

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
J U N E 2 0 0 8

Complex Forces Influence High and Low Tides

by Jenna Kinghorn

Nearly every day, some visitor approaches a Fitzgerald Marine Reserve staffer or volunteer and says something like, "I was here at this time last year and there were a lot more rocks out of the water," or "When I was here at this time of day last week the water was out much farther. Why is the tide so high right now?"

On Wednesday, June 4, 2008, FMR will see the second lowest tide of this century up to 2026: a whopping -2.11 at approximately 5:45 a.m. Perfect for tidepooling! And yet if you arrive at 5:45 a.m. just one week earlier or one week later, you'll find the tide so high that most of the reef will be submerged and inaccessible.

How much of the intertidal zone is uncovered at any particular moment in time is dependent on the tides, the cyclical rise and fall of the level of the surface of the ocean. And as repeat visitors discover, tides are not tied to the time of day or day of the week or most of the other time-cycles that dominate contemporary human life.

Often when a volunteer naturalist quizzes the students on a tour about tides, the kids supply a simple "The moon." While it's true the moon relative to the earth causes high and low tides, a host of other factors complicate the mechanics of tidal fluctuations, including the rotation of the earth, the gravitational force of the sun, the shape of the local ocean floor, and weather conditions.

The moon's gravitational pull on the earth's oceans is the main force driving our tides. You might think that when it is high tide at the reserve, the moon must be directly overhead, its gravitational attraction lifting the water along the west coast of North and South America straight up. Actually the moon's gravitational pull isn't strong enough to lift water straight up, but just as it is easier to pull a boat across the water than it is easier to lift it straight out of the water, the moon's attraction exerts horizontal tractive forces on waters not directly under the moon and pulls all that water towards one point. (See Figure 1.)

This creates a bulge in the oceans wrapping our planet. As points on the earth rotate through this bulge—and remember that the bulge itself keeps moving because the moon is moving relative to the earth as it orbits our planet—they experience high tide.



teer naturalist quizzes what controls the tides and concise answer: that the position of the moon is the main factor that dominates tides. The number of other factors that control tides is the main factor that dominates tides.

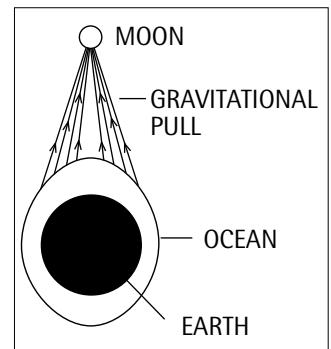


FIG 1: The pull of the moon's gravity on the ocean is the main force driving the cycle of tides. Drawing not to scale.

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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.

The graph displayed across the page bottoms shows tides for 5/19/08 to 12/15/08. Where the date appears is midnight. The reefs are accessible for exploring only during low tides. See: www.fitzgeraldreserve.org/resources.html and click on "high and low tides," for a more detailed tide chart. **Note:** the lowest tides this period are:

****-2.11 6/4 5:45 am**
-1.84 7/3 5:33 am
-1.26 7/31 4:33 am
-1.69 11/14 7:03 pm
-1.89 12/13 5:07 pm

****2nd lowest tide this century and lowest thru 2026!**

"Stormy Start" for 2008 Volunteer Naturalist Training Class

by Linda Ciotti

This year's annual training class got off to a rocky, or should I say, stormy start!

The original start date was January 5, but when a huge storm hit on January 4, causing major power outages all over the Coastsid, we canceled the class and rescheduled it for the following Saturday, January 12.

Then on January 10, the organizers for the Mavericks Surf Contest announced that the contest would be held on Saturday, January 12! Past Mavericks contests have taught us that traffic comes to a halt all over the Coastsid, so we postponed for one more week.

We finally got started January 19. Fifteen students started the class and eleven completed it. Please welcome these new volunteers to our ranks: Larry Arndt, Carrie Anne Caruso, John Chang, Anne-Ly Crump-Garay, Lauren Eisele, Wendy Figone, Melosa Granda, Linda Hirahara, Mary Lou Holding, Mike Laris, and Sarah Lecus.

Special thanks to all of our instructors who were extremely flexible to accommodate our unusual schedule: Ellen Gartside, Bob Breen, Sabbie Hopkins, and Heather Johnson. Also I would like to acknowledge the outstanding help I received from Tom Ciotti, Betty Cosgrove, and Mary DeLong. ♦



Two surfers ride the wild Maverick's Wave. Photo: Deborah D. Lattimore.

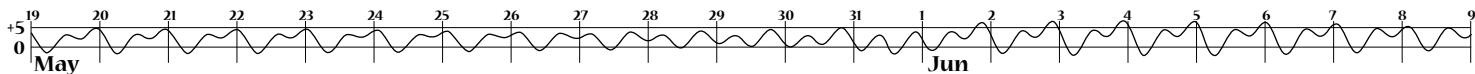
Work Continues on Selecting MPAs

For over a year now, former FMR ranger and FFMR board member Bob Breen has worked with a Marine Life Protection Act task force to identify North Central Coast areas that should be designated Marine Protected Areas (MPAs). After 50 days of formal meetings and public workshops and numerous informal meetings, the task force has come up with four proposals that they will present to the California Fish and Game Commission (CFG) this summer.

