

NOAA FISHERIES SERVICE



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PICES

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Inter-annual variability in larval production of rockfishes (*Sebastes* spp.) in the California Current

Sabrina G. Beyer^{1, 2}, Susan M. Sogard², E.J. Dick², David
M. Stafford^{1, 2}, Lyndsey S. Lefebvre^{1, 2}, Neosha S.
Kashef^{1, 2} and John C. Field²

¹ University of California Santa Cruz, Cooperative Institute for Marine
Ecosystems and Climate, Santa Cruz, CA, USA.

² NOAA Fisheries, Southwest Fisheries Science Center, Santa Cruz, CA,
USA



Outline

Background:

- Research Questions
- Study Area
- Study Species

Methods:

- Field Collections
- Sample processing
- Historical datasets

Results

- Maternal size effects
- Female condition
- Time series of fecundity data
- Environmental correlation

Summary

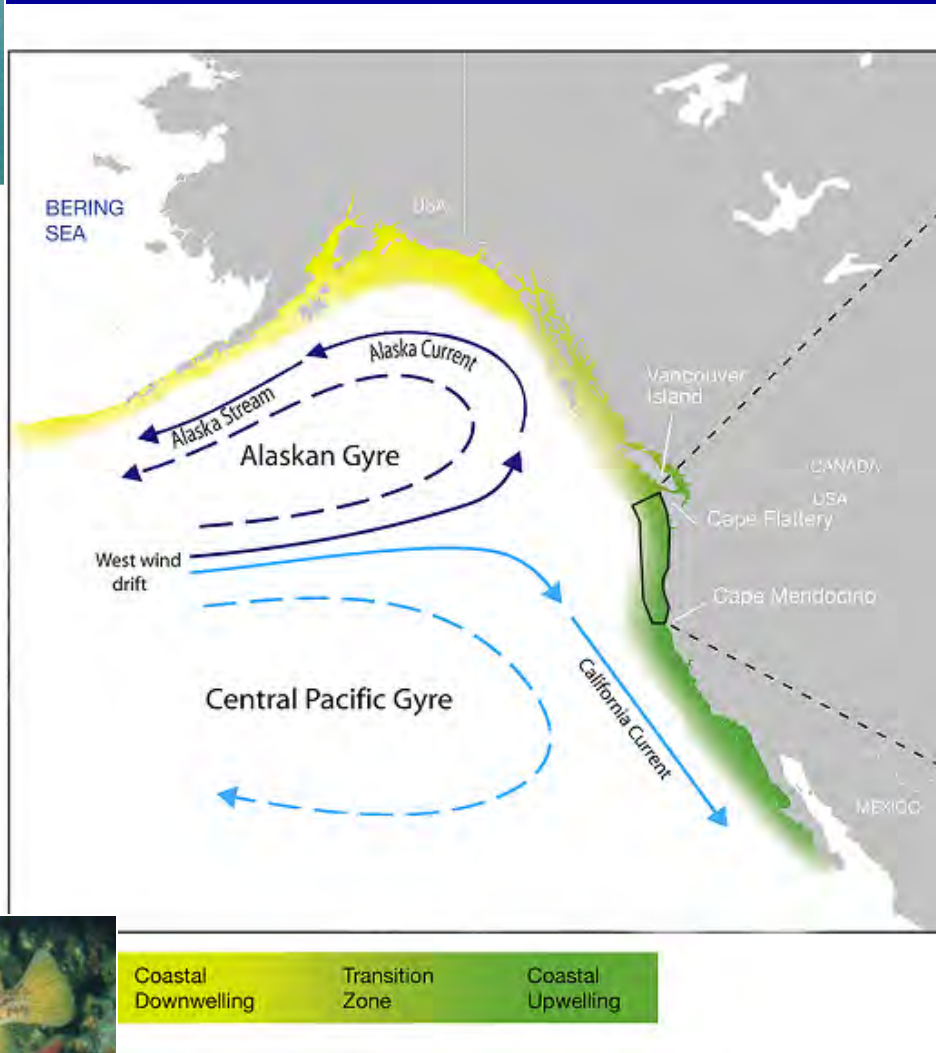


Research Questions

- What determines fecundity in rockfish?
 - Size
 - Condition
 - Environment
- Evidence of inter-annual variability in fecundity? Are there trends?
- Is there a deterministic link between ocean conditions, female condition and reproductive output and how may this be informative for population models?

