

BETWEEN *the* TIDES

F r i e n d s o f F i t z g e r a l d M a r i n e R e s e r v e

D e c e m b e r 2 0 1 9

Nudibranchs

by Susan Evans, DNA by Joseph Centoni

On Nov. 4, after many months of delays, Fitzgerald Naturalists were finally treated to a lecture by Dr. Terry Gosliner for a Continuing Education event. Terry is the Senior Curator of Invertebrate Zoology and Geology at the California Academy of Sciences. He has published more than 150 scientific papers and 5 books. His extensive field work has been conducted in many foreign countries and most recently in the Philippines. He has discovered more than 1000 new species of nudibranchs. After a 40-minute presentation, Naturalists asked many questions. Here are some highlights:

Climate change:

Climate change has been moving species north, especially *Phidiana hiltoni*. Terry said, "We're finding it's a boom or bust when viewing populations of nudibranchs." When there were many Hopkins Rose several years ago, warmer water temperatures had brought rosy bryozoan (their food source) north.

Impacts on coastal distribution patterns:

- Habitat loss: lack of suitable habitat
- Introduced species: new biotic interactions
- Short-term climatic shifts: ENSO cycles: El Niño, La Niña
 - o El Niño brings short term climatic shifts, warmer waters and an increase in the number of nudis. Warming conditions are good for nudis, "they're happy!" 2014 brought the Hopkins Rose bloom.
 - o La Niña brings cooler waters and fewer nudis.
- Long-term climate change

DNA sequencing:

Terry Gosliner discussed the use of DNA Leasequencing to differentiate between nudibranch species. DNA sequencing involves determining the exact order of DNA nucleotides for a particular gene or genes. The more closely related two species are, the more similarities there will be in the order of their DNA nucleotides.

There may be slight differences in the DNA sequence between members of the same species, but far less than would be found between members of different species. Gosliner discussed examples of nudibranchs that had superficially seemed to be members of the same species but actually varied in DNA sequence by 5% or more. This level of difference is an indication that they are actually separate species.

After similar-looking species are differentiated using molecular techniques, researchers can pinpoint anatomical differences (such as slight differences in color pattern) that can be used to distinguish between them.

Although two species might look similar to one another, they can actually have very different roles in the ecosystem such as feeding on different kinds of prey.

DNA sequencing is helping Gosliner and others uncover the evolutionary family tree of nudibranch species. According to Gosliner, DNA sequencing has also been helpful in tracking the spread of introduced and invasive species (including nudibranchs) in California as well as pinpointing the exact location from which these newcomers originated. Because introductions generally start with a small number of

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Susan Evans and Terry Gosliner

The best viewing times to see nudibranchs off our California coast is mid-April-July.

A good place to look for nudis is Pillar Point Reef.



Here and page2: Nudi slides by Terry Gosliner

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Nudibranchs, continued from page 1

individuals, the genetic variability in their population is extremely low. So, it is possible to determine whether members of a species that appear in new parts of California are spreading from one introduction or are the result of a new introduction. If the DNA of introduced individuals is compared to samples from across their original range, it is possible to determine the precise location from where they came. This may help indicate how they are traveling from one part of the world to another.

Upwelling:

The California coast is one of the five places in the world with the highest temperate diversity (related to the large ocean upwelling). Other places include S. Africa, Japan, Chile and New Zealand. There are 188 nudibranch species in California, which is equivalent to the Pacific coast of Panama (183). Tropical zones have many more species.

Best Viewing Times:

The best viewing times to see nudibranchs off our California coast is mid-April-July. After copulation, nudis lay their eggs in an egg mass within a couple of days. Very few self-fertilize even though they are hermaphroditic. Due to their low populations, any two can mate and hybrid species can result. Hybrid species are mostly on tropical reefs and we need to look

more closely to see if there are any hybrid species here in California.

Sub-orders:

There are 4 sub-orders of nudibranchs:

- Dorids: breathe through branchial plume (true gill)
- Aeolids: breathe through cerrata
- Dendronotids: breathe through branched structures (secondary gills) and body surface
- Arminina: breathe through cerrata and skin surface

Best Viewing Areas:

A good place to look for nudis is Pillar Point Reef. Giant nudis can be found on tunicates. Also look in muddy and sandy habitats.

Fun Facts:

- Spotted triopha (*Triopha maculata*): There is a seasonality to its color. As the nudis get larger (more than 1 inch), they get darker.
- Ringed dorid (*Diaulula sandiegensis*): These nudis add more circles as they get older!
- Some nudis in Antarctica live for 20 years (slower metabolism).
- Dotos at Pillar Point: The deep channel at Pillar Point provides their favorite hydroid food source. ◆

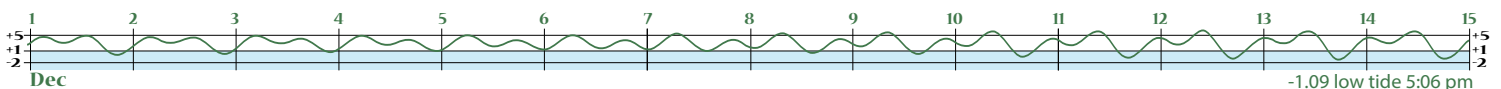


The graph displayed across the page bottoms shows tides for 12/1/19 to 4/19/20 at Princeton Harbor. Where the date appears is midnight. The reefs are accessible for exploring during low tides—at least +1 or below. This area is shaded light blue. See: <http://www.fitzgeraldreserve.org/newffmrsite/resources/> 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 this period at Princeton Harbor are:

