DOCUMENT RESUME

ED 194 325 SE 033 147

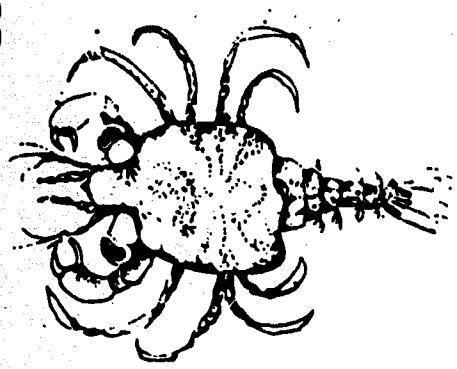
AUTHOR	Rawson, Mac; Trussell, Gale
TITLE	Alabama 4-H Marine Pilot Manual.
INSTITUTION	Auburn Univ., Ala. Cooperative Extension Service.; Mississippi-Alabama Sea Grant Consortium, Ocean Springs, Miss.
SPONS AGENCY	Extension Service (DOA), Washington, D.C.; National Oceanic and Atmospheric Administration (DOC), Rockville, Md. National Sea Grant Program.
REPORT NO	MASGP-78-024
PUB DATE	Aug 78
GRANT	NOAA-04-7-158-44017
NOTE	43p.: Contains occasional light and broken type.
AVAILABLE FROM	National Technical Information Service, Operations Div., Springfield, VA 22161 (Order No. PB-287 924/5WF, $6.00).
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Ecology; Environmental Education; *Marine Biology; *Oceanography; *Outdoor Education; Secondary Education; *Secondary School Science
IDENTIFIERS	*Marine Education

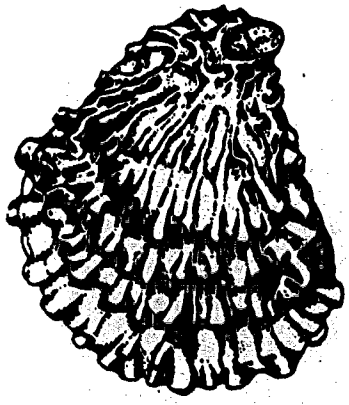
ABSTRACT

Brief descriptions and eight activities related to zooplankton, sharks, dune ecology, ocean currents, and sea products comprise this manual. Among the activities are harvesting seafood, making Japanese fish prints, and tracing marine currents with drift bottles. (WB)

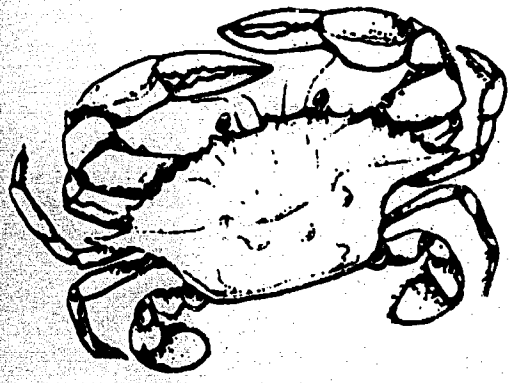
ALABAMA COOPERATIVE EXTENSION SERVICE / AUBURN UNIVERSITY / AUBURN, ALABAMA

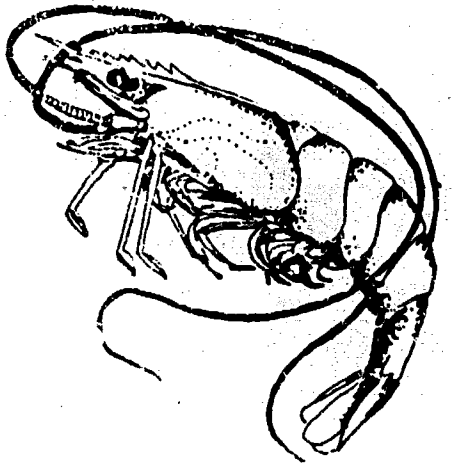
ALABAMA 4-H MARINE





PILOT MANUAL





MASGP-78-024

The Alabama Cooperative Extension Service

"EDUCATION IS OUR BUSINESS"

This work is partially sponsored by NOAA
Office of Sea Grant, U. S. Dept. of Commerce
under Grant #04-7-158-44017.

Compiled by

Mac Rawson, Specialist
Marine Resource Development

Gale Trussell, Specialist
Coastal Recreation & Tourism

Sea Grant Advisory Service
Alabama Cooperative Extension Service
955 Downtowner Blvd., Suite 108
Mobile, Alabama 36609

August 1978

Sea Grant Advisory Service
CONDUCTED BY THE ALABAMA COOPERATIVE EXTENSION SERVICE
FOR THE MISSISSIPPI-ALABAMA SEA GRANT CONSORTIUM

The Alabama Cooperative Extension Service
"EDUCATION IS OUR BUSINESS"

Issued in furtherance of Cooperative Extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. J. Michael Sprott, Director, Alabama Cooperative Extension Service, Auburn University. The Alabama Cooperative Extension Service offers educational programs and materials to all people without regard to race, color, or national origin. It is also an Equal Employment Opportunity Employer.

TABLE OF CONTENTS

INTRODUCTION

The Sea - A Mystery

The sea long kept its secrets locked deep in its mysterious depths. For centuries, man's interest in the sea was chiefly concerned with obtaining food from its shorelines and sailing his fragile crafts on its waters. Not until the middle of the 19th century did he undertake serious study of that strange world of the sea.

The changing times have brought us to the threshold of a reawakening to the essential role of the sea. The new awareness is caused by many factors, including these.

First, The resources of the land are dwindling. We must look to the sea for energy, food, minerals, and recreation.

Second, the economic well-being of the nation depends more than ever on water transportation, both on the oceans and the inland waters.

Third, the very size of America has expanded with an extension of our Fishery Conservation Zone seaward for 200 miles, crossing continental shelves of great richness and some of earth's most biologically productive waters.

Fourth, a majority of Americans now live in close proximity to the seas and Great Lakes.

Fifth, we recognize more and more the importance of maintaining the good health of the water environment and repairing some of the damage we have done, because the health of the water world is directly linked to our own health as a state and as individuals.

Transition From Fresh To Salt Water - Estuarine Waters

An estuary (aestus, tide) is a river mouth where tidal action brings about a mixing of salt and fresh water. Shallow bays, tidal marshes and bodies of water behind barrier beaches are included under the heading of "estuarine waters."

Although salinity and other conditions are intermediate between fresh-water and the sea, almost all of the strictly aquatic organisms are of marine origin, contributions from fresh-water being minor.

The potential high productivity of estuaries has often not been appreciated by man, who has frequently classed them as "worthless" areas suitable only for the dumping of waste materials or useful only if drained or filled and planted with some terrestrial crop. When the high costs of such changes are considered, it may well be that utilization in the natural state is preferable, especially since seafood is a dietary item that vegetables can not replace.

The Sea - Marine Waters

For centuries man regarded the sea as a restless surface which first hindered, than aided, his efforts to explore the world. He also learned that the sea was a source of food which could be harvested, to supplement the products of land and fresh water.

Increased knowledge is verifying what scientists had suspected, namely, that the ocean not only is the cradle of life but is still today the greatest reservoir of life itself and of the vital elements needed by life everywhere. The sea is thus a major force in shaping conditions of life on land and in fresh water as well.

The features of the sea which are of major ecological interest may be listed as follows:

1. The sea is big; it covers 70 per cent of the earth's surface.
2. The sea is deep, and life extends to all its depths.
3. The sea is continuous, not separated as are land and fresh water habitats. All the oceans are connected.
4. The sea is in continuous circulation.
5. The sea is dominated by waves of many kinds and by tides produced by the pull of moon and sun.
6. The sea is salty. The average salinity or salt content is 35 parts of salts by weight per 1000 parts of water or 3.5 per cent.
7. The concentration of dissolved nutrients is low and constitutes an important limiting factor in determining the size of marine populations.

We have too long overlooked our great opportunities in marine resources in Alabama. We must learn to appreciate these resources.

THE OCEAN'S WANDERING ANIMALS

Have you ever thought about what it would be like if animals were not confined to the earth's surface? Farmers would have to put their cows in cages instead of fences. You'd have to chase your dog all over the sky instead of the yard.

But that's the way it is in the ocean. Fish swim all over the place, and go wherever they want to.

There is another group of animals that moves around in the water. These animals are called zooplankton. They don't swim around like fish, but they are carried by the currents and tides. Their name comes from two words - "zoo," which means "animal," and "plankton," which means to "wander or drift." All the plants and animals that float on the currents in this way are collectively called "plankton."

Since there are many, many different kinds of zooplankton, we will discuss only the kinds that are more common.

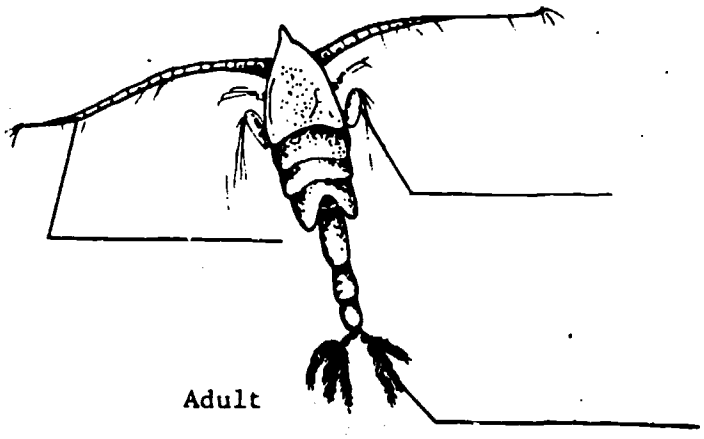
The zooplankton can be divided into two major groups: those animals that spend their whole life as plankton (holoplankton), and those that spend only part of their lives as plankton (meroplankton).

The Holoplankton

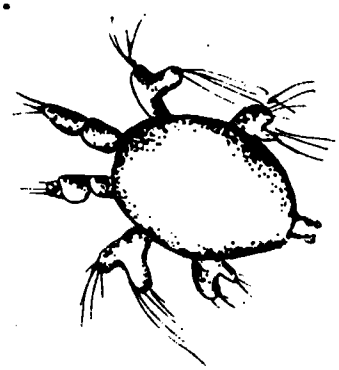
The most important members of the holoplankton are the copepods. These are little animals that look like shrimp, but may be smaller than the head of a pin. Copepods are one of the most common kinds of the zooplankton. Since many fish depend on the zooplankton for their food, the copepods are an important source of food.

