Timely Estimation of Post-Release Survival for Hatchery-Reared Juvenile Fishes

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MOTE

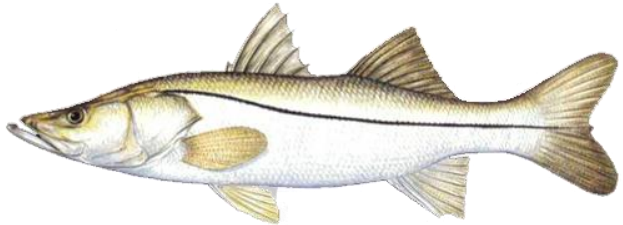
Snook Conservation & Enhancement Initiative

FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION

Fisheries Ecology & Enhancement Primary Objective

- Develop and test responsible marine stock enhancement strategies
  - Identify optimal release strategies
  - Inform adaptive management

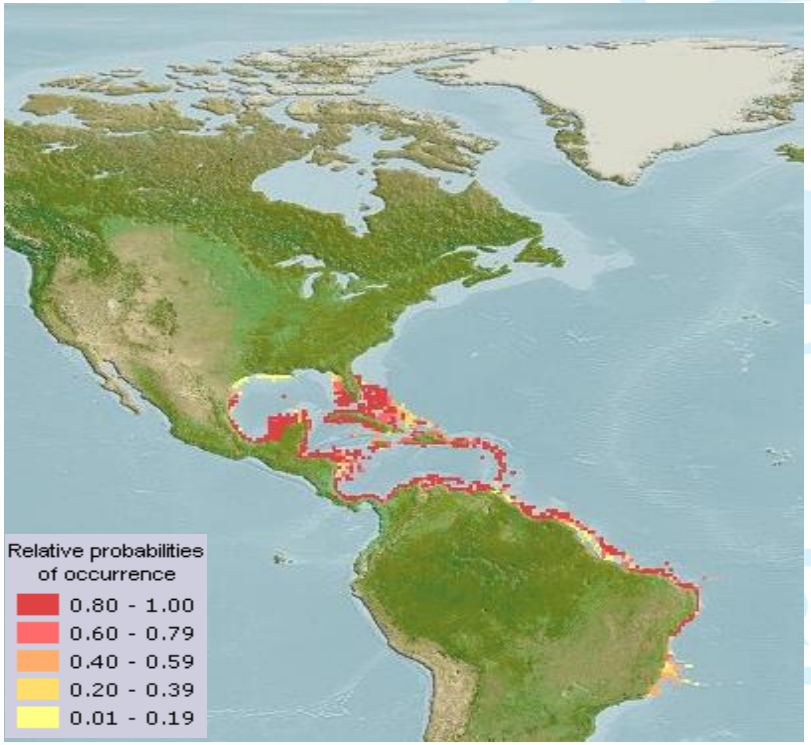
GOAL: Quantify post-release survival



Common Snook
Centropomus undecimalis

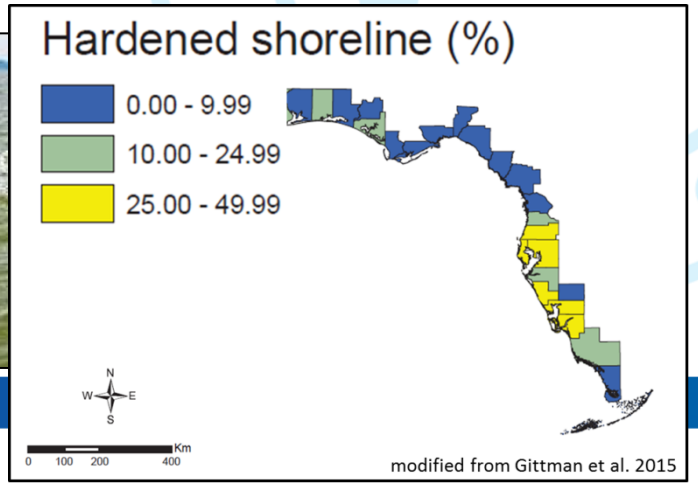
Snook Life History

- Large & long-lived
  - > 20 yrs
  - > 4.5 ft
  - Record: 53lb 10oz
- Coastal, tropical
- Two Florida populations



Why Snook?

