STOCK ASSESSMENT FOR ALL
MENU-DRIVEN SOFTWARE DEVELOPMENT TEAM

Menu-driven software series (No. 3)

JABBA_MANAGER (VER2.0.0) Manual

(August, 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 2.0.0. 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

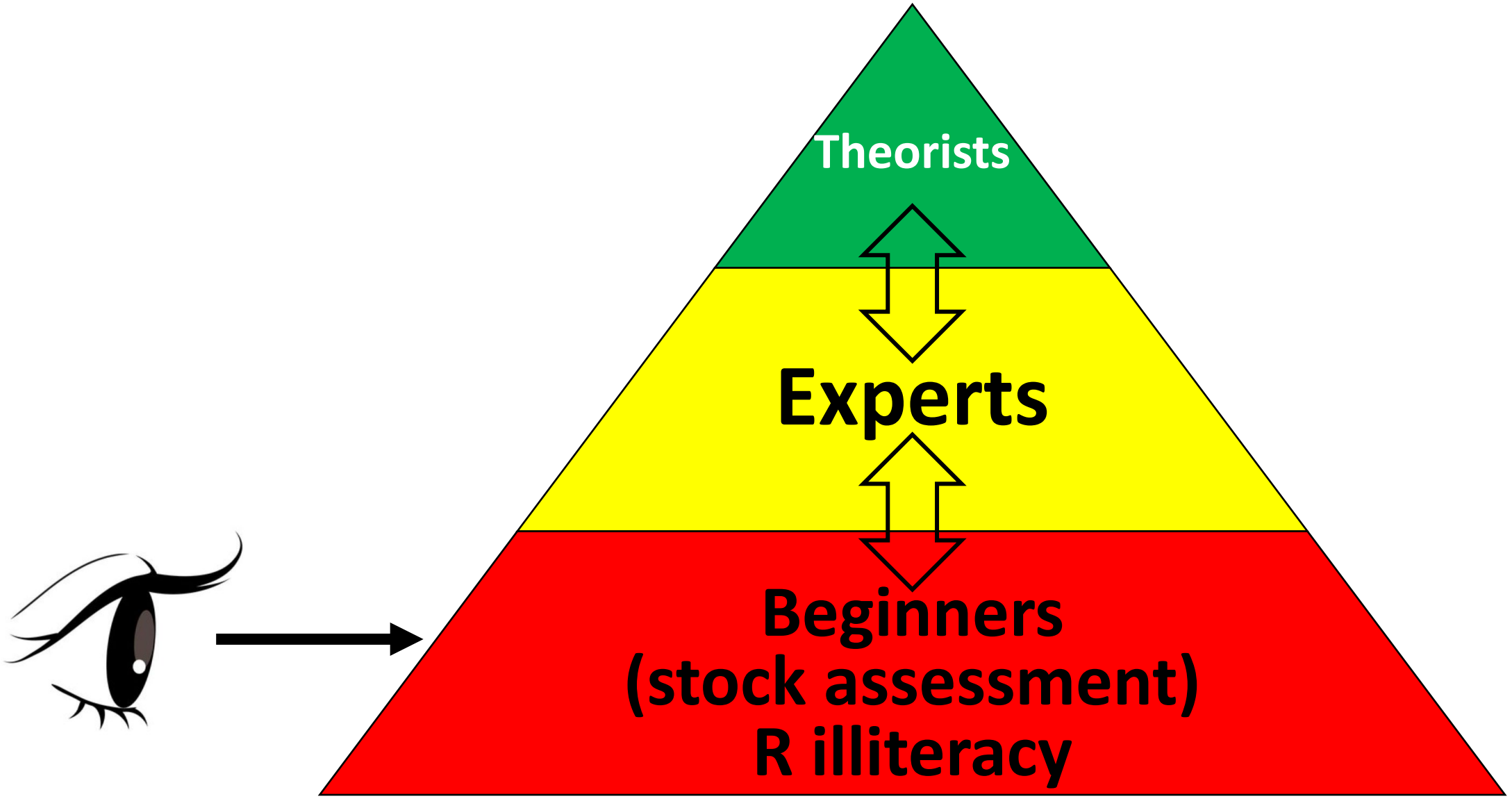
UPDATING

To be ready in September, 2025

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.

- Therefore, this manual uses with less mathematical, statistical formulae & notations and no R commands except a few commands in the installation.


Theorists
Experts
Beginners
(stock assessment)
R illiteracy

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

Three types of stock assessment models

TYPE	Data type	Information (data)	Data poor or rich	Data period	Reference Point (RP) (MSY, Fmsy, TBmsy, target & limit RP)	Models & Application (examples)	Implementation (Excel, R, software) (Examples)
TYPE 1	Qualitative	✓ Parameters				● ERA (Ecosystem Risk Assessment) ● PSA (Productivity Susceptibility Analysis)	✓ R ✓ SRAplus
TYPE 2	Quantitative	✓ Real data ✓ Parameter valuses ✓ Priors (Bayesian approach)	Data Poor (length)	Short (< a few years)	Temporal & relative (snap shot SA)	● Length based models (ELEFAN, FiSAT, Y/R, S/R, LBSPR, Thompson & Bell)	✓ Excel ✓ R ✓ Software (FAO & others)
			Data Poor (cach)	Long (> @10 years)	Avilable but relative (less relaible and robust)	● 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 (more reliable, robust, and objective)	● Surplus Production models (SPM) (ASPIC, SPiCT & JABBA) ● Age/size structured model (VPA, ASPM, SCAA, SCAS) ● Integrated models (SS, CASAL)	✓ Own codes ✓ R ✓ [MENU]

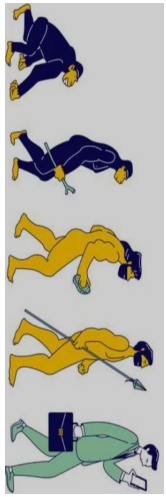
Nishida (2025)

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 SPMs (Surplus Production Models)

Evolution	Type	Author	Features				Note
			Non-equilibrium condition	Bayesian approach	Error type		
					Observation error (CPUE)	Process error (Model)	
	Original SPM	Shaeffer(1954), Pella & Tomlinson (1969) and Fox (1970)			■		Original SPM
	ASPIC (ver2~5)	Prager (2004~2013)	■		■		Non equilibrium SPM
	ASPIC (ver7)	Prager (2014~)	■	■	■		
	SPiCT (Stochastic surplus production model in continuous time)	Pedersen & Berg (2017)	■	■	■	■	Bayesian space state SPM
	JABBA (Just Another Bayesian Biomass Assessment)	Winker *et al* (2018)	■	■	■	■	
	JABBA -Select	Winker *et al* (2020)	■	■	■	■	

(Note) Representative SPMs are listed, while there are 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.

Specifications and data in three key Bayesian space state SPMs

Type	Author	Bayesian Space State SPM									Note
		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			
SPiCT (Stochastic surplus production model in continuous time)	Pedersen & Berg (2017)									Quarterly or finer-scale catch & CPUE	Fine scale (best)
JABBA (Just Another Bayesian Biomass Assessment)	Winker *et al* (2018)									Annual catch & CPUE	Coarse scale (standard)
JABBA -Select	Winker *et al* (2020)									Annual catch, CPUE & length-composition	Advanced JABBA (suitable for moderate data)

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.

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 vs. JABBA
(Color Legend) Green: GOOD Orange: NG

	ASPIC	JABBA	
Estimation method	Root Mean Square Error	Bayesian approach (MCMC)	Bayesian space state SPM (better approach)
Local minimum (biased results)	YES	NO (Convergence test)	
Observation error	YES	YES	
Process error	NO	YES	

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

3 features

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

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

(2) Base case and sensitivity

Both can be implemented.

(3) Scenario approach (grid search)

To search the best depletion rate producing the most optimum results.

(see the text for details)

JABBA: Features in details

Graphics

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

Diagnostics

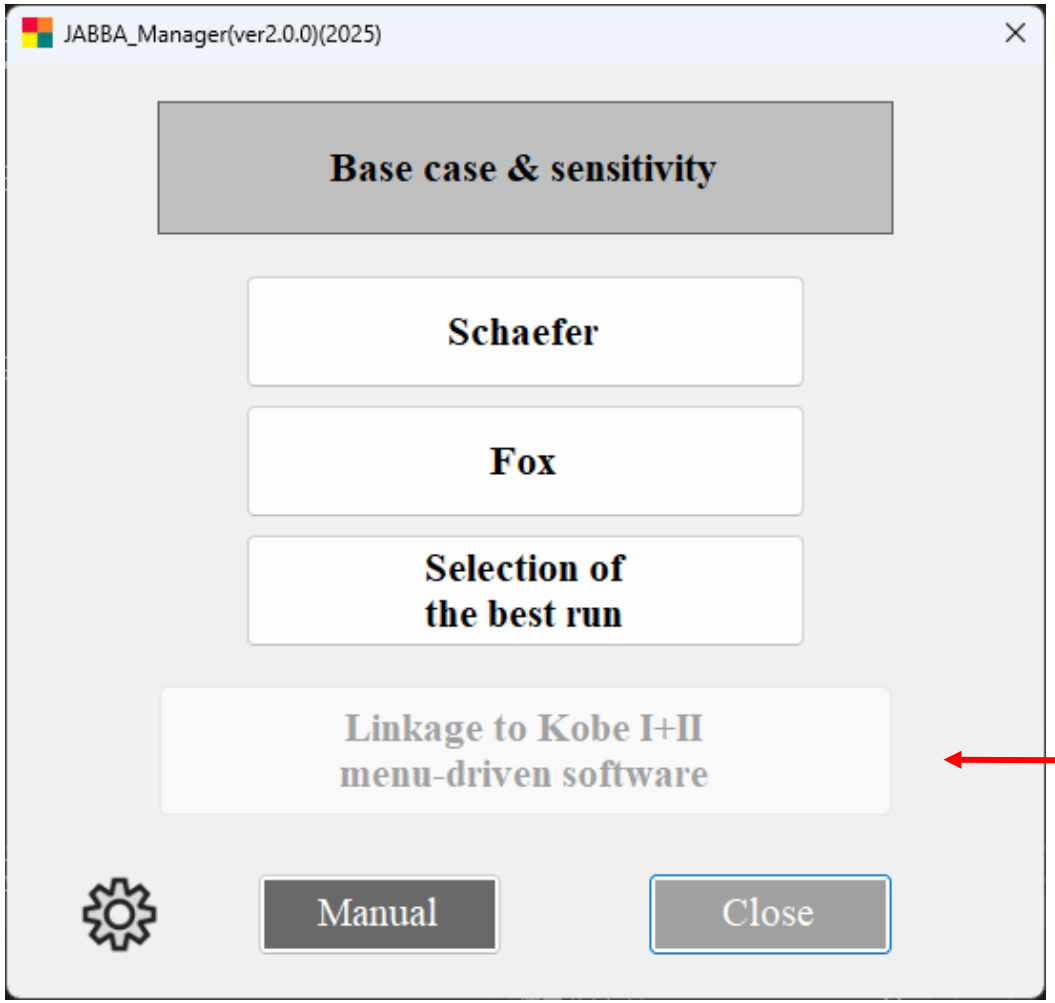
- Residual & MCMC diagnostics
- Model diagnostic tools

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



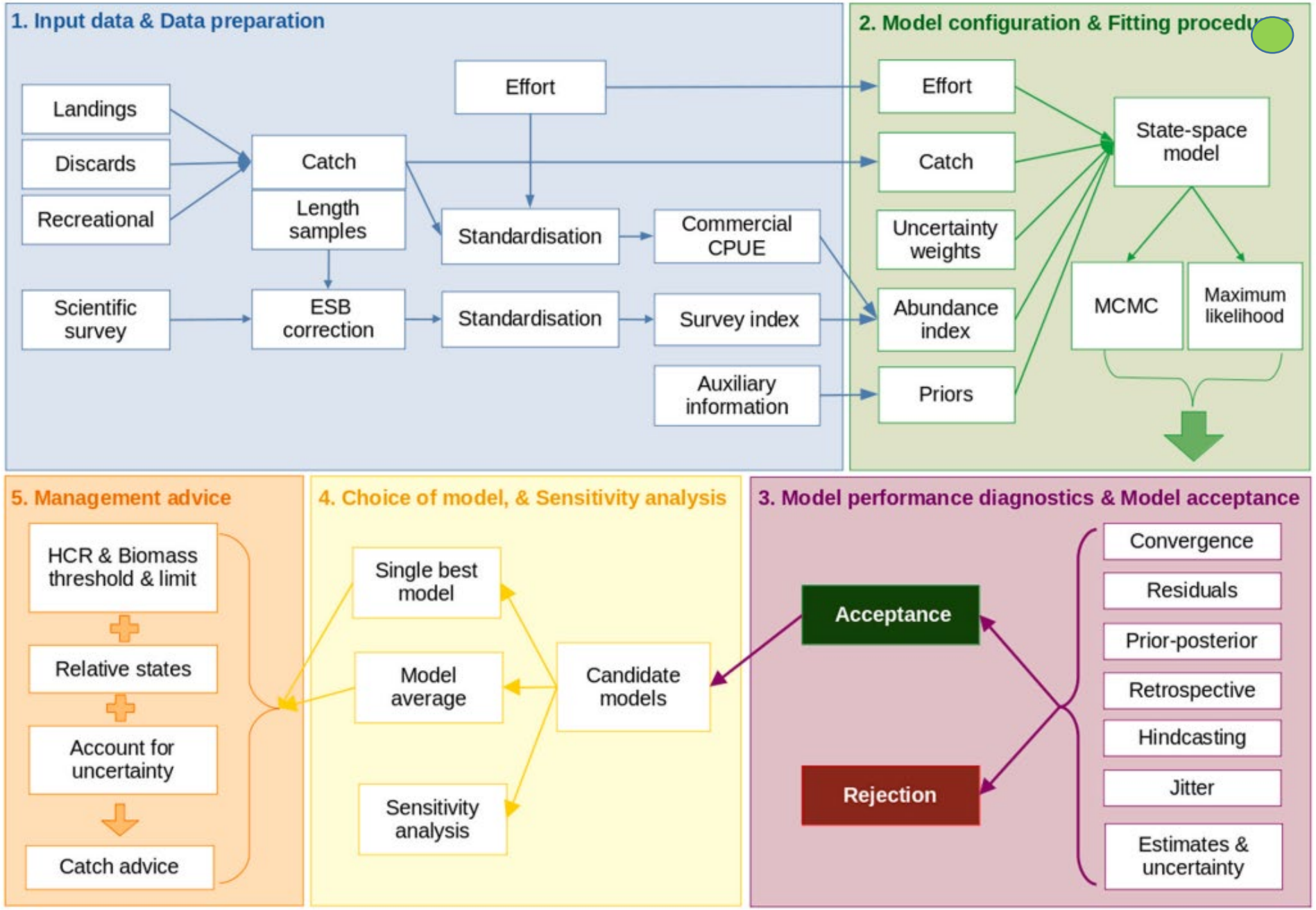
To be completed by 2026.

