BETWEEN the TIDES

Friends of Fitzgerald Marine Reserve

December 2017

2017 Annual Volunteer Appreciation Luncheon

The sun was shining brightly on Saturday, October 21, when Linda Ciotti welcomed FFMR naturalists and guests who gathered at the Half Moon Bay Yacht Club for the annual appreciation luncheon of delicious barbecued ribs, sliced turkey breast, and all the fixings.

After lunch, Linda began award presentations.

Sea Star Award – *Deb Landman*: Each year we make a special presentation to a new volunteer who has jumped right in and helped with tours or contributed in other ways. This year's recipient of the Sea Star Award was eager to help right away with conducting tours. Deb also participated in the full week of Junior Naturalist Camp.

Ginny Award – *Juliet Bolding*: We also make an award each year to acknowledge a longer-serving volunteer who has made many contributions to FFMR. Juliet, a volunteer naturalist since 2011, has been a steady tour leader, a participant in most of the July 4th parades, and for many years has helped with annual Ocean Week programs, particularly at Hatch Elementary School in Half Moon Bay.

Just as Linda was closing her presentation Tom Niesen asked to speak. He praised Linda for her outstanding FFMR involvement. He then gave an emotional account of the forced evacuation of his Santa Rosa home and the uncertainly (until two hours prior) that his house was unharmed by the fires. He said that he drove to the luncheon because he wanted to be with members of FFMR who mean a great deal to him. He reminded all of us of the value of our organization and to be proud of the important work we are doing as members.

The luncheon always ends with Linda passing out pewter pins to all of the naturalists. The featured animal is always a well-kept secret (even Linda's husband doesn't know what she has chosen). This year it was every child's delight, the hermit crab.

Special thanks to Linda Ciotti for chairing the event, to Hope Suchsland for handling the food and Carol Davies for securing the Half Moon Bay Yacht Club once again for our use and also for handling the beverages. ◆

Friends of Fitzgerald Marine Reserve

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Our Mission:

To inspire the preservation of our unique intertidal environment through education and the support of research.

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Plankton Discovery Workshop

by Karen Kalumuck

Plankton net

Ceratium

On Saturday, September 23, the Greater Farallones Marine Sanctuary hosted 15 FMR docents for a Continuing Education event, a Plankton Discovery Workshop.

It was a stunningly beautiful, sunny day, and we all enjoyed our time out on the organization's private pier at Crissy Field in San Francisco. Our host, Justin Holl, the Visitors Center Manager, helped each of us get comfortable doing a plankton drag off the pier with fine mesh nets, examining our "catch" with microscopes, and projecting images of the tiny organisms for all of us to learn about and enjoy.

Justin, a former FMR docent, guided us expertly through the identification of a variety of plankton types, both holoplankton (those that spend their entire lives as plankton) and meroplankton (where the planktonic form is juvenile and it metamorphoses into an adult form). Particularly abundant was the horned dinoflagellate *Ceratium,* the cause of red tide. Other common plankton in our samples included the sputnik-like *Actinopoda; Noctiluca,* the cause of phosphorescent waves; and varieties of the delightful Tintinnids that Jason dubbed the "roomba s of the sea" due to their voracious vacuuming of tiny food particles and their tendency to run into things and bounce off in another direction.

Justin Holl

While we don't tend to talk much about plankton in our FMR tours, they are a foundational basis for all marine ecosystems, as well as terrestrial ones. Marine photosynthesizers, including microscopic algae and phytoplankton, produce at least 50% of the oxygen in our atmosphere. (See more photos on page 12.) ◆

King Tides Coming to the Coast

The San Mateo Coastside will experience five major King Tides (extremely high tides) December 3–5 and January 1-2. (See tide chart below. Note that one of the highest tides and one of the lowest tides of 2017 both occur on December 4.)

The California King Tides Project invites the public to document these extreme tides as they will be playing an increasingly larger role in the future of the reserve and coastlines throughout the world: "The California King Tides Project helps people visualize how sea level rise will impact their lives. Via smartphones and social media, we invite you to document King Tides which will be the average water levels of the future. Everyone is welcome to participate!"

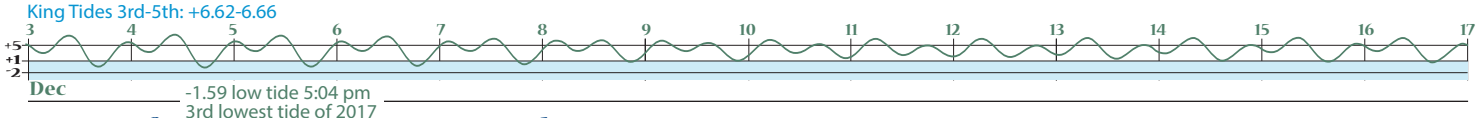
Check out their website: California.KingTides.net for information on guided tours on the San Mateo Coastside, a broadcast on the morning of Dec. 5th by the California State Parks, information on where and how to best shoot the events and other relevant information and happenings. ◆

The graph displayed across the page bottoms shows tides for 12/3/17 to 4/21/18. Where the date appears is midnight. The reefs are accessible for exploring during low tides—at least +1 or below. This area is shaded light blue. See: http://fitzgeraldreserve.org/resources and click on "Tides" for a more detailed tide chart.

