

Reports

1961

Salt-water Aquaria

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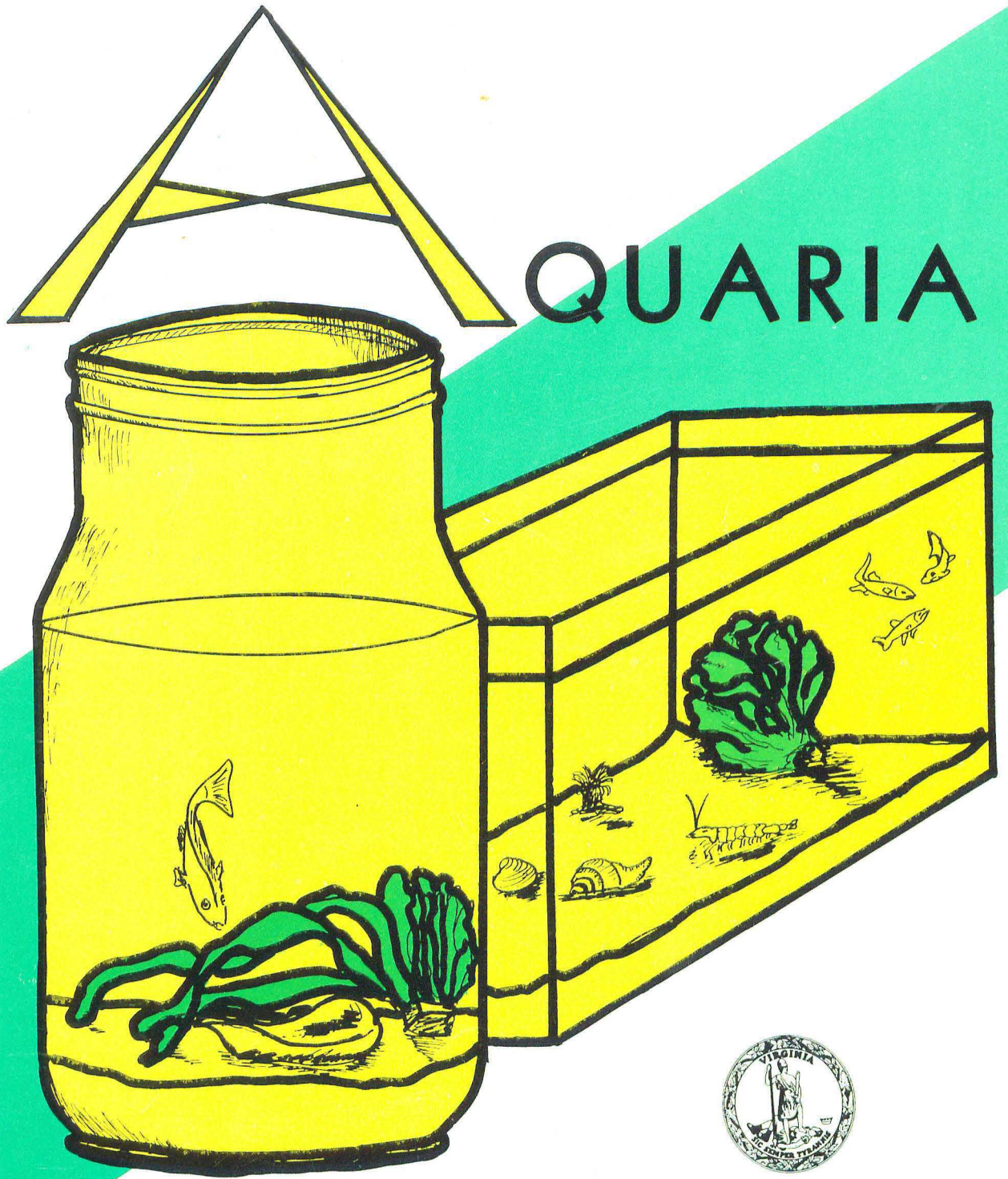
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Salt-Water



QUARIA



Virginia Institute of Marine Science

VIRGINIA FISHERIES LABORATORY

GLOUCESTER POINT, VIRGINIA



Salt-Water

AQUARIA

Information in this Booklet Compiled, Edited
and Published Through the Facilities of the

VIRGINIA INSTITUTE of MARINE SCIENCE

Virginia Fisheries Laboratory

Gloucester Point, Virginia

by Staff Information Officers

R. S. BAILEY

FRED C. BIGGS

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CONTENTS

INTRODUCTION	4
I. ESTABLISHING THE AQUARIUM	5
Container	5
Sand	6
Sea Water	6
Sea Lettuce	6
Lighting	7
Large, Permanent Aquariums	7
II. ANIMALS TO INCLUDE AND WHERE TO GET THEM	8
A Class Project	8
Where To Look For Specimens	9
Collecting Seasons	10
Special Handling of Clams	10
Animals That Clean The Aquarium.....	11
III. MAINTAINING THE AQUARIUM	15
Changing Water	15
Feeding	15
Cleaning The Aquarium	16
Aeration	16
Troubles and Remedies	17
IV. LEARNING FROM MARINE ANIMALS	18
V. APPENDIX	20
A List Of Gallon Aquarium Animals	20
Combinations For The Gallon Aquarium	20
Artificial Sea Water	20
Conversion Table	20
PHOTOGRAPHS OF AQUARIUM ANIMALS	12

