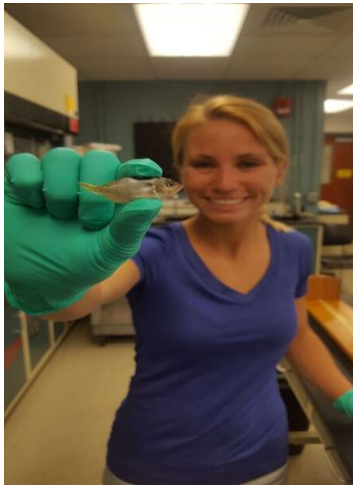
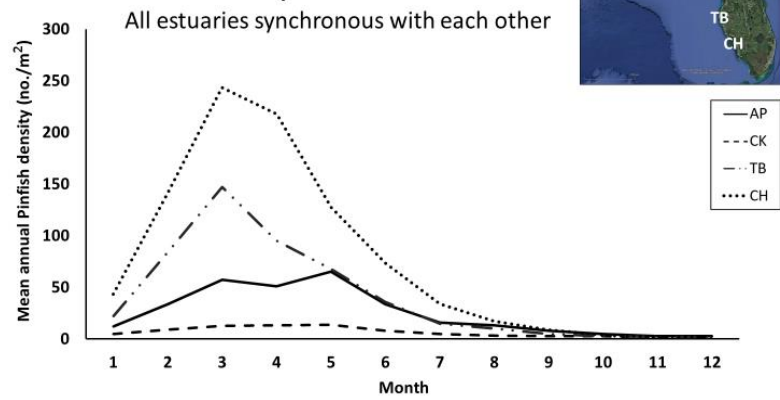




Population Dynamics of Pinfish in the Eastern Gulf of Mexico (1998-2016)



Intra-annual density



2017 Fellow, Meaghan Faletti (University of South Florida)

Identifying forage taxa potentially mediating red drum recruitment dynamics



Table 1. The ten most voluminous prey items for red drum age 0-1.

Rank	Prey item	Category	Proportion total volume
1	<i>Americamystis almyra</i>	Mysid shrimp	0.190552
2	<i>Farfantepenaeus sp.</i>	Penaeid shrimp	0.183078
3	<i>Eurytium limosum</i>	Mud crab	0.081837
4	<i>Dyspanopeus texanus</i>	Mud crab	0.069562
5	<i>Uca sp.</i>	Fiddler crab	0.055922
6	<i>Alpheus sp.</i>	Pistol shrimp	0.046374
7	<i>Arenicolidae</i>	Polychaete worm	0.040919
8	<i>Actinopterygii</i>	Ray-finned fish	0.040237
9	<i>Cyprinodon variegatus</i>	Sheepshead minnow	0.034099
10	<i>Xanthidae</i>	Mud crab	0.032735

Table 2. The ten most voluminous prey items for red drum age 1-2.

Rank	Prey item	Category	Proportion total volume
1	<i>Lagodon rhomboides</i>	Pinfish	0.452054
2	<i>Farfantepenaeus sp.</i>	Penaeid shrimp	0.059141
3	<i>Actinopterygii</i>	Ray-finned fish	0.057093
4	<i>Xanthidae</i>	Mud crab	0.042415
5	<i>Arenicola cristata</i>	Polychaete worm	0.035694
6	<i>Dyspanopeus texanus</i>	Mud crab	0.027853
7	<i>Arenicolidae</i>	Polychaete worm	0.0193
8	<i>Portunidae</i>	Swimming crab	0.017008
9	<i>Portunus sp.</i>	Swimming crab	0.016771
10	<i>Callinectes sapidus</i>	Blue crab	0.015801

2017 Fellow, Dr. Ed Camp (University of Florida)

2nd Annual Data Workshop Summary Report

Forage Fish Research Program Mission Statement

The *Forage Fish Research Program* (FFRP) recognizes both the vital economic and fundamental ecological importance of forage fish species in supporting recreational and commercial fisheries and sustaining healthy marine ecosystems. The overarching goal of the program is to increase scientific understanding of how Florida marine ecosystems work by engaging graduate students in support of the Fish and Wildlife Research Institute's (FWRI) research priorities and the Florida Fish & Wildlife Conservation Commission's (FWC) 2015 [Resolution on Forage Fish Conservation](#). The program seeks to improve fisheries science and ensure Florida's reputation as the "Fishing Capital of the World" by investigating unaccounted for linkages between important forage species and their dependent predators; their relationships to essential fish habitat; and their responses to climate change impacts and environmental perturbations.

