

Modern Fisheries Science and Global Partnership

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IFOP, Valparaiso
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Science for sustainable seas

ICES

- ▶ Overview of ICES
- ▶ Stock assessment and advice
- ▶ New transparent workflow
- ▶ Existing links between IFOP and ICES

Statistical computing

- ▶ Software
- ▶ Assessment models
- ▶ Methods and techniques
- ▶ Current modelling trends



International Council for the Exploration of the Sea

Marine research & cooperation since 1902

20 member countries (Europe, USA, Canada)

Affiliate countries include South Africa, Australia, New Zealand, and Chile

ICES - Structure



Other Services

Annual Science Conference
ICES Journal
Training Courses
Special Requests

Advice

Working Groups
Benchmarks
Peer Reviews
Final Advice
Transparent Workflow

Science

Working Groups
Ecosystem Approach
Impact on Habitat
Climate and Distribution
Surveys and Fishing Gear

Data

Submitted by Member Countries
Quality Controlled
Open and Available Online - Web Services

ICES - Stock assessment & advice



1. Preparation work at member institutes - data analysis
2. ICES Working Group (WG) meeting - review, report, early draft advice
3. ICES Advice Drafting Group (ADG) meeting - draft advice
4. ICES Advisory Committee (ACOM) meeting - final advice

Transparent Assessment Framework (TAF)

Transparent Assessment Framework (TAF)



Should be:

- ▶ **Encapsulated:** entire pathway from raw data to advice in one system
- ▶ **Repeatable:** data preparation and assessment workflow is recorded
- ▶ **Transparent:** anyone can browse on the web

New framework: TAF



Make it easier to:

- ▶ **Find** data and results from a given assessment
- ▶ **Rerun** model with different data or assumptions
- ▶ Prepare and run an **update** assessment
- ▶ **Access** ICES data web services

⇒ Will save time for WGs, ADGs, and ACOM

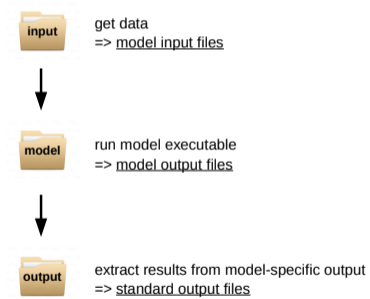
New framework: TAF



Help people to:

- ▶ See **changes** in model setup and data between years
- ▶ Use reproducible research to strengthen **institutional memory**
- ▶ Access data and results from all stocks for **big-picture research**

Core workflow



Preprocessing data



get data and preprocess
=> data values



convert data to model-specific format
=> model input files

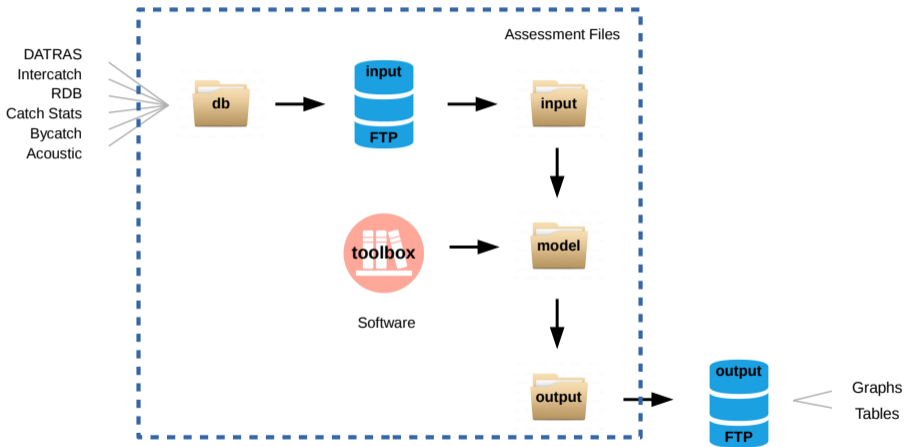


run model executable
=> model output files



extract results from model-specific output
=> standard output files

Data archives for input and output



R packages supporting TAF workflow



Web services

- icesDatras** trawl survey database
- icesSAG** stock assessment graphs
- icesSLD** stock database
- icesVocab** reference codes

Other

- icesAdvice** advisory methods
- icesTAF** support functions

GitHub assessment repository



The screenshot shows the GitHub repository page for the Transparent Assessment Framework (TAF). The page title is "Transparent Assessment Framework (TAF)" and the subtitle is "Repositories of fully functional ICES stock assessments". The repository is located in Copenhagen, Denmark, and is managed by <https://ices-taf.github.io/> and gthub@ices.dk.