INTRODUCTION

This booklet suggests ways to establish and maintain low cost aquaria, and it should be a helpful guide to the various salt-water animals that might be kept in classrooms. It also points out methods of securing and caring for marine animals and plants. The information is intended for use by teachers and biology students, and will assist elementary school children in establishing classroom aquaria.

Students of biology should work with living material. Marine life should be studied at the seashore, but additional information can be gained through the use of aquaria. This booklet contains suffi-

cient information to enable teachers and students to successfully keep a variety of marine animals alive for close observation.

Problems confronting the aquarist stimulate the imagination. Observation of live animals brought into the classroom arouses curiosity and sets the stage for interest in biological study.

Elementary school children may also profit from aquaria in their classrooms. Students of every age should cultivate the practices of questioning, observing and evaluating what they see. An attractive aquarium can encourage development of these attitudes.

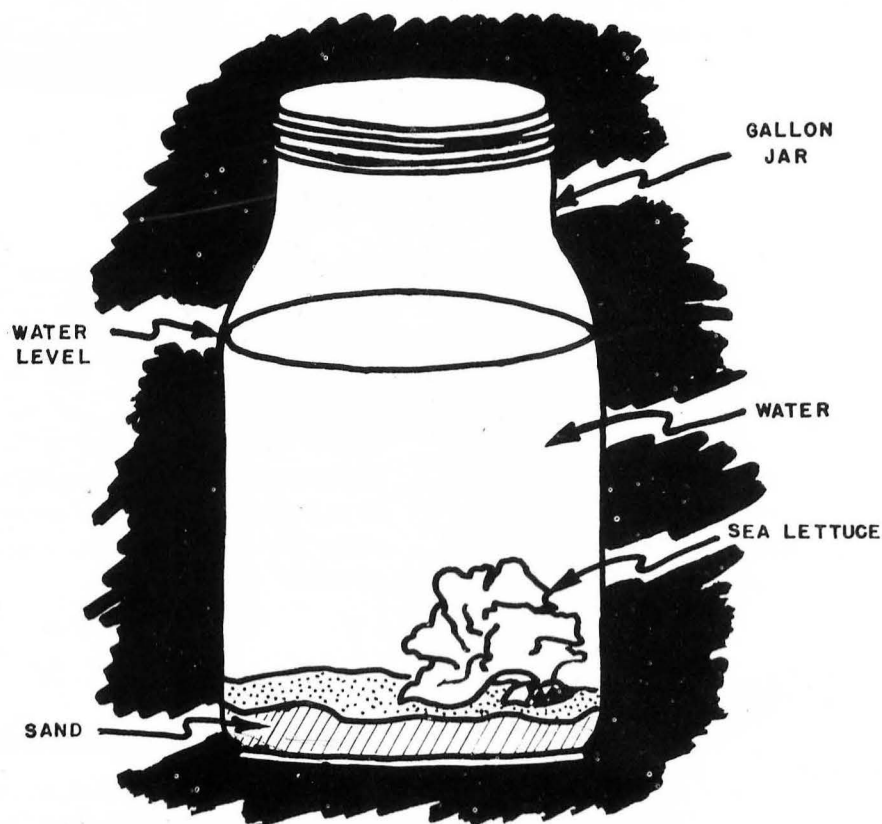
I

ESTABLISHING THE AQUARIUM

Greatest teaching values come when students set up and maintain their own aquaria. This prompts a more thorough

understanding of the principles involved in both the aquarium structure and its contents.

Container



GALLON AQUARIUM

An elaborate permanent aquarium is costly. Bearing this in mind, we will discuss principally a type of aquarium your school can assemble with relatively little cost involved.

Empty gallon jars (mayonnaise, mustard, pickle) obtained from drug stores, school cafeterias or lunch counters may be used with or without aeration.

Sand

Clean the jar thoroughly, and then place an inch of clean sand in the bottom. Either buy the sand from a pet shop or secure clean sand from a nearby beach. Select wet sand from the area where waves wash ashore. This will be easier to clean. Use small grained sand. Gravel size sand is unsatisfactory because bits of food will lodge in spaces and decay. As a result bacterial growth may kill your marine specimens.

Wash sand clean by adding half a jar of water (either salt or fresh). Stir the water and sand mixture vigorously and pour off the water before the silt settles. Repeat this until the water remains clear.



