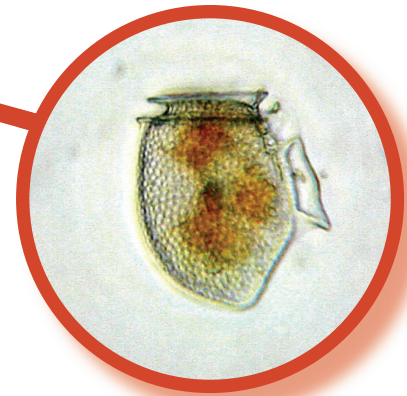
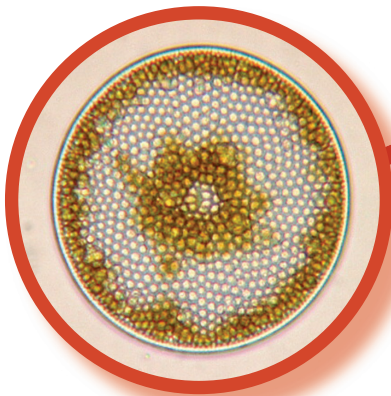
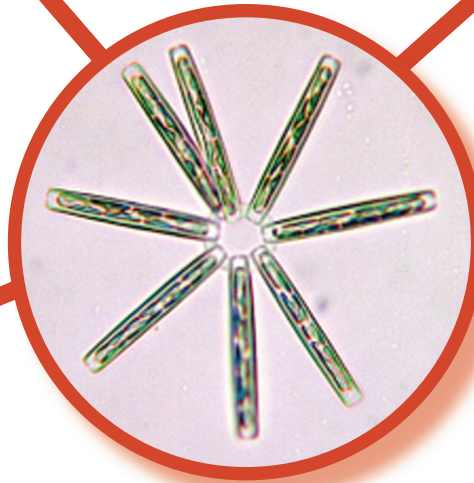
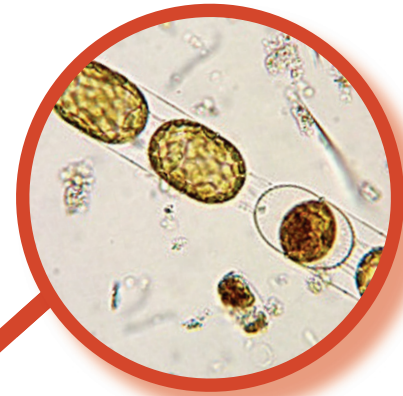
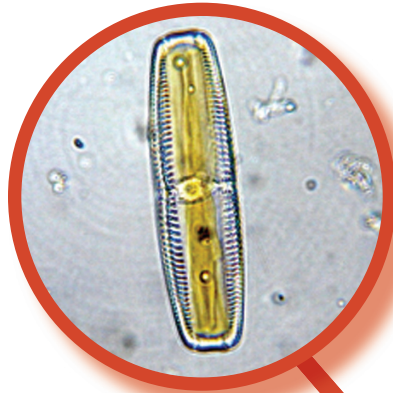




# The Great Bay Coast Watch Guide to Common Gulf of Maine Phytoplankton



A program of NH Sea Grant and UNH Cooperative Extension, the Great Bay Coast Watch is a network of citizen volunteers dedicated to protecting the long-term health and natural resources of New Hampshire's coastal waters and estuarine systems through monitoring and education projects.

[www.seagrants.unh.edu](http://www.seagrants.unh.edu)

[www.gbcw.unh.edu](http://www.gbcw.unh.edu)

# A Guide to Common Gulf of Maine Phytoplankton

By Steve Cooper and Candace Dolan, Great Bay Coast Watch

## Introduction

Since 1999, the Great Bay Coast Watch (GBCW) has been monitoring New Hampshire coastal waters for the presence of toxic phytoplankton cells. If present in large numbers, these cells can create the harmful algal blooms known as “red tides.” When filter feeders such as shellfish consume these cells, the toxins become concentrated in their tissues. People who eat the contaminated shellfish can become sick or die. Volunteer monitoring observations are now used in several coastal states to provide an early-warning system that serves as an adjunct to shellfish meat testing performed by state public health agencies.

