Marine Phytoplankton of South Central Alaska

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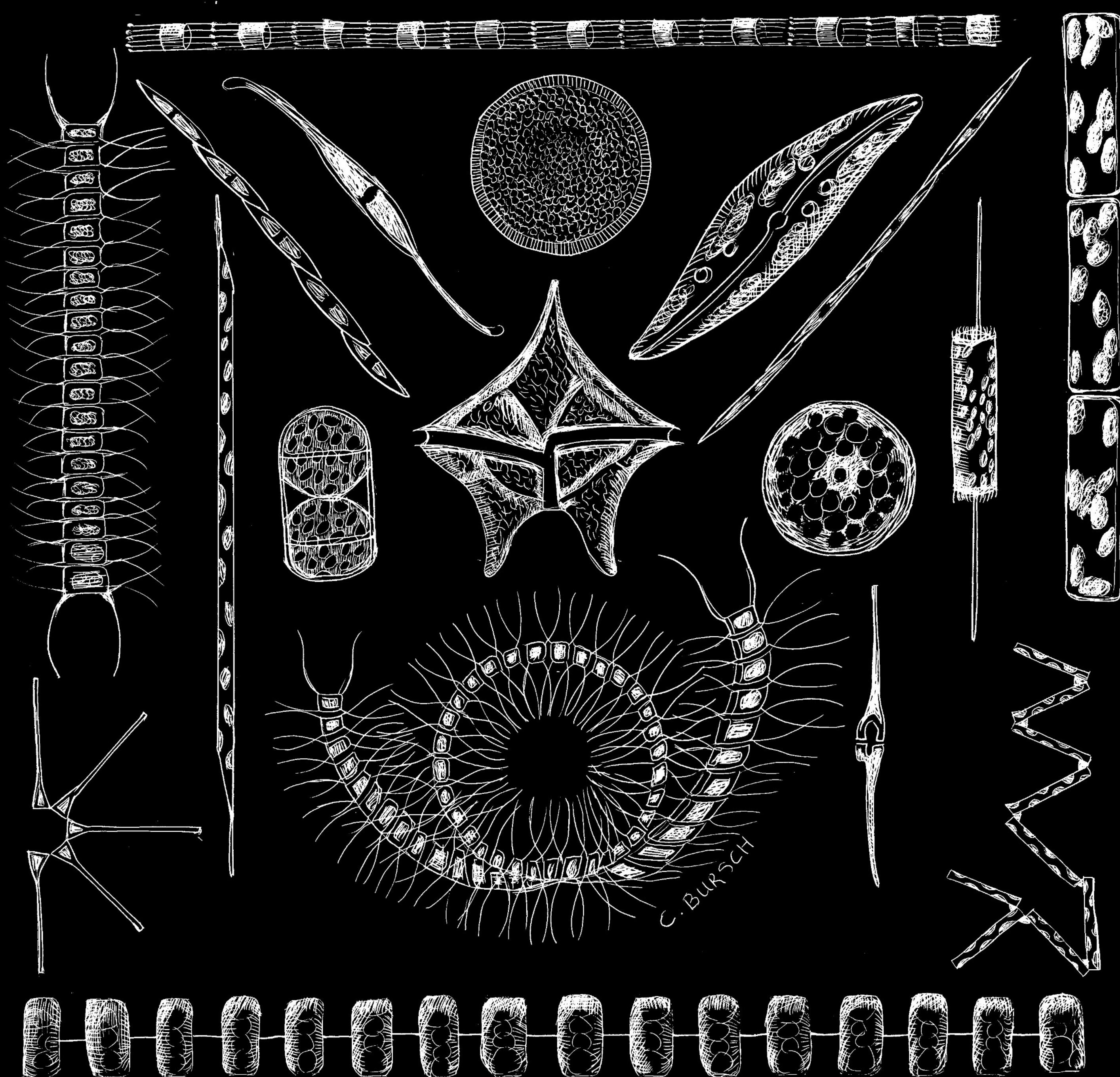
Kachemak Bay National Estuarine Research Reserve 2021



KBNERR Harmful Algal Bloom Program Overview

Kachemak Bay National Estuarine Research Reserve's Harmful Algal Bloom monitoring program was established in 2006. The main goal of the program is to look for groups of phytoplankton (microscopic plants that float in the water column) that are known to produce toxins that can result in shellfish poisoning in humans, birds, and marine mammals. Harmful algal blooms (HABs) occur when toxin producing phytoplankton become abundant and toxins accumulate in shellfish which can lead to severe health effects and potential fatalities when toxic shellfish are consumed. Algal blooms are a natural and important part of a healthy ecosystem providing food for many animals in the marine environment, with only a relative few capable of producing toxins which can have negative health impacts.

KBNERR's HAB program monitors phytoplankton in Kachemak Bay throughout the year, and does periodic toxin testing of wild shellfish during the summer months. Phytoplankton samples also are collected annually from April to October by trained community monitors at numerous locations throughout Kachemak Bay, Resurrection Bay, and Prince William Sound. These volunteers are trained in sampling techniques, providing a valuable service to the community. Samples are processed and analyzed by KBNERR, and community monitors trained in phytoplankton identification. Weekly reports on phytoplankton are distributed from KBNERR to state managers, private and public organizations, oyster farmers, local harvesters, tribal organizations, and our community monitors. Monitoring phytoplankton also provides us with valuable baseline information on the bloom cycles in Kachemak Bay.

This guide and KBNERR's HAB program typically identify to genus and includes the most common phytoplankton we have seen in samples collected since 2006. You will find a glossary at the back as well as a list of references. If you are interested in learning more about our program, becoming a volunteer, or bringing HABs and related phytoplankton curriculum into your classroom or community please contact Rosie Masui, rmmasui@alaska.edu, or Jasmine Maurer, jrmaurer@alaska.edu.

Collecting a phytoplankton sample at Seldovia Harbor.

Alaska Center for Conservation Science
University of Alaska Anchorage

PHYTOPLANKTON of SOUTH CENTRAL ALASKA
A GUIDE TO IDENTIFICATION

INTRODUCTION

Phytoplankton are one-celled organisms that float in the sunlit surface water where they convert solar energy to food energy that sustains almost all life in marine and estuarine ecosystems. Through their food production phytoplankton also prodoce 50% of Earth's oxygen. They are normally microscopic (less than 100 microns in diameter or a tenth of a millimeter.) The two most significant groups of phytoplankton that are visible with a microscope in south central Alaska are **DIATOMS** and **DINOFLAGELLATES.**

DIATOMS

Diatoms are comprised of a live cell surrounded by a glass cage made of silica that resembles a miniscule box—the bottom (hypotheca) fits snugly into a tight-fitting lid (epitheca)—much like a shoebox or tube of lipstick. The flat surfaces of the top of the epitheca and the bottom of the hypotheca are called "valves." Based on valve shape diatoms are loosely divided into groups by shape, the two most common shapes are—**centric** and **pennate**.

