

Seascape connectivity of Gulf sturgeon *Acipenser oxyrinchus desotoi* population units across the northern Gulf of Mexico

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Supplement 1.

Methods

Ship Island array from 2011 to 2015. Monitoring periods are from September to June annually to encompass overwintering. Monitoring periods for any zone can be determined from these data.

Monitoring Period	Dates	No. of Receivers	Zones
1	2011 – 2012	21	1, 2, 3, 4
2	2012 – 2013	29	1, 2, 3, 4, 5
3	2013 – 2014	39	1, 2, 3, 4, 5, 6, 7, 8, 9
4	2014 – 2015	39	1, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

Note: Zone 1 had 4 receivers, Zone 2 had 9 receivers, Zone 3 had 4 receivers, Zone 4 had 4 receivers, Zone 5 had 8 receivers, Zone 6 had 2 receivers, Zone 7 had 3 receivers, Zone 8 had 2 receivers, Zone 9 had 3 receivers, Zone 10 had 5 receivers, Zone 11 had 4 receivers, Zone 12 had 2 receivers, and Zone 13 had 2 receivers. Receivers in Zones 2 and 3 were moved to Zones 10, 11, 12 and 13 in monitoring period 4 (2014 – 2015).

Results

. Gulf Sturgeon detections on the Ship Island array by annual monitoring period (MP).

River	Population	Transmitter	FL (mm)	W (kg)	SC	TAD	MP 1	MP 2	MP 3	MP 4	TOTAL
BR	Eastern	A69-1303-45716	1470	22.4	A	16	0	282	0	0	282
BR	Eastern	A69-1303-45734	1520	26.9	A	71	0	0	1031	0	1031
BR	Eastern	A69-1303-45768	1580	NA	A	1	0	0	2	0	2
BR	Eastern	A69-1303-46420	1580	35.65	A	27	0	0	285	0	285
BR	Eastern	A69-1303-46423	1880	56	A	134	55	6106	9738	1263	17,162
BR	Eastern	A69-1303-46432	1600	37.7	A	115	0	0	12,232	12,373	24,605
BR	Eastern	A69-1303-46434	1630	33.1	A	28	0	610	17	0	627
BR	Eastern	A69-1303-61028	1880	60.05	A	4	0	0	0	23	23
BR	Eastern	A69-1303-61034	1660	31.8	A	19	1947	701	77	0	2725
BR	Eastern	A69-1303-61035	1870	57.7	A	31	0	0	0	1122	1122
BR	Eastern	A69-1303-61037	1370	23.8	A	15	0	0	2219	0	2219
BR	Eastern	A69-1303-61040	1640	38.6	A	103	0	11,021	1973	0	12,994
BR	Eastern	A69-1303-61041	1460	23.8	A	158	18	7633	18,278	0	25,929
BR	Eastern	A69-9001-30534	1290	16.9	A	48	2	7737	0	0	7739
BR	Eastern	A69-9001-30539	1390	22.3	A	97	0	0	67	12,218	12,285
BR	Eastern	A69-9001-30542	1550	33.45	A	50	0	0	1456	3190	4646
BR	Eastern	A69-9001-30545	1790	46.6	A	4	0	0	0	225	225
CR	Eastern	A69-1303-45862	1860	54	A	74	0	2383	0	0	2383
CR	Eastern	A69-1303-46183	1370	17.5	A	61	0	0	3444	0	3444
CR	Eastern	A69-9001-26238	1780	NA	A	68	0	0	0	12,422	12,422
CR	Eastern	A69-9001-29907	1710	44.5	A	14	0	0	893	18	911
ER	Eastern	A69-1303-45751	1480	22	A	40	3915	0	0	0	3915