The winter afternoon low tides change to morning low tides in March. There are almost equally low tides several days before and several days after the noted low tide dates.

The lowest tides and the King Tides this period are:

+6.62	12/3	9:20 am
+6.66	12/4	10:05 am
-1.59	12/4	5:04 pm
3rd lowest tide of 2017		
+6.53	12/5	10:53 am
-.52	12/18	4:50 pm
+6.85	1/1	9:00 am
+6.87	1/2	9:49 am
-1.70	1/2	4:53 pm
2nd lowest tide of 2018		
-.44	1/16	4:31 pm
-1.38	1/30	3:51 pm
-.90	2/28	3:32 pm
-.76	4/19	7:50 am



President's Report

The Friends of Fitzgerald Marine Reserve (FFMR) is a non-profit 501(c)3 organization whose group of volunteers work to inspire the preservation of our unique intertidal environment through education and the support of research.

I invite you to review the highlights of our activities this past year as shown in the infographics below. We hope you will be inspired to join us in our efforts either through a donation or by becoming an FFMR Naturalist (see the registration form on the back page).

Looking forward to seeing you at the tidepools,

Kathleen Hayes

GUIDED TIDEPOOL TOURS

FFMR volunteer naturalists led

2,300

students on educational tours of the reserve during the 2016-2017 school year.

SEAL WATCH

250-300

harbor seals live year-round at FMR. This rookery requires extra protection and FFMR provides materials to train volunteers for this special responsibility. These volunteers are called "Seal Sitters"! FFMR will also be purchasing spotting scopes so volunteers can better inform visitors about our resident pinnipeds.

BUS SCHOLARSHIPS

2 bus scholarships were awarded to schools to provide transportation for students from under-served populations to visit FMR and have an educational tour. For many of these students, this was their first visit to the ocean.

QUARTERLY NEWSLETTER AND WEBSITE

30 years worth of information and entertainment about Fitzgerald Marine Reserve has been provided by FFMR volunteers via the FFMR quarterly newsletter *Between the Tides* and the FFMR website: www.fitzgeraldreserve.org

SUMMER CAMPS

31 lucky campers spent five days at the reserve in the FFMR Junior Naturalist Summer Camp in July 2017. FFMR volunteers educated campers on the science and history of the reserve while entertaining them with arts and crafts, guided tours, games and competitions.

DOCENT TRAINING PROGRAMS

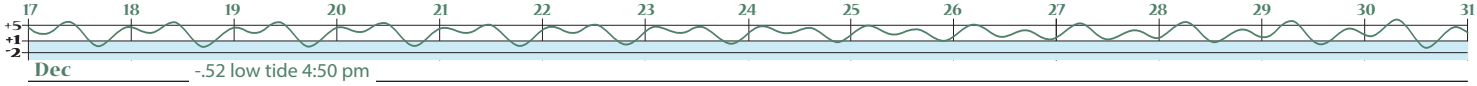
200 volunteer naturalists have been educated and trained over the past ten years by FFMR volunteers and local educators. These trained volunteer naturalists then educate the public by providing tidepool tours that foster a sense of stewardship through knowledge of the reserve. FFMR is always actively recruiting volunteers at the reserve. To find out more about all of the FFMR volunteer opportunities, please visit www. fitzgeraldreserve.org or contact volunteer@fitzgeraldreserve.org

SCHOLARSHIPS FOR LOCAL HIGH SCHOOL GRADUATES

$15,000 worth of scholarships were granted by FFMR to three Half Moon Bay High School students in 2017. A tradition since 2001, the scholarships are awarded to graduating seniors wishing to continue their education in marine science.

CITIZEN SCIENCE PROGRAMS

1000+ nudibranchs were observed during recent nudibranch surveys conducted by FFMR volunteers together with the California Academy of Sciences and other Citizen Scientists. These surveys of local nudibranch species are conducted each quarter.



