# Ocean Animal Aquarium

**Collection of Intertidal Organisms**
**Mini-Marine Ecosystem**

## *Teachers' Guide: Lessons and Activities*

**Prepared by Becky Lash**

What can you do with an ocean animal aquarium in your classroom? How can you involve the students in its set-up and maintenance? How can you keep the students' interest level high and continue to have the aquarium be a focal point of activities, rather than neglected once the initial novelty wears off? And... *How can you use the aquarium to teach across curriculum areas?*

This teachers' guide is intended to help you with the answers to these questions. What follows are ***suggestions*** for activities and ways to integrate the aquarium into daily classroom activities.

You can pick and choose from the activities and suggestions in this guide. Use what works for you and your class. You are sure to come up with your own ideas.

# *Before the Tank Becomes an Aquarium: Math Activities*

## Younger Students K-2

### *Materials*

- empty ten-gallon aquarium
- rulers/measuring tapes
- math materials for exploring properties of rectangles
- ten one-gallon jugs of tap water, displayed where kids can see them

*Before beginning: Do not tell the students ahead of time how much water the tank holds*

### *Activities*

Students identify:

- each glass side (face) of the tank as a rectangle, with four straight sides, each pair of opposite sides being the same length.
- other objects in the room that are shaped like rectangles.

Students take measurements to find out:

- how long each side of one of the tank's sides/faces is in inches/feet/cm.

Students trace or draw:

- rectangle the same size as one of the tank faces.

## Older Students 3-6

- empty ten-gallon aquarium
- rulers/measuring tapes
- several clean, empty, calibrated containers of various sizes (bottles, food tubs, cartons, jugs)
- ten empty, one-gallon water/milk Jugs or 20 two-liter soda bottles

*Before beginning: Find out how much the Empty aquarium tank weighs and do not Tell the students ahead of time how much water it holds*

Students identify:

- tank as rectangular prism (with a missing face).
- each face as a rectangle.
- three pairs of congruent/equal faces.
- eight edges and vertices.
- the face that will be the base that the tank will sit on to hold water.

Students take measurements calculate:

- the area of each face in square inches centimeters. (*length x width)*
- the volume of the tank in cubic in./ft./cm. (*length x width x depth)*

Students predict:

- the capacity of the tank in gallons/liters.

Students calculate:
- the area in square inches of the rectangles they drew, using tiles or the algorithm *length x width.*

Students predict:
- how full the tank will be when one gallon jug of water is poured into it. (*they can indicate what they think the water level will be by making marks on a strip of masking tape going up the side of the tank.)*

Students observe:
- that one gallon of water is only About one inch deep in the tank.

Students predict:
- how many more gallons it will take to fill the tank with water.

Students observe:
- that it takes a total of ten one-gallon Jugs to fill the tank (*Younger children Are usually amazed that it takes this many.)*

Students test predications using jugs of tap water.

Students identify:
- the number of quarts, pints, cups, and Fluid ounces in one gallon.

Students calculate:
- capacity of tank in qt, pt, c, fl.oz.

Students determine:
- weight of one gallon of water (8.3 LB).
- total weight of the aquarium when full of water *(Discuss the strategies students use to do this).*

***Caution! Do not move the tank when it's full of water. It could spring a leak. Scoop out the water before moving it.***

***Additional topics to explore:*** Properties of liquids

## *Setting Up the Aquarium: The Day the Seawater Arrives*

***Before beginning:*** *Choose a location for the tank in a cool spot in the room, out of direct sunlight, away from the heater, near an electrical outlet, and where there is ample viewing room for the kids.*

### *Materials*

- the aquarium tank
- under-gravel filter
- tubes that came with the filter
- air pump
- tubing to connect pump to filter tubes
- gang valve (air control valve)
- gravel
- aquarium thermometer

***Arrange the aquarium supplies where the kids have a chance to handle them and come up with ideas about what each piece is for, and how all the pieces might go together when the aquarium is set up.***

### *Activities*

**Younger Students K-2**

Students discuss:
- the needs any organism has for survival *(the right habitat, space, food, oxygen, Temperature range, light conditions, Clean environment).*

Students discuss:
- what is needed to make the aquarium tank a good place for the sea organism to live.

