Marine Biology Education Packet

GALVESTON HISTORICAL FOUNDATION

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www.galvestonhistory.org

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Introduction

Dear Educator,

Thank you for your interest in the Texas Seaport Museum's *Marine Biology Tour* aboard SEAGULL II. This program provides students with the opportunity to experience marine biology in a hands on floating classroom. This Educator's Packet has been developed to enhance your class visit to the Texas Seaport Museum.

The information and lessons in this packet should help you correlate your classroom lessons with your field trip to the Texas Seaport Museum.

The Texas Seaport Museum's Education Department recommends looking over the *FAQ packet* and using the *Pre-Visit* lesson plans before your field trip to the Texas Seaport Museum. The *Post-Visit* lesson plans will help reinforce concepts learned during our program.

This *Education Packet* reflects Galveston Historical Foundation's mission to broaden public awareness of maritime preservation and the seafaring legacy of Texas and the Gulf Coast.

We look forward to your visit!

Sincerely,

Education Staff

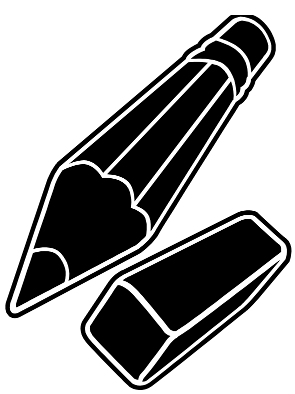
Texas Seaport Museum

Using this Packet

Use the following icons to help guide you through the *Teacher Resource Packet.*

Teacher Preparation

Use these pages to prepare your lessons and plan the field trip



Student Preparation

These sheets should be copied and distributed to students

Pre-Visit Lesson Plans

Listed below are lesson plans for you to use before your program at the Texas Seaport Museum. All activities meet Texas Essential Knowledge and Skills curriculum standards.

Pre-Visit Activity One - Water Quality:

Objectives: Conduct water quality tests using field sampling techniques

Compare water quality parameters between different locations
List two physical facts (measured) that affect solutions
Describe factors which influence salinity and dissolved oxygen levels
Discuss the roles of salinity, dissolved oxygen and pH in the aquatic environment.
Discuss nutrient enrichment of aquatic environments

Method: If possible, the student will perform water quality tests in the field, near a stream, river, bay, Gulf, or other body of water. If not possible a sample from the field should be collected by the teacher and brought into the classroom. Either way, students will perform water quality tests using field meters and titration methods endorsed by the Texas Watch Program. Quantitative determinations will be made for dissolved oxygen, salinity, temperature, pH, turbidity, phosphates, and nitrates.

Background: The parameter of dissolved oxygen, salinity, temperature, and pH often determine the quality of water in an aquatic system. Readings too low or too high for a normally healthy environment can cause death to marine organisms. While normal readings for any two aquatic environments may differ slightly, there are guidelines for acceptable levels (see chart at the end of lesson). For instance, a “good” level for dissolved oxygen in a bay system is 8 mg/L. In a slough, an acceptable level may be as low as 2 or 3 mg/L without any noticeable stress occurring. However, if the dissolved oxygen level in a bay was as low as 2.0 mg/L, many organisms would die.

Continued...

Materials:

Dissolved oxygen meter, salinity refractometer, pH meter, thermometer or titration kits (Texas Watch Program) or a hydrolab, clipboards, pencils, and data sheets.

Procedure:

Review water quality parameters in the classroom
Visit study sites
Conduct tests
Record data
Discuss readings
Perform water quality tests at different locations and compare the results with previous study sites.

Teacher Notes:

Be sure students are dressed appropriately for outdoor activities.

Evaluation:

What observations did you make about water quality at your first, second, and (or) third sites?
Were all study site water quality readings the same? Why or why not?
Demonstrate the field techniques you used.
What factors affected your readings? How does water quality effect marine life?
If used with other lessons, can any correlations be made with the water quality data and any organisms sampled?
Determine what kind of career involves collecting water quality data.

Extension:

Sample study sites at various times of the year. Would you expect the parameter readings to remain the same throughout the year? Why or why not? What factors could change readings? Have students keep a database of readings collected at sites throughout the year and possibly over many years. Have students make graphs showing their results and any previous results. Are there any trends evident? This lesson may be combine with any of the other water or wetland lessons.

Continued...

Vocabulary:

Dissolved Oxygen – The amount of oxygen that is present in water. This form of oxygen is the type fish and other organisms that breathe water require, since they cannot breathe air like we do.

Salinity – The amount of salt present in the water. Measured in parts per thousand (ppt). 0ppt is considered freshwater with 30+ppt considered saltwater. Salinity measurements between 0-30 is considered brackish.

pH – A measure of how acidic or basic the water is. The scale for pH runs from 0-14, with lower numbers representing acids and higher numbers representing basics. Pure water has a pH of 7.

Turbidity – A term that refers to the clarity of the water. The higher the turbidity levels, the less "clear" the water.

Phosphates and Nitrates – Phosphates and nitrates are two types of nutrients commonly tested for in water quality exercised. While their presence in water is acceptable at low levels, higher amounts can indicate serious problems in the watershed.

Name:

Date:

WATER QUALITY DATA SHEET

Sampling Site:____

Date:____

Names of Monitors:____

Percent Cloud Cover:___________________________________

Winder Direction:_____________________________________

Water Conditions (Circle One)

Calm Ripples SM Waves White Caps

Water Odor (Circle One)

None Slight Strong

Salinity:______________________________________

Air Temperature:_______________________________

Water Temperature:_____________________________

pH:____

Dissolved Oxygen:________________________________

Nitrates:____

Notes:

____

____

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____

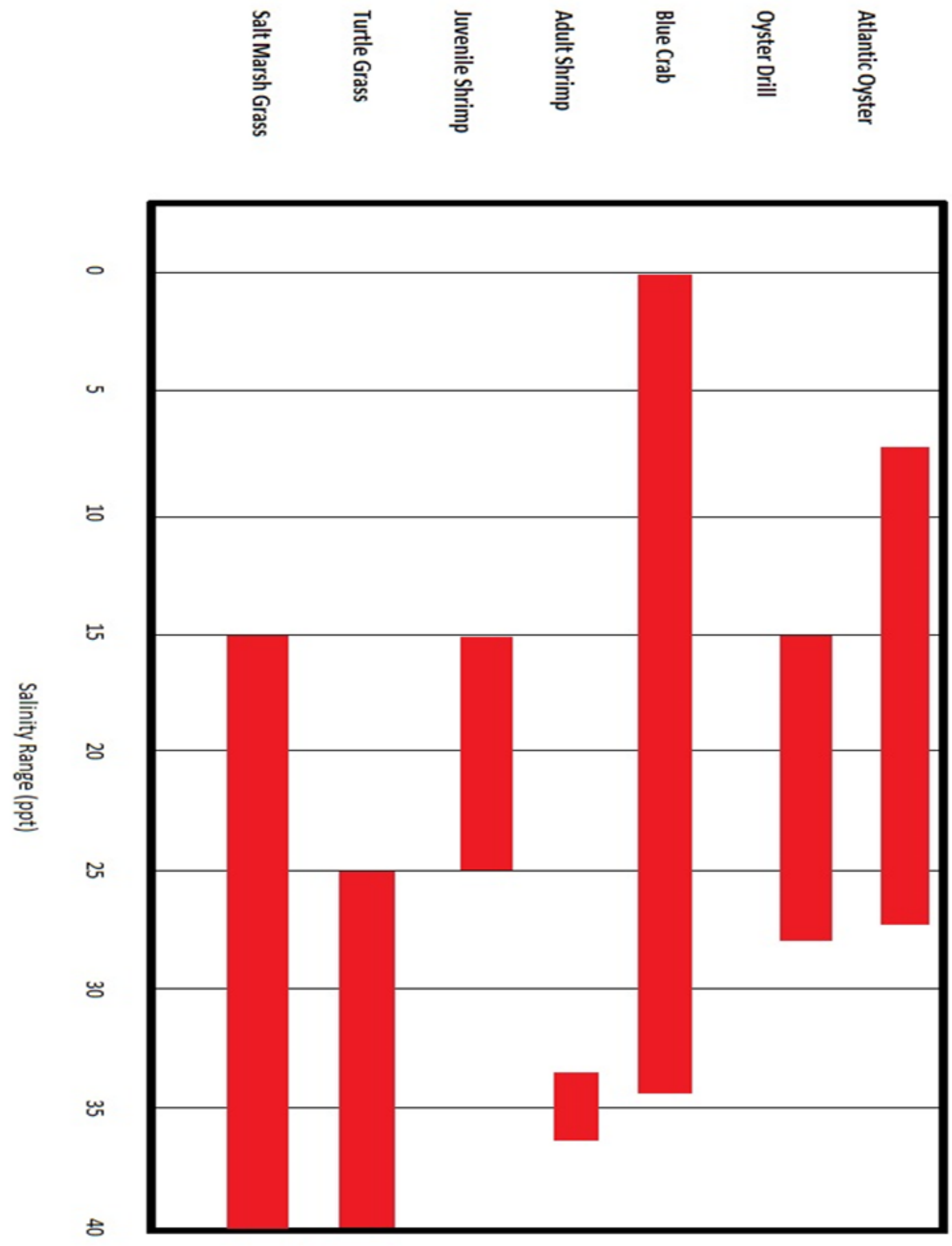
____

WATER QUALITY TESTING ANALYSIS INFORMATION

The following information is to be used as a general guide only. Readings can vary according to circumstances. If you are getting readings that are significantly out of range, consider any usual water conditions or make sure your equipment is performing accurately.

