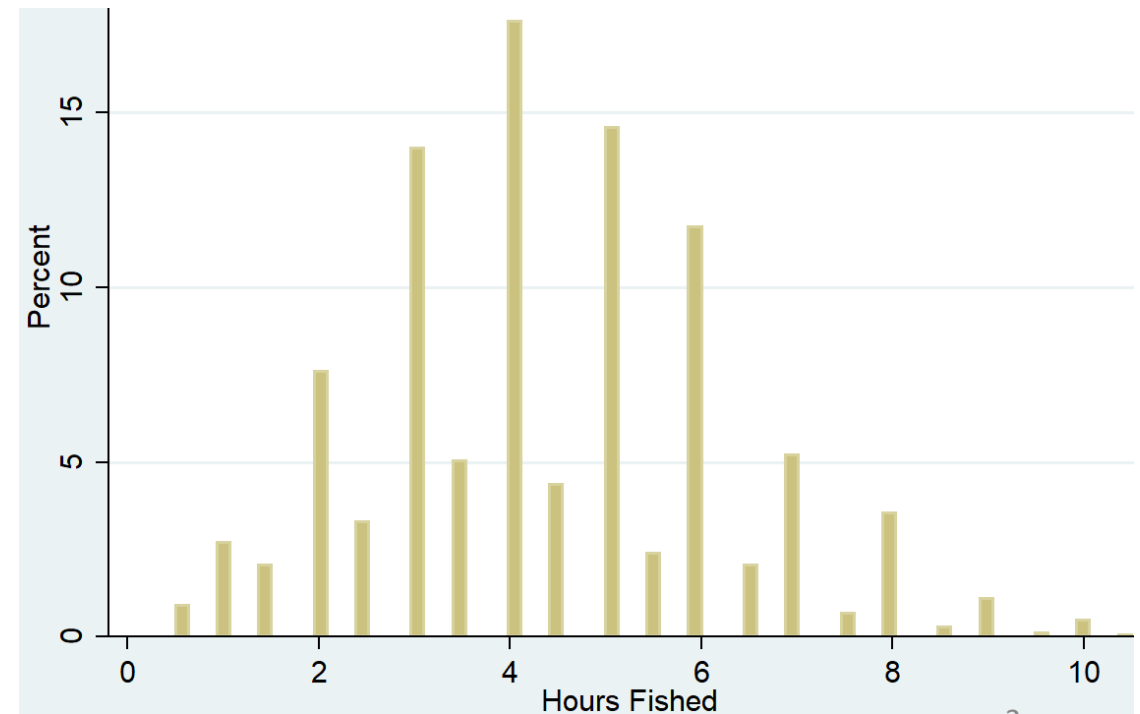


The benefits and challenges of using smartphone apps for recreational fisheries management and valuation

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What's missing in the economic analysis of recreational fisheries?

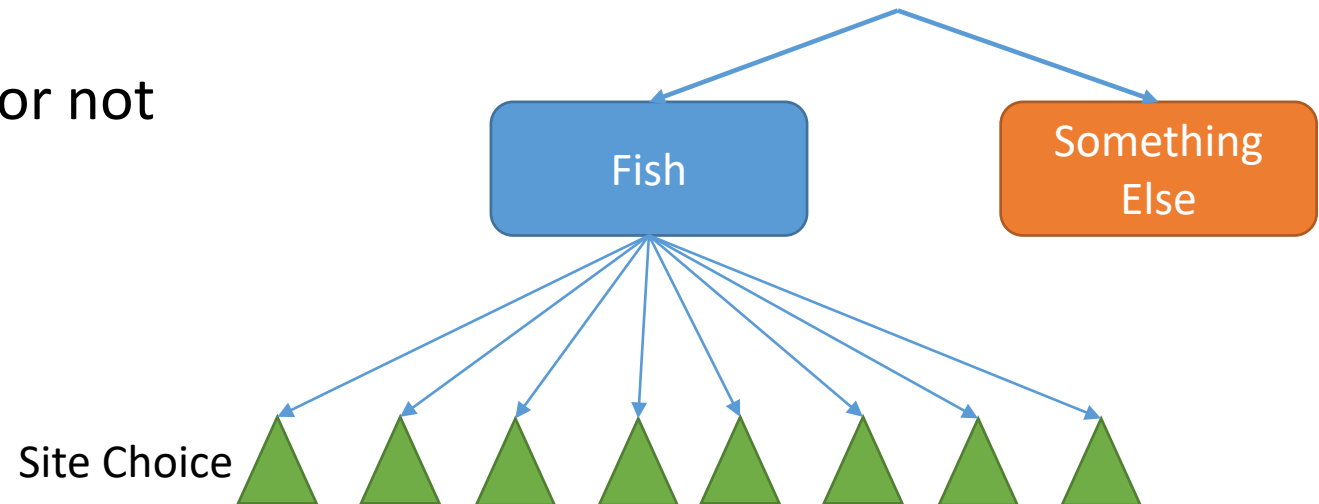
- Marine recreational anglers spend hours on the water and the choices that they make there are critical to the impact that they have on the impact of their activities and the value of their fishing experience.
- For the most part, economists have ignored these choices.