- Recreational saltwater fishing
  - $8 billion/year industry in FL
  - 3rd most targeted species on Gulf coast (2015 Snook Stock Assessment)
- Sustainability concerns
  - Cold stuns
  - Red tide
  - Habitat loss

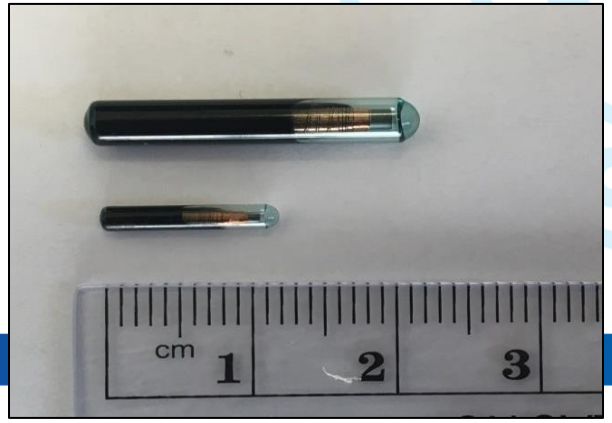


Methods Overview

- To quantify juvenile Common Snook survival:
  - Two replicate experiments with 960 snook released in Phillippi Creek
    - Nov-Dec 2016 = Fall
    - May-Jun 2017 = Spring
  - 2 years of resightings via antenna arrays
  - Mark-recapture models (Rmark)
    - Cormack-Jolly-Seber
      - Live encounters only
      - Emigration unknown