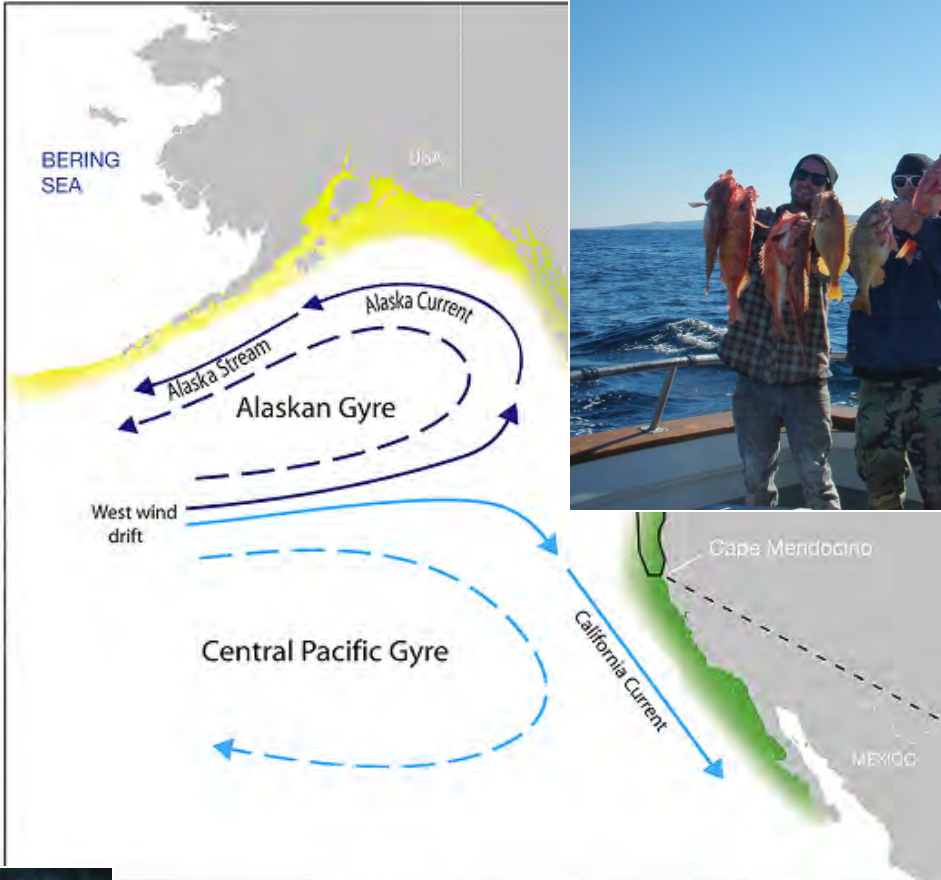


Study Area: California Current Ecosystem



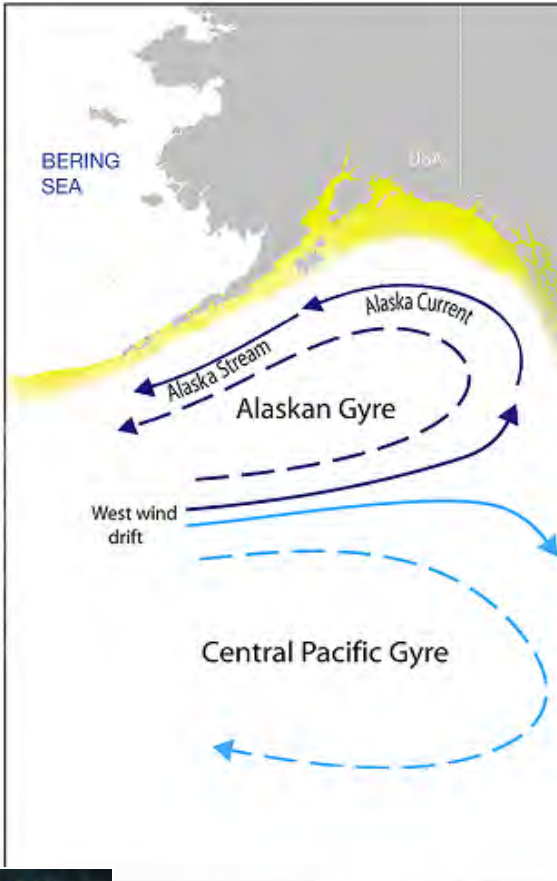


Study Area: California Current Ecosystem



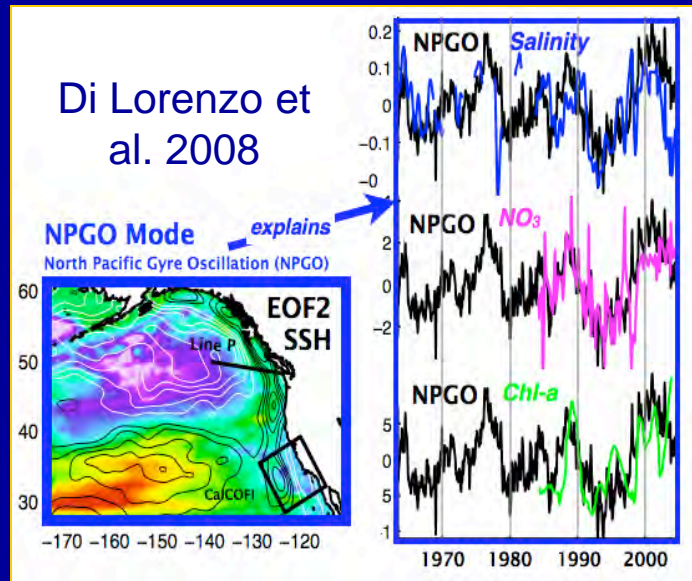
Coastal Downwelling	Transition Zone	Coastal Upwelling
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Study Area: California Current Ecosystem



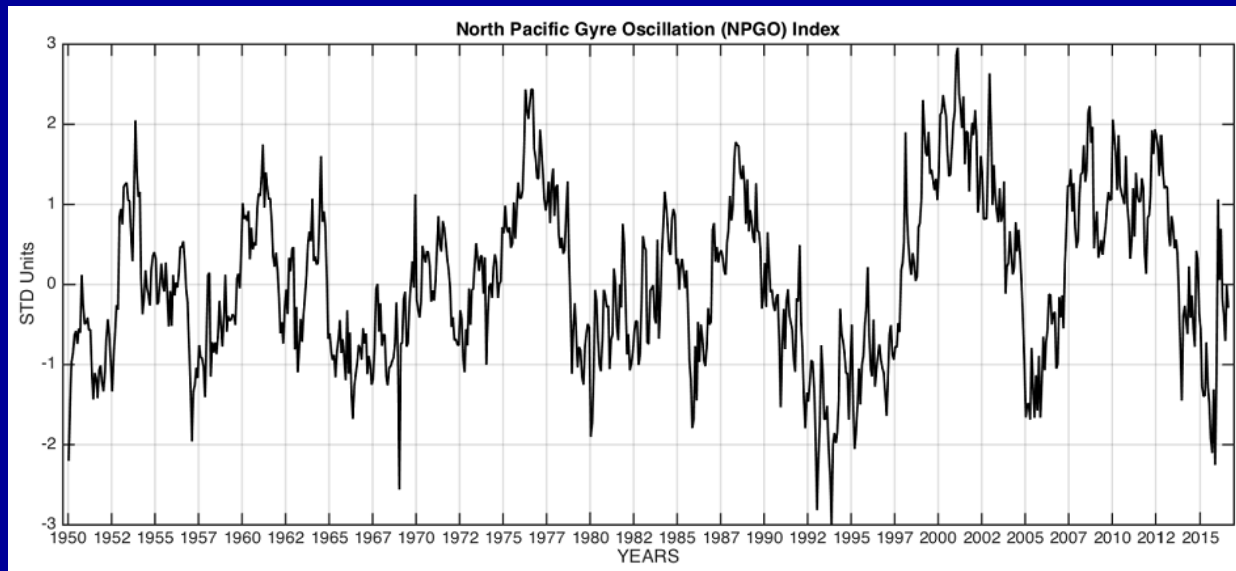
Coastal Downwelling Transition Zone Coastal Upwelling

California Current: Oceanographic variability



North Pacific Gyre Oscillation (NPGO)

“Measures changes in the North Pacific gyres circulation and explains key physical-biological ocean variables”



Background: Study species



Yellowtail Rockfish
(*Sebastes flavidus*)



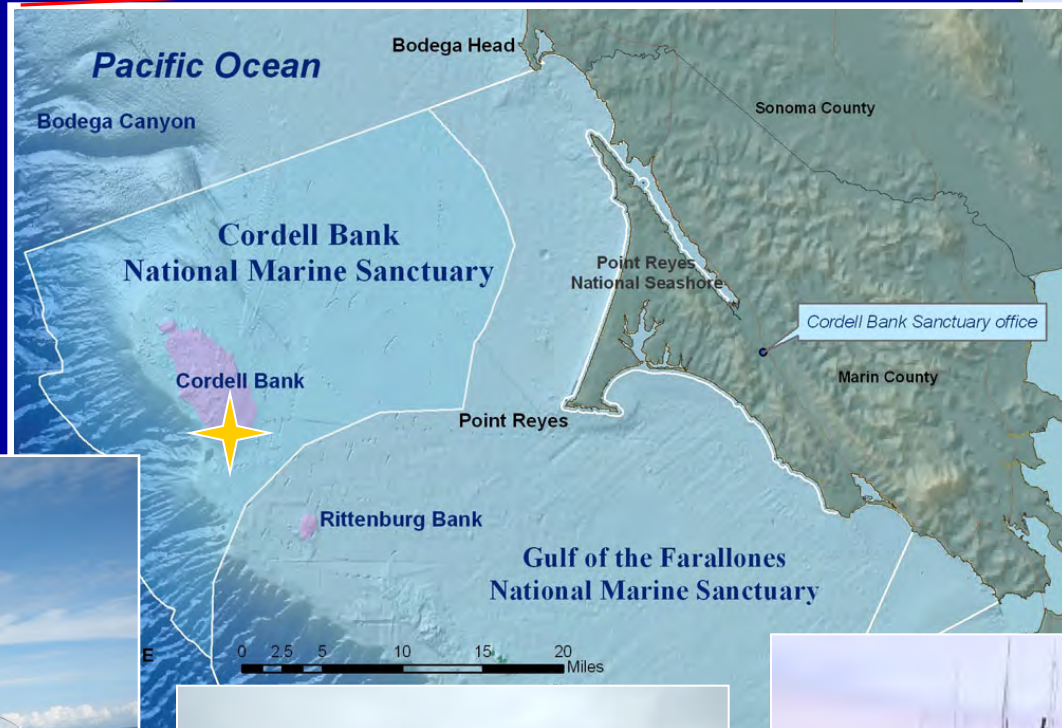
Chilipepper
(*Sebastes goodei*)