-1.09	12/13	5:06 pm	-0.85	1/23	3:59 pm
-1.18	12/25	4:11 pm	-1.18	2/08	4:11 pm
			-0.42	2/20	3:03 pm
-1.33	1/11	5:13 pm	-0.85	3/08	4:45 pm
		6th lowest tide of 2020	-0.89	4/10	7:07 am



Sharing the Share-A-Thon

by Karen Kalumuck · photos by Karen Kallumuck

Have you ever listened in on a fellow docent during a tour, and thought, “That’s really cool! I’m going to use that next time!” Or “She really reins in the students who are wandering off, what is she doing?” How do you deal with 3rd graders as compared to high school students? How much do you say about algae? If the tide’s not good and hardly any critters are around, what do you do?

Just before the 2019-2020 tour season kicked off, a group of about 15 docents got together on Saturday, October 26, to share ideas, strategies, and stories. We walked the usual tour course, and the following are some of the major points of information and pedagogy that rose to the top of the day.

Gathering at the picnic tables for the introductory safety talk

- Engage teachers to assist in the “wrangling” of the students.
- A whistle is useful for getting large group’s attention – but do not use on bluff tops near harbor seal haul out.
- Bathroom access– repeat multiple times to be sure everyone has used it.
- Regarding the touching of organisms – suggestions:
 - o No picking up anything unless you know it is dead; the docent should be the only one to do so.
 - o To avoid students touching everything, enforce a “no touching allowed” rule. As the tour comes toward the end on the way out to the reef, then you may allow touching of:
 - * attached, “hard” animals only; one finger wetted, using a gentle touch; and
 - * the base of large anemone, precautions as per above.

Small groups at picnic area

- Ask the group for team name suggestions; the docent chooses one.
- Speak directly to parent chaperones to enlist their help in keeping kids together in their group and an eye on the ocean. Make clear that they have responsibilities!

Stop at bridge

- This is a great place to talk about the earthquake fault line that runs under the parking lot and out to beach. Point out that the students who came from over the hill crossed onto the Pacific plate from the North American plate.
- Talk about the fresh water creek which flows into the saltwater ocean and how that affects the salinity of the tidepools during heavy rains.

- Point out the horsetail ferns and tell them that they evolved even before the dinosaurs, and are very ancient. The plants like moist areas, so the creek is a good spot for them to grow.



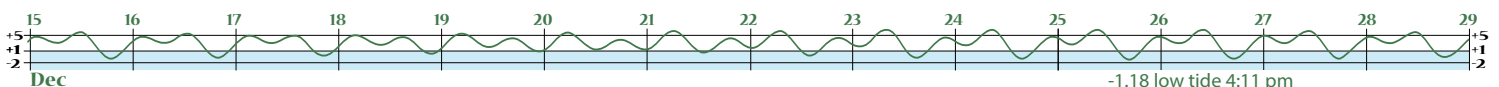
Horsetail ferns (Equisetum) have been around for 270 million years.

- This is an ideal spot for looking at birds; at far end of bridge, sometimes you can find owl pellets under trees.

Seal lookout

- Bring binoculars; have students pass them along quickly.
- It’s an optimal place to discuss tides – if you have one, you can show photo of site at high tide.
- The bluffs here were created by uplifting.
- We have a resident population of harbor seals. This is their home.
- They weigh about 200-300 pounds. The males are only slightly bigger (slight sexual dimorphism).
- Pups are born from late March until May and weigh about 15 pounds. They nurse for one month and then are on their own.
- The seals eat mainly fish and squid. Their predators are sharks, orcas, and dogs.
- The reef is a well-protected area for them. Point out cones and why we keep the beach closed.
- Seals can hold their breath for about 30 minutes. Only one half of their brain sleeps at a time.
- Seals differ physically from sea lions, which the students may have seen at Pier 39 or elsewhere:

continued on page 4



See drawings of each on page 12:

Harbor seals

Ear hole, no flap
Hind flippers can't rotate under body
Flippers relatively small
Scoots on land to move
Fairly quiet and shy

Sea lions

External earflap
Hind flipper can rotate under body
Flippers much larger
Can "walk" on land
More vocal

Forest walk

- Cypress Forest—the large trees on the perimeter and on the left side of the passageway featured in the movie *Memoirs of a Geisha* (2005) were planted by Juergen Wienke over 100 years ago. The smaller ones were not there in a 1928 photo. The Cypress trees are native to two groves on the Monterey peninsula.
- *Trentepohlia*—the orange growth on the trees that some kids call "Cheeto frost" is a green alga that gets its color from carotenoid pigments that are also found in carrots. It needs moisture from the ocean, so you only find it near the beach.



Not a fungus, nor a moss, Trentepohlia is a green alga found world wide, but particularly on the Cypress trees and fences at FMR.

