

Collaborative Fisheries with a SMILE (Size Matters: Innovative Length Estimates)



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Citizen Science

REEF Volunteer Fish Survey Project

- Roving diver surveys assess relative abundance and diversity
 - Database reports novice and expert surveys
- Recreational divers underutilized source of data collection
 - Valuable to fill data gaps in fisheries

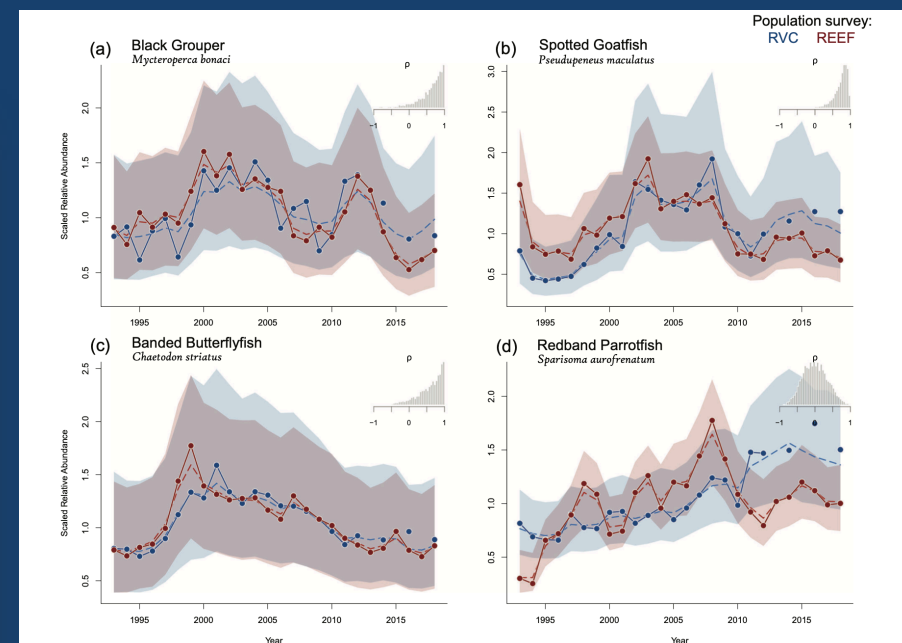
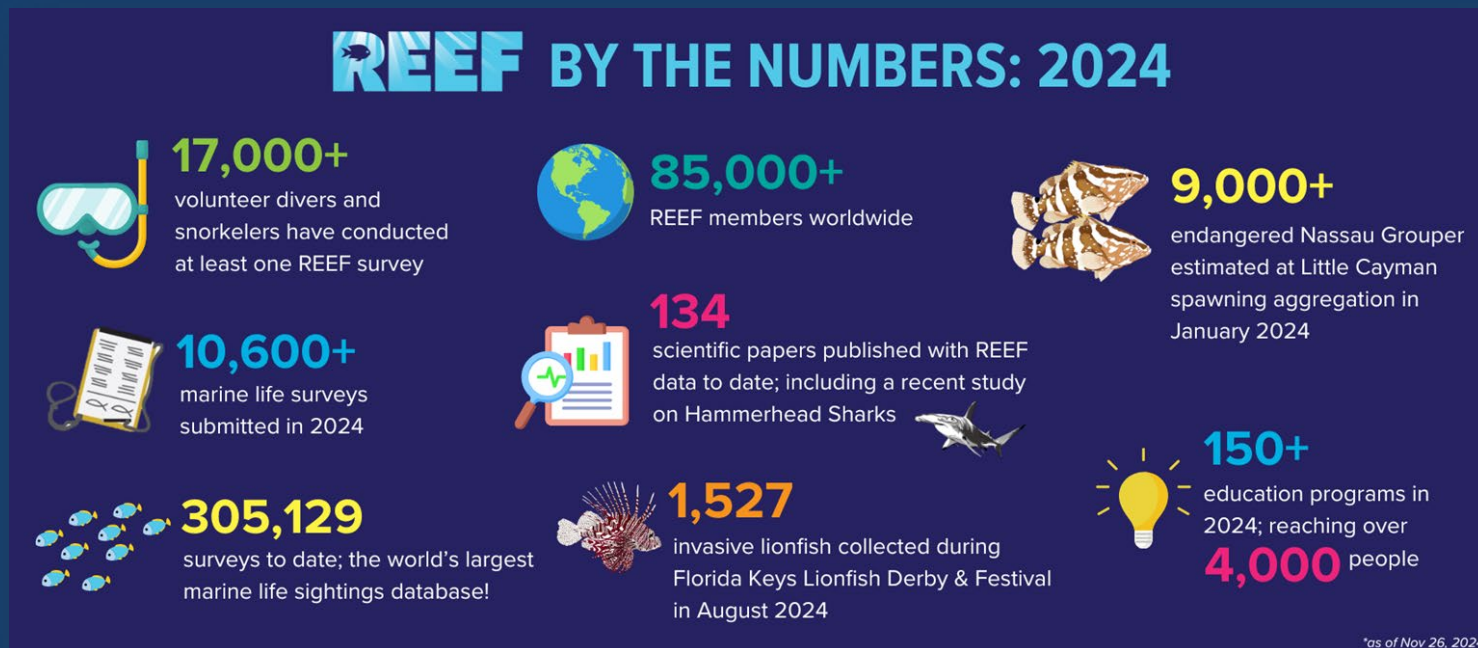
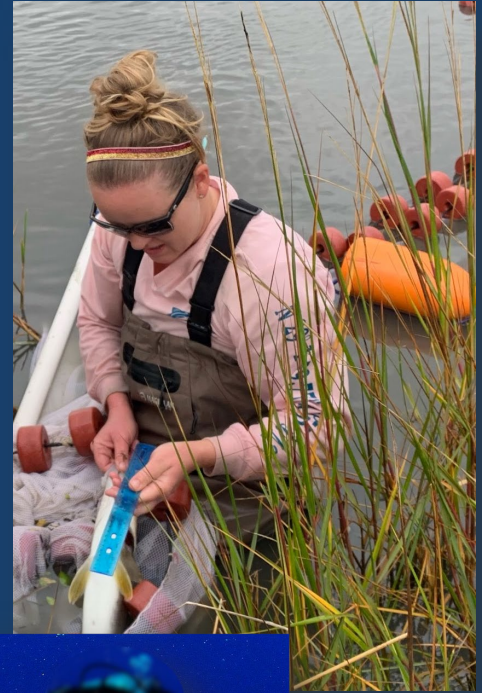