River	Population	Transmitter	FL (mm)	W (kg)	SC	TAD	MP 1	MP 2	MP 3	MP 4	TOTAL	
ER	Eastern	A69-1303-61008	1778	53.6	A	2	0	178	0	0	178	
ER	Eastern	A69-9001-30598	1370	22.1	A	5	0	0	365	20	385	
YR	Eastern	A69-9001-30554	1730	48.35	A	266	1915	14,811	13,161	10,313	40,200	
YR	Eastern	A69-9001-30564	1950	54.7	A	51	0	1663	887	1301	3851	
PR	Western	A69-1303-45053*	1040	6.55	SA	23	0	896	0	0	896	
PR	Western	A69-1303-46208	1380	19.5	A	2	34	90	0	0	124	
PR	Western	A69-1303-46210	1472	26.7	A	9	0	0	65	187	252	
PR	Western	A69-1303-46215	1470	23.6	A	21	1275	75	0	0	1350	
PR	Western	A69-1303-46567*	1020	7.98	SA	4	238	0	0	0	238	
PR	Western	A69-1601-30162*	899	5.2	SA	42	0	0	0	11,098	11,098	
PR	Western	A69-1601-31790*	1235	16.3	SA	47	0	0	44	715	759	
PR	Western	A69-1601-31791*	932	5.3	SA	1	0	0	0	98	98	
PR	Western	A69-1601-32246	1270	15.8	A	23	0	0	0	3488	3488	
PR	Western	A69-1601-32283*	1250	13.6	SA	59	0	0	0	4515	4515	
PR	Western	A69-1601-32284*	910	4.8	SA	63	0	0	0	4107	4107	
PR	Western	A69-9001-25595	1384	22.8	A	110	0	0	0	21,666	21,666	
PR	Western	A69-9001-29896	1570	26.94	A	67	0	0	1574	3953	5527	
PR	Western	A69-9001-29898	1152	11.1	SA	77	0	0	0	7139	7139	
PR	Western	A69-9001-29899	1316	17.66	A	188	0	3335	3656	9446	16,437	
PR	Western	A69-9001-29902	1350	21.77	A	35	0	0	3609	52	3661	
PR	Western	A69-9001-29903	1038	8.15	SA	59	0	0	0	9564	9564	
PR	Western	A69-9001-29904	1422	24.67	A	46	0	0	1151	3118	4269	
PR	Western	A69-9001-30587	1576	30.92	A	165	0	0	4438	19,856	24,294	
PR	Western	A69-9001-30589	1461	29	A	36	50	0	3025	0	3075	
PE	Western	A69-1303-45711	1360	23.8	A	55	0	0	9699	1963	11,662	
PE	Western	A69-1303-45714	1010	17.8	SA	47	0	0	0	10,850	10,850	
PE	Western	A69-1303-45717	1625	47.7	A	86	195	1055	814	0	2064	
PE	Western	A69-1303-45720	1700	43.6	A	112	1722	20,963	0	0	22,685	
PE	Western	A69-1303-45721	1480	16.5	A	1	0	41	0	0	41	
PE	Western	A69-1303-45731	1600	31.8	A	42	0	0	2331	3397	5728	
PE	Western	A69-1303-45737	1510	26.4	A	1	0	0	16	0	16	
PE	Western	A69-1303-45746	1320	29.9	A	137	623	8035	11,352	0	20,010	
PE	Western	A69-1303-45748	1590	NA	A	136	0	0	8978	8733	17,711	
PE	Western	A69-1303-45752*	1276	14.3	A	44	0	0	840	0	840	
PE	Western	A69-1303-45753	1370	NA	A	146	0	0	17,825	12,994	30,819	
PE	Western	A69-1303-45765	1210	26.4	SA	1	0	23	0	0	23	
PE	Western	A69-1303-45767	1480	24.2	A	1	0	198	0	0	198	
PE	Western	A69-1303-62661**	1670	51.3	A	74	1596	0	0	0	1596	
PE	Western	A69-1601-32244	1460	25.4	A	99	0	0	0	17,361	17,361	
TOTAL							3561	13,585	87,836	135,542	208,788	445,751

Note: Reported detections refer to the total detections after exact duplicate and simultaneous detections were removed. MP refers to monitoring period, which was from September to June. MP 1 refers to 2011 – 2012, MP 2 refers to 2012 – 2013, MP 3 refers to 2013 – 2014, and MP 4 refers to 2014 – 2015. Sixty-one Gulf Sturgeon were detected on the array from 2011 to 2015 with a total of 445,751 detections. River names are abbreviated as follows: Blackwater (BR), Choctawhatchee (CR), Escambia (ER), Yellow (YR), Pascagoula (PR), and Pearl (PE). Transmitters without an asterisk are V16s, while V13 are noted by * and V9s are noted by **. TAD refers to Total Active Days of the fish on the Ship Island Array over four monitoring periods. SC refers to Size Class which is A (adult) or SA (sub-adult).

Appendix B is modified from Appendices C and D found in Vick et al. 2018 in the *Journal of Coastal Research* 34(3): 640-650.

Supplement 2.

Methods

Detailed treatment of development and application of the Least Cost Path (LCP) model we use in this study.

The LCP model estimated the most conservative distance between the 'origin' and 'destination' points through Gulf Sturgeon aquatic habitat. This model required a raster of the data along with the latitude and longitudes of the 'origin' and 'destination' of the path. First, river (Pearl, Pascagoula, Escambia, Blackwater, Yellow, and Choctawhatchee) and northern GOM hydrography (USGS NHD data 2016) were converted from a shapefile into a raster with a cell size of 0.002 and reclassified into a single class raster with 1 = water. A mosaic raster of water and land was created with two classes (1 = water, 2 = land) and a cell size of 0.002, and this mosaic raster was used in all LCP routes or conservative distance estimated by the LCP model. Unless otherwise stated, the tools described in the LCP model are found in the Spatial Analyst Toolbox. The model used the Weighted Overlay tool to weight the costs of the raster; the water class was given a cost of 1 while the land was given a cost of 2, which made the exported 'Cost' lower in water, and thus, restricted the route of travel to water. The Cost Distance tool used the exported 'Cost' as well as 'Destination' (target Ship Island receiver) to export the 'Output Cost Distance' and 'Output Backlink.' The exported 'Output Cost Distance' and 'Output Backlink' are needed in the Cost Path tool along with 'Origin' (target river receiver) to create the LCP route, which is exported as a raster. The LCP raster is converted from a raster to a polyline using the Raster to Polyline tool found in the To Raster Toolbox within Conversion Tools Toolbox. Once the LCP polyline was exported, the conservative distance traveled was measured using Measure a Feature from Measure in the Tools Toolbar; all distances were measured in kilometers (km). LCP distance was estimated for all entry and exit movements of all individuals detected on the Ship Island array.