- Flag marker—During World War II, the Navy would conduct artillery practice where mainly female pilots flew planes pulling targets. Gunners would shoot at the targets from a spot near the Montara lighthouse. A flag was raised on this concrete marker to warn fishermen and the local residents to stay clear of the area during practice.
- Sometimes algal zonation is visible from this site.
- Nearby concrete pad—Tom Ciotti suspects it may have held a water tank for the house down the hill.
- House foundation and 3 canary palms—The house was built in 1887 by George and Sue Smith. George's brother was a sea captain and he brought the palms from the Canary Islands, so they are likely 100+ years old. George passed away shortly after the end of WWI, and Sue continued to live there until her death in the mid-1930s, when she left the property to

their son Harry, and eventually it fell into disrepair. Northern California developer Henry Doelger bought the land in 1947 and built a new home there. It (unoccupied at the time) burned down on Oct. 27, 1970.



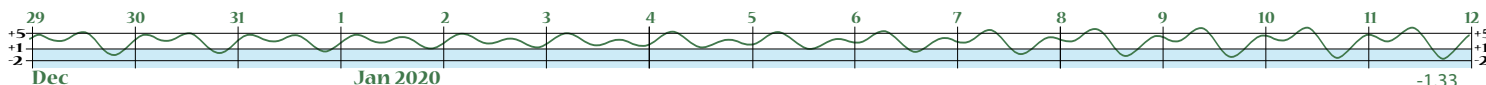
Phoenix canariensis palms traveled a long way by boat to end up thriving in Moss Beach.

- The property from the creek to seal cove was purchased from Westinghouse in 1983.
- Shell middens—Find shell fragments and ask children how they got there.
- A hearth and charcoal dated to 5000 years ago were found at this site. Ask students how this "garbage pile" differs from our contemporary garbage?

Beach

- We are entering a marine sanctuary—think of it as a living aquarium.
- Stop and look at the seaweed line and talk about the tides. What causes them? Why did their teacher choose this time to come?
- Pick up some seaweed and a holdfast on the beach. Talk about how it differs from land plants. Have them take a deep breath and thank the ocean for the oxygen; phytoplankton and seaweeds produce over half of the oxygen that we breathe.
- Stop at rocks covered with aggregating anemones and see if the kids can find the animals on the rock.,
- Look under ledges.
- When urchins visible, there is an area with a good sized pool on flat area of the reef where students can crouch around and watch, and potentially touch an urchin with docent's direction.
- Climate change discussion; Focus on "Now," not how things used to be; Have students discuss potential community/school-wide action to combat climate change. Resource: National Network for Ocean and Climate Change Interpretation.

<https://climateinterpreter.org/about/projects/NNOCICI>



Closing Comments

- Ask students to share one new thing that they learned on the tour.
- Remind them about our website so that they can learn more;
- Thank them, the teachers, and parent chaperones for joining us and we hope that they return, and perhaps bring their families.
- Remind them to wash their hands!!!!

Those of us who attended found the share-a-thon quite useful and a great warm-up for getting ready to lead tours. If there is interest, perhaps this will become an annual event.

Thanks to everyone who attended and made this event a success! Special thanks to Tom and Linda Ciotti for the historical information and reviewing the article and to Marian Miller for taking detailed notes and sharing them with us! ♦

Annual Volunteer Luncheon

Once again FFMR Naturalists were invited to the annual volunteer luncheon put on by the FFMR Board of Directors. This event is held each year to honor the service of those who participate in the many tours and activities sponsored by FFMR. This year's luncheon had a new venue—the beautiful, newly constructed Half Moon Bay Public Library.

Tom Ciotti, FFMR President, welcomed the guests and spoke of FFMR accomplishments during the September 2018–September 2019 time period.

- 80 tours for 2400 students were conducted. Interestingly this year we had 23 scheduled tours canceled mostly due to weather conditions. Had the weather not interfered we would have conducted over 100 tours.
- Our volunteers logged in over 3200 hours.
- 16 new volunteers successfully completed our annual Volunteer Naturalist Training Class.
- FFMR sponsored a one-week Jr Naturalist Summer Camp for 14 nine to twelve-year-old youngsters.
- We continued our “bus scholarship” program to fund transportation to the Reserve for schools who lack field trip funding.
- We awarded three \$5000.00 scholarships to graduates of the Half Moon Bay High School

marine ecology/environmental science classes

- And we participated in Greater Farallones National Marine Sanctuary “Get Into Your Sanctuary Day.”

Linda Ciotti then continued the day's festivities, announcing the recipients of the two awards given each year.

This year the Sea Star Award went to Beth Roellig. This award is given to a Naturalist from the most recent training class who has demonstrated a commitment to FFMR through enthusiastic participation. Since completing her Naturalist training in April, Beth has logged over 118 volunteer hours that included leading tours, “seal sitting,” and being a counselor in this summer's Junior Camp.

The Ginny Award is given to acknowledge a longer-serving volunteer who has made contributions to FFMR in many ways. Marian Miller has been an enthusiastic and steady tour leader since 2015. She also participates in “seal sitting” at the reserve.