The program is a partnership between the [Florida Forage Fish Coalition](#), FWRI, and Florida-based academic institutions. Through the FFRP, select graduate students are awarded a one-year fellowship to conduct a research project analyzing fisheries monitoring data collected by the FWRI. The fellows are strongly encouraged to submit their findings to a peer-reviewed journal in collaboration with FWRI scientists. Published results may then be used to inform stock assessments, ecosystem models and potentially, management decisions. In addition, the FFRP builds strong collaborative partnerships between academia and the FWRI and provides training and career development for the next generation of scientists dedicated to keeping Florida's fisheries sustainable and marine ecosystems healthy.

Workshop Synopsis

On April 23rd, 2018, the FWRI, in partnership with the Florida Forage Fish Coalition, hosted the 2nd Annual Forage Fish Data Workshop in St. Petersburg, Florida. In attendance were academics from the University of South Florida (Dr. Chris Stallings, Meaghan Faletti, Jonathan Peake, and Dr. Ernst Peebles), the University of Florida (Dr. Dave Chagaris and Dr. Ed Camp), and the University of Central Florida (Brittany Troast).

The goals of the workshop were threefold:

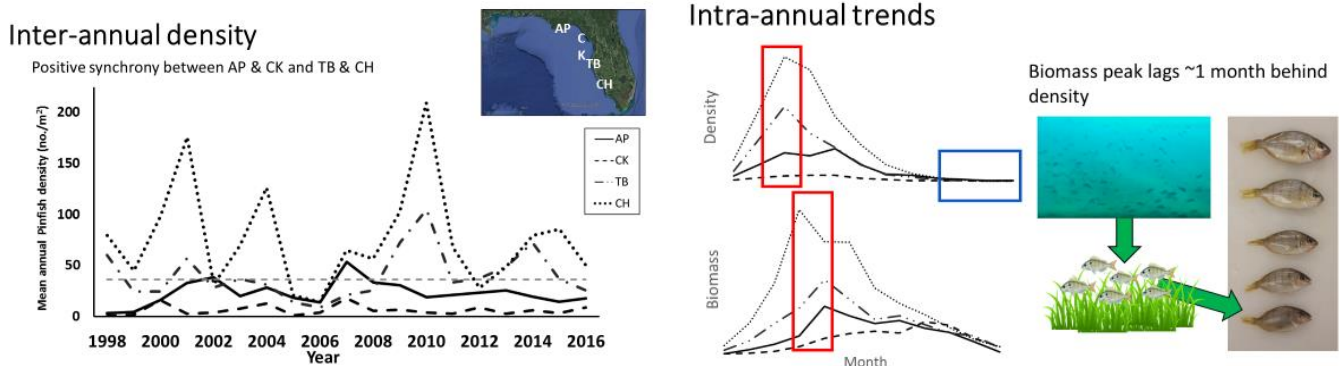
- 1) Review outcomes and develop program recommendations from the inaugural 2017-2018 fellowships;
- 2) Review and update FWRI's forage fish research priorities; and
- 3) Engage academic collaborators to develop new fellowship proposals for 2018-2019.

Tim MacDonald and Dr. Kevin Thompson of FWRI started the workshop off by reviewing the Fishery Independent Monitoring (FIM) program and Diet Lab databases. Meaghan Faletti (USF) and Dr. Ed Camp (UF) then presented project results from their first-year fellowships (see below for details). The half-day workshop concluded with a round table discussion to review project results, outline next steps for publication, and develop new ideas for potential FFRP proposals for the upcoming year. Because the inaugural fellowships examined forage species in Gulf of Mexico estuaries, FWRI identified a need for the 2nd year fellowships to improve our understanding of forage fish linkages and communities along the east coast and in particular, the Indian River Lagoon ecosystem.