A copepod has two long antennae which it uses to position itself in the water. It also has six pairs of legs, and a tail. The tail is divided into two lobes, each of which has five feathery bristles on it. On the adult copepod, below, locate and label an antenna, a leg, and the two tail-lobes.

When copepod eggs hatch, the young copepod is called nauplius. The nauplius does not look very much like the full-grown copepod. Both a nauplius and an adult copepod are shown below.



Adult

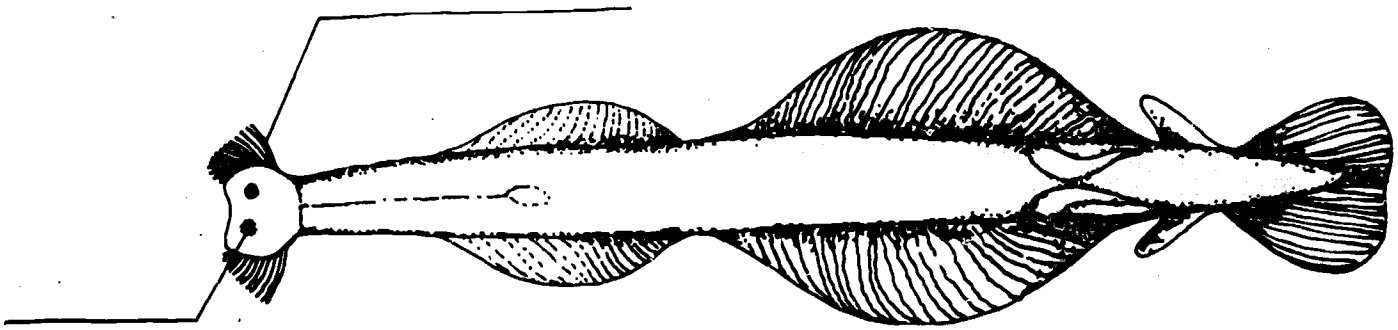


Nauplius

A member of the zooplankton that is only a little less common than the copepods is the arrow-worms. Arrow-worms are transparent, with three general body areas: the head, a long middle section, or trunk, and a short tail-piece with fins. Only the two small black eyes are easy to see.

Arrow-worms eat copepods and anything else they can find that is a little smaller than they are, including baby fish. They catch their prey with the grasping spines on their heads.

On the drawing of the arrow-worm below, locate and label the eyes and the grasping spines.

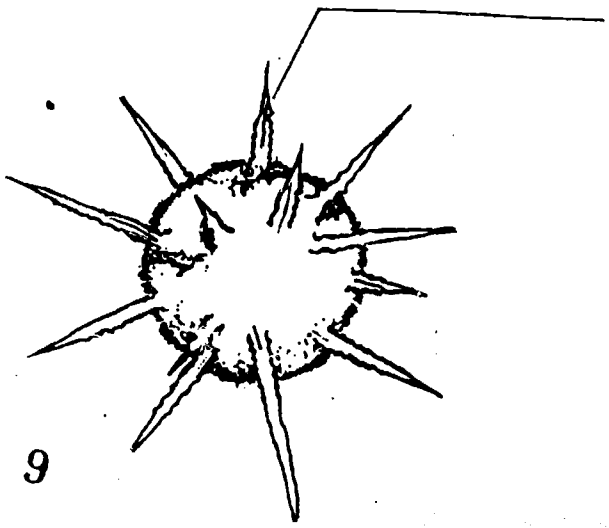


There are also one-celled zooplankton. The most familiar of these are the Radiolaria and the Foraminifera. These microscopic creatures have tiny hard capsules that protect them much like seashells protect the animals that live in them.

Radiolarians have many spines or spikes, and their capsules have only one chamber.

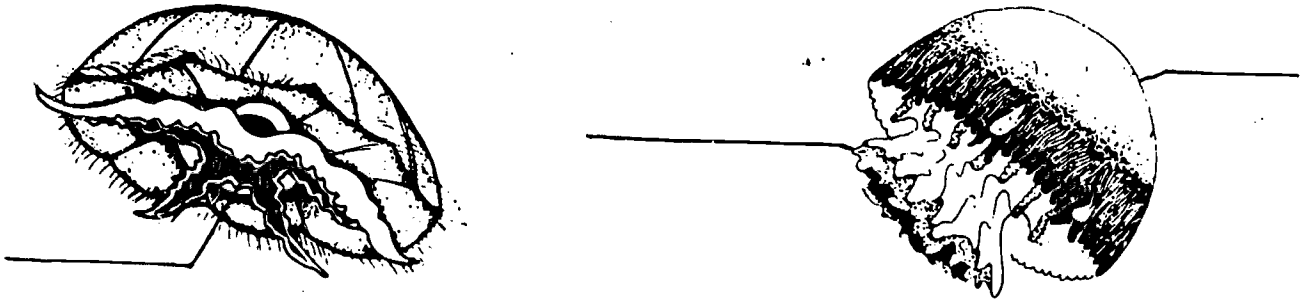
Foraminiferans have one to many chambers. Sometimes they have spines, but these are usually broken off when the animal is collected.

Label the drawings, below, of a Radiolarian, (R), and a Foraminiferan, (F).



Maybe the most well-known holoplankter is the jellyfish. Jellyfish are often seen floating in the water or stranded on the beach. A jellyfish has a mouth on its underside. The mouth is surrounded by a ring of stinging tentacles with which the jellyfish captures prey. The dome-shaped part of its body is called the umbrella.

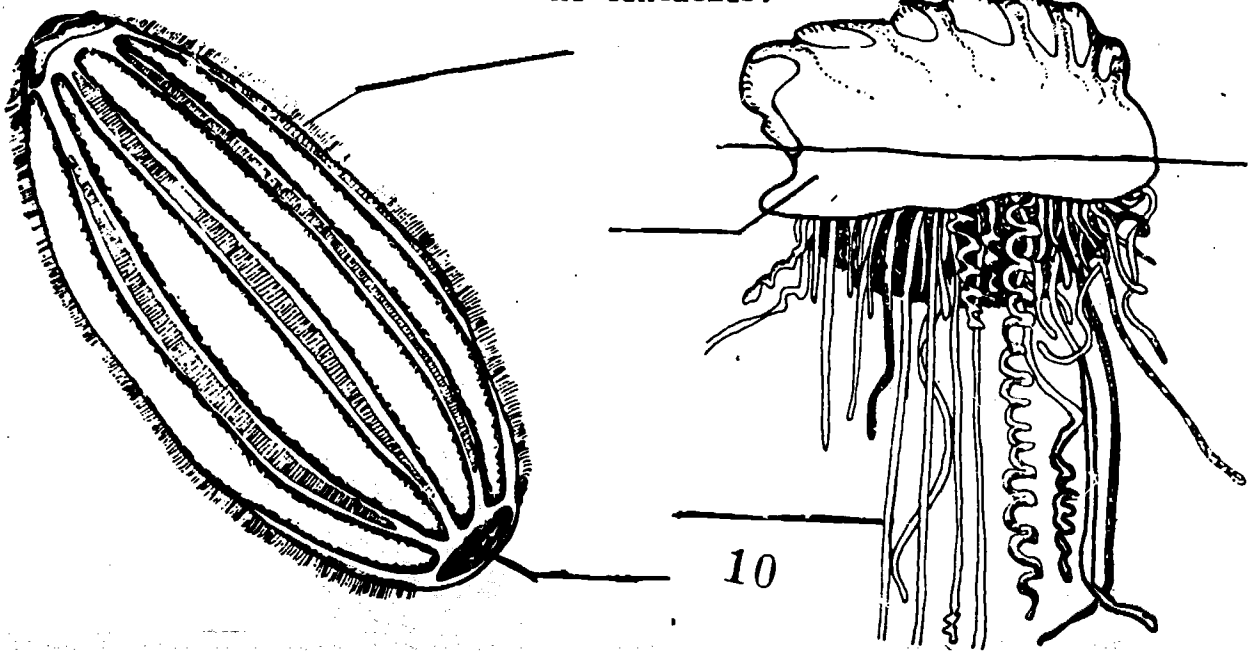
Below are drawings of two jellyfish you might commonly see in Florida waters. Locate and label a mouth, tentacles, and an umbrella.



Two more members of the holoplankton we will look at are two creatures that look much alike, and are related to, jellyfish. One is the comb-jelly or sea-gooseberry. This is not a true jellyfish, but it is clear and jelly-like, much like many jellyfish. Comb-jellies have a mouth at one end. They move about by beating the water with the rows of combs on their bodies.

In the waters around Florida, you might see what looks like a light blue Baggie floating on the surface of the water. This is the float of the Portuguese Man-of-War. Below the float hang tentacles that may be up to 30 feet long, much longer than those of most true jellyfish. These tentacles can sting you very badly, so if you see this creature, stay away from it!

On the drawing of the comb-jelly below, locate and label the mouth and the combs. On the drawing of the Portuguese Man-of-War below, locate and label the float and the tentacles.