When the GBCW phytoplankton program was established, the only field identification aids available were marginal black-and-white photos and small line drawings, both very different from the images seen through field microscopes. To improve the accuracy and utility of volunteer observations, GBCW volunteers identified and photographed cells commonly observed in the Gulf of Maine, including the target toxic cell species.

The photos made by GBCW volunteers are included in the following identification key sheets (pages 5-8). Because it was not possible for GBCW volunteers to photograph all the species that may be seen in the Gulf of Maine, photos made by other phytoplankton specialists are also included. These specialists have been attributed where possible.

GBCW phytoplankton monitors use these identification sheets in the field as an aid in phytoplankton species identification. Recently, volunteer monitors in Maine and Massachusetts have begun to use the identification sheets as well.

## Using the Identification Sheets

The identification key sheets picture common phytoplankton cells that may be observed using simple 100x or 400x field microscopes. The keys primarily focus on two major types of phytoplankton cells: diatoms and dinoflagellates. **Diatoms** are the best known and most abundant of the marine phytoplankton. They are distributed throughout all the oceans, from polar to temperate regions. Individual diatom cells range in size from five to 200 micrometers, but many species can chain together in strands of up to 4mm in length. The cell walls are composed of silica and resemble a hatbox with two halves; the bottom half (hypotheca) is slightly smaller and fits into the top half (epitheca). Diatoms vary in shape but are typically round (centric) or boat-shaped (pennate). Others may be triangular, square or egg-shaped. Cells may be solitary (such as *Coscinodiscus sp.*), linked by various arrangements into chains (such as *Thalassiosira sp.* or *Sketonema sp.*), or grouped in gelatinous colonies (such as *Phaeocystis sp.*).

Many kinds of phytoplankton can move around freely, sometimes in an extraordinary fashion. Diatom movement, however, is limited to the gliding motion exhibited by pennate species that have a slit known as a raphe in the cell wall. These diatoms secrete a mucilaginous material, allowing them to glide along a hard surface (such as a microscope slide).

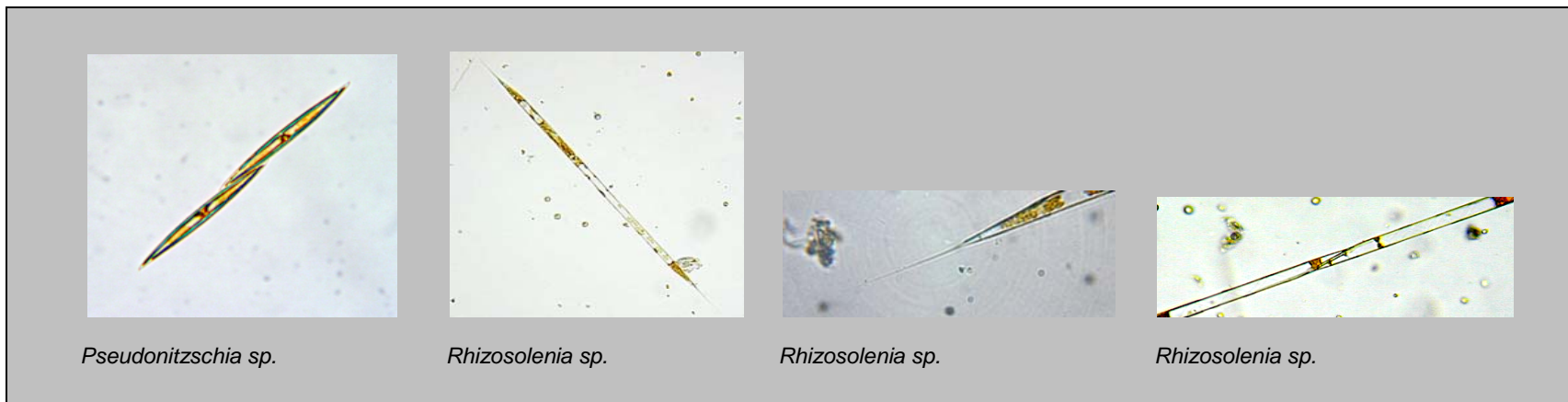
**Dinoflagellates** are a diverse and complex group of unicellular organisms that range in size from two to 200 micrometers. Dinoflagellates usually have one or more flagella, or hair-like whips. Some types, including *Alexandrium sp.* and *Prorocentrum sp.*, are characterized by a transverse flagellum that encircles the body (often in a groove known as the girdle or cingulum) and a longitudinal flagellum oriented perpendicular to the transverse flagellum. These flagella allow the dinoflagellates to swim in a distinctive spiral motion. In another dinoflagellate cell type, two dissimilar flagella emerge from the anterior or apex part of the cell. *Prorocentrum sp.* is an example of this type of dinoflagellate. These cells do not have a girdle and move in a less predictable, more random way than do dinoflagellates with a girdle.