FIGURE 2 Examples of species' relative abundance time-series estimated from structured RVC surveys (in blue) and opportunistic REEF citizen scientist surveys (in red). Solid lines and points represent median estimates of the annual expected abundance (α_t) with both process and measurement deviance, while dashed lines indicate the model-estimated estimated population state (x_t) with only process deviance. Shaded areas represent 90% Bayesian credible intervals for the latent population states. Time-series plots for all species comparisons are available in the Appendix.

Greenberg et al. 2024, *Cons. Lett.*

Size Data

- Fisheries stock assessments incorporate size data
- Lengths traditionally obtained via harvest or handling
 - Loss of fish or induces stress
 - Limited distribution of sizes and species
- Existing *in situ* methods is limited to scientists

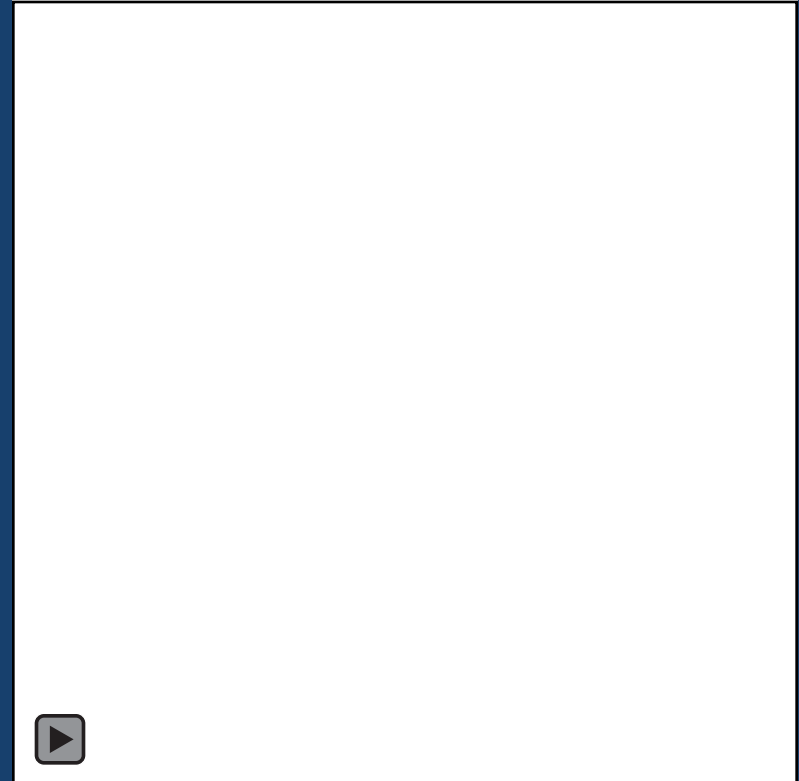


SMILE – Size Matters: Innovative Length Estimates

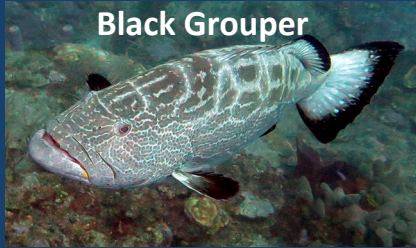
SMILE is a citizen science initiative to collect fish length measurements with an *in-situ* tool

Goal:

- Complement existing REEF fish surveys
- Improve future stock assessments for data-limited species, and inform management & conservation efforts



