

Datasets and R/Stan scripts for Fukaya et al. (2020) Estimating fish population abundance by integrating quantitative data on environmental DNA and hydrodynamic modeling. Molecular Ecology.

Data files

tracer_matrix.Rdata

An **R** binary data, including the tracer model matrix named as **A** (which is denoted as **A** in the article). This matrix has a dimension 20484×20484 , and its i -th row j -th column element indicates the contribution of unit individual density (per liter) in cell j to eDNA concentration (copies per liter) in cell i .

cell_attributes.csv

A data table of attributes of each grid cell of the tracer model, with the following columns:

no Unique ID of the grid cell.

lon Longitude of the grid cell.

lat Latitude of the grid cell.

dep_m Water depth (m) of the grid cell.

dep_level Vertical layer of the grid cell.

vol_m.3 Water volume (m^3) of the grid cell.

eDNA_measurements.csv

A data table of the eDNA survey, with the following columns:

st Unique ID of the sampling station.

dep The level of depth where the sample was collected. With three levels: **B** (bottom), **M** (medium), and **S** (surface).

conc Concentration of eDNA (copies/L).

cell The ID of the grid cell of the tracer model which corresponds to the water sampling location.

acoustic_measurements.csv

A data table of the acoustic survey, with the following columns.

Sv Extracted volume backscattering strength value (S_V) to determine individual density per 1 m^3 water cube.

cell The ID of the grid cell of the tracer model which corresponds to the S_V measurements.

coarser_cells.csv

A data table of integers that indicate IDs of coarser grid blocks for each grid cell.

200m Used for 200 m grid blocks.

300m Used for 300 m grid blocks.

400m Used for 400 m grid blocks.

R scripts

01_fit_model_eDNA.R

Fit the tracer model to the eDNA survey dataset.

02_fit_model_echosounder.R

Fit a linear mixed model to the acoustic survey dataset.

03_reproduce_main_results.R

Post-process the model fit objects to obtain the results shown in the main text.

04_fit_coarser_models.R

Fit the tracer model to the eDNA survey dataset in which fish density is estimated in coarser grid blocks.

05_reproduce_supplementary_results.R

Post-process the model fit objects to obtain the results shown in the supplementary file.

functions.R

Define the following auxiliary functions:

aggregate_abundance() Calculate vertically aggregated abundance.

aggregate_density() Calculate vertically aggregated density.

draw_map() Plot a map of fish density in Maizuru Bay.

Stan scripts

model_eDNA.stan

A Stan model code for the eDNA survey dataset.

model_eDNA_coarser.stan

A Stan model code for the eDNA survey dataset. Fish density is estimated in coarser grid blocks.

model_echosounder.stan

A Stan model code for the acoustic survey dataset.