



**NOAA
FISHERIES**

Southeast
Regional
Office

Snapper-Grouper Amendment 37: Recreational Decision Tools for Hogfish Management



SSC Meeting
May 2016
Charleston, SC

Goals

- Provide tools to the Council that allow them to see the combined effects of different seasonal closures, size limits, and bag limits for the FLK/EFL and GA-NC hogfish stocks
- Evaluate the impacts of effort shifting and uncertainty



Methods

Data Source

Modified SEFSC Recreational ACL Dataset

- Contains SRHS and MRIP landings by mode and wave
- 3 sub-regions prior to average weight assignment (FLK/EFL, GA-NC, GOM)
- Additional level of hierarchy in weight assignment:

sub-region, decade, year, state, mode of fishing, wave, area of fishing (i.e., inshore vs. offshore)

- Minimum sample sizes: GA-NC (n=10), FLK/EFL (n=30)
- Assume landings distributed uniformly within waves (MRIP) and months (headboat)

Seasonal Closures



- Daily catch rates for hogfish are highly seasonal
- RDT models allow user-specified days closed for each month
- Effort shift scalars designed to redistribute days as a proxy for increased effort before and after closures
 - Allows model to compensate for lost fishing days due to seasonal closures while preserving differences in daily catch rates between months.

$$L_{mode,m} = (BL_{mode,m} * O_m) * \left(1 + \sigma_m * \begin{cases} \text{if } < 100\% \text{ closed: } \left[\left(\frac{\sum_{d=Jan}^{Dec} 31 [d = \text{closed}]}{\sum_{d=Jan}^{Dec} 31 [d]} \right) * \left(1 + \frac{\sum_{m=Jan}^{Dec} [O_m = 0\%]}{\sum_{m=Jan}^{Dec} [O_m > 0\%]} \right) \right] \\ \text{if } 100\% \text{ closed: } 0 \end{cases} \right)$$

where $L_{mode,m}$: projected landings after accounting for change in open season, $BL_{mode,m}$: projected landings by mode and month, d : day of the month, O_m : percent of month open to fishing, and σ_m : effort shift scalar for open month m .

Size Limits



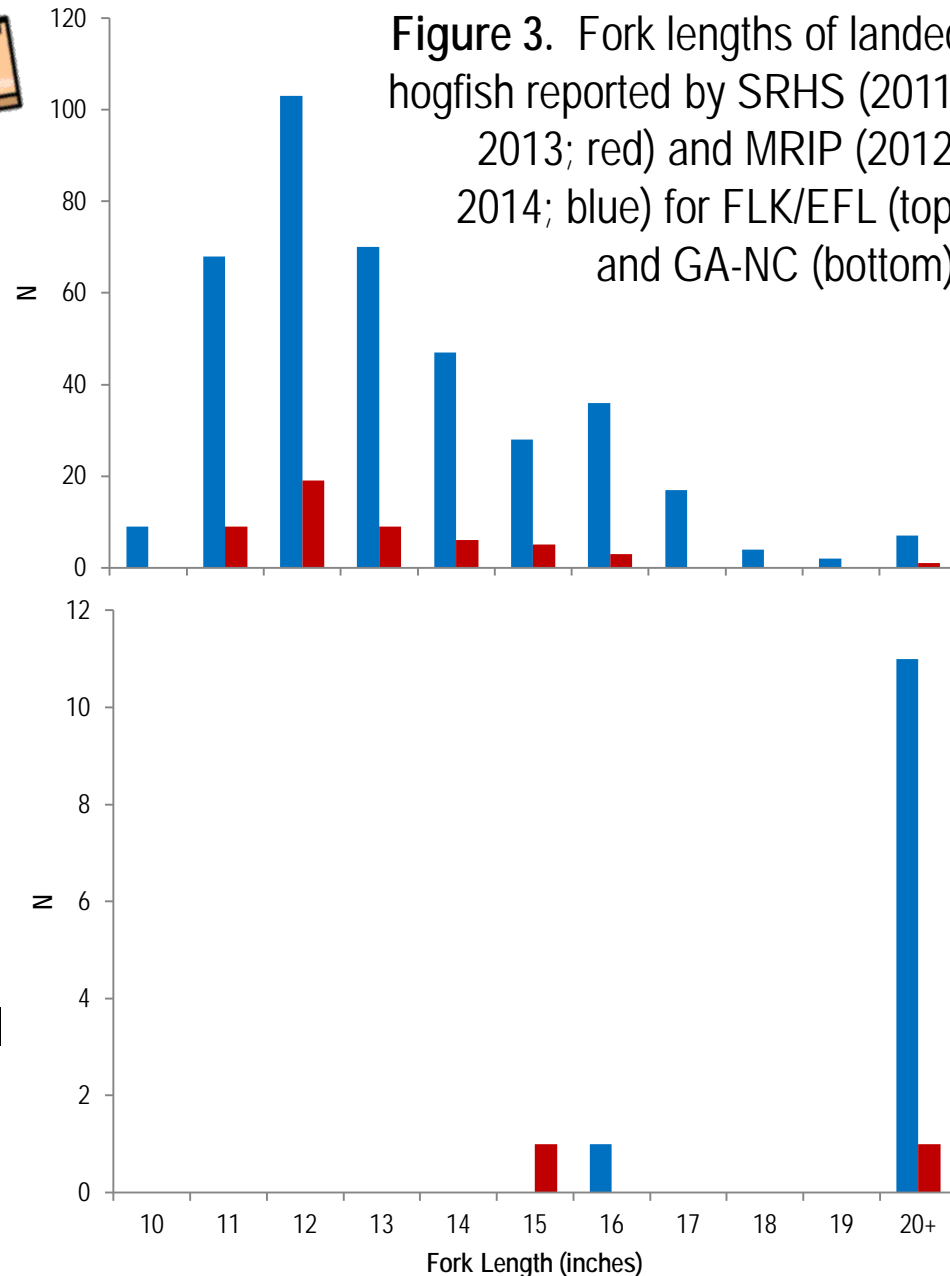
- Simulated size limit impacts by 'removing' oversized fish from catch files and recomputing landings.
- Pooled data across waves until $n \geq 30$

$$L_{mode,m} = BL_{mode,m} * S_{mode,m}$$

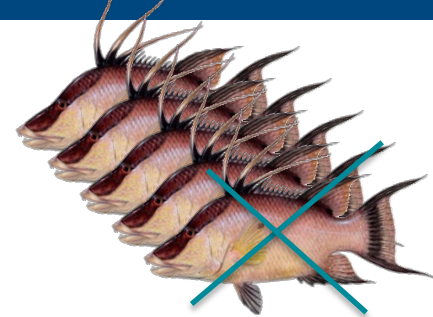
$$S_{mode,m} = (G + B)/C$$

where $S_{mode,m}$: MSL impact scalar, C : catch in number of fish at the current MSL, G : number of fish that are greater than or equal to the proposed MSL, and B : number of fish smaller than the current MSL (non-compliance/measurement error).

