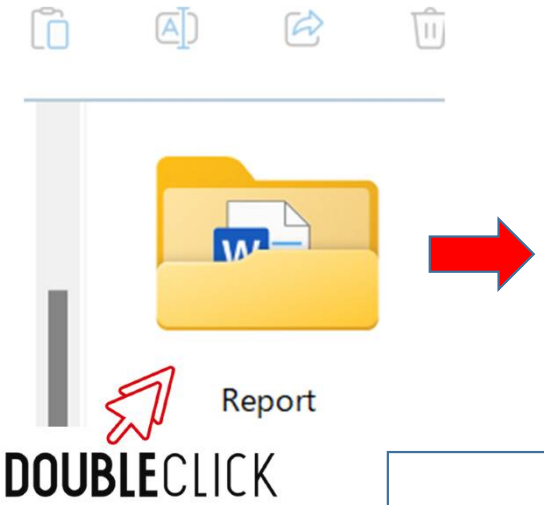
Contents SWO_1S

"One report folder" & "output of results (49 files)"

# of files will be @ 49 subject to availability.



To find out the Report



There are 2 files in the Report folder

(1) Log file containing logs of R execution.
(2) Another file is the Report word file (Report_SWO_1S in our case).

The Report has 7 Sections (20 pages)

Appendix B shows all pages of the Report_1S.

Report_SWO_1S (Schaefer)

Contents

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

Users now need to evaluate if results are OK.

How to evaluate ?

Evaluation will be done using “Key diagnostics” (below) available in Page 3 (Report) *(Details are explained in Report).*

Points to inspect
(by importance)

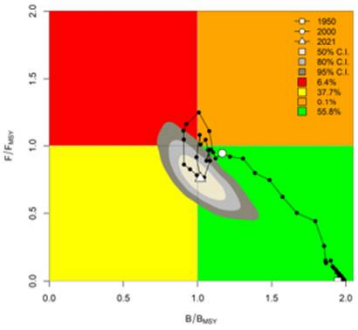
① Retrospective analyses
② Kobe plot
③ CPUE (Autocorrelation)
④ Convergence

This example shows
①, ② & ④ OK
③ 2 fleets NG

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

② KOBE PLOT

(#18) (page 18) Kobe plot



④ CONVERGENCE

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

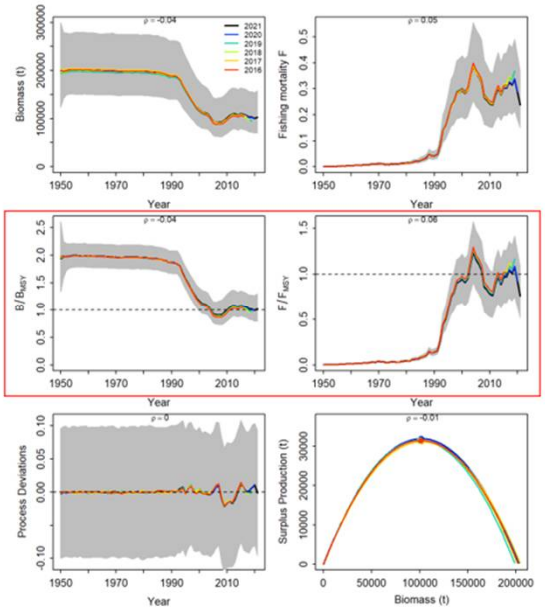
	Geweke.p	Heidel.p
K	0.80	0.57
r	0.96	0.67

① RETROSPECTIVE ANALYSES

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

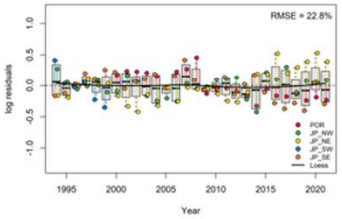
Mohan ρ	B	F
2021	-0.01	0.01
2020	-0.07	0.10
2019	-0.07	0.08
2018	-0.02	0.03
2017	-0.03	0.04
Average	-0.04	0.05

(#40) (p.14) Retrospective patterns



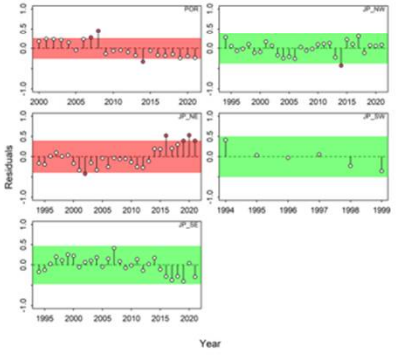
CPUE FITNESS

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



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

③



So, we now moving run2 from run1

3.2 Virgin stock

(1) Swordfish (SWO) Data type [V1]

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run

Sensitivity : No need

3.3 Non virgin stock

(1) Indian Mackerel (IM) Data type [NV2]

Schaefer + Fox : Base case + Sensitivity ➔ Scenarios

Selection of the best scenario from base case & sensitivity.

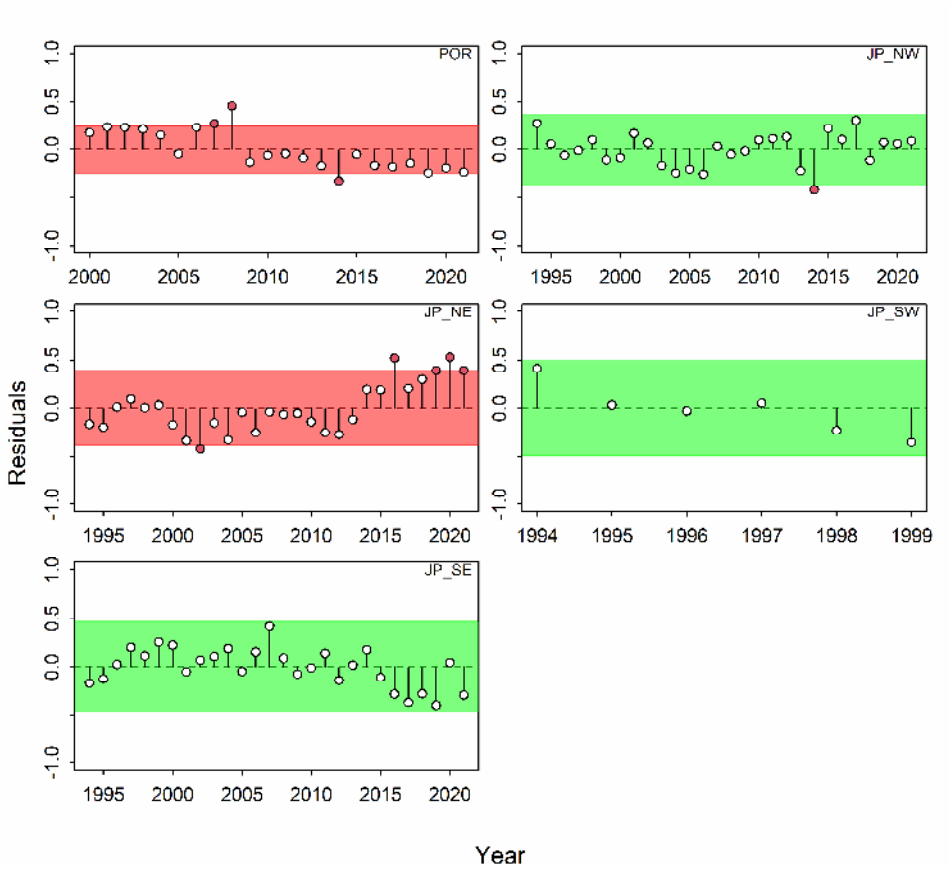
From the results and diagnoses,
①~③ are OK, but

④ #13 Autocorrelation problems for 2 fleets (red alerts)

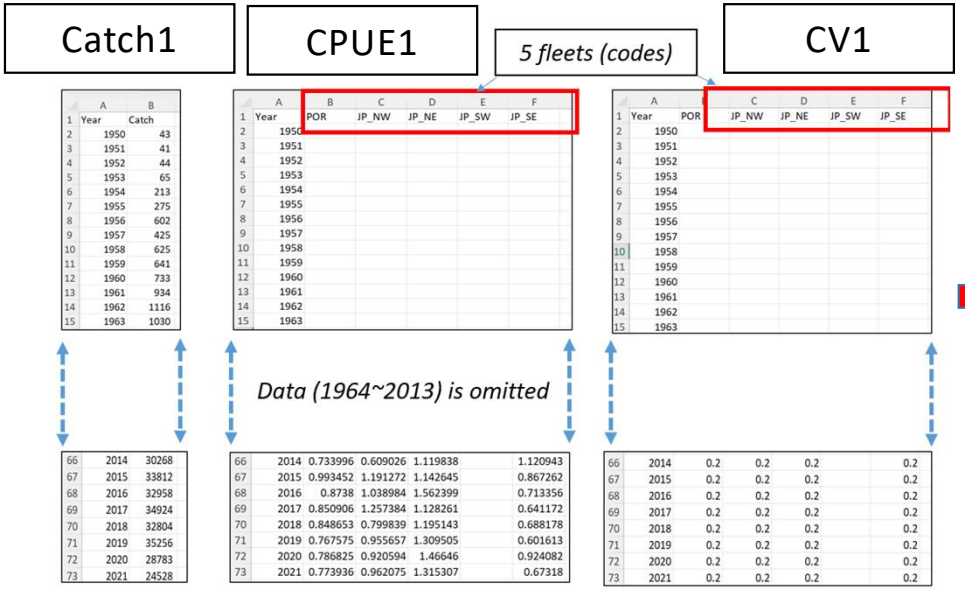
(no serious outliers)

We need to delete them and re-run (SWO_2S) and re-evaluate

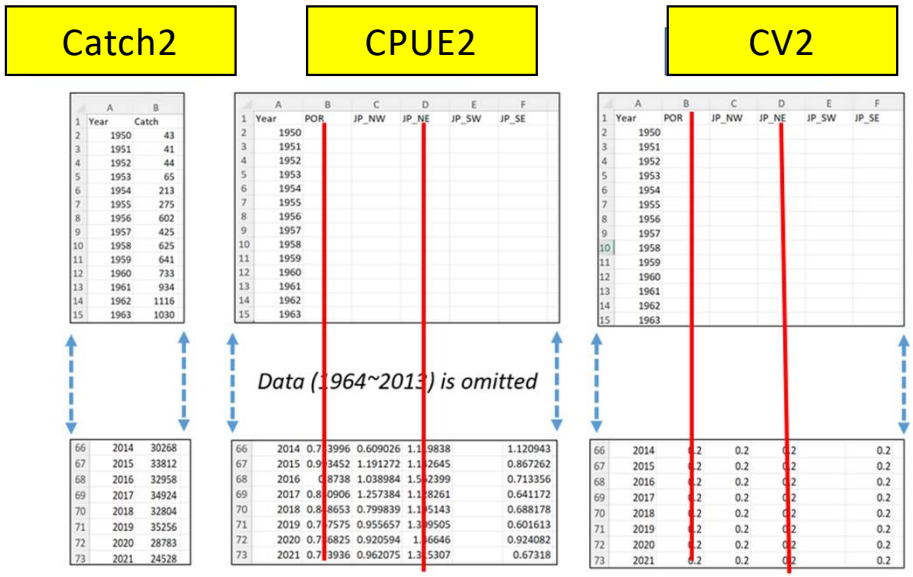
How to remove?



2 fleets data (CPUE & CV) will be removed
and create the new data set (see next)



Data set in the 1st run (SWO_1S)

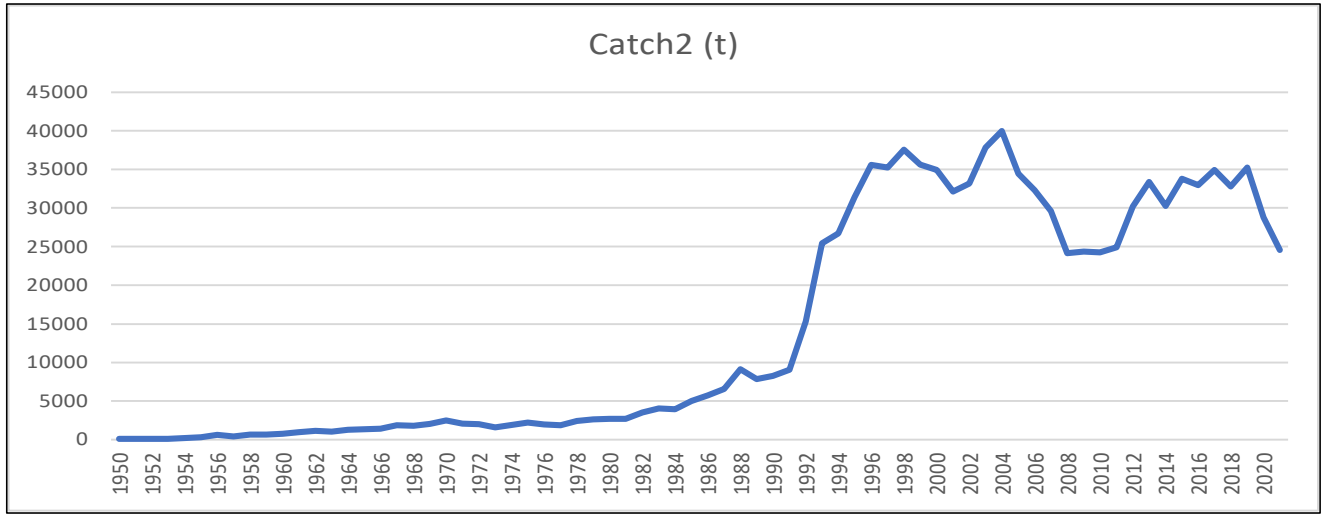


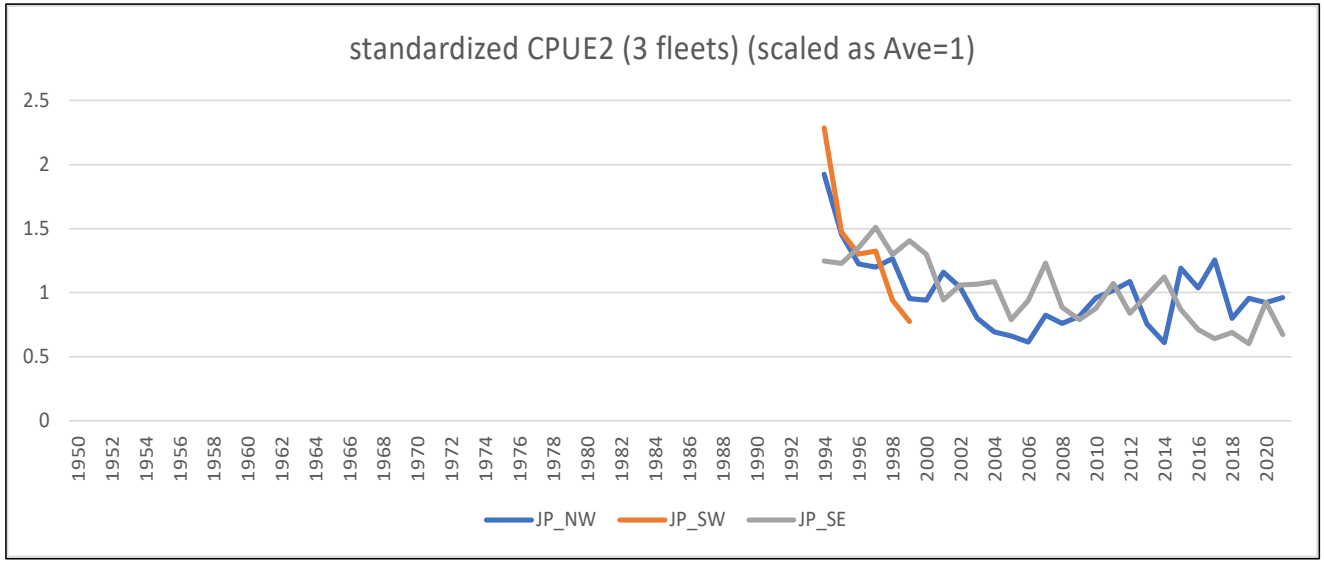
Revised data set for the 2nd run (SWO_2S)
deleting 2 fleets (CPUE1 & CV1).

Numbering for Catch, CPUE & CV

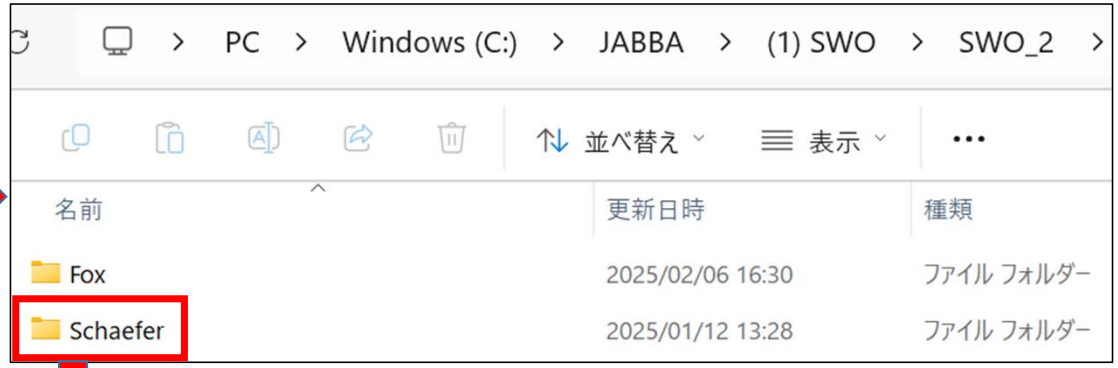
- Any number & combination can be assigned
- Fox example, Catch, CPUE1, CV3
- But same numbers like Catch1, CPUE1 & CV1 are easier for users to handle and distinguish.