"The preferred proposal is a milestone in that it protects more of the coast (20.4% v. 17.8%) than phase 1 South Cen-

tral MPA's that went in to effect in September, 2007," Bob wrote in a recent email to our supporters. "Thanks to all of you who helped, provided speaking venues, gathered signatures, wrote letters and did all of the others tasks that were so important to the success of this phase of the MLPA process. Without your support we would have never done so well."

Stay tuned—Bob will be asking for you to show your support with more letters and emails this summer as the CFGC considers the four proposals. For details, visit the MLPA website at <http://www.dfg.ca.gov/mlpa>. ♦



Tides continued from page 1

But FMR, like many other coastal areas around the world, doesn't experience just one high tide per day. We have what is called a semi-diurnal tide, meaning that we experience two high tides roughly twelve hours apart, and also two low tides that arrive half-way between these high tides.

This happens because there are actually two bulges in the world's oceans, located on opposite sides of the planet. The bulge on the side of earth facing the moon—the larger of the two bulges—is caused by the moon's pull. The counter-bulge on the far side of the planet is the result of forces that overcome the moon's pull, which is not as strongly felt on the far side of the earth. Here the pull of the moon's gravity on the solid body of the earth beneath the ocean is stronger than its pull on the water, so the earth in effect is pulled away from the water resting on its surface as it is drawn towards the moon. Another factor is the centrifugal force caused by the earth's curved path around the sun, which causes the water of the ocean to pile up. (See Figure 2.)

So roughly twelve hours after FMR rotates through the first high-tide bulge, we rotate through the second bulge. Because this second bulge is smaller than the first bulge, the measurement of this high tide is lower than the other high tide, and so these tides are called Lower High Tide and Higher High Tide.

In between the bulges are the ocean areas from which water has been pulled away to form the bulges. (See Figure 3.) When FMR rotates through these tidal depressions we experience low tides. These low tides are also slightly different in height, and we call them Lower Low Tide and Higher Low Tide. Lower low tides that fall during daylight hours are the preferred times for going tidepooling, because they expose more of the intertidal zone.

Looking at a tide table page in the High & Low Tides 2008 booklet of tide tables that Friends of Fitzgerald Marine Reserve send to members at the beginning of every year, we can see that all four of these extreme points in the

tidal cycle—higher high, higher low, lower high, and lower low—are accounted for in either the "A.M." or "P.M." columns of the booklet. Low tides that are especially good for tidepooling are highlighted in red ink and have a minus sign in front of them.

The minus sign indicates that the measurement predicted for that tide actually falls below the baseline or reference point from which all tides are measured. This point is called Mean Lower Low Water (MLLW)—the

height of the lower low tide averaged over a period of nineteen years. (This nineteen-year period is called the National Tidal Datum Epoch. The current epoch is 1983-2001, which

means that tides in the 2008 tide table are measured relative to the average MLLW of all the lower low tides that occurred from 1983 through 2001. The previous epoch was 1960-1978, and the one before that was 1941-1959.)

As you can see from looking at the tide tables or from observing the shore on several different days, the height of the tides—the thicknesses of the bulges and depressions previously described—changes from day to day. These changes are a result of the interaction of the moon's gravitational pull with the less-strongly-felt force of the sun's gravitational pull.

The sun's pull on the ocean is not as strong as the moon's because the sun is much, much further away than the moon, but it still has an influence. As the moon orbits earth, twice a month the two bodies form a straight line with the sun at the time of the new moon and the full moon. (See Figure 4.) The alignment of their gravitational pulls causes higher-than-normal high tides and lower-than-normal low tides. These extremes are called spring tides. (Spring comes from the Saxon word for ➤

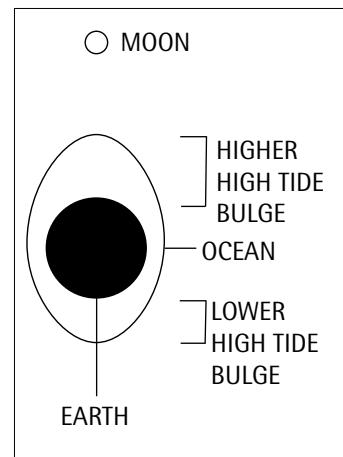


FIG 2: The moon and other forces create two bulges in the ocean that FMR experiences as Higher High Tide and Lower High Tide. As the earth rotates, FMR moves through these bulges approximately 12 hours apart. Drawing not to scale.

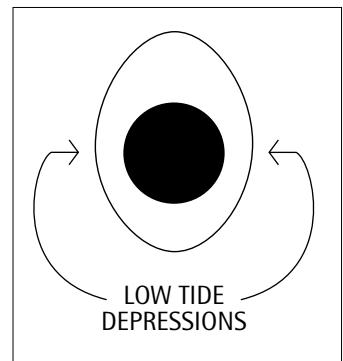
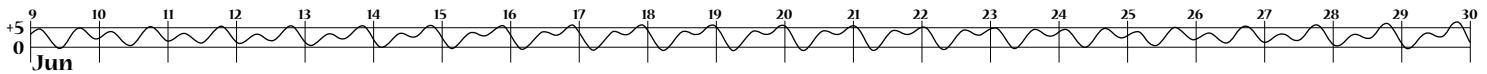


FIG 3: FMR experiences the tidal depressions as Lower Low Tide and Higher Low Tide. Drawing not to scale.



