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A PRELIMINARY CHECKLIST OF MARINE BENTHIC DIATOMS OF MISSISSIPPI

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ABSTRACT A checklist of diatoms collected from various benthic habitats in coastal salt marshes and offshore seagrass beds of Mississippi has been compiled for the first time. The checklist includes 213 taxa (species and their varieties) in 43 genera with 19 of these taxa found only on the leaves of offshore seagrasses. *Synedra fasciculata* var. *intermedia* (Grun.) Sulliv. comb. nov. is proposed to be consistent with the nomenclature of the nominate variety. Future work with this ecologically important group of marine algae should result in many new additions to this preliminary checklist.

INTRODUCTION

The marine benthic diatom flora of Mississippi remained an unknown entity until the publications of Sullivan (1978, 1979a). This is somewhat surprising in view of the great ecological importance of these organisms as major constituents of the base of food webs in marine coastal ecosystems. Conger et al. (1972) compiled a list of diatoms from the Gulf of Mexico based on reviews of the older literature, and on results of phytoplankton collections in oceanic waters of the Gulf. Despite the broad coverage of their review, a great many species found in Mississippi by this author were not included in their checklist; an up-to-date list of diatoms in Mississippi's coastal environments was thought to be needed. Furthermore, the present checklist reflects current taxonomic thinking, and restricts itself to a specific component of the flora (i.e., those forms leading a benthic existence).

Other major groups of marine algae in Mississippi have fared little better than the diatoms and only two published studies could be found. Humm and Caylor (1957) surveyed the blue-green, green, red, and brown algae of Mississippi Sound during two consecutive summers. The majority of collections were made around Ship Island, although a few were noted from such localities as Deer Island and a salt marsh near Ocean Springs. Sage and Sullivan (1978) collected blue-green algae from Graveline Bay Marsh over a yearly cycle, and noted the similarity between their flora and those of Atlantic coastal salt marshes.

CHECKLIST COVERAGE

Although the geographical limits of the checklist theoretically include all benthic habitats of the Mississippi coast and its salt marshes, as well as those of Mississippi Sound and its offshore barrier islands, the number of localities sampled are few and the actual coverage represents a very small percentage of the total area just defined. However, the similarity of the diatom flora from different salt marshes or seagrass beds suggests that the checklist, although pre-

liminary, is representative of the character of the marine benthic diatom flora of Mississippi. This similarity also suggests that the number of additions to the checklist will decrease with each new locality sampled.

The present checklist is biased towards the edaphic (sediment-associated) diatom flora of coastal salt marshes. Most of this work has been conducted in Graveline Bay Marsh which is located ca. 11 km southeast of the Gulf Coast Research Laboratory, Ocean Springs, Mississippi. Some of this work has been published (Sullivan 1978); the remaining data have been submitted for publication but without a complete listing of all diatom species encountered. Three different salt marshes in St. Louis Bay, MS, have been sampled, and these unpublished data also have been incorporated into this checklist. In addition, diatoms epiphytic on the red algae *Caloglossa leprieurii* (Mont.) J. Ag. and *Bostrychia radicans* Mont. in St. Louis Bay also have been included. Three different seagrass species in beds off the north shore of Horn Island recently were sampled (Sullivan 1979a) and form an important part of the checklist. Therefore, the flora reported herein is of an edaphic or epiphytic nature, and represents both inshore and offshore habitats.

CHECKLIST FORMAT

For the purposes of this checklist, diatoms are considered to constitute the single class Bacillariophyceae. There is no universal agreement among authorities as to which division diatoms should be assigned, and there is even less agreement on the number and identity of orders and families that should be recognized. Hendey (1974) provides pertinent comments on the problems involved in arriving at a natural classification of diatoms, and reviews the different classification systems that have been proposed. The most recently proposed classification is that of Simonsen (1979) who recognizes two orders, five suborders, and 21 families. In view of the flux and uncertainty characterizing current thinking concerning relationships between higher taxonomic categories, the present checklist is concerned only with genera and species of Bacillariophyceae in marine benthic habitats of Mississippi. Genera are arranged alphabetically, and species

and their varieties are arranged alphabetically within each genus following the format of Hendey's (1974) checklist of British marine diatoms. Numbers in brackets after a name refer to **NOTES** which immediately follow the checklist. Species and their varieties collected only from offshore seagrass beds are marked with an asterisk.

