Whale Fossil Discovered at Moss Beach May be 5 Million Years Old

By Bart H. Oxley

Submerged in mud beneath a large body of water where it died about five million years ago, the fossilized remains of a whale has been excavated from a hill of sandstone and mudstone at Moss Beach.

Discovered by Ranger Tim Sullivan last year, portions of the skull and mandibles of a baleen whale, a toothless filter feeder similar to a gray whale, was reported recently to scientists at the California Academy of Sciences in Golden Gate Park. Bob Breen, supervising naturalist at Fitzgerald Marine Reserve, explained:

"We wanted the excavation done by the Academy before this winter when storms could erode more of the hillside and possibly demolish the fossil altogether." He speculated there could be more fossils of this species buried beneath the mudstone of the tidepools.

Jean DeMouthe, a geologist with the California Academy of Sciences for 23 years, and fellow geologist Tony Summers, began the tedious and delicate task of removing remnants of the fossil on July 21. A chipping hammer and steel chisel were used to dislodge the skull and parts of the jaw bone from the rock. Brushes removed sand and pebbles from small fissures. The skull portion was narrow and long, and was upside down in the ground, while the jaw pieces were right side up.

According to DeMouthe, three major pieces of the fossil were removed: 60% of the right lower jaw, 40% of the left lower jaw, and 30% of the skull (top of the head that included the blow-hole area.) She also noted that the mandible sizes suggest this whale was the size of the modern blue whale, which can be 100 feet or more in length.

The geologists spent most of the day digging the skeletal portions out of the hillside.

"Once you've started a project like this," DeMouthe stressed, "it's necessary to get it done quickly before too many people are attracted to it and begin chipping at pieces of it." She said the the whale lived during the Pliocene Epoch, two to five million years ago.

"At that time this part of the coast range was covered by a shallow and quiet sea, with Montara Mountain the only exposed land mass in the area." She added that this portion of the coast has moved at least 40 miles northward from its original location along the San Andreas fault since this whale lived and died.

"It fell to the muddy floor of the sea where it died," DeMouthe said. "The tissues of its body gradually disintegrated, leaving only the hard bones to be buried and preserved as fossil."

Moss Beach is no stranger to geological discovery. In an archeological dig in 1994, scientists found a crescent stone that is believed to have been used by early Native Americans seven to nine thousand years ago.

But the finding of the baleen whale fossil is the oldest known discovery at Moss Beach.

The excavated fossil is the property of the County of San Mateo, and will be cleaned, coated with protective resin and kept at the California Academy of Sciences until such time that exhibit facilities are available at the Marine Reserve. In the meantime, anyone interested in viewing the "Sullivan/Fitzgerald" fossil at the Academy should call Jean DeMouthe at 415-750-7094.
ELAINE EISENBERG, above, is pictured with some of her photos of Fitzgerald Marine Reserve that were on display at the San Mateo City Hall during the month of July. Her pictures express the beauty of the living museum at Moss Beach. Accompanying Elaine’s photo display was a tidepool tribute written by Debbie Rogers (bottom col. 2)

Second Intertidal Class Scheduled For Students at HMB High School

A second class in intertidal interpretation will be taught again this fall for junior and senior students at Half Moon Bay High School.

"We were delighted with the first class last year," said Bud Eckert, high school principal, "and we are looking forward to its continuation this year."

Twenty students - the first ever from a high school - completed the 45-hour course in January, and have served as docents at the tidepools.

Bob Breen, supervising naturalist at the Fitzgerald Marine Reserve who will teach the class again this fall, said:

"It was a rewarding experience to see these kids work so hard and be as enthusiastic as they were considering that this course was in addition to their regular school curriculum."

The course is an advance placement class in biology, accredited by Skyline College, with credit transferable to the California State University system. Covered subjects will include biodiversity concepts, adaptation, and natural selection, food webs and food chains. Ecological concepts taught are habitat, niche, limiting factors, zonation and predator-prey relationships.

Docent Training Course Scheduled At Coyote Point Museum Sept. 19

If you have been thinking of becoming a volunteer and sharing the knowledge you will gain with others, there is an opportunity waiting for you on September 19. On this day a class in intertidal interpretation, taught by Bob Breen, supervising naturalist at the Fitzgerald Marine Reserve, begins a 13-week study of marine animal and plant life. The classes meet from 9 a.m. to 12 noon each Thursday at the Coyote Point Museum. College credit is given for the course if desired, and students must pass course tests and participate in scheduled tours at the tidepools.

