American Shad Sustainable Fishing Plan Update for Florida, St. Johns River

Prepared by

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June 30, 2017

On Behalf of

Florida Fish and Wildlife Conservation Commission

Fish and Wildlife Research Institute and Division of Marine Fisheries Management

Introduction - Summary

The spawning run of American shad in Florida's St. Johns River, Florida is subjected to a small, primarily catch and release recreational fishery. The stock abundance was last classified as low but stable (ASMFC 2007). There have been no commercial landings of American shad in Florida since 2000. Recreational fishing is open with a 10 fish bag limit. A majority of anglers voluntarily release their catch. Monitoring of relative stock abundance has been in place since 2003 and relative abundance has improved. Monitoring of relative abundance of young of the year has been in place since 2007 and the highly variable index shows successful recruitment in most years with a positive correlation between the juvenile abundance index and year class strength in the spawning stock. Fishery dependent monitoring resumed in 2011 after a six year hiatus and indicates that overall effort and harvest are low with catch per unit effort similar to earlier years. The Florida Fish and Wildlife Conservation Commission (FWC) seeks to maintain the open status of the recreational fishery as its existence should not threaten the maintenance and recovery of the St. Johns River population of American shad.

St. Johns River

The St. Johns River is entirely coastal and drops a total of 9.1 m over its entire 499km length. Most of that drop occurs upstream of river kilometer 314 (McLean 1955). The river passes through three large shallow lakes; Lake Harney (6200 acres) between rkm 306 and 314, Lake Monroe (9400 acres) between rkm 266 and 276, and Lake George (40,000 acres) between rkm 182 and 199. The head of the tide is generally at Lake George. The tidal freshwater reach below Lake George varies in width from 0.18 km to 2 km and has an average tide range of 0.33 m. Weak tides can reach as far as the Lake Monroe outlet at river kilometer 266 during low flow. The St. Johns River has a "southern river flow pattern" (Kelly and Gore 2008) in which low flow typically occurs from late winter into early summer and high flows occur in the late summer and early fall corresponding to a summer wet season. Spawning has been documented from river kilometer 235 to 400 but primarily occurs between river kilometer 276 and 378. The spawning season lasts from late December to Early May with peak activity from mid January to mid March. (Figures 1 and 2).

Description of the Fishery

Gear restrictions have effectively eliminated commercial harvest. Pound nets were phased out through the 1980's and 1990's. None are operating and new licenses will not be issued. Entanglement nets were prohibited by constitutional referendum in all state waters in 1995. There are no commercial fisheries operating in state waters that take shad deliberately or that are likely to take shad as bycatch. Furthermore, hook and line has been the only permissible gear for the taking of all *Alosa* species since 1997. A saltwater fishing license is required to

possess anadromous species. The current bag limit is 10 fish per angler per day for American shad and hickory shad in aggregate. The existing recreational fishery is small and dominated by catch and release fly fishermen that target fish on the spawning grounds. The aerial coverage of the fishery is restricted relative to the extent of spawning habitat. Angling primarily occurs between river kilometers 285 and 292 and between river kilometers 314 and 321 whereas spawning grounds primarily occur from river kilometer 280 to 295 and from river kilometer 314 to 378.

Stock Monitoring Programs

a) Fishery Independent

i. Juvenile abundance indices (JAI)

The relative abundance of young of the year American Shad has been assessed annually as catch per tow by a bow mounted push net since 2007. A standard sample night comprises 12 5-minute tows at stations selected at random within a 40 kilometer long sampling reach. Two representative index reaches were selected in 2010 based on a pilot project that ran from 2007 to 2009; one in the river run between river kilometer 210 and 260 and one in tidal freshwater between river kilometer 125 and 165 (Figure 1). Index sampling occurs bi-weekly from the end of March until the CPUE drops below 10% of the peak nighly average. The initial sustainable fishing plan did not identify which sampling index should be used as a benchmark citing a lack of information about which location would best perform in describing recruitment success or failure. The JAI from the tidal freshwater reach was correlated to year class strength in the spawning stock in subsequent years (Figure 3). The JAI has been highly variable but generally increasing (Figure 4). River discharge during the spawning season accounts for a large proportion of the interannual variability in JAI in the lower St. Johns River (Figure 5). The lower St. Johns River American Shad JAI appears to predict both recruitment to the spawning stock and recruitment response to a significant environmental variable.

ii. **Spawning stock survey**

The spawning stock survey tracks the relative abundance of adult American shad by electrofishing the spawning stock. The spawning stock index is reported as the geometric mean catch per standard sample. The current benchmark is that three consecutive years with the CPUE below the 25th percentile of the time series will trigger a management action. Sampling occurs biweekly from January through March between river kilometers 314 and 357 (Figure 3). A standard sample day includes 10 standard samples at randomly selected sites within the reach. Sampling will continue on an annual basis. Biological samples are collected for length, sex composition, and aging (beginning in 2011) from these electrofishing collections. This is the longest continuous index currently running on the St. Johns River. The CPUE was at the 25th

percerntile in the upper river reach between river kilometer 314 and 357 in both 2015 and 2016 (Figure 6). River discharge was above the 90th percentile during the spawning season in both years and this seems to have altered the distribution of fish within the sampling areas. Two peak season sampling trips also occur between river kilometers 279 and 297 (Figure 3). The CPUE was the highest and second highest in the time series between river kilometers 279 and 297 in 2015 and 2016 respectively.

