

Tideline



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Antioch Dunes / Don Edwards / Ellicott Slough / Farallon Island / Marin Islands / Salinas River / San Pablo Bay

Three-spined Stickleback—the Little Fish that Can

By *Jim Ervin*

This summer, as you take a hike along the San Francisco Bay marshes, peer into the water's edge. You might notice tiny, dark-looking fish darting about just below the surface. This tiny fish would be the native three-spined stickleback (*Gasterosteus aculeatus*).

Sticklebacks are native to San Francisco Bay and nearly all estuaries in the northern hemisphere below the arctic. Sticklebacks are a very successful family of fish. Of the five genera in the stickleback family, the three-spined stickleback is the most widespread and common.

Sticklebacks are not very impressive from a distance. They can grow up to three inches in length, but most adults are closer to one inch. Despite the small size, sticklebacks are a very attractive fish once you get to know them. Their saucer-like eyes are large for their size. Their dark gray backs turn olive green as summer camouflage.

In the United Kingdom they are commonly called *tiddlers* or *spricks*. They are easy to catch with a dip net. Generations of English and Scottish children learned their first lessons in ecology and fish biology by netting these tiddlers in local streams. The Swedish government even named a warship *Spiggen*, which is the Swedish name for this feisty little fish that defends its territory against much larger opponents.

Three-spined sticklebacks are widely known and much admired, in large part, because they are so hardy. They easily survive and thrive in a well-tended aquarium. Their natural range extends along the sea coasts of North America, Europe and northeast Asia including Japan.

More importantly, this fish readily swims far upstream and rapidly colonizes freshwater rivers and lakes. Some authorities classify three-spined sticklebacks as anadromous, fish that swim upstream from the ocean to spawn. The familiar salmon is also classified as anadromous. However,

Sticklebacks can raise and lock the spines in place when threatened. Though the spines are too small to harm humans, they are difficult and painful for large fish and bird predators that hunt in the marshes.

Ocean-going and brackish water



Four sticklebacks from San Francisco Bay in 2016: two females at front and top have bellies full of eggs. Photo: James Hobbs

sticklebacks are flexible in this regard; some populations spend their entire lives in sea water while others live in freshwater lakes cut off from the ocean for millennia.

Spines and Armor

Part of stickleback success is due to the spines for which they are named. There are actually more than three spines on a three-spined stickleback. In addition to three spines on the back, these fish have two large pelvic spines near the stomach and a rear spine near the anal fin.

sticklebacks also have a secondary defense system: 30 to 40 armor plates along their sides in lieu of scales. The spikes and armor plates make this little fish literally tough to swallow.

Aquatic Surface Respiration

Another secret to stickleback success is their ability to survive in still and stagnant water when dissolved oxygen concentrations drop. Like many species of small fish, stick-

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lebacks can respire using only the top one or two millimeters under the waters' surface. Oxygen concentrations are higher at this very uppermost level so their ability to draw oxygen here is critical for fish that dwell in tidepools, marshes, and slow-moving creeks. Larger fish, particularly fast moving predators like striped bass, are less able to draw from this tiny surface layer.

But, aquatic surface respiration also has its downside. A tiny fish breathing at the surface is highly visible to bird predators—hence the spines and armor. Aquatic surface respiration is one reason you may see sticklebacks wriggling at the surface on an August or September early morning.



A San Francisco Bay three-spined stickleback showing his spines. Photo: James Hobbs

Nest Building and Parental Care

The intimate life of a stickleback is complex and easily viewed in an aquarium. A number of YouTube videos depict their social life.

The stickleback is a schooling fish until mating season in late spring through early summer. As mating season commences, males leave the schools to pick a territory for nest building. His throat and belly turns cherry-red as he clears a bottom depression and grabs plant and algal material to build his bubble nest. He glues the nest using a mucous-like material excreted from his kidneys.

When the nest is finished, the male performs a zigzag mating dance to attract

egg-laden females. He easily recognizes females with eggs from their bloated bellies. Only females full of eggs attract his attention. The male will not dance for a skinny female. His goal is to construct a nest so enticing that the female will deposit her 40 to 300 eggs in the nest. If he succeeds, he quickly follows and fertilizes the eggs.

After a successful spawn, the male ignores the female and she leaves. The male defends the nest and fans the eggs until they hatch.

A Meso-predator in a Very Competitive Environment

Estuarine environments are very productive (full of food), but also intensely competitive. Survival depends on out-

growing, out-breeding, out-running, or out-consuming predators and competing species. Sticklebacks succeed by investing in a little of each strategy. They don't get very big, so they are always vulnerable to large fish and birds. However, they do breed readily, and as tiny omnivorous fish, they make use of almost any available zooplankton or algal food.

Sticklebacks are particularly prone to eating the eggs of some of their fish competitors and predators, called intraguild predation. This refers to one species, like the stickleback, preying on one of its competitors at a certain point of the competitor's life-cycle.

A number of studies in the Baltic Sea since the early 2000s have shown that stickleback consumption of fish eggs has

significant impact on populations of herring, perch, and pike. On the other hand, adult perch and pike eat large numbers of sticklebacks if they are lucky enough to survive to adulthood. Thus, tiny three-spined sticklebacks have been found to be an interesting fulcrum point in estuarine food-webs with planktonic food and larger fish competitors balanced around growing or shrinking stickleback populations.

A Shape-shifting Pioneer of the Fish World

This charismatic little fish has one more survival trick. It is a trick that has been highly studied since the advent of advanced gene sequencing over the last 20 years. Researchers have long been intrigued to find isolated populations of three-spined sticklebacks in freshwater lakes in Alaska, Japan, Scandinavia, Scotland, and Southern California, to name a few locations. In almost all cases, sticklebacks in freshwater lakes lose the pelvic spines and most of the body armor. This is a genetic change that was documented to occur in as little as 20 years in Loberg Lake in Alaska.

Michael Bell, of Bell Lab, and other researchers posit that large predators in and near the ocean favor the survival of spiky armored sticklebacks. But, large-mouthed predators are less common in freshwater lakes and streams. The most common predators in freshwater is dragonfly nymphs and other arthropods that can grab spines and armor.

It was further found that sticklebacks with fewer spines and armor also grow faster, thus quickly outgrowing their vulnerability to these freshwater predators. Other studies of California freshwater sticklebacks found that some of these isolated populations no longer interbreed with their ancestral stock after only a few decades.

