

Estimating the Average Weight of Recreationally Caught Hogfish from the FLK/EFL Stock for Converting the Recreational ACL from Pounds to Numbers under Different Minimum Size Limit Alternatives Proposed in Amendment 37

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The Florida Fish and Wildlife Conservation Commission completed a stock assessment for hogfish in 2014 (SEDAR-37 2014). The South Atlantic Fishery Management Council (Council)'s Scientific and Statistical Committee (SSC) reviewed the assessment and provided fishing level recommendations in October 2014. The Council received the SSC's recommendations at their December 2014 meeting. Based on genetic evidence, the SSC supported treating hogfish in the South Atlantic as two stocks: Georgia-North Carolina (GA-NC) and Florida Keys/East Florida (FLK/EFL). Each stock was then evaluated with regard to fishing level recommendations. The SSC developed catch level recommendations for the GA-NC stock using the Only Reliable Catch Stocks (ORCS) approach, as outlined in Level 4 of the Council's acceptable biological catch (ABC) control rule. For the FLK/EFL stock, the SSC considered the benchmark assessment to represent the best available science and recommended it for use in management. The Southeast Fisheries Science Center (SEFSC) concurred with this determination. The assessment results indicated the FLK/EFL stock is undergoing overfishing and is overfished and, therefore, in need of a rebuilding plan.

In response to the outcome of the SEDAR-37 (2014) assessment, the Council began development of Amendment 37 to the Fishery Management Plan for the Snapper Grouper Fishery of the South Atlantic Region (SG-37). SG-37 proposes different ABCs, annual catch limits (ACLs), annual catch targets, minimum size limits, and bag limits for the FLK/EFL and GA-NC hogfish stocks. This report presents the method developed by the Southeast Regional Office (SERO) staff for specifying the recreational ACL of hogfish in terms of numbers for the FLK/EFL stock within the framework of a recreational decision tool (RDT) developed to simulate the impacts of various combinations of proposed management measures to support SG-37.

For the FLK/EFL sub-region, an ABC recommendation in pounds was provided by the SEDAR-37 (2014) stock assessment. The RDT is configured to manage towards the SG-37 ACL alternatives based on the projected 2017 ABC of 38,367 pounds whole weight from projections at $Prebuild=72.5\%$ over 10 years. The recreational allocation of this ABC is 34,670 pounds whole weight. Because the SEDAR-37 (2014) assessment's terminal year was 2012, which was prior to the changes to the MRIP Access Point Intercept Survey enacted in 2013, the years 2012-2015 were selected for computation of a baseline mean weight. The 2012-2015 period incorporates the terminal year in the SEDAR-37 (2014) assessment and is consistent with the time period used for projecting landings. The mean weight for 2012-2015 in the FLK/EFL sub-region was 1.85 pounds whole weight. The RDT manages towards SG-37 ACL Alternatives 2a-2c (i.e., 100 percent, 95 percent, and 90 percent of the ABC).

Table 1 provides hogfish mean weights from the von Bertalanffy growth curve in SEDAR-37 (2014). Because SG-37 proposes to manage hogfish to an ACL in numbers of fish, but also contains alternatives to increase the minimum size limit, if the ACL is not adjusted to account for changes in mean weight anticipated under different minimum size limits, the allocation of the ABC could be exceeded. For example, off FLK/EFL, 20,576 fish at a 20-inch minimum size limit would weigh at least 115,431 pounds whole weight, or 3.3 times higher than the

recreational allocation of the ABC. Thus, if the ACL in numbers is not adjusted to reflect the change in mean weight of landed fish at different minimum size limits, the RDT could allow overfishing of the stock in pounds.

We explored different options for how to adjust the ACL in numbers at different minimum size limits for both sub-regions. For FLK/EFL, six approaches were explored for how to divide the recreational allocation in pounds by a mean weight to derive a recreational ACL in numbers that would prevent overfishing and reflect the projected mean size at different minimum size limits:

1. Divide by mean weight of fish at minimum size,
2. Divide by mean weight of fish at minimum size scaled up by 1.85/1.38 [ratio of observed landed mean weight at 12 inches limit relative to mean von Bertalanffy estimated size at 12 inches],
3. Divide by mean weight of fish at minimum size scaled up by observed 139 percent inter-growth bin ratio [mean weight at 12 inches is 1.38, mean weight at 13 inches is 1.72, observed mean weight is 1.85, approximately 139 percent of the way between 12-13 inches],
4. Divide by weighted mean of weights of intercepted fish in the remaining size bins at or above the specified minimum size,
5. Divide by weighted mean of weights of intercepted fish in the size bins two steps below to above the specified minimum size [accounting for observed undersized fish retention]
6. Divide by weighted mean of weights of intercepted fish in the remaining size bins at or above the specified minimum size scaled to the observed mean weight of 1.85 pounds whole weight per fish at a 12-inch minimum size limit.