Tides *continued from page 3*

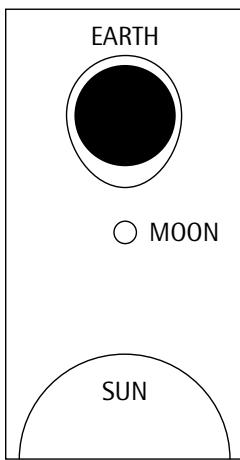


FIG 4: When the moon is aligned between the earth and sun, in its new moon position, we get a spring tide. Spring tides also occur when the moon is on the far side of the earth from the sun, in its full moon position.

Drawing not to scale.

"to swell," and has nothing to do with the season—we get spring tides twice every month all year long.)

One week after the full moon, the sun forms a right angle with the moon relative to the earth. Their gravitational forces pull against each other, somewhat canceling each other out, and the result is a neap tide, during which there is a smaller difference between the high and low tides. Another neap tide happens one week after the new moon as well, when the sun is on the other side of the earth and once again forms a right-angle with the moon. (See Figure 5.)

In between these four points in the monthly tidal cycle, the height of both the low and high tides rises and falls. When you examine the tide tables, you'll notice that the time of each tide happens later each day. Table 1, showing the times of a few tides predicted in May of 2008 at the San Francisco Golden Gate, illustrates this. The predictions made in the tide tables are calculated by computers that take into account many variables—moon and sun positions, local underwater topography, the strength and direction of local currents, and many smaller forces that complicate the behavior of tides.

You can find tide tables online, or find web pages that allow you to enter a location and date and have the tide calculated for it, but the official tide predictions are published by the U.S. Department of Commerce and approved by the U.S. Coast Guard.

Because there are so many variables, even with computers it is impossible to calculate the tide conditions for every single seaside community in the world. Instead, predictions are made for refer-

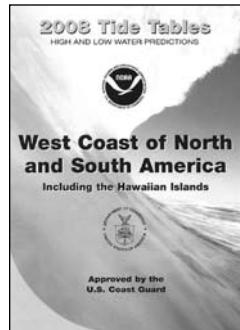
ence ports, and then tidal differences are published for a larger number of places.

Tide tables have been published by the U.S. government since 1853, but it wasn't until 1867 that the first tide tables gave predictions for every day of the year; even so, only high tides were listed, and only the Atlantic and Pacific coasts of the U.S. were covered.

Low tide predictions were added several years later. Through 1884 tides were calculated by humans. From 1885 through 1965 they were calculated by mechanical computers, and in 1896 the predictions extended around the maritime world. (See Table 2.)

The reference port for the High & Low Tides 2008 booklet available at FMR is the Golden Gate Bridge. The tidal differences for FMR are accounted for on the cover of the booklet, which states, "Low tide at the reserve is approximately 1 hour before the times shown." This means when the booklet says low tide is at 9:27 a.m. on a certain day, you subtract an hour to find out the time of low tide at FMR: 8:27 a.m. Flip to the center page of the booklet to see the time and height differences for many other San Francisco Bay Area shoreline communities.

Keep in mind that the times and heights of tides are predicted for average weather conditions. Prolonged onshore winds or low barometric pressure produces higher-than-predicted tides. Offshore winds or high barometric pressure yield lower-than-predicted tides. When a big storm hits during a very high tide, the results can be newsworthy! Always be sure you ➤



The book that predicts tides for the entire west coast of North and South America is more than 371 pages long.

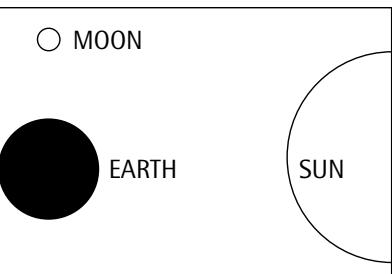


FIG 5: When the moon and sun form a right angle to earth, we experience neap tides. Like spring tides, neap tides come twice a month. Drawing not to scale.

Table 1

| Date | Lower Low Tide Time | Higher High Tide Time |
|-------------|---------------------|-----------------------|
| Fri. May 9 | 9:27 a.m. | 2:23 p.m. |
| Sat. May 10 | 10:28 a.m. | 3:23 p.m. |
| Sun May 11 | 11:29 a.m. | 4:30 p.m. |

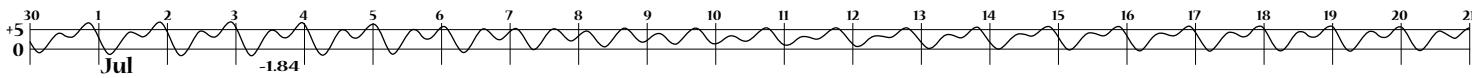


Table 2

| Year | Reference Ports | Tidal Differences |
|------|-----------------|-------------------|
| 1867 | 19 | 124 |
| 1896 | 20 | Approx 3000 |
| 2008 | 269 | Approx 6530 |

New California Law Moves to Eradicate Plastics from Marine Environment

Editor's Note: FFMR member and volunteer naturalist Marsh Cohen says "I came across AB258 during some research I was doing for a project at work. I was encouraged to find out about this new law, since we all have come across our fair share of plastic debris at FMR." Marsha copied the following text directly from the Legislative Analyst's report and submitted it to *Between the Tides*. Thanks for sharing this good news with us, Marsha! -- JK

As of January, 2008, a new state law was enacted that establishes a plastic debris eradication program to reduce the amount of preproduction plastics entering the marine environment. The author of the bill was Assembly Member Paul Krekorian.