Hypothesis

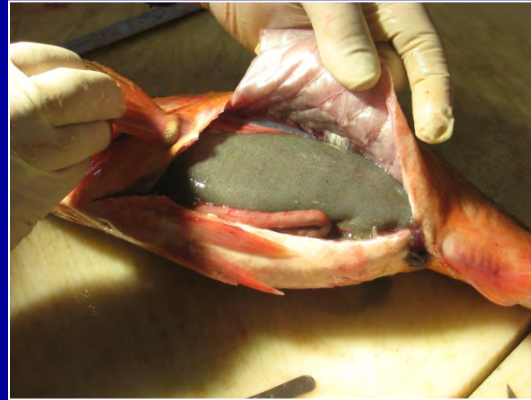
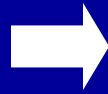
Female condition and reproductive output will increase in years of high ocean productivity and decrease in years of low productivity



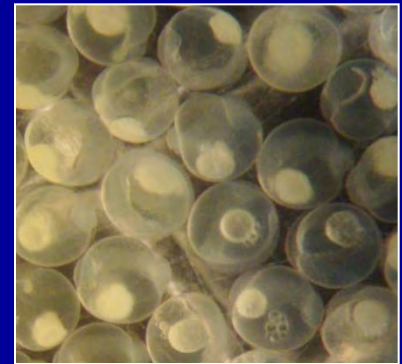
Methods: Field Collections



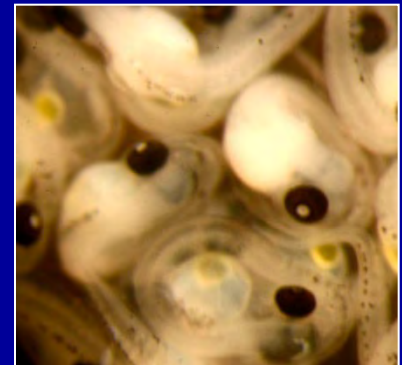
Methods: Sample Processing



Unfertilized



Fertilized

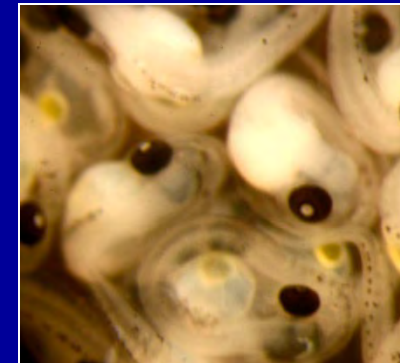
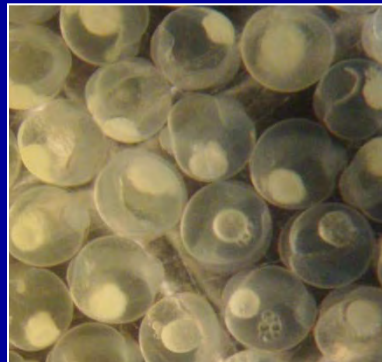


Eyed-larvae

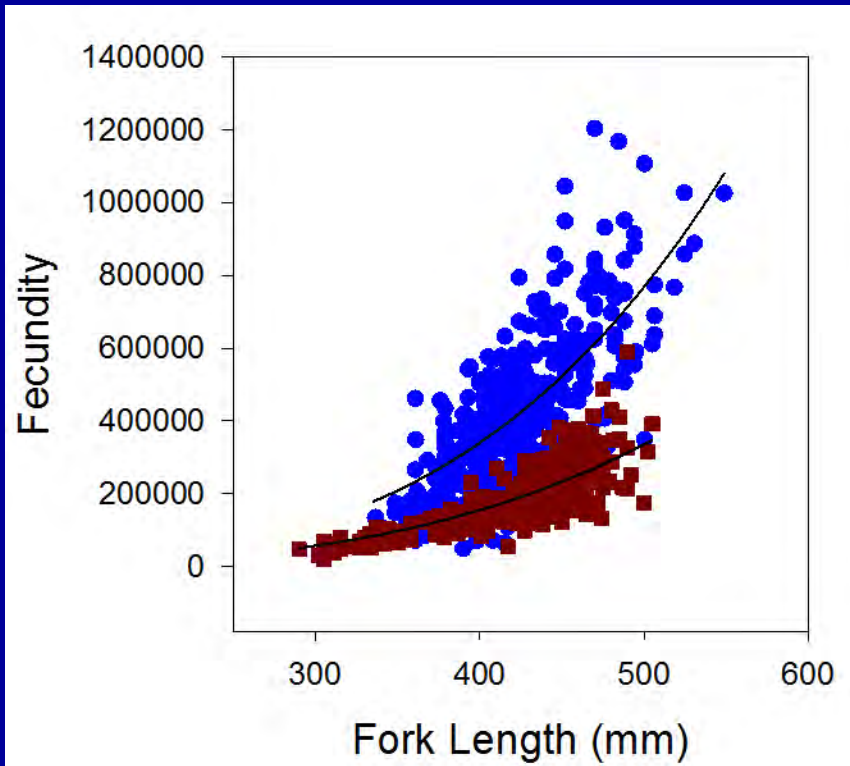
- Length
- Weight
- Liver (hepato-somatic index)
- Otoliths (age)
- Fin clip (genetics)
- Gonads (sex, maturity, stage, fecundity)

