

# Welcome to a practical course in SAM and RTMB

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Institute of marine research, Bergen, 2-4 December 2024



# Time and place

## Time:

2 December 2024 09:00-15:30

3 December 2024 09:00-15:30

4 December 2024 09:00-15:30

## Place:

Institute of Marine Research, Bergen

Room: Lille pynten

## Online participants:

Encourage you to sit together if possible

# Tentative agenda

## Day 1:

- ▶ Introduction to maximum likelihood and RTMB
- ▶ Introduction to assessment modeling
- ▶ Introduction to latent effects
- ▶ Set up a simple state-space assessment model with RTMB

## Day 2:

- ▶ Introduction to the state-space assessment model SAM
- ▶ Introduction to all SAM model configurations
- ▶ Validation
- ▶ Practical exercise to set optimal configurations with SAM

# Tentative agenda

## Day 3:

- ▶ Team session, describe configurations
- ▶ If relevant: Exercise with data from participants
- ▶ Practical exercise to set optimal configurations with SAM
- ▶ Short-term forecast

## Prepare for course by:

- ▶ Install RTMB on your computer via the instructions on:  
<https://github.com/kaskr/RTMB>
- ▶ Install SAM on your computer via the instructions on:  
<https://github.com/fishfollower/SAM>
- ▶ Try replicating the linear regression example on the next slides
- ▶ Try replicating the "Quick example" on  
<https://github.com/fishfollower/SAM>
- ▶ Report any problems to [olavbr@nr.no](mailto:olavbr@nr.no)
- ▶ Review the proposed agenda and feel free to suggest changes

## Example: Linear regression in RTMB - 1

- ▶ 10 observations are assumed to follow a linear regression model
- ▶ Copy the following lines to a plain text file named linreg.dat

```
x y
1 0.5
2 1.8
3 5.1
4 6.3
5 10.9
6 12.3
7 14.3
8 17.7
9 19.3
10 21.5
```

linreg.dat

- ▶ The model we want to fit is  $y_i = \alpha + \beta x_i + \varepsilon_i$ , where  $\varepsilon_i \sim \mathcal{N}(0, \sigma^2)$  are all independent.

► Try to run the following lines in R

```
1 library(RTMB)
2 dat <- read.table("linreg.dat", header=TRUE)
3
4 nll<-function(par){
5   getAll(dat,par)
6   pred <- alpha+beta*x
7   -sum(dnorm(y,pred,exp(logSigma),TRUE))
8 }
9
10 par <- list(alpha=0, beta=0, logSigma=0)
11
12 obj <- MakeADFun(nll,par)
13 opt <- nlminb(obj$par,obj$fn,obj$gr)
14 sdrep <- sdreport(obj)
15 summary(sdrep)
```

linreg.R

- line 1 Includes the RTMB library
- line 2 Reads the data
- lines 4-8 Defines the model and the corresponding objective function we want to minimize
- line 10 Sets the initial values for our model parameters
- line 12 Uses RTMB to allow fast computations
- line 13 Finds the best parameters by maximum likelihood
- lines 14-15 calculate and print model summaries

- ▶ If all went well you should be setup to run everything needed in the course
- ▶ If you got strange error messages, then please contact `olavbr@nr.no`
- ▶ Special requests or questions w.r.t. the agenda — please don't hesitate to ask.
- ▶ Looking forward to seeing you all in Bergen!