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Accessory Publication

Section A. The correlation coefficients between water depth and the sediment and geochemical variables (both winter and summer)

	%Mud	Sorting	$CaCO_3$	Total sulfur	Chlorophyll a	TSM	BAE PCA scores
August							
Depth	-0.45	-0.54	-0.55	-0.56	-0.06	-0.26	0.21
February							
Depth	-0.58	-0.63	-0.56	-0.47	-0.06	-0.19	0.53

Section B. Details of Model Selection Process

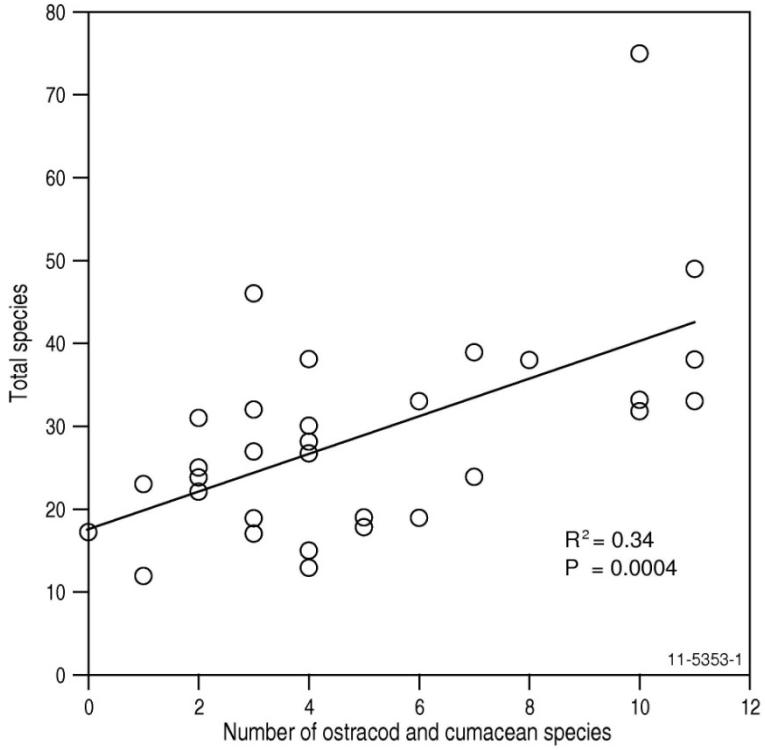
A number of factors can affect the performance of BDT. This study employed an intensive experimental process for the selection of a best performing BDT model for each target variable. The criterion of a best performing BDT was that it can yield the highest percentage of variance explained (R^2) from a cross-validation evaluation. The model selection process has four steps:

1. Setting initial model parameters. We set the model parameters: 200, 5, and 2 for the maximum number of trees, the depth of individual trees, and the minimum size node respectively. The number of cross-validation folds was selected from earlier experiments. It should be noted that the starting combinations have little influence on the selection of the final BDT model.
2. Searching the best combination of the explanatory variable groups. This was an iterative procedure. The nine variable groups were added to BDT, one at a time, using the starting combination of the model parameters (from Step 1). The variable group with the highest R^2 was retained for the next iteration; and the R^2 value was recorded. This procedure was repeated until all variable groups were added to BDT, and the combination of the variable group(s) with the highest R^2 was selected as the best combination.
3. Refining the model parameters. The settings of the four model parameters (number of cross-validation folds, depth of individual trees, minimum size nodes and maximum number of trees) were varied to find the best parameter combination under the new set of explanatory variables (from Step 2). The number of cross-validation folds was varied between two and ten. The depth of individual trees was varied between four and seven. The

