

The background is a light blue gradient with several realistic water droplets of various sizes scattered across it. The droplets have highlights and shadows, giving them a three-dimensional appearance.

THE SECRET LIFE OF LAKES

AMANDA MCQUAID, SARA STEINER & AMY SMAGULA

NHDES LIMNOLOGISTS (AKA, LAKE BIOLOGISTS)

AGENDA

- THE MICROSCOPIC WORLD OF LAKES
- CLOSER TO THE BOTTOM OF LAKES
- UNDERWATER AND ATTACHED



Limnology- the study of lakes

SUSPENDED IN THE WATER COLUMN

MICROSCOPIC LAKE LIFE THAT YOU WILL FIND FLOATING OR SWIMMING IN THE LAKE

PRESENTED BY AMANDA MCQUAID

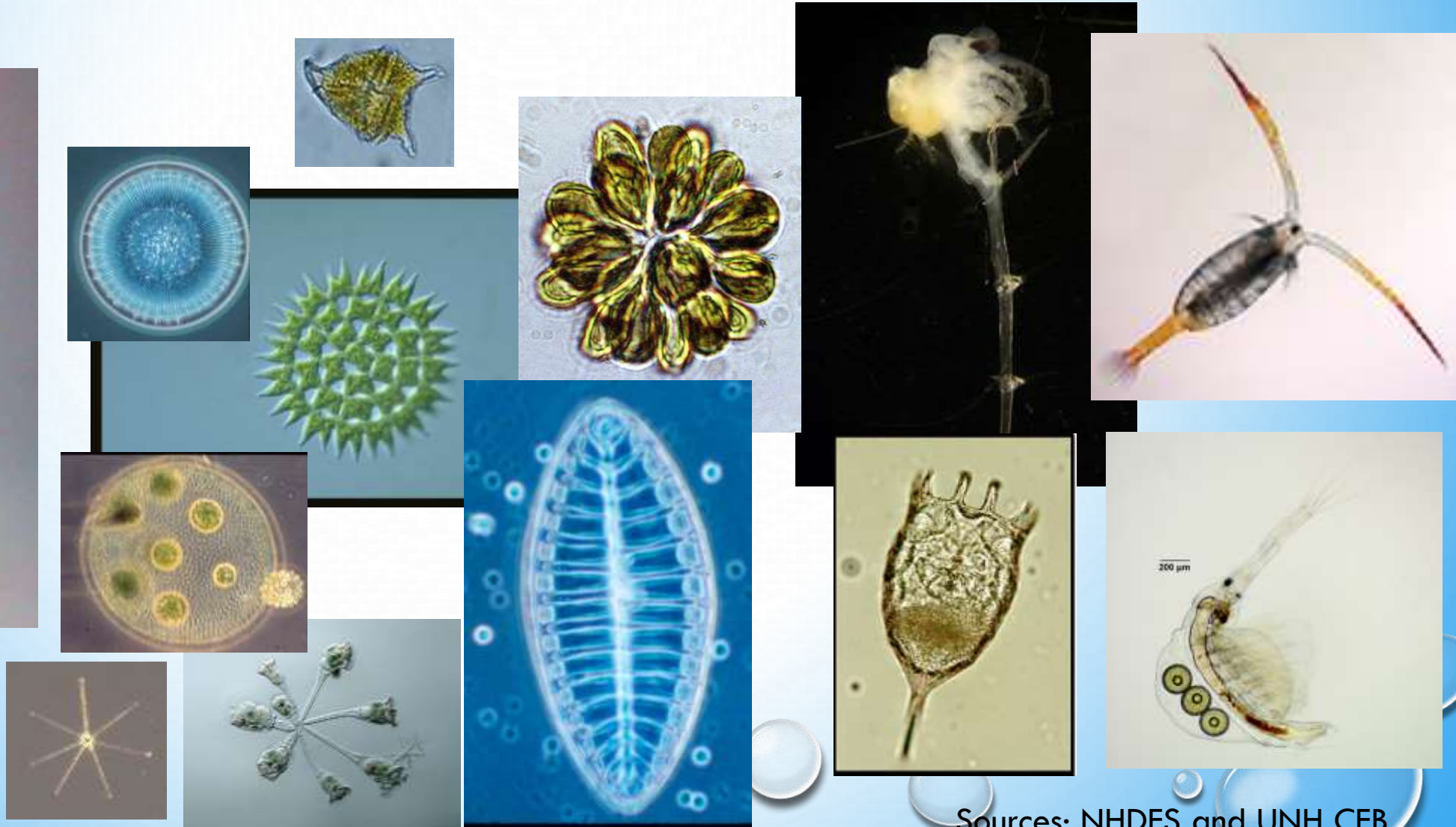
the microscopic world...



Plankton – “microscopic organisms and particles drifting or floating in the sea or fresh water”



Plankton nets





An Image-Based Key:
**Algae (PS Protista),
 Cyanobacteria,
 and other aquatic
 objects**



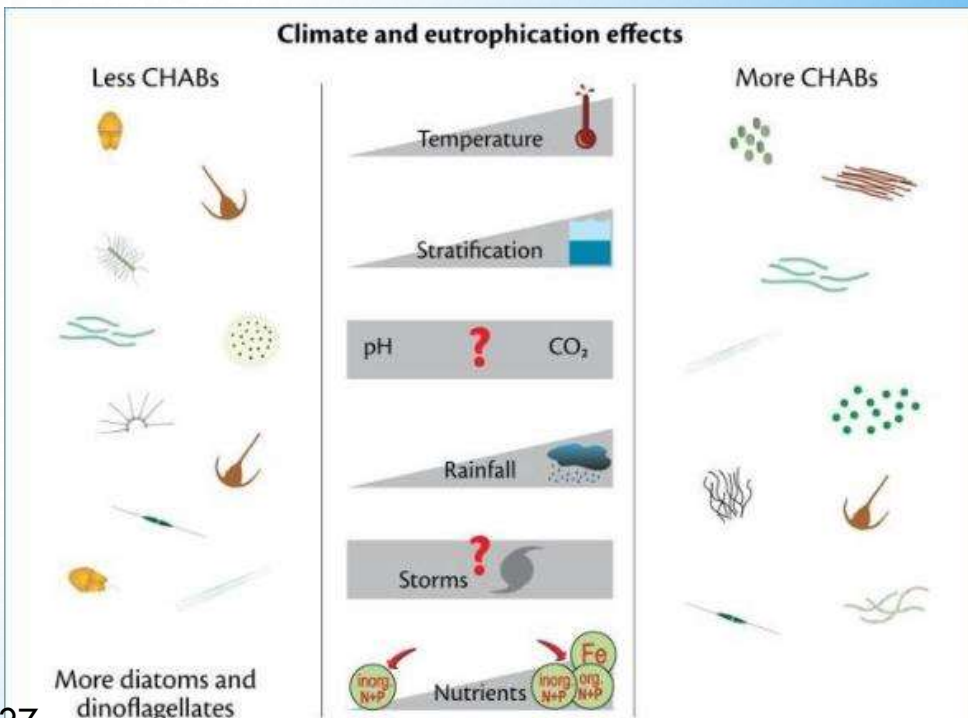
Phytoplankton – microscopic plants, photosynthetic bacteria, etc.

- Diatoms (Bacillariophyta)
- Golden-browns (Chrysophyta)
- Dinoflagellates (Pyrrophyta/Dinophyta)
- Greens (Chlorophyta)
- Cyanobacteria (Cyanophyta)
- Euglenoids (Euglenophyta)
- Yellow-greens (Xanthophyta)

