

# Monitoring abundance of *Carcinus maenas* developmental stages in Seadrift Lagoon



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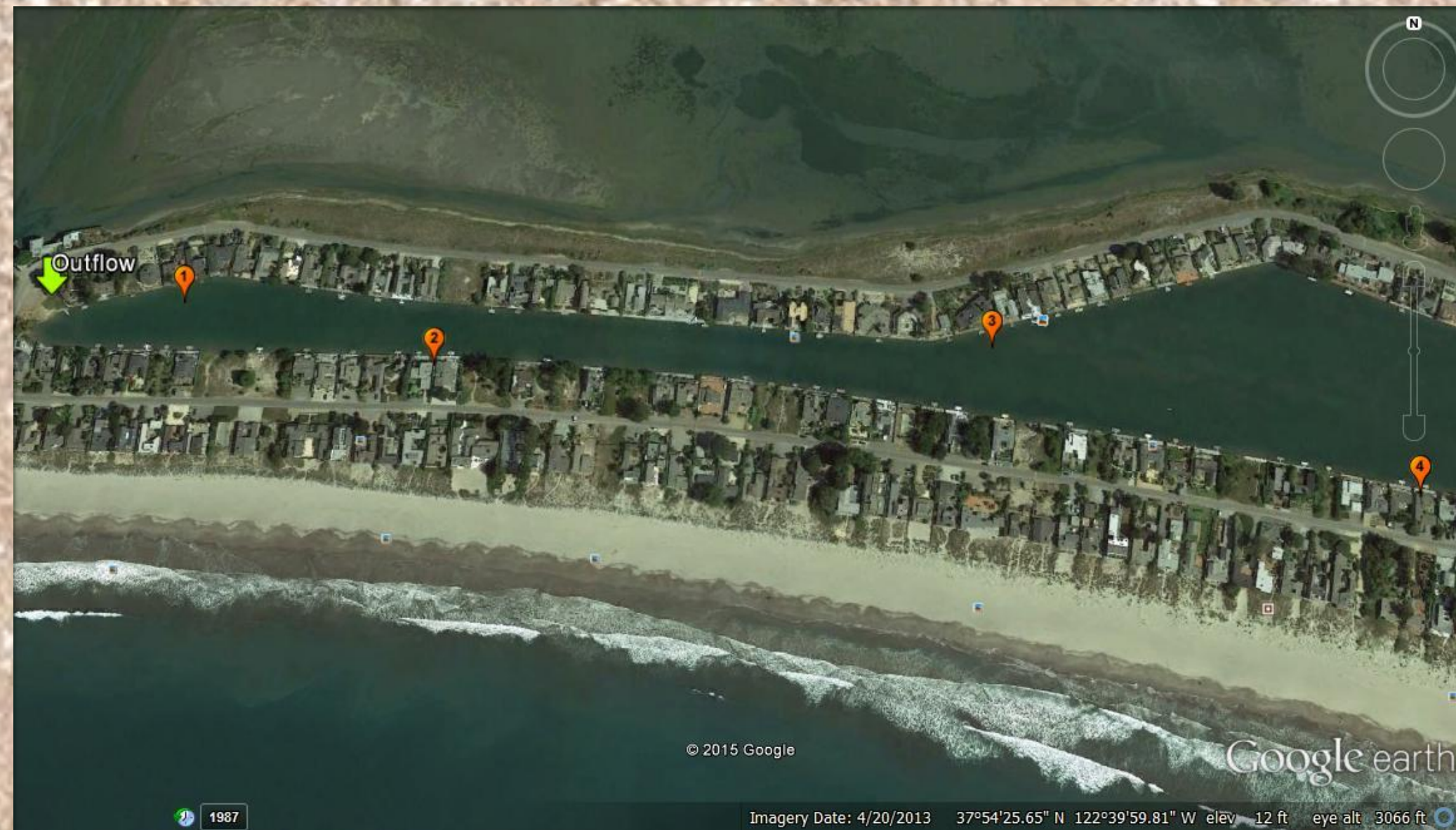


## Introduction

Since 2009, trapping efforts have sought to reduce the population of the invasive European green crab *Carcinus maenas* in Seadrift Lagoon. Data on captured gravid females and juvenile crabs (<32mm), compared with annual population estimates, help explain developmental timing and improve management plans in this species' non-native range.

