

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 8

Annual Volunteer Naturalist Appreciation Luncheon

On a sunny October afternoon, Linda Ciotti welcomed a record number (58) of FFMR naturalists and guests who gathered at the Half Moon Bay Yacht Club for the annual volunteer naturalist appreciation luncheon.

After a delicious lunch Linda presented some impressive statistics. During the 2017-2018 tour season, FFMR naturalists conducted 76 tours for approximately 2,500 students, and logged in over 3,500 hours of participation during the year.

Each year Linda presents two awards. The Sea Star Award was given to Jody Stewart, a new graduate from the 2018 Volunteer Naturalist Training Class for logging in the most hours for new graduates and for participating in a number of different activities. The Ginny Award was given to Dave Hankin, a volunteer since 2007, for logging in many hours, participating in a number of other activities and helping out on short notice. Introduction of FFMR board members followed.

Special recognition was given to those who contributed to activities beyond leading tours:

- ✧ Carol Ferguson, Merchandise Manager and Visitors Center Volunteer
- ✧ Janet Pelinka and Sasha Greenawalt, editors of BTT
- ✧ Steve Slomka, FFMR/FMR Information Updates
- ✧ Continuing Ed Committee: Susan Evans, Karen Kalumuck and Ariel Bauman
- ✧ Training Class Coordinator: Susan Evans
- ✧ The Seal Sitters Group: Audrey West and Mary Larenas
- ✧ Carol Davies: securing the use of the Half Moon Bay Yacht Club and Leon Smith for helping with set-up
- ✧ Hope Suchsland, luncheon food
- ✧ Ellen Clark, new FFMR Tour Scheduler
- ✧ 2018 Jr Naturalist Camp Counselors: Ron Olson, Karen Madsen, Allison Adams, Deb Landman, Jan Pelinka and Dave Hankin. Co-leaders of the camp: Juliette Applewhite and Ranger Katherine Wright. Glenn Gutleben who brought his microscopes for camper use on geology day.



As the event came to a close Linda gave out the much-anticipated annual marine animal pins. This year it was the rough limpet. ◆

Friends of Fitzgerald Marine Reserve

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www.fitzgeraldreserve.org

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Our Mission:

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

Newsletter Editors:

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Registration for 2019 FFMR Volunteer Naturalist Training Class

The 2019 FFMR Volunteer Training Class will consist of 11 Saturday classes, plus six additional hours spent at the reserve with a mentor. The classes will be held at or near the reserve. The proposed schedule (times to be determined) is: Feb. 2, Feb. 9, Feb. 16, March 2, March 9, March 16, March 23, March 30, April 6, April 13, April 27.

Volunteer naturalists must be at least 18 years old, physically capable of navigating the rocks and reef, and must volunteer a minimum of six hours per month. More information can be found at www.fitzgeraldreserve.org

SPACE is LIMITED—Your Registration Form and Fee must be received by Jan. 25, 2019. No refunds will be available after Jan. 25.

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

Susan Evans, FMR Training Class, P.O. Box 602, Half Moon Bay, CA. 94019

Name: _____

Address: _____

City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

How did you hear about the Training Class?

Tell us a little about yourself (any prior volunteer experience, education, travel or experiences relating to marine science).

King Tides are Coming

The King Tides for 2018-2019 at Princeton Harbor are:

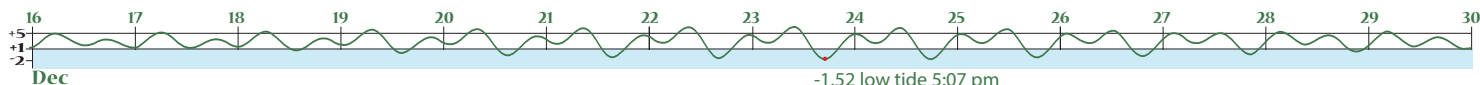
Note that these same days also have very low tides. For more information and a list of events and talks in the Bay Area, visit https://www.coastal.ca.gov/kingtides/	+ 6.58	12/22	9:18 am
	+ 6.62	12/23	10:03 am
	+ 6.79	1/20	9:01 am
	+ 6.84	1/21	9:51 am

The graph displayed across the page bottoms shows tides for 12/16/18 to 5/5/19 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://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 this period at Princeton Harbor are:

-1.52	12/23	5:07 pm	-0.37	2/3	4:10 pm
	4th lowest tide of 2018		-1.23	2/18	3:49 pm
-0.68	1/5	4:29 pm	-0.75	3/18	3:39 pm
-1.55	1/21	4:53 pm	-0.83	4/21	6:46 am
	lowest tide of 2019				





Three-line aeolid (*Orienthella trilineata*)



(*Dirona picta*)



MacDonald's dorid (*Limacia macdonald*)



Moonglow anemone (*Anthopleura artesima*)

PHOTOGRAPHS BY ARIAL BAUMAN



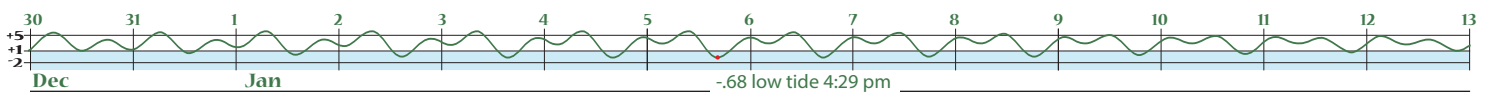
Opalescent nudibranch
(*Hermisenda opalescens*)



Sea Goddess
(*Doriopsilla albuspunctata*)



White dendronotus
(*Dendronotus albus*)



Diann Chethik



I now have seven pewter pins on my Fitzgerald jacket and I am still surprised and amazed at what we discover in the tidepools.