**Older Students 3-6**

Students discuss:
- the needs any organism has for survival *(the right habitat, space, food, oxygen, temperature range, light conditions, clean environment).*

Students discuss:
- what is needed to make the tank a good environment for the marine organisms

Students discuss:
- the ways the undergravel filter, tubes, pump and gravel might go together to bubble the water and keep it filtered.

Students identify:
- the different pieces of aquarium equipment.

Students discuss:
- how the pieces of equipment might work together to maintain the quality of seawater in the tank.

Students observe:
- as the aquarium is set up, the seawater poured in, and the pump plugged in.

Students discuss:
- what they think is happening to the water in the tank once the pump is plugged in.

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*You can explain to the students that the water temperature needs to stay around 65°, because the animals that will be arriving live in apart of the ocean where the temperature ranges from about 40° to 70° during a year. Also, the lower the temperature of water, the more dissolved oxygen it can hold. Oxygen is important to the animals and to the bacteria that make up the biological filter.*

*Let some volunteers stick a finger in the water to taste it and describe its saltiness.*

Students discuss and learn:
- that this water comes from the sea in Woods Hole, Massachusetts.
- that the water of all the oceans of the world is salty.
- that most of the sea animals would not be Able to survive in fresh water.

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Students do research (books, internet) to find out:

- ***Why are the oceans salty*** *Mostly from mineral salts washed into the seas from actions of erosion and weathering and accumulating over the past several billion years.*

- ***How salty is the ocean?*** *About 3.5% (35 parts per thousand.) For every 1, 000 pounds* of *water, 35 pounds are salt - about the same as that in the human body. 85% of the salts in the seas is sodium chloride, NaCl, which is common table salt.)*

***Other Topics/Question/Activities***

- *Can the needs of marine organisms be met long-term in the classroom aquarium?*

- *Look at table salt crystals with hand lenses to observe the cubic crystal structure.*

- *Dissolve table salt in water. Place the solution in a warm, dry location. Observe the salt crystals left behind as the water evaporates. Compare this to how salt is left behind in the oceans as part of the water cycle.*

- *Learn about density/buoyancy of salt water.*

- *If any of the students have an aquarium or fish tank at home, either fresh or salt, have them tell about it.*

- *Visit an aquarium in your community.*

## *Awaiting the Organisms*

*Once the aquarium has been set up and is bubbling away, and you are waiting for the shipment of organisms, you can do activities to give the students some background knowledge, and peak their interest. You could tape a sign like this to the tank:*

> **Coming soon to this tank:**
>
> ***Brittle Starfish*** *(Ophioderma)*
> ***Common Starfish*** *(Asterias forbesi)*
> ***Coral*** *(Astrangia)*
> ***Grass Shrimp*** *(Palaemonetes)*
> ***Hermit Crab*** *(Pagurus longicarpus)*
> ***Periwinkle Snails*** *(Littorina)*
> ***Sea Urchins*** *(Arbacla)*
> ***Sea Cucumbers*** *(Sclerodactyla)*
> ***Mussels*** *(Mytilus)*
> ***Barnacles*** *(Balanus)*
> ***Sea Lettuce*** *(Ulva)*

### Younger Students K-2

**Materials**

- **picture books,** articles from magazines such as Ranger Rick about seashores and the organisms that live there, especially coastal organisms of the North Atlantic (see Bibliography)
- **shells** and other seashore objects the kids might have at home and can bring in.
- any other available resources about the seashore

Students discuss:
- what they already know about seashores and seashore animals

Students are introduced to:
- the animals that will be living in the aquarium; through picture books read aloud, and other resources and activities.