Figure 3. Fork lengths of landed hogfish reported by SRHS (2011-2013; red) and MRIP (2012-2014; blue) for FLK/EFL (top) and GA-NC (bottom).



Bag Limits



- Mean of last 3 years (SRHS: 2011-2013; MRIP: 2012-2014)
- Simulated bag limit impacts by 'removing' fish over bag limit from catch files and recomputing landings.
- Pooled data across waves until $n \geq 30$

$$L_{mode,m} = BL_{mode,m} * \beta_{mode,m}$$

$$\beta_{mode,m} = (C - E - I)/C,$$

where $\beta_{mode,m}$: bag limit impact by mode and month, C : catch in number of fish at the current bag limit, E : number of fish on trip that exceed the proposed bag limit, I : number of fish above the current bag limit (non-compliance or measurement error)

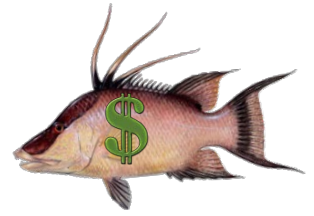
Combined Effects

$$L_{mode,m} = (BL_{mode,m} * O_m * \varsigma_{mode,m} * \beta_{mode,m}) * \left(1 + \sigma_m * \begin{cases} \text{if } < 100\% \text{ closed: } \left[\left(\frac{\sum_{d=Jan\ 1}^{Dec\ 31} [d = closed]}{\sum_{d=Jan\ 1}^{Dec\ 31} [d]} \right) * \left(1 + \frac{\sum_{m=Jan}^{Dec} [O_m = 0\%]}{\sum_{m=Jan}^{Dec} [O_m > 0\%]} \right) \right] \\ \text{if } 100\% \text{ closed: } 0 \end{cases} \right)$$

$$\text{Projected Dead Discards}_{mode,m} = BD_{mode,m} + (L_{mode,m} - BL_{mode,m}) * \%hook\&line * \%release\ mortality$$

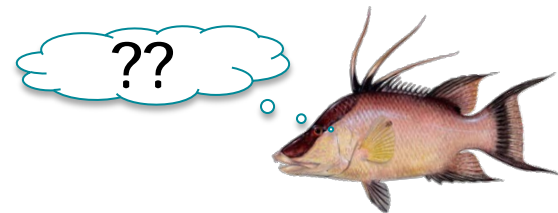
- Per SEDAR-37 (2014), approximately 4% of total discards are attributable to spear gear, despite this gear comprising a much larger proportion of the overall landings.
- FLK/EFL: 73% spear from 2010-2012 (SEDAR-37 2014, Tables 7.2.2.1, 7.2.3.5, and 7.2.3.6).
- GA-NC: Although anecdotal information suggests a high proportion of the GA-NC sub-region landings come from spear trips, no spear trips were sampled from 2010-2012 (SEDAR-37 2014, Table 7.2.3.1).
- 10% release mortality rate to convert to dead discards, consistent with the SEDAR-37 (2014) release mortality rate for hook-and-line gear.
- Projected dead discards added to projected landings to determine total removals.

Economic Effects



- Prior to SG-37, SAFMC hogfish managed as a single stock (EFL-NC), excluding MRIP landings from Monroe County, with an ACL of 85,355 pounds whole weight in MRIP-based units. Projected overage date was April 26 based on mean 2012-2015 landings. Monroe County hogfish managed in Gulf with no anticipated overage.
- FLK/EFL baseline: EFL (Jan 1-Apr 26) + Monroe County (Jan 1-Dec 31).
- GA-NC baseline: GA-NC (Jan 1-Apr 26)
- The RDT displays the total change in CS relative to the status quo under any combination of ACL, MSL, bag limit, and season closure alternatives.
 - $CS = L_{mode,m} * WTP_{snapper}$
 - CS: Consumer surplus; an estimate of the value received by recreational anglers from catching and keeping hogfish.
 - WTP: willingness to pay for an additional 'snapper' (\$12.37 USD₂₀₁₄) from Haab et al. (2012), the best proxy for willingness to pay for hogfish

