

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?



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



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)



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







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*).



Removal of the European Green Crab from Seadrift Lagoon

Edwin Grosholz

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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.

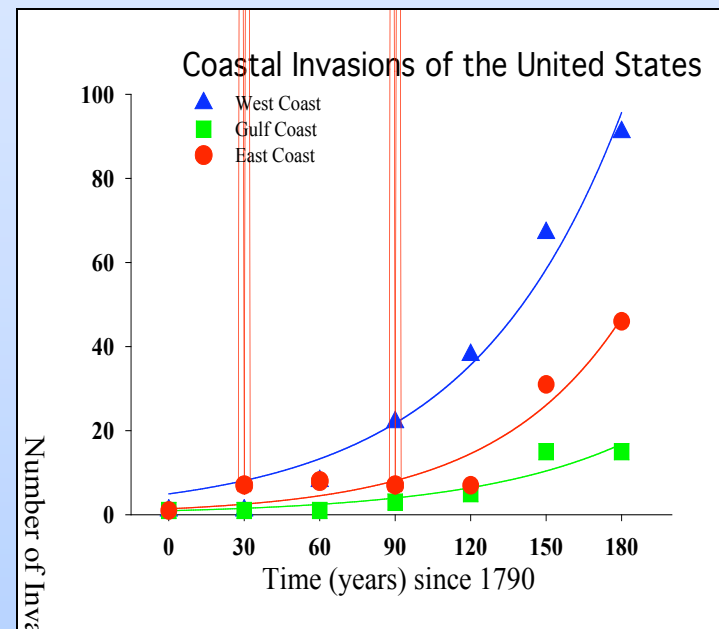
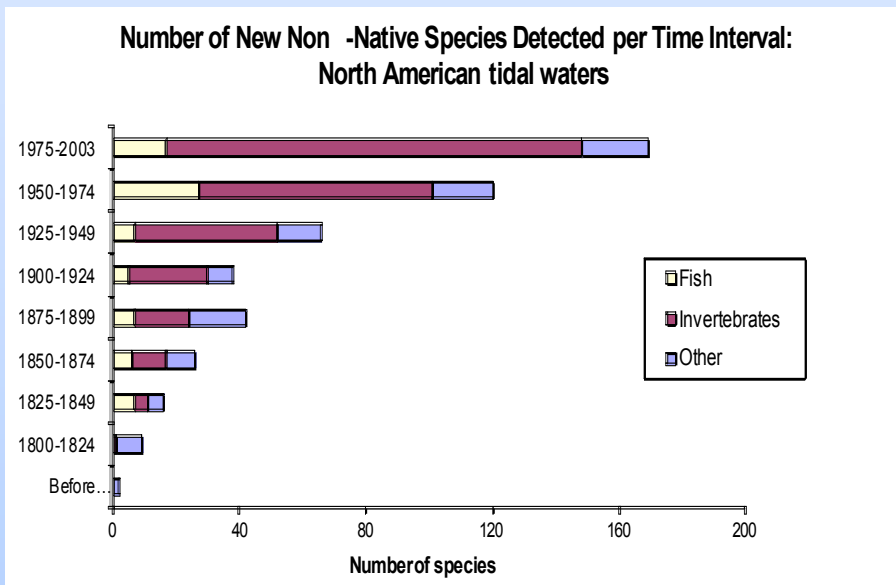


Why do we care?

- **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



Why do we care?