I...have a degree in Social Work from Rutgers University. I've worked as a social worker in New Jersey and later for the County of San Mateo and at the old Children's Hospital at Stanford, which has since been replaced.

I remember when I took the course to become a docent over seven years ago. We met at the sheriff's station in Moss Beach. I got through only two classes when I got a call from my sister in Delaware that my mother was dying. My mother was unconscious by the time I arrived. I spent the time at her bedside singing to her and reading Barbara Kingsolver's *Lacunae*. There was at least some link to the tidepools in that book since the main character, Shepherd, was at one point in an underwater cave going in and out with the tide. I returned from the East Coast in time to take the docent exam which I barely passed. It wasn't a great start but docenting at Fitzgerald was a healing experience. The place was teaming with life! My mother would have loved it. I will be forever grateful to Linda Ciotti. She was so helpful and understanding during that time.

I now have seven pewter pins on my Fitzgerald jacket and I am still surprised and amazed at what we discover in the tidepools. I still appreciate all the naturalists I've met and the friendships we've developed. I've also appreciated the times I've been able help at the naturalist camps.

I have always been an animal lover. Who isn't?! My siblings and I were forever bringing home stray animals. My little sister even showed up with a skunk that cuddled up to her and showed no sign of spraying. The household always had a cat or two. We only ever had two pet dogs: a springer spaniel and a standard poodle. All the other dogs were for hunting: a beagle for running rabbits and a retriever for picking up ducks and geese. We ate a lot of wild animals as children. My favorite was pheasant although picking out all the shot pellets was difficult. We even ate squirrel. It was very dry and all dark meat.

I was born in Alliance, Ohio, because my father was an aeronautical engineer and a glider specialist working on a possible delivery of the Enola Gaye by glider. He told us he was very grateful the glider wasn't used. He didn't want that on his conscience. He later became the plant engineer for a fiber company in Newark, Delaware. Unfortunately, he died of emphysema, probably because of inhaling the product.

We moved to rural Delaware when I was four. My uncle had bought a large piece of land which he sold in four acre lots to his siblings. I was raised with aunts and uncles and cousins living all around us. If we had a disagreement with a parent,

we could run away to a cousin's house and spend the night. I attended elementary school in a nearby town and often had a cousin in my class. One day, I even got off the school bus to discover that my mother was my substitute teacher for the day. I still remember trying to sit with her at her desk and being shooed back to my own. My aunt, a public official in charge of foreign languages, sent me to a private girls' school for junior high and high school. I was having problems with my studies in sixth grade. After testing at my new school, it was discovered that I was dyslexic. That might explain a lot to some of my fellow docents.

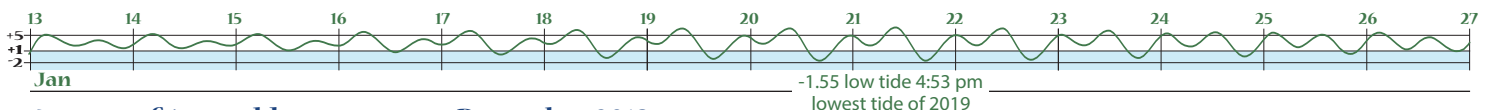
I attended a small women's college, Wilson, in Pennsylvania, on scholarship. I was the only applicant who qualified because the grant was only awarded to a student who was the daughter of a clergy person or a teacher and was majoring in religion. I also have a degree in Social Work from Rutgers University. I've worked as a social worker in New Jersey and later for the County of San Mateo and at the old Children's Hospital at Stanford, which has since been replaced.

I moved to California in the late 1970's to try a new environment. After working at Children's Hospital, I began a private psychotherapy practice in Menlo Park and retired eight years ago. My husband was working for Lockheed Martin at the time and we met at our psychotherapist's funeral. Take a minute to take that in. We're both certain he would never have approved but it's been 39 years so it looks like it will last.

My husband and I have traveled extensively. We honeymooned in Spain. We've been just about everywhere in Europe and the Caribbean. We have been on several cruises and enjoyed meeting people from other parts of the country.

My mother had a penpal she met through an ad in a women's magazine just after WWII. They were pairing up women whose husbands had been involved in the war. Our families have visited back and forth over the years. It was just two years ago that our British friends stayed a few weeks with us. We hooked up with them for a day this year when they took a cross-country train trip from the East Coast. Our British friend, Bob, is a train enthusiast. I think they have a special word for that. Maybe it's a trainer spotter.

I look forward to seeing everyone out on the reserve. ♦



A Workshop for the Birds!

