



SURVEY SUMMARY

NCWRC – Inland Fisheries Division – Coastal Region



Suitability of live-imaging sonar as an index of American Shad relative abundance

NEED

Since 2001, NCWRC has monitored American Shad in the Cape Fear River using boat electrofishing at each of the three USACE locks and dams. Anadromous fish locking has not been conducted since 2018, causing large aggregations in the tailrace of Lock & Dam 2 and Lock & Dam 3 and elevated mortality in the late spawning season due to the population's semelparous life history, warm water temperatures, and gear saturation. Live imaging sonar was investigated to determine if sonar counts at the locks and dams are correlated to electrofishing relative abundance, thereby providing a hydroacoustic index of abundance.

OBJECTIVES

1. Enumerate fish below lock and dam tailraces using live-imaging sonar.
2. Investigate correlation between sonar counts and American Shad electrofishing CPUE.

METHODS

Personnel: Kyle Rachels and April Boggs – District 4 fisheries biologists.

Waterbody: Cape Fear River.

Fish Sampling Gear: Lowrance Active Target Sonar and HDS-12 Live chartplotter; boat electrofisher (Smith Root Apex; 120 Hz; 5000–7000 peak watts; 10–20% duty cycle).

Other Gear Utilized: As applicable; devices used to measure discharge, secchi, water quality

Species of Primary Interest: American Shad.

Sample Date(s): March 2, 2022 – May 19, 2022.

Funding Source: Federal Aid in Sport Fish Restoration and agency license receipts.

Project Name in BIODÉ Fish: Live imaging sonar counts stored in excel spreadsheet on District 4 computers; electrofishing data in BIODÉ project Cape Fear River Anadromous Fish Stock Assessment.

Citation:

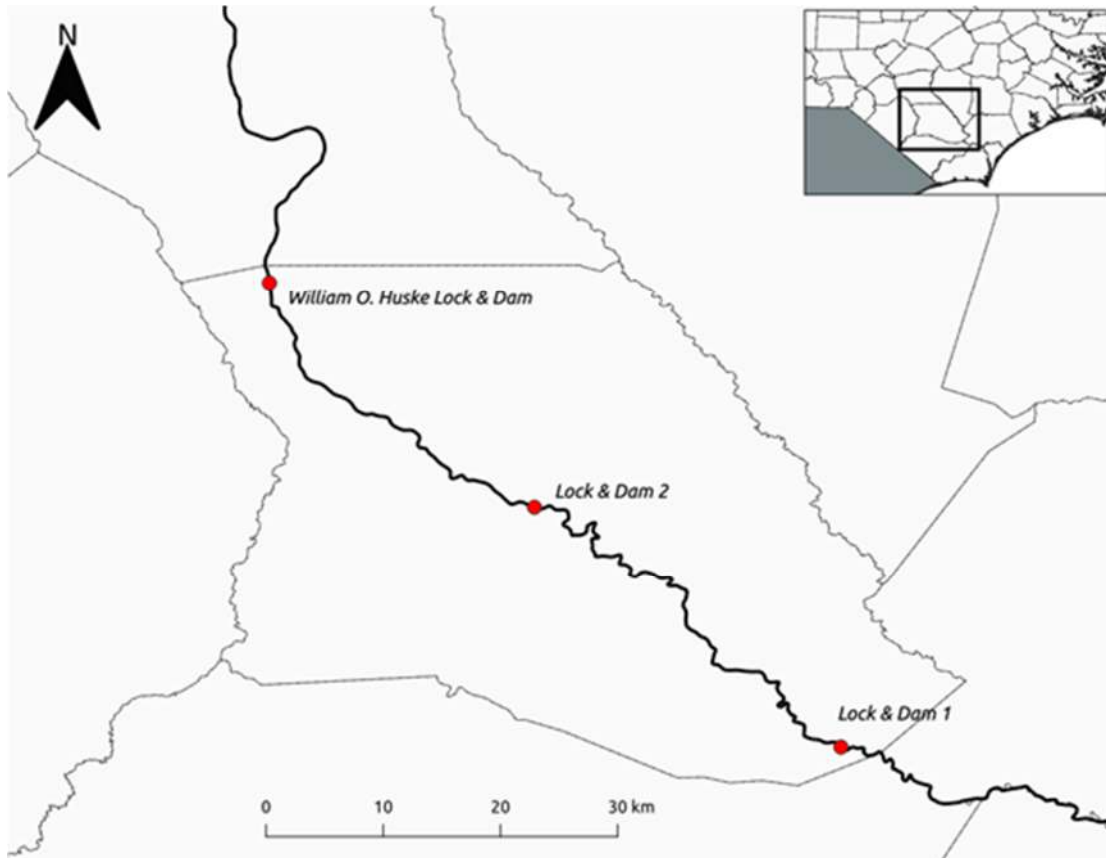
Rachels, K. T., and A. D. Boggs. 2022. Suitability of live-imaging sonar as an index of American Shad relative abundance. North Carolina Wildlife Resources Commission, Federal Aid in Sport Fish Restoration, survey summary, Raleigh.