On completion of the course the students join a corps of active tidepool docents at Moss Beach. At the present time there are 90 docents conducting tidepool tours for children. Last year docents conducted over 500 tours representing nearly 5000 students from schools in the Bay Area.

After graduation, new docents will be scheduled for school tours at the tidepools. Normally each docent is assigned six children on tours usually lasting from one to two hours duration. In most cases the tours are scheduled on a low tide day.

Interested personnel should call the Fitzgerald Marine Reserve at 728-3584.

Junior Rangers Meet at Tidepools For Final Summer Outing Aug 19

The second Junior Ranger program this year takes place at the tidepools from August 19-25. There are 12 youngsters, ages 9-12 who had signed up for the final outing of the year. The training will be conducted by Tim Sullivan, Deirdre Hall and Scott Clark.

The group will study biodiversity concepts, adaptation and natural selection, food webs and food chains.

Other activities will include coastal bird study and some beach seining.

Like most Junior Ranger activities this one was filled several weeks ago. The program is sponsored by the Friends of Fitzgerald Marine Life Refuge.

TIDEPOOL TRIBUTE

The tidepools belong to us all; they are
A precious gift to cherish and treasure.
This gift is magical; it inspires,
Fascinates, intrigues and delights.
Because it is so fragile, the beauty and
Diversity of this remarkable habitat will
Endure only with Thoughtfulness, Regard,
And Commitment on our part.

The above, by Debbie Rogers, was a tribute to the tidepools and was featured with Elaine Eisenberg's FMR photo display at the San Mateo City Hall during the month of July.
Iridescent Algae is Main Food Source Of Tidepool Monkeyface Prickelback

By Deirdre Hall

Most everyone who walks along the exposed rocky intertidal reef at Fitzgerald Marine Reserve notices the iridescent algae, Iridea cordata. It is dark brown, but as it billows with the tide it unveils a rainbow color. It can usually be found during very low tides.

Ever stop to wonder who eats it?

Here at the Marine Reserve we have a resident herbivore who eats this iridea most frequently. It is the main food source of the monkeyface prickelback, Cebidichthys violaceus, often called the monkeyface eel. It lives in the rocky crevices of the reef. Its coloration is light to dark brown with two dark bars below each eye. Its snout is bluntly rounded with prominent lips and two fleshy bumps on the head. It certainly is eel-like, its body is elongate and compressed. The fact that it has pectoral fins distinguishes it from a true eel. The monkeyface eel ranges from Brooking, Oregon, to Baja, California.

It seems that size is a factor in determining the diet of the monkeyface eel. When the fish is a juvenile it survives on animal material; once it reaches a length of 5 - 7 cm its diet shifts to plant food. The monkeyface eel has a varied diet of approximately 60 species of seaweed which suggests that it will eat any plant that is readily available. In the study conducted by Miller & Marshall of fish 30 cm or longer, it was found that on average 71% of its diet was composed of the iridea. It is true however, that trace amounts of invertebrate and animal foods have been found in its stomach.

Researchers have observed the captive monkeyface eel to see just how it eats the iridea, which tends to be quite long. The researchers found that when they dropped a blade of the iridea algae into the aquarium, "the fish bit one end and rapidly whirled its body and the blade, stopping to swallow the entire piece in one action."

The monkeyface eel has been the target of a sport fishery. The technique used by fishermen is called "poke poling." During very low tides anglers use long poles with a piece of wire at one end. The pole is baited and thrust into the crevices where the monkeyface eel resides. When the fish takes the bait it is then pulled up and captured.

Interestingly enough, the fishermen who go poke poling at the reserve usually use squid as a bait. Knowing that this fish is a herbivore, how could this be effective? It may be the large monkeyface eel. Like other herbivores, it will occasionally consume animal material in the absence of its ideal food source; or possibly it is just responding defensively to the pole being thrust into its crevice. In order to be sure, more studies will have to be conducted.

Deirdre Hall is a new member of the ranger personnel at Fitzgerald Marine Reserve. She holds a bachelor of science degree from Fairleigh Dickinson University in New Jersey. She will assist Tim Sullivan and Scott Clark in the Junior Ranger program. She will be working parttime during the school year.)

Geological Process Has Shaped Reserve to its Present Refuge

(The article below was written for the Tides in 1988 by Melvin B. Zucker, a Skyline College science teacher. With excavations at the Marine Reserve in recent years, we thought a review of how Moss Beach geology blends past with present age would be of interest to our readers Ed.)