In other words, scientists can observe evolution of a new species within a human lifespan! Stanford researchers went so far as to sequence the genomes of 21 sticklebacks to find the exact gene expressions that allow these changes with results published in *Nature* in 2012.

This is the ultimate secret to stickleback success: diversity and adaptability at the genetic level. Spines, armor, and aquatic surface respiration are all good enough to earn this little fish a niche in a competitive estuary or sea coast. But, the real success



Three-spined sticklebacks caught in Lower Coyote Creek in February 2018. Photo: Jim Ervin

lies in stickleback ability to rapidly adapt and colonize entirely new habitats like freshwater rivers and lakes.

Jim Ervin recently retired after 26 years with the San Jose-Santa Clara Regional Wastewater Facility (SJ-SC RWF) where he worked in the environmental laboratory, as an environmental inspector, a supervisor of the City of San Jose Stormwater Program, and most recently as Compliance Manager for the SJ-SC RWF

References:

Bystrom, Par et al. 2015. *Declining coastal piscivore populations in the Baltic Sea: Where and when do sticklebacks matter?* Published online 2015 May 28. doi: 10.1007/s13280-015-0665-5

Shen, Helen. 2012. *Stickleback genomes reveal path of evolution.* *Nature, International Weekly Journal of Science.* 4



Stickleback male red chin mating color. A male stickleback showing red chin color. Photo: Jim Ervin

April 2012. <https://www.nature.com/news/stickleback-genomes-reveal-path-of-evolution-1.10392>

Our Conservation Legacy

We have fallen heirs to the most glorious heritage a people ever received, and each one must do his part if we wish to show that the nation is worthy of its good fortune. - Theodore Roosevelt

The National Wildlife Refuge System traces its origins back to 1903 when President Theodore Roosevelt designated the first federal wildlife reserve at Pelican Island, Florida for the protection of wildlife. Roosevelt designated dozens of wildlife refuges during his administration, and since then, subsequent administrations, congressmen, conservation organizations, and the public have worked tirelessly to ensure that special places are protected and managed for fish, wildlife, plants and their habitats. Now the largest network of lands and waters set aside for conservation, the Refuge System has grown to include more than 560 refuges in addition to wetland management districts and other protected areas encompassing 150 million acres from the Caribbean to the Arctic.

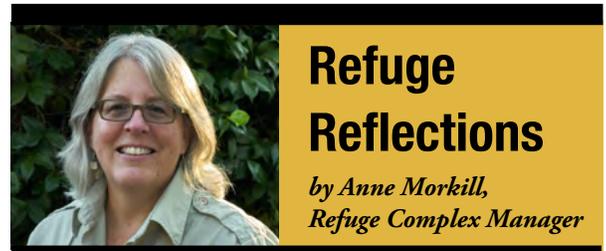
Here at the San Francisco Bay National Wildlife Refuge Complex, our staff of managers, biologists, education and interpretive specialists, administrative professionals, maintenance workers, and federal wildlife

officers, along with hundreds of volunteers and dozens of partners, are committed each day to ensure that Roosevelt's conservation legacy continues for present and future generations. As I've highlighted in previous issues of *Tidelines*, we have been focusing our efforts on a range of priorities across a diverse group of ecosystems represented by each of our seven unique refuges in the San Francisco and Monterey Bay areas.

We have made progress this year towards addressing critical threats and implementing key strategies for our priority conservation targets. Our work continues in both San Pablo Bay and South San Francisco Bay to restore diked baylands and former commercial salt ponds to tidal marsh through the import of clean dredge material and breaching levees to accelerate tidal marsh development. We are collaborating with partners in the Monterey Bay area to protect coastal dune habitats and engage experts in helping us design robust survey protocols to monitor Santa Cruz long-toed salamanders in the Pajaro Valley watershed. All of the refuges are busy monitoring key indicator species such as

the California Ridgway's rail, vernal pool grasslands, and breeding seabirds, as well as tackling the ongoing challenges of invasive plants and nuisance predators that affect many of our listed species.

We are also enhancing the public's opportunity to enjoy the refuges, such as improved access and new bridge at the Marshlands Road entrance to the Don



Edwards San Francisco Bay Refuge in Fremont, a proposed expansion of waterfowl hunting on San Pablo Bay Refuge, and starting soon will be construction of a new trail with interpretive signage at the Don Edwards' Ravenswood Unit in Menlo Park. These are just a handful of examples of the work our dedicated staff does each and every day. Thanks to Roosevelt's legacy, we are honored to be the "heirs to a glorious heritage" - our National Wildlife Refuges.



DON EDWARDS SAN FRANCISCO BAY NATIONAL WILDLIFE REFUGE
ENVIRONMENTAL EDUCATION CENTER

Free Marsh-In Summer Day Camp

Sponsored by:
San Francisco Bay Wildlife Society!
The non-profit Friends Group to the SFB
Refuge Complex.

**Live Animals,
Outdoor Activities,
Hikes & Crafts!**

July 30—August 3, 2018

Grades 1-6: Mon—Wed

9:15 am—1:30 pm

Overnight (Grades 4-6)

Thursday 6:00 pm—Friday 9:30 am

Monday - Bird Day!

Tuesday - Fish Day!

Wednesday - Mammal Day!

Overnight

Night hike, sleeping under the
stars, and ice cream making

Location:

1751 Grand Blvd, Alviso, CA 95002

Requirements:

Campers must be entering grades 1-6 in Fall 2018, provide their own transportation to and from camp, and attend ALL days of camp.

To Apply:

Download the application at:

http://www.fws.gov/refuge/don_edwards_san_francisco_bay

Applications due by June 15

Selections will be made by lottery — Applicants will be notified of their status by mail or email after June 19.



SFBWS.com

Questions? (408) 262-5513 ext. 100 Genie_Moore@fws.gov

Preguntas? (510) 792-0222 ext. 125 Jared_Underwood@fws.gov

San Francisco Bay Wildlife Society Quarterly Message

Changes Coming to Weekend

Support and Society Programs: In 1992, the Society with the U.S. Fish & Wildlife Service worked with two partners to build and deliver two programs: Living Wetlands (formerly known as Slow the Flow) and Watershed Watchers. For 20 years, Living Wetlands and Watershed Watchers educated hundreds of thousands of students and adults about watershed health, wetlands, and habitat preservation through personal and hands-on programming.

The good news is that Watershed Watchers was renewed for this coming year (July to June). Thus, this program funded by the Urban Runoff Pollution Prevention Program will continue working to prevent runoff pollution, increase the surrounding

communities' knowledge of such pollution, and reduce its harmful effects through personal behavior.