FFMR Continuing Education Event

by Karen Kalumuck

Fitzgerald Marine Reserve is the best place in the world to observe the most species of sea gulls, so we learned from Adam Dudley and Jane Dixon, tour leaders from the Sequoia Chapter of the Audubon Society. On October 13 about two dozen naturalists and friends looked, listened, photographed, laughed, and learned a tremendous amount about the resident, seasonal, and migratory birds that live in or visit the reserve—which happens to be right along the Pacific flyway for migratory birds.

Jane and Adam—who, bonus, both have melodic British accents—began the morning with an introduction to the first steps in narrowing down bird identity: Is it swimming, wading, or arboreal? The sort of beak it has gives us a clue as to what it eats. What color(s) is it? Size? The tail shape can also be very helpful.

Armed with this information, we went to the water's edge and saw many types of sea gull...or were they? We were much relieved to be told that sea gull identification can be very difficult as their adult plumage develops slowly over four years, and mating plumage differs from non-mating plumage. A handy tip is that the Western and Herring Gulls can be distinguished by their leg colors, yellow and pink respectively.

Next we positioned ourselves in front of the bridge and began quietly observing forest birds. Our patience was rewarded with a host of sparrows (song, fox, yellow-crowned, white-crowned and house), Anna's hummingbirds, golden crowned kinglets, goldfinches, black phoebes, and the utterly adorable pygmy nuthatch that can walk upside

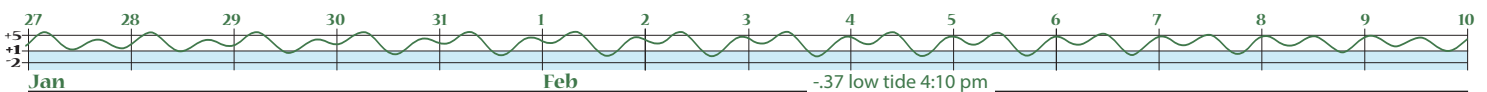
down on tree trunks and buries seeds in the trunk for its winter larder, and many other species!

We were delighted to discover a Cooper's hawk resting atop the telephone pole at the southeast corner of the bridge. This hawk hunts in forests for smaller birds. Before long, a flock of small chatty finches were hovering near the hawk, keeping many sharp eyes on the agile predator.

Over 240 different species of birds have been recorded at FMR. During our hour or so of viewing, we saw 35 different species thanks to Adam's and Jane's keen birding skills, patience and humor while working with our mostly-beginning birder group. We all agreed that it was a great day of learning and entertainment, that we now see the reserve through an additional lens, and that we are all more likely to draw attention to the birds of Fitzgerald during our tours. Practice, practice, practice! ♦



*Pygmy Nuthatch,
photo: Michael Woodruff,
Spokane County,
Washington, flickr*



All About Algae

by Janet Pelinka

What is the difference between algae, seaweed and kelp? Well, all seaweed are algae but not all algae are seaweed, and all kelp are seaweed but not all seaweed are kelp. Confusing? Algae are everywhere whereas all seaweed inhabit seawaters. Generally speaking, the larger brown seaweeds that you find washed up on the beach will be kelp. The three types of seaweed found in the tidepools are either green, red or brown. Here are the most common types seen in the reserve's tidepools.



Bright green and spongy, the filaments of the **green pincushion alga** (*Cladophora columbiana*) clump together giving it a mossy appearance. In fact, Juergen Weinke thought it was moss when he gave Moss Beach its name. Given its ability to hold water and tolerate exposure, it is typically found in the high intertidal zone.

This alga competes for space with other algae and sometimes with invertebrates, completely covering and smothering animals like mussels and barnacles.



Another green alga commonly found in the upper intertidal at the base of the main entrance to reserve tidepools (but can be seen throughout the intertidal) is **sea lettuce** (*Ulva lactuca*). Thin, crinkled bright green fronds that resemble a slightly translucent lettuce, these algae are often eaten dried, toasted or fresh in salads, soups and other dishes. In an area disturbed by sand abrasion or wave action, they are among the first algae to grow back and populate an area, before being grazed and replaced by other algae.



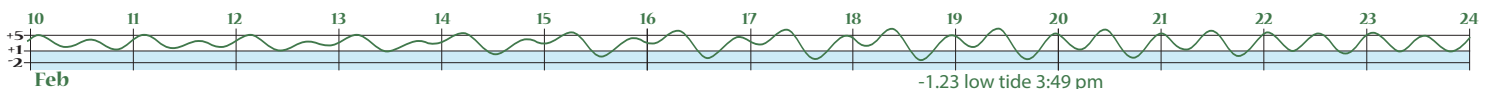
The alga *Endocladia muricata*, commonly called **brillo pad**, **scouring pad** or **nailbrush seaweed**, grows in the high intertidal in dark red to black or greenish brown spiny, bushy-looking clumps 1 1/2 to 3 inches tall. This hardy species can withstand long periods out of water and offers refuge for more than 90 species of animals, including snails, worms, mussels, and fly larvae.

Several algae species are found in the high to mid-intertidal zones. Two species of the brown alga **rockweed** frequently seen are *Fucus distichus* and *Silvetia compressa*.

