**Development of Algal Indices of Biotic Integrity for Southern California Wadeable Streams and Recommendations for their Application, v3**

*This document is the deliverable for Prop 50 grant Task # 4, which entailed preparation of a draft algal IBI for use in southern California wadeable streams.*

## Abstract

Using a large dataset from wadeable streams concentrated in southern California, we developed several Indices of Biotic Integrity (IBIs) consisting of metrics derived from diatom and/or non-diatom ("soft") algal assemblages including cyanobacteria. Over 100 metrics were screened based on metric score distributions, responsiveness to anthropogenic stress, and repeatability. High-performing metrics were combined into IBIs, which were classified according to the amount of field and laboratory effort required to generate their scores. IBIs were screened for responsiveness to anthropogenic stress, repeatability, mean correlation between component metrics, and indifference to natural gradients. Most IBIs resulted in good separation between the most disturbed and least disturbed (i.e., "reference") site classes, but they varied in terms of how well they distinguished intermediate-disturbance sites from the other classes, and based on some of the other performance criteria listed. In general, the best performing IBIs were "hybrids", containing a mix of diatom and soft-algae metrics. Of those tested, the soft-algae-only IBIs were better at distinguishing the intermediate from most highly disturbed site classes, and the diatom-only IBIs were marginally better than soft-algae based IBIs at distinguishing reference-quality from intermediate site classes. The single-assemblage IBIs also differed considerably in terms of the natural gradients to which they were most responsive. These collective findings may help explain the superiority of hybrid IBIs with respect to several performance criteria. We make recommendations for use of different IBIs under different monitoring applications, or alternatively, a tiered approach to applying IBIs requiring increasing effort depending upon interim monitoring outcomes. Our recommendations seek to maximize benefit:cost in order to accommodate various monitoring scenarios.

**key words:** stream algae, diatoms, cyanobacteria, bioassessment, index of biotic integrity, monitoring

## Introduction

The United States Environmental Protection Agency (US EPA) has been encouraging states to incorporate bioassessment into waterbody monitoring programs, preferably through the use of multiple biotic assemblages. Coordinated use of various assemblages yields multiple lines of evidence for assessing stream health and water quality, and can provide a broader range of perspectives on the attainment of aquatic life beneficial uses. For over a decade, bioassessment using benthic macroinvertebrates (BMIs) has been a standard practice in several California wadeable stream monitoring programs. The desire to incorporate multiple indicators combined with the need for an improved regulatory framework for nutrients is a primary impetus for developing algae-based bioassessment tools.

Algae can provide information complementary to that obtainable with BMIs alone in terms of types of stressors affecting them (Fore 2003, Griffith et al. 2005, Feio et al. 2007) and potentially also in terms of the levels of stress to which they are most responsive. While algae are well established as valuable indicators of organic pollution and stream nutrient status (Pan and Lowe 1994, van Dam et al. 1994, Winter and Duthie 2000, Douterelo et al. 2004, Berkman and Porter 2004, Parikh et al. 2006, Ponander and Charles 2004, Potapova and Charles 2007, Lavoie et al. 2008, Vis et al. 2008), they are also responsive to a variety of other stressor types. Several studies have identified toxic effects of certain metals on specific algal taxa (reviewed by Genter 1996), and others have demonstrated relationships between metals and aspects of benthic algal communities (Hill et al. 2000, Hirst et al. 2002, Ivorra et al. 2002, Griffith et al. 2005). In addition, some algal taxa are capable of motility. When covered by sediment, individuals can migrate toward the surface, and are therefore deemed better equipped to tolerate sedimentation, which has been the basis for some metrics (Bahls 1993).

In addition to responsiveness to stress, algal indicators are temporally complementary to BMIs (Stevenson and Smol 2003, Johnson and Hering 2004) because algae can reproduce/proliferate rapidly (Rott 1991, Lowe and Pan 1996, Hill et al. 2000, USEPA 2002) and communities can respond to changes in environmental conditions over shorter periods relative to other commonly used bioindicators (Stevenson and Pan 1999, Rimet et al. 2005, Lavoie et al. 2008). Another benefit of utilizing algae is the fact that they can colonize virtually any type of stream substratum, so their presence tends not to be limited by available habitat (Soininen and Könönen 2004, Feio et al. 2007). This attribute may enhance algal responsiveness to water quality within the context of a highly urbanized environment (e.g., where streams may be channelized, resulting in severely diminished physical habitat quality (Newall et al. 2006)).

The goal of using multiple assemblages (e.g., diatoms, soft algae, benthic macroinvertebrates) in biomonitoring raises the question of how to integrate the information obtained, and whether the value of results is cost-effectively enhanced through additional field and/or laboratory effort. The availability of community composition information from assemblages as diverse as diatoms, soft-algae, and cyanobacteria has provided us a comprehensive data set with which to evaluate their performance in biomonitoring applications, both as separate assemblages, and in an integrated format. Here we present our method for developing diatom and soft algal/cyanobacterial metrics and a series of IBIs based on various metric combinations. We grouped candidate IBIs in terms of the level of effort required to derive index scores based on what types of samples were collected and processed in the field, as well as what assemblages were identified in the laboratory. With respect to soft algal and cyanobacterial laboratory processing, we also looked at the effect of focusing on species-level identifications vs. higher taxonomic groupings, and species presence information vs. quantitative (biovolume) information. This study is the basis for a set of recommendations for algae bioassessment that is sensitive to the fact that higher resolution data (requiring higher sampling and analytical costs) may not be necessary for all monitoring applications, and a tiered approach to monitoring may offer the best overall solution for different assessment needs.

**Methods**

*Data sources*

Data used in IBI development were mostly collected over 2007-2009 under the auspices of several different projects and programs. These include a project funded by a California State Water Resources Control Board Proposition 50 grant, as well as the monitoring programs of the southern California Stormwater Monitoring Coalition (SMC), the State of California Perennial Stream Assessment (PSA), the state's Reference Condition Management Program (RCMP), and surveys by the San Diego and Los Angeles Regional Water Quality Control Boards. In all cases, the same field and laboratory protocols were used for sample collection and processing, and the same taxonomy laboratories (California State University, San Marcos and University of Colorado, Boulder) analyzed all of the samples. A small number of samples were also collected in 2010. Most sampling was concentrated in coastal southern California, but study sites were scattered throughout the rest of the state as well.

*Sample collection*

A "multi-habitat method" method was employed to collect benthic algae quantitatively from wadeable stream reaches throughout California. This sampling method, which is now the official Standard Operating Procedures of California's Surface Water Ambient Monitoring Program (SWAMP; Fetscher et al. 2009), is based largely on existing procedures of EPA's Environmental Monitoring and Assessment Program (EMAP). It involves objectively collecting from a known surface area specimens from a variety of stream substrata, in proportions aligning with their relative abundances in the stream, and combining them into a single "composite" sample for laboratory analyses. As such, a given sample may have been collected from any combination of cobbles, gravel, and sand, etc. The goal is to achieve a representative sample of the benthic algae from each study reach, in terms of both community composition and biomass. A "qualitative" sample of soft algae was often also collected, with the goal of trying to capture as much as possible of the diversity in the study reach. Over 650 sampling events occurred at >450 distinct sites throughout the state.

In addition to the multihabitat method, at a subset of southern California sites (N=6), a "targeted substratum" approach was used. At these sites, the three most dominant substratum types were identified, and from these, three samples were taken, each from a different substratum, for a total of four samples (one multihabitat sample, and 3 different targeted samples). The protocol followed for targeted substrata was that of the US Geological Survey National Water Quality Assessment (NAWQA) program (Moulton et al. 2002).

Additional data collected to aid in IBI development included water-chemistry constituents (nutrients, conductivity, pH, selected anions, dissolved organic carbon, selected metals, etc.), habitat variables (canopy cover, gradient, pebble size distribution, riparian disturbance indicators, wetted dimensions, flow habitats) using the methods outlined in Fetscher et al. (2009), and landscape variables (percent land use types, road density, and number of road crossings at various spatial scales, mines, elevation, stream order, watershed size, etc.)

*Laboratory analyses*

For the evaluation of diatoms, samples were cleaned by the method of Van Der Werff (1955). The cleaned material was processed into permanent microscope slides, using Naphrax as the mounting medium. For each sample, a target number of 600 valves were identified and enumerated with an Olympus BX-51 light microscope, using a 100x oil immersion objective with a N.A. of 1.40.

With respect to processing of soft-bodied algae (including cyanobacteria), for proper qualitative and quantitative identification and enumeration of taxa, macroalgae were processed separately from the microscopical algal fraction of each sample (Stancheva et al., in press). We adopted the concept of macroalgae as defined by Sheath and Cole (1992). Macroalgae were removed very gently with forceps from the original sample, squeezed to remove as much liquid as possible, and then placed into a graduated centrifuge tube with a known volume of distilled water. The total biovolume of macroalgae was determined by the increase of distilled water volume (mL) in the tube. Using a dissecting microscope, the number of macroalgal species and the proportion of each were determined. Identification of each macroalgal taxon encountered was carried out by microscopic examination, and the biovolume of each was calculated as the proportion of total biovolume that the fraction represented. For microalgal identification and enumeration, a 0.05 ml subsample of well homogenized suspension from original sample was pipetted onto a standard microscope slide and covered with a 22 x 30 mm coverslip. At microscope magnification 400x, a target number of 300 natural algal counting entities were identified and enumerated along a known number of optical transects across the microscope slide. Each optical transect held a known volume of counted sample. The natural algal counting entity was defined as each individual alga that is counted, whether it is a filament, coenocyte, tissue-like, colony, or single cell. The biovolume calculation of each microalgal taxon was according to Hillebrand et al. (1999). The biovolume of each encountered macroalgal and microalgal taxon was calculated as individual biovolume ($\mu m^3$) per $cm^2$ of area sampled after Lowe and Laliberte (1996), a method that accurately assesses algal biomass (Stevenson 1996). In our modified method for soft algae enumeration, we avoided homogenizing the entire original sample and using counting chambers (Lowe and Laliberte 1996, Stevenson and Bahls 1999). The separate processing of both algal fractions allowed identification of soft-algae to the lowest possible taxonomic level due to the high-quality preservation of macroalgal vegetative and reproductive structures and the even distribution of microalgae on a standard microscope slide. In addition to collecting the biovolume information, up to 100 epiphytes were enumerated, and taxa present in the “qualitative” sample were recorded, when the latter was available.

*Landscape analyses*

Watersheds were delineated for each site from 30-m digital elevation models (USGS 1999) using a geographic information system (GIS). Where necessary (i.e., if sites drained ambiguous watersheds with minimal topography), delineations were modified using CALWATER boundaries (California Department of Forestry and Fire Protection 2004), or were based on feedback from local experts. Then the watersheds were clipped at two additional spatial scales (5 km and 1 km) in order to evaluate conditions at levels more local to each site. Once watersheds were delineated, metrics were calculated from source layers relating to land cover (NOAA 2001), transportation (CDFG custom roads layer, P. Ode, unpublished data), hydrology (National Inventory of Dams and NHD Plus), and mining (Mineral Resource Data System, USGS 2005).

*Classifying study sites*

For index development, it is necessary to utilize data from a large number of “reference” sites (that are unaffected by anthropogenic activities, or only minimally so) in addition to sites along a disturbance gradient representing a variety of stressors. Reference sites serve to set expectations for what biotic communities should look like in the absence of human disturbance. For IBI development, we utilized the same definition of reference as that which was under consideration for the larger, California “Biological Objectives” initiative (http://www.swrcb.ca.gov/plans_policies/biological_objective.shtml). This definition is based largely on land use attributes at various spatial scales (i.e., at 1km and 5km radii from the site, as well as the entire watershed). In addition to landscape data, a limited number of local habitat data are included, as well as some water chemistry “backstops” used to identify potential anthropogenic influences at sites that have no obvious stressors based on the land use variables for which data are available. Table 1 summarizes the cut-points used for assigning “Reference” status to study sites. In addition to designating a subset of study sites as “Reference”, we also made a distinction among non-reference sites by classifying them as most “Disturbed” or “Intermediate”, based on several of the same variables used to designate reference status, but with more relaxed cut-points that were assigned in such a way that resulted in similar numbers of sites in the three categories.

**Table 1. Thresholds for site-disturbance-class designations of streams. All criteria had to be met in order for a site to be considered a member of a given class. Sites that met all criteria for "Intermediate" but not all criteria for "Reference" were deemed "Intermediate". Sites that met neither "Reference" nor "Intermediate" fell into "Disturbed".**

| Variable | Scale | Cut Points Reference | Cut Points Intermediate |
|---|---|---|---|
| Riparian disturbance (W1_Hall; Kaufmann 1999) | local | 1.5 | 3 |
| % Agriculture | 1k, 5k | 3 | 30 |
| | watershed | 10 | 30 |
| % Urban | 1k, 5k | 3 | 50 |
| | watershed | 10 | 30 |
| % Agriculture + Urban | 1k, 5k | 5 | - |
| % "Code 21[1]" land use | 1k, 5k | 7 | 50 |
| | watershed | 10 | - |
| Road density (km/km$^2$) | 1k, 5k | 2 | 10 |
| | watershed | 2 | - |
| Road crossings (crossings/km$^2$; paved only) | 1k | 5 | - |
| | 5k | 10 | - |
| | watershed | 50 | - |
| Dam distance (km) | - | 1 | - |
| % Canals, pipes | watershed | 10 | 50 |
| Instream gravel mines (mines/km) | 5k | 0.1 | - |
| Producer mines | 5k | 1 | - |
| Total N (mg/L) | - | 3 | - |
| Total P (mg/L) | - | 0.5 | - |

*Selecting samples for IBI development*

Some of the samples collected came from different locations on the same streams. Such sites were considered to be distinct for the purposes of IBI development if either of the following applied: 1) they were at least 1km apart, or 2) at least one tributary occurred between them (Cao et al. 2007). In the case where pairs of sites failed to meet either of these criteria, they were considered "geographic duplicates", and data from only one of them was used for IBI development.

A number of sites were sampled multiple times, either within visits or seasons, or across seasons or years. Only one sampling event per site was included in the pool of data for IBI development. Whatever event had more comprehensive data available was given preference. If all available sampling events had equal amounts of data, the event to use for IBI development was chosen at random. Data from replicate samplings were used to evaluate signal:noise and minimum detectable difference. Samples collected from the same site at different points in time were used to assess potential seasonality and inter-annual variation in IBI scores.

[1] "Code 21" encompasses a wide range of land uses primarily characterized by heavily managed vegetation (e.g., low-density residential development, parks, golf courses, highway medians)

*Data analysis*

Dataset preparation

The project dataset was split into two subsets: 70% of the sites were used for metric development and calibration and the remaining 30% were set aside for validation of candidate IBIs. Sites were stratified such that the two data sets had similar proportions of reference sites. In addition, an effort was made to maintain similar proportions of southern California sites in each. Within these constraints, sites were assigned at random to the calibration and validation subsets.

Metric development

A variety of metrics were tested for potential inclusion in the IBI. The themes within which metrics were developed, organized by broader categories (Fore and Grafe 2002), are listed in Table 2:

**Table 2. Categories and themes within which metrics were developed.**

| Metric Categories | Metric Themes |
|---|---|
| Tolerance/sensitivity | · association with specific water-quality constituents (nutrients, organic carbon, metals)<br>· tolerant to low dissolved oxygen<br>· tolerant to high-ionic-strength/saline waters |
| Autecological guild | · nitrogen fixers<br>· saprobic/heterotrophic taxa |
| Morphological guild | · sedimentation indicators<br>· scour/stagnation indicators |
| Relationship to reference | · taxa associated with reference vs. non-reference sites (Wang and Stevenson 2005) |
| Taxonomic groups | · Chlorophyta, Rhodophyta, Zygnemataceae, heterocystous cyanobacteria |
| Community form | · total biovolume (soft algae) |

Information of two general types were used in development of most of the metrics: 1) relative abundance of indicators of the stream chemical environment, with a focus on parameters of management interest (i.e., those chemical constituents primarily affected by anthropogenic activities), and 2) relative abundance of taxa with morphological/behavioral characteristics hypothesized to render them differentially adapted to stream physical environment conditions that can also be altered anthropogenically, such as sedimentation and flow regime. In addition, some metrics were based on the proportion of taxa/total biovolume belonging to taxonomic groupings that have been shown to be associated with stream condition parameters of management interest (Stancheva et al., in press).

Various sources were consulted to assign roles to taxa for raw metric calculations. For diatoms, these included of autecological information compiled by the USGS NAWQA program (Porter et al. 2008), which in turn derived from sources including Bahls (1993), van Dam (1994), and Potapova and Charles (2007). For soft-bodied algae, a smaller proportion of project taxa had autecological values available for any given indicator class; however sources consulted included

Palmer (1969), Sládeček (1973), VanLandingham (1982), and Rott et al. (1997, 1999). To the greatest extent possible, autecological attributes derived from the literature were used to develop candidate metrics. However, in the case of soft algae, this information was supplemented with stressor relationships derived from the project calibration dataset. Also, in some cases in which published information was unavailable (e.g., for assigning motility type or benthic vs. (tycho)planktonic habit for some of the taxa), best professional judgment was used.

Indicator species analysis

For the soft algae metrics, due to insufficient published autecological values across the taxa recorded in our study, we used indicator species analysis (Dufrêne and Legendre 1997) on our calibration data set to identify taxa significantly associated with selected water chemistry constituents to which other investigators have indicated algae are responsive (Palmer 1969, Cattaneo et al. 1997, Leland and Porter 2000, Guasch et al. 2002, Porter et al. 2008). Analyses were carried out on species absolute biovolume data using PC-ORD v6 software (McCune and Grace, 2002). In preparation for analyses, study sites were grouped according to their measured total phosphorus (TP), total nitrogen (TN), dissolved organic carbon (DOC), and dissolved copper, and based on their reference status. For the nutrients, we used the same concentration thresholds used by Potapova and Charles (2007) to assign study sites to "low" (under 0.2 mg/L for TN and 10μg/L for TP) vs. "high" (over 3mg/L for TN and 100μg/L for TP) categories. For other constituents (e.g., DOC and dissolved copper), we used the 25$^{th}$ quartile of project data set values as the threshold for "low" and the 75$^{th}$ quartile for "high". Monte Carlo simulation was used to generate significance levels for each taxon's group membership assignment. In calculating metrics, all taxa with significant indicator values associated with a "low" or "high" group were considered to be indicators for that constituent (or indicators for reference/non-reference sites).

Metric calculations

Both diatom-based and soft-algae-based metrics were developed within many of the themes (Table2). The number of metrics created and evaluated was intentionally limited, giving preference to metrics that had a basis in known biological/ecological traits that likely influence responses to stress, or that had established stress responses reported in the literature. In the case of diatoms, metrics were always expressed in terms of proportion of valves (e.g., proportion of total valves that belonged to the nitrogen-fixing genera *Epithemia* and *Rhopalodia*). In the case of soft algae, metrics were cast in various ways (e.g., proportion of total species or proportion of total biovolume). Biovolume-based metrics for soft algae were derived from the sum of the microalgal and macroalgal fractions within each sample. In order to boost the sometimes low soft-algae species numbers resulting from the biovolume data alone, species-presence metrics for soft algae were based on all species recorded in the sample, including the epiphytes and those encountered in the qualitative sample. In all cases in which metrics were calculated based on proportion of valves, species, or biovolumes associated within a certain indicator type, in any given sample only the taxa for which indicator assignments were available were included in the calculation.

Metric screening and scaling

All raw metrics were subjected to a preliminary screen consisting of evaluation of data distributions and visualization of scatterplots depicting metric values along a generalized stressor gradient (Hering et al. 2006). The gradient used was a draft multimetric index composed of a set of landscape parameters similar to those listed in Table 1 (D. Gillette unpublished). If a given metric failed to exhibit the expected trend of response to stress, and/or had a large proportion of zeros (Stoddard et al. 2008), that metric was excluded from further analysis. In addition, metrics that could not be calculated for some of the study sites (e.g., because none of the taxa recorded at those sites had indicator values) were eliminated from the pool for further consideration. Also eliminated were species-presence based soft-algal metrics showing sensitivity to whether a qualitative sample had been available for analysis. This was evaluated via t-tests of raw metric scores using as the grouping variable whether or not a qualitative sample had been collected.

The metrics that were not eliminated in the initial phase were scaled into standardized, unitless forms according to the following scheme, and using the raw metric data distributions from the sites in the calibration data set. For metrics expected to decrease with stress, sites scoring above the $80^{th}$ percentile of reference sites were assigned a score of 10, and sites scoring below the $10^{th}$ percentile of non-reference sites were assigned a score of 0. The intervening range of scores was divided into equal parts for scores 1 through 9. An analogous approach was taken for metrics that increase with stress, such that those scoring below the $20^{th}$ percentile of reference were assigned a score of 10, and those scoring above the $90^{th}$ percentile of non-reference sites were assigned a score of 0 (Ode et al. 2005).

The second phase of screening involved inferential analysis to assess relationships between scaled metrics and a composite stressor gradient constructed from conventional water chemistry parameters. Several constituents (chloride, DOC, conductivity, and sulfate) for which data were available for most samples in the project dataset, and which tend to increase as a result of anthropogenic influence, were used in a principal components analysis to generate an axis representing a generalized water chemistry gradient. The relationship between each of the metric scores and the principle component scores was determined by Spearman rank correlation. Signal:noise ratio was determined for each metric by comparing variance of each metric among streams (“signal”) with variance between replicate samples collected at the same site (“noise”) (Kaufmann et al. 1999) using restricted maximum likelihood (REML), to accommodate the unequal number of replicates across the dataset. Data distributions of the scaled metrics were visualized with histograms. Any metrics that exhibited a poor distribution (e.g., strongly bimodal, at the extremes of the range of scores) were eliminated. JMP v8 software was used for the principal components, correlation, and variance components analyses.

Based on these screens, a “long list” of successful metrics was generated by giving preference to those exhibiting the strongest relationships with stress (Fore and Grafe 2002), highest signal:noise ratios (Stoddard et al. 2008), and acceptable distributions. The best-performing metrics within each theme, up to a total of two within each of the diatom and soft-algae assemblages, were retained for use in the next phase.

IBI development

Candidate IBIs were selectively created by summing different sets of long-list diatom and/or soft-algal metrics that overlapped as little as possible in terms of metric themes, as opposed to exploring all possible permutations of metric combinations. Correction factors (multipliers) were used to scale the resulting IBIs to a maximum possible score of 100, as needed. The IBIs were divided into categories based on whether they were composed of metrics from a single assemblage (diatoms or soft) or both (i.e., "hybrid" IBIs). Among the hybrid IBIs, the distinction was also made between those that required carrying out the full soft-algae laboratory protocol, and those requiring a less involved subset of the effort described in that protocol. The "reduced-effort" soft algae metrics included those requiring only species-presence information, as well as those based on biovolumes, but not requiring identification all the way down to species level. The set of candidate IBIs was then subjected to a final set of screens based on the degree to which they related to stress, how repeatable their scores were across multiple samples collected on the same day, how little statistical redundancy there was among component metrics, and how indifferent the IBI scores were to natural gradients.

Using the validation data set, candidate IBIs were evaluated for relationships to stressors via two approaches. One involved looking at how well IBI scores separated sites belonging to the Disturbed, Intermediate, and Reference disturbance classes (Table 1) using ANOVA with Tukey's tests for multiple comparisons, along with visualization of box plots to evaluate overlap between interquartile ranges (Barbour et al. 1996, Klemm et al. 2002). The second was to look at the Spearman rank correlations between IBI scores and generalized stress in the form of the same water chemistry principal component axis used in the second phase of metric screening. This latter analysis was conducted both on the validation sites across the disturbance gradient, and on the validation and calibration sites combined within the Intermediate site disturbance class, in order to assess how well the IBIs could resolve sites subjected to intermediate levels of disturbance.

Signal:noise ratio was determined for each IBI similarly to the method described for metric screening. However, in addition to evaluating signal:noise among true replicate samples, we also looked at signal:noise across the multiple samples collected on the same day at the subset of study sites where both the multihabitat and targeted-substrata samplings were carried out. For the latter type, due to the balanced design of N=4 samples at each site, variance components were derived from ANOVA models.

One concern in developing multimetric indices is the potential effect of incorporating "redundant" metrics, which could unintentionally result in weighting some aspect of community condition more heavily than others (Hering et al. 2006). A favored approach to reducing redundancy between metrics has been to eliminate some of them during the metric-screening phase based upon their pairwise correlations. A correlation coefficient threshold of ≥0.7 has been used for this purpose (Fore and Grafe 2002, Ode et al. 2005, Flotemersch et al. 2006). However, metrics may be highly correlated simply because they are responsive to similar or confounded stressor gradients, and not as a result of inherent redundancy between them in terms of the aspects of the biotic assemblage they reflect (Cao et al. 2007). In addition, Van Sickle (2010) showed that, in terms of ultimate IBI performance, focusing on reducing *mean* correlation among metrics, and then using this criterion to help select *among candidate IBIs* was superior to eliminating metrics based on their pairwise exceedence of a predetermined threshold. Therefore, using the full set of study sites available, Spearman's rho was determined for all the pairwise combinations. The mean pairwise correlation coefficient among all component metrics was then calculated for each of the candidate IBIs.

Another essential feature of an IBI is relative indifference to sources of natural variation, such that variation in IBI scores among sites is most likely the result of anthropogenic rather than non-anthropogenic factors (Foerster et al. 2004). In order to evaluate all of the candidate IBIs with respect to this parameter, we used Spearman rank correlation to assess relationships between the candidate IBIs and a large suite of natural (or primarily natural) gradients to which algae might be responsive. These included: percent fines, percent fines + sand, alkalinity, slope (both reach- and landscape-level), canopy cover, stream order, watershed area, elevation, latitude, longitude, average precipitation, and average temperature. This analysis was conducted on the Reference group of sites only, in order to reduce the likelihood that any responsiveness realized might have an anthropogenic component, since some gradients can result from anthropogenic and natural factors combined (e.g., alkalinity; Cao et al., 2007).

In the event that no single candidate IBI scored the best across all screens, more importance was assigned to some screens over others in order to facilitate decision-making about which IBI to adopt. Relationship with stress was accorded priority (Fore 2003), with signal:noise deemed the second most important consideration. If values for these priority screens exhibited very little difference among multiple IBIs, then the remaining screen types (redundancy and relationship with natural gradients) were also taken into consideration to help finalize the decision. Finally, to facilitate comparison of top-performing candidate IBIs, linear regression was used to visualize relationships between IBI scores and the generalized water chemistry gradient using the principal components axis described previously.

<u>Establishing IBI scoring categories</u>

The number of scoring categories that an IBI can reliably distinguish was determined according to the method of Fore et al. (2001) based on Zar (1999) for calculating minimum detectable difference (MDD) with a two-sample t-test model. This involved using the error variance associated with replicate samples (mean squared error from ANOVA) to determine how different the IBI scores of two truly "different" sites must be in order to be statistically distinct given realized subsampling variance (i.e., within-site IBI score heterogeneity). An alpha value of 0.05 and a beta value of 0.9 were used for this determination. The range of possible scores for the IBI was divided by the MDD to arrive at the number of distinct scoring categories detectable with the IBI.

**Results**

Of all the study sites for which landscape data were available, 27% were classified as "Reference", 38% as "Intermediate", and 35% as "Disturbed" (Table 3). Reference sites were distributed throughout the state but were more common outside of southern California (Figs. 1a & b).