Source: Selected MRIP data for GOM private boat trips

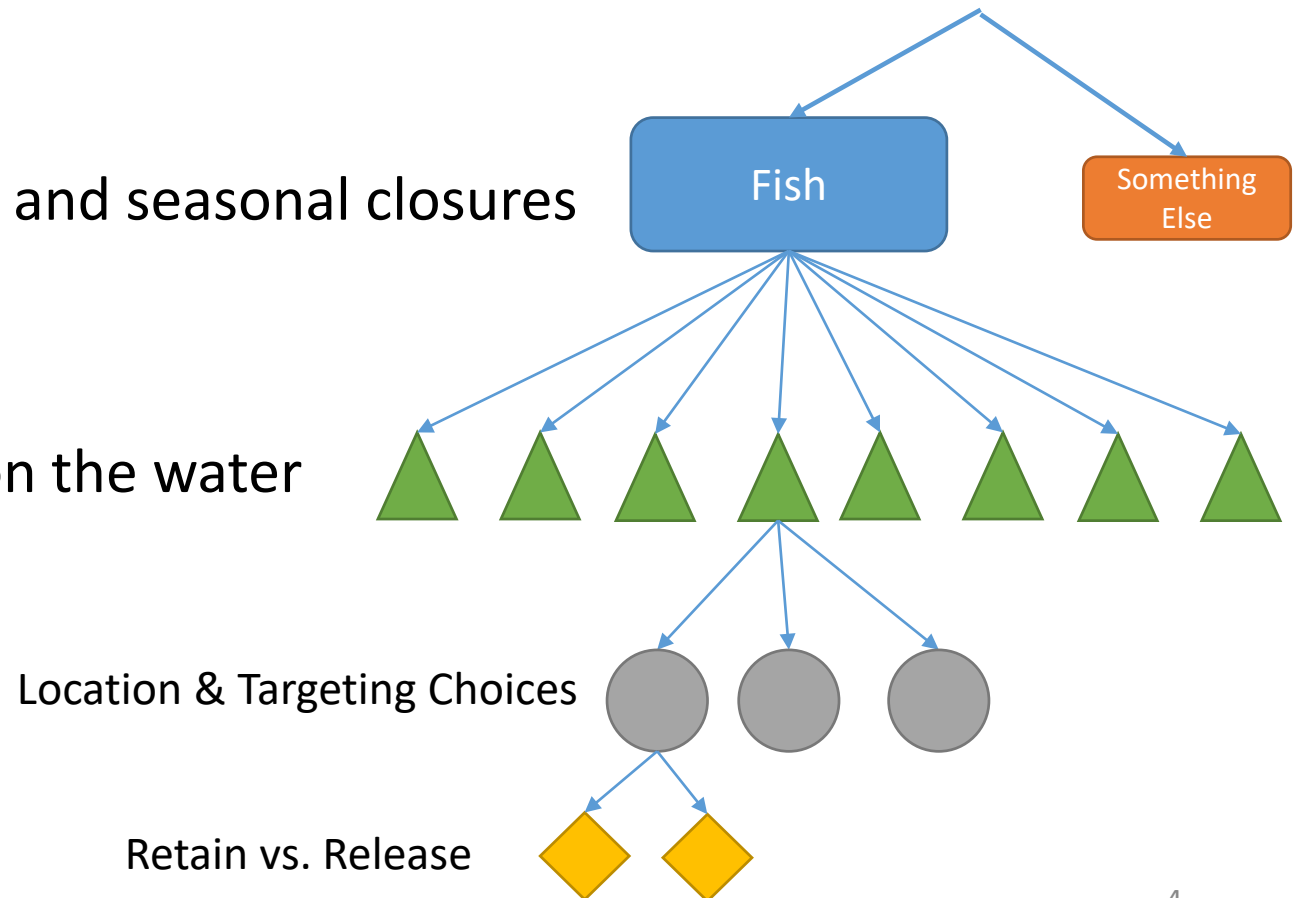
Standard empirical analysis of recreational fishing