Snook Raised at Mote Aquaculture Park

Passive Integrated Transponder Tags



PIT Tag Antenna Array

Modified design from Adams et al 2006

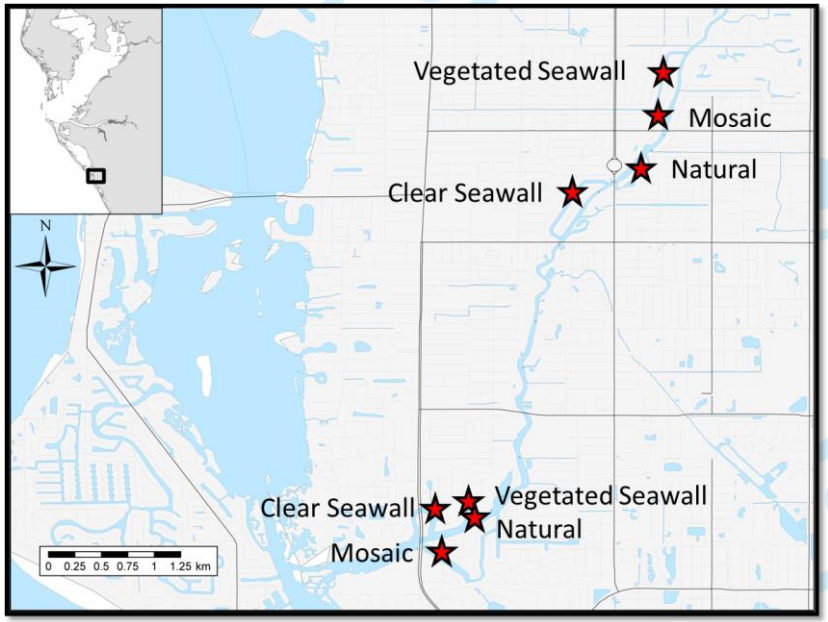
Four Habitats in Phillippi Creek

Clear seawall

Vegetated seawall

Natural

