A Preliminary Evaluation of Trawling for Young-of-year Gulf Sturgeon

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Abstract: We explored the feasibility of sampling young-of-year (yoy) Gulf sturgeon (*Acipenser oxyrinchus desotoi*) in the Apalachicola River, Florida, using modified balloon trawls during January and June 2009. Three yoy sturgeon (57 – 120 mm TL) were captured during June 2009 in the lower reaches of the river system. Initially, this method of assessment is labor intensive and may require more than 25 river kilometers (rkm) of trawling per capture. While this gear type has been remarkably efficient for sampling yoy *Scaphirhynchus* (i.e., pallid and shovelnose sturgeon) in the Mississippi River system, the depressed population size (ranging from a few hundred to perhaps 1,000 individuals) encountered in the Apalachicola River could make assessment of yoy Gulf sturgeon problematic.

Key words: gear assessment, early life stages, Gulf sturgeon, trawling

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A population viability analysis conducted in the Suwannee River (Pine et al. 2001) implied Gulf sturgeon (*Acipenser oxyrinchus desotoi)* are most sensitive to (1) egg to age-1 mortality, (2) the percentage of females that spawn annually, and (3) adult mortality. A recent Apalachicola River study (Flowers et al. 2009) suggested that flow regimes generated by releases at the Jim Woodruff Lock and Dam (rkm 170.6) could affect spawning habitat availability and recruitment. In a Biological Opinion on the operation of the Jim Woodruff Lock and Dam, the U.S. Fish and Wildlife Service (USFWS) included a Reasonable and Prudent Measure (RPM) to monitor the distribution and abundance of listed species in the Apalachicola River. The terms and conditions of the RPM specific to Gulf sturgeon include: (1) design studies measuring recruitment to age 1 in the Apalachicola River by 31 January 2009, and (2) to then implement these studies (USFWS 2008).

In most rivers within their range, Gulf sturgeon population sizes have been estimated, spawning sites have been located, and population trends evaluated using some form of population modeling. However, very little is known about Gulf sturgeon early life history. Egg deposition was measured in the Apalachicola River (Pine et al. 2006, Scollan and Parauka 2008) using egg mats described by Marchant and Shutters (1996). Little information on subadults (Sulak and Clugston 1998) exists in the Apalachicola system although this particular life history group has been readily captured with small-mesh gill nets in the Pearl River (Morrow et al. 1998, Rogillio et al. 2007). A few young-of-year (yoy) Gulf sturgeon have been captured in Apalachicola River system (Wooley et al. 1982; R. Lehnert, Florida Fish and Wildlife Conservation Commission (FWC), personal communication). In the Suwannee River, 18 yoy Gulf sturgeon were captured using benthic sleds, otter trawls, and electrofishing (Sulak and Clugston 1998). The trawling techniques developed in the Mississippi River (Herzog et al. 2005) for capturing larval *Scaphirhynchus* (i.e., pallid and shovelnose sturgeon) have yielded favorable success (Hrabik et al. 2007) and were applied to other study reaches within the basin (Braaten and Fuller 2007, Tripp et al. 2009, Phelps et al. 2010). Given the success with *Scaphirhynchus*, this approach may be suitable for sampling yoy Gulf sturgeon. Therefore, we tested the feasibility of capturing age 0 to age 1 Gulf sturgeon in the Apalachicola River with modified balloon trawls during 2009.

Methods

Sampling was conducted during January and June 2009. Modified trawls were used to sample for yoy Gulf sturgeon in the lower reaches of the Apalachicola River and its distributaries during January and in the upper, middle, and lower Apalachicola River and Brothers River during June (Figure 1.) Trawling was conducted within habitats deemed likely to hold fish (e. g., deep holes near tributary mouths), near known summering or spawning locations (Scollan and Parauka 2008), or near locations where several small Gulf sturgeon had been captured in trawls by FWC biologists during routine fisheries assessments.