SMILE Target Species



Black Grouper



Mutton Snapper



Blue Parrotfish



Nassau Grouper



Yellowtail Snapper



Juvenile Stoplight Parrot



Red Grouper



Gray/Mangrove Snapper



Intermediate Stoplight Parrot



Goliath Grouper



Midnight Parrotfish



Terminal Stoplight Parrot



Hogfish

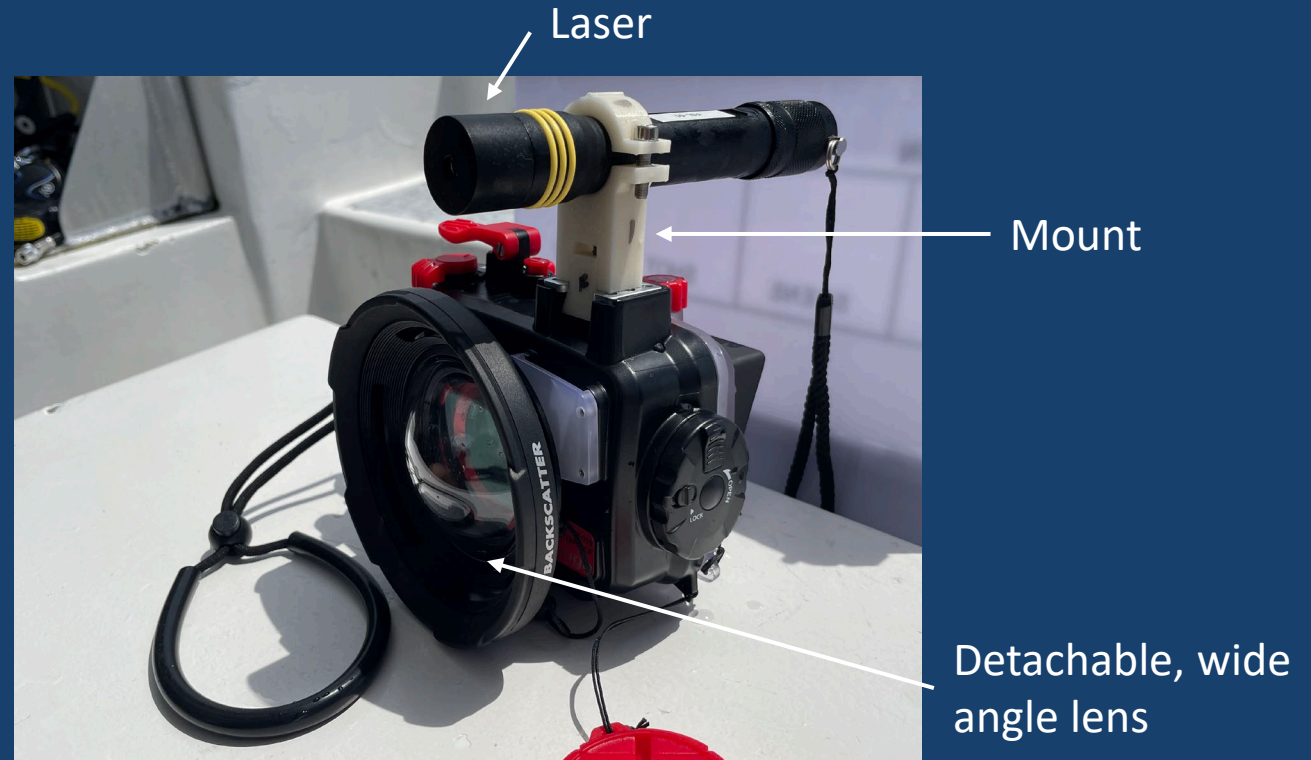


Rainbow Parrotfish



SMILE Camera (“FishSenseLite”)

