Survey data of benthic diatom resources in a Cijiawan Creek drainage basin in Wuling, Taiwan

武陵七家灣溪流域底棲矽藻資源調查資料

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Abstract

Background

Cijiawan Creek in Shei-Pa National Park of central Taiwan nurtures a unique and important natural resource, the Formosan landlocked salmon (*Oncorhynchus masou formosanus*). In order to conserve and restore the species population, many related researches are already underway, including long-term ecological monitoring. Benthic diatoms are the main basic producers of the food network of the stream ecosystem, and their species composition will directly or indirectly impact the entire ecosystem. This paper includes

a list of benthic diatoms and related information surveyed in a Cijiawan Creek drainage basin in 2019.

New information

In the paper we provide a detailed dataset that contains 1,839 benthic diatom occurrences collected during a field campaign in 2019. A total of 55 diatom (Bacillariophyta) taxa belonging to 9 orders, 17 families, and 27 genera were collected. The frequency analysis indicated that *Planothidium frequentissimum*, *Cocconeis placentula* var. *euglypta*, and *Achnanthidium convergens* were the most common diatom species at the sampling stations. The second most common diatom species were *Nitzschia amphibia* and *Synedra ulna*.

摘要

本調查資料是 2019 年間，在七家灣溪流域各樣站所採集之矽藻物種鑑定、藻種電顯影像、分布位置及環境因子等資料進行建置，可供為未來各項相關研究利用參考。調查結果顯示，9 個樣站共鑑定出 27 屬 55 種矽藻。將各樣點所採集之藻類進行頻度分析 *Planothidium frequentissimum*, *Cocconeis placentula* var. *euglypta*, 和 *Achnanthidium convergens* 這三種在各樣點出現頻度最高 ，其次是 *Nitzschia amphibia* 和 *Synedra ulna*。

Keywords: Bacillariophyta, benthic diatom, Cijiawan Creek

關鍵字：矽藻門、底棲矽藻、七家灣溪

Introduction

Cijiawan Creek is the main tributary in the upper stretch of Dajia River in Taiwan and is located in Wuling, Heping District, Taichung City. This creek is under the jurisdiction of Shei-Pa National Park and is regarded as the only surviving habitat of *Oncorhynchus masou formosanus.* This type of salmon mainly feeds on aquatic insects (Lin et al. 1988; Wang 1994), and these insects feed on epiphytic algae in streams, where diatoms have the highest species diversity (Yu 2008). Both diatoms and aquatic insects can be used as a biological indicator of the stream environment (Chu et al. 2006). According to the Wuling Long-Term Ecological Research and Modeling research team, several biological groups in the ecosystem food webs have been observed (Lin et al. 2007), with epiphytic algae at the upper stretch of Dajia River identified as one of the primary producers. Generally, the biomass of epiphytic algae may alter the energy flow of food webs in river ecosystems (Kano et al. 2016). Epiphytes can also conserve and store energy and materials, and provide food and habitat to other aquatic organisms, thereby affecting the composition of such organisms (Lock et al. 1984). In the streams of Wuling, epiphytes are mostly diatoms (Yu et al. 2006). The analysis of diatom communities and their biodiversity is a useful tool to secure an ecological and sustainable use of the water resources and the correct elaboration of guidelines for their preservation, in particular, in specially protected natural areas (Falasco and Bona 2011; Falasco et al. 2012; Neplyukhina et al. 2022). Relevant investigations are mostly about the relationship between algae and environmental factors (Lin 2011; Su 2009; Wu 2010; Ye 2011) and there are few surveys on the classification and identification of diatoms. In the past, the identification of diatoms was mainly based on optical microscopy. However, due to the limitation of observation multiples, it is not easy to