The luncheon always ends with Linda passing out pewter pins to all of the Naturalists. She manages to keep the featured animal a well-kept secret so its revealing is always a delightful surprise. This year it was the ever popular bat star. ♦



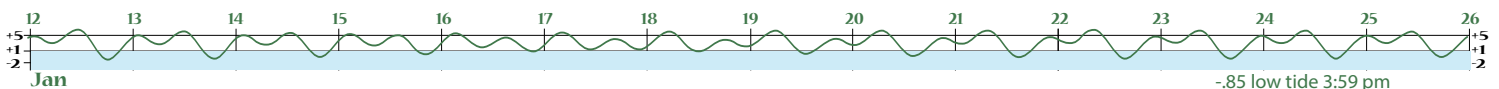
Beth Roellig, recipient of the Sea Star Award



Marian Miller, recipient of the Ginny Award



A five-pointed bat star, photo: Mary DeLong



A Conservation Success Story; with a Déjà vu twist or The Next Chapter

by Mary Jane Schramm



Gray whale near ice edge; mud plume from bottom feeding. Photo: Vicki Beaver, NOAA Fisheries-NMFS Permit No. 14245



Gray whale cow/calf pair. NOAA SWFSC & SR3: SeaLife Response, Rehab. and Research; NMFS permit #19091, MBNMS permit #2017-8

Her calf nursed hungrily at first, but gradually languished, and became less responsive, showing little of the rubbing and cuddling her previous calves had shown.

She had traveled thousands of miles since her last substantial meal of “mudbugs”—tiny crustaceans that live within the silt and detritus of the Arctic sea floor. En route, this gray whale, *Eschrichtius robustus*, and other pregnant females like her, passed through narrow Unimak Pass in the Aleutian Island chain, braving the killer whales that lurked there. She had swum around 6,000 miles, endured early winter storms, and was anxious to reach the calving lagoons of Baja California, Mexico. Heavy with calf and hardly pausing to rest, she had made this same journey every few years, for a decade.

Now, in mid-January, the gray whale neared her familiar breeding grounds, San Ignacio Lagoon. She rounded *Punta Abreojos*—named Point “Open Your Eyes!” to alert mariners to its dangers. Line after line of waves pushed in from the dark Pacific, launching themselves over the bar, and through the lagoon entrance. Practically surfing in, the whale cleared the narrow gap; her time was near, so she moved quickly past boisterous mating groups to the quiet Upper Lagoon nursery. There she gave birth in its warm, shallow, and salt-buoyant waters.

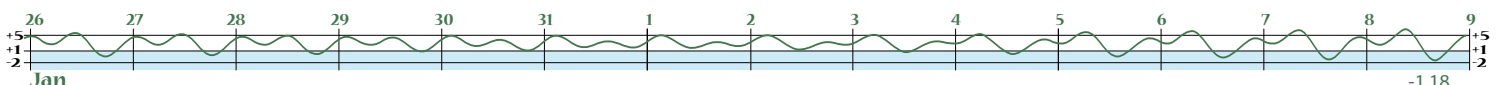
The birth was uneventful. Her calf nursed hungrily at first, but gradually languished, and became less responsive, showing little of the rubbing and cuddling her previous calves had shown. Weeks passed, and then one night, despite her nudges, trying to revive it, its spirit left;

the calf drifted slowly away. Perhaps the milk she produced wasn’t fat-rich enough to sustain it; perhaps the calf hadn’t developed properly. This year, she herself had become strangely and utterly exhausted by her long journey, and just by giving birth. Finally, she left for the journey back north, to forage so she might live to bear future calves.

The whale had spent her previous two summers foraging in the Arctic, but traveling farther than usual to find food, and finding less. Near the edges of the ice sheets that usually cover the shallow Bering and Chukchi seas, she would gorge on benthic amphipods, shrimp and cumaceans. An astonishing 14,000 amphipods might occupy one square meter of sediment, a feast. These tiny crustaceans feed on dead algae that rain onto the sea floor from beneath the ice where it grows. Near the ice edges, gray whales gouge out swaths of mud, teeming with these fat-filled living energy packets, and she should have acquired a several-inch thick blubber layer over the summer. *Blubber is Beautiful*, when you’re a whale. And these whales need that accumulated fat to survive their long fasting migration to Baja and back again. But this year, feeding was poor, and she left still hungry.

In 2017 and 2018 virtually no ice had formed in the Bering Sea, as wind and water temperatures were higher than normal. No ice: no algae. No algae: no amphipods, and a scarcity of amphipods meant the grays went hungry. Some tried switching to different prey and new locations, with limited success. Adaptability is the name of the survival game.

Nonetheless, the whales began their southbound journey, many without adequate energy reserves. On reaching the calving lagoons, half the single whales were noticeably thinner than usual—four times the average loss. Disease is a suspect in some cases; Opportunistic parasitic infestations may have contributed. Many grays never made it, but died at sea undetected; others washed up on shore. Surprisingly, weak and starving whales entered harbors and estuaries such as San Francisco Bay, in abnormally high numbers. They sought food, refuge from heavy



seas, and safety from killer whales against which they had little defense. A few grays that normally would have avoided the Golden Gate Straits and transited through Greater Farallones National Marine Sanctuary, were killed by ships as they converged on the same paths—the busy shipping lanes—into the bay.

Déjà Vu: In 1999-2000, NOAA declared an Unusual Mortality Event when 30% of the world's gray whale population died: an estimated 6,138 whales of approximately 21,000 total. The lack of Arctic ice and amphipods were deemed contributing causal factors then, but no definitive cause could be identified. But in 2007 the gray whale numbers again increased, and now number around 27,000. Clearly, this species has demonstrated resilience in the face of change. Their flexible opportunism has maintained the species through prehistoric gradual warming and cooling phases over its millions of years on our planet. Now, however, the rate of change has accelerated greatly.