BACILLARIOPHYCEAE

- ACHNANTHES** Bory, 1822
biasoletiana var. *sublinearis* Grun.
brevipes var. *intermedia* (Kütz.) Cl.
coarctata (Bréb.) Grun.
curvirostrum Brun
hauckiana Grun.
lanceolata var. *dubia* Grun. (15)
lemmermanni Hust.
temperei M. Perag.
- AMPHIPRORA** Ehrenberg, 1843
gigantea var. *decussata* (Grun.) Cl.
hyalina Eulenstein
paludosa W. Sm.
 var. *paludosa*
 var. *duplex* (Donk.) V.H.
pulchra Bailey
similis Hust.
- AMPHORA** Ehrenberg, 1831
angusta Greg.
 var. *angusta* (1)
 var. *oblongella* Grun.
caroliniana Giffen (2)
coffeiformis (Ag.) Kütz.
cymbelloides Grun.*
cymbiformis Cl.*
exigua Greg.
laevis var. *perminuta* Grun.
libyca Ehr.
pediculus (Kütz.) Grun.*
proteus Greg.
robusta Greg.*
sabyii Salah
tenerrima Hust.
tenuissima Hust.
- ANAULUS** Ehrenberg, 1844
balticus Simonsen
- ANOMOEONEIS** Pfitzer, 1871
vitrea (Grun.) Ross (3)
- BACILLARIA** Gmelin, 1778
paxillifer (Müll.) Hendey (4)
- BERKELEYA** Greville, 1827
rutilans (Trent.) Grun. (5)
- CALONEIS** Cleve, 1894
westii (W.Sm.) Hendey
- CAMPYLOSIRA** Grunow, 1882
alexandrica Salah
cymbelliformis (A.S.) Grun.
- CAPARTOGRAMMA** Kufferath, 1956
crucicula (Grun.) Ross
- COCCONEIS** Ehrenberg, 1838
deperdita Giffen
 cf. *discrepans* A.S.
disculoides Hust.
placentula var. *euglypta* (Ehr.) Grun.
placentula var. *lineata* (Ehr.) V.H.
scutellum Ehr.
 var. *scutellum*
 var. *parva* (Grun.) Cl.
woodii Reyes-Vasquez* (6)
- CYCLOTELLA** Kützing, 1833
caspia Grun.
meneghiniana Kütz.
stylorum Brightwell
- CYLINDROTHECA** Rabenhorst, 1859
gracilis (Bréb.) Grun.
- CYMATOSIRA** Grunow, 1862
belgica Grun.
- CYMBELLA** Agardh, 1830
pusilla Grun. (7)
- DENTICULA** Kützing, 1844
subtilis Grun.
- DIMEREGRAMMA** Ralfs, 1861
hyalinum Hust.
minor (Greg.) Ralfs
- DIPLONEIS** Ehrenberg, 1840
aestuaria Hust.
elliptica (Kütz.) Cl.
gruendleri (A.S.) Cl.
mediterranea (Grun.) Cl.
obliqua (Brun) Hust.*
pseudovalis Hust.
puella (Schum.) Cl.
smithii (Bréb.) Cl.
- EUNOTIA** Ehrenberg, 1837
naegelii Migula (8)
- EUNOTOGRAMMA** Weisse, 1854
laevis (*laeve*) Grun.
- FRAGILARIA** Lyngbye, 1819
atomus Hust.
gessneri Hust.
hyalina (Kütz.) Grun.*
obtusa Hust.
pinnata Ehr.
schulzi Brockmann
- FRUSTULIA** Agardh, 1824
asymmetrica (Cl.) Hust.
rhomboides var. *saxonica* (Rabh.) DeToni
similis Hust.