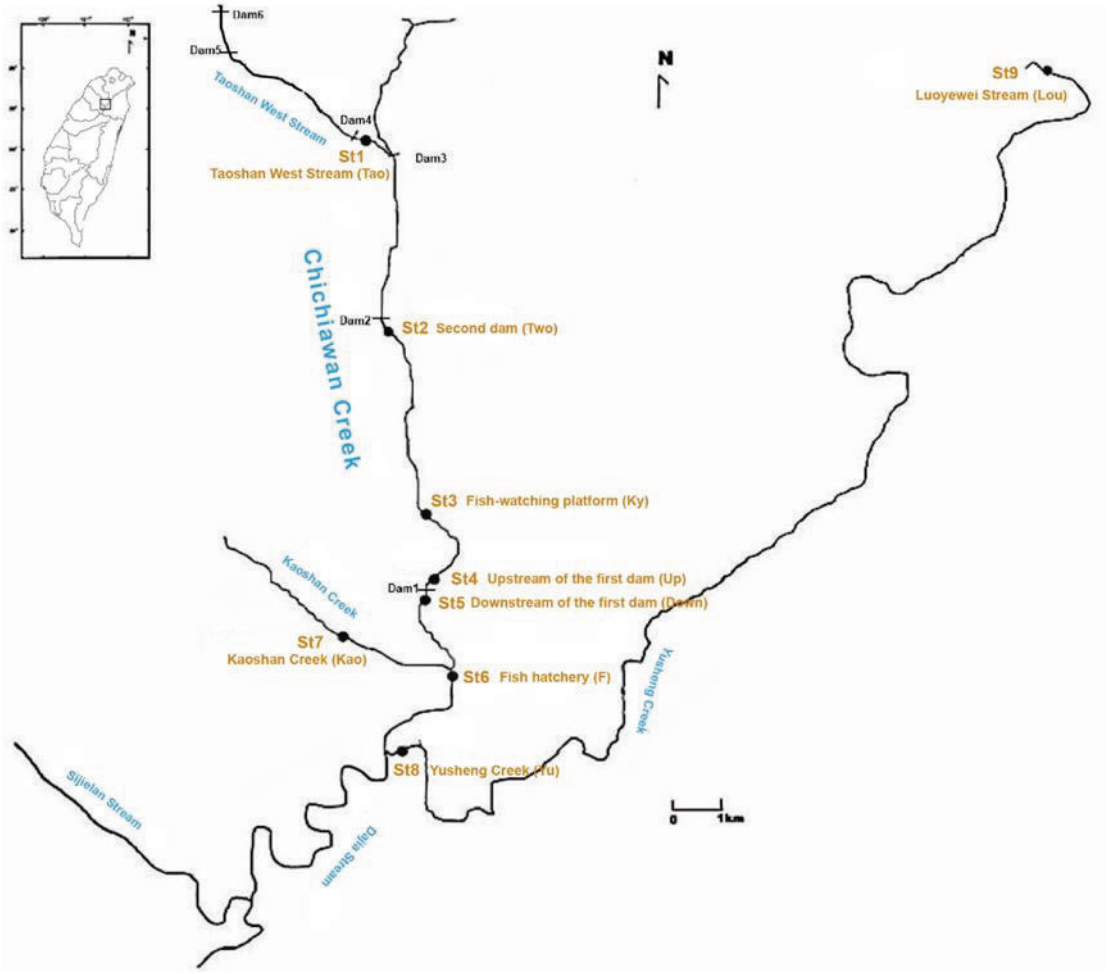

Fig 1. The sampling stations are shown in the Cijiawan Creek drainage basin. In Cijiawan Creek (from upstream to downstream) and its tributaries, nine sampling stations were installed. Characteristics of all the sampling stations are described in Table 1.

Table 1. Characteristics of sampling stations

Sampling station no.	Sampling station name	Code	Characteristics
St1	Taoshan West Stream	Tao	Located below the Wuling Suspension Bridge and divided into three mesohabitat units: riffles, run, and pools.
St2	Second dam	Two	Located nearly 100 m downstream of the damaged second dam and divided into two mesohabitat units: pools and runs.
St3	Fish-watching platform	Ky	An open sampling station located nearly 1 km downstream of the fish-watching platform and divided into three mesohabitat units: riffles, run, and pools.
St4	Upstream of the first dam	Up	An open terrain located 100 m upstream of the first dam. The river channel is located on the right bank, and the right-hand side is covered with little vegetation. Riffle and pool mesohabitat units are clearly observable, and a run unit is located downstream of the pool.
St5	Downstream of the first dam	Down	Located 100 m downstream of the first dam with steep rock walls on both sides. Compared with the upstream of the first dam, this sampling station is more shaded. Riffle and pool mesohabitat units are clearly observable, with the run unit being less marked.
St6	Fish hatchery	F	An open terrain where the riverway is widest among all sampling stations. Riffle and run mesohabitat units are clearly observable, and the pool unit is less marked and covered by gravel.
St7	Kaoshan Creek	Kao	A primary shaded sampling station where only a riffle unit is observable and the flow velocity is relatively high.
St8	Yusheng Creek	Yu	An area that is subjected to human-induced disturbances and agricultural activities and has a riffle unit with a relatively low flow velocity and relatively high nutrient concentration. The long-term monitoring results of the algal phase in this area considerably differ from those obtained at other sampling stations.
St9	Luoyewei Stream	Luo	The terrain on both sides of the strait is narrow and steep, thereby preserving the appearance of the primary forest and demonstrating high vegetation coverage on both sides.

distinguish diatoms in classification. In this investigation, electron microscope was mainly used to record the collected diatom morphology, so as to observe the diatom morphology more clearly for identification, and compile it into the database for reference with the data of the sampling station.