The Fitzgerald Marine Reserve is a museum of past and present geological processes that have shaped the refuge into its present shape. At the shoreline, at the outer margins, we find the remains of previous residents. This older rock layer holds the fossilized remains of clams and snails that lived in an ancient refuge millions of years before docents began to lead tours.

Beneath what is usually a thin, sandy beach deposit on the south side of the reserve, other rocks have revealed evidence of their ancient marine origins. Both whale and seal fossils have been observed embedded in these deposits.

Parts of the Fitzgerald Reserve fall victim to the pounding of Pacific storm waves. Structures in which humans dwell require protective seawalls to maintain their integrity in their struggle with the sea. The north end of the reserve has cliffs composed of young, poorly cemented sandy sediments that are especially vulnerable to erosion. Look for slumps and slides as evidence of the recently active undercutting of these cliffs.

The south end of the reserve is backed by cliffs with older and better cemented rocks that wear down more slowly in the surf. The sea picks away relentlessly at the more vulnerable rock layers and takes advantage of fracture planes of weakness. The more resistant rocks form the ledges of which we walk through the outer edges of the reserve. The weaker rocks have eroded down to form the tidepools. Thousands of years ago, sea cliffs stood where we today find the tidepools of the reserve. Much of the marine life of the reserve is dependent on this rocky shore environment for its successful existence. Differential erosion has left us the rich tidepools that are the display cases which give the reserve its protected status.

Next time you see someone bent over, or pointing to something in the reserve, consider that he might be observing the "museum" in which the marine life is exhibited.)
Physical factors acting on coral polyps and coral reefs may act to limit their distribution.

**Coral Reef Destruction Blamed on Natural as Well as Human Factors**

By Bob Breen
(Supervising Naturalist)

On a warm afternoon in late June I kicked out from the beach at Anini on Kauai’s North shore, heading towards the coral reef that is Kauai’s largest, extending out into the Pacific Ocean more than a half mile. Snorkeling past the sand pools with their numerous small fishes, and on to the shallow reef itself, I was struck by how gray and covered with algae the reef was. There were many herbivorous fishes and a few of their predators, but few living coral heads. The last year I had been here, 1991, numerous staghorn, *Fungia sp.*, and other corals could be seen. Missing also were the larger fishes (the area is heavily fished) and invertebrates such as nudibranchs, tube worms and seastars. Visibilities under water were very low for this area, about 20 to 25 feet, much different from the 100 to 150 visibilities that I had experienced in the 1970’s.

Coral reefs in Hawaii and elsewhere cover vast areas of shallow, inshore tropical waters. Coral reefs can be very ancient structures. Reefs in the South Pacific such as those found at Eniwetok Island are estimated to be 60 million years old. In contrast, those found in the Atlantic Ocean tend to be much younger, dating from the last ice age, 10,000 to 15,000 years ago.

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Coral reefs are found world wide from the polar seas to the tropics. Only in the tropics do they congregate in reefs. Central California has one species of solitary coral. The orange cup coral is about one-half inch in diameter and is found in low tide zones shaded from the sun. Unlike tropical reef-building coral this species does not harbor symbiotic algae in its tissues.

Light is a most important factor to coral reefs and their symbiotic algae. Called *Zooxanthellae*, the algae lives in the flesh of the coral and supplies it with as much as 90% of the energy it needs to produce Calcium Carbonate, (CaCO3) for polyp building. Among marine animals they are unique in their building of massive structures, done entirely by biological activity. The CaCO3 deposits are produced primarily by coral, with some contributions from calcareous algae similar to our local coralline algae. Coral reefs are among the most sensitive of marine organism to human impact. Siltation from construction, logging, and road building smother the coral, blocking the light and interfering with photo synthesis by its symbiotic algae. The *Zooxanthellae* algae needs crystal clear water to photosynthesize effectively.

Additional human impact factors causing large scale mortalities are chlorine from waste water, sewage, pesticides and herbicides from agriculture and runoff from roads and parking lots. Dynamiting as a fishing technique and the mining of coral for road building and construction aggregate are other major causes of reef destruction.