Fucus (top) generally have wider fronds with midribs, whereas *Silvetia* have narrower fronds that lack a midrib. Olive green to brown in color, they can reach one foot in length. Look closely at the swollen tips. When mature they contain gametes in separate male and female plants. When released the male gametes are attracted by a substance released by the eggs. The zygote settles out and produces a new plant. To discourage predation, rockweeds secrete a chemical that makes them hard to digest. These algae are frequently exposed to air at low tide, and can photosynthesize both in and out of water.



Common in these zones is the **Turkish washcloth** (*Mastocarpus papillatus*) This alga grows in two stages and was originally thought to be two separate species. The crust stage, often referred to as tar spot, is very dark brown or black and grows smoothly on rocks at a rate of 1/2 inch per year. It can live up to 90 years. This stage produces spores asexually that grow into the blade stage. The blades are yellowish brown to dark purple, either male or female and reproduce sexually. Upright in appearance, the blades are flat and develop small growths giving them a rough, or washcloth-like, appearance.



Typically, algae found in the mid to low intertidal are red algae.



In this zone much of the rocks, substrate and even shelled animals become encrusted with a pink substance called **coralline algae** (*Corallina, spp.*). There are 12 species in the reserve, some branching upright to six inches tall with jointed segments and feather-like branches. The calcium carbonate in the tissues make it difficult for most animals to digest this alga, with lined chitons and dunce cap limpets being the exception.

If you like sushi you have probably tasted **laver** (*porphyra sp.*), often referred to as **norri**, a purple to green alga, 8 to 60 inches long with a single broad blade ruffled at the edges, often found in dense clusters. In Japan this seaweed has been used as food for a 1000 years and is a big business there today.



Found in the low intertidal, the **iridescent alga**, (*Mazzaella splendens*) is notable due to its iridescence, especially when touched by sunlight under water. Varying in color from olive-green to bluish purple this alga is often seen waving back and forth in the surge channels; some people believe they are viewing oily water. It is used as a thickener in many foods.



Sometimes called dead man's fingers, **sea sacs** (*Halosaccion glandiforme*) vary in color from reddish purple to yellowish and olive brown. They grow in clusters and can be up to 12 inches long. When submerged the sacs fill with water. If squeezed water spurts out through their tiny pores.



At the northern end of the tidepools (at the bottom of the stairs leading to the beach) the mid and lower intertidal reef is relatively flat. Close to the beach it is covered with the green surfgrass plant (not an alga) that gives way to **black pine algae** (*Neorhodomela larix*). This red alga, dark brown to black in color, grows in mats of many individuals. It has short wiry branches with blunt tips and resembles a bottle brush.



At lower tidal levels the black pine is gradually replaced by *Neogastroclonium subarticulatum*. This species dominates the lower zone and has a reddish base with a greenish top.



Also found in the lower intertidal is the **Turkish towel** alga (*Chondracanthus corymbiferus*). The blades of this species can grow to 20 inches long and 8 inches wide in colors that range from brick red to purplish red. The tiny rasp-like bumps on the blade surface gives it a towel-like appearance. It is a source of carrageenan, a stabilizer for products that include cottage cheese and printer's ink.



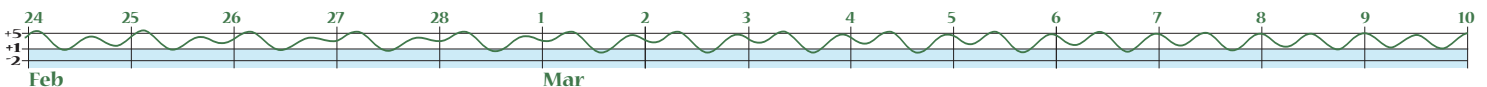
Three types of kelp typically seen in the reserve are often found washed up on the shore. However, the **sea palm** (*Postelsia palmaeformis*) can be seen from a distance on the outer reef. Looking like a miniature palm tree it is able to survive pounding surf and waves due to its hollow, flexible stipes.



Feather boa kelp (*Egregia menziesii*) can be found growing in the lower intertidal and subtidal zones and often draped over rocks. Olive green to brown in color it can grow to 33 feet tall. Children are sometimes seen playing jump rope with this plant or draping it around their shoulders. It has been used by coastal farmers as fertilizer for many years.

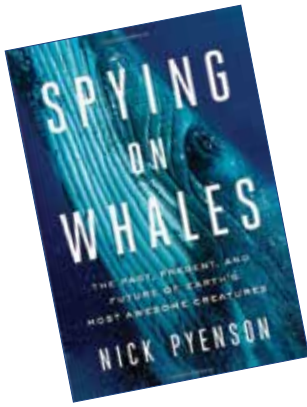


The subtidal **bullwhip kelp** (*Nereocystis luetkeana*), is commonly seen washed up on beaches after storms. One of the largest kelps in the world it can grow up to 90 feet (occasionally to 118 feet) in length with up to 20 brown blades attached to a single float. This kelp has been used to make fishing line, pickles, ornamental musical instruments and dolls. ◆



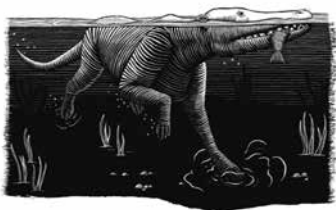
Spying on Whales

by Nick Pyenson, reviewed by Steve Slomka



The hippopotamus is the closest living relative of whales.

