Menu-driven software series (No. 3)

JABBA_MANAGER (VER 1.0.0) Manual

(October, 2024**)**

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https://www.esl.co.jp/assets/menu
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[MENU]© is supported by Environmental Simulation Laboratory (Japan)

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
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
SpiCT	Stochastic surplus production model in continuous time
SWO	Swordfish
TAC	Total Allowable Catch
TB	Total Biomass
TB_{MSY}	Total Biomass at MSY

Contents

1. Introduction
1.1 Backgrounds & JABBA Outline

- [MENU] have been using ASPIC (2004) for the Production Model (PM) in its menu-driven stock assessment software.

[MENU] Menu-driven stock assessment software developing team

- However, recently, PM has been progressed substantially.

  (see Table next slide).

1. Introduction
1.1 Backgrounds & JABBA Outline

Review : Evolution of Production Model(PM)

Evolution	Type	First author	Features				Comments
			Equilibrium Condition (EC) (death=increase) (un-realistic)	Error type		Bayesian (better) Approach	
				Observation (data) error	Process (model) error		
old	Original PM	Shaeffer(1954), PT(1969) & Fox (1970)	YES	■			Classical (Not recommended to use due to EC)
	ASPIC (Ver5.05)	Prager (2004)	NO	■			Basic and used by RFMOs & fishing countries (a bit outdated)
	ASPIC (ver7.5)	Prager (2017)		■		■	
	SpiCT (Stochastic surplus production model in continuous time)	Pedersen & Berg (2017)		■	■	■	Best as state space (all features considered) production models
new	JABBA (Just Another Bayesian Biomass Assessment)	Winker et al (2018)		■	■	■	

(Note) There are many other PM, but only representative PM are listed.

1. Introduction
1.1 Backgrounds & JABBA Outline (1/2)

- Based on the review of the PM evolution, the best PM is the state space PM that includes key features, i.e., observation & process errors, Bayesian approach, advanced data fitting, weighting and other functions.

- Currently, there are 2 outstanding state space PM (SPiCT & JABBA) for general use available via GitHub (internet hosting service) including many ready-made useful functions & graphs.

1. Introduction
1.1 Backgrounds & JABBA Outline (2/2)

- We consider that both are well developed & practical state space PM.

- We choose JABBA for our next menu-driven software for PM because of our previous experiences, thus more familiar with JABBA.

- We now review outlines & 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) ABBA presents a unifying, flexible framework for biomass dynamic modelling, runs quickly and generates reproducible stock status estimates and diagnostic tools; and

(3) To now, this software has been widely applied in stock assessments around the world.

JABBA: General features

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

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 shape with prior
- Optional estimation additional observation variance for CPUE time series
- Estimating or fixing the process variance

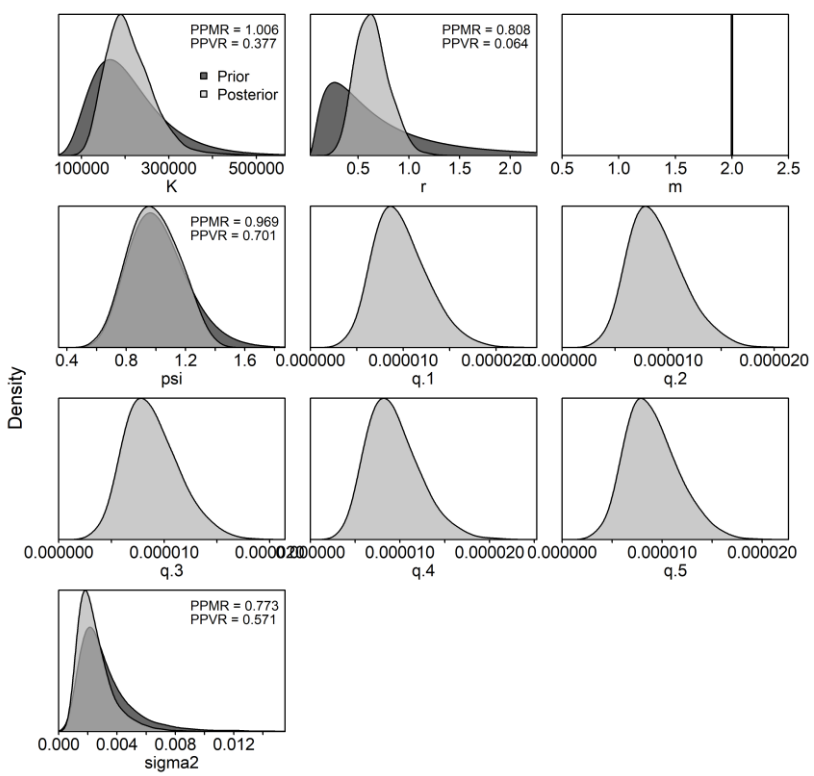
Projection

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

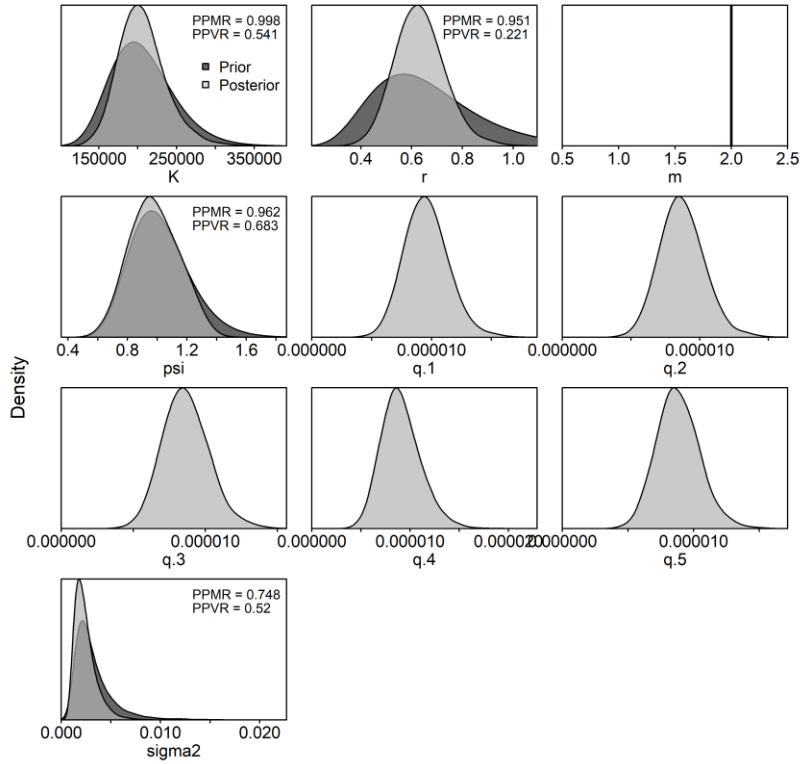
1. Introduction
1.2 JABBA application to the menu driven software

2nd step approach to estimate
Posterior Probability Distribution Function

1st step
Range (constant) function



2nd step
Log normal function



R codes were developed by Dr Sheng-Ping Wang, Professor National Taiwan Ocean University

(1) 2 models (Schaefer + Fox)

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

(2) **2 step approach to estimate Posterior Probability Distribution Function**

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

- This is an effective & robust approach. In the 1st step, the wider range in the constant model,

  will estimate the initial Posterior Probability Distribution Function (*).

- Then, in the 2nd step, it (*) will be used as the prior information for the log normal model to estimate the final Posterior Probability Distribution Function.

2nd step approach to estimate Posterior Probability Distribution Function

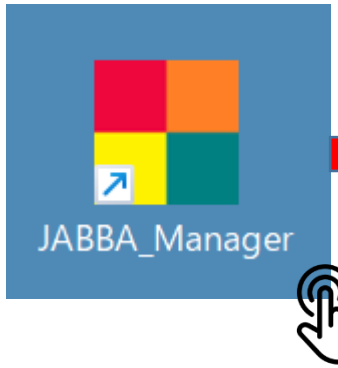
Note (1)

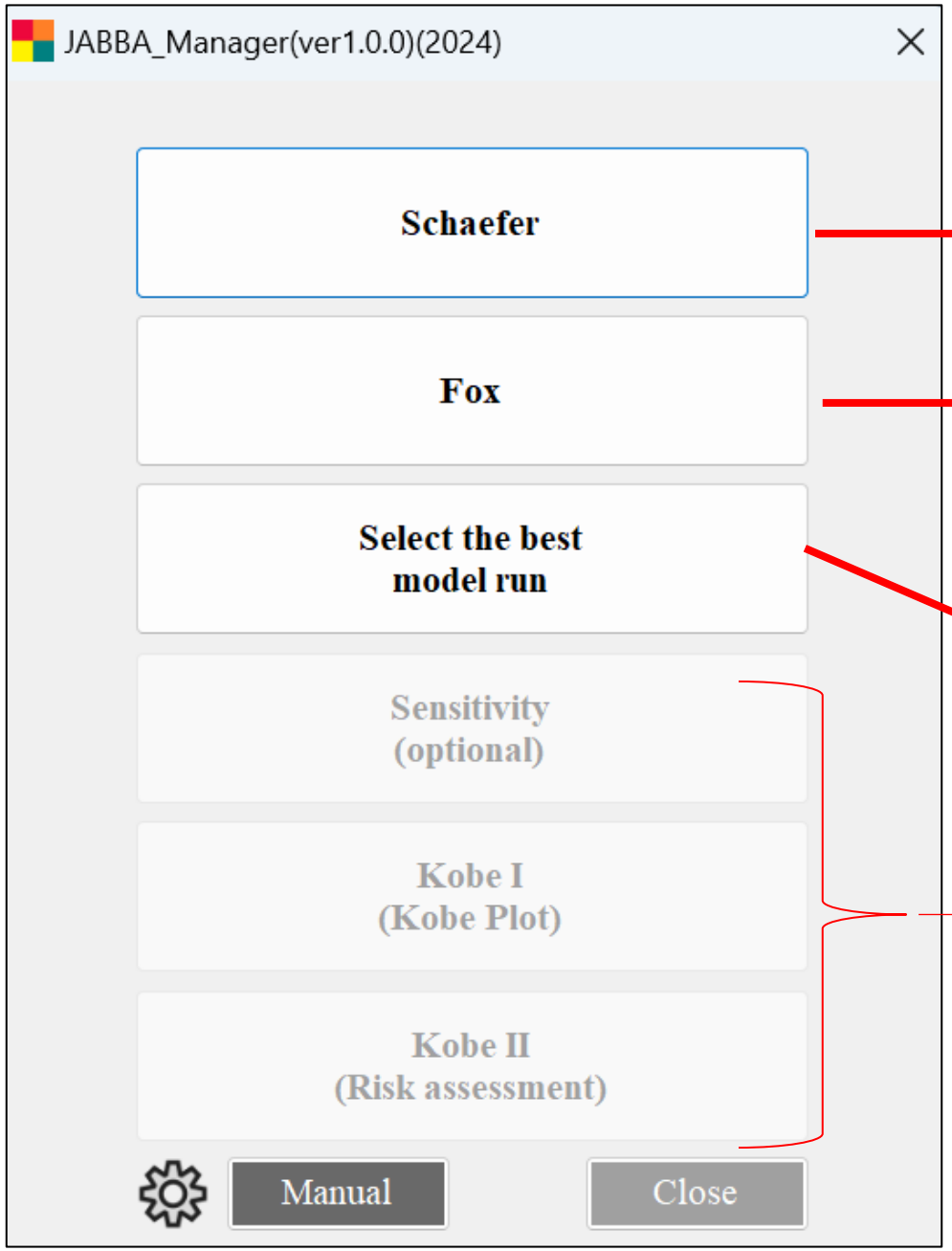
In this approach, no need to know even rough prior information such as r & K. However, it is suggested to check if r values are plausible by referring to Fish Base, Literatures, etc.

Note (2)

This is the 2 step approach. There are also one step approach, i.e., use just range model or lognormal model providing initial guess (seeding) values for parameters such as r, K, depletion etc.

MENU





Input ➔ Run ➔ Output ➔ Report ➔ Selection of the best run

Input ➔ Run ➔ Output ➔ Report ➔ Selection of the best run

Select the best run from Schaefer or Fox

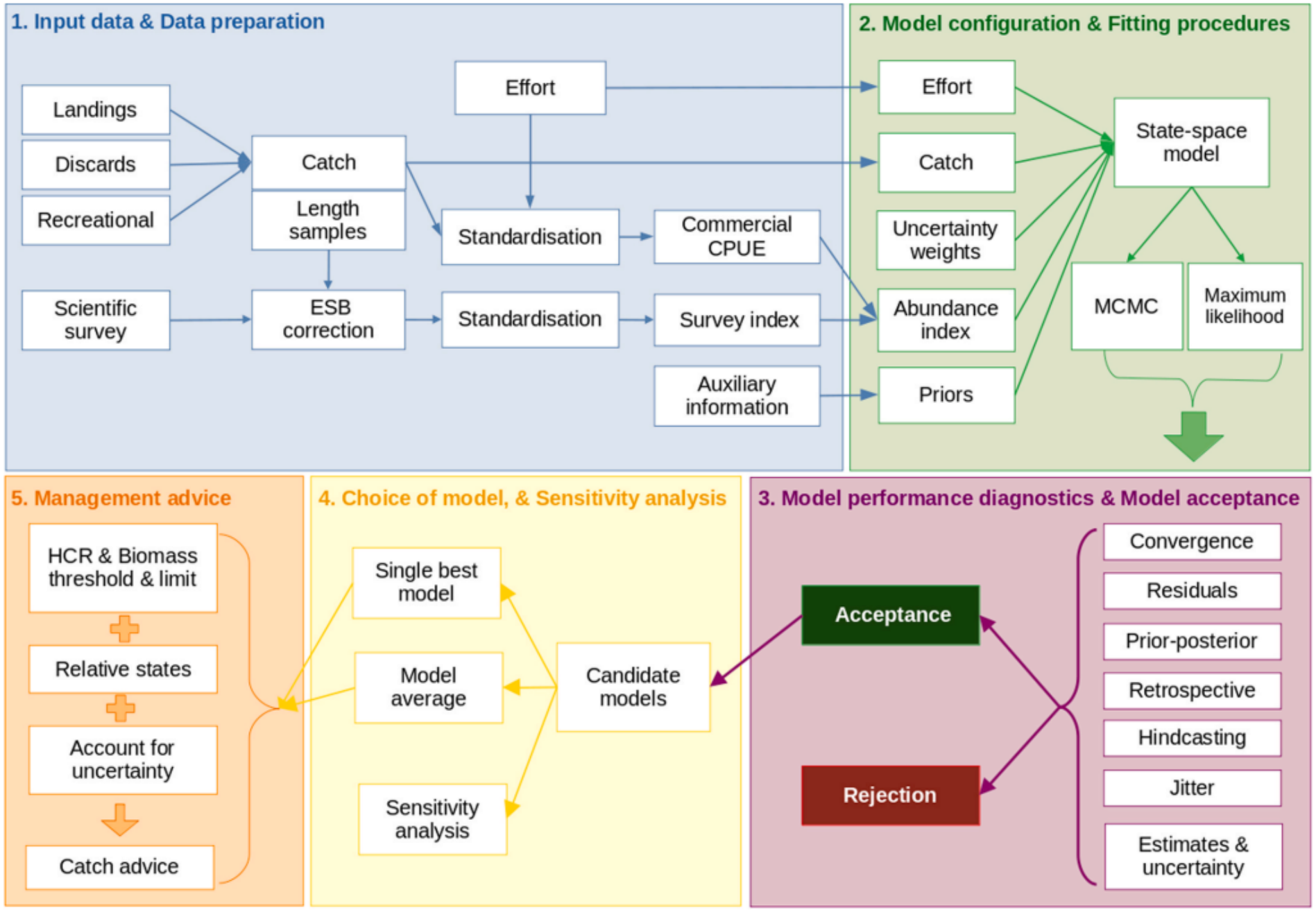
To be completed in 2025

1. Introduction
1.2 JABBA application to the menu driven software

Implementing JABBA menu driven software

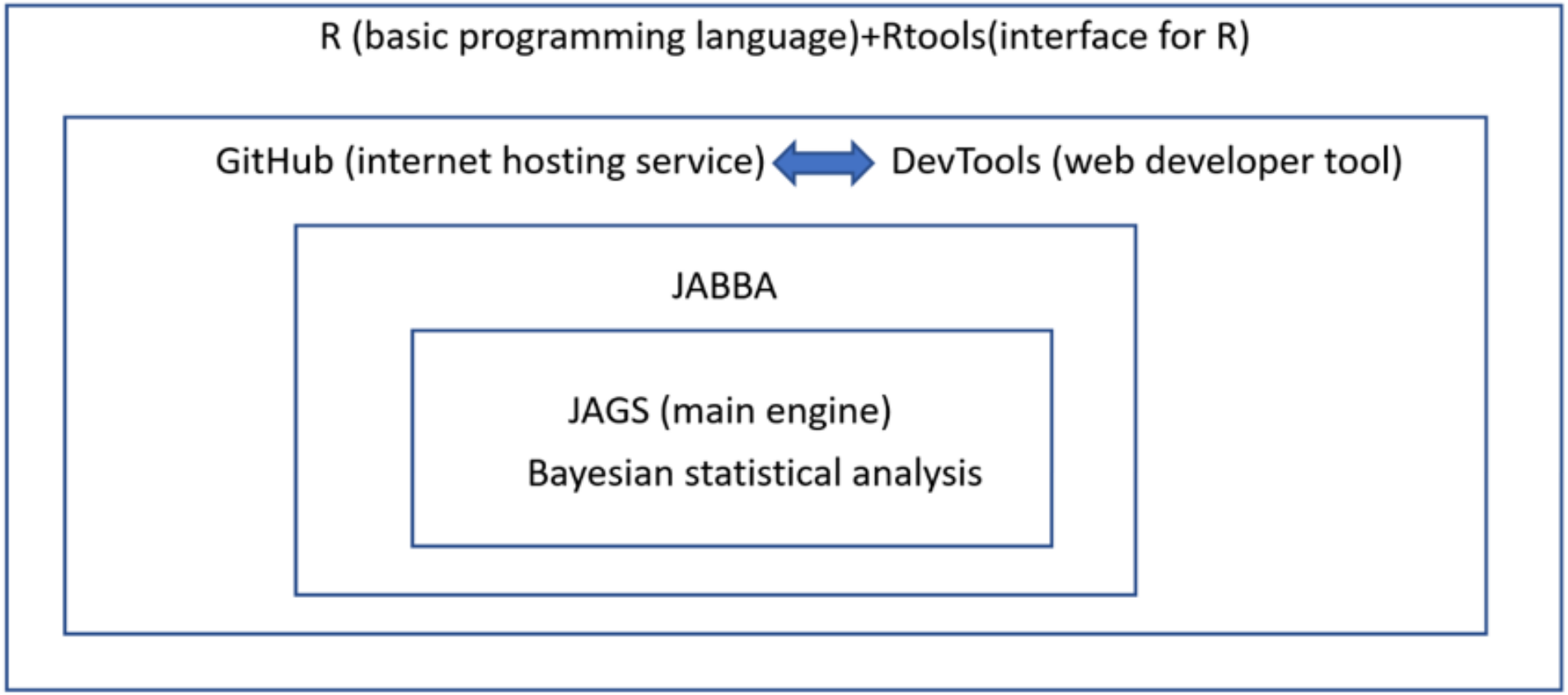
We will follow suggestions made by "Good practices for surplus production models"

Kokkalis *et al*. (2024)



1. Introduction
1.2 JABBA 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

Comparisons between JABBA vs. ASPIC to understand how JABBA is much more effective and superior (1/2)

	JABBA	ASPIC
(1) Estimation methods	Estimation method (Bayesian approach based on probability distribution) used by JABBA is theoretically much better, flexible & superior than the least mean square (tractional method) used by ASPIC.	
(2) Parameter estimation	JABBA can estimate parameters much easily & effectively in a short time by the Bayesian approach and MCMC.	ASPIC needs tedious grid (pin point) search (Batch job), which sometimes produce incorrect parameters due to local (false) minimum.

Comparisons between JABBA vs. ASPIC to understand how JABBA is much more effective and superior (2/2)

	JABBA	ASPIC
(3) CPUE	JABBA can accept any CPUE. After the run, implausible CPUE will be specified. More plausible results may be obtained if deleted.	ASPIC needs to check CPUE if it is plausible in advance. Otherwise, it is difficult to get convergence.
(4) Outliers	Outliers can be easily found after run by number of detection functions.	Need to check outliers before run. It is difficult to detect outliers after run as no detection functions as JABBA are available.
(5) Theory	JABBA theory is difficult & complicated. But it is easy to run if the menu-driven software is used.	Theory is not difficult as JABBA. But the estimation method is outdated and not effective.

Contents : Section 2 Preparations

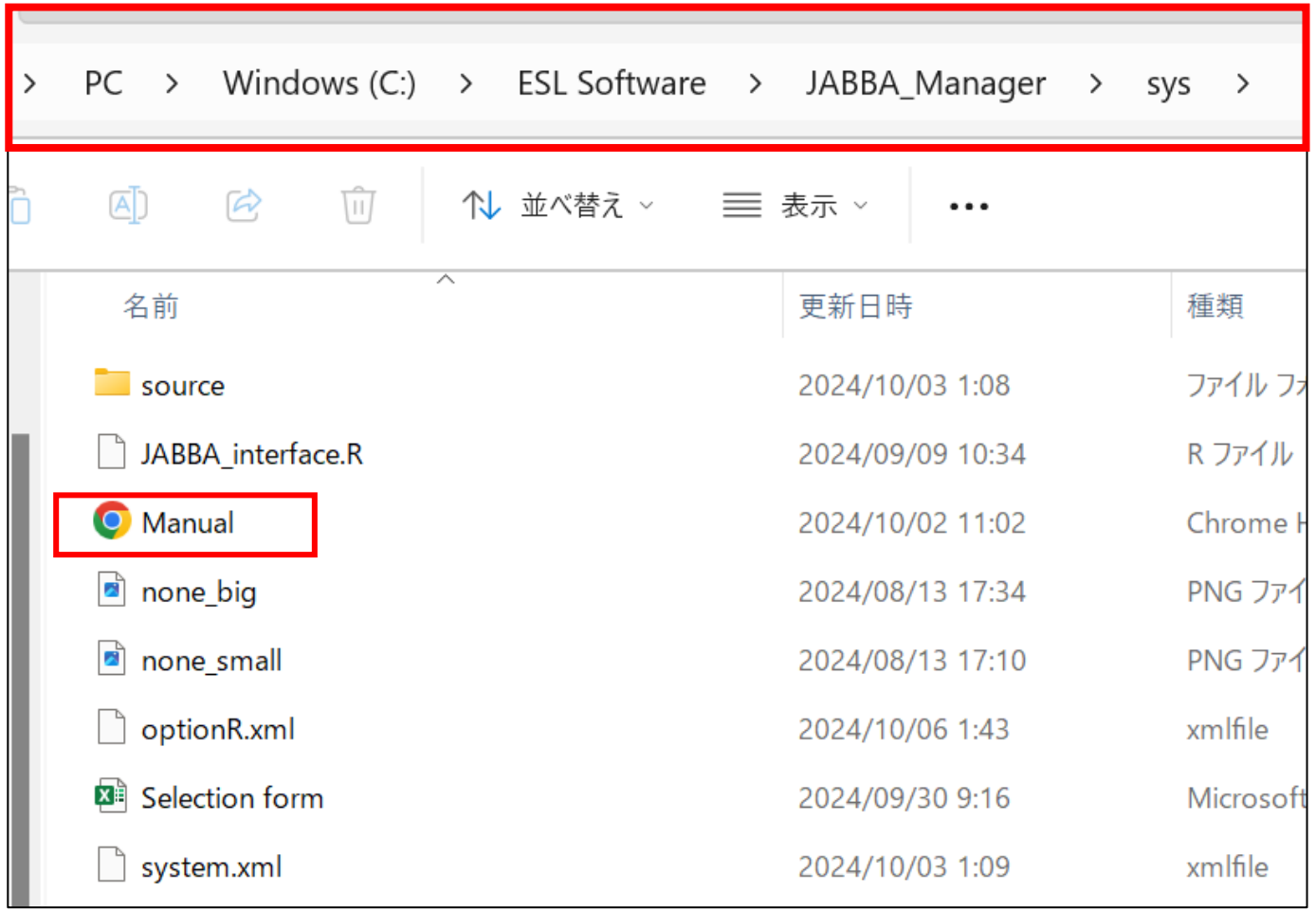
(1) Requirements for PC

- 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) Remarks (1/2)

Manual

- This PowerPoint is the manual.
- Users can get the manual (PDF file) (see right).
- Manual can be also obtained by “call button” available in menus of the software.



(2) Remarks (2/2)

Manual
This PowerPoint is the manual.
Manual can be used by “call button” available within menus in the software.

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

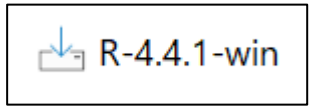
2.2 Installation

- 2.2.1 R
- 2.2.2 JAGS
- 2.2.3 DevTools
- 2.2.4 Reshape2
- 2.2.5 JABBA_Manager

2. Preparation
2.2 Installation
2.2.1 R

Install R-4.4.1-win (84MB, zipped)(179MB: unzipped) (JABBA Platform)

Download from Download R-4.4.1 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
2.2.2 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.

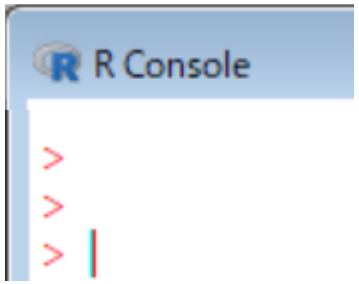
What is JAGS?
(Just Another Gibbs Sampler)

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

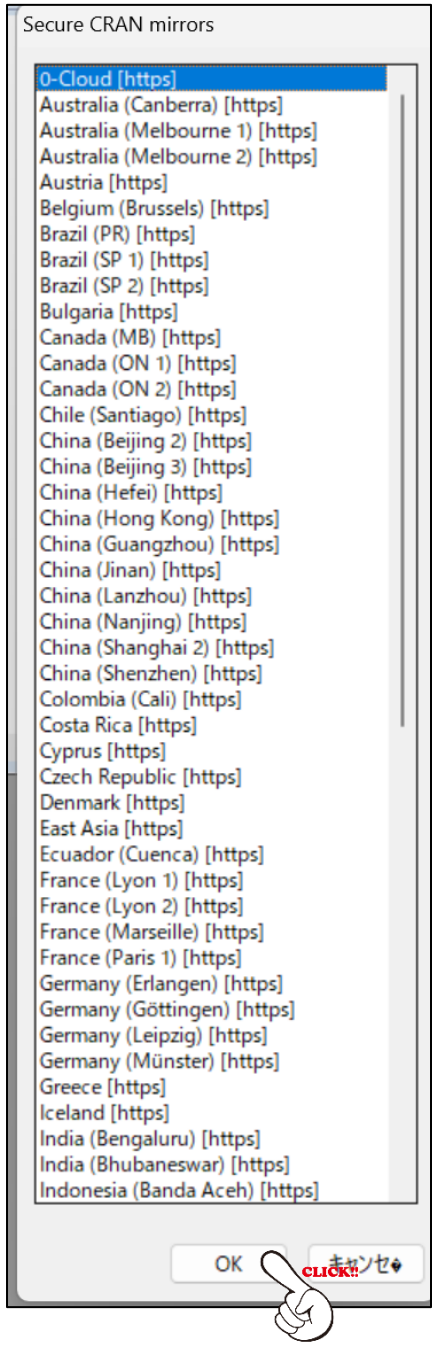
JAGS is the main engine for JABBA
（MCMC for JABBA)

2. Preparation
2.2 Installation
2.2.3 Devtools (R application)

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



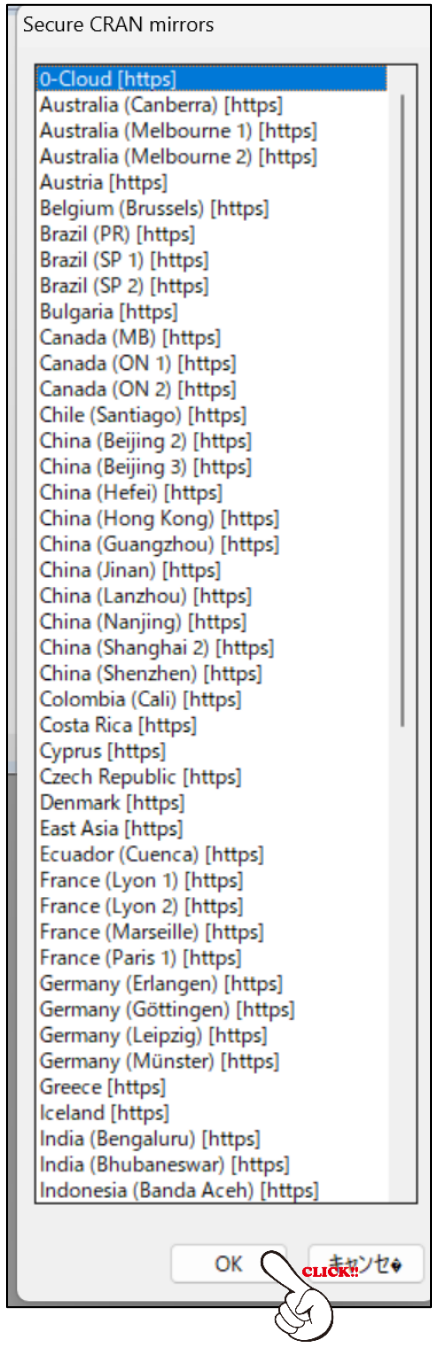
- Open R console, then execute (type)
  install.packages("devtools")
- Enter then users will see the window (right)
- Then Click OK to finish.