Methods: Combining Historical Datasets

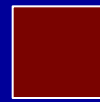
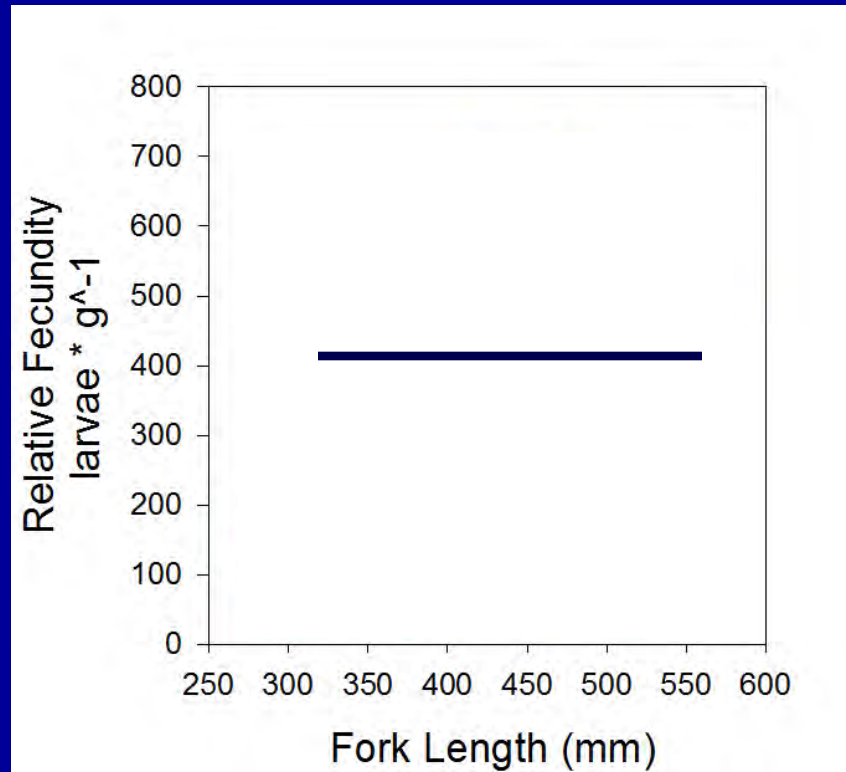
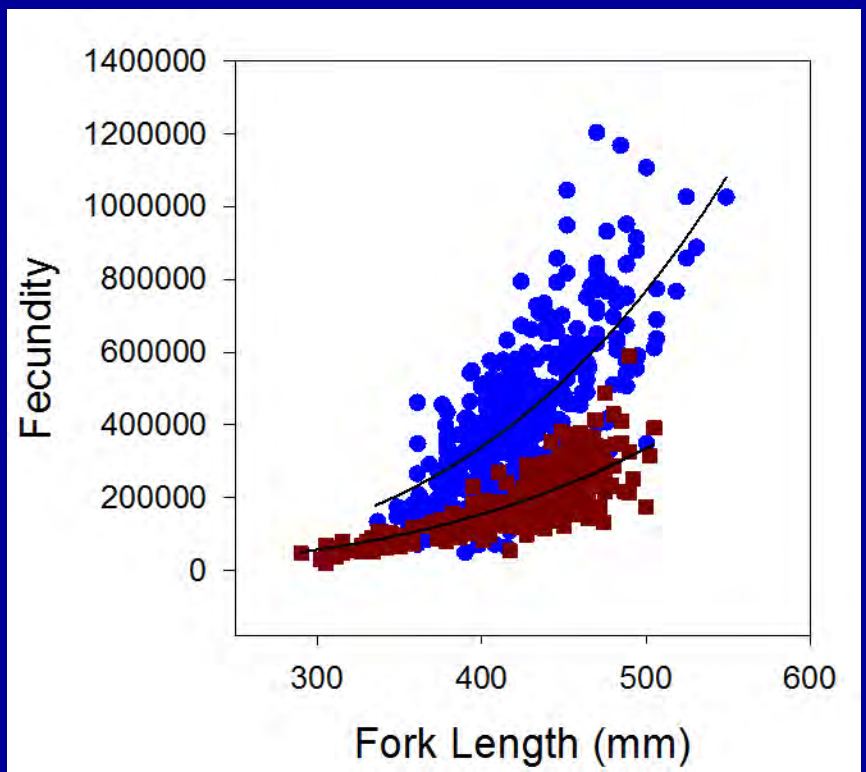
Years	2013-2016	2009-2012	2005-2007	1985-1991
Source	Current study	Beyer et al. 2015	Stafford et al. 2015	Eldridge and Jarvis 1995
Species collected	Chillipepper Yellowtail Others	Chillipepper Yellowtail Others	Chilipepper Yellowtail Others	Yellowtail



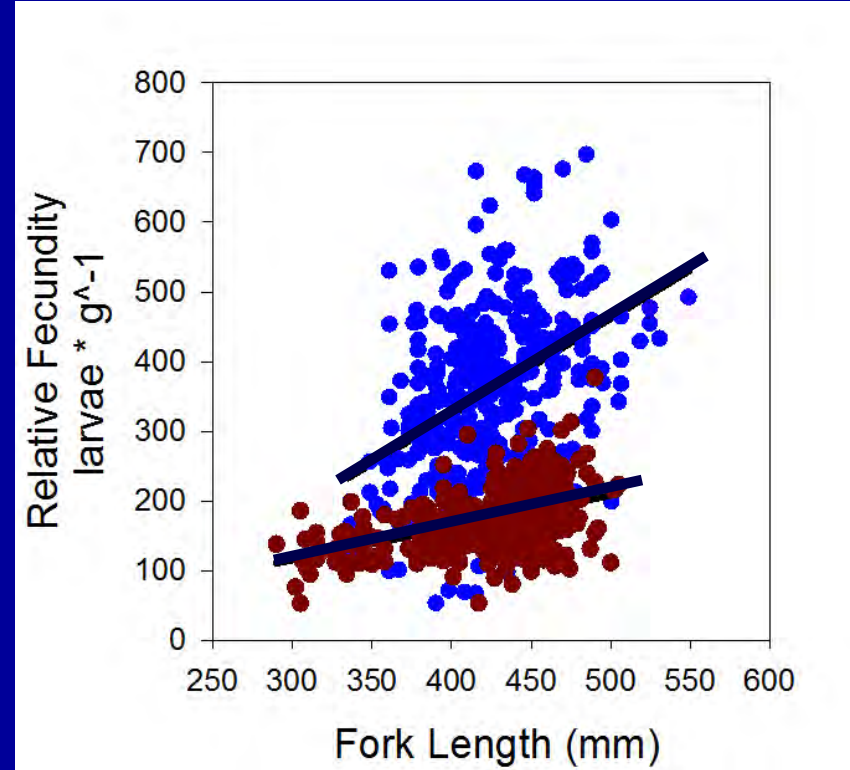
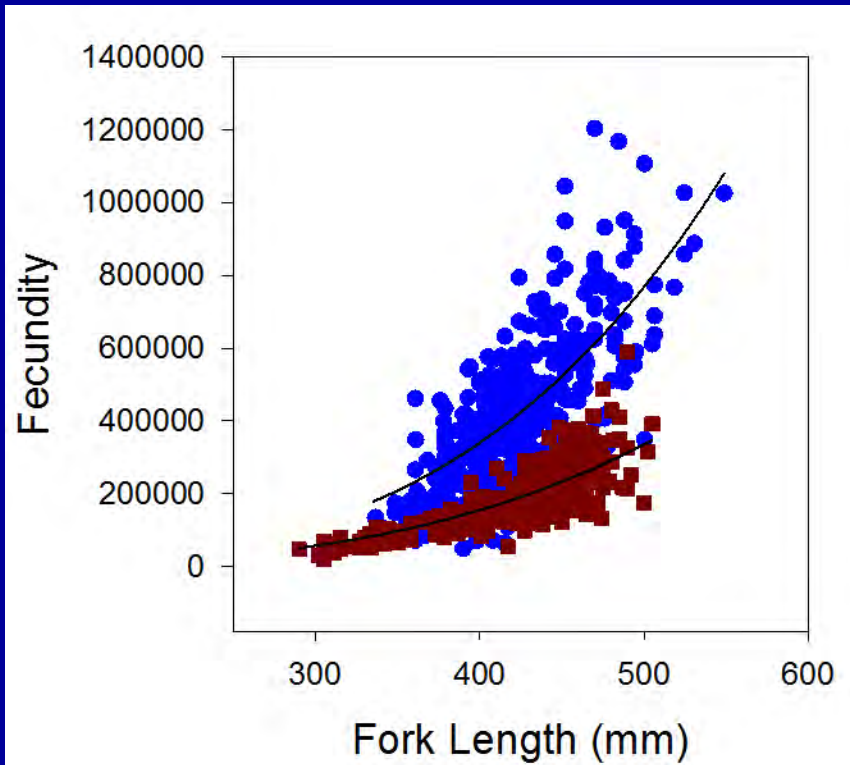
Results: Fecundity



