Corps Programs for Pine Gulch Creek Delta and Kent Island

Incremental Approach

- Continuing Authority Program 206
  - More consistent with incremental approach – Focus on Pine Gulch Creek Delta
  - No Congressional Authorization required for construction
  - Funding is no more certain in the near term
  - Available funds from old GI study used to fund USGS study of sea level
- Estuary Habitat Restoration Program
  - Federal Assistance program supporting Kent Island, other proposals?

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Estuary Restoration Act (ERA)

- Objectives:
  - Promote the restoration of estuary habitat
  - Develop a national strategy for creating and maintaining effective estuary habitat restoration partnerships
  - Provide Federal assistance for estuary habitat restoration projects
  - Develop and enhance monitoring, data sharing, and research capabilities
- Established Interagency Estuary Habitat Restoration Council

Estuary Habitat Restoration Program (EHRP)

- Estuary Habitat Restoration Council annually solicits, evaluates, and recommends project proposals for funding
- Evaluation Criteria:
  - Ecosystem benefits
  - Scientific merit
  - Technical feasibility
  - Cost-effectiveness
  - Supports Estuary Habitat Restoration Strategy
- 5 years of post-construction monitoring and reporting

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Kent Island Restoration Project

- One of 21 projects to be selected for funding under the EHRP since the program began.
- Proposal selected for funding in January 2010
- Awarded $470,000 in ERA funding
- Project will commence once Cooperative Agreement between the US Army Corps and the Marin County Open Space District is approved (July 2011)

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Kent Island Restoration Project Goals & Objectives

Goals

1) Improve habitat for rare and special status species of plant and animals,
2) De-anchor the island to allow its natural function as a dynamic flood-shoal island, and
3) Improve hydrologic function and sediment transport in Bolinas Lagoon as a whole.

Objectives:

1) Elimination of dominant non-native invasive plants
2) Restoration of native high salt marsh and beach vegetation
3) Community involvement and long-term community-based stewardship of Bolinas Lagoon resulting from an important restoration project

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Kent Island Restoration Project

- Expect to receive funds in July.
- Proceed with vegetation mapping, detail project design for “construction” and monitoring, and permitting.
- Project will include 5 years of monitoring after “construction”.
- LiDAR survey as part of monitoring effort (also tide gage and MCF grant).

Kent Island Restoration Project

- Community based approach. MCOSD and FMSA will coordinate the volunteer effort.
- Dr. Peter Baye is providing expertise on restoration and dune ecology.
- Methods for removing invasive species appropriate for site: flooding with salt water, hand removal, burying vegetation on site (no pesticides or heavy machinery).
- Revegetate via natural seed banks and planting. Custom-grow uncommon/native forbs like Astragalus pycnostachya, Atriplex californica, Castilleja ambigua; replant patches. Direct –seed (or propagate seed from locally collected founders) Chloropyron maritimum (current name for Cordylanthus maritimus).

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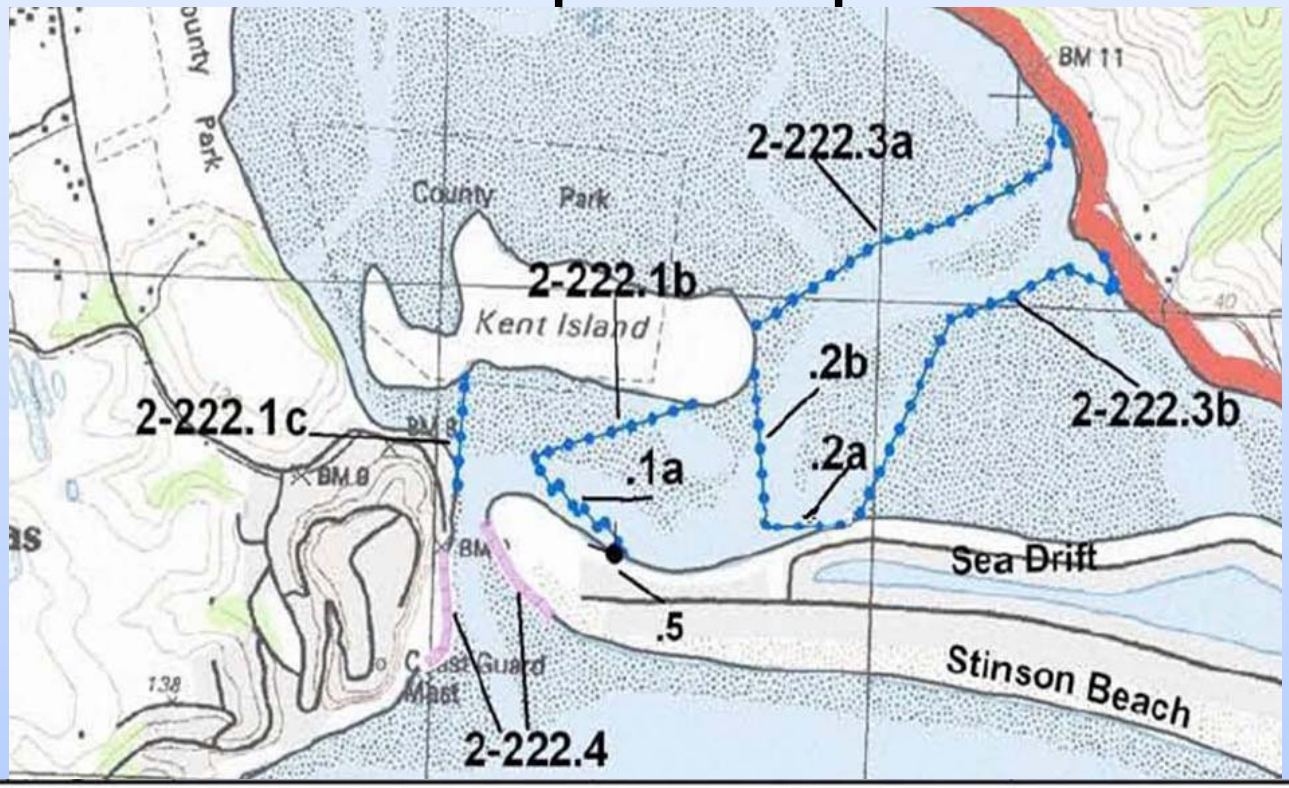
Oil Spill Response



CDFG-OSPR & USCG Site: 2-222 Name: Bolinas Lagoon

Dave Price (OSPR) & Jo Sanders (OSPR) Date: Aug. 13, 2008

- Harbor / Curtain Boom
- Swamp / River Boom
- all other boom types
- Sorbent boom
- Berm, Dam, or Dike
- Filter fence
- Boom tow
- SSS - Shoreside Skimming System
- SFS - Stationary Floating Skimmer
- SPS - Self Propelled Skimmer
- TSA - Towed Skimming Array

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Removal of the European Green Crab from Seadrift Lagoon

Edwin Grosholz

Department of Environmental Science and Policy

University of California, Davis

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What is an invasive species?

An invasive species is one that has moved to a location outside its original or native range.

Though many organisms are moved around by natural events, today species are often moved to new locations as a result of human activities such as shipping, aquaculture, the aquarium industry and bait packaging.







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Why do we care?