b) Fishery Dependent

A roving creel survey of recreational anglers was conducted between the mouth of Lake Jesup (river kilometer 285) and just south of Iron Bend (river kilometer 298) in 11 out of 13 years from 1992 to 2005 (McBride and Holder 2008). This creel documented declining effort and relatively stable catch rates (Figure 7 and Figure 8). An access point creel was introduced in 2011 and will continue annually as funds allow. The access point creel covers the old creel area (Mullet Lake Creel Area) via two boat ramps and an upstream area (Puzzle Lake Creel Area) via one boat ramp (Figure 3). Canvassing anglers on the water indicated that greater than 95% of shad fishing effort originates at these ramps. These ramps are the primary access points to the ~14 km of river in which most shad fishing occurs. The angler success rate in the Mullet Lake Creel Area from 2011 to 2016 was 0.92 fish/hour compared to the 0.71 fish/hour average for shad between 1992 and 2005 (McBride and Holder 2008). There has been no trend in angler CPUE (Figure 8) but effort continues to decline in the Mullet Lake Creel Area (Figure 7). Effort increased in the Puzzle Lake Creel Area though 2014 but was low in 2015 and 2016 due to high water related access difficulty.

A benchmark angler catch rate of 1 fish per angler hour was selected as a restoration target based on the previous roving creel (ASMFC 2007). However, the nature of the fishery has changed. The fish camp at river kilometer 287, from which much of the shad fishing effort occurred in the past, has closed and some fishing effort has shifted to another section of river (Figure 7). Additionally, fishing techniques have changed from primarily trolling to primarily fly fishing. Therefore we do not believe that angler catch rate should be used as a stand alone benchmark. Annual monitoring of this fishery through an access point creel will continue as long as funding is available.

Sustainable Fishery

FWC requests to maintain the recreational fishery on the St. Johns River as is. The fishery independent benchmark has not triggered a managmet action at this time and new time series have facilitated the establishment of a JAI benchmark.

a) Fishery Independent Spawning Stock Index Benchmark (Table 1)

The fishery independent spawning stock index median for the series 2003 through 2016 was 5.21 and the 25th percentile was 4.04 (Figure 6). The spawning stock index has been at the 25th percentile for two consecutive years following several years with values above the median. This warrants caution but no action at this time. Furthermore, the spawning stock index calculated from a secondary sample area indicated that fish abundance may have been higher than shown by the primary index (Figure 6). This secondary survey may be incorporated into a revised benchmark in the future that better accounts for interannual changes in spawning grounds locations. Monitoring spawning stock relative abundance will continue in both river reaches. The Shad and River Herring Technical committee suggested that a generalized linear model might be used in future sustainable fishing plan updates to reconcile differences in the spawning stock index from the two sampling areas that may arise from catchability differences between years abnormal water levels alter fish distribution in the respective sampling areas.

b) Proposed JAI based Benchmark (Table 1)

The JAI from the lower river has performed well in the period 2007 to 2016 with the adult spawning stock relative abundance at age being predicted by the JAI for the 2007-2011 year classes. Therefore we would like to set a 25th percentile benchmark for this time series with three consecutive years below the 25th percentile to trigger management review. The JAI has the potential to capture recruitment issues stemming from habitat and water quality changes.

c) Possible Future Benchmark to Incorporate Fishery Dependent Data

FWC feels that increasing catch and/or harvest in the recreational fishery without concurrent increases in fishery independent indices would be undesirable. We proposed in the initial SFMP to develop benchmarks based on the ratios of angler harvest and angler total catch to fishery independent electrofishing CPUE in the first SFMP for American Shad. We can calculate the ratio of catch and/or harvest to the fishery independent electrofishing CPUE (Figure 10). We do not know what level or what metric represents a critical value at this time. We propose to monitor the ratio of fishery metrics (e.g. effort, catch, harvest) to fishery independent abundance indexes for any possible trend in the interval until the next SFMP update and consider a relevant benchmark at a later date.

Literature Cited

ASMFC (Atlantic States Marin Fisheries Commission). 2007. American shad stock assessment peer review report. Washington, D.C.

Kelly, M.H. and J.A. Gore. 2008. Florida river flow patterns and the Atlantic multidecadal oscillation. River Research and Applications 24 (5): 598-616.

McBride, R.S and J. C. Holder. 2008. A review and updated assessment of Florida's anadromous shads: American shad and hickory shad. North American Journal of Fisheries Management 28: 1668-1686.