Uncertainty

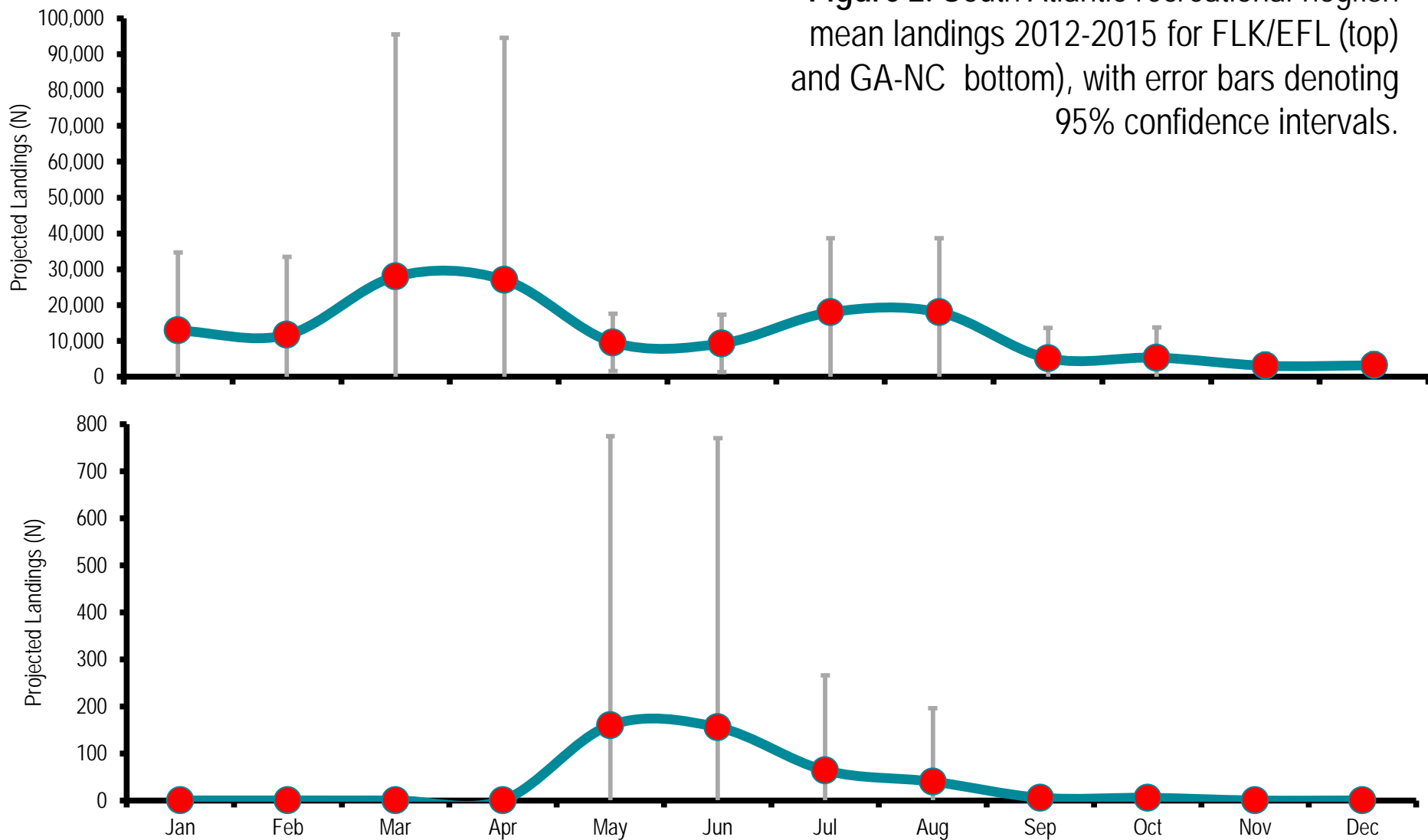


- Uncertainty in mean projected closure dates and projected landings were determined across 1000 bootstrapped runs of each user-selected model configuration.
- Bootstrapping runs accounted for uncertainty in projections data by averaging across 2012-2015 landings generated from random draws from a normal distribution fit to mean and standard deviation from landings survey data from the modified hogfish landings dataset discussed previously.
- Bootstrapping also accounted for uncertainty in size limit and bag limit reductions using random draws for these reductions drawn from normal distributions fit to the mean and standard deviation of the most recent three years of simulated size and bag limit reductions.

Results

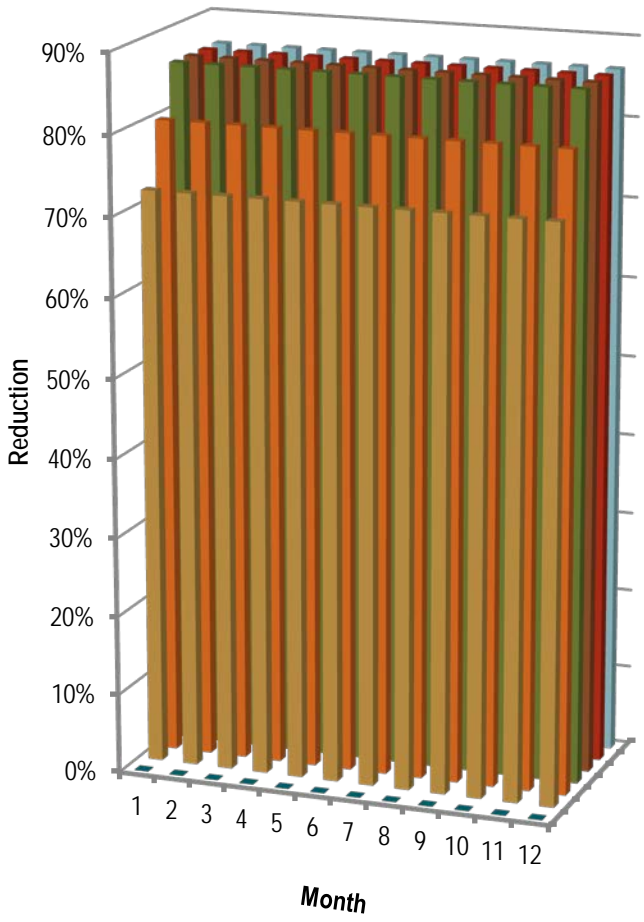
Projected Landings

Figure 2. South Atlantic recreational hogfish mean landings 2012-2015 for FLK/EFL (top) and GA-NC (bottom), with error bars denoting 95% confidence intervals.