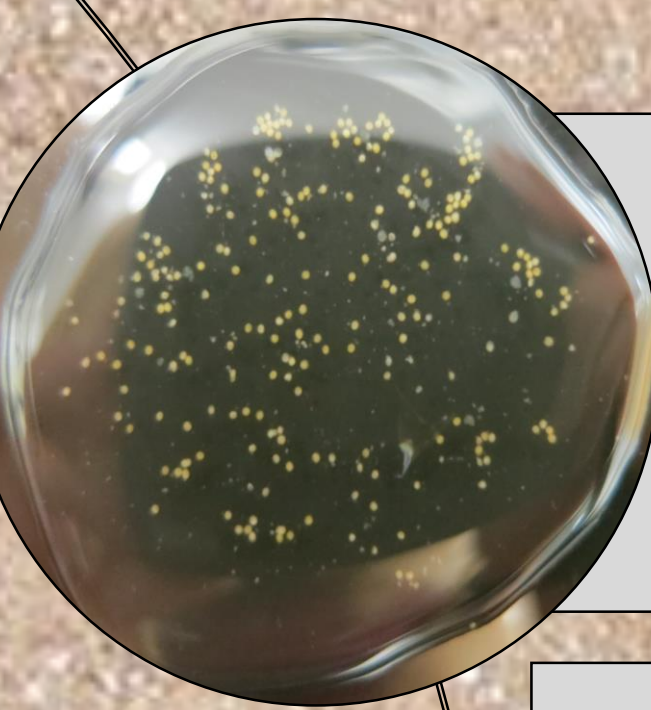


European green crabs can outcompete native species for food and habitat space throughout the San Francisco Bay.



Seadrift Lagoon is a manmade enclosure of Bolinas Lagoon, located immediately north of Stinson Beach, California.

## Methods

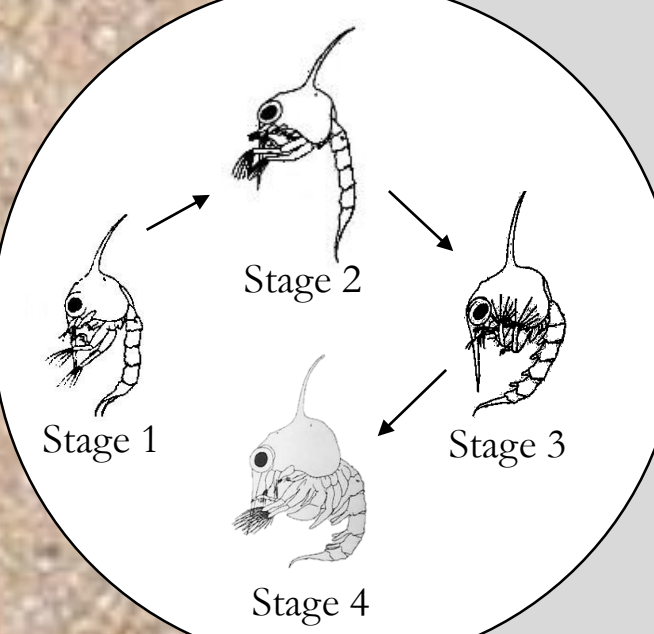


### Egg counts

Eggs were removed from preserved gravid (egg-carrying) females captured in July 2015, rinsed in a bleach solution to separate the strands, and counted by extrapolation from 1-mL aliquots.