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Table 1. Florida St. Johns River American Shad Management Benchmarks and Triggers

River System	Index	Index Years	Benchmark Value	Benchmark Level	Management Trigger
St. Johns River	Spawning Stock Electrofishing CPUE	2003-2016	4.04 shad/standard sample	25th percentile	3 consecutive years below the benchmark
St. Johns River	Pushnet Juvenile Abundance Index	2007-2016	2.33 shad/standard sample	25th percentile	3 consecutive year below the benchmark

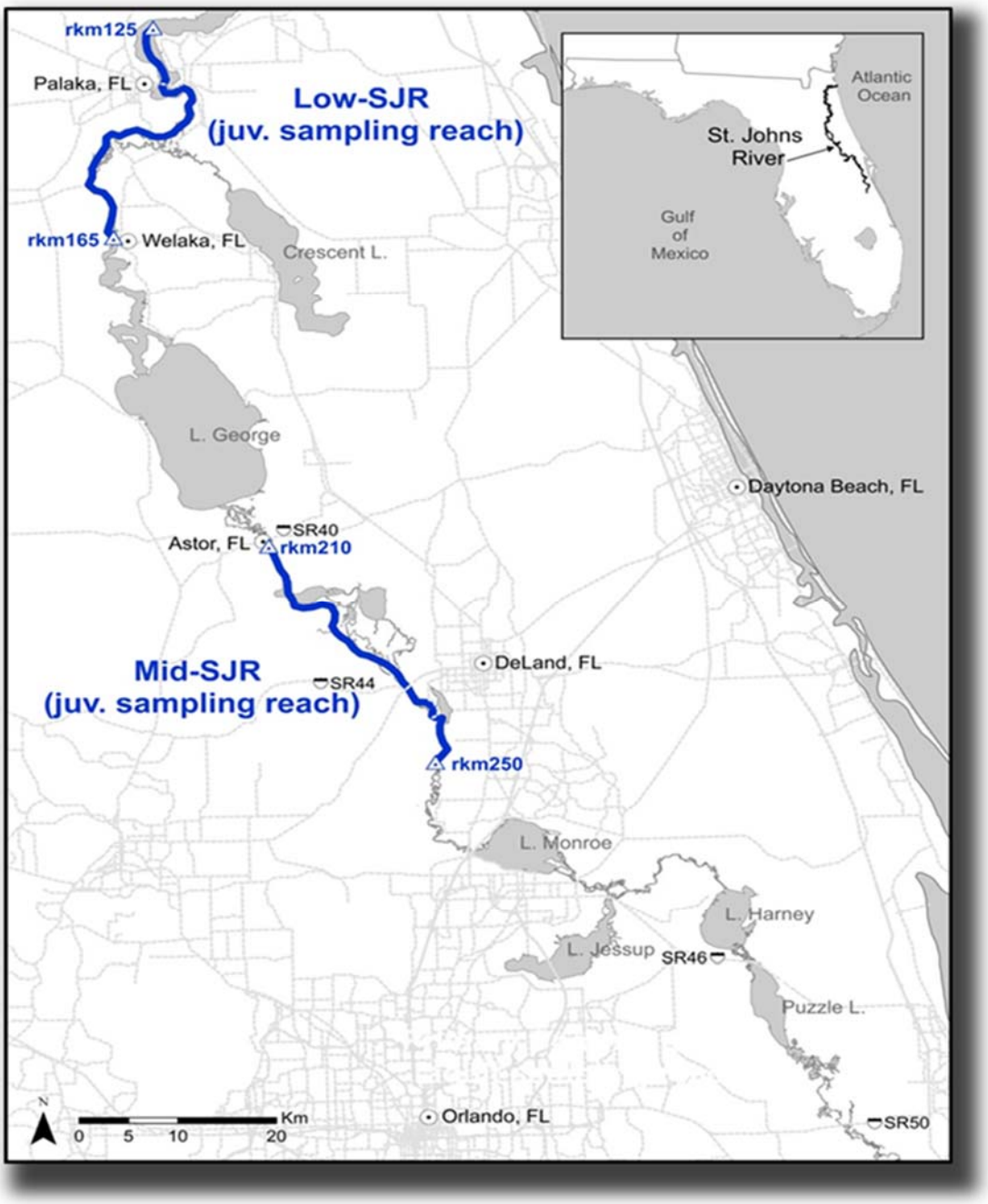

Figure 1. **Middle and lower St. Johns River. Diurnal tides extend up to Lake George. Spawning grounds begin between Lakes George and Monroe but are primarily south of Lake Monroe. Juvenile sampling by pushnet in 2007-2009 extended from rkm 125 to 305 from spring to fall. From 2010 forward, the Mid-SJR Sampling Reach (rkm 210-260) and the Low SJR Sampling Reach (rkm 125-165) are sampled biweekly from the end of the spawning season until the nightly CPUE drops below 10% of the seasonal peak.**