Eutrophic
more phyto

Mesotrophic
moderate phyto

Oligotrophic
few phyto



Toxic Cyanobacteria of New England

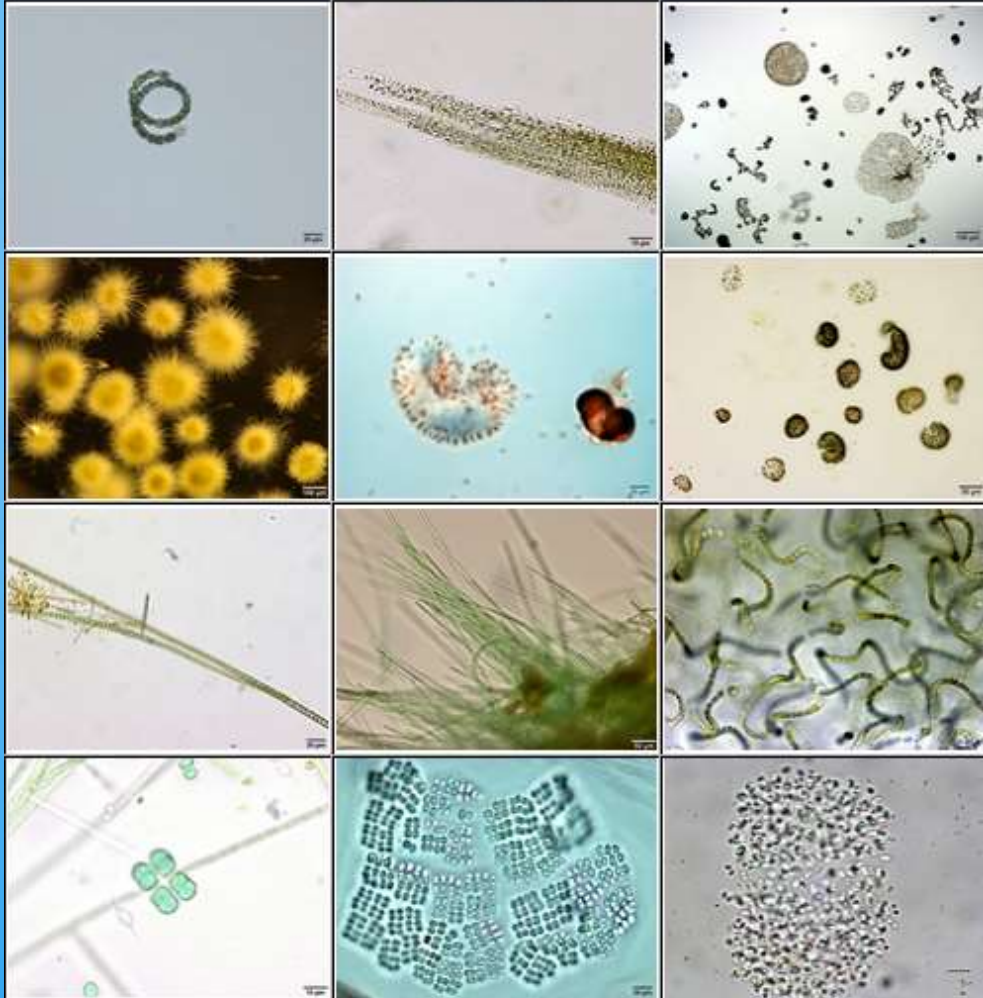
"The Dirty Dozen"

cfb.unh.edu

Purpose & Background



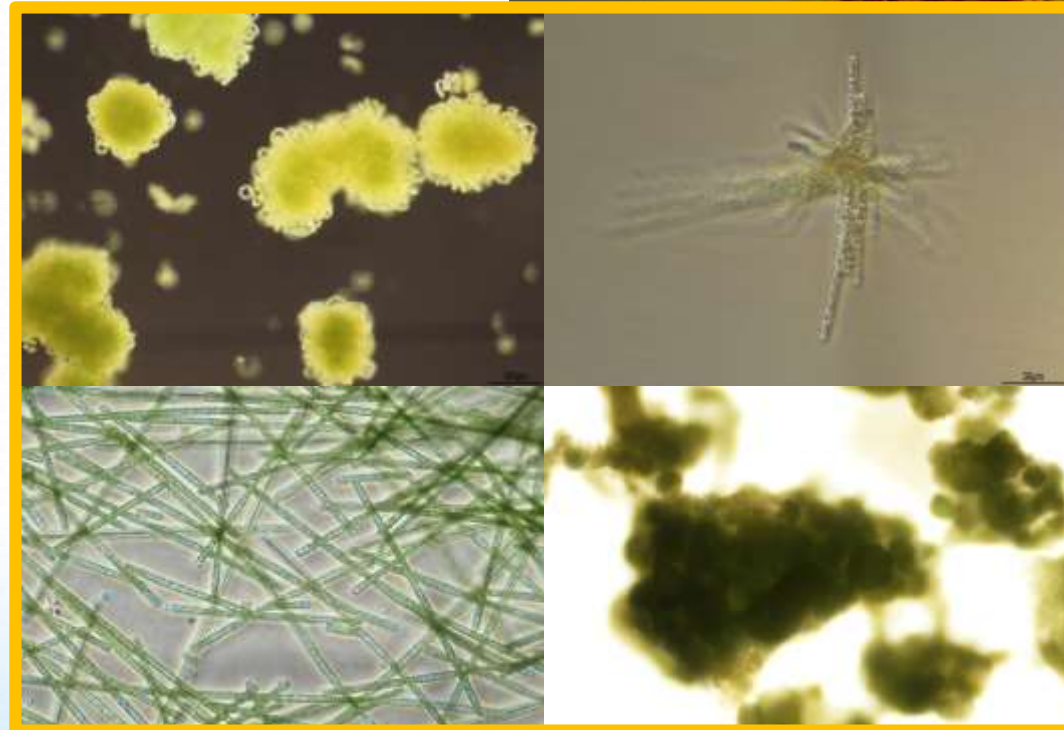
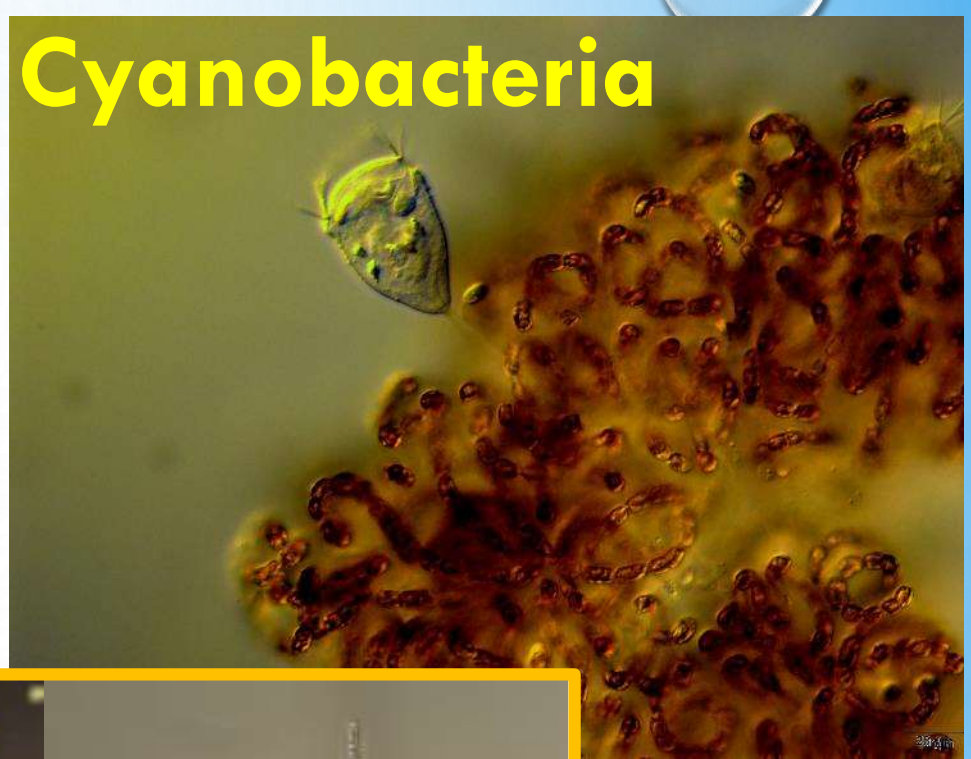
Genus List