A legislative analyst prepared a summary of why the bill was needed and what the new law will accomplish:

According to U.S. Environmental Protection Agency, marine debris has become a problem along shorelines, coastal waters, estuaries, and oceans throughout the world. It is commonly defined as any man-made, solid material that enters our waterways directly or indirectly. Objects ranging from detergent bottles, plastic bags, paper cups, preproduction plastic, hazardous medical wastes, cigarette butts and discarded fishing line all qualify as marine debris. In addition to being unsightly, it poses a serious threat to everything with which it comes into contact.

Marine debris can be life threatening to marine organisms and can wreak havoc on coastal communities and the fishing industry.

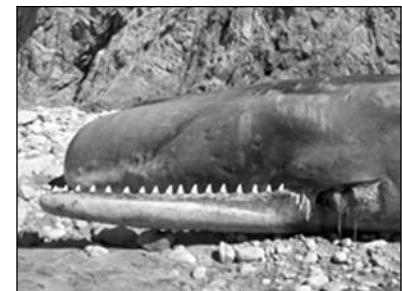
In general, there are two types of marine debris that pollute our ocean and coastline in California. The first is from ocean sources, and includes waste discharged by ships, recreational boaters and fishermen, and offshore oil and gas exploration and production facilities. The second, and by far more environmentally destructive, type of marine debris is from the land.

This type of debris includes storm water runoff, solid waste, floating structures, poorly maintained garbage bins and dumps and is transmitted to the marine environment by waterways. Land based litter constitutes nearly 80 percent of the marine debris found on our beaches and oceans, and 90 percent of it is plastic.

When debris from the land reaches the beaches and ocean, marine life is often threatened because they confuse the debris for food. Small pieces of preproduction plastic, plastic cups, bags, and cigarette filters are often found in the stomachs of fish, birds, whales, and other marine creatures.

Recent studies by the Algalita Marine Research Foundation and the Southern ➤

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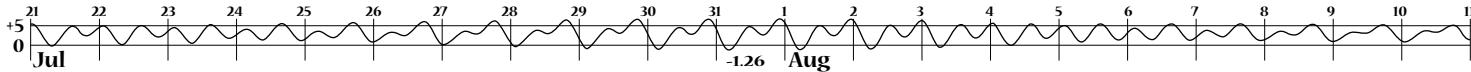
A dead male sperm whale measuring over 50 feet long washed ashore on a Pt. Reyes beach in March 2008. Photo by Keary Sorenson, courtesy of Farallones Marine Sanctuary Association (www.farallones.org)

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consider weather conditions as well as tide heights and times when you plan your trip to the tidepools.

A graphical representation of relative tide heights runs along the bottom of the pages of *Between the Tides* to give you a general idea of what the tide is doing from day to day. If you find yourself baffled by the tide

tables and unable to read the results of a web page predicting tides, you can always call the reserve. Even if a ranger is not available to answer your call, the time and height of the daytime low tide is included in our recording. So don't let the seemingly complicated art of predicting the tide keep you from visiting us this summer! ♦





As Elliot shows here, dressing in layers is key to having fun at FMR. When the rest of the peninsula is broiling, FMR is likely to be blanketed in cold, damp fog, so wear warm clothes that will dry quickly, or have a change of dry clothes waiting in the car.



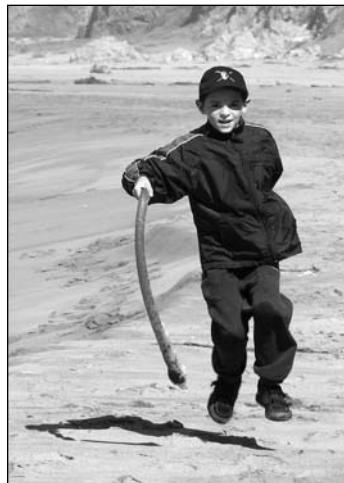
Lucy's ensemble highlights the importance of wearing shoes or boots that will give you a good grip—no open-toed shoes or heels, please!—and won't be ruined if they get wet.



Algae-covered rocks can be slippery, so Aunt Sarah and Cousin Lydia help each other out in tricky spots by holding hands.



Small kids sometimes find the best stuff—after all, their eyes are closer to the rocks! Although we don't recommend carrying infants onto the reef, toddlers make great tidepoolers.



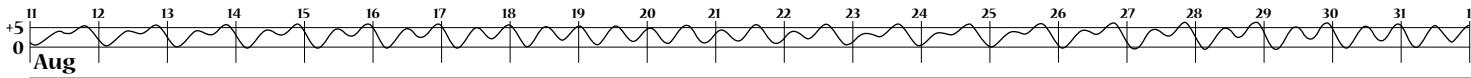
As Elliot demonstrates, doing a little running and jumping on the sandy beach before you reach the rocky reef area can help blow off steam after a long car ride or to warm up cold tidepoolers.