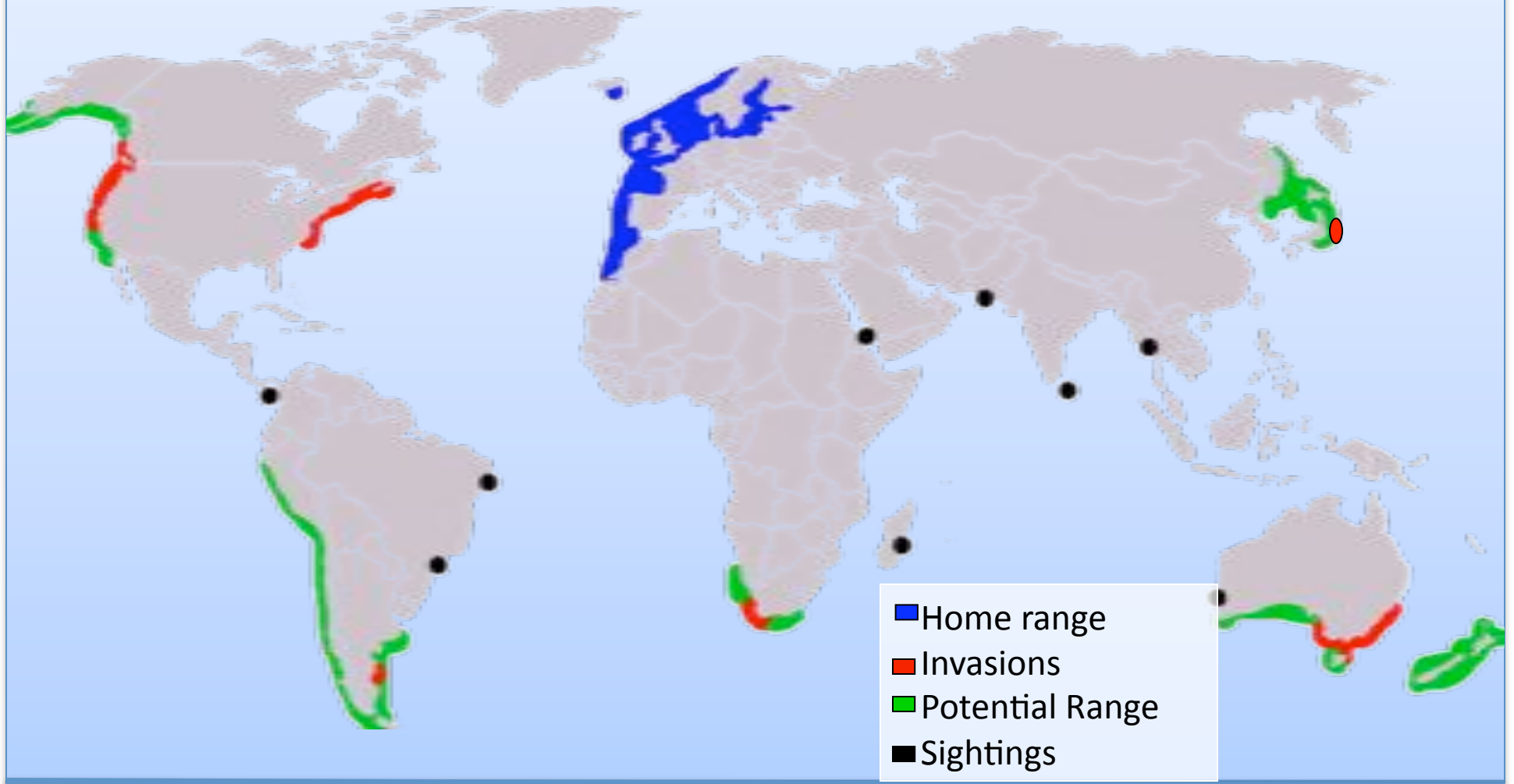


European Green Crab

Carcinus maenas



Worldwide Distribution



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)**



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)



Small Clams in Local Estuaries

Eastern Gem Clam
(*Gemma gemma*)