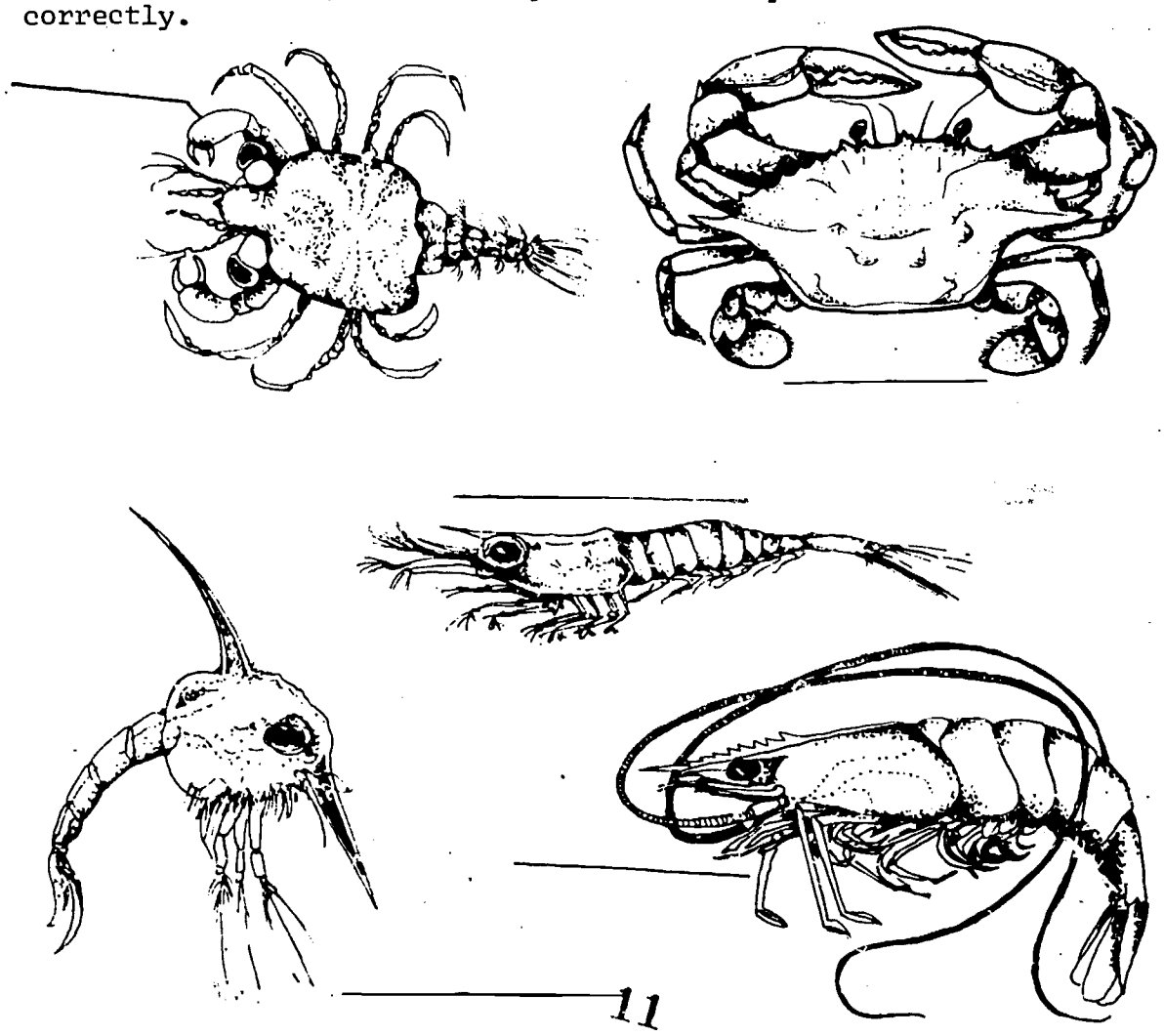
The Meroplankton

The meroplankton spend only part of their lives as plankton. For the rest of their lives they either crawl about on the sea floor, or are attached to something under the water.

Crabs are planktonic for a short time after they hatch from eggs. At first, a crab larva is called a zoea. Before it can become an adult crab, it must develop into another larval stage called a megalops, which is also planktonic, and resembles an adult crab. The megalops will then develop into an adult.

Shrimp are also planktonic when they first hatch from eggs. A shrimp larva is called a mysis, and looks very much like an adult shrimp.

Below are drawings of an adult crab with its zoea and megalops, and an adult shrimp with its mysis. See if you can label each one correctly.



SAND DUNES AND VEGETATION

Dunes are formed on beaches when wind blown sand begins to accumulate around pieces of dead vegetation washed ashore. As the plant matter decays, it enriches the soil and soon salt resistant plants like sea oats spring up. Gradually more sand builds up around the base of the plants, the plants multiply, and a line of sand dunes is formed.

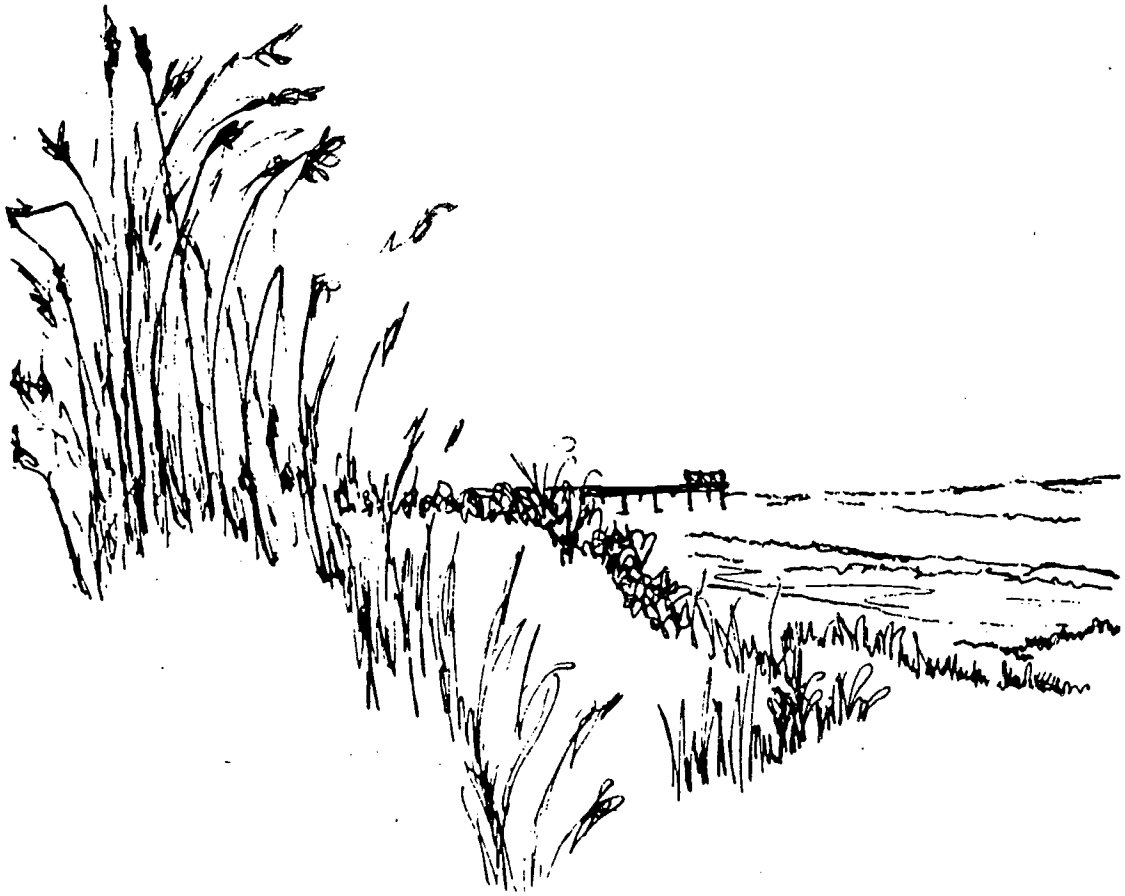
Dunes provide protection from erosion during storms by absorbing some of the shock of high winds and waves. The dunes also act as sand reservoirs, losing some during storms and rebuilding during calmer weather.

Well vegetated dunes are more stable and are preferred. Bare dunes can erode and migrate easily.

The Dutch have known for years that dunes deserve more than dune-buggy path status. They know that dunes are the first line of defense against the sea and that when storms hit, dunes will act as flexible barriers to high tides and waves. The Dutch also know that if dunes do give way to storm winds and water, the shifting mounds of sand will soon reappear. They know the dunes are reservoirs of sand that keep the shore intact.

So the Dutch have taken good care of their dunes and protected the sturdy grasses that hold the dunes to the land.

We have not been as smart on the Alabama coast. Early settlers led their cattle to the dunes and let them grow plump on the tall dune grasses. As the cattle grazed, their hoofs and teeth tore at the land and the grasses grew more sparsely. Later, settlers built homes, paved large areas and made roads through the dunes, adding to the destruction of the grass. With the disappearance of the grasses, the dunes lost the cement that held them in place, and they too gradually disappeared...leaving the coast defenseless against the sea. And leaving the homes and the people defenseless.



The importance of the sand dune barrier was recognized by the Alabama Legislature in 1973 with the passage of Act No. 775 and Act No. 971.

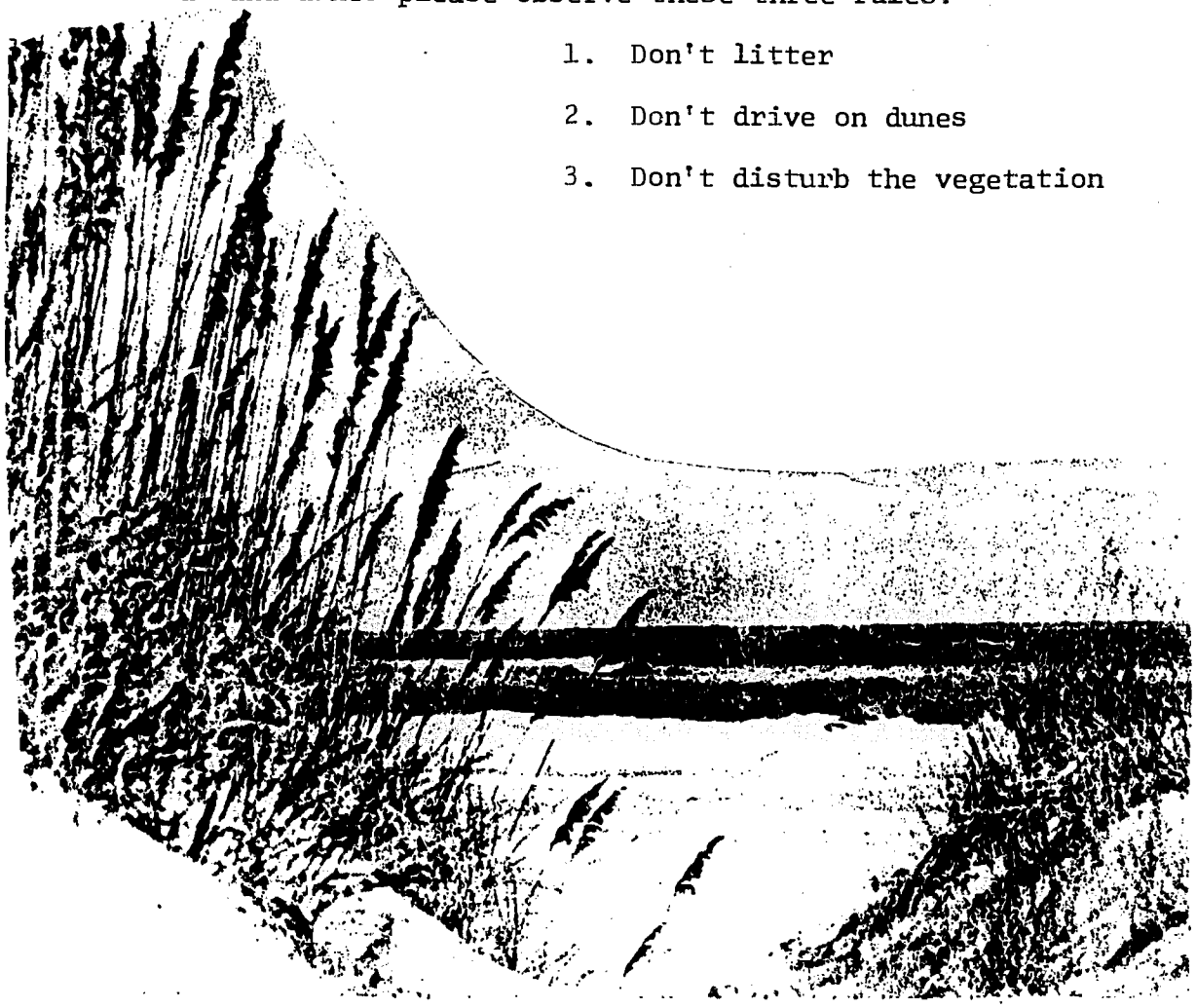
Act No. 775 is designed to protect the dunes from vehicular traffic and reads in part: "No person shall operate a motor vehicle upon coastal sand dunes located 50 feet or further from the water line.."