Making Tidepools

Photos by Amy and John Albers-Mead

Editor's Note: Amy and John Albers-Mead are family members of FFMR board member Lucy Mead. Amy handles all the tasks associated with scheduling volunteers on the reef. John is a Friends board member and very "the whisperer" for his uncanny ability to find the tiniest critters. Lucy and John have both appeared in many issues of *Between the Tides* and have been involved in several FFMR projects, including the redesign of our website. Amy and John enjoy sharing their family excursions on the reef, and some of their family excursions on the reef, and some success. We hope to see you in the tidepools this summer when you plan your visit.) – JK



ng a Family Affair

John Albers-Mead

Showing off your finds is fun, as Lucy's smile demonstrates. Be sure each kid gets a chance to point out some finds. Ask the kids what they know about each animal, and then tell them what you know about it. Flag down a ranger or volunteer naturalist if you have questions.

familiar faces around Fitzgerald Marine Reserve. Amy volunteer naturalists to cover tours and spends time out y active tour guide. He is known as "the nudibranch t and most colorful of sea slugs, and his photos have . He has donated his graphic design skills to our logo, and is now working on a soon-to-be-re- by sharing their passion for FMR with their twins, finds to cousins and friends. Here are some photos hints for making your own family trip to FMR a summer! (Make sure you check a tide table before

Interspecies encounters like this one between Elliot and a sunflower star—which is known as "the godzilla of the tidepools" because other animals flee at its approach—make great memories for the whole family.

Uncle Bryan shows Cousin Ryan the importance of patience as they wait for a hermit crab to come out of its shell. (For more information on how to safely handle hermit crabs, see the March 2008 issue of *Between the Tides*.)



Don't forget to check the sandy beach for interesting objects as you go to and from the tidepools—maybe you'll find something like this bullwhip kelp that Elliot and Amy are using to drum on a log.



One-on-one time is a great way to promote appreciation of each other as well as the intertidal creatures you encounter.



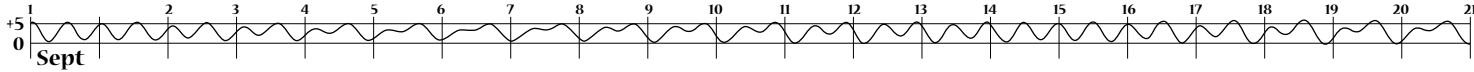
Be sure to take advantage of special tours such as the night tidepooling tour usually offered around Christmas time at FMR.



Not everyone's attention span will hold up to the rigors of tidepooling. Going to play quietly in the sand, within sight and calling distance of the rest of the party, is a good alternative for bored kids.



If you're coming with a group of more than 10 people, you need to make a reservation. For details check <http://fitzgeraldreserve.org/groups.html>.

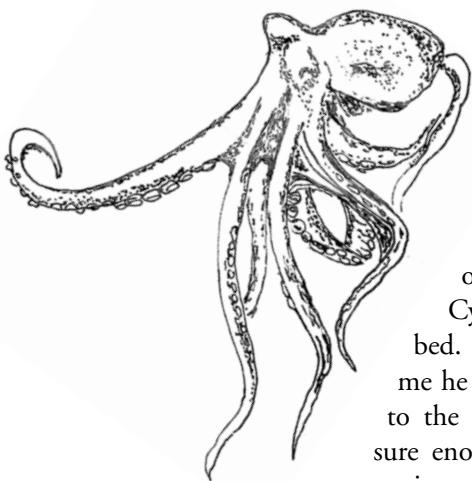


The Red Octopus

(or Confessions of a Cephalopodic)

by Tom Ciotti

sketches by Kelly Huber



One Sunday in early March of 2008 I was exploring the area off Cypress Point just below the mussel bed. A young man approached and told me he had seen a tentacle in a tidepool just to the north. I peered into that pool and, sure enough, an octopus arm was extending out into the pool from beneath a rock ledge. We stood and watched as more of the octopus emerged, its leading arm reaching out into the pool towards a hapless hermit crab that was rapidly retreating across the pool.

The octopus pursued the crab and caught it with an arm as it nearly reached the opposite side of the pool. It wrapped its body around the crab and propelled itself back across the pool and under the ledge, changing its normally red body to colors matching the pool bottom as it went. We had just seen the most amazing creature found in our intertidal environment: the red octopus (*Octopus rubescens*).

Octopuses (not octopi because “octopus” is of Greek, not Latin, origin) are relatives of clams and snails, although they lack the shells we usually associate with mollusks. Taxonomically within the phylum Mollusca and in the class Cephalopoda, octopuses are literally “head-footed”—although their eight super-flexible appendages are commonly called arms rather than feet. Of all the invertebrates found in our tidepools, octopuses have the most varied and unique array of adaptations that allow them to live and survive in the intertidal habitat.

They are without question the most intelligent invertebrate. In terms of the size of their brain to their body, they should approximate the intelligence of birds and are certainly more intelligent than most, if not all, of the intertidal vertebrates. In laboratory settings their intelligence allows them to exhibit learned behavior such as navigating complex mazes and opening jars in search of food. More than half of their nerves are located in their arms. This enables

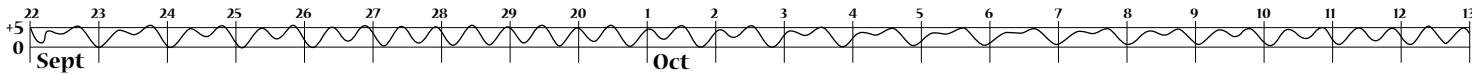
their arms to respond to local stimuli independently of control by their brains, which are freed to be used for higher purposes.