The not so good news is that the City of San Jose declined to renew the Living Wetlands program contract. Our long-term partnership was a fruitful one and will be missed. Recent changes to priorities, grant program requirements, and outreach strategies at the City of San Jose and the Regional Wastewater Facility have resulted in the city's decision to end the program. Read more here: <http://sfbws.com/blog/2018/03/21/farewell-living-wetlands>.

We are pursuing other grants to build a similar but different program. This loss will likely have other impacts that are not yet fully defined.

Efforts to Grow Resources for Refuge

Complex Support: San Francisco Bay Wildlife Society employees, several U.S. Fish & Wildlife Service staff members, and most of the Society's Board of Directors spent two days in January working with mentors from another Friends group and a retired U.S. Fish & Wildlife Service Refuge Manager. We learned a lot; we shared ideas and challenges. Over the next year we will be working to implement the ideas generated.

In mid-June, the wildlife refuges in the Pacific and Pacific Southwest Regions (essentially the West Coast, Idaho, Alaska, and Hawaii) and their Friends groups will be holding a conference. I will share the results of the conference in the fall issue of *Tideline*. Based on prior experiences, there will be productive discussions with other groups that face similar and unique challenges. The Society and all the other Friends groups are volunteers and give their time in support of their refuges.

Volunteer Opportunities: Volunteers are vital to nature store operations at Fremont and Alviso, as well as various committees that help the Society function and grow. Reach out to Mary Deschene at Mary.Deschene@SFBWS.com or 510-792-0222 ext. 364 for more information or dates! We also need people as docents for new programs and many other areas.

On the Trail: I had the opportunity to participate in a focus group organized by the state of California's Coastal Conservancy to discuss how we can improve access to public lands for individuals who might need extra support such as facilities and trails that meet American with Disabilities Act standards, commonly known as ADA. One challenge is effectively communicating information about what already exists. This website, <http://www.wheelingcalcoast.org>, is filled with helpful information for those who have mobility challenges and want to access the California coast including our Bay Area lands.

As always, check out <http://www.sfbws.com>. I also strongly recommend a visit to the National Wildlife Refuge Association site <http://refugeassociation.org> to understand the challenges facing our refuges today.

Cecilia (Ceal) D. Craig, PhD
President, SFBWS Board of Directors



Photo: Gregg Aronson

Connections to Pier Fishing

Learn how to fish for free at the

Dumbarton Fishing Pier in Fremont!

Saturday, June 9

9:00 a.m. -noon

Space is limited to 50 people. All equipment will be provided.

No fishing license needed. Please come on time.

To register, go to <http://donedwardsfishing.eventbrite.com>

or call 510-792-0222 ext. 476.

For more information, see page 7

The U.S. Fish & Wildlife Service is committed to providing access to this event for all participants. Please direct all requests for sign language interpreting services, close captioning, or other accommodation needs [name, phone, e-mail], to TTY 1-800-877-8339 with your request by June 1, 2018.

Thank you San Francisco Bay Wildlife Society Donors!

We gratefully acknowledge the following donors who have made gifts to the San Francisco Bay Wildlife Society between January 1 and March 31, 2018. These gifts will be used for publishing *Tideline*, environmental education, habitat restoration, and interpretive programs at the Don Edwards San Francisco Bay National Wildlife Refuge.

Sponsor

Valerie Boquet

Participant

John F Atwood, Mary & Gene Bobik, Richard Booth, Terry & Zeo Coddington, Tim & Cecilia Craig, Norman & Marcia Houseworth, Mark Jackson, Locke C Jorgensen, Gloria Laird, Laura E Mello, Aaron Royston, Varon Smith, Mark A & Kathleen Soulard

Supporter

Karen L Scriven, Tanis Walters

Family

Scott & Rachel Birkey, Alvin Dockter, Cathie Guernsey, Blanca L Haendler, Laura Jamieson, James Kellenberger, Bruce Kelly, Robert W Kirby, Jr, Jean Takekawa, Phillip Vallejo

Individual

Lynne Fitzjarrel, Donna H Olsen, Jennifer Vinzant, Stephen P Walker, Stephen Wilkerson, Rose Mary Wright

Senior/Student

Linda Beidleman, Mark Casaretto, Diane L Ciucci, Thomas Federico, Roman Kendzior, Bernice Lowney, Paula Mortensen, Ruth E Mundy, Lawrence Rosenblum

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Blossom Hill School – Environmental Education Fund
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Help Us Protect Your San Francisco Bay Wetlands!

Mail your membership donation to: San Francisco Bay Wildlife Society, P.O. Box 234, Newark, CA 94560. You may also become a member at www.sfbws.com/donate.

For a gift membership, call 510-792-0222 ext. 364.

San Francisco Bay Wildlife Society is a not-for-profit 501(c)(3) organization that raises money and awareness for the San Francisco Bay National Wildlife Refuge Complex.

YES! I want to support San Francisco Bay Wildlife Society and its programs.

Enclosed is my donation of:

- | | |
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| <input type="checkbox"/> \$35 Individual | <input type="checkbox"/> \$250 Sponsor |
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Check enclosed

For credit card payment, please use PayPal at www.sfbws.com/donate

Name _____

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Thank you for your support!

The San Francisco Bay Wildlife Society has:

- Introduced tens of thousands of students of all ages to the Don Edwards San Francisco Bay National Wildlife Refuge
- Provided weekend staffing at Visitor Centers
- Provided funding for restoration projects, a new boardwalk, trails, a greenhouse and native plant nursery

And much more ...

Become a Supporting Member of the Society. Benefits include:

- Free subscription to *Tideline* newsletter
- Tax deduction to the extent permitted by law
- 15% off at our nature stores
- Free book – *Exploring Our Baylands*
- The joy of helping protect this important environment

Summer Activity Schedule

Children under the age of 16 must be accompanied by an adult.

*Trails are generally level.
Surface and trail conditions vary.
Please call for accessibility information.

JUNE

Saturday, June 2

Stewardship Saturday

Visitor Center, Fremont

9:30 a.m.-noon

If you are interested in improving the refuge for visitors and for wildlife alike, join us at the Visitor Center for a stewardship project. We will do either a trash cleanup or a planting/weeding project. Dress appropriately for the task and for the weather. We will have gloves to lend and will provide the tools. Bring your own water bottle. Meet in the parking lot at the Visitor Center. Driving an additional 2.5 miles may be required since the project may be at a different location. For more information, or to make reservations, call 510-792-0222 ext. 361.