### Older Students 3-6

- **Resources** with information about coastal organisms of the North Atlantic; books, articles, web pages. (Recommended: A Field Guide to the Atlantic Seashore in the *Peterson Field Guide Series*, and Seashores in the Herbert Zim Golden Guides series.

Students discuss:
- what they already know about seashores, marine organisms, and the organisms that will be living in the aquarium.

Students do research to learn out about the organisms that will be living in the aquarium. They can present their findings to the class.

## *The Organisms Arrive*

*Hopefully, the organisms will arrive when the students can watch as they are put into the aquarium. Follow the directions in the section* **Organism Care Upon Arrival.**

## *Suggested Aquarium Precautions:*

*- Keep a cover on the tank, such as clear " plexi-glas ".*
*- Don't let the kids put their hands or anything else in the tank.*
*- Check often to make sure the pump is always plugged in and running, and that no tubing has become disconnected, especially before leaving for the weekend.*
*-The animals will last longer if the kids don't handle them.*

### Younger Students K-2

### Older Students 3-6

***Questions for discussion while observing the animals go into the tank:***
*Do the organisms look the way we thought they would?*
*What will they do when they first are put in the tank? Will they explore?*
*Will they seem scared? Will they hide?*
*How will we know when they are hungry?*

Students identify the organisms based on what they learned during the previous activities, and by using field guides.

Students create: a poster identifying the animals in the tank, using drawings or pictures cut from magazines.
*This poster can be kept near the tank for reference.*

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## *The Aquarium as a Learning Tool Over Time*

## *Some suggested activities:*

» Create a slideshow on the computer. Using an application such as *KidPix* or *Powerpoint,* each student can do research about one of the animals in the tank, make a drawing, and record a voice-over of information about that animal.

» Observation Journal. Keep a notebook next to the tank, where students can record their observations and thoughts. It could be a different student's job each day to write something in it, or students could make entries whenever they have something they'd like to write about.

*A second grade class recorded the following in an observation journal:*

"A starfish was ripped by a sea urchin. Its jaws came out, and pulled at the starfish."
"The seaweed disappeared. The hermit crabs ate it, I think."
"The sea cucumber divided."
"The sea cucumber puffed up."
"I saw a starfish on a clam."
"The brittle stars disappeared. Maybe they were eaten."
"Animals are dying. They're being eaten."
"There is a, dead hermit crab without a shell."
"The sea cucumber is ugly."

These observations can lead to interesting discussions. Younger students often have their own interpretations of what they're seeing. (The "dead hermit crab without a shell" was a molt.)

*** Have the students look in particular at *animal behaviors.* What are the animals *doing? Do* they sit, swim, hide, crawl, scurry, scuttle, look for food? How do they interact with each other? Who is eating whom?**

» "Things we want to know". Keep a list of the kids' questions that they can add to as they think of them. The questions can be used for ongoing research skill activities, or as jumping-off points for discussions.

*Among those that a second grade class came up with:*

**How many babies can a crab have?**
**What is the orange spot on the starfish?**
**How do the animals breathe under water?**
**Can snail see?**
**Can snails hear?**
**What is the largest crab in the world?**
**What would happen if we put the animals in fresh water?**
**How does a snail make its shell?**
**Could we put some goldfish in the tank?**

## *Additional Integrated Topics and Activities*

Math

- **Symmetries**: radial and bilateral. Create drawings or cut-outs showing bilateral symmetry (crab, shrimp, anemone, sea urchin, starfish), and radial symmetry (anemone, urchin, sea cucumber, starfish).

- **Multiplication and division of fives**, based on the number of arms each starfish has:
  - If you have six starfish, how many arms are there all together?
  - If you had a total of 45 starfish arms, how many starfish would you have?
  - Draw a picture of starfish to show 4 x 5.
- Write the fact family to go with this sentence (or picture): *There are nine starfish. Each one has five arms.*
- **Multiplication and division of tens,** based on the number of legs crabs and shrimp have. *Decapod crustaceans have ten ("deca") legs ("Pod").*

Language Arts

- Have fun with figures of speech involving marine organisms. - "happy as a clam" "move at a snail's pace" Have the students make up their own sayings

and similes based on observations of the tank animals. "As snug as a hermit crab in a snail shell."