2. Preparation
2.2 Installation
2.2.4 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.

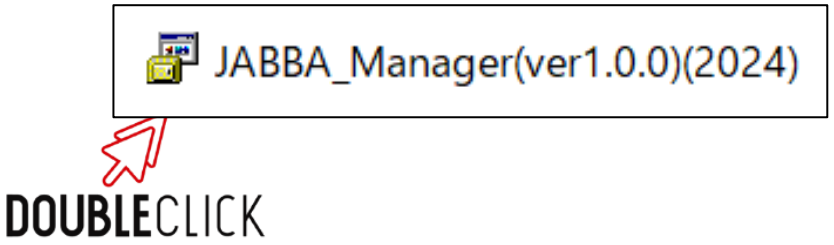


2. Preparation
2.2 Installation
2.2.5 JABBA_Manager

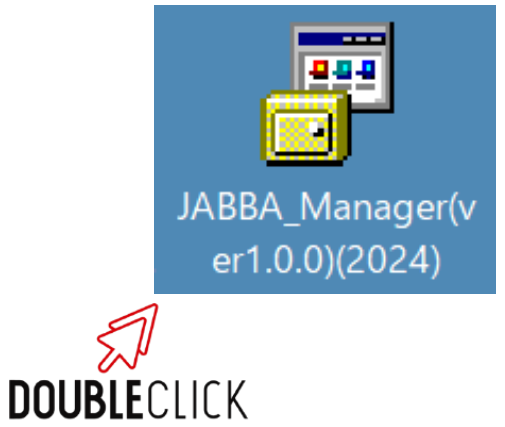
Users will get the download link (installer) from [MENU]

Double click the zipped installer

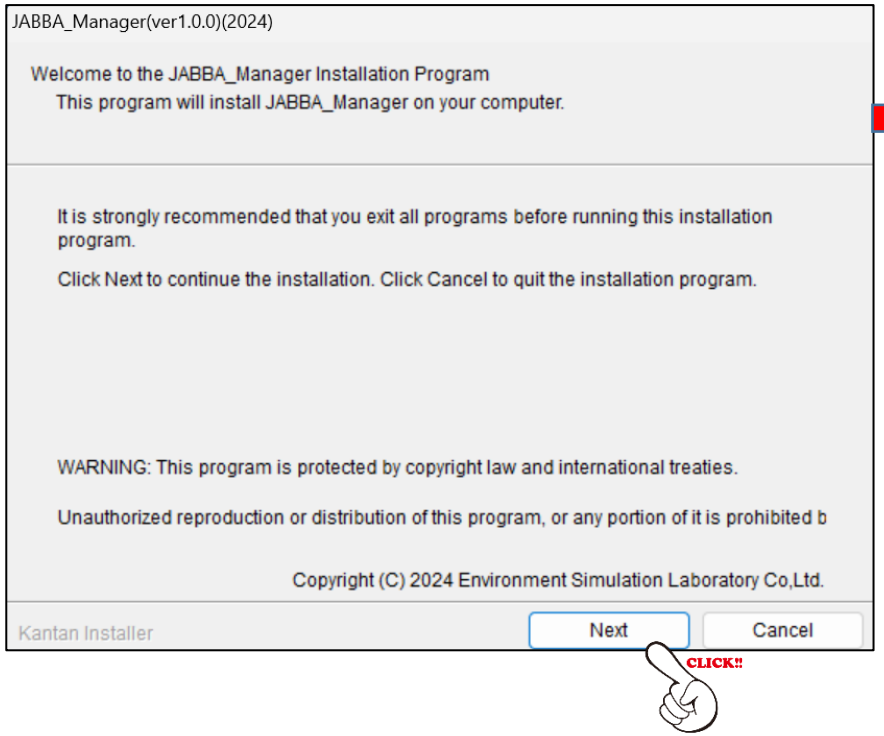
Installer (download folder)

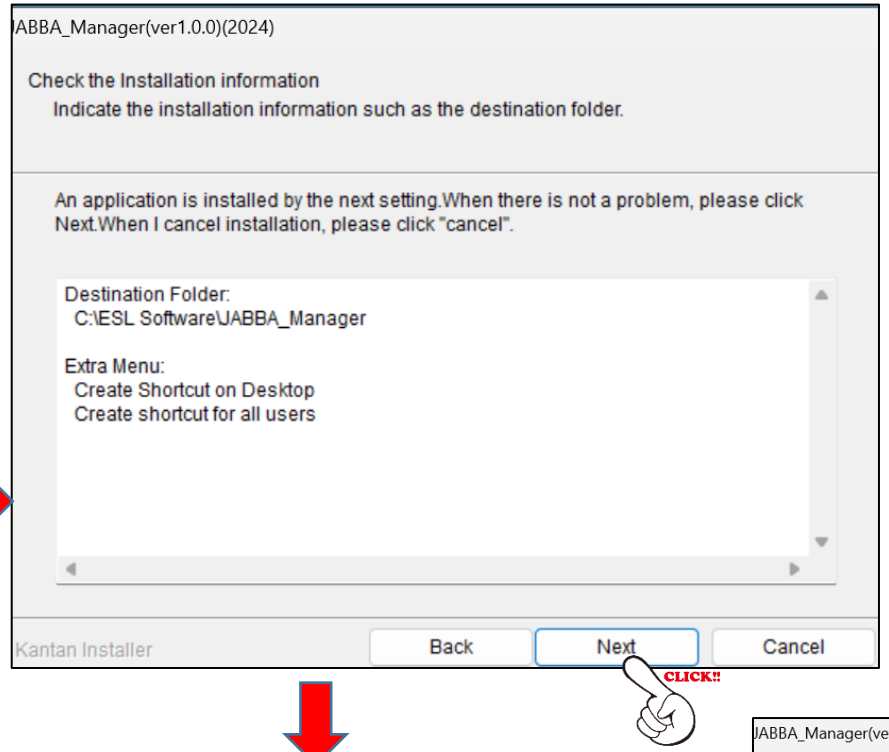


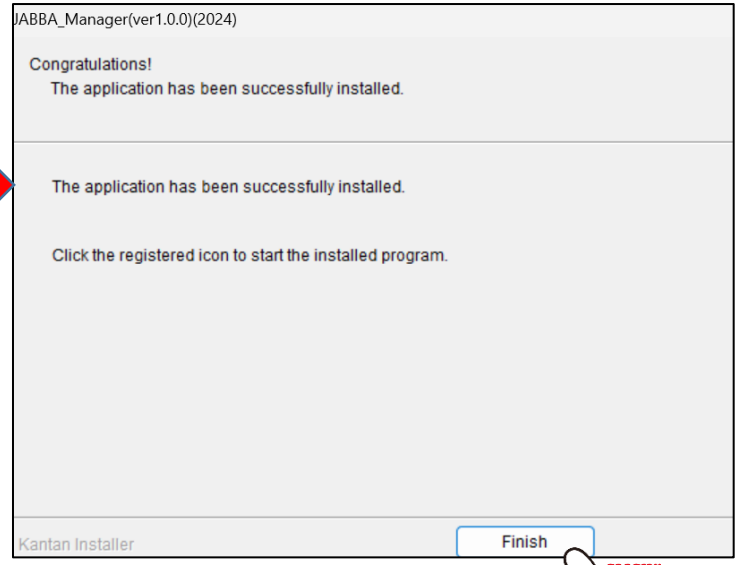
Installer (desktop)



2. Preparation
2.2 Installation
2.2.5 JABBA_Manager



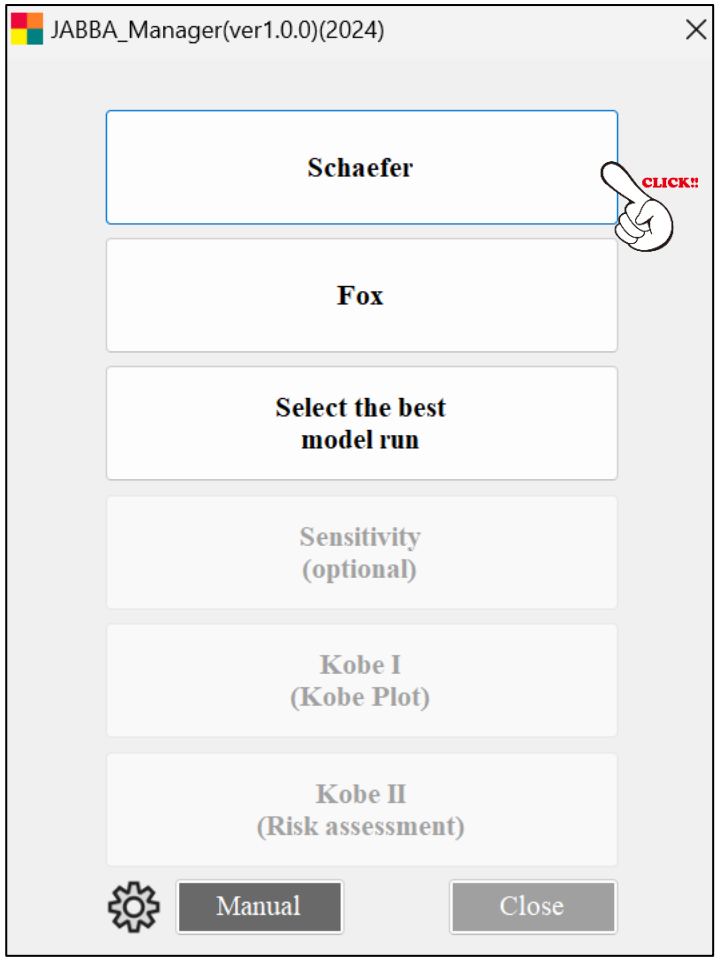




2. Preparation
2.2 Installation
2.2.5 JABBA_Manager

Users will get the icon in the desktop

DOUBLECLICK

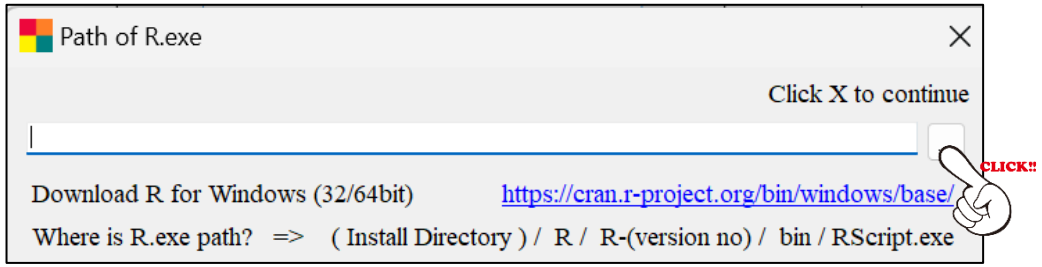


Before using the software,
users need to link to R.

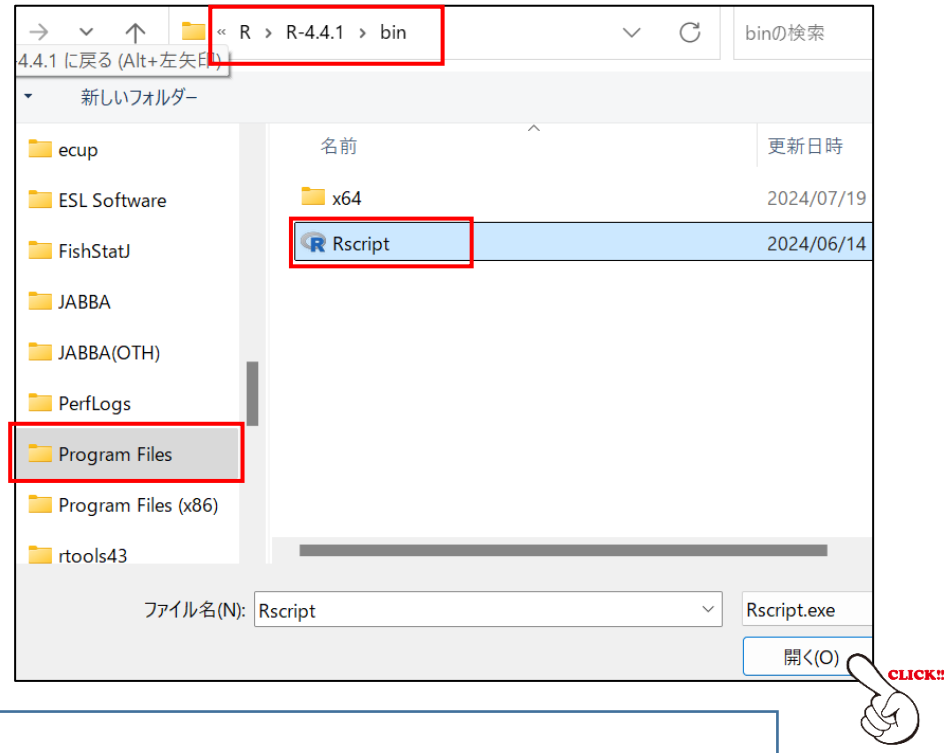
So, Click Schaefer

2. Preparation
2.2 Installation
2.2.5 JABBA_Manager

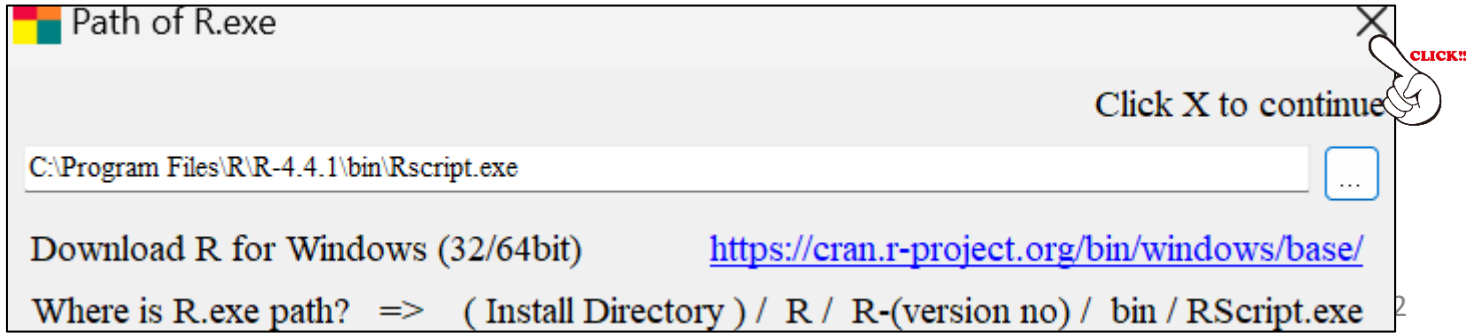
Users will see the window below to link to R



Then users will identify Rscript

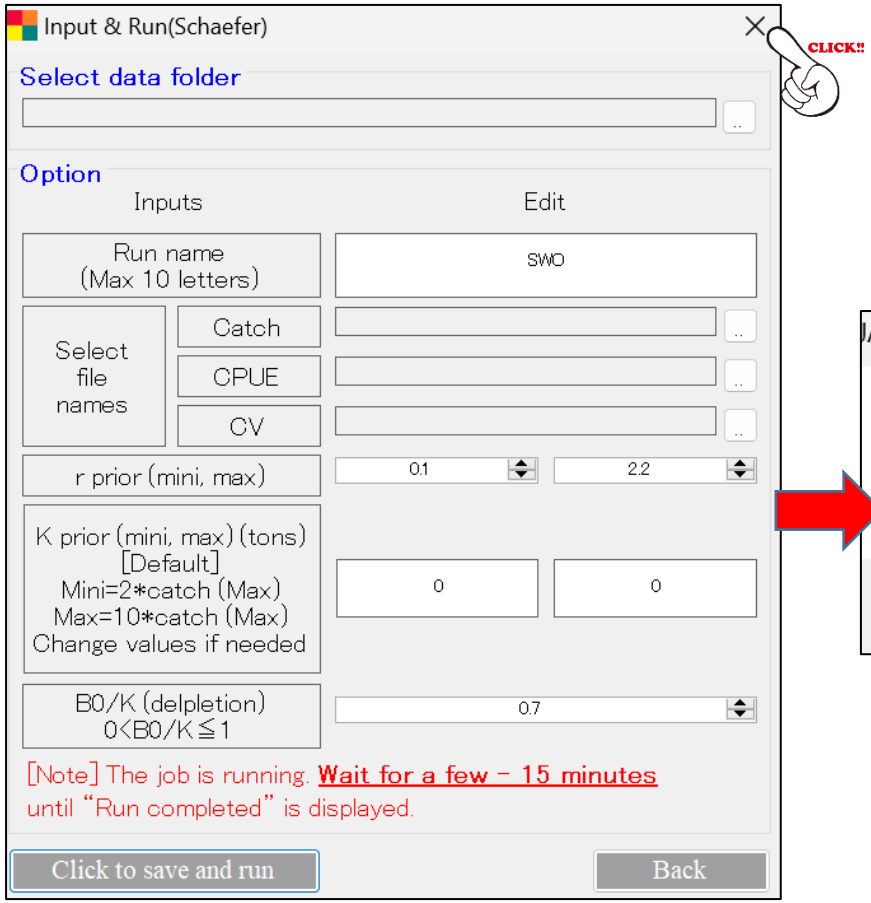


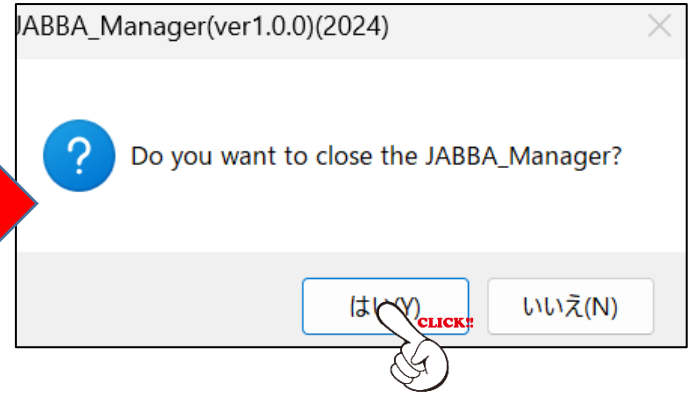
Then click X to continue



2. Preparation
2.2 Installation
2.2.5 JABBA_Manager

Then users will see the window (right) and click X to close.





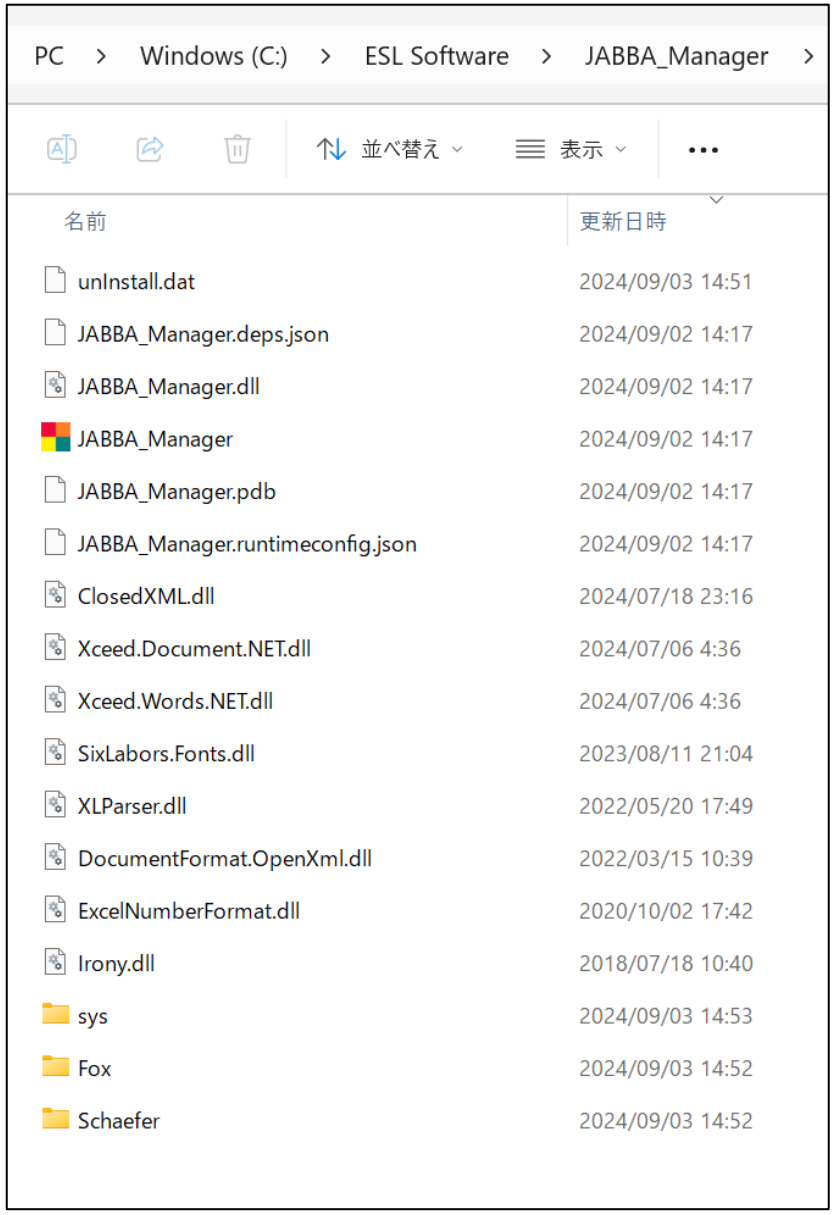
Then users can close JABBA_Manager.

Then uses can use the software.

2. Preparation
2.3 Uninstallation

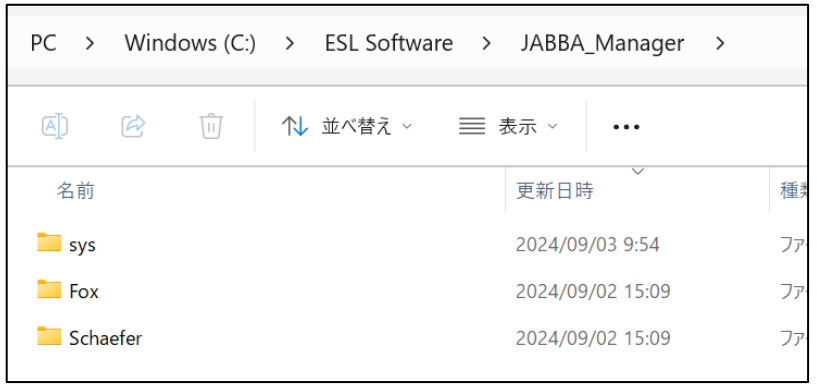
- When the new version of the menu driven JABBA is released, users need to re-install.
- Before re-installment, users need to un-install the current version.
- To un-install, users follow the normal procedures.
- After completed, normally all relevant files & folders should be deleted.

2. Preparation
2.3 Uninstallation



Original full folders & files before in-installation

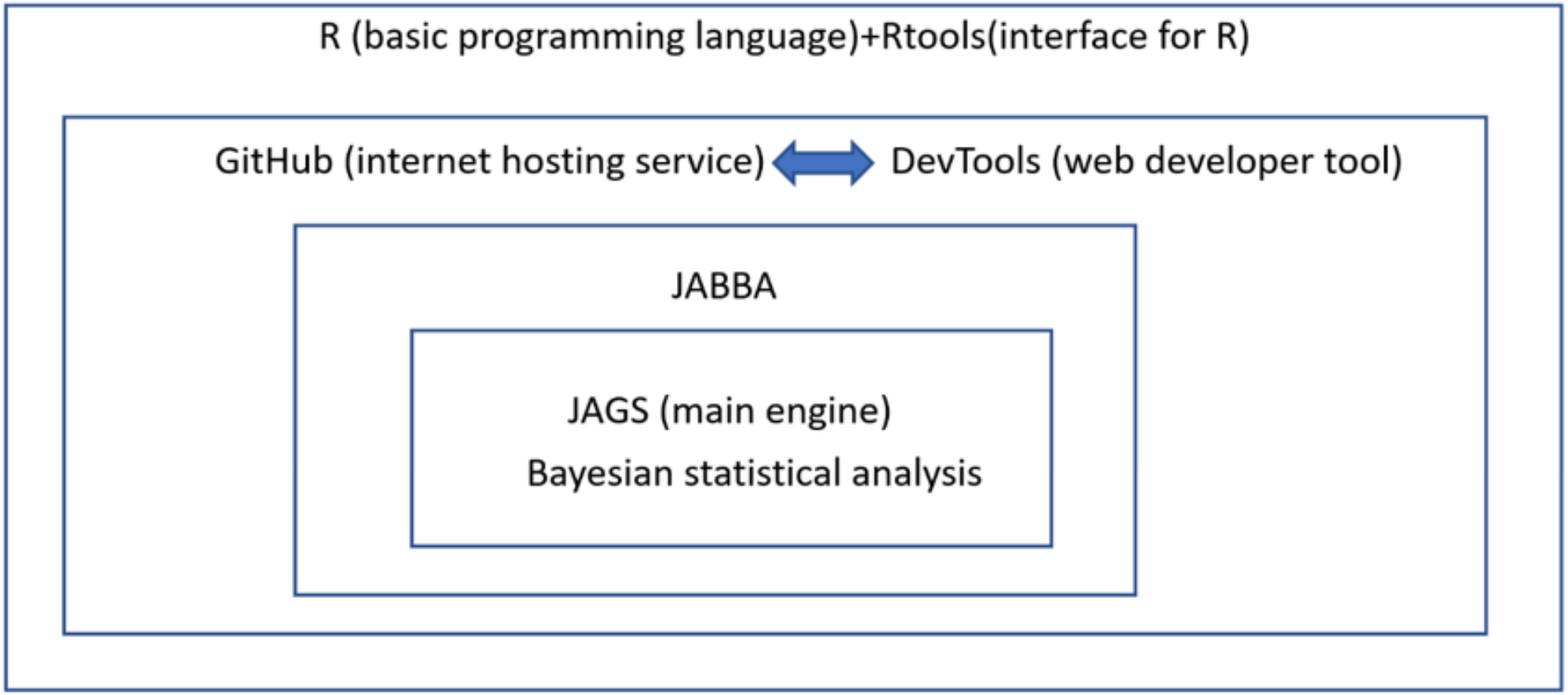
- However, some folders & files in JABBA_Manager are not completely deleted in the ESL software folder
  (see lists before & after).
- Users need to delete left-over files & folders manually.



Left-overs after un-installation

2. Preparation
2.4 Schematic diagram of JABBA

Schematic diagram of JABBA components and their relations



Note: JAGS (Just Another Gibbs Sampler)

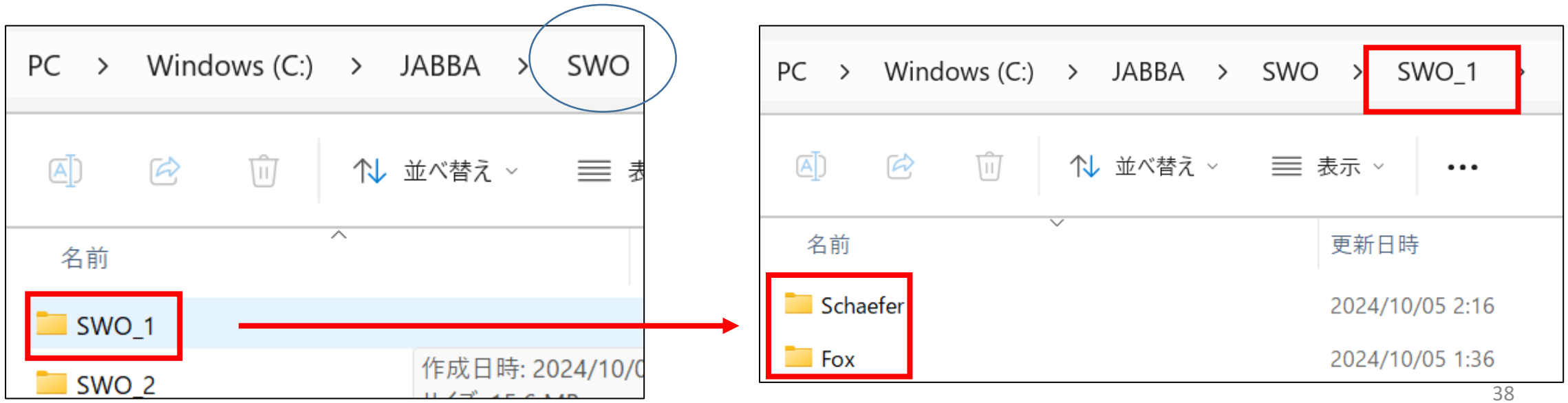
2. Preparation
2.5 Folders

Example for Schaefer will be demonstrated. Fox has the same structure, thus its example is omitted.