An octopus has two large eyes, one on either side of its head. While it cannot see colors, it can discern polarized light. This inability to see color may be attributed to the octopus’s nocturnal nature—there is little need to see color to effectively prowl around at night. On the other hand, the ability to distinguish polarized light may be very useful to visualize transparent bodies or the highly polarized reflections of moonlight from smooth surfaces such as crab shells. Their eye parts are similar to those of humans, but octopuses focus their eyes using a much different mechanism than we do. Octopus eyes focus by moving the lens back and forth within the eye—similar to a camera lens. Human eyes focus by changing the thickness of our lenses.

The eight arms of the octopus have rows of suckers which are used to hold onto rocks, move the animal, capture food and move captured food to the mouth. The suckers have chemosensory cells, which allow the octopus to sense food and chemicals in the water. The male octopus’s third arm has been modified for copulation. Unlike its other arms, the tip of the third arm, called the ligula, lacks suckers and instead has a groove for holding sperm during mating.

When an octopus captures prey, such as a shelled crab or other crustacean, it holds the prey with its arms and uses its radula (a file-like tongue) and chemicals secreted by its salivary glands to drill a hole in the shell of the prey. It then injects venom into the prey, which paralyzes or kills the prey and initiates digestion of the prey’s tissues. The octopus mouth is equipped with a beak that is used to cut the tissue of the prey into small pieces. An octopus can only consume its prey in small pieces since its esophagus passes through the middle of its brain. Ingesting large pieces of prey could cause brain damage! ➤

They are without question the most intelligent invertebrate. In terms of the size of their brain to their body, they should approximate the intelligence of birds and are certainly more intelligent than most, if not all, of the intertidal vertebrates.



The small octopuses at FMR are normally deep red in color. While this color makes them quite visible in the day, red appears black in the dim light of dusk, night and dawn—the times that octopuses are most active.

Octopuses change color by expanding or contracting special cells in their skin called chromatophores. Nerves in the brain directly control the chromatophores, enabling essentially instantaneous color change. Octopuses change color to camouflage themselves and hide from predators or prey, to communicate with other octopuses or to express mood changes.

In addition to chromatophores, their skin has other structures, called iridophores and leucophores, which are used to selectively reflect a variety of colors, including metallic colors, from their skin. Together with the chromatophores, these structures give octopuses an extensive palette from which to change the color of and patterns on their skin. To further help with camouflage, the octopus can also change the texture of its skin by raising papillae.

Red octopuses also come armed with an ink sac. Ink is squirted from the sac into the water to form a cloud of ink that serves as a screen or distraction to predators. The ink is composed of highly concentrated melanin, the same pigment responsible for skin color and dark hair in humans. The ink also contains the chemical tyrosinase, which may irritate a predator's eyes and temporarily paralyze its sense of smell.

Octopuses are semelparous, meaning they reproduce once in a lifetime and die shortly after reproducing. This makes their lifespan short by human standards—usually a few years at most. Males typically die within a few months of mating, although they may mate again during that period. During the period following mating the males may show abnormal behavior such as cessation of eating, aimless wandering and not taking shelter from predators.

Females “bulk up” after mating and find a suitable den in which to lay eggs. Eggs are typically hung from the ceiling of the maternal den. The female usually blocks the entrance to the

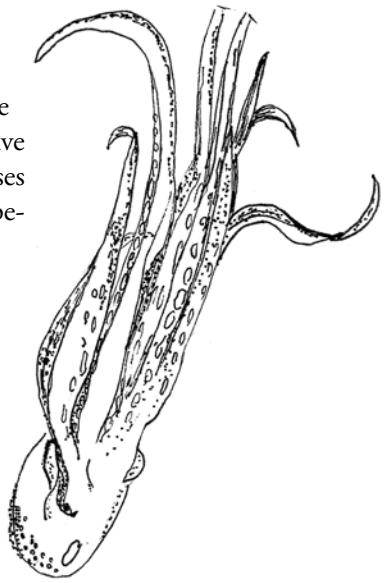
den with rocks to protect the eggs from predators. She stays with the eggs, brooding them for six to eight weeks until they hatch. While brooding she does not eat. Since octopuses have no fat, she lives off protein metabolism and loses up to half her weight during the brooding period. She dies shortly after the eggs hatch.

The day after I saw the octopus catch the hermit crab, I led a group of third graders on a tour of the reserve. When we stopped at Cypress Point I told them about seeing the octopus the day before. We approached the pool in which I had seen the octopus with great expectation! As the group huddled around the pool the octopus emerged from under its ledge.

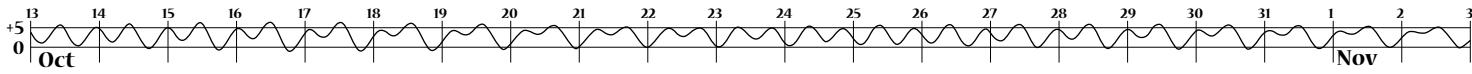
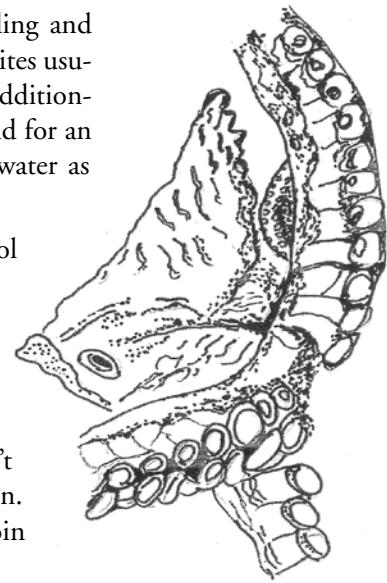
Despite a great deal of screaming—I now have to believe octopuses cannot hear—the octopus put on a wonderful show of swimming and crawling around the pool. It was simply an unforgettable tidepool moment for the kids and me.