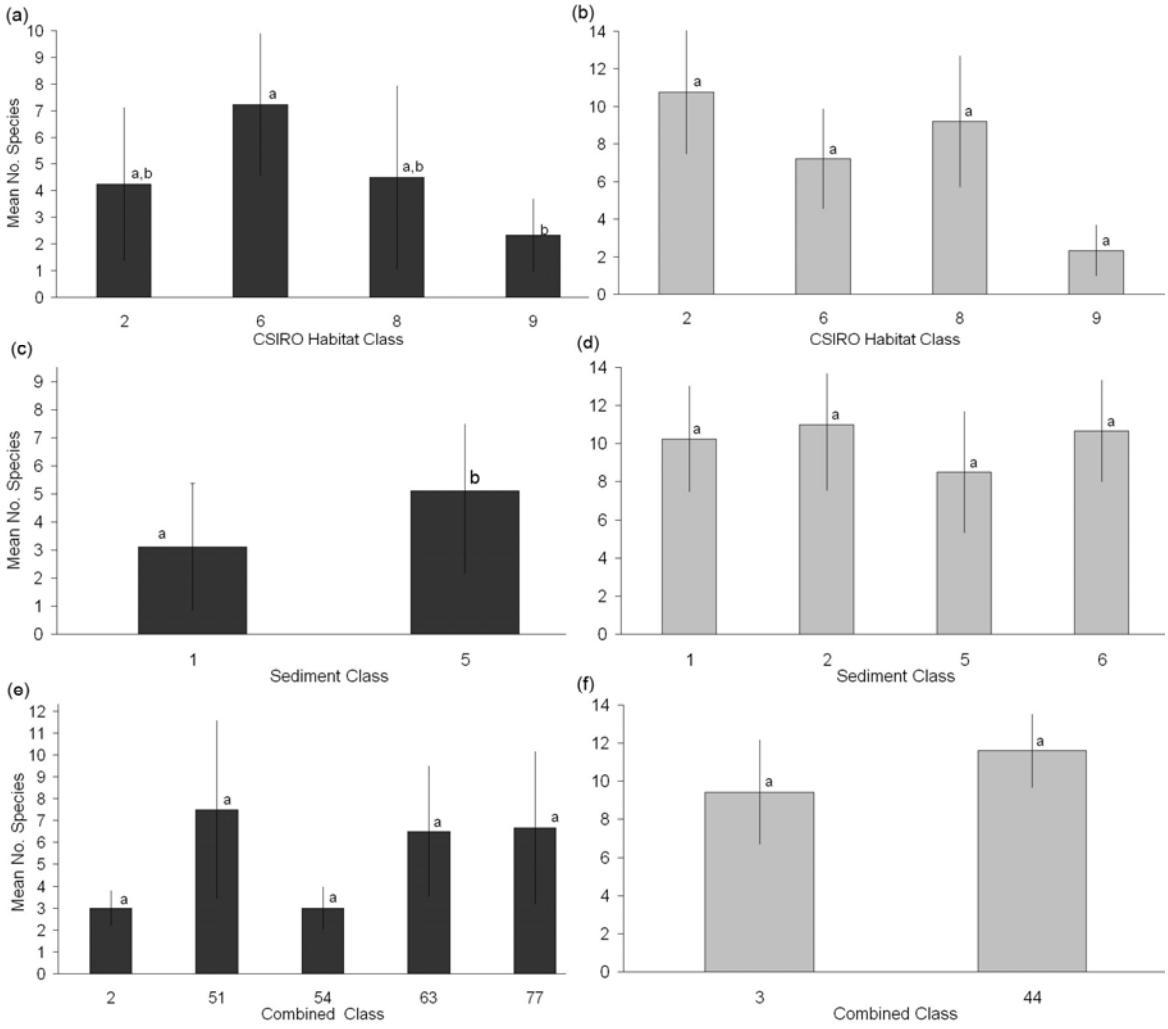
minimum size node to split was varied between two and three. The maximum number of trees was varied between 100 and 1000 with an increment of 100.

4. Refining the variables combination. The selected individual explanatory variables were then added to BDT in sequence from most important to least important. The set of individual variables with the highest R^2 constituted the final selection of the explanatory variables. The BDT with the final selection of the explanatory variables and the best combination of the model parameters was used to generate continuous layers for each of the target variables.