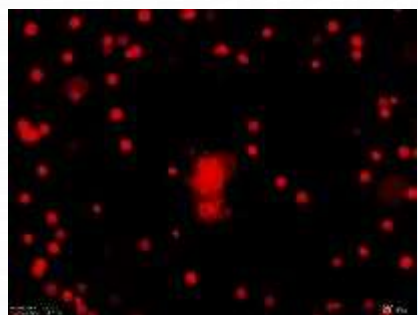
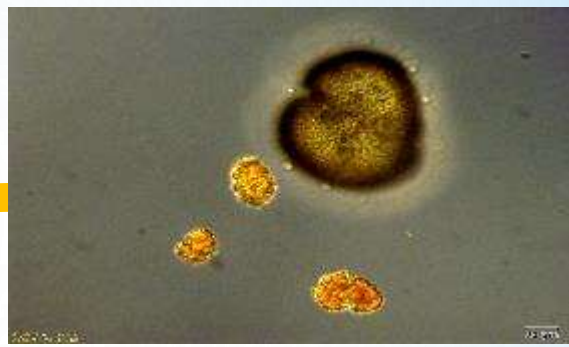
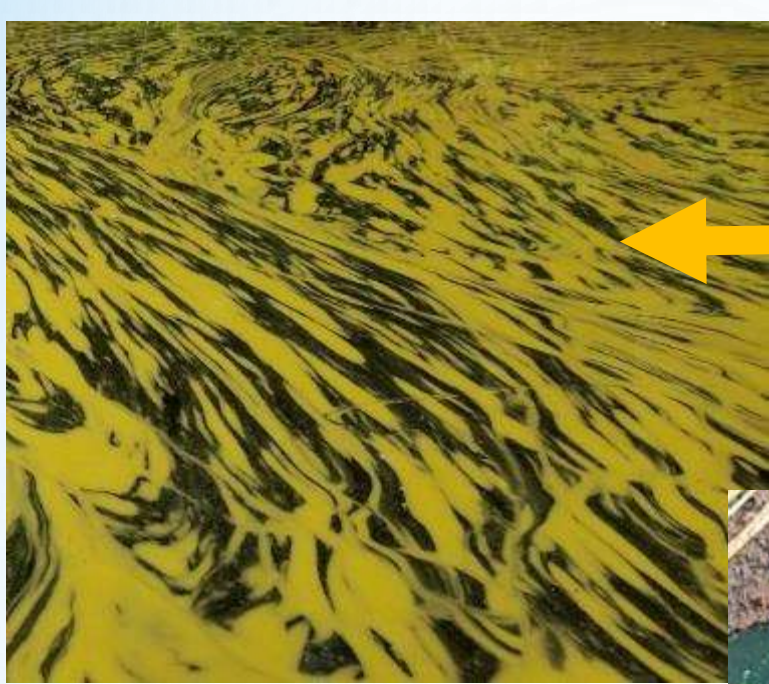
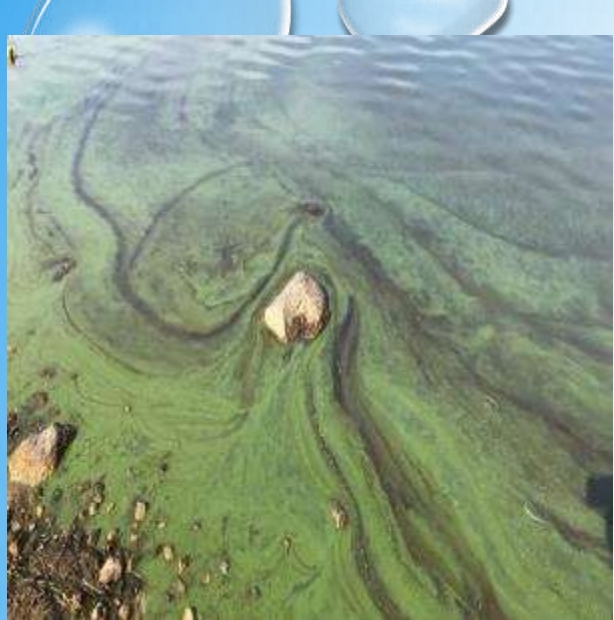
Cyanobacteria may produce toxins called **CYANOTOXINS**

Toxins may cause skin irritations, gastroenteritis, seizures, chronic illness and death.

Cyanobacteria



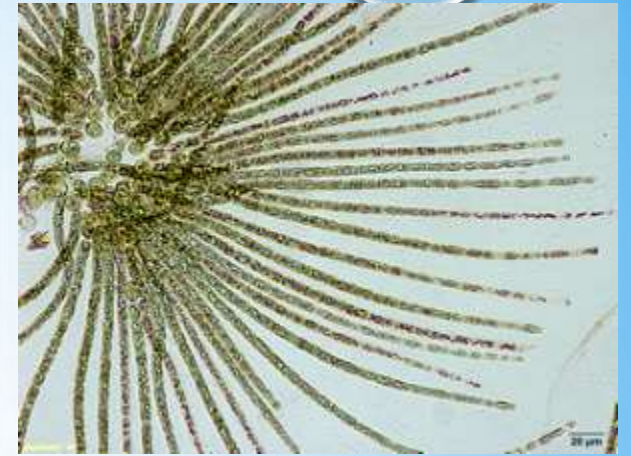
Not all cyanobacteria are toxic



• GLOEOTRICHIA



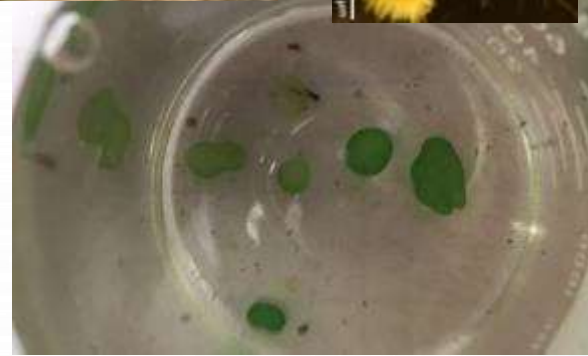
- LAKE WINNIPESAUKEE
- LAKE SUNAPEE



• NOSTOC



- PAWTUCKAWAY LAKE
- MILLEN POND



• STIGONEMATALES



- LAKE WINNIPESAUKEE
- SPOFFORD LAKE



a food chain story...

Cyanotoxin

Exposure

- Recreational
- Drinking water
- Dermal contact
- Inhalation
- **Food Webs...**

Photo Collage source:
JF Haney





What should I do if I see a bloom or if the water changes colors?

1. Avoid contact; keep pets and children out of the water.
2. Take a photo and record your location.
3. Contact NHDES by phone (603-848-8094) or email (HAB@des.nh.gov).





An Image-Based Key:
Wolffia
 (Watermeal)
 (Viridiplantae)

cfb.unh.edu

Click on images for larger format.



Wolffia

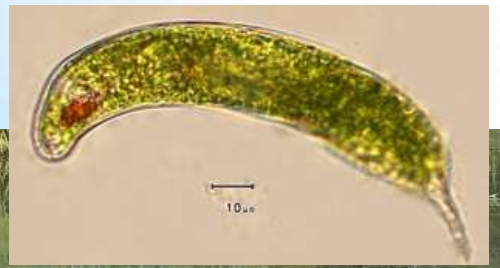
“Scums” that
 are not
 cyanobacteria
 ...