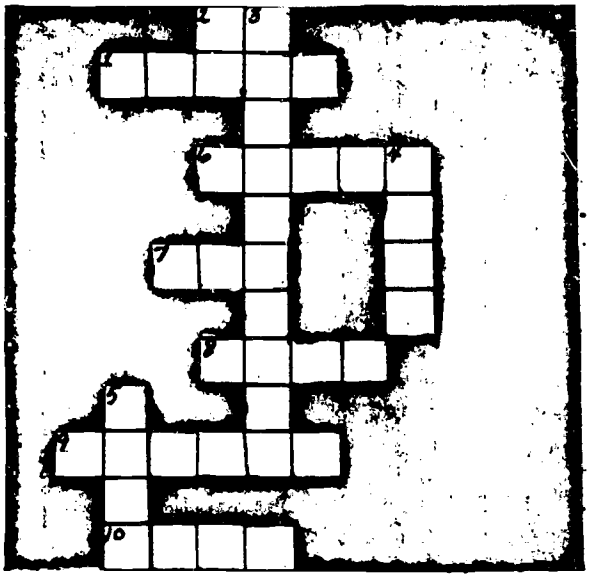
Vehicles destroy the dunes by killing the sea oats, morning glory and other vegetation that have extensive root systems holding the dunes in place. Large, bare, windswept gullies appear where vehicles have free access to the dunes. During storms and high tides, sea water rushes through these openings undermining more dunes and inflicting great property damage.

To enhance the natural restoration of the dunes and protect existing dune vegetation, Act. No. 971 was passed, making it "unlawful and a misdemeanor for any person to pick wild sea oats."

When around sand dunes please observe these three rules:

1. Don't litter
2. Don't drive on dunes
3. Don't disturb the vegetation





DOWN

1. Never _____ on dunes or the beach
2. Don't drive _____ dunes
3. Don't disturb dune _____
4. Greatest tide
5. Sea water

ACROSS

1. Coastal sand hills
6. Land between the sea and sand dunes
7. Salt water body
8. The invisible force that causes sand movement
9. Of or pertaining to the sea
10. Periodic rise and fall of sea waters

DOWN
1. dump
2. on
3. vegetation
4. high
5. salt

ACROSS
1. dunes
6. beach
7. sea
8. wind
9. marine
10. tide

Exploring Beach Sand

Provide Magnet and Magnifying Glass.

Materials needed:
1. Beach sand (if beach sand is not available, builders' sand may be substituted)
2. A sheet of paper
3. A hand lens or magnifying glass
4. A magnet
5. A quart jar and lid
6. A little oil (dirty crankcase oil will be excellent)
7. A small bowl

The purpose of this project is to find out about sand - what it is like, and what it will do. Where a place is left for you to write an answer, do so. Otherwise, just follow the directions and think about what you are doing.

1. Look at your sample of sand. What color is it?_____
Why?_____
Do you think it has shell fragments in it?_____

2. Some heavy minerals, especially those with iron in them, will be attracted by a magnet. Put a magnet in contact with the sand. Are the grains attracted to it?_____
Do you think your sand sample has any heavy minerals in it?_____

3. Pour a little of the sand onto a sheet of paper. Look at the grains through a magnifying glass or hand lens. Do all the grains look the same?_____
Shell fragments tend to be more rounded and less jagged-looking. Can you find one?_____ If so, draw a picture of it.

Draw a picture of a sand grain.

4. Pour a little sand into your hand. Describe what it feels like._____

_____

_____

5. Put about an inch of sand in the jar, then fill it almost full with water. Put the lid on. Tip the jar. What does the sand do?

_____

_____

Shake the jar. Does the sand settle back to the bottom immediately?

_____

The water in the oceans is constantly moving. Waves strike the beach endlessly, one after another. What effect do you think this constant movement of water might have on the sand that is under the water?_____

_____

6. Put some dry sand in a bowl. Gently, blow on it. Can you blow some of the sand grains around?_____
A breeze blows almost constantly at the beach. What effect do you think this might have on the sand of the beach?

_____

_____

7. Gently drain as much water as you can out of the jar. Into the sand, pour enough oil to get the sand covered with it. Then try to wash the oil out of the sand. Can you do it?_____

Occasionally an oil tanker will spill some oil out at sea. This oil is much heavier and stickier than what you have just used. When it floats to the beach, it covers everything with sticky black goo. Do you think that oil spills might be a problem to clean up?_____

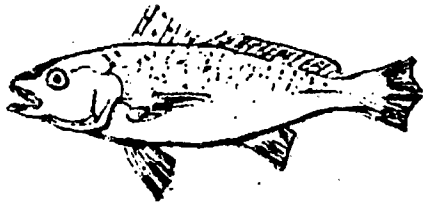
8. What other ways can you think of to experiment with sand?

LIVING PRODUCTS OF THE SEA

When we speak of things that come from the sea, most of us probably think first of its fish and shellfish, such as cod, herring, halibut, tuna, oysters, crabs, scallops, lobsters, and clams. In 1976, the world catch of these seafoods was nearly 162 billion pounds. In the United States, fishermen landed 5.4 billion pounds of fish and shellfish (including weight of their shells) at our ports--less than a third of the catch of Japanese fishermen, however. About half the fish caught by our fishermen is utilized in feed for poultry, cattle, fur animals, dogs, and cats, and in other industrial products.

Fish are the main source of protein--an important body builder--for many people of the world, notably the Japanese. The average American uses only about one-seventh the fish consumed by the average Japanese. Fish are an economical way to obtain one's supply of protein. It comes as a surprise to most of us to learn that the amount of protein in an average serving of fish is equal to, and often higher than, that in an average serving of beef. Fish and shellfish also supply valuable vitamins--A, B, and D. Oysters and shrimp are excellent sources of iron and copper needed by our bodies in building blood, and they supply us with five times the magnesium and more phosphorus than is in milk. Seafoods have from 50 to 200 times as much iodine (needed to keep our thyroid glands functioning properly) as most other foods.

Alabama Living Products of the Sea



Atlantic Croaker

The croaker is the most common fish caught. It is called a croaker because of the drumming croak it produces by vibrating muscles against its swim bladder like a drum. Croaking increases in spawning season or when they are touched, but biologists do not know why they make the sound.

Croakers are found in small groups, over sandy or grassy shallows. The young fish spend their entire first year in the estuary, but the adults move from the shallows in the late summer and early fall to wintering grounds of up to forty fathoms in ocean waters, returning in the spring. They have a long spawning season, from August into early December. Croakers are bottom-feeding fish. Their diet consists of shellfish and other smaller forms of marine life and they usually weigh less than 3 pounds.

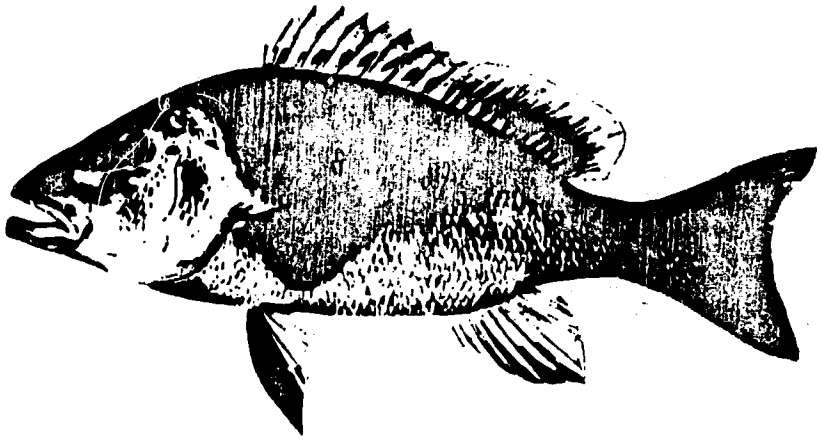
Fishing for croaker by hook and line is the best during the summer and early fall. Most fish sold at the market are caught by shrimpers who catch them accidently in their trawls. They are also caught in large numbers and used as cat food.

Red Snapper

The red snapper is one of the most delicious deep sea fish. As its name implies, red snapper is brilliant red in color and is one of the most colorful fish in a seafood market display case. It ranges in size up to 30 pounds in weight and 2-1/2 feet in length.