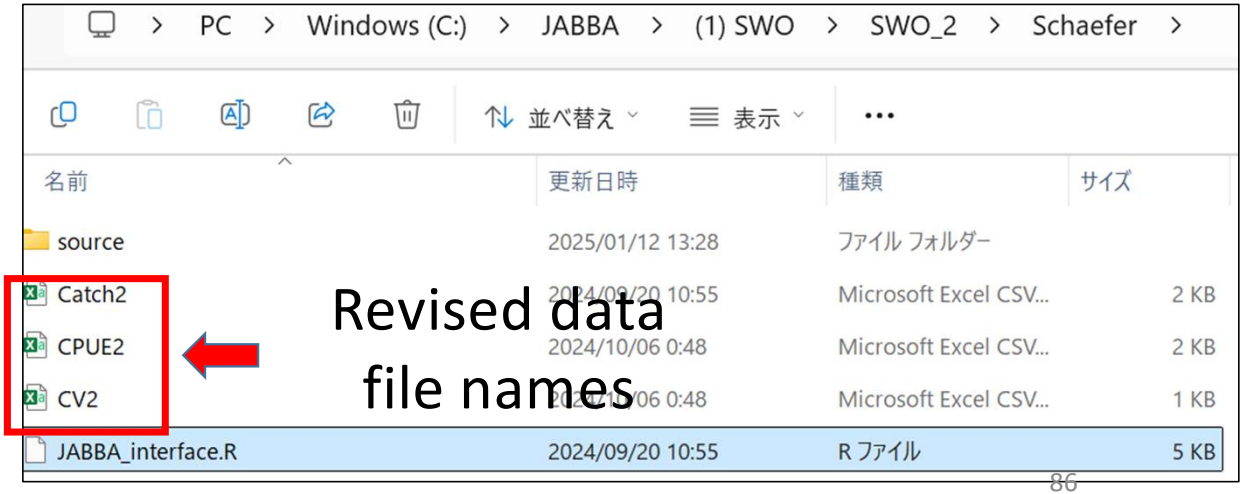
Catch and standardized CPUE (3 fleets) used to run SWO_2 (Schaefer & Fox)





We now use SWO_2 folder for the 2nd run

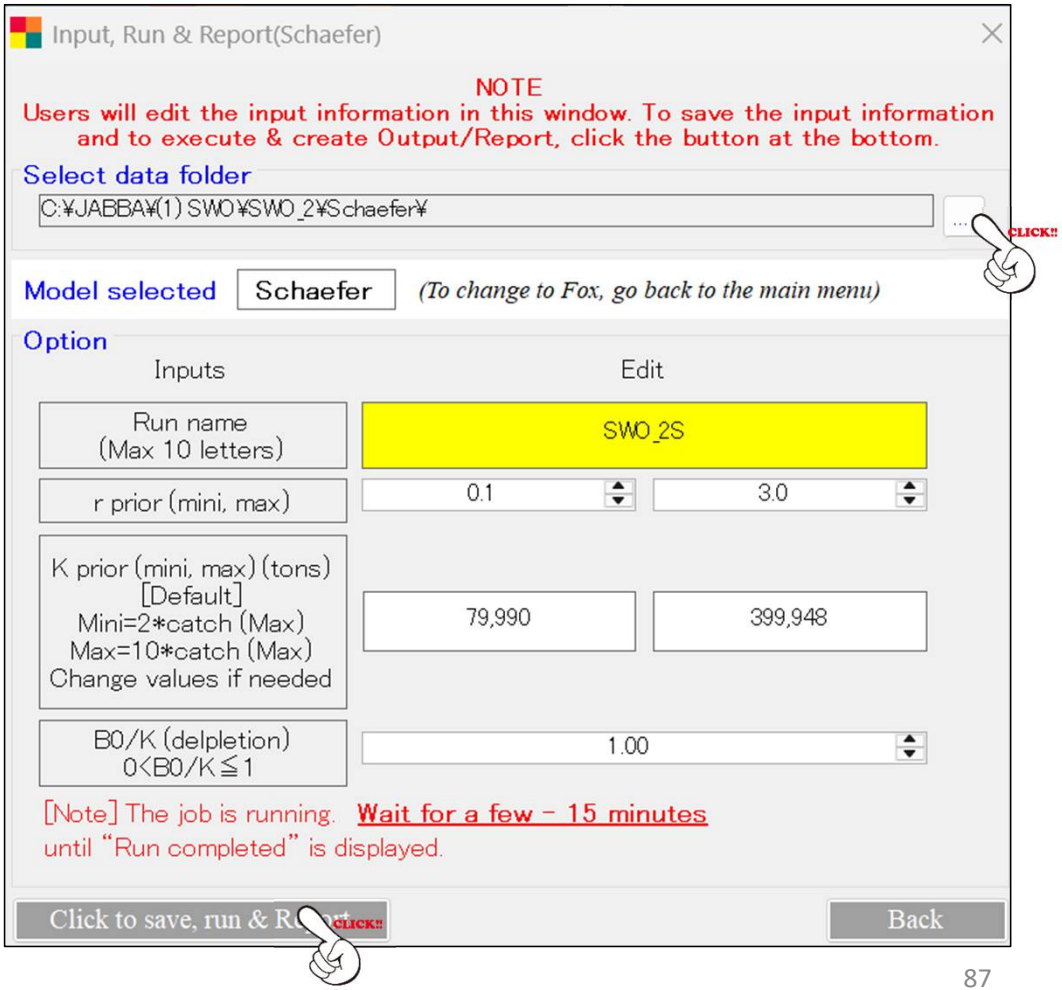




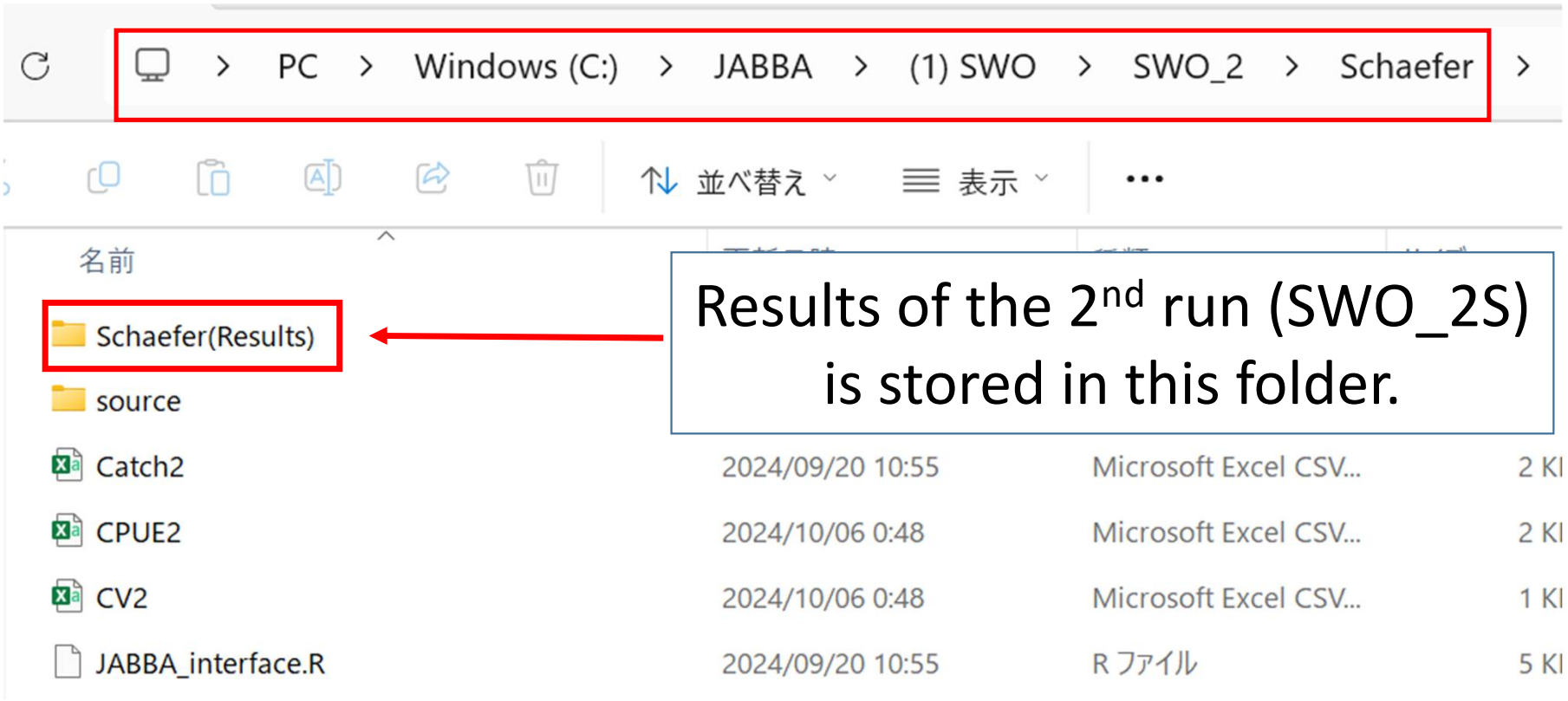
Revised data file names

After the working folder name “Schaefer” is selected, 3 CSV Data files (Catch2, CPUE2 & CV2) are automatically read. Then click to start run.

Users need to re-run with the revised data in the same way as for the 1st run (SWO_1).



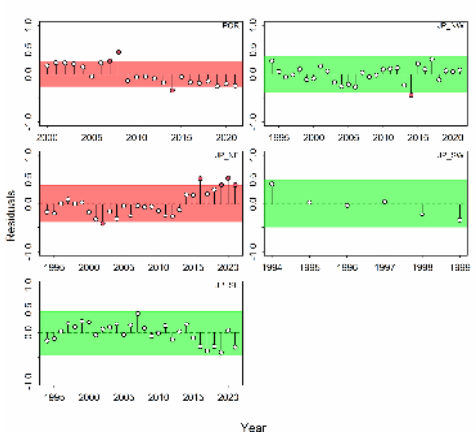
After re-run, users will get output results in the folder SWO_2 (see below)

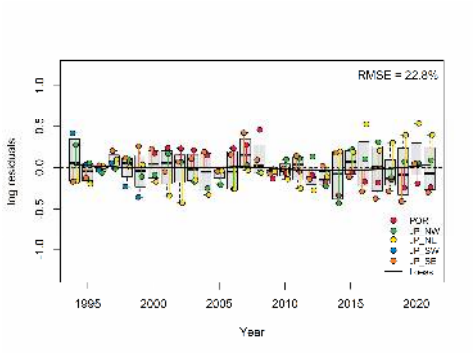


Results of the 2nd run (SWO_2S) is stored in this folder.

Improvements (SWO_1S ➔ SWO_2S)
Based on the comparisons (below), all improved except Convergence

SWO_1S

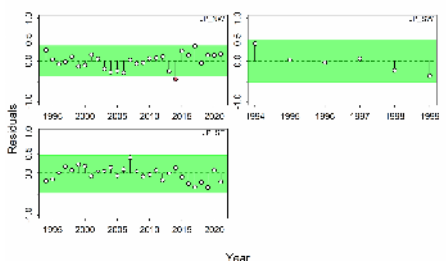


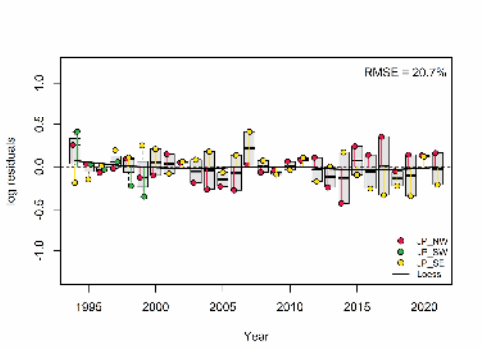


	Geweke.p	Heidel.p
K	0.80	0.57
r	0.96	0.67

Mohan ρ	B	F
2021	-0.01	0.01
2020	-0.07	0.10
2019	-0.07	0.08
2018	-0.02	0.03
2017	-0.03	0.04
Average	-0.04	0.05

SWO_2S





	Geweke.p	Heidel.p
K	0.13	0.08
r	0.21	0.12

Mohan ρ	B	F
2021	0.07	-0.05
2020	-0.06	0.07
2019	-0.01	0.02
2018	0.00	-0.01
2017	-0.05	0.07
Average	-0.01	0.02

Improved after 2 CPUE removed(all green)

Improved (RMSE) (22.8%➔20.7%)

Convergence（MCMC） (worsen)

Retrospective analyses (close to 0.025 better) (improved)

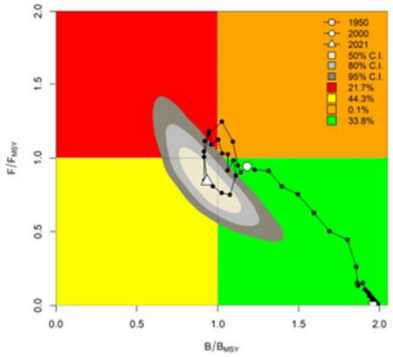
Summary of results for SWO_2S from page 3-4, Report next 2 slides

Page 3 (Report)

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

KOBE PLOT

(#18) (page 18) Kobe plot



CONVERGENCE

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

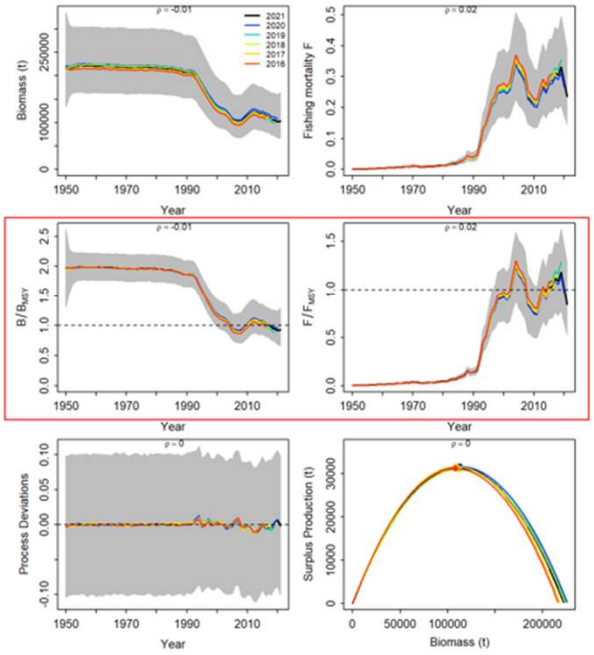
	Geweke.p	Heidel.p
K	0.13	0.08
r	0.21	0.12

RETROSPECTIVE ANALYSES

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

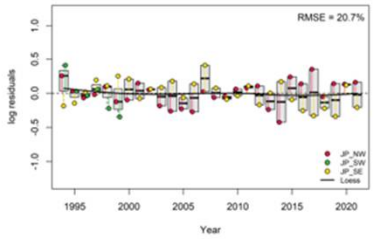
Mohan ρ	B	F
2021	0.07	-0.05
2020	-0.06	0.07
2019	-0.01	0.02
2018	0.00	-0.01
2017	-0.05	0.07
Average	-0.01	0.02

(#40) (p.14) Retrospective patterns

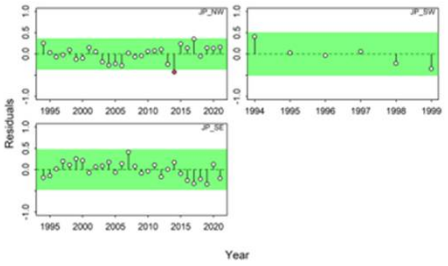


CPUE FITNESS

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



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



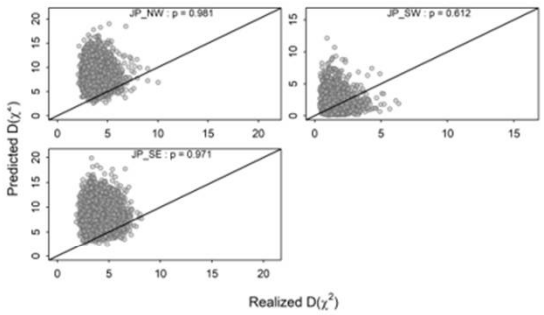
Page 4 (Report)

Summary of results & diagnoses (2/2)

MODEL FITS

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

Ave. p=___



ESTIMATED PARAMETER VALUES

(#21)
(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	222,634	168,101	298,602
r	Pop. growth rate	0.56	0.41	0.77
B0/K	Depletion (EST)	0.98	0.67	1.31
sigma.proc	Estimable process VAR	0.05	0.03	0.08
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.28	0.20	0.39
TBmsy	TB at MSY (t)	111,317	84,050	149,301
MSY	MSY (t)	31,342	28,303	35,901
Catch(2021)	Current catch	24,528		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(1950)/ K	Depletion (OBS)(start)	0.98	0.66	1.31
TB(2021)/ K	Depletion (OBS)(last)	0.47	0.33	0.65
TB/TBmsy	TB ratio	0.93	0.66	1.29
F/Fmsy	F ratio	0.84	0.52	1.29

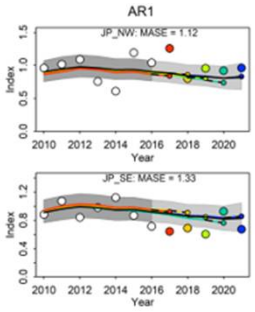
HINDCAST ANALYSES

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

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

Yellow markers (> 1)
Not acceptable

Index	MASE
JP_NW	1.12
JP_SW	NA
JP_SE	1.33
Average	1.24



3.2 Virgin stock

(1) Swordfish (SWO) Data type [V1]

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run

Sensitivity : No need

3.3 Non virgin stock

(1) Indian Mackerel (IM) Data type [NV2]

Schaefer + Fox : Base case & Sensitivity ➔ Scenarios

Selection of the best scenario from base case & sensitivity.

What is Next ?

(1) Run Fox in the same way as Schaefer

➔ As a result, the 2nd run is the best, same as Schaefer

➔ Results SWO_2F (run and get the Report)

3.2 Virgin stock

(1) Swordfish (SWO) Data type [V1]

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run

Sensitivity : No need

3.3 Non virgin stock

(1) Indian Mackerel (IM) Data type [NV2]

Schaefer + Fox : Base case ➔ Sensitivity

Selection of the best model run from 2 models in the sensitivity.

Selection of the best model run by Selection form

(1) Users now have the best run each for Schaefer (SWO_2S) & Fox (SWO_2F).

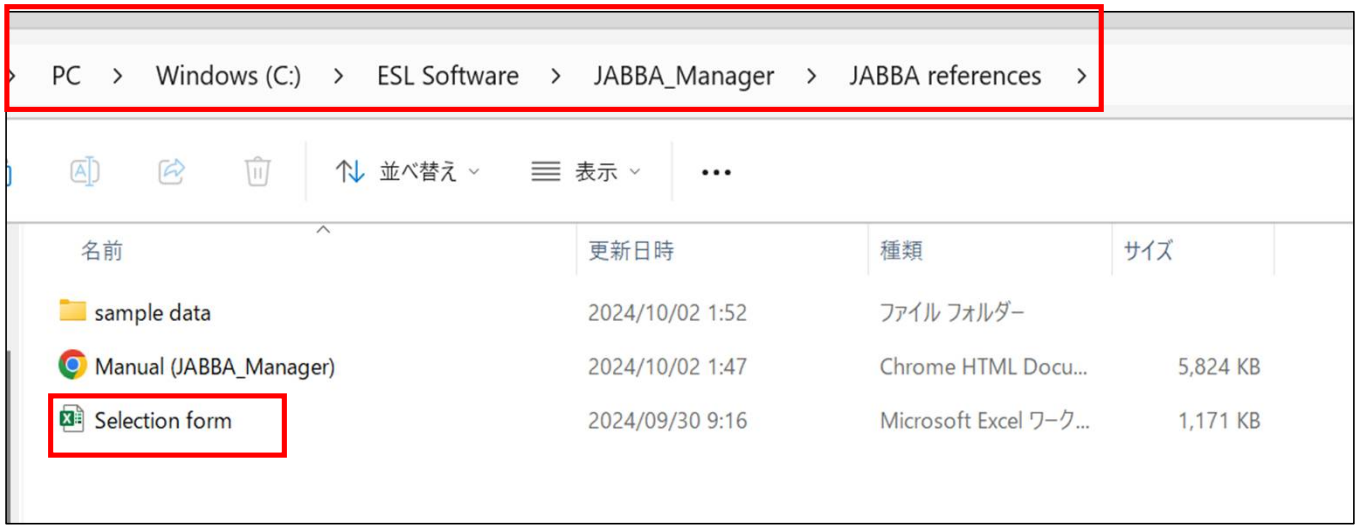
(2) (After runs), the results are available in each Report word files (page 3-4).
(the SWO_1S folder for Schaefer & the SWO_2F folder for Fox).

