

PORT TOWNSEND MARINE SCIENCE CENTER

Marine Exhibit Docent Guide



April 2012

Marine Exhibit Guide
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Greeting the Public

Welcome, Marine Exhibit Docent!

Docents are the people who make a visit to the Marine Science Center something to remember! Marine Exhibit docents greet visitors, take admissions, and provide a friendly, informed presence in the exhibit, answering questions and helping to engage visitors in the exhibit. Volunteers can live out the mission of the PTMSC, ‘inspiring conservation of the Salish Sea’ by making connections with the exhibit and the marine environment it represents.

Generally, you will work with another docent under the supervision of the “staff of the day”. The staff person is responsible for staying on site and only leaving for short breaks and will generally have lunch in the building, so you will always have someone to go to for help. You should discuss with the other docent how you want to break up the tasks. You may want to take turns sitting at the greeter station and interpreting the exhibit, or one person can tell people the rules at the door while the other handles the money and then you can both interpret and keep an eye on the door for new visitors. It depends on how crowded the exhibit is. You will find what works for you. If you are brand new, you can be immediately useful by learning to greet people at the door and telling them the rules for touching animals.

When you greet visitors to the Center, you take admission, make sure that visitors know the rules, and as much as is feasible, talk with them about membership, upcoming events, camps, etc. Minimum age to run the cash register without an adult present is 16. Exceptions to the age limitation are based on number of volunteer hours (50 or more) and staff approval.

1. Take Admission

Make sure that visitors know there is an admissions charge. Admission is \$5 for adults (Ages 18 and above) and \$3 for youth (Children ages 5 and under are free) when both exhibits are open, \$3 for adults and \$2 for youth when only one exhibit is open. Members get in free. Also, people who have had their hand stamped at the Natural History Exhibit get in free and vice versa. There is no senior discount. Occasionally, some visitors will have free passes or “two for one admission” coupons. Staff of the day will notify volunteers about groups with pre-arranged discounts or who have already paid. You will be given individual instruction on how to operate the cash register.

Please encourage visitors to visit the Natural History Exhibit and stamp their hand as they leave the Marine Exhibit (to limit the amount of ink from the stamp that gets into the tanks). To keep track of visitors to the Center the greeter must count *everyone* that walks in the door, even Free or Stamped Admissions, on the cash register.

Please help keep the Greeter Station clean and orderly – remove trash, recycle receipts, keep belongings out of sight, refresh displays. If you drink coffee or read the newspaper during slow periods, please make sure to take them away when you leave so that others don’t have to clean up after you.

2. Give the Rules at the Center

It is critical to the safety of our animals and of the public that everyone who enters the Center knows the basic rules. It is best to learn the set script below and make sure that every visitor that comes through the door hears it. The basic script is as follows:

"Welcome to the Marine Science Center. Have you been here before?"

Whether the answer is yes or no tell them the following rules:

A. *"You are allowed to touch animals in the four touch pools against the wall. You may touch anything in them except for fish, crabs, and the tube feet on the underside of the sea stars."*

- (The tube feet are on the underside. The reason we don't want people to touch them is the tube feet can stick on skin and the star may be damaged when a person tries to peel them off. This is really only true for the Sunflower Stars but to keep the rule simple, just say Sea Stars. Don't touch fish to avoid rubbing off their protective coating; crabs pinch.)

B. *"Touch with one finger, please be gentle, and don't lift any animal out of the water."*

3. Encourage visitors to explore and point out the other docents and staff who can answer their questions.

4. Promote memberships and PTMSC events. Without being pushy, suggest membership. For example: "Welcome to the Marine Science Center. Are you a member?" (You need to know whether they are members in order to let them in free.) If the person says no, you can ask whether they would like to be, so that they can get in free for a year, especially if it's a large family group coming in at the same time. Also take some time at the beginning of the shift to familiarize yourself with upcoming PTMSC events. If visitors have kids, you can give them a camp flyer or mention an upcoming family event. Adults might be interested in upcoming lectures or the Protection Island cruises. You can also do this after the visitor has spent some time in the exhibit, so that you don't delay and irritate them when they first arrive. Use your judgment.

5. Give each adult a SeaWatch card(s). These pocket cards put out by Monterey Aquarium are handy in advising consumers about buying sustainably-harvested fish or sushi. Doing this helps make the connection between human actions and the health of the marine environment. Without being pushy, try to connect what's in the exhibit with current ocean issues if you can. You can also direct them to the Action Corner to learn more about what they can do.



**On the job training will be given on the cash register and credit card machine, but here are a few tips —
Remember, to err is human but documenting your mistakes is divine.**

Membership:

To sell one, follow the procedure for a normal sale and enter “membership” as the category.

Note: New members must fill out a membership form and should get a Membership Card (fill the card in with the expiration date stated as a year from the date of the membership purchase). Note that this was done, write the sale date on their membership form and place it in the cash drawer.

VISA/MASTERCARD Sales:

Complete the regular transaction through the cash register. Slide the credit card and get a signature on the receipt. Remember to check the expiration date and signature on their card!

Mistakes:

Everyone makes mistakes. If at any time you make an error or can not figure out where you are at in a sale just enter a bogus amount and push *CA/AT*. Take the receipt, write "VOID" on it and place it in the till. Start your sale again. Please always document mistakes so we can figure out why the receipts don't match the till!

PTMSC EXHIBIT DAILY JOB LIST

Completed primarily by staff, but volunteers may assist, especially with underlined tasks.

--Check with staff for the latest updates--

Opening Inside

- Turn on lights
- Sweep floor
- Uncover touch pools
- Check head tank levels and tank flows
- Check for dead & diseased animals
- Vacuum tank debris
- Scrub algae off acrylic (*staff only*)
- Set up cash register
- Check/clean the camera
- Empty trash cans
- Windex windows near entrance
- Wipe down tank bases

Opening Outside

- Place the white board out with programs and tides
- Put out sign at end of dock
- Open front doors
- Raise flag
- Put out "OPEN" sign on exterior wall

Daily Tasks

- Record weather
- Set up for daily program

As Needed

- Thaw food (on feeding days)
- Collect kelp (on feeding days)
- Wash walls
- Check head tank flow

Closing Inside

- Cover touch tanks
- Zero out cash register, count till & secure cash tray
- Record patron and program counts
- Rewind videos
- Check head tank levels and flow
- Turn off lights

Closing Outside

- Lower flag
- Close & lock front doors
- Remove sign at end of dock
- Bring in white board
- Bring in wall "OPEN" sign

Interpreting the Exhibit with Visitors

The core responsibilities of the exhibit interpreter (docent) are to:

- Make sure that the rules of the PTMSC Exhibit are followed and that animals are treated with respect.
- Keep visitors safe by enforcing simple safety rules (For example, “No running”)
- Answer questions and help visitors explore the exhibit, classroom exhibits, marine issues and Citizen Science projects happening in our Discovery Lab.
- Encourage connections between human actions and the health of the marine environment through reference to the Action Corner and your own knowledge and experiences.



Being the Expert We would all like to be experts and have all the answers. It's gratifying to be



able to dazzle people with our knowledge, but teaching isn't necessarily about being an expert. It's about helping visitors discover the beauty and the drama of our natural world. When you are first learning to be a docent, it helps to identify something interesting or a fact about each tank. Then make sure you keep learning, or you will surely become as bored repeating the same facts as you would hearing someone else tell you the same thing over and over! Have a goal of learning or seeing something new each time you work in the exhibit.

Example:

If a child points to a crab and asks you about it, how do you choose your response?

- You could give the child a direct answer, "That's a Red Rock Crab or *Cancer productus*."
- You could pull out a field guide and show the child how to look up the crab her or himself (this is a great way to learn about more than just about *Cancer productus*).
- You could point to the pictures on the wall and ask if the child sees the crab pictured there, or take the opportunity to give them a laminated guide (that goes with the wall pictures)
- You could follow up with "Let's watch it and see how it moves."
- You could also talk about its red color and how this might have something to do with its name, or talk about other attributes of the crab from the strength of its claws, to what it likes to eat, to the habitat it needs to live in. But resist the opportunity to rattle off every single fact you know about the creature. Help the visitor explore!

These are all appropriate answers to the child's questions. It is simply a choice about which answer helps the child (and you!) learn more. The more you observe and learn, the more interesting and effective you can be as a docent.

Tips for Working with the Public



Appearance is important—PTMSC shirt and button required when working with the public. We've never been fancy, but we do attempt to be neat and clean— even when messin' about in tidepools! Please wear a PTMSC T-shirt or sweatshirt when greeting the public so you can be easily identified.