Green Filamentous Algae



Euglena





Cladocera



Copepoda



Rotifera



Other Arthropods

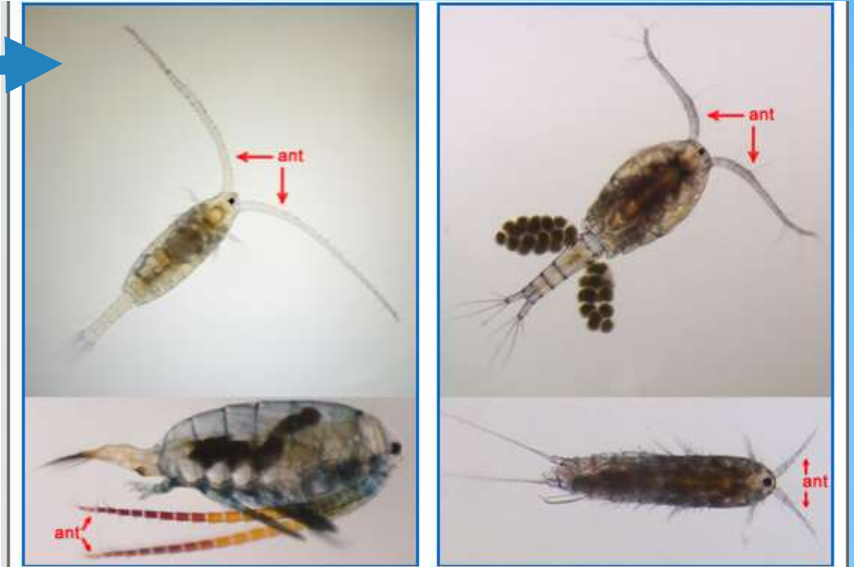
Cladocerans



Rotifers



Copepods



First antennae (ant) long relative to body, with 23 to 25 segments

First antennae (ant) short relative to body, with 18 or less segments

Taxonomy

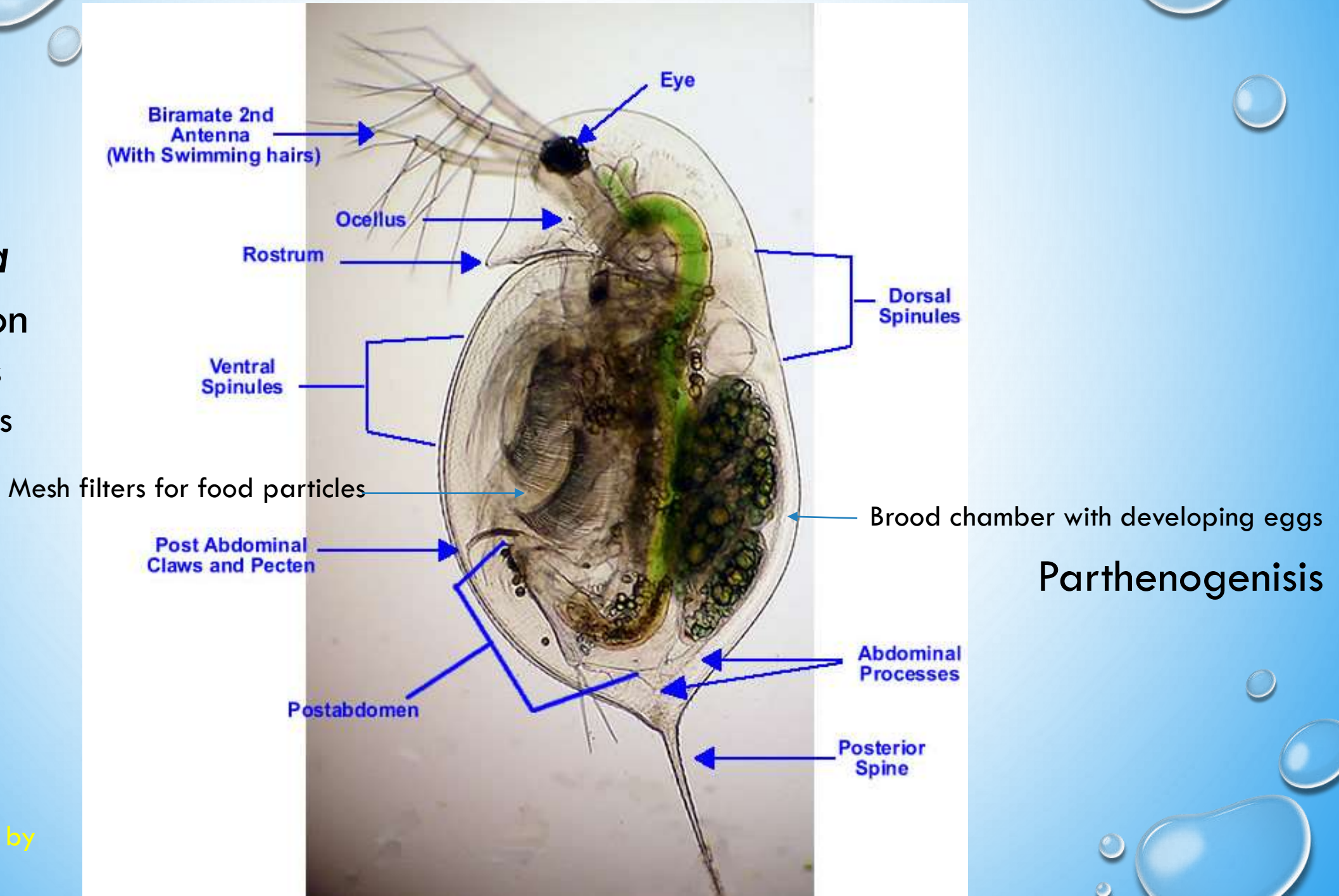
Phylum	Arthropoda
Subphylum	Crustacea
Class	Maxillopoda
Subclass	Copepoda

Zooplankton microscopic animals



Chaoborus

Daphnia
Zooplankton
Arthropods
Cladocerans



Parthenogenesis

DR. JIM HANEY'S VIDEO OF DAPHNIA REJECTING CYANOBACTERIA

Post Abdominal Rejections





Photo by Kevin Kelly

Resting eggs or “ephippia”
from *Daphnia*

Daphnia with ephippia



Photo by cfb.unh.edu

Daphnia reproduce by parthenogenesis (they clone themselves).

Daphnia may reproduce sexually, resulting in diapause eggs or ephippia.



Photo by Kevin Kelly

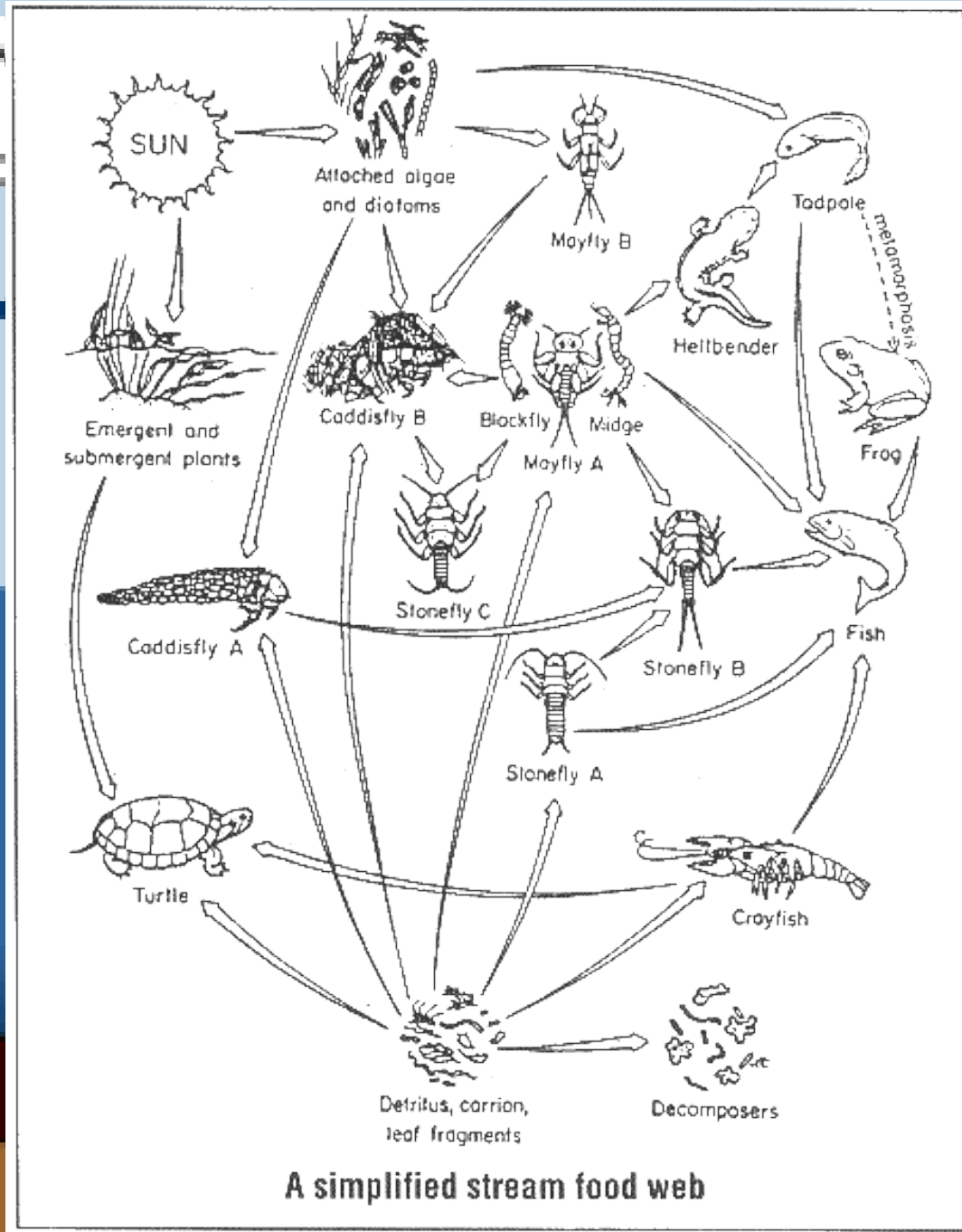
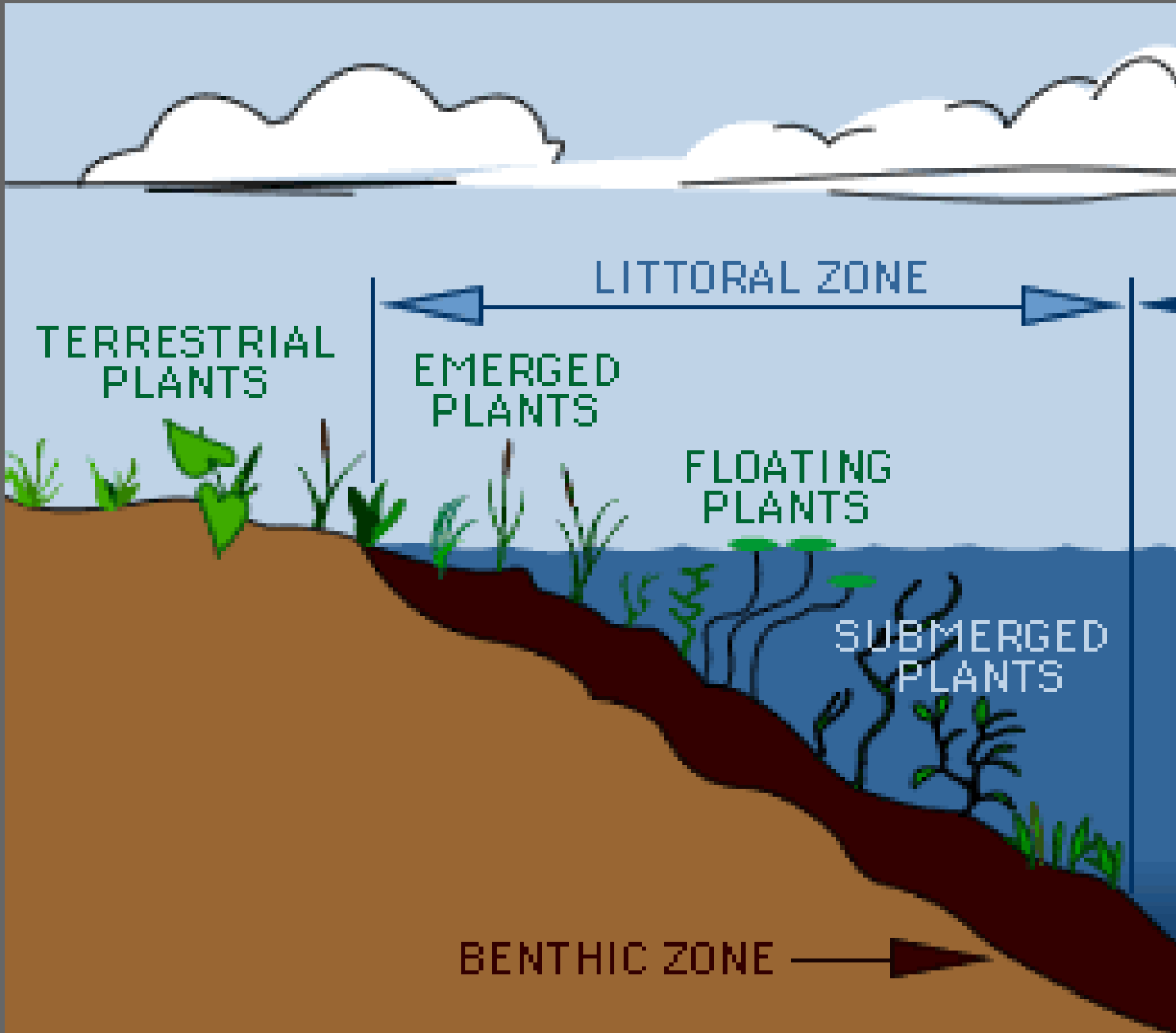
Lake foam (with ephippia)