Project description

Title:

Survey data of benthic diatom resources in a Cijiawan Creek drainage basin in Wuling

Study area description:

A total of nine sampling stations were installed in the Cijiawan Creek watershed, as shown in Figure 1.

Sampling methods

Sampling description:

Sampling stations in the Cijiawan Creek watershed were divided into three mesohabitat units for separate sample collection: riffles, run, and pools. Depending on the size of the substrate in the sampling area, stones representative of the particle size of the sampling station were randomly selected. At least three stones of the same particle size were collected from each habitat. Diatom samples (with an area of 16–25 cm^2) were scraped off the collected stones on the river bank and placed into a sample collection container along with stream water from the site. The samples were then sent to the laboratory for acid-wash treatment for identification (Su 2009).

A total of five sampling events were performed in January, April, July, August, and October, 2019. For the final two sampling events, samples were collected after Typhoon Lekima to determine the effect of typhoons on epiphytes.

Quality control:

For diatom identification, a number of manuals were used (Taylor et al. 2007,

Wu et al. 201). Valid diatom taxon names were referenced according to Guiry and Guiry (2022).

Step description:

1.Collect samples from habitats.

2.The samples underwent acid-wash treatment for identification.

3.Photograph the samples with an electron microscope.

4.Convert paper-based records from the field and laboratory into an electronic data format (Excel spreadsheets).

5.Organize the datasets into a standardized format.

6.Export data as a Darwin Core Archive.

7.Generate dataset-level metadata.

Statistical analysis:

R programming language (version 4.0.3; R Foundation for Statistical Computing, Vienna, Austria) was used for Bray–Curtis dissimilarity testing and nonmetric multidimensional scaling (NMDS) for understanding the differences in diatom communities among the sampling sites. Because the Luoyewei Stream sampling station (St9) was sampled only once, it was excluded from the analysis (see Figure 2). The results indicated that the diatom species composition of the sampling stations of Cijiawan Creek's tributaries (i.e., Kaoshan Creek [Kao], Yusheng Creek [Yu], and Taoshan West Stream [Tao]) was considerably different from that of other sampling stations in Cijiawan Creek. The results also indicated large differences between the aforementioned three sampling stations, which agreed with previous long-term monitoring results of algal species in this area. This is because the habitat environment and water quality of these three sampling stations considerably differed from those of Cijiawan Creek (Yu and Lin 2009).

As shown in Figure 3, the frequency analysis indicated that *Planothidium frequentissimum*, *Cocconeis placentula* var. *euglypta*, and *Achnanthidium convergens* were the most common diatom species at the sampling stations. The second most common diatom species were *Nitzschia amphibia* and *Synedra ulna*.