1. Introduction
1.2 JABBA application to the menu driven software

Implementing JABBA_Manager menu driven software

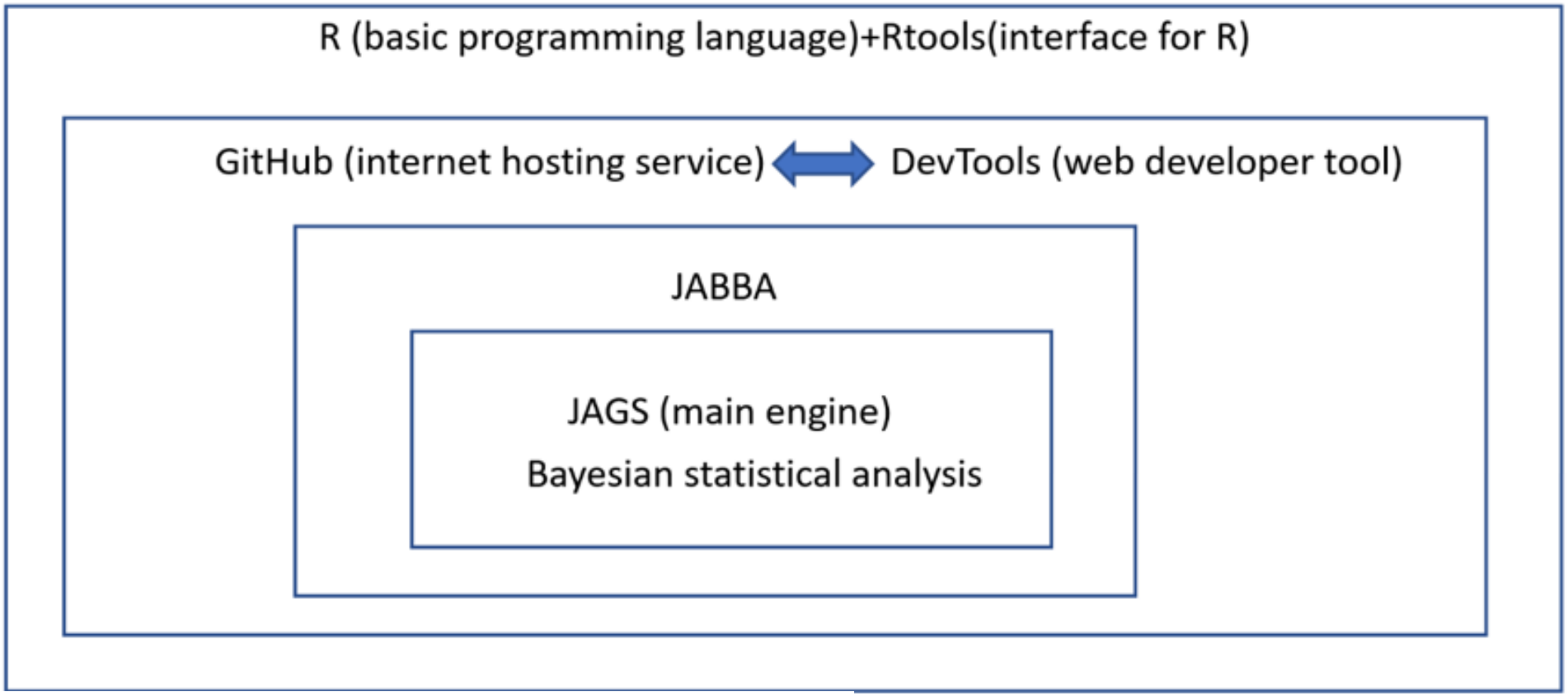
We follow suggestions made by "**Good practices for surplus production models**"

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

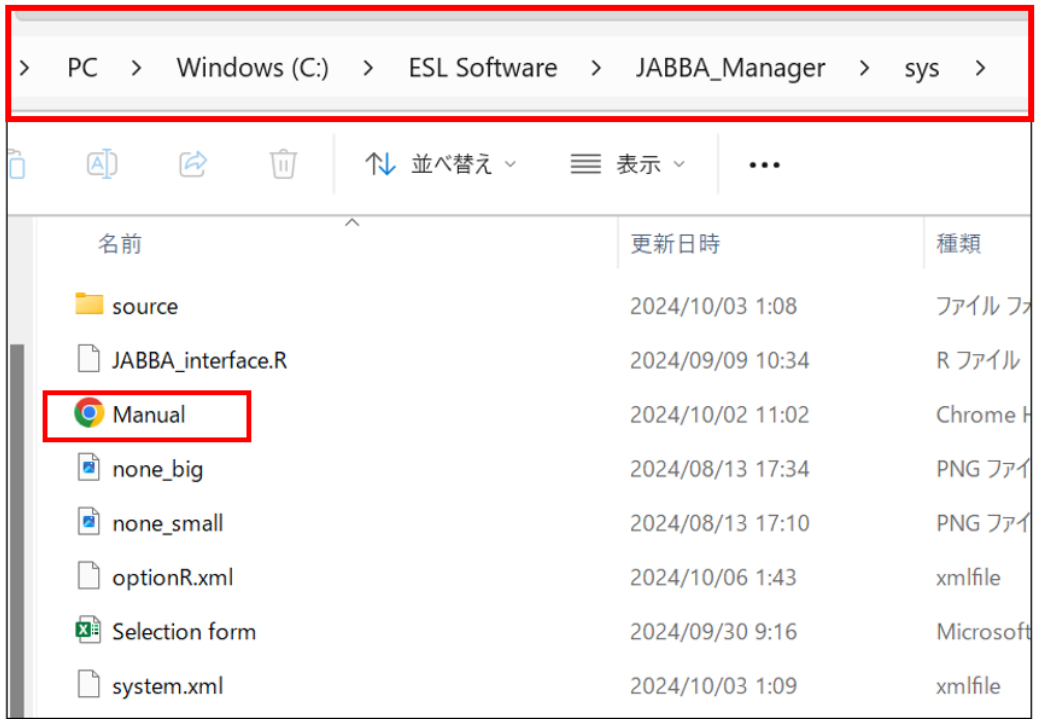
2. Preparations
2.1 Requirements for PC & Remarks

(1) Requirements for PC

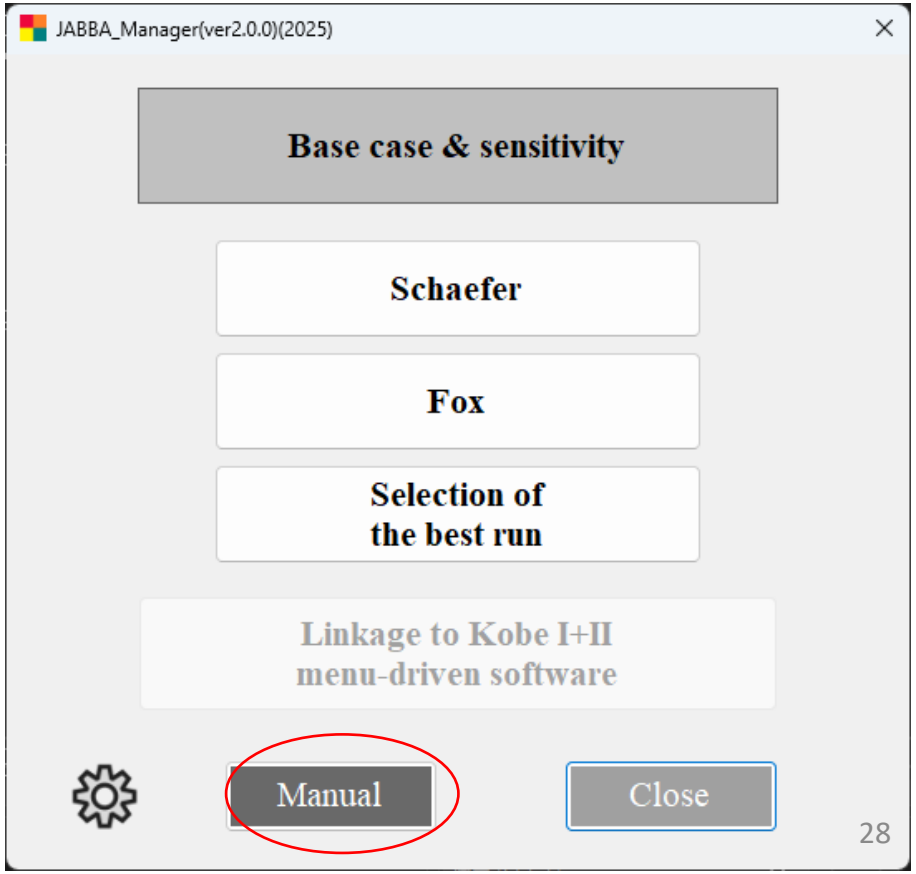
- Screen resolution: 800x700 pixels or higher.
- If the menu & sub-menus do not fit within the screen, set the display setting in Windows to 100%.
- Operation System: MS window 10 or 11 (OS should be updated).
- **NOT applicable for MAC (apple) PC.**
- 64bit PC.
- RAM: minimum 2GB.
- Basic software (Word,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

(2) 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

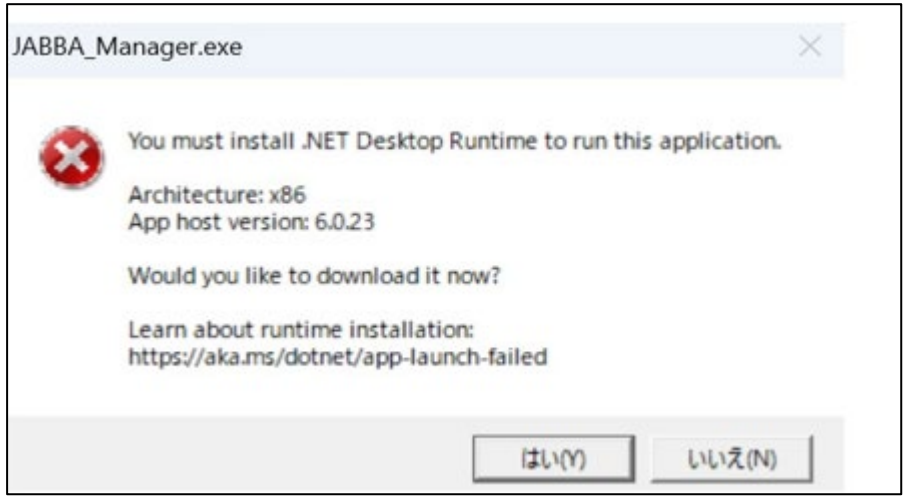
2.2 Installation

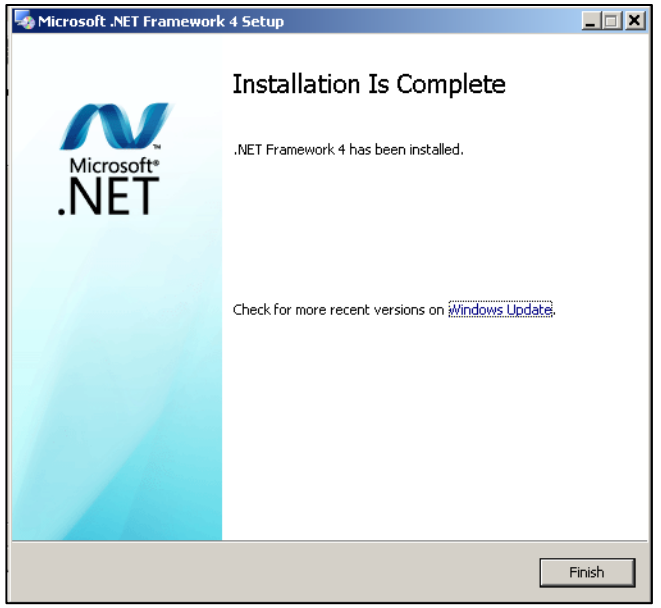
2.2.1 Internet environment

- 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).





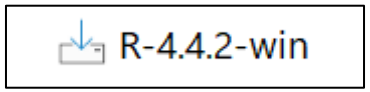
2. Preparation
2.2 Installation
2.2.3 R

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.

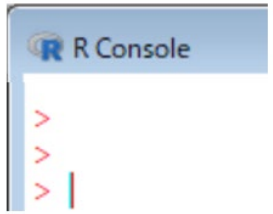
What is JAGS?
(Just Another Gibbs Sampler)

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.