- Economic costs
  - U.S. estimated cost of all invasive species is $137 billion per year
- Public health costs
  - Spread of disease/pathogens (e.g. *Vibrio cholerae)*
- Ecosystem costs
  - Biodiversity effects
  - Alteration of habitats

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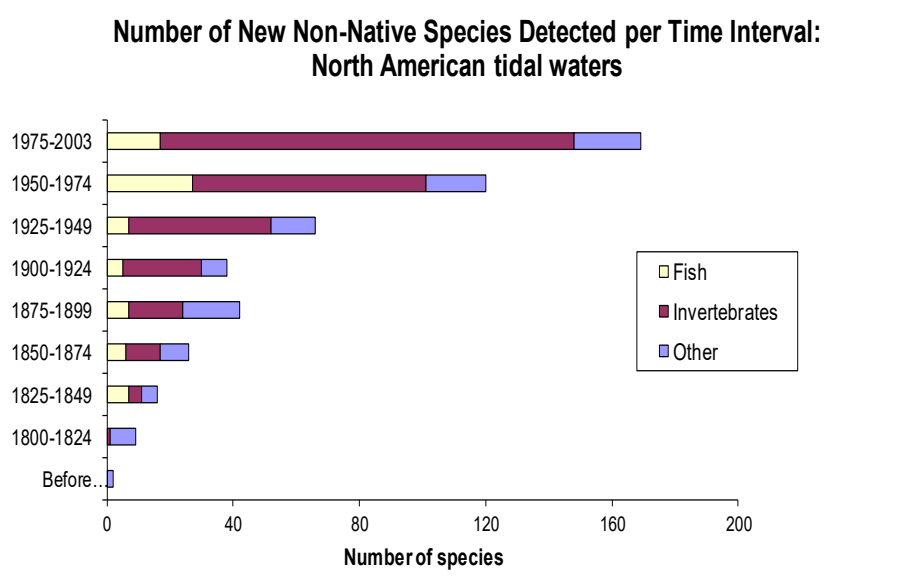
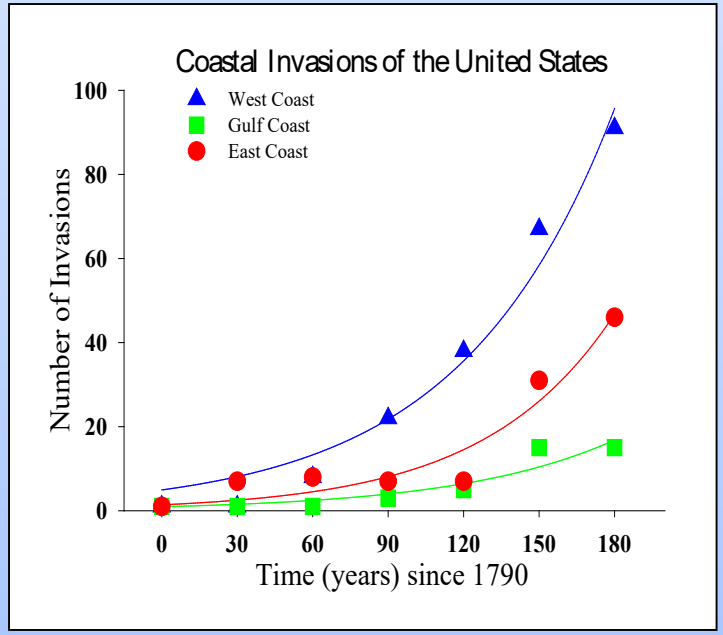
Why do we care?





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European Green Crab
Carcinus maenas

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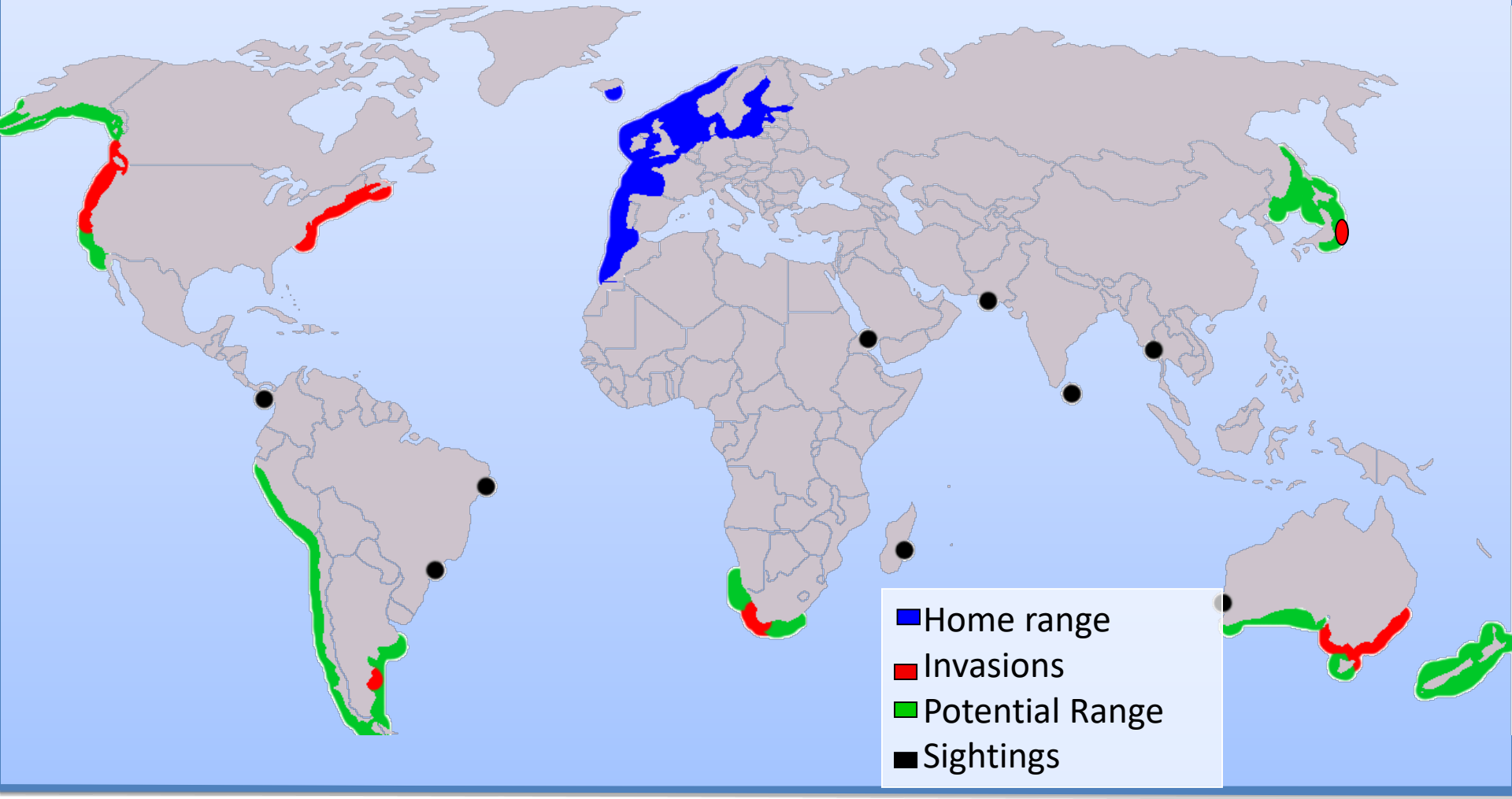
Worldwide Distribution



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Green Crab Life History

- Green crabs mature in their first year, reproduce 1-2x per year, and live for 5 yrs and grow up to 10 cm wide (~4 inches)
- Green crabs have a long-distance dispersing larval stage (3-4 weeks)
- They have a broad diet that can include many different invertebrates (clams, shrimp, worms, other crabs, etc.)
- They can be prey for fishes, birds and larger native crabs (rock crabs)

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Ecological and Economic Impacts of Green Crabs

- European green crab successfully established in five continents
- Resulted in collapse of clam fisheries in eastern North America (in 1950's) (Glude 1955)
- Threatens $45 million in shellfish production in western U.S. (Lafferty and Kuris 1996)
- Annual losses of $14-$18 million for east coast shellfish (2001-2005) (Lovell et al. 2008)
- Large reductions in populations of native crabs and clams in California (Grosholz et al. 2000)

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Small Clams in Local Estuaries