The Missouri trawl, described in Herzog et al. (2005), is a two-seam, balloon trawl with an inner and outer delta mesh that allows

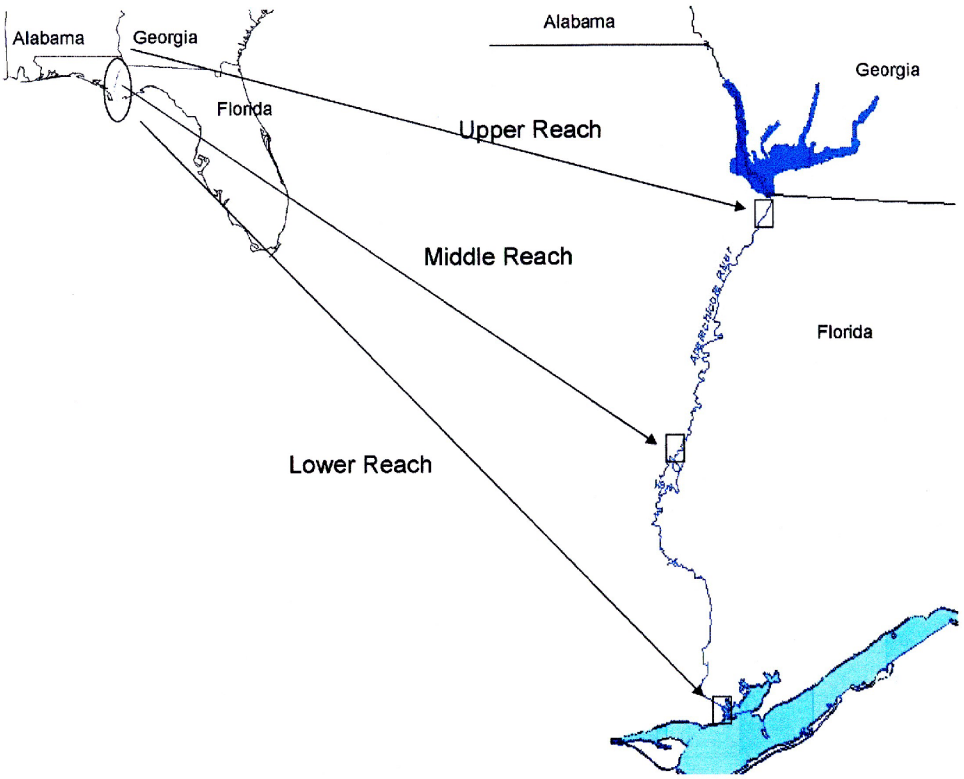

Figure 1. A diagrammatic illustration of the Apalachicola River system sampled for yoy Gulf sturgeon during January and June 2009. Highlighted boxes (i.e., upper, middle, and lower) represent generalized areas of sampling.

both large and small (i.e., larval) fish to be captured. The inner mesh size was 13 mm and the outer mesh was 3 mm (both measurements are bar mesh). The dimensions of trawl were modified to make it smaller (the mouth of the trawl was decreased to a width of 3.05 m) and thus easier to deploy and retrieve in small chutes or channels with woody debris and other structure. Otter boards, measuring 30 x 60 cm, keep the trawl open along the bottom. Vessel speed was approximately 90 to 180 cm/sec and tow-line length was about three times the water depth to ensure that the trawl maintained contact with the substrate while underway. Trawl distance varied depending upon obstructions, but ranged from 0.15 to 1.5 km. A trailer boat was usually available when the trawl became entangled on underwater obstructions. Boaters would then grab the buoy attached to the cod end of the trawl, reverse upstream, and these actions would usually lift the trawl off the obstruction.

Water quality parameters were determined for each river section sampled. Dissolved oxygen, pH, conductivity, and water temperature was measured with a Quanta Hydrolab. Turbidity was measured with a Hach 2100P turbidimeter. River width and distance to shore when trawling were measured using a Bushnell laser rangefinder. Water depth was taken at the beginning and end of each trawl and at 10 points along a cross sectional transect in the location where Gulf sturgeon were captured. These measurements were taken using a boat-mounted Garmin depth sounder. At the beginning and end of each trawl, GPS coordinates were taken using a Magellan GPS unit. Captured sturgeon were measured for total and standard length (0.1 mm) using a Mitutoyo digital caliper. Weights (0.1 g) were determined using an Ohaus model CS 200 portable digital scale.

