April 19 (Tue), 2016 Day 3

- (04) ASPIC outline

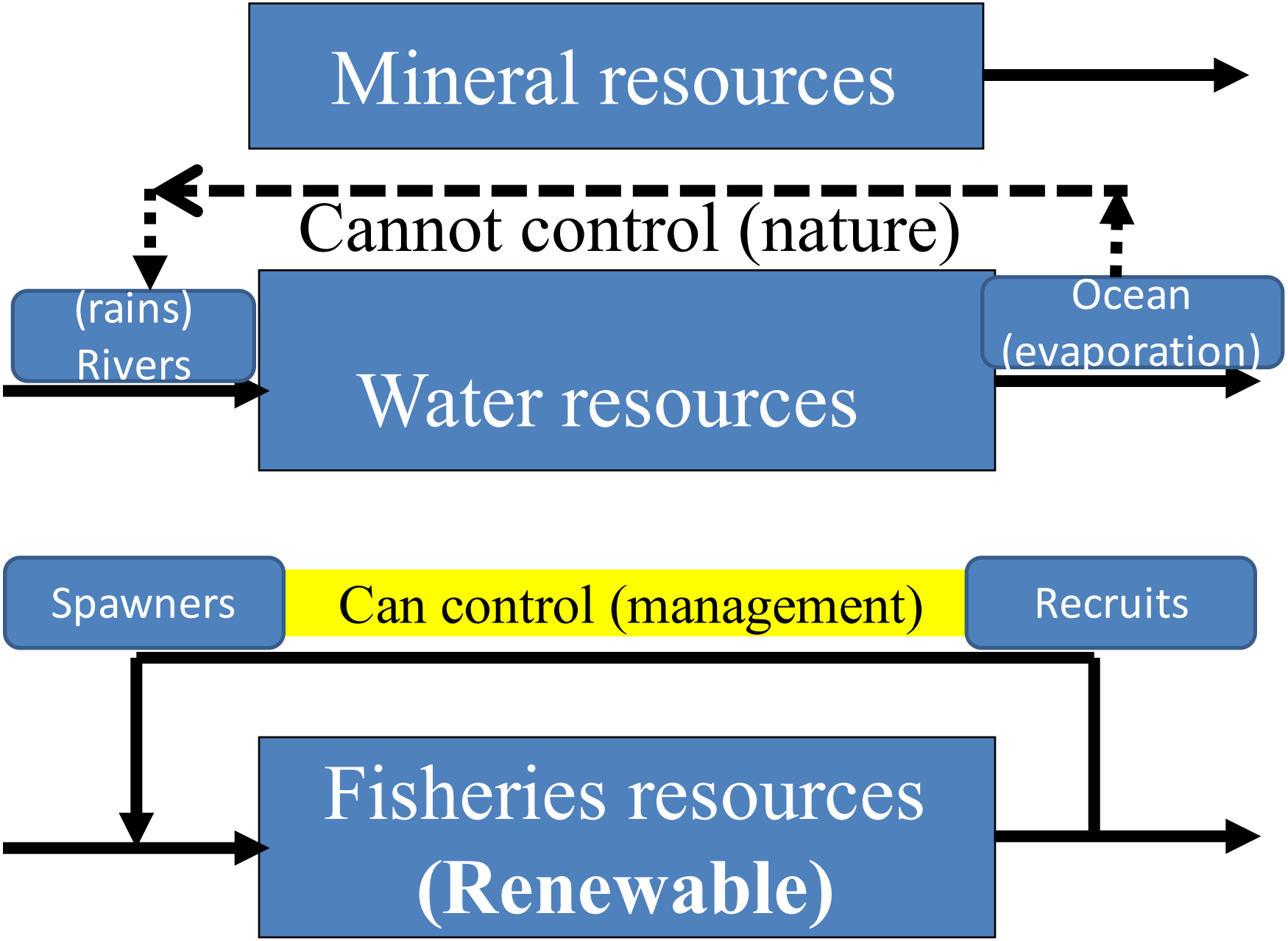
Stock assessments (SA) using ASPIC

Why we need stock assessments?

To understand **the status of the stock**
in order to manage the fisheries resources safely
for sustainable utilization

Fisheries resources is renewable
We need manage well

What is renewable ?


Mineral resources
Cannot control (nature)
(rains)
Rivers
Water resources
Ocean
(evaporation)
Spawners
Can control (management)
Recruits
Fisheries resources
(Renewable)

How do we use stock assessments results

Simple example

Catch (BET, Indian Ocean) in 2016

should not exceed

the MSY level (99,000 tons)

We need the reference point (MSY, Fmsy..)

by stock assessments for sustainable utilization

How many SA methods ? Many methods (about 10 types and more than 50 approaches)

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

IOTC (2015)

Table

seems to be complicated and complex

But….

SA methods: 2 categories

[1] Qualitative (demography, PSA..) (parameters only)

[2] Quantitative (catch, CPUE, Biological parameters)

(2a) Snap shot (short term average situation)(FiSAT)

➔ **Partial reference point (no MSY)**

(2b) **Traditional (PM, Age based)**

(2c) Catch model (data poor)

(2d) Integrated approaches (SS3, Multifan-cl)

➔ **ALL reference points (MSY, Fmsy…)**

Summary of catch discussion

- Pacific ➔ we will use FAO
- Indian Ocean ➔ we will consider both FAO and IOTC

➔ need to investigate causes of big different 1996-98

(LOT)

➔ If we can not find the causes, we might use averages

We need SA methods with ALL reference points

(2b) Traditional

(Production , Age based models)

(2c) Catch model (data poor method)

(2d) Integrated approaches (SS3, Multifan-cl)

We consider (2b) as a first step..

If we have only catch we will consider (2c)

We will not consider (2d) : too complicated

beyond our scope

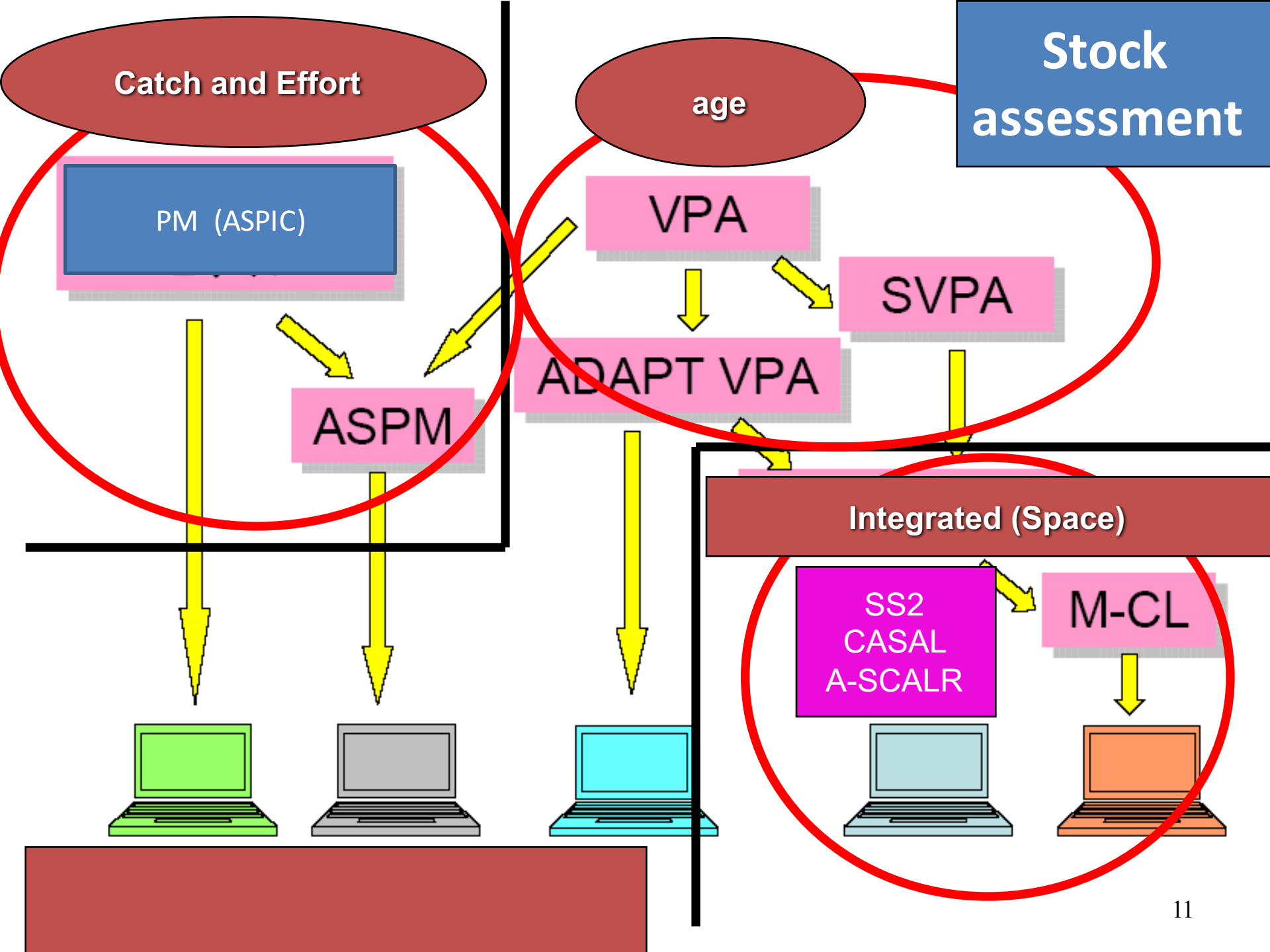
Within (2a) Traditional SA: Two types

Catch and CPUE➔ PM (production model)

Catch, CPUE and Biological parameters

➔ Age/size based SA (VPA, SCAA, ASPM etc)

We attempt the simple PM first..


Stock assessment
Catch and Effort
age
PM (ASPIC)
VPA
SVPA
ADAPT VPA
ASPM
Integrated (Space)
SS2
CASAL
A-SCALR
M-CL

Why we choose ASPIC ?