GRAMMATOPHORA Ehrenberg, 1840*oceanica* Ehr.***GYROSIGMA** Hassall, 1845*balticum* (Ehr.) Rabh.*beaufortianum* Hust.*macrum* (W.Sm.) Griff. & Henfr.*obliquum* (Grun.) Boyer*obscurum* (W.Sm.) Griff. & Henfr.*peisonis* (Grun.) Hust.**HANTZSCHIA** Grunow, 1880*distincte-punctata* Hust.**LICMOPHORA** Agardh, 1827*abbreviata* Ag.*cf. *debilis* (Kütz.) Grun.***MASTOGLOIA** Thwaites, 1856*exigua* Lewis*pumila* (Grun.) Cl.*pusilla* Grun.***MELOSIRA** Agardh, 1824*dubia* Kütz.*lineata* (Dillw.) Ag.*moniliformis* (Müll.) Ag.*nummuloides* Ag.*westii* W.Sm.**NAVICULA** Bory, 1822*abunda* Hust.*accomoda* Hust.*aequorea* Hust.*alpha* Cl.*ammophila* Grun.*amphipleuroides* Hust.**binodulosa* Sulliv. & Reim. (9)*capitata* var. *hungarica* (Grun.) Ross*circumtexta* Meister*clamans* Hust.*clementis* Grun.*cocconeiformis* Greg.*creuzburgensis* Krasske*digito-radiata* (Greg.) Ralfs*diserta* Hust.*fauta* Hust. (10)*fenestrella* Hust.*flanatica* Grun.*florinae* Møller*gregaria* Donkin*hanseni* Møller*hudsonis* Grun. (11)*incerta* Grun.*incomposita* Hagelstein*longirostris* Hust.*maculata* (Bailey) Edwards*mendotia* VanLand.cf. *menisculus* Schum.*mutica* Kütz. (12)*nolens* Simonsen*obsoleta* Hust.*orbiculata* Patrick (13)*pavillardii* Hust.**peregrina* (Ehr.) Kütz.*phyllepta* Kütz.*pseudocrassirostris* Hust.*pseudony* Hust.*pusilla* W.Sm.*radiostriata* Hust.*regularis* Hust.*rhynchocephala* Kütz.*salinarum* Grun. (14)*salinicola* Hust. (15)*schroeteri* Meister*spicula* (Hickie) Cl.*subforcipata* Hust.*subirritans* Giffen*taraxa* Hohn & Hellerm. (16)*tenera* Hust.*teneroides* Hust.*tripunctata* (Müll.) Bory (15,17)*yarrensis* Grun.*zostereti* Grun.**NITZSCHIA** Hassall, 1845 (18)*angularis* W.Sm.*apiculata* (Greg.) Grun.*bilobata* var. *ambigua* Manguin*brevissima* Grun. (19)*calida* Grun.*closterium* (Ehr.) W.Sm.*communis* var. *hyalina* Lund*constricta* (Greg.) Grun.**dissipata* (Kütz.) Grun.*dubia* W.Sm.*dubiformis* Hust.*epithemoides* Grun.*fasciculata* (Grun.) Grun.*filiformis* (W.Sm.) Schütt*gandersheimiensis* Krasske (20)*grana* Hohn & Hellerm.*granulata* Grun.*hungarica* Grun.*hustedtiana* Salah*levidensis* (W.Sm.) V.H.*lorenziana* Grun.var. *lorenziana*var. *subtilis* Grun.*microcephala* Grun.*minutula* Grun. (15,21)*obsidialis* Hust.*obtusa* W.Sm.var. *obtusa*var. *nana* Grun. (15)*palea* (Kütz.) W.Sm.*paleacea* Grun.*

- panduriformis* Greg.
 var. *panduriformis*
 var. *continua* Grun.
perversa Grun.
plana W.Sm.
pseudoamphioxys Hust. (22)
recta Hantz.
romana Grun.
romanooides Manguin
scalaris (Ehr.) W.Sm.
sigma (Kütz.) W.Sm.
socialis var. *massiliensis* Grun.
subvitrea Hust.
tryblionella Hantz.
visurgis Hust.
vitrea var. *salinarum* Grun.
- OPEPHORA** Petit, 1888
pacifica (Grun.) Petit
parva (Grun.) Krasske
schwarzii (Grun.) Petit
- PARALIA** Heiberg, 1863
sulcata (Ehr.) Cl. (23)
- PLAGIOGRAMMA** Greville, 1859
tenuistriatum Cl.
- PLEUROSIGMA** W. Smith, 1852
delicatulum W.Sm.
distinguendum Hust.
salinarum (Grun.) Grun.
- strigosum* W.Sm.
RHOPALODIA O. Müller, 1895
gibberula (Ehr.) Müll.
- STAURONEIS** Ehrenberg, 1843
amphioxys Greg.
 var. *amphioxys*
 var. *obtusa* Hendey
salina W.Sm.
- STRIATELLA** Agardh, 1832
unipunctata (Lyngbye) Ag.*
- SURIRELLA** Turpin, 1828
atomus Hust.
litoralis Hust.
ovalis Bréb.
striatula Turpin
- SYNEDRA** Ehrenberg, 1830
fasciculata (Ag.) Kütz. (24)
 var. *fasciculata*
 var. *intermedia* (Grun.) Sulliv. *comb. nov.** (24)
- THALASSIOSIRA** Cleve, 1873
eccentrica (Ehr.) Cl. (25)
- TRACHYNEIS** Cleve, 1894
aspera (Ehr.) Cl.*
- TRACHYSPHENIA** Petit, 1877
acuminata Perag.*
- TROPIDONEIS** Cleve, 1891
lepidoptera (Greg.) Cl.
vitrea (W.Sm.) Cl.