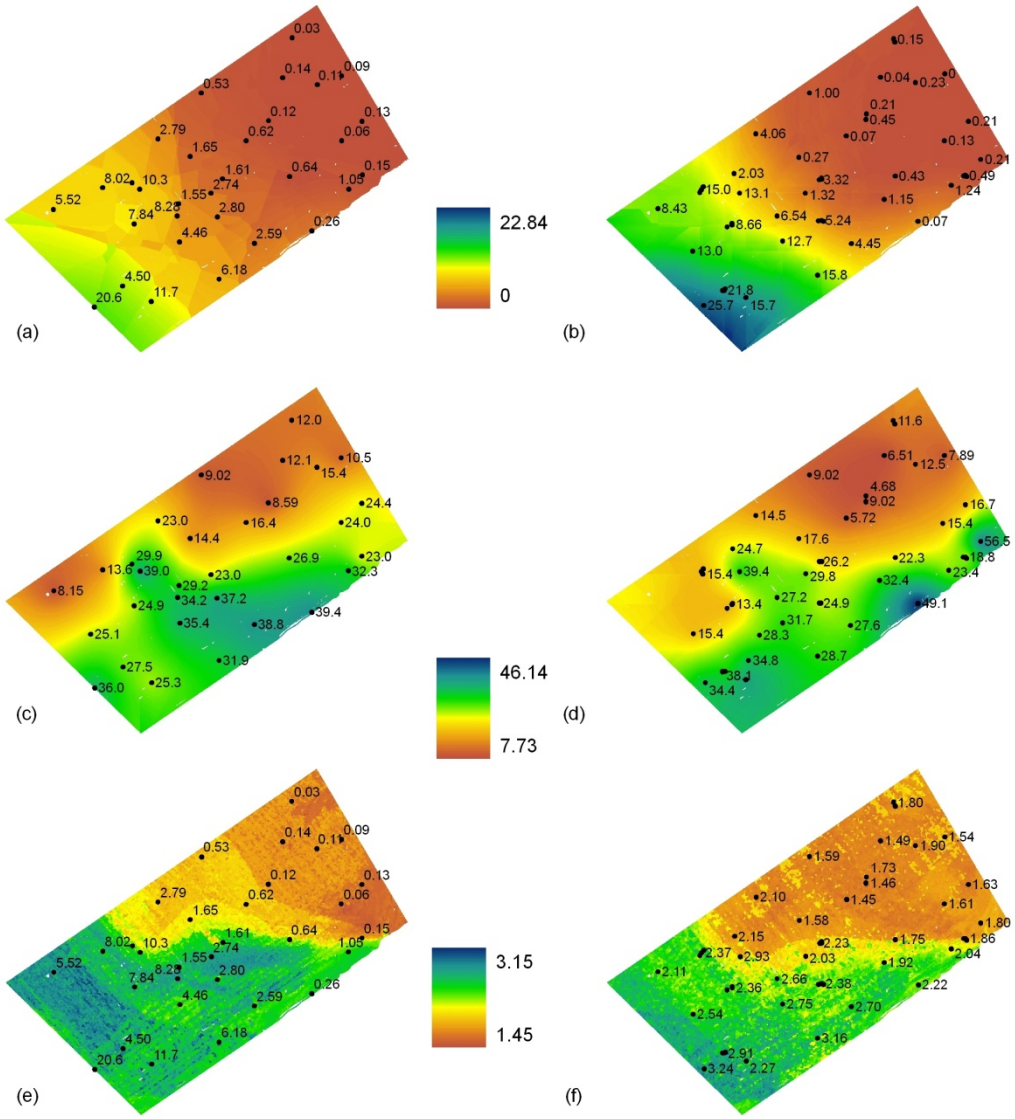
Section C. (a) Number of ostracod and cumacean species versus total number of infaunal species (>500 μm) in August 2008.