Tai Chi & Refuge Nature Walk

Environmental Education Center, Alviso

9:30 a.m.-11:00 a.m.



Morning Crane founder Chris Shelton is a certified Tai Chi and Qigong practitioner and instructor with 20 years of experience. Chris Shelton has helped thousands of people around the world reclaim their health and enjoy lives free from chronic pain. Join us for a short nature walk after to learn about the refuge. Sponsored by Morning Crane and San Francisco Bay Wildlife Society. No registration necessary.

*How to Hike—National Trails Day

Environmental Education Center, Alviso

10:00 a.m.-noon

Interested in hiking and enjoying nature but haven't made the effort yet to get outside? Come join us at the refuge for a fun introduction to hiking. Learn about the benefits of hiking, what you need, safety, and how to plan your next hiking adventure. This class covers the basics of hiking: gear, clothing, trip planning, food, navigation, safety, and local destinations. Families and people of all ages encouraged to join. Led by Steve Stolper, Certified California Naturalist. Reservations recommended. Go to <https://howtohike.eventbrite.com>. Questions? Call 408-262-5513 ext. 104.

Nature Walk for Health

Visitor Center, Fremont

10:30 a.m.-11:30 a.m.



Take a break from your busy schedule and refresh your spirit with nature at the refuge. Take a guided nature walk on the Tidelands Trail and hear what makes this National Wildlife Refuge unique. The 1.3-mile walk traverses through endangered species habitat and offers great views of south San Francisco Bay. Meet in front of the Visitor Center.

Here Comes the Otters!

Environmental Education Center, Alviso

2:00 p.m.-3:00 p.m.

Join us for a fun video and slide presentation. River otters are making a welcome come-back all around the San Francisco Bay. This is a good sign for our shared watershed! The River Otter Ecology Project wants to show and tell about river otters, their natural history, their importance to healthy watersheds, and how you can help make sure they continue to do well. Great for the whole family.

Saturday, June 9

Connections to Pier Fishing

Dumbarton Fishing Pier, Fremont

9:00 a.m.-noon

Have you ever wanted to try fishing but didn't know how to begin? Learn the fundamental basics of catch-and-release fishing at the Dumbarton fishing pier! Discover the types of wildlife living in the San Francisco Bay, learn the safety and ethics of fishing, and then try your luck out on the pier with our fishing poles. All participants receive free box with tackle. No fishing license needed. Space is limited to the first 50 people. Event is recommended for ages 5 and up. You must arrive at 9 a.m. to participate. REGISTRATION REQUIRED. Register at <http://donedwardsfishing.eventbrite.com> or call 510-792-0222 ext. 476.

Volunteer Orientation—Alviso

Environmental Education Center, Alviso

11:00 a.m.-noon

If you have an interest in wildlife and their conservation, enjoy working with people, and are enthusiastic and dependable, the refuge's volunteer program is for you! As a volunteer, you'll receive on-the-job training from staff and other volunteers in the project area you choose. Project areas are restoration projects, information desk on weekends, interpretive programs, school field trips, and citizen science/community service.

Drawbridge Van Excursion

Environmental Education Center, Alviso

1:00 p.m.-3:30 p.m.

An abandoned town in the San Francisco Bay? That's right! Nestled on an island in the salt marshes of South San Francisco Bay, the town of Drawbridge once boomed. Was it a quiet, peaceful town full of nature lovers, or people scabbling out a living? How long did it exist? Find out at this program led by Ceal Craig. We will start with a slideshow, and then take a short van excursion to view Drawbridge across Coyote Creek. Program will be of most interest to adults interested in history or nature; children 13 and

over with an adult are welcome. Space is very limited. RESERVATIONS REQUIRED. Go to <https://drawbridgesummer18.eventbrite.com>. Questions? Call Hope at 408-262-5513 ext.104. Note: we do not visit the town itself. We go to the closest spot that one can legally view Drawbridge.

*Twilight Marsh Walk

Visitor Center, Fremont

7:30 p.m.-9:15 p.m.

Cap off the day by experiencing the salt marsh at twilight on an easy stroll along Tidelands (1.3 miles) Trail. At the setting of the sun we will observe the beginning of nature's night shift. Come discover the sights, sounds, and smells of the refuge as night descends. Not suitable for young children. Go to <https://donedwardstwilight.eventbrite.com> or call 510-792-0222 ext. 363. Led by Mary and Gene Bobik.

Saturday, June 16

*Marshlands of Dreams

Visitor Center, Fremont

9:30 a.m.-10:30 a.m.

Join Paul Mueller on a 1-mile walk of the LaRiviere Marsh Trail to find traces of the past. Prior to marsh restoration, learn how Californians utilized the area for farming, quarrying, salt production, and transportation.

Restoration Work Day

Environmental Education Center, Alviso

10:00 a.m.-noon

Interested in volunteering at the refuge? Come out for a Restoration Work Day! We will be working in the butterfly garden and surrounding trails. Work will include weeding, mulching, and planting native plants. This is a great opportunity for middle school, high school, and college students to gain volunteer hours. Great for scout groups and families as well. All ages and skill levels are welcome to join. Gloves and tools are provided. Bring a lunch to enjoy after. Reservations required. Bring <https://restorationeec.eventbrite.com>. Questions? Call Hope at 408-262-5513 ext.104.

Volunteer Orientation—Fremont

Visitor Center, Fremont

1:00 p.m.-2:00 p.m.

Increase your quality of life with a resolution to volunteer for a good cause. Come to this presentation to see if volunteering at the Don Edwards San Francisco Bay National Wildlife Refuge is right for you. Begin by learning the mission and goals of the San Francisco Bay National Wildlife Refuge Complex, its parent agency U.S. Fish and Wildlife Service, and volunteer positions currently open at the Fremont location. Presented by Paul Mueller.

Saturday, June 23

*Family Bird Walk

Visitor Center, Fremont

10:00 a.m.-noon

Let family walks become a shared time of nature learning. We'll begin by helping kids cre-

continued next page

Summer Activity Schedule

Children under the age of 16 must be accompanied by an adult.

*Trails are generally level.
Surface and trail conditions vary.
Please call for accessibility information.

ate their personal bird watching field guides, and then head out onto the trails to find those birds. A limited number of binoculars are available to borrow. Recommended for children ages 5-10. RESERVATIONS REQUIRED. Go to <https://donedwardsfamilybird.eventbrite.com> or call 510-792-0222 ext. 363.