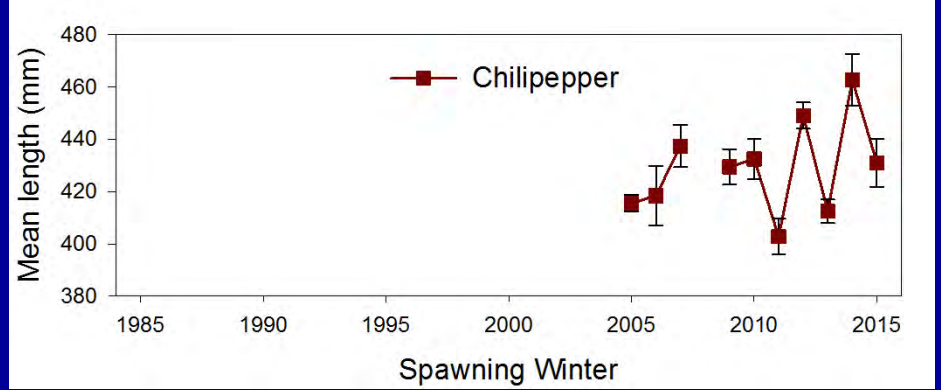
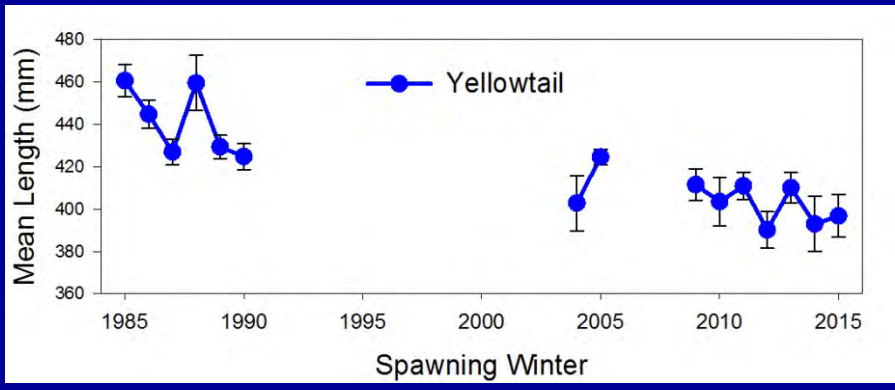
Results: Fecundity



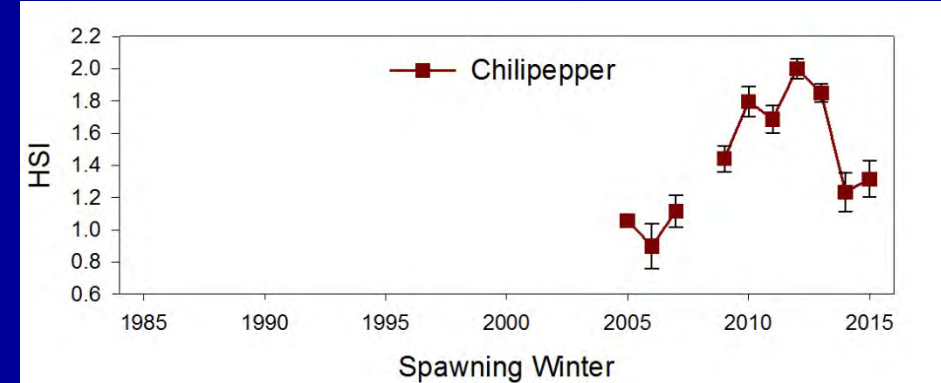
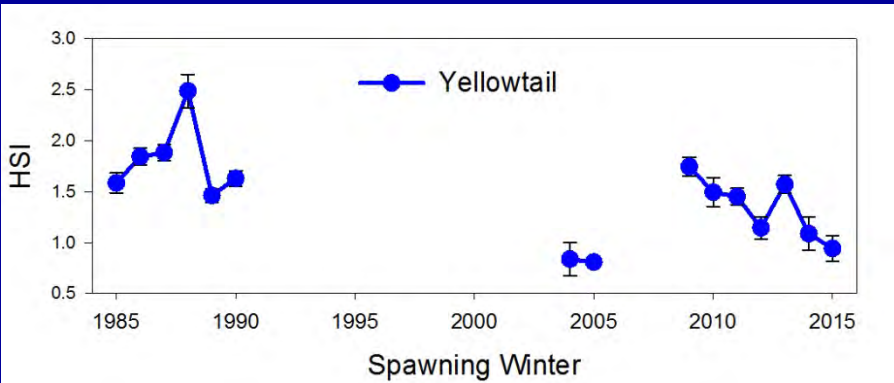
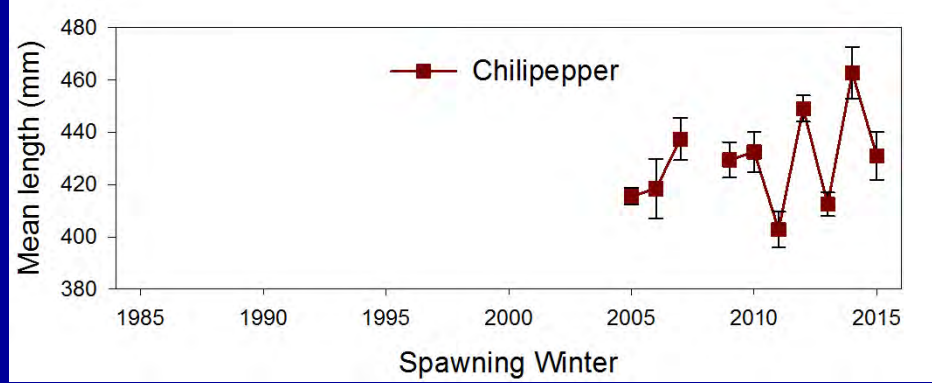
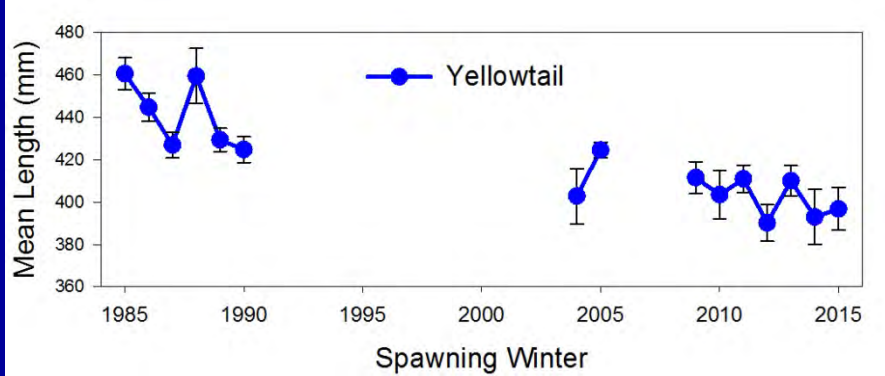
Results: Fecundity