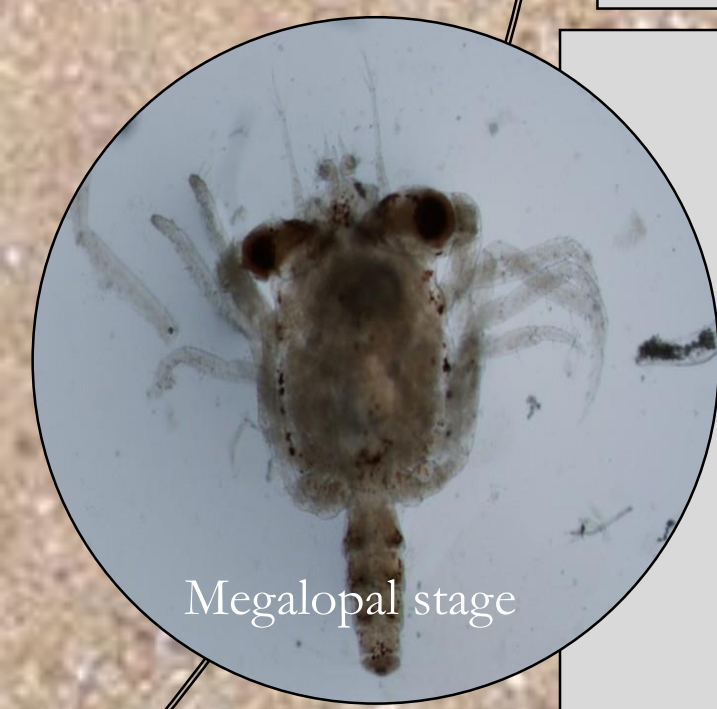
### Larvae sampling & abiotic conditions

16 plastic pot scrubbers, which mimic natural substrates, were attached to PVC poles throughout 4 sites around Seadrift Lagoon. Every 3-4 days, scrubbers were collected in small water samples and replaced. Salinity, temperature, and dissolved oxygen content were recorded. Samples were examined for zoea (planktonic larvae) and megalopae (benthic settlers) under a dissecting microscope.