Bay Bike Ride Meet at the Visitor Center, Fremont 10:00 a.m.

Go on an 11-mile bike ride with docent Gregg Aronson along Marshlands Road and on the Shoreline Trail to observe birds and the occasional leopard shark! Pass through several habitat types along the way including salt marsh, salt pond, and the bay. The paved and dirt trails are almost flat and trail and hybrid bicycles highly recommended. Helmets are required. Recommended for more experienced bicyclists. Program cancels if it rains the day before and the day of the program due to mud. Register at <https://donedwardsbike.eventbrite.com> or call 510-792-0222 ext. 363.

Saturday, June 30

Mindful Meditation and Hike Visitor Center, Fremont 8:30 a.m.-9:30 a.m.

 Start your day with an easy 0.75 mile walk soaking in the natural beauty of the wildlife refuge followed by 10-15 minutes of guided, seated meditation. By the end of the hour, you'll feel refreshed and ready to start your weekend. If you would like to sit on a cushion, please bring it. I will have a limited number of yoga blocks to sit on. Led by Carmen Minch.

*Plants for Beginners Environmental Education Center, Alviso 10:00 a.m. - 11:30 a.m.

They're in cracks in the sidewalk and they make up entire forests-plants are everywhere! Did you know that you can learn a lot about plants with some basic knowledge? We'll take a walk around the upland garden at a botanist's pace (sloowly) using the native plants to learn easy-to-remember plant terminology. Wear weather appropriate clothing for being outdoors, bring a water bottle, and a small sketchbook if drawing helps you remember. Be prepared to develop the vocabulary

you need to be plant literate. Good for all ages, adults encouraged! Reservations recommended. Go to: <https://plantsec.eventbrite.com>. Questions? Call 408-262-5513 ext. 104.

JULY

Saturday, July 7

*Marshlands of Dreams Visitor Center, Fremont 8:30 a.m.-9:30 a.m.

See June 16 for program description.

Tai Chi & Refuge Nature Walk Environmental Education Center, Alviso 9:30 a.m.-11:00 a.m.



Sponsored by Morning Crane and San Francisco Bay Wildlife Society. See June 2 for program description.

*Nature Walk for Health Visitor Center, Fremont 10:30 a.m.-11:30 a.m.



See June 2 for program description.

Volunteer Orientation—Alviso Environmental Education Center, Alviso 11:00 a.m.-noon

See June 9 for program description.

*Bird Watching for Beginners Visitor Center, Fremont 3:30 p.m.-5:00 p.m.

In this beginner's program, we will go over the use of binoculars, how to use a bird guide, and identify the birds we see on the trail. Recommended for ages 10 and up. Dress for the weather and wear comfortable shoes. Led by Carmen Minch.

Saturday, July 14

Stewardship Saturday Visitor Center, Fremont 9:30 a.m.-noon

See June 2 for program description and registration information.

Drawbridge Van Excursion Environmental Education Center, Alviso 9:30 a.m.-noon

See June 9 for program description. Register at <https://drawbridgesummer18.eventbrite.com>.

*Restoring Inner Bair Island Walking Tour Inner Bair Island, Redwood City 10:00 a.m.-11:00 a.m.

On this 1.5-mile walk, witness wetland restoration in progress. Hear the story of Bair Island and see how we are turning the former salt pond back into a healthy tidal marsh. Directions: Take Highway 101 and exit at Whipple Ave. in Redwood City. Head west toward the bay. The road winds 0.5 mile becoming East Bayshore, then Bair Island Road. The Don Edwards National

Wildlife Refuge Bair Island parking lot is on the right. Meet by the restrooms. RESERVATIONS RECOMMENDED. Go to <http://innerbairtour.eventbrite.com>.

Insect Exploration Environmental Education Center, Alviso 10:30 a.m.-noon

Insects have been on this Earth for hundreds of millions of years. Come learn about the many different insects that call the San Francisco Bay Area home. We will examine insects and learn how they've adapted to survive. Join us as we dig in the dirt and crawl through the plants, in search for our six-legged friends! Be prepared to get dirty. All ages are welcome. Reservations recommended. <http://eeinsect.eventbrite.com>. Questions? Call Hope at 408-262-5513 ext. 104.

*Twilight Marsh Walk Visitor Center, Fremont 7:30 p.m.-9:15 p.m.

See June 9 for program description. Register at <https://donedwardstwilight.eventbrite.com> or call 510-792-0222 ext. 363.

Sunday, July 15

Bair Island Paddle Bair Island Parking Lot, Redwood City 11:00 a.m.-1:00 p.m.

Get a different perspective of Bair Island from the sloughs as you paddle your kayak or canoe with experienced guide Vicki Martell. You must have paddling experience and bring your own kayak or canoe. Personal floatation device REQUIRED. We will first meet by the restrooms at the parking lot before heading to the marina. Program is subject to cancellation in case of inclement weather. Space is limited. Register at <https://bairislandpaddle.eventbrite.com>. Call Carmen at 510-792-0222 ext. 476 for questions.

Saturday, July 21

*Family Bird Walk Visitor Center, Fremont 10:00 a.m.-noon

See June 23 for program description. Register at <https://donedwardsfamilybird.eventbrite.com> or call 510-792-0222 ext. 363.

Nature Yoga Visitor Center, Fremont 10:00 a.m.-11:30 a.m.



Enjoy the benefits of Yoga outdoors with great views of the salt marsh. Through story and postures, learn what attracted people and wildlife to the Bay. There will be a short hike to the site on top of the hill from the Visitor Center. Bring a yoga mat. A limited number of mats are available to borrow. Wear comfortable clothing. Consult with your doctor before participating in new exercises. Recommended for ages 13 and up. All abilities welcome. Reservations are required. Register at <http://donedwardsyoga.eventbrite.com> or call 510-792-0222 ext. 476. Led by Carmen Minch.

Bay Bike Ride

Meet at the Visitor Center, Fremont

10:00 a.m.

See June 23 for program description. Register at <https://donedwardsbike.eventbrite.com> or call 510-792-0222 ext. 363.

Saturday, July 28

*Habitat Hike

Environmental Education Center, Alviso

10:00 a.m.-11:30 a.m.