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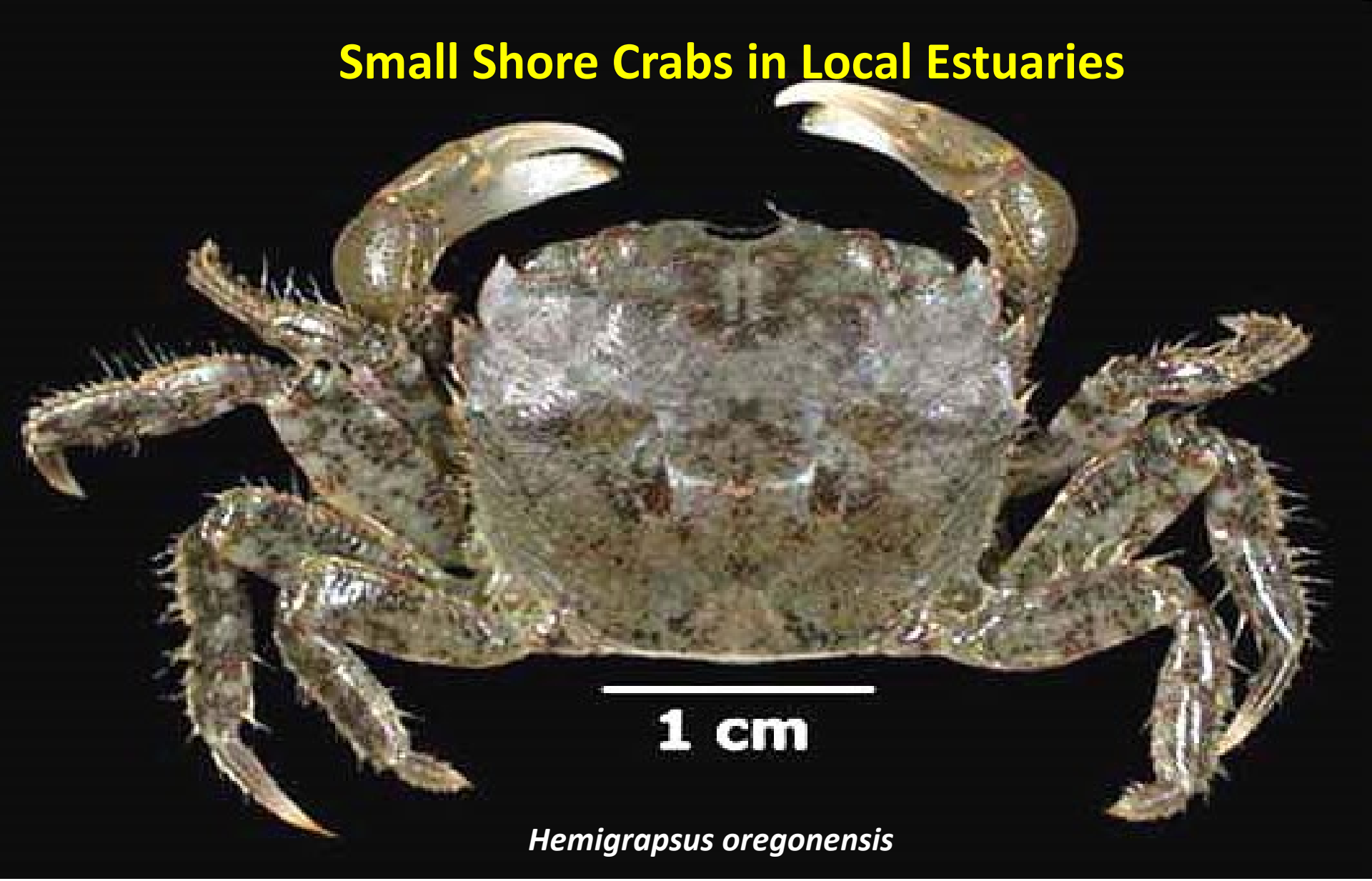
Small Shore Crabs in Local Estuaries



Hemigrapsus oregonensis

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Estuarine Invertebrates

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Potential Economic Losses

TABLE 1. Preliminary assessment of the economic value of the existing fishery harvest (landings) that are potentially threatened by the introduction of green crabs on the west coast of the United States. Landing estimates are conservative, based on information in Leet et al. (1992) and from S. Berry (*personal communication*); net value estimates† are also conservative. Other fisheries may be at risk if crabs extend their range to Washington State.

Landings		Threatened annual value (10^6 U.S.$)		
Type	Year	Northern and central California	Additional if crabs reach southern California	Additional if crabs reach Puget Sound
Dungeness crab	1990–1991	17.0	...	16.4
Rock crabs	1990	...	2.5	...
Mussels	1990	0.5	0.5	...
Oysters	1990–1991	1.0	...	20.0
Bait	1990–1991	0.5	...	...
Total		19.0	3.0	36.0
Net value†		15.2	2.4	29.1
Net value including secondary and tertiary values†		22.8	3.6	43.7

† Net value is the gross value of the landings less a liberal 20% estimate for the fishermen's expenses. Secondary values are processing and wholesaling; and tertiary value is in retailing; these are accounted for by multiplying the simple net value by 1.5.

Potential Economic Losses

TABLE 4. Current and potential future (PF) value of current annual and potential future harvest losses (in thousands of U.S. dollars, value in 2006) by state and species.

Species	California		Oregon		Washington		Alaska		West Coast total	
	Current	PF	Current	PF	Current	PF	Current	PF	Current	PF
Pacific littleneck clam	0–0	0–0	0†–0†	0.1–0.1	0–0	0.1–0.2	0–0	0.1–0.1	0–0	0.3–0.3
Soft-shell clam	0–0	0–0	0†–0†	0†–0†	0–0	0.1–0.2	0–0	0–0	0–0	0.1–0.2
Manila clam	0.6–1.1	1.3–3.0	0–0	0–0.1	0.2–0.3	27.2–51.6	0–0	0–0	0.7–1.4	28.5–54.76
Blue mussel	0.2–0.3	15.9–31.1	0–0	0–0.2	0–0	0.7–1.5	0–0	0–0	0.2–0.3	16.6–32.7
Total	0.7–1.4	17.1–34.1	0–0	0.2–0.4	0.2–0.3	28.1–53.4	0–0	0.1–0.1	0.9–1.7	45.5–88.0

Notes: The range for each cell includes low and high estimates of aquaculture losses based on high and low efficiency of predator exclusion. Potential future losses include estimates of the probability of future invasion for presently uninvaded sites.

† Value greater than $0, but less than $50.