Laser-Mounted Olympus TG6 Cameras

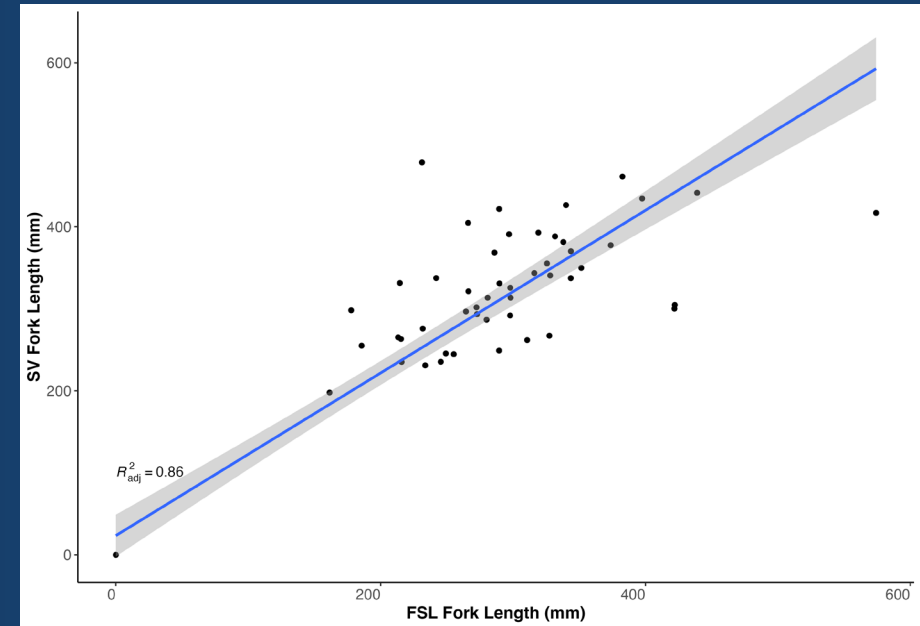
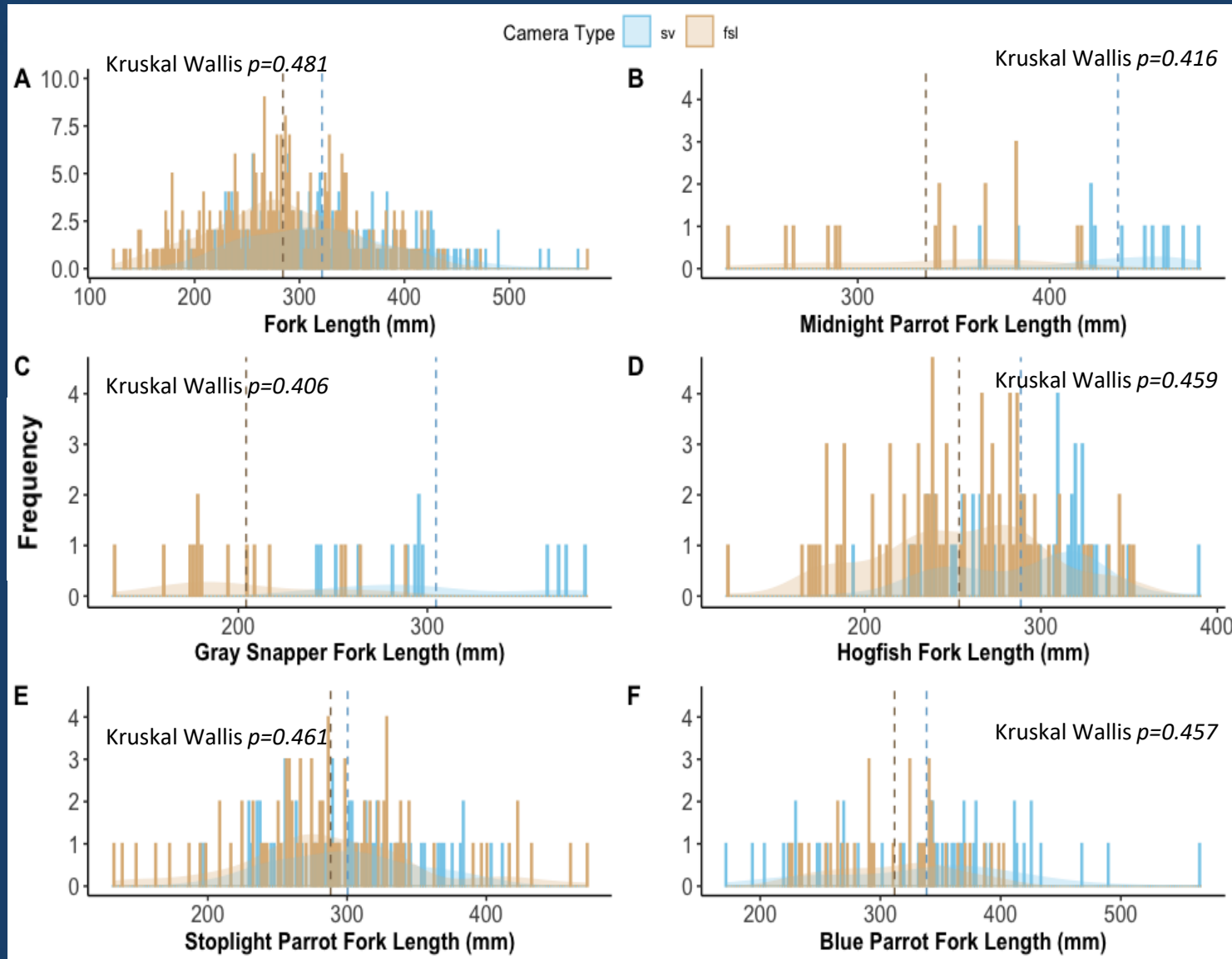