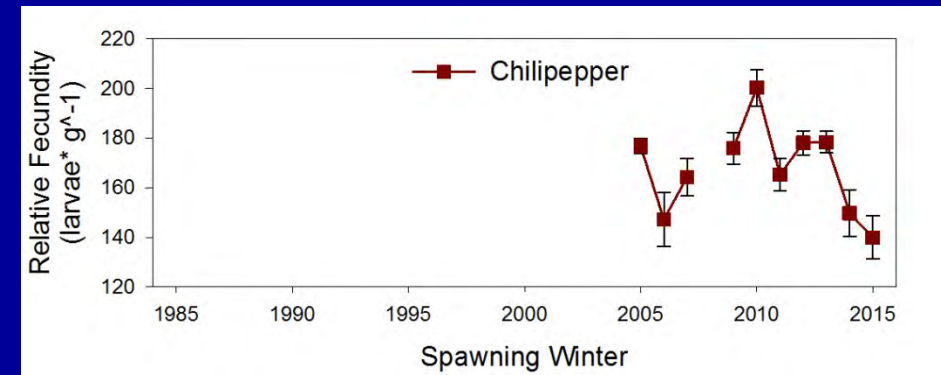
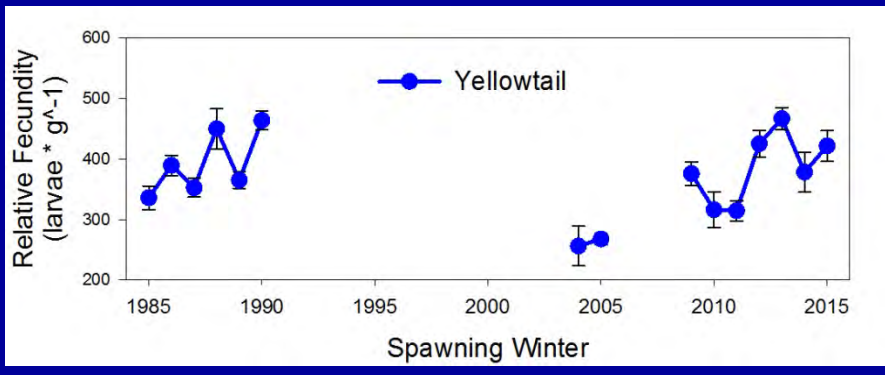
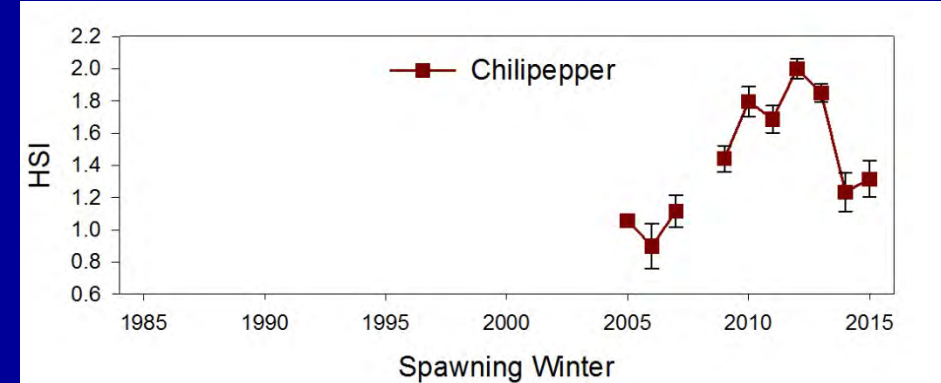
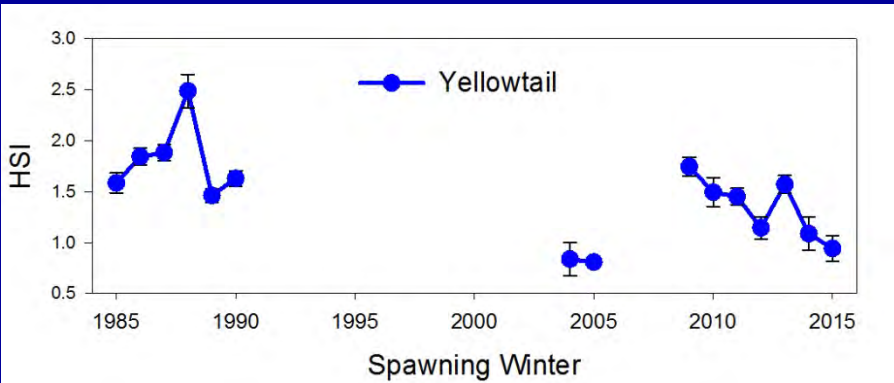
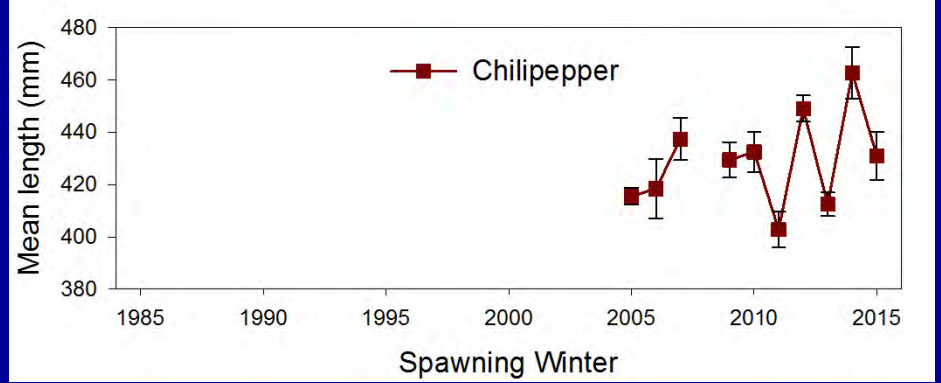
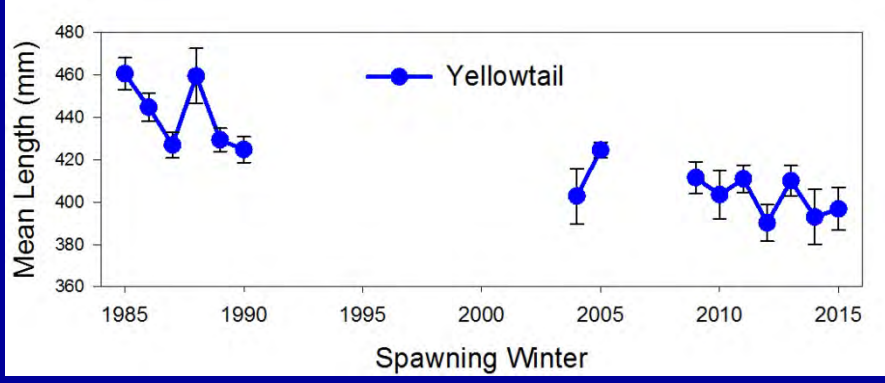
Results: Time series



