ATTRIBUTE OF THE EUROPEAN GREEN CRAB IN SALEM SOUND, MASSACHUSETTS, USA

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1865 THE UNIVERSITY OF MAINE

GREEN CRAB R&D

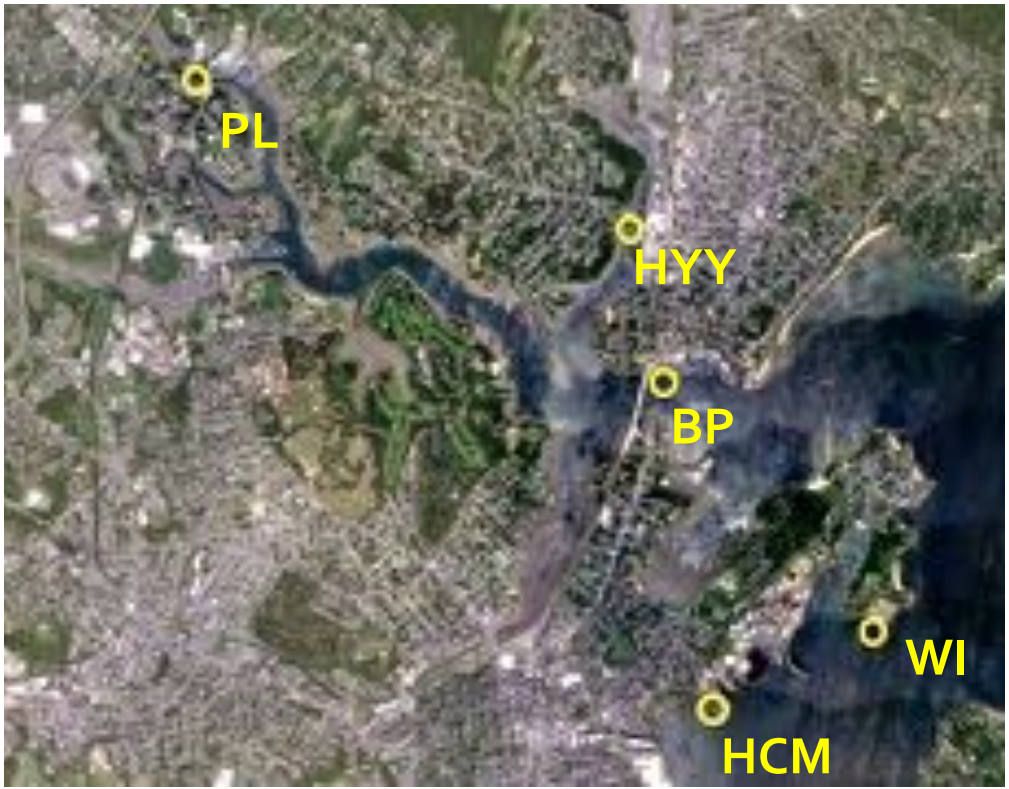
Salem STATE UNIVERSITY

TOPICS COVERED

- GREEN CRAB TRAPPING SURVEY (2013-2016)
- ADVANCEMENTS IN VENTRAL COLORATION AS BIOINDICATOR
- OPTIMAL TRAPPING AND HABITAT SUITABILITY

COLLECTING SITES

Pope's Landing (PL)
Hill's Yacht Yard (HYY)
Beverly Pier (BP)
Winter Island (WI)
Hawthorne Cove Marina (HCM)



18” x 24” x 9”
(46cm x 61cm x 23cm)

½” x 1” wire mesh
(5mm x 10mm)

3” (9cm) diameter entrance

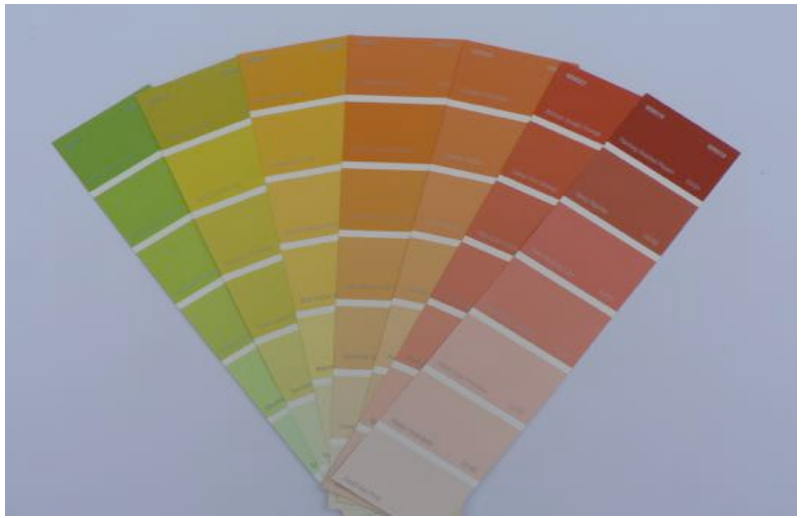
Green Crab Trap, Ketcham Supply, New Bedford, MA

bait:
various fish scraps
(swordfish, salmon, herring, etc.)

