Menu-driven software series (No. 2)

ASPIC_MANAGER (VER1.1.0) Manual

(April 8, 2024)

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

[MENU] is supported by Environmental Simulation Laboratory (Japan)

Contents

Warnings

(1) This software can be used only by those who had trainings by [MENU] (personal copy & personal use only).

(2) Please don’t give or sell copies to others.

(3) Please don’t inform the download link of this software to others.

(4) If uses want to make reports and/or publish papers using this software, please get permission from [MENU] at menu.soft.SEC@gmail.com

ACRONYMS

ASPIC	A Stock-Production Model Incorporating Covariates
ASPM	Age-Structured Production Model
B	Total biomass or Spawning Stock Biomass
BMSY	Total biomass or Spawning Stock Biomass at MSY
BO	Initial Biomass
BOT	Bootstrap (ASPIC Command)
CI	Confidence Interval
CPUE	Catch Per Unit Effort
DOS	Disk Operation System
EST	Estimated
F	Fishing mortality
FIT	To estimate (ASPIC Command)
F_{MSY}	Fishing mortality at MSY
GPS	Global Positioning System
ICCAT	International Commission for the Conservation of Atlantic Tunas
IOTC	Indian Ocean Tuna Commission
IRF	Iteratively Reweighted Fit (ASPIC Command)
JABBA	Just Another Bayesian Biomass Assessment
K	Carrying Capacity
LRP	Limit Reference Point
MCMC	Markov Chain Monte Carlo methods
MSY	Maximum Sustainable Yield
OBS	Observed
PT	Pella and Tomlinson
QC	Quality Control
RFMO	Regional Fisheries Management Organization
RMS	Root Mean Square (Error)
SA	Stock assessment
SAS	Statistical Analysis System
SB or SSB	Spawning Biomass or Spawning Stock Biomass
SB_{MSY} or SSB_{MSY}	Spawning Biomass or Spawning Stock Biomass at MSY
SPSS	Statistical Package for the Social Sciences
SRA	Stock Reduction Analysis
SS3	Stock Synthesis 3
STD	Standardized (CPUE)
SWO	Swordfish
TB	Total Biomass
TB_{MSY}	Total Biomass at MSY
TRP	Target Reference Point
Y/R	Yield per Recruit

1. Introduction
Evolution of PM (Production Model)

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

(Note) PT: Pella and Tomlinson

➔ This manual is for ASPIC_Manager to implement ASPIC(ver5.05)
JABBA_Manager for JABBA ➔ to be completed in 2024

1. Introduction : ASPIC_Manager

Pervious ASPIC software (2023 or before)

Only one menu (batch job) was available.

➔ It is now menu (1)

in the new ASPIC_Manager.

But all other works for menu (2)~(6)

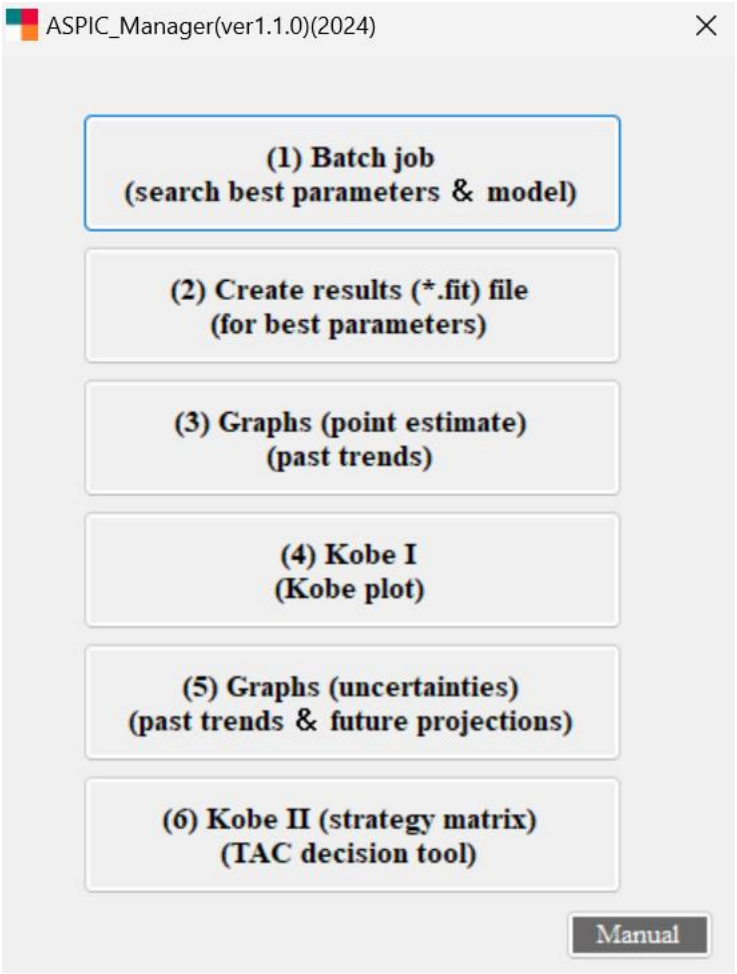
need to be done <u>manually</u>

caused many errors in the past

New software : ASPIC_Manager (from 2024) (6 menus)

<u>(ALL-in-one & Automated)</u>

Simple & friendly operations ➔No mistakes/errors



But users must understand meanings of processes

(this manual explains)

2. Requirements for PC and Remarks (1/4)

(1) Requirements for PC

- Operation System: MS window 10 or 11 and **NOT applicable for MAC (apple) PC.**
- 64bit PC.
- RAM: minimum 2GB.
- Basic software (Word, Excel and Notepad)
- R programming language for window (R-4.3.1-win) needs to be installed in advance. Its size is 80MB (zipped) and 180MB (unzipped).
- To make smooth operations, users need at least 30% of empty space of the hard disk.

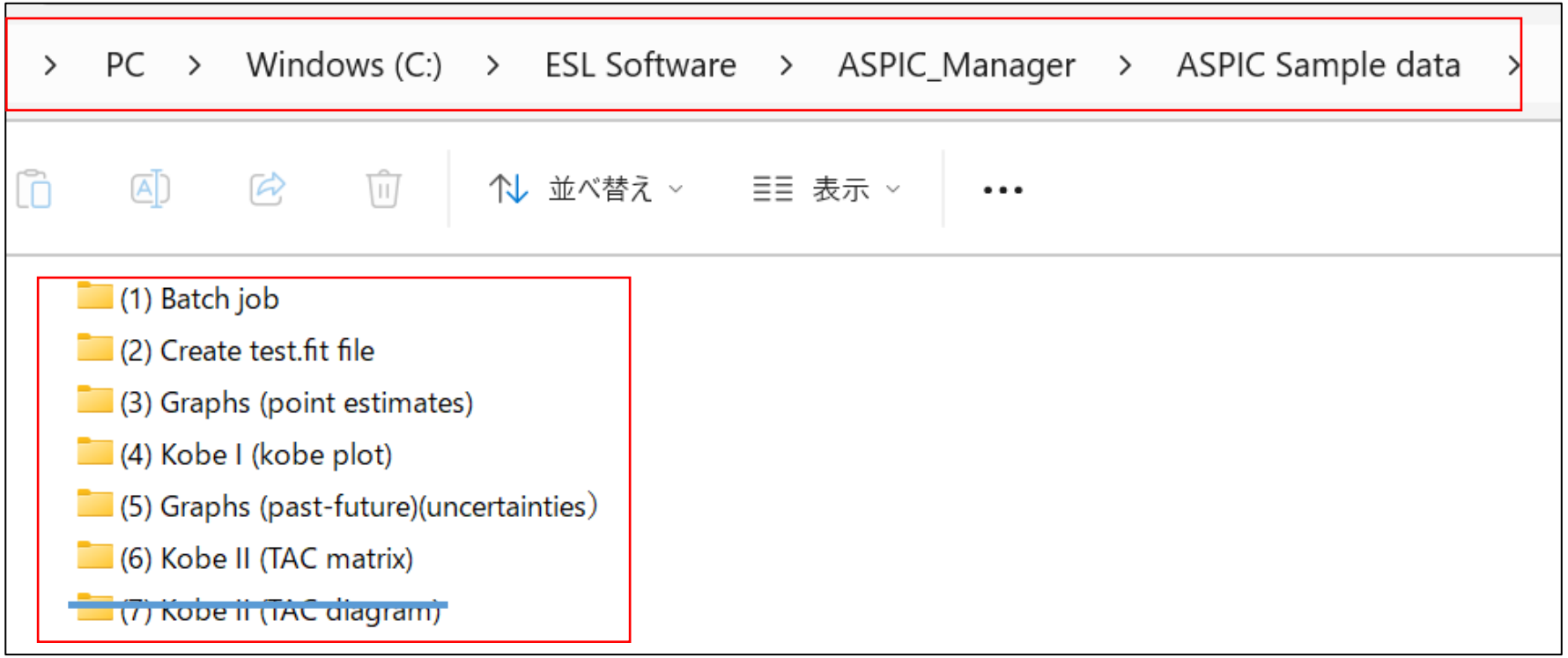
2. Requirements for PC and Remarks (2/4)

(2) Important remarks (sample data)　(REVISED)

- This manual uses the sample data for demo.
- Users can use the sample data for practice

  ➔ **important: Use the data available folders corresponding to the menu.**

- Location of the sample data (7 folders for 7 menus)



2. REQUIREMENTS FOR PC AND REMARKS (3/4)

(2) Important remarks *(continued)*

Manual
This PowerPoint is the manual (REVISED).
Manul call button is available in menus➔ do not use (old version)

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. REQUIREMENTS FOR PC AND REMARKS (4/4)

(2) Important remarks *(continued)*

- **Engines (programs and applications) underpinning this software**

- Microsoft Visual Studio (2019)
- Graphics: C# and. NetFrameWork4.7.2
- ASPIC Batch job (Grid search) menu-driven Software (Ver 1.1) (2018)
- Kobe_I_II(ver.6.1.5)(2023)
- R-4.3.1-win(2023)

3. Installation

3 application and Linking R to ASPIC_Manager

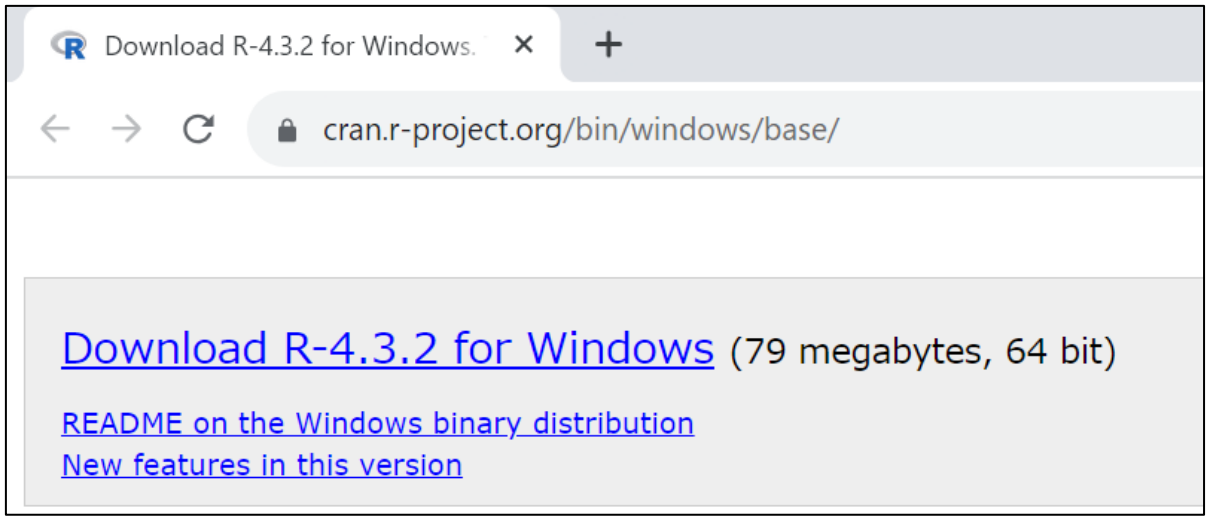
Before installation, uninstall old versions if uses have precious versions.

Order of the installation	Name of software	Download link	Size of Zipped file (MB)	Size of unzipped (actual) files (MB)	How to install? See slide # (This manual)
1	R-4.3.1-win	https://cran.r-project.org/bin/windows/base/ Download R-4.3.1 for Windows	80	180	12
2	Kobe_I_II (ver6.2.0) (2024)	*Get links from Menu-driven stock assessment software developing team [MUNE] Menu.soft.SEC@gmail.com*	7.4	13	13-14
3	ASPIC_Manager (ver1.1.0) (2024)		26	100	15-16
4	Linking R to ASPIC_Manager				17

3. Installation ： How to install “R-4.3.1-win”?

Go to https://cran.r-project.org/bin/windows/base/

Users will see the window below:



Then download from Download R-4.3.1 for Windows

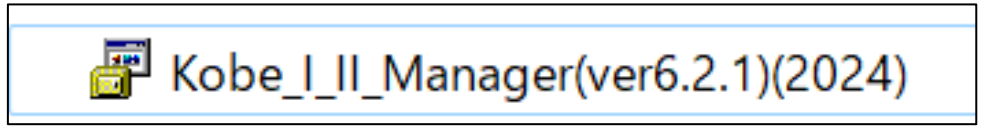
3. Installation： Kobe I (plot) & II (management tool)

Double click the zipped installer (located folder or desktop)

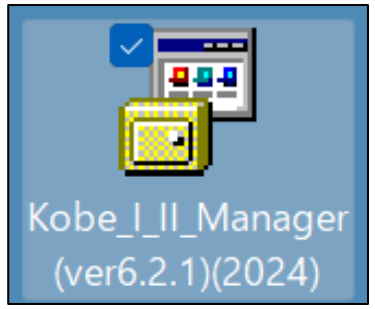
Users can get the download link of the software

from the [MENU] Secretariat at menu.soft.SEC@gmail.com

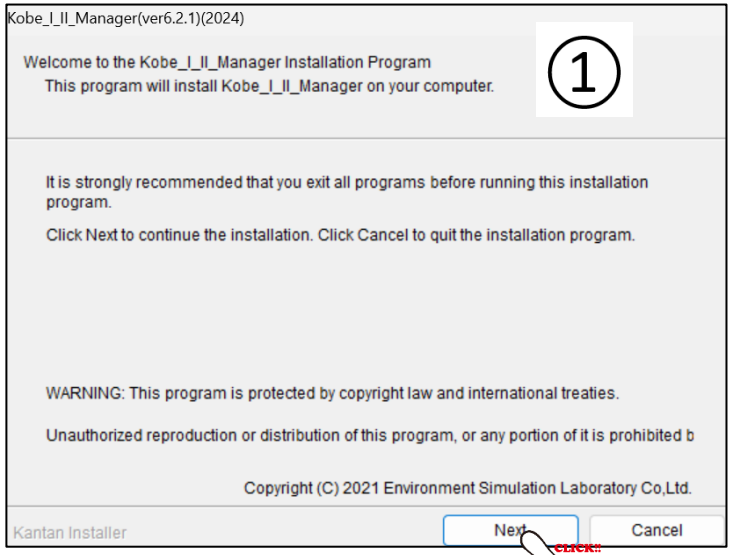
Installer (folder)

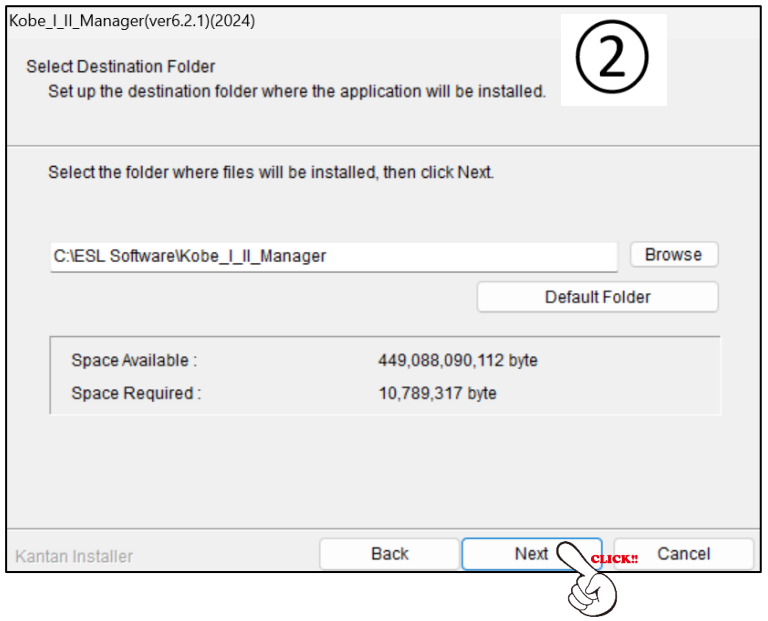


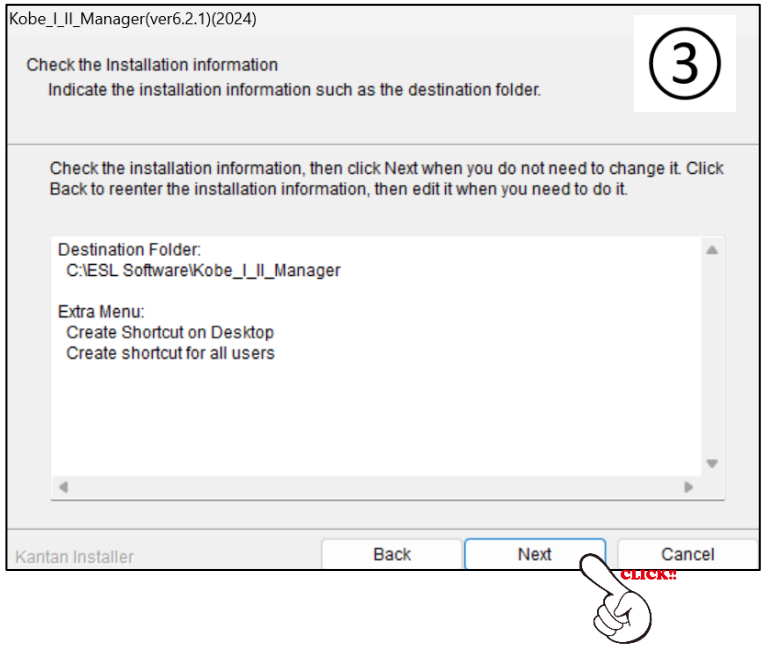
Installer (desktop)

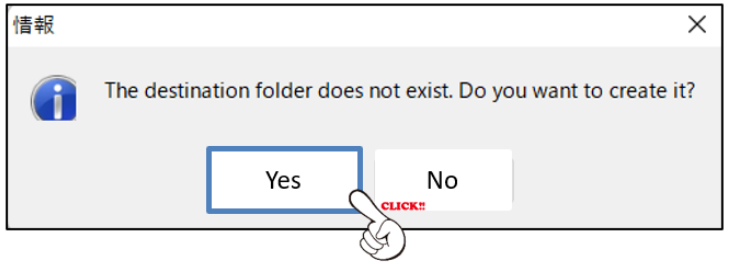


3. Installation: Kobe I+II　　Follow 5 steps

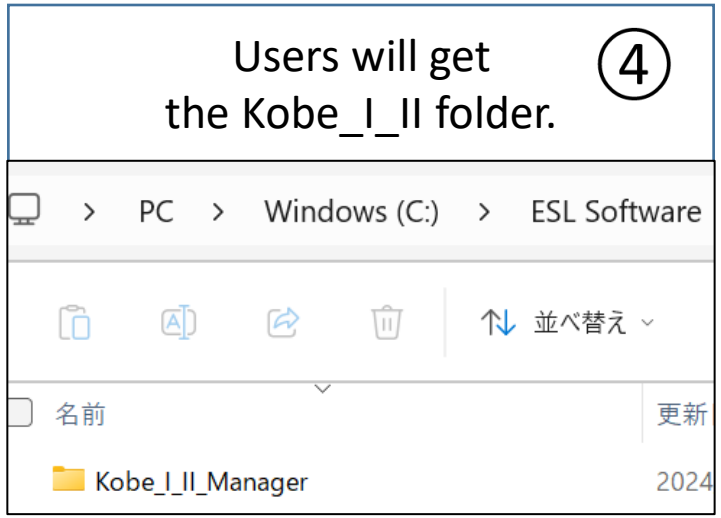


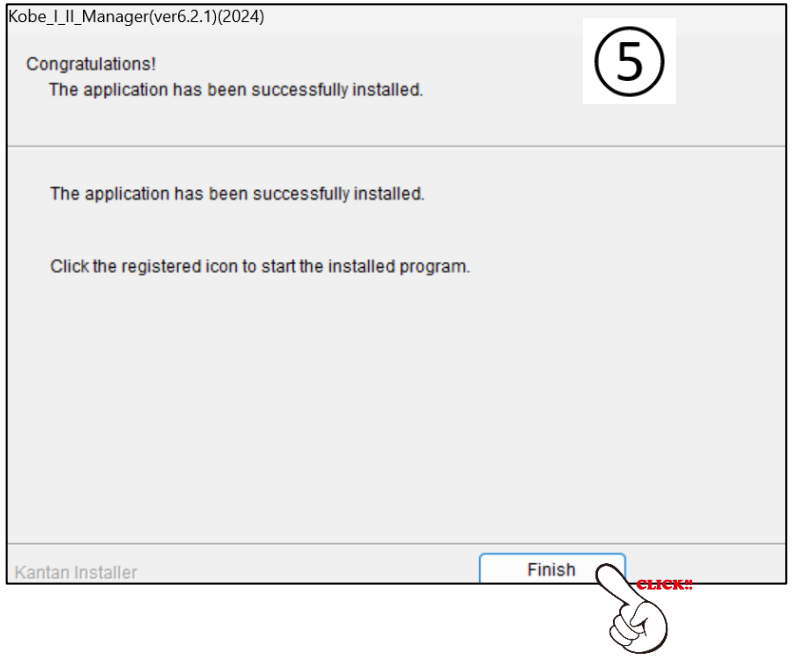






If the destination folder “ESL Software” exits, this window will not appear.





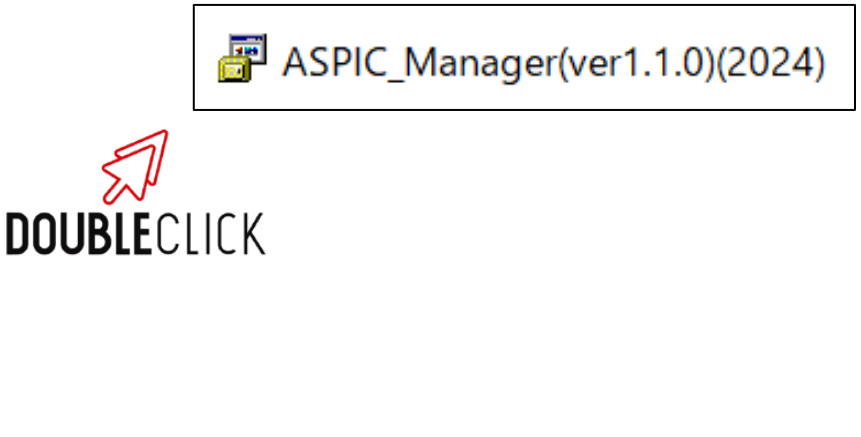
3. Installation: ASPIC_Manager

Double click the zipped installer (located folder or desktop)

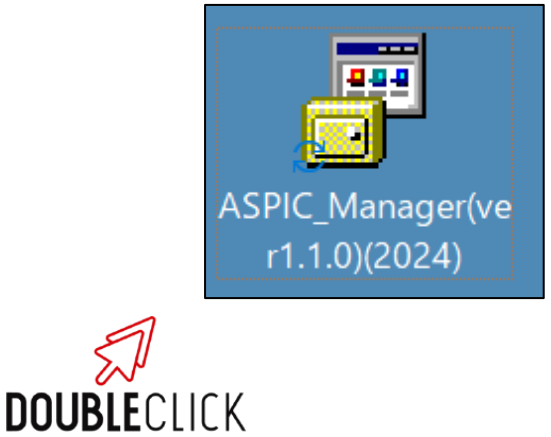
Users can get the download link of the software

from the [MENU] Secretariat at menu.soft.SEC@gmail.com

Installer (folder)



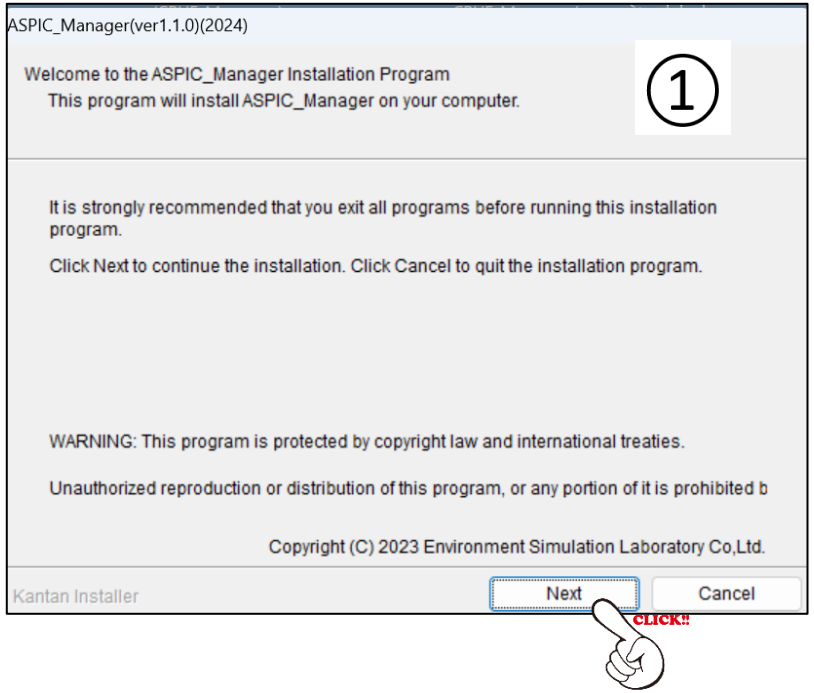
Installer (desktop)

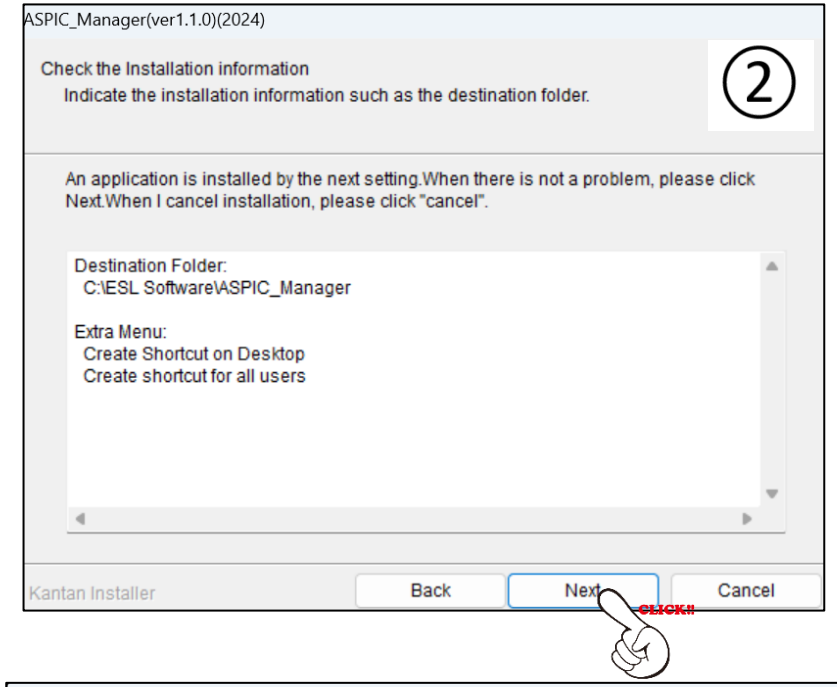


3. Installation

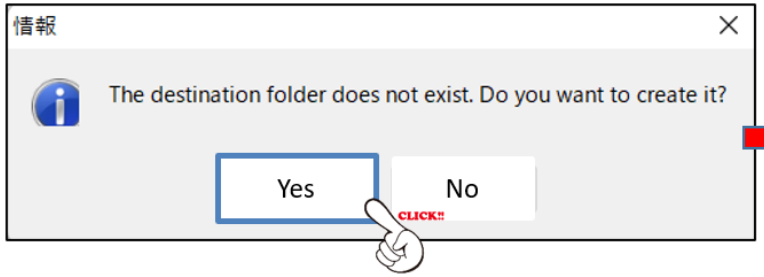
ASPIC_Manager

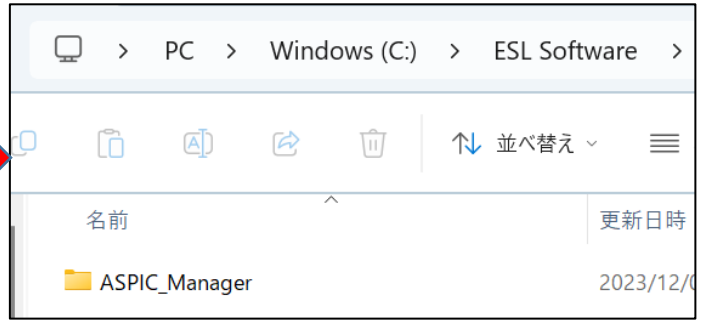
4 steps



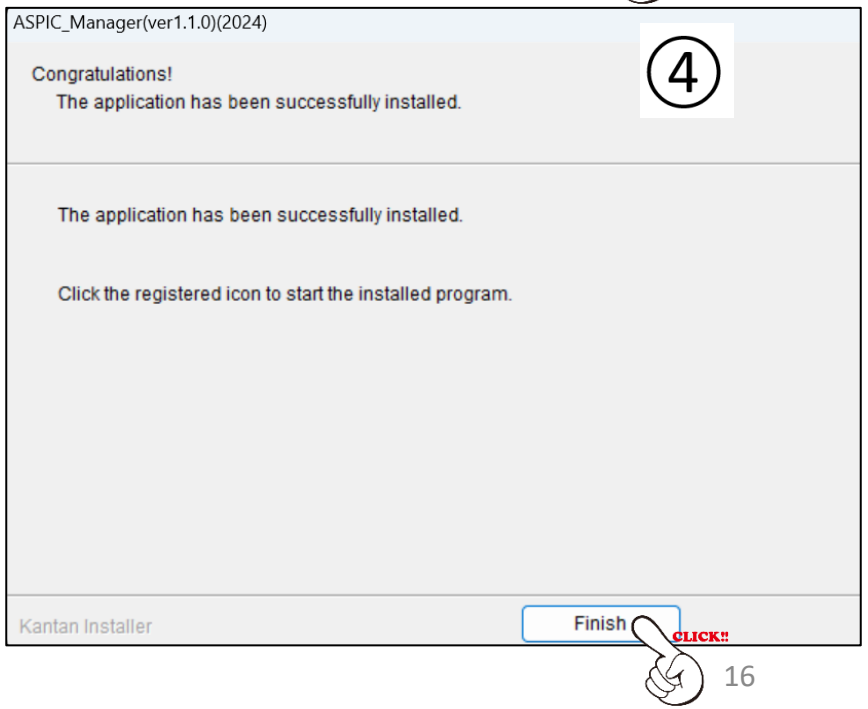


③

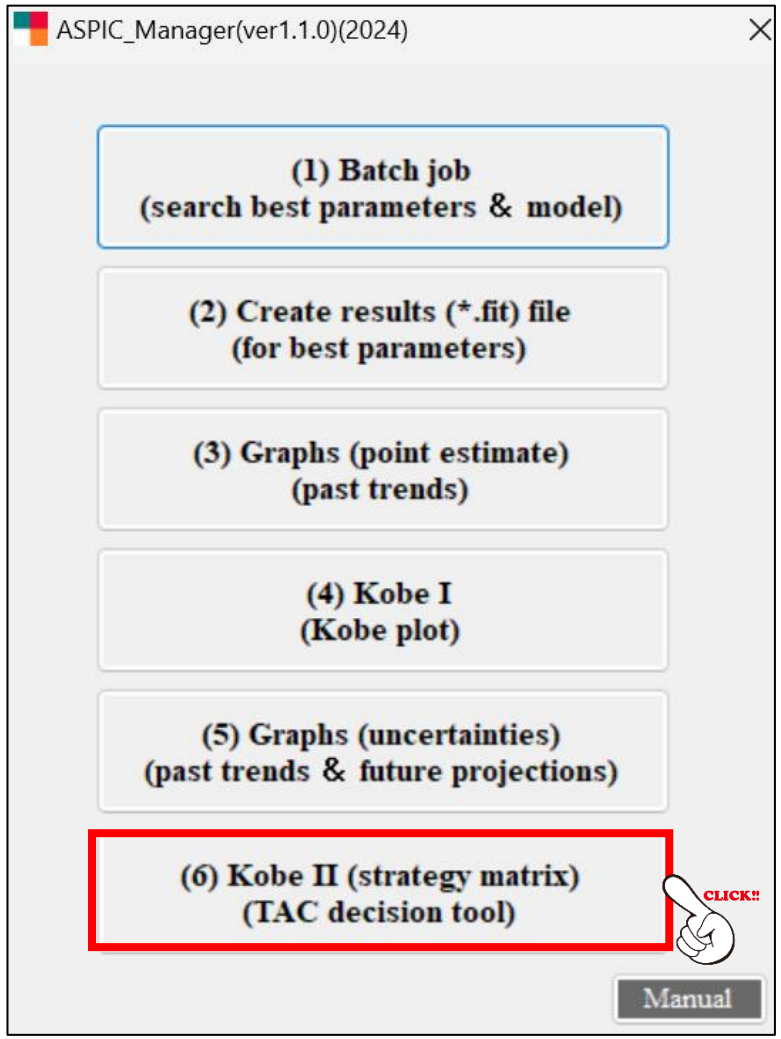


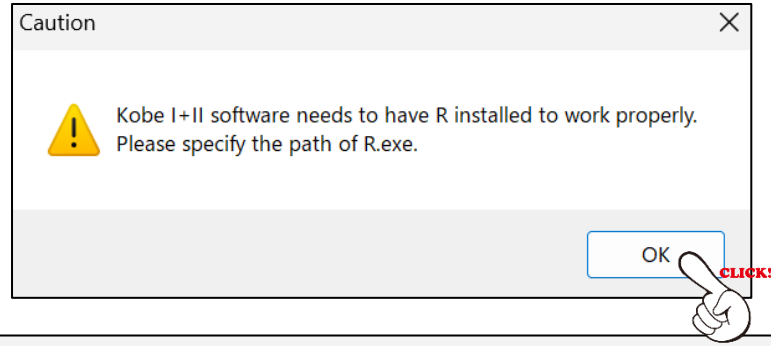


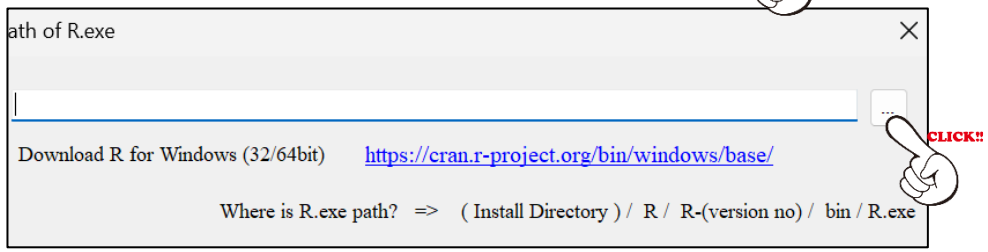
Users will get
the ASPIC_Manager folder

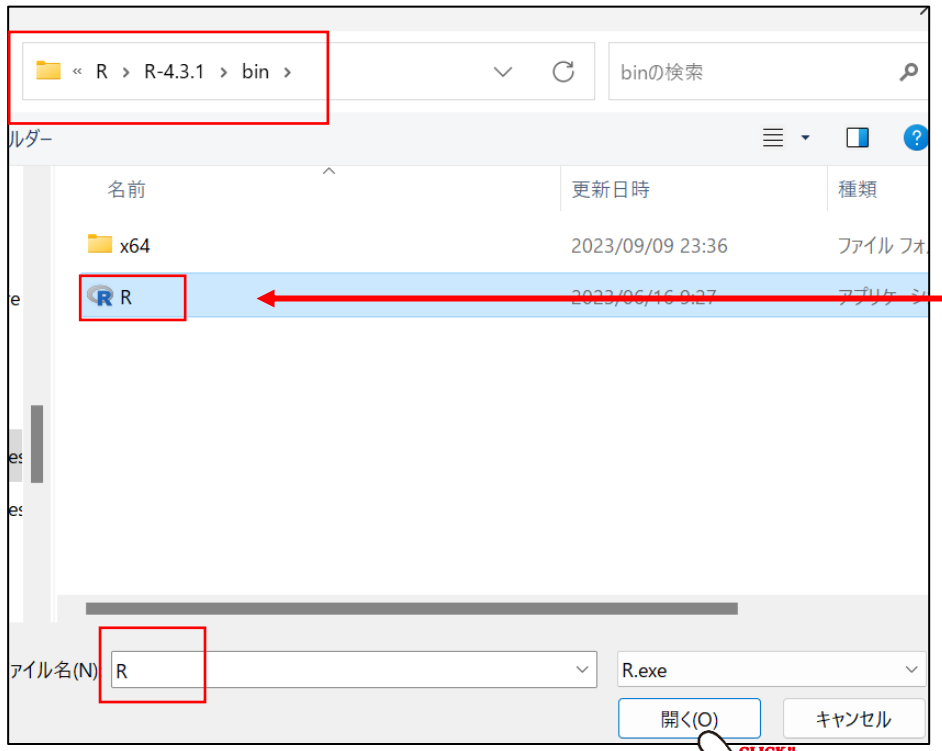


3. Installation
Linking R to ASPIC_Manager









Identify R

4. Running software (6 menus) ASPIC_Manager

4. Running ASPIC_Manager

4.1 Batch job

4. Running software : 4.1 Batch job

ASPIC needs **one input file (*.inp)** (program+ data)to search best parameters & model (batch job).