Centric diatom valves have radial symmetry, which means they are symmetrical around a central axis. Each valve of a centric diatoms radiates outward from its midpoint like a snowflake or dinner plate. The sides of the lid and the box are called the "girdle." The rectangular side view of a centric diatom (Fig. A) is called the "girdle view." The rectangular girdle view may resemble the edge of a thin coin, or be thicker like a shoebox or tall and thin like a lipstick tube.

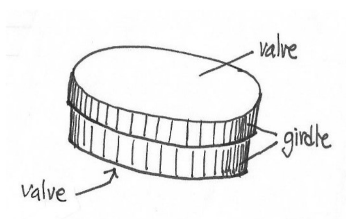


Figure A. Valve and girdle views of a single centric diatom.

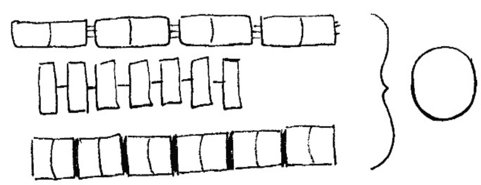


Figure B. Girdle views of 3 different centric diatom chains and valve view of all three.

Typically, centric diatoms are not motile—meaning they cannot propel themselves through the water. Hence they flourish in the active surface waters where waves and currents move them about, continually exposing them to new concentrations of vital nutrients. Some centric diatoms form chains (Fig. B) by joining their valves with those of adjacent diatoms of the same species. Chain formations, as well as spines, are adaptations that increase flotation of diatoms in the surface water.

Figure C Pennate: Girdle view

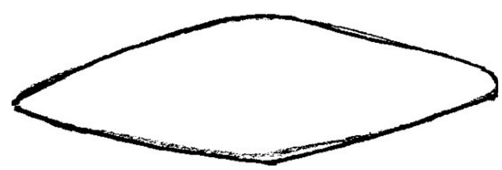


Figure D Pennate: Valve view

Pennate diatoms have bilaterally symmetrical valves, which means when a line is drawn down the midline of the valve the two halves created are mirror images of each other, in other words they have only one line of symmetry. The valves are usually wider in the middle and taper at both ends, but may be nearly rectangular.

Most pennate diatoms are benthic—dwelling near or on the ocean floor. The cells of many pennate diatoms have a thin tube-like slit that runs from one end to the other and opens through a hole in each end of the glass box, called a raphe. The cytoplasm of the cell secretes ions into the water of the slit at one end, creating an osmotic gradient along the raphe that pulls water into the raphe and moves it along to exit at the opposite end. This water action results in rather rapid motility of the diatom by jet propulsion, an important adaptation for obtaining nutrients in the benthic environment where there is little wave action to move them around.

DINOFLAGELLATES

Dinoflagellates are another form of phytoplankton that occur in south central Alaska and can be seen under a microscope —zipping and twirling in and out of the field of view of the microscope. A single dinoflagellate is basically a round cell confined in a capsule of close-fitting cellulose plates that may squeeze the cell into a different shape, like the one in Fig. E.

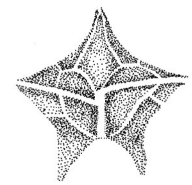


Figure E Dinoflagellate

A horizontal groove (cingulum) circles the cell and a second groove (sulcus) extends downward from the cingulum to the lower end of the cell. One flagellum, a whip like tail structure, lies in the cingulum and a second flagellum extends into the water from the sulcus.

The sulcus and ends of the cingulum can only be seen on the ventral (front) side of the dinoflagellate, as in Fig. F and G. Details of the positions of the cingulum ends relative to each other and to the sulcus vary greatly from one species to another, but are often helpful when identifying a given dinoflagellate. Wavy contractions of the transverse flagellum in the cingulum cause the dinoflagellate to spin, while the longitudinal flagellum in the sulcus propels the dinoflagellate forward.

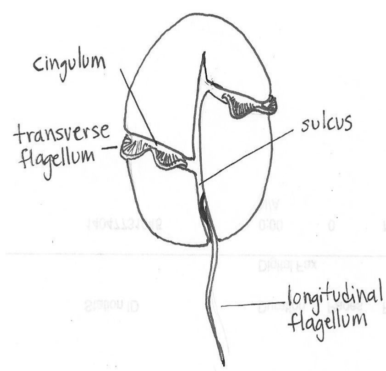


Figure F Ventral view of dinoflagellate

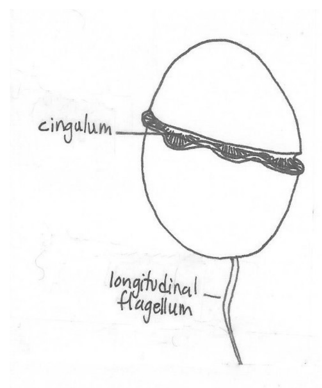


Figure G Dorsal view of dinoflagellate

Most dinoflagellates are <u>autotrophs</u> (produce their own food by photosynthesis), whereas a few are <u>heterotrophs</u> (obtain their food by capture of autotrophic cells). Some are both autotrophic and heterotrophic, in which case they are called <u>mixotrophs.</u> Fun fact, some mixotrophs gain the ability to photosynthesize after consuming autotrophs.

TOXIN PRODUCERS There are three genera of phytoplankton in Kachemak Bay that are known to produce toxins potentially harmful to humans. They are ***Pseudo-nitzschia***, a diatom, and ***Alexandrium*** and ***Dinophysis***, both dinoflagellates. They are indicated in red in this guide along with more detailed information about their toxins.

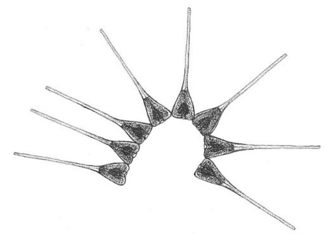
PHYTOPLANKTON OF KACHEMAK BAY, ALASKA

DIATOMS

Updated in 2021

***Asterionellopsis* sp.** 13-150µm long (pennate diatom)

- Basal end is triangular and thicker than the other end, like a plunger.
- Cells are held together in a star shape or spiral chain by the basal ends.
- Two chloroplasts are located in the basal ends but rarely seen.
- Part of the surf zone diatom community, sometimes abundant.



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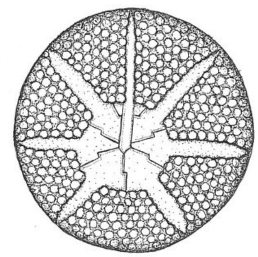
***Asteromphalus* sp.** 42-175µm diameter (centric diatom)

- Solitary cell, disc to pear shaped
- Has distinctive and plain rays
- Number of rays varies among the different species
- Girdle view has an undulated form, wavy



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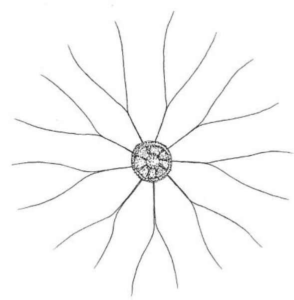
***Bacteriastrum* sp.** 6-15µm diameter (centric diatom)

- Valves of cells are round and cells may be linked in chains.
- Fused setae from adjacent cells extend perpendicular to chain, then sepa rate, producing a bifurcate end to the setae.
- Terminal setae, setae attached to last cell in the chain differ from other setae, not branched, not fused, and often curved
- Often associated with *Chaetoceros* sp. but rarely dominate a plankton sample.
- Can be confused with *Chaetoceros* sp., the identifying difference being the setae are forked at the ends in *Bacteriastrum* sp.
- *Bacteriastrum* sp. and *Chaetoceros* sp. are in the family Chaetocerotaceae.