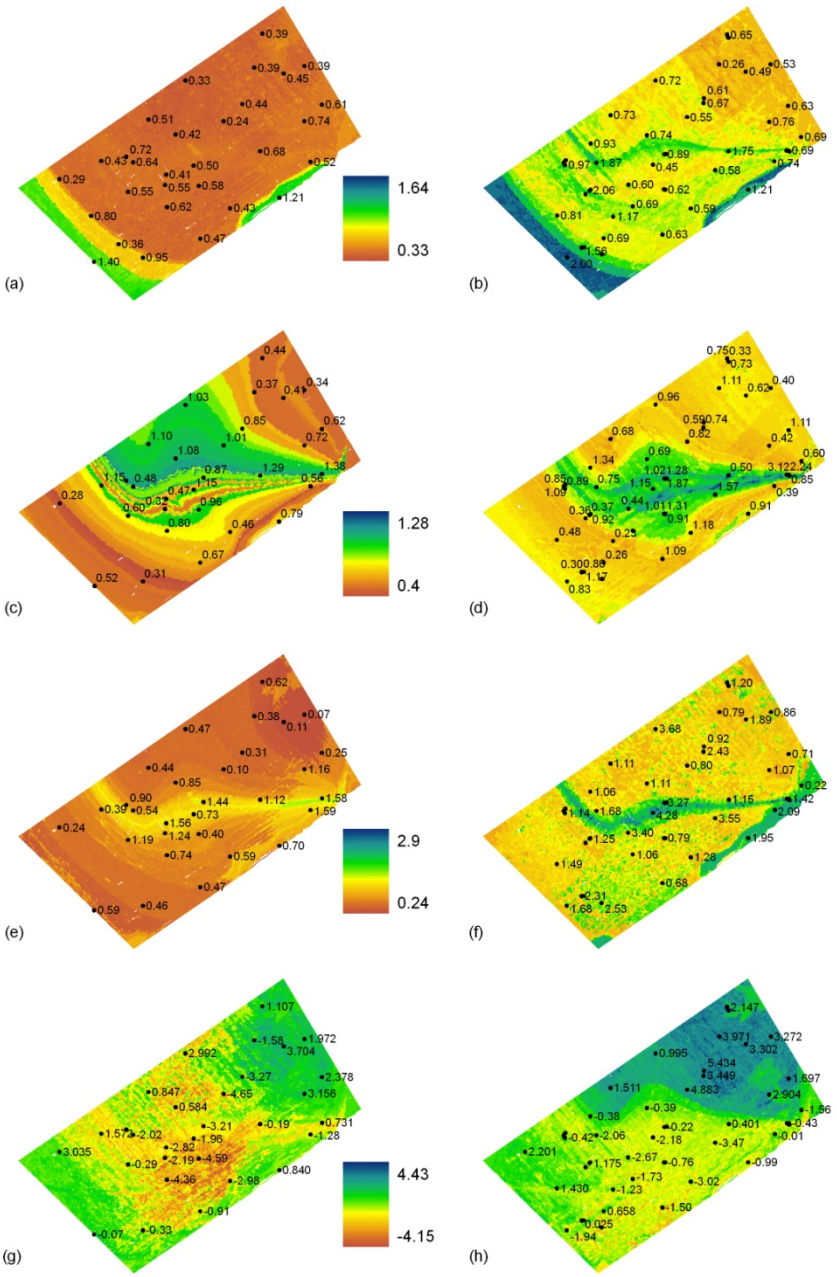
Section D. Infaunal diversity as measured by species richness among classes derived from (a) CSIRO video data, (b) sediment data and (c) combined sediment and geochemical data. Only classes for which there were ≥ 3 stations in each class are shown. Dark grey bars represent August datasets, and light grey bars represent February datasets. Error bars are standard error means. Within each panel, significant relationships between classes are indicated by different letters. These univariate analyses were performed with one-way ANOVAs using the R statistical platform (v. 2.7.2 with $\alpha = 0.05$) to determine if there were significant differences in species richness amongst patch-types. Species richness varied significantly amongst the video-based habitat types in winter with more species in patch 6 ($F_{3,25}$=3.8403, p =0.0217) (a). Although statistically significant differences were not detected in the summer dataset ($F_{3,25}$ =.7410, p =0.5376), fewer species were found in patch type 9 (rippled sands) (b). The low number of stations in this patch may have limited the detection of statistically significant differences (Type II error). Species richness was significantly different among the winter ($F_{1, 24}$ =6.2201, p = 0.0120) but not summer ($F_{2, 29}$ = 1.0003, p = 0.4072) sediment patches (c,d). Amongst combined patch types, species richness was not significantly different in winter ($F_{4, 15}$=2.0677, p = 0.1361) or summer ($F_{1, 11}$= 2.2577, p = 0.1639) (e,f), although low number of stations (3-4) in most patches may have again increased the risk of a Type II error. The numbers of the video-based patch-types correspond to bioturbated sands (2), bivalve clumps (3), drift-algae (6), polychaete hummocks (8) and rippled sands (9). See Fig. 4 for list of sediment-based patch-types and Fig. 6 and Sections I and J (Accessory Materials) for list of combined sediment/geochemistry patch-types.