SWO (swordfish) in the Indian Ocean data
are used as test (demo) runs (1950-2021)(5 fleets)

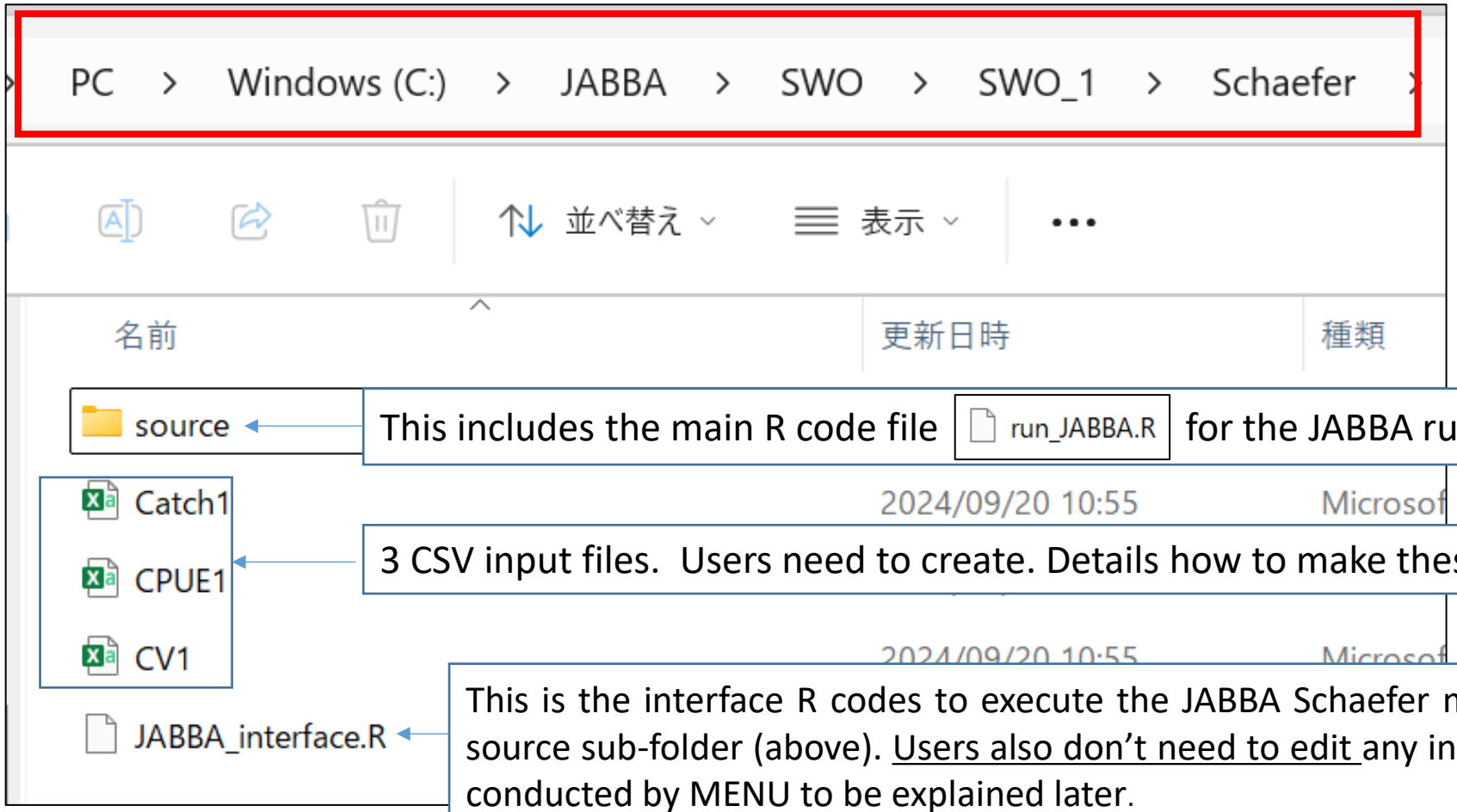
2. Preparation
2.5 Folders
2.5.1 Create folders

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



Setting up sub folder (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)



This includes the main R code file run_JABBA.R for the JABBA runs. Users don't need to edit.

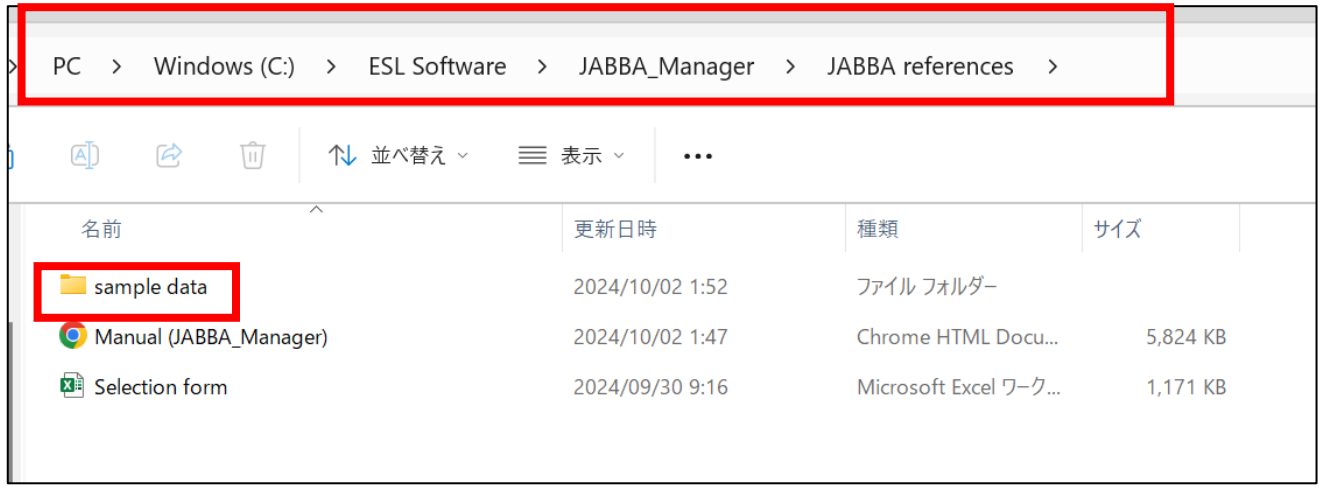
3 CSV input files. Users need to create. Details how to make these files will be explained in 2.6.

This is the interface R codes to execute the JABBA Schaefer model. Its source code is located in the source sub-folder (above). Users also don't need to edit any interface R codes. Necessary edits will be conducted by MENU to be explained later.

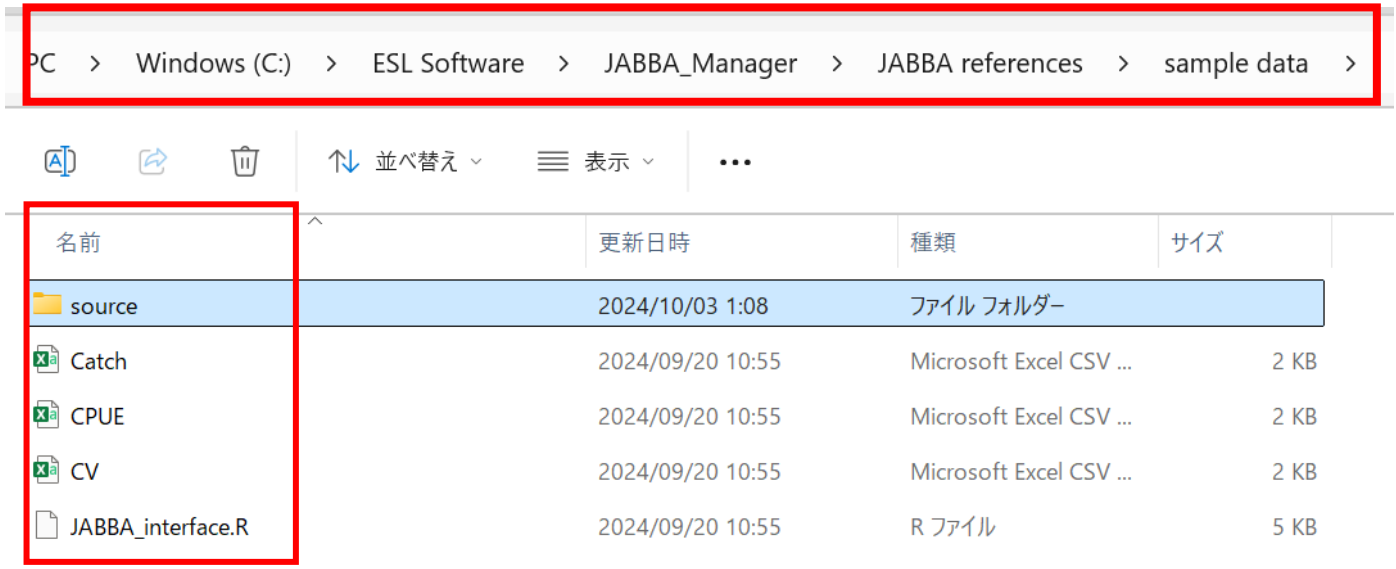
2. Preparation
2.5 Folders
2.5.1 Create folders

How to get the sample data?

Location
(ESL software folder in C:)



Copy & pastes
1 folder & 4 files
to your PC



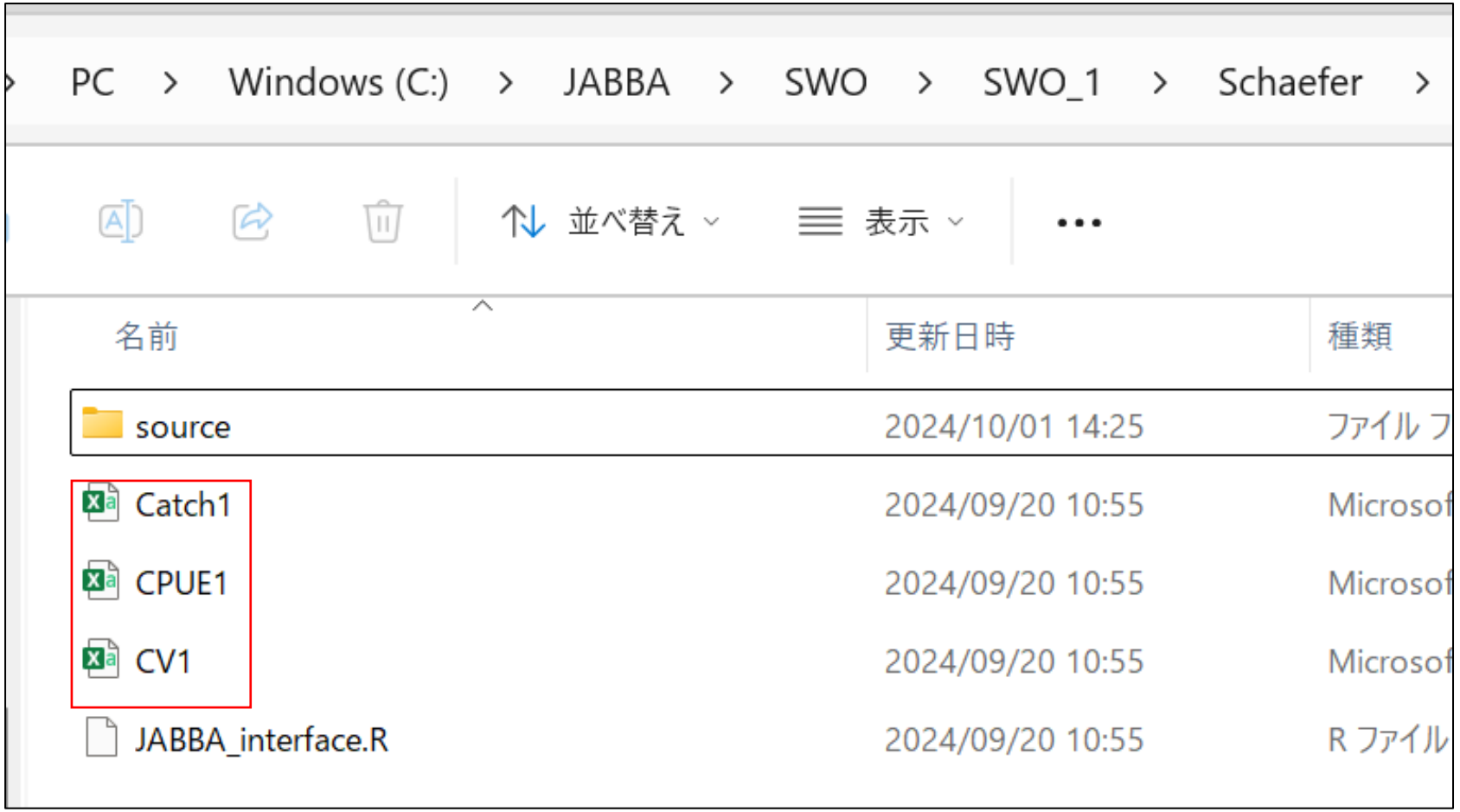
After copy & pastes, change as below:

- Catch → Ctach1
- CPUE→ CPUE1
- CV→CV1

This is because uses will use different data in several runs and they need to assign different numberings.

2. Preparations
2.6 Input Data (catch and CPUE)

What are the contents of 3 CSV files ?



2. Preparations
2.6 Input Data (catch & CPUE)

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					
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

Data (1964~2013) is omitted

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

Important Remarks

[Catch]

- Catch should be in tons. Kg is allowed, but users need to be careful to interpret the results.
- 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 robust assessments.

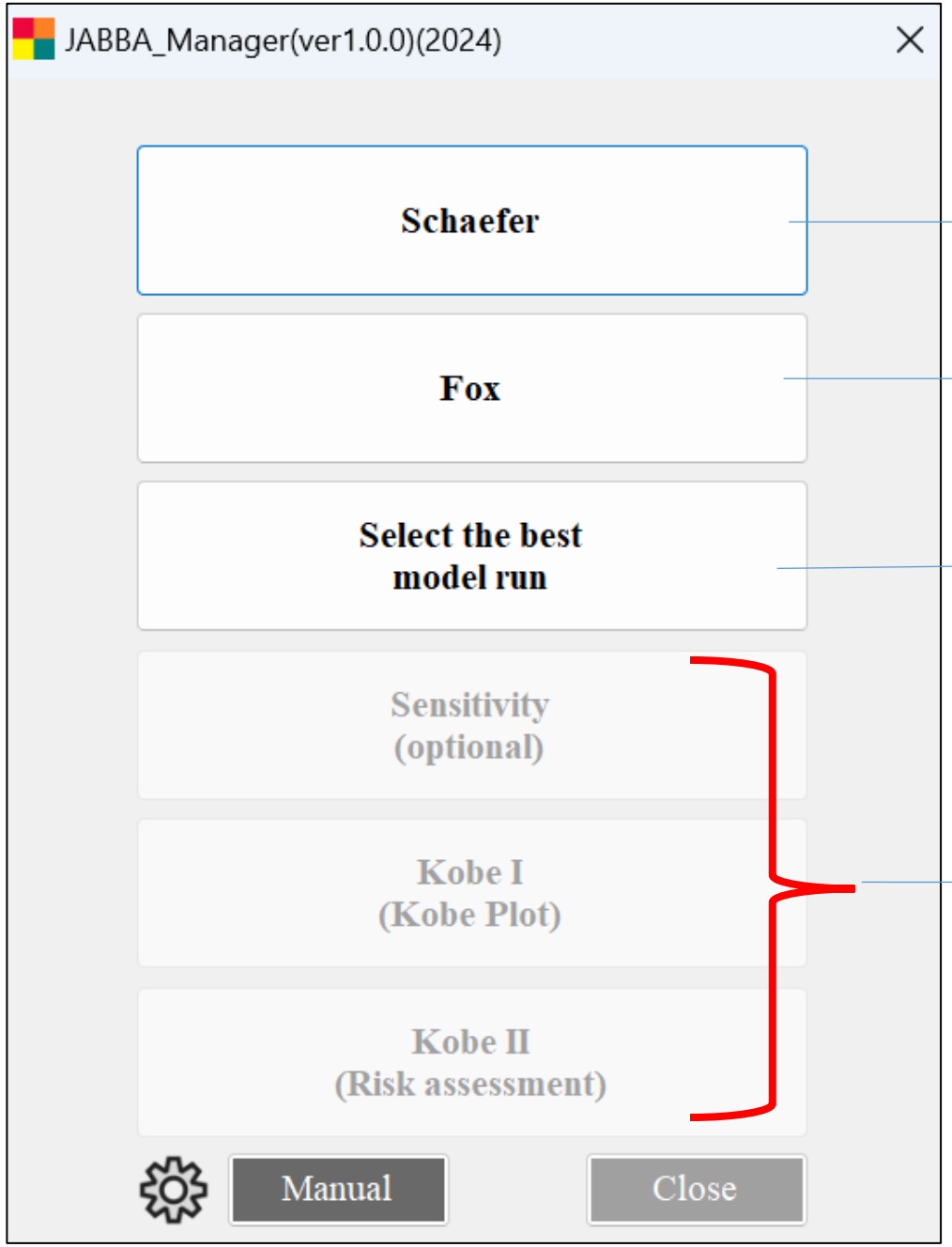
2. Preparations
2.6 Input Data (catch & CPUE)

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 example, AR1: AutoRegressive 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
2.7 MENU



Input ➔ run ➔ Output ➔ Report

Input ➔ run ➔ Output ➔ Report

Selection form

To be completed in 2025

Contents Section 3. JABBA runs (Schaefer▪Fox)

3. JABBA runs (Base case)
3.1 Outline

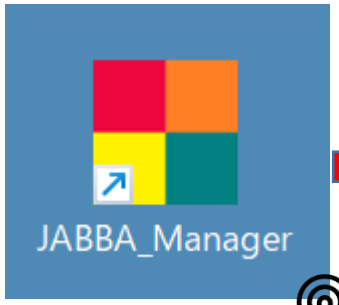
- In this section, demo runs by the Schaefer model are presented using sample data of SWO (swordfish, Indian Ocean).
- Please note that the same process need to be applied for the Fox model to select the best model.
- In each model, the best run will be selected using “Quick Evaluation (Diagnosis) ” based on 7 key criteria.
- Finally, the best model run will be selected from Schaefer or Fox model using additional criteria.

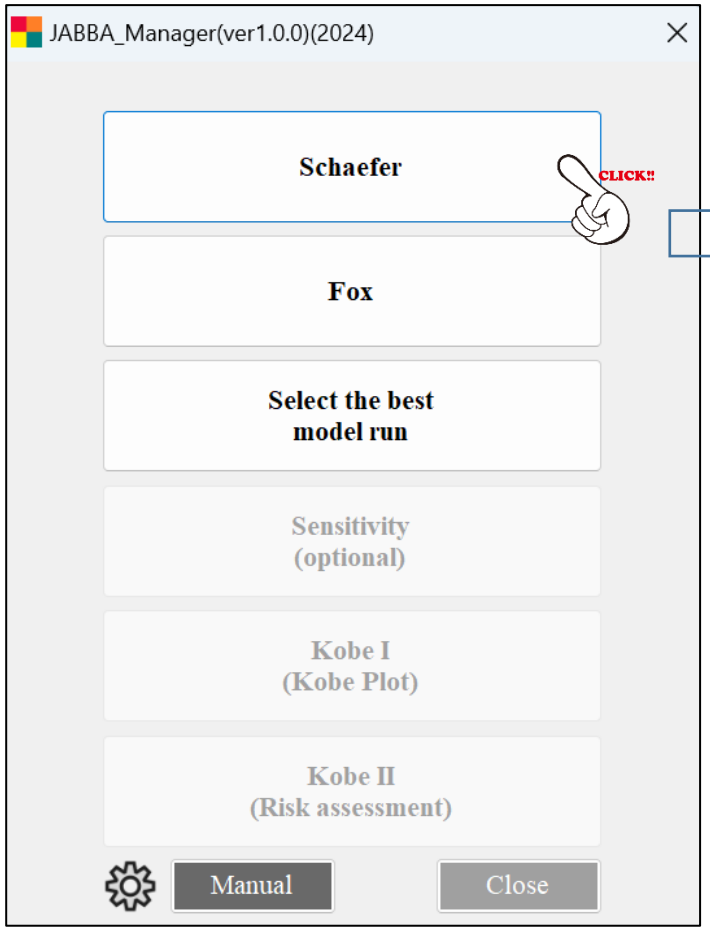
Important remarks on Runs

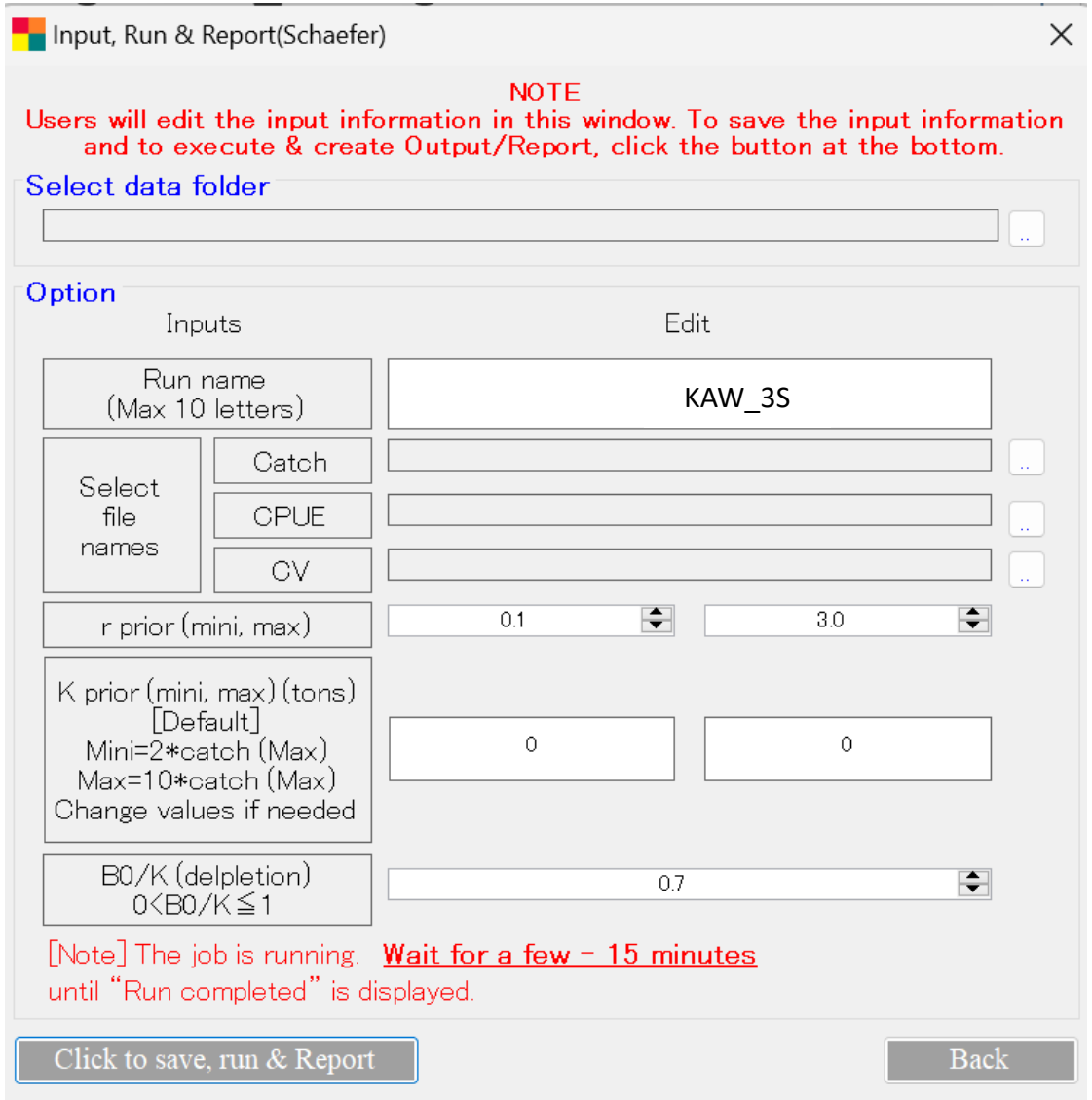
- Initially users need many preparatory runs before getting satisfactory results.
- In the preparatory runs, users need to use software as test
- In

3. JABBA runs (Schaefer・Fox)
3.2 JABBA runs
3.2.1 Entry, Run, Output & Report

Starting JABBA_Manager. Double click the icon then click “Schaefer”. Users will see the window (below). See next a few pages how to proceed.