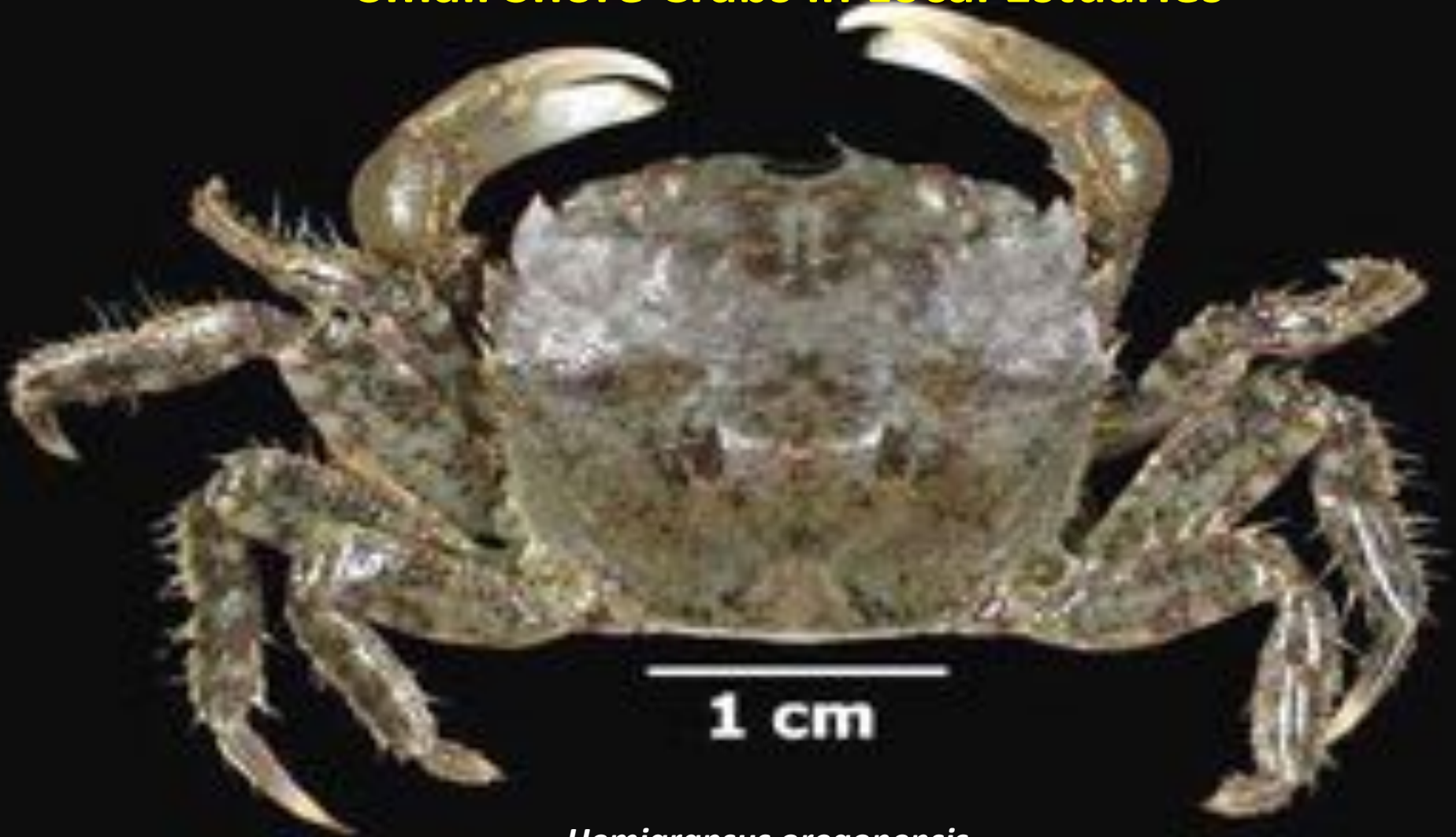
Native Clam
(*Nutricola confusa*)



Native Clam
(*Nutricola tantilla*)



Small Shore Crabs in Local Estuaries



Hemigrapsus oregonensis



Estuarine Invertebrates





Potential Economic Losses

TABLE 1. Preliminary assessment of the economic value of the existing fishery harvest (landings) that are potentially threatened by the construction of goose crafts on the west coast of the United States. Landings estimates are conservative, based on information in Lark et al. (1992) and from S. Beery (personal communication); net value estimates¹ are also conservative. Other fisheries may be at risk if crafts extend their range to Washington State.