Methods – Data Collection

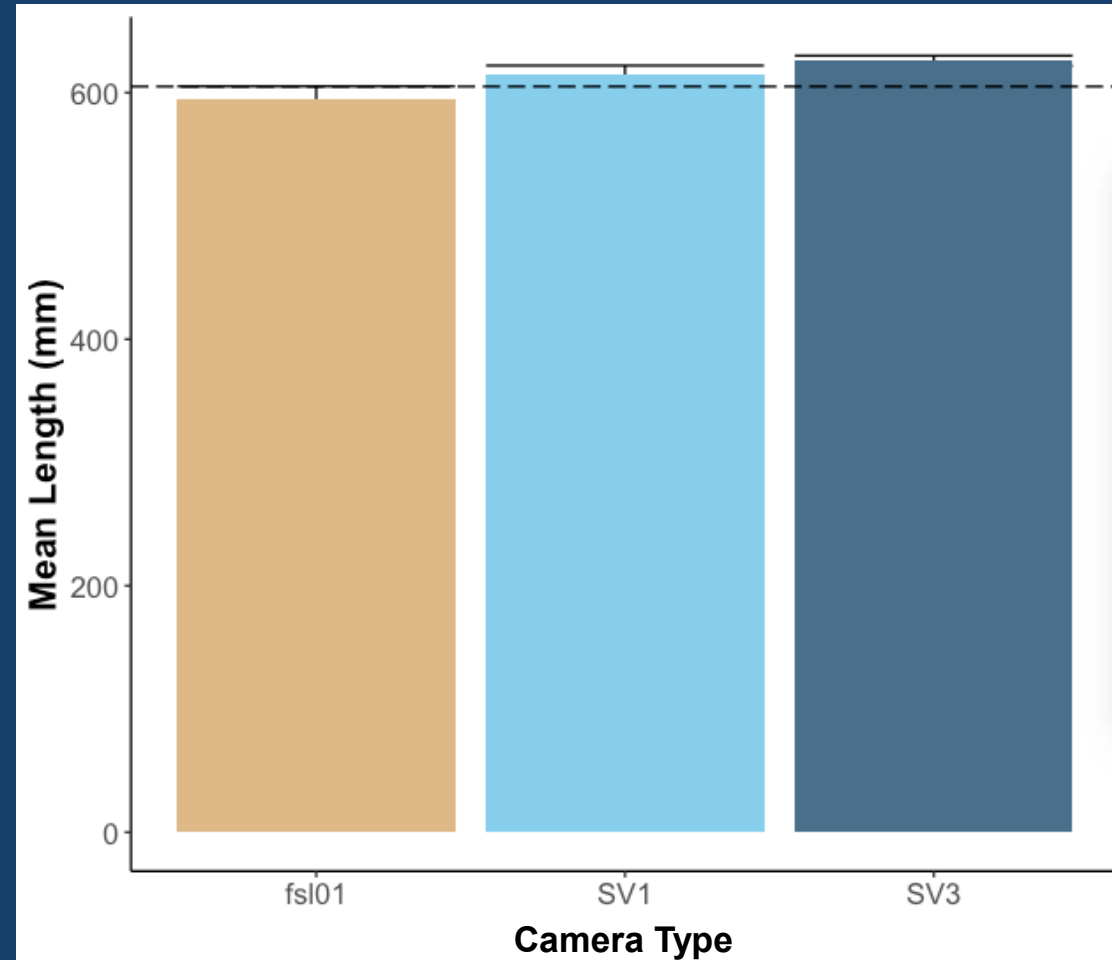
- Location: Florida Keys
- FSL camera used by citizen scientist divers to collect images with laser on lateral side of 12 target spp.
- Brief, online training and dockside instruction
- Perform dive: photos of dive calibration slate; images of fish on central, lateral side
- Stereovideo camera used by staff to compare with FSL cameras