Within PM: 2 types

Equilibrium (Pop increase=decrease)

PM: Schaefer, Fox, P-T models

Non equilibrium (Pop increase ≠ decrease)

ASPIC based Schaefer, Fox, P-T models

➔ **realistic and common among RFMOs**

We will use ASPIC

A Stock Production Model Incorporating Covariates

Problems in Stock assessments

Not like fine scale (**exact**) sciences
Unlike physics, chemistry, engineering type

But more **fuzzy** sciences
Large Uncertainties (data + model)

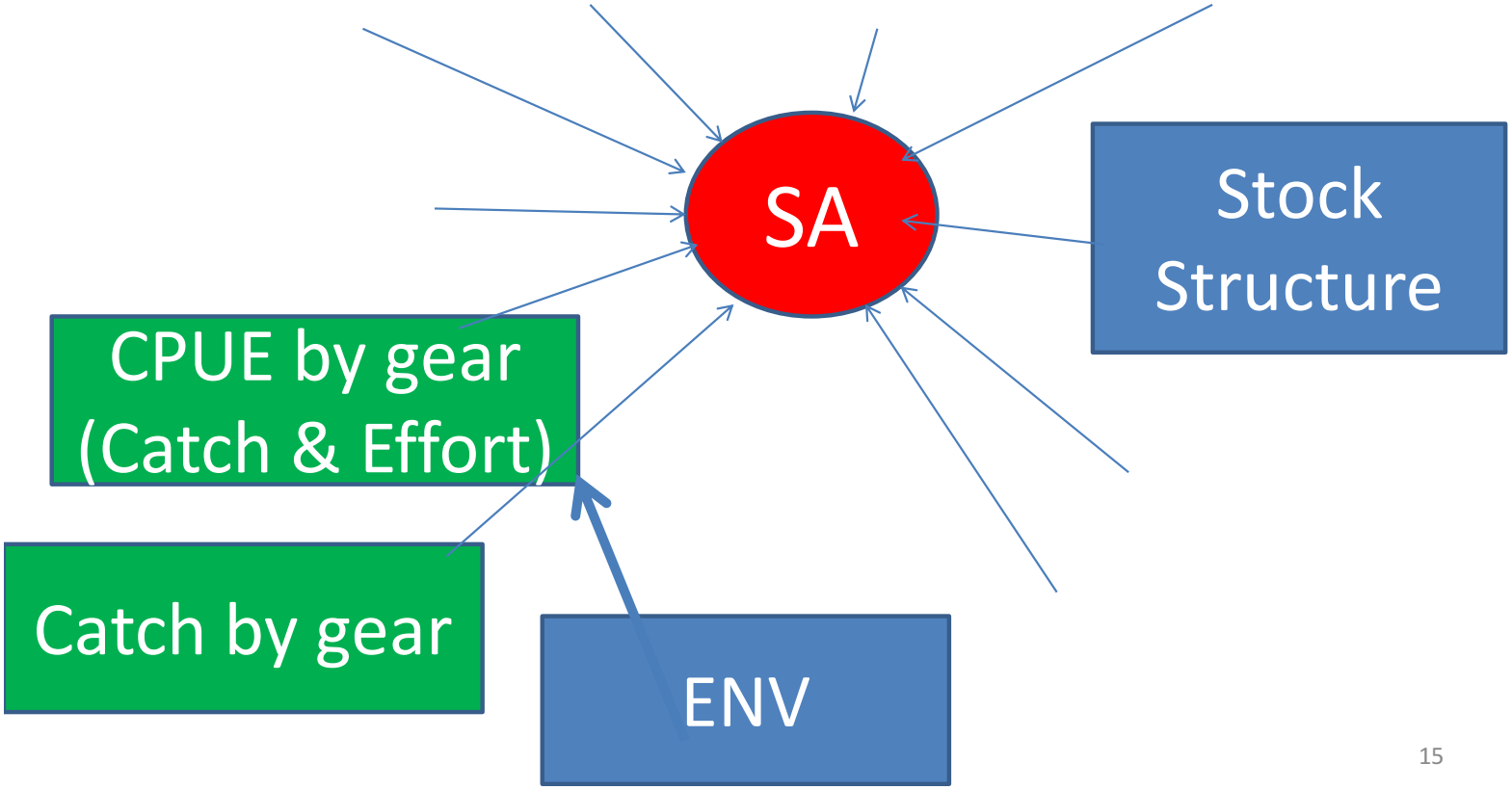
Uncertain results(MSY, Fmsy..)

Precautionary approach

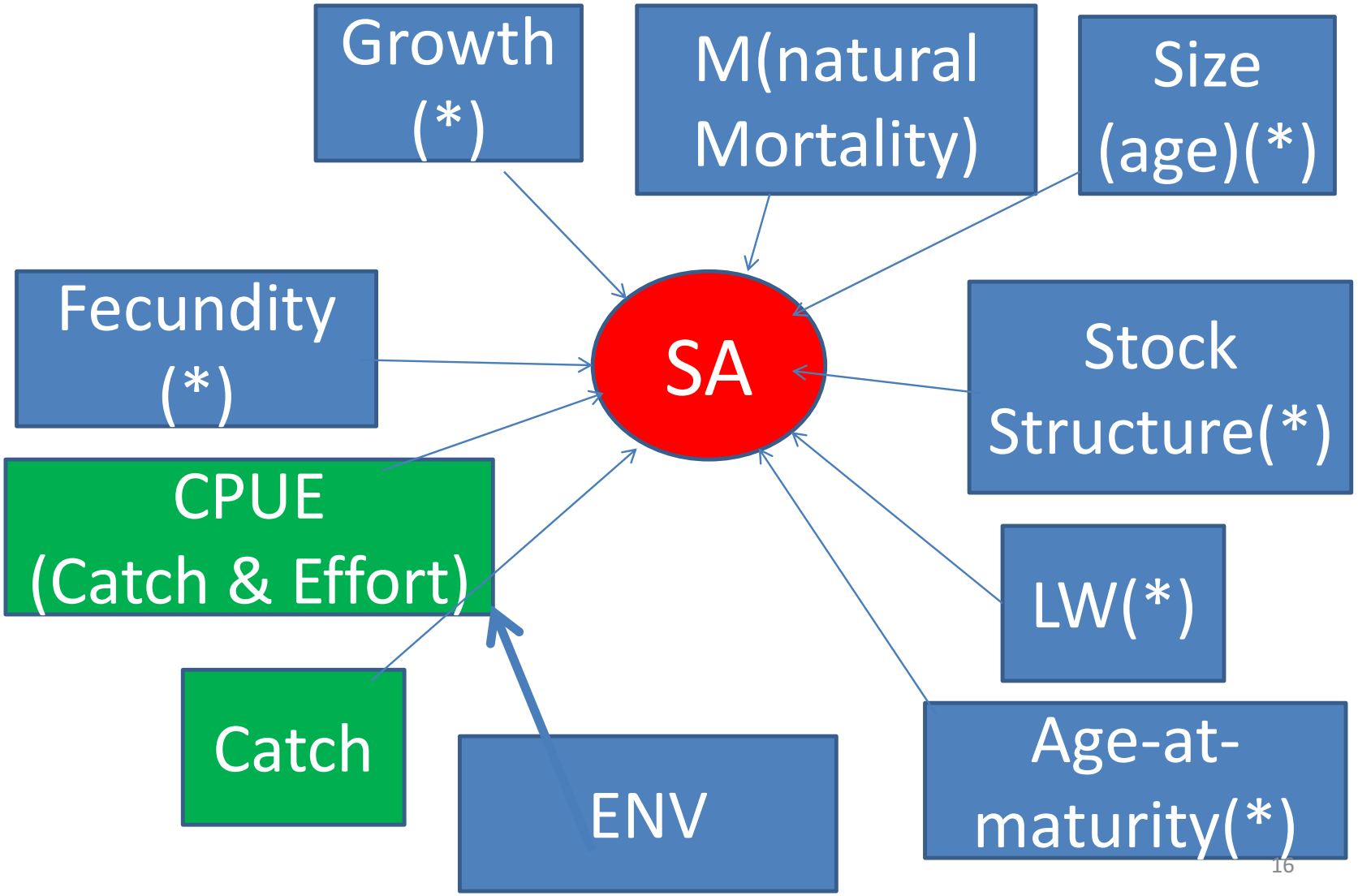
MSY=30,000 tons (95%CI: 10,000-40,000 tons)

We may choose **20,000 ton (2016 TAC)**

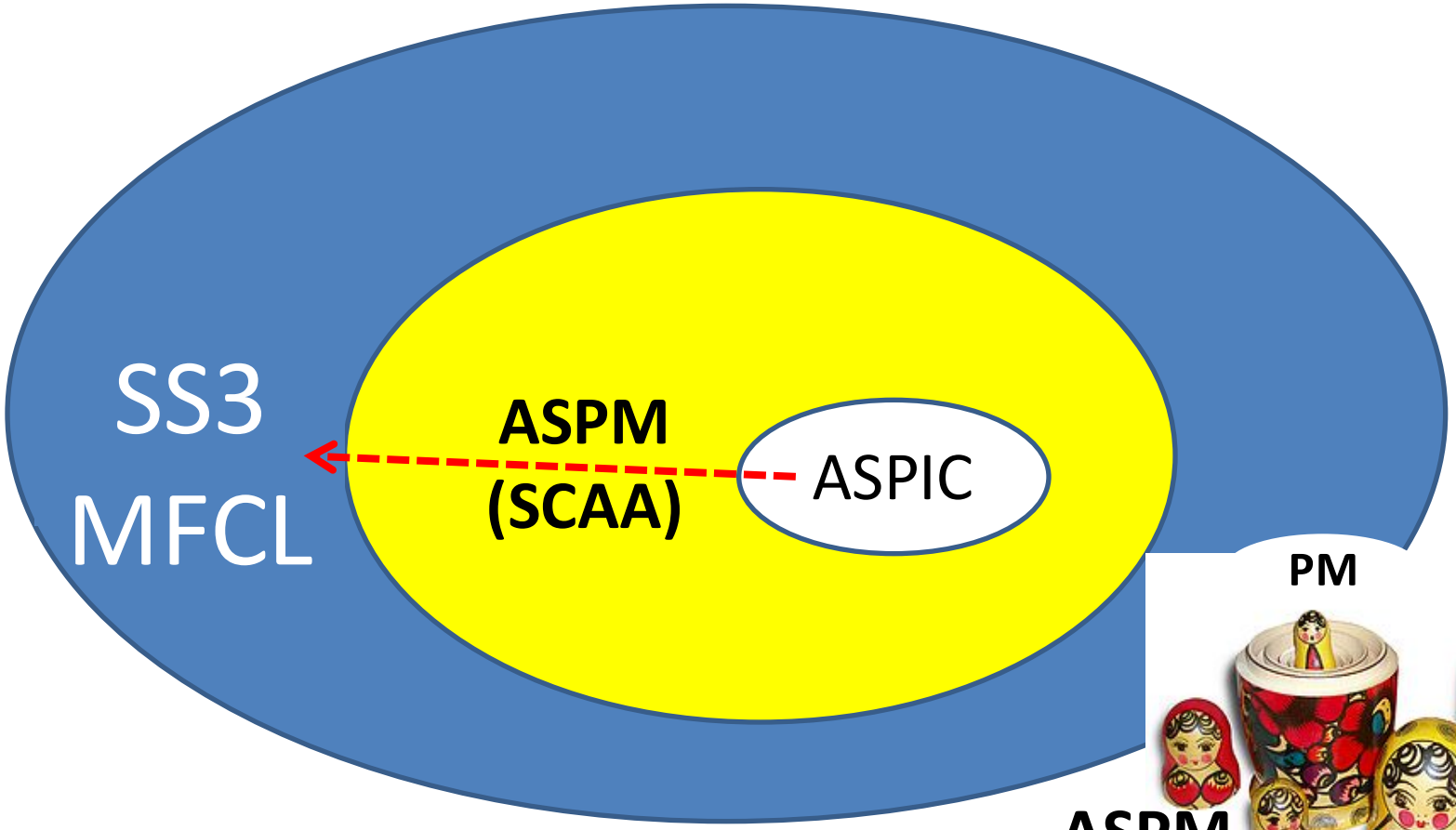
What do we need for SA(PM)



What do we need for SA(ASPM)



ASPM(SCAA) : Intermediate assessment model
not too simple(ASPIC)
not too complicated (MFCL, SS3, most complicate)



Complexity

But we are the family!