We require that you wear a PTMSC ID button. New volunteers should write their name on a write-on button with a wet-erase marker. Experienced volunteers will have buttons with their names printed on them. All buttons are kept in the ME office or the NHE office, based on your preference. You may also take your button home if it's easier for you to keep track of that way. If you lose or need a button, please tell a staff member so that we can make you one.

Be yourself

Visitors want, more than anything else, to meet other people — especially “local folk” who live here. Genuine interest and attention is what people will remember, more than facts. We teach more by sharing our enthusiasm than by pouring out the facts we have learned! Our docents are what make the experience of coming to PTMSC so rewarding.

Credibility

Now that we've said that, it's also important to stress that credibility is important. It's all right to say, “Good question! I don't know, but I will find out.”

Teach *how* to learn. There are always other volunteers and staff to ask, as well as resource books. Some of our volunteers walk around the exhibit with book in hand, awaiting the next stumper.

Should you not be able to find the answer, write down the visitor's question as well as address, research the answer (we can call experts at other institutions, too), and send a postcard with the answer to the visitor. You can bet s/he will never forget your care and dedication... and you will learn much in the process as well.

Model behavior, skills and attitudes

Show, with your attention, that you care for the visitor. And teach about how to treat the animals, by example. So much more than we realize is learned non-verbally, by observation.

Observe first, label last

We tend to label animals and plants — and forget to really look. Look, really look, until you can distinguish unique characteristics and behaviors about the animals. Help visitors focus on the small differences. Ask *them* to describe the plant or animal (or ask if they can tell which it is!), and perhaps to give it their own descriptive name. If you do know the name and teach it, find a way to associate the name with an observation. Keep vocabulary simple.

Don't forget about the kelps and other algae! Visitors and staff tend to overlook the algae in our exhibit. You can mention how some of these colonize themselves in our exhibit and also how they differ from land plants. If you don't know, ask!

Be enthusiastic about discovery

Though you may have watched a sunflower star eat many times, for a visitor this may be a first. Keep your enthusiasm high by relating to each person in turn and caring about their short experience here. Perhaps share something else about the star that intrigues you, or something that you would like to learn more about. Being a good listener is essential.

Engage learners in dialogue

Even if a visitor asks you a simple question, do your best to engage them in dialogue rather than offering a lengthy monologue. Discuss rather than tell. Pretend that each visitor is a favorite friend or relative; have a conversation, tell (and listen to!) stories about experiences with the animals or the sea. Visitors often want to tell a story about a previous encounter with marine life. You and they can learn from these stories.

Some Scenarios: What would you do?

1. He's out of control

You are working as an Exhibit Interpreter and you see a little boy running in the exhibit space. You catch the child and tell him not to run but as soon as you let him go, he's off again. His father is in the exhibit with him and he tries to stop him as well but it quickly becomes obvious that he can't control his son. The boy is very loud and disruptive, but he is not breaking any of the rules that he was told when he entered and he is very interested in the things he is seeing in the exhibit.

What should you do?

2. You've got it all wrong

It's a busy day at the Marine Science Center and you are working with another docent. You observe an interaction between the other docent and a group of high school students who have come to the Center as part of a school project. At one point, you hear the docent give some blatantly incorrect information to the students. The students are about to leave thinking that they now have the proper answer to their questions.

How should you correct the situation?

Would it be any different if you heard an adult visitor telling his/her child wrong information?

3. The poor crab

A small group of boys are standing around the touch pool with the sea star. You are ringing up some sales and the Exhibit Interpreter has taken a break to use the bathroom. You hear a lot of commotion and laughter over where the boys are and when you look over, you see that one of them is jabbing a pencil into the water and is apparently baiting a large crab. A woman standing near them has angrily told them to leave the crab alone but they ignore her.

How do you save the crab?

INTERPRETER'S GUIDE

Learning about the Exhibit and Marine Biology

Most of us have had a biology class somewhere along the line, but volunteering at the PTMSC may be a first experience working with wild animals. Or, you may have had a career in the life sciences and be extremely knowledgeable when you start docenting. Either way, everyone is guaranteed to learn something new by working in the Marine Exhibit and observing what happens and changes. There is always something spawning, taking over, dying, eating or being eaten.

There are a lot of animals in the exhibit; do not expect to get a grasp on all of them at once. Here are some suggestions for becoming comfortable and knowledgeable about the animals at the Center.

Where to Start

Follow your instincts. To which animals are you drawn? Read class hand-outs and lecture notes, study some of the field guides (we are always happy to suggest a place to begin), observe veteran volunteers, participate in public programs and volunteer enrichment classes. Once you begin to orient to learning about one or two favorite animals, you may find that adding new information on others will come easier. Keep in mind that what is most interesting for you will be what visitors are interested in as well; there is no need to memorize facts that are not relevant.



As you get familiar with an animal, consider its unique adaptations for:

- Where does it live? On a rocky beach? On a sand bottom? Among cobbles? In the open ocean?
- How does move? Swim? Scurry? Crawl? Cling onto things? Bury down?
- What does it eat? Plankton? Is it a predator? A scavenger? Vegetarian?
- How does it eat? What part of the body catches the food? Does it have a way to tear apart food or does it digest prey with juices?
- How does it stay wet? If the animal lives in the inter-tidal, how does it keep moist during low tide?
- How does it protect itself? Does it hide? Use camouflage? Have spines, teeth, claws, poisons, barbs....or just look dangerous?
- How does it reproduce? Internal or external fertilization? Hermaphroditic or separate sexes? Does it care for its young?

- Any other interesting information such as importance to medicine or myths?

Ways of Learning

Everyone has their own best ways of learning. Some learn by reading, some by hearing, and some by physically interacting with their environment. Most of us know intuitively or after thinking about it, which learning methods work best for them. Following are a few methods commonly used:

- Observe, observe, observe.
- Ask questions of other docents or staff. Do not hesitate to ask — *no* question is silly or unimportant. If you have the question, chances are, so will a visitor.
- Start a notebook on the major animal phyla. Add hand-outs, news article reprints and any other material that comes your way.
- Create an index-card file of animals, writing the common name on one side and information on the back so that you can quiz yourself. Note cards are easy to carry around and appropriate to use in the exhibit to answer questions.
- When coming to the PTMSC, try to come a little earlier or stay a bit longer to observe the animals, check out books or ask questions.
- Review the information on the volunteer desk and adjacent bookshelf. Here you will find the newsletters, references and relevant news articles and clippings.
- Participate in the volunteer enrichment classes and field trips. Take the opportunity to attend some of our public programs as well as programs at other aquariums.
- Go to websites with information on marine animals. Websites like Wikipedia have some good basic information. Check out the resources at the end of this guide for other ideas.



Marine Biology Basics

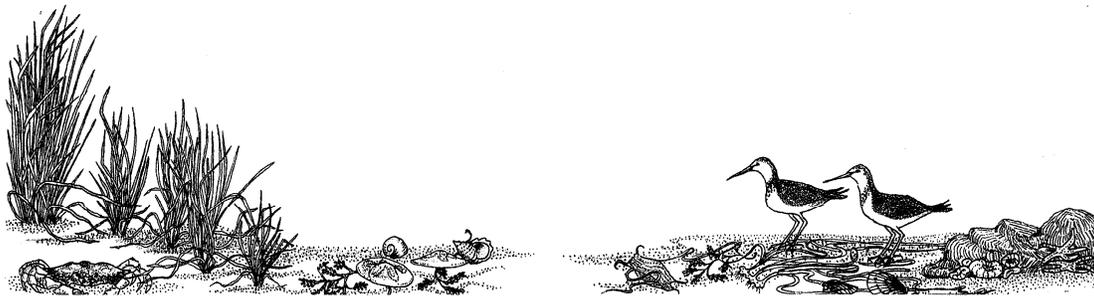
As a PTMSC volunteer, we ask that you take the initiative to learn a bit about our marine "backyard". Following is a brief overview of marine life. Please consider also delving into field guides and reading books, learning how to read a tide table, as well as exploring some of our exceptional beaches.

The ribbon of life where land meets the sea is a veritable garden of treasures. Here you will find brilliant colors and whimsical forms; sometimes it's hard to tell the animals from the plants! The sea is a world all its own.

There is an astounding diversity of organisms living at the edge of the sea. Constantly fluctuating water levels, crashing waves, drying sun and searing winds all serve to weed out organisms unable to adapt to these stresses. Only the hardy survive here, and their adaptations to this environment are fascinating.

There are many types of beaches, from those sandy expanses that we migrate to on warm summer days, to cobble beaches that are hard for us to walk on, to rocky beaches that support the greatest diversity of life forms. Each type of beach hosts a unique community of plants and animals specifically adapted for that habitat. Nothing lives by itself; interrelationships are complex and surprising.