California Quail

White-throated Sparrow

Winter Birds at FMR

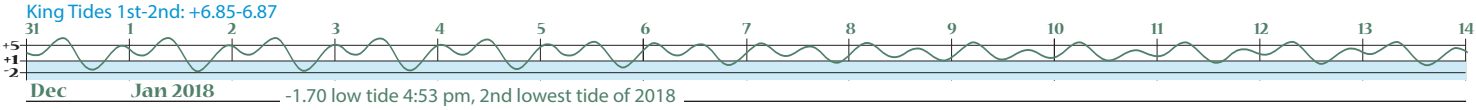
In addition to being a premier tidepooling location, Fitzgerald Marine Reserve is an outstanding place for birding. Not only are there interesting resident species, the location is also visited by many migrating birds. The ebird.org site (where most serious birders record their observations) is a real-time, online checklist program. The best location for spotting birds is right along the stream, particularly above the bridge. FMR is special in so many ways! If you want to learn more about the birds at Fitzgerald, join one of the excellent walks led by Sequoia Audubon, listed on their website:
http://www.sequoia-audubon.org/fieldtrips.html

Text and photos by Barbara Dye.

House Finches

Towsend"s Warbler

Northern Mockingbird



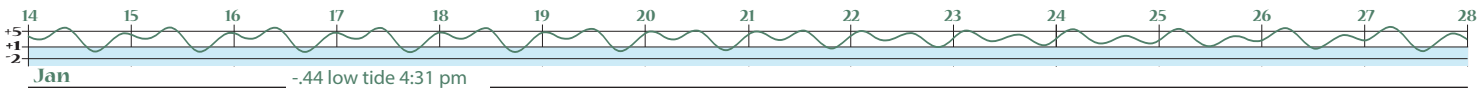
Northern Flicker

Red-shouldered Hawk

Ruby-crowned Kinglet

Fox Sparrow

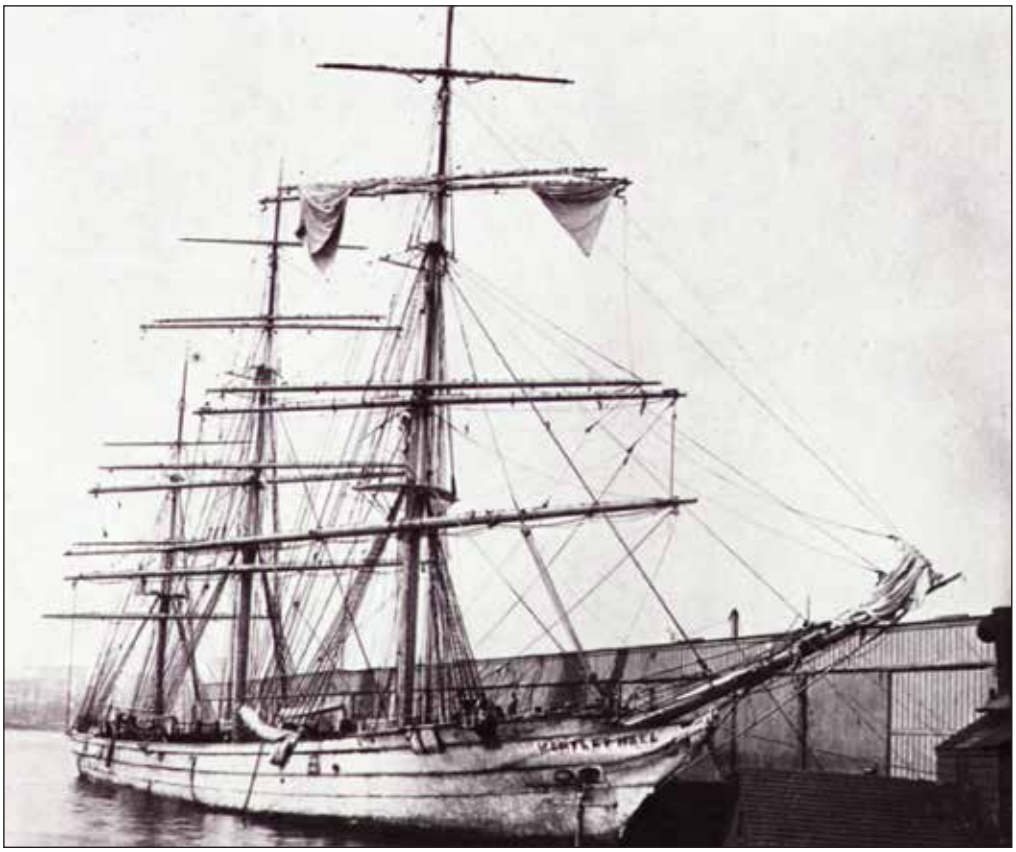
Red-breasted Sapsucker



The Wreck of the Rydal Hall on Frenchmans Reef

by Keith Mangold

The *Rydal Hall* was an iron hulled, "fully rigged" sailing ship built by Evans R. & J. & Co. of Liverpool in 1874. It was owned by Robert Alexander of the Sun Shipping Co., and operated in the Hall Line. The ship was a transport weighing 1864 tons. Its dimensions were 260 feet by 42 feet. It was dismasted early in its short life and became the subject of an insurance inquiry.



