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### Marine Plankton Identification Key

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#### Phytoplankton:

The phytoplankton are mainly unicellular plants known as algae. They are found dispersed throughout the photic zone of the oceans and account for the major share of primary productivity in the marine environment. The most important phytoplankton that are presently recognized are those 2-20  $\mu\text{m}$  in size, which are classified as **nannoplankton**. The major nannoplankton size groups in the oceans are the diatoms and the dinoflagellates, both unicellular forms of phytoplankton. These organisms may or may not be visible with light microscopy. Please use the enclosed black and white photographs to assist in identifications.

#### **Diatoms** (class *Bacillariophyceae*)

1. occur as single cells or in chains or other loose aggregates
2. cell sizes can range 15  $\mu\text{m}$  - 1000  $\mu\text{m}$ , although most diatom sizes range from 50 to 500  $\mu\text{m}$
3. presence of a porous, rigid cell wall (frustule) made mostly of silica and consisting of two closely fitting halves (epitheca and hypotheca)
4. presence of many small chloroplasts
5. occur in varied shapes: circular, triangular, and modified square shapes are known as centric diatoms (shaped like pillboxes), whereas the elongated ones (bilateral symmetry) are termed pennate diatoms
6. may possess spines or other projections that increase their surface area
7. some common representatives of centric diatoms: *Coscinodiscus*, *Chaetoceros* (chain), *Thalassiosira* (chain), *Pseudoecunotia* (chain), *Asteromphalus*, *Arachnoidiscus*, *Navicula* (chain), and *Triceratium*. Some common pennate diatoms are *Pleurosigma*, *Stauroneis*, *Gyrosigma*, *Rhizosolenia*, *Thalassiothrix* (chain), *Thalassionema* (chain), and *Nitzschia*

#### **Dinoflagellates** (class *Dinophyceae*)

1. occur as single cells, rarely in chains or other aggregates
2. cell sizes range from 25 to 1000  $\mu\text{m}$ , generally smaller than diatoms
3. presence of a porous cell wall made mostly of cellulose. In some armored forms, the cell wall consists of many articulating cellulose plates arranged irregularly over the cell surface
4. most possess several small chloroplasts usually located near the cell ends (a few species are not photosynthetic)
5. typical forms have a body surface with two grooves, each having a flagellum
6. may possess spines, horns or other projections
7. some common unarmored ("naked") representatives: *Gymnodinium*, *Cystidinium*, and *Glenodinium*. Some common armored species are *Peridinium*, *Ceratium*, *Dinophysis*, and *Gonyaulax*.

#### Protozoans:

A unicellular group that includes foraminiferans, radiolarians, and tintinnids. These organisms may or may not be visible with light microscopy. Please use the enclosed black and white photographs to assist in identifications.

### **Zooplankton:**

The zooplankton are more varied than the phytoplankton; in fact, almost every animal phyla are represented. The zooplankton are either grazers on phytoplankton (herbivores), feeders on other members of the zooplankton (carnivores) or feeders on both (omnivores). The most ecologically important groups are multicellular (metazoans). The **crustaceans** (Arthropoda; jointed appendages) are the most numerous of the holoplankton or permanent plankton.

### **The Crustaceans**

The crustaceans are characterized by five pairs of head appendages (two pairs of antennae, one pair of mandibles, and two pairs of maxillae) that are followed by a variable number of thoracic and abdominal appendages. Legs are only found on the abdomen and thorax. Most crustaceans hatch out as a *nauplius* larva with 3 pair of appendages. They may then have additional specialized larval stages or directly develop into the adult form. Three main body regions are the head, followed by the thorax, then the abdomen and the terminal tail appendage.

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A. *Class Maxillipoda* (***copepods, barnacles, and ostracods***)

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#### **Copepods**

1. body elliptical shape; body lengths generally range from 1 to 5 mm (maximum size=2 cm)
2. head region: a single, simple median eye; two jointed antennae
3. body divided into a broader oval anterior region, in which the segments are firmly united and immovable; and, a narrower posterior movable portion
4. all five pairs of swimming legs are located on the thorax; there are no appendages on the abdomen
5. the region behind the abdomen bears two extensions, the caudal rami
6. copepods pass through six larval stages as **nauplii**, which are minute oval larval forms with a single median eye near the anterior end
7. common representatives belong to three major orders:  
Calanoid copepods are abundant in the open ocean away from the shoreline;  
Cyclopoids are the smallest sized copepods and have only a few representatives; Harpacticoid copepods are most abundant nearshore in the benthic community and are medium in size.