Studying marine life means learning about these environments and how the inhabitants fit into their community: who eats whom, how they manage to eat without *being* eaten, how they depend upon each other for survival. There is a lot to be learned from these worlds that may, in turn, help *us* survive!



Tides

Tides are the movement of the sea, influenced by the pull of the moon and the sun. Many other factors add to the complexity of understanding tides, such as topography, barometric pressure, winds, etc. We have “mixed diurnal” tides: two cycles of a high tide and a low tide every 24 hours where the tides are of unequal heights. In our part of the world, low tides occur during the day in spring and summer and at night in fall and winter.

High Tide For many invertebrates, high tide is dinner time. The water brings in a rich broth of microscopic food for waiting mouths. Many animals are adapted for taking advantage of this feast: barnacles sweep in plankton with their feathery feet, clams slurp it up through their straw-like siphon, and cucumbers mop up the morsels with their tentacles. High tides not only bring in food and sweep away waste products, they also protect life forms from the drying effects of sun and wind, and offer cover from aerial predators (including people!) that forage when the tide is low.

Low Tide For most organisms, low tide is a time of stress. In order to keep from drying out, many shelled animals such as mussels, limpets and barnacles “clam up”, sitting tight until the next replenishing high tide. Seaweeds can rehydrate, yet the mid-day burning sun during a low tide may scorch them. Crabs and cucumbers find more protected places under rocks to wait out the dry times. Anemones tuck in their tentacles. Others seek a tidepool “oasis” left behind by the waves.

Low tide is the time of foraging for birds who hunt the water’s edge. Picking their way among rocks they probe long and slender bills into the sand or mud in search of prey, looking rather like busy sewing machines.

And low tide is the time for us to go exploring. Here is when that blanket of water rolls back to reveal an unseen world. It’s a special time, and one in which we need to take the greatest of care and patience. Let us visit with gratitude and respect, trusting that this undersea world will tolerate our probing fingers and curious minds. Remember to replace *all* overturned rocks and seaweed “roofs” to their exact original positions. Please take only memories and photographs, ask many questions, and leave nothing behind.

Tidal Zonation

Just as people have favorite environments in which they thrive, marine organisms, with little variation, are found in their habitat-of-choice.

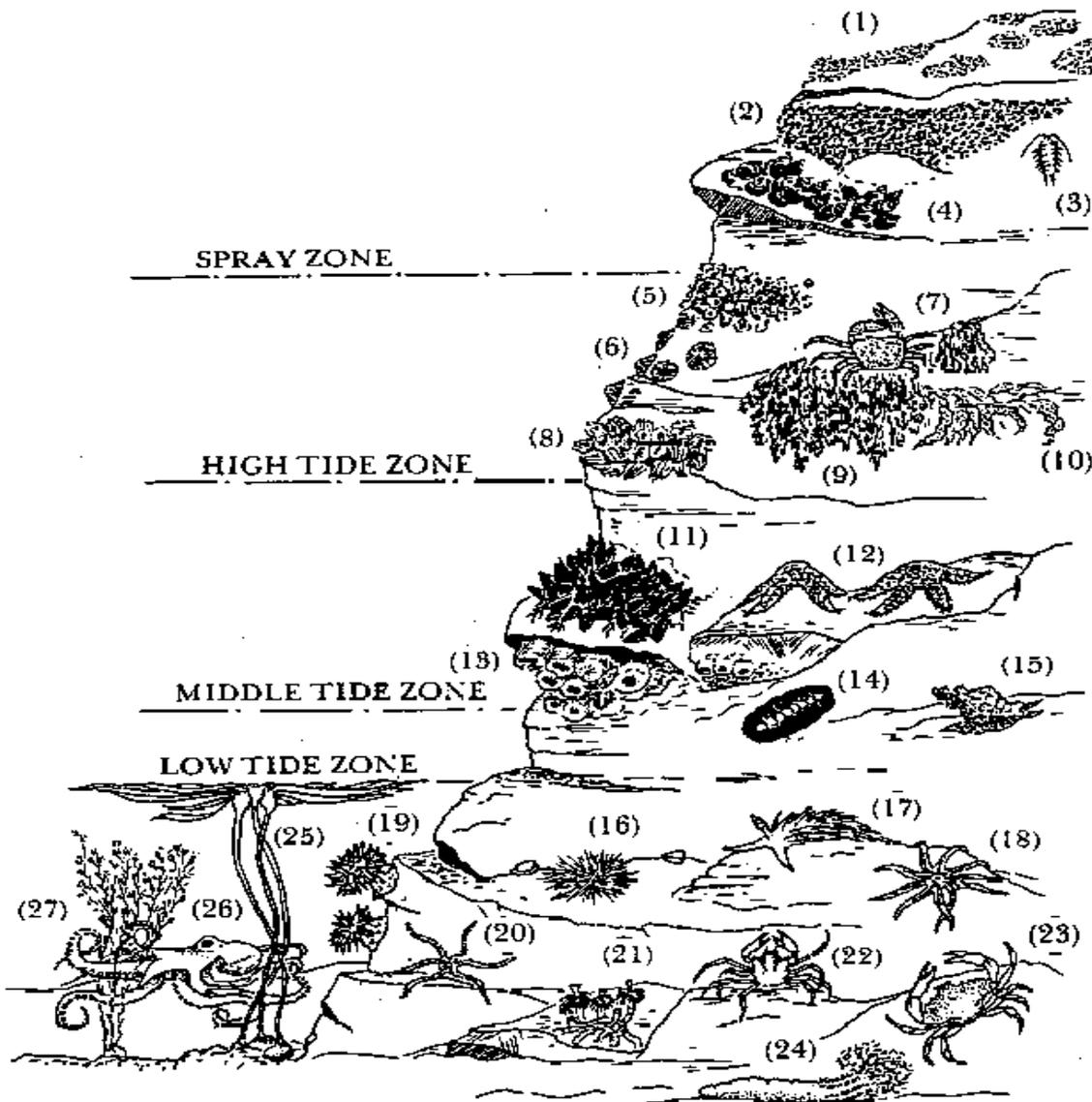
Few organisms are found at the highest rim of the shore which is covered only by the highest tides. Periwinkle snails and limpets are best adapted for this drier, exposed lifestyle. Barnacles, mussels and shore crabs are among the many that thrive in the mid-tide zone, spending part of each day covered by water. Here, too, is where you’ll find rockweed and green sea lettuce. The richest diversity is found in the lowest zone, rarely out of water. Brilliantly colored sea stars, urchins, anemones and cucumbers are tucked in among red and brown algae.

This banded distribution pattern is known as “zonation”. The supply of food, range of predators, amount of protection and ability to adapt to changing water levels are factors influencing where an organism will be found.

Marine Biology Basics (continued)

TIDAL ZONATION

Cross-section showing sample of vertical zonation on a rocky shore: 1. Lichens 2. Blue-green algae 3. Rock louse 4. Periwinkles 5. Small acorn barnacles 6. Limpets 7. Rock crab 8. Common acorn barnacles 9. Rockweed 10. Sea lettuce 11. Blue mussels 12. Ochre stars 13. Aggregate anemones 14. Black chiton 15. Wrinkled whelk 16. Sea urchin 17. Opalescent nudibranch 18. Sun star 19. Giant green anemone 20. Brittle star 21. Calcareous tube worm 22. Kelp crab 23. Red rock crab 24. Sea cucumber 25. Bull-whip kelp 26. Octopus 27. Sargassum --Based on Snively, *Exploring the Seashore*, 1978.



Marine Biology Basics (continued)

SYSTEMATICS: What are the Major Categories of Living Things?

In attempting to sort out the array of living organisms on earth, we build a system of classification. To define "ORGANISMS" we list common traits of all living things:

- Growth, metabolism, responsiveness, reproduction, made up of cells.
- Plants and algae use sun energy to make food and give off oxygen (photosynthesis)
- Animals do not ... they have to take in food

To sort out, and keep track of the myriad number of organisms a system of classification or "taxonomy" was developed in the 16th century. Some species are still known by the name given to them in the 16th Century. Others have been moved back and forth and continue to move as we learn more about genetics. Some organisms don't clearly fit into any neat category.

The basic system starts with the most inclusive term – "**Kingdom**" - to the less inclusive – "**Species**". Even the number and names of kingdoms has changed over the years.