Dinoflagellates may be heterotrophic (cells that eat other organisms) or autotrophic (cells that photosynthesize to produce food). Some dinoflagellate cells can do both. Dinoflagellates form a significant part of primary planktonic production in both oceans and lakes, and most species go through moderately complex life cycles involving several steps, sexual and asexual, motile and non-motile. Some species form cysts composed of an organic polymer, known as sporopollenin, and have been preserved as fossils.

GBCW volunteers monitor for seven potentially toxic dinoflagellate species of the genera *Alexandrium*, *Dinophysis*, *Pseudonitzschia* and *Prorocentrum*. These species are designated by a yellow border on the identification key sheets. Dinoflagellates are frequently in motion and it is often difficult to distinguish between species. Though subtle, there are differences in their shapes. You will often have to view dinoflagellates at 400x magnification to see these differences clearly. For example, although *Alexandrium sp.* and *Scropsiella sp.* both have a characteristic girdle, *Alexandrium* is more symmetrical (i.e., globular in shape). *Gymnodinium sp.* is also girdled, but one half is bell-shaped and the other half features two distinct projections (below).

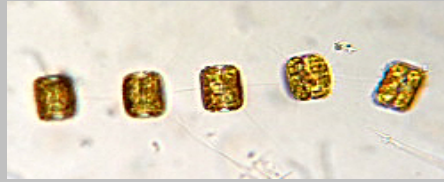


To assist in identifying diatoms, cells with similar structures are grouped together for easy reference. For example, one target cell, *Pseudonitzschia sp.*, a pennate diatom, can easily be mistaken for *Rhizosolenia sp.* Viewing photographs side by side illustrates the differences. Consider the three views of *Rhizosolenia sp.* that follow. When compared to *Pseudonitzschia sp.*, *Rhizosolenia sp.* has a longer, more needle-like tip. *Pseudonitzschia sp.* also chain together differently than *Rhizosolenia sp.* In the photo on the left, the chained *Pseudonitzschia sp.* cells look like canoes resting against each other end to end. In the 400x photo of *Rhizosolenia sp.* at lower right, the junction between cells is marked by a diagonal line, but the chained cells form a continuous cylindrical shape.

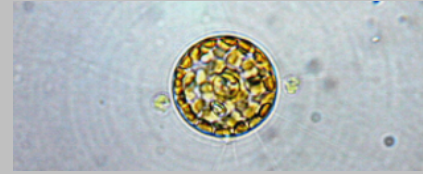


When identifying centric (round) diatoms, be aware that these types may be chained or solitary. If a species is normally chained and the chain is disrupted, you may see a “valve” view of a solitary cell rather than a “girdle” view of each cell in the chain. Although the cells look different, they are the same species (as in the photos of *Thalassiosira sp.*, page 4). Some diatoms are easily overlooked by the uncritical eye. Notorious among these are *Pseudonitzschia delicatissima* and *Cylindrotheca closterium*, which are both very small and narrow. *Coscinodiscus sp.* and *Thalassiosira sp.* (page 4) might also be confused. However, the former is much larger and usually has a beautiful honeycomb or rosette pattern of frustules.