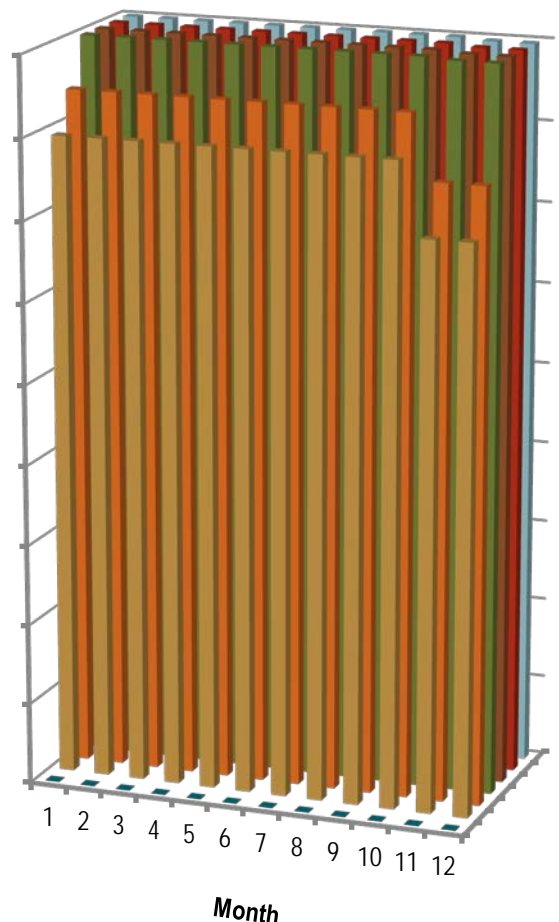


Size Limits: FLK/EFL

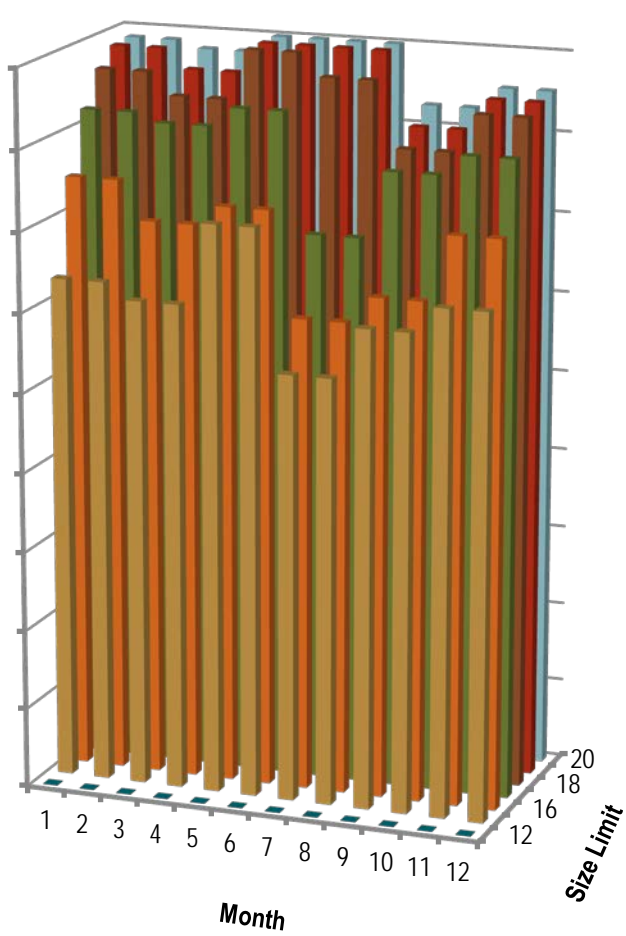
HEADBOAT



CHARTER

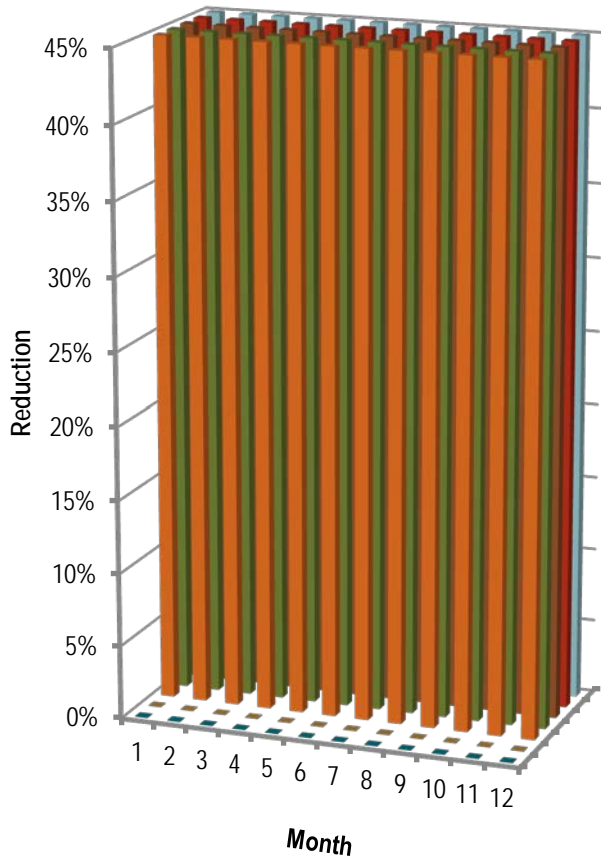


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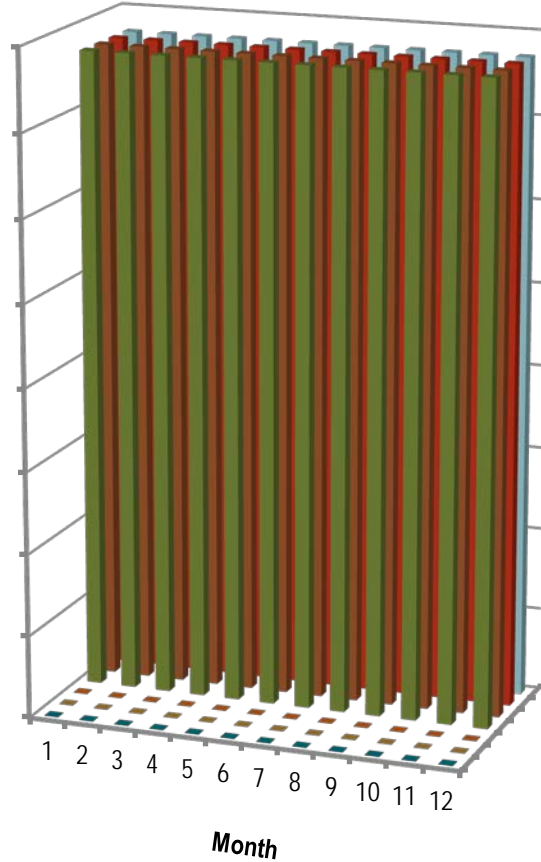