<u>CATEGORY</u>	<u>Human</u>	<u>Gorilla</u>	<u>Green Anemone</u>
Kingdom	Animalia	Animalia	Animalia
Phylum	Chordata	Chordata	Cnidaria
Sub-Phylum	Vertebrata	Vertebrata	---
Class	Mammalia	Mammalia	Anthozoa
Order	Primates	Primates	Actinaria
Family	Hominidae	Simiidae	Actiniidae
Genus	<i>Homo</i>	<i>Gorilla</i>	<i>Anthoplura</i>
Species	<i>sapiens</i>	<i>gorilla</i>	<i>xanthogrammica</i>

Each known organism is designated scientifically by a name called the "binomial" or "Latin name" that is composed of the genus and species. The term "species" applies to individuals that are capable of breeding freely with each other but not with members of other species. "Genus" includes one or more related species. In a binomial, the genus name is capitalized, the species is not; both are italicized or underlined. For instance, the human binomial is *Homo sapiens*. Sometimes the genus is abbreviated: *H. sapiens*.

Marine Biology Basics (continued)

Major Phyla Represented in our Tanks

The second most general term of classification after **Kingdom** is the **Phylum, and the phylum is a convenient point where we divide many marine animal groups for teaching and discussion.** One phylum includes several (or many) distinct groups of species which all share some common characteristic(s). If two types of animals belong to the same phylum (for example, the sea star and the sea urchin), they are believed by taxonomists to have diverged from one another relatively recently in evolutionary time. Most of the animals in our tanks belong to one of the following phyla.

Cnidaria: most members of this phylum have...

- jelly-like body with radial symmetry
- tentacles, stinging cells called “nematocysts”

example -> the sea pen, *Ptilosarcus gurneyi*

example -> the pink-tipped anemone, *Anthopleura elegantissima*

Annelida: most members of this phylum are worms that have segmented bodies.

example -> the feather-duster worm, *Eudistylia vancouveri*

Echinodermata: most members of this phylum have...

- spiny skin and tube feet

example -> the ochre sea star, *Pisaster ochraceus*

example -> the green sea urchin, *Strongylocentrotus droebachiensis*

example -> the sea cucumber, *Parastichopus californicus*

Mollusca: most members of this phylum have...

- soft body with zero, one, two or eight shell(s).

example -> the littleneck clam, *Protothaca staminea*

example -> the gumboot chiton, *Chrytochiton stelleri*

example -> the alabaster nudibranch, *Dirona albolineata*

Arthropoda: most members of this phylum have...

- an exoskeleton and jointed legs.

example -> the kelp crab, *Pugettia producta*

example -> the coon-stripe shrimp, *Pandalus danae*

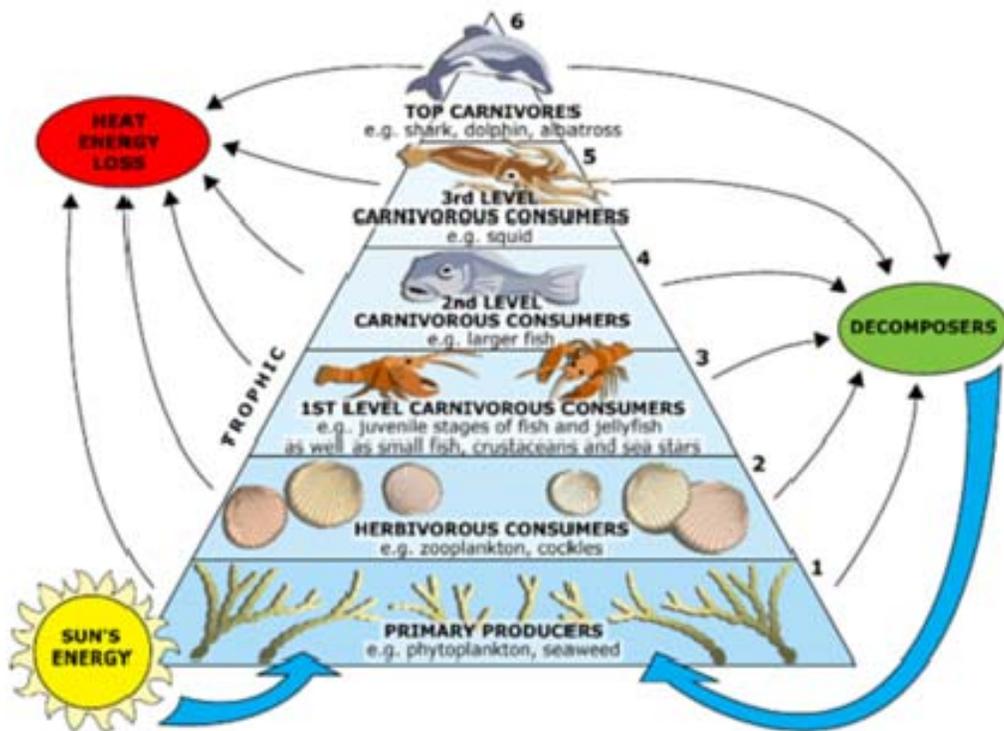
Chordata: most members of this phylum have a true backbone.

example -> the shiner perch, *Cymatogaster aggregata*

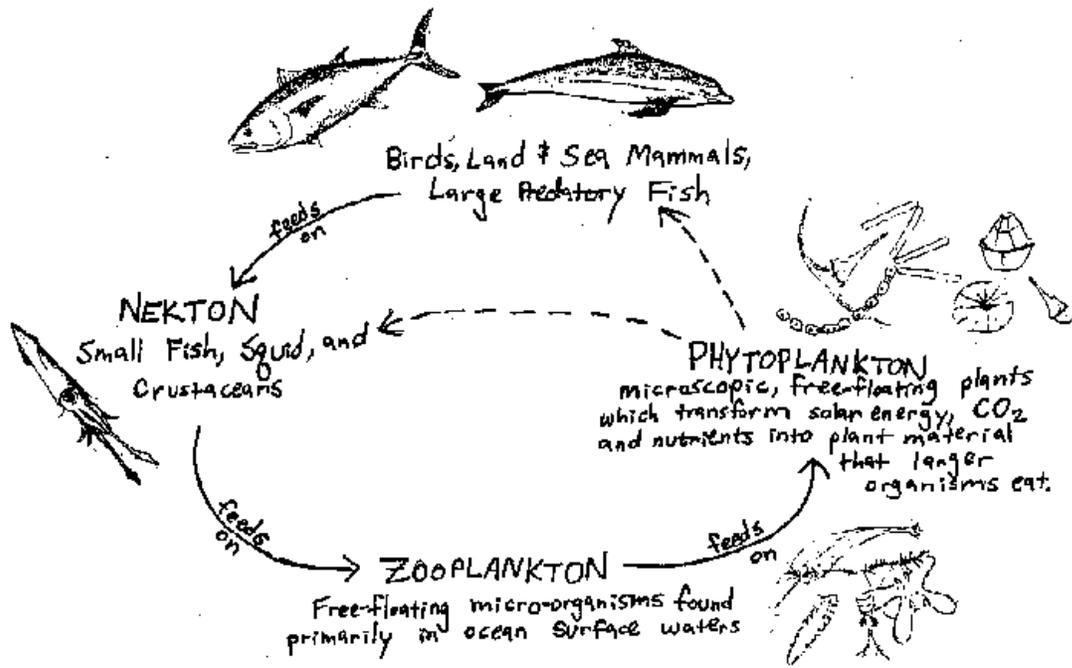
Marine Biology Basics (continued)

Energy Cycling

The process of energy cycling among living organisms begins (and continues) with the help of the sun and the replenishment of nutrients. Minerals wash down from land and decaying organic material and excreta from living organisms sink to the ocean floor. Then upwellings bring these to the surface to nourish the phytoplankton which will be fed upon by "higher" organisms. One way to conceptualize this "chain" of life-energy is a pyramid (1st below) which illustrates a small amount of larger, carnivorous animals belong on the top, being supported by many smaller plant-eating (or actual plant-type) organisms. However, a more modern and perhaps more accurate concept is that of the food web (2nd below) in which all organisms are shown to be interdependent and connected.