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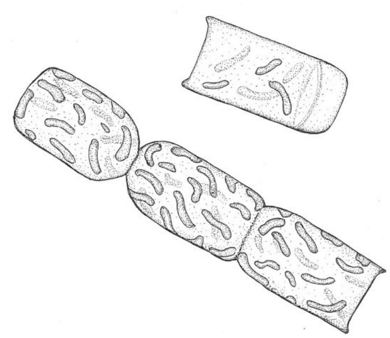
***Cerataulina* sp.** 30-60µm diameter (centric diatom)

- Cylindrical cells with scattered, often clumped, chloroplasts**.**
- Two small projections, located opposite of each other on the rim of each valve.***
- Valves are slightly arched
- Chains form when projections on valve of one cell fit into depressions on the valve of adjoining cell.

*** Projections are only visible alternately by fine magnification adjustments.



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DIATOMS

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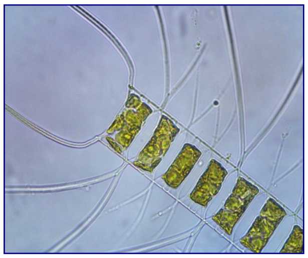


C*haetoceros* spp. Overview

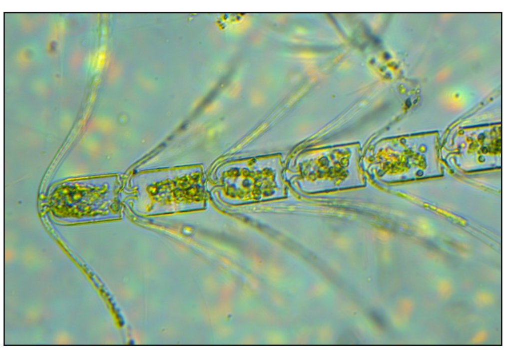
- *Chaetoceros* spp. are common in Kachemak Bay
- There are over 400 *Chaetoceros* species worldwide.
- Every cell has 2 spines on each valve. (upper photo at right)
- Chains form when spines of adjoining cells fuse together at their bases. (lower photo)
- Valves of adjoining cells in the chain don't touch—there is a space between them called the "aperture."
- Cells in a chain appear rectangular because we are seeing them in girdle view. Valve view of cells is round.
- *Chaetoceros* is important in the marine food web—it does **no apparent harm to animals that eat it**. It is even cultured as food for the bivalve industry.
- However, *Chaetoceros* sp. **can harm** fish held in pens by getting caught in their gills which can lead to suffocation. Fish in pens are susceptible because they can't swim away from *Chaetoceros* sp. when it blooms in the waters around and in their pen.

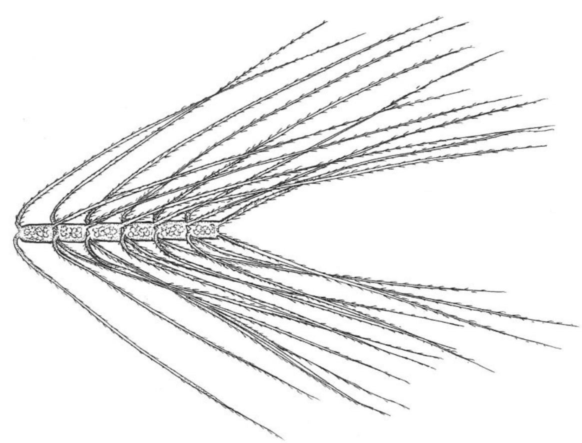
Chaetoceros sp. can damage the fish in three ways:

1. Spines lacerate the delicate gills of the small fish.
2. Spines introduce bacteria to the bloodstream through the lacerations.
3. Irritation of the gill surface by spines stimulates mucus production that cuts off oxygen passage through the gills.

Chaetoceros concavicornis 12-30 µm diameter (centric diatoms)
Chaetoceros convolutus 10-27 µm diameter

- These *Chaetoceros* species are usually joined in straight chains, sometimes occurs as a solitary cell.
- Upper valve is rounded with setae originating in the center and differs from lower valve that is flat with setae originating at valve margin.
- Known to kill fish in net pens.
- Setae are very long and wide, often with chloroplasts in setae
- These two species can be differentiated by the width of their setae: *C. concavicornis* setae are thin at the base and widen away from cell, *C. convolutus* setae are a uniform width.
- Can be confused with *C. danicus*. *Chaetoceros danicus* is relatively small (8-20 µm wide) often solitary or joined in chains of 4 or fewer cells and frequently appears in valve view. Cells are symmetrical in girdle view unlike *C. convolutus* and *C. concavicornis* which have domed upper valve and flat lower valve in girdle view.





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DIATOMS

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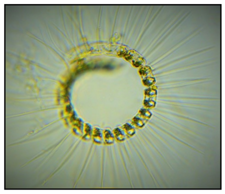
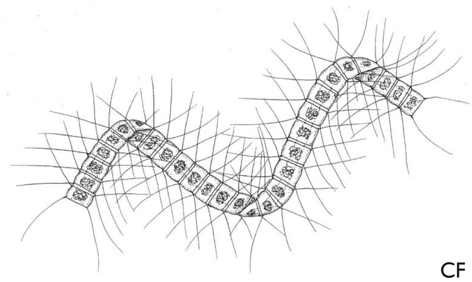
Chaetoceros debilis 8-40µm diameter (centric diatom)

- *Chaetoceros debilis* forms spirally twisted chains.
- Valves flat or slightly concave with rounded corners.
- Setae originate slightly inside cell margin and cross slightly outside the chain edge





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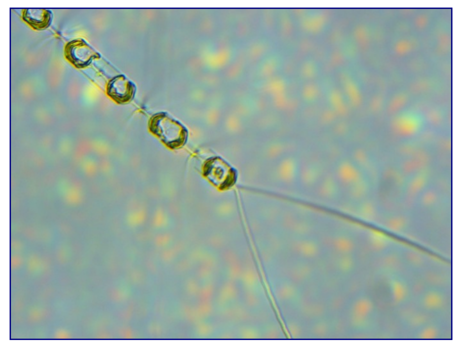
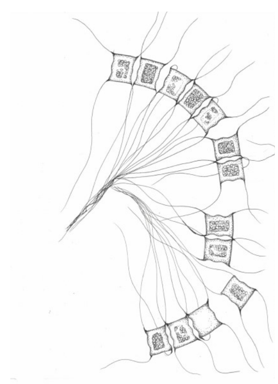
Chaetoceros laciniosus 10-42 µm diameter (centric diatom)

- *Chaetoceros laciniosus* is joined in loose, straight chains
- Rectangular in girdle view, valves surface slightly convex.
- Terminal setae longer and thicker than mid-chain setae
- Cells have rounded corners.