Size Limits: GA-NC

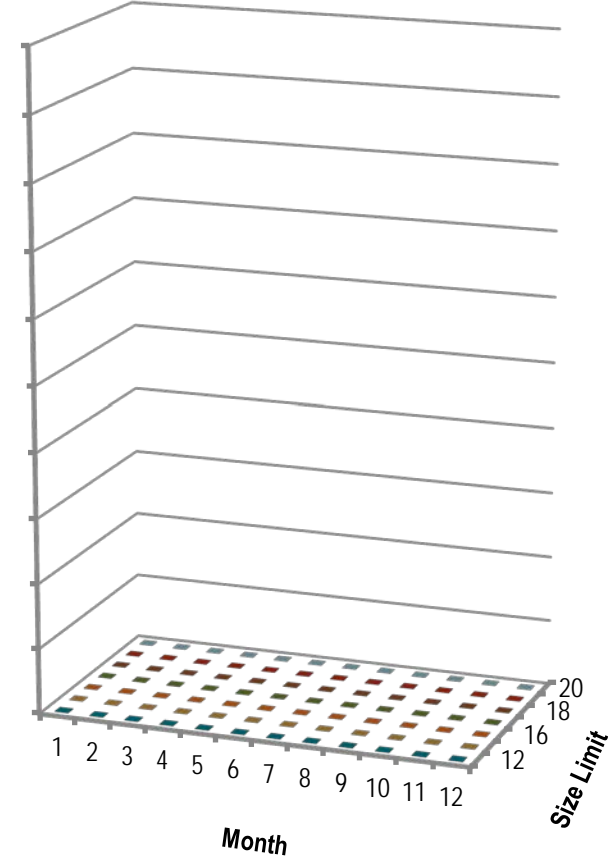
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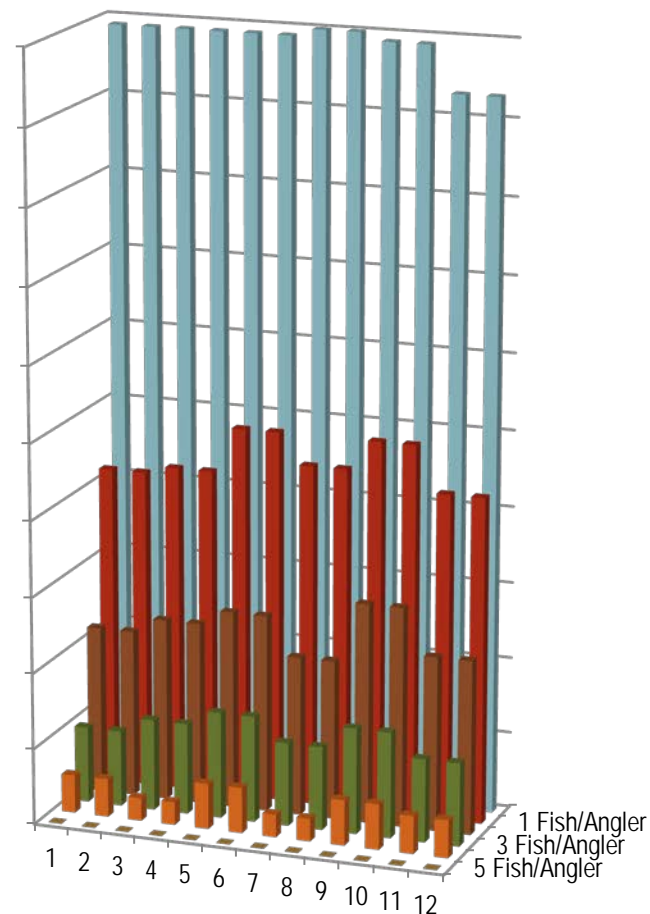
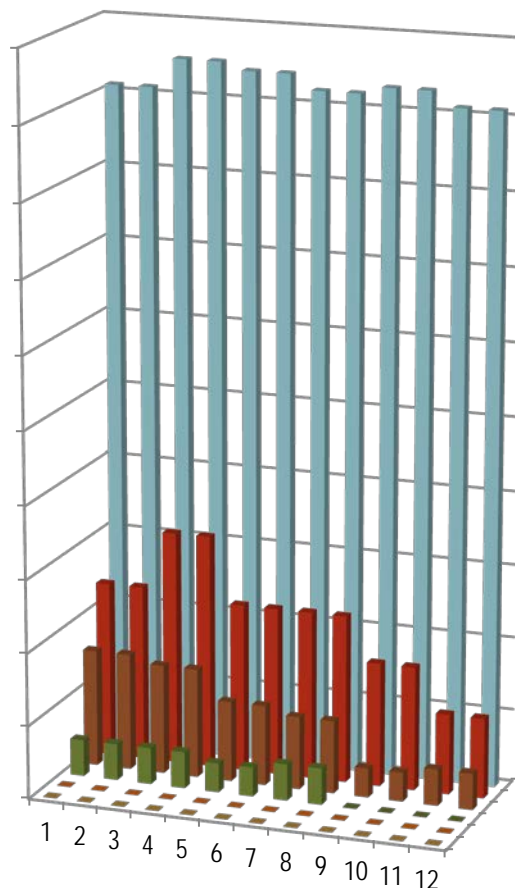
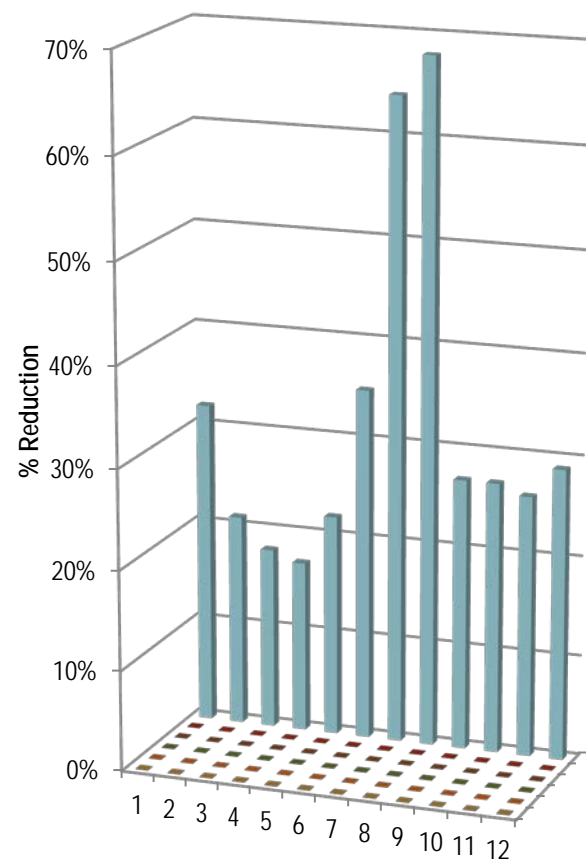