(a)
Mean No. Species
a,b
a
a,b
b
2
6
8
9
CSIRO Habitat Class
(b)
a
a
a
a
2
6
8
9
CSIRO Habitat Class
(c)
Mean No. Species
a
b
1
5
Sediment Class
(d)
a
a
a
a
1
2
5
6
Sediment Class
(e)
Mean No. Species
a
a
a
a
a
2
51
54
63
77
Combined Class
(f)
a
a
3
44
Combined Class

Section E. Continuous maps of the sedimentology variables. (a) August % mud; (b) February %mud; (c) August %$CaCO_3$; (d) February %$CaCO_3$; and (e) August sorting; and (f) February sorting. Measured values are overlain on the maps.



Section F. Continuous maps of the biogeochemistry variables. (a) August total sulfur; (b) February total sulfur; (c) August chlorophyll *a*; (d) February chlorophyll *a*; (e) August total sediment metabolism (f) February total sediment metabolism; (g) August bioactive elements; and (h) February bioactive elements. Measured values are overlain on the maps.



Section G. August geochemistry classes. Note that a cell encapsulates an area of $25m^2$. The abbreviations are as follows: Chl-a (chlorophyll *a*), TSM (total sediment metabolism), TS (total sulfur) and BAE (bioactive elements).

Class	Cell count	Class Name
1	291584	low Chl-a, low TSM, low TS, moderate BAE
2	27570	low Chl-a, low TSM, low TS, low BAE
5	28320	low Chl-a, moderate TSM, low TS, moderate BAE
7	47880	low Chl-a, low TSM, moderate TS, moderate BAE
8	1418	low Chl-a, moderate TSM, moderate TS, moderate BAE
16	3152	low Chl-a, moderate TSM, low TS, high BAE
17	46453	low Chl-a, low TSM, low TS, high BAE
20	37	moderate Chl-a, low TSM, low TS, low BAE
22	6083	moderate Chl-a, moderate TSM, low TS, moderate BAE
26	108538	moderate Chl-a, lowTSM, low TS, moderate BAE
31	232	moderate Chl-a, moderate TSM, low TS, high BAE
33	22314	moderate Chl-a, lowTSM, low TS, high BAE

Section H: February geochemistry classes. Note that a cell encapsulates an area of $25m^2$. The abbreviations are as follows: Chl-a (chlorophyll *a*), TSM (total sediment metabolism), TS (total sulfur) and BAE (bioactive elements).

Class	Cell count	Class Name
1	16468	low Chl-a; low TSM; low TS; moderate BAE
2	74295	low Chl-a; low TSM; low TS; low BAE
3	21414	low Chl-a; low TSM; moderate TS; low BAE
4	35005	low Chl-a; moderate TSM; moderate TS; low BAE
5	20287	low Chl-a; moderate TSM; low TS; moderate BAE
6	49843	low Chl-a; moderate TSM; low TS; low BAE
7	71671	low Chl-a; low TSM; moderate TS; moderate BAE
8	168214	low Chl-a; moderate TSM; moderate TS; moderate BAE
9	19195	low Chl-a; moderate TSM; high TS; moderate BAE
10	24112	low Chl-a; low TSM; high TS; moderate BAE
11	5401	low Chl-a; high TSM; moderate TS; moderate BAE
12	79	low Chl-a; high TSM; low TS; moderate BAE
13	114	low Chl-a; high TSM; high TS; moderate BAE
14	5273	low Chl-a; moderate TSM; moderate TS; high BAE
15	207	low Chl-a; low TSM; moderate TS; high BAE
16	114	low Chl-a; moderate TSM; low TS; high BAE
17	22	low Chl-a; low TSM; low TS; high BAE
18	568	low Chl-a; moderate TSM; high TS; high BAE
19	86	low Chl-a; low TSM; high TS; high BAE
20	16	moderate Chl-a; low TSM; low TS; low BAE
21	103	moderate Chl-a; moderate TSM; low TS; low BAE
22	9997	moderate Chl-a; moderate TSM; low TS; moderate BAE
23	46294	moderate Chl-a; moderate TSM; moderate TS; moderate BAE
24	7	moderate Chl-a; moderate TSM; moderate TS; low BAE
25	8454	moderate Chl-a; low TSM; moderate TS; moderate BAE
26	1742	moderate Chl-a; low TSM; low TS; moderate BAE
27	3685	moderate Chl-a; high TSM; moderate TS; moderate BAE
28	182	moderate Chl-a; moderate TSM; high TS; moderate BAE
29	64	moderate Chl-a; moderate TSM; moderate TS; high BAE
30	635	moderate Chl-a; high TSM; low TS; moderate BAE
31	15	moderate Chl-a; moderate TSM; low TS; high BAE
32	19	moderate Chl-a; low TSM; moderate TS; high BAE

Section I. Combined sedimentology and geochemistry classes for August. Note that a cell encapsulates an area of 25m^2. The abbreviations are as follows: Chl-a (chlorophyll *a*), TSM (total sediment metabolism), TS (total sulfur) and BAE (bioactive elements).