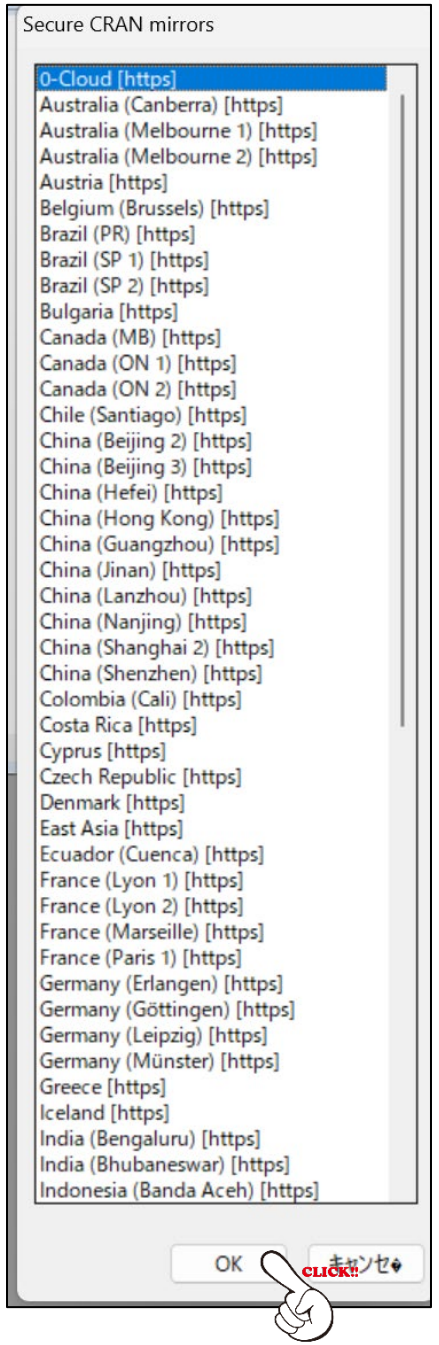


- Then copy & paste (below) and enter (execute)

  install.packages("devtools")

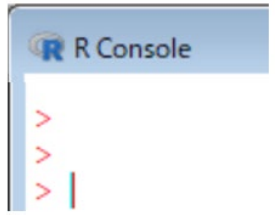
- Select “Yes” 2 times from choices (Yes/No/…)
- Enter then users will see the window (right)
- Then Click OK to finish.

(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.
- Open R console

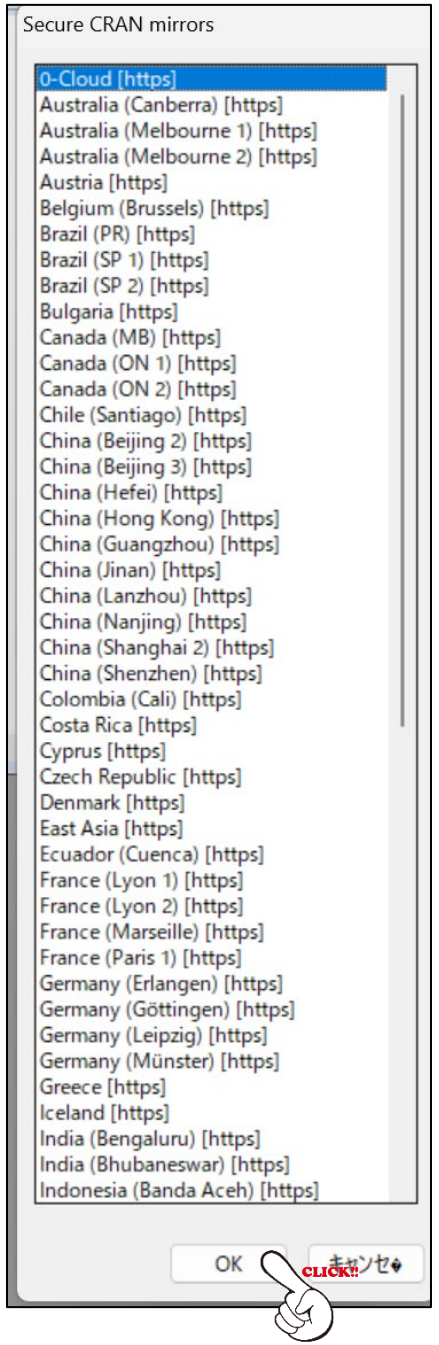


- then copy & paste (below) and enter (execute)

```
install.packages("reshape2")
```

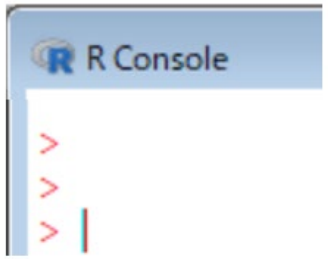
- Then users will see the window (right)
- Then Click OK to finish.

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
2.2.6 devtools:: install_github("jabbamodel/JABBA")

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



- then copy & paste (below) and enter (execute)

  devtools:: install_github("jabbamodel/JABBA")

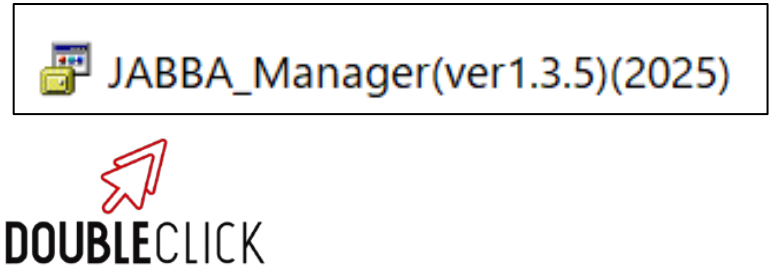
- Then Click OK to finish

2. Preparation
2.2 Installation
2.2.7 JABBA_Manager

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

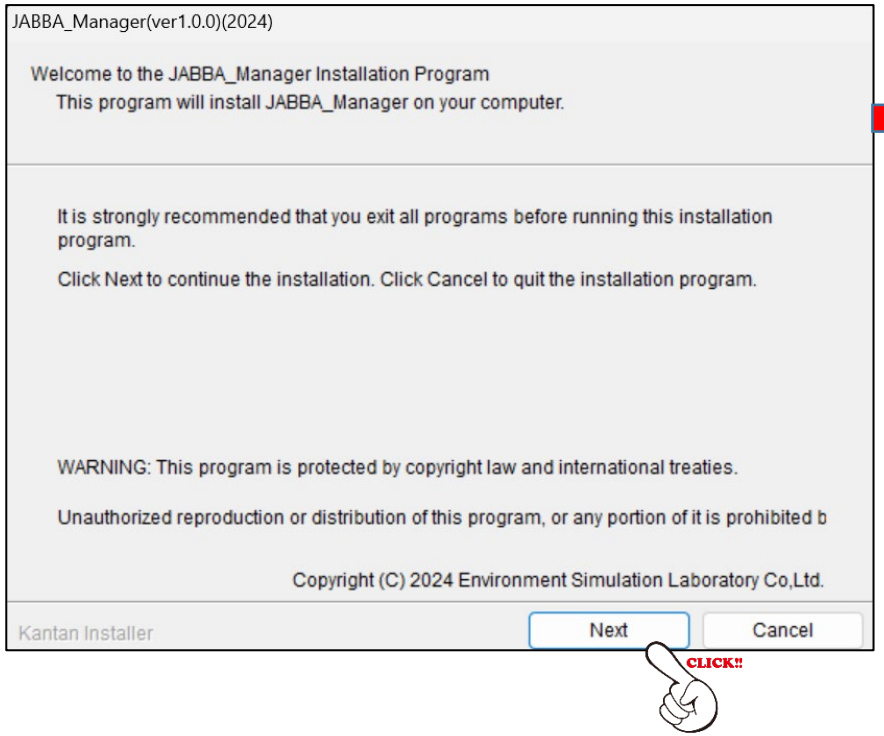
Double click the zipped installer

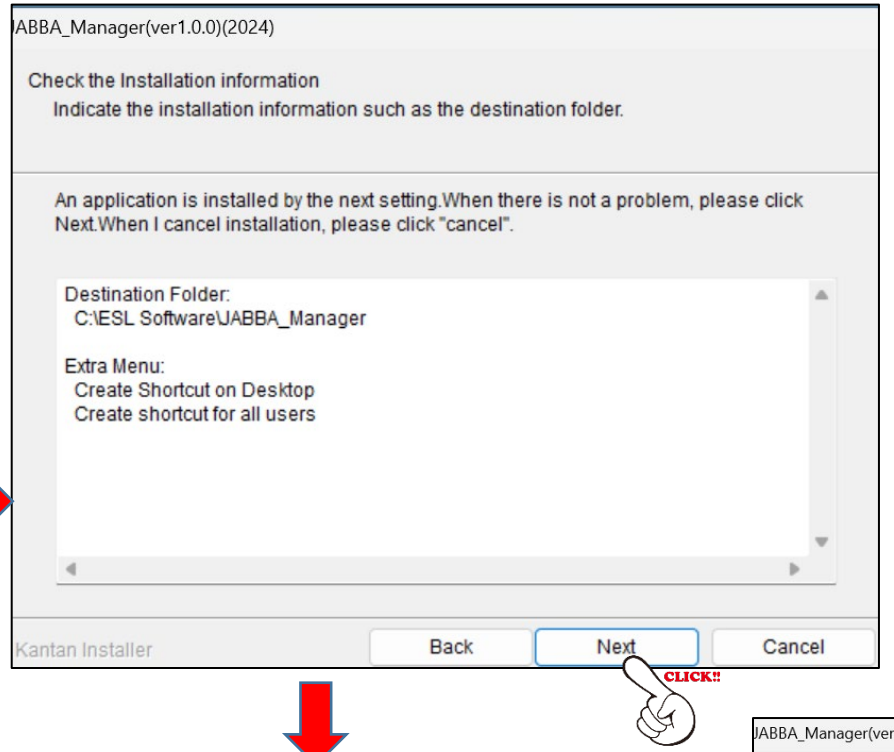
Installer (download folder)

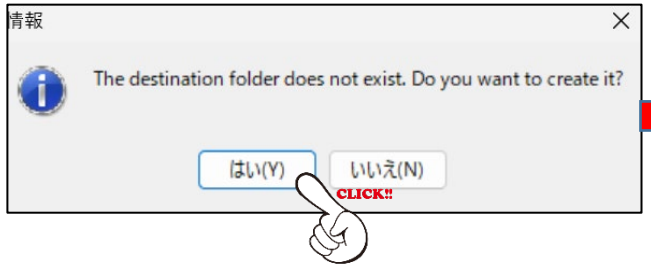


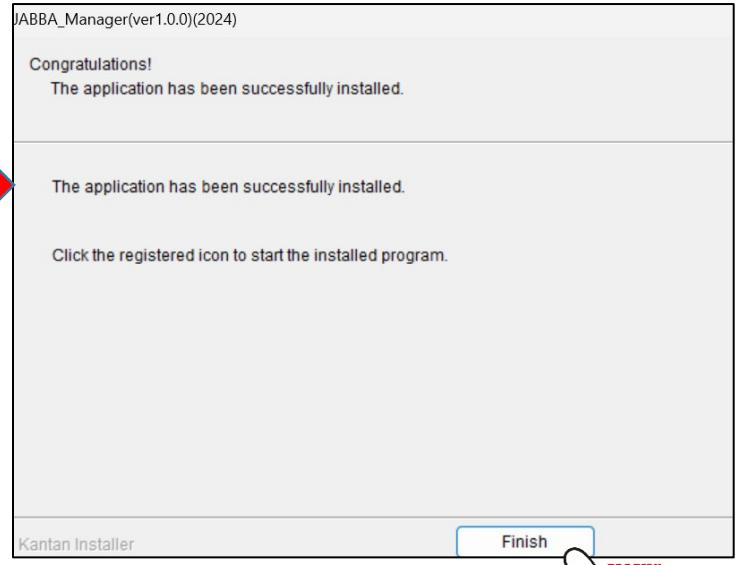
Installer (desktop)

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).

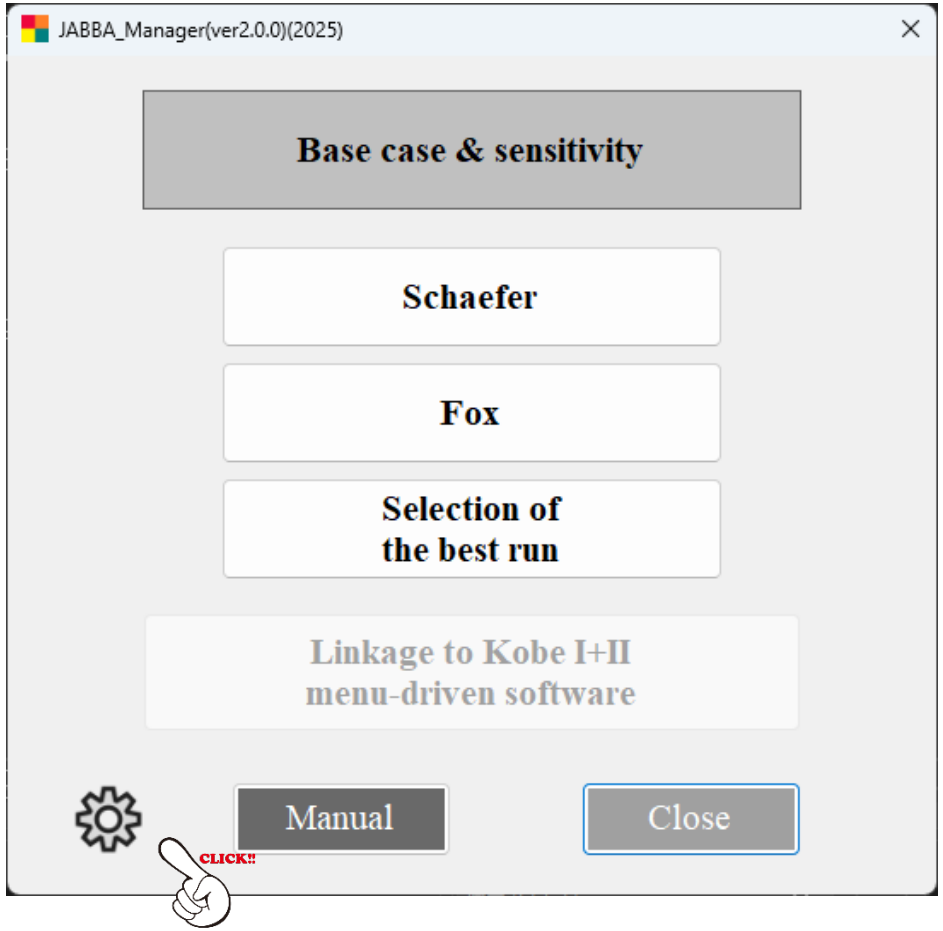
If not, users will be asked to install. Follow the instruction.