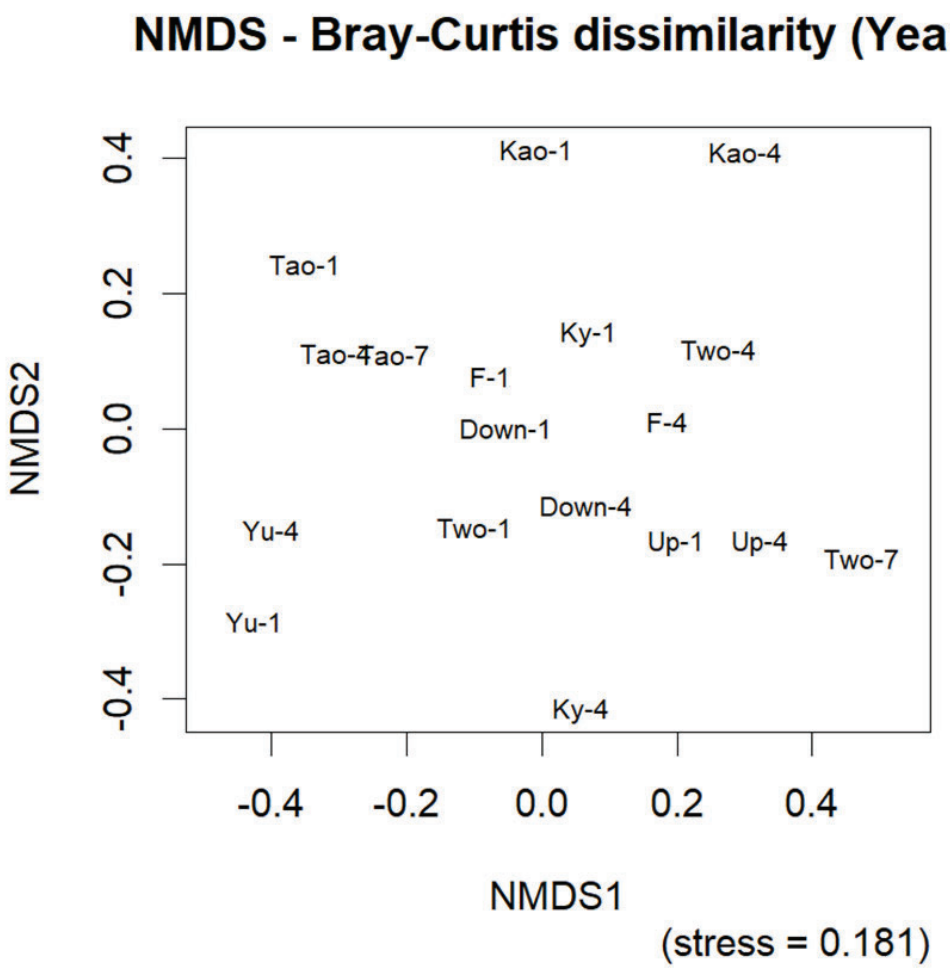

Fig. 2. The result of the diatom species composition of the sampling stations of the Cijiawan Creek drainage basin. Number 1 stands for riffle; number 4 stands for run; number 7 stands for pool.