Chaetoceros socialis 4-15µm diameter (centric diatom)

- *Chaetoceros socialis* has small cells joined in short flexibile chains.
- Setae originate inside cell corners and hairlike, three short setae and one long one entertwined with setae of adjacent cells.
- Colonies more or less in spherical.
- Colonies can look like debris due to the small cell size.
- Scattered very small cells are attached by faintly visible tendrils to a central structure, similar to a bundle of balloons.



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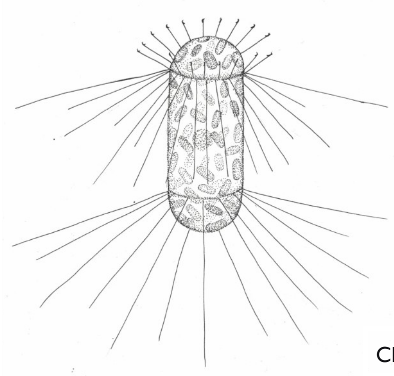
Corethron criophilum 20-300µm diameter (centric diatom)

- Single cells, tubular, with domed valves.
- Both valves bear marginal spines, pointing backward.
- Valve of epitheca bears a second set of shorter spines that end in twisted knobs and point forward like a crown.
- Chloroplasts numerous, small.



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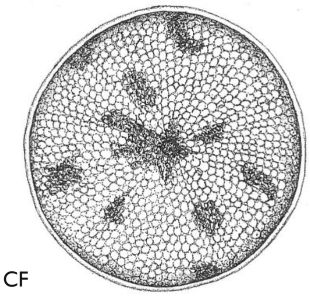

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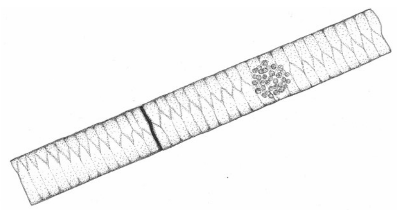
***Coscinodiscus* morphotype** 50-170µm diameter (centric diatom)

- Valve is large and round.
- Girdle view, not often seen, resembles a hockey puck.
- *Coscinodiscus* sp. controls its buoyancy by releasing oil droplets through a large central pore and many smaller pores aligned radially and around the circumference.
- View of radial pores is often blocked by chloroplasts.
- Often confused with single cells of *Thallasiosira* sp, but is larger.



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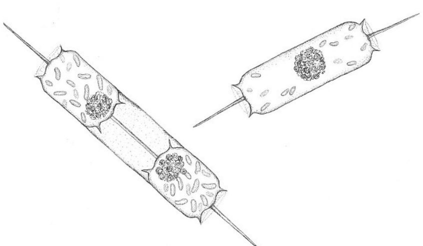
Dactyliosolen blavyanus 6-38 µm diameter (centric diatom)

- Girdle view is rectangular, with visible bands.
- Cells are cylindrical and solitary or in short chains.
- Chloroplasts often concentrated in middle or at one end of the cell.
- Valve surface is flat.



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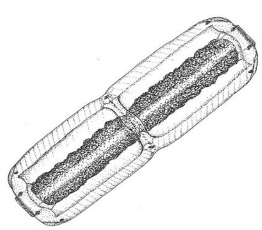
Ditylum brightwellii 80-130µm long (centric diatom)

- Girdle view is rectangular.
- Solitary or forming chains.
- A single stiff spine at the center of each end, valves also have marginal ridge.
- Valve view is triangular, but not often visible.



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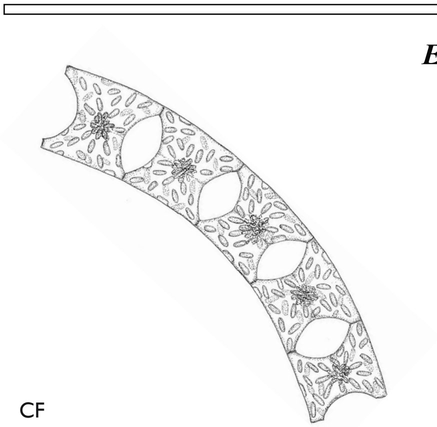
***Entomoneis* sp.** 40-140µm long (pennate diatom)

- (synonym = ***Amphiprora*** sp.)
- Large rectangular cell, large chloroplast, visible raphe.
- Usually benthic but may get swirled into the surface water.
- Often looks like it has a belt on with indentation around the middle.



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Eucampia sp. 10-61µm long

- Cells in curved chains.
- Cells connected by two blunt projections on both valves.
- Apertures, gaps or holes between cells, are large and circular.
- Can be mostly transparent

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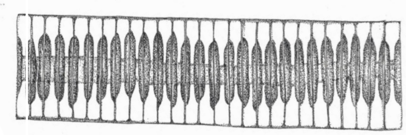
***Fragilariopsis* sp.** 30µm long (pennate diatom)

- Cells flattened and either single or pressed together in belt-like chains.
- Valves rod-shaped or elliptical.
- Large, central chloroplasts.
- Mostly benthic.



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***Guinardia* sp.** 6-45 µm diameter (centric diatom)

- Long cylindrical cells form straight or slightly curved chains.
- Valves somewhat convex.
- Chloroplasts many, small and round and may be clumped.

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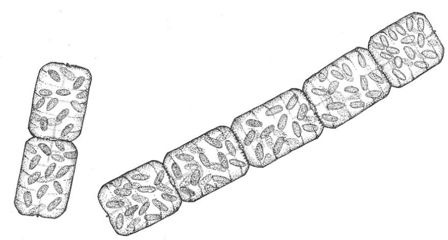
***Lauderia* sp.** 24-75µm diameter (centric diatom)

- Cylindrical cell
- United in straight chains
- Chloroplasts numerous, small, discoid, lobed.



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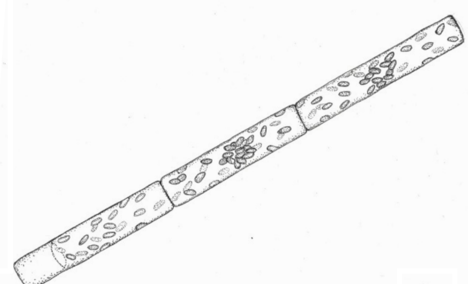
***Leptocylindrus* sp.** 5-60µm diameter (centric diatom)

- Long, slender cells form straight chains.
- In chains, cells are joined by the full surface of their valves.
- Cells have no spines nor horns.
- Important oyster food.
- Common in Kachemak Bay



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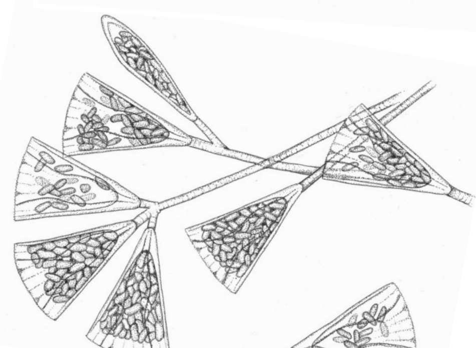
***Licmophora* sp.** 70µm long (pennate diatom)

- Wedge shaped cells.
- Can grow attached to seaweed or zooplankton, but sometimes breaks loose and floats freely in the water.
- Chloroplasts tend to be olive-green.