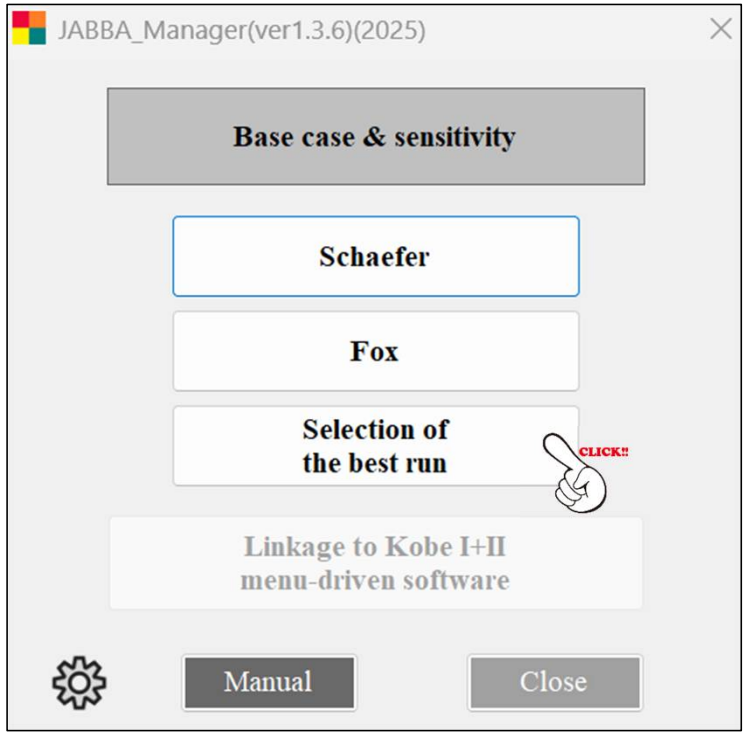
(3) Users need to select the best model run using 14 diagnostics.

(4) “Selection form (Excel table for comparison)” will be used

(5) Users can get this form located in the 3rd menu (right).

(7) For practices, users also can get it from ESL software, (see below) which is not linked to the software.





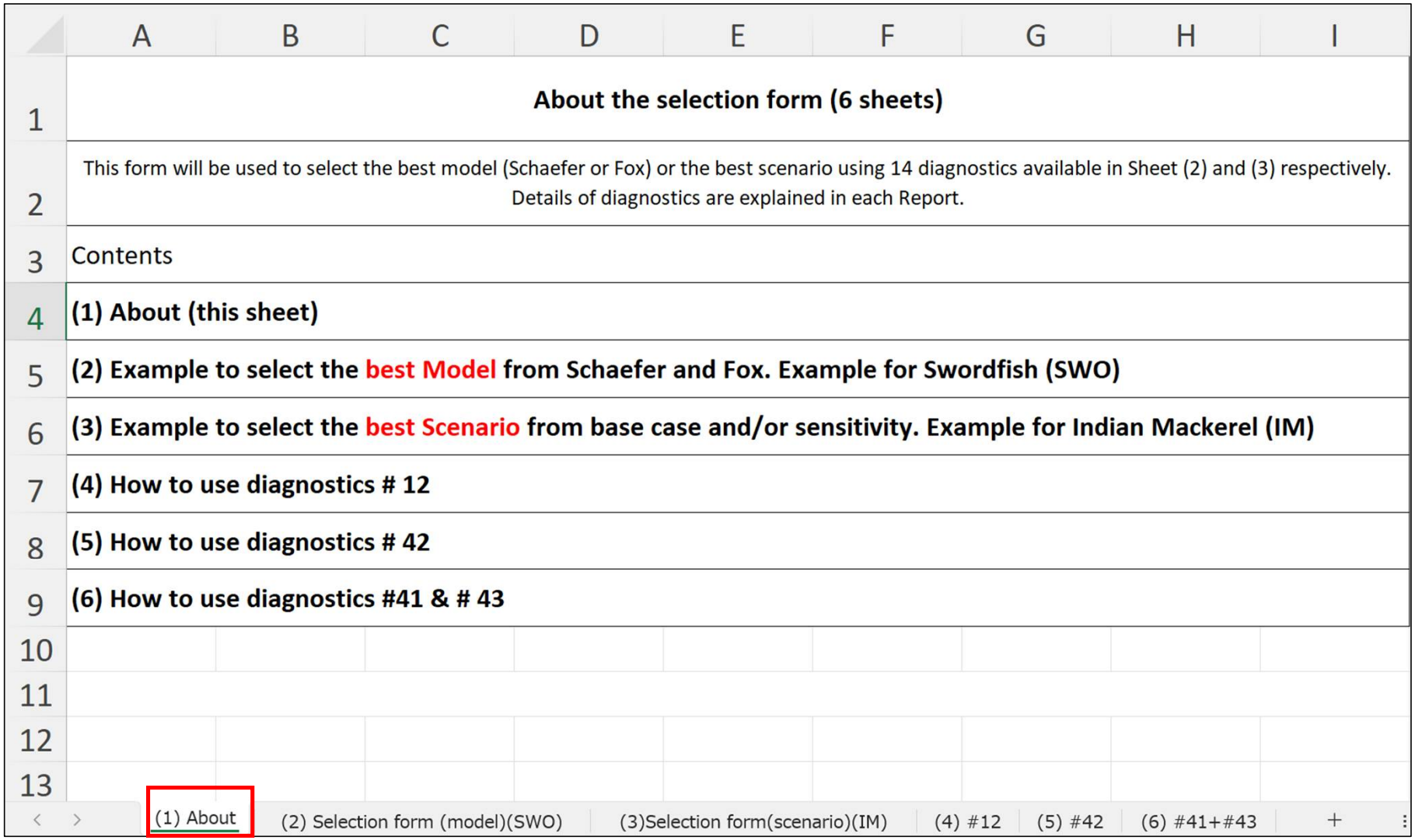
How to use the Selection form?

- The Selection form includes 14 diagnostics for 4 key themes.
- 4 themes are Convergence, Model fit, Retrospective analyses & Hindcasting.
- The Selection form includes 6 sheets shown from the 2nd slide from this sheet.
- There are 2 types of selection form, i.e., Sheet (2) to select from 2 models (Schaefer or Fox) (virgin stock case) and Sheet (3) another to select from scenarios (non virgin case).
- 14 diagnostics are equal weighted (default). If users want to change weighting, please do so by yourself.

How to use the Selection form? (refer to next 6 slides)

- As for sheet (2), based on the results of diagnoses, users will select the better model (Schaefer or Fox). See an example (our SWO) in sheet (2).
- The final decision on the best model will be made by more counts of "better model" as shown in sheet (2).
- As for this example (SWO), the Fox model & Fox (SWO_2F) was selected as shown in sheet (2).
- As for sheet (3), we will come back after we go through the example later for Indian Mackerel (IM).

Selection form (Excel) : Contents (6 slides)



	A	B	C	D	E	F	G	H	I
1	**About the selection form (6 sheets)**								
2	This form will be used to select the best model (Schaefer or Fox) or the best scenario using 14 diagnostics available in Sheet (2) and (3) respectively. Details of diagnostics are explained in each Report.								
3	Contents								
4	**(1) About (this sheet)**								
5	**(2) Example to select the best Model from Schaefer and Fox. Example for Swordfish (SWO)**								
6	**(3) Example to select the best Scenario from base case and/or sensitivity. Example for Indian Mackerel (IM)**								
7	**(4) How to use diagnostics # 12**								
8	**(5) How to use diagnostics # 42**								
9	**(6) How to use diagnostics #41 & # 43**								
10									
11									
12									
13									

(1) About | (2) Selection form (model)(SWO) | (3)Selection form(scenario)(IM) | (4) #12 | (5) #42 | (6) #41+#43

Selection of the best model run (Schaefer or Fox) using 14 diagnostics
(Use "Summary of results & diagnostics", page 3~4, Report) Example : Swordfish (SWO) (for details, see Manual)

Please see Manual for details on diagnostics.	Evaluation	1. Convergence (MCMC)				2. Model Fit					3. Retrospective analyses		4. Hindcast analyses			
		Heidelberger & Welch p test				2.1 CPUE residuals		2.2 RMSE	2.3 Posterior Predictive Check (PPC)							
	Methods	Geweke.p (larger value better)		Heidel.p (larger value better)		95% CI band		RMSE	Average p values (compute yourself)	Visual inspection	Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (# of yellow: non significant=NG predicted skill) (for B & F)		MASE (Average value)	Visual inspection
	Criteria	K	r	K	r	Red band Auto-correlation? No is better	total # of outliers less # is better	Less % better fit	Use the 5th sheet to compute. Closer to 0.5 is better	Ball shapes located in center are better (how many #?)	# of yellow markers (B & F ratio) less better	All trends should be similar patterns.	Less # better		should be < 1 & smaller better	# OBS points beyond the 95% CI band
	Output # (page#)	# 20 (p.3)				# 13 (p.3)		# 10 (p.3)	# 12 (p.4)		# 42 (p.3)	# 40 (p.3)	# 43 (p.4)			# 41 (p.4)
	diagnostics #	1	2	3	4	5	6	7	8	9	10	11	12		13	14
	Refer to sheet # how to do								(4)		(5)		(6)			
Users can add 1 more rows if 3 finalists (for example, 2 Fox & 1 Schaefer).	Schaefer (SWO_2S)	0.13	0.21	0.08	0.25	No	1	20.7%	0.854	not so good	0	OK	2		Non Significant(1.24)	3
	Fox (SWO_2F)	0.67	0.43	0.31	0.06	No	2	20.4%	0.873	not so good	0	bit better than Schaefer	2		Non Significant(1.19)	3
	Better model ?	FOX	FOX	FOX	Schaefer	Same	Schaefer	FOX	Schaefer	same	Same	FOX	Same		FOX	Same
Comments & decision	(1)	6 diagnoses are better for Fox, while 3 for Schaefer and 5 same. Thus Fox is the best.														
	(2)	Although performance between 2 models are very similar except convergence (Fox) much better than Schaefer.														
	(3)	Because of (1) & (2), Fox model is selected.														

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

(1) About | (2) Selection form (model)(SWO) | (3)Selection form(scenario)(IM) | (4) #12 | (5) #42 | (6) #41+#43

Selection of the best scenario run using 14 diagnostics

(Use "Summary of results & diagnostics", page 3~4, Report) Example : Indian Mackerel (IM) (for details, see Manual)

Please see Manual for details on diagnostics.	Evaluation	1. Convergence (MCMC)				2. Model Fit					3. Retrospective analyses		4. Hindcast analyses			
		Heidelberger & Welch p test				2.1 CPUE residuals		2.2 RMSE	2.3 Posterior Predictive Check (PPC)							
	Methods	Geweke.p (larger value better)		Heidel.p (larger value better)		95% CI band		RMSE	Average p values (compute yourself)	Visual inspection	Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (# of yellow: non significant=NG predicted skill) (for B & F)	MASE (Average value)	Visual inspection	
	Criteria	K	r	K	r	Red band Auto-correlation? No is better	total # of outliers less # is better	Less % better fit	Use the 5th sheet to compute. Closer to 0.5 is better	Ball shapes located in center are better (how many #?)	# of yellow markers (B & F ratio) less better	All trends should be similar patterns.	Less # better	should be < 1 & smaller better	# OBS points beyond the 95% CI band	
	Output # (page#)	# 20 (p.3)				# 13 (p.3)		# 10 (p.3)	# 12 (p.4)		# 42 (p.3)	# 40 (p.3)	# 43 (p.4)		# 41 (p.4)	
	diagnostics #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Refer to sheet # how to do								(4)		(5)		(6)			
Users can adjust # of scenarios to compare	Scenario #9 (MIN-MIN) 0.3S	0.92	0.77	0.66	0.76	OK	0	72.9%	0.478	OK	4	OK	0	0.77	1	
	Scenario #9 (MIN-MIN) 0.4S	0.91	0.75	0.51	0.74	OK	0	75.4%	0.479	OK	2	LESS	0	0.60	1	
	Scenario #9 (MIN-MIN) 0.5S	0.32	0.17	0.15	0.79	OK	0	77.5%	0.478	OK	0	OK	0	0.64	1	
	Best scenario?	0.3S	0.3S	0.3S	0.5S	same	same	0.3S	03S & 0.5S	same	0.5S	0.3S & 0.5S	same	0.4S	same	
Comments & decision	(1)	6 best diagnoses for 0.3S, 4 for 0.5S, 1 for 0.4S and 5 for same. Thus 0.3S is selected as the best.														
	(2)	In addition, 0.3S indicates much higher (better) convergence results than others.														
	(3)	In conclusoin, #3S is selected as the best scenario.														

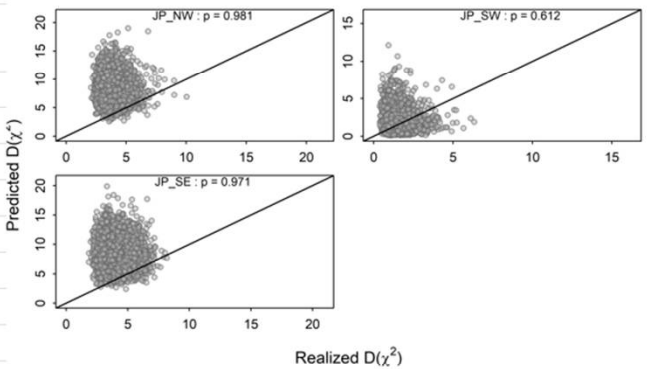
(1) About | (2) Selection form (model)(SWO) | (3)Selection form(scenario)(IM) | (4) #12 | (5) #42 | (6) #41+#43

This is an example of Sworfish (SWO) (Schaefer and Fox) & Indian Mackerel (IM) (3 Scenarios) from page 4 in each Report.
Compute average values using the template.

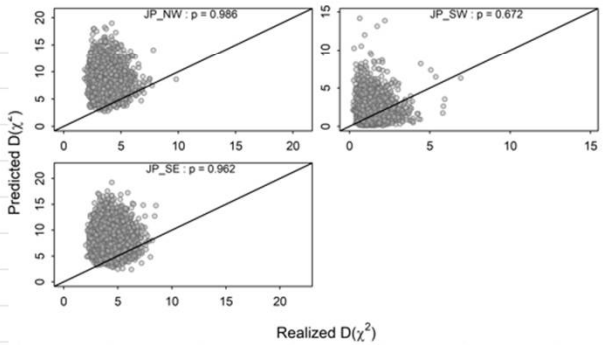
Model

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

Schaefer



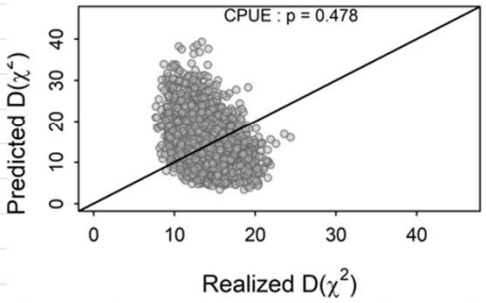
Fox



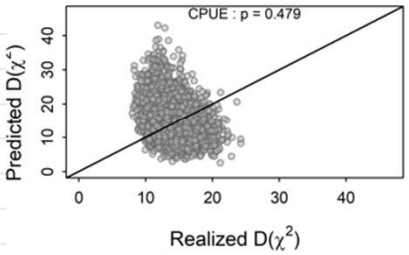
Scenario

	p value (PPC)		
scenario #	8		
depletion	0.3	0.4	0.5
fleet 1	0.478	0.479	0.478
fleet 2			
fleet 3			
fleet 4			
fleet 5			
fleet 6			
average	0.478	0.479	0.478

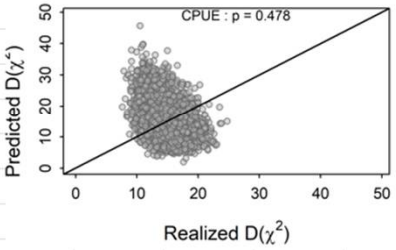
Depletion 0.3



Depletion 0.4



Depletion 0.5



(1) About | (2) Selection form (model)(SWO) | (3)Selection form(scenario)(IM) | (4) #12 | (5) #42 | (6) #41+#43

This example is from (3) scenario #9 0.3S, Indian Mackerel (IM) (page 3 , Report)

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

RETROSPECTIVE ANALYSES

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

Mohan ρ	B	F
2022	-0.20	0.25
2021	-0.08	0.09
2020	0.05	-0.05
2019	0.05	-0.05
2018	0.04	-0.05
Average	-0.03	0.04

For this case, # of yellow makers are 2

3. Retrospective analyses	
Mohan's ρ (-0.15~2.0)	Visual inspection
# of yellow markers (B & F ratio) less better	All trends should be similar patterns.
# 42 (p.3)	# 40 (p.3)

(1) About | (2) Selection form (model)(SWO) | (3)Selection form(scenario)(IM) | (4) #12 | (5) #42 | (6) #41+#43

This example is from (2) SWO_2S (page 4, Report)

SWO_2S(Schaefer)

agnoses (2/2)

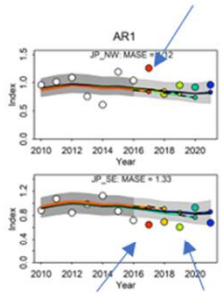
HINDCAST ANALYSES

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

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

Yellow markers (> 1)
Not acceptable

Index	MASE
JP_NW	1.12
JP_SW	NA
JP_SE	1.33
Average	1.24



4. Hindcast analyses		
MASE (# of yellow: non significant=NG predicted skill) (for B & F)	MASE (Average value)	Visual inspection
Less # better	should be < 1 & smaller better	# OBS points beyond the 95% CI band
# 43 (p.4)		# 41 (p.4)
12	13	14
(6)		
2	Non Significant(1.24)	3

(1) About | (2) Selection form (model)(SWO) | (3)Selection form(scenario)(IM) | (4) #12 | (5) #42 | (6) #41+#43

As a result of evaluation of 2 models (Schaefer & Fox) by Selection form
Fox (SWO_2F) was selected

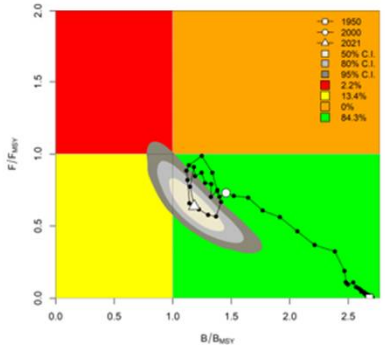
Major results (SWO_2F) are presented in next 3 slides

SWO_2F(Fox)