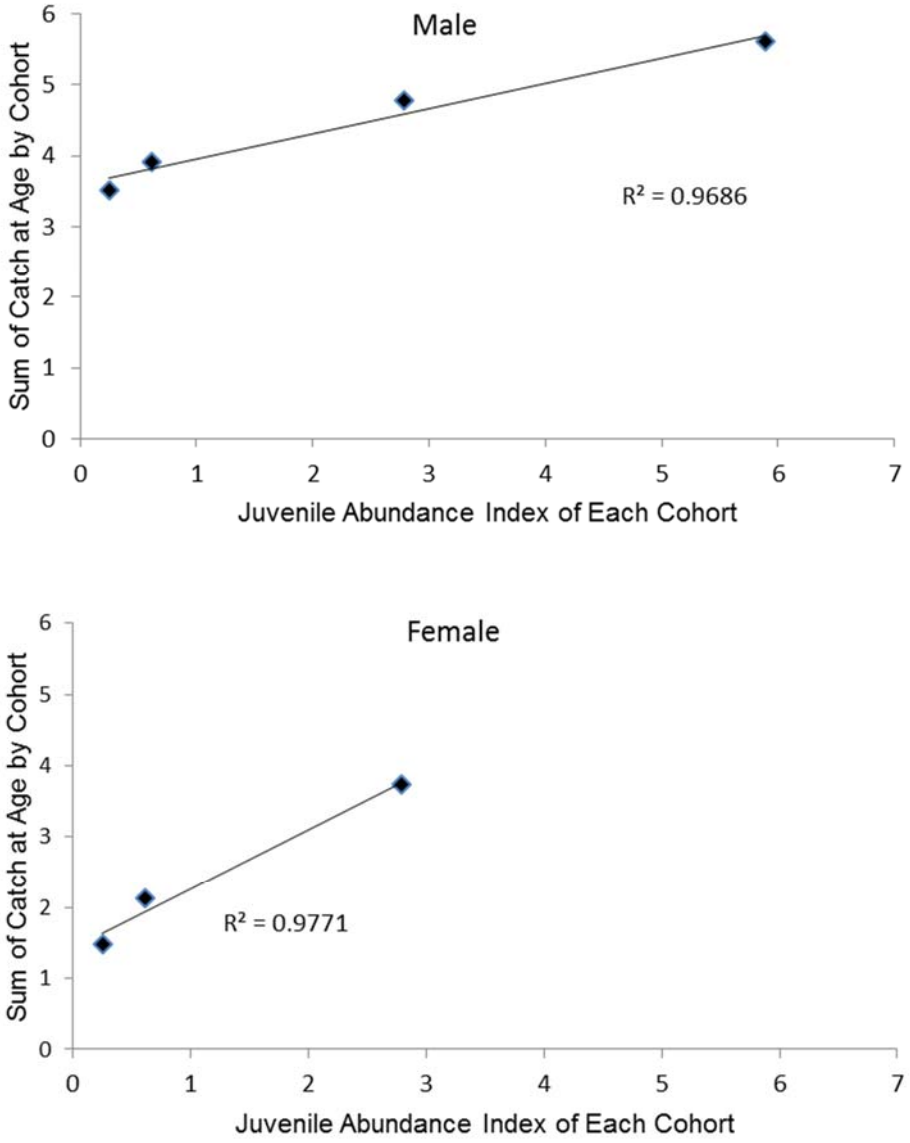

Figure 2. The CPUE at Age of the adult spawning stock versus the JAI in prior years. The electrofishing CPUE was summed across years for each age of each sex, ages 3 through 6 for males and ages 3 through 7 for females. This produced a sum of CPUE at Age for the 2007 through 2010 year classes of male American Shad and the 2007 through 2009 year classes of female American Shad. That value was tested for correlation with JAI. Males are in the top figure and females in the lower. Both simple linear regressions are significant at 0.05. As both regressions are short, the relationship will be tested with more robust methods as additional data are gathered.