A Smithsonian fossil of a blue whale jawbone is 23 feet long and weighs 1 ton.



Pakicetus, a land dweller, swims in an Eocene streambed.
Illustration: Alex Boersma

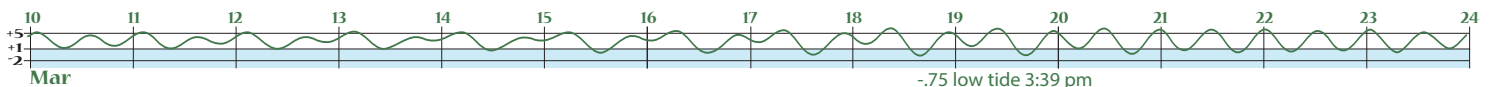
I remember in high school being confused by the assertion that Moby Dick was not about whales. In some ways, Nick Pyenson's book, *Spying on Whales*, isn't about them either. Make no mistake, the author, who is head marine paleontologist at the Smithsonian, includes plenty of whale facts and evolutionary evidence, but the book is more than that. It is about being a scientist—asking scientific questions and searching methodically, and sometimes frantically, for answers. Exploring the entire globe (the Smithsonian seems never at a loss for funding), Pyenson answers fundamental riddles about Earth's largest creatures and their evolutionary history, analyzes their feeding habits to calculate the energy needed to lunge feed, and speculates about a future in the oceans impacted by melting ice caps and changing marine populations. It is a very interesting read and I recommend it highly to this lay audience.

Here are some whale facts I learned from this book:

- Whales are about the same length as sauropod dinosaurs (110 feet), but the blue whale weighs twice as much.
- A Smithsonian fossil of a blue whale jawbone is 23 feet long and weighs 1 ton.
- Lunge feeders with baleen mouthparts are called Rorqual whales.
- Whales were originally terrestrial, evolving from *Pakicetus*, *Ambulocetus*, *Miacetus* and **Basilosaurus**. These were land roaming animals that looked a lot like alligators with hind legs, a nose, bladelike teeth and a weird little flap of skin over their ears. The fossils from these creatures date back 40–50 million years, from the Miocene period.
- The whales have maintained an involucrom, a fan-shaped appendage on the outer ear, from earliest fossils to today's animals.
- The hippopotamus is the closest living relative of whales.
- Toothed whales echolocate, Rorquals do not.
- Sharktooth Hill, a bonebed near Bakersfield, California, holds a collection of many dispersed fossil species with lots of broken bones and partial skulls. The bonebed was underwater during geological time.
- The Atacama Desert in Chile contains a whale fossil wonderland, the Cerro Ballena tidal flat, with dozens of untouched stranded whales lined nose to tail, along with seals, sloths and billfishes lying in four separate layers.
- Now, computer modeling of fossils allows for the 3D printing of creatures in their actual size.
- How is large size an advantage?
- What is the largest size a whale can attain?
- How have glaciers contributed to whale evolution?
- How do you determine the age of whales?
- How can global warming possibly help today's whale population?
- What is the role of whale excrement in the ecosystem?
- How does the natural history of freshwater whales compare to that of oceanic counterparts?
- How does commercial fishing bycatch impact whale populations?
- What specific behaviors are learned, e.g. team lunge feeding, as opposed to genetically inherited behaviors?
- How can sperm whale clans have different sound dialects?
- How did a gray whale fossil turn up on the outer bank of North Carolina when the creatures are only known in the Pacific today?

He starts with the simplest question, "Who are you?", then starts to tease out the answers.

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Offshore Drilling on California's Coast —Will It Happen?

by Janet Pelinka

- It would be the first West Coast oil lease sale since the 1980s.
- It proposes the largest number of lease sales in U.S. history.
- It includes six lease sites off the coast of California, two in Central California.
- It will make over 90 percent of the currently protected Outer Continental Shelf (OCS) available for consideration of future exploration and development.

This is the essence of the Draft Proposed Program announced by US Interior Secretary Ryan Zinke for developing the National Outer Continental Shelf Oil and Gas Leasing Program for the next five years. It would offer for lease a total of 47 areas off the U.S. coast from 2019 to 2024.

The plan began earlier this year when 155 members of congress gave their written support of a new five-year plan that recognizes America's potential for energy dominance. The Outer Continental Shelf Lands Act requires the Secretary of the Interior, through the Bureau of Ocean Energy Management, to prepare and maintain a schedule of proposed oil and gas lease sales in federal waters that would best meet national energy needs for the five-year period following Program approval.

Currently, there are 23 offshore oil and gas facilities in federal waters off California's coast, and four platforms and five artificial oil islands in state waters, according to the California State Lands Commission. In 1994 the Commission placed the entirety of California's coast off-limits to new oil and gas leases in state waters, from beaches out to three miles offshore.

The 1969 Santa Barbara oil spill still remains in the memory of many Californians, and the new Draft Proposed Program faces stiff resistance here. In September, Governor Jerry Brown signed a bill that bans new pipelines, piers, wharves, or other infrastructure that would be constructed in state waters. Many California cities had already adopted similar policies. And, according to Commission chair Lieutenant Governor Gavin Newsom, the State Lands Commission has adopted a resolution that directs staff "to take appropriate actions to ensure that any oil and gas product from new drilling never makes landfall in California." Further, Jerry Brown stated publicly that "California will resist this misguided and insane course of

action. Trump is AWOL but California is on the field, ready for battle."