Preliminary Results - Length Distribution x Species



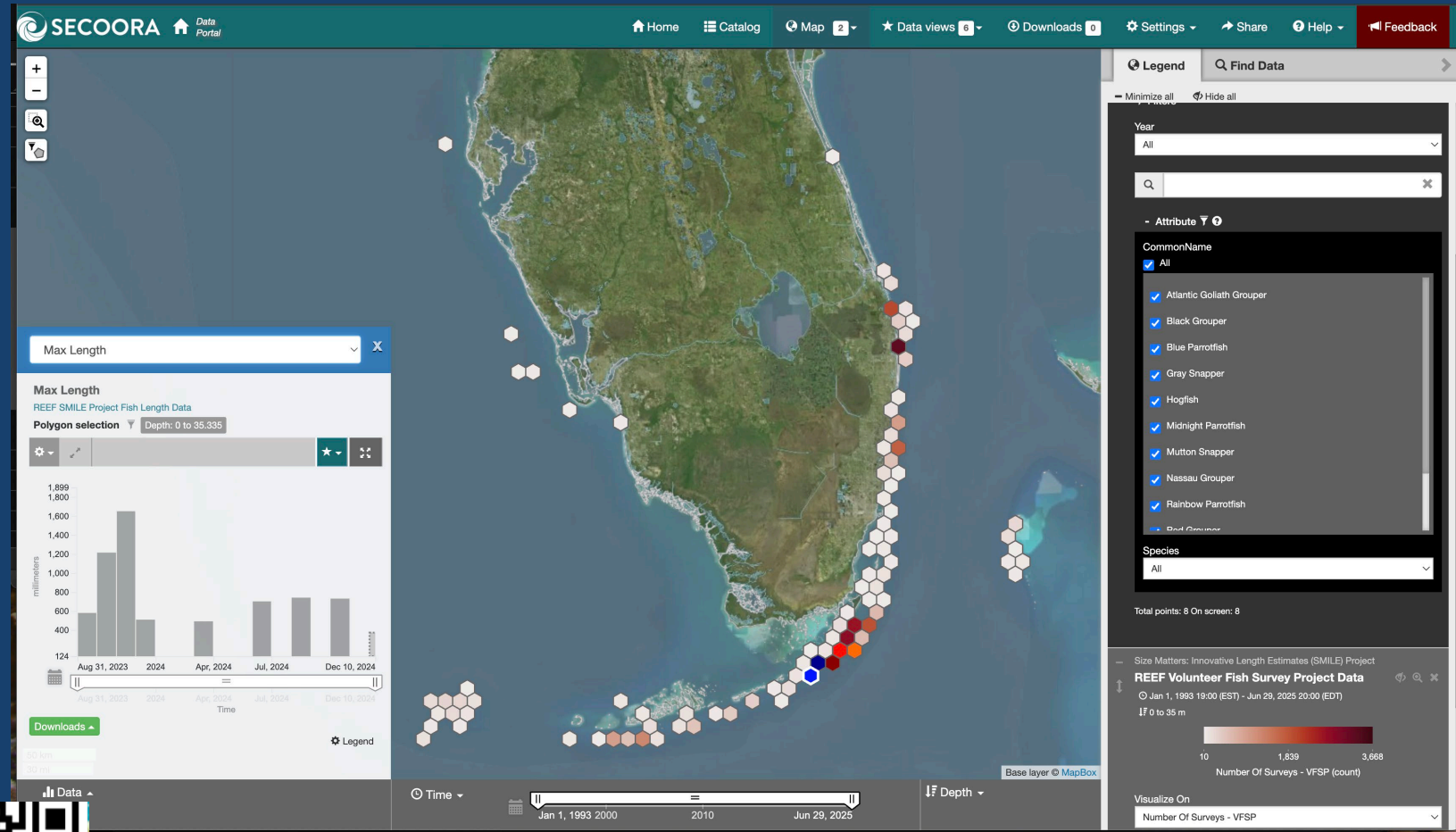
Preliminary Results – Known Objects



Kruskal-Wallis chi-squared = 4.4351, df = 3, p-value = 0.2181

Data Visualization

- Publicly available data!
- SMILE data layer
 - Length data
 - # of surveys
 - 2023-Present
- REEF's Volunteer Fish Survey Project layer
 - Sighting frequency
 - # of Surveys
 - 1993-Present



Citizen Science Participation

- 50+ different volunteers; 295 total dives in Keys; 9 REEF Survey Trips
- Local dive operators partnership
- Formal survey to examine motivators & barriers to participation; camera performance & use
 - Assess demographics for target audience

What would be your level of interest in using the camera as part of this project?

If you participate in marine species monitoring, how much of an impact do you believe your contribution would have on fisheries management?



What type of training would you prefer to learn the skills to participate in the project?

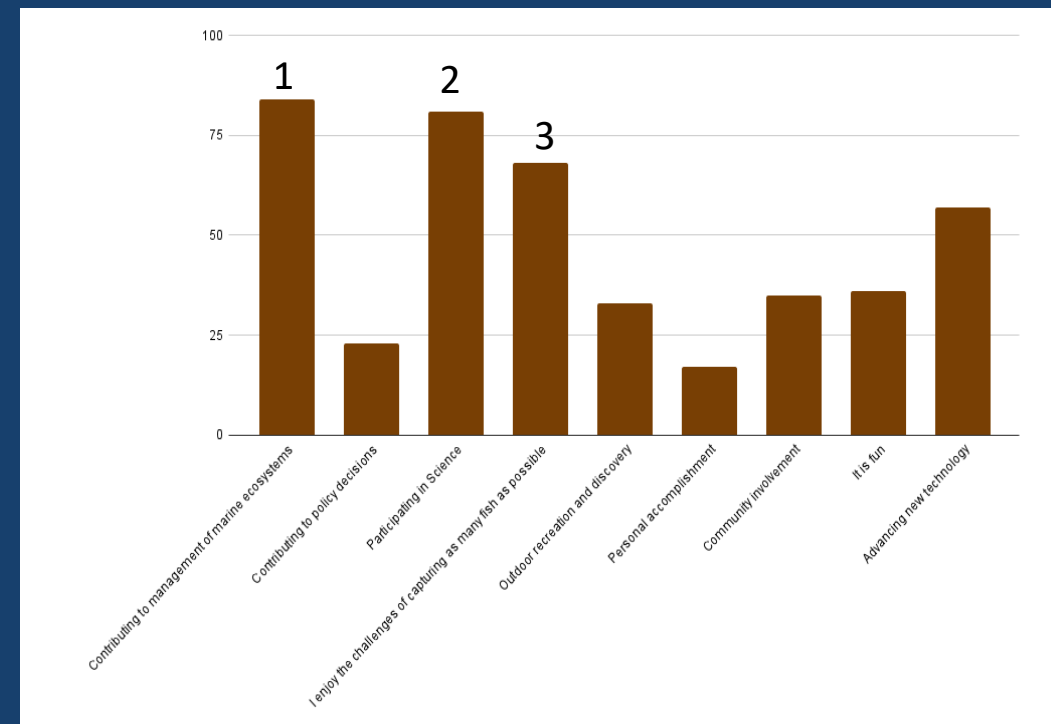
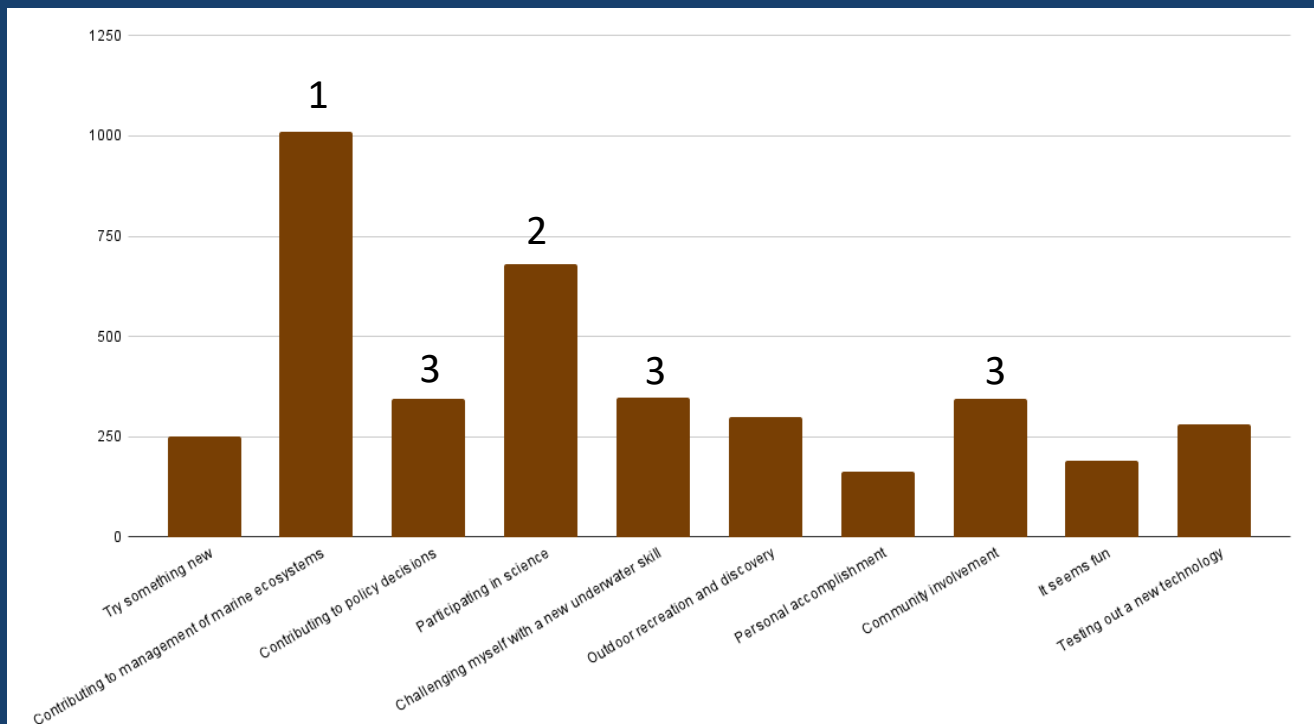
How easy was it to perform both a REEF survey and use the camera for the SMILE project at the same time?