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.



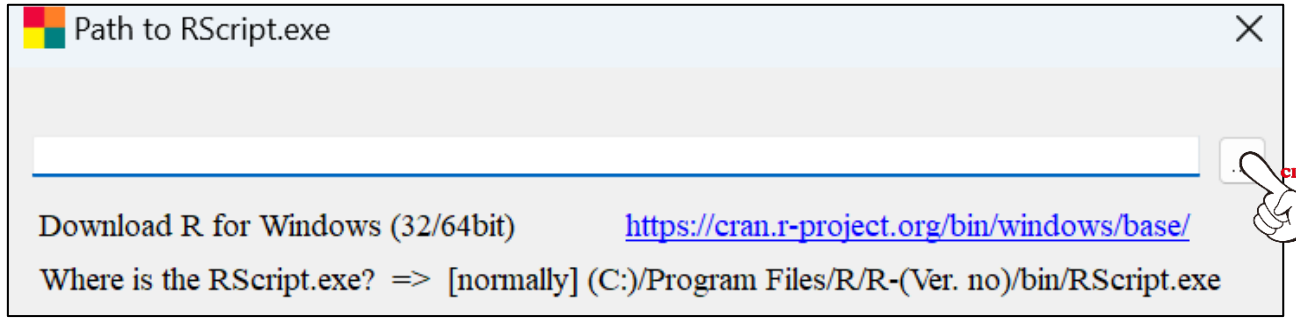
Linkage to R

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

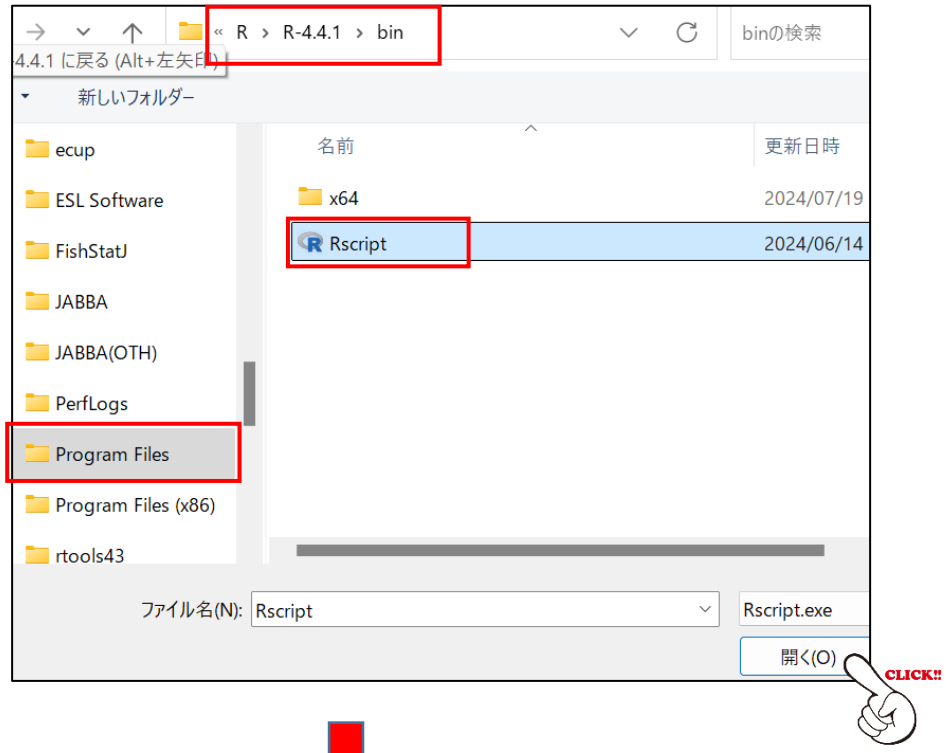
To do it, click the gear mark (lower left corner)

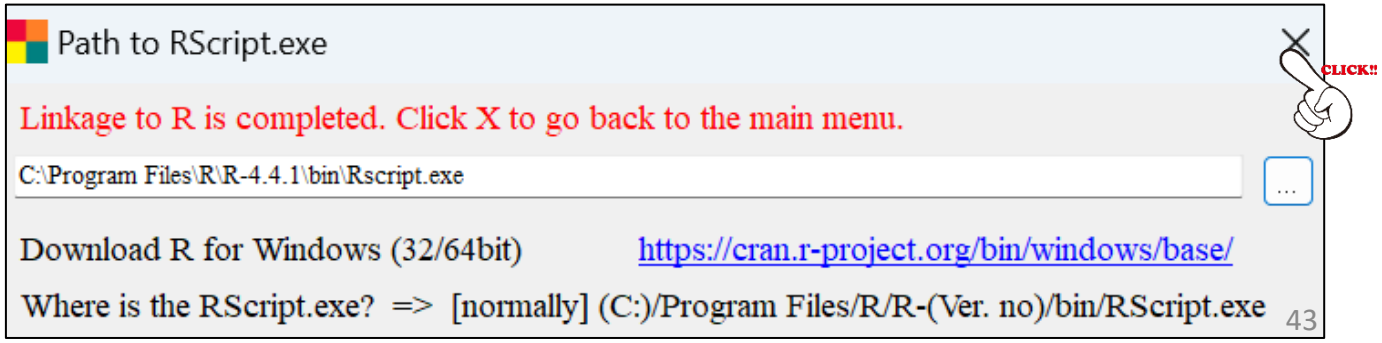
2. Preparation
2.2 Installation
2.2.7 JABBA_Manager

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



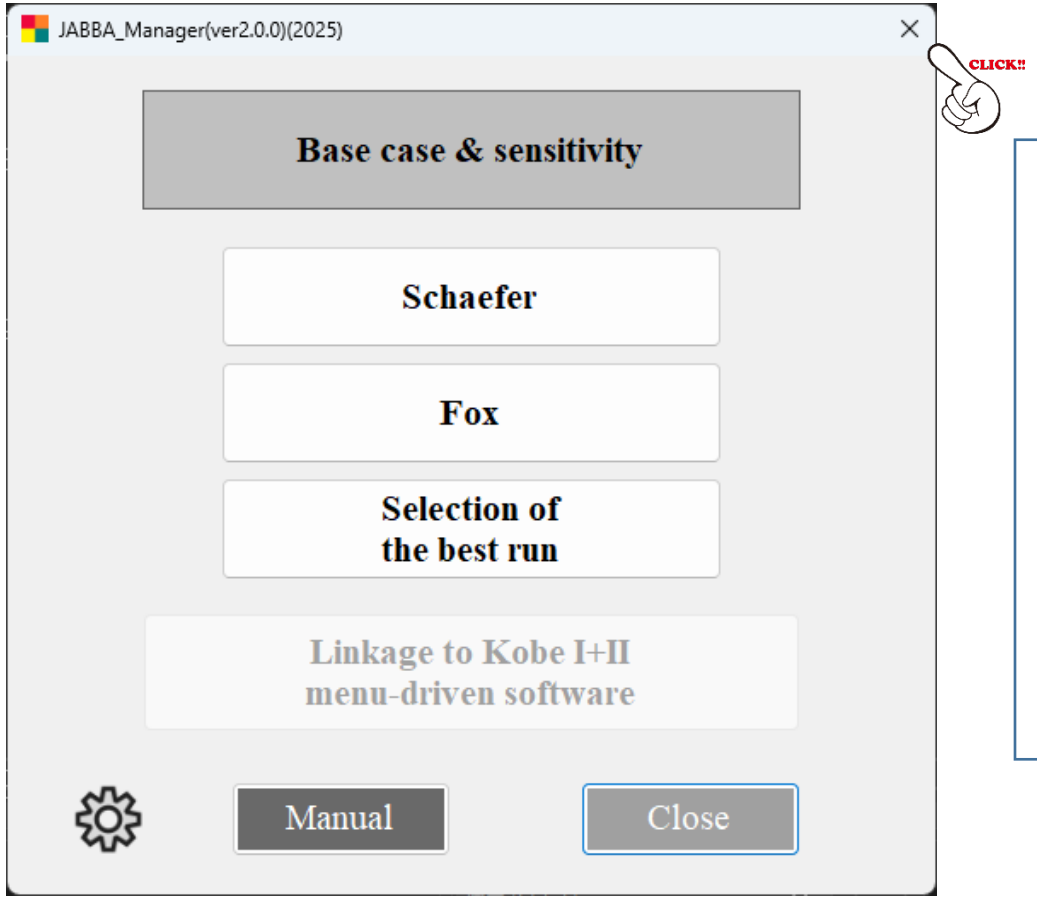
Then users will identify Rscript





2. Preparation
2.2 Installation
2.2.5 JABBA_Manager

Then, users will see the JABBA main menu again.

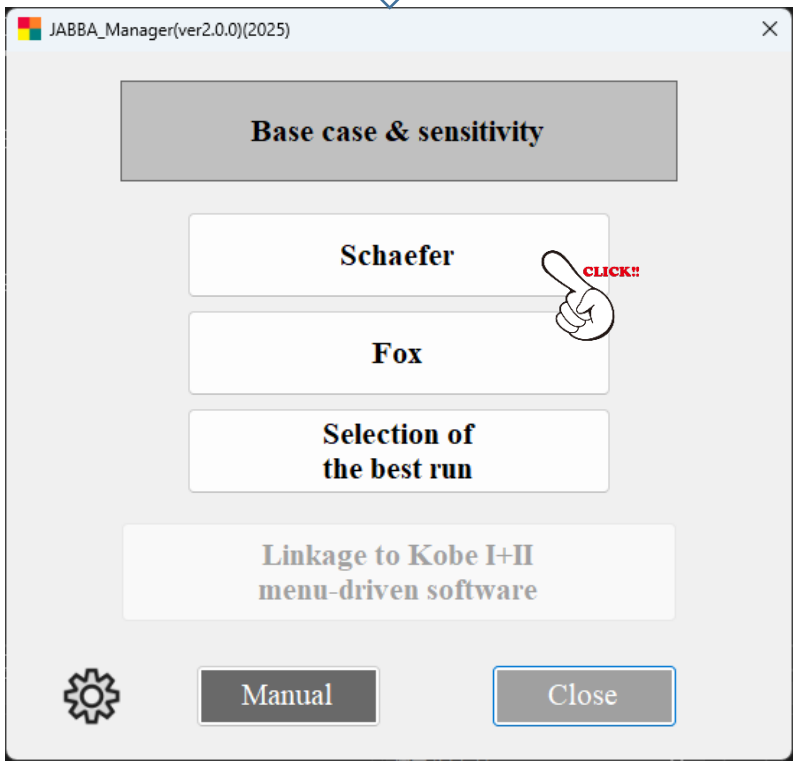


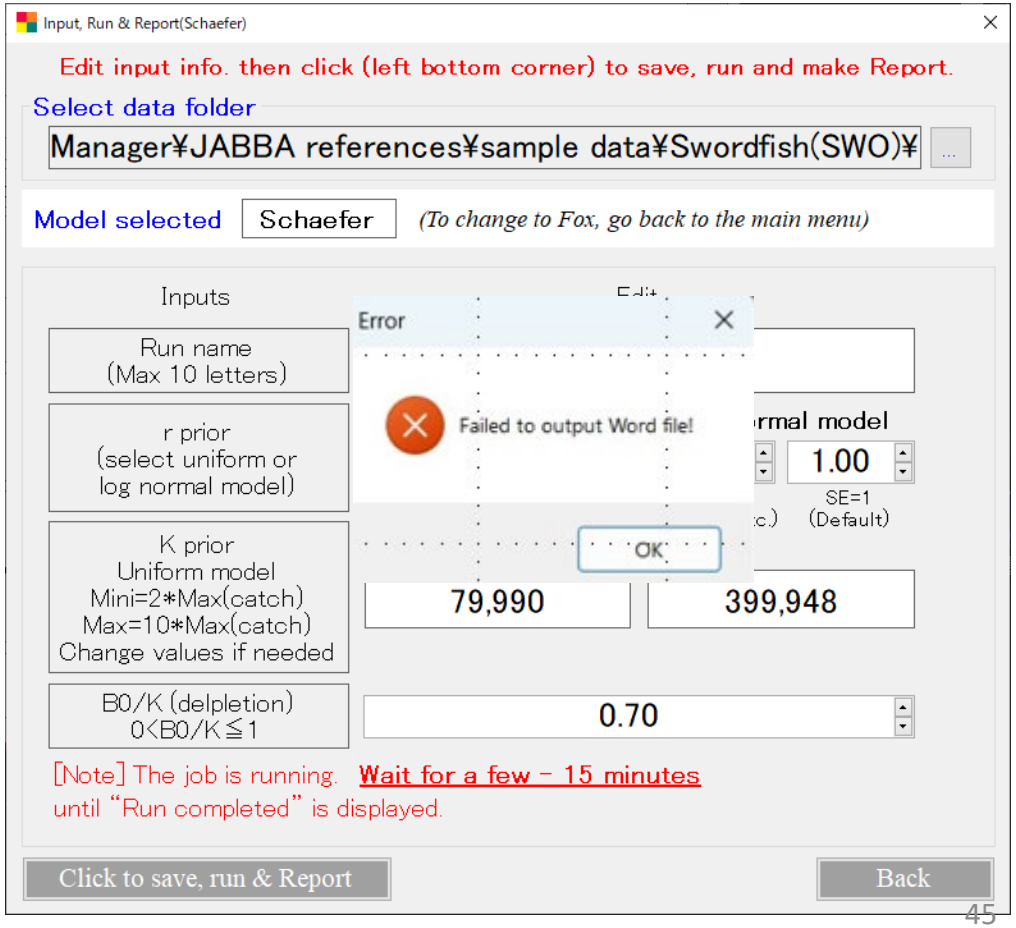
Now users are ready to use the software.