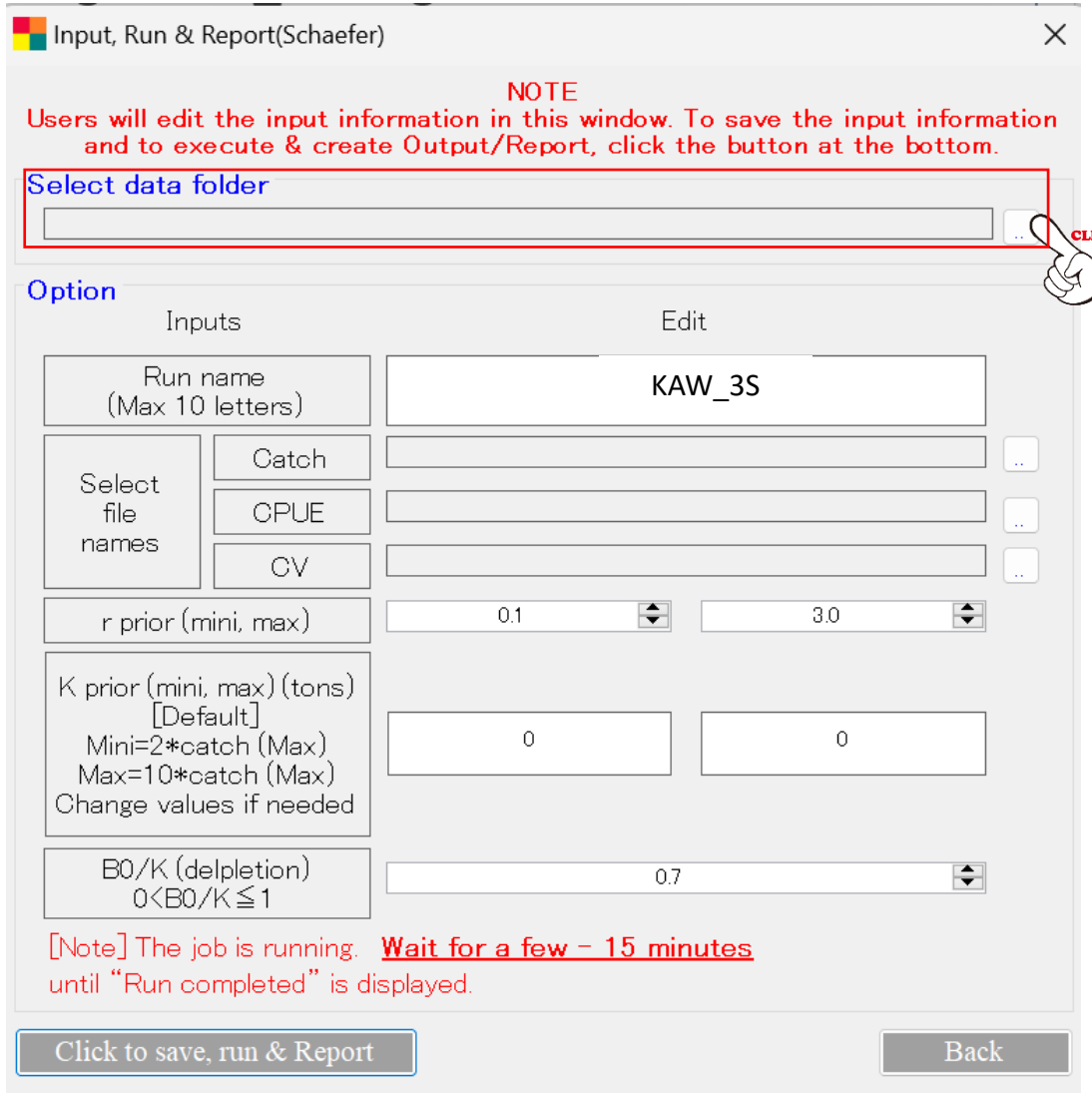


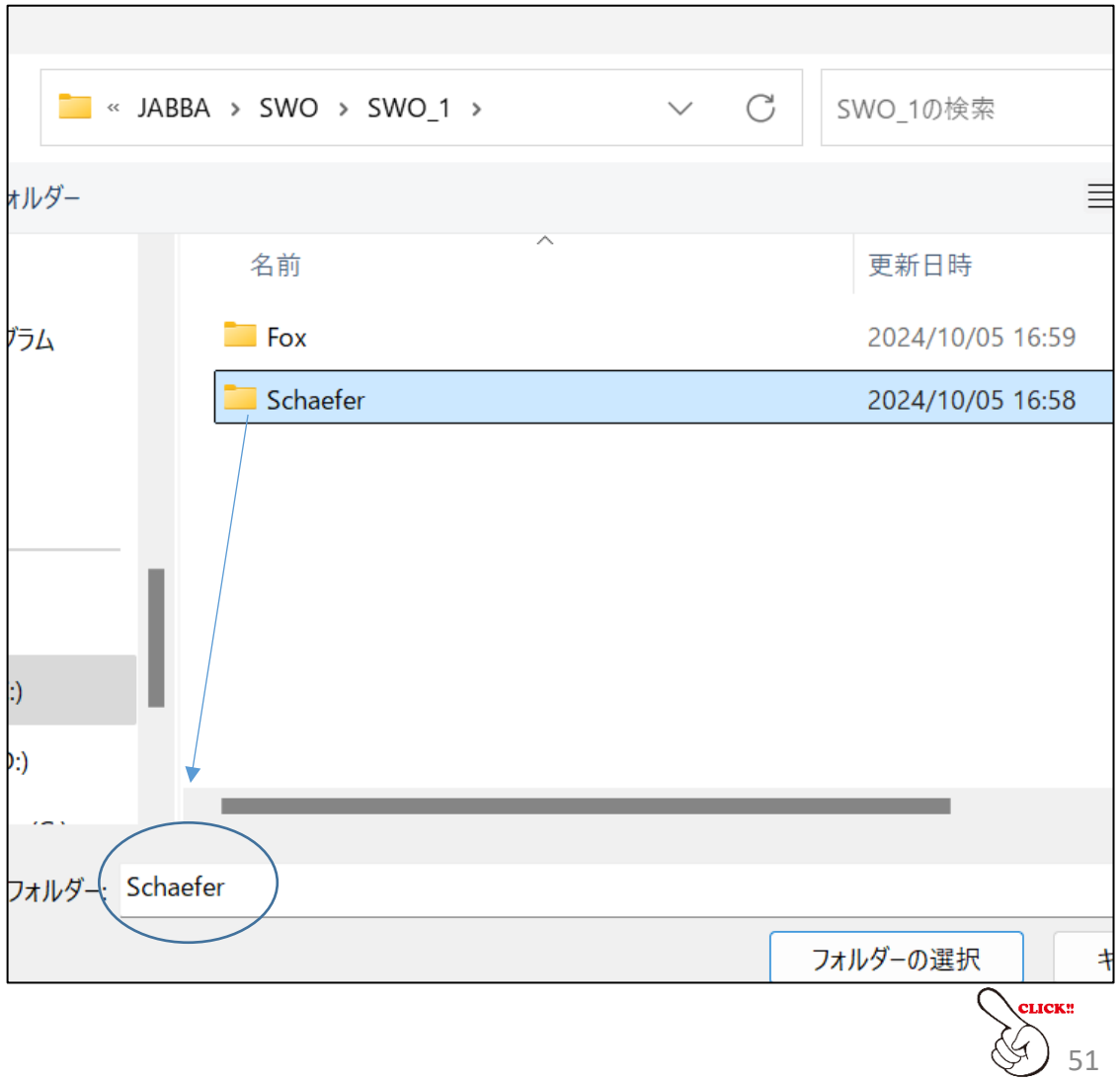




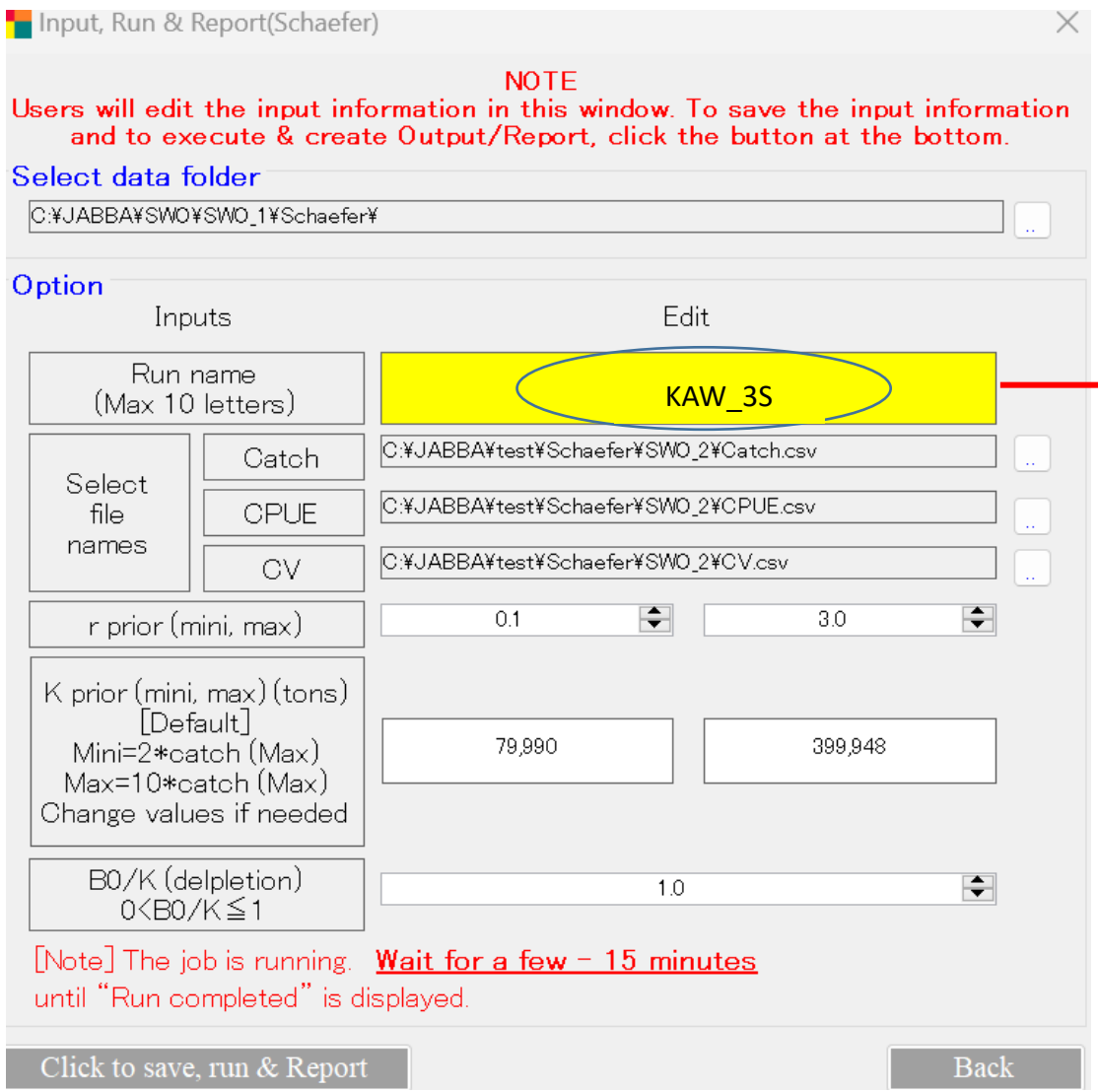
3. JABBA runs (Schaefer・Fox)
3.2 JABBA runs
3.2.1 Entry, Run, Output & Report

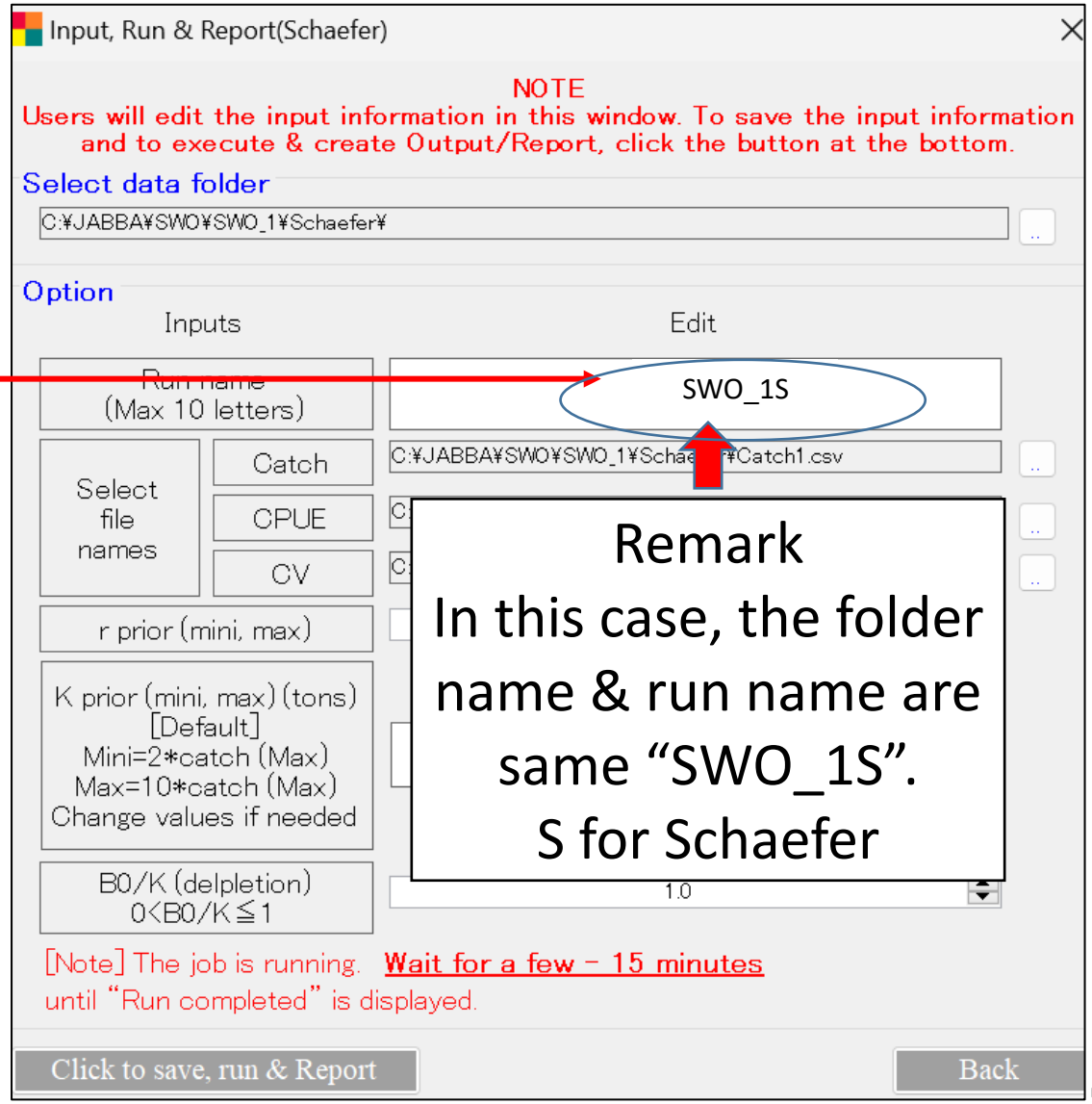
Selecting the data folder. Click “Select data folder” button, then go to the folder and click.





Edit Run name

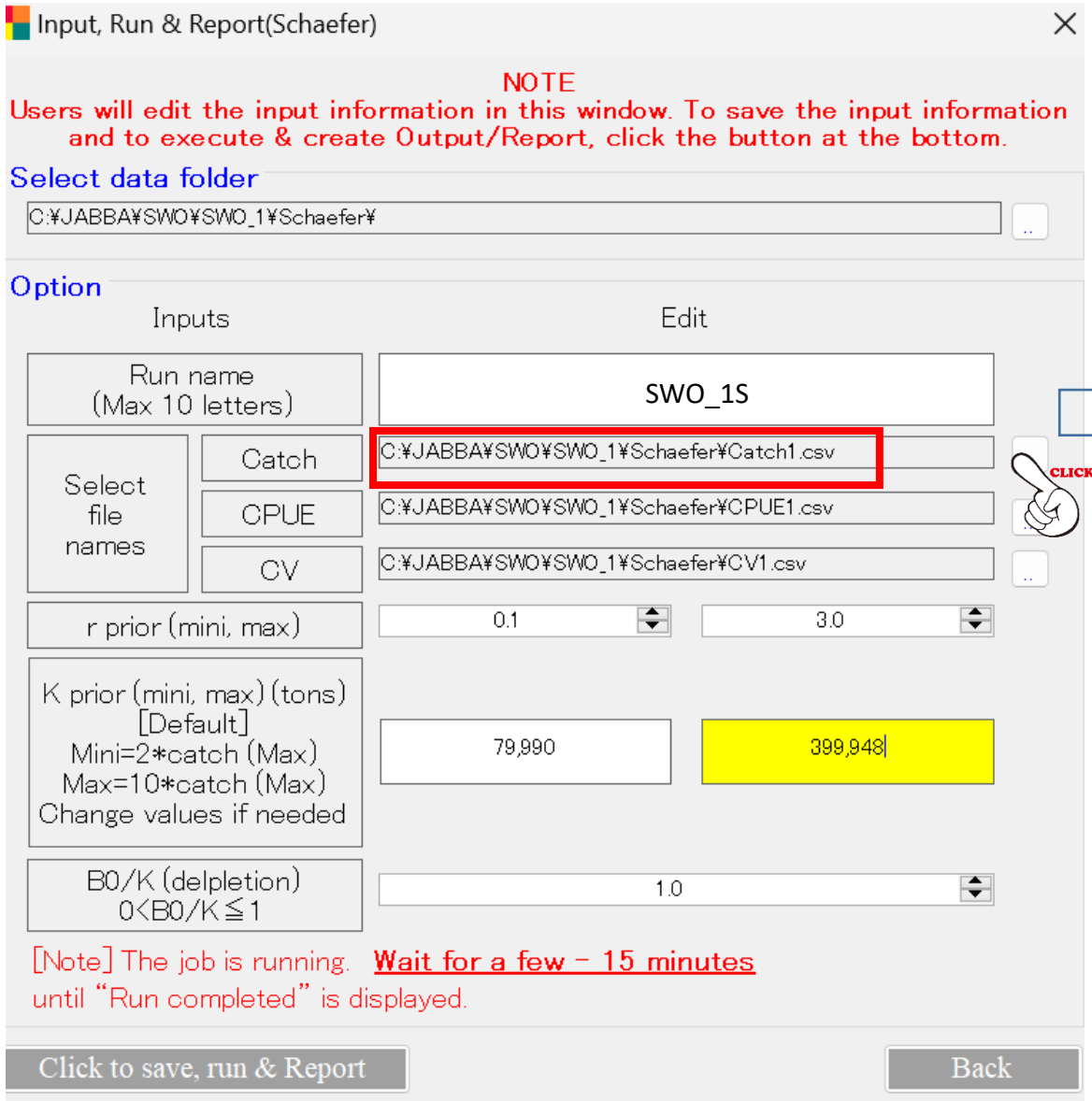


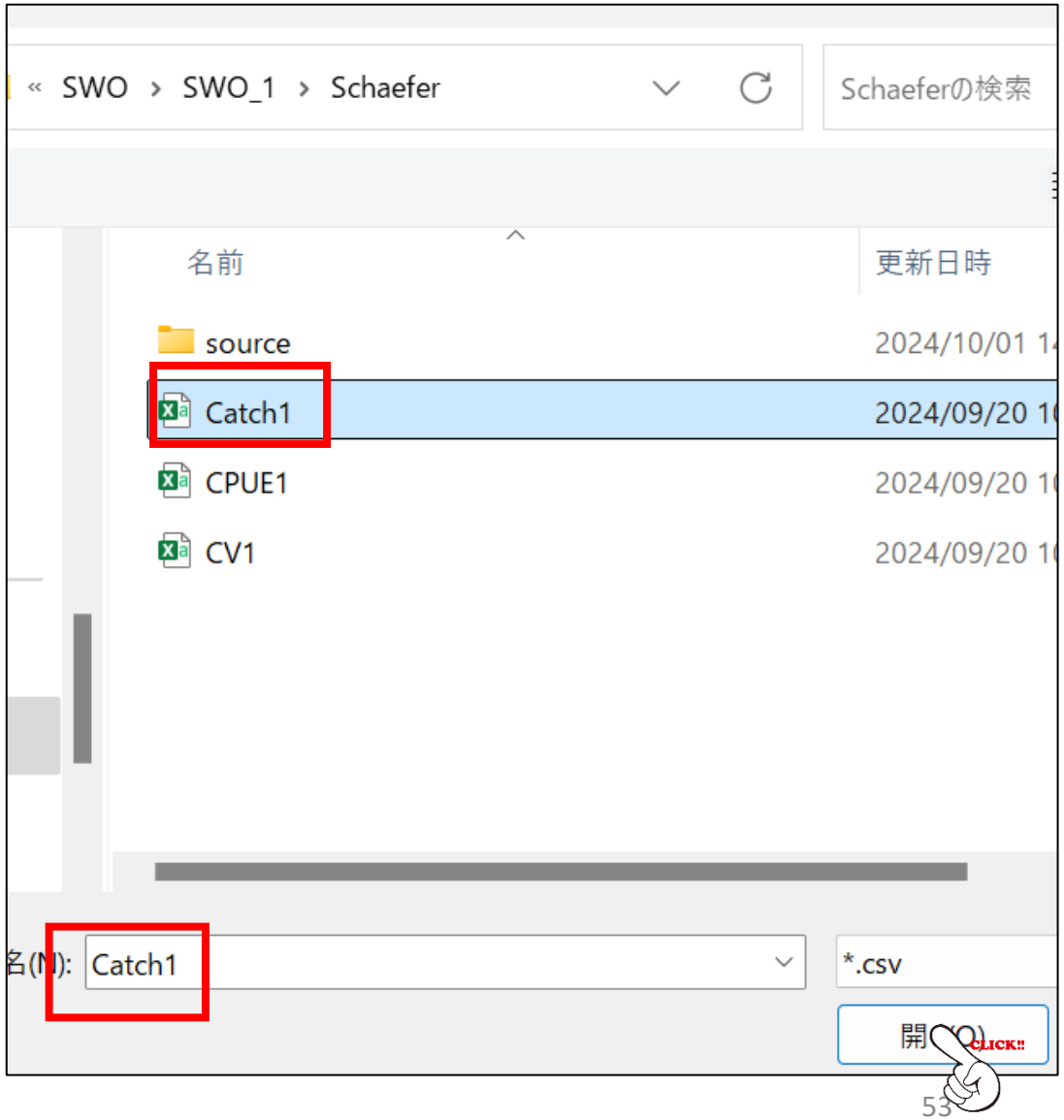


Remark
In this case, the folder name & run name are same "SWO_1S".
S for Schaefer

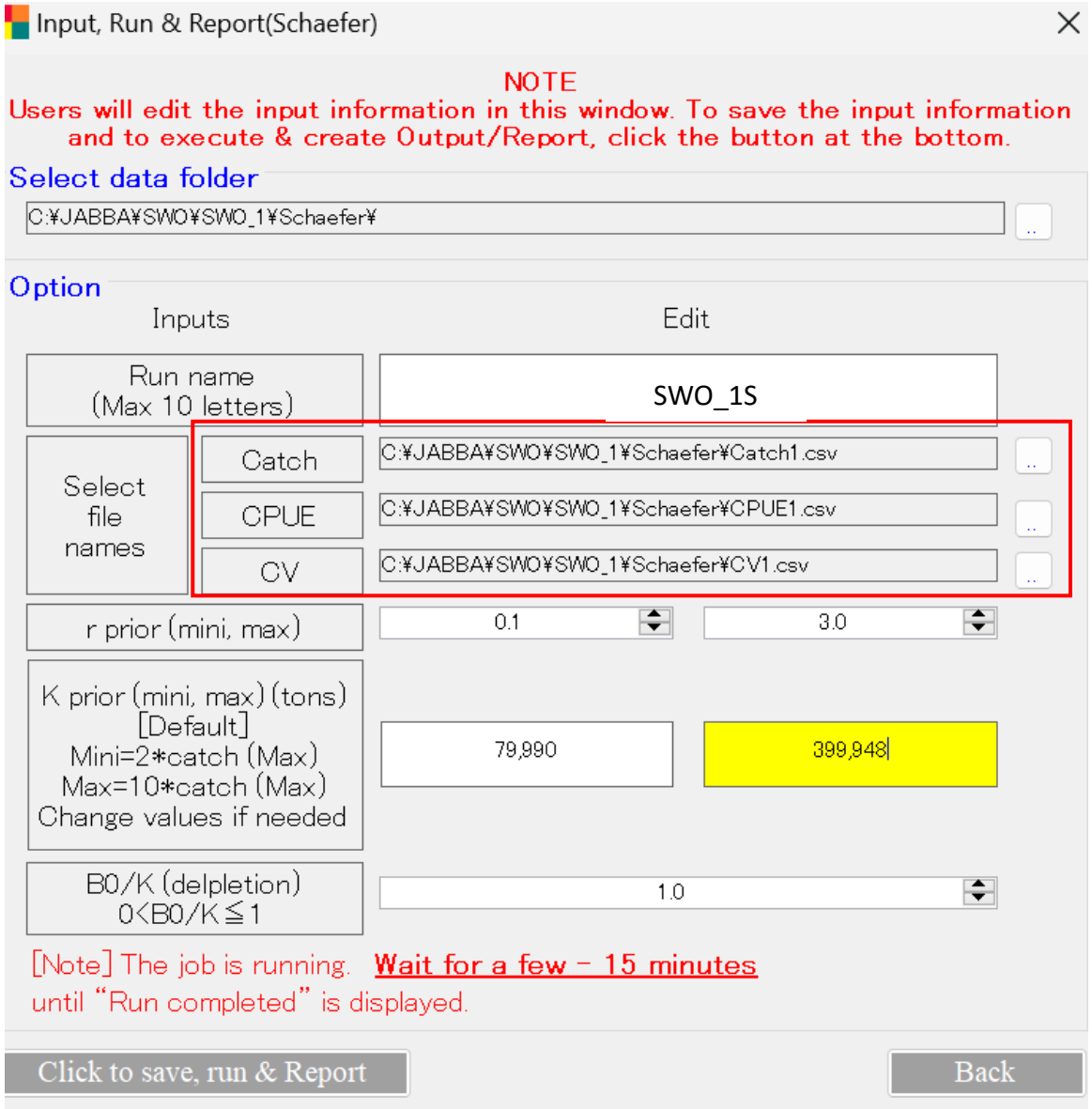
Selection of Catch file:

Click catch file selection button ➔ Select catch.csv file ➔ click



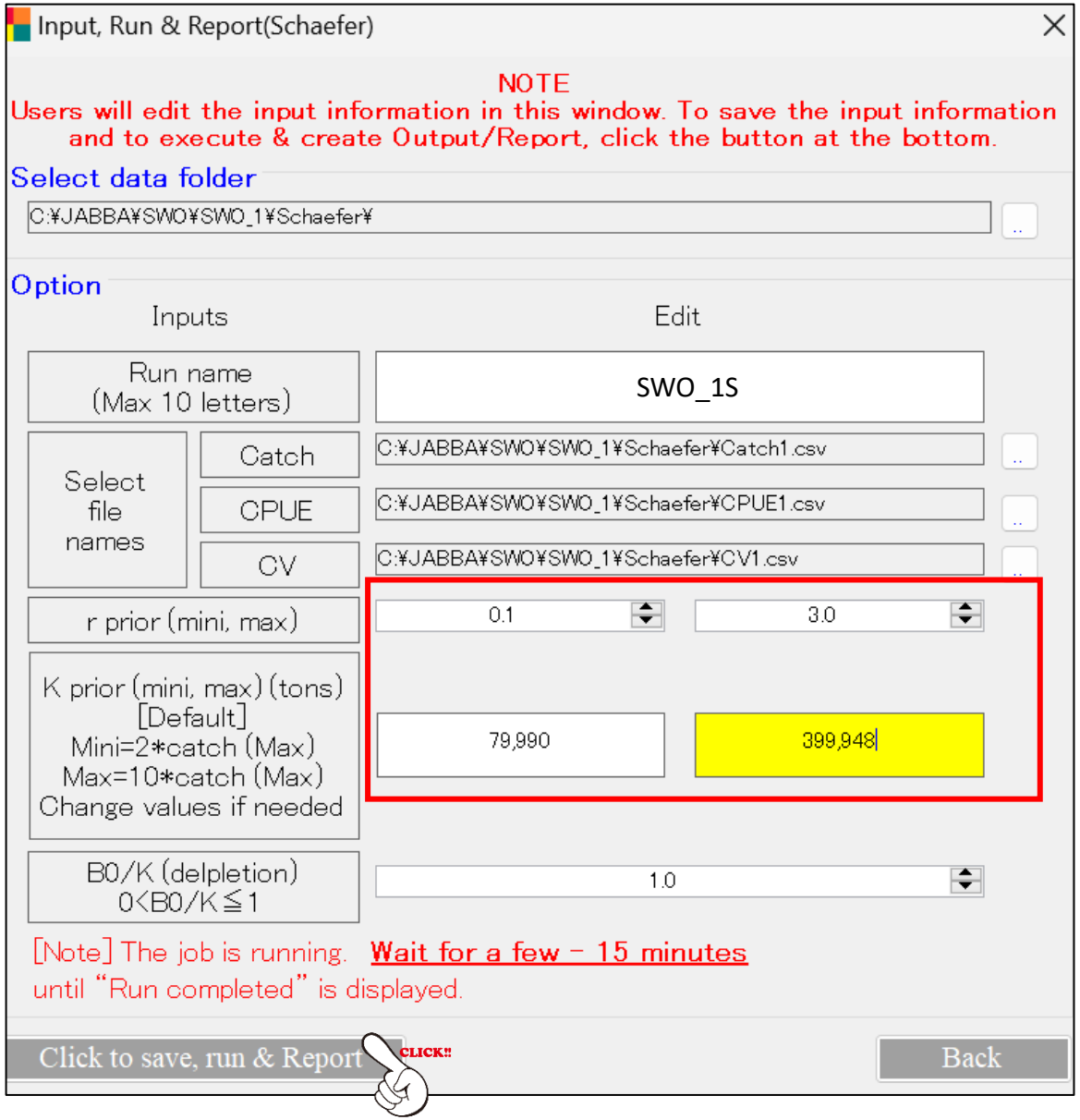


Selection of effort & CV file: follow the same way as catch



3 input files
(1) Catch1
(2) CPUE1
(3) CV1
are selected

3. JABBA runs (Schaefer・Fox)
3.2 JABBA runs
3.2.1 Entry, Run, Output & Report



Edit parameters and click to start

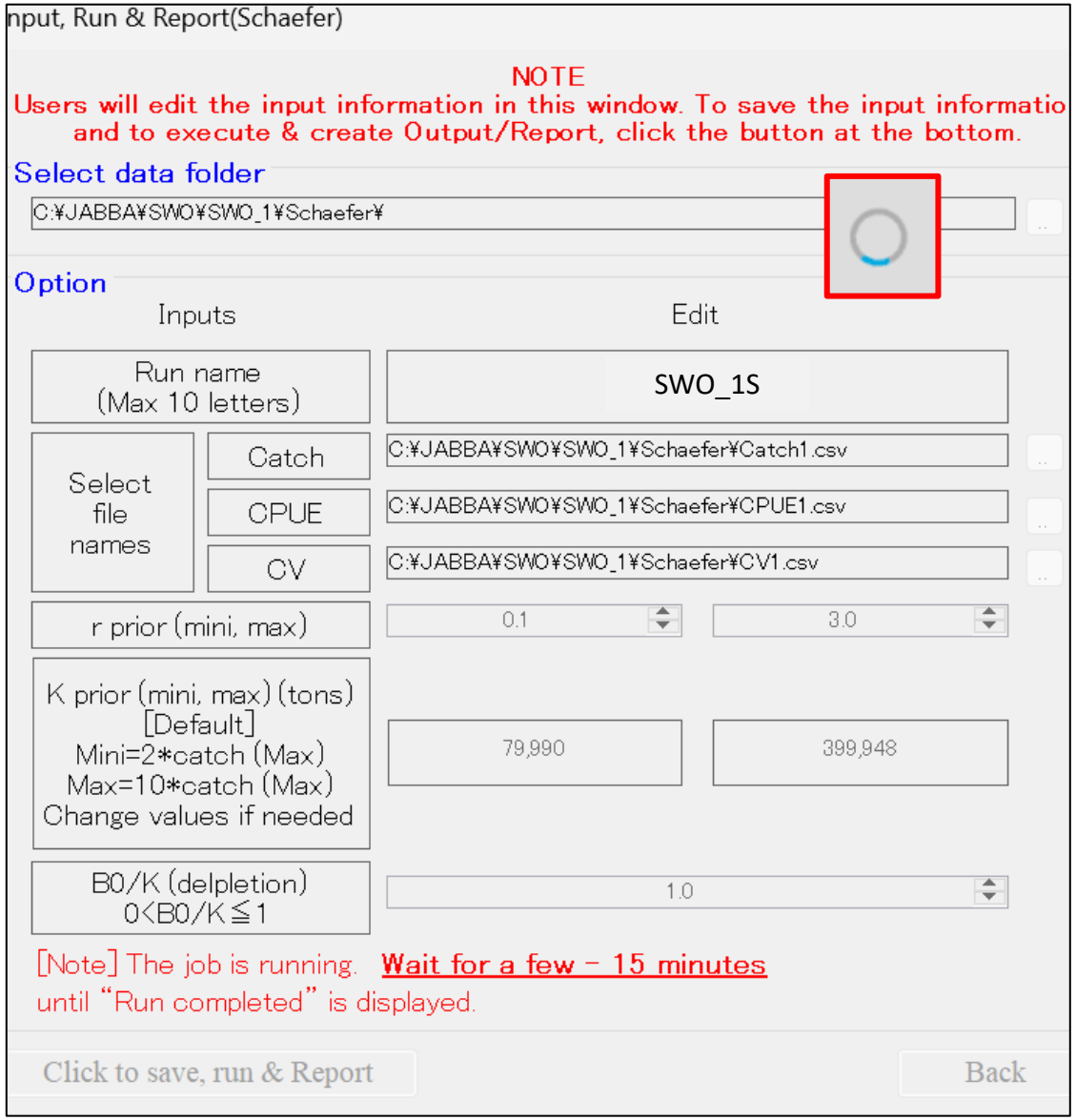
Defaults values are OK

Assign depletion guess value (1 for the virgin stock & other values considering history of fisheries)

3. JABBA runs (Schaefer・Fox)
3.2 JABBA runs
3.2.1 Entry, Run, Output & Report

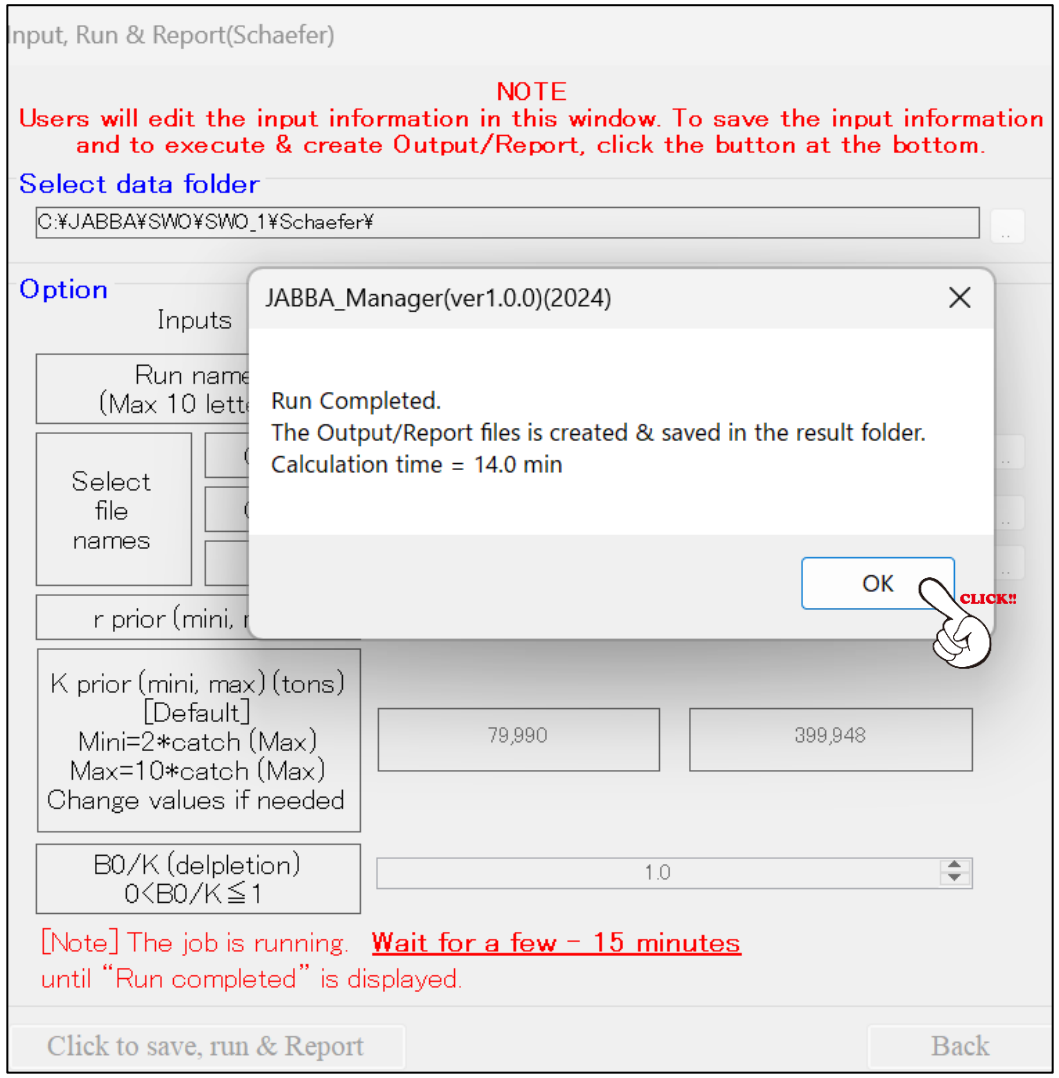
To complete all the process, it will take a few - 15 minutes depending on data volume (# of years & fleet) and PC performance.

