Office of Science and Technology

NOAA Fisheries Rare Event Species Working Group

South Atlantic Fishery Management Council Meetings
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Background

- NOAA Fisheries working group established to evaluate estimation options for species infrequently encountered in Access Point Angler Intercept Survey (APAIS)
- Participants are from NMFS regional Offices and Science Centers as well as Offices of Science and Technology and Sustainable Fisheries, Westat statistical consultants, Mike Brick and Jean Opsomer

Scope of work

- Today's presentation borrows "heavily" from a presentation made by Jean Opsomer of Westat to the National Academies Panel on "Data and Management Strategies for Recreational Fisheries with Annual Catch Limits"
- The work presented represents some of the options being considered by the working group and evaluated by Jean and others as potential alternative estimation methods

Improving estimation of rare event species in MRIP

Jean Opsomer, Westat

- Consultants have:
  - background in survey statistics and methods
  - long history working with MRIP staff on survey related research (e.g., sampling design, transition to new methods, certification of state surveys)
  - good understanding of recreational data collection and estimation challenges

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Rare Event Species

- MRIP produces estimates of catch for very large numbers of domains: by species, wave, state, mode fished, type of catch,area fished, etc
- Estimates serve as input to model fishery stocks, to set annual catch limits and monitor catch levels
- For some species, sample sizes are too small to lead to usable estimates and a large increase in sampling effort would be needed to improve estimates and may only be effective for some species
  - small area estimation problem
- Additional challenges: not practical to develop “custom" estimation methods for different species, and methods have to be able to handle in-season estimation

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Estimators

- Current estimator of catch t_y^* (species y, target year $*$):

$$\begin{aligned} \widehat{t_y^*} &= \sum_{s^*} w_i y_i = \sum_{s^*} w_i \frac{\sum_{s^*} w_i y_i}{\sum_{s^*} w_i} \\ &= \widehat{N}^* \bar{y}^* \end{aligned}$$

with $\widehat{N}^*$ estimating total number of trips (good) and $\bar{y}^*$ estimating average catch/trip (not good for rare species)

- Alternative estimators replace $\bar{y}^*$ by multiyear average

$$\tilde{y}^* = \sum_{j=1}^{J} a_j \bar{y}_j$$

(* is one of the j)

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Estimators

Table1: Coefficients for original and multi-year estimators evaluated in this study.

Estimator	-4	-3	-2	-1	Target year (*)	+1	+2
Original estimator (ORN)					1		
Time series prediction, 3-year (TS3)			1/3	1/3	1/3		
Time series prediction, 5-year (TS5)	1/5	1/5	1/5	1/5	1/5		
Moving average, 3-year (MA3)				1/3	1/3	1/3	
Moving average, 5-year (MA5)			1/5	1/5	1/5	1/5	1/5
Moving average, 5-year, modified version 1 (MA5_1)			1/10	¼	3/10	¼	1/10
Moving average, 5-year, modified version 2 (MA5_2)			1/12	¼	1/3	¼	1/12
Moving average, 5-year, modified version 3 (MA5_3)			1/12	1/6	1/2	1/6	1/12

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Evaluating Estimators

- Synthetic estimators are no longer unbiased, so need to assess mean squared error (bias and variance)
- Variance measure: coefficient of variation (CV), based on linearized variance
- Bias measure: fraction of times synthetic estimator falls outside of 95% confidence interval of original estimator
- Both measures are (very) imprecise for rare event species, so average over time periods and species

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Figure 1: Performance of estimators on both evaluation measures