Water Test	What it Measures	Normal Readings	Dangerous Readings	Source
Salinity	Amount of salt dissolved in water	Varies (a reading of 0 is freshwater with 30+ as saltwater)	Depends on aquatic environment	Rain and river water can decrease salinity. Evaporation or ocean flooding can increase salinity.
Dissolved Oxygen	Amount of dissolved oxygen in the water	7-14 ppm (parts per million)	3-5 = Stress 1-2 = Poor 0 =anoxic	Wind Waves Photosynthesis
pH	Acid / base of the water	In general 6.5 -7.5 (bogs tend to be lower)	Above or below 6.5-8.5	Acid rain Pollution Chemical spills
Phosphates and Nitrates	Amount of nutrients in the water	0.0-0.65 ppm (phosphates) 0.0-0.8 ppm (nitrates)	Any reading higher than normal	Sewage Detergents Fertilizer Animal wastes
Temperature	Amount of heat in the water	Varies	Usually above 27°C (81°F)	Solar heat Industrial waste heat
Turbidity	Clarity of water (or amount of suspended sediment)	80-120 cm depth reading (using a Secchi disk)	Anything above normal	Runoff Storms Excessive algae Boat traffic

Salinity Preference Range for Typical Coastal Organisms



Pre-Visit Activity Two – Plankton Characteristics:

Objectives:

Describe types and characteristics of plankton
Describe the importance of plankton in a marine food chain
Compare plankton collected in sample form different habitats

Method: Students will collect plankton samples and observe them with microscopy. If time permits, they'll sample plankton at different locations and compare organisms.

Background: There are two main groups of plankton that remain as small floaters or drifters for life: phytoplankton (plants) and zooplankton (animals). However, some zoo plankton begin their lives as phytoplankton, such as crabs, jellyfish, clams, oysters, corals, barnacles, and sea stars. The definition of a plankton is a "free-drifter," or an organism controlled by the current. If an organism can swim in a different direction than the cur rent, it is not a plankton. Phytoplankton are autotrophic, meaning they produce their own food through photosynthesis. Phytoplankton form the base of the marine food chain. Zooplankton feed on them, as well as larval oysters, fish, shrimp, and other marine species. A typical marine food chain would involve phytoplankton being eaten by zoo plankton, eaten by small fish, eaten by larger fish, and so on. Zooplankton can be broken into two groups: holoplankton and meroplankton. Holoplankton remain plankton their whole lives while meroplankton are only plankton during their juvenile stage. Phytoplankton produce roughly 67% of the air we breathe.

Materials:
Plankton net and rope, collecting jars, Discovery Scopes for magnification in the field, microscopes, eye dropper, microscope slides, plankton guide, clipboards, pencils, and da ta sheets.

Continued...

Procedure:

1. Review in class, how to pull a plankton net, and go over guides, if possible.
2. Have students take turns pulling the plankton net, a distance of 1 meter. To collect a diverse sample, perform three plankton tows and the save them in a jar.
3. Pour samples into the Discovery Scopes and let student observe samples in the field.
4. Place plankton samples on ice until you can observe them with a microscope.
5. Back at school collect a small sample using an eyedropper and place one drop on a microscope slide. Have student identify organisms using a guide, counting numbers of species in the sample.

Teacher Note:

Be sure students dress for the outdoor weather.

Evaluation:

Describe the importance of plankton in a food chain.
Describe the five most abundant organisms collected in your sample.
If multiple sites were sampled, how are sampled organisms different?
What role do plankton play in the amount of dissolved oxygen in the area?
Why are phytoplankton and zooplankton important to fish farms?
Name five marine organisms that start life as plankton but change into more familiar forms.

Extension:

You can ask the students to make graphs of the plankton found and compare it among different areas sampled. Have older students put together a short presentation on plankton and present it to a class of younger students. Make a video tape of selected samples. Add narration and present the program to school groups.

Continued...

Vocabulary:

Consumers – cannot produce their own food and eat lower organisms in the food web

Cyanobacteria – phytoplankton with bacteria-like cells and blue-green chloroplasts

Diatoms – a group of phytoplankton that are gold and have a shell of silicon. They make the water gold in color.

Holoplankton – permanent plankton; any plankton that spends its whole life drifting or floating with the currents.

Larvae – a life stage for some animals that go through complete metamorphosis (like the caterpillar stage of moths and butterflies) after hatching from an egg; a stage that appears much different than the adult.

Meroplankton – temporary plankton; zooplankton in the egg or larva stage that will live on the sea floor or become a more powerful swimmer as an adult

Nanoscale – tiny scales of space and time that can be observed with microscopes and lasers. Models at larger scales can be manipulated to better understand life at a smaller scale.

Photosynthesis – the process of plants converting water and carbon dioxide to produce food and oxygen using sunlight as energy

Phytoplankton – microscopic plants that drift in water currents; different types are found at all depths. They make their own food in the photic zone of the water column using sunlight. Some can also make their own food in the absence of light. Some can capture food.

Planktivore - an animal that feeds on plankton

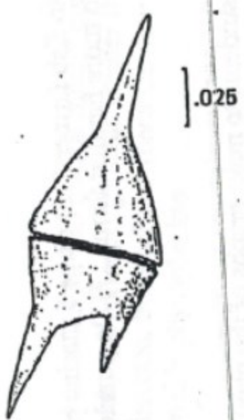
Plankton – living organisms that carried by water currents. "Free-drifters."

Producers – organisms that make their own food by photosynthesis or chemosynthesis

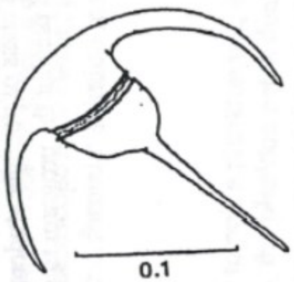
Red Tide – a patch of the water surface which has turned reddish-brown because of a bloom or population explosion of dinoflagellates.