Grosholz et al. 2011 *Ecological Applications*

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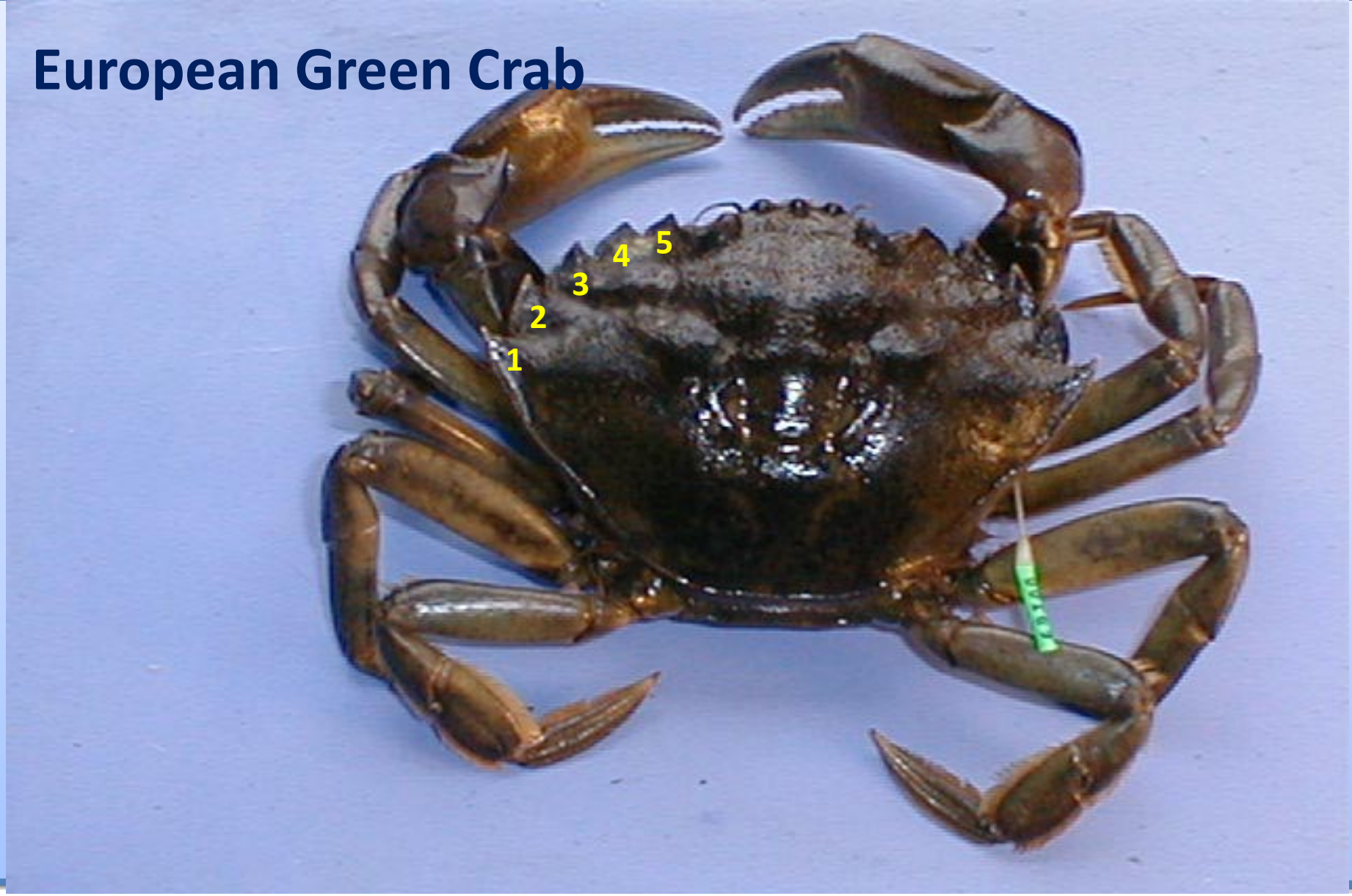
European Green Crab



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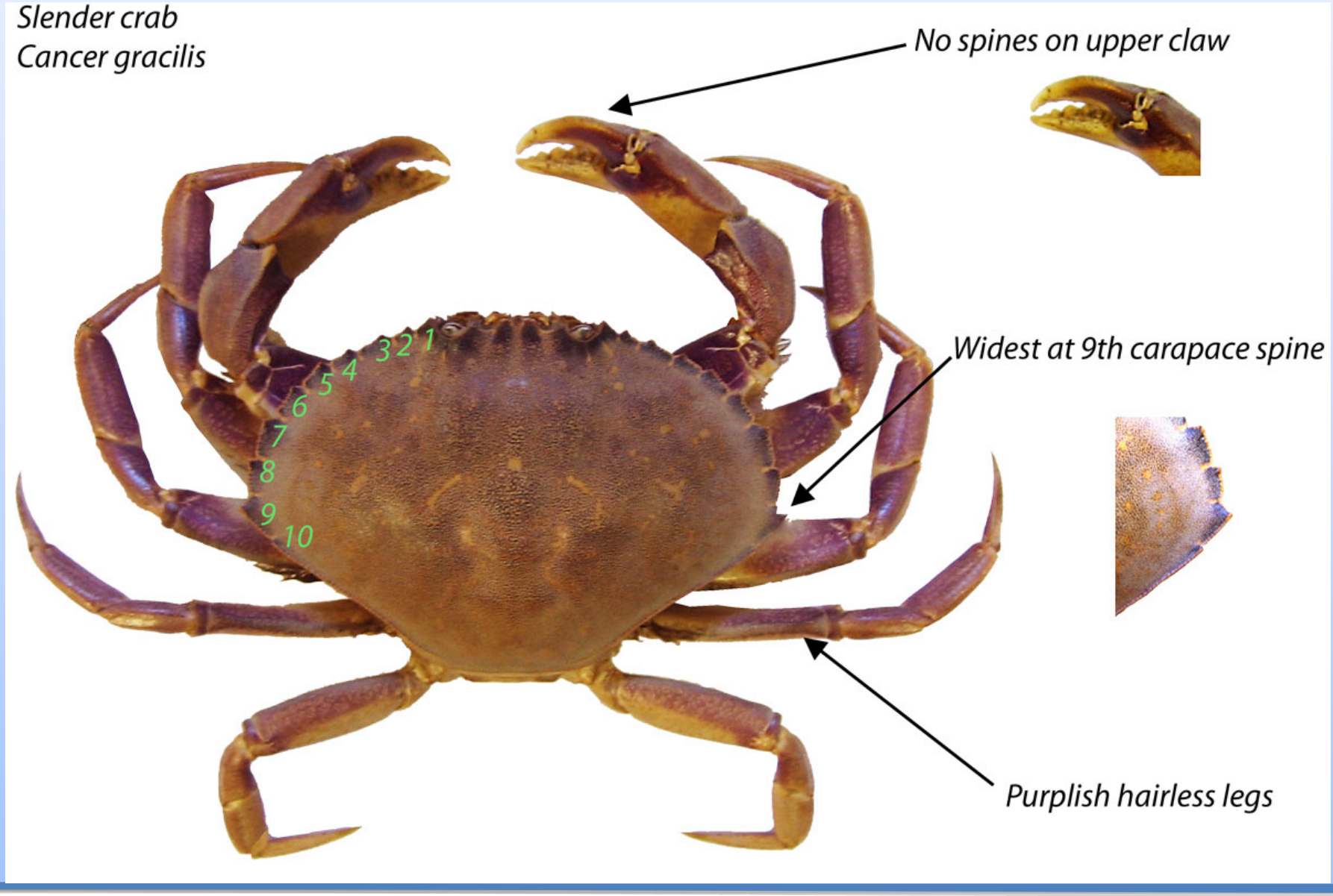
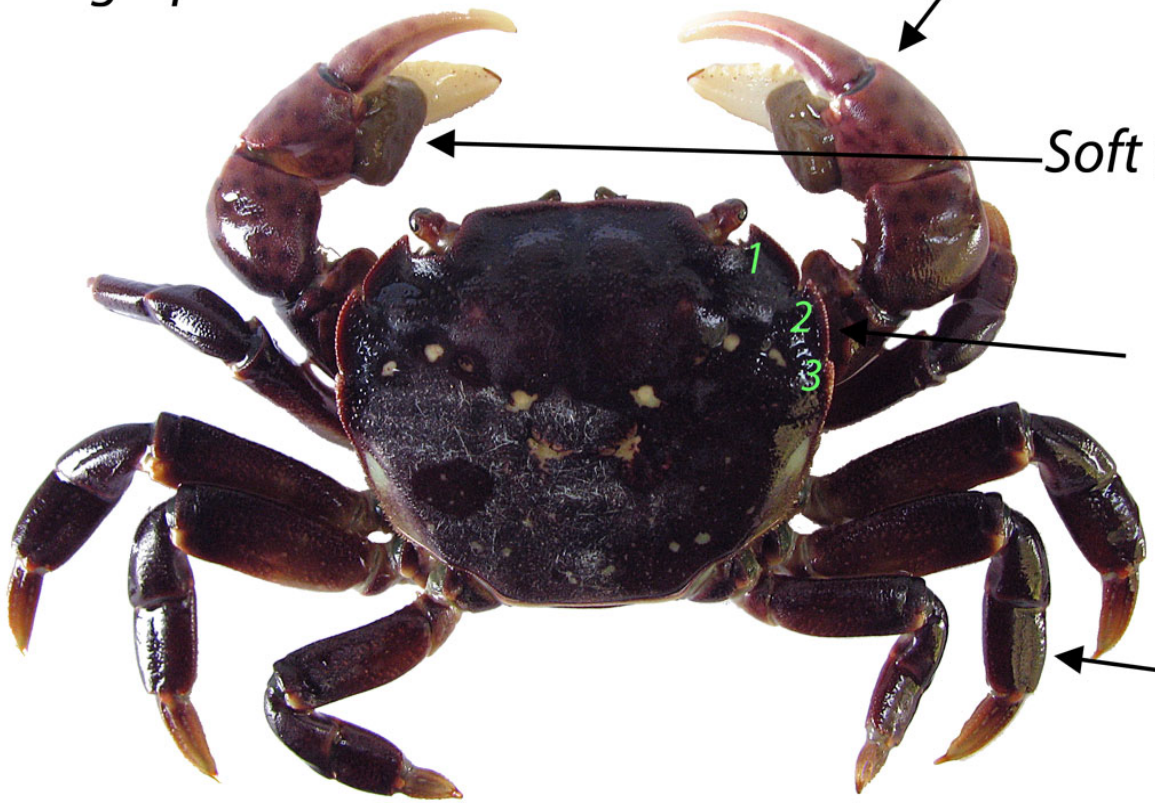