Although very little is known about the life history of the red snapper, commercial fishermen have learned that concentrations of snapper are usually found over certain types of bottom. Irregular hard bottom formations of rock and limestone covered with live coral and grass, called lumps or gullies, are especially preferred by snapper. Artificial reefs built of everything from concrete pipes to ships have been used by the Alabama Department of Conservation and National Resources. These artificial reefs have created valuable snapper fishing grounds for Alabama sport fishermen.

Most red snapper are caught in the Gulf of Mexico and landed in Florida where the red snapper industry is centered. Many modern fishing vessels range more than 400 miles from home, to the coasts of Yucatan and Honduras, for their catches. New electronic instruments like depth finders and LORAN (LOng RAnge Navigation) equipment help fishermen find the snapper banks but the old hook and line is the primary fishing method.



RED SNAPPER

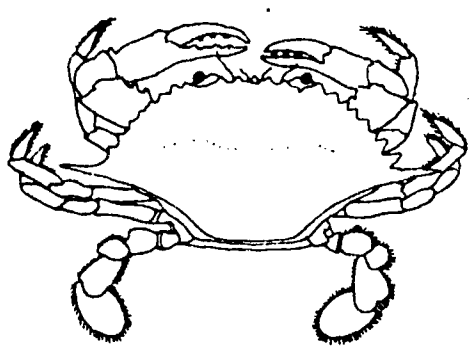
Blue Crab

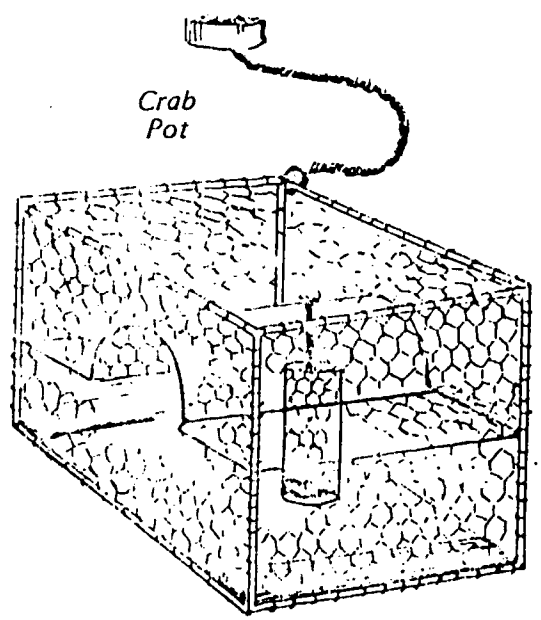
The blue crab is a tasty shellfish that spends most of its time walking along the bottom of the bays and sounds where it lives. However, when necessary, it swims through the water with great speed and ease.

Crabs have hard shells or exoskeletons. To grow, they shed this external armor or shell. This process is called molting. Before the molt starts, a new, soft exoskeleton forms inside and the crab backs out of the old shell as it loosens. The new shell is soft and elastic allowing the crab to grow. It is open to attack during the soft-shell stage and seeks refuge in a secluded spot until the new shell hardens. Crabs also lose one or more legs during their lifetimes, but are able to grow new ones.

When full grown they average 5 to 7 inches across the back of the shell. The shell is brownish green or dark green and is drawn out on each side into a long spine. The underside of the body and the legs are white, while the tops of the claws in both male and female show varying amounts of blue. The tips of the claws in the female blue crab are bright red. Essentially a shallow water crab, it lives in bays, sounds, and channels near the mouths of coastal rivers. Normally an inhabitant of salt water, the blue crab is also found in brackish water or fresh water.

Blue crabs are caught with trawls, traps and baited line. The commercial harvesting method used to catch blue crabs is the crab pot or trap. This trapping device allows the crab to enter through funnels which also make escape difficult. The crab trap is usually baited with fresh fish or shrimp head and placed in a line in shallow water area of the bay. Recreational crabbing is often done from a pier with a dip net and bait on a string. The crab is lured near the surface by the raising of the bait. Then the crab is dipped up.

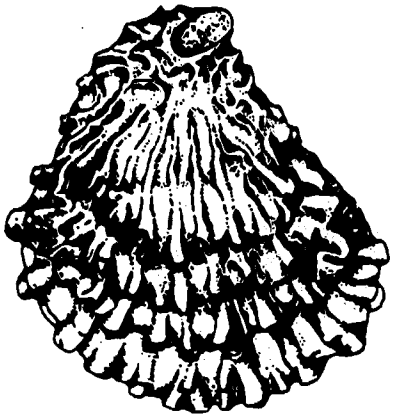


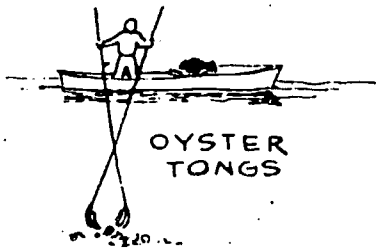


Oysters

Although no one knows how many centuries oysters have been enjoyed as food, it is known that oyster farming has been practiced in the West since the days of the Romans, and that oysters were cultivated in China long before the Christian Era. Early settlers in America were delighted to find an abundance of excellent oysters along the coastlines and in the bays of their newly-found land. Today oysters are more popular than ever. Oysters are still available and harvested from public oyster beds using oyster tongs. These are rake-like tools on long poles.

The Eastern or Atlantic oyster is found along the Gulf Coast and up the Atlantic Coast to Cape Cod. The Eastern oyster represents about 85 per cent of the total production. They are found along the temperate and tropical coastlines of all continents. They live and grow between tidal levels or in the shallow waters of bays and estuaries; however some oyster species live in waters several thousand feet deep. Oysters can adapt to living in waters with large changes in salinity and temperature but the growth is more rapid in warm waters. In Alabama it takes about 30 months for oysters to reach the legal size of 3 inches.

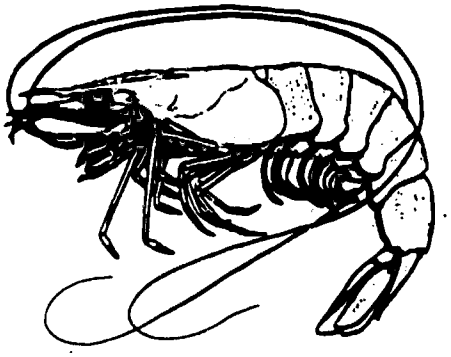


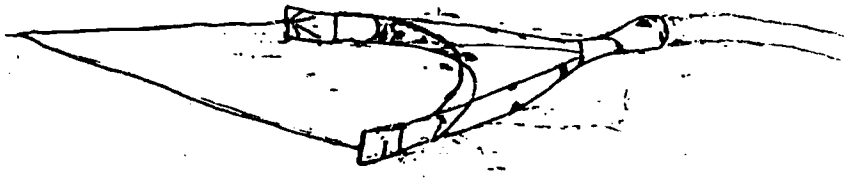


Shrimp

Shrimp are the most valuable shellfish in the U. S. There are three major commercially important species -- brown, white and pink. Shrimp are ten-legged crustacean that acquired its name from the middle English word "shrimpe" meaning puny person. Like other crustaceans, shrimp have a skeleton on the outside of the body and, to grow, it must shed its shell and grow a new one. Shrimp swim forward usually but when frightened they, with a flip of the abdomen, can propel themselves backward.

Most shrimp are caught with otter trawlers or "draggers" which drag or tow a large, flattened cone of nylon netting called an otter trawl. As the net moves along the bottom the shrimp are swept into the mouth of the net. Larger Gulf shrimpers often pull two trawls on each side of the boat. After pulling the net from 2 to 4 hours, the back end of the trawl, or bag, is hauled on board and the catch is dumped and sorted. Smaller 16 foot trawls are pulled by many boaters for 15 to 30 minutes in the bays.





Harvesting the Living Products of the Sea

Seafood production is an important part of Alabama's heritage and resources. The objective of this project is to learn how to harvest seafood, the living products of the sea. Any method can be used, but records must be kept of what, how much, and the value of the seafood harvested.

Materials Needed

1. A method of harvesting seafood (hook and line, cast net, crab trap, etc.)
2. Small scale to weigh up to 25 pounds
3. Small bucket
4. Cleaning utensils

Questions

1. What method did you use to harvest seafood?
   What is the common commercial harvesting method?
2. How much did you harvest:
   - in the round?
   - after processing?
3. What was the value of your harvest:
   - to the fishermen (dockside value)?
   - to the consumer (retail price)?