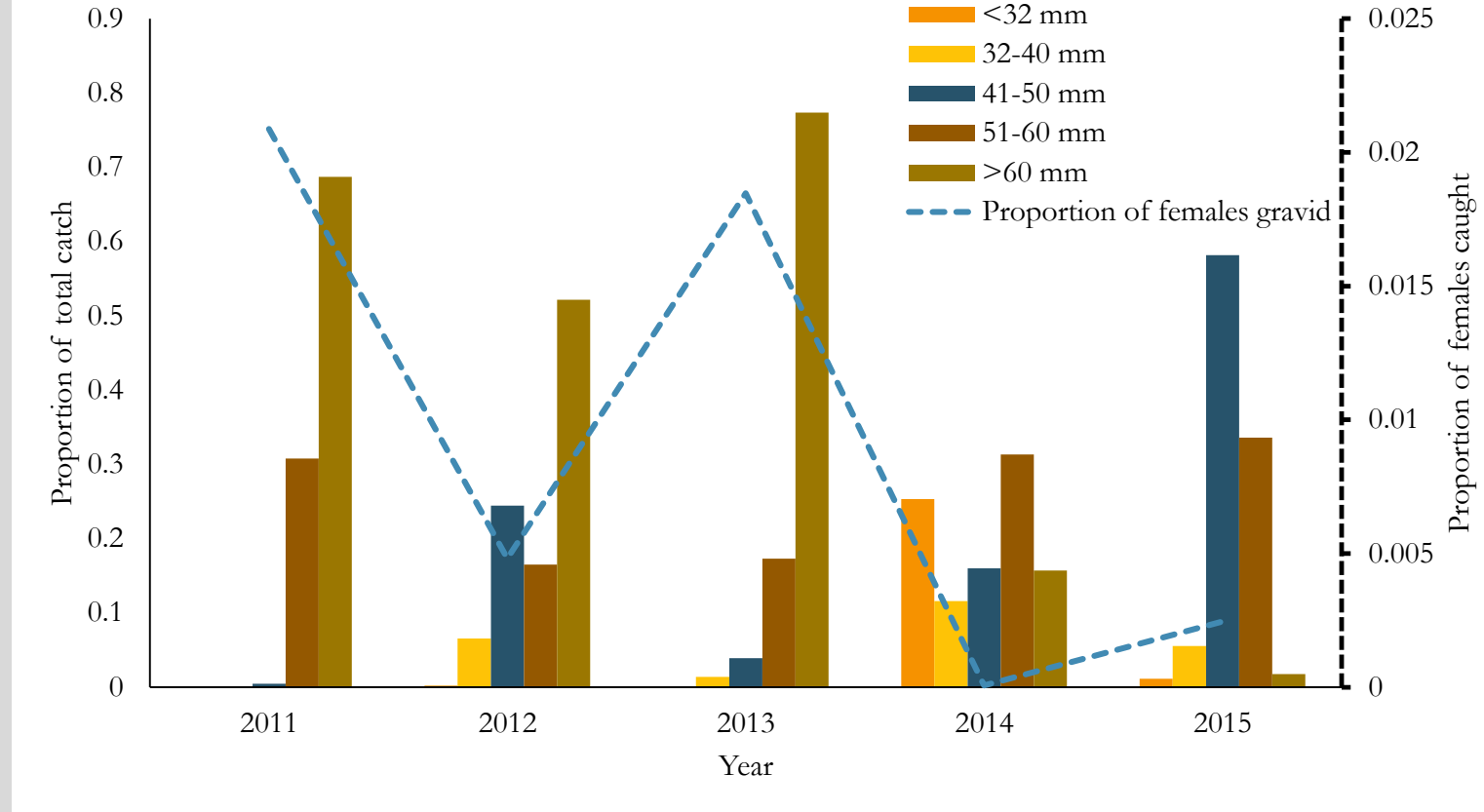
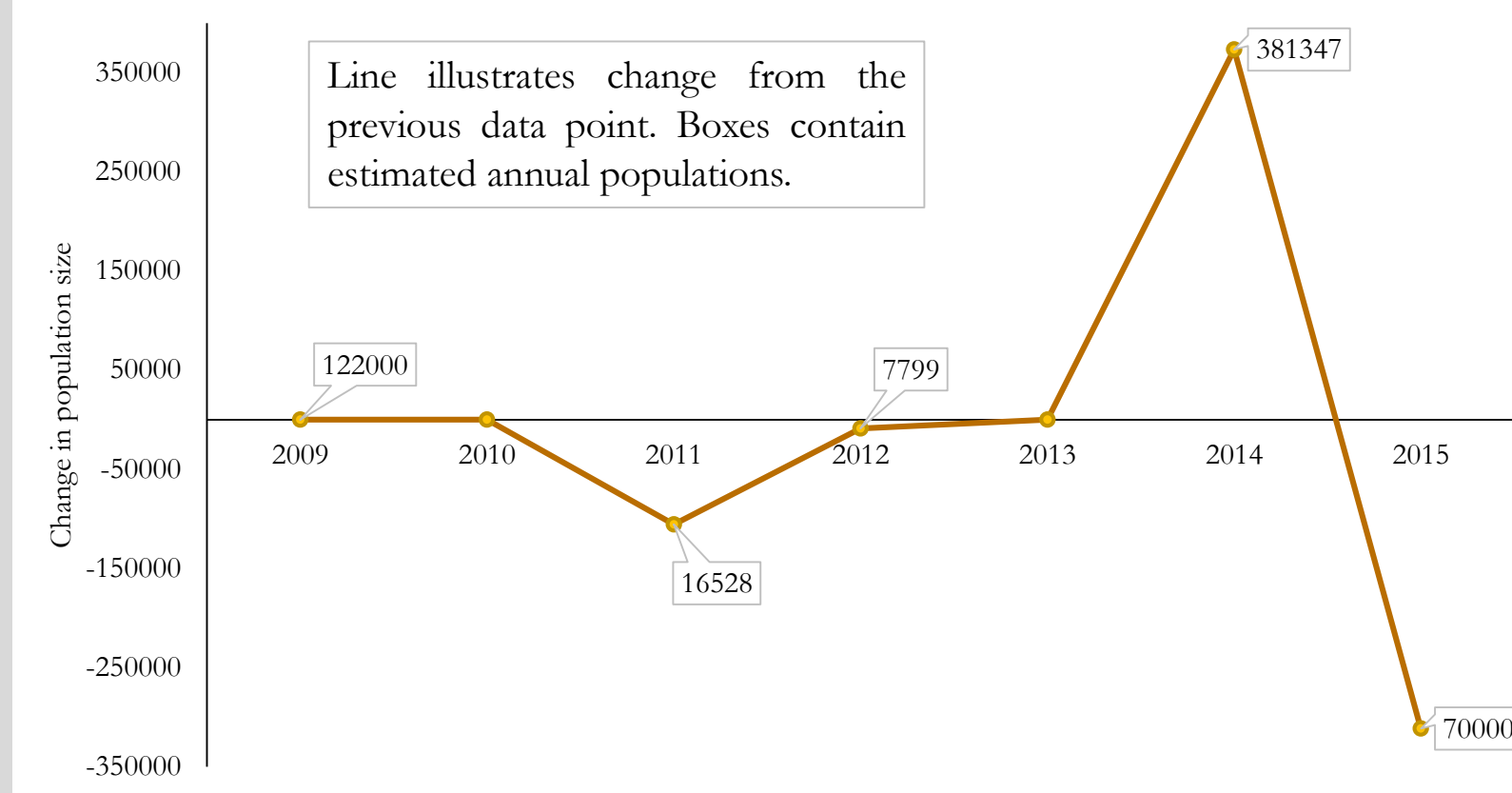
### Capture records