monthly samples

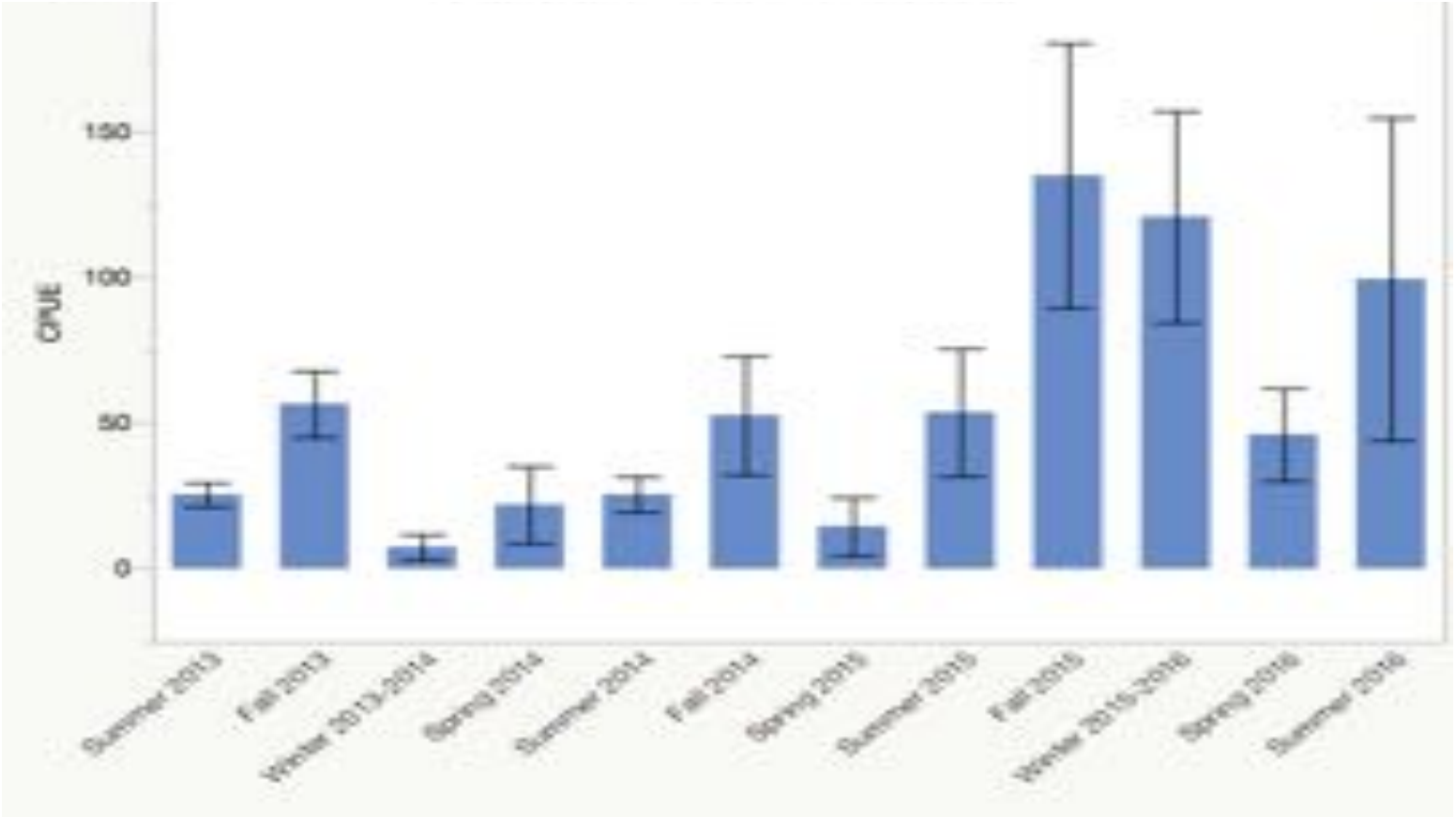
ATTRIBUTES MEASURED

- CARAPACE WIDTH
- SEDIMENT PREFERENCE
- SALINITY
- TEMPERATURE
- VENTRAL COLOR
- SEX
- GRAVIDNESS
- FOULING
- OPTIMAL TRAPPING
- DEPTH PREFERENCE
- AND MORE…

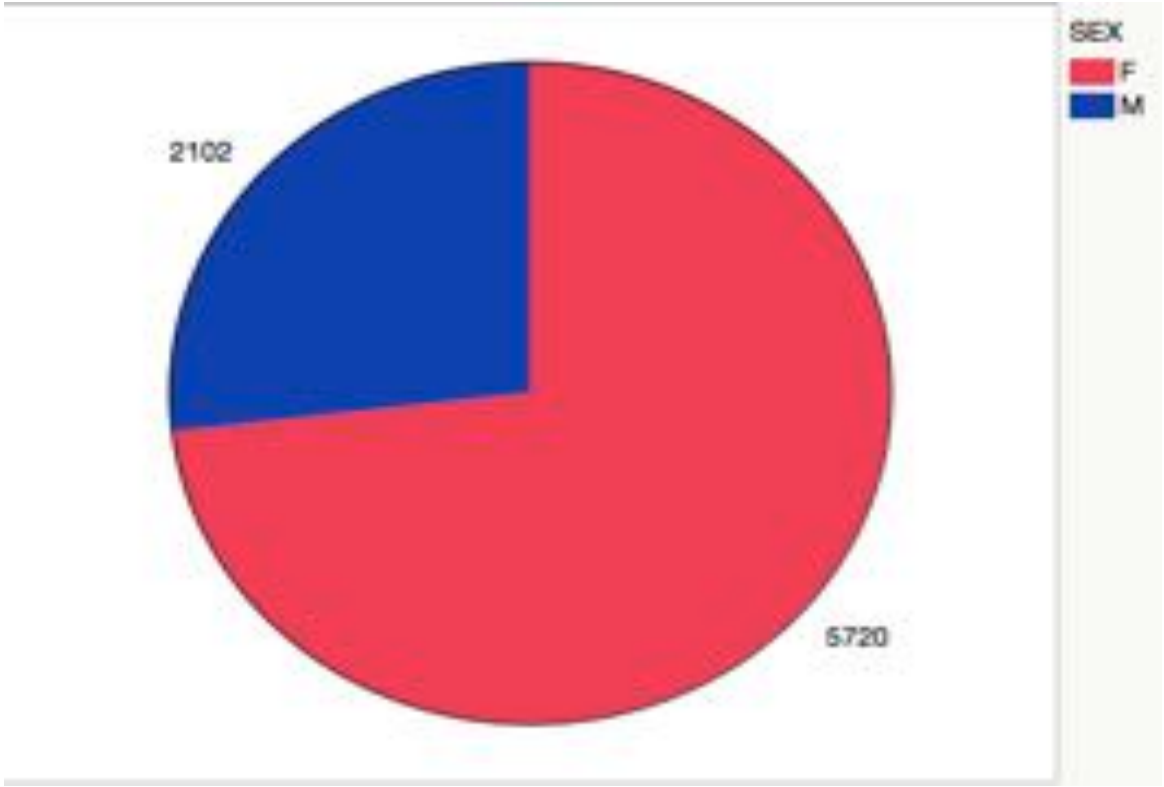


adapted from Lee, Karen T. et al. 2005. A low cost, reliable method for quantifying coloration in *Carcinus maenas* (Linnaeus, 1758) (Decapoda, Brachyura). **Crustaceana** 78 (5): 579-590.