Slender crab
Cancer gracilis
No spines on upper claw
Widest at 9th carapace spine
Purplish hairless legs
1
2
3
4
5
6
7
8
9
10

Purple shore crab
Hemigrapsus nudus



Purple/ red spotted claws

Soft tissues on at base of claws

3 spines on each side of carapace

legs with out hairs

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Why Seadrift Lagoon?

- **Unusually large population**
  - **2009 Mark Recapture Study estimated a population of 85-100k adult crabs**
- **Proximity to Bolinas Lagoon**
  - **Could be serve as a source for Lagoon and connected bays and estuaries**

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Why Seadrift Lagoon?

- **Bolinas Lagoon Ecosystem Restoration Project:**
  - **6-MG.** ***Recommendation: Remove introduced plant and invertebrate species found in the Bolinas Lagoon watershed***

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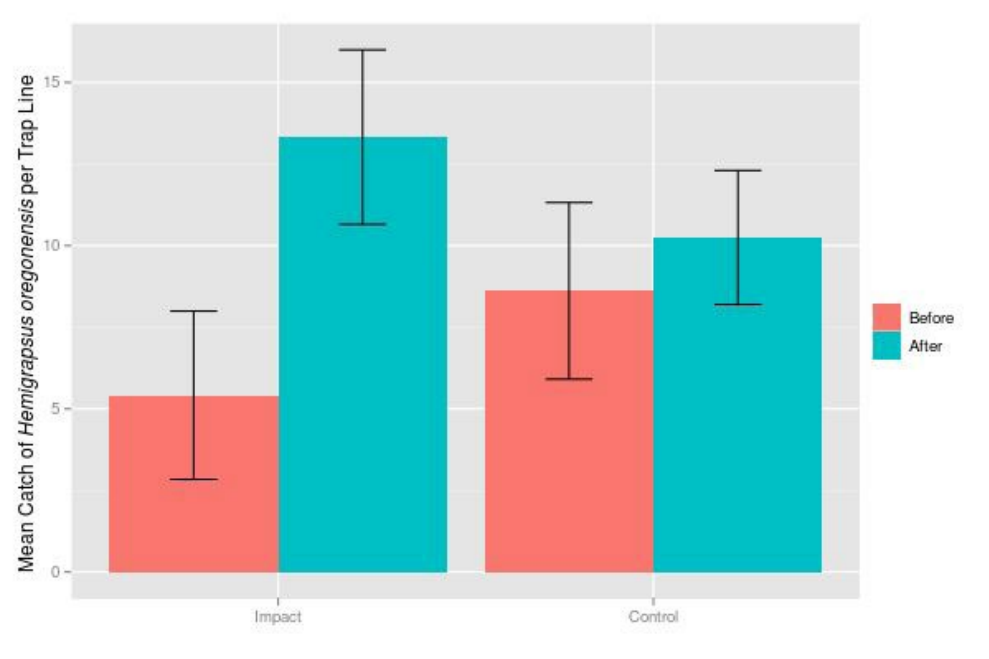
Potential Benefits for Bolinas Lagoon



- Reduce numbers of green crabs
- Increase abundance of native crab species
- Increase abundance and diversity of other invertebrate species

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Trapping/Removal Methods

- 6 core sites accessed by kayak
- Use baited collapsible traps
- 10-15 traps/site (60-90 total)
- Collected for 2 consecutive days
- Traps re-baited after each collection
- Native crabs are returned to the lagoon
- All crabs are counted, measured and sexed

Map of Removal Sites

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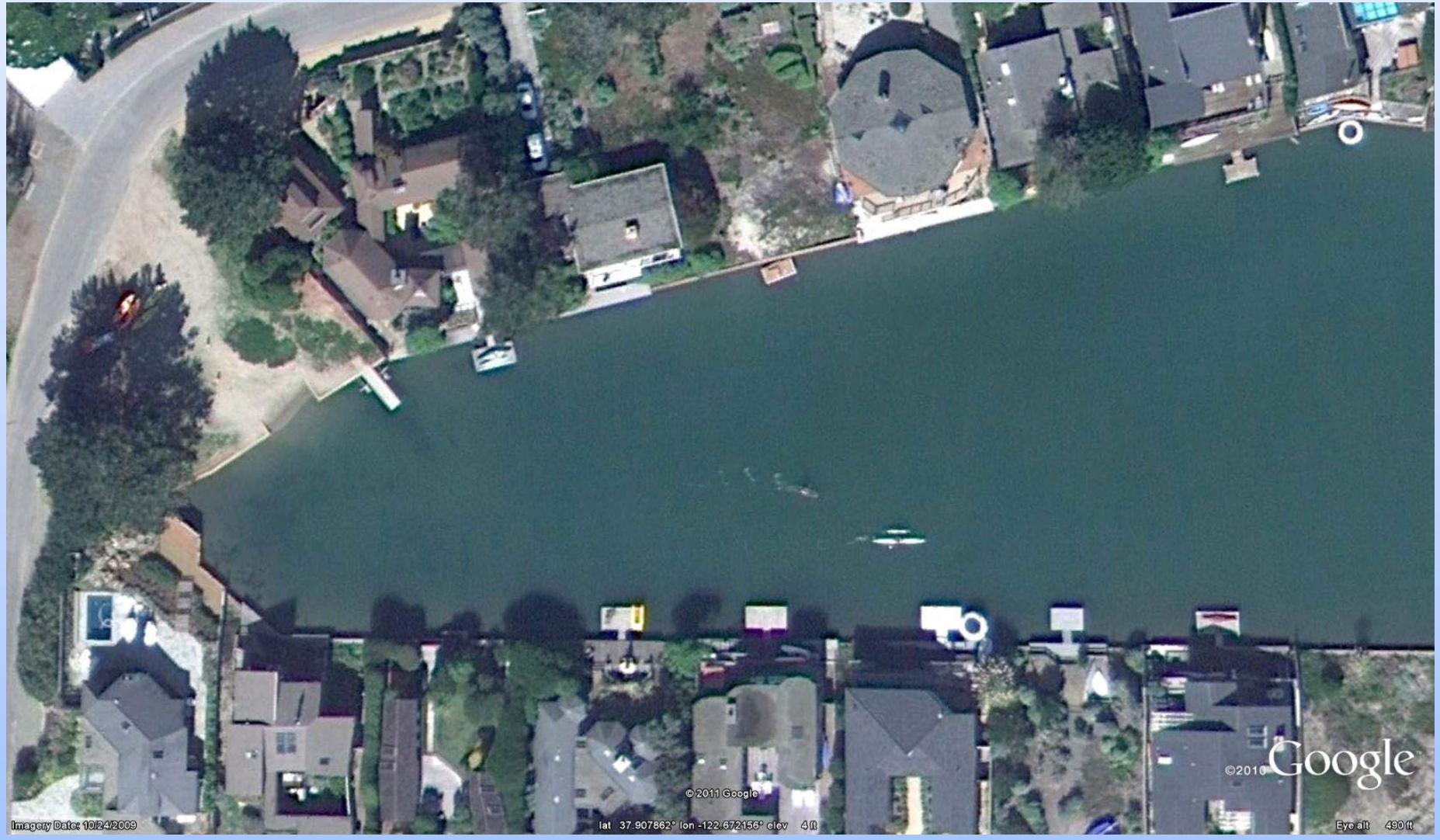