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

KOBE PLOT

(#18) (page 18) Kobe plot



CONVERGENCE

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

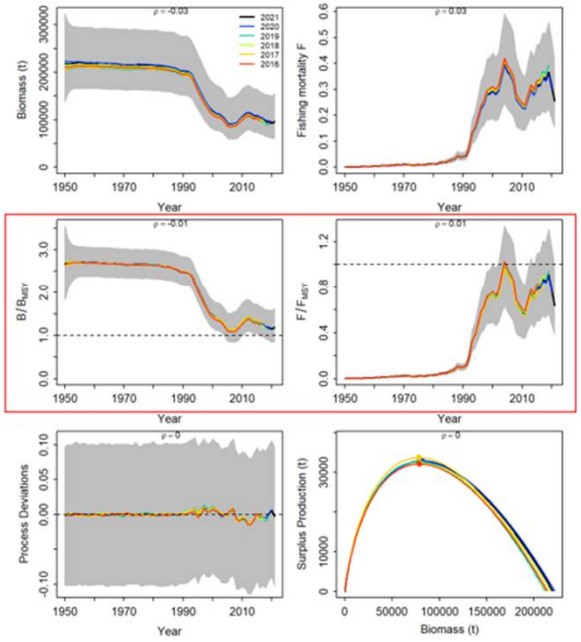
	Geweke.p	Heidel.p
K	0.67	0.31
r	0.43	0.06

RETROSPECTIVE ANALYSES

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

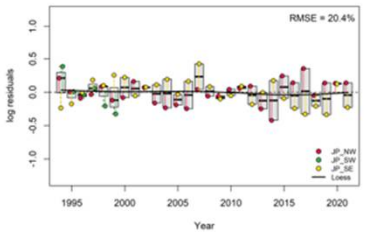
Mohan ρ	B	F
2021	0.03	-0.03
2020	-0.06	0.07
2019	-0.03	0.05
2018	-0.01	0.00
2017	-0.05	0.05
Average	-0.03	0.03

(#40) (p.14) Retrospective patterns

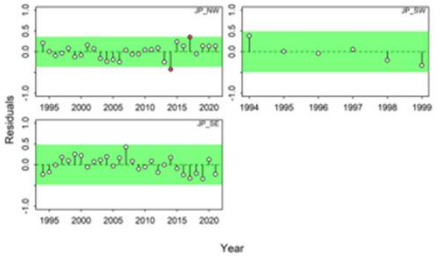


CPUE FITNESS

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



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

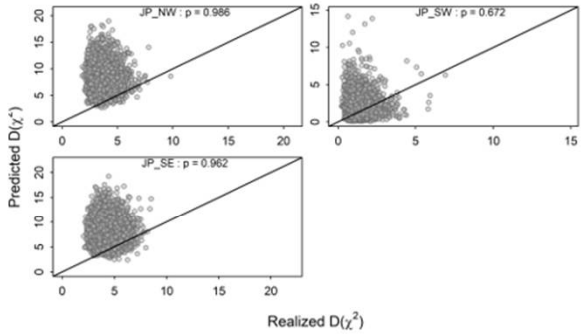


Summary of results & diagnoses (2/2)

MODEL FITS

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

Ave. p=___



ESTIMATED PARAMETER VALUES

(#21)
(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	220,322	171,844	287,317
r	Pop. growth rate	0.41	0.31	0.53
B0/K	Depletion (EST)	0.99	0.68	1.31
sigma.proc	Estimable process VAR	0.05	0.03	0.08
m	Shape parameter	1	1	1
Fmsy	F at MSY	0.40	0.30	0.53
TBmsy	TB at MSY (t)	81,092	63,250	105,751
MSY	MSY (t)	32,528	29,405	38,909
Catch(2021)	Current catch	24,528		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.37	0.37	0.37
TB(1950)/ K	Depletion (OBS)(start)	0.99	0.67	1.31
TB(2021)/ K	Depletion (OBS)(last)	0.44	0.32	0.60
TB/TBmsy	TB ratio	1.18	0.86	1.62
F/Fmsy	F ratio	0.64	0.38	0.99

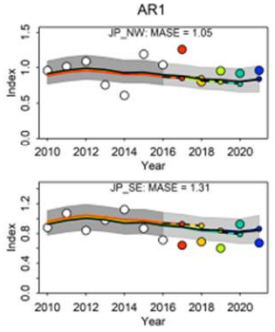
HINDCAST ANALYSES

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

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

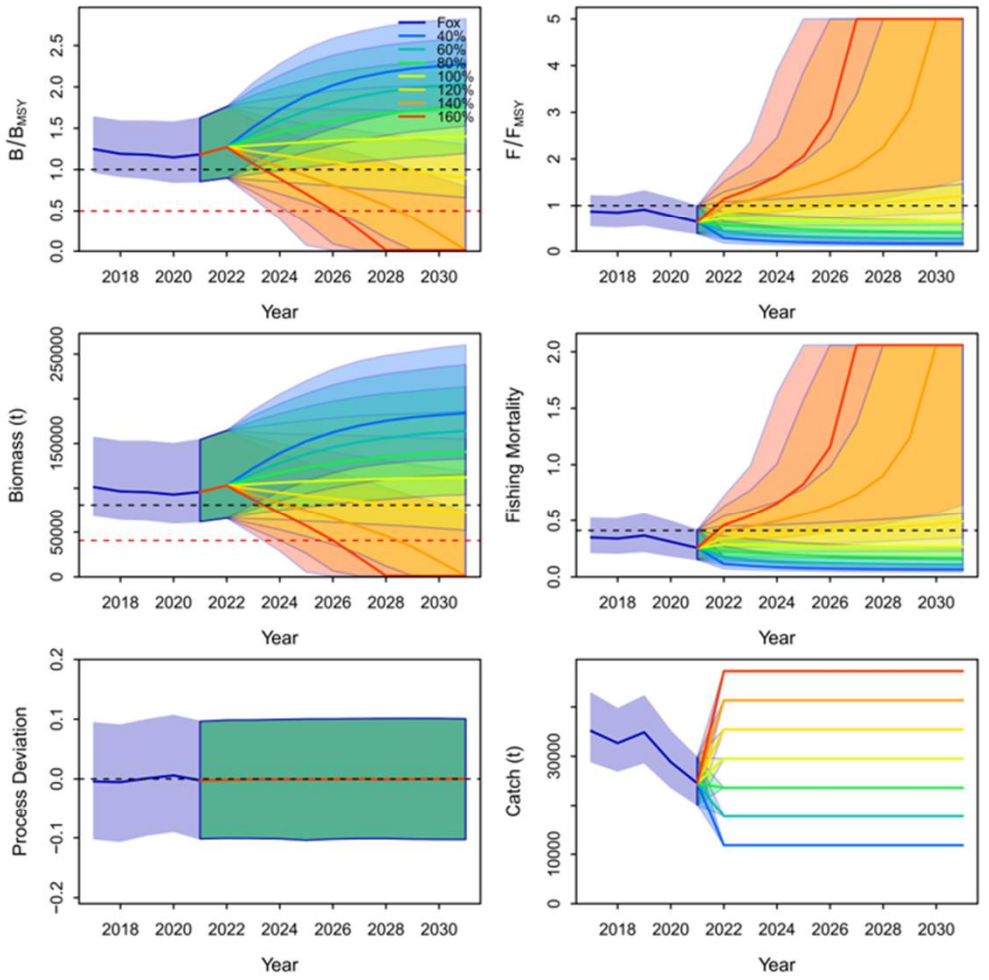
Yellow markers (> 1)
Not acceptable

Index	MASE
JP_NW	1.05
JP_SW	NA
JP_SE	1.31
Average	1.19



(#37) Future Projections

- Projections next 10 years (40%, 60%,80%,100%,120%,140% and 160% of the current catch).
- The current catch is the average catch of the last 3 years.
- Projection is based AR1 (time series biases filtered).



(#37) Future Projections

Summary of results
(JABBA stock assessment for swordfish (Indian Ocean)

- In the 1st runs, CPUE (2 fleets) had autocorrelation problems (Both models)
- In the 2nd runs after removals, all diagnoses are OK (both models), i.e., convergence, retrospective analyses, no autocorrelation and hindcasting.
- The final selection between 2 models by Selection form, Fox model (SWO_2F) was selected although both are similar performances except Fox model was much better in Convergence.
- Stock status (2021)

  ➔ Safe (green) zone (Pr < 84%) (B/Bmsy=1.18 F/Fmsy=0.64)
- Future projection (next 10 years until 2031)

  ➔ Current catch level (24,500 tons) are sustainable for B & F.

3. JABBA runs（Schaefer･Fox) (run1 & run 2)
3.2 Virgin stock [V1]
(1) Swordfish (SWO)

Summary (1/2): How to proceed JABBA runs and select the best model run (for the virgin stock case)

(1) (optional) Try the preliminary & exploratory runs. If Kobe plot, Convergence & retrospective analyses are OK, then do the formal run.

(2) Do the 1st run & if all key diagnoses are OK, then the 1st run is acceptable.

(3) If not converged, check (#13) time series CPUE residuals.
Delete CPUE with autocorrelation(red band) & extraordinary outliers.

(4) Do the 2nd run. If converged, #13, retrospective analyses & Kobe plot are OK, then the 2nd run is acceptable.

Summary (2/2): How to proceed JABBA runs and select the best model run (for the virgin stock case)

(5) But the 2nd run is still not converged, then no solution.

(6) Use other CPUE if available, do 3rd run & do the same checks.

(7) If all key diagnoses are OK, then the 3rd run is acceptable.

(7) If not, no solution, select the best run in each model using the diagnostics (page 3~4, Report).

(8) Select the best model run using the Selection form.

3.2 Virgin stock

(1) Swordfish (SWO) Data type [V1] (See next slide)

Base case : Schaefer(run1➔run2:best run)

: Fox (run1➔run2:best run)

: Selection of the best model run

Sensitivity : No need

3.3 Non virgin stock

(1) Indian Mackerel (IM) data type [NV2] (see next slide)

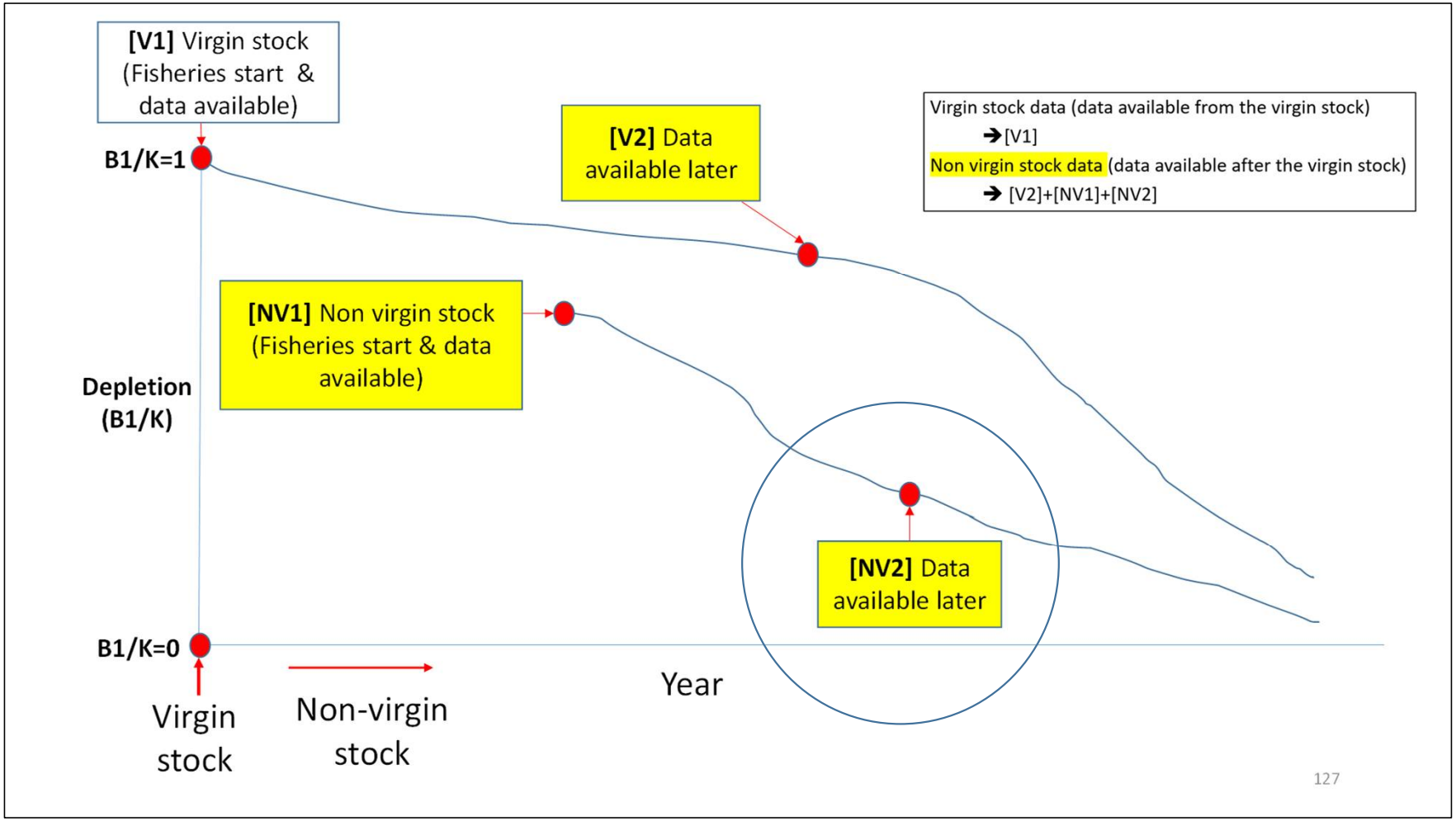
Schaefer : Base case & Sensitivity

Fox : Base case & Sensitivity

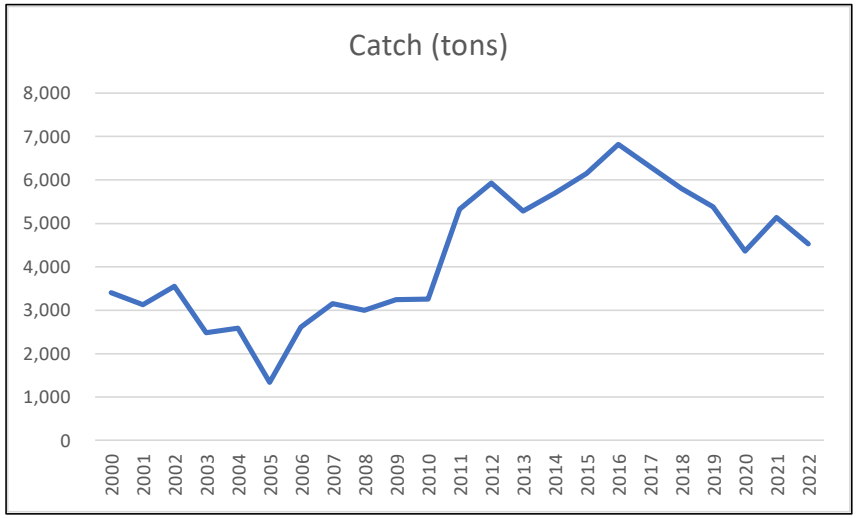
Selection of the best model run from all runs

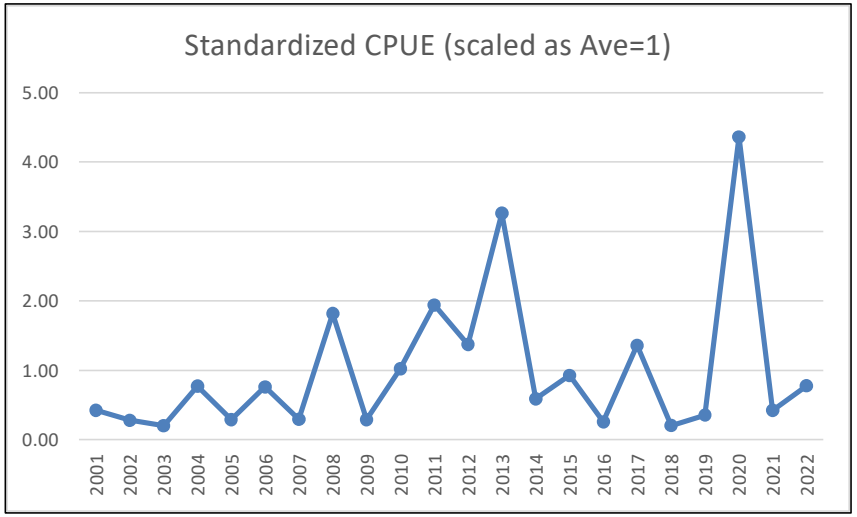
For the non virgin stock data : We now consider cases for [V2], [NV1] or [NV2]

Our example : Indian Mackerel（Sri Lanka) (IM) is [NV2]



Input data


Catch (tons)
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022


Standardized CPUE (scaled as Ave=1)
5.00
4.00
3.00
2.00
1.00
0.00
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022

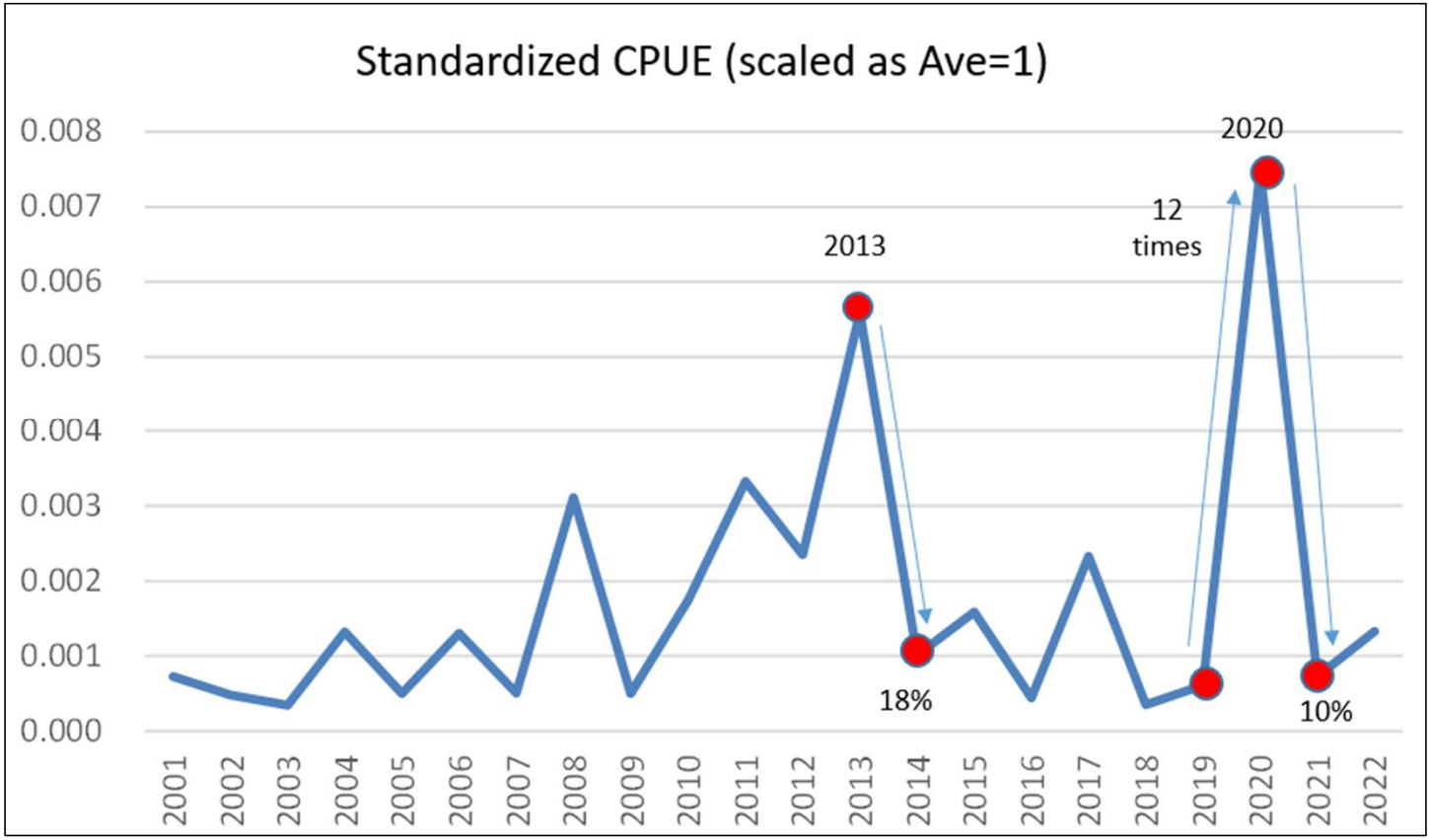
2 possible outliers (2013 & 2020) due to sharp increases & drops

