

The Sewage-Indicator-Baikal-Ecological-Response (SIBER): Co-located sewage pollution, periphyton, and benthic macroinvertebrate community and foodweb dataset from Lake Baikal (Siberia)

Overview

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Abstract

Treated and untreated sewage released from lakeside development can introduce nutrients and micropollutants and restructure aquatic ecosystems. Lake Baikal, the world's most ancient, biodiverse, and voluminous lake, has been experiencing localized sewage pollution from lakeside settlements, near which increasing filamentous algal abundance has suggested that littoral benthic communities are responding. We surveyed 40-km of Baikal's southwestern shoreline 19-23 August 2015 for sewage indicators, including pharmaceuticals and microplastics with co-located periphyton and macroinvertebrate relative abundance and indicators of food web structure (stable isotopes and fatty acids). Unique identifiers corresponding to sampling locations are retained throughout all data files to facilitate interoperability among the dataset's 125 variables. The data are structured in a tidy format (a tabular arrangement familiar to limnologists) to encourage future reuse. For Baikal, these data can supplement continued monitoring efforts. For lakes worldwide, these data can help synthesize sewage prevalence, intensity, and ecological consequences across spatial scales.

The SIBER data product can be cited as:

Meyer*, M.F., Hampton, S.E., Ozersky, T., Woo, K.H., Shchapov, K., Snow, D.D., Rosi, E.J., Timofeyev, M.A., Zaitseva, Yu.M., Karnaukhov, D.Yu., Bondarenko, N.A., Galloway, A.W.E., Schram, J., Brousil, M.R.

The Sewage-Indicator-Baikal-Ecological-Response (SIBER) dataset.
Environmental Data Initiative.

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Scripts and workflow

Scripts in this repository

Scripts that are central to the linear workflow of the SIBER build process are numbered consecutively.

1. `01_data_cleaning.R` : Aggregate datasets to site-level for analyses
 - Inputs: Disaggregated, replicate level CSVs and KML file derived from Google Earth project
 - Outputs: Site-level CSVs for each type of data collected within a new directory
2. `02_sewage_indicator_analysis.R` : Performs sewage indicator analyses
 - Inputs: Site-level aggregated data from `01_data_cleaning.R`
 - Outputs: Individual and combined plots for each regression analysis.
3. `03_community_composition_analysis.R` : Performs univariate and multivariate periphyton and benthic macroinvertebrate community composition analyses
 - Inputs: Site-level aggregated data from `01_data_cleaning.R`
 - Outputs: Individual and combined univariate and multivariate plots
4. `04_fatty_acid_analysis.R` : Performs univariate and multivariate analyses pertaining to primary producer and benthic macroinvertebrate fatty acid data
 - Inputs: Site and species-level aggregated data from `01_data_cleaning.R`
 - Outputs: CSV tables for particular fatty acid analyses as well as plots resulting from various univariate and multivariate analyses
5. `05_table_formatting.R` : Aggregate metadata and sewage indicators for accompanying manuscripts
 - Inputs: Site-level aggregated data from `01_data_cleaning.R`
 - Outputs: Metadata and sewage indicator tables for accompanying manuscripts
6. `06_map_making.R` : Create map of study site based on metadata and inverse distance weighted population
 - Inputs: Site-level aggregated data from `01_data_cleaning.R`
 - Outputs: Map of study region
7. `07_stable_isotope_biplot.R` : Make biplot based of stable isotope values
 - Inputs: Site-level aggregated data from `01_data_cleaning.R`
 - Outputs: Biplot of stable isotope data, aggregated by site and grouped IDW population values
8. `panel_cor_function.R` : Sourced script that performs pairwise correlations between variables and calculates R^2 as well as p-values.

Additional script repository

Data contained in this repository have been cleaned and wrangled using a prior script (`00_disaggregated_data_cleaning.R`). This script is not contained within the EDI repository to prevent confusion, but is available via the associated OSF page for this project ([DOI](#)). This script primarily removes any poorly preserved taxa that may be partially included in the dataset, corrects misspellings, and formats data into a tidy format, thereby enabling interoperability among all CSV files.

R session info:

The following R packages are essential to produce SIBER:

- [tidyverse](#)
- [lubridate](#)
- [stringr](#)
- [janitor](#)
- [sf](#)
- [spdpolyr](#)