Landings		Thousand annual value (\$P U.S.)		
		Number and cost California	Additional of crafts west California	Additional of crafts west Puget Sound
Type	Year			
Dungeness crab	1990-1991	17.8	—	16.4
Rock crabs	1990	—	2.4	—
Mussels	1990	0.5	6.5	—
Oysters	1990-1991	1.8	—	20.0
Sea urchin	1990-1991	0.9	—	—
Total		21.0	9.0	36.4
Net value ¹		15.2	2.4	26.1
Net value including secondary and tertiary values ¹		22.8	3.6	40.7

¹ 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

922

EDWIN GROSHOLZ ET AL.

Ecological Applications
Vol. 21, No. 3

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

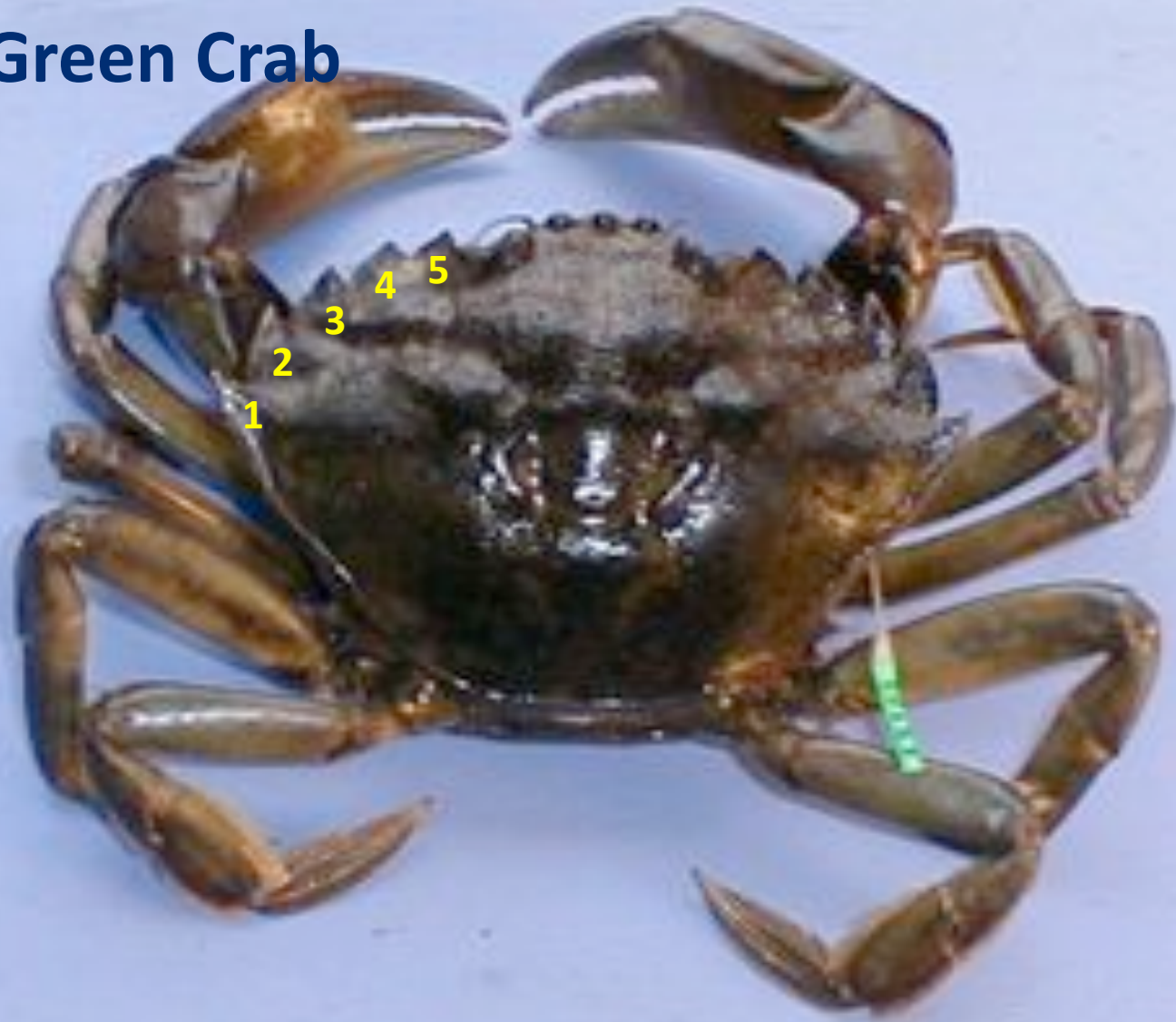
Notes: The range for each cell includes low and high estimates of aquaculture losses based on high and low efficiency of predator exclusion. Potential future losses include estimates of the probability of future invasion for presently uninvaded sites.