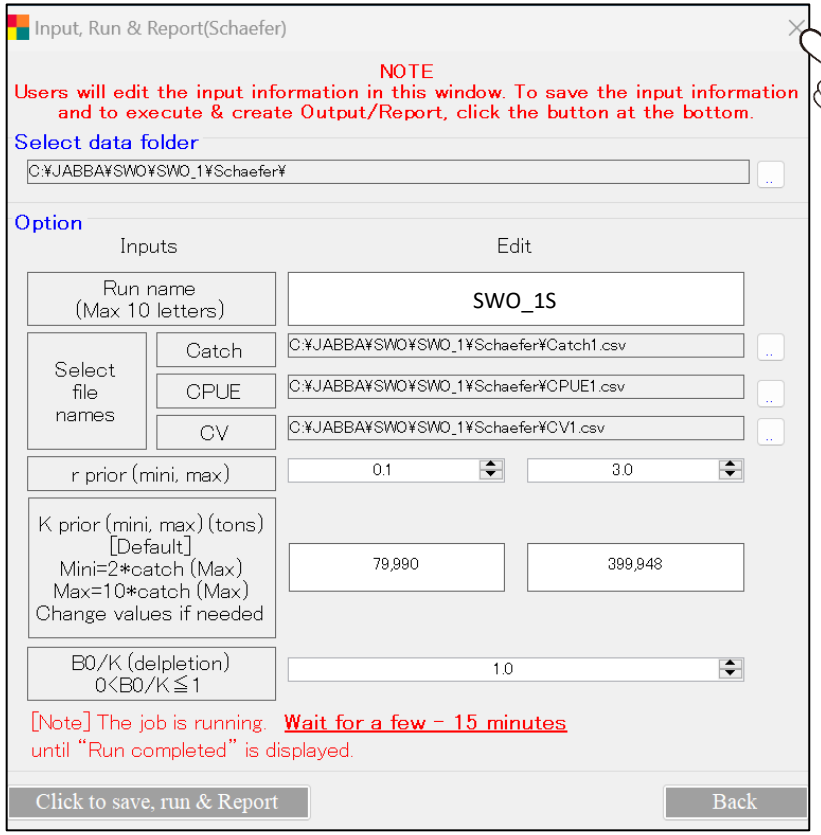
During the process, the processing marker (waiting time sign) will appear.

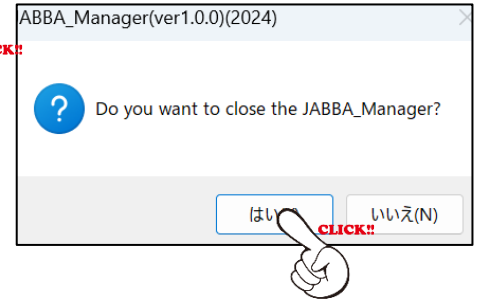


3. JABBA runs (Schaefer・Fox)
3.2 JABBA runs
3.2.1 Entry, Run, Output & Report

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

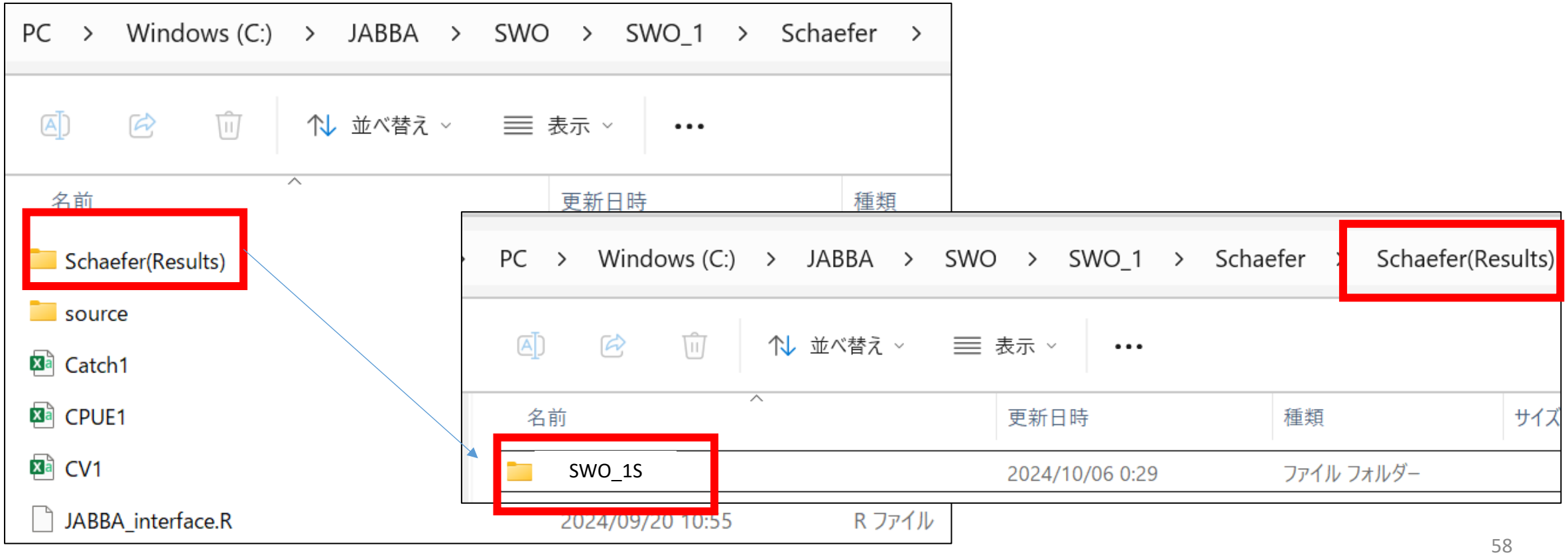






All outputs & Report are saved in the result folder (see next page).

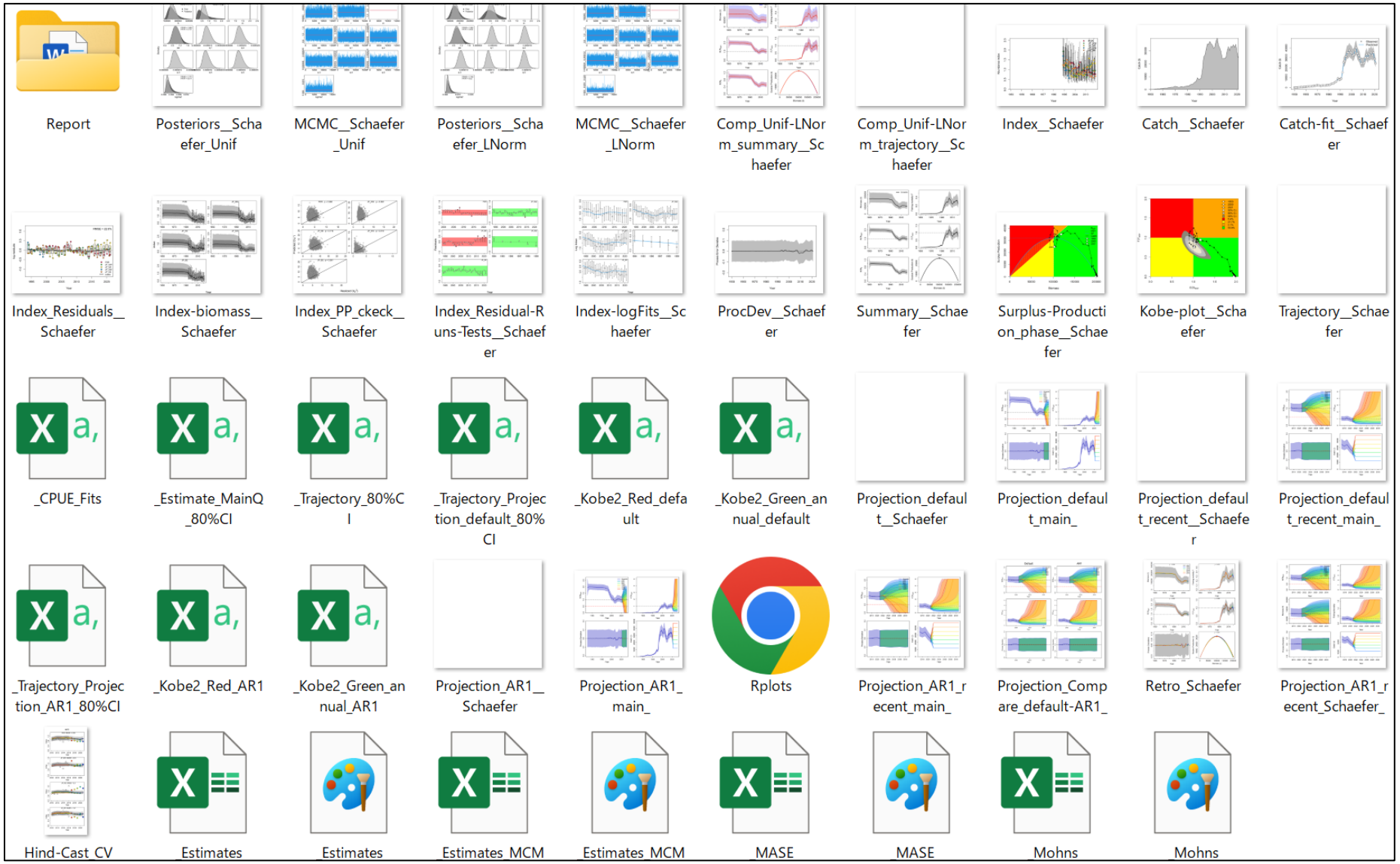
- Results are saved in Schaefer(results) folder.
- In our case, results of the (first) Run name (SWO_1S) are stored.
- Contents of SWO_1 is shown in next page.



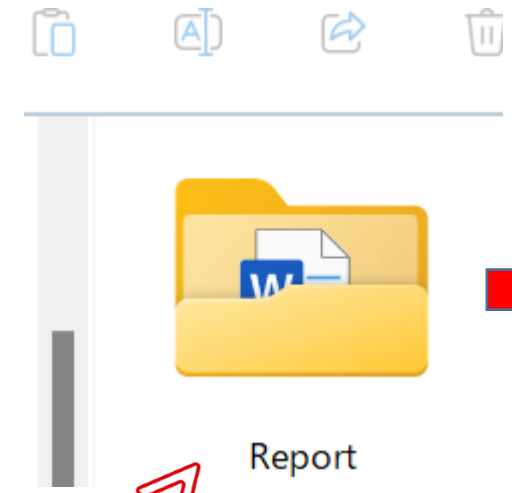
Contents
SWO_1S

"Report folder" & output of results including files to make the Report file.
(see next page)

Users will not use these output files, while they can refer to.



To find out the Report



There are 2 files in the Report folder

(1) Log file containing log of R execution. Users need to send to [MENU] if there are errors in the run. [MENU] will investigate and fix the problems and inform back to users.

(2) Another file is the Report file (Report_SWO_1S in our case). This includes important files of results for Report word file (see next pages)

3. JABBA runs (Schaefer▪Fox)
3.2 JABBA runs
3.2.1 Entry, Run, Output & Report

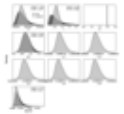
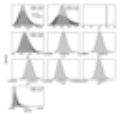
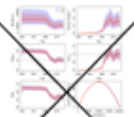
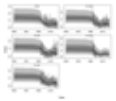
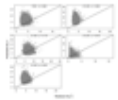
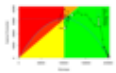
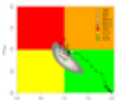
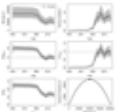
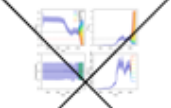
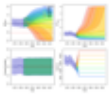
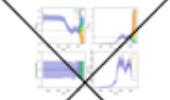
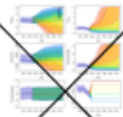
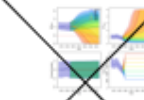
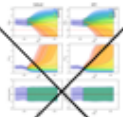
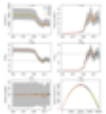
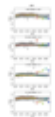
The Report (19 pages) has 7 Sections (below).
Appendix B shows all pages of the Report_1.

Report_SWO_1S (Schaefer)

Contents

Note: There may be blank pages due to missing output (figures and/or tables) caused by formatting problems. In such a case, please copy and paste from the original output list folder (one before the report folder). If there are no outputs in that output folder, please leave it empty as no results were obtained.

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-lngFits_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

3. JABBA runs

3.3 Selection of the best run in each model

In the previous section, we run SWO_1S

We now need to valuate if results are OK.

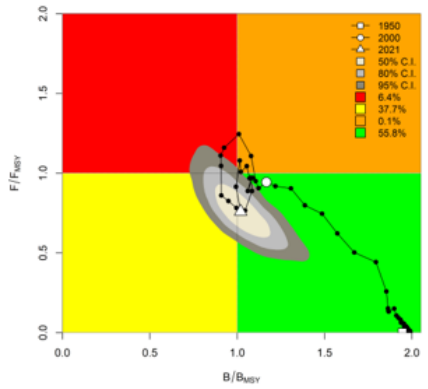
How to evaluate ?

3. JABBA runs
3.3 Selection of the best run in each model
3.3.1 How to evaluate & improve run results

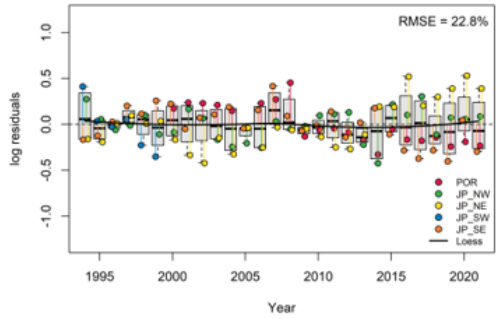
#13 is the Graph/Table number in Report

Quick evaluation (diagnosis)

(#18) (page 17) Kobe plot



(#10) (page 7) CPUE fitness (1)
(lower RMSE better)



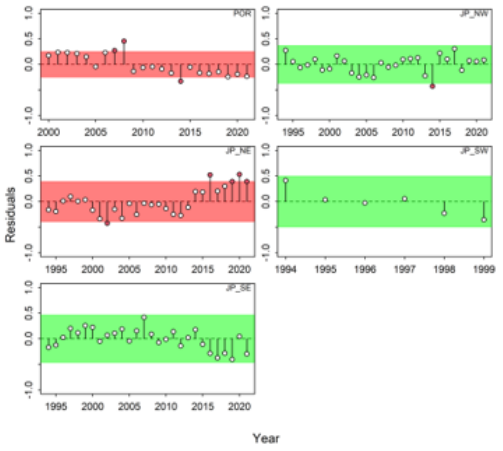
(#20) (page 4) Conversion (MCMC) (> 0.05)
(higher better)

	Geweke.p	Heidel.p
Average	0.80	0.42

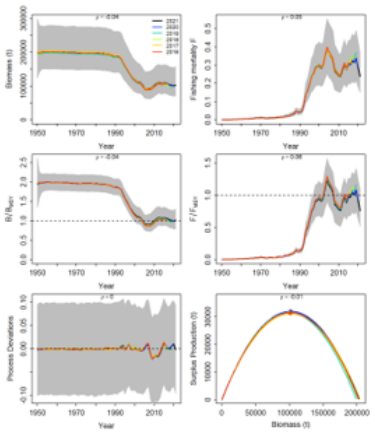
(#43) (page 13)
MASE
(Predictive skill)
(< 1)
(smaller better)

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

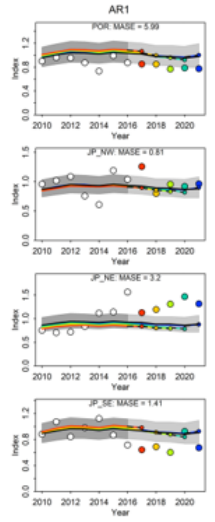
(#13) (page 6) CPUE fitness (2)
Red band (no randomness) & Red points (outliers)



(#40) (page 12) Retrospective analyses
(trends should be close together & similar)



(#41)
(page 14)
Hindcast
(predictive
skill)
Observed
values < 95%
CI

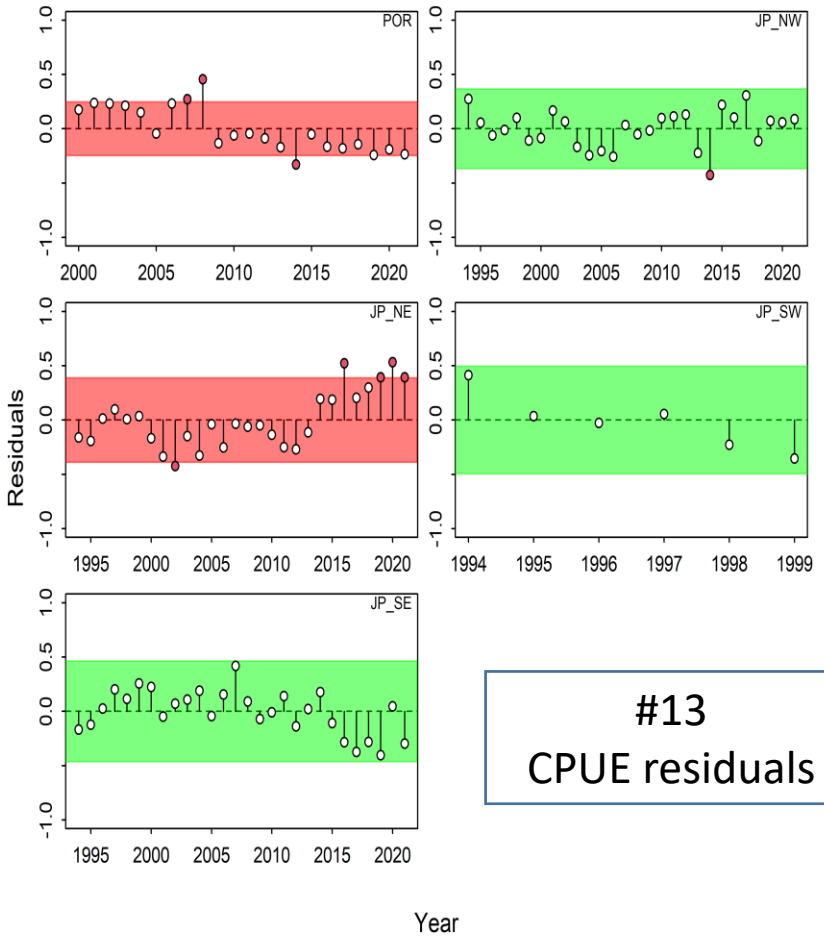


- Quick evaluation (diagnosis) by 7 criteria is available in page 3, Report.
- 7 criteria are explained in the Report (see pages indicated).
- The most important diagnosis is CPUE fitness (#13)(page 6 in Report affecting all other diagnoses.
- If CPUE are improved, all results will be improved.

How to evaluate CPUE(#13)?

(1) If the 95% CI of residual plots for some fleets are in red, it means that its time series data have autocorrelation (no randomness) problem. Thus, CPUE for such fleets need to be removed. In this example, POR and JP_NE.

(1) There are red points (outliers). POR & JP_NE have red points. But it is OK as whole CPUE are removed. Only one red point (JP_NW) is very close to the 95% CI, so it can be kept.



#13
CPUE residuals

Now we understand that the 1st run (SWO_1S) is NG.

- Then we need to improve.

- As suggested by quick diagnosis (#13 CPUE fit),

  ➔ we need to remove 2 CPUE (fleets) and re-run (SWO_2S)

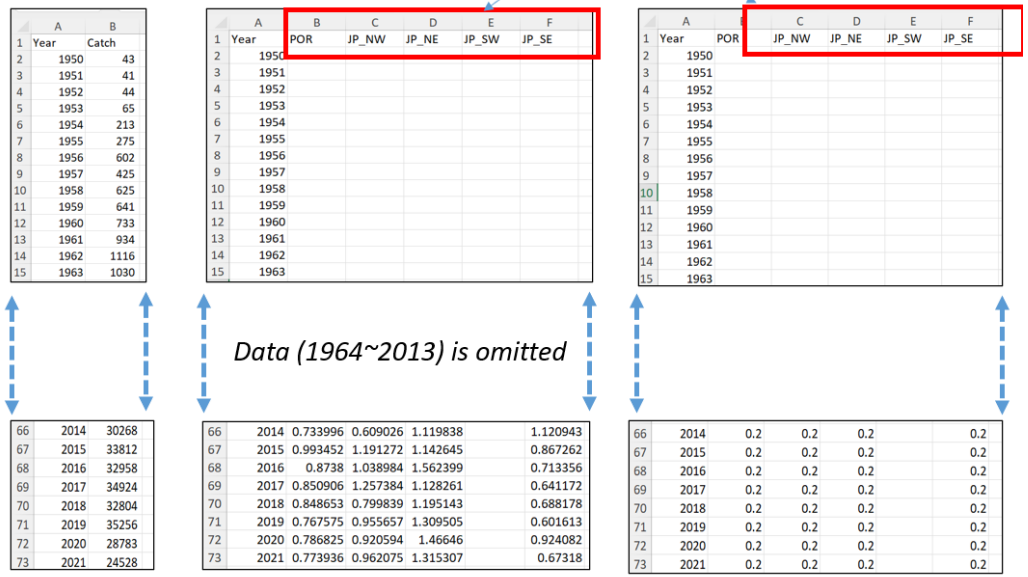
- How to remove and proceed ?

3. JABBA runs
3.3 Selection of the best run in each model
3.3.1 How to evaluate & improve run results

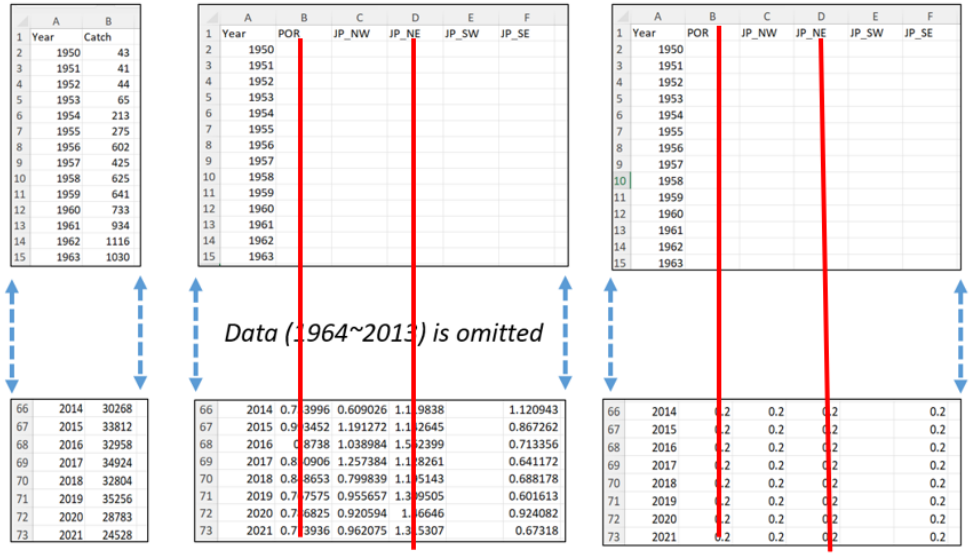
How to proceed after some CPUE fleets & outliers are removed?

- Users need to re-run using the new data set (CPUE & CV). How to set up the new data?
- Catch1 is same. Revised **CPUE & CV need to be created** without 2 fleets (POR & JP_NE) (see below). Change files names to Catch2, CPUE2 and CV2.