Mosaic

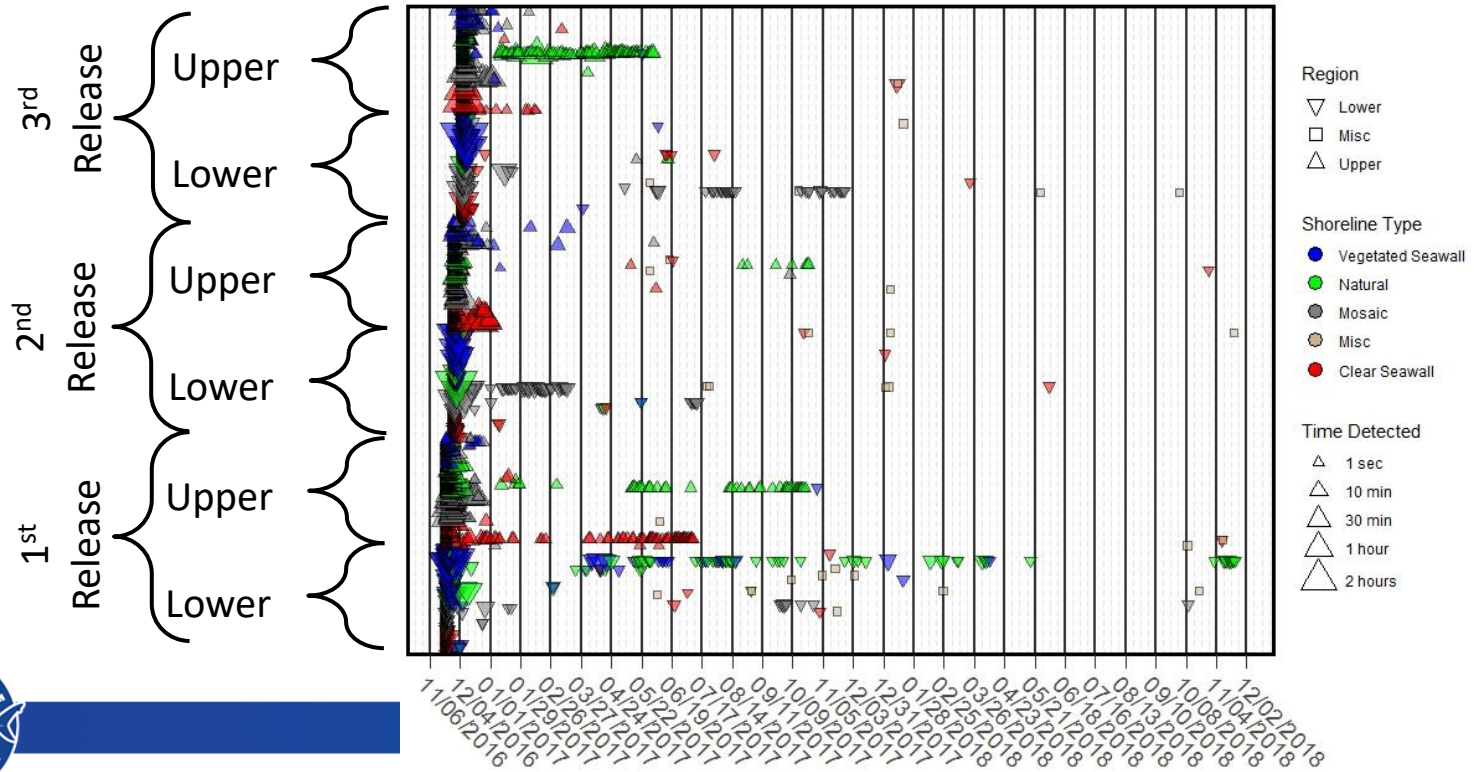


Three Weekly Releases each Experiment

- 40 snook at each of 8 release sites

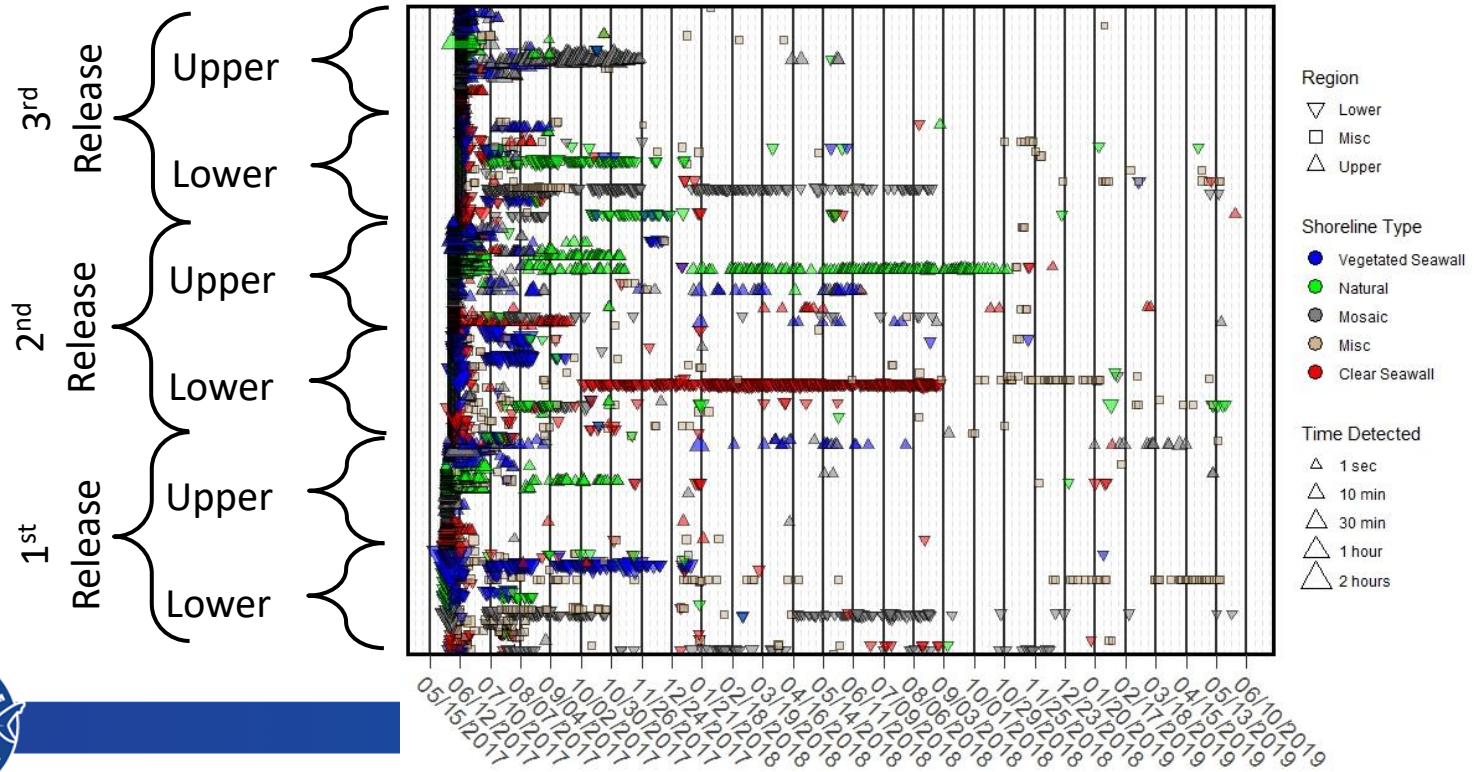
Fall Results: 135,703 Detections

749 of 960 fish, 343 days over 2 years