Of these approaches, (3) was selected for the FLK/EFL RDT. The selected option (3) accounts for some retention of fish above the minimum size limit and is based on a ratio between observed and modeled data. It results in weight estimates that are slightly above the minimum sizes for all sizes except 20 inches, because no intercepted fish were >20 inches (Table 1). Table 2 shows the results of this method when used to compute the recreational ACL at each of the proposed minimum size limits in Amendment 37. The first approach fails to consider that fish larger than the minimum size limit will be retained. It also implicitly assumes a normal distribution around the minimum size, which would be illegal as undersized fish should not be retained. The second approach fails to account for reduced ability to encounter larger fish as the size limit is increased. The fourth approach cannot be reconciled with observed data due to a lack of site weighting. The fifth approach assumes non-compliance and also cannot be reconciled with observed data at the current minimum size limit due to lack of site weighting. The sixth approach computationally results in average weights below the mean weight at the minimum size limit when the minimum size limit is above 14 inches.

Table 1. Hogfish mean weights (Wt, pounds whole weight) at different fork lengths (FL) from the von Bertalanffy growth curve in SEDAR-37 (2014), with modeled mean weights for each sub-region at different size limits accounting for selectivity. Recreational allocation of the ABC in pounds would remain fixed, but recreational sector ACL would change depending on minimum size limit, reflecting anticipated new mean weight of landed fish. Council preferred alternative in bold.

FL (cm)	FL (in)	Wt (g)	Wt (lbs)	FLK/EFL Mean Wt (lbs)	FLK/EFL Rec ABC Allocation (lbs)	FLK/EFL Rec ACL @ 100% ABC (N)	FLK/EFL Rec ACL @ 95% ABC (N)
25.4	10	380	0.84	1.19	34,670	29,189	27,730
27.94	11	493	1.09	1.49	34,670	23,215	22,054
30.48	12	626	1.38	1.85	34,670	18,710	17,775
33.02	13	780	1.72	2.26	34,670	15,324	14,558
35.56	14	956	2.11	2.72	34,670	12,737	12,100
38.1	15	1,156	2.55	3.23	34,670	10,728	10,192
40.64	16	1,380	3.04	3.81	34,670	9,111	8,655
43.18	17	1,630	3.59	4.44	34,670	7,811	7,420
45.72	18	1,907	4.2	5.15	34,670	6,737	6,400
48.26	19	2,212	4.88	5.90	34,670	5,881	5,587
50.8	20	2,546	5.61	5.61	34,670	6,180	5,871

Table 2. Recreational ACLs for the FLK/EFL stock of hogfish in pounds and numbers under each of the minimum size limit alternatives in Amendment 37 for Sub-alternatives 2a-2c in Action 6 and based on ABC projections from Preferred Alternative 3 in Action 5 where ABC is equal to the yield at a constant fishing mortality rate and rebuilds the stock in 10 years with a 72.5% probability of rebuilding success.

Sub-alternative 2a: ACL=OY=ABC													
Year	Total ABC (lbs)	Rec ACL (lbs)	Recreational ACL (numbers)										
			10 in	11 in	12 in	13 in	14 in	15 in	16 in	17 in	18 in	19 in	20 in
2017	38,367	34,672	29,136	25,750	20,739	16,977	14,106	11,878	10,070	8,641	7,450	6,503	6,839
2018	49,449	44,687	37,552	33,187	26,729	21,880	18,180	15,309	12,979	11,137	9,602	8,381	8,814
2019	61,982	56,013	47,070	41,599	33,504	27,426	22,788	19,189	16,268	13,960	12,035	10,505	11,048
2020	75,710	68,419	57,495	50,812	40,924	33,500	27,835	23,440	19,871	17,052	14,701	12,832	13,496
2021	90,469	81,757	68,703	60,717	48,902	40,031	33,261	28,009	23,745	20,376	17,567	15,334	16,126
2022	106,059	95,846	80,542	71,181	57,329	46,929	38,992	32,836	27,837	23,887	20,594	17,976	18,905
2023	122,197	110,429	92,798	82,011	66,052	54,069	44,925	37,832	32,073	27,522	23,728	20,711	21,782
2024	138,566	125,222	105,229	92,997	74,901	61,312	50,943	42,900	36,369	31,209	26,906	23,486	24,700
2025	154,851	139,939	117,596	103,927	83,703	68,518	56,931	47,941	40,643	34,876	30,068	26,246	27,603
2026	170,750	154,307	129,670	114,597	92,297	75,553	62,776	52,864	44,816	38,457	33,155	28,941	30,437
2027	186,018	168,104	141,264	124,844	100,550	82,309	68,389	57,591	48,824	41,896	36,120	31,528	33,158