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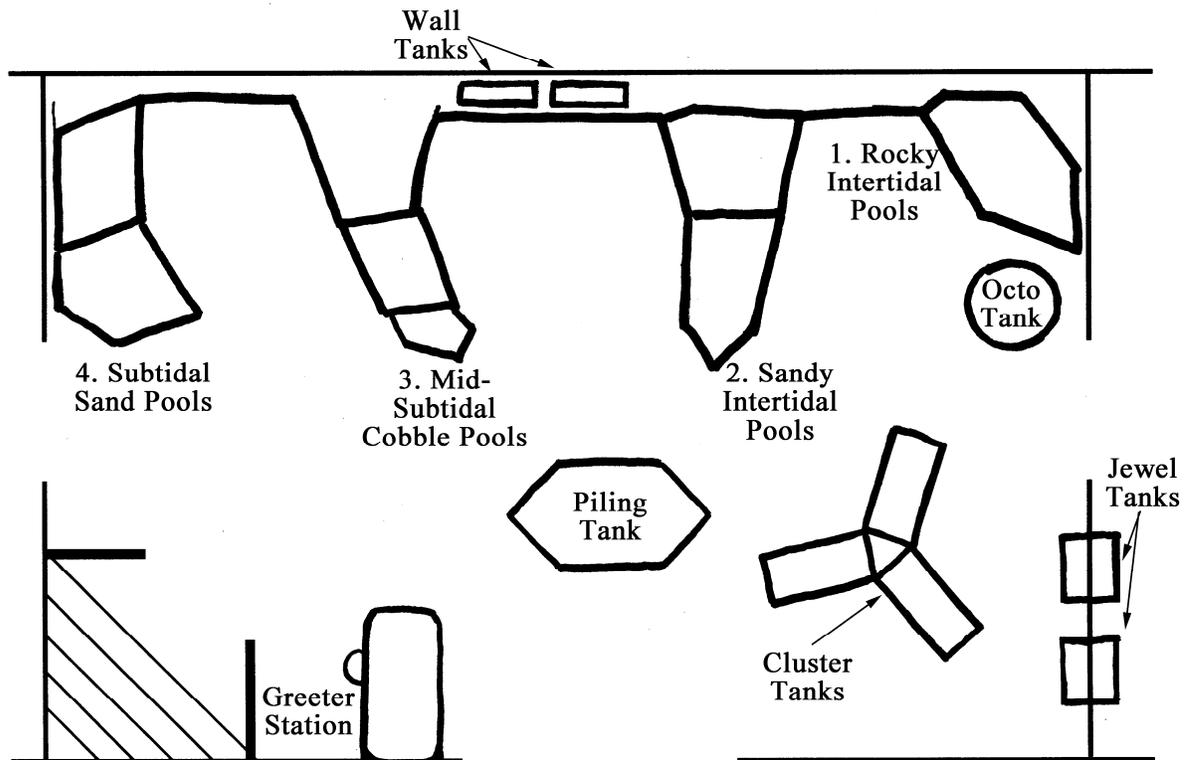


MARINE BIOLOGY BASICS (CONTINUED)

General Tank Map

This is a map (not drawn to scale!) of all the tanks in our exhibit area; it is provided here only for the purposes of orientation. Each tank is labeled here by the name used by staff. The exhibit touch pools and tanks are primarily designed to show habitat types. Staff usually call the touchtanks by their number (1 to 4), rather than their formal names.

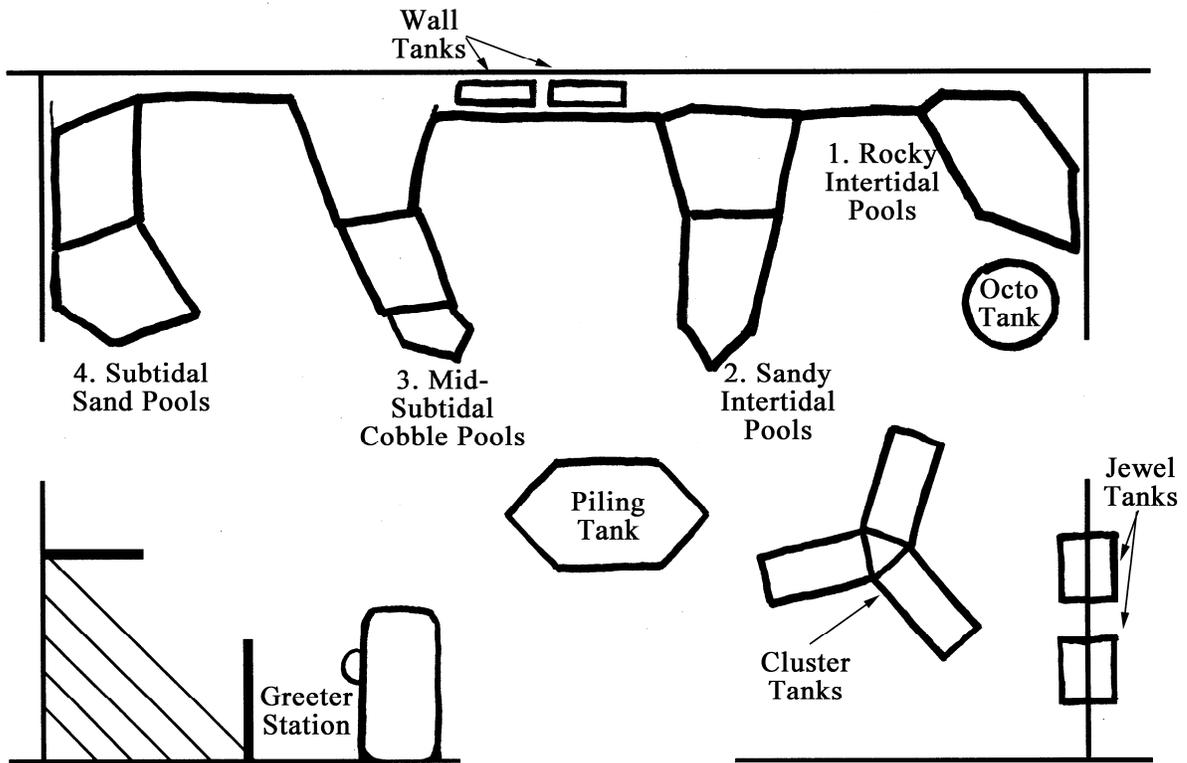
Please Note: Animals in our tanks are always changing as older ones are released (or die) and new ones are collected.



MAIN ENTRANCE

Tank Map of Fish Species

We don't always have the following fish available, but when we do, they tend to be in the following tanks.



COMMON FISH SPECIES and their usual locations in the Marine Exhibit:

Octo Tank:

Red Irish Lords, Rock Fish, Great Sculpin

Touch Tank #2:

Staghorn Sculpin, Sand Dab, Sole, Ronquil, Black-eyed Goby

Big Wall Tank:

Grunt Sculpin

Touch Tank #3:

Scaly Head Sculpin

Piling Tank:

Perch

Rocky Cluster:

Tidepool Sculpin

Eelgrass Cluster:

Tube snouts, Pipefish, Sailfin Sculpin, Pen Point Gunnels, other Gunnels, Three Spined Stickle Backs

Kelp Cluster: *Greenling, baby Rockfish, two types of sculpins*

Basic Information

About Common Marine Animal Groups

Sea Stars:

Senses:

Sea stars have modified tube feet at the end of each ray that are chemical receptors. They use these to “smell” and sense nearby prey or threats (the sunflower stars are a great example. Run your finger down the ray all the way to the tip. The ray should start moving towards where the touch originated.). They also have eye spots that see light and dark (to demonstrate have people close their eyes and find the brightest spot, that’s what a star sees).

Movement:

The off centered dot on the center disk is the sieve plate or the madreporite where water enters the body. Water travels out to the ampulla or the top of the tube feet. This is where the main muscle is for tube foot movement, which operates like a turkey baster. When the star wants to extend the tube foot it squeezes the muscle and water flows into the foot, releasing the suction. To retract (or exert suction) the star just releases the muscle and the water flows back up, just as you squeeze the bulb of a turkey baster to release fluid or release the bulb to draw liquid up. A star cannot move without water. Tell visitors that if they see a stranded/non moving sea star out of water to leave it. The star can survive out of water and wait for the tide to come back, but if you throw it back in during low tide, you may be putting it in a foreign or dangerous environment.

Regeneration:

All sea stars can re grow arms. We have some good examples in one of our jewel tanks. If a healthy arm that has fallen off has retained enough of the central disk (mouth and viscera), it will actually re grow into a full sea star.

Food:

Most stars eat bivalves (clams, scallops, mussels). They do this by covering a bivalve and pulling it at both sides trying to get it open. They only need it to open a crack. Then they throw up their stomach, which looks like a Safeway shopping bag, and shove it into the shell. They dissolve the insides and then move on. They have about 4 hours to open and eat the bivalve before the tides change and they are exposed to the air.

Boy or Girl?

We get this question a lot. The answer is that we won’t know until they start spawning. Males release sperm and females eggs.

Colors:

In touch tank #3 we have three different species (though people will think we have more due to the number of different colors), the Ochre, Mottled, and one Slime star. The way to distinguish between species is the size of the central disk compared to the length of the ray. If someone asks why within the species they are different colors ask them why they think there is a difference (no one really knows why, it could be food, temperature during development, location, protection...there has been a study that says it isn’t genetic).

Touch:

We get a lot of questions about the way the stars feel. The mossy stuff on the tops is gills. The hard parts are ossicles which make up the skeleton of the star. The farther apart the ossicles, the softer and more flexible (and faster) the star.