Class	Cell count	Class Name
1	115395	low Chl-a, low TSM, low TS, moderate BAE on moderately sorted calcareous silica sand bottom
2	27470	low Chl-a, low TSM, low TS, low BAE on moderately sorted calcareous silica sand bottom
4	37	moderate Chl-a, low TSM, low TS, low BAE on moderately sorted calcareous silica sand bottom
6	563	low Chl-a, moderate TSM, low TS, moderate BAE on moderately sorted calcareous silica sand bottom
11	1908	moderate Chl-a, moderate TSM, low TS, moderate BAE on moderately sorted calcareous silica sand bottom
15	45455	moderate Chl-a, lowTSM, low TS, moderate BAE on moderately sorted calcareous silica sand bottom
21	67	low Chl-a, low TSM, low TS, low BAE on moderately sorted silica sand bottom
28	25735	low Chl-a, low TSM, moderate TS, moderate BAE on poorly sorted calcareous silica muddy sand bottom
31	25153	low Chl-a, low TSM, low TS, moderate BAE on poorly sorted calcareous silica muddy sand bottom
49	16	low Chl-a, moderate TSM, low TS, moderate BAE on poorly sorted silica sand bottom
51	147907	low Chl-a, low TSM, low TS, moderate BAE on poorly sorted calcareous silica sand bottom
52	29	low Chl-a, low TSM, low TS, low BAE on poorly sorted calcareous silica sand bottom
54	27717	low Chl-a, moderate TSM, low TS, moderate BAE on poorly sorted calcareous silica sand bottom
57	1418	low Chl-a, moderate TSM, moderate TS, moderate BAE on poorly sorted calcareous silica sand bottom
58	21875	low Chl-a, low TSM, moderate TS, moderate BAE on poorly sorted calcareous silica sand bottom
63	60831	moderate Chl-a, lowTSM, low TS, moderate BAE on poorly sorted calcareous silica sand bottom
65	4169	moderate Chl-a, moderate TSM, low TS, moderate BAE on poorly sorted calcareous silica sand bottom
74	232	moderate Chl-a, moderate TSM, low TS, high BAE on poorly sorted calcareous silica sand bottom
76	3143	low Chl-a, moderate TSM, low TS, high BAE on poorly sorted calcareous silica sand bottom
77	45140	low Chl-a, low TSM, low TS, high BAE on poorly sorted calcareous silica sand bottom
78	1305	low Chl-a, low TSM, low TS, high BAE on moderately sorted calcareous silica sand bottom
79	6903	moderate Chl-a, lowTSM, low TS, high BAE on moderately sorted calcareous silica sand bottom
80	15038	moderate Chl-a, lowTSM, low TS, high BAE on poorly sorted calcareous silica sand bottom
81	216	moderate Chl-a, lowTSM, low TS, high BAE on moderately sorted silica sand bottom
82	148	moderate Chl-a, lowTSM, low TS, high BAE on poorly sorted silica sand bottom
83	2012	moderate Chl-a, lowTSM, low TS, moderate BAE on moderately sorted silica sand bottom
84	198	moderate Chl-a, lowTSM, low TS, moderate BAE on poorly sorted silica sand bottom
85	1635	low Chl-a, low TSM, low TS, moderate BAE on moderately sorted silica sand bottom
86	1351	low Chl-a, low TSM, low TS, moderate BAE on poorly sorted silica sand bottom

Section J. Combined sedimentology and geochemistry classifications for February. Note that a cell encapsulates an area of $25m^2$. The abbreviations are as follows: Chl-a (chlorophyll *a*), TSM (total sediment metabolism), TS (total sulfur) and BAE (bioactive elements).