NOTES

- (1) See Hendey (1974) for differences between *A. angusta* and *A. ventricosa* Greg.
- (2) Giffen (1980) examined the type slide of *Amphora granulata* Greg. and concluded that *A. granulata* sensu Hustedt (1955) represented a previously undescribed taxon, which he named and described as *A. caroliniana* after the type locality.
- (3) Only two valves were found in a St. Louis Bay salt marsh.
- (4) This taxon is better known as *Bacillaria paradoxa* Gmelin, but the correct name is *B. paxillifer* if one recognizes the validity of the genus *Bacillaria*. The former specific epithet aptly describes the paradoxical movements of colonial associations of this organism which have fascinated botanists for almost 200 years.
- (5) See Cox (1975a,b) for the separation of the genera *Berkelya* and *Amphipleura* Kützinger.
- (6) *Cocconeis woodii* differs from *C. scutellum* only by its sigmoid axial area on both valves of the frustule, and perhaps deserves only a varietal rank. In any event, the two entities clearly were separable in collections of epiphytic seagrass diatoms.
- (7) *Cymbella pusilla* is perhaps the only true marine member of the genus.
- (8) Only three valves were found in a St. Louis Bay salt marsh.
- (9) This taxon originally was described from a Delaware salt marsh by Sullivan and Reimer (1975), and only has been found within the sediments beneath *Distichlis spicata* (L.) Greene in Mississippi salt marshes.
- (10) *Navicula fauta* was first described by Hustedt (1954) from mangrove vegetation on the Pacific Coast of El Salvador, and has not been reported since to the best of my knowledge.
- (11) Considered to be conspecific with the earlier described taxon *N. pygmaea* Kütz. by Simonsen (1975).
- (12) Includes *N. mutica* var. *cohnii* (Hilse) Grun. as described by Patrick and Reimer (1966).
- (13) Observed only once in Graveline Bay Marsh.
- (14) Includes f. *minima* Kolbe which is likely to be identified by some authorities as *N. cryptocephala* var. *veneta* (Kütz.) Rabh.
- (15) One of the most abundant and characteristic salt marsh diatom taxa.
- (16) May be a synonym for *N. platyventris* Meister described earlier.

- (17) Later synonyms are *N. transversa* Bory and *N. gracilis* Ehr. (Patrick and Reimer 1966). See Cox (1979) for a detailed study of this highly variable and widely distributed taxon.
- (18) The revisions of Lange-Bertalot (1976), and Lange-Bertalot and Simonsen (1978) were used in identifying taxa belonging to the section Lanceolatae.
- (19) This taxon is identical with *Nitzschia parvula* Lewis.
- (20) Most specimens identified as this taxon fit the description of *Nitz. laevis* Hust., which is very likely a synonym of *Nitz. gandersheimiensis* according to Lange-Bertalot and Simonsen (1978).
- (21) Those individuals identified as *Nitzschia frustulum* (Kütz.) Grun. in Sullivan (1978) belong to this taxon based on interpretations of Lange-Bertalot (1976).
- (22) A very abundant diatom of Graveline Bay Marsh that could be mistaken for *Hantzschia amphioxys* var. *minor* Perag.
- (23) See Crawford (1979) for an excellent description of this taxon and its separation from *Melosira*.
- (24) Patrick and Reimer (1966) have determined that *Synedra affinis* Kütz. and *S. tabulata* (Ag.) Kütz. are later synonyms of *S. fasciculata* (Ag.) Kütz. Therefore, *S. (affinis var.) intermedia* Grun. in Van Heurck is to be properly regarded as a variety of *fasciculata*. See Sullivan (1979b) for a description of var. *intermedia*.
- (25) Based on the frequency of its appearance in salt marsh sediments, *Thalassiosira eccentrica* may be capable of a benthic as well as a planktonic existence.

GENERAL SUMMARY

A total of 213 taxa (species and their varieties) in 43 genera comprise the present checklist. Genera with the largest number of taxa are *Navicula* and *Nitzschia* with 53 and 44, respectively. This is not surprising in light of a sampling bias towards forms inhabiting salt marsh sediments where motility would appear to be a distinct advantage. The third most important genus in terms of number of taxa is *Amphora*, which also possesses a raphe system on both valves of the frustule (unicell). Also well represented are *Achnanthes*, *Cocconeis*, and *Diploneis* with eight taxa each.

Exactly 19 taxa were collected only from the leaves of offshore seagrasses in Mississippi Sound. If more collections were made in the seagrass beds, this number certainly would have been much higher. Clearly, the physicochemical characteristics of the waters that bathe diatom cells in inshore and offshore habitats are different as is evidenced by the distribution of diatom genera and taxa (e.g., *Grammatophora*, *Licmophora*, *Striatella*, and *Trachysphenia* are thus far only known from seagrass beds).

The present checklist provides important distributional information on an ecologically significant group of organisms. Future work along the Mississippi coast and in the Sound should result in many new additions to this preliminary checklist, and hopefully will encourage other workers in the remaining Gulf coastal states to compile similar checklists.

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