Bag Limit: FLK/EFL

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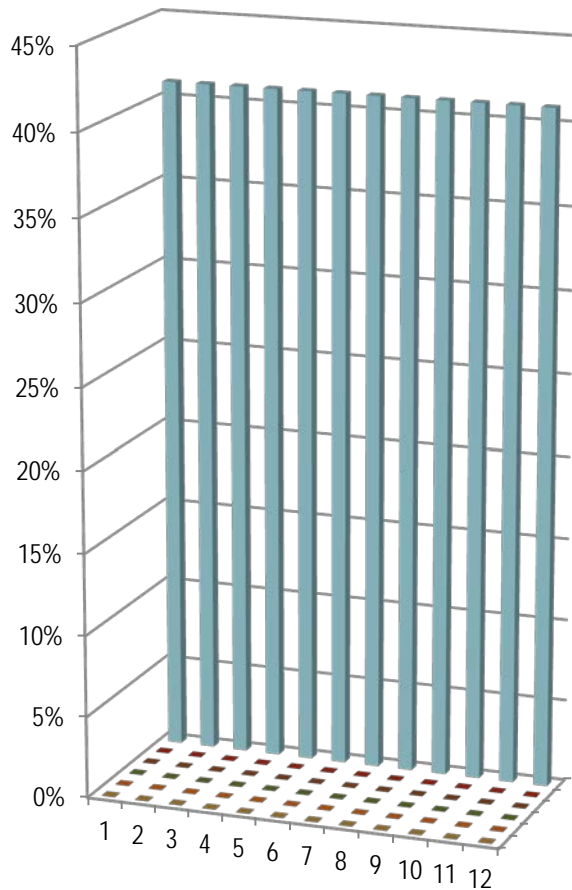
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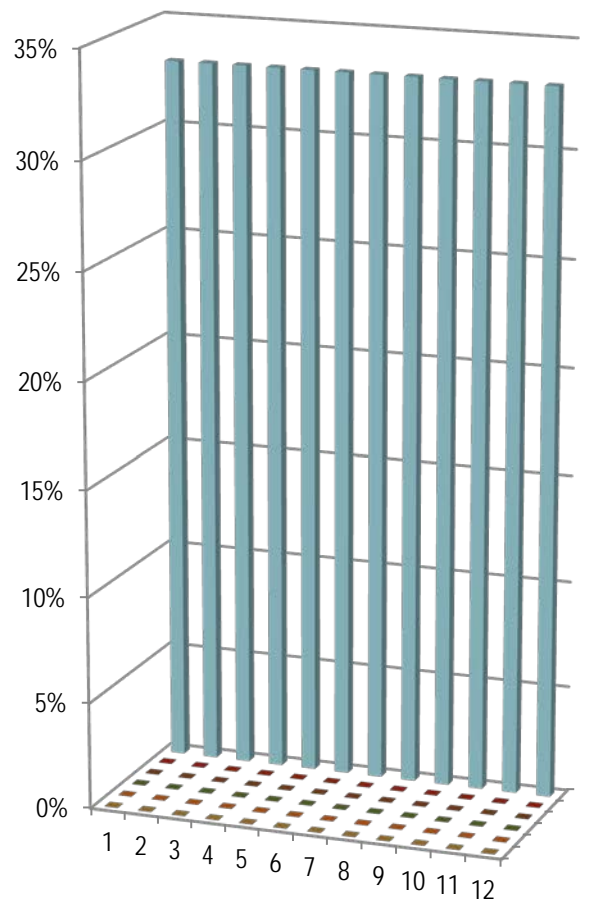
5 Fish/Angler 4 Fish/Angler
 3 Fish/Angler 2 Fish/Angler
 1 Fish/Angler 1 Fish/Vessel

Bag Limit: GA-NC

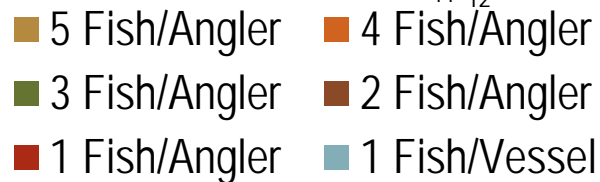
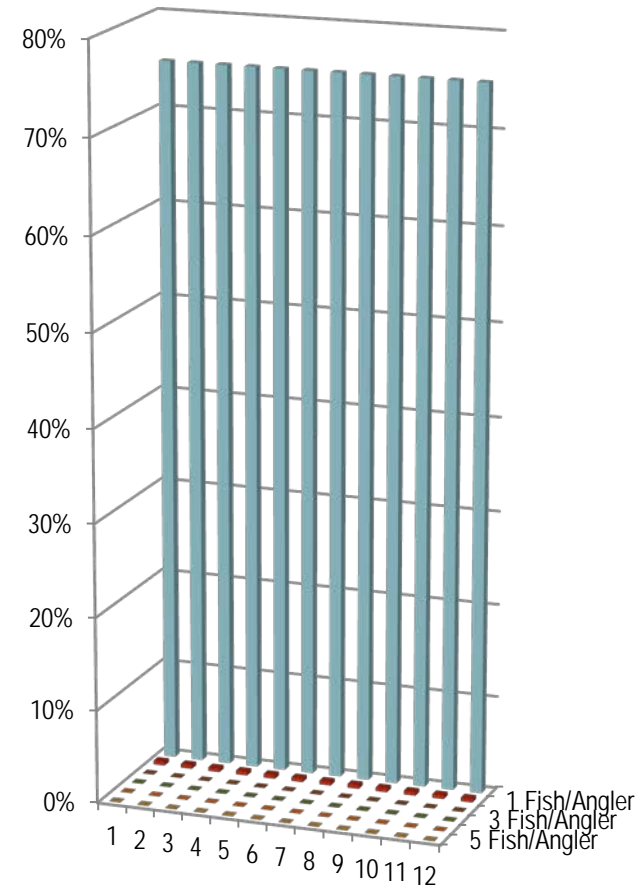
HEADBOAT