Class	Cell count	Class Name
1	12114	low Chl-a; low TSM; low TS; moderate BAE; moderately sorted calcareous silica sand
2	3234	low Chl-a; low TSM; low TS; moderate BAE; poorly sorted calcareous silica sand
3	57303	low Chl-a; low TSM; low TS; low BAE; moderately sorted calcareous silica sand
4	14280	low Chl-a; low TSM; moderate TS; low BAE; moderately sorted calcareous silica sand
5	1428	low Chl-a; low TSM; low TS; low BAE; poorly sorted calcareous silica sand
6	16	moderate Chl-a; low TSM; low TS; low BAE; moderately sorted calcareous silica sand
7	1024	low Chl-a; moderate TSM; moderate TS; low BAE; poorly sorted calcareous silica sand
8	5334	low Chl-a; moderate TSM; low TS; moderate BAE; poorly sorted calcareous silica sand
9	32473	low Chl-a; moderate TSM; low TS; low BAE; moderately sorted calcareous silica sand
10	11785	low Chl-a; moderate TSM; low TS; moderate BAE; moderately sorted calcareous silica sand
11	23822	low Chl-a; moderate TSM; moderate TS; low BAE; moderately sorted calcareous silica sand
12	1638	low Chl-a; moderate TSM; low TS; low BAE; poorly sorted calcareous silica sand
13	1712	low Chl-a; low TSM; moderate TS; low BAE; poorly sorted calcareous silica sand
14	15919	low Chl-a; low TSM; moderate TS; moderate BAE; moderately sorted calcareous silica sand
15	51358	low Chl-a; moderate TSM; moderate TS; moderate BAE; poorly sorted calcareous silica sand
16	21120	low Chl-a; low TSM; moderate TS; moderate BAE; poorly sorted calcareous silica sand
17	94	moderate Chl-a; moderate TSM; low TS; low BAE; moderately sorted calcareous silica sand
18	15405	low Chl-a; low TSM; low TS; low BAE; moderately sorted silica sand
19	15501	low Chl-a; moderate TSM; low TS; low BAE; moderately sorted silica sand
20	10091	low Chl-a; moderate TSM; moderate TS; low BAE; moderately sorted silica sand
21	217	low Chl-a; moderate TSM; low TS; low BAE; poorly sorted silica sand
22	5277	low Chl-a; low TSM; moderate TS; low BAE; moderately sorted silica sand
23	139	low Chl-a; low TSM; low TS; low BAE; poorly sorted silica sand
24	47	low Chl-a; moderate TSM; moderate TS; low BAE; poorly sorted silica sand
25	142	low Chl-a; low TSM; moderate TS; low BAE; poorly sorted silica sand
26	45	low Chl-a; moderate TSM; low TS; moderate BAE; poorly sorted silica sand
27	158	low Chl-a; moderate TSM; moderate TS; moderate BAE; moderately sorted silica sand
28	30	low Chl-a; moderate TSM; moderate TS; moderate BAE; poorly sorted silica sand
29	9	moderate Chl-a; moderate TSM; low TS; low BAE; moderately sorted silica sand
30	25307	low Chl-a; moderate TSM; moderate TS; moderate BAE; moderately sorted calcareous silica sand
31	614	moderate Chl-a; moderate TSM; low TS; moderate BAE; moderately sorted calcareous silica sand
32	14126	moderate Chl-a; moderate TSM; moderate TS; moderate BAE; moderately sorted calcareous silica sand
33	7	moderate Chl-a; moderate TSM; moderate TS; low BAE; moderately sorted calcareous silica sand
34	4235	moderate Chl-a; low TSM; moderate TS; moderate BAE; moderately sorted calcareous silica sand
35	4217	moderate Chl-a; low TSM; moderate TS; moderate BAE; poorly sorted calcareous silica sand
36	31917	moderate Chl-a; moderate TSM; moderate TS; moderate BAE; poorly sorted calcareous silica sand
37	216	moderate Chl-a; low TSM; low TS; moderate BAE; moderately sorted calcareous silica sand
38	6309	low Chl-a; moderate TSM; high TS; moderate BAE; poorly sorted calcareous silica sand
39	108	low Chl-a; low TSM; high TS; moderate BAE; poorly sorted calcareous silica sand
40	1520	moderate Chl-a; low TSM; low TS; moderate BAE; poorly sorted calcareous silica sand
41	200	low Chl-a; moderate TSM; high TS; moderate BAE; moderately sorted calcareous silica sand
42	3722	low Chl-a; high TSM; moderate TS; moderate BAE; poorly sorted calcareous silica sand
43	8937	moderate Chl-a; moderate TSM; low TS; moderate BAE; poorly sorted calcareous silica sand
44	91276	low Chl-a; moderate TSM; moderate TS; moderate BAE; poorly sorted calcareous silica muddy sand

