

# Metadata template for datasets of *L&O-Letters* articles

**Table 1.** Description of the fields needed to describe the creation of your dataset.

<b>Title of dataset</b>	Methane production & oxidation rates in lakes and reservoirs
<b>URL of dataset</b>	<a href="https://doi.org/10.6084/m9.figshare.12811778">https://doi.org/10.6084/m9.figshare.12811778</a>
<b>Abstract</b>	Here, we present a dataset of methane (CH <sub>4</sub> ) processing rates measured in peer-reviewed studies of lakes and reservoirs. The dataset includes rates of sediment CH <sub>4</sub> production, sediment CH <sub>4</sub> oxidation, and/or water column CH <sub>4</sub> oxidation rates measured with a commonly methodology (incubations) in 107 different lakes and reservoirs (n=77 studies). For each rate measurement, information on lake location, latitude, trophic status, incubation method, and incubation temperature are included.
<b>Keywords</b>	Methane, CH <sub>4</sub> , methane production, methanogenesis, methane oxidation, methanotrophy, eutrophication, lakes, reservoirs
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<b>Additional authors or contributors to the dataset</b>	John Harrison
<b>Organization associated with the data</b>	Washington State University Vancouver
<b>Funding</b>	- NSF Graduate Research Fellowship Program under NSF Grants #1347973 and #1842493 (PI: Lisa Gloss). - U.S. Army Corps of Engineers Climate Preparedness and Resilience Programs grant and a National Science Foundation DEB Grant #1355211 (co-PIs: John Harrison and Stephen Henderson).
<b>License</b>	CC BY 4.0
<b>Geographic location – verbal description</b>	Data were collected from previously published peer-reviewed articles. These articles contain measurements from all seven continents, although most measurements are from the US, Canada, and central/northern Europe.
<b>Geographic coverage bounding coordinates</b>	See individual publications for detailed geographic information in each study.
<b>Time frame - Begin date</b>	The earliest measurements in the dataset were from a study published in 1973.
<b>Time frame - End date</b>	The latest measurements in the dataset were from a study published in 2020.
<b>General study design</b>	We performed a literature search for peer-reviewed publications that reported incubation-based measurements of sediment CH <sub>4</sub> production, sediment CH <sub>4</sub> oxidation, and/or water column CH <sub>4</sub> oxidation rates in a freshwater or reservoir. From each study, we also extracted information on lake characteristics (lake location, latitude, and trophic status) as well as incubation methodology (type of incubation and incubation temperature).