That scenario seemed to repeat itself in late winter this year; the strandings bore an uncanny and disturbing resemblance to the earlier crash, giving scientists some direction for investigation. So, on May 31, 2019, NOAA Fisheries, the agency that protects whales, declared an Unusual Mortality Event, which gave them the mandate to investigate and mitigate the situation where possible with other agencies, research groups, sanctuaries and others; and it freed up some funding to do so.

Back From The Brink: The “California” gray whales whose obligingly coastal habits we love, had rebounded from near extinction during the whaling era, and was removed from the Endangered Species List in the mid-1990s. Now it faces new challenges.

Some scientists predict that 2020 may bring a repeat of this past season, but far more

may be learned this time, from many necropsies (post-mortems) and more sophisticated forensic tools now at our disposal.

Hopefully, those predictions will prove groundless; time will tell. But changing ocean climate emerges as a strong suspect in the events.

We as individuals all have ways in which to reduce our impacts on some of the potential causes: by reducing carbon fuel reliance, greater energy conservation overall, and other measures, great and small. This ongoing drama points up the fact that ecosystem changes in the Arctic due to warming events clearly have repercussions far beyond the remote vastness of the far north. This has become evident along our coast, in the news, and in our consciousness. Hopefully, the resilience the gray whales have demonstrated in the past will again prove their salvation.

Gray whales may prove to be important models for our monitoring of how wildlife adapt to a changing ocean. To see how this species has adapted in the past, see “Sentinels of Change: Gray Whales in the Arctic,” <https://www.fisheries.noaa.gov/feature-story/sentinels-change-gray-whales-arctic>. Note: It was written in 2016, before these recent strandings.

Mary Jane “MJ” Schramm is Media and Public Outreach Specialist for the NOAA Greater Farallones National Marine Sanctuary. ♦



Gray whale necropsy, SF Bay, May, 2019. Photo: Cara Field/The Marine Mammal Center; NOAA Fisheries MMHSRP Permit 18786-03



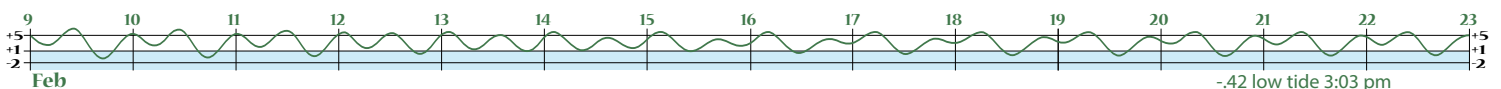
Careful measurements and tissue samples add to data on the species. Photo: TMMC Under NMFS Permit

Clearly, this species has demonstrated resilience in the face of change...

Now, however, the rate of change has accelerated greatly.

On the other hand, scientists in Spain and Israel were astounded to find a gray whale feeding in the Mediterranean several years ago. Yet another showed up off the coast of Namibia in southwestern Africa. These must be considered the loneliest whales in the world...but hopefully they've gotten back on course since then.

“Amor vincit omnia”—Love conquers all. In addition to being amenable to dietary changes, some grays from the Western Pacific Distinct Population Segment (Russian stock) have ventured to our side of the Pacific. “Varvara,” an adult female, and “Flex,” a younger male, are conducting a kind of “détente” in California waters and the Mexican calving lagoon of San Ignacio, proving that love can overcome geopolitical boundaries.



The Sooty Shearwater

by Janet Pelinka



Wikipedia



Wikipedia

Sooty shearwaters arrive by the thousands (a one-day estimate this year was over 60,000) after a very long flight;...a round-trip journey of around 39,000 miles

They appear as a massive black cloud. In seconds the cloud disappears and returns and disappears and returns, eventually settling on the ocean's surface. As beach walkers stop to marvel at the sight, the cloud transforms into a myriad of chocolate brown birds who arrive to partake of the bountiful feast of food brought to the surface by an upwelling of cold water that occurs when winds push warmer surface waters away. This is the annual sooty shearwater (*Puffinus griseus*) migration to our coast.

These birds are solo fliers during their migration but "buddy up" to gather together in an enormous flock when they smell out a large concentration of fish. The birds make rushes and use various scare tactics to force the panicked fish school to the surface, maneuvering it at the same time into the compact, defensive form referred to as a bait-ball. This action creates a frenzy of activity as the feeding "sooties" are joined by other birds, dolphins, seals and often whales. Sardine bait balls can be 10–20 meters in diameter and extend to a depth of 10 meters.



A bait-ball of sardines. Wikipedia



Flight patterns of 2 sooty shearwaters. National Institute of Water and Atmospheric Research-NZ

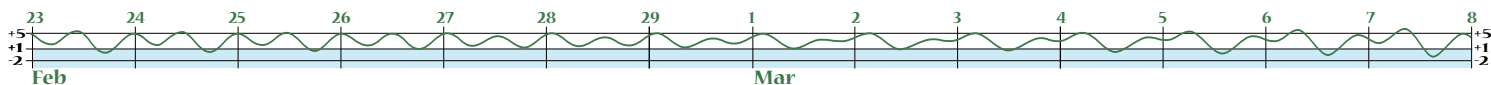
Tagging Of Pacific Pelagics (TOPP), which is deploying electronic tags on 23 species of top predators in the North Pacific Ocean, according to Daniel Costa, a professor of ecology and evolutionary biology at UCSC who oversees TOPP studies of marine mammals and seabirds.