**Table 3. Number of sites in each of the disturbance classes, by region. Only sites with available landscape data are enumerated. See Table 1 for definitions of site disturbance classes and Figs. 1a & b for maps of site locations.**

| Site Disturbance Class | Southern California | Outside of Southern California |
|---|---|---|
| Reference | 50 | 66 |
| Intermediate | 88 | 72 |
| Disturbed | 102 | 44 |

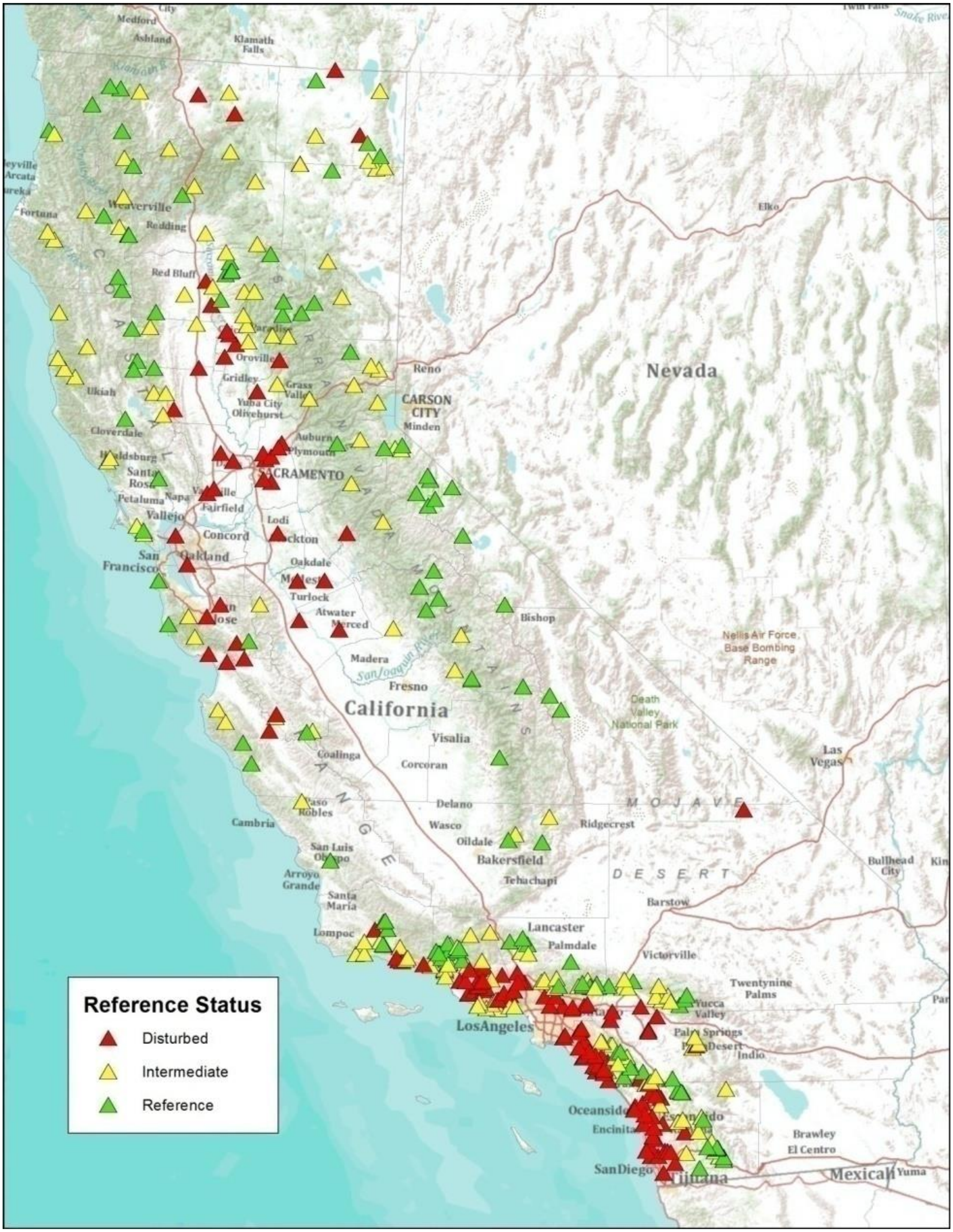


**Figure 1a. Statewide sites used for algae IBI development.**

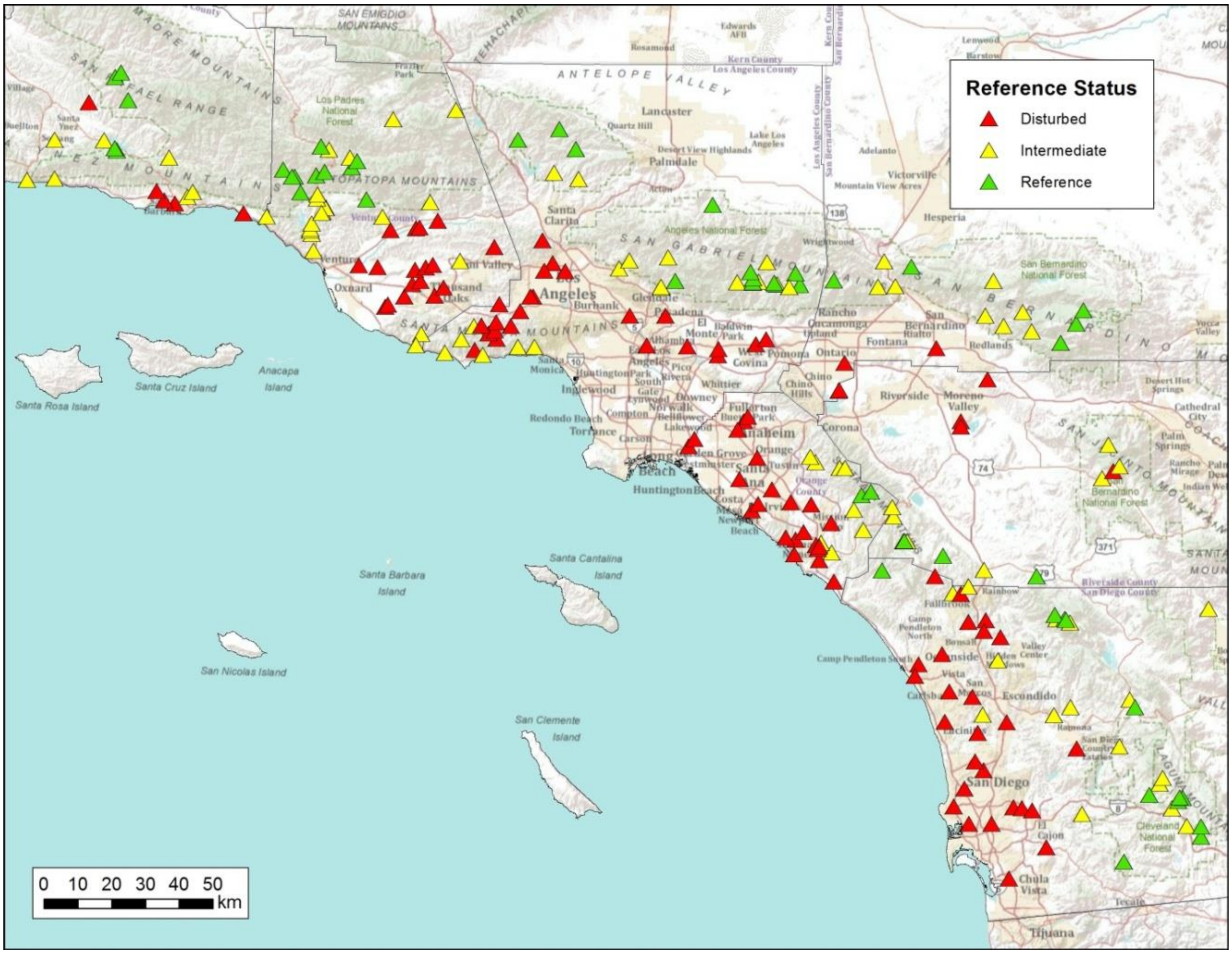


**Figure 1b. Detail: Southern California sites used for algae IBI development.**

<u>Metric development and screening</u>

Of 400 soft algal species in the calibration data set, indicator species analyses yielded a total of 38 significant low/high indicators for TP, 39 for DOC, 25 for dissolved copper, 17 for TN, and 19 for species associated with reference/non-reference site status (Appendix A). A list of the soft algal taxa with their indicator assignments based on these analyses is provided in Appendix B, which also includes literature- and best-professional-judgment-derived values used in the various metric calculations. Information for the diatoms is presented in Appendix C.

The list of 105 metrics developed and tested is presented in Appendix D. In total, 64% were excluded based on the initial screening of raw metrics, and another 16% during the second-phase screening of scaled metrics. Most eliminations in the first phase were due to poor distribution of metric scores and/or lack of obvious relationship to a generalized stressor gradient. Only a few were eliminated because their scores could not be calculated for all samples (N=3), or because of metric sensitivity to whether or not a qualitative sample had been collected (N=13). Poor distribution of scores was more common among the soft-algae metrics than the diatoms, and occurred both in species-number and biovolume-based metrics. Among the soft algae metrics assessed, those expected to relate to stream physical properties such as flow and sedimentation did not perform as well as the metrics relating to aspects of water chemistry. Among the diatoms, successful metrics were identified for physical environment as well as water chemistry parameters. Appendix D includes the responsiveness and signal:noise results for the long-list metrics.

The metrics that performed best in southern California were not all top performers among the sites beyond that region. Therefore, for present purposes we focused creation and testing of candidate IBIs on the southern California subset of data in the interest of best serving the needs of that region. Unless otherwise noted, all reported performance characteristics past the initial metric screeing phase focus only on the southern California subset of sites. However, once top performing IBIs (from the standpoint of southern California) were identified, we also looked at basic aspects of performance across the remainder of the statewide data set in order to inform future efforts to develop IBIs for application in other parts of the state.

IBI development and screening

A total of 25 candidate IBIs were developed, each composed of some combination of between 5 and 10 of the 21 long-list metrics (Table 4).

**Table 4. Metric composition of candidate IBIs for use in southern California. IBI names beginning with "H" are hybrids, "D" are diatom-only, and "S" are soft-algae-only. Metric names followed by "d" are derived from the diatom assemblage, and those followed by "s" are from the soft algae. Of the soft algae, those followed by: "b" are based on biovolume, "sp" are based on species presence, and "m" are the average of the "b" and "sp" counterpart metric values. "CRUS" stands for *Cladophora glomerata* + *Rhizoclonium hieroglyphicum* +*Ulva flexuosa* + *Stigeoclonium* spp. "ZHR" stands for Zygnemataceae + heterocystous cyanobacteria + Rhodophyta.**

| IBI | proportion highly motile (d) | proportion sediment tolerant (highly motile) (d) | proportion low N indicators (d) | proportion low P indicators (d) | proportion N heterotrophs (d) | proportion requiring >50% DO saturation (d) | proportion requiring nearly 100% DO saturation (d) | proportion halobiontic (d) | proportion oligo- & beta-mesosaprobic (d) | proportion poly- & eutrophic (d) | proportion *A. minutissimum* (d) | proportion Chlorophyta (s, b) | proportion of green algae belonging to CRUS (s, b) | Proportion ZHR (s, m) | Proportion ZHR (s, b) | proportion high DOC indicators (s, b) | proportion "non-reference" indicators (s, b) | proportion high Cu indicators (s, sp) | proportion high DOC indicators (s, sp) | proportion low TP indicators (s, sp) | proportion "non-reference" indicators (s, sp) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| H10 | | X | | X | X | | X | X | | | | | X | X | | | | X | | | |
| H13 | | X | | X | X | X | | X | | | | | X | | X | | X | | | | |
| H14 | | X | | X | X | X | | X | | | | | | | X | X | | | | | |
| H15 | | X | | X | X | X | | X | | | | | | X | | | | | X | | |
| H16 | X | | | X | X | X | | X | | | | | | | X | | | | X | | |
| H17 | | X | | X | X | X | | X | | | | | | X | | | | | | | X |
| H18 | | X | | X | X | X | | X | | | | | | | X | | X | | | | |
| H19 | | X | X | | X | X | | X | | | | | | | | X | | X | | X | |
| H2 | X | | | | X | X | | X | | | | | | X | | | | X | X | X | X |
| H20 | | X | X | | X | X | | X | | | | | | | | | | X | X | X | |
| H21 | | X | | X | X | X | | X | | | | X | | | X | | | | | | |
| H22 | | X | | X | X | X | | X | | | | | X | | X | | | | | | |
| H23 | | X | | X | X | X | | X | | | | | X | X | | | | | X | | |
| H3 | X | | X | X | X | X | | X | | | | | X | X | | | | | | | |
| H6 | | X | X | X | X | | | X | | | | | | X | | | | | X | | |
| H7 | | X | X | X | X | | | X | | | | | X | X | | | | X | X | | |
| H9 | | X | X | X | X | | X | X | | | | | X | X | | | | X | X | | |
| D13 | | X | X | X | X | | | X | | | | | | | | | | | | | |
| D14 | X | | X | X | X | | | X | | | | | | | | | | | | | |
| D16 | | X | X | X | X | X | | X | X | | X | | | | | | | | | | |
| D17 | X | | | | X | | X | X | X | X | X | | | | | | | | | | |
| D18 | | X | | X | X | X | | X | | | | | | | | | | | | | |
| S1 | | | | | | | | | | | | | X | X | | X | | X | | X | X |
| S11 | | | | | | | | | | | | | X | | X | | X | X | | X | |
| S2 | | | | | | | | | | | | | X | X | | | | X | X | X | X |

In general, the hybrid IBIs outperformed the single-assemblage IBIs in terms of responsiveness to stress assessed in various ways (Table 5). Hybrids were best able to discriminate between site disturbance classes based on IBI score distributions. Interquartile ranges for scores of top-performing hybrids exhibited less overlap between site disturbance classes than their single-assemblage counterparts (Fig. 2), among which the top-performing diatom IBI exhibited less separation between the Disturbed and Intermediate classes, and the soft algae IBI showed the opposite trend of less separation between Intermediate and Reference.

**Table 5. Candidate IBI performance results by effort category. Only data from sites in southern California are included in the analyses. IBIs in boldface type are treated in more detail in the following section.**

| Effort category | IBI | Correlation[1] with PC1 (validation) | Correlation[2] with PC1 (within Intermediate class) | $R^2$, ANOVA with Site Disturbance Class (validation) | Are all pairwise[3] differences significant? | Signal:noise (multihabitat replicates) | Signal:noise (targeted substrata) | Metrics mean pairwise correlation | No. natural gradients with significant correlation |
|---|---|---|---|---|---|---|---|---|---|
| single assemblage | **D18** | -0.71 | -0.47 | 0.32 | yes | 18.6 | 10.5 | 0.60 | 6 |
| | D13 | -0.68 | -0.44 | 0.34 | yes | 16.5 | 14.4 | 0.60 | 3 |
| | D14 | -0.68 | -0.42 | 0.33 | yes | 15.1 | 13.3 | 0.58 | 3 |
| | D16 | -0.66 | -0.42 | 0.36 | yes | 18.6 | 17.9 | 0.60 | 5 |
| | D17 | -0.65 | -0.38 | 0.31 | yes | 16.2 | 11.2 | 0.56 | 3 |
| | S2 | -0.57 | -0.29 | 0.52 | not R vs I | 18.2 | 3.2 | 0.61 | 3 |
| | S1 | -0.50 | -0.27 | 0.52 | not R vs I | 31.3 | 3.2 | 0.61 | 3 |
| | S11 | -0.43 | -0.22 | 0.48 | not R vs I | 24.0 | 4.3 | 0.55 | 4 |
| full effort | **H23** | -0.69 | -0.51 | 0.51 | yes | 34.7 | 7.3 | 0.43 | 1 |
| | H19 | -0.71 | -0.48 | 0.55 | not R vs I | 29.3 | 15.7 | 0.45 | 1 |
| | H2 | -0.67 | -0.45 | 0.54 | not R vs I | 21.2 | 6.3 | 0.47 | 0 |
| | H7 | -0.70 | -0.47 | 0.54 | yes | 24.6 | 11.5 | 0.44 | 2 |
| | H9 | -0.68 | -0.46 | 0.51 | yes | 21.7 | 11.7 | 0.42 | 2 |
| | H13 | -0.67 | -0.44 | 0.50 | not R vs I | 51.6 | 7.5 | 0.41 | 0 |
| | H10 | -0.68 | -0.45 | 0.48 | yes | 16.5 | 9.9 | 0.39 | 2 |
| | H18 | -0.65 | -0.44 | 0.47 | not R vs I | 40.7 | 10.0 | 0.44 | 0 |
| | H6 | -0.68 | -0.51 | 0.47 | yes | 26.8 | 11.8 | 0.50 | 4 |
| | H14 | -0.66 | -0.49 | 0.46 | not R vs I | 33.5 | 8.6 | 0.46 | 1 |
| | H15 | -0.71 | -0.53 | 0.46 | yes | 29.3 | 8.6 | 0.48 | 3 |
| | H17 | -0.70 | -0.50 | 0.45 | yes | 28.4 | 8.8 | 0.48 | 1 |
| | H3 | -0.66 | -0.47 | 0.45 | yes | 24.6 | 10.5 | 0.46 | 1 |
| | H16 | -0.69 | -0.52 | 0.44 | yes | 22.3 | 7.9 | 0.46 | 1 |
| | H22 | -0.67 | -0.46 | 0.44 | yes | 24.0 | 8.4 | 0.43 | 0 |
| reduced effort (no species-level for soft) | **H21** | -0.63 | -0.44 | 0.41 | yes | 24.6 | 12.9 | 0.42 | 1 |
| reduced effort (no biovolume) | **H20** | -0.72 | -0.51 | 0.51 | yes | 20.7 | 12.0 | 0.50 | 1 |

[1] all values significant ($\alpha = 0.05$)

[2] all values significant ($\alpha = 0.05$) except for S11 (p=0.08)

[3] "not R vs I" indicates that the Reference and Intermediate site disturbance class IBI scores were not significantly different

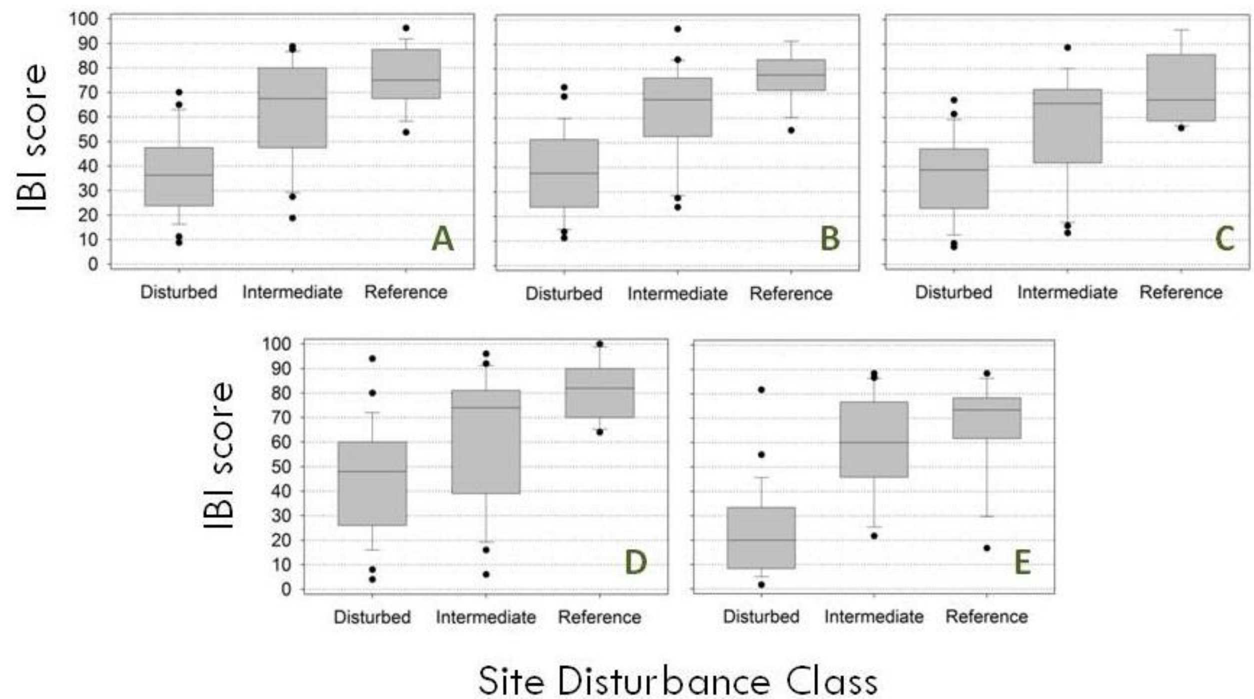


**Figure 2. Discriminatory power of IBIs from different effort classes. Scores are taken from the validation data set for the southern California study sites. A-C: hybrid IBIs (H23, H20, and H21, respectively), D: diatoms only (D18), E: soft algae only (S2).**

Signal:noise was consistently higher in the case of replicate samples collected using the multihabitat field protocol than that resulting from sampling different targeted substrata (Table 5). On average, hybrids outperformed single-assemblage IBIs (particularly the diatoms) for the replicate multihabitat sampling, and soft-algae-only IBIs exhibited the lowest signal:noise among the targeted-substrata samples.

Mean pairwise correlation coefficients among metrics for the candidate IBIs ranged from 0.39 to 0.61, and maximum pairwise metric correlations per IBI ranged from 0.73 (for S1) to 0.91 (for D13, D14, D16, H3, H6, H7, and H9). Perhaps not surprisingly, mean pairwise correlations were invariably lower among hybrids than the IBIs composed of a single assemblage (Table 5).

Candidate IBIs varied considerably in terms of their relationships to natural gradients, with some (H22, H18, H2, H13) not significantly correlated with any of the 13 factors tested, and others (D11, D18, S11, H6) correlated with four or more (Table 5). Of those tested, the natural gradient most commonly significantly correlated with IBI scores was watershed area (which was positively associated with a total of 17 hybrid and diatom IBIs) followed by stream order and percent fines (which were correlated with 7 IBIs each, positively for stream order and negatively for fines). Overall, the hybrid IBIs were least frequently associated with the natural gradients tested, whereas diatom-only IBIs exhibited significant relationships with the highest number of natural gradients (Table 5). Diatom-only and soft-algae-only IBIs exhibited very little similarity in terms of their associations with natural gradients. Diatom IBIs were particularly responsive to stream order, watershed area, and percent fines, and soft-algae IBIs were most responsive to canopy cover and slope (both negatively).

Based on the information in Table 5, the top performing IBI from each of the effort categories were selected for further evaluation. These included three hybrids representing different levels and types of laboratory effort (H23: requiring the full soft-algae laboratory protocol, H20: requiring no biovolume data, but species-level identification of soft-algal taxa, and H21: requiring soft-algal biovolumes, but genus-level or above identifications of soft-algal taxa), and one single-assemblage IBI (D18). Performance characteristics of the four candidate IBIs are highlighted in Figs 3-6.

With respect to stress response, within the validation data set across the range of site disturbance classes, slopes of the regressions of IBI scores on the generalized water chemistry gradient were similar among the four candidate IBIs, ranging from -13.6 (for H23) to -11.7 (for H21). $R^2$ values for the regressions, in descending order, were 0.504 for H20 , 0.485 for H23, 0.437 for D18, and 0.394 for H21 (Fig 3). Within the Intermediate class (for validation and calibration data combined), slopes ranged from -7.24 (for D18) to -6.1 (for H21) and $R^2$ values were 0.282 for H20 , 0.273 for H23, 0.236 for D18, and 0.208 for H21 (Fig 4). From the standpoint of proportion of variance explained, the top performer in each of the two analyses was the hybrid, H20.

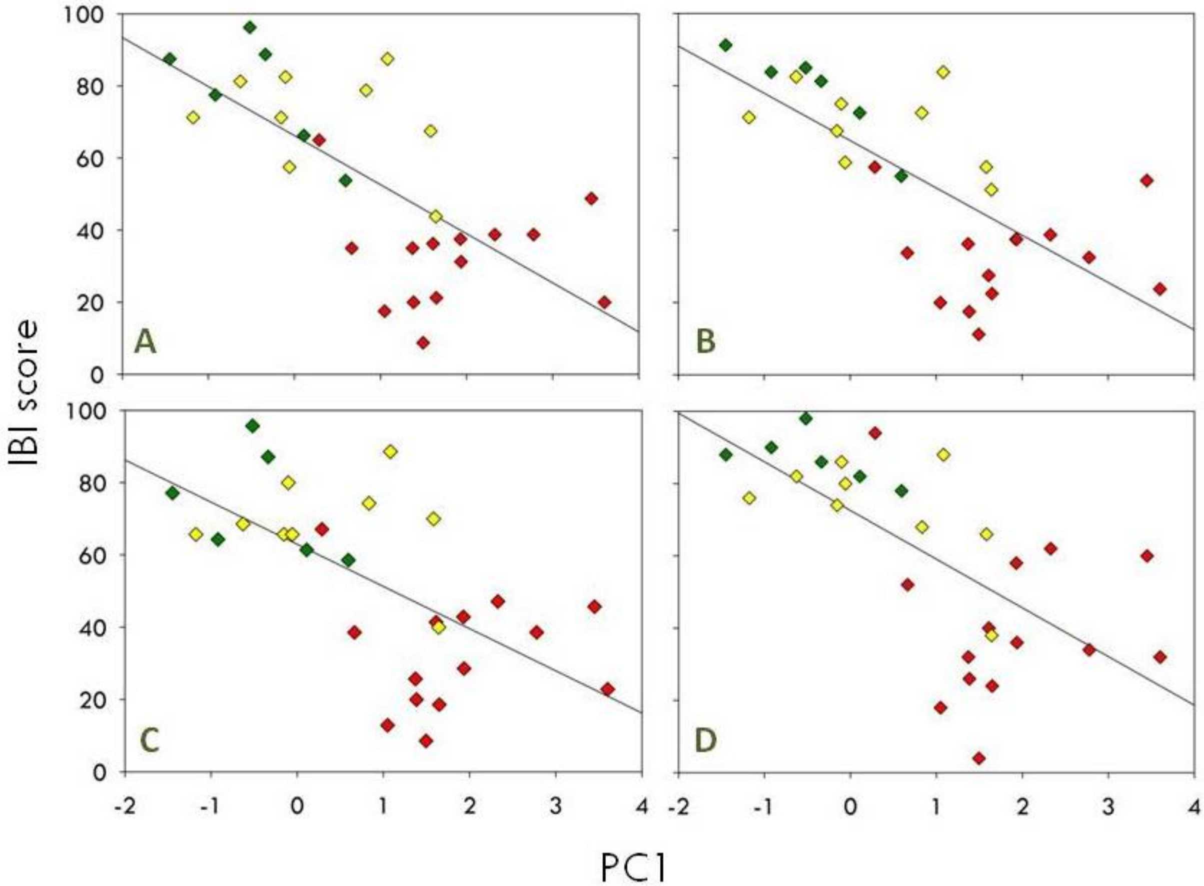


**Figure 3. Linear regression of IBI scores on water chemistry principal component scores. P<0.0003 for all relationships. Scores are taken from the validation data set for the southern California study sites. A-C: hybrid IBIs (H23, H20, and H21, respectively), D: diatoms only (D18). Green symbols = Reference sites, yellow = Intermediate, red = Disturbed.**

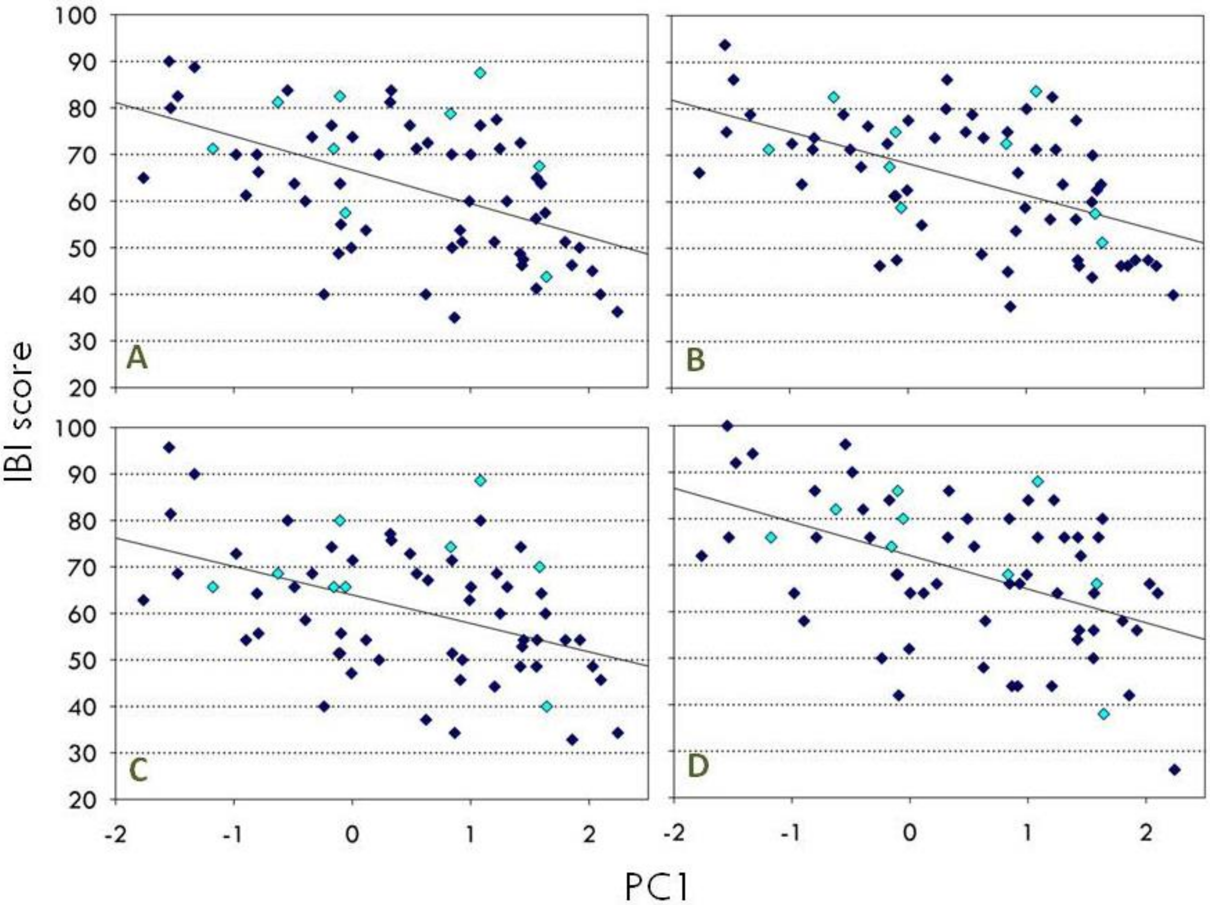


**Figure 4. Linear regression of IBI scores on water chemistry principal component scores. P<0.0002 for all relationships. Scores are taken from the Intermediate site disturbance class within southern California. A-C: hybrid IBIs (H23, H20, and H21, respectively), D: diatoms only (D18). Light blue symbols are from the validation data set and dark blue are from the calibration data set.**

With respect to repeatability of IBI scores, in addition to comparing signal:noise ratios (Table 5), we looked at the means of within-site ranges of scores ("mean spread") for each of the IBIs. Among field replicates, this varied from 5 points (on a scale of 100) corresponding to H23, to 6 points for both H20 and H21, and 8 points for D18 (Fig 5).