#### **Barnacles**

1. represented in the plankton by two larval forms; both with single median eye
2. nauplius stage is shield-shaped with spines and setae; nauplius has 2 horns at anterior end
3. settling stage larvae is called cypris; tear drop shaped; appendages may or may not be visible

**Ostracods** ("bean clams")

1. laterally compressed bean-shaped body
2. unpaired eye
3. body wholly enclosed within a bivalved, movable carapace; looks like a miniature clam
4. antennae may be visible extended outside of carapace
5. appendages are folded within the large bivalve carapace
6. region behind the abdomen has a short projection
7. development is direct: no free larval stages; (young hatch as juveniles that resemble the adult)
8. may be bioluminescent; some common representatives: *Cythere*, *Bairdia*, and *Conchoecia*

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B. *Class Malacostraca* (**crabs, shrimps, and their relatives**)  
 The balance of the planktonic crustaceans are found in this class.

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**Mysids** (mysid shrimps)

1. transparent, shrimp-like, elongated body
2. thin carapace; one pair of stalked eyes
3. eight thoracic appendages; statocysts (eyespot) on the tail fan
4. fast swimming pelagic organisms

**Amphipods**

1. laterally compressed sickle-shaped body
2. two large, sessile eyes
3. no carapace; body often flexed ventrally so abdominal region appears tucked or folded
4. seven pairs of legs on the thorax; additional appendages on the abdomen
5. region behind the abdomen is short
6. development is direct: there are no free larval stages (young hatch as juveniles that resemble adult)
7. three major groups; Hyperiid (large eyes and head; pelagic), Gammarids (small eyes and head), and Caprellids (skeleton shrimp)
8. some common representatives: *Orchestia*, *Caprella*, *Cuphocaris*, and *Euthemisto*

**True crab larvae** (decapods; crabs, shrimps, and lobsters)

There are three planktonic larval stages. The carapace covers the entire thorax. The thorax appendages are called pereopods or walking legs, while abdominal appendages become swimmerets.

1. *nauplius*: oval, unsegmented body shape; a single median eye; at least, three pairs of appendages Note: crabs pass through this stage within the egg.
2. *zoea*: body segmented into cephalothorax and abdomen, with eight pairs of appendages; a helmet-like carapace with long dorsal and anterior spines; two sessile eyes; thorax bears two pairs of legs

3. *megalops*: carapace is broad and lacks spines; eyes are large and stalked; thorax has five pairs of legs; general appearance of a crab, but abdomen is not tightly folded beneath the cephalothorax, as in the adult

### **Caridean and Penaeid shrimps**

1. shrimp-like body shape with a long rostrum (head spine)
2. one pair of compound stalked eyes
3. elongated, cylindrical abdomen; may have black or red pigment on body
4. pass through several nauplii stages after which the larvae develop
5. common representatives: *Penaeidae*, the pink and white shrimp used as food

### **Other Metazoans**

Other metazoans that are common members of the zooplankton include the mollusks, chaetognaths, and the meroplankton (eggs and larval stages of non-planktonic nektonic and benthic adult animals). Chaetognatha is a very small phylum, consisting of about 60 species; however, it is very abundant in the zooplankton. The meroplankton are more diverse. In fact, the number of larval forms in the oceans is greater than the number of adult species because many species go through a series of larval stages before becoming an adult. Thus, each of these species may be represented in the meroplankton by several different stages.

**Gastropods** (*snails, sea slugs, pteropods*) & **Bivalves** (clams, oysters, mussels)

1. Two larval stages; both transparent and rely on cilia for mobility
2. *trochophore*: pear-like body shape, with an equatorial band of cilia (the anterior hemisphere becomes the head of the mollusk, whereas the ventral portion of the lower hemisphere becomes the foot and the dorsal part becomes the mantle)
3. *veliger*: presence of two large, ciliated funnel-like lobes (collectively known as velum) that gradually shift to a dorsal position
4. In bivalves the veliger larva has 2 shells from which the velum opens for locomotion
5. In gastropods the veliger larva has one shell from which the velum opens for locomotion; other members are the sea butterflies (pteropods), sea slugs, and nudibranchs

**Chaetognaths** (arrow worms)

1. nearly transparent, long, slender, worm-like body; lengths of approximately 2 to 3 cm
2. presence of two dorsally located eyes
3. body straight and divided into three regions the head, trunk, and tail; with lateral fins
4. head has grasping bristles or spines that may be concealed under a hood-like fold of the body;
5. one or two pairs of lateral fins on the trunk region and a tail fin across the end of the body
6. development is direct: no larval stages, young resembles the adult; oceanic and coastal
7. some common representatives: *Sagitta*, *Pterosagitta*, and *Eukrohnia*

**Fish larvae (vertebrate)**

1. bilaterally symmetrical cylindrical or leaf-like (in eels) body shapes; translucent body
2. early stages, the yolk sac (located ventrally in the anterior part of the body) is visible
3. two, large round eyes (some may have elliptical or stalked eyes); in flatfishes one eye migrates to the opposite side of the head
4. undifferentiated fin folds: fins are fused into a single structure that surrounds the body

may have large spines in relation to the body size