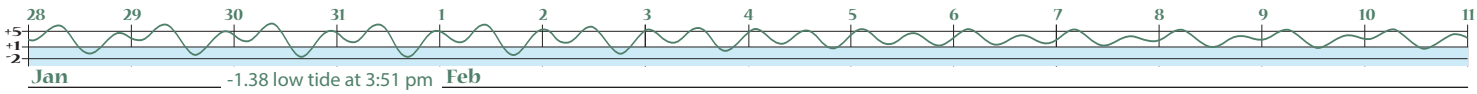
Sister Ship to the Rydal Hall? The iron hulled ship Mistley Hall docked in an unidentified port [iron ship, 1867 tons, 260.0 x 42.3 x 23.9]. Built 1874 by Evans R. & J. & Co. of Liverpool. Owners: Sun Shipping Co. Ltd., registered Liverpool. Note: The "Hall" name, of the Sun Line was owned by Alexander Hall, Both were built in 1874 by Evans R. & J. & Co. of Liverpool. Both were 160 feet in length and 42 feet wide. Mistley Hall was 1867 tons vs 1864 tons for the Rydal Hall (possibly due to mast reinforcement).

On October 17th, 1876, the ship was carrying "steam coal" from Cardiff, Wales when it ran aground on the tip of what is now named Frenchman's Reef off the Coast of San Mateo County within the current boundaries of the Fitzgerald Marine Reserve. The wreck resulted in the loss of ten lives. Many of the crew were rescued by whalers who used the cove inside the reef as a base of operations. Within three days of the shipwreck, the auctioneering company S. L. Jones and Company attempted to auction the salvage rights to the wreck although no salvage was apparently undertaken.

The wreck was forgotten for many years until it was rediscovered by an abalone diver in 1971. Local divers recovered numerous artifacts, including two anchors, a cannon, and the ship's bronze bell with the *Rydal Hall* name and the date of 1874. The cannon is on display at the San Mateo County ➦

The wreck was forgotten for many years until it was rediscovered by an abalone diver in 1971.

The Cannon (San Mateo County History Museum) When salvaged, the cannon looked pristine, ready to fire, but deteriorated rapidly on exposure to the air.



A Tribute to Deborah Sabelli

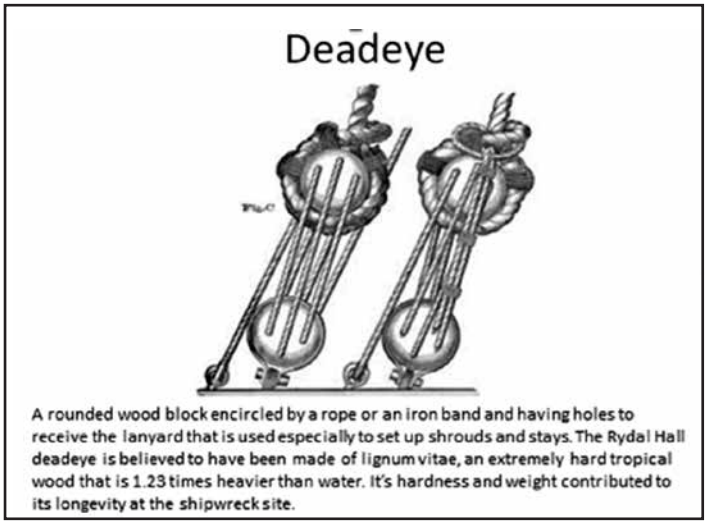
It is with sadness that we report the passing of one of our newest volunteers and also one of the most dedicated to FMR and FFMR, Deborah Sabelli. Deborah was married to Volunteer Glewn Gutleben. Once the new FMR Visitors Center was ready to open in March of this year, Ranger Rob Cala provided a training for interested FFMR volunteers to learn how to operate the video projections on the new large monitor inside the center, and also how to show others how to use the new Sprout computer that had been donated by Hewlett-Packard. Both Glenn and Deborah immediately signed up to help out. Since that training in March, Deborah and Glenn worked every weekend without exception. Deborah worked alongside Glenn in the Visitors Center and was an amazing ambassador for both FMR and FFMR. And, despite the fact that she had been volunteering just since March, Deborah logged in 98 hours of her time. So, we thank Glenn for introducing Deborah to us and for the many hours she spent helping the visitors to FMR. ◆

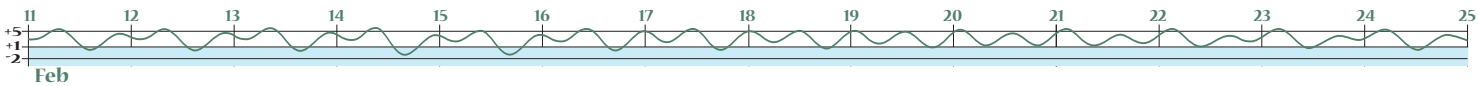
➥ Historical Museum. The anchor is outside the Half Moon Bay Brewing Company in Pillar Point Harbor. A deadeye is on display at the Fitzgerald Marine Reserve. Another anchor remains at the wreck site, cemented to the iron plates and 2,551 tons of Cardiff steam coal. ◆

Many of the crew were rescued by whalers who used the cove inside the reef as a base of operations.