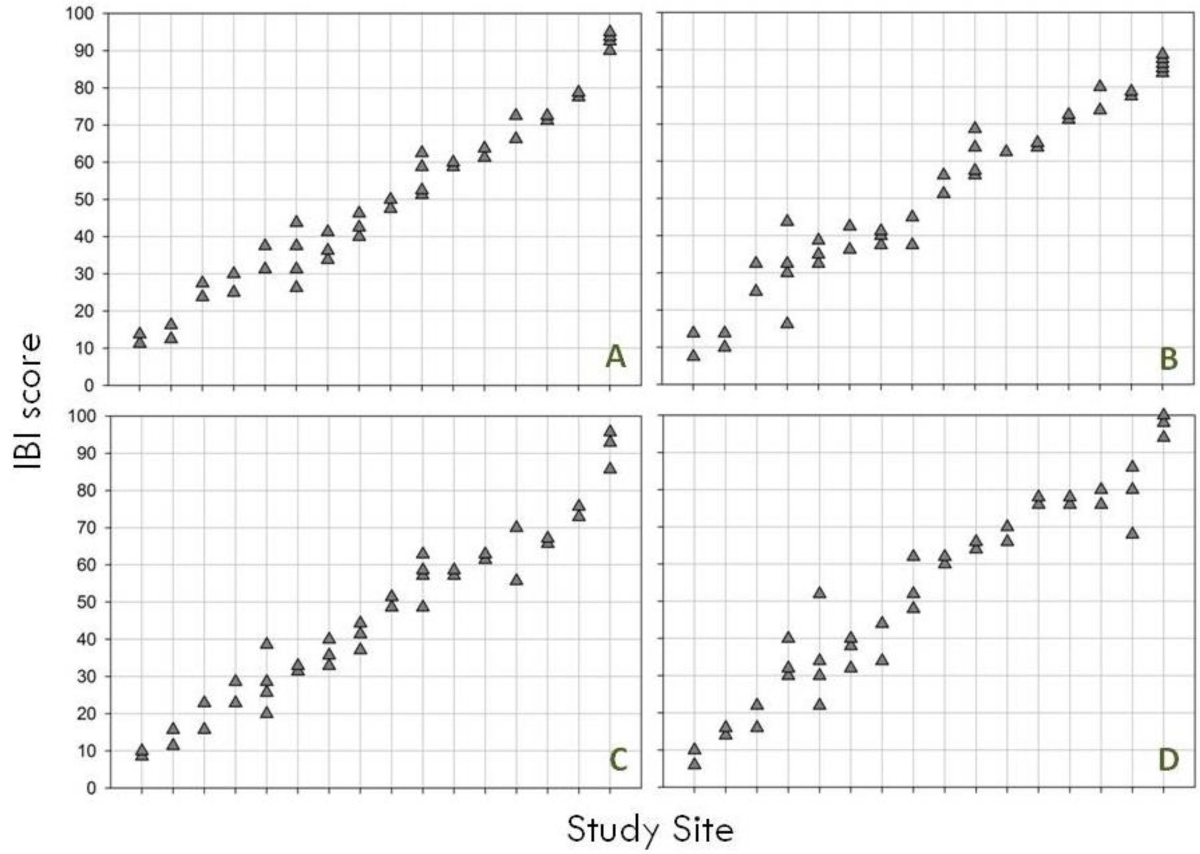


**Figure 5. Repeatability of IBI scores among replicate samples collected during a single site visit using the multihabitat field protocol. Only southern California study sites (N=16) are shown. A-C: hybrid IBIs (H23, H20, and H21, respectively), D: diatoms only (D18).**

With respect to "repeatability" of IBI scores across different substrate types, the broadest mean spread in scores corresponded to H23 (16 points), and the other three IBIs exhibited a mean spread of 13 points each (Fig 6). No substratum bias in IBI scores was evident for any of the IBIs, as no single substratum type was associated with the highest or lowest IBI score across sites.

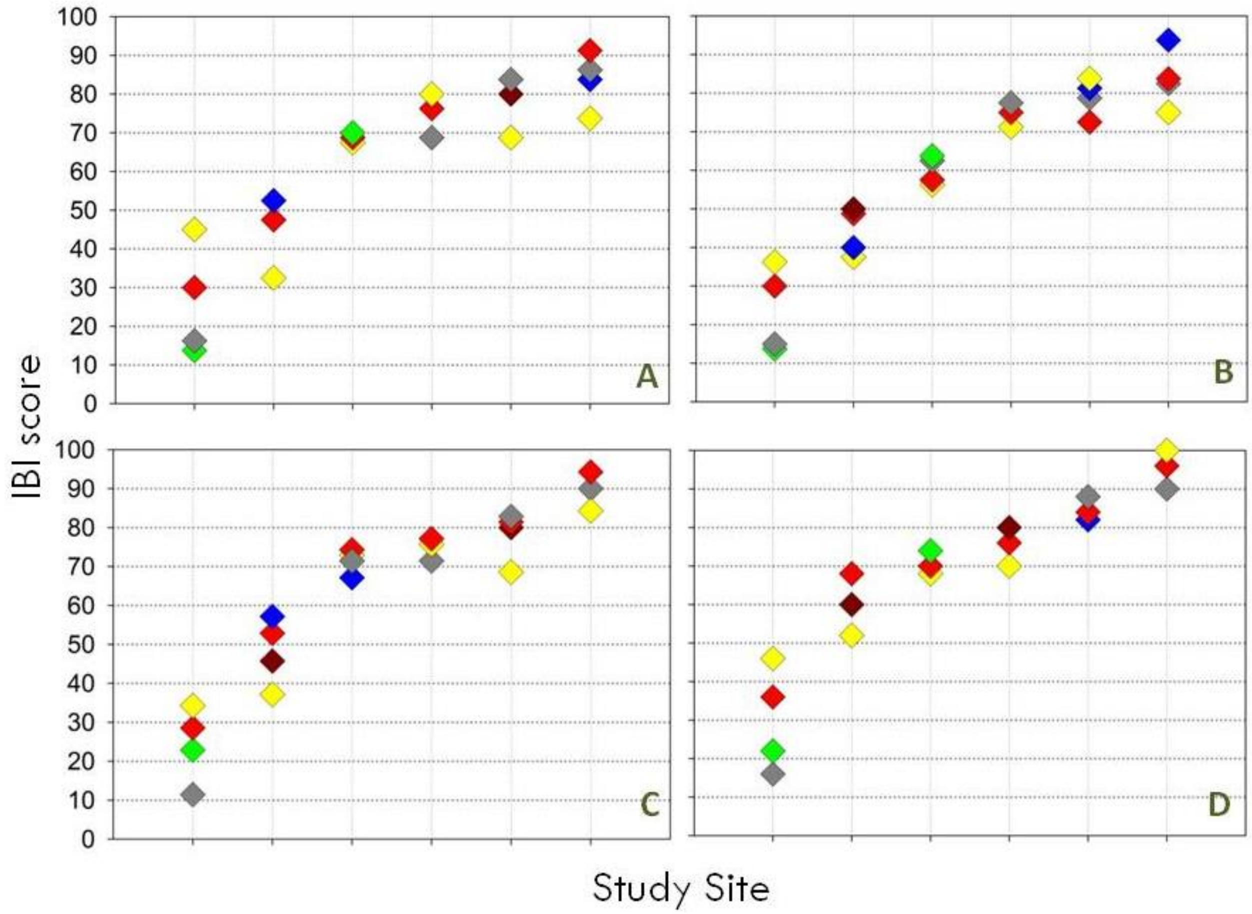


**Figure 6. "Repeatability" of IBI scores among samples collected from different substrata (N=4 samples/site) during a single site visit. Only southern California study sites (N=6) are shown. A-C: hybrid IBIs (H23, H20, and H21, respectively), D: diatoms only (D18). Substratum codes: red=multihabitat, grey=cobble, blue=gravel, yellow=sand, green=plant leaves/stems, brown=wood.**

In order to evaluate how stable the scores for one of our candidate IBIs might be expected to be across seasons/years, we selected the hybrid, H20, as a model to demonstrate temporal patterns in IBI scores (Fig 7). No seasonal nor annual bias in IBI scores was evident, as no single season nor year was associated with the highest or lowest IBI score across the study sites with multiple seasons/years represented.

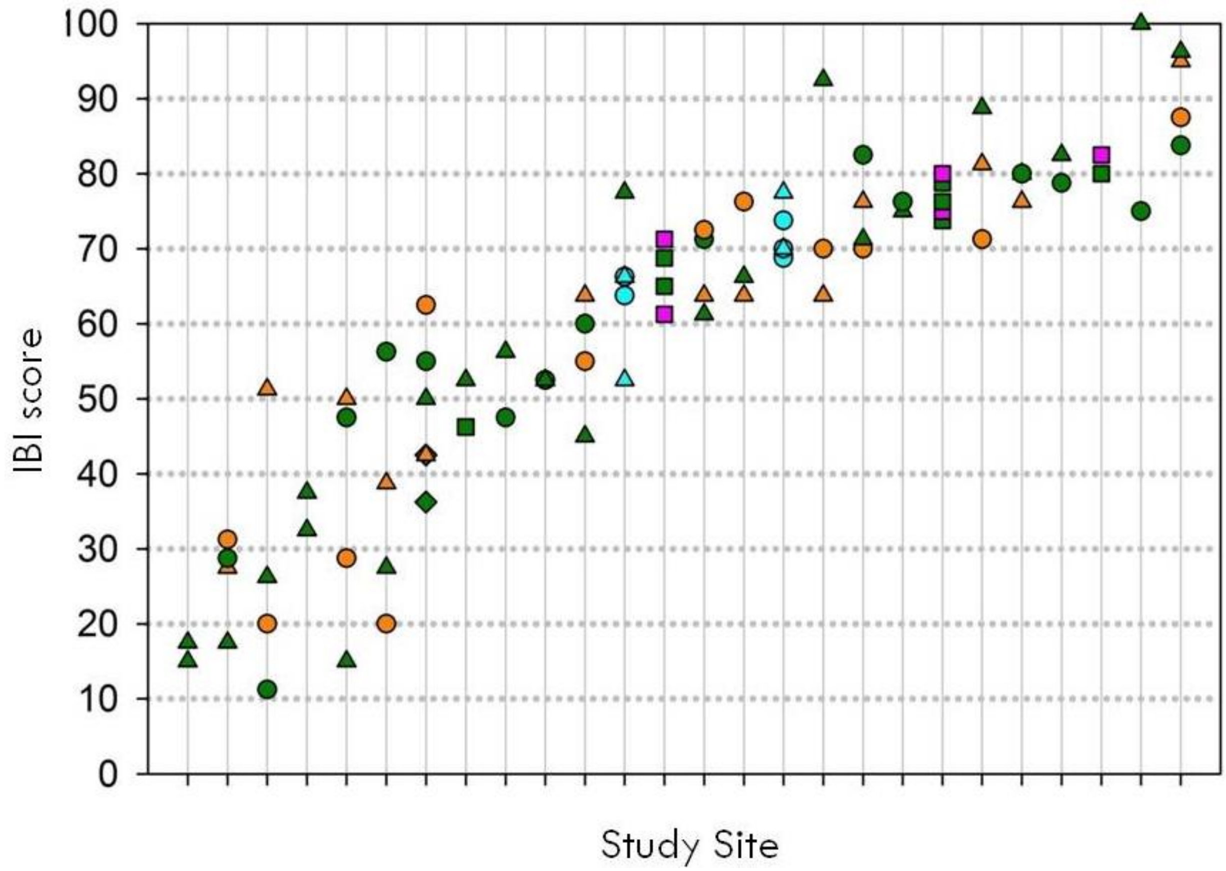


**Figure 7. Intra- and inter-annual variability in IBI (H20) scores at southern California study sites (N=26). Sample collection period: green= an extended "summer" index period, orange=fall, blue=winter, pink=spring; circle=2007, triangle=2008, square=2009, diamond=2010.**

In order to begin looking at the potential utility of the top-performing IBI for southern California in other parts of the state, we evaluated ability of H20 to discriminate among sites falling into the three disturbance classes using the data from Central and Northern California. A one-way ANOVA with site disturbance class as the main effect was highly signficant ($p<0.0001$) with an $R^2$ of 0.40. However, Tukey's test indicated that intermediate and reference site IBI scores were not statistically different when this IBI was applied to the data from sites outside of southern California (Fig. 8).

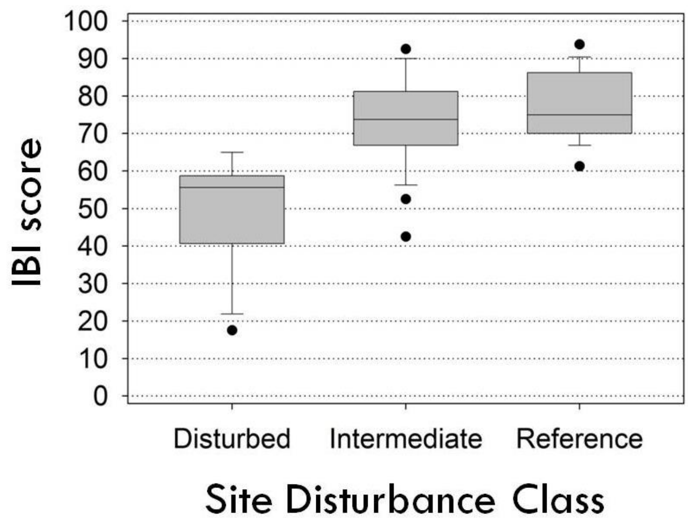


**Figure 8. Performance of IBI H20 in Central and Northern California sites (combined), using validation data only. Data shown include all study sites outside of southern California (see map in Fig. 1a for geographic distribution of sites, and Table 3 for a breakdown of numbers of sites by disturbance class).**

Performance Characteristics and Scoring Class Bins for IBI H20

We assessed the ability of IBI H20 to distinguish among sites of varying condition within southern California by calculating its associated minimum detectable difference (MDD). MDD was determined using two types of data. For a realistic estimate, we used same-day replicate sample data (N=3 per site) collected at 5 sites using the state-adopted multihabitat protocol to determine variance associated with sampling heterogeneity. For a more conservative estimate of MDD, we also calculated MDD using variance associated with same-day subsamples collected from divergent substratum types (N=4 per site) at 6 sites. The former approach yielded an MDD of 13.5 and the latter yielded 20.4. We divided the range of possible IBI scores (100) by each MDD estimate to arrive at the number of IBI scoring categories distinguishable under each scenario. This resulted in 7.6 categories for the former method and 4.9 for the latter. As a conservative compromise between the two, we considered H20 to be capable of distinguishing 5 categories in southern California wadeable streams.

We also used information on the distribution of H20 scores among reference sites in order to establish a statistical boundary below which IBI scores could be considered to be distinct from that associated with reference conditions. This boundary was designated as two standard deviations below the mean reference site score (Ode et al., 2005), which corresponded to an H20 IBI score of 57. The MDD analyses suggested that a conservative bin width for IBI scoring categories would be approximately 20 points, for a total of 5 bins across the breadth of possible IBI scores. Superimposing this information on the statistically defined reference boundary argued for placing two bins above 57 and 3 bins below. An IBI scoring-category scheme conforming to this, and with roughly equal bin widths, is as follows: 0-18 (“Category 1”), 19-38 (“Category 2”), 39-57 (“Category 3”), 58-79 (“Category 4”), and 80-100 (“Category 5”).

Metric scoring guidelines

Scoring guidelines for the 21 long-list metrics are provided in Tables 6 (diatoms) and 7 (soft-bodied algae).

**Table 6. Scoring ranges for diatom metrics comprising candidate IBIs.**

| Metric score | proportion halobiontic (d) | proportion N heterotrophs (d) | proportion sediment tolerant (highly motile) (d) | proportion requiring >50% DO saturation (d) | proportion low TN indicators (d) | proportion low TP indicators (d) | proportion poly- & eutrophic (d) | proportion oligo- & beta-mesosaprobic (d) | proportion highly motile (d) | proportion A. minutissimum (d) | proportion requiring nearly 100% DO saturation (d) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.533 + | 0.512 + | 0.488 + | 0 to 0.632 | 0 to 0.009 | 0 to 0.009 | 0.954 + | 0 to 0.221 | 0.417 + | 0 | 0 to 0.023 |
| 1 | 0.475 to 0.532 | 0.445 to 0.511 | 0.436 to 0.487 | 0.633 to 0.673 | 0.010 to 0.093 | 0.010 to 0.090 | 0.880 to 0.953 | 0.222 to 0.300 | 0.373 to 0.416 | > 0 to 0.034 | 0.024 to 0.087 |
| 2 | 0.417 to 0.474 | 0.389 to 0.444 | 0.385 to 0.435 | 0.674 to 0.713 | 0.094 to 0.177 | 0.091 to 0.171 | 0.806 to 0.879 | 0.301 to 0.380 | 0.329 to 0.372 | 0.035 to 0.068 | 0.088 to 0.152 |
| 3 | 0.359 to 0.416 | 0.333 to 0.388 | 0.333 to 0.384 | 0.714 to 0.754 | 0.178 to 0.260 | 0.172 to 0.252 | 0.732 to 0.805 | 0.381 to 0.460 | 0.286 to 0.328 | 0.069 to 0.102 | 0.153 to 0.216 |
| 4 | 0.301 to 0.358 | 0.277 to 0.332 | 0.282 to 0.332 | 0.755 to 0.794 | 0.261 to 0.344 | 0.253 to 0.333 | 0.659 to 0.731 | 0.461 to 0.539 | 0.242 to 0.285 | 0.103 to 0.136 | 0.217 to 0.281 |
| 5 | 0.243 to 0.300 | 0.221 to 0.276 | 0.231 to 0.281 | 0.795 to 0.835 | 0.345 to 0.428 | 0.334 to 0.414 | 0.585 to 0.658 | 0.540 to 0.619 | 0.198 to 0.241 | 0.137 to 0.170 | 0.282 to 0.345 |
| 6 | 0.185 to 0.242 | 0.165 to 0.220 | 0.179 to 0.230 | 0.836 to 0.875 | 0.429 to 0.512 | 0.415 to 0.495 | 0.511 to 0.584 | 0.620 to 0.699 | 0.155 to 0.197 | 0.171 to 0.204 | 0.346 to 0.410 |
| 7 | 0.127 to 0.184 | 0.109 to 0.164 | 0.128 to 0.178 | 0.876 to 0.916 | 0.513 to 0.595 | 0.496 to 0.576 | 0.437 to 0.510 | 0.700 to 0.778 | 0.111 to 0.154 | 0.205 to 0.239 | 0.411 to 0.474 |
| 8 | 0.069 to 0.126 | 0.053 to 0.108 | 0.076 to 0.127 | 0.917 to 0.956 | 0.596 to 0.679 | 0.577 to 0.658 | 0.363 to 0.436 | 0.779 to 0.858 | 0.067 to 0.110 | 0.240 to 0.273 | 0.475 to 0.539 |
| 9 | 0.011 to 0.068 | 0.008 to 0.052 | 0.025 to 0.075 | 0.957 to 0.997 | 0.680 to 0.763 | 0.659 to 0.739 | 0.289 to 0.362 | 0.859 to 0.938 | 0.024 to 0.066 | 0.274 to 0.307 | 0.540 to 0.603 |
| 10 | < 0.011 | < 0.008 | < 0.025 | > 0.997 | > 0.763 | > 0.739 | < 0.289 | > 0.938 | < 0.024 | > 0.307 | > 0.603 |

**Table 7. Scoring ranges for soft-algae metrics comprising candidate IBIs.**

| Metric score | proportion high Cu indicators (s, sp) | proportion high DOC indicators (s, sp) | proportion low TP indicators (s, sp) | proportion ZHR (s, m) | proportion "non-reference" indicators (s, sp) | proportion high DOC indicators (s, b) | proportion "non-reference" indicators (s, b) | proportion ZHR (s, b) | proportion Chlorophyta (s, b) | proportion of green algae belonging to CRUS (s, b) |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0.357 + | 0.714 + | 0 | 0 | 0.462 + | 1 | 0.999 + | 0 | 0.999 + | 1 |
| 1 | 0.317 to 0.356 | 0.650 to 0.713 | > 0 to 0.032 | > 0 to 0.067 | 0.419 to 0.461 | 0.889 to < 1 | 0.888 to 0.998 | > 0 to 0.103 | 0.888 to 0.998 | 0.889 to < 1 |
| 2 | 0.278 to 0.316 | 0.586 to 0.649 | 0.033 to 0.064 | 0.068 to 0.134 | 0.376 to 0.418 | 0.778 to 0.888 | 0.777 to 0.887 | 0.104 to 0.205 | 0.777 to 0.887 | 0.778 to 0.888 |
| 3 | 0.238 to 0.277 | 0.521 to 0.585 | 0.065 to 0.096 | 0.135 to 0.202 | 0.333 to 0.375 | 0.667 to 0.777 | 0.666 to 0.776 | 0.206 to 0.308 | 0.666 to 0.776 | 0.667 to 0.777 |
| 4 | 0.198 to 0.237 | 0.457 to 0.520 | 0.097 to 0.128 | 0.203 to 0.269 | 0.291 to 0.332 | 0.555 to 0.666 | 0.555 to 0.665 | 0.309 to 0.411 | 0.555 to 0.665 | 0.555 to 0.666 |
| 5 | 0.159 to 0.197 | 0.393 to 0.456 | 0.129 to 0.160 | 0.270 to 0.336 | 0.248 to 0.290 | 0.444 to 0.554 | 0.444 to 0.554 | 0.412 to 0.513 | 0.444 to 0.554 | 0.444 to 0.554 |
| 6 | 0.119 to 0.158 | 0.329 to 0.392 | 0.161 to 0.192 | 0.337 to 0.403 | 0.205 to 0.247 | 0.333 to 0.443 | 0.333 to 0.443 | 0.514 to 0.616 | 0.333 to 0.443 | 0.333 to 0.443 |
| 7 | 0.079 to 0.118 | 0.264 to 0.328 | 0.193 to 0.224 | 0.404 to 0.470 | 0.162 to 0.204 | 0.222 to 0.332 | 0.222 to 0.332 | 0.617 to 0.719 | 0.222 to 0.332 | 0.222 to 0.332 |
| 8 | 0.040 to 0.078 | 0.200 to 0.263 | 0.225 to 0.255 | 0.471 to 0.537 | 0.120 to 0.161 | 0.111 to 0.221 | 0.111 to 0.221 | 0.720 to 0.821 | 0.111 to 0.221 | 0.111 to 0.221 |
| 9 | 0.001 to 0.039 | 0.136 to 0.199 | 0.256 to 0.287 | 0.538 to 0.605 | 0.077 to 0.119 | 0.001 to 0.110 | 0.001 to 0.110 | 0.822 to 0.924 | 0.001 to 0.110 | 0.001 to 0.110 |
| 10 | < 0.001 | < 0.136 | > 0.287 | > 0.605 | < 0.077 | < 0.001 | < 0.001 | > 0.924 | < 0.001 | < 0.001 |

**Discussion**

All of the top-performing IBIs within the various effort categories resulted in good separation of the Disturbed and Reference classes. While no single IBI, nor IBI type, performed the best with respect to every measure, in general, hybrids outperformed single-assemblage IBIs in terms of responsiveness to stress assessed in various ways. For example, the top-performing hybrids were best able to discriminate between site disturbance classes based on IBI score distributions. This is in contrast to the top-performing diatom-only IBI, which exhibited less separation between the Disturbed and Intermediate classes, and the soft, which showed less separation between Intermediate and Reference. On average, hybrids also out-performed single-assemblage IBIs from the standpoint of signal:noise ratio for the replicate multihabitat sampling, and mean pairwise correlations were invariably lower among hybrids than among IBIs composed of a single assemblage. Furthermore, the hybrid IBIs were overall associated with fewer of the natural gradients tested than were the single-assemblage IBIs.

Among the hybrids, three types were recognized: those including metrics that, in aggregate, require execution of the full soft-bodied laboratory protocol (Stancheva et al., in press), and those requiring reduced effort of different types. Two reduced-effort candidate IBIs were evaluated in detail: H20 and H21. H21, which requires biovolume measurements but not species-level identification, did not perform as well in the priority performance screens as H20, which relies on species information but not biovolume. H20 and the top-performing, full-protocol hybrid (H23) were each superior with respect to different performance standards. H20 performed similarly to, or better than, H23 in terms of responsiveness to stress, but H23 was superior in terms of repeatability among replicate samples, and it had a lower mean of pairwise correlations between metrics. However, none of the differences between H20 and H23, with the exception of signal:noise, was particularly pronounced.

We selected H20 for additional evaluation because it was a top-performer in southern California, and required an intermediate level of laboratory effort. It should be noted that based on the data currently available, none of the top-performing IBIs in southern California were also deemed to perform adequately in other parts of the state. As such, it is likely that additional effort will be required to develop IBIs for use in other regions.

Whether H20 should be used for any or all monitoring applications in southern California could depend in part upon the degree to which its high performance attributes justify the effort required to generate its scores, as well as what quality of information is required for various applications. As a hybrid, H20 requires data from both the diatom and soft-bodied algal assemblages, and therefore higher field and laboratory costs than would be incurred for a single-assemblage IBI. In addition, there are technical challenges associated with using the soft-algae species-number metrics upon which H20 depends. These challenges, and the ways in which we addressed them, are as follows.

Sometimes only a low number of soft algal taxa is recorded from the quantitative sample at a given site, potentially rendering the soft-algal species-number metrics somewhat more vulnerable to error than would be the case for the biovolume-based metrics. To help mitigate this by boosting species numbers, we included in the soft-algae species-presence metrics data from the qualitative samples in addition to the quantitative. While this has the potential to increase susceptibility to sampling bias (due to potentially more subjectivity associated with the collection of the qualitative sample), we addressed this by screening for such vulnerable metrics and eliminating those showing sensitivity to whether or not a qualitative sample had even been collected. Another concern is that, for species-level identification, filamentous algae of the genera *Oedogonium*, *Mougeotia*, *Spirogyra*, *Zygnema* and *Vaucheria* require observation of reproductive structures, which are not always available on a given specimen. For monitoring purposes, we chose to group such ambiguous specimens into loose taxonomic categories ("morphospecies") based on readily determined morphological features such as filament width, number and type of chloroplasts, transverse cell wall type, and other vegetative characteristics, so that these morphospecies assignments could be applied consistently. Some of the "taxa" with the highest indicator values in our data set turned out to be morphospecies, thus providing an impetus to include them as "species" in metrics (see Appendices B and D). In support of this practice, precedence exists for applying indicator values to soft-algal morphosphecies for use in biomonitoring (Schneider and Lindstrøm 2011). All told, H20 performed very well in the validation phase of IBI testing. Based on this, and because we believe we applied adequate mitigatory measures to overcome the challenges associated with using soft-algal species-number metrics, we feel confident that H20 is a robust tool for stream assessment.

An additional, more general, concern with respect to including soft algae data in the IBI is the currently restricted capacity for having such samples analyzed. Given the expanding scope of algae-based monitoring in California, capacity for taxonomic identification should be taken into consideration in making implementation decisions. Potential alternative approaches to algae IBI implementation that take this factor into account might include: 1) analyzing only diatoms in the case of routine assessments, but analyzing both diatoms and soft algae samples for applications that require higher resolution data, or 2) regardless of the application, analyzing diatoms only, initially, and adding soft algae only if an intermediate diatom IBI score is realized, in order to achieve better resolution in the middle range of site condition, which is more difficult to resolve. Both of these alternatives would result in net cost savings, and would also help alleviate the current problem of limited capacity for analyzing soft-algae samples, yet allow the benefits of higher resolution information attainable from using both assemblages to be realized when that benefit will make the most difference. It should be borne in mind that if either of these approaches were followed, it would need to be determined whether data based on different IBIs would be sufficiently comparable across different uses, and if not, whether this would be problematic from the standpoint of how the IBIs will be implemented.