SURVEY SUMMARY
NCWRC – Inland Fisheries Division – Coastal Region



STUDY AREA



PROCEDURES

The live-imaging sonar (Figure 1) transducer was mounted approximately 0.5-m below and adjacent to the stern of the electrofishing boat using a trolling motor mount and oriented to ensonify the area beneath and forward of the vessel. The sonar was operated in “Scout” mode with a horizontal range of 12.2 m (40 feet). At each lock & dam, sonar recordings began as the boat proceeded upstream while approaching the downstream lock gates, continued around the outside of the lock wall towards the dam structure, and ended at a location near the bank opposite and downstream of the lock structure (Figure 2). Attempts were made to standardize the ensonified path at each lock & dam; sonar recordings varied in ensonified path and duration due to changes in streamflow, boating traffic, and sonar operator. A known-length artificial “Shad” target (Figure 3) was recorded at two distances away from the transducer to enable the estimation of the length of fish targets. Sonar recordings were saved on a 32-GB microSD card and archived on district computers. A single viewer played each recording using VLC Media Player in real time (1x speed) and counted all fish targets that appeared to be larger than approximately 300 mm. Counts were tracked using a pitch counter. The viewer paused the



SURVEY SUMMARY

NCWRC – Inland Fisheries Division – Coastal Region



recordings when needed but did not rewind or use image enhancements to modify the video. The viewer was blind to the location and date of each recording; however, habitat differences among the locations enabled the viewer to identify the sample site while viewing. Fish counts for each recording were divided by the recording duration to estimate fish per minute. It typically required 30 minutes to process a 10–12 minute video.

BIOLOGICAL OBSERVATIONS

Twenty-three live-imaging sonar recording/boat electrofishing paired samples were completed. Five live-imaging videos were conducted in May after electrofishing sampling ceased. An additional 12 live imaging sonar videos were made throughout the sampling season but were omitted due to nonstandard movement through the sample area or poor video quality. Fish counts (Table 1) ranged from 1.32 fish per minute at Lock & Dam 1 (March 2, 2022) to 70.15 fish per minute at Lock & Dam 2 (April 5, 2022). Spearman's ρ statistics between fish counts and American Shad electrofishing CPUE were 0.93 at Lock & Dam 1, 0.68 at Lock & Dam 2, and 0.73 at Lock & Dam 3 (Figure 4). Factors that influence incongruities between the sonar and electrofishing indices may be due to differences in the proportion of the fish assemblage comprised by American Shad, the relative proportion of habitat that is sampled by each gear, and acoustic noise in the tailrace that prohibits accurate sonar counts close to the dam where large aggregates of American Shad are collected while electrofishing.

MANAGEMENT RECOMMENDATIONS

1. Standardize live-imaging sonar recordings to approximately 600 seconds.
2. Investigate variability in sonar recordings by conducting replicate date/site samples.
3. Investigate stationary use of live-imaging sonar to provide run-count estimates of American Shad downstream of Lock & Dam 1.



SURVEY SUMMARY
NCWRC – Inland Fisheries Division – Coastal Region



Table 1. Sonar counts and American Shad electrofishing CPUE in 2022.