Results and Discussion

An effort of 40 hauls totaling 25.18 km was expended during January (Table 1). June effort totaled 60 hauls and 54.50 km. Overall effort was 100 hauls totaling 79.68 km.

Three yoy (i.e., age-0) Gulf sturgeon were captured at the exact same location (in two different trawl hauls) in the upper Brothers River (a tributary of the lower Apalachicola River) on 11 June 2009. These fish ranged in total length from 57.1 to 119.5 mm and weighed between 0.8 and 5.9 g (Table 2). The river at the capture site was about 92 m wide, capture depth was approximately 9 m with a hard mud bottom, and current velocities in the water column ranged 3 to 60 cm/sec along the transect where yoy sturgeon were captured.

Our study demonstrated the potential of capturing yoy Gulf

Table 1. Summary of trawling effort for Gulf sturgeon in the Apalachicola River system during January and June 2009

Date	River	Number of trawls	Distance (km)	Number captured
January	Jackson	1	0.40	0
	Apalachicola	20	10.23	0
	East	11	8.90	0
	Brothers	6	3.56	0
	Little St. Marks	2	2.09	0
	Total for January	40	25.18	0
June	Upper Apalachicola	19	15.12	0
	Middle Apalachicola	14	18.76	0
	Lower Apalachicola	4	4.34	0
	Brothers	23	16.28	3
	Total for June	60	54.50	3
	Grand Total for January and June	100	79.68	3

Table 2. Characteristics of young-of-year Gulf sturgeon and habitat variables associated with their capture in the Brothers River, Florida, on 11 June 2009.

	Gulf sturgeon sizes and weights		
Fish number	**Total length (mm)**	**Standard length (mm)**	**Weight (g)**
1	57.1	45.1	0.8
2	119.5	98.4	5.9
3	85.5	67.4	1.8
Habitat			
Location: 2992392N, 08504413W			
River width: 92 m			
Depth: approximately 9 m with hard mud bottom			
Water column velocities: 3 to 60 cm per second			
Water temperature: 27.1 C			
Conductivity: 0.126 umhos/cm			
pH: 7.47			
Dissolved oxygen: 5.17 ppm			
Turbidity: 29.1 NTU			

sturgeon with bottom trawls although substantial effort may be initially required (e.g., > 25 km per yoy sturgeon captured). If the experiences sampling *Scaphirhynchus* in the Mississippi River basin (Hrabik et al. 2007, Braaten and Fuller 2007, Phelps et al. 2010) are any indication, then sampling efficiency may increase as familiarity is gained with the river system (e.g., Phelps et al. (2010) captured 1,256 yoy during their four year study).

If trawling can develop into a cost-effective Gulf sturgeon assessment tool, then useful applications exist. In the middle Mississippi River, similar trawling techniques were used to evaluate mortality, abundance, growth rates, and hatching times of yoy *Scaphirhynchus* (Phelps et al. 2010). A large enough sample of Gulf sturgeon yoy may allow estimates of the instantaneous rate of total mortality (Ricker 1975) to be computed using a catch curve. This survival statistic is critical when relating flow regimes or other habitat variables. Less sampling effort could characterize relative abundance from year to year. However, if sufficient numbers of yoy are not captured to determine mortality or abundance, trawling may still have value as an assessment tool. For example, our trawling suggests additional spawning locations exist in addition to those depicted by Scollan and Parauka (2008). Three individuals captured in the Brothers River (located in the lower reaches of the Apalachicola River system) were found near locations used by summering adults. Given the small size of these fish and their distance downstream from nine potential spawning areas identified in the upper Apalachicola River, these fish may have been spawned at an unknown spawning location. Trawling and careful collection of habitat parameters could also be used to determine yoy Gulf sturgeon habitat preferences.

In conclusion, trawling to sample yoy Gulf sturgeon appears possible and has important applications. Sampling efficiency will need to improve for trawling to become a routine assessment methodology in the Apalachicola River. Achieving such sampling efficiency may prove problematic due to the small size of the Apalachicola River population which has been estimated to range from a few hundred to perhaps a thousand individuals (Flowers et al. 2009). Trawling in the Apalachicola River during 2010 and perhaps 2011 will ultimately determine if sampling yoy Gulf sturgeon in such a depressed population is feasible.

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