CHARTER



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TOOL DEMONSTRATION



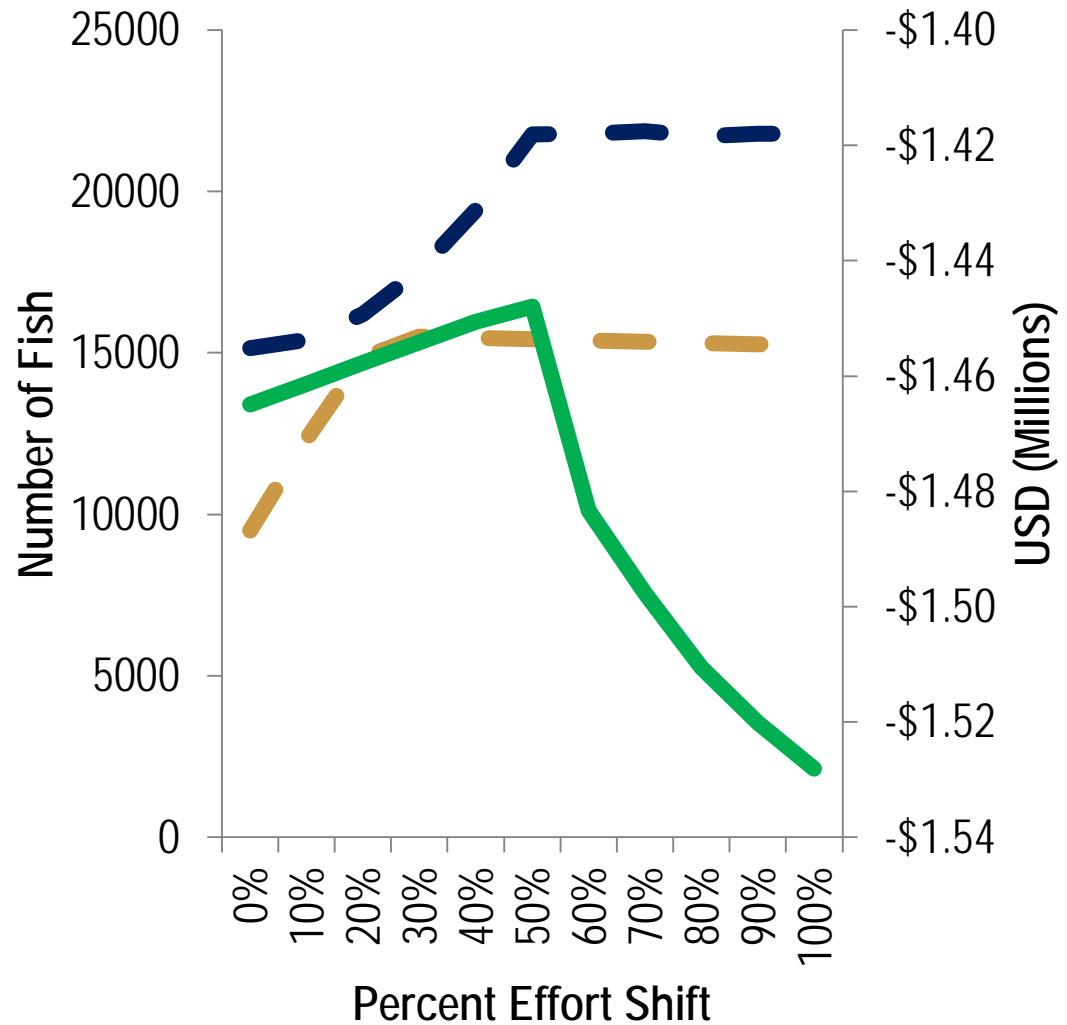
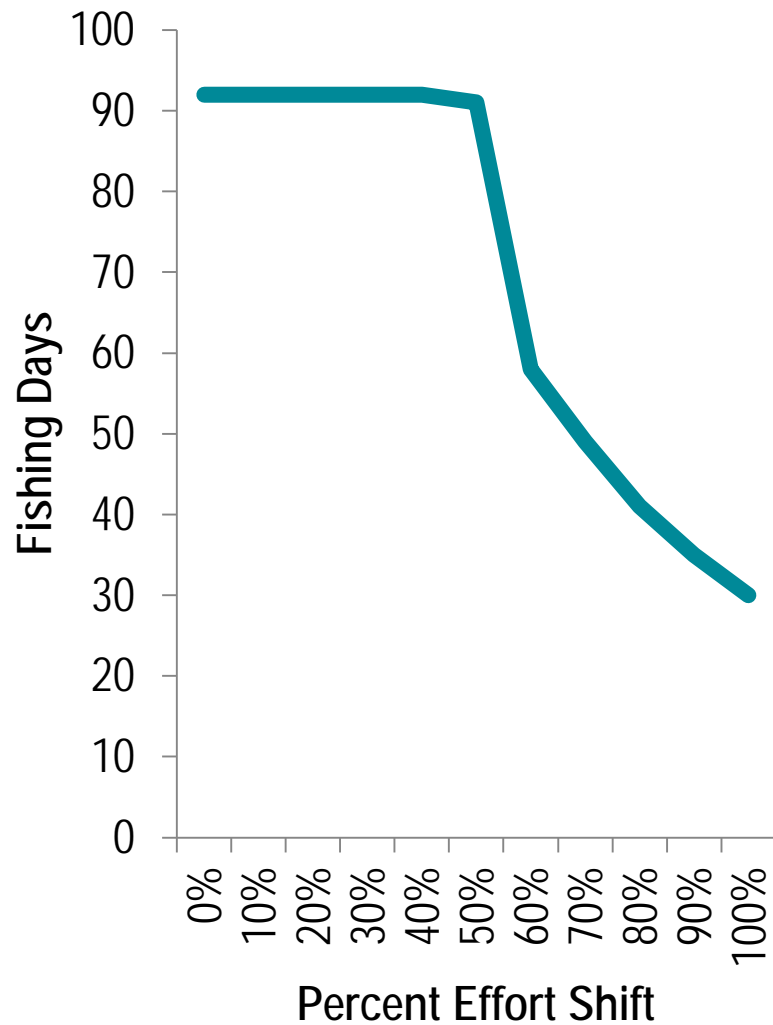
Combined Effects: FLK/EFL

Season	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Removals (N)	Change from SQ CS (\$)
Jan 1-Dec 31	12	5 Fish/Angler	7-Feb	37 ± 0.75	15,486 ± 121	21,394	(\$1,385,402.89)
Jan 1-Dec 31	15	1 Fish/Angler	20-Apr	37 ± 0.73	15,558 ± 98	21,394	(\$1,385,402.89)
July 1-Dec 31	15	2 Fish/Angler	16-Oct	114 ± 24.59	15,641 ± 79	21,633	(\$1,382,372.24)
July 1-Dec 31	16	2 Fish/Angler	9-Nov	184 ± 27.49	15,508 ± 408	21,610	(\$1,382,681.49)
July 1-Dec 31	16	1 Fish/Angler	8-Nov	184 ± 26.92	15,504 ± 384	21,610	(\$1,382,681.49)
May 1-Dec 31	17	2 Fish/Angler	12-Nov	245 ± 28.32	15,192 ± 670	19,759	(\$1,406,209.23)
May 1-Dec 31	16	1 Fish/Angler	5-Dec	245 ± 19.57	14,391 ± 826	19,711	(\$1,406,802.99)
July 1-Sept 30	16	1 Fish/Angler	31-Dec	92 ± 0	9,497 ± 890	15,141	(\$1,464,941.99)