➔ 2014: 10% of 2013, 2020: 12 times of 2012 and 2021: 10% of 2021

such up & down (huge biomass changes) not realistic

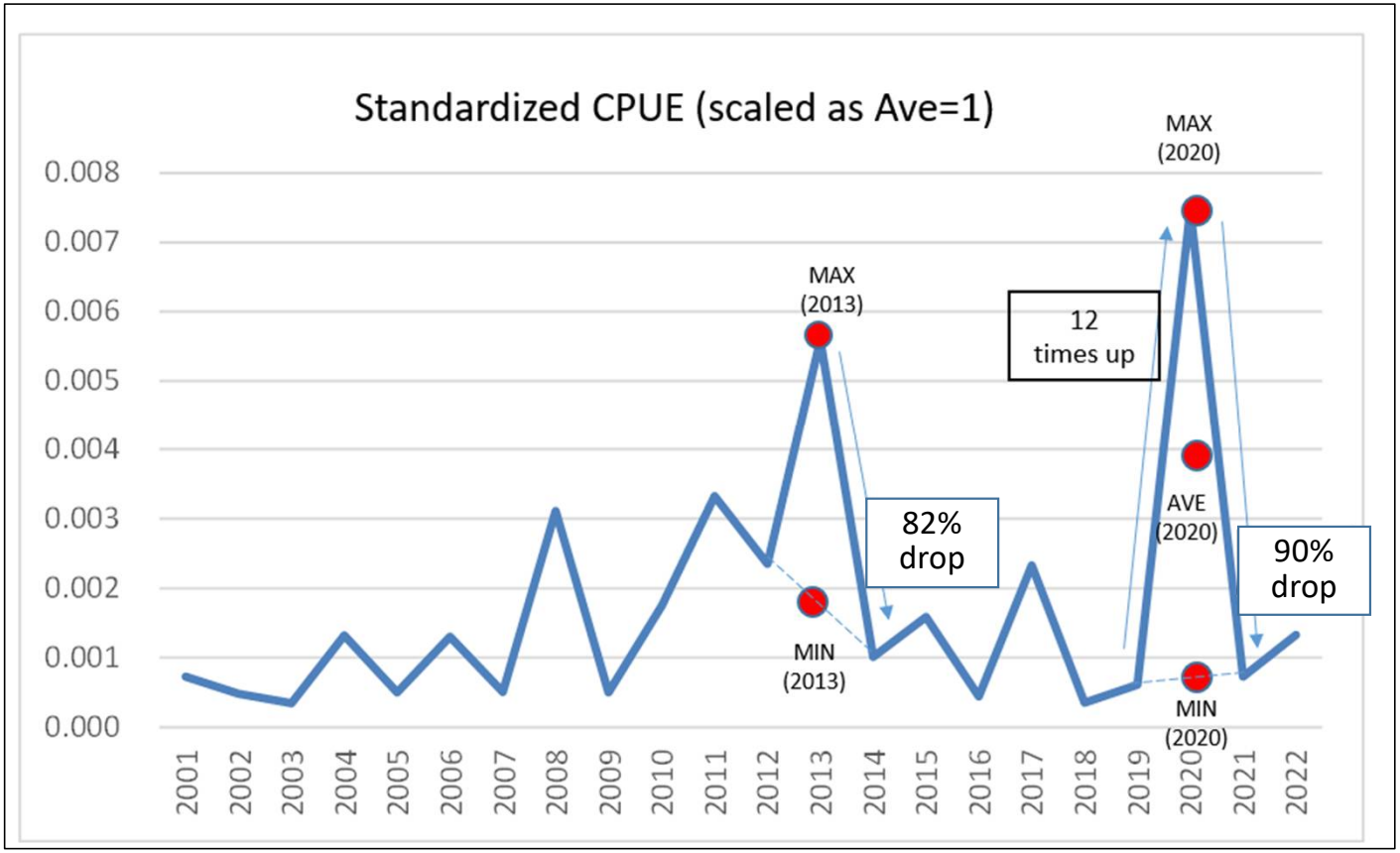
to investigate this, we set up base case & sensitivity

Base case : Original CPUE series & 5 sensitivity (next slide)



6 scenarios (1 base case & 5 sensitivity)

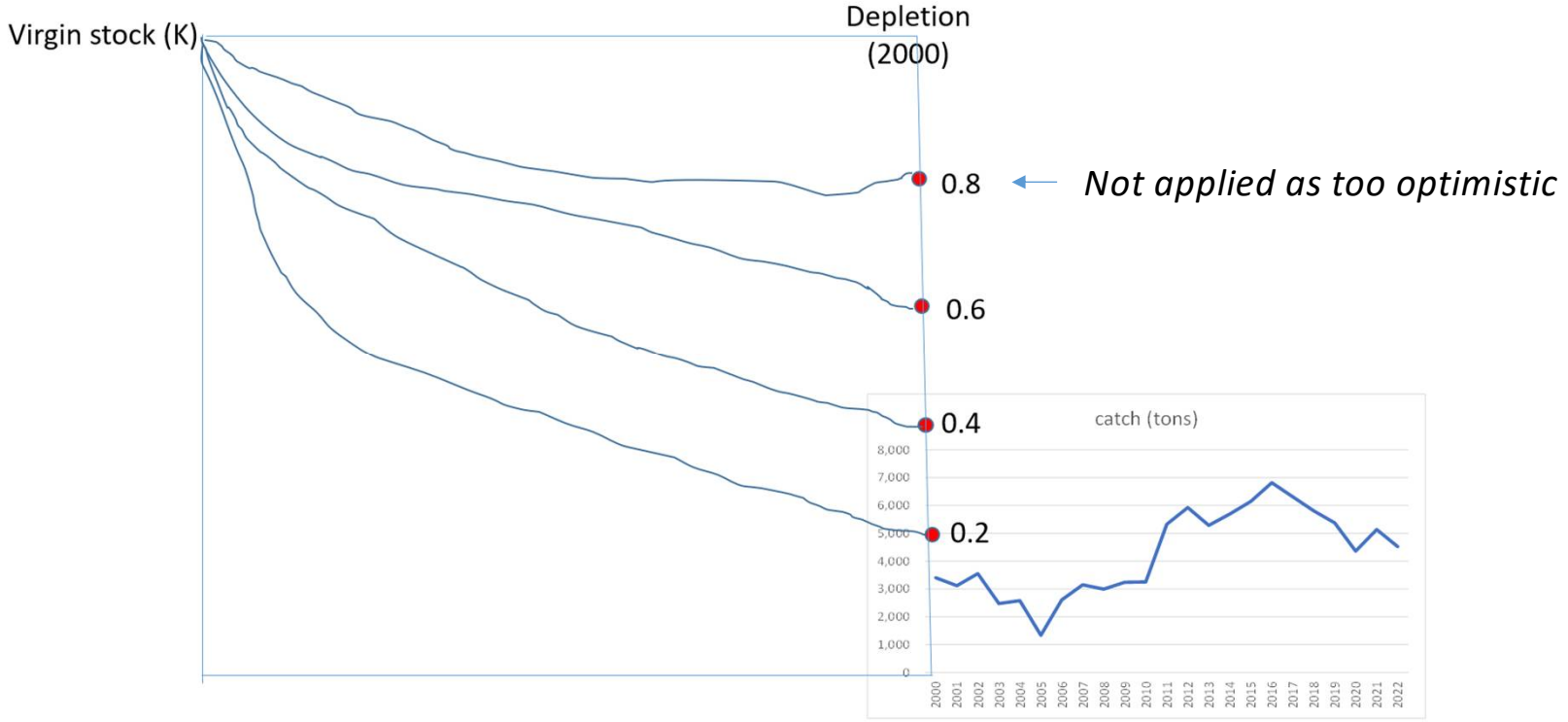
using 5 red dots : 2 for 2 outliers (Max) (2013 & 2020) , 2 for their Minima (average values before & after) & one for average values of Max & Min (2020)



Type	6 Scenarios
Base case (original CPUE series)	(1) Max-Max
Sensitivity	(2) Max-Ave
	(3) Max-Min
	(4) Min-Max
	(5) Min-Ave
	(6) Min-Min

Indian Mackerel (IM)(Sri Lanka) data : B1/K depletion

- As explained, we need to set up several scenarios for B1/K 1. How to set up? noting Catch start from 2000.
- As a 1st step, we will set 3 scenarios (0.2,0.4 & 0.6) (wider range by 0.2) to see the situation, then select the best scenario (B1/K).
- 0.8 is not included as fisheries start many years ago before 2000, hence 0.8 is likely too optimistic.



Considering 6 scenarios, 3 different depletion values (B1/K) & 2 models, we need to make 36 runs to evaluate the best run (most plausible results).

Type	6 Scenarios	Model					
		Schaefer			Fox		
		B1/K (depletion)			B1/K (depletion)		
Base case (original CPUE series)	(1) Max-Max	0.2	0.4	0.6	0.2	0.4	0.6
Sensitivity	(2) Max-Ave	0.2	0.4	0.6	0.2	0.4	0.6
	(3) Max-Min	0.2	0.4	0.6	0.2	0.4	0.6
	(4) Min-Max	0.2	0.4	0.6	0.2	0.4	0.6
	(5) Min-Ave	0.2	0.4	0.6	0.2	0.4	0.6
	(6) Min-Min	0.2	0.4	0.6	0.2	0.4	0.6

How to evaluate runs ?

(1) Initial evaluation by visual inspections

➔ Kobe plot & Retrospective analyses

(2) Evaluation by diagnostics

➔ After good runs are selected, they are inspected by the Selection form including 14 diagnostics, then the best run is identified.

Initial evaluation by visual inspection for Kobe plot & retrospective analyses

Visual inspection for the base case (1) (Max-Max) is demonstrated next 2 slides.
Table below shows the summary of results

(1) MAX-MAX (base case)				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot (*) too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	NG	NG	NG
	Fox	NG	NG	NG
Retrospective patterns (Visual inspection)	Schaefer	NA	NG	NG
	Fox	NG	NG	NG

(*) Criteria of the un-plausible Kobe plot

NG: No Good (not plausible) and NA : results are Not Available

Another initial criteria for future consideration

- Retrospective analyses by numerical evaluation using Mohan ρ values of Bratio (B/Bmsy) & Fratio(F/Fmsy), which are also important to evaluate stock assessment results.

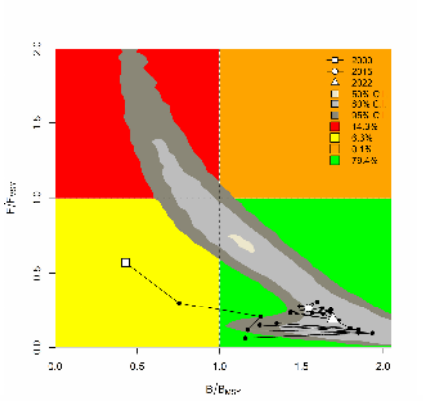
(1) Max-Max (base case) Kobe plot

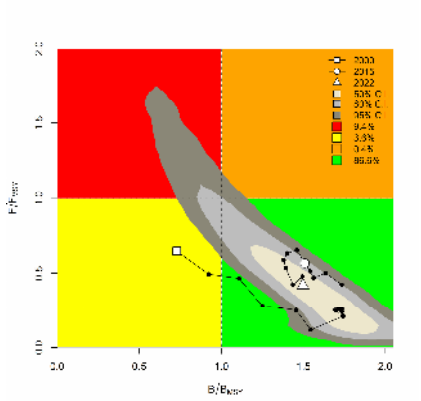
Depletion (B1/K=0.2) S: NG & F:NG

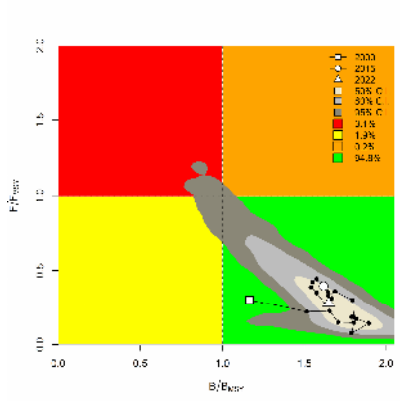
Depletion (B1/K=0.4) S: NG & F:NG

Depletion (B1/K=0.6) S: NG & F:NG

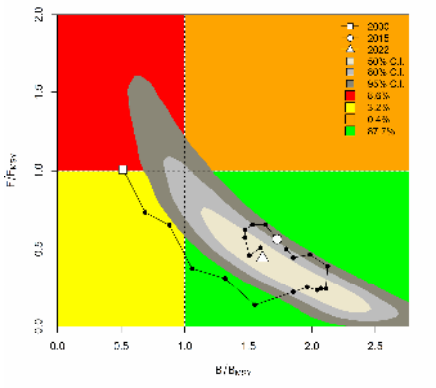
Schaefer(S)

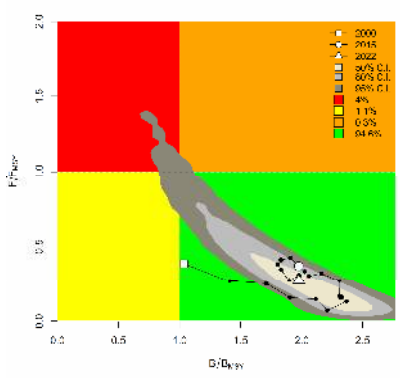


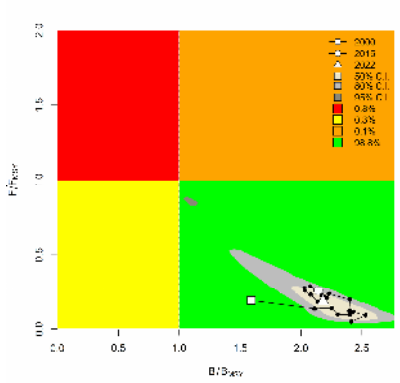




Fox(F)







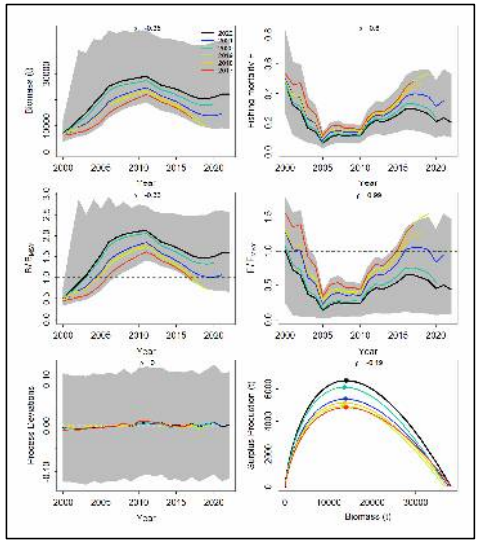
(1) Max-Max
(base case)
Retrospective patterns

S

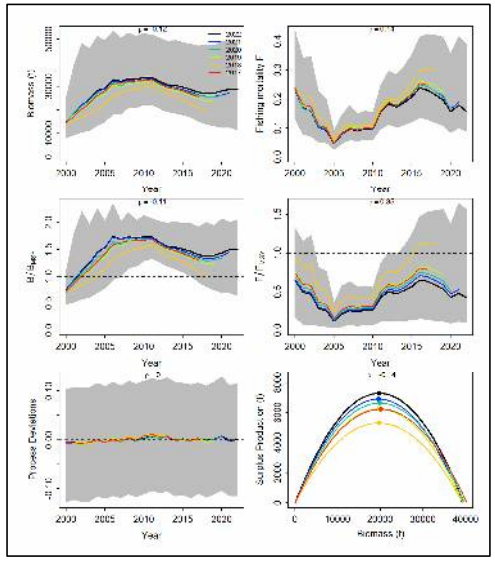
F

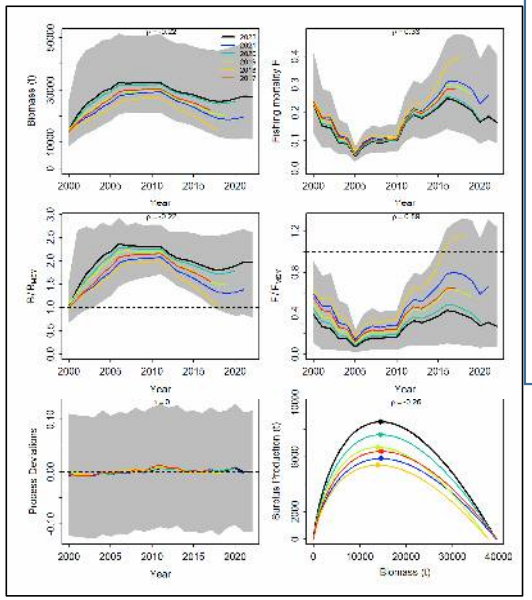
NA

0.2
(NG)

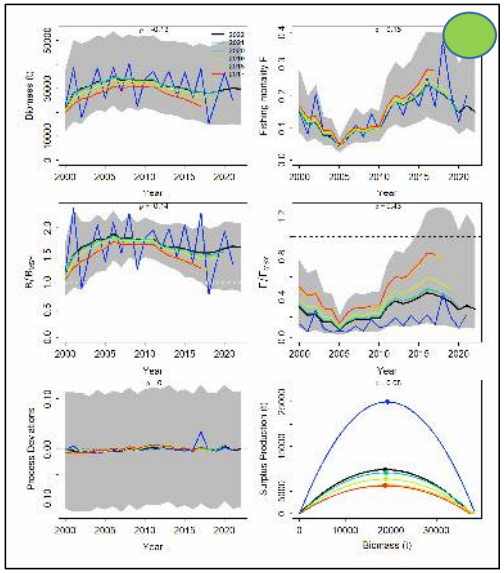


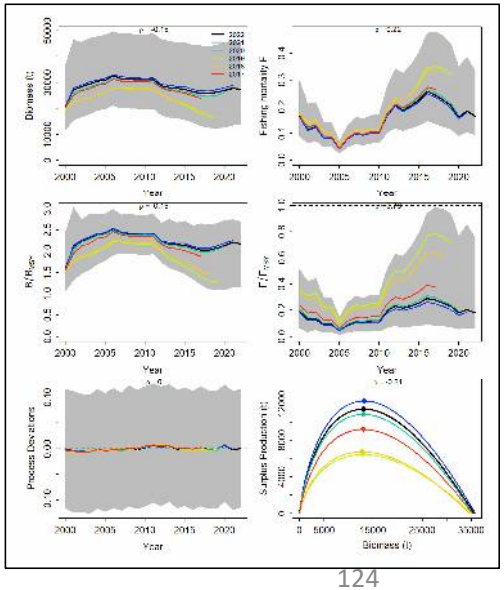
0.4
(NG)





0.6
(NG)





For other runs

- Using the same visual inspections, 5 sensitivity runs are inspected.
- Actual visual inspections are omitted as many slides are needed to show.
- Instead, summary of results of all 6 runs (1 base case & 5 sensitivity) are shown in the next slide.