PHYTOPLANKTON

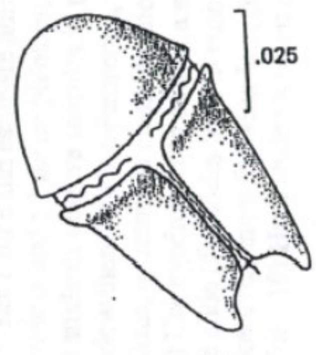
DINOFLAGELLATES



89 *Ceratium lineatum*

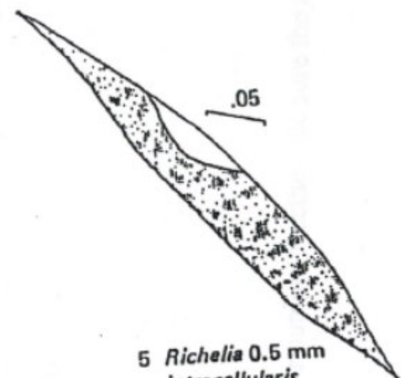


86 *Ceratium bucephalum*

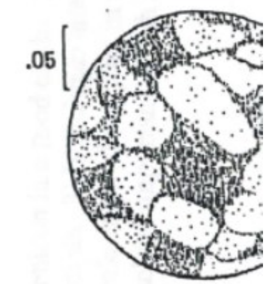


85 *Gymnodinium*

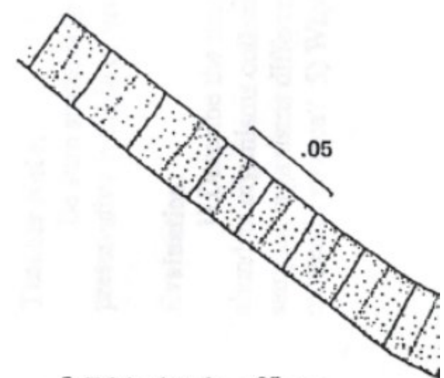
BLUE-GREEN ALGAE



5 *Richelia* 0.5 mm *intracellularis*



4 *Halosphaera v.* .05 mm

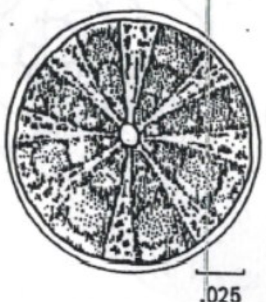


3 *Trichodesmium* .05 mm

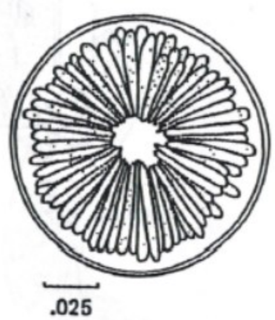
IMAGES COURTESY OF SMITH 1977

PHYTOPLANKTON

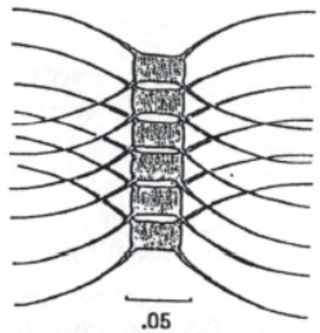
DIATOMS



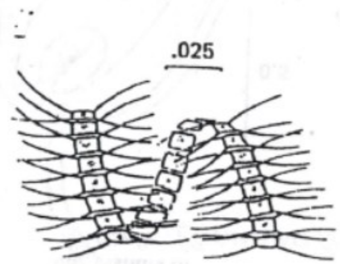
30 *Coscinodiscus*



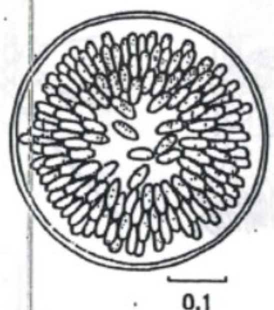
28 *Coscinodiscus*



58 *Chaetoceros*

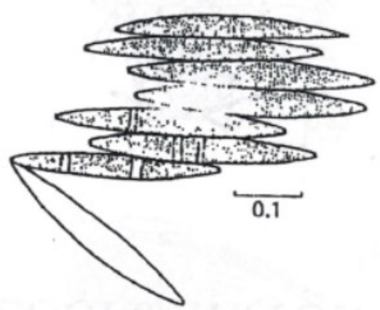


68 *Chaetoceros debilis*

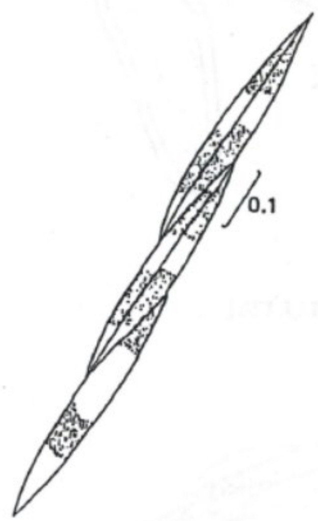


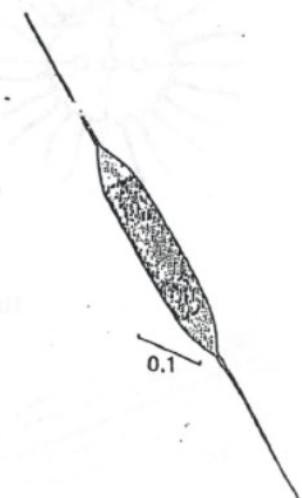
29 *Coscinodiscus*

IMAGES COURTESY OF SMITH 1977



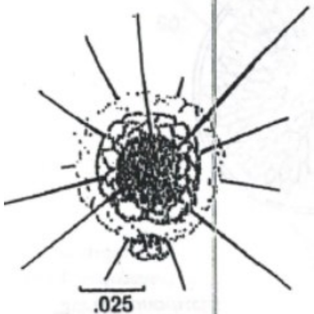
7 *Nitzschia paradoxa*



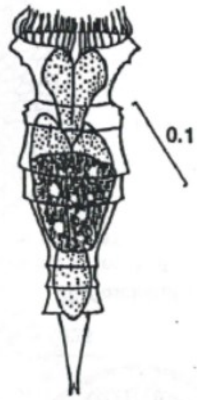


8 *...schia*

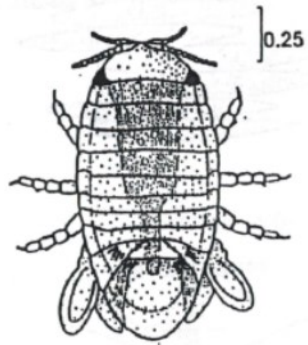
ZOOPLANKTON



99 Radiolaria

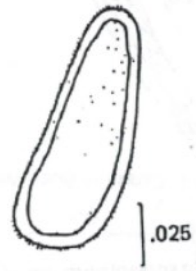


220 Rotifer

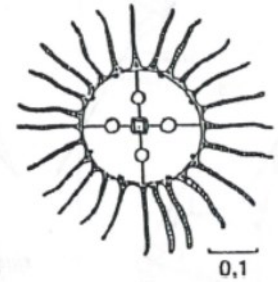


400 Isopod

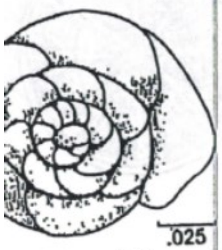
JELLYFISH



109 Planula of *Obelia*



123 *Obelia*

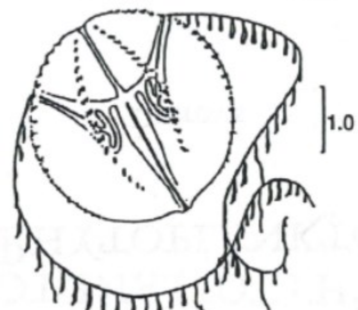


105 Foraminifera

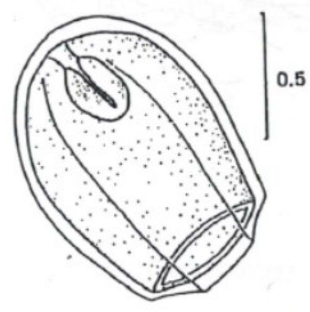
112 Coral Young Polyp

IMAGES COURTESY OF SMITH 1977

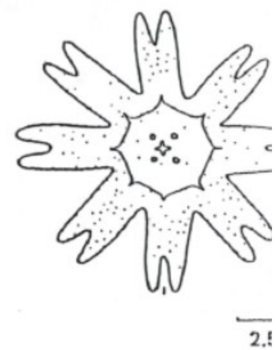
COMB JELLY



186 Ctenophore



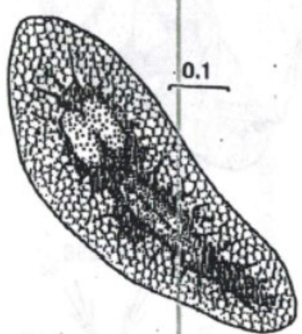
173 Nectophore Swimming Bell



117 Ephyra of *Aurelia*

Zooplankton

Flatworm

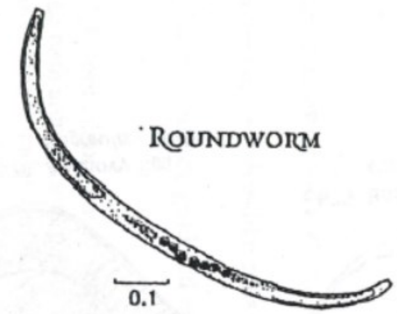