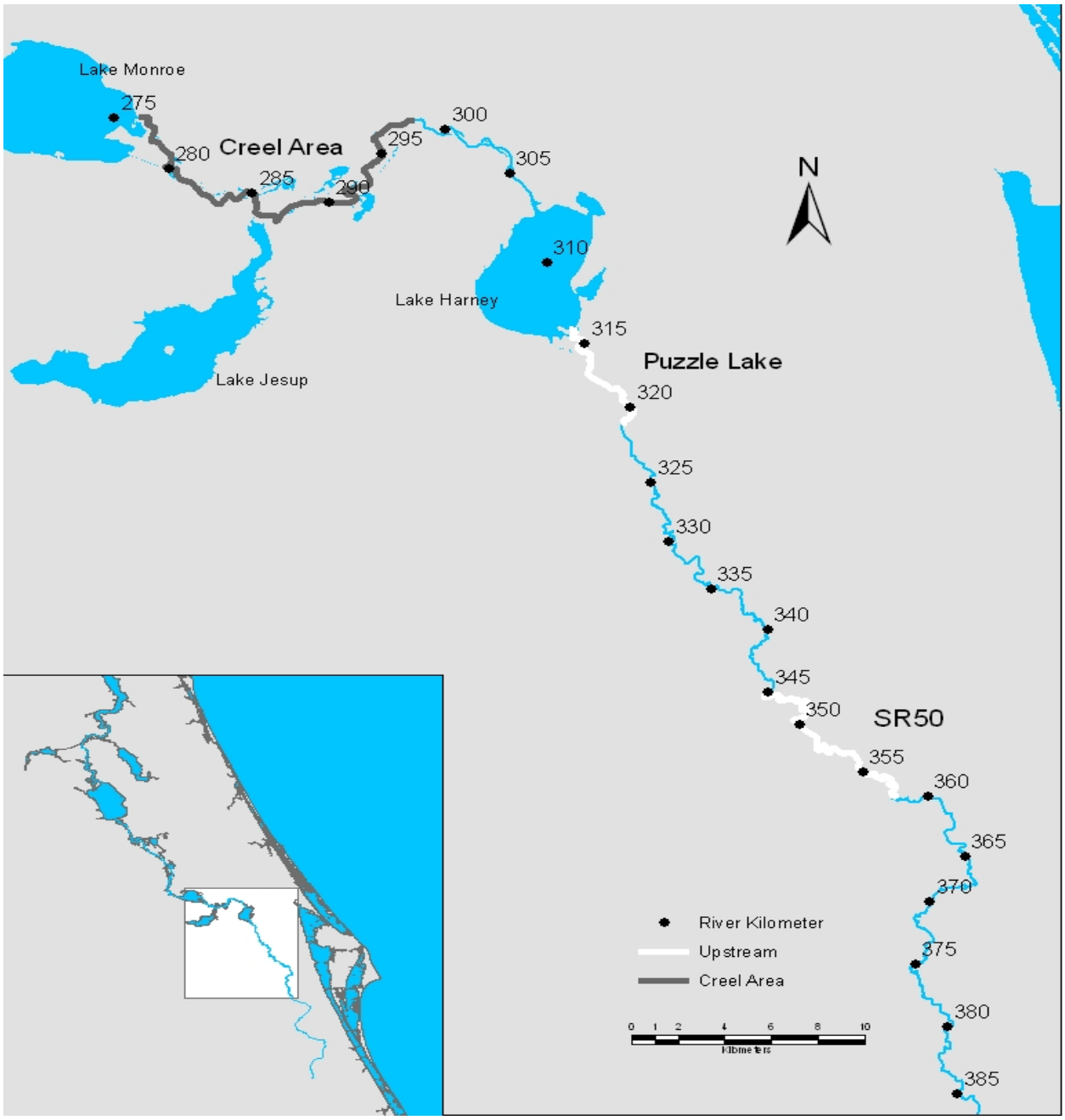

Figure 3. **Upper St. Johns River. Primary spawning grounds occur from river kilometer (rkm) 276 to 378. Fishery independent monitoring for adult American shad occurs at Puzzle Lake (rkm 314-320) and at State Road 50 (SR50, rkm 345-358). Additional fishery independent monitoring occurs at the Mullet Lake Creel Area (rkm 279-297) annoted on this figure as "Creel Area". The recreational fishery occurs mainly at the Creel Area and Puzzle Lake.**

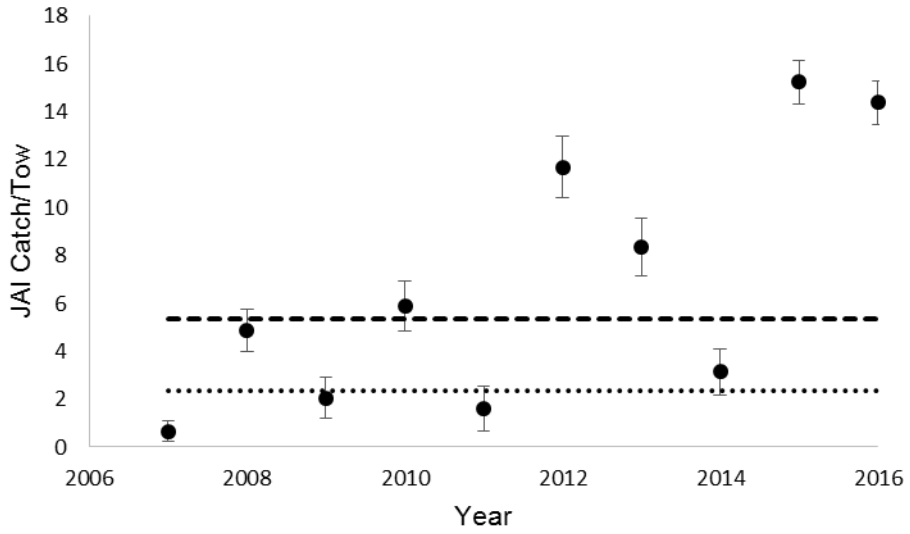

Figure 4. The summer juvenile abundance index, calculated as Geometric Mean, of American Shad from the lower St. Johns River, Florida from 2007 to 2016. Median is the dash line. 25th percentile is the dotted line.