RESULTS: CATCH PER SEASON

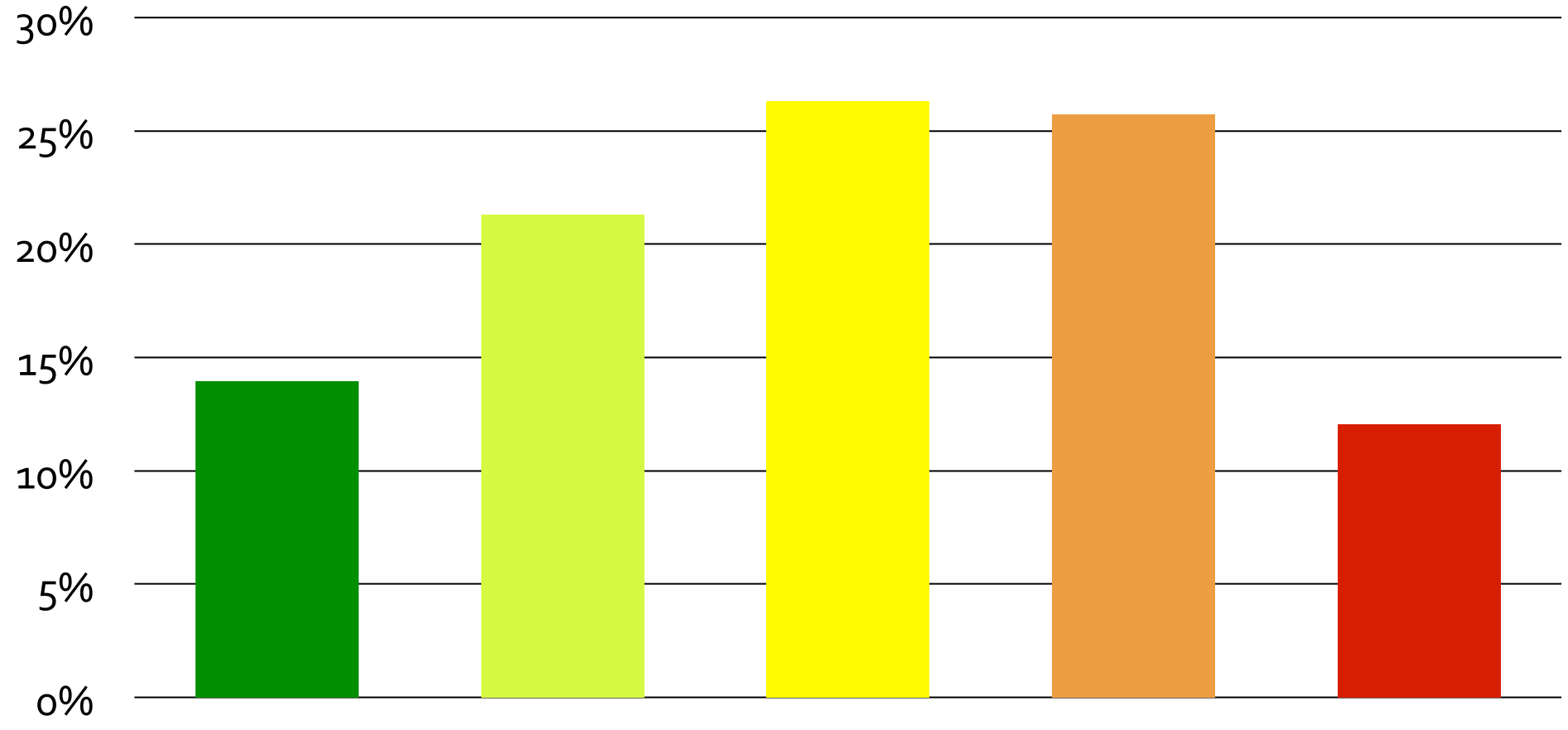


RESULTS: SEX RATIO

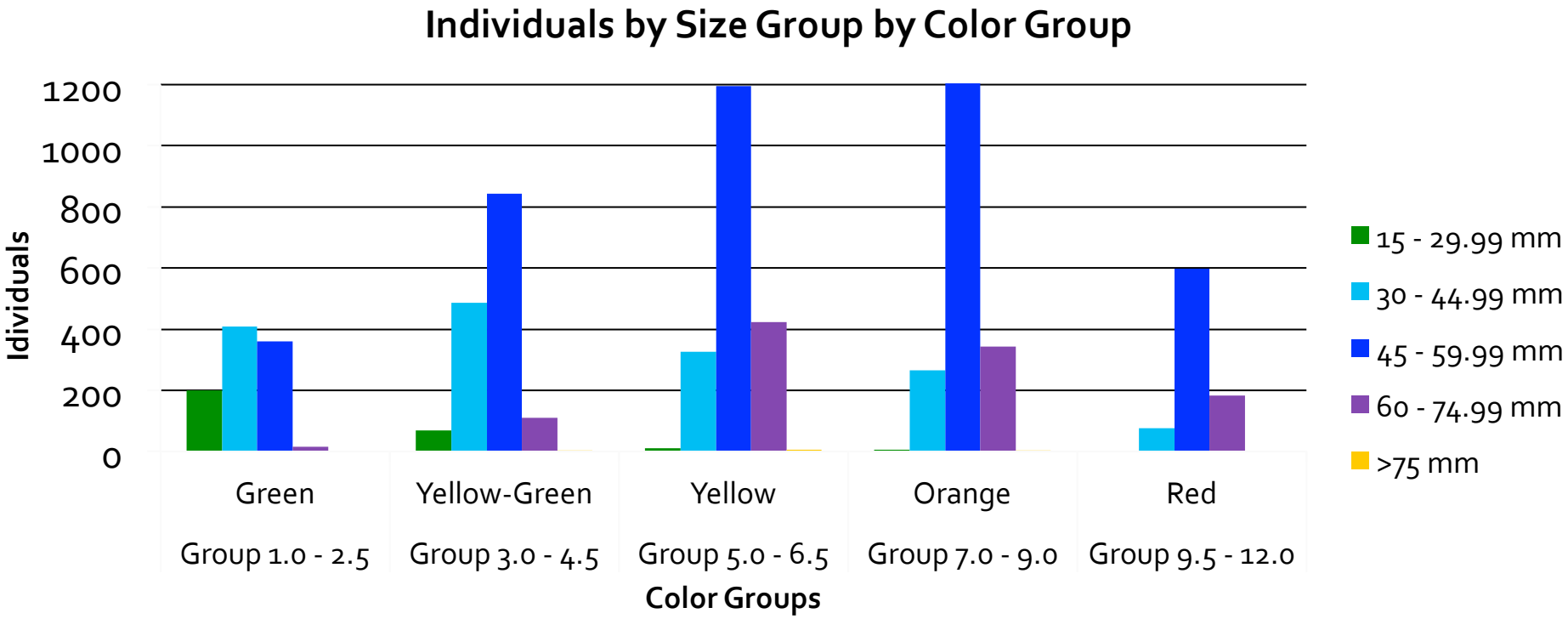


- ABOUT 75% FEMALES
- **SEX RATIOS TEND TO VARY BY REGION**

RESULTS: COLOR VARIABILITY



RESULTS: COLOR GROUP PER SIZE CATEGORY



DISCUSSION: WHY 30mm?