Lake foam is a product from natural degradation of organic material in waterbodies, lakes, rivers and streams.

HANGING OUT, ON THE BOTTOM...

LAKE LIFE THAT YOU WILL FIND LIVING IN OR NEAR THE LAKE BOTTOM

PRESENTED BY SARA STEINER



UMMP15VOL_Pisciranemata.tif



IP15VOL_Cammaridae.tif



UMMP15VOL_Pleurostoma.tif



spiders.tif



UMMP15VOL_Heptageniidae_2.tif



Sphaeriaceae.tif



UMMP15VOL_Perididae.tif



2 mm



UMMP15VOL_Larvicidae.tif



Images courtesy of Upper Merrimack Monitoring Program (UMMP)

Damselflies (Zygoptera)



Dragonflies (Anisoptera)



Gills

Jason Neuswanger
www.troutnut.com



©TheDragonflyWoman.com



UMMP15VOL_Aeshnidae.tif

Damselfly Nymphs



SVOL_Calopterygidae.tif



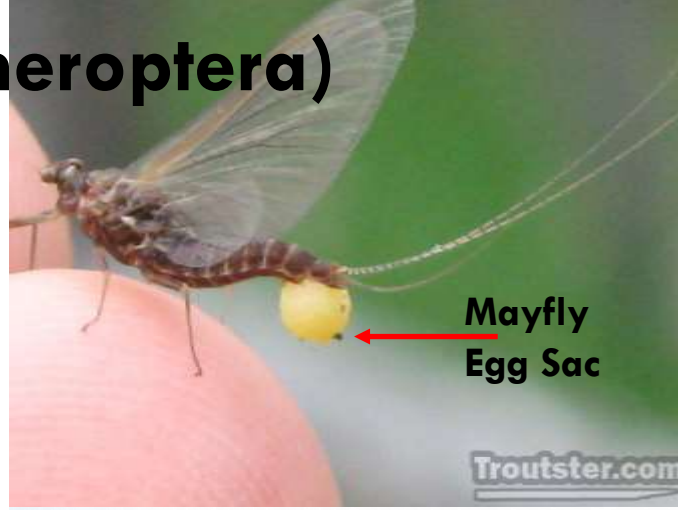
Lower jaw to capture prey

UMMP15VOL_Gomphidae.tif




AMPTFVCL_Ceruridae.tif

Mayflies (Ephemeroptera)



Dobsonfly (Megaloptera)

Adult male
mandibles



A photograph of an adult male dobsonfly, showing its large, dark, curved mandibles and its four large, patterned wings.

Photo: Lyle J. Buss, University of Florida

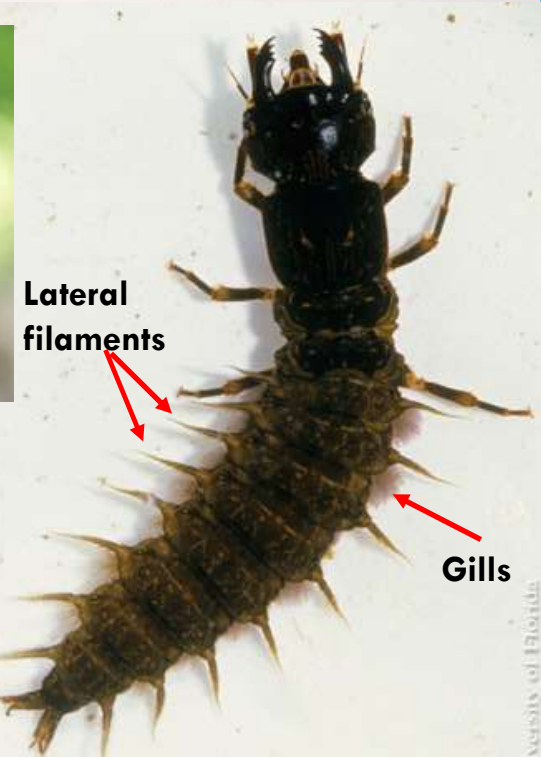


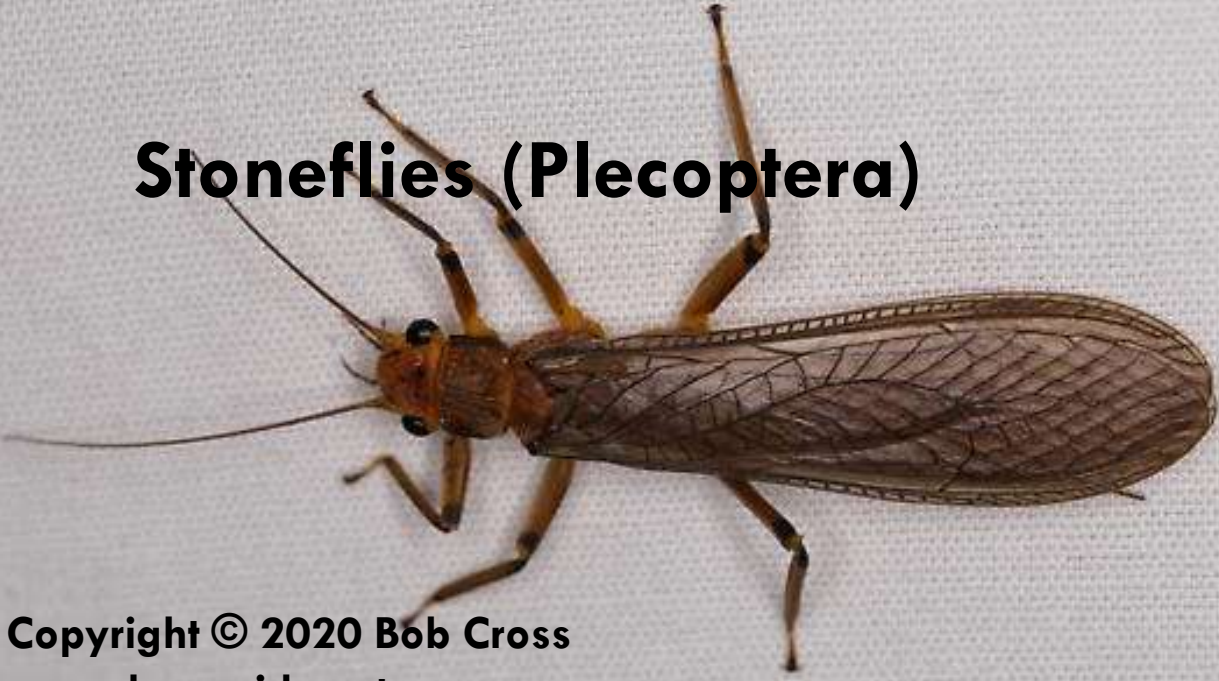
Photo: J.F. Butler, University of Florida

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Stoneflies (Plecoptera)

Copyright © 2020 Bob Cross
www.bugguide.net



Caddisflies (Trichoptera)



Image Copyright Jen and Des Bartlett/Bruce Coleman Inc.