Later we will attempt

ASPM

using biological data

size, growth,

ASPIC

INPUT : Catch (global) and CPUE by gear

CPUE (1 or more OK)

OUTPUT

MSY, F, r (intrinsic Pop growth rate),

K (Carrying capacity) and q (catchability)

Population size

(NO S-R relation ← critical points)

Introduction to 2 ASPIC software

- ASPIC **original software** (Prager, 2004)

  (06) ASPIC manual

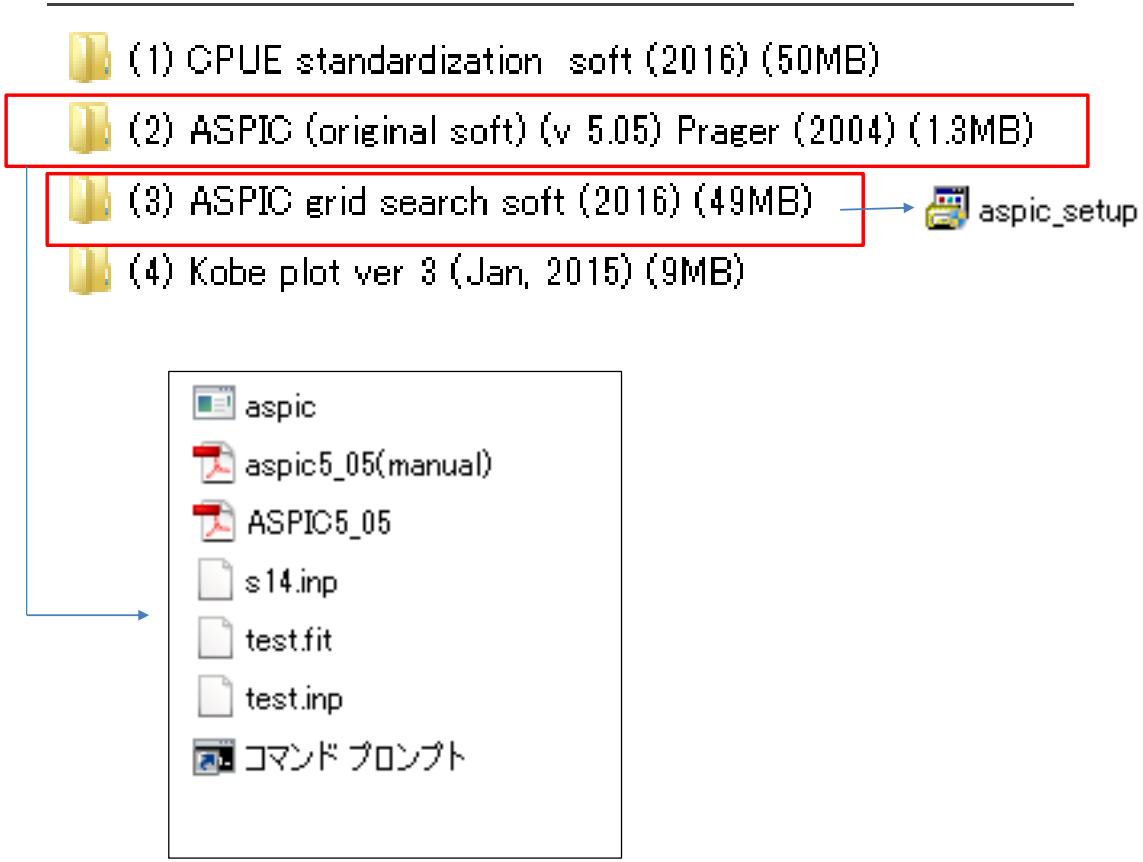
- ASPIC **grid (parameter) search**

  (menu driven software)

  (05) manual

Where are your software ?

4 software (109MB)



What are the relation between 2 software ?

ASPIC original software (Prager, 2004)

This is the basic ASPIC program

=> We will input initial seeding values

ASPIC grid (parameter) search (menu driven software)

The original program can run only one set of parameters at once.

This soft will search optimum parameters by grid search

using all combination of parameters

Original program

One run only at one time

You need to repeat until you find the optimum Parameters. **You may find the parameters at local minimum (Wrong answer)**