Summary of results base case + 5 sensitivity

NA
Not Available

NG(Not Good) not acceptable

Only 1 run (6) Min-Min satisfies the visual inspection thus selected

(1) MAX-MAX (base case)				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	NG	NG	NG
	Fox	NG	NG	NG
Retrospective patterns (Visual inspection)	Schaefer	NA	NG	NG
	Fox	NG	NG	NG

(2) MAX-AVE				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	OK	OK	NG
	Fox	OK	OK	NG
Retrospective patterns (Visual inspection)	Schaefer	NG	NG	NG
	Fox	NG	NG	OK

(3) MAX-MiN				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	OK	OK	NG
	Fox	OK	NG	NG
Retrospective patterns (Visual inspection)	Schaefer	NG	NG	NG
	Fox	NG	NG	NG

(4) MIN-MAX				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	NG	NG	NG
	Fox	NG	NG	NG
Retrospective patterns (Visual inspection)	Schaefer	NA	NG	NA
	Fox	NG	NG	NG

(5) MIN-AVE				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	NG	NG	NG
	Fox	NG	NG	NG
Retrospective patterns (Visual inspection)	Schaefer	NA	NG	NA
	Fox	OK	NG	NG

(6) MIN-MIN				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	OK	OK	NG
	Fox	OK	OK	NG
Retrospective patterns (Visual inspection)	Schaefer	NG	OK	NG
	Fox	NG	NG	NG

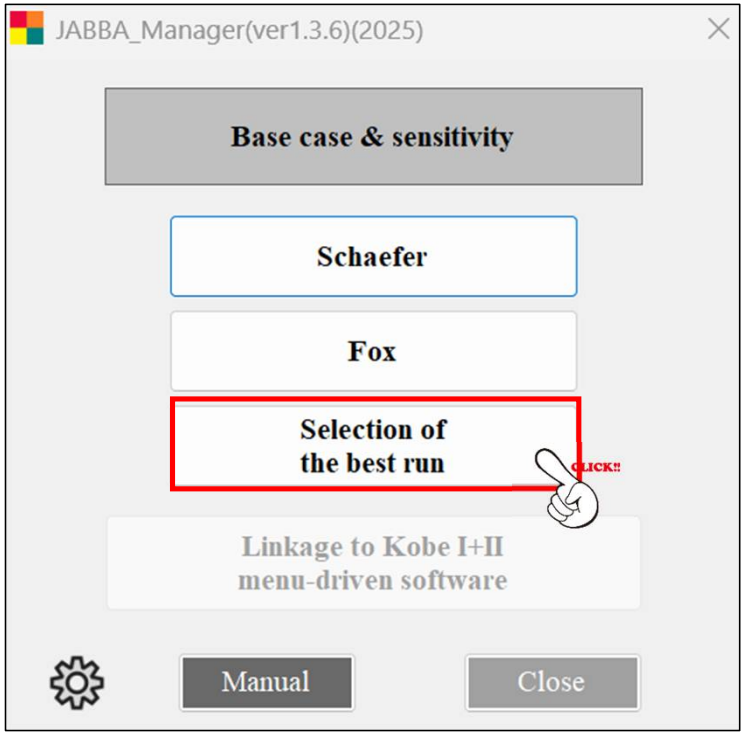
What is the next?

(6) MIN-MIN				
Scenario	B1/K	0.2	0.4	0.6
Kobe plot too optimistic (NG) if F/Fmsy < 0.5 & 1.5 < TB/TBmsy	Schaefer	OK	OK	NG
	Fox	OK	OK	NG
Retrospective patterns (Visual inspection)	Schaefer	NG	OK	NG
	Fox	NG	NG	NG

- As we use the wider range (every 0.2) for sensitivity.
- We need to investigate further sensitivity with narrower range (every 0.1)
- So, we will investigate 0.3, 0.4 and 0.5 (Schaefer) in details using 14 diagnostics available in the Selection form.

How to get the Selection form?

(1) From the 3rd menu



(2) Independently from the ESL software folder, which is not linked to the software.

Selection of the best scenario run based on 14 diagnostics Indian Mackerel (IM)																
Please see Manual for details on diagnostics.	Evaluation	1. Convergence (MCMC)				2. Model Fit					3. Retrospective analyses		4. Hindcast analyses			
		Heidelberger & Welch p test				2.1 CPUE residuals		2.2 RMSE	2.3 Posterior Predictive Check (PPC)							
	Methods	Geweke.p (larger value better)		Heidel.p (larger value better)		95% CI band		RMSE	Average p values (compute yourself)	Visual inspection	Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (# of yellow: non significant=NG predicted skill) (for B & F)	MASE (Average value)	Visual inspection	
	Criteria	K	r	K	r	Red band Auto-correlation? No is better	total # of outliers less # is better	Less % better fit	Use the 5th sheet to compute. Closer to 0.5 is better	Ball shapes located in center are better (how many #?)	# of yellow markers (B & F ratio) less better	All trends should be similar patterns.	Less # better	should be < 1 & smaller better	# OBS points beyond the 95% CI band	
	Output # (page#)	# 20 (p.3)				# 13 (p.3)		# 10 (p.3)	# 12 (p.4)		# 42 (p.3)	# 40 (p.3)	# 43 (p.4)		# 41 (p.4)	
	diagnostics #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	
	Refer to sheet # how to do								(4)		(5)		(6)			
Users can adjust # of scenarios to compare	Scenario #9 (MIN-MIN) 0.3S	0.92	0.77	0.66	0.76	OK	0	72.9%	0.478	OK	4	OK	0	0.77	1	
	Scenario #9 (MIN-MIN) 0.4S	0.91	0.75	0.51	0.74	OK	0	75.4%	0.479	OK	2	LESS	0	0.60	1	
	Scenario #9 (MIN-MIN) 0.5S	0.32	0.17	0.15	0.79	OK	0	77.5%	0.478	OK	0	OK	0	0.64	1	
	Best scenario?	0.3S	0.3S	0.3S	0.5S	same	same	0.3S	03S & 0.5S	same	0.5S	0.3S & 0.5S	same	0.4S	same	
Comments & decision	(1)	6 best diagnoses for 0.3S, 4 for 0.5S, 1 for 0.4S and 5 for same. Thus 0.3S is selected as the best.														
	(2)	In addition, 0.3S indicates much higher (better) convergence results than others.														
	(3)	In conclusoin, #3S is selected as the best scenario.														

Scenario #9 (Min-Min) 0.3S is selected as the best.

- If users wish to search more finer scale of the depletion levels for last 2 decimals (such as 0.032, 0.034….), the same process can be used.

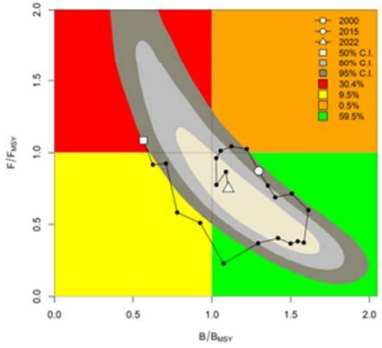
- But, one decimal such as 0.3 is enough considering sensitivities of results (accuracy levels), which is the standard level in the stock assessments.

Major results (next 3 slides)

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

KOBE PLOT

(#18) (page 18) Kobe plot



CONVERGENCE

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

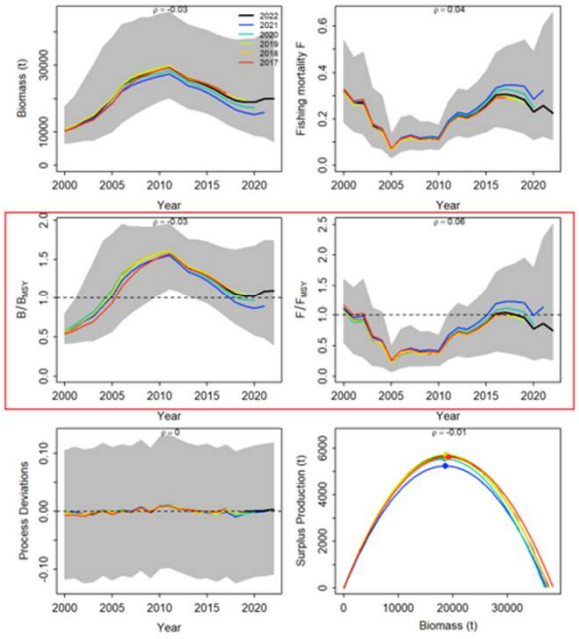
	Geweke.p	Heidel.p
K	0.92	0.66
r	0.77	0.76

RETROSPECTIVE ANALYSES

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

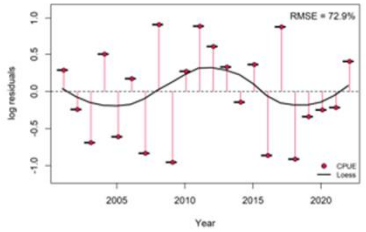
Mohan ρ	B	F
2022	-0.20	0.25
2021	-0.08	0.09
2020	0.05	-0.05
2019	0.05	-0.05
2018	0.04	-0.05
Average	-0.03	0.04

(#40) (p.14) Retrospective patterns

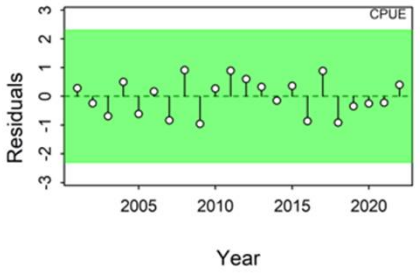


CPUE FITNESS

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



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

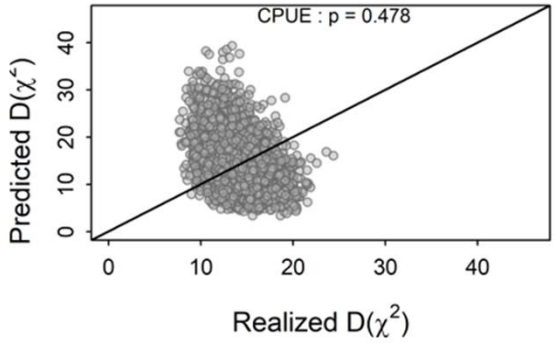


Summary of results & diagnoses (2/2)

MODEL FITS

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

Ave. p=___



ESTIMATED PARAMETER VALUES

(#21)
(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	37,476	26,994	53,156
r	Pop. growth rate	0.61	0.39	1.04
B0/K	Depletion (EST)	0.28	0.21	0.40
sigma.proc	Estimable process VAR	0.05	0.03	0.09
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.30	0.20	0.52
TBmsy	TB at MSY (t)	18,738	13,497	26,578
MSY	MSY (t)	5,475	4,365	9,893
Catch(2022)	Current catch	4,522		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(2000)/ K	Depletion (OBS)(start)	0.28	0.21	0.40
TB(2022)/ K	Depletion (OBS)(last)	0.55	0.20	0.87
TB/TBmsy	TB ratio	1.10	0.40	1.74
F/Fmsy	F ratio	0.75	0.27	2.51

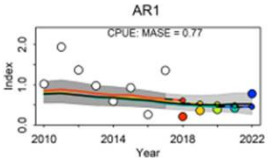
HINDCAST ANALYSES

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

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

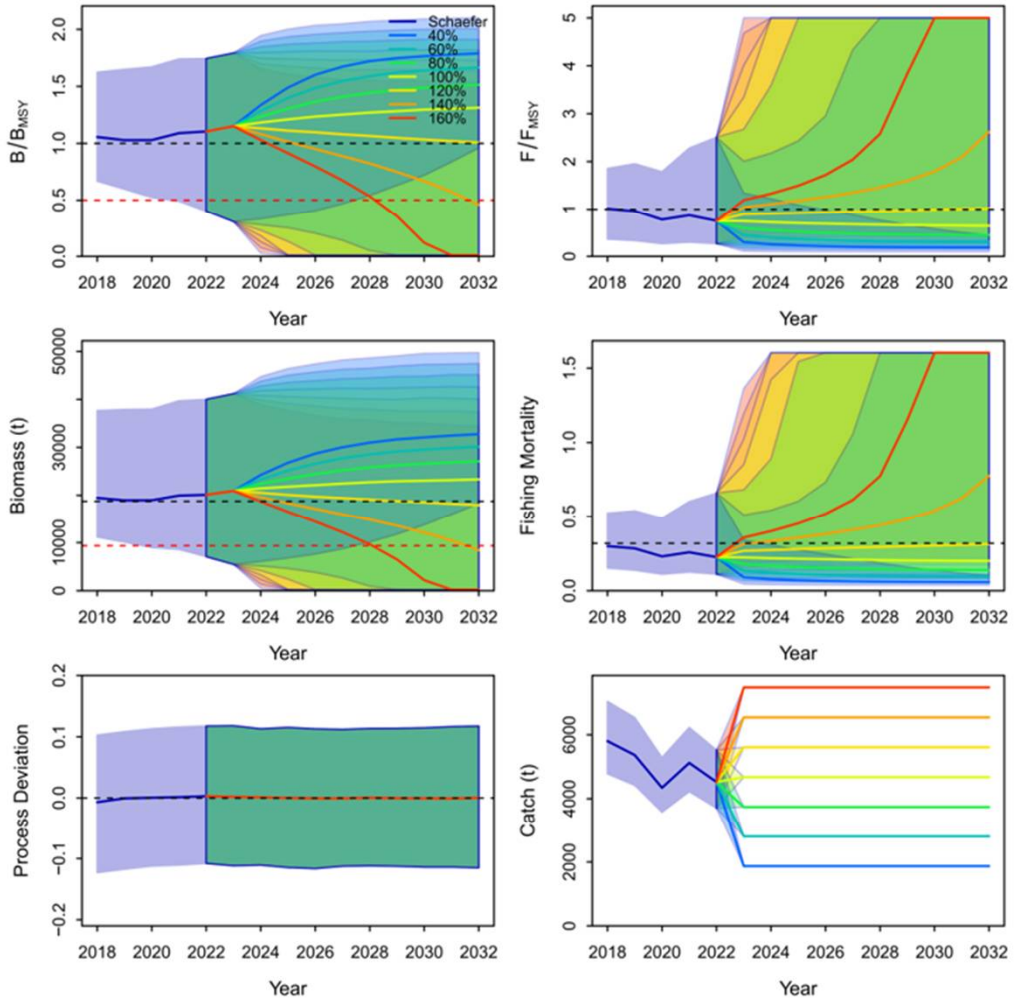
Yellow markers (> 1)
Not acceptable

Index	MASE
CPUE	0.77
Average	0.77



(#37) Future Projections

- Projections next 10 years (40%, 60%,80%,100%,120%,140% and 160% of the current catch).
- The current catch is the average catch of the last 3 years.
- Projection is based AR1 (time series biases filtered).



(#37) Future Projections

Summary of results
(JABBA stock assessment for Indian Mackerel in Sri Lanka)

- Standardized CPUE (MIN-MIN scenario) produced most plausible results.
  ➔ 2 peaks (2013 & 2020) are unlikely correct abundance index.
- Depletion level (2020) =0.3 in CPUE(MIN-MIN) produced reliable results.
  ➔ All diagnoses are OK, i.e., convergence, retrospective analyses, no autocorrelation and hindcasting.
- Stock status (2022)
  ➔ Safe (green) zone (60%) close to MSY levels (B/Bmsy=1.1 F/Fmsy=0.75)
- Future projection (next 10 years until 2032)
  ➔ Current catch level (4,500 tons) are sustainable (B & F)

4. Final Remarks (important)

- Through two JABBA case studies (Swordfish and Indian Mackerel), users well recognized that that process to get the best run is not easy and rather complex.

- This is because there are various treatments for JABBA run to get the best run (result) due to different attributes of each data.

- Thus, users need to work with us [MENU] to produce the best result as users know the data well and [MENU] know the software as a developer of the JABBA software.

Appendix A History of Development & Application underpinning this software

History of Development

2023/04	Start development
2024/10	Version (1.0.0) (Original version)
2024/12	Version (1.2.0) (Entry window improved)
2025/05	Version (1.3.6) (Report and Selection form are improved)

Application underpinning this software

- Microsoft Visual Studio (2022)
- Graphics: (1) C#, (2) . NetFrameWork4.7.2 and (3) . NetCore6.0
- R-4.3.1-win(2023)
- R related application
    - JAGS
    - DevTools
    - Reshape2

Appendix B Report of the JABBA run (Report_SWO_1S) (sample)

Report_SWO_1S (Schaefer)

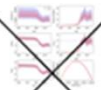
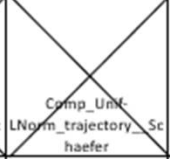
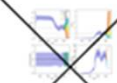
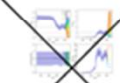
Contents

Output

Summary of results & diagnoses

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

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

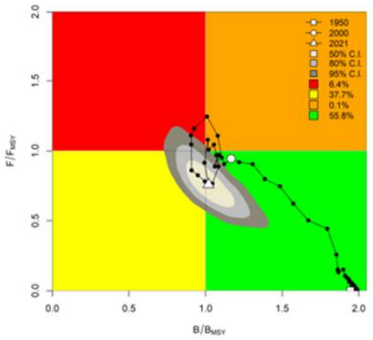
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
 Posteriors__Schaefer_Unif	 MCMC__Schaefer_Unif	 Posteriors__Schaefer_LNorm	 MCMC__Schaefer_LNorm	 Comp_Unif-LNorm_summary__Schaefer	 Comp_Unif-LNorm_trajectory__Schaefer	 Index__Schaefer	 Catch__Schaefer	 Catch-fit__Schaefer	 Index_Residuals__Schaefer
(11)	(12)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

(Note) Blanks means implausible results or not available.