Catch1 | CPUE1 | 5 fleets (codes) | CV1



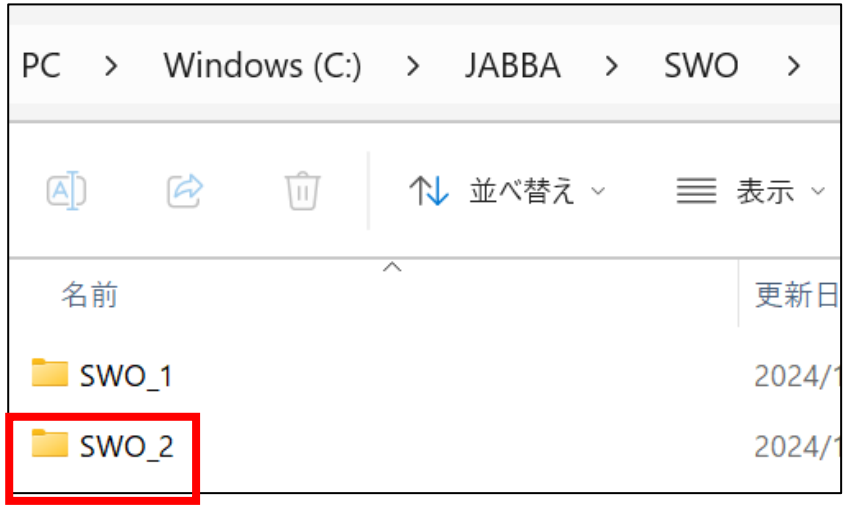
Catch2 | CPUE2 | CV2

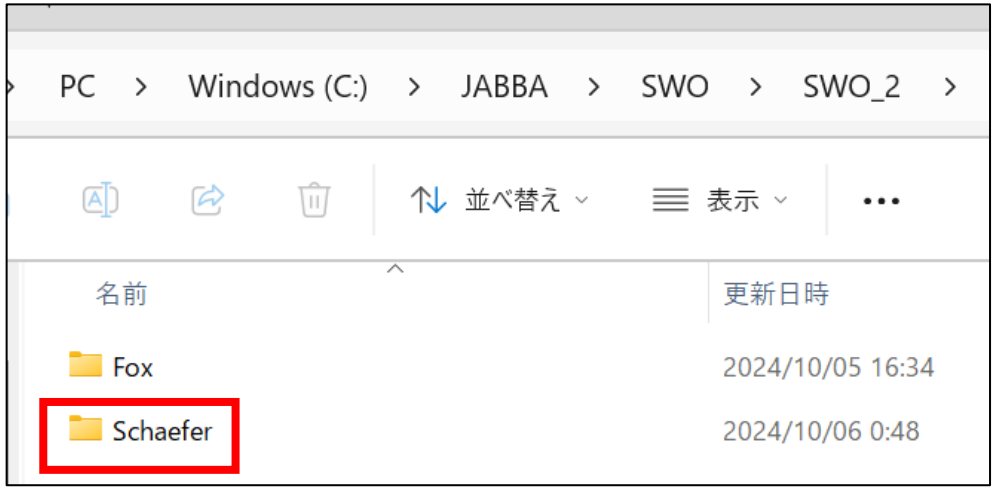


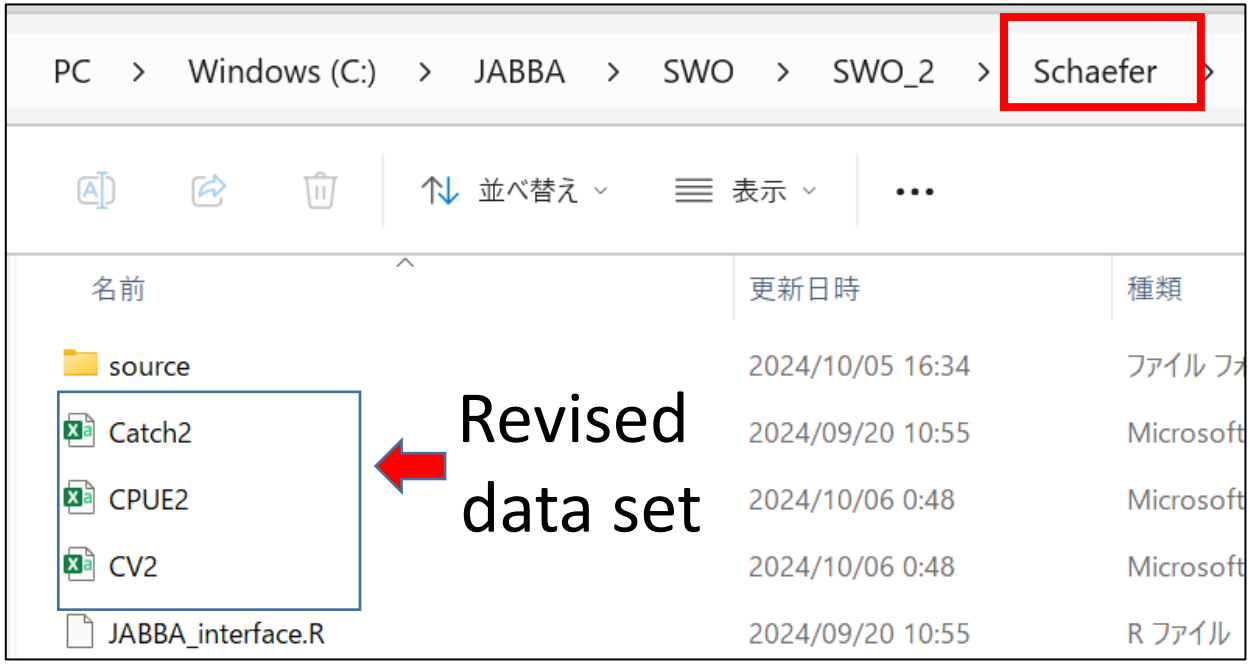
Data set in the 1st run (SWO_1S)

Revised data set for the 2nd run (SWO_2S) without 2 fleets CPUE (POR & JP_NE)

We now use SWO_2S for the 2nd run and change the revised data from (catch1, CPUE1 & CV1) to (Catch2, CPUE2 & CV2)

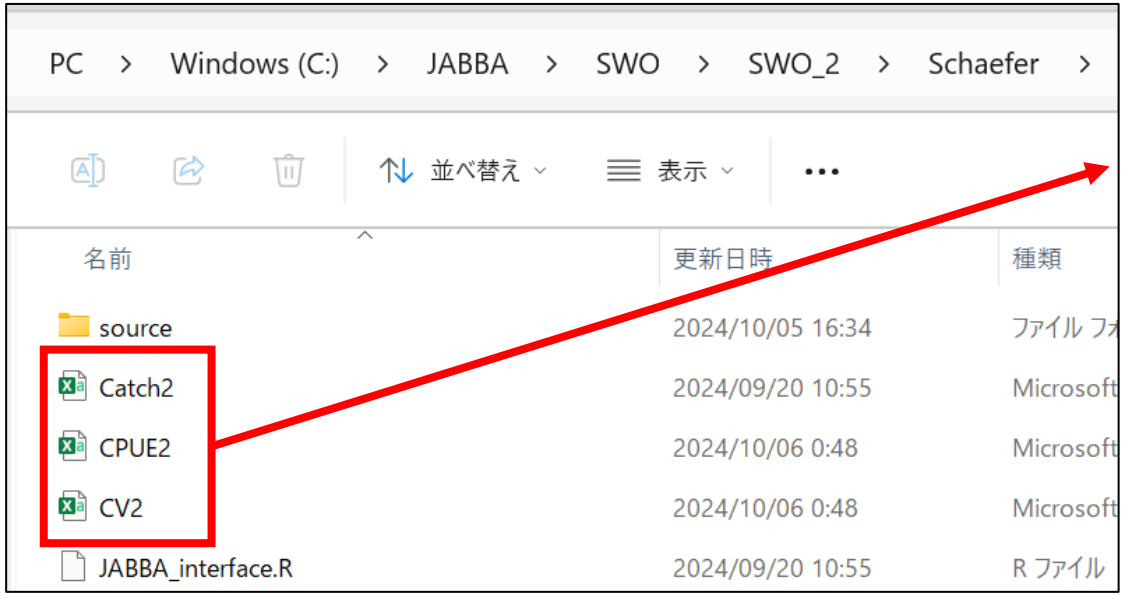


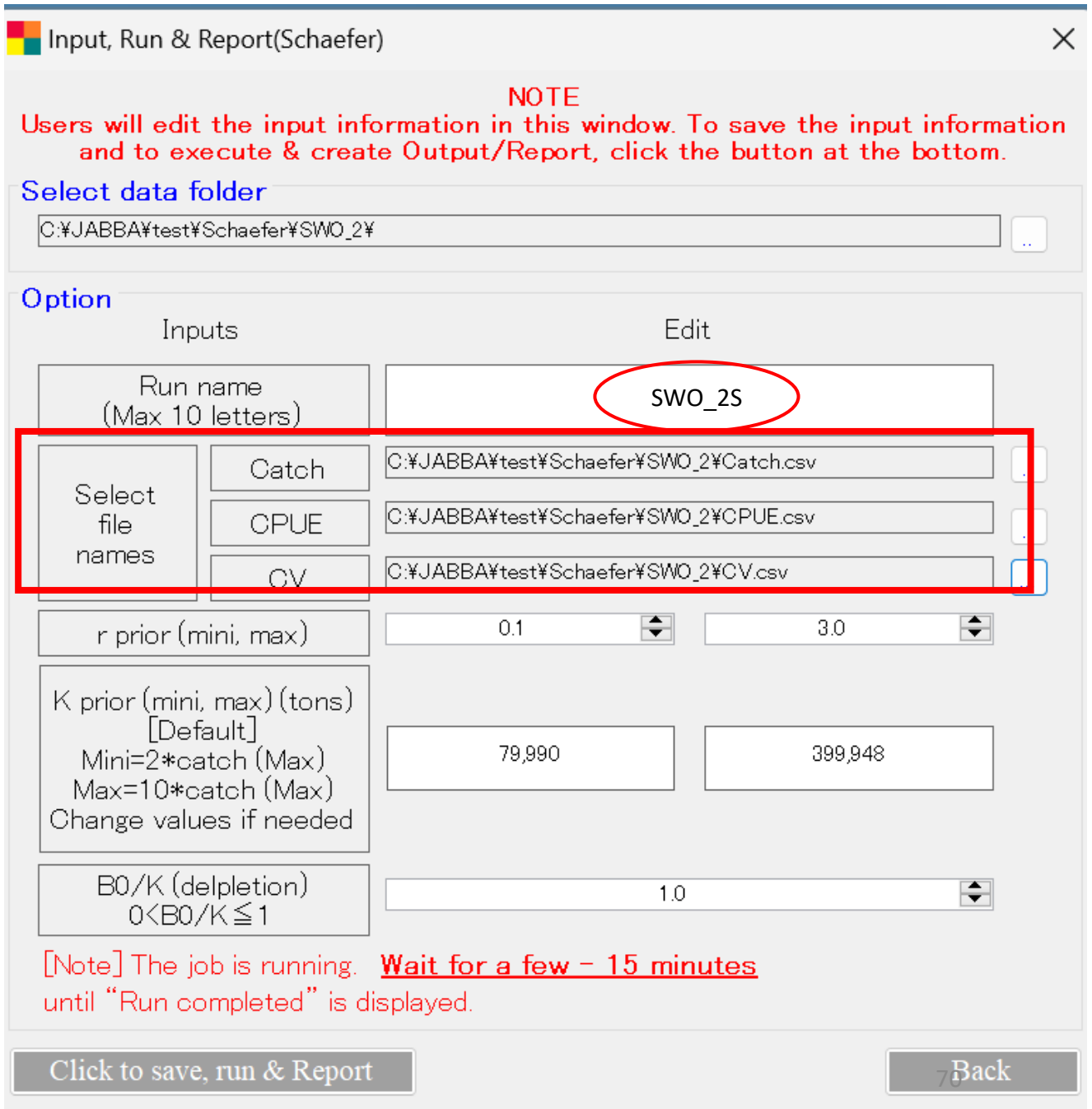




Revised data set

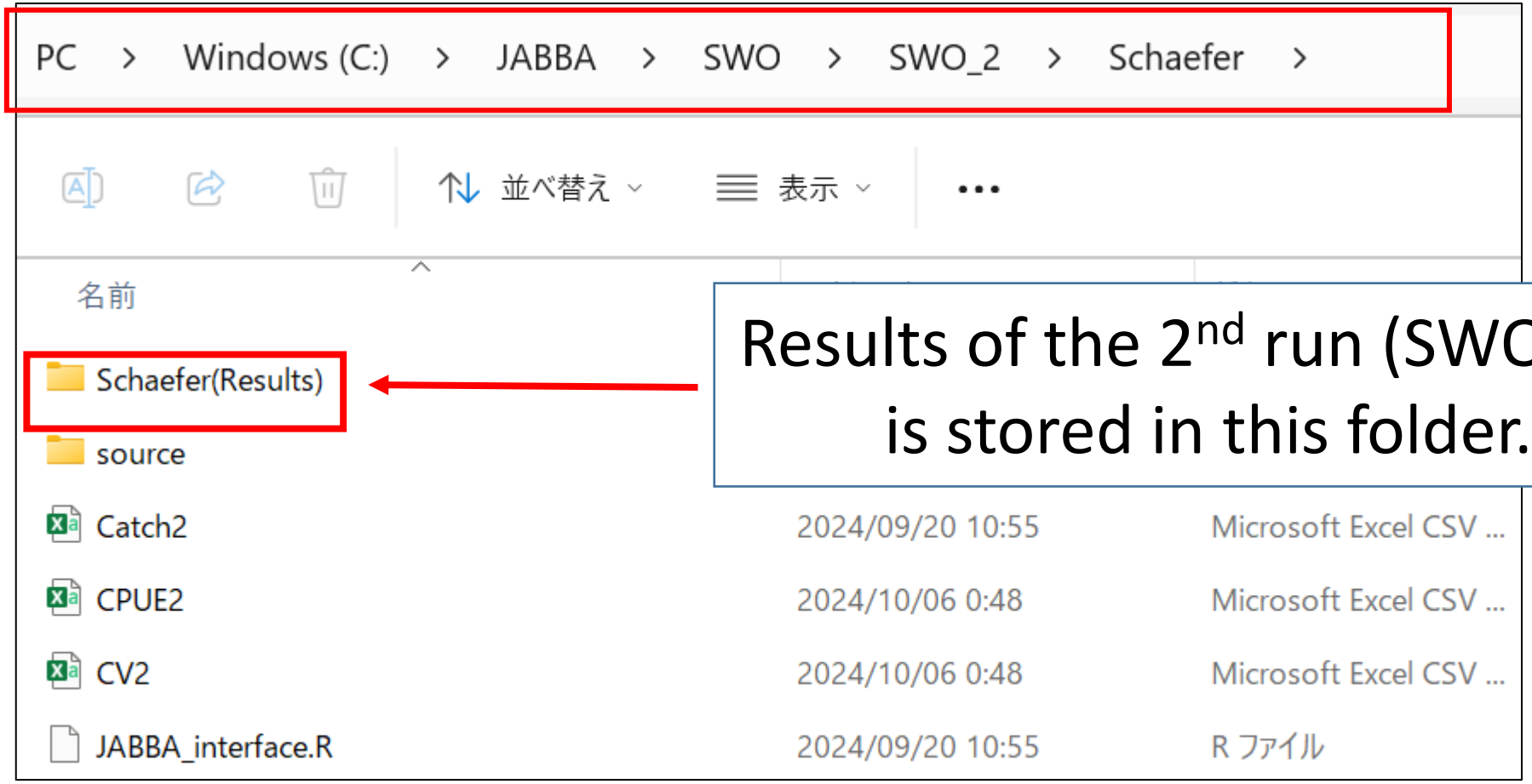
Users need to re-run with the revised data in the same way as for the 1st run (SWO_1).





3. JABBA runs
3.3 Selection of the best run in each model
3.3.2 How to improve the run

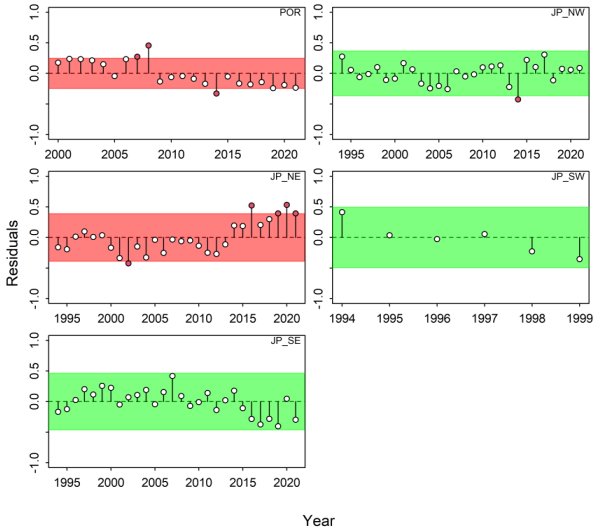
After re-run, users will get output results) folder SWO_2 (see below)

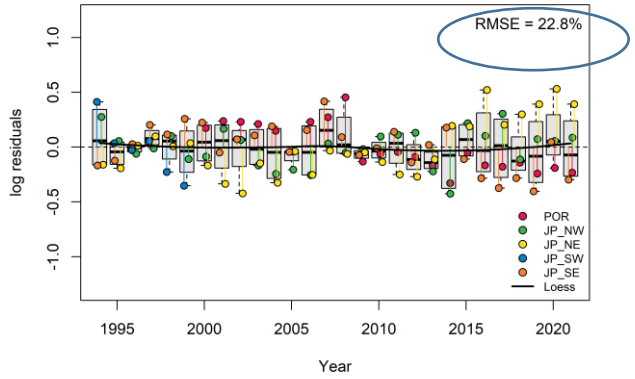


Results of the 2nd run (SWO_2S) is stored in this folder.

Results of improvements on major parameters (SWO_1S ➔ SWO_2S) from quick evaluation. All improved except Convergence(MCMC)

SWO_1S

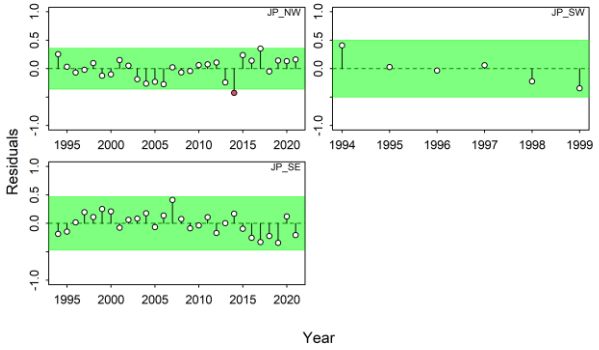


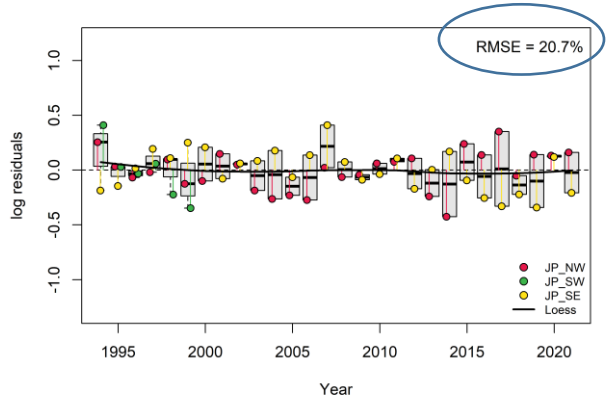


	Geweke.p	Heidel.p
Average	0.80	0.42

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

SWO_2S





	Geweke.p	Heidel.p
Average	0.27	0.25

Index	MASE
JP_NW	1.12
JP_SW	NA
JP_SE	1.33
Average	1.24

Very much improved after 2 CPUE removed(all green)

slightly improved (RMSE) (22.8%➔20.7%)

Convergence（MCMC） (worsen) (larger better)

Retrospective analyses (Improved but still not OK) Need to be < 1

Summary how to improve the run (1/2)

(1) Output #13 (CPUE fit) is the key diagnosis.

(2) If the red band (autocorrelation) in some fleets, delete them

(3) If large outliers(red circle), delete them.

Summary how to improve the run (2/2)

(4) Then re-run JABBA by changing names:

Ran name: SWO_1S➔ SWO_2S

Data file name : Catch1➔ Catch2, CPUE1➔CPUE2 & CV1➔CV2

(5) Check by quick evaluation if all are the improved. If so, SWO_2 is the best run.

(6) If still problems, repeat the same exercise by changing names

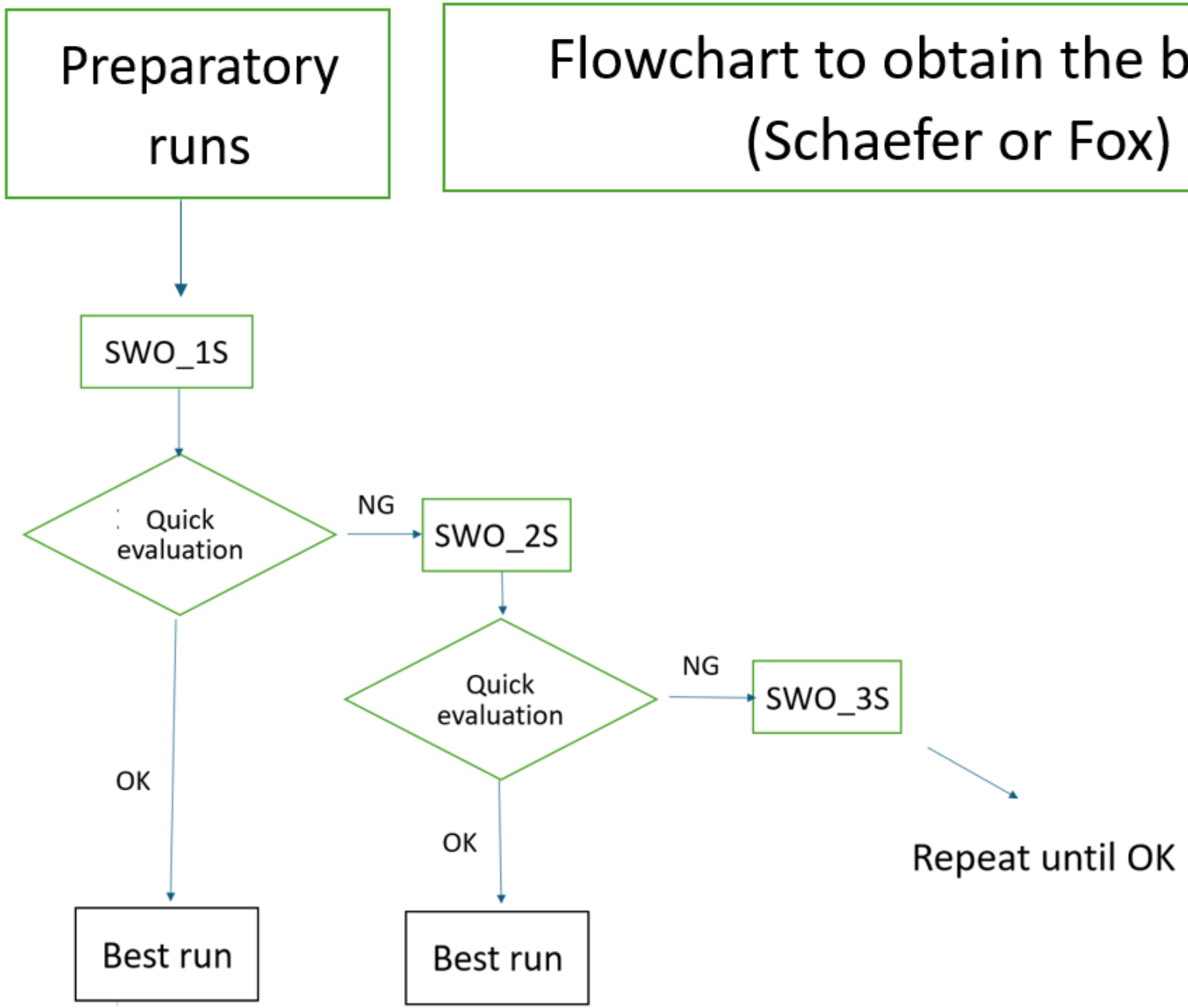
Ran name: SWO_2S➔ SWO_3S

Data file name : Catch2➔ Catch3, CPUE2➔CPUE3 & CV2➔CV3

(7) Stop run if users get the satisfactory results.

(8) That run is the best run (Schaefer or Fox)

Flowchart to obtain the best run (Schaefer or Fox)



3.4 Selection of the best model run from Schaefer & Fox

3.4 Selection of the best model run from Schaefer & Fox
3.4.1 How to evaluate the best model run

(1)Users now have the best run each for Schaefer and Fox.

(2)The results are available in each Report word files (for example, SWO_2S).

(3)Users need to select the best model run comparing results by 15 diagnosis in 2 Reports.

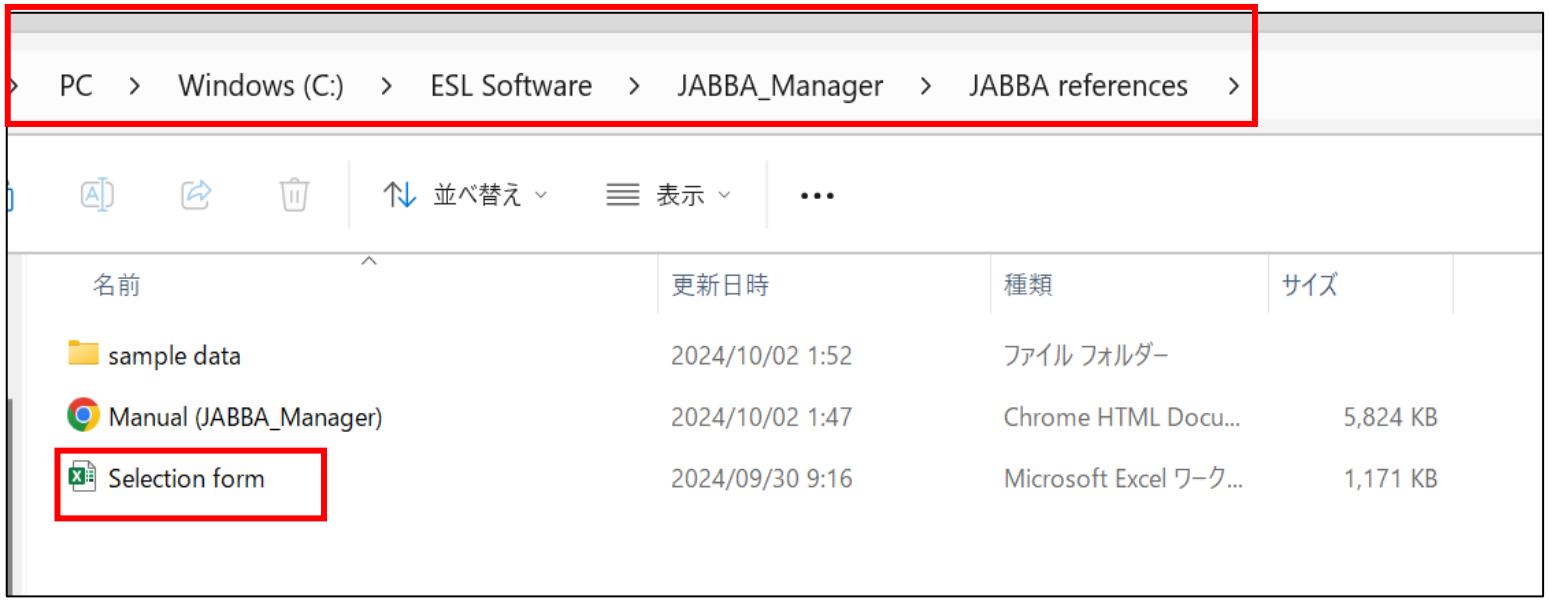
(4)It will be inconvenient to compare directly using Report files.

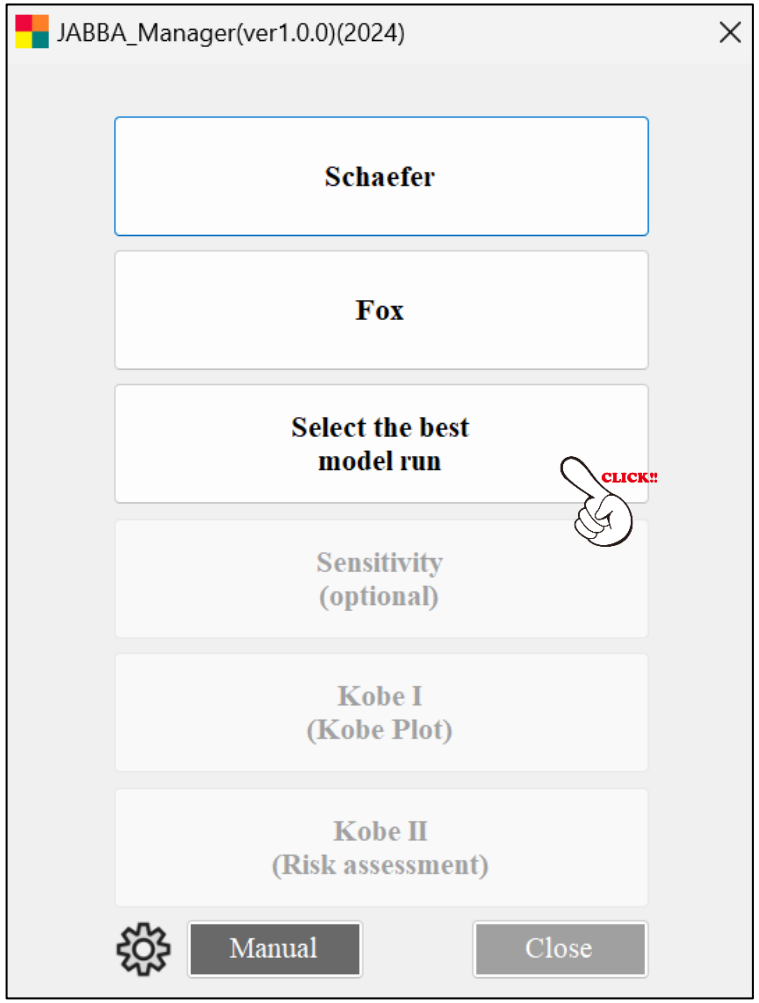
(5)Hence, “Selection form (Table for comparison)” is created to evaluate 15 items by diagnosis.

3.4 Selection of the best model run from Schaefer & Fox
3.4.1 How to evaluate the best model run

(6) Users need to use this form located in the 3rd menu (right).

(7) For practice, users can get it from ESL software, which is not linked to the software.





3.4 Selection of the best model run from Schaefer & Fox
3.4.1 How to evaluate the best model run

Selection form (Excel) : Contents

(1) 1st sheet Comparisons 15 diagnosis (example by SWO)

(2) 2nd sheet Blank format

(3) 3rd sheet Note (example) on diagnosis #6~#9

(4) 4th sheet Note (example) on diagnosis #10

(5) 5th sheet Note (example) on diagnosis #12

3.4 Selection of the best model run from Schaefer & Fox
3.4.1 How to evaluate the best model run

Selection forms (Excel)

- To make the Selection form, Users can use either example sheet (by editing previous entries) or blank sheet.
- 4 key evaluation themes with 15 items
- 15 items are equal weighting (default). If users want to change weighting, please do so by yourself.
- Based on the results of diagnosis, users will decide the best Model (Schaefer or Fox)

3.4 Selection of the best model run from Schaefer & Fox
3.4.1 How to evaluate the best model run

How to use the Evaluation form?

- ✓Evaluation items need to be filled out by copy & pastes using results available in Report. Hard copy is helpful for editions.
- ✓In each evaluation item, users will select “better model (Schaefer or Fox() by diagnosis.
- ✓The final decision will be made by numbers of “better model”.
- ✓ As for this example, the Fox model was selected.