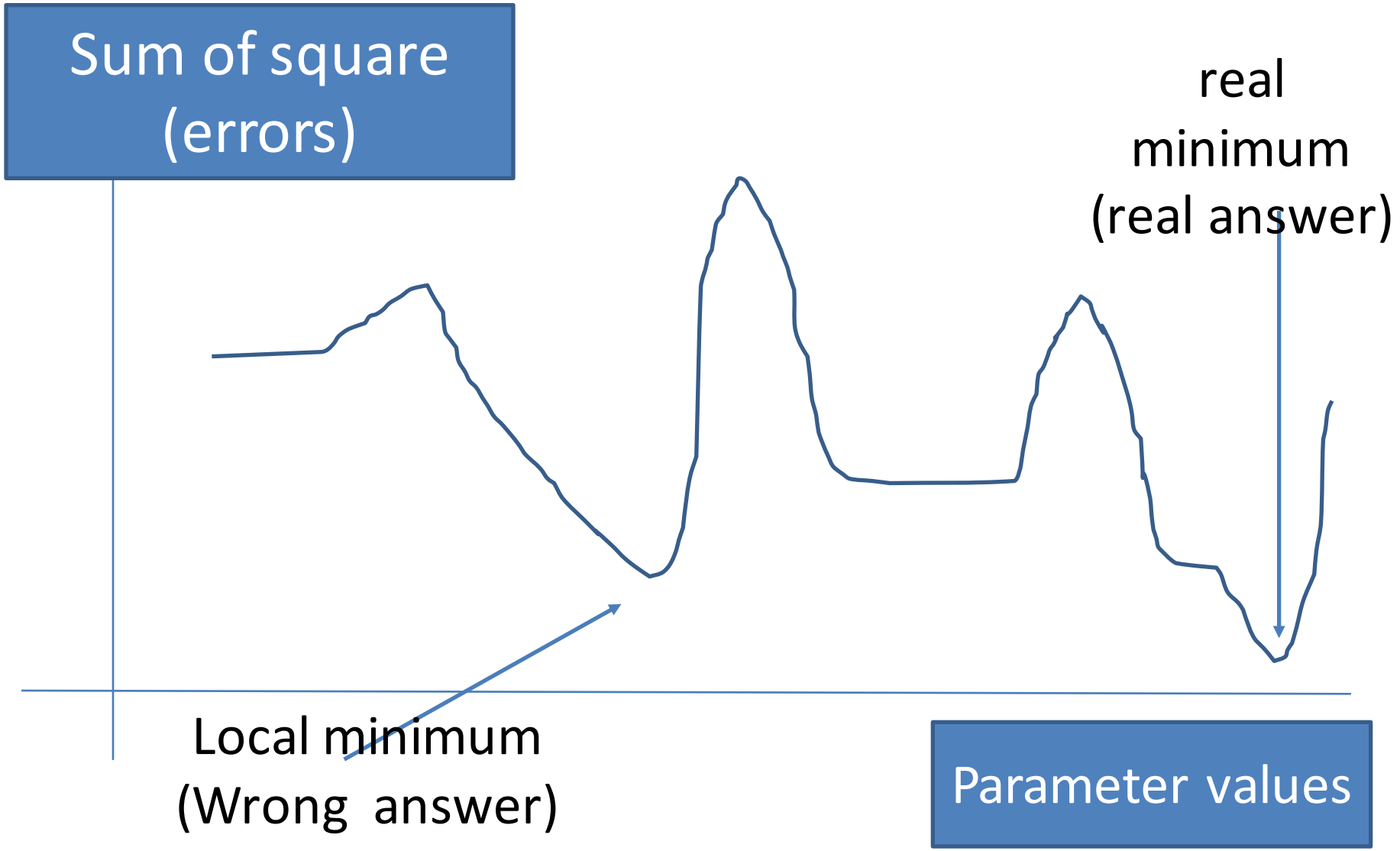
Grid search

This repeats runs for many combination of parameters at one time

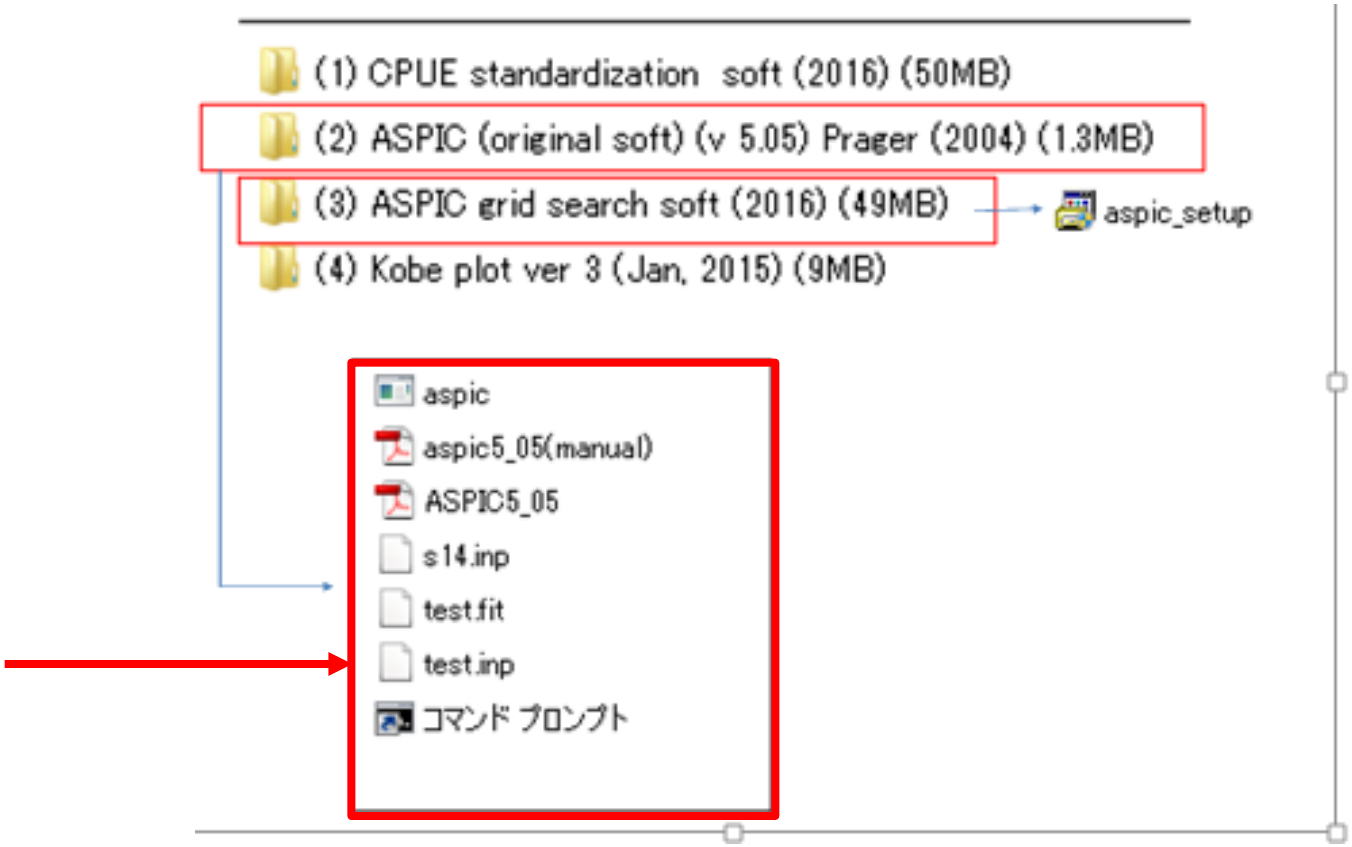
Thus most optimum parameters can be found

(**correct answer**)

What is the local minimum?

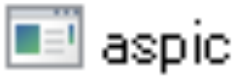


We now start the original program

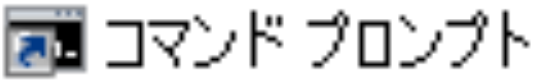


Basic ASPIC program

- INPUT file test.inp (example)
- Program



- Command prompt



There are many steps to run ASPIC

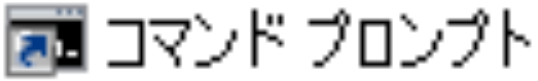
- We will repeat a few times so that we can run ASPIC

- As explained, it take one year to get used to the program.. As for a few times of practice, it still difficult to learn.

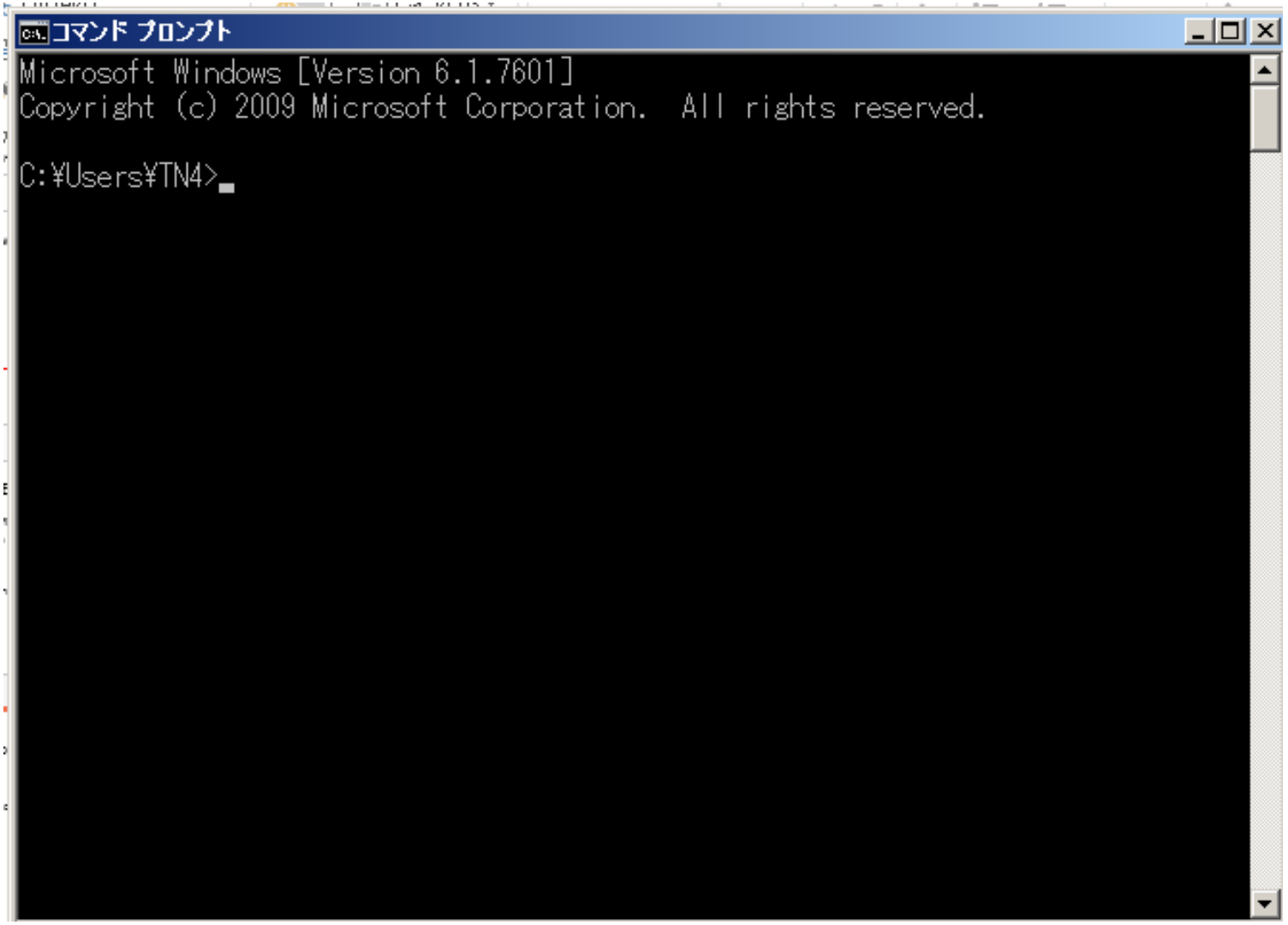
First you move to the command prompt mode in your folder

- How ?