1st Year Fellowship Project Results

Population Dynamics of Pinfish in the Eastern Gulf of Mexico (1998-2016)

Meaghan Faletti (University of South Florida)



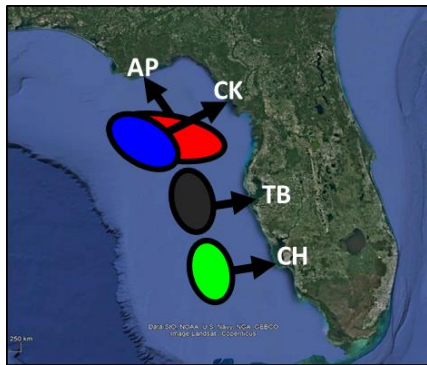
Results from analyzing over 18 years of FIM estuary monitoring data:

- Pinfish density and biomass were highest in southernmost estuaries with Charlotte Harbor having the highest numbers followed by Tampa Bay, Apalachicola Bay, and Cedar Key having the smallest numbers (i.e. CH > TB > AP > CK).
- Pinfish density and biomass were positively related to seagrass coverage for all four estuaries.
- Abundance of pinfish was also strongly correlated with salinity and temperature, which are factors known to be important for influencing seagrass distribution.

- Instantaneous growth rates of pinfish were similar across all eastern GoM estuaries.
- Habitat conditions are likely more favorable for juvenile recruitment in the southern estuaries (Charlotte Harbor and Tampa Bay).
- Positive *inter-annual* synchrony of populations occurred between the two northern estuaries (Apalachicola and Cedar Key) and between the two southern estuaries (Tampa Bay and Charlotte Harbor).

Population densities generally peaked in March-April, while biomass peaked a month later in April-May.

Results of isotope analyses of eye lenses from juvenile pinfish collected by the FIM program:



- Isotope analysis provides evidence of offshore spawning locations from newly settled juvenile pinfish in eGoM.
- Eye lens core $\delta^{13}\text{C}$ isotope values identified broad-scale offshore spawning locations.
- The isoscape distances between juvenile pinfish collected from different eGoM estuaries indicates regional population differentiation among offshore spawning locations.

Identifying forage taxa potentially mediating red drum recruitment dynamics

Dr. Ed Camp (University of Florida)

Results from gut content analyses of juvenile red drum from FWRI Diet Database:

- The first trophic analysis of juvenile red drum in Florida reveals shrimp (*Farfantepenaeus sp.*) and pinfish are key forage components of juvenile red drum, making up 24% and 45% of the prey consumed by volume, respectively.
- The methodology established a data standardization protocol to account for variations in FIM gear types and sampling protocols which is critical for comparisons between estuaries. This method can now be applied to other popular recreational species including gag grouper, gray snapper, and spotted seatrout.
- Directional trends in the abundance of shrimp (*Farfantepenaeus sp.*) from FIM monitoring data indicate declines in some Gulf estuaries which could potentially negatively impact red drum recruitment into the fishery. It will be important to keep abreast of these trends, because several

recreationally and commercially important species managed by the FWC consume shrimp as a high proportion of their diet (i.e. gray snapper, gag grouper, red drum, spotted seatrout).

- Using foraging arena theory, this project identifies how forage abundance and availability may be linked to the survival and relative recruitment of juvenile game fish, such as red drum.

Table 1. The ten most voluminous prey items for red drum age 0-1.

Rank	Prey item	Category	Proportion total volume
1	<i>Americamysis almyra</i>	Mysid shrimp	0.190552
2	<i>Farfantepenaeus sp.</i>	Penaeid shrimp	0.183078
3	<i>Eurytium limosum</i>	Mud crab	0.081837
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9	<i>Cyprinodon variegatus</i>	Sheepshead minnow	0.034099
10	<i>Xanthidae</i>	Mud crab	0.032735

Table 2. The ten most voluminous prey items for red drum age 1-2.