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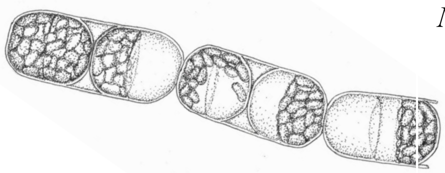

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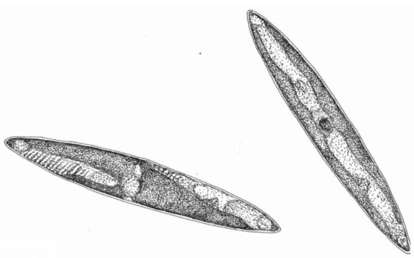
***Melosira* sp.** 17-70µm diameter (centric diatom)

- Cells united in beadlike chains by mucilage pads.
- Cells connected in pairs or triplets by their girdles
- Cells drum-shaped.
- Chloroplasts are numerous, irregular and discoid shaped.



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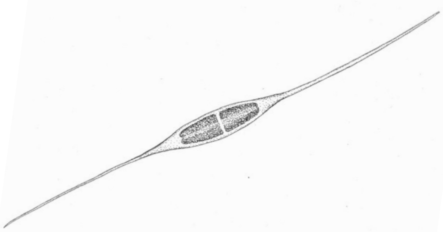
Navicula morphotype 50-110µm long (pennate diatom)

- Over 1000 pennate species have this morphotype (shape).
- Size ranges from mostly very small to a few quite large.
- Solitary, kayak or canoe shaped with somewhat rounded ends.
- When seen in a live sample they tend to be very active.
- A raphe is usually visible.



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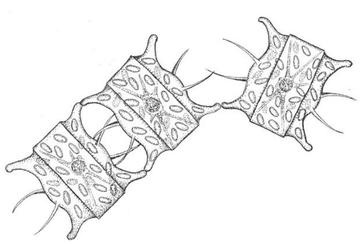
Nitzschia morphotype 60µm long (pennate diatom)

- Elongated cell with tapering pointed ends.
- The tapering ends *may* curve slightly, however this is not as pronounced as *Pleurosigma* sp., in fact it is often imperceptible.
- Two large chloroplasts centrally located.
- Cytoplasm extends into points of the cell.
- *Cylindrotheca* sp. is a synonym



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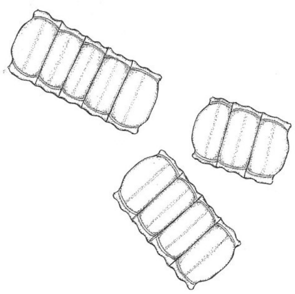
***Odontella* sp.** synonym ***Biddulphia* sp.** 10-11µm diameter (centric diatom)

- Valves have prominent bump(s) at their center and elliptical or lanceolate horns on the margin.
- Cells can be solitary or in straight or zigzag chains.
- Numerous small chloroplasts.
- Some species have long external tubes, resembling spines, extending from valve and overlap adjacent cells when chains are formed.



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***Paralia* sp.** 8-130µm diameter (centric diatom)

- Cylindrical cells are wider than long.
- Cell walls made of thick silica layers
- Forms short filaments linked by spines and interlocking ridges and grooves on the flattened valve surface
- Most abundant in shallow nearshore waters

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DIATOMS

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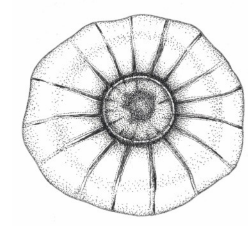
Planktoniella sol (centric diatom)

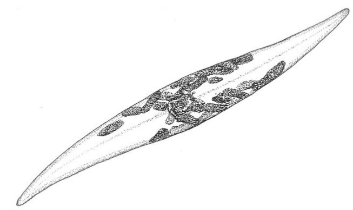
- Disc-shaped cell.
- A gel-like membrane circles the cell like a skirt.
- In the same family, Coscinodiscaceae, as *Conscinodiscus*



CF

Pleurosigma morphotype 60-200µm long (pennate diatom)

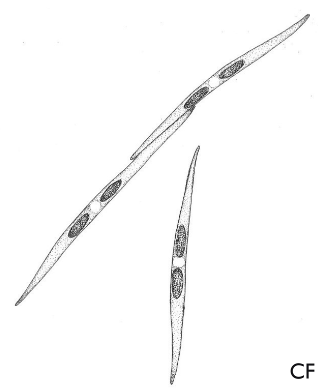
- Very large pennate diatom.
- Name from Gr. *Pleura*=rib and *sigma*=S-shaped.
- Ends always blunt—never pointed—and usually flex in opposite directions. Bending may not be apparent in side view.
- Raphe usually visible.



CF

***Pseudo-nitzschia* sp.** Lg 130-250µm. Sm 50-100µm (pennate diatom)

- Elongated cells with two large chloroplasts in the center.
- Usually joined in chains by overlapping ends, but overlap is not obvious if specimen is oriented sideways. Single cells also occur.
- Can produce domoic acid (DA) which is toxic to humans. Humans may develop Amnesic Shellfish Poisoning (ASP) after eating shellfish (crabs, clams, mussels) contaminated by DA.
- All species of ***Pseudo-nitzschia*** produce DA, but at different levels and times.
- One of the species found in Kachemak Bay, ***P. australis****,* is known to be a DA producer world-wide. In live samples ***Pseudo-nitzschia*** chains are very active.



CF

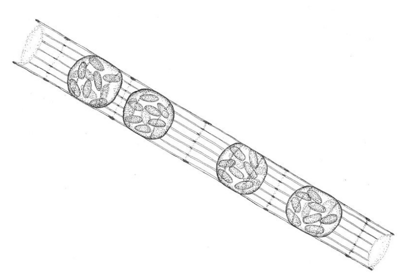
***Rhizosolenia* sp.** 200-400µm diameter (centric diatom)

- Most species are very long and large, but some are short.
- Sharp, pointed spines on each end are straight on the outer edge, curved concavely on the inner edge.
- Cylindrical with yellow-green chloroplasts.
- Can occur as a single cell or chains.

CF

***Skeletonema* sp.** 2-30µm diameter (centric diatom)

- Each valve bears a single ring of threads with a knuckle-like expansion at their ends. "Knuckles" of one cell attach to knuckles on threads of adjoining cells. The dark line of joined knuckles is visible between adjacent valves.
- Adjoining valves do not touch.
- Good food source for oysters and zooplankton.
- Cell shape can be round or cylindrical.
- Quite small and can be faint when viewed in a sample

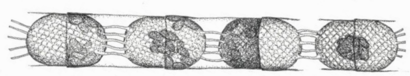


CF

PHYTOPLANKTON OF KACHEMAK BAY, ALASKA

DIATOMS

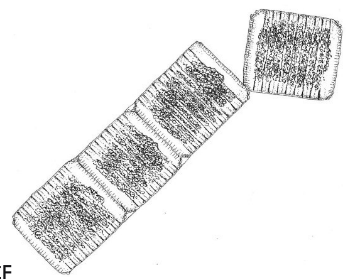
Updated in 2021



CF

***Stephanopyxis* sp.** 20-36µm diameter (centric diatom)

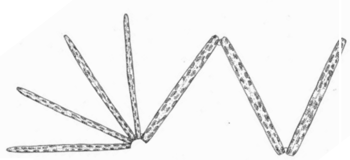
- Valves attached by threads just inside the valve margins, NO “knuckle” connecting threads midway between cells, as in *Skeletonema*.
- Adjacent valves do not touch.
- Cells capsule-shaped to spherical shaped.