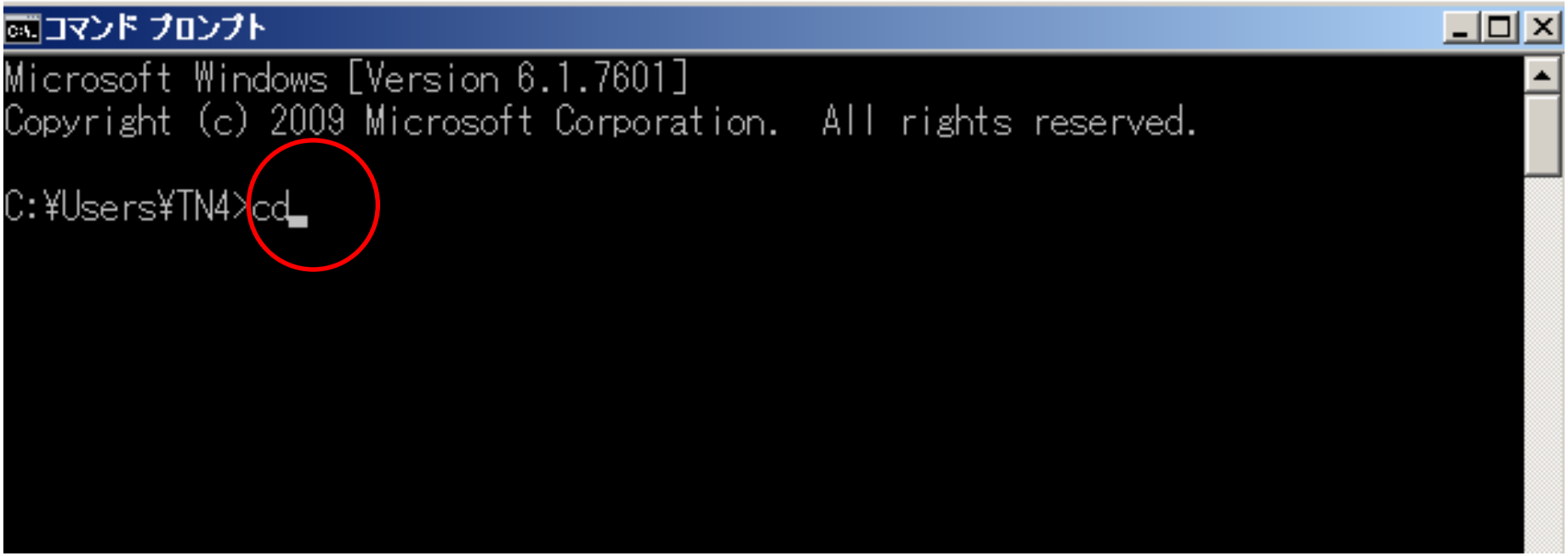
- Double click



Then you see the window like below

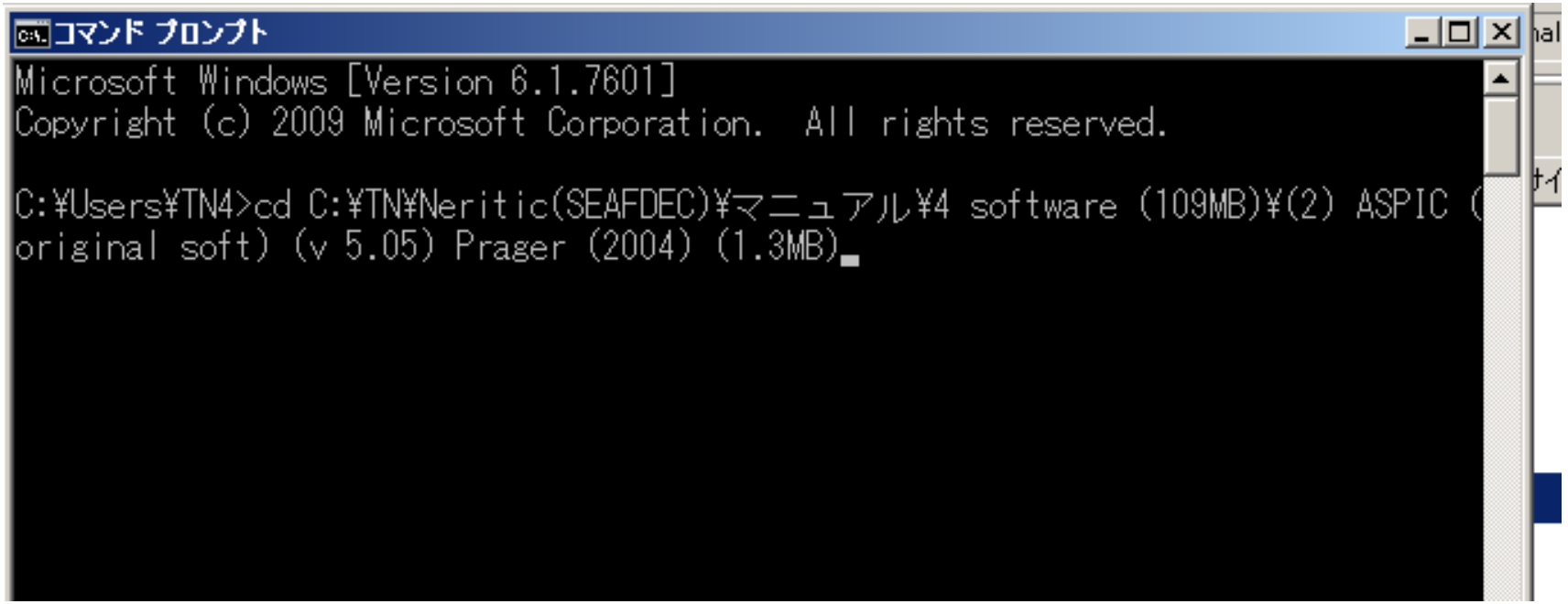


Change directory
type cd and make one space

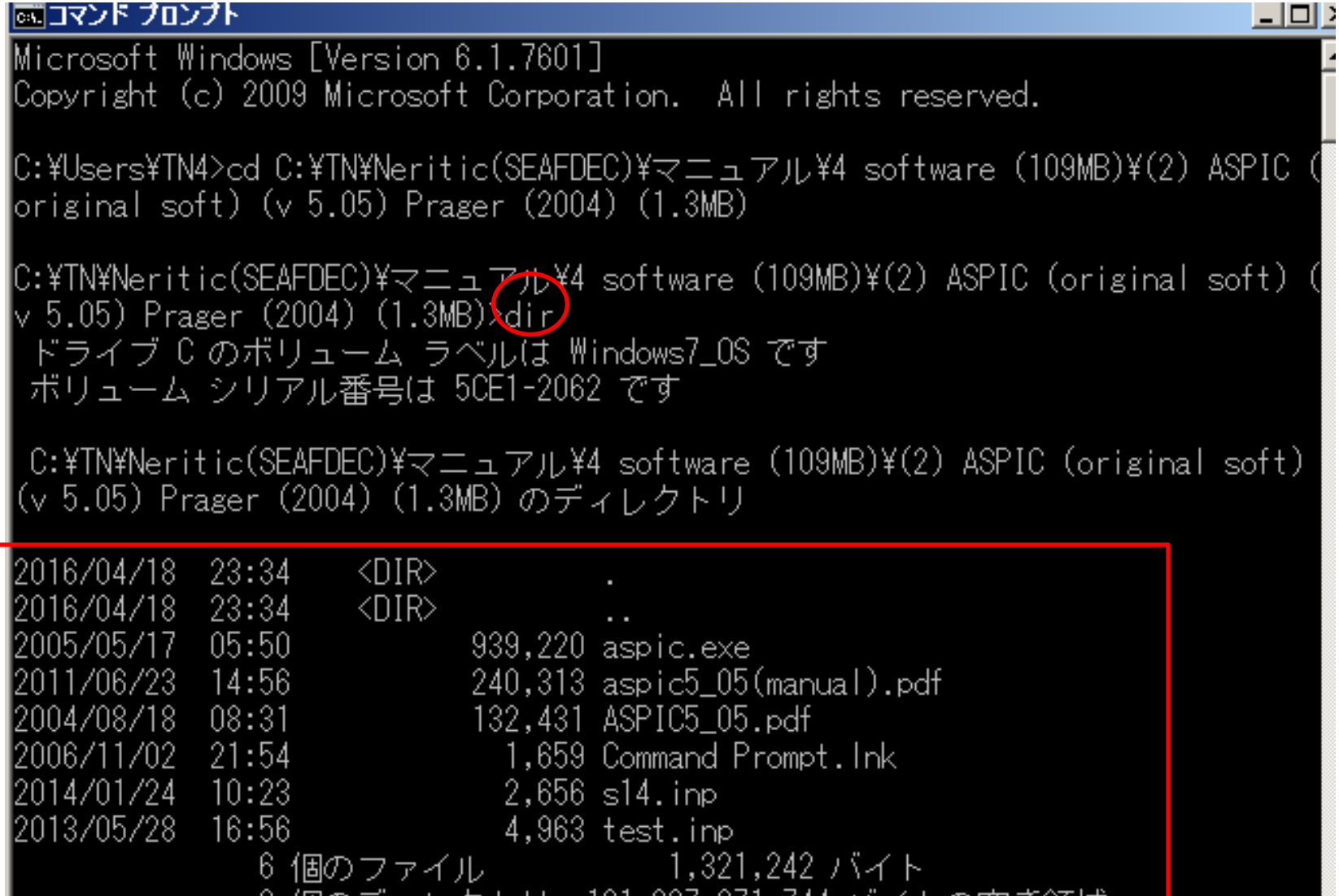


First copy the directory in the folder where you have you data file

Then paste


コマンド プロンプト
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.
C:¥Users¥TN4>cd C:¥TN¥Neritic(SEAFDEC)¥マニュアル¥4 software (109MB)¥(2) ASPIC (
original soft) (v 5.05) Prager (2004) (1.3MB)