- Come up with a list of descriptive terms for different ways the animals move; swim, scurry, *sidle, scuttle, scoot,* crawl, whip, ooze, climb. Have the kids use the words in sentences, paragraphs, stories.

- **Library/Research skills** Have students practice using the index and table of contents to find topics and information in a field guide/nonfiction book about marine life. Have them compare which is faster; thumbing through the pages until you see what you're looking for, using the table of contents, or using the index? (Game - say a topic or the name of an organism, see who can find it first in the book and explain which method was used -random thumbing, table of contents, index.)

## Social Studies/Geography

- Create range maps to show where some of the organisms live, or to show migration routes of some marine animals (whales, turtles, eels and various other fish, shorebirds, terns, osprey).
- Compare oceans in different climatic areas of the world: polar, temperate, tropical.
- Learn about the effects of ocean currents on events in human history.

- Multicultural: Find out which marine organisms are eaten, and where (seaweed in Japan, periwinkles in Europe). Buy some packaged dried Nori seaweed at a grocery store or health food store for the students to try.

- Economics: Find out about local economies that depend, or have depended, on fisheries - oysters and blue crabs in Maryland, shrimp in the Gulf of Mexico, cod in Nova Scotia and Newfoundland, lobster and scallops in New England. Learn about the causes of declining populations of some of these marine animals, and the effects this has on local fishing industries and economies.

## Science

- Classification:
- Learn about how animals are divided into groups according to shared

characteristics. With younger students, this can begin with activities involving sorting and grouping of attribute blocks or common objects such as buttons or nuts and bolts.

- Learn the phyla - groups - to which the ocean animals in the aquarium belong: Mollusks, Echinoderms, Arthropods, Cnidaria. Learn about other interesting animals in those groups. (An octopus is a mollusk, jellyfish are cnidarians, insects are arthropods!)

• Food chains and food webs: Use different examples to trace the flow of energy from the sun - to green plants (which make their own food using the sun's energy) - to herbivores and omnivores - to omnivores and carnivores - to top predators. Make a mural to illustrate a marine food web involving animals in the aquarium, and any others that can be added to show how complicated a marine ecosystem really is. (Remember to include phytoplankton and zooplankton! )

***Bibliography, K-3***


Life in a Tidepool, by Allan Fowler; Children's Press, 1997. Ages 4-8.
ISBN: 0516260839

The Shell Book, by Barbara Hirsch Lember; Houghton Mifflin, 1997. Ages 4-8.
ISBN:0395720303

Beachcombing the Atlantic Coast, by Peggy Kochanoff; Mountain Press, 1997,
ages 9-12, ISBN: 0878423451

Animals of Sea and Shore (A New True Book), by Illa Podendorf; Children's Press.
Ages 4-8 ISBN:0516016156

Look Closer: Tide Pool, by Christiane Gunzi, Frank Greenaway, Deni Brown; DK
Pub. Ages 4-8 ISBN:0789429721

Shore Walker (Jim Arnosky's Nature Notebooks), by Jim Arnosky; Random House, 1997.
ISBN: 067986718-X

At the Seashore *(Look Once, Look Again* Series), by David M. Schwartz; Gareth Stevens Pub.
Preschool- Early Reader, ISBN: 0836822242

Starfish, by Edith T. Hurd; Thomas Y. Crowell Co, 1965. Gr. K-2

Tide Pool, Frank Greenaway, Dorling Kindersley, 1992.