Artwork by Hubert Duprat/Caddisfly Larvae



Predacious Diving Beetle (Dytiscidae)



© 2010 dragonflywoman.wordpress.com

Water Scorpion (Hemiptera)



The Bug Lady, Univ. of Wisconsin, Milwaukee
<https://uwm.edu/field-station/water-scorpion/>

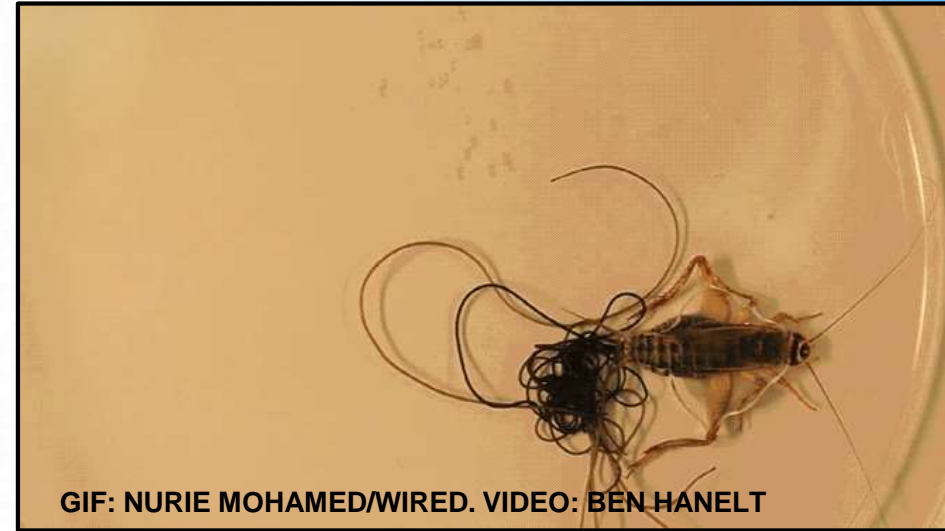
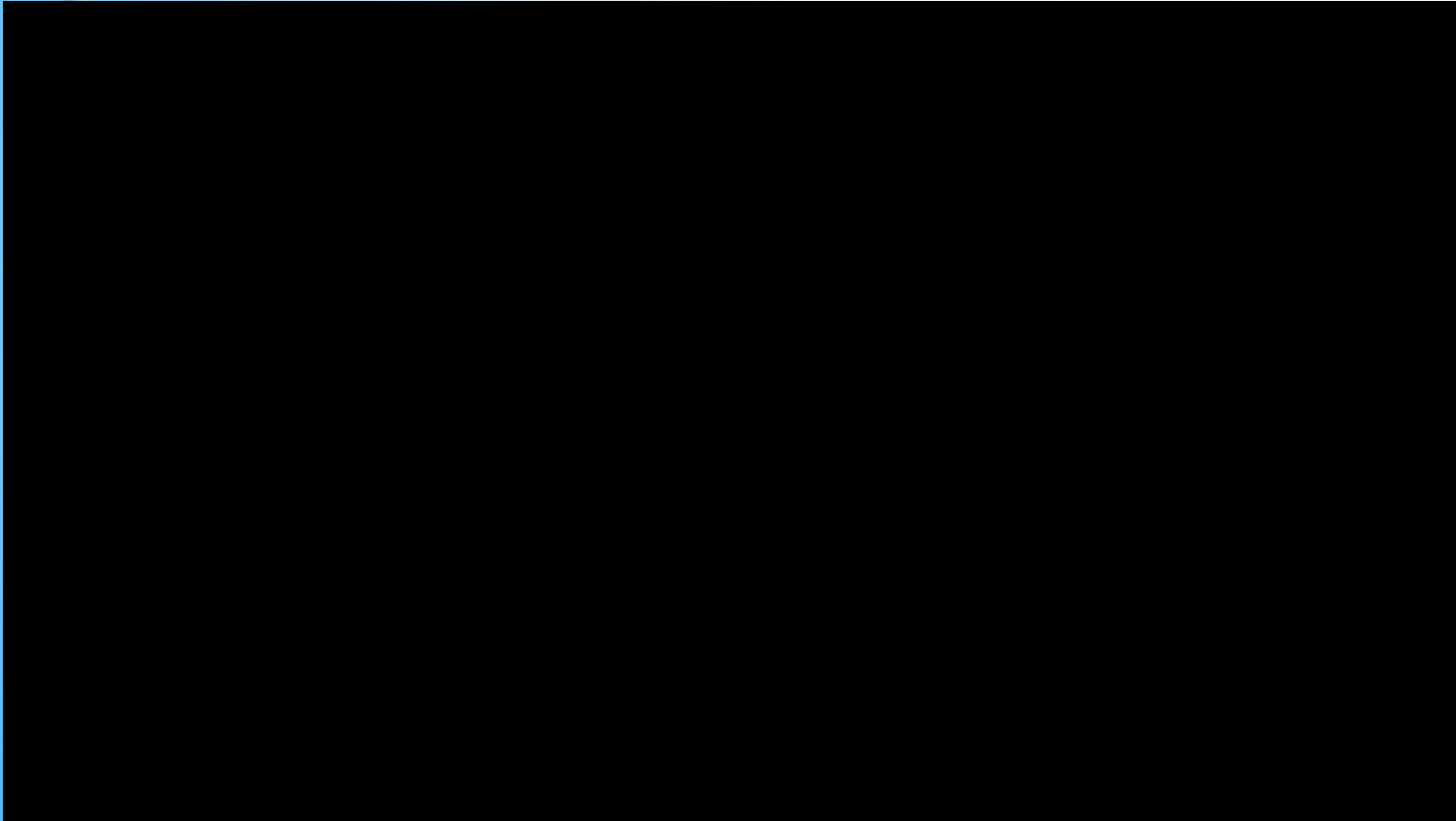
AQUATIC WORMS AND WORM-LIKE CREATURES



FLATWORMS



HORSEHAIR WORMS



LEECHES



The background is a light blue gradient with several realistic water droplets of various sizes scattered around the edges. The droplets have highlights and shadows, giving them a three-dimensional appearance.

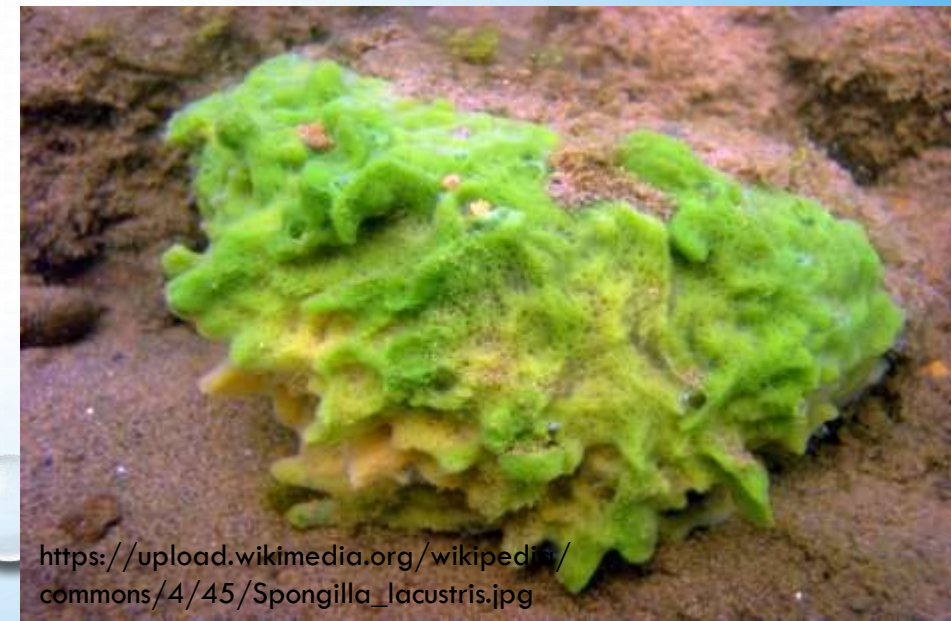
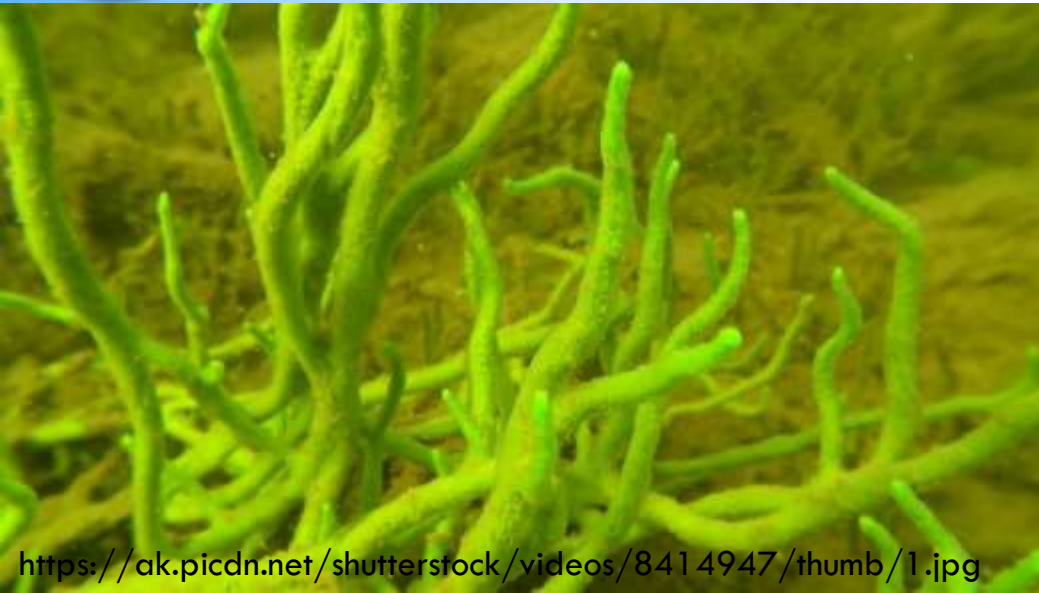
HANGING ON, BELOW THE SURFACE...