Then return then type dr
then you see files in your folder

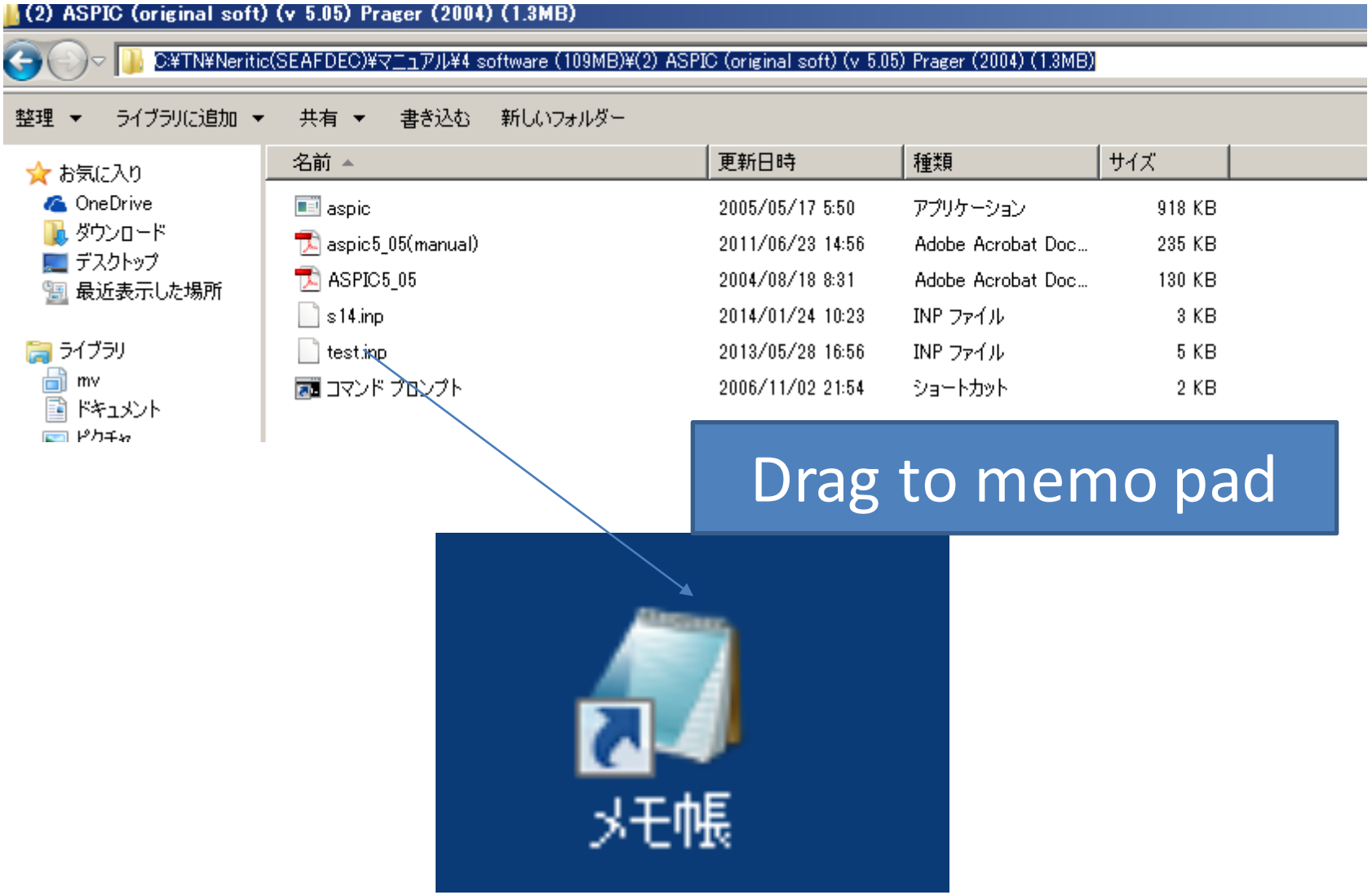


Now preparation of your input file

- You need the editor to edit your input file

- Use memo pad

First look at test.inp



Then you will see the ASPIC input program as below

test.inp - メモ帳

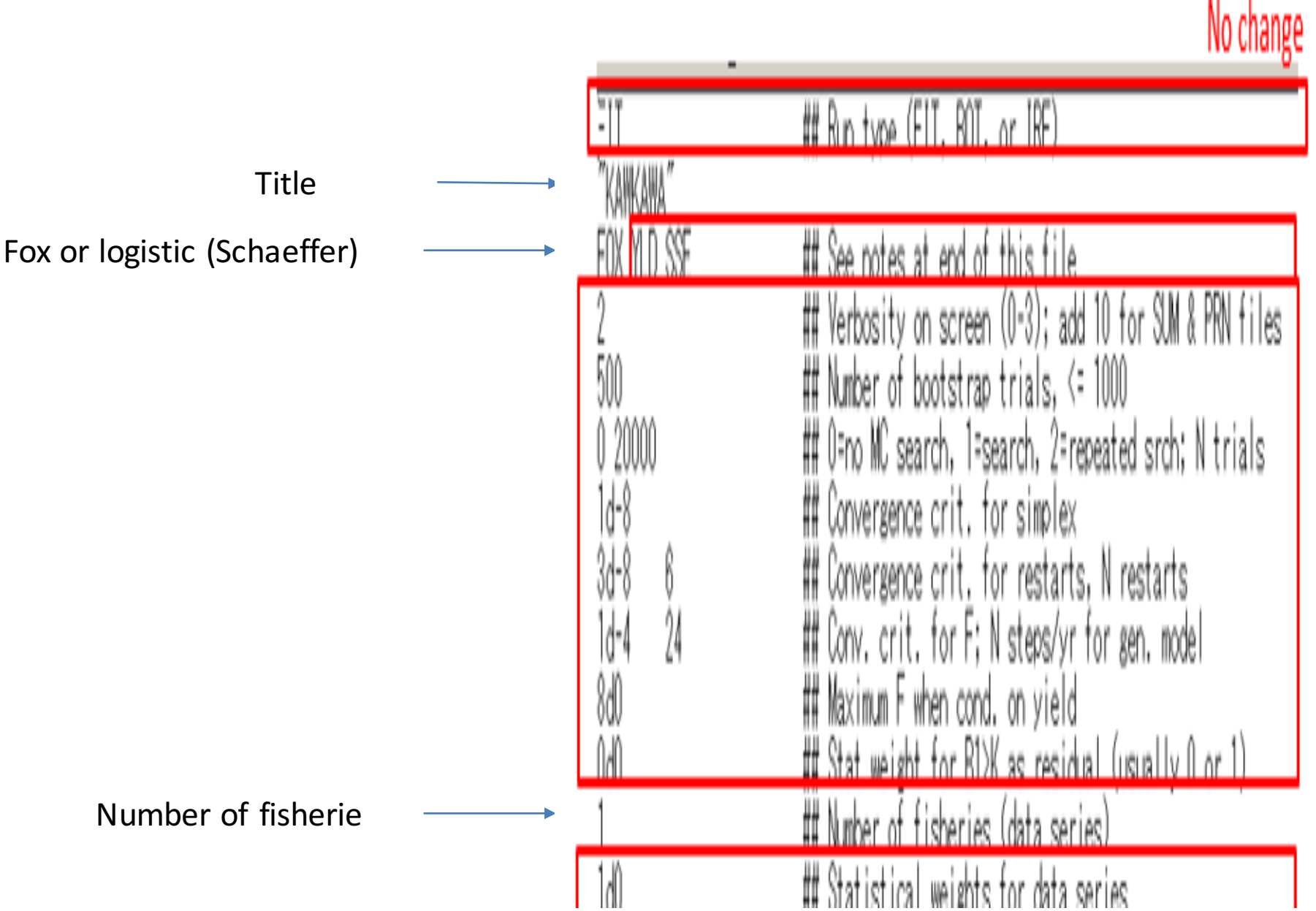
ファイル(F) 編集(E) 書式(O) 表示(V) ヘルプ(H)

```
IT                      ## Run type (FIT, BOT, or IRF)
KAWKAWA"
OX YLD SSE              ## See notes at end of this file
                        ## Verbosity on screen (0-3); add 10 for SUM & PRN files
00                      ## Number of bootstrap trials, <= 1000
 20000                  ## 0=no MC search, 1=search, 2=repeated srch; N trials
d-8                     ## Convergence crit. for simplex
d-8    6                ## Convergence crit. for restarts, N restarts
d-4    24               ## Conv. crit. for F; N steps/yr for gen. model
d0                      ## Maximum F when cond. on yield
d0                      ## Stat weight for B1>K as residual (usually 0 or 1)
                        ## Number of fisheries (data series)
d0                      ## Statistical weights for data series
.0d0                    ## B1/K (starting guess, usually 0 to 1)
.4d4                    ## MSY (starting guess)
.0d5                    ## K (carrying capacity) (starting guess)
.00d-5                  ## q (starting guesses -- 1 per data series)
 1 1 1 1                ## Estimate flags (0 or 1) (B1/K,MSY,K,q1...qn)
.0d4  2.0d4             ## Min and max constraints -- MSY
.5d5  2.0d5             ## Min and max constraints -- K
933285                  ## Random number seed (large integer)
2                       ## Number of years of data in each series]
KAW'                    ## Title for 1st series (<=40 chars)
C
950       -1       4845
951       -1       1783
952       -1       1945
953       -1       2072
954       -1       3206
```

No change

```
=IT                     ## Run type (FIT, BOT, or IRF)
"KAWKAWA"
FOX YLD SSE             ## See notes at end of this file
2                       ## Verbosity on screen (0-3); add 10 for SUM & PRN files
500                     ## 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
0d0                     ## Stat weight for B1>K as residual (usually 0 or 1)
1                       ## Number of fisheries (data series)
1d0                     ## Statistical weights for data series
1.0d0                   ## B1/K (starting guess, usually 0 to 1)
1.4d4                   ## MSY (starting guess)
1.0d5                   ## K (carrying capacity) (starting guess)
1.00d-5                 ## q (starting guesses -- 1 per data series)
0 1 1 1 1               ## Estimate flags (0 or 1) (B1/K,MSY,K,q1...qn)
1.0d4  2.0d4            ## Min and max constraints -- MSY
0.5d5  2.0d5            ## Min and max constraints -- K
3933285                 ## Random number seed (large integer)
62                      ## Number of years of data in each series]
"KAW'                   ## Title for 1st series (<=40 chars)
CC
1950        -1      4845
1951        -1      1783
1952        -1      1945
1953        -1      2072
1954        -1      3206
1955        -1      4122
```

```
1.0d0           ## B1/K (starting guess, usually 0 to 1)
1.4d4           ## MSY (starting guess)
1.0d5           ## K (carrying capacity) (starting guess)
1.00d-5         ## q (starting guesses -- 1 per data series)
0 1 1 1 1       ## Estimate flags (0 or 1) (B1/K,MSY,K,q1...qn)
1.0d4  2.0d4    ## Min and max constraints -- MSY
0.5d5  2.0d5    ## Min and max constraints -- K
3933285         ## Random number seed (large integer)
62              ## Number of years of data in each series]
"KAW'           ## Title for 1st series (<=40 chars)
```

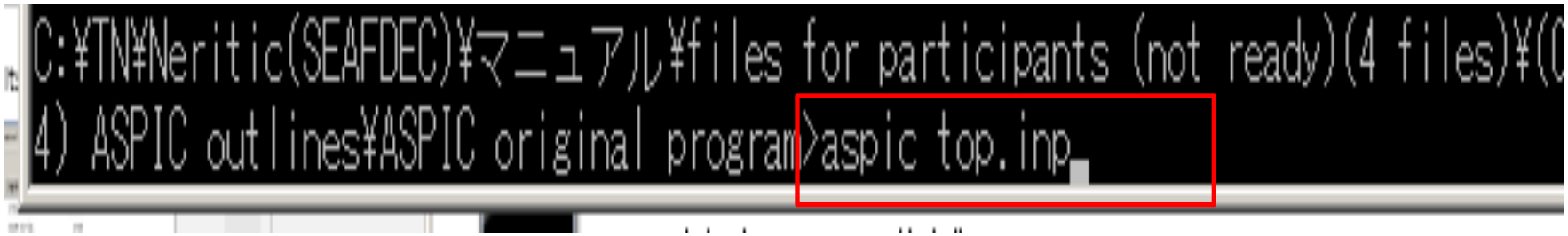

No change
-IT ## Run type (FIT, BOT, or IRF)
"KAWKAWA"
FOX MLO SSF ## See notes at end of this file
2 ## Verbosity on screen (0-3); add 10 for SUM & PRN files
500 ## Number of bootstrap trials, <= 1000
0 20000 ## 0=no MC search, 1=search, 2=repeated srch; N trials
1d-8 ## Convergence crit. for simplex
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
1 ## Number of fisheries (data series)
1d0 ## Statistical weights for data series
Title
Fox or logistic (Schaeffer)
Number of fisherie

Data (year, CPUE and catch) if CPUE is missing, then -1

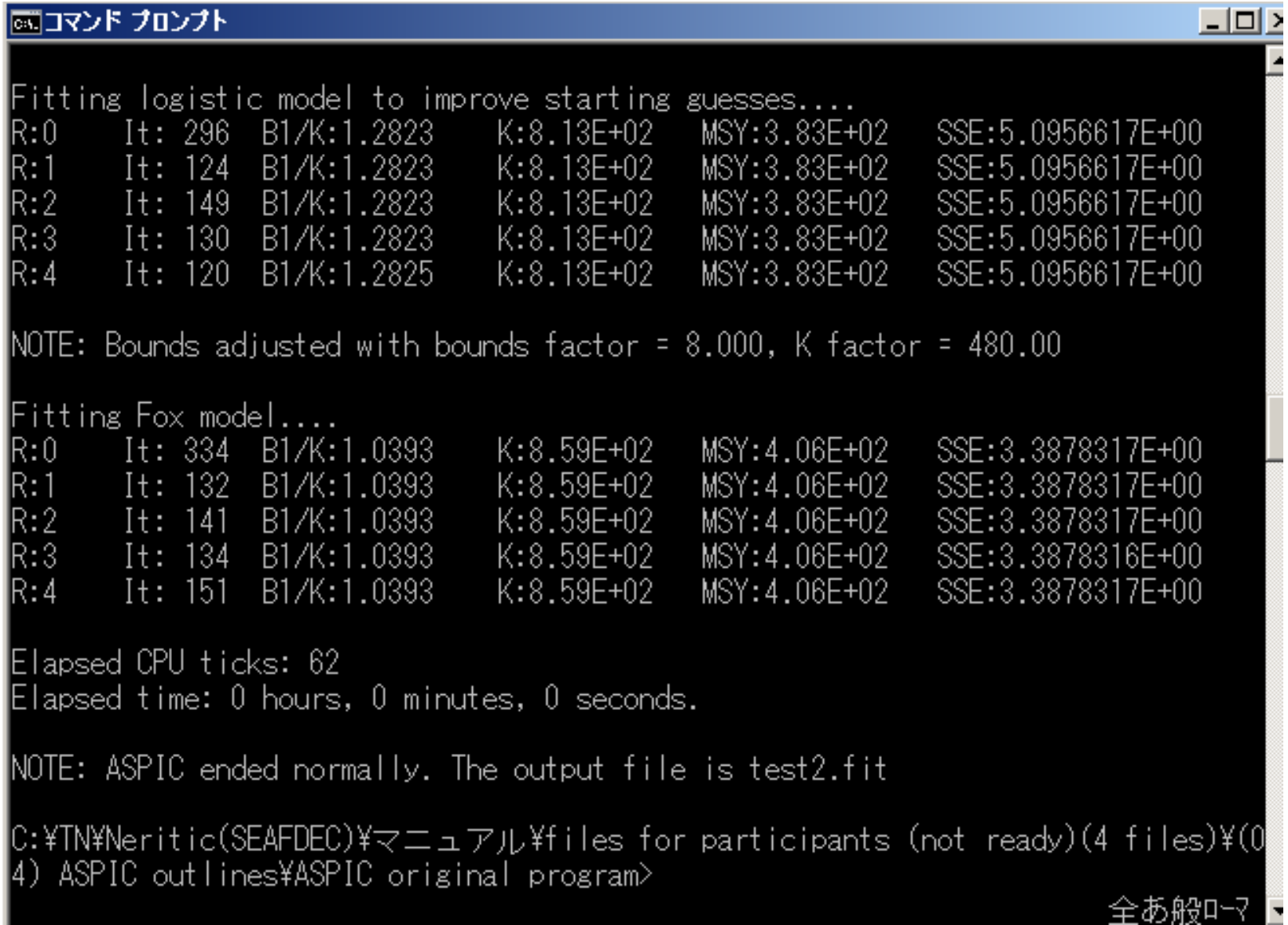
1997	-1	90277
1998	-1	84130
1999	-1	89138
2000	-1	93930
2001	-1	87998
2002	0.14846	93022
2003	-1	94272
2004	0.1579	94367
2005	0.20589	94433
2006	0.20458	108997
2007	0.13439	117597

