

**National Fish and Wildlife Foundation
Final Programmatic Report**

Project Name and Number: Hudson River Atlantic Sturgeon Habitat Study
2006-0087-002

Recipient Organization/Agency: Atlantic States Marine Fisheries Commission

Recipient Organization Web Address: www.asafc.org

Date Submitted:

1) Summary of Accomplishments

This project was part of a multi-agency, three year effort coordinated by the New York State Department of Environmental Conservation to investigate biology, movement, and habitat use of mature Hudson River Atlantic sturgeon within and outside the Hudson River Estuary. Sample crews collected and tagged mature Atlantic sturgeons during the 2006 – 2008 spawning seasons and successfully monitored movement of sonic-tagged fish within the estuary. Researchers also successfully estimated ocean locations of fish once they had emigrated from the estuary to the ocean. Key discoveries to date include:

- A previously unknown spawning location within in the estuary.
- A habitat preference for deep muddy substrate while in the estuary.
- High within river fidelity to spawning location among years.
- Every year or alternate year spawning of mature fish.
- Rapid emigration of females and delayed emigration of males following spawning.
- Ocean locations that were most often close to shore, in shallow water, and within the mid Atlantic Bight from Long Island, NY to North Carolina.
- Ocean concentration areas in the New York Bight and at the mouths of Delaware and Chesapeake Bays.

This project verified the usefulness of the satellite pop-off archival tags (PATs) in identifying ocean behavior of Atlantic sturgeon. The National Fish and Wildlife Foundation provided funding to purchase 20 of the PATs used in this multi-agency project.

2) Project Activities & Results

The Hudson River Estuary extends 246 km from NYC to the Federal Dam at Troy. Atlantic sturgeons appear to spawn between rkm 120 and 185.

Activities

- NYSDEC purchased the following equipment and supplies with state funds:
 - A research vessel, engine, and trailer;
 - Nets and fish processing and tagging apparatus;
 - Six PATs
- NYSDEC purchased 20 PATs using funds provided by the National Fish and Wildlife Foundation (NFWF). Tags were maintained with state funds.

- NYSDEC paid for satellite transmission from PATs with state funds.
- NYSDEC, USFWS, and ASMFC sample crews collected and tagged Atlantic sturgeons from downriver of or at suspected spawning areas. Most fish were tagged with Carlin and PITs, but a subsample was also tagged with various sonic and PAT tags. Sonic tags from Lotek Wireless Inc. were used to characterize within river movement while VEMCO sonic tags were used to detect movement into other coastal estuaries.
- Fixed station submersible data loggers from Lotek Wireless, Inc. were deployed above the suspected spawning reach within the river and at km 35 to determine movement above suspected spawning areas and times of immigration to and emigration from the estuary.
- Sonic tagged fish were tracked within the estuary each year until the adults left the system. Locations of tagged fish were recorded with a GPS unit. Since some of the sonic tags have a projected five-year life span, we will continue annual spring, summer, fall sonic tracking in the estuary through 2012.
- PAT tags were designed to detach from the fish at a predetermined time, float to the surface, and transmit data on date, time, temperature, light, and depth to a satellite. These data were downloaded from the satellite and used to estimate geolocations based on day length (latitude) and time at midday or midnight (longitude). Estimates were further refined by comparing recorded depths and water temperatures with data on bathymetry and sea surface temperature at date.

Results

The following summarize results of the three year project to date.

- All supplies and equipment identified in the grant agreement were purchased in a timely manner and all 26 PAT tags purchased with NFWF or state funds were successfully deployed on fish.
- Of the 184 Atlantic sturgeon collected, 178 were mature, 125 were identified as males, and 12 as females (Table 1). Males were generally smaller than females (Figure 1). Mean total length of mature males and females were 1.9 and 2.3 m (Table 2). Mean weights (2008 only) were 46.8 kg for males and 95.1 kg for females. The largest fish was a male 2.44 m long weighing 75.8 kg. The heaviest fish was a female 2.38 m long weighing 98.9 kg. We caught no shortnose sturgeon during this project.
- Sample crews tagged 134 Atlantic sturgeons during this project. We deployed a total of 96 Carlin tags, 132 PIT tags, 41 Lotek sonic tags, 12 VEMCO sonic tags, and 33 PAT tags on fish (Table 3). Most fish received two or more tags and a few received as many as five tags (Table 4).
- We caught seven previously tagged Atlantic sturgeons in 2008. One fish had been PIT tagged in the estuary as a juvenile in 1997 and had returned to spawn as an adult. The second fish had been tagged in the estuary the previous week and the third appeared to have been tagged in the early 1990s in Delaware Bay. The remaining four sturgeons had been tagged by project field crews in 2006. These fish were caught at the same spawning location that they had occupied at tagging.