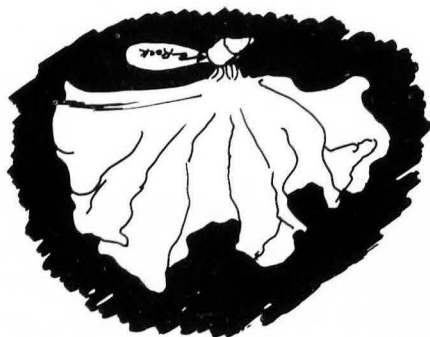
Sea Water

Fill the jar with sea water only to where the container's shoulder begins to curve. This provides the largest surface area through which oxygen from the air may dissolve in the water. It is best to use water from the locality where the animals were collected. However, a satisfactory artificial sea water may be devised according to a formula printed in the appendix. If you use natural sea water,

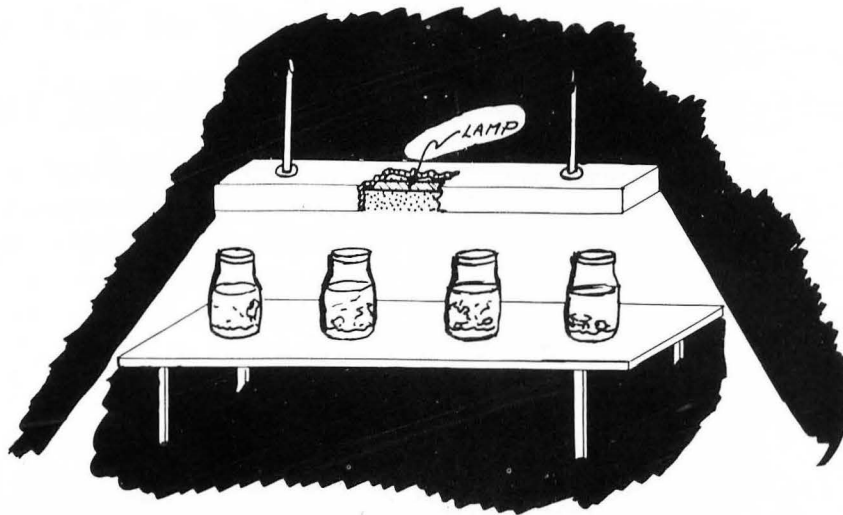
keep some extra on hand for a water change if needed (this is discussed in Chapter III).

No aeration pump will be needed for these small aquaria, but *be sure not to crowd them!* Only one or two small animals may be kept successfully at one time in a gallon jar. If you want more specimens for your display, simply add more aquaria.

Sea Lettuce



Sea lettuce (a brilliant green sheet-like alga) should be placed in each jar or tank. The plant you select should be attached to a shell or rock since unattached plants often die quickly. Sea lettuce about the size of your hand will be right for each gallon of water. This plant will add oxygen to the water, remove carbon dioxide and nitrogenous wastes produced by the animals and add beauty to the aquarium.



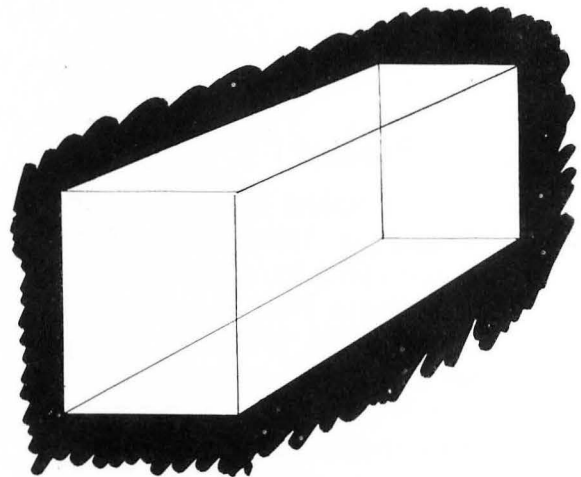
Lighting

If you have several aquaria in line on a single table and desire lighting to accent the display, this may be accomplished by devising a valance hood containing fluorescent lamps. This will focus atten-

tion on your display and enhance its appearance. Use your own imagination in this. Do not use high wattage incandescent lamps that will over-heat your aquaria and kill the animals.

Large, Permanent Aquaria

Of course, more elaborate (and also more expensive) aquarium containers are available. You may wish a permanent one for your classroom. We recommend the use of the new Plexiglas tanks which are now available and are especially suitable for marine aquaria because they have no metal frames to corrode. Care should be exercised to avoid scratching the sides since Plexiglas is not as hard and scratch-resistant as glass. Wiping the inside of the tank with a paper towel every few days will help keep it sparkling clean.



II

ANIMALS TO INCLUDE AND WHERE TO GET THEM

Try keeping a variety of sea animals. Those that will not survive for long in the classroom may be brought in, exhibited to classes and then returned to their

native habitats. Experience will teach you which will adapt themselves to aquarium life. These may be held several months.