How to run ASIPC ?

- Type aspic TOP.inp (in today's folder)



You will see the log of ASPIC run

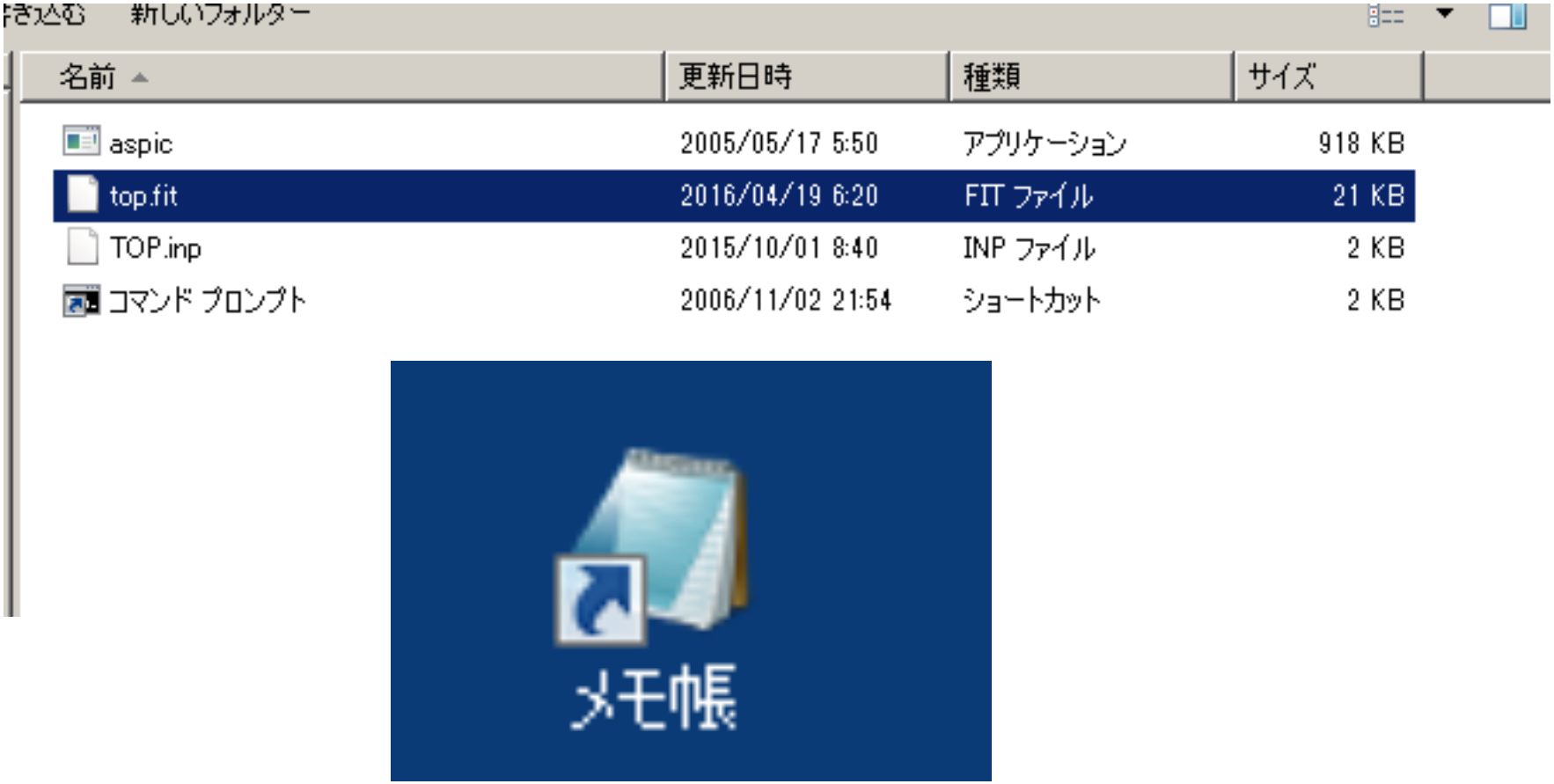


Results are in top.fit

```
Elapsed time: 0 hours, 0 minutes, 0 seconds.

NOTE: ASPIC ended normally. The output file is top.fit

C:¥TN¥Neritic(SEAFDEC)¥マニュアル¥files for participants (not ready)(4 files)¥(0
4) ASPIC outlines¥ASPIC original program>
C:¥TN¥Neritic(SEAFDEC)¥マニュアル¥files for participants (not ready)(4 files)¥(0
4) ASPIC outlines¥ASPIC original program>dir
 ドライブ C のボリューム ラベルは Windows7_09 です
 ボリューム シリアル番号は 5CE1-2062 です

 C:¥TN¥Neritic(SEAFDEC)¥マニュアル¥files for participants (not ready)(4 files)¥(
04) ASPIC outlines¥ASPIC original program のディレクトリ

2016/04/19  05:58    <DIR>          .
2016/04/19  05:58    <DIR>          ..
2005/05/17  05:50           939,220 aspic.exe
2006/11/02  21:54             1,659 Command Prompt.lnk
2016/04/19  06:20            20,528 top.fit
2015/10/01  08:40             1,731 TOP.inp
               4 個のファイル             963,138 バイト
               2 個のディレクトリ  101,921,665,024 バイトの空き領域

C:¥TN¥Neritic(SEAFDEC)¥マニュアル¥files for participants (not ready)(4 files)¥(0
4) ASPIC outlines¥ASPIC original program>
```