Program

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

Data

```
CC      ## Series type (CC = CPUE, catch)
1950    -1      3646
1951    -1      2581
1952    -1      2993
1953    -1      3303
1954    -1      3034

        (omitted)

1964    380     11258
1965    240     8652
1966    229     9349
1967    278     9107
1968    220     9172
1969    197     9203
1970    219     9495
1971    -1      5266
1972    -1      4766
1973    -1      6074
1974    -1      6362
1975    350     8839
1976    309     6696
1977    337     6409
1978    445     11835
1979    316     11937
1980    252     13558
1981    231     11180
1982    283     13215
1983    222     14527
1984    213     12791
```

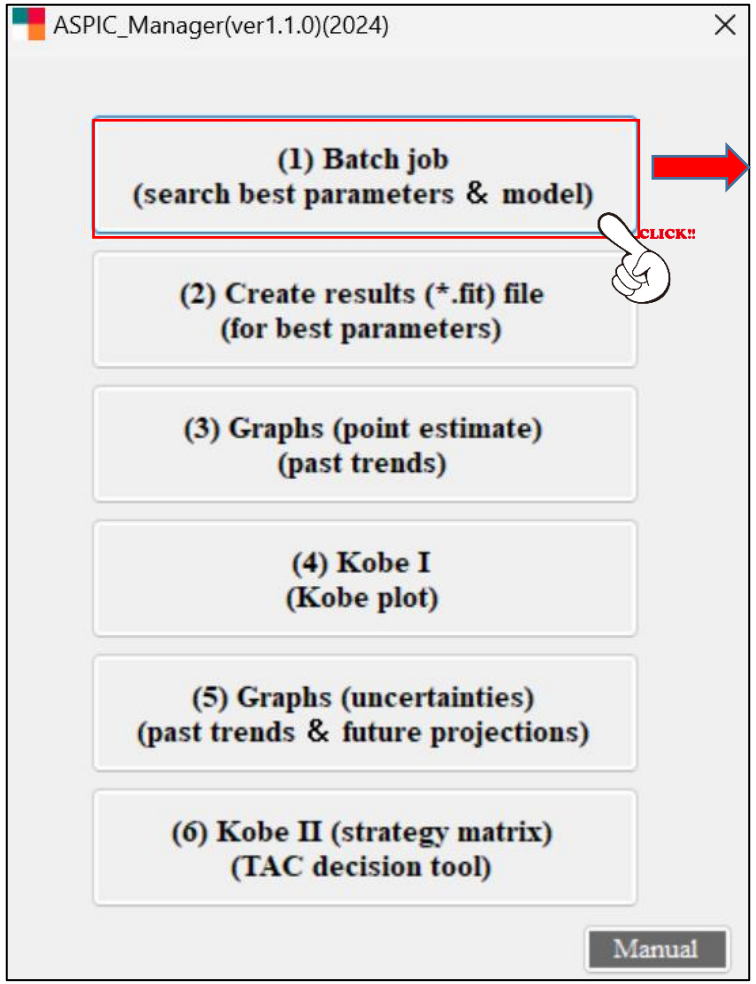
Entry items

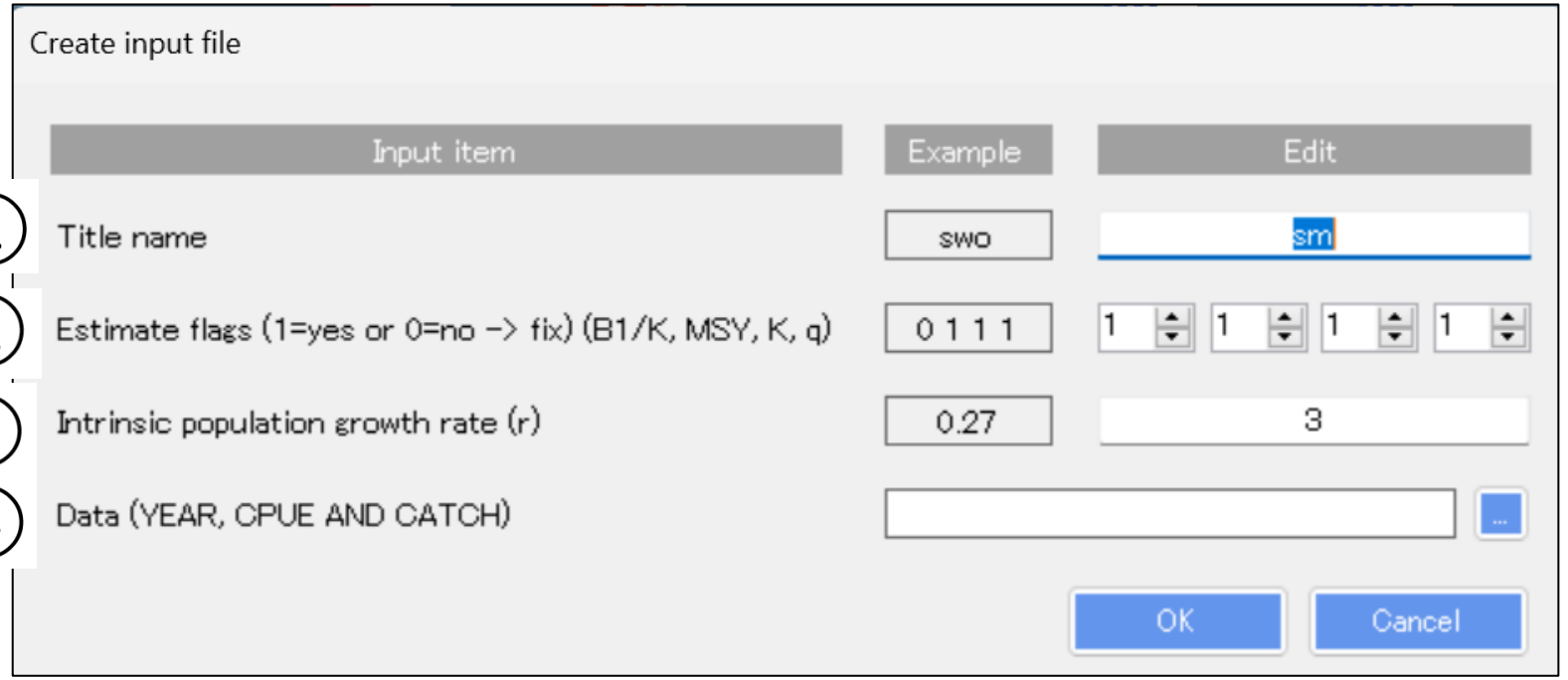
- ***Red boxes*** *:* ***Users must edits*** *(details are explained in this Section 4.1 Batch job).*
- ***Black boxes:*** *Numbers need to be entered using specific computing rules, which are automatically conducted by this software. Thus, users don't need to enter (for details, see* ***Appendix B)****.*
- *For all others: Default values/names will be used. Thus, users don't need to enter.*

Data (YEAR, CPUE CATCH in tons)
Users need to make this data set (see slide #28)

4. Running software : 4.1 Batch job

To start, click menu (1), then entry window will appear (below).
Users need to enter 5 items.





① is self-explanatory. ②~④ are explained in slides #21~#27.

4. Running software : 4.1 Batch job

② What are Estimate flags (1=yes or 0=no➔fix) (B1/K, MSY, K, q) ?

4 parameters (B1/K, K, MSY & q) need to be estimated.

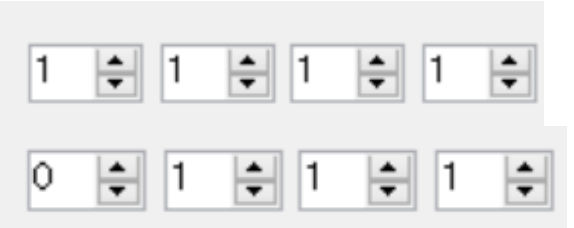
flag=1 (yes to estimate) or flag=0 (no estimate and fix some values)

For example,

If estimate all 4 parameters ➔

If no estimate B1/K (fix some value) ➔

B1/K, MSY, K, q



Normally at the beginning, all 4 parameters will be estimated.

If no convergences (all 4 parameters cannot be estimated)…

➔ 1 or 2 parameters will be fixed to get convergences

(see #37- #41 & #43 for details)

4. Running software : 4.1 Batch job

Relevant information on ②

What is B1/K (start guess or fixed value)(0 to 1)?

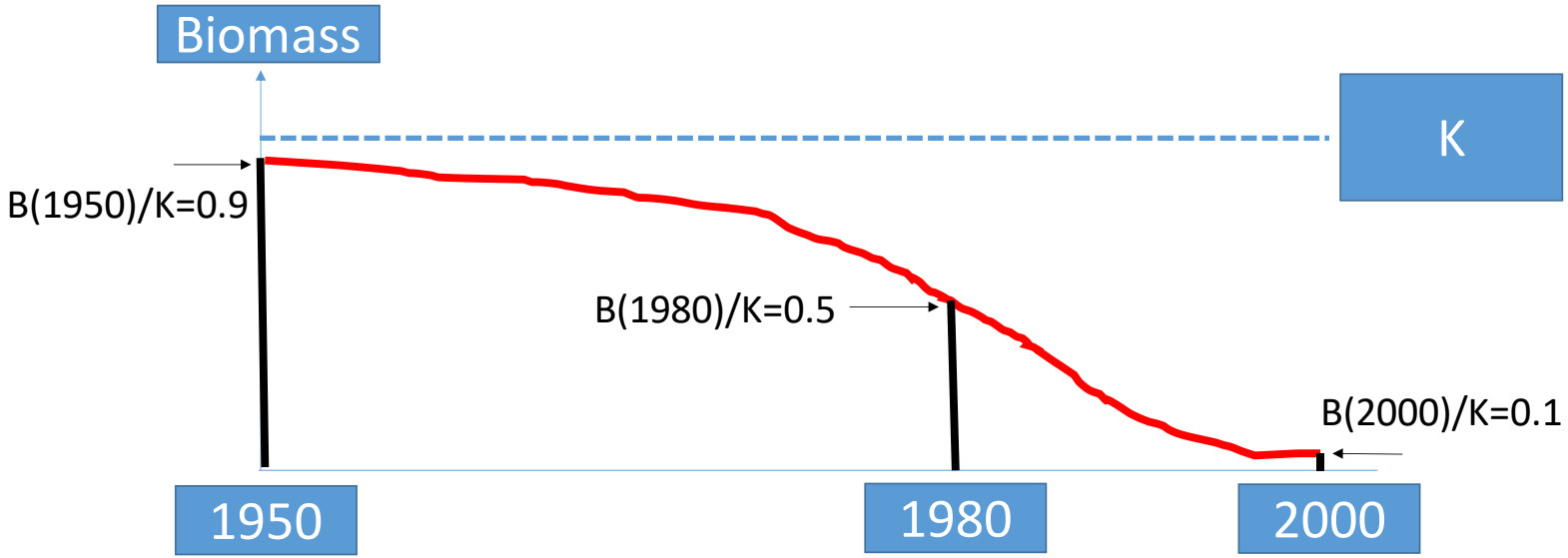
If there are fisheries

[K] Carrying Capacity (Maximum biomass)

[B1] Biomass (1st year of stock assessment) ➔ example: B(1980)

[B1/K] Depression (% decrease from K)➔ example: B(1980)/K=0.5 (50%)

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



Users need to assign one value ➔ Example: B1=B(1980)=0.5

4. Running software : 4.1 Batch job

Relevant information on ②

What is q (catchability coefficient) *(efficiency of catch).*

If gear A catches 2 times higher than gear B in the same effort,

q=1.0 (gear A) and q=0.5 (gear B)

Gear A is 2 times efficient

to catch same amount of catch in the same effort than Gear B

4. Running software : 4.1 Batch job

Relevant information on ②

Assigning initial seeding values for B1/K, MSY, K and q (Batch job)

MSY & K (carrying capacity) ➔ initial guess values & Min/Max values

q (catchability) ➔ initial guess value

Refer to next slide

Computing rules are applied.

This soft will automatically compute and assign.

➔ Thus users don't need to enter, but they understand the background.

4. Running software : 4.1 Batch job

Relevant information on ②

Definition of initial seeding values for 3 parameters (MSY, K and q)

(note) This software will automatically compute these values using definition (below) and assign to the batch job. Thus, users do not need to do this work, but need to understand the meanings.

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

*(*) K=(constant for Schaefer model)*MSY/r, where r is the intrinsic population growth rate (see slide #27-#28)*

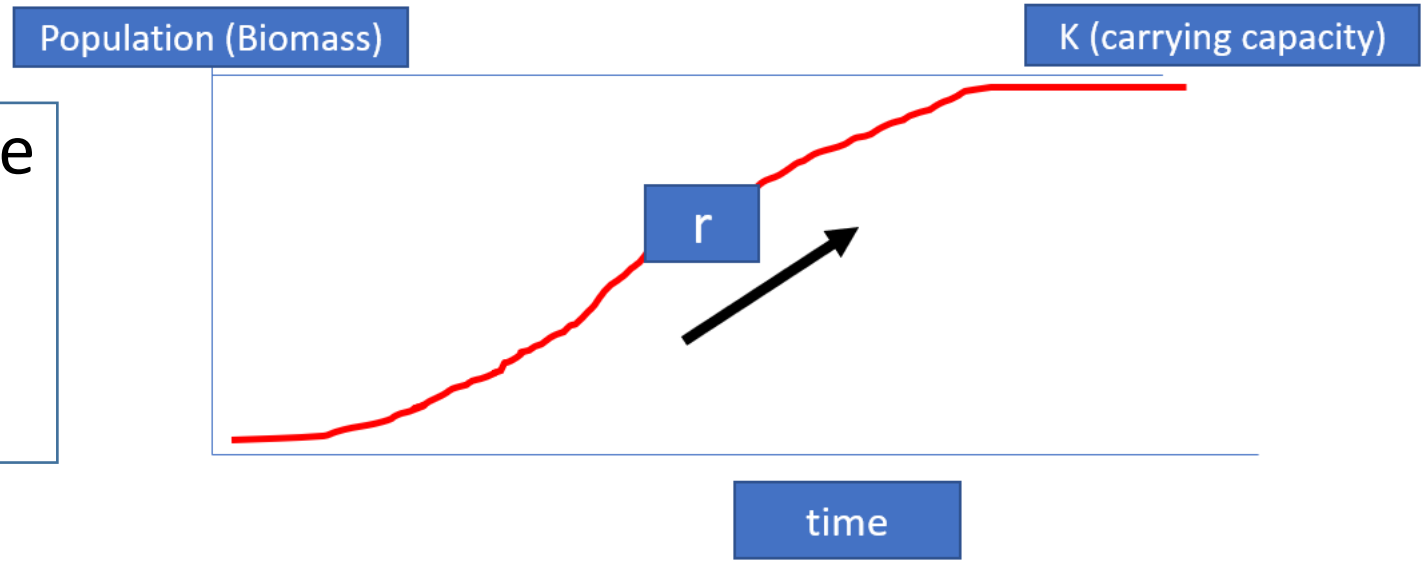
4. Running software : 4.1 Batch job

Relevant information on ③

What is the intrinsic population growth rate (r) ?

Speed of population increase

All the time
Even
there are
fisheries



r is different by species

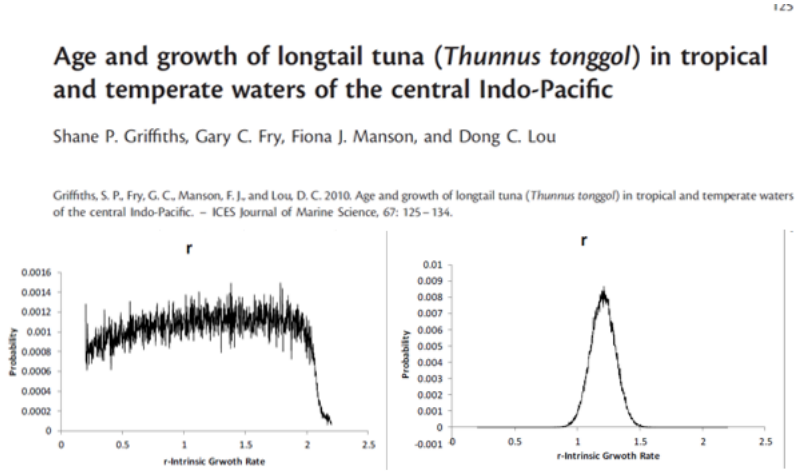
long live species ➔smaller r short live species➔ larger r

4. Running software : 4.1 Batch job intrinsic population growth rate (r)

r can be found FAO FishBase and/or Literatures

FishBase

Estimated r can be also found results of stock assessment.



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

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

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

Froese et al. (2017)

Table (below) shows examples
Range and selection of representative r
(LOT: longtail tuna and KAW: Kawakawa)

Area	Reference
World wide	Fishbase
Indian Ocean	Zhou and Sharma (2014)
Indian Ocean	IOTC (2015)
World wide	Fishbase
Indian Ocean	Sharma (2013)
Indian Ocean	Zhou and Sharma (2014)

sp	this WS (ave of Indian Ocean)	area	source	r														
				0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2	1.3	1.4
LOT	0.99	world wide	Fish base				0.32											
		Indian Ocean	Zhou and Shama (2014)										0.94					
			IOTC(2015)										1.03					
KAW	1.34	world wide	Fish base							0.57								
		Indian Ocean	Shama (2013)															1.37
			IOTC(2015)														1.3	

4. Running software : 4.1 Batch job

④

What is
Data (YEAR, CPUE, CATCH)?

3 basic input data

Make input file (excel)
(e.g. test.xlsx)
Put the file in working folder

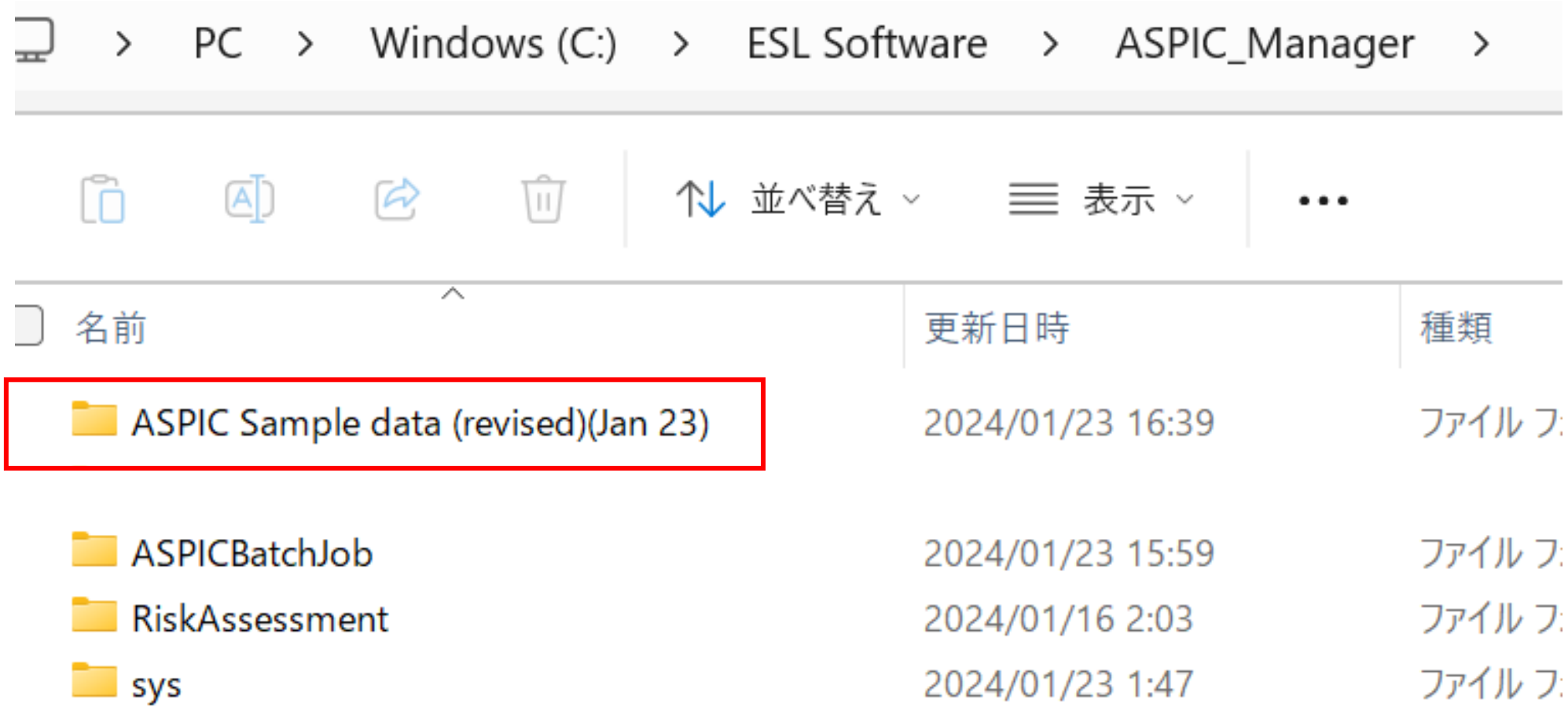
Missing CPUE value = -1

At least latest 4 consecutive years of CPUE data is needed, otherwise ASPIC will not run.

	A	B	C
1	YEAR	CPUE	CATCH
2	1950	-1	3646
3	1951	-1	2581
4	1961	-1	4381
5	1962	-1	5342
6	1963	-1	10190
7	1964	380	11258
8	1965	240	8652
9	1966	229	9349
10	1967	278	9107
11	1968	220	9172
12	1969	197	9203
13	1970	219	9495
14	1971	-1	5266
15	1972	-1	4766
16	1973	-1	6074
17	1974	-1	6362
18	1975	350	8839

Catch (tons)

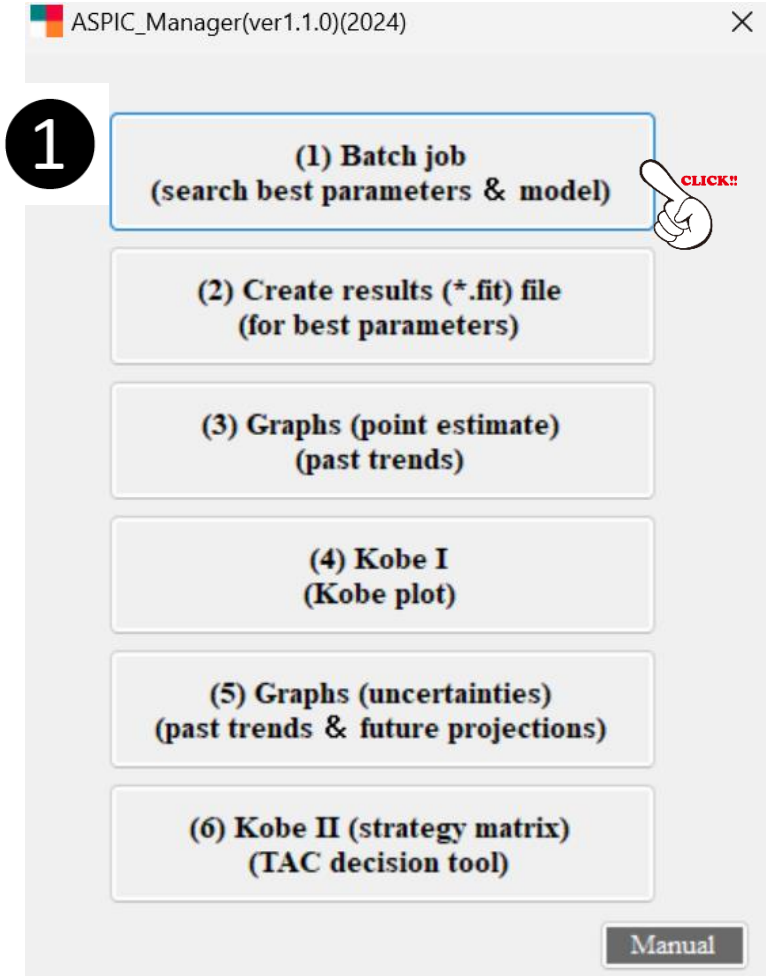
Now we will practice using Sample data (Revised)



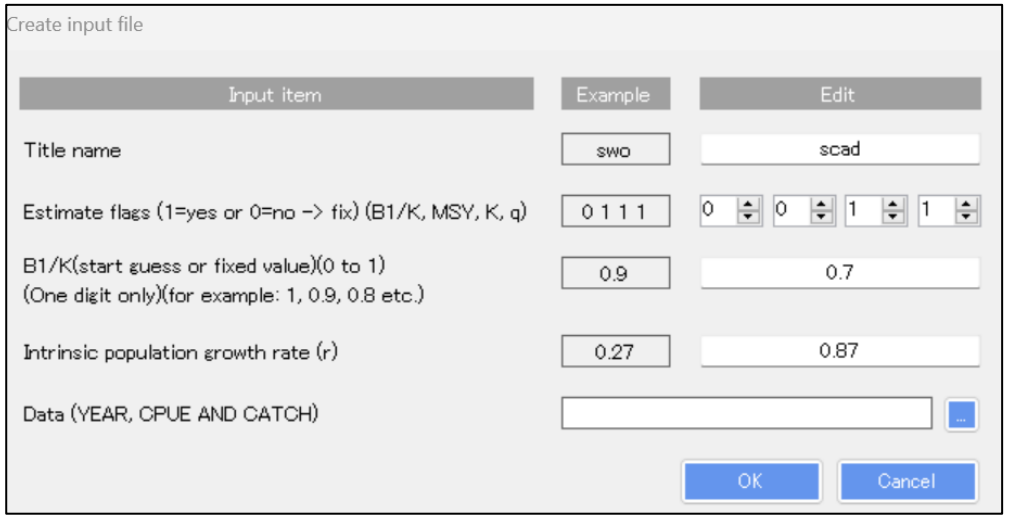
4. Running software : 4.1 Batch job

Starting the batch job & Set up

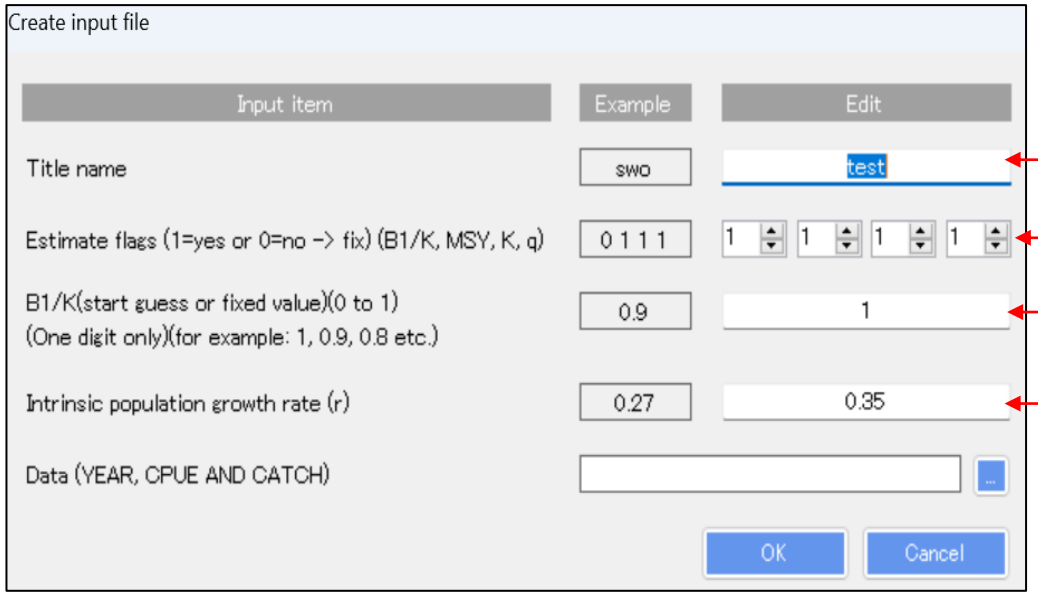
Follow ❶～ ⓫



❷ Previous input information will appear.



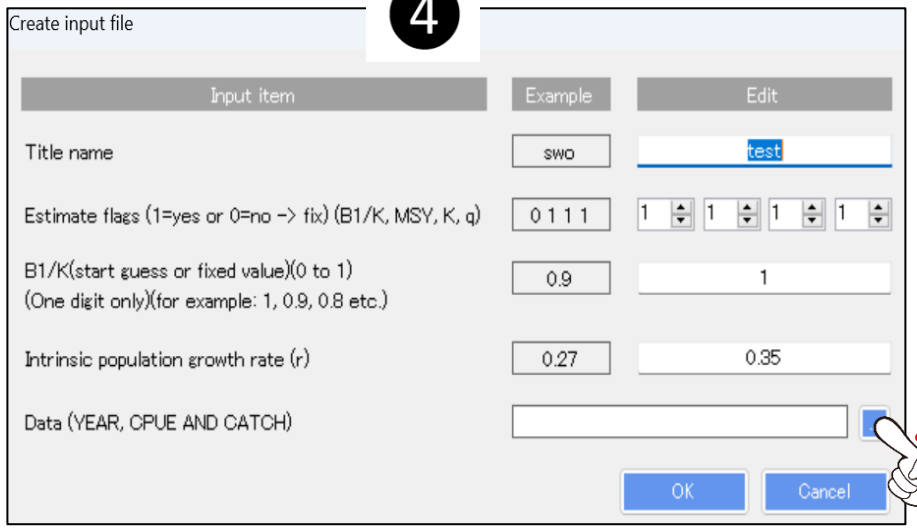
❸ Change to the current information



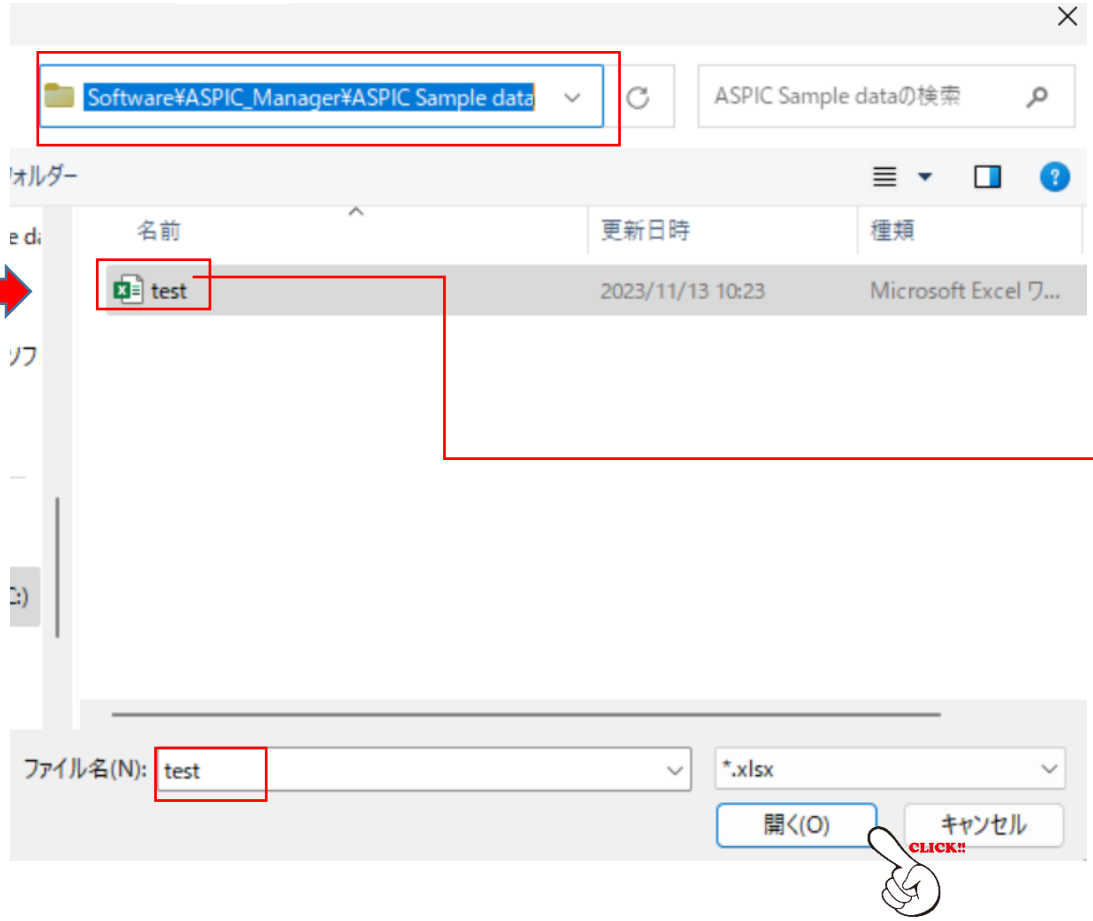
4. Running software 4.1 Batch job

Importing the input file (catch & effort) data

4

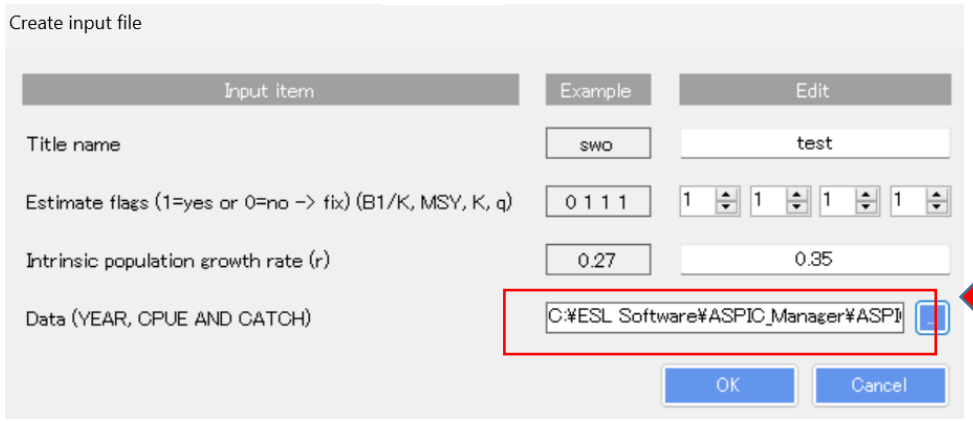


5 Select the test.xlsx file



	A	B	C
1	YEAR	CPUE	CATCH
2	1950	-1	3646
3	1951	-1	2581
4	1952	-1	2993
5	1953	-1	3303
6	1954	-1	3034
7	1955	-1	3502
8	1956	-1	3358
9	1957	-1	4578
10	1958	-1	4904
11	1959	-1	6232
12	1960	-1	3828
13	1961	-1	4381
14	1962	-1	5342
15	1963	-1	10190
16	1964	380	11258
17	1965	240	8652
18	1966	229	9349