Reef destruction can also be natural, such as the passage of tropical storms and hurricanes. Their passage over the reef such as occurred on Kauai from hurricane Iniki in 1992 can mean destruction of large areas. Damage is done during storms when coral colonies are uprooted by storm waves and carried off, freeing space for more opportunistic species to move in, such as quickly colonizing algae species. Recovery of an already weakened reef system can be further inhibited by algal mats which take over the coral skeletons. The slippery surface of the seaweed does not allow for a stable substrate for recolonizing coral.

How long it takes a reef to recover from catastrophic events is not known. What little information there is known about recolonization from hurricanes indicates that under the best of conditions recovery may take 25 to 30 years. Anini Beach Park is a beautiful beach (complete with boat launch); however, what the coral reef will look like in 2021 may not be what we saw in 1991, or what we expected to see in 1996.

**Gee Whiz Tidepool Quiz**

(The following questions come from articles that have appeared in *Between the Tides.* See how many you can get right before checking your answers at the bottom.)

1. A chiton has____ plates covering its body. a. 2. b. 4. c. 6. d. 8.

2. A hermit crab can walk among the tentacles of a giant green sea anemone without being harmed. T__F__

3. It forms a spongy, gritty, sheet-like growth on rocks and on other organisms. It is a ______

4. Octopuses in aquaria have been observed to remember classical conditioning experiences for up to: a. 1-week. b. 3-weeks. c. 4 weeks. d. six months.

5. It is not a true crab, and is closely related to the hermit crab. It has large, broad claws that break off easily. It is a________ crab.

6. A seastar has eyes and can see objects moving in the water. T__F__
Those Innocent Looking Barnacles Are Sexy Crustacean Stone Masons

By Robert Van Syoc

We can't miss the shore barnacles during our walks between the tides. They coat many of the hard surfaces underfoot, even growing atop mussel, limpet and snail shells. Permanently attached as adults, barnacles are unable to run away from danger. Instead they depend on their sturdy limestone homes for protection from crashing waves, predators and our trampling feet.

The word barnacle comes from the Celtic name for "shell-fish", bernacae. The Celts also used this term to refer to geese thought to hatch from the stalked "egg cases" seen on trees washed ashore in Northern England and Scotland. We now know that the Celts saw the beaching of drifting logs covered with stalked barnacles, Lepas sp.

Barnacles are the only crustacean with a calcium carbonate (limestone) shell that is not shed during molting. Only the exoskeleton covering the soft body and legs is lost. Because of their shell, barnacles were originally classified as mollusks!

A famous American naturalist, Louis Agassiz, once remarked that barnacles are like shrimp that build limestone houses, stand on their heads, and kick food into their mouths. No longer needed for walking about, the thoracic limbs of barnacles (cirri) have evolved into a net-like feeding apparatus. Plankton trapped in the "cirri net" is transferred down to the mouth parts. Here the plankton is chopped up and ground down by the mandibles, speared by the pitchfork-shaped maxillae and brushed into the mouth by the second maxillae and palps. The rhythmic beating of the legs also aids in respiration.

Glued to the bottom, barnacles face a potential dilemma when they reach sexual maturity and need to find a mate. Unable to cruise the beach for a compatible partner, they simply reach out and touch their neighbor with a prehensile penis that is seven to nine times their body length. Fortunately, all of their barnacle neighbors can act as a functional female, since all shore barnacles are hermaphrodites. A receptive "female" partner will open her opercular plates when a friendly "male" gently knocks on "her" shell. The "male" can then deposit sperm inside his "female" neighbor's shell. The sperm fertilize eggs that the female extrudes into her mantle cavity between the body and shell. The fertilized eggs develop inside the barnacle until they hatch as tiny larvae and swim up, out and away from their mother into the sea.

The larval barnacle babies float in the plankton soup of the Pacific for about three weeks before looking for a suitable place to settle down. The barnacle larvae (called cyprid larvae) swarm down along the sea covered reef at high tide, "sniffing" the bottom by touching it lightly with their antennae. Chemical sensors on the antennae allow the young barnacles to find a spot with the right "taste". This usually means finding adult barnacles of the same species.

Once they locate their friends, the larvae secrete glue from cement glands at the base of their antennae and stick themselves down. Within a few hours they begin a dramatic metamorphosis from larva to juvenile, taking on a typical barnacle shape.

Several species of barnacles commonly inhabit the intertidal zones of the central California coast. Shoreward and highest up we find the tiny Chthamalus dalli and Chthamalus fissus. These species are very tolerant of exposure at low tide, but vulnerable to competition from the larger Balanus glandula for space. Therefore, the upper intertidal band of Chthamalus is bounded by Balanus glandula below. The lower edge of the B. glandula population is regulated by predation by Pisaster ochraceous, the ochre seastar, and barnacle drills, predatory snails Acanthina spirata and Nucella emarginata. These snails can be seen at the lower margin of the B. glandula, presumably waiting for high tide so they can resume stalking their prey.