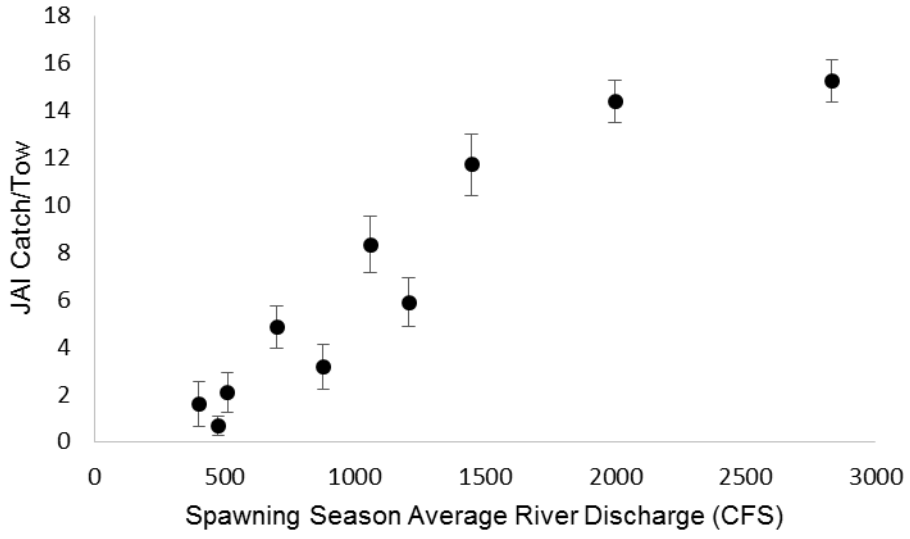

Figure 5. The summer juvenile abundance index of Amerian Shad from the lower St. Johns River, Florida from 2007 to 2016 versus the mean spawning season (January through March) discharge at USGS Gage 02232500 on the spawning grounds of the St. Johns River near State Road 50 in Christmas, Florida.

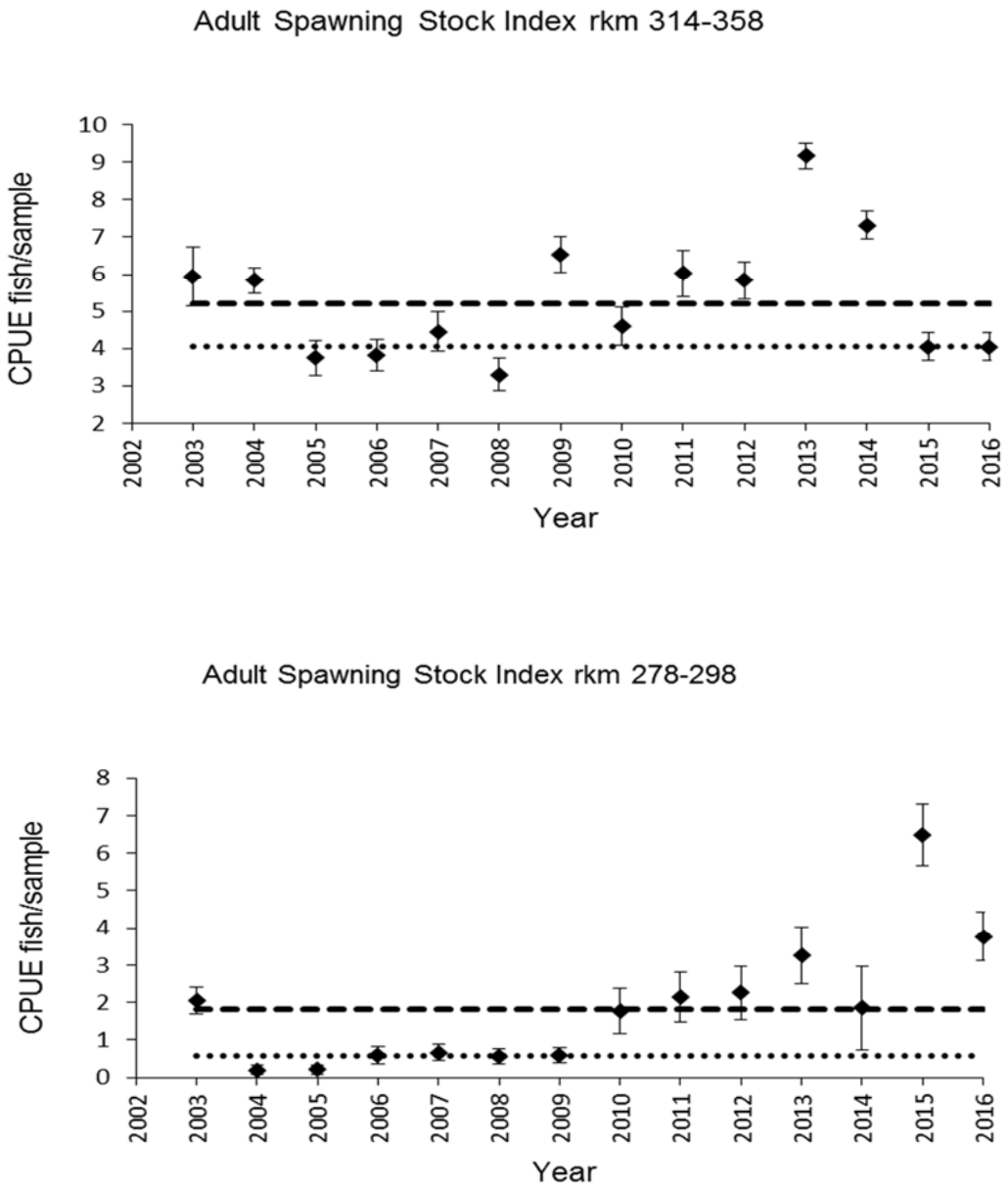

Figure 6. **Electrofishing catch per unit effort (geometric mean catch per 10 minute transect) of American Shad from the St. Johns River in each of two areas. Dashed line is the media. Dotted line is the 25th percentile. The spawning stock index from rkm 314-358 was designated as the index for a fishery independent benchmark in the initial SFMP.The water level in 2015 and 2016 was above the 90th percentile of historic levels during the spawning season and may have impacted the electrofishing survey's ability to correctly index relative abundance by causing the distribution of fish on the spawning ground to shift downstream.**