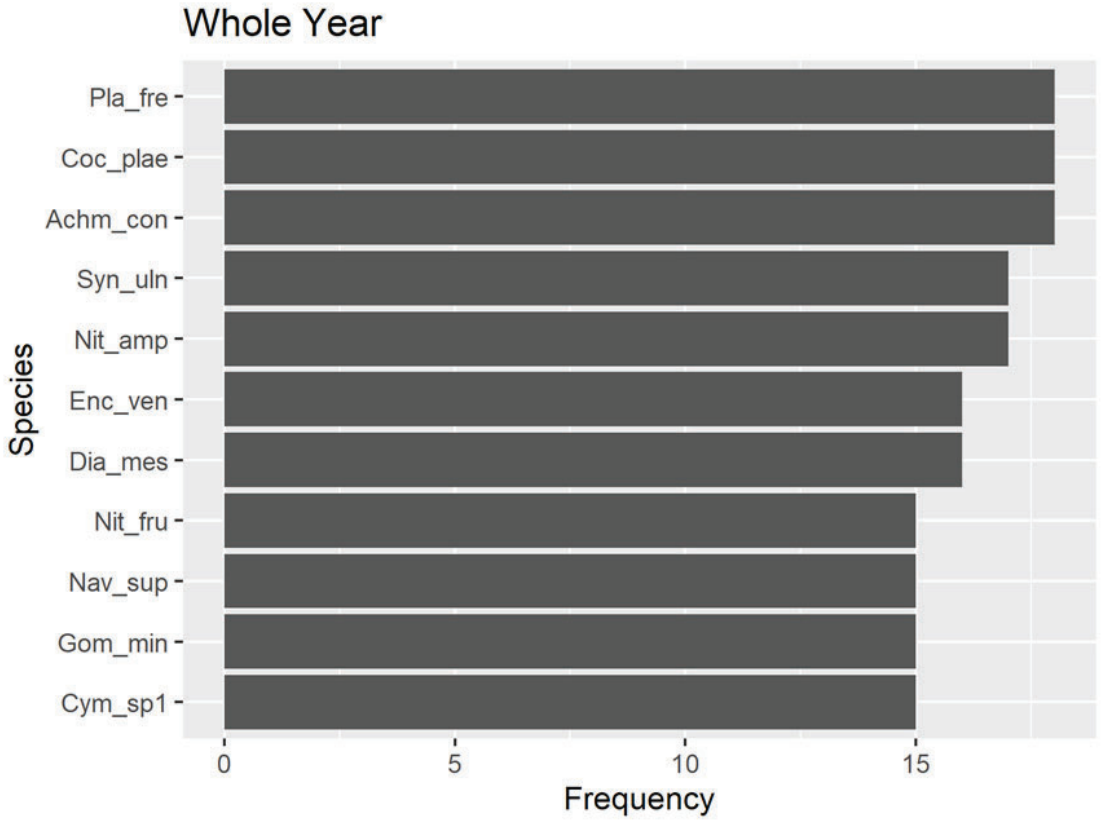

Fig. 3. The frequency of occurrence of diatom species in the Cijiawan Creek sampling stations in the whole year.

(Pla_fre= *Planothidium frequentissimum*；Coc_plae= *Cocconeis placentula* var. *euglypta*；Achm_con= *Achnanthidium convergens*; Syn_uln= *Synedra ulna*；Nit_amp= *Nitzschia amphibian*；Enc_ven= *Encyonema ventricosum*；Dia_mes= *Diatoma mesodon*；Nit_fru= *Nitzschia frustulum*; Nav_sup= *Navicula suprinii*；Gom_min= *Gomphonema minutum*；Cym_sp1= *Cymbella* sp.1)

Geographic coverage

Description:

Cijiawan Creek drainage basin, Shei-Pa National Park, Heping District, Taichung City, Taiwan.

Coordinates:

Sampling station no.	Sampling station name	N	E
St1	Taoshan West Stream	24.39802	121.3075
St2	Second dam	24.382139	121.310111
St3	Fish-watching platform	24.37083	121.31055
St4	Upstream of the first dam	24.36355	121.31163
St5	Downstream of the first dam	24.36383	121.31163
St6	Fish hatchery	24.35447	121.31383
St7	Kaoshan Creek	24.3587	121.3075
St8	Yusheng Creek	24.347773	121.310494
St9	Luoyewei Stream	24.39455	121.35119

Taxonomic coverage

Description:

All diatoms were identified to the genus or species level. In total, 55 species taxa were identified belonging to two classes, nine orders, 17 families, and 27 genera. The taxonomic coverage of the diatoms found in studied material is given in Table 2.

Table 2. Taxonomic coverage of diatoms from studied samples.

Orders	Families	Genera	Species
Achnanthales	2	5	12
Bacillariales	1	2	7
Cymbellales	3	7	15
Fragilariales	1	2	2
Melosirales	1	1	1
Naviculales	5	6	13
Licmophorales	1	1	1
Rhabdonematales	2	2	3
Thalassiophysales	1	1	1

Table 3. List of diatom species found in sample stations. (*presence)

	St1			St2			St3		St4		St5		St6		St7		St8		St9	
	Riffle	Run	Pool	Riffle	Run	Pool	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle
Achnanthes brevipes Agardh		*	*	*	*		*				*				*					
Achnanthes exigua Grunow in Cleve & Grunow																	*			
Achnanthes rupestoides Hohn	*	*	*										*		*				*	
Achnanthidium biasolettianum (Grunow) Round & Bukhtiyarova	*	*	*		*	*					*		*				*			
Achnanthidium convergens (Kobayasi) Kobayasi	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Achnanthidium minutissimum (Kützing) Czarnecki	*	*	*	*	*		*	*	*	*	*	*		*			*	*	*	
Amphora pediculus (Kützing) Grunow	*	*	*		*		*	*			*		*	*	*	*		*		
Amphora sp.1							*	*												
Caloneis bacillum (Grunow) Cleve	*	*	*	*	*	*		*												
Cocconeis pediculus Ehrenberg	*	*	*	*			*											*		*
Cocconeis placentula Ehrenberg	*	*	*	*	*			*	*											
Cocconeis placentula var. *euglypta* (Ehrenberg) Grunow	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cocconeis placentula var. *lineata* (Ehrenberg) Van Heurck	*	*	*	*			*						*	*	*	*			*	*
Cymbella affinis Kützing	*	*	*	*	*	*	*	*			*		*					*		
Cymbella turgidula Grunow in A.W.F.Schmidt	*	*	*	*	*	*	*	*			*	*	*				*	*		*
Cymbella sp.1	*	*	*	*	*	*	*	*	*	*	*	*	*	*				*		
Diatoma mesodon (Ehrenberg) Grunow	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*				*
Diatoma vulgaris Bory		*		*											*		*	*		
Diploneis elliptica (Kützing) Cleve														*						

Table 3. Cont.