A Class Project

Collecting aquarium animals might be a class project, or better still, might be a project attempted by a small group of interested students. Plan to arrive at the beach when the tide is low so that you can collect beyond the intertidal level. If the weather is too cool for bathing suits, rubber boots should be worn.

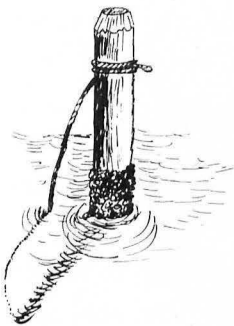
A minnow seine is very suitable for catching small fishes, shrimps and crabs in shallow water. A wide variety of animals live in beds of seaweed. Small animals are preferable to large ones unless your tank holds fifty or more gallons.

Where to Look for Specimens

Explore waters near home before going to distant places. If impossible to collect in an area near where you live, or if you live in a region far removed from salt water, trips to Virginia's marine laboratory at Gloucester Point may be planned. Write to the Information Officer, Virginia Institute of Marine Science, Virginia Fisheries Laboratory, Gloucester Point, Virginia, to secure an appointment before scheduling a collecting trip. Collecting gear will be provided for your use.



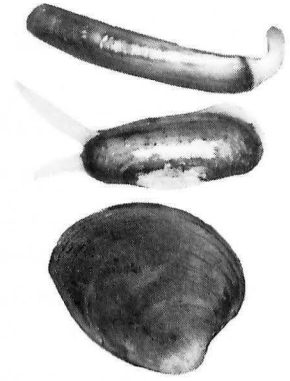
Some animals are attached to submerged objects. Look for barnacles, oysters and mussels on old pilings. They can be pried loose with an oyster knife or a screwdriver. Old weathered pilings free from creosote, which is used to preserve pilings because it is poisonous to marine animals, are the best places to collect attached animals.



Sea anemones, shrimps, mud crabs and many small animals are found on sponges attached to pilings. Other interesting animals are attached to oyster shells. Do not

attempt to keep sponges in your aquarium for they die quickly and contaminate the water.

Soft shell clams and razor clams, which live on many tidewater beaches, may be dug at any season with a shovel when the tide is out. They are easily dug in winter when tides are extremely low and the clams less active than in warm weather.



Collecting Seasons

Fishes, crabs and shrimps are not usually available in winter, so arrange to collect them in early autumn or spring. Other

animals, including oysters, clams and mussels, can be collected year-round.

Special Handling Of Clams



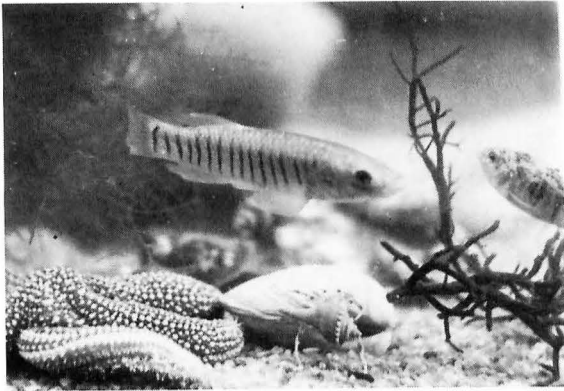
Clams (other than the hard shell commercial type) should be placed in jar aquaria two-thirds filled with muddy sand just as it is found (unwashed) on the beach where the clams are dug. They need the mud to help hold their shells together. Pour enough sea water into the jar to cover the mud two or three inches.

It will be interesting to watch the clams dig into the mud and extend their siphons to feed. The foot with which a clam digs may be seen clearly if the clam is placed against the side of the aquarium.

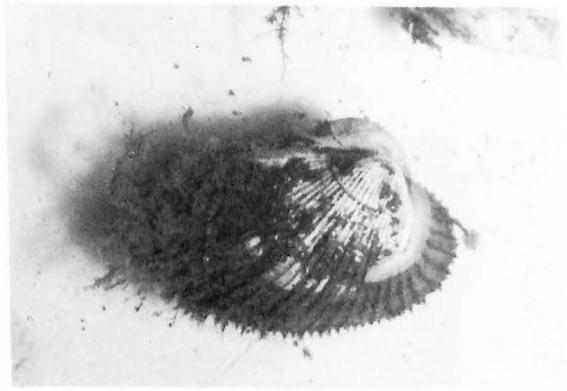
Animals That Clean The Aquarium

Clams, oysters, mussels, barnacles and sea anemones help keep the aquaria clean, for they feed on juices and small particles

of food fed to other animals. They also consume algae and other microorganisms which may grow in the water.