Date	Sonar duration (seconds)	Site	Sonar count	Sonar CPUE (fish/min)	Electrofishing CPUE (fish/h)
March 2	589	LD1	13	1.32	6.00
March 4	347	LD3	22	3.80	0.00
March 8	333	LD3	160	28.83	0.00
March 17	427	LD2	285	40.05	5.81
March 17	553	LD3	80	8.68	0.00
March 22	257	LD1	218	50.89	41.68
March 22	587	LD2	218	22.28	0.00
March 22	855	LD3	155	10.88	7.94
March 30	753	LD1	577	45.98	47.97
March 30	704	LD2	368	31.36	3.85
March 30	686	LD3	354	30.96	64.00
April 5	593	LD1	255	25.80	15.97
April 5	792	LD2	926	70.15	36.00
April 5	605	LD3	381	37.79	92.00
April 11	717	LD3	459	38.41	87.71
April 12	475	LD1	157	19.83	8.04
April 12	663	LD2	422	38.19	80.43
April 19	688	LD1	124	10.81	4.03
April 19	844	LD2	668	47.49	118.62
April 19	636	LD3	279	26.32	101.89
April 24	369	LD1	126	20.49	9.92
April 25	537	LD2	363	40.56	169.91
April 27	539	LD3	537	59.78	206.00
May 5	738	LD2	450	36.59	-
May 5	660	LD3	519	47.18	-
May 11	166	LD2	74	26.75	-
May 11	581	LD3	392	40.48	-
May 19	810	LD2	536	39.70	-



SURVEY SUMMARY
NCWRC – Inland Fisheries Division – Coastal Region



Figure 1. Lowrance ActiveTarget sonar processing unit, Lowrance HDS-12 live chartplotter, and lithium-ion 12V x 12Ah battery mounted within a waterproof case. The ActiveTarget transducer is visible to the right of the case and affixed to the transom of the boat using EMT conduit and a trolling motor mount when in use.



SURVEY SUMMARY
NCWRC – Inland Fisheries Division – Coastal Region

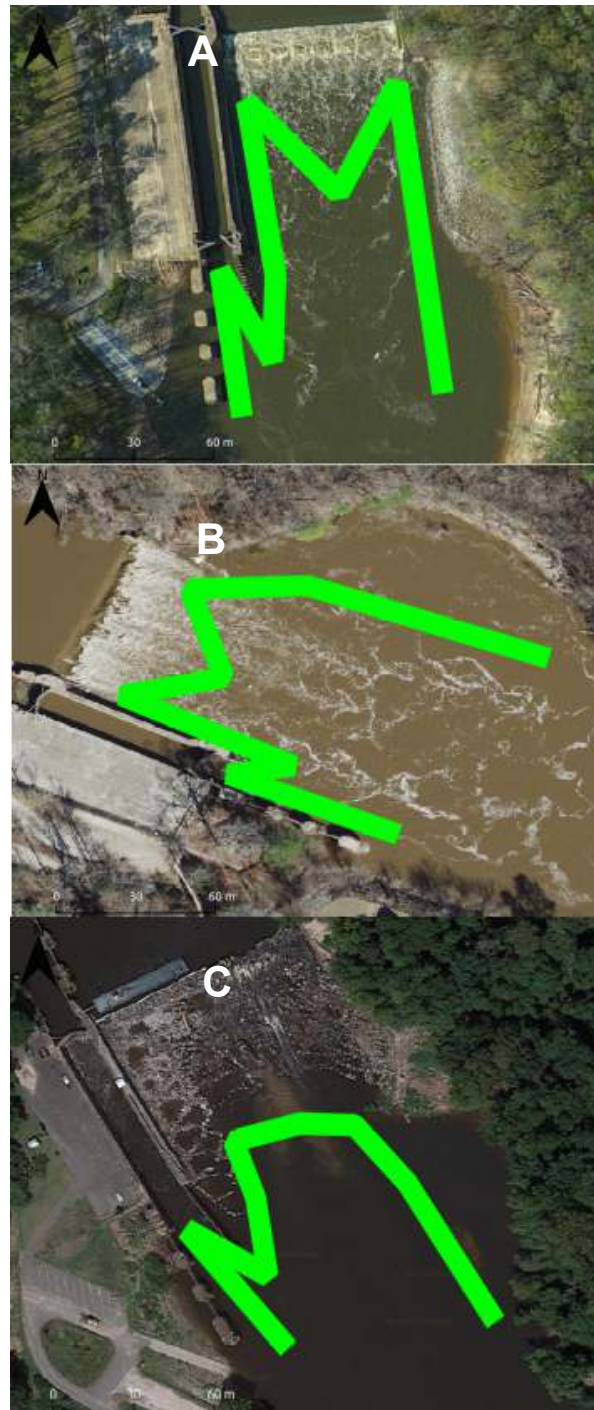


Figure 2. Example of typical live-imaging sonar path and ensonified area (green line) at Lock & Dam 3 (A), Lock & Dam 2 (B), and Lock & Dam 1 (C).