The page displays a list of pinned repositories:

- doc**: Community documentation for the TAF project
- ftp**: Input files for TAF assessments
- wgef**: Working Group on Elasmobranch Fishes (Language: R)

Below the pinned repositories, there is a search bar and filters for "Type: All" and "Language: All".

The main content area shows the repository **wgef** (Working Group on Elasmobranch Fishes) with a green progress bar and a note that it was updated 4 minutes ago. Below it, the repository **ices-taf.github.io** (HTML) is shown, updated 10 days ago. At the bottom, the repository **doc** is partially visible.

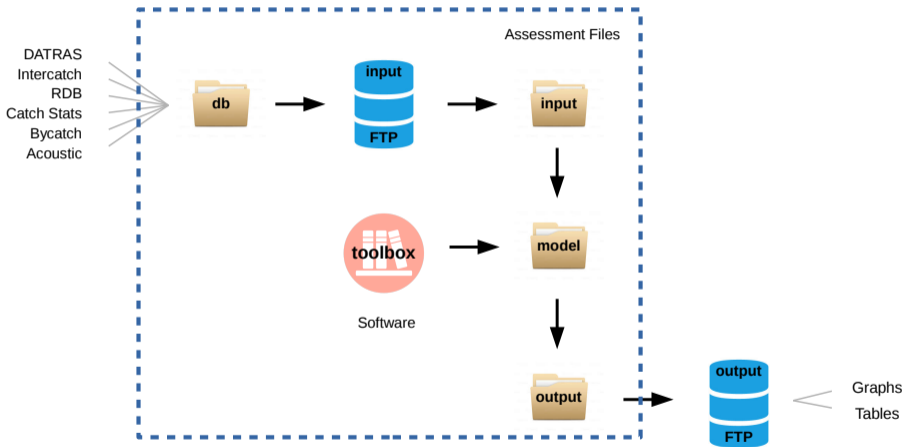
On the right side, there is a "Top languages" section showing R and HTML, and a "People" section listing contributors: **arnima-github** (Arni Magnusson) and **colinmillar** (Colin Millar).

Assessment = R scripts



A screenshot of a web browser displaying a GitHub repository page for 'wgef' by 'arnima-github'. The page shows the repository structure with a list of R scripts. The scripts are: 'clean.R', 'db.R', 'input.R', 'model.R', 'output.R', 'plot.R', and 'run.R'. The 'db.R', 'input.R', and 'output.R' files are highlighted with a red box. The repository page includes navigation tabs for 'Code', 'Issues', 'Pull requests', 'Projects', 'Wiki', 'Pulse', 'Graphs', and 'Settings'. The repository name is 'wgef / 2015 / rjm-347d /'. The latest commit is by 'arnima-github' with the message 'DLS plot' and a commit hash '3fb6ba5' from 15 minutes ago. The repository has 2 unwatchers, 0 stars, and 0 forks. The page footer includes copyright information for GitHub, Inc. and links for 'Contact GitHub', 'API', 'Training', 'Shop', 'Blog', and 'About'. The browser's address bar shows the URL 'https://github.com/ices-taf/wgef/tree/master/2015/rjm-347d'. The browser's taskbar at the bottom shows the system tray with icons for network, volume, and battery, and the time '8:10'.

TAF overview



Web user interface

(design outline)



Open taf.ices.dk in a web browser

Browse (everything is open) or **log in** to modify/run assessments

- Stock mode

upload, edit, save, run

- Boss mode

| HAWG | NWWG |
|---|---|
| <input checked="" type="radio"/> her-3a22 | <input checked="" type="radio"/> cod-iceg |
| <input type="radio"/> her-47d3 | <input checked="" type="radio"/> sai-faro |
| <input checked="" type="radio"/> her-67bc | <input checked="" type="radio"/> sai-icel |
| <input checked="" type="radio"/> her-irls | <input type="radio"/> smr-5614 |
| <input type="radio"/> ... | <input type="radio"/> ... |

Download any dataset into R using [read.csv](#)

Key benefits



- ▶ High **quality** science: online, peer-reviewed, reproducible
- ▶ Improved **time efficiency** and **reduced workload** on WGs
- ▶ Much more **open and structured** than current workflow

Follow ongoing development



taf.ices.dk

Main landing page

ices-taf.github.io

Technical overview and design comments

github.com/ices-taf

Assessments (R scripts)

github.com/ices-tools-prod

R packages

Statistical computing

Software

Working environment

- ▶ R

Model development

- ▶ AD Model Builder (ADMB)
- ▶ Template Model Builder (TMB)