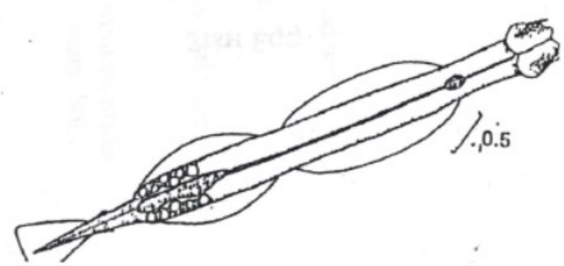
217 Polyclad Flatworm

200

Polychaete

Roundworm

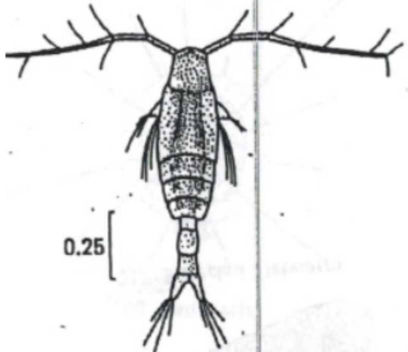




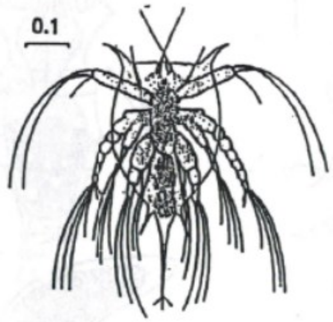
Images courtesy of Smith 1977

Zooplankton

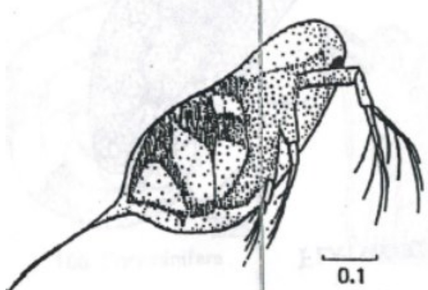
Crustaceans



358 *Acartia*

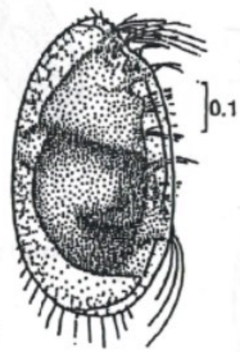


321
Nauplii of Barnacles



335 *Daphnia*

Images courtesy of Smith 1977

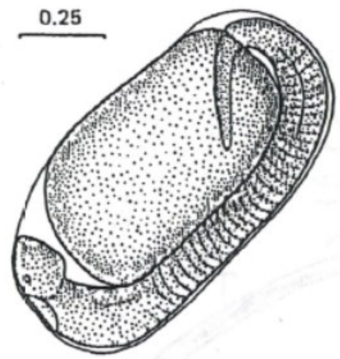


326 Ostracod

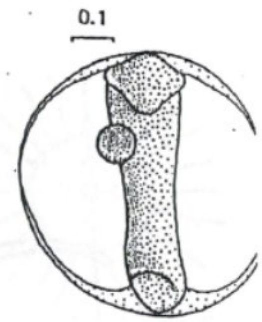
Crab

437

Fish Egg

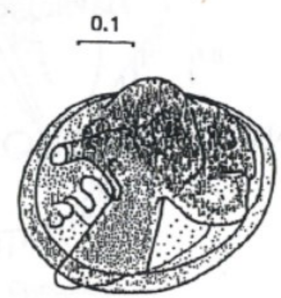


578 Anchovy Egg
Engraulis mordax



579 Bothid, Probably
Citharichthys sp.

Mollusk



508 Juvenile

466 Snail Egg Case

488 ...iger of S...

Suggested Reading List

Ulanski, Stan. "The Gulf Stream". Chapel Hill: Univ.of North Carolina Press, 2008.

Hoese,Dickson H. ; Moore, Richard H. "Fishes of the Gulf of Mexico" 2nd edition. College Station: Texas A&M Univ. Press, 1998.

Parsons, Glenn R. "Sharks, Skates, and Rays of the Gulf of Mexico". Jackson: Univ. Press of Mississippi, 2006.

Gosner, Kenneth L. "Guide to Identification of Marine and Estuarine Invertebrates". John Wiley and Sons Inc., 1971.

Johnson, Williams; Allen, Dennis M. "Zooplankton of the Atlantic and Gulf Coasts". Baltimore & London: The Johns Hopkins Univ. Press, 2005.

Rothschild, Susan B. "Beachcomber's Guide to Gulf Coast Marine Life." 3rd edition. Maryland: Taylor Trade Publishing, 2004.

Dunn,Jon L. ; Alderfer, Jonathan. "National Geographic Field Guide to the Birds of North America." Washington D.C.: National Geographic, 2008.

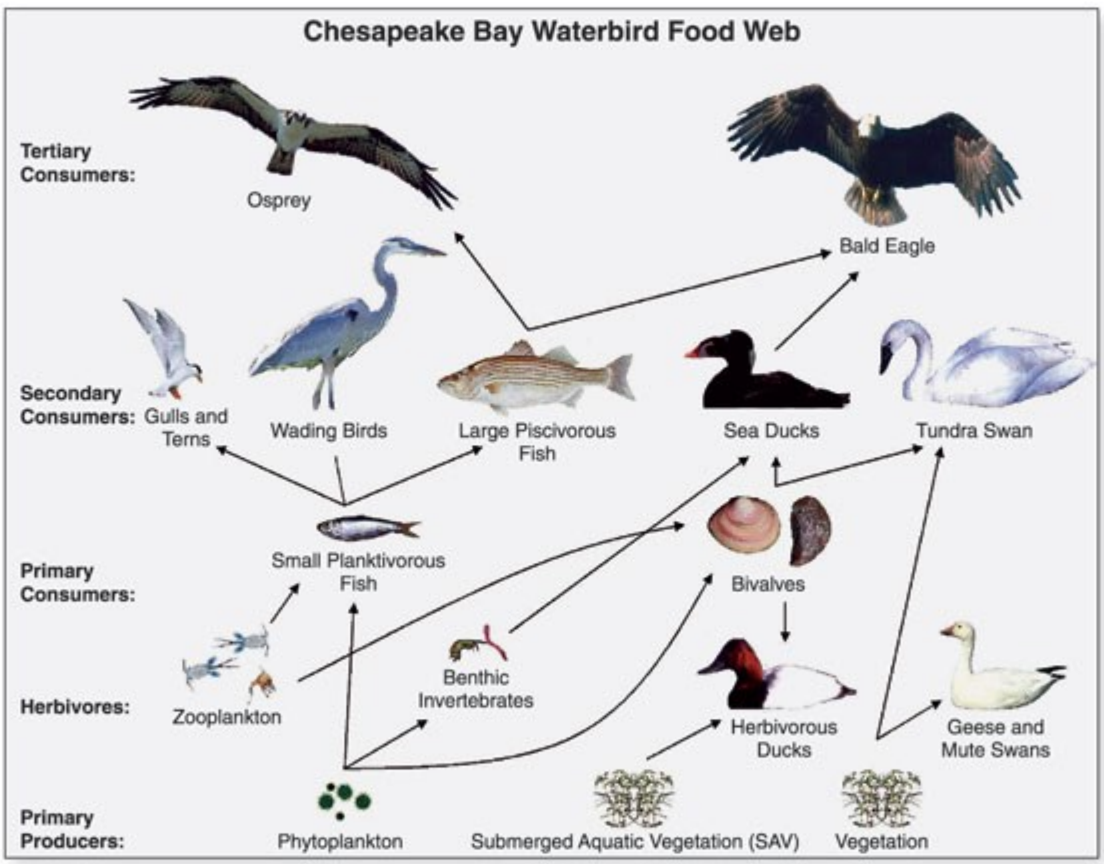
O'Brien, Michael; Crossley, Richard; Karlson, Kevin. "The Shorebird Guide." Boston: Houghton Mifflin Co., 2006.