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

KOBE PLOT

(#18) (page 18) Kobe plot



CONVERGENCE

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

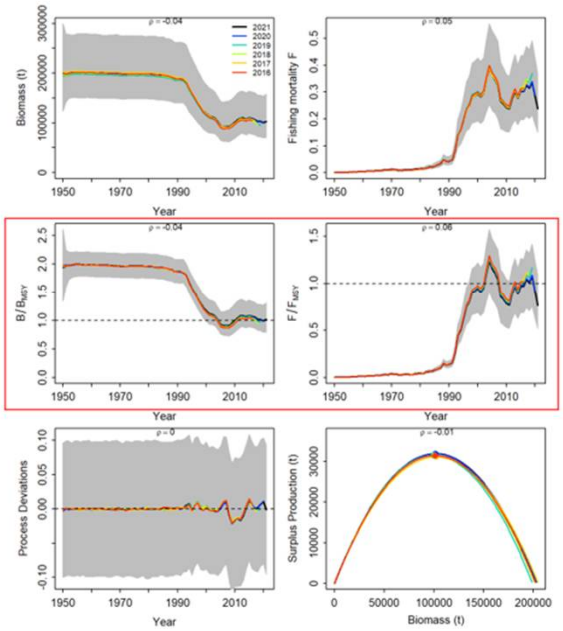
	Geweke.p	Heidel.p
K	0.80	0.57
r	0.96	0.67

RETROSPECTIVE ANALYSES

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

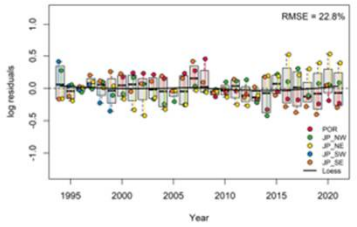
Mohan ρ	B	F
2021	-0.01	0.01
2020	-0.07	0.10
2019	-0.07	0.08
2018	-0.02	0.03
2017	-0.03	0.04
Average	-0.04	0.05

(#40) (p.14) Retrospective patterns

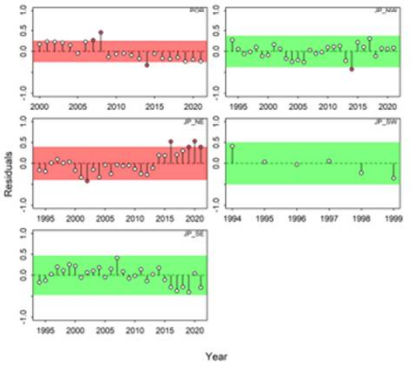


CPUE FITNESS

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



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

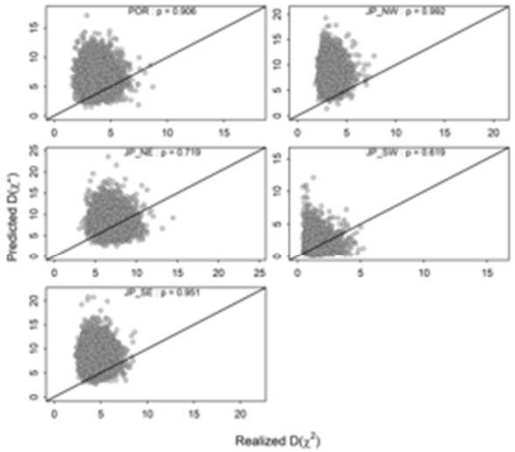


Summary of results & diagnoses (2/2)

MODEL FITS

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

Ave. p=___



ESTIMATED PARAMETER VALUES

(#21)
(page 16)

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	203,291	153,872	275,328
r	Pop. growth rate	0.63	0.46	0.84
B0/K	Depletion (EST)	0.97	0.68	1.30
sigma.proc	Estimable process VAR	0.05	0.03	0.07
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.31	0.23	0.42
TBmsy	TB at MSY (t)	101,645	76,936	137,664
MSY	MSY (t)	31,761	29,018	35,629
Catch(2021)	Current catch	24,528		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(1950)/ K	Depletion (OBS)(start)	0.97	0.67	1.30
TB(2021)/ K	Depletion (OBS)(last)	0.51	0.39	0.66
TB/TBmsy	TB ratio	1.02	0.79	1.31
F/Fmsy	F ratio	0.76	0.51	1.08

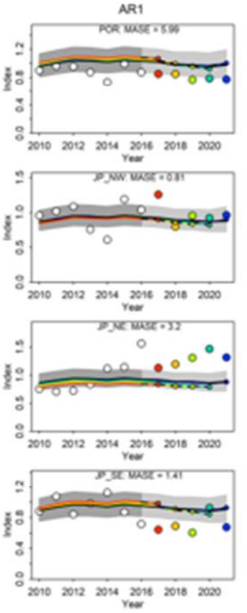
HINDCAST ANALYSES

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

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

Yellow markers (> 1)
Not acceptable

Index	MASE
POR	5.99
JP_NW	0.81
JP_NE	3.20
JP_SW	NA
JP_SE	1.41
Average	1.94



1. Convergences

1.1 Heidelberger and Welch Statistical test (#20)

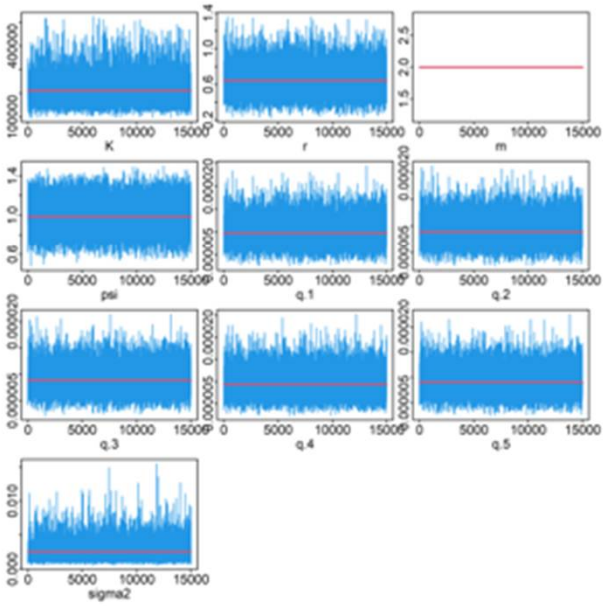
(#20) Heidelberger and Welch Statistical test on Convergence

	Geweke.p	Heidel.p
K	0.80	0.57
r	0.96	0.67
q.1	0.63	0.63
q.2	0.86	0.49
q.3	0.84	0.40
q.4	0.84	0.09
q.5	0.85	0.62
psi	0.55	0.20
sigma2	0.92	0.12
Average	0.80	0.42

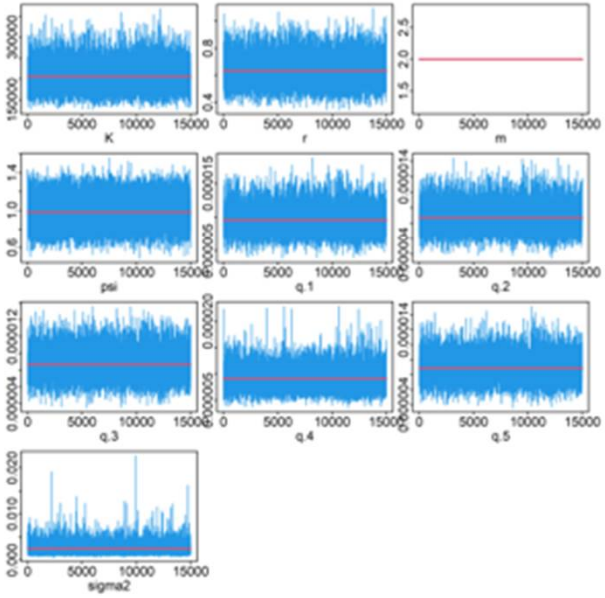
Ho: Pr (MCMC is converged)

Pr < 0.05(5%) ➔ not converged (yellow markers) and Higher Pr. ➔ better convergence (MCMC)

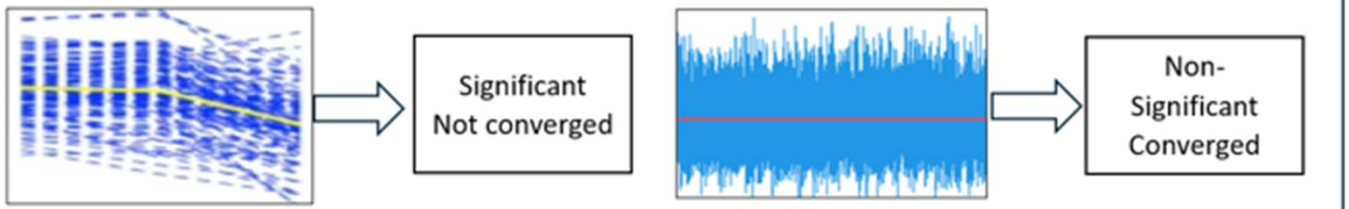
(#2) The 1st MCMC results for uniform models



(#4) The 2nd MCMC results for log-normal models



Reference for Visual Inspection

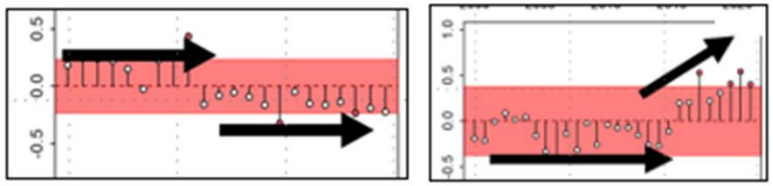


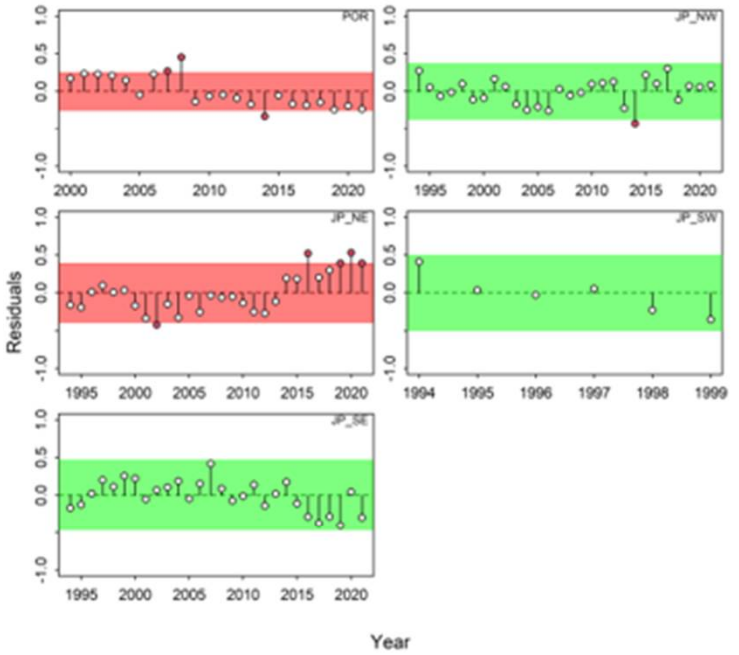
2. Model fit

2.1 CPUE residuals (Randomness & Outliers) (#13)

Reference for Visual Inspection

- Red band (No Randomness and Autocorrelation)
  ➔ Delete CPUE series (fleets)
- Green band (Randomness and No autocorrelation)
  ➔ Keep CPUE series (fleets)
- Red points (outliers)
  ➔ Delete if points are very far from the 95% CI bands.
  (Decisions depend on seriousness & personal judgements)
- Strange time series trends
  ➔ Time series trends of CPUE residuals should be even. If they have uneven trends (below), such CPUE need to be deleted.
  (Decisions depend on seriousness & personal judgements)

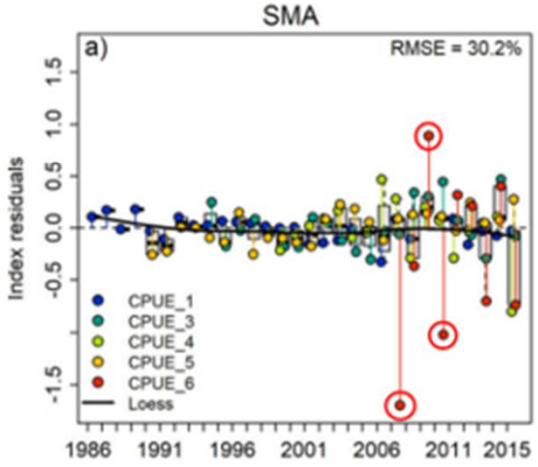


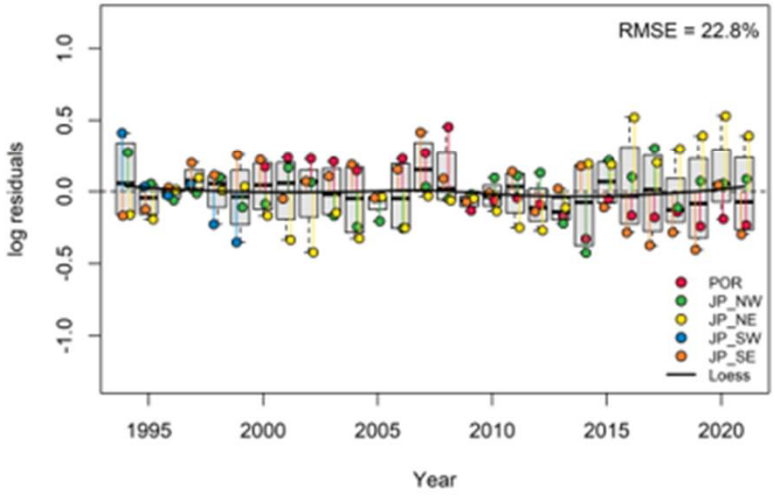


(#13) Randomness (Autocorrelation) test and outliers

2.2 RMSE (Root Mean Square Error) (#10)

- Box plots of joint residuals show the overall median with quantiles. Points beyond the quantiles indicated by the vertical dotted lines. Losses is the smoother through all residuals.
- Less RMSE (%) is better fit.
- Outliers far from the quantile box should be deleted.
- For example (below), 1~3 points with red circles below, are candidates of outliers. Decisions how many points should be deleted, depend on the personal judgements, i.e., some deletes the worse one, while some deletes all.



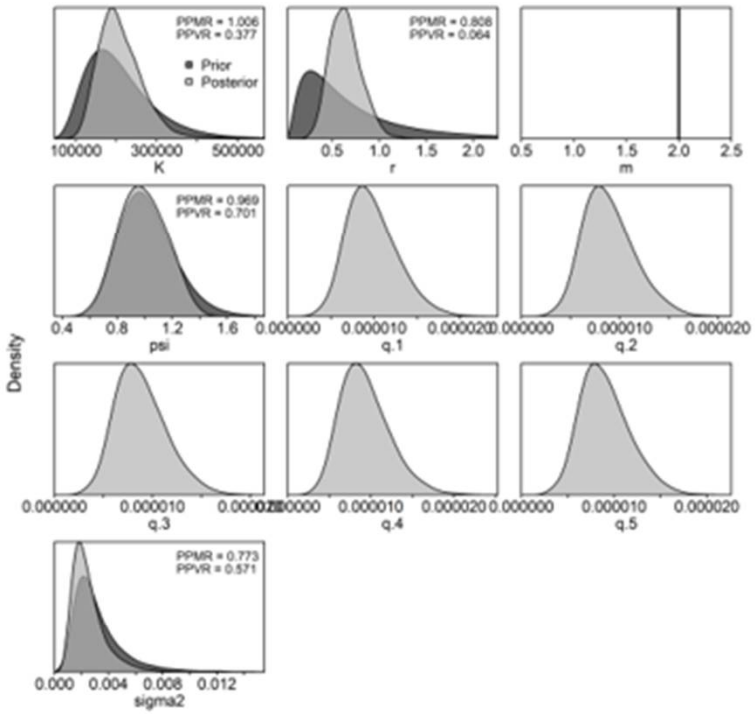


(#10) RMSE, quantiles & loess by fleet.

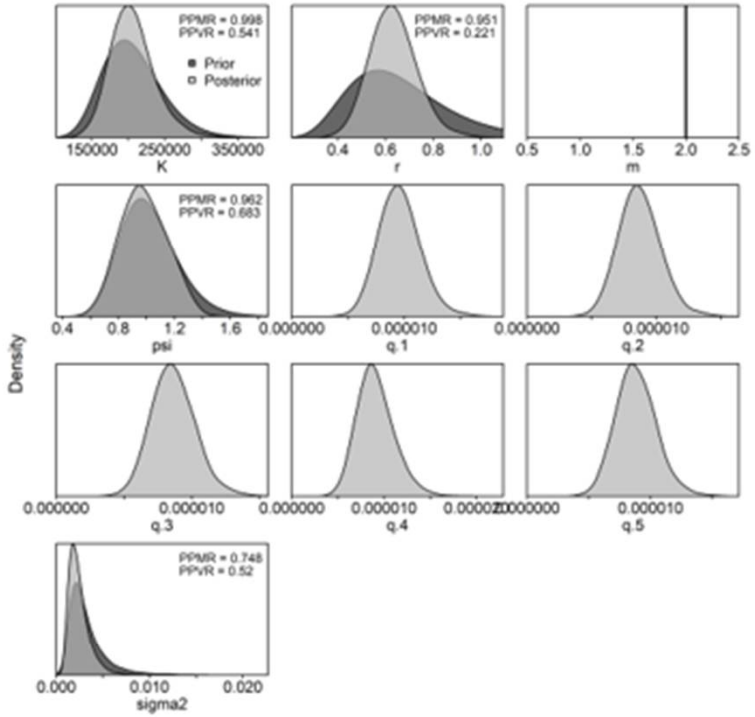
2.3 Prior to Posterior Median/Variance Ratio (PPMR & PPVR)

(Note)

- This JABBA application uses 2 steps to estimate the final Posterior Probability Distribution, i.e., 1st by uniform and 2nd by log normal model.
- In the 1st step by the uniform distribution, users need to input mini and max values for r and K and a point value for depletion and sigma2 in the input menu.
- In the 2nd step by the log normal model, the estimated parameters of the posterior from the 1st step will be used as the prior.
- As for q, no need to seed initial values as their probability distribution functions are estimated by optimization with others by MCMC.
- As for m, it is constant (2 for Schaefer & 1 for Fox).



(#1) Prior & posterior probability distribution estimated in the 1st step (uniform function).



(#3) Prior & posterior probability distribution estimated in the 2nd step (lognormal model).

PPMR & PPVR and Meanings of results		
	PPMR (Prior to Posterior **Median** Ratio)	PPVR (Prior to Posterior **Variance** Ratio)
1 >	Prior (median) was set smaller than estimated	Prior (variance) was set smaller than estimated
<1	Prior (median) was set larger than estimated	Prior (variance) was set larger than estimated
1	Perfect prior	

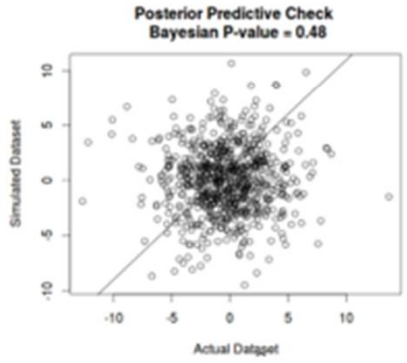
Criteria for fitness
If PPMR and PPVR is closer to 1, it means better fitness for point estimate and variance respectively.