SEAFOOD HARVEST RECORD SET

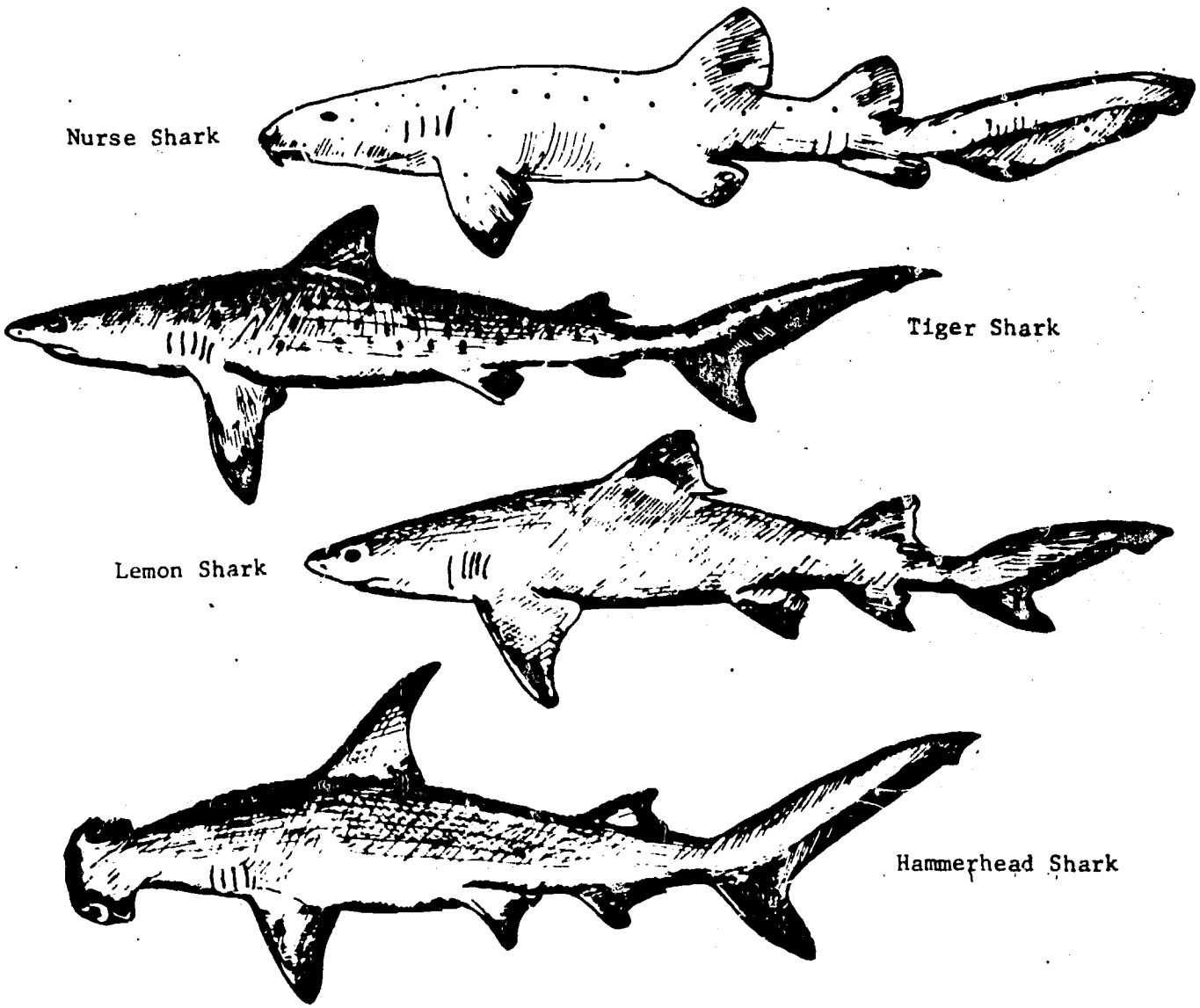
TYPE	LOCATION	DATE	TIME	IN ROUND WEIGHT	PROCESSED WEIGHT	DOCKSIDE VALUE	RETAIL VALUE	COMMENTS

SHARK FACTS

One of the first recorded shark attacks took place around 700 B.C. Since that time, sharks have been regarded as a fearful menace to man, and certain death to anyone who encounters them. Certain recent publicity has done much to worsen the shark's reputation.

But is this reputation really deserved? Let's find out a little more about them, and just how dangerous they are.

Some Sharks Seen in Alabama Waters



Words to Explore

Some of these words may be new to you. If you already know them, write a short definition for them on another piece of paper. If not, look them up in a dictionary or encyclopedia and then write a short definition in your own words before you go on.

1) Reproduce
2) Plankton
3) Predator
4) Scavenger
5) Prey

Questions You Might Ask About Sharks

Is a shark a fish?

A shark is a kind of fish, but sharks are different from other fish, because their skeleton is made of cartilage instead of bone. To get a good idea of what cartilage is, feel your ear above the lobe, which is made of cartilage. As you can feel, it is firm, not hard like bone, but strong enough to deep its shape. Sharks are related to fishes like the manta ray and sting-ray.

How many different kinds of sharks are there?

In the whole world there are about 250 different species (or kinds) of sharks. In the waters of the Gulf of Mexico there are about 30 different species.

What do sharks look like?

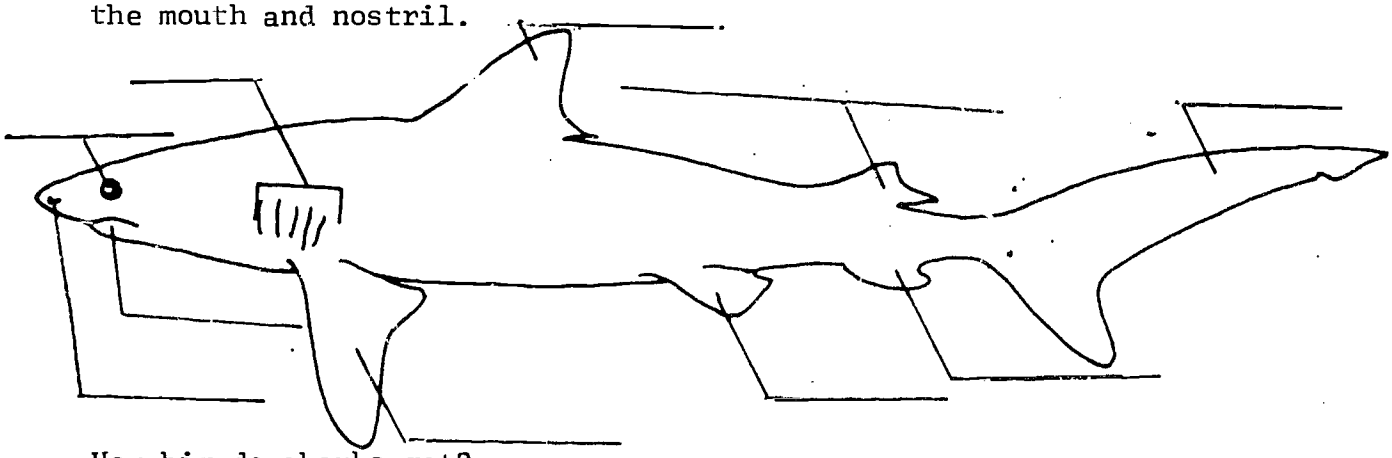
A shark resembles a fish, but many are very slender and streamlined. Though all sharks are a little different, they have what we might call a "basic body plan." All sharks resemble this "basic" shark, but many will not look exactly like it.

On the top side, or dorsum, our basic shark has two fins. The front, and larger one is the 1st dorsal fin, and the rear, and smaller one is called the 2nd dorsal fin.

The tail is also called caudal fin. On the bottom, or ventral side, our basic shark has two pairs of fins, and some sharks have one unpaired fin behind them. This farthest back, (posterior), unpaired fin is the anal fin. In front of it are paired fins, the pelvic fins. The largest pair, the front (anterior) pair, are the pectoral fins.

Like other fishes, the shark breathes by gills instead of lungs. Our basic shark has five gill slits but some sharks have six or seven. The shark has a pair of nostrils, but they are used only for sensing of "odors" in the water, and not for breathing. For breathing, water is drawn in through the mouth and expelled through the gills.

On the drawing, locate and label the eye, gill slits, 1st and 2nd dorsal fins, caudal fin, anal fin, pelvic fin, pectoral fin, and the mouth and nostril.



How big do sharks get?

The smallest known shark is known as tsuranagakobitozame, which is a Japanese word that means "the dwarf shark with a long face." It is about six inches long when full-grown. Only a few have ever been captured.

The largest known shark is the whale shark. It may be up to 60 feet long and weigh several tons. It is also the worlds largest fish. (Remember: a whale is not a fish!)

Where are sharks found?

Sharks are found all over the world. Some species have been seen captured only in water as deep as 9000 feet. Some species seem to prefer shallow water. Some are found in both deep and shallow water.

Many sharks are present along coastlines and beaches. Pilots of small planes have often seen them swimming among bathers and between bathers and the beach, and the people never knew they were there.

What is a shark's skin like?

A shark's skin is covered with tiny teeth called denticles. All the points on the denticles go in the same direction. If you stroked a shark from head to tail, the same direction the teeth point, the skin would feel smooth. If you stroked the shark the opposite direction, however, it would feel like a piece of coarse sandpaper and probably give you a bad scrape.

How do sharks find food?

Sharks have three methods for locating prey.

Sharks can "feel" vibrations in the water such as those that an injured and struggling fish might produce. They can feel these vibrations much farther away than they can smell or see what is causing them.

As a shark approaches a disturbance in the water, it uses smell to determine what the disturbance is. Sharks will be especially attracted to bait, blood, fish scraps, and anything else that might smell "fishy."

When a shark is about 50 feet from a distrubance in the water, it can finally see what it has been feeling and smelling. Sharks' vision is useful for finding food for a distance of only about 50 feet.

Are all sharks dangerous to man?

Sharks are present at most beaches where swimmers are, and the people usually don't know they are there. Attacks are far less frequent than some recent publicity would indicate. Only one swimmer in about five million has been bothered by a shark. There is a much greater danger in driving to the beach.

Man is not part of the shark's natural diet, and only a few species have ever been proven to have attacked man. You should, however, consider every shark potentially dangerous. Though the plankton-feeders cannot bite a man, a shark can nevertheless cause bad scrapes and bruises if it brushes against you.

Why do sharks attack man?

When a shark senses movement in the water that he thinks is food, he will bite it. If it happens to be a person, then you have a "shark attack." Some sharks may be merely curious. Some attacks have occurred when a swimmer grabbed a shark's tail or fin and attempted to hold or ride it.

What should you do if you see a shark while you're swimming?

Do not try to drive the shark away by splashing, yelling, or hitting rocks together underwater. This may attract the shark rather than frightening it away.

Do not, for any reason, try to touch or bother the shark in any way.

Do stay calm, and immediately wade or swim toward shore. Try not to make any noise or splashing you don't need to.

It is not a good idea to swim alone, as sharks seem to be less likely to attack swimmers in groups. Do not swim where blood, vomit, bait, or fish scraps are present, as these things attract sharks. Avoid swimming where the water is muddy or dirty, because you won't be able to see a shark if it is there.

Word-Hunt

Here are clues to words that are hidden in the "word-hunt." They may be written across, up and down, or sideways. Find as many as you can and draw a box around each word as shown. Some of the boxes may overlap. Happy word-hunting!