Disease:

Sometimes our stars begin to get lesions between their rays, disintegrating ray tips, and twisting of their own arms which results in pulling their arms off. We don't know a lot about it, but we move stars with these symptoms in case they are contagious. It's mostly a fatal disease.

Species:

Sunflower Stars: Can reach up to 3ft in diameter and are the #1 top predator of the intertidal habitats. It's the fastest sea star in the World and can move up to 3ft per minute. They can have anywhere from 12 to 24 arms which adds up to about 15,000 tube feet. It will eat other sea stars, all bivalves and has been known to eat sand dollars and brittle stars. In our tanks the only other animal we keep with them are the sea anemones, which are purposefully in front of the waterfall to keep the sunflower stars away from the scallops in the upper part of the tank. The only threats are from other sun stars, which can feed on sunflower stars.

Slime Star: When agitated/threatened can produce gallons of slime for protection from being eaten.

Leather Star: Allegedly smells like garlic.

Short Spined Star: aka big pinky. Only reach about 24" in the wild, but our guy is about 41" (possibly due to overfeeding. Fed three times a week, three to four clams each feed). Is a deep sea star and will die if exposed to air for longer than 10 minutes. The little pink guy in the sea urchin tank is also a short spined star.

Blood Stars: Are detritus (dead bits), plankton, and sponge eaters. Are the slowest sea stars though I haven't determined how slow yet. Some have grayish stuff on their disk that is part of their coloring and does not indicate sickness.

Six-rayed star: If it's the spring, look for permanently puffed up females, they are probably brooding eggs (will brood for 6 to 8 weeks).

Sand Dollars:

Related to stars, cucumbers, and urchins. Have tube feet and spines (use their spines instead of their tube feet for movement). Dig in the sand for food and protection. Clump together for protection against predators, and orient themselves towards the current. Can live up to 13 years.

Sea Urchins:

There are three species found in PS, green, purple, and red urchins. Eat kelp and are not poisonous. In fact the orange eggs on the outside of sushi are urchin eggs and urchin roe (the organs that make the eggs) are also eaten. Stick your finger in between the spines and the urchin will give you a "hug" (the spines close in to hold the finger while the tube feet "examine" the finger). Their mouth is in the middle of their underside. To get food, their tube feet move the seaweed to their mouth where they take star shaped bites.

- We have two types of local sea urchins here at our center (purple, and green), but in the Atlantic Ocean there are only green urchins! Some scientists have hypothesized that this is because the Pacific is an older ocean, in an evolutionary sense.

Sea Cucumbers:

California cucumbers are the long, red, spiky ones in touch tank #2.

Have a mop like mouth that mops at the sand (their poop is mostly sand). Something that always gets laughs...they breathe out of their butts! Their spikes are for show, don't feel spiky. Have tube feet as well. We have two other sea cucumber species, the Orange sea cucumber (dark red to orange) has smooth skin with beautiful plume like tentacles at the mouth, and the Stiff-footed cucumber (white with rigid, spiny looking tube feet). A Sea Cucumber (*Parastichopus californicus*) has a special strategy for getting rid of a pesky predator: if threatened, it may spit out its guts (internal organs) in the hope that the predator will eat the guts instead while the cucumber makes a hasty escape. In 2-3 months the cucumber will grow all new guts (recall that it is in the same phylum as the sea star which can also generate new body parts).

Sea Anemones and Sea Jellies:

Anemones can't hurt you (though there are a small number of people who are allergic to them). They feel sticky because when you touch them you are triggering their stinging cells (nematocysts) barbs to shoot into your skin. Our skin is too thick to feel pain, but if we were to use our lips or tongue the skin is thin enough that the barbs would reach our blood stream. Then the anemone would pump poison into us, and most would go into anaphylactic shock (this is what happens to anemone prey). The sticky feeling is us pulling away and the barbs coming out of our skin. The sea anemones with thin, feather like tentacles (plumose anemones) are filter feeders, whereas the fat tentacle animals are predators ...Anemones are related to jellyfish (basically the anemone looks like an upside down sea jelly). All of the tentacles of clear sea jellies found around here won't hurt and will feel like a sea anemone. The colored jellies will sting and it will feel between a nettle to a bee sting depending on the person's sensitivity. One important thing to remember, the stinging cells are a physical response and therefore the animal doesn't need to be alive to sting you!

Sea Squirts/Tunicates:

These inverts are all over our tanks, though the one that gets pointed out to us the most is the sea peach. Depending on your audience, for example if they seem religious based on their questions and comments, I just tell them that they are sea squirts, which are animals that have internal gills. If it seems that they lean more towards the evolutionary theory you can tell them that when they are babies they are free swimming and that they have the three same distinguishing characteristics of vertebrates as we do at that development stage (notochord, post anal tail, gill slits). Even though they lose the tail when they settle they have a gill basket, heart, and notochord inside and are our distant cousins (most closely related invert to us).

Crabs:

We have many crabs in our tanks, though they are difficult to locate (though they have sharp legs and pinchers, crabs hate to be out in the open). Some of the cooler crabs to show are

the pygmy rock crabs living in the dead giant barnacle shells in the middle of touch tank #3 and tank #1, the kelp crabs all over the fucus (dark green finger like seaweed) in tank #1 and #3, and the graceful crabs that have buried themselves under the sand and grass in tank #2 (look for their eyes and mouth in the sand). The way to tell the difference between males and females is to look at the underside (we have a couple of male and female molts for illustration), the male's tail (folded up on the belly) is carrot shaped and the female's is noticeably rounder.

The story I tell about crabs (and shrimp) is how they molt (we have a good crab and shrimp molt, which can usually be found on the top of the amphitheater walls or in the classroom on the shelves with all the coral... "Crabs and shrimp are Arthropods which means they have a hard skin or exoskeleton. When they get too big they grow a new skin while still inside the old one. The new skin is baggy and stretchy like a sweatshirt. The crab then breaks out of the back of his shell (between the carapace and belly...in shrimp it breaks open in the same place, which you can see with our molt) and backs out of the shell. He leaves everything behind including gill coverings, antennae and eye coverings. To remove his legs from the jointed parts of the shell it atrophies its muscles, this why most soft crabs can't move. The crab then fills his new skin with bubbles to stretch it out and waits for it to dry. It takes a couple of days (when you eat soft shell crab you are eating a crab that is about a day away from completely hardening). Once the crab is hard it blows the bubbles out of the shell and he has all that room to grow. Young crabs will molt once a month, older ones once a year. When a female molts she is also ready to mate. A male will mate with her and guard her until she is hard to prevent other males to mate with her.

You can also talk about the difference between crabs and true crabs, especially if someone has noticed the king crab in the classroom. Hermit crabs and king crabs are more closely related because they only have 3 pairs of walking legs, while true crabs like Dungeness and Red rock crabs (the two commercially fished crabs in PS) have 4 pairs.

Scallops:

These guys are cool because they have black eye spots on the outside of their mantles. If you use a flashlight you can really see them well. The eye spots detect light and dark so when you lean over them or your finger gets too close their eye spots detect that change in light and close up tight. We have three types of scallops, the rock scallops and the smooth pink scallops (swimming scallops), and the spiny pink scallop. This bivalve appears to have more encrusting animals growing on their shells than others. We have a couple of good examples in touch tank # 4. Most people have eaten scallops before but don't know what part of the animal they are eating. In most other bivalves people eat most of what is inside the shell. In the scallop they are only eating the muscle that the animal uses to keep its shell closed. Therefore, the big scallops you can buy in the store come from shells much bigger than the ones we have in our tanks.

Nudibranchs:

Nudibranchs, or sea slugs, are cool because there are so many of them (200 species in the Pacific Northwest). They come in all shapes, sizes, and colors (blues, greens, yellows, reds, oranges, purples, blacks, whites, etc). The paired horn looking projections at the top of the head are sensory (rhinophores). Has either plume-like gills with many tufts near the end of the body or numerous processes covering the body (cerata). The best examples we have are the Monterey Sea Lemons in the jewel tank. The white spirals on the rock are egg spirals, which contain about 2 million eggs.

Encrusting Stuff:

General rule of thumb: if it feels slimy it's a tunicate, if it feels spongy it's a sponge, if it feels like sandpaper it's a bryozoan (this animal is calcified and is often confused with hydroids and tunicates).

Tubeworms:

We have a number of tube worms in our tanks, many of which we have not collected (wash-ins) or identified. The ones we get questions about are the tube worms. On the sides of all our touch tanks live calcareous tube worms (hard, limey white tube, red fringe). The red fringe that pops back inside when touched is the worm's mouth and it's retracting the mouth as a caution against predation. We also have many Feather Duster worms that look like feathery flowers, and Slime tube worms.