Further down, in the mid-intertidal, we may find the red thatched barnacle, Tetracclita rubescens. San Francisco marks the northern end of the range for this four-plated barnacle.

The upper surfaces of the outer reef are home to patches of the intertidal stalked barnacle, Pollicipes polymerus. P. polymerus often lives among beds of the California mussel, Mytilus californianus. Barnacle and mussel compete for space in the surf zone along the outer rocky reefs. Although larval Pollicipes are more adept at colonizing bare rock surface, the fast growing Mytilus can eventually "muscle out" the crustacean. The ochre seastar, Pisaster ochraceous, is a leading actor in this action drama. It prowls the edges of the mussel beds. During high tides it crawls up onto a mussel and eats the hapless bivalve. A single hungry star can leave a swath of empty shells. A mussel bed so weakened by the seastar's appetite is more susceptible to being ripped from the rock by winter storm surf. The bare rock exposed after removal of the mussel bed is then available again for colonization by the next spring's swarm of larval barnacles.

(Robert J. Van Syoc, Ph.D., is a marine biologist with the Department of Invertebrate Zoology and Geology at the California Academy of Sciences in Golden Gate Park. He has studied a variety of topics in marine ecology and invertebrate zoology. His current primary research interest is the evolution and biogeography of barnacles for which he employs recently developed techniques of DNA analysis to study genetic relationships and speciation at the molecular level.)
HMB High School Student Sets Goal for Career in Marine Biology

By Janina Arianna Larenas

Ever since I was a little girl I have wanted to become a marine biologist. My father lived in the Princeton harbor and used to show me all the wonderful little creatures living under the docks. To this day my step-mother says she looks at me and sees a little girl lying on the docks, poking stuff. I can’t remember ever wanting to do anything other than become a marine biologist, although my mom swears I had aspirations to be a garbage collector. Taking the docent program with the Fitzgerald Marine Reserve has meant so much to me, especially since, next to marine life, little kids are the next best thing.

Janina Larenas

It is uplifting to take a group of five or six kids to the tidepools who may never have even been to the beach before, and show them the wonders of the sea. The first thing they want to see are the hermit crabs. In the process of searching for them, they see limpets, chitons, barnacles, the not so “interesting” (though only because they don’t move) but just as important creatures of the sea. Next it’s the fish, then the sea stars, then the crabs. Everyone wants to hold the crabs. You pick up a full grown purple shore crab with its pinchers outstretched, ready to fight, and the first words out of the kids mouths are, “Will he pinch? Can I hold him?” So you hand them a porcelain crab or a young green lined shore crab and they are almost satisfied; but, you still hear them ask for the big crabs every time you pick one up.

I always tell the kids how to identify the animals, but I never thought it actually sunk in. Then, on my third or fourth tour I began asking the kids to identify them; they always got it—almost. “That’s a, um, I know, purple crab...” or, “That’s a shore, green, crab.” It’s amazing how much affect learning about and seeing these animals has on those kids. You really do teach them to respect the environment.

After the Fourth of July I gave a tour to some kids who had never been to the beach, not one of them. As we were walking back from the tour one of them pointed out a gray stick on one of the rocks. “What’s that?” It was a firework, and as we looked around we saw several of them lying on the rocks and in the water. The boy looked at me and said, “Who could do that to a place so full of life?” I thought about it, and realized it was probably the locals of the coastline, the people who have seen the ocean every day for most of their lives. It made me really sad. A lot of people take advantage of the fact that the ocean is here, but I always assumed it be tourists, the ones who don’t have to see the disaster, just the beauty. We sometimes forget what a wonderful and living place the ocean can be; but for me, giving these tours reminds me every day.

There is more than just the satisfaction of teaching the kids, there is a personal satisfaction in just watching the ocean change. I have been giving tours most of this year. In July I

Please turn to page 7. See Student
of the most diverse intertidal areas in California. The need for continued wildlife protection at the reserve and, indeed, along the whole county coast is urgent. We hope that you will join with us in this effort to insure that the Fitzgerald Marine Life Refuge (FFMLR) retains its integrity as a rich and diverse resource for generations to come. All you need do is to complete the coupon below and with your tax deductible donation mail it to the address listed.