If users want to finish the software, click X.

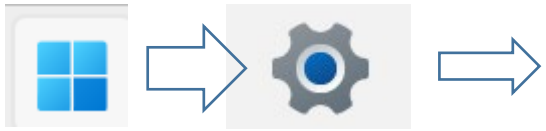
2. Preparations
2.2 Installation
2.2.8 Check language if software does not work

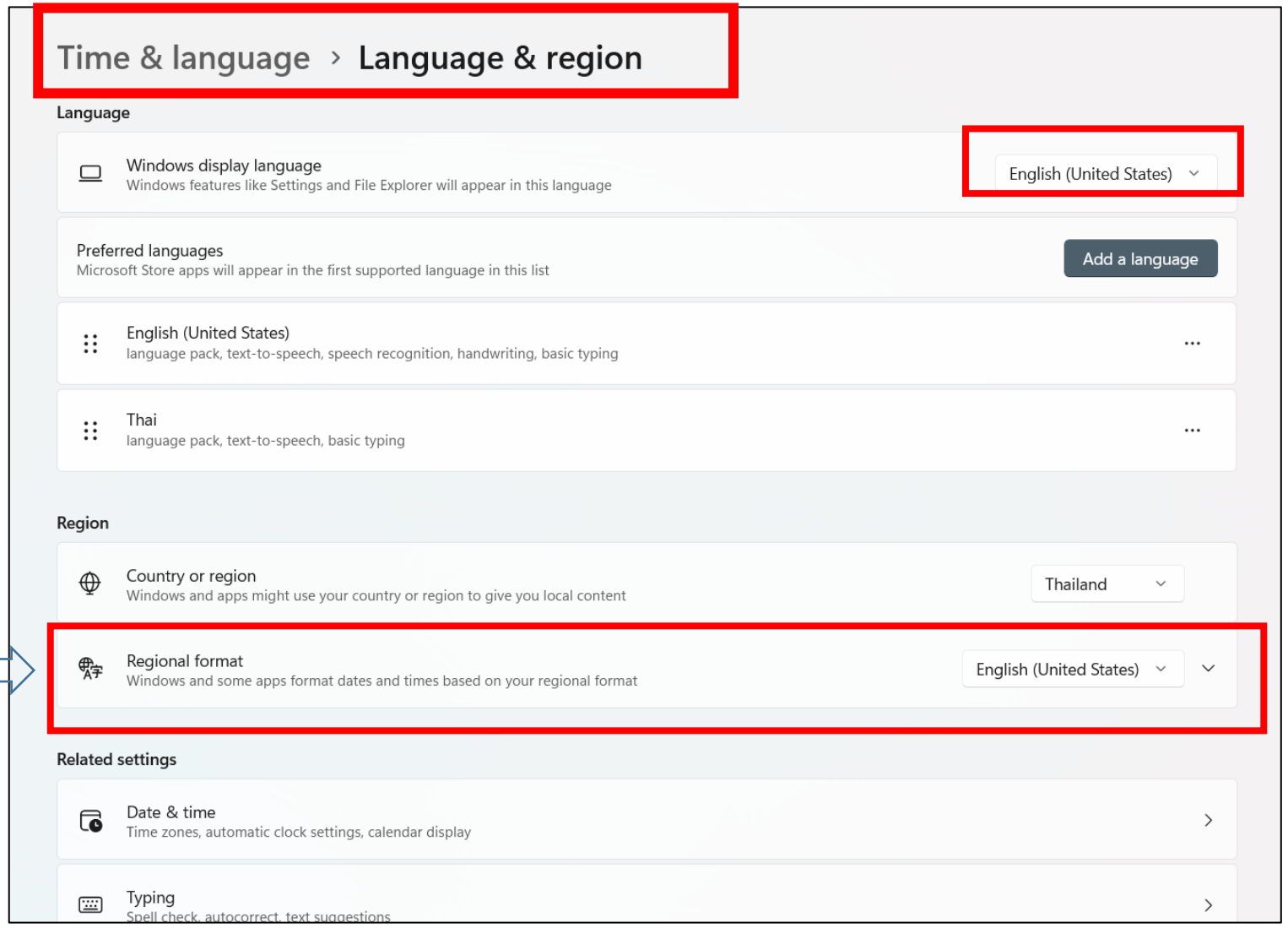
After properly installed and if an error message (below) is observed in the 1st run, users need to change the language (see next)





2. Preparations
2.2 Installation
2.2.8 Check language if software does not work



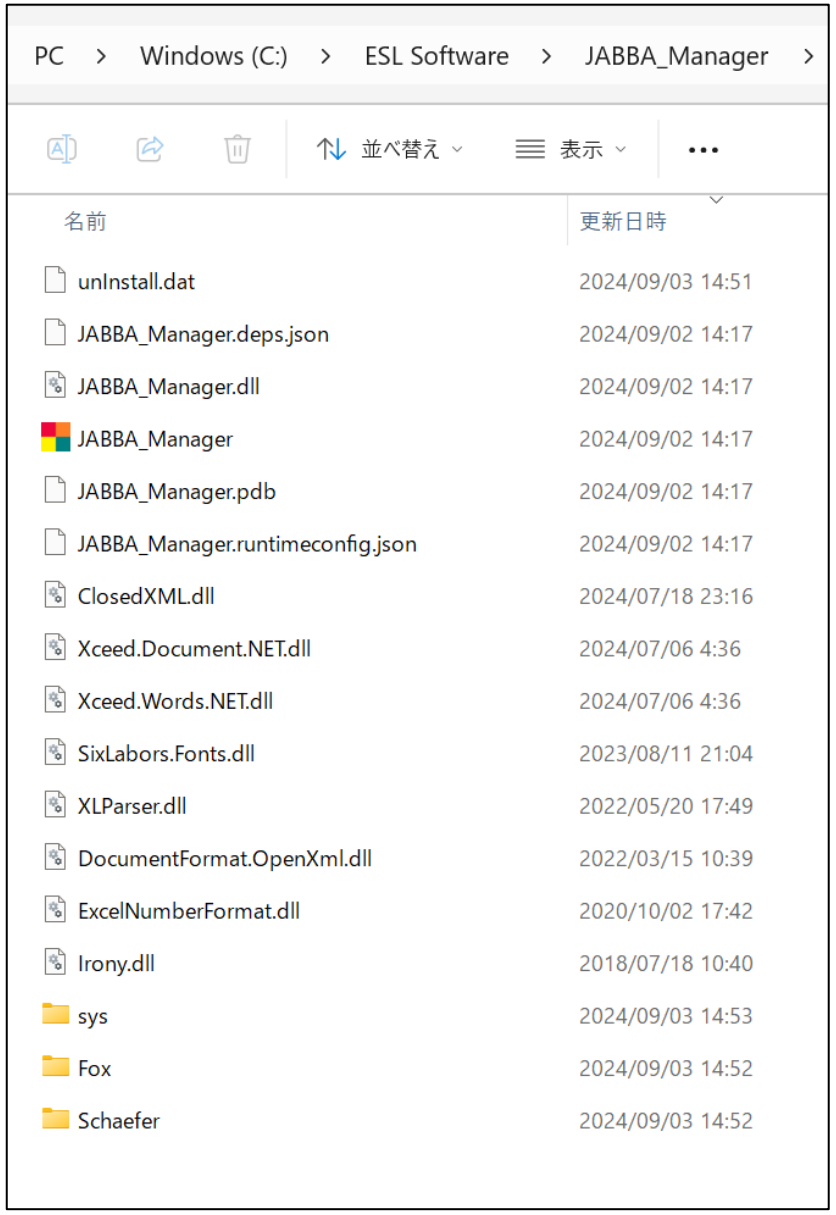


Change regional format to “English (United States)”. Then it should work. If not, contact [MENU]

2. Preparation
2.3 Uninstallation

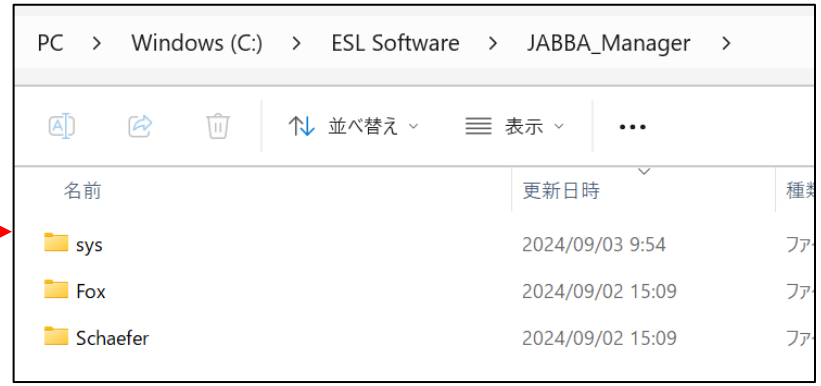
- When the new version of the menu driven JABBA_Manager is released, users need to re-install.
- Before re-installment, users need to un-install the current version.
- To un-install, users follow the normal procedures.
- After completed, some files & folders are still remained, which should be deleted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

2. Preparation
2.3 Uninstallation



Original full folders & files before in-installation

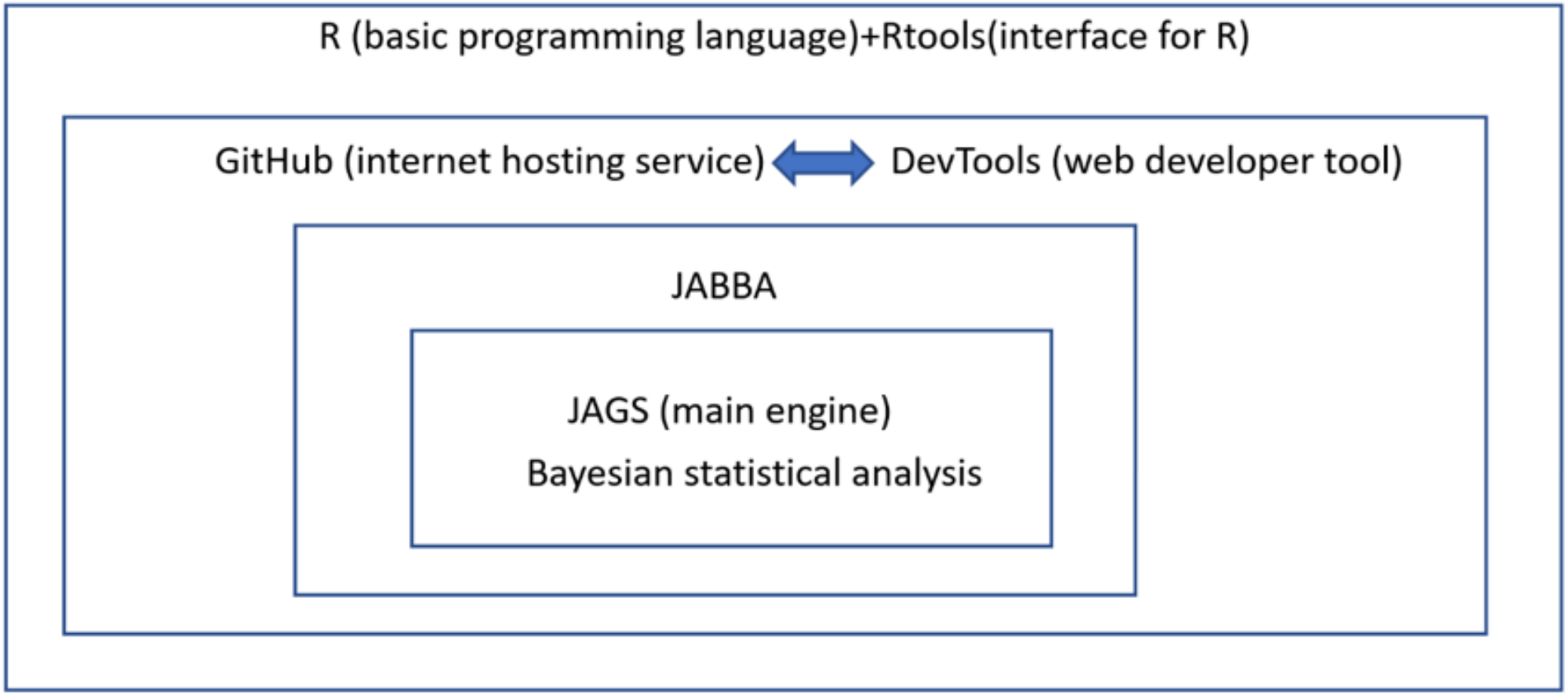
- Some folders & files in JABBA_Manager are not completely deleted in the ESL software folder (see lists before & after).
- Users need to delete left-over files & folders manually.