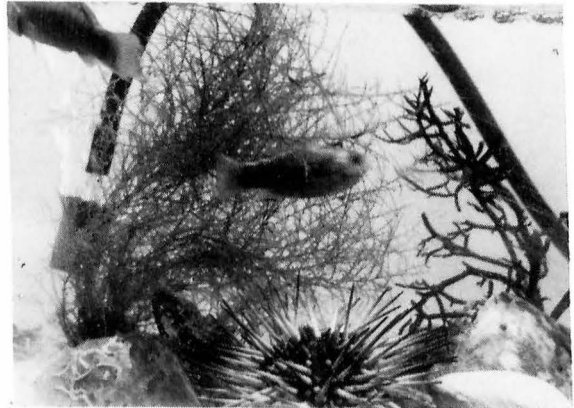
Striped Killifish



Bloody Clam



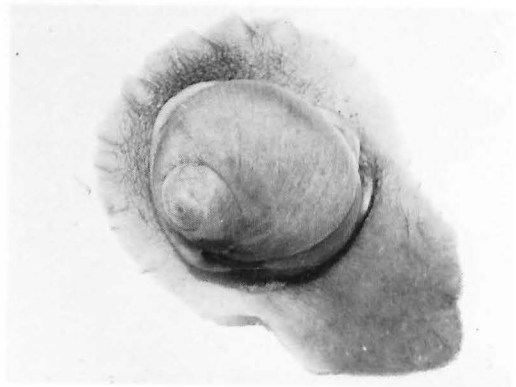
Mud Crab



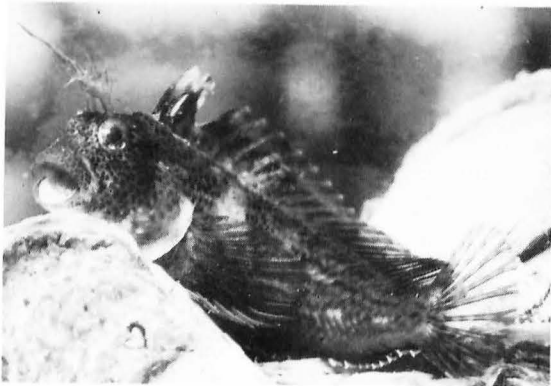
Sea Urchin (foreground)