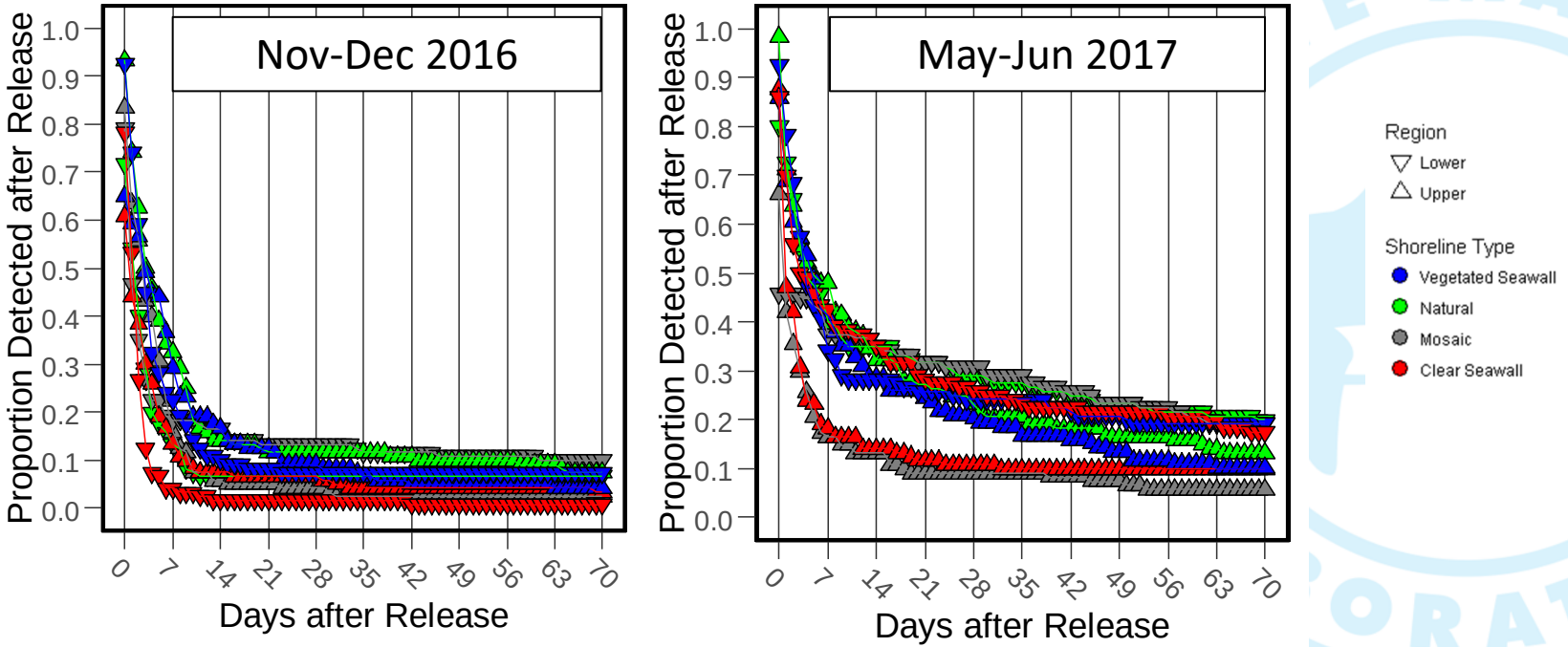


Spring Results: 133,408 Detections

772 of 960 fish, 608 days over 2 years



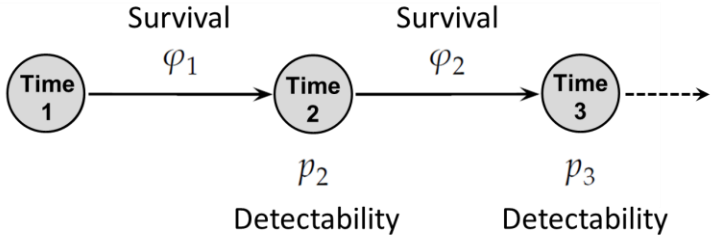
Recapture Rates over Time

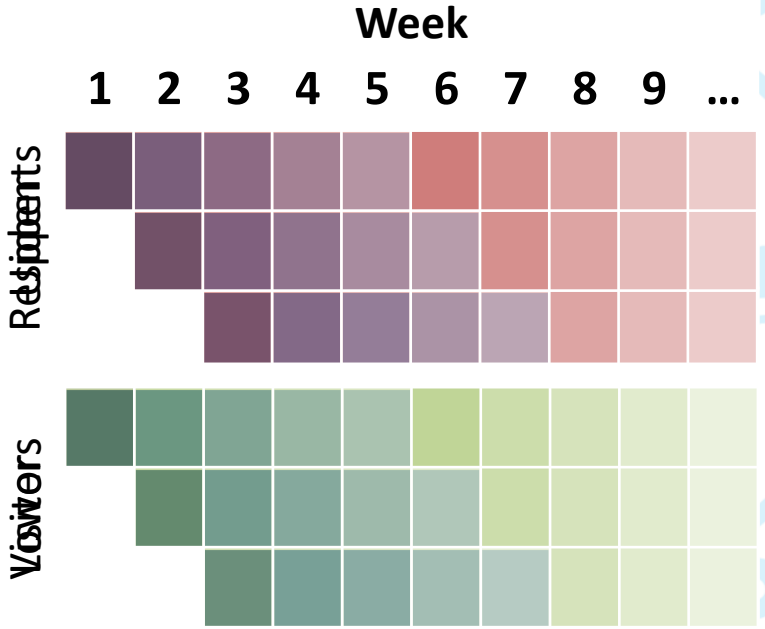


What changed, survival or detectability?