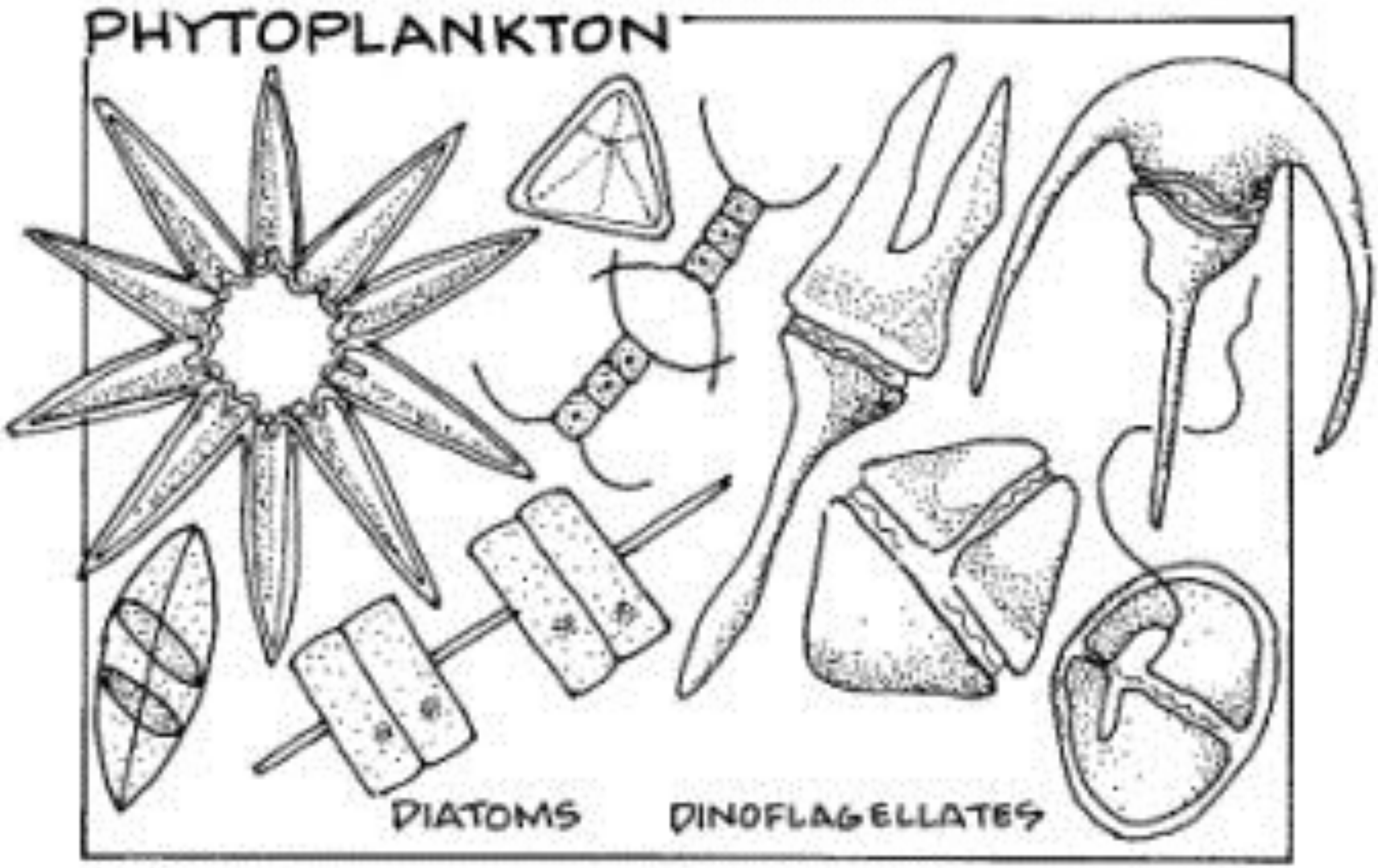
Post Visit Lesson Plans

Food Chains of the Bay

Attached is a packet of sea creatures from the Gulf. Hand out the animals to your students and encourage them to color them as they saw them. Then, on your chalk board, create a food chain of all the animals in the packet. Discuss the roles of all animals in the circle.

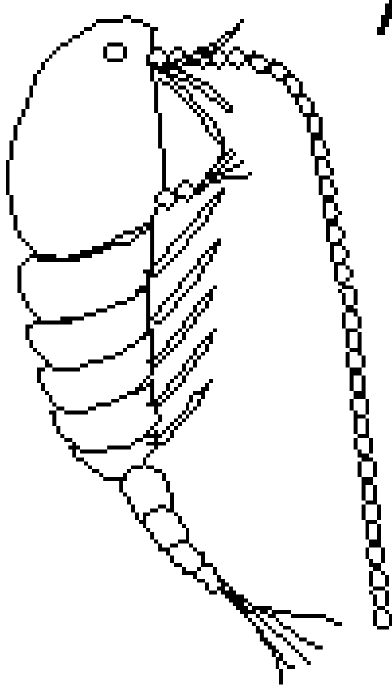
Use the example below as a guide.