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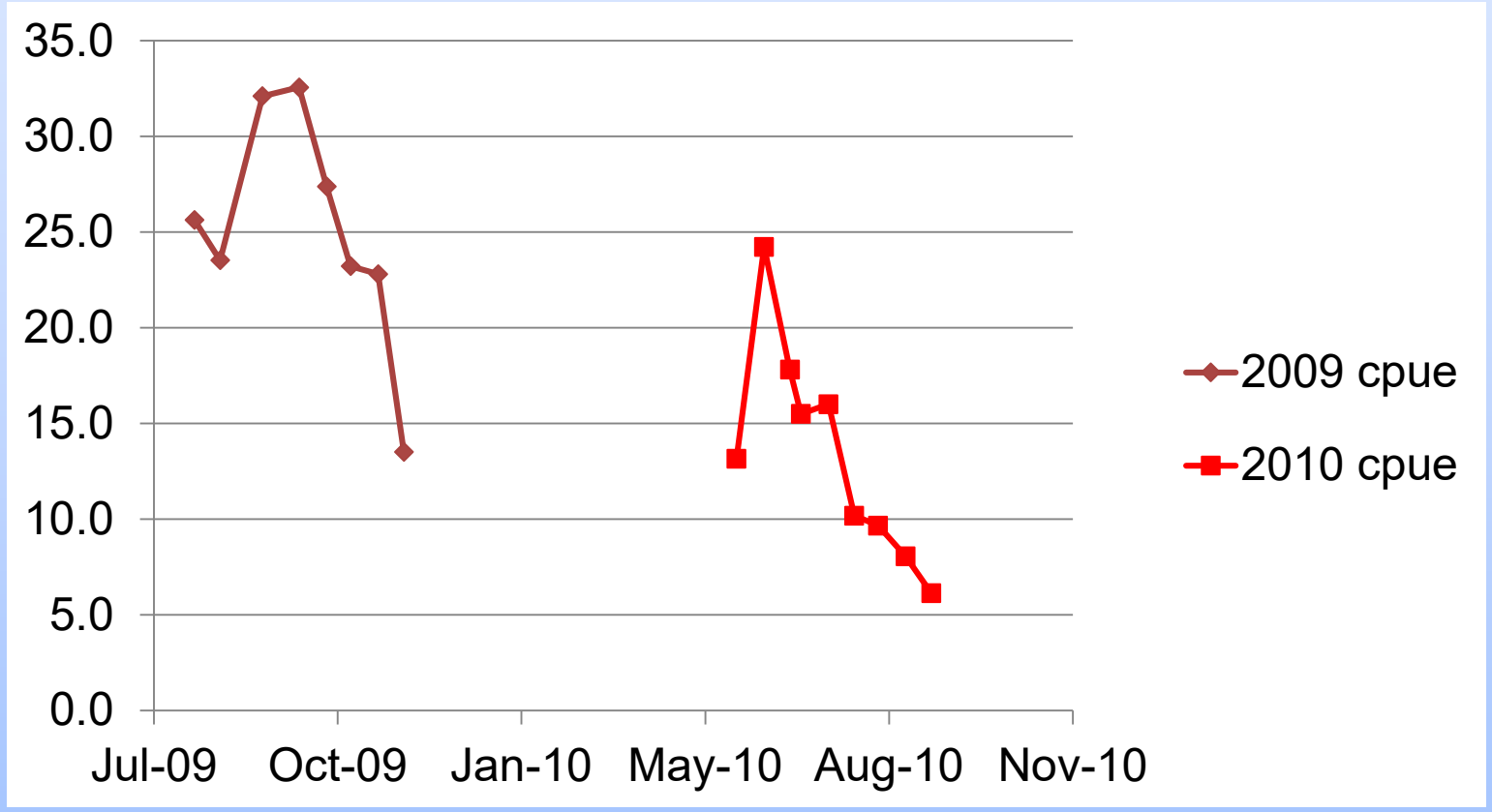
Removal Effort to Date



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Removal Effort to Date

2009 Population Estimate =

85,409 - 100,255 crabs

2009 Total crabs removed = 31,922

CPUE = 25.1

2010 Total crabs removed = 16,824

CPUE = 13.4

Total crabs removed = 48,746

% of population removed = 49-57%

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What to do with the crabs?

- After collection, green crabs are humanely euthanized by freezing
- Once frozen, crabs are brought to local farms for use as compost
  - Gospel Flat Farms
  - Paradise Valley Farms
  - Slide Ranch

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Thank you!

- GFNMS, Kate Bimrose and Maria Brown
- Seadrift Association, Kirin Neiderberg
- Gail Graham
- Peter Wilson
- All the many volunteers who endured pinched and cut fingers

The crab team:

Dr. Ted Grosholz – UC Davis/Bodega Marine Lab
Dr. Greg Ruiz – SERC
Dr. Cat DeRivera – Portland State University
Chris Brown – SERC/Romberg Tiburon Center
Brian Turner – Portland State University
Seth Kotke – UC Davis/CSUMB

Several interns and numerous volunteers from the Bolinas-Stinson community and beyond.

To volunteer, or for more information, please email

browncw@si.edu
tedgrosholz@ucdavis.edu

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Caltrans 2011 Bolinas Lagoon Marin/Highway 1 Rehabilitation Project

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Caltrans will replace 14 culverts between postmiles 15 and 17 with smooth interior plastic pipes.

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Caltrans will remove and rehabilitate approximately 4,900’ of Rock Slope Protection on the Lagoon side of the highway.

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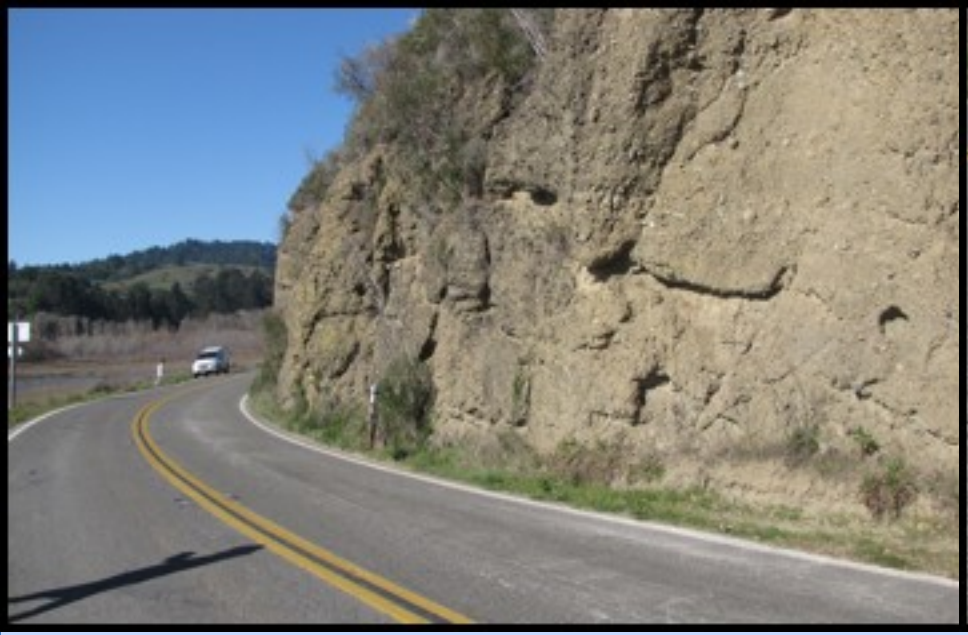

Caltrans will digout and repave the entire 2 mile length of the project. 1’ to 2’ shoulders will be installed on the Lagoon side of the highway where feasible.