Counts and sizes of gravid females were gathered from 2009-2015 annual trapping data. Counts were separated by date to develop timelines for high rates of reproduction within this closed population. Aggregate data from each year was also analyzed for demographic structure.

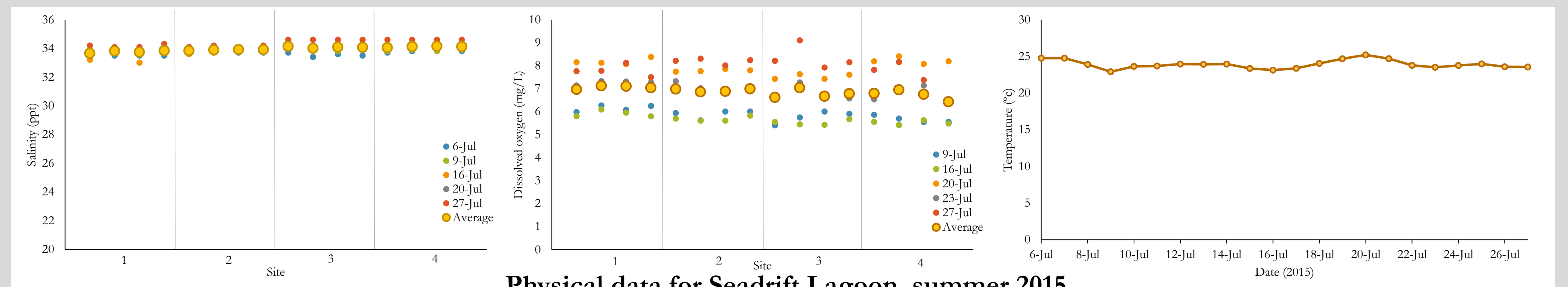


## Results

In 2015, egg counts yielded an average of 30,000 eggs per gravid female (average carapace width of 49.5mm). In optimal conditions, females may carry nearly 200,000 eggs at a time.



- Population decreases (intensive trapping) from 2009-2011
- Rapid rise and climax in 2014
- Apparent crash in 2015 (little trapping)
- Higher proportion of gravid females in 2011 and 2013
- Higher proportion of smaller (younger) crabs in 2012 and 2014



- Abiotic conditions (above) are consistently within the range for successful recruitment
- No *Carcinus* zoea or megalopae were observed** within the 115 samples collected throughout the sampling period

## Conclusions

- Higher densities of gravid females precede more even distribution of size classes in annual surveys, i.e. greater proportions of young individuals appear the year after more gravid females are present.
- The dramatic natural decrease in population size and lack of observed larvae in summer 2015 suggests a density-dependent resource, such as **food supply for new recruits, may be scarce or exhausted.**
- Intraspecific predation may be occurring** within this population, reducing the number of young and larval crabs. Predation from other species may also influence abundance.
- The **timing of samples may not have coincided with high larval densities** due to delayed development (lack of food) or otherwise altered recruitment timelines. Further study with alternate methods such as light traps may be helpful for detecting *Carcinus* larvae.

## Acknowledgements

Generous support and resources were provided through the Cal Poly STAR Program and the Smithsonian Environmental Research Center in Tiburon, CA. This project has been made possible with support from Chevron ([www.chevron.com](http://www.chevron.com)).