The Anchor (Half Moon Bay Brewing Company)

The Deadeye (Fitzgerald Marine Reserve)





Meeting the Challenge of Rising Seas

by Janet Pelinka

The Dutch have devised lakes, garages, parks and plazas to be enormous reservoirs for when the seas and rivers spill over.

Malé…is now renting out islands and using the money to reclaim, fortify and even build new islands.

In 2003, the people of the Carteret Islands became the world's first environmental refugees.

There is some disagreement regarding the cause, but the consequences of melting ice and expanding water due to an increase in climate temperatures present a demoralizing array of challenges. Many government agencies are embracing these challenges in varied and innovative ways. Following are just a few ideas and implementations that are taking place.

Holland, famous for its dikes, has adopted a different philosophy for protection from the sea, and that is to live with the water rather than struggle to defeat it. The Dutch have devised lakes, garages, parks and plazas to be enormous reservoirs for when the seas and rivers spill over. It has installed plazas with fountains, gardens and basketball courts in underserved neighborhoods that can act as retention ponds. Fortifications, big and small, have been knitted into streets and squares.

London's city planners have also developed a range of flexible options that would protect the Thames Estuary against up to 5m of sea-level rise. These include raising defenses, implementing flood storage and constructing a new and bigger Thames Barrier further downstream from the existing barrier.

Malé, the capital of the Maldives, is surrounded by a sea wall that for lack of space limits future coastal protection as sea levels rise. So the government is now renting out islands and using the money to reclaim, fortify and even build new islands. The idea is for people living on smaller, lower-lying islands to be relocated to more flood-resistant islands when needed. A new island, Hulhumalé, has been constructed by a state-owned company. The Maldivian government has also started a joint venture with the architectural firm Dutch Docklands International to build the world's largest artificial floating-island project.

In 2003, the people of the **Carteret Islands** became the world's first environmental refugees. Papua New Guinea authorized a government-funded evacuation of the island because of rising seas and salt water intrusion. A grassroots organization has continued the work to relocate islanders to the autonomous Region of Bougainville, east of mainland Papua New Guinea, and is hoping to relocate more than half of the population by 2020. They have received 85 hectares from the Catholic Church; that can resettle about 35 families. Finding funding to build houses is among the many challenges the refugees must face.

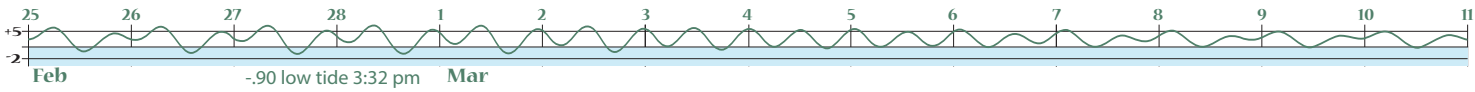
Da Nang, Vietnam, is a critical port city sitting right in the middle of the country. The coastal areas around the city have trouble keeping water out, and many of the homes are too poorly built to withstand flood waters. So the Institute for Social and Environmental Transition has partnered with the Rockefeller Foundation's Climate Change Coordination Office to give Da Nang's residents the resources to build stronger, flood-resistant homes

Semarang, the capital of Indonesia's Central Java province, is another southeast Asian port city with a major flooding problem. Their city developmental planning and environmental projection board is partnering with international development organization Mercy Corps to create a flood forecasting system. The system focuses on determining which prevention and response strategies work best, which areas of the city are in the most danger, where flood shelters can be built and how to create an effective forecasting model that brings all of these efforts together.

Recent reports from groups as dissimilar as the World Bank, the Menzies Research Centre and the Lowy Institute have suggested allowing open-access migration from Pacific Islands to Australia as a more effective economic stimulus than aid, and as a strategy for coping with the impacts of climate change, which are already beginning to see islands across the Pacific lost to the sea.

The Inupiat Eskimo village of **Kivalina** has constructed a wall to hold the waters back. Sea ice used to protect the barrier reef the village is situated on, but the ice melts sooner each year, leaving the community unprotected from storms. Residents understand that they will eventually have to relocate, but relocation costs have been estimated at more than $400 million. So the village sued nine oil companies, 14 power companies and a coal company, claiming that the greenhouse gases they generate are to blame for the rising waters endangering their community

As rising sea levels pose a growing threat to **Boston's** future, city officials are exploring the feasibility of building a vast sea barrier that would form



a protective arc around Boston Harbor. Other ideas are to shore up house foundations, raise electrical and mechanical equipment to safe levels, change building codes, and introduce canals into lower-lying back alleys and some main streets in an alternating pattern that would crisscross the streets of the Back Bay.