Fish:

Gunnels: We usually have at least two species of gunnels in the eelgrass and other tanks. Gunnels look like, but are not eels, despite what visitors may say. Unlike other fish, eels have one continuous fin that forms a single ribbon running along much of the length of the animal. Look closely and you'll see that this does not describe gunnel fins.

Tube Snouts: Males have a pair of orange paddles underneath, on their bellies. During the spring they build a nest (produce sticky strands that they use to wrap together the blades of the eelgrass near the area where the blades begin to branch), and then try to attract a female. They will flash their orange paddles to the nearby females. If the male is successful then the female will lay her eggs on the male's nest. The male will then care for the eggs (guard them and clean them) until they hatch.

Pipe fish: Usually in the eelgrass tank with tube snouts. Pipe fish are related to, and look like, uncurled seahorses. They are almost indistinguishable from the eelgrass fronds where they hide out. The pipe fish holds onto the eelgrass blade with its tail. They are a fun challenge for visitors to find.

Grunt Sculpin: Has bright orange fins and hops along the bottom of the floor, can be found in the wall tanks.

This is just a start! There are many more species, and much more about them, than we can include here. Get to know the guidebooks in the exhibit.

Whales:

Orcas: We are doing an increasing amount of interpretation about orcas because of our work with developing an orca exhibit featuring the skeleton of the transient orca known as CA-189. Try to stay up to date with the status of this developing project. Check out our website information on this project: <http://www.ptmsc.org/science/orcaproj.html>.

We are also part of the Salish Sea hydrophone network. We have a new hydrophone exhibit that is functional but still under development. You will be given instruction on using it with visitors. Tell staff if you have ideas for how the exhibit can be improved..

Baleen whales: Baleen is an alternative to teeth and is made out of keratin, the same stuff as fingernails. The hair-like part of the baleen hangs inside the mouth. The whale takes a mouth full of water and uses its tongue to push the water out between the baleen slats, while krill and other food gets stuck on the hairy parts. The whale then scraps off the food and swallows, using his tongue again.

The Gray Whale is a baleen whale. We have a gray whale skeleton, including the baleen, in the Natural History Exhibit. The skull is on permanent display and the rest of the skeleton is put together as a class exercise. There are a couple of larger pieces of baleen from a Bowhead whale in the ME classroom. The Humpback, another baleen whale, eats about 3 tons of krill a day. For reference, a krill ball (a kind of ‘school’ of shrimp-like krill) may contain 2 million tons of krill.)

Seals: People will ask you when the best times are to see seal pups. The answer is late spring to mid summer. There might be some on or near the beaches and piers around Port Townsend, but Protection Island is by far the best place to see resting harbor seals and elephant seals. Sea lions sometimes haul out on the buoys in the area.

Otters: Visitors often see otters out on the dock. The otters around here are River Otters. Sea otters are only found in California, Alaska, and isolated parts of Washington, but are not seen here. River otters live in dens inland and come to the ocean for food and play. The otters haul out on our pier to sleep and eat (A sea otter lives in the ocean during its lifetime and often floats on its back). There is an exhibit about the differences between sea and river otters in the NHE.

Frequently Asked Questions - Miscellaneous

○ Where are the rest rooms located?

The public rest rooms are at the end of the dock, in the same building as the store but on the far right side.

○ What are your hours?

We are open from the first weekend in April to mid-June from 12:00 to 4:00 pm on Fridays, Saturday and Sunday. From mid-June -Labor Day we're open from 11:00 am to 5:00 pm,

every day except Tuesday. Then from Labor Day through October we go back to our weekend schedule, open 12:00 to 4:00 pm on Friday, Saturday and Sunday. After the Marine Exhibit shuts down in the Fall, the Natural History Exhibit remains open Friday through Sunday, 12:00 to 4:00 pm. The NHE is closed in January.

○ **Why does the Marine Exhibit shut down in the winter?**

Mainly because the building is un-insulated and cold in the winter, and it's expensive to keep the full complement of pumps running when we have very few visitors in the park. Also, it gives us a chance to release many of the animals and do yearly maintenance on the exhibit.

○ **Can you smoke, eat or drink in the Center?**

No. It is especially important that food and drinks are not allowed, to prevent either of these from accidentally getting into the tanks. In addition, lotions, perfumes and nicotine on hands can adversely affect life in the tanks.

○ **What is there to do in PT? Do you know a good restaurant?**

If you find yourself searching for answers, give the visitor one of the free maps and guides available in the gift shop. They are provided by the Chamber of Commerce — another place to get information. You can also say your favorite restaurant, but don't give bad reviews of a place you don't like.

○ **Is fishing or crabbing allowed off the dock?**

Yes, but people need to know the regulations... a copy should be nearby, or check with staff.

○ **Where is a good spot to dig for clams? How do I know if they are safe?**

You are allowed to clam at most state and county parks with a shellfish license, but not at Fort Worden. There is a "Red Tide Hotline" for information on PSP (paralytic shellfish poisoning) and on beach closures. Call 1-800-562-5632.

○ **Do you have a formal training program for your volunteers?**

Yes. We offer formal docent trainings in the Spring. We also offer special training for volunteers who work in our Natural History Exhibit. Once a person completes the training, they are encouraged to commit to 8 hours or more a month during our busy season. Volunteers work with the public, help feed the animals and maintain the tanks, participate in scientific research and monitoring, serve on the Board and committees, assist with fundraising events and many other tasks.

○ **Who painted the murals?**

Andhi Spath of Pacific Studio. He also painted the murals at the Natural History Exhibit.

○ **Who sculpted the rock formations that the touch pools are made of?**

The PTMSC Exhibit Design group had seen and selected Quimper rock formations on the southwest side of Indian Island, just west of the bridge (OK to walk there to see them, it's before the warning sign) and down on the southeast side of Discovery Bay (only access is through people's yards - definitely NOT advisable - or by boat).

We took photographs in both places and showed them to Turnstone, the company selected to do the work. Mark Van Wickler, a sculptor known for deep sea coral exhibits in Japan and the Congo exhibit at the Bronx Zoo, was the sculptor. We took him to the Discovery Bay site, where he took additional photos. Then working with two others, he reproduced sections of the rock, tailoring them to meet the needs of the animals in the tanks (vertical sides inside to discourage climbing out/nice waterfalls, varying depth levels) and the needs of visitors (wheelchair accessibility/safe places to climb for little ones, places to lean & sit, viewing access for classes).

○ **What is the Quimper Formation?**

The Quimper formation (similar to the Keasey Formation) is approximately 20 to 40 million years old. Marine fossils that are found in it include mollusks, coral fragments, shark teeth, barnacle plates & urchins. They were all animals that lived in shallow water. There are probably similar formations all around the area but most of them have been pushed down by the huge glacial bluffs above them. At Indian Island and Discovery Bay, the overlying glacial deposits were eroded away &/or the land rose, revealing these older formations.

○ **How are the tanks constructed?**

The tanks themselves are fiberglass. Around them is a structure of rubberized mesh. Concrete was blown into the mesh to form a light but strong layer of concrete. Many places were shaped by hand, putting in details of specific rocks, fossils, shells, etc. When it was dry, the concrete was colored to reproduce the natural rock color.

○ **How long has the Center been in operation?**

The PTMSC was started by volunteers (Judy & Frank D'Amore and Libby Palmer) in 1982. The ME underwent a major renovation in 2000- 2001, the same time that the Natural History Exhibit opened.



Libby Palmer & Judy D'Amore in the old Marine Exhibit, 2000

○ **How is the Marine Center funded?**

The PTMSC is a non-profit corporation with a Board of directors. The Center depends heavily on volunteers. Funding comes from: donations, grants, fees for education programs, admission fees and gift shop sales.

○ **How many visitors go through the Center in a year?**

We have approximately 20,000 visitors each year, including education program participants.

Where does the water come from?

We take in water directly below this building. If you walk down to the floating dock, on the landing is a locked gate. Look through the slats in the gate and see our pump, with a PVC pipe that reaches down into the water. Our pump is strong - it can handle 85 gallons/minute. From the pump, a large diameter pipe goes up to our head tank.



o What does the head tank do?

The head tank is directly above the Food Prep Room/Office, accessible via ladder only to authorized staff/volunteers. It is our reservoir, holding 550 gallons. We sometimes find animals in the head tank. They may have survived the pump as plankton and then found the head tank a convenient aquarium to live in. Both the pump and the head tank have electronic sensors (called a sensaphone). If the pump goes off or if the tank overflows, the sensaphone automatically starts continually calling people authorized to deal with such situations.

o Do you filter the water?