CF

***Striatella* sp.** 35–125µm diameter (pennate diatom)

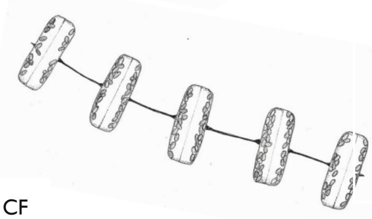
- Rectangular in girdle view (at left).
- Valve view is kayak shaped.
- Many prominent horizontal bands.
- Adjoining cells attach at corners, forming chains.
- Cell corners are rounded, or angled
- Large cells, often covered with debris.



CF

***Thalassionema* sp.** 10-80µm long (pennate diatom)

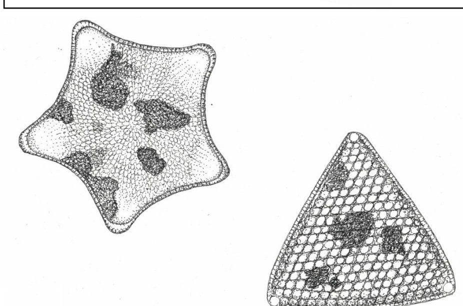
- Long rectangular cells are joined randomly in zigzag chains by a gelatinous cushion at valve corners.
- Chloroplasts scattered throughout.
- Sometimes seen as solitary cells



CF

***Thalassiosira* sp.** 10-78µm diameter (centric diatom)

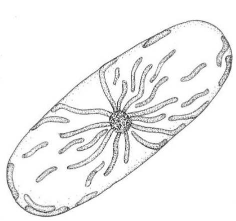
- Cells are united in flexible chains by a single gelatinous thread connecting the centers of adjacent cells.
- Single cells resemble *Coscinodiscus* in valve view, but chloroplasts appear larger, compared to cell size, than those of *Coscinodiscus* sp.



CF

***Triceratium* morphotype** (centric diatoms)

- Members of this genus have diverse morphology, they can have three to seven points. There are over 400 species within this genus.
- Valve surface similar to *Coscinodiscus* with visible large pores.
- Cells are solitary and vary in size.



CF

***Tropidoneis* sp.** 160-350µm long (pennate diatom)

- Lanceolate in valve view, elliptical or slightly constricted in girdle view
- Chloroplast rod-like, nermous, radiating along the cell wall from the central nucleus

PHYTOPLANKTON OF KACHEMAK BAY, ALASKA

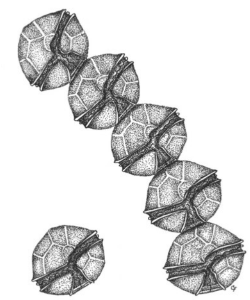
DINOFLAGELLATES

Updated in 2021

Alexandrium sp.

24-50µm long

- Cells are spherical to hemispherical to oval, no spines or horns.
- Waistline groove (cingulum) is deep and has a staggered intersection with the right end being lower than the left end.
- Densely pigmented reddish-brown.
- May occur singly or in chains
- Several species produce saxitoxin, a powerful poison that causes potentially fatal Paralytic Shellfish Poisoning (PSP) in humans who have eaten shellfish with concentrations of saxitoxin.

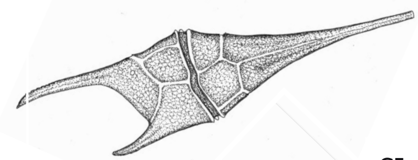


CF

Ceratium furca morphotype

70-200µm long

- *Ceratium furca* morphotype represents a group of dinoflagellates with three horns—one on the epitheca and two on the hypotheca.
- The two horns on the hypotheca are relatively straight and usually appear parallel to one another, but may be flexed outward somewhat.
- Horns on hypotheca are usually unequal in length.

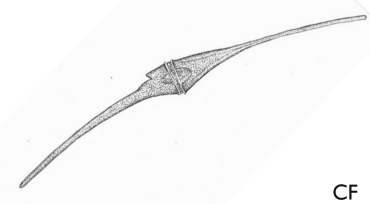


CF

Ceratium fusus morphotype

100-300µm long

- *C. fusus* represents a group of dinoflagellates with two prominent horns, one on the epitheca and one on the hypotheca.
- There is a second hypothecal horn that is a rudimentary stub.

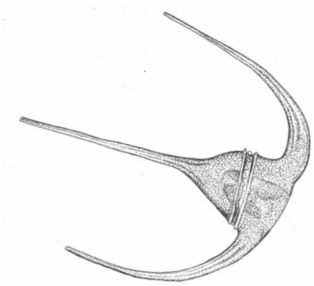


CF

Ceratium longipes morphotype

70-300µm long

- The hypothecal horns on species with *C. longipes* morphotype are long and severely flexed forward.
- Horns of other species with this morphotype may be very long and have bizarre kinks and twists.

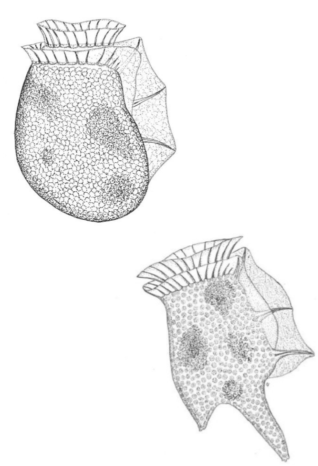


CF

Dinophysis sp.

36-105µm long

- Has unique collar above the cingulum near the top and a wing-like structure (sulcal list) along the side.
- Cells are laterally flattened.
- Common in Kachemak Bay and very active.
- Multiple species of ***Dinophysis*** produce a toxin, okadaic acid, which causes Diarrhetic Shellfish Poisoning (DSP) and is a known tumor promoter.
- DSP is not fatal but causes intestinal discomfort in humans who eat shellfish that have accumulated toxic ***Dinophysis*** sp.
- Species identification determined by cell size and shape, dorsal and ventral cell curvature, length of the sulcal list and position of the three ribs that support the sulcal list.