California isn't alone in the rejection of Zinke's Draft Program. The plan was immediately met by protests from other coastal states and environmental groups. And the tourist industry is objecting to the unsightly nature of oil rigs and platforms. In California they can be constructed just beyond the three-mile state water boundary. To put that in perspective, the Farallon Islands are 27 miles offshore and can be seen from many sites along the coast. No drilling is planned locally but one may need only to travel a few miles north or south for a view of the platforms.

The threat of an oil spill should be deterrent enough given the bleak spectacle of recovery after the Horizon Oil Spill. Yet a draft plan has been issued by the government that loosens the present oil-drilling rules that require more frequent safety inspections of oil rig equipment.

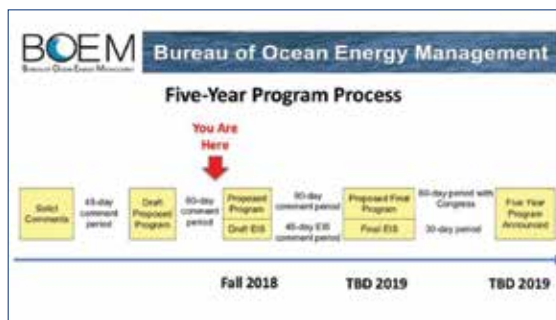
Beyond the threat of oil spills there is the certainty of other environmental consequences. Oil exploration requires seismic surveys to locate and estimate the size of oil reserves. Such surveys are accomplished by emitting high-decibel explosive impulses to map the ocean floor. The blasts are so destructive that in 2014, the Bureau of Ocean Energy Management completed a Programmatic Environmental Impact Statement on proposed seismic surveying in the

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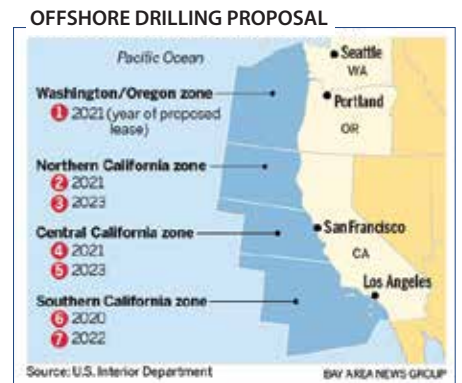


Platform A, Dos Cuadras, 1969 oil spill

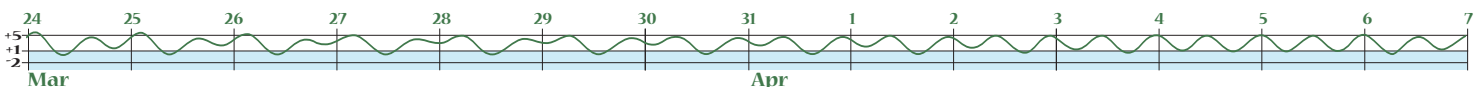
This oil spill now ranks third in oil spills in U.S. waters after the 2010 Deepwater Horizon and 1989 Exxon Valdez spills. It remains the largest oil spill to have occurred in the waters off California. Within a ten-day period, an estimated 80,000 to 100,000 barrels of crude oil spilled into the Channel and onto the beaches of Santa Barbara County. The spill had a significant impact on marine life in the Channel, killing an estimated 3,500 sea birds, as well as other marine animals.
—Wikipedia



KQED Science



U.S. Interior Department





Spying on Whales shows the transition from speculation to accepted theory via tangible evidence.

He goes on an Alaskan herring run to better understand how whale hearts are able to send thousands of liters of blood throughout the animal and how the lungs can support two hours of underwater activity between breaths.

Spying on Whales, continued from page 8

Next comes the painstaking lab work that necessarily follows each discovery, especially the weird one from Panama. Fossils are cleaned of debris and glued back together when needed. As described in the book, Pyenson "rolled the crate into the vertebrate paleontology preparation lab where staff skilled in anatomy, manual dexterity and material properties started the process of exhuming the fossil encased in plaster and rock... They sawed and ripped the hardened plaster bandages away, then slowly brushed, scraped and drilled away sediment, layer by layer, around the skull." After that process, the skull was too ungainly and too fragile to hold, so they scanned the skull and created a digital 3-D model, and then printed a full-sized plastic replica. They reviewed the literature and decided that their find was a relative of the Amazon river dolphin, 5.8 to 6.1 million years old. They named it Isthminia panamensis. The discovery reminded them "that features we assumed had evolved for life in the Amazon were also found millions of years earlier in a marine cousin that inhabited the Central American Seaway."

He discusses the fate of vaquitas, porpoises uniquely found in the northern corner of the Gulf of California. They are very small—you can hold one in your arms—and quite fragile, so they can't be transported to other locales. Unfortunately, they share a fishing ground with a totoaba, a large fish whose swim bladder is highly prized by Asian cultures. In the gulf,

illegal gill nets rake in both totoaba and vaquitas. As Pyenson asserts, "Doing nothing will almost certainly lead to their demise; and capturing any living ones and trying to implement a captive breeding program may only accelerate the same fate."