Rank	Prey item	Category	Proportion total volume
1	<i>Lagodon rhomboides</i>	Pinfish	0.452054
2	<i>Farfantepenaeus sp.</i>	Penaeid shrimp	0.059141
3	<i>Actinopterygii</i>	Ray-finned fish	0.057093
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Next steps for 1st year Forage Fish Research Program Fellows

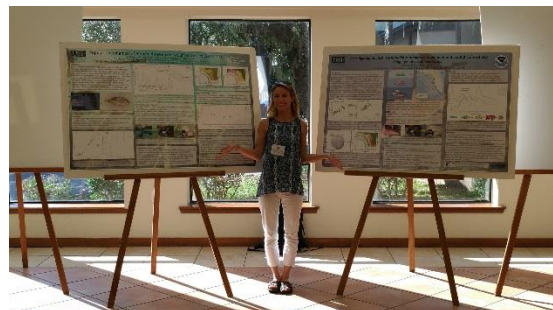
Both fellows are currently working with FWRI to prepare their results for publication in peer-reviewed scientific journals. In addition, Ed Camp will be submitting an "extension document" to the University of Florida known as an "Electronic Data Information

Source (EDIS) publication" that are intended to provide useable information to end users

(anglers/fishers/conservationists) and other stakeholders (agency/NGOs/Sea Grant agents).

Meaghan Faletti (right) has already presented her

pinfish results at the Florida Chapter of the American Fisheries Society (AFS) and will also present them at the [National AFS meeting this summer in Atlantic City.](#)



2nd Year Forage Fish Research Fellowships

Four FFRP fellowship proposals were submitted and the Selection Committee, unanimously chose two proposals to fund that will address key research priorities for FWRI by examining forage fish biodiversity and community structure among east and west coast Florida estuaries. They are:

- 1) Jonathan Peake (University of South Florida, [Dr. Chris Stallings Lab](#)): Community structure and dynamics of forage fishes in the eastern Gulf of Mexico (1998-2017).
- 2) Brittany Troast (University of Central Florida, Dr. [Geoffrey Cook's Lab](#)): A Comparative Analysis of Forage Fish Community Dynamics among Florida's East Coast Estuaries.

The 2018-2019 FFRP fellows will begin work on their research projects this summer. Through contributions from The Pew Charitable Trusts and donations made through the "[School up for Forage Fish](#)" crowdsource campaign, the Florida Forage Fish Coalition provided a total of \$30,000 in funds for the second year of the program.

FFRP Advisory Panel Recommendations

On the second day of the workshop, the FFRP Advisory Panel identified the following recommendations and research priority updates for the program.

- 1) FWRI Research Priorities:

The FFRP will support projects that:

- a. Focus primarily on Fishery Independent Monitoring and Diet Lab data mining with minimal new sampling based on appropriateness to project goals and FWRI research priorities.
- b. Examine the ecological importance and life history of anchovies (*Anchoa sp.*) as potential indicator species of declining benthic habitats and pinfish as indicator species of healthy seagrass habitats.
- c. Investigate the impacts of large scale fluctuations of abiotic parameters such as salinity and temperature and environmental perturbations like harmful algal blooms and cold kills.
- d. Integrate other fisheries monitoring and habitat data sets (i.e. SEAMAP and Seagrass Integrated Mapping and Monitoring) into forage fish analyses.
- e. Investigate finer scale sampling and patterns of forage fish community structure over spatial-temporal scales.

- f. Compare South Atlantic vs. Gulf of Mexico forage fish abundances and distributions.
- g. Examine forage fish linkages with coral reef and offshore species (i.e. red grouper, red snapper).

2) FFRP Recommendations for Improving Fisheries Science and Management

The FFRP will seek to disseminate peer reviewed published research findings resulting from the program through:

- a. Identifying opportunities to improve FWRI fishery models with explanatory hypotheses and underlying principles (e.g. the importance of interconnectivity between pinfish offshore spawning and gag grouper productivity) that help advance FWRI's application of EBFM models and improve the context and resolution of single species stock assessments.
- b. Educational outreach of the program's goals and results that help improve stakeholder understanding of fundamental linkages of forage species to Florida's total fish biomass, their interactions with essential fish habitat, and their role in maintaining the stability of Florida's recreational and commercial fisheries.
- c. Potentially including results in the summary of "Future Research Recommendations and Data Gaps" of the Southeast Data Assessment and Review (SEDAR).