Be aware as well that there are many varieties of *Navicula* species. All are pennate and most are canoe-shaped; however they do not chain like many of the *Pseudonitzschia* species.



*Thalassiosira* sp. chain (girdle view)



*Thalassiosira* sp. cell (valve view)



*Coscinodiscus* sp.





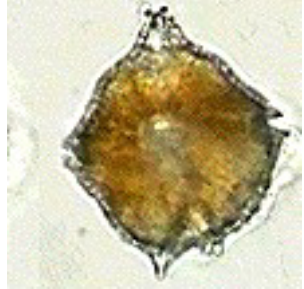
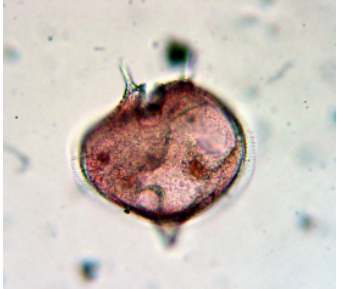










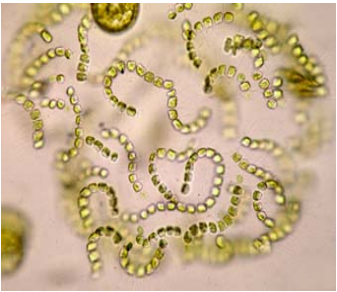
*Navicula* sp.



*Navicula* sp.

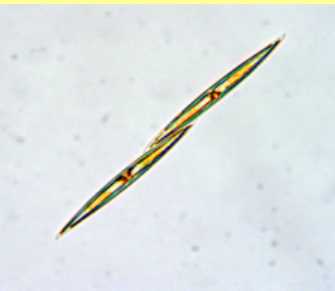


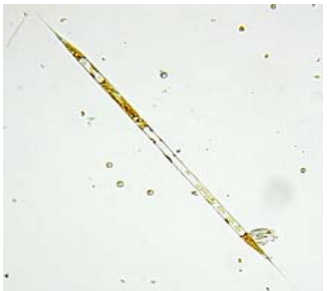
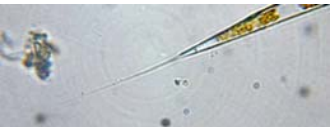
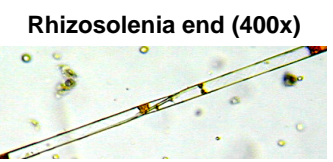

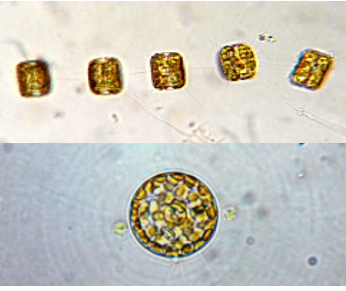
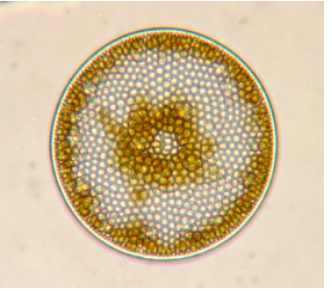
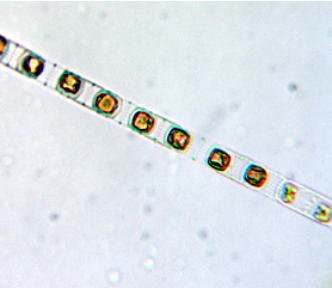
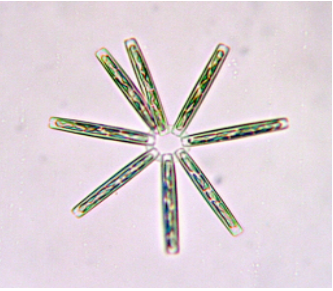