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

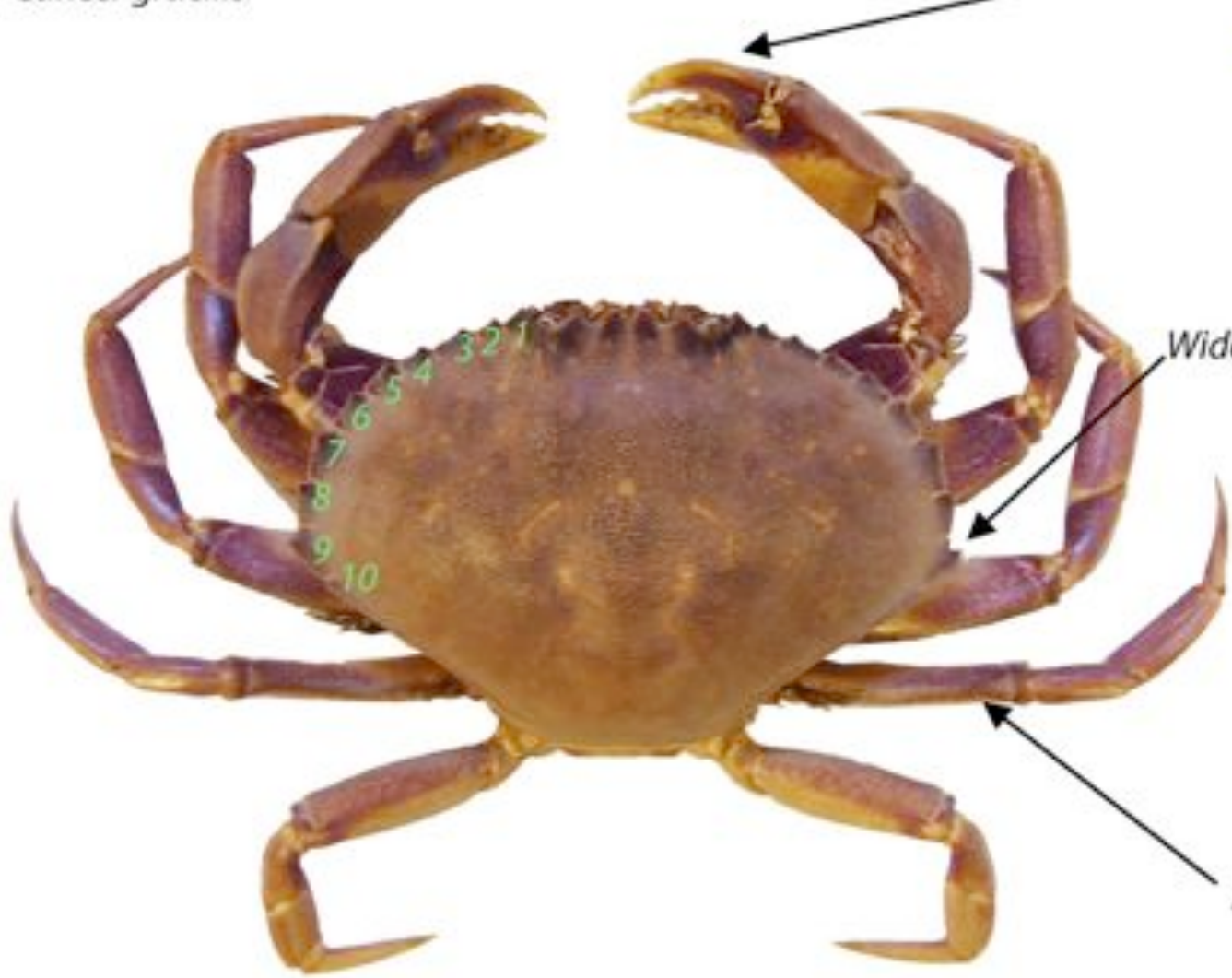
Grosholz et al. 2011 *Ecological Applications*