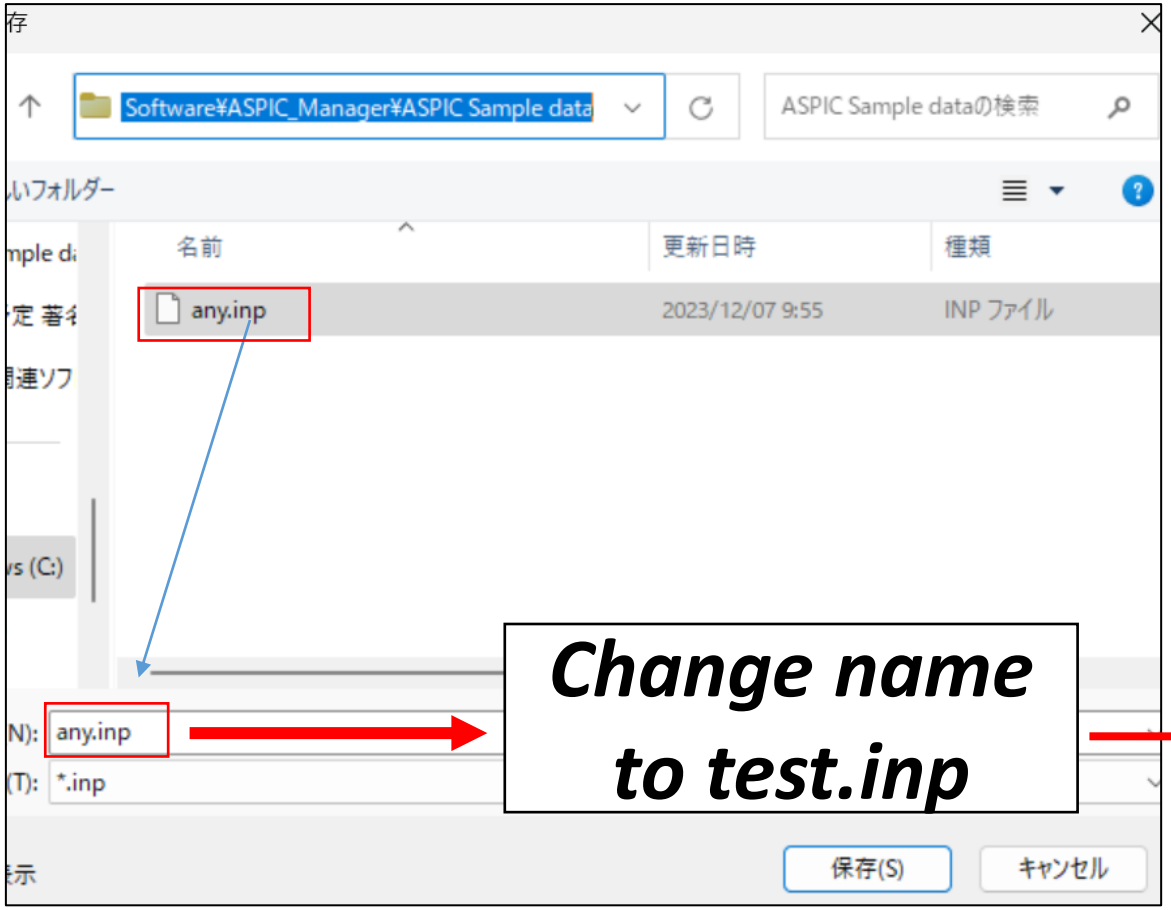
6

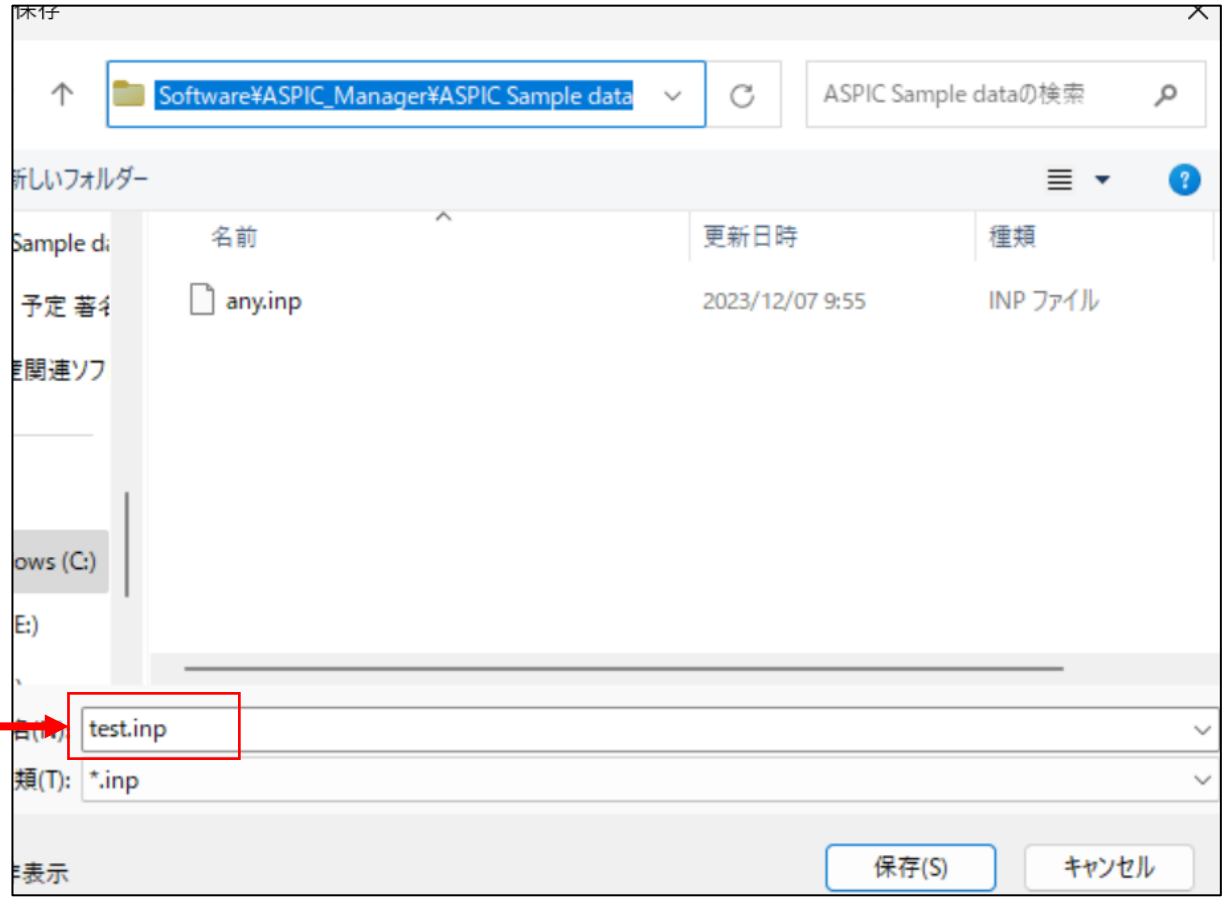


The test.xlsx file is imported from
C：¥ESL Software¥ASPIC_Manager¥ASPIC(Sample data)¥folder

4. Running software: 4.1 Batch job

❼ Creating the new input file by overwriting to the any previous input file.
Example(below) any.inp ➔ test.inp





4. Running software
4.1 Batch job

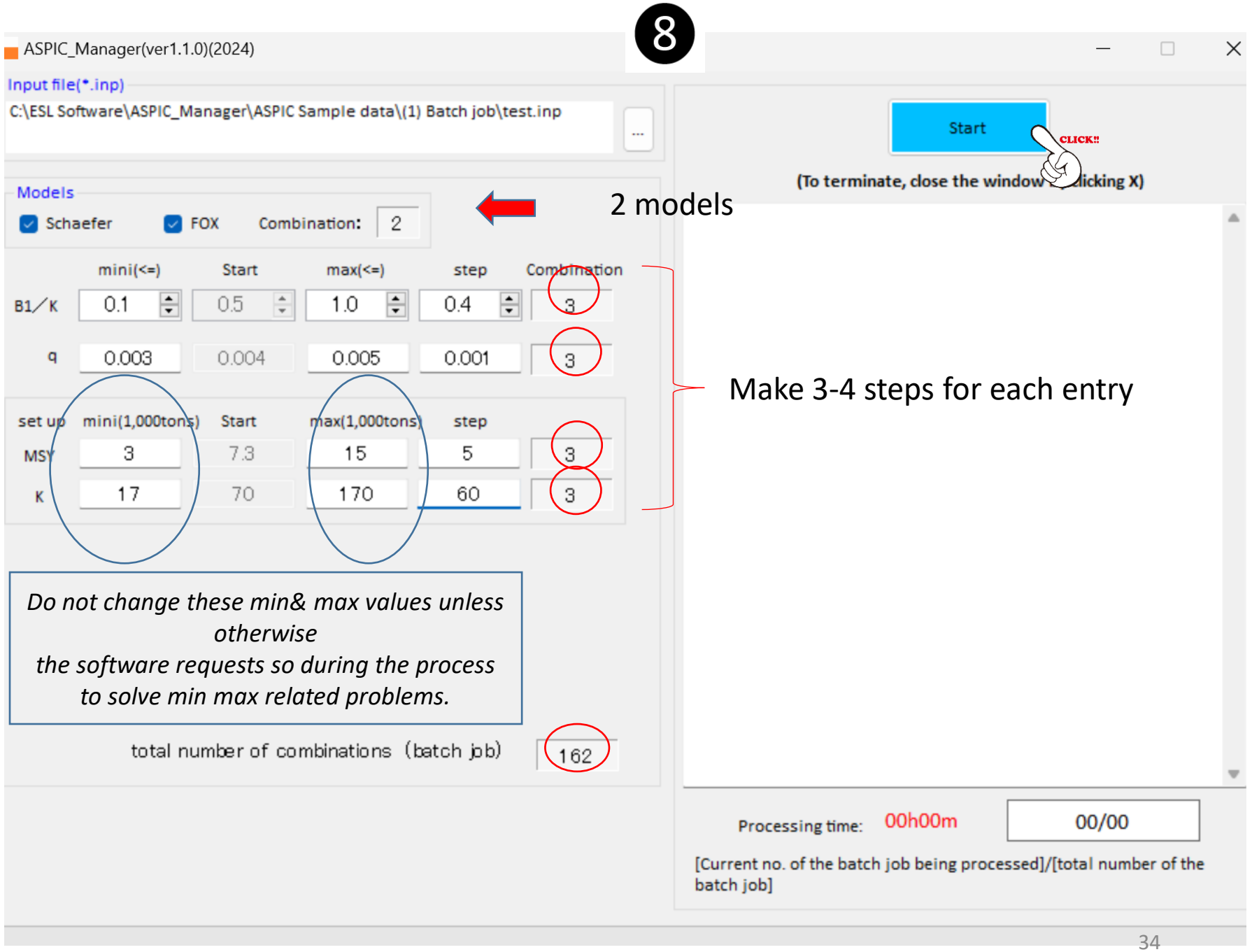
Setting up entries for the batch job

After creating the (new) test.inp file, the batch job window will appear.

Edit entries
3-4 steps
for each entry
(B1/K, q. MSY, K)

↓

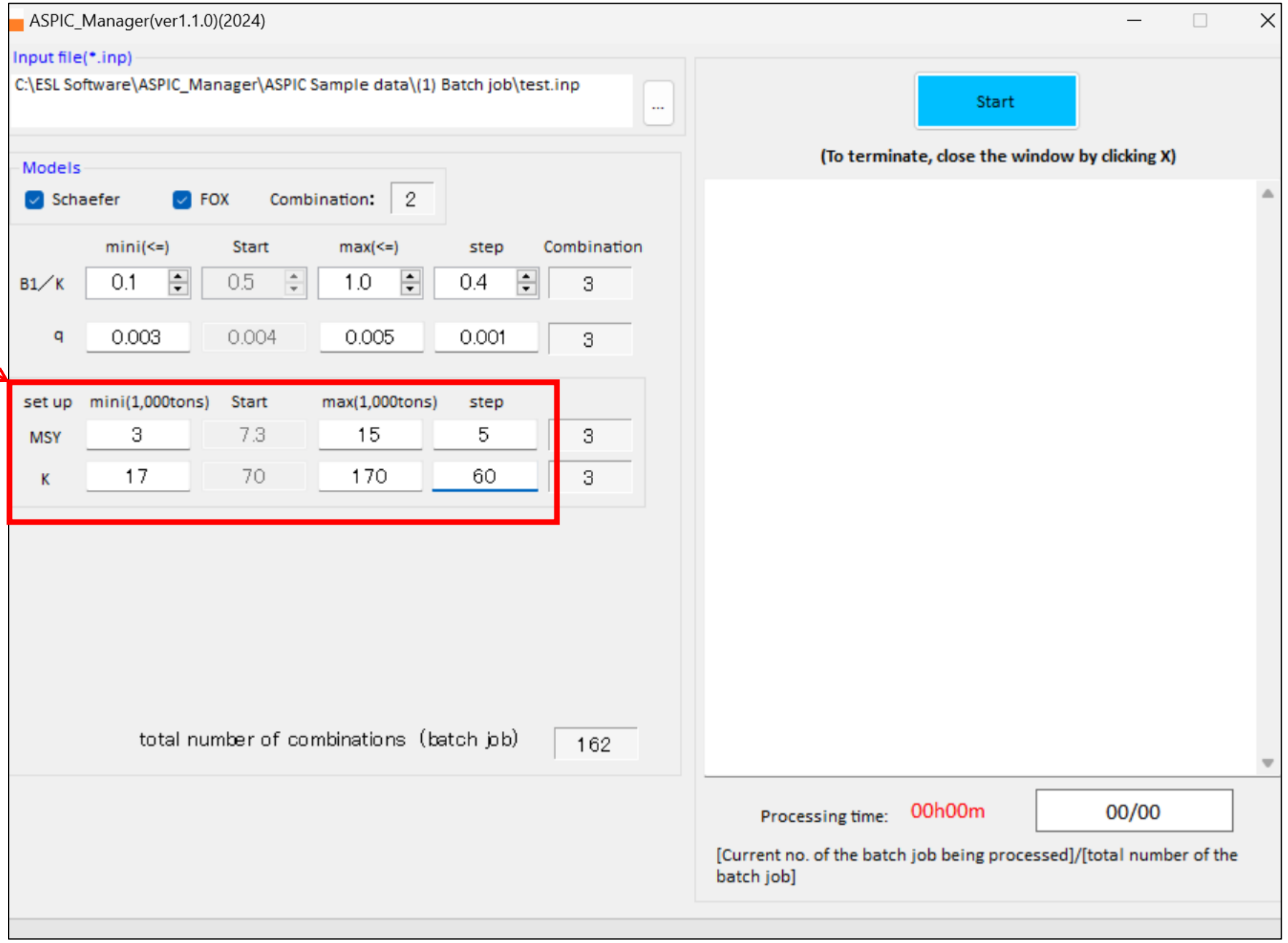
162 combinations (runs)



Important note

Even when values of MSY & K for mini, start & max are valid, for some cases, there will be warning messages for invalid values and no results.

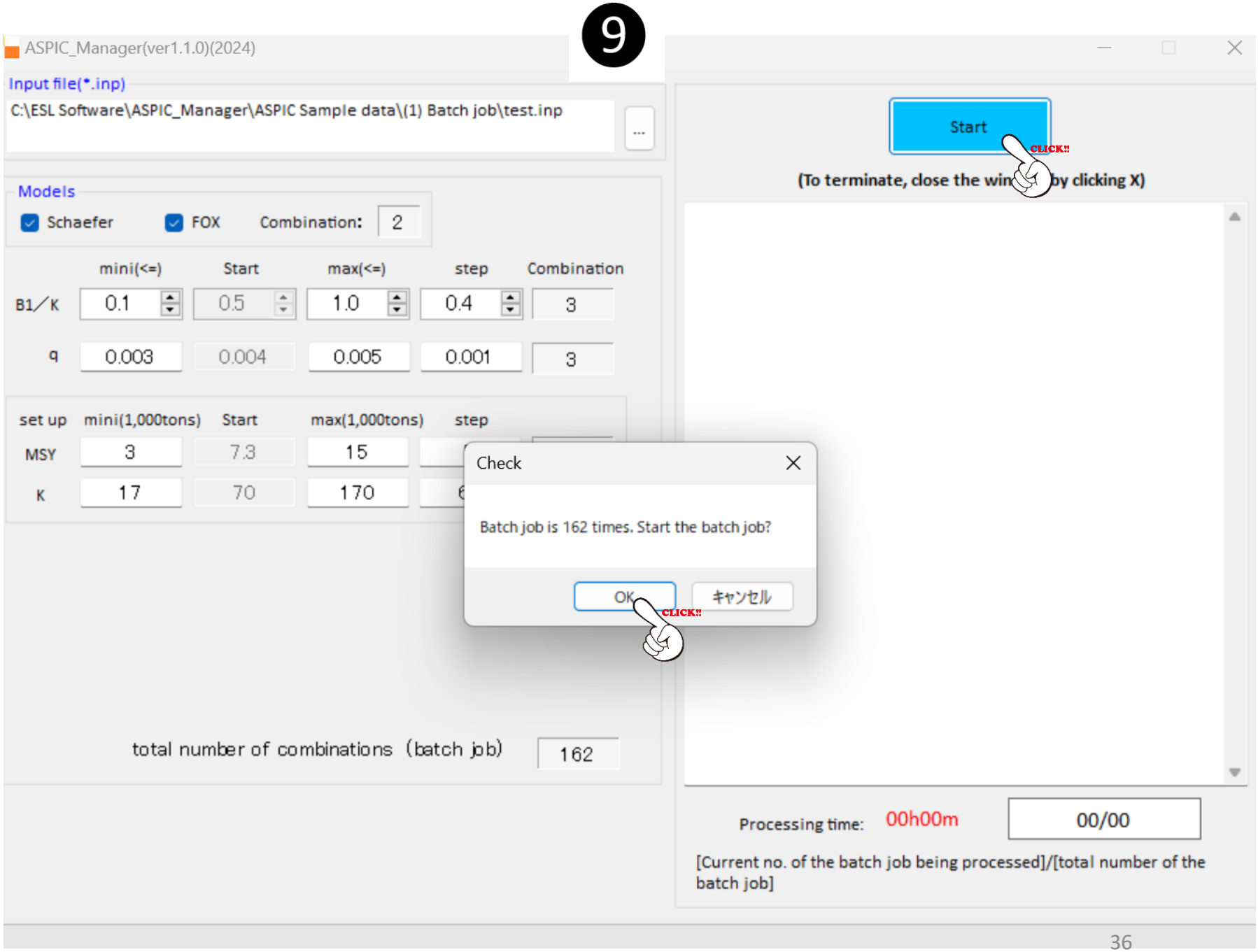
This is caused by r values. In such case, try other r values, then there will be no warnings and results will be obtained.



4. Running software
4.1 Batch job

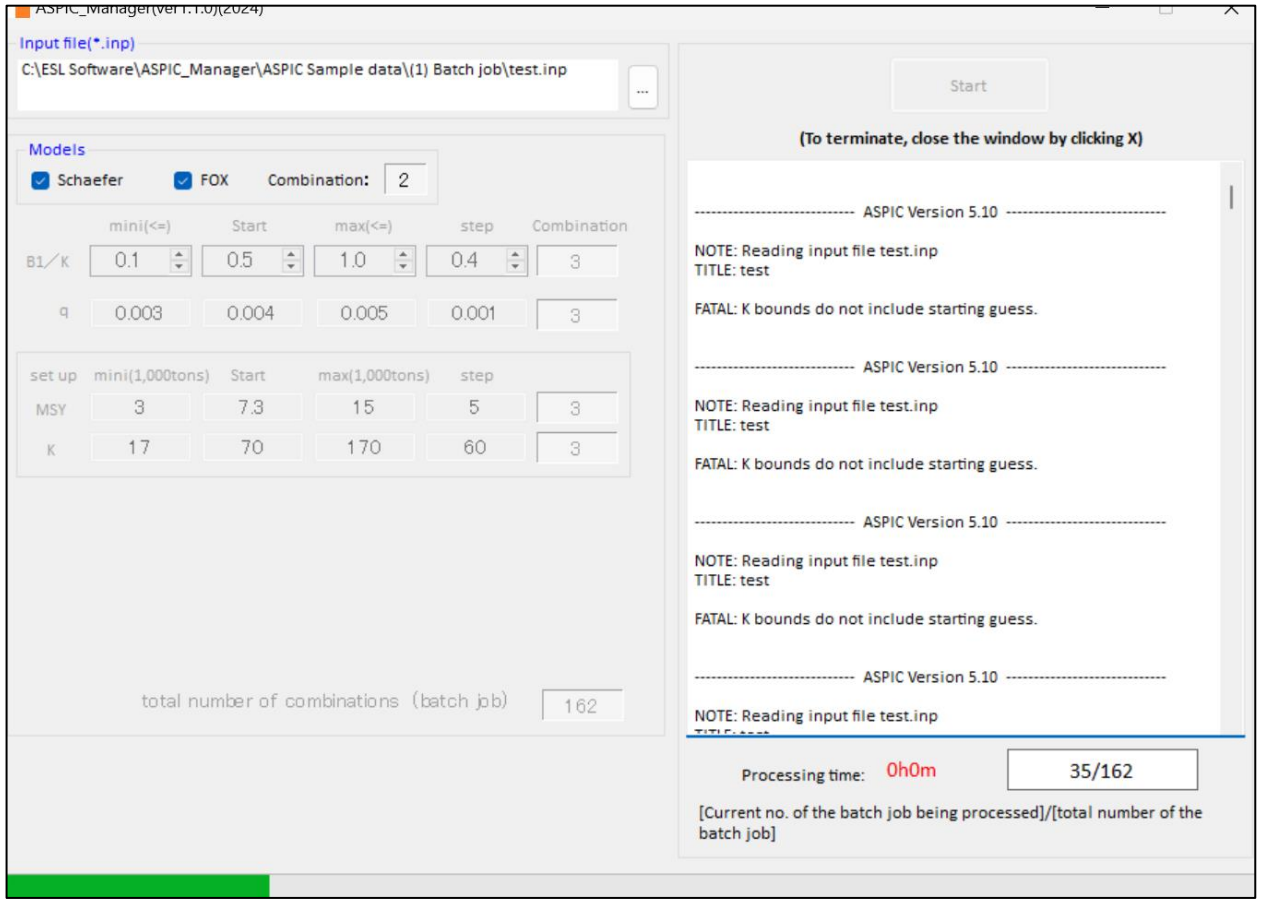
After clicking the start button, the confirmation (check) window will appear.
If OK, click OK.

If not OK, click cancel and revise entries.

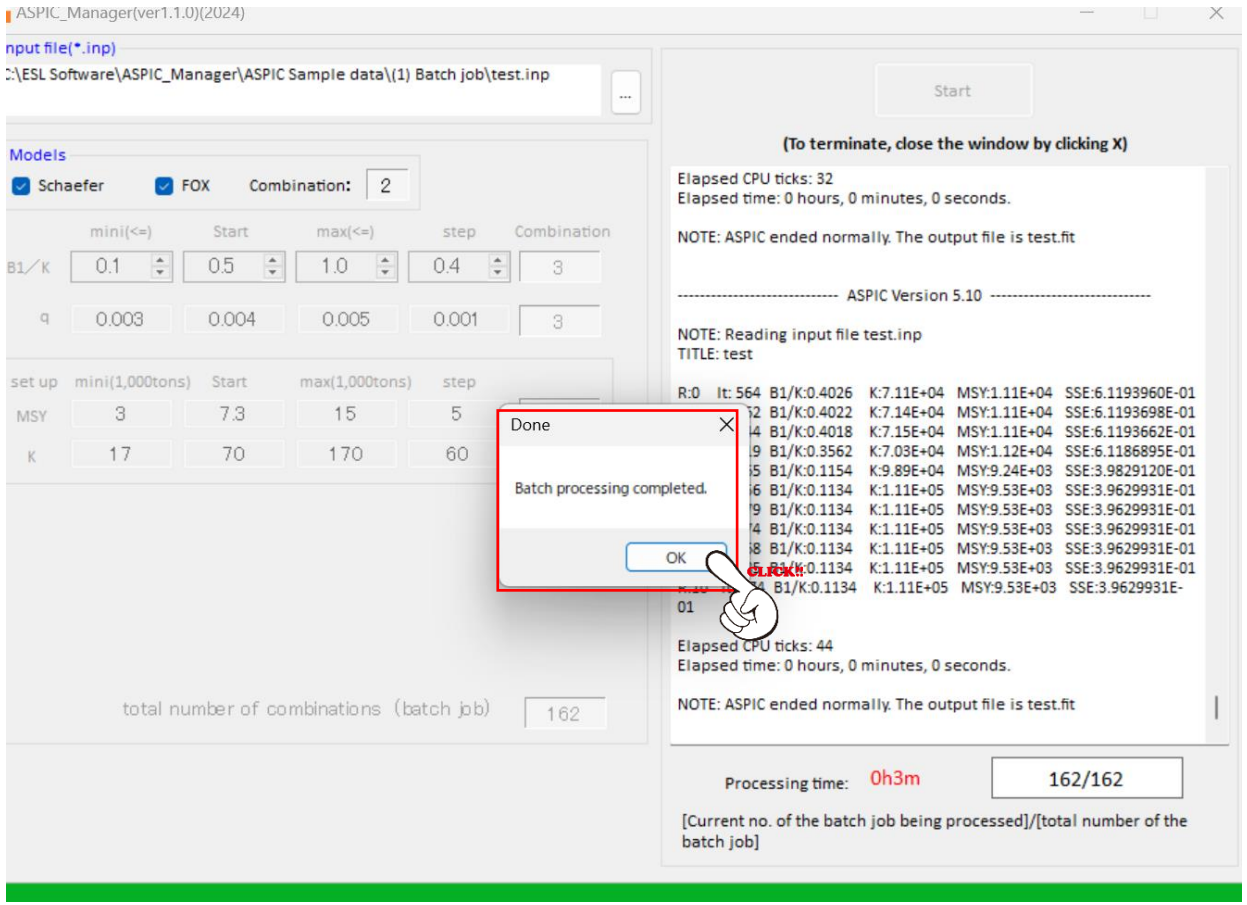


4. Running software: 4.1 Batch job

⑩ Snapshot of the processing during the batch job (35th run)

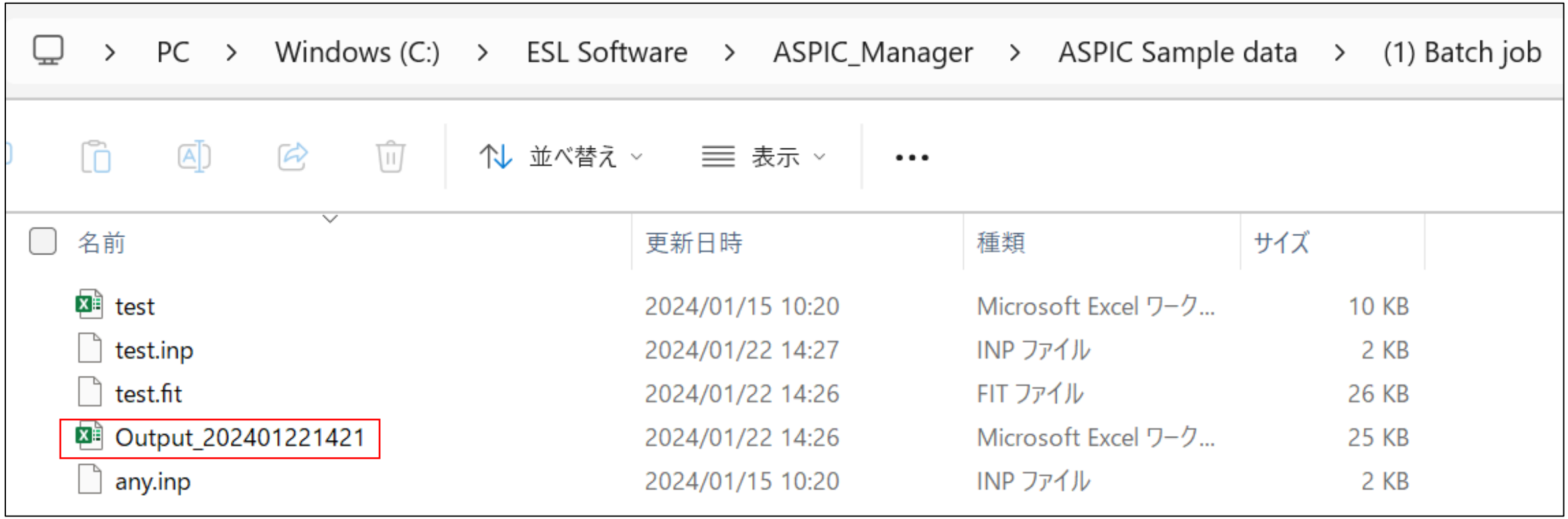


⑪ Batch job done message Click OK



4. Running software: 4.1 Batch job

Results of all runs will be stored in the excel file with time stamp.



4. Running software: 4.1 Batch job Results

Results (Excel file) (2 sheets)➔ ”Converged” & “Not converged/Errors”

Users will use the “Converged” sheet to select the best parameters (see next slide).

If no results in “Converged sheet”, users need to fix one parameter & re-run the batch job (see #38-#40 for details)

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

Run time information

Information for the batch job

See the next slide, how to decide the best parameters using results.

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

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

Converged | Not converged or Errors

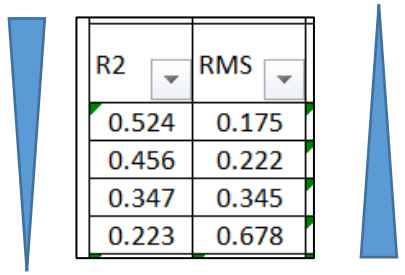
4. Running software: 4.1 Batch job

How to decide the best parameters using results

Step 1: Sort R2: descending & RMS: ascending order.

R2: Correlation coefficient and RMS: Root Mean Square Error

➔ R2: Higher and RMS: lower better



R2	RMS
0.524	0.175
0.456	0.222
0.347	0.345
0.223	0.678

Step 2 Check B1/K if OK.

For this case, B1/K=0.113 is too low as it is he virgin stock (should be close to 1).

Best answer →

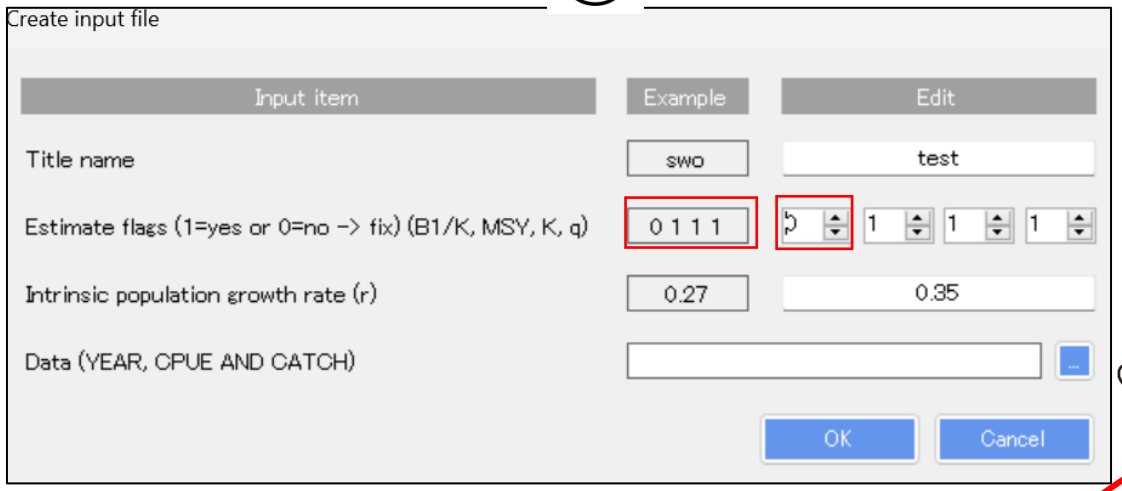
Results													
R2	RMS	r [Est]	Model	B1/K [Est]	MSY [Est]	K [Est]	q [Est]	Current catch	TBmsy [Est]	TB [Est]	Fmsy [Est]	B/Bmsy [Est]	F/Fmsy [Est]
0.524	0.175	0.3435	Schaefer	0.113	9.533	111	0.0066	12.79	55.52	31.7	0.172	0.472	2.58
0.524	0.175	0.3436	Schaefer	0.113	9.534	111	0.0066	12.79	55.52	31.69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

We cannot accept this result. As next step, we will fix B1/K=1 & do batch job again

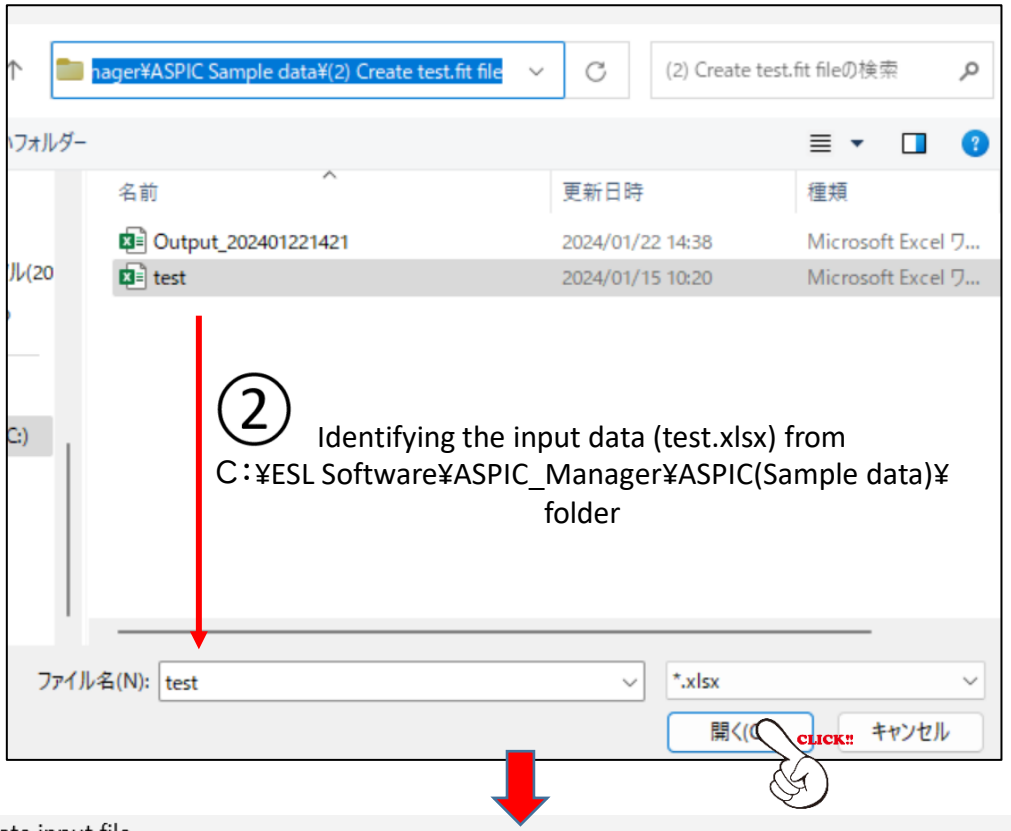
4. Running software: 4.1 Batch job

Fix B1/K =1 because of the virgin stock
(B1 ≈ K)
then, re-run the batch job (same process)

①

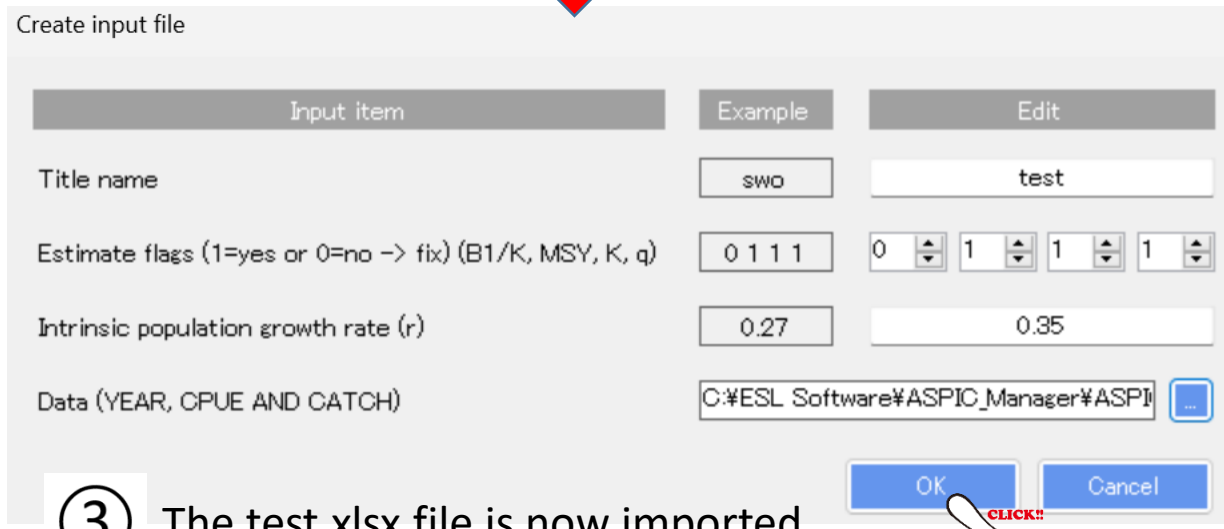


Click to Import
the input data



②

Identifying the input data (test.xlsx) from
C：¥ESL Software¥ASPIC_Manager¥ASPIC(Sample data)¥
folder

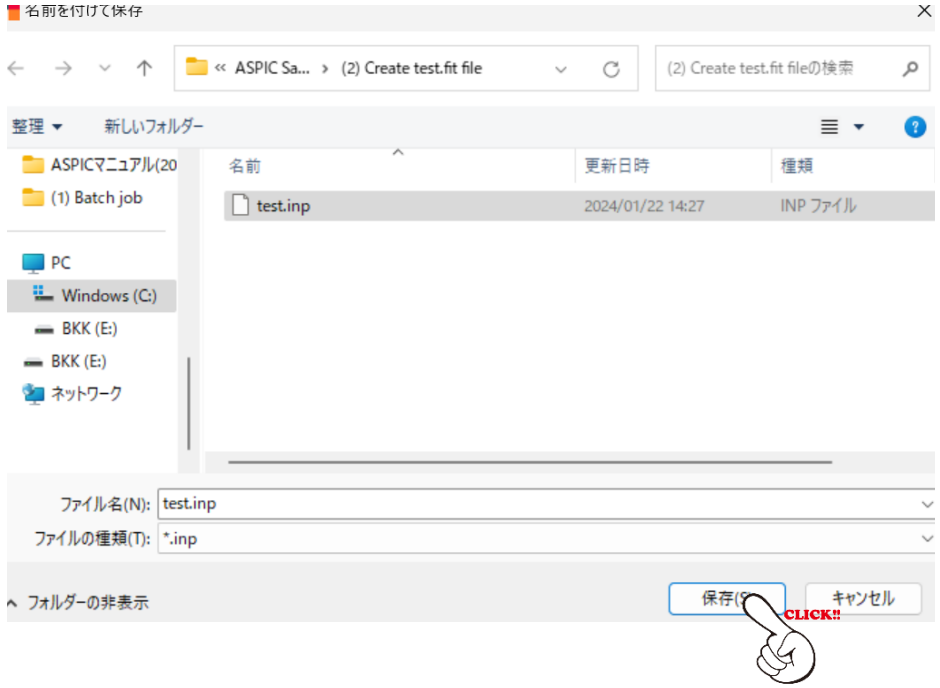


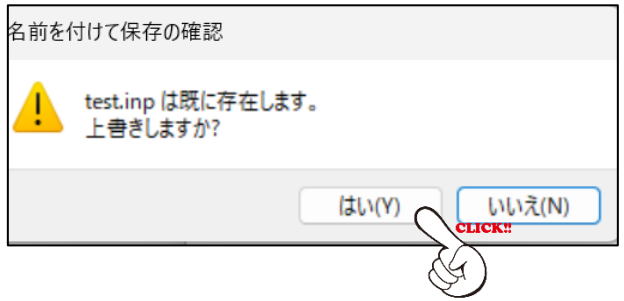
③ The test.xlsx file is now imported

4. Running software: 4.1 Batch job

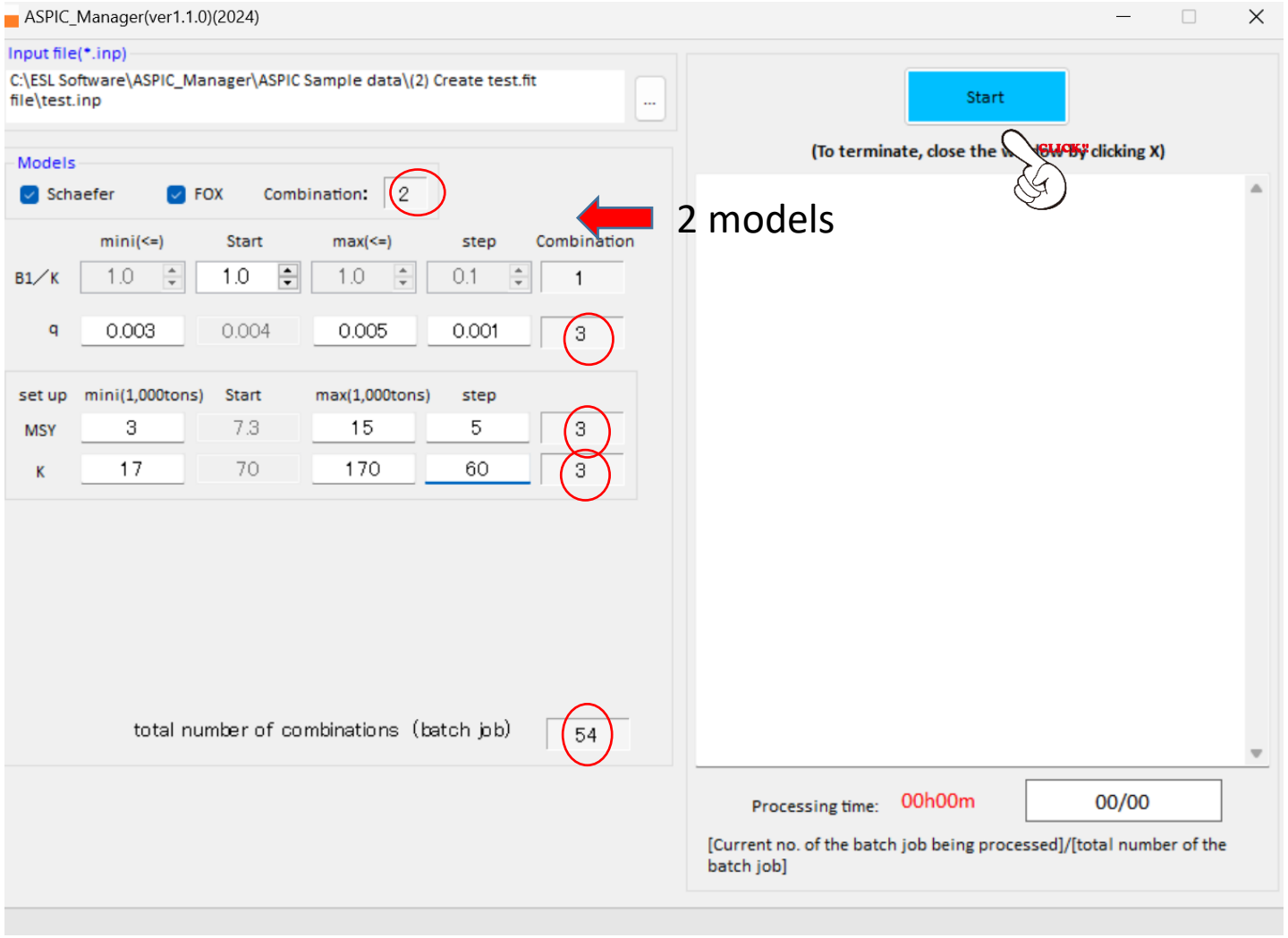
Fix B1/K =1 because of the virgin stock (B1 ≈ K), then re-run the batch job

④ Save the same input file name as before (test.inp) by overwriting





⑤ Edit the parameters as before except B1/K =1 (fixed), so need to enter values.