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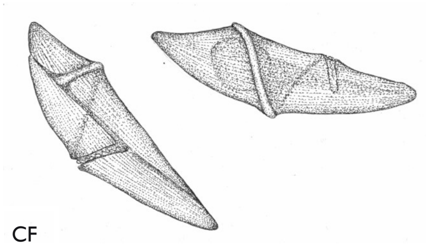
PHYTOPLANKTON OF KACHEMAK BAY, ALASKA

DINOFLAGELLATES

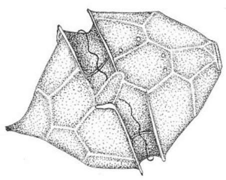
Updated in 2021



CF

Gyrodinium spiralis 75-145µm long

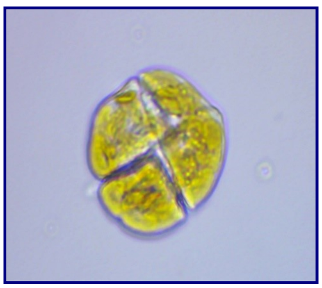
- Some species quite small, some large.
- Members of this genus are very active
- Oval to elliptical in shape
- Cingulum descends sharply as it spirals around the cell so the ends are widely displaced in front.



CF

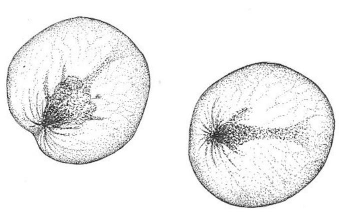
***Heterocapsa* sp.** 16-30µm long

- A very small dinoflagellate. May be confused with *Alexandrium* sp*.,* if not for the horn on one end.
- Cingulum is deep, nearly circular. In ventral view right end of cingulum is only slightly displaced downward, distinct from *Alexandrium*'s staggered cingulum.
- Epitheca round to conical with straight sides; hypotheca has an asymmetrical horn
- No spines or ornamentation



Karenia mikimotoi 40µm long

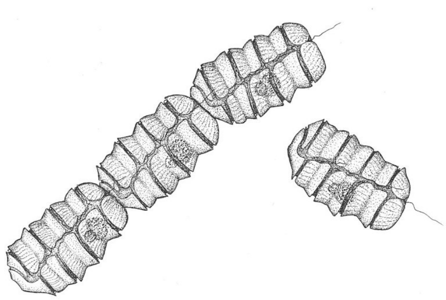
- Small, slightly oval cell.
- Hypotheca (below cingulum) somewhat larger than epitheca (above cingulum).
- Ventral ends of cingulum do not meet —one end is higher than the other.
- Apical groove is offset from sulcus by a protruding flap.
- Dorsoventral compression becomes evident when cell spins.
- A major brownish bloom of *K. mikimotoi* occurred in Kachemak Bay in Sep.-Oct. 2013, this uncommon bloom caused public alarm.



CF

Noctiluca scintillans 400µm

- This very large cell has atypical structure for a dinoflagellate.
- Noctiluca is a heterotroph with two sticky food-gathering flagella extending from a slit along one side.
- Feeds mostly on diatoms. Chloroplasts are absent.
- Often bioluminescent, greenish or blue, at night when water is disturbed. Most common near shore in marine water.
- Does not produce a toxin, but following a large bloom the dying cells release large amounts of ammonia that may kill fish.
- Large vacuole increases buoyancy.



CF

Polykrikos kofodii 130µm x 70µm

- A pile of 4 to16 single dinoflagellate cells form a pseudocolony.
- Each cell has a cingulum, slightly descending in ventral view.
- All cells in the stack share a single sulcus down the middle.
- This is a phagocytrophic dinoflagellate that captures other cells including *Alexandrium tamarense.*

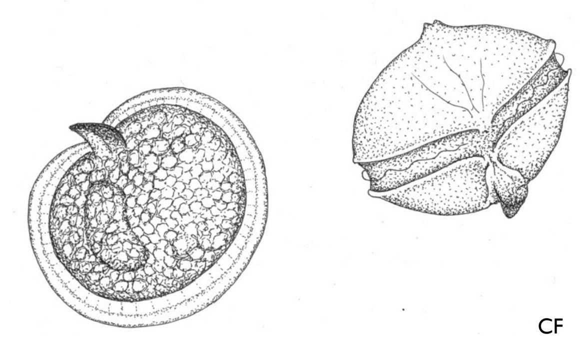
PHYTOPLANKTON OF KACHEMAK BAY, ALASKA

DINOFLAGELLATES

Updated in 2021

***Preperidinium* sp.** 28-60µm diameter

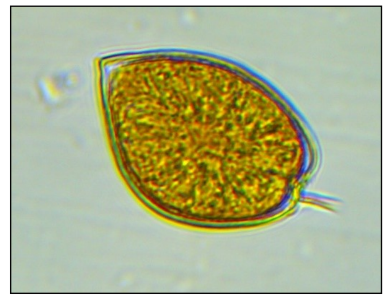
- Flattened ellipsoid cell shape
- Small horn at edge of one side.
- Visible short cilia around edge.
- Some species appear to be more semi-circular rather than circular



CF

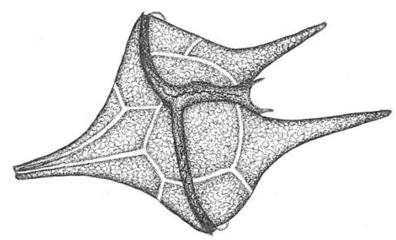
***Prorocentrum* sp.** 35-70µm long

- Many species worldwide, several locally.
- Spheroid to ovoid in shape with 1 or 2 flagella at apical end. One flagellum in line with the cell axis. The second flagellum encircles the first at its base.
- Active swimmers.
- No cingulum nor sulcus.



***Protoperidinium* morphotype** 20-90µm long

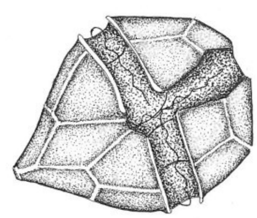
- Small, plump cell with two small horns on the hypotheca and one on the epitheca.
- Cingulum is prominent.
- Common in local tows—several species in Kachemak Bay.
- *Protoperidinium* sp. is a heterotroph. The "polka dots" in the cytoplasm are undigested pigments of the diatoms it eats.



CF

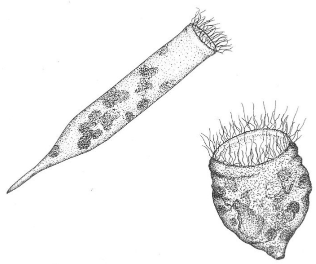
***Scrippsiella* sp.** 30-50µm long

- Small cell with conical epitheca, upper half, and rounded hypotheca, lower half.
- Chloroplasts present.
- The pointed epitheca and cingulum in alignment (not displaced) distinguishes it from *Alexandrium* sp.



CF

OTHER MARINE PLANKTON CAUGHT WITH PHYTOPLANKTON

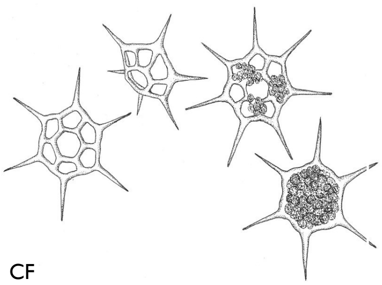


CF

CILIOPHORA—Tintinnids 20-200µm long

These zooplankton occur often in our samples, and are very active when alive.