Selection of the best model run (Schaefer or Fox) by 15 diagnosis *(Use hard copy of 2 Reports for easy process & edits)*

(Note) You can use this sheet to edit or the blank sheet (next sheet)

Evaluation	1. Convergence (MCMC)		2. Model Fit								3. Retrospective analyses		4. Hindcast analyses	
			2.1 CPUE residuals		2.2 RMSE	2.3 Prior to Posterior Ratio				2.4 Posterior Predictive Check (PPC)				
Methods	Heidelberger & Welch p test (higher better)		95% CI band	outliers	RMSE	PPMR (Prior to Posterior Median Ratio)		PPVR (Prior to Posterior Variance Ratio)		Average p values (compute yourself)	Visual inspection	Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (smaller better)	Visual inspection
Criteria	Geweke.p (average)	Heidel.p (average)	Red band No Randomness Green band Randomness	# of outliers	Less % better fit	Average value of 4 parameters (r, K, depletion & sigma2) (compute by yourself) (Use the 3rd sheet to compute) closer 1 is better				(Use the 3rd sheet to compute) Closer to 0.5 is better	Ball like shapes & centralized are better	# of outside range (see 5th sheet) (please count) (less # better)	Smooth & no strange trends nor patterns	< 1 better	# OBS points beyond the 95% CI band
Output #	# 20		# 13		# 10	#1		#3		# 12		# 42	# 40	# 43	# 41
						1st	2nd	1st	2nd						
Diagnosis #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Copy & paste from Reports															
Schaefer	0.27	0.25	OK	0	20.7%	0.89	0.43	0.93	0.53	0.83	not so good	0	OK	NG (1.24)	1
Fox	0.58	0.57	OK	2	20.4%	0.84	0.43	0.93	0.52	0.87	not so good	0	OK	NG (1.19)	1
Better model ?	FOX	FOX	same	Schaefer	FOX	Schaefer	same	same	Schaefer	Schaefer	same	same	same	FOX	Same

Comment & decision

(1) The large difference is that convergence (MCMC) is twice better performance for Fox.
(2) 4 diagnosis for Fox are better and 4 for Schaefer. But all are similar performances (except convergence) and the rest of 7 are same.
(3) As convergence for FOX is twice better than Schaefer, while others are similr or same for both. Thus, Fox is selected.

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

(Note) You can use this sheet to edit or the blank sheet (next sheet)	Selection of the best model run (Schaefer or Fox) by 15 diagnosis *(Use hard copy of 2 Reports for easy process & edits)*														
	Evaluation	1. Convergence (MCMC)		2. Model Fit								3. Retrospective analyses		4. Hindcast analyses	
				2.1 CPUE residuals		2.2 RMSE	2.3 Prior to Posterior Ratio		2.4 Posterior Predictive Check (PPC)			Mohan's ρ (-0.15~2.0)	Visual inspection	MASE (smaller better)	Visual inspection
	Methods	Heidelberger & Welch p test (higher better)		95% CI band	outliers	RMSE	PPMR (Prior to Posterior Median Ratio)	PPVR (Prior to Posterior Variance Ratio)	Average p values (compute yourself)	Visual inspection					
	Criteria	Geweke.p (average)	Heidel.p (average)	Red band No Randomness Green band Randomness	# of outliers	Less % better fit	Average value of 4 parameters (r, K, depletion & sigma2) (compute by yourself) (Use the 3rd sheet to compute) closer 1 is better		(Use the 3rd sheet to compute) Closer to 0.5 is better	Ball like shapes & centralized are better		# of outside range (see 5th sheet) (please count) (less # better)	Smooth & no strange trends nor patterns	< 1 better	# OBS points beyond the 95% CI band
	Output #	# 20		# 13		# 10	#1	#3	# 12			# 42	# 40	# 43	# 41
							1st	2nd	1st	2nd					
	Diagnosis #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Copy & paste from Reports	Schaefer															
	Fox															
	Better model ?															
	Comment & decision															

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

Schaefer

Copy #1 & #3 graphs from Report Ppage 8-9) & replace.
Read off probabilities & enter below (replace).
Then, Copy & Paste averages to diagnosis #6~#9 (selection form).

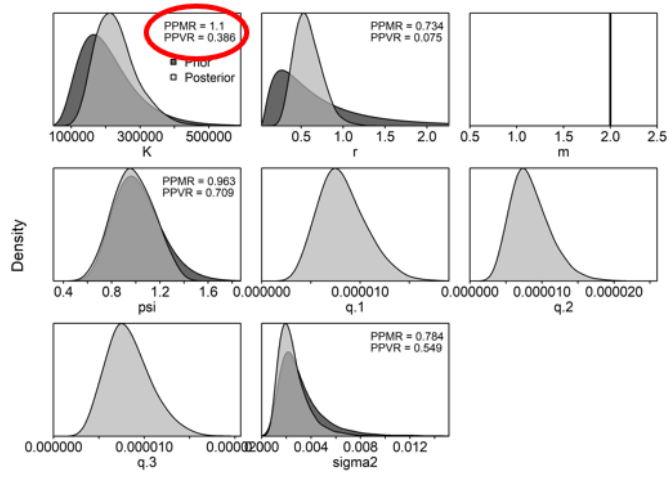
	1st step		2nd step	
	PPMR	PPVR	PPMR	PPVR
K	1.10	0.39	0.99	0.54
r	0.73	0.08	0.96	0.25
psi	0.96	0.71	0.97	0.75
sigma2	0.78	0.55	0.78	0.57
Ave	0.89	0.43	0.93	0.53

Fox

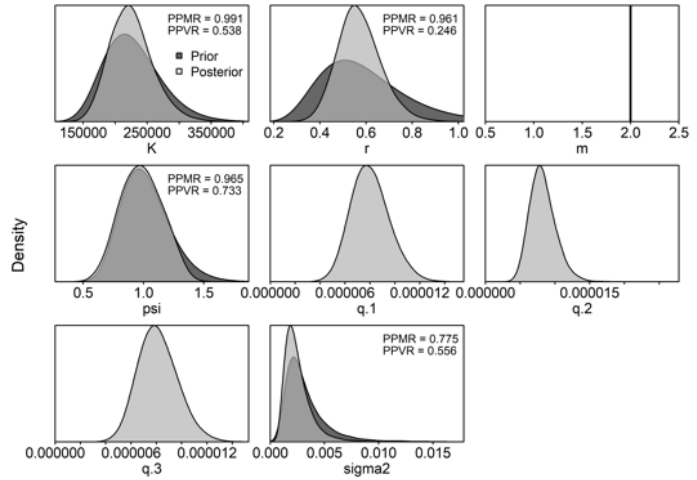
Copy #1 & #3 graphs from Report Ppage 8-9) & replace.
Read off probabilities & enter below (replace).
Then, Copy & Paste averages to diagnosis #6~#9 (selection form).

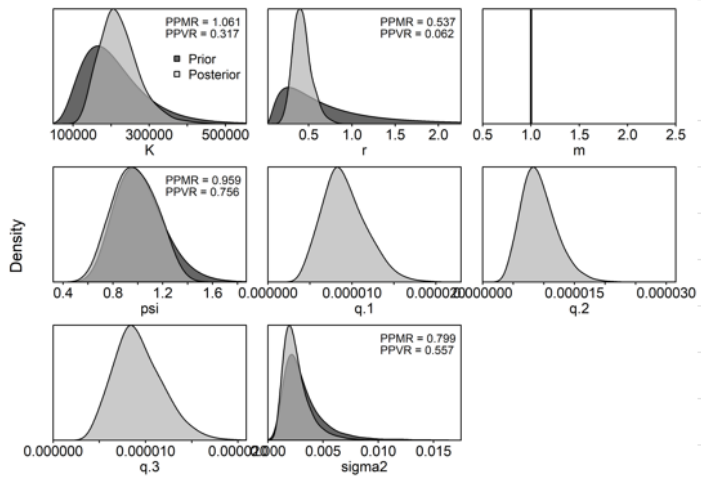
	1st step		2nd step	
	PPMR	PPVR	PPMR	PPVR
K	1.06	0.32	0.99	0.54
r	0.54	0.06	0.96	0.25
psi	0.96	0.76	0.97	0.73
sigma2	0.80	0.56	0.78	0.56
Ave	0.84	0.43	0.93	0.52

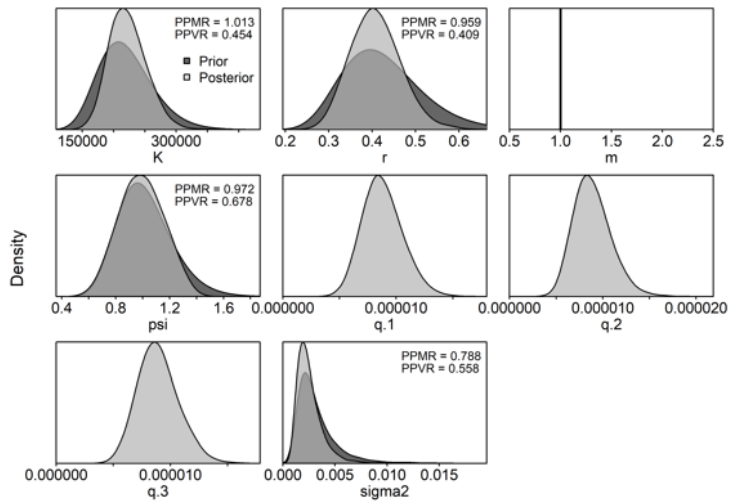
step1



step2







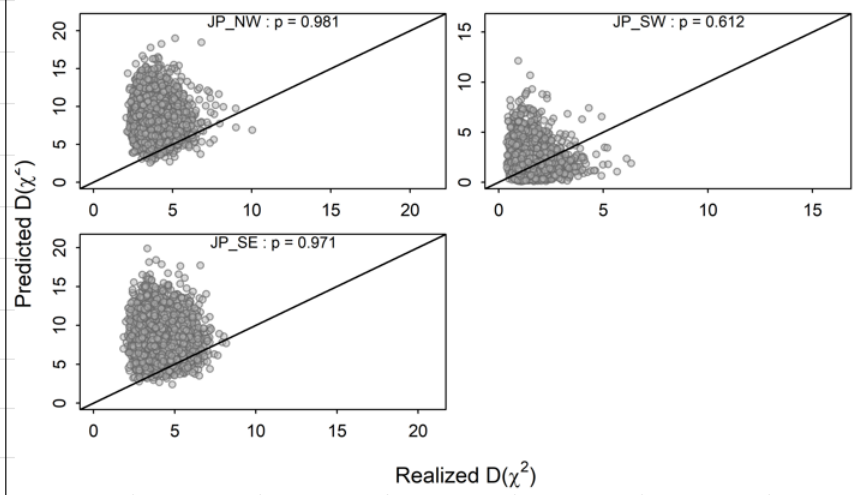
(1) Example(SWO) | (2) blank sheet | (3) diagnosis#6~9 | (4) diagnosis#10 | (5) diagnosis#12

This information is available in Report (page 10)

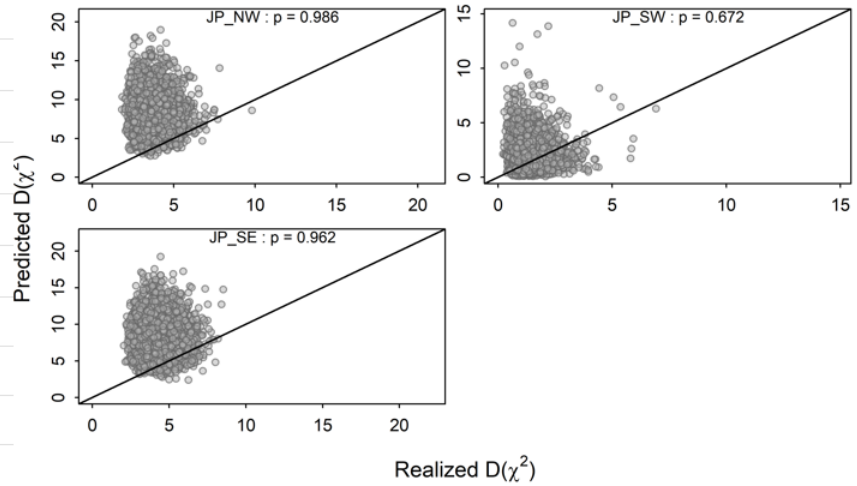
	p value (PPC)	
	Schaefer	Fox
fleet 1	0.91	0.99
fleet 2	0.61	0.67
fleet 3	0.97	0.96
fleet 4		
fleet 5		
fleet 6		
average	0.83	0.87

Replace graphs and Read off p values. Then replace (Table) and copy & paste average values to the 1st sheet.

Schaefer



Fox



(1) Example(SWO) | (2) blank sheet | (3) diagnosis#6~9 | (4) diagnosis#10 | (5) diagnosis#12

Count # of outside the allowable range (-0.15 ~0.2) (# of yellow markers).
This is for both Schaefer & Fox.

The example below is from the different run, just for demo.
The table below is available in Report Page 11)

For this case, # is 7. For our example (SWO) is 0.

	B	F	Bmsy	Fmsy	procB	MSY	Average
2021	0.16	-0.13	0.19	-0.18	0.01	0.02	0.01
2020	0.04	-0.04	0.04	-0.09	0.01	0.04	0.00
2019	0.08	-0.07	0.08	-0.12	0.01	0.04	0.00
2018	-0.26	0.35	-0.25	0.33	-0.01	-0.02	0.02
2017	-0.32	0.50	-0.30	0.55	-0.01	-0.08	0.06
Average	-0.06	0.12	-0.05	0.10	0.00	0.00	0.02

(1) Example(SWO) | (2) blank sheet | (3) diagnosis#6~9 | (4) diagnosis#10 | (5) diagnosis#12

Appendix A Development history & Application underpinning this software

Development History

April, 2023 Start development

October, 2024 1st version released

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_1 (Schaefer)

Contents

Output

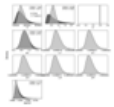
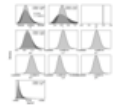
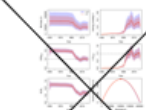
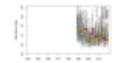
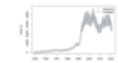
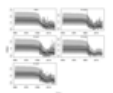
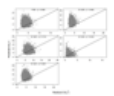
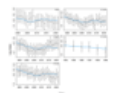
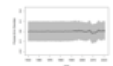
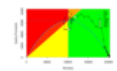
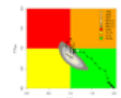
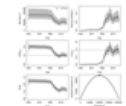
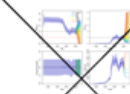
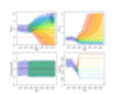
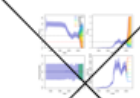
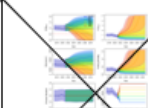
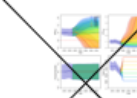
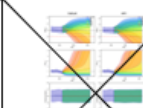
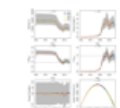
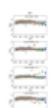
Quick evaluation (diagnosis)

1. Convergence
   Heidelberger and Welch Statistical test (MCMC)
2. Model fit
   - 2.1 CPUE Residuals (Randomness & outliers)
   - 2.2 RMSE (Root Mean Square Error)
   - 2.3 Prior to Posterior Median/Variance Ratio
   - 2.4 Posterior Predictive Check (PPC)
3. Retrospective analyses (model mis-specification)
4. Hindcast analyses (prediction power)
5. Estimated parameter values (optional)
6. Visual inspection (optional)
7. Next step (Selection of Schaefer or Fox)

Note
(updated information)
SWO_1S should be used instead of SWO_1
(updated notation)
to distinguish between
S (Schaefer) vs. F (Fox)

Note: There may be blank pages due to missing output (figures and/or tables) caused by formatting problems. In such a case, please copy and paste from the original output list folder (one before the report folder). If there are no outputs in that output folder, please leave it empty as no results were obtained.

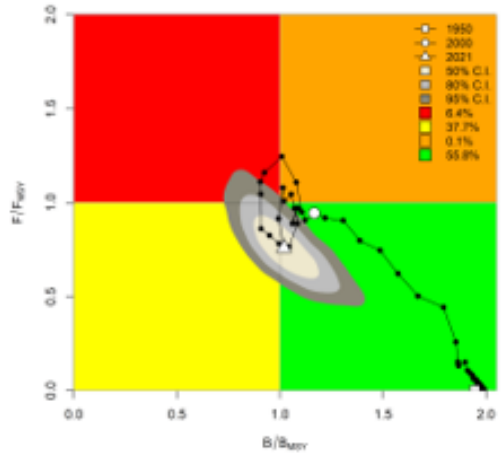
Output (43 files) *(24 files are used in this Report, while not for 19 files with X)*

(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							

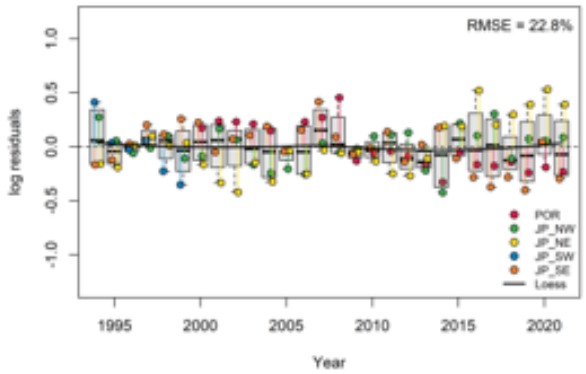
(Note) Blanks means implausible results or not available.

Quick evaluation (diagnosis)

(#18) Kobe plot



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



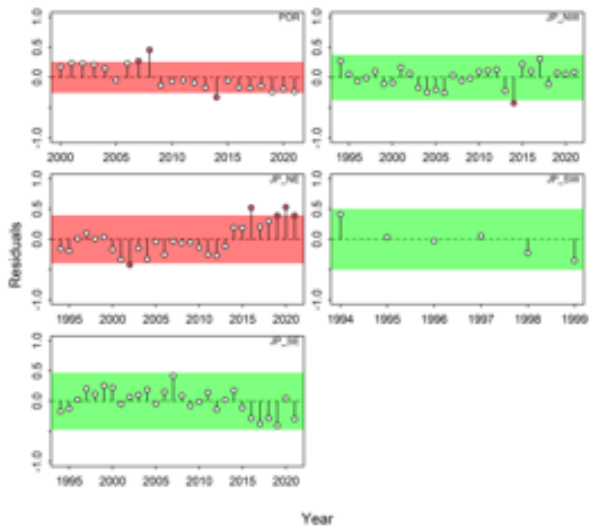
(#20) Conversion (MCMC) (> 0.05)
(higher better)

	Geweke.p	Heidel.p
Average	0.80	0.42

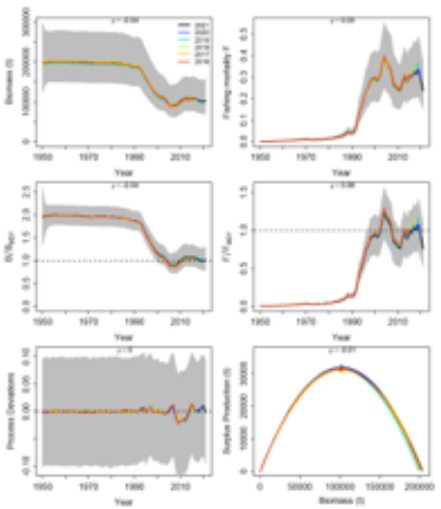
(#43) MASE
(Predictive skill)
(< 1)
(smaller better)

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

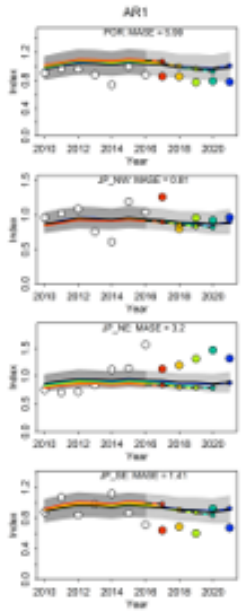
(#13) CPUE fitness (2)
Red band (no randomness) & Red points (outliers)



(#40) Retrospective analyses
(trends should be close together & similar)



(#41)
Hindcast
(predictive
skill)
Observed
values < 95%
CI



1. Convergences

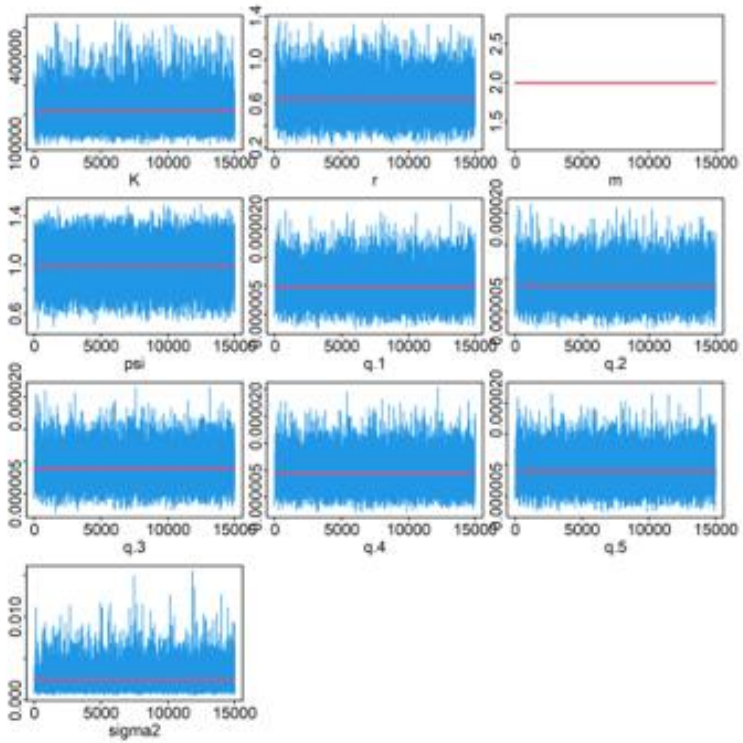
1.1 Heidelberger and Welch Statistical test (#20)

(#20) Heidelberger and Welch Statistical test on Convergence

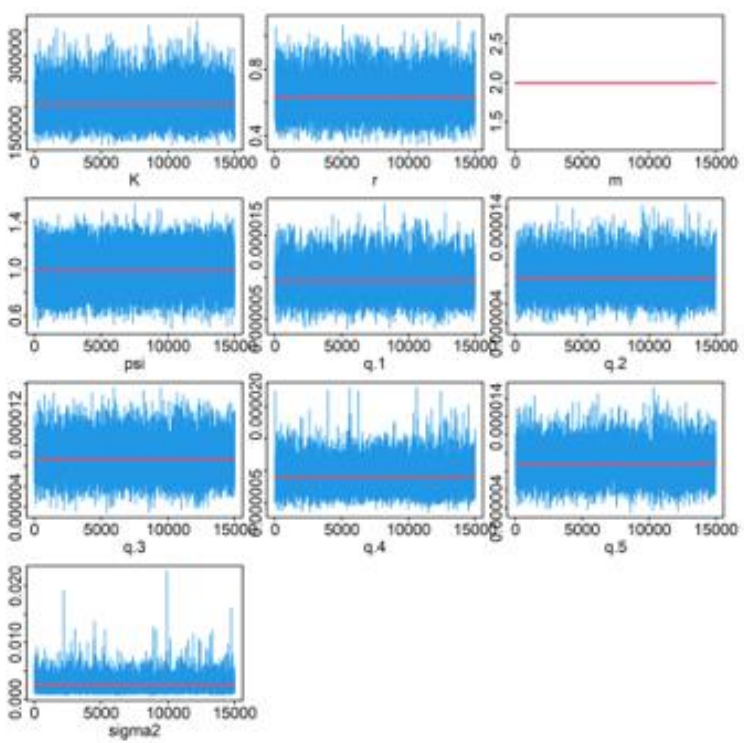
	Geweke.p	Heidel.p
K	0.80	0.57
r	0.96	0.67
q.1	0.63	0.63
q.2	0.86	0.49
q.3	0.84	0.40
q.4	0.84	0.09
q.5	0.85	0.62
psi	0.55	0.20
sigma2	0.92	0.12
Average	0.80	0.42

Ho: Pr (MCMC is converged)

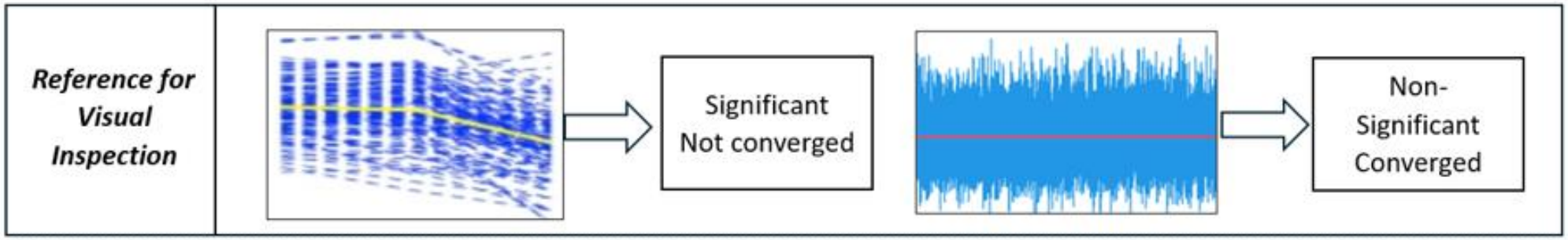
Pr < 0.05(5%) ➔ not converged and Higher Pr. ➔ better convergence (MCMC)



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



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

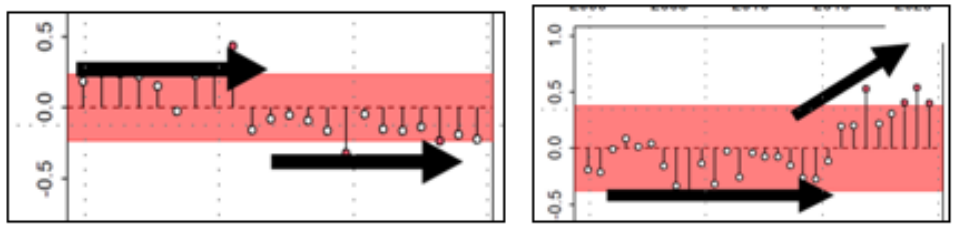


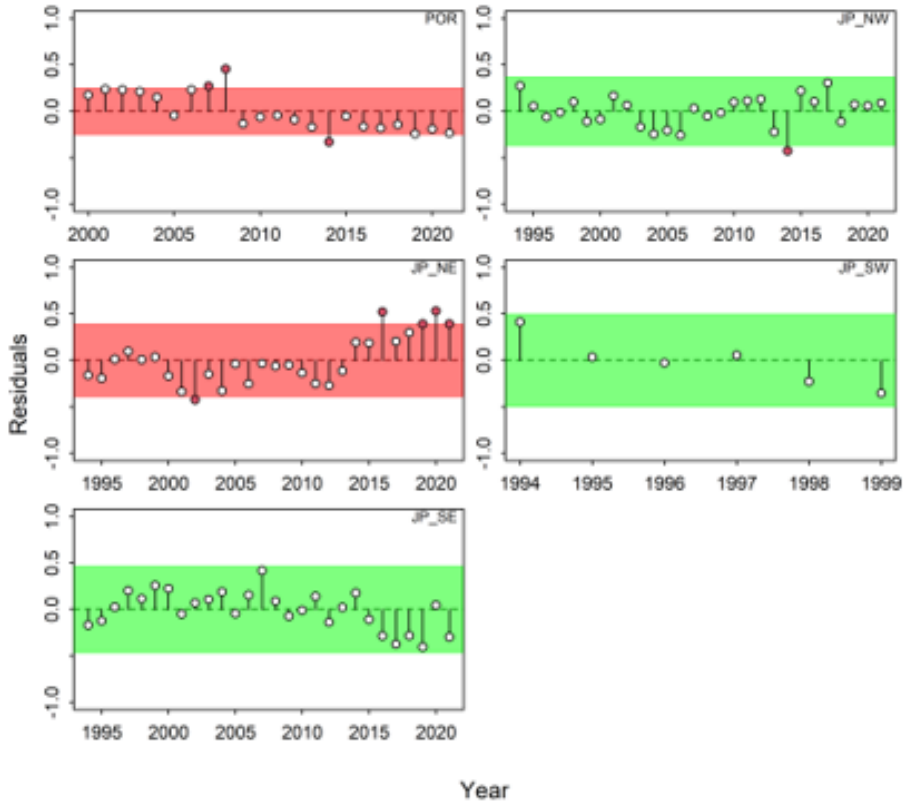
2. Model fit

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)

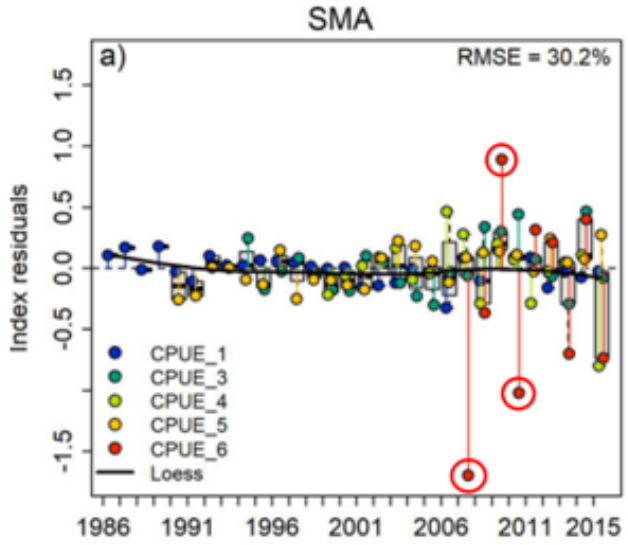


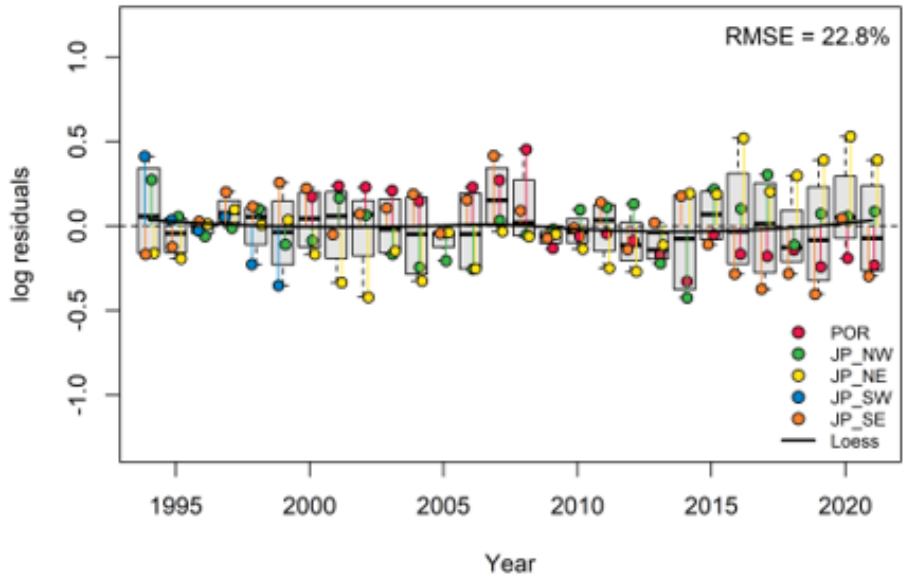


(#13) Randomness (Autocorrelation) test and outliers

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.