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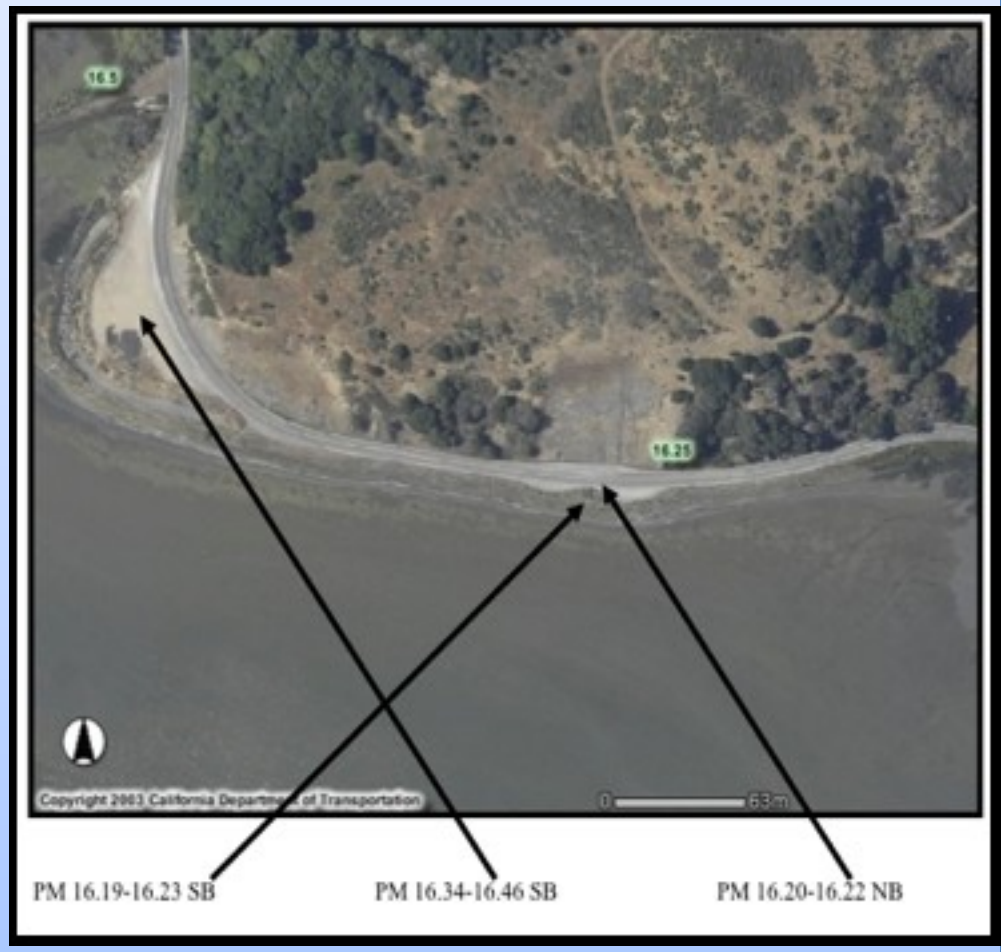
Caltrans will reconstruct 14 existing dirt pullouts with porous pavement to improve Lagoon water quality.



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Construction Start Date: TBD

Projected Construction End Date: TBD

Road Traffic During Construction: One way traffic control with delays up to 5 minutes.

As a requirement of the California Coastal Commission waiver, Caltrans must develop a public access plan for this two mile stretch of highway.

As part of this plan, interpretive signage along Bolinas Lagoon is a possibility.

The following slides are examples of signage that Caltrans has utilized in past projects as well as existing signage provided by Marin County, GFNMS, and FMSA.

Housing Developments in Guadalcanal Village.
Photo courtesy of Vallejo Naval Historical Museum and the Solano County Historical Society.

A naval family at home in Guadalcanal Village.
Photo courtesy of National Archives, San Bruno, California.

Aerial View, mid 1990's.
Photo courtesy of USGS.

Levee breach, October 31,2001.
Photo courtesy of Chuck Morton, Caltrans.

n 1940 the Navy and other public agencies began building housing developments in Vallejo and on Mare Island to accommodate a tremendous influx of WWII servicemen, civilians, and their families. The last wartime development was Guadalcanal Village, built in 1945 on reclaimed wetland on the northernmost tip of Mare Island. Named for the South Pacific island where the United States' first large-scale amphibious assault took place, Guadalcanal Village was built to house 442 naval families, both enlisted and commissioned, in one and two story multiple-family neighborhood units. This group of connected-home units were designed to separate pedestrian and automobile traffic. Living rooms and bedrooms faced a central green with paths and play structures; kitchens were in the back of the units, convenient to parking. The streets in Guadalcanal Village were named for lost ships manufactured here. Tang, Tullibee and Gudgeon were named for three missing submarines; the Ward was a minesweeper, the Perry a mine vessel, and the Kanawha, an oil tanker, all sunk in the South Pacific.

Although Guadalcanal Village was built as permanent housing, its location was given to frequent flooding, causing maintenance and infrastructure problems. The development was razed in the late 1960s.

Aerial View, December 2001.
Photo courtesy of Air Photo ®.

Cordgrass, *Spartina sp.*, observed at Guadalcanal Village, October 2002, Natural Recruitment.
Photo courtesy of Isa Woo, USGS.

Snowy Plover, *Charaduis alexandrinus*, observed in May 2002 at Guadalcanal Village.
Photo courtesy of John Takekawa, USGS.

The California Department of Transportation (Caltrans) widened State Route 37 in Vallejo. The project was designed to minimize impacts to adjacent tidally influenced wetlands. In coordination with the San Francisco Bay Conservation and Development Commission (BCDC), the US Fish and Wildlife Service, the San Pablo Bay National Wildlife Refuge and other Federal and State resource agencies, a plan was developed to restore Guadalcanal Village to a tidally influenced salt marsh. The restoration of Guadalcanal Village to tidal influence is considered mitigation for the impacts to 8 acres of wetlands that could not be avoided as part of the widening of State Route 37.

The Guadalcanal Village restoration site was developed to replicate the natural hydraulic system of the adjacent Pritchard Marsh. The elevations are typical of tidal marshes occurring in the San Pablo Bay Estuary complex. In the early summer of 2000, existing vegetation and remaining infrastructure such as roadways and housing foundations were removed. The site was then graded to allow tidal influence. Guadalcanal Village was restored to tidal influence on October 31, 2001. Tidal influence has allowed recruitment of native plants such as pickleweed, and cord grass. Avian activity began the day of the breaching and has included sightings of the snowy plover, a Federally threatened listed species. White pelicans and a variety of ducks are commonly seen on the site. The restoration created approximately 14.8 acres of mudflat and sub-tidal sloughs, 29.1 acres of tidal wetland habitat and 5.6 acres of upland habitat.

Guadalcanal Village Marsh Restoration

Caltrans

CT1404 District 4 Audio Visual Graphic Services 1/05

Example of Large Sign; Size 24” x 32”

Plants

Coyote Brush (*Baccharis pilularis*) is a widespread evergreen shrub in California found in many different habitats below 3,000 feet in elevation. It is most common at lower elevations particularly, where soils are moist. It is a dioceous plant, meaning that one plant has either male or female flowers, but not both. It flowers late in the year, usually during the late summer and autumn months. It provides good cover for many species of animals.

Saltbush (*Atriplex patula*) are evergreen shrubs that grow in salt marshes and alkali flats when the salt content of the soil is lower than what pickleweed can tolerate. They can tolerate alkaline soils by absorbing both salt and water, then excrete the salt on the surface of their leaves, which gives the leaves a silvery sheen.

Pickleweed (*Salicornia virginica*) is a dominant member of the coastal salt marshes (usually found along the average high tide line) of California as well as the interior alkaline flats of the San Joaquin Valley. It provides habitat and forage for Salt Marsh Harvest Mouse. It is a succulent plant, and is used to make sodium ash, which was a component of glass making. **Dodder** *(Cuscuta salina)* is an annual parasite vine, related to morning glory, with typicallly bright orange threadike stems that is often found growing on Salicornia sp. (especially *Salcornia virginica*) during the summer months.