4. Running software
4.1 Batch job

Re-running

the batch job

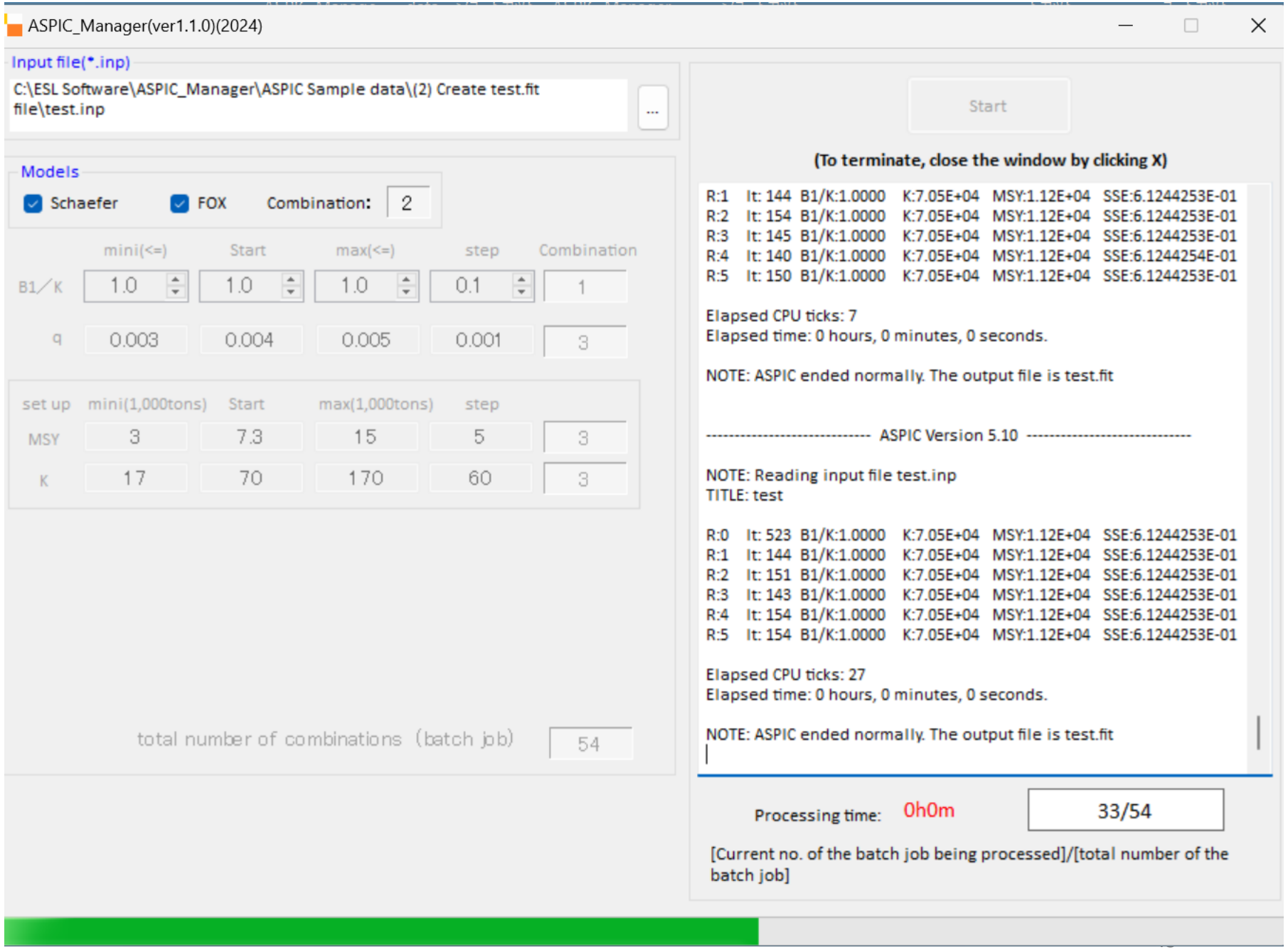
by fixing B1/K=1

because

the initial run did not produce plausible results

and

the virgin stock is assumed (B1/K).



4. Running software: 4.1 Batch job

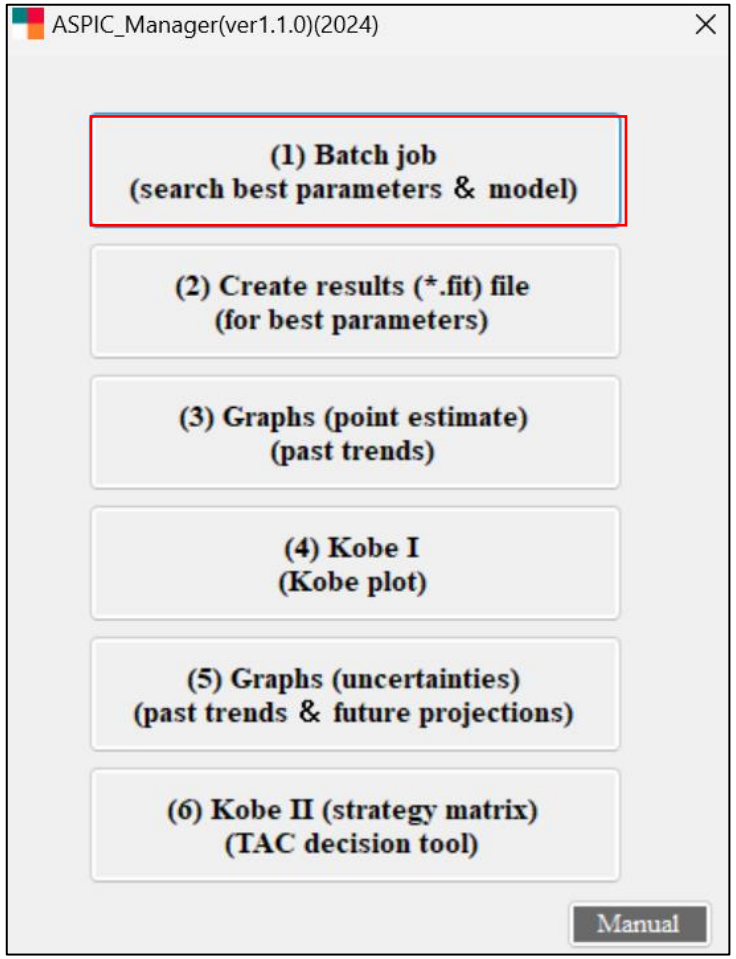
Results													
R2	RMS	r [Est]	Model	B1/K [Fix]	MSY [Est]	K [Est]	q [Est]	Current catch	TBmsy [Est]	TB [Est]	Fmsy [Est]	B/Bmsy [Est]	F/Fmsy [Est]
0.295	0.209	0.6334	Schaefer	1.000	11.16	70.48	0.0054	12.79	35.24	38.74	0.317	1.05	1.07
0.294	0.209	0.6334	Schaefer	1.000	11.16	70.48	0.0054	12.79	35.24	38.74	0.317	1.05	1.07

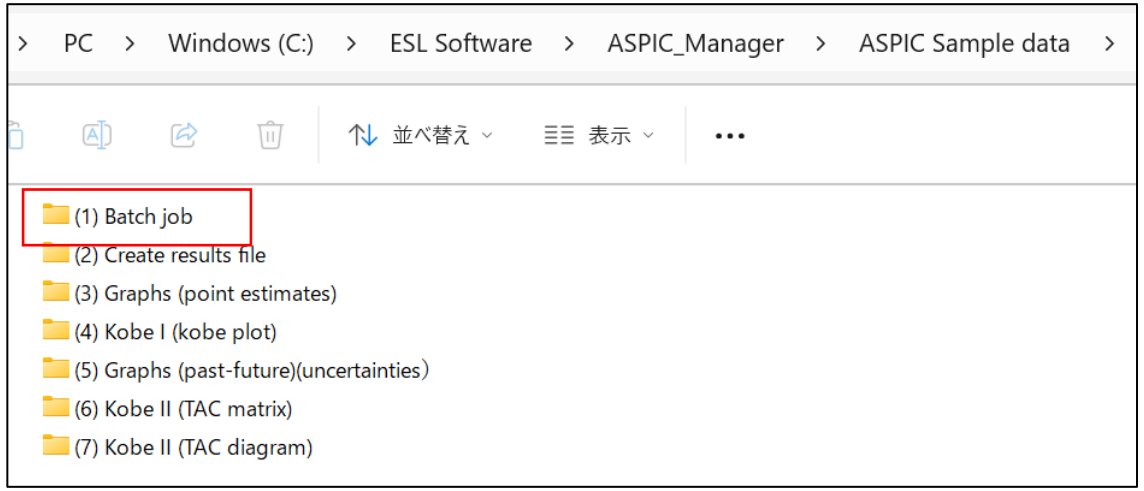
Run with the highest R2 & the Lowest RMS
was selected as the best answer

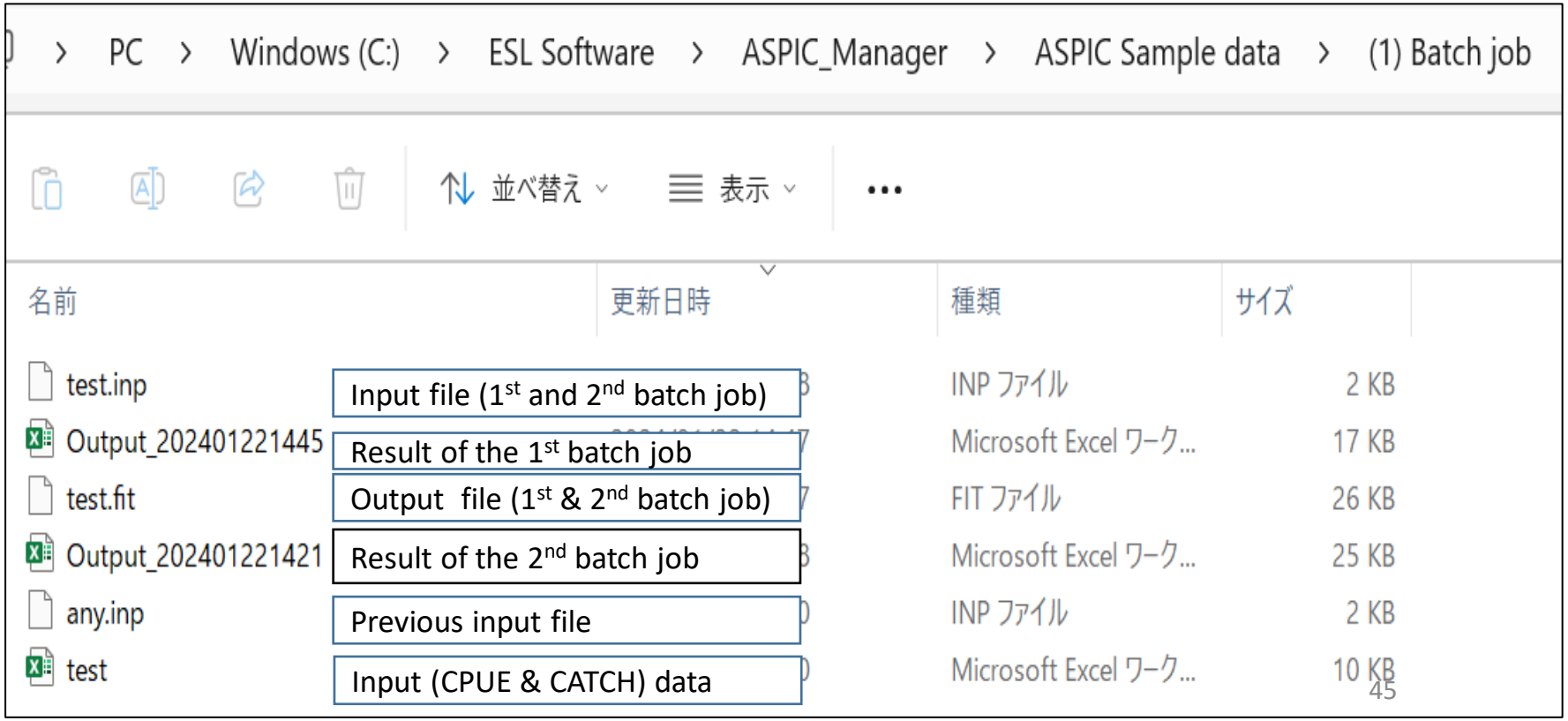
Estimated r=0.63 different from r=0.35

4. Running software:
4.1 Batch job

ASPIC Sample data
List of INPUT & OUTPUT files for menu (1) Batch job



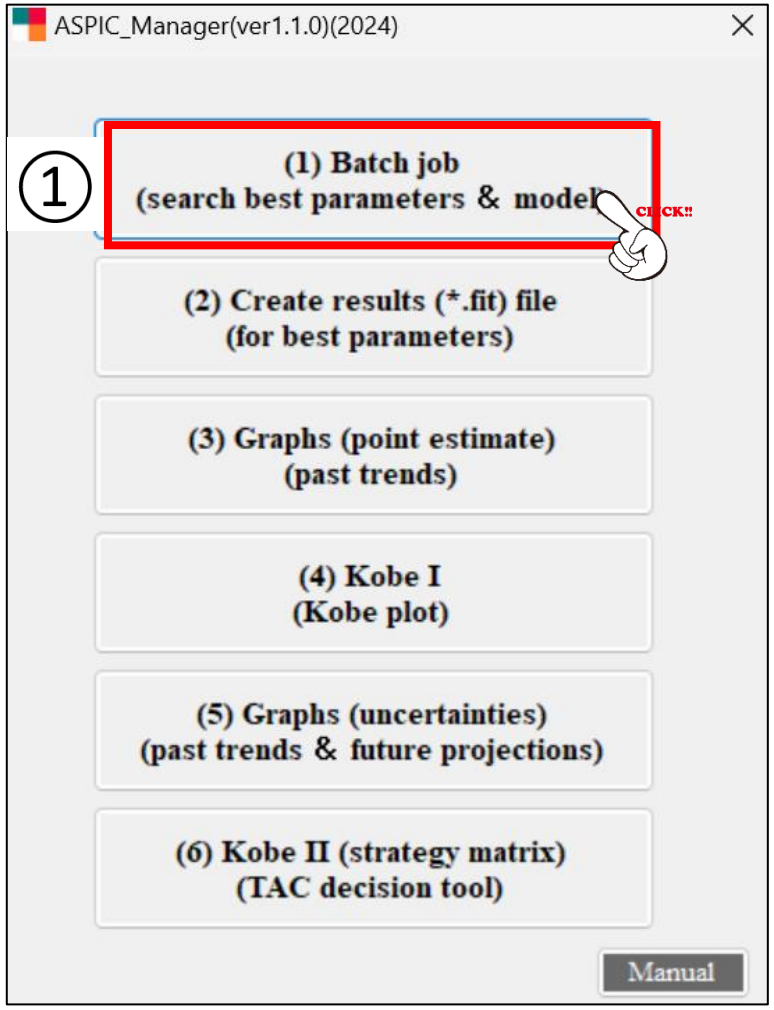




4. Running software: 4.1 Batch job Summary

- Data QC ➔ check catch & CPUE
- Batch job is the most fundamental part of ASPIC (80%).
- Need to estimate the best solution for 4 parameters & Model, i.e.,
  ➔ 4 parameters(B1/K, MSY, M & q) and Model (Schaefer or Fox)
- In the 1st trail, estimate all 4 parameters (1111) and Model.
- To select the best run, choose the run with **highest R2 and lowest RMS**.
  (Check B1/K. If not realistic, fix B1/K=1 (if the virgin stock). Do the same)
- If no answers (convergences), check data.
- If data OK, fix 1 parameter (e.g., 0111).
- If still no answer, fix 2 (e.g., 0101).
- If still no➔ not possible to do ASPIC (one of answers/results)

4. Running software:
4.2 Creating results (*.fit) file for best parameters & model



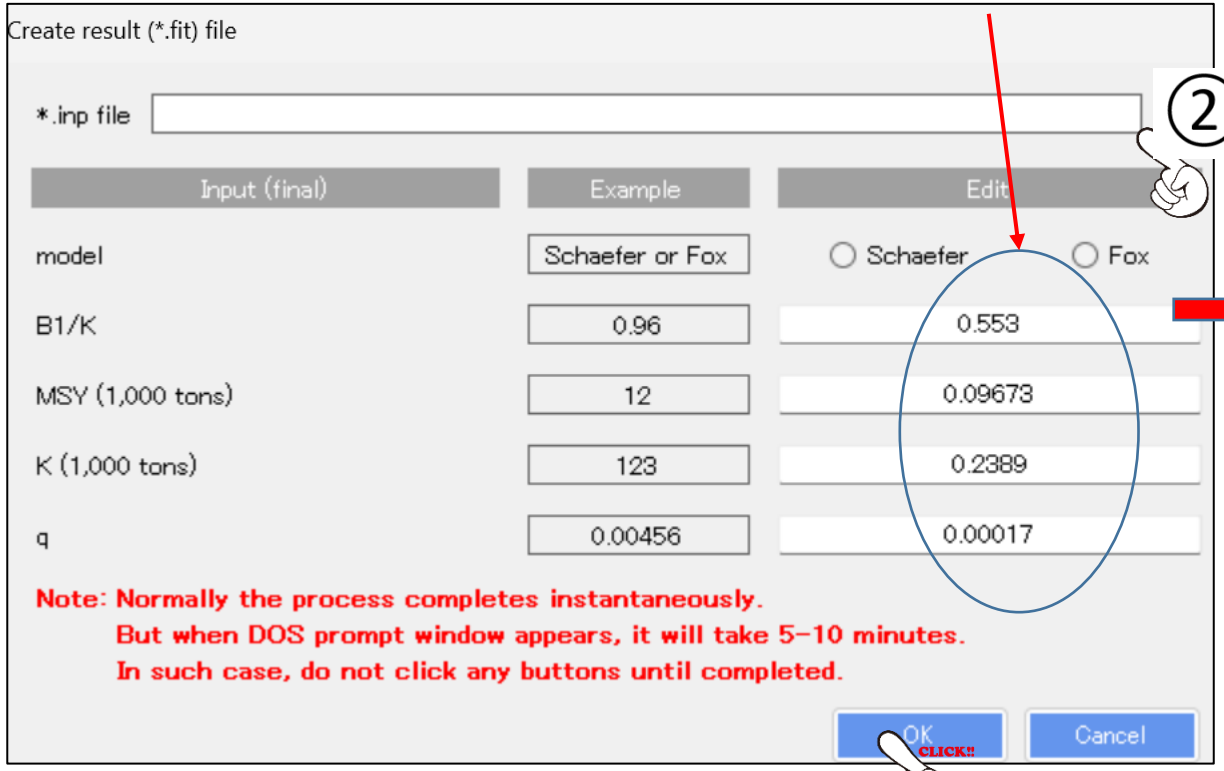
4. Running software: 4.2 Creating results (*.fit) file for best parameters & model

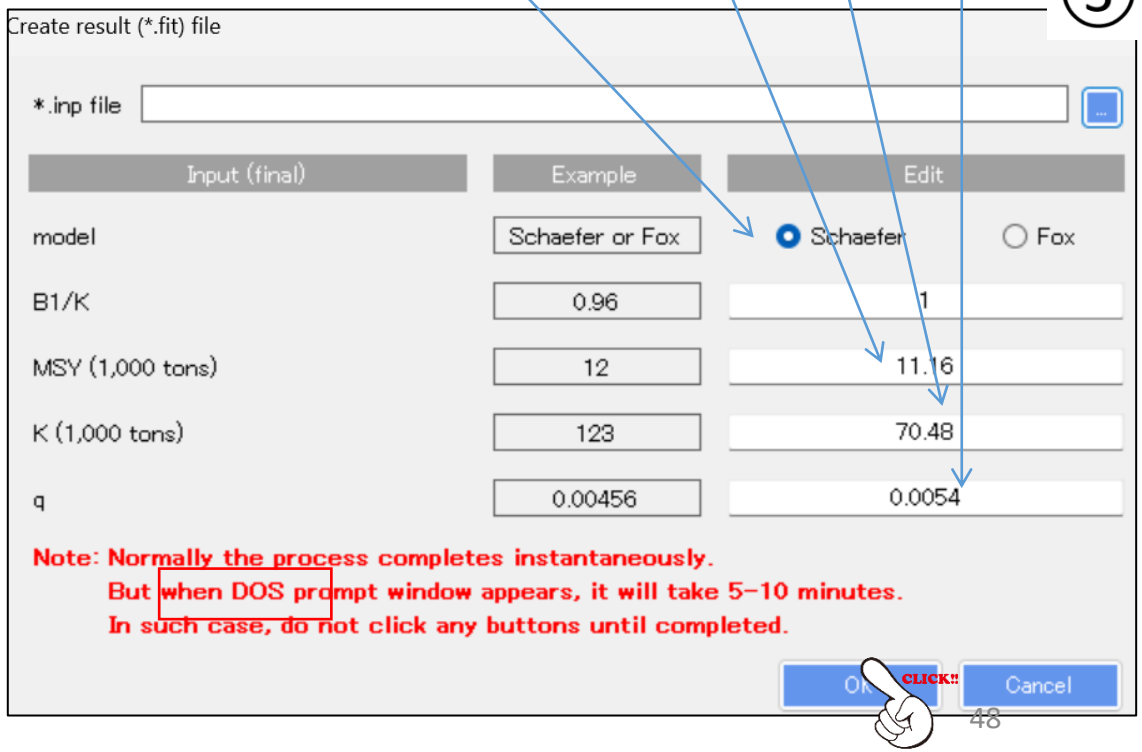
Using the best parameters & model selected in (1) Batch job, full numerical output (results) (*.fit file) will be obtained. The *.fit file will be used for further analyses in Menu (3)~(7)

Change to the new information

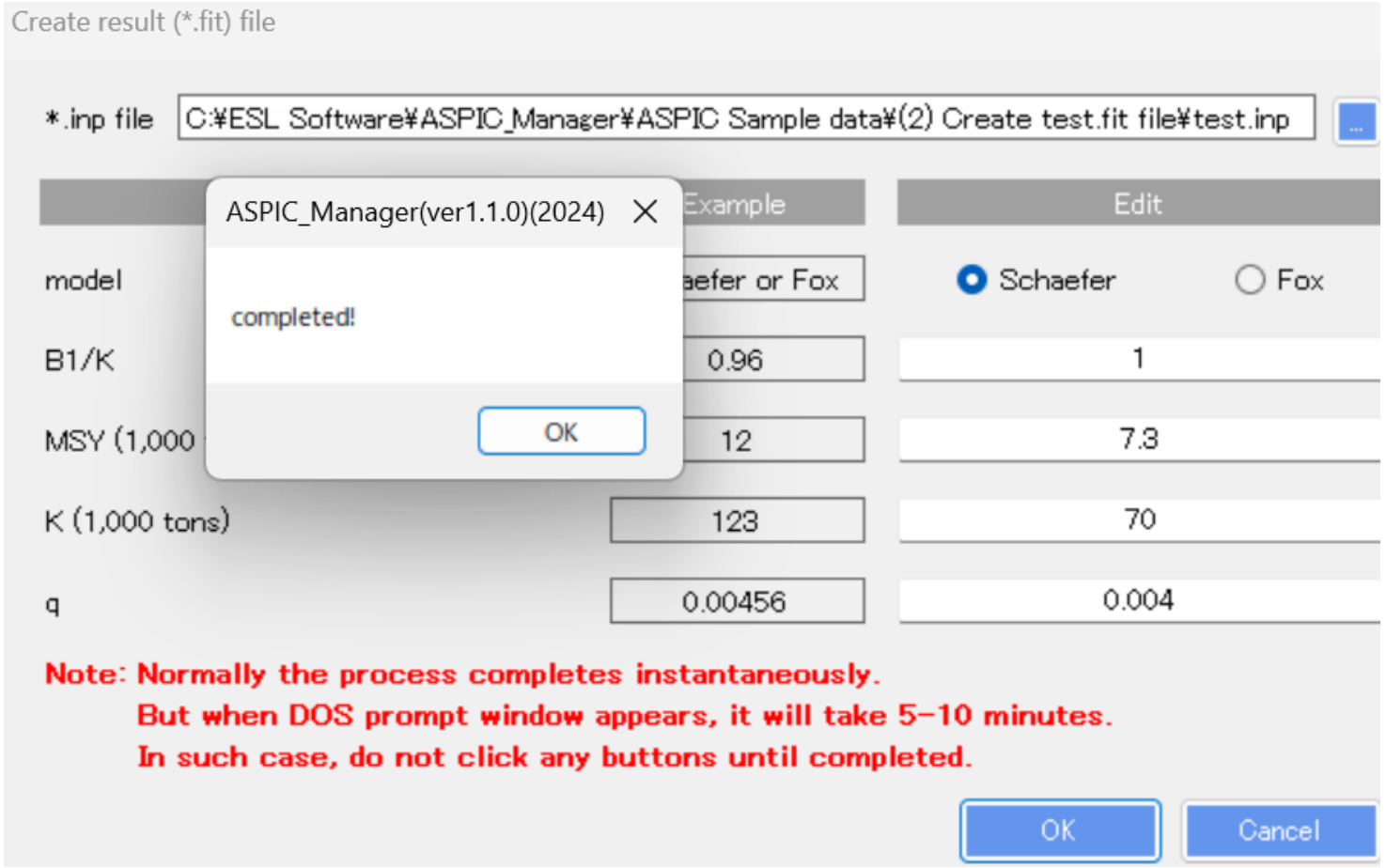
R2	RMS	r [Est]	Model	B1/K [Fix]	MSY [Est]	K [Est]	q [Est]
0.295	0.209	0.6334	Schaefer	1.000	11.16	70.48	0.0054

Previous information





4. Running software 4.2 Creating results (*.fit) file for best parameters & model

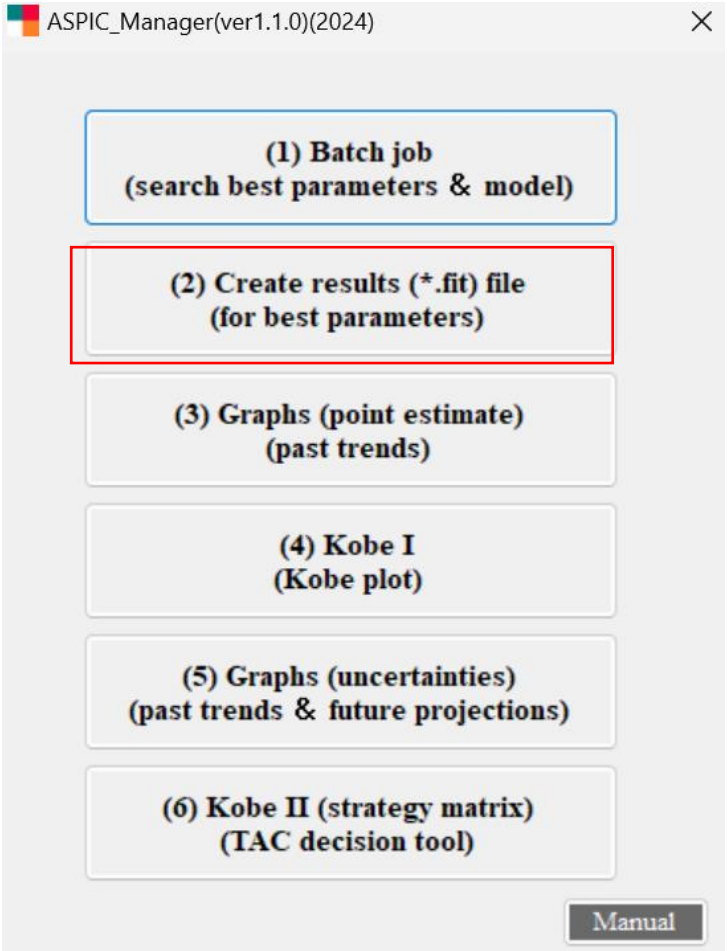


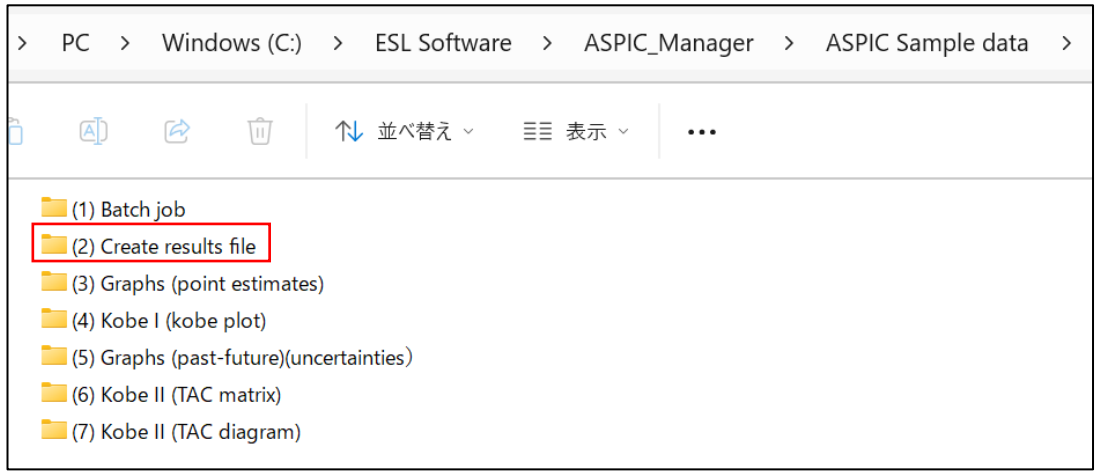
4. Running software

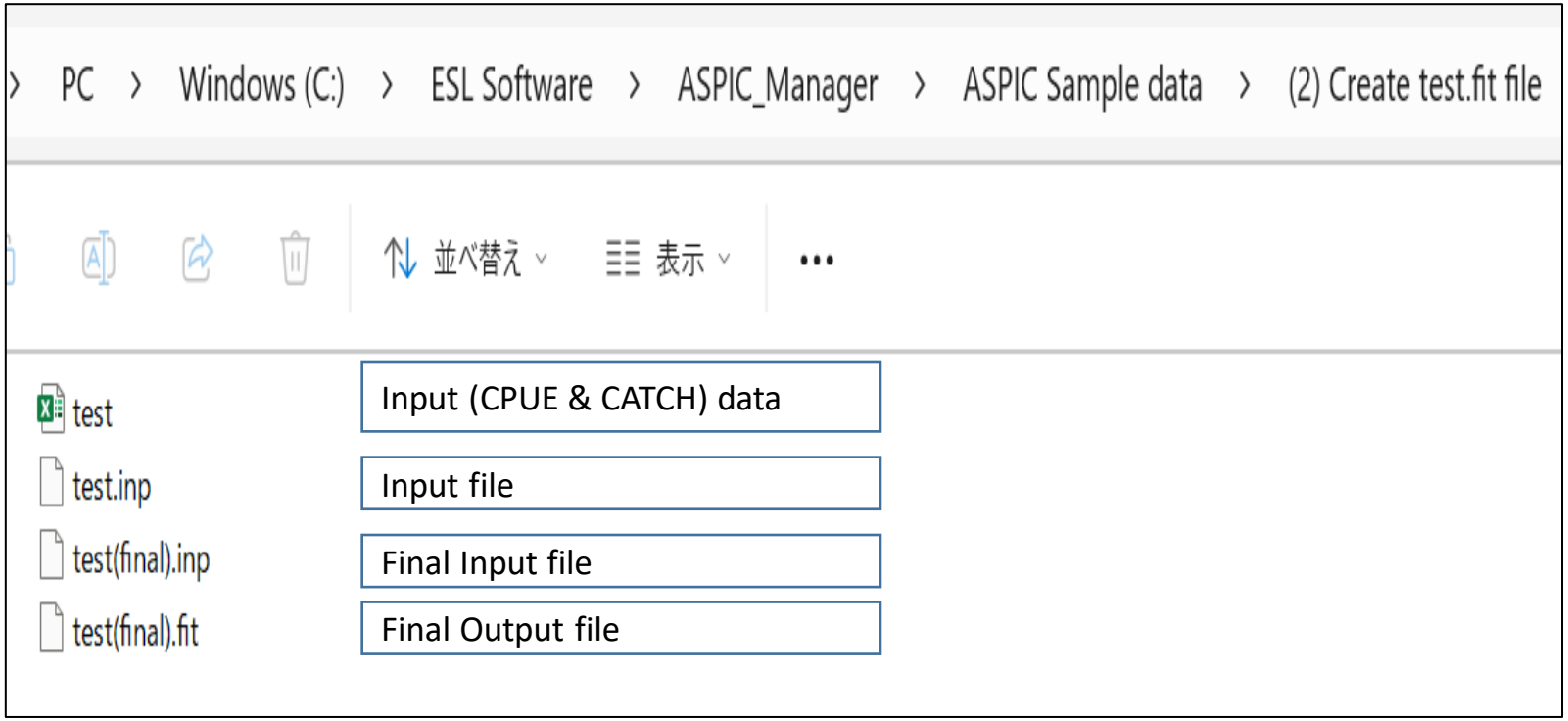
4.2 Creating results (*.fit) file for best parameters & model

ASPIC Sample data

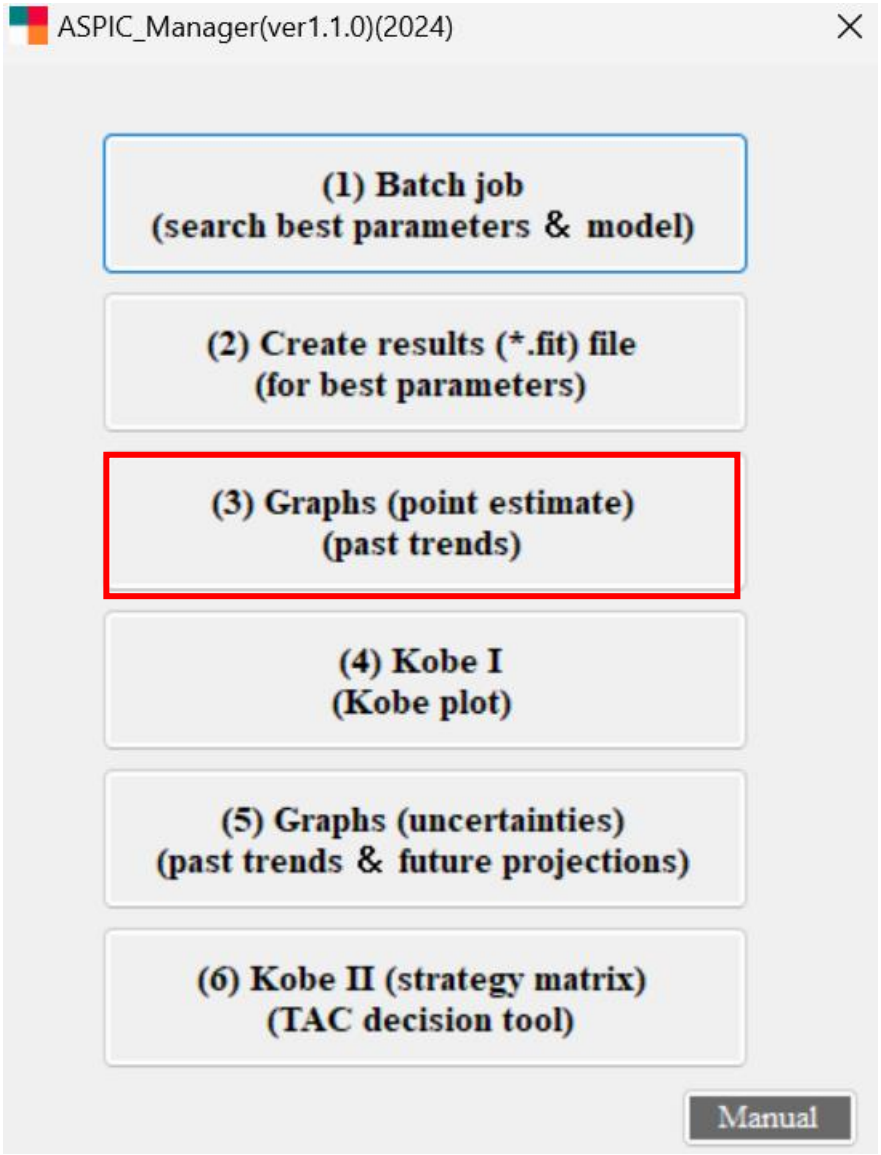
List of INPUT & OUTPUT files for menu (2) Create test.fit file