Clues

The smallest shark
What a shark's skeleton is made of
The largest shark
A shark's skin feels like this
The "teeth" on a shark's skin

From the oil of shark's livers
Made from sharkskin
Size of the largest shark
_____ _____ organs

O B A S T U T X R S A C E W Y M K R R W A B U E B I C T B G C O E P V
A S D T S B S I X T Y F E E T F U A E H F L R G N N H L B M J H L N I
S E O A V E F S U L N K J L R F D W H A P B A B G S G D C R S G T B T
A T B W C W J V O T L K O A Z O A C M L D C N D A N O E S E F D D T A
D X U A U E P O Y M N D L T A R B C H E C I A J D T K R T L M Y E M M
O F X I G Y C U E M N P N E Q G E E N S O C G K F E E O Y U G P F Q I
B H V I Y A I Q J A Y P M R I N F F S H D T A C U A N M E P V J W H N
K Z L L D R M K N Q N E R A R G G M P A A Y K R Z V F T F A I B P G A
M O Z P A C G Q P F B K A L X H I N F R E E O B T D F E I C L T D M J
H R I S N T O U B J S A S L C I O D O K M P B N A I O L G C R P O S O
B T S U R A N A G A K O B I T O Z A M E Z C I H W R L H R A L I B R C
S A N D P A P E R X G T N N H U S I C E T D T B S X T A L I F E K L G
U M T K S L W P V A B M N E Q E G P S O V P O Y I Q M S G P K R S T O
L E A T H E R P L W R Z R C D F L R K A R B Z J U N J O T E C R L N D

OCEAN CURRENTS

Ocean currents are important in many ways. The best fishing is often found where two currents come together. Also, currents transport fish and shellfish that are too young to swim to areas rich in food, thus ensuring their survival.

There are several types of currents. The best known are wind-caused currents where the wind actually pushes the water along. In the demonstration below, you can observe two lesser known factors that cause currents--differences in salinity and temperature densities between two masses of water.

Materials

Two 1-pint milk bottles or two 250-milliliter Erlenmeyer flasks with flat rims

Table salt
Food coloring
Paper towels or rags
Plastic dishpan (optional)

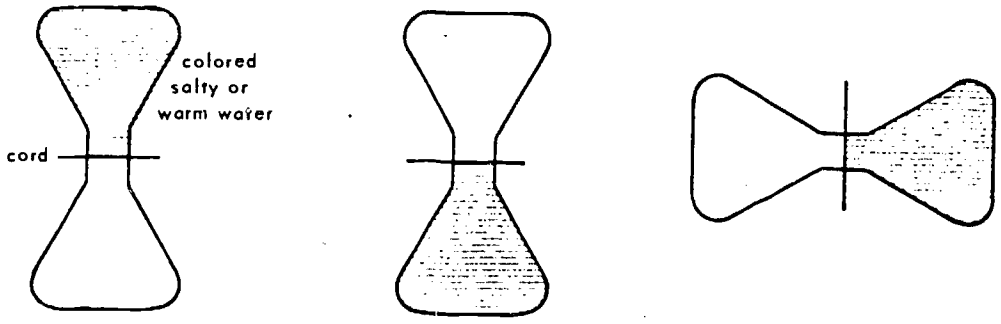
Some 3- by 5-inch cards

NOTE: You might want to use the plastic dishpan when you do these demonstrations in case of spillage.

Method

Salinity currents. Fill both bottles with tap water. Dissolve ½ teaspoon of salt in one bottle to make salt water. Add a drop of food coloring to identify it. Place a 3- by 5-inch card on top of the jar of salt water and carefully turn the bottle upside down. The upward pressure of air will hold the card in place. Place the container of salt water on top of the jar of fresh water and carefully remove the card. Observe. Next place the bottle of fresh water on top of the container of salt water and remove the card. Observe. Then place both jars horizontally, remove the card, and observe. Is salt water heavier or lighter (higher or lower density) than fresh water? What happens to river water when it flows into the ocean?

Temperature currents. Fill one bottle with warm tap water and the other with cool tap water. Add a drop of food coloring to the container of warm water. Do the three variations shown below. Is warm water heavier or lighter than cool water?



Questions

1. Where in the world's oceans might these factors be most noticed? Where does most heating take place? Where does most dilution of sea water occur?

2. Is it easier for a human to swim in salty water or in fresh water? In cool water or in warm water?

A DRIFT-BOTTLE EXPERIMENT YOU CAN DO

Tracing ocean currents helps us to understand weather patterns, climate, and the distribution of plankton and fish in the oceans. In shipping, utilizing ocean currents can speed transoceanic voyages.

Materials

1. Glass bottles with screw-on caps (catsup, salad dressing, soft drink bottles--or any others you can think of)
2. dry sand
3. rubber stoppers or corks
4. self-addressed post cards
5. paraffin

Constructing drift bottles

You can make drift bottles from almost any empty glass bottles; clear glass is best. (Do not use plastic bottles; they float too high and are driven by wind, not waves.)

First, prepare the data cards (see example). You can use U.S. post cards, which finders within the U.S. can drop in mail boxes without buying stamps (and this may be possible in some foreign countries). In any case, be sure each card is preaddressed to the school or class. Place one prepared data card inside each bottle. To minimize the effect of wind drift, ballast each bottle with dry sand, so bottles are nearly submerged when released (test in a sink or tank of water). Seal each bottle with a rubber stopper and a screw-on cap (preferably plastic). You may use corks instead of rubber stoppers-and-caps, but they must be sealed with wax. There is a definite problem with corks, even when sealed this way with wax: air bubbles in the wax will eventually break, and the corks may be eaten by marine organisms--causing the bottles to sink.

Releasing drift bottles

When you have sealed all the drift bottles, they are ready for release in the ocean. You can talk to local fishermen, boaters, or your marine Extension agent, to arrange to have your bottles dropped at sea. Find out if the person who releases the bottles can record the release points for you, in latitude and longitude. If at all possible, arrange that bottles be released at different distances from shore (e.g. 3, 5, 10, and 15 nautical miles).

Recovering drift bottles

Sandy beaches are numerous on the coast, and many people are interested in beachcombing. When you release drift bottles, there are certain key steps to follow; maintaining public interest is most important. You should send a letter and a map to each person who returns a drift-bottle card. The letter (see example) should explain your drift-bottle project and its objectives. The map (see example) should show ocean current patterns off the U.S. Gulf Coast,

so the finder will understand why she or he found the bottle. The School of Oceanography at Oregon State University has had great success with its drift-bottle program because it follows these steps to keep the public informed.

Questions

1. Discuss the reasons for ballasting the drift bottles.
2. If you received a latitude and longitude record of the points where your bottles were released, plot their release and return points as you plotted the paths of the bottles in A Drift-Bottle Experiment using R/V Yaquina Data (Ocean Currents).
3. Discuss the current patterns off the Gulf coast as indicated by your drift bottle study.
4. Do drift bottles contribute to pollution of the sea? One class discussed this; their answer was to add to the message they put in their bottles a request that the finder properly recycle the bottle (or the bottle parts, if it was broken). What would your answer be?

5. Does the distance from shore at which bottles were released have any effect on where they are found?

Other activities

How might ocean currents have aided or hindered early explorers in the New World?
Construction of drift bottles; designing an emblem and choosing a name for the project.
How do ocean currents off the Gulf affect our climate?
Preparation of letters to inform persons who return cards about the project and its results.

Books - Gross, M. Grant, Oceanography (Columbus, Ohio: Merrill, 1971)
- Yasso, Warren E., Oceanography: A Study of Inner Space (New York: Holt, Rinehart, and World, 1965)

Stamp

Your Name
Your Address
City, State Zip Code

PLEASE FILL IN THE INFORMATION AS INDICATED AND SEND IN MAIL. ALABAMA 4-H'ERS ARE MAKING A GULF OF MEXICO CURRENT AND DRIFT STUDY.

BREAK THIS BOTTLE

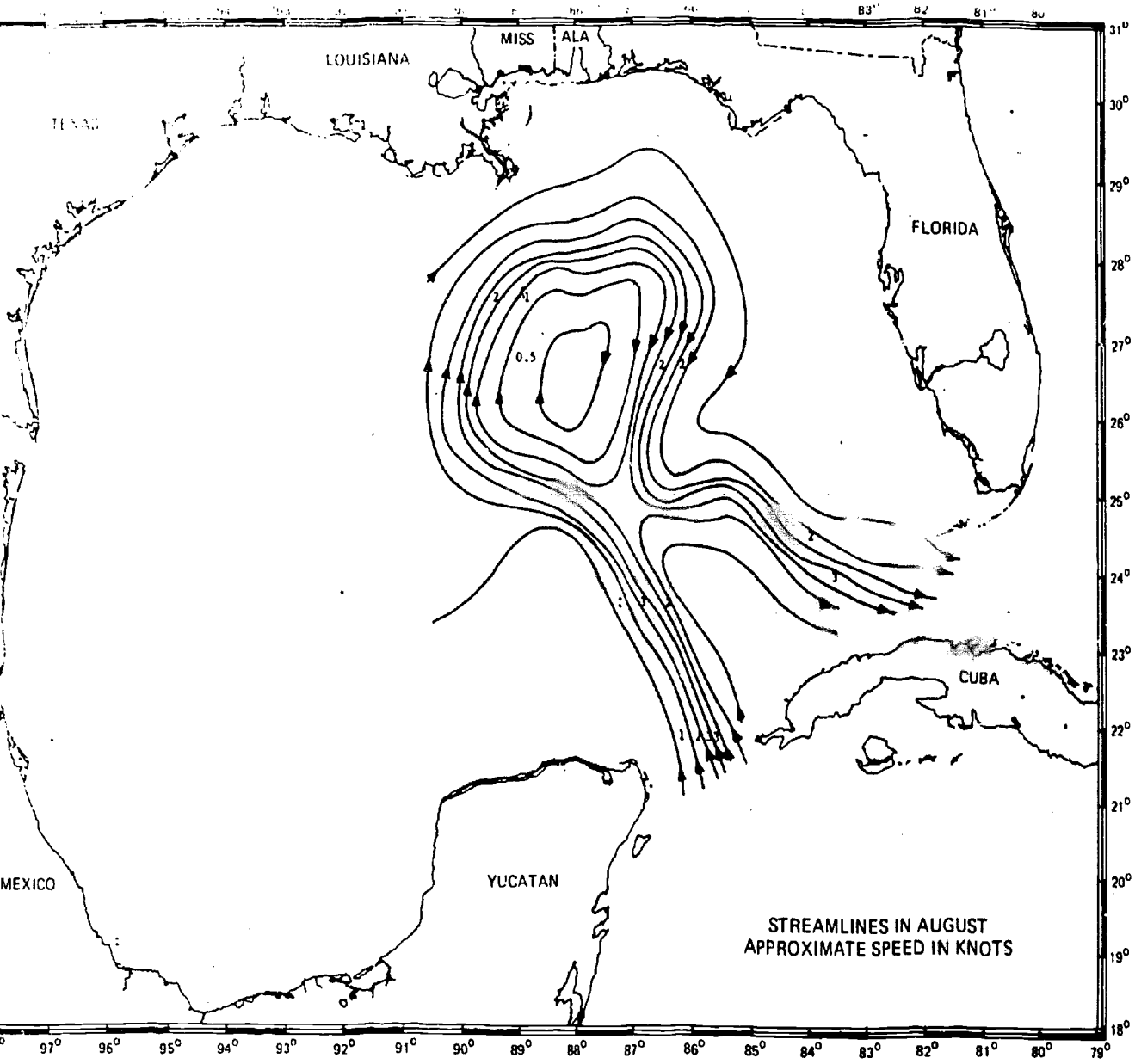
TIME AND DATE FOUND:_____

WHERE FOUND, NAME OF BEACH OR PLACE ON SHORE, NEAR WHAT PROMINENT REFERENCE POINT:_____

_____

_____

Bottle Number



Loop Current Streamlines, August, 1966. (Eleuterius, 1974)

MARINE PHOTOGRAPHY

This marine science photography activity is intended to help you develop an awareness of marine ecology. It is hoped that you will use this activity to evolve your ability to see and understand the uniqueness of the marine environment. This method of study is non-consumptive because it does not involve collecting plants and animals. Instead the result is a permanent collection of photographs, which you can use for information and enjoyment. Any type of camera equipment works well.