LAKE LIFE THAT YOU WILL FIND ATTACHED TO UNDERWATER SURFACES

PRESENTED BY AMY SMAGULA

FRESHWATER SPONGES

- TYPE: ANIMAL
- COLOR: THE SPONGE IS GREEN BECAUSE OF A SYMBIOTIC RELATIONSHIP WITH AN ALGAE THAT LIVES WITHIN THE SPONGE MATRIX, AND EACH BENEFITS FROM THE OTHER
- NOTES: TYPICALLY FOUND GROWING ON ROCKS OR SUBMERSED WOOD ON THE LAKE BOTTOM, OR ON UNDERWATER LEDGE
- MAY LOOK LIKE LONG GREEN FINGERS, OR FORM A THIN MAT/CRUST ON THE ROCK
- HAVE SOME "SKELETON STRUCTURE" FROM SPICULES WHICH ARE MADE OF SILICA
- FOOD- FILTER FEEDER



BRYOZOANS

- TYPE: COLONIAL ANIMAL
- COLOR: TAN, BROWN, WHITISH, CLEAR
- NOTES: TYPICALLY FOUND ATTACHED TO UNDERWATER SURFACES LIKE WOOD, DOCKS, ROCKS AND PLANTS
- OFTEN DESCRIBED AS LOOKING LIKE A BRAIN
- CAN RANGE IN SIZE FROM A COUPLE OF INCHES TO A FOOT OR MORE IN DIAMETER
- FOOD- FILTER FEEDER



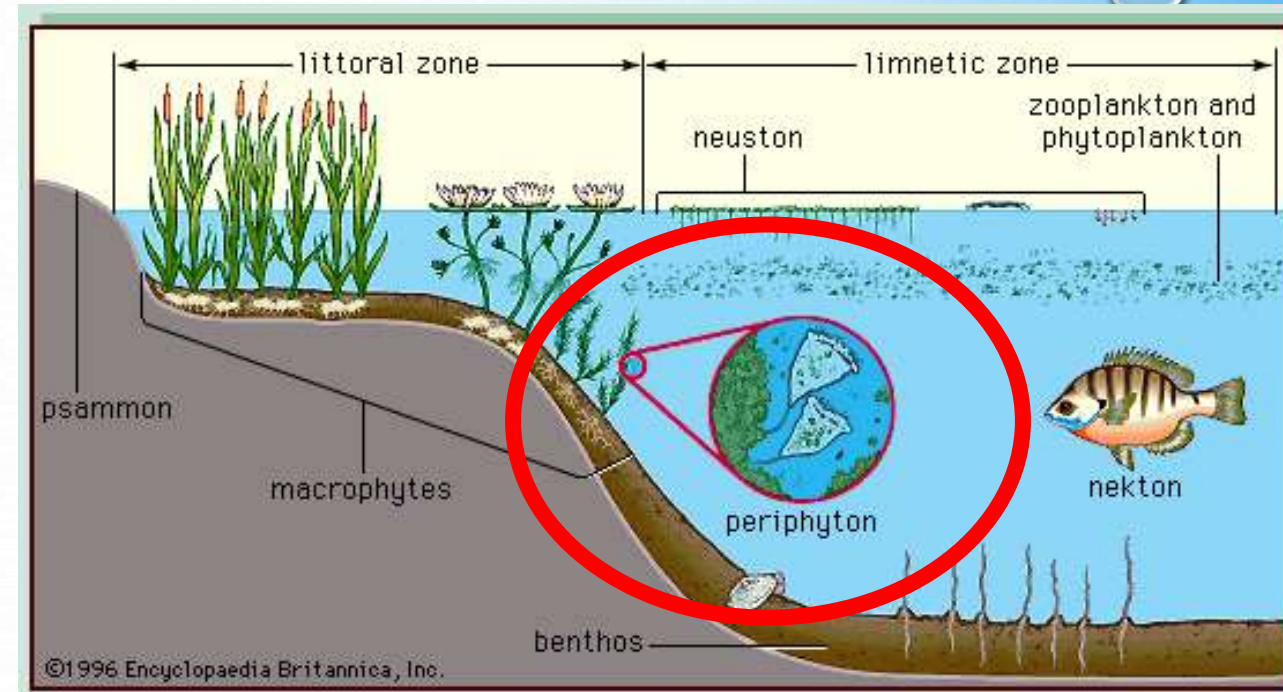
<https://www.platinumlakemanagement.com/img/http/aHR0cDovL3d3dy5wbGF0aW51bWxha2VrYW5hZ2VtZW50LnVibS9sZWdhY3kvd3AtY29udGVudC91cGxvYWZlZlwtYTYvMDcvSU1HXZlwnZMuanBn?w=900&q=80&s=97ae6ced72f7388320bbb027beb17ee8>



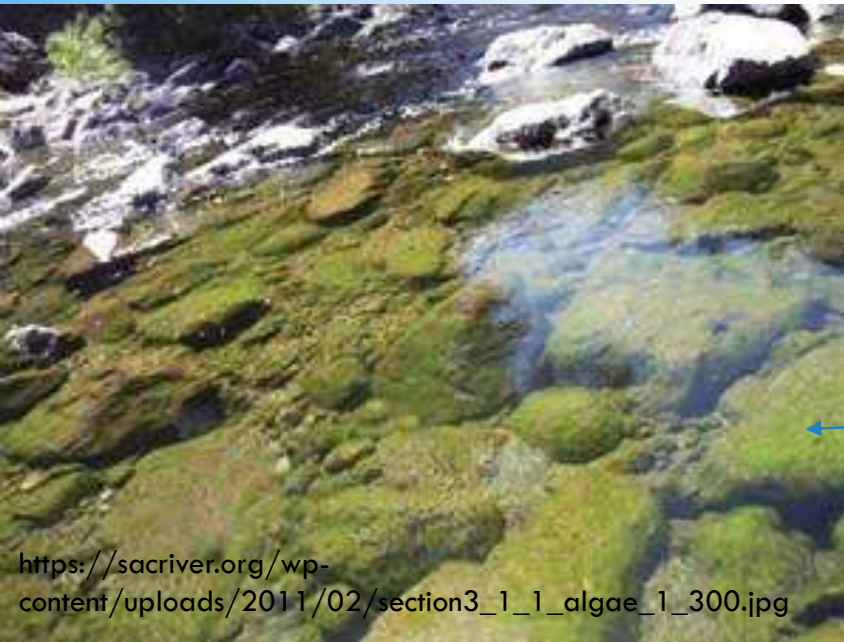
<https://wmap.blogs.delaware.gov/files/2018/12/bryozoan-colony.jpg>

PERIPHYTON- ATTACHED ALGAE

- TYPE: MANY TYPES OF ALGAE HAVE SPECIES THAT ATTACH, LIKE DIATOMS, GREEN ALGAE AND MORE
- ATTACHES TO PLANTS, ROCKS, DOCKS, MUSSEL SHELLS, AND LOTS MORE!



https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.britannica.com%2Fscience%2Ffreshwater&psig=AOvVaw2k_kk4wyqUmq3b4iYbfFMO&ust=1614697321600000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCOihv7quj-8CFQAAAAAdAAAAABAc



Thin film of growth,
makes rocks slippery!

Longer tufts
of algae



<https://encrypted-tbn0.gstatic.com/images?q=tbn:ANd9GcTLTDaXLEEQdG141j6cGctS9IXCr-M7fplHmA&usqp=CAU>

EGG MASSES



Snail eggs on the underside of a pondweed leaf



Insect eggs on the underside of aquatic plant leaves



Bug Lady

Eggs of giant water bug glued to the back of a male of the species, they can also stick them to vegetation, the male still guards them.