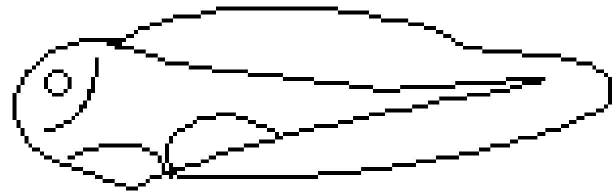

PHYTOPLANKTON
DIATOMS
DINOFLAGELLATES

A Variety of Zooplankton

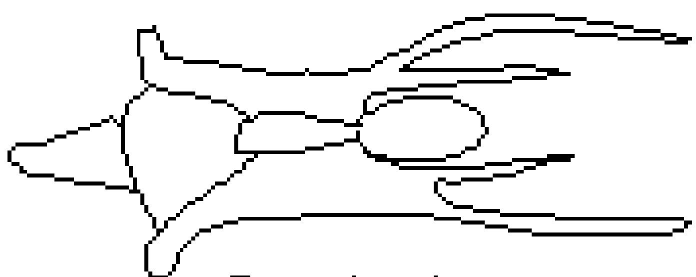
Microscopic, floating animals



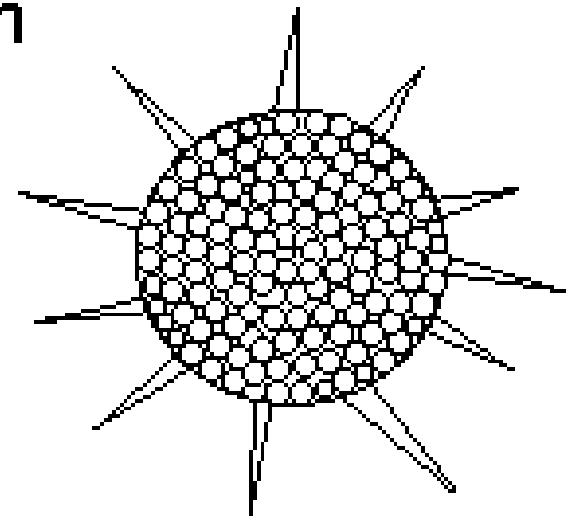
A copepod, a tiny crustacean