Mark-Recapture Models

- Cormack-Jolly-Seber





Step 1: 1-8 week stocking effect (age)

Step 2: Full models

- Time after release (continuous)
- Spatial scale
- Residents (unequal recapture)
- Interactions
- Covariates: FL, water height

Step 3: Confirm stocking effect for best full model

- Identify KEY factors describing weekly survival and detectability

‘Best’ Model: Nov-Dec 2016

- Survival

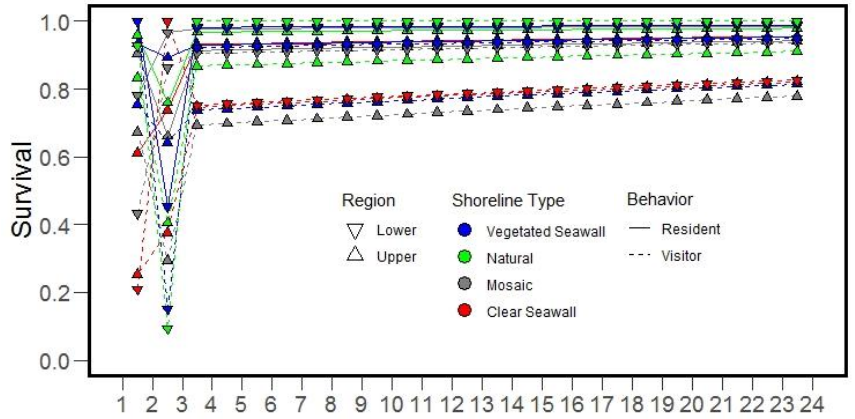
2-week stocking effect * Site + Resident + Time + Fork Length

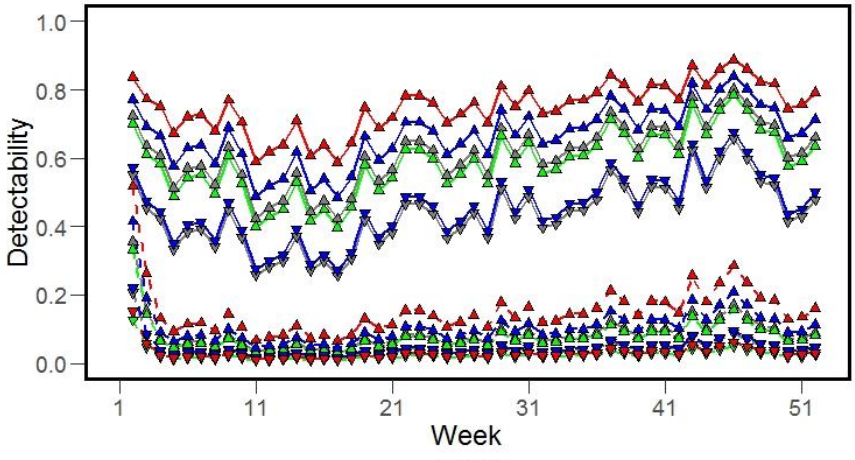
  - Low survival in 1st two weeks

- Detectability

2-week stocking effect * Resident + Site + Water height

  - Consistently higher for residents
  - Declines first few weeks





‘Best’ Model: May-Jun 2017

- Survival

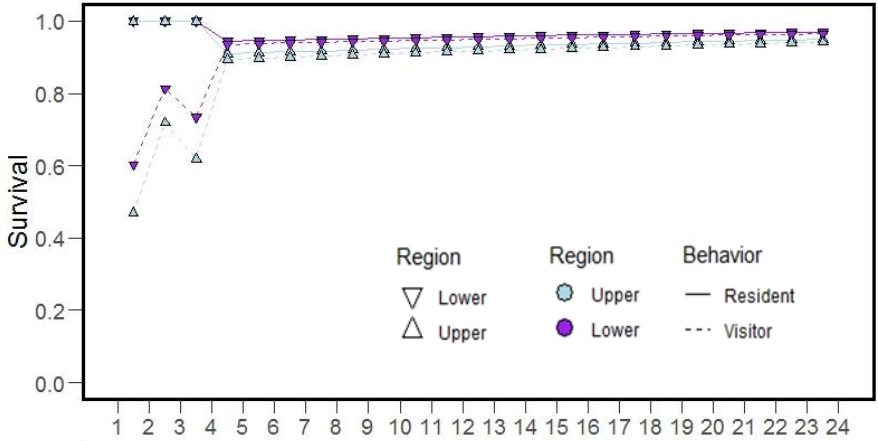
3-week stocking effect * Resident + Release region + Time + Fork length