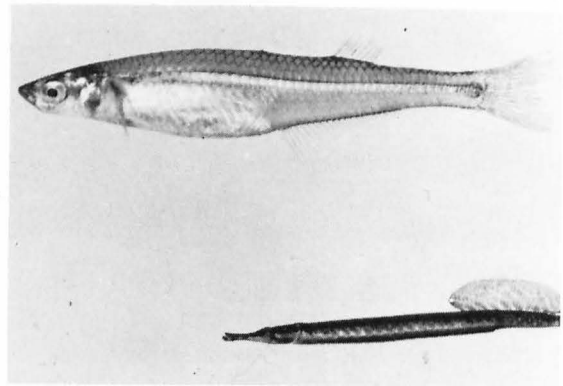
Oyster Drill



Moon Snail



Horned Blenny



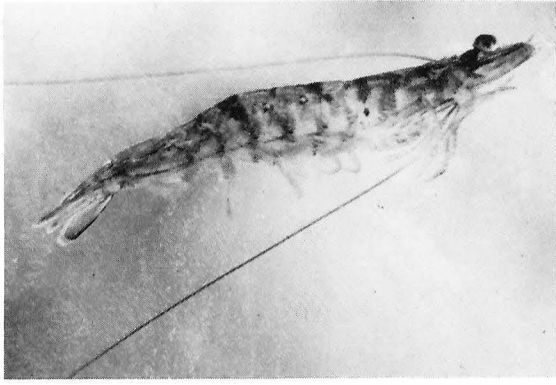
Silverside (above) and Pipefish



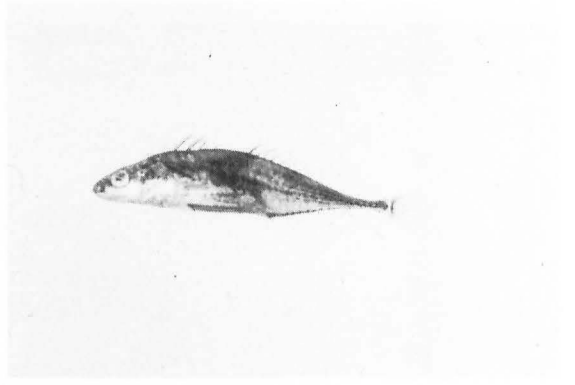
Pipefish



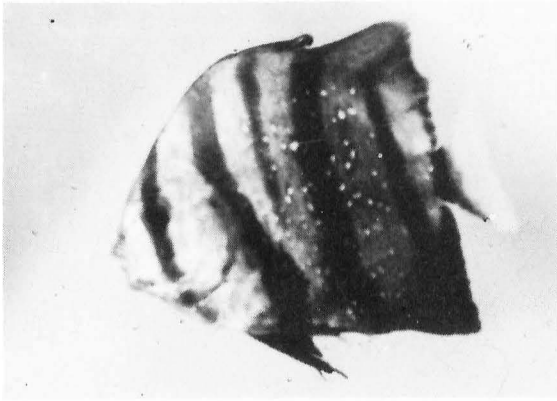
Seahorses



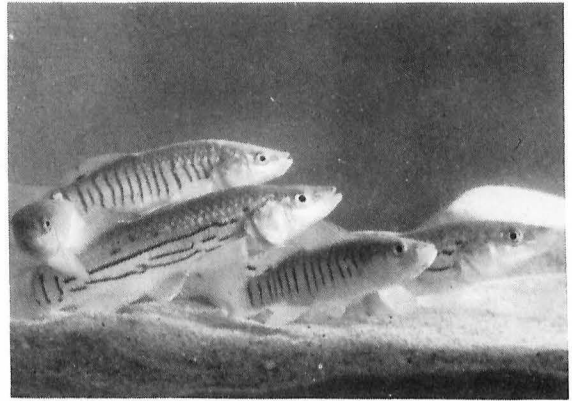
Shrimp



Stickleback



Spadefish



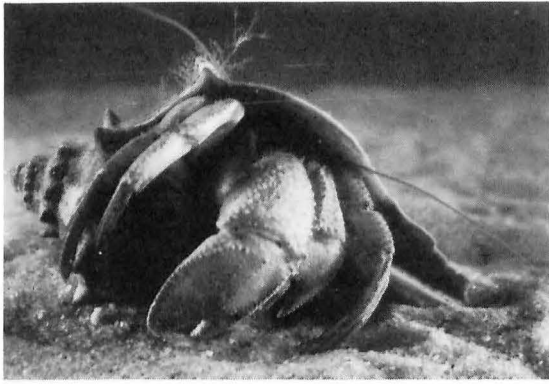
Male and Female Striped Killifish



Conch Laying Eggs



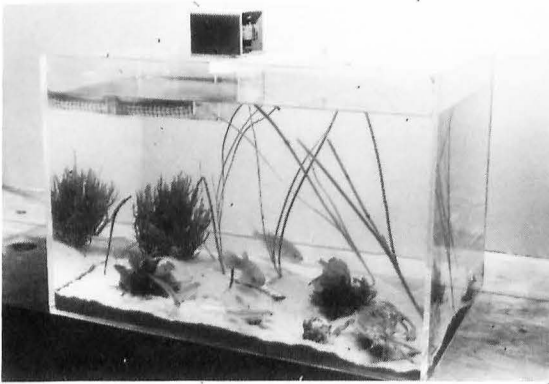
Spider Crab



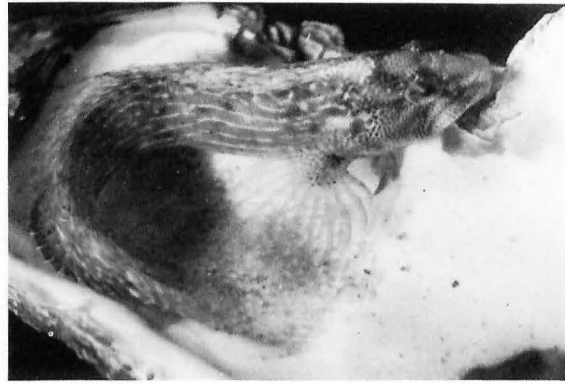
Hermit Crab



Red Finger Sponge



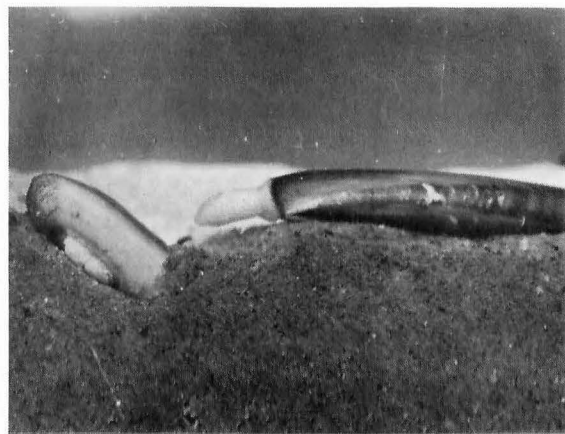
Plexiglas Aquarium Showing Silversides, Killifish, Eelgrass, Red Finger Sponge, Sea Lettuce and Crabs



Blenny in Oyster Shell



Whip Coral, Barnacles, Hydroids and Shellfish



A Softshell and a Razor Clam

III

MAINTAINING THE AQUARIUM

It is important to know from the beginning proper means of maintaining your aquarium. The following information will

guide you in changing water, feeding, aerating and cleaning.