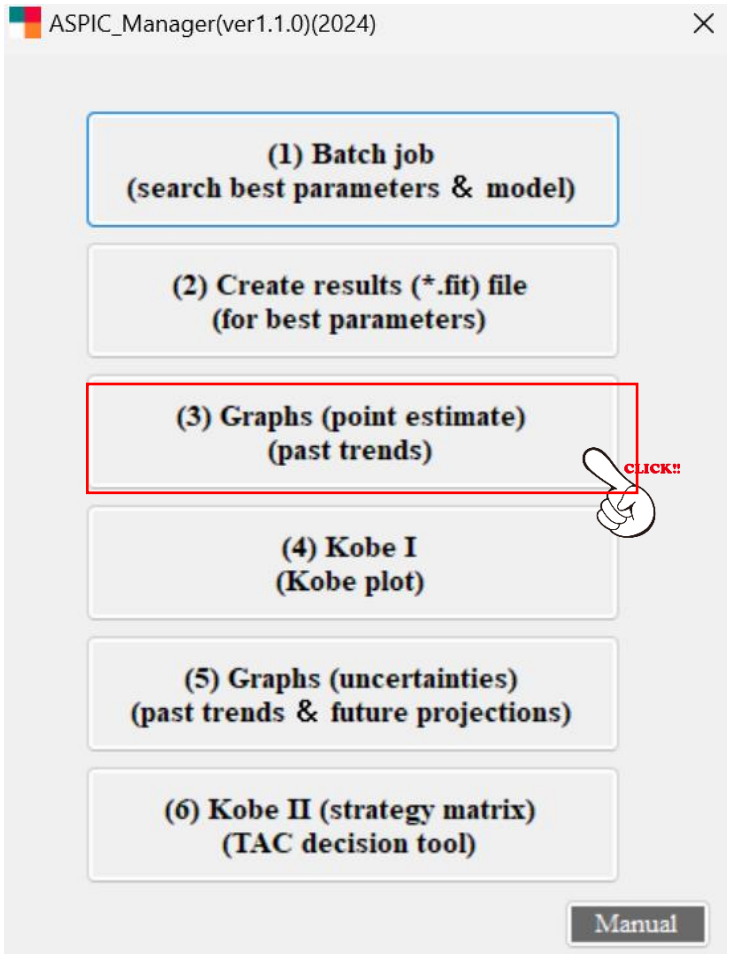


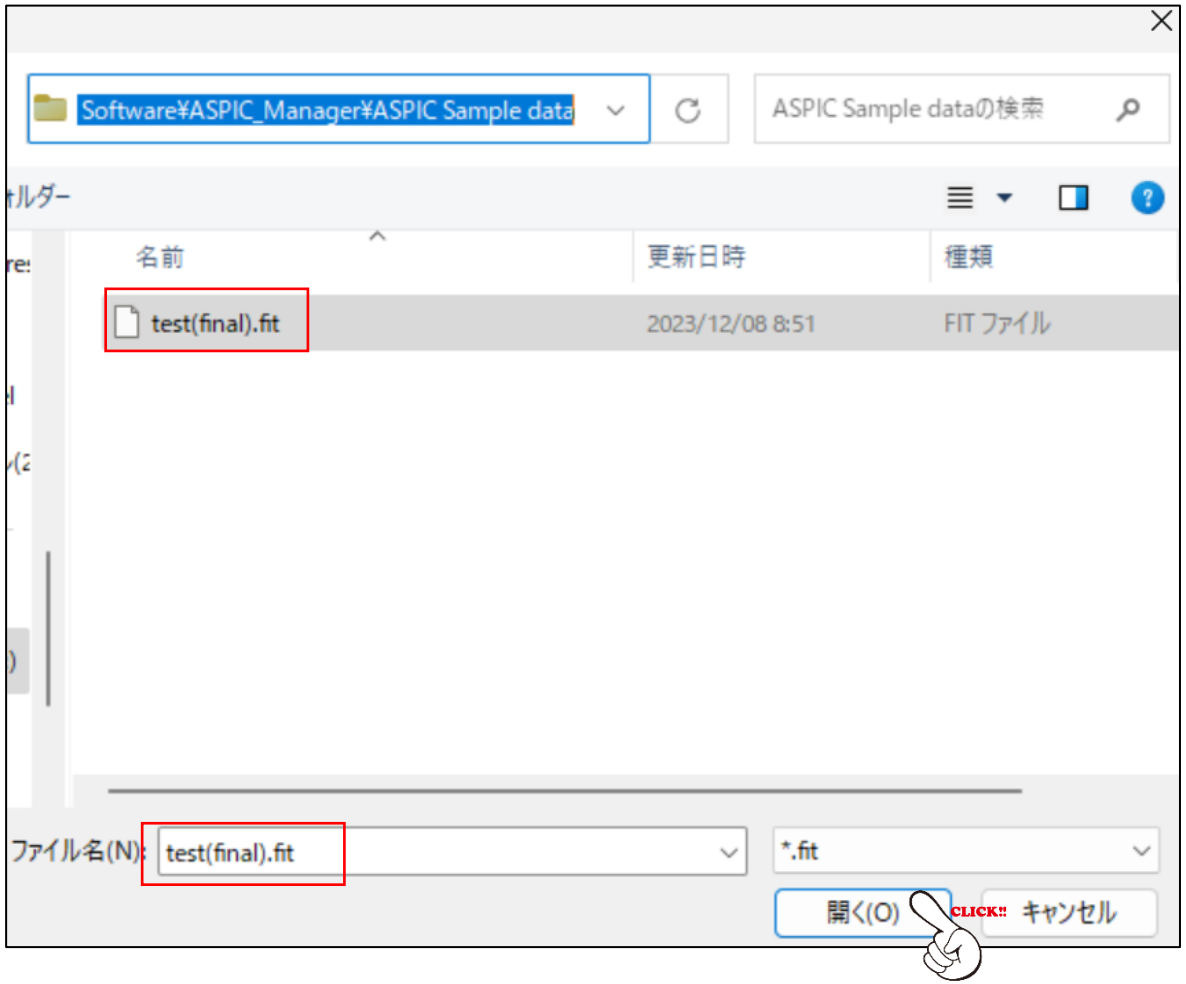
4. Running software
4.3 Graphs
(Past trends for point estimates)
(6 graphs)



4. Running software
4.3 Graphs (Past trends for point estimates) (6 graphs)

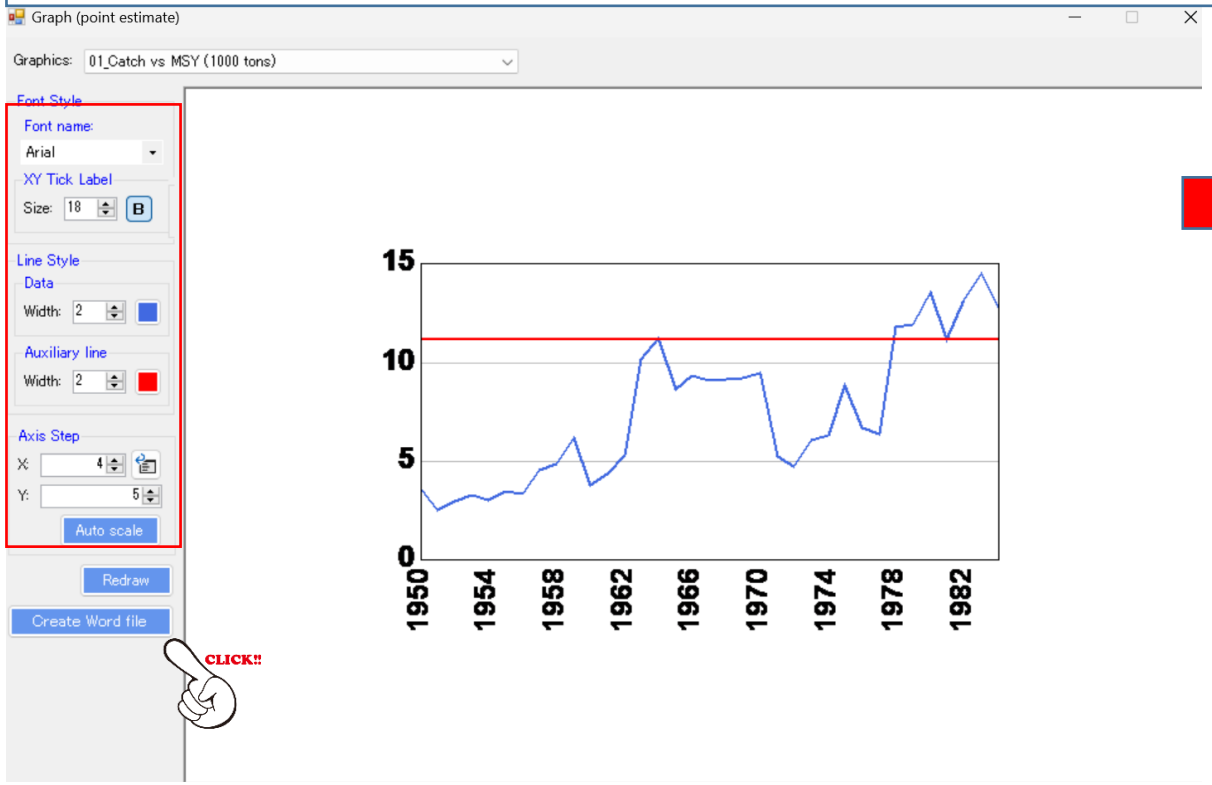
Open *(final).fit file ➔ test(final).fit (our example)

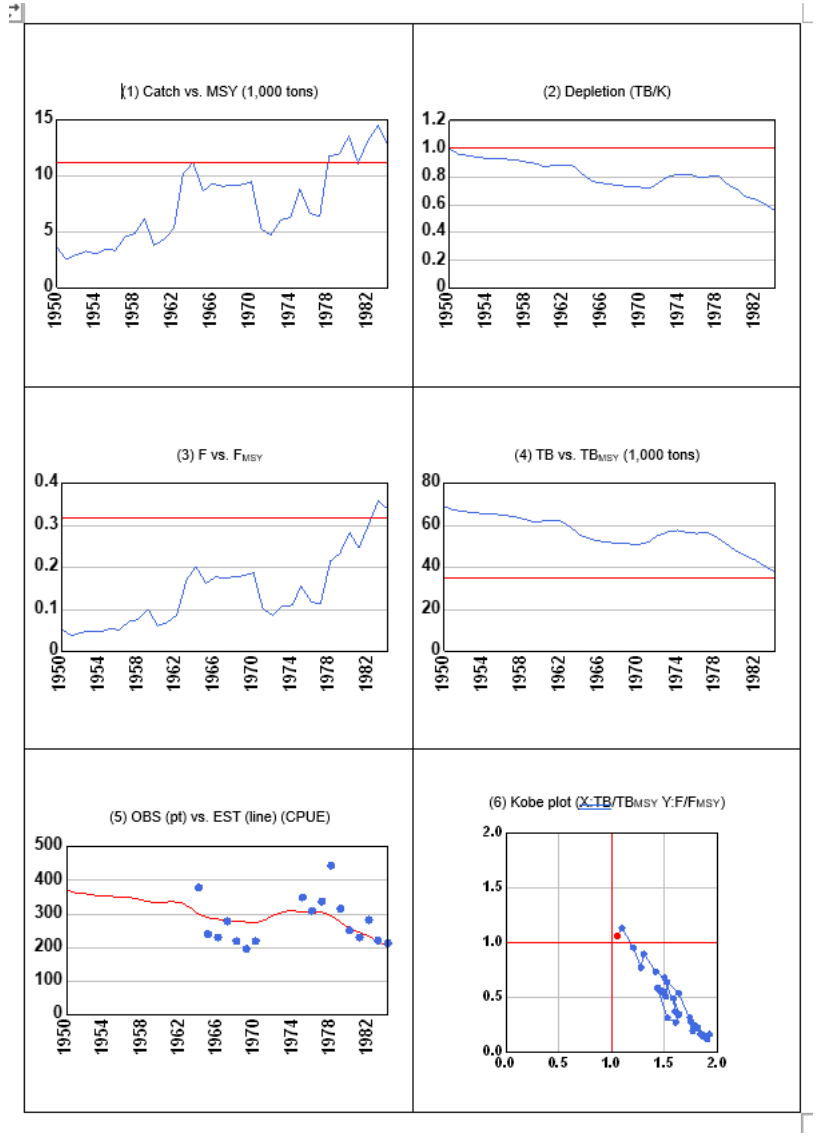




4. Running software: 4.3 Graphs (Past trends for point estimates) (6 graphs)

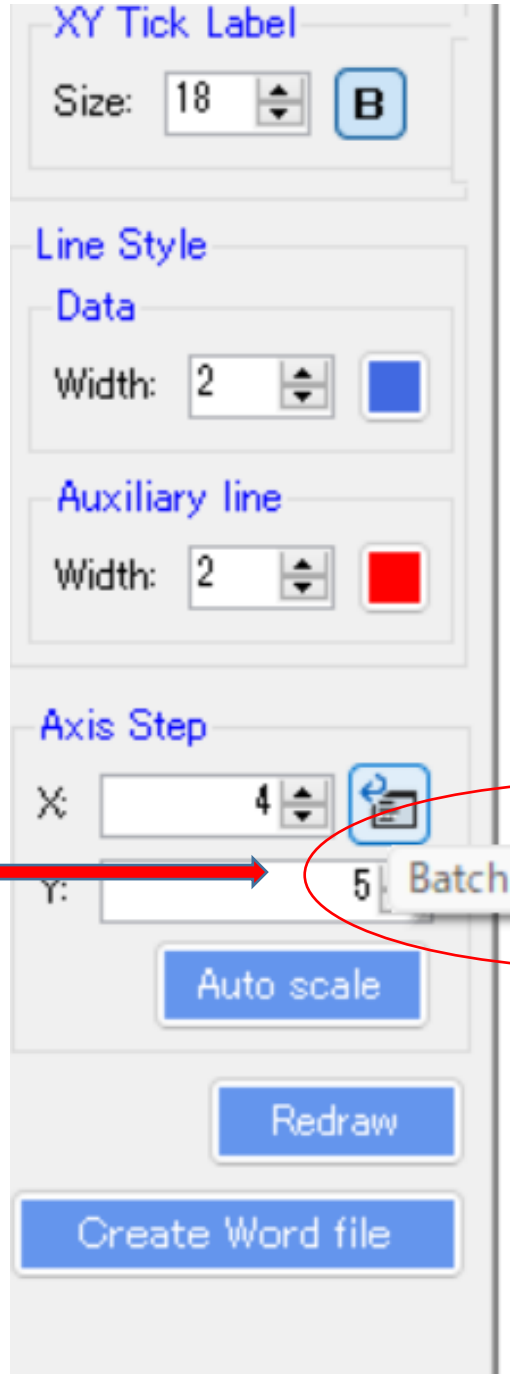
After clicking “Open” (previous slide), the 1st graph (catch vs. MSY) appears (below). Users can edit 6 graphs one by one using graph settings functions (red box) available on left except X-axis batch settings for 5 graphs (for details, see next slide). After completing editions, click “Create word file” bottom. Then all 6 graphs will be made and saved in the word file with time stamp➔ Graphs (point estimate)_20231117162058





4. Running software:
4.3 Graphs
(Past trends for point estimates) (6 graphs)

What is the batch setting of X-axis ?

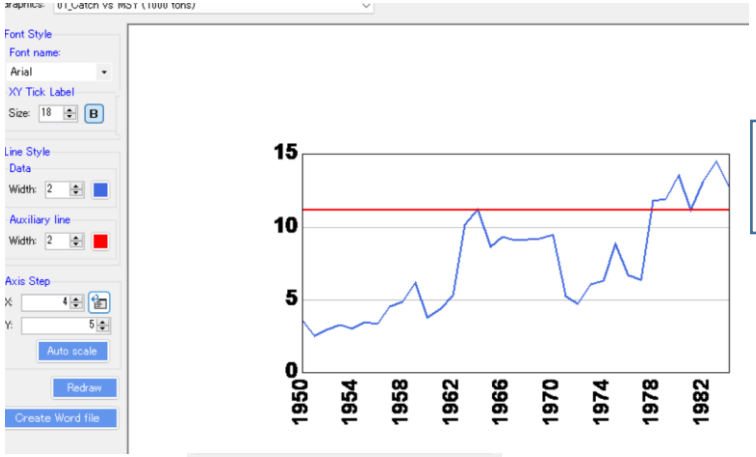


4. Running software
4.3 Graphs (Past trends for point estimates) (6 graphs)

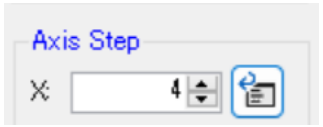
What is X-axis batch setting?

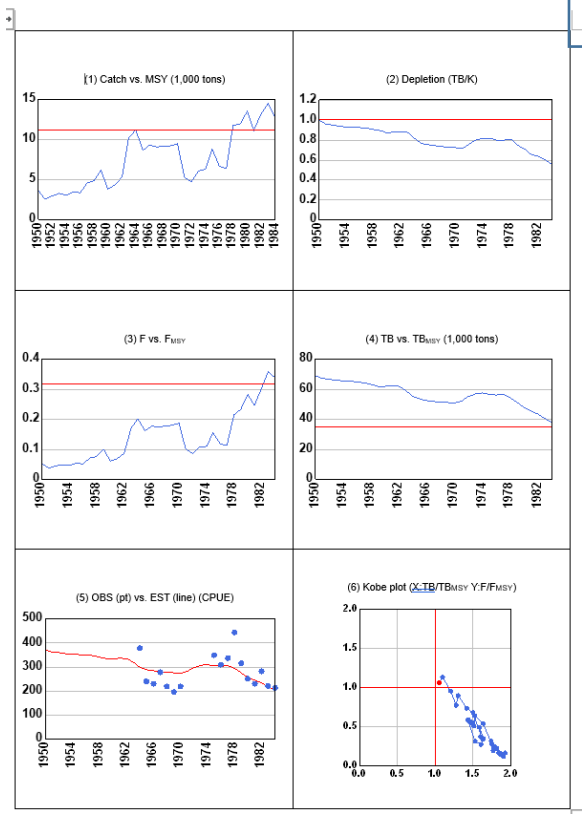
Normally Y axis are different scales, thus optimum steps need to be adjusted one by one.

However, X axis is common all for years except the last Kobe plot. Thus this x-axis batch setting can change steps for 5 graphs automatically.

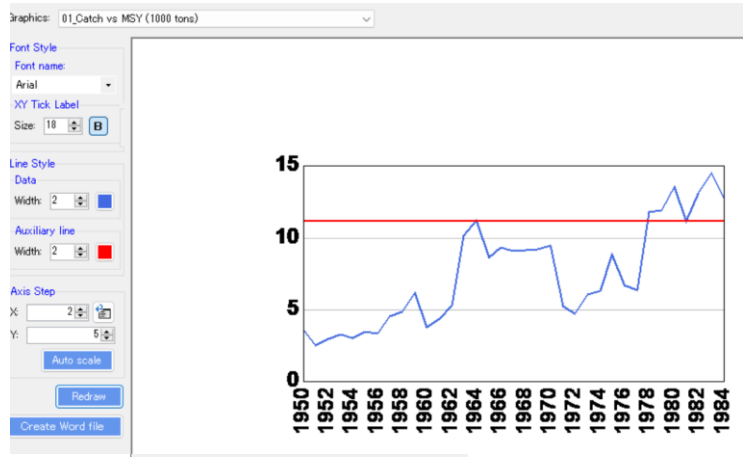


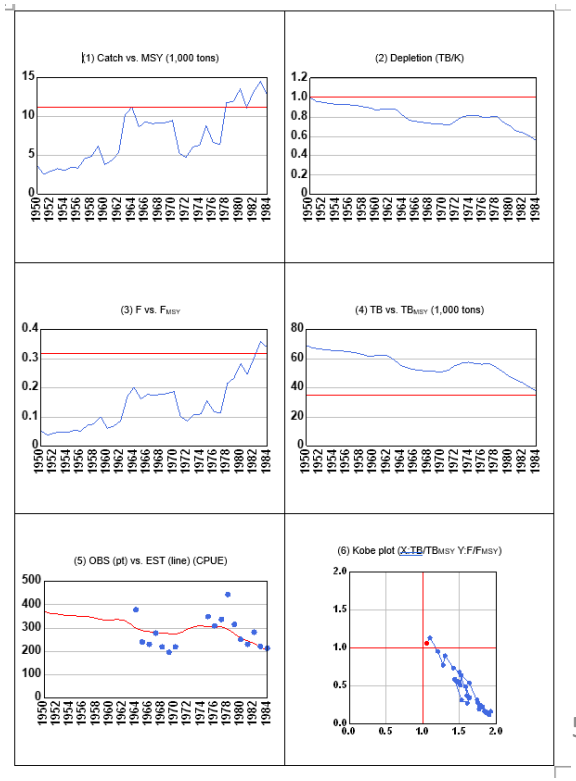
example





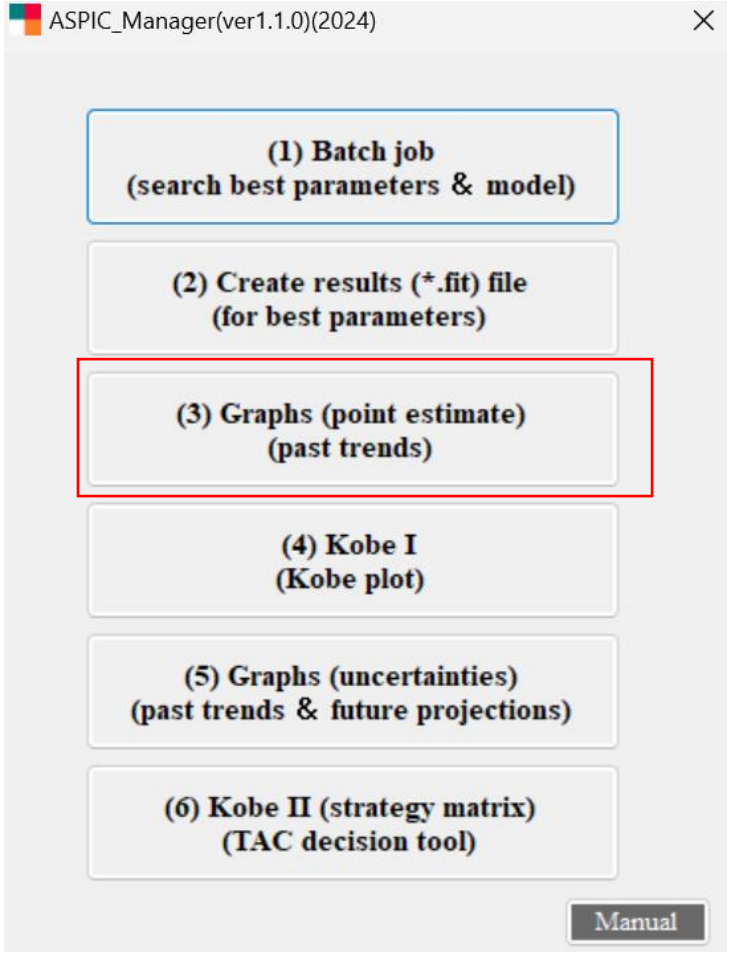
Change the step from 4 to 2 for 5 graphs at once.

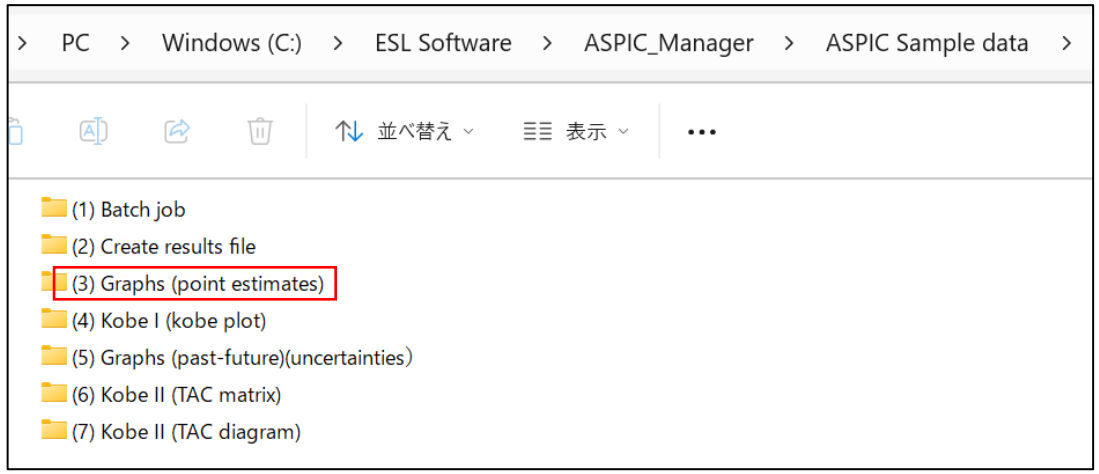


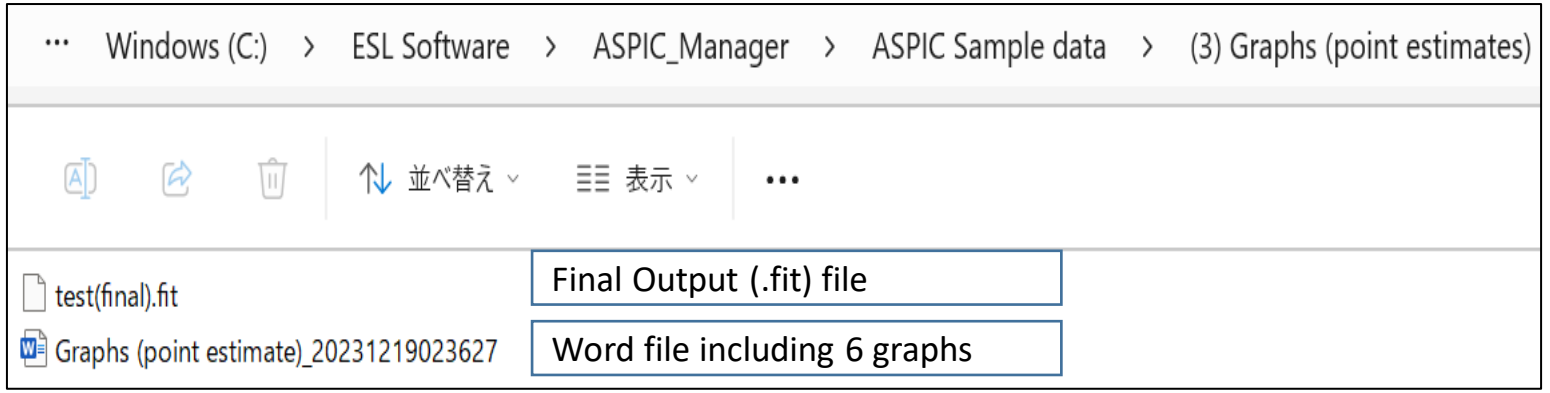


4. Running software
4.3 Graphs (Past trends for point estimates) (6 graphs)

ASPIC Sample data List of INPUT & OUTPUT files for menu (3) Graphs (point estimate)

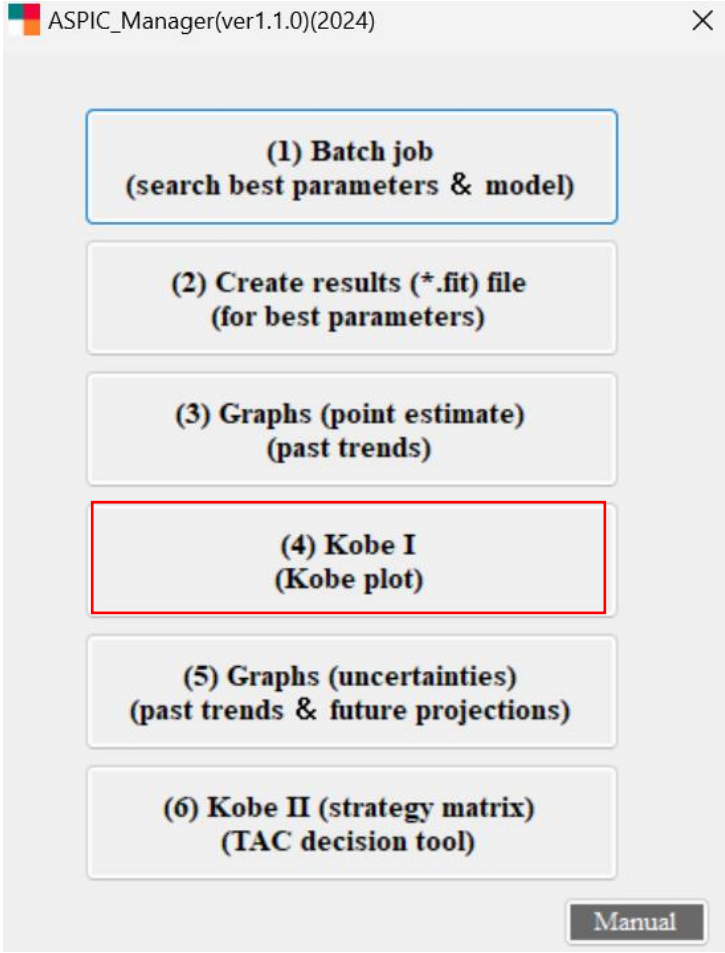






4. Running software: 4.4 Kobe I (Kobe plot)

Produce Kobe plot with uncertainties (confidence surface)



4. Running software: 4.4 Kobe I (Kobe plot) Locate Kobe_I_II.exe file

IMPORTANT ➔ This will be done only when users use this menu <u>at the first time</u>

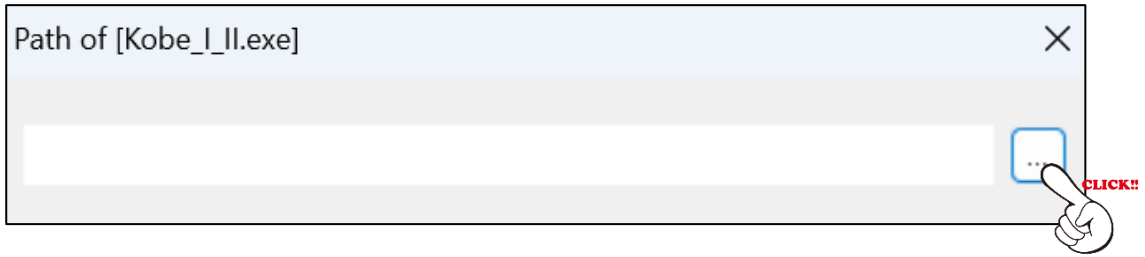
After clicking the menu,

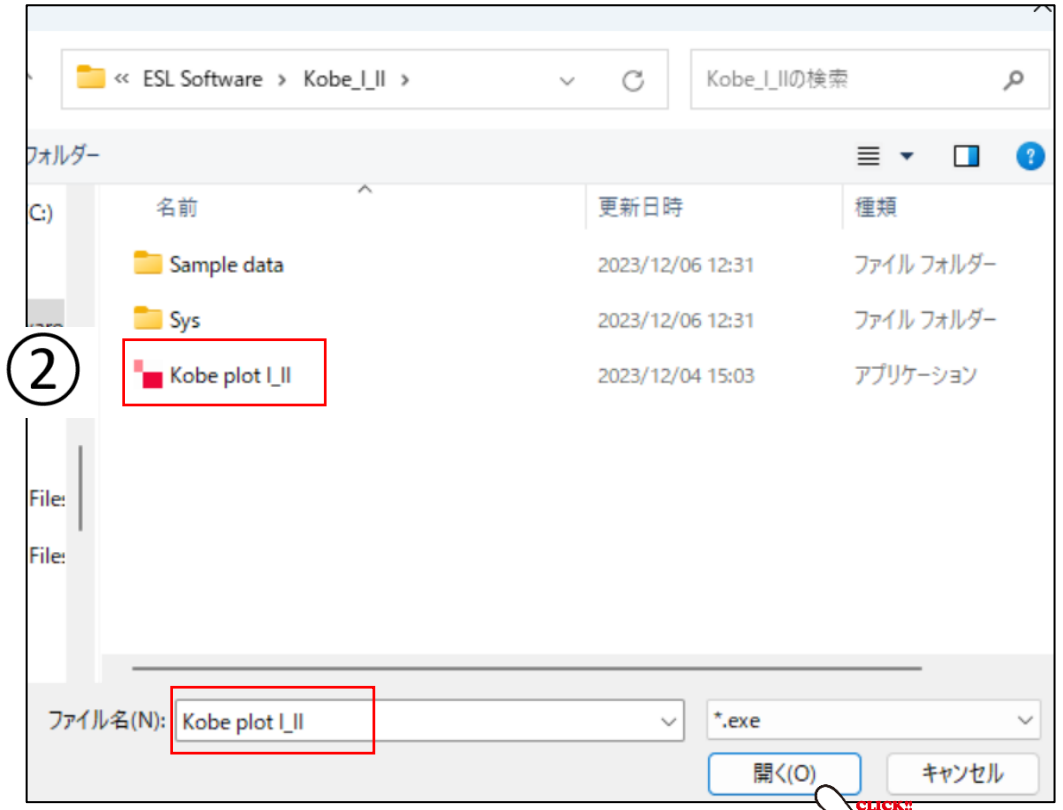
① Users will see the 1st window requesting to locate Path of [Kobe_I_II.exe] then Click.