© C. L. Goforth

© C. L. Goforth



© Chucky Eisenstat



Yellow Perch Eggs

Anglers Sport Center

Puncture holes along a plant stem from a damselfly laying eggs inside

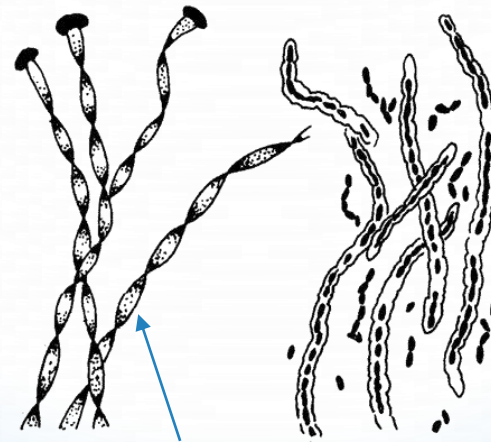
IRON BACTERIA/IRON PRECIPITATE

- IRON BACTERIA ARE MICROSCOPIC BUT THEIR STALKS CAN BE MACROSCOPIC
- THE IRON FLOC AND SLIME THEY CAUSE IS MACROSCOPIC AND VERY VISIBLE
- CAN STICK TO BOTTOM, COAT ROCKS, OR BE A SLUDGY MAT
- NOT HARMFUL, BUT CAN BE UNSIGHTLY
- CAN EVEN OCCUR IN WELLS!



alamy stock photo

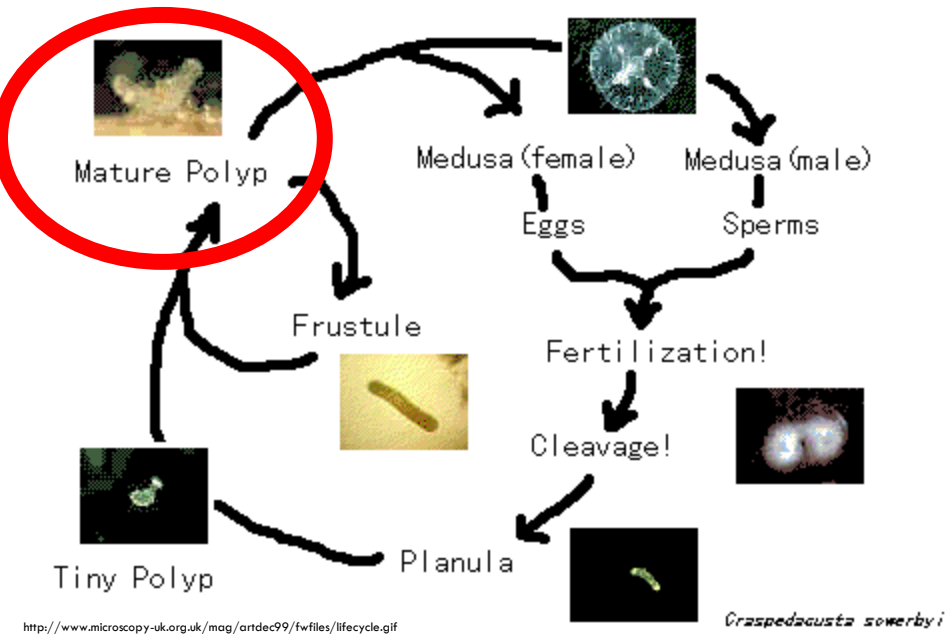
The touch test: Does it shatter or go right back together? If it shatters, it's iron!



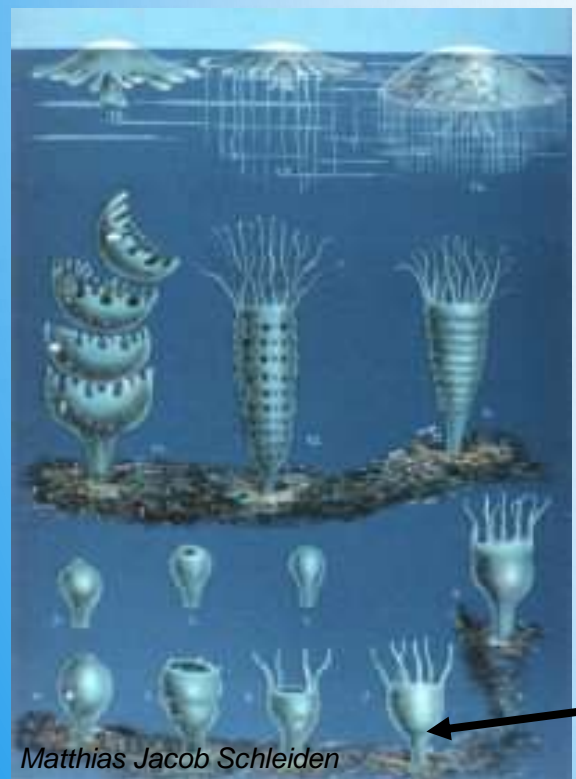
Some research suggests
That these stalks help attach
The bacterium to the sediment



https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.piquenewsmagazine.com%2Fwhistler-news%2Fnaturespeak-is-that-oil-on-the-beach-2507979&psig=AOvVaw19mrvq_I7WqG8wlbll6a6J&ust=1614697874563000&source=images&cd=vfe&ved=0CAIQjRxqFwoTCMCa38ywj-8CFQAAAAAdAAAAABAP



FRESHWATER JELLYFISH POLYP STAGE



- THE POLYP STAGE (A DEVELOPMENTAL FORM) OCCUR ON THE BOTTOM SEDIMENTS OF LAKES WITH JELLYFISH, RARELY OBSERVED
- THE MEDUSA (FREE SWIMMING) IS THE FORM WE SEE UP IN THE WATER COLUMN



NATIVE FRESHWATER SNAILS

- HABITAT: ATTACHED TO UNDERWATER SUBSTRATES, ROCKS, PLANTS
- AT LEAST 26 SPECIES OF NATIVE FRESHWATER SNAILS DOCUMENTED IN NH, NONE OF WHICH ARE SPECIES OF CONCERN
- HARD TO SPOT AS MOST ARE TINY



Planorbella armigera

https://lh3.googleusercontent.com/proxy/i_baFTMcgB76L5a88pcCIUAcyZ5GbVsWx8ZgIPNhN7nmjdpHeo7z-A2PSUKHZ5OQm1b8PZ3pwzeefkt9IB2pJXqgF1XUOoxdawUOaunllvrtmvSHXSf-koJHK55AibYhntyAHFgjZB6zPfsMblHOSq



Spurwinkia salsa

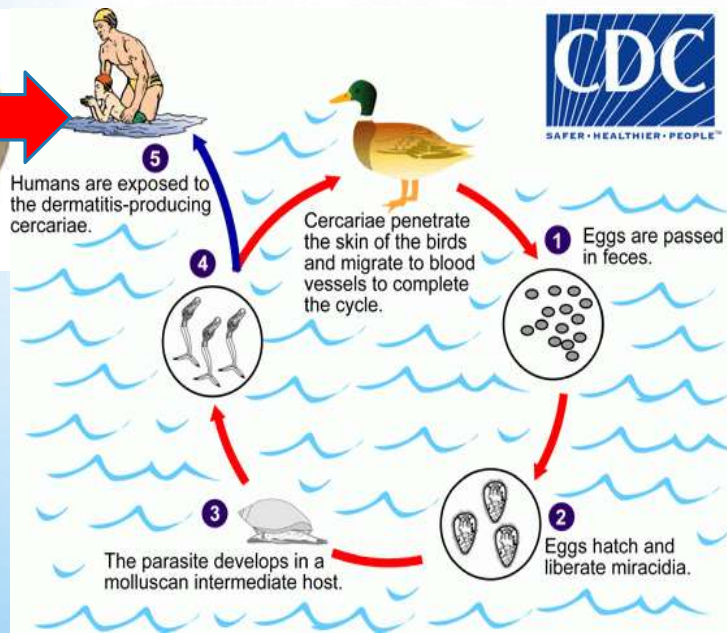
<https://manayunkia.files.wordpress.com/2014/09/hydrobiid-snail-spurwinkia-salsa-rowley-massachusetts.jpg?w=724>



*Stagnicola emarginata****

<https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.pinterest.com%2Fpin%2F27521222720956402%2F&psig=AOvVaw3WvpuPsS-yNaDVT2kknf&ust=1614699907137000&source=images&ved=0CAIQjRxfwoTCMigypW4j-8CFQAAAAAABAD>

***Intermediate host for the swimmer's itch parasite!



Helisoma anceps (ram's horn)

<https://manayunkia.files.wordpress.com/2014/09/hydrobiid-snail-spurwinkia-salsa-rowley-massachusetts.jpg?w=724>

TUBERS

- NOT REALLY ATTACHED----BUT A COMMONLY ASKED ABOUT OBJECT IN LAKES
- THESE ARE IN THE SEDIMENT, AND ATTACHED TO THE FLOATING PADS OF YELLOW WATER LILY PLANTS
- GAS BUBBLES IN THE SEDIMENT MAKE THESE “POP’ FROM THE SEDIMENT, AND GASSES TRAPPED IN THE TUBER MAKE IT FLOAT.



Some are actually quite large!



Tuber floating in lake



Decomposed tuber

THANK YOU FOR JOINING US!

CONTACT US AT

- Amanda McQuaid, Harmful Algal & Cyanobacteria Bloom Program and Beach Inspection Program
 - Amanda.McQuaid@des.nh.gov, HAB@des.nh.gov, 603-848-8094 (cyano hotline).
 - <https://www.des.nh.gov/water/healthy-swimming/>
- Sara Steiner, VLAP Coordinator
 - Sara.Steiner@des.nh.gov
- Amy Smagula, Limnologist & Exotic Species Program Coordinator
 - Amy.Smagula@des.nh.gov
- Visit our website at www.des.nh.gov