Sooty shearwaters are 40–51 cm in length with a 94- to 110-cm wingspan (the size of a small seagull). They fly close to the surface in a "shearing" flight (thus the name), dipping from side to side on stiff wings with few wing beats. Capable of diving to a depth of 60 m, they plunge into water from a few feet above the surface and swim underwater, using their half-opened wings and webbed feet for propulsion, to pursue food. They typically dive from the surface, to catch prey at or just below the surface while sitting on water.

Partners are attracted to each other by courtship calls and mating behaviors and then enter a life-long, monogamous relationship. The breeding season begins in the fall when the birds return to islands in the South Pacific, usually to the same nesting area. Their nests are lined with leaf litter in a chamber at the end of a burrow that is sometimes shared by several pairs. When a single white egg (77 x 4 mm in size) is laid, both parents participate in its incubation and share the frequent night feedings and care of their chick. The care continues until the young birds are independent at fledging some time in late spring when they are abandoned by their parents.

While sooty shearwater number in the millions, their numbers are declining as they experience the effects of pollution, loss of habitat, and other environmental threats that are experienced by many of the world's animals. They are also harvested by descendants of Rakiura Maori who call them by the Māori name *tītī* and as "muttonbird." As reported in New Zealand Birds Online, a digital encyclopedia of New Zealand birds, "Muttonbirders' can access the islands from 15 March to prepare for the harvest, which starts on 1 April and can continue until 31 May. During the first half of the season, chicks are extracted from their burrows during the daytime. Once the chicks start emerging at night in

Sooty shearwaters arrive by the thousands (a one-day estimate this year was over 60,000) after a very long flight; in fact, it is the longest animal migration ever recorded, thanks to the development of miniature electronic tracking devices. These formidable birds fly across the entire Pacific Ocean in figure-eight patterns, making a round-trip journey of around 39,000 miles from their main breeding grounds in New Zealand islands to the coasts of one of three discrete feeding grounds off Japan, Alaska or California. Their migration has been closely studied by a consortium of some of the top scientists in the world, who are contributing to a Census of Marine Life project called



preparation for their departure (mainly in May), they are captured in large numbers on the surface, with the daily take limited by the time it takes to pluck and process the birds the following day. The total harvest from the Stewart Island region is estimated to be around 400,000 chicks per annum.”

The legendary migration of the “sooties” is not their only distinction. They may have inspired Alfred Hitchcock’s frightening film “The Birds” depicting flocks of birds attacking and killing residents in a community in Bodega Bay located on the California coast. Hitchcock lived in Monterey and read an article in the local newspaper, the Santa Cruz Sentinel, about the appearance of thousands of crazed birds. The birds that were identified as sooty shearwaters, regurgitat-

ed anchovies, flew into objects and died on the streets.

It was later determined that the bizarre behavior was due to domoic acid poisoning, a neuro-toxin produced by algae and found in shellfish, sardines, and anchovies. Domoic acid can cause confusion, disorientation, scratching, seizures and death in birds and marine mammals like sea lions.

So when you see a black cloud of birds flying over the ocean, don’t run for cover. Stand and watch in amazement as the seemingly choreographed flight of thousands of birds swirl and land in waters near the shore where you are standing. They are not coming after you. Their focus is on the enormous meal they hope to consume. ♦

They (sooty shearwaters) are harvested by descendants of Rakiura Māori... “The total harvest from the Stewart Island region is estimated to be around 400,000 chicks per annum.”

2019 Friends of Fitzgerald Marine Reserve Junior Naturalist Camp

by Beth Roellig

Do you have fond memories of summer camp where you spent all of your time outdoors surrounded by trees, plants, and native wildlife? I do, and as a Volunteer Naturalist I enjoyed it all again when I participated in the annual FFMR Junior Naturalist Camp from August 5–9, 2019. We had fourteen wonderful campers between the ages of nine to twelve, and they always arrived eager, happy and ready for their 10 am to 3 pm day of adventures.

After a short talk to campers on tidepool safety and etiquette on the first morning, we all went to explore the tidepools. And speaking of these tidepools, I don’t think there are a lot of summer camps where you get the opportunity to experience an area like this marine reserve. Even though most of the tide levels were on the higher side during the week, we still had at least two low tides for further exploration. One afternoon we took binoculars and a couple of big scopes to the trail above the sandy beach to see the harbor seals hauled out on Nye’s Rocks in the outer reef.

Here are a few highlights of the presentations, crafts, games, music, and play campers experienced during their week.

Alex Tabone, a California State Park Ranger, started with a talk and slide show about the

Ohlone, the Native American population of this area. The focus of his presentation, Nature’s Supermarket, showed how the Ohlone harvested grain from native plants to make into porridge for their daily diet. He then led everyone on a walk in an area across the road from the Ranger Hut and actually gathered grain from the species of plants that were around when the Ohlone occupied this area. After that, using the same type of tools and baskets as the indigenous inhabitants had, he showed how the grain was processed and then cooked over an open fire. Everyone enjoyed eating some of this home cooked porridge from a centuries-old recipe!

Keith Mangold, a fellow FFMR Volunteer Naturalist and amazing expert geologist, taught our campers about the historical and present-day geology of the area. After sitting raptly through

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Decorating pots



Celebrating 10 years of Nudibranch Counts

by Julie Walters

El Niño years and warming ocean temperatures may bring species typically not found in our area. We may see another El Niño year in 2020.