Naturally the kids wanted to touch and handle the octopus. I cautioned them that this would be unsafe for both the octopus and us. Touching the octopus would remove a protective mucus from its skin, thus exposing it to infection. Handling it might result in the octopus giving the handler a venomous bite with its beak. While such a bite is not likely to be lethal, it could be quite serious. Bites usually involve severe pain, swelling and paralysis at the bite site. Also, octopus bites usually do not heal well and often require additional medical treatment. Immediate first aid for an octopus bite is to bathe the site with water as hot as the victim can withstand.

I have returned to the pool beneath Cypress Point often since seeing the octopus with the third graders. Except for what might have been a fleeting glance of it later that week, I have not seen the secretive, nocturnal master of camouflage again. But I haven't given up hope. I just have to see it again. I'm hooked! Guess it's time to join Cephalopodics Anonymous. ♦



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A 400-pound mass of plastic and other human-made debris was recovered from the sperm whale's stomach during necropsy. The wad of trash measured six feet by nine feet.
Photo by Kearny Sorenson, courtesy of Farallones Marine Sanctuary Association (www.farallones.org)

California Coastal Water Research Project have found that the average mass of plastics in the seawater off the coast of Long Beach is two and a half times greater than the average mass of plankton. After storms with excessive runoff, the mass of plastics is even greater. A similar study over seawater 1,000 miles west of San Francisco found the mass of plastics was six times that of plankton.

Operation Clean Sweep

The plastics industry attempted to address the release of preproduction plastics into the marine environment by developing a voluntary program called Operation Clean Sweep. This program, developed by the Society of Plastics Industry and the American Plastics Council, developed Best Management Practices (BMPs) to reduce discharges of preproduction plastic through proper handling and cleanup.

Where implemented, Operation Clean Sweep has been shown to reduce the release of preproduction plastic. However, because the program is voluntary and many plastic manufacturers and processors have chosen not to implement its recommendations, AB 258 will put

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in place uniform requirements that will better prevent preproduction plastics from entering the marine environment.

This bill:

1. Defines "preproduction plastic" as plastic resin pellets and powdered coloring for plastics.
2. Requires the State Water Resources Control Board (SWRCB) and Regional Water Quality Control Boards (RWQCBs) by January 1, 2009, to implement a program for the control of discharges of preproduction plastics from point and nonpoint sources, including waste discharge, monitoring, and reporting requirements that, at a minimum, target plastic manufacturing, handling, and transportation facilities, and the implementation of specified minimum best management practices for the control of discharges of preproduction plastic.
3. Requires the SWRCB to determine the appropriate regulatory methods to address the discharges from point and nonpoint sources.
4. Requires the SWRCB, in developing the program, to consult with any RWQCB, with plastic manufacturing, handling, and transportation facilities located within the RWQCB's jurisdiction, which has already voluntarily implemented a program to control discharges of preproduction plastic.

For more information about marine debris and what is being done to eliminate it, see: www.plasticdebris.org/CA_Action_Plan_2006.pdf ♦

Friends of Fitzgerald Marine Reserve

Membership Secretary, P.O. Box 669, Moss Beach, CA 94038

Contribution Levels:

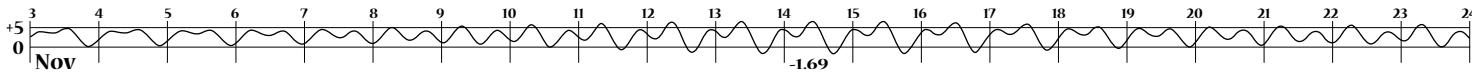
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 \$50 \$500 Other _____

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Meet Jenna Kinghorn

by Kelly Huber

Growing up in Connecticut, Jenna Kinghorn fell in love with the ocean during summer vacations spent on the coast of Maine. "When I was about ten my parents and I read *A Seal Called Andre* and then stopped on our way up the coast to see Andre, a harbor seal who was the honorary 'harbormaster' in Rockport, Maine."

Jenna's parents divorced when she was thirteen and she and her mother moved to landlocked Wisconsin, much to Jenna's chagrin. Jenna graduated from high school in Wisconsin and went to Hartford College for Women in Connecticut. She received her B.A. from Beloit College in Beloit, Wisconsin in the self-designed major of Science Writing.

After graduation, Jenna came to Mendocino to visit her aunt. "As soon as I reached the Pacific I saw the spouts of gray whales and got so excited I had to pull the car over." The visit became a permanent relocation when Jenna landed a job as a park aide at the Ford House Museum, where she worked for about a year.

A job as a technical writer brought Jenna to the Bay Area and ultimately Moss Beach in 1990. Soon after moving here, her corporate job was slashed. Jenna spent her mornings job-hunting; then she rewarded herself with time in the tidepools. As Jenna's interest in the intertidal habitat grew, she read, learned scuba, and took marine biology classes. When the FFMR naturalist class was offered on Saturdays, she jumped at the opportunity to take it.