- Site choice models:
 - Where to launch as a function of conditions at the launch site such as catch rates and water quality
- Extensive margin
 - Whether to go fishing or not



Little empirical analysis of the choices anglers make while on the water

- Targeting and Retention vs. Release
 - Impacts on fishing mortality
 - Impacts on angler satisfaction
 - Affected by bag limits, size limits and seasonal closures
- Location choice
 - Impacts on fishing mortality
 - Travel costs include movement on the water



Questions that cannot be answered in standard site choice analysis

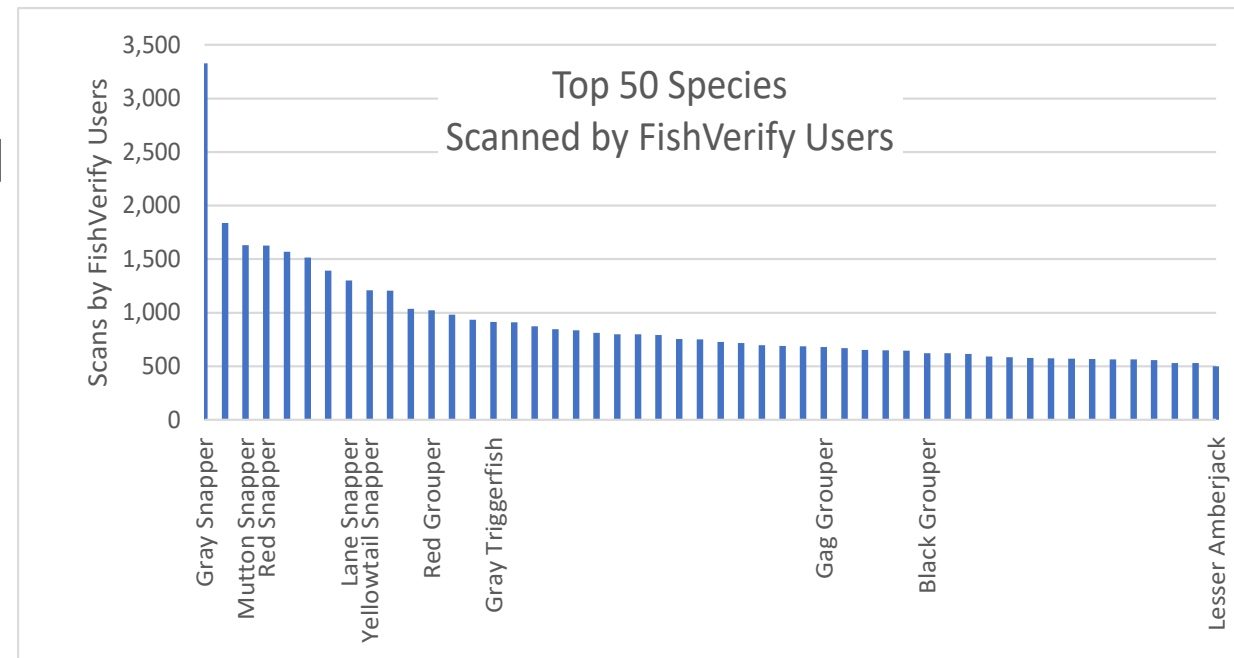
- Management
 - How do size and bag limits affect angler decisions?
 - Discards of target species
 - Targeting of alternative species
 - Travel on the water
 - How do oil & gas rigs and artificial reefs affect angler decisions?
- Valuation
 - How should on-water travel be incorporated into recreational fishing valuation?
 - When fishing opportunities are spatially dispersed in the water, a spatially explicit model of angler choices is needed

A need for new technology

- “Both random utility models and choice experiments can take advantage of emerging technologies to sample anglers through hand held mobile electronic devices such as smartphones and tablets”
(Lipton et al., 2014, p. 14).
- **The time has come!** As of early February 2021, 85% of Americans owned a smartphone, up from only 35% in 2011 (Pew Research).
- Technological advances in storage, battery life and processor speeds have opened up many options.
- Apps used to date (e.g., FishBrain, iSnapper, iFishForever) have been quite limited.