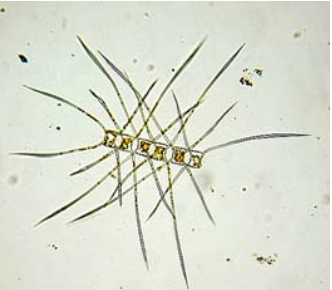
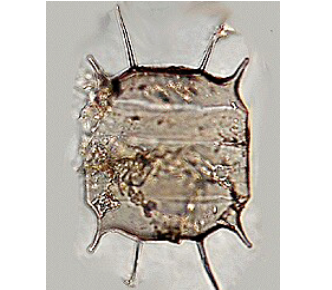
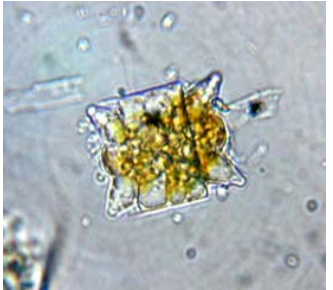
If you're new to identifying phytoplankton, don't worry. A vast (and unknown) number of phytoplankton species exist in the Gulf of Maine. You will not be able to identify them all. Definitively identifying many phytoplankton to the species level is challenging even for experienced taxonomists, who use sophisticated tools including electron microscopes and nucleic acid-based probe assays. This identification key is designed simply as a tool to help volunteers and others glimpse the diversity and beauty of a few common species.

# Common Gulf of Maine Phytoplankton

|  |  |   |  |  |
|--|--|---|--|--|
|   |   |   |   |   |
| <b>Alexandrium sp (AL) (400x)</b>  | <b>Gymnodinium sanguineum (GY) (400x)</b>  | <b>Gonyaulax spinifera (GS) (400x)</b>  | <b>Protoperdinium sp (PT) (400x)</b>   | <b>Scrippsiella sp (SC) (400x)</b>   |
|   |   |   |   |   |
| <b>Dinophysis norvegica (DN) (400x)</b>  | <b>Dinophysis acuminata (DA) (400x)</b>  | <b>Dinophysis tripos (DT)(400x)</b>   | <b>Prorocentrum lima (PL) (400x)</b>   | <b>Prorocentrum micans (PM) (400x)</b>   |
|  |  |  |  |  |
| <b>Ceratium fusus (CF) (100x)</b>  | <b>Ceratium lineatum (CL) (100x)</b>   | <b>Ceratium longipes (CP) (100x)</b>  | <b>Phaeocystis sp (PC) (100x)</b>  | <b>Chaetoceros socialis (CS) (100x)</b>  |

Note: Species pictured in yellow boxes may produce harmful toxins.

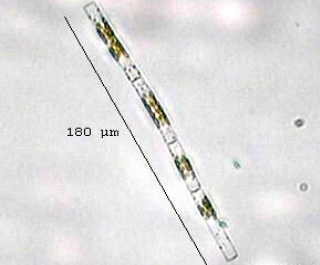


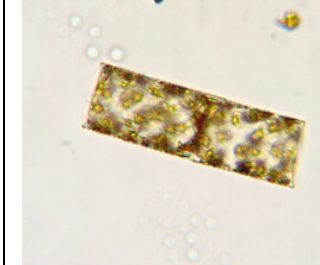
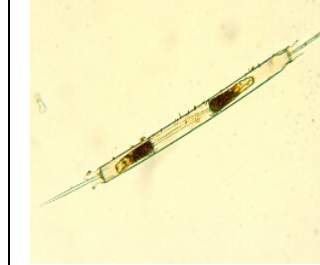