Sub-alternative 2a: ACL=OY=95% ABC													
Year	Total ABC (lbs)	Rec ACL (lbs)	Recreational ACL (numbers)										
			10 in	11 in	12 in	13 in	14 in	15 in	16 in	17 in	18 in	19 in	20 in
2017	38,367	32,939	27,680	25,750	20,739	16,977	14,106	11,878	10,070	8,641	7,450	6,503	6,839
2018	49,449	42,453	35,675	33,187	26,729	21,880	18,180	15,309	12,979	11,137	9,602	8,381	8,814
2019	61,982	53,212	44,716	41,599	33,504	27,426	22,788	19,189	16,268	13,960	12,035	10,505	11,048
2020	75,710	64,998	54,620	50,812	40,924	33,500	27,835	23,440	19,871	17,052	14,701	12,832	13,496
2021	90,469	77,669	65,268	60,717	48,902	40,031	33,261	28,009	23,745	20,376	17,567	15,334	16,126
2022	106,059	91,053	76,515	71,181	57,329	46,929	38,992	32,836	27,837	23,887	20,594	17,976	18,905
2023	122,197	104,908	88,158	82,011	66,052	54,069	44,925	37,832	32,073	27,522	23,728	20,711	21,782
2024	138,566	118,961	99,967	92,997	74,901	61,312	50,943	42,900	36,369	31,209	26,906	23,486	24,700
2025	154,851	132,942	111,716	103,927	83,703	68,518	56,931	47,941	40,643	34,876	30,068	26,246	27,603
2026	170,750	146,591	123,186	114,597	92,297	75,553	62,776	52,864	44,816	38,457	33,155	28,941	30,437
2027	186,018	159,699	134,201	124,844	100,550	82,309	68,389	57,591	48,824	41,896	36,120	31,528	33,158

Sub-alternative 2a: ACL=OY=90% ABC													
Year	Total ABC (lbs)	Rec ACL (lbs)	Recreational ACL (numbers)										
			10 in	11 in	12 in	13 in	14 in	15 in	16 in	17 in	18 in	19 in	20 in
2017	38,367	31,205	26,223	25,750	20,739	16,977	14,106	11,878	10,070	8,641	7,450	6,503	6,839
2018	49,449	40,218	33,797	33,187	26,729	21,880	18,180	15,309	12,979	11,137	9,602	8,381	8,814
2019	61,982	50,412	42,363	41,599	33,504	27,426	22,788	19,189	16,268	13,960	12,035	10,505	11,048
2020	75,710	61,577	51,746	50,812	40,924	33,500	27,835	23,440	19,871	17,052	14,701	12,832	13,496
2021	90,469	73,581	61,833	60,717	48,902	40,031	33,261	28,009	23,745	20,376	17,567	15,334	16,126
2022	106,059	86,261	72,488	71,181	57,329	46,929	38,992	32,836	27,837	23,887	20,594	17,976	18,905
2023	122,197	99,386	83,518	82,011	66,052	54,069	44,925	37,832	32,073	27,522	23,728	20,711	21,782
2024	138,566	112,700	94,706	92,997	74,901	61,312	50,943	42,900	36,369	31,209	26,906	23,486	24,700
2025	154,851	125,945	105,836	103,927	83,703	68,518	56,931	47,941	40,643	34,876	30,068	26,246	27,603
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2027	186,018	151,294	127,138	124,844	100,550	82,309	68,389	57,591	48,824	41,896	36,120	31,528	33,158