- They are ciliates enclosed in an external case, called a lorica.
- A collar of cilia (small motile hairs) around the opening creates currents that stir up the water, propelling the animal forward and drawing food particles in.
- Two kinds of tintinnids are illustrated at left. The lower illustrations shows *Tintinniopsis* sp. whose lorica is made of small bits of shell or other foreign material. The upper illustration is a tintinnid with a clear, transparent lorica.

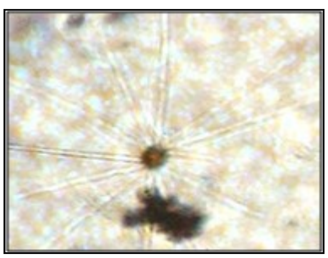


CF

CHRYSOPHYTA 19-34µm + spines

***Dictyocha* sp.** A Silicoflagellate.

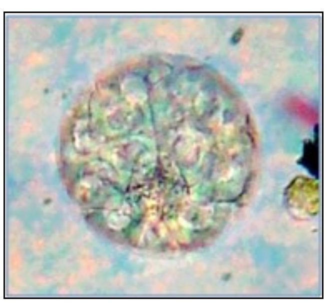
- Related to diatoms, this tiny phytoplankton is encased in a silica wreath with holes and spines.
- Appears to be spherical in top view, but is actually fairly flat.
- Very distinctive, often entangled with other phytoplankton or debris.
- The number of spines varies



SARCOMASTIGOPHORA 620µm, including spines

Actinopods

- This tiny zooplankton is related to amoebas.
- The cell is encased in a sphere usually made of silica with holes through which thin transparent feet of the amoeba extrude to capture food.



PRYMNESIOPHYTA <30µm, may be <10µm

Coccolithophore

- These are tiny photosynthetic organisms formerly classed with diatoms in Phylum Chrysophyta.
- Very tiny and nearly colorless, the circular calcareous plates are characteristic of this species.
- Coccolithophores are rarely visible because the smaller species slip out through the 20µm mesh of our tows.
- Coccolithophores are very numerous and important food producers in the marine ecosystem.

SPRUCE POLLEN Generally large

- Spruce pollen is common in phytoplankton samples in late spring and early summer.
- It is typically a yellow-brown color and has the form of two or three globes stuck together.

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OTHER MARINE PLANKTON CAUGHT WITH PHYTOPLANKTON

ROTIFER
- Large very active animal.
- Body can extend and contract.
- Large mouth parts extend rapidly to consume other animals and phytoplankton in a sample.

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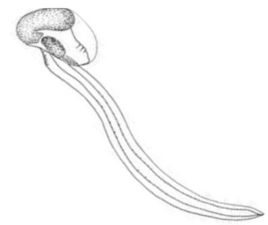
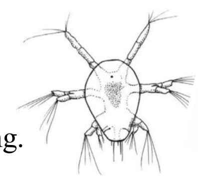
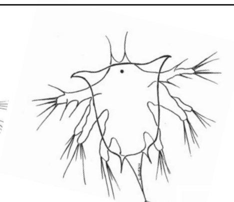
APPENDICULARIAN
- Soft bodied animal with long tail.
- They build mucus houses to filter out miniscule food particles, these houses are not typically seen in the sample.
- Important part of the marine food web.



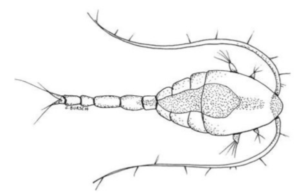
CB

NAUPLI
- Naulpi are the larval forms of barnacles and copepods.
- Seen frequently in phytoplankton samples.
- No tail, single eye spot, many appendages extend out from central body covering.
- Can be transparent or pigmented.

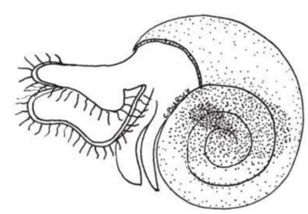
CB

COPEPODS
- Sometimes whole copepods are present, more often we see parts of their molts.
- Bodies are segmented, antennae and tail lengths vary with different species.
- Can be pigmented red to green or colorless.



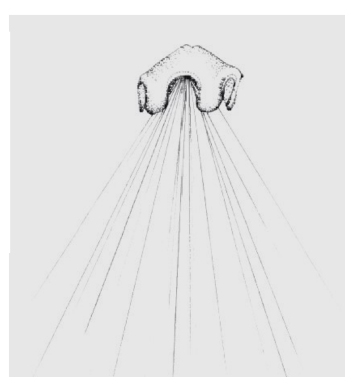
CB

SNAIL VELIGER Large, image from SERC
- Transparent snail shell
- Lobes may be pulled inside of shell or extended as shown in the image on the right.



CB

POLYCHAETE LARVA
- Spine like projections can be faint and hard to see.
- Unique shape and movement when seen alive in a sample.




CB

GLOSSARY

Aperature The space between two cells in a chain
Autotroph Organism capable of producing its own food by photosynthesis.
Basal The bottom or attached end of a spine or other structure.
Benthic Sea bottom or organism that lives at the bottom of the water column.
Bifurcate When a branch or spine divides into two.
Bilateral symmetry A body form that can be divided into two equal halves.
Bloom A high concentration of phytoplankton in an area caused by increased reproduction.
Cilia Microscopic hairs capable of moving in unison to capture food or move an organism.
Cingulum Groove around a dinoflagellate—contains the transverse flagellum.
Dorsal The back or upper side of an organism—back side of a dinoflagellate.
Epitheca Upper (and older) half of a diatom; part of dinoflagellate above the cingulum.
Estuary A partially enclosed bay or cove where fresh and sea water meet and mix.
Heterotroph Organism that cannot make its own food, must consume external food.
Horn On a diatom or dinoflagellate, any stout process that is not tapered or sharp.
Hypotheca The lower (and younger) half of a diatom; part of dinoflagellate below the cingulum.
Marginal Pertains to structures on the outer rim of a diatom valve.
Morphotype Having the same or similar shape.
Motile Having the ability to move under one's own power.
Osmotic gradient Movement of water across a membrane from area of higher concentration to area of lower concentration—creates current in raphe of pennate diatoms.
Phagocytropic An organism that gets its nutrition by consuming food made by other organisms.
Photosynthesis The chemical process that converts solar energy into food.
Phyto- A prefix that means "plants."
Plankton All the organisms that float in the sea and move with the waves and currents.
Process Any structure that juts out from a cell, such as spine, seta or horn.
Radial symmetry When a structure can be divided into two or more equal parts radiating from a central point.
Raphe A microscopic tube or fissure along the axis of a pennate diatom, makes movement possible.
Seta A thin, stiff hair or bristle, somewhat flexible. Plural noun, setae
Spine An elongated, thin, stiff process tapering to a blunt or sharp tip.
Sulcus On a dinoflagellate**,** a groove on the front side running from the cingulum to the posterior end.
Synonym When a scientific name of an organism is changed, the old name is listed as a synonym.
Valve On a diatom, the flat top or bottom: a circle in centric diatoms— kayak-shaped or rectangular on pennate diatoms.
Ventral On a dinoflagellate, the front side (where sulcus and ends of cingulum are located); on a sea star, the bottom surface.

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