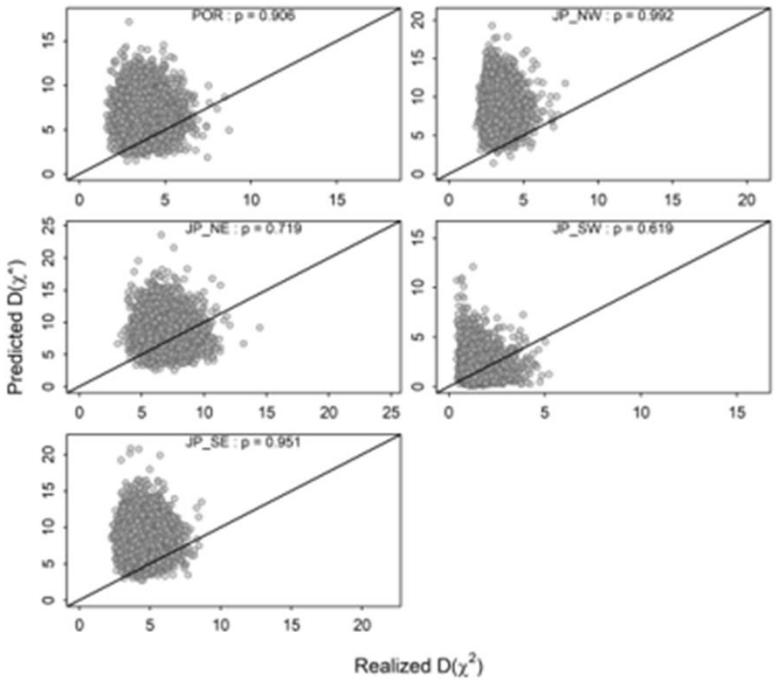
Users need to compute average of 4 parameters (K, r, depletion & sigma2) for PPMR & PPVR respectively. These values will be used to evaluate the best model (Schaefer or Fox).
(see the selection form, the 3rd menu)

2.4 Posterior Predictive Check (PPC) (#12)

Posterior Predictive Check (PPC)

- PPC is conducted by CPUE fitness between observed & predicted CPUE. Plausible range of test statistic p is 0.2~0.8 and value closer to 0.5 fits well.
- The example (right) indicates that POR, JP_NW & JP_SE are beyond 0.2~0.8 (not well fit), thus they might need to drop from JABBA. Other inspection results (#13 & #10) need to be referred for the final decision.
- Plots like a ball & centralized indicate better fits (below).





(#12) PPC (CPUE fitness) (Average p =____)
Users need to compute the average p value using 5 p values above (for example).
The average value will be used to evaluate the best model (Schaefer or Fox)
(see the selection form, the 3rd menu).

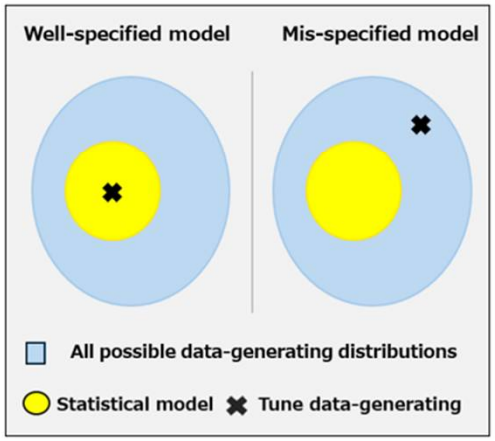
3. Retrospective analyses (#42)

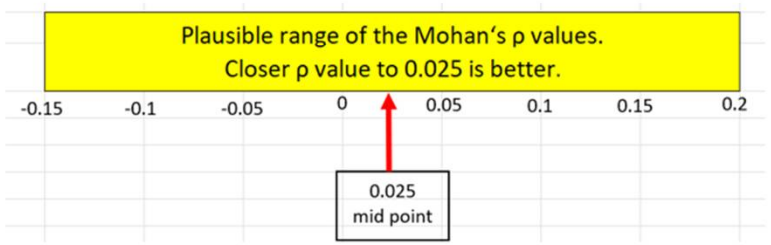
(#42) Retrospective analyses to inspect model mis-specification using Mohan ρ values & graphs

	B	F	Bmsy	Fmsy	procB	MSY	Average
2021	-0.01	0.01	-0.01	0.01	0.00	0.00	0.00
2020	-0.07	0.10	-0.04	0.08	-0.01	-0.01	0.01
2019	-0.07	0.08	-0.07	0.09	0.00	-0.01	0.00
2018	-0.02	0.03	-0.04	0.06	0.00	-0.01	0.00
2017	-0.03	0.04	-0.03	0.05	0.00	-0.01	0.00
Average	-0.04	0.05	-0.04	0.06	0.00	-0.01	0.00

Mohan ρ: -0.15 < ρ < 0.2 ➔ converged. If not converged, they are indicated by yellow markers.
B(B/Bmsy) and F(F/Fmsy) are the most important parameters as for results of stock assessments.
Thus, they will be used for evaluation (see page 3).

Schematic diagram showing well & miss specified model

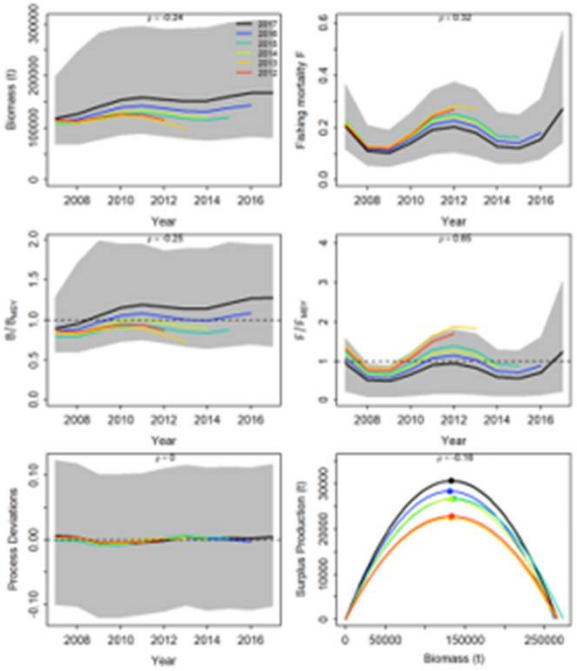


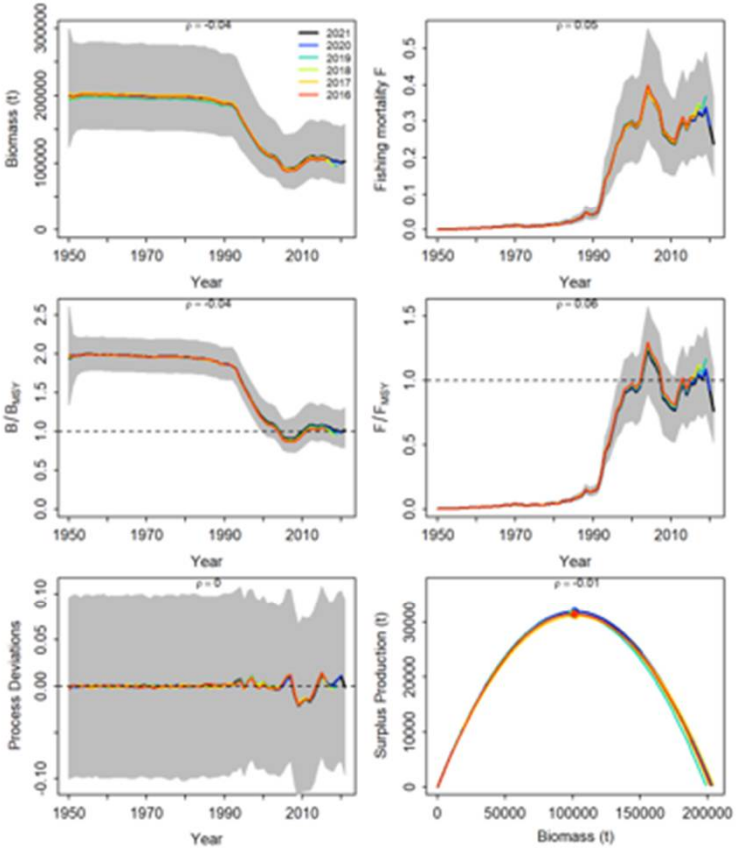


(#40) Plots of retrospective analyses

Reference for Visual Inspection

6 Graphs (below) showing retrospective trends & patterns for last 5 years. During 5 retro years, trends should be smooth, no large differences among lines nor strange behaviors. As 6 graphs (below) show large differences except Process Deviations, there is a model mis-specification problem. Users need to inspect convergence and model fitness.





4.Hindcast analyses (#43)

(#43) Hindcast analyses to examine the prediction power by MASE (Mean Absolute Scaled Error)

Index	MASE
POR	5.99
JP_NW	0.81
JP_NE	3.20
JP_SW	NA
JP_SE	1.41
Average	1.94

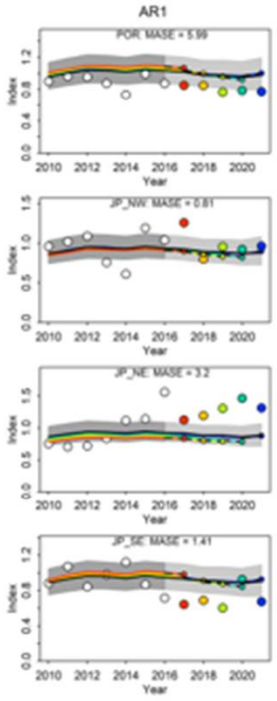
If MASE (Mean Absolute Scaled Error) < 1 ➔ better prediction ability

MASE ≥ 1 (yellow markers) ➔ Poor prediction power
(Larger MASE values, less prediction power)

(#41) Plots of Hind cast analyses

Interpretation of graphs (4 fleets example)

- Small color circles are the predicted values, and the large color circles are the actual observed points. The white circle is observed point before hand-casting years.
- If the large color circles are outside the 95% CI, it can be interpreted that the JABBA predictive performance is low because the prediction does not match the actual measured value (smaller color circle).
- The JABBA can predict the CPUE of JP_NW well, but the predictive performance of the other CPUE is low.
- Even if the hindcasting results are poor, the estimated current state of the stocks themselves may be true for some cases.



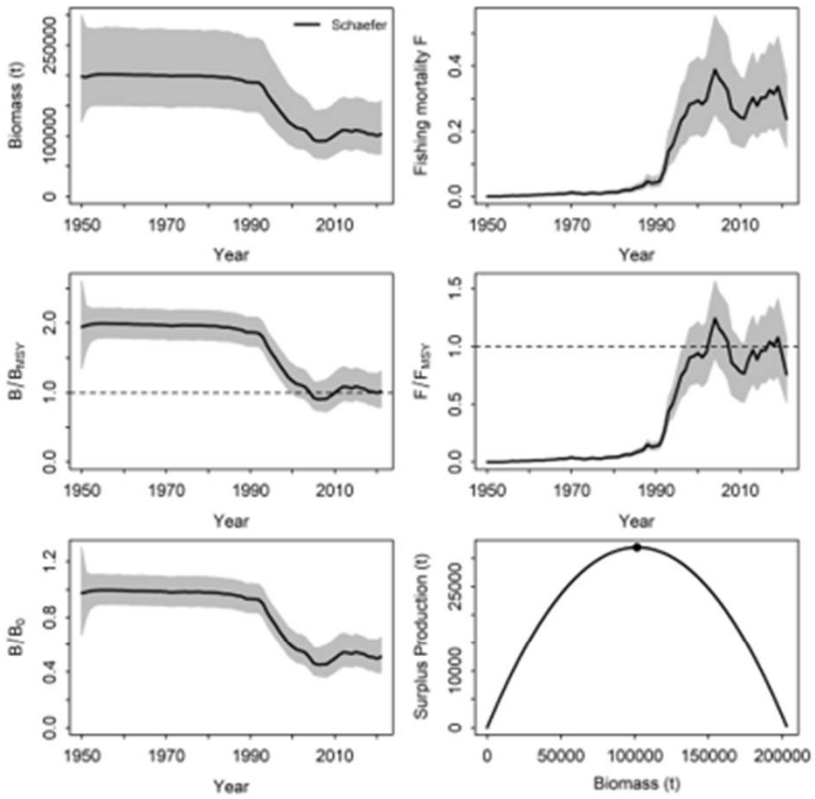
5. Estimated parameter values

Note

- Users need to check estimated parameter values table (right) (#21) and trajectories for 6 relevant parameters (#19) (next page or available in the result folder).
- If users find the implausible values or trends (graphs), users can change 4 input parameters values, i.e., K, r, B0/K (depletion) and sigma.proc. In addition, autocorrelated time series CPUE and outliers need to remove (refer to #13, page 8). Thus users need to consider relevant factors synthetically for improvement.
- In this example, values and trajectories for 6 relevant parameters trends (graphs #19) seem to be plausible, thus users can use same seeding values when the next run is implemented for improvements.

Parameter	Meaning	Mean	Lower (95%)	Upper (95%)
K	Carrying capacity (t)	203,291	153,872	275,328
r	Pop. growth rate	0.63	0.46	0.84
B0/K	Depletion (EST)	0.97	0.68	1.30
sigma.proc	Estimable process VAR	0.05	0.03	0.07
m	Shape parameter	2	2	2
Fmsy	F at MSY	0.31	0.23	0.42
TBmsy	TB at MSY (t)	101,645	76,936	137,664
MSY	MSY (t)	31,761	29,018	35,629
Catch(2021)	Current catch	24,528		
bmsyk	Limit Ref. Point (TB/TBmsy)	0.50	0.50	0.50
TB(1950)/K	Depletion (OBS)(start)	0.97	0.67	1.30
TB(2021)/K	Depletion (OBS)(last)	0.51	0.39	0.66
TB/TBmsy	TB ratio	1.02	0.79	1.31
F/Fmsy	F ratio	0.76	0.51	1.08

(#21) Estimated parameter values

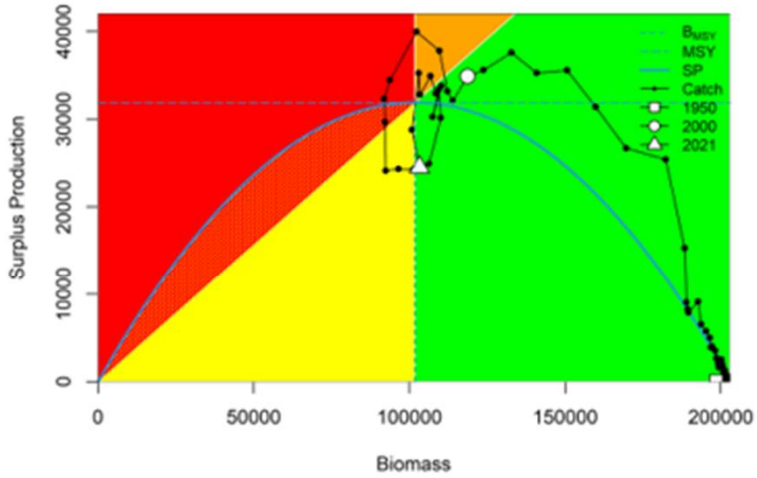


(#19) Trajectories of 6 key parameters with 95% CI.

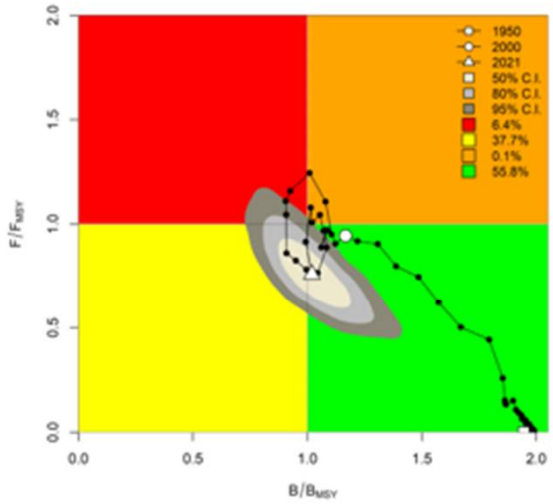
(Note) Red broken lines indicate those for B/Bmsy=0.5.

6. Visual inspection

- In addition to the specialized evaluations (previous Section 1~5), there are "visual inspection" for evaluation as follows:
- Surplus Production (SP) Phase plot (#17) and Kobe Phase plot (#18) (this page), Projections (#31) (next page) and Trajectories of 6 key parameters (#19) (previous page).
- There are also CPUE residuals plots (#7, #11 and # 14) available in the results folder.
- Users need to inspect visually to see if there are implausible behaviors.
- As users cannot improve these plots directly, after the next run for improvements (Section 1~5) is implemented, problems might be solved.



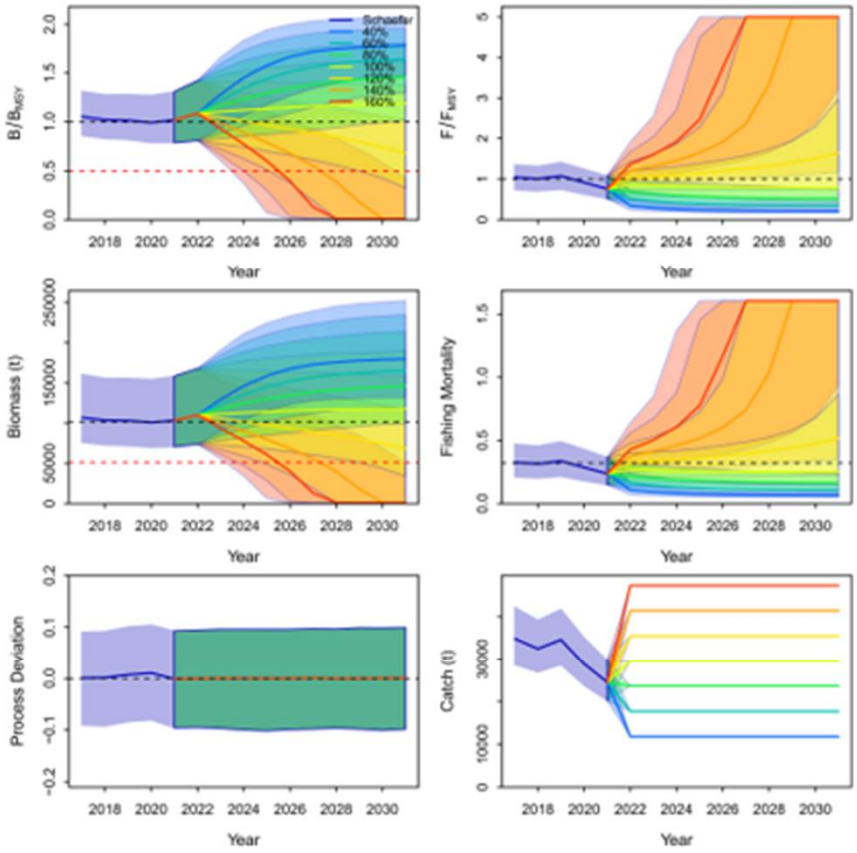
(#17) Surplus Production (SP) Phase plot



(#18) Kobe plot

(#37) Future Projections

- Projections next 10 years (40%, 60%,80%,100%,120%,140% and 160% of the current catch).
- The current catch is the average catch of the last 3 years.
- Projection is based AR1 (time series biases filtered).



(#37) Future Projections

7. Next step (Selection of Schaefer or Fox)

After users select the best (representative) run each for Schaefer and Fox model, move back to the main menu, click the 3rd menu (see below) and create the “Selection form” using results from Schaefer & Fox model to decide the best model run.