New York dealt with costly and destructive flooding after Hurricane Sandy. Now, work will begin on several anti-flooding projects that recently received a combined $1 billion in funding from the federal Department of Housing and Urban Development. The projects include a U-shaped berm that will hug the Lower East Side of Manhattan and will shield ten miles of coastline with an isolated flood zone and recreational areas with salt-resistant vegetation. Also included is a living breakwater along Staten Island's South Shore, and a flood prevention plan for Southern Nassau County.

Ocean currents and geology are causing the seas to rise at twice the global average in **Norfolk,** Virginia, home of the world's largest naval base. The Pentagon has barely begun the hard work of adaptation. And in surrounding areas where base employees live, flooding is already so routine that giant rulers have been erected beside the city roads outside the base to show whether water is too deep to drive into. In the summer of 2016 the Dutch were invited by Norfolk officials to conduct a weeklong workshop where they introduced "living with water," an approach that has influenced the city's new resilience plan that includes marshes, rain gardens and permeable pavements. Barriers that incorporate a walking path along the top, and marsh grasses that will migrate up the shore as water levels rise are part of this new philosophy.

The **San Francisco** Planning and Urban Research Association has suggested the idea of constructing a giant tidal barrier stretched across the Golden Gate. The group said a large dam, gate or lock to manage tidal flows in and out of the San Francisco Bay, and under the Golden Gate Bridge, might protect "a huge area of land from flooding with one project." Other strategies mentioned in their report are levee and sea wall construction along the coast, moving development to higher elevations, building more structures that float, and managing a calculated retreat from low-lying areas more likely to be submerged by 2100.

City planners in **Newport Beach** are raising seawalls, and new homes along the city's harbor are being built on foundations several feet higher.

The city of **Ventura,** California, used grant funds from the California Coastal Conservancy and the Federal Highway Administration to retreat from the ocean and relocate a bike path and beach parking lot out of harm's way from rising sea levels. As of 2014, the beach at Surfers' Point has a 70-foot wide buffer zone and a significant sediment reservoir.

State agencies are updating the State of California Sea-Level Rise Guidance Documents to reflect recent scientific advances. This will help cities and counties as they comply with a new law that requires them to incorporate climate change into their planning efforts and assist state agencies to prepare for and adapt to climate change, as directed by Governor Brown's recent Executive Order.

The Department of Transportation has identified which highways will be moved back from the coast and which low-lying roads must be elevated. The parks department is considering relocating parking lots and restrooms away from the beach. The Coastal Commission has assisted California's 15 coastal counties in identifying structures to be moved and areas where it is too dangerous to build. The commission, which approves permits for all development along the coast, has denied the siting of a wastewater treatment plant in Morro Bay and has deemed a power plant in Oxnard to be in harm's way.

But for all the state's studies, the precise details for responding to sea rise are mostly local decisions involving zoning, building codes and engineering projects with crippling costs attached.

The **County of San Mateo** initiated a countywide sea level rise vulnerability assessment in June 2015. it was released in May 2017. The goal of the assessment is to identify vulnerable assets on the bay and coast side of the San Mateo County peninsula, determine types of impacts, issue initial recommendations on adaptation measures, and improve flooding and sea level rise mapping. The County of San Mateo will manage and oversee the collaboration of many organizations working together to plan and adapt for sea level rise, in partnership with the California State Coastal Conservancy.

Ultimately, these case studies illustrate that cities have unique challenges that must be met individually. Adaptation and innovation have to be recognized as the key to meeting rising sea level threats. Engineering design, government authorities and social attitudes must acknowledge that change needs to occur if we're to avoid disaster. ◆

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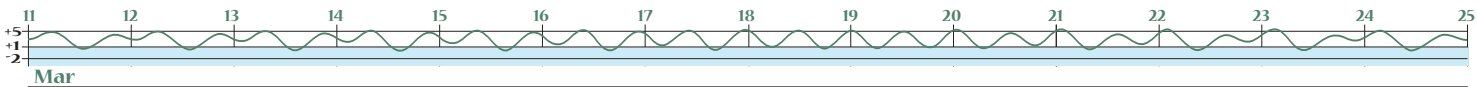


The Ancient Chitons

by Sasha Greenawalt

Chitons are one of the oldest species of animal found on the reef at FMR. It's fossil record dates back 400 million years.