45	34597	low Chl-a; low TSM; moderate TS; moderate BAE; poorly sorted calcareous silica muddy sand
46	1603	low Chl-a; high TSM; moderate TS; moderate BAE; moderately sorted calcareous silica sand
47	3115	low Chl-a; moderate TSM; low TS; moderate BAE; poorly sorted calcareous silica muddy sand
48	1156	moderate Chl-a; high TSM; moderate TS; moderate BAE; poorly sorted calcareous silica sand
49	2516	moderate Chl-a; high TSM; moderate TS; moderate BAE; moderately sorted calcareous silica sand
50	430	moderate Chl-a; moderate TSM; low TS; moderate BAE; poorly sorted calcareous silica muddy sand
51	1116	low Chl-a; low TSM; low TS; moderate BAE; poorly sorted calcareous silica muddy sand
52	222	moderate Chl-a; moderate TSM; moderate TS; moderate BAE; poorly sorted calcareous silica muddy sand
53	147	moderate Chl-a; moderate TSM; high TS; moderate BAE; poorly sorted calcareous silica sand
54	20	moderate Chl-a; moderate TSM; moderate TS; high BAE; poorly sorted calcareous silica sand
55	44	moderate Chl-a; moderate TSM; moderate TS; high BAE; moderately sorted calcareous silica sand
56	495	moderate Chl-a; high TSM; low TS; moderate BAE; moderately sorted calcareous silica sand
57	140	moderate Chl-a; high TSM; low TS; moderate BAE; poorly sorted calcareous silica sand
58	77	low Chl-a; high TSM; low TS; moderate BAE; poorly sorted calcareous silica sand
59	6	moderate Chl-a; low TSM; low TS; moderate BAE; poorly sorted calcareous silica muddy sand
60	104	low Chl-a; high TSM; high TS; moderate BAE; poorly sorted calcareous silica sand
61	890	low Chl-a; moderate TSM; moderate TS; high BAE; poorly sorted calcareous silica sand
62	23802	low Chl-a; low TSM; high TS; moderate BAE; poorly sorted calcareous silica muddy sand
63	12647	low Chl-a; moderate TSM; high TS; moderate BAE; poorly sorted calcareous silica muddy sand
64	160	low Chl-a; low TSM; moderate TS; high BAE; poorly sorted calcareous silica sand
65	69	low Chl-a; high TSM; moderate TS; moderate BAE; poorly sorted calcareous silica muddy sand
66	35	moderate Chl-a; moderate TSM; high TS; moderate BAE; poorly sorted calcareous silica muddy sand
67	15	moderate Chl-a; moderate TSM; low TS; high BAE; poorly sorted calcareous silica sand
68	47	low Chl-a; low TSM; moderate TS; high BAE; poorly sorted calcareous silica muddy sand
69	19	moderate Chl-a; low TSM; moderate TS; high BAE; poorly sorted calcareous silica sand
70	4374	low Chl-a; moderate TSM; moderate TS; high BAE; poorly sorted calcareous silica muddy sand
71	27	low Chl-a; moderate TSM; low TS; high BAE; poorly sorted calcareous silica sand
72	6	low Chl-a; low TSM; low TS; high BAE; poorly sorted calcareous silica sand
73	16	low Chl-a; low TSM; low TS; high BAE; poorly sorted calcareous silica muddy sand
74	87	low Chl-a; moderate TSM; low TS; high BAE; poorly sorted calcareous silica muddy sand
75	568	low Chl-a; moderate TSM; high TS; high BAE; poorly sorted calcareous silica muddy sand
76	80	low Chl-a; low TSM; high TS; high BAE; poorly sorted calcareous silica muddy sand
77	10	low Chl-a; high TSM; high TS; moderate BAE; poorly sorted calcareous silica muddy sand