	St1			St2			St3		St4		St5		St6		St7		St8		St9	
	Riffle	Run	Pool	Riffle	Run	Pool	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle
Encyonema ventricosum (Agardh) Grunow		*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*		*
Eolimna minima (Grunow) Lange-Bertalot & W.Schiller		*												*			*	*		
Epithemia cistula (Ehrenberg) Ralfs	*	*	*	*																
Fragilaria capucina var. *vaucheriae* (Kützing) Lange-Bertalot		*	*	*	*		*		*		*	*		*	*			*		*
Frustulia vulgaris (Thwaites) De Toni											*									
Geissleria decussis (Østrup) Lange-Bertalot & Metzeltin		*					*		*		*									
Gomphoneis sp.1				*	*	*								*			*		*	
Gomphoneis sp.2	*	*	*	*	*						*		*	*	*	*	*	*		*
Gomphonema clevei (Fricke) Gil							*													
Gomphonema lagenula Kützing				*	*	*												*		
Gomphonema lateripunctatum Reichardt & Lange-Bertalot	*		*	*	*	*						*				*		*	*	*
Gomphonema minutum (C.Agardh) C.Agardh	*	*	*	*		*	*	*			*	*	*	*	*	*	*	*	*	
Gomphonema sp.1			*	*								*	*				*	*	*	*
Grunowia tabellaria (Grunow) Rabenhorst	*	*	*	*	*	*				*			*				*			
Melosira varians Agardh	*	*	*	*	*	*	*	*	*	*	*			*						
Navicula cryptocephala Kützing	*	*	*	*		*		*					*							*
Navicula cryptotenella Lange-Bertalot. Dataset						*		*			*			*		*				
Navicula cryptotenelloides Lange-Bertalot	*	*	*	*	*			*												
Navicula germainii J.H.Wallace		*	*	*	*															
Navicula pseudobryophila Hustedt		*														*				
Navicula radiosa Kützing	*	*	*	*	*		*	*			*	*	*	*	*					*

Table 3. Cont.

	St1			St2			St3		St4		St5		St6		St7		St8		St9	
	Riffle	Run	Pool	Riffle	Run	Pool	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle	Run	Riffle
Navicula suprinii Gerd Moser, Lange-Bertalot and Metzeltin		*	*	*	*		*	*	*	*	*		*	*	*	*	*	*		
Navicula tripunctat (O.F.Müller) Bory de Saint-Vincent	*	*	*	*	*	*					*						*	*		
Nitzschia alpine Hustedt	*	*	*						*		*	*					*	*		
Nitzschia amphibia Grunow	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*
Nitzschia frustulum (Kützing) Grunow	*	*	*	*		*	*	*	*		*	*	*	*	*		*	*		
Nitzschia inconspicua Grunow	*		*			*		*									*	*		
Nitzschia linearis (Agardh) W. Smith		*					*	*		*	*		*		*		*	*		*
Nitzschia palea (Kützing) W. Smith				*		*	*	*	*	*	*	*	*	*	*		*			
Pinnularia molaris var. *asiatica* Skvortzow		*	*																	
Placoneis gastrum (Ehrenberg) Mereschkowsky	*	*	*						*			*	*	*						
Planothidium frequentissimum (Lange-Bertalot) Lange-Bertalot	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Reimeria sinuata (W.Gregory) Kociolek & Stoermer			*	*	*	*	*	*	*	*	*	*	*	*			*	*		
Rhoicosphenia abbreviata (C.Agardh) Lange-Bertalot	*	*	*								*						*	*	*	*
Synedra ulna (Nitzsch) Ehrenberg	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Ulnaria acus (Kützing) M.Aboal			*										*	*						

Temporal coverage

Notes:

Sample in January, April, July, August, and October, 2019.

Usage license

Usage license:

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Data resources

Data package title:

Darwin Core Archive Survey Data of Diatoms in Cijiawan Creek

Resource link:

https://www.gbif.org/dataset/9e6b-f53c-8dba-470a-9142-3607dfe21c41

Alternative identifiers:

https://doi.org/10.15468/rwjwkj

https://ipt.taibif.tw/resource?r=-survey_data_of_diatoms_in_Cijiawan_creek

Data set name:

Survey Data of Diatoms in Cijiawan Creek

Data format:

Darwin Core Archive

Data format version:

1.6 published on September 30, 2022

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