Suggestions for Photographs

Birds. There are many species of beautiful shorebirds, both on the beach and around bays. Identify the birds and study their habits. Where do they feed and on what? Where do they nest? Why are their bills shaped the way they are? Try to get photographs that show the natural behavior patterns of different birds.

Beach. Find, identify, and photograph plants and animals. Show the different plants and animals in different parts of the intertidal zone. How do the animals protect themselves from drying by wind and sun? Do you see any marine mammals in the area?

Fishing boats and gear. Photograph or draw the different kinds of fishing boats and gear used for commercial fishing. Find out how this gear is used and for what species of fish.

Types of fish. Watch sportsfishing or commercial boats unloading. Identify and photograph the kinds of fish or shellfish that are unloaded. Where do they come from? Photograph sportsfishermen and their catches. How do they catch their fish? Why do they go fishing?

Estuary ecology. Photograph the plants and animals found in bays. How is this environment different than the ocean beaches? How do the organisms adapt to this environment? Find and photograph examples of pollution. In what ways does pollution change the environment?

Man's uses of the marine environment. Photograph man's use of the marine and estuarine environment. How do man's activities alter the environment? Is it a wise use of marine resources? Why or why not?

GYOTAKU --- JAPANESE FISH PRINTING

The technique of Japanese fish printing has been used in Japan for over 100 years to record catches of sports fish and to gain ichthyological (fish biology) information. These prints have even been used at the University of Washington to study how the physiology of a fish is related to its surface area.

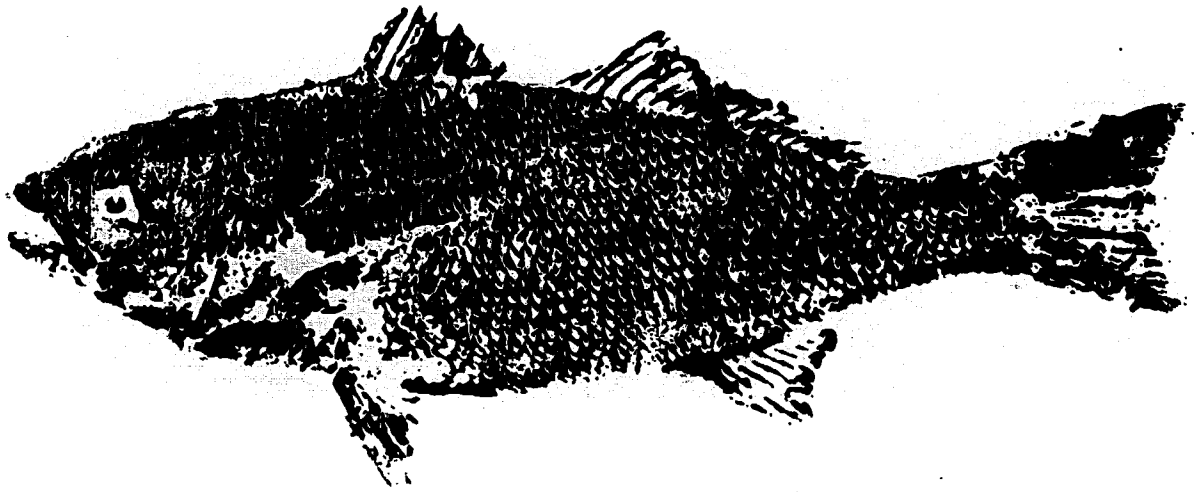
The art of gyotaku (pronounced ghio-ta'-koo) is a good way to gain an understanding and appreciation of the beauty and great variety of marine organisms. You can also use this technique for making prints of shells, rocks, flowers, and other items.

Before you make a print, identify the fish. What are the distinguishing characteristics of the fish? Study the life history of the fish. Where and how was it caught?

Materials

Obtain a very fresh fish-flounders, bluegills, or rockfishes are good to start with. If you buy the fish at a market, select one that has bright red gills, clear eyes, and a fresh smell. If the fish has been gutted, make sure that it has not been cut anywhere else on the body.

You also need:
* newspaper
* plastic modeling clay
* pins
* water-base ink (linoleum block ink is best)
* a stiff ½-inch brush
* a very small brush
* rice paper, newsprint, or other moisture-tolerant paper
  Since rice paper is expensive, you might prefer to start with newsprint.



Method

1. Use soap and water to clean the outside of the fish as completely as possible. The cleaner the fish, the better the print. Dry the fish well.

2. Place the fish on a table covered with newspapers. Spread the fins out over some clay and pin them in this position. Continue to dry the fish.

3. Brush on a thin, even coat of ink. Leave the eye blank, unless you prefer to fill it in.

4. Place a piece of newsprint or rice paper over the top of the fish.

5. Carefully lay the paper over the entire fish. Use your fingers to gently press the paper over the surface area of the fish. Be careful not to move the paper too much since this results in double prints. Then remove the paper and you have a fish print.

6. Use a small brush to paint the eye.

GLOSSARY

Artificial reefs	- Material placed in locations in the Gulf to attract fish
Barrier island	- An island which lies parallel to a coast, but is separated by water from the mainland. It acts as a protective barrier of storms for the mainland.
Ballast	- Weights placed in a ship or drift bottle to stabilize it in water
Brackish water	- the water in the area where salt and fresh water mix
Current	- a body of water that flows in a definite direction
Density	- the quality of being dense or compact; the ratio of the mass of an object to its volume
Drift bottle	- a bottle released in the Gulf to study surface water currents
Dunes	- the small hill of sand which lies just behind, and parallel to, a beach
Environment	- all the things (conditions, circumstances, and influences) that surround and affect organisms
Estuary	- an inlet of the ocean, usually formed at the mouth of a river. Mobile Bay is an example of an estuary.
Exoskeleton	- the hard skeleton on the outside of many animals which supports and protects them, i.e. crabs
Fauna	- animal life of a region
Fishery Conservation Zone	- an area from our 3 mile national territorial sea to a boundary 200 nautical miles from the coast
Flora	- plant life of a region
Intertidal zone	- area between the highest high tide and the lowest low tide

Kilometers	- 1.85 nautical miles
Knot	- a speed of one nautical mile per hour
Latitude	- the imaginary lines which are used to measure north and south distance on the earth surface from the equator
Longitude	- the imaginary lines which are used to measure east and west distance on the earth surface from a line through Greenwich, England
Marine ecology	- relationships between marine plants and animals and their environment
Marine mammal	- ocean animals that have backbones (vertebrates), the females of which have glands used for feeding milk to their young. For example, whales and seals are marine mammals.
Nautical Mile	- 1.15 statute (land) miles or 0.54 kilometers
Nutrient trap	- an area where the minerals needed for proper growth are concentrated. i.e. an estuary
Organism	- any living thing
Plankton	- the small drifting or floating plants and animals living in water
Salinity	- the amount of salts in water, usually expressed in parts per thousand
Shellfish	- water living animals which have a protective shell on the outside of their body, i.e. shrimp, oysters
Species	- a population or group of distinct organisms that have some common characteristics and are reproductively isolated from other distinct organisms.
Shoreline	- the land at the waters edge
Tidal	- an area or activity which is between the high-point and the lowest point the tide reaches
Tide	- the rising and falling of the earth's oceans due to force created mainly by the sun and moon

Acknowledgments

We gratefully acknowledge the assistance of Mr. Shelton Hawsey, CA-4-H, and the County Agents-4-H in Baldwin, Clarke, Escambia, Mobile, Montgomery and Washington Counties for evaluating marine 4-H materials. Gratitude is also expressed to the Sea Grant Programs of California, Florida, Oregon, North Carolina and South Carolina for allowing us to use their materials.

Adapted from:

Bird, N. Handbook for Coastal Property Owners. South Carolina Sea Grant Marine Advisory Bulletin 10.

Dewees, C. M. and J. K. Hooper. Gyotaku-Japanese Fish Printing. California Sea Grant Marine Advisory Publication AXT-445-3.

_____, Marine Photography. California Sea Grant Marine Advisory Publication AXT-445-8.

_____, Ocean Currents. California Sea Grant Marine Advisory Publication AXT-445-11.

Gosser, D. F. A drift-bottle experiment you can do. Marine Science Education Tips. (Ocean Currents 2). Oregon Sea Grant Marine Advisory Program.

National Consumer Educational Services Office, National Marine Fisheries Service, U. S. Department of Commerce. Food Fish Facts No. 1, 7, 10, 45.

Parmer, C. Zooplankton--The Ocean's Wandering Animals. Florida 4-H Marine Program. Marine Science 4-H Special Interest Series 4-H 31 110.1M.

_____, Shark Facts. Florida 4-H Marine Program. Florida 4-H Special Interest Series 4-H 31 110.4M.

Seltz, J. The Dune Book--How to Plant Grasses for Dune Stabilization. University of North Carolina Sea Grant College Publication UNC-SG-76-16.