THE PRESIDENT’S CORNER

By Virginia Welch
(FFMLR Board Chairman)

It has been my privilege to serve on a committee formed by Bob Breen to establish long-range interpretive and educational programs for the Fitzgerald Marine Reserve. The committee is composed of nine enthusiastic and knowledgeable people: Ellen Gartside, Kelly Huber, Jan MacFarland-Brown, Mallory Nomura-Saul, Tim Sullivan, Beth Tempesta, and Debbie Yee-Vollmer. They started meeting in March, and hope to have a plan to present to Director Patrick Sanchez by January, 1997. The committee would welcome any ideas you might have. Send them to Bob Breen, PO Box 451, Moss Beach, Ca., 94038, or talk to any committee member.

The Teacher Workshop has been scheduled for Saturday, February 8, 1997. This workshop will be a great help to teachers planning to bring their classes to the Marine Reserve. The registration fee is $25 which includes instructor materials. The course has been prepared and will be presented by Bob Breen, supervising naturalist at the reserve, and Dr. Tom Niesen, Department of Biology, San Francisco State University. For more information or registration information call the Marine Reserve, 728-3584.

THE WILY OCTOPUS

The octopus, long depicted in stories and movies as the giant killer "devilfish", is really a shy and gentle creature. A mollusk without a shell, the octopus has a highly developed nervous system and is the most intelligent invertebrate. Octopuses have been found, through shock and reward, to retain memory for up to three weeks. In other tests small crabs (a favorite food of the octopus) have been placed in a jar of water where an octopus lives. Before very long the octopus will unscrew the lid on the jar and reach in with one of its tentacles and get its dinner.

Become a member of the FRIENDS OF FITZGERALD MARINE LIFE REFUGE and help to:

- Protect and preserve a remarkable natural area;
- Encourage educational and research programs at the refuge;
- Support educational and interpretive services to the public and youth groups;
- Provide special programs for our members;
- Publish and distribute the quarterly Between the Tides.

Fill out this slip and mail with your check made out to FFMLR to:
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TIDEPOOL TALES
By Debbie Rogers

Every visit to a beach is an adventure. There's always a feeling of anticipation, mystery and wonder. The beach pulls like a magnet, and the attraction never fails to deepen an already existing strong interest and curiosity.

A visit to a new beach recently was a reminder of how much about an area is revealed by what is or is not found on the sand. During medium tide at the new beach there were no shells of any kind on the sand, only a few stray wisps of algae, and the coarseness of the sand grains indicated a pretty rough surf. Though there were smooth rocky outcroppings at either end of the beach, the lack of any bits and pieces on the shore probably means that tidepools will not be revealed at even the lowest tides.

By contrast, visits to the beach at Fitzgerald Marine Reserve during ANY tide always gives the visitor hints of the rich abundance of life that exists there. And it is the diversity of life along this stretch of shore that so amazes. School children visiting this area for the first time are stopped in their tracks as soon as they encounter all the flotsam and jetsam on the sand: the colorful shells of one and two-shelled creatures, crab legs small and large, myriad kinds of algae, sometimes in great heaps, bits of fish bone, rocks with dead kelp holdfasts still clutching them, rocks pock-marked from rock-boring clams - a seemingly endless assortment advertising the rich animals and plant life of the area.

With the changing seasons the beach can have a very different overall look, i.e., in summer the visitor can stroll on a sandy beach but in winter, due to wave action and currents, it's a rocky beach, which is when the petrified whale bone rib is exposed. And at certain times of the year the beach might be BLUE with all the stranded velella-velella which have unfortunately been washed ashore and died, their blue coloring giving way to what looks like clear plastic discs with little sails on top. One of the most astonishing sights ever was during an El Nino season, and to this visitor's great surprise the beach and exposed reef were PINK with pelagic crabs which had been washed ashore and died. They COVERED the landscape. But as is always the case here, no food is wasted and the misfortune of the crabs was indeed a free lunch for the inundated anemones which, according to Bob Breen, grew an extra measure that year!

The relationship of a beach to its intertidal zone is, in some ways, like the relationship of an overture to its musical show or opera. The former captures our attention, gives us samplings of what we are about to experience and draws us closer to the main attraction.

FEATHER DUSTER WORMS

These tube worms live in the lower intertidal zones, constructing their mucus and sand tubes between the rocks. The worms may attain lengths of up to two feet.