He goes on to say that, "Most whale species that ever evolved are extinct. Today, there is no confusion: human agency in all its forms produces the strongest extinction pressure on whales."

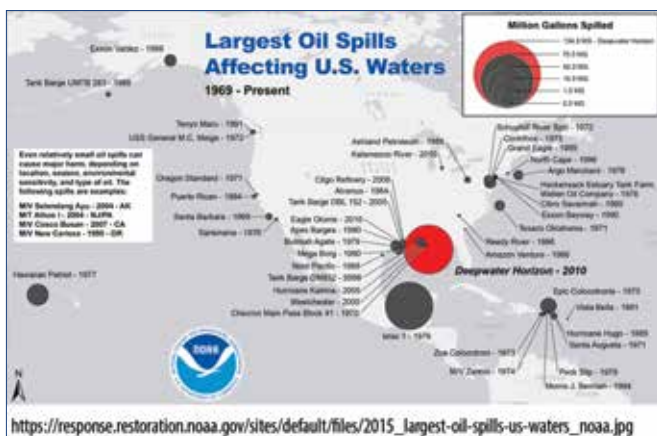
Surveillance of whales must become surveillance of us, as animals reveal how the oceans are altered by human activity. As cetacean blubber stores trace chemicals, scientists are able to follow the effects increasing pollutants have on whales. And, through electronic tagging scientists can chart the changes in whale behavior as the oceans warm. As we continue to shape the ecosystems in which whales exist, we are determining their evolutionary path.

Spying on Whales shows the transition from speculation to accepted theory via tangible evidence. This is important to remember when today many unsubstantiated "facts" are circulated and the work of scientists is devalued as being too process oriented. Scientists aren't just guided by their gut feelings. They pose many, many interesting questions and must do a lot of digging (literally in many cases) to answer them. The book shows men trying to learn from and about these creatures as we change their environments. ♦

Offshore Drilling, continued from page 9

Atlantic, and estimated that 13.6 million marine animals would be disrupted. Also to be considered are the enormous amounts of polluted waste water released in the drilling process. That water contains toxic substances like benzene, zinc, arsenic, radioactive materials, and other contaminants used to lubricate drill bits and maintain pressure.

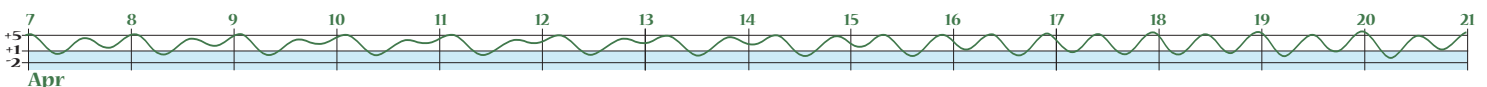
But perhaps there is some light on the horizon. An oil industry analyst, Justin Devery, said that there is little chance oil developers will enter California's North Coast



considering the political opposition, lack of facilities and the persistently weak price for crude oil which is presently around \$70 per barrel. "The North Coast is an oil-drilling frontier where investments would take

years to pay off," he added. In April this year, Reuters News Agency reported that Secretary Zinke said he has had little demand from oil and gas companies for new offshore drilling leases. Speaking to an offshore wind conference in New Jersey, Zinke said drilling companies are not that interested in new areas offshore while there's "strong opposition" in most of the neighboring states. During the requisite 60-day public comment period that ended March 9 this year, over 1.6 million Americans submitted comments to the Department of the Interior, with the vast majority expressing opposition to the drilling proposal (Surfrider Foundation blog).

So it is unclear if and when the offshore drilling will come to pass. A comprehensive policy proposal has yet to be published. Further extensive reviews are required by Federal Law and there will be more opportunities for public comment. For now the 2017-2022 Five Year Program that protects large tracts of ocean waters will continue to be implemented until the new National OCS Program is approved. ♦



Cows, Methane and Algae

by Sasha Greenawalt

Recently in a discussion of climate change someone asked what could be done about it, other than the apparent things like conserving resources. One suggestion was that we could stop eating meat. No one thought that was a likely event. And I think the original quester was thinking about some geophysical, large-scale endeavor. Surprisingly, a few days later I was handed an article about a study of the emission of methane by cows and its reduction by supplementing their diets with a specific type of seaweed.

Methane is a potent greenhouse gas, and has about 25-30 times more short-term heat-trapping power than carbon dioxide. In California, 1.8 million dairy cows and a smaller number of beef cattle emit 11.5 million metric tons of carbon dioxide equivalent every year—equivalent to 2.5 million cars. In the U.S., of the amount of methane emitted into the atmosphere due to human activity, domestic livestock contribute 36 per cent, according to the U.S. Environmental Protection Agency.

This is methane produced by “enteric fermentation,” the digestive process that takes place in an animal’s upper stomach chamber, the rumen (cows have four stomachs), in which microbes pre-digest fiber and starch, releasing gases when the animal belches or exhales. Belching is a bigger problem than flatulence; about 95 percent of the gas emitted is from the mouth. The use of algal additives in cattle feed has the potential to reduce enteric methane by 30 percent or more, says Ryan McCarthy, science advisor to the California Air Resources Board. There are 12 Holstein cows participating in experiments being conducted by UC Davis animal science professor Ermias Kebreab, with one type of marine algae reducing methane by more than 50 percent. That is the red alga *Asparagopsis*, an organism found off the coast of Queensland, Australia. Two species, *A. armata* and *A. taxiformis*, have been used in studies done in the U.S. and in Australia.