Detailed R session info is below:

```
- Session info -----
setting  value
version  R version 3.6.2 (2019-12-12)
os       Windows 10 x64
system   x86_64, mingw32
ui       RStudio
language (EN)
collate  English_United States.1252
ctype    English_United States.1252
tz       America/Los_Angeles
date     2020-10-15

- Packages -----
package      * version date      lib source
assertthat   0.2.1   2019-03-21 [1] CRAN (R 3.6.2)
backports    1.1.8   2020-06-17 [1] CRAN (R 3.6.2)
broom        0.5.3   2019-12-14 [1] CRAN (R 3.6.2)
cellranger   1.1.0   2016-07-27 [1] CRAN (R 3.6.2)
class        7.3-15  2019-01-01 [2] CRAN (R 3.6.2)
classInt     0.4-2   2019-10-17 [1] CRAN (R 3.6.2)
cli          2.0.2   2020-02-28 [1] CRAN (R 3.6.3)
colorspace   1.4-1   2019-03-18 [1] CRAN (R 3.6.1)
crayon       1.3.4   2017-09-16 [1] CRAN (R 3.6.2)
DBI          1.1.0   2019-12-15 [1] CRAN (R 3.6.2)
dbplyr       1.4.2   2019-06-17 [1] CRAN (R 3.6.2)
dplyr        * 1.0.0   2020-05-29 [1] CRAN (R 3.6.3)
e1071        1.7-3   2019-11-26 [1] CRAN (R 3.6.2)
ellipsis     0.3.1   2020-05-15 [1] CRAN (R 3.6.3)
fansib       0.4.1   2020-01-08 [1] CRAN (R 3.6.2)
forcats      * 0.4.0   2019-02-17 [1] CRAN (R 3.6.2)
fs           1.3.1   2019-05-06 [1] CRAN (R 3.6.2)
generics     0.0.2   2018-11-29 [1] CRAN (R 3.6.2)
ggplot2      * 3.3.2   2020-06-19 [1] CRAN (R 3.6.3)
glue         1.4.1   2020-05-13 [1] CRAN (R 3.6.3)
gtable       0.3.0   2019-03-25 [1] CRAN (R 3.6.2)
haven        2.2.0   2019-11-08 [1] CRAN (R 3.6.2)
hms          0.5.3   2020-01-08 [1] CRAN (R 3.6.2)
httr         1.4.1   2019-08-05 [1] CRAN (R 3.6.3)
janitor      * 1.2.1   2020-01-22 [1] CRAN (R 3.6.2)
jsonlite     1.7.0   2020-06-25 [1] CRAN (R 3.6.3)
KernSmooth   2.23-16 2019-10-15 [2] CRAN (R 3.6.2)
lattice      0.20-38 2018-11-04 [2] CRAN (R 3.6.2)
lazyeval     0.2.2   2019-03-15 [1] CRAN (R 3.6.2)
lifecycle    0.2.0   2020-03-06 [1] CRAN (R 3.6.3)
lubridate    * 1.7.4   2018-04-11 [1] CRAN (R 3.6.2)
magrittr     1.5     2014-11-22 [1] CRAN (R 3.6.2)
modelr       0.1.5   2019-08-08 [1] CRAN (R 3.6.2)
munsell      0.5.0   2018-06-12 [1] CRAN (R 3.6.2)
nlme         3.1-142 2019-11-07 [2] CRAN (R 3.6.2)
pillar       1.4.4   2020-05-05 [1] CRAN (R 3.6.3)
pkgconfig    2.0.3   2019-09-22 [1] CRAN (R 3.6.2)
purrr        * 0.3.4   2020-04-17 [1] CRAN (R 3.6.3)
R6           2.4.1   2019-11-12 [1] CRAN (R 3.6.2)
Rcpp         1.0.5   2020-07-06 [1] CRAN (R 3.6.3)
readr        * 1.3.1   2018-12-21 [1] CRAN (R 3.6.2)
readxl       1.3.1   2019-03-13 [1] CRAN (R 3.6.2)
reprex       0.3.0   2019-05-16 [1] CRAN (R 3.6.2)
rlang        0.4.6   2020-05-02 [1] CRAN (R 3.6.3)
rstudioapi   0.11    2020-02-07 [1] CRAN (R 3.6.3)
```

rvest	0.3.5	2019-11-08	[1]	CRAN (R 3.6.2)
scales	1.1.1	2020-05-11	[1]	CRAN (R 3.6.3)
sessioninfo	1.1.1	2018-11-05	[1]	CRAN (R 3.6.2)
sf	* 0.9-5	2020-07-14	[1]	CRAN (R 3.6.3)
sp	* 1.3-2	2019-11-07	[1]	CRAN (R 3.6.2)
spbabel	0.5.0	2019-01-08	[1]	CRAN (R 3.6.2)
spdpplr	* 0.3.0	2019-05-13	[1]	CRAN (R 3.6.2)
stringi	1.4.6	2020-02-17	[1]	CRAN (R 3.6.2)
stringr	* 1.4.0	2019-02-10	[1]	CRAN (R 3.6.2)
tibble	* 3.0.1	2020-04-20	[1]	CRAN (R 3.6.3)
tidyr	* 1.1.0	2020-05-20	[1]	CRAN (R 3.6.3)
tidyselect	1.1.0	2020-05-11	[1]	CRAN (R 3.6.3)
tidyverse	* 1.3.0	2019-11-21	[1]	CRAN (R 3.6.3)
units	0.6-5	2019-10-08	[1]	CRAN (R 3.6.2)
vctr	0.3.1	2020-06-05	[1]	CRAN (R 3.6.3)
withr	2.2.0	2020-04-20	[1]	CRAN (R 3.6.3)
xml2	1.3.2	2020-04-23	[1]	CRAN (R 3.6.3)

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