SURVEY SUMMARY
NCWRC – Inland Fisheries Division – Coastal Region



Figure 3. Known-length (500-mm TL) target. Target was constructed of southern yellow pine to the approximate proportions described for American Shad by Menhinick (1991) and mounted on a 3-m length of EMT conduit.



SURVEY SUMMARY
NCWRC – Inland Fisheries Division – Coastal Region

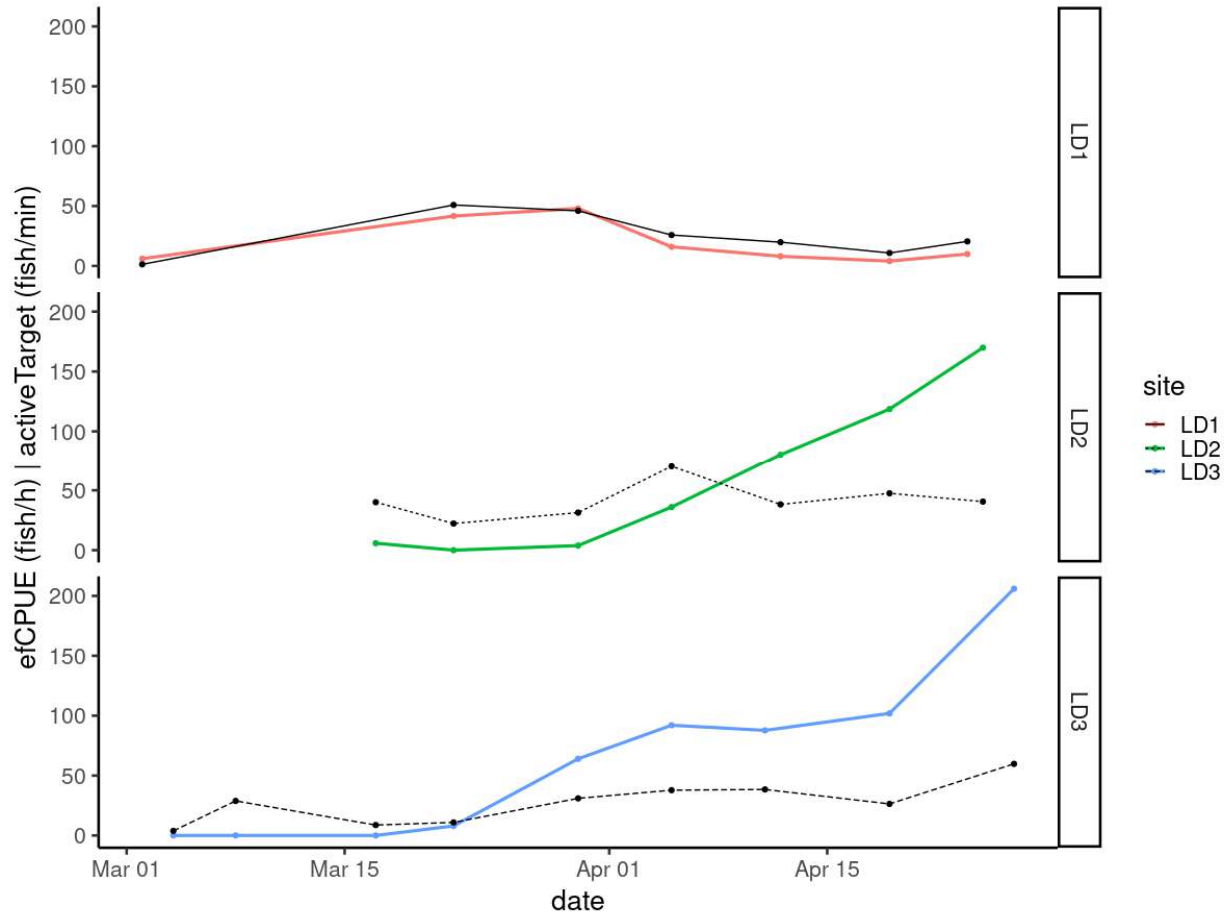


Figure 4. Paired live-imaging sonar CPUE (black lines) and American Shad electrofishing CPUE (color lines) by date and sample site.