While exploring FMR tidepools you have probably stepped over, or even on, one of the oldest species of animal found on the reef at FMR—the chiton. (Its fossil record dates back 400 million years.) These animals can be easily identified by their shells that are composed of 8 plates, or valves, which overlap slightly at the front and back edges, and yet articulate well with one another. In this way the shell provides protection and flexibility to the animal at the same time. It permits the chiton to flex upward when needed for locomotion, and even allows the animal to curl up into a ball when dislodged from rocks. The valves are encircled by a skirt known as a girdle. Chitons live on rocks, under rocks or in rock crevices. Most chitons are herbivorous, but some are omnivorous and some carnivorous.

Gumboot Chiton
Photo: AlaskaSealife.org

Sometimes referred to as the "wandering meatloaf," the **gumboot chiton,** *Cryptochiton stelleri,* is the largest of its class (up to 14 inches in length). It doesn't appear to fit the chiton description because its plates are completely hidden by its leathery upper girdle, which is usually reddish-brown, brown, and occasionally orange in color. The name is said to be derived from its resemblance to a Wellington rubber boot. Its regular diet is algae, scraped off of rocks with its rasp-like retractable radula, which is covered with rows of magnetite-tipped teeth. It also eats other marine vegetation such as sea lettuce and giant kelp. A nocturnal creature, the gumboot generally feeds at night and often remains in a hiding place during the day—although on foggy days it may be found exposed in tide pools or on rocks. The gumboot can live for over 40 years. It has few natural predators.

Black Katy
Photo: GroundTruthTreking.org

It is always exciting to spot a **black Katy chiton**, *Katharina tunicate,* because they aren't commonly seen. This animal can grow up to 4.7 inches long and has a black leathery girdle in which are embedded the eight protective plates. The girdle is covered with a chitinous cuticle. Like other chitons, this animal is a slow moving grazer that consumes several species of brown and red algae including kelps, sea lettuce, and encrusting diatoms. It is also known to eat sponges, small barnacles, and bryozoans. Its predators include sea urchins, leather stars, black oystercatchers, glaucous-winged gulls, and humans.

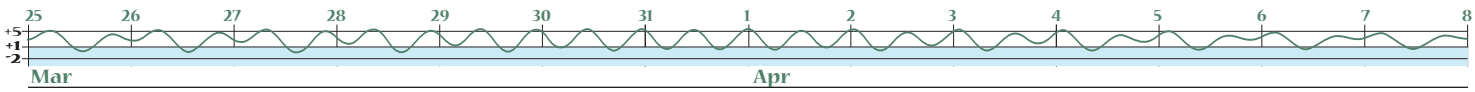
Mossy Chiton
Photo: Mark Brown

The one chiton that a visitor to the tidepools is sure to spot is the ubiquitous **mossy chiton,** *Mopalia muscos.* The most distinguishing characteristic of this chiton is its mossy-textured girdle formed by long stiff hairs that are usually distinctly shaggy-looking. The shell plates are dark brown or grey and fairly drab, and they are surrounded by an even width of girdle.

Nutall's Chiton
Photo: Flickriver.com

Sometimes mistaken for the Mossy chiton is the **Nuttall's chiton,** *Nuttallina californica,* that has narrow plates and a girdle coarse with tufts of short spines. This creature was named after Thomas Nuttall, an early 19th century botanist and zoologist. The World Register of Marine Species lists 44 marine genera and species named after him

Probably the most beautiful chiton in the tidepools is the **lined chiton,** *Tonicella lineata.* Its shell is very colorful, having blue, purple



or black straight or zig-zag lines on each of the eight valves. The background color of the valves is often brown or red, but can also be bright blue or yellow to orange. The girdle is hairless and brown to red or pink, often with regular yellow or white patches. This species grows to 2 inches in length. Its major food is coralline algae and it is often found on rocks encrusted by that algae.

Not frequently seen is the **woody chiton,** *Mopalia lignose,* whose girdle hairs are not as long as the girdle is wide. The lateral areas of plates 2-7 are separated from the middle region by a ridge or series of small tubercles. The surface of the plates has longitudinal rows of small pits visible with low magnification, especially in the central areas. Its plates have streaks and lines of brown, purple-brown, mahogany, or occasionally white, and its girdle is cream, brown, or purple-brown above and orange below.

Possibly the most unusual characteristic of the **veiled chiton,** *Placiphorella velata,* is its taste for other invertebrates. This species not only grazes on microalgae but traps small crustaceans and worms. When these creatures crawl under its raised veil, it lowers its veil rapidly, virtually "stomping" on them. Smaller crustaceans are swallowed whole. Larger prey, including crabs up to .4 inches across, are torn up by the radula before being eaten. It can measure up to 2 inches long, has all eight plates visible, and its dorsal surface of its girdle has long scaly hairs. The anterior girdle is much wider than elsewhere, often is lighter in color than the rest of the girdle, and may be held high above the substrate like a veil. The valves are short and wide, brownish or reddish, mottled and streaked with white, beige, green, and occasionally black. Juveniles may have bright spots on valves. ◆

Lined Chiton
Photo: Reef Sanctuary

Woody Chiton
Photo: Don Loarie, iNaturalist

Veiled Chiton
Photo: Sara Wickham

Can a Chiton See?