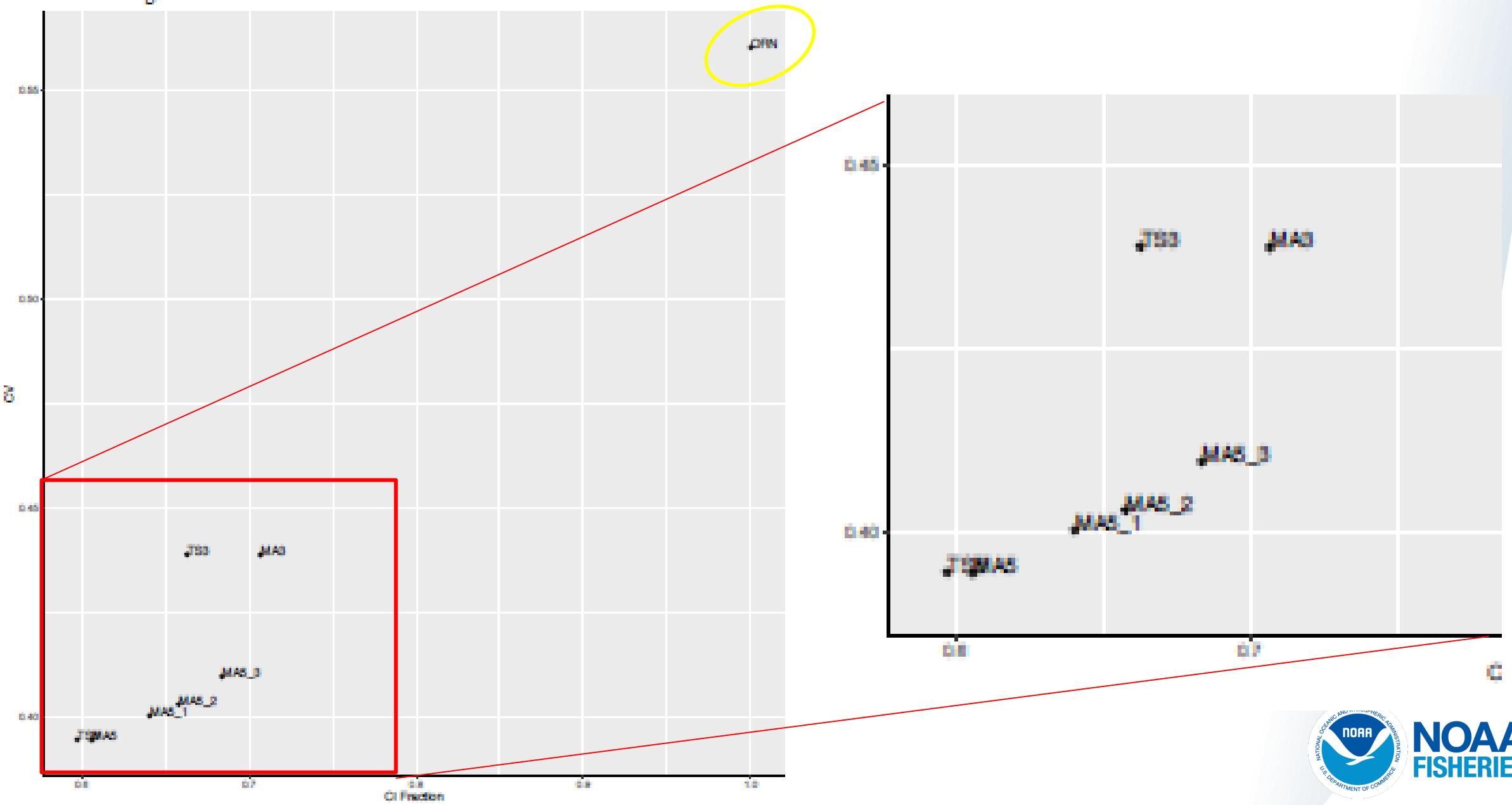
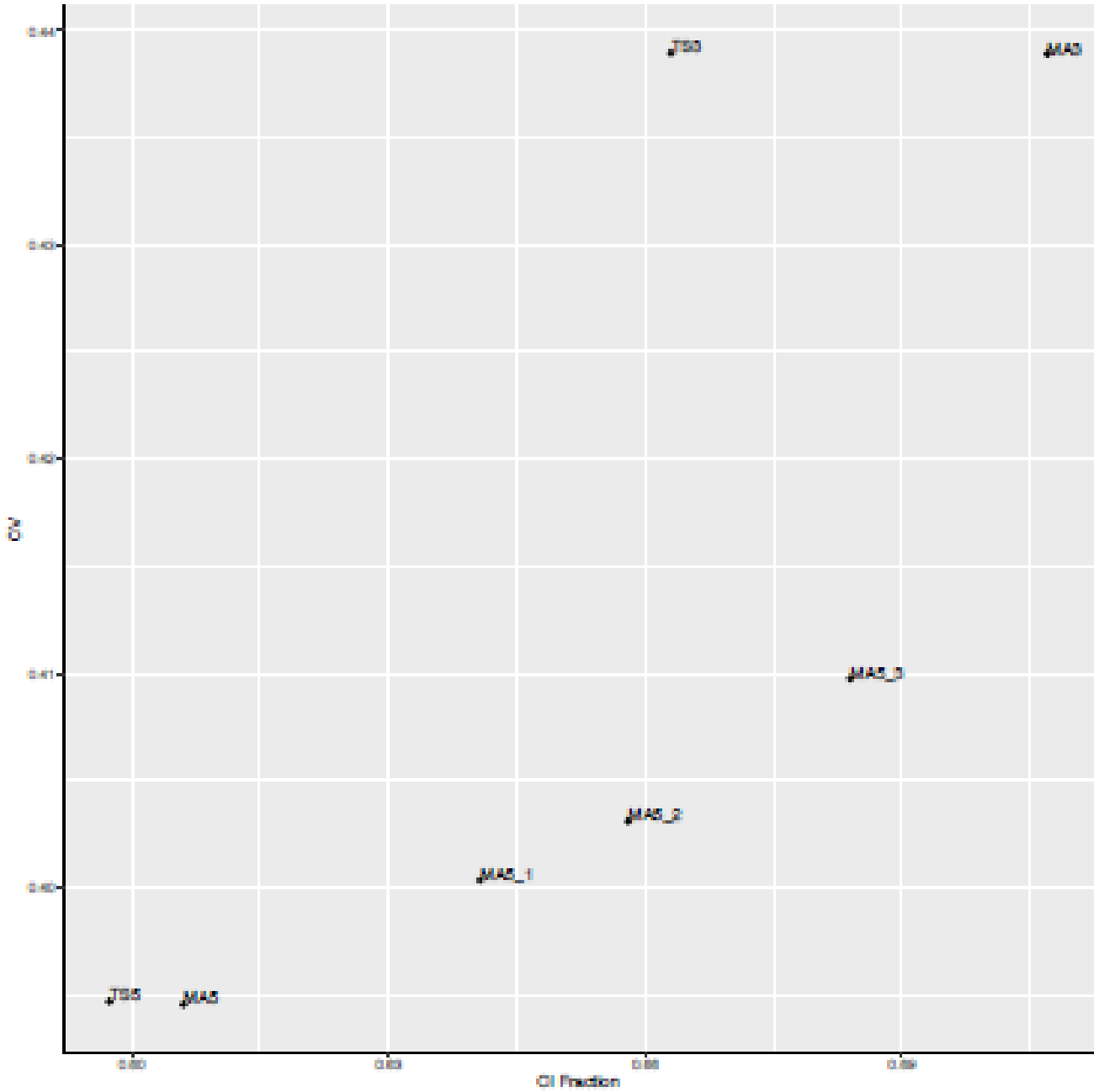


Figure 2: Performance of multi-years estimators on both evaluation measures.



- Original Estimator (ORN) removed
- 5 year moving averages (MA5) and time series (TS5) “better” than 3 year average (TS3).

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Conclusions

- Possible to improve estimates by pooling over time (although application of moving averages would have management implications)
- Simple to implement and explain
  (Other more complex approaches (modeling) should also be evaluated)
- Provides estimates even when no catch observed in target period

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Considerations moving forward

- Initial work shows that there may be a number of viable options available to improve estimates
  - Implications for application of methods
    - Standards for application (e.g. consistency and comparability)
  - Resulting estimators no longer unbiased
- Next steps will be to evaluate more sophisticated approaches such as modeling
  - Application of more complex methods may pose some additional challenges
- It is not likely that there will be a “best” method

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