Fish larva

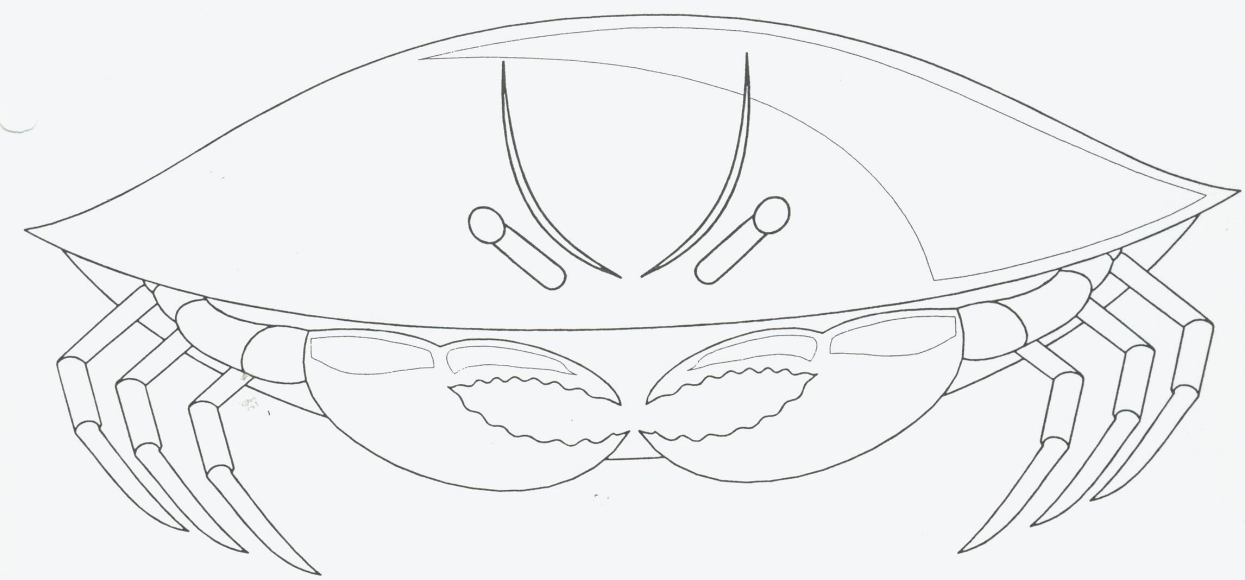


Seastar larva

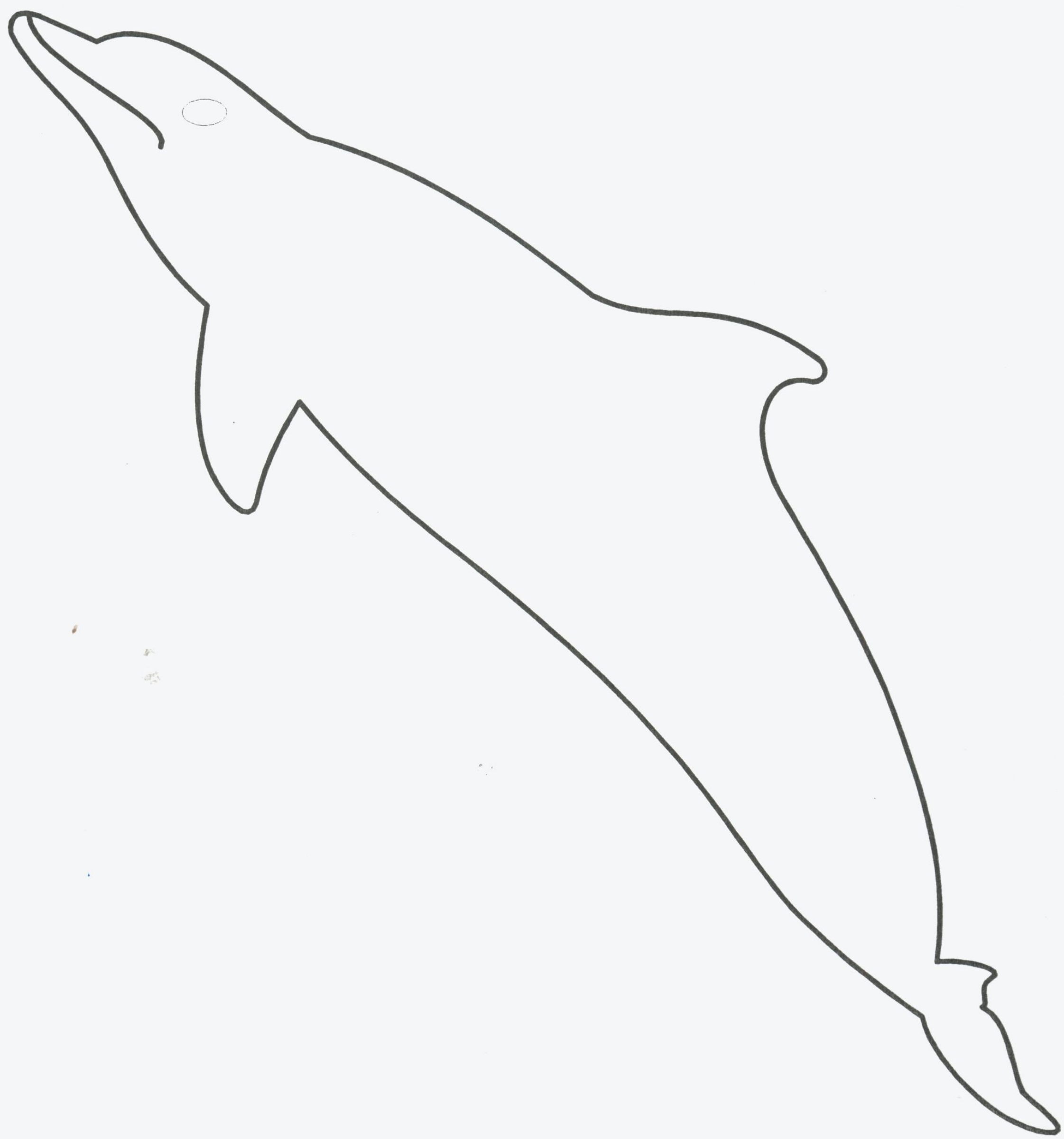


A radiolarian

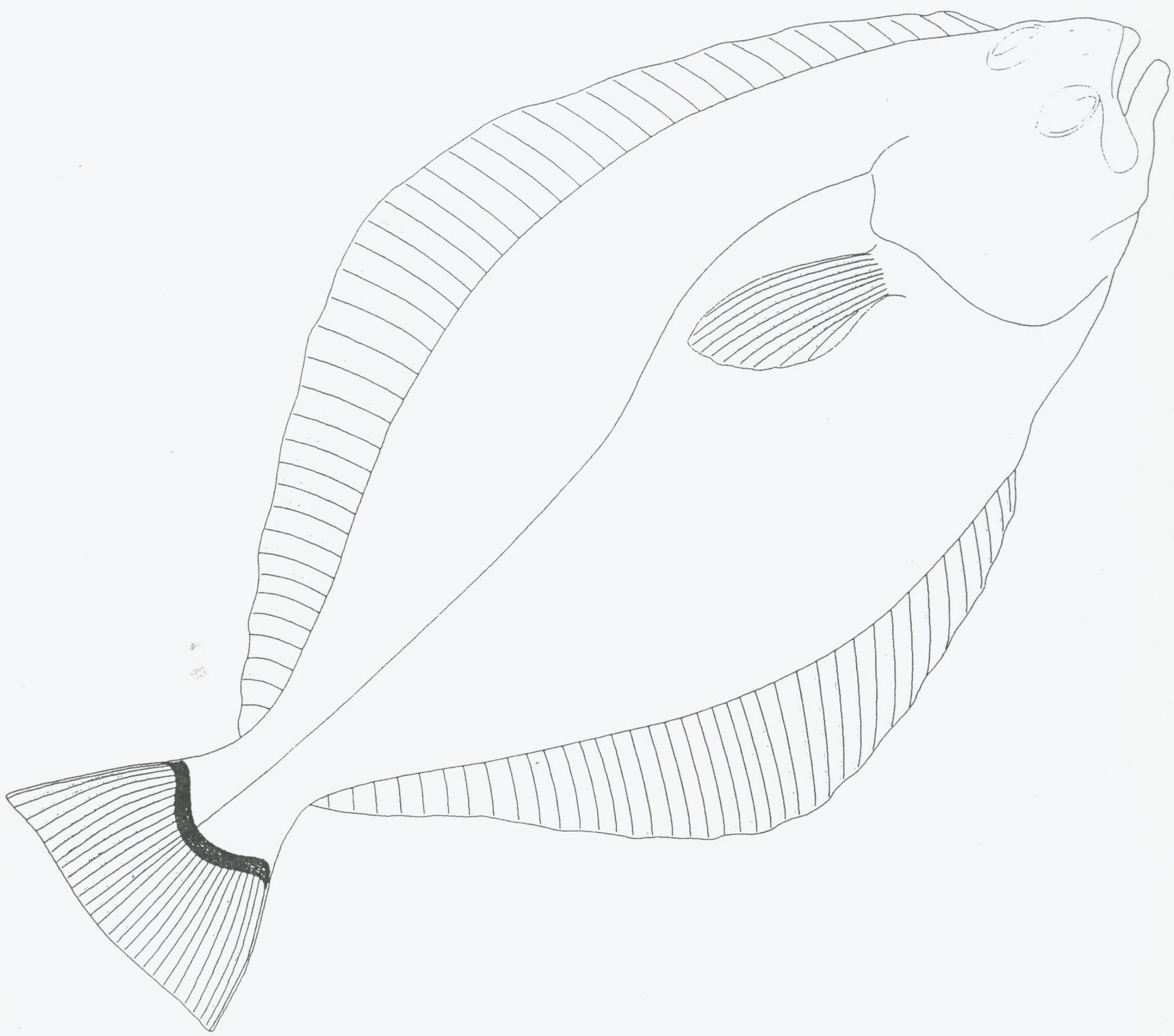
Crab



Dolphin

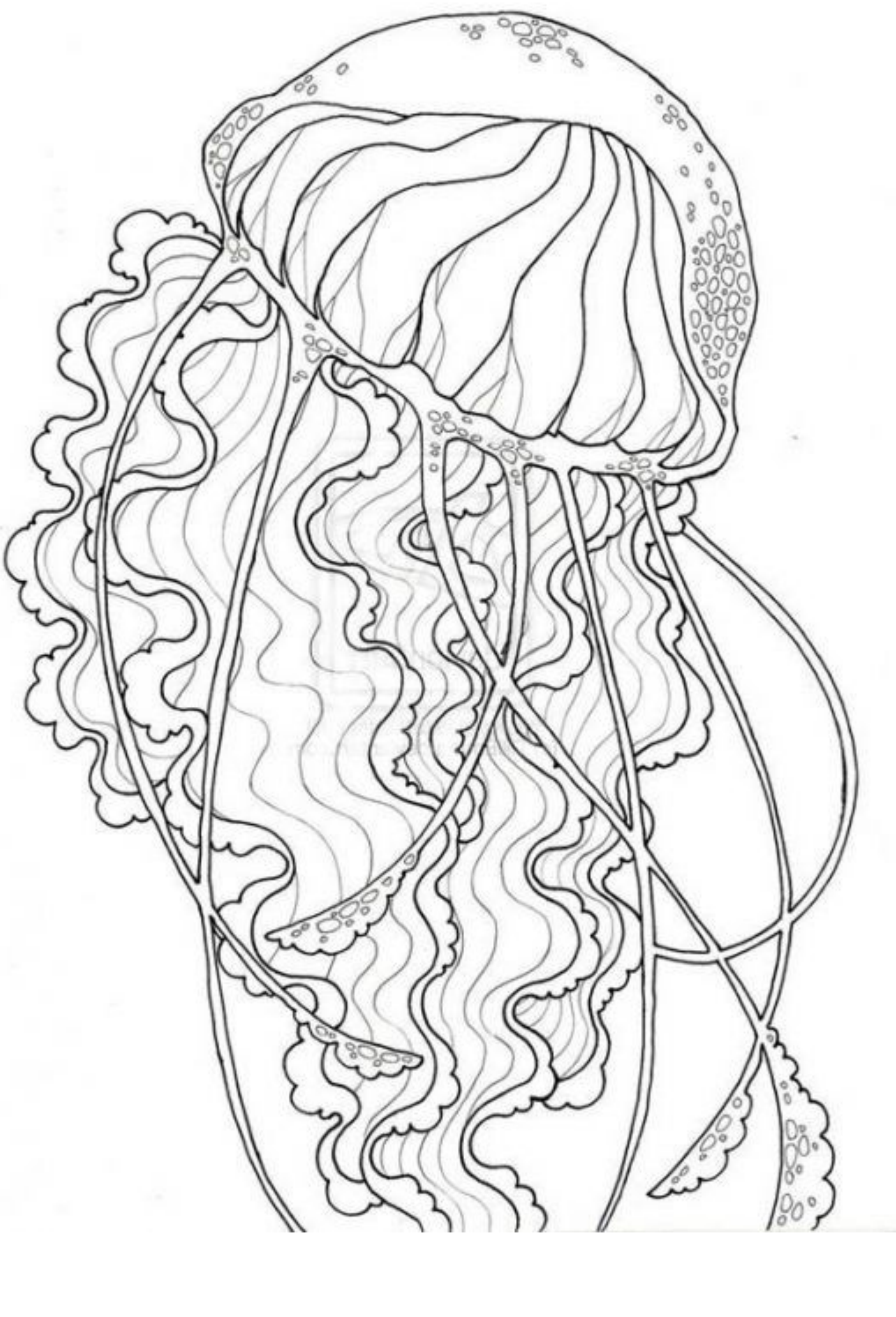


Flounder