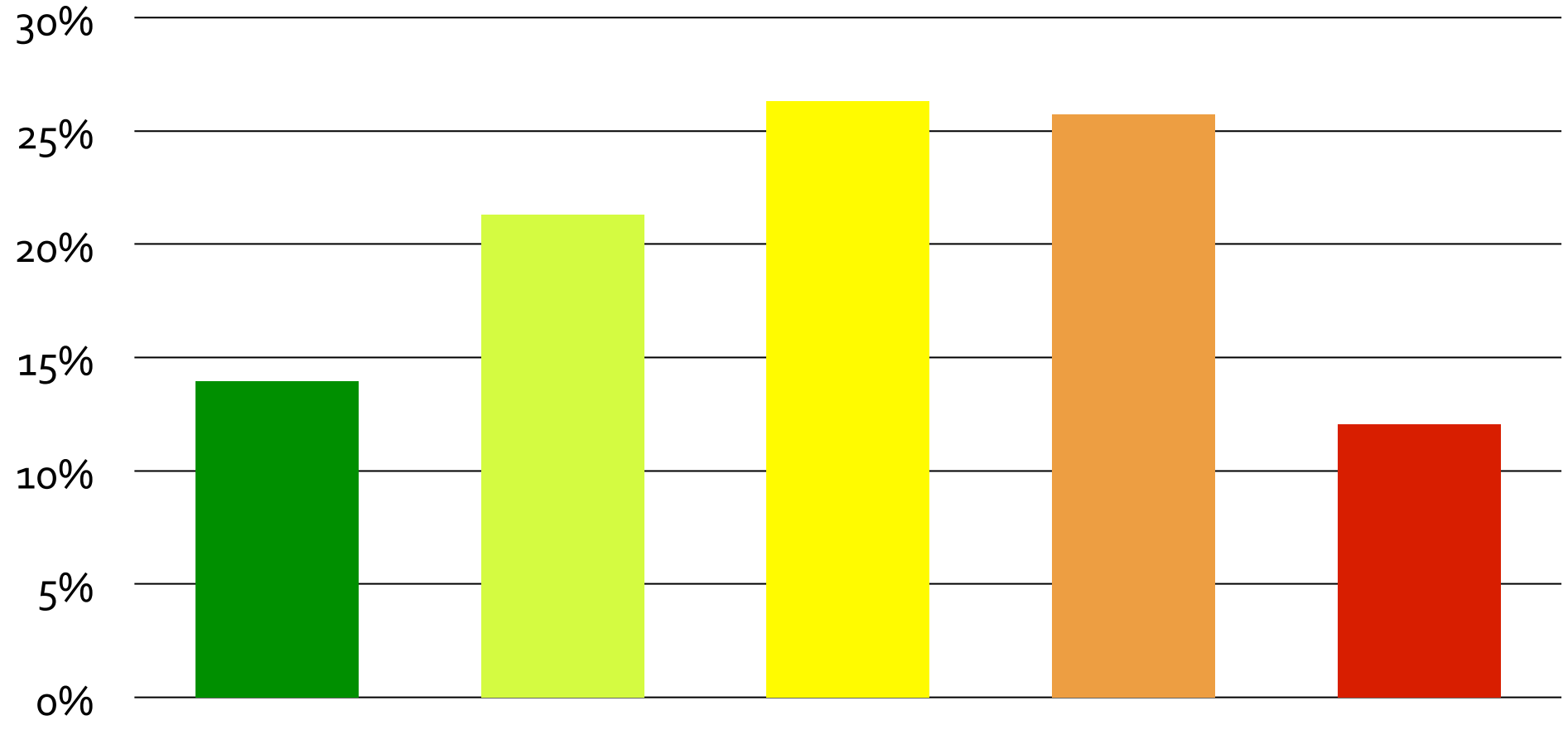
- 30mm is approx. sexual maturity (Berrill, 1982)
- Red phase = reproductive focus, Green phase = NOT

Several differences noted between two life stages

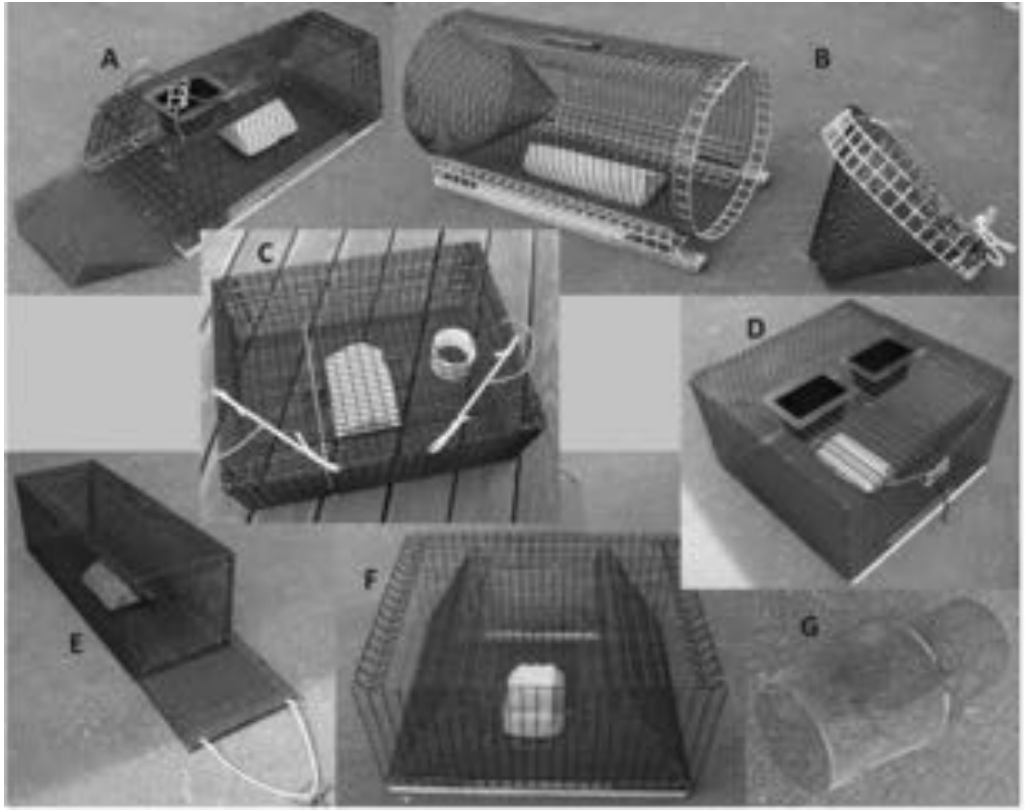
→ QUESTION: Green phase crabs and Red phase crabs are in different life stages, but what about yellow?