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# Appendix A: Soft-algae indicator species results summary



| Parameter | Indicator Class | Species | Observed Indicator Value (IV) | p |
|---|---|---|---|---|
| copper, dissolved | high | Chlorella vulgaris Beij. | 18.7 | 0.001 |
| copper, dissolved | high | Chroococcopsis epiphytica Geitler | 11.0 | 0.022 |
| copper, dissolved | high | Chroococcus dispersus (Keissler) Lemmermann | 6.2 | 0.044 |
| copper, dissolved | high | Chroococcus minimus (Keissler) Lemmerm. | 18.7 | 0.045 |
| copper, dissolved | high | Cladophora glomerata (L.) Kütz. | 35.3 | 0.009 |
| copper, dissolved | high | Cosmarium reniforme (Ralfs) W.Archer | 9.4 | 0.010 |
| copper, dissolved | high | Gongrosira sp. 1 | 8.5 | 0.041 |
| copper, dissolved | high | Komvophoron minutum (Skuja) Anagn. et Komárek | 6.2 | 0.048 |
| copper, dissolved | high | Merismopedia punctata Meyen | 14.8 | 0.004 |
| copper, dissolved | high | Monoraphidium contortum (Thuret) Komàrková-Legnerová | 9.4 | 0.011 |
| copper, dissolved | high | Monoraphidium minutum (Nägeli) Komárk.-Legn. | 17.1 | 0.002 |
| copper, dissolved | high | Oocystis lacustris Chodat | 6.2 | 0.044 |
| copper, dissolved | high | Oocystis parva W. West et G.S. West | 8.8 | 0.031 |
| copper, dissolved | high | Phormidium subfuscum Kütz. ex Gomont | 9.4 | 0.012 |
| copper, dissolved | high | Rhizoclonium hieroglyphicum (C. Agardh) Kütz. | 26.2 | 0.035 |
| copper, dissolved | high | Scenedesmus abundans (Kirchn.) Chodat | 41.6 | 0.000 |
| copper, dissolved | high | Scenedesmus communis E. Hegewald | 15.3 | 0.002 |
| copper, dissolved | high | Scenedesmus dimorphus (Turpin) Kütz. | 36.3 | 0.001 |
| copper, dissolved | high | Scenedesmus ellipticus Corda | 44.3 | 0.001 |
| copper, dissolved | high | Scenedesmus intermedius Chodat | 15.4 | 0.002 |
| copper, dissolved | high | Scenedesmus raciborskii Wołłosz. | 17.3 | 0.021 |
| copper, dissolved | low | Chamaesiphon polymorphus Geitler | 29.6 | 0.021 |
| copper, dissolved | low | Microspora tumidula Hazen | 12.3 | 0.018 |
| copper, dissolved | low | Tribonema viride Pascher | 21.6 | 0.019 |
| copper, dissolved | low | Tychonema sp. 2 | 19.0 | 0.007 |
| dissolved organic carbon | high | Chlamydomonas sp. 1 | 6.9 | 0.041 |
| dissolved organic carbon | high | Chlorella vulgaris Beij. | 12.5 | 0.001 |
| dissolved organic carbon | high | Chroococcopsis fluviatilis (Lagerh.) Komárek et Anagn. | 14.3 | 0.000 |
| dissolved organic carbon | high | Cladophora glomerata (L.) Kütz. | 34.7 | 0.000 |
| dissolved organic carbon | high | Closterium acerosum (Schrank) Ehrenb. ex Ralfs | 5.2 | 0.034 |
| dissolved organic carbon | high | Eudorina elegans Ehrenb. | 3.6 | 0.046 |
| dissolved organic carbon | high | Heteroleibleinia kossinskajae (Elenkin) Anagn. et Komárek | 77.2 | 0.013 |
| dissolved organic carbon | high | Leptolyngbya foveolara (Mont. ex Gomont) Anagn. et Komárek | 80.6 | 0.014 |
| dissolved organic carbon | high | Merismopedia punctata Meyen | 9.7 | 0.005 |
| dissolved organic carbon | high | Merismopedia tenuissima Lemmerm. | 13.5 | 0.000 |

## Appendix A: Soft-algae indicator species results summary



| Parameter | Indicator Class | Species | Observed Indicator Value (IV) | p |
|---|---|---|---|---|
| dissolved organic carbon | high | Monoraphidium arcuatum (Korshikov) Hindák | 6.5 | 0.010 |
| dissolved organic carbon | high | Monoraphidium contortum (Thuret) Komàrková-Legnerová | 4.2 | 0.043 |
| dissolved organic carbon | high | Monoraphidium minutum (Nägeli) Komárk.-Legn. | 13.5 | 0.000 |
| dissolved organic carbon | high | Oedogonium sp. 1 | 17.3 | 0.001 |
| dissolved organic carbon | high | Oocystis parva W. West et G.S. West | 8.3 | 0.016 |
| dissolved organic carbon | high | Oocystis pusilla Hansg. | 6.8 | 0.048 |
| dissolved organic carbon | high | Oocystis sp. 1 | 3.6 | 0.049 |
| dissolved organic carbon | high | Pediastrum boryanum (Turpin) Menegh. | 13.9 | 0.028 |
| dissolved organic carbon | high | Pediastrum duplex Meyen | 3.6 | 0.046 |
| dissolved organic carbon | high | Rhizoclonium hieroglyphicum (C. Agardh) Kütz. | 30.3 | 0.000 |
| dissolved organic carbon | high | Rivulariaceae 1 | 7.1 | 0.001 |
| dissolved organic carbon | high | Scenedesmus abundans (Kirchn.) Chodat | 31.0 | 0.000 |
| dissolved organic carbon | high | Scenedesmus aff. communis E. Hegewald | 8.5 | 0.007 |
| dissolved organic carbon | high | Scenedesmus communis E. Hegewald | 8.0 | 0.013 |
| dissolved organic carbon | high | Scenedesmus dimorphus (Turpin) Kütz. | 26.0 | 0.001 |
| dissolved organic carbon | high | Scenedesmus dispar Bréb. | 5.2 | 0.010 |
| dissolved organic carbon | high | Scenedesmus ellipticus Corda | 38.1 | 0.000 |
| dissolved organic carbon | high | Scenedesmus intermedius Chodat | 14.2 | 0.000 |
| dissolved organic carbon | high | Scenedesmus microspina Chodat | 6.5 | 0.013 |
| dissolved organic carbon | high | Scenedesmus opoliensis P.G.Richt. | 8.1 | 0.002 |
| dissolved organic carbon | high | Scenedesmus raciborskii Wołłosz. | 11.9 | 0.001 |
| dissolved organic carbon | high | Scenedesmus sp. 2 | 5.4 | 0.010 |
| dissolved organic carbon | high | Spirogyra sp. 12 | 5.4 | 0.008 |
| dissolved organic carbon | high | Tychonema sp. 3 | 8.8 | 0.004 |
| dissolved organic carbon | high | Ulva flexuosa Wulfen | 10.0 | 0.015 |
| dissolved organic carbon | high | Vaucheria sp. 1 | 18.3 | 0.003 |
| dissolved organic carbon | low | Bluegreen coccoid 4 | 4.8 | 0.024 |
| dissolved organic carbon | low | Tolypothrix distorta Kütz. ex Bornet et Flahault | 9.4 | 0.040 |
| dissolved organic carbon | low | Ulothrix zonata (Weber et Mohr) Kütz. | 7.9 | 0.002 |
| reference-status | non-reference | Cladophora glomerata (L.) Kütz. | 37.2 | 0.000 |
| reference-status | non-reference | Heteroleibleinia kossinskajae (Elenkin) Anagn. et Komárek | 92.1 | 0.001 |
| reference-status | non-reference | Merismopedia tenuissima Lemmerm. | 6.8 | 0.047 |
| reference-status | non-reference | Oedogonium sp. 1 | 11.4 | 0.048 |
| reference-status | non-reference | Oedogonium sp. 3 | 15.1 | 0.044 |
| reference-status | non-reference | Pediastrum boryanum (Turpin) Menegh. | 12.8 | 0.049 |

# Appendix A: Soft-algae indicator species results summary



| Parameter | Indicator Class | Species | Observed Indicator Value (IV) | p |
|---|---|---|---|---|
| reference-status | non-reference | Rhizoclonium hieroglyphicum (C. Agardh) Kütz. | 21.2 | 0.003 |
| reference-status | non-reference | Scenedesmus abundans (Kirchn.) Chodat | 18.2 | 0.007 |
| reference-status | non-reference | Scenedesmus dimorphus (Turpin) Kütz. | 20.3 | 0.014 |
| reference-status | non-reference | Scenedesmus ellipticus Corda | 26.3 | 0.015 |
| reference-status | non-reference | Ulva flexuosa Wulfen | 8.9 | 0.031 |
| reference-status | reference | Calothrix parietina (Nägeli) Thuret | 15.1 | 0.006 |
| reference-status | reference | Chamaesiphon polymorphus Geitler | 40.1 | 0.000 |
| reference-status | reference | Chlorophyta 3 | 7.8 | 0.041 |
| reference-status | reference | Chroodactylon ornatum (C. Agardh) Basson | 9.3 | 0.000 |
| reference-status | reference | Mougeotia sp. 3 | 3.8 | 0.040 |
| reference-status | reference | Nostoc verrucosum Vaucher ex Bornet et Flahault | 33.6 | 0.000 |
| reference-status | reference | Tolypothrix distorta Kütz. ex Bornet et Flahault | 15.6 | 0.000 |
| reference-status | reference | Ulothrix zonata (Weber et Mohr) Kütz. | 6.6 | 0.002 |
| nitrogen, total | high | Chlamydomonas sp. 1 | 8.4 | 0.045 |
| nitrogen, total | high | Chlorophyta 1 | 10.0 | 0.022 |
| nitrogen, total | high | Cladophora glomerata (L.) Kütz. | 40.2 | 0.001 |
| nitrogen, total | high | Merismopedia punctata Meyen | 9.7 | 0.016 |
| nitrogen, total | high | Oedogonium sp. 5 | 6.6 | 0.034 |
| nitrogen, total | high | Oocystis lacustris Chodat | 6.7 | 0.012 |
| nitrogen, total | high | Pediastrum boryanum (Turpin) Menegh. | 14.7 | 0.039 |
| nitrogen, total | high | Pediastrum integrum Nägeli | 15.2 | 0.005 |
| nitrogen, total | high | Rhizoclonium hieroglyphicum (C. Agardh) Kütz. | 29.2 | 0.000 |
| nitrogen, total | high | Scenedesmus acutiformis Schröd. | 6.3 | 0.026 |
| nitrogen, total | high | Scenedesmus raciborskii Wołłosz. | 11.6 | 0.019 |
| nitrogen, total | high | Vaucheria sp. 1 | 21.0 | 0.005 |
| nitrogen, total | low | Aphanothece stagnina (Spreng.) A. Braun | 15.7 | 0.026 |
| nitrogen, total | low | Calothrix epiphytica W.West et G.S.West | 25.7 | 0.020 |
| nitrogen, total | low | Calothrix fusca (Kütz.) Bornet et Flahault | 21.0 | 0.021 |
| nitrogen, total | low | Nostoc verrucosum Vaucher ex Bornet et Flahault | 29.1 | 0.010 |
| nitrogen, total | low | Tribonema viride Pascher | 15.0 | 0.043 |
| phosphorus, total | high | Chlamydomonas sp. 1 | 7.7 | 0.032 |
| phosphorus, total | high | Chlorella vulgaris Beij. | 6.9 | 0.049 |
| phosphorus, total | high | Cladophora glomerata (L.) Kütz. | 24.3 | 0.012 |
| phosphorus, total | high | Heteroleibleinia kossinskajae (Elenkin) Anagn. et Komárek | 74.8 | 0.046 |
| phosphorus, total | high | Phormidium cortianum (Meneghini ex Gomont) Anagnostidis & Komárek | 8.6 | 0.002 |

# Appendix A: Soft-algae indicator species results summary



| Parameter | Indicator Class | Species | Observed Indicator Value (IV) | p |
|---|---|---|---|---|
| phosphorus, total | high | Scenedesmus abundans (Kirchn.) Chodat | 15.5 | 0.044 |
| phosphorus, total | high | Scenedesmus acuminatus (Lagerh.) Chodat | 5.2 | 0.017 |
| phosphorus, total | high | Scenedesmus dimorphus (Turpin) Kütz. | 21.3 | 0.018 |
| phosphorus, total | high | Scenedesmus ellipticus Corda | 24.5 | 0.034 |
| phosphorus, total | high | Scenedesmus intermedius Chodat | 11.8 | 0.001 |
| phosphorus, total | high | Scenedesmus opoliensis P.G.Richt. | 8.1 | 0.004 |
| phosphorus, total | high | Spirogyra sp. 4 | 8.6 | 0.001 |
| phosphorus, total | low | Batrachospermum boryanum Sirodot | 4.0 | 0.035 |
| phosphorus, total | low | Bluegreen coccoid 4 | 3.9 | 0.040 |
| phosphorus, total | low | Chamaesiphon polymorphus Geitler | 30.8 | 0.044 |
| phosphorus, total | low | Chroococcus limneticus Lemmerm. | 13.0 | 0.008 |
| phosphorus, total | low | Chroodactylon ornatum (C. Agardh) Basson | 11.8 | 0.000 |
| phosphorus, total | low | Merismopedia glauca (Ehrenb.) Kütz. | 5.1 | 0.045 |
| phosphorus, total | low | Mougeotia calcarea (Cleve) Wittr. | 4.0 | 0.037 |
| phosphorus, total | low | Mougeotia sp. 1 | 13.2 | 0.005 |
| phosphorus, total | low | Mougeotia sp. 2 | 16.4 | 0.005 |
| phosphorus, total | low | Mougeotia sp. 3 | 5.8 | 0.012 |
| phosphorus, total | low | Nostoc verrucosum Vaucher ex Bornet et Flahault | 25.5 | 0.013 |
| phosphorus, total | low | Nostochopsis lobatus Wood em. Geitler | 6.0 | 0.008 |
| phosphorus, total | low | Oocystis solitaria Wittr. | 10.8 | 0.009 |
| phosphorus, total | low | Paralemanea catenata (Kützing) Vis et Sheath | 4.4 | 0.041 |
| phosphorus, total | low | Phormidium incrustatum Gomont ex Gomont | 4.0 | 0.036 |
| phosphorus, total | low | Phormidium sp. 1 | 9.7 | 0.004 |
| phosphorus, total | low | Rivularia minutula (Kütz.) Bornet et Flahault | 12.0 | 0.003 |
| phosphorus, total | low | Spirogyra borgeana Transeau | 5.9 | 0.012 |
| phosphorus, total | low | Spirogyra majuscula Kütz. | 4.0 | 0.032 |
| phosphorus, total | low | Spirogyra sp. 1 | 17.4 | 0.002 |
| phosphorus, total | low | Spirogyra sp. 2 | 12.0 | 0.005 |
| phosphorus, total | low | Spirogyra varians (Hassall) Kütz. | 7.5 | 0.014 |
| phosphorus, total | low | Spirogyra weberi Kütz. | 6.0 | 0.006 |
| phosphorus, total | low | Tychonema sp. 2 | 11.4 | 0.005 |
| phosphorus, total | low | Zygnema sp. 1 | 9.6 | 0.004 |
| phosphorus, total | low | Zygnema sterile Transeau | 16.8 | 0.000 |

# Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Actinastrum hantzschii Lagerheim | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | T |
| Anabaena cylindrica Lemmermann | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | T |
| Anabaena inaequalis (Kütz.) Bornet et Flahault | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Anabaena iyengarii Bharadwaja | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Anabaena lapponica Borge | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Anabaena oscillatorioides Bory de Saint-Vincent ex Bornet & Flahault | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Anabaena sp. 1 | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Anabaena sp. 2 | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Anabaena sp. 3 | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Anabaena sp. 5 | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Anabaena variabilis Kütz. | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Anabaenopsis elenkinii V.V.Miller | Cyanobacteria | heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Ankistrodesmus falcatus (Corda) Ralfs | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | T |
| Ankistrodesmus fusiformis Corda ex Korshikov | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Ankistrodesmus spiralis (W.B.Turner) Lemmerm. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Apatococcus lobatus (Chodat) J.B.Petersen | Chlorophyta | non-heterocystous | NA | terrestrial | nonmotile | no | NI | NI | | NI | NI | |
| Apatococcus sp. 1 | Chlorophyta | non-heterocystous | NA | terrestrial | nonmotile | no | NI | NI | NI | NI | NI | |
| Aphanocapsa delicatissima W. West et G.S. West | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Aphanocapsa hyalina (Lyngbye) Hansgirg | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanocapsa parasitica (Kütz.) Komárek et Anagn. | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Aphanocapsa planctonica (G.M.Smith) Komárek & Anagnostidis | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanocapsa sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanochaete polychaete (Hansgirg) F.E.Fritsch | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Aphanochaete repens A. Braun | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Aphanothece caldariorum Richter | Cyanobacteria | non-heterocystous | NA | aerophytic | nonmotile | no | NI | NI | | NI | NI | |

# Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Aphanothece clathrata W. West et G.S. West | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Aphanothece elabens (Brébisson) Elenkin | Cyanobacteria | non-heterocystous | stagnant | benthic/ tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanothece floccosa (Zalessky) Cronberg et Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic/ tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Aphanothece minutissima (W.West) Komárková-Legnerová et Cronberg | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Aphanothece nebulosa Skuja | Cyanobacteria | non-heterocystous | stagnant | benthic/ tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanothece nidulans Richter | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanothece saxicola Nägeli | Cyanobacteria | non-heterocystous | NA | aerophytic | nonmotile | no | NI | NI | | NI | NI | |
| Aphanothece stagnina (Spreng.) A. Braun | Cyanobacteria | non-heterocystous | stagnant | benthic/ tychoplanktonic | nonmotile | no | NI | NI | NI | low | NI | S |
| Apiocystis brauniana Nägeli | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Arthrospira sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | motile | no | NI | NI | NI | NI | NI | |
| Asterococcus limneticus G.M. Sm. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Audouinella hermannii (Roth) Duby | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Batrachospermum boryanum Sirodot | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | NI | NI | S |
| Batrachospermum sp. 1 | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Binuclearia tetrana Wittrock | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Bluegreen coccoid 2 | Cyanobacteria | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Bluegreen coccoid 3 | Cyanobacteria | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Bluegreen coccoid 4 | Cyanobacteria | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Brachynema sp. 1 | Cyanobacteria | non-heterocystous | | | nonmotile | no | | | | | | |
| Bulbochaete mirabilis Wittrock | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | | NI | NI | NI | |
| Bulbochaete sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Calothrix clavata G.S.West | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | | | | | | |
| Calothrix crustaceae (Thuret) Bornet et Flahault | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Calothrix epiphytica W.West et G.S.West | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | NI | NI | NI | low | NI | |
| Calothrix fusca (Kütz.) Bornet et Flahault | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | NI | NI | NI | low | NI | S |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calothrix parietina (Nägeli) Thuret | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | NI | NI | NI | NI | reference | S |
| Calothrix sp. 1 | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | | | | | | |
| Calothrix sp. 2 | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | | | | | | |
| Calothrix sp. 3 | Cyanobacteria | heterocystous | moderate-low | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Capsosira brebissonii Kützing ex Bornet & Flahault | Cyanobacteria | heterocystous | NA | aerophytic | nonmotile | no | NI | NI | | NI | NI | |
| Carteria klebsii (P.A.Dangeard) Francé | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Carteria sp. 1 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | |
| Ceratium hirundinella (O.F.Müller) Dujardin | Dinoflagellata | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | S |
| cf. Peridinium | Dinoflagellata | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| cf. Stylochrysalis | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Chaetophora elegans (Roth) C.Agardh | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Chaetophora incrassata Hazen | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Chaetophora sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Chaetophorales | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Chaetosphaeridium globosum (Nordstedt) Klebahn | Charophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Chamaesiphon confervicola A. Braun | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Chamaesiphon incrustans Grunow | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Chamaesiphon investiens Skuja | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Chamaesiphon minutus (Rostaf.) Lemmerm. | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Chamaesiphon polymorphus Geitler | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | low | NI | low | NI | reference | S |
| Chamaesiphon sp. 1 | Cyanobacteria | non-heterocystous | moderate-low | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Chamaesiphon subglobosus (Rostaf.) Lemmerm. | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Chantransia sp. 1 | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chantransia sp. 2 | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chantransia sp. 3 | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chara globularis Thuiller | Charophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chara sp. 1 | Charophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Chara vulgaris L. | Charophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Chlamydomonadopsis sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlamydomonas ambigua Gerloff | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Chlamydomonas debaryana Gorozh. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Chlamydomonas ehrenbergii Gorozh. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | T |
| Chlamydomonas globosa J. Snow | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Chlamydomonas reinhardtii P.A.Dangeard | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Chlamydomonas snowiae Printz | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | |
| Chlamydomonas sp. 1 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | high | high | NI | high | NI | |
| Chlamydomonas sp. 2 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Chlamydomonas stellata Dill | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | |
| Chlorella sp. 1 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorella sp. 2 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorella sp. 5 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorella vulgaris Beij. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | high | high | high | NI | NI | T |
| Chlorogloea sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorophyta 1 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | high | NI | |
| Chlorophyta 10 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorophyta 11 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Chlorophyta 12 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorophyta 13 | Chlorophyta | non-heterocystous | | | nonmotile | no | | | | | | |
| Chlorophyta 2 | Chlorophyta | non-heterocystous | | | nonmotile | no | | | | | | |
| Chlorophyta 3 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | reference | |
| Chlorophyta 4 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Chlorophyta 5 | Chlorophyta | non-heterocystous | | | nonmotile | no | | | | | | |
| Chlorophyta 6 | Chlorophyta | non-heterocystous | | | nonmotile | no | | | | | | |

# Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Chlorophyta 7 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Chlorophyta 8 | Chlorophyta | non-heterocystous | | | nonmotile | no | | | | | | |
| Chroococcopsis epiphytica Geitler | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | high | NI | NI | |
| Chroococcopsis fluviatilis (Lagerh.) Komárek et Anagn. | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | high | NI | NI | NI | S |
| Chroococcopsis sp. 1 | Cyanobacteria | non-heterocystous | moderate-low | benthic | nonmotile | no | | | | | | |
| Chroococcus dispersus (Keissler) Lemmermann | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | high | NI | NI | S |
| Chroococcus limneticus Lemmerm. | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | S |
| Chroococcus minimus (Keissler) Lemmerm. | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | high | NI | NI | |
| Chroococcus minor (Kütz.) Nägeli | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chroococcus minutus (Kütz.) Nägeli | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chroococcus sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chroococcus sp. 2 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Chroococcus turgidus (Kütz.) Nägeli | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chroococcus vacuolatus Skuja | Cyanobacteria | non-heterocystous | stagnant | benthic/ tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Chroodactylon ornatum (C. Agardh) Basson | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | NI | reference | S |
| Chroomonas pulex Pascher | Cryptophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Chrysophyceae 2 | Ochrophyta | non-heterocystous | | | nonmotile | no | | | | | | |
| Chrysopyxis sp. 1 | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Chrysosphaera paludosa (Korshikov) Bourrelly | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Cladophora aff. fracta (O.F.Müll. ex Vahl) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Cladophora aff. glomerata (L.) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Cladophora fracta (O.F.Müll. ex Vahl) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Cladophora glomerata (L.) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | high | high | high | high | non-reference | |
| Cladophora sp. 3 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Clastidium rivulare (Hansg.) Hansg. | Cyanobacteria | non-heterocystous | high | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Clastidium setigerum Kirchner | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | S |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Closteriopsis acicularis (Chodat) J.H. Belcher et Swale | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium acerosum (Schrank) Ehrenb. ex Ralfs | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | T |
| Closterium acerosum var. tumidium Hughes | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium aff. littorale F. Gay | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium attenuatum Ralfs | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium ehrenbergii Meneghini ex Ralfs | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | S |
| Closterium kuetzingii Bréb. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Closterium leibleinii Kützing ex Ralfs | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | T |
| Closterium littorale F. Gay | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Closterium lunula Ehrenberg & Hemprich ex Ralfs | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Closterium moniliferum Ehrenb. ex Ralfs | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium parvulum Nägeli | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | T |
| Closterium parvum var. maius West | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium praelongum Brébisson | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Closterium ralfsii var. hybridum Rabenh. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Closterium striatum K.P.Biswas | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Coccoid UNK (colonial) | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Coelastrum astroideum De Notaris | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Coelastrum microporum Nägeli | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | T |
| Coelomoron pusillum (Van Goor) Komárek | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Coelomoron sp. 1 | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Coleochaete irregularis Pringsheim | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Coleochaete sp. 1 | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Coleodesmium wrangelii (C.Agardh) Borzi | Cyanobacteria | heterocystous | high-moderate | benthic | nonmotile | no | | | | | | S |
| Compsopogon chalybeus Kützing | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Cosmarium abbreviatum Raciborski | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cosmarium granatum Bréb. ex Ralfs | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Cosmarium laeve Rabenhorst | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Cosmarium regnellii Wille | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Cosmarium reniforme (Ralfs) W.Archer | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | high | NI | NI | |
| Cosmarium sp. 1 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Cosmarium sp. 2 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Cosmarium sp. 3 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Cosmarium sportella var. subnudum W.West et G.S.West | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Cosmarium subcrenatum Hantzsch | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Cosmarium subtumidum var. minutum (Krieg.) Krieg. et Gerloff | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Crucigeniella apiculata (Lemmermann) Komárek | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | T |
| Cryptomonad cell 2 | Cryptophyta | non-heterocystous | | | motile | yes | NI | NI | | NI | NI | |
| Cryptomonad cell 3 | Cryptophyta | non-heterocystous | | | motile | yes | NI | NI | | NI | NI | |
| Cryptomonas (palmelloid) | Cryptophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Cryptomonas anomala F.E. Fritsch | Cryptophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | |
| Cryptomonas erosa Ehrenb. | Cryptophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | T |
| Cryptomonas sp. 1 | Cryptophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Cyanobium diatomicola (Geitler) Komárek, J. Kopeck et V. Cepák | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Cyanodermatium fluminense (Fritsch) Komárek & Anagnostidis | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Cyanophanon mirabile Geitler | Cyanobacteria | non-heterocystous | high | benthic | nonmotile | no | | | | | | S |
| Cyanophyceae 5 | Cyanobacteria | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Cyanophyceae 7 | Cyanobacteria | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Cyanostylon microcystoides Geitler | Cyanobacteria | non-heterocystous | variable | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Cyanothece aeruginosa (Nägeli) Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Cylindrocapsa geminella var. minor Hansgirg | Chlorophyta | non-heterocystous | moderate | benthic/ tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Cylindrocapsa geminella Wolle | Chlorophyta | non-heterocystous | moderate | benthic/ tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cylindrospermum sp. 1 | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Cylindrospermum stagnale (Kütz.) Bornet et Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Desmodesmus armatus (Chodat) Chodat | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Dichothrix gypsophyla (Kütz.) Bornet et Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | | | | | | S |
| Dichothrix hosfordii (Wolle) Bornet | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Dictyosphaerium ehrenbergianum Nägeli | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Dictyosphaerium pulchellum H.C.Wood | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Dictyosphaerium sp. 1 | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Dinobryon divergens O.E.Imhof | Ochrophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Draparnaldia glomerata (Vaucher) C. Agardh | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Draparnaldia mutabilis (Roth) Cedergr. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | | NI | NI | NI | S |
| Draparnaldia sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | | NI | NI | NI | |
| Elakatothrix sp. 1 | Charophyta | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Eudorina elegans Ehrenb. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | motile | yes | NI | high | NI | NI | NI | |
| Euglena acus Ehrenberg | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | NI | NI | | NI | NI | T |
| Euglena oxyuris Schmarda | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | | | | | | |
| Euglena proxima P.A.Dangeard | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | | | | | | T |
| Euglena sp. 1 | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | |
| Euglena sp. 2 | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | | | | | | |
| Euglena sp. 3 | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | | | | | | |
| Euglena spirogyra Ehrenberg | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | | | | | | |
| Euglena spiroides Lemmermann | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | | | | | | T |
| Euglena variabilis G.A.Klebs | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | T |
| Euglena viridis (O.F.Müll.) Ehrenb. | Euglenozoa | non-heterocystous | moderate | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | T |
| Geitleribactron periphyticum Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Geitlerinema amphibium (C.Agardh) Anagnostidis | Cyanobacteria | non-heterocystous | moderate | benthic | motile | no | NI | NI | NI | NI | NI | T |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Geitlerinema sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | motile | no | NI | NI |  | NI | NI |  |
| Geitlerinema splendidum (Greville) Anagnostidis | Cyanobacteria | non-heterocystous | moderate | benthic | motile | no | NI | NI |  | NI | NI | T |
| Geminella elipsoidea (Prescott) G.M.Smith | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no |  |  |  |  |  |  |
| Geminella interrupta (Turpin) Lagerh. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Geminella ordinata (West & G.S.West) Heering | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no |  |  |  |  |  |  |
| Glaucospira sp. 1 | Cyanobacteria | non-heterocystous |  |  | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gloeobotrys limneticus (G.M.Smith) Pascher | Ochrophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gloeocapsa biformis Ercegović | Cyanobacteria | non-heterocystous | NA | aerophytic | nonmotile | no |  |  |  |  |  |  |
| Gloeocapsa fusco-lutea (Nägeli) Kützing | Cyanobacteria | non-heterocystous | NA | aerophytic | nonmotile | no | NI | NI |  | NI | NI |  |
| Gloeocapsa punctata Nägeli | Cyanobacteria | non-heterocystous | NA | aerophytic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gloeocapsa siderochlamys (Skuja) Starmach | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no |  |  |  |  |  |  |
| Gloeocapsa sp. 1 | Cyanobacteria | non-heterocystous | stagnant |  | nonmotile | no |  |  |  |  |  |  |
| Gloeocapsopsis sp. 1 | Cyanobacteria | non-heterocystous | stagnant |  | nonmotile | no |  |  |  |  |  |  |
| Gloeocystis vesiculosa Nägeli | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gloeotrichia natans (Hedwig) Rabenhorst | Cyanobacteria | heterocystous | stagnant | benthic/ tychoplanktonic | nonmotile | no | NI | NI |  | NI | NI | T |
| Gomphosphaeria aponina Kütz. | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Gomphosphaeria sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gongrosira debaryana Rabenh. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Gongrosira schmidlei P.G.Richt. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gongrosira sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | high | NI | NI |  |
| Gongrosira sp. 2 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gongrosira sp. 3 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Gongrosira sp. 4 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI |  |
| Green germinating | Chlorophyta | non-heterocystous |  |  | nonmotile | no |  |  |  |  |  |  |
| Haematococcus pluvialis Flot. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes |  |  |  |  |  | T |
| Hapalosiphon hibernicus West & G.S.West | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI |  | NI | NI |  |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Heteroleibleinia kossinskajae (Elenkin) Anagn. et Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | high | high | NI | NI | non-reference | |
| Hibberdiales 1 | Ochrophyta | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Homoeothrix juliana (Bornet et Flahault) Kirchner | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Homoeothrix sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Homoeothrix stagnalis (Hansgirg) Komárek et Kováčik | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Homoeothrix varians Geitler | Cyanobacteria | non-heterocystous | high-moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Homoeothrix woronichinii Margalef | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Hormidiopsis sp. 1 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Hydrococcus rivularis Kützing | Cyanobacteria | non-heterocystous | high | benthic | nonmotile | no | | | | | | S |
| Hydrodictyon reticulatum (L.) Bory | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Hydrurus foetidus (Villars) Trevisan | Ochrophyta | non-heterocystous | high-moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Kirchneriella irregularis (G.M.Smith) Korshikov | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Kirchneriella lunaris (Kirchner) K.Möbius | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Kirchneriella obesa (G.S.West) Schmidle | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Klebsormidium crenulatum (Kütz.) Lokhorst | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Klebsormidium flaccidum (Kützing) P.C.Silva, K.R.Mattox & W.H.Blackwell | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | S |
| Klebsormidium klebsii (G.M.Smith) P.C.Silva, K.R.Mattox & W.H.Blackwell | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Klebsormidium rivulare (Kütz.) M.O.Morison et Sheath | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Klebsormidium sp. 1 | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Klebsormidium subtile (Kützing) Tracanna ex Tell | Charophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | S |
| Komvophoron constrictum (Szafer) Anagnostidis & Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | | no | NI | NI | | NI | NI | |
| Komvophoron minutum (Skuja) Anagn. et Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | | no | NI | NI | high | NI | NI | |
| Komvophoron schmidlei (Jaag) Anagn. et Komárek | Cyanobacteria | non-heterocystous | moderate | benthic | | no | NI | NI | | NI | NI | |
| Lagynion sp. 1 | Ochrophyta | non-heterocystous | | | nonmotile | no | | | | | | |

# Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Leibleinia epiphytica (Hieronymus) Compère | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Lemanea borealis Atkinson | Rhodophyta | non-heterocystous | high | benthic | nonmotile | no | | | | | | |
| Leptolyngbya foveolara (Mont. ex Gomont) Anagn. et Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | high | NI | NI | NI | T |
| Leptolyngbya granulifera (Copeland) Anagnostidis | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Leptolyngbya nostocorum (Bornet ex Gomont) Anagnostidis & Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | S |
| Leptolyngbya notata (Schmidle) Anagn. et Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Leptolyngbya sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Leptolyngbya tenuis (Gomont) Anagn. et Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Leptolyngbya valderiana (Gomont) Anagnostidis & Komárek | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Limnothrix sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | motile | no | | | | | | |
| Lobomonas sp. 1 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Lyngbya aestuarii (Mert.) Liebman ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Lyngbya major Menegh. ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic/ tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Lyngbya martensiana Meneghini ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic/ tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Lyngbya sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Merismopedia glauca (Ehrenb.) Kütz. | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | S |
| Merismopedia punctata Meyen | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | high | high | NI | T |
| Merismopedia tenuissima Lemmerm. | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | non-reference | T |
| Merismopedia trolleri Bachm. | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Micractinium pusillum Fresenius | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Microcoleus codii Frémy | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Microcoleus lacustris (Rabenh.) Farlow ex Gomont | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Microcoleus sp. 1 | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Microcoleus vaginatus (Vaucher) Gomont ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | S |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Microcrocis irregularis (Lagerheim) Geitler | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Microcrocis sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Microcystis firma (Kütz.) Schmidle | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Microspora abbreviata (Rabenhorst) Lagerheim | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Microspora amoena (Kützing) Rabenhorst | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | S |
| Microspora pachyderma (Wille) Lagerh. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Microspora sp. 1 | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Microspora sp. 2 | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Microspora tumidula Hazen | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | low | NI | NI | S |
| Mischococcus confervicola Nägeli | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Monoraphidium arcuatum (Korshikov) Hindák | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Monoraphidium contortum (Thuret) Komàrková-Legnerová | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | high | NI | NI | |
| Monoraphidium minutum (Nägeli) Komárk.-Legn. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | high | NI | NI | |
| Monoraphidium sp. 1 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | NI | | | | |
| Mougeotia calcarea (Cleve) Wittr. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Mougeotia scalaris Hassall | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | S |
| Mougeotia sp. 1 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Mougeotia sp. 2 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Mougeotia sp. 3 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | reference | |
| Mougeotia sp. 4 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Mougeotia sp. 5 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Mougeotia sp. 6 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Muriella terrestris J.B.Petersen | Chlorophyta | non-heterocystous | NA | terrestrial | nonmotile | no | | | | | | |
| Nephrocytium agardhianum Nägeli | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Nephrocytium limneticum (G.M. Sm.) G.M. Sm. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Netrium digitus (Brébisson ex Ralfs) Itzigsohn & Rothe | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nodularia harveyana (Thwaites) Thur. | Cyanobacteria | heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Nodularia spumigena Mert. | Cyanobacteria | heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Nostoc linckia (Roth) Bornet ex Bornet et Flahault | Cyanobacteria | heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Nostoc muscorum C.Agardh | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Nostoc parmelioides Kützing ex Bornet & Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Nostoc punctiforme (Kützing) Hariot | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Nostoc sp. 1 | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Nostoc sp. 2 | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Nostoc spongiaeforme C.Agardh ex Bornet & Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Nostoc verrucosum Vaucher ex Bornet et Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | low | reference | S |
| Nostochopsis lobatus Wood em. Geitler | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | NI | NI | |
| Oedogonium capilliforme Kütz. | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Oedogonium crassum (Hassall) Wittrock | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Oedogonium curvum E.G.Pringsheim | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Oedogonium multisporum H.C.Wood | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Oedogonium punctatostriatum De Bary | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Oedogonium sp. 1 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | high | NI | NI | non-reference | |
| Oedogonium sp. 2 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Oedogonium sp. 3 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | non-reference | |
| Oedogonium sp. 4 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Oedogonium sp. 5 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | high | NI | |
| Oedogonium sp. 6 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Oedogonium sp. 7 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Oedogonium sp. 8 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Oedogonium sp. 9 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Oedogonium stellatum Wittrock | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oedogonium vaucherii (Le Clerc) A. Braun | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Oocystis borgei J. Snow | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Oocystis elliptica West | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Oocystis lacustris Chodat | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | | high | high | NI | S |
| Oocystis naegelii A.Braun | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Oocystis natans (Lemmermann) Lemmermann | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Oocystis parva W. West et G.S. West | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | high | high | NI | NI | |
| Oocystis pusilla Hansg. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Oocystis solitaria Wittr. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Oocystis sp. 1 | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Ophiocytium arbusculum (A. Braun) Rabenh. | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Ophiocytium sp. 1 | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Oscillatoria jenensis G.Schmid | Cyanobacteria | non-heterocystous | stagnant | benthic | motile | no | NI | NI | NI | NI | NI | |
| Oscillatoria limosa (Dillwyn) C. Agardh | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | NI | NI | NI | NI | T |
| Oscillatoria nigro-viridis Thwaites | Cyanobacteria | non-heterocystous | moderate | benthic | motile | no | NI | NI | NI | NI | NI | |
| Oscillatoria sp. 1 | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | NI | NI | NI | NI | |
| Oscillatoria sp. 2 | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | NI | NI | NI | NI | |
| Palmellopsis gelatinosa Korshikov | Chlorophyta | non-heterocystous | moderate | benthic/ tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Pandorina morum (O.F.Müller) Bory de Saint-Vincent | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Paralemanea catenata (Kützing) Vis et Sheath | Rhodophyta | non-heterocystous | high | benthic | nonmotile | no | low | NI | NI | NI | NI | S |
| Paralemanea sp. 2 | Rhodophyta | non-heterocystous | high | benthic | nonmotile | no | | | | | | |
| Paulschulzia pseudovolvox (Schultz) Skuja | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Paulschulzia tenera (Korshikov) J.W.G.Lund | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Pediastrum boryanum (Turpin) Menegh. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | high | non-reference | |
| Pediastrum boryanum var. longicorne Reinsch | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Pediastrum cornutum (Raciborski) Troitskaya | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |

# Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Pediastrum duplex Meyen | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | S |
| Pediastrum duplex var. rugulosum Raciborski | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Pediastrum integrum Nägeli | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | high | NI | |
| Pediastrum simplex Meyen | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Peridinium sp. 1 | Dinoflagellata | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | | NI | NI | NI | |
| Phacus acuminatus Stokes | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Phacus cf. caudatus Hübner | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | T |
| Phacus circumflexus Pochmann | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Phacus longicauda (Ehrenberg) Dujardin | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Phacus orbicularis K.Hübner | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Phacus sp. 1 | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Phacus sp. 2 | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Phacus sp. 3 | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Phacus sp. 4 | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Phacus striatus Francé | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Phaeogloea mucosa Chodat | Ochrophyta | non-heterocystous | | | nonmotile | no | NI | NI | | NI | NI | |
| Phormidium ambiguum Gomont ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Phormidium chalybeum (Mert. ex Gomont) Anagn. et Komárek | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | T |
| Phormidium cortianum (Meneghini ex Gomont) Anagnostidis & Komárek | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | high | NI | NI | NI | NI | |
| Phormidium incrustatum Gomont ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | NI | NI | S |
| Phormidium inundatum Kützing ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Phormidium lucidum (C.Agardh) Kütz. ex Gomont | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Phormidium nigrum (Vaucher ex Gomont) Anagnostidis & Komárek | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | T |
| Phormidium retzii (C. Agardh) Kütz. ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Phormidium sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | NI | NI | |
| Phormidium sp. 2 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phormidium sp. 3 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Phormidium sp. 4 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Phormidium sp. 5 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Phormidium subfuscum Kütz. ex Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | high | NI | NI | T |
| Phormidium uncinatum (C.Agardh) Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Pithophora oedogonia (Montagne) Wittrock | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Planktolyngbya sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Planktothrix agardhii (Gomont) Anagnostidis & Komárek | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | T |
| Pleurocapsa minor Hansgirg | Cyanobacteria | non-heterocystous | variable | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Pleurocapsa sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Pleurotaenium ehrenbergii (Brébisson ex Ralfs) Delponte | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Prasiola mexicana J.Agardh | Chlorophyta | non-heterocystous | high | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Protoderma viride Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Pseudoanabaena sp. 1 | Cyanobacteria | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Pseudocharaciopsis minuta (A. Braun) Hibberd | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Radiofilum conjunctivum Schmidle | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Rhabdogloea linearis (L.Geitler) J.Komárek | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Rhizoclonium hieroglyphicum (C. Agardh) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | high | high | high | non-reference | |
| Rhodomonas sp. 1 | Cryptophyta | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Rivularia atra Roth ex Bornet & Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Rivularia haematites (DC.) Bornet et Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Rivularia minutula (Kütz.) Bornet et Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | low | NI | NI | NI | NI | |
| Rivulariaceae 1 | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Rivulariaceae 2 | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Scenedesmus abundans (Kirchn.) Chodat | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | high | high | high | NI | non-reference | |
| Scenedesmus aculeolatus Reinsch | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenedesmus acuminatus (Lagerh.) Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | high | NI | NI | NI | NI | T |
| Scenedesmus acutiformis Schröd. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | high | NI | |
| Scenedesmus aff. armatus (R.Chodat) R.Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Scenedesmus aff. communis E. Hegewald | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Scenedesmus aff. pannonicus Hortobágyi | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Scenedesmus apiculatus (W.West et G.S.West) Chodat | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus armatus (R.Chodat) R.Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Scenedesmus bicaudatus (Hansgirg) Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus brasiliensis Bohlin | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | T |
| Scenedesmus brevispina (G.M.Smith) R.Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Scenedesmus circumfusus Hortobágyi | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus communis E. Hegewald | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | high | NI | NI | T |
| Scenedesmus denticulatus Lagerh. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Scenedesmus dimorphus (Turpin) Kütz. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | high | high | high | NI | non-reference | |
| Scenedesmus dispar Bréb. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Scenedesmus ellipticus Corda | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | high | high | high | NI | non-reference | T |
| Scenedesmus flavescens Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus intermedius Chodat | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | high | high | high | NI | NI | |
| Scenedesmus intermedius var. balatonicus Hortobágyi | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Scenedesmus kissii Hortobágyi | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Scenedesmus komarekii Hegewald | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus magnus Meyen | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus microspina Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Scenedesmus obliquus (Turpin) Kütz. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Scenedesmus opoliensis P.G.Richt. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | high | high | NI | NI | NI | T |
| Scenedesmus raciborskii Wołłosz. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | high | high | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scenedesmus semipulcher Hortobágyi | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus smithii Chodat | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Scenedesmus sp. 1 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scenedesmus sp. 2 | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Scenedesmus sp. 3 CF | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Schizothrix arenaria (Berk.) Gomont | Cyanobacteria | non-heterocystous | NA | terrestrial | nonmotile | no | NI | NI | NI | NI | NI | |
| Schizothrix lacustris (A.Braun) Gomont | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Schizothrix sp. 1 | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scytonema bohneri Schmidle | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Scytonema crispum (C.Agardh) Bornet | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Siphononema polonicum (Raciborski) Geitler | Cyanobacteria | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | S |
| Sirodotia huillensis (Welw. ex W. West et G.S. West) Skuja | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Sirodotia sp. 1 | Rhodophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Sphaerobotrys fluviatilis Butcher | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Sphaerocystis planctonica (Korshikov) Bourelly | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Sphaerocystis schroeteri Chodat | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Sphaerocystis sp. 1 | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra aff. varians (Hassall) Kütz. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra borgeana Transeau | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Spirogyra fluviatilis Hilse | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Spirogyra foveolata (Skuja) Czurda | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra longata (Vaucher) Kützing | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra lutetiana Petit | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra majuscula Kütz. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Spirogyra maxima (Hassall) Wittrock | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra parvula (Transeau) Czurda | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | | NI | NI | NI | S |
| Spirogyra scrobiculata (Stockm.) Czurda | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Spirogyra sp 111 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp 222 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp. 1 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Spirogyra sp. 10 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp. 11 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra sp. 12 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | high | NI | NI | NI | |
| Spirogyra sp. 13 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp. 14 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra sp. 2 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Spirogyra sp. 3 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Spirogyra sp. 4 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | high | NI | NI | NI | NI | |
| Spirogyra sp. 5 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp. 6 | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Spirogyra sp. 7 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp. 8 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra sp. 9 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra spreeiana Rabenh. | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Spirogyra teodoresci Transeau | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Spirogyra varians (Hassall) Kütz. | Charophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | T |
| Spirogyra weberi Kütz. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | S |
| Spirogyra zygotes | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Spirulina corakiana Playfair | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | NI | | NI | NI | |
| Spirulina major Kütz. | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | NI | | NI | NI | |
| Spirulina subtilissima Kütz. | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | | | | | | T |
| Spirulina tenerrima Kützing | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | motile | no | | | | | | |
| Staurastrum lapponicum (Schmidle) Grönblad | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Staurastrum orbiculare var. minor G.W.Prescott | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Staurastrum punctulatum Bréb. | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Staurastrum sp. 1 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Stauridium tetras (Ehrenb.) E. Hegewald | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Stigeoclonium basal stage | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Stigeoclonium lubricum (Dillwyn) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | T |
| Stigeoclonium nanum (Dillwyn) Kützing | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Stigeoclonium sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Stigeoclonium subsecundum (Kütz.) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Streptophyta 1 | Chlorophyta | non-heterocystous | | | nonmotile | no | NI | NI | NI | NI | NI | |
| Strombomonas sp. 1 | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | |
| Stylococcus sp. 1 | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Synechococcus ambiguus Skuja | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Synechococcus nidulans (Pringsheim) Komárek | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | | NI | NI | |
| Synechococcus sp. 1 | Cyanobacteria | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Tetraedron caudatum (Corda) Hansg. | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Tetraedron minimum (A. Braun) Hansg. | Chlorophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Tetraspora gelatinosa (Vaucher) Desv. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | S |
| Tetraspora sp. 1 | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Tetrasporidium javanicum K.Möbius | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Tetrastrum komarekii Hindák | Chlorophyta | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | | | | | | |
| Tolypothrix distorta Kütz. ex Bornet et Flahault | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | low | NI | NI | reference | S |
| Tolypothrix tenuis Kützing | Cyanobacteria | heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | S |
| Trachelomonas cylindrica Ehrenberg | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Trachelomonas globularis (Averintsev) Lemmermann | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Trachelomonas hispida (Perty) F.Stein | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | T |
| Trachelomonas oblonga Lemmermann | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | T |
| Trachelomonas sp. 1 | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | NI | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Trachelomonas verrucosa var. irregularis Deflandre | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Trachelomonas volvocina Ehrenberg | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | NI | NI | | NI | NI | T |
| Trachelomonas volvocinopsis Svirenko | Euglenozoa | non-heterocystous | stagnant | tychoplanktonic | motile | yes | | | | | | |
| Tribonema affine (Kütz.) G.S. West | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Tribonema minus (Wille) Hazen | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Tribonema monochloron Pascher & Geitler | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Tribonema utriculosum (Kütz.) Hazen | Ochrophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Tribonema viride Pascher | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | low | low | NI | |
| Tychonema sequanum (Couté) Anagn. et Komárek | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | NI | NI | NI | NI | |
| Tychonema sp. 2 | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | low | NI | low | NI | NI | |
| Tychonema sp. 3 | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | motile | no | NI | high | NI | NI | NI | |
| Ulothrix aequalis Kützing | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | S |
| Ulothrix tenerrima Kütz. | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Ulothrix tenuissima Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Ulothrix zonata (Weber et Mohr) Kütz. | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | low | NI | NI | reference | S |
| Ulva flexuosa Wulfen | Chlorophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | high | NI | NI | non-reference | T |
| Uronema confervicola Lagerh. | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Uronema sp. 1 | Chlorophyta | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Vaucheria cf. undulata C.-C.Jao | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | | NI | NI | |
| Vaucheria frigida (Roth) C.Agardh | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Vaucheria geminata (Vaucher) DC. | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | T |
| Vaucheria pachyderma Walz | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Vaucheria prona T.A.Christensen | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Vaucheria sessilis (Vaucher) DC. | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Vaucheria sp. 1 | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | high | NI | high | NI | |
| Vaucheria sp. 2 | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |
| Vaucheria taylorii Blum | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | NI | NI | NI | NI | NI | |

## Appendix B: Soft algae species attributes

| Species | Taxonomic Group | Heterocystous? | Flow Regime | Habit | Motility | Flagel-lated? | Indicator Class for TP | Indicator Class for DOC | Indicator Class for Cu | Indicator Class for TN | Indicator Class for "reference" | Organic Pollution Tolerance |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Vaucheria terrestris (Vaucher) De Candolle | Ochrophyta | non-heterocystous | moderate | benthic | nonmotile | no | | | | | | |
| Woronichinia elorantae J.Komárek & J.Komárková-Legnerová | Cyanobacteria | non-heterocystous | moderate | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Xanthonema exile (G.A.Klebs) P.C.Silva | Ochrophyta | non-heterocystous | NA | terrestrial | nonmotile | no | NI | NI | | NI | NI | |
| Xenococcus gracilis Lemmermann | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Xenococcus minimus Geitler | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Xenococcus sp. 1 | Cyanobacteria | non-heterocystous | stagnant | benthic | nonmotile | no | | | | | | |
| Zygnema aff. stellinum (Vaucher) C.Agardh | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | S |
| Zygnema aplanosporum Stancheva, J.D. Hall et Sheath | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Zygnema argillarii Kadłubowska | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Zygnema californicum Stancheva, J.D. Hall et Sheath | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Zygnema cylindricum Transeau | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Zygnema sp. 1 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |
| Zygnema sp. 2 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | NI | NI | NI | NI | NI | |
| Zygnema sp. 3 | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | | | | | | |
| Zygnema sterile Transeau | Charophyta | non-heterocystous | stagnant | tychoplanktonic | nonmotile | no | low | NI | NI | NI | NI | |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator[1] classification | TN indicator[1] classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Achnanthes | | | | | | | | benthic | non-motile |
| Achnanthes coarctata (Brébisson ex W. Smith) Grunow in Cleve & Grunow | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Achnanthes inflata (Kützing) Grunow | | | | | | | fresh-brackish | benthic | non-motile |
| Achnanthes saxonica Krasske in Hustedt | | | | | | | | benthic | non-motile |
| Achnanthes sp. A SWAMP EWT | | | | | | | | benthic | non-motile |
| Achnanthes sp. A SWAMP JPK | | | | | | | | benthic | non-motile |
| Achnanthidium | | | | | | | | benthic | non-motile |
| Achnanthidium biasolettianum (Grunow in Cleve & Grunow) Round & Bukhtiyarova | | | mesotrophic | | | | fresh-brackish | benthic | non-motile |
| Achnanthidium deflexum (Reimer) Kingston | | | | | low | low | | benthic | non-motile |
| Achnanthidium exiguum (Grunow) Czarnecki | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Achnanthidium exiguum var. heterovalvum (Krasske) Czarnecki | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Achnanthidium jackii Rabenhorst | | | | | | | | benthic | non-motile |
| Achnanthidium macrocephalum (Hustedt) Round & Bukhtiyarova | | | | | | | | benthic | non-motile |
| Achnanthidium minutissimum (Kützing) Czarnecki | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | non-motile |
| Achnanthidium subhudsonis (Hustedt) H. Kobayasi in Kobayasi et al. | | | | | | | | benthic | non-motile |
| Achnanthidium subsalsum (J.B. Petersen) M. Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector | | | | | | | | benthic | non-motile |
| Adlafia bryophila (J.B. Petersen) G. Moser, H. Lange-Bertalot & D. Metzeltin | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | high | freshwater | benthic | moderately-motile |
| Adlafia minuscula (Grunow) H. Lange-Bertalot in H. Lange-Bertalot & S.I. Genkal | | beta-mesosaprobous | oligotrophic | | low | low | freshwater | benthic | moderately-motile |
| Adlafia minuscula var. muralis (Grunow) H. Lange-Bertalot in H. Lange-Bertalot & S.I. Genkal | >50% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | | | fresh-brackish | benthic | moderately-motile |
| Adlafia suchlandtii (Hustedt) G. Moser, H. Lange-Bertalot & D. Metzeltin | | | | | | | | benthic | moderately-motile |
| Amphipleura | | | | | | | | benthic | moderately-motile |
| Amphipleura pellucida (Kützing) Kützing | >75% DO saturation | alpha-meso/polysaprobous | oligotrophic-mesotrophic | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Amphipleura sp. 1 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Amphipleura sp. A SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphipleura sp. B SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora | | | | | | | | benthic | moderately-motile |
| Amphora copulata (Kützing) Schoeman & Archibald | | | | | | high | | benthic | moderately-motile |
| Amphora inariensis K. Krammer | | | oligotrophic | | | | fresh-brackish | benthic | moderately-motile |
| Amphora ovalis (Kützing) Kützing | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | moderately-motile |
| Amphora pediculus (Kützing) Grunow in Schmidt et al. | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Amphora perpusilla (Grunow in Van Heurck) Grunow in Van Heurck | | | | | | | | benthic | moderately-motile |
| Amphora sp. 1 CAL | | | | | | | | benthic | moderately-motile |
| Amphora sp. 1 EPA JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. 1 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Amphora sp. 1 SCCWRP MCB | | | | | | | | benthic | moderately-motile |
| Amphora sp. 1 SWAMP JPK | | | | | | | | benthic | moderately-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Amphora sp. 2 JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. 2 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Amphora sp. 3 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. 4 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. 5 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. 5 SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. A SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. B SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. C SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. D SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora sp. E SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Amphora stoermerii M. Edlund & Z. Levkov in Z. Levkov | | | | | | | | benthic | moderately-motile |
| Anomoeoneis sphaerophora var. sculpta (Ehrenberg) Otto Müller | | | | | | | brackish | benthic | non-motile |
| Ardissonea cuneata Mills | | | | | | | | benthic | non-motile |
| Astartiella bahusiensis (Grunow in Van Heurck) Witkowski, Lange-Bertalot & Metzeltin in Moser, Lange-Bertalot & Metzeltin | | | | | | | | benthic | non-motile |
| Asterionella formosa Hassall | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | planktonic | non-motile |
| Aulacoseira | | | | | | | | planktonic | non-motile |
| Aulacoseira alpigena (Grunow in Van Heurck) Krammer | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | planktonic | non-motile |
| Aulacoseira ambigua (Grunow in Van Heurck) Simonsen | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | planktonic | non-motile |
| Aulacoseira canadensis (Hustedt) Simonsen | | | | | | | | planktonic | non-motile |
| Aulacoseira crassipunctata K. Krammer | | | | | | | | planktonic | non-motile |
| Aulacoseira crenulata (Ehrenberg) Thwaites | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | planktonic | non-motile |
| Aulacoseira distans (Ehrenberg) Simonsen | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | planktonic | non-motile |
| Aulacoseira granulata (Ehrenberg) Simonsen | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | planktonic | non-motile |
| Aulacoseira italica (Ehrenberg) Simonsen | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | planktonic | non-motile |
| Aulacoseira sp. 2 SCCWRP BSL | | | | | | | | planktonic | non-motile |
| Aulacoseira sp. Coarse SCCWRP JPK | | | | | | | | planktonic | non-motile |
| Aulacoseira subarctica (Müller) Haworth | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | planktonic | non-motile |
| Aulacoseira valida (Grunow in Van Heurck) K. Krammer | | | | | | | | planktonic | non-motile |
| Bacillaria | | | | | | | | benthic | highly-motile |
| Bacillaria paradoxa Gmelin in Linneaeus | >30% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish | benthic | highly-motile |
| Berkeleya | | | | | | | | | |
| Biremis circumtexta (Meister ex Hustedt) H. Lange-Bertalot & A. Witkowski in A. Witkowski, H. Lange-Bertalot & D. Metzeltin | | | | | | | | benthic | moderately-motile |
| Biremis sp. 1 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Brachysira | | | | | | | | benthic | moderately-motile |
| Brachysira aponina Kützing | | | | | | | | benthic | moderately-motile |
| Brachysira brebissonii R. Ross in Hartley | >75% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | moderately-motile |

## Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Brachysira vitrea (Grunow) R. Ross in Hartley | >75% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Caloneis | | | | | | | | benthic | moderately-motile |
| Caloneis alpestris (Grunow) Cleve | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Caloneis amphisbaena (Bory) Cleve | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | brackish-freshwater | benthic | moderately-motile |
| Caloneis bacillum (Grunow) Cleve | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | high | fresh-brackish | benthic | moderately-motile |
| Caloneis branderii (Hustedt) Krammer in Krammer & Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Caloneis clevei (Lagerstedt) Cleve | | | | | | | | benthic | moderately-motile |
| Caloneis hyalina Hustedt | | | | | | | | benthic | moderately-motile |
| Caloneis lauta Carter & Bailey-Watts | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Caloneis macedonica Hustedt | | | | | | high | | benthic | moderately-motile |
| Caloneis schumanniana (Grunow in Van Heurck) Cleve | >75% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Caloneis silicula (Ehrenberg) Cleve | >75% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Caloneis tenuis (Gregory) Krammer in Krammer & Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Campylodiscus | | | | | | | | benthic | highly-motile |
| Campylodiscus clypeus Ehrenberg | | | | | | | | benthic | highly-motile |
| Campylodiscus hibernicus Ehrenberg | | | eutrophic | | | | fresh-brackish | benthic | highly-motile |
| Cavinula cocconeiformis (Gregory ex Greville) Mann & Stickle in Round, Crawford & Mann | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Cavinula jaernefeltii (Hustedt) Mann & Stickle in Round, Crawford & Mann | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Cavinula lapidosa (Krasske) Lange-Bertalot in Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | | low | freshwater | benthic | moderately-motile |
| Cavinula pseudoscutiformis (Hustedt in Schmidt et al.) Mann & Stickle in Round, Crawford & Mann | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Centric sp. 1 SCCWRP BSL | | | | | | | | | non-motile |
| Centric sp. 2 SCCWRP BSL | | | | | | | | | non-motile |
| Chamaepinnularia bremensis (Hustedt) Lange-Bertalot in Lange-Bertalot & Metzeltin | | | | | | | | benthic | moderately-motile |
| Chamaepinnularia mediocris (Krasske) Lange-Bertalot in Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | moderately-motile |
| Chamaepinnularia soehrensis var. hassica (Krasske) Lange-Bertalot in Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Chamaepinnularia soehrensis var. muscicola (Petersen) Lange-Bertalot & Krammer in Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Cocconeis disculus (Schumann) Cleve | | oligosaprobous | | | | | brackish-freshwater | benthic | non-motile |
| Cocconeis neodiminuta Krammer | | | | | | | fresh-brackish | benthic | non-motile |
| Cocconeis pediculus Ehrenberg | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | brackish-freshwater | benthic | non-motile |
| Cocconeis placentula Ehrenberg | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Cocconeis placentula var. euglypta (Ehrenberg) Grunow | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Cocconeis placentula var. lineata (Ehrenberg) Van Heurck | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Cocconeis pseudolineata (Geitler) Lange-Bertalot in Werum & Lange-Bertalot | | | | | high | | | benthic | non-motile |
| Cocconeis scutellum Ehrenberg | | | | | | | | benthic | non-motile |
| Cocconeis sp. A SWAMP BSL | | | | | | | | benthic | non-motile |
| Coscinodiscus | | | | | | | | planktonic | non-motile |
| Craticula accomoda (Hustedt) Mann in Round, Crawford & Mann | about 10% DO saturation or less | polysaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | moderately-motile |
| Craticula cuspidata (Kützing) Mann in Round, Crawford & Mann | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Craticula halophila (Grunow ex Van Heurck) Mann in Round, Crawford & Mann | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish | benthic | moderately-motile |
| Craticula minusculoides (Hustedt) Lange-Bertalot | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | | | fresh-brackish | benthic | moderately-motile |
| Cyclostephanos dubius (Fricke) Round | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | planktonic | non-motile |
| Cyclostephanos invisitatus (Hohn & Hellerman) Theriot, Stoermer & Håkansson | | | | | high | high | | planktonic | non-motile |
| Cyclostephanos tholiformis Stoermer, Hakansson & Theriot | | | | | | high | | planktonic | non-motile |
| Cyclotella atomus Hustedt | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | planktonic | non-motile |
| Cyclotella comensis Grunow in Van Heurck | | | | | | | fresh-brackish | planktonic | non-motile |
| Cyclotella gamma Sovereign | | | | | | | | planktonic | non-motile |
| Cyclotella meneghiniana Kützing | about 10% DO saturation or less | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | brackish-freshwater | planktonic | non-motile |
| Cyclotella ocellata Pantocsek | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | freshwater | planktonic | non-motile |
| Cyclotella operculata (Agardh) Kützing | | | | | | | | planktonic | non-motile |
| Cylindrotheca gracilis (Brébisson in Kützing) Grunow in Van Heurck | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | | | | brackish | benthic | highly-motile |
| Cymatopleura elliptica (Brébisson ex Kützing) W. Smith | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | highly-motile |
| Cymatopleura solea (Brébisson in Brébisson & Godey) W. Smith | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | highly-motile |
| Cymbella | | | | | | | | benthic | non-motile |
| Cymbella affinis Kützing | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Cymbella aspera (Ehrenberg) Cleve | nearly 100% DO saturation | oligosaprobous | indifferent | N-autotrophic-low organic N | | | fresh-brackish | benthic | non-motile |
| Cymbella austriaca var. erdobenyiana (Pantocsek) Krammer in Krammer & Lange-Bertalot | | | | | | | | benthic | non-motile |
| Cymbella cistula (Hemprich in Hemprich & Ehrenberg) Kirchner | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Cymbella gracilis (Ehrenberg) Kützing | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Cymbella helvetica Kützing | nearly 100% DO | oligosaprobous | mesotrophic | N-autotrophic-low | | | fresh-brackish | benthic | non-motile |

## Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Cymbella janischii (Schmidt in Schmidt et al.) Cleve | | | | | | | | benthic | non-motile |
| Cymbella laevis Nägeli in Kützing | | | | | low | low | | benthic | non-motile |
| Cymbella lata Grunow ex Cleve | | | | | | | fresh-brackish | benthic | non-motile |
| Cymbella leptoceras (Ehrenberg) Kützing | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Cymbella mexicana (Ehrenberg) Cleve | | | | | low | | | benthic | moderately-motile |
| Cymbella proxima Reimer in Patrick & Reimer | | | mesotrophic | | | | freshwater | benthic | non-motile |
| Cymbella sp. 1 SCCWRP JPK | | | | | | | | benthic | non-motile |
| Cymbella sp. 3 SCCWRP JPK | | | | | | | | benthic | non-motile |
| Cymbella tumida (Brébisson ex Kützing) Van Heurck | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Cymbella turgidula Grunow in Schmidt et al. | | | | | | | | benthic | non-motile |
| Cymbellafalsa diluviana (Krasske) Lange-Bertalot & Metzeltin in Metzeltin, Lange-Bertalot & Nergui | | | | | | | | benthic | non-motile |
| Cymbopleura amphicephala (Näegeli) Krammer | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Cymbopleura budayana (Pantocsek) K. Krammer | | | | | | | | benthic | non-motile |
| Cymbopleura citrus (Carter & Bailey-Watts) K. Krammer | | | | | | | | benthic | non-motile |
| Cymbopleura cuspidata (Kützing) K. Krammer | | oligosaprobous | | | low | | fresh-brackish | benthic | non-motile |
| Cymbopleura hauckii (Van Heurck) K. Krammer | | | | | | | | benthic | non-motile |
| Cymbopleura hustedtii (Krasske) E. Novelo, R. Tavera & C. Ibarra | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Cymbopleura incerta (Grunow) K. Krammer | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Cymbopleura lapponica (Grunow) Krammer | | | oligotrophic | | | | freshwater | benthic | non-motile |
| Cymbopleura naviculiformis (Auerswald ex Heiberg) K. Krammer | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | low | fresh-brackish | benthic | non-motile |
| Cymbopleura naviculiformis (Auerswald ex Heiberg) K. Krammer | | | | | | | | benthic | non-motile |
| Delicata delicatula (Kützing) K. Krammer | | | | | | | | benthic | non-motile |
| Delicata sp. 1 SWAMP JPK | | | | | | | | benthic | non-motile |
| Denticula | | | | | | | | benthic | moderately-motile |
| Denticula kuetzingii Grunow | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | moderately-motile |
| Denticula subtilis Grunow | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | | | brackish-freshwater | benthic | moderately-motile |
| Denticula tenuis Kützing | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | moderately-motile |
| Denticula thermalis Kützing | | | | | | | | benthic | moderately-motile |
| Diadesmis | | | | | | | | benthic | moderately-motile |
| Diadesmis confervacea Kützing | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | brackish-freshwater | benthic | moderately-motile |
| Diadesmis contenta (Grunow ex Van Heurck) Mann in Round, Crawford & Mann | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Diadesmis gallica W. Smith | | | | | | | | benthic | moderately-motile |
| Diadesmis perpusilla (Grunow) Mann in Round, Crawford & Mann | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Diatoma anceps (Ehrenberg) Kirchner | | | | | | | | benthic | non-motile |
| Diatoma anceps var. linearis M. Peragallo in Tempère & Peragallo | | | | | | | | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Diatoma hiemale (Lyngbye) Heiberg | | | | | | | | benthic | non-motile |
| Diatoma mesodon Kützing | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Diatoma moniliforme Kützing in litt., Kützing | | | | | | | | benthic | non-motile |
| Diatoma sp. 1 SWAMP JPK | | | | | | | | benthic | non-motile |
| Diatoma tenuis Agardh | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | non-motile |
| Diatoma vulgaris Bory | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Diatoma vulgaris var. linearis Grunow in Van Heurck | | | | | | | | benthic | non-motile |
| Diatomella balfouriana Greville | | | | | | | | benthic | non-motile |
| Didymosphenia geminata (Lyngbye) M. Schmidt in Schmidt et al. | | | | | low | low | | benthic | non-motile |
| Diploneis | | | | | | | | benthic | moderately-motile |
| Diploneis aestuari Hustedt | | | | | | | | benthic | moderately-motile |
| Diploneis elliptica (Kützing) Cleve | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Diploneis marginestriata Hustedt | | oligosaprobous | | | | | freshwater | benthic | moderately-motile |
| Diploneis oblongella (Naegeli in Kutzing) Cleve-Euler in Cleve-Euler | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Diploneis ovalis (Hilse in Rabenhorst) Cleve | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Diploneis parma Cleve | | | | | low | low | | benthic | moderately-motile |
| Diploneis pseudovalis Hustedt | | | | | low | | | benthic | moderately-motile |
| Diploneis puella (Schumann) Cleve | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | high | | fresh-brackish | benthic | moderately-motile |
| Diploneis smithii (Brébisson in W. Smith) Cleve | | | | | | | | benthic | moderately-motile |
| Diploneis sp. 1 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Diploneis sp. 2 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Diploneis sp. 6 SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Diploneis sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Diploneis sp. A SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Diploneis sp. B SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Diploneis subovalis Cleve | | | | | | | | benthic | moderately-motile |
| Discostella pseudostelligera (Hustedt) Houk & Klee | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | planktonic | non-motile |
| Discostella stelligera (Cleve & Grunow) Houk & Klee | | | | | high | high | fresh-brackish | planktonic | non-motile |
| Ellerbeckia arenaria (Moore ex Ralfs) Crawford | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Encyonema | | | | | | | | benthic | moderately-motile |
| Encyonema auerswaldii Rabenhorst | | | | | low | low | | benthic | moderately-motile |
| Encyonema caespitosum Kützing | | alpha-mesosaprobous | indifferent | | low | low | fresh-brackish | benthic | moderately-motile |
| Encyonema elginense (Krammer) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Encyonema hebridicum (Gregory) Grunow in Cleve & Moller | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Encyonema hilliardii (Manguin) Krammer | | | | | | | | benthic | moderately-motile |
| Encyonema mesianum (Cholnoky) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Encyonema minutum (Hilse in Rabenhorst) Mann in Round, Crawford & Mann | | | | | low | low | fresh-brackish | benthic | moderately-motile |
| Encyonema muelleri (Hustedt) Mann in Round, Crawford & Mann | | | | | low | low | | benthic | moderately-motile |
| Encyonema norvegicum (Grunow) Mayer | nearly 100% DO | oligosaprobous | oligotrophic | N-autotrophic-low | | | freshwater | benthic | moderately-motile |

## Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Encyonema obscurum (Krasske) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Encyonema prostratum (Berkeley) Kützing | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | moderately-motile |
| Encyonema silesiacum (Bleisch in Rabenhorst) Mann in Round, Crawford & Mann | >50% DO saturation | alpha-mesosaprobous | indifferent | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Encyonopsis cesatii (Rabenhorst) Krammer | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Encyonopsis falaisensis (Grunow) Krammer | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Encyonopsis microcephala (Grunow) Krammer | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Entomoneis | | | | | | | | benthic | highly-motile |
| Entomoneis alata Ehrenberg | | | | | | | | benthic | highly-motile |
| Entomoneis paludosa (W. Smith) Reimer in Patrick & Reimer | | oligosaprobous | | | | | brackish-freshwater | benthic | highly-motile |
| Entomoneis sp. A SWAMP JPK | | | | | | | | benthic | highly-motile |
| Eolimna minima (Grunow) Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Eolimna subadnata (Hustedt) G. Moser, H. Lange-Bertalot & D. Metzeltin | | | | | | | | benthic | moderately-motile |
| Eolimna subminuscula (Manguin) Moser, Lange-Bertalot & Metzeltin | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | moderately-motile |
| Eolimna tantula (Hustedt) H. Lange-Bertalot in Werum & Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Epithemia | | | | | | | | benthic | moderately-motile |
| Epithemia adnata (Kützing) Brébisson | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Epithemia adnata var. proboscidea (Kützing) Patrick in Patrick & Reimer | | | | | | | | benthic | moderately-motile |
| Epithemia argus (Ehrenberg) Kützing | | oligosaprobous | mesotrophic | | | | fresh-brackish | benthic | moderately-motile |
| Epithemia frickei Krammer in Lange-Bertalot & Krammer | | | | | | | fresh-brackish | benthic | moderately-motile |
| Epithemia hyndmanii W. Smith | | | | | | | | benthic | moderately-motile |
| Epithemia sorex Kützing | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Epithemia turgida (Ehrenberg) Kützing | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Epithemia turgida var. granulata (Ehrenberg) Brun | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Epithemia turgida var. westermannii (Ehrenberg) Grunow | | | | | low | low | | benthic | moderately-motile |
| Eucocconeis flexella (Kützing) Cleve | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | | freshwater | benthic | non-motile |
| Eucocconeis laevis (Østrup) H. Lange-Bertalot in H. Lange-Bertalot & S.I. Genkal in H. Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Eunotia | | | | | | | | benthic | non-motile |
| Eunotia arcus Ehrenberg | | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Eunotia bilunaris (Ehrenberg) Schaarschmidt | >75% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Eunotia circumborealis Lange-Bertalot & Nörpel in Lange-Bertalot | | | | | | | freshwater | benthic | non-motile |
| Eunotia cristagalli Cleve | | | | | | | | benthic | non-motile |
| Eunotia flexuosa (Brébisson in Kützing) Kützing | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Eunotia implicata Norpel, Alles & Lange-Bertalot in Alles, Norpel & Lange-Bertalot | | | | | low | low | freshwater | benthic | non-motile |
| Eunotia incisa Smith ex Gregory | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Eunotia intermedia (Krasske ex Hustedt) Nörpel & Lange-Bertalot in Lange-Bertalot | | | oligotrophic | | | | freshwater | benthic | non-motile |
| Eunotia minor (Kützing) Grunow in Van Heurck | | oligosaprobous | | | | | freshwater | benthic | non-motile |
| Eunotia muscicola Krasske | | | | | | | | benthic | non-motile |
| Eunotia muscicola var. tridentula Nörpel & Lange-Bertalot in Lange-Bertalot | | | | | | | | benthic | non-motile |
| Eunotia pectinalis (Kützing) Rabenhorst | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-high organic N | low | low | freshwater | benthic | non-motile |
| Eunotia praerupta Ehrenberg | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | low | freshwater | benthic | non-motile |
| Eunotia quaternaria Ehrenberg | | | | | | | | benthic | non-motile |
| Eunotia subarcuatoides Alles, Norpel & Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Fallacia | | | | | | | | benthic | moderately-motile |
| Fallacia cryptolyra (Brockmann) Stickle & Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Fallacia helensis (Schulz) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Fallacia litoricola (Hustedt) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Fallacia lucinensis (Hustedt) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Fallacia maceria (Schimanski) Lange-Bertalot in Lange-Bertalot & Metzeltin | | | | | | | | benthic | moderately-motile |
| Fallacia monoculata (Hustedt) Mann in Round, Crawford & Mann | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | | high | fresh-brackish | benthic | moderately-motile |
| Fallacia pulchella Sabbe & Muylaert in Sabbe, Vyverman & Muylaert | | | | | | | | benthic | moderately-motile |
| Fallacia pygmaea (Kützing) Stickle & Mann in Round, Crawford & Mann | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | brackish-freshwater | benthic | moderately-motile |
| Fallacia sp. A SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Fallacia subforcipata (Hustedt) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Fallacia sublucidula (Hustedt) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Fallacia tenera (Hustedt) Mann in Round, Crawford & Mann | | | | | high | | | benthic | moderately-motile |
| Fistulifera pelliculosa (Brébisson) Lange-Bertalot | | | oligotrophic-mesotrophic | | low | low | fresh-brackish | benthic | non-motile |
| Fistulifera saprophila (Lange-Bertalot & Bonik) Lange-Bertalot | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | fresh-brackish | benthic | non-motile |
| Fragilaria | | | | | | | | benthic | non-motile |
| Fragilaria capucina Desmazières | | beta-mesosaprobous | mesotrophic | | | | fresh-brackish | benthic | non-motile |
| Fragilaria capucina var. gracilis (Østrup) Hustedt | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Fragilaria construens f. gracilis Rabenhorst | | | | | | | | benthic | non-motile |
| Fragilaria crotonensis Kitton | >75% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-high organic N | low | high | fresh-brackish | planktonic | non-motile |
| Fragilaria mesolepta Rabenhorst | | | | | | | fresh-brackish | benthic | non-motile |
| Fragilaria neoproducta Lange-Bertalot in Krammer & Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Fragilaria sp. 2 SCCWRP BSL | | | | | | | | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Fragilaria tenera (W. Smith) Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | | freshwater | benthic | non-motile |
| Fragilaria vaucheriae (Kützing) Petersen | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | low | fresh-brackish | benthic | non-motile |
| Fragilaria vaucheriae var. capitellata (Grunow in Van Heurck) Ross | | | | | | | | benthic | non-motile |
| Fragilariforma virescens (Ralfs) Williams & Round | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Frustulia | | | | | | | | benthic | moderately-motile |
| Frustulia amphipleuroides (Grunow in Cleve & Grunow) Cleve-Euler | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Frustulia crassinervia (Brébisson) Lange-Bertalot & Krammer in Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | low | freshwater | benthic | moderately-motile |
| Frustulia creuzburgensis (Krasske) Hustedt | | | | | | | | benthic | moderately-motile |
| Frustulia krammeri Lange-Bertalot & Metzeltin in Metzeltin & Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | moderately-motile |
| Frustulia vulgaris (Thwaites) De Toni | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | moderately-motile |
| Geissleria | | | | | | | | benthic | moderately-motile |
| Geissleria acceptata (Hustedt) Lange-Bertalot & Metzeltin | nearly 100% DO saturation | beta-mesosaprobous | | | | high | freshwater | benthic | moderately-motile |
| Geissleria decussis (Østrup) Lange-Bertalot & Metzeltin | | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | high | fresh-brackish | benthic | moderately-motile |
| Geissleria ignota (Krasske) Lange-Bertalot & Metzeltin | | | | | | | | benthic | moderately-motile |
| Geissleria paludosa (Hustedt) Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Geissleria schoenfeldii (Hustedt) Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | moderately-motile |
| Gomphoneis | | | | | | | | benthic | non-motile |
| Gomphoneis eriense (Grunow) Skvortzow & Meyer | | | | | low | low | | benthic | non-motile |
| Gomphoneis eriense var. variabilis Kociolek & Stoermer | | | | | | | | benthic | non-motile |
| Gomphoneis geitleri Kociolek & Stoermer | | | | | | | | benthic | non-motile |
| Gomphoneis herculeana var. septiceps M. Schmidt in Schmidt et al. | | | | | | | | benthic | non-motile |
| Gomphoneis mamilla (Ehrenberg) Cleve | | | | | | | | benthic | non-motile |
| Gomphoneis minuta (Stone) Kociolek & Stoermer | | beta-mesosaprobous | eutrophic | | low | low | fresh-brackish | benthic | non-motile |
| Gomphoneis olivaceoides (Hustedt) Carter in Carter & Bailey-Watts | | | | | | | | benthic | non-motile |
| Gomphoneis olivaceum (Hornemann) Dawson ex Ross & Sims | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Gomphoneis rhombica (Fricke) Merino, García, Hernández-Mariné & Fernández | | | | | | | | benthic | non-motile |
| Gomphoneis sp. A SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema | | | | | | | | benthic | non-motile |
| Gomphonema acuminatum Ehrenberg | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-low organic N | | low | fresh-brackish | benthic | non-motile |
| Gomphonema affine Kützing | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Gomphonema amoenum Lange-Bertalot in Krammer & Lange-Bertalot | | | | | | | | benthic | non-motile |
| Gomphonema angustatum (Kützing) Rabenhorst | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | high | high | fresh-brackish | benthic | non-motile |
| Gomphonema augur Ehrenberg | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | non-motile |

[Type text]

## Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Gomphonema brebissonii Kützing | | | | | | | | benthic | non-motile |
| Gomphonema clavatum Ehrenberg | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Gomphonema clevei Fricke in Schmidt et al. | | | | | | | | benthic | non-motile |
| Gomphonema commutatum Grunow in Van Heurck | | | | | | | | benthic | non-motile |
| Gomphonema contraturris Lange-Bertalot & Reichardt in Lange-Bertalot | | | | | | | | benthic | non-motile |
| Gomphonema entolejum Østrup | | | | | | | | benthic | non-motile |
| Gomphonema exilissimum (Grunow) Lange-Bertalot & Reichardt in Lange-Bertalot & Metzeltin | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Gomphonema freesei Lowe & Kociolek | | | | | | | | benthic | non-motile |
| Gomphonema gracile Ehrenberg | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Gomphonema insigne Gregory | | | | | high | high | fresh-brackish | benthic | non-motile |
| Gomphonema intricatum Kützing | | | | | low | low | | benthic | non-motile |
| Gomphonema kobayasii Kociolek & Kingston | | | | | | high | | benthic | non-motile |
| Gomphonema lagenula Kützing | | | | | | | | benthic | non-motile |
| Gomphonema mexicanum Grunow in Van Heurck | | | | | low | low | | benthic | non-motile |
| Gomphonema micropumilum Reichardt | | | | | | | | benthic | non-motile |
| Gomphonema micropus Kützing | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Gomphonema minutum (Agardh) Agardh | | beta-mesosaprobous | eutrophic | | | high | fresh-brackish | benthic | non-motile |
| Gomphonema montanum (Schumann) Grunow in Schneider | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Gomphonema parvulum (Kützing) Kützing | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | fresh-brackish | benthic | non-motile |
| Gomphonema procerum Reichardt & Lange-Bertalot | | | | | | | | benthic | non-motile |
| Gomphonema pseudoaugur Lange-Bertalot | | alpha-mesosaprobous | eutrophic | | | | fresh-brackish | benthic | non-motile |
| Gomphonema pumilum (Grunow) Reichardt & Lange-Bertalot | | | indifferent | | low | low | fresh-brackish | benthic | non-motile |
| Gomphonema sarcophagus Gregory | | beta-mesosaprobous | mesotrophic | | low | | fresh-brackish | benthic | non-motile |
| Gomphonema sp. 1 SCCWRP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. 10 SCCWRP BSL | | | | | | | | benthic | non-motile |
| Gomphonema sp. 10 SWAMP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. 15 SWAMP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. 3 SCCWRP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. 4 SCCWRP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. 76 SWAMP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. 9 SWAMP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. A SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. B SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. B SWAMP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. C SWAMP JPK | | | | | | | | benthic | non-motile |
| Gomphonema sp. D SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. E SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. F SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. G SWAMP BSL | | | | | | | | benthic | non-motile |
| Gomphonema sp. G SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphonema sp. H SWAMP BSL | | | | | | | | benthic | non-motile |
| Gomphonema sp. H SWAMP EWT | | | | | | | | benthic | non-motile |

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Gomphonema sp. I SWAMP BSL | | | | | | | | benthic | non-motile |
| Gomphonema sp. J SWAMP BSL | | | | | | | | benthic | non-motile |
| Gomphonema sphaerophorum Ehrenberg | | | | | low | low | | benthic | non-motile |
| Gomphonema subclavatum (Grunow in Van Heurck) Grunow | nearly 100% DO saturation | beta-mesosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | non-motile |
| Gomphonema subtile Ehrenberg | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Gomphonema truncatum Ehrenberg | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | non-motile |
| Gomphonema truncatum var. elongata (Peragallo & Héribaud) Patrick in Patrick & Reimer | | | | | | | | benthic | non-motile |
| Gomphosphenia sp. 9 JPK | | | | | | | | benthic | non-motile |
| Gomphosphenia sp. A SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphosphenia sp. B SWAMP EWT | | | | | | | | benthic | non-motile |
| Gomphosphenia sp. C SWAMP EWT | | | | | | | | benthic | non-motile |
| Gyrosigma | | | | | | | | benthic | highly-motile |
| Gyrosigma acuminatum (Kützing) Rabenhorst | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | fresh-brackish | benthic | highly-motile |
| Gyrosigma attenuatum (Kützing) Rabenhorst | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Gyrosigma nodiferum (Grunow) Reimer | | | | | | | | benthic | highly-motile |
| Gyrosigma obtusatum (Sullivant) Boyer | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Gyrosigma sp. 1 SCCWRP JPK | | | | | | | | benthic | highly-motile |
| Gyrosigma spencerii (Smith) Griffith & Henfrey | | | | | | | | benthic | highly-motile |
| Halamphora acutiuscula (Kützing) Z. Levkov | | | | | high | | | benthic | moderately-motile |
| Halamphora coffeaeformis (Agardh) Z. Levkov | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Halamphora holsatica (Hustedt) Z. Levkov | | | | | | | | benthic | moderately-motile |
| Halamphora montana (Krasske) Z. Levkov | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Halamphora normanii (Rabenhorst) Z. Levkov | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Halamphora thumensis (A. Mayer) Z. Levkov | | | | | | | | benthic | moderately-motile |
| Halamphora veneta (Kützing) Z. Levkov | >50% DO saturation | alpha-meso/polysaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | benthic | moderately-motile |
| Hannaea arcus (Ehrenberg) Patrick | nearly 100% DO saturation | beta-mesosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Hantzschia | | | | | | | | benthic | highly-motile |
| Hantzschia amphioxys (Ehrenberg) Grunow in Cleve & Grunow | >75% DO saturation | alpha-mesosaprobous | indifferent | N-autotrophic-high organic N | high | | fresh-brackish | benthic | highly-motile |
| Hantzschia sp. 1 SCCWRP MCB | | | | | | | | benthic | highly-motile |
| Hippodonta | | | | | | | | benthic | moderately-motile |
| Hippodonta capitata (Ehrenberg) Lange-Bertalot, Metzeltin & Witkowski | >50% DO saturation | alpha-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Hippodonta costulata (Grunow) Lange-Bertalot, Metzeltin & Witkowski | | beta-mesosaprobous | | | | | fresh-brackish | benthic | moderately-motile |
| Hippodonta hungarica (Grunow) Lange-Bertalot, Metzeltin & Witkowski | >50% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Hippodonta sp. 1 SCCWRP JPK | | | | | | | | benthic | moderately-motile |

## Appendix C: Diatom species attributes



| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Karayevia amoena (Hustedt) Bukhtiyarova | | | | | | | brackish | benthic | non-motile |
| Karayevia bottnica (Cleve) Lange-Bertalot in Krammer & Lange-Bertalot | | | | | | | | benthic | non-motile |
| Karayevia clevei (Grunow in Cleve & Grunow) Round & Bukhtiyarova | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | non-motile |
| Karayevia laterostrata (Hustedt) Bukhtiyarova | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Karayevia nitidiformis (Lange-Bertalot) Bukhtiyarova | | | | | | | | benthic | non-motile |
| Karayevia oblongella (Østrup) Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector | | | | | | | | benthic | non-motile |
| Karayevia suchlandtii (Hustedt) Bukhtiyarova | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | non-motile |
| Kolbesia gessneri (Hustedt) Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector | | | | | | | | benthic | non-motile |
| Lemnicola hungarica (Grunow) Round & Basson | >30% DO saturation | alpha-mesosaprobous | polytrophic (hypereutrophic) | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Luticola | | | | | | | | benthic | moderately-motile |
| Luticola cohnii (Hilse) Bukhtiyarova | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | moderately-motile |
| Luticola goeppertiana (Bleisch in Rabenhorst) Mann in Round, Crawford & Mann | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | fresh-brackish | benthic | moderately-motile |
| Luticola mutica (Kützing) Mann in Round, Crawford & Mann | nearly 100% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | brackish-freshwater | benthic | moderately-motile |
| Luticola mutica var. ventricosa (Kützing) Hamilton in Hamilton et al. | | | | | | | | benthic | moderately-motile |
| Luticola muticopsis (Van Heurck) Mann in Round, Crawford & Mann | | | | | | | | benthic | moderately-motile |
| Luticola nivalis (Ehrenberg) Mann in Round, Crawford & Mann | | beta-mesosaprobous | eutrophic | | | | brackish-freshwater | benthic | moderately-motile |
| Luticola sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Martyana martyi (Héribaud) Round in Round, Crawford & Mann | | | | | | | | benthic | non-motile |
| Mastogloia | | | | | | | | benthic | moderately-motile |
| Mastogloia elliptica (Agardh) Cleve in Schmidt et al. | | | | | low | low | brackish | benthic | moderately-motile |
| Mastogloia grevillei W. Smith in Gregory | | | eutrophic | | | | fresh-brackish | benthic | moderately-motile |
| Mastogloia smithii Thwaites in lit. ex W. Smith | | beta-mesosaprobous | | | low | low | brackish | benthic | moderately-motile |
| Mayamaea agrestis (Hustedt) Lange-Bertalot | | | | | high | high | fresh-brackish | benthic | moderately-motile |
| Mayamaea atomus (Kützing) Lange-Bertalot | >75% DO saturation | alpha-meso/polysaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | moderately-motile |
| Mayamaea fossalis (Krasske) Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Mayamaea fossalis var. obsidialis (Hustedt) Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Mayamaea muraliformis (Hustedt) Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Melosira | | | | | | | | benthic | non-motile |
| Melosira varians Agardh | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | | high | fresh-brackish | benthic | non-motile |
| Meridion circulare (Greville) Agardh | >75% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Meridion circulare var. constrictum (Ralfs) Van Heurck | >75% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | | high | fresh-brackish | benthic | non-motile |
| Microcostatus krasskei (Hustedt) Johansen & Sray | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |

# Appendix C: Diatom species attributes



| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Muelleria terrestris (Petersen) Spaulding & Stoermer | | | | | | | | benthic | highly-motile |
| Navicula | | | | | | | | benthic | moderately-motile |
| Navicula absoluta Hustedt | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Navicula angusta Grunow | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Navicula arenaria Donkin | | | | | | | | benthic | moderately-motile |
| Navicula arvensis Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula aurora Sovereign | | | | | | | | benthic | moderately-motile |
| Navicula capitatoradiata Germain | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Navicula cari Ehrenberg | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-low organic N | | high | fresh-brackish | benthic | moderately-motile |
| Navicula cincta (Ehrenberg) Ralfs in Pritchard | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | fresh-brackish | benthic | moderately-motile |
| Navicula concentrica Carter & Bailey-Watts | | | oligotrophic | | | | freshwater | benthic | moderately-motile |
| Navicula convexa W. Smith | | | | | | | | benthic | moderately-motile |
| Navicula cryptocephala Kützing | >50% DO saturation | alpha-mesosaprobous | indifferent | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Navicula cryptotenella Lange-Bertalot in Krammer & Lange-Bertalot | | beta-mesosaprobous | indifferent | | high | high | fresh-brackish | benthic | moderately-motile |
| Navicula cryptotenelloides Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Navicula detenta Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula difficillima Hustedt | nearly 100% DO saturation | | oligotrophic-mesotrophic | | | | freshwater | benthic | moderately-motile |
| Navicula digitoradiata (Gregory) Ralfs in Pritchard | | | | | | | | benthic | moderately-motile |
| Navicula duerrenbergiana Hustedt in Schmidt et al. | | | | | low | low | | benthic | moderately-motile |
| Navicula eidrigiana Carter | | | | | | | | benthic | moderately-motile |
| Navicula elginensis var. cuneata (M. Moller ex Foged) Lange-Bertalot in Krammer & Lange-Bertalot | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Navicula erifuga Lange-Bertalot in Krammer & Lange-Bertalot | | | eutrophic | | high | high | brackish-freshwater | benthic | moderately-motile |
| Navicula gerloffii Schimanski | | | | | | | | benthic | moderately-motile |
| Navicula gottlandica Grunow in Van Heurck | | | | | | | | benthic | moderately-motile |
| Navicula gregaria Donkin | >30% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | benthic | moderately-motile |
| Navicula harderi Hustedt in Brendemuhl | | | | | | high | freshwater | benthic | moderately-motile |
| Navicula hasta Pantocsek | | | | | | low | | benthic | moderately-motile |
| Navicula incertata Lange-Bertalot in Krammer & Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Navicula ingenua Hustedt | | | | | high | high | | benthic | moderately-motile |
| Navicula kotschyi Grunow | nearly 100% DO saturation | oligosaprobous | | | | | fresh-brackish | benthic | moderately-motile |
| Navicula lanceolata (Agardh) Kützing | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | benthic | moderately-motile |
| Navicula leptostriata Jørgensen | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Navicula libonensis Schoeman | | | | | | | | benthic | moderately-motile |
| Navicula limata Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula longa (Gregory) Ralfs in Pritchard | | | | | | | | benthic | moderately-motile |
| Navicula margalithii Lange-Bertalot in Krammer & Lange-Bertalot | | | | | | | fresh-brackish | benthic | moderately-motile |