On April 18th, 2010, Fitzgerald docents conducted their first nudibranch count at Fitzgerald and documented 26 nudibranchs. Within several years, we would be seeing over 900 per survey. With ten years of data, we now have some interesting facts to share.

Here's a summary of the highlights over the last 10 years:

2010 With only 4 volunteers we saw 26 nudibranchs and a total of 8 species. The bright orange nudibranch, *Triopha maculata*, was the most common one.

2011 San Diego dorid was the most commonly one seen in this year. The second most common was Hilton's Aeolid. We now have 7-10 volunteers at each count.

2012 In June of 2012 the counts moved from Fitzgerald to Pillar Point, where we saw *Dendronotus subramosus* for the first time. It was the most common species seen in June of 2012.

2013 We are now seeing upwards of 20 different species as our spotting skills and knowledge increase. *Triopha maculata*, Hilton's aeolid, *Geitodoris heathi* and *Dendronotus subramosus* are seen in large numbers.

2014 Our counts this year ranged between 255 and 359 nudibranchs, with 29 different species and 12 docents. Our June count was with the California Academy of Sciences as part of their BioBlitz event. Unusual finds were *Aphysiopsis enteromorphae* and *Diaphana californica*.

2015 This was the year of the Hopkins rose. In July of 2015, we started seeing large numbers of this bright pink nudibranch. It continued to dominate our counts until December 2016. An unusual find was the *Crimora coneja* (coneja means rabbit in Spanish) which has been seen only once since then.

2016 This was the year that broke all the records. In May, 2016, with a -1.5 low tide we had the largest quantity

ever seen: 901. Hilton's aeolid was the most frequent with 192, followed by Sea goddess (154) and Hopkins rose (120). We also saw 80 of the tiny *Doto amyra*.

2017 During our spring count with a -1.7 low tide we found 635 nudibranchs. of which 266 were Hilton's aeolid. Rare finds were *Tenellia Columbiana*, *Dendronotus albus*, and olive's aeolid. The Hopkins rose population had diminished; we saw only 3. This year we saw two extremes for conditions. In the spring, we had ideal conditions with clear, calm tidepools. However, during the winter count in December, we had high surf and cloudy water limiting our access and resulting in only 46 nudibranchs observed.

2018 In May we had 12 volunteers for our -1.4 low tide and observed 140 nudibranchs. *Triopha maculata* and Hilton's aeolid were once again out in large numbers.

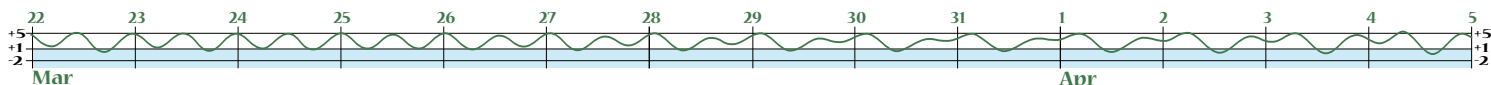
2019 Hilton's aeolid is becoming more and more common with very large individuals reaching 3" in length. We also observed the return of the Monterey dorid and San Diego dorid in numbers that we had not seen in years. Also, we started to see larger numbers of *Dirona picta* which previously had been rarely seen. *Hancockia californica* was also spotted. The last time it was observed was during one of our counts in 2012.

Some notes on variables during our surveys:

Low tides: Some years have lower tides than others. More of the reef is exposed during a good low tide so more animals are exposed. Also, since we try to have our counts on a weekend during daylight hours, we don't always hit the lowest tide.

El Niño years and warming ocean temperatures may bring species typically not found in our area. We may see another El Niño year in 2020.

Water clarity and wave action: Despite having very good low tides in November and December, winter counts have increased wave activity and consequently murky water. This limits our ability to get to prime areas and also limits visibility to spot animals which may be in the bottom of



pools. These are some of the reasons why we typically see lower numbers during our surveys done in the winter months. They may be there, but we cannot get to them or cannot see them due to lack of water clarity.

Some species are easier to spot than others: Brightly colored nudibranchs, such as the orange *Triopha maculata* and the bright pink Hopkins rose are easy to spot and therefore their quantities are higher. Conversely, cryptic species like the *Dendronotus subramosus*, which often blend into their background, can be more difficult to find. Spotting tiny nudibranchs such as the *Doto amyra* and *Doto kya* require excellent eyesight and getting down low into the water.

Area covered and number of volunteers: Obviously the more volunteers we have and the more knowledgeable they are, the

higher the counts. We can cover more area with more people since Pillar Point is a large area.

Docent involvement: These counts are greatly enjoyed by our docents as they work in teams and explore the tidepools together. In addition to broadening our knowledge, these counts also build camaraderie among the docents as they work together and share their knowledge and enthusiasm for these colorful creatures.

The next nudibranch count will be an early morning in May. An email will go out to all docents with more information closer to the date. Not a docent but want to be involved in our nudibranch counts? Take the docent training class starting in January 2020. For more information, go to fitzgeraldreserve.org/newffmrsite/volunteer ♦



Photos by Julie Walters

Junior Naturalist Camp, *continued from page 9*

Keith's talk and slide show in the Ranger Hut, we all followed him to the Upper Reef Flat of the preserve and were able to identify the real geologic strata of the cliffs and rocky reef. Following Keith's talk and walk, campers used oil pastels and water colors, and their imaginations, to create art work of what they saw by the reef.