Changing Water

It is not necessary to change water in your aquarium unless an animal dies, causing bacterial growth to occur. This condition can be detected by discoloration of the water. Other animals in the aquarium will die unless this contaminated water is replaced with a fresh supply. If you detect the dead animal before the water clouds up, simply remove the carcass right away and there will be no need for a water change.

As water evaporates from your aquarium, add fresh water to maintain the original level. A piece of glass or plastic

placed over the aquarium will help prevent evaporation, keep animals in and dust out.

Those who have large aquaria (10 gallons or more) will find it helpful to remove one gallon of water each week and replace it with fresh sea water. Some unknown substance in fresh sea water seems to benefit aquarium animals enabling them to live longer. Before adding the water, allow it to stand in the room until its temperature is the same as that of the aquarium water. Fresh tap water allowed to stand overnight may be added to keep the water level constant.

Feeding

Feeding aquarium animals is not difficult and can be done with tropical fish food. Such food is labeled "fine," "medium," or "coarse." Unless your fish are very tiny (less than $\frac{3}{4}$ inches long) or oversized (more than 3 inches long), "medium"-sized food is best for them. *Never over-feed!*

Ribbed mussels may be collected along marshy creek or river banks where their beaks stick out of the mud. Dig up a clump, allowing mud to remain on them. Keep them moist and in a cool place. They will live many weeks, and when cut into bits make excellent food for all the aquarium animals.

The juice of mussels, clams and oysters is fine food for sea anemones, corals, hydroids, oysters and clams.



A small piece of meat placed on the tentacles of an anemone will be grabbed and thrust into its mouth. Be sure to see this!

Tiny bits of *raw, lean* meat or liver are excellent food to use occasionally. Canned cat food is acceptable to most salt water animals, but may induce bacterial growth in the tank since juices and small particles cannot be removed easily from the water. Oysters, clams and fish, when available, may be used for food, but *don't over-feed the animals.*

It is easy to understand how students

might kill their watery friends with intended kindness by over-feeding. Growing boys and girls often have ravenous appetites and greatly enjoy frequent snacks. However, aquarium animals should usually not be fed more often than once a day. Unless the food is consumed immediately, it should be removed from the tank. Any scraps left in the tank will decay and cause trouble. During cold weather many animals will eat nothing for days or even weeks at a time. *Do not leave food in tanks when animals are not hungry!*

Cleaning The Aquarium

Long-handled forceps can be used to remove pieces of uneaten food and dead animals. They are also useful in arranging oysters, mussels, clams and plants in an attractive manner. They are excellent for handling crabs.

Check daily to be certain that snails, oysters and clams in the tank are alive. If even a small animal dies and remains undetected for several hours, the water will cloud up and must be changed.

A dip tube (purchased from a pet shop for a few cents) will be useful in removing small food particles and trash. *Never leave food in the tank to decay!*

One-celled plants (algae) may grow on the sides of aquariums and be unattractive, but they will not harm the animals. Keep algal growth down by wiping the inside walls of the aquarium with a soft clean cloth or a paper towel every few days. Should the inside walls become ugly with algal growth, then clean with a razor blade and remove the scrapings with a dip tube. Oysters, clams, and barnacles, which are plankton feeding animals, consume one-celled plants and help keep the aquarium clean.



Aeration

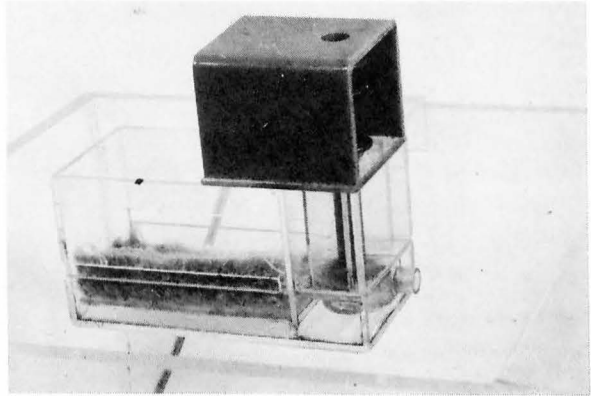
Aquaria holding more than two gallons of water will require an aerator. A very satisfactory one may be bought for ten or eleven dollars from an aquarium supply

store, mail-order house or the ten-cent store. This aerator will also operate a filter system that will keep the water clean.

A more elaborate combination aerator

and filter may be set up as shown in the accompanying picture. All these supplies are available from pet shops, but if you are unable to afford them you may simply aerate the water by hand. Pump air in with a syringe or dip water from the aquarium and pour it back. If hand aeration is used, keep fewer animals in the tank than you would if constant aeration is used.

The most satisfactory aerator-filter is the impeller pump shown in the illustration. The initial cost is high, but it will last for a long time. When the pump is working, water is filtered, aerated, and circulated all at one time. An electric timer is useful for cutting the pump on and off at hourly intervals.