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

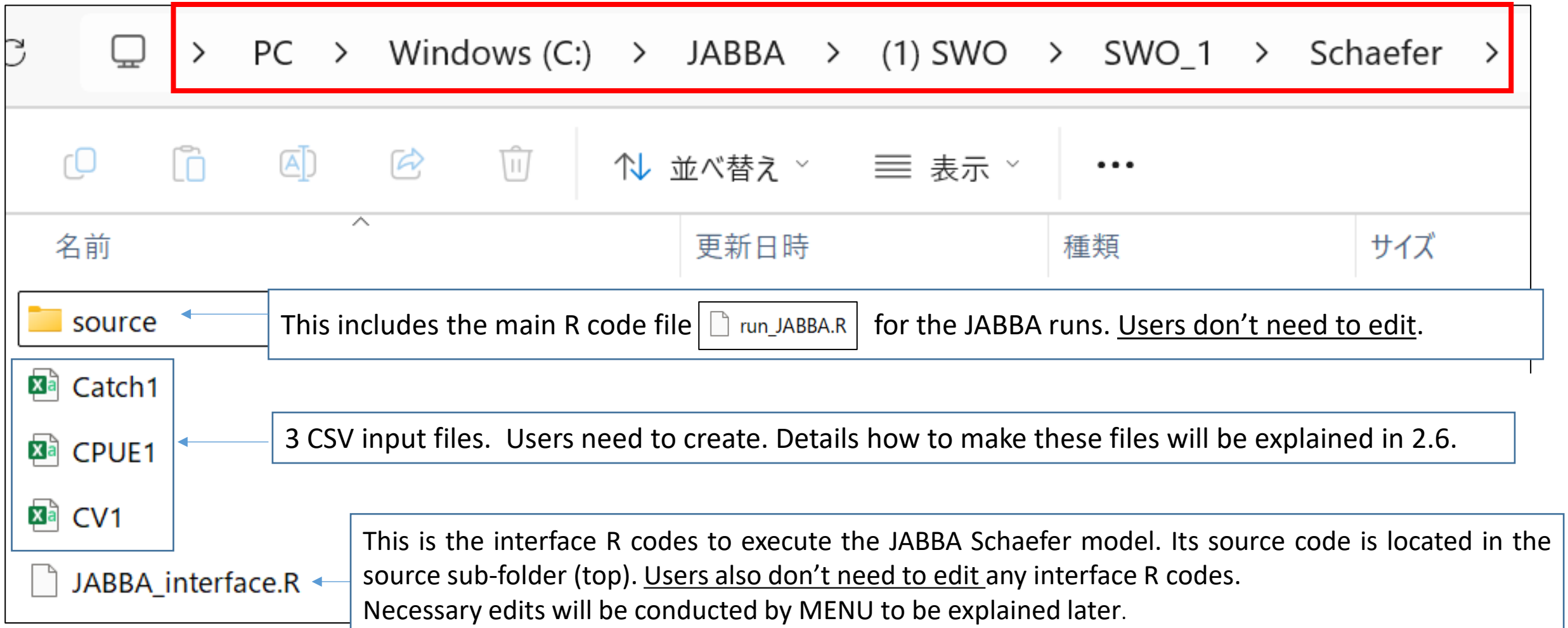


Note: JAGS (Just Another Gibbs Sampler)

2. Preparation
2.5 Setting up folders & files

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)



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

UPDATING
(To be ready in September, 2025)

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

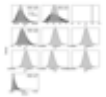
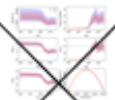
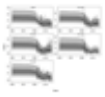
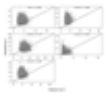
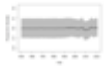
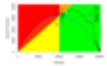
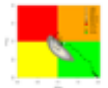
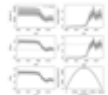
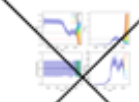
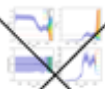
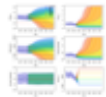
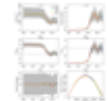
Output

Summary of results & diagnoses

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 (PPMR/PPVR)
   2.4 Posterior Predictive Check (PPC)
3. Retrospective analyses (model mis-specification)
4. Hindcast analyses (prediction power)
5. Estimated parameter values
6. Visual inspection
7. Next step (Selection of Schaefer or Fox)

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)*

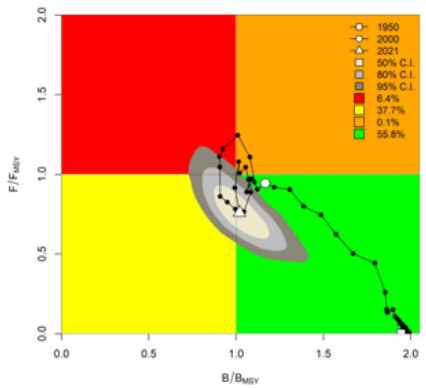
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
 Posteriors__Schaefer_Unif	 MCMC__Schaefer_Unif	 Posteriors__Schaefer_LNorm	 MCMC__Schaefer_LNorm	 Comp_Unif-LNorm_summary__Schaefer	 Comp_Unif-LNorm_trajectory__Schaefer	 Index__Schaefer	 Catch__Schaefer	 Catch-fit__Schaefer	 Index_Residuals__Schaefer
(11)	(12)	(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)

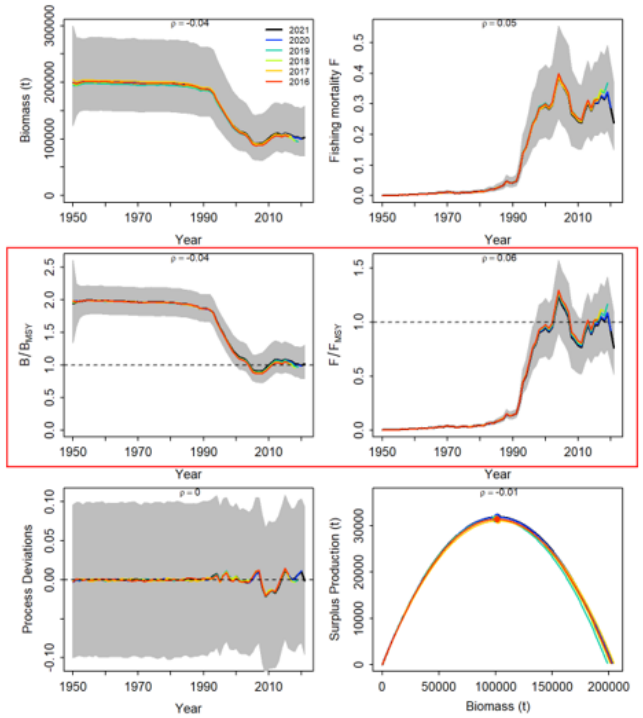
	Geweke.p	Heidel.p
K	0.80	0.57
r	0.96	0.67

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)

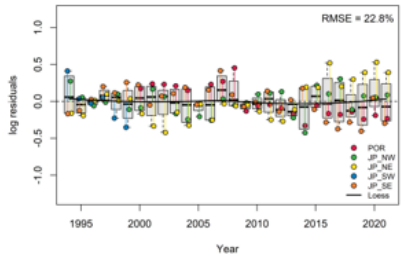
Mohan ρ	B	F
2021	-0.01	0.01
2020	-0.07	0.10
2019	-0.07	0.08
2018	-0.02	0.03
2017	-0.03	0.04
Average	-0.04	0.05

(#40) (p.14) Retrospective patterns

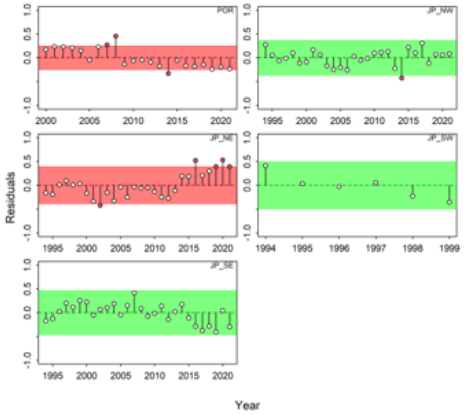


CPUE FITNESS

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



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

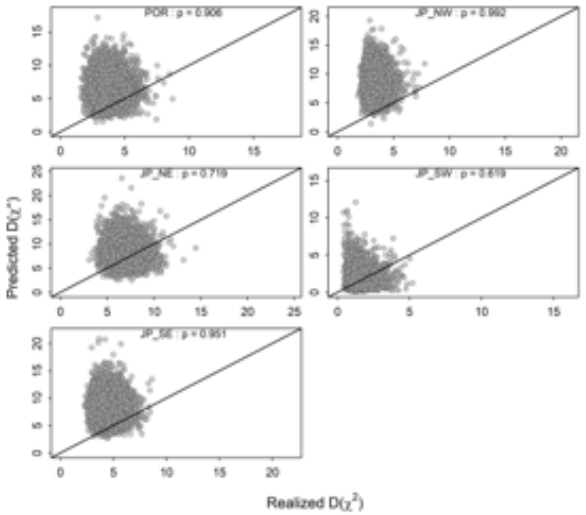


Summary of results & diagnoses (2/2)

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

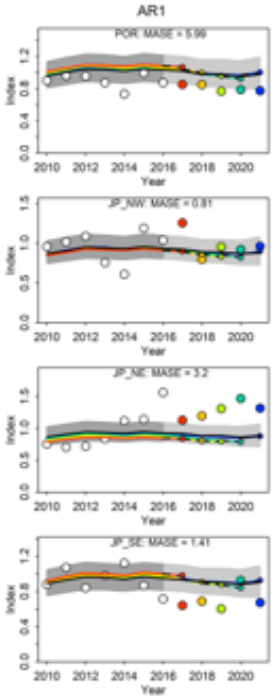
HINDCAST ANALYSES

(#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)

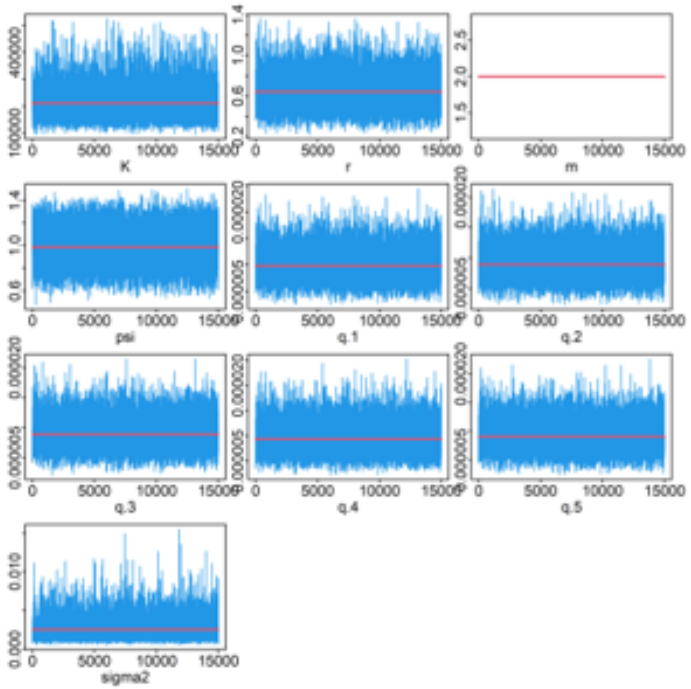
(#20) Heidelberger and Welch Statistical test on Convergence

	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

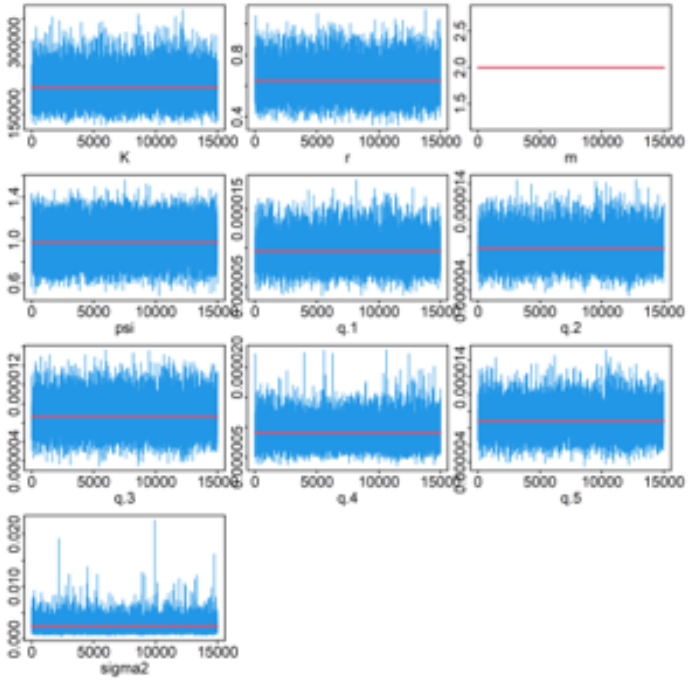
Ho: Pr (MCMC is converged)

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

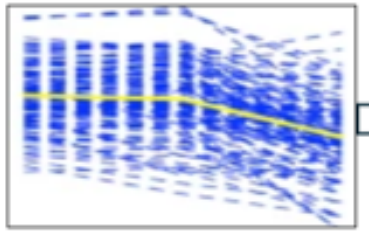
(#2) The 1st MCMC results for uniform models



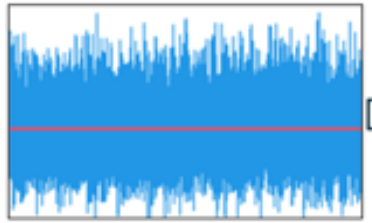
(#4) The 2nd MCMC results for log-normal models



Reference for Visual Inspection



Significant
Not converged



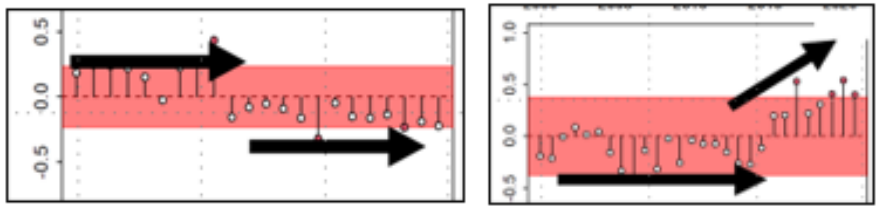
Non-
Significant
Converged

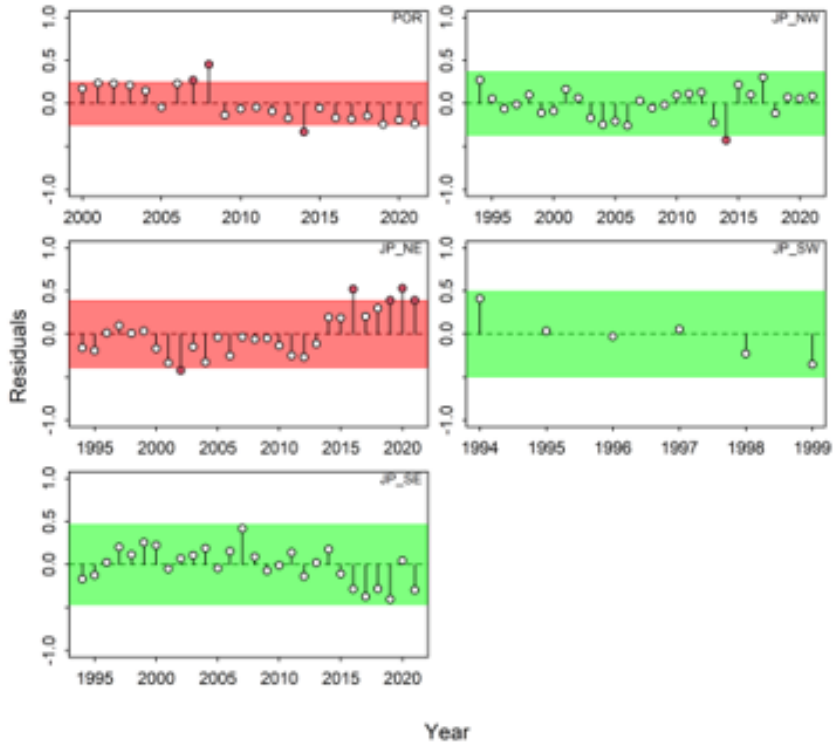
2. Model fit

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)