Enjoy the days of summer and join volunteer Laura Adams for a habitat hike at the refuge. We will search for signs of wildlife, use binoculars to view birds, and taste pickleweed. Walk is short, less than one mile, and families are encouraged to join. Reservations recommended. Go to: <https://caminatadehabitat.eventbrite.com>. Questions? Call Hope at 408-262-5513 ext. 104.

*Caminata de Hábitat

Centro de Educación Ambiental Alviso

10:00 a.m.-11:30 a.m.

¡Disfruta de los días de verano y únete a la voluntaria Laura Adams para la caminata de hábitat en el Refugio! Buscaremos señales de vida silvestre, usaremos binoculares para ver aves y degustaremos Pickleweed. ¡La caminata es corta, menos de 1 milla, y las familias son bienvenidas a unirse a la caminata! Se recomienda hacer reservaciones. Ir a <https://caminatadehabitat.eventbrite.com>. ¿Preguntas? Jared: 510-792-0222 ext. 125.

AUGUST

Saturday, August 4



*Nature Walk for Health

Visitor Center, Fremont

10:30 a.m.-11:30 a.m.

See June 2 for program description.

Bay Bike Ride

Meet at the Visitor Center, Fremont

10:00 a.m.

See June 23 for program description. Register at <https://donedwardsbike.eventbrite.com> or call 510-792-0222 ext. 363.

*Twilight Marsh Walk

Visitor Center, Fremont

7:00 p.m.-8:45 p.m.

See June 9 for program description. Register at <https://donedwardstwillight.eventbrite.com> or call 510-792-0222 ext. 363.

Friday, August 10

Night Sky Party!

Environmental Education Center, Alviso

8:30 p.m.-10:30 p.m.

Meet the stars of summer! Join our amateur astronomers as we learn about constellations. Make a star chart and then venture outside to view the night sky through a telescope. Go for a night hike on the boardwalk to look for signs of nocturnal animals. Afterwards, warm up with

some hot chocolate. Bring your own binoculars or spotting scopes if you have them. Dress warmly as it gets cold in the evening. Fun for the whole family. Great for Scout groups. Reservations recommended. Go to <https://nightskysummer18.eventbrite.com>. Questions? Call Hope at 408-262-5513 ext.104.

Saturday, August 11

Tai Chi & Refuge Nature Walk

Environmental Education Center, Alviso

9:30 a.m.-11:00 a.m.

Sponsored by Morning Crane and San Francisco Bay Wildlife Society. See June 2 for program description.

Stewardship Saturday

Visitor Center, Fremont

9:30 a.m.-noon

See June 2 for program description and registration information.

*Family Bird Walk

Visitor Center, Fremont

10:00 a.m.-noon

See June 23 for program description. Register at <https://donedwardsfamilybird.eventbrite.com> or call 510-792-0222 ext. 363.

Volunteer Orientation—Alviso

Environmental Education Center, Alviso

11:00 a.m.-noon

See June 9 for program description.

Saturday, August 18

*Marshlands of Dreams

Visitor Center, Fremont

8:30 a.m.-9:30 a.m.

See June 16 for program description.

Nature Yoga

Visitor Center, Fremont

10:00 a.m.-11:30 a.m.

See July 21 for program description. Register at <http://donedwardsyoga.eventbrite.com> or call 510-792-0222 ext. 476.

Intro to Geo PDF Maps

Visitor Center, Fremont

10:00 a.m.-noon

What's a Geo PDF map? How do you use it? A Geo PDF map is a map that you download and store on your smart phone. Use the free app called PDFMaps to view and navigate from the stored map in your phone. Use it on hikes or bike rides to log your distance, start time, and duration, as well as perform other functions. You don't need wi-fi or a data connection once the app is installed. It uses your phone's GPS feature so it works even if you are out of range of mobile phone service. Meet at the Visitor Center to see a slideshow and find out how to obtain a copy of a Geo PDF map of the Don Edwards SF Bay National Wildlife Refuge. A live demonstration will follow. Led by docent Gregg Aronson. Register at <https://geopdf.eventbrite.com>.

Summer Activity Schedule

Children under the age of 16 must be accompanied by an adult.

*Trails are generally level.
Surface and trail conditions vary.
Please call for accessibility information.

*Why Tides Matter

Environmental Education Center, Alviso

1:00 p.m.-2:00 p.m.

Docent Laurel Stell will talk and walk you through all things tides. What are they? How do they affect wildlife? How have humans reshaped the Bay's tidal lands? Program starts indoors but will move outside for an easy 0.5-mile walk. All are welcome. Reservations recommended. Go to <https://eectides2018.eventbrite.com>. Questions? Call Hope at 408-262-5513 ext.104.

Saturday, August 25



Mindful Meditation and Hike

Visitor Center, Fremont

8:30 a.m.-9:30 a.m.

See June 30 for program description.

Drawbridge Van Excursion

Environmental Education Center, Alviso

9:30 a.m.-noon

See June 9 for program description. Register at <https://drawbridgesummer18.eventbrite.com>.

Indicators that Fox are in

Your Area

Visitor Center, Fremont

2:00 p.m.-3:30 p.m.

Do you sometimes see paw prints in mud or scat (poop) on the trails and assume that a dog left it? It could be from something else. Come along with me and I will show you how to distinguish and identify the markings of a gray fox. Gain some insights into the fox's nature and their behavior during the walk. By the time we are through, you will have a set of "tools" you can use to identify the presence of foxes in any area that you are in. Bring a hat, binoculars, and good walking shoes. Led by Bill Leikam, from Urban Wildlife Reserach Project. Register at <http://donedwardsfox.eventbrite.com>.

Field Trips to the Refuge

Wetland Round-Up Program*

Wetland Round-Up field trip programs, designed for Kinder to 4th grade students, are offered at our headquarters in Fremont and at the Environmental Education Center in Alviso.

This program actively involves teachers, adult volunteers, and students in investigating the diverse habitats and wildlife at the refuge. The hands-on, small-group activities are designed to teach basic ecological concepts and to introduce endangered species, migratory birds, and wetland habitats to the students. All programs have been correlated to the appropriate State of California Education Standards. We are piloting new and modified activities that support Next Generation Science Standards.

Educators and adult leaders conduct their own field trips after attending a field trip workshop. We provide easy to follow scripts for each station, but both leaders and chaperones are strongly encouraged to attend a field trip workshop. New teachers must attend a field trip workshop.