Troubles and Remedies

Do not be disappointed if you do not meet with immediate success. Remember that some animals live much better than others. Experience will soon teach you which animals are easy to keep and which will require changes of water and special attention.

The most likely killers of your aquarium will be:

1. Over-crowding
2. Excessive heat
3. Over-feeding

Most failures at keeping salt water aquaria will disappear if these trouble factors are avoided.

Animals living in water must have oxygen and the water in an aquarium can dissolve only a limited amount. *Do not crowd too many fish, crabs, snails, and other animals into tanks!* Allow one inch of fish, exclusive of tail, for one gallon of water to assure an adequate supply of oxygen. Perhaps this is being over-cautious, but animals crowded in jars or tanks will soon come to a tragic end. Re-

member that *all* animals (oysters, clams, and barnacles as well as fish) require oxygen, and they can use only oxygen which is dissolved in the water surrounding them.

It is less difficult to maintain aquaria in cool weather than in hot, largely because oxygen dissolves more readily in cold than in hot water. Furthermore, animals are less active at low temperatures and require less oxygen. Aquaria placed near radiators or in direct sunlight may become overheated. Select the coolest spot in your room to place your aquarium. Sunlight is helpful to marine plants but may heat the water to an unbearable temperature. Direct sunlight is not desirable. Fluorescent tubes may be used to supply light without producing much heat. Aquarium animals do not require sunlight.

The possibility of over-feeding has already been adequately stressed. Feed animals only when they are hungry, and feed them only an amount they will quickly consume.



IV

LEARNING FROM MARINE ANIMALS

Students and teachers will become acquainted with a variety of marine animals and will observe them in their native habitat while collecting for their aquaria. This in itself is worthwhile.

By observing the animals in the artificial environment, further knowledge may be obtained and many questions may arise, and answers be discovered.

A variety of organisms maintained in the classroom often helps the student understand what he reads in textbooks.

Adaptations and the environmental requirements of organisms can be studied firsthand.

Crabs may regenerate lost legs.

Barnacles will be seen waving feather-like legs through the water as they gather food. The shadow of a hand waved between them and the light will cause them to close tightly.

Shells of barnacles, shrimps and crabs may be found in the tank, and perhaps

these animals will be observed in the process of shedding.

Oysters will snap their shells together to purge themselves of waste material.

Sea anemones will draw bits of meat into their sac-like stomachs.

Animals may be used for demonstrating reactions to stimuli or to illustrate special structures and behavior patterns.

Many elementary school teachers use salt water animals to motivate instruction in spelling, defining words, and as subjects for composition and art. Pupils

whose interests have been aroused are anxious to learn more about sea animals and plants and thus are led to read magazines and books.

An important lesson which these simple animals may teach all of us is a respect for life. Teachers and pupils often go to considerable trouble to return living animals to their native haunts after they have served their classroom purpose. Will you, too, respect and care for marine animals which have depended on you and have given you a clearer insight into the meaning of life?

V

APPENDIX

A List of Gallon Aquarium Animals

CRABS	CLAMS	FISH	SNAILS	MUSSELS	MISCELLANEOUS
spider	soft shell	killifish	moon*	ribbed	shrimps
mud	short razor	clingfish	mud	bent	pistol shrimp*
hermit	long razor	silversides	periwinkles	blue	mud shrimp*
blue	hard	pipefish	oyster drills		hydroids*
	angelwing	goby	conch		whip coral*
		blenny			comb jellies*
		seahorse			stinging nettles*
		mud toad			red finger sponges*
					barnacles

*Interesting to keep for a few days, but do not survive well.

Note. Sponges do not survive well and should not be placed in aquaria with other animals, even for a day.

Sea lettuce (*Ulva*) is the best aquarium plant. Others may be kept for a short period.

Eelgrass may survive for several weeks in well-lighted aquaria.

Combinations for Gallon Aquaria

The following are some possible combinations of marine animals you might include in your gallon aquaria.

1. A medium-size oyster with barnacles attached and one killifish.
2. A medium-size oyster with several anemones and two or three small shrimp.
3. One or two small blue crabs and a clingfish.
4. A small clam, a shrimp or two, and a pipefish.

Artificial Sea Water

Artificial sea water (satisfactory for many animals) may be made by mixing the following salts in 22.2 liters† of pure water (rainwater preferably) in the amounts indicated:

Calcium chloride crystals (CaCl ₂ ·2H ₂ O)	30.2g
Magnesium chloride crystals (MgCl ₂ ·6H ₂ O)	103.5g
Magnesium sulfate crystals (MgSO ₄ ·7H ₂ O)	139.6g
Sodium bicarbonate (NaHCO ₃)	4.5g
Sodium chloride (NaCl)	549.3g
Potassium chloride (KCl)	14.9g

†Conversion Table:	1353 cu. in	=	5.86 gal.
	5.86 gal.	=	23.44 qts.
	23.44 qts.	=	22.2 liters