“Yellow Phase” proposed as an intermediate life stage

RESULTS: COLOR VARIABILITY

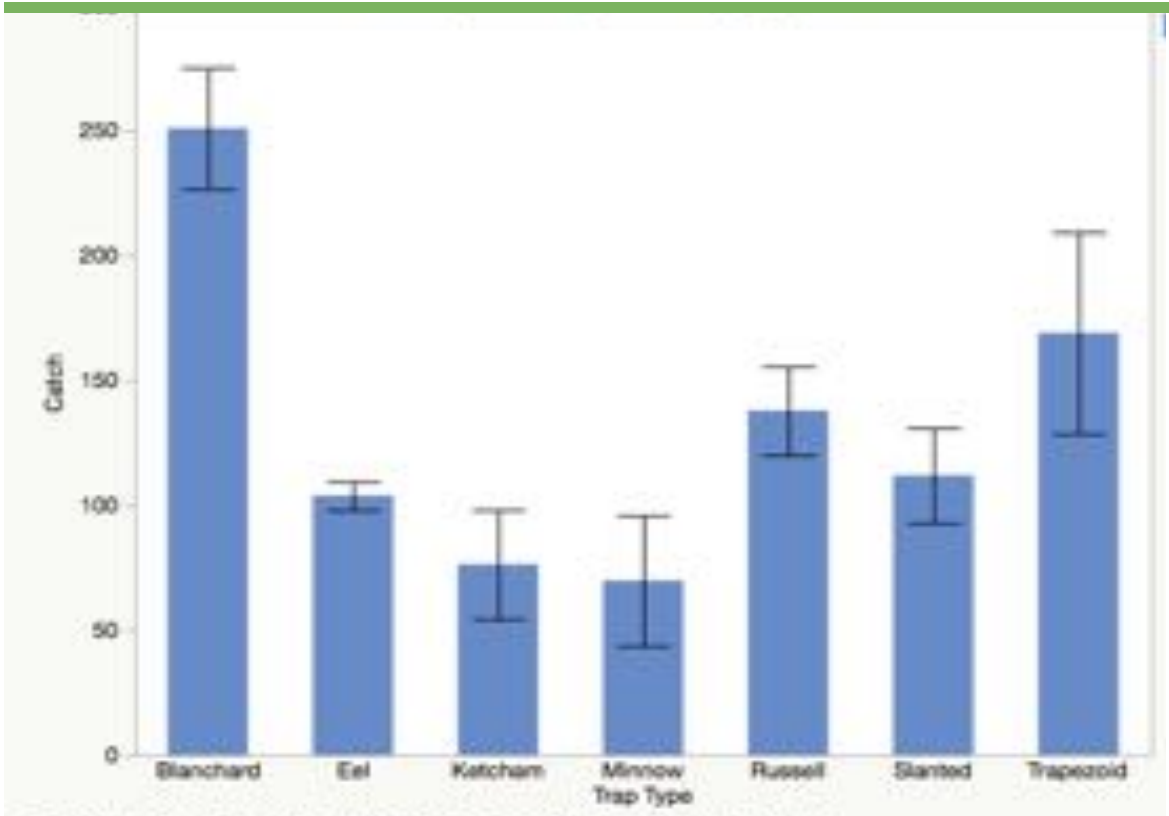


TRAP STUDY RESULTS



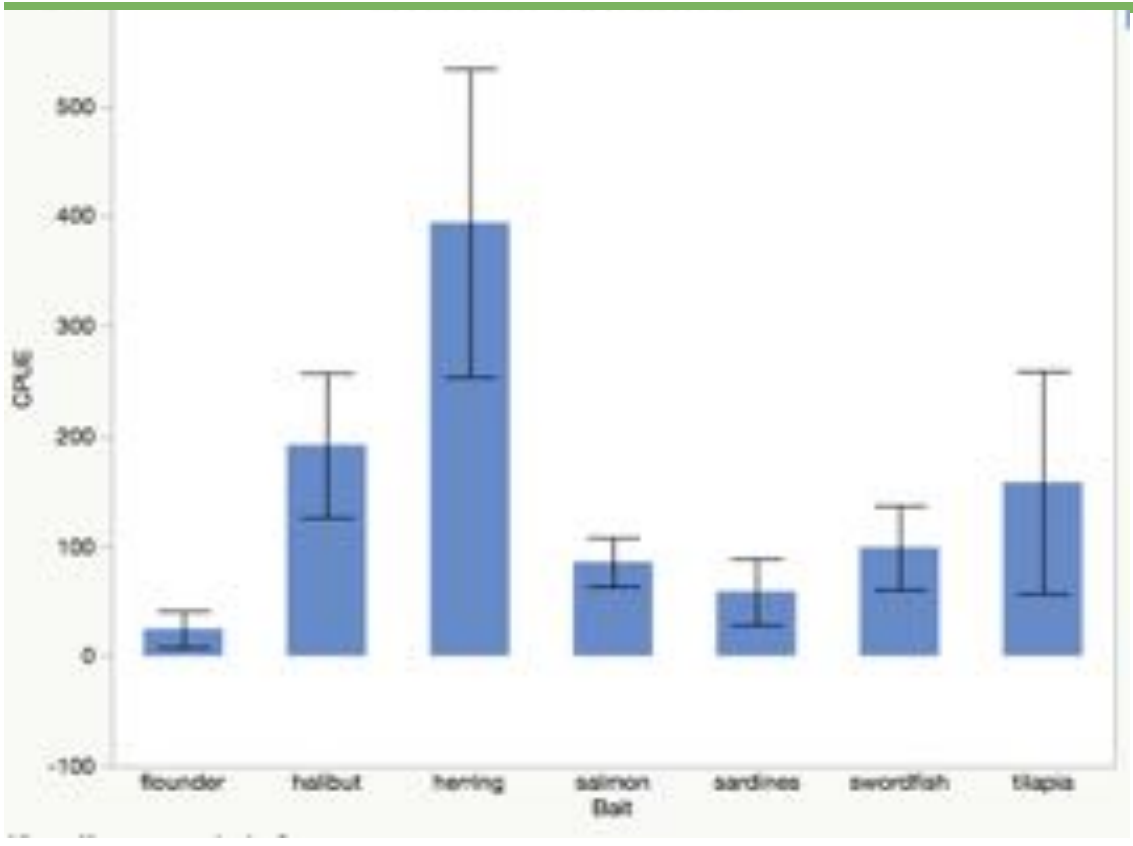
A = Trapezoidal trap
B = “Blanchard”
C = “Ketcham”
D =“Terminator”
E = Eel trap
F = “Slanted-Sides”
G = Minnow trap