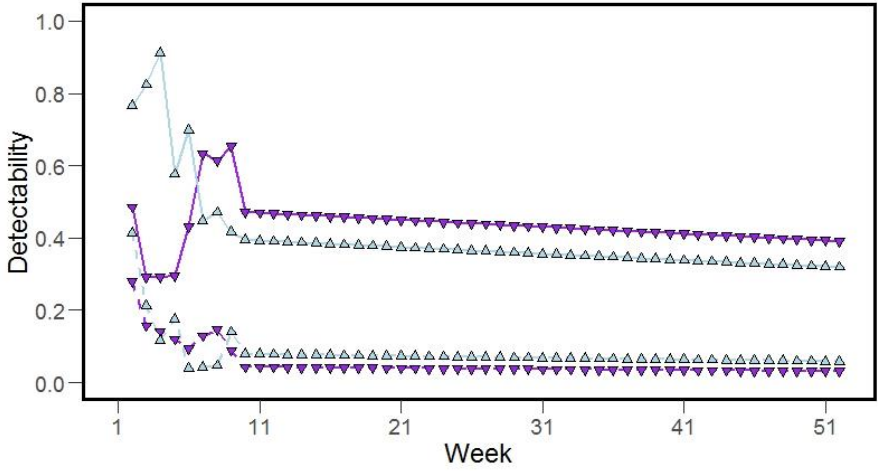
  - Initial survival higher than in Nov 2016
  - Higher for lower creek sites

- Detectability

8-week stocking effect * Resident * Release region + Time

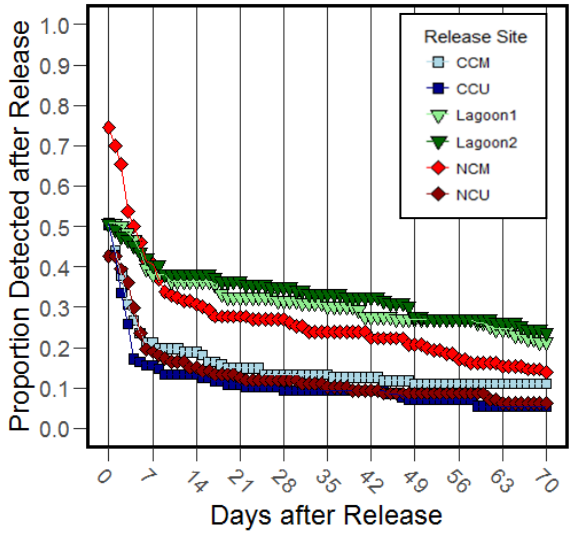
  - Initial and long-term decrease
  - No influence of water height





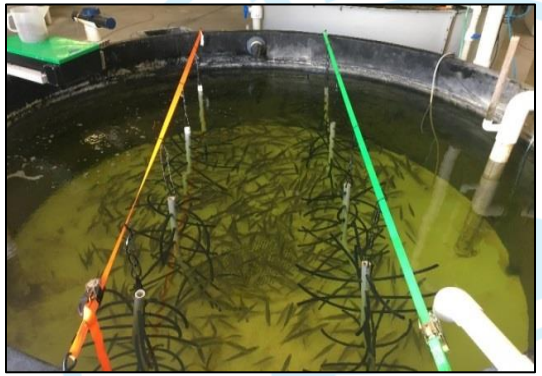
Conclusions

- Initial survival critical for effective stock enhancement
  - Timing matters
  - Identify high quality systems, regions, or habitats
- Timely estimation can inform adaptive management



Considerations for Applying Approach

- Antenna array locations
  - Home range of juveniles
  - Migratory pathways
- Weekly vs Monthly releases
- Applications for:
  - Conditioning in hatchery
  - Acclimation at release site
- Minimum number/percent of tagged fish




QUESTIONS?

Snook Life History

- Spawn Apr-Sep
  - Outgoing tide
  - Eggs develop offshore
  - Larvae washed into tidal creeks
- Juveniles reside in the creeks through winter
  - May join adults to spawn as early as age 1