Wetland Round-Up at the Learning Center in Fremont

Registration information for the 2018-2019 school year will be announced on the refuge's website in August 2018. Go to <https://go.usa.gov/xQkCv>

Contact the Environmental Education Staff at Fremont:

Office: 510-792-0222 ext. 475

Cell: 510-377-7269

Email: tia_glagolev@fws.gov

Field Trips at the Environmental Education Center in Alviso

Wetland Round-Up Field Trips

Registration information for the 2018-2019 school year will be announced on the refuge's website in August 2018. Go to <https://go.usa.gov/xQkCf>

Contact the Environmental Education Staff at Alviso:

Office: 408-262-5513 ext. 100

Email: genie_moore@fws.gov

Wetland Round-Up Field Trip Workshops

The workshop dates will be announced on-line with the field trip registration information (see above).

Watershed Watchers Program in Alviso

The Watershed Watchers program is excited to announce the addition of Habitat Restoration Service Learning field trips for grades 5-12. Students have the opportunity to learn about the important habitats that surround the Bay, the wildlife that depend on them, and how they can help on the refuge and at home. Watershed Watchers is an interpretive program offered at no cost though the cooperative efforts of the Santa Clara Valley Urban Runoff Pollution Prevention Program, U.S. Fish & Wildlife Service, and the San Francisco Bay Wildlife Society.

Field trips include a habitat hike on the boardwalk and levee trails to see the five habitats at the refuge, restoration work, and upland habitat improvements in the butterfly garden and surrounding areas by removing invasives and planting native plants. A trash pickup using the Litterati app to document the types of trash found can also be included in the field trip. Field trips are limited to a maximum of 35 students with a minimum of 10. Field trips are 10:00 a.m.-1:00 p.m. and includes time for lunch.

Programs are offered September-May on Tuesdays and Thursdays at the Environmental Education Center in Alviso. Due to funding restrictions, program dates are limited and first priority will be given to

schools located within Santa Clara County.

Contact Hope Presley, Watershed Watchers Program Coordinator, at hope.presley@sfbws.com or 408-262-5513 ext. 104 to set up your field trip.

College and University Field Trips in Alviso

Staff-led Field Trips

Guided field trips by staff are two hours long and include a PowerPoint presentation followed by a habitat hike at the Environmental Education Center in Alviso. Reservations must be made at least eight weeks in advance of the desired field trip date. Please contact Hope Presley at hope.presley@sfbws.com or 408-262-5513 ext. 104.

College Instructor-led Field Trips

Instructors from local colleges can lead their own field trip excursions at the Environmental Education Center in Alviso. All instructors planning this type of excursion must make a reservation at least eight weeks in advance of the desired field trip date. If your group size is over 25, you will need to acquire a special use permit from our headquarters office in Fremont. Please contact Hope Presley at hope.presley@sfbws.com or 408-262-5513 ext. 104.

Due to funding restrictions, reservations are limited and first priority will be given to schools located within Santa Clara County.

*All of our programs are offered FREE of charge. Location of activities and trail conditions may vary. Please call for accessibility information.

Programs for Scout Groups

Programs offered for Boy and Girl Scout groups at the Environmental Education Center in Alviso and are sponsored by the Watershed Watchers Program. Please note that programs are 1.5 hours, and are offered September-May only. Programs must be scheduled 8-12 weeks in advance, and badges are not provided. Group leaders are responsible for fulfilling badge requirements. Visit https://www.fws.gov/refuge/Don_Edwards_San_Francisco_Bay/Scouts.html for additional information and to choose desired program. Contact Hope Presley at hope.presley@sfbws.com to schedule.

Due to funding restrictions, the number of programs offered is limited and first priority will be given to groups located within Santa Clara County.

Living Wetlands Program – Farewell Notice!

We regret to inform you, that after nearly 20 years of environmental education and interpretation, the Living Wetlands program will be discontinued as of June 30, 2018. Recent changes to priorities, grant program requirements, and outreach strategies at the City of San Jose and the Regional Wastewater Facility have resulted in the city's decision to end the program.

Formed through a partnership between the City Environmental Services Department on behalf of the Regional Wastewater Facility, the San Francisco Bay Wildlife Society, and the Don Edwards San Francisco Bay National Wildlife Refuge, Living Wetlands has offered Santa Clara Valley communities a unique connection to the South Bay and its habitats. The program touched the lives of many through its field trips, classroom presentations and special events. At its core, the program focused on encouraging and fostering life-long environmental stewardship. We have appreciated the many years of opportunity to provide these services.

In those 20 years approximately 144,850 people have participated in the program and outreach events. We appreciate every one of you. Thank you all for your participation and support.

For questions or comments regarding the discontinuation of the Living Wetlands Program please contact Ken Davies (Sustainability & Compliance Manager for City of San Jose's Environmental Services Department) at 408-975-2587 or at Ken.Davies@sanjoseca.gov.

Application for 2018-2019 Blue Goose Bus Fund

The San Francisco Bay Wildlife Society provides funding for the 2018-2019 school year through a generous grant from the City of San Jose and the California Coastal Conservancy's Explore the Coast program.

The program is administered by the U.S. Fish & Wildlife Service and San Francisco Bay Wildlife Society staff. The fund was created to help Title 1 schools and schools with proven hardships to access the Wetland Round-Up and Watershed Watchers field trip programs at the Don Edwards San Francisco Bay National Wildlife Refuge Environmental Education Center in Alviso and the Newark Slough Learning Center in Fremont.

Please refer to our website for more information at <https://go.usa.gov/xRVMJ>. You may also contact Genie Moore at 408-262-5513 ext. 100 or at genie_moore@fws.gov.

Volunteer Training at the Don Edwards SF Bay National Wildlife Refuge

Train to volunteer at the Fremont Visitor Center desk! Volunteers work a minimum of two shifts a month for a minimum of four months. You must be able to attend both training days to volunteer.

Training dates:

| | |
|--------------------|------------------------|
| Sunday, July 15 | 10:00 a.m. – 3:00 p.m. |
| Wednesday, July 18 | 6:00 p.m. – 8:00 p.m. |

For more information and to register, visit https://donedwards_infodesk.eventbrite.com.

Or, call 510-792-0222 ext. 361 for Paul Mueller, or ext. 476 for Carmen Minch.

Volunteers are Awesome!



The San Francisco Bay National Wildlife Refuge Complex held its annual volunteer appreciation banquet in April. Volunteers make tremendous contributions to our biology, visitor services, maintenance, and administrative programs. Congratulations to the volunteers listed below who received special recognition.