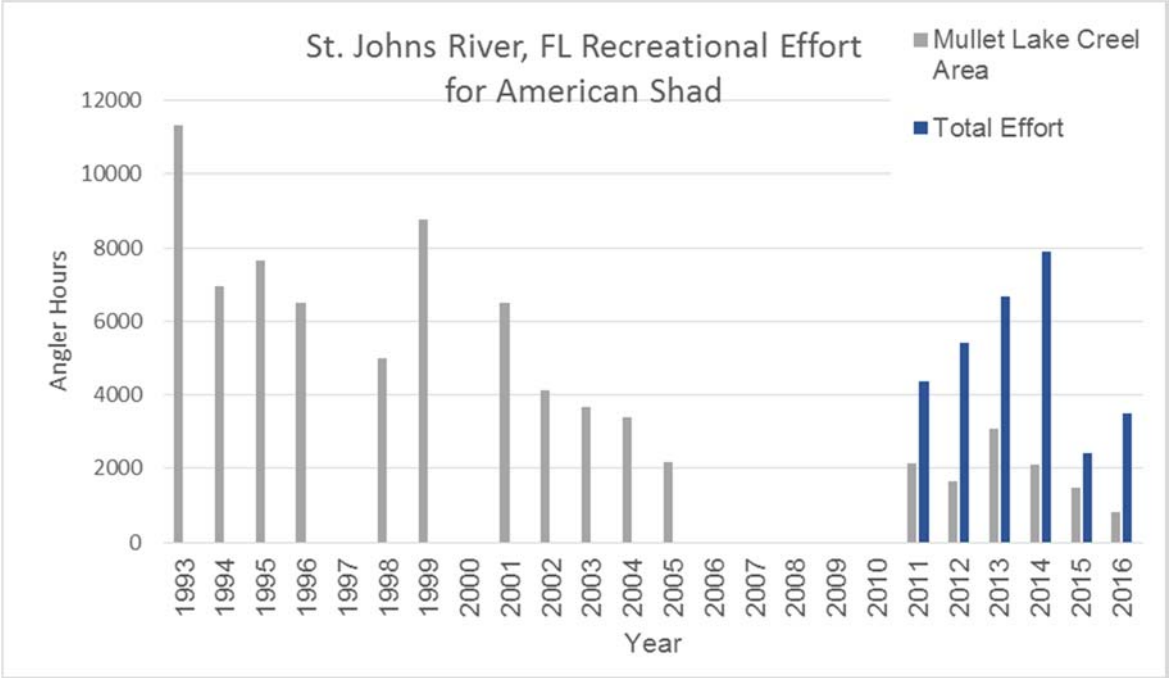

Figure 7. Recreation effort for American Shad in the St. Johns River, Florida expressed as angler-hours. An additional stratum was added in 2011 as effort shifted away from the orginial area. "Mullet Lake Creel Area" is still treated as a unique stratum for comparison to the 1993 to 2005 data.

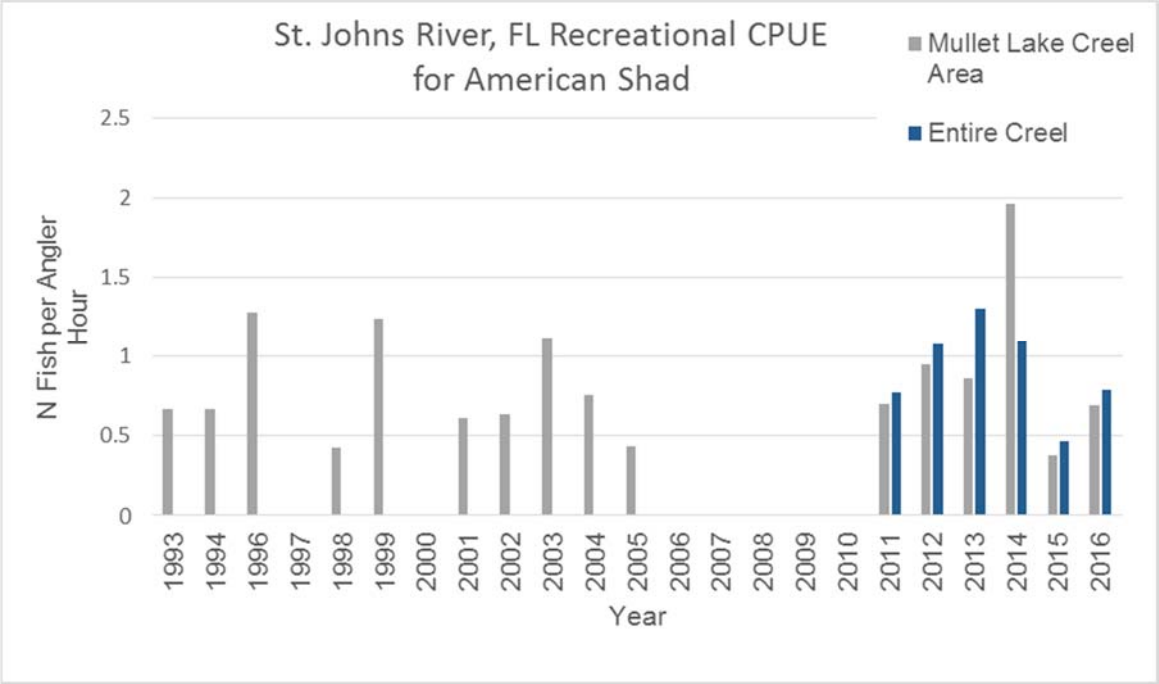

Figure 8. The catch per unit effort of American Shad from the recreational fishery in the St. Johns River, Florida from the Mullet Lake Creel Area stratum and averaged across both creel strata from 2011 to 2016.