	We use this information to examine potential environmental drivers of CH <sub>4</sub> production and oxidation in lakes and reservoirs.
<b>Methods description</b>	<p>Literature searches for relevant peer-reviewed publications were done using online search engines JSTOR, Web of Science, and ScienceDirect in November 2020. Production and oxidation rates were only extracted if presented by the authors in units that could be converted to per-area (<math>\mu\text{mol CH}_4 \text{ m}^{-2} \text{ d}^{-1}</math>), per-volume (<math>\mu\text{mol CH}_4 \text{ L}^{-1} \text{ d}^{-1}</math>), or per-mass (<math>\mu\text{mol CH}_4 \text{ gram dry sediment}^{-1} \text{ d}^{-1}</math>) units. Studies from freshwater systems other than lakes or reservoirs were excluded, such as rivers, wetlands, ponds, and marine or brackish ecosystems. We also excluded lakes with extreme environmental conditions such as those described as soda, saline, karst, acidic, or alkaline lakes by the authors of the study.</p> <p>During our literature search, we extracted one mean rate of sediment CH<sub>4</sub> production, sediment CH<sub>4</sub> oxidation, and/or water column CH<sub>4</sub> oxidation for each lake in each study. A few mean rates (8%) were estimated from a figure in the article if rate measurements were not reported explicitly in tables or text. If no mean rate for an individual lake was presented, the mean rates or range of rates were averaged between different sampling sites, times, and/or depths within the sediment or the water column. This approach occasionally required averaging across sediment or water column depths with differing oxygen conditions, therefore we do not distinguish between aerobic and anaerobic rates in our analysis.</p>
<b>Laboratory, field, or other analytical methods</b>	<p>See individual studies in dataset for specific methods details. All studies included in the dataset used incubations to measure CH<sub>4</sub> processing rates. Incubations typically involve sealing sediment and/or water samples from a lake in a gastight vial, incubating at a constant temperature in the lab or at ambient temperatures <i>in situ</i>, and monitoring the change in CH<sub>4</sub> concentrations over time to estimate net CH<sub>4</sub> production or oxidation rates. Sediment incubations in our dataset include those done with homogenized (slurried) sediment, fully intact sediment cores, and sediment subcores (slices from different layers of intact sediment cores).</p> <p>In order to compile a dataset of rates as close to <i>in situ</i> conditions as possible, “potential” rates were excluded from our data collection. Rates were considered potentials if they were reported as potentials by the authors or the incubation had amendments of carbon precursors for methanogenesis (e.g. supplemented CO<sub>2</sub> or bicarbonate for hydrogenotrophic methanogenesis, supplemented acetate for acetoclastic methanogenesis) or methanotrophy (supplemented CH<sub>4</sub>). Incubations that injected an isotopic tracer (<sup>13</sup>C or <sup>14</sup>C labeled CH<sub>4</sub>, CO<sub>2</sub>, etc.) were excluded unless the authors specified that such an addition did not significantly change ambient concentrations in the incubation. Furthermore, rates from incubations with additional nutrient amendments were excluded in order to keep conditions as close to <i>in situ</i> as possible. If incubations at multiple temperatures were performed, rates were extracted from the incubation closest to the reported <i>in situ</i> temperature. For sediment rates, if incubations were done at both oxic and anoxic conditions, anoxic rates were used to represent typical sediment conditions.</p>
<b>Taxonomic species or groups</b>	N/A

<b>Quality control</b>	Data synthesized from previously published articles, so refer to those articles for quality control details taken by each author.
<b>Additional Information</b>	Grey rows in "data" tab indicate rates reported in per-area unit and therefore used in manuscript analysis (see Methods for details).

**Table 2. Data dictionary: description of the variables (i.e., columns) in EACH dataset.** You must provide sufficient detail for another user to understand and use the data. If there are 10 variables (i.e., columns) in the dataset, then there should be 10 rows in this table that describe each column. Be sure to include all relevant information for your dataset, including the unique identifiers for your dataset or system, dates, replicate numbers, latitude and longitude of sampling locations, etc.

**Dataset filename:** ch4\_processing\_data.xls

**Dataset description:** Contains incubation-based measurements of sediment methane production, sediment methane oxidation, or water column methane oxidation from peer-reviewed studies in our literature search. Also includes information on lake characteristics (location, latitude, and trophic status) and incubation methodology (type and temperature of incubation). The dataset includes per-area ( $\mu\text{mol CH}_4 \text{ m}^{-2} \text{ d}^{-1}$ ), per-volume ( $\mu\text{mol CH}_4 \text{ L}^{-1} \text{ d}^{-1}$ ), or per-mass ( $\mu\text{mol CH}_4 \text{ gram dry sediment}^{-1} \text{ d}^{-1}$ ) rate measurements. Given these units cannot be directly compared, only per-area rates (the most common unit) were analyzed in the main manuscript.