Methods

- ▶ State-space models

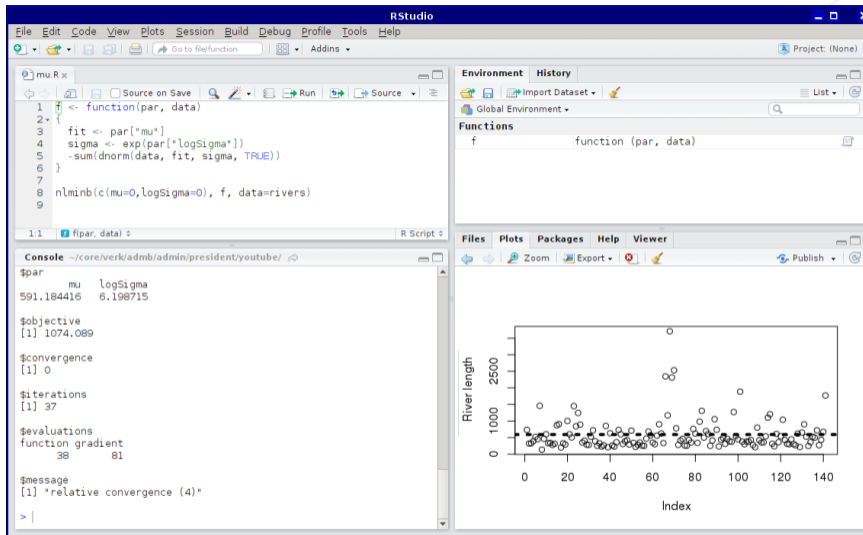
random effects, sam

- ▶ Evaluating uncertainty

*delta method, bootstrap
profile likelihood, mcmc*

- ▶ Simulations

uncertainty, test performance of methods



```

DATA_SECTION
  init_int n
  init_vector x(1,n)

PARAMETER_SECTION
  init_number mu
  init_number logSigma
  objective_function_value f

PROCEDURE_SECTION
  f = 0.5*n*log(2.0*PI) + n*logSigma + sumsq(x-mu)/(2.0*exp(2.0*logSigma));

```

```

-:--- admb.tpl      All (12,0)      (ADMB)
- final statistics:
2 variables; iteration 40; function evaluation 53
Function value 1.0741e+03; maximum gradient component mag -7.5192e-07
Exit code = 1; converg criter 1.0000e-04
Var Value Gradient |Var Value Gradient |Var Value Gradient
1 591.1844 3.00364e-08 | 2 6.19872 -7.51923e-07 |
Estimating row 1 out of 2 for hessian
Estimating row 2 out of 2 for hessian

Process admb finished

```

U:*-- *ADMB Output* Bot (30,0) (Fundamental)

```

#include <TMB.hpp>

template<class Type>
Type objective_function<Type>::operator() ()
{
  DATA_VECTOR(x);
  PARAMETER(mu);
  PARAMETER(logSigma);

  Type f;
  f = -sum(dnorm(x, mu, exp(logSigma), true));

  return f;
}

```

```

-:--- tmb.cpp      All (15,0)      (TMB)
outer mgc: 0.004028486
outer mgc: 0.003154463
outer mgc: 4.127663e-05
outer mgc: 4.127663e-05
outer mgc: 4.127719e-05
outer mgc: 4.127723e-05
outer mgc: 0.281677
outer mgc: 0.2823235
sdreport(.) result
      Estimate Std. Error
mu      591.184381 41.4436720
logSigma 6.198715 0.0595491
Maximum gradient component: 4.127663e-05
>

```

U:*-- *R* Bot (113,2) (iESS [R]: run E1Doc)

ICES

- ▶ Introduction to stock assessment
- ▶ Advanced stock assessment
- ▶ Introduction to the R environment
- ▶ AD Model Builder (ADMB)
- ▶ Template Model Builder (TMB)

United Nations University

Introduction to stock assessment

Special request

Universidad de Concepción - curso verano
Aplicaciones en R y modelación en
sistemas biológicos

Summary

Summary



ICES - assessment reviews, annual science conference, etc.

Modern workflow - fully scripted and transparent online

Statistical computing - R, ADMB, TMB, uncertainty, random effects

IFOP - affiliate member of ICES, has sent people to training courses

Training courses - can also be organized in Valparaíso

Thanks!



Questions?

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