European Green Crab



Slender crab
Cancer gracilis



No spines on upper claw



Widest at 9th carapace spine



Purplish hairless legs



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



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

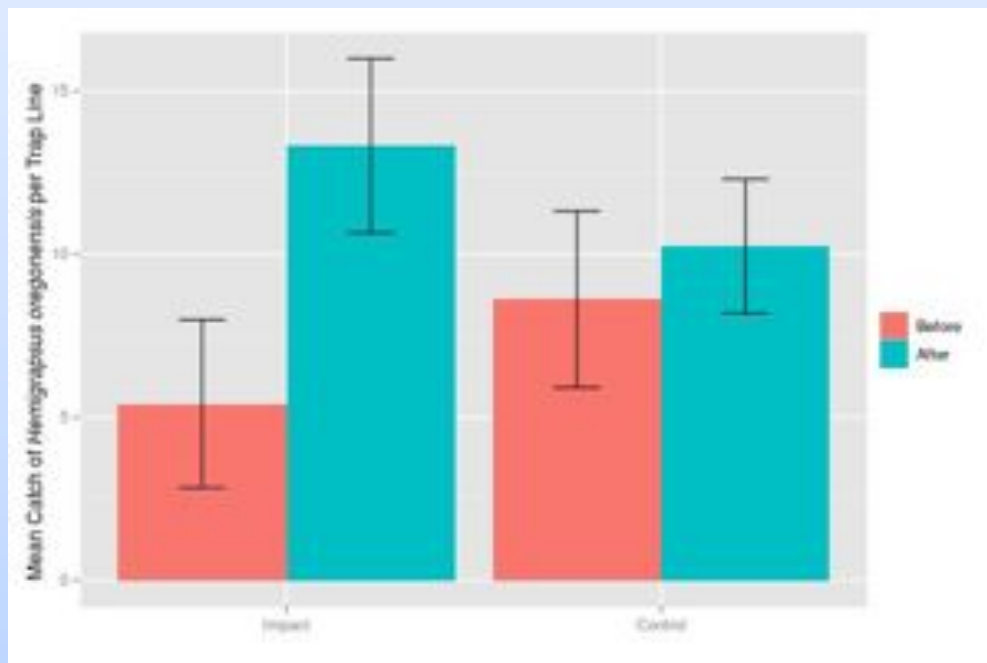


Why Seadrift Lagoon?