Walk by the Seashore, Caroline Arnold; Silver Burdett, 1990. Gr. Pre-1

When the Tide is Low, Sheila Cole; Lee&Shepard, 1985. Gr. K-3

Is This a House for Hermit Crab? by Megan McDonald

Looking for Crabs by Bruce Whatley

The Seashore Book by Charlotte Zolotow

I Wonder Why the Sea is Salty and Other Questions About the Oceans,
Anita Ganeri
*Do you wonder which fish is the fastest, what causes waves in the ocean, or what sand is made of? This book has the answers!* Grades K - 3.

The World of Crabs, Jennifer Coldrey
*Discover where crabs live, why they leave their shells behind, and how they fit into the food chain.* Grades 2 - 4

### *K-3 continued*

Sea Animals, Angela Royston
*See photographs of dolphins, crabs, sea lions, starfish, and learn about these and other animals found in the ocean.* Grades K - 2.

The Seaside Naturalist, Deborah A. Coulombe. Simon & Schuster, 1984

A Field Guide to the Atlantic Seashore, (Peterson Field Guides) Kenneth L. Gosner,Roger Tory Peterson

National Audubon Society Field Guide to North American Seashore Creatures, Norman A. Melnkoth, Norman A. Meinkoth

Seashores, (Golden Guides), Lester Ingle, Herbert Zim

Wet and Wild: A Multidisciplinary Marine Education Teacher Guide, Grades K-6
Murphy, Richard C., Evaluation, Dissemination, and Assessment Center, 1983. ill. *A set of six units developed by the USC Sea Grant Program, organized around themes emphasizing different physical, chemical, and biological, economic and cultural* aspects *of the marine world. Each teacher guide contains information and activities for grades K-3 and 4-6.* Also available in Spanish. Order from: Evaluation, Dissemination and Assessment Center, California State University, Los Angeles, CA 90032.

## *Bibliography, Gr. 3-6*

The Seaside Naturalist, Deborah A. Coulombe. Simon & Schuster, 1984

A Field Guide to the Atlantic Seashore, (Peterson Field Guides) Kenneth L. Gosner, Roger Tory Peterson

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Living in Water:An Aquatic Science Curriculum for Grades 4-6
National Aquarium in Baltimore, 1989. 315p. ill.
*A comprehensive unit about water. Includes physical properties, habitats, how animals live in water, etc. Numerous hands-on activities, corresponding worksheets and tips for setting up and implementing the procedures.*

MARE: Marine Activities Resources and Education
Strang, Craig, Catherine Halversen and Roberta Dean, Regents of the University of California, 1995. ill.

The Lawrence Hall of Science in Berkeley, CA has developed a comprehensive program for marine science education. Units are available for all elementary age levels focused on the various marine habitats. The individual units maybe ordered from Lawrence Hall of Science (510) 642-5008 or through their website: http://www.lhs.berkeley.edu/EdResources.html.

Water Inspectors: Examining H20
Shinkle, Jill, California Aquatic Science Education Consortium, 50p. ill.
*Nine activities teach basic* scientific concepts related *to* the physical characteristics *of* water. Gr 5-9.

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Sea Soup: Zooplankton, Mary Cerullo,
*How can* creatures small *enough* to fit through *the eye of a needle* make a submarine "disappear?" *Find out* as you explore the world of *zooplankton* from *baby* shrimp to *nourishing krill* to giant jellyfish. Grades 5 - 8.

The Ocean Book: Aquarium and Seaside Activities for All Ages, Center for Marine Conservation. A variety *of* experiments *and* activities designed *for children* grades K - 6 *on* marine life, *food chains, and* ecosystems. Includes *a* useful reference list, glossary, *and* solutions to the activities.

## *Useful Web Resources*

http://www.education. noaa.gov
National Oceanic & Atmospheric Administration Education Resources
*For teachers and students. Lots of great information, pictures, maps and links.*

http://www.vims.edu/bridge
Ocean Sciences Teacher Resource Center, Information and online resources about the marine environment for students and teachers. Created by the Virginia Institute of Marine Science, sponsored by the National Marine Educators Association and the national network of NOAA/Sea Grant educators.
*Fantastic resources and links of all kinds.*