A proposal for using a smartphone app for economic analysis of marine recreational fishing

- Fish Verify®
 - Commercial app
 - Species identification using image recognition
 - Location tracking
 - 10,000 monthly active users
 - Over 50,000 fish have been identified



A proposal for using a smartphone app for economic analysis of marine recreational fishing

- TAMU-FV
 - Already developed with support from NOAA Fisheries
 - Builds on Fish Verify including its image recognition technology
 - Will allow us to deploy the app to anglers who agree to use the app during a single trip
 - Pre- and post-trip surveys on the app allow stated choice questions and analysis of angler satisfaction.
 - Researcher interface
 - Very positive feedback from members of the Upper Keys Fishing Club regarding the pre- and post-trip survey interfaces.

A proposal for using a smartphone app for economic analysis of marine recreational fishing

- Data to be gathered
 - Anglers will be recruited to use the app during a single trip
 - Anglers will be asked to record all fish landed and indicate if the fish is retained or discarded
 - Paired with a sign-up survey gathering
 - Pre- and post-trip surveys on the app allow stated choice questions and the determinants of analysis of angler satisfaction. Other question can be added to address specific issues

A RUM model with on-water choices

- Consider the utility of an angler at the end of the day (time T) having caught the vector of fish C_T , retained the fish R_T , and returned to the dock, $L_T = L_0$

$$V_T(C_T, R_T, L_T) = U^T\left(C_T, R_T, \{L_t, \varepsilon_t\}_{t=1}^T\right) - \sum_{t=1}^T d(|L_t, L_{t-1}|)$$

where $d(|L_t, L_{t-1}|)$ is the cost of traveling the distance $|L_t, L_{t-1}|$.

- The ex-ante value, therefore is

$$V_0(0, 0, L_0) = E_{t=0} \left[U^T\left(C_T, R_T^*, \{L_t^*, \varepsilon_t\}_{t=1}^T\right) - \sum_{t=1}^T d(|L_t^*, L_{t-1}^*|) \right]$$

where R_T^* and L_t^* are the optimal choices of what fish to retain and what locations to choose.

A RUM model with on-water choices.

Example: fish or move.

- At time t , during a trip, assume that the angler chooses whether to fish, $z_t = f$, or move to a new location, $z_t = m$:

$$V_t(C_t, R_t, L_t) = \max_{z_t = f, m} \begin{cases} E \left[\max_{r_t \leq c_t} u(c_t(L_t), r_t, C_t, R_t, L_t, \varepsilon_t) \right] + EV_{t+1}(C_{t+1}, R_{t+1}, L_{t+1}) & \text{if } z_t = f \\ \max_{L_{t+1}} -d(|L_{t+1}, L_t|) + EV_{t+1}(C_{t+1}, R_{t+1}, L_{t+1}) & \text{if } z_t = m \end{cases}$$

This is a dynamic optimization problem in which the state variables include the angler's current location, time of day, catch so far and catch retained (relative to the bag limit).

- While estimating such a model will be extremely challenging – it is possible with the data anticipated using the app.

Challenges of using smartphone apps

- Biases inherent in app data (Lipton et al. 2014, Papenfuss et al., 2015).
 - Who is willing to participate?
 - Will participants fully participate or at least participate at a level that is easily identified by the researchers?
 - Will anglers honestly report catch and release decisions?
 - Will anglers be highly averse to location tracking?
- Proposed “solutions” to these problems
 - Significant financial incentives.
 - Clear messaging on the need for better information on recreational fishing
 - Strong assurances of confidentiality and anonymity

Conclusions

- Smartphone apps have been employed for analysis of recreational fishing, but given current technology, they are well short of their potential.
- The question is not whether smartphone apps will be a central part of data collection for recreational fisheries, but when?
 - Offer the potential to address new and important questions in recreational fisheries management and valuation.