Combined Effects: GA-NC

Season	Size Limit	Bag Limit	Closure Date	Open Days	Landings (N)	Removals (N)	Change from SQ CS (\$)
Jan 1-Dec 31	12	None	No Closure	365 ± 0	470 ± 33	493	5,059.33
Jan 1-Dec 31	17	2 Fish/Angler	No Closure	365 ± 0	412 ± 30	493	5,059.33
Jan 1-Dec 31	16	2 Fish/Angler	No Closure	365 ± 0	445 ± 32	493	5,059.33
Jan 1-Dec 31	20	4 Fish/Angler	No Closure	365 ± 0	445 ± 32	498	5,133.55

Impacts of Effort Shifting



Discussion

Uncertainty

- RDT outputs dependent on accuracy of underlying data and input assumptions
- Projected baseline landings and discards highly uncertain
- Economic conditions, weather events, changes in CPUE, fisher response to regulations, uncertainty in survey estimates may all impact future catch rates
- Given highly variable historic landings and substantial changes in management boundaries and regulations, past may not be a good predictor of future
- Bootstrapping suggests closure date could vary by >1 month
- Uncertainty highest for longer seasons and less draconian management measures

Limitations

- User-defined effort shifting
 - Gulf GAJ 2009-2010 vs. 2011-2015: 0-100%
- Size and bag limit impacts computed separately
- Gears evaluated in aggregate and parsed by SEDAR-37 observations
- Assumes no spearfishing off GA-NC; likely overestimates dead discards

Conclusions

- Combination of size limit, bag limit, and seasonal closure needed to constrain FLK/EFL harvest below ACL. Size at 50% male maturation in Keys estimated at 16.4" FL (McBride et al. 2008).
- No additional measures needed to constrain GA-NC harvest below ACL. Size at 50% male maturation in NC appears to be 24" FL (Van Sant, SEFSC, unpublished data.)

Questions?

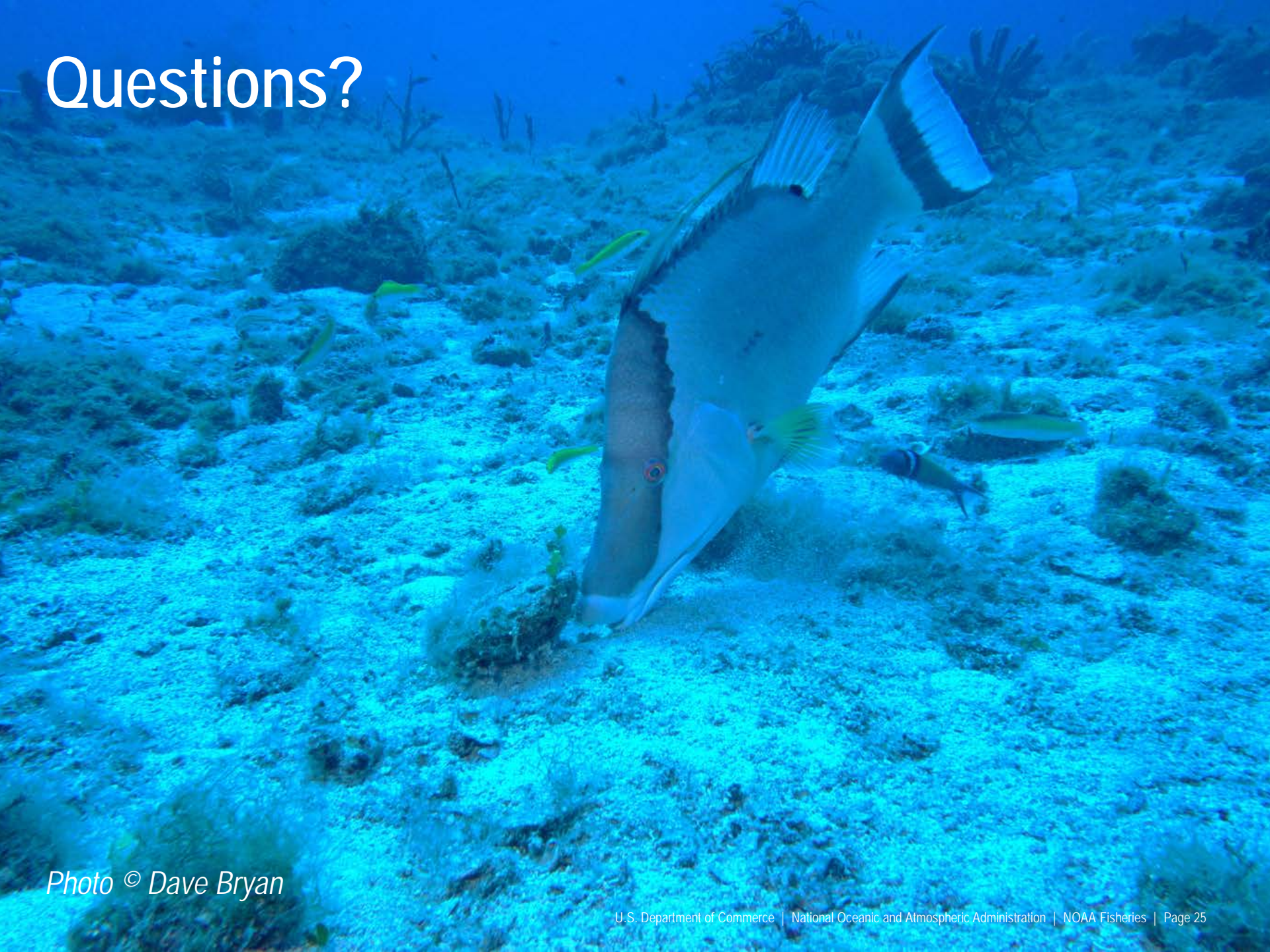


Photo © Dave Bryan