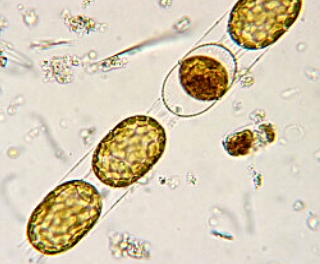



# Common Gulf of Maine Phytoplankton

|  |  |   |  |  |
|--|--|---|--|--|
|  <p><b>Pseudonitzschia sp (PS)<br/>(100x)</b></p> |  <p><b>Pseudonitzschia delicatissima<br/>(PS) (400x)</b></p>                    |  <p><b>Cylindrotheca closterium<br/>(NZ) (400x)</b></p>   |  <p><b>Rhizosolenia sp (RH) (100x)</b></p>          |  <p><b>Rhizosolenia end (400x)</b></p>  <p><b>Rhizosolenia junction (400x)</b></p> |
|  <p><b>Rhizosolenia sp (RH) (100x)</b></p>        |  <p><b>Thalassiosira sp (TL) (400x)<br/>girdle view(tp)/valve view(btm)</b></p> |  <p><b>Coscinodiscus sp (CO)(400x)<br/>valve view</b></p> |  <p><b>Skeletonema costatum (SK)<br/>(400x)</b></p> |  <p><b>Thalassionema nitzschioides<br/>(TA) (400x)</b></p>  |
|  <p><b>Chaetoceros sp (CH) (100x)</b></p>        |  <p><b>Chaetoceros sp (CH) (100x)</b></p>                                      |  <p><b>Chaetoceros sp (CH) (100x)</b></p>                |  <p><b>Biddulphia sp (BD) (400x)</b></p>           |  <p><b>Odontella sp (OD) (400x)</b></p>  |

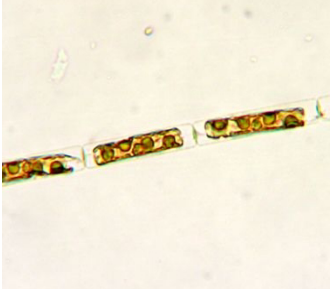

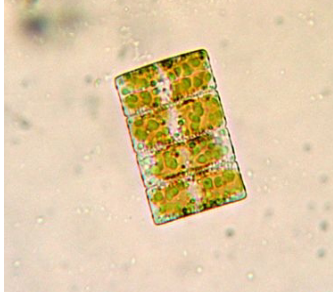

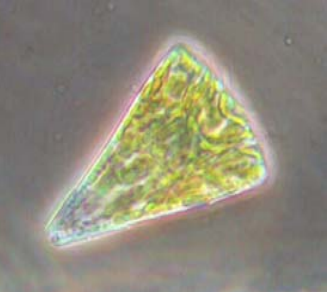
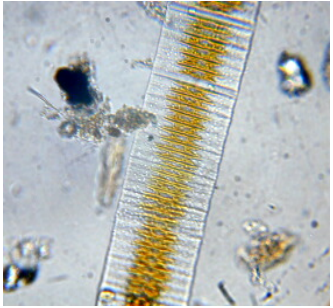
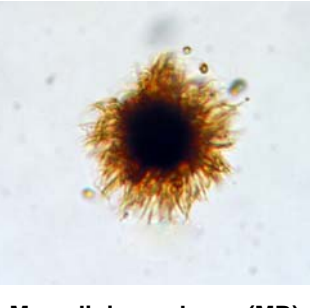
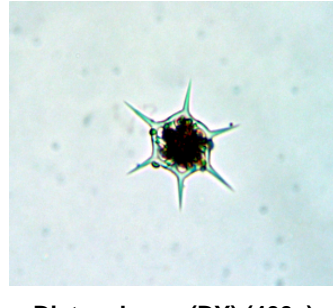