Yes, but only through 1/2" holes to prevent large pieces of debris or seaweed from entering the system. The water itself contains a continuous supply of plankton (tiny plants and animals), which are food eaten by many of our animals.

o Why is the water sometimes cloudy?

The water in the tanks is exactly the same as the water below the pier. Sometimes the silt is stirred up by waves and wind. (We don't filter out smaller particles because we prefer to keep the supply of plankton constant.)

o Where does the water go from the head tank?

Water in the head tank flows via gravity down into several pipes. Some pipes go to the touch tanks, some to the acrylic aquaria and some to the tanks in the Discovery Lab. Each pipe has a large, conspicuous handle that is the on/off valve.

o How does the water get out of the tanks?

Every tank has its own outflow pipe that simply dumps water back out below the building. In the touch tanks, those pipes are behind the skimmers (the net barricades to keep the animals from going down). In the acrylic tanks, they are just pipes.

o What temperature is the water?

The water averages 10 C or 50 F. It varies little during the year (8-10.5 C or 48-54 F).

Frequently Asked Questions – Animals

- **What do you do with the animals when the Center is closed?**

They are maintained by staff and volunteers on a regular schedule — fed 3 times a week. The Center is equipped with pump monitors in case of pump failure when no one is here.

- **How old are some of the animals?**

It's hard to know. Octopuses live for 3-5 years, rock scallops can be 45 years, most sea stars vary from 5-30 years, and anemones live for hundreds of years!

- **Where do you get your animals? Are they local?**

Yes, they are all from Northern Puget Sound and the Strait of Juan de Fuca, though from different “zones”, or depths, in the water. We collect animals from below the dock, from pulling our beach seine (100' net) through the water, or from other beaches. Some are brought in by divers or fisherfolk.

- **What do you feed the animals?**

Many of the animals feed themselves — the “filter-feeders” (like barnacles, clams, white plumous anemones, scallops, mussels) eat plankton that is always in the water. The grazers (abalones, urchins, chitons, limpets and some snails) feed on the seaweed we supply or grow naturally in the tanks. Detritivores (animals that eat detritus: bits of dead stuff — like sea cucumbers) help “recycle” the organic debris in the tanks. We feed the predators (animals that prey on other animals — sea stars, fishes, anemones) and the scavengers (animals that eat dead animals — crabs, hermit crabs and shrimp). These are fed fish, clams, mussels, krill and squid three times a week. We also catch live shrimp when possible.

- **Can I touch the animals? Why can't I touch the fish, crabs, or the sea star suction cups?**

We ask that you touch the animals gently, and only with one finger. This keeps them under the water. Fish can be damaged if touched and their protective slime disturbed, Crabs can pinch you, and the suction cups on the underside of the sea stars are very sticky- so when a finger is pulled away, it can injure the animal.

- **Why do sea stars have different numbers of arms?**

They belong to different species which have evolved over time to have different habitats and feeding habits. The leather star has 5 arms, the six-armed - 6, and the sunflower may have as many as 24 arms. Sometimes sea stars lose arms to predators. It may take several weeks, but they are able to regenerate the lost arm.



RESOURCES- WEBSITES

Plankton information:

Strickland, Richard, The Fertile Fjord: Plankton in Puget Sound, UW press, 1983.

Out of print, but available online:

<http://www.wsg.washington.edu/communications/online/fjord/fjord.html>

Other plankton sites:

<http://www.st.nmfs.noaa.gov/plankton/>

http://www.ecy.wa.gov/programs/eap/mar_wat/mwalgae.html

Marine Inverts, Fish, and Algae online resources:

Intertidal Invertebrates of Puget Sound—start with Arthropods, Echinoderms, Cnidarians, Molluscs, then move on to other phyla

<http://www.nwmarinelife.com/index.html>

General natural history or intertidal organisms, including marine algae

<http://www.beachwatchers.wsu.edu/ezidweb/ezidindx.htm>

Exploring Puget Sound Shorelines—WA Department of Ecology; good over view of shoreline habitats and ecology and some of the key species found there

<http://www.ecy.wa.gov/programs/sea/pugetsound/species/species.html>

Pacific Northwest Scuba—Check out the flashcards on fish and invertebrates and the Critter of the Month pages

<http://www.pnwscuba.com/critterwatchers/index.htm>

Key to Marine Invertebrates found at or near the Rosario Beach Laboratory

<http://www.wallawalla.edu/academics/departments/biology/rosario/inverts/>

Orcas—Get ready for lots of orca questions this year!

Short Article on Puget Sound orcas

<http://www.nwf.org/nationalwildlife/article.cfm?issueid=110&articleid=1385>

Other local resources:

<http://www.orcanetwork.org/>

<http://www.whalemuseum.org/index.html>

<http://www.whaleresearch.com/>

<http://www.cascadiaresearch.org/robin/kwindex.htm>

RESOURCES — BOOKS

Following are some of our favorite resources. Please help us update the list. Many of these are in our library. Reference books may be used in the exhibit; non-reference books may be borrowed for two week periods.

- Angell, Tony and Kenneth C. Balcomb III, *Marine Birds and Mammals of Puget Sound*, Seattle: Puget Sound Books, 1982.
- Berrill, J.J. and Jacquelyn, *1001 Questions Answered About the Seashore*, New York: Dover Publications, 1957.
- Carefoot, Thomas, *Pacific Seashores*, Seattle: University of Washington Press, 1977
- Coulombe, Deborah, *The Seaside Naturalist*, New Jersey: Prentice-Hall, Inc., 1984.
- Gotshall, Daniel, *Pacific Coast Inshore Fishes*, Los Osos, CA: Sea Challengers, 1981.
- Gotshall, Daniel and Laurence Laurent, *Pacific Coast Subtidal Marine Invertebrates*, Los Osos, CA: Sea Challengers, 1981
- Guberlet, Muriel Lewin, *Seaweeds at Ebb Tide*, Seattle, WA: University of Washington Press, 1956.
- Harbo, Rick, *Tidepool and Reef*, Vancouver, B.C.: Hancock House Publications, Ltd., 1980.
- Harbo, Rick, *Whelks to Whales*, Madeira Park, BC Canada: Harbour Publishing, 1999.
- Jensen, Gregory, *Pacific Coast Crabs and Shrimps*, Monterey, CA: Sea Challengers, 1995.
- Kozloff, Eugene, *Seashore Life of the Northern Pacific Coast*, Seattle, WA: University of Washington Press, 1983.
- Lamb, Andy and Phil Edgell, *Coastal Fishes of the Pacific Northwest*, Madeira Park, B.C.: Harbour Publishing, 1986.
- McLachlan, Dan, *Fieldbook of Pacific Northwest Sea Creatures*, California: Naturegraph Publishers, Inc., 1979.
- Niesen, Thomas, *The Marine Biology Coloring Book*, California: Harper Perennial, 1982.
- Ricketts, Ed. and J. Calvin, *Between Pacific Tides*, Stanford, CA: Stanford University Press, 1968.
- Sept, J. Duane, *The Beachcombers Guide to Seashore Life in the Pacific Northwest*, Madeira Park, BC Canada: Harbour Publishing, 1999.
- Smith, DeBoyd L., *A Guide to Marine Coastal Plankton*, West Coast Plankton Studies, 1971.
- Snively, Gloria, *Exploring the Seashore of British Columbia, Washington and Oregon*, Vancouver, B.C.: Gordon Soules Book Publishers Ltd., 1978
- Strickland, Richard, *The Fertile Fjord: Plankton in Puget Sound*, Seattle, WA: University of Washington Press, 1983.
- Yates, Steve, *Marine Wildlife of Puget Sound, the San Juans, and the Strait of Georgia*, Connecticut: The Globe Pequot Press, 1988.

Resources — Organizations

Northwest Aquatic and Marine Educators

President: Gene Williamson
P.O. Box 21
Manning, OR 97125-0021

An active organization of educators and enthusiasts interested in marine and aquatic education; NAME is the regional chapter of the National Marine Education Association.

RESOURCES — OTHER

Arthur Feiro Marine Lab

Peninsula College
1502 E. Lauridsen Blvd.
Port Angeles, WA 98362
(360) 452-9277

Padilla Bay National Estuarine Research Reserve

1043 Bayview-Edison Road
Mount Vernon, WA 98273
(360) 428-1558

Point Defiance Aquarium

5400 North Pearl Street
Tacoma, WA 98407
(206) 591-5335

Poulsbo Marine Science Center

18743 Front Street
Poulsbo, WA 98370
(360) 779-5549

The Seattle Aquarium

Pier 59, Waterfront Park
Seattle, WA 98101
(206) 625-4358

The Whale Museum

P.O. Box 945
Friday Harbor, WA 98250
(360) 378-4710