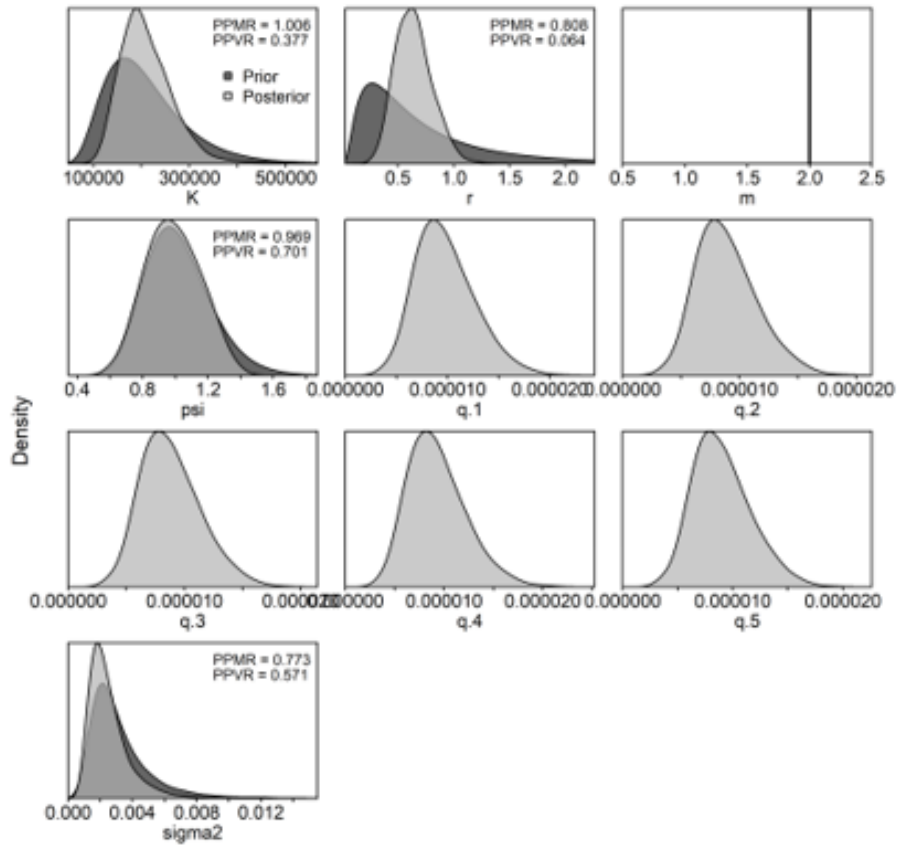


(#10) RMSE, quantiles & loess by fleet.

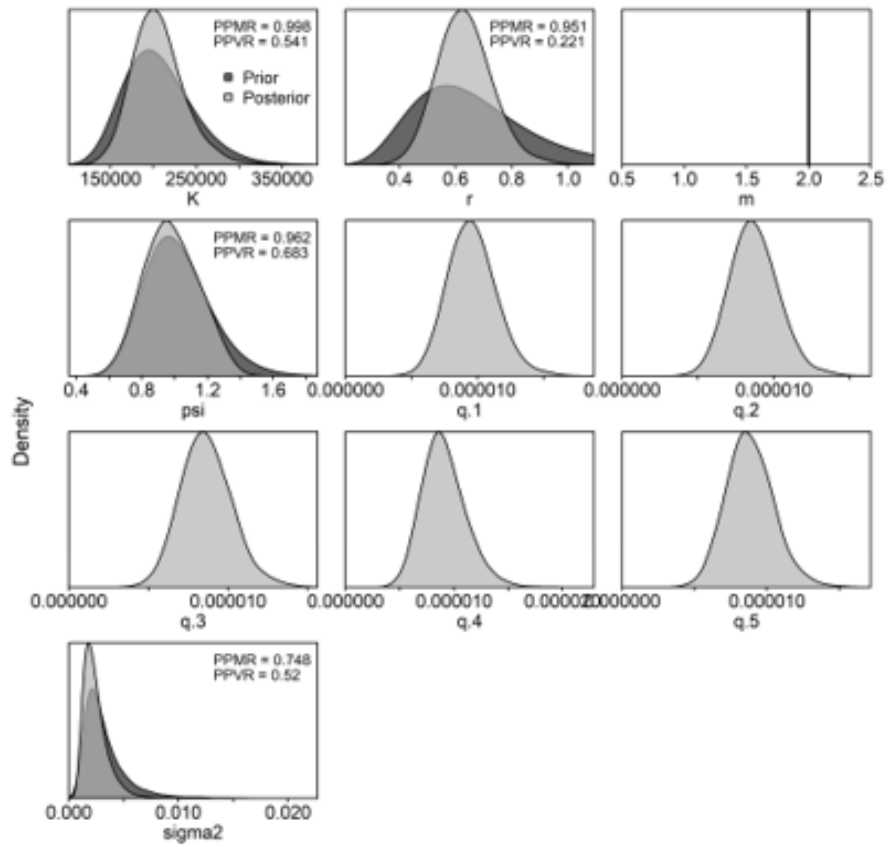
2.3 Prior to Posterior Median/Variance Ratio (PPMR & PPVR)

(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	

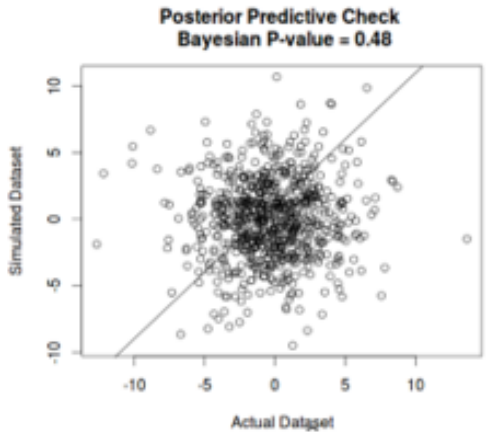
Criteria for fitness
If PPMR and PPVR is closer to 1, it means better fitness for point estimate and variance respectively.

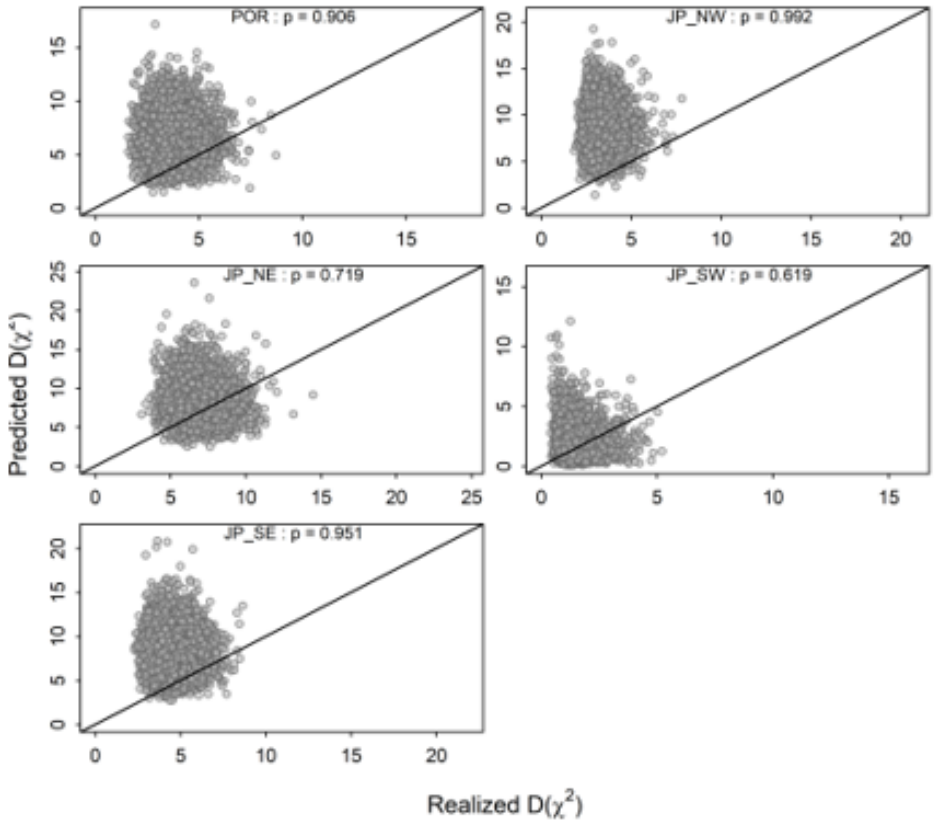
Users need to compute average of 4 parameters (K, r, depletion & sigma2) for PPMR & PPVR respectively. These values will be used to evaluate the best model (Schaefer or Fox).
(see the selection form, the 3rd menu)

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).

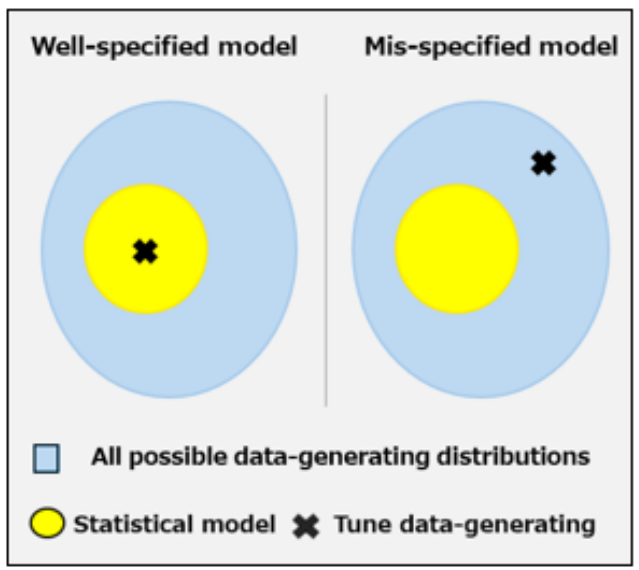
3. Retrospective analyses (#42)

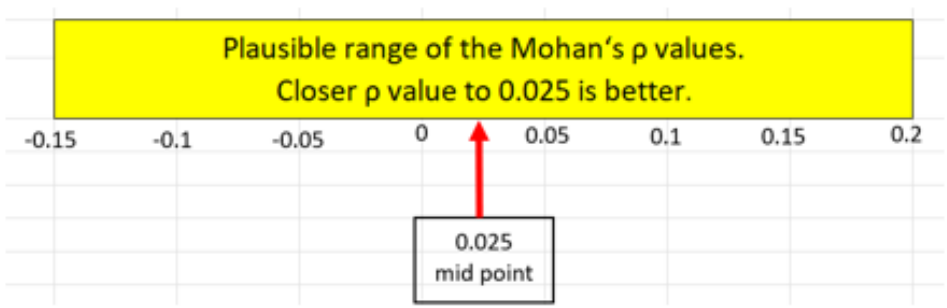
(#42) Retrospective analyses to inspect <u>model mis-specification</u> using Mohan ρ values & graphs

	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

Schematic diagram showing well & miss specified model

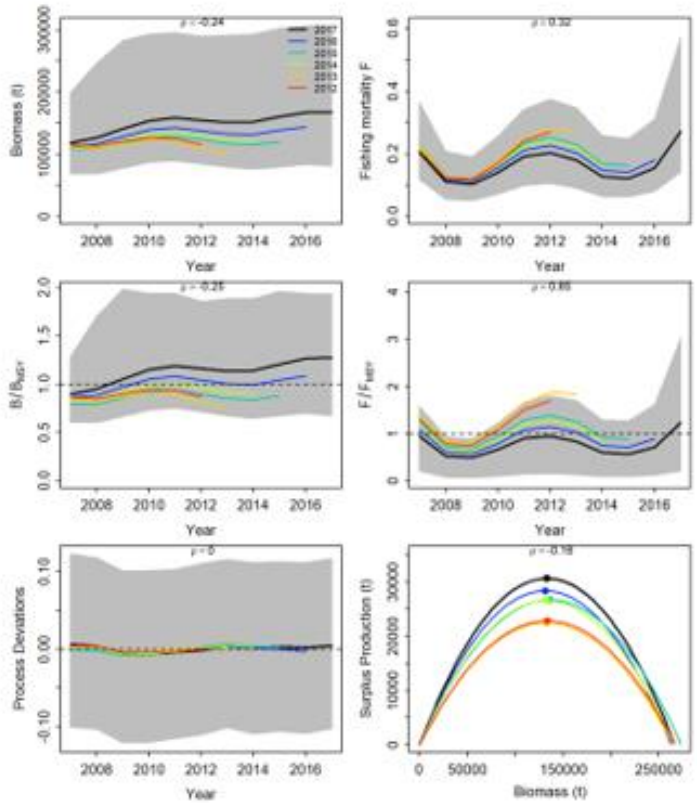


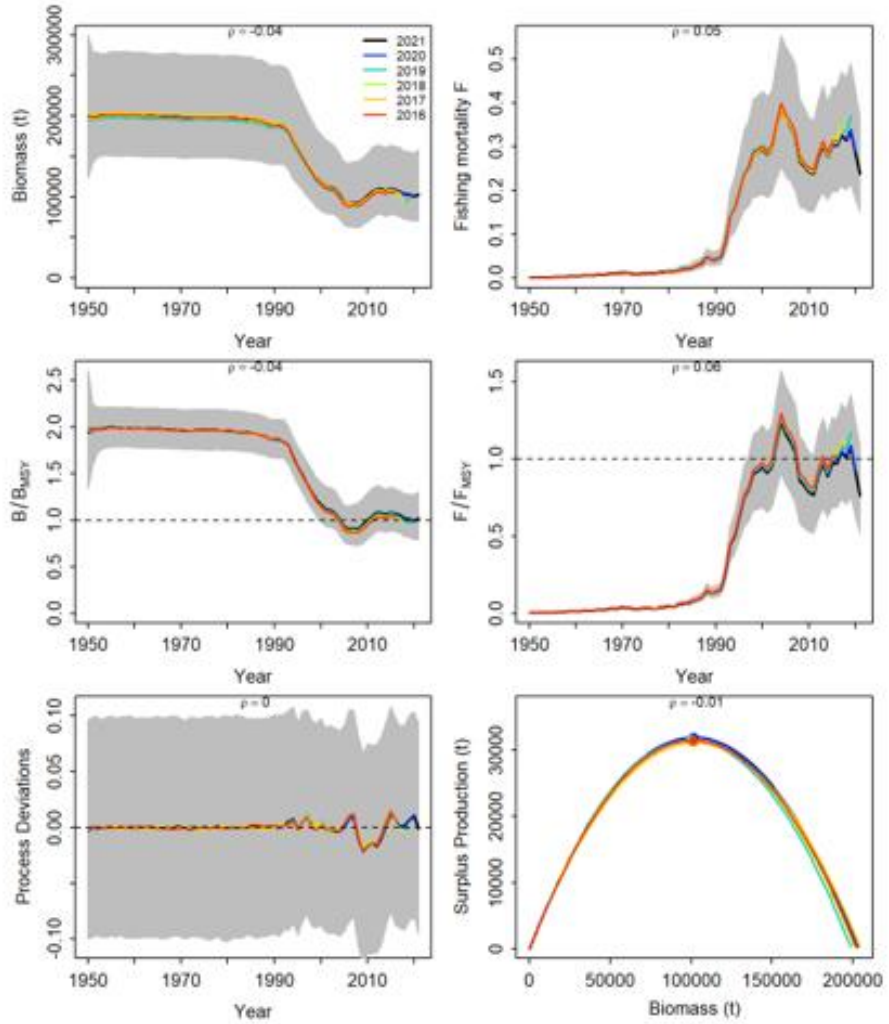


(#40) Plots of retrospective analyses

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

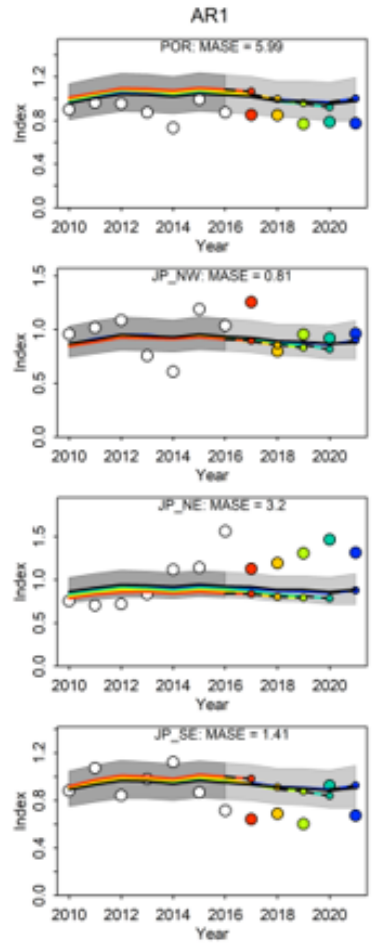
If MASE (Mean Absolute Scaled Error) < 1 ➔ better prediction ability

Yellow and green (average) marker MASE ≥ 1 ➔ 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.



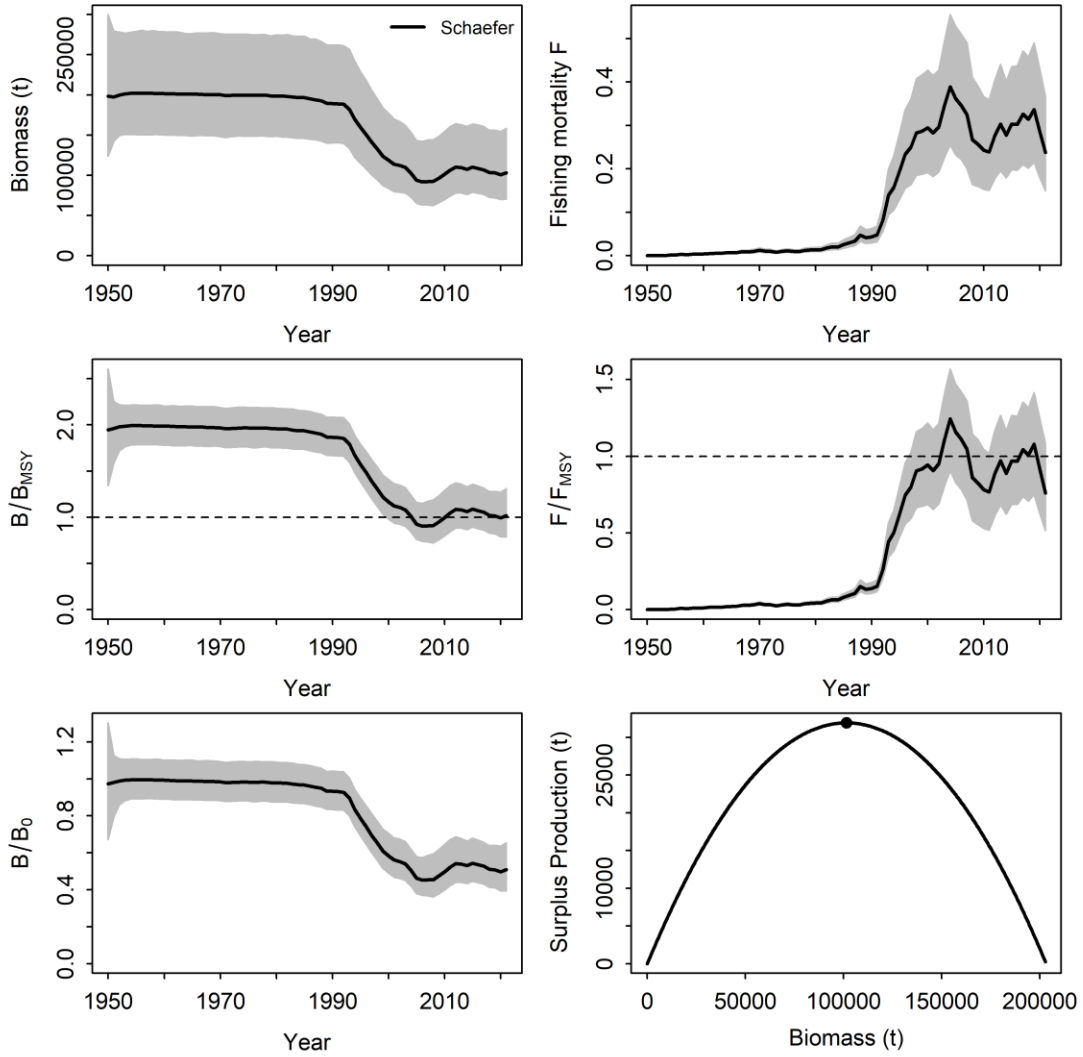
5. Estimated parameter values

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, CPUE may need to revise (see Section 2). 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.

	Mean	Lower (95%)	Upper (95%)
K	203,291	153,872	275,328
r	0.63	0.46	0.84
B0/K	0.97	0.68	1.30
sigma.proc	0.05	0.03	0.07
m	2	2	2
Fmsy	0.31	0.23	0.42
TBmsy	101,645	76,936	137,664
MSY	31,761	29,018	35,629
bmsyk	0.50	0.50	0.50
TB(1950)/ K	0.97	0.67	1.30
TB(2021)/ K	0.51	0.39	0.66
TB/TBmsy	1.02	0.79	1.31
F/Fmsy	0.76	0.51	1.08

(#21) Estimated parameter values

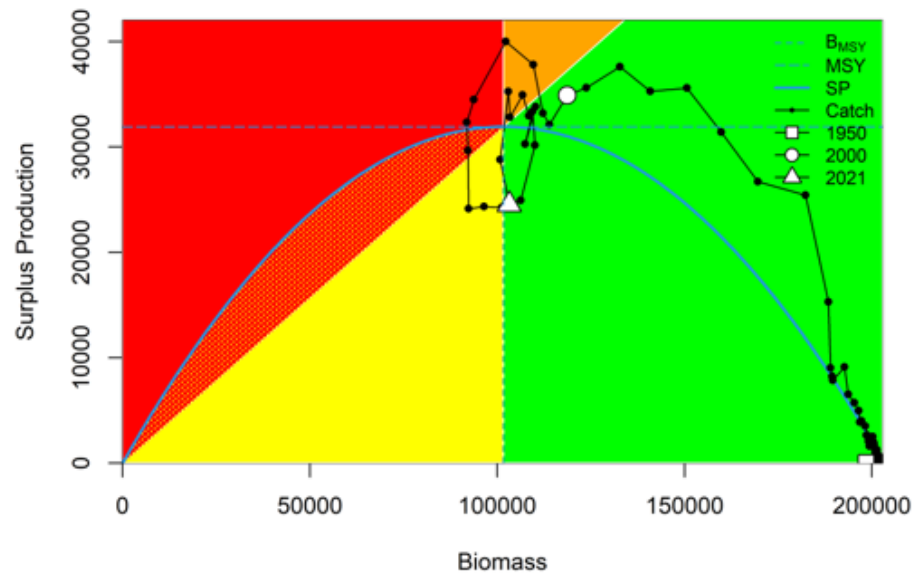


(#19) Trajectories of 6 key parameters with 95% CI.

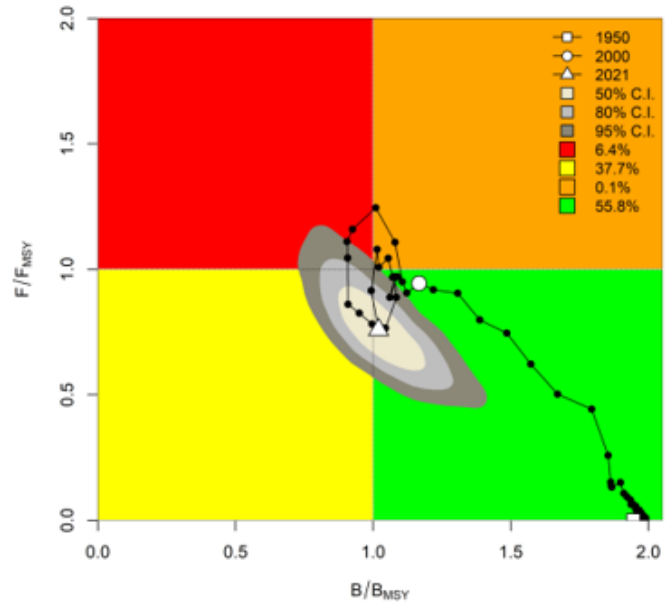
(Note) Red broken lines indicate those for B/Bmsy=0.5.

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.



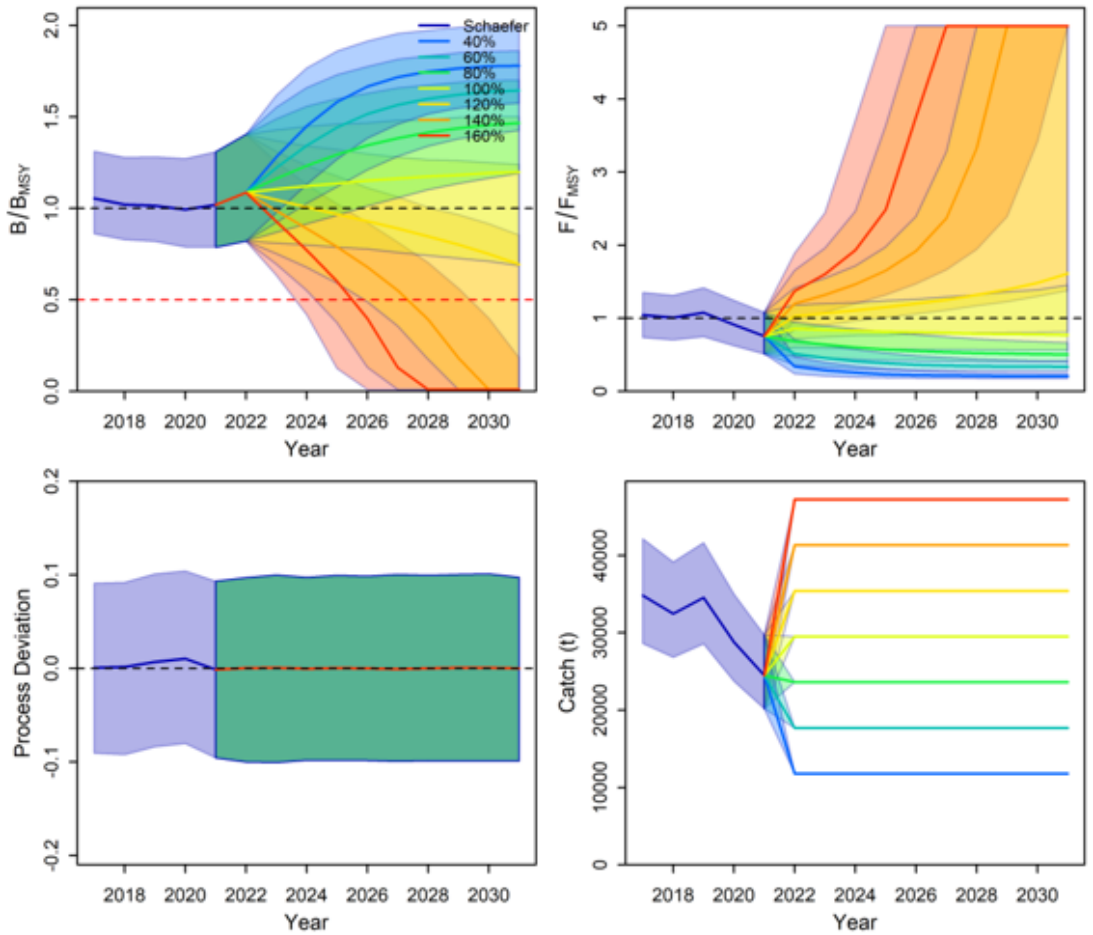
(#17) Surplus Production (SP) Phase plot



(#18) Kobe plot

(#31) 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).



(#31) 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.