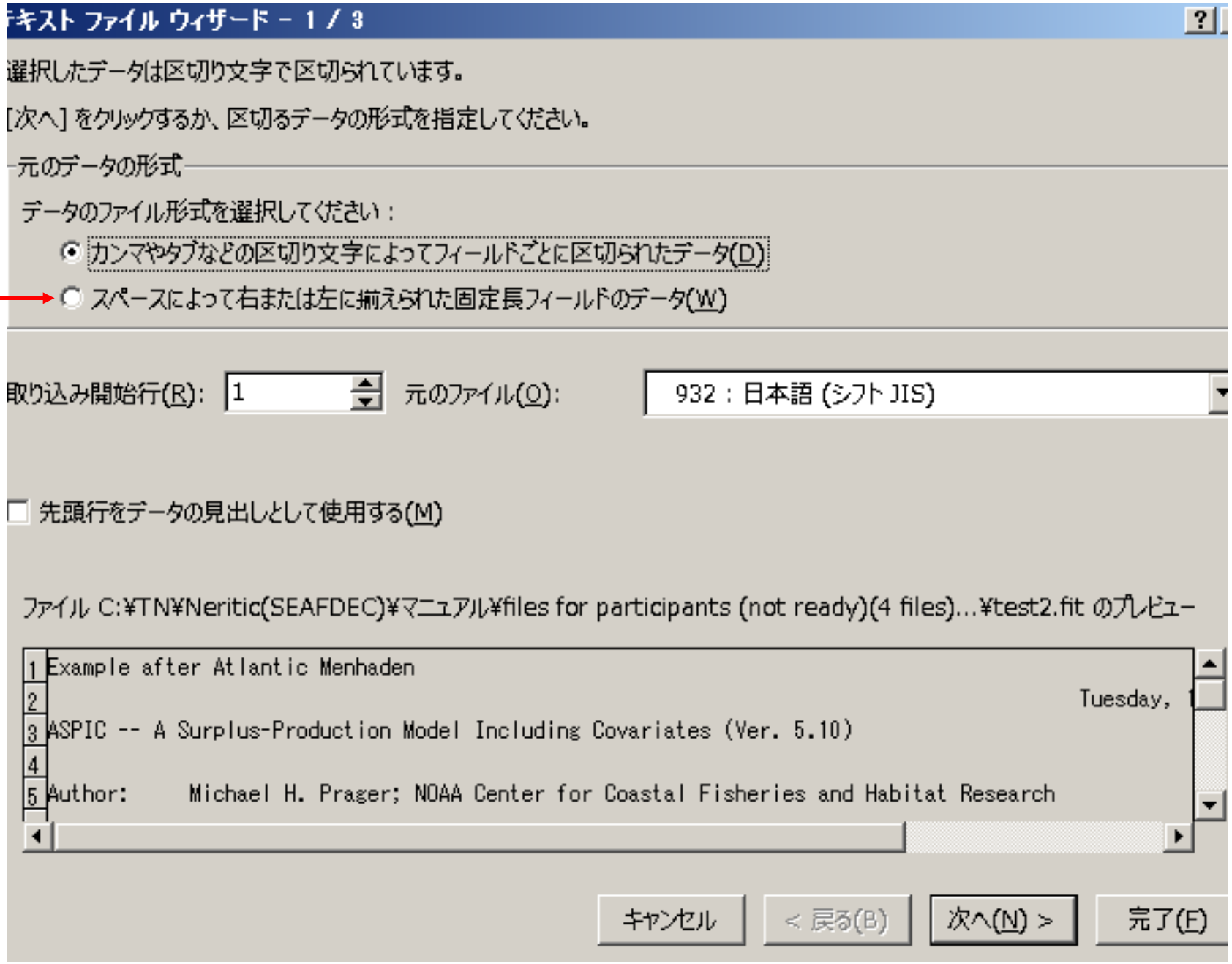
To see results

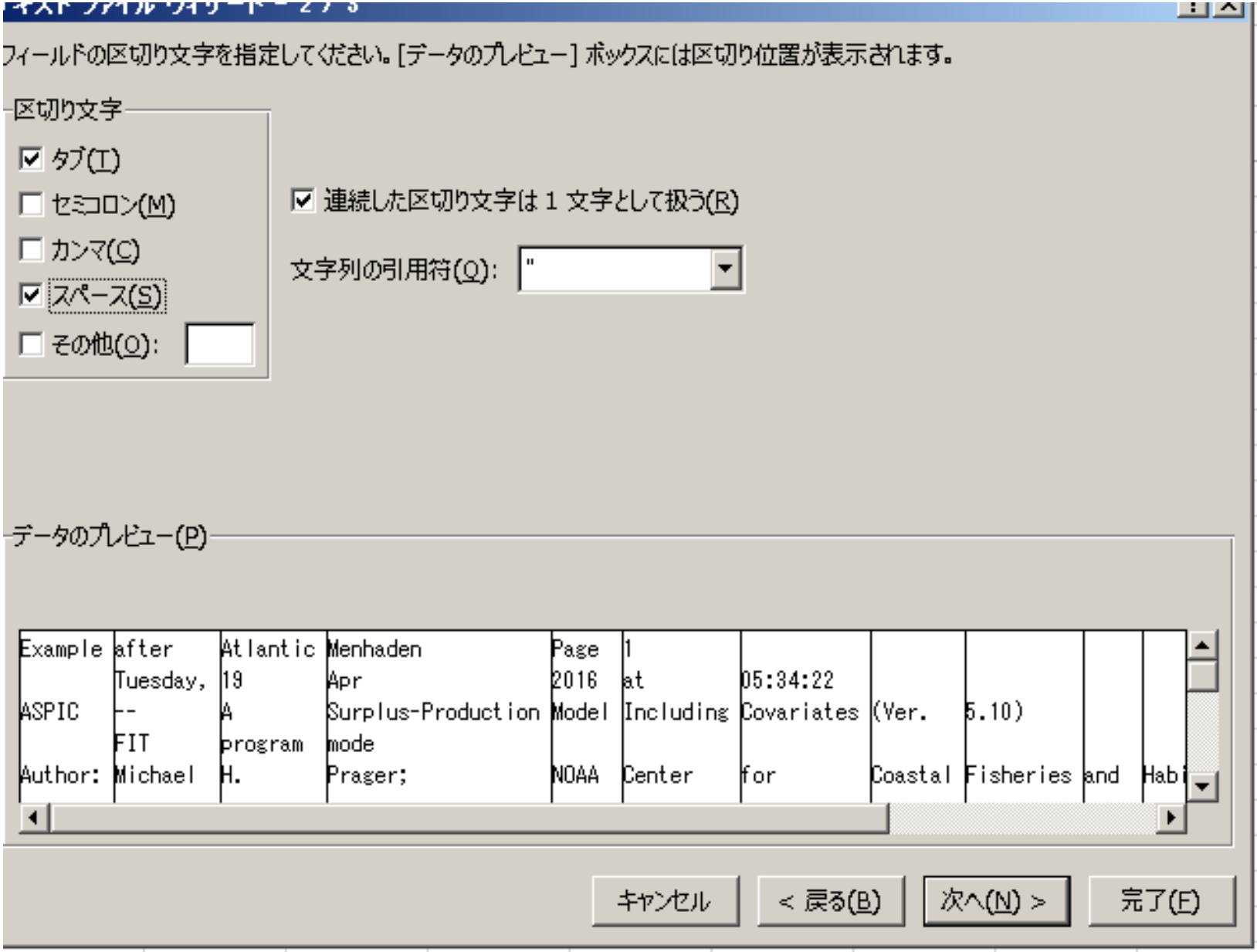
- Import to memo.pad



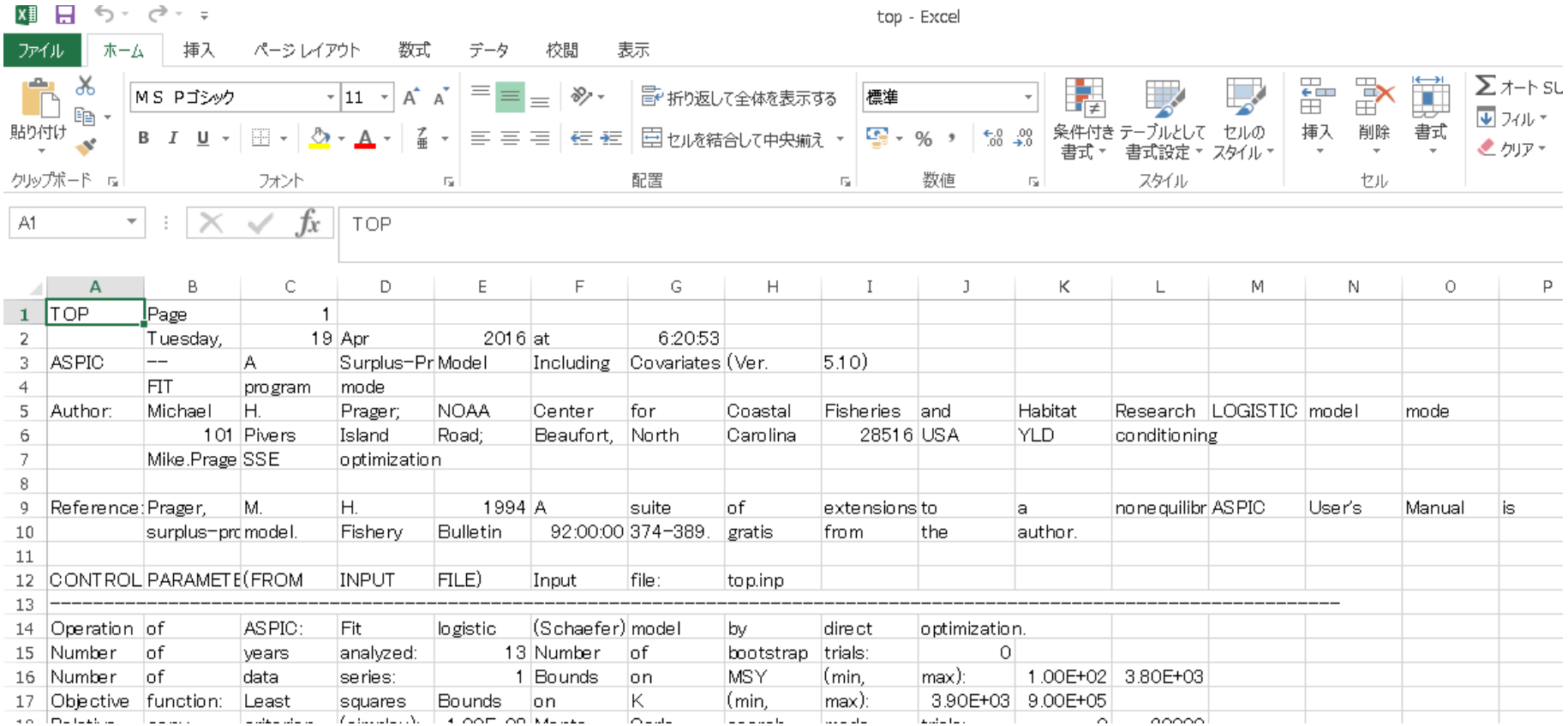
To see and use results for your paper

- Import test2.fit to excel


テキスト ファイル ウィザード - 1 / 3
選択したデータは区切り文字で区切られています。
[次へ] をクリックするか、区切るデータの形式を指定してください。
元のデータの形式
データのファイル形式を選択してください :
カンマやタブなどの区切り文字によってフィールドごとに区切られたデータ(D)
スペースによって右または左に揃えられた固定長フィールドのデータ(W)
取り込み開始行(R):
1
元のファイル(O):
932 : 日本語 (シフト JIS)
先頭行をデータの見出しとして使用する(M)
ファイル C:¥TN¥Neritic(SEAFDEC)¥マニュアル¥files for participants (not ready)(4 files)...¥test2.fit のプレビュー
1 Example after Atlantic Menhaden
2 Tuesday,
3 ASPIC -- A Surplus-Production Model Including Covariates (Ver. 5.10)
4
5 Author: Michael H. Prager; NOAA Center for Coastal Fisheries and Habitat Research
キャンセル
< 戻る(B)
次へ(N) >
完了(F)


テキストファイル ウィザード - 2 / 3
フィールドの区切り文字を指定してください。[データのプレビュー] ボックスには区切り位置が表示されます。
区切り文字
タブ(T)
セミコロン(M)
カンマ(C)
スペース(S)
その他(O):
連続した区切り文字は 1 文字として扱う(R)
文字列の引用符(Q):
"
データのプレビュー(P)
Example after Atlantic Menhaden Page 1
Tuesday, 19 Apr 2016 at 05:34:22
ASPIC -- A Surplus-Production Model Including Covariates (Ver. 5.10)
FIT program mode
Author: Michael H. Prager; NOAA Center for Coastal Fisheries and Habi
キャンセル
< 戻る(B)
次へ(N) >
完了(F)

You have output in excel



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
1	TOP	Page	1													
2		Tuesday,	19	Apr	2016	at	6:20:53									
3	ASPIC	--	A	Surplus-Pr	Model	Including	Covariates	(Ver.	5.10)							
4		FIT	program	mode												
5	Author:	Michael	H.	Prager;	NOAA	Center	for	Coastal	Fisheries	and	Habitat	Research	LOGISTIC	model	mode	
6		101	Pivers	Island	Road;	Beaufort,	North	Carolina	28516	USA	YLD	conditioning				
7		Mike.Prage	SSE	optimization												
8																
9	Reference:	Prager,	M.	H.	1994	A	suite	of	extensions	to	a	nonequilibr	ASPIC	User's	Manual	is
10		surplus-pro	model.	Fishery	Bulletin	92:00:00	374-389.	gratis	from	the	author.					
11																
12	CONTROL	PARAMETE	(FROM	INPUT	FILE)	Input	file:	top.inp								
13	----------															
14	Operation	of	ASPIC:	Fit	logistic	(Schaefer)	model	by	direct	optimization.						
15	Number	of	years	analyzed:	13	Number	of	bootstrap	trials:	0						
16	Number	of	data	series:	1	Bounds	on	MSY	(min,	max):	1.00E+02	3.80E+03				
17	Objective	function:	Least	squares	Bounds	on	K	(min,	max):	3.90E+03	9.00E+05					