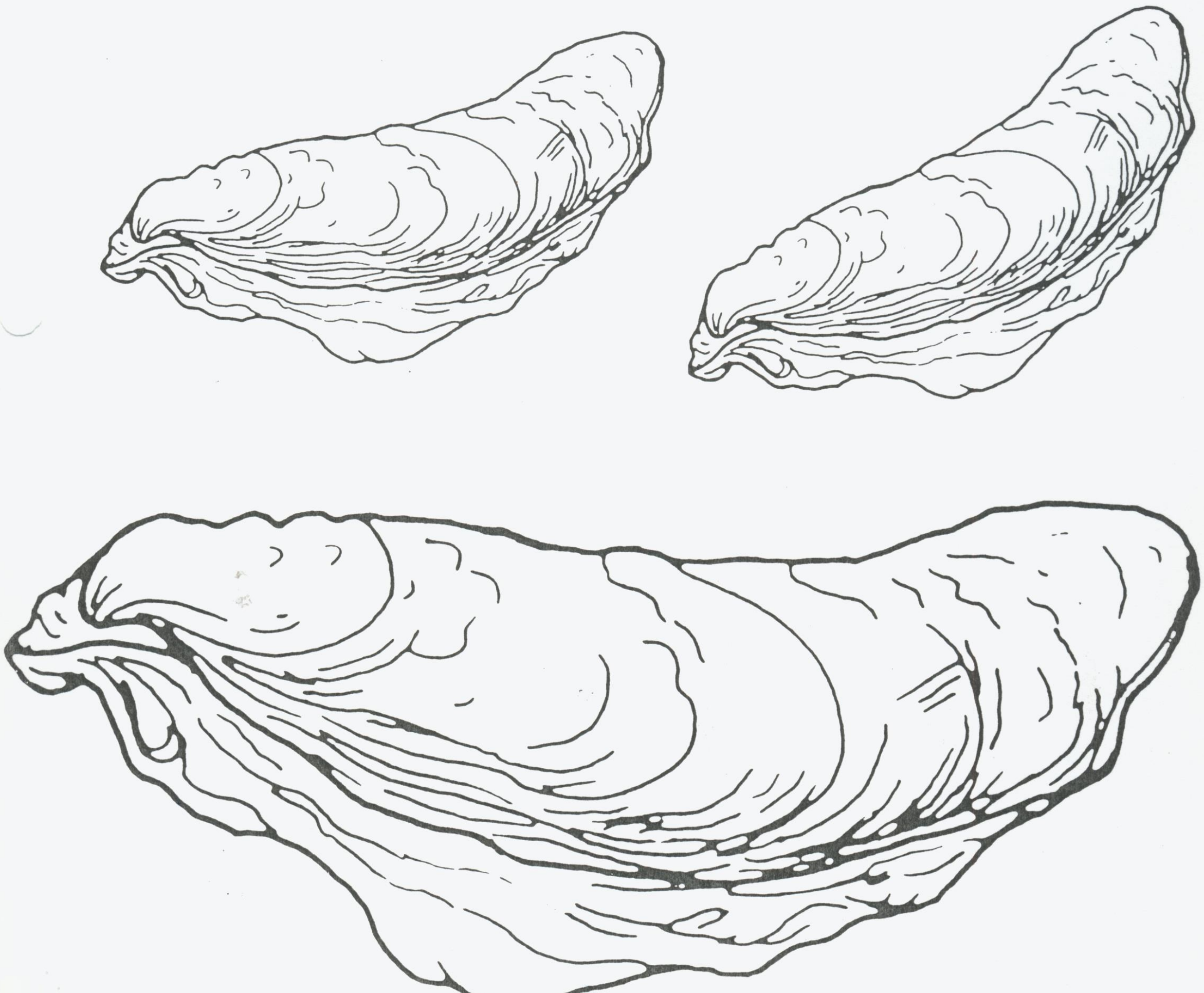


Blue Heron

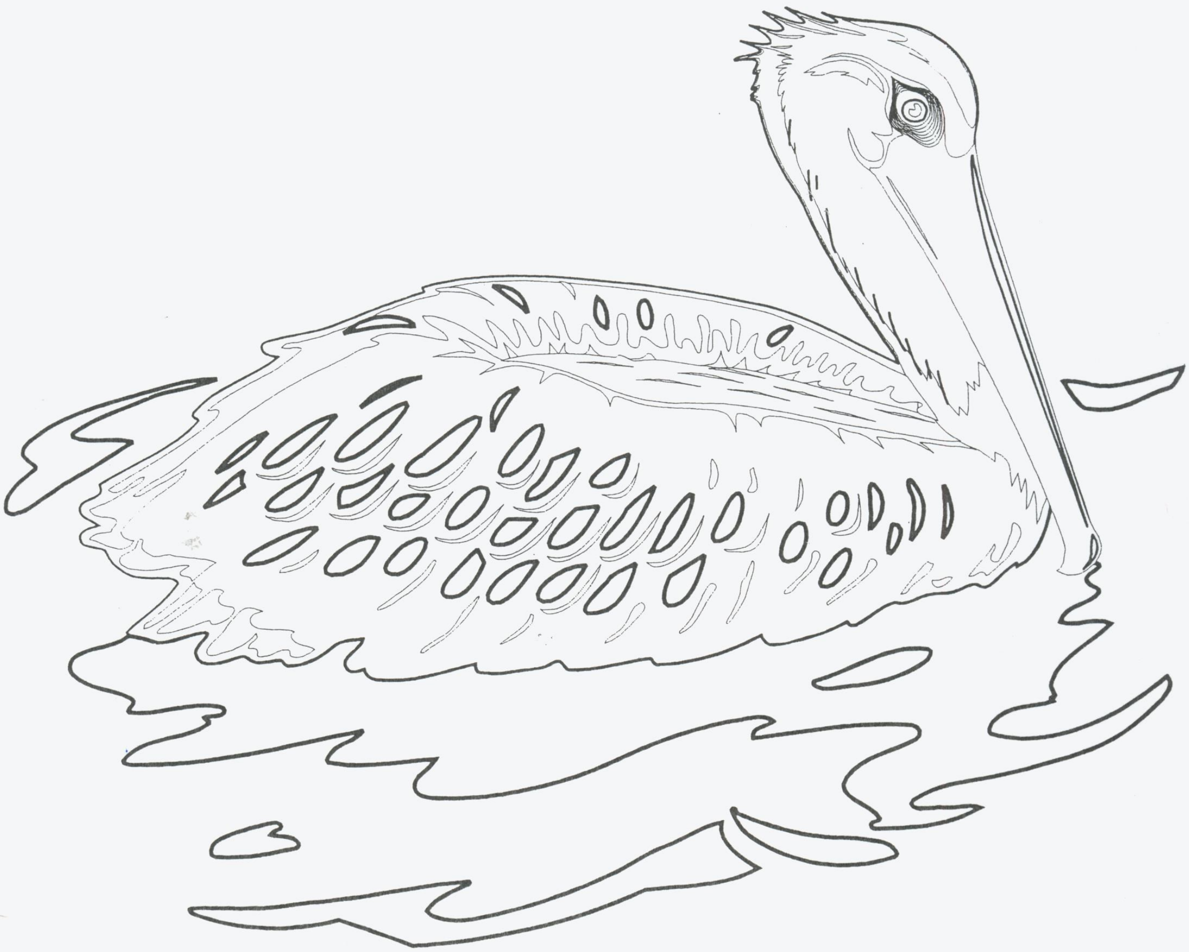
JELLY FISH



Oysters

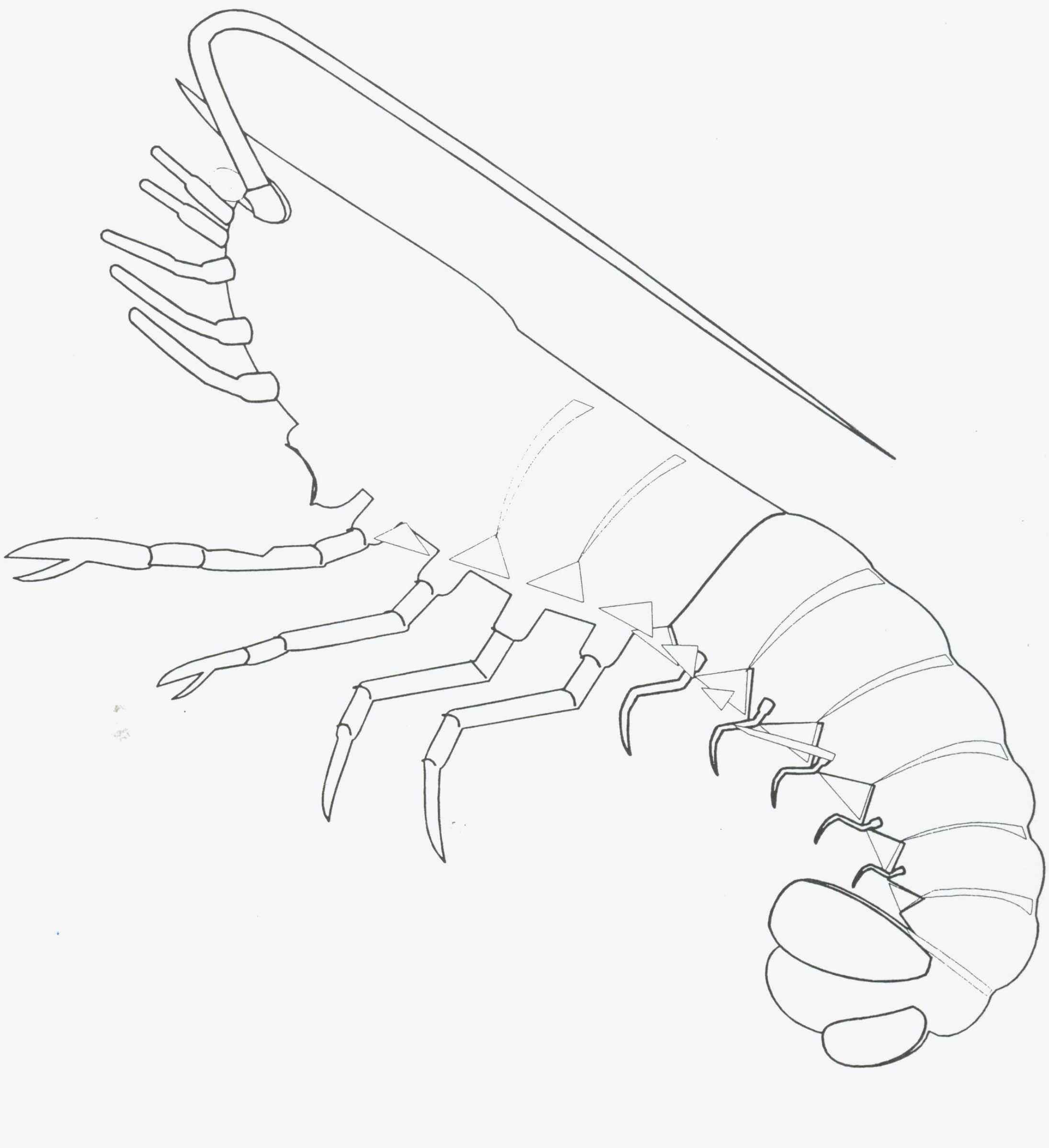


Brown Pelican

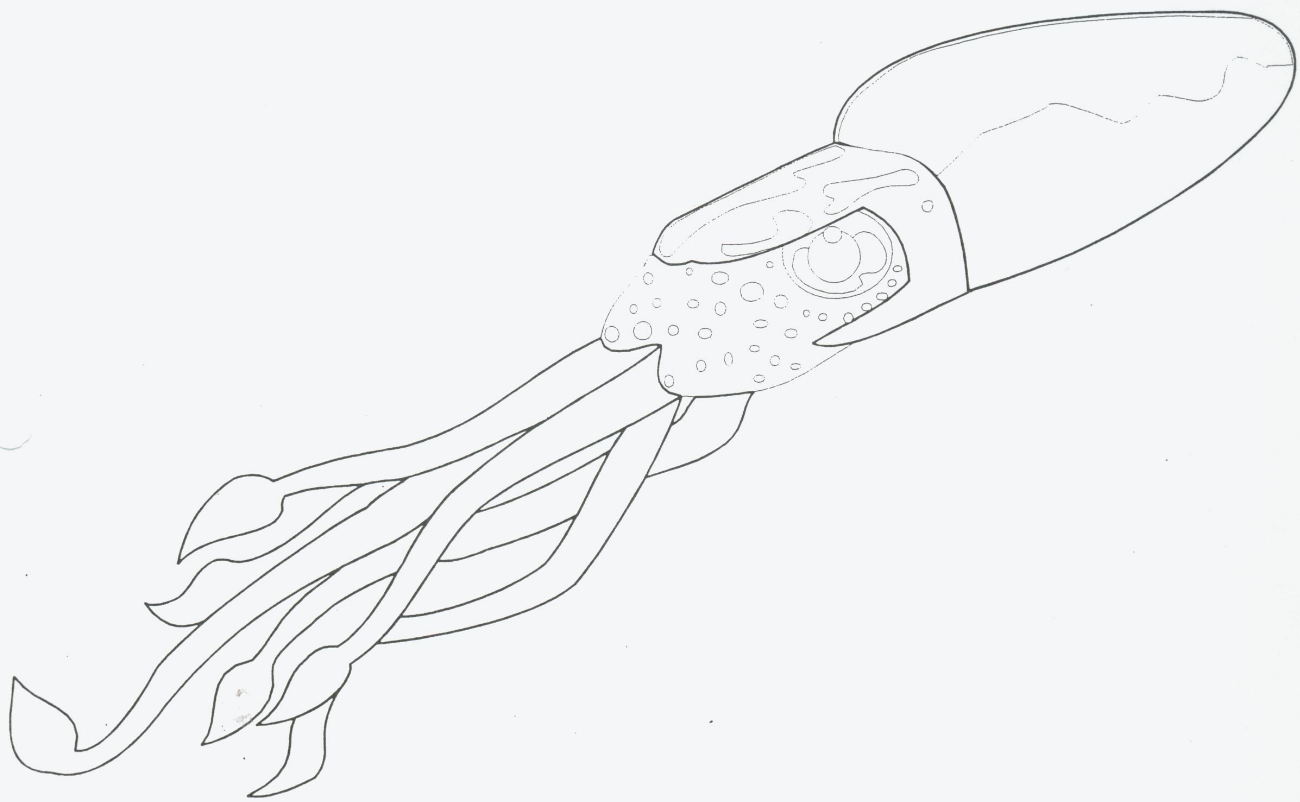


RIBBON FISH

Shrimp



Squid



Turtle