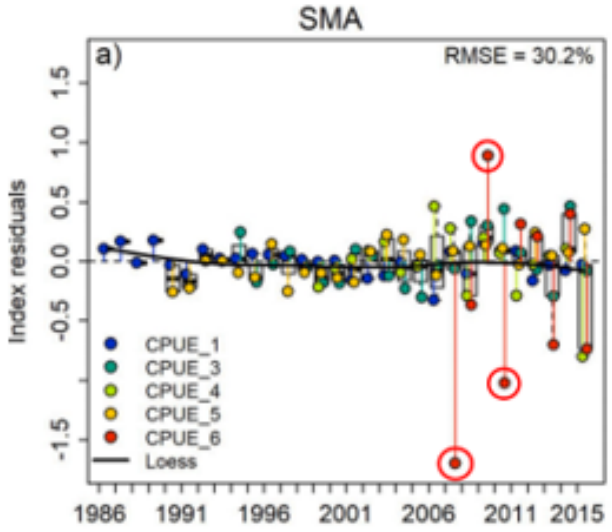


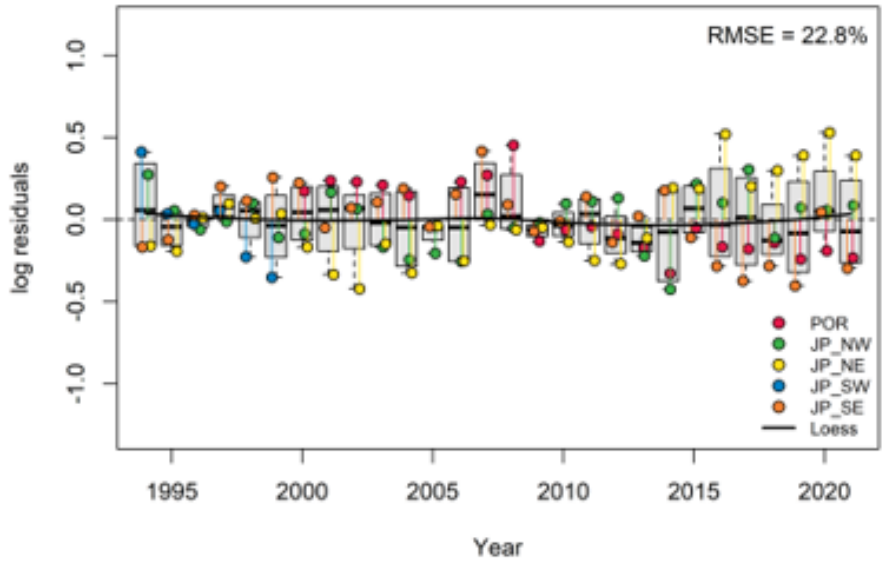


(#13) Randomness (Autocorrelation) test and outliers

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.



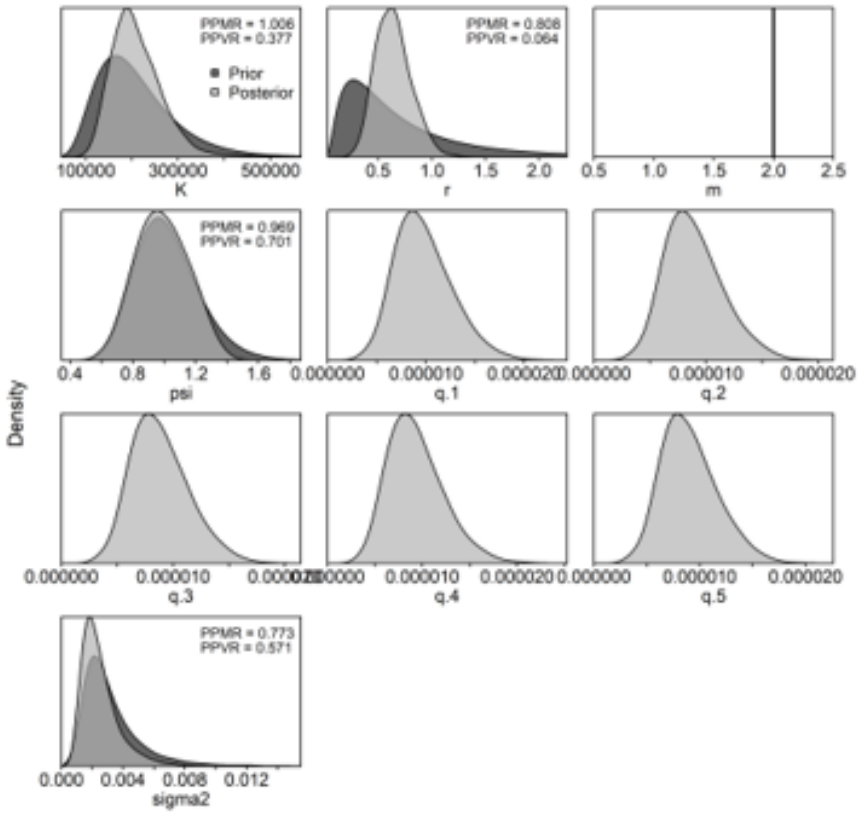


(#10) RMSE, quantiles & loess by fleet.

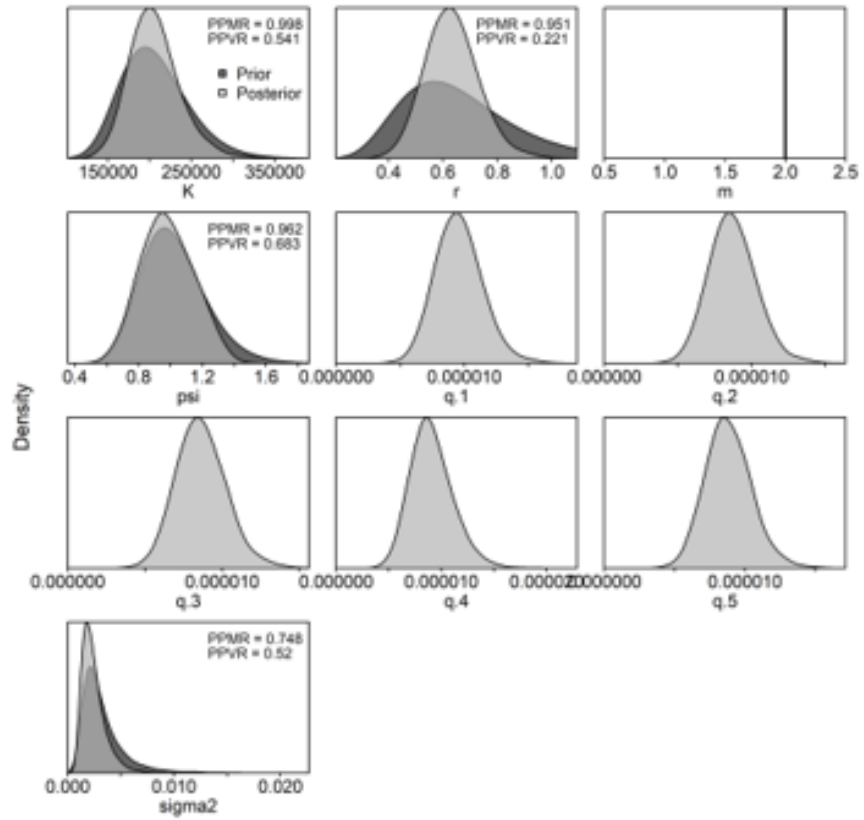
2.3 Prior to Posterior Median/Variance Ratio (PPMR & PPVR)

(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	

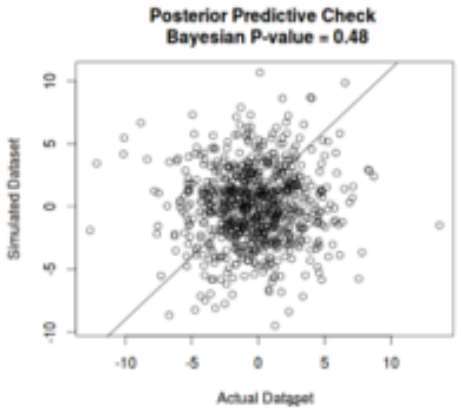
Criteria for fitness
If PPMR and PPVR is closer to 1, it means better fitness for point estimate and variance respectively.

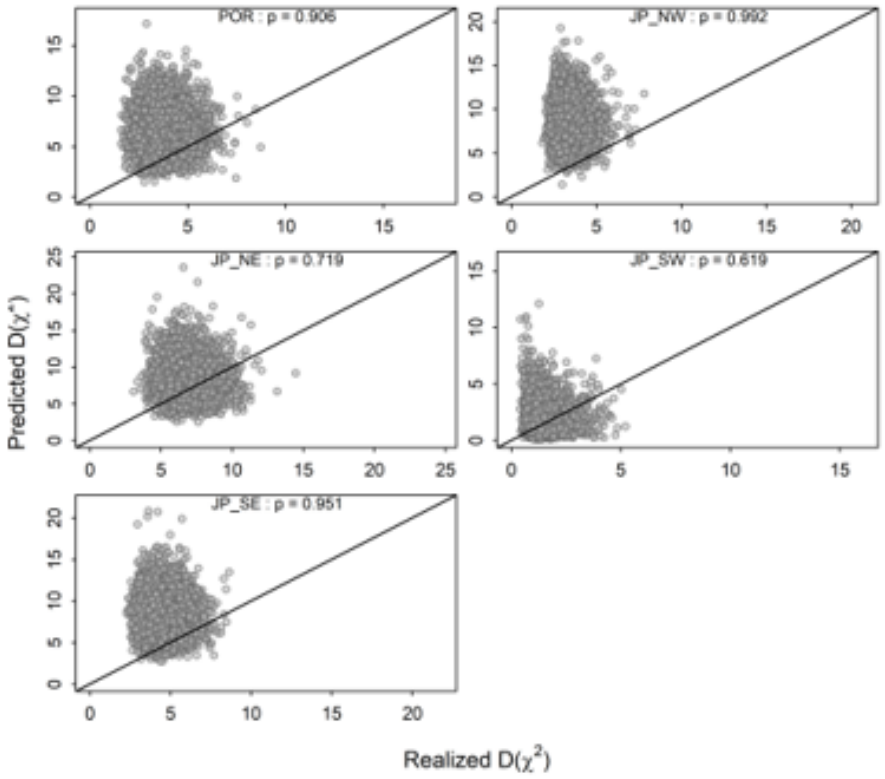
Users need to compute average of 4 parameters (K, r, depletion & sigma2) for PPMR & PPVR respectively. These values will be used to evaluate the best model (Schaefer or Fox).
(see the selection form, the 3rd menu)

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).