California Cordgrass (*Spartina foliosa*) forms narrow bands or meadows at edges of salt marshes, mudflats and shorelines. It can withstand up to one day of tidal submergence. It is usally solitary or found in small clumps. One of the world's most productive plants, it produces 5-10X as much nutrient material and oxygen per acre as wheat. This helps in the stabilization of mud deposits in the mudflats. Root systems trap sediment and detritus which contributes to the food chain. It is a federally listed **Species of Local Concern**.

Animals

The **Killdeer (*Charadrius vociferus*)** is usually found along open country areas near water. Call: shrill, sounds like "*kill-deee, fill-deee*" or "*killdeer, killdeer*". Nests in shallow depression lined with grass on bare ground. They use "broken wing display" for calling and dragging themselves along the ground as if injured to lure potential predators away from their nests.

The **California Clapper Rail (*Rallus longirostris*)** inhabits salt marshes and some freshwater marshes. The majority of this species is found in the San Francisco Bay. They nest in a depression with dead marsh grasses, and are often found along dense stands of **cord grass** or **pickleweed**. Call: harsh, clattering series of "kek's" (sounds similar to "clapping"). Listed as a federal and state **Endangered** species.

The **Salt Marsh Harvest Mouse (*Reithrodontomys raviventris*)** inhabits tidal and diked salt marshes characterized by dense stands of pickleweed and adjacent thick grasslands providing cover. They are primarily nocturnal, and are good swimmers and climbers. They build grass nests or use abandoned bird nests. They feed on seeds, grasses and forbs in their habiat (primarily on **pickleweed** and **salt bush**). It is found throughout the San Francisco Bay and is listed as a federal and state **Endangered** species.

The **Green Sturgeon (*Acipenser medirostris*)** can be as large as 12' 6" long and weigh 1,387 lbs. They have boney plates on their bodies and heads. Females are usually larger than and mature later than males. They are found over soft ocean bottoms or deep pools of large rivers. They spawn in rivers during the spring and feed on small fishes, crutaceans, and mollusks. They can live up to 34+ years and do not reach sexual maturity until 11 years old. Listed as a **Candidate** for proposed listing as an Endangered or Threatened Species.

The **Central California Costal Steelhead (*Oncorhynchus mykiss*)** range from southern California to Alaska in the Pacific Ocean drainages. Steelhead are salmonids and are the anadromous form of the rainbow trout, which means that steelhead are born in fresh water, emigrate to the ocean for two to three years to complete most of their growth cycle, and then return to fresh water to spawn. Listed as a federal **Threatened** species.

Salt Marsh Zone of Sonoma Creek

Caltrans

CT1404 District 4 Audio Visual Graphic Services 12/03

Example of Large Sign; Size 24” x 32”

Example of Large Sign; Size 24” x 32”

Example of Small Sign(s); Size ~ 6” x 12”

Example of Small Sign; Size ~ 6” x 12”

- Please take a minute to fill out your comment sheet and tell us what you think.

- If signs are to be posted, they will be placed at up to 3 major use pullouts between post miles 15 and 17.

MARIN COUNTY OPEN SPACE DISTRICT
DEPARTMENT OF PARKS AND OPEN SPACE

NATIONAL MARINE SANCTUARIES
GULF OF THE FARALLONES

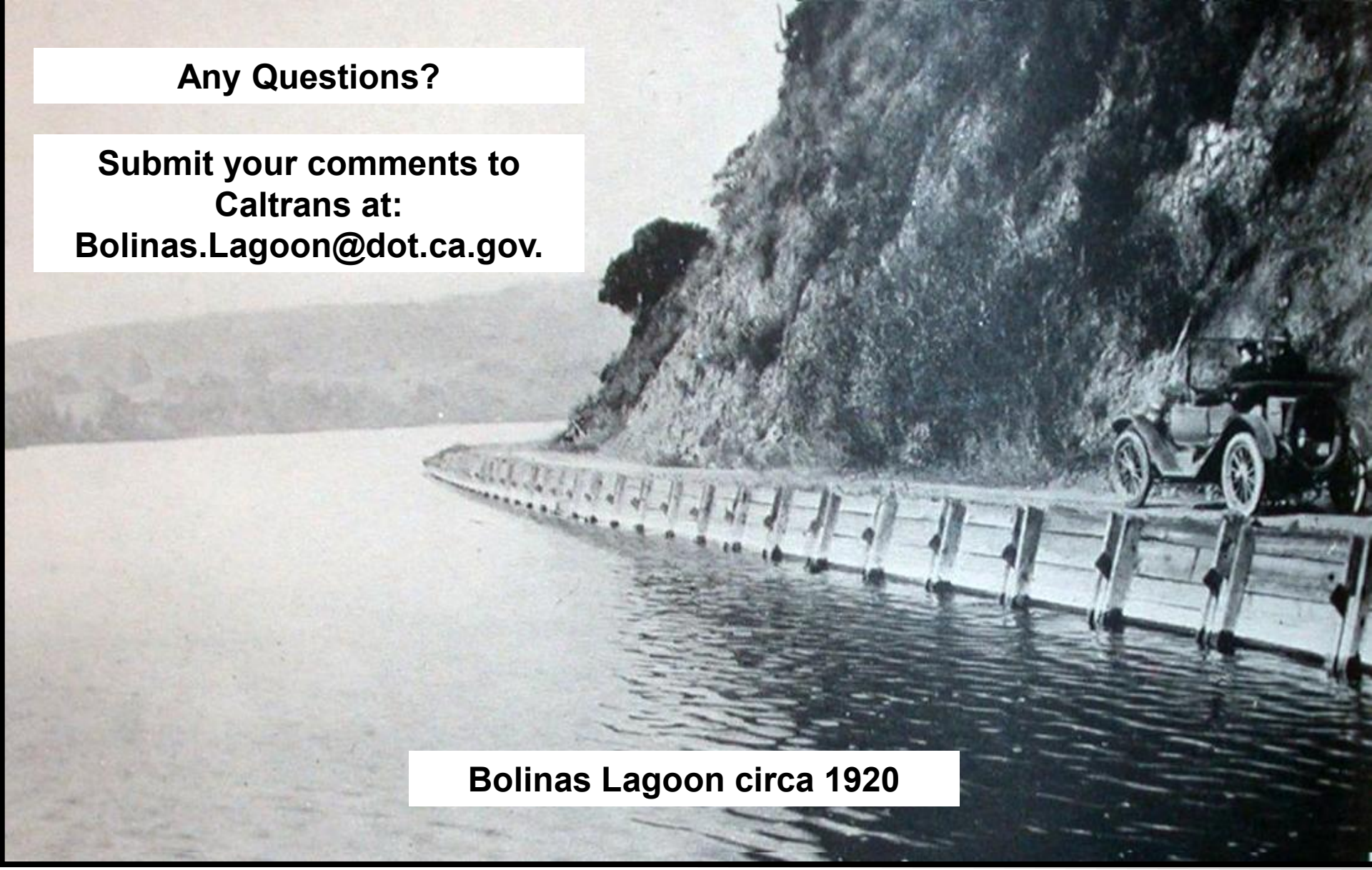
US Army Corps of Engineers

Caltrans

BODEGA MARINE LABORATORY

Public Access Plan Process

- Sign examples presented and public input continued at BLTAC meeting on June 3rd
- Public comment deadline for input on sign examples, July 1st
- Final Public Access Plan presentation and potential sign template presentation at BLTAC meeting on September 9th



Any Questions?

Submit your comments to Caltrans at: Bolinas.Lagoon@dot.ca.gov.

Bolinas Lagoon circa 1920

MARIN COUNTY OPEN SPACE DISTRICT
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BODEGA MARINE LABORATORY

Thank you to the funding and partner organizations that make restoring Bolinas Lagoon possible.

Bolinas Lagoon Foundation

Bolinas Rod and Boat Club

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are needed to see this picture.

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Point Reyes National Seashore

Seadrift Homeowners Association