TRAP STUDY RESULTS



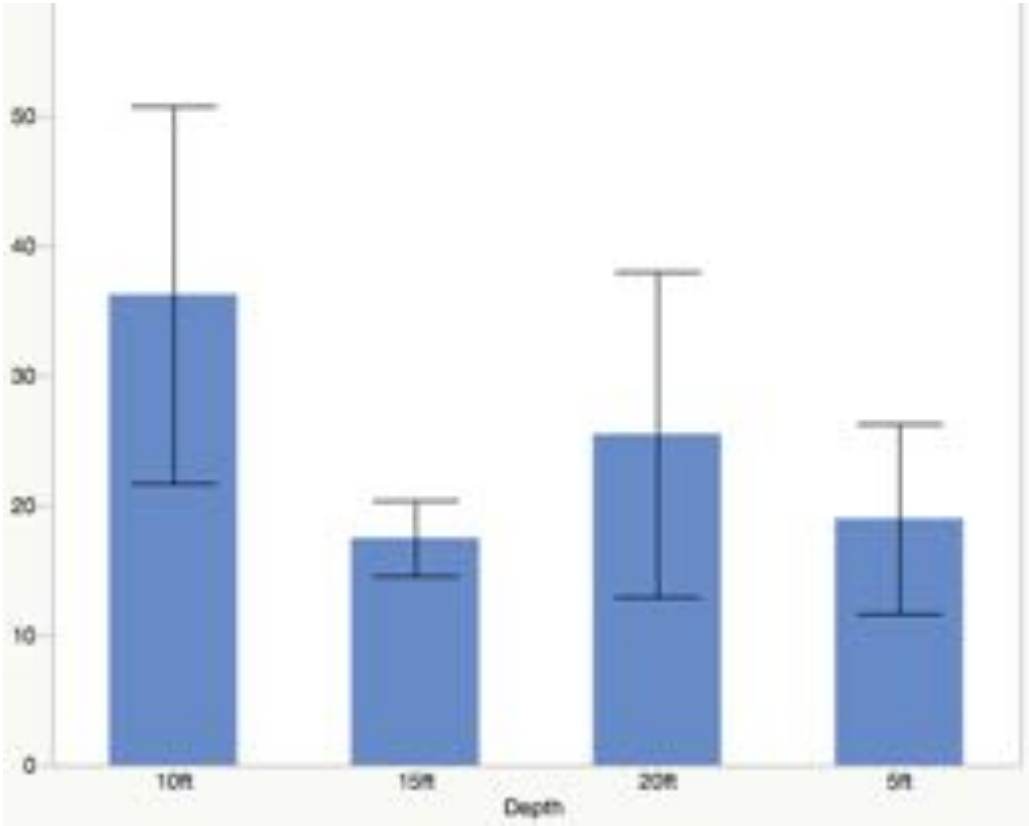
- LAGER NOT NECESSARILY BETTER
- DEPENDS ON APPLICATION…
- **Please see Young et al., 2017 for more details**

BAIT STUDY RESULTS



- OILIER, THE BETTER
- **Please see Young et al., 2017 for more details**

DEPTH STUDY RESULTS



- NO DIFFERENCE SEEN AT DIFFERENT DEPTHS
- **Please see Young et al., 2017 for more details**

SEDIMENT DATA

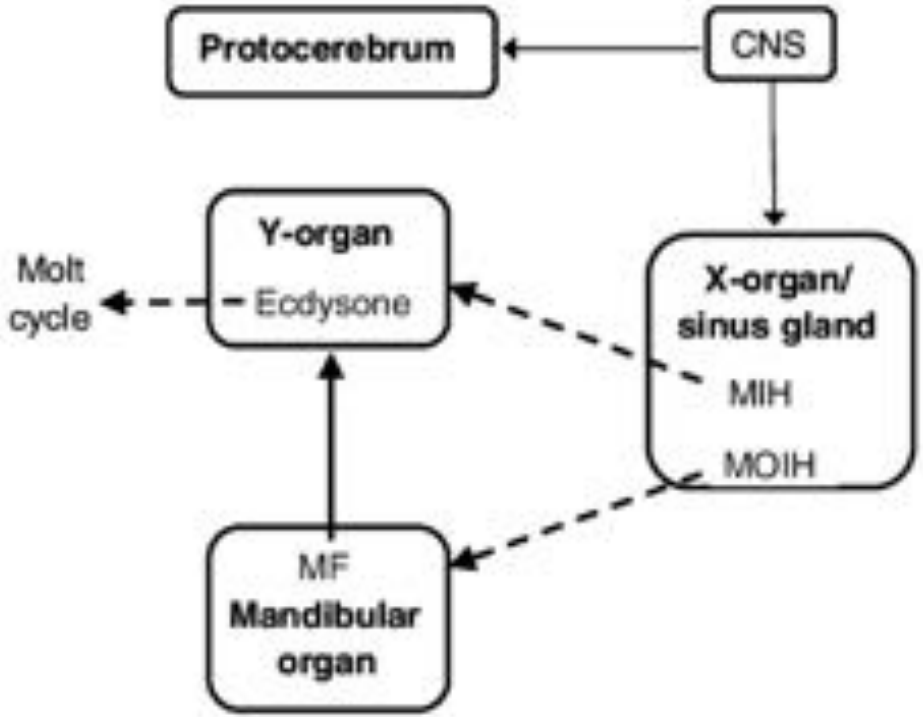
- Finer Sediments = Increased CPUE
- BUT, N=5…

- More on that later!

The Relationship Between Methyl Farnesoate Levels and Ventral Coloration in the European Green Crab (Elliott et al., 2018, Submitted)

- Crabs were held controlled conditions and color was tracked over time with MF levels
- Separated males and females to test pheromone interference and observe differences
- Selected crabs between 40-67 mm

Methyl Farnesoate, the crustacean juvenile hormone…



Methyl Farnesoate (MF) a widely studied hormone secreted by the **Mandibular organ** that shares functions in several aspects of crustacean physiology:

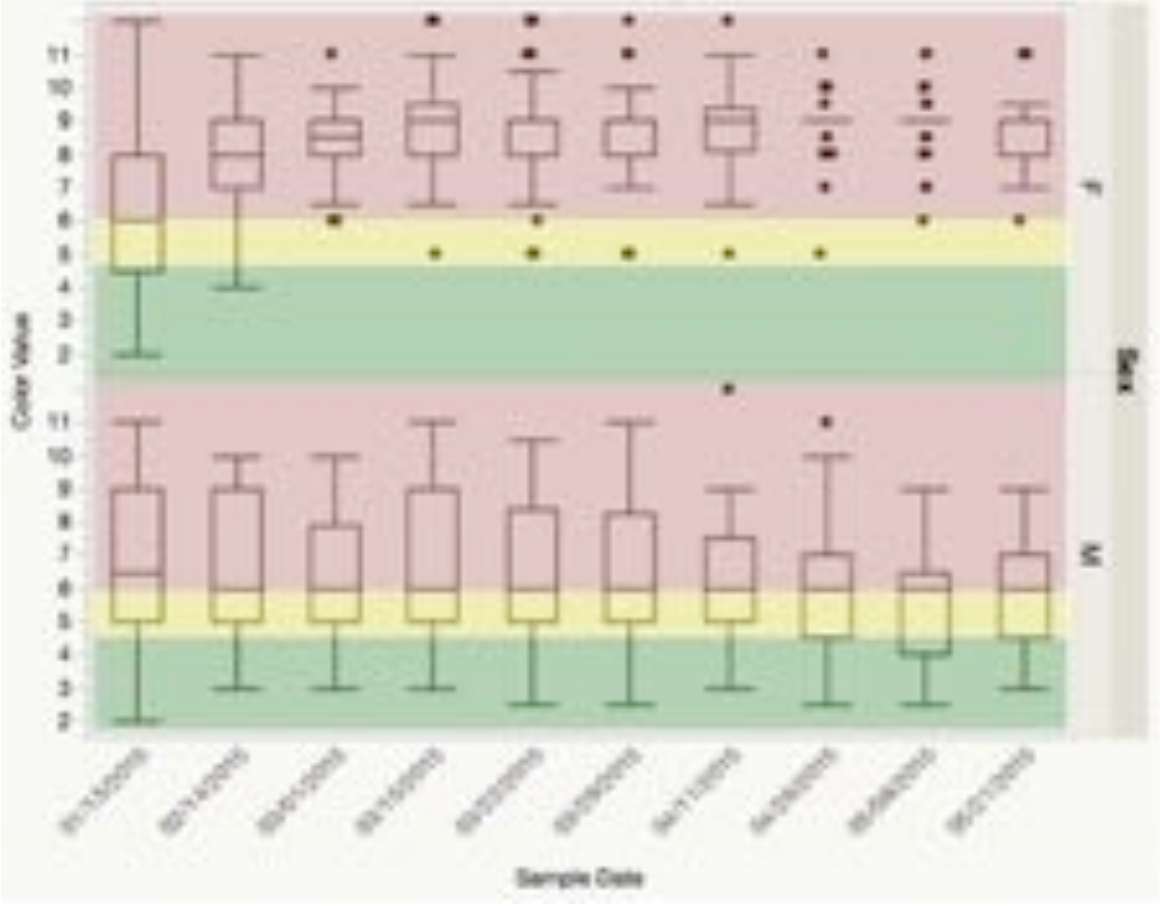
- Molting
- Reproduction
- Osmoregulation
- Morphogenesis
- and other functions…

HYPOTHESIS

- It was predicted that there will be a higher concentration of methyl farnesoate in crabs in the red phase (Nagaraju and Borst, 2008).

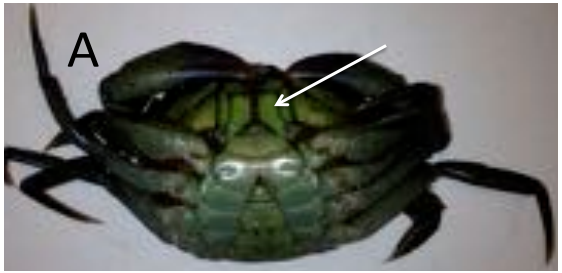
- IF yellow phase is indicative of an intermediate life stage, THEN the hormone levels should be different from red phase.

RESULTS: COLOR PROGRESSION



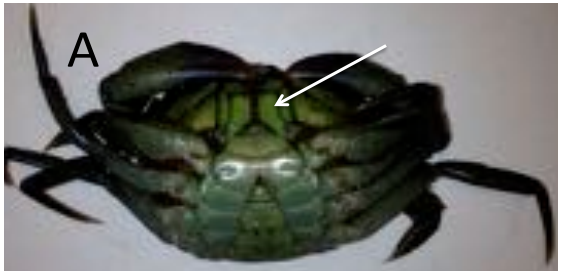
- Females a bit more dynamic in color change, while males exhibited little fluctuations over the course of the experiment ($p<0.001$).
- NO statistical difference in color changes between sex-isolated and mixed sex groups.
- Molting occurred across color phases, but N=6…

RESULTS: MF and Color Phases



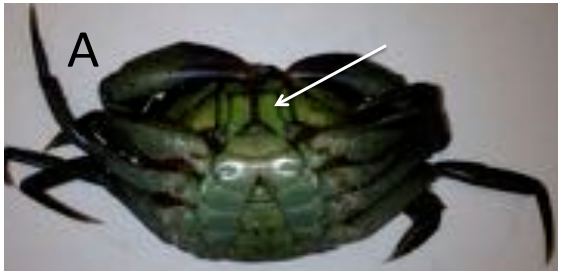
- The results indicate that a red phase crab would likely have a higher level of MF than green and yellow phase crabs

RESULTS: MF and Color Phases



- The results indicate that a red phase crab would likely have a higher level of MF than green and yellow phase crabs
- This finding reinforces the need for a **distinction between green and yellow phases** when measuring the physiology of crabs with different ventral pigmentation

RESULTS: MF and Color Phases



- The results indicate that a red phase crab would likely have a higher level of MF than green and yellow phase crabs
- This finding reinforces the need for a **distinction between green and yellow phases** when measuring the physiology of crabs with different ventral pigmentation
- Ventral coloration has a positive relationship with increasing endogenous MF levels and sexual maturity, **BUT** additional research is needed to determine if either aspect is useful as a bioindicator for molting