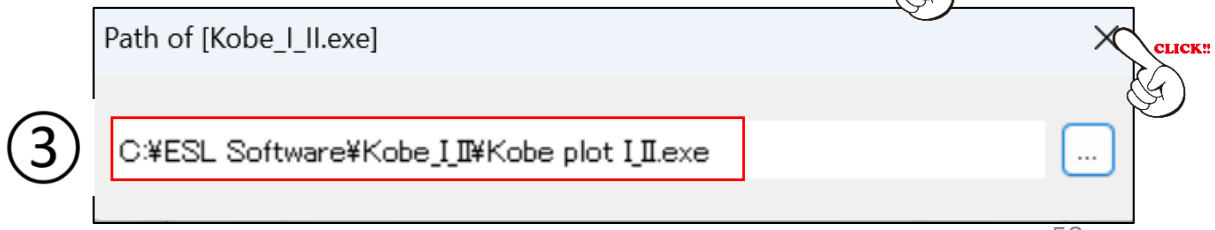
② Identify the file

③ Confirm window will appear. & close window

①



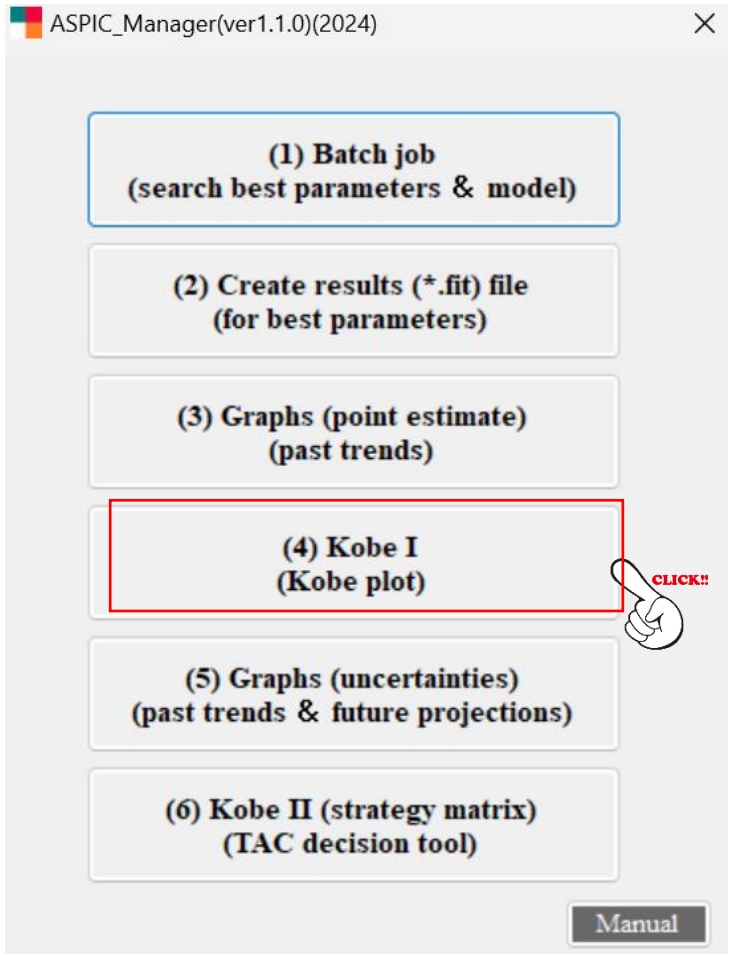


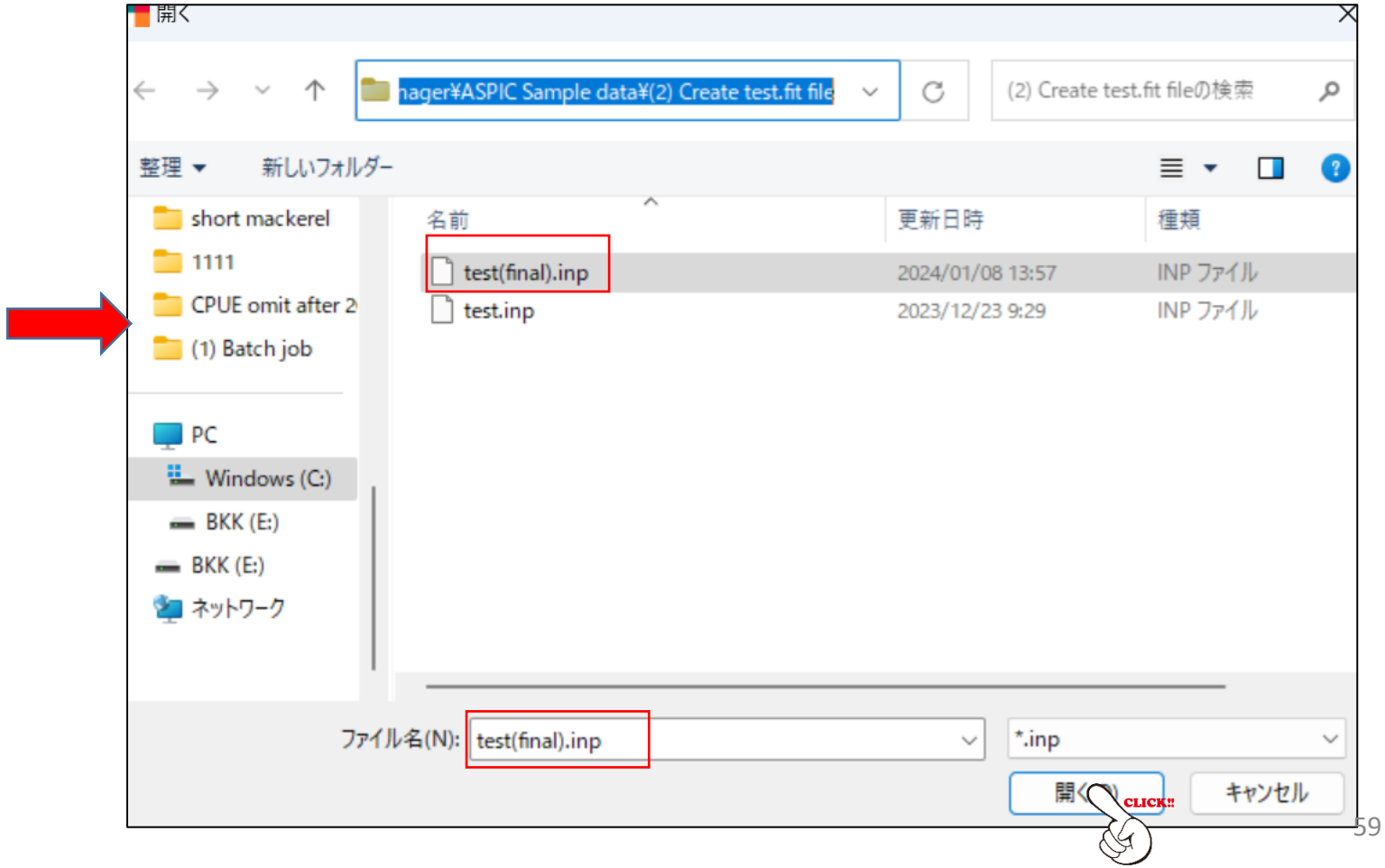


4. Running software: 4.4 Kobe I (Kobe plot)

Produce Kobe plot with uncertainties (confidence surface)using *(final).inp

Import the test(final).inp file (example) to conduct bootstrap (1,000 times) to estimate uncertainties in the final stock assessment year (take some time). Bootstrap is one of methods to estimate uncertainties by re-sampling the data used.





4. Running software: 4.4 Kobe I (Kobe plot)

If users see the following Note,

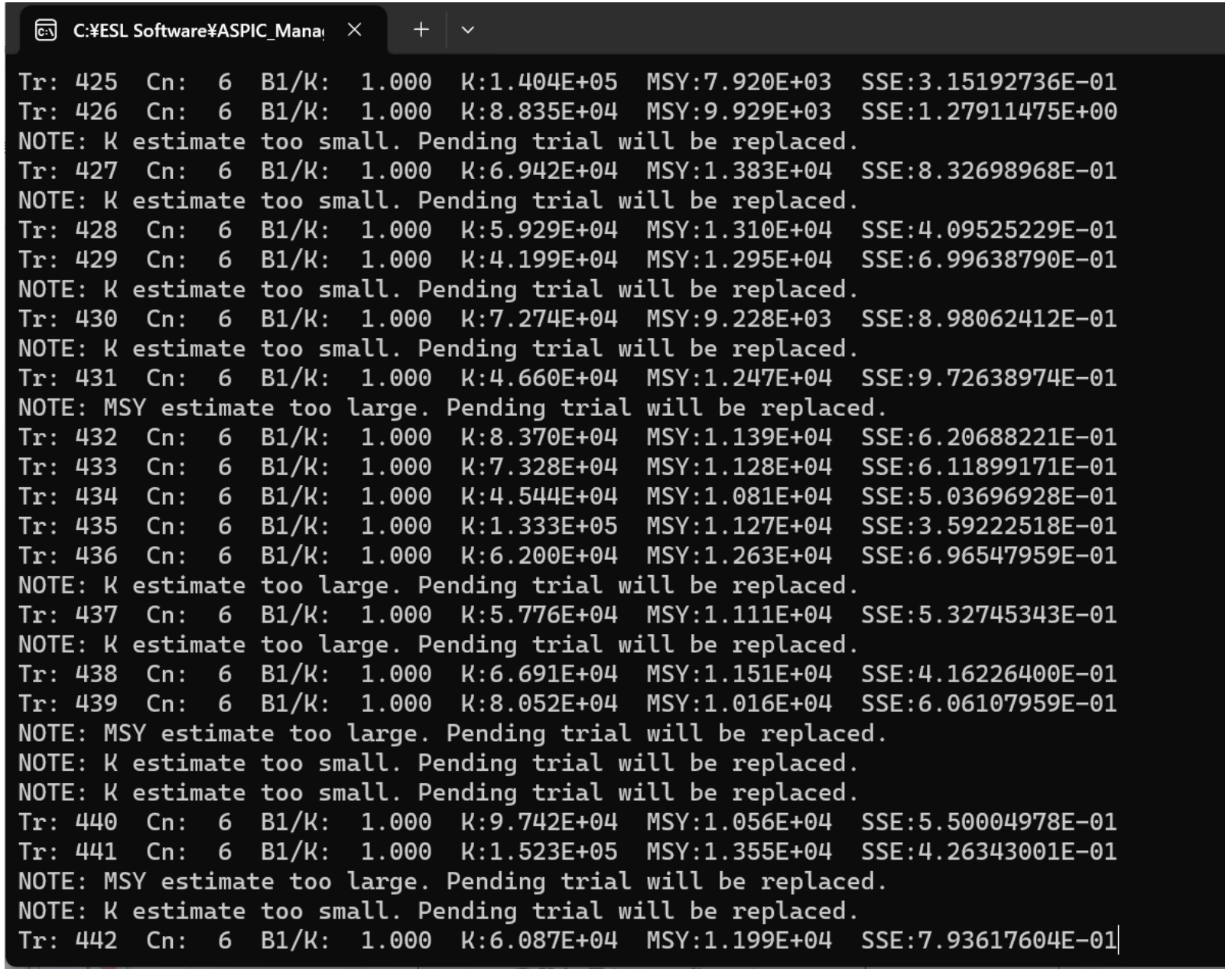
please change K values to make Kobe plot.

Note: K for initial value is too high or too low. Expand Min K and/or Max K values in the batch job window and try again.

4. Running software
4.4 Kobe I
(Kobe plot)

Snapshot
during processing
the bootstrap
by the DOS prompt

For this example,
it will take 15-30 minutes
(some case 2-5 hours)
depending on data set &
PC performance.



4. Running software: 4.4 Kobe I (Kobe plot) Locate R path

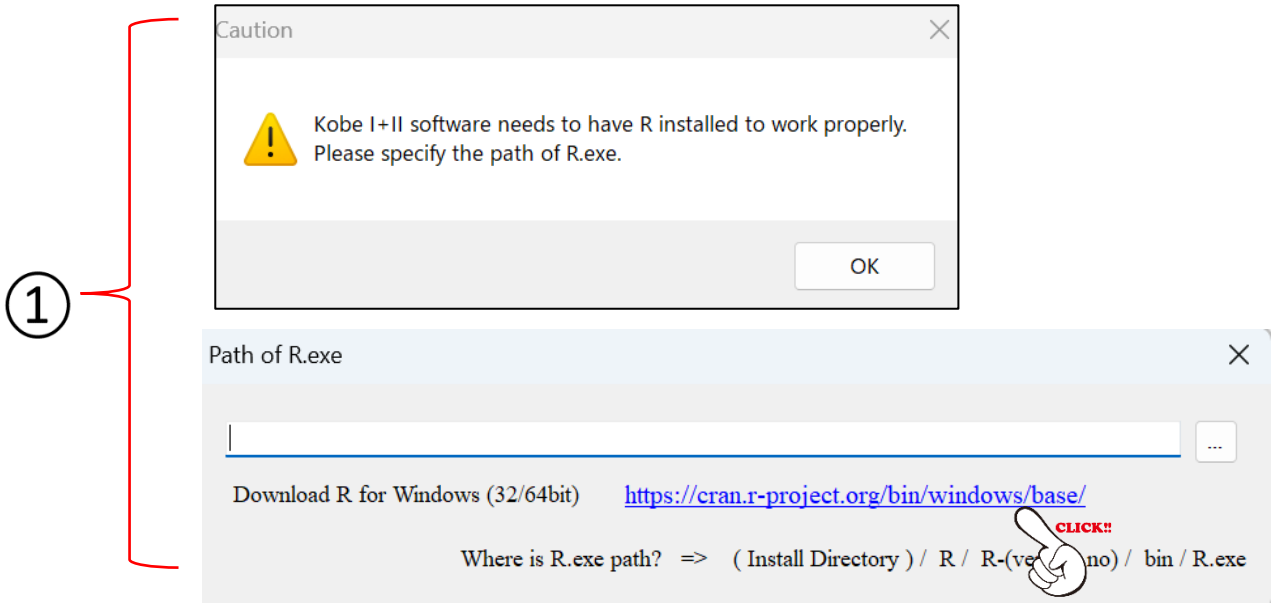
IMPORTANT ➔ This will be done only when users use this menu at the first time

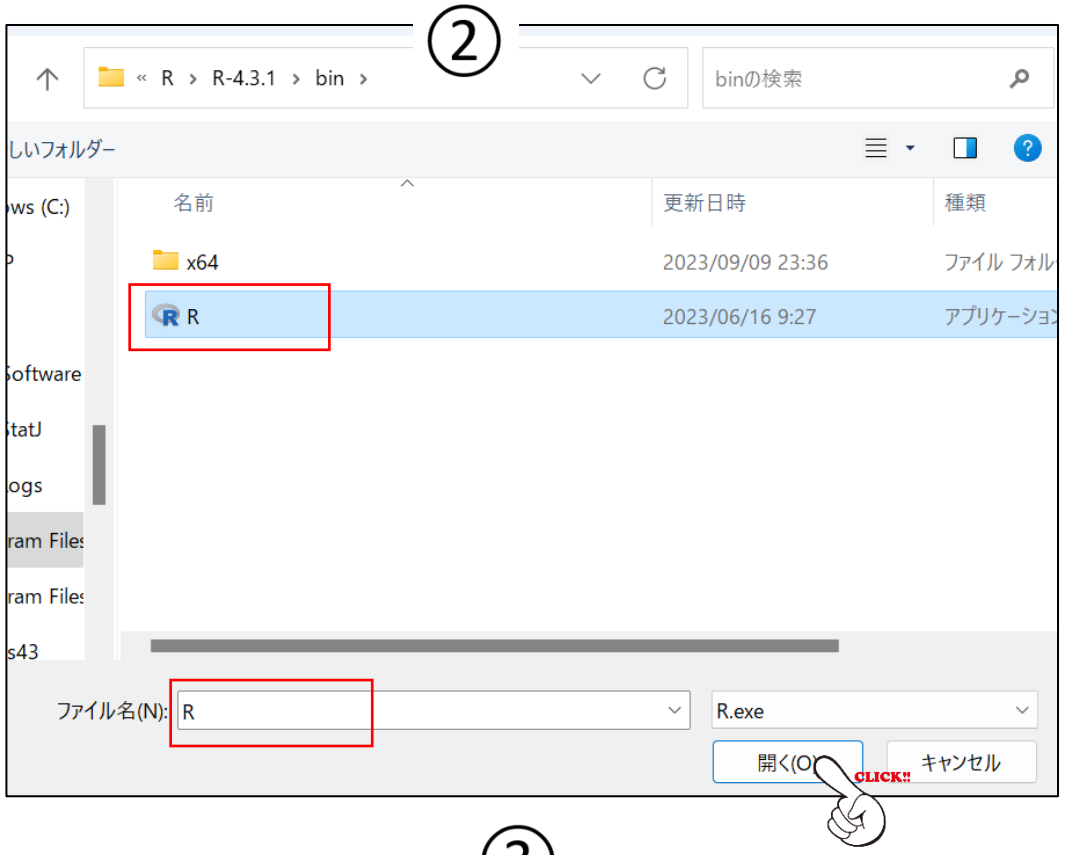
After the bootstrap is completed,

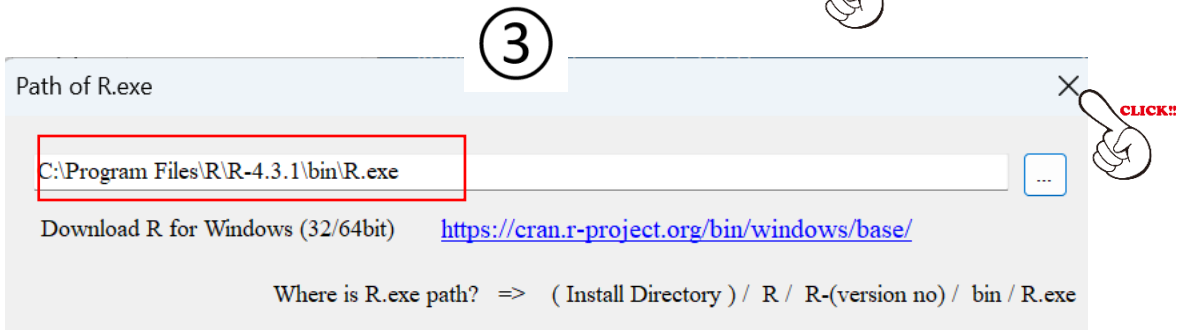
① users will see 2 windows requesting to locate the R path.

② Identify and import the R.exe file

③ Confirm window will appear. & close window





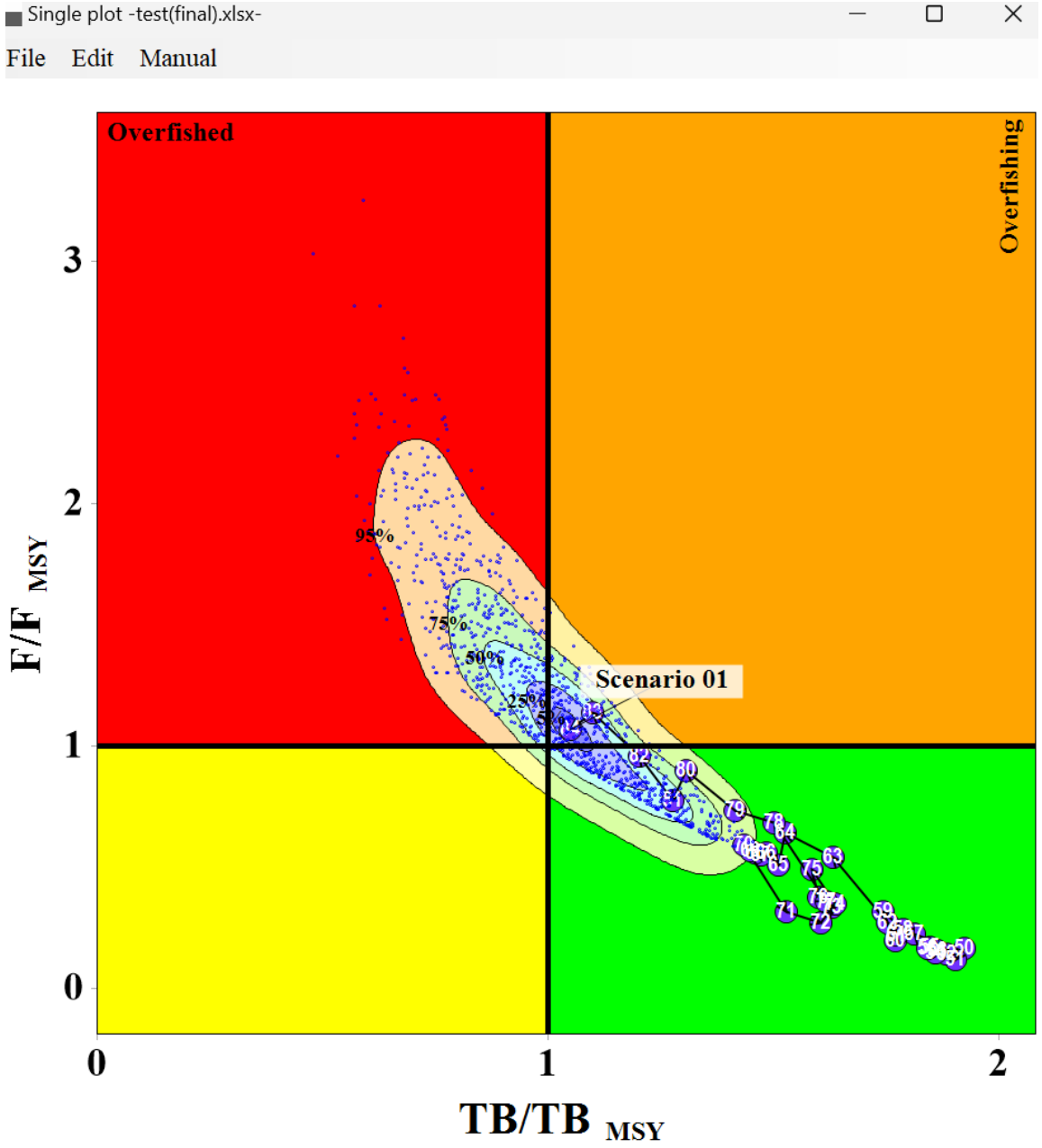


4. Running software
4.4 Kobe I (Kobe plot)

After the bootstrap is completed, the default Kobe plot appears.

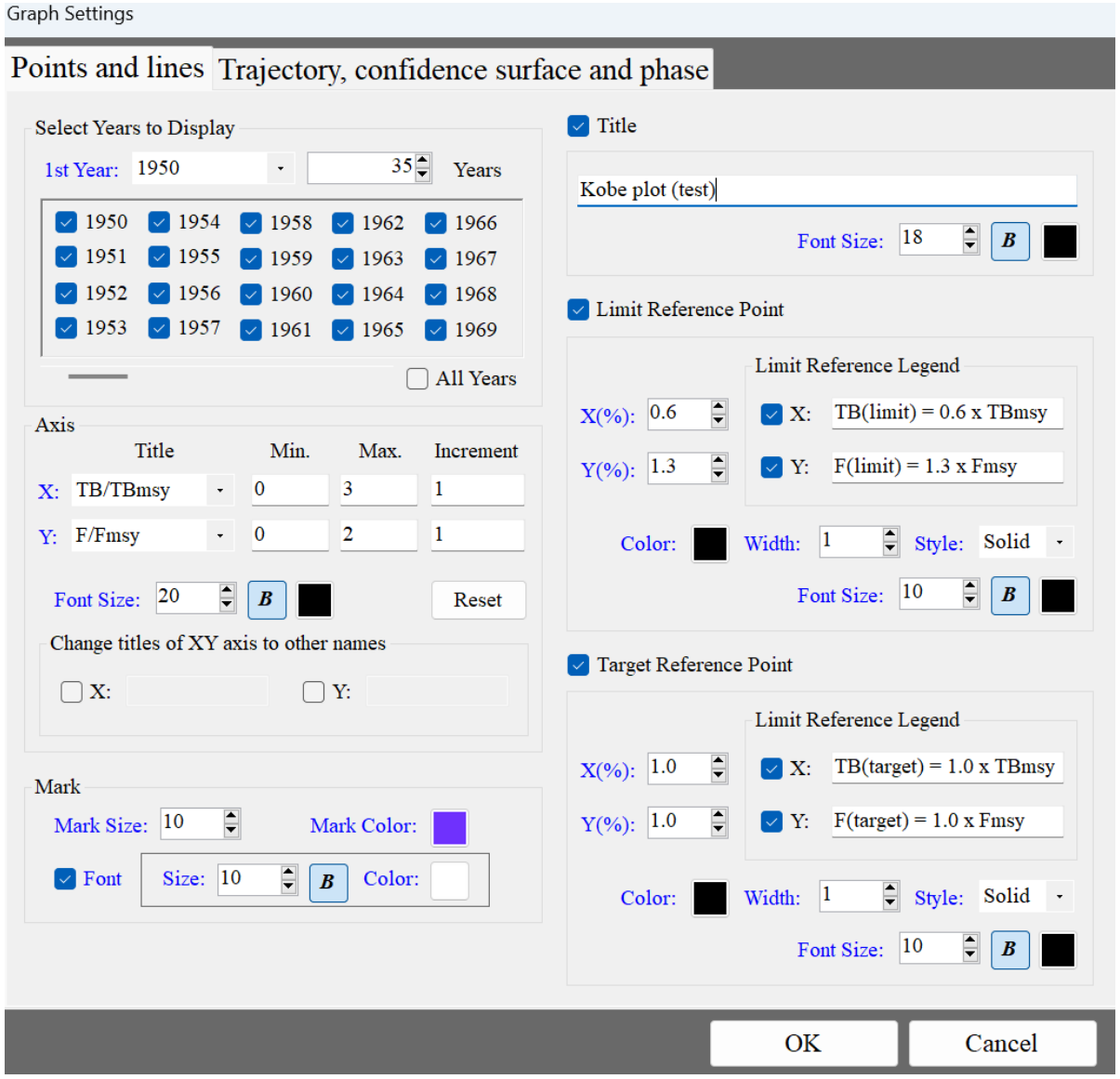
Users can edit using 2 graph setting functions to make the final plot
(see next 2 slides).

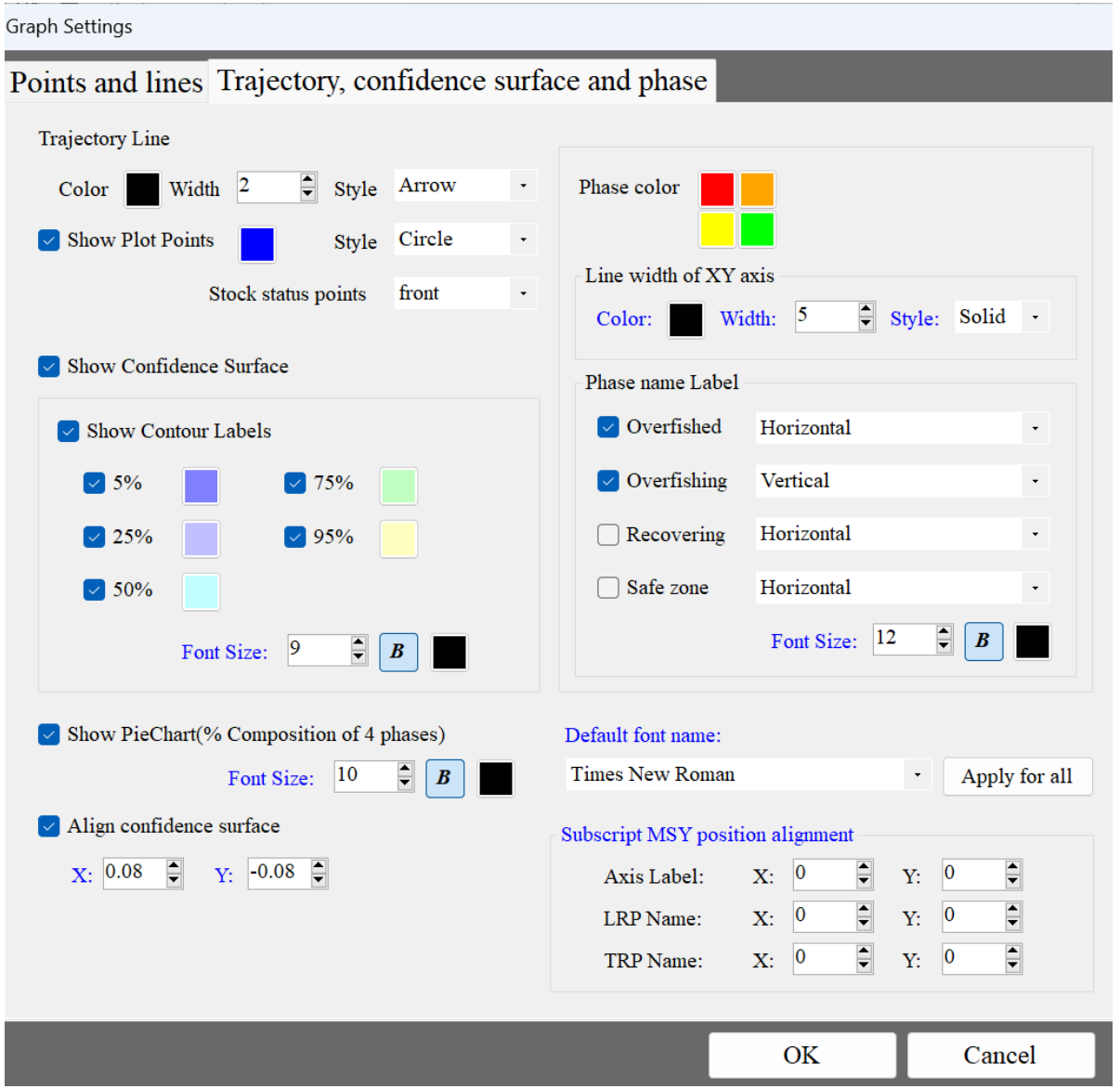
For details on graph setting functions, refer to the Kobe I+II manual.



4. Running software: 4.4 Kobe I (Kobe plot)

2 graph setting functions (for details, refer to Kobe I+II manual)

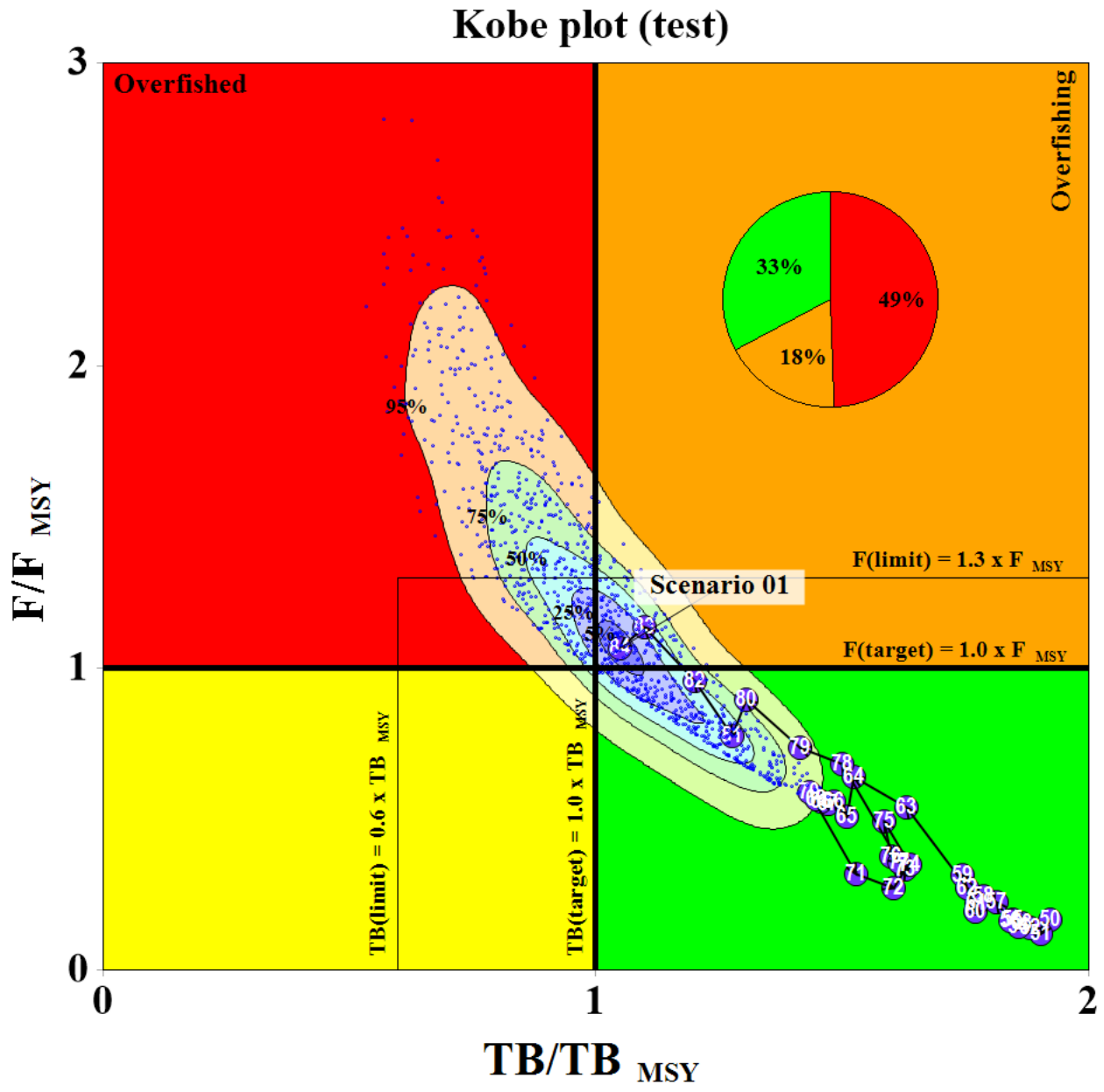




4. Running software
4.4 Kobe I (Kobe plot)

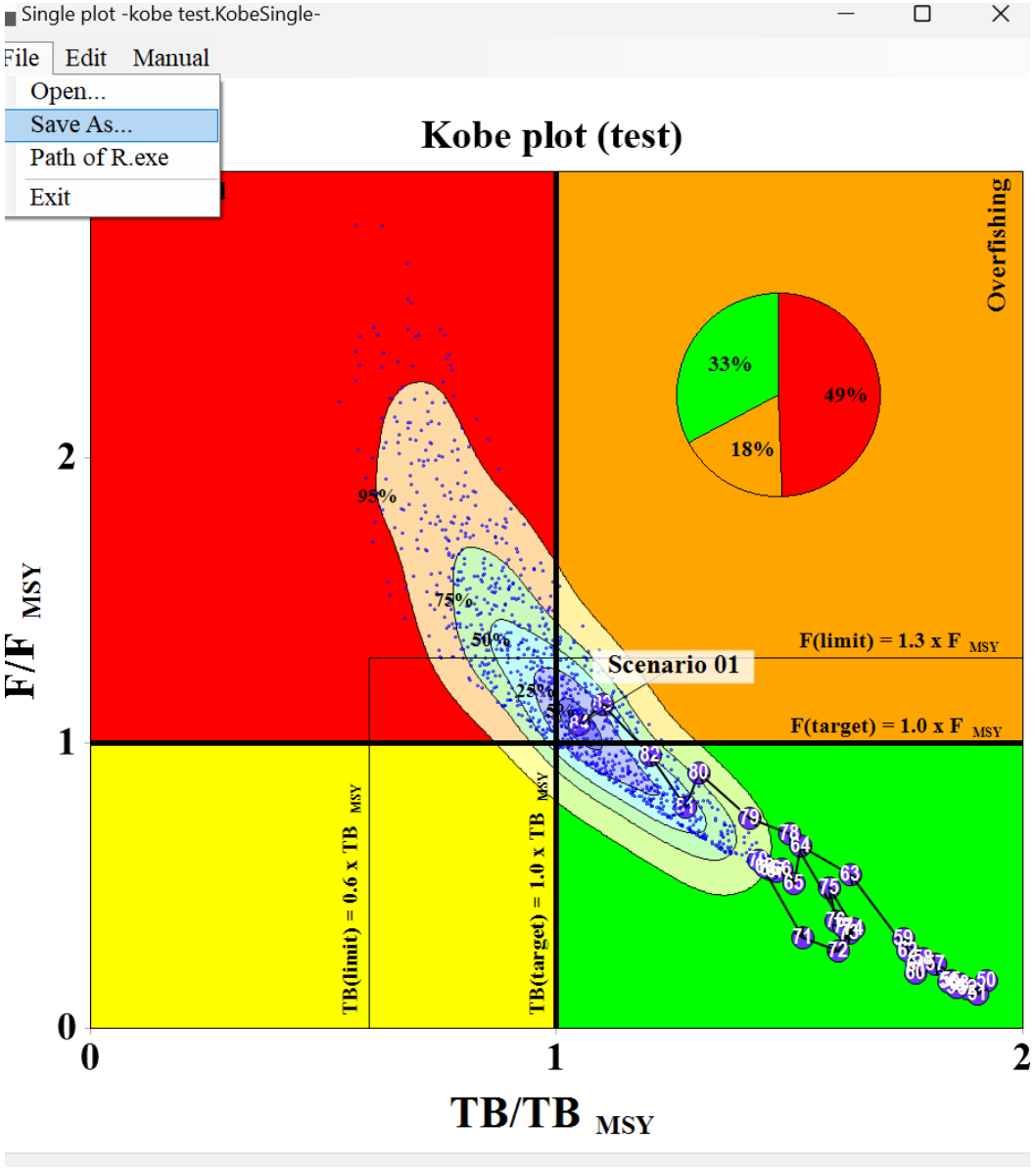
Final Kobe plot
(edited)

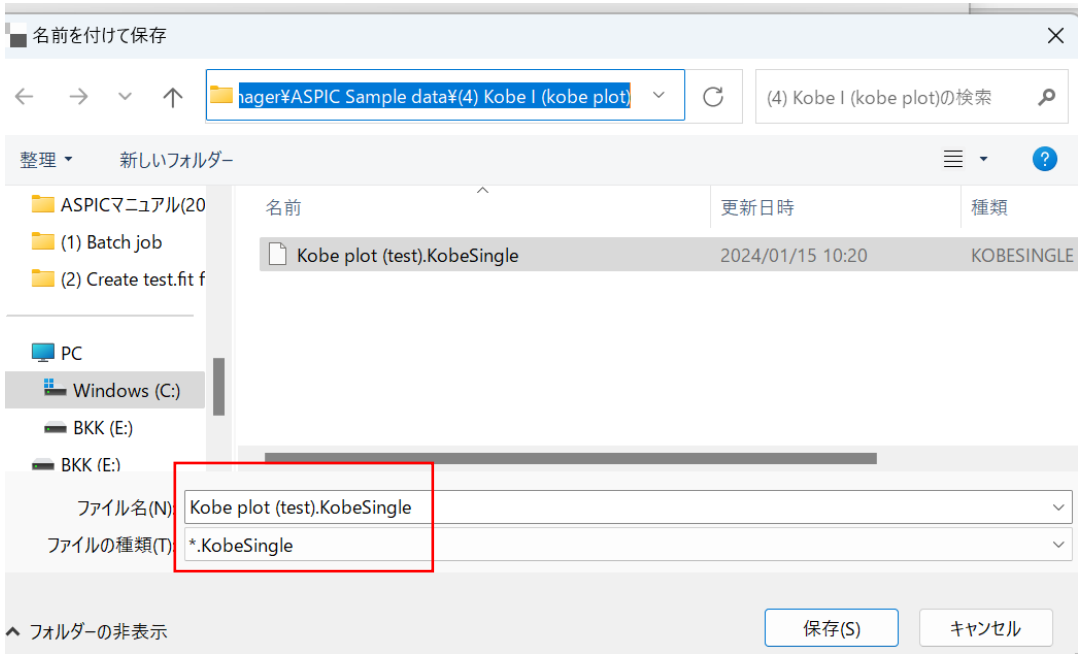
How to save ?
See next 2 slides

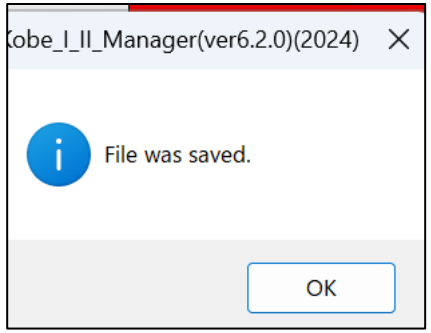


4. Running software: 4.4 Kobe I (Kobe plot)

① Save to reproduce the last plot



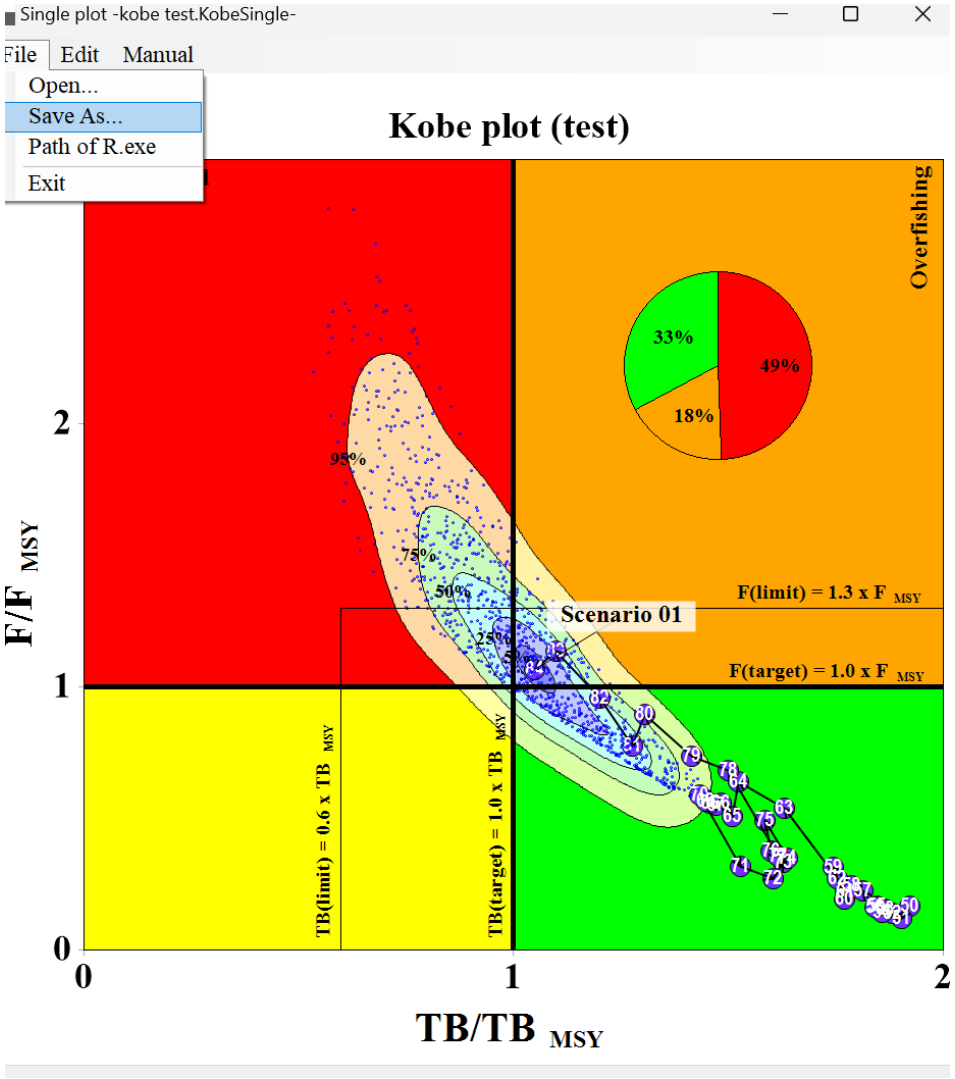


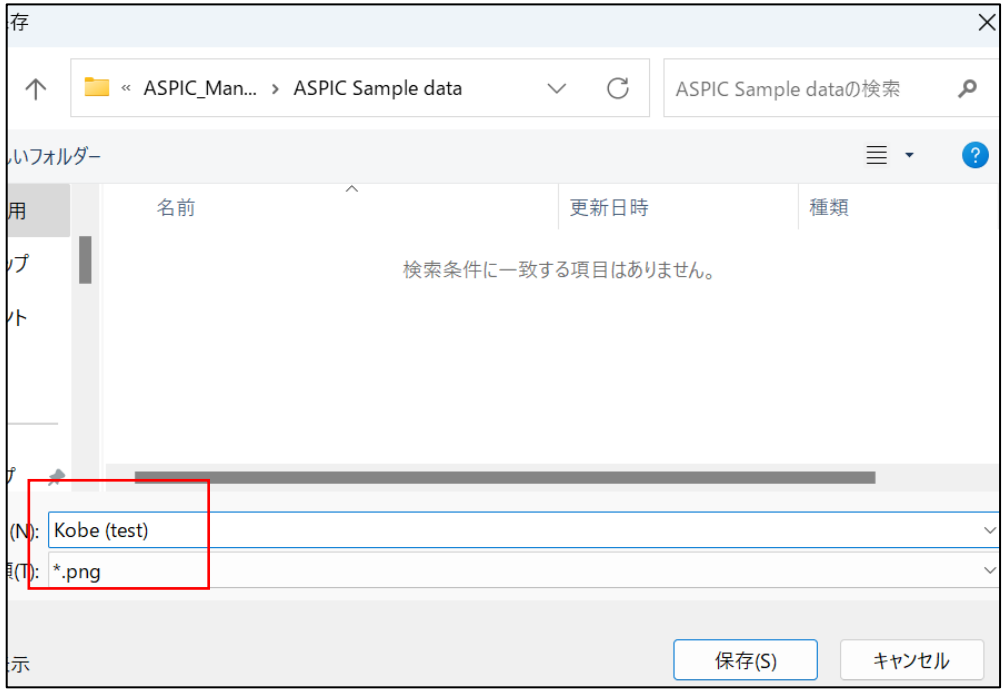


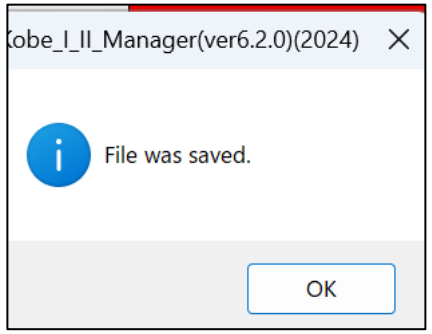
4. Running software: 4.4 Kobe I (Kobe plot)

② Save the image for your report

➔ 3 types(bmp, png or emf)➔ *.png is recommended.