What would most motivate you to participate in the project?

Citizen Science Survey - Motivations

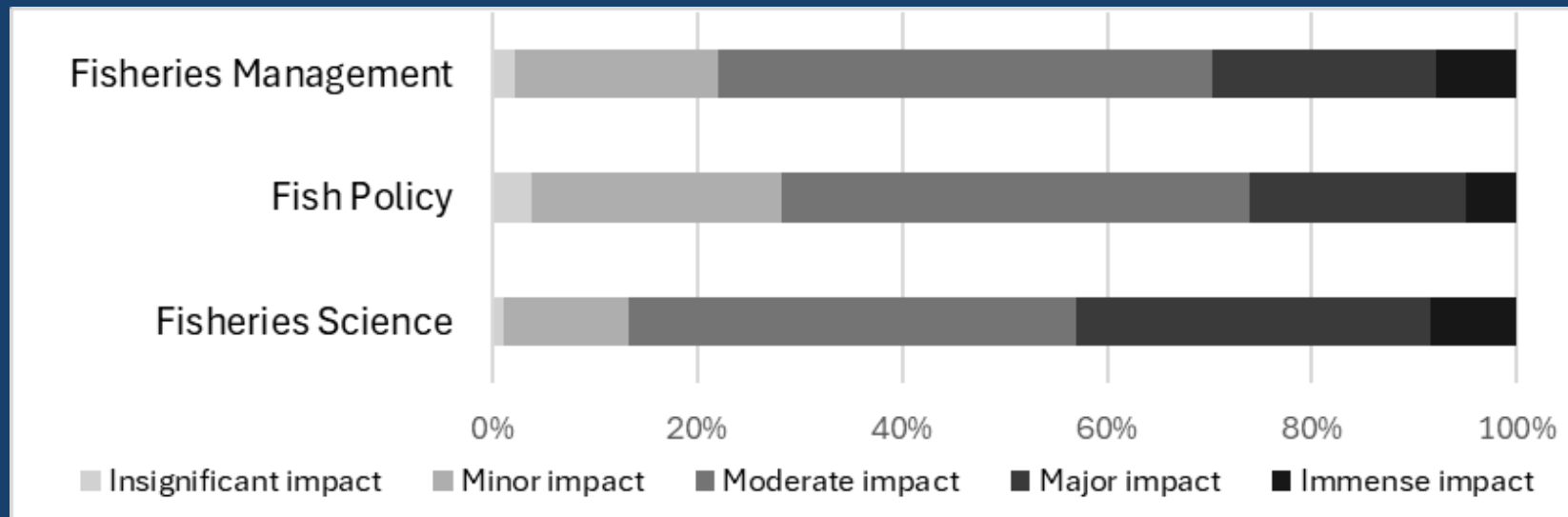
What would motivate citizen scientists to participate in SMILE?

What would motivate SMILE-users to participate again in the future?



Citizen Science Survey - Impact

- Majority feel they have at least a moderate impact on fisheries science, management, and policy
- Divers are a motivated, engaged group to collect fish data!



Positive, though weak, correlation between perceived impact and interest in participation
($\rho = 0.24$, $p < .001$, $n = 413$)

Summary

- Camera systems are comparable to each other to generate lengths
 - Stereo-video tends to measure larger than Fish Sense Lite
- Positive citizen scientist response
- Publicly available data, akin to REEF's VFSP



Thank you!