# Appendix C: Diatom species attributes



| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Navicula medioconvexa Hustedt | | | | | high | high | freshwater | benthic | moderately-motile |
| Navicula menisculus Schumann | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | moderately-motile |
| Navicula meniscus Schumann | | | eutrophic | | | | brackish-freshwater | benthic | moderately-motile |
| Navicula modica Hustedt | | oligosaprobous | | | | | freshwater | benthic | moderately-motile |
| Navicula normaloides Cholnoky | | | | | | | | benthic | moderately-motile |
| Navicula oblonga (Kützing) Kützing | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Navicula oppugnata Hustedt | | oligosaprobous | | | | | fresh-brackish | benthic | moderately-motile |
| Navicula peregrina (Ehrenberg) Kützing | | | eutrophic | | high | high | brackish | benthic | moderately-motile |
| Navicula perminuta Grunow in Van Heurck | | | | | low | low | | benthic | moderately-motile |
| Navicula phyllepta Kützing | | | | | | | | benthic | moderately-motile |
| Navicula phylleptosoma H. Lange-Bertalot in H. Lange-Bertalot & S.I. Genkal | | | | | | | | benthic | moderately-motile |
| Navicula pseudoarvensis Hustedt | | | | | | | fresh-brackish | benthic | moderately-motile |
| Navicula pseudolanceolata Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Navicula pseudoventralis Hustedt in Schmidt et al. | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | high | fresh-brackish | benthic | moderately-motile |
| Navicula radiosa Kützing | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Navicula radiosa var. tenella (Brébisson ex Kützing) Van Heurck | | | | | | | | benthic | moderately-motile |
| Navicula recens (Lange-Bertalot) Lange-Bertalot in Krammer & Lange-Bertalot | | alpha-mesosaprobous | eutrophic | | high | high | brackish-freshwater | benthic | moderately-motile |
| Navicula reinhardtii (Grunow) Grunow | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Navicula rhynchocephala Kützing | >30% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | low | | fresh-brackish | benthic | moderately-motile |
| Navicula rostellata Kützing | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Navicula salinarum Grunow | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish | benthic | moderately-motile |
| Navicula salinicola Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula schadei Krasske | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Navicula schmassmanni Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula schroeteri Meister | nearly 100% DO saturation | beta-mesosaprobous | eutrophic | | | | brackish-freshwater | benthic | moderately-motile |
| Navicula sp. 1 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 1 SCCWRP MCB | | | | | | | | benthic | moderately-motile |
| Navicula sp. 10 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 11 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 15 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 16 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 2 SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 200 JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 201 JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 22 EPA EWT | | | | | | | | benthic | moderately-motile |
| Navicula sp. 3 SCCWRP BSL | | | | | | | | benthic | moderately-motile |

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Navicula sp. 3 SCCWRP MCB | | | | | | | | benthic | moderately-motile |
| Navicula sp. 3 SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 4 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 4 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 5 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 5 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 6 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 6 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. 8 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. 9 SCCWRP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. A SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Navicula sp. A SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. B SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. B SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Navicula sp. B SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. C SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. C SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Navicula sp. D SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. D SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Navicula sp. D SWAMP JPK | | | | | | | | benthic | moderately-motile |
| Navicula sp. E SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Navicula sp. E SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Navicula splendicula VanLandingham | | | | | | | | benthic | moderately-motile |
| Navicula stankovici Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula striolata (Grunow) Lange-Bertalot in Krammer & Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Navicula subinflatoides Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula submuralis Hustedt | | | | | | high | | benthic | moderately-motile |
| Navicula subrhynchocephala Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula subrotundata Hustedt | | oligosaprobous | | | | | fresh-brackish | benthic | moderately-motile |
| Navicula tenelloides Hustedt | nearly 100% DO saturation | oligosaprobous | eutrophic | N-autotrophic-low organic N | high | | fresh-brackish | benthic | moderately-motile |
| Navicula tripunctata (Müller) Bory | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Navicula trivialis Lange-Bertalot | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | benthic | moderately-motile |
| Navicula upsaliensis (Grunow in Van Heurck) M. Peragallo | | beta-mesosaprobous | | | | | fresh-brackish | benthic | moderately-motile |
| Navicula veneta Kützing | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | benthic | moderately-motile |
| Navicula ventralis Krasske | | | | | | | | benthic | moderately-motile |
| Navicula viridula (Kützing) Ehrenberg | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | moderately-motile |
| Navicula viridula var. linearis Hustedt | | | | | | | | benthic | moderately-motile |
| Navicula viridulacalcis subsp. viridulacalcis Rumrich & Lange-Bertalot in U. Rumrich, H. Lange-Bertalot, & M. Rumrich | | | | | | | | benthic | moderately-motile |
| Navicula vulpina Kützing | | | | | | | | benthic | moderately-motile |
| Navicula walkeri Sovereign | | | | | | | | benthic | moderately-motile |
| Neidium | | | | | | | | benthic | moderately-motile |
| Neidium affine (Ehrenberg) Pfitzer | nearly 100% DO | oligosaprobous | meso/eutrophic | N-autotrophic-low | | | fresh-brackish | benthic | moderately-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Neidium ampliatum (Ehrenberg) Krammer in Krammer & Lange-Bertalot | | | oligotrophic-mesotrophic | | | | fresh-brackish | benthic | moderately-motile |
| Neidium binodeforme Krammer in Krammer & Lange-Bertalot | | | | | | | | benthic | moderately-motile |
| Neidium binodis (Ehrenberg) Hustedt | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Neidium dubium (Ehrenberg) Cleve | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | moderately-motile |
| Neidium sp. A SWAMP BSL | | | | | | | | benthic | moderately-motile |
| Neidium sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Nitzschia | | | | | | | | benthic | highly-motile |
| Nitzschia acicularioides Hustedt | | | | | | | | benthic | highly-motile |
| Nitzschia acicularis (Kützing) Smith | >30% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia acidoclinata Lange-Bertalot | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | highly-motile |
| Nitzschia agnita Hustedt | | | | | high | | brackish | benthic | highly-motile |
| Nitzschia alpina Hustedt | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | highly-motile |
| Nitzschia amphibia Grunow | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia amphibioides Hustedt | | | | | | | | benthic | highly-motile |
| Nitzschia angustatula Lange-Bertalot in Lange-Bertalot & Krammer | | | eutrophic | | | low | brackish-freshwater | benthic | highly-motile |
| Nitzschia archibaldii Lange-Bertalot | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | highly-motile |
| Nitzschia aurariae Cholnoky | >30% DO saturation | alpha-mesosaprobous | | N-heterotrophic-high organic N (facultative) | | | brackish | benthic | highly-motile |
| Nitzschia austriaca Hustedt | >50% DO saturation | beta-mesosaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | high | high | brackish-freshwater | benthic | highly-motile |
| Nitzschia bacilliformis Hustedt | | | | | | | | benthic | highly-motile |
| Nitzschia bacillum Hustedt | | | | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia bryophila (Hustedt) Hustedt | nearly 100% DO saturation | oligosaprobous | | N-autotrophic-low organic N | | | freshwater | benthic | highly-motile |
| Nitzschia calica Grunow in Cleve & Grunow | | | | | | | | benthic | highly-motile |
| Nitzschia capitellata Hustedt in Schmidt et al. | | polysaprobous | polytrophic (hypereutrophic) | | high | high | brackish | benthic | highly-motile |
| Nitzschia clausii Hantzsch | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish | benthic | highly-motile |
| Nitzschia communis Rabenhorst | >50% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | | | fresh-brackish | benthic | highly-motile |
| Nitzschia commutata Grunow in Cleve & Grunow | | | | | | | brackish | benthic | highly-motile |
| Nitzschia commutatoides Lange-Bertalot in Lange-Bertalot & Krammer | | | | | | | | benthic | highly-motile |
| Nitzschia compressa var. vexans (Grunow) Lange-Bertalot in Lange-Bertalot & Krammer | | | | | | | | benthic | highly-motile |
| Nitzschia desertorum Hustedt | | | | | | | | benthic | highly-motile |

## Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Nitzschia dissipata (Kützing) Grunow | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia dubia W. Smith | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | highly-motile |
| Nitzschia elegantula Grunow in Van Heurck | | | | | | | | benthic | highly-motile |
| Nitzschia fasciculata (Grunow) Grunow in Van Heurck | | | | | | | brackish | benthic | highly-motile |
| Nitzschia filiformis (W. Smith) Van Heurck | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | brackish | benthic | highly-motile |
| Nitzschia flexa Schumann | | oligosaprobous | | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia flexoides Geitler | | | | | | | | benthic | highly-motile |
| Nitzschia fonticola (Grunow) Grunow in Van Heurck | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia frustulum (Kützing) Grunow in Cleve & Grunow | >50% DO saturation | beta-mesosaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | high | high | brackish-freshwater | benthic | highly-motile |
| Nitzschia gracilis Hantzsch in Rabenhorst | >75% DO saturation | beta-mesosaprobous | mesotrophic | | high | high | freshwater | benthic | highly-motile |
| Nitzschia hantzschiana Rabenhorst | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | high | freshwater | benthic | highly-motile |
| Nitzschia heufleriana Grunow | | beta-mesosaprobous | | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia incognita Legler & Krasske | | | | | low | low | brackish | benthic | highly-motile |
| Nitzschia inconspicua Grunow | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | brackish-freshwater | benthic | highly-motile |
| Nitzschia intermedia Hantzsch ex Cleve & Grunow | | beta-mesosaprobous | eutrophic | | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia kotschii (Grunow) F.W. Mills | | | | | | | | benthic | highly-motile |
| Nitzschia lacuum Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | highly-motile |
| Nitzschia lanceolata W. Smith | | | eutrophic | | | | brackish | benthic | highly-motile |
| Nitzschia liebethruthii Rabenhorst | | | | | low | low | | benthic | highly-motile |
| Nitzschia linearis (Agardh) W. Smith | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia littorea Grunow in Van Heurck | | | | | | | | benthic | highly-motile |
| Nitzschia microcephala Grunow | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia minuta Bleisch | | | | | | | | benthic | highly-motile |
| Nitzschia nana Grunow in Van Heurck | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia normanii Grunow ex Van Heurck | | | | | | | | benthic | highly-motile |
| Nitzschia obtusa Smith | | | | | | high | | benthic | highly-motile |
| Nitzschia ovalis Arnott in Cleve & Grunow | | | | | | | | benthic | highly-motile |
| Nitzschia palea (Kützing) W. Smith | >30% DO saturation | polysaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia palea var. tenuirostris Grunow in Van Heurck | | | | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia paleacea Grunow in Van Heurck | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (obligate) | | | fresh-brackish | benthic | highly-motile |

[Type text]

## Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Nitzschia pellucida Grunow in Cleve & Grunow | | | | | | | | benthic | highly-motile |
| Nitzschia perminuta (Grunow in Van Heurck) M. Peragallo | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia perpusilla Rabenhorst | | | | | | | | benthic | highly-motile |
| Nitzschia perspicua Cholnoky | | | | | | | | benthic | highly-motile |
| Nitzschia pseudofonticola Hustedt | | | eutrophic | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia pumila Hustedt | | | | | | | | benthic | highly-motile |
| Nitzschia pura Hustedt | | oligosaprobous | | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia pusilla Grunow | >75% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia recta Hantzsch ex Rabenhorst | >75% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | highly-motile |
| Nitzschia reversa Smith | | | | | high | | | benthic | highly-motile |
| Nitzschia romana Grunow in Van Heurck | | | | | | | | benthic | highly-motile |
| Nitzschia rosenstockii Lange-Bertalot | | | | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia scalpelliformis Grunow in Cleve & Grunow | | | | | | | | benthic | highly-motile |
| Nitzschia sigma (Kützing) W. Smith | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | brackish | benthic | highly-motile |
| Nitzschia sigmoidea (Nitzsch) W. Smith | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | highly-motile |
| Nitzschia siliqua Archibald | | | | | | | | benthic | highly-motile |
| Nitzschia sinuata (Thwaites in W. Smith) Grunow in Cleve & Grunow | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | highly-motile |
| Nitzschia sinuata var. delognei (Grunow in Van Heurck) Lange-Bertalot | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | | fresh-brackish | benthic | highly-motile |
| Nitzschia sinuata var. tabellaria (Grunow) Grunow in Van Heurck | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | highly-motile |
| Nitzschia solita Hustedt | | | eutrophic | | high | high | brackish-freshwater | benthic | highly-motile |
| Nitzschia sp. 3 SCCWRP JPK | | | | | | | | benthic | highly-motile |
| Nitzschia sp. 4 SCCWRP JPK | | | | | | | | benthic | highly-motile |
| Nitzschia sp. 5 SCCWRP JPK | | | | | | | | benthic | highly-motile |
| Nitzschia sp. 6 SCCWRP BSL | | | | | | | | benthic | highly-motile |
| Nitzschia sp. 7 SCCWRP BSL | | | | | | | | benthic | highly-motile |
| Nitzschia sp. A SWAMP EWT | | | | | | | | benthic | highly-motile |
| Nitzschia sp. A SWAMP JPK | | | | | | | | benthic | highly-motile |
| Nitzschia sp. B SWAMP EWT | | | | | | | | benthic | highly-motile |
| Nitzschia subacicularis Hustedt in Schmidt et al. | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-low organic N | | | fresh-brackish | benthic | highly-motile |
| Nitzschia supralitorea Lange-Bertalot | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | | high | fresh-brackish | benthic | highly-motile |
| Nitzschia tubicola Grunow in Cleve & Grunow | | | | | | | | benthic | highly-motile |
| Nitzschia umbonata (Ehrenberg) Lange-Bertalot | about 10% DO saturation or less | polysaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (obligate) | high | high | fresh-brackish | benthic | highly-motile |
| Nitzschia valdecostata Lange-Bertalot & Simonsen | | | | | | | | benthic | highly-motile |
| Nitzschia valdestriata Aleem & Hustedt | nearly 100% DO saturation | | | | | | | benthic | highly-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Nitzschia vermicularis (Kützing) Hantzsch in Rabenhorst | nearly 100% DO saturation | beta-mesosaprobous | indifferent | | | | fresh-brackish | benthic | highly-motile |
| Nitzschia vitrea Norman | | | eutrophic | | low | | brackish | benthic | highly-motile |
| Nupela | | | | | | | | benthic | non-motile |
| Nupela silvahercynia (Lange-Bertalot) Lange-Bertalot in Lange-Bertalot & Metzeltin | | | | | | | | benthic | non-motile |
| Opephora | | | | | | | | benthic | non-motile |
| Opephora americana M. Peragallo in Tempère & Peragallo | | | | | | | | benthic | non-motile |
| Opephora marina (Gregory) Petit | | | | | | | | benthic | non-motile |
| Opephora olsenii Møller | | | | | | | | benthic | non-motile |
| Opephora pacifica (Grunow) Petit | | | | | | | | benthic | non-motile |
| Orthoseira roeseana (Rabenhorst) O'Meara | | | | | | | | benthic | non-motile |
| Parlibellus protracta (Grunow) Witkowski, Lange-Bertalot & Metzeltin | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | moderately-motile |
| Pinnularia | | | | | | | | benthic | moderately-motile |
| Pinnularia acrosphaeria (Brébisson) W. Smith | >50% DO saturation | oligosaprobous | oligotrophic-mesotrophic | | | | freshwater | benthic | moderately-motile |
| Pinnularia appendiculata (Agardh) Cleve | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Pinnularia biceps Gregory | | | | | | | | benthic | moderately-motile |
| Pinnularia borealis Ehrenberg | nearly 100% DO saturation | beta-mesosaprobous | oligotrophic-mesotrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Pinnularia borealis var. rectangularis Carlson | | | | | | | | benthic | moderately-motile |
| Pinnularia divergens W. Smith | | oligosaprobous | oligotrophic | | | | freshwater | benthic | moderately-motile |
| Pinnularia divergentissima (Grunow in Van Heurck) Cleve | | | oligotrophic | | | | freshwater | benthic | moderately-motile |
| Pinnularia gibba (Ehrenberg) Ehrenberg | >50% DO saturation | alpha-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Pinnularia hemiptera (Kützing) Rabenhorst | nearly 100% DO saturation | oligosaprobous | oligotrophic | | | | freshwater | benthic | moderately-motile |
| Pinnularia interrupta Smith | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Pinnularia legumen Ehrenberg | | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Pinnularia maior (Kützing) Rabenhorst | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Pinnularia microstauron (Ehrenberg) Cleve | >50% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | low | | fresh-brackish | benthic | moderately-motile |
| Pinnularia sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Pinnularia subrostrata (A. Cleve) Cleve-Euler | | | | | | | | benthic | moderately-motile |
| Pinnularia viridis (Nitzsch) Ehrenberg | >50% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Placoneis | | | | | | | | benthic | moderately-motile |
| Placoneis clementioides (Hustedt) Cox | | | | | | | | benthic | moderately-motile |
| Placoneis clementis (Grunow) Cox | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | moderately-motile |
| Placoneis elginensis (Gregory) Cox | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Placoneis gastrum (Ehrenberg) Mereschkowsky | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Placoneis hambergii (Hustedt) K. Bruder in Bruder & Medlin | nearly 100% DO saturation | | | | | low | | benthic | moderately-motile |
| Placoneis placentula (Ehrenberg) Mereschkowsky | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | | low | fresh-brackish | benthic | moderately-motile |
| Placoneis sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Plagiotropis | | | | | | | | benthic | moderately-motile |
| Plagiotropis lepidoptera (Gregory) Kuntze | | | | | | | | benthic | moderately-motile |
| Planothidium daui (Foged) Lange-Bertalot | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | non-motile |
| Planothidium delicatulum (Kützing) Round & Bukhtiyarova | | | | | high | | brackish | benthic | non-motile |
| Planothidium dubium (Grunow) Round & Bukhtiyarova | | | | | | | | benthic | non-motile |
| Planothidium engelbrechtii (Cholnoky) Round & Bukhtiyarova | | | | | | | brackish | benthic | non-motile |
| Planothidium granum (Hohn & Hellerman) Lange-Bertalot | >75% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Planothidium haynaldii (Schaarschmidt) Lange-Bertalot | >50% DO saturation | alpha-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Planothidium lanceolatum (Brébisson ex Kützing) Lange-Bertalot | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Planothidium lanceolatum var. omissum (C.W. Reimer) N.A. Andresen, E.F. Stoermer, & R.G. Kreis, Jr. | | | | | | | | benthic | non-motile |
| Planothidium peragallii (Brun & Héribaud) Round & Bukhtiyarova | nearly 100% DO saturation | beta-mesosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Planothidium pericavum (Carter) H. Lange-Bertalot | | | | | | | | benthic | non-motile |
| Planothidium pungens (Cleve-Euler) H. Lange-Bertalot | | | | | | | | benthic | non-motile |
| Planothidium robustum (Hustedt) H. Lange-Bertalot | | | | | high | high | | benthic | non-motile |
| Planothidium rostratum (Østrup) Lange-Bertalot | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | fresh-brackish | benthic | non-motile |
| Platessa conspicua (A. Mayer) H. Lange-Bertalot in Krammer & Lange-Bertalot | >75% DO saturation | oligosaprobous | indifferent | N-autotrophic-low organic N | high | high | freshwater | benthic | non-motile |
| Pleurosigma | | | | | | | | benthic | highly-motile |
| Pleurosigma elongatum W. Smith | | | | | high | | | benthic | highly-motile |
| Pleurosigma salinarum (Grunow) Grunow in Cleve & Grunow | | oligosaprobous | | | high | high | brackish | benthic | highly-motile |
| Pleurosigma sp. 1 SCCWRP JPK | | | | | | | | benthic | highly-motile |
| Pleurosira laevis (Ehrenberg) Compère | | oligosaprobous | eutrophic | | high | high | brackish | benthic | non-motile |
| Prestauroneis integra (W. Smith) Bruder in Bruder & Medlin | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | non-motile |
| Proschkinia bulnheimii (Grunow) Karajeva | | | | | | | | benthic | moderately-motile |
| Psammodictyon constrictum (Gregory) Mann in Round, Crawford & Mann | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish | benthic | highly-motile |
| Psammothidium abundans fo. rosenstockii (Lange-Bertalot in Lange-Bertalot & Krammer) Bukhtiyarova in Round & Bukhtiyarova | | | | | | | | benthic | non-motile |
| Psammothidium bioretii (Germain) Bukhtiyarova & Round | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | | high | fresh-brackish | benthic | non-motile |
| Psammothidium chlidanos (Hohn & Hellerman) H. Lange-Bertalot | | | | | | | | benthic | non-motile |
| Psammothidium curtissimum (J.R. Carter) Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector | | | | | | | | benthic | non-motile |
| Psammothidium daonense (Lange-Bertalot in Lange-Bertalot & Krammer) H. Lange-Bertalot | | | | | | | | benthic | non-motile |
| Psammothidium didymum (Hustedt) Bukhtiyarova & Round | | | | | | | | benthic | non-motile |

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Psammothidium levanderi (Hustedt) Bukhtiyarova & Round | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | non-motile |
| Psammothidium marginulatum (Grunow) Bukhtiyarova & Round | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | low | freshwater | benthic | non-motile |
| Psammothidium rechtensis (Leclercq) H. Lange-Bertalot | | | | | | | | benthic | non-motile |
| Psammothidium sacculum (Carter) Bukhtiyarova in Bukhtiyarova & Round | | | | | | | | benthic | non-motile |
| Psammothidium subatomoides (Hustedt) Bukhtiyarova & Round | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | | high | freshwater | benthic | non-motile |
| Pseudostaurosira brevistriata (Grunow in Van Heurck) Williams & Round | nearly 100% DO saturation | oligosaprobous | indifferent | N-autotrophic-low organic N | high | low | fresh-brackish | benthic | non-motile |
| Pseudostaurosira elliptica (Schumann) Edlund, Morales & Spaulding | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | non-motile |
| Pseudostaurosira parasitica (Smith) Morales | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | high | high | fresh-brackish | benthic | non-motile |
| Pseudostaurosira parasitica var. subconstricta (Grunow) Morales | | | | | | | | benthic | non-motile |
| Pseudostaurosira pseudoconstruens (Marciniak) Williams & Round | | | | | | | | benthic | non-motile |
| Pseudostaurosira subsalina (Hustedt) Morales | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | non-motile |
| Puncticulata bodanica (Grunow in Schneider) Håkansson | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | planktonic | non-motile |
| Reimeria sinuata (Gregory) Kociolek & Stoermer | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | non-motile |
| Reimeria uniseriata Sala, Guerrero & Ferrario | | | | | | | | benthic | non-motile |
| Rhoicosphenia | | | | | | | | benthic | non-motile |
| Rhoicosphenia abbreviata (Agardh) Lange-Bertalot | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | non-motile |
| Rhoicosphenia sp. 1 SCCWRP EWT | | | | | | | | benthic | non-motile |
| Rhoicosphenia sp. 1 SCCWRP JPK | | | | | | | | benthic | non-motile |
| Rhoicosphenia sp. 2 SCCWRP EWT | | | | | | | | benthic | non-motile |
| Rhoicosphenia sp. 3 SWAMP JPK | | | | | | | | benthic | non-motile |
| Rhoicosphenia sp. A SWAMP JPK | | | | | | | | benthic | non-motile |
| Rhoicosphenia sp. B SWAMP EWT | | | | | | | | benthic | non-motile |
| Rhoicosphenia sp. C SWAMP EWT | | | | | | | | benthic | non-motile |
| Rhopalodia | | | | | | | | benthic | moderately-motile |
| Rhopalodia acuminata Krammer in Lange-Bertalot & Krammer | | | | | | | | benthic | moderately-motile |
| Rhopalodia brebissonii Krammer in Lange-Bertalot & Krammer | | | | | low | low | brackish-freshwater | benthic | moderately-motile |
| Rhopalodia constricta (W. Smith) Krammer in Lange-Bertalot & Krammer | | | | | | | | benthic | moderately-motile |
| Rhopalodia gibba (Ehrenberg) Müller | >50% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-low organic N | high | low | fresh-brackish | benthic | moderately-motile |
| Rhopalodia gibba var. minuta Krammer in Lange-Bertalot & Krammer | | | | | | | | benthic | moderately-motile |
| Rhopalodia gibberula (Ehrenberg) Müller | nearly 100% DO saturation | | | | high | low | brackish-freshwater | benthic | moderately-motile |
| Rhopalodia musculus (Kützing) Müller | | oligosaprobous | | | | | brackish | benthic | moderately-motile |
| Rhopalodia operculata (C. A. Agardh) Håkansson | | | | | | | | benthic | moderately-motile |
| Rhopalodia rupestris (W. Smith) Krammer in Lange-Bertalot & Krammer | | | | | | | | benthic | moderately-motile |
| Rossithidium nodosum (A. Cleve) Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector | | | | | | | | benthic | non-motile |
| Rossithidium pusillum (Grunow) Round & Bukhtiyarova | nearly 100% DO | oligosaprobous | oligotrophic | N-autotrophic-low | | | fresh-brackish | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Sellaphora | | | | | | | | benthic | moderately-motile |
| Sellaphora bacillum (Ehrenberg) Mann | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | moderately-motile |
| Sellaphora disjuncta (Hustedt) Mann | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | moderately-motile |
| Sellaphora hustedtii (Krasske) H. Lange-Bertalot & M. Werum in Werum & Lange-Bertalot | nearly 100% DO saturation | | | | high | | freshwater | benthic | moderately-motile |
| Sellaphora joubaudii (Germain) Aboal in Aboal, Alvarez-Cobelas, Cambra & Ector | | beta-mesosaprobous | | | | | fresh-brackish | benthic | moderately-motile |
| Sellaphora laevissima (Kützing) Mann | nearly 100% DO saturation | oligosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | freshwater | benthic | moderately-motile |
| Sellaphora mutata (Krasske) Lange-Bertalot in Lange-Bertalot, Kulbs, Lauser, Norpel-Schempp & Willmann | | beta-mesosaprobous | oligotrophic-mesotrophic | | high | high | fresh-brackish | benthic | moderately-motile |
| Sellaphora nyassensis (Müller) Mann | | | | | | | | benthic | moderately-motile |
| Sellaphora pseudopupula (Krasske) Lange-Bertalot in Lange-Bertalot, Kulbs, Lauser, Norpel-Schempp & Willmann | | | | | | | | benthic | moderately-motile |
| Sellaphora pupula (Kützing) Mereschkowsky | >50% DO saturation | alpha-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | moderately-motile |
| Sellaphora seminulum (Grunow) Mann | >30% DO saturation | alpha-meso/polysaprobous | eutrophic | N-heterotrophic-high organic N (facultative) | high | high | fresh-brackish | benthic | moderately-motile |
| Sellaphora sp. 1 SCCWRP JPK | | | | | | | | benthic | moderately-motile |
| Sellaphora stroemii (Hustedt) Kobayasi in Mayama, Idei, Osada & Nagumo | | | | | | | | benthic | moderately-motile |
| Seminavis pusilla (Grunow) E.J. Cox & G. Reid | | | | | | | | benthic | moderately-motile |
| Simonsenia delognei (Grunow) Lange-Bertalot | nearly 100% DO saturation | alpha-mesosaprobous | eutrophic | | high | | brackish-freshwater | benthic | highly-motile |
| Stauroneis | | | | | | | | benthic | moderately-motile |
| Stauroneis anceps Ehrenberg | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Stauroneis gracilis Ehrenberg | | | | | | | | benthic | moderately-motile |
| Stauroneis kriegeri Patrick | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Stauroneis obtusa Lagerstedt | nearly 100% DO saturation | oligosaprobous | oligotrophic | N-autotrophic-low organic N | | | freshwater | benthic | moderately-motile |
| Stauroneis phoenicenteron (Nitzsch) Ehrenberg | >50% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Stauroneis smithii Grunow | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | | | fresh-brackish | benthic | moderately-motile |
| Stauroneis sp. A SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Stauroneis sp. B SWAMP EWT | | | | | | | | benthic | moderately-motile |
| Stauroneis tackei (Hustedt) Krammer & Lange-Bertalot | | | | | | | fresh-brackish | benthic | moderately-motile |
| Stauroneis undata Hustedt | | | | | | | | benthic | moderately-motile |
| Stauroneis wislouchii Poretzky & Anissimova | | | | | | | | benthic | moderately-motile |
| Staurosira | | | | | | | | benthic | non-motile |
| Staurosira bidens (Heiberg) Grunow | | | | | | | | benthic | non-motile |
| Staurosira construens Ehrenberg | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | | | fresh-brackish | benthic | non-motile |
| Staurosira construens var. binodis (Ehrenberg) Hamilton in Hamilton, Poulin, Charles & Angell | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Staurosira construens var. pumila (Grunow) Kingston | | | | | | | | benthic | non-motile |
| Staurosira construens var. venter (Ehrenberg) Hamilton in Hamilton, Poulin, Charles & Angell | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | N-autotrophic-high organic N | | | fresh-brackish | benthic | non-motile |
| Staurosira punctiformis A. Witkowski, D. Metzeltin & H. Lange-Bertalot in A. Witkowski, H. Lange-Bertalot & D. Metzeltin | | | | | | | | benthic | non-motile |
| Staurosira sp. 1 SCCWRP JPK | | | | | | | | benthic | non-motile |
| Staurosirella lapponica (Grunow in Van Heurck) Williams & Round | | | | | low | | fresh-brackish | benthic | non-motile |
| Staurosirella leptostauron (Ehrenberg) Williams & Round | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | N-autotrophic-low organic N | low | low | fresh-brackish | benthic | non-motile |
| Staurosirella pinnata (Ehrenberg) Williams & Round | nearly 100% DO saturation | beta-mesosaprobous | indifferent | N-autotrophic-high organic N | high | low | fresh-brackish | benthic | non-motile |
| Staurosirella pinnata var. intercedens (Grunow in Van Heurck) Hamilton in Hamilton, et al. | | | | | | | | benthic | non-motile |
| Stephanodiscus | | | | | | | | planktonic | non-motile |
| Stephanodiscus hantzschii Grunow in Cleve & Grunow | >30% DO saturation | alpha-meso/polysaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (facultative) | high | high | fresh-brackish | planktonic | non-motile |
| Stephanodiscus medius Håkansson | | | | | | | | planktonic | non-motile |
| Stephanodiscus minutulus (Kützing) Cleve & Möller | >50% DO saturation | alpha-mesosaprobous | polytrophic (hypereutrophic) | N-autotrophic-high organic N | | high | fresh-brackish | planktonic | non-motile |
| Stephanodiscus sp. 1 SCCWRP JPK | | | | | | | | planktonic | non-motile |
| Surirella | | | | | | | | benthic | highly-motile |
| Surirella angusta Kützing | >75% DO saturation | beta-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | fresh-brackish | benthic | highly-motile |
| Surirella bifrons Ehrenberg | | oligosaprobous | eutrophic | | | | fresh-brackish | benthic | highly-motile |
| Surirella biseriata Brébisson in Brébisson & Godey | | beta-mesosaprobous | eutrophic | | | | fresh-brackish | benthic | highly-motile |
| Surirella brebissonii Krammer & Lange-Bertalot | | | | | high | high | brackish-freshwater | benthic | highly-motile |
| Surirella brebissonii var. kuetzingii Krammer & Lange-Bertalot | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | fresh-brackish | benthic | highly-motile |
| Surirella brightwellii W. Smith | | | | | | | | benthic | highly-motile |
| Surirella elegans Ehrenberg | nearly 100% DO saturation | oligosaprobous | mesotrophic-eutrophic | | | | fresh-brackish | benthic | highly-motile |
| Surirella linearis var. constricta Grunow | | | | | | | | benthic | highly-motile |
| Surirella minuta Brébisson | >50% DO saturation | alpha-mesosaprobous | eutrophic | | high | high | fresh-brackish | benthic | highly-motile |
| Surirella ovalis Brébisson | >30% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | low | low | brackish | benthic | highly-motile |
| Surirella ovata Kützing | | | | | | | | benthic | highly-motile |
| Surirella robusta Ehrenberg | >75% DO saturation | beta-mesosaprobous | indifferent | | | | fresh-brackish | benthic | highly-motile |
| Surirella sp. A SWAMP EWT | | | | | | | | benthic | highly-motile |
| Surirella splendida (Ehrenberg) Kützing | >75% DO saturation | beta-mesosaprobous | mesotrophic-eutrophic | | | low | fresh-brackish | benthic | highly-motile |
| Surirella striatula Turpin | | | eutrophic | | | | brackish | benthic | highly-motile |
| Surirella tenera Gregory | >75% DO saturation | beta-mesosaprobous | eutrophic | | low | | fresh-brackish | benthic | highly-motile |
| Synedra | | | | | | | | benthic | non-motile |
| Synedra acus Kützing | >75% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | non-motile |
| Synedra cyclopum Brutschy | | | | | | | | benthic | non-motile |
| Synedra delicatissima W. Smith | | | mesotrophic | | low | | fresh-brackish | benthic | non-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Synedra gaillonii (Bory; Turpin) Ehrenberg | | | | | | | | benthic | non-motile |
| Synedra goulardi Brébisson ex Cleve & Grunow | | | | | | | | benthic | non-motile |
| Synedra mazamaensis Sovereign | | | | | low | low | | benthic | non-motile |
| Synedra rumpens Kützing | | | oligotrophic-mesotrophic | | low | | fresh-brackish | benthic | non-motile |
| Synedra tenera W. Smith | nearly 100% DO saturation | oligosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | | freshwater | benthic | non-motile |
| Synedra ulna (Nitzsch) Ehrenberg | >50% DO saturation | alpha-meso/polysaprobous | indifferent | N-autotrophic-high organic N | low | low | fresh-brackish | benthic | non-motile |
| Synedra ulna f. contracta Hustedt | | | | | | | | benthic | non-motile |
| Tabellaria fenestrata (Lyngbye) Kützing | nearly 100% DO saturation | beta-mesosaprobous | oligotrophic-mesotrophic | N-autotrophic-low organic N | low | | freshwater | planktonic | non-motile |
| Tabellaria flocculosa (Roth) Kützing | nearly 100% DO saturation | beta-mesosaprobous | mesotrophic | N-autotrophic-low organic N | low | low | freshwater | planktonic | non-motile |
| Tabellaria ventricosa Kützing | | | | | | | | planktonic | non-motile |
| Tabularia | | | | | | | | benthic | non-motile |
| Tabularia fasciculata (Agardh) Williams & Round | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | high | brackish | benthic | non-motile |
| Tabularia investiens (W. Smith) Williams & Round | | | | | | | | benthic | non-motile |
| Tabularia tabulata (Agardh) Snoeijs | | | | | | high | | benthic | non-motile |
| Terpsinoë musica Ehrenberg | | | | | | | brackish-freshwater | benthic | non-motile |
| Thalassionema nitzschioides (Grunow) Van Heurck | | | | | | | | planktonic | non-motile |
| Thalassiosira | | | | | | | | planktonic | non-motile |
| Thalassiosira lacustris (Grunow) Hasle | | | | | | | | planktonic | non-motile |
| Thalassiosira levanderi Van Goor | | | | | | | | planktonic | non-motile |
| Thalassiosira pseudonana Hasle & Heimdal | >50% DO saturation | alpha-mesosaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (facultative) | | high | brackish-freshwater | planktonic | non-motile |
| Thalassiosira sp. 1 SCCWRP JPK | | | | | | | | planktonic | non-motile |
| Thalassiosira sp. 2 SWAMP JPK | | | | | | | | planktonic | non-motile |
| Thalassiosira sp. 3 SWAMP JPK | | | | | | | | planktonic | non-motile |
| Thalassiosira weissflogii (Grunow) Fryxell & Hasle | >50% DO saturation | alpha-mesosaprobous | polytrophic (hypereutrophic) | N-heterotrophic-high organic N (facultative) | high | high | brackish-freshwater | planktonic | non-motile |
| Tryblionella acuminata W. Smith | | | | | | | | benthic | highly-motile |
| Tryblionella angustata W. Smith | | | | | | | | benthic | highly-motile |
| Tryblionella calida (Grunow in Cleve & Grunow) Mann in Round, Crawford & Mann | | | eutrophic | | high | high | brackish-freshwater | benthic | highly-motile |
| Tryblionella constricta (Kützing) Poulin in Poulin, Berard-Therriault, Cardinal & Hamilton | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish | benthic | highly-motile |
| Tryblionella debilis Arnott ex O'Meara | nearly 100% DO saturation | alpha-mesosaprobous | | N-autotrophic-high organic N | | | fresh-brackish | benthic | highly-motile |
| Tryblionella gracilis W. Smith | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | | | brackish-freshwater | benthic | highly-motile |
| Tryblionella hungarica (Grunow) Frenguelli | >30% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | high | brackish-freshwater | benthic | highly-motile |
| Tryblionella levidensis W. Smith | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | brackish-freshwater | benthic | highly-motile |