- We tracked and located 32 of the 41 Lotek sonic-tagged fish in the estuary during the three year project. Sonic-tagged fish were detected as early as April and as late as October. Most females left the river shortly after tagging or spawning. Most males left the river by the end of August or the beginning of September.
- We observed three aggregations of sonic tagged fish. One was near Norrie Point (km 136) in the spring and it was a known spawning location from previous studies. The second aggregation occurred in spring in upper Newburgh Bay (km 127). This was a previously unknown potential spawning location. The third aggregation occurred in summer in the Highlands from Bear Mountain Bridge (km 76) to about km 90. The presence of mature fish in spawning condition was verified at the two upriver locations by gill net sampling.
- Sonic-tagged sturgeons in the Hudson Estuary were most often found in areas of muddy substrate (Figure 2). However, this may have been due, in part, to the high percentage of mud substrate within the estuary. To identify affinity for a given substrate, we compared the percent of fish observations over that substrate with the fraction of that substrate in the estuary. The fraction of observations of fish over gravel and mud exceeded the fraction of those substrates available suggesting a preference for those substrates (Figure 3).
- Sediment environments in the Hudson River Estuary include areas of deposition, erosion, and dynamic (in a state of change). Most sonic-tagged sturgeons were located over areas of dynamic sediment habitats (Figure 4). The percent of fish location observations over a dynamic sediment environment exceeded the fraction of such environment in the estuary (Figure 5) suggesting a preference for dynamic environments. Further comparisons of sediment environment and habitat combinations with percent of the same combination available in the estuary suggested an affinity for dynamic mud (Figure 6)
- We deployed 10 PATs from Wildlife Computers (WC) in 2006, 13 PATs from Microwave Computers (MC) in 2007, and 7 MC and 3 WC PATs in 2008. We obtained data from five of the WC tags and 10 of the 13 MC tags deployed in 2006 and 2007. Tags deployed in 2008 will not begin to provide data until this winter.
- Tag pop-off locations thus far ranged from the mouth of Chesapeake Bay through the Bay of Fundy, Nova Scotia. Preliminary analyses of ocean-locational data from the 2006 and 2007 tags indicate that most tagged sturgeon remained relatively close to shore, at depths of 5 – 40 m, and within the Mid Atlantic Bight from Long Island, NY to North Carolina. Apparent ocean concentration areas included the New York Bight, the mouth of Delaware Bay, and the mouth of the Chesapeake Bay.

The following summarize results that differed somewhat from planned or expected.

- We caught fewer mature Atlantic sturgeon downriver of the spawning reach than expected. Since we had planned to use these fish to locate new spawning locations, the lower number probably hindered full achievement of that objective. Low downriver catches did not affect the achievement of other project objectives.
- Several PAT tags detached prematurely and or did not transmit useful data about Ocean location. Although frustrating, the malfunctioning tags did not preclude the

characterization of ocean behavior because we deployed a large number of PAT tags and those that functioned well provided us with substantial locational data.

3) Lessons Learned

- Most of the PAT tags that malfunctioned were manufactured by Wildlife Computers. Few problems were encountered with PAT tags manufactured by Microwave Telemetry.
- The purchase cost of MC PAT tags does not include the cost of storing and transmitting satellite data. These costs were additional and were substantial.
- Sonic tracking and tag recaptures provided new information on spawning fidelity and spawning frequency of Hudson River Atlantic sturgeon. Several sonic-tagged fish were tracked in both 2006 and 2007. Eight fish sonic-tagged in 2006 on the spawning ground were located again in 2007 at the same location. Four recaptures in 2008 were collected at the same locations that the fish had been tagged in 2006. These results suggest that there is some within river fidelity to spawning location and that some fish spawn every year or every other year. Future sampling will be required to learn if we detect fish with greater intervals between spawns.
- Use of the PAT tags suggested ocean movement close to shore and ocean concentration areas in the NY Bight and the mouths of Delaware and Chesapeake Bays. Since these are also areas of concentrated commercial fishing and commercial vessel activity, sturgeon interaction with fishing gear and ships is likely. We recommend focused monitoring of commercial fishing in these areas and a public outreach effort to obtain information on sturgeons that die from ship strikes.

4) Dissemination

Project researchers gave the following presentations about results at professional conferences and workshops:

- August, 2008. "Use of pop up satellite archival tags and GIS to estimate movements, habitat use, and threats of Atlantic sturgeon in ocean waters". By D. Erickson, A. Kahnle, M. Millard, G. Bryja, A. Higgs, J. Mohler, J. Sweeka, G. Kenney, and M. Dufour. Presented at the annual meeting of the American Fisheries Society, Ottawa, Ontario, Canada.
- November, 2007. "New York Atlantic sturgeon sampling". By A. Higgs and M. Dufour. Presented at the Atlantic States Marine Fisheries Commission Atlantic Sturgeon Research and Sampling Workshop, Annapolis, MD.
- February, 2007. "Atlantic sturgeon of New York" by K. Hattala, A. Cosman, and G. Kenney. Presented at the annual meeting of the New York Chapter of the American Fisheries Society, West Point, NY.

Project researchers developed the following reports and papers:

- NY State Department of Environmental Conservation. 2008. Habitat use of mature Atlantic sturgeon in the Hudson River Estuary. A report to the Atlantic States Marine Fisheries Society.

- Wildlife Conservation Society and Pew Institute for Ocean Science. 2007. Research for the recovery of Atlantic sturgeon in the Hudson and Altamah Rivers, A report to the Hudson River Foundation
- A scientific paper on results of the ocean behavioral studies is in preparation.

Project researchers also gave numerous talks about the project to public audiences, executives of the NY State Department of Environmental Conservation, the Hudson River Estuary Advisory Committee, and the environmental organization “River Keeper” We also developed news releases, brought the press along on several sampling trips, and were interviewed by the press regarding the project.

5) Project Documents

News releases, newspaper articles, a report, and photos are attached.