A unique chiton feature are its organs called aesthetes, which are light-sensitive cells located just below the surface of the shell. In some cases they are modified to form ocelli, a cluster of individual photoreceptor cells lying beneath a small aragonite-based lens. Each lens can form clear images, and is composed of relatively large, highly crystallographically-aligned grains to minimize light scattering. An individual chiton may have thousands of these ocelli. Only fossils younger than ten million years have ocelli. The image produced by the chiton eye is over a thousand times coarser than that produced by the human eye. Research continues as to the extent of chitons' visual acuity. Studies have been done to show that chitons can differentiate between a predator's shadow and changes in light caused by clouds. Thus their aragonite-based eyes make them the most recent animal eyes to evolve. ◆

Possibly the most unusual characteristic of the veiled chiton, Placiphorella velata, *is its taste for other invertebrates.…[it] traps small crustaceans and worms. When these creatures crawl under its raised veil, it lowers its veil rapidly, virtually "stomping" on them.*

Friends of Fitzgerald Marine Reserve

Membership Secretary, P.O. Box 669, Moss Beach, CA 94038, or through our website: www.fitzgeraldreserve.org

Contribution Levels:

❑ $25 ❑ $100 ❑ $1000

❑ $50 ❑ $500 ❑ Other _____

❑ I want to double the value of my gift through my employer's matching gift program (please enclose the matching gift forms).

Name _____

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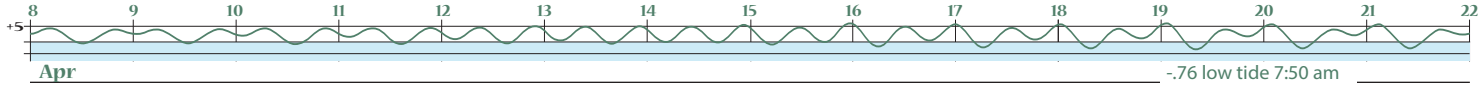
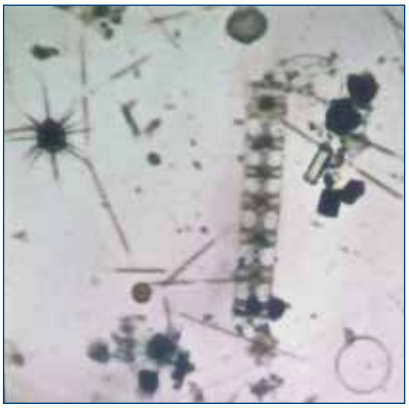
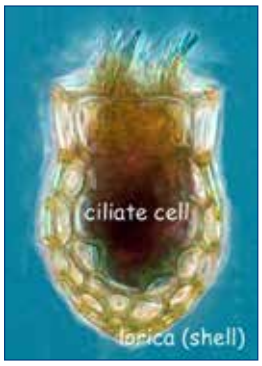


Additional photos from "Plankton Discovery Workshop," page 2



A variety of plankton types

Examining our "catch" with microscopes.



The delightful Tintinnids that Jason dubbed the "roombas of the sea" due to their voracious vacuuming of tiny food particles and their tendency to run into things and bounce off in another direction.

ANNUAL VOLUNTEER NATURALIST TRAINING CLASS, FEBRUARY 3–APRIL 14, 2018

There are many opportunities to volunteer at Fitzgerald Marine Reserve: assisting visitors at the Visitors Center, helping protect the harbor seal population, and leading tours. To become an FFMR volunteer naturalist, you are required to complete and pass our volunteer naturalist training curriculum. Naturalists must be over 17 years old and able to navigate slippery rocks.

Classes will be held near the reserve and at the reserve on the following dates: Feb.3 (Introductions/Tides/Zonation, 9-2); Feb.10 (Echinoderms/Cnidarians), 9-2:30; Feb. 24 (Marine Mammals), 9-3; March 3 (Arthropods), 12-5; March 10 (Mollusks), 9-2:30; March 17 (Geology), 12-5; March 24 (Algae), 9-2; April 7 (Worms/Bryozoans/Tunicates/Sponges), 9-2; April 14 (Evolution/Tidepool Ecology), 12-5. Additional time must be spent at the reserve with a mentor.

Mail the completed Registration Form with $70 check made payable to FFMR to:

FFMR Training Class
P.O. Box 669
Moss Beach CA 94038

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

How did you hear about FFMR's Training Class?

_____

Tell us a little about yourself (any prior volunteer experience or education in marine science).

_____

For more information contact: susanmtnvw@aol.com

(Volunteers who have completed past trainings may attend any class by reserving a seat.)