# Appendix C: Diatom species attributes[Type text]

| Species | Oxygen requirements | Saprobity | Trophic state | Nitrogen uptake metabolism | TP indicator classification | TN indicator classification | Salinity | Habit | Motility |
|---|---|---|---|---|---|---|---|---|---|
| Tryblionella littoralis (Grunow in Cleve & Grunow) Mann in Round, Crawford & Mann | >50% DO saturation | | eutrophic | | | | brackish | benthic | highly-motile |
| Tryblionella salinarum (Grunow in Cleve & Grunow) Pelletan | | | | | | | | benthic | highly-motile |
| Tryblionella scalaris (Ehrenberg) Siver & Hamilton | | | eutrophic | | | | brackish-freshwater | benthic | highly-motile |
| Tryblionella sp. 1 SWAMP JPK | | | | | | | | benthic | highly-motile |
| Tryblionella sp. A SWAMP JPK | | | | | | | | benthic | highly-motile |
| Tryblionella victoriae Grunow | >50% DO saturation | alpha-mesosaprobous | eutrophic | N-autotrophic-high organic N | high | | brackish-freshwater | benthic | highly-motile |
| Unidentified Achnanthaceae | | | | | | | | benthic | non-motile |
| Unidentified Araphid | | | | | | | | | non-motile |
| Unidentified Centrales | | | | | | | | planktonic | non-motile |
| Unidentified Cymbelloid | | | | | | | | benthic | moderately-motile |
| Unidentified Fragilariaceae | | | | | | | | | non-motile |
| Unidentified Naviculaceae | | | | | | | | benthic | moderately-motile |
| Unidentified Pennales | | | | | | | | | |
| Unidentified Pennales | | | | | | | | | |
| Unidentified Raphid | | | | | | | | benthic | moderately-motile |

[1] Based on indicators values for national data set, when available, or regional values as long as there was no conflict in indicator assignment among regions (Potapova and Charles (2007)).

## Appendix D: Metric definitions and screening results summary



| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description | Spearman's rho[1] (all p values are < 0.01) | signal:noise |
|---|---|---|---|---|---|---|---|---|---|
| kept ("long list") | proportion requiring >50% DO saturation (d) | diatom | autecological guild | dissolved oxygen | proportion of valves | van Dam et al. (1994) | proportion of valves that require at least 50% dissolved oxygen saturation (sum 50+75+100) | -0.478 | 19.8 |
| kept ("long list") | proportion requiring nearly 100% DO saturation (d) | diatom | autecological guild | dissolved oxygen | proportion of valves | van Dam et al. (1994) | proportion of valves that require nearly 100% dissolved oxygen saturation | -0.371 | 12.3 |
| kept ("long list") | proportion halobiontic (d) | diatom | autecological guild | ionic strength/ salinity | proportion of valves | van Dam et al. (1994) | proportion of valves that are brackish-fresh+brackish (i.e., they have a tolerance of, or requirements for, dissolved salts) | -0.600 | 7.5 |
| kept ("long list") | proportion poly- & eutrophic (d) | diatom | autecological guild | nutrients | proportion of valves | van Dam et al. (1994) | proportion of valves that are polytrophic+eutrophic | -0.450 | 16.5 |
| kept ("long list") | proportion N heterotrophs (d) | diatom | autecological guild | organic pollution | proportion of valves | van Dam et al. (1994) | proportion of valves that are heterotrophs (includes both obligate and facultative heterotrophs) | -0.525 | 6.6 |
| kept ("long list") | proportion oligo- & beta-mesosaprobic (d) | diatom | autecological guild | organic pollution | proportion of valves | van Dam et al. (1994) | proportion of valves that are oligosaprobous+(beta-mesosaprobous) | -0.324 | 13.1 |
| kept ("long list") | proportion highly motile (d) | diatom | morphological guild | sedimentation | proportion of valves | | proportion of valves that are highly motile | -0.377 | 4.6 |
| kept ("long list") | proportion sediment tolerant (highly motile) (d) | diatom | morphological guild | sedimentation | proportion of valves | | proportion of valves for which there is information that are highly motile + all planktonic | -0.437 | 11.2 |
| kept ("long list") | proportion "non-reference" indicators (s, b) | soft | relationship to reference | reference | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of "non-Reference" sites | -0.391 | 5.6 |
| kept ("long list") | proportion "non-reference" indicators (s, sp) | soft | relationship to reference | reference | relative species numbers | indicator species analysis | proportion of total species richness composed of indicators of "non-Reference" sites | -0.531 | 3.2 |
| kept ("long list") | proportion *A. minutissimum* (d) | diatom | taxonomic group | *A. minutissimum* | proportion of valves | | proportion of valves that are *Achnanthidium minutissimum* | -0.539 | 13.1 |

# Appendix D: Metric definitions and screening results summary



| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description | Spearman's rho (all p values are < 0.01) | signal:noise |
|---|---|---|---|---|---|---|---|---|---|
| kept ("long list") | proportion Chlorophyta (s, b) | soft | taxonomic group | Chlorophyta | relative biovolumes | | proportion of total micro+macro biovolume composed of Chlorophyta | -0.268 | 3.3 |
| kept ("long list") | proportion of green algae belonging to CRUS (s, b) | soft | taxonomic group | Chlorophyta | relative biovolumes | | proportion of green algae (Chlorophyta+Charophyta) micro+macro biovolume composed of *Cladophora glomerata, Rhizoclonium hieroglyphicum, Ulva flexuosa*, and *Stigeoclonium* spp. | -0.395 | 23.4 |
| kept ("long list") | proportion ZHR (s, b) | soft | taxonomic group | ZygnHetero Rhod | relative biovolumes | | Zygnemataceae+ heterocystous cyanobacteria + Rhodophyta | -0.337 | 5.6 |
| kept ("long list") | proportion ZHR (s, m) | soft | taxonomic group | ZygnHetero Rhod | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics | -0.406 | 10.2 |
| kept ("long list") | proportion high Cu indicators (s, sp) | soft | tolerance/sensi tivity | copper | relative species numbers | indicator species analysis | proportion of total species richness composed of high copper (dissolved) indicators | -0.414 | 2.6 |
| kept ("long list") | proportion low TN indicators (d) | diatom | tolerance/sensi tivity | nitrogen | proportion of valves | Potapova and Charles (2007) | proportion of valves that are indicators for low TN levels | -0.493 | 17.2 |
| kept ("long list") | proportion high DOC indicators (s, b) | soft | tolerance/sensi tivity | organic pollution | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of high DOC | -0.519 | 13.3 |
| kept ("long list") | proportion high DOC indicators (s, sp) | soft | tolerance/sensi tivity | organic pollution | relative species numbers | indicator species analysis | proportion of total species richness composed of high DOCq indicators | -0.596 | 6.5 |
| kept ("long list") | proportion low TP indicators (d) | diatom | tolerance/sensi tivity | phosphorus | proportion of valves | Potapova and Charles (2007) | proportion of valves that are indicators for low TP levels | -0.483 | 17.2 |
| kept ("long list") | proportion low TP indicators (s, sp) | soft | tolerance/sensi tivity | phosphorus | relative species numbers | indicator species analysis | proportion of total species richness composed of low TP indicators | -0.646 | 3.2 |

# Appendix D: Metric definitions and screening results summary



| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 2 | proportion requiring >75% DO saturation (d) | diatom | autecological guild | dissolved oxygen | proportion of valves | van Dam et al. (1994) | proportion of valves that require at least 75% dissolved oxygen saturation (sum 75+100) |
| 2 | proportion heterocystous (s, m) | soft | autecological guild | nitrogen | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 2 | proportion heterocystous (s, sp) | soft | autecological guild | nitrogen | relative species numbers | | proportion of total species that are heterocystous |
| 2 | proportion of cyanobacteria belonging to heterocystous species (s, b) | soft | autecological guild | nitrogen | relative biovolumes | | proportion of cyanobacteria micro+macro biovolume composed of heterocystous species |
| 2 | proportion of cyanobacteria belonging to heterocystous species (s, m) | soft | autecological guild | nitrogen | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 2 | proportion of cyanobacteria belonging to heterocystous species (s, sp) | soft | autecological guild | nitrogen | relative species numbers | | proportion of cyanobacteria species that are heterocystous |
| 2 | proportion motile (d) | diatom | morphological guild | sedimentation | proportion of valves | | proportion of valves that are motile (includes highly + moderately motile) |
| 2 | proportion sediment tolerant (motile) (d) | diatom | morphological guild | sedimentation | proportion of valves | | proportion of all valves for which there is information that are motile (highly or moderately) + all planktonic |
| 2 | proportion "reference" indicators (s, b) | soft | relationship to reference | reference | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of "Reference" sites |
| 2 | proportion "reference" indicators (s, sp) | soft | relationship to reference | reference | relative species numbers | indicator species analysis | proportion of total species richness composed of indicators of "Reference" sites |
| 2 | proportion CRU (s, b) | soft | taxonomic group | Chlorophyta | relative biovolumes | | proportion of total micro+macro biovolume composed of *Cladophora glomerata*, *Rhizoclonium hieroglyphicum*, and *Ulva flexuosa* |
| 2 | proportion of Chlorophyta belonging to CRU (s, b) | soft | taxonomic group | Chlorophyta | relative biovolumes | | proportion of Chlorophyta micro+macro biovolume composed of *Cladophora glomerata*, *Rhizoclonium hieroglyphicum*, and *Ulva flexuosa* |

| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 2 | proportion ZHR (s, sp) | soft | taxonomic group | ZygnHetero Rhod | relative species numbers | | Zygnemataceae+ heterocystous cyanobacteria + Rhodophyta |
| 2 | proportion low TN indicators (s, sp) | soft | tolerance/sensitivity | nitrogen | relative species numbers | indicator species analysis | proportion of total species richness composed of low TN indicators |
| 1 | proportion characteristic of "freshwater" (d) | diatom | autecological guild | ionic strength/ salinity | proportion of valves | van Dam et al. (1994) | proportion of valves that are considered characteristic of freshwater (not brackish) habitats |
| 1 | proportion heterocystous (s, b) | soft | autecological guild | nitrogen | relative biovolumes | | proportion of total micro+macro biovolume composed of heterocystous species |
| 1 | proportion N fixers (d) | diatom | autecological guild | nitrogen | proportion of valves | | proportion of valves belonging to genera that can fix N2 (Epithemia + Rhopalodia) |
| 1 | proportion meso- & oligo-meso- & oligotrophic (d) | diatom | autecological guild | nutrients | proportion of valves | van Dam et al. (1994) | proportion of valves that are mesotrophic+(oligo-mesotrophic)+oligotrophic |
| 1 | proportion oligo-meso- & oligotrophic (d) | diatom | autecological guild | nutrients | proportion of valves | van Dam et al. (1994) | proportion of valves that are (oligotrophic-mesotrophic)+oligotrophic |
| 1 | proportion alpha-poly- & polysaprobic (d) | diatom | autecological guild | organic pollution | proportion of valves | van Dam et al. (1994) | proportion of valves that are (alpha-meso/polysaprobous)+polysaprobous |
| 1 | proportion N autotrophs (low N) (d) | diatom | autecological guild | organic pollution | proportion of valves | van Dam et al. (1994) | proportion of valves that are "N autotroph - low organic N" |
| 1 | proportion obligate N heterotrophs (d) | diatom | autecological guild | organic pollution | proportion of valves | van Dam et al. (1994) | proportion of valves that are "N heterotroph - high organic N (obligate)" |
| 1 | proportion of total soft algae biovolume as microalgae | soft | community form | primary productivity | relative biovolumes | | proportion of total biovolume of all micro+macro algae in the form of microalgae |
| 1 | total soft algal biovolume | soft | community form | primary productivity | total biovolume | | cubed root of total biovolume of all micro+macro algae |
| 1 | proportion centric (d) | diatom | morphological guild | flow regime | proportion of valves | | proportion of valves that are centric |
| 1 | proportion planktonic (d) | diatom | morphological guild | flow regime | proportion of valves | | proportion of valves that are planktonic |
| 1 | proportion tychoplanktonic (s, b) | soft | morphological guild | flow regime | relative biovolumes | | proportion of total micro+macro biovolume composed of tychoplanktonic species (includes "benthic/tychoplanktonic" species) |

| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 1 | proportion tychoplanktonic (s, m) | soft | morphological guild | flow regime | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion tychoplanktonic (s, sp) | soft | morphological guild | flow regime | relative species numbers | | proportion of total species that are tychoplanktonic (includes "benthic/tychoplanktonic " species) |
| 1 | proportion stagnation tolerant (s, b) | soft | morphological guild | flow regime | relative biovolumes | | proportion of total micro+macro biovolume composed of stagnation indicators |
| 1 | proportion stagnation tolerant (s, m) | soft | morphological guild | flow regime | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion stagnation tolerant (s, sp) | soft | morphological guild | flow regime | relative species numbers | | proportion of total species that are stagnation indicator species |
| 1 | proportion araphid (d) | diatom | morphological guild | sedimentation | proportion of valves | | proportion of valves that are araphid |
| 1 | proportion biraphid (d) | diatom | morphological guild | sedimentation | proportion of valves | | proportion of valves that are biraphid (includes reduced biraphids) |
| 1 | proportion flagellated (s, b) | soft | morphological guild | sedimentation | relative biovolumes | | proportion of total micro+macro biovolume composed of flagellated species |
| 1 | proportion flagellated (s, m) | soft | morphological guild | sedimentation | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion flagellated (s, sp) | soft | morphological guild | sedimentation | relative species numbers | | proportion of total species that are flagellated |
| 1 | proportion motile (s, b) | soft | morphological guild | sedimentation | relative biovolumes | | proportion of total micro+macro biovolume composed of motile species |
| 1 | proportion motile (s, m) | soft | morphological guild | sedimentation | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion motile (s, sp) | soft | morphological guild | sedimentation | relative species numbers | | proportion of total species that are motile |

| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 1 | proportion sediment tolerant (motile) (s, b) | soft | morphological guild | sedimentation | relative biovolumes | | proportion of total micro+macro biovolume composed of species deemed to be sedimentation tolerant (meaning all benthic species known to grow on silt plus all motile species (flagellated or otherwise motile)) |
| 1 | proportion sediment tolerant (motile) (s, m) | soft | morphological guild | sedimentation | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion sediment tolerant (motile) (s, sp) | soft | morphological guild | sedimentation | relative species numbers | | proportion of total species that are species deemed to be sedimentation tolerant (meaning all benthic species known to grow on silt plus all motile species (flagellated or otherwise motile)) |
| 1 | proportion sediment tolerant (motile/ tychoplanktonic) (s, b) | soft | morphological guild | sedimentation | relative biovolumes | | proportion of total micro+macro biovolume composed of species deemed to be sedimentation tolerant (meaning all benthic species known to grow on silt plus all motile species (flagellated or otherwise motile) plus all tychoplanktonic species) |
| 1 | proportion sediment tolerant (motile/ tychoplanktonic) (s, m) | soft | morphological guild | sedimentation | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion sediment tolerant (motile/ tychoplanktonic) (s, sp) | soft | morphological guild | sedimentation | relative species numbers | | proportion of total species that are species deemed to be sedimentation tolerant (meaning all benthic species known to grow on silt plus all motile species (flagellated or otherwise motile) plus all tychoplanktonic species) |
| 1 | proportion Chlorophyta (s, m) | soft | taxonomic group | Chlorophyta | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion Chlorophyta (s, sp) | soft | taxonomic group | Chlorophyta | relative species numbers | | proportion of total species that belong to Chlorophyta |
| 1 | proportion CRU (s, m) | soft | taxonomic group | Chlorophyta | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion CRU (s, sp) | soft | taxonomic group | Chlorophyta | relative species numbers | | proportion of total species that are *Cladophora glomerata*, *Rhizoclonium hieroglyphicum*, and *Ulva flexuosa* |
| 1 | proportion CRUS (s, b) | soft | taxonomic group | Chlorophyta | relative biovolumes | | proportion of total micro+macro biovolume composed of C. *glomerata, R. hieroglyphicum, U. flexuosa,* and *Stigeoclonium* |

## Appendix D: Metric definitions and screening results summary



| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 1 | proportion CRUS (s, m) | soft | taxonomic group | Chlorophyta | relative species number and biovolumes | | mean of  scores for the corresponding species number and biovolume metrics |
| 1 | proportion CRUS (s, sp) | soft | taxonomic group | Chlorophyta | relative species numbers | | proportion of total species that are Cladophora glomerata, Rhizoclonium hieroglyphicum, Ulva flexuosa, and Stigeoclonium spp. |
| 1 | proportion of Chlorophyta belonging to CRU (s, m) | soft | taxonomic group | Chlorophyta | relative species number and biovolumes | | mean of  scores for the corresponding species number and biovolume metrics |
| 1 | proportion of Chlorophyta belonging to CRUS (s, b) | soft | taxonomic group | Chlorophyta | relative biovolumes | | proportion of Chlorophyta micro+macro biovolume composed of *Cladophora glomerata, Rhizoclonium hieroglyphicum, Ulva flexuosa*, and *Stigeoclonium* spp. |
| 1 | proportion of Chlorophyta belonging to CRUS (s, m) | soft | taxonomic group | Chlorophyta | relative species number and biovolumes | | mean of  scores for the corresponding species number and biovolume metrics |
| 1 | proportion of green algae belonging to CRUS (s, m) | soft | taxonomic group | Chlorophyta | relative species number and biovolumes | | mean of  scores for the corresponding species number and biovolume metrics |
| 1 | proportion of green algae belonging to CRUS (s, sp) | soft | taxonomic group | Chlorophyta | relative species numbers | | proportion of total green algae (Chlorophyta+Charophyta) species that are *Cladophora glomerata*, *Rhizoclonium hieroglyphicum*, *Ulva flexuosa*, and *Stigeoclonium* spp. |
| 1 | proportion cyanobacteria (s, b) | soft | taxonomic group | cyanobacteria | relative biovolumes | | proportion of total micro+macro biovolume composed of cyanobacteria |
| 1 | proportion cyanobacteria (s, m) | soft | taxonomic group | cyanobacteria | relative species number and biovolumes | | mean of  scores for the corresponding species number and biovolume metrics |
| 1 | proportion cyanobacteria (s, sp) | soft | taxonomic group | cyanobacteria | relative species numbers | | proportion of total species that belong to cyanobacteria |
| 1 | proportion Rhodophyta (s, b) | soft | taxonomic group | Rhodophyta | relative biovolumes | | proportion of total micro+macro biovolume composed of Rhodophyta |
| 1 | proportion Rhodophyta (s, m) | soft | taxonomic group | Rhodophyta | relative species number and biovolumes | | mean of  scores for the corresponding species number and biovolume metrics |

| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 1 | proportion Rhodophyta (s, sp) | soft | taxonomic group | Rhodophyta | relative species numbers | | proportion of total species that belong to Rhodophyta |
| 1 | proportion of green algae belonging to Zygnemataceae (s, b) | soft | taxonomic group | Zygnematace ae | relative biovolumes | | proportion of green algae (Chlorophyta+Charophyta) micro+macro biovolume composed of Zygnemataceae |
| 1 | proportion of green algae belonging to Zygnemataceae (s, m) | soft | taxonomic group | Zygnematace ae | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion of green algae belonging to Zygnemataceae (s, sp) | soft | taxonomic group | Zygnematace ae | relative species numbers | | proportion of total green algae (Chlorophyta+Charophyta) species belonging to Zygnemataceae |
| 1 | proportion Zygnemataceae (s, b) | soft | taxonomic group | Zygnematace ae | relative biovolumes | | proportion of total micro+macro biovolume composed of Zygnemataceae |
| 1 | proportion Zygnemataceae (s, m) | soft | taxonomic group | Zygnematace ae | relative species number and biovolumes | | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion Zygnemataceae (s, sp) | soft | taxonomic group | Zygnematace ae | relative species numbers | | proportion of total species that belong to Zygnemataceae |
| 1 | proportion high Cu indicators (s, b) | soft | tolerance/ sensitivity | copper | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of high copper (dissolved) |
| 1 | proportion low Cu indicators (s, b) | soft | tolerance/ sensitivity | copper | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of low copper (dissolved) |
| 2 | proportion low Cu indicators (s, sp) | soft | tolerance/ sensitivity | copper | relative species numbers | indicator species analysis | proportion of total species richness composed of low copper (dissolved) indicators |
| 1 | proportion high TN indicators (s, b) | soft | tolerance/ sensitivity | nitrogen | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of high TN |
| 1 | proportion high TN indicators (s, sp) | soft | tolerance/ sensitivity | nitrogen | relative species numbers | indicator species analysis | proportion of total species richness composed of high TN indicators |

## Appendix D: Metric definitions and screening results summary



| Phase when (if) eliminated | Metric | Assemblage | Metric category | Metric theme | Data type | Source of indicator values | Metric description |
|---|---|---|---|---|---|---|---|
| 2 | proportion low TN indicators (s, b) | soft | tolerance/ sensitivity | nitrogen | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of low TN |
| 1 | proportion low DOC indicators (s, b) | soft | tolerance/ sensitivity | organic pollution | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of low DOC |
| 1 | proportion low DOC indicators (s, sp) | soft | tolerance/ sensitivity | organic pollution | relative species numbers | indicator species analysis | proportion of total species richness composed of low DOC indicators |
| 1 | proportion organic pollution tolerant (s, b) | soft | tolerance/ sensitivity | organic pollution | relative biovolumes | several sources cited in Methods | proportion of total micro+macro biovolume composed of species deemed "tolerant" to organic pollution |
| 1 | proportion organic pollution tolerant (s, m) | soft | tolerance/ sensitivity | organic pollution | relative species number and biovolumes | several sources cited in Methods | mean of scores for the corresponding species number and biovolume metrics |
| 1 | proportion organic pollution tolerant (s, sp) | soft | tolerance/ sensitivity | organic pollution | relative species numbers | several sources cited in Methods | proportion of total species that are species deemed "tolerant" to organic pollution |
| 1 | proportion high TP indicators (s, b) | soft | tolerance/ sensitivity | phosphorus | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of high TP |
| 1 | proportion high TP indicators (s, sp) | soft | tolerance/ sensitivity | phosphorus | relative species numbers | indicator species analysis | proportion of total species richness composed of high TP indicators |
| 2 | proportion low TP indicators (s, b) | soft | tolerance/ sensitivity | phosphorus | relative biovolumes | indicator species analysis | proportion of total micro+macro biovolume composed of indicators of low TP |

[1] Based on correlation with generalized water chemistry gradient from principal components analysis as described in Methods.