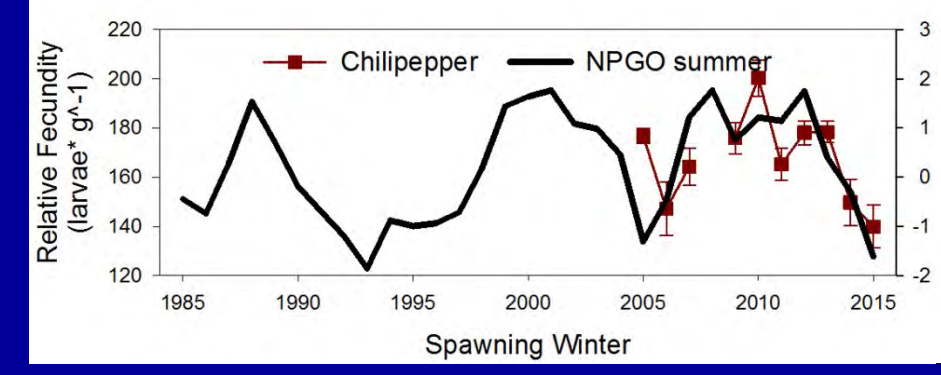
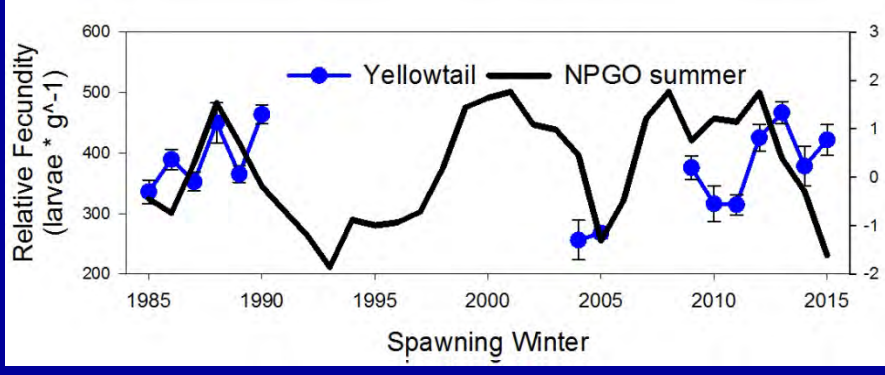
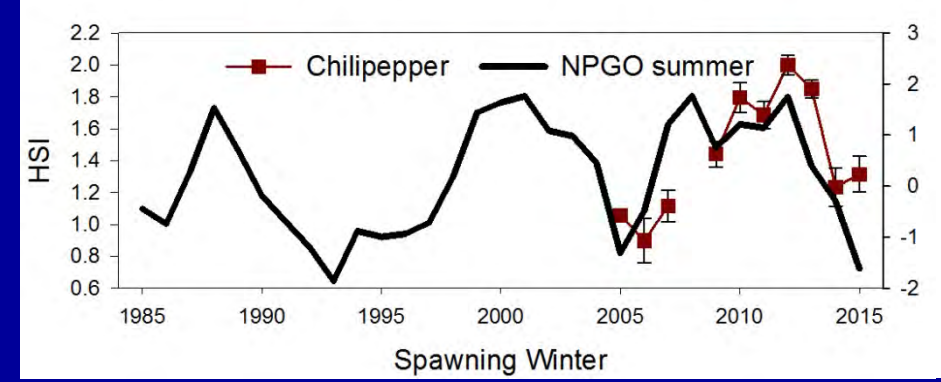
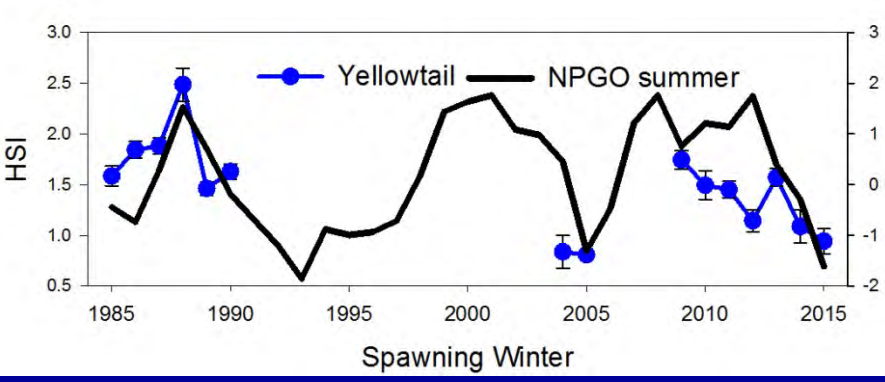
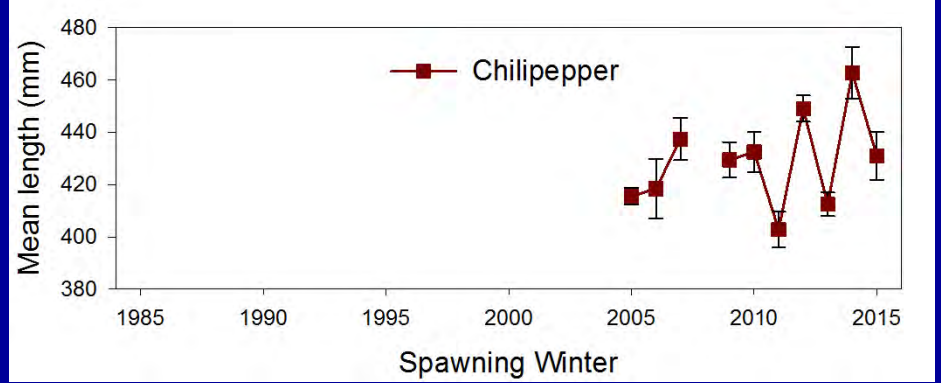
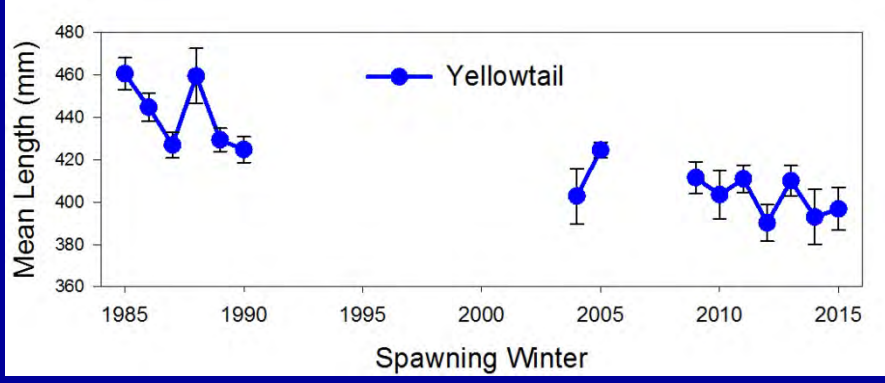
Results: Time series



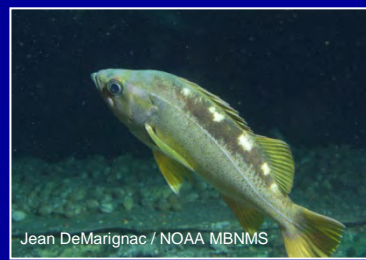
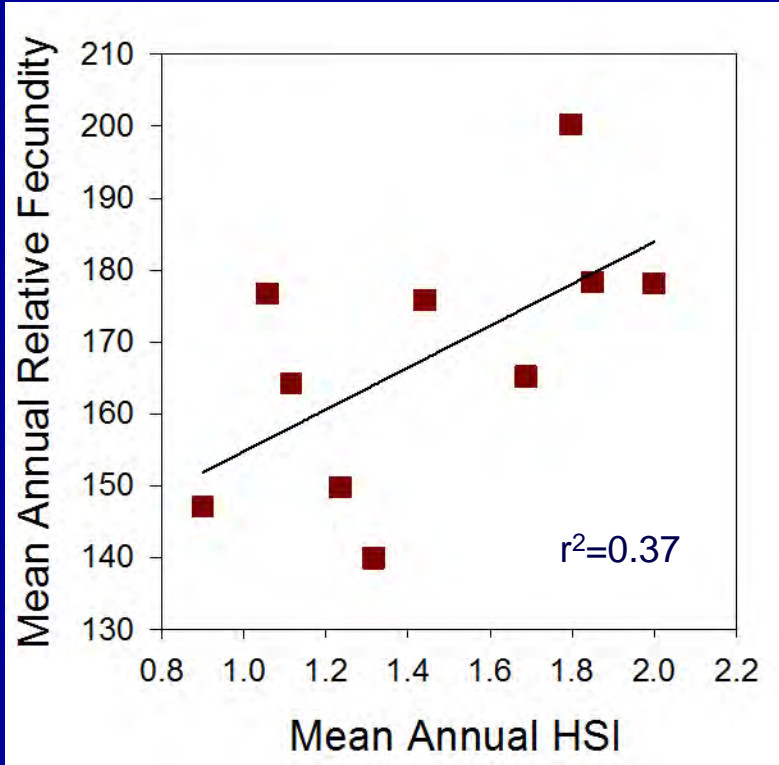
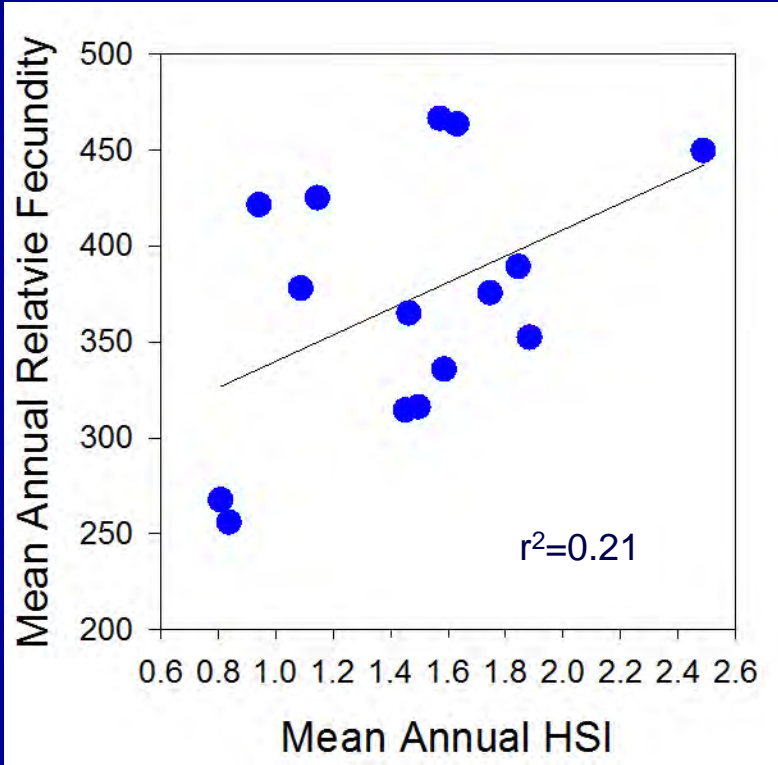
Results: Time series