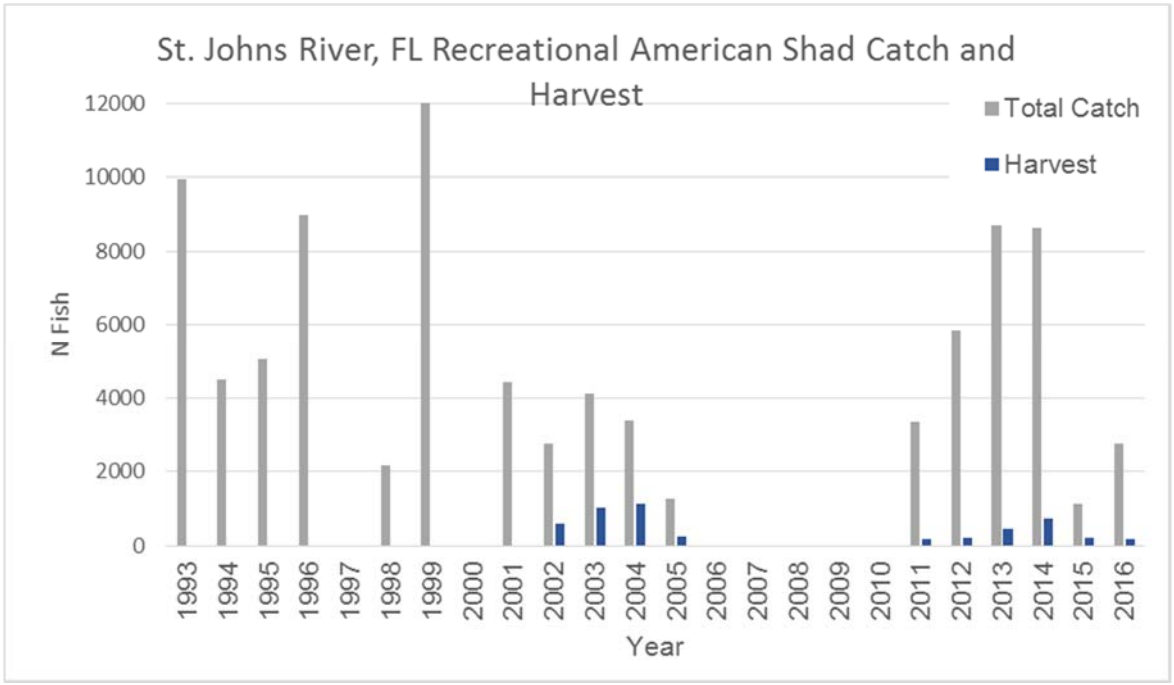

Figure 9. The total catch and harvest of American Shad in the recreational fishery in the St. Johns River, Florida.

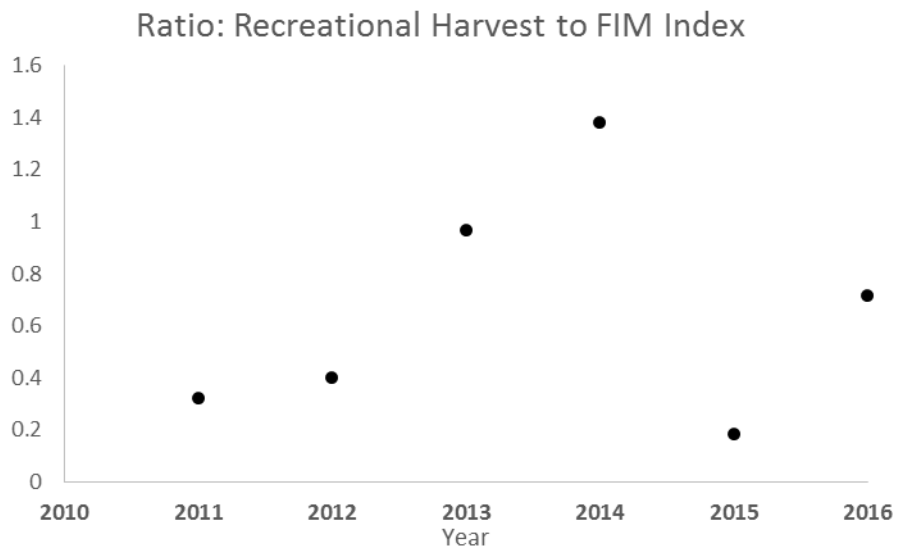

Figure 10. Relative harvest index. This is calculated as the ratio of the total number of American Shad harvested by the recreational fishery to the annual geometric mean electrofishing CPUE multiplied by 100. These data may be suitable to create a benchmark that combines fishery catch/harvest data and independent monitoring data in the future.