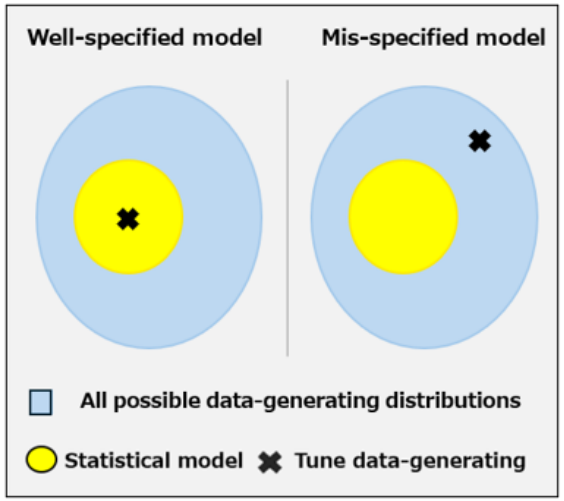
3. Retrospective analyses (#42)

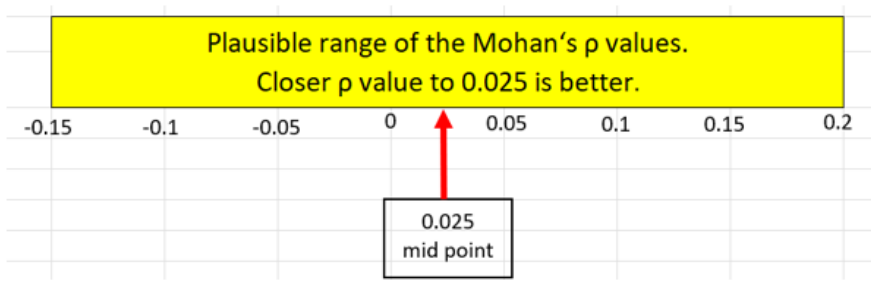
(#42) Retrospective analyses to inspect model mis-specification using Mohan ρ values & graphs

	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

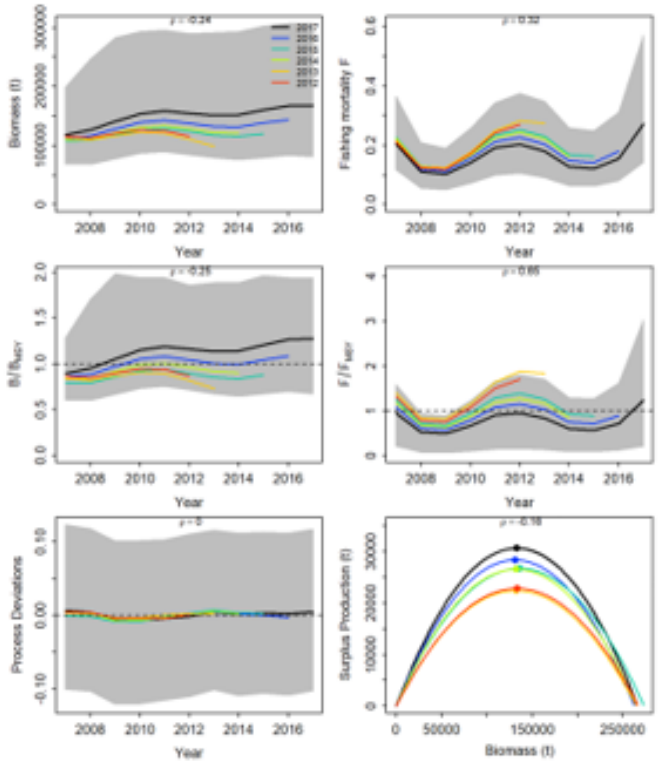


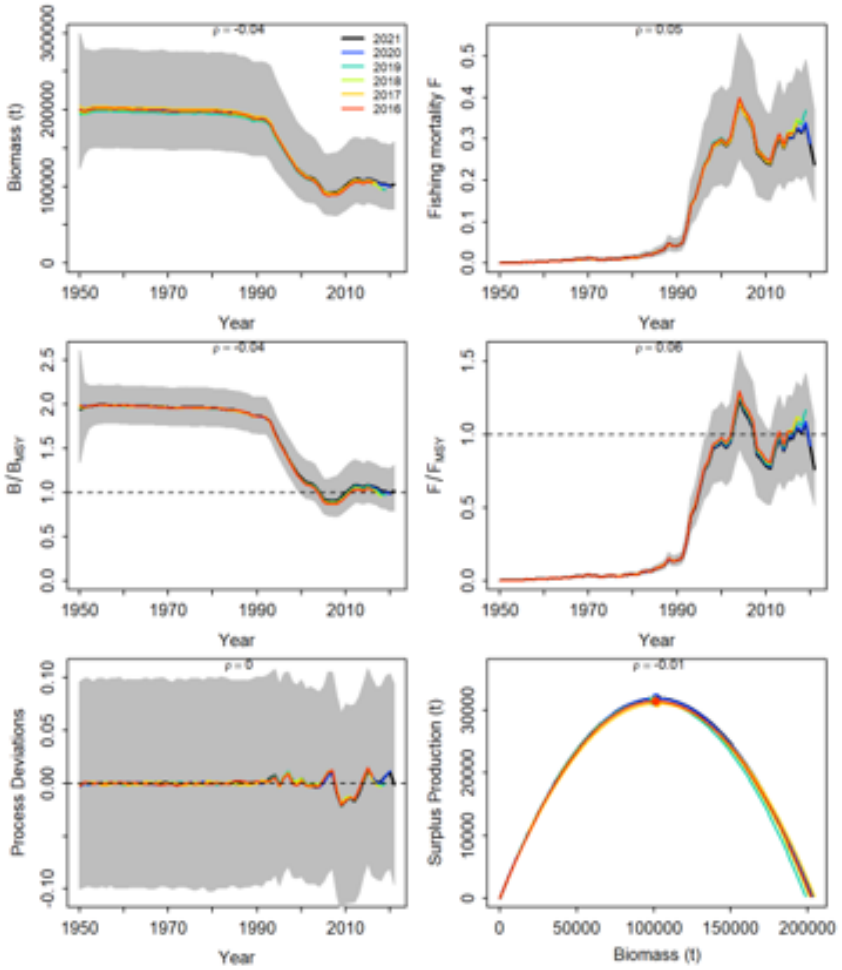


(#40) Plots of retrospective analyses

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

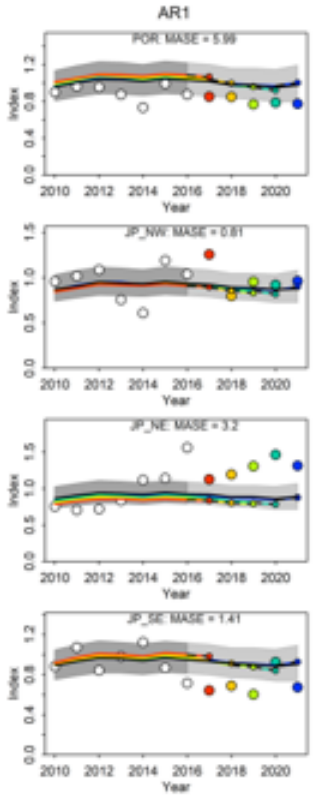
If MASE (Mean Absolute Scaled Error) < 1 ➔ better prediction ability

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.



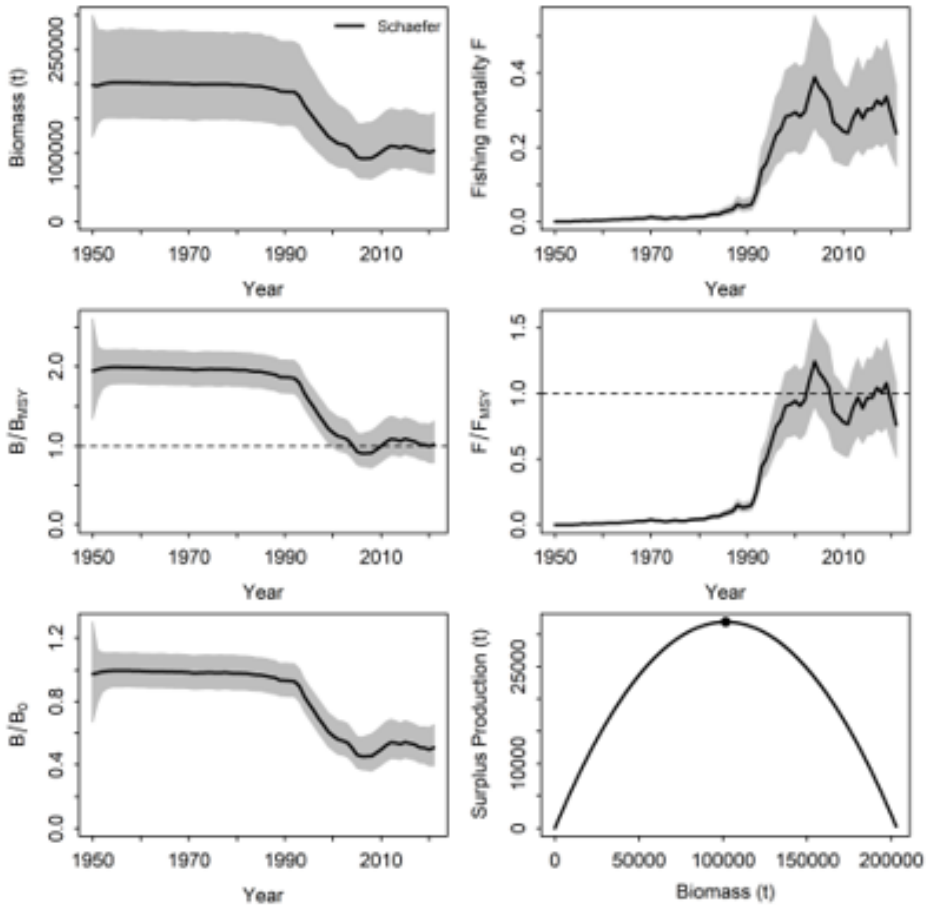
5. Estimated parameter values

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

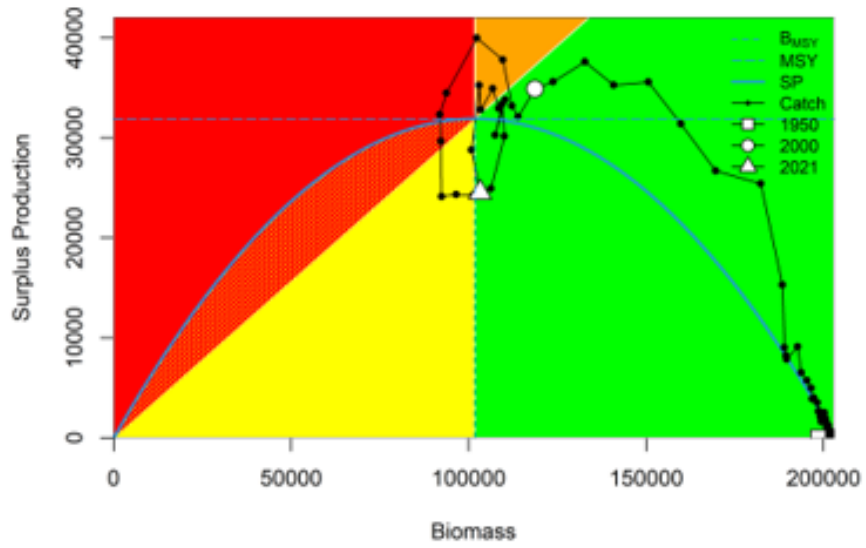


(#19) Trajectories of 6 key parameters with 95% CI.

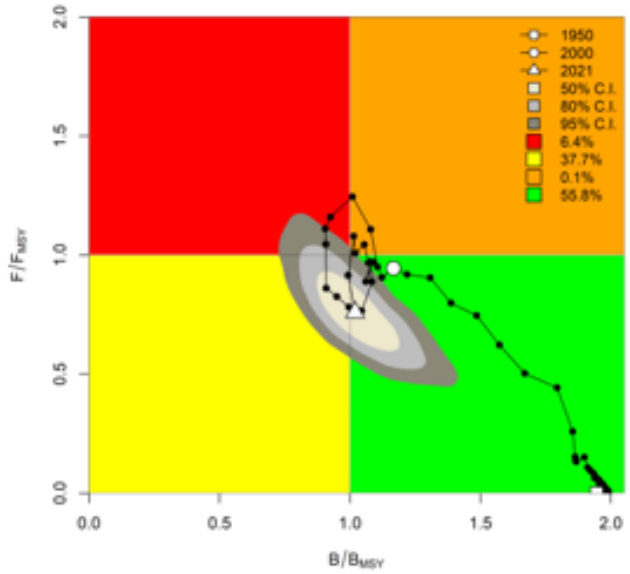
(Note) Red broken lines indicate those for B/Bmsy=0.5.

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.



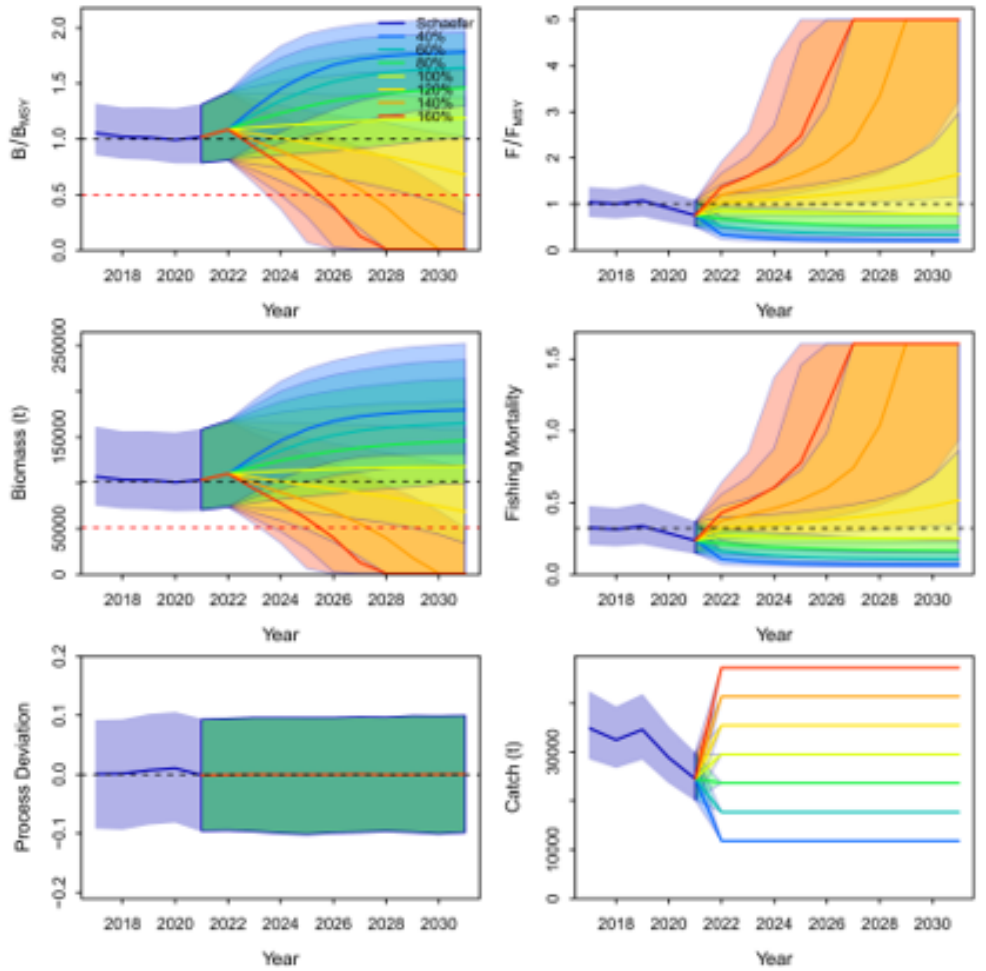
(#17) Surplus Production (SP) Phase plot



(#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.