Supplementary data, code: Ward et al 2025 ICES Journal of Marine Science

This directory contains supplementary data and scripts associated with our publication:

- **Title:** Exploring mechanisms of change in a Southern Ocean fishery with a co-produced network model
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- Journal: ICES Journal of Marine Science

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Overview:

The study involved a large number of repetitive R scripts to read in 128 different versions of the model from separate .dia files, simulate QNM data from them, and conduct the different analyses. We provide example scripts for all key steps, along with data required to run them.

Size warning for two of the data files: TDresps.Rdata (121.4MB) and savedsims4.Rdata (2.6GB).

Download options:

- <u>Ward_et_al_2025_ICES-JMS_SuppMat_code_data</u> [browsable folder] browse to select files for download
- <u>Ward_et_al_2025_ICES-JMS_SuppMat_code_data_FULL.zip</u> [direct download] full zip package of the files above, including large files
- Ward_et_al_2025_ICES-JMS_SuppMat_code_data_SELECT.zip [direct download]

full zip package of all files excluding the 2.6GB full simulated dataset, and also excluding the dia model files (excepting one example called in the first script).

The scripts:

• 1_Example_load_model_run_sims.html

This script reads in a dia model ("Model_NP_5N.dia"), calling the script dia.r as source code. It then applies self-limitation for all nodes, simulates 10000 quantitative versions of the model, and looks at the impact table (containing average responses of each node to a press increase in another node).

• dia.r

This is source code to support the reading of dia files in R.

• 2_PlotFig2_MeanResponses-to-perturbation.html

This script reproduces Figure 2 from the paper. It loads the data file meanresps.rdata, categorises qualitative responses as described in the paper, and plots qualitative responses of nodes to each of the eight press perturbation scenarios in a matrix.

• 3_Fig3_meanResponses_by_edgeSign.html

This script reproduces Figure 3 from the paper. It loads the data file "MeanResponses_by_UnknownEdge-Sign-Press-combination.Rdata" and shows the steps to reproduce the figure.

• 4_WranglingPressResponses_SSTexample.html

This script illustrates the process of accessing and wrangling the data from individual simulations (as opposed to mean data in the previous scripts). It calls the full simulation data set "savedsims4.Rdata". Please note this file is 2.6GB. The script prepares the data for analysis (focusing on responses to SST press perturbation as an example), and optionally saves a data file to reproduce Figure 5a in the next script. The same process could be used to prepare the data for plotting the rest of the subplots of Figure 5.

- 5_PlotFig5a_strength-of-SST-effects.html
 This script reproduces Figure 5a from the paper, using the data saved in the previous script.
- 6_PlotFig6ad_responses_by_strength-of-TempDepth-effects.html
 This script reproduces Figure 6a and 6d from the paper, calling the data file
 "TDresps.Rdata". This file was created as illustrated for SST responses in script
 4. The same process can be used to recreate the remaining subplots.

The data:

- Dia models: all 128 dia model files are supplied. The process for reading in and running simulations is exemplified in the first script, using the file "Model_NP_5N.dia" as an example.
- meanresponses.Rdata: This is a long table of the mean responses of each node to press perturbations, averaged across model versions and simulations. It is called in script 2 to reproduce Figure 2 from the paper.

- MeanResponses_by_UnknownEdge-Sign-Press-combination.Rdata: This file contains a dataframe of the mean responses (averaged across simulations in each model) of each node, this time organised by unknown edge x sign x press combination. This is used in script 3 to reproduce Figure 3 from the paper.
- savedsims4.Rdata: this file contains the full simulated dataset structured as a list of lists, and is 2.6GB. Each model version is one element on the main list, and QPress output for each model version (i.e. all 10,000 simulations of that model version) is contained in the nested list. The code for using this data is illustrated in script 4.
- TDresps.Rdata: this large dataframe (121.4MB; dim=[1280000, 29]) contains the simulated responses of nodes to press increases in TempDepth (created as illustrated in script 4 for SST press scenario).
 - > col[1]: model version name
 - > col[2:9]: raw simulated responses of key nodes to press TempDepth increase
 - > col[10]: sign of TempDepth to ShallowPrey edge ("neg" or "pos")
 - > col[11]: sign of TempDepth to DeepPrey edge ("neg" or "pos")
 - > col[12]: sign of TempDepth to SmallFish edge ("neg" or "pos")
 - > col[13]: sign of TempDepth to BigFish edge ("neg" or "pos")
 - > col[14]: sign of TempDepth to LiceMBPs edge ("neg" or "pos")
 - > col[15]: simulated edge weight TempDepth to BigFish
 - > col[16]: simulated edge weight TempDepth to LiceMBPs
 - > col[17]: simulated edge weight TempDepth to SmallFish
 - > col[18]: simulated edge weight TempDepth to DeepPrey
 - > col[19]: simulated edge weight TempDepth to Catch
 - > col[20]: simulated edge weight TempDepth to ShallowPrey
 - > col[21]: simulated edge weight LiceMBPs to Catch
 - > col[22:29]: qualitative responses of key nodes to press TempDepth increases (-1, 0, or 1).