Researchers worldwide have been working on the methane problem in livestock for years; they have tried selectively breeding less gassy cows, and they’ve tried vaccinations to suppress the bacteria that turn carbon and oxygen into methane in the rumen, the “methanogens.” There were too many different methanogens to vaccinate against, and breeding didn’t help. Food additives have shown more promise. Kebreab, a native of Eritrea, has been working on the problem for 15 years, and for feed he uses a mixture of dried red algae (*Asparagopsis armata*) in two dose sizes, blended with molasses (some cows don’t like the salty seaweed taste) and plain cow feed (a mixture of alfalfa and hay), for the experimental cows. The control cows get only plain

feed. After they eat, the cows are enticed into a compartment where an instrument much like a breathalyzer analyzes their emissions three times a day.

Study results have exceeded everyone’s expectations. The higher dose of algae reduced enteric methane by more than 50 percent. At this dose the researchers noticed a slight drop in the amount of food the cows were eating and the amount of milk they produced. Kebreab explains, “It’s basically the palatability issue. It’s something they haven’t had before, and when you have it at one percent they smell it. It smells like the ocean,

I guess. That’s why our next work is going to be how to deliver the seaweed so that they don’t notice it.”

The team also worried that the taste of the milk might change with the seafood diet, so they had 25 panelists in for a blind taste test. The panel of tasters could not detect a difference between the different cows’ milk. In later experiments with ➡



Credit: Foodtank.com

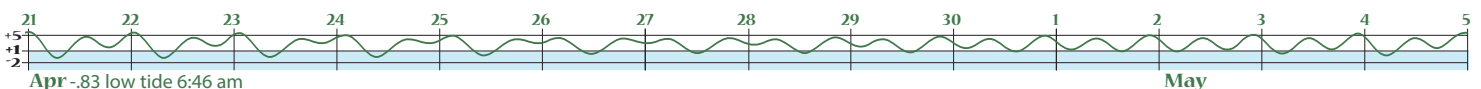


Ground-up *Asparagopsis*.
Gregory Urquiaga/
UC Davis

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There is good evidence that farmers in ancient Greece and 18th-century Iceland deliberately grazed their cows on beaches.





Cows, Methane and Algae, *continued from page 11*

reduced dosages of algae, milk production from the experimental cows was steady or increased.

There is good evidence that farmers in ancient Greece and 18th-century Iceland deliberately grazed their cows on beaches. And a dairy farmer in Canada, Joe Dorgan, observed that his cows kept in paddocks on the beaches of Prince Edward Island got pregnant faster and gave more milk than his cows in inland paddocks. When Dorgan retired from dairy farming, he launched a new business, North Atlantic Organics, to make what he calls “stormtoss shoreweed” available to inland farmers. To get data for marketing purposes Dorgan contacted environmental scientist Rob Kinley at Dalhousie University in Nova Scotia. In 2014 Kinley and a colleague analyzed different varieties of seaweed for nutritional value and health impacts on ruminants.



Red algae (Asparagopsis armata) with two common two-banded sea bream (Diplodus vulgaris) Photo : Matthieu Sontag, Licence CC-BY-SA, Wikimedia Commons

Kinley later moved to Australia and, in partnership with James Cook University and Meat and Livestock Australia, began screening seaweeds for their influence

on methane emissions of ruminant livestock. *Asparagopsis* turned out to be the most effective anti-methanogenic seaweed. Upon digestion, *Asparagopsis* produces a compound called Bromoform (CHBR3), which interacts with enzymes in ruminant stomachs and halts the cycle of methane production before the gas is released into the atmosphere.

But Kinley warns that this alga does not grow in abundance all over the planet, and it would have to be farmed if it turns out to be a global solution to enteric methane. This is not a bad thing, however, as Kinley says, since seaweed cultivation takes up excess nitrogen and dissolved carbon dioxide from ocean waters. Joan Salwen, an environmental science fellow at Stanford University who introduced UC Davis scientists to the seaweed properties, says, “This supplement, if it proves out in all animal testing, could be offered in all livestock production systems that we know about.” Salwen is a founder of Elm Innovations, a nonprofit trying to explore the adoption of this technology if it proves scientifically sound.

Jonathan Reinbold, sustainability program manager for Organic Valley, a cooperative of more than 1,800 dairy farmers, says, “Methane is an indication of an inefficiency in the animal’s digestion. If you can increase the digestion efficiency of a cow by five percent you could remove five percent of the land you use for production for cows...If the benefits are real and make sense financially, why wouldn’t we have the entire cooperative of 1,800 dairy farmers using it? We certainly hope that’s the case.”

Next the UC Davis researchers will determine whether the seaweed changes the nutritional content of the milk, and they are planning an experiment over a longer time span, and one with beef cattle.

This is one promising possible answer to the question, “What is to be done?” ♦

Friends of Fitzgerald Marine Reserve

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