Column name	Description	Units	Code explanation	Data format	Missing data code
<b>study</b>	Author and year of original article (see references spreadsheet in dataset for full citation)	N/A	N/A	Single-author paper stored as [Author Name yyyy]; two-author paper stored as [Author 1 & Author 2 yyyy], for 3 or more authors stored as [Author et al. yyyy]	No missing data
<b>process</b>	Methane transformation pathway: sediment methane production, sediment methane oxidation, or water column methane oxidation.	N/A	N/A	Stored as either sediment methane production, sediment methane oxidation, or water column methane oxidation.	No missing data
<b>rate</b>	Numeric rate of sediment methane production, sediment methane oxidation, or water column methane oxidation.	Varies—see “rate. units” column	N/A	Stored in scientific notation. All rates rounded to one place after the decimal point.	No missing data
<b>rate.units</b>	Units for rate column.	N/A	N/A	Stored as either $\mu\text{mol CH}_4 \text{ m}^{-2} \text{ d}^{-1}$ , $\mu\text{mol CH}_4 \text{ L}^{-1} \text{ d}^{-1}$ , or $\mu\text{mol CH}_4 \text{ gram dry sediment weight}^{-1} \text{ d}^{-1}$ ( $\mu\text{mol CH}_4 \text{ gdw}^{-1} \text{ d}^{-1}$ ).	No missing data

<b>lake.name</b>	Name of lake where CH <sub>4</sub> measurement was taken.	N/A	N/A	Stored as text string.	Stored as "Unclear (not named)"
<b>location</b>	Location of the lake where CH <sub>4</sub> measurement was taken.	N/A	N/A	Stored as a text string. State, country, and/or continent reported when possible.	No missing data
<b>latitude</b>	Latitude of lake where CH <sub>4</sub> measurement was taken.	Degrees North	N/A	Positive numbers indicate lake in northern hemisphere; negative numbers indicate lake in southern hemisphere.	No missing data
<b>trophic.status</b>	Trophic status of lake where CH <sub>4</sub> measurement was taken.	N/A	N/A	Stored as a text string. Possible categories are dystrophic, oligotrophic, oligo-mesotrophic, mesotrophic, meso-eutrophic, or eutrophic.	Stored as "Unclear"
<b>trophic.group</b>	Lakes grouped based on their trophic status into low trophic status (dystrophic, oligotrophic, or oligo-mesotrophic) or high trophic status systems (mesotrophic, eutrophic, or meso-eutrophic).	N/A	N/A	Stored as a text string. Possible categories are "high_trophic" or "low_trophic" (see Methods for how trophic statuses were grouped).	Stored as "unclear"
<b>method</b>	Type of incubation used in rate measurement.	N/A	N/A	Stored as text string. Possible categories include water incubation, sediment slurry incubation, sediment subcore incubation, intact sediment core incubation, or sediment incubation (if unclear if slurry, intact cores, or subcores used). Incubations done with a <sup>13</sup> C or <sup>14</sup> C isotopic	No missing data

				tracer indicated as “isotopically labeled”.	
<b>incubation.temp.c</b>	Temperature of incubation used in rate measurement.	Degrees Celsius	“Multiple” indicates incubation done at multiple temperatures.	Stored as number, rounded to one decimal point.	Stored as “Unclear”
<b>manuscript.analysis</b>	Indicates whether or not rate was used in manuscript analysis. Given per-area, per-mass, and per-volume rates cannot be compared directly, rates in the most common unit (per-area) were used for analysis.	N/A	N/A	Stored as text string “yes” or “no”.	No missing data

**Dataset filename:** ch4\_processing\_refs.xlsx

**Dataset description:** Contains full citations for all studies included in ch4\_processing\_data.xls

Column name	Description	Units	Code explanation	Data format	Missing data code
References	Full citation for each study given in ch4_processing_data.xls	N/A	N/A	Citations are stored in the Nature citation style.	No missing data

### Table 3. Data provenance

If you used data derived from other sources, provide the information here so future users know where the data came from.

Dataset title	Dataset DOI or URL	Creator (name & email)	Contact (name & email)
N/A			

### Scripts/code (software) – OPTIONAL

It is recommended that you also provide your scripts along with your data, although it is not required at this time in our journal.

File name	Description	Scripting language
N/A		

**Notes and Comments:** Data provenance and scripts/code sections not applicable.