Gemma Rice is also a fellow FFMR Volunteer Naturalist and a high school senior working on a Girl Scout Gold Award project. Part of her project focuses on sustainability, and in her talk and slide show Gemma explained to our campers how they can reuse items and reduce plastic waste to support a healthy environment and even create art. For a craft at the beginning of the week, Gemma brought the materials for the campers to make a reusable sandwich wrap. She gave them pieces of shower curtains that had been cut into squares for the base and they decorated them

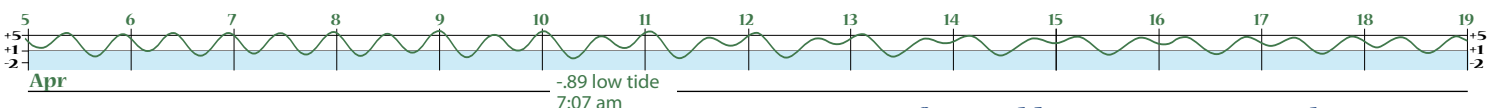
with colored markers or used fabric glue to attach pieces of colorful remnants. Velcro was attached to fold the wraps securely so nothing would fall out. Many of the campers used these wraps for their lunch sandwiches each day. At the end of the week, Gemma took campers on a hike to gather dead items such as tree leaves, twigs and rocks. They placed their items on sun paper, placed it in the sun, and voila, it was art!



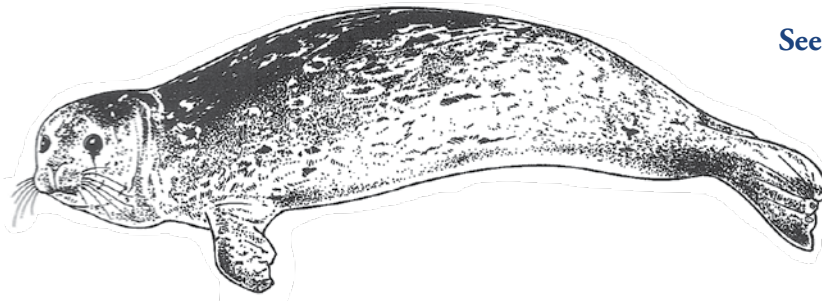
Learning about harbor seals

Music was an important part of the week. San Mateo County Park Ranger

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See Tales from the Tidepools,
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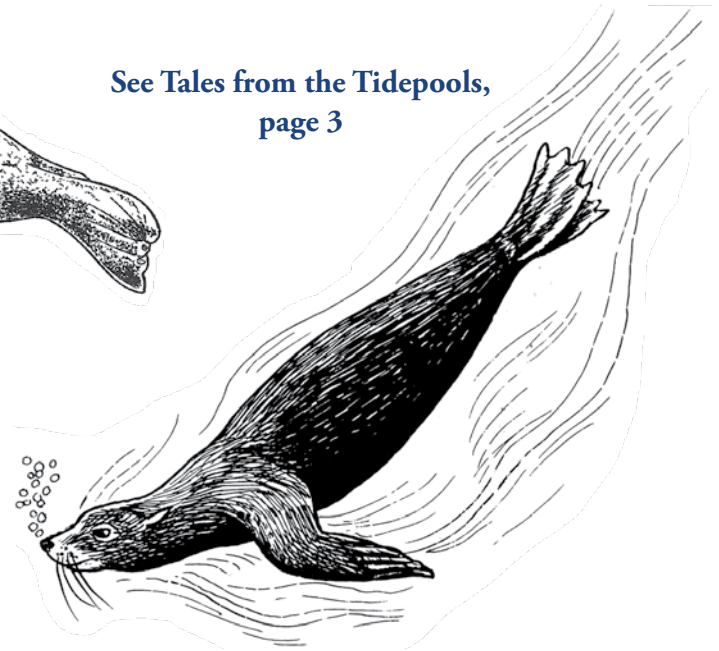


Harbor seal: above

Ear hole, no flap
Hind flippers can't rotate under body
Flippers relatively small
Scoots on land to move
Fairly quiet and shy

Sea lion: right

External earflap
Hind flipper can rotate under body
Flippers much larger
Can "walk" on land
More vocal



Junior Naturalist Camp, continued from page 11

Katherine Wright was always there with her ukulele to lead campers in sing-along songs and to play fun Disney songs as we relaxed on a sun-filled last day at the beach.

And, as with any summer camp, games were fun. Camouflage was the favorite. It's a little complicated to explain, but let's just say it was a great game with lots of running and hiding in the forest area of the reserve. There was one fallen tree in particular that served as both a hiding place and resting spot to gather up more energy for running.

Just as a great camaraderie developed among the campers, one just as great existed among all of our adult volunteers. FFMR Volunteer Naturalist Juliette Applewhite and Park Ranger Katherine Wright were fantastic Co-Camp Leaders. Also there from San Mateo County Parks were Ranger Lauren Ford-Peterson and interns Hana Hogan and Rebecca Dupont. And from our FFMR Volunteer Naturalist group we include Allison Adams, Linda and Tom Ciotti, Ron Olson, Gemma Rice, and Dan Woodward. A big thank you to everyone for one of the best weeks of any summer camp! ♦



Digging for Treasure

Friends of Fitzgerald Marine Reserve

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

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