Jenna's interest in natural history has taken her around the world, from Baja and Cozumel, Mexico to Papua, New Guinea. She has had astounding adventures in the natural world, including petting gray whale calves, having orcas dive beneath her inflatable dinghy, listening to wolves howl in Yellowstone in winter, and getting a little too close to a mother grizzly teaching her two cubs how to fish.

Her most recent trip involved diving in Maui, where she heard humpback whales singing in the background as she encountered a 16-foot manta ray, played hide-and-seek with an octopus, and swam with sea turtles and sharks. You can read more about her travels and her mystery reading habits in her new blog, *Wish You Were Here*, at <http://jennakinghorn.blogspot.com/>

In addition to being a board member for the Friends of Fitzgerald, helping Ranger Sarah Lenz with Junior Rangers Camp, and writing the *Between the Tides* newsletter on a quarterly basis, Jenna lives a full life. She is writing a mystery novel inspired by her travels. In 2005 she married Morgan Conrad and moved to Montara

with him. They share a household with Boomer, their cherished 2-year-old Irish Water Spaniel, and two cats: Mr. Tigger and Princess Tigger. Jenna fills her time with photography, reading, writing, traveling and agility training with her dog. ♦



Jenna and Boomer

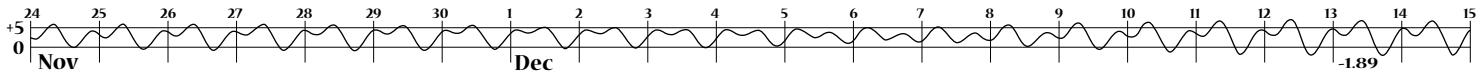
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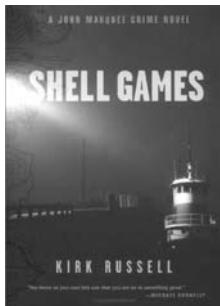
As soon as I reached the Pacific I saw the spouts of gray whales and got so excited I had to pull the car over.



From Jenna's Maui blog

...we drifted, watching the 40-something foot long beast roll back and forth on the calm surface of the ocean, repeatedly flinging one 15-foot-long front flipper skyward and then bringing it down on the water with a resounding smack. White water fountained up around the graceful pectoral fin each time it plunged into the sea, and cascaded off it again as the pec rose for another slap...Researchers suspect the slapping is a form of communication between humpbacks—the sound carries for quite a distance both above and below water—but what it really means is for the whales to know and us to wonder.





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Shell Games: A John Marquez Crime Novel

by Kirk Russell; Chronicle Books; 2003; 347 pages; \$12.95 (paperback)

Reviewed by Jenna Kinghorn

Shell Games is a well-told mystery with numerous plot twists and turns. Protagonist John Marquez is a California Department of Fish and Game (DFG) warden, one of the unsung heroes in society's struggle to save what's left of our natural resources. Working undercover, he and his team of DFG agents are hot on the trail of large-scale abalone poachers who are threatening the survival of the species. "A century ago, abalone had been so plentiful along the California shoreline that all you had to do was wade in a foot or two and pick them up. Shellmounds attested to how plentiful they'd once been...Diving came after the easy stuff was gone and we're down to the end game for a species that has survived for a million years."

The book begins with the discovery of a pile of hundreds of empty abalone shells and two abalone divers tortured to death in a state park. Marquez believes he recognizes the handiwork of a criminal mastermind he crossed swords with when he worked undercover in the Drug Enforcement Agency (DEA).

He and his agents stake out harbors, dive sites, and houses up and down the northern California coast from Pillar Point Harbor in Half Moon Bay to Mendocino, Fort Bragg and Eureka.

Time and again the team comes within striking distance of the bad guys, only to have their bust thwarted by a turncoat informant, an unexpected maneuver by the poachers or, the most frustrating and frequently encountered hurdle, jurisdictional problems. And Marquez and his team aren't just up against the evildoers; in this post-

9/11 world, they must also deal with their wardens and patrol boats being diverted to operations for Homeland Security.

Marquez is a believable protagonist, physically and mentally strong and devoted to his work. Although everyone around him thinks he's gone off the deep end when he jumps to the conclusion that his quarry is a shadowy figure from his own dark days in the DEA, he trusts his instincts. He is emotionally grounded in the world with strong feelings for his estranged wife and stepdaughter, affection for his agents, and concern even for the informants who may be betraying him—feelings that raise the stakes as the action unfolds.

The story isn't flawless. There are so many minor characters that I had a hard time keeping track of some of the agents on Marquez's team and his informants. And I thought the foreshadowing of the book's climax was a little heavy-handed.

But Marquez and those characters close to him are people I enjoyed spending time with, and I loved the glimpses of how a DFG agent works. "Tell most people that white abalone was the first ocean species humankind could genuinely claim bragging rights to extinguishing and they'd shrug. Big deal, extinctions happened. Talk about managing resources and they'd agree with you, as long as it didn't cut into their lifestyle too much...Not much glamour in an abalone and there never would be."

Russell's descriptions of the various places where the action unfolds had me feeling the fog on my face and hearing the surf in the background. I'm looking forward to reading the rest of the John Marquez series. ♦



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