PRELIMINARY RESULTS: CURRENT PROJECTS

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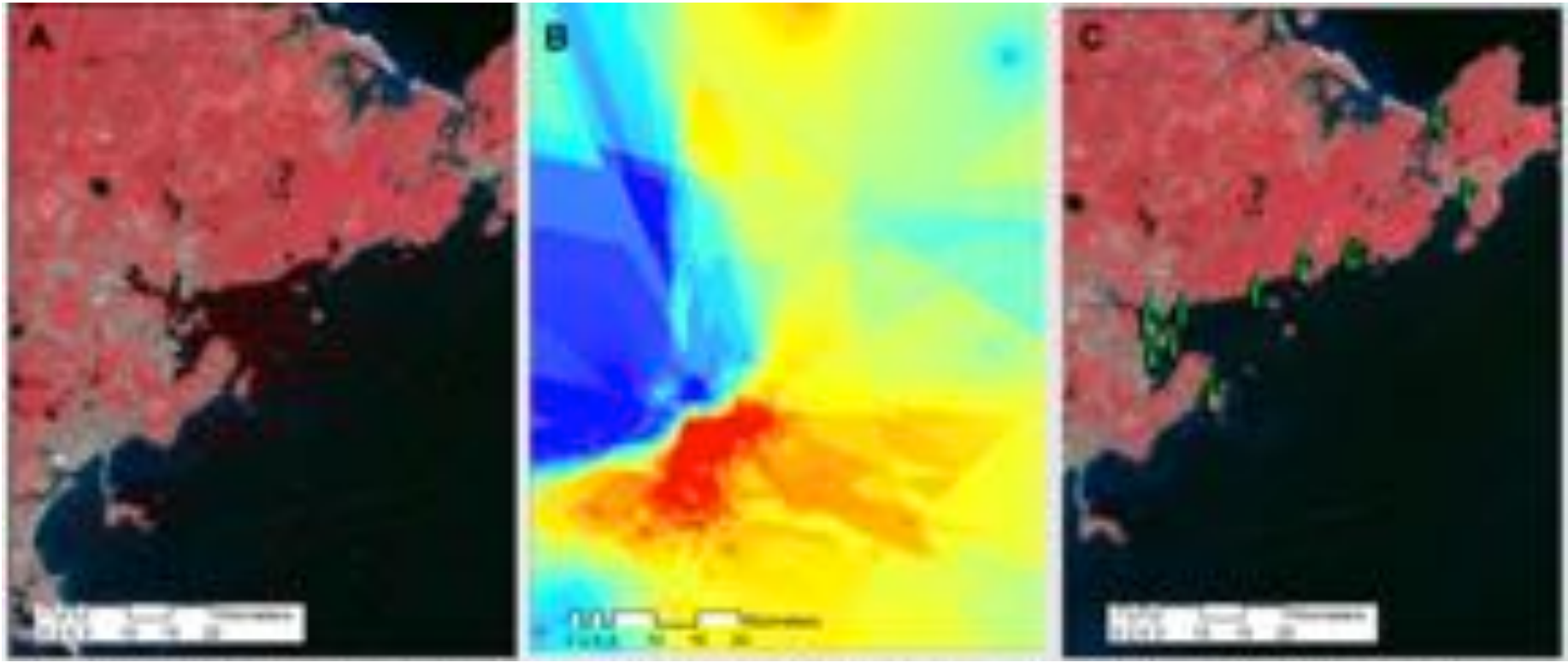

THANKS EVERYONE!

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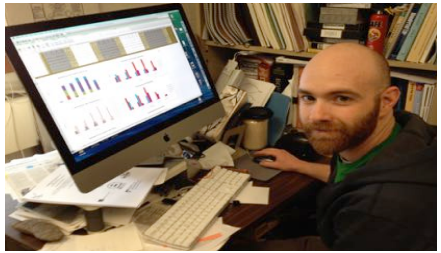

Joe Incatasciato

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- **Elliott, J.A.**, Young, A.M., Taylor, M.L., Vasilenko, M., & Laufer H. 2018. The Relationship Between Methyl Farnesoate Levels and Ventral Coloration in the European Green Crab (*Carcinus maenas*). *Journal of Experimental Biology*. (in prep)
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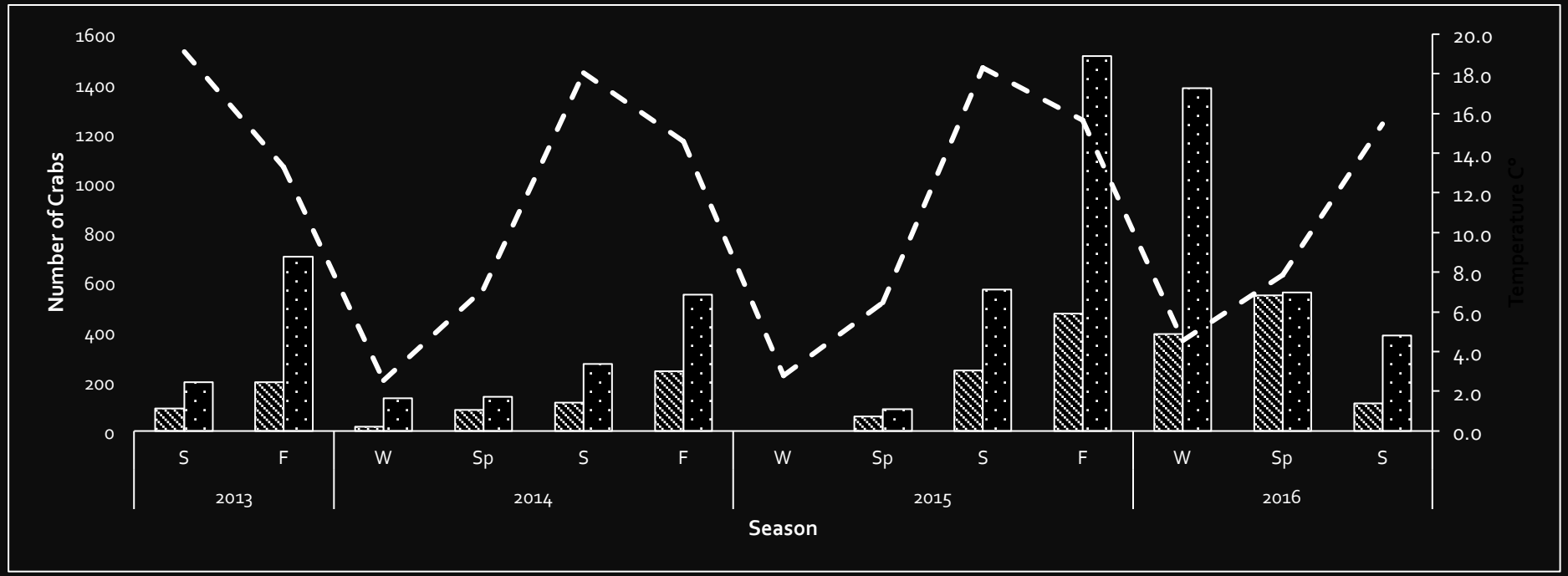
Number of Crabs
1600
1400
1200
1000
800
600
400
200
0
Temperature C°
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
S
F
W
Sp
S
F
W
Sp
S
F
W
Sp
S
2013
2014
2015
2016
Season