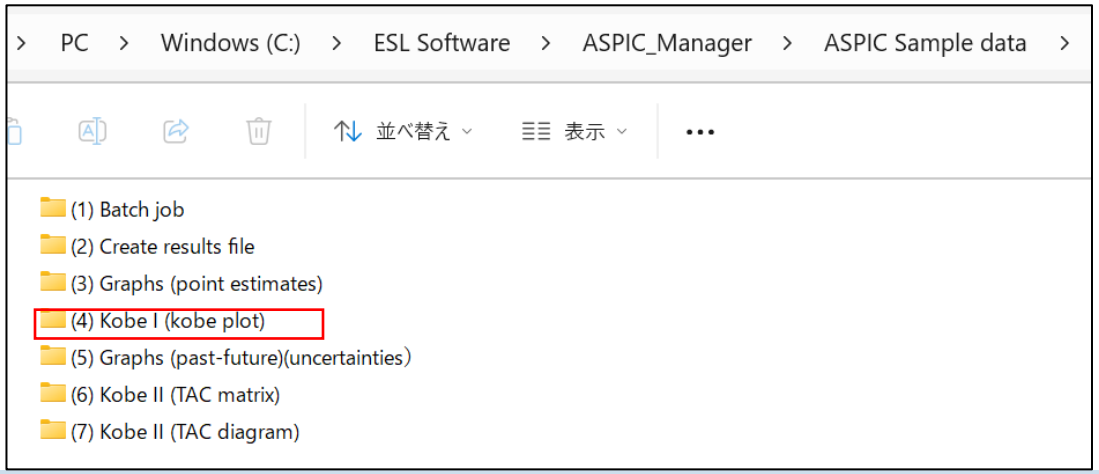


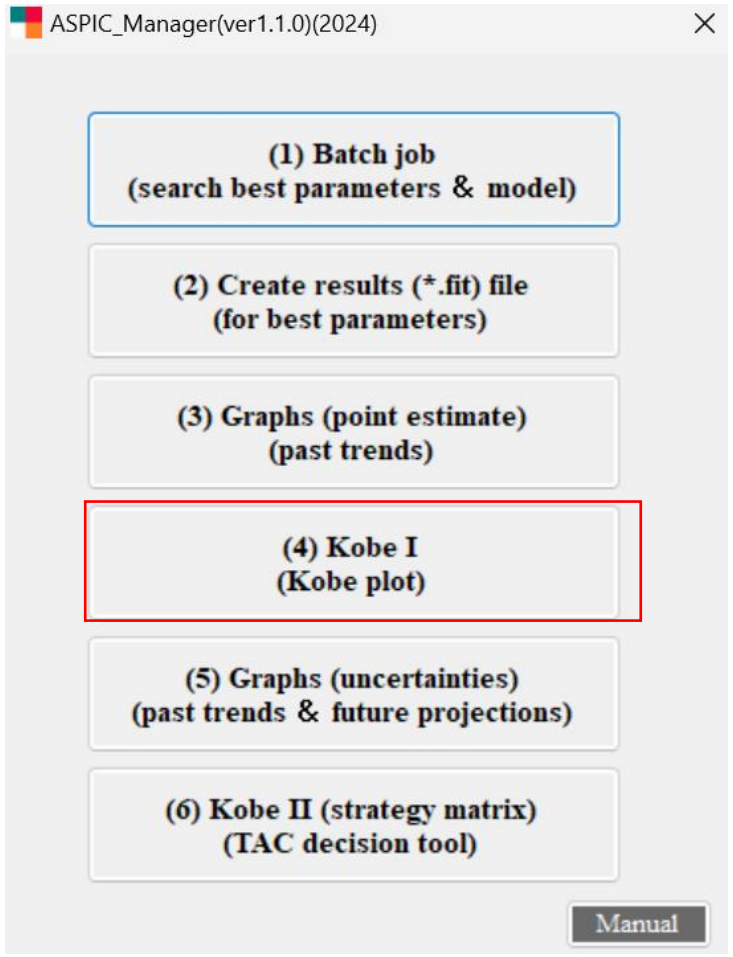


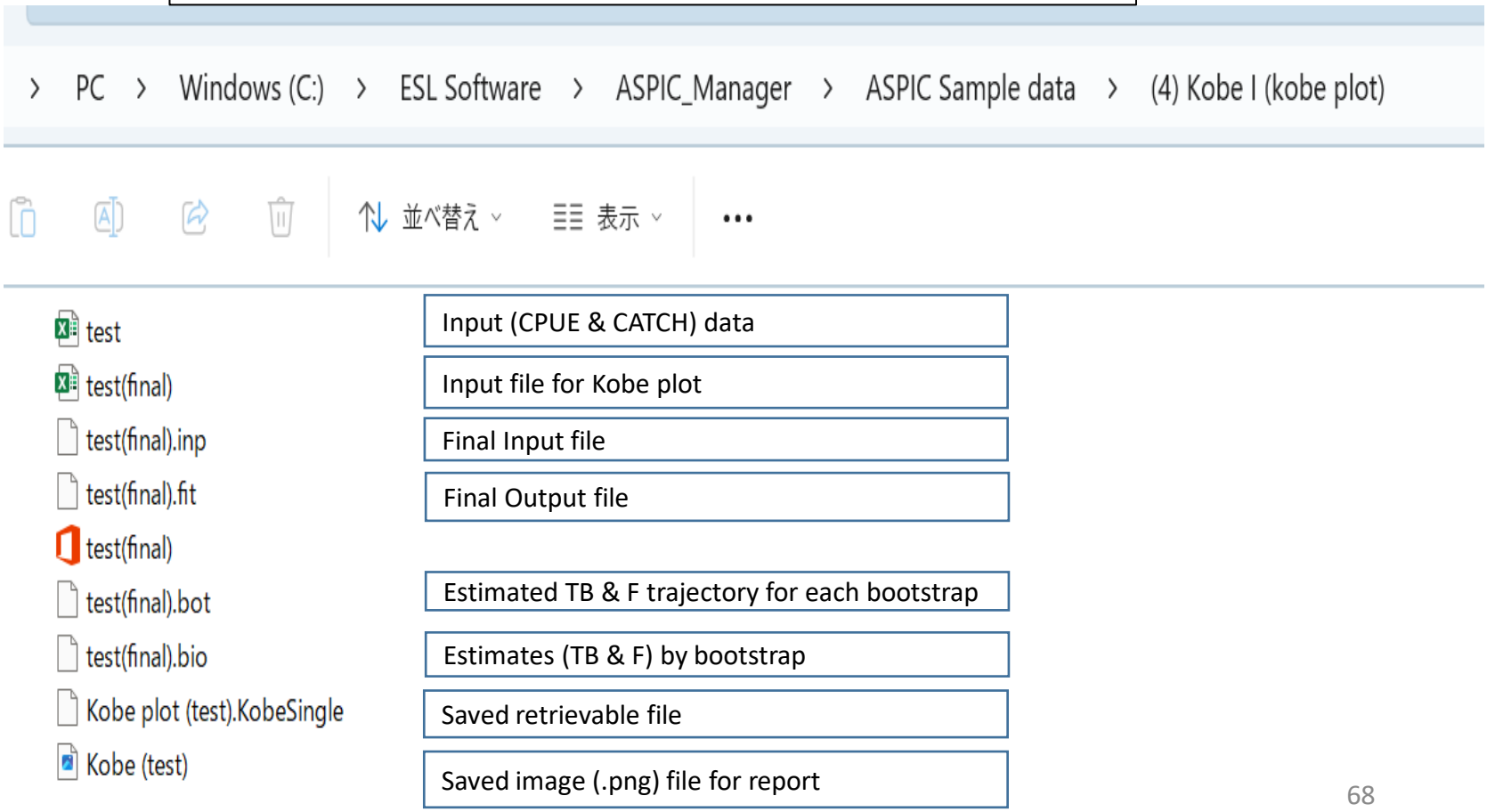
4. Running software: 4.4 Kobe I (Kobe plot)

ASPIC Sample data

List of INPUT & OUTPUT files for menu (4) Kobe I (Kobe plot)



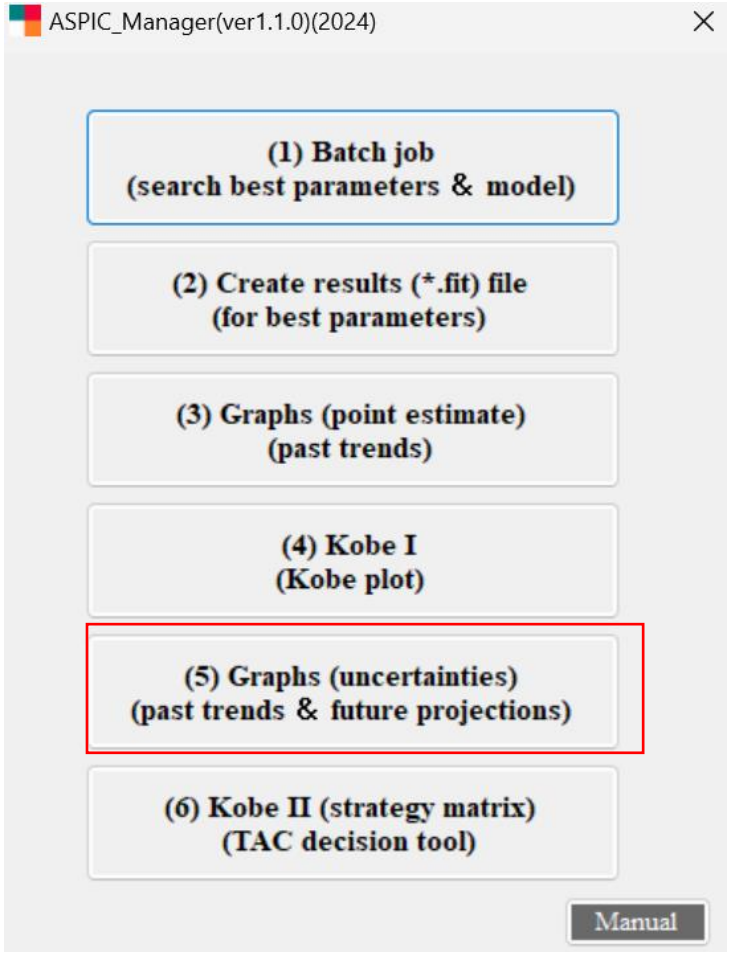




4. Running software

4.5 Graphs (Past trends & future projections with uncertainties)

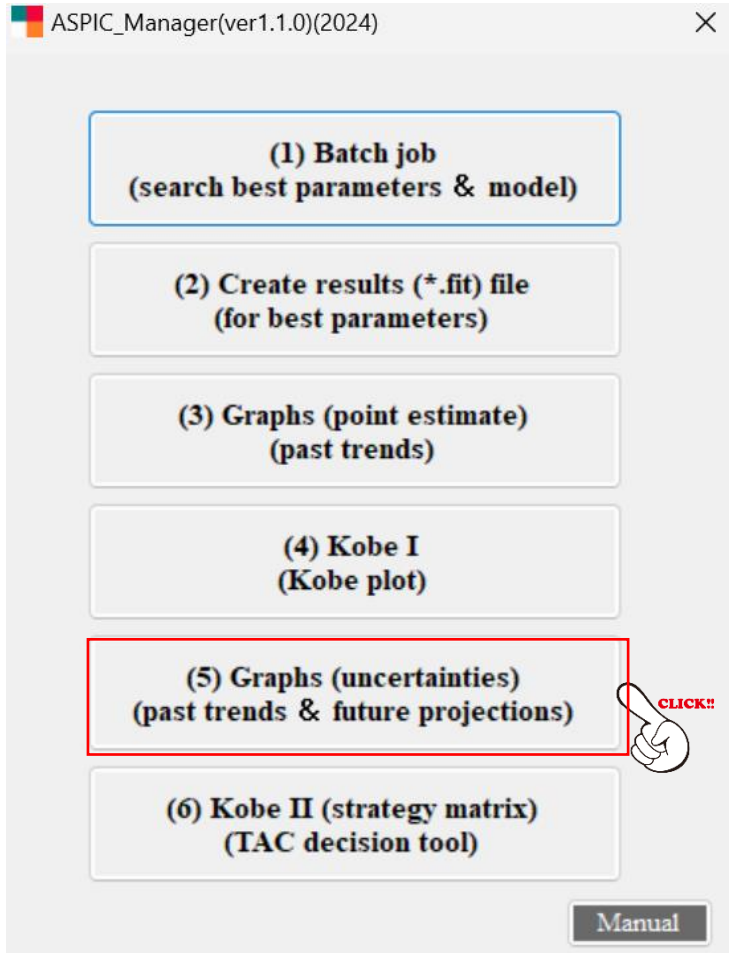
Trends of 6 key parameters with uncertainties estimated by bootstrap



4. Running software

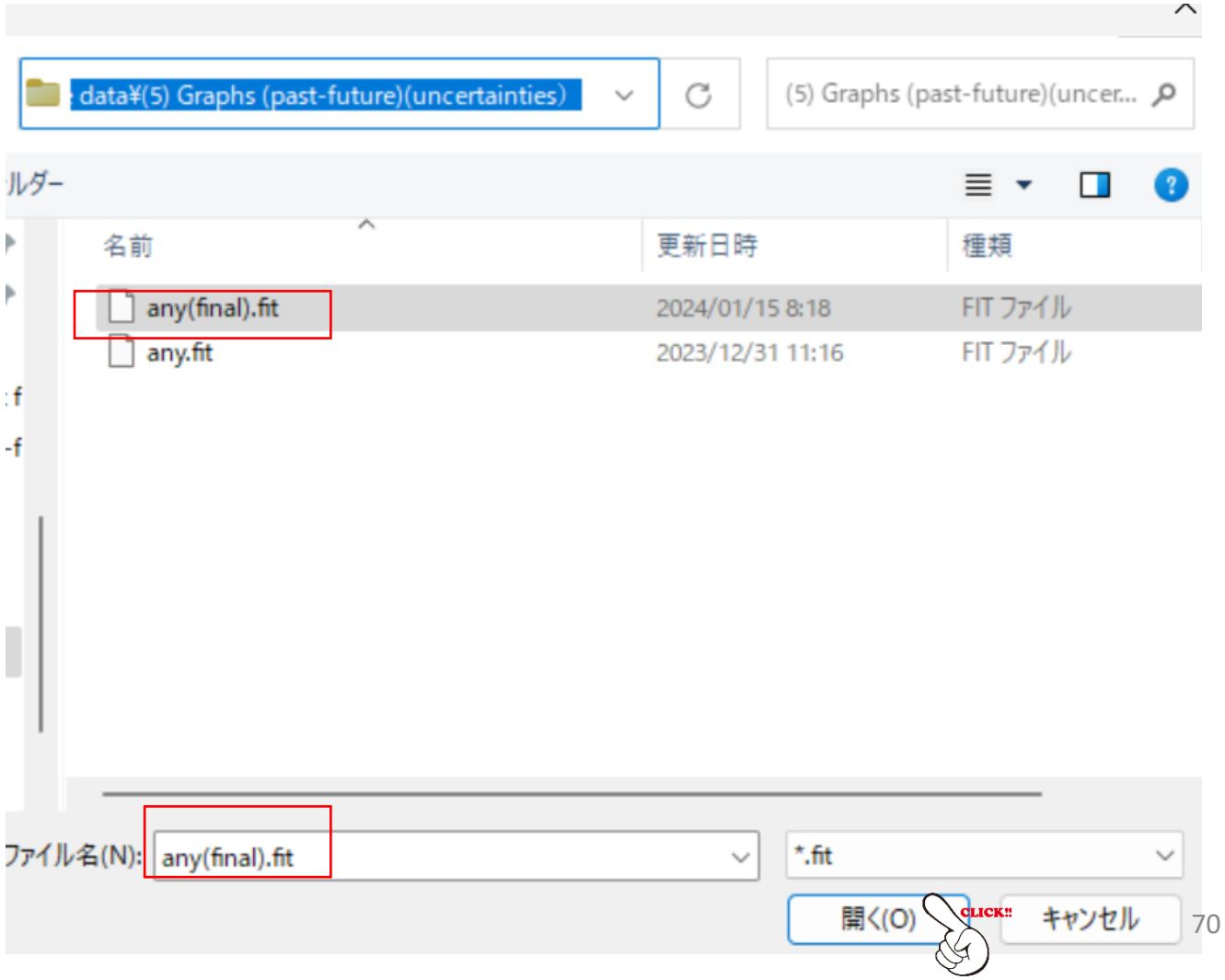
4.5 Graphs (Past trends & future projections with uncertainties)

Trends of 6 key parameters with uncertainties estimated by bootstrap (using other sample data)



Import the *(final).fit file

Test(final).fit (our example)

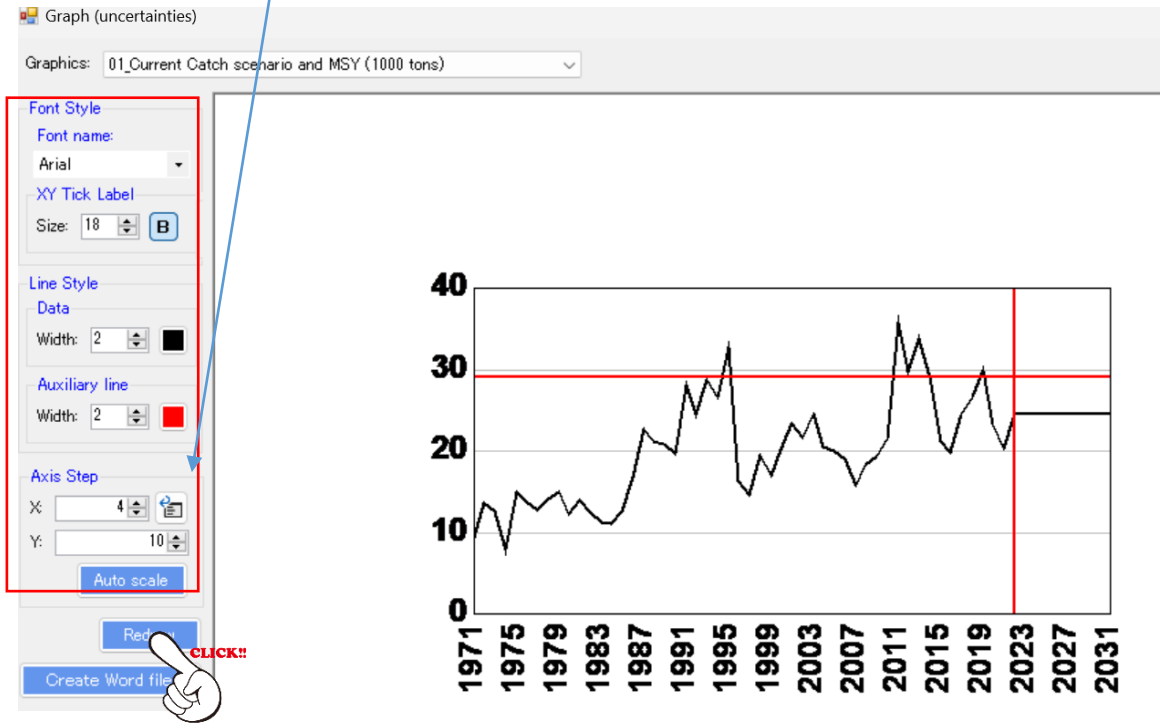


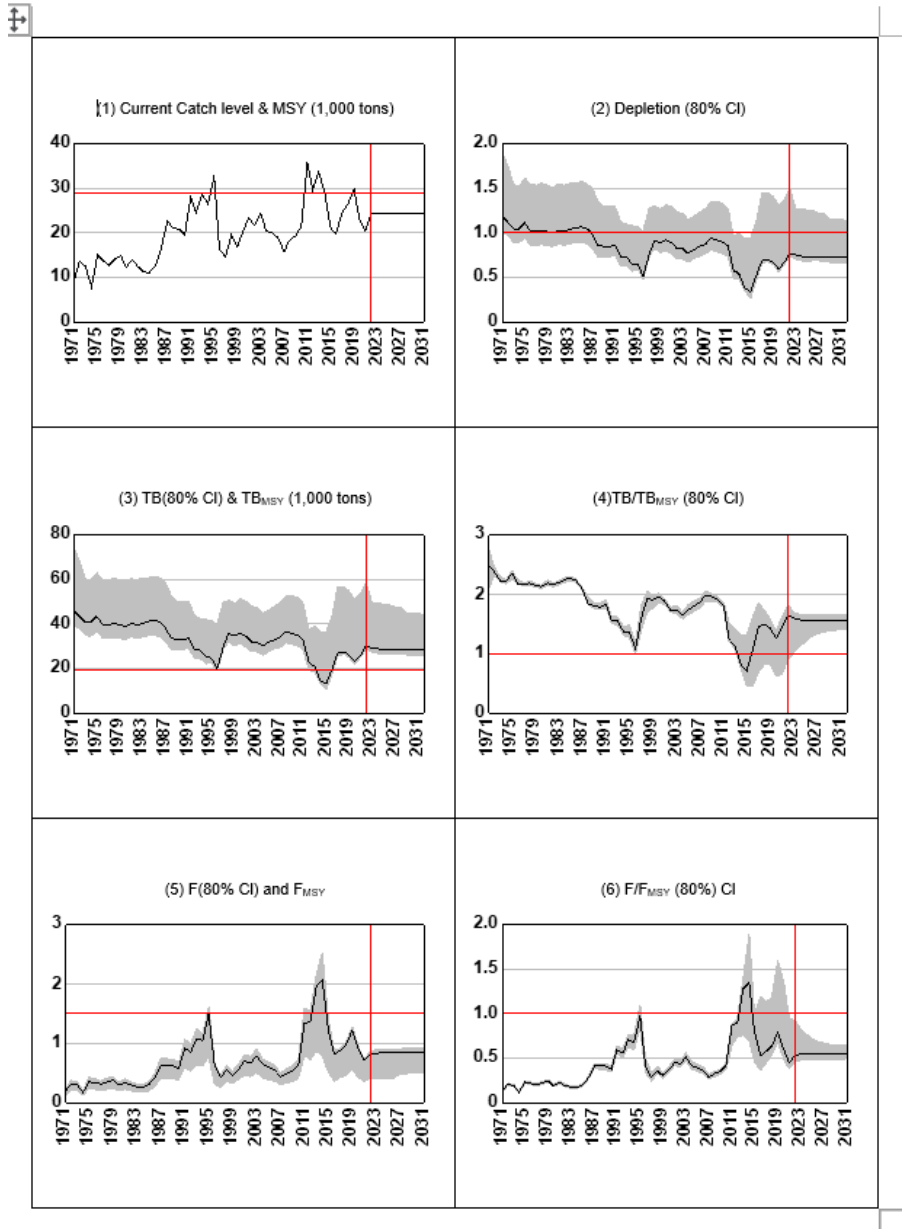
4. Running software

4.5 Graphs (Past trends & future projections with uncertainties)

After clicking “Open” (previous slide), users will see DOS process for bootstrapping for a short time. Then, the 1st graph (catch vs. MSY) appears (below). Users can edit 6 graphs using graph settings functions available on left (red box) except x-axis batch setting (for details, see slide # 51). After completing editions, click “Create word file” bottom. Then all 6 graphs will be made and saved in the word file with time stamp➔

Graphs (projection)_20231130125624

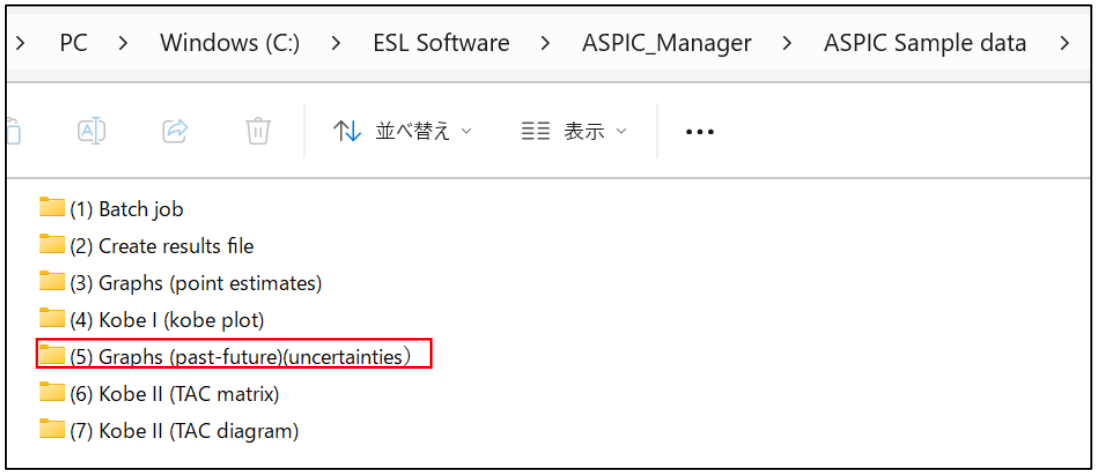


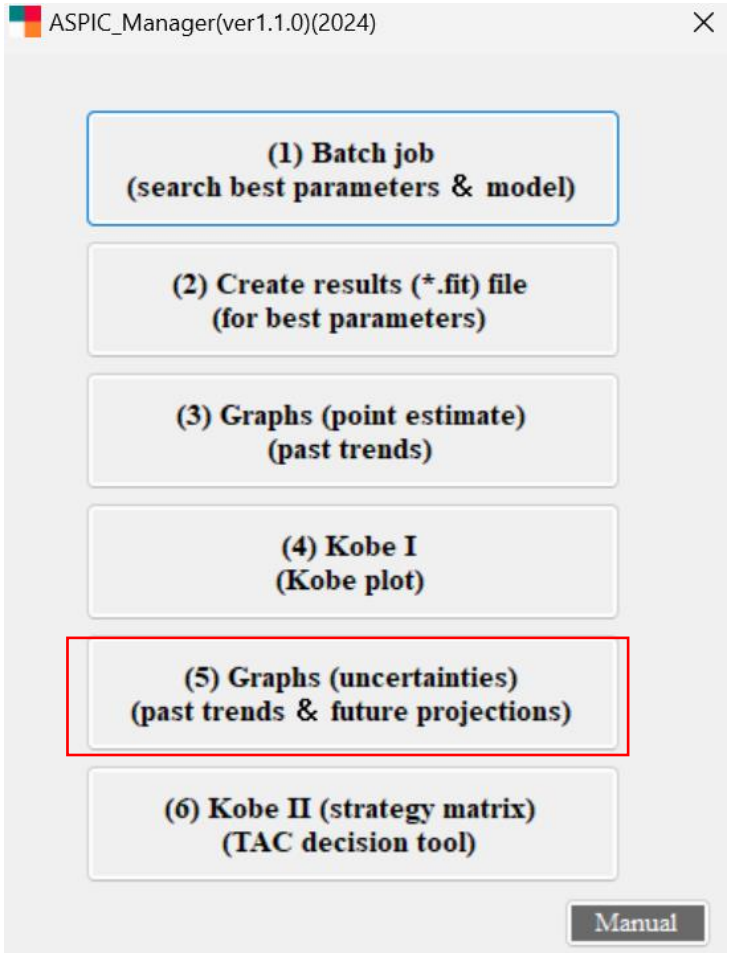


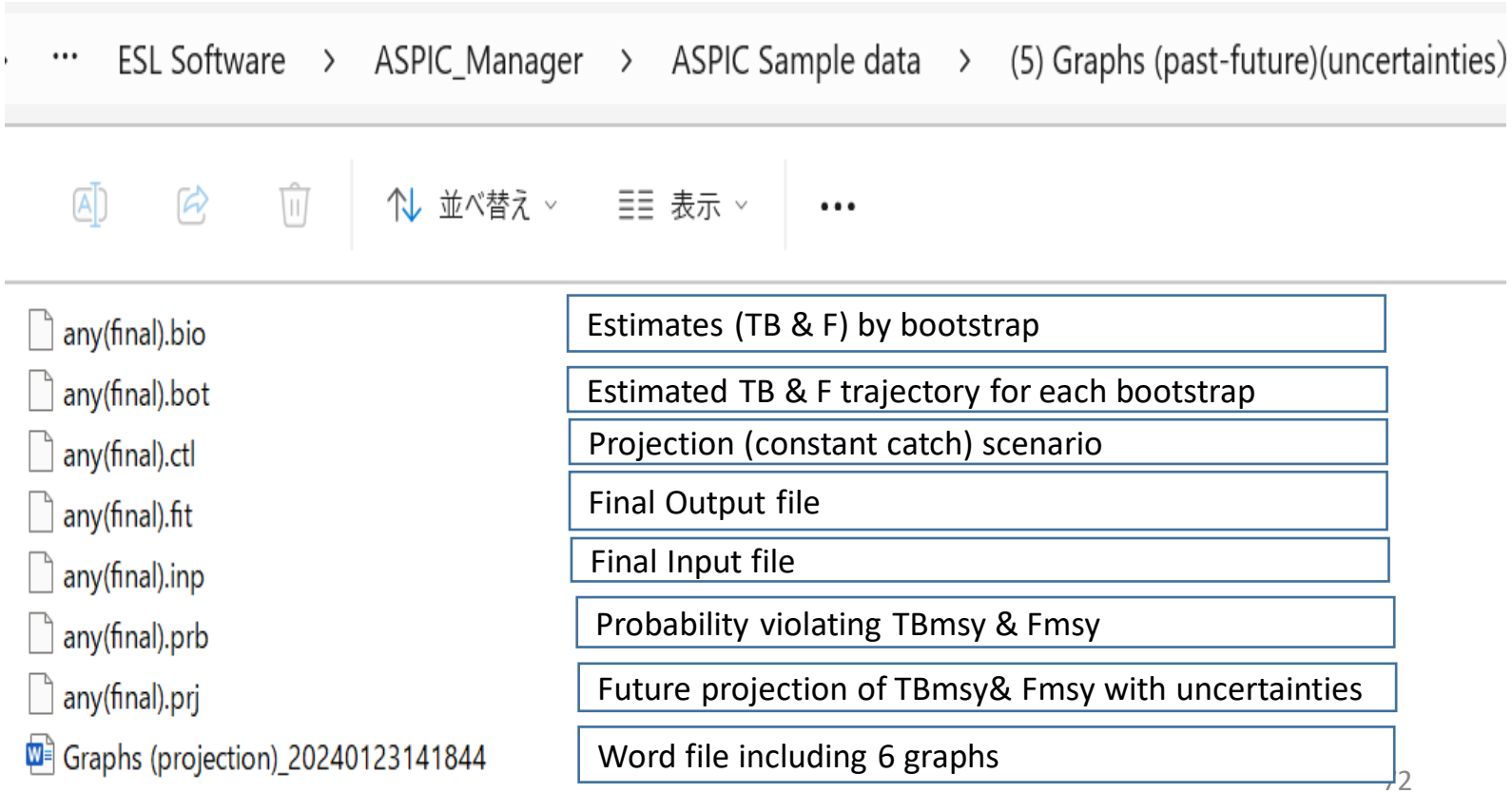
4. Running software

4.5 Graphs (Past trends & future projections with uncertainties)

ASPIC Sample data: List of INPUT & OUTPUT files

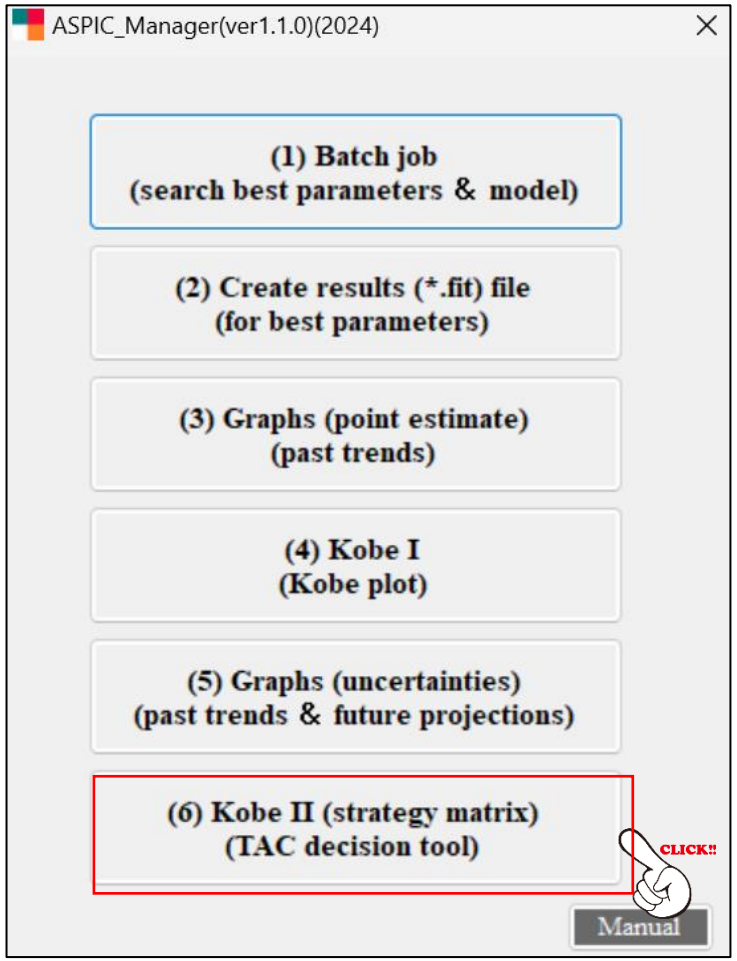




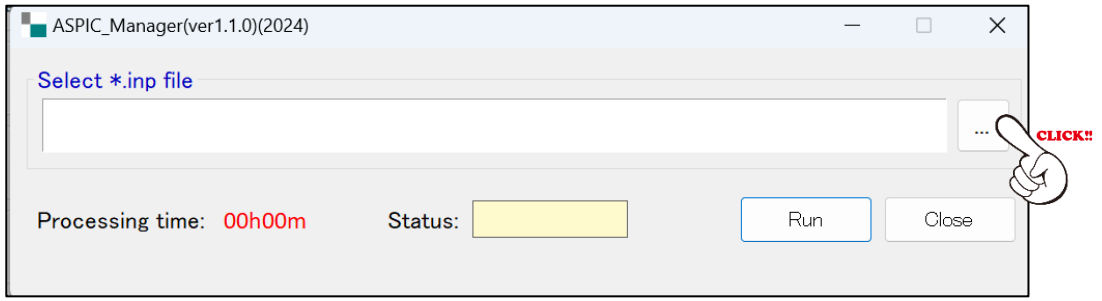


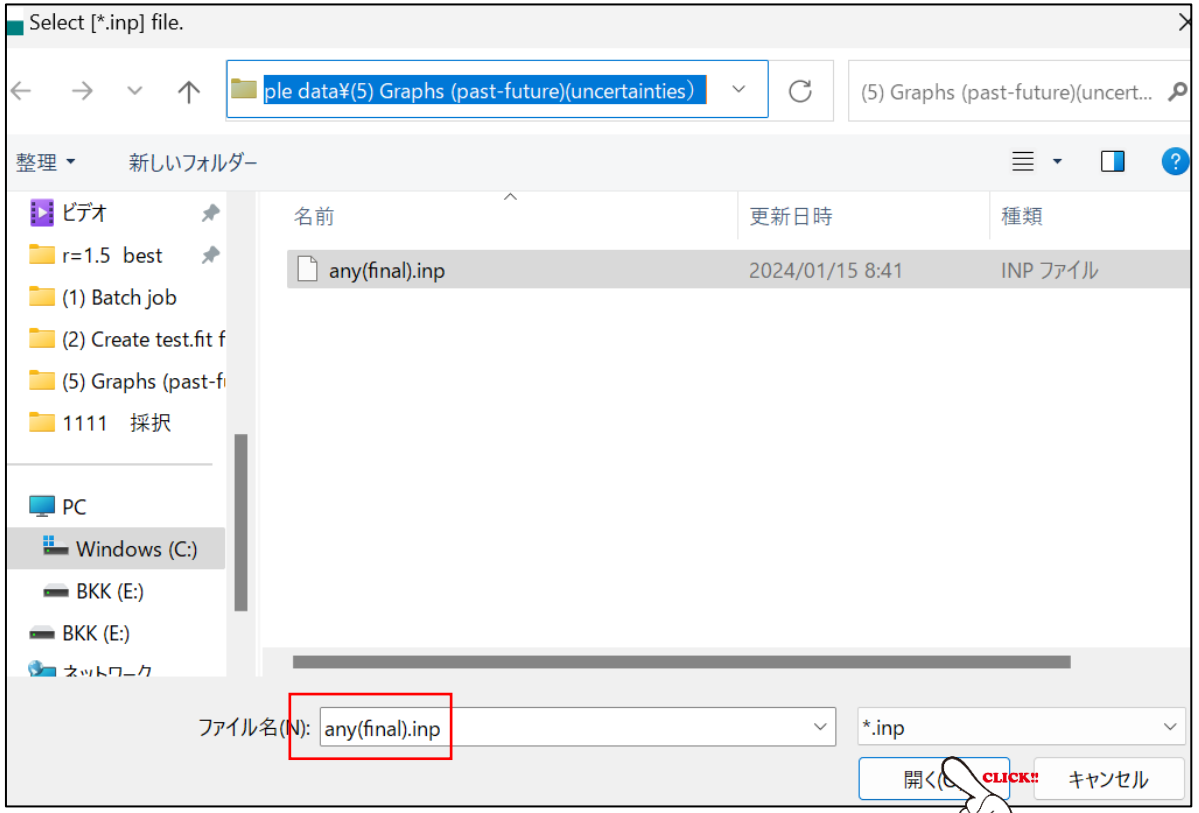
4. Running software : 4.6 Kobe II (Strategy matrix)(TAC decision tool by risk assessment)