Our team of volunteers

Forever Young Spearfishing Charters

Funding: NOAA CRCP Grant # FNA22NMF4410182

Project Partners:



SECOORA
SOUTHEAST
COASTAL OCEAN OBSERVING
REGIONAL ASSOCIATION

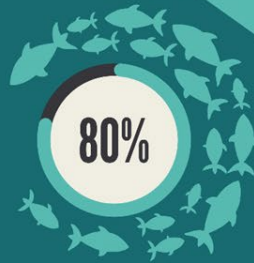


The SMILE Project: Size Matters, Innovative Length Estimates



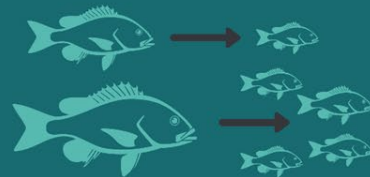
www.REEF.org/smile-project

SCAN TO
LEARN MORE



We are data limited for 80% of fish stocks in South Atlantic and Gulf of Mexico federal waters *

Length data provide key insight into the status of fish populations



Older, bigger fish are often more reproductively active and produce more eggs than younger, smaller fish

* Williams, E. (2017, May). SEDAR Stock Assessments: Transitioning from Benchmarks/Updates to Research/Operational. NOAA Fisheries.



Measuring fish often requires handling or harvesting, which can be stressful to the fish



Length data are often limited on ecologically important fish such as parrotfish and grouper



With the SMILE project, citizen science divers photograph key species like Black Grouper with laser mounted cameras

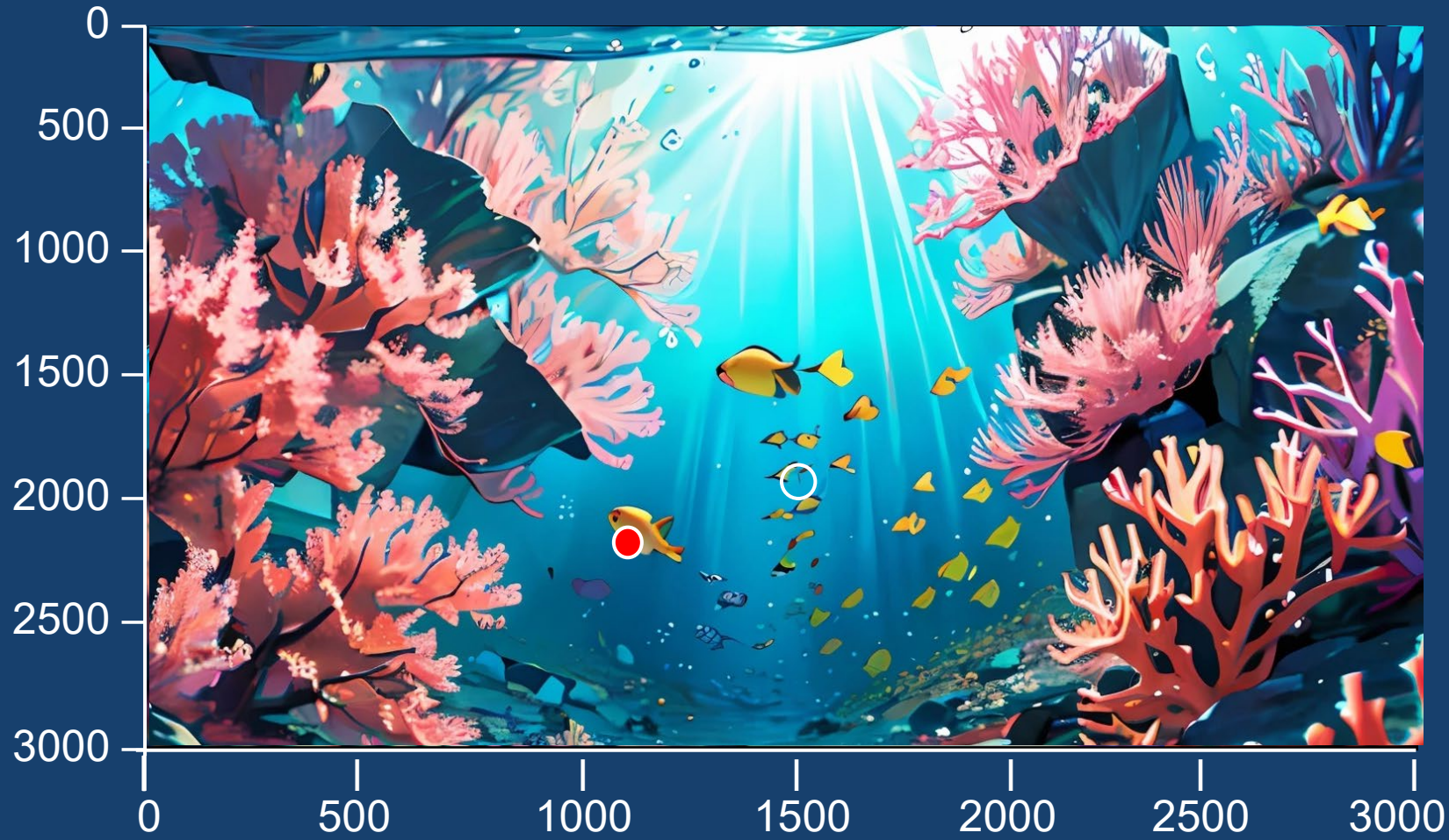


Photos are analyzed to generate a length estimate without handling fish

Questions?

Methods – FSL Data Processing

Single-laser method relies on depth-of-field, AI workflow to I.D. head/tail, and raw image file to compute fish length



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