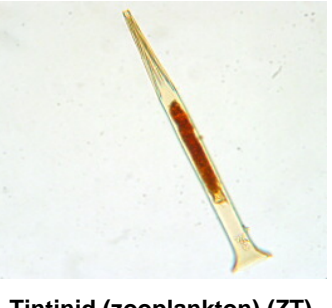
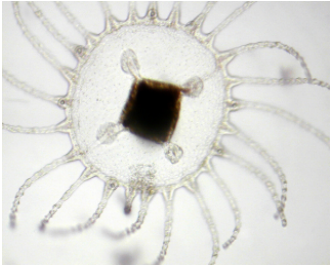

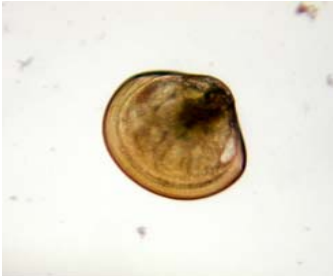


Note: Species pictured in yellow boxes may produce harmful toxins.



# Common Gulf of Maine Phytoplankton

|   |  |   |  |  |
|---|--|---|--|--|
|  <p>180 µm<br/>C. COUDRE</p> |   |   |   |   |
| <p><b>Leptocylindrus danicus (LP)</b><br/><b>(400x)</b></p>   | <p><b>Leptocylindrus minimus (LP)</b><br/><b>(400x)</b></p>                        | <p><b>Melosira sp (ML) (400x)</b></p>   | <p><b>Guinardia flaccida (GN)</b><br/><b>(400x)</b></p>                              | <p><b>Ditylum brightwelli (DM)</b><br/><b>(100x)</b></p>                             |
|                              |   |   |   |   |
| <p><b>Navicula sp (NV) (400x)</b></p>   | <p><b>Navicula sp (NV) (400x)</b></p>  | <p><b>Navicula sp (NV) (400x)</b></p>   | <p><b>Bacillaria paradoxa (BP)</b><br/><b>(400x)</b></p>                             | <p><b>Pleurosigma sp (PG) (400x)</b></p>   |
|                             |  |  |  |  |
| <p><b>Grammatophore sp (GM)</b><br/><b>(400x)</b></p>   | <p><b>Stephanopyxis sp (SP)</b><br/><b>(400x)</b></p>                              | <p><b>Paralia sulcata (PS) (400x)</b></p>   | <p><b>Corethron sp (CR) (400x)</b></p>   | <p><b>Eucampia sp (EU) (400x)</b></p>  |

# Common Gulf of Maine Phytoplankton

|  |  |   |  |  |
|--|--|---|--|--|
|   |   |   |   |   |
| <b>Dactyliosolen sp (DS) (400x)</b>  | <b>Detonula sp (DL) (400x)</b>   | <b>Fragilariopsis sp (FR) (400x)</b>  | <b>Asterionellopsis sp (AS) (400x)</b>   | <b>Licmophora sp (LC) (400x)</b>   |
|   |   |   |   |   |
| <b>Fragilariopsis sp (FR) (400x)</b>   | <b>Mesodinium rubrum (MR) (400x)</b>   | <b>Dictyocha sp (DY) (400x)</b>   | <b>Pollen (not plankton) (PO) (100x)</b>   | <b>Tintinid (zooplankton) (ZT) (100x)</b>  |
|  |  |  |  |  |
| <b>Obelia (zooplankton) (OB) (100x)</b>  | <b>Copepod nauplius (zooplankton) (ZN) (100x)</b>                                  | <b>Bivalve larva (zooplankton) (ZC) (100x)</b>                                      | <b>Trichome (not plankton) (TC) (100x)</b>   | <b>Copepod sp - top view (zooplankton) (CO) (100x)</b>                               |

Photos by S. Cooper except: C. Coudre (LP1), C. Dolan (OB, TC, ZC, RH3), A. Godhe (GS), S. Hedrick (GY), Rebecca Jones (CO), B. Karlson (DT, LP2), L. Maranda (PL), J. Parmentier (CS), A. Smith (SC), B. Trow (MR), M. Webber (LC), Unknown (BD, CR, EU, ML, PM)

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