Probability violating TBmsy & Fmsy in 3 & 10 years if current catch level contuses based on 1,000 bootstrapping



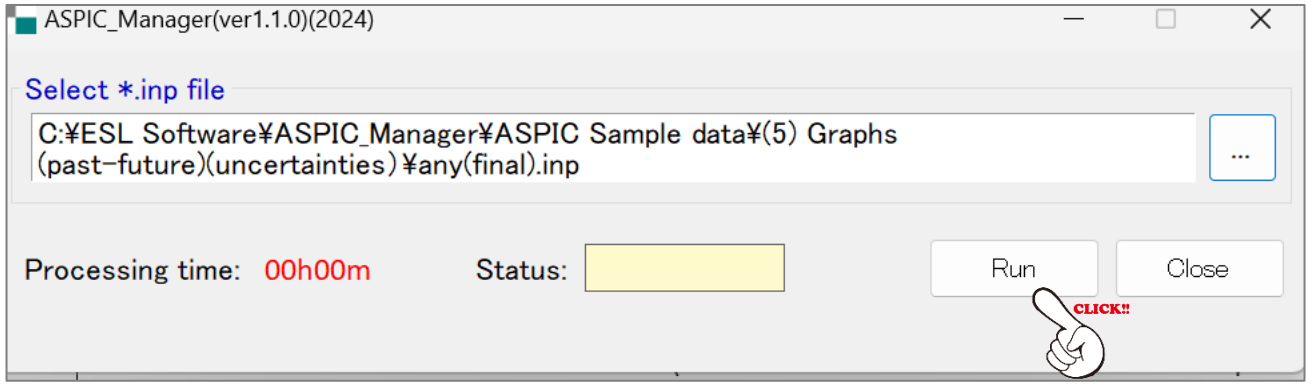
Import the test(final).inp (example)



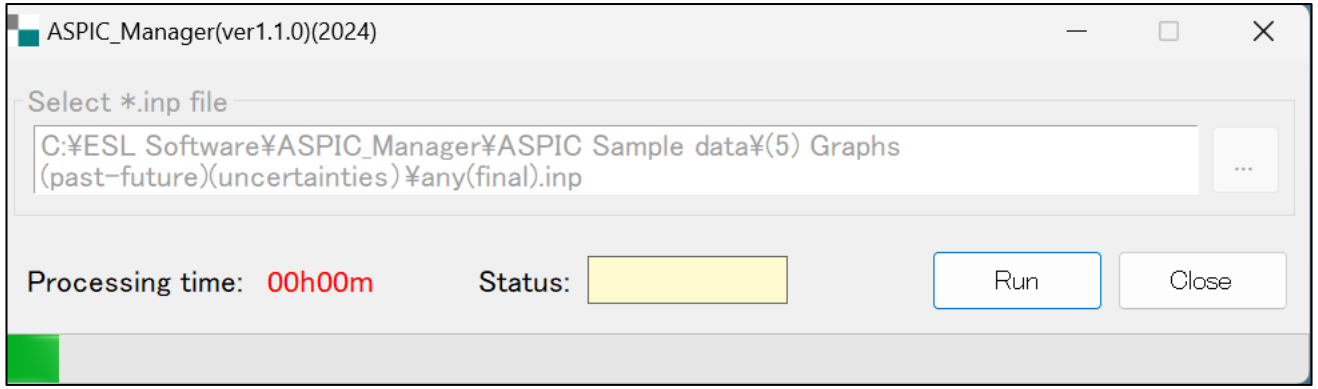


4. Running software: 4.6 Kobe II (Strategy matrix)

After importing the conformation window will appear (below)



It will take 10-30 minutes (sometimes a few hours) to complete depending on the data set and PC



4. Running software
4.6 Kobe II
(Strategy matrix)

Then, one excel sheet
(TB_F_KOBEII.xlsx)
containing
4 sheets is created.
(for the next 10 years)

1st Sheet :
TB_Kobe_II_Matrix

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

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

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

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

TB_Kobe_II_Matrix | F_Kobe_II_Matrix | TB_Projection | F_Projection

4. Running software
4.6 Kobe II
(Strategy matrix)

Then, one excel sheet (TB_F_KOBEII.xlsx) containing 4 sheets is created. (for the next 10 years)

2nd Sheet :
F_Kobe_II_Matrix

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

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

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

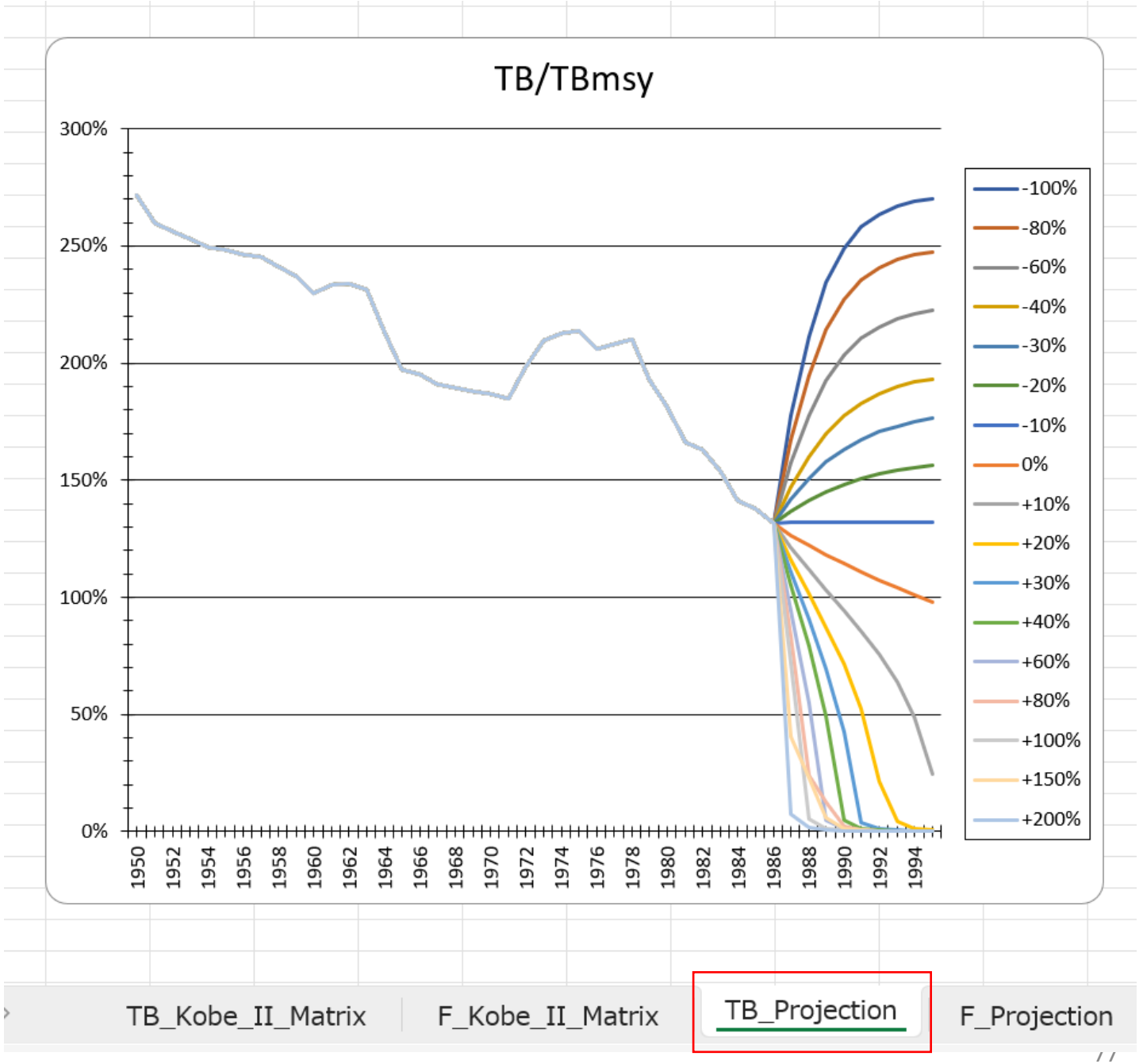
*(Note) * Average catch for 3 last assessments years ** MSY level*

TB_Kobe_II_Matrix | F_Kobe_II_Matrix | TB_Projection | F_Projection

4. Running software
4.6 Kobe II
(Strategy matrix)

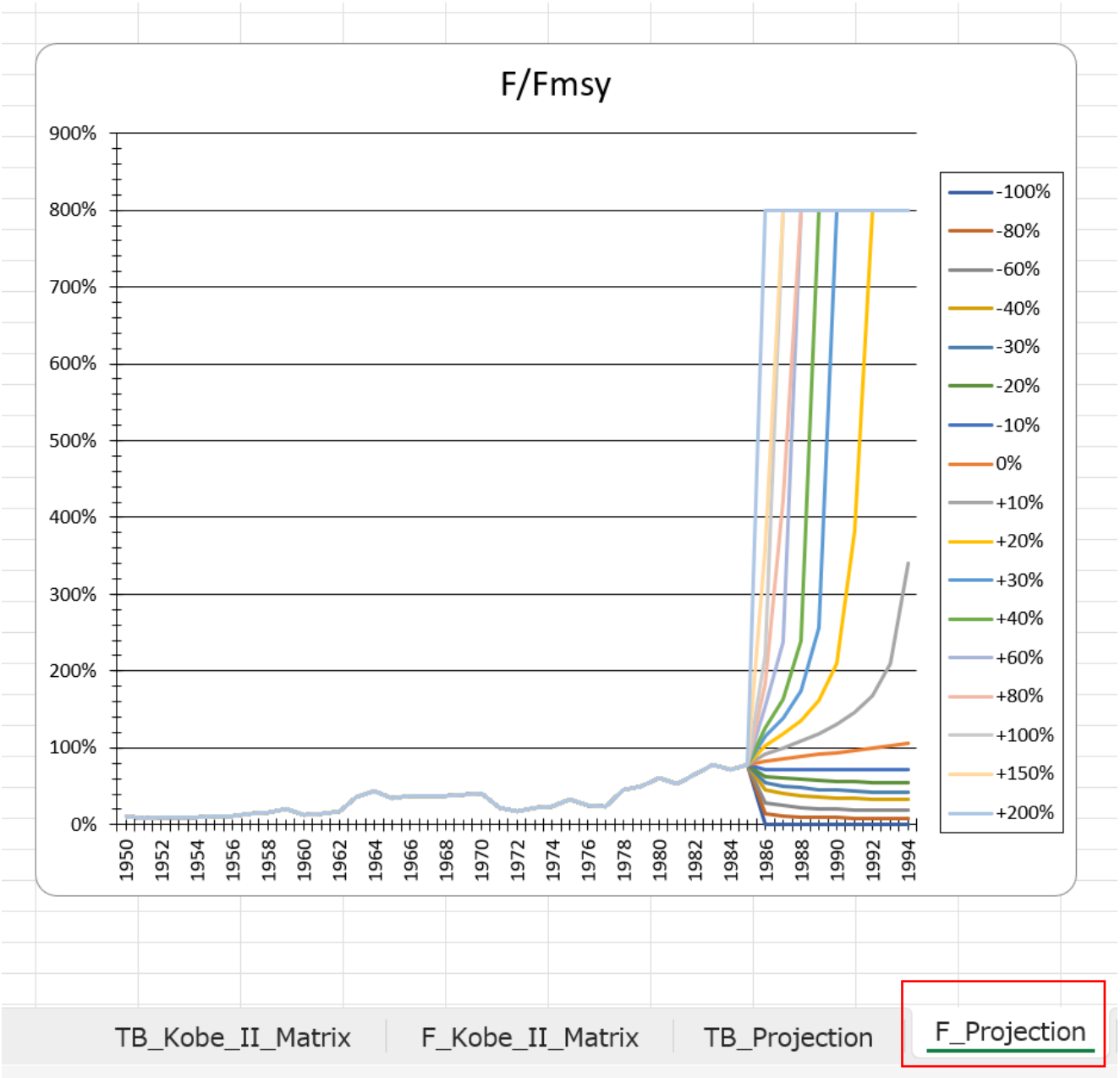
Then, one excel sheet
(TB_F_KOBEII.xlsx)
containing
4 sheets is created.
(for the next 10 years)

3rd Sheet :
TB_Projection



4. Running software
4.6 Kobe II
(Strategy matrix)

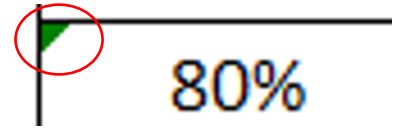
Then, one excel sheet
(TB_F_KOBEII.xlsx)
containing
4 sheets is created.
(for the next 10 years)



4th sheet :
F_Projection

Note:

Some users might have green triangles in the upper left corner of the cell
There are a few methods to clear. Please refer to the Excel manual.



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

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

	%	Catch (tons)	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994
% Increased from the current catch level	200%	40,533	36%	41%	85%	97%	100%	100%	100%	100%	100%	100%
	150%	33,778	36%	41%	79%	94%	99%	100%	100%	100%	100%	100%
	100%	27,022	36%	41%	71%	87%	95%	98%	99%	100%	100%	100%
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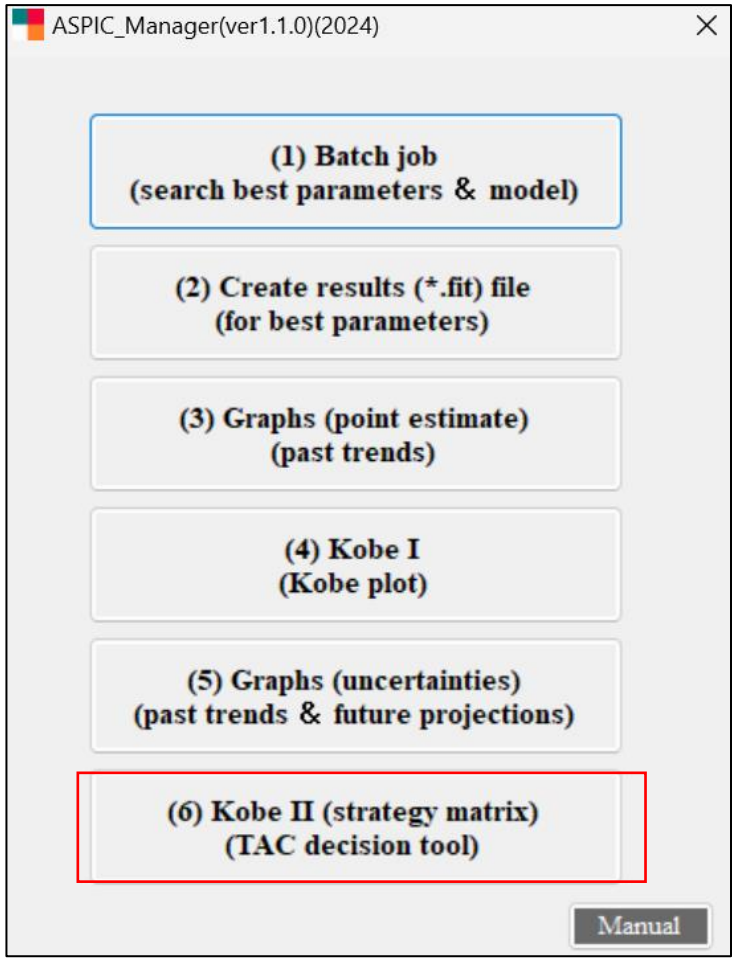
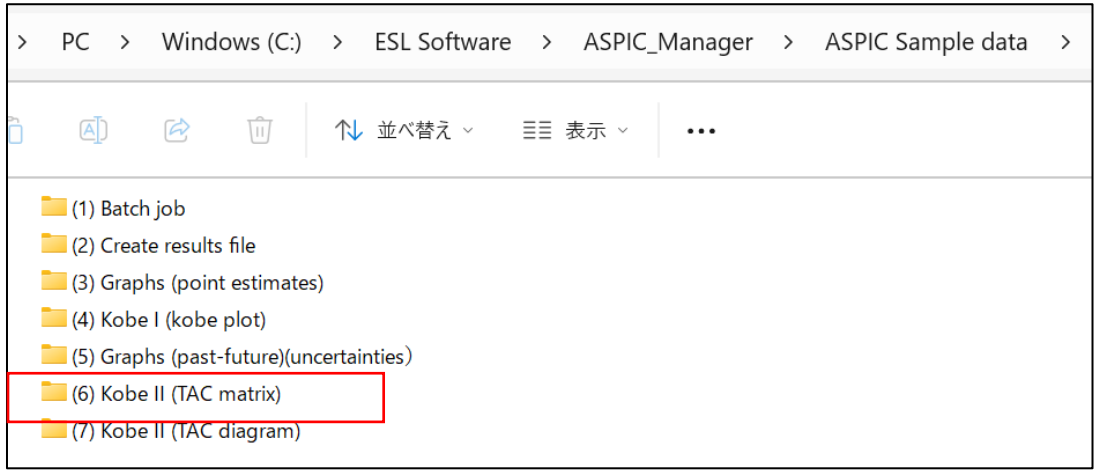
	40%	18,915	36%	41%	57%	70%	80%	87%	91%	94%	95%	97%
	30%	17,564	36%	41%	54%	67%	75%	82%	87%	91%	93%	95%
	20%	16,213	36%	41%	52%	61%	70%	77%	81%	86%	89%	90%
	10%	14,862	36%	41%	49%	56%	63%	69%	75%	79%	82%	84%
*** Current catch**	0%	13,511	36%	41%	47%	51%	56%	60%	64%	68%	71%	74%
% decreased from the current catch level	-5.6%	**12,760	36%	41%	45%	47%	50%	54%	57%	59%	62%	64%
	-10%	12,160	36%	41%	43%	45%	47%	50%	52%	53%	56%	58%
	-20%	10,809	36%	41%	40%	39%	37%	37%	37%	37%	37%	38%
	-30%	9,458	36%	41%	35%	31%	29%	27%	24%	23%	22%	21%
	-40%	8,107	36%	41%	32%	26%	19%	16%	14%	13%	12%	11%
	-60%	5,404	36%	41%	26%	13%	8%	6%	6%	6%	6%	6%
	-80%	2,702	36%	41%	19%	6%	3%	3%	3%	3%	3%	3%
	-100%	0	36%	41%	12%	2%	1%	1%	1%	1%	1%	1%

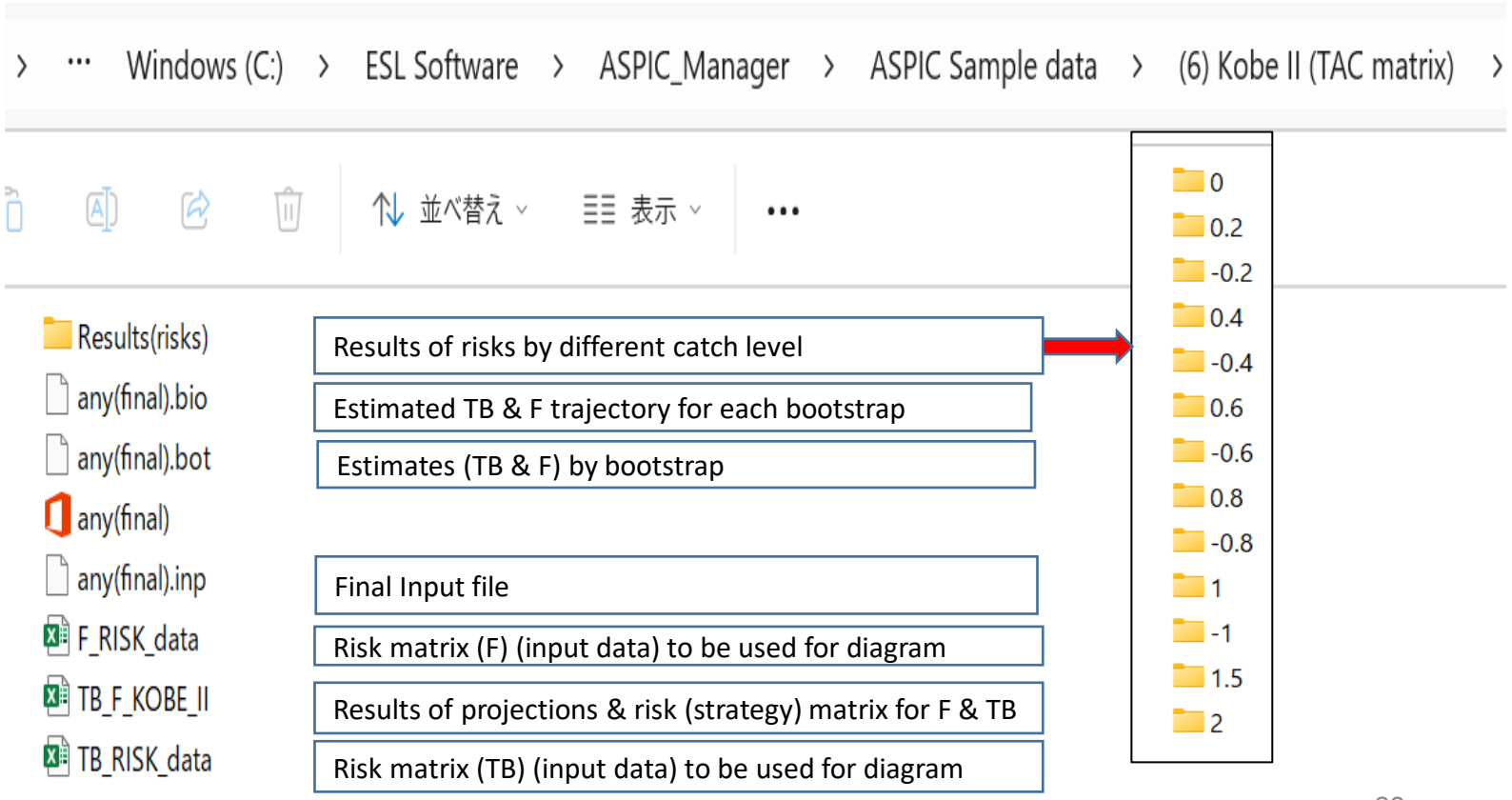
*(Note) * Average catch for 3 last assessments years ** MSY level*

4. Running software: 4.6 Kobe II (Strategy matrix)

ASPIC Sample data :List of INPUT & OUTPUT files







Appendix A: History of development

ASPIC Batch job (Grid search) menu-driven software (single menu)

➔ *Equivalent to Menu (1) in ASPIC_Manager*

Ver 1.1	February 13	2018
Ver 1.1 (REV)	February 18	2018
Ver 2.0	August 6	2018

ASPIC_Manager (all-in-one)

Ver 1.0.0	August	2023	6 menus (original)
Ver 1.0.7	September	2023	6 menus (Batch job improved)
Ver 1.1.0	April	2024	6 menus (Risk matrix improved)

Appendix B
Results of the batch job : test(final).fit

(next 4 slides)

Users will not use results as ASPIC_Manager software uses results in this file.
Majority of results are self-explanatory.
If users have difficulties to understand meanings of some of results,
refer to the original ASPIC manual (Prager, 2004) or
contact [MENU] Menu-driven stock assessment software developing team.

Friday, 08 Dec 2023 at 08:51:29

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

FIT program mode
FOX model mode
YLD conditioning
SSE optimization

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

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

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

CONTROL PARAMETERS (FROM INPUT FILE)

Input file: test(final).inp

Operation of ASPIC: Fit Fox exponential-yield model by direct optimization.

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

COMPARISON OF LOGISTIC AND FOX MODELS

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

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

PROGRAM STATUS INFORMATION (NON-BOOTSTRAPPED ANALYSIS)

error code 0

Normal convergence
Number of restarts required for convergence: 5

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

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

MODEL PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

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

MANAGEMENT and DERIVED PARAMETER ESTIMATES (NON-BOOTSTRAPPED)

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

ESTIMATED POPULATION TRAJECTORY (NON-BOOTSTRAPPED)

Obs	Year or ID	Estimated total F mort	Estimated starting biomass	Estimated average biomass	Observed total yield	Model total yield	Estimated surplus production	Ratio of F mort to Fmsy	Ratio of biomass to Bmsy
1	1950	0.057	6.562E+04	6.405E+04	3.646E+03	3.646E+03	7.852E+02	1.077E-01	2.718E+00
2	1951	0.041	6.276E+04	6.229E+04	2.581E+03	2.581E+03	1.709E+03	7.838E-02	2.600E+00
3	1952	0.049	6.189E+04	6.142E+04	2.993E+03	2.993E+03	2.138E+03	9.217E-02	2.564E+00
4	1953	0.054	6.103E+04	6.062E+04	3.303E+03	3.303E+03	2.535E+03	1.031E-01	2.528E+00
5	1954	0.050	6.027E+04	6.013E+04	3.034E+03	3.034E+03	2.778E+03	9.545E-02	2.496E+00
6	1955	0.059	6.001E+04	5.972E+04	3.502E+03	3.502E+03	2.970E+03	1.109E-01	2.486E+00
7	1956	0.057	5.948E+04	5.936E+04	3.358E+03	3.358E+03	3.144E+03	1.070E-01	2.464E+00
8	1957	0.078	5.926E+04	5.866E+04	4.578E+03	4.578E+03	3.468E+03	1.476E-01	2.455E+00
9	1958	0.085	5.815E+04	5.763E+04	4.904E+03	4.904E+03	3.946E+03	1.610E-01	2.409E+00
10	1959	0.111	5.720E+04	5.628E+04	6.232E+03	6.232E+03	4.553E+03	2.095E-01	2.369E+00
11	1960	0.068	5.552E+04	5.599E+04	3.828E+03	3.828E+03	4.705E+03	1.293E-01	2.300E+00
12	1961	0.078	5.639E+04	5.645E+04	4.381E+03	4.381E+03	4.492E+03	1.468E-01	2.336E+00
13	1962	0.095	5.651E+04	5.612E+04	5.342E+03	5.342E+03	4.634E+03	1.801E-01	2.341E+00
14	1963	0.191	5.580E+04	5.337E+04	1.019E+04	1.019E+04	5.784E+03	3.612E-01	2.311E+00
15	1964	0.228	5.139E+04	4.928E+04	1.126E+04	1.126E+04	7.424E+03	4.321E-01	2.129E+00
16	1965	0.183	4.756E+04	4.730E+04	8.652E+03	8.653E+03	8.182E+03	3.460E-01	1.970E+00
17	1966	0.201	4.709E+04	4.659E+04	9.349E+03	9.349E+03	8.431E+03	3.796E-01	1.951E+00
18	1967	0.198	4.617E+04	4.593E+04	9.107E+03	9.108E+03	8.661E+03	3.751E-01	1.913E+00
19	1968	0.201	4.572E+04	4.552E+04	9.172E+03	9.172E+03	8.799E+03	3.811E-01	1.894E+00
20	1969	0.204	4.535E+04	4.519E+04	9.203E+03	9.203E+03	8.909E+03	3.852E-01	1.879E+00
21	1970	0.212	4.506E+04	4.481E+04	9.495E+03	9.495E+03	9.035E+03	4.009E-01	1.866E+00
22	1971	0.114	4.460E+04	4.636E+04	5.266E+03	5.266E+03	8.535E+03	2.149E-01	1.847E+00
23	1972	0.097	4.787E+04	4.932E+04	4.766E+03	4.766E+03	7.463E+03	1.828E-01	1.983E+00
24	1973	0.119	5.056E+04	5.097E+04	6.074E+03	6.074E+03	6.816E+03	2.254E-01	2.095E+00
25	1974	0.124	5.131E+04	5.145E+04	6.362E+03	6.362E+03	6.621E+03	2.339E-01	2.125E+00
26	1975	0.175	5.156E+04	5.054E+04	8.839E+03	8.839E+03	6.962E+03	3.308E-01	2.136E+00
27	1976	0.134	4.969E+04	4.996E+04	6.696E+03	6.696E+03	7.205E+03	2.535E-01	2.058E+00
28	1977	0.127	5.020E+04	5.051E+04	6.409E+03	6.409E+03	6.993E+03	2.400E-01	2.079E+00
29	1978	0.244	5.078E+04	4.851E+04	1.184E+04	1.183E+04	7.711E+03	4.615E-01	2.103E+00
30	1979	0.265	4.666E+04	4.501E+04	1.194E+04	1.194E+04	8.946E+03	5.016E-01	1.933E+00
31	1980	0.325	4.366E+04	4.169E+04	1.356E+04	1.356E+04	9.970E+03	6.152E-01	1.809E+00
32	1981	0.281	4.008E+04	3.973E+04	1.118E+04	1.118E+04	1.054E+04	5.324E-01	1.660E+00
33	1982	0.346	3.943E+04	3.817E+04	1.322E+04	1.321E+04	1.092E+04	6.548E-01	1.633E+00
34	1983	0.409	3.714E+04	3.548E+04	1.453E+04	1.453E+04	1.152E+04	7.744E-01	1.538E+00
35	1984	0.380	3.413E+04	3.363E+04	1.279E+04	1.279E+04	1.188E+04	7.194E-01	1.414E+00
36	1985		3.322E+04						1.376E+00

RESULTS FOR DATA SERIES # 1 (NON-BOOTSTRAPPED) CPUE Catch

Data type CC: CPUE-catch series Series weight: 1.000

Obs	Year	Observed CPUE	Estimated CPUE	Estim F	Observed yield	Model yield	Resid in log scale
1	1950	*	3.912E+02	0.0569	3.646E+03	3.646E+03	0.00000
2	1951	*	3.804E+02	0.0414	2.581E+03	2.581E+03	0.00000
3	1952	*	3.751E+02	0.0487	2.993E+03	2.993E+03	0.00000
4	1953	*	3.702E+02	0.0545	3.303E+03	3.303E+03	0.00000
5	1954	*	3.672E+02	0.0505	3.034E+03	3.034E+03	0.00000
6	1955	*	3.647E+02	0.0586	3.502E+03	3.502E+03	0.00000
7	1956	*	3.625E+02	0.0566	3.358E+03	3.358E+03	0.00000
8	1957	*	3.582E+02	0.0780	4.578E+03	4.578E+03	0.00000
9	1958	*	3.520E+02	0.0851	4.904E+03	4.904E+03	0.00000
10	1959	*	3.437E+02	0.1107	6.232E+03	6.232E+03	0.00000
11	1960	*	3.419E+02	0.0684	3.828E+03	3.828E+03	0.00000
12	1961	*	3.448E+02	0.0776	4.381E+03	4.381E+03	0.00000
13	1962	*	3.427E+02	0.0952	5.342E+03	5.342E+03	0.00000
14	1963	*	3.259E+02	0.1909	1.019E+04	1.019E+04	0.00000
15	1964	3.800E+02	3.010E+02	0.2284	1.126E+04	1.126E+04	-0.23319
16	1965	2.400E+02	2.888E+02	0.1829	8.652E+03	8.652E+03	0.18525
17	1966	2.290E+02	2.845E+02	0.2007	9.349E+03	9.349E+03	0.21701
18	1967	2.780E+02	2.805E+02	0.1983	9.107E+03	9.107E+03	0.00879
19	1968	2.200E+02	2.780E+02	0.2015	9.172E+03	9.172E+03	0.23395
20	1969	1.970E+02	2.760E+02	0.2037	9.203E+03	9.203E+03	0.33709
21	1970	2.190E+02	2.736E+02	0.2119	9.495E+03	9.495E+03	0.22269
22	1971	*	2.831E+02	0.1136	5.266E+03	5.266E+03	0.00000
23	1972	*	3.012E+02	0.0966	4.766E+03	4.766E+03	0.00000
24	1973	*	3.112E+02	0.1192	6.074E+03	6.074E+03	0.00000
25	1974	*	3.142E+02	0.1237	6.362E+03	6.362E+03	0.00000
26	1975	3.500E+02	3.086E+02	0.1749	8.839E+03	8.839E+03	-0.12575
27	1976	3.090E+02	3.051E+02	0.1340	6.696E+03	6.696E+03	-0.01257
28	1977	3.370E+02	3.085E+02	0.1269	6.409E+03	6.409E+03	-0.08840
29	1978	4.450E+02	2.962E+02	0.2440	1.184E+04	1.184E+04	-0.40692
30	1979	3.160E+02	2.749E+02	0.2652	1.194E+04	1.194E+04	-0.13938
31	1980	2.520E+02	2.546E+02	0.3252	1.356E+04	1.356E+04	0.01016
32	1981	2.310E+02	2.426E+02	0.2814	1.118E+04	1.118E+04	0.04894
33	1982	2.830E+02	2.331E+02	0.3462	1.322E+04	1.322E+04	-0.19383
34	1983	2.220E+02	2.167E+02	0.4094	1.453E+04	1.453E+04	-0.02420
35	1984	2.130E+02	2.054E+02	0.3803	1.279E+04	1.279E+04	-0.03638

* Asterisk indicates missing value(s).


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