Results: Time series



Results: Female condition and relative fecundity





Model Results

Relative fecundity ~ Length + Condition + Gonad Stage + Year



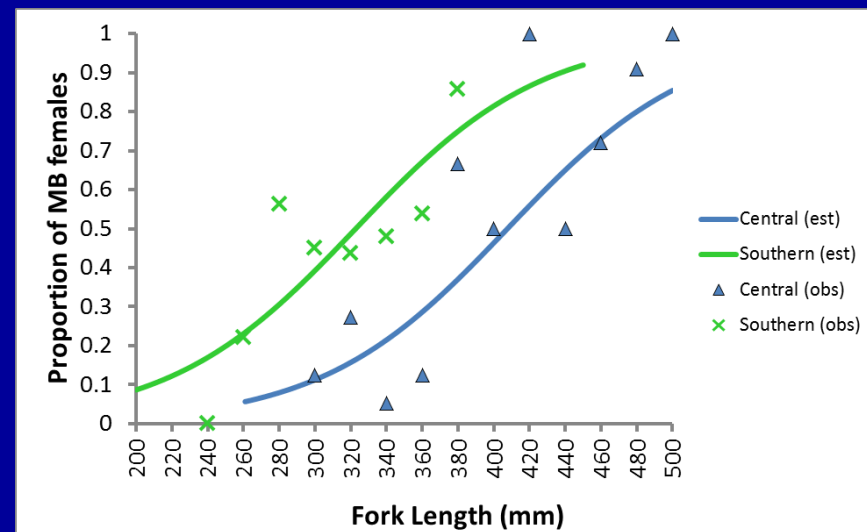
Model Results

Relative fecundity ~ Length + Condition + Gonad Stage + Year

Effect	Yellowtail	Chilipepper
Length (p-value)	<0.001	<0.001
H S I (p-value)	<0.001	<0.001
Stage (p-value)	<0.001	<0.001
Year (p-value)	<0.001	<0.001
r^2	0.52	0.35



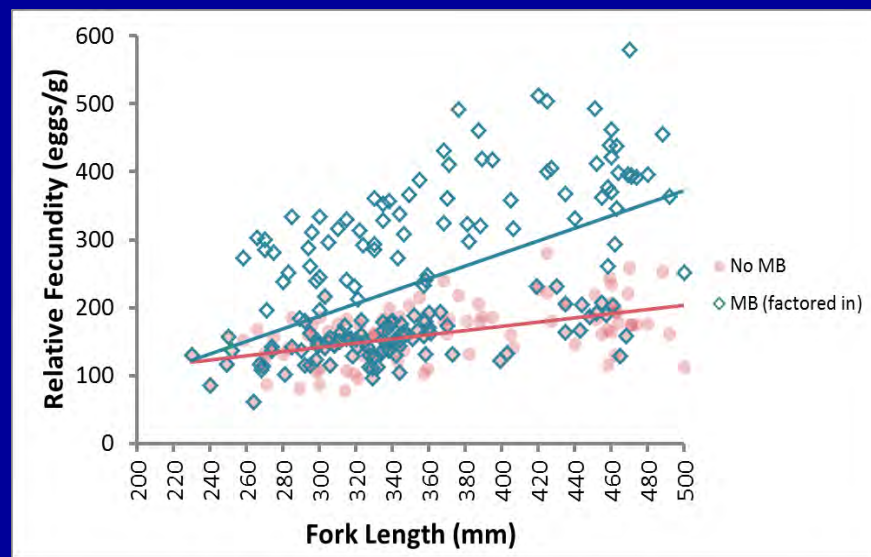
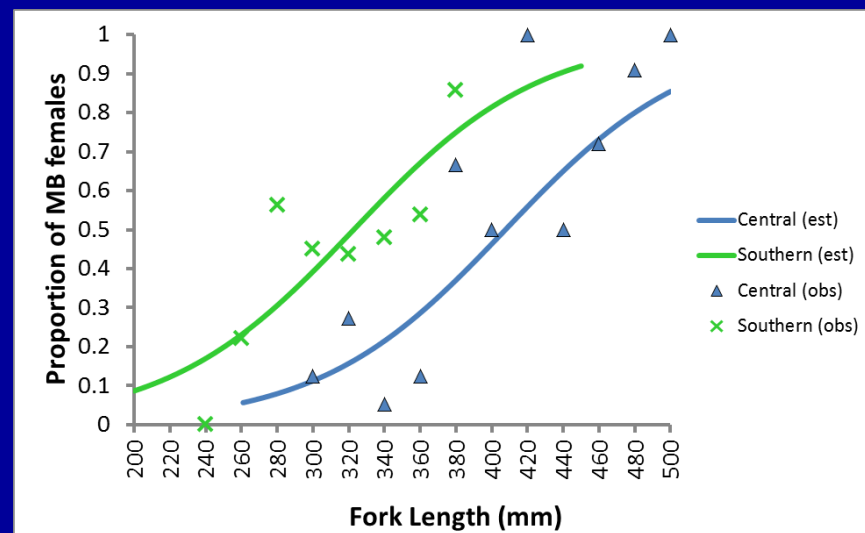
Multiple broods



Lefebvre et al. poster



Multiple broods



Lefebvre et al. poster

Summary

- Larger females produce disproportionately more young; maternal size effect differs by species
 - Explore multiple broods
- Variability in female condition and relative fecundity in time series data of fish from Cordell Bank (Central California)
 - 15 years of data for Yellowtail Rockfish
 - 10 years of data for Chilipepper
- Females that are in better condition have increased fecundity
 - Further work to explore aspects of condition
- Inter-annual differences in female condition and fecundity likely related to environmental variability
 - Further work to explore local and regional oceanographic variability at Cordell Bank



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Moss Landing Marine Labs
Cordell Bank National Marine Sanctuary

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