Volunteers of the Year

Mary and Gene Bobik

Friends Group Volunteer of the Year

Ceal Craig

Special Achievement Award for Special Programs

Laurel Stell
Steve Stolper

Volunteer Team of the Year

Drue Freeman
Ibrahim Khatri

TIDELINE

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To receive *Tideline*, email carmen_leong-minch@fws.gov, or write to: *Tideline*, San Francisco Bay National Wildlife Refuge Complex, 1 Marshlands Rd, Fremont, CA 94555

San Francisco Bay National Wildlife Refuge Complex

Administered by the U.S. Fish & Wildlife Service, San Francisco Bay National Wildlife Refuge Complex exists to preserve wildlife habitat, protect threatened and endangered species, protect migratory birds, and provide opportunities for nature study. Seven refuges are managed from the headquarters in Fremont: Antioch Dunes NWR, Don Edwards San Francisco Bay NWR, Ellicott Slough NWR, Farallon Islands NWR, Marin Islands NWR, Salinas River NWR, and San Pablo Bay NWR.

Tideline is On-Line Visit our web sites at

http://www.fws.gov/refuge/antioch_dunes
http://www.fws.gov/refuge/don_edwards_san_francisco_bay
http://www.fws.gov/refuge/ellicott_slough
<http://www.fws.gov/refuge/farallon>
http://www.fws.gov/refuge/marin_islands
http://www.fws.gov/refuge/salinas_river
http://www.fws.gov/refuge/san_pablo_bay



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SUMMER 2018
Volume 41, Number 2

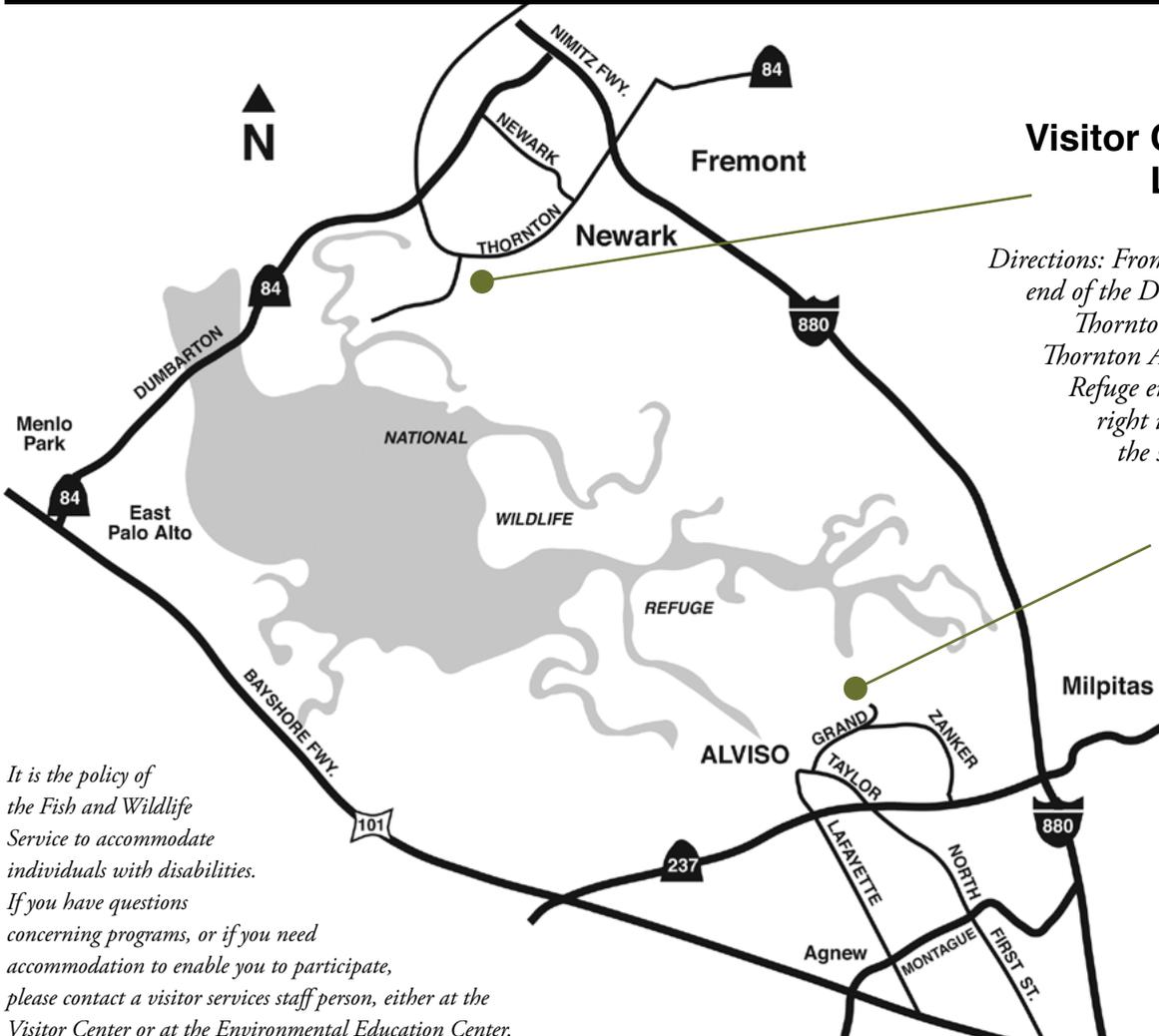
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Tideline



Don Edwards / Antioch Dunes / Ellicott Slough / Farallon Island / Marin Islands / Salinas River / San Pablo Bay



Visitor Center, Fremont Learning Center

(510) 792-0222 ext. 363
Directions: From Highway 84 (at the east end of the Dumbarton Bridge), exit at Thornton Avenue. Travel south on Thornton Avenue for 0.8 miles to the Refuge entrance on the right. Turn right into the Refuge and follow the signs to the Visitor Center.

Environmental Education Center, Alviso

(408) 262-5513
Directions: From I-880 or US-101, exit on CA-237 toward Mountain View/Alviso. Turn north onto Zanker Road. Continue on Zanker Road for 2.1 miles to the Environmental Education Center entrance road (a sharp turn at Grand Blvd.).

It is the policy of the Fish and Wildlife Service to accommodate individuals with disabilities. If you have questions concerning programs, or if you need accommodation to enable you to participate, please contact a visitor services staff person, either at the Visitor Center or at the Environmental Education Center.