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



Potential Benefits for Bolinas Lagoon



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



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



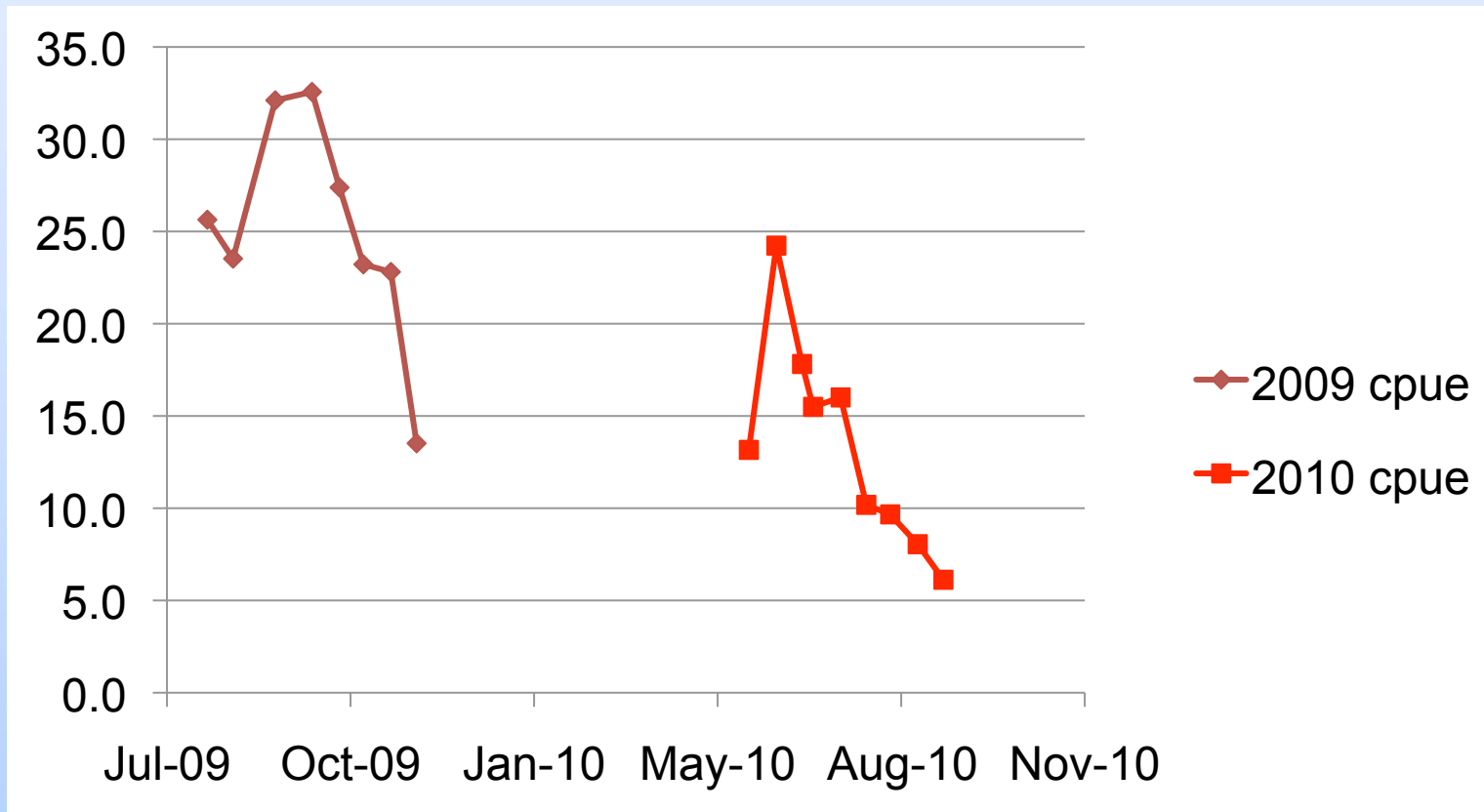
Map of Removal Sites







Removal Effort to Date



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%



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**



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**





**Caltrans 2011 Bolinas Lagoon
Marin/Highway 1
Rehabilitation Project**





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





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





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.



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



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.



Guadalcanal Village Marsh Restoration

Caltrans

171440 - Section 4 - 4/16/01 - 1/16/01

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.



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



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



Bolinas Lagoon Foundation



Bolinas Rod and Boat Club



Point Reyes National Seashore

Seadrift Homeowners Association

